MV RMU CIRCUIT - BREAKER
MV RMU SWITCH DISCONNECTOR
MV RMU TRASFORMER PROTECTION
MV FOR ENERGY MEASUREMENT
MV SELF PROTECTED TRANSFORMER

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Revision	Data	List of modification
Rev. 0	10-2019	First Emission

	Emission	Collaboration		Verification	Approval
Organization	GI&N-O&M-NCS	DIS/TER/SMG	GI&N-O&M-NCS	GI&N-O&M-NCS	GI&N-O&M-NCS
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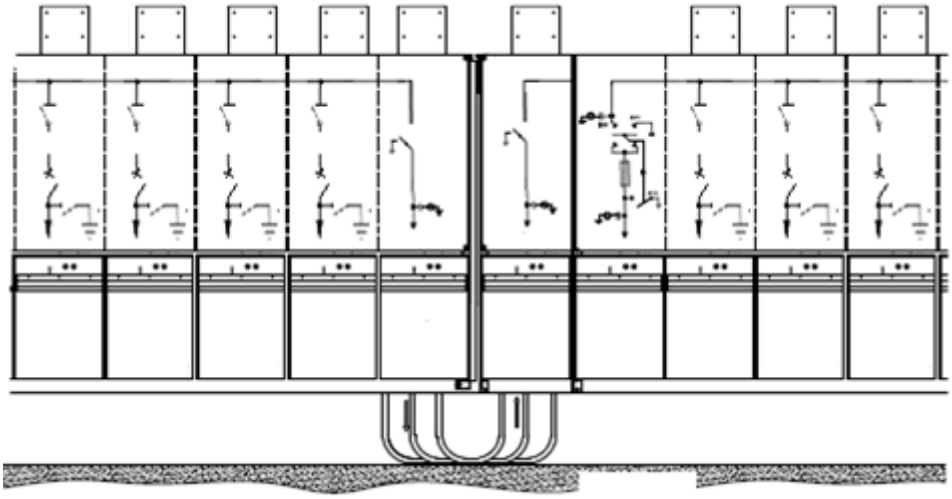
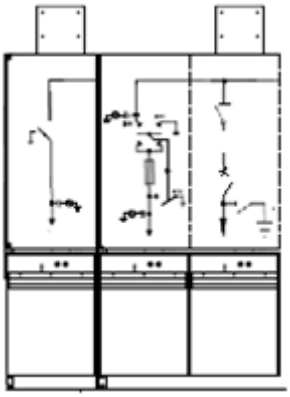


Example of 4CBL + 1L coupled 1T + 3CBL + 1L



Example of 1T + 1CBL + 1L

1 SCOPE

The purpose of Technical Specification is to describe the construction features of gas insulated modular cells equipped with an automatic switch, an SD line, a combination of fuses on the transformer, a TMA and a device for measurement to be used in the secondary substations of the Group Enel Distribuzione:

- **Enel Distribución Colombia** **Colombia**
- **Enel Distribución Perú** **Perú**
- **Edesur** **Argentina**
- **e-distributie Banat** **Romania**
- **e-distributie Dobrogea** **Romania**
- **e-distributie Muntenia** **Romania**

- **e-distribuzione** **Italy**
- **EDISTRIBUCION Redes Digitales SLU** **Spain**
- **Enel Distribución Chile** **Chile**
- **Enel Distribuição Ceará** **Brazil**
- **Enel Distribuição Rio** **Brazil**
- **Enel Distribuição Goiás** **Brazil**
- **Enel Distribuição São Paulo** **Brazil**

Note: Some requirements are applicable only to one or more companies. Therefore, depending on the destination, the equipment supplied shall meet these specific requirements. The indication "LATAM" refers to the distribution companies located in South America.

2 LIST OF COMPONENTS

TYPE	**TF** *SWITCH DISCONNECTOR WITH FUSES FOR TRANSFORMER PROTECTION*	**CBL** *CIRCUIT BREAKER AND LINE DISCONNECTOR*	**L RMU** *SWITCH DISCONNECTOR*	**AT** *AUTOPROTECT TRANSFORMER*	**M** *MEASUREMENT COMPARTMENT WITH EARTHING SWITCH*

Type code	Description	Busbar voltage detector	Rated short circuit breaking current [kA]	Rated voltage [kV]
GSCM004/1	1T+1CBL	YES	16	24
GSCM004/2	1T+ 2CBL	YES	16	24
GSCM004/3	1T+3CBL	YES	16	24
GSCM004/4	1T+4CBL	YES	16	24
GSCM004/5	2T+2CBL	YES	16	24
GSCM004/6	3CBL	YES	16	24
GSCM004/7	4CBL	YES	16	24
GSCM004/8	1T+1CBL+1L	YES	16	24
GSCM004/9	1T+1CBL+2L	YES	16	24
GSCM004/10	1T+2CBL+1L	YES	16	24
GSCM004/11	1T+2CBL+2L	YES	16	24
GSCM004/12	1T+3CBL+1L	YES	16	24
GSCM004/13	1CBL+2L	YES	16	24
GSCM004/14	2CBL+2L	YES	16	24
GSCM004/15	3CBL+1L	YES	16	24
GSCM004/16	4CBL+1L	YES	16	24
GSCM004/17	1T+1CBL	NO	20	24
GSCM004/18	1T+ 2CBL	NO	20	24
GSCM004/19	1T+3CBL	NO	20	24
GSCM004/20	1T+4CBL	NO	20	24
GSCM004/21	2T+2CBL	NO	20	24
GSCM004/22	3CBL	NO	20	24
GSCM004/23	4CBL	NO	20	24
GSCM004/24	1T+1CBL+1L	NO	20	24
GSCM004/25	1T+1CBL+2L	NO	20	24
GSCM004/26	1T+2CBL+1L	NO	20	24
GSCM004/27	1T+2CBL+2L	NO	20	24
GSCM004/28	1T+3CBL+1L	NO	20	24
GSCM004/29	1CBL+2L	NO	20	24
GSCM004/30	2CBL+2L	NO	20	24
GSCM004/31	3CBL+1L	NO	20	24
GSCM004/32	4CBL+1L	NO	20	24
GSCM004/33	1T+1CBL	NO	16	36
GSCM004/34	1T+ 2CBL	NO	16	36
GSCM004/35	1T+3CBL	NO	16	36
GSCM004/36	1T+4CBL	NO	16	36
GSCM004/37	2T+2CBL	NO	16	36
GSCM004/38	3CBL	NO	16	36
GSCM004/39	4CBL	NO	16	36

Type code	Description	Busbar voltage detector	Rated short circuit breaking current [kA]	Rated voltage [kV]
GSCM004/40	1T+1CBL+1L	NO	16	36
GSCM004/41	1T+1CBL+2L	NO	16	36
GSCM004/42	1T+2CBL+1L	NO	16	36
GSCM004/43	1T+2CBL+2L	NO	16	36
GSCM004/44	1T+3CBL+1L	NO	16	36
GSCM004/45	1CBL+2L	NO	16	36
GSCM004/46	2CBL+2L	NO	16	36
GSCM004/47	3CBL+1L	NO	16	36
GSCM004/48	4CBL+1L	NO	16	36
GSCM004/49	1T+1CBL	NO	20	36
GSCM004/50	1T+ 2CBL	NO	20	36
GSCM004/51	1T+3CBL	NO	20	36
GSCM004/52	1T+4CBL	NO	20	36
GSCM004/53	2T+2CBL	NO	20	36
GSCM004/54	3CBL	NO	20	36
GSCM004/55	4CBL	NO	20	36
GSCM004/56	1T+1CBL+1L	NO	20	36
GSCM004/57	1T+1CBL+2L	NO	20	36
GSCM004/58	1T+2CBL+1L	NO	20	36
GSCM004/59	1T+2CBL+2L	NO	20	36
GSCM004/60	1T+3CBL+1L	NO	20	36
GSCM004/61	1CBL+2L	NO	20	36
GSCM004/62	2CBL+2L	NO	20	36
GSCM004/63	3CBL+1L	NO	20	36
GSCM004/64	4CBL+1L	NO	20	36

Type code	Description	Busbar voltage detector	Rated short circuit breaking current [kA]	Rated voltage [kV]
GSCM004/134	1T+1CBL	NO	16	24
GSCM004/135	1T+ 2CBL	NO	16	24
GSCM004/136	1T+3CBL	NO	16	24
GSCM004/137	1T+4CBL	NO	16	24
GSCM004/138	2T+2CBL	NO	16	24
GSCM004/139	3CBL	NO	16	24
GSCM004/140	4CBL	NO	16	24
GSCM004/141	1T+1CBL+1L	NO	16	24
GSCM004/142	1T+1CBL+2L	NO	16	24
GSCM004/143	1T+2CBL+1L	NO	16	24
GSCM004/144	1T+2CBL+2L	NO	16	24
GSCM004/145	1T+3CBL+1L	NO	16	24
GSCM004/146	1CBL+2L	NO	16	24
GSCM004/147	2CBL+2L	NO	16	24
GSCM004/148	3CBL+1L	NO	16	24
GSCM004/149	4CBL+1L	NO	16	24

Type code	Description	Busbar voltage detector	Rated short circuit breaking current [kA]	Rated voltage [kV]
GSCM004/150	2T+1CBL+1L	NO	16	24
GSCM004/151	2T+1CBL+2L	NO	16	24
GSCM004/152	2T+2CBL+1L	NO	16	24
GSCM004/153	2CBL+1L	NO	16	24
GSCM004/154	2T+1CBL+1L	NO	20	24
GSCM004/155	2T+1CBL+2L	NO	20	24
GSCM004/156	2T+2CBL+1L	NO	20	24
GSCM004/157	2CBL+1L	NO	20	24
GSCM004/158	2T+1CBL+1L	NO	16	36
GSCM004/159	2T+1CBL+2L	NO	16	36
GSCM004/160	2T+2CBL+1L	NO	16	36
GSCM004/161	2CBL+1L	NO	16	36
GSCM004/162	3CBL	NO	16	36
GSCM004/179	1CBL+2L	YES	16	36
GSCM004/180	2T+1CBL+1L	YES	16	36
GSCM004/181	2T+1CBL+2L	YES	16	36
GSCM004/82	2T+2CBL+1L	YES	16	36
GSCM004/183	2CBL+1L	YES	16	36
GSCM004/184	3CBL	YES	16	36
GSCM004/185	1T+1CBL	YES	16	36
GSCM004/186	1T+ 2CBL	YES	16	36
GSCM004/187	1T+3CBL	YES	16	36
GSCM004/188	1T+4CBL	YES	16	36
GSCM004/189	2T+2CBL	YES	16	36
GSCM004/190	4CBL	YES	16	36
GSCM004/191	1T+1CBL+1L	YES	16	36
GSCM004/192	1T+1CBL+2L	YES	16	36
GSCM004/193	1T+2CBL+1L	YES	16	36
GSCM004/194	1T+2CBL+2L	YES	16	36
GSCM004/195	1T+3CBL+1L	YES	16	36
GSCM004/196	2CBL+2L	YES	16	36
GSCM004/197	3CBL+1L	YES	16	36
GSCM004/198	4CBL+1L	YES	16	36

Table 1: List of components (24 and 36 kV)

3 REFERENCE LAWS

3.1 BRAZIL

NR-10 - segurança em instalações e serviços em eletricidade;
NR 33 – segurança e saúde nos trabalhos em espaços

3.2 CHILE

NSEG 5. E.n.71 - Reglamento de Instalaciones Eléctricas de Corrientes Fuertes.

3.3 COLOMBIA

RETIE - Reglamento Técnico de Instalaciones Eléctricas.
NSR - 10 Norma Sismo Resistente Colombiana.

3.4 SPAIN

R.D. 614/2001, de 8 de junio, sobre disposiciones mínimas para la protección de la salud y seguridad de los trabajadores frente al riesgo eléctrico.
R.D. 337/2014, de 9 de mayo, por el que se aprueban el Reglamento sobre condiciones técnicas y

3.5 GARANTÍAS DE SEGURIDAD EN INSTALACIONES ELÉCTRICAS DE ALTA TENSIÓN Y SUS INSTRUCCIONES TÉCNICAS COMPLEMENTARIAS ITC-RAT 01 A 23.

R.D. 223/2008, de 15 de febrero, por el que se aprueban el Reglamento sobre condiciones técnicas y garantías de seguridad en líneas eléctricas de alta tensión y sus instrucciones técnicas complementarias ITC-LAT 01 a 09.

3.6 ITALY

D.P.R. n. 341 of the 13th of February 1981.
D.Lgs n. 81 of the 9th of April 2008 and subsequent modifications.

3.7 ALL EUROPEAN COUNTRIES

Regulation (EU) of the European Parliament and of the Council 517/2014 of the 16th of April 2014.
Regulation (EC) of the Commission 1494/2007 of the 17th of December 2007.
D.P.R. n. 43 of the 27th of January 2012.

3.8 SISMIC QUALIFICATION LEVEL

Enel Distribución Colombia	IEC 62271-210	Severity level 1 – PGA 0,5	Class 2
Enel Distribución Chile	IEC 62271-210	Severity level 1 – PGA 0,5	Class 2
e-distributie Romania	IEC 62271-210	Severity level 1 – PGA 0,5	Class 2
e-distribuzione	IEC 62271-210	Severity level 1 – PGA 0,5	Class 2
Enel Distribución Perú	IEC 62271-210	Severity level 1 – PGA 0,5	Class 2

4 STANDARDS

4.1 COMMON INTERNATIONAL STANDARDS

The below listed reference documents shall be intended in the in-force edition at the contract date (amendments and *errata corrige* included). Unless otherwise specified, these documents are valid until the new editions replace them. The terms used in this document are according to the standards listed below.

Standards	Edition
IEC 62271-1	See product standard
IEC 62271-100	2017-06-15
IEC 62271-102	2018-05-15
IEC 62271-105	2012-09-27
IEC 62271-200	2011-10-24
IEC 62271-201	2014-03
IEC 62271-206	2011-01-27
IEC 62271-304	200805
IEC 61243-5	2009-06-25
IEC 60529	2013-08-29
EN 50181	2010-11
ISO 4042	11-10-2018

IEC 60034-1	2011-03-01
IEC 62262	2002-02
IEC 60068-2-52	2017-11
ISO 12944	2018
IEC 60815-1	2008
ISO 2409	2018
IEC 60447	2004-01-12
IEC 62271-210	2013-02
IEC 60282-1	2014-07-22
IEC 60137	2017-06-22

4.2 COMMON TECHNICAL SPECIFICATIONS

Technical Specification	Edition	Edition
ANNEX E	1	2019
GSCC006	3	09/07/2018
GSTR001/1	1	08/08/2017
GSCT005	0	2018
GSCT003	2	2016

The MV RMU WITH CIRCUIT-BREAKER unit is part of the protection system in MV Network, which includes the following approved materials:

Component	Global Standard
UP2020	GSTR001/1 / GSTR002
RGDM	GSTP011/ GSCT005
ACCUMULATORS FOR POWERING REMOTECONTROLDEVICE	GSCB001

The installation of the unit must be done with all the elements that make up the network protection system, so that the configuration for which they are designed is respected. The assembly of the complete system guarantees the safety levels of people and asset.
It is responsibility of the user connecting the equipment to components corresponding to the standard network protection system for which it is designed.

4.3 LOCAL TECHNICAL SPECIFICATIONS

Italy

PVR006 – Barcode

5 SERVICE CONDITIONS

Service conditions are the normal service conditions according to 62271-200, with the following additions/modifications:

Minimum ambient air temperature for internal installation	- 15 °C
Network neutral earthing systems	Effectively earthed neutral system Non effectively earthed neutral system

Table 2: Requirements for Switchgear service conditions

The maximum reference altitude will be 1500 m, but for Colombia the maximum reference altitude is 2.700 m.

6 TECHNICAL CHARACTERISTICS

6.1 SWITCHGEAR CHARACTERISTICS

The switchgear shall be compliant with IEC 62271-200. The solutions for the insulation of switchgear are SF6 (Gas alternative to SF6 can be considered and are subject to Enel approval) gas . The main characteristics are listed in table 3.

Rated insulation level	Rated Voltage [kV]	24	36
	Rated short-duration power-frequency withstand voltage [kV]	50	70
	Rated short-duration power-frequency between the open contact of the disconnectors and switch disconnectors [kV]	60	80
	Rated lightning impulse withstand voltage [kV]	125	170
	Rated lightning impulse withstand voltage - Across the isolating distance (switch-disconnectors and line disconnectors) kV]	145	195
Rated frequency [Hz]		50 (and 60)	
Rated normal current :			
✓ for busbars and lines [A]		630	
✓ for the transformer Unit [A]		200	
Rated short-time withstand current [kA]		16/20	
Rated peak withstand current [kAc]		40 (and 41,6) / 50 (and 52)	
Rated duration of short-circuit [s]		1	
Degree of protection :		IP3X	
Argentina			
Italy			
Romania			
Spain			
Degree of protection :		IP51	
Brasil			
Chile			
Colombia			
Perù			
Degree of protection for the operating devices (even with the operating lever inserted)		IP2XC	
Internal arc test	Type of accessibility	AFL	
	Rated arc fault current [kA]	16/20	
	Rated arc fault duration [s]	1	
Rated supply voltage of closing and opening devices and of auxiliary circuits [Vcc]		24V -15% +20%	

Table 3: Characteristics of the switchgear

The enclosure shall have a SF6 volume less than 1500 liters and its filling, to be implemented exclusively in the factory, shall be made in order that the maximum operating relative pressure at 45 °C does not exceed 0,5 kg/cm2 (49,033 kpa) and it forms a sealed pressure system (IEC 62271-200) and the absolute pressure shall be lower than 1,5 kg/cm^2.

The switchgear shall be sealed. The elements used in the factory for filling and recovering the SF_6 at the end of life (if present) shall be identified with a self-adhesive plate and protected from accidental shocks. On the plate it shall be written in the language of the country to which it will be supplied: "*Remove the cap at the end of the switchgear's operating life only for the possible recovery of gas*". This plate shall have a yellow RAL 1021 background and the words in black RAL 9005.

The switchgear shall be manufactured in a SF_6 insulated single shell containing the busbars, the switchgear and the earthing switches. Strains during operation and transport shall be taken into account. The switchgear shall have an overpressure valve, equipped with a metallic disc for the protection against accidental strains, placed at a proper distance from the valve itself. The MV fuse-carrier, which shall be protected by a metal enclosure, can be installed inside of the SF_6 shell or outside it.

The enclosure where the auxiliary circuits will be housed and the mechanical shunting devices will have a minimum degree of protection IK08 according to IEC 62262 (5 J).

To connect the MV cable terminals, the switchgear shall be equipped with external cone bushings with capacitive voltage divider in accordance with EN 50181. Bushings shall have a 630 A rated normal current for the lines (type C interface shown in the technical specification GSCC006) and 250 A rated normal current for the transformer protection (type A interface for 24 kV switchgears and type B for 36 kV switchgears, as indicated in the technical specification GSCC006). For RMU for energy measurement, the bushings must be of type C.

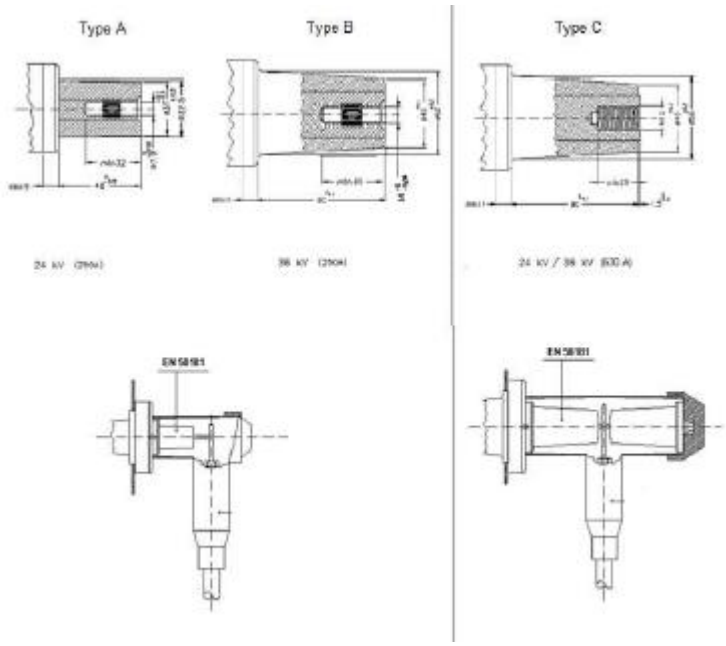


Figure 1 - Bushings

RMU type CBL and L will be equipped with capacitive voltage dividers for the voltage presence and with LPIT.

The switchgear shall be equipped with “safe position devices” for the indication of the real position of the main moving contacts of the switches, as required by IEC 62271-200.

Interlocks are described in each function unit paragraph and resumed in Annex A.

The operating point, the position indicator of a device (LD, CB or ES) and the corresponding VDS indicator should be framed in the same space, clearly differentiated from the other elements.

6.2 FUNCTIONAL SCHEMES

The general functional electric schemes are shown in pictures below which show the admitted constructive solutions for T, L unit and CB unit; other possible alternative solutions are subject to Enel approval.

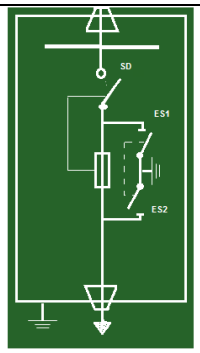
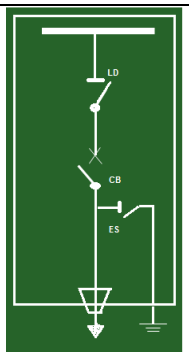
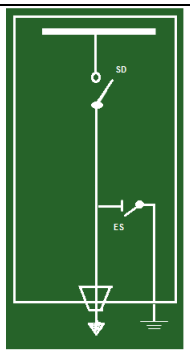
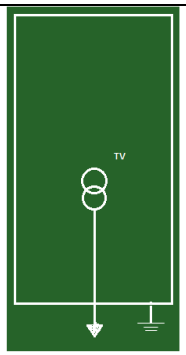
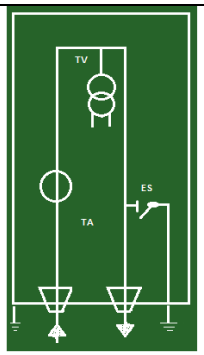
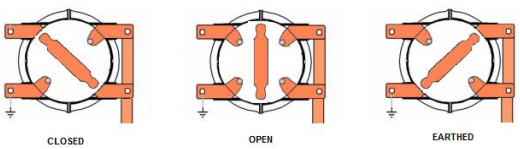
RMU - Typical units					
TYPE	TF Switch Disconnector with fuses for Transformer protection	CBL CIRCUIT BREAKER AND LINE DISCONNECTOR	L RMU SWITCH DISCONNECTOR	AT AUTOPROTECT TRANSFORMER	M Measurement compartment with earthing switch

Figure 2 - General functional electric scheme

Description	
	CB: Circuit Breaker vacuum
	LD: Line Disconnector
	SD: Switch Disconnector
	Voltage transformer
	Current transformer
	Fuse
	Cable
	Capacitive divider to feed the voltage detecting system
	ES – ES1 – ES2 : Earthing switches

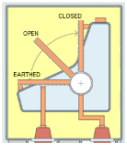
Type Solution

VACUUM CIRCUIT BREAKER



THREE POSITION SWITCH-DISCONNECTOR .

ROTARY TYPE



THREE POSITION SWITCH-DISCONNECTOR .

6.2.1 Constructive solutions:

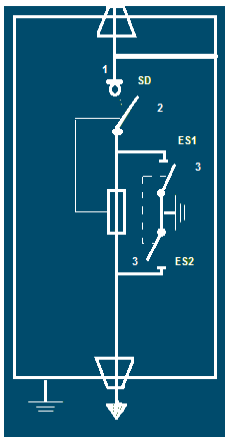
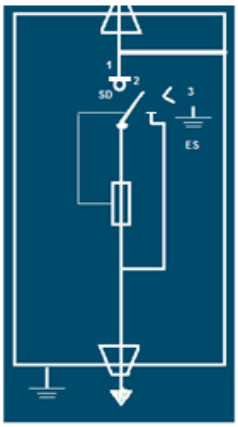
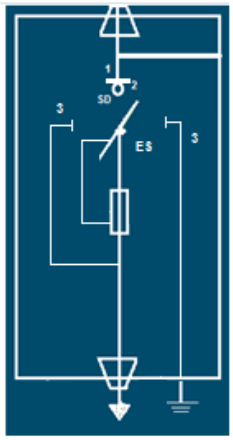
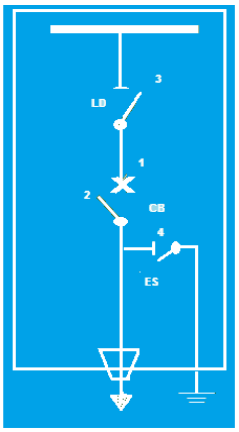
TF TRANSFORMER PROTECTION UNIT		
		
A	B	C
Earthing switch and switch disconnector with making capacity with the positions CLOSED-OPEN-EARTHED. Configuration with two earthing switches	Switch-disconnector and earthing switch with making capacity with the positions CLOSED-OPEN-EARTHED. Configuration with an earthing switch	Switch-disconnector and earthing switch of rotary type with making capacity with the positions CLOSED-OPEN-EARTHED. Configuration with an earthing switch

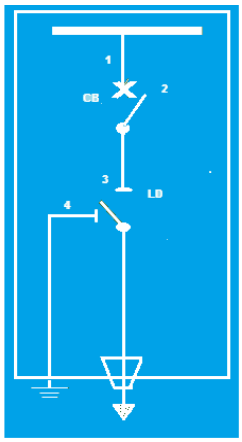
Figure 3 – Possible constructive solutions for T unit electrical scheme and sequence of maneuvers

CBL



A

2-position SF6 or vacuum circuit-breaker
CLOSED – OPEN,
2- position line- disconnector CLOSED-OPEN
2- Position earthing switch with making capacity
OPEN - EARTHED



B

2-position SF6 or vacuum circuit-breaker
CLOSED - OPEN
3 position line-disconnector and earthing
CLOSED - OPEN - EARTHED

Figure 4– RMU with CB possible constructive solutions for L unit electrical scheme and sequence of maneuvers

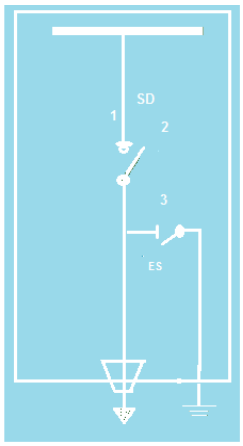
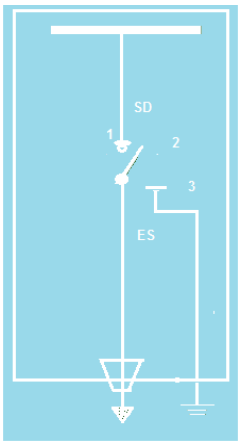
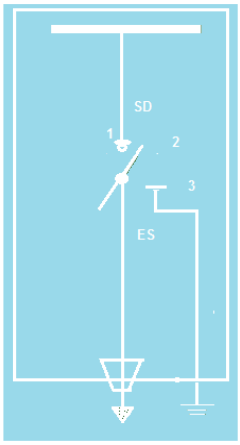
L-RMU		
		
A 2 position Switch-disconnector with making capacity CLOSED-OPEN 2 position earthing switch OPEN EARTHED.	B 2 position Switch-disconnector with making capacity CLOSED-OPEN 2 position earthing switch OPEN EARTHED.	C 3 position Switch-disconnector and earthing switch rotary type with making capacity CLOSED-OPEN-EARTHED.

Figure 5 – RMU Possible constructive solutions for L unit electrical scheme and sequence of maneuvers

6.3 SF6

The expected operating life with regard to leakage performance shall be 40 years.

The characteristics of the first filling gas shall meet the requirements of IEC 60376. The humidity content of the first filling gas shall be less than 15 ppm in weight and, during operation, the absence of condensation at the minimum operating expected temperatures must be guaranteed. The manufacturer shall ensure that at the end of the expected life of the equipment (40 years) the gas pressure remains greater than (or equal) the minimum operating pressure p_m (minimum necessary pressure to ensure the performances prescribed for the device). In any case, the loss shall not exceed the 0.1% value in weight per year (IEC 62271-1).

For installations above 1.500 meters, the supplier must indicate the installation operating methods.

7 CONSTRUCTION CHARACTERISTICS

7.1 CIRCUIT BREAKER (CBL)

7.1.1 Characteristics of the MV circuit-breaker

The circuit-breaker shall comply with the IEC 62271-100. The characteristics of the circuit-breaker are shown in table 4.

Rated Voltage		$[kV]$	24	36
Rated normal current		$[A]$	630	
Rated short-circuit breaking current		[kA]	16/20	
Rated duration of short-circuit		[s]	1	
Sequence of operations			O-0,3s-CO-15s-CO	
Circuit-breaker class			C2, E2, M2, S1	
First-pole-to-clear factor		[kpp]	1,5	
Break-time			≤ 80ms	
Rated breaking current	• Rated cable-charging breaking current	[A]	31,5 / 50	
	• Rated out-of-phase making and breaking current	[A]	To see 4.106 of IEC 62271-100	
Max motor absorption		[W]	300	

Table 4: Characteristics of the MV circuit-breaker

The movement of the power contacts of the circuit breaker shall be carried out by means of mechanical transmissions, the switching energy supplied by an accumulation device mechanical type (spring command). A complete system shall be provided for the recovery of the energy storage of the circuit breaker in the absence of auxiliary voltage.

Alternative construction solutions for the storage device energy are subject to Enel approval, without prejudice to compliance with all the requirements functionalities of this specification.

- with functioning motor:

  O – 0,3 s – CO – 15 s – CO starting from the status of closed circuit breaker and charged closing springs.
- with non-functioning motor:
  - O– 0,3 s – CO starting from the status of closed circuit breaker and charged closing springs;
  - CO starting from the status of open circuit breaker and charged closing springs;
  - O starting from the status of closed circuit breaker and discharged closing springs.

When the circuit breaker is closed, the opening springs shall always be charged.

In the event that during an operation appears the request to perform an opposite operation, the consensus to the implementation of the latter shall be given after the completion of the operation in course. The operating conditions of the releases are indicated in the IEC 62271-1.

The MV circuit-breaker shall be equipped with a tripolar control equipped with the following circuits and devices:

- ✓ shunt release three-pole closing device;
- ✓ shunt release three-pole opening device;
- ✓ anti-pumping device which has the purpose to prevent reclosing after the first close-open operation when there is an opening during the first closing request. This device shall not be deactivated by functional restrictions.

Circuits and/or devices shall be provided to inhibit the closing command when at least one of the following events occurs:

- ✓ insufficient energy for the closing operation (springs discharged);
- ✓ command and or opening maneuver in progress.

Without the power supply to the motor circuit the motorization circuit shall not absorb any current when it is in the stand-by state. For the detailed electrical characteristics of the CB refer to Annex B.

The circuit-breakers will be in class E2 and must be subjected to the electrical durability test as specified in List 1 of Table 33 of the 62271-100 standard.

Testing current (percentage of rated short-circuit breaking current) %	Operating sequences	Number of operating sequences (List 1)
10	O	84
	O – 0,3 s – CO	14
	O – 0,3 s – CO – ***t*** – CO	6
30	O	84
	O – 0,3 s – CO	14
	O – 0,3 s – CO – ***t*** – CO	6
60	O	2
	O – 0,3 s – CO – ***t*** – CO	2
100% (symmetrical)	O – 0,3 s – CO – ***t*** – CO	2

Table 5– Classification of circuit-breakers as a function of electrical endurance

7.1.2 Characteristics of the line disconnectors (LD)

The manual line disconnector shall comply with IEC 62271-102. The characteristics of the line disconnectors (LD) are shown in table 6 below.

Rated normal current	[A]	630
Rated short-time withstand current	[kA]	16/20
Rated duration of short-circuit	[s]	1
Rated peak withstand current	[kAc]	40 (and 41,6) / 50 (and 52)
Mechanical endurance class		M1

Table 6: Characteristic of the line disconnector with command manual (LD)

7.1.3 Characteristics of earthing switches (ES)

The manual earthing switches shall comply with the IEC standard 62271-102. The characteristics of the earthing switches (ES) are shown in table 7.

Rated short-time withstand current	[kA]	16/20
Rated peak withstand current	[kA_c]	40 (and 41,6) / 50 (and 52)
Rated values of mechanical endurance for disconnectors		M1
Rated values of electrical endurance for earthing switches		E2

Table 7: Characteristics of the earthing switch (ES)

7.1.4 Unit with CB command

The line unit has 2 possible alternative construction solutions:

- 1 MV circuit-breaker (CB) + 1 Line Disconnector (LD) + Earthing Switch (ES) (see Figure 4-A);
- 1 MV circuit-breaker (CB) + 1 integrated Line Disconnector (LD)/Earthing Switch (ES) (see Figure 4-B);

The circuit breaker shall interact with the UP peripheral unit taking into account the mechanical and electrical interlocks of this specification and of the characteristics shown in the following paragraphs. The connections with the UP GSTR001/1 remote control peripheral unit, the type of connector and the pin assignment shall comply with the requirements indicated in paragraph annex B. The closing and opening remote controls and the remote-signals status refer to the circuit-breaker.

The manual controls of the LD and ES shall be at dead point both in opening and in closing and shall be of rotating or vertical motion type (see IEC 60447 standard). The operation direction shall be compliant with IEC 60447.

7.1.5 Unit with CB command front panel

The devices to be provided on the front of the control panel shall be such as to make them easily visible and accessible. On the front of the command the following devices shall be provided:

- Two electric opening and closing buttons and two mechanical opening and closing buttons (total 4 buttons) for operating the CB. The opening buttons shall be green, while the closing buttons shall be red, with the word indication according to table 8. All the buttons shall be protected against accidental pressure and provided with a plate indicating the function performed;
- manual device for restoring switching energy; the sense of actuation shall be indicated on the front side. To guarantee the safety of the operator, this device shall prevent the return of energy through the engine or the spring, loading lever shall not be dragged by the electric motor;
- switching point for opening and closing of LD, with indication of the operating direction, in accordance with Figure 11 and Table 8;
- switching point for opening and closing of ES, with indication of the operating direction, in accordance with the Figures 12 and Table 8.

The following indications shall also be provided:

- status indication of the CB. The device used shall be mechanically interconnected with the mobile power contacts and the relative position shall be displayed using the following symbols:
  - black “I” letter on red background corresponding to the close position of the circuit-breaker;
  - black “O” letter on green background corresponding to the open position of the circuit-breaker;

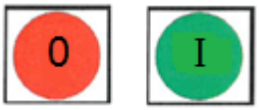
All countries	Colombia
	

Figure 6

- Equipments to be installed in Brazil will be provided with:
  - Closure - White "L" on a red background;
  - Opening: white 'D' on a green background.

Figure 7

- display of the signal state of the energy storage device:
  - orange color, charged energy storage device;
  - white color, discharged energy storage device;

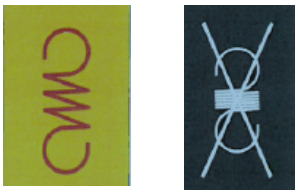


Figure 8

- status signal of the LD. The device shall be mechanically interconnected with the mobile power contacts and the position shall be displayed using the following symbols:
- black "I" letter on red background 3000 RAL-F2 corresponding to the position of line disconnector LD closed;
- black "O" letter on green background 6017 RAL-F2 corresponding to the position of the open LD line disconnector;

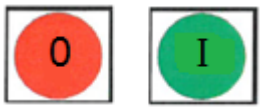
All countries	Colombia
	

Figure 9

- status indication of the earthing switch ES. The device shall be mechanically interconnected with the mobile power and auxiliary contact, and shall be displayed using the following symbols:
    - black "I" letter on yellow background 1021 RAL-F2 corresponding to the position of earthing switch ES closed;
    - black "O" letter on gray background 7030 RAL-F2 corresponding to the position of the earthing switch ES open;

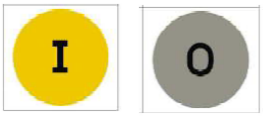


Figure 10

- counter of the circuit-breaker openings, with a non-resettable five-digit numerator.

Language	Opening	Closing
Italian	APRE	CHIUDE
Spanish	ABRIR	CERRAR
Portuguese	ABRIR	FECHAR
Romanian	DESCHIDE	INCHIDE

Table 8: Function of the operation

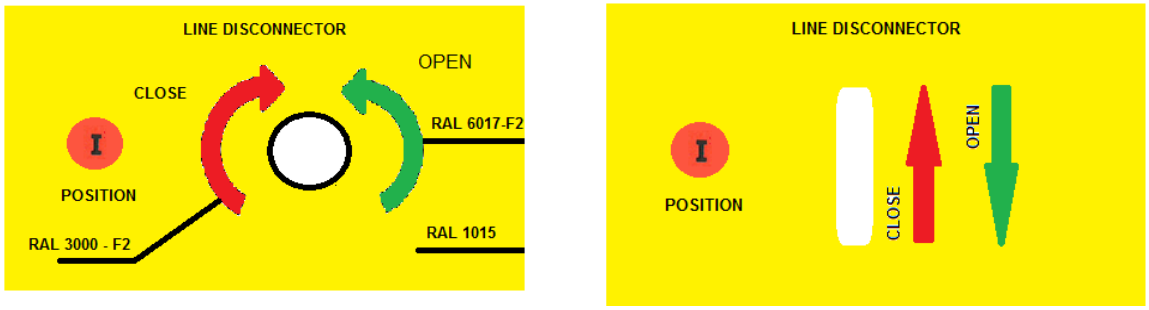


Figure 11 - Masks for the operating point of the line disconnector (see table 8 for the correct wording)

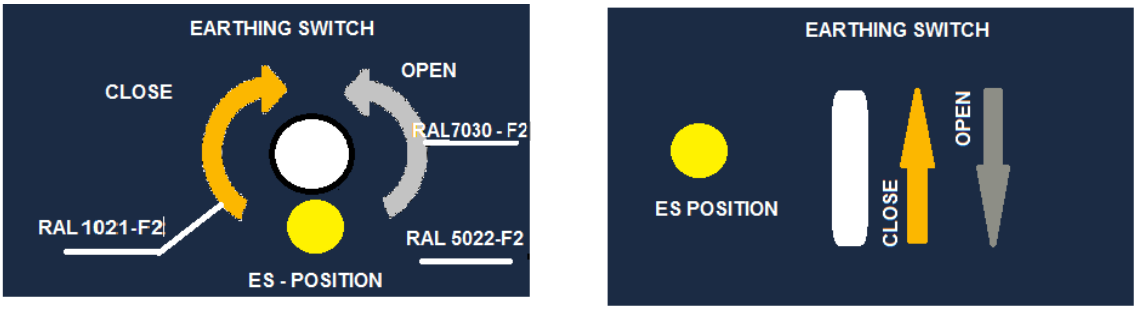


Figure 12 - Mask for the operating point of the earthing switch (see table 8 for the correct wording)

7.1.6 Unit with CB command interlocks

The sequence of operations for putting in service the equipment, irrespective of the possible constructive solutions, shall be:

1. opening of the ES earthing switch ;
2. closing of the LD line disconnector;
3. closing of the CB circuit breaker.

Interlocking and operating directions shall comply with the IEC 62271-200.

The sequence of operations for putting out of service the line shall be the reverse.

The following interlocks for figures 4A e 4B , irrespective of the possible constructive solutions, shall be provided (the complete list of interlocks is also represented in Annex A):

1. The line disconnector can be operated only with circuit-breaker in open position; this condition shall be realized by a mechanical interlock;
2. The earthing switch can be closed only with line disconnector in open position; this condition shall be realized with a mechanical interlock;
3. The disconnector can be closed only with earthing switch in open position; this condition shall be realized with a mechanical interlock;
4. The circuit breaker can be operated electrically and mechanically with the lever not inserted engaged at any point of operation:
    - with the line disconnector (LD) in the closed position (I) and the grounding switch (ES) in the open position (O);

Interlocking must be carried out both electrically with an interruption of the electrical controls of the switch (by means of limit switches) and mechanically.

5. The cable compartment access panel must be removed only in safe conditions, with the earthing switch closed (I); this condition must be achieved with a mechanical interlock.
6. The earthing switch ES can be open only with access panel of the cable compartment closed.

The access panel of the cable compartment must be removed only in safe conditions, with the switch-disconnector open (O) and earthing switch closed (I); this condition must be achieved with mechanical interlock;

Additional connections or interlocks must not be introduced.

In normal conditions, during maneuvering there shall not occur interference nor obstruction or interruption.

In case there aren't obstruction stoppages, when stressing the switchgears commands in the locked position with a moment up to 400 Nm, the contacts of switchgears shall remain in a position where they can maintain their functionality; in case there are obstruction stoppages, it shall be verified that they cannot be removed, if not intentionally and with special tools defined and provided by the manufacturer with each unit.

With the access panel of the cable compartment removed, it must not be possible to carry out operations.

The interlock of the opening of the earthing switch, once removed, shall return to its initial position when the earthing switch has been opened. Always with the panel of the cable compartment removed, it must not be possible, without the special tools, to remove the interlocks of the earthing switch and, if the interlocks are removed, it must not be possible to replace the panel until the earthing switch is closed.

Two points must be provided where a padlock can be inserted to lock the operation of the line-disconnector and of the earthing switch, in both open and closed positions. This padlock will have an arch of up to 6 mm diameter.

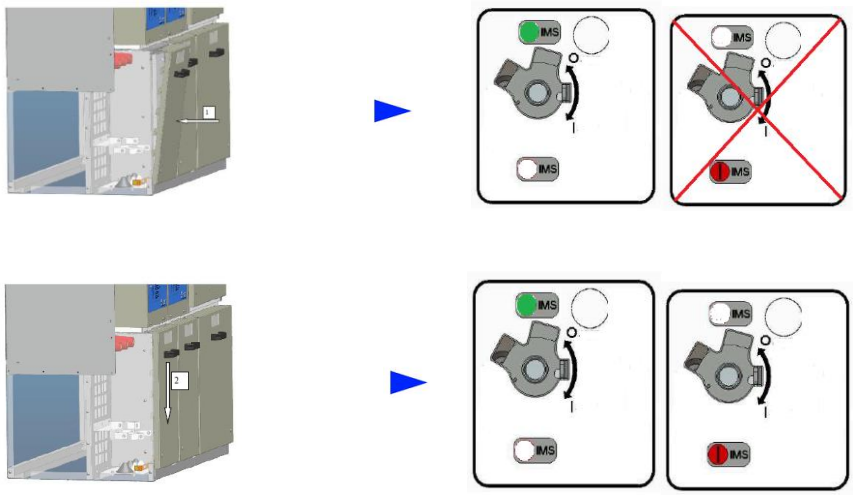


Figure 13 – Interlocks

7.2 TRANSFORMER PROTECTION UNIT (TF)

7.2.1 Characteristic of the switch-disconnector

The manual switch-disconnector (SD) combined with fuses, for the MV / LV transformer protection, shall comply with the IEC 62271-105 and IEC 62271-103. The characteristics are shown in table 9.

Alternating current switch-fuse combinations (SD)			
Rated Voltage	$[kV]$	24	36
Rated normal current	[A]	200	
Rated short-time withstand current	[kA]	16/20	
Rated peak withstand current	[kA_c]	40 (and 41,6) / 50 (and 52)	
Rated duration of short-circuit	[s]	1	
Mechanical endurance class		M1	
Electrical endurance class		E3	

Table 9 - switch-disconnector (SD)

7.2.2 Characteristics of earthing switches (ES)

The manual earthing switches shall comply with the IEC standard 62271-102. The characteristics of the earthing switches are shown in table 10.

Earthing switches ES1 (in case of constructive solution Figure 3-A), ES (in case of constructive solution Figure 3-B and 3C)		
Rated short-time withstand current	[kA]	16/20
Crest value of the rated short-time withstand current	[kA$_c$]	40 (and 41,6) / 50 (and 52)
Rated short-circuit duration	[s]	1
Mechanical endurance class		M0
Electrical endurance class		E2
Earthing switch ES2 (in case of constructive solution Figure 3-A)		
Rated short-time withstand current	[kA]	1
Crest value of the rated short-time withstand current	[kA$_c$]	2,5
Rated short-circuit duration	[s]	1
Mechanical endurance class		M0
Electrical endurance class		E2

Table 10: Characteristics of the earthing switches

7.2.3 Transformer protection unit command

The switch-disconnector operating point shall be separated from that of the earthing switches (in case of Figure 3-A solution the operating point of ES1 and ES2 shall be unique) and interlocked with them. At the end of the closing operation, the opening springs of the switch- disconnector shall be charged.
All the operation directions (SD and ES) shall be compliant with IEC 60447.

7.2.4 Transformer unit front panel

The devices to be provided on the front of the control shall be such as to make them easily visible and accessible. On the front of the command the following devices shall be provided:

- switching point for opening and closing of SD, with indication of the operating direction, in accordance with the figures 15and Table 9;
- switching points for opening and closing of earthing switches (ES1+ES2 or ES), with indication of the operating direction, in accordance with the Figures 18 and Table 10.

Alternative solutions based on buttons will be considered, subject to Enel approval.
The following indications shall also be provided:

- status signal of the transformer unit switch-disconnector (SD). The device shall be mechanically interconnected with the mobile power contacts and the position shall be displayed using the following symbols:
  - black "I" letter on red background 3000 RAL-F2 corresponding to the position of SD closed;

- black "O" letter on green background 6017 RAL-F2 corresponding to the position of the open SD line disconnector;

Figure 14

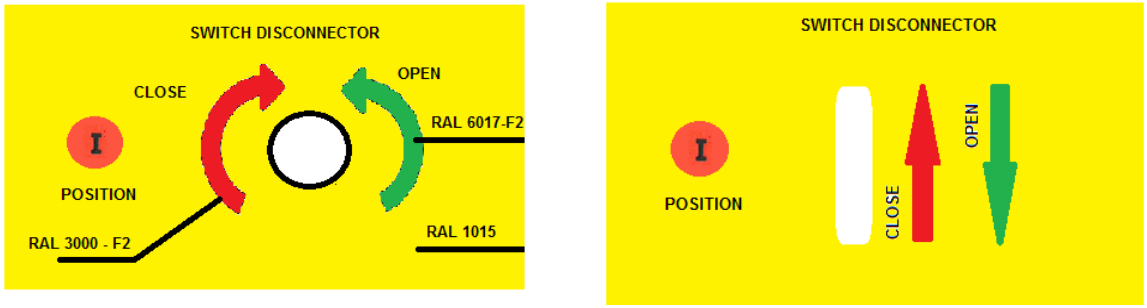


Figure 15 - Masks for the operating point of the switch disconnector (see table 8 for the correct wording)

- status indication of the earthing switches (ES1+ES2 or ES). The device shall be mechanically interconnected with the mobile power and contacts auxiliary, and shall be displayed using the following symbols:
- black "I" letter on yellow background 1021 RAL-F2 corresponding to the position of earthing switch closed;
- black "O" letter on gray background 7030 RAL-F2 corresponding to the position of the earthing switch open;

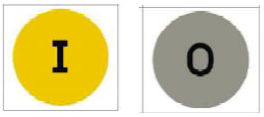
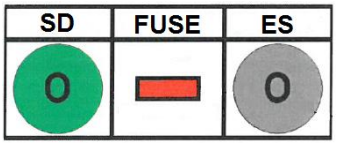


Figure 16

- Slot for the fuses intervention signalization



“fuse active” “fuse not active”

Figure 17 - fuse intervention signaling device

Figure 18 - Mask for the operating point of the transformer unit earthing switches (see table 8 for the correct wording) and for fuse-cover release (to be translated in local languages)

7.2.5 Transformer unit interlocking

Interlock and operating directions must comply with IEC 62271-200.

The sequence of operations for putting in service the equipment, irrespective of the possible constructive solutions, shall be:

- ✓ opening of the ES1 and ES2 earthing switches (or ES earthing switch);
- ✓ closing of the SD switch-disconnector.

The sequence of operations for putting out of service the line shall be the reverse.

The following interlocks, irrespective of the possible constructive solutions, shall be provided (the complete list of interlocks is also represented in Annex A):

1. The earthing switches can be closed only with switch-disconnector in open position; this condition shall be accomplished with a mechanical interlock;
2. The swith-discconnector SD can be closed only with earthing switches in open position; This condition shall be accomplished with a mechanical interlock;
3. Access to the transformer protection fuse compartment and cable compartment shall be possible only with earthing switches in closed position
4. The earthing switches ES, ES1 and ES2 cannot be open with transformer protection fuse compartment and / or cable compartment open.

The intervention of one or more fuses shall cause the opening of the switch-disconnector. Moreover, it shall be provided a point in which a padlock can be inserted in order to lock the operations of the switch-disconnector and of the earthing switches ES, ES1 and ES2 .

7.2.6 Fuse-carriers and fuses

The fuse-carrier is composed by a container made of insulating material and has got an appropriate closing device that ensures the protection against dust pollutants (degree of protection IP4X - IEC 60529).

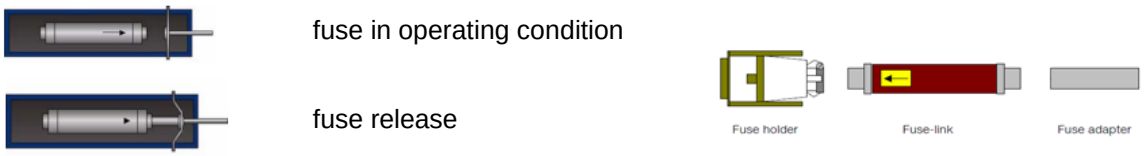


Figure 19 - Fuse and operation scheme

The enclosure shall be accessible without depressurizing the enclosure housing and shall also be protected externally by a grounded metal casing interlocked with the earthing switch.

The opening of the fuse-carrier shall always happen at a pressure which is not dangerous for the operator.

There shall be a system that does not go in overpressure or that releases the accumulated pressure before opening.

The shell of the fuse-carrier shall prevent the projection of material towards the external part of the switchgear in case of internal overpressure, which may cause its unwanted opening or explosion in case of failure.

The fuses intervention shall be reported on a special slot on the front of the transformer protection unit

The container shall have dimensions that are suitable to the use of fuses with maximum rated voltage of 12 kV, 17.5 kV, 24 kV and 36 kV (characteristics in accordance to IEC 60282-1 and annex D). In case of fuses with a nominal voltage other than 24 kV or 36 kV, an appropriate adapter must be provided.

The removal and replacement of fuses, as a result of their intervention, shall be allowed without using tools insulating greases or similar products. The kinematics of the fuse-carrier, where the striker acts for the opening of the switch-disconnector, shall be made so as to be operated independently from the striker's diameter and, in any case, up to a maximum of 20 mm.

The indicator shall be protected by a transparent window which prevents the entry of foreign bodies in order to prevent its indication from being altered by external manipulation.

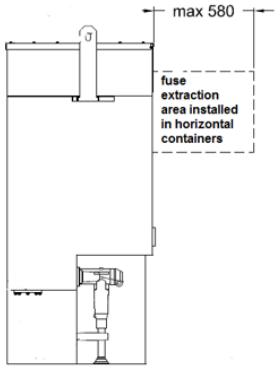


Figure 20 – fuse extraction area

7.2.7 Trip coils

The equipment to be supplied for Spain must be equipped with a release coil. The coil must work with 230 Vac and perform correctly between 85% and 110% of that voltage. This coil can be connected from the outside feeder circuit and shall be replaced without service interruption. Other coil operating voltages may be required. Insulation 10 kV towards metallic media of the secondary substations (10 kV, 50 Hz, 1 min and 20kV to lighting impulse (1,2/50μs) must be achieved. The connection point must be easily accessible.

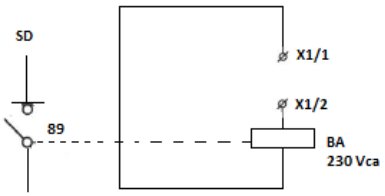


Figure 21 - Electric diagram of coil connection

7.3 RMU LINE (L-RMU)

7.3.1 Characteristics of the switch-disconnectors

The switch-disconnectors must comply with IEC 62271-103 and IEC 62271-102 for the earthing switches. The control devices of the earthing switches must be separate from those of the line switching device and interlocked with them. The grounding blades must have only one manual control. The movement of the triplet of the poles must be simultaneous. The nominal characteristics of the switch-disconnectors are shown in table 11.

SD				
Rated Voltage		$[kV]$	24	36
Rated normal current		[A]	630	
Rated short-time withstand current		[kA]	16/20	
Rated peak withstand current		[kA_c]	40 (and 41,6) / 50 (and 52)	
Rated duration of short-circuit		[s]	1	
Mechanical endurance class			M1	
Electrical endurance class			E3	
Rated breaking current	-of a mainly active load	[A]	630	
	- of a no-load transformer	[A]	6,3	
	- of a no-load line	[A]	10	13
	-of a no-load cable	[A]	31,5	40
	- in case of earth fault	[A]	50	
	- with cable-charging in case of earth fault	[A]	16	25
Earthing switches ES				
Rated short-time withstand current		[kA]	16/20	
Crest value of the rated short-time withstand current		[kA_c]	40 (and 41,6) / 50 (and 52)	
Rated short-circuit duration		[s]	1	
Mechanical endurance class			M0	
Electrical endurance class			E2	

Table 11: Characteristics of the switch-disconnectors and of the earthing switches

The three-pole manual operating device of the switch-disconnectors has to be dead-center overcoming both in opening and closing, vertical, rotational or translational movement (IEC 60447).
The operations must be performed by applying a moment that does not exceed 200 Nm, and the opening and closing speed must be independent of the action of the operator.

In case that switch-disconnectors and earthing switches are separated, the shaft of the earthing blades shall be mechanically interlocked with that of the line blades operating on the main switch disconnector shaft and not on the operating shaft.

The manual operation of the switch-disconnector must be possible at any time, regardless of the motorized operation; the insertion of the operating lever for manual operation must prevent the motorized operation. Such interlock must already act before the end of the lever engages on of whatever operating shafts.

This condition can be achieved both with a mechanical mechanism (decoupling of the gearmotor) and with an electric solutions (cutting engine power).

An electrical interlock should allow the motor to operate only when the grounding blades are completely open. To show the open position of the switch-disconnector, a micro-switch shall be provided. This micro-switch shall be put inside the operating device protective shell and shall be able to switch small currents.

7.3.2 Devices and signal position

The devices to be provided on the front of the command shall be easily visible and accessible whatever the switch-disconnector positioning height. The front of the command shall be equipped with the following devices:

- two buttons for the electrical opening and closing operations in case of switchgears with electric command. The opening button shall be green in the language that corresponds to the Country in which the switchgear shall be delivered; the closing button shall be red in the language that corresponds to the Country in which the switchgear shall be delivered. The buttons shall be protected from accidental pressures and shall have a nameplate indicating their performed function;
- operating place for the opening and closing of the switch-disconnector, with the indication of the driving direction, in accordance with figure 22.

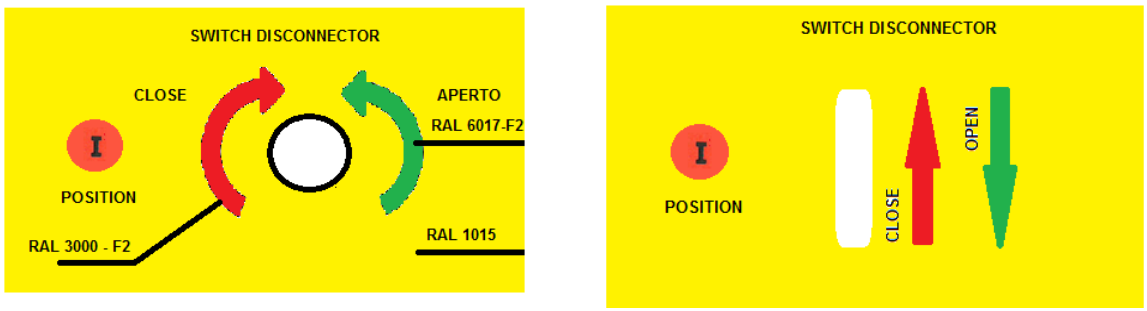


Figure 22 – Mask opening and closing of the switch-disconnector (see table 8 for the correct wording)

- operating place for the opening and closing of the earthing switch, with the indication of the driving direction, in accordance with figure 23;

Figure 23 - Mask opening and closing of the earthing switch (see table 8 for the correct wording)

Moreover the following indications shall be provided:

- switch-disconnector signal position, through the following symbology:
  - black letter “I” on 3000 RAL F2 red background corresponding to the close position of the switch-disconnector;
  - black letter “O” on 6017 RAL F2 green background corresponding to the open position of the switch-disconnector;

Figure 24

- earthing switch’s signal position. The used device shall be mechanically interlocked with the main circuit moving contacts and the correspondent position shall be displayed through the following symbology:
  - black letter “I” on 1021 RAL F2 yellow background corresponding to the close position of the earthing switch;
  - black letter “O” on 7030 RAL F2 grey background corresponding to the open position of the earthing switch;

Figure 25

The signal positions shall be visible even with the protection shell is removed.

7.3.3 Interlocking

The sequence of operations for putting in service the equipment shall be:

1. opening of the ES earthing switch;
2. closing the SD switch disconnector.

Interlocking and operating directions shall comply with the IEC 62271-200.

The sequence of operations for putting out of service the line shall be the reverse.

The list of interlocks is represented in Annex A.

The disconnector and earthing switch must have a device that allows the maneuver to be locked in the open and closed position.

Figure 26 – example mechanical padlock

The access panel of the cable compartment must be removed only in safe conditions, with the switch-disconnector open (O) and earthing switch closed (I); this condition must be achieved with mechanical interlock;

Additional connections or interlocks must not be introduced.

In normal conditions, during maneuvering there shall not occur interference nor obstruction or interruption.

In case there aren't obstruction stoppages, when stressing the switchgears commands in the locked position with a moment up to 400 Nm, the contacts of switchgears shall remain in a position where they can maintain their functionality; in case there are obstruction stoppages, it shall be verified that they cannot be removed, if not intentionally and with special tools defined and provided by the manufacturer with each unit.

With the access panel of the cable compartment removed, it must not be possible to carry out operations.

The interlock of the opening of the earthing switch, once removed, shall return to its initial position when the earthing switch has been opened. Always with the panel of the cable compartment removed, it must not be possible, without the special tools, to remove the interlocks of the earthing switch and, if the interlocks are removed, it must not be possible to replace the panel until the earthing switch is closed.

Two points must be provided where a padlock can be inserted to lock the operation of the line-disconnector and of the earthing switch, in both open and closed positions. This padlock will have an arch of up to 6 mm diameter.

7.4 MODULE WITH SELF-PROTECTED VOLTAGE TRANSFORMER AT

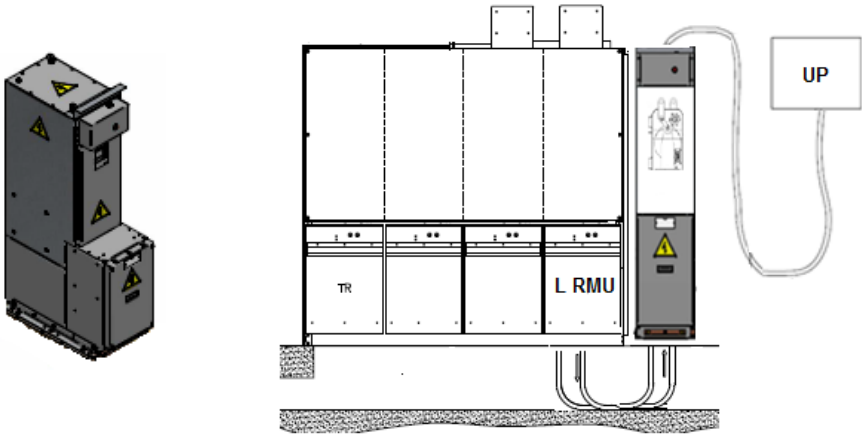


Figure 27– Example AT

7.4.1 Characteristics

The main characteristics are listed in table 3. Degrees of protection:
External: IP3X
Indoor: IP2XC
Type of insulation: solid
Filling: air

The construction features of the medium-voltage 24/36kV equipment shall be such as that can be coupled to any self-protected voltage transformer according to the Global GSCT003. The vertical working position of the SVT, shall be validated by the manufacturer of the SVT, and included in the TCA of the cabin.

The external cone will be of the type A (24 kV) or B (36 kV) indicated in figure 1.

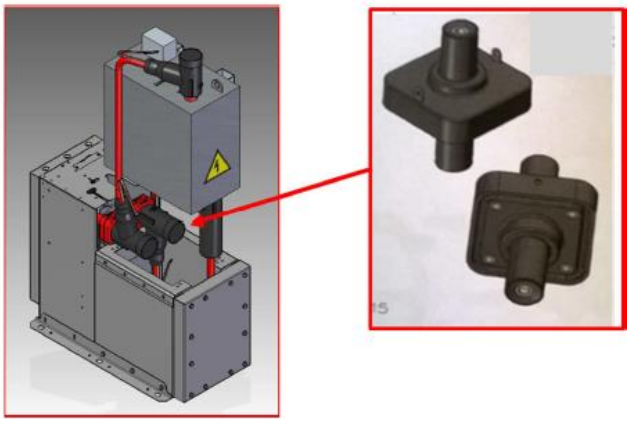


Figure 28 - Example of medium voltage internal connections of the RMU module with AT

Downline of the SVT (GSCT003) 5 single-pole fuse disconnectors shall be provided.

From the outside of the cabin, it will be possible to select the operating voltage of the SVT with a commutator, protected against accidental manouvers.

Upstream of the fuses, a device for the presence of voltage according to IEC 61243-5 must be connected to the secondary SVT GSCT003.

The design and construction of the module shall take into account the stresses to which the switchgear is subjected during handling, transport and installation.

The requirements for the connection cable are the same that for the busbar, as indicated in point 6.1. The width of the cell shall be max L 350 mm.

On the cell, a plate with the indications provided in par.19 and the indications on the SVT (GSCT003) provided in the IEC 61869-1-3 standard, shall be installed.

For the completion of the TCA process, the manufacturer shall provide, in addition to what is indicated in point 24, dimensional drawings of the equipment (views and sections) with at least the following indications:

• Position of the SVT (GSCT003) inside the panel;

• Single-line electrical diagram of the auxiliary circuits of the equipment;

• Plate design.

7.4.2 Warning nameplate

The equipment shall show the following labeling on the front of the switchgear (Figure 46) according to warning sign W012 from SO7010 .

7.4.3 Label holder

Every upright shall have a label holder with a transparent window 120x50 mm (Figure 47).
The SVT GSCT003 is a self-protected voltage transformer used for auxiliary services for the medium voltage network remote control system.

7.4.4 Type tests

The type tests are listed in par. 28.1 and par. 7.2 of specification GSCT003, including the internal arc test.

7.4.5 Routine tests

The routine tests are those listed in paragraph 30 including the tests prescribed in par. 7.3 of the GSCT003 specification. If the SVT is a sub-supply, manufacturer shall present a test report complete with all the tests indicated in par. 7.3.

Enel reserves the right to attend the routine tests at the SVT sub-supply factory.

	GLOBAL TYPE	GSCT003/1	GSCT003/2	GSCT003/3
	SVT Primary Voltage Level (kV)	20-15-13,2-10	13,8-13,2-12-11,4	33-25-23
COUNTRIES	DISTRIBUTION COMPANY	COUNTRY CODE		
ARGENTINA	EDESUR	0102-1902		0102-1903
BRAZIL	ENEL DISTRIBUIÇÃO RIO *		6812214	6812215
	ENEL DISTRIBUIÇÃO CEARÁ *		6812217	
CHILE	CHILECTRA		-	-
COLOMBIA	CODENSA	6812342	6812343	6812344
IBERIA	ENDESA DISTRIBUCION ELECTRICA	110572		110573
ITALY	E-DISTRIBUZIONE	53 45 13		53 45 15
PERU	EDELNOR			
ROMANIA	ENEL DISTRIBUTIE BANAT	53 45 13		
	ENEL DISTRIBUTIE DOBROGEA	53 45 13		
	ENEL DISTRIBUTIE MUNTENIA	53 45 13		

Table 13 - Type of SVT (GSCT003)

* Le matricole di Enel Cearà ed Enel Rio sono valide per tutte le aziende di Enel Brasile

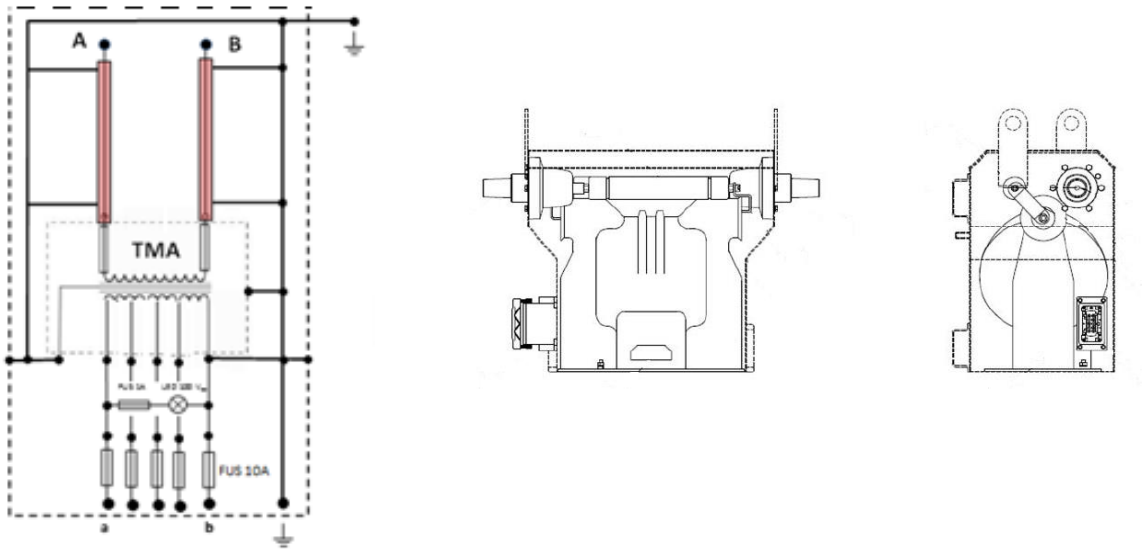


Figure 29 - Electric scheme and example SVT

7.4.6 **BT connections**

A connection with BT cable must be provided with the equipment 2x2,5 mm^2 of length 8 mt, mechanically protected by flexible sheath of color grey for indoor use, does not propagate the flame, with its sheath press in the part upper housing of the secondary connections. The cable must be type FG16H1R16, insulation level 0,6-1kV, formation 2x2,5 mmq CU (colour of the conductors blue and brown), with a grey outer sheath, flame-retardant, low temperature emission of toxic and corrosive fumes and gases, suitable for indoor installation.

7.5 RMU FOR ENERGY MEASUREMENT (M)

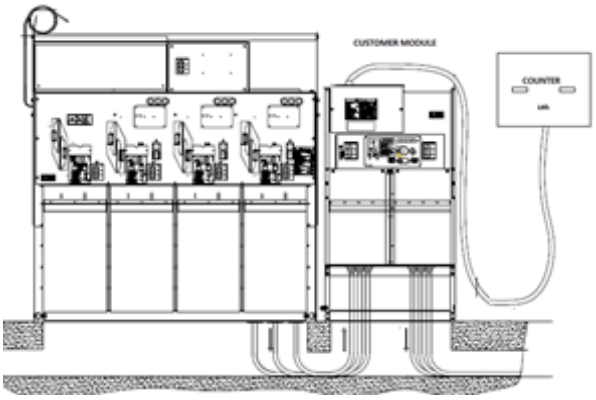


Figure 30 - Example

7.5.1 Characteristics

The main characteristics are listed in table 3.

The enclosure shall have a SF6 volume less than 1500 liters and its filling, to be implemented exclusively in the factory, shall be made in order that the maximum operating relative pressure at 45 °C does not exceed 0,5 kg/cm2 (49,033 kpa) and they have to form a sealed pressure system (IEC 62271-200).

The switchgear shall be sealed. The elements used in the factory for filling and recovering the SF_6 at the end of life shall be identified with a self-adhesive plate and protected from accidental shocks. On the plate it shall be written, in the language of the country to which it will be supplied: "*Remove the cap at the end of the switchgear's operating life only for the possible recovery of gas*". This plate shall have a yellow RAL 1021 background and the words in black RAL 9005.

The 24 kV or 36 kV switchgear can be manufactured in a SF_6 insulated single shell containing the busbars, the switchgear and the earthing switches.

Strains during operation and transport shall be taken into account.

The switchgear shall have an overpressure valve, equipped with a metallic disc for the protection against accidental strains, placed at a proper distance from the valve itself.

To connect the MV cable terminals, the switchgear shall be equipped with external cone bushings with capacitive voltage divider in accordance with EN 50181. Bushings shall have a 630 A rated normal current for the lines (type C interface shown in the technical specification GSCC006).

The current and voltage transformers must be of the approved type conforming respectively to the local standards as indicated in the table 14:

Countries' I&N	Standard local current transformer	Standard local voltage transformer
Argentina	**D.E.M. NRO. 001 DEL 10/96 (REV. 3)**	**D.E.M. NRO. 001 DEL 10/96 (REV. 3)**
Brazil	**E-SE-007**	**E-SE-007**
Chile		
Colombia	**E-SE-08 (SECTION 9.3)**	**E-SE-08 (SECTION 9.3)**
Spain		
Italy	**DMI031052**	**DMI031015**
Peru	**MAT-OYM-NDS-18-309-ESP**	**MAT-OYM-NDS-18-309-ESP**
Romania		

Table 14- local standards

7.5.2 Measurement connector and wiring

The secondary circuits of the voltage and current transformers must be wired with 2.5 mm^2 copper conductors for the voltage circuits and 6 mm^2 for the amperometric circuits. The conductors relating to the voltage and current transformers inside the equipment must be properly spaced from each other to avoid the possibility of an accidental short circuit.

The secondary circuits in gas-air through-out must be connected to a female connector, respecting the connection diagram shown in the figure 31.

The female connector must be suitable for connection with the male connector required by the DMI031082 specification relating to the cord for connecting the metering units. The connector must have a sealable protection cover with IP41 degree.

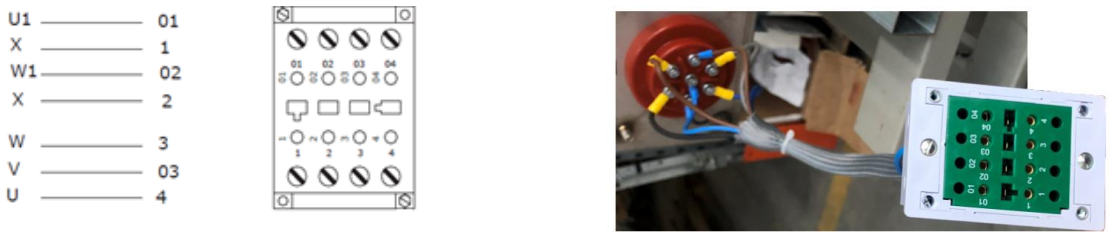


Figure 31 - Connector

7.5.3 Characteristics of earthing switches (ES)

The manual earthing switches shall comply with IEC 62271-102. The characteristics of earthing switches (ES) are given in table 7, with mechanical life class M0.

To connect the MV cable terminals, the switchgear shall be equipped with external cone bushings with capacitive voltage divider in accordance with EN 50181. Bushings (see Figure 1C) shall have a 630 A rated normal current for the lines (type C interface shown in the technical specification GSCC006).

7.5.4 Operational directs and switchgear command

The operating direction shall be in accordance with IEC 60447 and with everything written in this technical specification. Directions of movement and positions shall be "open" or "closed". During operations, the command lever must not protrude from both sides of the panel.

The switch-disconnectors and earthing switches must preferably be operated with a lever compliant with the technical specifications and, in any case, with IEC 62271-1 regarding delay between closing and opening operations.

The operating directions must be visible even if the protective cover is removed.

7.5.5 Functional schemes

The general functional electric schemes are shown in Figure 32 which exemplifies the admissible constructive solutions:

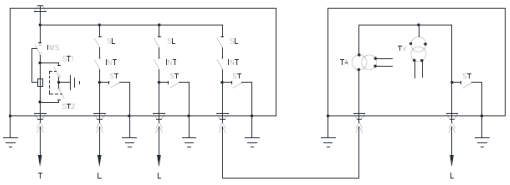


Figure 32 - Example

The wiring diagram of the User Panel circuits must be according to figure 33.

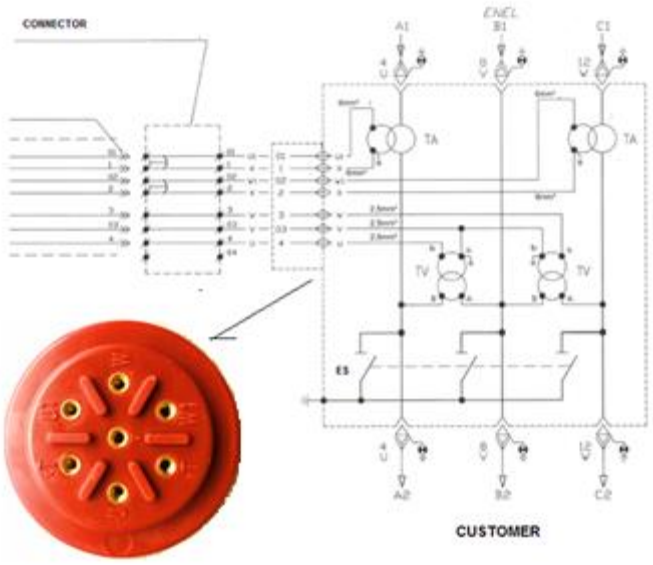


Figure 33 - example of a connection diagram

7.5.6 Earthing switch

The earthing switch must be equipped with a three-pole manual control operated by independent closing; the control devices must be mounted on the outside of the SF6 insulated enclosure and can protrude from the front of the panel no more than 200 mm. The effort required for maneuvering must not exceed 200 Nm. The degree of protection of the operating and control units shall be IP3X.

With the lever inserted, the degree of protection may be reduced to IP2XC.

The earthing disconnector must be operated preferably with the lever par. 18 which must comply with IEC EN 62271-1 with regard to the delay between the closing and opening maneuvers. The direction of movement for the execution of the maneuvers must comply with the provisions of standard EN 60447.

With regard to the status indication of the position of the contacts of the earth switch, refer to the requirements below:

The 'open' and 'closed' position of the earthing disconnectors shall be indicated a by means of a safe indicator device (standard EN 62271-102).

In correspondence with the operating socket of the earthing disconnector the template shown in Figure 34 must be applied.

The insertion of the operating lever of the earth disconnecting switch in the socket with the switchboard in service must be precluded with an electromagnetic interlock.

The device shall be powered only by the capacitive divider of the POWER INPUT line.

In proximity of the earth disconnector operating seat, a plate with the following wording: "The earth leakage switch (ES) must only be operated with power supply disconnector, from the panel, in “open” position and, in any case in the absence of voltage".

Moreover, the following indications shall be provided of switch-disconnector position:

- black letter “I” on 1021 RAL F2 yellow background corresponding to the close position of the earthing switch;
- black letter “O” on 7030 RAL F2 grey background corresponding to the open position of the earthing switch;

The signal positions shall be visible even with the protection shell is removed.

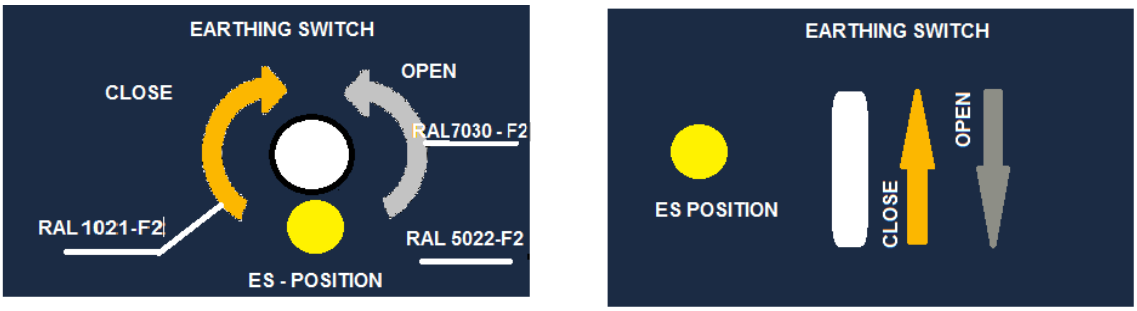


Figure 34 - Mask for the operating point of the earthing switch (see table 8 for the correct wording)

7.5.7 Interlocking

The cable compartment access panel must be removed only in safe condition with closed earthing switch. In all other cases, the padlock insertion must be mechanically forbidden.

Panel reposition must not be possible until closing the earthing switch.

A point must be provided for padlock insertion, to lock the operations of the earthing switches.

7.5.8 Attachments for lifting, moving and transport

The panel must be equipped with special attachments (welded M12 nuts) to fix the eyebolts lifting. The position of the eyebolts attachments must be chosen so that the assembly (eyebolts, steel ropes, etc.) prepared for lifting does not exceed maximum overall dimensions (700 mm) provided.

7.5.9 Voltage presence / absence detectors

The panel must be equipped with presence / absence detectors conforming to the ANNEX E specification.

7.5.10 Supply requirements

Each switchgear shall be supplied with:

- n. 2 Current transformer

- n. 2 Voltage transformer
- n.1 cable type DMI 031082.
- One Command lever”
- Coupling kit (if any)
- Installation and operation in the language of the Country in which the switchgear has to be delivered;

7.5.11 Warning nameplate

The equipment shall show the following labeling on the front of the switchgear (Figure 49) according to warning sign W012 from SO7010 .

7.5.12 Label holder

Every upright shall have a label holder with a transparent window 120x50 mm (Figure 47).

7.6 MANOMETER

To measure the SF6 pressure, on the type codes to be supplied in Spain, Peru, Chile, Argentina and Brasil a manometer shall be provided (Figure 35).
The manometer shall not be extractable and, in normal conditions, the pressure indication shall be between 25% and 75% of the area marked as safe. The area marked as safe shall be green RAL 6017 whereas the other area shall be red RAL 3000.
The manometer is mounted on the front of the panel and will be clearly visible under normal operating conditions.

Figure 35 - Manometer

7.7 EARTH CONNECTIONS

The earth of the switchgear shall be made with a copper wire whose section shall not be less than 50 mm².
The operating shafts of the switch-disconnectors and of the earthing switches shall be connected to the earth (with conductors whose section shall not be less than 30 mm²) and to the other metallic objects. This connection is not necessary if the switchgear internal shaft is made of insulating material.
From the switchgear earthing point, a conductor or a copper bar, whose section shall not be less than 50 mm², shall be derived and it shall develop along the entire length of the switchgear in correspondence

of the line and transformer protection uprights; it shall be provided with a M12 bolt on which the earthing connections of the MV cable shields shall be fixed. This conductor or copper bar shall allow the connection to the secondary substation earth from both sides of the external part of the switchgear. For this reason it shall be provided with two M12 bolts.

The metal part around the bolts must not be painted.

Grounding points on the outside of the cell must have a grounding symbol.

The conductor or copper bar shall be realized so that it's not necessary to disassemble, totally or partially, the switchgear by inserting or removing a cable and its corresponding terminal.

Figure 36 - Earth Connections

7.8 INSTALLATION

The switchboard shall be fixed to the floor through M12 screws.

Figure 37 - Floor fixing

7.9 CABLE COMPARMENTS

For each TF and M unit with circuit breaker line unit the cable compartment shall include:

- Unipolar steel supports suitable for the installation of MV cables in a vertical plane layout (standardized plug-in termination GSCC006);
- Steel panel to close the bottom of the compartment, with 3 holes in the bottom and relative cable glands for MV terminals with a diameter from 35 to 65 mm;
- 40 mm diameter metal conduit to connect the bottom of the compartments with the fault detection device.

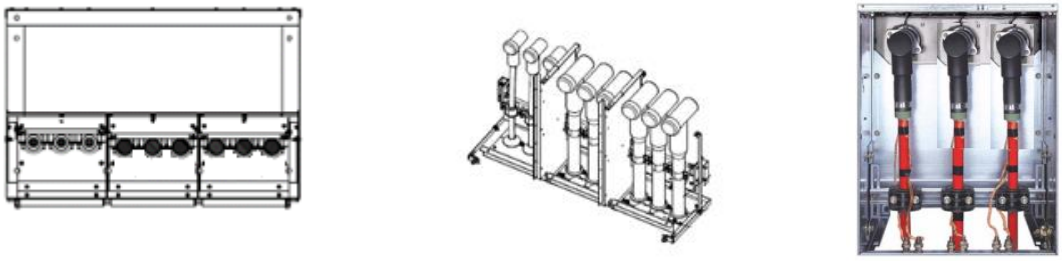


Figure 38 – Cables compartments

For each line unit (CBL and L RMU) the cable compartment shall include:

- Steel panel to close the bottom of the compartment, with 3 holes in the bottom and related cable for MV terminals with a diameter from 35 to 65 mm;
- 40 mm diameter metal conduit to connect the bottom of the compartments with the fault detection device.

Figure 39 - Cables compartments

The panels in the cable compartment shall not be bolted.

7.10 CAPACITIVE DIVIDERS AND VOLTAGE DETECTING SYSTEMS

The capacitive dividers shall have the following characteristics (tab.1 IEC 61243-5):

Designation of the VDS	*Input impedance X_c of the indicator*		*Load capacitance C_s of the coupling system*		*Electrical threshold conditions at the interface*			
	X_{cmin} MΩ	X_{cmax} MΩ	C_{smin} pF	C_{smax} pF	I_{tmin} µA	I_{tmax} µA	U_{tmin} V	U_{tmax} V
Medium resistance MR	12	14,4	221	265	1,39	2,5	20	30

Table 15 – Characteristics capacitive dividers

The panel shall be equipped with presence / absence voltage detectors conforming to the ANNEX E specification with related capacitive dividers with features compliant with the annex C:

- busbar side, one for each type of board ;
- cable side, for each line unit and transformer.

Figure 40 – VDS ANNEX E

Figure 41 - Capacitive type ANNEX E and example of connection of the bar voltage detector

Each voltage detector system, clearly distinct for each riser, shall be surrounded by a box with the words "SIDE BARS" or "CABLE SIDE". These bushings must be covered to be protected against direct contacts.

Language	SIDE BARS	CABLE SIDE
Italian	LATO SBARRE	LATO CAVI
Spanish	LADO BARRAS	LADO CABLES
Portuguese	LADO BARRA	LADO CABO
Romain	LATERAL SBARRE	LATERAL CABLU

Table 16: Function of the operation

7.11 SUPPORT FOR THE FAULT DETECTOR DEVICE

In the upper part of the switchgear, a cable duct for the external wiring of the cables that connect the motor and the fault detector to the UP shall be provided.

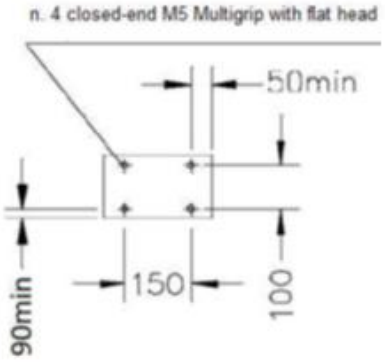


Figure 44 -Support for the fault detector device

Moreover a metal duct with a diameter of 40 mm to connect the bottom of the compartments with the fault detector device shall be provided.

7.12 COMMAND LEVER

The operating lever will be constructed in accordance with paragraph 5.7 of the IEC 62271-1 standard regarding the delay between the closing and the opening of the equipment and the maximum dimensions shown in the drawing in figure below. The lever must be made of EN 10216-1 steel, treated with electrolytic zinc-plating according to the ISO 2081 (FZn 12 III) standard and must be stamped with the name of the manufacturer preferably with molding or, in any case, with a permanent indelible solution.

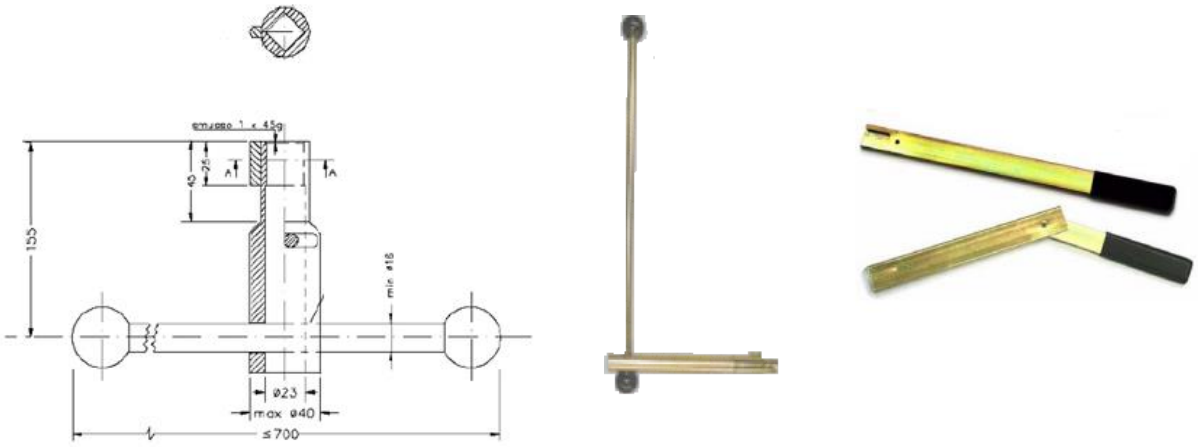
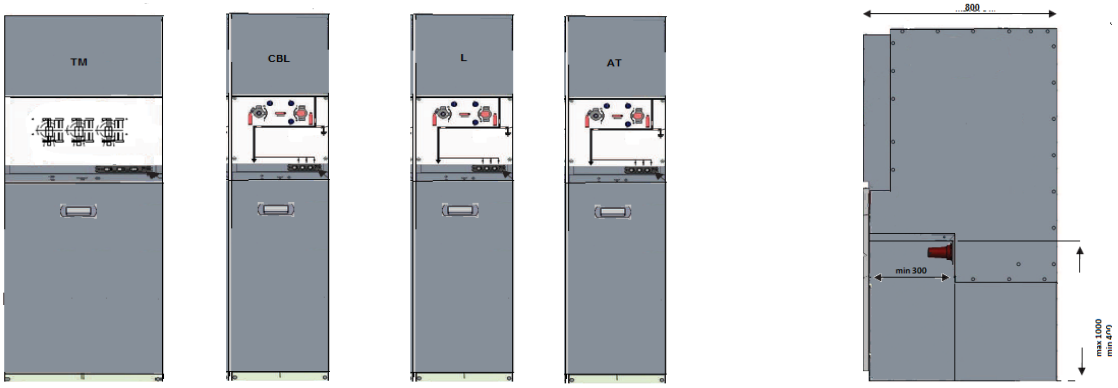


Figure 45 - Example command lever

7.13 SWITCHGEAR DIMENSIONS

The maximum overall dimensions shall comply with table 17.



TYPE CODE	24 kV WIDTH MAX (mm)	36kV WIDTH MAX (mm)	HEIGHT MAX (mm)	DEPTH (mm) 24 kV	DEPTH (mm) 36 kV
TM	600	600	2000	830	1200
CBL	450	550	2000	830	1200
L	400	450	2000	830	1200
AT	350	450	2000	830	1200
M	700	700	2000	830	1200

Table 17 – Dimensions

7.14 PROTECTIVE COATING

For the painting of the structure an epoxy or polyurethane anticorrosive protection system is required, with an average expected durability according to ISO 12944 and a class of corrosivity C3.
Technical characteristics protective coating:

PAINT THICKNESS µ	COLOR RAL-F2	TEST PROCEDURE TABLE	DURABILITY CLASS
60	GRAY N. 7030	C3	MEDIUM

Table 18 - Technical characteristics protective coating

As an alternative it is possible to use pre-galvanized steel type EN 10142 with coating thickness> 200 [g / m2] with the exception of the terminal compartment door and frontal panel.
The ferrous parts of the operating controls shall be protected by an electrolytic coating of 12 µm of zinc, or alternatively in stainless steel.

Mounting nuts and bolts and small accessories, unless otherwise specified, shall be protected with electrolyte zinc Fe III Zn EN ISO 4042.

The verification of the protective cell coating must be as prescribed in the standard 62271-304 level 1.

In case of installation in high pollution environment (equipment to be supplied to in Enel Brasil, Chile, Colombia e Perù), ENEL could require the following optional requirements:

- Degree of protection for the operating devices (even with the operating lever inserted) IP51 (see Table 3 for the standard requirement)
- Protective coating according to SPS class from IEC 60815-1 indicating for each type code and with class of corrosivity C5M-H according to ISO 12944 (see chapter 18 for the standard requirement).
- New salt mist/corrosion standard with method 6 IEC 60068-2-52 standard.
- Alternative solutions/tests to demonstrate the suitability in this kind of environment can be proposed by the manufacturer and are subject to Enel approval.

In general, medium voltage distribution cells must be supplied to function satisfactorily in the internal environment in the following conditions of service:

	EDESUR	ENEL RIO	ENEL CEARÁ	ENEL GOIÁS	ENEL SÃO PAULO	ENEL CHILE	ENEL COLOMBIA	E-DISTRIBUZIONE	ENEL PERU'	ENEL DISTRIBUTIE	EDISTRIBUCION R.U.
HIGH POLLUTION	C3M	C5H	C5H	C3M	C5H	C3M	C3M	C3M	C5H	C3M	C3M

Table 19 - installation in high pollution environment

7.15 NAMEPLATES

7.15.1 Rating plate

The switchgear rating plate shall contain information on the code that the manufacturer assigns to each series of the same type. It shall contain the information required by IEC 62271-200 (table 101), IEC 62271-102, IEC 62271-100, IEC 62271-105, IEC 62869-10 and IEC 61869-11, with the following additions: manufacturer name, year of manufacture, manufacturer code, serial number, Enel code.

Subclause 5.10 of IEC 62271-1 is applicable with the following additions: the nameplates shall be made of anodized aluminum with a 0.8 ÷ 1 mm thickness and shall be secured with screws or rivets. They shall have borders, boxes and white or silver written on opaque black with the exception of the area intended for the company that may be of a different color; the lettering of the required data shall be punched or black printed.

The nameplates can also be adhesive printed with a laser printer; in this case the manufacturer, at the moment of the request, shall submit adequate documentation demonstrating that, after tests as prescribed for protective coatings, can keep adhesiveness, readability and resistance.

In the rating plate proximity there shall be a barcode with the characteristics described in Nota Operativa Presidio Vendor Rating PVR006.

An informative nameplate with the sentence “Contains fluorinated greenhouse gases covered by the Kyoto Protocol”, in accordance with Commission Regulation (EC) 1494/2007 of 17th of December 2007, has to be provided.

7.15.2 Operating sequence nameplate and synoptic scheme

The switchgears shall be equipped with an "operating sequence nameplate” on which the sequence of operations to be executed shall be reported, respectively: put in service, the sequence to put in secure configuration (earthing output) and sequence to access to the fuses (if applicable).

The switchgear electric scheme shall also be contained. This nameplate shall be positioned on the protective shell of each command so as to be clearly visible.

7.15.3 Signal masks on the operating places

On each line and transformer protection upright, in correspondence of each manual operating place, signal masks for the position of the devices and the indication of the movement direction for the execution of the operations shall be provided.

7.15.4 Warning nameplate for the switchgear drilling

In a location clearly visible during service, each switchgear shall have a circular nameplate indicating the prohibition to use drill, or similar tool, to avoid the perforation of the shell containing SF6 in pressure.

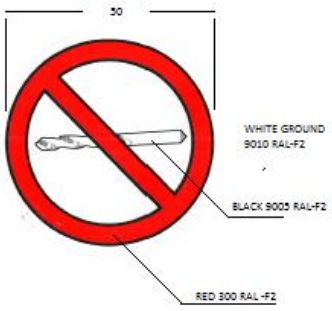


Figure 46

7.15.5 Label holder

Every upright shall have a label holder with a transparent window 120x50 mm .

Figure 47

7.15.6 Marks of the phases

In correspondence with bushings the L1 - L2 - L3 signals shall be applied to identify the three different phases. For Italy and Romania, to identify the phases, the reports 4 - 8 -12 shall be applied.

Figure 48

7.15.7 Warning nameplate

Equipment shall show the following labeling on the front of the switchgear according to warning sign W012 from ISO7010

- Triangle background: yellow
- Arrow: black
- Plate: stainless steel, aluminum or 3 mm thick plastic
- The plate is riveted to the door plate
- For Colombia, this sign shall comply with the terms of article 11 of RETIE

Figure 49

7.16 LOW-POWER INSTRUMENT TRANSFORMERS (LPIT)

Each phase of each line unit (CBL and L RMU) shall be equipped with low-power instrument transformer (LPIT) compliant with technical specifications GSCT005 "Technical characteristics of LPITs for RGDM / RGDAT", with the clarifications indicated below:

The connection cables (one per phase, for each line unit) and the related connectors, considered an integral part of the LPIT, shall comply with the GSCT005 specification and integrated into the equipment, exiting near the RGDAT/RGDM support, with sufficient length available (the cables shall exit the compartment for 30 cm).
The secondary terminations of the LPVT intended to be connected to the ground shall be connected to the compartment ground inside it.

The switchgear shall be submitted to the integrative tests as in the GSCT005 (can be proposed by the supplier, and subject to Enel approval, the performance of some type tests on LPIT "stand-alone" rather than on the complete switchboard, technically justifying their applicability to the integrated product).

7.17 MAINTENANCE

The switchgear shall be maintenance free for the entire expected service life (40 years).

Figure 50

7.18 PACKAGING, HANDLING AND IMPACT INDICATORS (SHOCKWATCH)

The switchgear chassis shall have adequate strength, taking into account the stresses to which it is subject during transport. On the upper part of the switch, eye bolts shall be installed to allow movement by means of bridge crane, forklift or overhead crane.

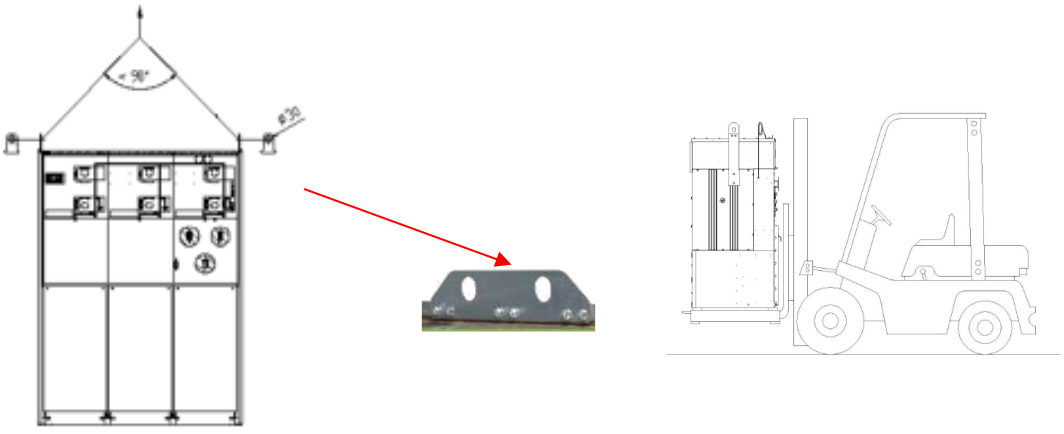


Figure 51 - Examples for handling

The equipment shall be packed with a plastic waterproof film wrapped around it, with polystyrene panels to protect command.

Each equipment shall be equipped with a shock indicator (ShockWatch).

Indicators consist of labels containing a red liquid in suspension. If the device is subjected to an impact higher than a specific G level declared by the manufacturer, the impact will cause the red liquid to escape, clearly visible. The label shall be on the front of the appliance and clearly visible.

Figure 52 - ShockWatch

8 TESTING

All tests described in the following paragraphs shall be performed on the switchgear:

Tests are divided in:

- Type tests
- Individual test;
- Routine tests;

The tests described in the following paragraphs shall be carried out on the panel according to IEC 62271-100, IEC 62271-102, IEC62271-103, IEC 62271-105 and IEC 62271-200.

Type and individual tests will be performed on samples submitted to the TCA .

8.1 TYPE TEST

Visual inspection	IEC 62271-200/GSCM004	
Dielectric tests	IEC 62271-200	6.2
Partial discharge test	IEC 62271-200	6.2.9.
Measurement of the resistance of the main circuit	IEC 62271-200	6.4
Temperature-rise tests	IEC 62271-200	6.5
Short-time withstand current and peak withstand current tests	IEC 62271-200	6.6
Control of the degree of protection (IP)	IEC 62271-200	6.7
Internal arc test	IEC 62271-200	6.106
Tightness tests	IEC 62271-200	6.8
Electromagnetic compatibility tests (EMC)	IEC 62271-200	6.9
Additional test on auxiliary and control circuits	IEC 62271-200	6.10
Verification of making and breaking capacities	IEC 62271-200	6.101
X-radiation test procedures for vacuum interrupters	IEC 62271-200	6.11
Mechanical operation tests	IEC 62271-200	6.102 – 6.105
Pressure withstand test for gas-filled compartments	IEC 62271-200	6.103
Tests for the verification in humid atmosphere	IEC 62271-200	62271-304 LEVEL 1
Verification of the protective coating	ISO 2409	LEVEL 0
Test to verify the protection against mechanical impacts	IEC 62262	6
Particular type tests for circuit-breaker		
Mechanical and environmental tests	IEC 62271-100	6.101
Short-circuit current making and breaking tests	IEC 62271-100	6.102 - 6.106
Critical current tests	IEC 62271-100	6.107
Single-phase and double-earth fault tests	IEC 62271-100	6.108
Out-of-phase making and breaking tests	IEC 62271-100	6.110
Capacitive current switching tests	IEC 62271-100	6.111
Electrical endurance tests	IEC 62271-100	6.112
Particular type tests for switch disconnector		
Verification of switchgear and earthing switches safe devices	IEC 62271-102	A.6.105.1.3 and A.6.105.2
Particular test type RMU with measurement		
Dielectric tests	IEC 62271-102	6.2
Measurement of the resistance of circuits	IEC 62271-102	6.4
Temperature-rise tests	IEC 62271-102	6.5
Short-time withstand current and peak withstand current tests	IEC 62271-102	6.6
Verification of the protection	IEC 62271-102	6.7
Tightness tests	IEC 62271-102	6.8
Electromagnetic compatibility tests (EMC)	IEC 62271-102	6.9
Test to prove the short-circuit making performance of earthing switches	IEC 62271-102	6.101
Operating and mechanical endurance tests	IEC 62271-102	6.102
Operation under severe ice conditions	IEC 62271-102	6.103
Test to verify the proper functioning of the position indicating device	IEC 62271-102	6.105
Making and breaking tests on switch disconnector	IEC 62271-103	6.101
Mechanical and enviromental tests on switch disconnecror	IEC 62271-103	6.102
Test seismic	IEC 62271-210	5.1

Table 20 –Type test

8.2 INDIVIDUAL TEST

8.2.1 Tests on the fuse-carrier

The test is divided in two phases.

Safe opening of the cap at rated normal current:

- the test shall be performed by keeping the three phases at rated normal current, considering the largest fuse. The current shall be maintained for enough time to get to the temperature stabilization. The temperature shall be detected on the cap of every phase.

The test is positive if there aren't breaks in any fuse-carrier and the cap is not projected outside its place, also during the fuse-carrier opening in isolated and earthed conditions.

Internal arc under fault conditions:

- The test shall be performed by connecting a copper wire, with a 0,5 diameter, between the fuse-carrier contacts and with the cap inserted.

The test result is positive if, by giving a 16/20 kA current for 30 ms, the fuse-carrier doesn't break or, in case, if it doesn't hit the indicators put in the same way as the internal arc test of the switchgear itself (AFL).

8.2.2 Additional tests for switch-disconnector combined with fuses

Excluding the command, in case the switch-disconnector is the same one used in the line uprights, the following additional tests will be asked during the homologation process:

1a) Verification of the release device

This verification shall be made simulating the intervention of the striker of medium type fuses with minimum energy (IEC 60282-1 par. 4.14).

1b) Measurement of the resistance

In addition to the measurement of the resistance in in accordance with IEC 62271-200 § 6.4, considering the instruction of IEC 62271-105 § 6.4, it shall be verified the resistance at the end of the clamps of the fuse-striker, inserting 63 A fuses and operating at 24 kV or 36 kV, depending on the type of RMU.

1c) Temperature-rise tests

In order to verify the fuse-carrier clamps too, it shall be carried out a temperature –rise test at 40 A inserting three 63 A fuses or, alternatively, using three sample tubes.

1d) Verification of the signal for fuse intervention

The test shall be performed by tripping the installed fuses twice. At the end of the test, if indicated by an appropriate plate on the shell, it shall be done the additional operation to take the command also in open position.

When the test is performed as a routine test, it can be carried out with the testing fuse.

8.2.3 Internal Arc

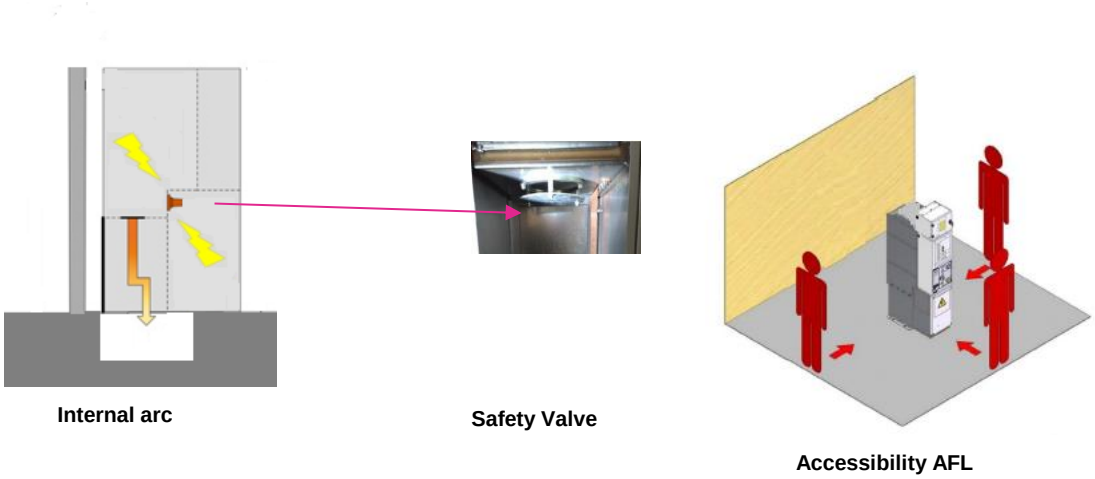


Figure 54

8.2.4 Verification of the protective coating

The following checks shall be performed on the protective coating:

1) Check of the thickness

   The thickness of the individual layers making up the protective coating shall be measured at five points on the painted surface.

   The verification is positive if the values for each single layer comply the following conditions:

   - the average of the measurements must not be less than the nominal value of the single layer;
   - no measurement must be less than the minimum value of the single layer.

2) Checking adherence

   It is carried out with the method of squaring the surface according to the standards ISO 2409:2013.

   The measurement points are five and must be chosen randomly on the painted surface.

   The verification is positive for all tests if the degree of alteration does not exceed Gt 2.

8.2.5 Dielectric test

In addition to the expected dielectric tests, an insulation test must be carried out according to the indicated scheme.

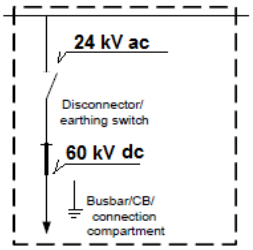


Figure 55 - scheme for dielectric test

8.2.6 Tests to verify the effectiveness of the protection against pollution

Referring to point 5.102 of IEC 62271-102, in the absence of a safe connection to earth, to verify the effectiveness of the protection against pollution in service of the insulating materials, it shall be performed the following test:

1) with the switch-disconnector isolated, it shall be applied a 60 kV power frequency voltage (for 24 kV RMU) or 80 kV power frequency voltage (for 36 kV RMU) between inlet and outlet, measuring the leakage current3.5.

2) the switch-disconnector is then subject to the following cycle, that simulates a 10 years electrical service life to be repeated 3 times:

- 20 openings at 100 Arms and cosφ = 0,7
- 8 closings at 4 kArms and cosφ = 0,15
- 15 closings at 3 kArms and cosφ = 0,15
- 10 openings at 100 Arms and cosφ = 0,7
- 30 closings at 200 Arms and cosφ = 0,7
- 37 closings at 2 kArms and cosφ = 0,15
- 15 closings at 1 kArms and cosφ = 0,15
- 15 openings at 100 Arms and cosφ = 0,7

3) the switch-disconnector shall be subject to the tests of the previous point 1.

The test result is positive if there are no discharges on the sectioning and if the leakage current value doesn't exceed 30 mA.

8.2.7 Tests to verify the tightness with the repeated temperature variations IEC

In accordance with paragraph 7.4 of IEC 62271-**100.**

8.3 ROUTINE TESTS PLAN

All the routine tests indicated in the following table shall be carried out by the supplier on all the samples prepared for the commissioning. For each piece that belongs to the prepared batch, the supplier shall prepare a test report with the results of the tests performed.

The routine tests shall be repeated by the supplier, under the Distribution Companies surveillance, on a sample chosen randomly among those ones of the batch that has already been successfully tested by the supplier. The tests shall be carried out on samples defined by the sampling plan below

At the end of the commissioning, within the measurement uncertainty, there shall not be differences between the measured values and those ones in the acceptation ranges of the approved test values.

In case of commissioning attended by the Distribution Companies, the entire batch will be rejected if the results of one of any test is negative.

A	1 sample for type
B	At least 1sample for type(serial number Enel/Endesa/LATAM) prepared for commissioning with at least 3 total samples, and in these selected samples have to be tested a total of 3 modules for each type (TF,CBL,LRMU,AT,M)
D	Test to be certified on single units by the supplier
K	If the samples is constructed as a unique tank, these test can be executed on the complete tank with the same Sampling plan indicated for the modules

Table 21 - Sampling plan

N.	Test	Standard	Sampling plan				
			TF	CBL	L RMU	AT	M
1	Visual inspection (a)	GSCM004					
2	Dielectric test on the main circuit (g) (K)	IEC 62271-200 – 7.1	B		B	B	B
3	Tests on auxiliary and control circuits (b)	IEC 62271-200 – 7.2	B	B	B	B	B
4	Measurement of the resistance of the main circuit (e) (K)	IEC 62271-200 – 7.3	B	B	B	B	B
5	Tightness test (D)	IEC 62271-200 – 7,4	D	D	D	D	D
6	Design and visual checks (a)	IEC 62271-200 – 7-5	A	A	A	A	A
7	Partial discharge measurement (i)	IEC 62271-200 -7.101	D	D	D	D	D
8	Mechanical operation tests (c) (K)	IEC 62271-200 -7.102	B	B	B		B
9	Tests of auxiliary electrical, pneumatic and hydraulic devices (K)	IEC 62271-200 – 7.104	B	B	B		B
10	Tests on voltage detecting system	IEC 62271-200 -7.105	B	B	B	B	B
11	Verification of proactive coating	ISO 2808	B	B	B	B	B
12	Dielectric test on the main circuit (g)	IEC 62271-100 -7.1			B		
15	Tightness test	IEC 62271-100 – 7.4		B			
16	Design and visual checks (a)	IEC 62271-100- 7.5		B			
17	Mechanical operating tests (d)	IEC 62271-100 – 7.101		B			
18	Dielectric test on the main circuit (g)	IEC 62271-102 § 7.1		B			
23	Mechanical operating tests (c)	IEC 62271-102 § 7.101	B	B	B		B
	Verification of earthing function	IEC 62271-102 § 8.102	B	B	B	B	B
24	Check of VT and CT routine tests		A	A	A		A

Table 22 - Testing plan

a	Including the verification of the enclosures' degree of protection (IP).
b	1 kV power frequency testing voltage (10 kV for trip coil) during 1 seconds.
c	perform 5 manual maneuvers of the SD (transformer) measuring the speed of the main contacts in opening and closing and 5 manual operations of the earthing switch Es (line) and of the earthing switches ES1 - ES2 (transformer) measuring the speed of the pristip contacts in closure. During the maneuvers verify all the mechanical interlocks provided.
d	5 closing and 5 opening operations at Vmin (24 Vcc-15%) and Vmax (24 Vcc + 20%). At Vn (24 Vcc) perform 5 C-O cycles and 5 Ot-C-O cycles (IEC 62271-100 § 101). In the last cycle of every sequence, measure the operation times, the absorption current of the coils and of the spring charging motor. All the measured times and maximum values of absorption shall be included in the limits specified by the Manufacturer and, in any case, they shan't be outside the ± 15% of the reference values obtained during the type tests.
e	Test to be performed on the same configuration used during the homologation process.
g	The test shall be performed with the operating devices closed and on the sectioning distance. All the tests shall be performed at a 50 kV power frequency voltage (for 24 kV line disconnector) or 70 kV power frequency voltage (for 36 kV line disconnector).
h	Perform the thickness verification with sampling plan "B" and the adherence verification on one sample only.
i	Test to be certified on single units by the supplier

Table 23 - Additional information

8.4 PARTICULAR TYPE TESTS FOR LPIT

When required (see tables 1 and 2) the switchgear sensors shall be tested according the document GSCT005 "Technical Characteristics of LPITs for RGDM/RGDAT".

9 SUPPLY REQUIREMENTS

Each switchgear shall be supplied with:

- One Command lever
- For Spain, the "declaración de Confirmidad" requested by RD337/2014
- Installation and operation manual in the language of the Country in which the switchgear has to be delivered, in compliance with provisions of 62271 series standards (including indication about SF6 end-of-life management and methods of recovery of gas SF6, see chapter 13 of 62271-1);
- A connection cable for each motorized upright equipped with connectors for connection between the equipment and the UP peripheral unit.
- A connection cable for remoting of the status of the SD in the transformer protection mounting opening position.

Outside the box containing the equipment, the following indications shall be reported with clearly legible characters:

- name of the Distribution Company;

- name of the supplier;
- description of the product;
- code assigned by the supplier;
- type code and serial number of the Distribution Company;
- gross weight.

In case of switchgear delivered to Colombia, the manufacturer shall include the mandatory RETIE certificate in the TCA dossier.

In case of switchgear delivered to Spain, the manufacturer shall include in the TCA dossier the mandatory certificate prescribed at ITC-RAT 03 in R.D. 337/2014. This Certificate must be attached to each supplied equipment.

10 ANNEX A INTERLOCKS CHECKING

Status	Disconnector	Earthing ES1 and ES2	Allowed	Forbidden	Impossible	Protection fuse and cable compartment
0	OPEN	OPEN	0,1,2		3	NO
1	OPEN	CLOSED	0,1	3	2	YES
2	CLOSED	OPEN	0,2	3	1	NO
3	CLOSED	CLOSED				

Transformer protection unit interlock check-in

Status	Disconnector	Circuit Breaker	Earthing	Allowed	Forbidden	Impossible	Access panel of the cable compartment
0	OPEN	OPEN	OPEN	0,1,7	5	2,3,4,6	NO
1	OPEN	OPEN	CLOSED	0,1,6		2,3,4,5,7	YES
2	CLOSED	OPEN	CLOSED				
3	CLOSED	CLOSED	OPEN	3,7	5	0,1,2,4,6	NO
4	CLOSED	CLOSED	CLOSED				
5	OPEN	CLOSED	OPEN	0,5	3	1,2,4,6,7	NO
6	OPEN	CLOSED	CLOSED	1,6	5	0,2,3,4,7	YES
7	CLOSED	OPEN	OPEN	0,3,7		1,2,4,5,6	NO

Circuit breaker unit - Interlock check-in

Status	Swirch disconnector	Earthing	Allowed	Forbidden	Impossible	Access panel of the cable compartment
0	OPEN	OPEN	0,1,2		3	NO
1	OPEN	CLOSED	0,1	3	2	YES
2	CLOSED	OPEN	0,2	3	1	NO
3	CLOSED	CLOSED				

RMU line unit – Interblock chech-in

Non reachable status

In order to check the correct functioning of the interlocks, it shall be necessary to verify their operation according tables.

Terminology:

Allowed: Status that is possible to reach from the current status.

Forbidden: Status that is impossible to reach from the current status as a result of the operation of the interlocks

Impossible: Status that is physically impossible to reach from the current status.

ANNEX B

Characteristics of the electrical command of the circuit breaker SWITCH DISCONNECTOR

10.1 ELECTRIC MOTOR

The circuit breaker motor for energy storage shall be driven by an electric motor, suitable for continuous service, having the following characteristics:

Supply voltage	[V_{cc}]	24 +20% -15%
Power consumption at full speed	[W]	≤ 300
Ratio between nominal power and absorbed power		≥ 1,4
Degree of protection		≥ IP3X
Other characteristics		IEC 60034-1

Table 24 - Characteristics of the electric motor

10.2 ELECTRIC COMMAND CIRCUIT BREAKER

The CB command must have the following functional characteristics:

- the motorization circuit must not absorb any current when it is in the stand-by state;
- the excitation time of the electric control must be such as to provide self-latching with a command pulse lasting no more than 300 ms;
- when the power supply to the motor circuit is missing, the fallout of all self-retainers must be verified;
- In case of padlock insertion power supply to electric maneuvers shall be cut out.

An electrical interlock must allow the operation of the motor only when the earth blades are completely open.

In case of manual control of the line or earthing switches, the insertion of the operating lever must prevent the electrical and manual controls of the switch; this interlock must as soon as the lever goes to engage the socket of any of the shafts.

10.3 ELECTRIC COMMAND LINE DISCONNECTOR

The electrical control of the LD must implement an operating cycle by means of a gearmotor of the dead point exceeding type with the following functional characteristics:

- the stability of the position of the SD contacts must be ensured until the dead center has been exceeded;

- if, during any maneuver, a power failure should occur before the dead center is exceeded, the system must allow the kinematic mechanism to be reset so that the operating lever can be inserted and, if the carter is removed springs must discharge;
- when the power supply to the motor circuit is missing, the self-retainers must fall;
- the motorization circuit must not absorb any current when it is in the stand-by state;
- the energizing time of the electric control must be such as to guarantee self-latching with a command pulse lasting no longer than 300 ms;
- power supply must be cut so as to prevent, in addition to manual operations, also electric ones.

An electrical interlock must allow the motor to operate only when the ground blades are completely open.

In the case of manual control, the insertion of the operating lever must prevent the operation of the motorization; this interlock must act as soon as the lever goes to engage the socket.

This condition can be achieved with both a mechanical solution (decoupling of the gearmotor) and an electric one (cutting of the motor supply).

10.4 CONNECTIONS

The energy for the motorized control is supplied by a special power supply housed in the peripheral unit for remote control of the secondary substations (GSTR002).

Inside the power supply, both the direct current sorting for the motors (± M) and the auxiliaries (± A) and the centralization of the remote controls and signals for all the compartments of the switchboard are carried out. The supply circuits for the motors (± M) and for the auxiliaries (± A) shall remain separate and isolated from each other and are protected by different bipolar protections in the power supply.

For the wiring between the motorized control and the power supply (line upright) a multipolar cable shall be provided, as indicated in figure 32, equipped at the ends with the flying parts of the connectors described in figure.

On both edges of the cable a mark of a PVC strap shall be applied on which the indication of the number and the denomination of the compartment to which they refer will be affixed during installation.

For remoting of the status of the SD in the transformer protection mounting opening position, a 2x1.5 mm2 LV cable with a length of 8 m shall be provided. This cable shall be wired from the auxiliary contact towards the outside of the trolley without interposed connection. At the end of the cable "SD-TF" shall be indicated The supplier shall provide appropriate protection against possible damages to these connections deriving from the handling and transport of the compartment.

For the unit with circuit-breaker function the total resistance (LV cable + coil) of open and close command circuit shall be between 5 and 5000Ω.

The characteristics of the cables shall be the following:

Rated insulation voltage	[V]	300/500
cable training (line upright)	n	11
cable training (transformer protection upright)	n	2
lenght	[m]	8 +0,2
Outer diameter (on insulation) of cores	[mm]	≤ 3
Flexible string conductors of annealed non-tinned copper		
PVC insulation of quality R2		
Distinction of cores by marked numbers (according to CEI EN 50334) match the numbers marked with these identifying the connector pins		
Rz quality PVC sheath		
Fire non-propagation characteristics according to IEC 20-22		

Table 25 - Characteristics of the external cable

10.5 INTERNAL WIRING

For internal wiring shall be used wire sections suitable for the correct operation of the equipment.
The end of each connection shall be equipped with pre-insulated terminals suitable for the type of connection required (faston, cylindrical, eyelet, etc.), identification marks, as well as reference to the wiring diagram.
Each cable passage hole shall be equipped with a suitable cable gland.

10.6 CONNECTORS

In order to interface the circuit of the electric control with the power supply, the fixed part of a circular connector, of the type shown in figure, shall be provided, on which the flying part provided at one end of the connection cable mentioned in point B.2 shall be inserted.
The coupling of the parts, facilitated by polarization guides, shall be ensured by means of a quick-release screw ring nut.
The flying part of the rectangular connector provided at the other end of the cable shall be of the type shown in figure 56. The coupling with the fixed part shall be facilitated by polarization guides and secured by means of elastic locking appendices.
Both the fixed and the flying parts shall be made of insulating material with dielectric characteristics.

The fixed part of the connector shall be accompanied by a cap (anti loss type); the flying ones shall have cable clamps.

The fixed connector shall be installed on the front of the control.

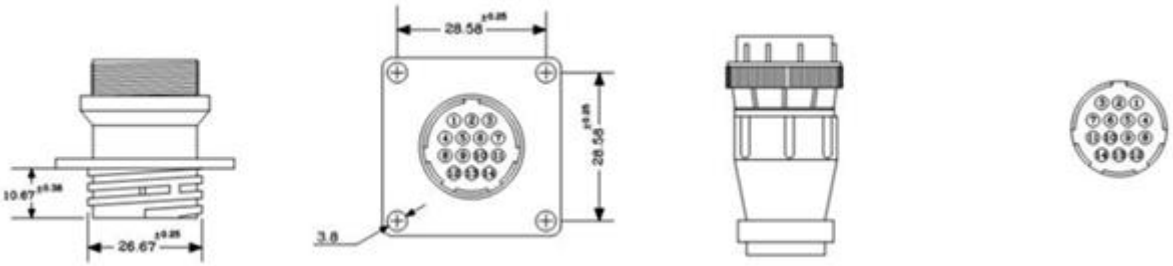


Figure 56 - Connector

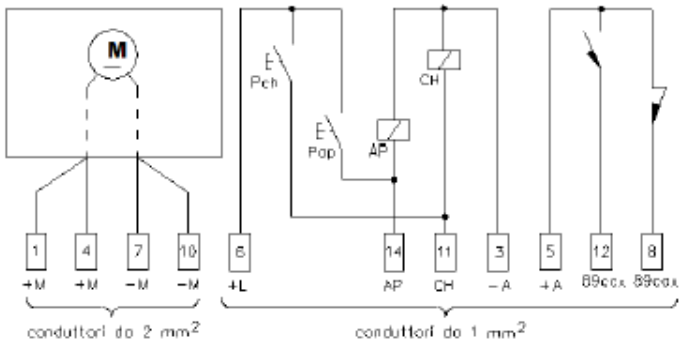


Figure 57 - electric scheme of the CB command

2		Not used	9		Not used
3	- A	Common (-24 VDC) commands	10	- M	Power supply (-24 Vcc) enginer
4	+ M	Power supply (+24 VDC) motor	11	CH	Remote control of closing
5	Com TS	Common Telesignals LCB	12	89ccx	Telesignal LCB Closed
6	+ L	Alim. (+24 Vcc) local commands	13	89 LD	LD Closed
7	- M	Power supply (-24 VDC) motor	14	AP	Remote control of Opening

Table 26 - Use of the motor-side connector pin

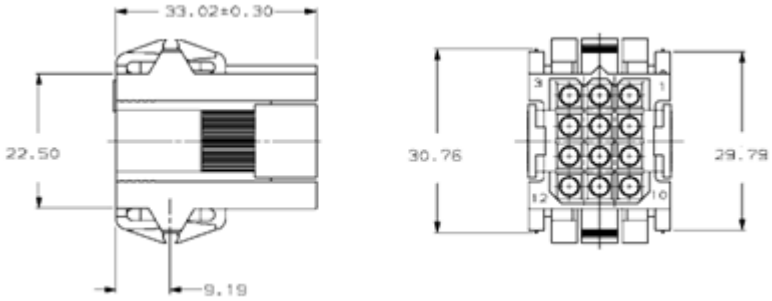


Figure 58 - Device connector on the Peripheral Unit side

1	+ L	Local commands (+24 Vcc)	7	AP	Opening Remote Control
2	+ M	Power supply (+24 VDC) motor	8	CH	Closing remote control
3	+ M	Power supply (+24 VDC) motor	9	89cax	Telesignal LCB OPEN
4	89ccx	Telesignal LCB chiuso	10	- M	Power supply (-24 VDC) motor
5	Com TS	Telesegnal state LCB	11	- M	Power supply (-24 VDC) motor
6		Not used	12	- A	Common (-24 Vcc) commands

Table 27 - Connector features on the Peripheral Units side

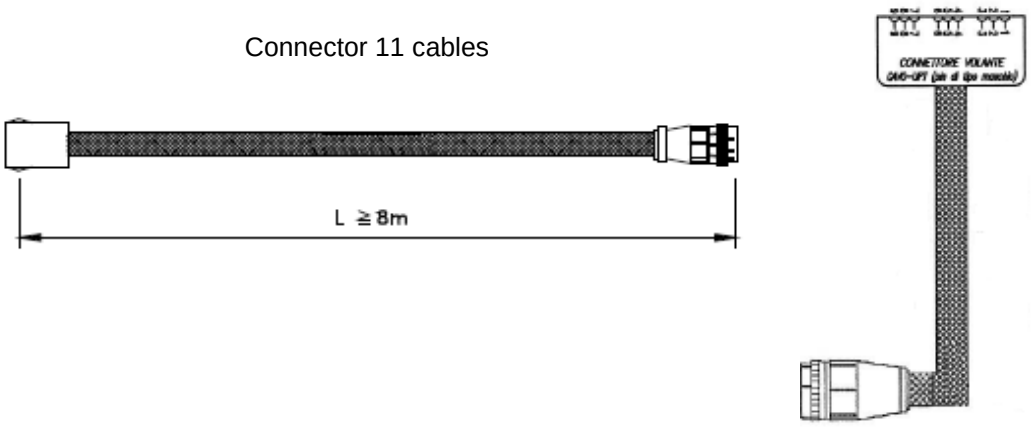


Figure 59- Connection cable between motorization and Peripheral Unit for uprights line

10.7 COMMAND COIL PARAMETERS

The opening and closing coils, connected to the mechanical system for the opening and closing of the CB poles, shall have an instantaneous maximum peak absorption of no more than 5 A. Each coil both

for opening and closing, shall be equipped with a system to dampen overvoltage caused by sudden variation of the coil current. The device shall be connected between the negative polarity of the 24 Vdc auxiliary power supply of the compartment and the input terminal for the open and close command. The device can be of the linear type (capacity type) or non linear type (diode type).

ANNEX C

11 TEST REQUIREMENTS FOR MV INSULATED BUSHINGS WITH CAPACITIVE SOCKET OF THE PRESENCE OF VOLTAGE

11.1 PURPOSE OF APPLICATION

Annex C shows the characteristics and tests to be applied to bushing insulators with capacitive socket for voltage presence detecting, manufactured according to DIN 50181 and GSCM004 specification. In particular, it applies to all bushing insulators defined in point 3 of the IEC 60137 standard, used for MV electrical equipment in three-phase alternating current systems at a frequency of 50/60 Hz.

11.2 CONDITIONS OF SUPPLY

The bushings shall have successfully achieved the TCA process according to GSCG002 Enel standard.

Common international standards

- IEC 60137
- DIN 50181

Common technical specifications

- GSCM004
- ANNEX E

11.3 LIST OF TESTS

All tests described in the following paragraphs shall be performed on the switchgear:
Tests are divided in:
- Type tests
- Routine Tests

11.4 TYPE TESTS

The tests shall be carried out in accordance with the requirements of paragraph 7 of IEC 60137.

LIST OF TESTS	STANDARD EN 60137	TYPE TEST	ROUTINE TEST
Dry or wet power-frequency voltage withstand test	8.1	X	
Long duration power-frequency voltage withstand test (ACLD)	82.	X	
Dry lightning impulse voltage withstand test (BIL)	8.3	X	
Dry or wet switching impulse voltage withstand test (SIL)	8.4	X	
Thermal stability test	8.5	X	
Electromagnetic compatibility tests (EMC)	8.6	X	
Temperature rise test	8.7	X	
Verification of thermal short-time current withstand	8.8	X	
Cantilever load withstand test	8.9	X	
Tightness test on liquid-filled, compound-filled and liquid-insulated bushings	8.10	X	
Internal pressure test on gas-filled, gas-insulated and gas-impregnated bushings	8.11		
External pressure test on partly or completely gas-immersed bushings	8.12	X	
Verification of dimensions (b)	8.13	X	X
Electrical characterization (b)		X	X
Checking the operation of the voltage detector (ANNEX E (a)		X	
Measurement of dielectric dissipation factor (tanб) and capacitance at ambient temperature (b)	9.1		x
Dry lightning impulse voltage withstand test (BIL) (b)	9.3		x
Dry power-frequency voltage withstand test (b)	9.3		x
Measurement of partial discharge quantity (b)	9.4		
Tests of tap insulation (b)	9.5		x
Internal pressure test on gas-filled, gas-insulated and gas-impregnated Bushings (b)	9.6		x
Tightness test on liquid-filled, compound-filled and liquid-insulated bushing (a)	9.7		x
Tightness test on gas-filled, gas-insulated and gas-impregnated bushings	9.8		x
Tightness test at the flange or other fixing device	9.9		x
Visual inspection and dimensional check	9.10		x

ANNEX D FUSES

12 PURPOSE OF APPLICATION

The characteristics of the combined-type fuses to be used for the protection of transformers are given in Annex D. All fuses are fitted with a striker, which acts as a disconnector release device.

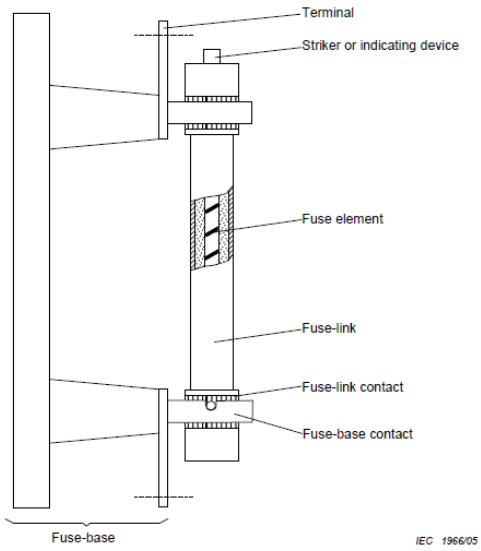


Figure 1

12.1 CONDITIONS OF SUPPLY

The fuse shall have achieved successfully the TCA process according to the GSCG002 Enel standard.

12.2 COMMON INTERNATIONAL STANDARDS

IEC 60282-1.

12.3 COMMON TECHNICAL SPECIFICATIONS

GSCM004.

12.4 CHARACTERISTICS

The fuses must be of back-up class type according to par. 9.3.3.2. of 60282-1 standard.

The minimum breaking current must be low enough to ensure proper coordination with breaking currents of distribution network (see IEC 62271-105).

Rated insulation level

Rated voltage of the fuse kV	Rated lightning impulse withstand voltage (negative and positive polarity)				Rated 1 min power-frequency withstand voltage (dry and wet) kV (r.m.s.)	
	List 1 kV (peak)		List 2 kV (peak)			
	To earth and between poles	Across the isolating distance of the fuse-base (see note)	To earth and between poles	Across the isolating distance of the fuse-base (see note)	To earth and between poles	Across the isolating distance of the fuse-base (see note)
12	60	70	75	85	28	32
17,5	75	85	95	110	38	45
24	95	110	125	145	50	60
36	145	165	170	195	70	80

Table 1

12.5 RATED FREQUENCY

Standard values of rated frequency are 50 Hz and 60 Hz.

12.6 RATED CURRENT

The rated current of the transformer is 200 A.

12.7 RATED SHORT-TIME WITHSTAND CURRENT

16/20 kA.

12.8 MECHANICAL CHARACTERISTICS OF STRIKERS

The striker shall be of the medium type according to paragraph 4.14 of standard 60282-1.

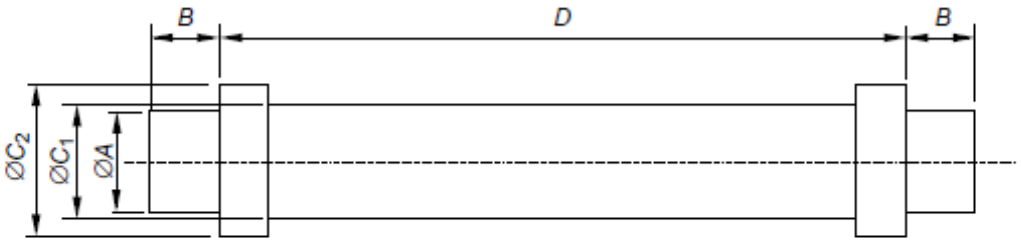
Type	Energy	Mechanical characteristics					
		Values of		Actual travel		Minimum withstand force	Maximum duration of travel
		Free travel (OA) (footnote a)	Further travel during which energy must be delivered (AB) (footnote a)	Min. (OB) (footnote a)	Max. (OC) (footnote a)		(footnote b)
	J	mm	mm	mm	mm	N	ms
Medium	1 ± 0,5	4	16	20	40	20	50

Table 2

12.9 TYPES AND DIMENSIONS

The dimensions of the fuses must be as indicated (annex D standard 60282-1)

Dimensions in millimetres



kV	ØA	B	ØC2 min.	ØC1 and C2 max.	D -1 0
12 17,5 24 36	45 ± 1	33 +2 0	50	88	292 367 442 537

Table 3

13 ANNEX E VOLTAGE PRESENCE INDICATORS

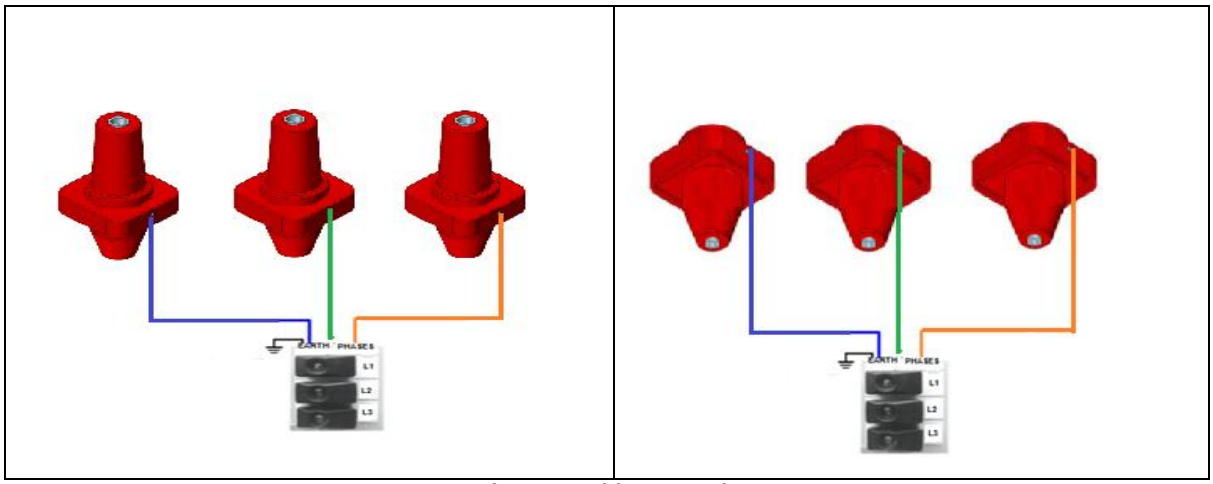


Figure 1 – wiring example

13.1 PURPOSE OF APPLICATION

The Annex is applicable to unipolar voltage detector systems with capacitive coupling to live parts. They are used to detect the presence or absence of operating voltage on AC systems with voltages from 11.4 kV to 38 kV and frequencies from 50 Hz to 60 Hz.

13.2 COMMON INTERNATIONAL STANDARDS

IEC 62271-206
IEC 61243-5

13.3 SPECIFICATIONS

The voltage detector system must be of separable type according to EN 61243-5. The hand-held indicator must be connected to a fixed coupling system by means of an interface.
For EDESTRIBUCION R.D. SLU the VDS will be with the indicators fixed and integrated in the interface, alternatives can therefore be considered

Figure 2 – Voltage presence indicators

The system will be of the MR type defined by a maximum threshold voltage of 30V and a corresponding current of 2.5µA at 50Hz and 60Hz at the interface.

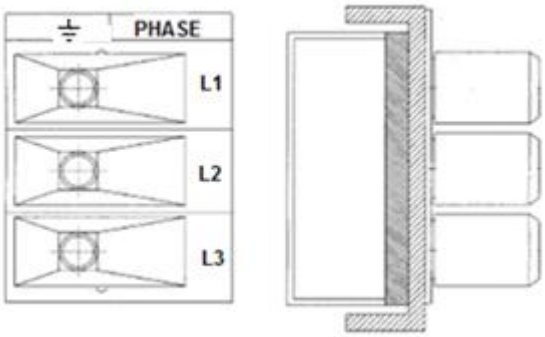


Figure 3 – interface and indicator

13.4 INTERFACE

The interface must ensure correct electrical contact between the connection conductor and the connection terminal. The contact points must be protected against corrosion. The interface must be equipped with sockets in accordance with Table 2 of EN 61243-5 and arranged according to it.

The test points shall ensure correct electrical contact.

The contact points shall be protected against corrosion and shall consist of a single socket in accordance with Table 2 of EN 61243-5.

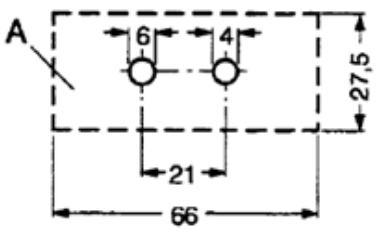
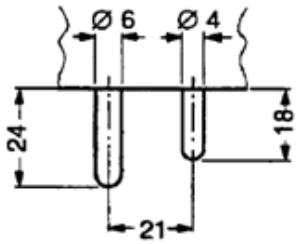
System designation	*Socket arrangement and minimum spare area A for indicator or plug*	*Plug arrangement*
MR Resistenza media *MR Medium resistance*		

Figure 4 - dimensional characteristic of interface

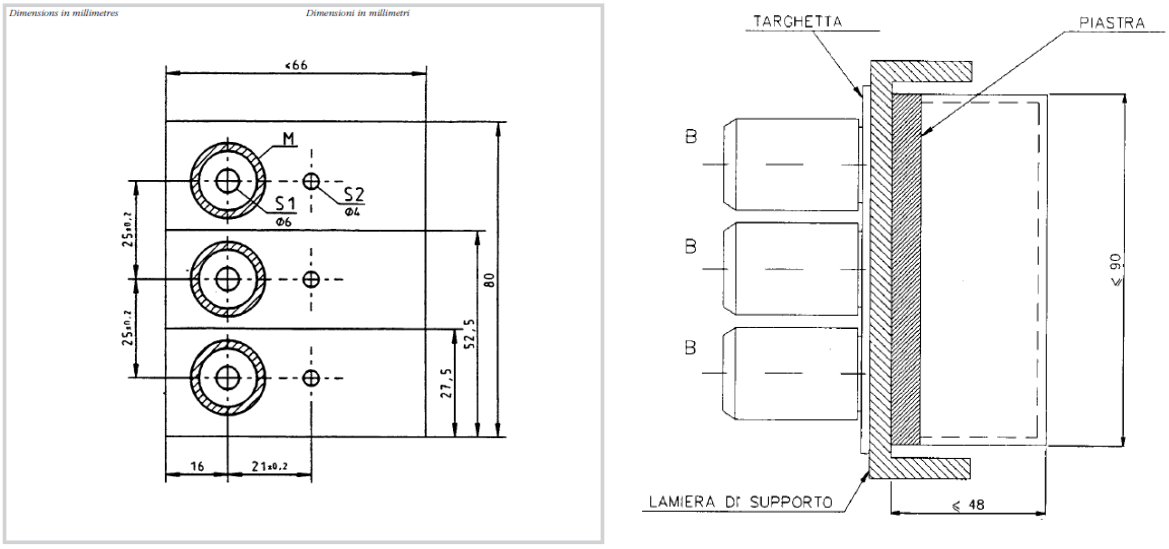


Figure 5 – Socket MR

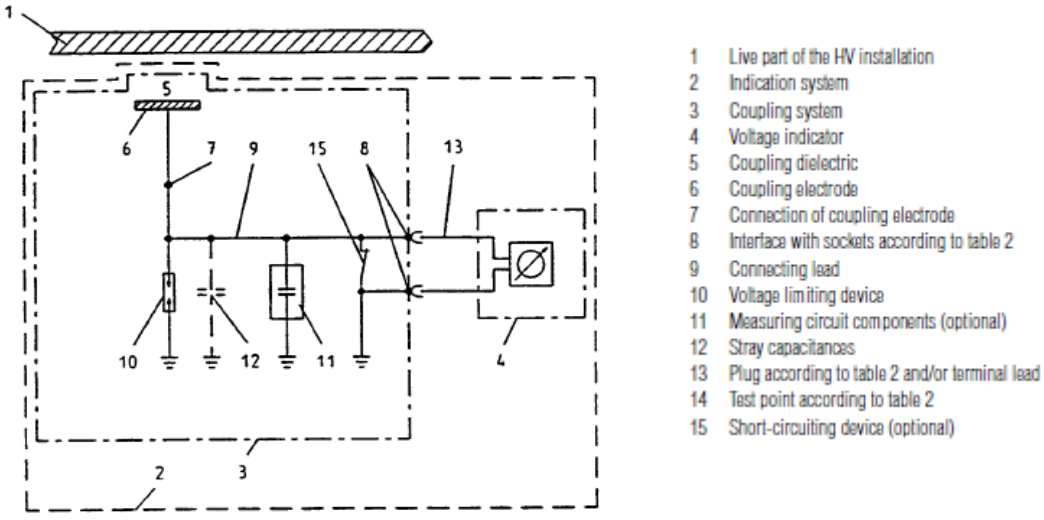


Figure 6 – Voltage detecting system

The insulation resistance of voltage measuring parts to earth must be at least 120 MΩ.

To provide protection for operators against the presence of operating voltage on the interface or the test point, it shall be ensured that any insulation failure of the coupling dielectric will necessarily cause a permanent earth fault.

The voltage of the limiting device must comply with point 4.5.4 of IEC 61243-5.

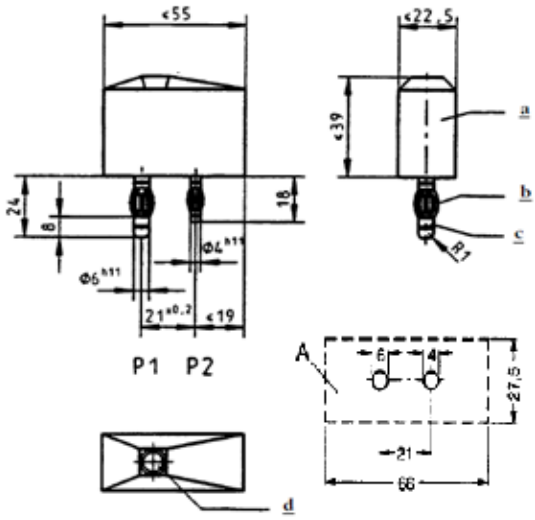
13.5 INDICATOR

The indicators shall be constructed in accordance with point 4.9 of EN 61243-5.

The indicators shall be designed to indicate the presence of AC voltage with a nominal frequency range of 50 Hz to 60 Hz. They shall not have flexible terminal connections.

The indicators shall be visual and indoor-type without built-in power supply and shall have the following technical characteristics:

- The indication "presence of voltage" must appear when the voltage between the phases and earth is between 45% and 120% of the rated voltage and must not appear if this voltage is less than 10% of the rated voltage.
- The indicators must provide a safe indication of the voltage status or phase concordance.
- The repetition frequency must be at least 1 Hz for phase-to-ground voltages equal to or greater than 45% of the rated voltage or for a measuring voltage equal to or greater than Utmax.
- For a phase-to-ground voltage less than 10% of the rated voltage and in the case of a measurement voltage less than Utmin, the indication must be "no voltage", with no active signal for the indicators.



Voltage indicator MR, main dimensions

CAPTION

a	Metallic housing
b	Elastic contact
c	Metallic tip
d	Indicating element
P1	Earthed pole
P2	Pole with signal
	The housing is metallic and connected to P1

Figure 7 - dimension

13.6 DEGREE OF PROTECTION

The indicators must comply with the IP2X degree of protection according to IEC 60529. The indication must not be distorted by dust and/or moisture.

13.7 OPERATING CONDITIONS

The operating and storage conditions are as follows:

- ambient temperature: - 25 + 55 °C
- atmospheric pressure: 86 kPa to 106 kPa.:
- relative humidity: 45°+ 75°%

13.8 MARKS

The following markings shall be legibly affixed to the interface, in characters at least 3 mm high:

- Capacitive interface symbol (fig. 4 IEC 61243-5) 
- Symbol of the detection system (MR);
- On each interface: phase designation of the busbar side and also the earth symbol ⏚ (fig. 5 IEC 61243-5).

Group Enel	
Enel Distribución Colombia	L1 – L2 - L3
Enel Distribución Perú	L1 – L2 - L3
Edesur	L1 – L2 - L3
e-distributie Banat	4 – 8 - 12
e-distributie Dobrogea	4 – 8 - 12
e-distributie Muntenia	4 – 8 - 12
e-distribuzione	4 – 8 - 12
Endesa Distribución Eléctrica	L1 – L2 - L3
Enel Distribución Chile	L1 – L2 - L3
Enel Distribuição Ceará	L1 – L2 - L3
Enel Distribuição Rio	L1 – L2 - L3
Enel Distribuição Goiá	L1 – L2 - L3
Enel Distribuição São Paulo	L1 – L2 - L3

Table 1

Country	Marking on indicators
Italian	LATO SBARRE
Spanish	LATO BARRAS
Portuguese	LADO BARRA
Romain	LATERAL SBARRE

Table 2

The indications must be clearly visible even with the indicators inserted.

Each indicator must bear the following markings in characters at least 2 mm high:

- IEC 61243-5;
- Symbol of the detection system (MR);

- Identification of the phases as in the table,
- Builder;
- Year of production;
- Rated frequency if different from 50HZ;
- Type or serial number.

13.9 INSTRUCTION FOR USE

The VDS must be accompanied by instructions for use which include: instructions for use, maintenance, storage, transport, assembly, voltage range for safe indication, function and use tests (according to Annex B of EN 61243-5).

13.10 LIST AND CLASSIFICATION OF TESTS

13.10.1 TYPE TEST

13.10.2 ROUTINE TEST

TYPE TEST	Part to be tested	Type test	Routine test
Arrangement, assembly, markings, instructions for use	Coupling system	5.2	5.2
Dielectric strength of coupling system	Test sample of coupling system	5.3	
Maximum current of coupling electrode	Test sample of coupling system	5.4	
Interface conditions	Coupling system	5.5	5.5
Voltage limiting device	Test sample of coupling system	5.6	
Temperature dependence of coupling system	Test sample or coupling system	5.7	
Phase rotation of coupling system	Coupling system	5.8	
Insulation resistance under pollution	Test sample of coupling system	5.9	
Connecting leads	Test sample of coupling system	5.10	
Arrangement, assembly, markings, instructions for use	Indicator	5.2	5.2
Vibration resistance	Indicator	5.12	
Drop and impact resistance	Indicator	5.13	
Dielectric strength	Indicator	5.14.1 5.14.2	
Threshold voltage	Indicator	5.15	5.27
Climatic resistance of threshold voltage	Indicator	5.16.1	
Time Response	Indicator	5.17	
Non response to d.c. voltage	Indicator	5.18.1	
Clear perceptibility	Indicator	5.22 5.23	
Temperature dependence	Indicator	5.21	

Table 3 – Type test and routine test

14 ANNEX F - ENEL CODES

14.1 RMU CODES

TYPE CODE	EDESUR	ENEL DISTRIBUCÃO RIO	ENEL DISTRIBUCÃO CEARÁ	ENEL DISTRIBUCÃO GOIÁS	ENEL DISTRIBUCÃO SÃO PAULO	ENEL DISTRIBUCION CHILE	ENEL DISTRIBUCION COLOMBIA	E-DISTRIBUZIONE	ENEL DISTRIBUCION PERU'	ENEL DISTRIBUTIE	EDESTRIBUCION R.D. SLU
GSCM004/1	0109-0441					140113				140016	
GSCM004/2	0109-0440	T140020			316284	140114	140045	140050		140017	
GSCM004/3	0109-0439	T140016			316285	140115	140047	140049		140018	
GSCM004/4	0109-0438	T140022			316286	140116	140049	140048		140019	
GSCM004/5	0109-0437					140117		140047		140020	
GSCM004/6	0109-0436	T140019			316287	140118		140046		140021	
GSCM004/7	0109-0435				316288	140119		140045		140022	
GSCM004/8	0109-0434					140120				140023	
GSCM004/9	0109-0433					140121				140024	
GSCM004/10	0109-0432					140122	140046			140025	
GSCM004/11	0109-0431					140123				140026	
GSCM004/12	0109-0430					140124	140044			140027	
GSCM004/13	0109-0429					140125	140058			140028	
GSCM004/14	0109-0428					140126	140057			140029	
GSCM004/15	0109-0427					140127				140030	
GSCM004/16	0109-0426					140128				140031	
GSCM004/17	0109-0425										140699
GSCM004/18	0109-0424										140698
GSCM004/19	0109-0423										140696
GSCM004/20	0109-0422										140686
GSCM004/21	0109-0421										
GSCM004/22	0109-0420										140697
GSCM004/23	0109-0419										140695

TYPE CODE	EDESUR	ENEL DISTRIBUCÃO RIO	ENEL DISTRIBUCÃO CEARÁ	ENEL DISTRIBUCÃO GOIÁS	ENEL DISTRIBUCÃO SÃO PAULO	ENEL DISTRIBUCION CHILE	ENEL DISTRIBUCION COLOMBIA	E-DISTRIBUZIONE	ENEL DISTRIBUCION PERU'	ENEL DISTRIBUTIE	EDESTRIBUCION R.D. SLU
GSCM004/24	0109-0418										140700
GSCM004/25	0109-0417								140032		140689
GSCM004/26	0109-0416										140684
GSCM004/27	0109-0415								140036		140628
GSCM004/28	0109-0414										140683
GSCM004/29	0109-0413										140682
GSCM004/30	0109-0412								140033		140680
GSCM004/31	0109-0411								140037		140679
GSCM004/32	0109-0410										140678
GSCM004/33	0109-0409										140681
GSCM004/34	0109-0408										140675
GSCM004/35	0109-0407										140685
GSCM004/36	0109-0406										140677
GSCM004/37	0109-0405										
GSCM004/38	0109-0404										140674
GSCM004/39	0109-0403										140672
GSCM004/40	0109-0402										140673
GSCM004/41	0109-0401										140670
GSCM004/42	0109-0400										140671
GSCM004/43	0109-0399										140661
GSCM004/44	0109-0398										140660
GSCM004/45	0109-0397										
GSCM004/46	0109-0396										140659

TYPE CODE	EDESUR	ENEL DISTRIBUCÃO RIO	ENEL DISTRIBUCÃO CEARÁ	ENEL DISTRIBUCÃO GOIÁS	ENEL DISTRIBUCÃO SÃO PAULO	ENEL DISTRIBUCION CHILE	ENEL DISTRIBUCION COLOMBIA	E-DISTRIBUZIONE	ENEL DISTRIBUCION PERU'	ENEL DISTRIBUTIE	EDESTRIBUCION R.D. SLU
GSCM004/47	0109-0395										140657
GSCM004/48	0109-0394										140658
GSCM004/49							140055				140656
GSCM004/50							140050				140654
GSCM004/51							140052				140653
GSCM004/52							140054				140652
GSCM004/53											
GSCM004/54											140651
GSCM004/55											140650
GSCM004/56											140655
GSCM004/57											140648
GSCM004/58							140051				140649
GSCM004/59											140647
GSCM004/60							140053				140644
GSCM004/61							140059				
GSCM004/62											140646
GSCM004/63							140056				140643
GSCM004/64											140642
GSCM004/134											140645
GSCM004/135											140640
GSCM004/136											140639
GSCM004/137											140638
GSCM004/138											

TYPE CODE	EDESUR	ENEL DISTRIBUCÃO RIO	ENEL DISTRIBUCÃO CEARÁ	ENEL DISTRIBUCÃO GOIÁS	ENEL DISTRIBUCÃO SÃO PAULO	ENEL DISTRIBUCION CHILE	ENEL DISTRIBUCION COLOMBIA	E-DISTRIBUZIONE	ENEL DISTRIBUCION PERU'	ENEL DISTRIBUTIE	EDESTRIBUCION R.D. SLU
GSCM004/139											140688
GSCM004/140											140636
GSCM004/141											140635
GSCM004/142											140641
GSCM004/143											140634
GSCM004/144											140633
GSCM004/145											140632
GSCM004/146											
GSCM004/147											140637
GSCM004/148											140676
GSCM004/149											140687
GSCM004/150											
GSCM004/151											
GSCM004/152											
GSCM004/153											140631
GSCM004/154											
GSCM004/155											
GSCM004/156											
GSCM004/157											140630
GSCM004/158											
GSCM004/159											
GSCM004/160											
GSCM004/161											140629

TYPE CODE	EDESUR	ENEL DISTRIBUCÃO RIO	ENEL DISTRIBUCÃO CEARÁ	ENEL DISTRIBUCÃO GOIÁS	ENEL DISTRIBUCÃO SÃO PAULO	ENEL DISTRIBUCION CHILE	ENEL DISTRIBUCION COLOMBIA	E-DISTRIBUZIONE	ENEL DISTRIBUCION PERU'	ENEL DISTRIBUTIE	EDESTRIBUCION R.D. SLU
GSCM004/162											
GSCM004/179						140091					
GSCM004/180						140092					
GSCM004/181						140093					
GSCM004/182						140094					
GSCM004/183						140095					
GSCM004/184					316292	140096					
GSCM004/185						140097					
GSCM004/186					316289	140098					
GSCM004/187					316290	140099					
GSCM004/188					316291	140100					
GSCM004/189						140101					
GSCM004/190					316293	140102					
GSCM004/191						140103					
GSCM004/192						140104					
GSCM004/193						140105					
GSCM004/194						140106					
GSCM004/195						140107					
GSCM004/196						140108					
GSCM004/197						140109					
GSCM004/198						140110					

14.2 MV SELF PROTECTED TRANSFORMER CELL

COUNTRIES	COMPANY	DESCRIPTION	COUNTRY CODE	TYPE CODE	GSCT003/1 20-15 – 13,2 - 10	GSCT003/2 13,8 - 13,2 – 12 – 11,4	GSCT003/03 33 – 25 -23
ARGENTINA	EDESUR	1AT		GSCM004/73	0102-1902		
ARGENTINA	EDESUR	1AT		GSCM004/74			0102-1903
BRAZIL	E.D. RIO	1AT	T530002	GSCM004/75		6812214	
	E.D. RIO	1AT	T530003	GSCM004/76			6812215
	E.D. CEARA	1AT	T530070	GSCM004/77		6812217	
	E.D. SÃO PAULO	1AT	313088	GSCM04/207			
	E.D. SÃO PAULO	1AT	313089	GSCM004/208			
CHILE	ENEL DISTRIBUCION CHILE	1AT	140111	GSCM004/78			530035
		1AT	140112	GSCM004/206		530034	
COLOMBIA	ENEL DISTRIBUCION COLOMBIA	1AT		GSCM004/79	6812342		
COLOMBIA	ENEL DISTRIBUCION COLOMBIA	1AT		GSCM004/80		6812343	
COLOMBIA	ENEL DISTRIBUCION COLOMBIA	1AT		GSCM004/81			6812344
SPAIN	EDESTRIBUCION R.D. SLU	1AT		GSCM004/82	6711582		
SPAIN	EDESTRIBUCION R.D. SLU	1AT		GSCM004/83			6711583
ITALY	E-DISTRIBUZIONE	1AT	140032	GSCM004/84	534513		
PERU'	ENEL DISTRIBUCION PERU'	1AT	140035	GSCM004/85	530008		
ROMANIA	ENEL ROMANIA	1AT	140041	GSCM004/88	534513		

14.3 MV MEASUREMENT CELL

COUNTRIES	COMPANY	COUNTRY CODE	DESCRIPTION	TYPE CODE	TV		TA		RATED SHORT CIRCUIT BREAKING CURRENT [KA]	RATED VOLTAGE [KV]
					LOCAL CODE	RATIO KV/V	LOCAL CODEX	RATIO A/A		
ARGENTINA	EDESUR		1M	GSCM004/121		13200/110				
			1M	GSCM004/122		13200/110	0102-0146	10/5	16	14,5
			1M	GSCM004/123		13200/110	0102-0148	20/5	16	14,5
			1M	GSCM004/124		13200/110	0102-0150	30/5	16	14,5
			1M	GSCM004/125		13200/110	0102-0154	50/5	16	14,5
			1M	GSCM004/126		13200/110	0102-0156	75/5	16	14,5
			1M	GSCM004/127		13200/110	0102-0158	100/5	16	14,5
			1M	GSCM004/128		13200/110	0102-0160	150/5	16	14,5
			1M	GSCM004/129		13200/110	0102-0162	200/5	16	14,5
			1M	GSCM004/130		13200/110	0102-0164	300/5	16	14,5
			1M	GSCM004/131		13200/110	0102-0166	400/5	16	14,5
			1M	GSCM004/132		13200/110	0102-0168	600/5	16	14,5
			1M	GSCM004/133		13200/110	0102-1891	2000/5	16	14,5
BRAZIL	E.D. RIO / CEARÁ / GOIÁS		1M	GSCM004/90	T530074	13800/√3/115	T530083	10/5	16	24
			1M	GSCM004/91	T530074	13800/√3/115	T530080	15/5	16	24
			1M	GSCM004/199	T530074	13800/√3/115	T530071	20/5	16	24

COUNTRIES	COMPANY	COUNTRY CODE	DESCRIPTION	TYPE CODE	TV		TA		RATED SHORT CIRCUIT BREAKING CURRENT [KA]	RATED VOLTAGE [KV]
					LOCAL CODE	RATIO KV/V	LOCAL CODEX	RATIO A/A		
			1M	GSCM004/200	T530074	13800/√3/115	T530072	25/5	16	24
			1M	GSCM004/201	T530074	13800/√3/115	T530072	50/5	16	24
			1M	GSCM004/202	T530074	13800/√3/115	T530073	100/5	16	24
			1M	GSCM004/203	T530074	13800/√3/115	T530081	200/5	16	24
			1M	GSCM004/204	T530074	13800/√3/115	T530082	400/5	16	24
			1M	GSCM004/205	T530074	13800/√3/115	T530084	500/5	16	24
CHILE	ENEL DISTRIBUCION CHILE	140075	1M	GSCM004/163	530258	12√3/120√3	530177	5-10/5		15
		140076	1M	GSCM004/164	530258	12√3/120√3	530176	10-15/5		15
		140077	1M	GSCM004/165	530258	12√3/120√3	530175	20-25/5		15
		140078	1M	GSCM004/166	530258	12√3/120√3	530174	40-50/5		15
		140079	1M	GSCM004/167	530258	12√3/120√3	530173	75-100/5		15
		140080	1M	GSCM004/168	530258	12√3/120√3	530172	150-200/5		15
		140074	1M	GSCM004/169	530258	12√3/120√3	530171	300-400/5		15
		140081	1M	GSCM004/170	530258	12√3/120√3	530170	600-800/5		15
		140082	1M	GSCM004/171	530161	24√3/120√3	530169	5-10/5		25
		140083	1M	GSCM004/172	530161	24√3/120√3	530168	10-15/5		25

COUNTRIES	COMPANY	COUNTRY CODE	DESCRIPTION	TYPE CODE	TV		TA		RATED SHORT CIRCUIT BREAKING CURRENT [KA]	RATED VOLTAGE [KV]
					LOCAL CODE	RATIO KV/V	LOCAL CODEX	RATIO A/A		
		140084	1M	GSCM004/173	530161	24√3/120√3	530167	20-25/5		25
		140085	1M	GSCM004/174	530161	24√3/120√3	530166	40-50/5		25
		140086	1M	GSCM004/175	530161	24√3/120√3	530165	75-100/5		25
		140087	1M	GSCM004/176	530161	24√3/120√3	530164	150-200/5		25
		140088	1M	GSCM004/177	530161	24√3/120√3	530163	300-400/5		25
		140089	1M	GSCM004/178	530161	24√3/120√3	530162	600-800/5		25
COLOMBIA	ENEL DISTRIBUCION COLOMBIA	140061	1M	GSCM004/93		34000/200		100/5	16	36
SPAIN	EDESTRIBUCION R.D. SLU		1M	GSCM004/94						
		140044	1M	GSCM004/95	535017	15000/100 V	532057	50/5	16	24
		140043	1M	GSCM004/96	535017	15000/100 V	532070	400/5	16	24
		140042	1M	GSCM004/97	535017	15000/100 V	532071	630/5	16	24
		140041	1M	GSCM004/98	535024	20000/100 V	532057	50/5	16	24
ITALIA	E-DISTRIBUZIONE	140040	1M	GSCM004/99	535024	20000/100 V	532070	400/5	16	24
		140039	1M	GSCM004/100	535024	20000/100 V	532071	630/5	16	24
		140038	1M	GSCM004/101	535051	8400/100 V	532057	50/5	16	24
		140037	1M	GSCM004/102	535051	8400/100 V	532070	400/5	16	24
		140036	1M	GSCM004/103	535051	8400/100 V	532071	630/5	16	24

COUNTRIES	COMPANY	COUNTRY CODE	DESCRIPTION	TYPE CODE	TV		TA		RATED SHORT CIRCUIT BREAKING CURRENT [KA]	RATED VOLTAGE [KV]
					LOCAL CODE	RATIO KV/V	LOCAL CODEX	RATIO A/A		
		140035	1M	GSCM004/104	535882	22000/100 V	532057	50/5	16	24
		140034	1M	GSCM004/105	535882	22000/100 V	532070	400/5	16	24
		140033	1M	GSCM004/106	535882	22000/100 V	532071	630/5	16	24
ROMANIA	E.D. BANAT E.D. DOBROGEA E.D. MUNTENA	140032	1M	GSCM004/108	535012	10000/100 V	532057	50/5	16	24
		140033	1M	GSCM004/109	535012	10000/100 V	535070	400/5	16	24
		140034	1M	GSCM004/110	535012	10000/100 V	535071	630/5	16	24
		140035	1M	GSCM004/111	535024	20000/100 V	532057	50/5	16	24
		140036	1M	GSCM004/112	535024	20000/100 V	532070	400/5	16	24
		140037	1M	GSCM004/113	535024	20000/100 V	532071	630/5	16	24
		140038	1M	GSCM004/114	653260	6000/100 V	532057	50/5	16	24
		140039	1M	GSCM004/115	653260	6000/100 V	532070	400/5	16	24
		140040	1M	GSCM004/116	653260	6000/100 V	532071	630/5	16	24
PERU’	ENEL DISTRIBUCION PERU’	140034	1M	GSCM004/107	140034	20000-10000/100 V		150-300/5A	20	24
		140031	1M	GSCM004/117	140031	20000-10000/100	530987	50/5	20	24
		140030	1M	GSCM004/118	140030	20000-10000/100	530989	450/5	20	24
COLOMBIA	CODENSA	140038	1M	GSCM004/119		12000/200		200/5	16	24
COLOMBIA	CODENSA	140060	1M	GSCM004/120		34500/200		100/5	16	36