BONOMI



AIR-ON PLUS 24 kV

GAS FREE RING MAIN UNIT

Dry-air insulated ring main units with vacuum interruption for secondary distribution

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AIR-ON PLUS: THE GAS FREE RMU

The new AIR-ON PLUS series by Gruppo Bonomi has been designed to meet all medium-voltage secondary distribution needs up to 24 kV.

We have developed optimal SF6-free insulated switchgear for a wide range of applications, from industrial requirements to power generation and distribution.



GWP = 0

Dry air as insulating medium: no SF6 and a Global Warming Potential index of zero.

VACUUM INTERRUPTION

Vacuum bottles coupled with a three-position disconnector ensure breaking and isolating performance.

SAME PLATFORM

Same user interface, footprint, spare parts and operation as the SF_6 platform.

ADVANTAGES

ENVIRONMENTAL SUSTAINABILITY

No SF_6: the new panel uses DRY AIR technology for insulation; thanks to the characteristics of this gas, a Global Warming Potential (GWP) index of zero is achieved.

Sealed system: a stainless steel tank contains all active parts and switching functions, ensuring a high level of reliability, personnel safety and a maintenance-free system.

0
GWP

SAFETY

- Tested against internal arc
- All live parts are housed in a hermetically sealed tank
- Mechanical / electrical interlocking to prevent unsafe operations
- Voltage presence indicators

24 kV
Rated voltage

630A
Rated current

RELIABILITY

- Full insulation with lifetime sealing
- Factory routine tests on 100% of the units

16/20 kA · 1 s
Short-time withstand

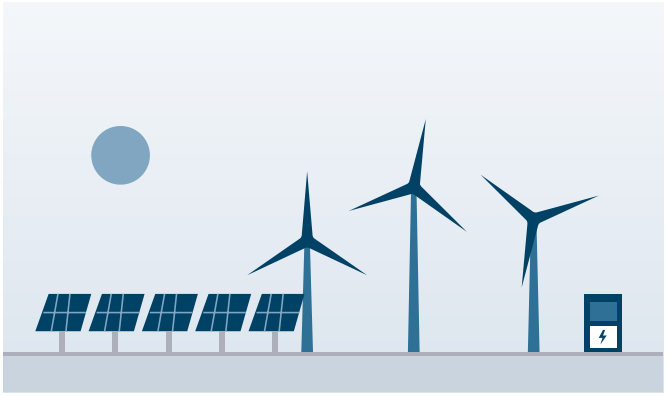
EFFICIENCY

- Modular design, extensible on both sides
- Easy front access to install and test
- Medium-voltage cables and fuses
- Compact size and lightweight

100%
Factory routine tested

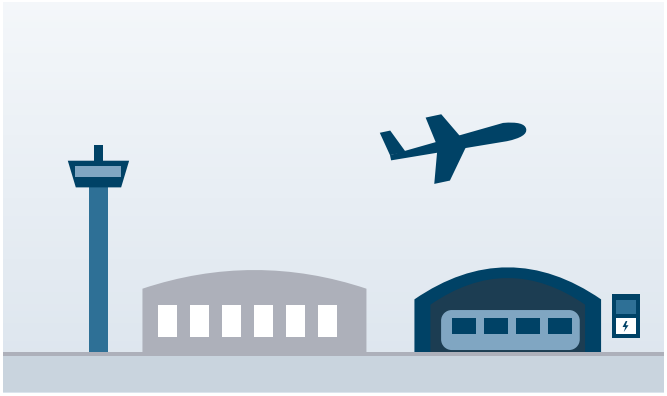
APPLICATIONS

From renewable generation to critical infrastructure: one modular platform for every secondary distribution substation.



ENERGY

- Generation: wind power, solar power
- Distribution: compact substations, ring main network protection
- Private metering
- Large transformer substations
- Separate MV consumer substations



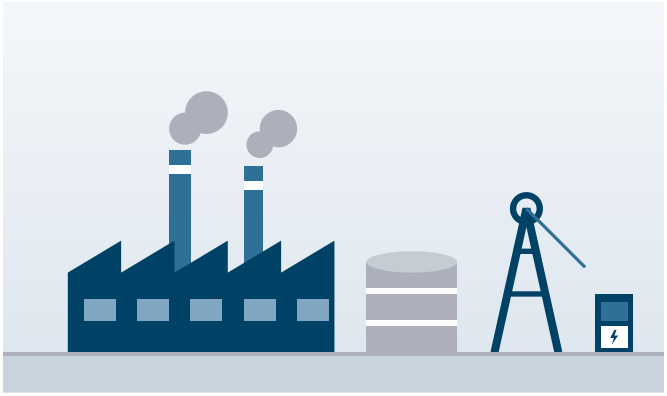
INFRASTRUCTURE

- Tunnels, airports, seaports
- Metro stations, underground railways



BUILDINGS

- Commercial buildings: hospitals, shopping centres, hotels, office buildings, data centres, schools
- Residential buildings: houses, apartments



INDUSTRY

- Tunnels, airports, seaports
- Metro stations, underground railways

OPERATING MECHANISMS

1

CIRCUIT BREAKER OPERATING MECHANISM

The CB unit control mechanism is designed to withstand a mechanical endurance cycle of 10,000 operations.

The operating mechanism is equipped with a mechanical anti-pumping system which guarantees the correct operation of the CB if the closing signal remains active.

The CB operating mechanism can be equipped with an opening coil, a closing coil and a spring charging motor.

2

LBS OPERATING MECHANISM

The mechanism consists of an energy storage system that allows the main shaft of the LBS to rotate in the three positions: open, closed and ground.

The switch-disconnector (LBS) and the earthing switch cannot be closed simultaneously.

The mechanism incorporates mechanical interlocks and padlocks to enhance operational safety.

Anti-reflex mechanism. Installed right on the operating lever, it allows sufficient time for the main (primary or upstream) breaker to trip and clear a fault.

STANDARD	TITLE
IEC 62271-1	Common specifications for alternating current switchgear and controlgear
IEC 62271-100	Alternating current circuit-breakers
IEC 62271-102	Alternating current disconnectors and earthing switches
IEC 62271-103	Switches for rated voltages above 1 kV up to and including 52 kV
IEC 62271-105	Alternating current switch-fuse combinations
IEC 62271-200	AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV

SAFETY FEATURES



Internal arc withstand

01 The sealed stainless steel tanks are fully internal arc rated to ensure maximum operator safety in the event of internal faults. Overpressure valves expel hot gases at the bottom of the panel.

Gas pressure indicator

02 Green and red sectors show the minimum permissible pressure for safe operation. Optional remote pressure alarm and temperature compensated gauge.

Earth and test facility

03 Cable insulation tests and fault location without removing the main cables. The test access cover cannot be opened until the LBS is in the earth position.

OPERATOR SAFETY BY DESIGN

INTERLOCKED
CABLE COMPARTMENT

Compartments are earthed and fully interlocked: access only when the cables are grounded through theearthing switch.

Earth stud
MAIN EARTHING CONNECTION

Fixed inside the cable compartment, towards the bottom of the unit, for connection to the main earthing system.

LSC 2B · PM
SERVICE CONTINUITY

Each compartment can be accessed while the rest of the switchboard stays in service.

GENERAL FEATURES

From renewable generation to critical infrastructure: one modular platform for every secondary distribution substation.

TRANSFORMER PROTECTION

- By a fuse-switch combination for transformers up to 2,000 kVA
- By a circuit breaker with protection relay for transformers up to 8,000 kVA

NETWORK CONNECTIONS

Thanks to line protection with 630 A circuit breakers, network switching by switch-disconnectors and integrated power-supply remote control devices, our RMUs allow different connections.

Enclosure	Metal enclosure, single busbar
Installation	Indoor use up to 1000 m altitude (for higher altitudes please contact the manufacturer)
Ambient temperature	Standard from –15 °C to +40 °C
Loss of service continuity	LSC 2B
Partition class	PM
Rated frequency	50 Hz

24 kV
Rated voltage

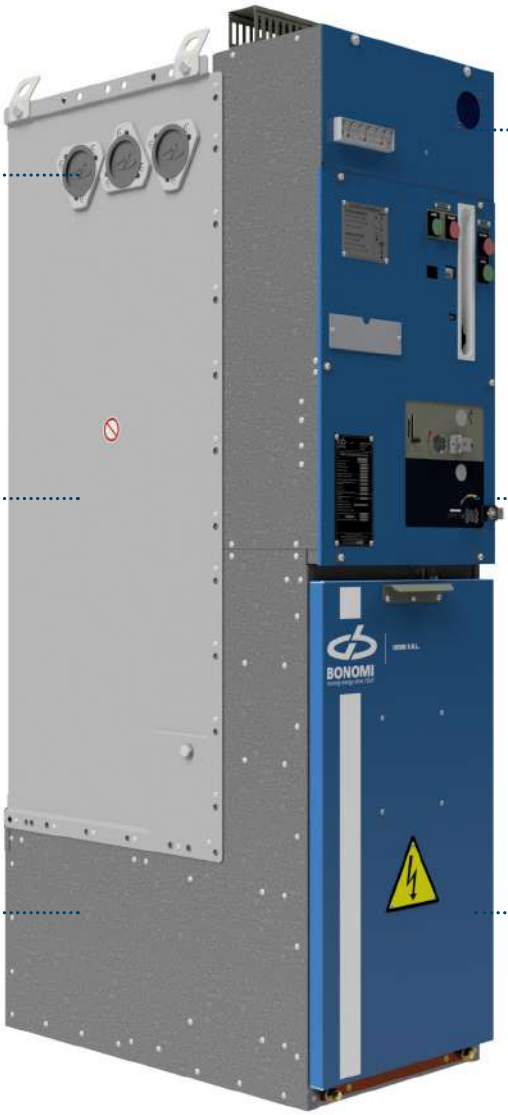
630A
Rated current

16/20 kA · 1 s
Short-time withstand

IP30
Degree of protection

DESIGN

One compact unit built around five functional areas, all accessible from the front.



Busbar connection
Omnibus busbar connection

Voltage indicator system
Voltage presence lamps

Dry-air
Sealed stainless steel tank

Actuator box
Operating mechanisms

Base
Supporting base frame

Cable compartment
Interlocked cable access

INTERLOCKED
OPERATIONS
LBS and earthing switch cannot be closed at the same time.

DRY-AIR
TANK
All live parts inside a hermetically sealed stainless steel tank.

LSC2B · PM
SERVICE CONTINUITY
Each compartment is accessible while the rest of the switchboard stays in service.

MAIN ELECTRICAL FEATURES

LINE LOAD BREAK SWITCH (LBS)		
Rated voltage - U_r	kV	24
Rated lightning impulse withstand voltage, phase-to-earth - U_p	kV	125
Rated lightning impulse withstand voltage, across isolating distance - U_p	kV	145
Rated power-frequency withstand voltage, 1 min - U_d	kV	50
Rated power-frequency withstand voltage, 1 min, across isolating distance - U_d	kV	60
Rated frequency - f_r	Hz	50
Rated current in continuous service - I_r	A	630
Short time withstand current - I_k	kA	16 / 20
Peak withstand curren - I_p	kAp	40 / 50
Short-circuit duration - t_k	s	1
Degree of protectio	-	IP30
Mainly active load breaking curren - I_{load}	A	630
Open loop breaking current – I_{loop}	A	630
No-load line breaking current - I_{lc}	A	13
No-load cable breaking current - I_{cc}	A	40
Mechanical operation class	-	M1
Electrical operation class	-	E3
Short-circuit breaking capacity	kAp	40 / 50
Internal arc classification (AFL)	kA	16 / 20
Arc test duration	s	1

INTEGRATED VACUUM CIRCUIT BREAKER

VACUUM CIRCUIT BREAKER - 24 KV		
Parameter	Unit	Value
Short-time withstand current	kA × s	20 × 1
Making capacity	kAp	50
Rated breaking current – mainly active load	A	630
Rated breaking current – no-load line	A	10
Rated breaking current – no-load cable	A	31.5
First-pole-to-clear factor	-	1.5
Break time	ms	≤ 80
Electrical class	-	E2-C2-S2
Operating sequence	-	O-0.3 s-CO-15 s-CO
Mechanical endurance	-	10,000 (M2)

Vacuum interruption. The circuit breaker unit is associated with a three-position disconnector, suitably interlocked, which guarantees cable disconnection and earthing operations in total safety for the operator.

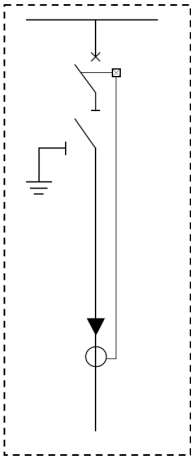
EARTHING SWITCHES

LINE EARTHING SWITCH ST1 - 24 KV		
Parameter	Unit	Value
Short-time withstand current Ik	kA	16 / 20
Peak withstand current Ip	kAp	40 / 50
Short-circuit duration tk	s	1
Short-circuit making capacity	kAp	40 / 50
Mechanical operation class	-	M0
Electrical operation class	-	E2

TRANSFORMER PROTECTION EARTHING SWITCH ST2 - 24 KV		
Parameter	Unit	Value
Short-time withstand current Ik	kA	1
Peak withstand current Ip	kAp	2.6
Short-circuit duration tk	s	1
Short-circuit making capacity	kA	2.6
Mechanical operation class	-	M0
Electrical operation class	-	E2

STANDARD COMPONENTS



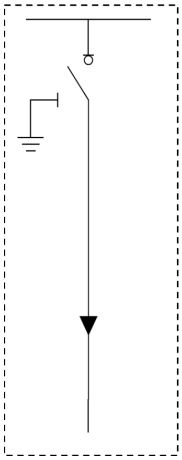


CIRCUIT BREAKER UNIT

I

- Incoming / outgoing unit with vacuum circuit breaker and interlocked three-position disconnector
- Optional sensor bushings (LPIT) as an alternative to CTs and VTs
- Programmable control unit for protection against fault currents up to 50 kAp



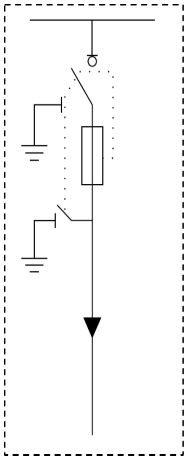


FEEDER UNIT

L

- Incoming, ring or shunt unit
- 3-position load break switch (LBS)
- Cable compartment accessible in “earth” position; manual or motorized control



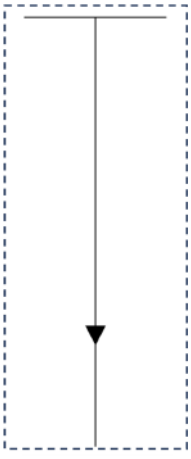


FUSE PROTECTION UNIT

T

- Transformer protection with MV fuses, extensible on both sides
- Opening coil available
- Integrated earthing switch upstream, additional earthing switch downstream of the fuses





RISER UNIT

R

- Direct connection of cables to the omnibus busbar system
- Voltage presence lamps and gas pressure indicator
- Fixed lower front door, opened only with a dedicated tool

REMOTE MONITORING AND CONTROL

Motorized units can be supervised and operated from the control centre: the following signals, commands and measures are available.

PANEL STATUS INFORMATION	COMMANDS FROM CONTROL CENTRE	MEASURES
Closed / open CB / LBS	Single line closing / opening	Voltage
Earthing switch status	Single line locking / unlocking	Current
Local / remote selector		Frequency
Single line lock / unlock		Power
Gas pressure status		
Power supply voltage status		
LV cabinet doors open / closed		

Padlockable local / remote selector. All motorized units can be equipped with a LOCAL / REMOTE selector which inhibits remote operation of the motorization. A padlock can be applied when the selector is in the LOCAL position.

AVAILABLE CONFIGURATIONS

Single units and compact configurations, shown to scale.



Front view to scale · height and width in mm, weight in kg · units 1408 mm high shown on a 238 mm raising plinth

Configuration	Height (mm)	Width (mm)	Depth (mm)	Weight (kg)
I 24 kV	1.646	450	836,5	210
L 24 kV	1.408	381	762,5	180
T 24 kV	1.408	521	762,5	236
M 24 kV	1.408	601	862,5	310
2I+1T 24 kV	1.646	1.394	836,5	645
3I 24 kV	1.646	1.318	836,5	665

I Circuit breaker unit · L Feeder unit · T Fuse protection unit · M Metering unit · The Gas Free version shares the same footprint as the SF_6 platform.

OEM PARTNERSHIP: LOCAL INTEGRATION

A partnership model for locally integrated MV secondary distribution panels. Gruppo Bonomi manufactures and tests the core of the RMU; the local partner completes, assembles and tests the panel close to the end market.

01

BONOMI

MANUFACTURING & TESTING

- Motor operating mechanism, incoming/outgoing line (LBS)
- Fuse protection LBS
- Stainless steel main tank
- Voltage detecting system
- Standard bushings
- In-line & routine tests
- Packaging

02

SHIPMENT

SEMI - FINISHED GOODS

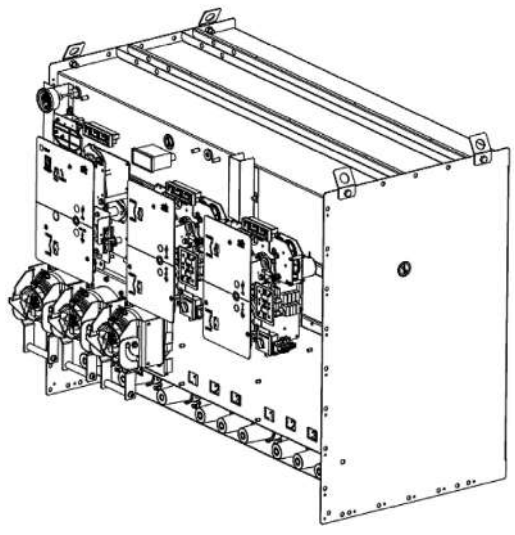
- Core parts shipped to the partner
- Transport to site
- Import duties on semi-manufactured goods for localintegration

03

PARTNER

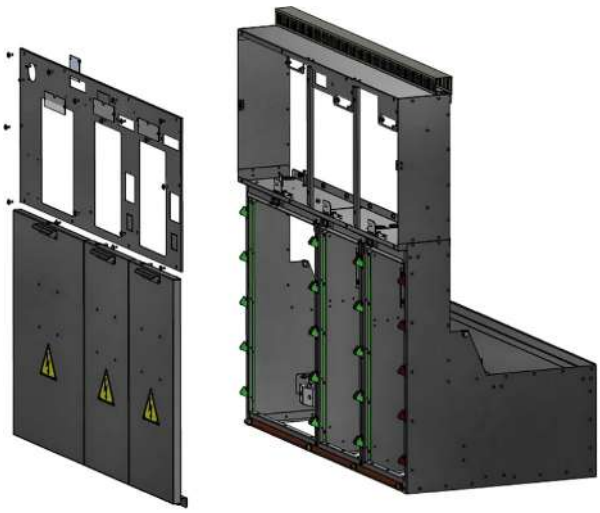
FINAL ASSEMBLY

- Panel completion items: base, carter, doors, auxiliary compartment
- Assembly and wiring
- Mechanical interlock test
- Functional operation test



BONOMI SCOPE · COREPARTS

Stainless steel main tank, operating mechanisms (LBS), bushings and voltage detecting system, manufactured and routine-tested by Gruppo Bonomi.



PARTNER SCOPE · PANEL COMPLETION

Base, carter, doors and auxiliary compartment, plus assembly, wiring, mechanical interlock and functional tests.

VDS AND VPIS

VOLTAGE DETECTING SYSTEM

PERSONNEL PROTECTION TO THE MOST RESTRICTIVE STANDARD

RMU panels with circuit breaker can be equipped with a protection relay interfaced through an RJ45 plug with the sensored bushings installed in the unit, simplifying installation and instrument cell engineering.



IEC 61243 - 5
Tested and manufactured to standard

SELF-POWERED
Leakage current from MV insulators, no auxiliary supply

PERMANENT INDICATION
High-brightness LEDs or display per phase



ENEL HOMOLOGATED

DETECTORS TO DY811 SPECIFICATIONS

- SMTE/F — fixed flush-mounted part
- SMTE/ML — three moving parts, one for each phase
- Capacitive coupling as power supply source
- New LED technology signalling inside the moving parts

VPIS ready. Sensored bushings ISCT 24I / 24E provide a capacitive coupling of about 10–15 pF on a dedicated output, usable with VDS according to IEC 61243-5 and with Voltage Presence Indicating Systems (VPIS) according to IEC 62271-206.

FAULT INDICATOR AND PROTECTION RELAYS

FAULT INDICATOR

Our RMUs can be equipped with a fault indicator system that identifies the fault and reports it immediately, inside and outside the MV substation.

CURRENT SENSORS

Applied directly to the MV cables

FAULT DETECTION

Phase-to-phase or phase-to-earth

LOCAL ALARM

Message shown on the device display

REMOTE SIGNAL

To monitoring devices and / or an external light

PROTECTION RELAY

PLUG-AND-PLAY RJ45 CONNECTION

RMU panels with circuit breaker can be equipped with a protection relay interfaced through an RJ45 plug with the sensored bushings installed in the unit, simplifying installation and instrument cell engineering.



SCT 24 I

RJ45

Protection relay

COMPATIBLE PROTECTION RELAYS

Relays compatible with our LPIT-type sensors — all offer a wide range of protections for every plant requirement.

ABB
REC615

THYTRONIC
NA60 series

FANOX
Protection relays

SEL
Schweitzer Engineering Laboratories 715

SCT 24I · Bushing insulator with combined LPIT current / voltage sensor for indoor use.

BUSHING INSULATORS WITH SENSOR ISCT 24I AND ISCT 24E

Models ISCT 24I and ISCT 24E are a new type of bushing insulators equipped with measuring systems, proposed as an alternative to traditional CTs and VTs for measuring current and voltage, reducing known criticalities such as reliability, size and cost.

MAIN CONCEPTS

This new generation of sensors is made without ferromagnetic cores, allowing high linearity and accuracy over a wide bandwidth in the measurement of currents and voltages, including higher-order harmonics. The absence of ferromagnetic cores also prevents hysteresis and saturation phenomena, which can cause deflagration and permanent damage to the network. ISCT 24I and ISCT 24E are passive sensors with negligible energy absorption and are therefore "energy saving" products. They can be used with electronic protection relays that allow the setting of transformation ratios and have RJ-45 inputs.

Standards: IEC 61869-10 (2018) and IEC 61869-11 (2018).

LPCT – CURRENT SENSOR

The current sensor uses a Rogowski transducer and therefore offers a differential voltage output signal [pin 1.s1 and pin 2.s2 of the RJ45 connector]. As per IEC 61869-10, there is no current output as in conventional CT models.

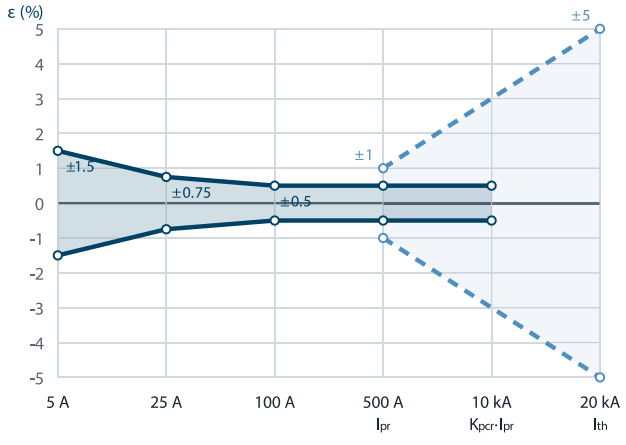
LPVT – VOLTAGE SENSOR

The voltage sensor uses a capacitive divider coupled to the primary busbar, providing a single-ended polarized voltage output signal [pin 7.a and pin 8.n of the RJ45 connector].

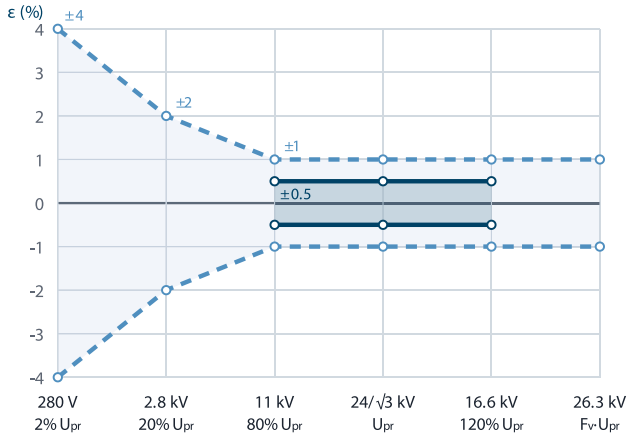
Application. The new LPIT ISCT 24I and ISCT 24E bushings are compact and designed for indoor and outdoor gas-insulated switchgear (RMU). Outdoor: silicone cover, creepage distance over 820 mm and male M16 threaded termination. Indoor: type C interface according to EN 50180 and EN 50181, female M16 threaded termination, compatible with the separable connectors prescribed in EN 61238-1.

LINEARITY, ACCURACY AND CONNECTORS

This generation of LPIT bushing insulators performs differently from older ferromagnetic-core versions: the current sensor is in accuracy class 0.5S / 5P40, while the voltage sensor is in class 0.5 / 1P.



LPCT CHARACTERISTIC CURVE (CURRENT)



LPVT CHARACTERISTIC CURVE (VOLTAGE)

CORRECTION FACTORS

The phase error of the current and voltage sensors is constant and does not depend on primary voltage and current. Each ISCT 24I / 24E bushing is characterized in terms of ratio error and phase error against a class 0.1 reference, in both current and voltage. This characterization can be fed into the protection relay to achieve the highest accuracy class.

CONNECTORS

As prescribed in IEC 61869-10 and IEC 61869-11, the ISCT 24I and ISCT 24E bushings are equipped with a CAT-6 cable with RJ-45 connector for signal transmission, wired as follows:

RJ45 connector	1	2	3	4	5	6	7	8
Passive LPCT	S1	S2						
Passive LPVT							a	n
Reserved for TEDS			+			-		
Reserved for power supply				+	-			

EARTHING AND TECHNICAL DATA

EARTH REFERENCE

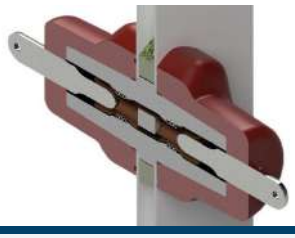
No screen inside the sensor assembly is referred to earth via the protection relay, to prevent its damage in the event of faults. The earth reference of the ISCT 24I / 24E bushings is ensured by the RMU fixing inserts and by an additional redundancy cable.

CAPACITIVE COUPLING FOR VOLTAGE SIGNALLING

A capacitive coupling of about 10–15 pF is available as voltage absence / presence signal, through a dedicated output and cable separate from the RJ-45 cable. It can be used with VDS according to IEC 61243-5 and VPIS according to IEC 62271-206.

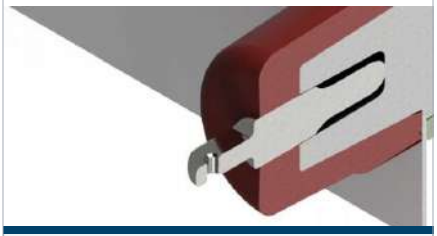
TECHNICAL DATA • ISCT 24I / 24E	
Max. voltage U_m	24 kV
Insulation level	24 / 50 / 125 kV
Nominal frequency	50 / 60 Hz
VOLTAGE SENSOR LPVT	**IEC 61869-11**
U_m Max. voltage	24 kV
U_{pr} Primary voltage	24/√3 kV
K_r Transformation ratio	10,000 : 1
Accuracy class	0.5 / 1P
R_{br} Rated burden	≥ 2 MΩ, ≤ 50 pF
F_v Rated voltage factor	1.9 / 8 h
CURRENT SENSOR LPCT	**IEC 61869-10**
Nominal current	630 A
Rated primary current	500 A: 150 mV @ 50 Hz, 180 mV @ 60 Hz
Accuracy class	0.5 / 5P40
R_{br} Rated burden	≥ 20 kΩ, ≤ 500 pF
K_{pcr} Extended primary current factor	40
I_{th} Short-time thermal current	20 kA × 1 s
I_{dyn} Dynamic short-circuit current	50 kA

JOINT SYSTEM AND EXTENSIBILITY



JOINT SYSTEM

Our complete system allows the connection of two RMU switchboards up to 24 kV and 630 A. The customer is provided with everything, including the contacts inside the joint, rated 20 kA Icc.



EXTENSIBILITY CAP

An RMU switchboard can be prepared for a future junction with a corresponding RMU up to 24 kV and 630 A. Everything needed to plug the hole prepared for the future joint is supplied.



BUSBAR CABLE ARRIVAL KIT

The kit transforms an RMU with end bushings into a unit with cable arrival directly on the omnibus busbars, saving a riser unit in highly compact solutions.



SILICONE BUSHING FOR JOINT

Designed to couple the busbars of gas-insulated switchgear.

ITEM	Um (kV)	In (A)	Icc (kA)
Bushing incl. sealing and safety ring	24	630	20



SILICONE DUMMY PLUG FOR JOINT

Closes the joint interface when no extension is installed.

ITEM	Um (kV)
Dummy plug	24

OUR REFERENCES

DID YOU KNOW THAT ...

We are energy: we live following our ideas, we stimulate ingenuity and turn it into high-performance solutions. Our numerous certifications, approvals and patents confirm we are moving in the right direction and guarantee our customers top-level references.



UTILITIES THAT CHOSE GRUPPO BONOMI

Ampla
CELG DISTRIBUIÇÃO
edelnor
Electricity Of Lebanon
enel
EDESUR
CODENSA Mucho más que energía
endesa
chilectra
coelce Companhia Energética do Ceará
senelec
Office National de l'Electricité
SONELGAZ

NOTE

BONOMI
moving energy since 1928

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