Derwent Top 100 Global Innovator 2020

Gas Insulated Switchgear

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Growing into a World's Best from Nation's First

The company serves its customers!

Leading company in the industrial electric, electronic, materials and energy field following its separation from LG in 2003. LS aims to develop into a company that provides its clients with total solutions, contributes to the overall society, and offers a business environment where employees can realize their dreams.



Innovators in industrial electrical and automation systems

LS goes toward a global leading company in the Industrial electric & Automation field, providing customers with the total solution.

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We provide customers with distinctive and eco-friendly products & Win-Win Strategy in the various fields such as Power Transmission & Distribution ; Electric Equipment ; Automation Equipment & Systems and Smart Grid.



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Gas Insulated Switchgear

Satisfying your various needs



LS's indoor or outdoor GIS are generally selected for many types of power plants and substations to satisfy customers various needs. By opening and closing the Circuit Breaker under normal and fault condition, customer can prevent & protect the implemented facilities over the whole system. LS's GIS complies with the latest international standards & requirement by performing global test laboratory within the range from 25.8kV to 420kV. LS's compact size GIS is comparable with other manufactures within the same rating and we can provide economical & feasible solutions for the customers who has only limited space for GIS.



What's in it for customer?



Compact Design to save Space

A design highly optimized to provide maximum efficiency mechanically and electrically, the 3-phase common encapsulated construction with ideal combination of CB with CT, DS and ES are built into realization.

This spacesaving design, is ideal for use in compact places especially in urban or industrial zone. It is also environment friendly with minimal SF₆ gas usage



High Reliability & Safety

Since the main parts of the switchgear are completely sealed in metal enclosure, GIS is less affected from pollution, climatic changes and dielectric deterioration in consequence of time than air insulated switchgear (AIS).

Our GIS is given early life test and full life test for custo-mers to ensure safety and reliability. Also, diffusion of accident can be prevented by robust gas barrier in case of failure or fault found inside of the GIS.



Long Life and Minimal Maintenance Cost

From design to test operation, our GIS is fully tested and supervised to ensure maximum performance and highest level of quality. Built to last over 30 years, it provides long service life at the lowest maintenance Maintenance is not needed by customer and major inspection is performed 25 years after installation.



Fast Delivery and Easy Installation

With compact and modular design, 2 or 3 bays can be equipped as a single set to save time and cost, resulting faster production and delivery. Using the flange joint from each unit, the GIS can be easily installed and can be expanded without disconnecting power of neighboring module.



Compact Design



Easy Installation & Convenient Maintenance



LS GIS is useful to use in urban-place

Breaking Design

LS's circuit breaker uses superior insulation & arc quenching performance of the SF₆ gas and adopts the puffer and Self-blast, which has a simple operation principle and structure.



Self-Blast Breaking Test



before current zero, for arcextinguish comparing the pressure rise of expansion chamber with arc-voltage



Self-Blast Breaking Test

- 1. Arc energy modeling by considering the nozzle melting
- When shutting off high current, PTFE + SF₆ gas are melted and flow backward into the expansion chamber and it causes pressure to rise
- 3. High current performance evaluation by calculating such as arc energy, pressure at current zero

Mechanical Design

To maximize the mechanical safety of the GIS, values (mass, shape, stress, transformation, etc) of all parts of the GIS are precisely analyzed using the structure analysis programs and three-dimensional design.

Static Stress Analysis





Mechanical Design

Fatigue / Vibration Analysis

Obtain material properties for improved fatigue life and prediction by fatigue analysis







To verify the performance of vibration and seismic, Mechanical Design consider gravitational load, vertical load, wind load for getting GIS mechanical safety

Insulation Design

Coupling : Magnetic Field + Temperature + Heat Flow

Temperature

Velocity Vector

rty r 11





Gas Flow



Temperature





Mechanism Design

The operating mechanism for circuit breaker is hydraulic type or spring stored-energy type that is installed at the bottom of the in parallel, for manual operation and easy to check close-open status for convenient maintenance. The circuit breaker mechanism is composed of separate module which make it a simple design, highly reliable apparatus made from latest technology.

The lifetime of circuit breaker ensures over 10,000 use if the use of the parts is minimal. The circuit breaker mechanism minimizes the influence of temperature.



Operation without Oil pressure recharging	0-00-00-00
Recharging time (from lockout pressure to rated operating pressure)	Below 2 min.
Mechanical endurance (Guaranteed value)	10,000 operations (without oil leakage & deformation)
Service life	30 years

Spring Mechanism

- Closing spring
- Irip spring
- It wheel
- 4 Trip latch
- Closing latch
- Closing chain
- Motor



Operation without spring recharging	0-C0	
Recharging time (from released spring force to charged spring force)	Below 15 sec.	
Mechanical endurance (Guaranteed value)	10,000 operations (without oil leakage & deformation)	
Service life	30 years	

Spring Charging

The motor(7) starts charging the closing spring(1) through the drive gears. The fly Wheel(4) meets the closing latch(5).

Then, the motor is turned off by a control mechanism.

Closing

When the closing latch(5) is released by closing solenoid, the closing spring(1) rotate the fly wheel(4). The main cam(9) which is located on the closing shaft(8) with the fly wheel(4) makes the crank lever(10) rotate. The main shaft(11) is rotated and makes the CLOSE position, and simultaneously the trip spring(2) is charged until meets the trip latch(3).

Tripping

When the trip latch(3) is released by the trip solenoid, the crank lever rotates by the trip spring. And the main shaft(11) is free to rotate in the OPEN direction. At the end of the tripping operation, the rotation of the crank lever is decelerated by oil damper(12) and stopped.



PDPS (Power Equipment Diagnosis & Preventive System)

Through regular monitoring of major power equipment, accidents can be prevented and database management system of events and history of each unit support efficient management of power equipment

GIS / Tr, Switchgear



- SF₆ Gas Density Monitoring
- Analysis of Circuit Breaker operating & Condition
- · Cumulative breaking current
- Cable PD Monitoring
- · Lightening Arrester leakage current

- FAN driving current / time • PUMP driving current / time
- OLTC operating current / time

Diagnosis HMI



Switchgear Diagnosis

- UHF PD Diagnosis (Inside of the PNL)
- VHF PD Diagnosis (Cable)
- Contactless IR Temp Diagnosis (Phase Temp)
- Contact Temp Diagnosis
- Thermo-graphic Diagnosis

Major Monitoring and Supporting Report



GIS PD Diagnosis HMI • Upgrade Reliability for using Neural Network /

- Fuzzy Algorithm • Visual Diagnosis function providing 2D/3D
- chart • PD Pattern by Sensor & Event Filtering





TR Multi-Gas Diagnosis HMI • TR Degradation Diagnosis Function for using Gas Density • Easy for using in-put • Quick search time to be judged

immediately enter the gas concentration



GIS & TR Diagnosis HMI • GIS Partial Discharge

- GIS Gas Density
 Lightening Leakage
- TR Oil- Dissolved Gas

Abnormal Temperature (Oil Temp / Coil Temp)

- TR .FAN Group (Operating Current /Time)
- OLTC (Operating Current / Time)



Total Diagnosis & Report

- Diagnosis by Sensor & Period
- Day / Month / Year Trend Diagnosis
 Max / Min/ Average statistics by Period
- Providing of the Trend data Expansion & Reduction
- Report by Excel Export

CB Mech. Operating Diagnosis



TR Duval's / Dissolve Gas Analysis



PD Data Diagnosis for Using Neural Network/Fuzzy Algorithm



- PD Pattern by Sensor & Event Filtering Function

Multi Channel PD Diagnosis



Switchgear / Mold TR Diagnosis



GIS Line-Up

Installation, Maintenance & Repair Convenience







170	245	362	420
1250~4000	~3150	4000~6300	4000
50	40/50	50/63	50
325	460	520	650
750	1050	1175	1425



Technical Data



IEC 62271-100, 200

IEC 62271-200

IEC 62271-203 / IEC 62271-102



Rateo	kV, rms			
Rated sho	kA, rms			
Rated	sec			
Rated bre	aking current	kA, rms		
Rate	d current	A, rms		
Rated	frequency	Hz		
Rated ma	aking current	kA, peak		
Rated b	reaking time	cycle		
Power	Common	kV, rms		
Frequency Withstand	Across the	kV, rms		
Voltage	isolating distance			
Lightning	Common	kV, peak		
Impulse Withstand	Across the	kV, peak		
Voltage	isolating distance	, թ		
Rated operating sequence -				
Phase	Busbar	-		
ent	Feeder	-		
a	СВ	-		
Operating	DS	-		
	ES	-		
Applicat	ble Standard	-		

25.8	36	72.5	
25/40	40	20	31.5
3	3	1	3
40	40	20	31.5
~3150	1250/2500	20	00
60	50	60	50/60
104	100	50	79/82
	:	3	
70	70	14	40
77	80	160	
150	170	32	25
165	195	375	
	O - 0.3sec - C	0 - 3min - CO	
3 Phases Encapsulate	3 Phases Encapsulate	2 Phases Encapsulate	3 Phases Encapsulate
3 Phases Encapsulate	3 Phases Encapsulate	2 Phases Encapsulate	3 Phases Encapsulate
Motor spring	Motor spring	Hydraulic Motor spring	
Motor	Motor	Mc	otor
Motor	Motor	Manual	Motor



145	170	24	45	30	62	420
40	50	40	50	50	63	50
3	1	3	3	1	1	3
40	50	40	50	50	63	50
~ 3150	1250, 2000, 3150, 4000	up to	3150	4000	~ 6300	4000
50/60	60	50/60	50	6	60	50
100/104	130	100/104	125	130	164	125
	3	3	3	;	3	2
275	325	46	60	52	20	650
315	375 530 675		530		815	
650	750	1050		1050 1175		1425
750	860	12	00	11	75	1425(+240)

O - 0.3sec - CO - 3min - CO

3 Phase Encapsulated	3 Phase Encapsulated	3 Phase Encapsulated	3 Phase Encapsulated	Single Phase Segregated
3 Phase Encapsulated	3 Phase Encapsulated	Single Phase Segregated	Single Phase Segregated	Single Phase Segregated
Motor Spring	Hydraulic	Motor Spring	Hydraulic	Hydraulic
Motor	Motor	Motor	Motor	Motor
Motor Spring	Manual, Motor Spring	Motor, Motor Spring	Manual, Motor Spring	Motor

IEC 62271-100 / IEC 62271-203 / IEC 62271-102

Gas Insulated Switchgear 25.8/36kV GIS

Construction & Single Line Diagram

- 40kA 3150A high performance & designed Vacuum Interrupter.
- Analysis & design of temperature flow for large current.
- Compact Insulator.
- Simplified main circuit part.







- Operating mechanism for CB
- Operating mechanism for 3 position switch
- O Vacuum interrupter
- ④ 3 position switch
- Insulating spacer
- 6 Main bus
- Earth bushing
- Cable
- Current transformer
- Rupture disk
- Absorbent
- Local control panel
- B DS/ES unit
- Circuit breaker
- Earth busbar





Gas Insulated Switchgear

72.5kV GIS

Construction & Single Line Diagram

- Compact design can reduce space requirement.
- Maximize system security with a minimum of maintenance.
- Modular system makes our GIS easier to operate.
- Environmentally friendly Modules are designed optimally to fit in the installation space and the use of SF₆ gas is minimized.





- Bus disconnector with maintenance earthing switch
- Bus disconnector
- Gas barrier
- 4 Circuit breaker
- Operating mechanism for CB
- Current transformer
- Line disconnector with maintenance earthing switch
- Potential transformer
- High speed earthing switch (HSES)

Cable head



Layout - Typical Bay Arrangement



Gas Insulated Switchgear

145kV GIS

Construction & Single Line Diagram

- Maximize system security with a minimum of maintenance.
- Modular system makes our GIS easier to operate.
- Environmentally friendly Modules are designed optimally to fit in the installation space and the use of SF₆ gas is minimized.





- Circuit breaker
- Bus disconnector with maintenance earthing switch
- Bus disconnector
- BCT
- 6 Line DS/ES
- High speed ES (HSES)
- Cable head
- Operating mechanism for CB
- Potential transformer
- Gas area



Layout - Typical Bay Arrangement



Gas Insulated Switchgear

170kV GIS

Construction & Single Line Diagram

- Space-saving design is ideal for use in compact places especially in urban or industrial zone.
- Our GIS is given early life test and full life test for customers to ensure safety and reliability.
- Environmentally friendly Modules are designed optimally to fit in the installation space and the use of SF_6 gas is minimized.







CB/CT Unit

- Line DS/2ES Unit
- Busbar DS/ES Unit
- 4 Bushing Unit
- Operating Mechanism

6 Control panel



Layout - Typical Bay Arrangement



Gas Insulated Switchgear 245kV 40kA GIS

Construction & Single Line Diagram

- · Spacing-saving design for using in compact place in urban & industrial zone
- · Long life and minimal operation cost.





- Gas to air bushing
- Oircuit Breaker
- Current transformer
- Oisconnector and earthing switch
- 6 Main bus
- (f) High speed earthing switch
- Potential transformer
- B Lightning arrester
- Operating mechanism and control panel



Layout - Typical Bay Arrangement



Gas Insulated Switchgear 245kV 50kA GIS

Construction & Single Line Diagram

- · Maximum efficiency mechanically and electrically.
- Space-saving design for using in compact place especially in urban or industrial zone.
- Long life and minimal operation cost.
- Minimal use of SF6 gas by compact design with our high technology.





- Gas to air bushing
- Oircuit Breaker
- Current transformer
- Oisconnector and earthing switch
- 6 Main bus
- (f) High speed earthing switch
- Potential transformer
- B Lightning arrester
- Operating mechanism and control panel



Layout - Typical Bay Arrangement



Gas Insulated Switchgear 362kV 50kA GIS

Construction & Single Line Diagram

- · Condenserless type CB development by Breaking analysis tech up-grade.
- Input resistance optimization by Input thermal capacity analysis.
- DS/ES 3-phase Encapsulate control development by Phase distance downscale.
- It is based to parallel DS design for made Layout compact universal design (DS/ES control, CT & B.G)
- Quality upgrade by One-Bed delivery by Phase distance downscale.
- It is possible to add GIS to established substation.







- Main bus
- Bus disconnector 8 Earthing switch for maintenance
- 4 Current transformer
- G Circuit breaker
- Line disconnector
- Earthing switch for making-proof
- Bushing
- Insulating spacer
- Operating mechanism for CB



Layout - Typical Bay Arrangement



Gas Insulated Switchgear 362kV 63kA GIS

Construction & Single Line Diagram

- Modules are designed to fit in optimal space for installation, while protecting the environment from minimal use of SF6 gas
- · Maximized system security with a minimum of maintenance



- Main bus
- Bus disconnector 8 Earthing switch for maintenance
- 4 Current transformer
- G Circuit breaker
- Line disconnector
- Earthing switch for making-proof
- Bushing
- Insulating spacer
- Operating mechanism for CB



Layout - Typical Bay Arrangement



Gas Insulated Switchgear 420kV 50kA GIS

Construction & Single Line Diagram

- Modules are designed to fit in optimal space for installation, while protecting the environment from minimal use of SF₆ gas
- · Maximized system security with a minimum of maintenance



- Main bus
- Bus disconnector
- 8 Earthing switch for maintenance
- 4 Current transformer
- G Circuit breaker
- 6 Line disconnector
- Earthing switch for makingproof
- Bushing
- Insulating spacer
- Operating mechanism for CB
- Potential Transformer



Layout - Typical Bay Arrangement



Manufacturing

Manufacturing Process

Each stage is strictly controlled for the quality and all the assembly works are done in a clean room to ensure the highest level of insulation of the GIS.

The GIS is completely assembled in an assembling room according to the customer's layout and it shall be done the final routine test and assembling check in accordance with customer's requirement to prevent every possible failure. Only those products that have passed the test are delivered to our customer.

GIS Manufacturing



Preparation



Docking



Final Inspection & Testing



Unit Assembling



Unit Assembling



Installation at Site

Research & Development

LS obtained certification about major research and development tasks in some leading countries and continues to invest in developing the best GIS product for our customers worldwide. To produce the highest quality GIS, optimized design is conducted through 3D electric field analysis, arc diagnosis and structure & temperature analysis.



Electro Technology R&D Center



Multi-Physics Technology



DS/ES unit temperature prediction using electro-Magnetic field and temperature flow analysis

Optimized Electric Field Control



3D electric field analysis is used for effective space design and optimization

Interruption Performance Analysis



Arc movement prediction to evaluated breaker capability

Power Testing & Technology Institute



PT&T is a KOLAS-qualified (Korea Laboratory Accreditation Scheme) accredited testing laboratory and provides worldwide testing service with its 1,600MVA-capacity high power laboratory, high voltage laboratory and reliability testing laboratory.



High Voltage Test | Impulse Test

Quality Assurance

Quality product and service to lead customer satisfaction is the motto of LS, and is what motivates the company to perfecting zero-defect product.

The Quality Assurance Program by LS provides strict quality control from promotion, manufacture and delivery in compliance to ISO 9001. It is our goal to provide world-best product to our customers, only to be done by maintaining the latest quality system and service.



Certificates

Customer Satisfaction through Quality & Service - LS is the name you can trust.

LS electric equipment and systems ranging from low to high voltage acquired the KEMA, CESI, ASTA, KERI and other certificates for efficient design and excellent quality. The outstanding quality of our products is recognized for being manufactured with international standards such as IEC, UL, ANSI, GOST and KS.

We also provide the total solution that encompasses rational design and engineering, efficient production and installation, as well as highly accurate testing and analysis of power equipment.





Global Management

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



► R&D



R&D Campus

Focuses on gaining competitive advantages through development industry and continuously developing for LSIS of next generation platforms



Power Device R&D Center

Leading technology in electric future-growth dynamic engines



Automation R&D Center Serves as the main Research Institute Internationally-renowned testing



PT&T (Testing laboratory) center that has formed partnerships with the UL, CE, KEMA and CESI

► Factory



Cheongiu factory (Korea) Electric Products, Mold TR, MV/LV Switchgear, HV GIS











Dalian factory (China) MV/LV Switchgear, MV Contactor



Hanoi factory (Vietnam) MV/LV Switchgear, Mold TR

Cheonan factory (Korea)Busan factory (Korea)PLC, AC Drive, HMI, DCS, PV ModuleHV TR, HVDC, FACTS



efficient and convenient energy solutions.



Safety Instructions

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



· According to The WEEE Directive, please do not discard the device with your household waste.



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