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DISTRIBUTION SOLUTIONS

LeanGear ZS9

Arc-proof Air-insulated Switchgear
for Primary Distribution
12kV 630...2000A 25kA



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Product introduction

LeanGear ZS9

LeanGear ZS9 is an arc-proof medium voltage air-insulated switchgear designed to meet space requirements and ratings of low electrical distribution grids.

It offers optimal safety and reliability standards, consistent with the ABB's Unigear range of switchgear.

The cubicle is fitted with VInd/L, floor-rolling circuit breaker for simple racking-in/out operations without a separate handling trolley.

The switchgear and the earthing switch are operated from the front with the door closed.

With proven robustness and flexibility, the LeanGear ZS9 is tested for tropical conditions.

Main Benefits

- **Safety:** Increased safety level assured by integrated ducting system against effects of internal arc
- **Security:** Comprehensive interlocks provide optimum protection for both personnel and equipment
- **Space:** Maximum functionality in a compact design with reduced footprint and height
- **Space:** Ease of service operation by personnel as switchgear and cable termination height are ergonomically designed
- **Speed:** Minimal service downtime attributable to modular circuit breaker design and built-in features that eliminate use of special handling tools
- **Strength:** Robust panel structure that is proven against external mechanical impacts

Main features

- Type-tested to IEC standards by STL laboratory
- Internal arc classification IAC AFLR 25kA 1s
- Classified as LSC2B-PM
- Up to 1250A, proven for severe climatic conditions compliant to IEC62271-304 Class 2
- Cable termination height of 700mm
- IP4X degree of protection
- Extensible on both sides
- Integrate with ABB Relion® series relay for protection and control

Standard

LeanGear ZS9 switchgear and main apparatus, VInd/L contained in it comply with the following Standards:

- IEC 62271-1 for general purposes
- IEC 62271-200 for the switchgear
- IEC 62271-100 for the circuit breaker
- IEC 62271-102 for the earthing switch
- IEC 60529 for degree of protections

Operating conditions

- Maximum ambient temperature: +40°C
- Minimum ambient temperature: -5°C
- Maximum 24h average of relative humidity: 95%
- Maximum monthly average of relative humidity: 90%
- The normal operation altitudes is up to 1,000m above sea level. For higher altitude, please contact ABB
- Special operating conditions must be discussed with the manufacturer in advance

Application

- Utilities
- Light industries
- Building and infrastructure
- Water and wastewater
- Data centers

Technical data	Unit	Rating	Rating
Rated voltage	[kV]	12	12
Rated power frequency withstand voltage	[kV 1 min]	28/38	28
Rated lightning impulse withstand voltage	[kV]	75/95	75
Rated frequency	[Hz]	50	50
Rated short time withstand current	[kA 3 s]	25	25
Peak current	[kA]	63	63
Rated main busbar current (40°C)	[A]	630...1250	2000
Rated branch connection current (40°C)	[A]	630...1250	2000
Internal arc withstand current	[kA 1 s]	25	25
Internal arc classification to IEC 62271-200		IAC AFLR	IAC AFLR
Overall dimensions of basic cubicles		H[mm]	2235
		W[mm]	800
		D[mm]	1560...2070 ¹⁾
Degree of protection (internal and external)		IP4X ²⁾	IP4X ²⁾
Cable connection height	[mm]	700	700
Approximate weight	[kg]	600	1000

¹⁾ Varies according to the configuration

²⁾ Higher rating up to IP42 external degree of protection available on request

Panel design

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Fig. 1: Basic structure for typical feeder panel.
A: Circuit breaker compartment
B: Busbar compartment
C: Cable compartment
D: Low voltage compartment
E: Integral panel gas duct

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Fig. 2: View of busbar compartment.

IEC Classification

According to IEC 62271-200, LeanGear ZS9 switchgear can be defined as follows:

1. **Loss of service continuity – LSC-2B**
The continued operation of the main busbar and of the cable compartment is guaranteed when normal maintenance is being carried out in the circuit breaker compartment.
2. **Partition Metallic – PM**
LeanGear ZS9 is defined with PM partition class having segregations made of metallic sheets/shutters.
3. **Interlock-controlled accessible compartment**
The front side of LeanGear ZS9 is classified interlock controlled because access to compartments containing high-voltage parts, intended to be opened for normal operation and/or normal maintenance, is controlled by the integral design of the switchgear.
4. **Tool-based accessible compartment**
The rear part of the LeanGear ZS9 is classified tool-based because it is possible to open the compartment containing high-voltage parts, that may be opened but not for normal operation and maintenance, only using a tool. Special procedures are required.
5. **Internal arc classification – IAC AFLR**
The IAC classification is proved by the test according to the following designations:
 - Accessibility: A (switchgear accessible to authorized personnel only), B (to all) and C (not accessible due to installation).
 - F, L, R: Access from the front (F), from the sides (L) and from the rear (R).
 - Test values: test current in kilo amperes (kA), and duration in seconds.
 The LeanGear ZS9 switchgear is classified IAC AFLR 25kA 1s.

Compartment

Each LeanGear ZS9 switchgear has three power compartments: circuit breaker [A], busbar [B] and cables [C], which are segregated from each other by metallic partitions.

Each unit is also fitted with a low voltage compartment [D] where all the instruments and cabling are housed.

The switchgear is provided with an integral panel gas duct [E] for evacuation of the gases produced by an arc.

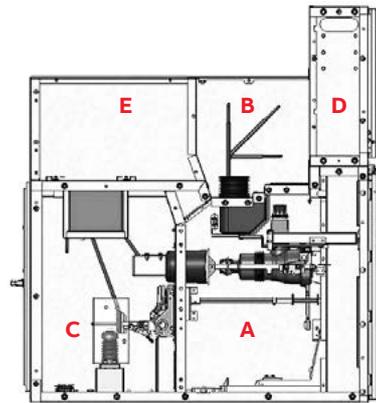


Fig. 1

Main busbar

The busbar compartment contains the main busbar system along the length of the switchgear, which is connected to the fixed upper isolating contacts of the circuit breaker by means of branch connections. The main busbar is made of electrolytic copper with rectangular cross section, and it is covered by insulating material.



Fig. 2

Fig. 3: Internal view of the cable connection compartment.

Fig. 4: Main earth bar assembly.

Fig. 5: Gasduct Exhaust at left end panel.

Cable connections

The cable compartment contains the branch system for connection of the power cables to the lower contacts of the circuit breaker. The feeder connections are made of electrolytic copper and they are flat busbars for the whole range of currents.



Fig. 3

Earthing switch

Each incoming/outgoing feeder compartment can be fitted with an earthing switch for cable earthing. This switch can also be used to earth the busbar system (Bus PT and Bus coupler units). The earthing has short circuit making capability of E1 class.

The position of the earthing switch can be seen from the front of the switchgear by means of a mechanical switch position indicator (refer to Fig. 6).

Earthing busbar

The earthing busbar is made of electrolytic copper. It runs longitudinally all along the switchgear, thereby guaranteeing maximum personnel and installation safety.

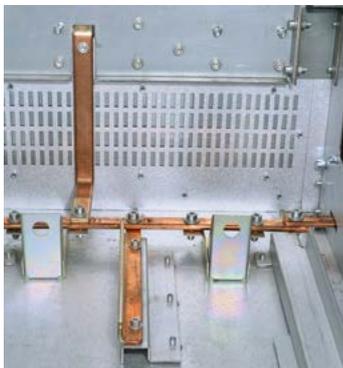


Fig. 4

Cables

Single and three-core cables up to a maximum of two cables per phase with a maximum cross-section of 630mm².

Integral gas duct

The integral gas duct is located just above the cable compartment and runs along its entire length.

Each power compartment is fitted with a flap fixed with steel screws on one longitudinal side and a breakable plastic rivet on the other side.

The pressure generated by the fault opens the flap, allowing the gas to pass into the duct in the event of internal arc.

Gasduct Exhaust

A vertical Gasduct Exhaust is required for releasing the hot gasses generated during internal arc fault to guarantee personnel safety and conformity with the Standards. It is recommended to position on panels at extreme ends of the substation (left or right).

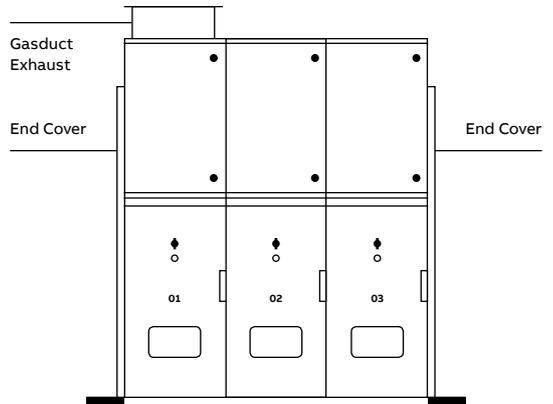


Fig. 5

Interlocking

LeanGear ZS9 has a series of interlocks provided as described below to prevent hazardous situations and erroneous operation and thereby protecting both personnel and equipment.

- The apparatus can only be racked in/out when the door is closed.
- The circuit breaker can only be moved from the test position (and back) when the circuit breaker and earthing switch are off. In the intermediate position, the circuit breaker and earthing switch are mechanically interlocked.

Fig. 6: Locking devices on CB door.

Fig. 7: Mechanical emergency trip arrangement.

- The circuit breaker can only be switched on when it is in the test or service position. In the intermediate position, the circuit breaker is mechanically interlocked.
- In the service position, the circuit breaker can only be switched off manually when no control voltage is being applied and it cannot be closed.
- The earthing switch can only be switched on if the circuit breaker is in the test position or outside of the panel.
- If the earthing switch is on, the circuit breaker cannot be moved from the test position to service position.
- Details of possible interlocks, for example in connection with a locking magnet on earthing switch drive, can be obtained from the relevant references.

The circuit breaker compartment door can be locked in the closed position by means of a padlock.

The operations of circuit breaker racking-in/out and earthing switch opening/closing can be prevented by applying the padlocks to the insertion slots of the relevant operating levers.



Fig. 6

Emergency trip button

LeanGear ZS9 is fitted with a mechanical emergency trip push button. During emergency situation, mechanical trip push button can be used to trip circuit breaker mechanically with front door closed when circuit breaker is in service position.



Fig. 7

ES mechanical switch position indicator

Switchgear tests

Fig. 8(a): LeanGear ZS9 before internal arc test.

Fig. 8(b): LeanGear ZS9 after internal arc test.

LeanGear ZS9 switchgear has undergone all tests required by the International (IEC) Standards.

As indicated in these standards, the tests were carried out on the switchgear units considered most sensitive to the effects of the tests and therefore the results were extended across the whole range.

Routine factory tests are performed on each switchgear unit before delivery. These tests are intended to provide a functional check of the switchgear based on the specific characteristics of each installation.



Fig. 8(a)



Fig. 8(b)

Typical type tests include:

- Short-time withstand current and peak withstand current tests
- Temperature rise tests and measurement of the resistance of circuits (main circuit and auxiliary circuits)
- Capacitor current switching and cable-charging switching tests
- Dielectric tests on the main circuits, and auxiliary and control circuits
- Verification of making and breaking capacity of the circuit breaker
- Verification of making capacity of earthing switch
- Mechanical operation and endurance tests
- Internal arc tests
- Verification of the degree of ingress protection (IP)

Additional type tests include:

- Electromagnetic compatibility tests
- Verification of Design Class 2 for indoor switchgear to be used in severe climatic conditions as per IEC 62271-304
- Verification of the degree of impact protection (IK)

IEC routine factory tests include:

- Dielectric test on the main circuit
- Tests on auxiliary and control circuits
- Resistance measurement of the main circuit
- Design and visual check
- Mechanical operation test

VInd/L circuit breaker

Fig. 9: VInd/L circuit breaker.

Fig. 10: Circuit breaker operating elements.

The new VInd/L medium voltage circuit breakers are the synthesis of ABB technology in designing and constructing vacuum interrupters and of the excellence of design, engineering and production of the circuit breakers. They find their ideal use in LeanGear ZS9 switchgear.

The VInd/L circuit breakers use vacuum interrupters embedded in the poles. This construction technique makes the circuit-breaker poles particularly sturdy and protects the interrupter from impact, dust, deposits, and humidity. The vacuum interrupter houses the contacts and makes up the interrupting chamber.

The ratings are up to 12kV, 2000A, and 25kA.

VInd/L circuit breaker are used in electrical distribution for protection and control of cables, transformers, and capacitor banks.

Operating mechanism

The VInd/L series is fitted with a mechanical operating mechanism of simple conception and use, derived from the same mechanical operating mechanism which equips the VD4 series.

The stored energy operating mechanism with free trip allows opening and closing operations independent of the operator. The spring system of the operating mechanism can be recharged both manually and by means of a geared motor.

Opening and closing of the apparatus can take place by means of the push buttons located on the front of the panel and by means of the electric releases (shunt closing, shunt opening, and undervoltage).

The circuit breaker is always fitted with a mechanical anti-pumping device to prevent repeated sequences of opening and closing operations following simultaneous and maintained opening and closing commands (local and/or remote).

Truck

The poles and operating mechanism are mounted on a metal supporting and handling truck. The truck is fitted with a set of wheels, making rack-in and rack-out of the service position possible with door closed.

The earthing connection between the truck and the panel is established by finger contact in circuit breaker frame and copper connection in panel.

Apparatus-operator interface

The circuit breaker is fitted with the following parts:

- ON button
- OFF button
- An operation counter
- Circuit breaker ON/OFF indicator
- Operating spring Charged/Discharged indicator
- A manual spring operator



Fig. 9



Fig. 10

Typical units

Item	01	02	03	04
Application	IF – Incoming/ outgoing feeder	IF – Incoming feeder with measurements	IF – Incoming feeder with measurements	M – Measurements
Rated current (A)	630-2000A	630-2000A	630-2000A	—
Earthing switch (option)	■	■	■	■
Number of DIN CT per phase	1 / 2	1 / 2	1 / 2	—
Number of VT per phase				
1 Fixed fuse	—	■	—	—
1 Isolatable fuse	—	—	■	—
1 withdrawable fuse	—	—	—	■

Item	05	06	07
Application	BC – Bus coupler	R – Bus riser	RM – Bus riser with measurements
Rated current (A)	630-2000A	630-2000A	630-2000A
Earthing switch (option)	■	—	—
Number of DIN CT per phase	1	—	—
Number of VT per phase			
1 Fixed fuse	—	—	—
1 Isolatable fuse	—	—	—
1 withdrawable fuse	—	—	■



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