

**Application Areas**

Perimeter: *Global*  
 Staff Function: -  
 Service Function: -  
 Business Line: *Enel Grids*

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**Material Specification code:** GRI-GRI-MAT-E&C-0020

Version no. 4 dated 14/05/2024

**Subject:** GSCH001 HV CIRCUIT BREAKERS

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THE HEAD OF GLOBAL NETWORK COMPONENTS

**Fabrizio GASBARRI**

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## 1 DOCUMENT AIMS AND APPLICATION AREA

Scope of this document is to provide technical requirements for the supply of three-poles Alternating Current Circuit-Breakers 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
Colombia	Codensa
Iberia	e-distribución
Italy	e-distribuzione

Note: the indication "Latam" refers to the Enel Group Distribution companies in South America.

Alternating Current Circuit-Breakers (hereinafter CBs) are SF6 insulated (in alternative, non-fluorinated greenhouse gases and vacuum circuit breakers are also acceptable), for outdoor installations in Primary Substations.

Some requirements are applicable only to one or more companies, therefore, depending on the destination of the CBs, the supplied equipment shall comply these specific requirements.

*This document shall be implemented and applied to the extent possible within the Enel Grids Business Line and in compliance with any applicable laws, regulations and governance rules, including any stock exchange and unbundling-relevant provisions, which in any case prevail over the provisions contained in this document.*

### 1.1 RELATED DOCUMENTS TO BE IMPLEMENTED AT COUNTRY LEVEL

This document does not require implementation of further documents.

Anyway, each Enel Grids Company can issue, under the supervision of Enel Grids Global Network Components a detailed document, according to the provisions of the present document and in case of specific needs.

## 2 DOCUMENT VERSION MANAGEMENT

Version	Date	Main changes description
0	26/07/2013	First emission
1	09/02/2017	3.1.3 Add reference laws for Spain 3.2.2.2 Added specific standards for Spain 4.2.3. Seismic qualification level of Codensa 6.5.1.2. Added specific requirement for Control Box for Italy

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		<p>6.5.1.3 Added specific requirement for Control Box for Spain</p> <p>6.6.1 Modification in bushing terminations Latam</p> <p>6.8.1. Added specific requirement for E-distribución</p> <p>7.1.1.1. Added specific requirement for E-distribución</p> <p>ANNEX B: Added to note 7 for Spain.</p> <p>9.2.2 Added 18) Only for E-distribución Distribución</p> <p>ANNEX C.1. Electrical scheme E-distribución changed heating circuit</p> <p>ANNEX C.3. Electrical scheme for Enel Rio changed</p> <p>ANNEX C.2. Electrical scheme for Enel changed</p>
2	03/08/2017	<p>Editorial revision: Modification of the cover format</p> <p>3.2.2.4 PVR001 replaced with PVR006.</p> <p>8.3.2 Added: The density meters verification can be also performed using SF6, if precautions are taken to prevent SF6 dispersion in the environment.</p> <p>Annex B – Table 2, 3 and 4 modifications</p>
	17/12/2020	Material codes updated E4E. Publishing ammendment to rev 2 - 02/11/2020
3	15/11/2021	<p>Editorial revision. Document format</p> <p>Update company names</p> <p>SPS class standardized to Very Heavy (e)</p> <p>Gas density control device details</p> <p>Amendments inclusion. Only composite insulators and new company codes</p> <p>ANNEX C.1 and C.3 are replaced by the scheme C.1.1 and C.1.2 (for Spain, Latam and Romania)</p> <p>New SF6 free codes for Spain, Chile and Colombia</p> <p>Colors of spring indicators</p> <p>for e-distribuzione Seismic calculations for the support</p>
4	24/11/2022	<p>Wiring control box modification 7.4.5</p> <p>New codes for Brasil 3150A</p> <p>7.10.2.2 Capacitive trip for all Brasil</p> <p>Update of Company Name in Enel Grids</p> <p>Alignment to the new format</p>
	03/03/2023	Introducción códigos de Perú GSCH001/1
	14/05/2024	<p>Deleted Romania, Goiás, Perú and Chile</p> <p>Added new SF6 FREE codes for Spain and Italy</p>

**3 UNITS IN CHARGE OF THE DOCUMENT**

Responsible for drawing up the document:

- Enel Grids: Engineering and Construction / Components and Devices Design / Network Components unit.

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Responsible for authorizing the document:

- Enel Grids: Head of Network Components unit
- Enel Grids: Head of 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;
- Enel Global Compliance Program (EGCP);
- Integrated Policy for Quality, Health and Safety, Environment, anti-Bribery and Information security;
- ISO 9001:2015 - Quality Management System - Requirements;
- ISO 14001:2015 - Environmental Management System - Requirements and user guide;
- ISO 45001:2018 - Occupational Health and Safety Management System - Requirements and user guide;
- ISO 50001:2018 - Energy management systems - Requirements with guidance for use;
- ISO 37001:2016 - Anti-bribery Management System - Requirements with guidance for use.
- IEC 62271-1 - High-voltage switchgear and controlgear - Part 1: Common specifications
- IEC 62271-100 - High-voltage switchgear and controlgear – Part 100: Alternating current circuit-breakers
- IEC/TR 62271-300 - High-voltage switchgear and controlgear - Part 300: Seismic qualification of alternating current circuit-breakers
- IEC/TR 62271-301 - High-voltage switchgear and controlgear – Part 301: Dimensional standardization of high-voltage terminals
- CLC/TR 62271-303 - High-voltage switchgear and controlgear - Part 303: Use and handling of sulphur hexafluoride (SF6)
- IEC 60376 - Specification of technical grade sulfur hexafluoride (SF6) for use in electrical equipment

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- IEC 60073 - Basic and safety principles for man-machine interface, marking and identification – Coding principles for indicators and actuators
- IEC 60447 - Basic and safety principles for man-machine interface, marking and identification - Actuating principles
- IEC 61936-1 - Power installations exceeding 1 kV a.c. - Part 1: Common rules
- IEC/TS 60815-1 - Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 1: Definitions, information and general principles
- IEC/TS 60815-2 - Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 2: Ceramic and glass insulators for a.c. systems
- IEC/TS 60815-3 - Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 3: Polymer insulators for a.c. systems
- IEC 62155 - Hollow pressurized and unpressurized ceramic and glass insulators for use in electrical equipment with rated voltage greater than 1000 V
- IEC 61462 - Composite hollow insulators – Pressurized and unpressurized insulators for use in electrical equipment with rated voltage greater than 1000 V – Definitions, test methods, acceptance criteria and design recommendations
- 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 60947-7-1        Low-voltage switchgear and controlgear – Part 7-1: Ancillary equipment - Terminal blocks for copper conductors
- IEC 60947-7-2        Low-voltage switchgear and controlgear – Part 7-2: Ancillary equipment - Protective conductor terminal blocks for copper conductors
- IEC 60068-2-17 - Environmental testing – Part 2: Tests – Test Q: Sealing
- ISO 1461 - Hot dip galvanized coatings on fabricated iron and steel articles- Specifications and test methods
- ISO 2178 - Non-magnetic coatings on magnetic substrates - Measurement of coating thickness - Magnetic method

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- ISO 4126 - Safety devices for protection against excessive pressure
- ISO 9223 - Corrosion of metals and alloys -- Corrosivity of atmospheres -- Classification, determination and estimation
- ISO 12944 - Paints and varnishes -- Corrosion protection of steel structures by protective paint systems
- EN 1005-3:2002 - Safety of machinery. Human physical performance Recommended force limits for machinery operation
- Specific for Europe:
  - 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).
  - Specific for E-Distribuzione and Italy:
    - 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 – Conessioni: forme e dimensioni
    - ENEL operative note PVR006 (bar code)
    - LM 1023 (double cable 245 kV clamp)
    - LM 1026 (single cable 245 kV clamp)
    - D.M. 1/12/1980 and subsequent modification D.M. 10/9/1981 “Disciplina dei contenitori a pressione di gas con membrane miste di materiale isolante e di materiale metallico, contenenti parti attive di apparecchiature elettriche”.
- Specific for e-distribución and Spain:
  - Real Decreto Riesgo Eléctrico 614/2001 sobre disposiciones mínimas para la protección de la salud y seguridad de los trabajadores frente al riesgo eléctrico
  - Reglamento Electrotécnico para Baja Tensión, Real Decreto 842/2002.
  - Reglamento de puntos de Medida Real Decreto 1110/2007.
  - Reglamento sobre condiciones técnicas y garantías de seguridad en instalaciones eléctricas de alta tensión, Real Decreto 337/2014.
  - IEC 60332 Métodos de ensayo para cables eléctricos y cables de fibra óptica sometidos a condiciones de fuego. Parte 1-1: Ensayo de resistencia a la propagación vertical de la llama para un conductor individual aislado o cable.
  - IEC 60754-1 and 60754-2 Ensayo de los gases desprendidos durante la combustión de materiales procedentes de los cables.

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- Reglamento sobre condiciones técnicas y garantías de seguridad en instalaciones eléctricas de alta tensión, Real Decreto 337/2014.
- NMC001: Procedimiento para el conexionado de armarios cuadros y paneles
- NNC007: Cables de control multipolares
- NNM001 – Normas de operación definiciones
- NZC001 – Procedimiento para la confección de proyectos de control y protección
- Specific for Brasil:
  - NR-10 - SEGURANÇA EM INSTALAÇÕES E SERVIÇOS EM ELETRICIDADE
- Specific for Colombia:
  - Resolución 9 0708 de Agosto 30 de 2013 con sus ajustes – REGLAMENTO TÉCNICO DE INSTALACIONES ELÉCTRICAS RETIE.
  - NTC 2050 Código Eléctrico Colombiano

## Notes:

- The above listed reference documents shall be intended in the in-force edition at the contract date (amendment included).
- For Latin America destinations the reference standards are the IEC/ISO, whilst for Europe destinations the reference standard are the correspondent European standards (EN).

## 5 ORGANIZATIONAL PROCESS POSITION IN THE PROCESS TAXONOMY

Value Chain/Process Area: Engineering and Construction

Macro Process: Devices and Components Development

Process: Standard Catalog Management

## 6 DEFINITIONS AND ACRONYMS

Acronym and Key words	Description
<b>Technical Conformity Assessment (TCA)</b>	A “conformity assessment” <sup>1</sup> with respect to “specified requirements” <sup>2</sup> 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

<sup>1</sup> Definition 2.1 of ISO/IEC 17000

<sup>2</sup> Definition 3.1 of ISO/IEC 17000



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	local applicable regulation and laws and possession of relevant requested certifications
<b>Type A documentation</b>	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
<b>Type B documentation</b>	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

**7 DESCRIPTION****7.1 COMPONENTS LIST**

The following CBs are covered by this global standard:

Type code	Rated voltage $U_r$ (kV)	Rated normal current $I_r$ (A)	Rated short-circuit breaking current $I_{sc}$ (kA)	Type of operation
GSCH001/1	72,5	2000	31,5	Three-pole
GSCH001/2	72,5	2000	40	Three-pole
GSCH001/3	145	2000	40	Single-pole
GSCH001/4	145	2000	40	Three-pole
GSCH001/5	145	3150	40	Three-pole
GSCH001/6	145	3150	50	Three-pole
GSCH001/7	170	2000	40	Single-pole
GSCH001/8	170	2000	40	Three-pole
GSCH001/9	245	2000	40	Single-pole
GSCH001/10	245	2000	40	Three-pole
GSCH001/11	245	3150	40	Single-pole
GSCH001/12	245	3150	40	Three-pole
GSCH001/13	145	2000	50	Three-pole
GSCH001/14	145	4000	40	Three-pole
GSCH001/15*	145	2000	40	Three-pole
GSCH001/16	245	3150	50	Three-pole

\* Vdc=220V and VCA=380/220V

For local components codification see annex A.



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## 7.2 SERVICE CONDITIONS

### 7.2.1 General service conditions

Unless otherwise specified, the reference service conditions are the outdoor normal service conditions of IEC 62271-1 (par. 2.1.2).

Minimum ambient air temperature (°C)	-25
SPS Class (IEC/TS 60815 series)	e (Very Heavy)
RUSCD (mm/kV)	53,7
Ice coating (mm)	10

### 7.2.2 Specific service conditions

#### 7.2.2.1 Colombia (Codensa)

The reference altitude is 2.600 m.

### 7.2.3 Seismic qualification level

Codensa	AF3 (IEC/TR 62271-300)
e-distribuzione	AF5 (IEC/TR 62271-300)



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### 7.3 TECHNICAL CHARACTERISTICS

In addition to IEC 62271-100, the following requirements are prescribed.

<b>Rated voltage <math>U_r</math> (kV)</b>	<b>72,5</b>	<b>145</b>	<b>170</b>	<b>245</b>
Rated short-duration power-frequency withstand voltage $U_d$ (kV rms):	140	275	325	460
Rated lightning impulse withstand voltage $U_p$ (kVp):	325	650	750	1050
Rated frequency $f_r$ (Hz)	, Edesur, E-distribución Distribución, and Enel Distribuzione		50	
	Enel Rio, Codensa, Enel Ceara, Sao Paulo		60	
Rated normal current $I_r$ (A)	See table in chapter 7			
Rated short-circuit breaking current $I_{sc}$ (kA)	See table in chapter 7			
First-pole-to-clear factor $k_{pp}$	1,5 (non-effectively earthed neutral system)			1,3
Rated operating sequence	O - 0,3 s - CO - 1 min – CO <sup>3</sup>			
Maximum break-time (ms)	60			
Circuit breaker class	C2 - E1 - M2			
Rated line-charging breaking current $I_l$ (A)	10	50	63	125
Rated cable-charging breaking current $I_c$ (A)	125	160		250
Rated out-of-phase making and breaking current $I_d$ (kA)	Clause 4.106 of IEC 62271-100			
Degrees of protection provided by enclosures	IP 54 <sup>4</sup>			
Rated supply voltage $U_a$ (Vdc)	Enel Distribuzione		110	
	E-distribución, Enel Rio, Enel Ceara, Sao Paulo, Codensa		125	
	Enel Sao Paulo*		48	
	Edesur, Enel Rio**		220	
d.c. maximum absorbed power (W)	2000			
Undervoltage release (if requested) dc max. abs. power (W/coil)	100			
Rated supply voltage for anti-	E-distribución and Enel		230	

<sup>3</sup> 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.

<sup>4</sup> Applicable also to the Control Box and to the Operating Device Box(es).

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condensation circuits (Vac)	Distribuzione	
	Enel Rio, Enel Ceara, Sao Paulo, Edesur	220
	Codensa	120
a.c. maximum absorbed power (VA)		250
Auxiliary contact classes (Table 6 IEC 62271-1)		1

\*For Enel São Paulo for code 305966 and 315884 use 48 Vdc

\*\*For Enel Rio de Janeiro for code 990217 use 220 Vdc

## 7.4 CONSTRUCTION CHARACTERISTICS

### 7.4.1 General characteristics

The CBs shall be manufactured in accordance with IEC 62271-100.

The dimensional drawings are in annex B, where are indicated:

- the main CBs binding dimensions;
- the metallic support (3 or 2 uprights, depending on the company);
- the external grounding connections;
- the cable shaft of the civil works.

The support, quoted separately, shall be always supplied when a seismic qualification level is required (see 7.2.3), otherwise it's an optional supply.

If interface plates and other accessories are necessary to adapt the support to the civil works, they shall be included in the supply of the support and shall be preliminary approved by Enel Group Distribution companies.

The poles naming shall be A, B, C, from left to right, looking the CB from the side with the main contact position indicators.

The normal use, control and maintenance operations shall be performed with total workers safety.

### 7.4.2 Insulators

The insulators are requested by Enel Group Distribution companies only in composite materials.

Insulators shall be in light grey color and compliant with IEC 62231. The envelope shall be made of silicone rubber, HTV type (High Temperature Vulcanized) or LSR type (Liquid Silicone Rubber) and completely free of EPDM or other organic rubbers

### 7.4.3 Additional requirements for vacuum CBs

The breaking elements shall have an expected life above 30 years.

If an insulation gas is present, the manufacturer shall declare:

- the type of gas used (chemical composition of gas or gas blend) and the rated filling pressure at 20 °C;
- the type of system (closed pressure system or sealed pressure system, in the second case with an expected life above 30 years).

### 7.4.4 Additional requirements for gas CBs

#### 7.4.4.1 Additional requirements for SF6 gas CBs

Generally the dielectric mean for insulation and arc extinction is SF6, with a pressure over the atmospheric one.

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The gas SF6 shall comply with IEC 60376 standard. The manufacturer has to provide the necessary instructions for use and handling of SF6, in accordance with Technical Report IEC IEC/TR 62271-303. In case of single-poles CB's a distinct SF6 circuit and connection for each pole is required.

In case of three-pole CB's the number of SF6 circuits and consequent connections is the following:

CB's rated voltage (kV)	Number of SF6 circuits			
	Latam	E-distribución	Enel Distributie	e-distribuzione
72,5	Unique for the 3 poles			
145	Unique for the 3 poles	One for each pole		
170	One for each pole			
245	One for each pole			

Each SF6 circuit shall provide a connection elements (type DILO VK/BG-03/8 or equivalent), 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 1.800 mm from the ground level).

The SF6 circuit piping shall be performed using stainless steel or, in alternative, painted copper, in order to reduce the stealing risk.

#### 7.4.4.2 Additional requirements for non-fluorinated greenhouse gases CBs

In alternative to the SF6, non-fluorinated greenhouse gases are also acceptable.

In case of single-poles CB's a distinct gas circuit and connection for each pole is required.

In case of three-pole CB's the number of gas circuits and consequent connections is the same of SF6 gas CBs (see table in 7.4.4.1).

Each gas circuit shall provide a connection elements (the manufacturer will propose a suitable type different from the one used for SF6, in order to avoid mistakes), with a non-return valve, both for gas control device and for gas filling/replenishment, provided by not-losable protection screw taps (located not higher than 1.800 mm from the ground level).

#### 7.4.4.3 Gas (SF6 or non-fluorinated greenhouse gases) density control

The CB is a closed pressure system. The relative leakage rate shall be  $Frel \leq 0,5\%$  per year. The value for the time between replenishments shall be at least 10 years.

It shall be possible to perform the gas replenishment with the equipment in service, avoiding the unwanted operation of the gas density control device.

Each pole and partition shall have a distinct Gas (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 ), 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 gas density control device shall be:

- suitable to work in the provided temperature range;
- located in order to avoid the solar radiation influence on the external temperature measuring;
- indicator needle cannot be tampered with.
- insensitive to the vibration produced by the equipments operation;

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- manufactured with stainless materials;
- realized in order to allow the functionality verification and the substitution with the poles under 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:

- 1<sup>st</sup> minimum gas density level: alarm (replenishment necessary) with 1 contacts;
- 2<sup>nd</sup> minimum gas density level: block (to get out of service) with 2 contacts working separately on 2 opening circuits (depending on specific requirements in chapter 7.10).

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

#### 7.4.4.4 Overpressure safety devices

Safety devices against the internal overpressure is mandatory only in case of ceramic insulators.

The devices shall be compliant with ISO 4126 and shall be 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.

#### 7.4.4.5 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 Enel 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  $0\div 1$  MPa, 0,5 class, minim resolution  $\pm 5$  kPa, accompanied with a calibration certificate;
- flexible tube 5 meters long, DN $\geq 8$ .

In case of non-fluorinated greenhouse gases, the manufacturer will propose a suitable solution compliant, when applicable, with the above mentioned requirements for the SF6 version.

### 7.4.5 Control Box and Operating Device Box(es)

The requested cabinets are the followings:

- a cabinet for control and interface with the remote control system (hereinafter "Control Box")
- cabinet(s) for the operating device (hereinafter "Operating Device Box"), 3 for single-pole CBs, 1 for three-pole CBs.

The Control Box can be physically integrated in the Operating Device Box (in one of the 3 operating device boxes in case of single-pole CBs).

#### 7.4.5.1 Control Box

The Control Box shall be fixed on the CB support, compatibly with the civil works. The CBs shall be equipped with proper conduits for the connection cables to the substation control system, from the Control Box to the existing cable shaft of the civil works; the minimum dimensions of the conduits shall be 100x50 mm.

All CBs auxiliary and control equipments shall be placed in the Control Box.

In addition to the IP requirement of table at chapter 7.3 the box protection degree with open doors shall be minimum IP2X.

**Application Areas**

Perimeter: *Global*  
 Staff Function: -  
 Service Function: -  
 Business Line: *Enel Grids*

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In addition to the dimensions shown in Annex B, the box base height respect to the ground shall be  $\geq 400$  mm and all HMI (Human Machine Interface) elements (controls and signalizations) shall be at  $\leq 1800$  mm.

The box interior shall be accessible from the front by mean of a door provided of handle and lock. The door (simple or double), hinged and equipped with an anti-wind system, shall be provided with a window in order to make visible from outside the signalization lamps. It shall be possible to open the door over  $90^\circ$ .

All accessories (hand-crank, document pocket etc.) shall be accommodated in the internal part of the box door.

All electric equipments 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.

In particular, the extractible ones, plug-in connector included, shall be provided with proper anti-mistake coding.

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.

The box internal wiring shall be performed with conductors with adequate section (always  $\geq 1\text{mm}^2$ ), flexible type, compliant with IEC 60332-3-24 and insulated at  $U_0/U = 450/750$  V.

The cable ends shall be provided of 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 ( $\geq 1,5\text{ mm}^2$ ), shielded, flexible, compliant with IEC 60332-3-24 and insulated at  $U_0/U = 0,6/1$  kV.

Inside the Control Box an internal collector (in tin-plated or nickel-plated copper, section  $\geq 60\text{ mm}^2$  and with M5 regular interval threaded hole) shall be present for the grounding connection of all cable shields; the manufacturer shall guarantee its effective connection to the CB grounding system.

The entrance of all cables (both CB's cables and control system cables) shall be from the Control Box bottom side, where a removable loophole (in aluminum, with useful dimension of  $150 \times 100$  mm) shall be provided.

The Control Box shall include:

- remote/local selector switch
- control buttons for circuit breaker, with the following colors:



**Application Areas**

Perimeter: *Global*  
 Staff Function: -  
 Service Function: -  
 Business Line: *Enel Grids*

Operation	Enel Distribución Chile, Codensa, Enel Perú, Edesur, E-distribución, Enel Distributie and Enel Distribuzione (according with IEC 60073)	Enel Rio, Enel Ceara, Enel Goiás, Enel São Paulo (according with NR10)
Closing	White	White "L" on Red white background
Opening	Black	White "D" on Green white background

- magneto-thermic automatic circuit breakers for the supplies protection (motors, lighting lamp, anti-condensation circuits – fuses are not admitted);
- interface terminal board for substation control system;
- anti-condensation circuit;
- internal lighting lamp, with automatic switching in case of open door;
- only in case of three gas circuits, gas density signalization lamps (for each gas circuit, yellow color about 1<sup>st</sup> minimum gas density level; red color about 2<sup>nd</sup> minimum gas density level);
- only in case of three gas circuits, lamps testing button.
- 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

The signalization lamps and the internal lighting lamps shall not be incandescent type.

The grounding of a dc supply polarity is not admitted.

The terminal boards shall be made with modular terminals. In particular, the terminals of control system interface terminal board shall have section 4 mm<sup>2</sup> for control, signalization and anti-condensation circuits and section 10 mm<sup>2</sup> for the motors supply circuit.

It shall be provided 2 bridged terminals couples for the anti-condensation circuit and 2 for the motor supply circuit.

If diodes are used for the circuit separations or for the voltage return protection, they shall have inverse voltage  $\geq 3$  kV.

The cable trucking systems for the internal wiring shall have sufficient residual space ( $\geq 10\%$  of used volume); the cables shall be anchored in some points on order to avoid their falling.

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.

#### 7.4.5.2 Latam specific requirements

The remote/local selector switch shall have auxiliary contacts.

The Control Box shall also include an electric socket output (Vac).

About the terminal boards, provision should be made for 20% of free terminals.

The control box shall also include auxiliary switch contacts to indicate CB position. The quantities of auxiliary contacts available (NO-Normally Open or NC-Normally Closed) for the different companies is indicated in Annex C.1.



**Application Areas**

Perimeter: *Global*  
 Staff Function: -  
 Service Function: -  
 Business Line: *Enel Grids*

**7.4.5.3 Enel Distribuzione specific requirements**

In alternative to IEC 60332-3-24, cables compliant with Italian standard CEI 20-22/2 and marked with "CEI 20-22 II" can be accepted.

It's necessary a space in the control box with a DIN bar width 150mm, height 200mm, depth 150mm for a device DV7203 (conversion digital signal in optical)

**7.4.5.4 E-distribución specific requirements**

For E-distribución the remote/local selector switch and the control buttons for opening and closing are not required in the CB. Please check Annex C.1

**7.4.5.5 Operating Device Box(es)**

The operating devices, the CB operation counters (mechanical, four-digits, not-resettable), the auxiliary electric equipments, the auxiliary contacts and the terminal boards (or connectors) shall be located: in a single cabinet for three-pole CBs; in 3 cabinet for single-pole CBs.

Each operating device box shall be equipped with spring loading condition signalization and with main contact position indicators, having the following characteristics:

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

During normal operation, with encloses and doors closed, the main contact position indicators and the spring loading condition signalization shall be visible from ground level.

In order to allow the verification, during maintenance activity, of the unchanged characteristics of the no-load travel curve (see note in 7.14.2-11b), manufacturer shall provide the measuring points, properly machined.

In addition to the IP requirement of table at chapter 7.3, the box(es) protection degree with open doors or when using hand-crank (to charge CB's springs) 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 casings, IP2X, in order to prevent the access to parts in movement (see par. 5.13.1 of IEC 62271-1).

The manufacturer shall provided the instruction for a safety access to mechanical organs.

**7.4.5.6 Latam specific requirements**

The operation counter can be mechanical or electromechanical.

**7.5 Nameplates**

Par. 5.10 of IEC 62271-100 apply, specifying that both CB nameplate and operating devices nameplates shall include:

- the optional values;
- the Enel Group type code (see table in chapter 7) and the local components codification (see Annex A).

For traceability purpose, if the Control Box is not integrated in the Operating Device Box(es), in the internal part of the Control Box door shall be located a self-adhesive nameplate with the following information:

**Application Areas**

Perimeter: *Global*  
 Staff Function: -  
 Service Function: -  
 Business Line: *Enel Grids*

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- box manufacturer;
- serial number of the Control Box;
- year of construction.

**7.5.1 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.

**7.5.2 European countries specific requirements**

If applicable, an informative nameplate with the sentence “*Contains fluorinated greenhouse gases covered by the Kyoto Protocol*” (in accordance with Commission Regulation (EC) 1494/2007 of 17 December 2007) shall be provided.

**7.6 HV terminals****7.6.1 Latam**

The HV terminals 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  $\varnothing$  14.3mm
- Distance between holes 44.5mm

**7.6.2 E-distribución**

The HV terminals shall be compliant with fig. 6 (2x4 hole pattern) of IEC/TR 62271-301.

**7.6.3 Enel Distribuzione**

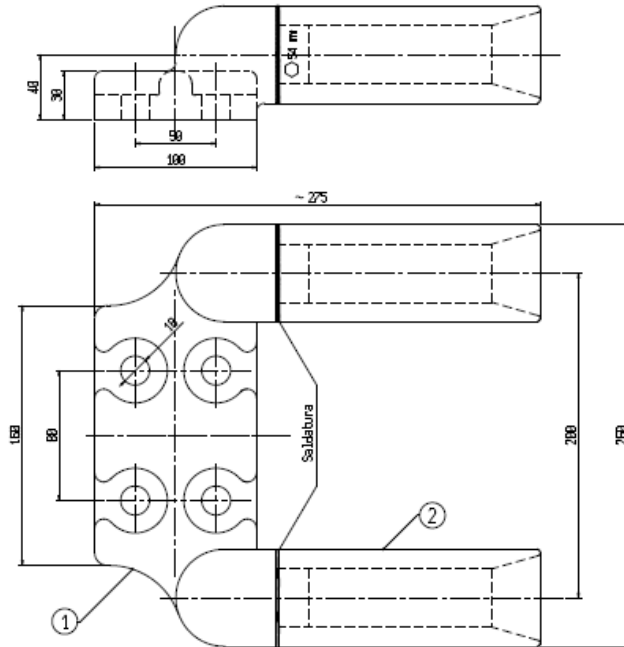
The HV terminals shall be realized with corrosion resistant copper or aluminum alloy, in order to be interfaced with aluminum alloy clamps.

For CBs up to 170 kV the HV terminals shall have  $\varnothing$  40  $\pm$ 0,25 X 80 min (mm) (fig. 1 of IEC/TR 62271-301) dimensions.

For 245 kV CBs the HV terminals shall be suitable to be interfaced with standardized Enel clamps LM 1023 (double cable) and LM 1026 (single cable).

**Application Areas**

Perimeter: *Global*  
 Staff Function: -  
 Service Function: -  
 Business Line: *Enel Grids*

**7.7 Grounding**

The manufacturer shall ensure the equi-potentiality between all parts forming the equipment.

At the base of each support upright two grounding points shall be provided, equipped with M12 stainless steel bolts (included in the supply).

If interface plates are necessary to adapt the support to the civil works, they shall be designed taking into account the position of the external grounding connections (see Annex B).

**7.8 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, controlled by a thermostat with fixed regulation at 25 °C (box internal temperature), shall be unique for the overall equipment, supplied in a.c. (see table in chapter 7.3; **Error! No se encuentra el origen de la referencia.** for the supply rated voltage) and protected with a magneto-thermic automatic circuit breaker.

The heating elements shall be preferably connected in series in order to have the circuit opening in case of failure of an element; a minimum current sensor shall detect and signal the anomaly.

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.

**7.8.1 E-distribución specific requirements**

For the heating system, the minimum current sensor is not necessary. See Annex C.1.

**7.9 Protective treatments**

All external surfaces shall have an effective and enduring anti-corrosion protection.

**Application Areas**

Perimeter: *Global*  
 Staff Function: -  
 Service Function: -  
 Business Line: *Enel Grids*

All iron parts (e.g. support, Control Box, Operating Device Box(es), bolts etc.) shall be in non-corrosive material 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 prove its fitness.

The metallic elements in contact between them shall be designed in order to avoid corrosion due to humidity galvanic effect.

**7.9.1 Latam specific requirements**

In Brazil (Enel Rio y Enel Ceara) there is atmospheric corrosive environments "Very High" (C5- ISO 9223 and ISO 12944). Thus, in case of hot dip galvanized steel for control box or cabinet, it will apply a system of painting with ink wash primer, primer and finishing, with a minimum total thickness of 100 µm.

**7.10 FUNCTIONAL CHARACTERISTICS****7.10.1 Operating Devices***7.10.1.1 General requirements*

The CB controls shall be realized in order to be managed both remotely and locally. For this purpose a selector switch shall be located in the Control Box for the operation type choice: remote or local (hereinafter "remote/local selector switch"<sup>5</sup>).

In "remote" position the remote controls are enabled and the local controls are disabled. In "local" position the enabling are the opposite.

The switch operation shall not cause unwanted equipment operations.

The local operation of circuit breakers (three-pole operations, it shall not be possible to operate locally single-pole operations) shall be controlled by the push-buttons located in the Control Box (see 7.4.5.1).

During normal operation temporary block signalizations shall not be sent to the control system.

The CBs operating device shall be spring type, three-pole or single-pole type.

The operating device energy storage shall be normally made by mean of a d.c. electric motor (see table in chapter 7.3 for the supply rated voltage); when necessary it shall be possible to restore manually the operating device energy, with a maximum effort below 250 N. The manual device shall exclude the motor operation, or in alternative shall be designed excluding its possible movement in case of unexpected spring operation.

All releases, both for closing and for opening, shall not work with a signal duration ≤ 3 ms.

The CBs operating device shall be able to perform the following cycles<sup>6</sup>:

- 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;

<sup>5</sup> the words "remote" and "local" have to be translated in all documents as:

- Italian language:      "*Servizio*" (S)      and      "*Prova*" (P)
- Spanish language:    "*Remoto*"            and      "*Local*"
- Portuguese language: "*Remoto*"            and      "*Local*"

<sup>6</sup> with the CB closed the opening springs shall be always charged.

**Application Areas**

Perimeter: *Global*  
 Staff Function: -  
 Service Function: -  
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- O with CB closed and opening springs charged.

The single-pole CBs shall be equipped with a device for the signalization of poles not being in the same position (closed or open).

#### 7.10.1.2 *E-distribución specific requirements*

The selector is located in a centralized control box, for this reason it's not necessary the local-manual-remote selector in the control box. For the same reason the open-close buttons are not necessary. See Annex C.1.

### 7.10.2 Release drive circuits

#### 7.10.2.1 *General requirements*

The release drive circuits typologies are (see specific requirements for details):

- drive circuit of shunt closing release;
- drive circuit of shunt opening release;
- drive circuit of under-voltage release (if required in local requirements sections).

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.

If during an operation an opposite operation request is received, the consent to 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 be over the required limits).

The closing circuit shall be equipped with anti-pumping devices (1 for three-pole CBs and 3 for single-pole 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).

#### 7.10.2.2 *Latam specific requirements*

The circuit breaker will be provided with two opening and independent coils.

Function trip circuit supervision: it shall be possible, if not supplied with the CB, to install a monitoring open circuit device, which aim to explore safely and permanently in the continuity of such circuits open, regardless of the CB position (open or closed), so that the open operation results in all cases satisfactory.

It shall be possible to perform the CB closing and opening (when H.V. and d.c. supplies are off, i.e. due to a fault) by means of (safety located) hand operated levers or buttons.

For Enel Brasil: capacitive source for circuit breaker opening. (Capacitive trip)

For Enel Rio, Goias, Ceará and São Paulo: Required to have coil supervision, with supervision relay for opening and closing coils 1 and 2. Other requirements for different companies are in Annex C.1.

#### 7.10.2.3 *E-distribución specific requirements*

The circuit breaker will be provided with two opening and independent coils.

It shall be possible to perform the CB closing and opening (when H.V. and d.c. supplies are off, i.e. due to a fault) by means of (safety located) hand operated levers or buttons.

#### 7.10.2.4 *Enel Distribuzione specific requirements*

The three-pole CBs shall be provided with the following drive circuits:

- a) N° 1 drive circuit of shunt closing release;
- b) N° 1 drive circuit of shunt opening release;

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 Staff Function: -  
 Service Function: -  
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- c) N° 1 drive circuit of under-voltage release.

The single-pole CBs shall be provided with the following drive circuits:

- a) N° 1 drive circuit of shunt closing release;  
 b) N° 2 drive circuits of shunt opening release;  
 c) N° 1 drive circuit of under-voltage release.

The three-pole CBs can be installed only in transformer's bay.

The single-pole CB can be installed both in line's bay and in transformer's bay, selecting the service type by mean of a selector switch named "43LT" included in the Control Box: in case of transformer's bay use the selector switch will be in "T" position; in case of line's bay use the selector switch will usually be in "L" position (in case of line bays in substations looking out to substations with HV SF6 GIS, it shall be used single-pole CBs with the L/T selector switch in "T" position).

The single-pole CBs shall be provided of a congruency check (and consequent alarm) between the L/T selector switch position and the under-voltage release manual lock/unlock devices position.

The three-pole CBs shall be provided of an alarm signalization in case of under-voltage release manually locked.

It shall be possible to manually lock/unlock the under-voltage release by mean of a device provided of the "bloccato"/"sbloccato" indication. This device shall be located externally to the Operating Device Box and shall be maneuverable from the ground level. It shall be possible to operate this device with the CB in service and without causing an unwanted opening.

In the functional scheme it shall be provided the locked under-voltage release signalization.

Under-voltage releases consisting of energy storage systems (for example capacitors) are not admitted.

The CB closing consensus shall be interdict in case of under-voltage release drive circuit not supplied or locked (only if "43LT" selector is in "T" position, see flowcharts in annex C.2).

### 7.10.3 Interlocking devices

#### 7.10.3.1 General requirements

All operations shall be dependent to the internal CB interlockings.

The following interlocking circuits shall be provided, depending on the monitored values (springs status, gas pressure etc.):

- reclosing
- closing
- opening or, if required, automatic opening with open position blocking.

Further details are in the specific requirements.

#### 7.10.3.2 Latam specific requirements

For the interlocking requirements refer to the annex C.1.

#### 7.10.3.3 E-distribución specific requirements

For the interlocking requirements refer to the annex C.1.

#### 7.10.3.4 Enel Distribuzione specific requirements

For the interlocking devices and for the automatic opening with open position blocking, IEC 62271-100 applies with the clarifications in the following.

The following interlockings are requested:

- a) Closing block (enabled in both positions of the remote/local selector switch)
- b) Opening block (enabled in both positions of the remote/local selector switch) or in alternative automatic opening with open position blocking (enabled only in remote position of the remote/local selector switch)

The refresh shall occur automatically only after the ending of the condition causing the block.

**Application Areas**

Perimeter: *Global*  
 Staff Function: -  
 Service Function: -  
 Business Line: *Enel Grids*

Both during normal CB working and during operations shall not be sent to the control system temporary block signalizations.

7.10.3.4.a) *Closing block*

The closing block shall be activated if one of the following conditions occur:

- a) 2<sup>nd</sup> minimum gas density level (only in case of gas CBs);
- b) discharged closing springs (at least one of the three springs in case of single-pole CBs).

In case of three-pole CBs or single-pole CBs with L/T selector switch in "T" position, the closing block shall be activated also in the following conditions:

- a) drive circuit of under-voltage release not supplied;
- b) under-voltage release mechanically locked (at least one of the three releases in case of single-pole CBs).

In case of single-pole CBs with L/T selector switch in "L" position, the closing block shall be activated also in the following conditions:

- a) at least one of the three under-voltage releases mechanically locked.

7.10.3.4.b) *Opening block*

In case of single-pole gas CBs with L/T selector switch in "L" position, the opening block shall be activated in case of 2<sup>nd</sup> minimum gas density level intervention.

7.10.3.4.c) *Automatic opening with open position blocking*

In case of three-pole gas CBs or single-pole gas CBs with L/T selector switch in "T" position, the automatic opening with open position blocking shall be activated in case of 2<sup>nd</sup> minimum gas density level intervention.

The automatic openings operate in the same time:

- a) for three-pole CBs, on the shunt release and on the under-voltage release;
- b) for single-pole CBs, only on the shunt releases.

**7.11 Electric schemes, controls and signalizations****7.11.1 General requirements**

The electric schemes shall:

- a) be represented in the reference conventional conditions:
  - a.1) CB in open position;
  - a.2) absence of a.c. and d.c. auxiliary supplies;
  - a.3) gas absence (only for gas insulated CBs – SF6 or non-fluorinated greenhouse gases);
  - a.4) all coils and releases are non-excitation and uncharged
  - a.5) absence of HV;
  - a.4) closing springs discharged;
  - a.8) Selector switch 'manual-local-remote' in 'remote' position. Removable key selector only in manual position;
  - a.9) aux.switch is in the state when its corresponding primary equipment is at opening position
  - a.10) operation buttons of every primary equipment are at reset position
  - a.11) when the control box door is open, the light is on
  - a.12) Automatic temperature and humidity controller (if any), heaters are on standby
    - a.6) in case of micro-switches with the state dependent on the opening/closing of the boxes/carters of operating devices, they shall be represented disable (that is with boxes/carters open).
  - a.14) unlocked under-voltage release (when requested) for CB.



**Application Areas**

Perimeter: *Global*  
 Staff Function: -  
 Service Function: -  
 Business Line: *Enel Grids*

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- b) report, only for gas CBs, 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) contain the functional scheme, all information useful to identify the single wires and cables, 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:

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

Further details are in the specific requirements and in annex C.

7.11.1.1 *Latam specific requirements*

The details of the requirements are in the annex C.1.

7.11.1.2 *E-distribución specific requirements*

The details of the requirements are in the annex C.1.

7.11.1.3 *Enel Distribuzione specific requirements*

7.11.1.3.a) *Electric schemes*

The electric schemes are indicatively represented (where applicable in case of vacuum CBs) in Figure 3 (for three-pole CBs), Figure 4 (for 72,5 ÷ 170 kV single-pole CBs) and Figure 5 (for 245 kV single-pole CBs) of Annex C.2. In these figures are also represented the two versions of “E” interface terminal board for substation control system.

Further reference conventional conditions are:

- a) for remote/local selector switch: S/P switch in S position and L/T switch (if present) in L position;
- b) unlocked under-voltage release for three-pole CBs;
- c) locked under-voltage releases for single-pole CBs.

7.11.1.3.b) *Controls*

The CBs operating logics are represented in the flowcharts in Annex C.2 (where applicable in case of vacuum CBs).

It shall be reported in the terminal board the contacts referred to the following controls:

- a) single-pole CBs
  - a.1) drive circuit of shunt closing release control (CH-ABC)
  - a.2) 1<sup>st</sup> drive circuit of shunt opening release control (1° AP-A; 1°AP- B; 1°AP-C)
  - a.3) 2<sup>nd</sup> drive circuit of shunt opening release control (2° AP-ABC)
  - a.4) 3<sup>rd</sup> drive circuit of under-voltage release control (3° AP-ABC)



**Application Areas**

Perimeter: *Global*  
 Staff Function: -  
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- b) three-pole CBs
  - b.1) drive circuit of shunt closing release control (CH-ABC)
  - b.2) 1<sup>st</sup> drive circuit of shunt opening release control (1° AP-ABC)
  - b.3) 3<sup>rd</sup> drive circuit of under-voltage release control (3° AP-ABC)

7.11.1.3.c) *Signalizations*

It shall be reported in the terminal board the contacts referred to the following signalizations:

- a) single-pole CBs
  - a.1) remote/local selector switch in local (P) position (43SP-Prova)
  - a.2) intervention of motor protection device and/or auxiliary supply missing (42RT)
  - a.3) anti-condensation circuit anomaly (AnR152)
  - a.4) motor maximum operation time (BX)
  - a.5) discharged springs (P4 MOLLE)
  - a.6) 1<sup>st</sup> minimum gas density level (P1 GAS)
  - a.7) 2<sup>nd</sup> minimum gas density level (P4 GAS)
  - a.8) open position (caX152)
  - a.9) close position (ccX152)
  - a.10) poles discrepancy (DP)
  - a.11) incongruence of drive circuit of under-voltage release control (3°AP-INC)
  - a.12) locking of drive circuit of under-voltage release control (BL3°AP-ABC)
  - a.13) open position (n° 3 152 NC)
  - a.14) close position (n° 3 152 NA)
- b) three-pole CBs
  - b.1) remote/local selector switch in local (P) position (43SP-Prova)
  - b.2) intervention of motor protection device and/or auxiliary supply missing (42RT)
  - b.3) anti-condensation circuit anomaly (AnR152)
  - b.4) motor maximum operation time (BX)
  - b.5) discharged springs (P4 MOLLE)
  - b.6) 1<sup>st</sup> minimum gas density level (P1 GAS)
  - b.7) 2<sup>nd</sup> minimum gas density level (P4 GAS)
  - b.8) open position (caX152)
  - b.9) close position (ccX152)
  - b.10) locking of drive circuit of under-voltage release control (BL3°AP-ABC)
  - b.11) open position (n° 3 152 NC)
  - b.12) close position (n° 3 152 NA)

7.11.1.3.d) *Specific requirements for 245 kV CBs*

In case of single-pole CBs, the 2<sup>nd</sup> drive circuit of shunt opening release shall work in single-pole way and shall be, including everything is connected to it, galvanically separated respect to all other control and signalization circuits.

About the two 2<sup>nd</sup> minimum gas density level contacts, the 2<sup>nd</sup> circuit contact shall operate by mean of a suitable separator relay also on the terminal board signalizations of the 1<sup>st</sup> circuit, as well as on the closing block.

**Application Areas**

Perimeter: *Global*  
 Staff Function: -  
 Service Function: -  
 Business Line: *Enel Grids*

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**7.12 TESTING****7.12.1 General information**

IEC 62271-100 applies.

The tests to be performed on CBs are divided in:

- Type tests;
- Routine tests;
- Commissioning tests.

**7.12.2 Type tests***7.12.2.1 Visual inspection*

The CB, 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.

*7.12.2.2 Dielectric tests*

(IEC 62271-100 par. 6.2)

*7.12.2.3 Radio interference voltage (r.i.v.) tests*

(IEC 62271-100 par. 6.3)

Not applicable for 72,5 kV CBs.

*7.12.2.4 Measurement of the resistance of the main circuit*

(IEC 62271-100 par. 6.4)

It shall be measured the contact resistance between each HV terminal and the correspondent CB plate: the measured value shall be  $\leq 10 \mu\Omega$ .

*7.12.2.5 Temperature-rise tests*

(IEC 62271-100 par. 6.5)

The temperature rise test shall be performed excluding the HV terminals.

*7.12.2.6 Short-time withstand current and peak withstand current tests*

(IEC 62271-100 par. 6.6)

*7.12.2.7 Verification of the degree of protection*

(IEC 62271-100 par. 6.7)

*7.12.2.8 Tightness tests*

(IEC 62271-100 par. 6.8)

Only in case of gas CBs ( SF6 or non-fluorinated greenhouse gases).

The test must be done using test Qm, method 1 "Cumulative Test", IEC 60068-2-17.

The initial gas concentration Co, with CB filled at rated pressure, shall be measured after at least 2 hours from pressurizing; the final concentration C1 must be measured after more than 8 hours.

*7.12.2.9 Electromagnetic compatibility (EMC) tests*

(IEC 62271-100 par. 6.9)

*7.12.2.10 Additional tests on auxiliary and control circuits*

(IEC 62271-100 par. 6.10)

For this verification the manufacturer shall provide a paper copy of the CB electric schemes.

The correct operation of all controls, interlocking, automatic openings and signalizations shall be also verified.

**Application Areas**

Perimeter: *Global*  
 Staff Function: -  
 Service Function: -  
 Business Line: *Enel Grids*

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

- 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 absorption curves of the motors, taking note of the maximum values (inrush excluded) and of the springs charging times, shall be registered in the following situations:

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

#### 7.12.2.11 *Mechanical and environmental tests*

(IEC 62271-100 par. 6.101)

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 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.

#### 7.12.2.12 *Short-circuit current making and breaking tests*

(IEC 62271-100 par. 6.102 to 6.106)

#### 7.12.2.13 *Critical current tests*

(IEC 62271-100 par. 6.107)

If applicable (see 6.107.1)

#### 7.12.2.14 *Single-phase and double-earth fault tests*

(IEC 62271-100 par. 6.108)

#### 7.12.2.15 *Short-line fault tests*

(IEC 62271-100 par. 6.109)

#### 7.12.2.16 *Out-of-phase making and breaking tests*

(IEC 62271-100 par. 6.110)

#### 7.12.2.17 *Capacitive current switching tests*

(IEC 62271-100 par. 6.111)

#### 7.12.2.18 *X-radiation test procedure for vacuum interrupters*

(IEC 62271-1 par. 6.11)

Only in case of vacuum CBs.

#### 7.12.2.19 *Seismic qualification*

If requested, CBs (including the support) shall be compliant with seismic qualification, according with standards listed in 7.2.3.

**Application Areas**

Perimeter: *Global*  
 Staff Function: -  
 Service Function: -  
 Business Line: *Enel Grids*

**7.12.2.20 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.

**7.12.2.21 Tests on insulators**

The ceramic insulators shall be tested in accordance with IEC 62155.

The composite insulators shall be tested in accordance with IEC 61462.

**7.12.2.22 Specific type tests****7.12.2.22.a) *Enel Distribuzione*****7.12.2.22.a.1 Tests to verify the enclosures endurance to gas internal pressure**

Only in case of gas CBs.

On the number and typologies of encloses provided by D.M. 1/12/1980 and subsequent modifications, it shall be performed the required tests to obtain INAIL (ex-ISPESEL) certification for the verification of encloses endurance to gas internal pressure.

**7.12.3 Routine tests**

The Routine tests (also called acceptance tests) shall be made in the manufacturer's factory on each apparatus supplied, to ensure the product compliance with the sample approved during the conformity assessment (homologation, certification etc.) process and on which the type tests have been performed.

Test values/results shall be in compliance with rated values (and relative tolerances).

The manufacturer shall provide, for each CB supplied, the report of all measures and tests carried out.

**7.12.3.1 *Dielectric test on the main circuit***

(IEC 62271-100 par. 7.1)

**7.12.3.2 *Tests on auxiliary and control circuits***

(IEC 62271-100 par. 7.2)

Functional tests (par. 7.2.2 of IEC 62271-1) shall be done only at rated voltage. About density meters, the verification shall be performed at ambient temperature, in the real operating position, using nitrogen and no SF<sub>6</sub>, with decreasing pressure values. The density meters verification can be also performed using SF<sub>6</sub>, if precautions are taken to prevent SF<sub>6</sub> dispersion in the environment.

Dielectric tests (par. 7.2.4 of IEC 62271-1) shall be done 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.

**7.12.3.3 *Measurement of the resistance of the main circuit***

(IEC 62271-100 par. 7.3)

It shall be performed after mechanical operating tests.

The ambient temperature influence can be neglected.

The test can be performed without HV terminals, specifying it in the test report.

**7.12.3.4 *Tightness test***

(IEC 62271-100 par. 7.4)

It shall be performed at least at 2<sup>nd</sup> minimum gas density level (block).

**7.12.3.5 *Design and visual checks***

(IEC 62271-100 par. 7.5)

The checks shall be performed referring to conformity assessment (homologation, certification etc.) documents and verifying damage absence.

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Perimeter: *Global*  
 Staff Function: -  
 Service Function: -  
 Business Line: *Enel Grids*

**7.12.3.6 Mechanical operating tests**

(IEC 62271-100 par. 7.101)

It shall be recorded:

- a. at  $V_{max}$ ,  $V_n$ ,  $V_{min}$ , closing (C) and opening (O) times, time spread (on each release);
  - a1. at  $V_{max}$ ,  $V_n$ ,  $V_{min}$ , opening (O) times, time spread of under-voltage release (if present – see 7.12.2.11) and it shall be verified its compliance with IEC 62271-1 par. 5.8.4;
- b. at  $V_n$ , close-open (CO) time and open-close-open (O – t - CO) cycle;
- c. at  $V_n$ , 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 spring recharging time of the motor after a closing operation and its absorption (maximum value, inrush excluded) shall be measured only at  $V_n$ .

**7.12.3.7 Protective treatments**

The thickness of the protective coatings shall be verified according with 7.12.2.20.

**7.12.3.8 Specific routine tests****7.12.3.8.a) Enel Distribuzione****7.12.3.8.a.1 Tests to verify the encloses endurance to gas internal pressure**

Only in case of gas CBs.

Manufacturer shall provide the “*Certificazione di rispondenza*” (see D.M. 1/12/1980).

**7.12.4 Commissioning tests**

(IEC 62271-100 par. 10.2)

The Commissioning tests (also called on-site acceptance tests) shall be performed in the Enel Group Distribution Company plant on each apparatus supplied, after its installation.

The manufacturer, at the end of the on-site tests, will deliver the report containing the results of measures and tests performed on the CB.

This report, in paper and in electronic format (e.g. one or more “pdf” files) shall include also factory routine tests.

**7.12.4.1 Visual inspection, general checks and functionality test of the auxiliary and control circuits**

The correct assembling (performed in accordance with manufacturer’s drawings and instructions), the damages absence and the presence of all accessories and of the required documentation shall be verified.

Functionality tests of the auxiliary and control circuits shall be performed after dielectric tests. About density meters, the verification shall be performed with the same modalities of the routine test (see 7.12.3.2), paying attention to the ambient conditions (solar radiation, temperature) and, in case of three density meters, comparing between them the intervention threshold pressure measured values.

**7.12.4.2 Mechanical Operating Tests**

Before mechanical operating tests 10 C-O cycles on each release shall be performed.

It shall be recorded:

- a. at  $V_{max}$ ,  $V_n$ ,  $V_{min}$ , closing (C) and opening (O) times, time spread (on each release);
  - a1. at  $V_{max}$ ,  $V_n$ ,  $V_{min}$ , opening (O) times, time spread of under-voltage release (if present – see 7.12.2.11) and it shall be verified its compliance with IEC 62271-1 par. 5.8.4;
- b. at  $V_n$ , close-open (CO) time and open-close-open (O – t - CO) cycle;
- c. at  $V_n$ , 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.

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

**Application Areas**

Perimeter: *Global*  
 Staff Function: -  
 Service Function: -  
 Business Line: *Enel Grids*

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**7.12.4.3 Dielectric tests to the auxiliary and control circuits**

Dielectric tests (par. 7.2.4 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.

**7.12.4.4 Measurement of resistance to the main circuit**

It shall be performed after mechanical operating tests.

The ambient temperature influence can be neglected.

The test have to be performed with HV terminals on CB plate.

It shall also be measured the contact resistance between each HV terminal and the correspondent CB plate: the measured value shall be  $\leq 10 \mu\Omega$ .

**7.12.4.5 Tightness test**

Only in case of gas CBs (SF6 or non-fluorinated greenhouse gases).

It shall be performed at rated pressure.

The test have to be done 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 (HV insulators have been checked in manufacturer's factory).

The sensitivity of the sniffing device shall be at least  $10^{-8} \text{ Pa} \times \text{m}^3/\text{s}$ .

**7.13 SUPPLY REQUIREMENTS****7.13.1 Tender's technical documentation**

For each CB typology offered in the tender the supplier shall provide the Annex D properly filled.

**7.14 TECHNICAL CONFORMITY ASSESSMENT****7.14.1 Technical Conformity Assessment process**

The conformity assessment processes (homologation, certification etc.) are specified in the proper contractual documents and GSCG002.

**7.14.2 Technical Conformity Assessment documentation**

The project documentation that the supplier uses to manufacture each CB typology can be divided in Type A documents (public, not confidential) and Type B document (confidential).

For each Enel Group Distribution company requesting a specific CB typology, the manufacturer shall provide a specific documentation set according with the specific requirements stated in this document.

The Type A documentation shall consist at least in:

- 1) type A documents list;
- 2) type B documents list;
- 3) Annex D properly filled;
- 4) overall dimensions drawing, including the stresses transmitted to the foundations;
- 5) insulators drawings and characteristics;
- 6) electric diagram (low voltage components list included);
- 7) Control Box and Operating Device Box(es) layout drawings;
- 8) overall CB, Control Box and Operating Device Box(es) (with open/closed doors) pictures;
- 9) nameplate and labels drawings (Control Box and Operating Device Box(es), poles, coils etc.);
- 10) CBs installation, use and maintenance handbook/manual;
- 11) routine and commissioning tests:



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 Staff Function: -  
 Service Function: -  
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- a) test report form (two documents, one for factory tests and one for on-site tests);
- b) reference values table (with tolerances);  
 Note: specific detailed instructions to verify the no-load travel curves during maintenance activity shall be included in CB's manual;
- c) protective coatings (typology, minimum thickness, reference standards);
- 12) documentation of safety device for protection against pole excessive pressure (ISO 4126, only if present);
- 13) list of documentation, materials and accessories supplied;
- 14) only for gas CBs:
  - a) gas circuit(s) drawing;
  - b) gas density control device characteristics and drawings;
  - c) pressure/temperature table for rated density level, 1<sup>st</sup> minimum gas density level and 2<sup>nd</sup> minimum gas density level;
- 15) main sub-components suppliers list;
- 16) only for e-distribuzione, INAIL (ex ISPESL) Certification "Certificato di conformità del prototipo" - D.M. 01/12/1980;
- 17) only for e-distribuzione, Manufacturing and Control Plan (PFC).
- 18) Only for e-distribuzione Seismic calculations for the support
- 19) Only for E-distribución: List of components in the Control Box and data sheet of each one

**7.15 Packaging, transport, storage and installation/testing**

Par. 10.1 and 10.2 of IEC 62271-100 applies.

CB's 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) Enel component codification (see Annex A; i.e.: GSH001/1 - XXXXX);
- 6) contract number;
- 7) destination substation;
- 8) total weight;
- 9) lifting information (showing the points and the correct method of lifting);
- 10) only for Enel Distribuzione, the bar code, in accordance with PVR006.

With each CB the following items shall be supplied (items from 3 to 8 on paper):

- 1) the support structure (only if requested, including any interface plates if necessary) and the anchor bolts to the civil works (stainless or hot dip galvanized steel, chemical or expansion type);
- 2) springs hand-crank (and other tools according to the manufacturer design);
- 3) list of documentation, materials and accessories supplied;
- 4) overall dimensions drawing;
- 5) electric diagram;
- 6) CB installation, use and maintenance handbook/manual;



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- 7) routine and commissioning tests:
  - a) routine (factory) test reports;
  - b) reference values table (with tolerances);
- 8) only for gas CBs:
  - a) dielectric gas;
  - b) pressure/temperature table for rated density level, 1<sup>st</sup> minimum gas density level and 2<sup>nd</sup> minimum gas density level;

Waste (including packaging and the gas cylinders) shall be disposed by Manufacturer.





## Application Areas

Perimeter: *Global*  
 Staff Function: -  
 Service Function: -  
 Business Line: *Enel Grids*

## ANNEX A – LOCAL COMPONENTS CODIFICATION

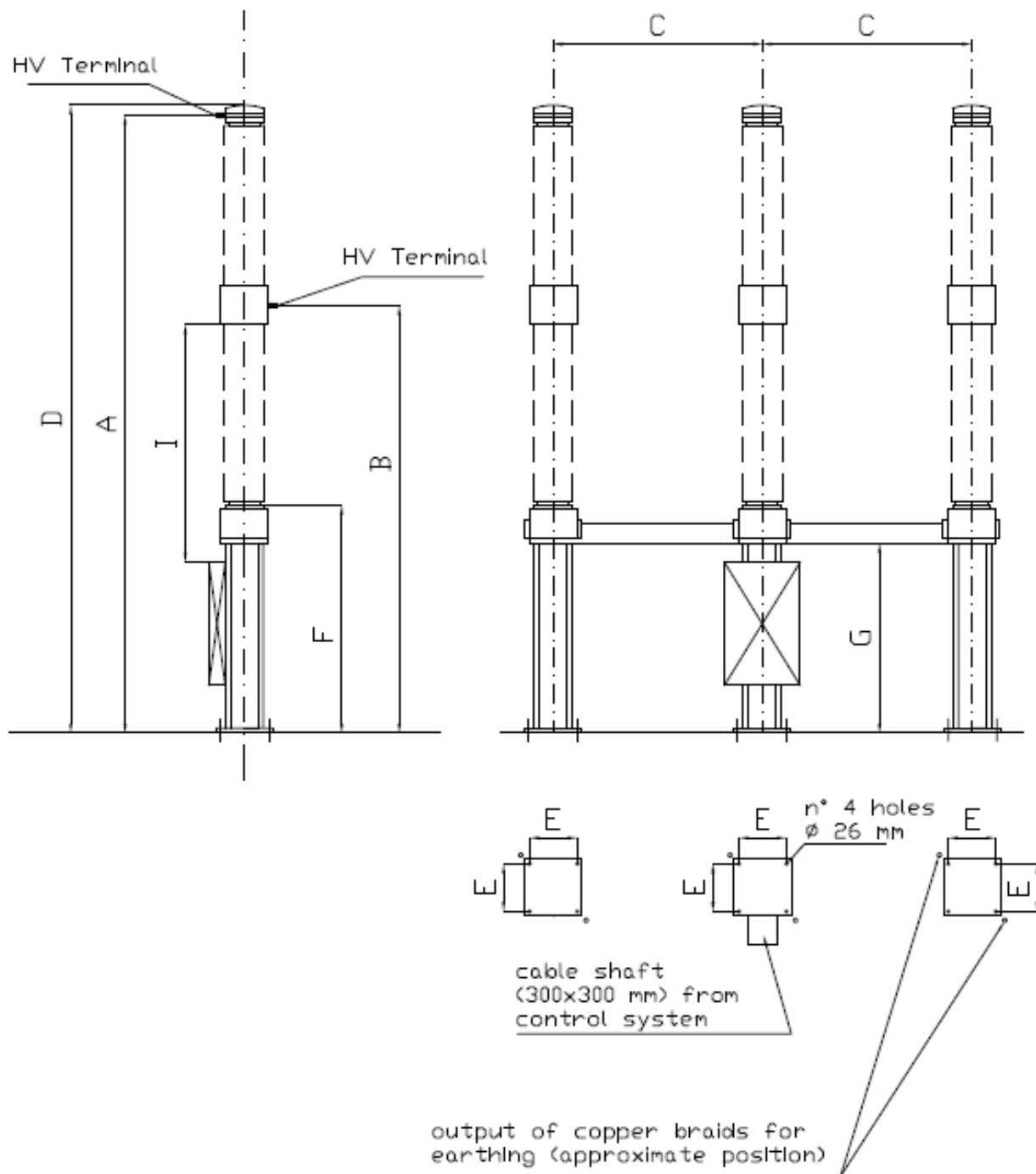
Type code	Ur (kV)	Ir (A)	Isc (kA)	Operation	Edesur	Enel Rio	Ceará	Sao Paulo	Codensa	Enel Distribuz.	E-distribución
GSCH001/1	72,5	2000	31,5	Three-pole		150740	150740				140032
GSCH001/1 (SF6 FREE)	72,5	2000	31,5	Three-pole							150562
GSCH001/2	72,5	2000	40	Three-pole							
GSCH001/3	145	2000	40	Single-pole						150126	140033
GSCH001/3 (SF6 FREE)	145	2000	40	Single-pole						150027	
GSCH001/4	145	2000	40	Three-pole		150755		305965 305966	150640	150127	140034
GSCH001/4 (SF6 FREE)	145	2000	40	Three-pole					150124	150026	150552
GSCH001/5	145	2000	40	Three-pole	0103-2500	150143	150143	161765 315884			140035
GSCH001/5 (SF6 FREE)	145	3150	40	Three-pole							150563
GSCH001/6	145	3150	50	Three-pole					150106		
GSCH001/7	170	2000	40	Single-pole						150186	
GSCH001/8	170	2000	40	Three-pole						150187	
GSCH001/9	245	2000	40	Single-pole						150196	
GSCH001/10	245	2000	40	Three-pole					150612	150197	
GSCH001/11	245	3150	40	Single-pole	0103-0303						
GSCH001/12	245	3150	40	Three-pole							
GSCH001/13	145	2000	50	Three-pole		150990					
GSCH001/14	145	4000	40	Three-pole		150969					
GSCH001/15	145	2000	40	Three-pole		990217					
GSCH001/16	245	3150	50	Three-pole							



**Application Areas**

Perimeter: *Global*  
 Staff Function: -  
 Service Function: -  
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**ANNEX B – DIMENSIONAL DRAWINGS**

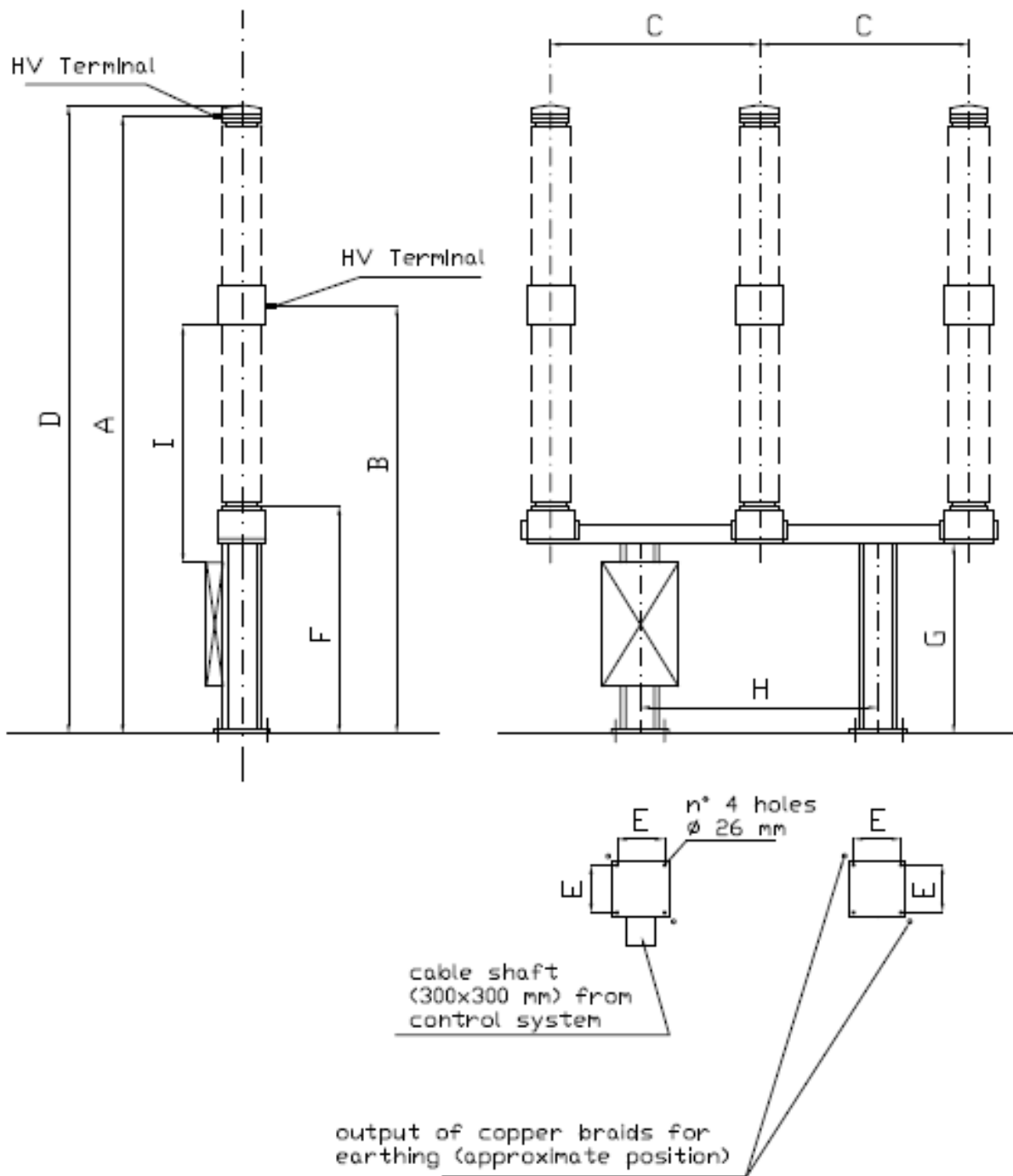


**Figure 1**



**Application Areas**

Perimeter: *Global*  
 Staff Function: -  
 Service Function: -  
 Business Line: *Enel Grids*



**Figure 2**



## Application Areas

Perimeter: *Global*  
 Staff Function: -  
 Service Function: -  
 Business Line: *Enel Grids*

Company	Ref. figure	A	B	C	D	E	F	G	H	I
Enel Rio, Ceará	2	-	≥ 3300	≥ 790	≤ 4300	-	≥2250 <sup>7</sup>	≥1700	-	-
E-distribución	2	-	≥ 3130	≥630	-	-	≥2300 <sup>8</sup>	-		≥1400 <sup>7</sup>

Table 1 – Dimensions for 72,5 kV CBs (in mm)<sup>9</sup>

Company	Ref. figure	A	B	C	D	E	F	G	H	I
Enel Rio	2	-	≥4000	≥1630	≤5200	-	≥2250 <sup>6</sup>	≥2530		-
E. Sao Paulo	2	-	≥4270	≥1750	-	400	≥2500	-	2530	-
Codensa	2	≥ 5180	≥ 3630	≥ 1750	≥ 5480	370 x 230	≥2250 <sup>6</sup>	2530		
Edesur			≥3700				≥2250 <sup>6</sup>			
E-distribución	2	-	≥ 3800	≥1300	-	-	≥2300 <sup>7</sup>	-		≥2000 <sup>7</sup>
Enel Distribuz.	1	≤6500	4500 ±30	2200	≤6500	500	≥2250 <sup>6</sup>	≥2000		

Table 2 – Dimensions for 145 kV CBs (in mm)<sup>8</sup>

Company	Ref. figure	A	B	C	D	E	F	G	H	I
Enel Distribuz.	1	≤6500	4500 ±30	2200	≤6500	500	≥2250 <sup>6</sup>	≥2000		

Table 3 – Dimensions for 170 kV CBs (in mm)<sup>8</sup>


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<sup>6</sup> In accordance with par. 7.2.4 of IEC 61936-1

<sup>7</sup> In accordance with Real Decreto Riesgo Eléctrico 614/2001 and NNM001.- Normas de operación definiciones. This distance is mandatory unless there is a physical barrier allowing distance I to be shorter.

<sup>8</sup> Blank cell means that there isn't a mandatory requirement for that characteristic



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Company	Ref. figure	A	B	C	D	E	F	G	H	I
Codensa							$\geq 2250^6$			
Edesur			$\geq 4600$				$\geq 2250^6$			
Enel Distribuz.	1	$\leq 8000$	$5300 \pm 30$	3200		500	$\geq 2250^6$	$\geq 2000$		

**Table 4 – Dimensions for 245 kV CBs (in mm)<sup>8</sup>**



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Service Function: -

Business Line: *Enel Grids*

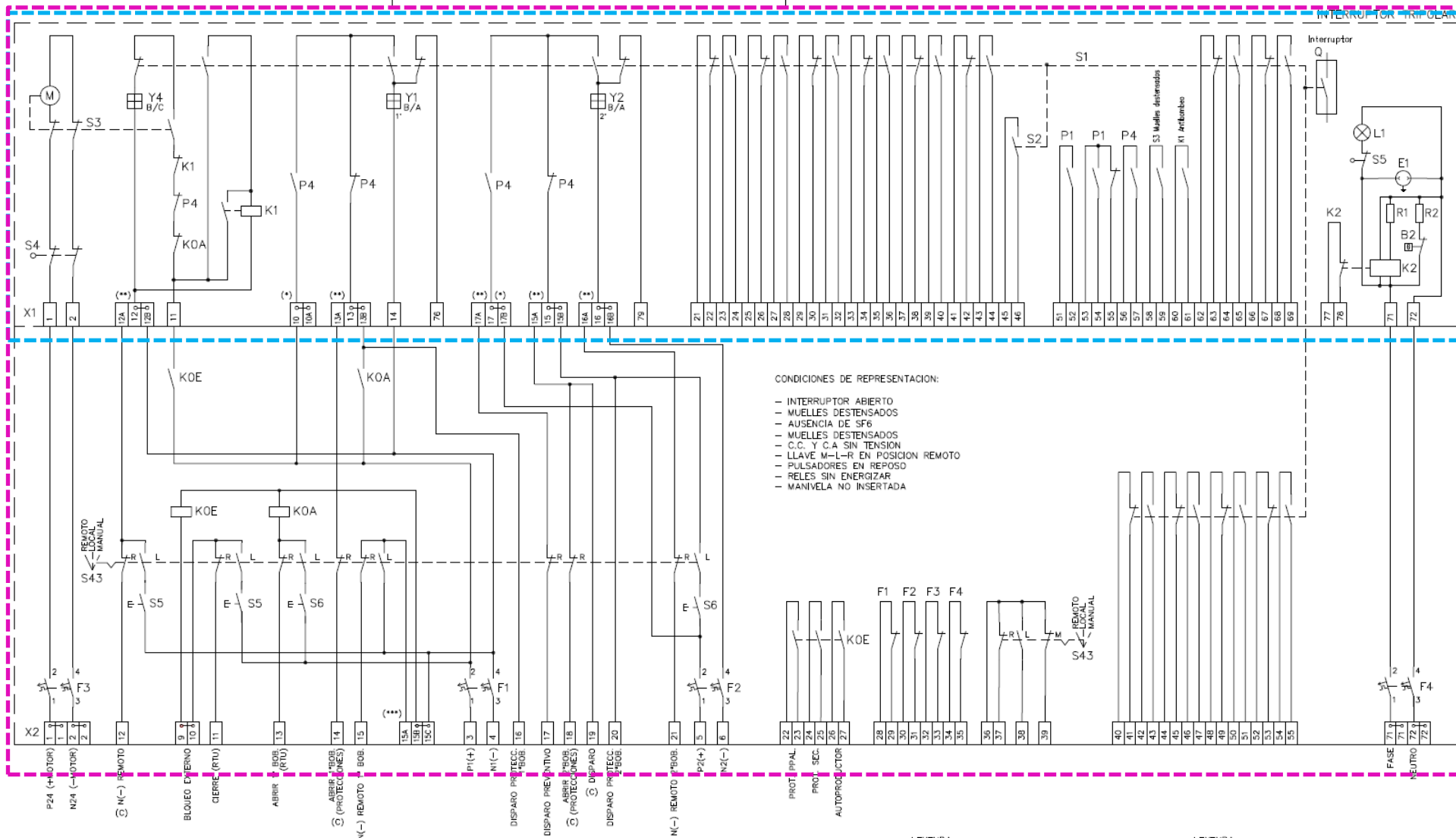
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**ANNEX C – ELECTRICAL SCHEMES**

*C.1.1 – E-DISTRIBUCIÓN, LATAM AND ROMANIA TRIPOLAR*

Providers should deliver the electrical scheme for each country:

- SPAIN: Functionalities described for terminal blocks X1 (Blue box)
- LATAM: Functionalities described for terminal blocks X1, X2 (Pink box)



CONDICIONES DE REPRESENTACION:  
 - INTERRUPTOR ABIERTO  
 - MUELLES DESTENSADOS  
 - AUSENCIA DE SF6  
 - MUELLES DESTENSADOS  
 - C.C. Y C.A SIN TENSION  
 - LLAVE M-L-R EN POSICION REMOTO  
 - PULSADORES EN REPOSO  
 - RELES SIN ENERGIAR  
 - MANIVELA NO INSERTADA

- (\*) DISPARO PREVENTIVO 1ª BOBINA (BORNES X1-10/10A)  
RETIRAR PUENTE METALICO EN CASO DE NO QUERER DISPARO PREVENTIVO
- DISPARO PREVENTIVO 2ª BOBINA (BORNES X1-17A/17B/17C)  
RETIRAR PUENTE METALICO EN CASO DE NO QUERER DISPARO PREVENTIVO
- (\*\*) PARA COLOMBIA SITUAR LOS PUENTES METALICOS EN BORNES:  
(X1-12/12A) (X1-13/13A) (X1-15/15A) (X1-16/16A) (X1-17/17A)
- (\*\*\*) PARA COLOMBIA SITUAR PUENTE METALICO EN BORNES:  
(X2-15A/15B)
- (C) SOLO PARA COLOMBIA

MANODENSOSTATO  
GAS SF6

TIPOS DE CONTACTO	FUNCION
P1	CONTROL GAS SF6 ALARMA
P4	CONTROL GAS SF6 BLOQUEO 1ªB
P4	CONTROL GAS SF6 BLOQUEO 2ªB

LEYENDA

P1,P4	MANODENSOSTATO
B2	TERMOSTATO
E1	TOMA DE CORRIENTE
K1	RELE ANTIBOMBEO
K2	MONITORIZACION RESISTENCIAS
M	MOTOR TENSADO DE MUELLES
R1,R2	RESISTENCIAS DE CALEFACCION
S1	CONTACTOS AUXILIARES
S2	CONTACTO IMAGEN
S3	(58-59) CONTACTO CERRADO CON MUELLES DESTENSADOS
S4	CONTACTOS INTRODUCCION MANIVELA
X1	REGLETA DE BORNES
Y4	BOBINA DE CIERRE
Y1	1ª BOBINA DE APERTURA
Y2	2ª BOBINA DE APERTURA

LEYENDA

S43	LLAVE MANUAL-LOCAL-REMOTO
S5	PULSADOR CERRAR
S6	PULSADOR ABRIR
F1	MAGNETOTERMICO ALIMENTACION P1-N1
F2	MAGNETOTERMICO ALIMENTACION P2-N2
F3	MAGNETOTERMICO ALIMENTACION MOTOR
F4	MAGNETOTERMICO ALIMENTACION CALEFACCION
KOE	RELE AUXILIAR CERRAR
KOA	RELE AUXILIAR ABRIR
X2	REGLETA DE BORNES



**Technical Specification code: MAT-E&C-NC-2021-0066-GIN**

Version no. 4 dated 14.05.2025

**Subject: Global Infrastructure and Networks GSCH001 HV CIRCUIT BREAKERS**

**Application Areas**

Perimeter: *Global*

Staff Function: -

Service Function: -

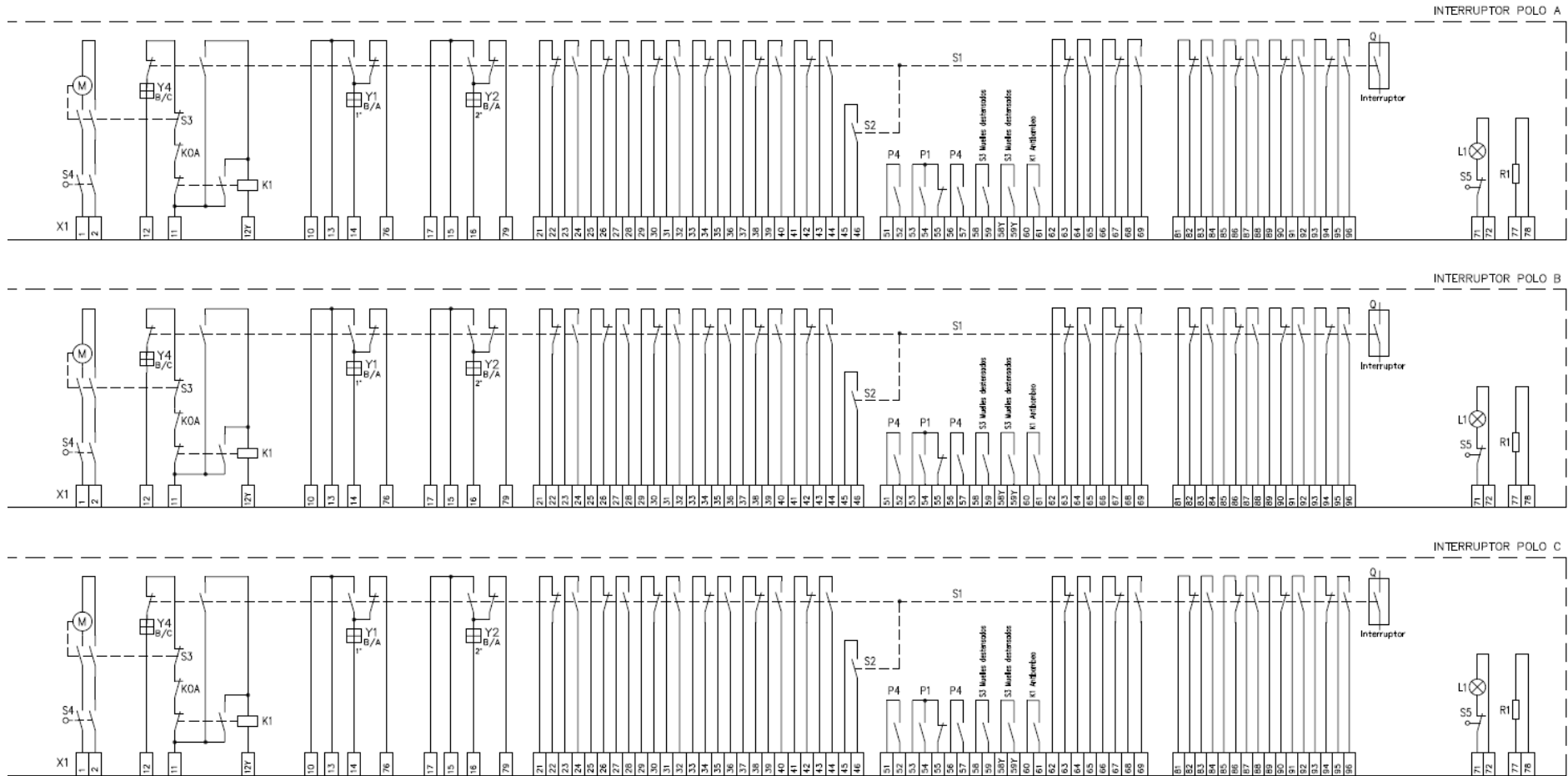
Business Line: *Infrastructure & Networks*

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C.1.2. LATAM UNIPOLAR







**LEYENDA INTERRUPTOR**

- P1,P4 MANODENSOSTATO
- B2 TERMOSTATO
- E1 TOMA DE CORRIENTE
- K1 RELE ANTIBOMBEO
- K2 MONITORIZACION RESISTENCIAS
- M MOTOR TENSADO DE MUELLES
- R1,R2 RESISTENCIAS DE CALEFACCION
- S1 CONTACTOS AUXILIARES
- S2 CONTACTO IMAGEN
- S3 (S8-S9) CONTACTO CERRADO CON MUELLES DESTENSADOS
- S4 CONTACTOS INTRODUCCION MANIVELA
- X1 REGLETA DE BORNAS
- Y4 BOBINA DE CIERRE
- Y1 1ª BOBINA DE APERTURA
- Y2 2ª BOBINA DE APERTURA

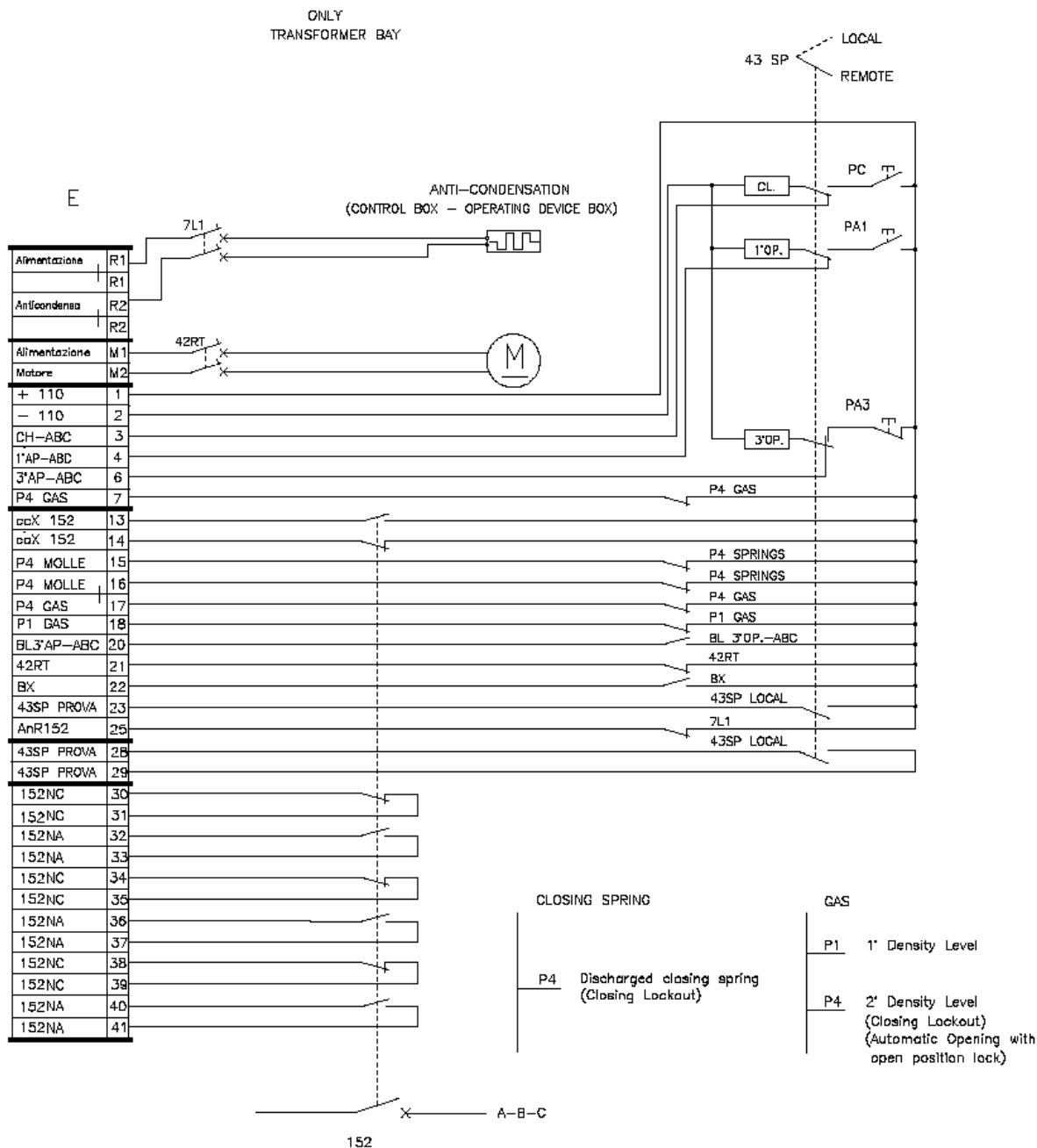
**MANODENSOSTATO GAS SF6**

TIPOS DE CONTACTO	FUNCION
P1	CONTROL GAS SF6 ALARMA
P4	CONTROL GAS SF6 BLOQUEO 1ºB
P4	CONTROL GAS SF6 BLOQUEO 2ºB

**Application Areas**

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

**C.2 – ENEL DISTRIBUZIONE ELECTRICAL SCHEMES AND FLOWCHARTS**



NOTE:

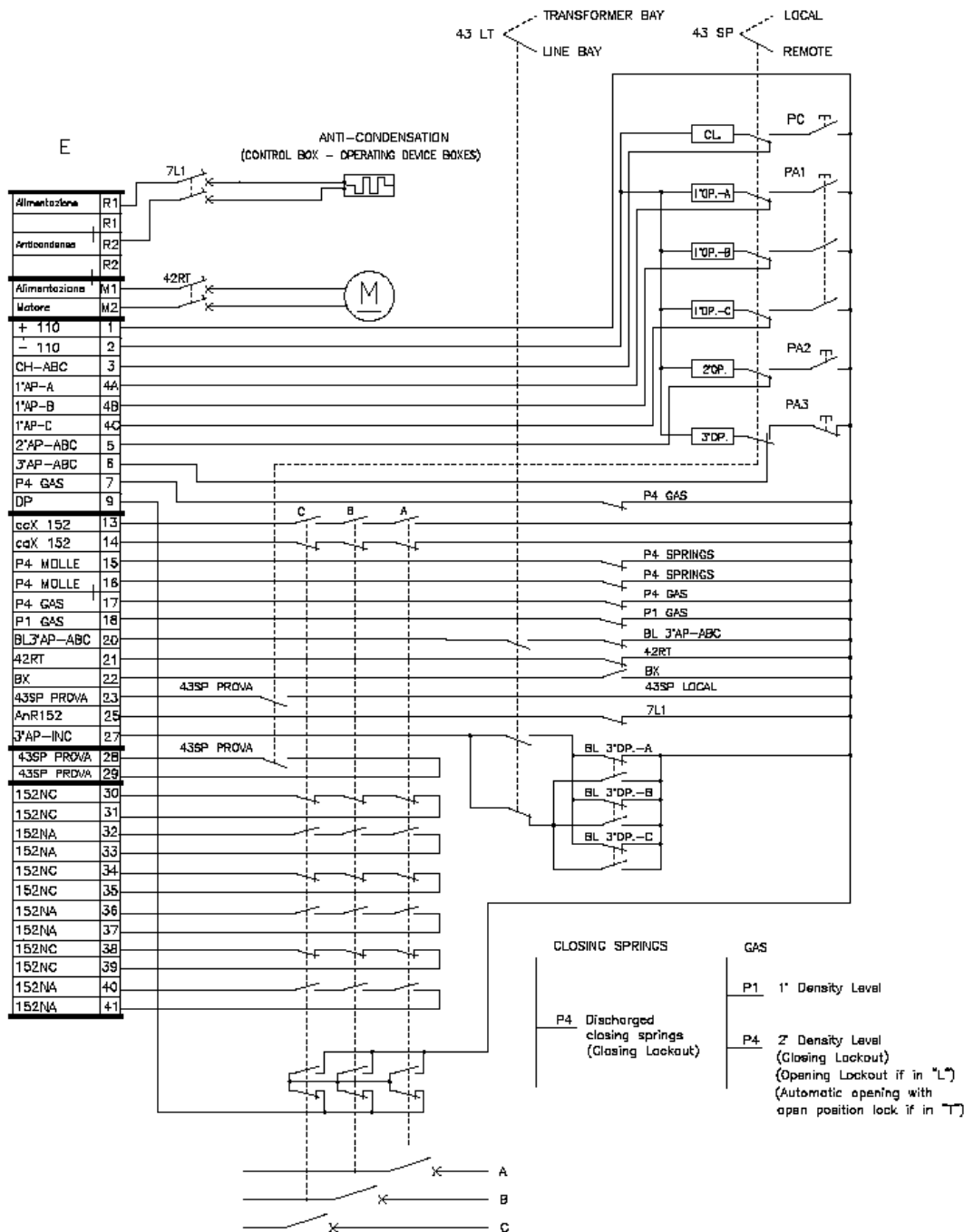
Circuit diagram – Reference conventional conditions: CB in open position, closing spring discharged, gas absence (only for gas insulated CB), 43 SP selector in S position, undervoltage release unlocked, absence of A.C. and D.C. auxiliary supplies.

**Figure 3 (three-pole CBs electrical scheme)**



Application Areas

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



NOTES:

- 1) Circuit diagram – Reference conventional conditions: CB in open position, closing springs discharged, gas absence (only for gas insulated CB), 43 SP selector in S position, 43 LT selector in L position, undervoltage release locked, absence of A.C. and D.C. auxiliary supplies.
- 2) If CB is used in transformer bay, jumper between the gaups of terminal block: 4A – 4B – 4C  
2D – 21 – 22 – 23.
- 3) Only for gas insulated CB's: Low density gas CB's automatic opening (1' and 2' release) are ON if 43 LT selector is in T position.

Figure 4 (72,5 ÷ 170 kV single-pole CBs electrical scheme)



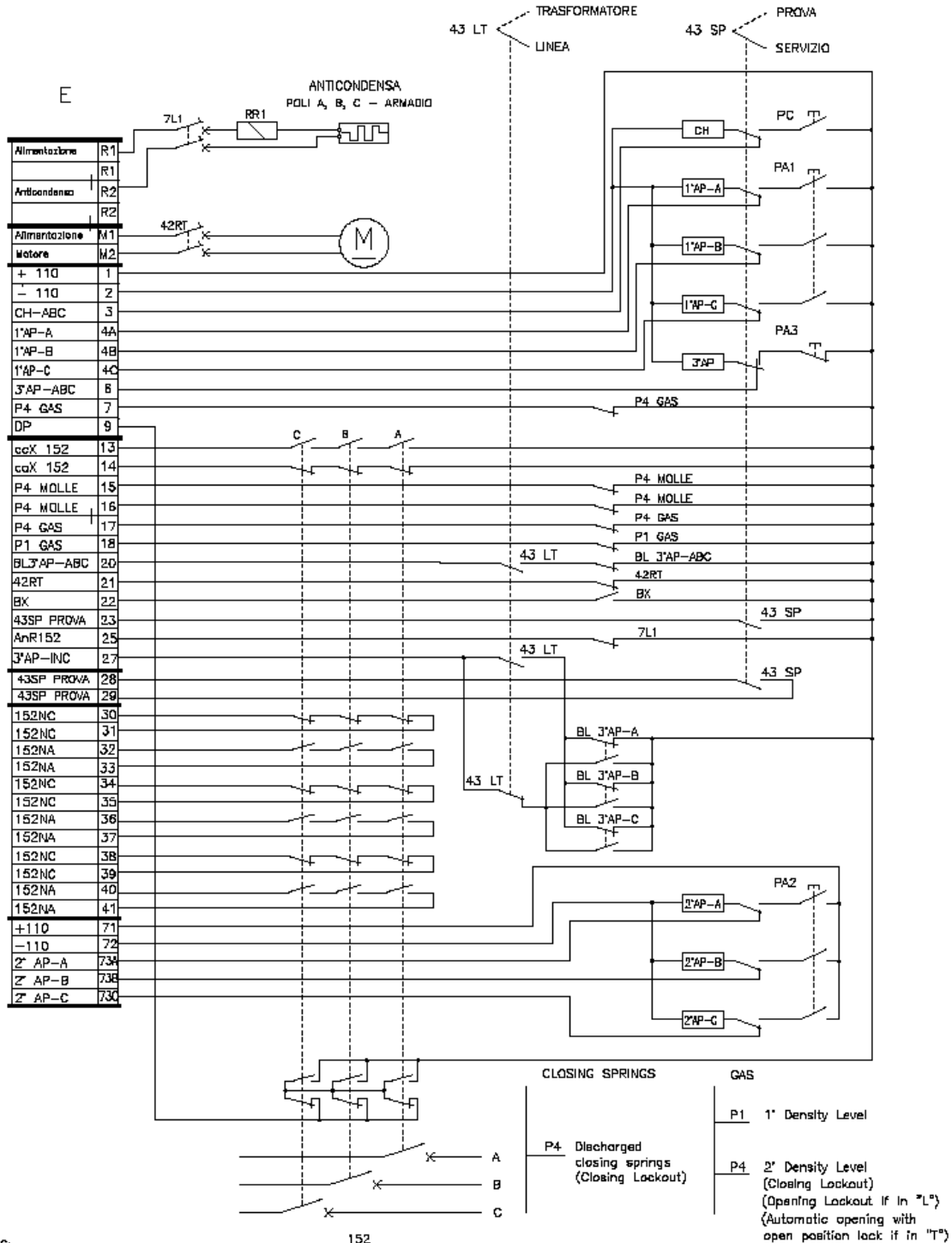
Application Areas

Perimeter: Global

Staff Function: -

Service Function: -

Business Line: Infrastructure & Networks



NOTES:

- 1) Circuit diagram - Reference conventional conditions: CB in open position, closing springs discharged, gas absence (only for gas insulated CB), 43 SP selector in S position, 43 LT selector in L position, undervoltage release locked, absence of A.C. and D.C. auxiliary supplies.
- 2) If CB is used in transformer bay, jumper between the groups of terminal blocks: 4A - 4B - 4C  
2D - 21 - 22 - 23.  
73A - 73B - 73C
- 3) Only for gas insulated CB's: Low density gas CB's automatic opening (1\* and 2\* release) are ON if 43 LT selector is in T position.

Figure 5 (245 kV single-pole CBs electrical scheme)

THREE-POLE CIRCUIT BREAKERS FLOWCHARTS:



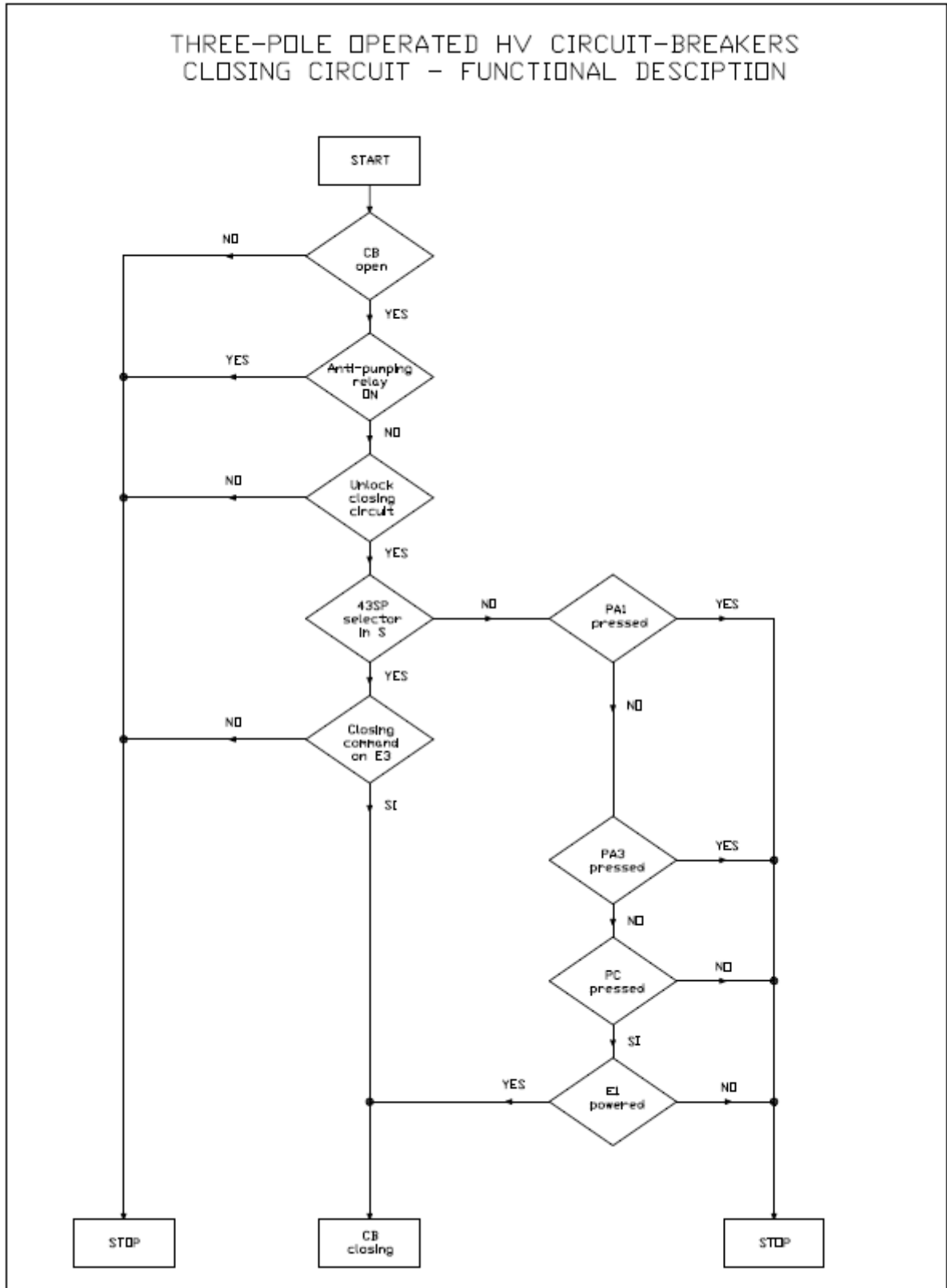
**Application Areas**

Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Infrastructure & Networks*





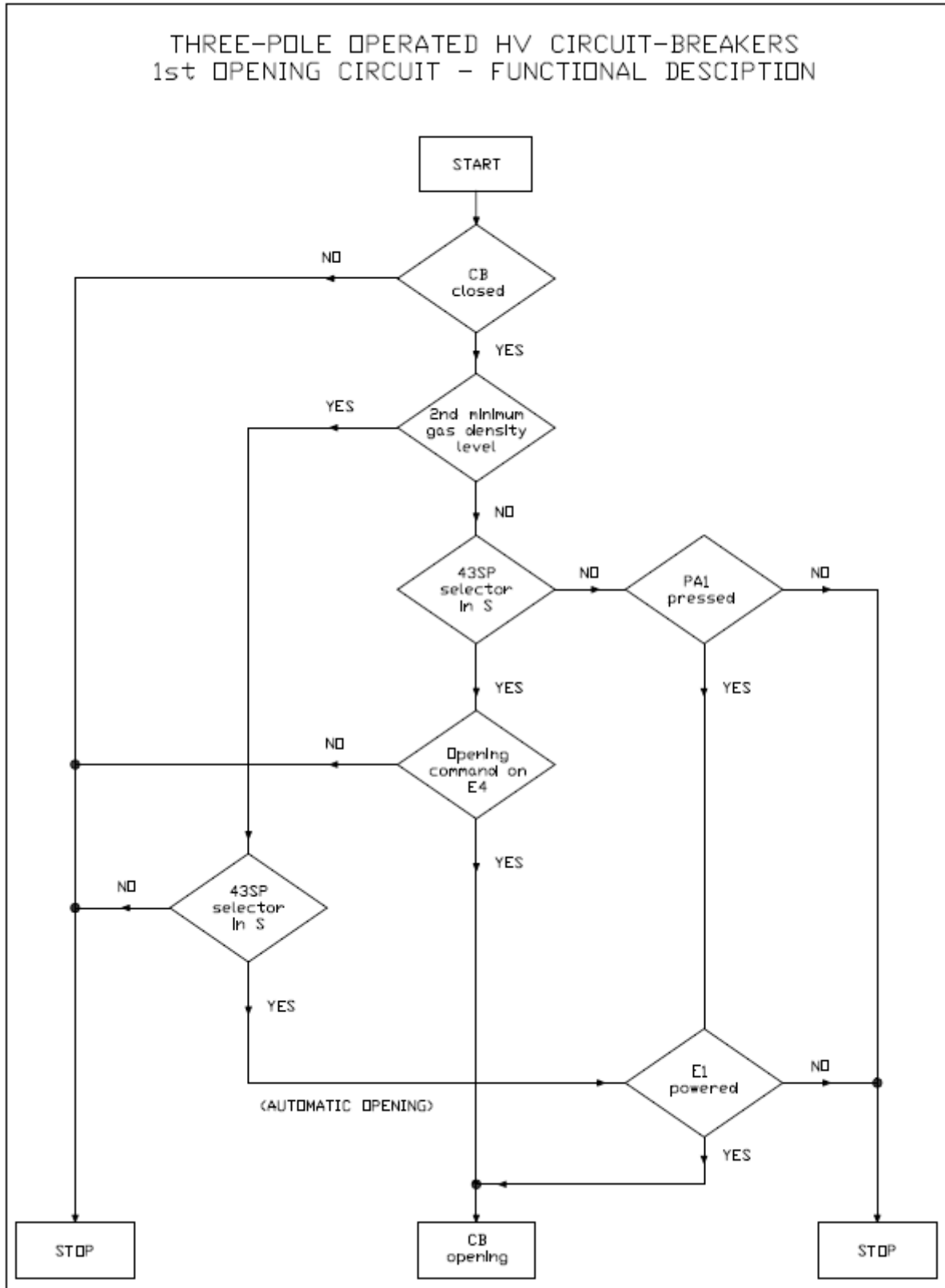
**Application Areas**

Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Infrastructure & Networks*





**Application Areas**

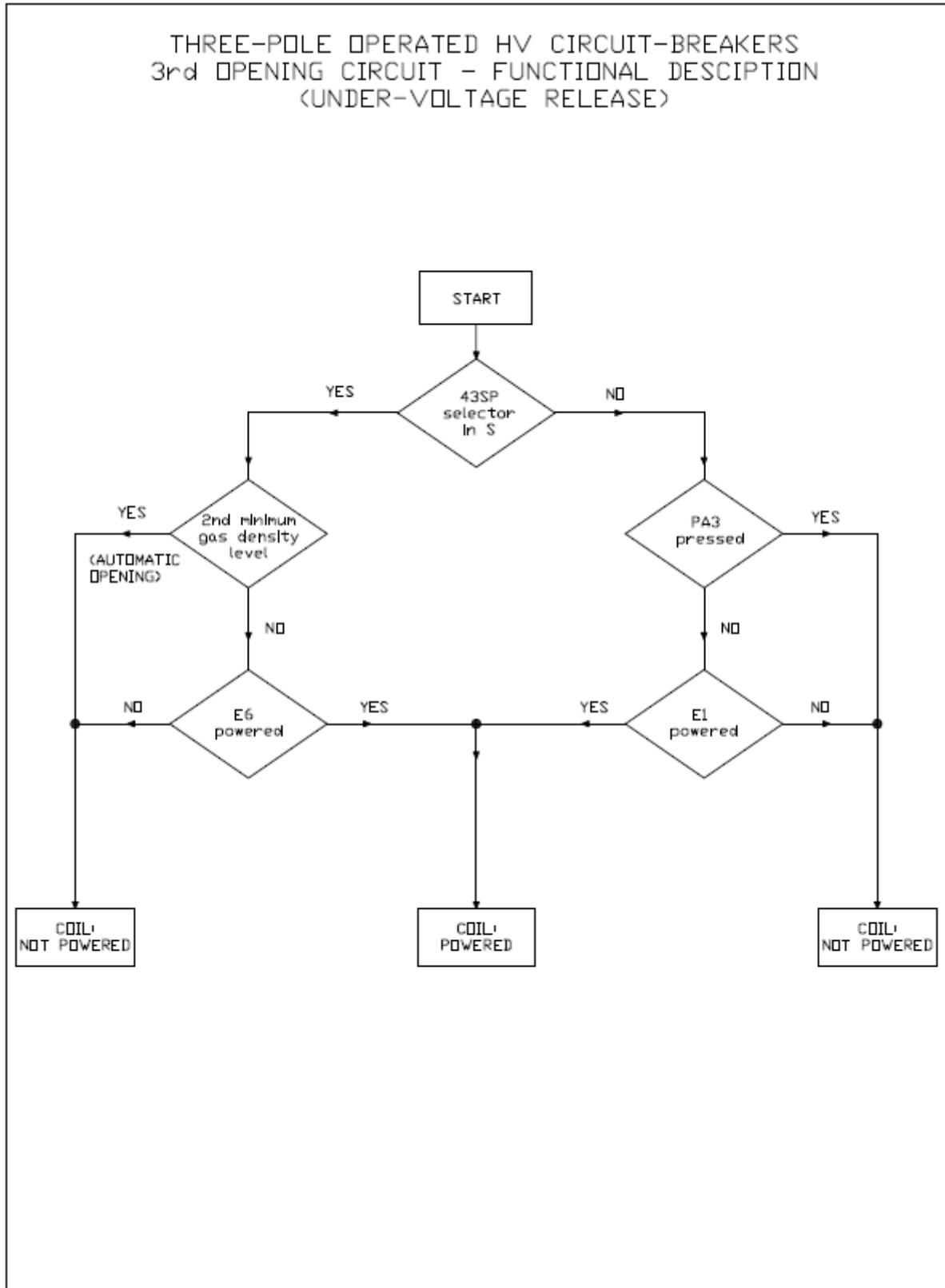
Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Infrastructure & Networks*

THREE-POLE OPERATED HV CIRCUIT-BREAKERS  
3rd OPENING CIRCUIT - FUNCTIONAL DESCRIPTION  
(UNDER-VOLTAGE RELEASE)







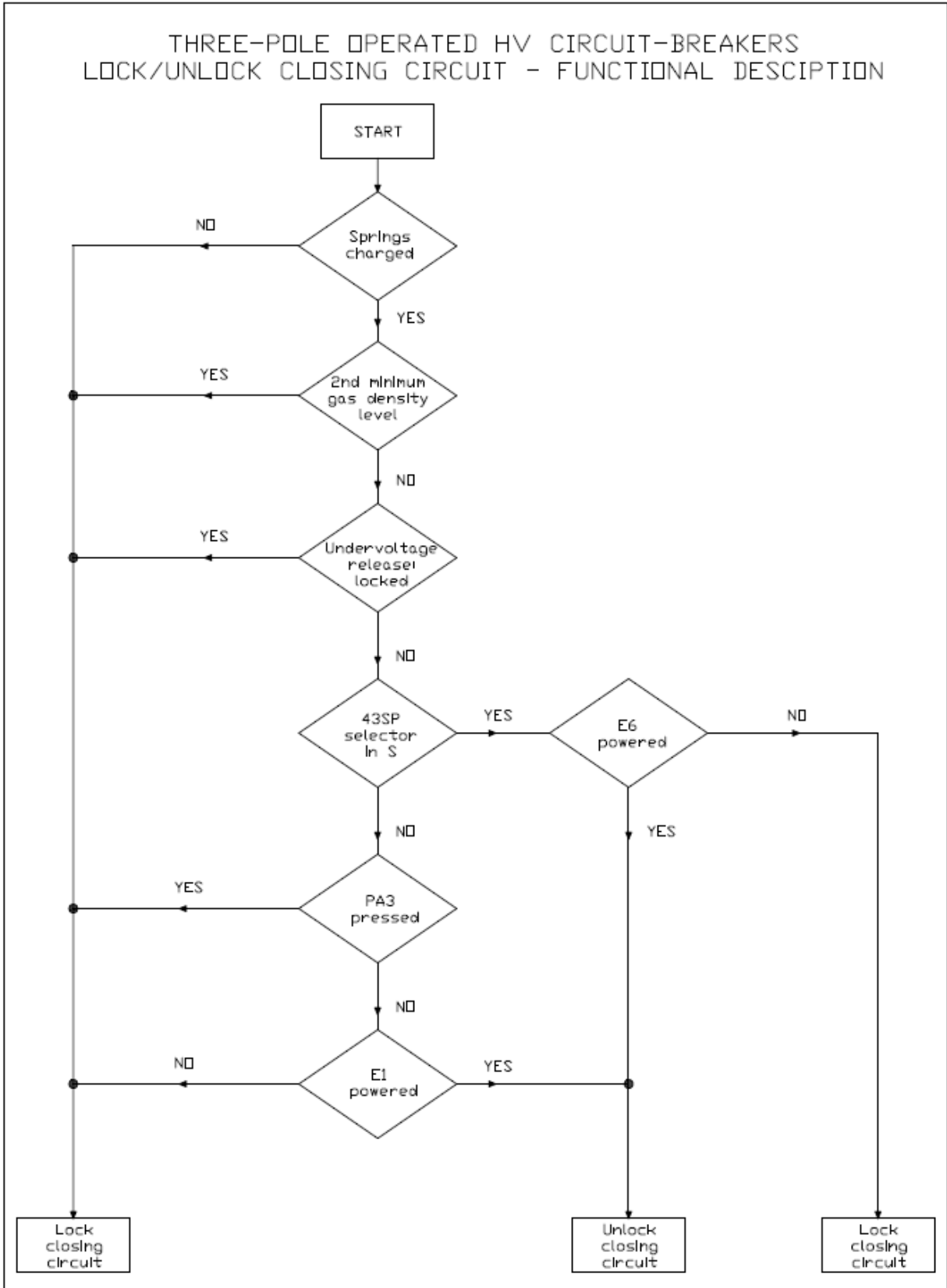
**Application Areas**

Perimeter: Global

Staff Function: -

Service Function: -

Business Line: Infrastructure & Networks





**Application Areas**

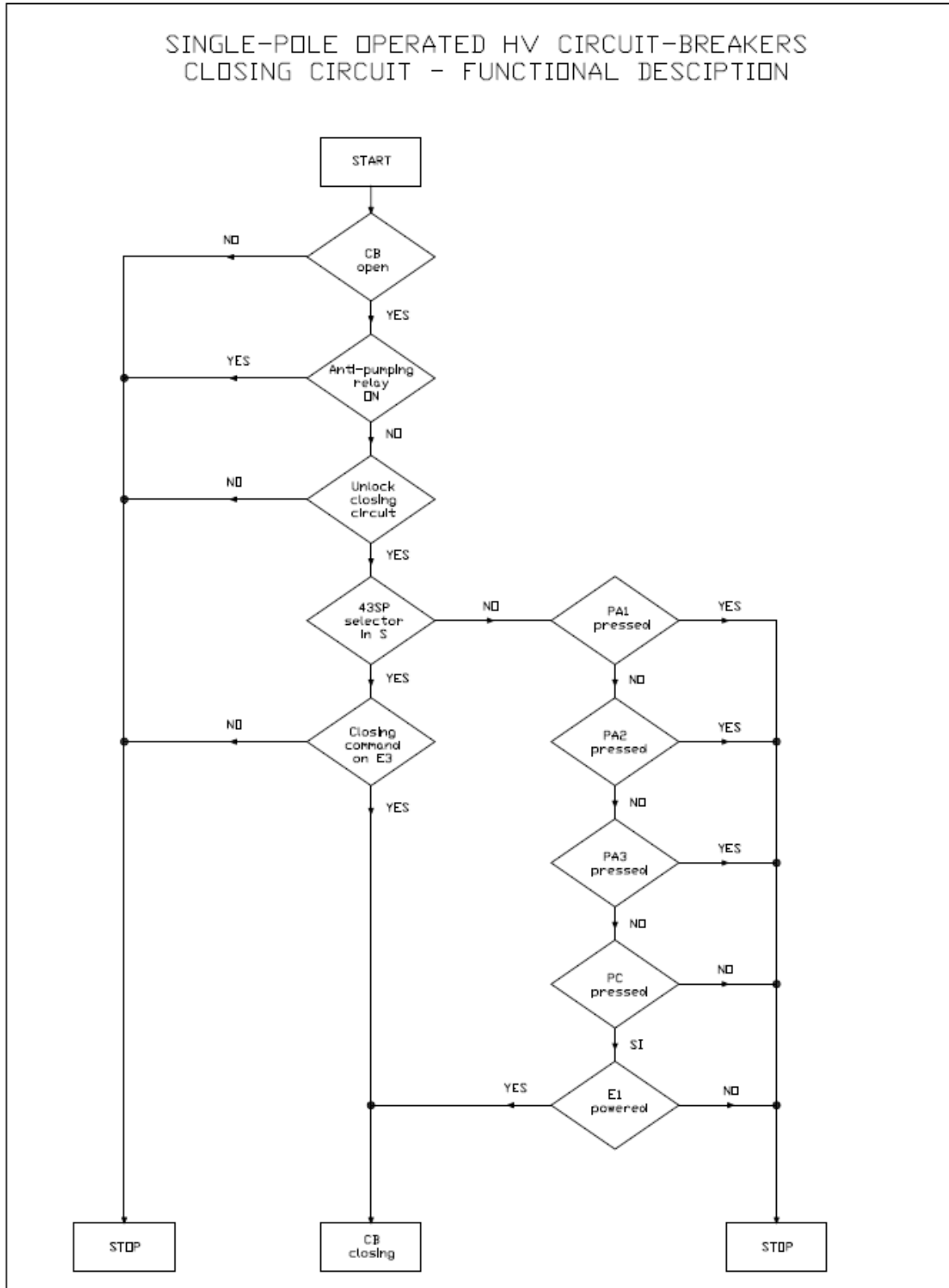
Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Infrastructure & Networks*

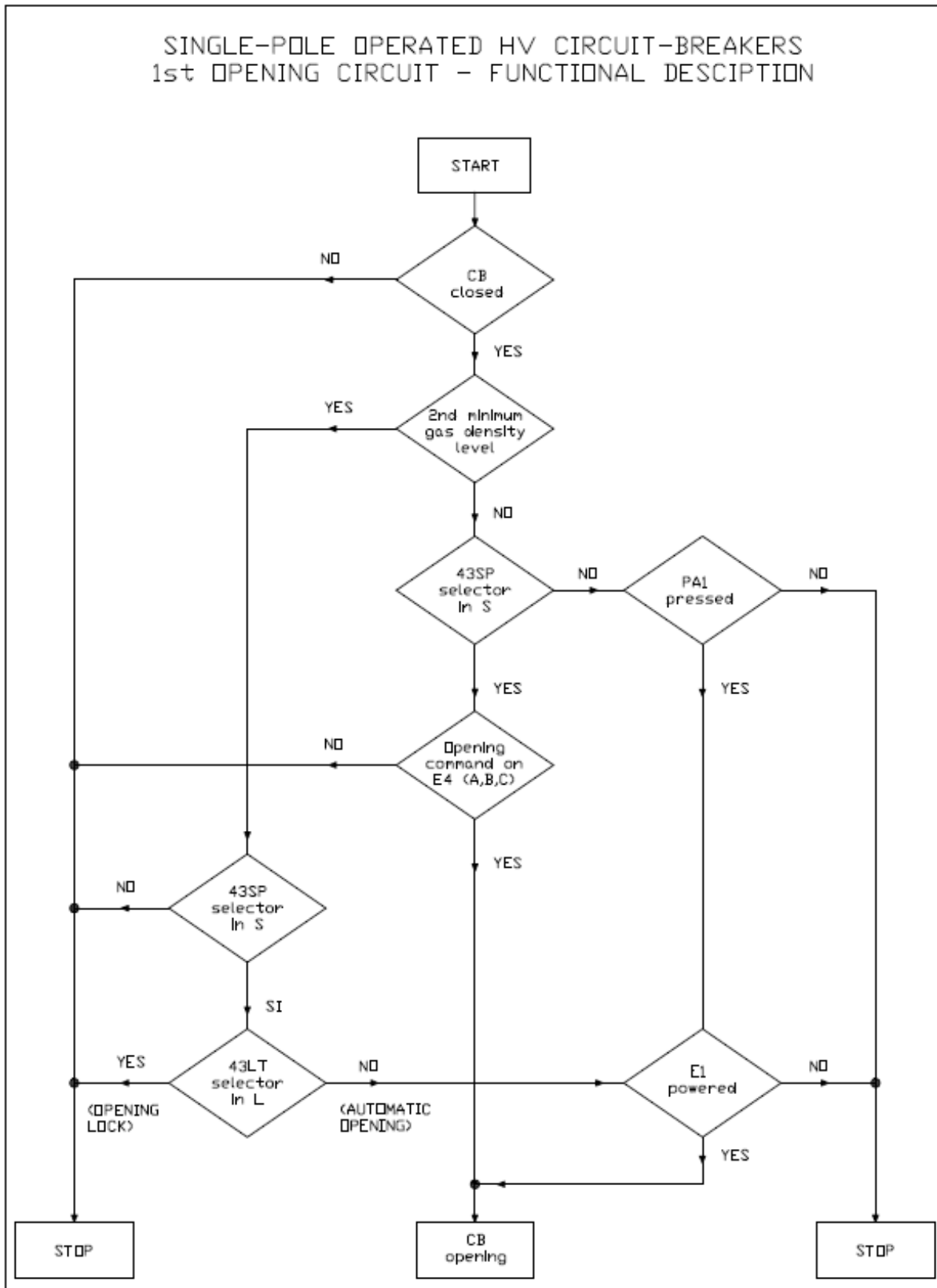
**SINGLE-POLE CIRCUIT BREAKERS FLOWCHARTS:**





**Application Areas**

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





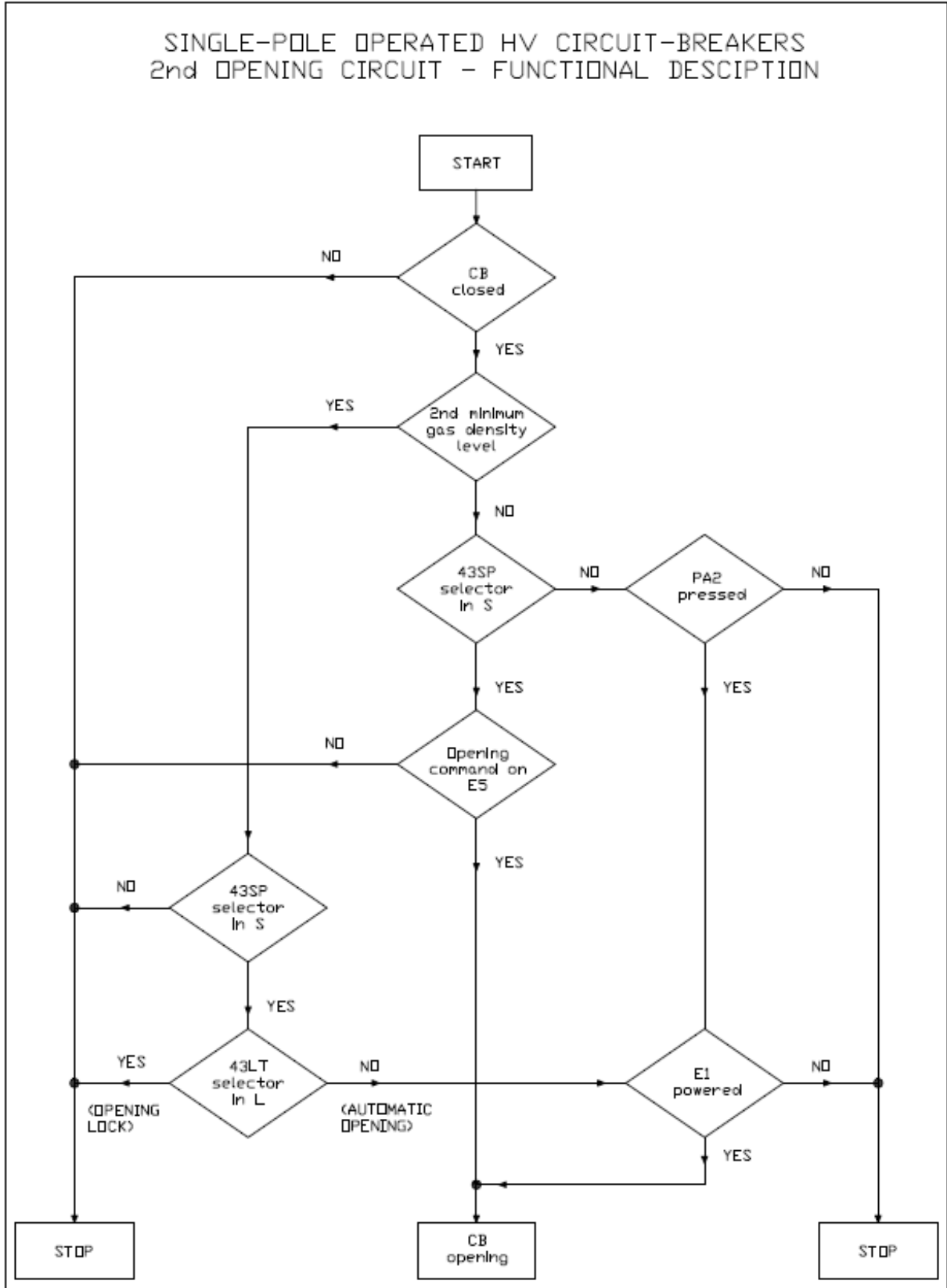
**Application Areas**

Perimeter: Global

Staff Function: -

Service Function: -

Business Line: Infrastructure & Networks





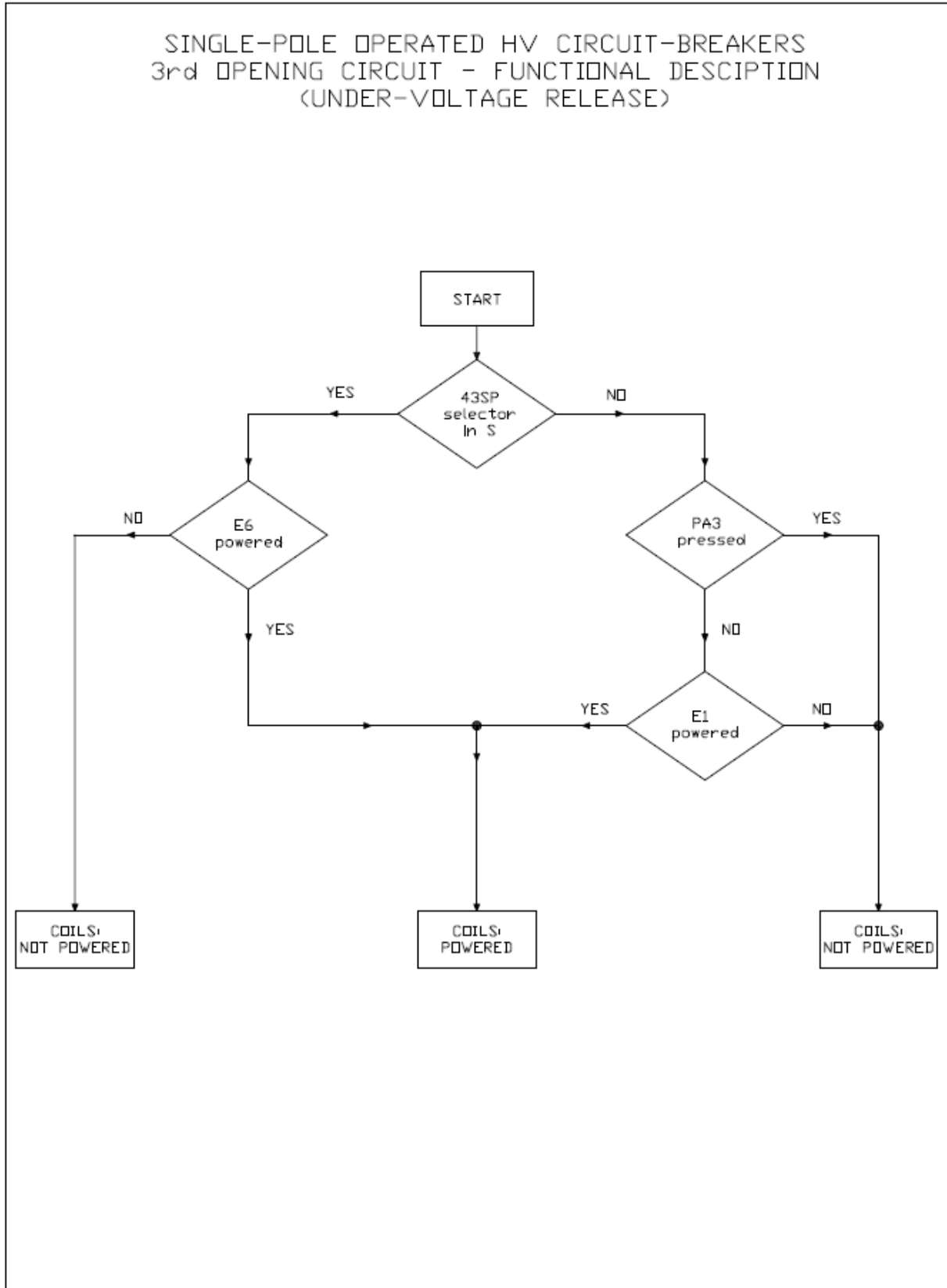
**Application Areas**

Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Infrastructure & Networks*





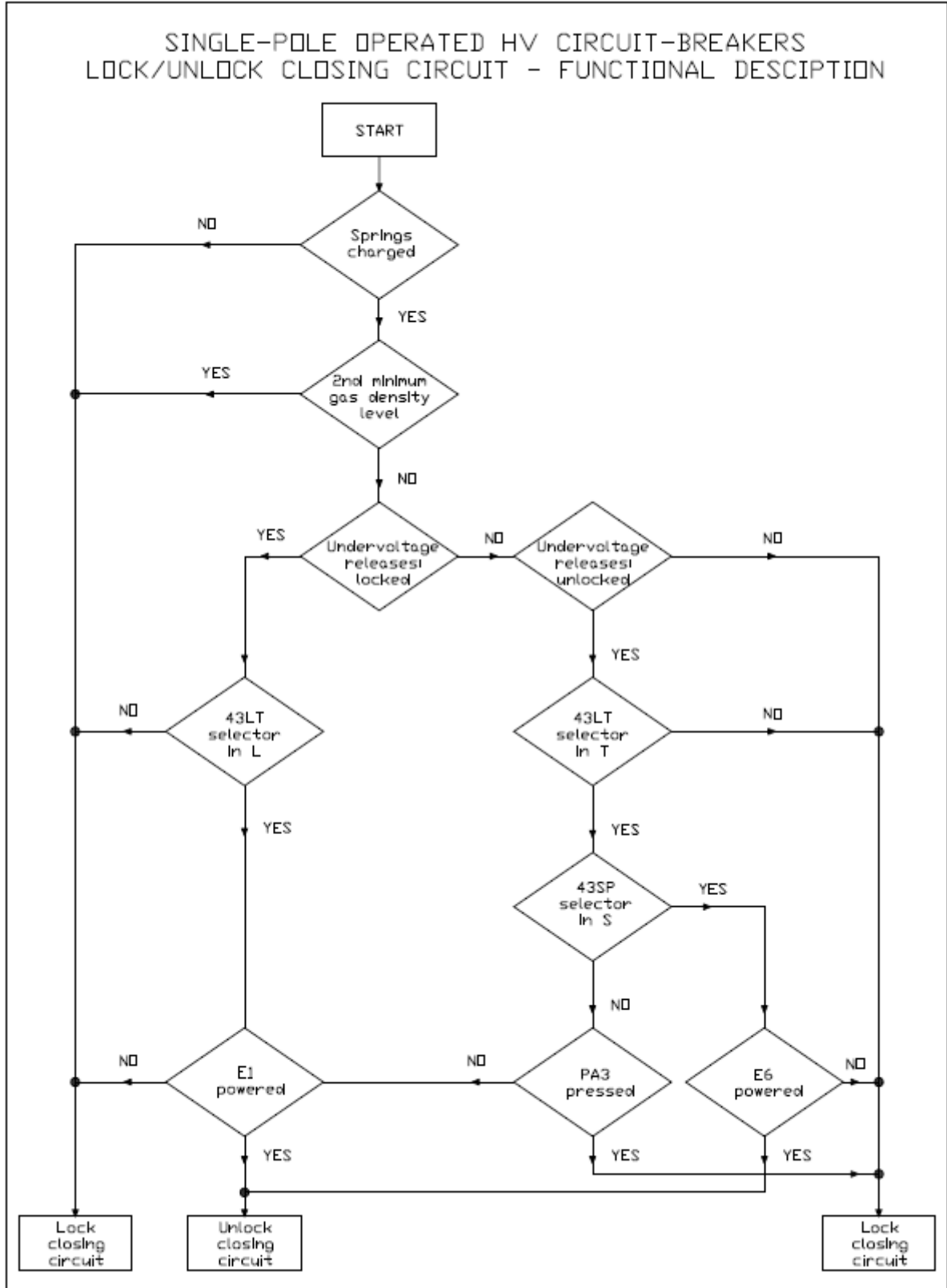
**Application Areas**

Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Infrastructure & Networks*




**Technical Specification code: MAT-E&C-NC-2021-0066-GIN**

Version no. 4 dated 14.05.2025

**Subject: Global Infrastructure and Networks GSCH001 HV CIRCUIT BREAKERS**
**Application Areas**

 Perimeter: *Global*

Staff Function: -

Service Function: -

 Business Line: *Infrastructure & Networks*
**ANNEX D – TENDER’S TECHNICAL DOCUMENTATION**

<b>GLOBAL STANDARD:</b> GSH001 – HV Circuit Breakers	<b>TENDER:</b>	
<b>SUPPLIER:</b>	<b>FACTORY:</b>	
<b>ENEL GROUP TYPE CODE:</b> GSH001/___	<b>SUPPLIER MODEL:</b>	
<b>TECHNICAL CHARACTERISTICS</b>	<b>STANDARD REQUIREMENT</b>	<b>SUPPLIER OFFER</b>
<i>Service conditions</i>	outdoor normal service conditions of IEC 62271-1	
<i>Reference altitude (m)</i>	< 1.000 (2.600 for Colombia)	
<i>Minimum ambient air temperature (°C)</i>	-25 (-30° for Romania)	
<i>SPS Class (IEC/TS 60815 series)</i>	d) or e)	
<i>Ice coating (mm)</i>	10 (22 for Romania)	
<i>Seismic qualification level</i>	See table in 7.2.3	
<i>Arc-suppression medium</i>	SF6, non-fluorinated greenhouse gases or vacuum	
<i>Rated short-duration power-frequency withstand voltage Ud (kV rms)</i>		
<i>Rated lightning impulse withstand voltage Up (kVp)</i>		
<i>Rated frequency fr (Hz)</i>	50 or 60	
<i>Rated normal current Ir (A)</i>		
<i>Rated short-circuit breaking current Isc (kA)</i>		
<i>Type of operation</i>		
<i>First-pole-to-clear factor k<sub>pp</sub></i>		
<i>Rated operating sequence</i>	O - 0,3 s - CO - 1 min – CO	
<i>Maximum break-time (ms)</i>	60	
<i>Rated opening time (ms)</i>	-	
<i>Rated closing time (ms)</i>	-	
<i>Circuit breaker class</i>	C2 - E1 - M2	
<i>Rated line-charging breaking current II (A)</i>		
<i>Rated cable-charging breaking current Ic (A)</i>		
<i>Rated out-of-phase making and breaking current Id (kA)</i>	Clause 4.106 of IEC 62271-100	
<i>Auxiliary contact classes (Table 6 IEC 62271-1)</i>	1	
<i>Dimensions</i>	See Annex A	To enclose an overall equipment drawing for each Enel Group Distribution Company
<i>Insulators materials</i>	Composite	