Live Tank Circuit Breakers
72.5-550kV — Reliability through Technical Excellence

with Primary Plus™
Pre-engineered solution set that digitizes XDGE primary equipment and provides factory installed and configured protection, monitoring, diagnostics and communications.
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.

Robust, High Quality and Reliable Breaker Technology
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 SF₆ 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
Technology

XD|GE 252kV and below SF₆ 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 SF₆ high-voltage breakers, while 252kV and above SF₆ 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 SF₆ 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).
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 electrically, 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

High pressure oil

Low pressure oil

a. Uncharged, open position
b. Charged, open position
c. Charged, closed position
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, including both visual inspections as well as stopped flow inspections, all performed to documented test plans. 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 measurement and inspection department with a certified full time inspector 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.
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
Primary Plus

Pre-Engineering Secondary Equipment
Primary Plus, XD|GE’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, XD|GE 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 SF₆ Live Tank Circuit Breaker

LW9A-72.5

All measurements are in millimeters (mm)
126 to 145kV SF₆ Live Tank Circuit Breaker


Live Tank Circuit Breakers — 72.5–550kV
170kV SF₆ Live Tank Circuit Breaker

LW25-170

All measurements are in millimeters (mm)
Live Tank Circuit Breakers — 72.5–550kV

252kV SF$_6$ Live Tank Circuit Breaker

LW25-252

[Diagram of LW25-252 Live Tank Circuit Breaker]
252kV SF₆ Live Tank Circuit Breaker

LW15C-252

All measurements are in millimeters (mm)
363 to 420 kV SF₆ Live Tank Circuit Breaker

LW25-363/LW25-420

Control Cabinet
Foundation

Grounding Terminal

LW25-363 is available with closing resistors if required (increased height)
363kV SF₆ Live Tank Circuit Breaker

LW15A-363

All measurements are in millimeters (mm)

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

All measurements are in millimeters (mm)
550kV SF₆ Live Tank Circuit Breaker

LW15A-550

All measurements are in millimeters (mm)
## Technical Specifications

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

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<td>325</td>
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252kV Live Tank SF₆ Circuit Breaker

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

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<td><strong>2. Mechanical Parameters</strong></td>
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<td>2.1 Type of mechanism</td>
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<td>Hydro-mechanical</td>
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<td>2.12 Three phase operation/ single phase</td>
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<td>3p</td>
<td>3p</td>
<td>3p/1p</td>
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<td>2.15 Weight (Kg)</td>
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### Spring Operating Mechanism

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<tr>
<th>Item</th>
<th>Unit</th>
<th>Ratings</th>
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<tbody>
<tr>
<td>Voltage of control &amp; auxiliary circuit</td>
<td>V</td>
<td>DC110/DC220</td>
</tr>
<tr>
<td>Current of open winding</td>
<td>A</td>
<td>5.8/2.5</td>
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<tr>
<td>Current of close winding</td>
<td>A</td>
<td>3.3/2</td>
</tr>
<tr>
<td>Voltage of energizing motor</td>
<td>V</td>
<td>DC220/DC110/AC220</td>
</tr>
<tr>
<td>Voltage of heater</td>
<td>V</td>
<td>AC220</td>
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### Hydro-Mechanical Operating Mechanism for CB (CYA3, CYA4)

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<thead>
<tr>
<th>Item</th>
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<tbody>
<tr>
<td>Voltage of control circuit</td>
<td>V</td>
<td>DC220/DC110</td>
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<td>Current of trip coil</td>
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<td>1.43/3.06</td>
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<tr>
<td>Current of close coil</td>
<td>A</td>
<td>1.43/3.06</td>
</tr>
<tr>
<td>Voltage of energizing motor</td>
<td>V</td>
<td>AC220/DC220/DC110</td>
</tr>
<tr>
<td>Power of energy-store motor</td>
<td>W</td>
<td>660/1100</td>
</tr>
<tr>
<td>Voltage of heater</td>
<td>V</td>
<td>AC220</td>
</tr>
<tr>
<td>Power of heater</td>
<td>W</td>
<td>100/250W</td>
</tr>
<tr>
<td>Related operating pressure of mechanism</td>
<td>MPa</td>
<td>44.9/53.1</td>
</tr>
</tbody>
</table>
## Ordering

<table>
<thead>
<tr>
<th>LW</th>
<th>*</th>
<th>-</th>
<th>*</th>
<th>/</th>
<th>*</th>
<th>-</th>
<th>*</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF, Circuit Breaker Outdoor</td>
<td>LW</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design Sequence No.</td>
<td>9A</td>
<td>25</td>
<td>15A</td>
<td></td>
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<td></td>
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<tr>
<td>Rated Voltage</td>
<td>72.5</td>
<td>126</td>
<td>145</td>
<td>170</td>
<td>252</td>
<td>363</td>
<td>420</td>
</tr>
</tbody>
</table>

### Operating System:
- T: Spring Mechanism
- Y: Hydro-mechanical Mechanism

### Rated Current (A):
- 3150
- 4000
- 5000

### Rated Interrupting Current (kA):
- 40
- 50
- 63

---

### Live Tank Circuit Breaker Product Line

<table>
<thead>
<tr>
<th>With Spring Mechanism:</th>
<th>With Hydro-mechanical Mechanism:</th>
</tr>
</thead>
<tbody>
<tr>
<td>LW9A-72.5/T3150-40</td>
<td>LW15C-252/Y5000-63</td>
</tr>
<tr>
<td>LW25A-145/T3150-40</td>
<td>LW25-363/Y4000-50</td>
</tr>
<tr>
<td>LW25-170/T3150-40</td>
<td>LW15A-363/Y5000-63</td>
</tr>
<tr>
<td>LW25-252/T4000-50</td>
<td>LW15A-550/Y5000-63</td>
</tr>
</tbody>
</table>

### 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.

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