BONOMI



RMU 17.5 · 24 · 36 kV

RING MAIN UNIT

SF_6 gas-insulated ring main units for medium-voltage secondary distribution

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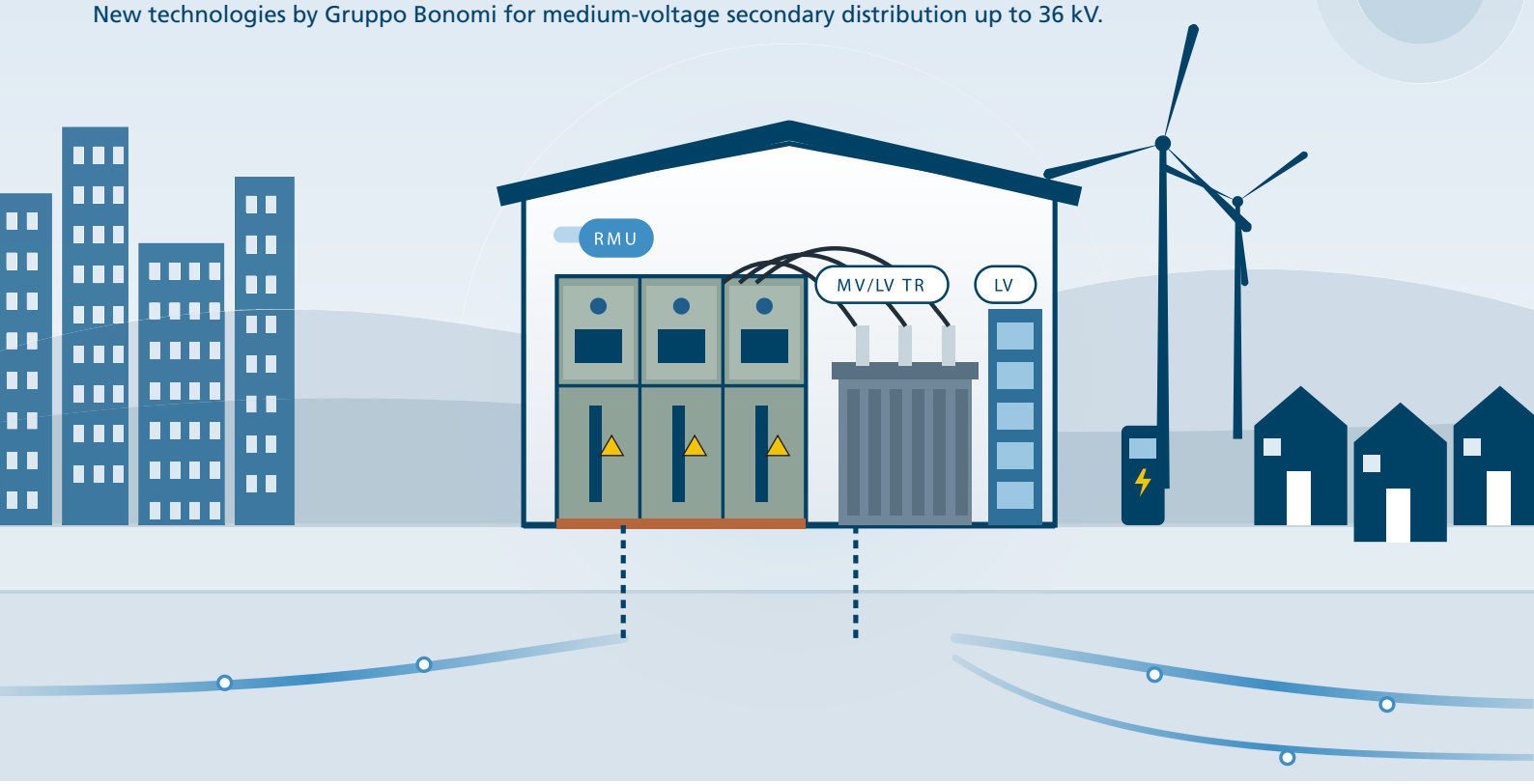
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OUR NEW RMU

New technologies by Gruppo Bonomi for medium-voltage secondary distribution up to 36 kV.



The new RMU series by Gruppo Bonomi has been designed to meet all medium-voltage secondary distribution needs up to 36 kV.

We have developed optimal SF_6 gas-insulated switchgear for a wide range of applications, from industrial requirements to power generation and distribution.

MODULES I L T M R

36 kV
Max rated voltage

630 A
Rated current

21 kA · 3 s
Short-time withstand (17.5 kV)

100 %
Factory routine tested

SEALED FOR LIFE
Stainless steel SF_6 tank

MODULAR
Extensible on both sides

ARC-RATED
Internal arc classified (AFL)

WHY OUR RMU

SAFETY

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

RELIABILITY

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

MECHANICAL ENDURANCE

10,000

operations, CB operating mechanism (M2)

EFFICIENCY

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

THREE VOLTAGE CLASSES · ONE PLATFORM

Insulation levels per rated voltage U_r



17.5 kV
BIL 95 kV · 38 kV 1 min · 21 kA × 3 s

24 kV
BIL 125 kV · 50 kV 1 min · 20 kA × 1 s

36 kV
BIL 170 kV · 70 kV 1 min · 20 kA × 1 s

630 A
Rated current

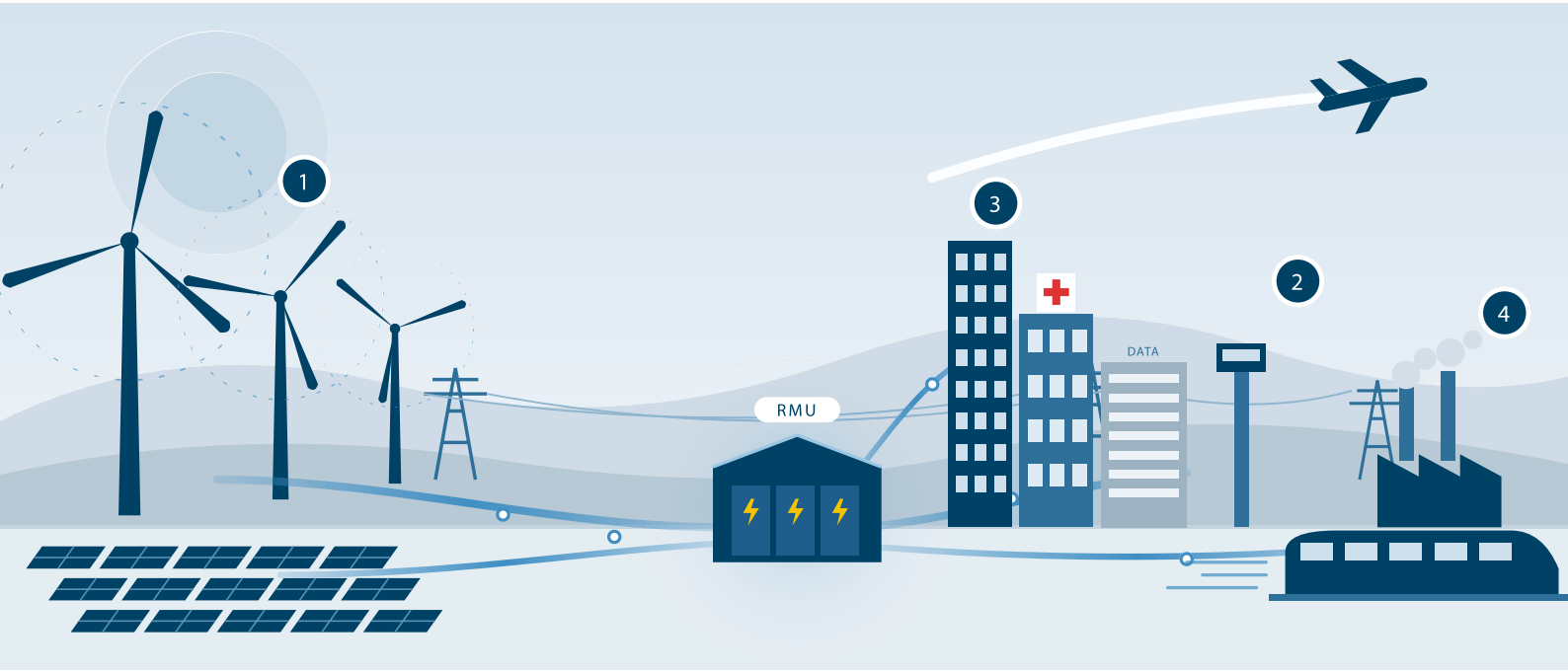
IP30
Degree of protection

E3 · M1
LBS electrical / mechanical class

LSC2B
Loss of service continuity

APPLICATIONS

From renewable generation to critical infrastructure: one modular platform at the heart of every secondary distribution substation.



1

Energy

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

2

Infrastructure

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

3

Buildings

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

4

Industry

- Water and waste water, mining, minerals, automotive
- Iron and steel, cement and petroleum

OPERATING MECHANISMS

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 correct operation of the CB if the closing signal remains active.

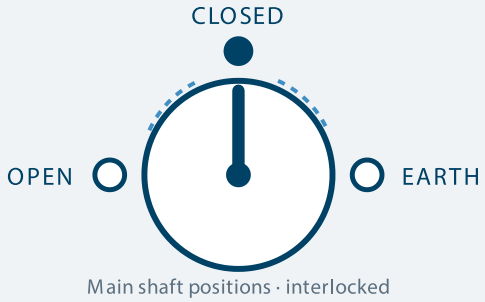
It can be equipped with an opening coil, a closing coil and a spring-charging coil.

CB | Opening coil | Spring charging

LOAD BREAK SWITCH MECHANISM

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

The switch-disconnector and the earthing switch cannot be closed simultaneously. Mechanical interlocks and padlocks 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.

REFERENCE STANDARDS

The RMU switchgear is designed and tested according to the following IEC standards.

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 BY DESIGN

Gas pressure indicator

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

Internal arc withstand

The SF_6-insulated stainless steel tanks are fully internal-arc rated for maximum operator safety in the event of internal faults. Overpressure valves expel hot gases at the bottom of the panel.



Earth and test facility

Cable insulation tests and fault location without removing the main cables. The test access cover is interlocked: it opens only with the LBS in earth position.

Cable compartment

Earthed and fully interlocked: operator access is allowed only with the function in the earth ON position.

Earth stud

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

INTERLOCKED

OPERATIONS

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

SEALED FOR LIFE

GASTANK

All live parts inside a hermetically sealed stainless steel tank.

LSC2B · PM

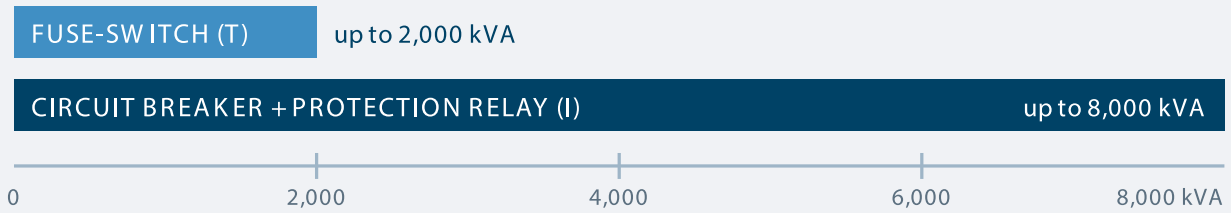
SERVICE CONTINUITY

Each compartment is accessible while the rest of the switchboard stays in service.

GENERAL FEATURES

Gruppo Bonomi's gas-insulated RMU switchboards enable the connection, supply and protection of transformers in open-ring or radial networks.

TRANSFORMER PROTECTION



NETWORK CONNECTIONS

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

DESIGN

- Busbar connection
- Gas tank
- Actuator box
- Voltage indicator system
- Cable compartment
- Base

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

MAIN ELECTRICAL FEATURES

LINE LOAD BREAK SWITCH	UNIT	17.5 kV	24 kV	36 kV
Rated voltage U_r	kV	17,5	24	36
Rated lightning impulse withstand voltage, phase-to-earth U_p	kV	95	125	170
Rated lightning impulse withstand voltage, across isolating distance U_p	kV	110	145	195
Rated power-frequency withstand voltage, 1 min U_d	kV	38	50	70
Rated power-frequency withstand voltage, 1 min, across isolating distance U_d	kV	45	60	80
Rated frequency f_r	Hz	50/60	50/60	50/60
Rated continuous current I_r	A	630	630	630
Short-time withstand current I_k	kA	21	20	20
Peak withstand current I_p	kA	55	52	52
Short-circuit duration t_k	s	3	1	1
Degree of protection	–	IP30	IP30	IP30
Mainly active load breaking current I_{load}	A	630	630	630
Open-loop breaking current I_{loop}	A	630	630	630
No-load line breaking current I_{lc}	A	13	13	13
No-load cable breaking current I_{cc}	A	40	40	40
Mechanical endurance class	–	M1	M1	M1
Electrical class	–	E3	E3	E3
Short-circuit making capacity	kA	55	52	52
Internal arc classification (AFL)	kA	21	20	20
Arc test duration	s	1	1	1

VACUUM CIRCUIT BREAKER AND EARTHING SWITCHES

INTEGRATED VACUUM CIRCUIT BREAKER	UNIT	17.5 KV	24 KV	36 KV
Short-time current	kA × s	21 × 3	20 × 1	20 × 1
Making capacity	kAp	55	50	50
Rated breaking current – mainly active load	A	630	630	630
Rated breaking current – no-load line	A	10	10	10
Rated breaking current – no-load cable	A	31.5	31.5	31.5
First-pole-to-clear factor	–	1.5	1.5	1.5
Break time	ms	≤ 80	≤ 80	≤ 80
Electrical class	–	E2-C2-S2	E2-C2-S2	E2
Operating sequence	–	O-0.3 s-CO-15 s-CO	O-0.3 s-CO-15 s-CO	O-0.3 s-CO-15 s-CO
Mechanical life	–	10,000 – M2	10,000 – M2	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.

LINE EARTHING SWITCH ST1	Unit	17.5	24	36
Short-time withstand Ik	kA	21	20	20
Peak value Ip	kA	55	52	52
Short-circuit time tk	s	3	1	1
Making capacity	kA	55	52	52
Mechanical class	–	M0	M0	M0
Electrical class	–	E2	E2	E2

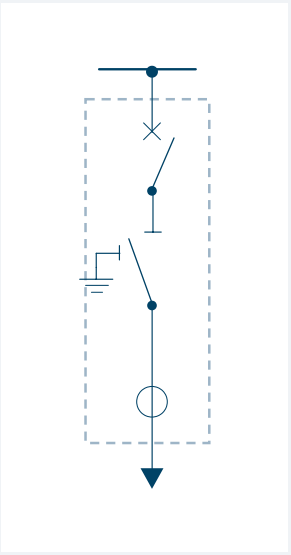
TRANSFORMER EARTHING SWITCH ST2	Unit	17.5 / 24	36	36
Short-time withstand Ik	kA	1	1	20
Peak value Ip	kA	2.6	2.6	52
Short-circuit time tk	s	1	1	1
Making capacity	kA	2.6	2.6	52
Mechanical class	–	M0	M0	M0
Electrical class	–	E2	E2	E2

SINGLE-FUNCTION MODULES

I Circuit breaker unit

- Incoming / outgoing unit with vacuum CB and interlocked three-position disconnector
- Optional sensor bushings (LPIT instead of CTs / VTs
- Programmable protection against fault currents up to 50 kAp

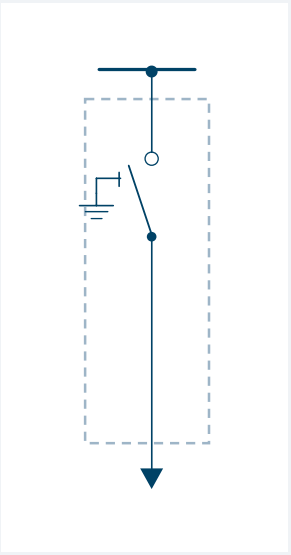




L Feeder unit

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

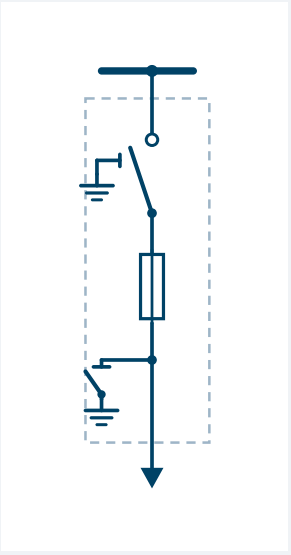




T Fuse protection unit

- Transformer protection with MV fuses, extensible on both sides
- LBS opening coil available
- Earthing switches upstream (integrated) and downstream of the fuses

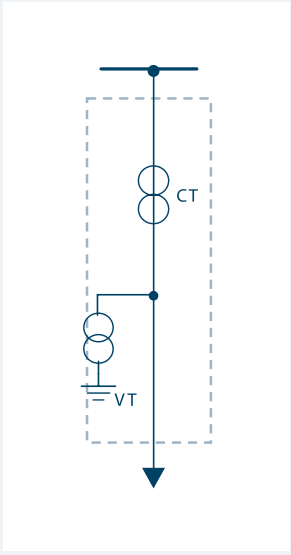




M Metering unit

- Dedicated panel for busbar current and voltage measurement
- DIN-type CTs and VTs with ratios to customer specification
- Instrument transformers embedded in an SF_6-insulated case

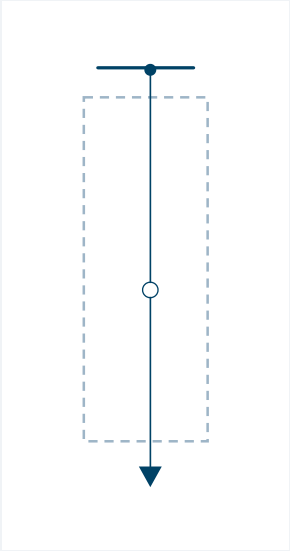




R Riser unit

- 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



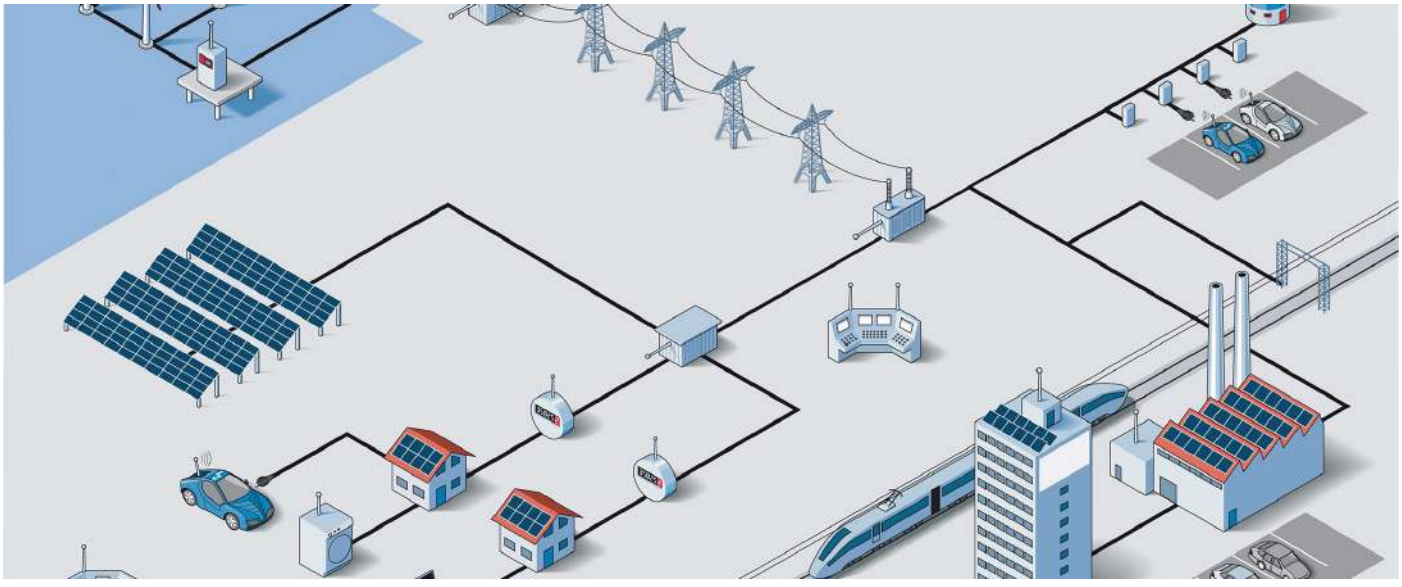


MIX & MATCH

Single units can be coupled with any other module of the RMU family to compose the substation layout best suited to each customer.

Extensible on both sides through the joint system.

L + I + T + M + R

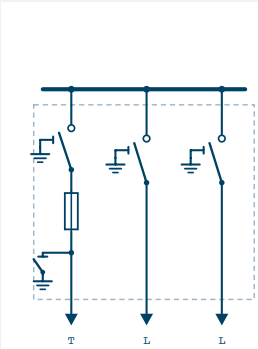


COMPACT MULTI-FUNCTION UNITS

2L+T Double feeder + fuse protection

- Transformer protection module plus two incoming / outgoing LBS feeders
- Fuse earthing upstream and downstream; opening coil available
- Available with right and/or left extensibility

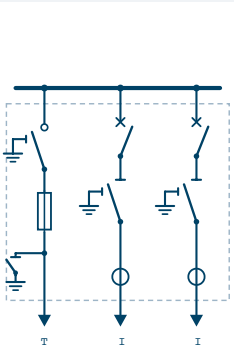




2I+T Double CB feeder + fuse protection

- Two incoming / outgoing CB feeders and a transformer protection module
- Embedded sensor bushings with programmable control unit, protection up to 50 kAp
- Manual or motorized control

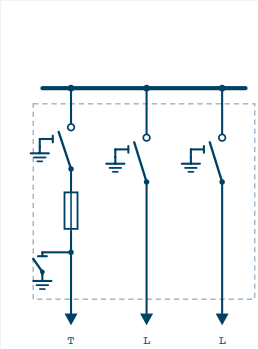




LITE 2L+T 24 kV lite version

- Innovative cell layout: significantly reduced dimensions, same electrical and mechanical performance
- Easy handling and installation in confined substations
- Accessories configurable to end-customer needs

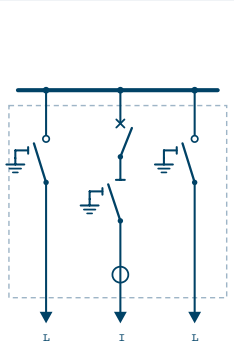




TEE-OFF 2L + 1I SEC unit

- Two feeder units and a CB unit used as transformer protection
- Designed to SEC 32-SDMS-11 and 32-SDMS-01, with cable test
- system
- Conventional and SMART versions





TEE-OFF UNIT: REMOTE MONITORING AND CONTROL



A new SF_6-insulated switchgear of the RMU family, consisting of two feeder units and a circuit-breaker unit used for transformer protection, developed in accordance with technical specifications **SEC 32-SDMS-11** and **32-SDMS-01**.

A cable test system allows each cable to be tested without removing it from the panel; the interlocking systems guarantee the highest level of safety for the operator and for the network.

Conventional

Relays and current sensors for network protection, completed by an earth-fault relay.

SMART

Remote control via RTU + 4G modem over secure VPN / APN connection.



PANEL STATUS
Closed / open CB / LBS
Earthing switch status
Local / remote selector
Single line lock / unlock
SF_6 pressure status
Power supply voltage status
LV cabinet doors open / closed

REMOTE COMMANDS
Single line closing / opening
Single line locking / unlocking

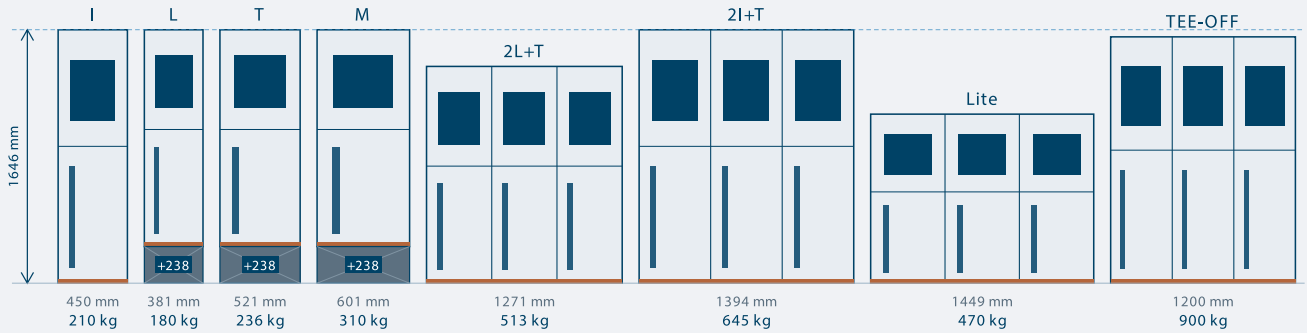
MEASURES
Voltage
Current
Frequency
Power

> 24 h

or 50 open / close cycles of energy buffer from the battery system, powering all 24 V DC circuits: auxiliary relays, RTU, modem and operating system.

AVAILABLE CONFIGURATIONS

Front views to scale (24 kV versions).



CONFIGURATION	HEIGHT (MM)	WIDTH (MM)	DEPTH (MM)	WEIGHT (KG)
SINGLE MODULES				
I 24 kV / 36 kV	1646	450 / 500	836.5	210 / 250
L 24 kV / 36 kV	1408	381	762.5 / 862.5	180 / 190
T 24 kV / 36 kV	1408	521 / 601	762.5 / 862.5	236 / 266
M 24 kV / 36 kV	1408	601	862.5 / 927.5	310 / 360
COMPACT CB-BASED UNITS • 24 KV				
2I+1T	1646	1394	836.5	645
3I	1646	1318	836.5	665
3I+1T	1646	1834	836.5	810
4I	1646	1763	836.5	865
4I+1T	1646	2289	836.5	1162
2I+2T	1646	1928	836.5	934
COMPACT LBS-BASED UNITS				
2L+T 24 kV / 36 kV	1408	1271 / 1351	762.5 / 862.5	513 / 540
2L+2T 36 kV	1408	1948	862.5	780
3L+T 36 kV	1408	1726	862.5	481
4L+T 36 kV	1408	2100	862.5	720
3L 24 kV	1408	1130	762.5	460
4L 24 kV	1408	1406	762.5	610
SPECIAL VERSIONS				
2L+I 17.5 kV	1593	1198	1006	600
2L+1T 24 kV Lite version	1098	1449	920	470
2L+1I SEC TEE-OFF	1600	1200	860	900

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

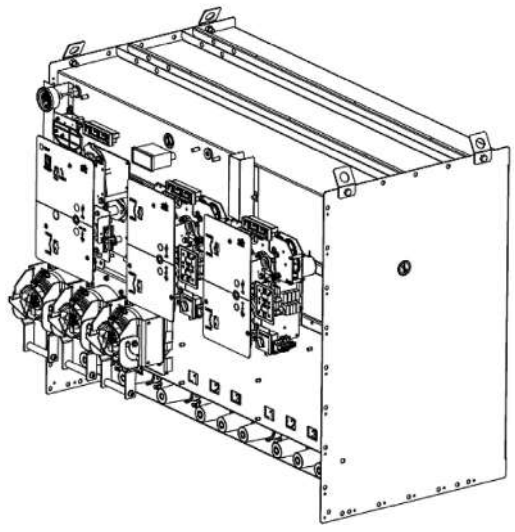
- Core parts shipped to the partner
- Transport to site
- Import duties on semi-manufactured goods for localintegration

03

PARTNER

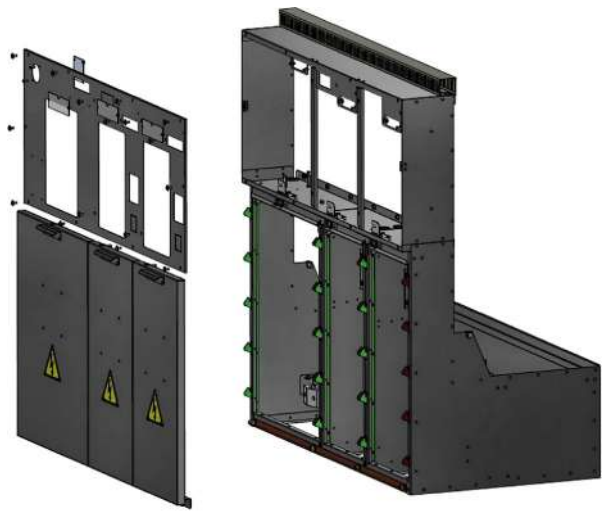
FINAL ASSEMBLY

- 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 phase-to-phase or phase-to-earth faults through current sensors applied directly to the MV cables, and reports them 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 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

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.

BUSHING INSULATORS WITH SENSOR ISCT 24I AND ISCT 24E

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

This new generation of sensors is made without ferromagnetic cores, achieving high linearity and accuracy over a wide bandwidth, including higher-order harmonics. Without ferromagnetic cores there is no hysteresis or saturation, which can cause deflagration and permanent damage to the network.

ISCT 24I and 24E are passive sensors with negligible energy absorption — "energy saving" products. They work with electronic protection relays that allow transformation-ratio setting and have RJ-45 inputs.



IEC 61869 - 10 · -11 (2018)

CURRENT SENSOR

LPCT

Uses a Rogowski transducer with differential voltage output [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.

OUTDOOR · ISCT 24E

LPVT

Outdoor silicone cover, creepage distance greater than 820 mm and male M16 threaded termination, for indoor and outdoor SF_6-insulated RMUs.

INDOOR · ISCT 24I

C-type connection interface according to EN 50180 / EN 50181, female M16 threaded termination, compatible with disconnectable terminals to EN 61238-1.

OUTDOOR · ISCT 24E

Outdoor silicone cover, creepage distance greater than 820 mm and male M16 threaded termination, for indoor and outdoor SF6-insulated RMUs.

NO SATURATION

No ferromagnetic core: no hysteresis, no saturation

WIDE BAND

High linearity, including higher-order harmonics

ENERGY SAVING

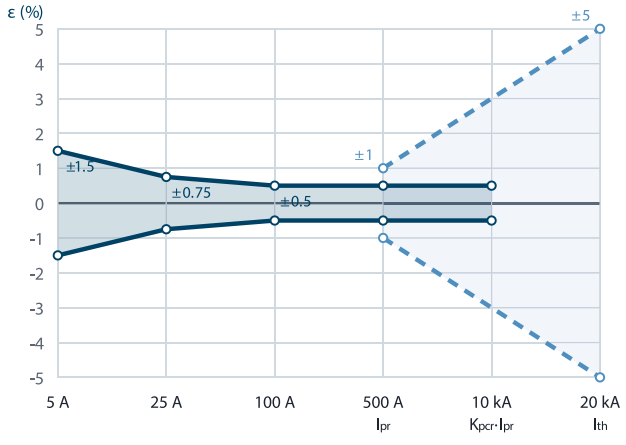
Passive sensors with negligible absorption

RJ-45

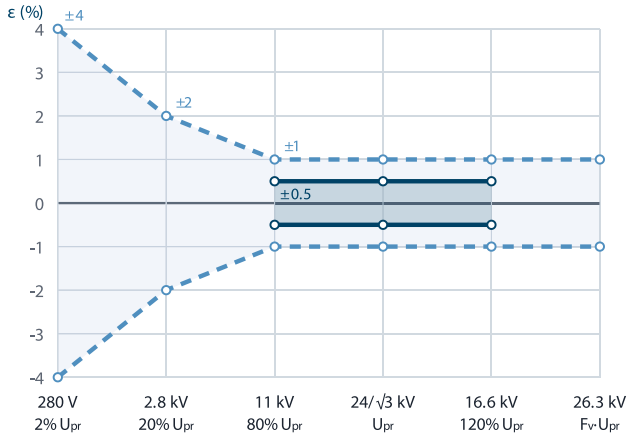
Direct link to electronic protection relays

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, preventing 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 a voltage absence / presence signal through a dedicated output and cable, separate from the RJ-45 cable, usable with VDS to IEC 61243-5 and VPIS 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

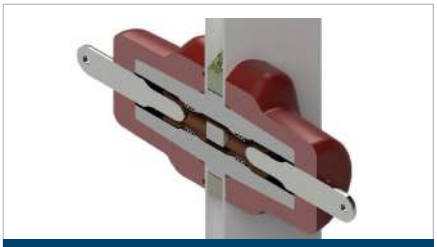
VOLTAGE SENSOR LPVT · IEC 61869-11	
U_m Max. voltage	24 kV
U_{pr} Primary voltage	$24/\sqrt{3}$ kV
K_r Transformation ratio	10,000 : 1
Accuracy class	0.5 / 1P
R_{br} Rated burden	≥ 2 MΩ, ≤ 50 pF
F_v Rated voltage factor	1.9 / 8 h

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	0.5S / 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

APPLICABLE STANDARDS

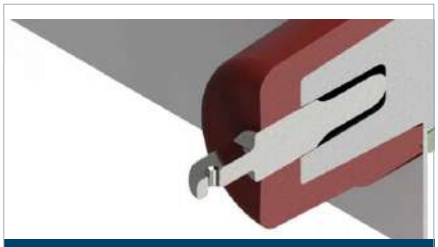
IEC 61869-10 · IEC 61869-11 · EN 50180 · EN 50181 · EN 61238-1 · IEC 61243-5 (VDS) · IEC 62271-206 (VPIS)

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.

Joint ratings for switchboard extension, delivered as a complete kit.

36	630	20	230
kV	A	kA · 1s	mm phase distance



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

NOTE

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