Subject: Global Infrastructure and Networks **GSCH006** SHIELDED SINGLE OR DOUBLE BUSBAR EQUIPMENT WITH SULPHUR HEXAFLUORIDE INSULATION (SF6) OF 72.5-145-170-245 kV

Application Areas
Perimeter: *Global*
Staff Function: -
Service Function: -
Business Line: *Infrastructure & Networks*

CONTENTS

1 DOCUMENTS AND APPLICATION AREA

Scope of this document is to provide technical requirements for the supply of GIS with rated voltage from 72,5 kV to 245 kV to be used in Primary Substations of the Enel Group Distribution companies, listed below:

Country	Distribution Company
Argentina	Edesur
Brazil	Enel Distribuição Rio Enel Distribuição Ceará Enel Distribuição Goiás Enel Enel Distribuição São Paulo
Chile	Enel Distribución Chile
Colombia	Codensa
España	e-distribución
Italy	e-distribuzione
Peru	Enel Distribución Perú
Romania	Enel Distributie Banat Enel Distributie Dobrogea Enel Distributie Muntenia

1.1 RELATED DOCUMENTS TO BE IMPLEMENTED AT COUNTRY LEVEL

This document applies to both Enel Global Infrastructure and Networks Srl Company and to Infrastructure and Networks Business Line perimeter, when each Company does not have to issue further documents.

2 DOCUMENT VERSION MANAGEMENT

Version	Date	Main changes description
00	29/09/2017	First emission
01	21/08/2019	It incorporates a simple bar scheme to the original proposal that considered only a double bar scheme 2 Replacement of the UN - EN 600 44-1 standard by the IEC 61869 standard. 6.5 Add a short circuit current greater than 40kA as a special case. 6.7 Add a short circuit current greater than 40kA as a special case. 6.10 Add a short circuit current greater than 40kA as a special case. 6.11 Add a short circuit current greater than 40kA as a special case. 8.1 Responsibility of the user to have the detail of module plans for interfaces. 9 In the case of Enel Distribution Chile, the gloss of the nameplate must be written in the local language. The same situation for the installation and maintenance and operation manuals. 13 Annex 1 the table consider the option of single or double bar. 13 Annex 1 Add a short circuit current greater than 40kA as a special case. 13 Annex 2 adds simple bar schemes
02	03/03/2020	13 PACKAGING, TRANSPORT, STORAGE AND INSTALLATION/TESTING
03	20/03/2020	Multiple chapters

04	06/10/2021	Multiple chapters and annexes
05	10/05/2022	Multiple chapters and annexes
06	10/01/2023	7.6.2 Wiring control box modification 7.4.7 Changes in Current Transformer characteristics and codes. 7.4.8 Added new Voltage Transformer types. ANNEX A TAM country detail codes added. 7.6.1.2.1 Manual operation counter of turns, deleted. ANNEX B Schemes actualization.
06	09/08/2024	ANNEX A TAM country detail codes updated. 7.7.2 and 7.7.3 update of IEC chapters for type and routine test

3 UNITS IN CHARGE OF THE DOCUMENT

Responsible for drawing up the document:

- Global Infrastructure and Networks: Operation and Maintenance / Network Components Standardization

Responsible for authorizing the document:

- Global Infrastructure and Networks: Head of Operation and Maintenance unit
- Global Infrastructure and Networks: Head of Health, Safety, Environment and Quality unit.

4 REFERENCES

- Code of Ethics of Enel Group;
- Enel Human Right Policy;
- The Enel Group Zero Tolerance of Corruption (ZTC) Plan;
- Organization and management model as per Legislative Decree No. 231/2001;
- RACI Handbook Infrastructure and Networks no. 06;
- Enel Global Compliance Program (EGCP);
- Integrated Policy of Quality, Health and Safety, Environment and anti-Bribery;

5 ORGANIZATIONAL PROCESS POSITION IN THE PROCESS TAXONOMY

Value Chain/Process Area: Networks Management

Macro Process: Materials management

Process: Network components standardization

6 DEFINITIONS AND ACRONYMS

Acronym and Key words	Description
Manufacturer Product	Component manufactured by a Supplier in accordance with a technical specification
Technical Conformity Assessment (TCA)	A "conformity assessment"[1] with respect to "specified requirements"[2] consists in functional, dimensional, constructional and test characteristics required for a product (or a series of products) and quoted in technical specifications and quality requirements issued by Enel Group distribution companies. This also includes the verification of conformity with respect to local applicable regulation and laws and possession of relevant requested certifications
Conformity assessment body	Body that performs the conformity assessment activities [ISO 17000]
Enel Equipment Key code	It's an equipment representative for a group (family) of similar equipment chose by Enel
Enel Equipment Family code	Equipment belonging to a specific group (family) in which another equipment is identified as key code
TCA systems	The "conformity assessment systems", is applicable specifying that the rules and procedures to carry on the TCA are those specified in the present document
Type A documentation	Not confidential documents used for product manufacturing and management from which it is possible to verify the product conformity to all technical specification requirements, directly or indirectly
Type B documentation	Confidential documents used for product manufacturing and management where all product project details are described, in order to uniquely identify the product object of the TCA
TCA report	Document describing the activities carried out for TCA
TCA dossier	Set of final documents delivered by the Supplier for the TCA

[1] Definition 2.1 of ISO/IEC 17000
[2] Definition 3.1 of ISO/IEC 17000

Material LifeCycle Management (MLM)	Integrated IT platform to manage the processes of Technical Specifications (TSM), Technical Conformity Assessment (TCA), Quality Control Tools (QCA), Defects Managing (CMD), Warranties and Materials Shipping(MSH)

7 DESCRIPTION

7.1 REFERENCE LAWS AND STANDARD

7.1.1 Laws

7.1.1.1 Latam

7.1.1.1.a) Brasil

NR-10 - segurança em instalações e serviços em eletricidade

7.1.1.2 Italy

D.M. 1/12/1980 and subsequent modification D.M. 10/9/1981 *"Disciplina dei contenitori a pressione di gas con membrature miste di materiale isolante e di materiale metallico, contenenti parti attive di apparecchiature elettriche".*

7.1.1.3 Spain

Reglamento sobre condiciones técnicas y garantías de seguridad en instalaciones eléctricas de alta tensión, Real Decreto 337/2014.
Real Decreto Riesgo Eléctrico Real Decreto 614/2001.
Reglamento Electrotécnico para Baja Tensión, Real Decreto 842/2002.
Reglamento de puntos de Medida Real Decreto 1110/2007.

7.1.1.4 All European countries

Commission Regulation (EC) 1494/2007 of 17 December 2007 (form of labels and additional labelling requirements as regards products and equipment containing certain fluorinated greenhouse gases).

7.1.2 Standards

The below listed reference documents shall be intended in the in-force edition at the contract date (amendments included).

7.1.2.1 Common Standards

For Latin America destinations the reference standard are the IEC/ISO, whilst for Europe destinations the reference standard are the correspondent European standards (EN).

EN 1005-3	Safety of machinery. Human physical performance Recommended force limits for machinery operation

IEC 60068-2-17	Environmental testing – Part 2: Tests – Test Q: Sealing
IEC 60073	Basic and safety principles for man-machine interface, marking and identification – Coding principles for indicators and actuators
IEC 60137	Insulated bushings for alternating voltages above 1000 V
IEC 60332-3-24	Tests on electric and optical fibre cables under fire conditions – Part 3-24: Test for vertical flame spread of vertically-mounted bunched wires or cables – Category C
IEC 60376	Specification of technical grade sulfur hexafluoride (SF6) for use in electrical equipment
IEC 60447	Basic and safety principles for man-machine interface, marking and identification - Actuating principles
IEC 60529	Degree of protection provided by enclosures (IP Code)
IEC 61869-1	Instrument transformers – Part 1: General requirements
IEC 61869-2	Instrument transformers – Part 2: Additional Requirements for Current Transformers
IEC 61869-3	Instrument transformers – Part 3: Additional Requirements for Inductive Voltage Transformers
IEC 62271-1	High-voltage switchgear and controlgear – Part 1: Common specifications
IEC 62271-100	High-voltage switchgear and controlgear – Part 100: Alternating current circuitbreakers
IEC 62271-102	High-voltage switchgear and controlgear – Part 102: High-voltage alternating current disconnectors and earthing switches
IEC 62271-203	High-voltage switchgear and controlgear – Part 203: Gas-insulated metalenclosed switchgear for rated voltages above 52 kV
IEC 62271-207	High-voltage switchgear and controlgear – Part 207: Seismic qualification for gas-insulated switchgear assemblies for rated voltages above 52 kV
IEC 62271-209	High-voltage switchgear and controlgear – Part 209: Cable connections for gas-insulated metal-enclosed switchgear for rated voltages above 52 kV - Fluid-filled and extruded insulation cables – Fluid-filled and dry-type cable terminations
IEC 62271-211	High-voltage switchgear and controlgear – Part 211: Direct connection between power transformers and gas-insulated metal-enclosed switchgear for rated voltages above 52 kV
IEC 62271-4	High-voltage switchgear and controlgear – Part 4: Handling procedures for sulphur hexafluoride (SF6) and its mixtures
ISO 1461	Hot dip galvanized coatings on fabricated iron and steel articles- Specifications and test methods
ISO 4126	Safety devices for protection against excessive pressure
ISO 12944-1	Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 1: General introduction
IEC 62262	Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)

IEC 60840	Power cables with extruded insulation and their accessories for rated voltages above 30 kV (Um= 36 kV) up to 150 kV (Um = 170 kV) - Test methods and requirements
IEC 62067	Power cables with extruded insulation and their accessories for rated voltages above 150 kV (Um = 170 kV) up to 500 kV (Um = 550 kV) - Test methods and requirements

7.1.3.1 Specific standards

CNS-O&M-S&L-2021-0032-EGIN – Global Infrastructure and Networks Barcode specification

7.1.3.1.1 Enel Distribución Chile

ETGI-1020 - Especificaciones técnicas generales - Requisitos de diseño sísmico para equipo eléctrico

7.1.3.1.2 e-distribución

NNM001 – Normas de operación definiciones
NMC007 – Cables de control multipolares
NZC001 – Procedimiento para la confección de proyectos de control y protección

7.1.3.1.3 E-Distributie

Prescriptia Energetica PE 101/85 – Normativ pentru construcţia instalaţiilor electrice de conexiuni şi transformare cu tensiuni peste 1 kV
NTE 011/12/00 - NORMĂ TEHNICĂ PENTRU PROIECTAREA SISTEMELOR DE CIRCUITE SECUNDARE ALE STAŢIILOR ELECTRICE

7.1.3.1.4 e-distribuzione

CEI 20-22/2 – Prove di incendio su cavi elettrici – Parte 2: Prova di non propagazione dell'incendio
UNI 11144 – Bombole trasportabili per gas – Valvole per bombole per pressioni di esercizio 250 bar – Connessioni: forme e dimensioni
ENEL operative note PVR001 (guarantee management)
ENEL operative note PVR006 (bar code)
ENEL Global Standard GST002 Power Transformers

7.2 SERVICE CONDITIONS

7.2.1 General service conditions

Unless otherwise specified, the reference service conditions are the indoor normal service conditions of IEC 62271-1 (par. 2.1.1).

Installation	Indoor
Service class	Continuous
Altitude	Less than 1000 m
Ambient air temperature	Category –5 / 40 Minimum –5º C Maximum 40º C
Solar radiation	Negligible
Ambient air pollution	Negligible

Humidity conditions	Those established in Standard IEC 62271-1
Condensations	For the design, the possibility that they may appear must be considered.

7.2.2 Specific service conditions

7.2.2.1 Colombia (Enel_Codensa)

The reference altitude is 2.600 m.

7.2.2.2 Seismic qualification level

Enel Distribución Chile	ETGI-1020
Enel_Codensa	AF3 (IEC 62271-207)
Enel Perú	AF5 (IEC 62271-207)
E-Distributie	AF5 (IEC 62271-207)
e-distribuzione	AF5 (IEC 62271-207)

7.3 GIS COMPOSITION

The shielded equipment with SF6 insulated, single-phase or three-phase housing, formed by single-pole or three-pole elements, where the switchgear could be single-pole or three-pole action, will be composed of a determined number of bays arranged adjacently one beside the other forming a single row. In all cases it must allow a future expansion by both ends.

The design shall be such that it will enable the replacement of any one bay leaving out of service the adjacent positions.

The bay must be designed so that the normal operating, control and maintenance operations can be carried out without any risk for people.

The equipment shielded in gas will be suitably compartmentalized to avoid an internal arc in one of the compartments from extending to others. The same reasoning will be applied for a possible gas leak, which must only affect the compartment in question and not the others.

The compartmentalization must not restrict the possibilities of maintenance offered by the considered configurations.

The composition of the different types of bays that form the unit of the shielded double busbar installation, with sulphur hexafluoride insulation (SF6), It's up to the manufacturer to verify the coherence and, if necessary, to ask for clarifications.

The capacity of the separators between compartments will be such that it allows the replacement of a complete position or element leaving out of service, at most, the two adjacent positions.

Each compartment will have filling and emptying elements, and a gas pressure supervision system.

The equipment construction form must allow its future expansion, leaving the end position out of service, if the expansion is via the end of the equipment or the two adjacent positions if it is in the middle of the equipment.

All construction materials and identical characteristics that can be replaced must be interchangeable.

The housing must be metal, diamagnetic and have a mechanical rigidity to ensure the perfect operation of the moving parts located inside it. The housing must withstand the vacuum in the gas filling process.

All external surfaces of the housing must be protected against external agents, to guarantee an effective anti-corrosion protection.

7.3.1 Transformer bay

- 1 (SB) or 2 (DB) Busbar spans with single-pole or three-pole housing.
- 1 (SB) or 2 (DB) Busbar disconnectors with three-pole electric actuation.
- 1 Earthing switch, with three-pole electric actuation.
- 1 Circuit breaker with three-pole actuation.
- 3 or 4 Toroidal current transformers per phase of the appropriate ratio, for metering, measurement or protection.
- 1 Earthing switch, with blades totally insulated from the rest of the housing, with three-pole electric actuation with sudden closure.
- 3 Single-phase voltage detectors with solid state light indicators.
- 3 Single-phase voltage detector EVDS - Electronic Voltage Detector System (capacitive dividers included)
- 1 Complete single-pole or three-pole housing, fixed part and plug-in part for cable terminals, dry type, of the corresponding section according to standard GSCC006.
  Option 1: one cable per phase (> 72.5kV)
  Option 2: two cables per phase (72.5kV).

This bay will be complemented with:

- 1 Inductive voltage transformer per phase, of the appropriate ratio, for metering, measurement or protection.

Whenever it corresponds to a connection cell of the secondary of a HV/HV transformer or Electrical System Metering Points (hereinafter ESMP in general) is required in said transformer.

7.3.2 Line bay by Underground cable

- 1 (SB) or 2 (DB) Busbar spans with single-pole or three-pole housing.
- 1 (SB) or 2 (DB) Busbar disconnectors with three-pole electric actuation.
- 1 Earthing switch, with three-pole electric actuation.
- 1 Circuit breaker with single-pole or three-pole actuation.
- 3 or 4 Toroidal current transformers per phase, of the appropriate ratio, for metering, measurement or protection.
- 1 Earthing switch, with blades totally insulated from the rest of the housing with three-pole electric actuation.
- 1 Input disconnector with three-pole electric actuation.
- 1 Earthing switch, with three-pole electric actuation with sudden closure.
- 1 Inductive voltage transformer per phase, of the appropriate ratio, for metering, measurement or protection (not applicable when high frequency communications are required).
- 3 Single-phase voltage detectors with solid state light indicators.

- 1 Complete single-pole or three-pole housing, fixed part and plug-in part for cable terminals of the dry type of the corresponding section according to standard GSCC006.
- Option 1: one cable per phase
- Option 2: two cables per phaseIf required, Point Of Wave (hereinafter POW in general) will be requested for singular applications.

7.3.3 Line bay by Overhead line

- 1 (SB) or 2 (DB) Busbar spans with single-pole or three-pole housing.
- 1 (SB) or 2 (DB) Busbar disconnectors with three-pole electric actuation.
- 1 Earthing switch, with three-pole electric actuation.
- 1 Circuit breaker with single-pole or three-pole actuation.
- 3 or 4 Toroidal current transformers per phase of the appropriate ratio, for metering, measurement or protection.
- 1 Earthing switch, with blades totally insulated from the rest of the housing with three-pole electric actuation.
- 1 Input disconnector with three-pole electric actuation.
- 1 Earthing switch, with three-pole electric actuation with sudden closure.
- 3 Single-phase voltage detectors with solid state light indicators.
- 1 Inductive voltage transformer per phase, of the appropriate ratio, for metering, measurement or protection (not applied when high frequency communications are required).
- 1 Single-phase or three-phase conductors equipped with bushings type SF6-aire for connection to overhead line.
- If required, Point Of Wave (hereinafter POW in general) will be requested for singular applications.

7.3.4 Coupling bay

- 1 (SB) or 2 (DB) Busbar spans with single-pole or three-pole housing.
- 1 (SB) or 2 (DB) Busbar disconnectors with three-pole electric actuation.
- 1 Earthing switch, with blades totally insulated from the rest of the housing with three-pole electric actuation.
- 1 Earthing switch, three-pole electric actuation.
- 1 Circuit breaker with three-pole actuation.
- 2 Toroidal current transformers per phase of the appropriate ratio, for measurement or protection.

7.3.5 Measurement busbar

The collector busbars, with single-phase or three-phase metal housing, will be insulated with sulphur hexafluoride (SF6), and they will be equipped with the following elements:

- 1 Voltage transformer connected to a single phase for each set of busbars.
- 1 Earthing switch, with blades totally insulated from the rest of the housing with three-pole electric actuation with sudden closure in each set of busbars.

7.4 TECHNICAL CHARACTERISTICS

7.4.1 Common general ratings

Rated voltage *Ur* (kV)		**72.5**	**145**	**170**	**245**
Rated short-duration power-frequency withstand voltage *Ud* (kV rms):	Phase-to-earth, across open switching device and between phases	140	275		395
	Across the isolating distance	160	315		460
Rated lightning impulse withstand voltage *Up* (kVp):	Phase-to-earth, across open switching device and between phases	325	650		950
	Across the isolating distance	375	750		1050
Rated frequency *fr* (Hz)	Enel Distribución Chile, Edesur, e-distribución, E-Distributie and e-distribuzione	50			
	Enel Distribuição Rio, Enel_Codensa, Enel Distribuição Ceará, Enel Distribuição Goiás, Enel Distribuição São Paulo and Enel Perú	60			
Rated normal current *Ir* (A)		2000			
Rated short time withstand current *Ik* (kA) [3]		31.5		40[4]	
Degrees of protection provided by enclosures (IEC 60529)		IP 54[5]			
Rated supply voltage *Ua* (Vdc)	e-distribución, Enel Distribuição Rio, Enel_Codensa, Enel Distribuição Ceará, Enel Distribuição Goiás, Enel Distribuição São Paulo, Enel Distribución Chile, Enel_Codensa, Enel Perú, E-Distributie and e-distribuzione	110~125			
	Edesur	220			
D.C. maximum absorbed power, for each bay (W/bay)		2.000			

[3] The peak value of the permissible rated short-time current will compliant with the IEC62271-100 4.103.
[4] For special cases a higher capacity of permissible rated short-time will be considered (50 kA or 63 kA, respectively) and time of associated duration.
[5] Applicable also to the Control Box and to the Operating Device Box(es).

Under-voltage release (if requested) – d.c. maximum absorbed power (W/coil)		100
Rated supply voltage for anti-condensation circuits (Vac)	e-distribución, E-Distributie and e-distribuzione	230
	Enel Distribuição Rio, Enel_Codensa, Enel Distribuição Ceará, Enel Distribuição Goiás, Enel Distribuição São Paulo, Enel Distribución Chile, Enel Perú and Edesur	220
	Enel_Codensa	120
a.c. maximum absorbed power (VA)		600
Protection stage (tab. 4 EN 62271-203)		2
Auxiliary contact classes (Table 6 EN 62271-1)		1
Bushings SPS Class (IEC/TS 60815 series)		e (Very Heavy)

(*): For special cases a higher capacity of permissible rated short-time will be considered (50 kA or 63 kA, respectively) and time of associated duration.

7.4.2 Circuit breakers

In addition to paragraph 4 and to IEC 62271-100 requirements, the following further circuit-breakers ratings are required.

Rated voltage *Ur* (kV)	72.5	145	170	245
Rated short-circuit breaking current *Isc* (kA)	31.5	40[6]		
First-pole-to-clear factor k_{pp}	1,5[7] (non-effectively earthed neutral system)			1,3
Rated operating sequence	O - 0,3 s- CO -1 min - CO[8]			
Maximum break-time (ms)	60			
Circuit-breaker class	C2 – E1 – M2			
Rated line-charging breaking current *Il* (A)	10	50	63	125
Rated cable-charging breaking current *Ic* (A)	125	160		250
Rated out-of-phase making and breaking current *Id* (kA)	Clause 4.106 of IEC 62271-100			

[6] For special cases a higher capacity of permissible rated short-time will be considered (50 kA or 63 kA, respectively) and time of associated duration.
[7] In specific cases the request would be 1.5 plus 1.3.
[8] This requirement can be verified by mean of type tests performed with O – 0,3 s – CO -3 min – CO operating sequence and a declaration of the manufacturer about the CB compliance with O – 0,3 s – CO – 1 min – CO operating sequence.

7.4.3 Disconnectors and earthing switches

In addition to paragraph 4 and to IEC 62271-102 requirements, the following further disconnectors and earthing switches ratings are required.

Rated voltage *Ur* (kV)		72.5	145	170	245
Number of poles		3			
Opening (closing) time for motor operation (s)		≤15			
Disconnector mechanical endurance class *Mr*		M1			
Bus-transfer current switching by disconnectors (only if requested)	Rated bus-transfer current for disconnectors (A)	Clause B.4.106.1 of IEC 62271-102			
Bus-transfer current switching by disconnectors (only if requested)	Rated bus-transfer voltages for disconnectors (V)	Clause B.4.106.2 of IEC 62271-102 (referring to Air insulated disconnectors values)			
Earthing switches class		E0 – M1 – A			

The signaling of the position (open-closed) of the disconnectors must be performed by means of a mechanical transmission directly associated to the operating mechanism of the disconnectors. The manufacturer must attach explicit information with respect to how this function is carried out (in compliance with the IEC 62271-102 A.5.104.3.1).

Furthermore, the earthing blades will have the following rated characteristics:

EARTHING BLADES	72.5kV	145-170-245 kV
Permissible rated short-time current, kA (1 sec)	31.5	40[9]
Peak value of the permissible rated current, kA	80	100

There will be two types of earthing switches

Slow-switching earthing switches, such as those positioned on both sides of the circuit breaker in the line or busbar connection bays.

Sudden closure earthing switches, with a closing power of 100 kA. (peak value), such as those located in busbars or in the arrival of the lines.

It has been indicated that the earthing switches, line-circuit breaker side must have blades completely isolated from the enclosure or housing to allow carrying out tests on both sides of the circuit breaker-current transformer unit, i.e. with the aim of providing resistance measurements of circuit breaker contacts and allowing the injection of primary intensity for current transformer and circuit breaker tests.

The disconnectors will be equipped with a padlock on the lid of the operating mechanisms.

[9] For special cases a higher capacity of permissible rated short-time will be considered (50 kA or 63 kA, respectively) and time of associated duration.

7.4.4 SF6-air bushings

7.4.4.1 General requirements

The SF6-air bushings for the connections of GIS terminations shall be compliant with IEC 60137, outdoor type, with internal SF6 insulation, composite type with glass fiber tube covered with silicone rubber. The color shall be light grey.
The complete GIS, bushing included, shall be designed to withstand static terminal load according to Table 14 of IEC 62271-100 (e.g. manufacturer shall demonstrate that stresses doesn't affect the proper CB and/or DS/ES functioning).
Bushings shall also be compliant with minimum values of cantilever withstand load provided by Table 1 of IEC 60137, Level I.

7.4.4.2 Bushing terminations

7.4.4.2.1 Latam

The bushing terminations shall be manufactured with corrosion resistant copper or aluminum alloy, in order to be interfaced with aluminum alloy connectors or clamps.
The terminals shall be rectangular shape with the following dimensions, according to fig. 3 (2x2 hole pattern) or fig. 4 (2x3 hole pattern) of IEC/TR 62271-301:

- Hole diameters Ø 14.3mm
- Distance between holes 44.5mm

7.4.4.2.2 e-distribución, E-Distributie and e-distribuzione

The bushing terminations shall be realized with corrosion resistant copper or aluminum alloy, in order to be interfaced with aluminum alloy clamps.
The final bushing terminations shall have Ø 40 ±0,25 X 80 min (mm) (fig. 1 of IEC/TR 62271-301) dimensions.
For 245 kV GIS the HV terminals shall be suitable to be interfaced with standardized e-distibuzione clamps (double cable). Fig.1

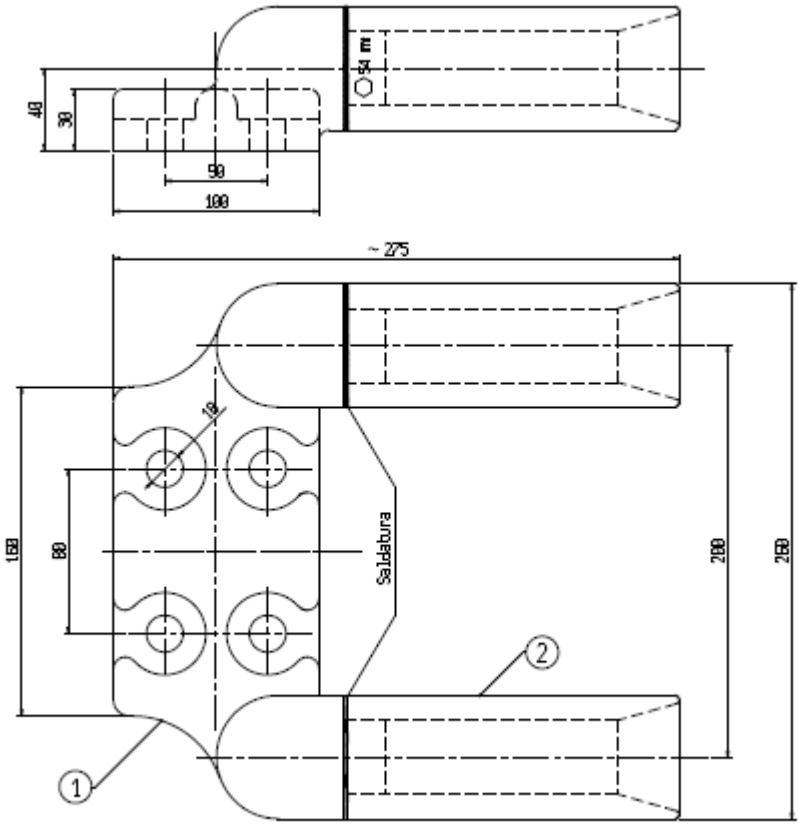


Fig. 1

7.4.5 Direct connections between bus-duct and power transformer with SF6/oil bushings

The direct connection between the bus-duct and the HV/MV power transformer can be requested in compliance with one of the following document:

a) IEC 62271-211

b) Enel Global Standard GST002 Power Transformers - Local section e-distribuzione

Compatibility verification of the interfaces of the bus-duct with the substation in order to ensure the proper connection is a manufacturer responsibility.

7.4.6 Cable connections

IEC 62271-209 applies.
Usually the cable connection enclosure shall be suitable for the dry-type cable-termination (see figure 5 of IEC62271-209); only if requested it shall be for fluid-filled cable terminations (see figure 3 of IEC 62271-209).
In case of “plug-in” dry-type cable-terminations, they will be provided by Enel Group Distribution companies in order to be mounted by the manufacturer; if the GIS transportation is possible with components fully assembled in a single unit, it’s required the female cone factory preassembly.

7.4.6.1 Shielded-Cable interface

The terminal cone of the cable shall be included in the supply of the equipment.

The following will be included in the scope of the supplier of the shielded equipment:

- The connection of the current line of the shielded installation to the cable terminal, even the supply of the necessary adaptation elements.
- The connection of the housing of the shielded equipment to the terminal cone flange, even the supply of the necessary adaptation elements.
- The housing to the terminal cone, which will comply with the IEC 60840 (Un ≤ 170kV), the IEC 62067 (170kV > Un ≤ 500kV) and the Enel Global Standard.
- Supply of the cable terminal cone, plug in without the need to replace materials when connection and disconnection operations of the female located in the shielded equipment are performed, nor of emptying of gas. The execution of the terminal cone shall be performed together with the laying of the cable by the party responsible for the cable.
- The supplier of the shielded equipment will provide all means necessary to the cable supplier so that it performs the dielectric tests and resistance measurements of the cable, once the connection with the shielded equipment is made (bushing for connection of the test transformer, disconnectors of the line voltage transformers if they do not withstand the tests voltages of the cables or insulating cap for the plug-in terminal of the end of the cable which makes it possible to perform the insulation tests of the same being disconnected from the bay, etc.).
- The insulation of the cable incoming module must be dimensioned for the direct/alternating voltage of the cable test.
- The underground cables will comply with Enel Standard GSCH010.

7.4.7 Current transformers

In addition to IEC 61869-1 and IEC 61869-2 requirements, the following further toroidal current transformers requirements are prescribed.

Base component code	**GSCH006/ 601**	**GSCH006/ 602**	**GSCH006/ 603**	**GSCH006/ 604**	**GSCH006/ 605**	**GSCH006/ 606**
Rated short-time thermal current I_{th} (kA)	40					
Rated continuous thermal current I_{cth} (kA)	120% of I_{pr}					
Rated transformation ratio k_r (A/A)	400-800-1.600/1/1/1	400-800-1.600/1/1	400-800-1.600/1	400-800/1/1/1	400-800/1/1	200-400/1
Core number	3	2	1	3	2	1
Accuracy class[10]	0,5 – 5P30	5P30	5P30	0,2 – 5P30	0,5-5P30	0,2s – FS<5
	5P30	5P30	n.a.	5P30	5P30	n.a.
	5P30	n.a.	n.a.	5P30	n.a	n.a.
Rated burden (VA)	30	30	30	30	30	30
Maximum secondary winding resistance (R_{ct}) at 75 °C (Ω)	5	5	5	5	5.	5

[10] the accuracy requirements refer to all specified transformation ratio

Base component code	**GSCH006/ 607**	**GSCH006/ 608**	**GSCH006/ 609**	**GSCH006/ 610**	**GSCH006/ 611**	**GSCH006/ 612**
Rated short-time thermal current I_{th} (kA)	40					
Rated continuous thermal current I_{cth} (kA)	120% of I_{pr}					
Rated transformation ratio k_r (A/A)	400-800/1	200-400/5	400-800/5	1.000-2.000/5/5/5	400-800/5/5/5	1.000-2.000/5/5
Core number	1	1	1	3	3	2
Accuracy class[11]	0,2s – FS<5	0,2s – FS<5	0,2s – FS<5	0,5 – 5P20	0,5 – 5P20	5P20
	n.a.	n.a.	n.a.	5P20	5P20	5P20
	n.a.	n.a.	n.a.	5P20	5P20	n.a.
Rated burden (VA)	30	30	30	30	30	30
Maximum secondary winding resistance (R_{ct}) at 75 °C (Ω)	5	n.a.	n.a.	n.a.	n.a.	n.a.

[11] the accuracy requirements refer to all specified transformation ratio

Base component code	**GSCH006/ 613**	**GSCH006/ 614**	**GSCH006/ 615**	**GSCH006/ 616**	**GSCH006/ 617**	**GSCH006/ 618**
Rated short-time thermal current I_{th} (kA)	40					
Rated continuous thermal current I_{cth} (kA)	120% of I_{pr}					
Rated transformation ratio k_r (A/A)	1000-2000/5	2500/1/1	400-800/5/5	1.000-2.000/5	200-400/1/1/1	600-1200/1/1/1
Core number	1	2	2	1	3	3
Accuracy class[12]	0,2s – FS<5	0,5s – FS>5	5P30	5P20	0,2 - 5P30	0,2 - 5P30
	n.a.	5P30	5P30	n.a.	5p20	5P30
	n.a.	n.a.	n.a.	n.a.	5P30	5P30
Rated burden (VA)	30	30	30	30	30	30
Maximum secondary winding resistance (R_{ct}) at 75 °C (Ω)	n.a.	5	n.a.	n.a.	5	5

[12] the accuracy requirements refer to all specified transformation ratio

Base component code	**GSCH006/ 619**	**GSCH006/ 620**	**GSCH006/ 621**	**GSCH006/ 622**	**GSCH006/ 623**	**GSCH006/ 624**
Rated short-time thermal current I_{th} (kA)	40					
Rated continuous thermal current I_{cth} (kA)	120% of I_{pr}					
Rated transformation ratio k_r (A/A)	600-1200/1/1/1	300-600/1/1/1	2000/1/1/1	600-1200/1	300-600/11	2000/1
Core number	3	3	3	1	1	1
Accuracy class[13]	5P30	5P30	5P30	0.5s – FS>5	0.5s – FS>5	0.5s – FS>5
	5P30	5P30	5P30	n.a.	n.a.	n.a.
	5P30	5P30	5P30	n.a.	n.a.	n.a.
Rated burden (VA)	15	15	15	15	15	15
Maximum secondary winding resistance (R_{ct}) at 75 °C (Ω)	5	5	5	5	5	5

[13] the accuracy requirements refer to all specified transformation ratio

Base component code	**GSCH006/ 625**	**GSCH006/ 626**	**GSCH006/ 627**	**GSCH006/ 628**	**GSCH006/ 629**	**GSCH006/ 630**
Rated short-time thermal current I_{th} (kA)	40					
Rated continuous thermal current I_{cth} (kA)	120% of I_{pr}					
Rated transformation ratio k_r (A/A)	1000-2000/1/1/1	1000-2000/1/1/1	2000/1/1	1000-2000/1	600-1000/1/1/1	600-1000/1
Core number	3	3	2	1	3	1
Accuracy class[14]	Class: TPY Issc = 40 kA tp =0,040 seg t´= t´al = 0,100 seg tfr = 0,300 seg t'' = t''al = 0,060 seg Rb = 5 Ohm	Class: TPX Issc = 40 kA tp =0,030 seg t´= t´al = 0,060 seg Rb = 5 Ohm	0.2-5P20	0.2s – FS<5	Class: TPY Issc = 40 kA tp =0,030 seg t´= t´al = 0,100 seg tfr = 0,300 seg t'' = t''al = 0,060 seg Rb = 5 Ohm	0.2s – FS<5
	Class: TPY Issc = 40 kA tp =0,030 seg t´= t´al = 0,100 seg tfr = 0,300 seg t'' = t''al = 0,060 seg Rb = 5 Ohm	Class: TPX Issc = 40 kA tp =0,030 seg t´= t´al = 0,060 seg Rb = 5 Ohm	5P20	n.a.	Class: TPY Issc = 40 kA tp =0,030 seg t´= t´al = 0,100 seg tfr = 0,300 seg t'' = t''al = 0,060 seg Rb = 5 Ohm	n.a.
	0.2-5P20	0.2-5P20	n.a.	n.a.	0.2-5P20	n.a.
Rated burden (VA)	30 (not applicable for the TPY cores)	30 (not applicable for the TPX cores)	30	30	30 (not applicable for the TPY cores)	30
Maximum secondary winding resistance (R_{ct}) at 75 °C (Ω)	5 (not applicable for the TPY cores)	5 (not applicable for the TPX cores)	5	5	5 (not applicable for the TPY cores)	5

[14] the accuracy requirements refer to all specified transformation ratio

Base component code	**GSCH006/ 631**	**GSCH006/ 632**
Rated short-time thermal current I_{th} (kA)	40	
Rated continuous thermal current I_{cth} (kA)	120% of I_{pr}	
Rated transformation ratio k_r (A/A)	1000-2000/5/5/5	1600/1
Core number	3	1
Accuracy class[15]	0.5	5P30
	5P30	n.a.
	5P30	n.a.
Rated burden (VA)	30	30
Maximum secondary winding resistance (R_{ct}) at 75 °C (Ω)	5	5

[15] the accuracy requirements refer to all specified transformation ratio

7.4.8 Voltage transformers

In addition to IEC 61869-1 and IEC 61869-3 requirements, the following further inductive SF6 insulated voltage transformers requirements are prescribed.

Base component code	**GSCH006/ 701**	**GSCH006/ 702**	**GSCH006/ 711**	**GSCH006/ 712**	**GSCH006/ 713**
Highest voltage for equipment U_m (kV)	72,5	72,5	145	145	145
Rated Insulation levels	According to 5.1				
Rated transformation ratio k_r (kV/kV)	$\frac{60:\sqrt{3}}{0{,}11:\sqrt{3}}$	$\frac{66:\sqrt{3}}{0{,}11:\sqrt{3}}$	$\frac{110:\sqrt{3}}{0{,}11:\sqrt{3}}$	$\frac{115:\sqrt{3}}{0{,}115:\sqrt{3}}$	$\frac{120:\sqrt{3}}{0{,}1:\sqrt{3}}$
Secondary windings	2	2	2	2	2
Rated voltage factor F_v	1,5 (rated time 30 s)				
Accuracy class	0,5 – 3P	0,5 – 3P	0,2	0,2	0,2
	3P	0,5 – 3P	0,5 – 3P	0,5 – 3P	0,2 – 3P
Rated burden (VA)	25	25	15	25	15

Base component code	**GSCH006/ 714**	**GSCH006/ 715**	**GSCH006/ 716**	**GSCH006/717**
Highest voltage for equipment U_m (kV)	145	145	145	170
Rated Insulation levels	According to 5.1			
Rated transformation ratio k_r (kV/kV)	$\frac{115:\sqrt{3}}{0{,}115:\sqrt{3}}$	$\frac{115:\sqrt{3}}{0{,}115:\sqrt{3}}$	$\frac{132:\sqrt{3}}{0{,}11:\sqrt{3}}$	$\frac{150:\sqrt{3}}{0{,}1:\sqrt{3}}$
Secondary windings	2	3	2	1
Rated voltage factor F_v	1,5 (rated time 30 s)			
Accuracy class	0,5 3P	3P	0,5 – 3P	0.2 3P
	0,5 3P	0,2	0,5 – 3P	n.a
	n.a.	3P	n.a.	n.a.
Rated burden (VA)	25	25	25	25

Base component code	**GSCH006/718**	**GSCH006/719**	**GSCH006/720**	
Highest voltage for equipment U_m (kV)	170	245	245	
Rated Insulation levels				
Rated transformation ratio k_r (kV/kV)	$\frac{150:\sqrt{3}}{0{,}1:\sqrt{3}}$	$\frac{220:\sqrt{3}}{0{,}1:\sqrt{3}}$	$\frac{220:\sqrt{3}}{0{,}1:\sqrt{3}}$	
Secondary windings	2	1	2	
Rated voltage factor F_v				
Accuracy class	0,5-3P	0,2 3P	0,5-3P	
	0,2	n.a.	0,2	
	n.a.	n.a.	n.a.	
Rated burden (VA)	25	25	25	

Referring to IEC 61869-1 table 8 “Arc fault duration and performance criteria”, it is requested:

- Protection stage: 2
- Internal arc fault protection: class II

7.4.8.1 Specific requirements

7.4.8.1.1 e-distribuzione

The SF6 insulated VT are included in the scope of D.M. 1/12/1980 and subsequent modification (D.M. 10/9/1981).

7.4.9 Example of functionality CT/VT by bay type:

7.4.9.1 Transformer bay

RATIO	**BURDEN**	**CLASS**	**USE**
Rated transformation ratio k_r (kV/kV)	25 VA	0.2	Metering
Rated transformation ratio k_r (kV/kV)	25 VA	0.5 / 3 P	Measurement and Protection
Rated transformation ratio k_r (kV/kV)	25 VA	0.5 / 3 P	Protection

RATIO	BURDEN	CLASS	USE
Rated transformation ratio k_r (A/A)	20 VA	0.2 s, Fs< 5	RPM
Rated transformation ratio k_r (A/A)	30 VA	5 P 20 Class 0.5	Prot. Phase Diff.
Rated transformation ratio k_r (A/A)	30 VA	5 P 20	Prot. Overcurrent
Rated transformation ratio k_r (A/A)	30 VA	5 P 20	Prot. PF + Busbar diff.

7.4.9.2 Line bay

RATIO	BURDEN	CLASS	USE
Rated transformation ratio k_r (kV/kV)	25 VA	0.2	Metering
Rated transformation ratio k_r (kV/kV)	25 VA	0.5 / 3 P	Measurement and Protection
Rated transformation ratio k_r (kV/kV)	25 VA	0.5 / 3 P	Protection

RATIO	BURDEN	CLASS	USE
Rated transformation ratio k_r (A/A)	20 VA	0.2 s, Fs< 5	RPM
Rated transformation ratio k_r (A/A)	30 VA	5 P 20 Class 0.5	Prot. Distance
Rated transformation ratio k_r (A/A)	30 VA	5 P 20	Prot. PF + Busbar diff.
Rated transformation ratio k_r (A/A)	**30 VA**	5 P 20	Prot. Longitudinal diff.

7.4.9.3 Coupling bay

RATIO	BURDEN	CLASS	USE
Rated transformation ratio k_r (A/A)	30 VA	5 P 20	Prot. PF + Busbar diff.
Rated transformation ratio k_r (A/A)	30 VA	5 P 20	Prot. Overcurrent

7.4.9.4 Busbar measurement bay

RATIO	BURDEN	CLASS	USE
Rated transformation ratio k_r (kV/kV)	25 VA	0.5 / 3 P	Measurement and Protection
Rated transformation ratio k_r (kV/kV)	25 VA	0.5 / 3 P	Measurement and Protection

7.5 CONSTRUCTION CHARACTERISTICS

7.5.1 General characteristics

The GIS shall be manufactured in accordance with IEC 62271-203.
Being the GIS formed by metal enclosed switchgear devices, the requirements of IEC 62271-203 are applicable.
The normal use, control and maintenance operations shall be performed with total workers safety.
Components identifications shall be performed by plates located close to them.
All the written tests (labels, synoptic etc.) shall be in the local language of destination.
The SF6 solid decomposition products shall not influence the insulation and the equipment operation.
The over-voltages caused by breaking or making of capacitive current shall not compromise dielectric insulation of components enclosed in the enclosure.

7.5.2 Enclosures and structure

The enclosures shall be metallic and with the mechanical robustness necessary to ensure the correct operation of all internal mobile parts.
Any cover or detachable part of the equipment shouldn't be likely to be lost. All the detachable parts (including bolts) should be attached.

The enclosures shall be suitable for the vacuum treatment during gas filling processing, in factory or in field. Furthermore shall be able to absorb mechanical expansion due to normal service conditions.
The enclosures and support structure disposition shall ensure that:

- All equipment parts are easily accessible for normal check operations with the equipment in service. Manual operations shall be easily performed from the ground (maximum height 1.900 mm);
- The design shall be such that it will enable the replacement of any one bay leaving out of service a maximum of the two adjacent positions.

7.5.3 Dielectric mean

The dielectric mean for insulation and arc extinction is SF6, with a pressure over the atmospheric one.
The gas shall comply with EN 60376 standard. The manufacturer has to provide the necessary instructions for use and handling of SF6, in accordance with IEC 62271-4.
In alternative, non-fluorinated greenhouse gases and internal vacuum breaking unit are also acceptable.

7.5.4 Gas density control

The GIS is a closed pressure system. The relative leakage rate shall be *Frel* ≤ 0,5% per year. The value for the time between replenishments shall be at least 10 years (also valid for voltage transformers, if present).
It shall be possible to perform the SF6 replenishment with the equipment in service, avoiding the unwanted operation of the SF6 density control device.
Each partition shall have a distinct SF6 circuit, with a device for the density control.

Each SF6 circuit shall provide a connection element (type DILO VK/BG-03/8 or equivalent[16]), with a non-return valve, both for SF6 control device and for gas filling/replenishment, provided by not losable protection screw taps (located not higher than 1.900 mm from the ground level).
The SF6 circuit piping shall be performed using stainless steel or painted copper, in order to reduce the stealing risk. Alternative solutions can be considered if the manufacturer proves their similar visible effect and equivalent technical and ageing characteristics.
The alarm threshold calibration has to take into account the leakage rate. The block threshold calibration shall be at least 0,02 MPa lower respect to the alarm threshold.

The SF6 density control device shall be:

- suitable to work in the provided temperature range;
- your indicator needle cannot be tampered with.
- insensitive to the vibration produced by the equipments operation;
- manufactured with stainless materials;
- realized in order to allow the functionality verification and the substitution with pressure;
- with the following scale(s) for a visible indication of gas density level:
    - The density meter should be colored and graduated.
    - There should be a nameplate with the relation between the SF6 pressure and ambient temperature

The SF6 density control device shall provide 2 operating levels independently adjustable (see details and specific requirements in Annex C):

- 1st minimum gas density level (“P1 gas”): alarm (replenishment necessary), with 2 contacts;
- 2nd minimum gas density level (“P4 gas”): to get out of service, with 2 contacts.

[16] In case of non-fluorinated green house gases, the Manufacturer will propose a suitable type different from the one used for SF6, in order to avoid mistakes.

The contacts operating tolerance shall be lower than ± 1,5% (referred to the full scale) in the provided temperature range; the contacts of each minimum gas density level shall have a difference ≤ 0,005 MPa between them.

7.5.5 Gas filling/replenishment device (Optional)

At request the manufacturer shall supply a device for the gas replenishment.
In case of SF6, the device shall be provided by female thread connection, W 21,7 x 1/14" (UNI 11144 – only for e-distribuzione) on gas bottle side and DILO VK/BG-03/8 or equivalent on pole junction device side. The device will consist of:

- pressure regulator
- a safety valve (ISO 4126 compliant, calibrated at 8 bar rel);
- a pressure gauge 0÷1 MPa, 0,5 class, minim resolution ± 5 kPa, accompanied with a calibration certificate;
- flexible tube 5 meters long, DN≥8.

7.5.6 Partitioning

7.5.6.1 Common requirements

Each partitioning will be managed including in the electric scheme the additional functionalities of the interlocking, automatic openings and remote signaling.
The partitions shall have adequate mechanical resistance to static and dynamic stresses and to vibrations due to both normal and short circuit operation. The partitions shall be designed for the maximum differential pressure in case of vacuum performed in one of the sections.
The manufacturer should consider the necessary partitions for the correct operation and It will be subjected to Enel Group Distribution companies approval.

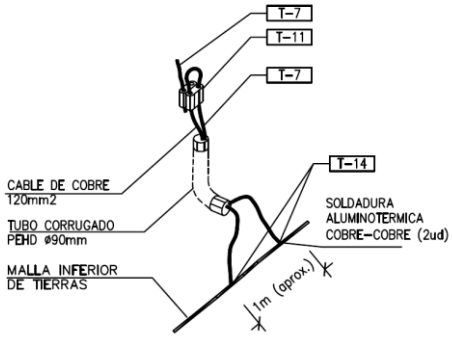
7.5.6.2 Specific requirements

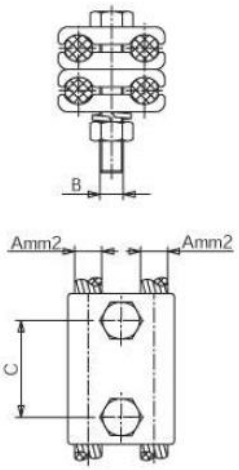
7.5.6.3 e-distribuzione

The partitions are included in the scope of D.M. 1/12/1980 and subsequent modification (D.M. 10/9/1981).

7.5.7 Earthing

The manufacturer shall ensure the equi-potentiality between all parts forming the equipment.
On the base there shall be 2 earthing points equipped with (AISI 316) M12 stainless steel bolts (included in the scope of supply) separated 50 mm vertically.





The earthing path, even for CTs and VTs, has to be a directly connection to the earthing points.
The manufacturer must ensure that the earthing at each of these points independently establishes that all parts of the equipment are equipotential. The equipment does not need additional grounding points to ensure an equipotential bonding of all components.

As for instrument transformers, the following secondary terminals shall be earthed:

	e-distribuzione	**E-distributie, e-distribución and Latam**
CTs	S1 (Busbar side)	S2 or S3 (according to the used transformation ratio)
VTs	n	n

7.5.8 Internal arc and overpressure safety devices

The shielded gas equipment will have the necessary elements to absorb any expansions that may arise therein.
In order to provide a high protection to workers, the external effects of an internal arc (pressure increase of gas and possible burn-through of enclosure) must be limited.
Referring to item 5.102.2 of IEC 62271-203 and the performance criteria – Table 104 – it is requested protection stage 2: no fragmentation (burn-through is acceptable).
All enclosures (VT included, if any) shall be equipped with safety devices against the internal overpressures compliant with ISO 4126 (alternative solutions could be evaluated if the manufacturer proves their adequacy) and properly calibrated over the maximum operating pressure, in order to avoid improper operations.
In case of overpressure safety valves operation, the expelled gas shall not run over people around the equipment and shall not damage GIS vital parts.

7.5.9 Current Transformers

The indoor current transformers shall be manufactured in compliance to IEC 61869-1 and IEC 61869-2, toroidal type. They will be located close to the bushings/cable/Bus-duct connections.
The secondary terminal box shall be located in order to be easily accessible.
Inside the Control Box shall be located a CT's terminal board, additional to the previous in the secondary terminal box, 6 mm^2 section. The terminal board inside the Control Box shall be short-circuitable on CT side and disconnectable on Control System side, with test sockets.
The connection cables between the secondary terminal boxes and the CT's terminal board shall be 2,5 mm^2 section if Isn =1 A or 4 mm^2 section if 5 A.
It is specified that the primary terminal "P1" shall be positioned toward the internal GIS side, as the "P2" is to bushings/cable/Bus-duct connections.

7.5.10 Voltage Transformers

The indoor voltage transformers shall be manufactured in compliance to IEC 61869-1 and IEC 61869-3 and partitioned respect to the GIS enclosures.

7.5.11 Anti-condensation circuit

Inside all boxes a proper anti-condensation system shall be provided in order to prevent humidity damages and to ensure a proper air replacement.
The anti-condensation circuit shall be one for the overall equipment, supplied in a.c (see table in chapter 5 for the supply rated voltage) and protected with a magnetothermic automatic circuit-breaker. It shall be controlled by a humidistat; thermostat is admitted in addiction if the manufacturer needs it to comply the minimum ambient temperature requirement. Both shall have fixed regulation (typical regulation values are 60% R.H. and + 5°C) and the contacts shall be connected in parallel.
The heating elements shall be connected in series in order to open the circuit in case of breaking of an element; a minimum current sensor shall detect and signal the anomaly (obviously not when circuit is OFF for environmental causes).
In parallel connection case, the manufacturer shall assure a correct fault detection and distance anomaly signaling in case of failure of an element, properly evaluating the tolerances of the supply voltage and of the components resistance.
The heating elements should be easily replaced without affecting any other component of the enclosure (even wiring) and with the equipment in service.

7.5.12 Protective treatments

All external surfaces shall have an effective and enduring anti-corrosion protection.
On request the enclosures shall be painted in light gray color (RAL 7035). Painting is anyway admitted even if not expressly requested.
The external visible part of partitions, if any, shall be in orange color (RAL 2004).
All iron parts (e.g. Control Box, Drive Mechanism Boxes, bolts etc.) shall be in non-corrosive material (AISI 316) or hot dip galvanized in compliance with ISO 1461. All processing shall be completed before the protective treatments.
Protective treatments alternative to the hot dip galvanization could be accepted if the manufacturer proves its adequacy.
The metallic elements in contact shall be designed in order to avoid corrosion due to humidity galvanic effect.

7.5.13 Nameplate

7.5.13.1 Common requirements

The nameplates shall be in stainless steel. Alternative materials can be considered if the manufacturer proves the marking endurance respect to the ageing.
The nameplate must be in the language of the destination country.
5.10 of IEC 62271-203 applies. Moreover the nameplate, placed on the external side of the Control Box door, shall include:

- Art 5.10 Nameplates Applies 5.10 of IEC 62271-1 with the following addition: A common nameplate must be provided to identify the compact multi-function module. It must, as a minimum, specify the nominal characteristics listed in art. 4 of this Standard. The common plate must be clearly legible from the position of the local operating zone. For each individual appliance, a plate, in accordance with its own standard, is required when the nominal characteristics are not specified on the common plate.
- Art 4 Rated characteristics Article 4 of IEC 62271-1 applies in part with the following particularities: The rated characteristics of a compact multi-function module and its control equipment include the following:
- (a) rated voltage (Ur);
- (b) nominal insulation level;
- (c) rated frequency (fr);
- (d) rated thermal current (Ir) (for main circuits);
- (e) rated short-time permissible current (Ik) (for main and ground circuits);
- (f) Nominal permissible peak current (Ip) (for main and ground circuits);
- (g) rated short circuit duration (tk); and, where applicable,
- (h) the rated values of the equipment of the compact module, including its switching equipment (supply voltage and frequency) and its ancillary and control equipment.
- The rated characteristics of a compact multi-function module shall be assigned to ensure that the operation of the module within the limits of the assigned ratings does not expose any individual device to conditions exceeding its rated powers and ranges.
- reference to this Global Standard and revision
- composition type (SB or DB);
- optional values, if any;
- the rated filling pressure value at 20°C (relative value).
- include number of SF6 kg and number of CO2 equivalent kgs.
- Include the sentence “Contains fluorinated greenhouse gases covered by the Kyoto Protocol” (in accordance with Commission Regulation (EC) 1494/2007 of 17 December 2007).
- Nameplate in the language of the destination country

7.5.13.2 Latam specific requirements

The self-adhesive nameplate to be located in the internal part of the Control Box door shall also contain the contract number.

7.5.13.3 e-distribuzione specific requirements

According to PVR006/ PVR016 a bar code shall be assigned to each base component and to the overall assembly (containing references to the base components forming the assembly). Further details will be discussed during the conformity assessment process.

7.6 FUNCTIONAL CHARACTERISTICS

7.6.1 Drive mechanisms

7.6.1.1 General requirements

The equipment controls shall be realized in order to be managed by one or more selector switches for the operation type choice, with the following characteristics:

Companies	Selector switches positions	Names	Key
e-distribución, Enel Distribuição Rio, Enel_Codensa, Enel Distribuição Ceará, Enel Distribuição Goiás, Enel Distribuição São Paulo, Enel Distribución Chile, Edesur, Enel_Codensa, Enel Perú, E-Distributie and e-distribuzione	3	Manual Local Remote	Requested (extractable only in manual position)

These selector switches shall be located inside the Control Box.

In “remote” position the electric remote controls are enabled and the electric local controls are disabled.
In “local” position the electric remote controls are disabled and the electric local controls are enabled.
In “manual” position all electric (local and remote) operations are disabled.

The switch operation shall not cause unwanted equipment operations.
The local operation of circuit-breakers (only three-pole operations, it shall not be possible to operate locally single-pole operations) and disconnectors/earthing switches shall be controlled by push-buttons located in the Control Box (see 0), with the following colors:

Operation	**Enel Distribución Chile, Enel Codensa, Enel Perú, Edesur, e-distribución, E-Distributie and e-distribuzione** (according with IEC 60073)	**Enel Distribuição Rio, Enel Distribuição Ceará, Enel Distribuição Goiás, Enel Distribuição São Paulo** (according with NR10)
Closing	Black “I” on white background	White "L" on Red background
Opening	White “O” on black background	White "D" on Green background

The test lamp push button located in the Control Box should have the following color:

Push button	**Enel Distribución Chile, Enel Codensa, Enel Perú, Edesur, e-distribución, E-Distributie, e-distribuzione, Enel Distribuição Rio, Enel Distribuição Ceará, Enel Distribuição Goiás and Enel Distribuição São Paulo** (according with IEC 60073)
Test/reset lamp	White

Only one lamp test push button for the whole bay.

The main contact position of circuit-breaker and disconnector/earthing switch indicators have the following characteristics:

Position	**Enel Distribución Chile, Enel Codensa, Enel Perú, Edesur, e-distribución, E-Distributie and e-distribuzione** (according with IEC 60073)	**Enel Distribuição Rio, Enel Distribuição Ceará, Enel Distribuição Goiás, Enel Distribuição São Paulo** (according with NR10)
Close	Black “I” on white background	White "L" on Red background
Open	White “O” on black background	White "D" on Green background

The location of the equipment's position indicator devices (open-closed) must guarantee that they are always visible to the operator at every instant of the operation.

Temporary block signalizations shall not be sent to the control system during normal operation.

As for D.C. supply it’s specified that:

- the remote/local control supply of each bay shall be independent from the others;
- the motors supply is common for all circuit-breakers and disconnector of the equipment. All motors shall be equipped with protection magnetothermic automatic circuit-breaker.

The springs charge indicator has to be:

Springs indicator	**Enel Distribución Chile, Enel Codensa, Enel Perú, Edesur, e-distribución, E-Distributie, e-distribuzione, Enel Distribuição Rio, Enel Distribuição Ceará, Enel Distribuição Goiás and Enel Distribuição São Paulo**
Charged	Black symbol on white background
Uncharged	White symbol on black background

7.6.1.2 HANCircuit-breakers drive mechanism

7.6.1.2.1 General requirements

The Circuit-breakers drive mechanism shall be spring type, three-pole or single-pole type.
The drive energy storage shall be normally made by mean of d.c. electric motor (see table in chapter 7.4.1 for the supply rated voltage); when necessary it shall be possible to restore manually the operating device energy, with a maximum effort below 200 N (EN 1005-3:2002+A1:2008) during the hole charge. The equipment must have an indicator of the state of the spring (loaded/unloaded) and it has to be visible from the maneuver position. The manual device shall exclude the motor operation, The insertion of the crank handle in the case of manual loading must automatically suppress any power supply to the motorized equipment being maneuvered, or in alterative shall be designed excluding its possible movement in case of unexpected spring operation. Every GIS shall have only one handcrank for each type of CB mechanism. Plastic component is forbidden in the handcrank design.
All releases, both for closing and for opening, shall not work with a signal duration ≤ 3 ms.
The Circuit-breakers drive mechanism shall be able to perform the following cycles[17]:

- with motor working:
  - O – 0,3 s – CO – 1 min – CO with CB closed and opening and closing springs charged;
- with motor not working:
  - O – 0,3 s – CO with CB closed and opening and closing springs charged;
  - CO with CB open and closing springs charged;
  - O with CB closed and opening springs charged.

The single-pole CBs shall be equipped with a device for the signalization of poles not in the same position (closed or open). This is applicable also for three-pole CBs when they are electrically obtained by single-pole CBs, paralleling the releases coils.

7.6.1.2.2 Release drive circuits

The release drive circuits typologies are:

- drive circuit of shunt closing release (always required);
- drive circuit of shunt opening release (1° and 2° circuit both independents);
- drive circuit of under-voltage release (3° circuit).

The control circuits for the different cases are shown in the electric schemes in annex C.
It shall be possible to request the CB opening acting both on a single circuit at a time and concurrently on any combination of the different opening circuits.
In case during an operation an opposite operation request is received, the consent on the last operation shall be given only after the completion of on-going operation (in this case, only for single-pole CBs, the discrepancy between poles can exceeds the required limits)
The closing circuits shall be equipped with antipumping devices (1 for tripolar CBs and 3 for unipolar CBs) in order to inhibit further closing operations after the first one if an opening occurs during the initial closing request.
The main contacts position shall be assured stably and surely in the open and closed position. The CBs shall not operate in case of accidental auxiliary circuits supply interruption or in case of supply restore (excluding the drive circuit of under-voltage release).

[17] with the CB closed the opening springs shall be always charged.

It shall be possible to perform the CB closing and opening (when HV and d.c. supplies are off, i.e. due to a fault) by means of (safety located) hand operated levers or buttons.
The springs will be tightened in less than 15 seconds.

The other characteristics will meet Standards IEC 62271-100 High-voltage switchgear and controlgear – Part 100: Alternating current circuit-breakers, when applicable.

7.6.1.2.3 e-distribuzione specific requirements

It shall be possible to manually lock/unlock the under-voltage release(s), both three-pole or single-pole type, by mean of a device provided of the “block”/“unblock” indication (in local language). This device(s) shall be easily and safely accessible (shall not be necessary to open the part of the Operating Device Box where the operating devices are located) and shall be maneuverable from the ground level (maximum height 1.900 mm).
It shall be possible to operate this device(s) with the CB in service and without causing an unwanted opening.
In the functional scheme the locked under-voltage release signalization shall be provided.
Under-voltage releases consisting of energy storage systems (for example capacitors) are not admitted.
The CB closing consensus shall be interdict in case under-voltage release drive circuits are not supplied.

7.6.1.3 Disconnectors (DSs), earthing switches (ESs) and fast earthing switches (FES) drive mechanism

The DSs and ESs operation shall be performed by three-pole motor-drive mechanisms with the possibility of emergency (for instance: absence of DC power supply) manual operation in case of need. It will consist of a gear motor (see table in paragraph 7.4.1 for the supply rated voltage) which will transmit its movement to the drive shaft of the disconnector. The same applies to earthing switch.
The motor drive system can be unique for DS and ES.
The drive mechanism shall operate on a highly reliable transmission system, in order to avoid any interruptions.
The control of the driving mechanisms of the disconnectors shall not be performed directly on their motors. These motors will implement a control based on auxiliary relays, which will receive and execute the opening and closure orders of the disconnectors.

An exclusive control must be implemented for each opening and closure switching of each disconnector. For this reason, the three-position disconnectors-switches (pass-open-output to earth), for example, shall implement four controls: opening and closure of the pass disconnector, opening and closure of the earthing switch.

Every GIS shall have only one handcrank for each type of DS and ES mechanism. Plastic component is forbidden in the handcrank design.
Position indicating devices of disconnectors and earthing switches shall comply IEC 62271-102, annex A.
The location of the equipment's position indicator devices (open-closed) must guarantee that they are always visible to the operator at every instant of the operation.

DS and ES shall be both equipped with the following circuits:

a) n° 1 drive circuit of shunt closing release;
b) n° 1 drive circuit of shunt opening release.

The ongoing operations shall be completed even in case of opposite operation request.
The operation requests persistence after the operation conclusion shall not produce effects.
In case of a DS/ES operation is not completed, any previously received operation requests shall not remain stored. In case of motor supply outage during a DS/ES operation, the drive mechanism shall ensure:

- the keeping of the reached position, both during supply absence and at its restore;
- the execution after the supply restore of any requested closing or opening operation, independently from the operation type ongoing at supply outage instant;
- that in case of not completed operation the operation sequence shall be stopped and an anomaly remote signalization (Switch Not Maneuverable) shall be sent, by mean of a timed contact.

The operations shall not be carried out if the request signal duration is shorter than 3 ms.
The hand-crank insertion for the manual emergency operation shall be enabled only when the 3 position selector switch (MANUAL–LOCAL–REMOTE) is in “manual” position and in presence of all requested consensus conditions.
The hand-crank for manual operation shall be withdrawable type; its insertion shall cause a signalization and shall disable the electric operations, both local and remote.

The insertion of the crank handle in the case of manual loading must automatically suppress any power supply to the motorized equipment being maneuvered.

The manual operation of DS and ES shall be compliant with IEC 60447.
The turns number for a complete manual operation shall not exceed 50.
All controls (MANUAL, LOCAL and REMOTE) shall be subject to the conditions represented in the electric scheme of annex C.

Everything defined in this section is applied both to the slow-switching disconnectors and the fast earthing switch closure disconnectors.

7.6.1.3.1 e-distribución, Enel Distibutie and Latam specific requirements

It shall be possible to lock DS/ES in open or closed position by mean of padlocks with Ø = 6 ÷ 10 mm pin.

7.6.1.3.2 DS/ES mechanical locks and interlocks

DS combined with ES as a single unit shall have a mechanical interlocking device that prevent the closure of ES when DS is closed and prevent closure of DS when ES is closed (not applicable in case of DS/ES for which it’s not physically possible to have these conditions).
All mechanical locks and interlocks shall be designed to withstand, preventing damages and without need of maintenance:

- in case of motor-operation, to the strains produced by the motor starting torque;
- in case of manual-operation, refers to 5.105 of 62271-102.

7.6.2 Control Box and Drive Mechanism Box

The requested cabinets are the followings:

- a cabinet for control and interface with the remote control system (hereinafter “Control Box”)
- cabinets for the CBs, DSs and ESs operating devices (hereinafter “Operating device Box”)

All the interconnection cables between the different devices/control box should be ducted and protected with resistant material to external environmental aggressions or external impacts.
Boxes internal wiring minimum type required must be:
Cca: EN 50399: FS ≤ 2,00m; THR ≤ 30MJ; HHR ≤ 60MJ; FIGRA ≤ 300Ws-1 /// EN 60332-1-2: H≤425 mm
s1b: TSP1200 ≤ 50 m2; SPR 0,25 m2/s; transmittance≥ 60 % < 80%
a1: conductivity < 2,5 µS/mm y pH > 4,3
d1: no fall for 1200 s of droplets / flaming particles persisting for more than 10 s

7.6.2.1 Control Box

All GIS bay auxiliary and control equipments shall be placed in the Control Box; In this box also the cables coming from CTs and, if any, VTs shall be connected to the respective terminal boards (see par. 7.5.9 and annex C). The connection between the CB and the GIS must be with heavy duty connection type (harting).
The location of the control box should always consider pedestrian access to the equipment (projected and/or existing). Always prioritizing to facilitate the access and the operation of this.
In addition to the IP requirement of table al chapter 7.4.1, the box protection degree with open doors shall be minimum IP2X.
All HMI (Human Machine Interface) elements (controls and signalizations) shall be at ≤ 1900 mm.
The box interior shall be accessible only from the front by mean of a door provided of handle and lock. The door (simple or double), hinged and provided of anti-wind system, shall be provided of a window in order to make visible from outside the synoptic and the signalization lamps. It shall be possible to open the door over 90°.
All accessories (hand cranks, document pocket etc.) shall be accommodated In the internal part of the box door.
All electric equipment components shall be:

- compliant with the respective IEC standards;
- equipped with an identification label indicating the codification used in the functional electric schemes;
- easily accessible for maintenance or substitution operations;
- of typologies for which interchangeable components are easily available in commerce (delivery time within 2 weeks) in the GIS destination country.

In particular, the extractible ones, plug-in connector included, shall be provided with proper anti-mistake coding.
The box internal wiring shall be made with conductors with adequate section (≥ 1mm^2), flexible type, compliant with IEC 60332-3-24 and insulated at Uo/U = 450/750 V.
The cable ends shall be provided by pre-insulated compression type terminals, suitable for the clamps where they have to be connected.
The connection cable from the Control Box to the equipments shall be of adequate section (≥ 1,5 mm^2), shielded, flexible, compliant with IEC 60332-3-24 and insulated at Uo/U = 0,6/1 kV.
Inside the Control Box an internal collector (in copper, section ≥ 60 mm^2 and M5 regular interval threaded hole) shall be present for the earthing connection of all cable shields; the Manufacturer shall guarantee its effective connection to the GIS earthing system.
The entrance of cable coming from equipments and control system shall be from the Control Box bottom side, where a removable loophole (in aluminum, with useful dimension of 300x300 mm) shall be provided.
At about 200 mm below the Control Box shall be provided a removable horizontal crossbar, suitable for the anchorage of all the cables by mean of cable-fixers.

The Control Box shall include:

- selector switches;
- synoptic representing the HV electric scheme, with the equipments position (close or open), the partitioning (if any), the alarm/block signalization lamps and the lamps testing button; the synoptic shall also include control buttons for CBs, DS and ES;
- gas density signalization lamps (for each gas circuit, yellow color about 1st minimum gas density level; red color about 2nd minimum gas density level).
- magnetothermic automatic circuit-breakers for the supplies protection (motors, lighting lamp, anti-condensation circuits – fuses are not admitted);
- interface terminal board for substation control system, including the CTs and VTs testing terminals (with correspondent automatic circuit-breakers);
- anti-condensation circuit;
- internal lighting lamp, with automatic switching in case of open door. The whole internal control box must
- be lightened to make easier the wiring works.

The internal wiring of the control box and operating device box must be clearly, visibly and unambiguously identified with the following minimum requirements:

- Name of the terminal block and number of the destination terminal

In all cases, it must be visible from the front of the elements, without the need to turn or move the control cables or any other element of the indicated boxes.
Likewise, the substitution of any element inside these boxes must not imply the removal or movement of other elements.
These conditions of labeling and visibility must be guaranteed throughout the useful life of the equipment.

For each GIS the interface terminal boards composition depends on the HV bay typologies that form the whole assembly.
The interface terminal boards (and their modular terminals) shall be according to principle electric schemes shown in annex C.
The terminals shall have section 4 mm² for control, signalization and anti-condensation circuits and section 10 mm² for the motors supply circuit.
The VTs (if any) terminals and protection circuit-breakers shall be located in the bottom part of the box, as close as possible to the cable entrance, in order to minimize the short circuit hazard.
Similarly also the CTs terminals shall be located in the bottom part of the box.
The cable trunks close to the interface terminal boards shall be used for the control system wiring and cannot be used for the internal wiring.
The connections between the different equipment should be with the heavy duty connection type (harting). The protection degree has to be IP68.
The cable trunking systems for the internal wiring shall shave sufficient residual space (≥ 10% of used volume); the cables shall be anchored in some points in order to avoid their falling. The cable entry must have a cable gland.
The signalization lamps and the internal lighting lamps shall not be incandescent type (LED preferably). The lighting lamps shall be easily removable.
All provided electromechanical block keys shall be differently codified.
The earthing of a d.c. supply polarity is not admitted.
If diodes are used for the circuit separations or for the voltage return protection, they shall have reverse voltage ≥ 3 kV.
Control box wiring and construction must be compliant with the ENEL internal procedures and Global Standards.

Minimum type required:

Cca: EN 50399: FS ≤ 2,00m; THR ≤ 30MJ; HHR ≤ 60MJ; FIGRA ≤ 300Ws-1 /// EN 60332-1-2: H≤425 mm
s1b: TSP1200 ≤ 50 m2; SPR 0,25 m2/s; transmittance≥ 60 % < 80%
a1: conductivity < 2,5 µS/mm y pH > 4,3
d1: no fall for 1200 s of droplets / flaming particles persisting for more than 10 s

7.6.2.1.1 e-distribución
It must be considered as a low voltage equipment. For that reason it also must be compliant with Reglamento Electrotécnico para Baja Tensión, Real Decreto 842/2002.

7.6.2.2 Operating devices boxes

The drive mechanisms, the CB operation counters (four-digits, not-resettable, mechanical or in alternative electromechanical – in the latter case located in the Control Box), the auxiliary electric equipments, the auxiliary contacts and the terminal boards (or connectors) shall be located:

- in a single cabinet for disconnectors/earthing switches and three-pole CBs;
- in 3 cabinets for single-pole CBs.

During normal operation, with enclosures and doors closed, the main contact position indication (close/open) and, for CBs, the spring loading condition signalization shall be visible from ground level.
During manual and local operation the main contact position indication (close/open) and, for CBs, the spring loading condition signalization and the counter maneuver has to be visible.
In order to allow the verification, during maintenance activity, of the unchanged characteristics of the CB's no-load travel curve, manufacturer shall provide the measuring points, properly machined.
In addition to the IP requirement of table at chapter 5, the box(es) protection degree with open doors or when using hand-crank (to charge CB's springs or manual operation on DS/ES) shall be minimum IP2X (unless the box can be opened only using tools).
All mechanical organs (included the motion transmission rods for three-pole CBs) shall be enclosed in metallic enclosures, IP2X, in order to prevent the access to parts in movement, unless they have slow motion (see par. 5.13.1 of IEC 62271-1) without cutting and crushing hazard.
The manufacturer shall provide the instruction for a safety access to mechanical organs.

7.6.3 Electronic Voltage Detector System EVDS

The EVDS detects the voltage presence in order to implement interlocks for preventing incorrect operation of disconnectors and earthing switches.
It is equipped with internal self-diagnostic.
The EVDS shall have a DC/failure auxiliary contact signalization.
If it is equipped with an ON/OFF button, in OFF position shall activate the DC/failure auxiliary contact signalization.

It's a low performance electronic device, not for measuring purpose, made by 2 parts.
The first device part, self-supplied, is connected to a capacitive divider tern located on the GIS. It provides a digital information related to the presence or absence of the HV voltage; it pilots an optical fiber interface, one for each pole, making a galvanic separation.

In alternative, this first part can be made with 3 separate units, each connected to its capacitive divider and each with its optical fiber connection.

The fixing system of the FO for the EVDS must guarantee a correct connection of this element through time, in the same way this connection must be able to withstand the vibrations inherent to the equipment maneuvers and/or any type of internal or external movement.
The second device part includes relays and is supplied in d.c.; it receives and elaborates the optical fiber signals and it implements the requested interlocks.
The operation and hysteresis threshold shall provide that:

- the voltage absence signalization is guaranteed with < 10% of rated voltage;
- the voltage presence signalization is guaranteed with > 45% of rated voltage.

The EVDS is equipped with 2 electromechanical relays.

The first relay signals the voltage presence/absence and disables/enables the operations in accordance with the logic of the following table:

HV presence	EVDS supply presence	Voltage detector relay coil	Interlocks contact
YES	NO	Not-energized	Open
YES	YES	Not-energized	Open
NO	NO	Not-energized	Open
NO	YES	Energized	Close

The voltage absence signalization and its restoration shall not be instantaneous but delayed of about 1s.
The second relay is activated by the internal self-diagnostic.

This diagnostic relay, if not energized, provides:

- to remote signal the “HV presence anomaly”, by mean of wiring to the substation interface terminal board;
- to interact with the voltage presence/absence circuit, blocking operations for safety reason.

  The diagnostic relay enables, if energized, the disconnectors or earth disconnectors operation in absence of HV.

Each EVDS shall be equipped with two leds for the following local state signalizations:

- red led on: voltage presence
- green led on: voltage absence

  As for the first EVDS part:
- if three-phase type, it shall be located in the Control Box; the connections to the capacitive dividers shall be made using shielded cable; moreover, immediately close to each capacitive divider a restorable surge arrester shall be provided, in order to limit the residual voltage, in case of overvoltage, to 200 V;
- if single-phase type, the three devices shall be located immediately close to each capacitive divider. Three fiber optic cables, inserted in protective tubes, connect each device from capacitive divider to the second part.

The second EVDS part shall be located in the Control Box.

The EVDS correct operation shall be guaranteed in the required temperature range.

The EVDS supply shall be protected with an automatic circuit-breaker, whose operation signalization shall be associated with the “HV presence anomaly” in the substation interface terminal board.

7.6.4 Interlocking

The bays will be equipped with interlocking between the circuit breaker, busbar disconnectors and earthing switches, necessary to guarantee safety of the personnel and the material, preventing false switchings, both if carried out with electrical or mechanical driving.
The manufacturer must attach information on the type of interlocking used and the operation thereof.

7.6.5 Electric schemes, controls and signalizations

7.6.5.1 General requirements

The electric schemes shall:

a) be represented in the reference conventional conditions:
   - a.1) CB, DS, ES and FES (if any) in open position;
   - a.2) absence of a.c. and d.c. auxiliary supplies;
   - a.3) all coils and releases are non-excitation and uncharged
   - a.4) absence of HV;
   - a.5) gas absence;
   - a.6) closing springs discharged;
   - a.7) Selector switch 'manual-local-remote' in 'remote' position. Removable key selector only in manual position;
   - a.8) aux.switch is in the state when its corresponding primary equipment is at opening position
   - a.9) operation buttons of every primary equipment are at reset position
   - a.10) when the control box door is open, the light is on
   - a.11) Automatic temperature and humidity controler (if any), heaters are on standby
   - a.12) in case of micro-switches with the state dependent on the opening/closing of the boxes/carters of operating devices, they shall be represented disabled (that is with boxes/carters open).
   - a.13) unlocked under-voltage release (when requested) for CB.

b) report the following pressures values at 20°C (relative values):
   - b.1) rated filling pressure;
   - b.2) threshold setting pressure of the 1st minimum gas density level (alarm, replenishment necessary);
   - b.3) threshold setting pressure of the 2nd minimum gas density level (block or automatic opening with open position blocking).

c) include the functional scheme, all information useful to identify each wire and cable, the equipments wiring schemes (auxiliary contacts, relays, gas density control devices etc.), the topographic schemes for interconnections between boxes, the topographic schemes about all the electric components in Control box/Operating device box(es), the anti-mistake coding.

The schemes has also to include:

- SLD
- Interlockings chart
- Components technical data chart
- Control box layout
  - Main dimensions
  - Components identification
  - Synoptic detail
- Contact operation diagram
- Device Schematic description

Further details are in the specific requirements and in annex C, where the principle electric schemes of the different switchgears (and their functional typologies) are represented.

7.6.5.2 Spain, Romania and Latam specific requirements

Manufacturer definitive schemes must be compliant with internal ENEL procedures.

7.6.6 Controls, signalizations, interlock and automatic openings

7.6.6.1 Spain, Romania and Latam specific requirements

Check the annex C.

7.6.6.2 Italy specific requirements

Check the annex C.

7.7 TESTING

7.7.1 General information

The applicable standard is the IEC 62271-203 tests with the clarifications stated in this chapter.
The tests to be performed on GIS are divided in:

- Type tests;
- Routine tests on factory;
- Commissioning tests.

7.7.2 Type tests

7.7.2.1 General

In principle type tests should be performed on a complete GIS manufactured in accordance with the present technical specification.
Type tests are be classified in:

- tests on the complete assembly
- tests on base components

7.7.2.2 Type tests on the complete assembly

(7.1 of IEC 62271-203)
The tests listed in the following paragraphs shall be performed on a complete GIS manufactured in accordance with the present technical specification (the layout shall be suggested by the manufacturer and approved by user).
The applicability of a type test performed on one of the provided layouts to an equipment with a different layout shall be demonstrated by the manufacturer (by mean of a technical report) and approved by the user.

7.7.2.2.1 Visual check and constructive characteristics check

The GIS, complete of all accessories and fully assembled in operation layout, shall be subject to a visual inspection in order to verify its functional, dimensional and constructive compliance with this Global Standard and with technical documentation listed in paragraph 7.8.2.2.
Visual inspection shall be repeated each time the required assembly includes at least one new base components never subject to this check.

7.7.2.2.2 Dielectric tests

(7.2 of IEC 62271-203)

7.7.2.2.3 Radio interference voltage (r.i.v.) test

(7.3 of IEC 62271-203)
Applicable only to SF6/air bushings.

7.7.2.2.4 Measurement of the resistance of circuits

(7.4 of IEC 62271-203)
The measure shall cover all GIS components, using all available access points.

7.7.2.2.5 Temperature-rise tests

(7.5 of IEC 62271-203)

7.7.2.2.6 Short-time withstand current and peak withstand current tests

(7.6 of IEC 62271-203)

7.7.2.2.7 Verification of the protection

(7.7 of IEC 62271-203)

7.7.2.2.8 Tightness test

(7.8 of IEC 62271-203)[18]
Test must be performed using test Qm, method 1 “Cumulative Test”, IEC 60068-2-17.
The initial gas concentration Co, with GIS filled at nominal density, shall be measured after at least 2 hours from pressurizing; the final concentration C1 shall be measured after more than 8 hours.

7.7.2.2.9 Electromagnetic compatibility tests (EMC)

(7.9 of IEC 62271-203)

7.7.2.2.10 Additional tests on auxiliary and control circuits

(7.10 of IEC 62271-203)
For this verification the manufacturer shall provide a paper copy of the GIS electric schemes.
The correct operation of all controls, interlocking, automatic openings and signalizations shall be also verified.
The absorption curves of closing and opening (shunt and under-voltage) releases, taking note of the maximum values, shall be registered in the following conditions:

- at rated voltage;
- at 110% of the rated voltage;
- at 70% of the rated voltage, for opening releases;
- at 85% of the rated voltage, for closing release.

[18] 6.102 quoted in this paragraph shall be intended as 7.7.2.2.12 of this document.

The absorption curves of the CB and DS/ES motors (taking note of the maximum values, inrush excluded), of the springs charging times and of the DS/ES operating times, shall be registered in the following conditions:

- at rated voltage;
- at 110% of the rated voltage;
- at 85% of the rated voltage.

The heating and/or anti-condensation circuit absorption shall be measured.

7.7.2.2.11 Verification of making and breaking capacities

(7.101 of IEC 62271-203)
According with this requirement the manufacturer shall demonstrate that associated components excluded from this test or changed respect to the tested one don't affect the making and breaking performances.

7.7.2.2.12 Mechanical and environmental tests

7.102 of IEC 62271-203 applies with the following additional information.
The static terminal load test (6.101.5 of IEC 62271-205) shall be performed considering the requirements in 7.3 of this document.

7.7.2.2.13 Tests on Circuit-breakers

Mechanical and environmental tests
(IEC 62271-100 par. 7.101)
Humidity test is not required.
A new definition for operation with under-voltage release is added, similar to "opening time", IEC 62271-100 par. 3.7.133 a):
"*The opening time with under-voltage release is the time interval between the instant when the voltage drops suddenly to zero, the circuit-breaker being in the closed position, and the instant when the arcing contact are separated in all poles.*"
In case of the under-voltage release is requested, its characteristics shall be verified in accordance with IEC 62271-1 (par. 5.8.4) at ambient temperature.
Moreover, for routine tests and commissioning tests purpose, the reference values and their tolerance at 110%, 100% and 70% of the rated voltage shall be provided.

7.7.2.2.14 Tests on disconnectors DS and earth switches ES

IEC 62271-102 (and Annex E) applies with following additional information
Operating and mechanical endurance test
(IEC 62271-102 par. 7.102)
Note: par. 7.102.3.2 applies also to measuring of resistance of earthing switch.
During test, referring par. 7.6.1.3.2 of this Global Standard, the DS/ES mechanical locks and interlocks operation shall be checked.
Operation under severe ice conditions
(IEC 62271-102 par. 7.103)
Note: par. 7.103.4.2 applies also to measuring of resistance of earthing switch.
This test is mandatory.
Operation at the temperature limits
(IEC 62271-102 par. 7.104)
This test is mandatory.

7.7.2.2.15 Proof tests for enclosures

(7.103 of IEC 62271-203)

7.7.2.2.16 Pressure test on partitions

(7.104 of IEC 62271-203)

7.7.2.2.17 Test under conditions of arcing due to an internal fault

(7.105 of IEC 62271-203)

7.7.2.2.18 Insulator tests

(7.106 of IEC 62271-203)
Corrosion test on earthing connections
(7.107 of IEC 62271-203)

7.7.2.2.19 Corrosion test on enclosures

(7.108 of IEC 62271-203)

7.7.2.2.20 Protective treatments

Hot dip galvanized coatings on iron and steel components shall be verified in accordance with ISO 1461 by mean of magnetic flux equipments, performing at least 5 measures on each component, in uniform manner on the various surfaces, avoiding edges and angular parts.
The verification of other protective coatings shall be performed considering their characteristics: the manufacturer will indicate the minimum thickness allowed and the others characteristics.

7.7.2.2.21 Seismic verification

If requested, GIS shall be compliant with seismic qualification, according with standards listed in 02.

7.7.2.3 Type tests on base components

The type tests listed in the following paragraphs can be performed on the single base component or on a different assembly equipped with the same component used for the GIS.
The applicability of these type tests on the different GIS layouts shall be demonstrated by the manufacturer (by mean of a technical report) and approved by the user.

7.7.2.3.1 Tests on Circuit-breakers

IEC 62271-100 applies with the following additional information

7.7.2.3.1.1 X-radiation test procedure for vacuum interrupters
(7.11 of IEC 62271-203)
Only in case of vacuum CBs.

7.7.2.3.2 Critical current tests

(IEC 62271-100 par. 7.107)
If applicable (see 7.107.1)

7.7.2.3.3 Tests on disconnectors DS and earth switches ES

IEC 62271-102 applies with the following additional information.

7.7.2.3.4 Test to verify the proper functioning of the position indicating device

(IEC 62271-102 par. 7.105)
This test is mandatory.

7.7.2.3.5 Bus-transfer current switching tests

(IEC 62271-102 par. 7.106)

This test is mandatory only for DS for which this characteristic is requested (see par. 7.4.3 of this document).

7.7.2.3.6 Induced current switching test

(IEC 62271-102 par. 7.107)
This test is mandatory.

7.7.2.3.7 Tests on toroidal Current Transformers

(IEC 61869-2)
Manufacturer shall perform also the IEC 61869-2 par. 7.3.201 test; the CT technical documentation shall include the tolerance range for the secondary winding resistance.

7.7.2.3.8 Tests on Voltage Transformers

(IEC 61869-3)
Test under conditions of arcing due to an internal fault is required
Manufacturer shall perform also the IEC 61869-3 par. 7.4.6 and 7.4.7 tests.

7.7.2.3.9 Tests on SF6/air bushings, cable connections, transformer connections

SF6/air bushings, cable connections and transformer connections shall be tested in accordance with their respective IEC standards.

7.7.2.3.10 Tests on EVDS

Following checks shall be performed:

- verification of the intervention and hysteresis threshold;
- verification of interlocks with the line disconnectors and/or earth switches;
- verification of activation of self diagnostic function (internal fault presence signaling).

7.7.2.4 Specific requirements

7.7.2.5 e-distribuzione

Tests on enclosures, partitions, voltage transformer, SF6/air bushings, insulator, are included in the scope of D.M. 1/12/1980 and subsequent modification (D.M. 10/9/1981).

7.7.3 Routine tests in factory

(IEC 62271-203 par. 8)
The Routine tests (also called acceptance tests) shall be made in the manufacturer's factory on each GIS supplied, to ensure the product compliance with:

- base components approved during the conformity assessment (homologation, certification etc.) process and on which the type tests have been performed;
- the approved technical documentation of the assembly specific layout to be supplied (layout drawing, electric schemes - both HV and low voltage, Control Box drawing etc.).

Test values/results shall be in compliance with rated values (and respective tolerances).
The manufacturer shall provide, for each GIS supplied, the report of all measures and tests carried out.

7.7.3.1 Dielectric test on the main circuit

(8.2 of 62271-203, partial discharge included)
Alternative methods for the partial discharge measurement can be proposed by the manufacturer and shall be approved by Enel Group Distribution companies.

7.7.3.2 Tests on auxiliary and control circuits

(IEC 62271-203 par. 8.3)

Functional tests (par. 8.3.2 of IEC 62271-1) shall be performed together with tests in par. 7.7.3.10, only at rated voltage.
Dielectric tests (par. 8.3.4 of IEC 62271-1) shall be performed applying 1 kV for 1 s.
Electronic devices, motors etc. can be excluded by dielectric test only if agreed during the conformity assessment (homologation, certification etc.) process.
EVDS shall be disconnected before dielectric test.

7.7.3.3 Measurement of the resistance of the main circuit

(IEC 62271-203 par. 8.4)
To be performed after mechanical operating tests.
The ambient temperature influence can be neglected.
The test shall be performed also on ES.

7.7.3.4 Tightness test

(IEC 62271-203 par. 8.5)
To be performed at least at 2nd minimum gas density level (block).
Manufacturer shall provide the results of tests on subassemblies. Sniffing device may be used to check the joint between subassemblies.

7.7.3.5 Design and visual checks

(IEC 62271-203 par. 8.6)
Following items shall be verified:

- switchgear compliance with approved documents;
- no visible defects;
- protective coatings (par. 7.7.2.2.20 of this document applies).

7.7.3.6 Pressure tests of enclosures

(IEC 62271-203 par. 8.101)
Manufacturer shall provide the results of internal tests.

7.7.3.6.1 e-distribuzione Specific requirements

Manufacturer shall provide the “Certificazione di rispondenza” (see: D.M. 1/12/1980, Allegato A, Regola VSR.8.B.1, par. 5.2), including partitions, bushings and VTs (if any).

7.7.3.7 Mechanical operation tests

(IEC 62271-203 par. 8.102)

7.7.3.8 Tests on Circuit-Breakers

(IEC 62271-100 par.8.101)
The following items shall be recorded:

a. at Vmax, Vn, Vmin, closing (C) and opening (O) times, time spread (on each release);
a1. at Vmax, Vn, Vmin opening (O) times, time spread of under-voltage release coil (if present - see 7.7.2.2.13) and it shall be verified its compliance with IEC 62271-1 par. 5.8.4;
b. at Vn, close-open (CO) time and open-close-open (O-t-CO) cycle;
c. at Vn, the operation time of one of each type (make and break) of auxiliary contacts, respect to the operation of main contacts on closing and on opening of CB;
d. no-load travel curves.

The absorption curves of closing and opening (shunt and under-voltage) releases, taking note of the maximum values, shall be registered in the following conditions:

- at rated voltage;
- at 110% of the rated voltage;
- at 70% of the rated voltage, for opening releases;
- at 85% of the rated voltage, for closing release.

The spring recharging time of the motor after a closing operation and its absorption (maximum value, inrush excluded) shall be measured at rated voltage.

7.7.3.9 Tests on disconnectors DS and earth switches ES

(IEC 62271-102 par. 8-101)
The following items shall be verified:

- operation times and the drive motor absorption (inrush excluded) at Vmax, Vn, Vmin;
- manual and electrical operation and its (mechanical and electrical) interlock devices;
- satisfactory operation of the auxiliary contacts and position indicating devices;
- mechanical locks.

7.7.3.10 Tests on auxiliary circuits, equipment and interlocks in the control mechanism

(IEC 62271-203 par. 8.103)
For this verification the manufacturer shall provide a paper copy of the GIS electric schemes.
Following items shall be verified:

- EVDS device (operation, interlocks with DS or ES, internal self-diagnostic) referring to its testing procedures;
- SF6 density control devices: the verification shall be performed at ambient temperature, in the real operating position, using nitrogen, with decreasing pressure values. SF6 can be used only in presence of recovery systems.

7.4.6.2 Test reports issued by the density control device manufacturer shall be provided (test position shall be evidenced too).

- correct operation of all controls, interlocking, automatic openings and signalizations, including galvanic separation between the power supplies of various circuits;
- heating and/or anti-condensation circuit absorption.

7.7.3.11 Pressure test on partitions

(IEC 62271-203 par. 8.104)
Manufacturer shall provide the results of testing on partitions.

7.7.3.12 Tests on Current Transformers

(IEC 61869-2 par. 7.1.2, Table 10: Routine tests including par. 7.3.201; Sample Test, par. 7.5.2 when applicable).
The tests of CTs shall be repeated sampling at least one unit for each tern.
It shall be verified also:

a. the CTs compliance with approved documents;
b. no visible defects;
c. the presence of producer test reports of all CTs.

7.7.3.12.1 e-distribuzione Specific requirements

The supplier shall inform e-distribuzione for routine tests in the instrument transformers manufacturer factory. In case Enel will not attend these tests they shall be repeated in the GIS manufacturer factory according to the given criteria.

7.7.3.13 Tests on Voltage Transformers

(IEC 61869-3 par. 7.1.2, Table 10: Routine tests par. 7.3).
The tests of VTs shall be repeated sampling one unit for each tern.
It shall be verified also:

a. the VTs compliance with approved documents;
b. no visible defects;
c. the presence of producer test reports of all VTs;
d. SF6 density control devices: 7.7.3.10 applies.

7.7.3.13.1 e-distribuzione Specific requirements

The supplier shall inform e-distribuzione for routine tests in the instrument transformers manufacturer factory. In case Enel will not attend these tests they shall be repeated in the GIS manufacturer factory according to the given criteria.

7.7.3.14 Bushing tests

(IEC 60137 par.9.6)
Test reports issued by insulator manufacturer shall be provided.

7.7.4 Commissioning tests

(IEC 62271-203 par. 10)
The Commissioning tests shall be performed in the Enel Group Distribution company plant on each GIS supplied, after its installation.
The manufacturer, at the end of the on-site tests, shall deliver the report containing the results of the measures and tests performed on the GIS. These measures shall include check of transportation pressure, to be performed before installation.
This report, in paper and in electronic format (e.g. one or more “pdf” files) shall include also factory routine tests and all sub-components test reports.
IEC 62271-1 Par. 10.2.1 is applicable.

7.7.4.1 Dielectric test on the main circuit

(IEC 62271-203 par. 11.101.2 and C.3.2.3)
Dielectric test shall be performed on GIS, if disassembled in transport units and if stated in the approved technical documentation of the assembly specific layout to be supplied.
In alternative to test methods provided by par. 11.101.2.3 of IEC 62271-203, a test applying the grid rated voltage (see IEC - par. C.3.2.3) for 24 hours without energy transit can be performed.

7.7.4.2 Dielectric test on auxiliary circuits

(IEC 62271-203 par 11.101.3; IEC 62271-1 applies only par. 7.2.4)
Dielectric tests shall be performed applying 1 kV for 1 s.
EVDS shall be disconnected before dielectric test; others electronic devices, motors etc. can be excluded by dielectric test only if agreed during the conformity assessment (homologation, certification etc.) process.

7.7.4.3 Measurement of the resistance of the main circuit

(IEC 62271-203 par. 11.101.4)
To be performed after mechanical operating tests.
The ambient temperature influence can be neglected.
The test shall be performed also on ES.

7.7.4.4 Gas tightness test

(IEC 62271-203 par. 10.2.101.5)

To be performed at rated pressure.
The test shall be performed using test Qm, method 2 “Probing Test”, IEC 60068-2-17, after all the other tests, eight hours after the gas filling (for example one night is enough).
Fittings, gas density control devices and piping shall be checked. Manufacturer shall verify all on-site assembled connections between transport units.
The sensitivity of the sniffing device shall be at least 10^{-8} Pa x m^3/s.

7.7.4.5 Checks and verifications

(IEC 62271-203 par. 11.101.6)
Following items shall be verified:

- assembly in accordance with the manufacturer’s drawings and instructions;
- control of damage absence;
- presence of accompanying required documentation and materials (see par. 7.8.3).

7.7.4.6 Mechanical operation tests

7.7.4.6.1 Tests on Circuit-Breakers

7.4.6.3 (IEC 62271-100 par. 11.2.102.2)

Before this tests at least 30 C-O no-load operations shall be performed.
The following items shall be recorded:

a. at Vmax, Vn, Vmin, closing (C) and opening (O) times, time spread (on each release);
a1. at Vmax, Vn, Vmin opening (O) times, time spread on under-voltage release coil (if present see 7.7.2.2.13) and it shall be verified its compliance with IEC 62271-1 par. 5.8.4;
b. at Vn, close-open (CO) time and open-close-open (O-t-CO) cycle;
c. at Vn, the operation time of one of each type (make and break) of auxiliary contacts, respect the operation of main contacts on closing and on opening of CB.

The absorption curves of closing and opening (shunt and under-voltage) releases, taking note of the maximum values, shall be registered in the following conditions:

- at rated voltage;
- at 110% of the rated voltage;
- at 70% of the rated voltage, for opening releases;
- at 85% of the rated voltage, for closing release.

The spring recharging time of the motor after a closing operation and its absorption (maximum value, inrush excluded) shall be measured only at Vn.

7.7.4.6.2 Tests on disconnectors DS and earth switches ES
(IEC 62271-102 par. 8.101)
The par. 7.7.3.9 of this document applies. The operation times and the drive motor absorption shall be performed only at rated voltage.

7.7.4.7 Tests on auxiliary circuits, equipment and interlocks in the control mechanism

(IEC 62271-203 par. 8.103)
To be performed after dielectric test on auxiliary circuit.
The following items shall be verified:

- EVDS device (operation, interlocks with DS or ES, internal self-diagnostic) referring its testing procedures;
- all SF6 density control devices, including VT’s ones - SF6 can be used only in presence of recovery systems; the verification shall be performed with the same modalities of the routine test (see 7.7.3.10), taking into account the ambient conditions (solar radiation, temperature) and comparing between them the intervention threshold pressure measured values;

- functional operations of whole circuit diagram (fault signals, switchgear automatic openings, interlocks etc. including from/to external ones);
- heating and/or anti-condensation circuit absorption.

7.7.4.8 Gas quality verifications

(IEC 62271-203 par. 11.101.7)
Manufacturer shall perform this verifications on GIS which have been object of vacuum treatment, i.e. in case of:

- on-field assembling and connections between transport units;
- enclosure opening, with gas recovery and new filling.

In this case the gas tightness checks shall be repeated.

7.8 SUPPLY REQUIREMENTS

7.8.1 Tender's technical documentation

For tender's technical evaluation the supplier shall provide the Annex F properly filled for each one of the possible rated voltages for the equipment (72,5 kV, 145-170 kV, 245 kV).

7.8.2 Conformity assessment

7.8.2.1 Conformity assessment process

The conformity assessment processes (homologation, certification etc.) are specified in the proper contractual documents.

7.8.2.2 Conformity assessment documentation

The "Conformity assessment documentation" consists in the project documentation that the supplier uses to manufacture GIS and can be divided in:

a) "Specific Assembly Type A documents" (public, not confidential, referred to a specific assembly);

b) "General Type A documents" (public, not confidential, including common documents and base components type A documents);

c) "General Type B documents" (confidential, referred to each base components).

The documentation shall be collected separately for each Enel Group Distribution company, for each composition type (see par. 0) and for each rated voltage Ur (72.5, 145-170, 245 kV). All the conformity assessment documentation has to be in English in addition also the manuals that has to be in the local language of destination.

7.8.2.2.1 Specific Assembly Type A documents

The Specific Assembly Type A documentation shall consist at least in:

1) Specific Assembly Type A documents list;
2) composition of the assembly, consisting in a list of the base components indicating:
   - base component;
   - local codification;
   - base component description;
   - corresponding supplier's model designation;

3) overall dimensions drawing (including the stresses transmitted to the foundations, the transport units, the partitions – if any – and their density control devices position); The height of all the manual operations must be included.
4) overall GIS pictures or 3D drawings;
5) HV single-line diagram;
6) Electric diagram (see par. 7.6.5.1-0, low voltage components list included);
7) Control Box layout drawing;
8) reference resistance values.

7.8.2.2.2 General Type A documents

The General Type A documentation shall consist at least in:

1) General Type A documents list, sub-divided into common documents and into each base component documents;
2) Operating Device Box(es) layout drawings;
3) Electric diagram of individual devices (CB, DS, ES);
4) Interconnection cables path (typical);
5) Nameplate (typical);
6) Installation, use and maintenance handbook/manual;
7) Routine and commissioning tests:
a) test report form (two documents, one for factory tests and one for on-site tests);
b) reference values table (with tolerances)[19];
c) EVDS device - testing procedures;
d) protective coatings description (typology, minimum thickness, reference standards);
8) documentation of safety device for protection against pole excessive pressure (ISO 4126, only if present);
9) list of documentation, materials and accessories supplied;
10) about gas:
a) gas circuit(s) drawing with density control device positions;
b) gas density control device characteristics and drawings;
c) pressure/temperature table for rated density level, 1st minimum gas density level and 2nd minimum gas density level;
11) main sub-components suppliers list, subdivided into the various types of base components;
12) List of materials used including packaging and relevant quantities (for disposal purposes and recycle);
13) only for e-distribuzione, INAIL (ex ISPESL) Certification “Certificato di conformità del prototipo” - D.M. 01/12/1980.

[19] specific detailed instructions to verify the CBs no-load travel curves during maintenance activity shall be included in the manual

7.8.2.2.3 General Type B documents

The General Type B documentation shall consist at least in:

1) General Type B documents list, sub-divided into each base component documents;
2) overall base component dimensions drawing;
3) nameplate and labels drawings (Operating Device Box(es), poles, coils, sequence operation plate, only for e-distribuzione: manual lock/unlock of under-voltage release, etc.).

7.8.3 Packaging, transport, storage and installation/testing

Par. 10.1 and 10.2 of IEC 62271-203 apply.
The package shall be suitable to guarantee:

- the protection during transport (including by ship, if necessary);
- an elevation from the ground at least of 100 mm;
- the external storage for at least three months.

On external side of packaging, the following information shall be present:

1) manufacturer name;
2) manufacturing year/month;
3) manufacturer designation type;
4) manufacturer serial number;
5) reference to this Global Standard;
6) contract number;
7) destination substation;
8) total weight;
9) lifting information (showing the points and the correct method of lifting);
10) only for e-distribuzione, the assembly bar code, in accordance with PVR006.

With each assembly the following items shall be supplied in English (item 7) shall be in English and in the local language of destination) and items from 4) to 9) shall be provided in paper form:

1) the support structure;
2) anchor bolts to the civil works (optional supply, they shall be provided only if expressly requested. In this case they shall be stainless or hot dip galvanized steel, chemical type);
3) springs hand-crank (and other tools according to the manufacturer design);
4) list of documentation, materials and accessories supplied (“packing list”);
5) overall dimensions drawing;
6) Electric diagram;
7) installation, use and maintenance handbook/manual;
8) routine and commissioning tests:

a) routine (factory and commissioning) test reports;
b) reference values table (with tolerances);

9) about gas:

a) dielectric gas;
b) pressure/temperature table for rated density level, 1st minimum gas density level and 2nd minimum gas density level;

10) one digital support containing the whole type A documentation (pdf file format);

11) only for e-distribuzione: Manufacturer shall provide the “Certificazione di rispondenza” (see: D.M. 1/12/1980, Allegato A, Regola VSR.8.B.1, par. 5.2), including partitions, bushings and VTs (if any).

Only for e-distribuzione, items from 4) to 9) shall be also provided in electronic format together with the guarantee and barcode data requested by PVR001 and PVR006 (The file sending modalities will be discussed during the conformity assessment process).
If on-site assembly is performed by the manufacturer, waste (including packaging) shall be disposed by him.

7.8.3.1 Specific requirements for Spain

The provider will also attach a declaration of conformity as indicated in ITC-RAT 03 of Reglamento sobre condiciones técnicas y garantías de seguridad en instalaciones eléctricas de alta tensión, Real Decreto 337/2014.

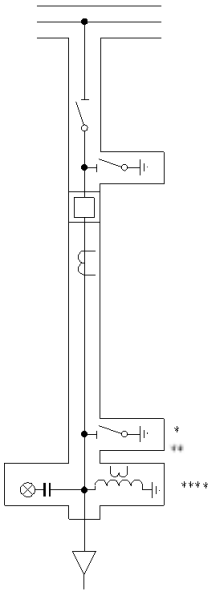
ANNEX A – COMPONENTS CODIFICATION

TAM	COUNTRY	TYPE CODE	Rated voltage Ur (kV)	MESURE BUSB/ MESURE	BAY TYPE	Type of operation	Coils	VTs	CTs
150098	CO	GSCH006/1103	145	SB	LINE CABLE	TPO	1a + 2a	GSCH006/712	GSCH006/610
150157	CO	GSCH006/1103	145	SB	LINE CABLE RPM	TPO	1a + 2a	GSCH006/713	GSCH006/608+610
150097	CO	GSCH006/1109	145	SB	TRAFO CABLE	TPO	1a + 2a	NA	GSCH006/608 +615 + 616
150096	CO	GSCH006/1115	145	SB	COUPLING	TPO	1a + 2a	NA	GSCH006/612
150095	CO	GSCH006/1117	145	SB	MESURE BUSBAR	NA	NA	GSCH006/712	NA
150139	CO	GSCH006/1102	145	DB	LINE CABLE	TPO	1a + 2a	GSCH006/714	GSCH006/631
150140	CO	GSCH006/1108	145	DB	TRAFO CABLE	TPO	1a + 2a	GSCH006/712	GSCH006/631+632
150141	CO	GSCH006/1114	145	DB	COUPLING	TPO	1a + 2a	NA	GSCH006/612
150142	CO	GSCH006/1116	145	DB	MESURE BUSBAR	NA	NA	GSCH006/715	NA
150147	CO	GSCH006/1102	145	DB	LINE CABLE	TPO	1a + 2a	GSCH006/712	GSCH006/610
150156	CO	GSCH006/1102	145	DB	LINE CABLE RPM	TPO	1a + 2a	GSCH006/712	GSCH006/608+610
150148	CO	GSCH006/1108	145	DB	TRAFO CABLE	TPO	1a + 2a	NA	GSCH006/608 +615 + 616
150149	CO	GSCH006/1114	145	DB	COUPLING	TPO	1a + 2a	NA	GSCH006/612
150150	CO	GSCH006/1116	145	DB	MESURE BUSBAR	NA	NA	GSCH006/715	NA
150412	ES	GSCH006/1002	72,5	DB	LINE CABLE	TPO	1a + 2a	GSCH006/702	GSCH006/610
150411	ES	GSCH006/1008	72,5	DB	TRAFO CABLE	TPO	1a + 2a	GSCH006/702	GSCH006/611
150409	ES	GSCH006/1014	72,5	DB	COUPLING	TPO	1a + 2a	NA	GSCH006/612
150410	ES	GSCH006/1016	72,5	DB	MESURE BUSBAR	NA	NA	GSCH006/702	NA
150392	ES	GSCH006/1102	145	DB	LINE CABLE	TPO	1a + 2a	GSCH006/716	GSCH006/610
150390	ES	GSCH006/1108	145	DB	TRAFO CABLE	TPO	1a + 2a	NA	GSCH006/611
150555	ES	GSCH006/1108	145	DB	TRAFO CABLE	TPO	1a + 2a	GSCH006/716	GSCH006/611
150387	ES	GSCH006/1114	145	DB	COUPLING	TPO	1a + 2a	NA	GSCH006/612
150554	ES	GSCH006/1116	145	DB	MESURE BUSBAR	TPO	1a + 2a	GSCH006/716	NA
150556	ES	GSCH006/1119	145	SB	REMONTE CABLE	TPO	1a + 2a	NA	GSCH006/610
150042	IT	GSCH006/1207	170	SB	LINE CABLE	SPO	1a + 2a	GSCH006/717	GSCH006/601
150041	IT	GSCH006/1209	170	SB	TRAFO CABLE	TPO	1a + 3a	NA	GSCH006/605+603+606
150039	IT	GSCH006/1215	170	SB	COUPLING	TPO	1a + 2a	NA	GSCH006/602
150040	IT	GSCH006/1217	170	SB	MESURE BUSBAR	NA	NA	GSCH006/718	NA
150063	IT	GSCH006/1205	170	SB	LINE AIR	SPO	1a + 2a	GSCH006/717	GSCH006/601
150038	IT	GSCH006/1306	245	DB	LINE CABLE	SPO	1a + 2a	GSCH006/719	GSCH006/601
150037	IT	GSCH006/1308	245	DB	TRAFO CABLE	TPO	1a + 3a	NA	GSCH006/605+603+606
150034	IT	GSCH006/1314	245	DB	COUPLING	TPO	1a + 2a	NA	GSCH006/602
150035	IT	GSCH006/1316	245	DB	MESURE BUSBAR	NA	NA	GSCH006/720	NA
150036	IT	GSCH006/1312	245	DB	TRAFO DUCT	TPO	1a + 3a	NA	GSCH003/605+603+606
150051	IT	GSCH006/1318	245	NA	BUS-DUCT(1 LINEAL MTx3 POLES)	NA	NA	NA	NA
150032	IT	GSCH006/1309	245	SB	TRAFO CABLE	TPO	1a + 3a	NA	GSCH003/605+603+606
150030	IT	GSCH006/1317	245	SB	MESURE BUSBAR	NA	NA	GSCH006/720	NA
150029	IT	GSCH006/1315	245	SB	COUPLING	TPO	1a + 2a	NA	GSCH003/602
150033	IT	GSCH006/1307	245	SB	LINE CABLE	SPO	1a + 2a	GSCH006/719	GSCH006/601
150031	IT	GSCH006/1311	245	SB	TRAFO AIR	TPO	1a + 3a	NA	GSCH003/605+603+606
150049	IT	GSCH006/1213	170	SB	TRAFO DUCT	TPO	1a + 3a	NA	GSCH003/605+603+606
150050	IT	GSCH006/1218	170	NA	BUS-DUCT(1 LINEAL MTx3 POLES)	NA	NA	NA	NA
150043	IT	GSCH006/1214	170	DB	COUPLING	TPO	1a + 2a	NA	GSCH006/602
150044	IT	GSCH006/1216	170	DB	MESURE BUSBAR	NA	NA	GSCH006/718	NA
150045	IT	GSCH006/1210	170	DB	TRAFO AIR	TPO	1a + 3a	NA	GSCH006/605+603+606
150046	IT	GSCH006/1208	170	DB	TRAFO CABLE	TPO	1a + 3a	NA	GSCH006/605+603+606
150047	IT	GSCH006/1204	170	DB	LINE AIR	SPO	1a + 2a	GSCH006/717	GSCH006/601
150048	IT	GSCH006/1206	170	DB	LINE CABLE	SPO	1a + 2a	GSCH006/717	GSCH006/601
150068	IT	GSCH006/1300	245	SB	GIS CP AGNANO	NA	NA	NA	NA
150066	IT	GSCH006/1300	245	SB	GIS CP SALERNO PORTO	NA	NA	NA	NA
150067	IT	GSCH006/1200	170	DB	GIS CP AUGUSTA	NA	NA	NA	NA
150069	IT	GSCH006/1200	170	SB	GIS CP MESSINA NORD	NA	NA	NA	NA
150065	IT	GSCH006/1200	170	SB	GIS CP CASALOTTO	NA	NA	NA	NA
140973	PE	GSCH006/1002	72,5	DB	LINE CABLE	TPO	1a + 2a	GSCH006/701	GSCH006/619+622
140974	PE	GSCH006/1008	72,5	DB	TRAFO CABLE	TPO	1a + 2a	NA	GSCH006/620+623
140975	PE	GSCH006/1014	72,5	DB	COUPLING	TPO	1a + 2a	NA	GSCH006/614+624
140977	PE	GSCH006/1016	72,5	DB	MESURE BUSBAR	NA	NA	GSCH006/701	NA

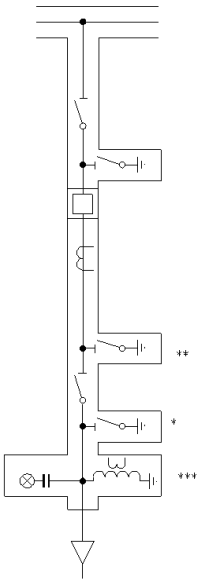
ANNEX B – LAYOUT

B.1.1 – HV SINGLE BUSBAR DIAGRAMS FOR EACH TYPE OF BAY

Transformer bay

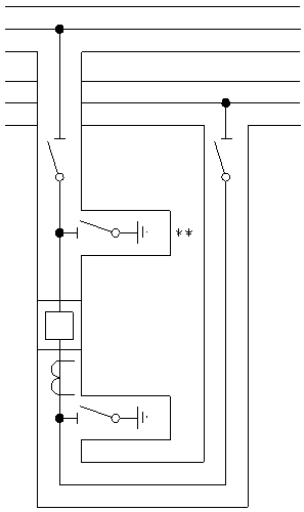


Output or Self-producer bay

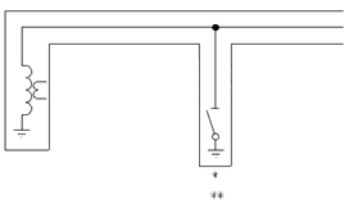


S

Coupling bay

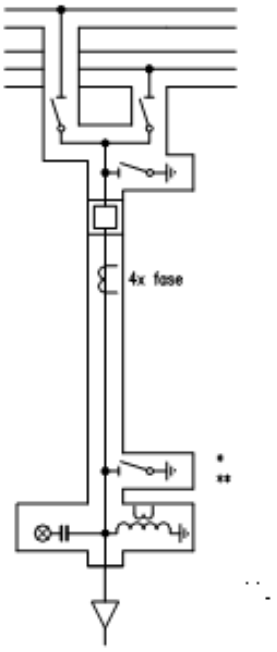


Measurement busbars

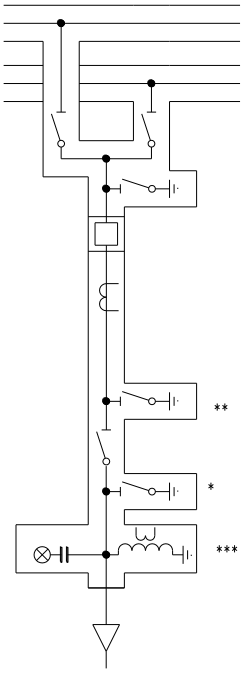


B.1.1 – HV DOUBLE BUSBAR DIAGRAMS FOR EACH TYPE OF BAY

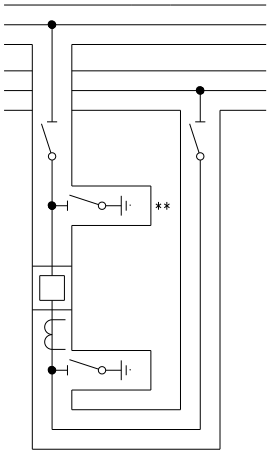
Transformer bay



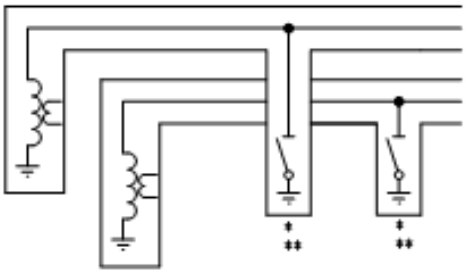
Output or Self-producer bay



Collector busbar coupling bay



Measurement busbars

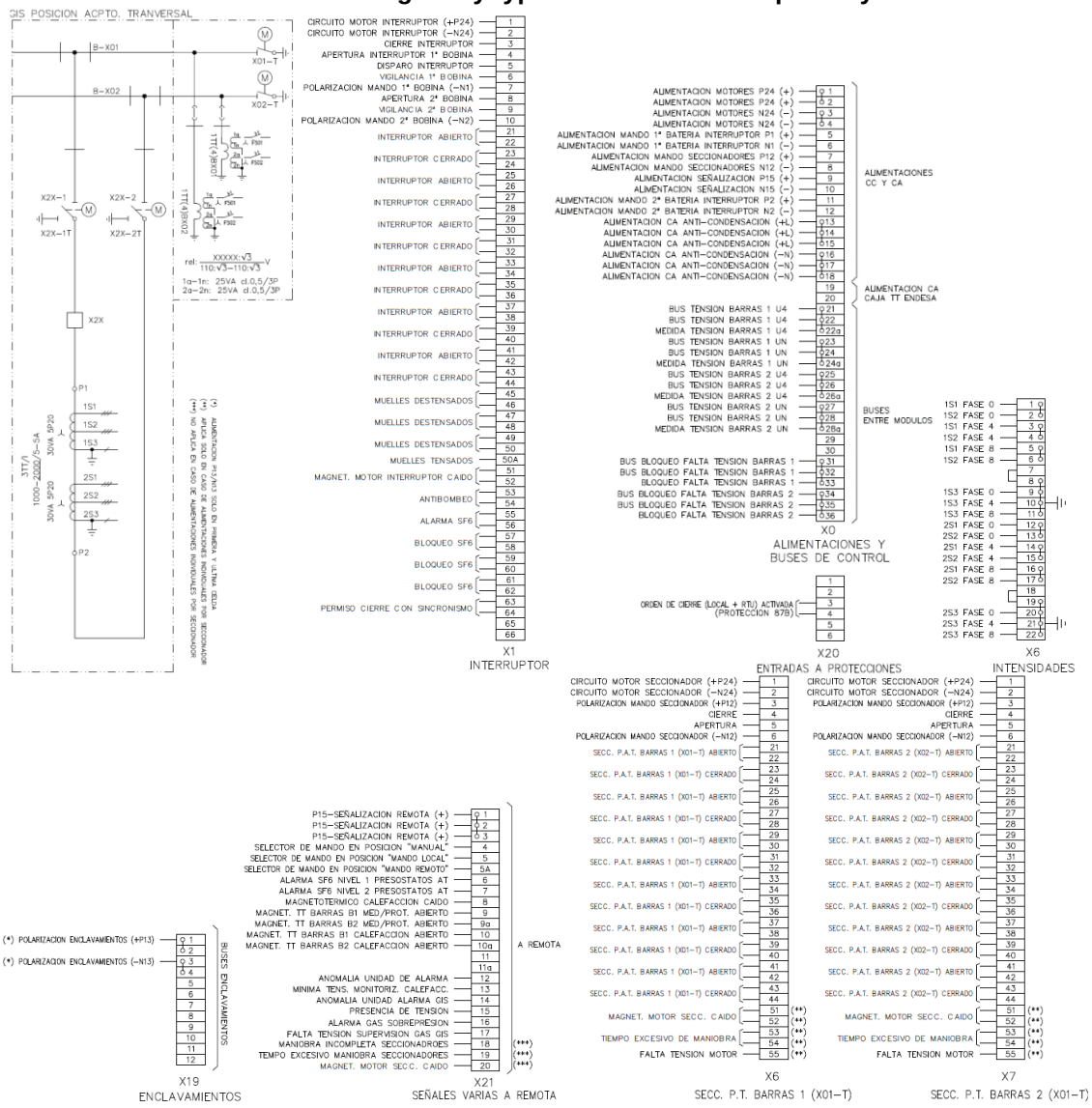


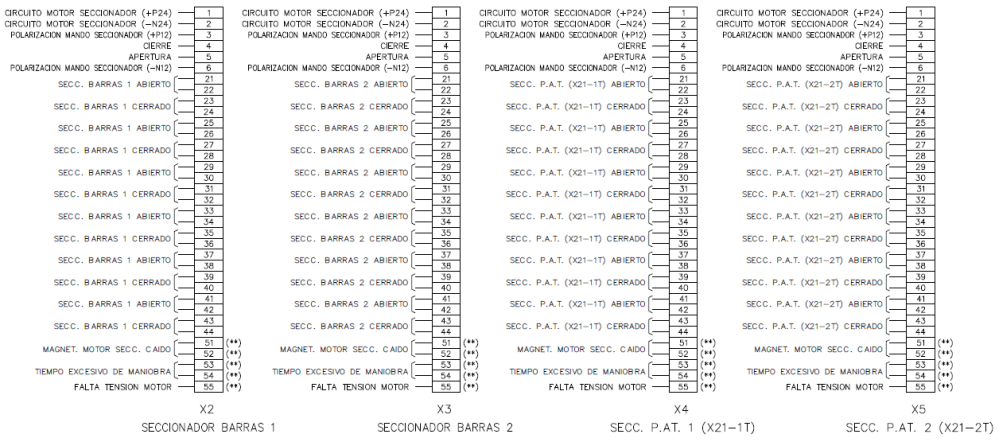
*** Sudden closure earthing switches**
**** Disconnectors with blades insulated from the housing**
***** These VT will not be necessary if high frequency communication is required.**
****** These VT are only necessary in the case of HV/HV or HV/MT transformers with ESMP.**
The characteristics of the instrument transformers will be those indicated in the Standard.

ANNEX C – ELECTRICAL SCHEMES

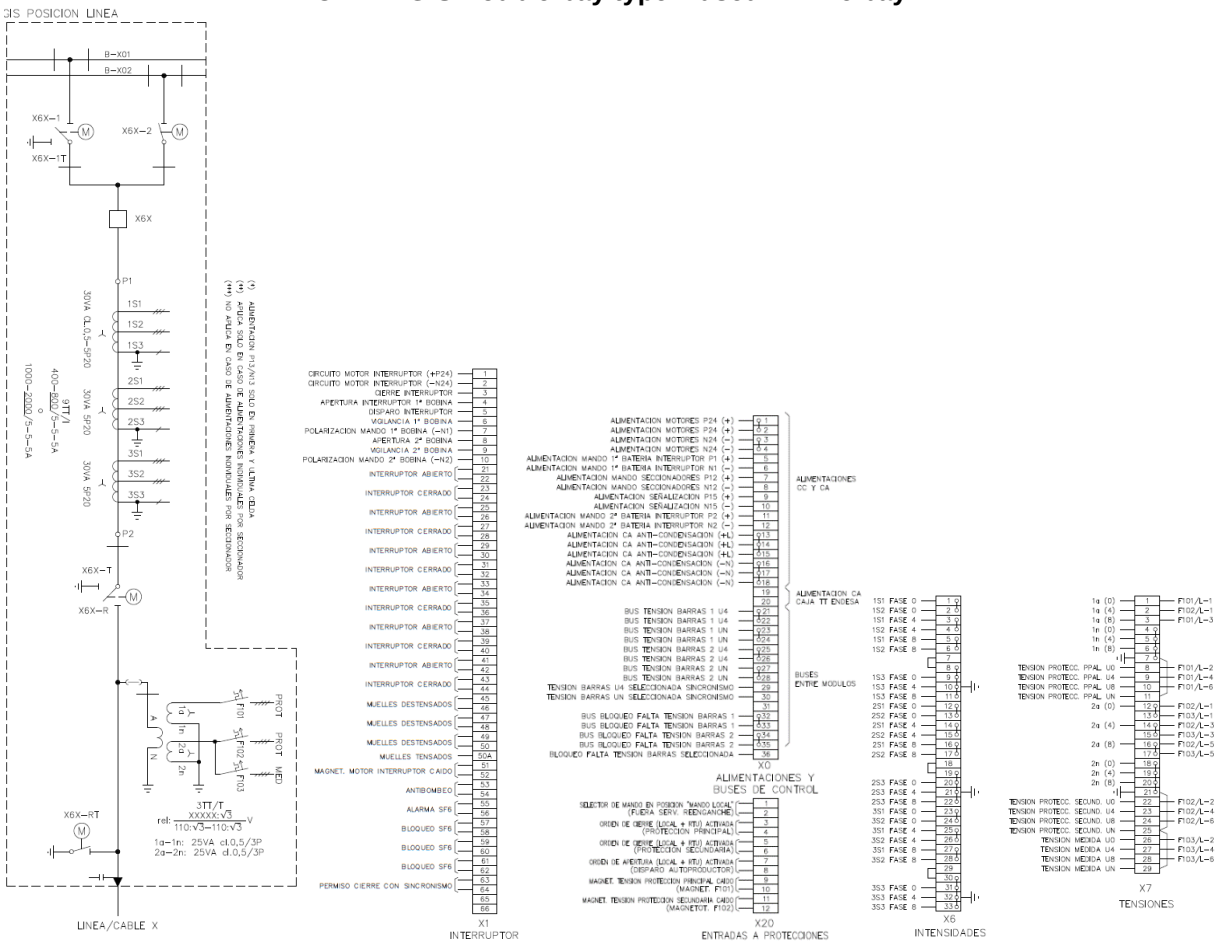
C.1 – SPAIN, LATAM AND ROMANIA ELECTRICAL DIAGRAMS

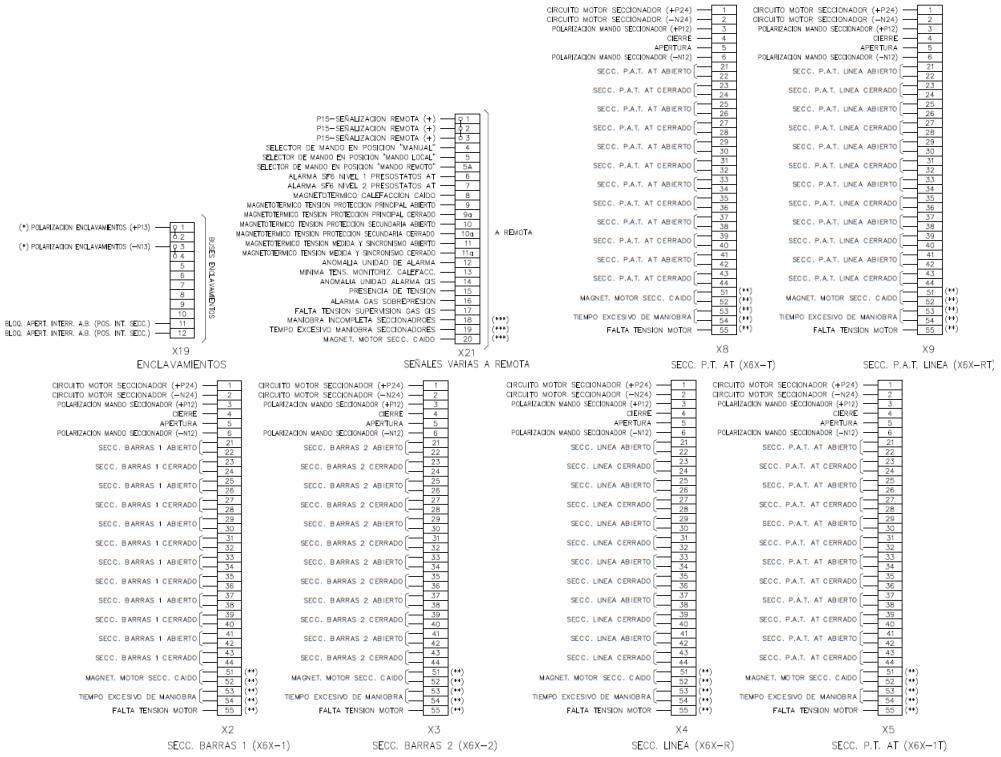
C.1.1 – GIS Single-bay type – used in Bus coupler bay



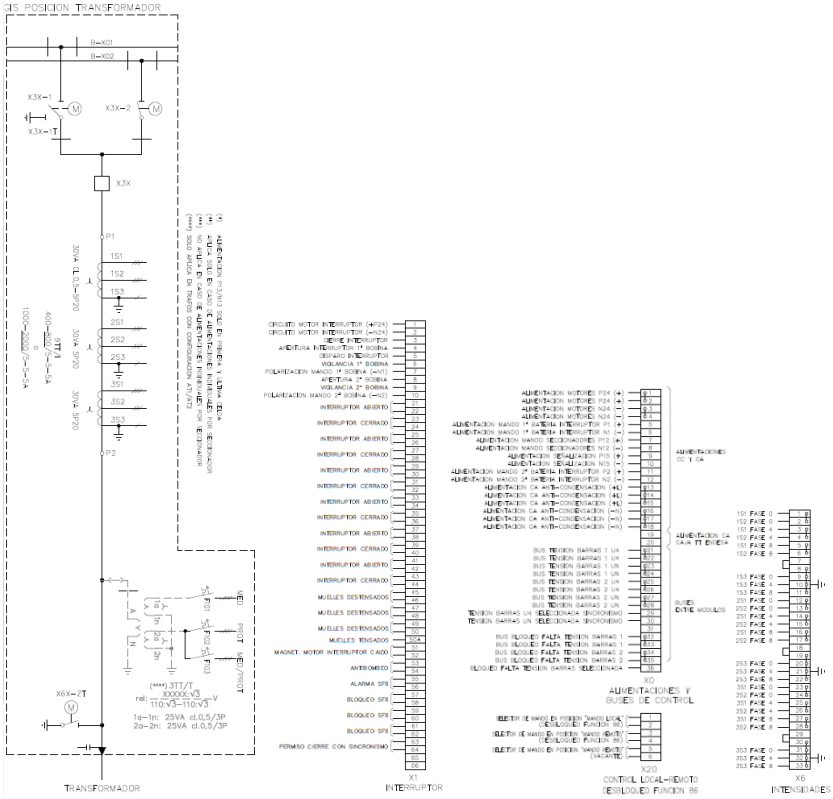


C.1.2 – GIS Double-bay type – used in Line bay



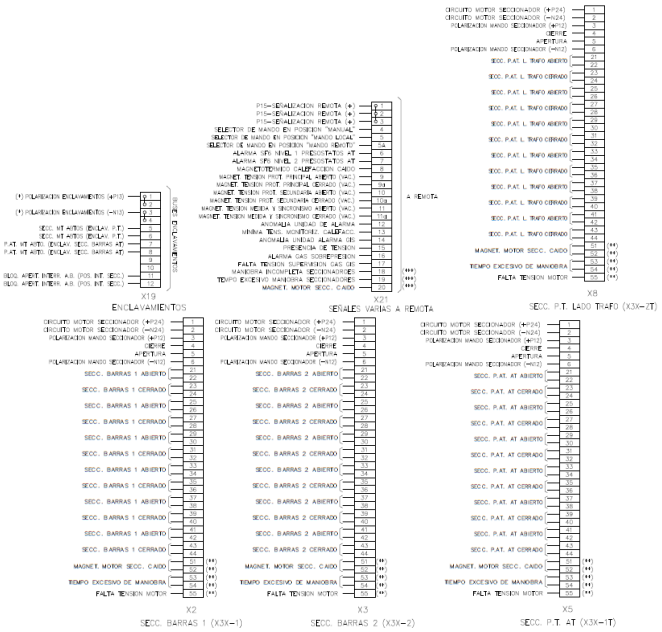


C.1.3 – GIS Double-bay type – used in Trafo bay

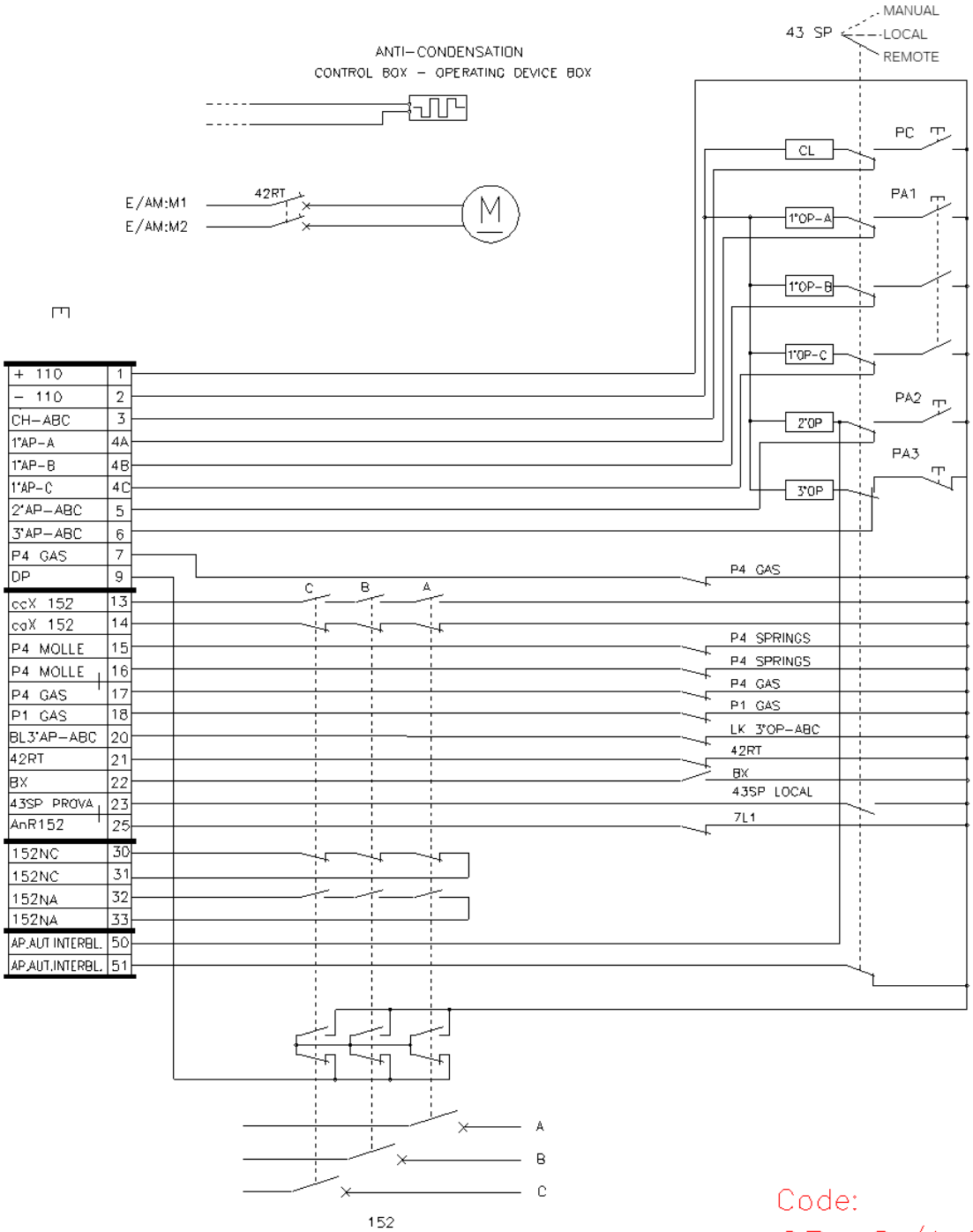


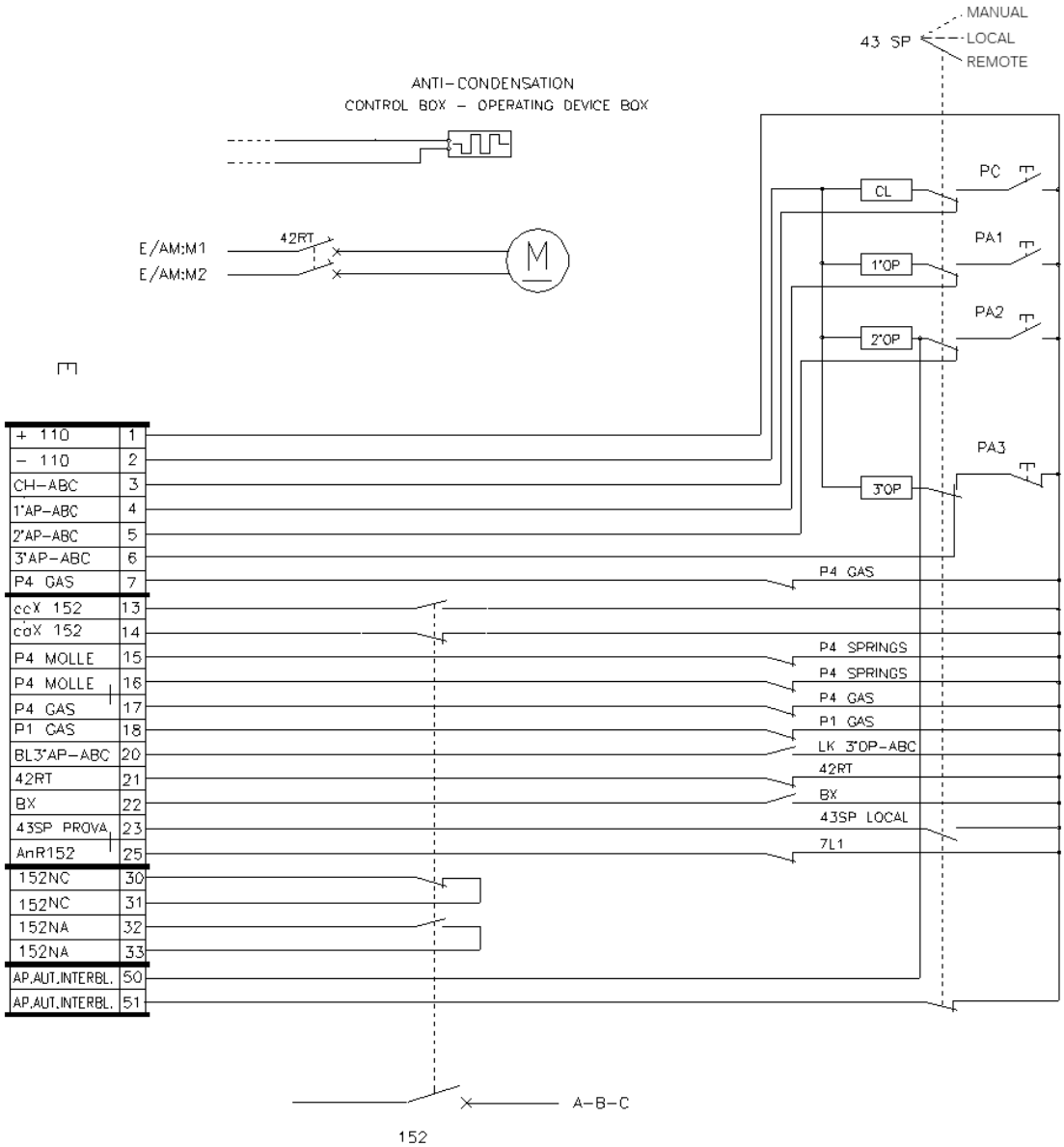
Subject: Global Infrastructure and Networks **GSCH006** SHIELDED SINGLE OR DOUBLE BUSBAR EQUIPMENT WITH SULPHUR HEXAFLUORIDE INSULATION (SF6) OF 72.5-145-170-245 kV

Application Areas
Perimeter: *Global*
Staff Function: -
Service Function: -
Business Line: *Infrastructure & Networks*

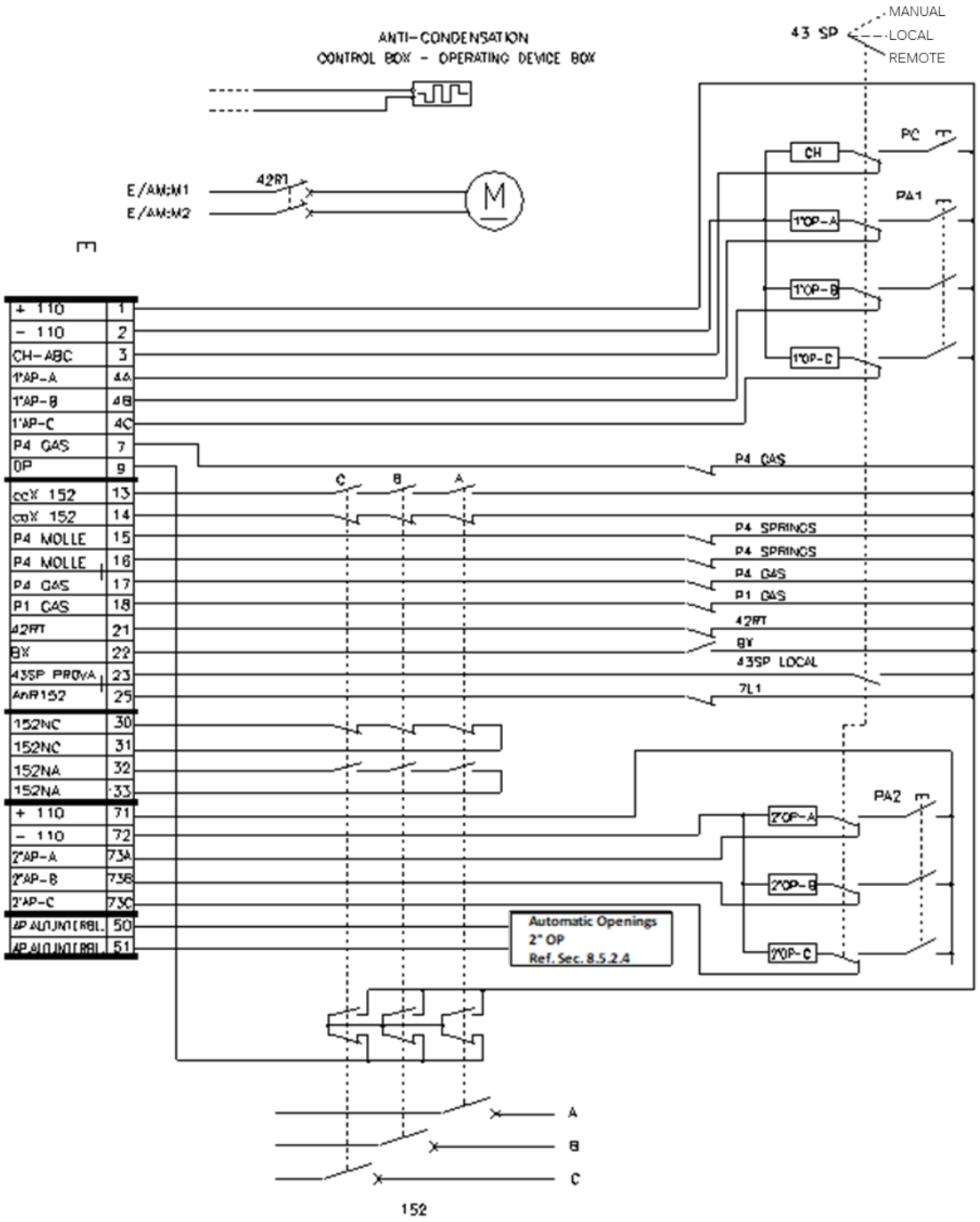


C.2 – ITALY ELECTRICAL DIAGRAMS
C.2.1 – GIS



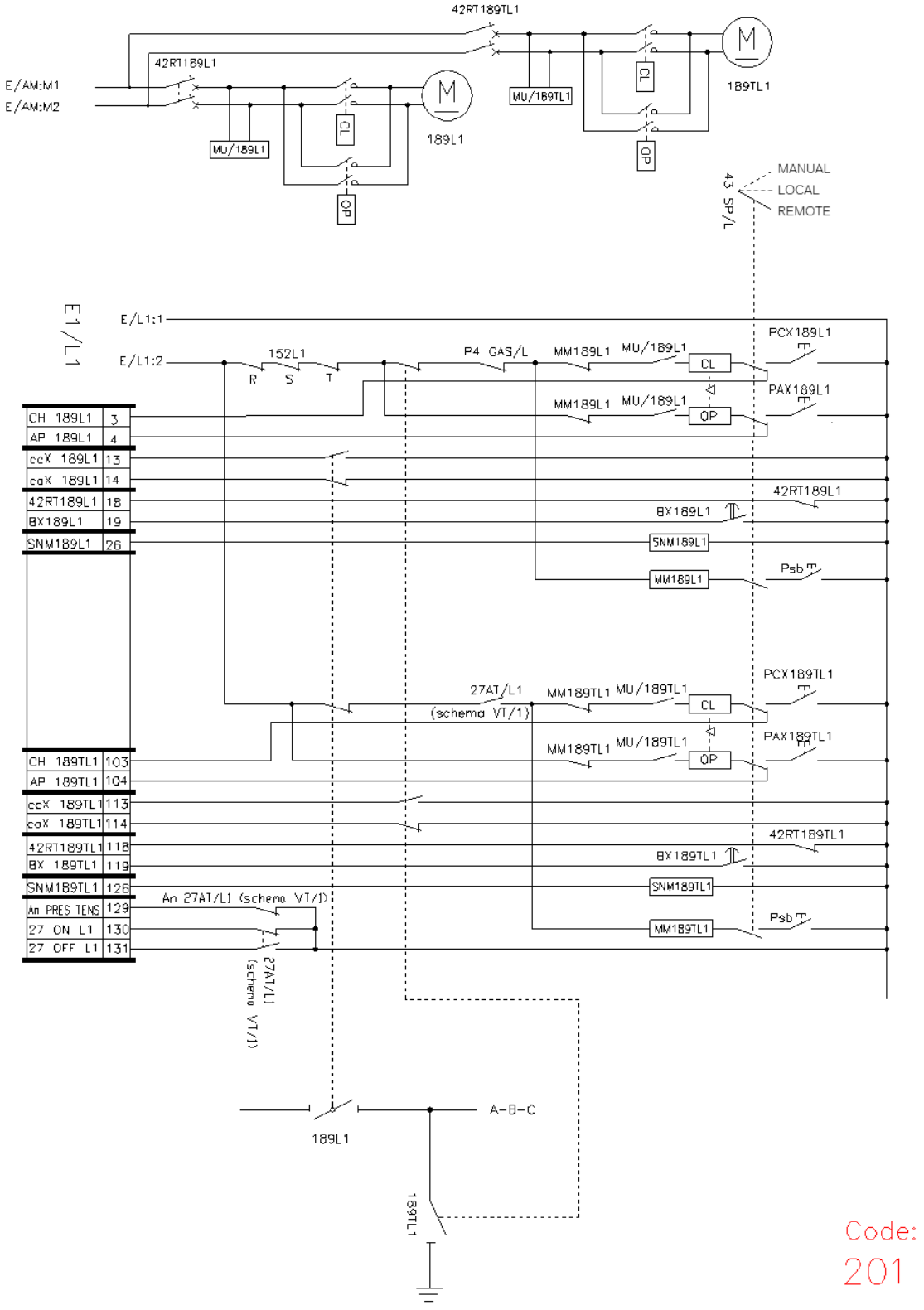

43 SP
MANUAL
LOCAL
REMOTE
ANTI-CONDENSATION
CONTROL BOX - OPERATING DEVICE BOX
E/AM:M1
E/AM:M2
42RT
M
PC
CL
PA1
1°OP
PA2
2°OP
PA3
3°OP
+ 110 1
- 110 2
CH-ABC 3
1°AP-ABC 4
2°AP-ABC 5
3°AP-ABC 6
P4 GAS 7
coX 152 13
coX 152 14
P4 MOLLE 15
P4 MOLLE 16
P4 GAS 17
P1 GAS 18
BL3°AP-ABC 20
42RT 21
BX 22
43SP PROVA 23
AnR152 25
152NC 30
152NC 31
152NA 32
152NA 33
AP.AUT.INTERBL. 50
AP.AUT.INTERBL. 51
P4 GAS
P4 SPRINGS
P4 SPRINGS
P4 GAS
P1 GAS
LK 3°OP-ABC
42RT
BX
43SP LOCAL
7L1
A-B-C
152

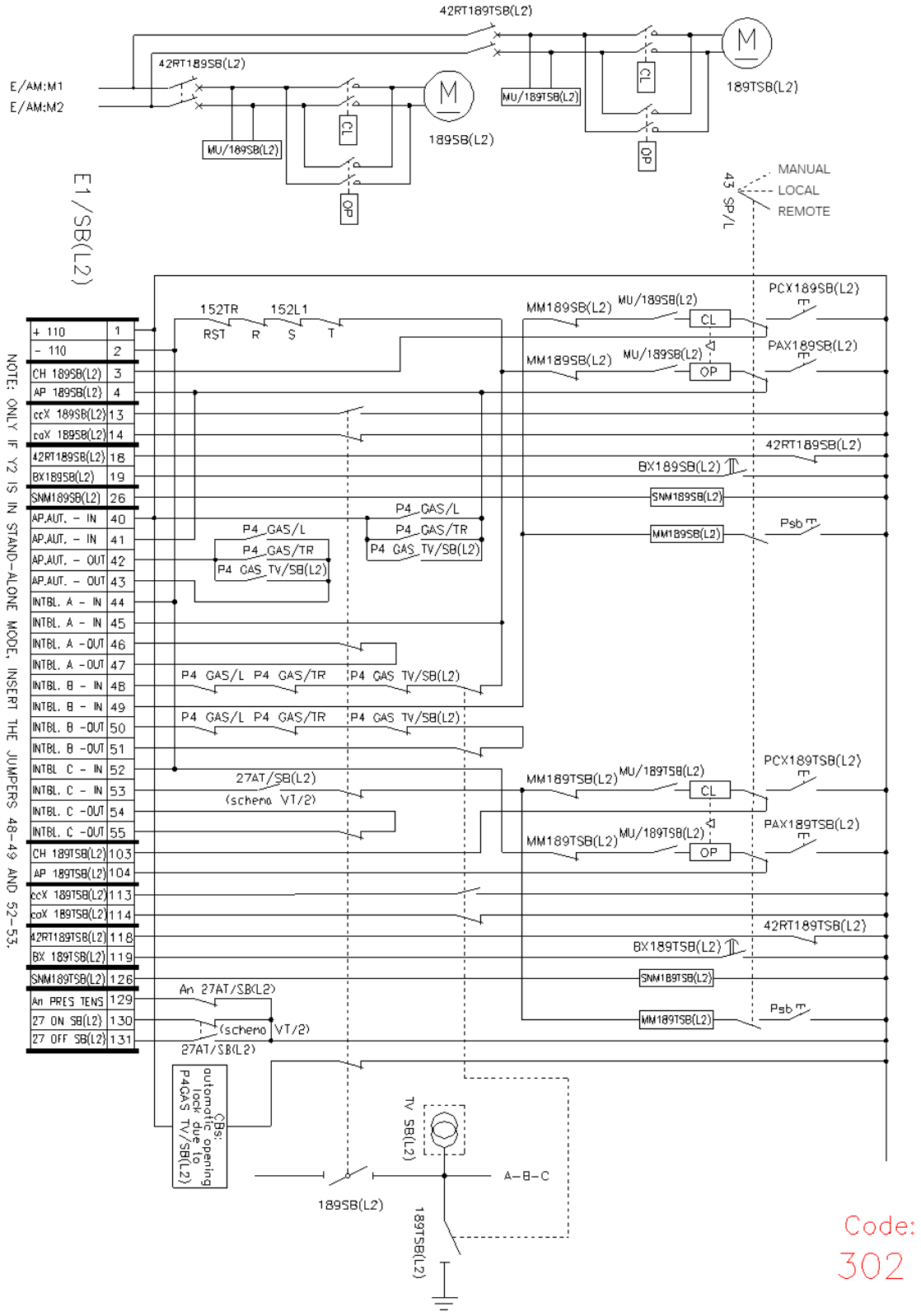
Code:
CB-T/1.2.3

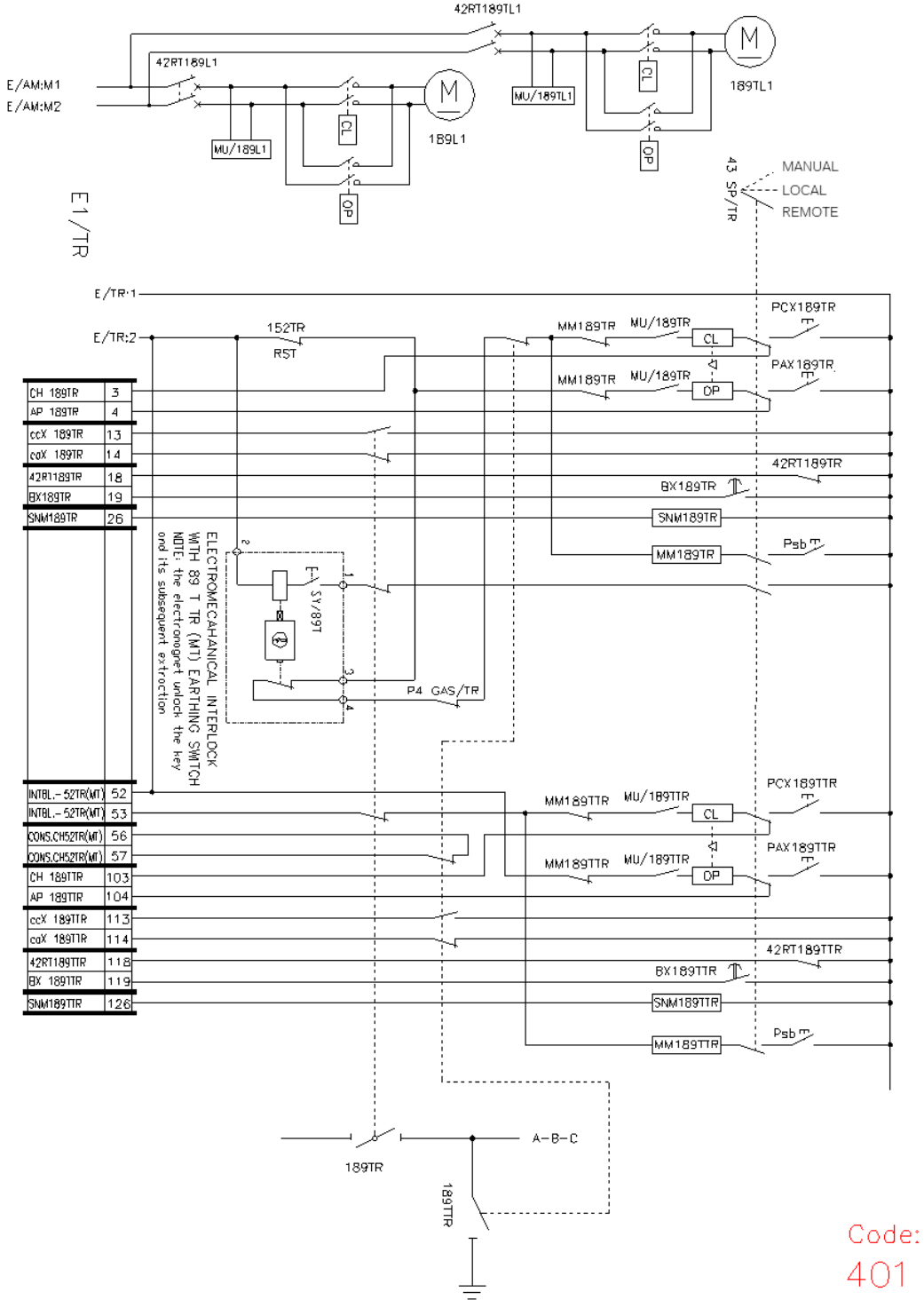


Code:
245 CB-S/1.2.

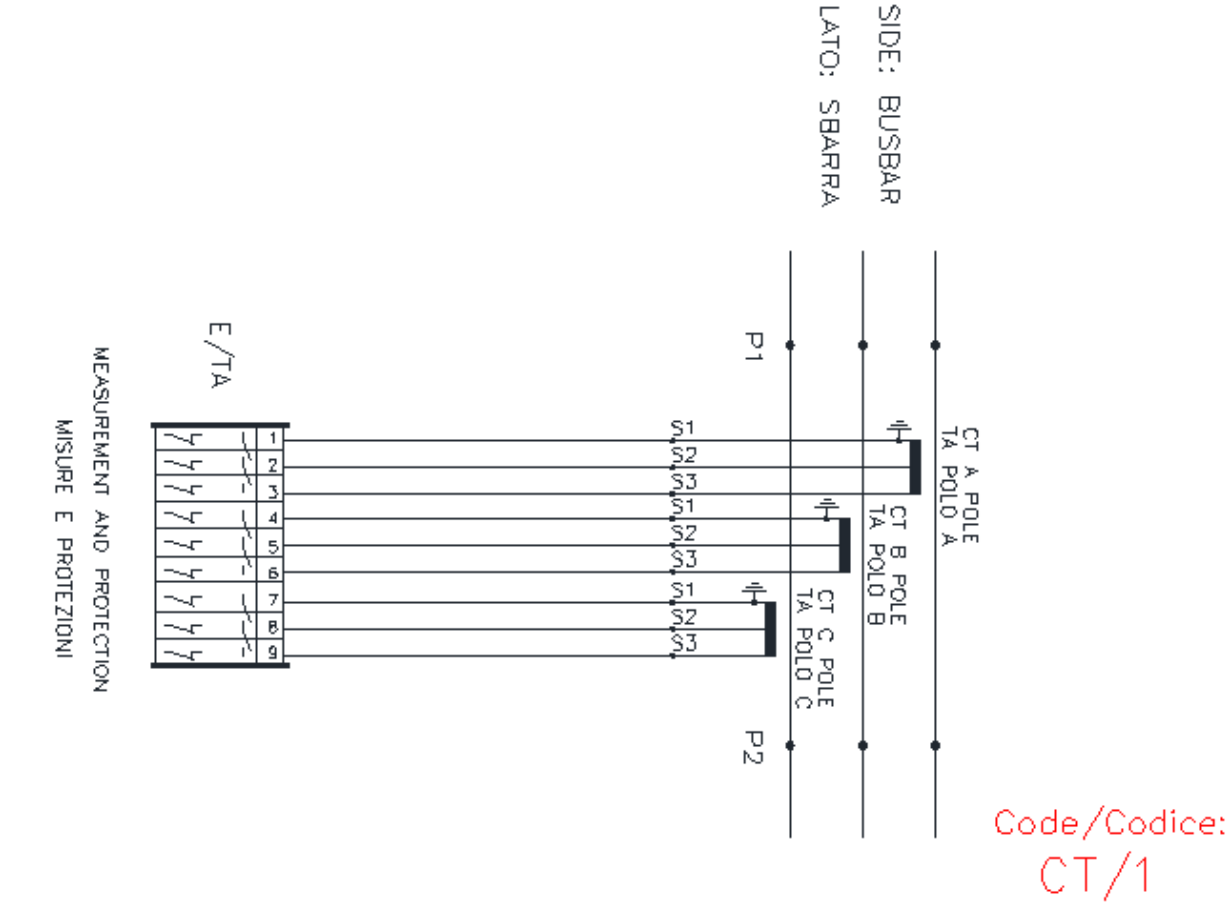
The 3rd coil is necessary in this scheme.
It's also necessary the signal of the each position of the selector 43SP (MANUAL-LOCAL-REMOTE).

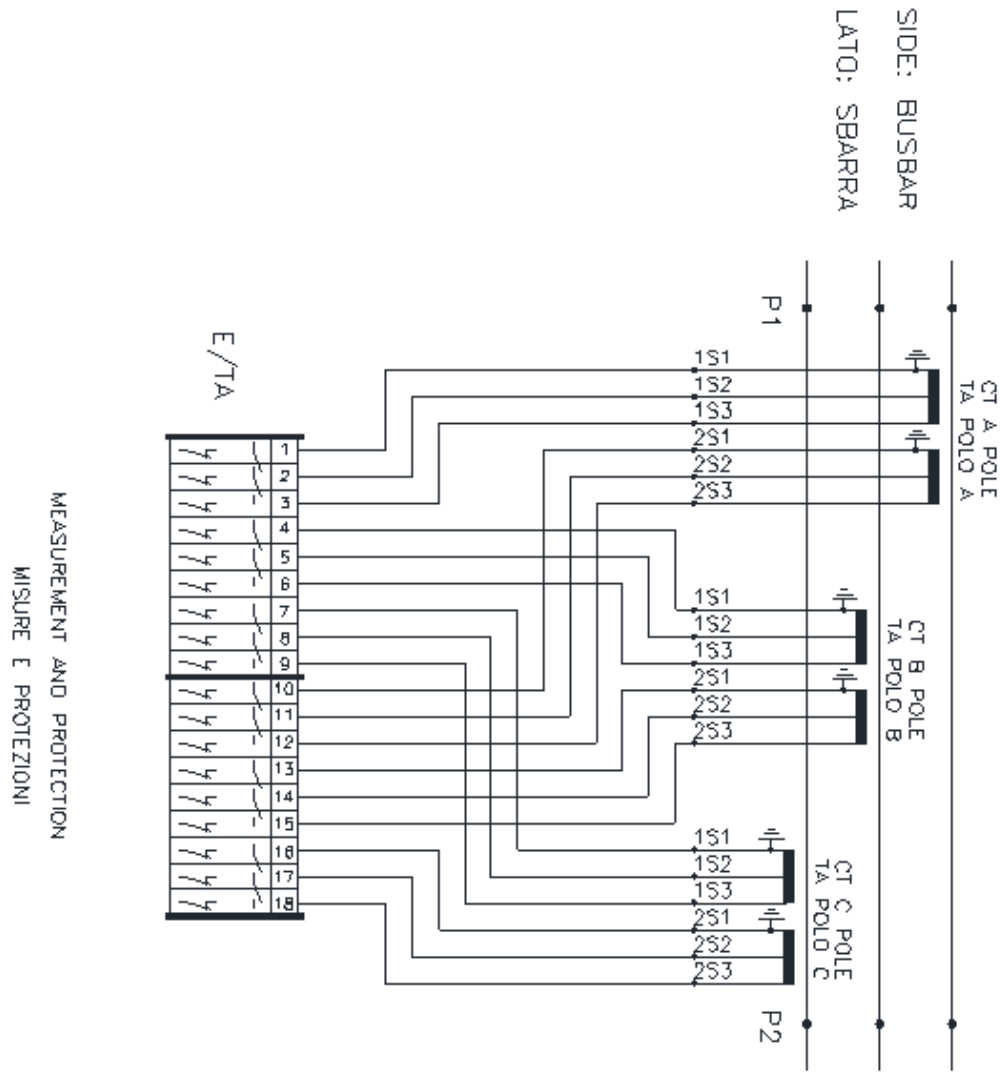

42RT189TL1
42RT189L1
E/AM:M1
E/AM:M2
MU/189L1
CL
OP
189L1
MU/189TL1
189TL1
MANUAL
LOCAL
REMOTE
43 SP/L
E1/L1
E/L1:1
E/L1:2
152L1
R
S
T
P4 GAS/L
MM189L1
PCX189L1
PAX189L1
42RT189L1
BX189L1
SNM189L1
Psb
CH 189L1 3
AP 189L1 4
ccX 189L1 13
caX 189L1 14
42RT189L1 18
BX189L1 19
SNM189L1 26
27AT/L1
(schema VT/1)
CH 189TL1 103
AP 189TL1 104
ccX 189TL1 113
caX 189TL1 114
42RT189TL1 118
BX 189TL1 119
SNM189TL1 126
An PRES TENS 129
27 ON L1 130
27 OFF L1 131
An 27AT/L1 (schema VT/1)
A-B-C
Code:
201


42RT189TSB(L2)
42RT189SB(L2)
E/AM:M1
E/AM:M2
MU/189SB(L2)
CL
OP
189SB(L2)
MU/189TSB(L2)
189TSB(L2)
E1/SB(L2)
43 SP/L
MANUAL
LOCAL
REMOTE
152TR
152L1
RST
R
S
T
+ 110
- 110
CH 189SB(L2)
AP 189SB(L2)
ccX 189SB(L2)
coX 189SB(L2)
42RT189SB(L2)
BX189SB(L2)
SNM189SB(L2)
AP.AUT. - IN
AP.AUT. - IN
AP.AUT. - OUT
AP.AUT. - OUT
INTBL. A - IN
INTBL. A - IN
INTBL. A -OUT
INTBL. A -OUT
INTBL. B - IN
INTBL. B - IN
INTBL. B -OUT
INTBL. B -OUT
INTBL. C - IN
INTBL. C - IN
INTBL. C -OUT
INTBL. C -OUT
CH 189TSB(L2)
AP 189TSB(L2)
ccX 189TSB(L2)
coX 189TSB(L2)
42RT189TSB(L2)
BX 189TSB(L2)
SNM189TSB(L2)
An PRES TENS
27 ON SB(L2)
27 OFF SB(L2)
NOTE: ONLY IF Y2 IS IN STAND-ALONE MODE, INSERT THE JUMPERS 48-49 AND 52-53.
MM189SB(L2)
PCX189SB(L2)
PAX189SB(L2)
Psb
P4 GAS/L
P4 GAS/TR
P4 GAS TV/SB(L2)
MM189TSB(L2)
PCX189TSB(L2)
PAX189TSB(L2)
27AT/SB(L2)
(schema VT/2)
An 27AT/SB(L2)
CBs: automatic opening lock due to P4GAS TV/SB(L2)
TV SB(L2)
A-B-C
Code:
302

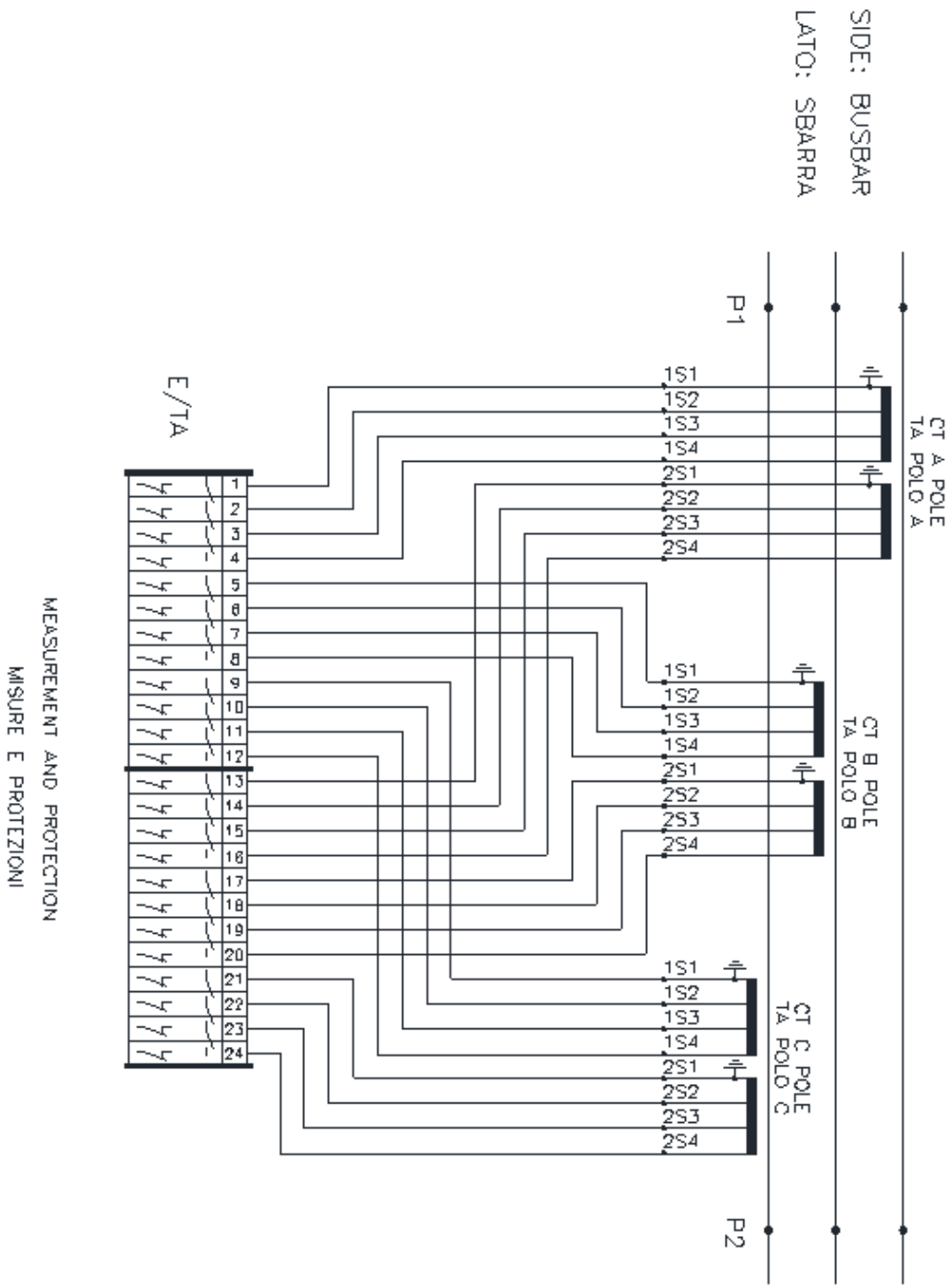

42RT189TL1
42RT189L1
E/AM:M1
E/AM:M2
MU/189L1
CL
OP
189L1
MU/189TL1
189TL1
43 SP/TR
MANUAL
LOCAL
REMOTE
E1/TR
E/TR:1
E/TR:2
152TR
RST
MM189TR
MU/189TR
PCX189TR
PAX189TR
42RT189TR
BX189TR
SNM189TR
Psb
MM189TTR
PCX189TTR
PAX189TTR
42RT189TTR
BX189TTR
SNM189TTR
CH 189TR 3
AP 189TR 4
ccX 189TR 13
coX 189TR 14
42RT189TR 18
BX189TR 19
SNM189TR 26
INTBL.-52TR(MT) 52
INTBL.-52TR(MT) 53
CONS.CH52TR(MT) 56
CONS.CH52TR(MT) 57
CH 189TTR 103
AP 189TTR 104
ccX 189TTR 113
coX 189TTR 114
42RT189TTR 118
BX 189TTR 119
SNM189TTR 126
ELECTROMECHANICAL INTERLOCK WITH 89 T TR (MT) EARTHING SWITCH
NOTE: the electromagnet unlock the key and its subsequent extraction
SY/89T
P4 GAS/TR
189TR
189TTR
A-B-C
Code:
401


E/AM
ANTICOND. SUPPLY
ANTICOND. SUPPLY
+MOTORS
+MOTORS
+MOTORS
-MOTORS
-MOTORS
-MOTORS
MOTORS (D.C.) AND ANTI-CONDENSATION (A.C.) POWER SUPPLIES
ALIMENTAZIONI MOTORI (C.C.) E ANTICONDENSA (C.A.)
Code/Codice:
AM

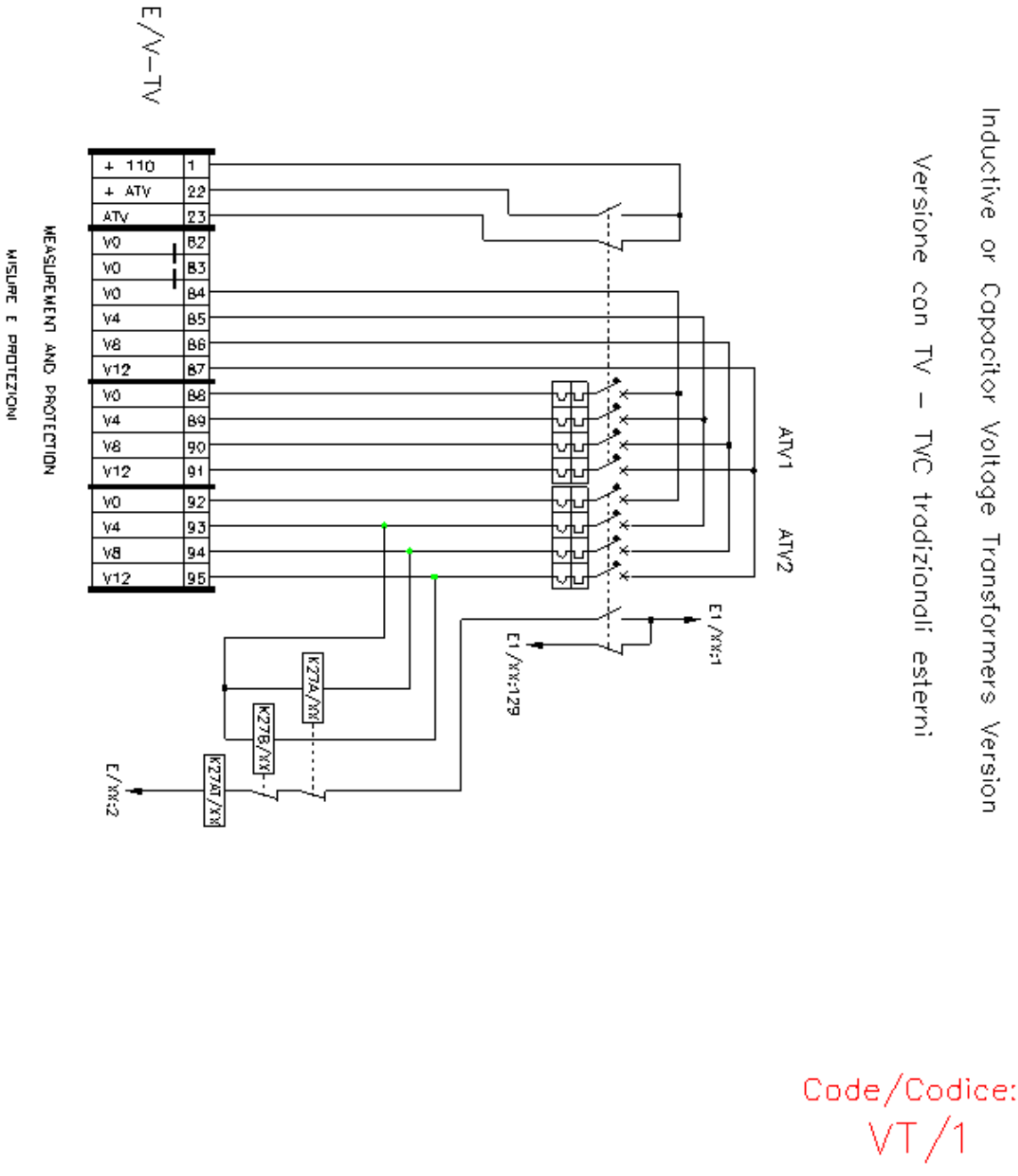

E/TA
MEASUREMENT AND PROTECTION
MISURE E PROTEZIONI
P1
P2
S1
S2
S3
CT A POLE TA POLO A
CT B POLE TA POLO B
CT C POLE TA POLO C
SIDE: BUSBAR
LATO: SBARRA
Code/Codice:
CT/1

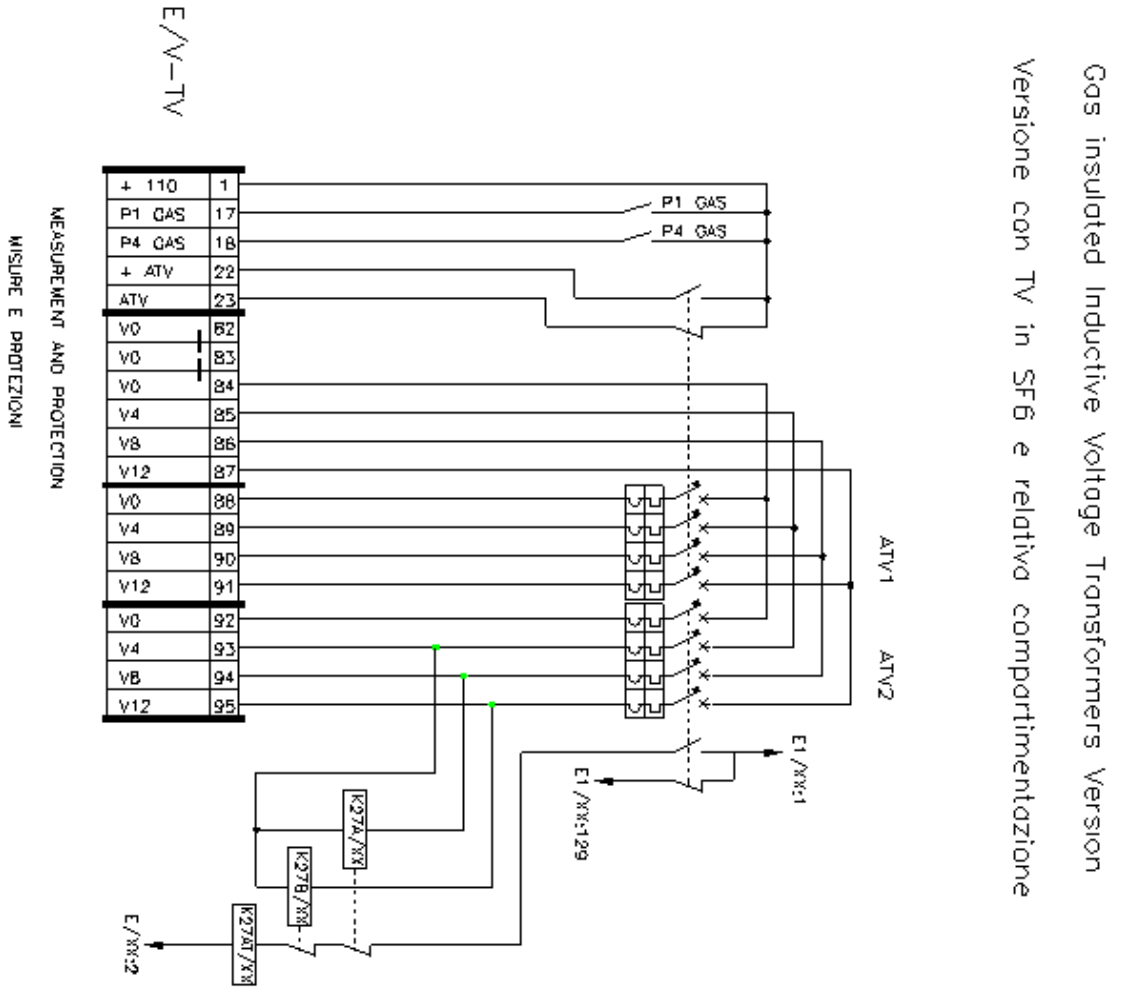


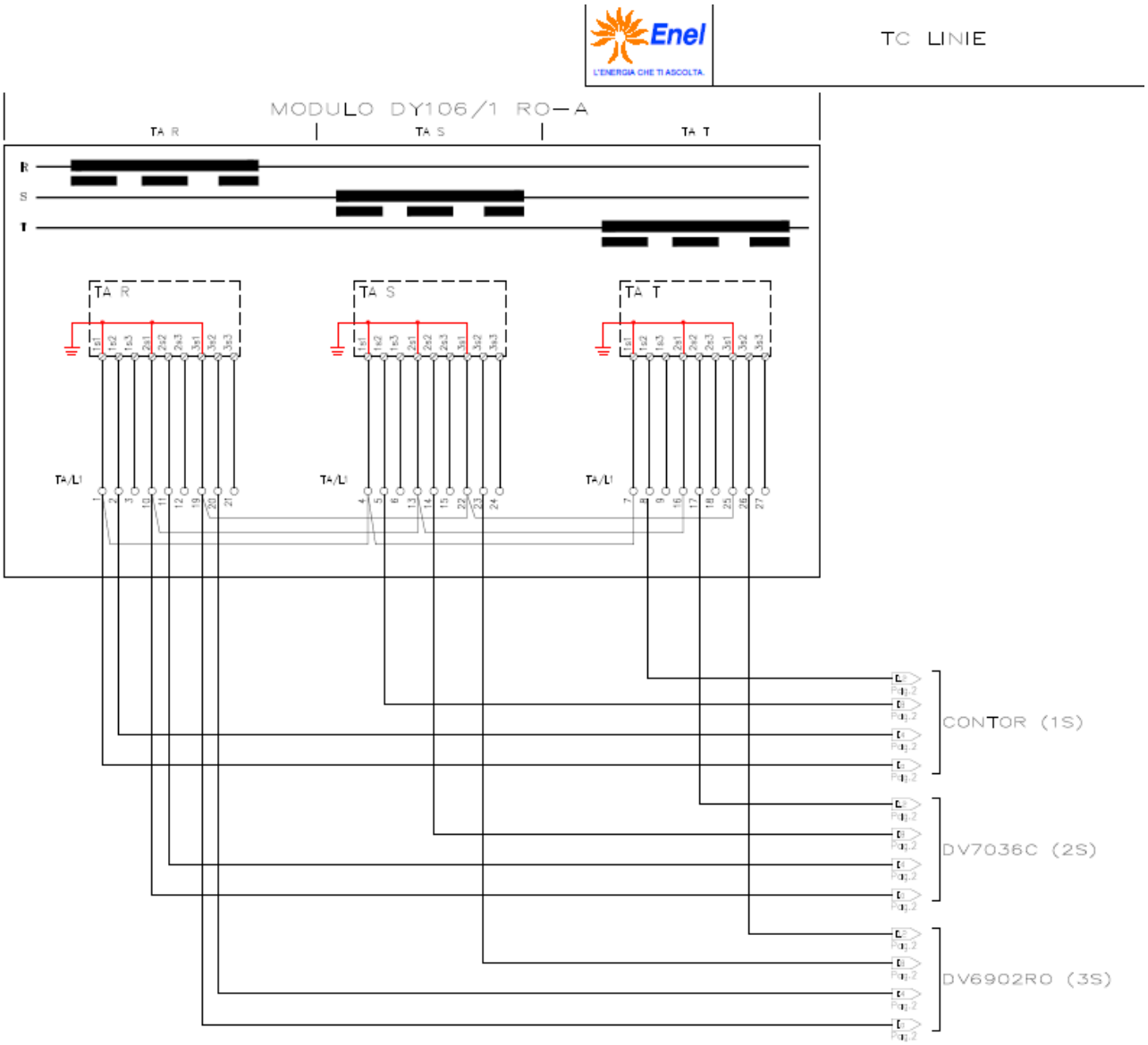
Code/Codice:
CT/2

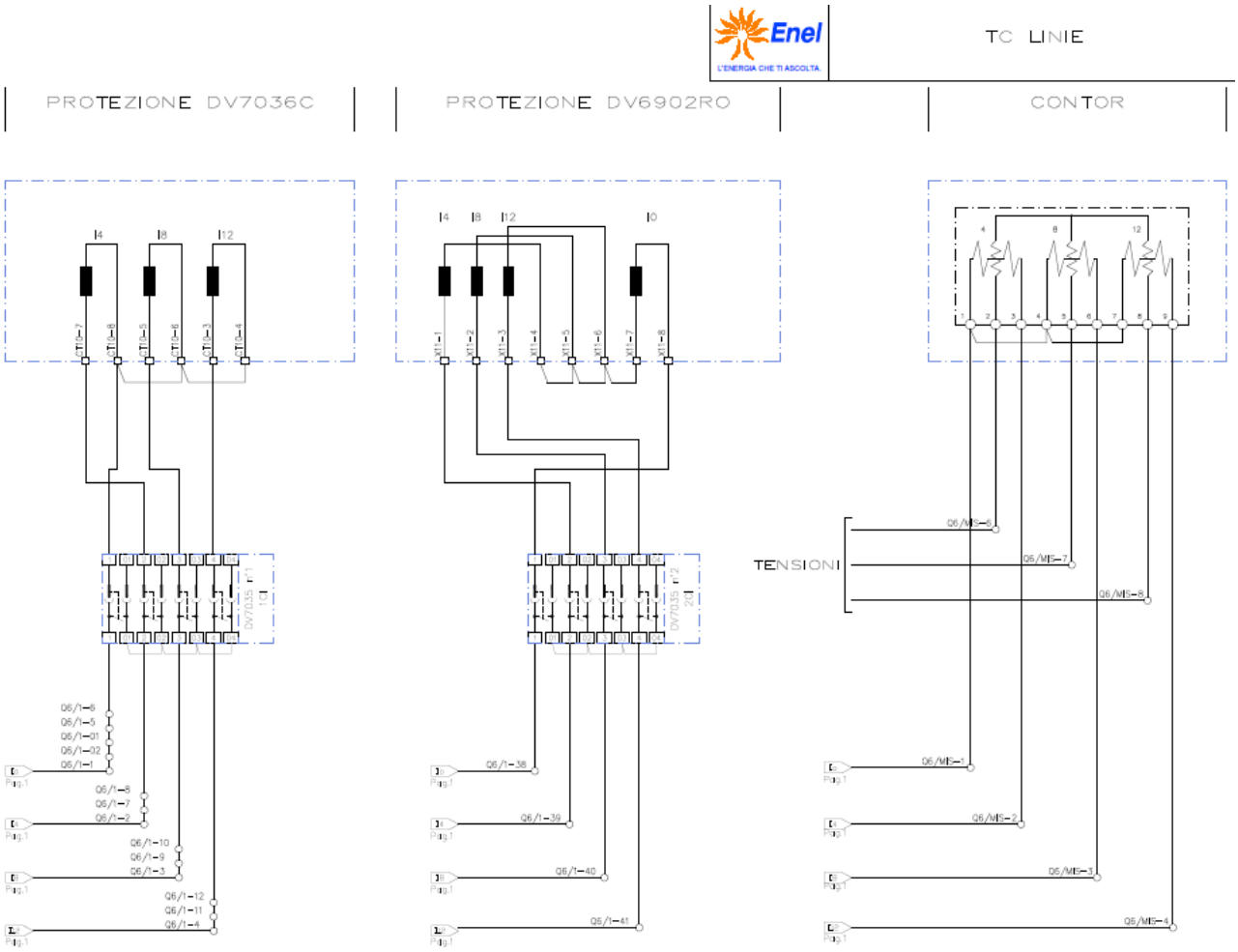


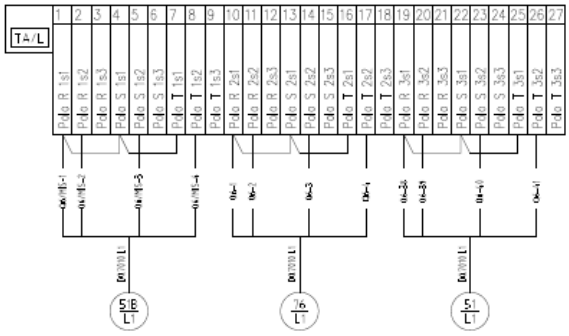
Code/Codice:
CT/3

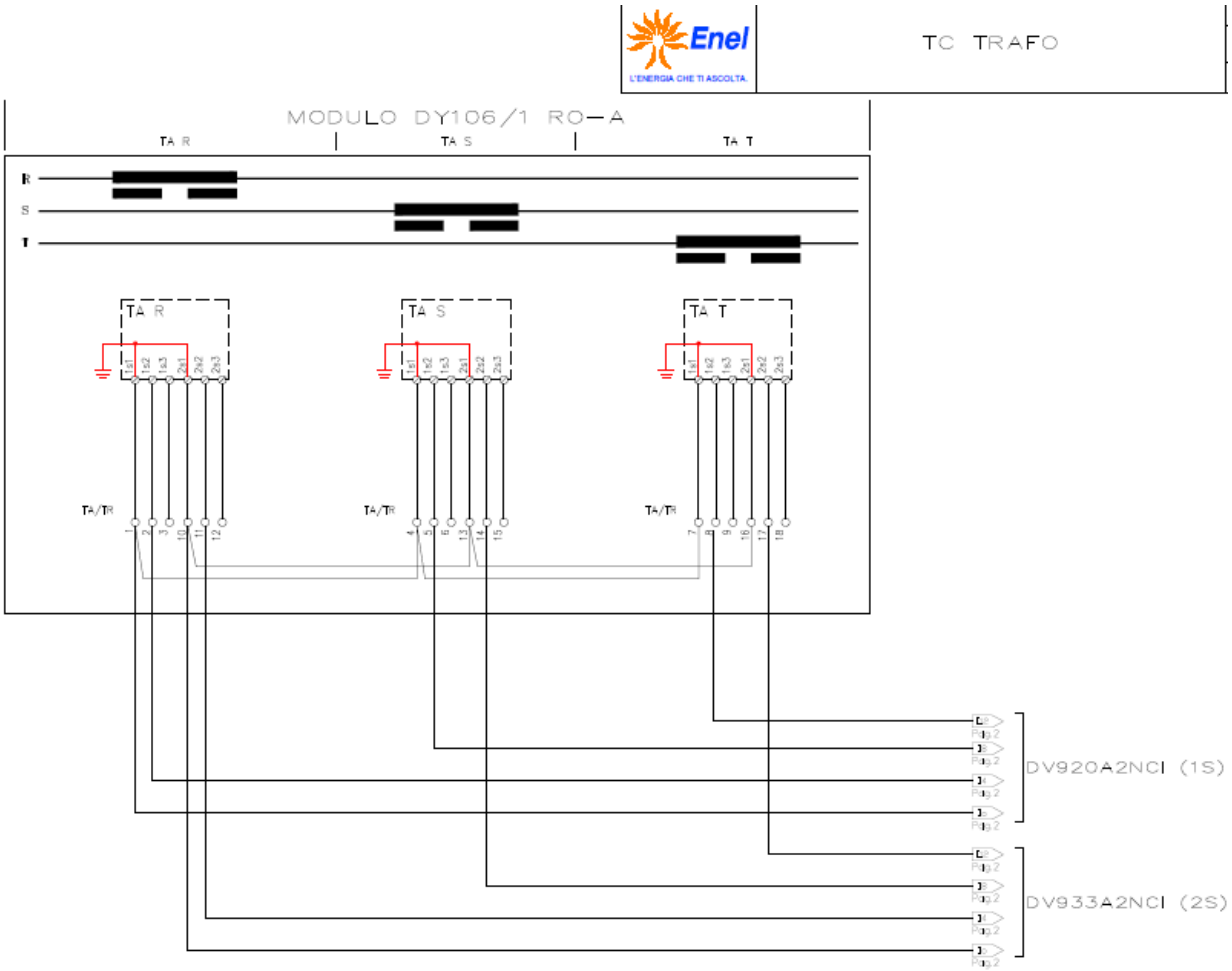

Inductive or Capacitor Voltage Transformers Version
Versione con TV - TVC tradizionali esterni
E/V-TV
MEASUREMENT AND PROTECTION
MISURE E PROTEZIONI
+ 110
+ ATV
ATV
V0
V0
V0
V4
V8
V12
V0
V4
V8
V12
V0
V4
V8
V12
1
22
23
B2
B3
B4
B5
B6
B7
B8
B9
90
91
92
93
94
95
ATV1
ATV2
E1/XX:1
E1/XX:129
K27A/XX
K27B/XX
K27AT/XX
E/XX:2
Code/Codice:
VT/1

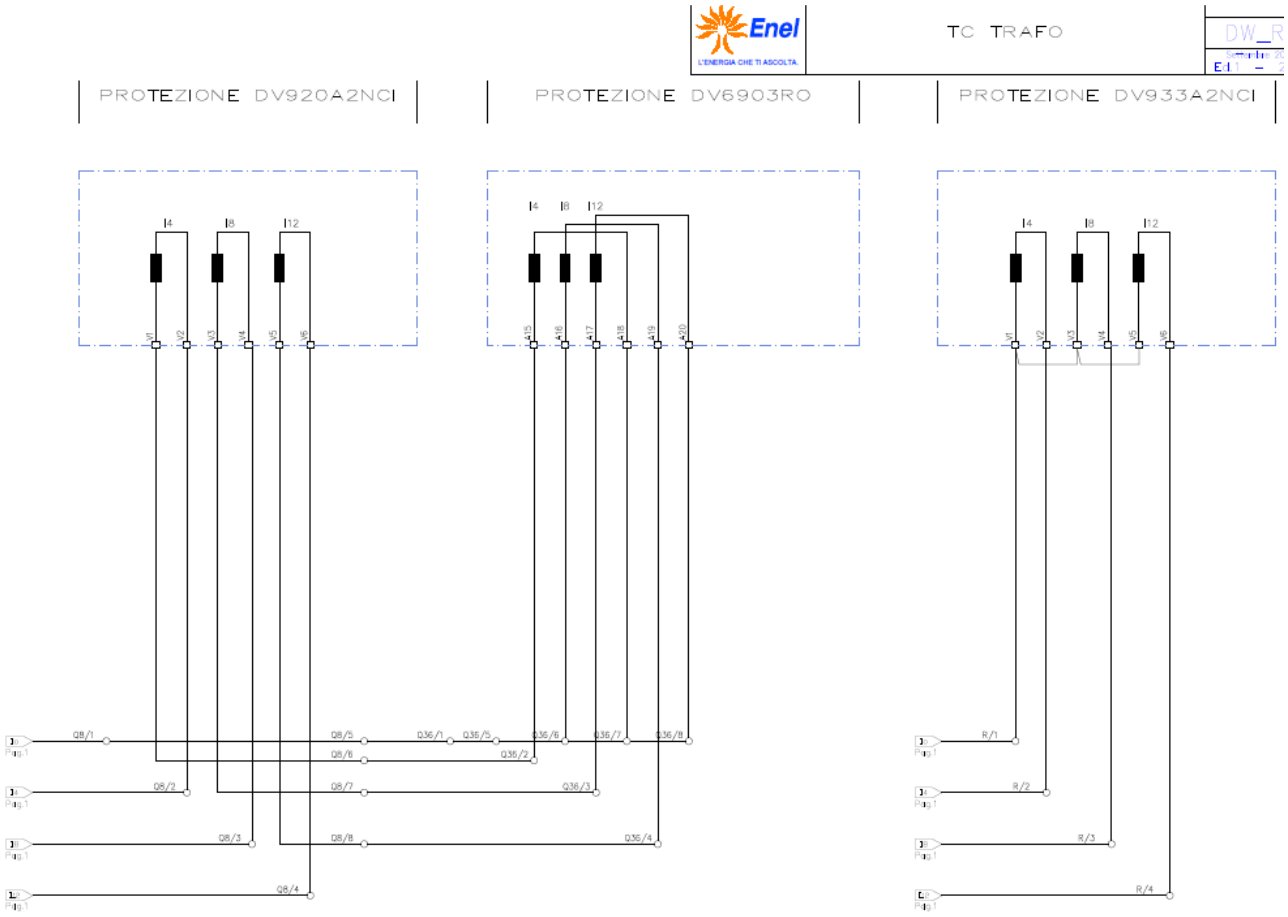

E/V-TV
MEASUREMENT AND PROTECTION
MISURE E PROTEZIONI
+ 110
P1 GAS
P4 GAS
+ ATV
ATV
V0
V4
V8
V12
1
17
18
22
23
82
83
84
85
86
87
88
89
90
91
92
93
94
95
P1 GAS
P4 GAS
ATV1
ATV2
E1/XX:1
E1/XX:129
K27A/XX
K27B/XX
K27AT/XX
E/XX:2
Gas insulated Inductive Voltage Transformers Version
Versione con TV in SF6 e relativa compartimentazione
Code/Codice:
VT/2

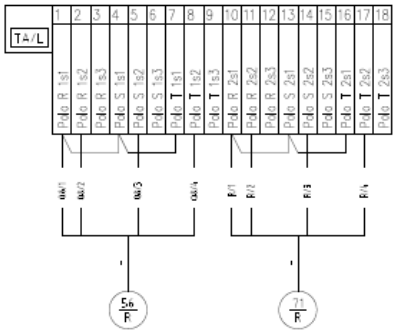

Enel
L'ENERGIA CHE TI ASCOLTA
TC LINIE
MODULO DY106/1 RO-A
TA R
TA S
TA T
R
S
T
TA/LI
CONTOR (1S)
DV7036C (2S)
DV6902RO (3S)

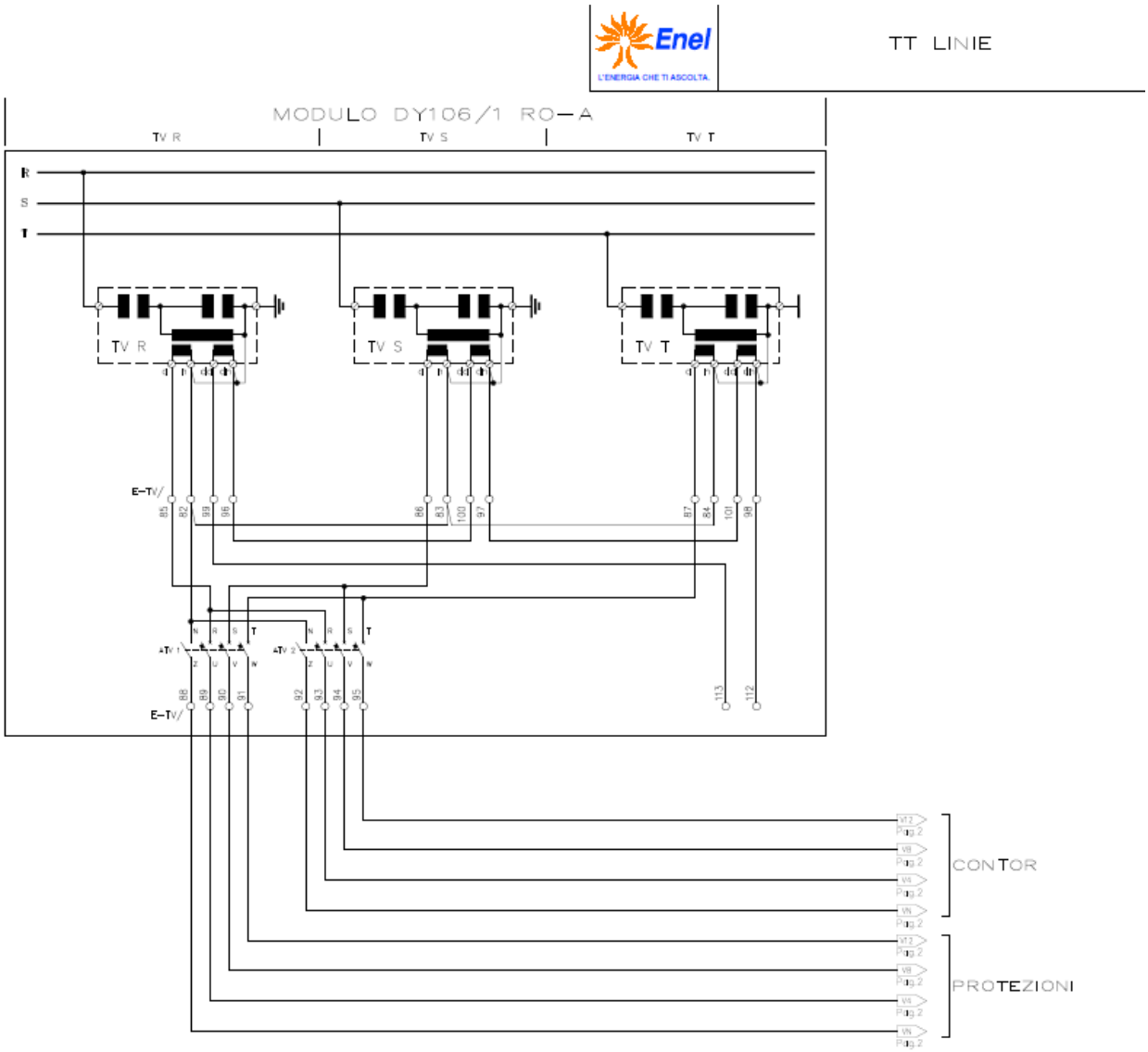

TC LINIE
PROTEZIONE DV7036C
PROTEZIONE DV6902RO
CONTOR
TENSIONI

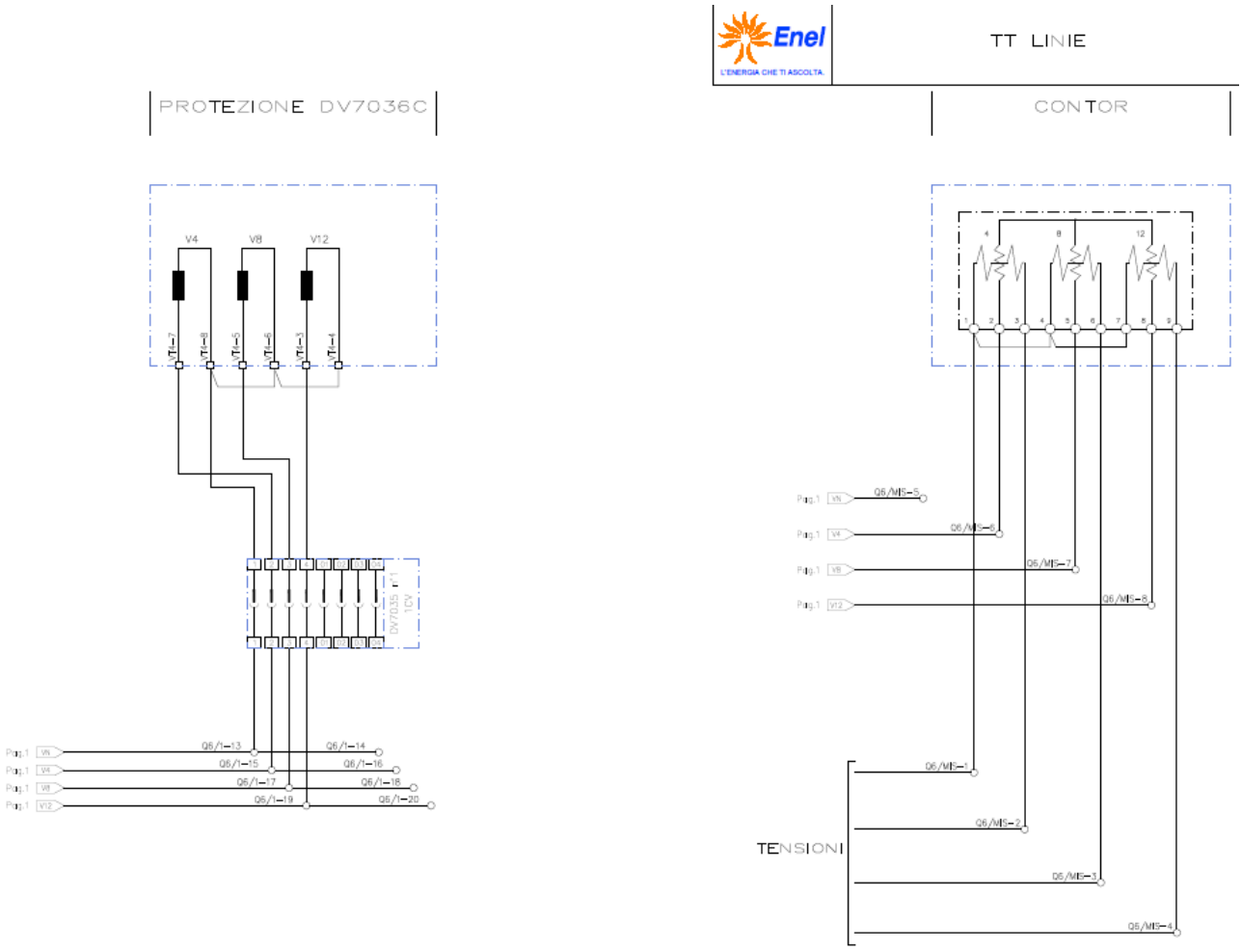



TC TRAFO
MODULO DY106/1 RO-A
TA R
TA S
TA T
R
S
T
TA/TR
DV920A2NCI (1S)
DV933A2NCI (2S)

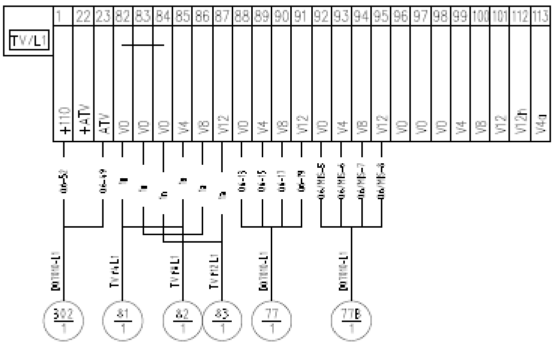

TC TRAFO
PROTEZIONE DV920A2NCI
PROTEZIONE DV6903RO
PROTEZIONE DV933A2NCI


TA/L
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
Pdo R 1s1
Pdo R 1s2
Pdo R 1s3
Pdo S 1s1
Pdo S 1s2
Pdo S 1s3
Pdo T 1s1
Pdo T 1s2
Pdo T 1s3
Pdo R 2s1
Pdo R 2s2
Pdo R 2s3
Pdo S 2s1
Pdo S 2s2
Pdo S 2s3
Pdo T 2s1
Pdo T 2s2
Pdo T 2s3


Enel
L'ENERGIA CHE TI ASCOLTA
TT LINIE
MODULO DY106/1 RO-A
TV R
TV S
TV T
R
S
T
TV R
TV S
TV T
E-TV/
ATV 1
ATV 2
E-TV/
CONTOR
PROTEZIONI


Enel
L'ENERGIA CHE TI ASCOLTA
TT LINIE
PROTEZIONE DV7036C
CONTOR
V4
V8
V12
TENSIONI

TT LINIE


TV/L1
1
22
23
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
112
113
+110
+ATV
ATV
V0
V0
V0
V4
V8
V12
V0
V4
V8
V12
V0
V4
V8
V12
V0
V0
V0
V4
V8
V12
V12h
V4d
302
1
81
1
82
1
83
1
77
1
77B
1

ANNEX D – TENDER'S TECHNICAL DOCUMENTATION

RATINGS	REFERENCE VALUES	REAL VALUES
Tender	GME000?????? or spontaneous	
Supplier Name		
Supplier CUI		
Factory Name		
Factory Address		
Factory CUI		
Supplier Model		
TAM Code		
Local Code		
GIS serial number		
Country (Enel Group)	Enel Distribuição Rio (Brazil) Enel Distribución Chile (Chile) Enel Codensa (Colombia) Enel Distribuição Ceará (Brazil) Enel Distribuição Goiás (Brazil) Enel Distribuição São Paulo (Brazil) Enel Perú (Perú) Edesur (Argentine) e-distribución (Spain) E-Distributie Banat (Romania) E-Distributie Dobrogea (Romania) E-Distributie Muntenia (Romania) e-distribuzione (Italy)	
SB / DB	SB/DB	
Service Conditions (acc. to IEC 62271-1)	Normal or Special	
Minimum ambient air temperature (°C)	-5ºC	
Maximum ambient air temperature (°C)	40ºC	
Rated frequency: fr (Hz)	50 or 60	
SPS Class (IEC/TS 60815 series)	Very Heavy ("e")	
Reference altitude	1000 m or 2600 m	
Seismic qualification level	NONE, AF2, AF3, AF5 or ETGI-1020	
Rated HV U_r (kV)	72,5, 145, 170 or 245	
Rated short-duration power-frequency withstand voltage Ud (kV rms) Phase-to-earth, across open switching device and between phases	140, 275, 395	

Rated short-duration power-frequency withstand voltage Ud (kV rms) Across the isolating distance	160, 315, 460	
Rated lightning impulse withstand voltage Up (kVp): Phase-to-earth, across open switching device and between phases	325, 650, 950	
Rated lightning impulse withstand voltage Up (kVp):Across the isolating distance	375, 750, 1050	
Rated normal current Ir (A)	2000	
Rated short time withstand current Ik (kA)	31,5, 40, 50	
Degrees of protection provided by enclosures (IEC 60529)	IP54	
Control box protection degree with open doors	IP2X	
Rated supply voltage Ua (Vdc)	110~125 or 220	
D.C. maximum absorbed power, for each bay (W/bay)	2000	
Under-voltage release (if requested) – d.c. maximum absorbed power (W/coil)	100	
Rated supply voltage for anti-condensation circuits (Vac)	220, 230 or 120	
a.c. maximum absorbed power (VA)	≤ 600	
Protection stage (tab. 4 EN 62271-203)	2	
Auxiliary contact classes (Table 6 EN 62271-1)	1	
Insulating Gas	SF6	
Three-Pole Circuit breaker	**YES/NO**	
Rated voltage Ur (kV)	72,5, 145, 170 or 245	
Rated short-circuit breaking current Isc (kA)	31,5, 40, 50	
First-pole-to-clear factor kpp	1,5 (non-effectively earthed neutral system) or 1,3	
Rated operating sequence	O-0.3s-CO-1min-CO, O-0.3s-CO-3min-CO + This requirement can be verified by mean of type tests performed with O - 0,3 s – CO -3 min – CO operating sequence and a declaration of the manufacturer about the CB compliance with O - 0,3 s – CO - 1 min – CO operating sequence.	
Maximum break-time (ms)	60	
Opening time (ms)	-	

Closing time (ms)	-	
Fault closing time (ms)	-	
Circuit-breaker class	C2 – E1 – M2	
Rated line-charging breaking current Il (A)	10, 50, 63 or 125	
Rated cable-charging breaking current Ic (A)	125, 160 or 250	
Rated out-of-phase making and breaking current Id (kA)	Clause 4.106 of IEC 62271-100	
Circuit-breaker drive mechanism subcode	1st + 2nd, 1st + 3rd, 1st + 2nd + 3rd	
Number of turns (manual spring charge)	≤ 50	
Manufacturer mechanism	Manufacturer name	
Mechanism model reference		
CB serial number		
Pole R Circuit breaker	**YES/NO**	
Rated voltage Ur (kV)	72,5, 145, 170 or 245	
Rated short-circuit breaking current Isc (kA)	31,5, 40, 50	
First-pole-to-clear factor kpp	1,5 (non-effectively earthed neutral system) or 1,3	
Rated operating sequence	O-0.3s-CO-1min-CO, O-0.3s-CO-3min-CO + This requirement can be verified by mean of type tests performed with O - 0,3 s – CO -3 min – CO operating sequence and a declaration of the manufacturer about the CB compliance with O - 0,3 s – CO - 1 min – CO operating sequence.	
Maximum break-time (ms)	60	
Circuit-breaker class	C2 – E1 – M2	
Rated line-charging breaking current Il (A)	10, 50, 63 or 125	
Rated cable-charging breaking current Ic (A)	125, 160 or 250	
Rated out-of-phase making and breaking current Id (kA)	Clause 4.106 of IEC 62271-100	
Circuit-breaker drive mechanism subcode	1st + 2nd, 1st + 3rd, 1st + 2nd + 3rd	
Number of turns (manual spring charge)	≤ 50	
Manufacturer mechanism	Manufacturer name	
Mechanism model reference		
CB serial number		

Pole S Circuit breaker	**YES/NO**	
Rated voltage Ur (kV)	72,5, 145, 170 or 245	
Rated short-circuit breaking current Isc (kA)	31,5, 40, 50	
First-pole-to-clear factor kpp	1,5 (non-effectively earthed neutral system) or 1,3	
Rated operating sequence	O-0.3s-CO-1min-CO, O-0.3s-CO-3min-CO + This requirement can be verified by mean of type tests performed with O - 0,3 s – CO -3 min – CO operating sequence and a declaration of the manufacturer about the CB compliance with O - 0,3 s – CO - 1 min – CO operating sequence.	
Maximum break-time (ms)	60	
Circuit-breaker class	C2 – E1 – M2	
Rated line-charging breaking current Il (A)	10, 50, 63 or 125	
Rated cable-charging breaking current Ic (A)	125, 160 or 250	
Rated out-of-phase making and breaking current Id (kA)	Clause 4.106 of IEC 62271-100	
Circuit-breaker drive mechanism subcode	1st + 2nd, 1st + 3rd, 1st + 2nd + 3rd	
Number of turns (manual spring charge)	≤ 50	
Manufacturer mechanism	Manufacturer name	
Mechanism model reference		
CB serial number		
Pole T Circuit breaker	**YES/NO**	
Rated voltage Ur (kV)	72,5, 145, 170 or 245	
Rated short-circuit breaking current Isc (kA)	31,5, 40, 50	
First-pole-to-clear factor kpp	1,5 (non-effectively earthed neutral system) o 1,3	
Rated operating sequence	O-0.3s-CO-1min-CO, O-0.3s-CO-3min-CO + This requirement can be verified by mean of type tests performed with O - 0,3 s – CO -3 min – CO operating sequence and a declaration of the manufacturer about the CB compliance with O - 0,3 s – CO - 1 min – CO operating sequence.	

Maximum break-time (ms)	60	
Circuit-breaker class	C2 – E1 – M2	
Rated line-charging breaking current Il (A)	10, 50, 63 or 125	
Rated cable-charging breaking current Ic (A)	125, 160 or 250	
Rated out-of-phase making and breaking current Id (kA)	Clause 4.106 of IEC 62271-100	
Circuit-breaker drive mechanism subcode	1st + 2nd, 1st + 3rd, 1st + 2nd + 3rd	
Number of turns (manual spring charge)	≤ 50	
Manufacturer mechanism	Manufacturer name	
Mechanism model reference		
CB serial number		
Three-Pole Disconnectors with earthing switches	**YES/NO**	
Rated voltage Ur (kV)	72,5, 145, 170 or 245	
Number of poles	3	
Opening (closing) time for motor operation (s)	≤ 15s	
Disconnector mechanical endurance class Mr	M1	
Rated bus-transfer current for disconnectors (A) (only if requested)	Clause B.4.106.1 of IEC 62271-102	
Rated bus-transfer voltages for disconnectors (V) (only if requested)	Clause B.4.106.2 of IEC 62271-102 (referring to Air insulated disconnectors values)	
Earthing switches class	E0-M1-A	
Manufacturer mechanism	Manufacturer name	
Mechanism model reference		
DS/ES serial number		
Three-Pole Disconnector	**YES/NO**	
Rated voltage Ur (kV)	72,5, 145, 170 or 245	
Number of poles	3	
Opening (closing) time for motor operation (s)	≤ 15s	
Disconnector mechanical endurance class Mr	M1	
Rated bus-transfer current for disconnectors (A) (only if requested)	Clause B.4.106.1 of IEC 62271-102	
Rated bus-transfer voltages for disconnectors (V) (only if requested)	Clause B.4.106.2 of IEC 62271-102 (referring to Air insulated disconnectors values)	

Manufacturer mechanism	Manufacturer name	
Mechanism model reference		
DS serial number		
Three-Pole Earthing switch	**YES/NO**	
Rated voltage Ur (kV)	72,5, 145, 170 or 245	
Number of poles	3	
Opening (closing) time for motor operation (s)	≤ 15s	
Disconnector mechanical endurance class Mr	M1	
Rated bus-transfer current for disconnectors (A) (only if requested)	Clause B.4.106.1 of IEC 62271-102	
Rated bus-transfer voltages for disconnectors (V) (only if requested)	Clause B.4.106.2 of IEC 62271-102 (referring to Air insulated disconnectors values)	
Manufacturer mechanism	Manufacturer name	
Mechanism model reference		
DS serial number		
Three-Pole Disconnector with ability of Bus-transfer current switching	**YES/NO**	
Rated voltage Ur (kV)	72,5, 145, 170 or 245	
Number of poles	3	
Opening (closing) time for motor operation (s)	≤ 15s	
Disconnector mechanical endurance class Mr	M1	
Rated bus-transfer current for disconnectors (A) (only if requested)	Clause B.4.106.1 of IEC 62271-102	
Rated bus-transfer voltages for disconnectors (V) (only if requested)	Clause B.4.106.2 of IEC 62271-102 (referring to Air insulated disconnectors values)	
Manufacturer mechanism	Manufacturer name	
Mechanism model reference		
Bus-transfer ability DS serial number		
Three-Pole Fast Earthing Switch	**YES/NO**	
Rated voltage Ur (kV)	72,5, 145, 170 or 245	
Number of poles	3	
Opening (closing) time for motor operation (s)	≤ 15s	
Disconnector mechanical endurance class Mr	M1	

Rated bus-transfer current for disconnectors (A) (only if requested)	Clause B.4.106.1 of IEC 62271-102	
Rated bus-transfer voltages for disconnectors (V) (only if requested)	Clause B.4.106.2 of IEC 62271-102 (referring to Air insulated disconnectors values)	
Earthing switches class	E0-M1-A	
Manufacturer mechanism	Manufacturer name	
Mechanism model reference		
Bus-transfer ability DS serial number		
Pole R Direct connections with bus-duct	**YES/NO**	
Bus-duct (1 linear meter)	YES/NO	
Bus-duct (1 linear meter) quantity		
Bus-duct curve	YES/NO	
Bus-duct curve quantity		
Bus-duct expansion compensator	YES/NO	
Bus-duct expansion compensator quantity		
Bus-duct joint	YES/NO	
Bus-duct joint quantity		
connection between bus-duct and HV/MV power transformer	IEC 62271-211 o GST002	
Pole S Direct connections with bus-duct	**YES/NO**	
Bus-duct (1 linear meter)	YES/NO	
Bus-duct (1 linear meter) quantity		
Bus-duct curve	YES/NO	
Bus-duct curve quantity		
Bus-duct expansion compensator	YES/NO	
Bus-duct expansion compensator quantity		
Bus-duct joint	YES/NO	
Bus-duct joint quantity		
connection between bus-duct and HV/MV power transformer	IEC 62271-211 o GST002	
Pole T Direct connections with bus-duct	**YES/NO**	
Bus-duct (1 linear meter)	YES/NO	
Bus-duct (1 linear meter) quantity		
Bus-duct curve	YES/NO	
Bus-duct curve quantity		
Bus-duct expansion compensator	YES/NO	
Bus-duct expansion compensator quantity		
Bus-duct joint	YES/NO	
Bus-duct joint quantity		

connection between bus-duct and HV/MV power transformer	IEC 62271-211 o GST002	
Pole R Cable connections	**YES/NO**	
Cable connection upward exit	YES/NO	
Cable connection downward exit	YES/NO	
Equipments for direct connection between busduct and power transformer	YES/NO	
cable connection enclosure	dry-type or fluid-filled cable terminations	
Manufacturer "plug in" dry-type	Manufacturer name	
Supplier/Model		
Cable connection serial number		
Pole S Cable connections	**YES/NO**	
Cable connection upward exit	YES/NO	
Cable connection downward exit	YES/NO	
Equipments for direct connection between busduct and power transformer	YES/NO	
cable connection enclosure	dry-type or fluid-filled cable terminations	
Manufacturer "plug in" dry-type	Manufacturer name	
Supplier/Model		
Cable connection serial number		
Pole T Cable connections	**YES/NO**	
Cable connection upward exit	YES/NO	
Cable connection downward exit	YES/NO	
Equipments for direct connection between busduct and power transformer	YES/NO	
cable connection enclosure	dry-type or fluid-filled cable terminations	
Manufacturer "plug in" dry-type	Manufacturer name	
Supplier/Model		
Cable connection serial number		
Pole R Current transformers	**YES/NO**	
Rated short-time thermal current Ith (kA)	40	
Rated continuous thermal current Icth (kA)	120% of Ipr	

Rated transformation ratio kr (A/A)	400-800-800/1/1/1, 400-800-1600/1/1, 400-800-1600/1, 400-800/1/1/1, 400-800/1/1, 200-400/1, 400-800/1, 200-400/5, 400-800/5, 1000-2000/5/5/5, 400-800/5/5/5, 1000-2000/5/5, 1000-2000/5, 1000-2000/1, 1000-2000/1/1/1, 2500/1/1, 400-800/5/5, 1000-2000/5, 400-800/1/1/1, 200-400/1/1/1, 600-1200/1/1/1, 600-1200/1, 300-600/1/1/1, 300-600/1, 2000/1/1/1, 2000/1	
Core number	1, 2, 3	
Accuracy class Core 1	0.2s-2≥FS≤5; 0.5-5P30, 0.5-5P20, 5P30, 5P20, 0.5S-FS>5, 0.2-5P30, TPY, TPX	
Accuracy class Core 2	NONE, 5P30, 5P20, TPY, TPX	
Accuracy class Core 3	NONE, 5P30, 5P20	
Rated burden (VA)	15, 30	
Maximum secondary winding resistance (Rct) at 75 °C (Ω)	NONE, 5 (only for 1A cores)	
Manufacturer	Manufacturer name	
Model reference		
CT serial number		
Pole S Current transformers	**YES/NO**	
Rated short-time thermal current Ith (kA)	40	
Rated continuous thermal current Icth (kA)	120% of Ipr	
Rated transformation ratio kr (A/A)	400-800-800/1/1/1, 400-800-1600/1/1, 400-800-1600/1, 400-800/1/1/1, 400-800/1/1, 200-400/1, 400-800/1, 200-400/5, 400-800/5, 1000-2000/5/5/5, 400-800/5/5/5, 1000-2000/5/5, 1000-2000/5, 1000-2000/1, 1000-2000/1/1/1, 2500/1/1, 400-800/5/5, 1000-2000/5, 400-800/1/1/1, 200-400/1/1/1, 600-1200/1/1/1, 600-1200/1, 300-600/1/1/1, 300-600/1, 2000/1/1/1, 2000/1	
Core number	1, 2, 3	

Accuracy class Core 1	0.2s-2≥FS≤5; 0.5-5P30, 0.5-5P20, 5P30, 5P20, 0.5S-FS>5, 0.2-5P30, TPY, TPX	
Accuracy class Core 2	NONE, 5P30, 5P20, TPY, TPX	
Accuracy class Core 3	NONE, 5P30, 5P20	
Accuracy class Core 4	NONE, 5P30, 5P30	
Rated burden (VA)	15, 30	
Maximum secondary winding resistance (Rct) at 75 °C (Ω)	NONE, 5 (only for 1A cores)	
Manufacturer	Manufacturer name	
Model reference		
CT serial number		
Pole T Current transformers	**YES/NO**	
Rated short-time thermal current Ith (kA)	40	
Rated continuous thermal current Icth (kA)	120% of Ipr	
Rated transformation ratio kr (A/A)	400-800-800/1/1/1, 400-800-1600/1/1, 400-800-1600/1, 400-800/1/1/1, 400-800/1/1, 200-400/1, 400-800/1, 200-400/5, 400-800/5, 1000-2000/5/5/5, 400-800/5/5/5, 1000-2000/5/5, 1000-2000/5, 1000-2000/1, 1000-2000/1/1/1, 2500/1/1, 400-800/5/5, 1000-2000/5, 400-800/1/1/1, 200-400/1/1/1, 600-1200/1/1/1, 600-1200/1, 300-600/1/1/1, 300-600/1, 2000/1/1/1, 2000/1	
Core number	1, 2, 3	
Accuracy class Core 1	0.2s-2≥FS≤5; 0.5-5P30, 0.5-5P20, 5P30, 5P20, 0.5S-FS>5, 0.2-5P30, TPY, TPX	
Accuracy class Core 2	NONE, 5P30, 5P20, TPY, TPX	
Accuracy class Core 3	NONE, 5P30, 5P20	
Accuracy class Core 4	NONE, 5P30, 5P30	
Rated burden (VA)	15, 30	
Maximum secondary winding resistance (Rct) at 75 °C (Ω)	NONE, 5 (only for 1A cores)	
Manufacturer	Manufacturer name	
Model reference		
CT serial number		

Pole R Voltage transformers	**YES/NO**	
Highest voltage for equipment Um (kV)	72,5, 145, 170 or 245	
Rated Insulation levels	According to GSCH002 - 6.1	
Rated transformation ratio kr (kV/kV)	60:√3/0.1:√3, 66:√3/0.11:√3, 110:√3/0.11:√3, 115:√3/0.115:√3, 120:√3/0.1:√3, 132:√3/0.1:√3, 132:√3/0.11:√3, 150:√3/0.1:√3, 220:√3/0.1:√3	
Secondary windings	1, 2, 3	
Rated voltage factor Fv	1,5 (rated time 30 s)	
Accuracy class Core 1	0.2, 0.2-3P, 0.5-3P, 3P	
Accuracy class Core 2	NONE, 0.2-3P, 0.5-3P, 3P, 0.2	
Accuracy class Core 3	NONE, 0.2-3P, 0.5-3P, 3P	
Rated burden (VA)	15, 25	
Arc fault duration and performance criteria (IEC 61869-1 table 8) Protection stage	2	
Arc fault duration and performance criteria (IEC 61869-1 table 8) Internal arc fault protection	class II	
Manufacturer	Manufacturer name	
Model reference		
VT serial number		
Pole S Voltage transformers	**YES/NO**	
Highest voltage for equipment Um (kV)	72,5, 145, 170 or 245	
Rated Insulation levels	According to GSCH002 - 6.1	
Rated transformation ratio kr (kV/kV)	60:√3/0.1:√3, 66:√3/0.11:√3, 110:√3/0.11:√3, 115:√3/0.115:√3, 120:√3/0.1:√3, 132:√3/0.1:√3, 132:√3/0.11:√3, 150:√3/0.1:√3, 220:√3/0.1:√3	
Secondary windings	1, 2, 3	
Rated voltage factor Fv	1,5 (rated time 30 s)	
Accuracy class Core 1	0.2, 0.2-3P, 0.5-3P, 3P	
Accuracy class Core 2	NONE, 0.2-3P, 0.5-3P, 3P, 0.2	
Accuracy class Core 3	NONE, 0.2-3P, 0.5-3P, 3P	
Rated burden (VA)	15, 25	
Arc fault duration and performance criteria (IEC 61869-1 table 8) Protection stage	2	

Arc fault duration and performance criteria (IEC 61869-1 table 8) Internal arc fault protection	class II	
Manufacturer	Manufacturer name	
Model reference		
VT serial number		
Pole T Voltage transformers	**YES/NO**	
Highest voltage for equipment Um (kV)	72,5, 145, 170 or 245	
Rated Insulation levels	According to GSCH002 - 6.1	
Rated transformation ratio kr (kV/kV)	60:√3/0.1:√3, 66:√3/0.11:√3, 110:√3/0.11:√3, 115:√3/0.115:√3, 120:√3/0.1:√3, 132:√3/0.1:√3, 132:√3/0.11:√3, 150:√3/0.1:√3, 220:√3/0.1:√3	
Secondary windings	1, 2, 3	
Rated voltage factor Fv	1,5 (rated time 30 s)	
Accuracy class Core 1	0.2, 0.2-3P, 0.5-3P, 3P	
Accuracy class Core 2	NONE, 0.2-3P, 0.5-3P, 3P, 0.2	
Accuracy class Core 3	NONE, 0.2-3P, 0.5-3P, 3P	
Rated burden (VA)	15, 25	
Arc fault duration and performance criteria (IEC 61869-1 table 8) Protection stage	2	
Arc fault duration and performance criteria (IEC 61869-1 table 8) Internal arc fault protection	class II	
Manufacturer	Manufacturer name	
Model reference		
VT serial number		
Three-Pole Gas density control	**YES/NO**	
Maximum SF6 leakage rate (% / year)	≤ 0,5%	
Connection element (each SF6 circuit)	DILO VK/BG-03/8 or equivalent (ISO 1179)	
Manufacturer	Manufacturer name	
Model reference		
Density Meter serial number		
Gas density control Total Quantity		
Pole R Gas density control	**YES/NO**	
Maximum SF6 leakage rate (% / year)	≤ 0,5%	
Connection element (each SF6 circuit)	DILO VK/BG-03/8 or equivalent (ISO 1179)	

Manufacturer	Manufacturer name	
Model reference		
Density Meter serial number		
Gas density control Total Quantity		
Pole S Gas density control	**YES/NO**	
Maximum SF6 leakage rate (% / year)	≤ 0,5%	
Connection element (each SF6 circuit)	DILO VK/BG-03/8 or equivalent (ISO 1179)	
Manufacturer	Manufacturer name	
Model reference		
Density Meter serial number		
Gas density control Total Quantity		
Pole T Gas density control	**YES/NO**	
Maximum SF6 leakage rate (% / year)	≤ 0,5%	
Connection element (each SF6 circuit)	DILO VK/BG-03/8 or equivalent (ISO 1179)	
Manufacturer	Manufacturer name	
Model reference		
Density Meter serial number		
Gas density control Total Quantity		
Partitioning with three-pole gas management (including relative equipments and control circuits).	**YES/NO**	
Partitioning with three-pole gas management (including relative equipments and control circuits). Quantity		
Pole R Partitioning with single-pole gas management (including relative equipments and control circuits).	**YES/NO**	
Pole R Partitioning with single-pole gas management (including relative equipments and control circuits). Quantity		
Pole S Partitioning with single-pole gas management (including relative equipments and control circuits).	**YES/NO**	
Pole S Partitioning with single-pole gas management (including relative equipments and control circuits). Quantity		

Pole T Partitioning with single-pole gas management (including relative equipments and control circuits).	**YES/NO**	
Pole T Partitioning with single-pole gas management (including relative equipments and control circuits). Quantity		
Assembled GIS		
Support		
SF6 gas		
Total		
Total in transport configuration		
Height manual spring charge CB Three-Pole ≤	1900	
Height manual spring charge CB Pole R ≤	1900	
Height manual spring charge CB Pole S ≤	1900	
Height manual spring charge CB Pole T ≤	1900	
Height manual maneuver DS/ES ≤	1900	
Height manual maneuver DS ≤	1900	
Height manual maneuver ES ≤	1900	
Height manual maneuver FES ≤	1900	