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HYBRID MODULES


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Revision	Data	List of modifications
00	28/11/2014	First emission
01	16/09/2016	Overall dimensions for Spain (annex C table 2) 2.- Components list Y2 for Latam, support 72,5 kV for EDE. Y2 type – Annex B.1 fig. 1 6.4.2 Bushing terminations – 6.4.2.1 Latam 6.7.- Current transformers. Codes.- 612 and 621 ANNEX A – LOCAL COMPONENTS CODIFICATION
02	25/11/2016	2 - COMPONENTS LIST. Current Transformer. Code – 620 Typographic error - 6.1 - Common general ratings. Protection stage. 6.7.- Current transformer. Code.- 620


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03	06/11/2019	<p>2- COMPONENTS LIST. Circuit-breaker drive mechanism. Code – 263 removed</p> <p>4.1- General service conditions; SPS Class, only class e (Very Heavy)</p> <p>4.2.3- Seismic qualification level; Enel_Codensa (AF5)</p> <p>6.4.2- Bushing terminations; For 245 kV CBs the HV terminals shall be suitable to be interfaced with standardized e-distribuzione clamps (double cable).</p> <p>6.7- Current transformer, New Code- 624.</p> <p>6.8- Voltage transformers, New Code- 712.</p> <p>8.1.1- General requirements, Selector switches positions, only 3 positions (Manual; Local; Remote)</p> <p>8.1.2- Circuit-breakers drive mechanism, General requirements, manually the operating device energy, with a maximum effort below 200 N (EN 1005-3:2002+A1:2008) during the hole charge.</p> <p>ANNEX A – LOCAL COMPONENTS CODIFICATION</p> <p>ANNEX C – DIMENSIONAL DRAWINGS</p> <p>ANNEX D – ELECTRICAL SCHEMES</p>
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1 SCOPE

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

- 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)

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

Hybrid Modules are compact metal-enclosed switchgear assemblies, SF6 insulated (in alternative, non-fluorinated greenhouse gases and vacuum circuit-breakers are also acceptable), for outdoor or indoor installation in Primary Substations. The outgoing connections can be air type, cable type or bus-duct type.

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

2 COMPONENTS LIST

The Hybrid Modules are composed by assembling the modular base components listed below (intended as terns of 3 elements, one for phase, obviously with the exception of support and Control Box). Each base component operates individually but interacting with the others components, even by mean of functional and safety interlocks.

Some typical typologies are provided in chapter 5.

If for manufacturer's design two or more base components are integrated in one component, it could be acceptable if compliant with the other requirements of this standard (in particular functional requirements).

Base component code	Base component description			
GSH002/011	Lateral bay	With circuit-breaker	Air connection	72,5 kV
GSH002/012				145 kV
GSH002/013				170 kV
GSH002/014				245 kV
GSH002/021			Cable connection	72,5 kV
GSH002/022				145 kV



GSH002/023			Bus-duct connection	170 kV		
GSH002/024				245 kV		
GSH002/031				72,5 kV		
GSH002/032				145 kV		
GSH002/033				170 kV		
GSH002/034				245 kV		
GSH002/061			Central bay	Without circuit-breaker	Air connection	72,5 kV
GSH002/062						145-170 kV
GSH002/063						245 kV
GSH002/071					Cable connection	72,5 kV
GSH002/072						145-170 kV
GSH002/073						245 kV
GSH002/081					Bus-duct connection	72,5 kV
GSH002/082						145-170 kV
GSH002/083	245 kV					
GSH002/111		Without circuit-breaker			Air connection	72,5 kV
GSH002/112						145-170 kV
GSH002/113						245 kV
GSH002/121					Cable connection	72,5 kV
GSH002/122						145-170 kV
GSH002/123			245 kV			
GSH002/131			Bus-duct connection	72,5 kV		
GSH002/132				145-170 kV		
GSH002/133				245 kV		
GSH002/211	Circuit-breaker drive mechanism	Single-pole	1°, 2° opening circuit	72,5 kV		
GSH002/212				145-170 kV		
GSH002/213				245 kV		
GSH002/221			1°, 2°, 3° opening circuit	72,5 kV		
GSH002/222				145-170 kV		
GSH002/261		Three-pole	1°, 3° opening circuit	72,5 kV		
GSH002/262				145-170 kV		
GSH002/271			1°, 2°, 3° opening circuit	72,5 kV		
GSH002/272				145-170 kV		
GSH002/281				72,5 kV		

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GSH002/282			1°, 2° opening circuit	145-170 kV
GSH002/311	Disconnecter	72,5 kV		
GSH002/312		145-170 kV		
GSH002/313		245 kV		
GSH002/321	Disconnecter with earthing switch	72,5 kV		
GSH002/322		145-170 kV		
GSH002/323		245 kV		
GSH002/331	Disconnecter with ability of Bus-transfer current switching	72,5 kV		
GSH002/332		145-170 kV		
GSH002/333		245 kV		
GSH002/411	Bushing SF6/air class "d"	72,5 kV		
GSH002/412		145-170 kV		
GSH002/413		245 kV		
GSH002/421	Bushing SF6/air class "e"	72,5 kV		
GSH002/422		145-170 kV		
GSH002/423		245 kV		
GSH002/461	Cable connection upward exit	72,5 kV		
GSH002/462		145-170 kV		
GSH002/463		245 kV		
GSH002/464	Cable connection downward exit	72,5 kV		
GSH002/465		145-170 kV		
GSH002/466		245 kV		
GSH002/481	Equipments for direct connection between bus-duct and power transf.	72,5 kV		
GSH002/482		145-170 kV		
GSH002/483		245 kV		
GSH002/511	Bus-duct (1 linear meter x 3 poles)	72,5 kV		
GSH002/512		145-170 kV		
GSH002/513		245 kV		
GSH002/521	Bus-duct curve	72,5 kV		
GSH002/522		145-170 kV		
GSH002/523		245 kV		
GSH002/531	Bus-duct expansion compensator	72,5 kV		
GSH002/532		145-170 kV		
GSH002/533		245 kV		

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GSH002/541	Bus-duct joint	72,5 kV
GSH002/542		145-170 kV
GSH002/543		245 kV
GSH002/561	Partitioning with single-pole gas management (including relative equipments and control circuits)	72,5 kV
GSH002/562		145-170 kV
GSH002/563		245 kV
GSH002/564	Partitioning with three-pole gas management (including relative equipments and control circuits)	72,5 kV
GSH002/565		145-170 kV
GSH002/566		245 kV
GSH002/601	Current Transformer	
GSH002/602		
GSH002/603		
GSH002/604		
GSH002/605		
GSH002/606		
GSH002/607		
GSH002/608		
GSH002/611		
GSH002/612		
GSH002/620		
GSH002/621		
GSH002/622		
GSH002/623		
GSH002/624		
GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	
GSH002/701	Voltage Transformer	
GSH002/702		
GSH002/703		
GSH002/704		
GSH002/705		
GSH002/711		
GSH002/712		



GSH002/721					
GSH002/722					
GSH002/801	Support	e-distribuzione	Y1 type and Y2 type	72,5 kV	
GSH002/802				145-170 kV	
GSH002/803				245 kV	
GSH002/804			Single-bay type	72,5 kV	
GSH002/805				145-170 kV	
GSH002/806				245 kV	
GSH002/811		E-Distributie	Y2 type	145 kV	
GSH002/812				Single-bay type	145 kV
GSH002/821		e distribución	Y1 type	145 kV	
GSH002/822				Y2 type	145 kV
GSH002/823				Single-bay type	145 kV
GSH002/824			Y1 type	72,5 kV	
GSH002/825				Y2 type	72,5 kV
GSH002/826				Single-bay type	72,5 kV
GSH002/841		Edesur	Y1 type	145 kV	
GSH002/842				245 kV	
GSH002/843			Y2 type	145 kV	
GSH002/844				245 kV	
GSH002/845			Single-bay type	145 kV	
GSH002/846				245 kV	
GSH002/851		Enel Perú	Y1 type	72,5 kV	
GSH002/852				245 kV	
GSH002/853			Y2 type	72,5 kV	
GSH002/854				245 kV	
GSH002/855			Single-bay type	72,5 kV	
GSH002/856				245 kV	
GSH002/861		Enel Distribuição Ceará	Y1 type	72,5 kV	
GSH002/862			Y2 type	72,5 kV	
GSH002/863			Single-bay type	72,5 kV	
GSH002/871		Enel_Codensa	Y1 type	145 kV	
GSH002/872	Y2 type		145 kV		
GSH002/873	Single-bay type		145 kV		

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GSH002/881		Enel Distribución Chile	Y1 type	145 kV
GSH002/882				245 kV
GSH002/883			Y2 type	145 kV
GSH002/884				245 kV
GSH002/885			Single-bay type	145 kV
GSH002/886				245 kV
GSH002/891		Enel Distribuição Rio, Enel Distribuição Goiás, Enel Distribuição São Paulo	Y1 type	72,5 kV
GSH002/892				145 kV
GSH002/893			typeY2 type	72,5 kV
GSH002/894				145 kV
GSH002/895			Single-bay type	72,5 kV
GSH002/896				145 kV
GSH002/901	Control Box	e-distribuzione	Y1 type	
GSH002/902			Y2 type	
GSH002/903			Single-bay type	
GSH002/911		E Distributie	Y2 type	
GSH002/912			Single-bay type	
GSH002/921		e distribución	Y1 type	Line bay
GSH002/922				Transformer bay
GSH002/923			Single-bay type	Bus Coupler
GSH002/924				Line bay
GSH002/925				Transformer bay
GSH002/926			Y2 type	
GSH002/931		Latam	Y1 type	
GSH002/932	Y2 type			
GSH002/933	Single-bay type			

For local components codification see annex A.


3 REFERENCE LAWS AND STANDARDS

3.1 Laws

3.1.1 Latam

3.1.1.1 *Brasil*

NR-10 - segurança em instalações e serviços em eletricidade

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3.1.2 Italy

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”*.

3.1.3 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.

3.1.4 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).


3.2 Standards

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

3.2.1 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).

IEC 62271-205	High-voltage switchgear and controlgear - Part 205: Compact switchgear assemblies for rated voltages above 52 kV
IEC 62271-1	High-voltage switchgear and controlgear - Part 1: Common specifications
IEC 62271-203	High-voltage switchgear and controlgear - Part 203: Gas-insulated metal-enclosed switchgear for rated voltages above 52 kV
IEC 62271-100	High-voltage switchgear and controlgear – Part 100: Alternating current circuit-breakers
IEC 62271-102	High-voltage switchgear and controlgear – Part 102: High-voltage alternating current disconnectors and earthing switches
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 60376	Specification of technical grade sulfur hexafluoride (SF6) for use in electrical equipment
IEC/TR 62271-301	High-voltage switchgear and controlgear – Part 301: Dimensional standardization of high-voltage terminals

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IEC 62271-4	High-voltage switchgear and controlgear – Part 4: Handling procedures for sulphur hexafluoride (SF6) and its mixtures
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 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 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 60815-3	Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 3: Polymer insulators for a.c. systems
IEC 60137	Insulated bushings for alternating voltages above 1 000 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 60529	Degree of protection provided by enclosures (IP Code)
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 4126	Safety devices for protection against excessive pressure
EN 1005-3:2002	Safety of machinery. Human physical performance Recommended force limits for machinery operation

3.2.2 Specific standards

3.2.2.1 *Latam*

NMC001 – Procedimiento para el conexionado de armarios cuadros y paneles

3.2.2.1.a) *Enel Distribución Chile*

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


3.2.2.2 *e distribución*

NNM001 – Normas de operación definiciones

NMC001 – Procedimiento para el conexionado de armarios cuadros y paneles

NNC007 – Cables de control multipolares

NZC001 – Procedimiento para la confección de proyectos de control y protección

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3.2.2.3 *E Distributie*

Prescriptia Energetica PE 101/85 – Normativ pentru construcția instalațiilor electrice de conexiuni și transformare cu tensiuni peste 1 kV

NTE 011/12/00 - NORMĂ TEHNICĂ PENTRU PROIECTAREA SISTEMELOR DE CIRCUITE SECUNDARE ALE STAȚIILOR ELECTRICE

3.2.2.4 *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 – Conessioni: forme e dimensioni

ENEL operative note PVR001 (guarantee management)

ENEL operative note PVR006 (bar code)

ENEL Global Standard GST002 Power Transformers

4 SERVICE CONDITIONS

4.1 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)
Ice coating (mm)	10

4.2 Specific service conditions

4.2.1 Colombia (Enel_Codensa)

The reference altitude is 2.600 m¹.

4.2.2 Romania² (E Distributie)


Minimum ambient air temperature (°C)	-30
Ice coating (mm)	22

4.2.3 Seismic qualification level

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

¹ For Colombia the rated insulation levels in chapter 5 already consider the altitude effect on the external insulation, therefore the correction in clause 2.1.1 of IEC 62271-1 is not required. On the contrary are confirmed the precautions to be taken for low-voltage auxiliary and control equipments.

² In accordance with Prescriptia Energetica PE 101/85

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e-distribuzione	AF5 (IEC 62271-207)
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5 HYBRID MODULES COMPOSITION

In the following the typical Hybrid Modules compositions are described (the figures shall be intended as terms of 3 elements, one for phase). Considering the modularity of Hybrid Module, different compositions could be required. See annex A for some layout examples.

For each Hybrid Module the Enel Group Distribution company will provide the proper component list (using items in chapter 2) and the HV single-line diagram. It's up to the manufacturer to verify the coherence between the 2 documents and, if necessary, to ask for clarifications.

5.1 Y1 type

- n° 1 circuit-breaker with three-pole or single-pole mechanism
- n° 1 toroidal current transformer
- n° 3 SF6-air bushings (or cable connections or bus-duct connections)

Additionally, depending by the HV single-line diagram, the composition could include:

- up to n° 2 disconnectors (optionally with ability of Bus-transfer current switching), with motor-driven three-pole mechanism;
- up to n° 3 disconnector combined with earthing switch, with motor-driven three-pole mechanism
- up to n° 2 line voltage presence detectors

5.2 Y2 type

- n° 3 disconnectors combined with earthing switches, with motor-driven three-pole mechanism
- n° 2 circuit-breakers with three-pole or single-pole mechanism
- n° 2 toroidal current transformers
- n° 1 line voltage presence detector
- n° 3 SF6-air bushings (or cable connections or bus-duct connections)

5.3 Single-bay type

- n° 1 disconnector combined with earthing switch, with motor-driven three-pole mechanism
- n° 1 circuit-breaker with three-pole or single-pole mechanism
- n° 1 toroidal current transformer
- n° 2 SF6-air bushings (or cable connections or bus-duct connections)

Additionally, depending by the HV single-line diagram, the composition could include:

- n° 1 disconnector, with motor-driven three-pole mechanism
- n° 1 disconnector combined with earthing switch, with motor-driven three-pole mechanism

6 TECHNICAL CHARACTERISTICS

6.1 Common general ratings


Rated voltage U_r (kV)		72,5	145	170	245
Rated short-duration power-frequency withstand voltage U_d (kV rms):	Phase-to-earth, across open switching device and between phases	140	275		395
	Across the isolating distance	160	315		460

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Rated lightning impulse withstand voltage U_p (kVp):	Phase-to-earth, across open switching device and between phases	325	650	950
	Across the isolating distance	375	750	1050
Rated frequency f_r (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 I_r (A)		2000		
Rated short time withstand current I_k (kA)		31,5	40/50 ³	
Degrees of protection provided by enclosures (IEC 60529)		IP 54 ⁴		
Rated supply voltage U_a (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		
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		

³ Only in particular cases a value of 50 kA (I_k) will be requested.

⁴ Applicable also to the Control Box and to the Operating Device Box(es).

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6.2 Circuit-breakers

In addition to paragraph 6.1 and to IEC 62271-100 requirements, the following further circuit-breakers ratings are required.

Rated voltage U_r (kV)	72,5	145	170	245
Rated short-circuit breaking current I_{sc} (kA)	31,5	40/50 ⁵		
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 ⁶			
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			

6.3 Disconnectors and earthing switches

In addition to paragraph 6.1 and to IEC 62271-102 requirements, the following further disconnectors and earthing switches ratings are required.

Rated voltage U_r (kV)	72,5	145	170	245
Number of poles	3			
Opening (closing) time for motor operation (s)	≤15			
Disconnector mechanical endurance class M_r	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		
	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			


6.4 SF6-air bushings

6.4.1 General requirements

The SF6-air bushings for the connections of Hybrid Modules 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.

⁵ Only in particular cases a value of 50 kA (I_{sc}) will be requested.

⁶ 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.

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The complete Hybrid Module, 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.

6.4.2 Bushing terminations

6.4.2.1 *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 \varnothing 14.3mm
- Distance between holes 44.5mm

6.4.2.2 *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 \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 e-distribuzione clamps (double cable). Fig.1

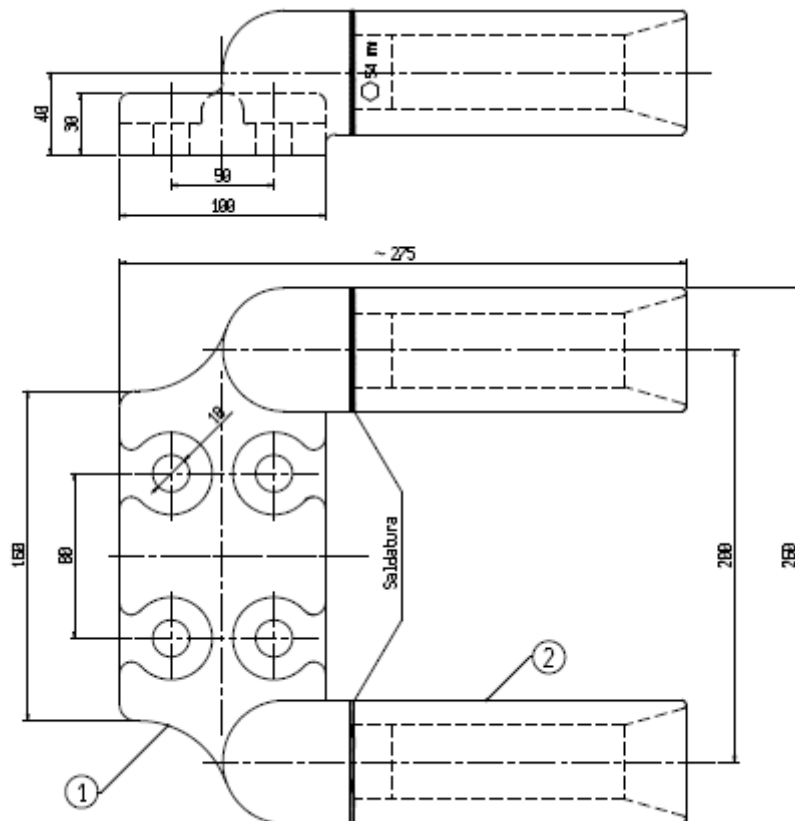



Fig. 1

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6.5 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.

6.6 Cable connections

IEC 62271-209 applies.


The cable connections can be requested with upward exit or downward exit (in upward case, the manufacturer shall ensure the on-site compatibility between cable supports and Hybrid Module).

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 Hybrid Module transportation is possible with components fully assembled in a single unit, it's required the female cone factory preassembly.


6.7 Current transformers

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

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Base component code (see par. 2)	GSH002/ 601 604	GSH002/ 602 605	GSH002/ 603 606	GSH002/ 607	GSH002/ 608	GSH002/ 611	GSH002/ 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)	200-400/1	400-800/1	1.600/1	200-400/1/1	400-800-1.600/1/1	200-400/1/1	400-800/5/1/1
Core number	1	1	1	2	2	2	3
Accuracy class ⁷	5P30	5P30	5P30	5P30	5P30	5P30	0,2 – FS10
							5P30
							5P30
Rated burden (VA)	15	15	15	15	15	15	15
Maximum secondary winding resistance (R_{ct}) at 75 °C (Ω)	5	5	5	5	5	5	5 (only for 1 A cores)

⁷ the accuracy requirements refer to all specified transformation ratio


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Base component code (see par. 2)	GSH002/620	GSH002/621	GSH002/621C	GSH002/622	GSH002/622C	GSH002/623	GSH002/624
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)	1.000-2.000/5/5/5	1.000-2.000/5/1/1	1.000-2.000/5/1/1	400-800/5/5/5	400-800/5/5/5	1.000-2.000/5/5	300-600-1000/5/5/5/5
Core number	3	3	3	3	3	2	4
Accuracy class ⁸	0,5 – 5P20	0,2s – FS10	0,5 – 5P20	0,5 – 5P20	0,2s – FS10	5P20	0,2s – 2 \geq FS \leq 5
	5P20	5P20	5P20	5P20	5P20		5P20
	5P20	5P20	5P20	5P20	5P20		5P20
	n.a.	n.a.	n.a.	n.a.	n.a.		5P20
Rated burden (VA)	30	30	30	30	30	30	30
Maximum secondary winding resistance (R_{ct}) at 75 °C (Ω)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

6.8 Voltage transformers

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

⁸ the accuracy requirements refer to all specified transformation ratio

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Base component code	GSH002/ 701	GSH002/ 702	GSH002/ 703	GSH002/ 704	GSH002/ 705
Highest voltage for equipment U_m (kV)	72,5	145	170	245	72,5
Rated Insulation levels	According to 6.1				
Rated transformation ratio k_r (kV/kV)	$\frac{60:\sqrt{3}}{0,1:\sqrt{3}}$	$\frac{132:\sqrt{3}}{0,1:\sqrt{3}}$	$\frac{150:\sqrt{3}}{0,1:\sqrt{3}}$	$\frac{220:\sqrt{3}}{0,1:\sqrt{3}}$	$\frac{66:\sqrt{3}}{0,11:\sqrt{3}}$
Secondary windings	1	1	1	1	2
Rated voltage factor F_v	1,5 (rated time 30 s)				
Accuracy class	0,2 – 3P	0,2 – 3P	0,2 – 3P	0,2 – 3P	0,5 – 3P 0,5 – 3P
Rated burden (VA)	25	25	25	25	25

Base component code	GSH002/ 711	GSH002/ 712	GSH002/ 721	GSH002/ 722
Highest voltage for equipment U_m (kV)	145	145	145	145
Rated Insulation levels	According to 6.1			
Rated transformation ratio k_r (kV/kV)	$\frac{120:\sqrt{3}}{0,1:\sqrt{3}}$	$\frac{110}{110:\sqrt{3}}$	$\frac{132:\sqrt{3}}{0,11:\sqrt{3}}$	$\frac{110:\sqrt{3}}{0,11:\sqrt{3}}$
Secondary windings	2	3	2	2
Rated voltage factor F_v	1,5 (rated time 30 s)			
Accuracy class	0,2 0,2 – 3P n.a.	0,2 0,2 – 3P 0,2 – 3P	0,5 – 3P 0,5 – 3P n.a.	0,5 – 3P 0,5 – 3P n.a.
Rated burden (VA)	15	15	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

6.8.1 Specific requirements


6.8.1.1 *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 CONSTRUCTION CHARACTERISTICS

7.1 General characteristics

The Hybrid Module shall be manufactured in accordance with IEC 62271-205.

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According to par. 1.101 of IEC 62271-205, each switching device and its controlgear forming part of a compact switchgear assembly shall comply with the relevant individual standard. Being the Hybrid Module formed also by metal enclosed switchgear devices, the requirements of IEC 62271-203 are applicable.

The Hybrid Module consists of a single enclosure for each phase.

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.

Hybrid modules shall comply with dimensional constraints shown in annex C.

7.2 Enclosures and support 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) and shall be at ≥ 2.000 mm from HV terminals
- It is possible to easily replace the complete pole elements without affect other poles;
- The maintenance or complete equipment/parts replacing are executable accessing with lifting vehicle (the manufacturer's maintenance manual shall indicate the procedure for carrying out this movement of the equipment).

The Hybrid Module enclosures shall be assembled on a metallic support structure suitable to be fixed on a foundation by means of chemical plugs or similar systems.

7.3 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.


7.4 Gas density control

The Hybrid Module 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 (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 pole and partition shall have a distinct SF6 circuit, with a device for the density control.

Solely the gas control circuit of the voltage transformers (when present) can be three-pole.

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Each SF6 circuit shall provide a connection element (type DILO VK/BG-03/8 or equivalent⁹), 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;
- located in order to avoid the solar radiation influence on the external temperature measuring;
- 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 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 (see details and specific requirements in 8.5):

- 1st minimum gas density level ("P1 gas"): alarm (replenishment necessary), with 2 contacts (1 contact in case of Single-bay type or voltage transformers);
- 2nd minimum gas density level ("P4 gas"): to get out of service (see 8.5 for details), with 2 contacts (1 contact in case of Single-bay type or voltage transformers).

The contacts operating tolerance shall be lower than $\pm 1,5\%$ (referred 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.


7.5 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 \geq 8.

⁹ 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.

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7.6 Partitioning

7.6.1 Common requirements

Generally the partitioning of each pole should be unique. At request could be required to have other partitions: in this case the new partitions 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.

If the manufacturer consider necessary further partitions (i.e. V.T. presence), they will be subjected to Enel Group Distribution companies approval.

Partition examples are in annex B (represented in red color).

7.6.2 Specific requirements

7.6.2.1 *e-distribuzione*

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

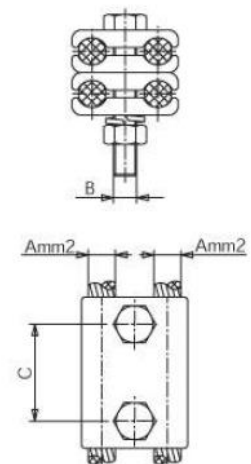
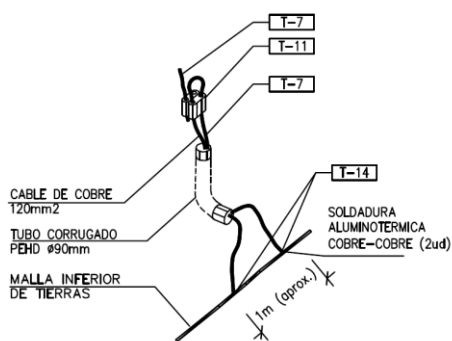
For 245 kV Y2 Hybrid Modules a partitioning between the two circuit-breakers shall be added (see annex B, Y2 examples, fig. 2); in this case the central bay, including its disconnector, will be part:

- a) in case if one CB is used on Transformer bay, of the line bay partition;
- b) in case of both CBs used on line bays, of one of them.

7.7 Earthing


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

On the base of each support there shall be 2 earthing points equipped with (AISI 316) M12 stainless steel bolts (included in the scope of supply) separated 50 mm vertically.



Support cannot be used as earthing path (even for CTs and VTs, that will also have an earthing path connection directly to the earthing points in the support base).

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.

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

	Enel Distributie, e-distribuzione and Latam	Endesa Distribución Eléctrica
CTs	S1	S2 or S3 (according to the used transformation ratio)
VTs	n	n

7.8 Internal arc and overpressure safety devices

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 Hybrid Module vital parts.

7.9 Current Transformers

The outdoor current transformers shall be manufactured in compliance to IEC 61869-1 and IEC 61869-2, toroidal type and suitable for exposed installation. They will be located close to the bushings (or to the cable or 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 mm² 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 mm² section if $I_{sn} = 1$ A or 4 mm² section if 5 A.

Manufacturer may omit the secondary terminal boxes: on this purpose the connections between the secondary windings and cables to CT's terminal board inside the Control Box shall be welded inside CTs. In this case the terminal board becomes the secondary terminals.

With reference to the annex C dimensional drawings, it is specified that the primary terminal "P1" shall be positioned toward the internal hybrid module side, as the "P2" is to SF6/air bushing or cable connection.


7.10 Voltage Transformers

The outdoor voltage transformers, suitable for exposed installation, shall be manufactured in compliance to IEC 61869-1 and IEC 61869-3 and partitioned respect to the hybrid modules enclosures.

7.11 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 6 for the supply rated voltage) and protected with a magnetothermic automatic circuit-breaker. It shall be

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controlled by a humidistat; thermostat is admitted in addition 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.

7.12 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. support, 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.

7.13 Nameplate


7.13.1 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 62271-205 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 (U_r);
 - (b) nominal insulation level;
 - (c) rated frequency (f_r);
 - (d) rated thermal current (I_r) (for main circuits);
 - (e) rated short-time permissible current (I_k) (for main and ground circuits);
 - (f) Nominal permissible peak current (I_p) (for main and ground circuits);

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- (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 (Y1, Y2 or Single-bay);
- 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

7.13.2 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.

7.13.3 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.

8 FUNCTIONAL CHARACTERISTICS

8.1 Drive mechanisms

8.1.1 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) If the Hybrid Module have more than one, they have to be different

These selector switches shall be located inside the Control Box.

In particular the following switches are necessary:

- for Y1, single-bay and double bus-bar types: n° 1;

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- for Y2 type: n° 2 (one for bay 1 and 2 and one for bay 3 – see annex B).

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 8.2.1), 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 hybrid module.

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;

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- 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.

8.1.2 Circuit-breakers drive mechanism

8.1.2.1 General requirements

The Circuit-breakers drive mechanism shall be spring type, three-pole or single-pole type, except for 245kV has to be single-pole type.

The drive energy storage shall be normally made by mean of d.c. electric motor (see table in chapter 6.1 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 alternative shall be designed excluding its possible movement in case of unexpected spring operation. The manual loading must have a device counter turns, this device will restart each time the loading of the spring is completed and the desired operation is executed. Every hybrid module 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 cycles¹⁰:

- 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.

8.1.2.2 Release drive circuits

Referring to the table in chapter 2, 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).

In the electric schemes in annex D both the control circuits for the different cases and the interlocks described in the paragraph 8.5 are shown.

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)

¹⁰ with the CB closed the opening springs shall be always charged.

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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).

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.

8.1.2.2.a) *E-Distributie and 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 "bloccato"/"sbloccato" 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.

8.1.3 Disconnectors (DSs) and earthing switches (ESs) 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 6.1 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.

Every hybrid module 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

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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 manual emergency operation shall be enabled by a Consensus Electromagnetic Device (CED¹¹):

- in case of 2 positions selector switch the hand-crank insertion is enabled only in “local” position, pressing a button¹² and in presence of all requested consensus conditions (see electric schemes);
- in case of 3 positions selector switch the hand-crank insertion is enabled only in “manual” position and in presence of all requested consensus conditions (see electric schemes).

The hand-crank for manual operation shall be withdrawable type; its insertion shall cause an anomaly remote signalization¹³ 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 (remote, local and manual) shall be subject to the conditions described in paragraph 8.5 and represented in the electric scheme of annex D.

8.1.3.1 *Endesa Distribución, Enel Distributie and Latam specific requirements*

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

8.1.3.2 *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).

Electrical interlocks are described in paragraph 8.5.

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, to 3 times the maximum force required for manual operation (5.105 of 62271-102), or, if a strain limiting device is present, to 1,5 times its intervention rated value.

8.2 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”)

¹¹ “DEC – Dispositivo Elettromagnetico Consenso” for Enel Distribuzione and Enel Distributie.

¹² Different designs with the same functional results can be evaluated by Enel.

¹³ “SNM – Sezionatore Non Manovrabile” for Enel Distribuzione and Enel Distributie.

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8.2.1 Control Box

All Hybrid Module auxiliary and control equipments shall be placed in the Control Box, located in correspondence of the central pole, on the side indicated in annex C; the Control Box can be fixed on the Hybrid Module support or on a specific independent support (in this case see annex C for maximum distance). In this box also the cables coming from CTs and, if any, VTs shall be connected to the respective terminal boards (see par. 7.9 and annex D). If the manufacturer proposes the control box separate from the module, the connection between the CB and the module must be with heavy duty connection type (harting)

In case of interferences with some equipment parts (e.g. with VTs and HV cable connection) the box shall be located on the Hybrid Module side in correspondence with the LV cable shaft of the civil works (in this case some additional information should be provided by the user and the Control box position will be agreed).

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 6.1, the box protection degree with open doors shall be minimum IP2X.

In addition to the dimensions shown in annex C, the box base height respect to the ground shall be ≥ 400 mm and all HMI (Human Machine Interface) elements (controls and signalizations) shall be at ≤ 1800 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 Hybrid Module 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 ($\geq 1\text{ mm}^2$), flexible type, compliant with IEC 60332-3-24 and insulated at $U_0/U = 450/750$ V.


The cable ends shall be provided 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 ($\geq 1,5\text{ mm}^2$), 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 copper, section $\geq 60\text{ mm}^2$ 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 Hybrid Module 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 300×300 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.

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The Control Box shall include:

- selector switches;
- synoptic (see annex E) 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, see par. 8.5);
- 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.

For each Hybrid Module the interface terminal boards composition depends on the HV switchgear typologies that form the whole assembly.

The interface terminal boards (and their modular terminals) shall be grouped, for every bay, switchgear by switchgear, according to principle electric schemes shown in annex D.

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.

Two bridged terminals couples for the anti-condensation circuit and 2/3 (depending on the number of bays) bridged terminal couples for the motor supply circuit shall be provided.

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 have sufficient residual space ($\geq 10\%$ 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 (installed i.e. on transformer bay) 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.


8.2.1.1 *e-distribuzione and E-Distributie specific requirements*

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

8.2.1.2 *e-distribución specific requirements*

Control box wiring and construction must be compliant with internal Endesa procedure NMC001, and NNC007.

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.

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8.2.2 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.

In order to allow the verification, during maintenance activity, of the unchanged characteristics of the CB's no-load travel curve (see note in par. 10.2.2-9b), manufacturer shall provide the measuring points, properly machined.

In addition to the IP requirement of table at chapter 6, 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.

8.3 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 Hybrid Module (on the line or busbar bay). 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:

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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.

8.4 Electric schemes, controls and signalizations

8.4.1 General requirements

The electric schemes shall:

- a) be represented in the reference conventional conditions:
 - a.1) CB, DS and ES (if any) in open position;
 - a.2) CED not energized;
 - a.3) absence of a.c. and d.c. auxiliary supplies;
 - a.3) absence of HV;
 - a.4) gas absence;
 - a.5) closing springs discharged;
 - a.6) remote/local selector switch(es) in remote position;

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- a.7) 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.8) 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.

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

8.4.2 Endesa specific requirements

Manufacturer definitive schemes must be compliant with Endesa internal procedure NZC001.

8.4.3 e-distribuzione, E-Distributie and Latam specific requirements

The Annex D principle electric schemes (and their identifying code) are listed in the following tables, with the references to previous e-distribuzione and E-Distributie technical specifications (the previous reference doesn't mean that the electric scheme is exactly the same – some modifications have been introduced).

8.4.3.1 *Circuit-breakers*

Code	Description	Previous reference
CB-S/1.2.	C.B. Single-pole operation - 1°, 2° opening circuit	DY 2063 DY 2063 RO
CB-S/1.2.3.	C.B. Single-pole operation - 1°, 2°, 3° opening circuit	DY 2063/1 DY 2063/1 RO
CB-T/1.3.	C.B. Three-pole operation - 1°, 3° opening circuit	DY 2064 DY 2064 RO
CB-T/1.2.3.	C.B. Three-pole operation - 1°, 2°, 3° opening circuit	DY 2064/1 DY 2063/1 RO
CB-T/1.2.	C.B. Three-pole operation - 1°, 2° opening circuit	DY 2064/2 DY 2064/2 RO
245 CB-S/1.2.	245 kV C.B. Single-pole operation - 1°, 2° opening circuit	-

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8.4.3.2 *Disconnectors/Earthing switches*

Code	Description	Previous reference
101	Line 1 Bay (Only "Y1" – EVDS)	DY 1107 p.2
102	Line 2 Bay (Only "Y1" – EVDS)	DY 1107 p.3
103	Customer Bay (Only "Y1")	-
104	Busbar Bay (Only "Y1" – joined with Customer Bay)	-
201	Line Bay (External Voltage Transformers)	DY 1108 p.2
202	Line Bay (Integrated Gas insulated Inductive Voltage Transformers)	DY 1108 p.3
301	Busbar (or Line 2) Bay (EVDS)	DY 1109 p.2
302	Busbar (or Line 2) Bay (Integrated Gas insulated Inductive Voltage Transformers)	DY 1109 p.3
303	Busbar (or Line 2) Bay (EVDS and Partition)	-
401	Transformer Bay	DY 1110 p.2
402	Transformer Bay (Integrated Gas insulated Inductive Voltage Transformers)	DY 1110 p.3
DS electric scheme code	Description	Previous reference
501	Busbar Bay (Only "Single-bay" type)	DY 1111 p.2
502	Busbar Bay (Only "Single-bay" type - Partition)	-

8.4.3.3 *Motors and anti-condensation power supplies*


Code	Description	Previous reference
AM	Motors and anti-condensation terminal board power supplies	-

8.4.3.4 *Current and Voltage Transformers for e-distribuzione*

Code	Description	Previous reference
CT/1	Current Transformers (type GSH002/601 ÷ 606)	DY 1106 p.2
CT/2	Current Transformer (type GSH002/607)	-
CT/3	Current Transformer (type GSH002/608)	-
VT/1	Voltage Transformers (Inductive or Capacitor Voltage Transformers Version)	DY 1113 p. 2
VT/2	Voltage Transformers (Gas insulated Inductive Voltage Transf. Version)	DY 1113 p. 3

8.4.3.5 *Current and Voltage Transformers for Enel Distributie*

See the electric diagrams from page 110 to page 118.

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8.5 Controls, signalizations, interlock and automatic openings

8.5.1 e-distribución specific requirements

8.5.1.1 Hybrid module Single-bay type – used in Bus coupler bay

d.c. and a.c. supply

- Terminal block for the CB and DSs motors d.c. supply (See Annex D - Terminals X0:1-4)
- Terminal block for the CB drive circuit of shunt release (1st circuit) d.c. supply (See Annex D - Terminals X0:5-6)
- Terminal block for the DSs drive circuits of shunt release d.c. supply (See Annex D - Terminals X0:7-8)
- Terminal block for the connection of the d.c. supply for the circuit associated with the control box synoptic signalization and for the signals communicated to the RTU (See Annex D - Terminals X0:9-10)
- Terminal block for the CB drive circuit of shunt release (2nd circuit) d.c. supply (See Annex D - Terminals X0:11-12)
- Terminal block for the a.c. supply for the anti-condensation circuit associated with the CB, DSs and VTs of busbar 1 and busbar 2 control boxes (See Annex D - Terminals X0:13-18).

Current circuits


- Terminal block for the CT secondary terminals (See Annex D - Terminals X6:1-16 if CTs are supplied directly from factory with the primary transformation ratio required for each installation).

Voltage circuits

- Busbar voltage circuit bus. Terminals associated with this functionality shall receive the voltages from the VTs of busbar 1 and busbar 2. This bus shall transmit the voltage of both busbars to each hybrid module in the substation (See Annex D - Terminals X0:21-28)
- Busbar voltage absence block selection bus. Terminals associated with this functionality shall receive the overcurrent protection miniature circuit breaker or molded case circuit breaker (hereinafter MCB in general) open signal from the VTs of busbar 1 and busbar 2 (See Annex D - Terminals X0:29-37).

1st battery CB control and protection (P1-N1)

- 1st drive circuit of shunt closing release control. The requirements described in SF6 Gas and simultaneous operations shall apply.
- In case of two batteries, the drive circuit of shunt closing release control has to take into account the SF6 second alarm level from the two batteries.
- Anti-pumping circuit and priority to the LOCAL opening maneuver has to work properly. None of two conditions should interfere with the other.
- 1st drive circuit of shunt opening release control. The requirements described in SF6 Gas and simultaneous operations shall apply. The drive circuit of shunt opening release shall be prepared to supervise the shunt opening release.
- 1st battery CB closing (K0E) and opening (K0A) auxiliary relays. These relays shall receive closing and opening commands from the pushbuttons located in the Control Box and from RTU, depending on the S43 Manual-Local-Remote selector switch (hereinafter S43 M-L-R selector switch) position. The auxiliary closing relay coil K0E energization shall be able to include the synchronism permission to local and remote command, in series with the closing command. For both, closing and opening relays, a normally open contact shall be used to activate the drive circuit of shunt closing and opening release.

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2nd battery CB control and protection (P2-N2)

- 2nd drive circuit of shunt opening release control. The requirements described in SF6 Gas and simultaneous operations shall apply. The drive circuit of shunt opening release shall be prepared to supervise the shunt opening release.

DSs control (P12-N12)

- DSs driving mechanisms operation shall not be executed directly on their motors. These motors shall implement control based on auxiliary relays, which shall receive the opening and closing commands.
- DSs automatism shall guarantee that simultaneous operation of several DSs may not be performed.
- No DSs shall be operated when the CB is in closed position.
- The auxiliary contacts of each DS operation diagram shall be represented, including precise identification of the DS position during its whole itinerary.

Busbar differential relay


- Open and closed DSs positions shall be reported (See Annex D - Select terminals from X2 and X3 terminal blocks).
- Open and closed CB position shall be reported (See Annex D - Select terminals from X1 terminal block).
- A normally open voltage-free contact connected to terminals of K0E (auxiliary closing relay) shall be used to inform the busbar differential relay when a circuit breaker closing command occurs (See Annex D - Terminals X20:3-4) .

Interlocking between hybrid modules

- A closed bus coupler circuit shall be created through the X19 terminal block. This closed bus coupler circuit will generate the closed bus coupler state. Closed state implies that both DSs and CB are closed. The closed bus coupler circuit will enable the operation of all busbar DSs of the switchyard (See Annex D - Terminals X19:1-6)

Signals to RTU (P15-N15)

- Open and closed CB position shall be reported (See Annex D – Select terminals from X1 terminal block).
- Open and closed DSs positions shall be reported (See Annex D – Select terminals from X2 and X3 terminal blocks).
- Every motorized switchgear MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminals X1:51-52; X2:51-52 y X3:51-52).
- Anti-condensation circuit F3 MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal X21:8)
- Anti-condensation circuits d.c. supply MCB open signal, located in the Busbar 1 voltage control box, shall be reported. The signal shall be sent to the hybrid module control box by means of a normally closed contact (See Annex D – Terminals X21:13-14).
- Anti-condensation circuits d.c. supply MCB open signal, located in the Busbar 2 voltage control box, shall be reported. The signal shall be sent to the hybrid control box by means of a normally closed contact (See Annex D – Terminals X21:15-16).
- Busbar 1 voltage MCB open signal, located in busbar 1 voltage control box, shall be reported. The signal shall be sent to the module control box by means of a normally closed contact (See Annex D – Terminals X21:9-10).
- Busbar 2 voltage MCB open signal, located in busbar 2 voltage control box, shall be reported. The signal shall be sent to the module control box by means of a normally closed contact (See Annex D – Terminals X21:11-12).

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- Manual position signal of S43 M-L-R selector switch shall be reported by means of a closed contact when the selector is in that position (See Annex D – Terminal X21-4).
- Local position signal of S43 M-L-R selector switch shall be reported by means of a closed contact when the selector is in that position (See Annex D – Terminal X21-5).
- The anti-pumping relay activation shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminals X1:53-54).
- SF6 CB alarm signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminals X1:55-56).
- SF6 CB block signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminals X1:57-58).
- Discharged springs signal shall be reported by means of a voltage-free contact connected to terminals. If this signal comes from an auxiliary relay, the auxiliary relay MUST be a temporized one (See Annex D – Terminals X1:45-46).
- Operating time exceeded signal shall be reported by means of voltage-free contact connected to terminals (See Annex D – Terminals X2:53-54 and X3:53-54).
- SF6 busbar or module alarm signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminal X21-6).
- SF6 busbar or module block signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminal X21-7).


8.5.1.2 *Hybrid module Y1 type – used in Line bay*

d.c. and a.c. supply

- Terminal block for the CB and DS/ESs motors d.c. supply (See Annex D - Terminals X0:1-4).
- Terminal block for the CB drive circuit of shunt release (1st circuit) d.c. supply (See Annex D – Terminals X0:5–6).
- Terminal block for the DS/ESs drive circuits of shunt release d.c. supply (See Annex D – Terminals X0:7–8).
- Terminal block for the connection of the d.c. supply for the circuit associated to the control box synoptic signalization and for the signals communicated to the RTU (See Annex D - Terminals X0:9-10).
- Terminal block for the CB drive circuit of shunt release (2nd circuit) d.c. supply (See Annex D - Terminals X0:11-12)
- Terminal block for the CB and DS/ESs anti-condensation circuit a.c. supply (See Annex D - Terminals X0:13-18). Two extra terminals shall be available within the heating circuit, to be used for the heating power supply of the boxes associated to the VTs bay (if exists), installed by ENEL (See Annex D - Terminals X0:19-20)
- F1 MCB for protecting circuits of the CB motor d.c. supply (See Annex D - Terminals X0:1/2-3/4).

SPECIFIC REQUIREMENTS BRAZIL

- F1 MCB for protecting circuits of the CB motor d.c. supply (See Annex D - Terminals X0:2-3).
- F21/S1, F21/S2, F21/TR and F22/TR MCBs for protecting circuits of the DS/ES motors d.c. supply (See Annex D - Terminals X0:3-4).
- F2 MCB for protecting circuits of the DS/ES drive circuit of shunt release d.c. supply (See Annex D - Terminals X0:7-8).

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SPECIFIC REQUIREMENTS COLOMBIA

- *F11 MCB connected to the terminal block for the CB drive circuit of shunt release (1st circuit) d.c. supply (See Annex D – Terminals X0:39-40, X0:5-6 and X0:11-12).*

Current circuits

- Terminal block for the CT secondary terminals (See Annex D - Terminals X6:1-24 if CTs are supplied directly from factory with the primary transformation ratio required for each installation).

Voltage circuits


- Terminal block for the VT secondary terminals (See Annex D - Terminals X7:1-29)
- MCBs for protecting circuits from X7 terminal block, associated with VTs bay. They shall be installed in the control box with the corresponding signal for each circuit breaker:
 - F101-MAIN PROTECTION RELAY VOLTAGE: 1 tripolar+neutral MCB with 2 normally closed + 2 normally open voltage-free contacts connected to terminals.
 - F102-SECONDARY PROTECTION RELAY VOLTAGE: 1 tripolar+neutral MCB with 2 normally closed + 2 normally open voltage-free contacts connected to terminals.
 - F103-MEASURE AND SYNCHRONISM VOLTAGE: 1 tripolar+neutral MCB with 2 normally closed + 2 normally open voltage-free contacts connected to terminals. The normally open contact is used to lock the line earthing switch.
- Bus related to synchronism busbar voltage circuit (See Annex D - Terminals X0:21-30).
- Bus related to block selection caused by lack of busbar voltage (See Annex D - Terminals X0:32-38).
- The auxiliary relays associated with the voltage presence shall be energized from the measure and synchronism voltage winding, to allow line earthing switch operation. The interlock is a series circuit of:
 - Normally closed contacts of the voltage presence auxiliary relays and
 - A normally open F103 MCB contact.

SPECIFIC REQUIREMENTS BRAZIL

- *For the F101, F102 and F103 voltage-free contacts, one of them connected to the terminal block (See Annex D - Terminals X21:12, X21:13 and X21:14) and with the common positive from the protection control box to the RTU.*

1st battery CB control and protection (P1-N1)

- 1st drive circuit of shunt closing release control. The requirements described in SF6 Gas and simultaneous operations shall be applied.
- In case of two batteries, the drive circuit of shunt closing release control has to take into account the SF6 second alarm level from the two batteries.
- Anti-pumping circuit and priority to the LOCAL opening maneuver has to work properly. None of two conditions should interfere with the other.
- 1st drive circuit of shunt opening release control. The requirements described in SF6 Gas and simultaneous operations shall be applied. The drive circuit of shunt opening release shall be prepared to supervise the shunt opening release.
- 1st battery CB closing (K0E) and opening (K0A) auxiliary relays. These relays shall receive closing and opening commands from the pushbuttons located in the Control Box and from RTU, depending on the S43 M-L-R selector switch position. The auxiliary closing relay coil K0E energization shall be able to include the synchronism permission to local and remote command, in series with the closing

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command (X1:63–64). For both, closing and opening relays, a normally open contact shall be used to activate the drive circuit of shunt closing and opening release.


- A normally open voltage-free contact connected to terminals of K0E (auxiliary closing relay) shall be used to inform the main protection relay when a circuit breaker closing command occurs (See annex D – Terminals X20: 3-4).
- It shall be necessary to have a normally open voltage-free contact, connected to terminals of the opening auxiliary relay K0A in case of bays with distributed generation connected (See annex D – Terminals X20:7-8).
- It is necessary to have a contact in S43 M-L-R selector switch (when it is in “LOCAL” position) to set the reclosing automatism out of service (See annex D – Terminals X20:1-2).
- The main protection relay shall be informed when F101 MCB is open. A normally closed voltage-free contact connected to terminals shall be used for this purpose (See annex D – Terminals X20: 9-10)
- Open and closed CB position shall be reported to the main protection relay (See annex D – Select terminals from X1 terminal block (X1:21-24))
- Discharged springs signal shall be reported to the main protection relay by means of a voltage-free contact connected to terminals. These contacts shall be limit switch end position of circuit breaker discharged springs. If there are not enough available contacts, an auxiliary timing relay shall be used for this purpose (See annex D – Terminals X1: 45-46)
- SF6 circuit breaker block shall be reported to the main protection relay by means of a voltage-free contact connected to terminals (See annex D – Terminals X1: 57-58)

SPECIFIC REQUIREMENTS COLOMBIA

- *When S43 M-L-R selector switch is in “LOCAL” position has to cut the negative of the K0E and K0A auxiliary relays. When S43 M-L-R selector switch is in “REMOTE” position, the K0E and K0A auxiliary relay connect to the negative from X1 terminal block (See annex D – Terminals X1:67)*

2nd battery CB control and protection (P2-N2)

- 2nd drive circuit of shunt opening release control. The requirements described in SF6 Gas and simultaneous operations shall be applied. The drive circuit of shunt opening release shall be prepared to supervise the shunt opening release.
- A normally open voltage-free contact connected to terminals of K0E (auxiliary closing relay) shall be used to inform the secondary protection relay when a circuit breaker closing command occurs (See annex D – Terminals X20: 5-6).
- Open and closed CB position shall be reported to the secondary protection relay (See Annex D – Select terminals from X1 terminal block (X1:25-28)).
- The secondary protection relay shall be informed when F102 MCB is open. A normally closed voltage-free contact connected to terminals shall be used for this purpose (See Annex D – Terminals X20:11-12).
- Discharged springs signal shall be reported to the secondary protection relay by means of a voltage-free contact connected to terminals. These contacts should be limit switch end position of circuit breaker springs discharged. In case that there are not enough available contacts, an auxiliary timing relay shall be used for this purpose (See Annex D – Terminals X1: 47-48).
- SF6 circuit breaker block shall be reported to the secondary protection relay by means of a voltage-free contact connected to terminals (See Annex D – Terminals X1:59-60).

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SPECIFIC REQUIREMENTS COLOMBIA

- When S43 M-L-R selector switch is in “REMOTE” position, both positive and negative connect to the X1 terminal block (See annex D – Terminals X1:8A-8B)
- When S43 M-L-R selector switch is in “REMOTE” position, the positive of the preventive opening will be conditioned (See annex D – Terminals X1:67)

DS/ESs control (P12-N12)

- DS/ESs driving mechanisms operation shall not be executed directly on their motors. These motors shall implement control based on auxiliary relays, which shall receive the opening and closing commands.
- DS/ESs automatism shall guarantee that simultaneous operation of several DS/ESs may not be performed.
- No DS/ESs shall be operated when the CB is in closed position.
- Extra terminals to connect the external interlockings shall be available.
- In case of line earthing switch the interlocking which prevents the operation with voltage presence in line shall be included (reserve 2 terminal blocks in the chain condition to include the interlocking). The interlock is a series circuit of:
 - Normally closed contacts of the voltage presence auxiliary relays and
 - A normally open F103 MCB contact.
- The auxiliary contacts of each DS/ES operation diagram shall be represented, including precise identification of the DS/ES position during its whole itinerary.
- The busbar DS maneuver must contemplate the necessary interlocks to be able to make a busbar change taking into account:
 - The busbar coupling and the other busbar DS closed
 - Or the CB open and other busbar DS open.

Busbar differential relay


- Open and closed busbar DSs positions shall be reported (See Annex D - Select terminals from X2 and X3 terminal blocks)

Interlocking between hybrid modules

- A closed bus coupler shall be created through the X19 terminal block. This closed bus coupler circuit will receive the closed bus coupler state. The closed bus coupler circuit will enable the hybrid module busbar DSs operation (See Annex D - Terminals X19:1-6)
- The state of the hybrid module DSs shall be reported to the bus coupler. The bus coupler circuit breaker opening operation shall be locked if any DS of the switchyard is in the intermediate position (See Annex D - Terminals X19:7-8)

Signals to RTU (P15-N15)


- Open and closed CB position shall be reported.(See Annex D – Select terminals from X1 terminal block (X1:29-32))
- Open and closed DS/ESs positions shall be reported (See Annex D – Select terminals from X2:21-24, X3:21-24,X4:21-24 and X5:21-24 terminal blocks)
- Every motorized switchgear MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminals X1:51-52; X2:51-52; X3:51-52; X4:51-52 and X5:51-52)
- Anti-condensation circuit F3 MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal X21:8)

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- F101 MCB open signal shall be reported by means of a normally closed (See Annex D – Terminal X21:9) and a normally open (See Annex D – Terminal X21:12) voltage-free contacts connected to terminals
- F102 MCB open signal shall be reported by means of a normally closed (See Annex D – Terminal X21:10) and a normally open (See Annex D – Terminal X21:13) voltage-free contacts connected to terminals
- F103 MCB open signal shall be reported by means of a normally closed (See Annex D – Terminal X21:11) and a normally open (See Annex D – Terminal X21:14) voltage-free contacts connected to terminals
- “MANUAL” position signal of S43 M-L-R selector switch shall be reported by means of a closed contact when the selector is in that position (See Annex D – Terminal X21:4)
- “LOCAL” position signal of S43 M-L-R selector switch shall be reported by means of a closed contact when the selector is in that position (See Annex D – Terminal X21:5)
- “REMOTO” position signal of S43 M-L-R selector switch shall be reported by means of a closed contact when the selector is in that position (See Annex D – Terminal X21:5A)
- The anti-pumping relay activation shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminals X1:53-54)
- SF6 CB alarm signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminals X1:55-56)
- SF6 CB block signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminals X1:61-62)
- Discharged/Charged springs signal shall be reported by means of a voltage-free contact connected to terminals. If this signal comes from an auxiliary relay, the auxiliary relay MUST be a temporized one (See Annex D – Terminals X1:49-50 for discharged springs and X1:49-50A for charged springs)
- Operating time exceeded signal shall be reported by means of voltage-free contact connected to terminals (See Annex D – Terminals X2:53-54; X3:53-54; X4:53-54 and X5:53-54)
- SF6 busbar or module Alarm signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminal X21:6)
- SF6 busbar or module Block signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminal X21:7)
- DS/ES motor power supply signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminal X2:55; X3:55; X4:55; X5:55;)

SPECIFIC REQUIREMENTS BRAZIL

- *Positive power supply for digital inputs to the RTU from the protection control box has to be independent of the power to local signals.*
- *F21/S1 MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal X2:52)*
- *F21/S2 MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal X3:52)*
- *F21/TR MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal X4:52)*
- *F22/TR MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal X5:52)*
- *Positive Remote signal supply terminals for the main protection (See Annex D – Terminal X0:37)*
- *Positive Remote signal supply terminals for the secondary protection (See Annex D – Terminal X0:38)*

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8.5.1.3 Hybrid module Y1 type – used in Transformer bay

d.c. and a.c. supply

- Terminal block for the CB and DSs motors d.c. supply (See Annex D - Terminals X0:1–4)
- Terminal block for the CB drive circuit of shunt release (1st circuit) d.c. supply (See Annex D - Terminals X0:5–6)
- Terminal block for the DSs drive circuits of shunt release d.c. supply (See Annex D - Terminals X0:7–8)
- Terminal block for the connection of the d.c. supply for the circuit associated to the control box synoptic signalization and for the signals communicated to the RTU (See Annex D - Terminals X0:9–10)
- Terminal block for the CB drive circuit of shunt release (2nd circuit) d.c. supply (See Annex D - Terminals X0:11–12)
- Terminal block for the CB and DSs anti-condensation circuit a.c. supply (See Annex D - Terminals X0:13-18). Two extra terminals shall be available within the heating circuit, to be used for the heating power supply of the boxes associated to the VTs bay (if exists), installed by Endesa (See Annex D - Terminals X0:19-20).
- F1 MCB for protecting circuits of the CB motor d.c. supply (See Annex D - Terminals X0:1/2-3/4).

SPECIFIC REQUIREMENTS BRAZIL

- F1 MCB for protecting circuits of the CB motor d.c. supply (See Annex D - Terminals X0:2-3).
- F21/S1, F21/S2, F21/TR and F22/TR MCBs for protecting circuits of the DS/ES motors d.c. supply (See Annex D - Terminals X0:3-4).
- F2 MCB for protecting circuits of the DS/ES drive circuit of shunt release d.c. supply (See Annex D - Terminals X0:7-8).

SPECIFIC REQUIREMENTS COLOMBIA


- F11 MCB connected to the terminal block for the CB drive circuit of shunt release (1st circuit) d.c. supply (See Annex D – Terminals X0:39-40, X0:5–6 and X0:11-12).

Current circuits

- Terminal block for the CTs secondary terminals (See Annex D - Terminals X6:1-24 if CTs are supplied directly from factory with the primary transformation ratio required for each installation).

Voltage circuits

- Terminal block for the VTs secondary terminals (See Annex D - Terminals X7:1-29)
- MCBs to protect circuits from X7 terminal block, associated with VTs bay. They shall be installed in the control box with the corresponding signal for each circuit breaker:
 - F101-MAIN PROTECTION RELAY VOLTAGE: 1 tripolar+neutral MCB with 2 normally closed + 2 normally open voltage-free contacts connected to terminals.
 - F102-SECONDARY PROTECTION RELAY VOLTAGE: 1 tripolar+neutral MCB with 2 normally closed + 2 normally open voltage-free contacts connected to terminals.
 - F103-MEASURE AND PROTECTION VOLTAGE: 1 tripolar+neutral MCB with 2 normally closed + 2 normally open voltage-free contacts connected to terminals. The normally open contact is used to lock the line earthing switch.
- Bus related to synchronism busbar voltage circuit and interlocked with the DS position (See Annex D - Terminals X0:21-30)

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- Bus related to block selection caused by lack of busbar voltage and interlocked with the DS position (See Annex D - Terminals X0:32-38)

SPECIFIC REQUIREMENTS BRAZIL

- *For the F101, F102 and F102 voltage-free contacts, one of them connected to the terminal block (See Annex D - Terminals X21:12, X21:13 and X21:14) and with the common positive from the protection control box to the RTU.*

Regulation of measuring points (RD 1110/2007)

- When regulated measuring point is required for the transformers bay, a sealable terminal block shall be available.

1st battery CB control and protection (P1-N1)

- 1st drive circuit of shunt closing release control. The requirements described in SF6 Gas and simultaneous operations shall be applied. In addition to this, there shall be two spare terminals in the closing circuit for including external interlockings.
- In case of two batteries, the drive circuit of shunt closing release control has to take into account the SF6 second alarm level from the two batteries.
- Anti-pumping circuit and priority to the LOCAL opening maneuver has to work properly. None of two conditions should interfere with the other.
- 1st drive circuit of shunt opening release control. The requirements described in SF6 Gas and simultaneous operations shall be applied. The drive circuit of shunt opening release shall be prepared to supervise the shunt opening release.
- 1st battery CB closing (K0E) and opening (K0A) auxiliary relays. These relays shall receive closing and opening commands from the pushbuttons located in the control box and from RTU, depending on the S43 M-L-R selector switch position. The auxiliary closing relay coil K0E energization shall be able to include the synchronism permission to local and remote command, in series with the closing command. For both, closing and opening relays, a normally open contact shall be used to activate the drive circuit of shunt closing and opening release.
- There shall be a contact in local position and a contact in remote position of S43 M-L-R selector switch in order to deactivate the blocking trip relay located in the protection panel (See Annex D – Terminals X20:1-2 and X20:3-4).

2nd battery CB control and protection (P2-N2)


- 2nd drive circuit of shunt opening release control. The requirements described in SF6 Gas and simultaneous operations shall be applied. The drive circuit of shunt opening release shall be prepared to supervise the shunt opening release.

SPECIFIC REQUIREMENTS COLOMBIA

- *When S43 M-L-R selector switch is in “REMOTE” position, both positive and negative connect to the X1 terminal block (See annex D – Terminals X1:8A-8B)*
- *When S43 M-L-R selector switch is in “REMOTE” position, the positive of the preventive opening will be conditioned (See annex D – Terminals X1:67)*

DSs control (P12-N12)

- DSs driving mechanisms operation shall not be executed directly on their motors. These motors shall implement control based on auxiliary relays, which shall receive the opening and closing commands.

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- DSs automatism shall guarantee that simultaneous operation of several DS/ESs may not be performed.
- No DSs shall be operated when the CB is in closed position.
- Extra terminals to connect the external interlockings shall be available.
- The auxiliary contacts of each DS operation diagram shall be represented, including precise identification of the DS position during its whole itinerary.

Busbar differential relay

- Open and closed busbar DSs positions shall be reported (See Annex D - Select terminals from X2 and X3 terminal blocks)

Interlocking between hybrid modules


- A closed bus coupler shall be created through the X19 terminal block. This closed bus coupler circuit will receive the closed bus coupler state. The closed bus coupler circuit will enable the hybrid module DSs operation (See Annex D - Terminals X19:1-6)
- The state of the hybrid module DSs shall be reported to the bus coupler. The bus coupler circuit breaker opening operation shall be locked if any DS of the switchyard is in the intermediate position (See Annex D - Terminals X19:7-8)

Signals to the main protection relay (P15-N15)

- Open and closed CB position shall be reported to the main protection relay (See Annex D - Select terminals from X1:21–24 terminal block)

Signals to RTU (P15-N15)

- Open and closed CB position shall be reported (See Annex D – Select terminals from X1 terminal block)
- Open and closed DSs positions shall be reported (See Annex D – Select terminals from X2 and X3 terminal blocks)
- Every motorized switchgear MCB open signal shall be reported by means of a normally closed, voltage-free contact connected to terminals (See Annex D – Terminals X1:51-52; X2:51-52 and X3:51-52)
- Anti-condensation circuit F3 MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal X21:8)
- F101 MCB open signal shall be reported by means of a normally closed (See Annex D – Terminal X21:9) and a normally open (See Annex D – Terminal X21:12) voltage-free contacts connected to terminals
- F102 MCB open signal shall be reported by means of a normally closed (See Annex D – Terminal X21:10) and a normally open (See Annex D – Terminal X21:13) voltage-free contacts connected to terminals
- F103 MCB open signal shall be reported by means of a normally closed (See Annex D – Terminal X21:11) and a normally open (See Annex D – Terminal X21:14) voltage-free contacts connected to terminals
- Manual position signal of S43 M-L-R selector switch shall be reported by means of a closed contact when the selector is in that position (See Annex D – Terminal X21-4)
- Local position signal of S43 M-L-R selector switch shall be reported by means of a closed contact when the selector is in that position (See Annex D – Terminal X21-5)
- “REMOTO” position signal of S43 M-L-R selector switch shall be reported by means of a closed contact when the selector is in that position (See Annex D – Terminal X21:5A)
- The anti-pumping relay activation shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminals X1:53-54)

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- SF6 CB alarm signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminals X1:55-56)
- SF6 CB block signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminals X1:61-62)
- Discharged springs signal shall be reported by means of a voltage-free contact connected to terminals. If this signal comes from an auxiliary relay, the auxiliary relay **MUST** be a temporized one (See Annex D – Terminals X1:49-50 for discharged springs and X1:49-50A for charged springs)
- Operating time exceeded signal shall be reported by means of voltage-free contact connected to terminals (See Annex D – Terminals X2:53-54 and X3:53-54)
- SF6 busbar or module alarm signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminal X21-6)
- SF6 busbar or module block signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminal X21-7)
- DS/ES motor power supply signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminal X2:55; X3:55; X4:55; X5:55;)


SPECIFIC REQUIREMENTS BRAZIL

- *Positive power supply for digital inputs to the RTU from the protection control box has to be independent of the power to local signals.*
- *F21/S1 MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal X2:52)*
- *F21/S2 MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal X3:52)*
- *F21/TR MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal X4:52)*
- *F22/TR MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal X5:52)*
- *Positive Remote signal supply terminals for the main protection (See Annex D – Terminal X0:37)*
- *Positive Remote signal supply terminals for the secondary protection (See Annex D – Terminal X0:38)*

8.5.1.4 Hybrid module Single-bay type – used in Line bay

d.c. and a.c. supply

- Terminal block for the CB and DS/ESs motors d.c. supply (See Annex D - Terminals X0:1-4)
- Terminal block for the CB drive circuit of shunt release (1st circuit) d.c. supply (See Annex D - Terminals X0:5-6)
- Terminal block for the DS/ESs drive circuits of shunt release d.c. supply (See Annex D - Terminals X0:7-8)
- Terminal block for the connection of the d.c. supply for the circuit associated to the control box synoptic signalization and for the signals communicated to the RTU (See Annex D - Terminals X0:9-10)
- Terminal block for the CB drive circuit of shunt release (2nd circuit) d.c. supply (See Annex D - Terminals X0:11-12)
- Terminal block for the CB and DS/ESs anti-condensation circuit a.c. supply (See Annex D - Terminals X0:13-18). Two extra terminals shall be available within the heating circuit, to be used for the heating power supply of the boxes associated to the VTs bay (if exists), installed by Endesa (See Annex D - Terminals X0:19-20).

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- F1 MCB for protecting circuits of the CB motor d.c. supply (See Annex D - Terminals X0:1/2-3/4).

SPECIFIC REQUIREMENTS BRAZIL

- *F1 MCB for protecting circuits of the CB motor d.c. supply (See Annex D - Terminals X0:2-3).*
- *F21/S1, F21/S2, F21/TR and F22/TR MCBs for protecting circuits of the DS/ES motors d.c. supply (See Annex D - Terminals X0:3-4).*
- *F2 MCB for protecting circuits of the DS/ES drive circuit of shunt release d.c. supply (See Annex D - Terminals X0:7-8).*

Current circuits

- Terminal block for the CTs secondary terminals (See Annex D - Terminals X6:1-24 if CTs are supplied directly from factory with the primary transformation ratio required for each installation).

SPECIFIC REQUIREMENTS COLOMBIA


- *Short circuit and connected to the ground terminal blocks when open in order to inject to the protection control box. Furthermore, include accessories to open simultaneously 3 phases and neutral with the capability to measure 1 phase.*

Voltage circuits

- Terminal block for the VTs secondary terminals (See Annex D - Terminals X7:1-29)
- MCBs to protect circuits from X7 terminal block, associated with VTs bay. They shall be installed in the control box with the corresponding signal for each circuit breaker:
 - F101-MAIN PROTECTION RELAY VOLTAGE: 1 tripolar+neutral MCB with 2 normally closed + 2 normally open voltage-free contacts connected to terminals.
 - F102-SECONDARY PROTECTION RELAY VOLTAGE: 1 tripolar+neutral MCB with 2 normally closed + 2 normally open voltage-free contacts connected to terminals.
 - F103-MEASURE AND SYNCHRONISM VOLTAGE: 1 tripolar+neutral MCB with 2 normally closed + 2 normally open voltage-free contacts connected to terminals. The normally open contact is used to lock the line earthing switch.
- Bus related to synchronism busbar voltage circuit (See Annex D - Terminals X0:21-26)
- Bus related to block selection caused by lack of busbar voltage (See Annex D - Terminals X0:27-29)
- The auxiliary relays associated with the voltage presence shall be energized from the measure and synchronism voltage winding, to allow the line earthing switch operation. The interlock is a series circuit of:
 - Normally close contacts of the voltage presence auxiliary relays and
 - A normally open F103 MCB contact.

SPECIFIC REQUIREMENTS BRAZIL

- *For the F101, F102 and F103 voltage-free contacts, one of them connected to the terminal block (See Annex D - X21 Terminals) and with the common positive from the protection control box to the RTU.*

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1st battery CB control and protection (P1-N1)


- 1st drive circuit of shunt closing release control. The requirements described in SF6 Gas and simultaneous operations shall be applied.
- In case of two batteries, the drive circuit of shunt closing release control has to take into account the SF6 second alarm level from the two batteries.
- Anti-pumping circuit and priority to the LOCAL opening maneuver has to work properly. None of two conditions should interfere with the other.
- 1st drive circuit of shunt opening release control. The requirements described in SF6 Gas and simultaneous operations shall be applied. The drive circuit of shunt opening release shall be prepared to supervise the shunt opening release.
- 1st battery CB closing (K0E) and opening (K0A) auxiliary relays. These relays shall receive closing and opening commands from the pushbuttons located in the control box and from RTU, depending on the S43 M-R-L selector switch position. The auxiliary closing relay coil K0E energization shall be able to include the synchronism permission to local and remote command, in series with the closing command. For both, closing and opening relays, a normally open contact will be used to activate the drive circuit of shunt closing and opening release.
- A normally open voltage-free contact connected to terminals of K0E (auxiliary closing relay) shall be used to inform the main protection relay when a circuit breaker closing command occurs (See annex D – Terminals X20: 3-4).
- It shall be necessary to have a normally open voltage-free contact, connected to terminals of the opening auxiliary relay K0A in case of bays with distributed generation connected (See annex D – Terminals X20: 7-8).
- It is necessary to have a contact in S43 M-L-R selector switch (when it is in “LOCAL” position) to set the reclosing automatism out of service (See annex D – Terminals X20: 1-2)
- The main protection relay shall be informed when MCB F101 is open. A normally closed voltage-free contact connected to terminals shall be used for this purpose (See annex D – Terminals X20: 9-10)
- Open and closed CB position shall be reported to the main protection relay (See annex D – Select terminals from X1 terminal block)
- Discharged springs shall be reported to the main protection relay by means of a voltage-free contact connected to terminals. These contacts shall be limit switch end position of circuit breaker discharged springs. If there are not enough available contacts, an auxiliary timing relay shall be used for this purpose (See annex D – Terminals X1: 45-46)
- SF6 circuit breaker block shall be reported to the main protection relay by means of a voltage-free contact connected to terminals (See annex D – Terminals X1: 57-58)

SPECIFIC REQUIREMENTS COLOMBIA

- *When S43 M-L-R selector switch is in “LOCAL” position has to cut the negative of the K0E and K0A auxiliary relays. When S43 M-L-R selector switch is in “REMOTE” position, the K0E and K0A auxiliary relay connect to the negative from X1 terminal block (See annex D – Terminals X1:67)*

2nd battery CB control and protection (P2-N2)

- 2nd drive circuit of shunt opening release control. The requirements described in SF6 Gas and simultaneous operations shall be applied. The drive circuit of shunt opening release shall be prepared to supervise the shunt opening release.

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- A normally open voltage-free contact connected to terminals of K0E (auxiliary closing relay) shall be used to inform the secondary protection relay when a circuit breaker closing command occurs (See annex D – Terminals X20: 5-6).
- Open and closed CB position shall be reported to the secondary protection relay (See Annex D – Select terminals from X1 terminal block).
- The secondary protection relay shall be informed when F102 MCB is open. A normally closed voltage-free contact connected to terminals shall be used (See Annex D – Terminal block X20:11-12).
- The secondary protection relay shall be informed about discharged springs by a voltage-free contact connected to terminals. These contacts shall be limit switch end position of springs discharged of circuit breaker. In case that there are not enough available contacts, an auxiliary timing relay shall be used for this purpose (See Annex D – Terminal block X1: 47-48).
- SF6 circuit breaker block shall be reported to the secondary protection relay by means of a voltage-free contact connected to terminals (See Annex D – Terminal block X1:59-60).

SPECIFIC REQUIREMENTS COLOMBIA

- *F11 MCB connected to the terminal block for the CB drive circuit of shunt release (1st circuit) d.c. supply (See Annex D – Terminals X0:39-40, X0:5-6 and X0:11-12).*
- *When S43 M-L-R selector switch is in “REMOTE” position, both positive and negative connect to the X1 terminal block (See annex D – Terminals X1:8A-8B)*
- *When S43 M-L-R selector switch is in “REMOTE” position, the positive of the preventive opening will be conditioned (See annex D – Terminals X1:67)*

DS/ESs control (P12-N12)


- DS/ESs driving mechanisms operation shall not be executed directly on their motors. These motors shall implement control based on auxiliary relays, which shall receive the opening and closing commands.
- DS/ESs automatism shall guarantee that simultaneous operation of several DS/ESs may not be performed.
- No DS/ESs shall be operated when the CB is in closed position.
- Extra terminals to connect the external interlockings shall be available.
- In case of line earthing switch, the interlocking which prevents the operation with voltage presence in line shall be included (reserve 2 terminal blocks in the chain condition to include the interlocking). The interlock is a series circuit of:
 - Normally closed contacts of the voltage presence auxiliary relays and
 - A normally open F103 MCB contact.
- The auxiliary contacts of each DS operation diagram shall be represented, including precise identification of the DS position during its whole itinerary.

Busbar differential relay

- Open and closed busbar DSs positions shall be reported (See Annex D - Select terminals from X2 terminal blocks)

Signals to RTU (P15-N15)


- Open and closed CB position shall be reported.(See Annex D – Select terminals from X1 terminal block)
- Open and closed DS/ESs positions shall be reported (See Annex D – Select terminals from X2, X4 and X5 terminal blocks)

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- Every motorized switchgear MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminals X1:51-52; X2:51-52; X4:51-52 and X5:51-52)
- Anti-condensation circuit F3 MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal X21:8)
- F101 MCB open signal shall be reported by means of a normally closed (See Annex D – Terminal X21:9) and a normally open (See Annex D – Terminal X21:12) voltage-free contacts connected to terminals
- F102 MCB open signal shall be reported by means of a normally closed (See Annex D – Terminal X21:10) and a normally open (See Annex D – Terminal X21:13) voltage-free contacts connected to terminals
- F103 MCB open signal shall be reported by means of a normally closed (See Annex D – Terminal X21:11) and a normally open (See Annex D – Terminal X21:14) voltage-free contacts connected to terminals
- “MANUAL” position signal of S43 M-L-R selector switch shall be reported by means of a closed contact when the selector is in that position (See Annex D – Terminal X21:4)
- “LOCAL” position signal of S43 M-L-R selector switch shall be reported by means of a closed contact when the selector is in that position (See Annex D – Terminal X21:5)
- “REMOTO” position signal of S43 M-L-R selector switch shall be reported by means of a closed contact when the selector is in that position (See Annex D – Terminal X21:5A)
- The anti-pumping relay activation shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminals X1:53-54)
- SF6 CB alarm signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminals X1:55-56)
- SF6 CB block signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminals X1:61-62)
- Discharged/Charged springs signal shall be reported by means of a voltage-free contact connected to terminals. If this signal comes from an auxiliary relay, the auxiliary relay MUST be a temporized one (See Annex D – Terminals X1:49-50 for discharged springs and X1:49-50A for charged springs)
- Operating time exceeded signal shall be reported by means of voltage-free contact connected to terminals (See Annex D – Terminals X2:53-54; X4:53-54 and X5:53-54)
- SF6 busbar or module Alarm signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminal X21-6)
- SF6 busbar or module block signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminal X21-7).
- DS/ES motor power supply signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminal X2:55; X4:55; X5:55;)

SPECIFIC REQUIREMENTS BRAZIL

- *Positive power supply for digital inputs to the RTU from the protection control box has to be independent of the power to local signals.*
- *F21/S1 MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal X2:52)*
- *F21/TR MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal X4:52)*
- *F22/TR MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal X5:52)*

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- *Positive Remote signal supply terminals for the main protection (See Annex D – Terminal X0:21)*
- *Positive Remote signal supply terminals for the secondary protection (See Annex D – Terminal X0:22)*

8.5.1.5 Hybrid module Single-bay type – used in Transformer bay

d.c. and a.c. supply

- Terminal block for the CB and DSs motors d.c. supply (See Annex D - Terminals X0:1-4)
- Terminal block for the CB drive circuit of shunt release (1st circuit) d.c. supply (See Annex D - Terminals X0:5-6)
- Terminal block for the DSs drive circuits of shunt release d.c. supply (See Annex D - Terminals X0:7-8)
- Terminal block for the connection of the d.c. supply for the circuit associated to the control box synoptic signalization and for the signals communicated to the RTU (See Annex D - Terminals X0:9-10)
- Terminal block for the CB drive circuit of shunt release (2nd circuit) d.c. supply (See Annex D - Terminals X0:11-12)
- Terminal block for the CB and DSs anti-condensation circuit a.c. supply (See Annex D - Terminals X0:13-18). Two extra terminals shall be available within the heating circuit, to be used for the heating power supply of the boxes associated to the VTs bay (if exists), installed by Endesa (See Annex D - Terminals X0:19-20).

SPECIFIC REQUIREMENTS BRAZIL


- *F1 MCB for protecting circuits of the CB motor d.c. supply (See Annex D - Terminals X0:2-3).*
- *F21/S1, F21/TR and F22/TR MCBs for protecting circuits of the DS/ES motors d.c. supply (See Annex D - Terminals X0:3-4).*
- *F2 MCB for protecting circuits of the DS/ES drive circuit of shunt release d.c. supply (See Annex D - Terminals X0:7-8).*

Current circuits

- Terminal block for the CTs secondary terminals (See Annex D - Terminals X6:1-24 if CTs are supplied directly from factory with the primary transformation ratio required for each installation).

Voltage circuits

- Terminal block for the VTs secondary terminals (See Annex D - Terminals X7:1-29)
- MCBs for protecting circuits from X7 terminal block, associated with VTs bay. They shall be installed in the control box with the corresponding signal for each circuit breaker:
 - F101-MAIN PROTECTION RELAY VOLTAGE: 1 tripolar+neutral MCB with 2 normally closed + 2 normally open voltage-free contacts connected to terminals.
 - F102-SECONDARY PROTECTION RELAY VOLTAGE: 1 tripolar+neutral MCB with 2 normally closed + 2 normally open voltage-free contacts connected to terminals.
 - F103-MEASURE AND PROTECTION VOLTAGE: 1 tripolar+neutral MCB with 2 normally closed + 2 normally open voltage-free contacts connected to terminals. The normally open contact is used to lock the line earthing switch.
- Bus related to synchronism busbar voltage circuit and interlocked with the DS position (See Annex D - Terminals X0:21-26)

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- Bus related to block selection caused by lack of busbar voltage and interlocked with the DS position (See Annex D - Terminals X0:27-29)

SPECIFIC REQUIREMENTS BRAZIL

- *For the F101, F102 and F103 voltage-free contacts, one of them connected to the terminal block (See Annex D - Terminals X21:12, X21:13 and X21:14) and with the common positive from the protection control box to the RTU.*

Regulation of measuring points (RD 1110/2007)

- When regulated measuring point is required for the transformers bay, a sealable terminal block shall be available.

1st battery CB control and protection (P1-N1)

- 1st drive circuit of shunt closing release control. The requirements described in SF6 Gas and simultaneous operations shall be applied. In addition to this, there shall be two spare terminals in the closing circuit for including external interlockings.
- In case of two batteries, the drive circuit of shunt closing release control has to take into account the SF6 second alarm level from the two batteries.
- Anti-pumping circuit and priority to the LOCAL opening maneuver has to work properly. None of two conditions should interfere with the other.
- 1st drive circuit of shunt opening release control. The requirements described in SF6 Gas and simultaneous operations shall be applied. The drive circuit of shunt opening release shall be prepared to supervise the shunt opening release.
- 1st battery CB closing (K0E) and opening (K0A) auxiliary relays. These relays shall receive closing and opening commands from the pushbuttons located in the Control Box and from RTU, depending on the S43 M-L-R selector switch position. The auxiliary closing relay coil K0E energization shall be able to include the synchronism permission to local and remote command, in series with the closing command. For both, closing and opening relays, a normally open contact will be used to activate the drive circuit of shunt closing and opening release.
- There shall be a contact in local position and a contact in remote position of S43 M-L-R selector switch in order to deactivate the blocking trip relay located in the protection panel (See Annex D – Terminals X20: 1-2 and X20: 3-4).

SPECIFIC REQUIREMENTS COLOMBIA


- *When S43 M-L-R selector switch is in “LOCAL” position has to cut the negative of the K0E and K0A auxiliary relays. When S43 M-L-R selector switch is in “REMOTE” position, the K0E and K0A auxiliary relay connect to the negative from X1 terminal block (See annex D – Terminals X1:67)*

2nd battery CB control and protection (P2-N2)

- 2nd drive circuit of shunt opening release control. The requirements described in SF6 Gas and simultaneous operations shall be applied. The drive circuit of shunt opening release shall be prepared to supervise the shunt opening release.

SPECIFIC REQUIREMENTS COLOMBIA

- *F11 MCB connected to the terminal block for the CB drive circuit of shunt release (1st circuit) d.c. supply (See Annex D – Terminals X0:39-40, X0:5–6 and X0:11-12).*

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- *When S43 M-L-R selector switch is in "REMOTE" position, both positive and negative connect to the X1 terminal block (See annex D – Terminals X1:8A-8B)*
- *When S43 M-L-R selector switch is in "REMOTE" position, the positive of the preventive opening will be conditioned (See annex D – Terminals X1:67)*

DS control (P12-N12)

- DSs driving mechanisms operation shall not be executed directly on their motors. These motors shall implement control based on auxiliary relays, which shall receive the opening and closing commands.
- DSs automatism shall guarantee that simultaneous operation of several DS/ESs may not be performed.
- No DSs shall be operated when the CB is in closed position.
- Extra terminals to connect the external interlockings shall be available.
- The auxiliary contacts of each DS operation diagram shall be represented, including precise identification of the DS position during its whole itinerary.

Busbar differential relay


- Open and closed busbar DSs positions shall be reported (See Annex D - Select terminals from X2 terminal blocks)

Signals to the main protection relay (P15-N15)

- Open and closed CB position shall be reported to the main protection relay (See Annex D - Select terminals from X1 terminal block)

Signals to RTU (P15-N15)

- Open and closed CB position shall be reported.(See Annex D – Select terminals from X1 terminal block)
- Open and closed DSs positions shall be reported (See Annex D – Select terminals from X2 terminal block)
- Every motorized switchgear MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminals X1:51-52 and X2:51-52)
- Anti-condensation circuit F3 MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal X21-8)
- F101 MCB open signal shall be reported by means of a normally closed (See Annex D – Terminal X21:9) and a normally open (See Annex D – Terminal X21:12) voltage-free contacts connected to terminals
- F102 MCB open signal shall be reported by means of a normally closed (See Annex D – Terminal X21:10) and a normally open (See Annex D – Terminal X21:13) voltage-free contacts connected to terminals
- F103 MCB open signal shall be reported by means of a normally closed (See Annex D – Terminal X21:11) and a normally open (See Annex D – Terminal X21:14) voltage-free contacts connected to terminals
- "MANUAL" position signal of S43 M-L-R selector switch shall be reported by means of a closed contact when the selector is in that position (See Annex D – Terminal X21:4)
- "LOCAL" position signal of S43 M-L-R selector switch shall be reported by means of a closed contact when the selector is in that position (See Annex D – Terminal X21:5)
- "REMOTO" position signal of S43 M-L-R selector switch shall be reported by means of a closed contact when the selector is in that position (See Annex D – Terminal X21:5A)
- The anti-pumping relay activation shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminals X1:53-54)

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- SF6 CB alarm signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminals X1:55-56)
- SF6 CB block signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminals X1:61-62)
- Discharged/Charged springs signal shall be reported by means of a voltage-free contact connected to terminals. If this signal comes from an auxiliary relay, the auxiliary relay MUST be a temporized one (See Annex D – Terminals X1:49-50 for discharged springs and X1:49-50A for charged springs)
- Operating time exceeded signal shall be reported by means of voltage-free contact connected to terminals (See Annex D – Terminals X2:53-54)
- SF6 busbar or module alarm signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminal X21-6)
- SF6 busbar or module block signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminal X21-7)
- DS/ES motor power supply signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminal X2:55; X4:55; X5:55;)

SPECIFIC REQUIREMENTS BRAZIL

- *Positive power supply for digital inputs to the RTU from the protection control box has to be independent of the power to local signals.*
- *F21/S1 MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal X2:52)*
- *F21/TR MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal X4:52)*
- *F22/TR MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal X5:52)*
- *Positive Remote signal supply terminals for the main protection (See Annex D – Terminal X0:21)*
- *Positive Remote signal supply terminals for the secondary protection (See Annex D – Terminal X0:22)*

8.5.1.6 Hybrid module Y2 type

d.c. and a.c. supply


- Terminal block for the CB and DS/ESs motors d.c. supply (See Annex D - Terminals X0:1-6)
- F3 MCB for the protection of the CB and DS/ES Anti-condensation circuits.
- Terminal block for the CB and DSs anti-condensation circuit a.c. supply (See Annex D - Terminals X0:7-10). Two extra terminals shall be available within the heating circuit, to be used for the heating power supply of the boxes associated to the VTs bay (if exists), installed by Endesa (See Annex D - Terminals X0:11-12).

SPECIFIC REQUIREMENTS BRAZIL

- *F21/X and F22/X MCBs for protecting circuits of the DS/ES motors d.c. supply (See Annex D - Terminals X0x:1A-2A).*

Signals to RTU (P15-N15)

- Anti-condensation circuit F3 MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal X21-4)

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8.5.1.6.a) Hybrid module Y2 type – Line bay

d.c. and a.c. supply

- Terminal block for the CB drive circuit of shunt release (1st circuit) d.c. supply (See Annex D - Terminals X0L:1-2)
- Terminal block for the DS/ESs drive circuits of shunt release d.c. supply (See Annex D - Terminals X0L:3-4)
- Terminal block for the connection of the d.c. supply for the circuit associated to the control box synoptic signalization and for the signals communicated to the RTU (See Annex D - Terminals X0L:5-6)
- Terminal block for the CB drive circuit of shunt release (2nd circuit) d.c. supply (See Annex D - Terminals X0L:7-8)
- F1/L MCB for protecting circuits of the CB motor d.c. supply (See Annex D - Terminals).
- F2/L MCB for protecting circuits of the DS/ES drive circuit of shunt release d.c. supply (See Annex D - Terminals).

SPECIFIC REQUIREMENTS BRAZIL

- *F1 MCB for protecting circuits of the CB motor d.c. supply (See Annex D - Terminals X0:2-3).*
- *Independent MCBs (F21/L and F22/L) for circuits of the DS/ES motor d.c. supply (See Annex D - Terminals X0L:1A-2A).*
- *F31L MCB for protecting circuits of the DS/ES drive circuit of shunt release d.c. supply (See Annex D - Terminals X0L:3-4).*

Current circuits


- Terminal block for the CTs secondary terminals (See Annex D - Terminals X6L:1-24 if CTs are supplied directly from factory with the primary transformation ratio required for each installation).

SPECIFIC REQUIREMENTS COLOMBIA

- *Short circuit and connected to the ground terminal blocks when open in order to inject to the protection control box. Furthermore, include accessories to open simultaneously 3 phases and neutral with the capability to measure 1 phase.*

Voltage circuits

- Terminal block for the VTs secondary terminals (See Annex D - Terminals X7L:1-29)
- MCBs to protect circuits from X7 terminal block, associated with VTs bay. They shall be installed in the control box with the corresponding signal for each circuit breaker:
 - F101/L-MAIN PROTECTION RELAY VOLTAGE: 1 tripolar+neutral MCB with 2 normally closed + 2 normally open voltage-free contacts connected to terminals.
 - F102/L-SECONDARY PROTECTION RELAY VOLTAGE: 1 tripolar+neutral MCB with 2 normally closed + 2 normally open voltage-free contacts connected to terminals.
 - F103/L-MEASURE AND SYNCHRONISM VOLTAGE: 1 tripolar+neutral MCB with 2 normally closed + 2 normally open voltage-free contacts connected to terminals. The normally open contact is used to lock the line earthing switch.
- Bus related to synchronism busbar voltage circuit (See Annex D - Terminals X0L:9-14)
- Bus related to block selection caused by lack of busbar voltage (See Annex D - Terminals X0L:15-17)

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- The auxiliary relays associated with the voltage presence shall be energized from the measure and synchronism voltage winding, to allow the line earthing switch operation. The interlock is a series circuit of:
 - Normally close contacts of the voltage presence auxiliary relays and
 - A normally open F103/L MCB contact.

SPECIFIC REQUIREMENTS BRAZIL

- *For the F101/L, F102/L and F103/L voltage-free contacts, one of them connected to the terminal block (See Annex D - Terminals) and with the common positive from the protection control box to the RTU.*

1st battery CB control and protection (P1-N1)

- 1st drive circuit of shunt closing release control. The requirements described in SF6 Gas and simultaneous operations shall be applied.
- In case of two batteries, the drive circuit of shunt closing release control has to take into account the SF6 second alarm level from the two batteries.
- Anti-pumping circuit and priority to the LOCAL opening maneuver has to work properly. None of two conditions should interfere with the other.
- 1st drive circuit of shunt opening release control. The requirements described in SF6 Gas and simultaneous operations shall be applied. The drive circuit of shunt opening release shall be prepared to supervise the shunt opening release.
- 1st battery CB closing (K0EL) and opening (K0AL) auxiliary relays. These relays shall receive closing and opening commands from the pushbuttons located in the control box and from RTU, depending on the S43/L M-R-L selector switch position. The auxiliary closing relay coil K0EL energization shall be able to include the synchronism permission to local and remote command, in series with the closing command. For both, closing and opening relays, a normally open contact will be used to activate the drive circuit of shunt closing and opening release.
- A normally open voltage-free contact connected to terminals of K0EL (auxiliary closing relay) shall be used to inform the main protection relay when a circuit breaker closing command occurs (See annex D – Terminals X20L: 3-4).
- It shall be necessary to have a normally open voltage-free contact, connected to terminals of the opening auxiliary relay K0AL in case of bays with distributed generation connected (See annex D – Terminals X20L: 7-8).
- It is necessary to have a contact in S43/L M-L-R selector switch (when it is in “LOCAL” position) to set the reclosing automatism out of service (See annex D – Terminals X20L:1-2)
- The main protection relay shall be informed when MCB F101/L is open. A normally closed voltage-free contact connected to terminals shall be used for this purpose (See annex D – Terminals X20L: 9-10)
- Open and closed CB position shall be reported to the main protection relay (See annex D – Select terminals X1L:21-24)
- Discharged springs shall be reported to the main protection relay by means of a voltage-free contact connected to terminals. These contacts shall be limit switch end position of circuit breaker discharged springs. If there are not enough available contacts, an auxiliary timing relay shall be used for this purpose (See annex D – Terminals X1L:45-46)
- SF6 circuit breaker block shall be reported to the main protection relay by means of a voltage-free contact connected to terminals (See annex D – Terminals X1L:57-58)

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SPECIFIC REQUIREMENTS COLOMBIA

- *When S43L M-L-R selector switch is in "LOCAL" position has to cut the negative of the K0E and K0A auxiliary relays. When S43 M-L-R selector switch is in "REMOTE" position, the K0E and K0A auxiliary relay connect to the negative from X1 terminal block (See annex D – Terminals X1L:3A)*

2nd battery CB control and protection (P2-N2)


- 2nd drive circuit of shunt opening release control. The requirements described in SF6 Gas and simultaneous operations shall be applied. The drive circuit of shunt opening release shall be prepared to supervise the shunt opening release.
- A normally open voltage-free contact connected to terminals of K0EL (auxiliary closing relay) shall be used to inform the secondary protection relay when a circuit breaker closing command occurs (See annex D – Terminals X20L:5-6).
- Open and closed CB position shall be reported to the secondary protection relay (See Annex D – Select terminals X1L:25-28).
- The secondary protection relay shall be informed when F102/L MCB is open. A normally closed voltage-free contact connected to terminals shall be used (See Annex D – Terminal block X20L:11-12).
- The secondary protection relay shall be informed about discharged springs by a voltage-free contact connected to terminals. These contacts shall be limit switch end position of springs discharged of circuit breaker. In case that there are not enough available contacts, an auxiliary timing relay shall be used for this purpose (See Annex D – Terminal block X1L:47-48).
- SF6 circuit breaker block shall be reported to the secondary protection relay by means of a voltage-free contact connected to terminals (See Annex D – Terminal block X1L:59-60).

SPECIFIC REQUIREMENTS COLOMBIA

- *F4L MCB connected to the terminal block for the CB drive circuit of shunt release (1st circuit) d.c. supply (See Annex D – Terminals X0L:20-21, X0L:1/7 and X0L:2/8).*
- *When S43/L M-L-R selector switch is in "REMOTE" position, both positive and negative connect to the X1 terminal block (See annex D – Terminals X1L:8A-8B)*
- *When S43/L M-L-R selector switch is in "REMOTE" position, the positive of the preventive opening will be conditioned (See annex D – Terminals X1L:71)*

DS/ESs control (P12-N12)

- DS/ESs driving mechanisms operation shall not be executed directly on their motors. These motors shall implement control based on auxiliary relays, which shall receive the opening and closing commands.
- DS/ESs automatism shall guarantee that simultaneous operation of several DS/ESs may not be performed.
- No DS/ESs shall be operated when the CB is in closed position.
- Extra terminals to connect the external interlockings shall be available.
- In case of line earthing switch, the interlocking which prevents the operation with voltage presence in line shall be included (reserve 2 terminal blocks in the chain condition to include the interlocking). The interlock is a series circuit of:
 - Normally closed contacts of the voltage presence auxiliary relays and
 - A normally open F103/L MCB contact.

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- The auxiliary contacts of each DS operation diagram shall be represented, including precise identification of the DS position during its whole itinerary.

Signals to RTU (P15-N15)

- Open and closed CB position shall be reported.(See Annex D – Select terminals X1L:29-32)
- Open and closed DS/ESs positions shall be reported (See Annex D – Select terminals X4L:21-24 and X5L:21-24)
- Every motorized switchgear MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminals X1L:51-52; X4L:51-52 and X5L:51-52)
- F101/L MCB open signal shall be reported by means of a normally closed (See Annex D – Terminal X21L:9) and a normally open (See Annex D – Terminal X21L:12) voltage-free contacts connected to terminals
- F102/L MCB open signal shall be reported by means of a normally closed (See Annex D – Terminal X21L:10) and a normally open (See Annex D – Terminal X21L:13) voltage-free contacts connected to terminals
- F103/L MCB open signal shall be reported by means of a normally closed (See Annex D – Terminal X21L:11) and a normally open (See Annex D – Terminal X21L:14) voltage-free contacts connected to terminals
- “MANUAL” position signal of S43/L M-L-R selector switch shall be reported by means of a closed contact when the selector is in that position (See Annex D – Terminal X21L:4)
- “LOCAL” position signal of S43/L M-L-R selector switch shall be reported by means of a closed contact when the selector is in that position (See Annex D – Terminal X21L:5)
- “REMOTO” position signal of S43/L M-L-R selector switch shall be reported by means of a closed contact when the selector is in that position (See Annex D – Terminal X21L:5A)
- The anti-pumping relay activation shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminals X1L:53-54)
- SF6 CB alarm signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminals X1L:55-56)
- SF6 CB block signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminals X1L:61-62)
- Discharged/Charged springs signal shall be reported by means of a voltage-free contact connected to terminals. If this signal comes from an auxiliary relay, the auxiliary relay MUST be a temporized one (See Annex D – Terminals X1L:49-50 for discharged springs and X1L:49-50A for charged springs)
- Operating time exceeded signal shall be reported by means of voltage-free contact connected to terminals (See Annex D – Terminals X4L:53-54 and X5L:53-54)
- SF6 busbar or module Alarm signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminal X21L-6)
- SF6 busbar or module block signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminal X21L-7).
- DS/ES motor power supply signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminal X4L:55; X5L:55;)

SPECIFIC REQUIREMENTS BRAZIL

- *Positive power supply for digital inputs to the RTU from the protection control box has to be independent of the power to local signals.*

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- *F21/L MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal)*
- *F22/L MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal)*
- *F31/L MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal)*
- *Positive Remote signal supply terminals for the main protection (See Annex D – Terminal X0L:18)*
- *Positive Remote signal supply terminals for the secondary protection (See Annex D – Terminal X0L:19)*

8.5.1.6.b) Hybrid module Y2 type – Transformer bay

d.c. and a.c. supply

- Terminal block for the CB drive circuit of shunt release (1st circuit) d.c. supply (See Annex D - Terminals X0T:1-2)
- Terminal block for the DSs drive circuits of shunt release d.c. supply (See Annex D - Terminals X0T:3-4)
- Terminal block for the connection of the d.c. supply for the circuit associated to the control box synoptic signalization and for the signals communicated to the RTU (See Annex D - Terminals X0T:5-6)
- Terminal block for the CB drive circuit of shunt release (2nd circuit) d.c. supply (See Annex D - Terminals X0T:7-8)
- F1/T MCB for protecting circuits of the CB motor d.c. supply (See Annex D - Terminals).
- F2/T MCB for protecting circuits of the DS/ES drive circuit of shunt release d.c. supply (See Annex D - Terminals).

SPECIFIC REQUIREMENTS BRAZIL


- *F1 MCB for protecting circuits of the CB motor d.c. supply (See Annex D - Terminals X0:2-3).*
- *Independent MCBs (F21/T and F22/T) for circuits of the DS/ES motor d.c. supply (See Annex D - Terminals X0L:1A-2A).*
- *F31L MCB for protecting circuits of the DS/ES drive circuit of shunt release d.c. supply (See Annex D - Terminals X0T:3-4).*

Current circuits

- Terminal block for the CTs secondary terminals (See Annex D - Terminals X6T:1-24 if CTs are supplied directly from factory with the primary transformation ratio required for each installation).

Voltage circuits

- Terminal block for the VTs secondary terminals (See Annex D - Terminals X7T:1-29)
- MCBs for protecting circuits from X7 terminal block, associated with VTs bay. They shall be installed in the control box with the corresponding signal for each circuit breaker:
 - F101/T-MAIN PROTECTION RELAY VOLTAGE: 1 tripolar+neutral MCB with 2 normally closed + 2 normally open voltage-free contacts connected to terminals.
 - F102/T-SECONDARY PROTECTION RELAY VOLTAGE: 1 tripolar+neutral MCB with 2 normally closed + 2 normally open voltage-free contacts connected to terminals.

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- F103/T-MEASURE AND PROTECTION VOLTAGE: 1 tripolar+neutral MCB with 2 normally closed + 2 normally open voltage-free contacts connected to terminals. The normally open contact is used to lock the line earthing switch.
- Bus related to synchronism busbar voltage circuit and interlocked with the DS position (See Annex D - Terminals X0T:9-14)
- Bus related to block selection caused by lack of busbar voltage and interlocked with the DS position (See Annex D - Terminals X0T:15-17)

SPECIFIC REQUIREMENTS BRAZIL

- *For the F101/T, F102/T and F103/T voltage-free contacts, one of them connected to the terminal block (See Annex D - Terminals) and with the common positive from the protection control box to the RTU.*

Regulation of measuring points (RD 1110/2007)

- When regulated measuring point is required for the transformers bay, a sealable terminal block shall be available.

1st battery CB control and protection (P1-N1)


- 1st drive circuit of shunt closing release control. The requirements described in SF6 Gas and simultaneous operations shall be applied. In addition to this, there shall be two spare terminals in the closing circuit for including external interlockings.
- In case of two batteries, the drive circuit of shunt closing release control has to take into account the SF6 second alarm level from the two batteries.
- Anti-pumping circuit and priority to the LOCAL opening maneuver has to work properly. None of two conditions should interfere with the other.
- 1st drive circuit of shunt opening release control. The requirements described in SF6 Gas and simultaneous operations shall be applied. The drive circuit of shunt opening release shall be prepared to supervise the shunt opening release.
- 1st battery CB closing (K0ET) and opening (K0AT) auxiliary relays. These relays shall receive closing and opening commands from the pushbuttons located in the Control Box and from RTU, depending on the S43/T M-L-R selector switch position. The auxiliary closing relay coil K0ET energization shall be able to include the synchronism permission to local and remote command, in series with the closing command. For both, closing and opening relays, a normally open contact will be used to activate the drive circuit of shunt closing and opening release.
- There shall be a contact in local position and a contact in remote position of S43/T M-L-R selector switch in order to deactivate the blocking trip relay located in the protection panel (See Annex D – Terminals X20T:1-2 and X20T:3-4).

SPECIFIC REQUIREMENTS COLOMBIA

- *When S43/T M-L-R selector switch is in "LOCAL" position has to cut the negative of the K0E and K0A auxiliary relays. When S43 M-L-R selector switch is in "REMOTE" position, the K0E and K0A auxiliary relay connect to the negative from X1 terminal block (See annex D – Terminals X1T:3A)*

2nd battery CB control and protection (P2-N2)

- 2nd drive circuit of shunt opening release control. The requirements described in SF6 Gas and simultaneous operations shall be applied. The drive circuit of shunt opening release shall be prepared to supervise the shunt opening release.

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SPECIFIC REQUIREMENTS COLOMBIA

- *F4T MCB connected to the terminal block for the CB drive circuit of shunt release (1st circuit) d.c. supply (See Annex D – Terminals X0T:20-21, X0T:1/7 and X0T:2/8).*
- *When S43/T M-L-R selector switch is in “REMOTE” position, both positive and negative connect to the X1 terminal block (See annex D – Terminals X1L:8A-8B)*
- *When S43/T M-L-R selector switch is in “REMOTE” position, the positive of the preventive opening will be conditioned (See annex D – Terminals X1L:71)*

DS control (P12-N12)


- DSs driving mechanisms operation shall not be executed directly on their motors. These motors shall implement control based on auxiliary relays, which shall receive the opening and closing commands.
- DSs automatism shall guarantee that simultaneous operation of several DS/ESs may not be performed.
- No DSs shall be operated when the CB is in closed position.
- Extra terminals to connect the external interlockings shall be available.
- The auxiliary contacts of each DS operation diagram shall be represented, including precise identification of the DS position during its whole itinerary.

Signals to the main protection relay (P15-N15)

- Open and closed CB position shall be reported to the main protection relay (See Annex D - Select terminals X1T:21-24)

Signals to RTU (P15-N15)

- Open and closed CB position shall be reported.(See Annex D – Select terminals X1T:25-28)
- Open and closed DSs positions shall be reported (See Annex D – Select terminals X4T:21-24 and X5T:21-24)
- Every motorized switchgear MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminals X1T:51-52, X4T:51-52 and X5T:51-52)
- F101/T MCB open signal shall be reported by means of a normally closed and a normally open (See Annex D – X21T Terminals) voltage-free contacts connected to terminals
- F102 MCB open signal shall be reported by means of a normally closed and a normally open (See Annex D – X21T Terminals) voltage-free contacts connected to terminals
- F103 MCB open signal shall be reported by means of a normally closed and a normally open (See Annex D – X21T Terminals) voltage-free contacts connected to terminals
- “MANUAL” position signal of S43/T M-L-R selector switch shall be reported by means of a closed contact when the selector is in that position (See Annex D – Terminal X21T:4)
- “LOCAL” position signal of S43/T M-L-R selector switch shall be reported by means of a closed contact when the selector is in that position (See Annex D – Terminal X21T:5)
- “REMOTO” position signal of S43/T M-L-R selector switch shall be reported by means of a closed contact when the selector is in that position (See Annex D – Terminal X21T:5A)
- The anti-pumping relay activation shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminals X1T:53-54)
- SF6 CB alarm signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminals X1T:55-56)

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- SF6 CB block signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminals X1T:61-62)
- Discharged/Charged springs signal shall be reported by means of a voltage-free contact connected to terminals. If this signal comes from an auxiliary relay, the auxiliary relay MUST be a temporized one (See Annex D – Terminals X1T:49-50 for discharged springs and X1T:49-50A for charged springs)
- Operating time exceeded signal shall be reported by means of voltage-free contact connected to terminals (See Annex D – Terminals X4T:53-54 and X5T:53-54)
- SF6 busbar or module alarm signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminal X21T:6)
- SF6 busbar or module block signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminal X21T:7)
- DS/ES motor power supply signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminal X4T:55 and X5T:55;)

SPECIFIC REQUIREMENTS BRAZIL

- *Positive power supply for digital inputs to the RTU from the protection control box has to be independent of the power to local signals.*
- *F21/T MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal)*
- *F22/T MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal)*
- *F31/T MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal)*
- *Positive Remote signal supply terminals for the main protection (See Annex D – Terminal X0T:18)*
- *Positive Remote signal supply terminals for the secondary protection (See Annex D – Terminal X0T:19)*


8.5.1.6.c) *Hybrid module Y2 type – BusBar bay*

d.c. and a.c. supply

- Terminal block for the DSs drive circuits of shunt release d.c. supply (See Annex D - Terminals X0S:3-4)
- Terminal block for the connection of the d.c. supply for the circuit associated to the control box synoptic signalization and for the signals communicated to the RTU (See Annex D - Terminals X0S:5-6)
- F2/S MCB for protecting circuits of the DS/ES drive circuit of shunt release d.c. supply (See Annex D - Terminals).

SPECIFIC REQUIREMENTS BRAZIL

- *Independent MCBs (F21/S and F22/S) for circuits of the DS/ES motor d.c. supply (See Annex D - Terminals X0S:1A-2A).*
- *F31S MCB for protecting circuits of the DS/ES drive circuit of shunt release d.c. supply (See Annex D - Terminals X0S:3-4).*

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DS control (P12-N12)

- DSs driving mechanisms operation shall not be executed directly on their motors. These motors shall implement control based on auxiliary relays, which shall receive the opening and closing commands.
- DSs automatism shall guarantee that simultaneous operation of several DS/ESs may not be performed.
- No DSs shall be operated when the CB is in closed position.
- Extra terminals to connect the external interlockings shall be available.
- The auxiliary contacts of each DS operation diagram shall be represented, including precise identification of the DS position during its whole itinerary.

Signals to RTU (P15-N15)


- Open and closed DSs positions shall be reported (See Annex D – Select terminals X2S:21-24 and X3S:21-24)
- Every motorized switchgear MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminals X2S:51-52 and X3S:51-52)
- “MANUAL” position signal of S43/S M-L-R selector switch shall be reported by means of a closed contact when the selector is in that position (See Annex D – Terminal X21S:4)
- “LOCAL” position signal of S43/S M-L-R selector switch shall be reported by means of a closed contact when the selector is in that position (See Annex D – Terminal X21S:5)
- “REMOTO” position signal of S43/S M-L-R selector switch shall be reported by means of a closed contact when the selector is in that position (See Annex D – Terminal X21S:5A)
- Operating time exceeded signal shall be reported by means of voltage-free contact connected to terminals (See Annex D – Terminals X2S:53-54 and X3S:53-54)
- SF6 busbar or module alarm signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminal X21S:6)
- SF6 busbar or module block signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminal X21S:7)
- DS/ES motor power supply signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminal X2S:55 and X3S:55;)

SPECIFIC REQUIREMENTS BRAZIL

- *Positive power supply for digital inputs to the RTU from the protection control box has to be independent of the power to local signals.*
- *F21/S MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal)*
- *F22/S MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal)*
- *F31/S MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal)*

8.5.1.7 Automatic openings

Circuit breaker should open when second level of SF6 alarm activates. Circuit breaker should keep blocked in open position.

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8.5.2 e-distribuzione, E-Distributie and Latam specific requirements

8.5.2.1 Terminal Boards for interface with the control system

The equipment controls, the contacts related to their operating status and the possible anomalies shall be reported in the terminal boards for the interface with the substation control system, as shown in the principle electric diagrams listed in par. 8.4.3.

As required in par. 8.1.1, during normal operation temporary block signalizations shall not be sent to the control system.

Used abbreviations in electric diagrams and their meaning are listed in the following; for those related to the substation interlocks see the relevant section.

Italian is the language used in the terminal boards abbreviations; for the other languages the equivalent abbreviations as well as the synoptic will be agreed with the specific Enel Group Distribution company.

Circuit-breakers


- drive circuit of shunt closing release control (CH-ABC)
- 1st drive circuit of shunt opening release control (1° AP-A; 1°AP- B; 1°AP-C or 1°AP-ABC)
- 2nd drive circuit of shunt opening release control (2° AP-ABC)
- 3rd drive circuit of under-voltage release control (3° AP-ABC)
- close position (ccX152 or 152NA)
- open position (caX152 or 152NC)
- remote/local selector switch in local (P) position (43SP-PROVA)
- 1st minimum gas density level (P1 GAS)
- 2nd minimum gas density level (P4 GAS)
- discharged springs (P4 MOLLE)
- intervention of motor protection device and/or auxiliary supply missing (42RT)
- motor maximum operation time (BX)
- anti-condensation circuit anomaly (AnR152)
- poles discrepancy - only single-pole CB (DP)
- locking of drive circuit of under-voltage release control – only if assembled (BL3°AP-ABC)

Disconnectors – Earthing Switches

- drive circuit of shunt closing release control (DS: CH189"XY"; ES: CH189T"XY"; "XY" means the bay name i.e. L1, L2, TR, etc.)
- drive circuit of shunt opening release control (DS: AP189"XY"; ES: AP189T"XY"; "XY" means the bay name i.e. L1, L2, TR, etc.)
- close position (DS: ccX189"XY"; ES: ccX189T"XY")
- open position (DS: caX189"XY"; ES: caX189T"XY")
- intervention of motor protection device and/or auxiliary supply missing (DS: 42RT189"XY"; ES: 42RT189T"XY")
- motor maximum operation time (DS: BX189"XY"; ES: 42RT189T"XY")
- not-maneuverable DS (DS: SNM189"XY"; ES: 42RT189T"XY")

Earthing Switches

Further specific control circuits, using signals from secondary terminals of on-site Inductive or Capacitive Voltage Transformers (see electric diagrams "VT/1" and "VT/2"), elaborate absence of

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voltage on HV line (and status ON/OFF of relative low voltage protection CBs) to enable the ES closing:

- voltage presence (27ON"XY")
- voltage absence (27OFF"XY")
- voltage presence anomaly (An PRES TENS"XY")

For this purpose the low voltage components shall have the following characteristics.

- 3P+N switch for protection of VT secondary circuits:
Ue = 400 V ac; In = 3A; Electromagnetic overcurrent relay - short-circuit current setting: 12 A ("type MA");
Icu ≥ 25 kA;
- K27A/L, K27B/L and K27ATL relays:
Rated voltage = 100 V AC.

Disconnectors – special cases – codes "101" and "102"

Similarly to the above "Earthing Switches" the specific voltage control circuits shall enable not only the ES closing but also the DS closing/opening, to guarantee operations without energy transit:

- voltage presence (27ON"XY")
- voltage absence (27OFF"XY")
- voltage presence anomaly (An PRES TENS"XY")

Voltage transformers – codes "VT/1" and "VT/2"

(more details in "Earthing Switches")

- Phase voltage (V"X"; "X" means the electrical phase i.e, 4, 8, 12; 0 is ground potential)
- Open position low voltage CB "ATV1" (ATV)
- Closed position low voltage CB "ATV1" (+ATV)
- 1st minimum gas density level – only SF6 VTs (P1 GAS)
- 2nd minimum gas density level – only SF6 VTs (P4 GAS)

8.5.2.2 *Synoptic*

The synoptic alarm/block signalization lamps (see par. 8.2.1) shall be those indicated in the previous paragraph.

Some signalizations, due to their nature, may be common to more switchgears, therefore they shall be grouped together.


For example, in the case of hybrid module Y2 type, having two remote/local selector switches ("Servizio/Prova"), one for Line-bay and Bus-bar, the other for Transformer bay, we have:

Line-bay and Bus-bar common signalizations

- remote/local selector switch in local (P) position (43SP/L-PROVA).
- 1st minimum gas density level (P1 GAS).
- 2nd minimum gas density level (P4 GAS).
- anti-condensation circuit anomaly (AnR)
- Lamps test button (PL) (only one but working also on lamps of the other bay)

Transformer-bay common signalizations

- remote/local selector switch in local (P) position (43SP/TR-PROVA).
- 1st minimum gas density level (P1 GAS).

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- 2nd minimum gas density level (P4 GAS).
- anti-condensation circuit anomaly (AnR)

In annex E some synoptic drawing examples are shown; other cases will be assessed with the manufacturer.

Note: In case of single-pole CB, the synoptic shall have an additional signal lamp that is activated when the three mechanical locks of the under-voltage releases are - between them - in a not congruent position.

8.5.2.3 *Interlocks*

The hybrid modules shall be equipped with operation locks to ensure safety of both workers and switchgears, preventing wrong operations being performed either in electric (remote or local) or manual mode (only for DS/ESs, in local mode).

The required operation locks are:

- specific of the single switchgear (locks);
- between switchgears part of the same hybrid module (interlocks);
- between interfaced equipments (substation interlocks):
 - a. switchgears of different hybrid modules
 - b. stand-alone switchgears (CBs, DSs/ESs)
 - c. medium voltage switchboards

There are two types of substation interlocks:

- incoming (working on the hybrid module)
- outgoing (working on switchgears external to the hybrid module)


The differentiation is included in the abbreviations used for the same type of interlock (see in the principle electric diagrams, i.e. "INTBL. A – IN"; "INTBL. B – OUT").

The main operating locks, divided for module type, are listed in the following.

8.5.2.3.a) *Hybrid module Y1 type*

"Linea 1" bay – code "101" (or "Linea 2" – code "102")

- Disconnecter 189L1 (or 189L2) closing lock for 2nd minimum gas density level ("P4 gas");
- Interlock between CB 152, disconnector 189L1 and disconnector 189L2: impossibility of disconnector 189L1 (or 189L2) operation if CB 152 and disconnector 189L2 (or 189L1) are closed. The opening and closing operations of this disconnector are enabled, alternatively to the opening of CB 152 and disconnector 189L2 (or 189L1), by an external consensus (substation interlocks: "INTBL. A – IN");
- Impossibility of disconnector 189L1 (or 189L2) operation in presence of HV on both lines L1 and L2. The closing and opening operations of this disconnector are enabled, alternatively to the HV absence on both lines L1 and L2, by an external consensus (substation interlocks: "BLOCCO 27");
- Interlock between disconnector 189L1 (or 189L2) and his earthing switch 189TL1 (or 189TL2): impossibility to close the earthing switch if disconnector is closed and vice versa;
- Impossibility to close disconnector 189L1 (or 189L2) for external consensus absence (i.e. for presence of external earthing switch in closed position or for SF6 absence; substation interlocks: "INTBL. B – IN");
- Impossibility to close earthing switch 189TL1 (or 189TL2) for external consensus absence (substation interlocks: "INTBL. C – IN");
- Impossibility to close earthing switch 189TL1 (or 189TL2) for presence of HV on line L1 (or L2).

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Circuit breaker bay

Circuit breaker bay shall be provided of the same locks as for Y2 type described in the following par. 8.5.2.3.b), differentiating their use whether as Line bay (see "Line 1" bay) or as Transformer bay (see "Transformer" bay).

Specifically, the:

- Closing lock of CB 152TR (or 152L) for disconnectors incomplete operation, shall be related to the three hybrid module disconnectors.

8.5.2.3.b) *Hybrid module Y2 type¹⁴*

"Linea 1" bay – code "201" and "202"

- CB 152L1 and disconnector 189L1 closing lock for 2nd minimum gas density level ("P4 gas");
- CB 152L1 closing lock for discharged springs;
- CB 152L1 closing lock for under-voltage release circuit not-supplied (if any) and, if single-pole type, with mechanical locks of the three under-voltage releases in a not congruent position (between them);
- CB 152L1 closing lock for incomplete operation of disconnectors 189L1 and 189Sb(L2);
- Impossibility to operate disconnector 189L1 when CB 152L1 is closed;
- Interlock between disconnector 189L1 and his earthing switch 189TL1: impossibility to close the earthing switch if disconnector is closed and vice versa;
- Impossibility to close earthing switch 189TL1 for presence of HV on line L1.


"Sbarra (Linea 2)" bay – code "301", "302" and "303"

- Disconnector 189SB1 closing lock for 2nd minimum gas density level ("P4 gas");
- Interlock between disconnector 189Sb(L2) and his earthing switch 189TSB(L2): impossibility to close the earthing switch if disconnector is closed and vice versa;
- Interlock between disconnector 189Sb(L2), CB 152 L1 and CB 152TR: impossibility to operate disconnector 189SB(L2) if these CBs are closed. The opening and closing operations of this disconnector are enabled, alternatively to the opening of CBs 152L1 and 152TR, by an external consensus (substation interlocks: "INTBL. A – IN");
- Impossibility to close disconnector 189SB(L2) for external consensus absence (i.e. for presence of external earthing switch in closed position or for SF6 absence; substation interlocks: "INTBL. B – IN");
- Impossibility to close earthing switch 189SB(L2) for external consensus absence (substation interlocks: "INTBL. C – IN");
- Impossibility to close earthing switch 189SB(L2) for presence of HV on busbar/Line2.

"Trasformatore" bay – code "401" and "402"

- CB 152TR and disconnector 189TR closing lock for 2nd minimum gas density level ("P4 gas");
- CB 152TR1 closing lock for discharged springs;
- CB 152TR1 closing lock for under-voltage release circuit not supplied;

¹⁴ Note: in the following is described the case in which the two CBs of the Y2 type hybrid module are used in a Line bay and in a Transformer bay; but if both are used in Line bays the symbol "152TR" in sub-paragraph "Sbarra (Linea 2)" bay – code "301", "302" and "303"" becomes "152L2". The same applies in principle electric diagrams.

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- CB 152TR1 closing lock for disconnectors 189TR and 189Sb(L2) incomplete operation;
- Impossibility to operate disconnector 189TR when CB 152TR is closed;
- Interlock between disconnector 189TR and his earthing switch 189TTR: impossibility to close the earthing switch if disconnector is closed and vice versa;
- Interlock between disconnector 189TR and earthing switch 89TTR on MV side of HV/MV transformer: impossibility to close the disconnector 189TR if earthing switch 89TTR is closed and vice versa. This function shall be achieved by means of a device containing an electromagnet, which is energized, by means of a push-button, by a discordant auxiliary contact of the disconnector 189 TR if the remote/local selector switch is in “Prova” position. The device shall allow the rotation and extraction of a key enabling the closing of the MV earthing switch 89TTR.
- Interlock between earthing switch 189TTR and CB MV 52TR: impossibility to close the earthing switch 189TTR if CB MV 52TR is closed and vice versa.

8.5.2.3.c) *Hybrid module Single-bay type*

Circuit-breaker bay

Circuit breaker bay shall be equipped with the same locks as for Y2 type described in cap. 8.5.2.3.b), using according to the application locks of Line bay (see “Linea 1” bay, changing the “L1” part of the abbreviation in “L”) or locks of Transformer bay (see “Trasformatore” bay).

Specifically, the:

- CB 152L (or 152TR) closing lock for disconnectors incomplete operation, shall be related to all disconnectors of the hybrid module.

“Sbarra” bay – code “501” and “502”

- Disconnector 189SB closing lock for 2nd minimum gas density level (“P4 gas”);
- Interlock between CB 152L (or 152 TR) and disconnector 189 SB: impossibility to operate disconnector 189SB when CB is closed;
- Impossibility to close disconnector 189SB for external consensus absence (i.e. for presence of external earthing switch in closed position or for SF6 absence; substation interlocks: “INTBL. B – IN”).

8.5.2.4 *Automatic openings*

Following intervention for SF6 gas low-pressure (P4gas) due to a severe failure in a switchgear, the HV faulty part of the substation shall be isolated from the healthy part not subject to failure.

For this purpose commands for automatic opening shall be activated and simultaneously condition for the service restoring shall be prepared, even by means of specific substation automatisms.

If partitions are present the automatic opening logical operations shall work with the same criteria (see i.e. code “303” and “502”).


The automatic opening commands work both internally, in the faulty hybrid module, and simultaneously externally to the substation HV sections still healthy.

Consequently the automatic opening commands, similarly to the substation interlocks, can be both incoming and outgoing; in the principle electric diagrams of DS/ES they are abbreviated with “AP.AUT. – IN” and “AP.AUT. – OUT”, while in CBs ones the command (only incoming) is “AP.AUT.INTERBL”.

All the automatic openings are enabled only if remote/local selector switch is in “Servizio” position.

Generally in CBs case the automatic opening having internal origin work on 1st and 2nd drive circuits of shunt opening release control; in case of 152TR they work on 1st drive circuit of shunt opening release control and on 3rd drive circuit of under-voltage release control.

Circuit breaker, after the automatic opening, shall be blocked in open position.

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Specifically, for 2nd minimum gas density level ("P4 gas") intervention, the following operations shall occur, depending on the hybrid module type (see the principle electric diagrams; possible special cases will be assessed with the manufacturer):

Y1 type

CB opens and in line disconnectors an auxiliary contact (voltage-free) becomes available for an outgoing open command;

Y2 type

CBs and disconnector 189Sb(L2) open and in busbar disconnector an auxiliary contact (voltage-free) becomes available for an outgoing open command;

Single-bay type

CB open and in busbar disconnector 189SB (if present) an auxiliary contact (voltage-free) becomes available for an outgoing open command.

In case of failure in one of the SF6 insulated VT (if presents), the interventions for SF6 low pressure (P4 gas) in their specific partition work as follows:

Y1 type

- a) if the fault has occurred in a VT of "Line 1" (or "Line 2") bay the CB opens and, in case of external consensus (i.e. HV = off), the disconnector L1 (or L2) opens as well. The disconnector 189L1 (or 189L2), once open, intercepts the automatic opening command coming from the VT of "Line 1" (or "Line 2") bay in order to allow the CB closing.
- b) if the fault has occurred in a VT of the CB bay, the CB opens;

Y2 type

- a) if the fault has occurred in a VT of the CB bay, the CB opens;
- b) if the fault has occurred in a VT of SB(L2) bay, both CBs and the busbar disconnector open. The busbar disconnector, once open, intercepts the automatic opening command coming from the VTs in order to allow the CBs closing;

Single-bay type

CB and busbar 189SB disconnector (if any) open.


9 TESTING

9.1 General information

The applicable standard is IEC 62271-205, where is stated (par. 1.101) "If part of the compact switchgear assembly is formed by metal enclosed switchgear devices the requirements of IEC 62271-203 apply", consequently the IEC 62271-203 tests are also applicable with the clarifications stated in this chapter.

The tests to be performed on Hybrid Module are divided in:

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

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9.2 Type tests

9.2.1 General

In principle type tests should be performed on a complete Hybrid Module manufactured in accordance with the present technical specification.

Type tests are be classified in:

- tests on the complete assembly
- tests on base components

9.2.2 Type tests on the complete assembly

(6.1 of IEC 62271-205)

The tests listed in the following paragraphs shall be performed on a complete Hybrid Module 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.

9.2.2.1 *Visual check and constructive characteristics check*

The Hybrid Module, 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 10.2.2.

Visual inspection shall be repeated each time the required assembly includes at least one new base components never subject to this check.

9.2.2.2 *Dielectric tests*

(6.2 of IEC 62271-203)

9.2.2.3 *Radio interference voltage (r.i.v.) test*

(6.3 of IEC 62271-203)

Applicable only to SF6/air bushings.

9.2.2.4 *Measurement of the resistance of circuits*

(6.4 of IEC 62271-203)

The measure shall cover all Hybrid Module components, using all available access points.

9.2.2.5 *Temperature-rise tests*

(6.5 of IEC 62271-203)

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

(6.6 of IEC 62271-203)

9.2.2.7 *Verification of the protection*


(6.7 of IEC 62271-203)

9.2.2.8 *Tightness test*

(6.8 of IEC 62271-203)¹⁵

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

¹⁵ 6.102 quoted in this paragraph shall be intended as 9.2.2.12 of this document.

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The initial gas concentration C_0 , with Hybrid Module filled at nominal density, shall be measured after at least 2 hours from pressurizing; the final concentration C_1 shall be measured after more than 8 hours.

9.2.2.9 *Electromagnetic compatibility tests (EMC)*
(6.9 of IEC 62271-203)

9.2.2.10 *Additional tests on auxiliary and control circuits*
(6.10 of IEC 62271-203)

For this verification the manufacturer shall provide a paper copy of the Hybrid Module 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.

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.

9.2.2.11 *Verification of making and breaking capacities*
(6.101 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.

9.2.2.12 *Mechanical and environmental tests*

6.101 of IEC 62271-205 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 6.4.1 of this document.

9.2.2.12.a) *Tests on Circuit-breakers*

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 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.

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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.

9.2.2.12.b) *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. 6.102)

Note: par. 6.102.3.2 applies also to measuring of resistance of earthing switch.

During test, referring par. 8.1.3.2 of this Global Standard, the DS/ES mechanical locks and interlocks operation shall be checked.

Operation under severe ice conditions

(IEC 62271-102 par. 6.103)

Note: par. 6.103.4.2 applies also to measuring of resistance of earthing switch.

This test is mandatory.

Operation at the temperature limits

(IEC 62271-102 par. 6.104)

This test is mandatory.

9.2.2.13 *Proof tests for enclosures*

(6.103 of IEC 62271-203)

9.2.2.14 *Pressure test on partitions*

(6.104 of IEC 62271-203)

9.2.2.15 *Test under conditions of arcing due to an internal fault*

(6.105 of IEC 62271-203)

9.2.2.16 *Insulator tests*

(6.106 of IEC 62271-203)

9.2.2.17 *Corrosion test on earthing connections*

(6.107 of IEC 62271-203)

9.2.2.18 *Corrosion test on enclosures*

(6.108 of IEC 62271-203)

9.2.2.19 *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.


9.2.2.20 *Seismic verification*

If requested, Hybrid Module (including the support) shall be compliant with seismic qualification, according with standards listed in 4.2.3.

9.2.3 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 Hybrid Modules.

The applicability of these type tests on the different Hybrid Modules layouts shall be demonstrated by the manufacturer (by mean of a technical report) and approved by the user.

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9.2.3.1 Tests on Circuit-breakers

IEC 62271-100 applies with the following additional information

9.2.3.1.a) *X-radiation test procedure for vacuum interrupters*

(6.11 of IEC 62271-203)

Only in case of vacuum CBs.

9.2.3.1.b) *Critical current tests*

(IEC 62271-100 par. 6.107)

If applicable (see 6.107.1)

9.2.3.2 Tests on disconnectors DS and earth switches ES

IEC 62271-102 applies with the following additional information.

9.2.3.2.a) *Test to verify the proper functioning of the position indicating device*

(IEC 62271-102 par. 6.105)

This test is mandatory.

9.2.3.2.b) *Bus-transfer current switching tests*

(IEC 62271-102 par. 6.106)

This test is mandatory only for DS for which this characteristic is requested (see par. 6.3 of this document).

9.2.3.2.c) *Induced current switching test*

(IEC 62271-102 par. 6.107)

This test is mandatory.

9.2.3.3 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.

9.2.3.4 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.

9.2.3.5 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.

9.2.3.6 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).

9.2.4 Specific requirements

9.2.4.1 *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).

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9.3 Routine tests in factory

(IEC 62271-203 par. 7)

The Routine tests (also called acceptance tests) shall be made in the manufacturer's factory on each Hybrid module 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 Hybrid Module supplied, the report of all measures and tests carried out.

9.3.1 Dielectric test on the main circuit

(7.1 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.

9.3.2 Tests on auxiliary and control circuits

(IEC 62271-203 par. 7.2)

Functional tests (par. 7.2.2 of IEC 62271-1) shall be performed together with tests in par. 9.3.8, only at rated voltage.

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.

EVDS shall be disconnected before dielectric test.

9.3.3 Measurement of the resistance of the main circuit

(IEC 62271-203 par. 7.3)

To be performed after mechanical operating tests.

The ambient temperature influence can be neglected.

The test shall be performed also on ES.

9.3.4 Tightness test

(IEC 62271-203 par. 7.4)

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.

9.3.5 Design and visual checks

(IEC 62271-203 par. 7.5)


Following items shall be verified:

- switchgear compliance with approved documents;
- no visible defects;
- protective coatings (par. 9.2.2.19 of this document applies).

9.3.6 Pressure tests of enclosures

(IEC 62271-203 par. 7.101)

Manufacturer shall provide the results of internal tests.

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9.3.6.1 *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).

9.3.7 Mechanical operation tests

(IEC 62271-203 par. 7.102)

9.3.7.1 *Tests on Circuit-Breakers*

(IEC 62271-100 par.7.101)

The following items 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 coil (if present - see 9.2.2.12.a)) 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 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.

9.3.7.2 *Tests on disconnectors DS and earth switches ES*

(IEC 62271-102 par. 7-101)

The following items shall be verified:


- operation times and the drive motor absorption (inrush excluded) at V_{max} , V_n , V_{min} ;
- manual and electrical operation and its (mechanical and electrical) interlock devices;
- satisfactory operation of the auxiliary contacts and position indicating devices;
- mechanical locks.

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

(IEC 62271-203 par. 7.103)

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

Following items shall be verified:

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- 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.
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.

9.3.9 Pressure test on partitions

(IEC 62271-203 par. 7.104)

Manufacturer shall provide the results of testing on partitions.

9.3.10 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.

9.3.10.1 *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 Hybrid Modules manufacturer factory according to the given criteria.

9.3.11 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: 9.3.8 applies.

9.3.11.1 *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 Hybrid Modules manufacturer factory according to the given criteria.

9.3.12 Bushing tests


(IEC 60137 par.9.6)

Test reports issued by insulator manufacturer shall be provided.

9.4 Commissioning tests

(IEC 62271-203 par. 10)

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

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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 Hybrid Module. 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.

9.4.1 Dielectric test on the main circuit

(IEC 62271-203 par. 10.2.101.2 and C.3.2.3)

Dielectric test shall be performed on Hybrid Module, 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. 10.2.101.2.3 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.

9.4.2 Dielectric test on auxiliary circuits

(IEC 62271-203 par 10.2.101.3; 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.

9.4.3 Measurement of the resistance of the main circuit

(IEC 62271-203 par. 10.2.101.4)

To be performed after mechanical operating tests.

The ambient temperature influence can be neglected.

The test shall be performed also on ES.

9.4.4 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 m³/s.

9.4.5 Checks and verifications

(IEC 62271-203 par. 10.2.101.6)

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. 10.3).

9.4.6 Mechanical operation tests


9.4.6.1 Tests on Circuit-Breakers

(IEC 62271-100 par. 10.2.102.2)

Before this tests at least 30 C-O no-load operations shall be performed.

The following items shall be recorded:

- a. at V_{max}, V_n, V_{min}, closing (C) and opening (O) times, time spread (on each release);

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- a1. at V_{max} , V_n , V_{min} opening (O) times, time spread on under-voltage release coil (if present see 9.2.2.12.a)) 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 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 V_n .

9.4.6.2 *Tests on disconnectors DS and earth switches ES* (IEC 62271-102 par. 7.101)

The par. 9.3.7.2 of this document applies. The operation times and the drive motor absorption shall be performed only at rated voltage.

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

(IEC 62271-203 par. 7.103)

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 9.3.8), 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.

9.4.8 **Gas quality verifications**

(IEC 62271-203 par. 10.2.101.7)

Manufacturer shall perform this verifications on Hybrid Module 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.

10 **SUPPLY REQUIREMENTS**

10.1 **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).

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10.2 Conformity assessment

10.2.1 Conformity assessment process

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

10.2.2 Conformity assessment documentation

The “Conformity assessment documentation” consists in the project documentation that the supplier uses to manufacture Hybrid Modules 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. 5) and for each rated voltage U_r (72.5, 145-170, 245 kV).

10.2.2.1 *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 code (see par. 2);
 - local codification (see Annex A);
 - 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 Hybrid Module pictures or 3D drawings;
- 5) HV single-line diagram;
- 6) electric diagram (see par. 8.4.1-c), low voltage components list included);
- 7) Control Box layout drawing;
- 8) reference resistance values.

10.2.2.2 *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);

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- b) reference values table (with tolerances)¹⁶;
- 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.

10.2.2.3 *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.).

10.3 **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);

¹⁶ specific detailed instructions to verify the CBs no-load travel curves during maintenance activity shall be included in the manual

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10) only for e-distribuzione, the assembly bar code, in accordance with PVR006.

With each assembly the following items shall be supplied (items from 4) to 9) shall be in the local language of destination and 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.

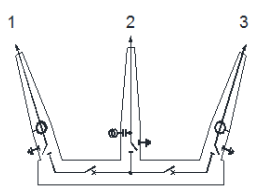
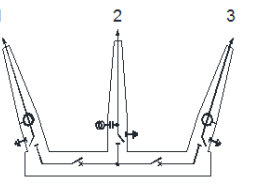
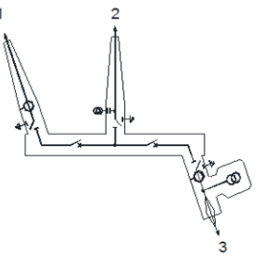
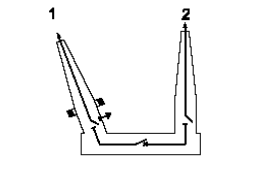
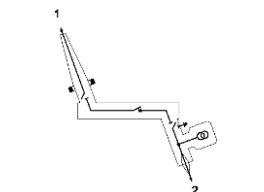
10.3.1 Specific requirements for Spain

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.

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ANNEX A – LOCAL COMPONENTS CODIFICATION

Lot 1: e-distribuzione (Italy)

Hybrid Module: Configuration from base components						
Code	TS		Description	Units/ Module		
Local code	Type Code	GSH002 SubCode	Description	Bay	Q.ty	
Tab UE DY106/1	GSH002/924	162131	IBRIDO A 3 STALLI 170 kV 2 INT. AR-AR-AR			
		GSH002/013	Lateral bay - With circuit-breaker - Air_connection - 170 kV	1	1	
		GSH002/013	Lateral bay - With circuit-breaker - Air_connection - 170 kV	3	1	
		GSH002/112	Central bay - Without circuit-breaker - Air_connection - 145-170 kV	2	1	
		GSH002/322	Disconnecter with earthing switch 145-170 kV	1	1	
		GSH002/322	Disconnecter with earthing switch 145-170 kV	2	1	
		GSH002/322	Disconnecter with earthing switch 145-170 kV	3	1	
		GSH002/605	Current Transformer 400-800/1 145-170 kV	1	1	
		GSH002/604	Current Transformer 200-400/1 145-170 kV	3	1	
		GSH002/212	Circuit-breaker drive mechanism - Single_pole - 1°, 2° opening circuit - 145-170 kV	1	1	
		GSH002/422	Bushing SF6/air class "e" 145-170 kV	1	1	
		GSH002/422	Bushing SF6/air class "e" 145-170 kV	2	1	
		GSH002/422	Bushing SF6/air class "e" 145-170 kV	3	1	
		GSH002/262	Circuit-breaker drive mechanism - Three_pole - 1°, 3° opening circuit - 145-170 kV	3	1	
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	2	1	
		GSH002/802	Support - Y1 type and Y2 type 145-170 kV	-	1	
		GSH002/902	Control Box - Y2 type	-	1	
Tab UE DY106/2	GSH002/924	162132	IBRIDO A 3 STALLI 170 kV 2 INT. AR-AR-AR			
		GSH002/013	Lateral bay - With circuit-breaker - Air_connection - 170 kV	1	1	
		GSH002/013	Lateral bay - With circuit-breaker - Air_connection - 170 kV	3	1	
		GSH002/112	Central bay - Without circuit-breaker - Air_connection - 145-170 kV	2	1	
		GSH002/322	Disconnecter with earthing switch 145-170 kV	1	1	
		GSH002/322	Disconnecter with earthing switch 145-170 kV	2	1	
		GSH002/322	Disconnecter with earthing switch 145-170 kV	3	1	
		GSH002/605	Current Transformer 400-800/1 145-170 kV	1	1	
		GSH002/605	Current Transformer 400-800/1 145-170 kV	3	1	
		GSH002/212	Circuit-breaker drive mechanism - Single_pole - 1°, 2° opening circuit - 145-170 kV	1	1	
		GSH002/212	Circuit-breaker drive mechanism - Single_pole - 1°, 2° opening circuit - 145-170 kV	3	1	
		GSH002/422	Bushing SF6/air class "e" 145-170 kV	1	1	
		GSH002/422	Bushing SF6/air class "e" 145-170 kV	2	1	
		GSH002/422	Bushing SF6/air class "e" 145-170 kV	3	1	
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	2	1	
		GSH002/802	Support - Y1 type and Y2 type 145-170 kV	-	1	
		GSH002/902	Control Box - Y2 type	-	1	
Tab UE DY106/5	GSH002/925	162135	IBRIDO A 3 STALLI 170 kV 2 INT. AR-AR-CA			
		GSH002/013	Lateral bay - With circuit-breaker - Air_connection - 170 kV	1	1	
		GSH002/112	Central bay - Without circuit-breaker - Air_connection - 145-170 kV	2	1	
		GSH002/322	Disconnecter with earthing switch 145-170 kV	1	1	
		GSH002/322	Disconnecter with earthing switch 145-170 kV	2	1	
		GSH002/322	Disconnecter with earthing switch 145-170 kV	3	1	
		GSH002/605	Current Transformer 400-800/1 145-170 kV	1	1	
		GSH002/212	Circuit-breaker drive mechanism - Single_pole - 1°, 2° opening circuit - 145-170 kV	1	1	
		GSH002/422	Bushing SF6/air class "e" 145-170 kV	1	1	
		GSH002/422	Bushing SF6/air class "e" 145-170 kV	2	1	
		GSH002/262	Circuit-breaker drive mechanism - Three_pole - 1°, 3° opening circuit - 145-170 kV	3	1	
		GSH002/023	Lateral bay - With circuit-breaker - Cable_connection - 170 kV	3	1	
		GSH002/465	Cable connection downward exit 145-170 kV	3	1	
		GSH002/604	Current Transformer 200-400/1 145-170 kV	3	1	
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	2	1	
		GSH002/703	Voltage Transformer 150kV 170 kV	3	1	
		GSH002/802	Support - Y1 type and Y2 type 145-170 kV	-	1	
		GSH002/902	Control Box - Y2 type	-	1	
Tab UE DY107/2	GSH002/918	162152	IBRIDO MONOST. 170 kV ARIA-ARIA TRIP			
		GSH002/013	Lateral bay - With circuit-breaker - Air_connection - 170 kV	1	1	
		GSH002/112	Central bay - Without circuit-breaker - Air_connection - 145-170 kV	2	1	
		GSH002/322	Disconnecter with earthing switch 145-170 kV	1	1	
		GSH002/422	Bushing SF6/air class "e" 145-170 kV	1	1	
		GSH002/422	Bushing SF6/air class "e" 145-170 kV	2	1	
		GSH002/262	Circuit-breaker drive mechanism - Three_pole - 1°, 3° opening circuit - 145-170 kV	1	1	
		GSH002/604	Current Transformer 200-400/1 145-170 kV	1	1	
		GSH002/312	Disconnecter 145-170 kV	2	1	
		GSH002/805	Support - Single-bay type 145-170 kV	-	1	
		GSH002/903	Control Box - Single-bay type	-	1	
Tab UE DY107/4	GSH002/919	162154	IBRIDO MONOST. 170 kV ARIA-CAVO TRIP (cp.A)			
		GSH002/013	Lateral bay - With circuit-breaker - Air_connection - 170 kV	1	1	
		GSH002/322	Disconnecter with earthing switch 145-170 kV	2	1	
		GSH002/422	Bushing SF6/air class "e" 145-170 kV	1	1	
		GSH002/262	Circuit-breaker drive mechanism - Three_pole - 1°, 3° opening circuit - 145-170 kV	1	1	
		GSH002/465	Cable connection downward exit 145-170 kV	2	1	
		GSH002/604	Current Transformer 200-400/1 145-170 kV	1	1	
		GSH002/312	Disconnecter 145-170 kV	1	1	
		GSH002/122	Central bay - Without circuit-breaker - Cable_connection - 145-170 kV	2	1	
		GSH002/702	Voltage Transformer 132kV 145 kV	2	1	
		GSH002/805	Support - Single-bay type 145-170 kV	-	1	
		GSH002/903	Control Box - Single-bay type	-	1	



Local code	Type Code	GSH002 SubCode	Description	Bay	Q.ty		
Tab UE DY107/4	GSH002/919	IBRIDO MONOST. 170 kV ARIA-CAVO TRIP (op.B)					
		GSH002/013	Lateral bay - With circuit-breaker - Air_connection - 170 kV	1	1		
		GSH002/322	Disconnector with earthing switch 145-170 kV	2	1		
		GSH002/422	Bushing SF6/air class "e" 145-170 kV	1	1		
		GSH002/262	Circuit-breaker drive mechanism - Three_pole - 1°, 3° opening circuit - 145-170 kV	1	1		
		GSH002/465	Cable connection downward exit 145-170 kV	2	1		
		GSH002/604	Current Transformer 200-400/1 145-170 kV	1	1		
		GSH002/312	Disconnector - 145-170 kV	1	1		
		GSH002/122	Central bay - Without circuit-breaker - Cable_connection - 145-170 kV	2	1		
		GSH002/703	Voltage Transformer 150kV 170 kV	2	1		
GSH002/805	Support - Single-bay type 145-170 kV	-	1				
GSH002/903	Control Box - Single-bay type	-	1				
Tab UE DY107/7	GSH002/918	IBRIDO MONOST. 170 kV ARIA-ARIA UNIP					
		GSH002/013	Lateral bay - With circuit-breaker - Air_connection - 170 kV	1	1		
		GSH002/112	Central bay - Without circuit-breaker - Air_connection - 145-170 kV	2	1		
		GSH002/322	Disconnector with earthing switch 145-170 kV	1	1		
		GSH002/605	Current Transformer 400-800/1 145-170 kV	1	1		
		GSH002/212	Circuit-breaker drive mechanism - Single_pole - 1°, 2° opening circuit - 145-170 kV	1	1		
		GSH002/422	Bushing SF6/air class "e" 145-170 kV	1	1		
		GSH002/422	Bushing SF6/air class "e" 145-170 kV	2	1		
		GSH002/312	Disconnector 145-170 kV	2	1		
		GSH002/805	Support - Single-bay type 145-170 kV	-	1		
GSH002/903	Control Box - Single-bay type	-	1				
Tab UE DY107/7	GSH002/900	IBRIDO MONOST. 72.5 kV ARIA-ARIA UNIP					
		GSH002/011	Lateral bay - With circuit-breaker - Air_connection - 72.5 kV	1	1		
		GSH002/421	Bushing SF6/air class "e" 72.5 kV	1	1		
		GSH002/322	Disconnector with earthing switch 145-170 kV	2	1		
		GSH002/211	Circuit-breaker drive mechanism - Single_pole - 1°, 2° opening circuit - 72.5 kV	1	1		
		GSH002/311	Disconnector 72.5 kV	2	1		
		GSH002/602	Current Transformer 400-800/1 72.5 kV	1	1		
		GSH002/111	Central bay - Without circuit-breaker - Air_connection - 72.5 kV	2	1		
		GSH002/321	Disconnector with earthing switch 72.5 kV	1	1		
		GSH002/804	Support - Single-bay type 72.5 kV	-	1		
GSH002/903	Control Box - Single-bay type	-	1				
Tab UE DY106/1	GSH002/935	IBRIDO A 3 STALLI 245 kV 2 INT. AR-AR-AR (op.A)					
		GSH002/014	Lateral bay - With circuit-breaker - Air_connection - 245 kV	1	1		
		GSH002/014	Lateral bay - With circuit-breaker - Air_connection - 245 kV	3	1		
		GSH002/423	Bushing SF6/air class "e" 245 kV	1	1		
		GSH002/423	Bushing SF6/air class "e" 245 kV	3	1		
		GSH002/213	Circuit-breaker drive mechanism - Single_pole - 1°, 2° opening circuit - 245 kV	1	1		
		GSH002/323	Disconnector with earthing switch 245 kV	1	1		
		GSH002/323	Disconnector with earthing switch 245 kV	2	1		
		GSH002/323	Disconnector with earthing switch 245 kV	3	1		
		GSH002/608	Current Transformer 400-800-1.600/1 245 kV	1	1		
		GSH002/263	Circuit-breaker drive mechanism - Three_pole - 1°, 3° opening circuit - 245 kV	3	1		
		GSH002/607	Current Transformer 200-400/1 245 kV	3	1		
		GSH002/133	Central bay - Without circuit-breaker - Bus_duct_connection - 245 kV	2	1		
		GSH002/704	Voltage Transformer 220kV 245 kV	1	1		
		GSH002/704	Voltage Transformer 220kV 245 kV	2	1		
		GSH002/803	Support - Y1 type and Y2 type 245 kV	-	1		
GSH002/902	Control Box - Y2 type	-	1				
GSH002/513	Bus-duct (1 linear meter x 3 poles) 245 kV	2	7				
GSH002/543	Bus-duct joint 245 kV	2	8				
GSH002/523	Bus-duct curve 245 kV	2	1				
Tab UE DY106/1	GSH002/935	IBRIDO A 3 STALLI 245 kV 2 INT. AR-AR-AR (op.B)					
		GSH002/014	Lateral bay - With circuit-breaker - Air_connection - 245 kV	1	1		
		GSH002/014	Lateral bay - With circuit-breaker - Air_connection - 245 kV	3	1		
		GSH002/423	Bushing SF6/air class "e" 245 kV	1	1		
		GSH002/423	Bushing SF6/air class "e" 245 kV	3	1		
		GSH002/213	Circuit-breaker drive mechanism - Single_pole - 1°, 2° opening circuit - 245 kV	1	1		
		GSH002/323	Disconnector with earthing switch 245 kV	1	1		
		GSH002/323	Disconnector with earthing switch 245 kV	2	1		
		GSH002/323	Disconnector with earthing switch 245 kV	3	1		
		GSH002/608	Current Transformer 400-800-1.600/1 245 kV	1	1		
		GSH002/263	Circuit-breaker drive mechanism - Three_pole - 1°, 3° opening circuit - 245 kV	3	1		
		GSH002/607	Current Transformer 200-400/1 245 kV	3	1		
		GSH002/133	Central bay - Without circuit-breaker - Bus_duct_connection - 245 kV	2	1		
		GSH002/704	Voltage Transformer 220kV 245 kV	1	1		
		GSH002/803	Support - Y1 type and Y2 type 245 kV	-	1		
		GSH002/902	Control Box - Y2 type	-	1		
GSH002/513	Bus-duct (1 linear meter x 3 poles) 245 kV	2	7				
GSH002/543	Bus-duct joint 245 kV	2	7				
GSH002/523	Bus-duct curve 245 kV	2	1				



IBRIDO A 3 STALLI 245KV AR-CO-AR				
162592	GSH002/803	Supporto per moduli Y2 a 245kV e-distribuzione		1
162597	GSH002/902	Armadio di comando e-distribuzione tipo Y2		1
162549	GSH002/423	Passanti SF6 aria di classe "e" a 245kV		2
162546	GSH002/323	Sezionatore con sezionatore di terra a 245kV		3
162503	GSH002/014	Ingressi laterali con interruttore e connessione in aria a 245kV		2
162527	GSH002/133	Ingresso centrale senza interruttore per collegamento a condotto 245kV		1
162530	GSH002/213	Comando interruttore tipo unipolare con 1° e 2° circuito di apertura per interruttori a 245kV		1
162535	GSH002/263	Comando interruttore tipo tripolare con 1° e 3° circuito di apertura per interruttori a 245kV		1
162589	GSH002/704	Trasformatori di tensione		1
162584	GSH002/6XX	Trasformatori di corrente lato linea AT 245kV		1
162583	GSH002/607	Trasformatori di corrente lato TR 245kV		1
162585	GSH002/700	EVDS - Electronic Voltage Detector System		1
Condotta con TV 245KV				
162589	GSH002/704	Trasformatori di tensione		1
162561	GSH002/513	Condotta a 245kV		14
162570	GSH002/543	Giunti per condotta a 245kV		15

170kV - Variation in the cost if the base configuration change with:

- 1 One bay connection change from air to cable
- 2 Include one EVDS
- 3 Circuit-breaker drive mechanism change from Single-pole to Three-pole.
- 4 Include the VT GSH002/702
- 5 Include the VT GSH002/703
- 6 Include the CT GSH002/604
- 7 Include the CT GSH002/605

72,5kV - Variation in the cost if the base configuration change with:

- 1 One bay connection change from air to cable
- 2 Include one EVDS
- 3 Circuit-breaker drive mechanism change from Single-pole to Three-pole.
- 4 Include the VT GSH002/701
- 5 Include the CT GSH002/601

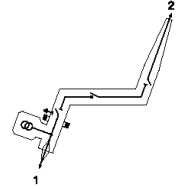
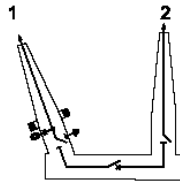
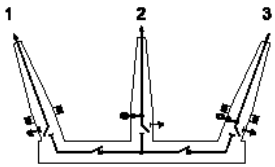
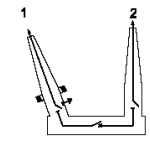
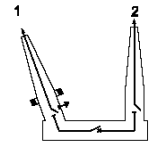
245kV - Variation in the cost if the base configuration change with:

- 1 One bay connection change from air to cable
- 2 Include one EVDS
- 3 Circuit-breaker drive mechanism change from Single-pole to Three-pole.
- 4 Include the VT GSH002/704
- 5 Include the CT GSH002/602
- 6 Include the CT GSH002/608



Lot 2: Endesa Distribución (Spain)

Hybrid Module: Configuration from base components					
Code	TS	Description	Units/ Module	Bay	
Local code	Type Code	GSH002 SubCode	Description		
6705448	GSH002/909	150457	HYBRID MODUL SINGLE BAY TYPE LI 145 kV AIR-AIR		
		GSH002/112	Central bay - Without circuit-breaker - Air_connection - 145-170 kV	1	2
		GSH002/322	Disconnector with earthing switch 145-170 kV	1	1
		GSH002/412	Bushing SF6/air class "d" 145-170 kV	2	1+2
		GSH002/620	Current Transformer 1.000-2.000/5/5/5	1	1
		GSH002/012	Lateral bay - With circuit-breaker - Air_connection - 145 kV	1	1
		GSH002/282	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 145-170 kV	1	1
		GSH002/312	Disconnector 145-170 kV	1	2
		GSH002/823	Support - Single-bay type 145 kV	1	-
		GSH002/924	Control Box - Single-bay type Line bay	1	-
6705449	GSH002/909	150458	HYBRID MODUL SINGLE BAY TYPE LI 145 kV AIR-AIR		
		GSH002/112	Central bay - Without circuit-breaker - Air_connection - 145-170 kV	1	2
		GSH002/322	Disconnector with earthing switch 145-170 kV	1	1
		GSH002/412	Bushing SF6/air class "d" 145-170 kV	2	1+2
		GSH002/620	Current Transformer 400-800/5/5/5	1	1
		GSH002/012	Lateral bay - With circuit-breaker - Air_connection - 145 kV	1	1
		GSH002/282	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 145-170 kV	1	1
		GSH002/312	Disconnector 145-170 kV	1	2
		GSH002/823	Support - Single-bay type 145 kV	1	-
		GSH002/924	Control Box - Single-bay type Line bay	1	-
6708241	GSH002/915	220034	HYBRID MODUL Y2 TYPE 145 kV AIR-AIR-AIR		
		GSH002/112	Central bay - Without circuit-breaker - Air_connection - 145-170 kV	1	2
		GSH002/322	Disconnector with earthing switch 145-170 kV	3	1+2+3
		GSH002/412	Bushing SF6/air class "d" 145-170 kV	3	1+2+3
		GSH002/620	Current Transformer 1.000-2.000/5/5/5	1	1
		GSH002/012	Lateral bay - With circuit-breaker - Air_connection - 145 kV	2	1+3
		GSH002/282	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 145-170 kV	2	1+3
		GSH002/622	Current Transformer 400-800/5/5/5	1	3
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	2	2+3
		GSH002/822	Support - Y2 type 145 kV	1	-
		GSH002/926	Control Box - Y2 type	1	-
6705468	GSH002/909	150466	HYBRID MODUL SINGLE BAY TYPE TR 145 kV AIR-AIR		
		GSH002/112	Central bay - Without circuit-breaker - Air_connection - 145-170 kV	1	2
		GSH002/412	Bushing SF6/air class "d" 145-170 kV	2	1+2
		GSH002/012	Lateral bay - With circuit-breaker - Air_connection - 145 kV	1	1
		GSH002/282	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 145-170 kV	1	1
		GSH002/312	Disconnector 145-170 kV	1	2
		GSH002/622	Current Transformer 400-800/5/5/5	1	1
		GSH002/322	Disconnector with earthing switch 145-170 kV	1	1
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	1	1
		GSH002/823	Support - Single-bay type 145 kV	1	-
		GSH002/925	Control Box - Single-bay type Transformer bay	1	-
6705425	GSH002/910	150444	HYBRID MODUL SINGLE BAY TYPE TR 145 kV AIR-CABLE		
		GSH002/112	Central bay - Without circuit-breaker - Air_connection - 145-170 kV	1	2
		GSH002/322	Disconnector with earthing switch 145-170 kV	1	1
		GSH002/412	Bushing SF6/air class "d" 145-170 kV	1	2
		GSH002/282	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 145-170 kV	1	1
		GSH002/022	Lateral bay - With circuit-breaker - Cable_connection - 145 kV	1	1
		GSH002/622	Current Transformer 400-800/5/5/5	1	1
		GSH002/702	Voltage Transformer 132kV 145 kV	1	1
		GSH002/312	Disconnector 145-170 kV	1	2
		GSH002/465	Cable connection downward exit	1	1
		GSH002/823	Support - Single-bay type 145 kV	1	-
		GSH002/925	Control Box - Single-bay type Transformer bay	1	-





Local code	Type Code	GSH002 SubCode	Description			
6708263	GSH002/906	220037	HYBRID MODUL Y2 TYPE 72,5 kV AIR-AIR-AIR			
		GSH002/620	Current Transformer 1.000-2.000/5/5/5	1	1	
		GSH002/622	Current Transformer 400-800/5/5/5	1	3	
		GSH002/011	Lateral bay - With circuit-breaker - Air_connection - 72,5 kV	2	1+3	
		GSH002/411	Bushing SF6/air class "d" 72,5 kV	3	1+2+3	
		GSH002/281	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 72,5 kV	2	1+3	
		GSH002/321	Disconnector with earthing switch 72,5 kV	3	1+2+3	
		GSH002/111	Central bay - Without circuit-breaker - Air_connection - 72,5 kV	1	2	
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	2	2+3	
		GSH002/826	Control Box - Y2 type	1	-	
		GSH002/826	Support - Single-bay type 72,5 kV	1	-	
6705358	GSH002/900	150419	HYBRID MODUL SINGLE BAY TYPE TR 72,5 kV AIR-AIR			
		GSH002/620	Current Transformer 1.000-2.000/5/5/5	1	1	
		GSH002/011	Lateral bay - With circuit-breaker - Air_connection - 72,5 kV	1	1	
		GSH002/411	Bushing SF6/air class "d" 72,5 kV	2	1+2	
		GSH002/281	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 72,5 kV	1	1	
		GSH002/321	Disconnector with earthing switch 72,5 kV	1	1	
		GSH002/111	Central bay - Without circuit-breaker - Air_connection - 72,5 kV	1	2	
		GSH002/311	Disconnector 72,5 kV	1	2	
		GSH002/825	Control Box - Single-bay type Transformer bay	1	-	
		GSH002/826	Support - Single-bay type 72,5 kV	1	-	
6705446	GSH002/912	150455	HYBRID MODUL Y1 LINE TYPE 145 kV AIR-AIR-AIR			
		GSH002/112	Central bay - Without circuit-breaker - Air_connection - 145-170 kV	1	2	
		GSH002/322	Disconnector with earthing switch 145-170 kV	1	3	
		GSH002/332	Disconnector 145-170 kV with ability of Bus-transfer current switching	2	1+2	
		GSH002/412	Bushing SF6/air class "d" 145-170 kV	3	1+2+3	
		GSH002/012	Lateral bay - With circuit-breaker - Air_connection - 145 kV	1	3	
		GSH002/620	Current Transformer 1.000-2.000/5/5/5 (3 cores)	1	3	
		GSH002/282	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 145-170 kV	1	3	
		GSH002/062	Lateral bay - Without circuit-breaker - Air_connection - 145-170 kV	1	1	
		GSH002/821	Support - Y1 type 145 kV	1	-	
		GSH002/921	Control Box - Y1 type	1	-	

SINGLE BAY - Variation in the cost if the base configuration change with:

- 1 One bay connection change from air to cable
- 2 Include one EVDS
- 3 Circuit-breaker drive mechanism change from Single-pole to Three-pole.
- 4 Include the VT GSH002/721
- 5 Include the VT GSH002/722
- 6 Include the CT GSH002/622
- 7 Include the CT GSH002/620

Y2 TYPE - Variation in the cost if the base configuration change with:

- 1 One bay connection change from air to cable
- 2 Include one EVDS
- 3 Circuit-breaker drive mechanism change from Single-pole to Three-pole.
- 4 Include the CT GSH002/622
- 5 Include the CT GSH002/620



Lot 3: RIO (Brazil)

Hybrid Module: Configuration from base components						
Code	TS		Description	Units/Module	Bay	
Local code	Type Code	GSH002 SubCode	Description			
	GSH002/915	6815218	HM Y2 145kV AIR-AIR-TI:2000			
		GSH002/112	Central bay - Without circuit-breaker - Air_connection - 145-170 kV	1	2	
		GSH002/322	Disconnector with earthing switch 145-170 kV	3	1+2+3	
		GSH002/412	Bushing SF6/air class "d" 145-170 kV	3	1+2+3	
		GSH002/932	Control Box - Y2 type	1	-	
		GSH002/012	Lateral bay - With circuit-breaker - Air_connection - 145 kV	2	1+3	
		GSH002/620	Current Transformer 1.000-2.000/5/5/5 (3 cores)	2	1+3	
		GSH002/282	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 145-170 kV	2	1+3	
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	2	2+3	
		GSH002/894	Support - Y2 type 145 kV	1	-	
		GSH002/894	Support - Y2 type 145 kV	1	-	
	GSH002/915	T150103	HM Y2 145kV AIR-AIR-TI:800			
		GSH002/112	Central bay - Without circuit-breaker - Air_connection - 145-170 kV	1	2	
		GSH002/322	Disconnector with earthing switch 145-170 kV	3	1+2+3	
		GSH002/412	Bushing SF6/air class "d" 145-170 kV	3	1+2+3	
		GSH002/932	Control Box - Y2 type	1	-	
		GSH002/012	Lateral bay - With circuit-breaker - Air_connection - 145 kV	2	1+3	
		GSH002/622	Current Transformer 400-800/5/5/5 (3 cores)	2	1+3	
		GSH002/282	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 145-170 kV	2	1+3	
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	2	2+3	
		GSH002/894	Support - Y2 type 145 kV	1	-	
		GSH002/894	Support - Y2 type 145 kV	1	-	
	GSH002/915	T150104	HM Y2 145kV AIR-AIR-TI:2000 y 800			
		GSH002/112	Central bay - Without circuit-breaker - Air_connection - 145-170 kV	1	2	
		GSH002/322	Disconnector with earthing switch 145-170 kV	3	1+2+3	
		GSH002/412	Bushing SF6/air class "d" 145-170 kV	3	1+2+3	
		GSH002/932	Control Box - Y2 type	1	-	
		GSH002/012	Lateral bay - With circuit-breaker - Air_connection - 145 kV	2	1+3	
		GSH002/620	Current Transformer 1.000-2.000/5/5/5 (3 cores)	1	1	
		GSH002/622	Current Transformer 400-800/5/5/5 (3 cores)	1	3	
		GSH002/282	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 145-170 kV	2	1+3	
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	2	2+3	
		GSH002/894	Support - Y2 type 145 kV	1	-	
	GSH002/912	6815217	HM Y1 145kV AIR-AIR-TPO TRAF0 TI 800			
		GSH002/112	Central bay - Without circuit-breaker - Air_connection - 145-170 kV	1	2	
		GSH002/322	Disconnector with earthing switch 145-170 kV	1	3	
		GSH002/332	Disconnector 145-170 kV with ability of Bus-transfer current switching	2	1+2	
		GSH002/412	Bushing SF6/air class "d" 145-170 kV	3	1+2+3	
		GSH002/012	Lateral bay - With circuit-breaker - Air_connection - 145 kV	1	3	
		GSH002/622	Current Transformer 400-800/5/5/5 (3 cores)	1	3	
		GSH002/282	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 145-170 kV	1	3	
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	1	3	
		GSH002/062	Lateral bay - Without circuit-breaker - Air_connection - 145-170 kV	1	1	
		GSH002/892	Support - Y1 type 145 kV	1	-	
		GSH002/931	Control Box - Y1 type	1	-	
	GSH002/912	T150102	HM Y1 145kV AIR-AIR-TPO TRAF0 TI 2000			
		GSH002/112	Central bay - Without circuit-breaker - Air_connection - 145-170 kV	1	2	
		GSH002/322	Disconnector with earthing switch 145-170 kV	1	3	
		GSH002/332	Disconnector 145-170 kV with ability of Bus-transfer current switching	2	1+2	
		GSH002/412	Bushing SF6/air class "d" 145-170 kV	3	1+2+3	
		GSH002/012	Lateral bay - With circuit-breaker - Air_connection - 145 kV	1	3	
		GSH002/620	Current Transformer 1.000-2.000/5/5/5 (3 cores)	1	3	
		GSH002/282	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 145-170 kV	1	3	
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	1	3	
		GSH002/062	Lateral bay - Without circuit-breaker - Air_connection - 145-170 kV	1	1	
		GSH002/892	Support - Y1 type 145 kV	1	-	
		GSH002/931	Control Box - Y1 type	1	-	
	GSH002/912	T150101	HM Y1 145kV AIR-AIR-TPO LINE TI 2000			
		GSH002/112	Central bay - Without circuit-breaker - Air_connection - 145-170 kV	1	2	
		GSH002/322	Disconnector with earthing switch 145-170 kV	1	3	
		GSH002/332	Disconnector 145-170 kV with ability of Bus-transfer current switching	2	1+2	
		GSH002/412	Bushing SF6/air class "d" 145-170 kV	3	1+2+3	
		GSH002/012	Lateral bay - With circuit-breaker - Air_connection - 145 kV	1	3	
		GSH002/620	Current Transformer 1.000-2.000/5/5/5 (3 cores)	1	3	
		GSH002/282	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 145-170 kV	1	3	
		GSH002/062	Lateral bay - Without circuit-breaker - Air_connection - 145-170 kV	1	1	
		GSH002/892	Support - Y1 type 145 kV	1	-	
		GSH002/931	Control Box - Y1 type	1	-	
	GSH002/912	T150015	HM Y1 145kV AIR-AIR-TPO TRAF0 TI 800			
		GSH002/112	Central bay - Without circuit-breaker - Air_connection - 145-170 kV	1	2	
		GSH002/322	Disconnector with earthing switch 145-170 kV	1	3	
		GSH002/332	Disconnector 145-170 kV with ability of Bus-transfer current switching	2	1+2	
		GSH002/412	Bushing SF6/air class "d" 145-170 kV	3	1+2+3	
		GSH002/012	Lateral bay - With circuit-breaker - Air_connection - 145 kV	1	3	
		GSH002/622	Current Transformer 400-800/5/5/5 (3 cores)	1	3	
		GSH002/282	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 145-170 kV	1	3	
		GSH002/062	Lateral bay - Without circuit-breaker - Air_connection - 145-170 kV	1	1	
		GSH002/892	Support - Y1 type 145 kV	1	-	
		GSH002/931	Control Box - Y1 type	1	-	
	GSH002/909	6815216	HM SB 145kV AIR-AIR-TPO TRAF0 TI 800			
		GSH002/112	Central bay - Without circuit-breaker - Air_connection - 145-170 kV	1	2	
		GSH002/322	Disconnector with earthing switch 145-170 kV	1	1	
		GSH002/312	Disconnector 145-170 kV	1	2	
		GSH002/412	Bushing SF6/air class "d" 145-170 kV	2	1+2	
		GSH002/622	Current Transformer 400-800/5/5/5 (3 cores)	1	1	
		GSH002/012	Lateral bay - With circuit-breaker - Air_connection - 145 kV	1	1	
		GSH002/282	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 145-170 kV	1	1	
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	1	1	
		GSH002/896	Support - Single-bay type 145 kV	1	-	
		GSH002/933	Control Box - Single-bay type	1	-	



GLOBAL STANDARD

HYBRID MODULES

GSH002

Rev. 03

06/11/2019

Local code	Type Code	GSH002 SubCode	Description			
	GSH002/909	T150003	HM SB 145kV AIR-AIR TPO TRAF0 TI 2000			
		GSH002/112	Central bay - Without circuit-breaker - Air_connection - 145-170 kV	1	2	
		GSH002/322	Disconnector with earthing switch 145-170 kV	1	1	
		GSH002/312	Disconnector 145-170 kV	1	2	
		GSH002/412	Bushing SF6/air class "d" 145-170 kV	2	1+2	
		GSH002/620	Current Transformer 1.000-2.000/5/5/5 (3 cores)	1	1	
		GSH002/012	Lateral bay - With circuit-breaker - Air_connection - 145 kV	1	1	
		GSH002/282	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 145-170 kV	1	1	
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	1	1	
		GSH002/896	Support - Single-bay type 145 kV	1	-	
		GSH002/933	Control Box - Single-bay type	1	-	
	GSH002/909	T150110	HM SB 145kV AIR-AIR TPO LINE TI 2000			
		GSH002/112	Central bay - Without circuit-breaker - Air_connection - 145-170 kV	1	2	
		GSH002/322	Disconnector with earthing switch 145-170 kV	1	1	
		GSH002/312	Disconnector 145-170 kV	1	2	
		GSH002/412	Bushing SF6/air class "d" 145-170 kV	2	1+2	
		GSH002/620	Current Transformer 1.000-2.000/5/5/5 (3 cores)	1	1	
		GSH002/012	Lateral bay - With circuit-breaker - Air_connection - 145 kV	1	1	
		GSH002/282	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 145-170 kV	1	1	
		GSH002/896	Support - Single-bay type 145 kV	1	-	
		GSH002/933	Control Box - Single-bay type	1	-	
	GSH002/909	T150111	HM SB 145kV AIR-AIR TPO LINE TI 800			
		GSH002/112	Central bay - Without circuit-breaker - Air_connection - 145-170 kV	1	2	
		GSH002/322	Disconnector with earthing switch 145-170 kV	1	1	
		GSH002/312	Disconnector 145-170 kV	1	2	
		GSH002/412	Bushing SF6/air class "d" 145-170 kV	2	1+2	
		GSH002/622	Current Transformer 400-800/5/5/5 (3 cores)	1	1	
		GSH002/012	Lateral bay - With circuit-breaker - Air_connection - 145 kV	1	1	
		GSH002/282	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 145-170 kV	1	1	
		GSH002/896	Support - Single-bay type 145 kV	1	-	
		GSH002/933	Control Box - Single-bay type	1	-	
	GSH002/906	6815291	HM Y2 72,5kV AIR-AIR TI:2000			
		GSH002/932	Control Box - Y2 type	1	-	
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	2	2+3	
		GSH002/011	Lateral bay - With circuit-breaker - Air_connection - 72,5 kV	2	1+3	
		GSH002/411	Bushing SF6/air class "d" 72,5 kV	3	1+2+3	
		GSH002/281	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 72,5 kV	2	1+3	
		GSH002/321	Disconnector with earthing switch 72,5 kV	3	1+2+3	
		GSH002/620	Current Transformer 1.000-2.000/5/5/5 (3 cores)	2	1+3	
		GSH002/111	Central bay - Without circuit-breaker - Air_connection - 72,5 kV	1	2	
		GSH002/893	Support - Y2 type 72,5 kV	1	-	
	GSH002/906	T150108	HM Y2 72,5kV AIR-AIR TI:800			
		GSH002/932	Control Box - Y2 type	1	-	
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	2	2+3	
		GSH002/011	Lateral bay - With circuit-breaker - Air_connection - 72,5 kV	2	1+3	
		GSH002/411	Bushing SF6/air class "d" 72,5 kV	3	1+2+3	
		GSH002/281	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 72,5 kV	2	1+3	
		GSH002/321	Disconnector with earthing switch 72,5 kV	3	1+2+3	
		GSH002/622	Current Transformer 400-800/5/5/5 (3 cores)	2	1+3	
		GSH002/111	Central bay - Without circuit-breaker - Air_connection - 72,5 kV	1	2	
		GSH002/893	Support - Y2 type 72,5 kV	1	-	
	GSH002/906	T150109	HM Y2 72,5kV AIR-AIR TI:2000 y 800			
		GSH002/932	Control Box - Y2 type	1	-	
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	2	2+3	
		GSH002/011	Lateral bay - With circuit-breaker - Air_connection - 72,5 kV	2	1+3	
		GSH002/411	Bushing SF6/air class "d" 72,5 kV	3	1+2+3	
		GSH002/281	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 72,5 kV	2	1+3	
		GSH002/321	Disconnector with earthing switch 72,5 kV	3	1+2+3	
		GSH002/620	Current Transformer 1.000-2.000/5/5/5 (3 cores)	1	1	
		GSH002/622	Current Transformer 400-800/5/5/5 (3 cores)	1	3	
		GSH002/111	Central bay - Without circuit-breaker - Air_connection - 72,5 kV	1	2	
		GSH002/893	Support - Y2 type 72,5 kV	1	-	
	GSH002/903	6815290	HM Y1 72,5kV AIR-AIR TPO TRAF0 TI 800			
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	1	3	
		GSH002/931	Control Box - Y1 type	1	-	
		GSH002/011	Lateral bay - With circuit-breaker - Air_connection - 72,5 kV	1	3	
		GSH002/411	Bushing SF6/air class "d" 72,5 kV	3	1+2+3	
		GSH002/281	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 72,5 kV	1	3	
		GSH002/321	Disconnector with earthing switch 72,5 kV	1	3	
		GSH002/331	Disconnector 72,5 kV with ability of Bus-transfer current switching	2	1+2	
		GSH002/622	Current Transformer 400-800/5/5/5 (3 cores)	1	3	
		GSH002/111	Central bay - Without circuit-breaker - Air_connection - 72,5 kV	1	2	
		GSH002/061	Lateral bay - Without circuit-breaker - Air_connection - 72,5 kV	1	1	
		GSH002/891	Support - Y1 type 72,5 kV	1	-	
	GSH002/903	T150112	HM Y1 72,5kV AIR-AIR TPO LINE TI 2000			
		GSH002/931	Control Box - Y1 type	1	-	
		GSH002/011	Lateral bay - With circuit-breaker - Air_connection - 72,5 kV	1	3	
		GSH002/411	Bushing SF6/air class "d" 72,5 kV	3	1+2+3	
		GSH002/281	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 72,5 kV	1	3	
		GSH002/321	Disconnector with earthing switch 72,5 kV	1	3	
		GSH002/331	Disconnector 72,5 kV with ability of Bus-transfer current switching	2	1+2	
		GSH002/620	Current Transformer 1.000-2.000/5/5/5 (3 cores)	1	3	
		GSH002/111	Central bay - Without circuit-breaker - Air_connection - 72,5 kV	1	2	
		GSH002/061	Lateral bay - Without circuit-breaker - Air_connection - 72,5 kV	1	1	
		GSH002/891	Support - Y1 type 72,5 kV	1	-	
	GSH002/903	T150113	HM Y1 72,5kV AIR-AIR TPO LINE TI 800			
		GSH002/931	Control Box - Y1 type	1	-	
		GSH002/011	Lateral bay - With circuit-breaker - Air_connection - 72,5 kV	1	3	
		GSH002/411	Bushing SF6/air class "d" 72,5 kV	3	1+2+3	
		GSH002/281	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 72,5 kV	1	3	
		GSH002/321	Disconnector with earthing switch 72,5 kV	1	3	
		GSH002/331	Disconnector 72,5 kV with ability of Bus-transfer current switching	2	1+2	
		GSH002/622	Current Transformer 400-800/5/5/5 (3 cores)	1	3	
		GSH002/111	Central bay - Without circuit-breaker - Air_connection - 72,5 kV	1	2	
		GSH002/061	Lateral bay - Without circuit-breaker - Air_connection - 72,5 kV	1	1	
		GSH002/891	Support - Y1 type 72,5 kV	1	-	

Local code	Type Code	GSH002 SubCode	Description			
	GSH002/900	6815219	HM SB 72,5kV AIR-AIR TPO TRAF0 TI 800			
		GSH002/622	Current Transformer 400-800/5/5/5 (3 cores)	1	1	
		GSH002/933	Control Box - Single-bay type	1	-	
		GSH002/011	Lateral bay - With circuit-breaker - Air_connection - 72,5 kV	1	1	
		GSH002/411	Bushing SF6/air class "d" 72,5 kV	2	1+2	
		GSH002/281	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 72,5 kV	1	1	
		GSH002/321	Disconnecter with earthing switch 72,5 kV	1	1	
		GSH002/111	Central bay - Without circuit-breaker - Air_connection - 72,5 kV	1	2	
		GSH002/311	Disconnecter 72,5 kV	1	2	
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	1	1	
		GSH002/895	Support - Single-bay type 72,5 kV	1	-	
	GSH002/900	T150114	HM SB 72,5kV AIR-AIR TPO LINE TI 2000			
		GSH002/620	Current Transformer 1.000-2.000/5/5/5 (3 cores)	1	1	
		GSH002/933	Control Box - Single-bay type	1	-	
		GSH002/011	Lateral bay - With circuit-breaker - Air_connection - 72,5 kV	1	1	
		GSH002/411	Bushing SF6/air class "d" 72,5 kV	2	1+2	
		GSH002/281	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 72,5 kV	1	1	
		GSH002/321	Disconnecter with earthing switch 72,5 kV	1	1	
		GSH002/111	Central bay - Without circuit-breaker - Air_connection - 72,5 kV	1	2	
		GSH002/311	Disconnecter 72,5 kV	1	2	
		GSH002/895	Support - Single-bay type 72,5 kV	1	-	
	GSH002/900	T150115	HM SB 72,5kV AIR-AIR TPO LINE TI 800			
		GSH002/622	Current Transformer 400-800/5/5/5 (3 cores)	1	1	
		GSH002/933	Control Box - Single-bay type	1	-	
		GSH002/011	Lateral bay - With circuit-breaker - Air_connection - 72,5 kV	1	1	
		GSH002/411	Bushing SF6/air class "d" 72,5 kV	2	1+2	
		GSH002/281	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 72,5 kV	1	1	
		GSH002/321	Disconnecter with earthing switch 72,5 kV	1	1	
		GSH002/111	Central bay - Without circuit-breaker - Air_connection - 72,5 kV	1	2	
		GSH002/311	Disconnecter 72,5 kV	1	2	
		GSH002/895	Support - Single-bay type 72,5 kV	1	-	

145kV - Variation in the cost if the base configuration change with:

- 1 One bay connection change from air to cable
- 2 Include one EVDS
- 3 Circuit-breaker drive mechanism change from Three-pole to Single-pole
- 4 Include the VT GSH002/702
- 5 Include the VT GSH002/711
- 6 Include the VT GSH002/721
- 7 Include the VT GSH002/722
- 8 Include CT GSH002/605
- 9 Include CT GSH002/621

72,5kV- Variation in the cost if the base configuration change with:

- 1 One bay connection change from air to cable
- 2 Include one EVDS
- 3 Circuit-breaker drive mechanism change from Three-pole to Single-pole
- 4 Include the VT GSH002/701
- 5 Include CT GSH002/602
- 6 Include CT GSH002/601
- 7 Include CT GSH002/621



Lot 4: CEARA (Brazil)

Hybrid Module: Configuration from base components						
Code	TS		Description	Units/Module	Bay	
Local code	Type Code	GSH002 SubCode	Description			
	GSH002/900	T150106	HM SB 72,5kV AIR-AIR TPO TRAF0 TI:2000			
		GSH002/620	Current Transformer 1.000-2.000/5/5/5 (3 cores)	1	1	
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	1	1	
		GSH002/933	Control Box - Single-bay type	1	-	
		GSH002/011	Lateral bay - With circuit-breaker - Air_connection - 72,5 kV	1	1	
		GSH002/281	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 72,5 kV	1	1	
		GSH002/321	Disconnector with earthing switch 72,5 kV	1	1	
		GSH002/111	Central bay - Without circuit-breaker - Air_connection - 72,5 kV	1	2	
		GSH002/421	Bushing SF6/air class "e" 72,5 kV	2	1+2	
		GSH002/311	Disconnector 72,5 kV	1	2	
		GSH002/863	Support - Single-bay type 72,5 kV	1	-	
Local code	Type Code	GSH002 SubCode	Description			
	GSH002/900	T150107	HM SB 72,5kV AIR-AIR TPO LINE TI:2000			
		GSH002/620	Current Transformer 1.000-2.000/5/5/5 (3 cores)	1	1	
		GSH002/933	Control Box - Single-bay type	1	-	
		GSH002/011	Lateral bay - With circuit-breaker - Air_connection - 72,5 kV	1	1	
		GSH002/281	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 72,5 kV	1	1	
		GSH002/321	Disconnector with earthing switch 72,5 kV	1	1	
		GSH002/111	Central bay - Without circuit-breaker - Air_connection - 72,5 kV	1	2	
		GSH002/421	Bushing SF6/air class "e" 72,5 kV	2	1+2	
		GSH002/311	Disconnector 72,5 kV	1	2	
		GSH002/863	Support - Single-bay type 72,5 kV	1	-	
Local code	Type Code	GSH002 SubCode	Description			
	GSH002/900	6811997	HM SB 72,5kV AIR-AIR TPO TRAF0 TI:800			
		GSH002/622	Current Transformer 400-800/5/5/5 (3 cores)	1	1	
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	1	1	
		GSH002/933	Control Box - Single-bay type	1	-	
		GSH002/011	Lateral bay - With circuit-breaker - Air_connection - 72,5 kV	1	1	
		GSH002/281	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 72,5 kV	1	1	
		GSH002/321	Disconnector with earthing switch 72,5 kV	1	1	
		GSH002/111	Central bay - Without circuit-breaker - Air_connection - 72,5 kV	1	2	
		GSH002/421	Bushing SF6/air class "e" 72,5 kV	2	1+2	
		GSH002/311	Disconnector 72,5 kV	1	2	
		GSH002/863	Support - Single-bay type 72,5 kV	1	-	
Local code	Type Code	GSH002 SubCode	Description			
	GSH002/900	T150105	HM SB 72,5kV AIR-AIR TPO LINE TI:800			
		GSH002/622	Current Transformer 400-800/5/5/5 (3 cores)	1	1	
		GSH002/933	Control Box - Single-bay type	1	-	
		GSH002/011	Lateral bay - With circuit-breaker - Air_connection - 72,5 kV	1	1	
		GSH002/281	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 72,5 kV	1	1	
		GSH002/321	Disconnector with earthing switch 72,5 kV	1	1	
		GSH002/111	Central bay - Without circuit-breaker - Air_connection - 72,5 kV	1	2	
		GSH002/421	Bushing SF6/air class "e" 72,5 kV	2	1+2	
		GSH002/311	Disconnector 72,5 kV	1	2	
		GSH002/863	Support - Single-bay type 72,5 kV	1	-	
Local code	Type Code	GSH002 SubCode	Description			
	GSH002/906	T150004	HM Y2 72,5kV AIR-AIR-AIR TI:2000 y 800			
		GSH002/932	Control Box - Y2 type	1	-	
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	2	2+3	
		GSH002/011	Lateral bay - With circuit-breaker - Air_connection - 72,5 kV	2	1+3	
		GSH002/421	Bushing SF6/air class "e" 72,5 kV	3	1+2+3	
		GSH002/281	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 72,5 kV	2	1+3	
		GSH002/321	Disconnector with earthing switch 72,5 kV	3	1+2+3	
		GSH002/620	Current Transformer 1.000-2.000/5/5/5 (3 cores)	1	1	
		GSH002/622	Current Transformer 400-800/5/5/5 (3 cores)	1	3	
		GSH002/111	Central bay - Without circuit-breaker - Air_connection - 72,5 kV	1	2	
		GSH002/862	Support - Y2 type 72,5 kV - Coelce	1	-	
Local code	Type Code	GSH002 SubCode	Description			
	GSH002/906	T150005	HM Y2 72,5kV AIR-AIR-AIR TI:800			
		GSH002/932	Control Box - Y2 type	1	-	
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	2	2+3	
		GSH002/011	Lateral bay - With circuit-breaker - Air_connection - 72,5 kV	2	1+3	
		GSH002/421	Bushing SF6/air class "e" 72,5 kV	3	1+2+3	
		GSH002/281	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 72,5 kV	2	1+3	
		GSH002/321	Disconnector with earthing switch 72,5 kV	3	1+2+3	
		GSH002/622	Current Transformer 400-800/5/5/5 (3 cores)	2	1+3	
		GSH002/111	Central bay - Without circuit-breaker - Air_connection - 72,5 kV	1	2	
		GSH002/862	Support - Y2 type 72,5 kV - Coelce	1	-	

72,5kV- Variation in the cost if the base configuration change with:

- 1 One bay connection change from air to cable
- 2 Include one EVDS
- 3 Circuit-breaker drive mechanism change from Three-pole to Single-pole
- 4 Include the VT GSH002/701
- 5 Include CT GSH002/602
- 6 Include CT GSH002/601
- 7 Include CT GSH002/621
- 8 Include CT GSH002/608
- 9 Include CT GSH002/612
- 10 Include CT GSH002/623



Lot 3: GOIÁS (Brazil)

Hybrid Module: Configuration from base components						
Code	TS		Description	Units/Module	Bay	
Local code	Type Code	GSH002 SubCode	Description			
	GSH002/915	6815218	HM Y2 145kV AIR-AIR-AIR TI:2000			
		GSH002/112	Central bay - Without circuit-breaker - Air_connection - 145-170 kV	1	2	
		GSH002/322	Disconnector with earthing switch 145-170 kV	3	1+2+3	
		GSH002/412	Bushing SF6/air class "d" 145-170 kV	3	1+2+3	
		GSH002/932	Control Box - Y2 type	1	-	
		GSH002/012	Lateral bay - With circuit-breaker - Air_connection - 145 kV	2	1+3	
		GSH002/620	Current Transformer 1.000-2.000/5/5/5 (3 cores)	2	1+3	
		GSH002/282	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 145-170 kV	2	1+3	
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	2	2+3	
		GSH002/894	Support - Y2 type 145 kV	1	-	
		GSH002/915	HM Y2 145kV AIR-AIR-AIR TI:800			
	GSH002/915	T150104	HM Y2 145kV AIR-AIR-AIR TI:2000 y 800			
		GSH002/112	Central bay - Without circuit-breaker - Air_connection - 145-170 kV	1	2	
		GSH002/322	Disconnector with earthing switch 145-170 kV	3	1+2+3	
		GSH002/412	Bushing SF6/air class "d" 145-170 kV	3	1+2+3	
		GSH002/932	Control Box - Y2 type	1	-	
		GSH002/012	Lateral bay - With circuit-breaker - Air_connection - 145 kV	2	1+3	
		GSH002/620	Current Transformer 1.000-2.000/5/5/5 (3 cores)	1	1	
		GSH002/622	Current Transformer 400-800/5/5/5 (3 cores)	1	3	
		GSH002/282	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 145-170 kV	2	1+3	
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	2	2+3	
		GSH002/894	Support - Y2 type 145 kV	1	-	
	GSH002/912	6815217	HM Y1 145kV AIR-AIR TPO TRAF0 TI 800			
		GSH002/112	Central bay - Without circuit-breaker - Air_connection - 145-170 kV	1	2	
		GSH002/322	Disconnector with earthing switch 145-170 kV	1	3	
		GSH002/332	Disconnector 145-170 kV with ability of Bus-transfer current switching	2	1+2	
		GSH002/412	Bushing SF6/air class "d" 145-170 kV	3	1+2+3	
		GSH002/012	Lateral bay - With circuit-breaker - Air_connection - 145 kV	1	3	
		GSH002/622	Current Transformer 400-800/5/5/5 (3 cores)	1	3	
		GSH002/282	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 145-170 kV	1	3	
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	1	3	
		GSH002/062	Lateral bay - Without circuit-breaker - Air_connection - 145-170 kV	1	1	
		GSH002/892	Support - Y1 type 145 kV	1	-	
		GSH002/931	Control Box - Y1 type	1	-	
	GSH002/912	T150102	HM Y1 145kV AIR-AIR TPO TRAF0 TI 2000			
		GSH002/112	Central bay - Without circuit-breaker - Air_connection - 145-170 kV	1	2	
		GSH002/322	Disconnector with earthing switch 145-170 kV	1	3	
		GSH002/332	Disconnector 145-170 kV with ability of Bus-transfer current switching	2	1+2	
		GSH002/412	Bushing SF6/air class "d" 145-170 kV	3	1+2+3	
		GSH002/012	Lateral bay - With circuit-breaker - Air_connection - 145 kV	1	3	
		GSH002/620	Current Transformer 1.000-2.000/5/5/5 (3 cores)	1	3	
		GSH002/282	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 145-170 kV	1	3	
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	1	3	
		GSH002/062	Lateral bay - Without circuit-breaker - Air_connection - 145-170 kV	1	1	
		GSH002/892	Support - Y1 type 145 kV	1	-	
		GSH002/931	Control Box - Y1 type	1	-	
	GSH002/912	T150101	HM Y1 145kV AIR-AIR TPO LINE TI 2000			
		GSH002/112	Central bay - Without circuit-breaker - Air_connection - 145-170 kV	1	2	
		GSH002/322	Disconnector with earthing switch 145-170 kV	1	3	
		GSH002/332	Disconnector 145-170 kV with ability of Bus-transfer current switching	2	1+2	
		GSH002/412	Bushing SF6/air class "d" 145-170 kV	3	1+2+3	
		GSH002/012	Lateral bay - With circuit-breaker - Air_connection - 145 kV	1	3	
		GSH002/620	Current Transformer 1.000-2.000/5/5/5 (3 cores)	1	3	
		GSH002/282	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 145-170 kV	1	3	
		GSH002/062	Lateral bay - Without circuit-breaker - Air_connection - 145-170 kV	1	1	
		GSH002/892	Support - Y1 type 145 kV	1	-	
		GSH002/931	Control Box - Y1 type	1	-	
	GSH002/909	6815216	HM SB 145kV AIR-AIR TPO TRAF0 TI 800			
		GSH002/112	Central bay - Without circuit-breaker - Air_connection - 145-170 kV	1	2	
		GSH002/322	Disconnector with earthing switch 145-170 kV	1	1	
		GSH002/312	Disconnector 145-170 kV	1	2	
		GSH002/412	Bushing SF6/air class "d" 145-170 kV	2	1+2	
		GSH002/622	Current Transformer 400-800/5/5/5 (3 cores)	1	1	
		GSH002/012	Lateral bay - With circuit-breaker - Air_connection - 145 kV	1	1	
		GSH002/282	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 145-170 kV	1	1	
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	1	1	
		GSH002/896	Support - Single-bay type 145 kV	1	-	
		GSH002/933	Control Box - Single-bay type	1	-	



GLOBAL STANDARD

HYBRID MODULES

GSH002

Rev. 03

06/11/2019

Local code	Type Code	GSH002 SubCode	Description			
	GSH002/909	T15003	HM SB 145kV AIR-AIR TPO TRAF0 TI 2000			
		GSH002/112	Central bay - Without circuit-breaker - Air_connection - 145-170 kV	1	2	
		GSH002/322	Disconnector with earthing switch 145-170 kV	1	1	
		GSH002/312	Disconnector 145-170 kV	1	2	
		GSH002/412	Bushing SF6/air class "d" 145-170 kV	2	1+2	
		GSH002/620	Current Transformer 1.000-2.000/5/5/5 (3 cores)	1	1	
		GSH002/012	Lateral bay - With circuit-breaker - Air_connection - 145 kV	1	1	
		GSH002/282	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 145-170 kV	1	1	
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	1	1	
		GSH002/896	Support - Single-bay type 145 kV	1	-	
		GSH002/933	Control Box - Single-bay type	1	-	
	GSH002/909	T15010	HM SB 145kV AIR-AIR TPO LINE TI 2000			
		GSH002/112	Central bay - Without circuit-breaker - Air_connection - 145-170 kV	1	2	
		GSH002/322	Disconnector with earthing switch 145-170 kV	1	1	
		GSH002/312	Disconnector 145-170 kV	1	2	
		GSH002/412	Bushing SF6/air class "d" 145-170 kV	2	1+2	
		GSH002/620	Current Transformer 1.000-2.000/5/5/5 (3 cores)	1	1	
		GSH002/012	Lateral bay - With circuit-breaker - Air_connection - 145 kV	1	1	
		GSH002/282	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 145-170 kV	1	1	
		GSH002/896	Support - Single-bay type 145 kV	1	-	
		GSH002/933	Control Box - Single-bay type	1	-	
	GSH002/909	T15011	HM SB 145kV AIR-AIR TPO LINE TI 800			
		GSH002/112	Central bay - Without circuit-breaker - Air_connection - 145-170 kV	1	2	
		GSH002/322	Disconnector with earthing switch 145-170 kV	1	1	
		GSH002/312	Disconnector 145-170 kV	1	2	
		GSH002/412	Bushing SF6/air class "d" 145-170 kV	2	1+2	
		GSH002/622	Current Transformer 400-800/5/5/5 (3 cores)	1	1	
		GSH002/012	Lateral bay - With circuit-breaker - Air_connection - 145 kV	1	1	
		GSH002/282	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 145-170 kV	1	1	
		GSH002/896	Support - Single-bay type 145 kV	1	-	
		GSH002/933	Control Box - Single-bay type	1	-	
	GSH002/906	6815291	HM Y2 72,5kV AIR-AIR TI 2000			
		GSH002/932	Control Box - Y2 type	1	-	
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	2	2+3	
		GSH002/011	Lateral bay - With circuit-breaker - Air_connection - 72,5 kV	2	1+3	
		GSH002/411	Bushing SF6/air class "d" 72,5 kV	3	1+2+3	
		GSH002/281	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 72,5 kV	2	1+3	
		GSH002/321	Disconnector with earthing switch 72,5 kV	3	1+2+3	
		GSH002/620	Current Transformer 1.000-2.000/5/5/5 (3 cores)	2	1+3	
		GSH002/111	Central bay - Without circuit-breaker - Air_connection - 72,5 kV	1	2	
		GSH002/893	Support - Y2 type 72,5 kV	1	-	
	GSH002/906	T150108	HM Y2 72,5kV AIR-AIR TI 800			
		GSH002/932	Control Box - Y2 type	1	-	
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	2	2+3	
		GSH002/011	Lateral bay - With circuit-breaker - Air_connection - 72,5 kV	2	1+3	
		GSH002/411	Bushing SF6/air class "d" 72,5 kV	3	1+2+3	
		GSH002/281	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 72,5 kV	2	1+3	
		GSH002/321	Disconnector with earthing switch 72,5 kV	3	1+2+3	
		GSH002/622	Current Transformer 400-800/5/5/5 (3 cores)	2	1+3	
		GSH002/111	Central bay - Without circuit-breaker - Air_connection - 72,5 kV	1	2	
		GSH002/893	Support - Y2 type 72,5 kV	1	-	
	GSH002/906	T150109	HM Y2 72,5kV AIR-AIR TI 2000 y 800			
		GSH002/932	Control Box - Y2 type	1	-	
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	2	2+3	
		GSH002/011	Lateral bay - With circuit-breaker - Air_connection - 72,5 kV	2	1+3	
		GSH002/411	Bushing SF6/air class "d" 72,5 kV	3	1+2+3	
		GSH002/281	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 72,5 kV	2	1+3	
		GSH002/321	Disconnector with earthing switch 72,5 kV	3	1+2+3	
		GSH002/620	Current Transformer 1.000-2.000/5/5/5 (3 cores)	1	1	
		GSH002/622	Current Transformer 400-800/5/5/5 (3 cores)	1	3	
		GSH002/111	Central bay - Without circuit-breaker - Air_connection - 72,5 kV	1	2	
		GSH002/893	Support - Y2 type 72,5 kV	1	-	
	GSH002/903	6815290	HM Y1 72,5kV AIR-AIR TPO TRAF0 TI 800			
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	1	3	
		GSH002/931	Control Box - Y1 type	1	-	
		GSH002/011	Lateral bay - With circuit-breaker - Air_connection - 72,5 kV	1	3	
		GSH002/411	Bushing SF6/air class "d" 72,5 kV	3	1+2+3	
		GSH002/281	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 72,5 kV	1	3	
		GSH002/321	Disconnector with earthing switch 72,5 kV	1	3	
		GSH002/331	Disconnector 72,5 kV with ability of Bus-transfer current switching	2	1+2	
		GSH002/622	Current Transformer 400-800/5/5/5 (3 cores)	1	3	
		GSH002/111	Central bay - Without circuit-breaker - Air_connection - 72,5 kV	1	2	
		GSH002/061	Lateral bay - Without circuit-breaker - Air_connection - 72,5 kV	1	1	
		GSH002/891	Support - Y1 type 72,5 kV	1	-	
	GSH002/903	T150112	HM Y1 72,5kV AIR-AIR TPO LINE TI 2000			
		GSH002/931	Control Box - Y1 type	1	-	
		GSH002/011	Lateral bay - With circuit-breaker - Air_connection - 72,5 kV	1	3	
		GSH002/411	Bushing SF6/air class "d" 72,5 kV	3	1+2+3	
		GSH002/281	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 72,5 kV	1	3	
		GSH002/321	Disconnector with earthing switch 72,5 kV	1	3	
		GSH002/331	Disconnector 72,5 kV with ability of Bus-transfer current switching	2	1+2	
		GSH002/620	Current Transformer 1.000-2.000/5/5/5 (3 cores)	1	3	
		GSH002/111	Central bay - Without circuit-breaker - Air_connection - 72,5 kV	1	2	
		GSH002/061	Lateral bay - Without circuit-breaker - Air_connection - 72,5 kV	1	1	
		GSH002/891	Support - Y1 type 72,5 kV	1	-	
	GSH002/903	T150113	HM Y1 72,5kV AIR-AIR TPO LINE TI 800			
		GSH002/931	Control Box - Y1 type	1	-	
		GSH002/011	Lateral bay - With circuit-breaker - Air_connection - 72,5 kV	1	3	
		GSH002/411	Bushing SF6/air class "d" 72,5 kV	3	1+2+3	
		GSH002/281	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 72,5 kV	1	3	
		GSH002/321	Disconnector with earthing switch 72,5 kV	1	3	
		GSH002/331	Disconnector 72,5 kV with ability of Bus-transfer current switching	2	1+2	
		GSH002/622	Current Transformer 400-800/5/5/5 (3 cores)	1	3	
		GSH002/111	Central bay - Without circuit-breaker - Air_connection - 72,5 kV	1	2	
		GSH002/061	Lateral bay - Without circuit-breaker - Air_connection - 72,5 kV	1	1	
		GSH002/891	Support - Y1 type 72,5 kV	1	-	



Local code	Type Code	GSH002 SubCode	Description			
	GSH002/900	6815219	HM SB 72,5kV AIR-AIR TPO TRAF0 TI 800			
		GSH002/622	Current Transformer 400-800/5/5/5 (3 cores)	1	1	
		GSH002/933	Control Box - Single-bay type	1	-	
		GSH002/011	Lateral bay - With circuit-breaker - Air_connection - 72,5 kV	1	1	
		GSH002/411	Bushing SF6/air class "d" 72,5 kV	2	1+2	
		GSH002/281	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 72,5 kV	1	1	
		GSH002/321	Disconnecter with earthing switch 72,5 kV	1	1	
		GSH002/111	Central bay - Without circuit-breaker - Air_connection - 72,5 kV	1	2	
		GSH002/311	Disconnecter 72,5 kV	1	2	
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	1	1	
		GSH002/895	Support - Single-bay type 72,5 kV	1	-	
	GSH002/900	T150114	HM SB 72,5kV AIR-AIR TPO LINE TI 2000			
		GSH002/620	Current Transformer 1.000-2.000/5/5/5 (3 cores)	1	1	
		GSH002/933	Control Box - Single-bay type	1	-	
		GSH002/011	Lateral bay - With circuit-breaker - Air_connection - 72,5 kV	1	1	
		GSH002/411	Bushing SF6/air class "d" 72,5 kV	2	1+2	
		GSH002/281	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 72,5 kV	1	1	
		GSH002/321	Disconnecter with earthing switch 72,5 kV	1	1	
		GSH002/111	Central bay - Without circuit-breaker - Air_connection - 72,5 kV	1	2	
		GSH002/311	Disconnecter 72,5 kV	1	2	
		GSH002/895	Support - Single-bay type 72,5 kV	1	-	
	GSH002/900	T150115	HM SB 72,5kV AIR-AIR TPO LINE TI 800			
		GSH002/622	Current Transformer 400-800/5/5/5 (3 cores)	1	1	
		GSH002/933	Control Box - Single-bay type	1	-	
		GSH002/011	Lateral bay - With circuit-breaker - Air_connection - 72,5 kV	1	1	
		GSH002/411	Bushing SF6/air class "d" 72,5 kV	2	1+2	
		GSH002/281	Circuit-breaker drive mechanism - Three_pole - 1°, 2° opening circuit - 72,5 kV	1	1	
		GSH002/321	Disconnecter with earthing switch 72,5 kV	1	1	
		GSH002/111	Central bay - Without circuit-breaker - Air_connection - 72,5 kV	1	2	
		GSH002/311	Disconnecter 72,5 kV	1	2	
		GSH002/895	Support - Single-bay type 72,5 kV	1	-	

145kV - Variation in the cost if the base configuration change with:

- 1 One bay connection change from air to cable
- 2 Include one EVDS
- 3 Circuit-breaker drive mechanism change from Three-pole to Single-pole
- 4 Include the VT GSH002/702
- 5 Include the VT GSH002/711
- 6 Include the VT GSH002/721
- 7 Include the VT GSH002/722
- 8 Include CT GSH002/605
- 9 Include CT GSH002/621

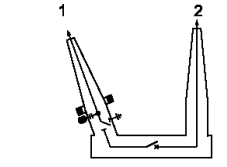
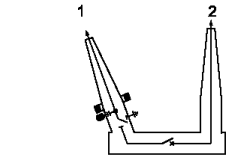
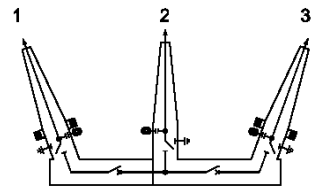
72,5kV- Variation in the cost if the base configuration change with:

- 1 One bay connection change from air to cable
- 2 Include one EVDS
- 3 Circuit-breaker drive mechanism change from Three-pole to Single-pole
- 4 Include the VT GSH002/701
- 5 Include CT GSH002/602
- 6 Include CT GSH002/601
- 7 Include CT GSH002/621




Lot 5: Codensa (Colombia)

Hybrid Module: Configuration from base components					
Code	TS		Description	Units/Module	Bay
Local code	Type Code	GSH002 SubCode	Description		
6815945	GSH002/915	111150	HYBRID MODULE Y2 TYPE 145kV AIR-AIR-AIR		
		GSH002/112	Central bay - Without circuit-breaker - Air_connection - 145-170 kV	1	2
		GSH002/322	Disconnector with earthing switch 145-170 kV	3	1+2+3
		GSH002/412	Bushing SF6/air class "d" 145-170 kV	3	1+2+3
		GSH002/621C	Current Transformer 1.000-2.000/5/1/1 (0,5-5P20/5P20/5P20)	1	1
		GSH002/606	Current Transformer rated ratio 1.600/1	2	1+3
		GSH002/932	Control Box - Y2 type	1	-
		GSH002/012	Lateral bay - With circuit-breaker - Air_connection - 145 kV	2	1+3
		GSH002/282	Circuit-breaker drive mechanism - Three_pole - 1", 2" opening circuit - 145-170 kV	2	1+3
		GSH002/622C	Current Transformer 400-800/5/5/5 (0,2s-FS10/5P20/5P20)	1	3
		GSH002/872	Support - Y2 type 145 kV	1	-
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	3	1+2+3
		GSH002/562	Partitioning with single-pole gas management (including relative equipments and control circuits) 145-170 kV	1	1
6815946	GSH002/909	150032	HYBRID MODULE SINGLE-BAY TYPE 145 kV AIR-AIR (TRAFO)		
		GSH002/112	Central bay - Without circuit-breaker - Air_connection - 145-170 kV	1	2
		GSH002/322	Disconnector with earthing switch 145-170 kV	1	1
		GSH002/412	Bushing SF6/air class "d" 145-170 kV	2	1+2
		GSH002/012	Lateral bay - With circuit-breaker - Air_connection - 145 kV	1	1
		GSH002/282	Circuit-breaker drive mechanism - Three_pole - 1", 2" opening circuit - 145-170 kV	1	1
		GSH002/622C	Current Transformer 400-800/5/5/5 (0,2s-FS10/5P20/5P20)	1	1
		GSH002/606	Current Transformer 1.600/1 145-170 kV	1	1
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	1	1
		GSH002/933	Control Box - Single-bay type	1	-
		GSH002/873	Support - Single-bay type 145 kV	1	-
6815947	GSH002/909	150033	HYBRID MODULE SINGLE-BAY TYPE 145 kV AIR-AIR (LINEA)		
		GSH002/112	Central bay - Without circuit-breaker - Air_connection - 145-170 kV	1	2
		GSH002/322	Disconnector with earthing switch 145-170 kV	1	1
		GSH002/412	Bushing SF6/air class "d" 145-170 kV	2	1+2
		GSH002/621C	Current Transformer 1.000-2.000/5/1/1 (0,5-5P20/5P20/5P20)	1	1
		GSH002/606	Current Transformer 1.600/1 145-170 kV	1	1
		GSH002/012	Lateral bay - With circuit-breaker - Air_connection - 145 kV	1	1
		GSH002/282	Circuit-breaker drive mechanism - Three_pole - 1", 2" opening circuit - 145-170 kV	1	1
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	1	1
		GSH002/933	Control Box - Single-bay type	1	-
		GSH002/873	Support - Single-bay type 145 kV	1	-



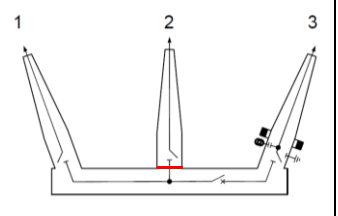
145kV- Variation in the cost if the base configuration change with:

- 1 One bay connection change from air to cable
- 2 Include one EVDS
- 3 Circuit-breaker drive mechanism change from Three-pole to Single-pole
- 4 Include the VT GSH002/702
- 5 Include the VT GSH002/711
- 6 Include the VT GSH002/721
- 7 Include the VT GSH002/722
- 8 Include CT GSH002/606
- 9 Include CT GSH002/612
- 10 Include CT GSH002/621

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Lot 6: Enel Distribución Perú (Antigua Edelinor) (Peru)

Hybrid Module: Configuration from base components					
Code	TS		Description	Units/Module	Bay
Local code	Type Code	GSH002 SubCode	Description		
6811992	GSH002/912	110853	Hibrido Y1 TRAF0 tipo 5 (245kV)		
		GSH002/014	Lateral bay - With circuit-breaker - Air_connection - 245 kV	1	3
		GSH002/063	Lateral bay - Without circuit-breaker - Air_connection - 245 kV	1	1
		GSH002/113	Central bay - Without circuit-breaker - Air_connection - 245 kV	1	2
		GSH002/213	Circuit-breaker drive mechanism - Single_pole - 1 ^o , 2 ^o opening circuit - 245 kV	1	3
		GSH002/323	Disconnecter with earthing switch 245 kV	1	3
		GSH002/333	Disconnecter with ability of Bus-transfer current switching 245 kV	2	1+2
		GSH002/423	Bushing SF6/air class "a" 245 kV	3	1+2+3
		GSH002/563	Partitioning with single-pole gas management (including relative equipments and control circuits) 245 kV	1	2
		GSH002/607	Current Transformer 200-400/1 245 kV	1	3
		GSH002/XYZ	Current transformer (medida). 200-400/1, Clase 0.2 S, FS 5, 15 VA, 2 nucleos	1	3
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	1	3
		GSH002/852	Support - Y1 type 245 kV	1	-
		GSH002/931	Control Box - Y1 type	1	-



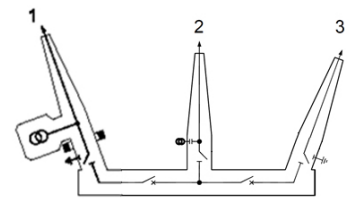
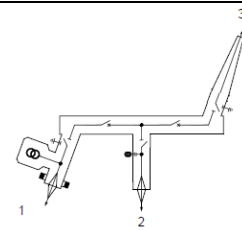
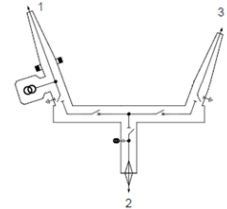
EQUIPO COMPACTO PASS 220kV 40kA (INT. SECC. BARRAS y LÍNEAS TRANS CORR.)
PROYECTO DE AMPLIACION SE LOMERA
Fecha de entrega: Junio 2016

245kV- Variation in the cost if the base configuration change with:
1 One bay connection change from air to cable
2 Include one EVDS
3 Circuit-breaker drive mechanism change from Single-pole to Three-pole.
4 Include the VT GSH002/704



Lot 7: Enel Argentina

Hybrid Module: Configuration from base components					
Code	TS		Description	Units/Module	Bay
Local code	Type Code	GSH002 SubCode	Description		
P-8008	GSH002/916	0103-2786	HYBRID MODUL Y2 TYPE 145 kV AIR-CAB-AIR		
Q-3819			Lateral bay - With circuit-breaker - Air_connection - 145 kV	2	1+3
		GSH002/012	Central bay - Without circuit-breaker - Cable_connection - 145-170 kV	1	2
		GSH002/282	Circuit-breaker drive mechanism - Three_pole - 1", 2" opening circuit - 145-170 kV	2	1+3
		GSH002/312	Disconnector 145-170 kV	1	2
		GSH002/322	Disconnector with earthing switch 145-170 kV	2	1+3
		GSH002/412	Bushing SF6/air class "d" 145-170 kV	2	1+3
		GSH002/465	Cable connection downward exit 145-170 kV	1	2
		GSH002/612	Current Transformer 400-800/5/1/1 (3 cores)	1	1
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	1	2
		GSH002/721	Voltage Transformer 145kV 132:√3/0,11:√3 0,5-3P/0,5-3P	1	1
		GSH002/843	Support - Y2 type 145 kV	1	-
		GSH002/932	Control Box - Y2 type	1	-
T-3817	GSH002/916	0103-2787	HYBRID MODUL Y2 TYPE 145 kV CAB-AIR-CAB		
		GSH002/022	Lateral bay - With circuit-breaker - Cable_connection - 145 kV	1	1
		GSH002/012	Lateral bay - With circuit-breaker - Air_connection - 145 kV	1	3
		GSH002/122	Central bay - Without circuit-breaker - Cable_connection - 145-170 kV	1	2
		GSH002/282	Circuit-breaker drive mechanism - Three_pole - 1", 2" opening circuit - 145-170 kV	2	1+3
		GSH002/312	Disconnector 145-170 kV	1	2
		GSH002/322	Disconnector with earthing switch 145-170 kV	2	1+3
		GSH002/412	Bushing SF6/air class "d" 145-170 kV	1	3
		GSH002/465	Cable connection downward exit 145-170 kV	2	1+2
		GSH002/612	Current Transformer 400-800/5/1/1 (3 cores)	1	1
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	1	2
		GSH002/721	Voltage Transformer 145kV 132:√3/0,11:√3 0,5-3P/0,5-3P	1	1
		GSH002/843	Support - Y2 type 145 kV	1	-
		GSH002/932	Control Box - Y2 type	1	-
Q-3800	GSH002/915	0103-2788	HYBRID MODUL Y2 TYPE 145 kV AIR-AIR-AIR		
		GSH002/012	Lateral bay - With circuit-breaker - Air_connection - 145 kV	2	1+3
		GSH002/112	Central bay - Without circuit-breaker - Air_connection - 145-170 kV	1	2
		GSH002/282	Circuit-breaker drive mechanism - Three_pole - 1", 2" opening circuit - 145-170 kV	2	1+3
		GSH002/312	Disconnector 145-170 kV	1	2
		GSH002/322	Disconnector with earthing switch 145-170 kV	2	1+3
		GSH002/412	Bushing SF6/air class "d" 145-170 kV	3	1+2+3
		GSH002/612	Current Transformer 400-800/5/1/1 (3 cores)	1	1
		GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	1	2
		GSH002/721	Voltage Transformer 145kV 132:√3/0,11:√3 0,5-3P/0,5-3P	1	1
		GSH002/843	Support - Y2 type 145 kV	1	-
		GSH002/932	Control Box - Y2 type	1	-



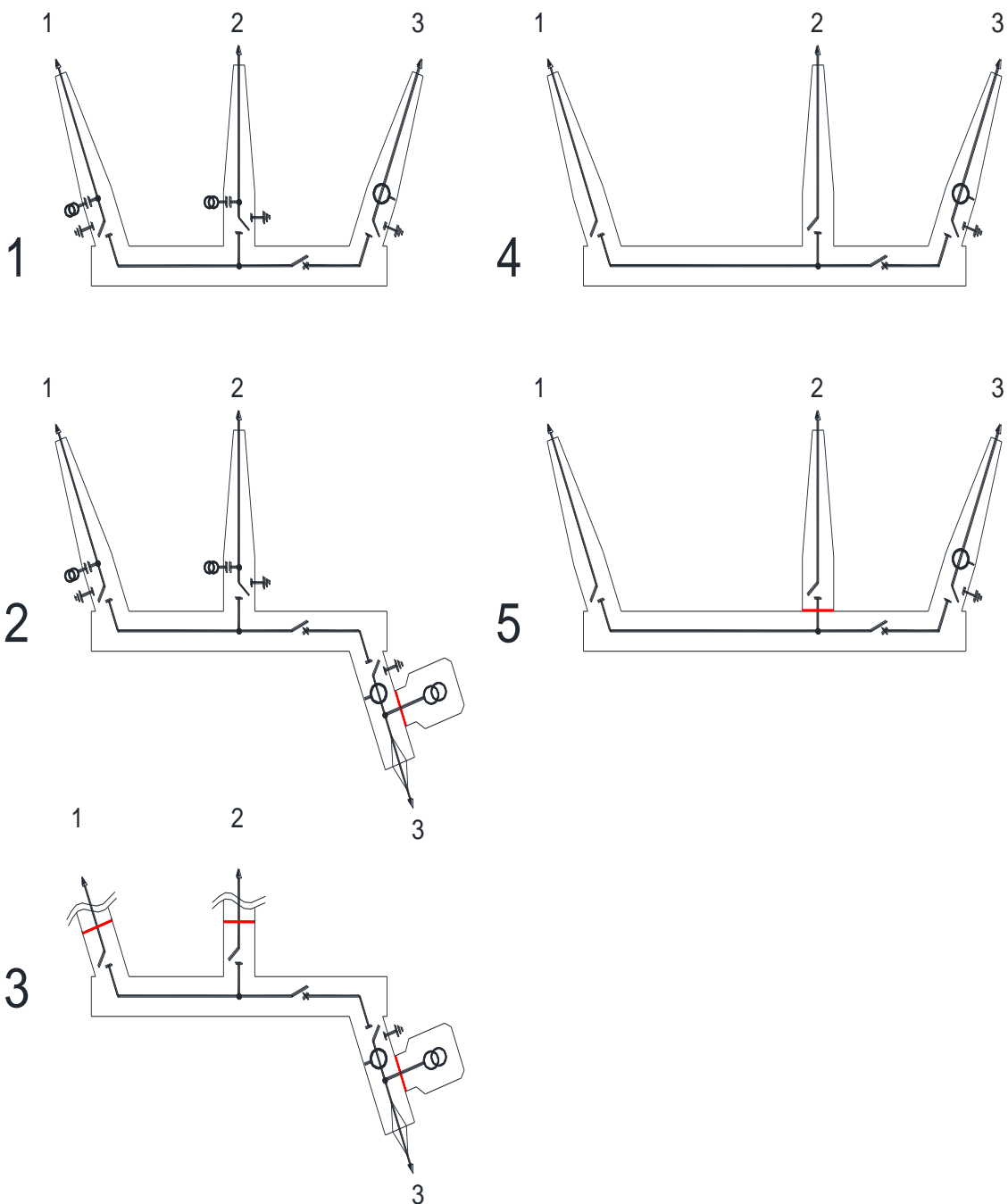
Variation in the cost if the base configuration change with:

- 1 One bay connection change from air to cable
- 2 Include one EVDS
- 3 Circuit-breaker drive mechanism change from Three-pole to Single-pole
- 4 Include the VT GSH002/702
- 5 Include the VT GSH002/711
- 6 Include the VT GSH002/721
- 7 Include the VT GSH002/722
- 8 Include CT GSH002/605
- 9 Include CT GSH002/621

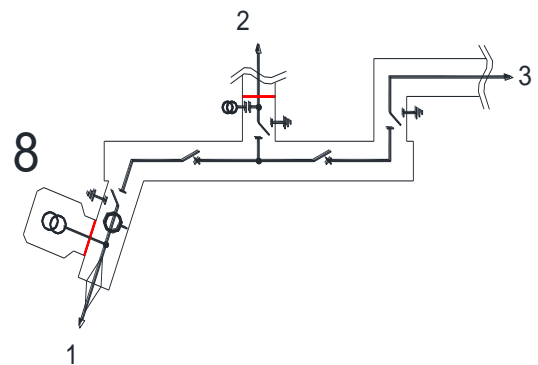
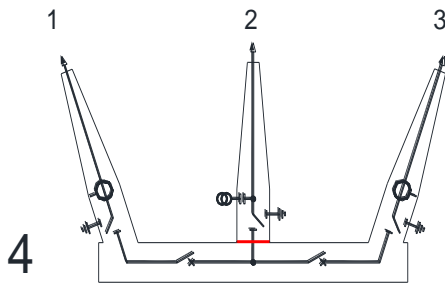
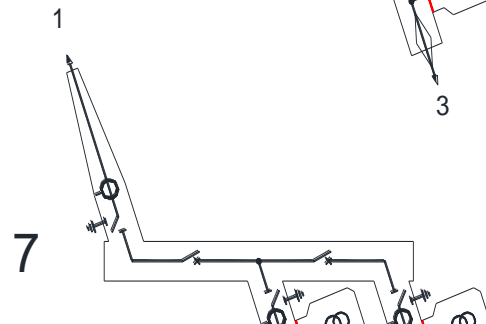
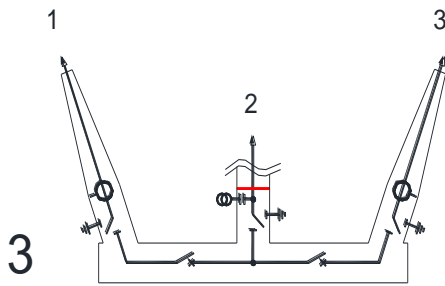
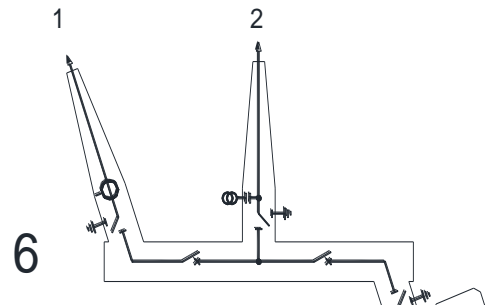
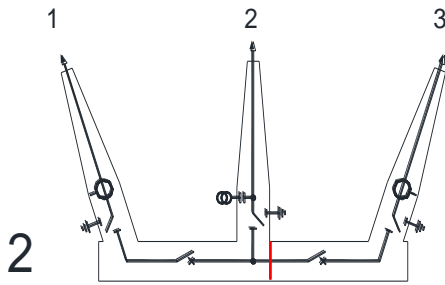
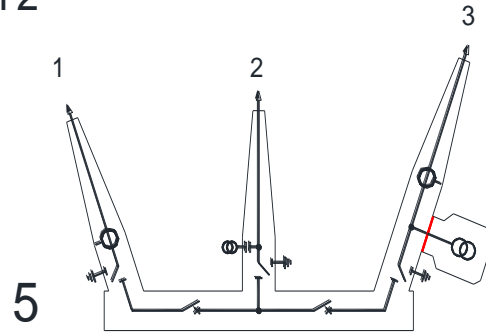
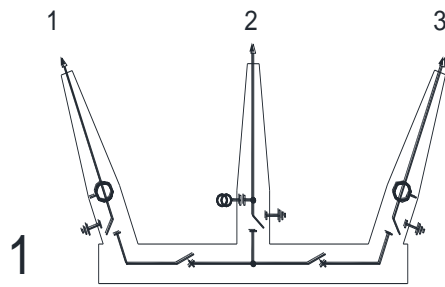
ANNEX B – LAYOUT EXAMPLES

B.1 – Examples of layout compositions with single line diagrams

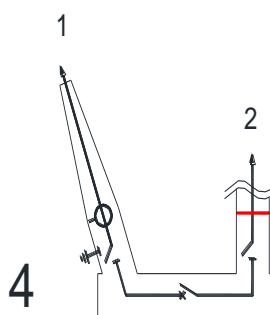
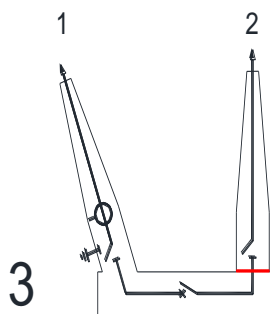
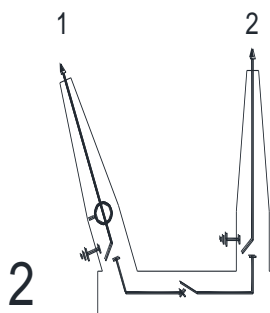
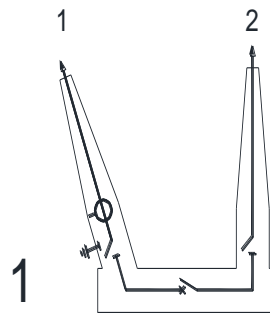
Y1




Y2



Single bay



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B.2 - Examples of composition lists using “Base component codes”

Y1 type – Annex B.1 fig. 4:

Base component description	BAY	Base component code GSH002/...	Nr (terns)
Lateral bay - Without circuit-breaker - Air connection	1	062	1
Central bay - Without circuit-breaker - Air connection	2	112	1
Lateral bay - With circuit-breaker - Air connection	3	012	1
Circuit-breaker drive mechanism - Three-pole	3	282	1
Disconnecter with ability of Bus-transfer current switching	1	332	1
Disconnecter with ability of Bus-transfer current switching	2	332	1
Disconnecter with earthing switch	3	322	1
Bushing SF6/air class “e”	1	422	1
Bushing SF6/air class “e”	2	422	1
Bushing SF6/air class “e”	3	422	1
Current Transformer	3	622	1
Support	-	821	1
Control Box - Y1 type used in Line bay	-	921	1

Note (referring Annex B1 drawings):

- BAY 1: Lateral Bay
- BAY 2: Central Bay
- BAY 3: Lateral Bay


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Y2 type – Annex B.1 fig. 1:

Base component description	BAY	Base component code GSH002/...	Nr (terns)
Lateral bay - With circuit-breaker - Air connection	1	013	1
Central bay - Without circuit-breaker - Air connection	2	112	1
Lateral bay - With circuit-breaker - Air connection	3	013	1
Circuit-breaker drive mechanism - Single-pole	1	212	1
Circuit-breaker drive mechanism - Three-pole	3	262	1
Disconnecter with earthing switch	1	322	1
Disconnecter with earthing switch	2	322	1
Disconnecter with earthing switch	3	322	1
EVDS - Electronic Voltage Detector System (capacitive dividers included)	2	700	1
Bushing SF6/air class "e"	1	422	1
Bushing SF6/air class "e"	2	422	1
Bushing SF6/air class "e"	3	422	1
Current Transformer	1	605	1
Current Transformer	3	604	1
Support	-	802	1
Control Box – Y2 type	-	902	1

Note (referring Annex B1 drawings):

- BAY 1: Lateral Bay
- BAY 2: Central Bay
- BAY 3: Lateral Bay


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Single bay type – Annex B.2 fig. 1:

Base component description	BAY	Base component code GSH002/...	Nr (terns)
Lateral bay - With circuit-breaker - Air connection	1	012	1
Central bay - Without circuit-breaker - Air connection	2	112	1
Circuit-breaker drive mechanism - Three-pole	1	282	1
Disconnecter with earthing switch	1	322	1
Disconnecter	2	312	1
Bushing SF6/air class "e"	1	422	1
Bushing SF6/air class "e"	2	422	1
Current Transformer	1	622	1
Support	-	822	1
Control Box – Single bay type used in Line bay	-	924	1

Note (referring Annex B1 drawings):

- BAY 1: Lateral Bay
- BAY 2: Central Bay

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ANNEX C – DIMENSIONAL DRAWINGS

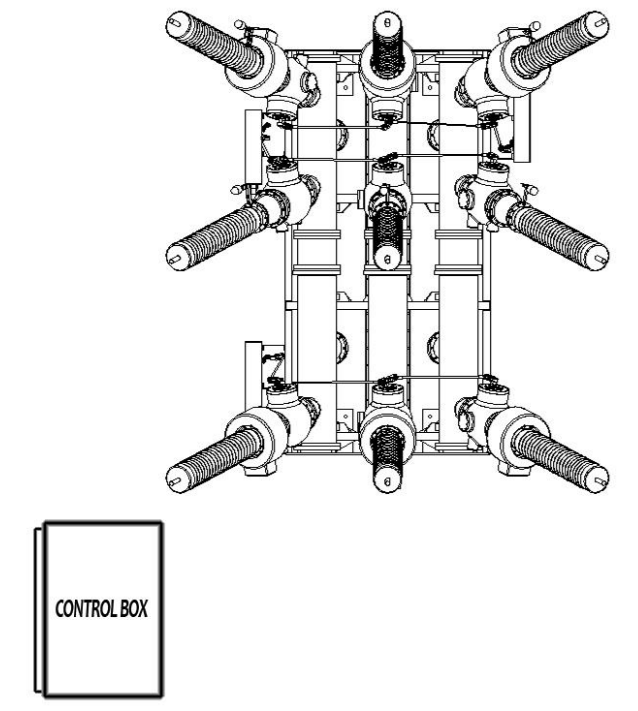
CONTROL BOX LOCATION

	BAY 1	BAY 2	BAY 3
Y1	LINE/TRAFO (*)	BUSBAR 1	BUSBAR 2
Y2	LINE	BUSBAR 1	TRAFO (*)
SB	LINE/TRAFO (*)	BUSBAR 1	-

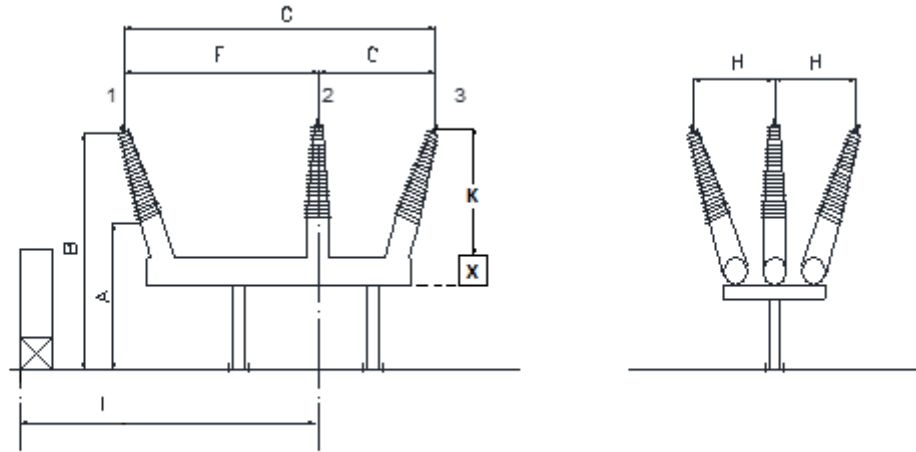
(*)

PHYSICAL POSITION CONTROL BOX

In case the control box is not attached to the equipment position should follow the figure below (in order to take out the hybrid module with a lift truck):

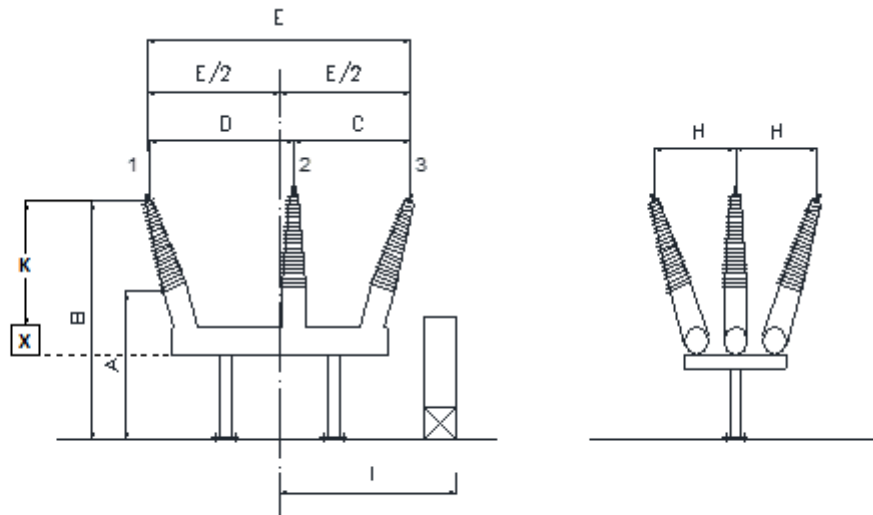


Y1




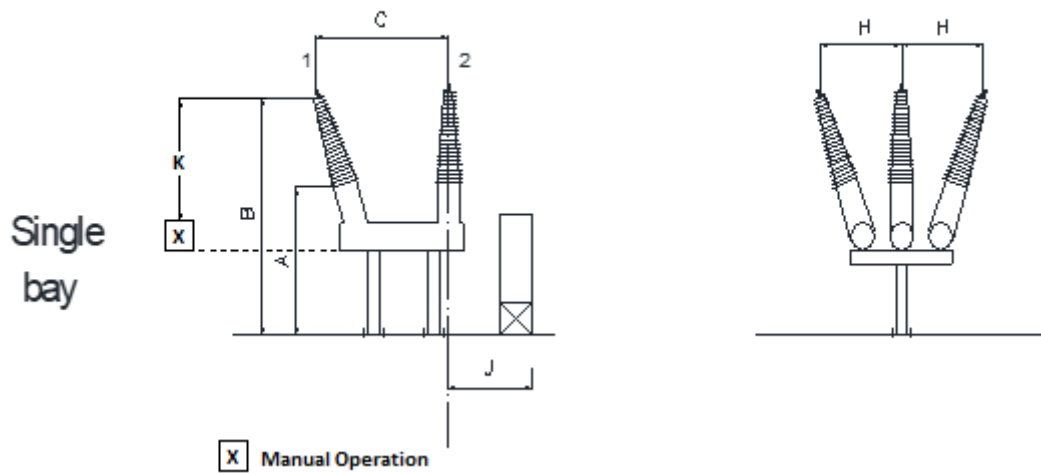
Manual Operation

Y2



Manual Operation

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Ref. figure	A	B	C	D	E	F	G	H	I	J	K
Y1	$\geq 2250^{17}$	≤ 3800	≥ 890	n.a.	n.a.	≥ 890	≤ 3000	≤ 1400	≤ 2200	n.a.	> 1400
Y2				≥ 890	≤ 3000	n.a.	n.a.		≤ 2200		
Single bay				n.a.	n.a.	n.a.	n.a.		n.a.	≤ 1300	

Table 1 – Dimensions for 72,5 kV Hybrid Modules (mm)¹⁸

¹⁷ In accordance with the Real Decreto Riesgo Eléctrico 614/2001

¹⁸ Blank cell means that there isn't a mandatory requirement for that characteristic

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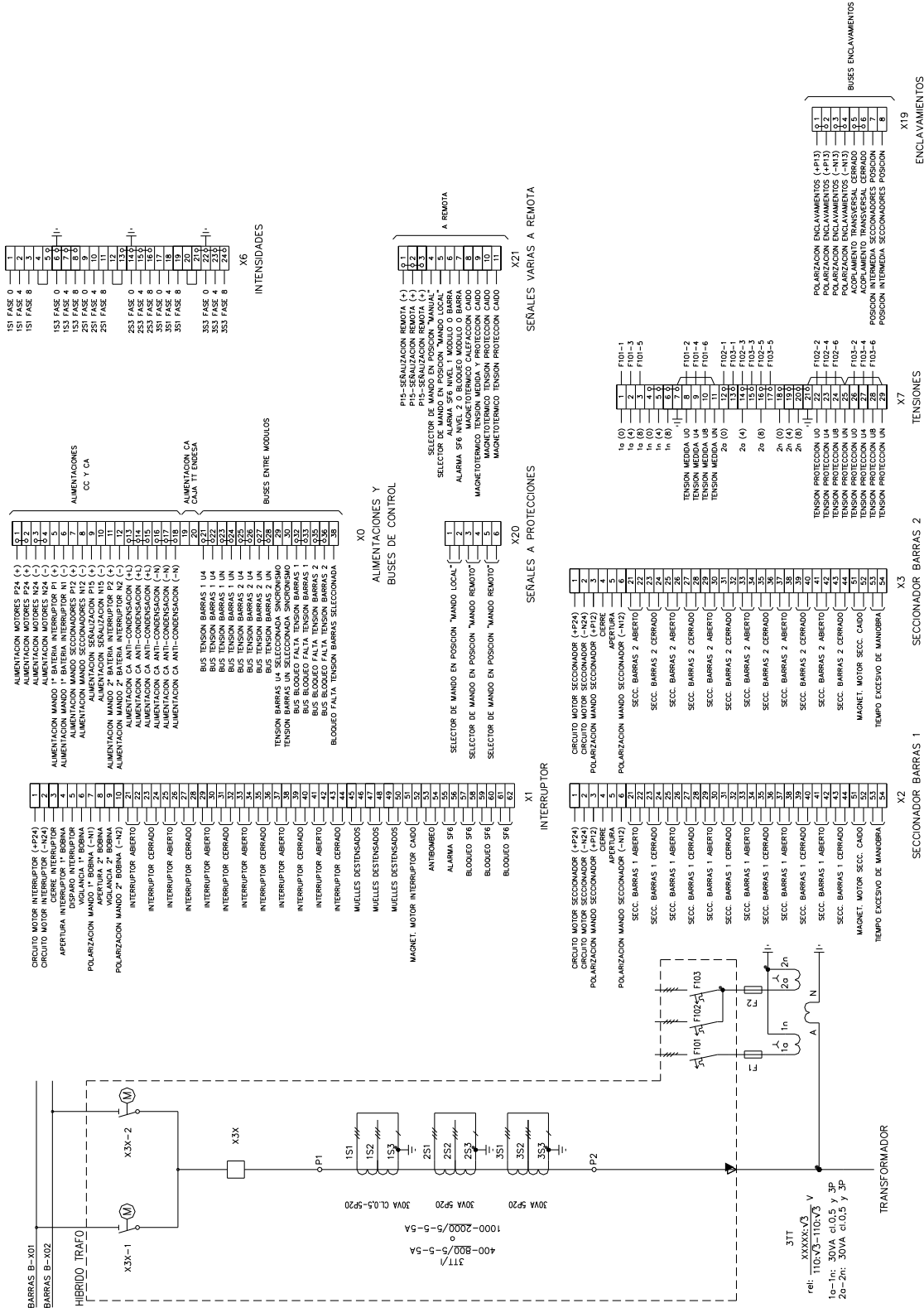
Ref. figure	A	B	C	D	E	F	G	H	I	J	K
Y1	$\geq 2300^{16}$	≥ 3800 ≤ 4700	≥ 1725	n.a.	n.a.	≥ 1725	≤ 5000	≥ 1300 ≤ 2200	≤ 3000	n.a.	> 2000
Y2				≥ 1725	≤ 5000	n.a.	n.a.				
Single bay				n.a.	n.a.	n.a.	n.a.		n.a.	≤ 1300	

Table 2 – Dimensions for 145 kV (and, only for e-distribuzione, 170 kV) Hybrid Modules (mm)¹⁶

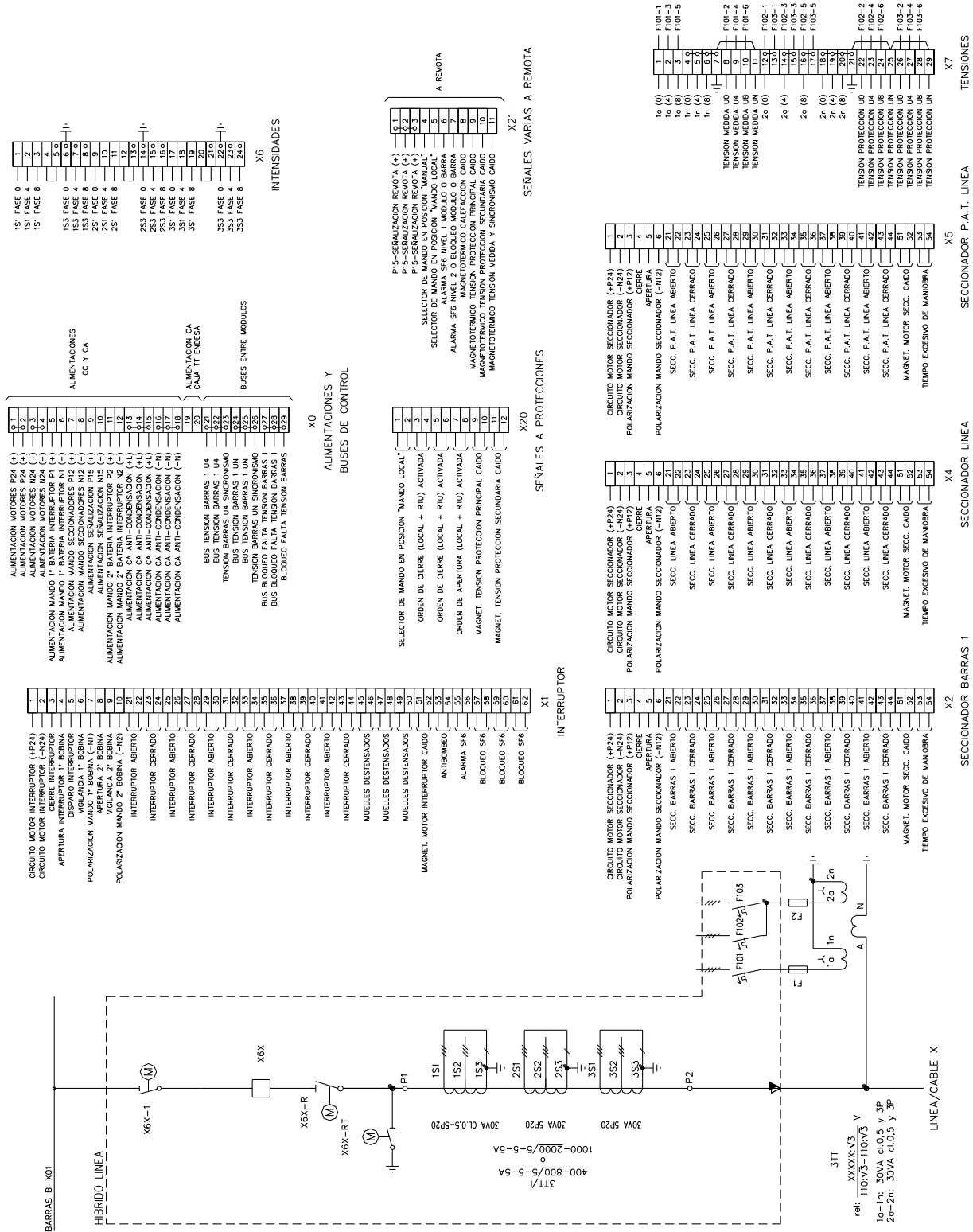
Ref. figure	A	B	C	D	E	F	G	H	I	J	K
Y1	$\geq 2250^{16}$	≤ 6000	≥ 2475	n.a.	n.a.	≥ 2475	≤ 6500	≤ 3200	≤ 3750	n.a.	> 3000
Y2				≥ 2475	≤ 6500	n.a.	n.a.				
Single bay				n.a.	n.a.	n.a.	n.a.		n.a.	≤ 1300	

Table 3 – Dimensions for 245 kV Hybrid Modules (mm)¹⁶

Hybrid module Y1 type – used in Transformer bay



Hybrid module Single-bay type – used in Line bay

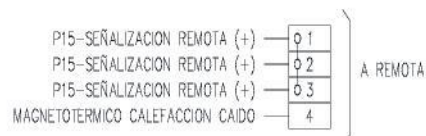


Hybrid module Y2 type



X0

ALIMENTACIONES Y
BUSES DE CONTROL



X21

SEÑALES VARIAS A REMOTA



HYBRID MODULES

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CERRE INTERRUPTOR	3
APERTURA INTERRUPTOR 1ª BOBINA	4
DISPARO INTERRUPTOR	5
VIGILANCIA 1ª BOBINA	6
POLARIZACION MANDO 1ª BOBINA (-N1)	7
APERTURA 2ª BOBINA	8
VIGILANCIA 2ª BOBINA	9
POLARIZACION MANDO 2ª BOBINA (-N2)	10
INTERRUPTOR ABIERTO	21
INTERRUPTOR CERRADO	22
INTERRUPTOR ABIERTO	23
INTERRUPTOR CERRADO	24
INTERRUPTOR ABIERTO	25
INTERRUPTOR CERRADO	26
INTERRUPTOR ABIERTO	27
INTERRUPTOR CERRADO	28
INTERRUPTOR ABIERTO	29
INTERRUPTOR CERRADO	30
INTERRUPTOR ABIERTO	31
INTERRUPTOR CERRADO	32
INTERRUPTOR ABIERTO	33
INTERRUPTOR CERRADO	34
INTERRUPTOR ABIERTO	35
INTERRUPTOR CERRADO	36
INTERRUPTOR ABIERTO	37
INTERRUPTOR CERRADO	38
INTERRUPTOR ABIERTO	39
INTERRUPTOR CERRADO	40
INTERRUPTOR ABIERTO	41
INTERRUPTOR CERRADO	42
INTERRUPTOR ABIERTO	43
INTERRUPTOR CERRADO	44
MUELLES DESTENSADOS	45
MUELLES DESTENSADOS	46
MUELLES DESTENSADOS	47
MUELLES DESTENSADOS	48
MUELLES DESTENSADOS	49
MUELLES DESTENSADOS	50
MAGNET. MOTOR INTERRUPTOR CAIDO	51
MAGNET. MOTOR INTERRUPTOR CAIDO	52
AHTIBOMBEO	54
ALARMA SF6	55
BLOQUEO SF6	56
BLOQUEO SF6	57
BLOQUEO SF6	58
BLOQUEO SF6	59
BLOQUEO SF6	60
BLOQUEO SF6	61
BLOQUEO SF6	62

ALIMENTACION MANDO 1ª BATERIA INTERRUPTOR P1 (+)	1
ALIMENTACION MANDO 1ª BATERIA INTERRUPTOR N1 (-)	2
ALIMENTACION MANDO SECCIONADORES P12 (+)	3
ALIMENTACION MANDO SECCIONADORES N12 (-)	4
ALIMENTACION SEÑALIZACION P15 (+)	5
ALIMENTACION SEÑALIZACION N15 (-)	6
ALIMENTACION MANDO 2ª BATERIA INTERRUPTOR P2 (+)	7
ALIMENTACION MANDO 2ª BATERIA INTERRUPTOR N2 (-)	8
BUS TENSION BARRAS 1 U4	9-9
BUS TENSION BARRAS 1 U4	010
TENSION BARRAS U4 SINCRONISMO	011
BUS TENSION BARRAS 1 UN	012
BUS TENSION BARRAS 1 UN	013
TENSION BARRAS UN SINCRONISMO	014
BUS BLOQUEO FALTA TENSION BARRAS 1	015
BUS BLOQUEO FALTA TENSION BARRAS 1	016
BLOQUEO FALTA TENSION BARRAS 1	017

ALIMENTACIONES
CC

BUSES ENTRE MODULOS

X0L

ALIMENTACIONES Y
BUSES DE CONTROL

1S1 FASE 0	1
1S1 FASE 4	2
1S1 FASE B	3
	4
	5-9
1S3 FASE 0	6-6
1S3 FASE 4	7-6
1S3 FASE B	8-6
2S1 FASE 0	9
2S1 FASE 4	10
2S1 FASE B	11
	12
	13-9
2S3 FASE 0	14-9
2S3 FASE 4	15-9
2S3 FASE B	16-9
3S1 FASE 0	17
3S1 FASE 4	18
3S1 FASE B	19
	20
	21-9
3S3 FASE 0	22-9
3S3 FASE 4	23-9
3S3 FASE B	24-9

X6L

INTENSIDADES

SELECTOR DE MANDO EN POSICION "MANDO LOCAL"	1
	2
ORDEN DE CIERRE (LOCAL + RTU) ACTIVADA	3
	4
ORDEN DE CIERRE (LOCAL + RTU) ACTIVADA	5
	6
ORDEN DE APERTURA (LOCAL + RTU) ACTIVADA	7
	8
MAGNET. TENSION PROTECCION PRINCIPAL CAIDO	9
	10
MAGNET. TENSION PROTECCION SECUNDARIA CAIDO	11
	12

X20L

SEÑALES A PROTECCIONES

P15-SEÑALIZACION REMOTA (+)	9-1
P15-SEÑALIZACION REMOTA (+)	9-2
P15-SEÑALIZACION REMOTA (+)	9-3
SELECTOR DE MANDO EN POSICION "MANUAL"	4
SELECTOR DE MANDO EN POSICION "MANDO LOCAL"	5
ALARMA SF6 NIVEL 1 MODULO O BARRA	6
ALARMA SF6 NIVEL 2 O BLOQUEO MODULO O BARRA	7
	8
MAGNETOTERMICO TENSION PROTECCION PRINCIPAL CAIDO	9
MAGNETOTERMICO TENSION PROTECCION SECUNDARIA CAIDO	10
MAGNETOTERMICO TENSION MEDIDA Y SINCRONISMO CAIDO	11

A REMOTA

X21L

SEÑALES VARIAS A REMOTA

X1L
INTERRUPTOR

CIRCUITO MOTOR SECCIONADOR (+P24)	1
CIRCUITO MOTOR SECCIONADOR (-N24)	2
POLARIZACION MANDO SECCIONADOR (+P12)	3
CERRE	4
APERTURA	5
POLARIZACION MANDO SECCIONADOR (-N12)	6
SECC. SALIDA ABIERTO	21
SECC. SALIDA CERRADO	22
SECC. SALIDA ABIERTO	23
SECC. SALIDA CERRADO	24
SECC. SALIDA ABIERTO	25
SECC. SALIDA CERRADO	26
SECC. SALIDA ABIERTO	27
SECC. SALIDA CERRADO	28
SECC. SALIDA ABIERTO	29
SECC. SALIDA CERRADO	30
SECC. SALIDA ABIERTO	31
SECC. SALIDA CERRADO	32
SECC. SALIDA ABIERTO	33
SECC. SALIDA CERRADO	34
SECC. SALIDA ABIERTO	35
SECC. SALIDA CERRADO	36
SECC. SALIDA ABIERTO	37
SECC. SALIDA CERRADO	38
SECC. SALIDA ABIERTO	39
SECC. SALIDA CERRADO	40
SECC. SALIDA ABIERTO	41
SECC. SALIDA CERRADO	42
SECC. SALIDA ABIERTO	43
SECC. SALIDA CERRADO	44
MAGNET. MOTOR SECC. CAIDO	51
MAGNET. MOTOR SECC. CAIDO	52
TEMPO EXCESIVO DE MANIOBRA	53
TEMPO EXCESIVO DE MANIOBRA	54

X4L

SECCIONADOR SALIDA

CIRCUITO MOTOR SECCIONADOR (+P24)	1
CIRCUITO MOTOR SECCIONADOR (-N24)	2
POLARIZACION MANDO SECCIONADOR (+P12)	3
CERRE	4
APERTURA	5
POLARIZACION MANDO SECCIONADOR (-N12)	6
SECC. P.A.T. SALIDA ABIERTO	21
SECC. P.A.T. SALIDA CERRADO	22
SECC. P.A.T. SALIDA ABIERTO	23
SECC. P.A.T. SALIDA CERRADO	24
SECC. P.A.T. SALIDA ABIERTO	25
SECC. P.A.T. SALIDA CERRADO	26
SECC. P.A.T. SALIDA ABIERTO	27
SECC. P.A.T. SALIDA CERRADO	28
SECC. P.A.T. SALIDA ABIERTO	29
SECC. P.A.T. SALIDA CERRADO	30
SECC. P.A.T. SALIDA ABIERTO	31
SECC. P.A.T. SALIDA CERRADO	32
SECC. P.A.T. SALIDA ABIERTO	33
SECC. P.A.T. SALIDA CERRADO	34
SECC. P.A.T. SALIDA ABIERTO	35
SECC. P.A.T. SALIDA CERRADO	36
SECC. P.A.T. SALIDA ABIERTO	37
SECC. P.A.T. SALIDA CERRADO	38
SECC. P.A.T. SALIDA ABIERTO	39
SECC. P.A.T. SALIDA CERRADO	40
SECC. P.A.T. SALIDA ABIERTO	41
SECC. P.A.T. SALIDA CERRADO	42
SECC. P.A.T. SALIDA ABIERTO	43
SECC. P.A.T. SALIDA CERRADO	44
MAGNET. MOTOR SECC. CAIDO	51
MAGNET. MOTOR SECC. CAIDO	52
TEMPO EXCESIVO DE MANIOBRA	53
TEMPO EXCESIVO DE MANIOBRA	54

X5L

SECCIONADOR P.A.T. SALIDA

1a (0)	1	F101/L-1
1a (4)	2	F101/L-3
1a (8)	3	F101/L-5
1n (0)	4-9	
1n (4)	5-9	
1n (8)	6-9	
	7-9	
	8-9	
TENSION MEDIDA U0	8	F101/L-2
TENSION MEDIDA U4	9	F101/L-4
TENSION MEDIDA UB	10	F101/L-6
TENSION MEDIDA UN	11	
2a (0)	12-9	F102/L-1
	13-9	F103/L-1
2a (4)	14-9	F102/L-3
	15-9	F103/L-3
2a (8)	16-9	F102/L-5
	17-9	F103/L-5
2n (0)	18-9	
2n (4)	19-9	
2n (8)	20-9	
	21-9	
TENSION PROTECCION U0	22	F102/L-2
TENSION PROTECCION U4	23	F102/L-4
TENSION PROTECCION UB	24	F102/L-6
TENSION PROTECCION UN	25	
TENSION PROTECCION U0	26	F103/L-2
TENSION PROTECCION U4	27	F103/L-4
TENSION PROTECCION UB	28	F103/L-6
TENSION PROTECCION UN	29	

X7L

TENSIONES



HYBRID MODULES

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CERRE INTERRUPTOR	3
APERTURA INTERRUPTOR 1ª BOBINA	4
DISPARO INTERRUPTOR	5
VIGILANCIA 1ª BOBINA	6
POLARIZACION MANDO 1ª BOBINA (-N1)	7
APERTURA 2ª BOBINA	8
VIGILANCIA 2ª BOBINA	9
POLARIZACION MANDO 2ª BOBINA (-N2)	10
INTERRUPTOR ABIERTO	21
INTERRUPTOR CERRADO	22
INTERRUPTOR ABIERTO	23
INTERRUPTOR CERRADO	24
INTERRUPTOR ABIERTO	25
INTERRUPTOR CERRADO	26
INTERRUPTOR ABIERTO	27
INTERRUPTOR CERRADO	28
INTERRUPTOR ABIERTO	29
INTERRUPTOR CERRADO	30
INTERRUPTOR ABIERTO	31
INTERRUPTOR CERRADO	32
INTERRUPTOR ABIERTO	33
INTERRUPTOR CERRADO	34
INTERRUPTOR ABIERTO	35
INTERRUPTOR CERRADO	36
INTERRUPTOR ABIERTO	37
INTERRUPTOR CERRADO	38
INTERRUPTOR ABIERTO	39
INTERRUPTOR CERRADO	40
INTERRUPTOR ABIERTO	41
INTERRUPTOR CERRADO	42
INTERRUPTOR ABIERTO	43
INTERRUPTOR CERRADO	44
MUELLES DESTENSADOS	45
MUELLES DESTENSADOS	46
MUELLES DESTENSADOS	47
MUELLES DESTENSADOS	48
MUELLES DESTENSADOS	49
MUELLES DESTENSADOS	50
MAGNET. MOTOR INTERRUPTOR CAIDO	51
ANTIBOMBEO	52
ANTIBOMBEO	53
ALARMA SF6	54
ALARMA SF6	55
BLOQUEO SF6	56
BLOQUEO SF6	57
BLOQUEO SF6	58
BLOQUEO SF6	59
BLOQUEO SF6	60
BLOQUEO SF6	61
BLOQUEO SF6	62

X1T
INTERRUPTOR

ALIMENTACION MANDO 1ª BATERIA INTERRUPTOR P1 (+)	1
ALIMENTACION MANDO 1ª BATERIA INTERRUPTOR N1 (-)	2
ALIMENTACION MANDO SECCIONADORES P12 (+)	3
ALIMENTACION MANDO SECCIONADORES N12 (-)	4
ALIMENTACION SEÑALIZACION P15 (+)	5
ALIMENTACION SEÑALIZACION N15 (-)	6
ALIMENTACION MANDO 2ª BATERIA INTERRUPTOR P2 (+)	7
ALIMENTACION MANDO 2ª BATERIA INTERRUPTOR N2 (-)	8
BUS TENSION BARRAS 1 U4	9-9
BUS TENSION BARRAS 1 U4	10-10
TENSION BARRAS U4 SINCRONISMO	11-11
BUS TENSION BARRAS 1 UN	12-12
BUS TENSION BARRAS 1 UN	13-13
TENSION BARRAS UN SINCRONISMO	14-14
BUS BLOQUEO FALTA TENSION BARRAS 1	15-15
BUS BLOQUEO FALTA TENSION BARRAS 1	16-16
BLOQUEO FALTA TENSION BARRAS	17-17

X0T
ALIMENTACIONES Y
BUSES DE CONTROL

1S1 FASE 0	1
1S1 FASE 4	2
1S1 FASE 8	3
	4
	5-0
1S3 FASE 0	6-0
1S3 FASE 4	7-0
1S3 FASE 8	8-0
2S1 FASE 0	9
2S1 FASE 4	10
2S1 FASE 8	11
	12
	13-0
2S3 FASE 0	14-0
2S3 FASE 4	15-0
2S3 FASE 8	16-0
3S1 FASE 0	17
3S1 FASE 4	18
3S1 FASE 8	19
	20
	21-0
3S3 FASE 0	22-0
3S3 FASE 4	23-0
3S3 FASE 8	24-0

X6T
INTENSIDADES

SELECTOR DE MANDO EN POSICION "MANDO LOCAL"	1
SELECTOR DE MANDO EN POSICION "MANDO REMOTO"	2
SELECTOR DE MANDO EN POSICION "MANDO REMOTO"	3
SELECTOR DE MANDO EN POSICION "MANDO REMOTO"	4
SELECTOR DE MANDO EN POSICION "MANDO REMOTO"	5
SELECTOR DE MANDO EN POSICION "MANDO REMOTO"	6

X20T
SEÑALES A PROTECCIONES

P15-SEÑALIZACION REMOTA (+)	0-1
P15-SEÑALIZACION REMOTA (+)	0-2
P15-SEÑALIZACION REMOTA (+)	0-3
SELECTOR DE MANDO EN POSICION "MANUAL"	4
SELECTOR DE MANDO EN POSICION "MANDO LOCAL"	5
ALARMA SF6 NIVEL 1 MODULO O BARRA	6
ALARMA SF6 NIVEL 2 O BLOQUEO MODULO O BARRA	7
MAGNETOTERMICO TENSION MEDIDA Y PROTECCION CAIDO	8
MAGNETOTERMICO TENSION PROTECCION CAIDO	9
MAGNETOTERMICO TENSION PROTECCION CAIDO	10
MAGNETOTERMICO TENSION PROTECCION CAIDO	11

X21T
SEÑALES VARIAS A REMOTA

CIRCUITO MOTOR SECCIONADOR (+P24)	1
CIRCUITO MOTOR SECCIONADOR (-N24)	2
POLARIZACION MANDO SECCIONADOR (+P12)	3
CERRE	4
APERTURA	5
POLARIZACION MANDO SECCIONADOR (-N12)	6
SECC. SALIDA ABIERTO	21
SECC. SALIDA CERRADO	22
SECC. SALIDA ABIERTO	23
SECC. SALIDA CERRADO	24
SECC. SALIDA ABIERTO	25
SECC. SALIDA CERRADO	26
SECC. SALIDA ABIERTO	27
SECC. SALIDA CERRADO	28
SECC. SALIDA ABIERTO	29
SECC. SALIDA CERRADO	30
SECC. SALIDA ABIERTO	31
SECC. SALIDA CERRADO	32
SECC. SALIDA ABIERTO	33
SECC. SALIDA CERRADO	34
SECC. SALIDA ABIERTO	35
SECC. SALIDA CERRADO	36
SECC. SALIDA ABIERTO	37
SECC. SALIDA CERRADO	38
SECC. SALIDA ABIERTO	39
SECC. SALIDA CERRADO	40
SECC. SALIDA ABIERTO	41
SECC. SALIDA CERRADO	42
SECC. SALIDA ABIERTO	43
SECC. SALIDA CERRADO	44
MAGNET. MOTOR SECC. CAIDO	51
MAGNET. MOTOR SECC. CAIDO	52
TIEMPO EXCESIVO DE MANIOBRA	53
TIEMPO EXCESIVO DE MANIOBRA	54

X4T
SECCIONADOR SALIDA

CIRCUITO MOTOR SECCIONADOR (+P24)	1
CIRCUITO MOTOR SECCIONADOR (-N24)	2
POLARIZACION MANDO SECCIONADOR (+P12)	3
CERRE	4
APERTURA	5
POLARIZACION MANDO SECCIONADOR (-N12)	6
SECC. P.A.T. SALIDA ABIERTO	21
SECC. P.A.T. SALIDA CERRADO	22
SECC. P.A.T. SALIDA ABIERTO	23
SECC. P.A.T. SALIDA CERRADO	24
SECC. P.A.T. SALIDA ABIERTO	25
SECC. P.A.T. SALIDA CERRADO	26
SECC. P.A.T. SALIDA ABIERTO	27
SECC. P.A.T. SALIDA CERRADO	28
SECC. P.A.T. SALIDA ABIERTO	29
SECC. P.A.T. SALIDA CERRADO	30
SECC. P.A.T. SALIDA ABIERTO	31
SECC. P.A.T. SALIDA CERRADO	32
SECC. P.A.T. SALIDA ABIERTO	33
SECC. P.A.T. SALIDA CERRADO	34
SECC. P.A.T. SALIDA ABIERTO	35
SECC. P.A.T. SALIDA CERRADO	36
SECC. P.A.T. SALIDA ABIERTO	37
SECC. P.A.T. SALIDA CERRADO	38
SECC. P.A.T. SALIDA ABIERTO	39
SECC. P.A.T. SALIDA CERRADO	40
SECC. P.A.T. SALIDA ABIERTO	41
SECC. P.A.T. SALIDA CERRADO	42
SECC. P.A.T. SALIDA ABIERTO	43
SECC. P.A.T. SALIDA CERRADO	44
MAGNET. MOTOR SECC. CAIDO	51
MAGNET. MOTOR SECC. CAIDO	52
TIEMPO EXCESIVO DE MANIOBRA	53
TIEMPO EXCESIVO DE MANIOBRA	54

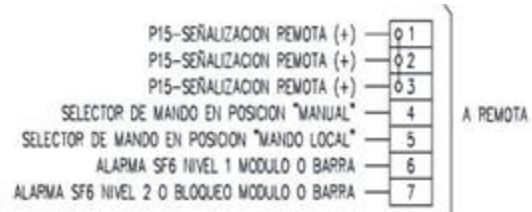
X5T
SECCIONADOR P.A.T. SALIDA

1e (0)	1	F101/T-1
1e (4)	2	F101/T-3
1e (8)	3	F101/T-5
1n (0)	4-0	
1n (4)	5-0	
1n (8)	6-0	
	7-0	
TENSION MEDIDA U0	8	F101/T-2
TENSION MEDIDA U4	9	F101/T-4
TENSION MEDIDA U8	10	F101/T-6
TENSION MEDIDA UN	11	
2e (0)	12-0	F102/T-1
	13-0	F103/T-1
2e (4)	14-0	F102/T-3
	15-0	F103/T-3
2e (8)	16-0	F102/T-5
	17-0	F103/T-5
2n (0)	18-0	
2n (4)	19-0	
2n (8)	20-0	
	21-0	
TENSION PROTECCION U0	22	F102/T-2
TENSION PROTECCION U4	23	F102/T-4
TENSION PROTECCION U8	24	F102/T-6
TENSION PROTECCION UN	25	
TENSION PROTECCION U0	26	F103/T-2
TENSION PROTECCION U4	27	F103/T-4
TENSION PROTECCION U8	28	F103/T-6
TENSION PROTECCION UN	29	

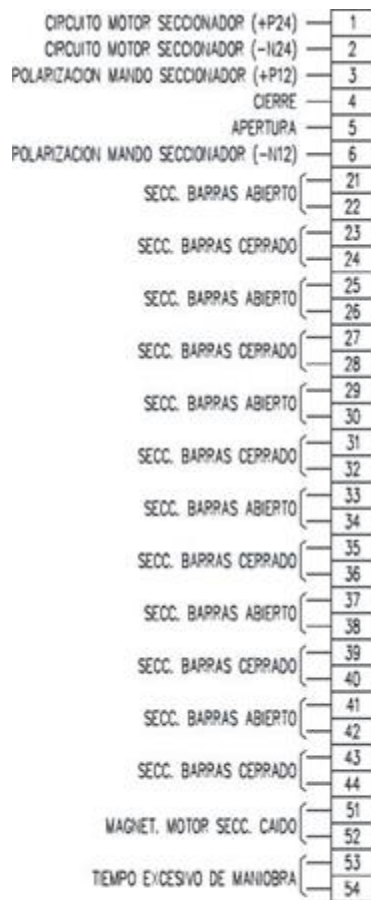
X7T
TENSIONES



ALIMENTACIONES Y
BUSES DE CONTROL

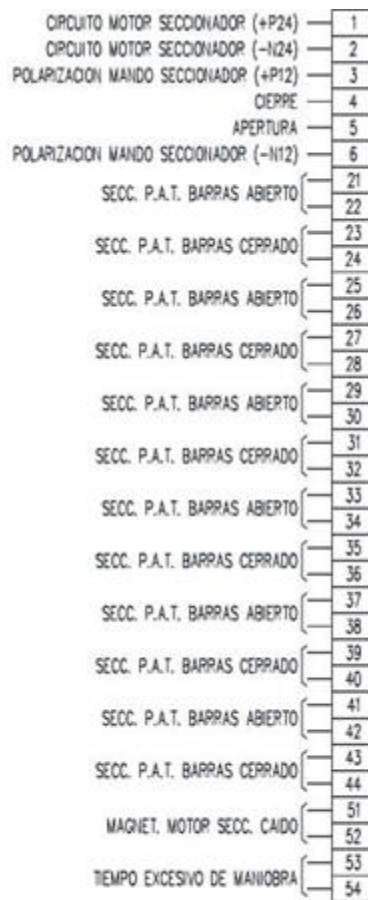


SEÑALES VARIAS A REMOTA



X2S

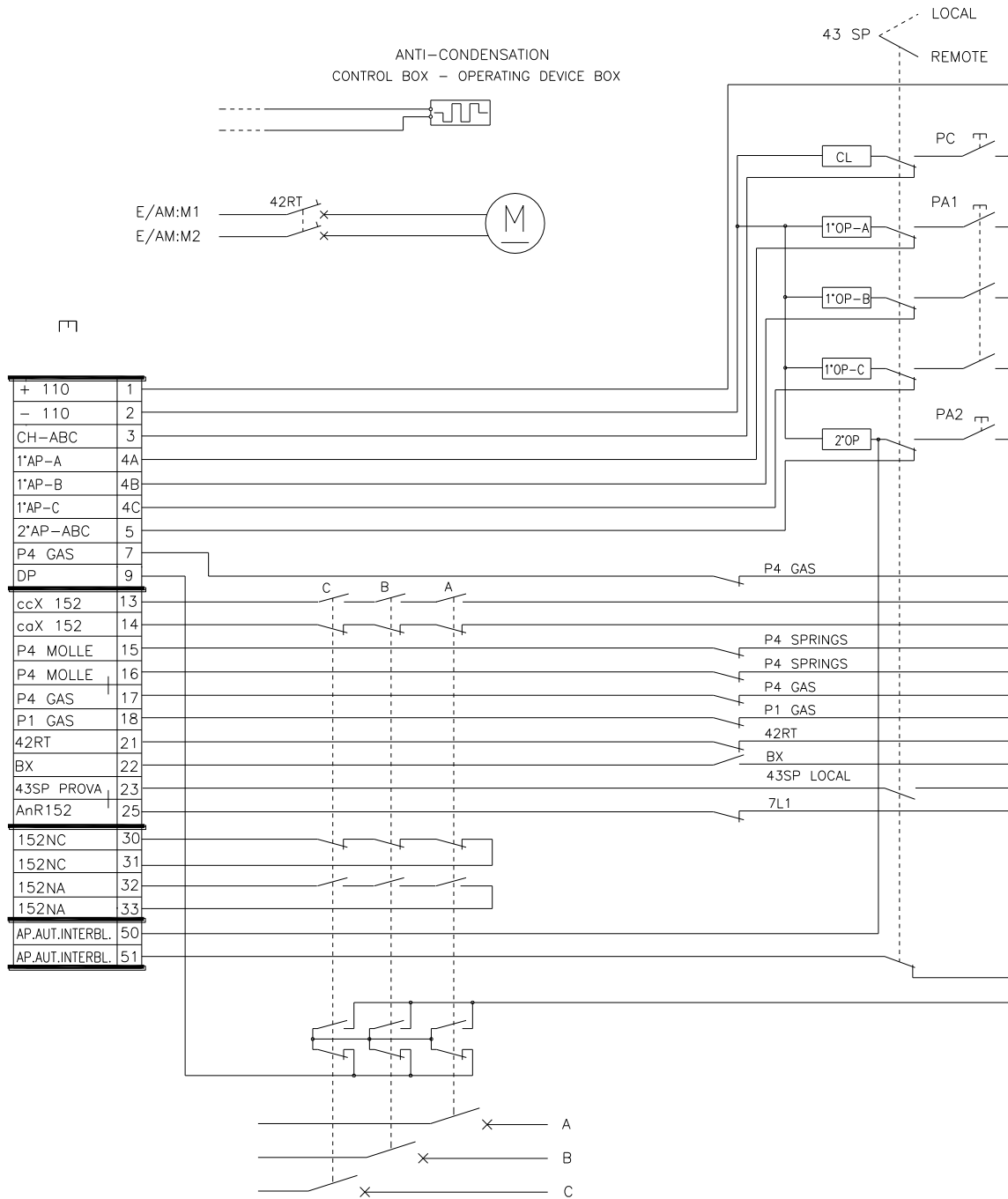
SECCIONADOR BARRAS



X3S

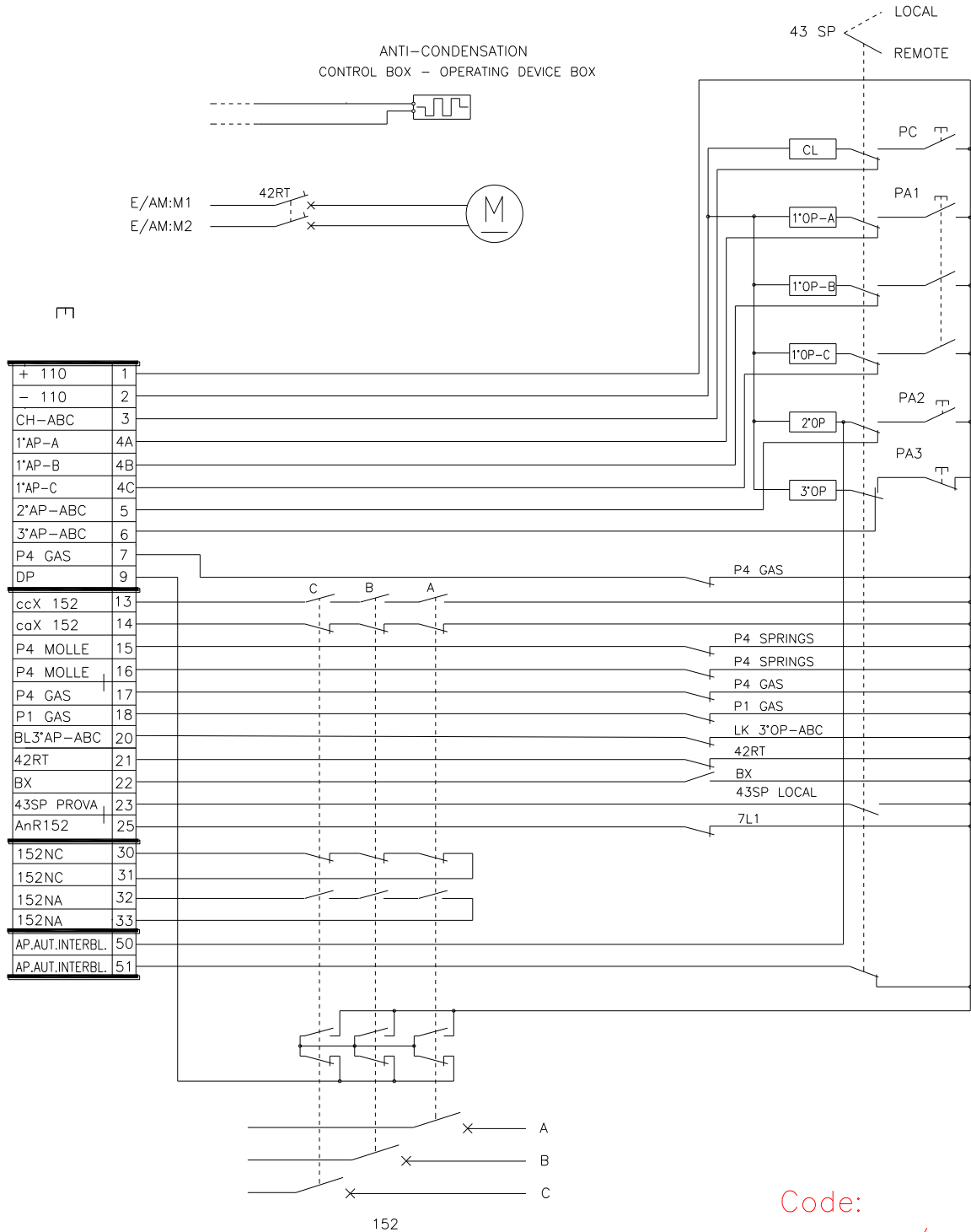
SECCIONADOR P.A.T. BARRAS

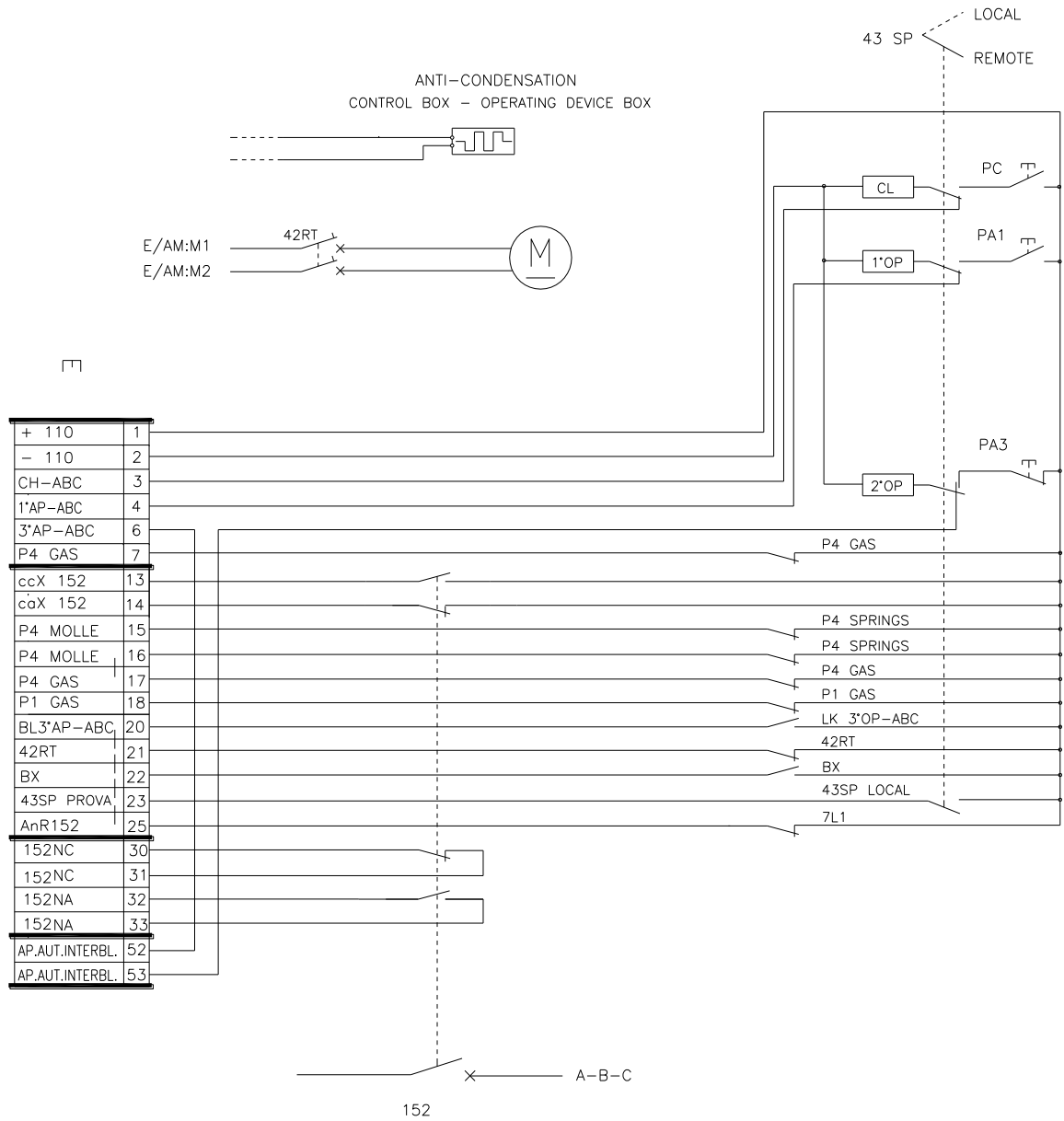
D.2 – ENEL DISTRIBUTIE, ENEL DISTRIBUZIONE AND LATAM ELECTRICAL DIAGRAMS



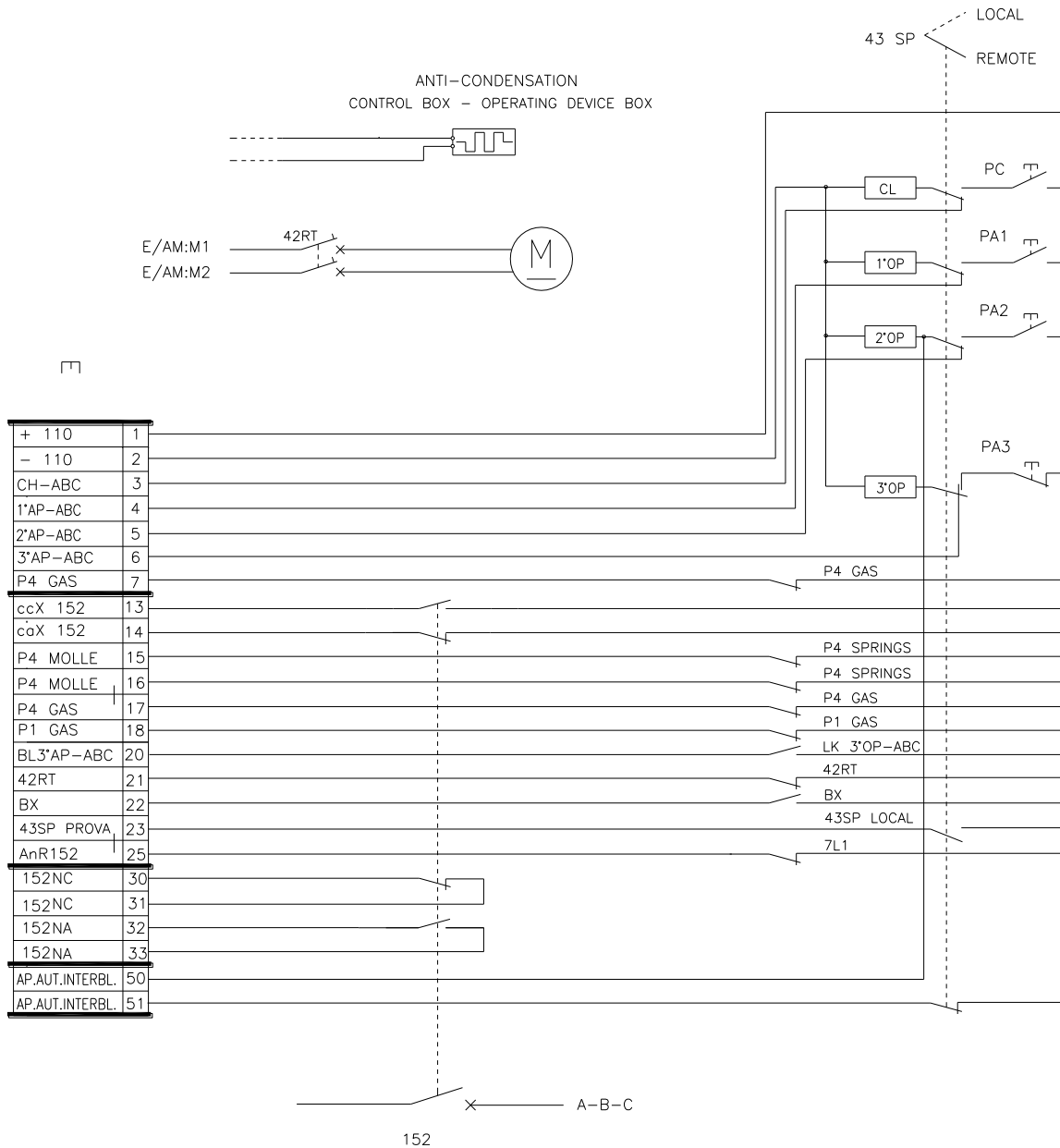
152

Code:
CB-S/1.2.

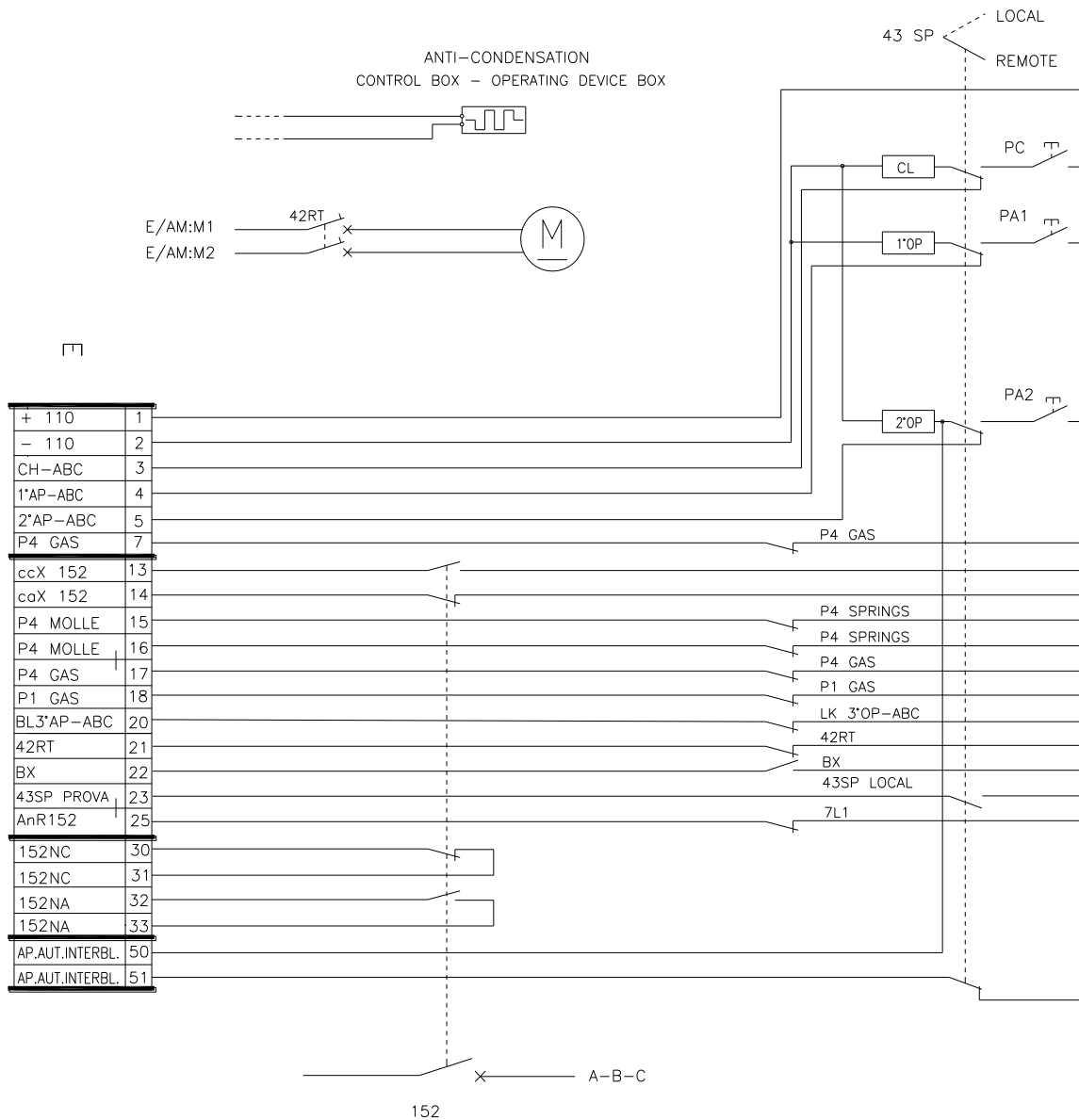




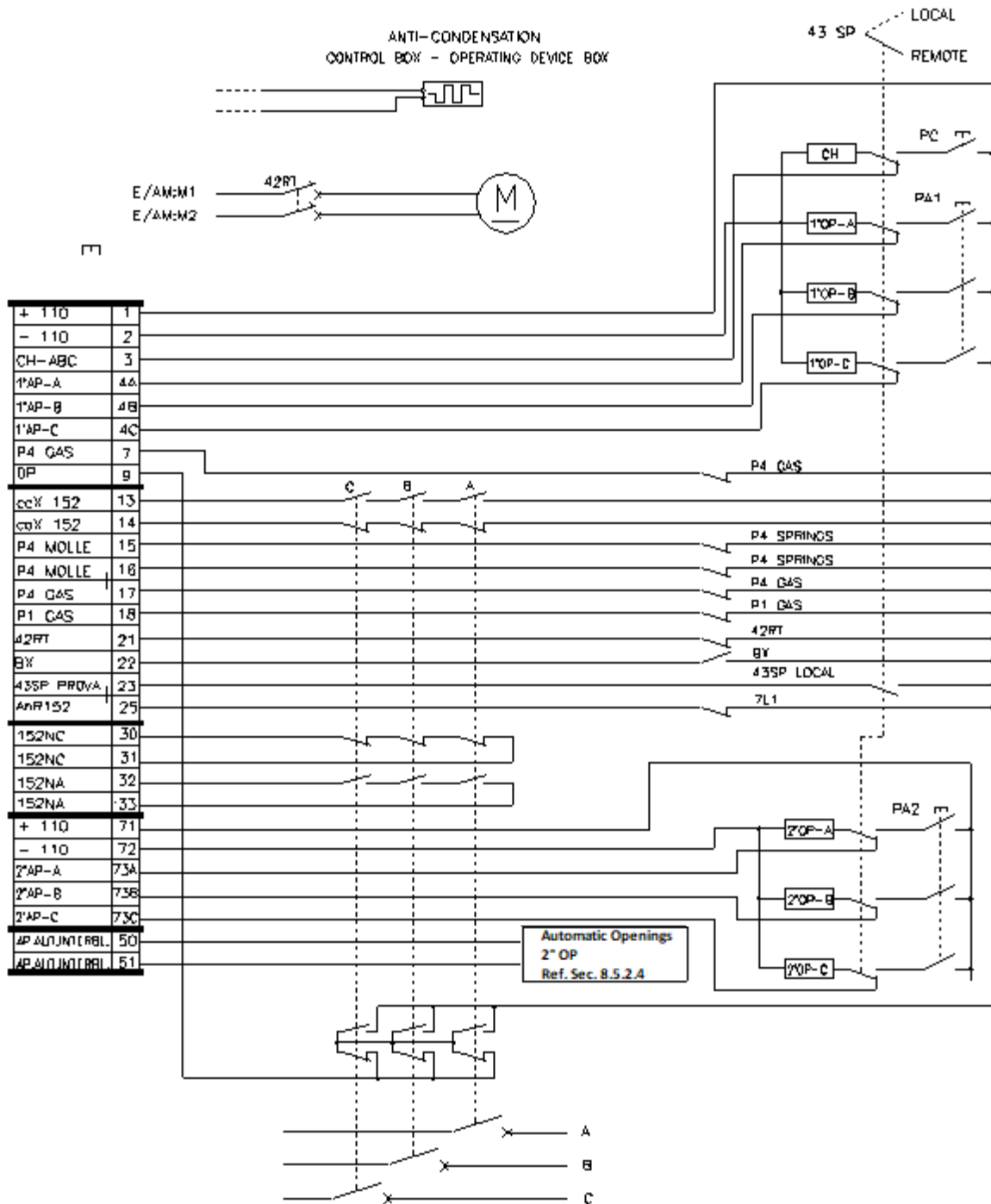
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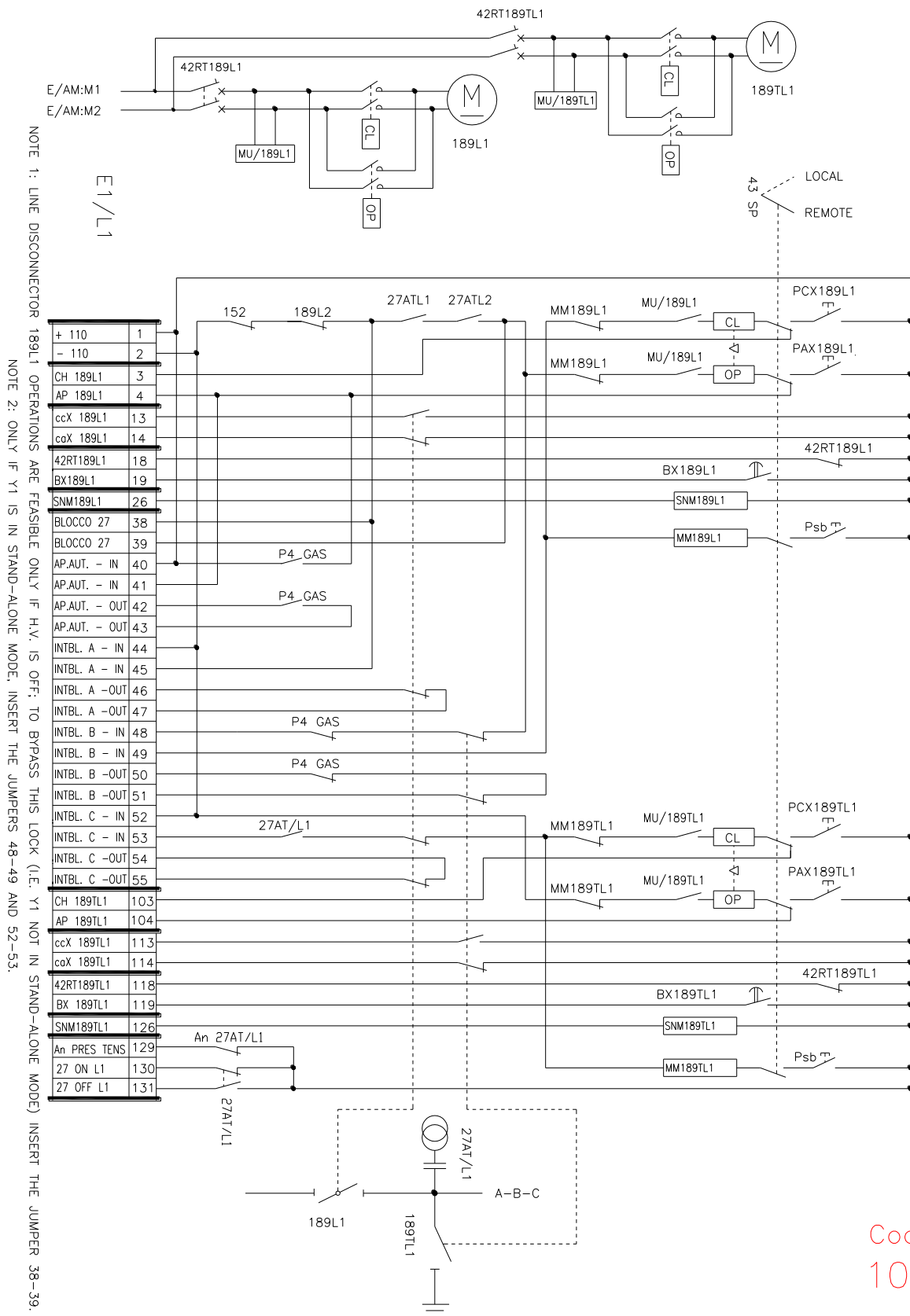
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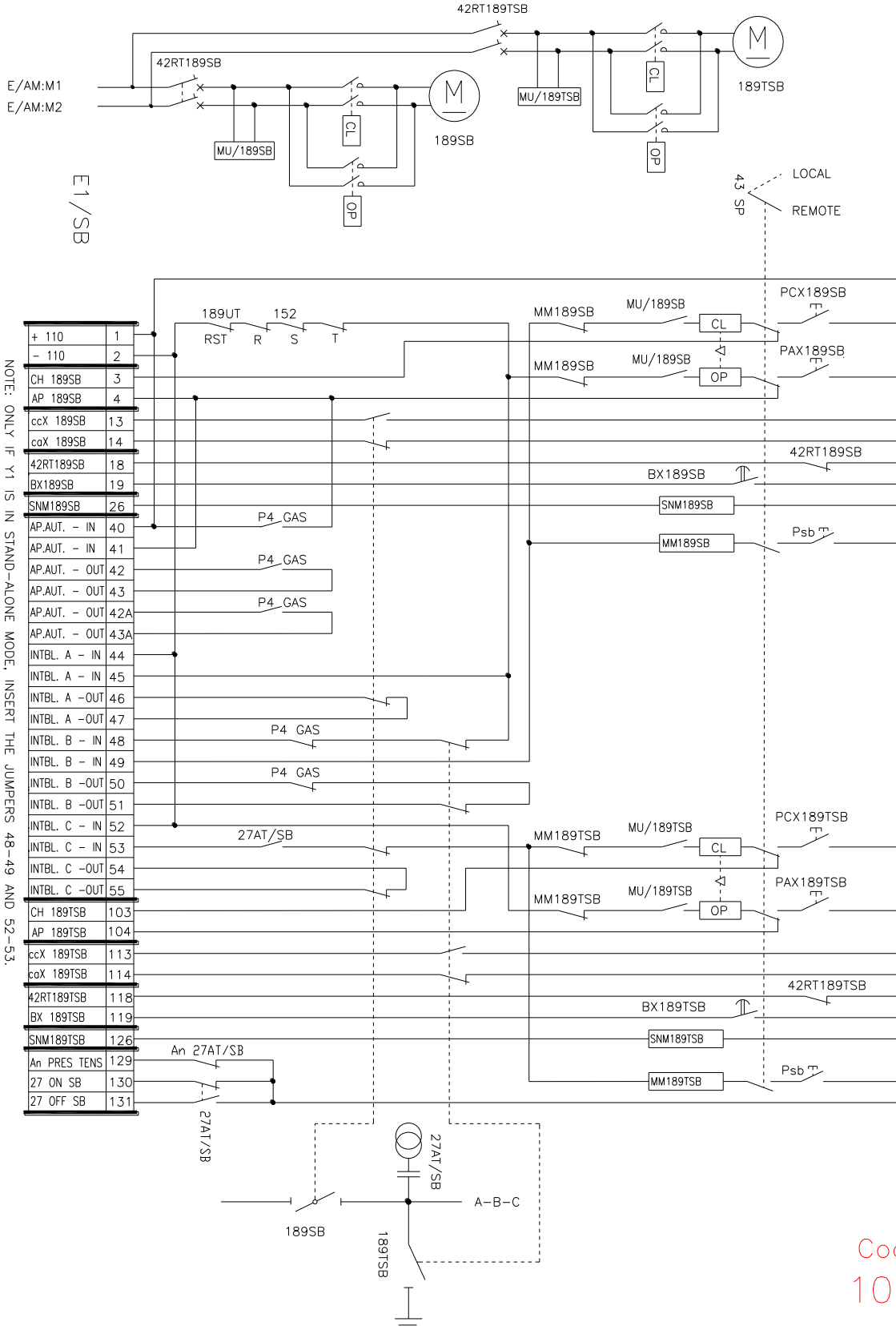
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CB-T/1.2.



Code:
245 CB-S/1.2.

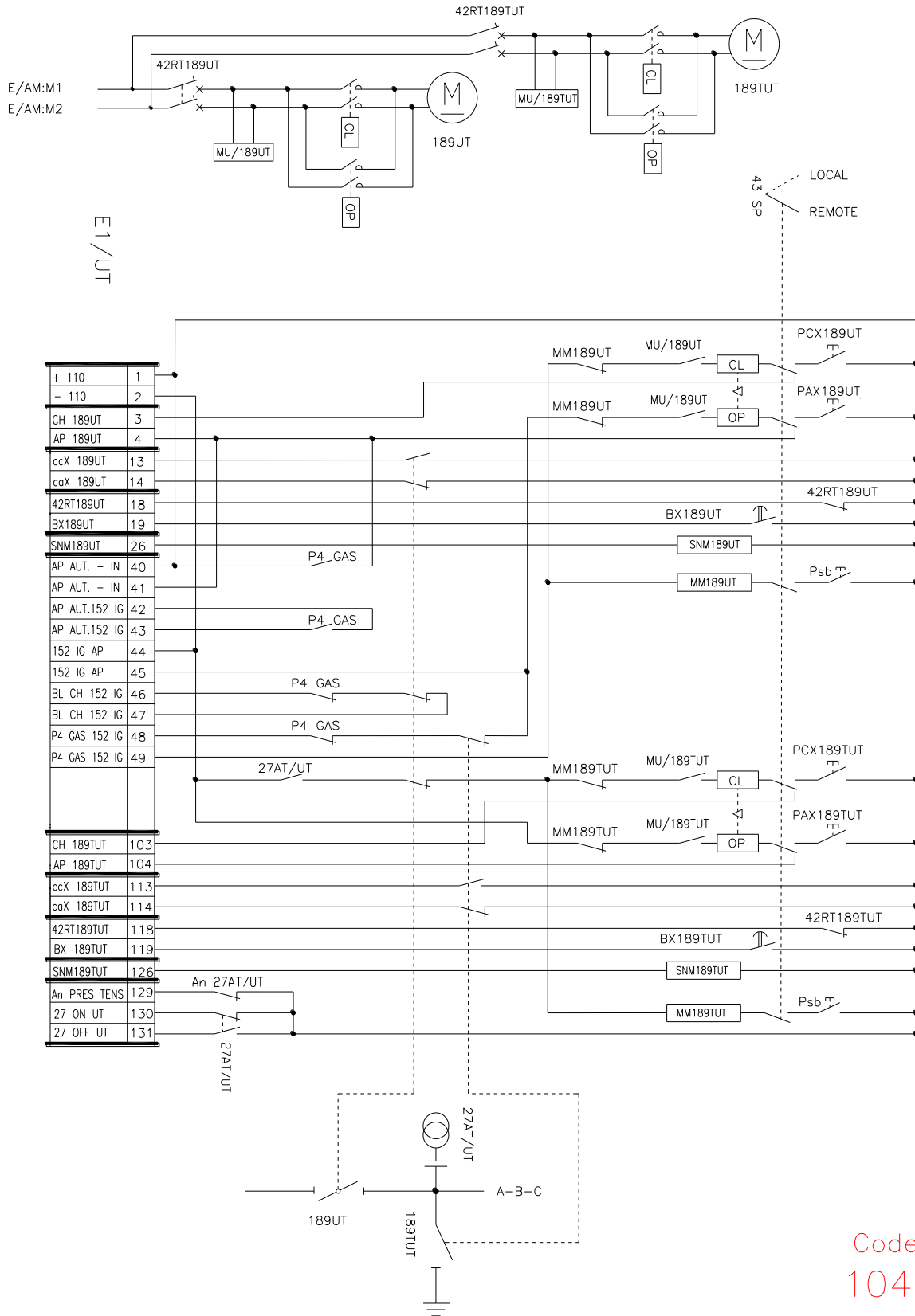


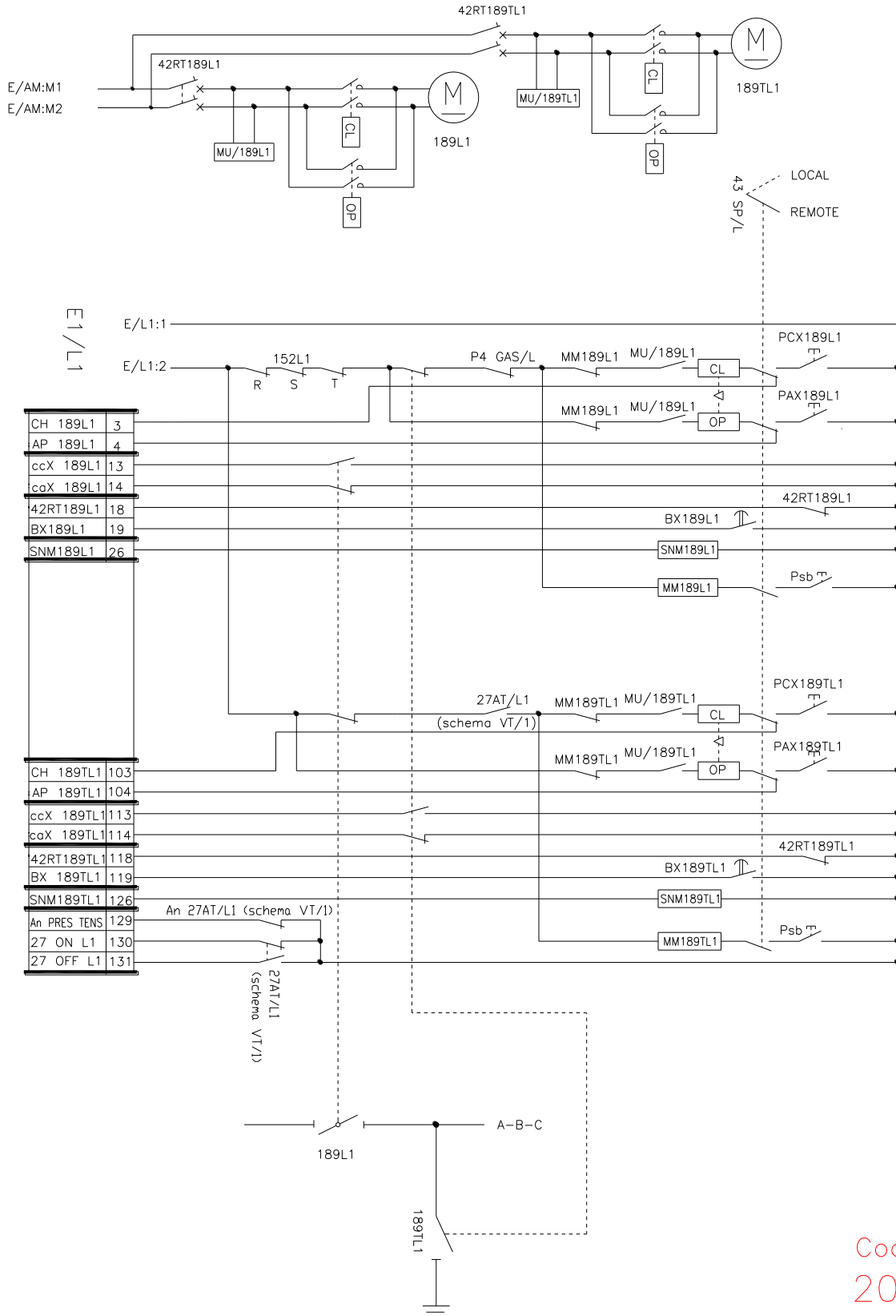
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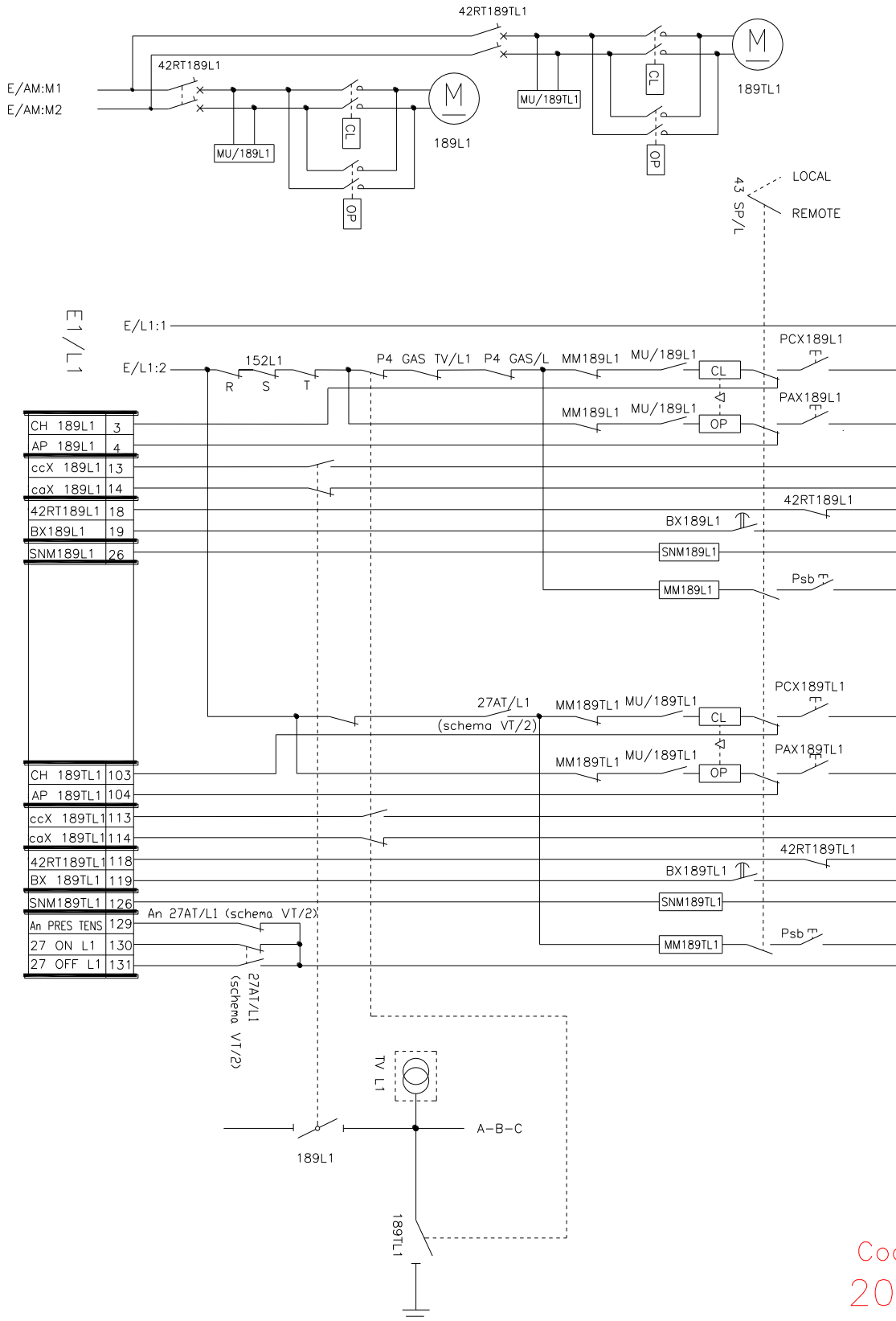


NOTE: ONLY IF Y1 IS IN STAND-ALONE MODE, INSERT THE JUMPERS 48-49 AND 52-53.

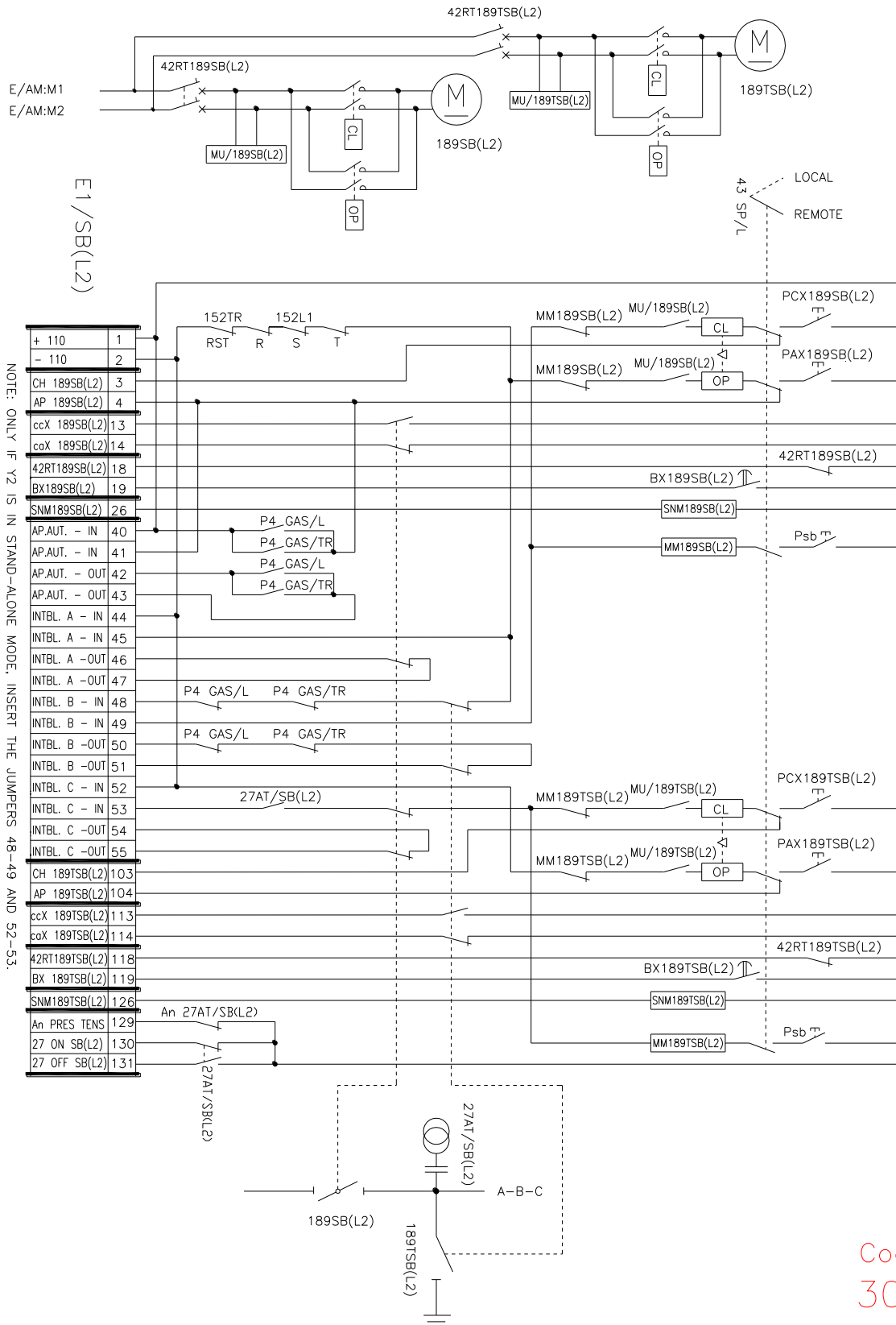
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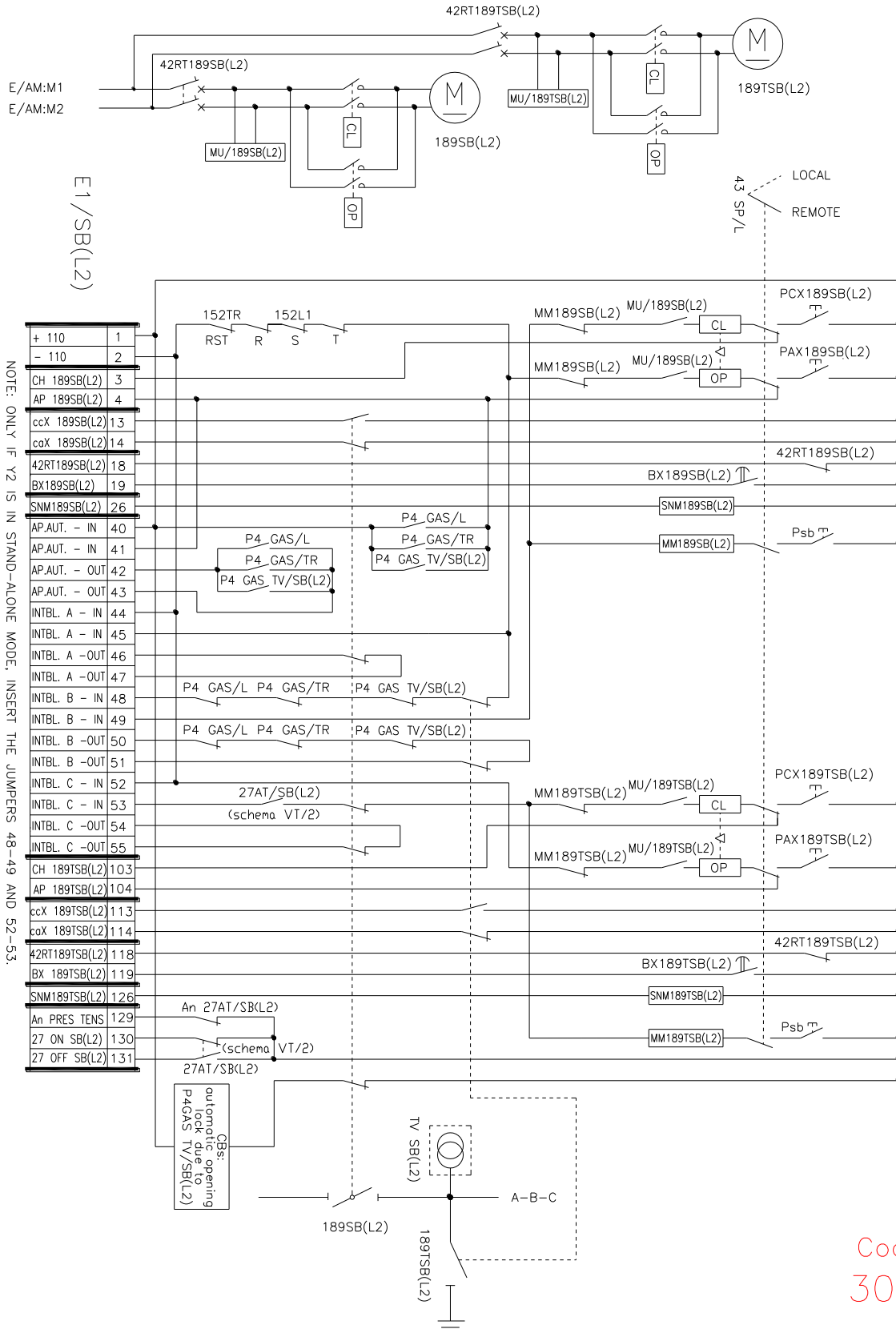




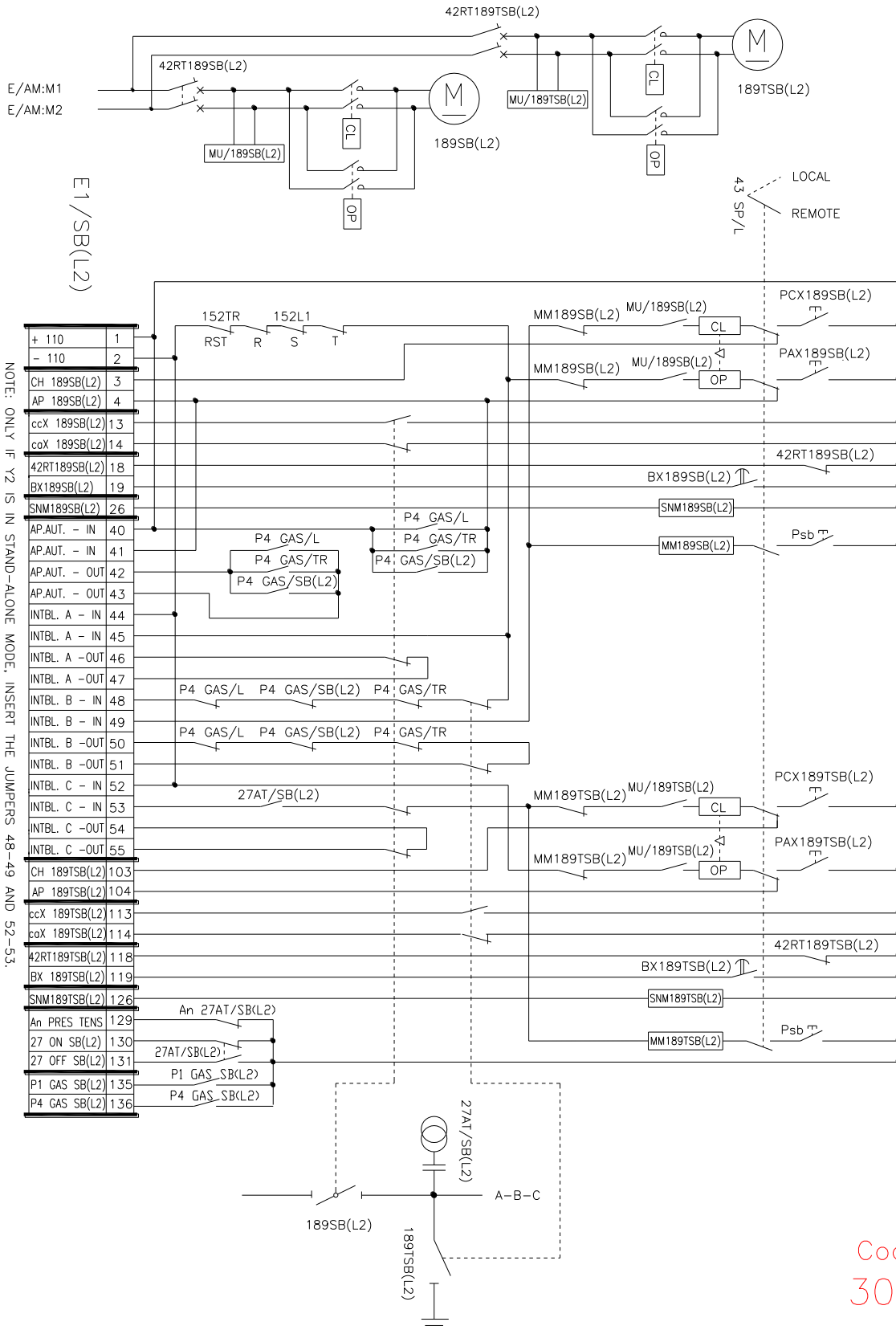
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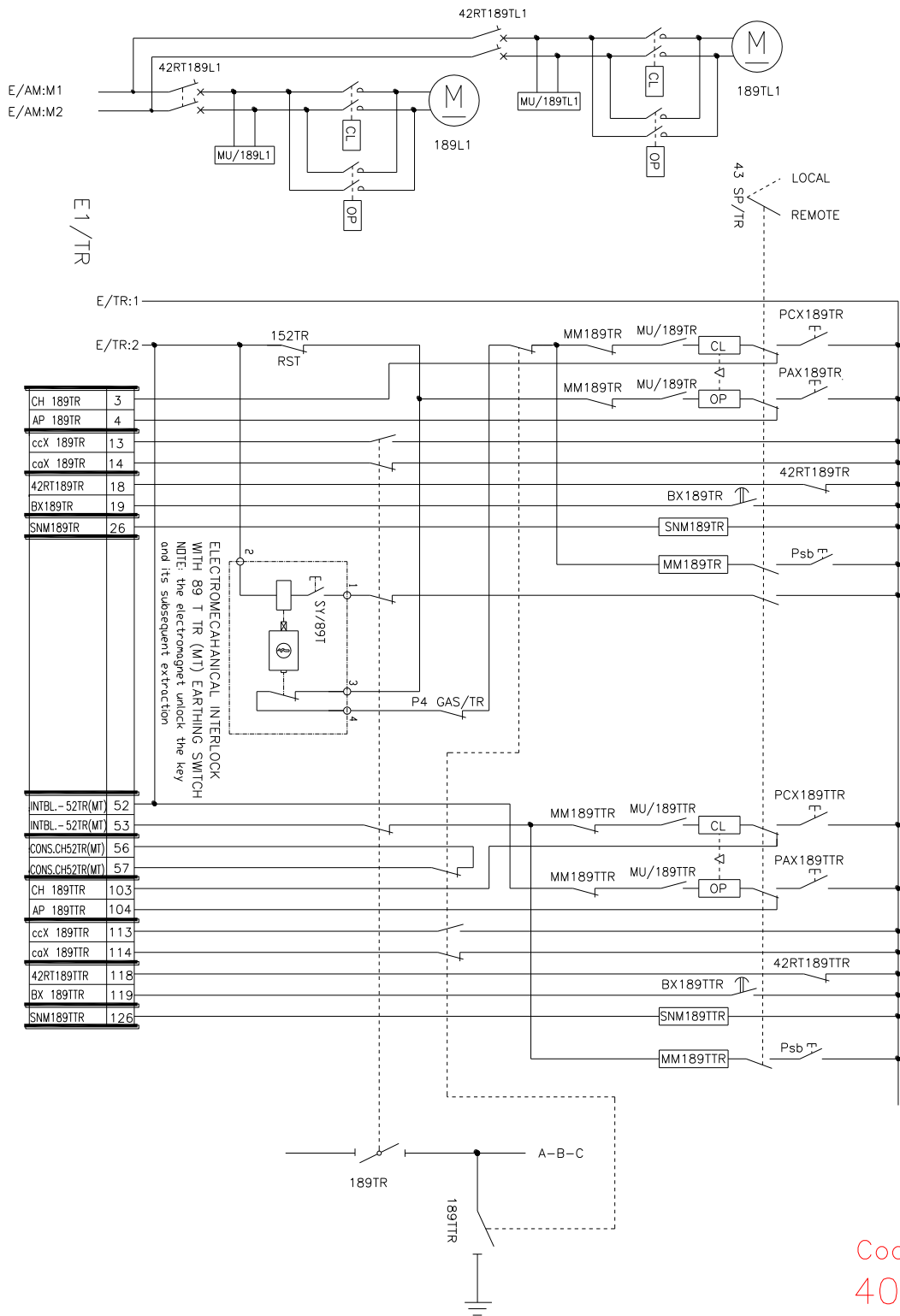
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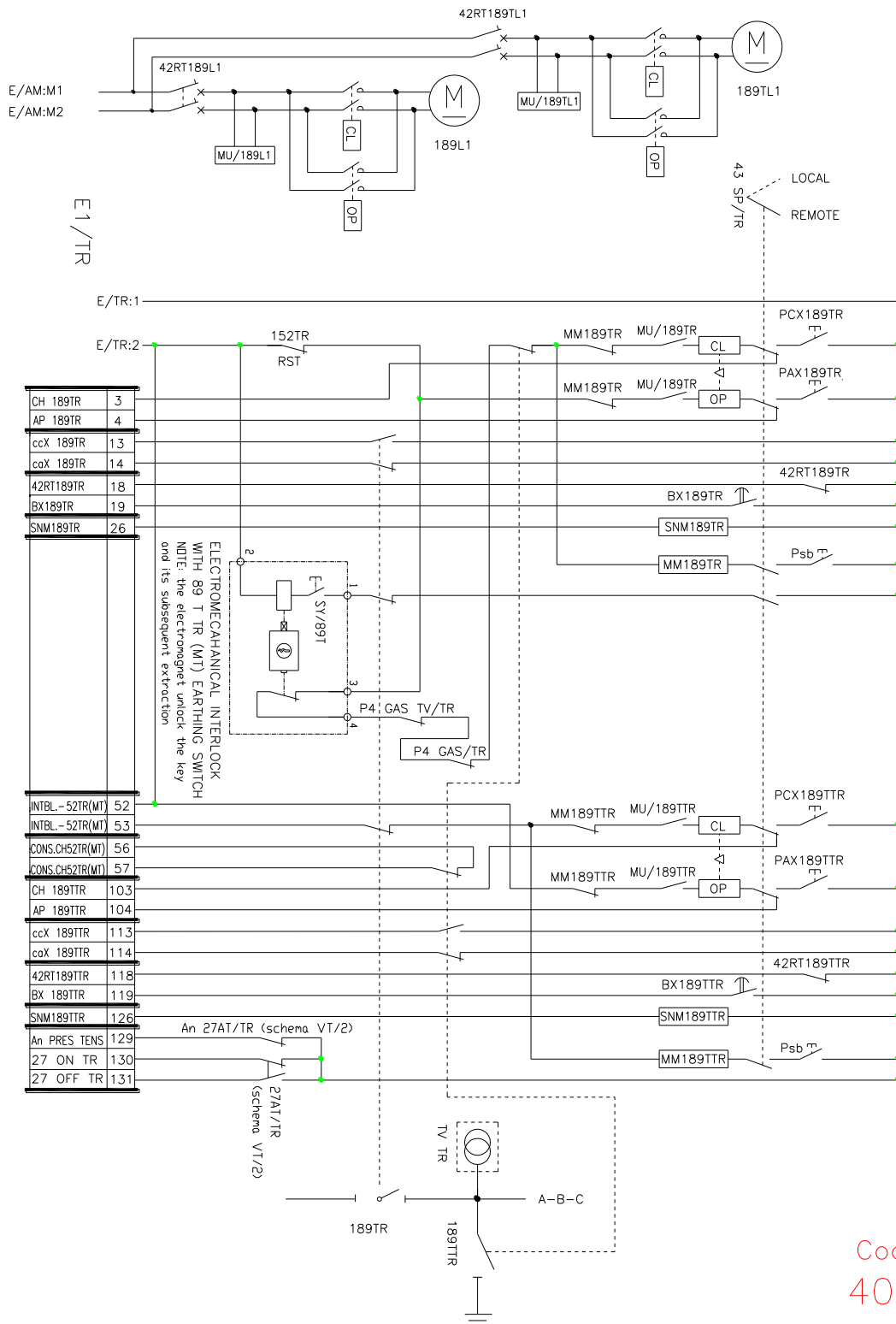


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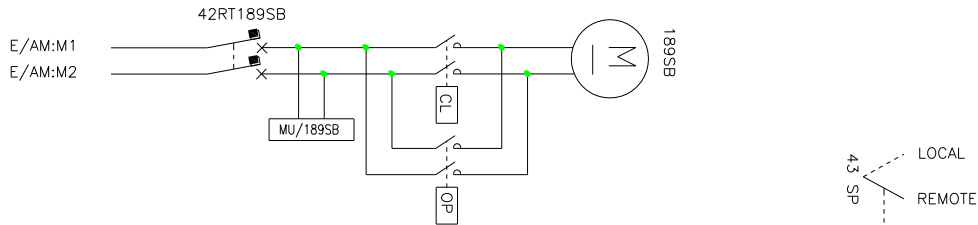


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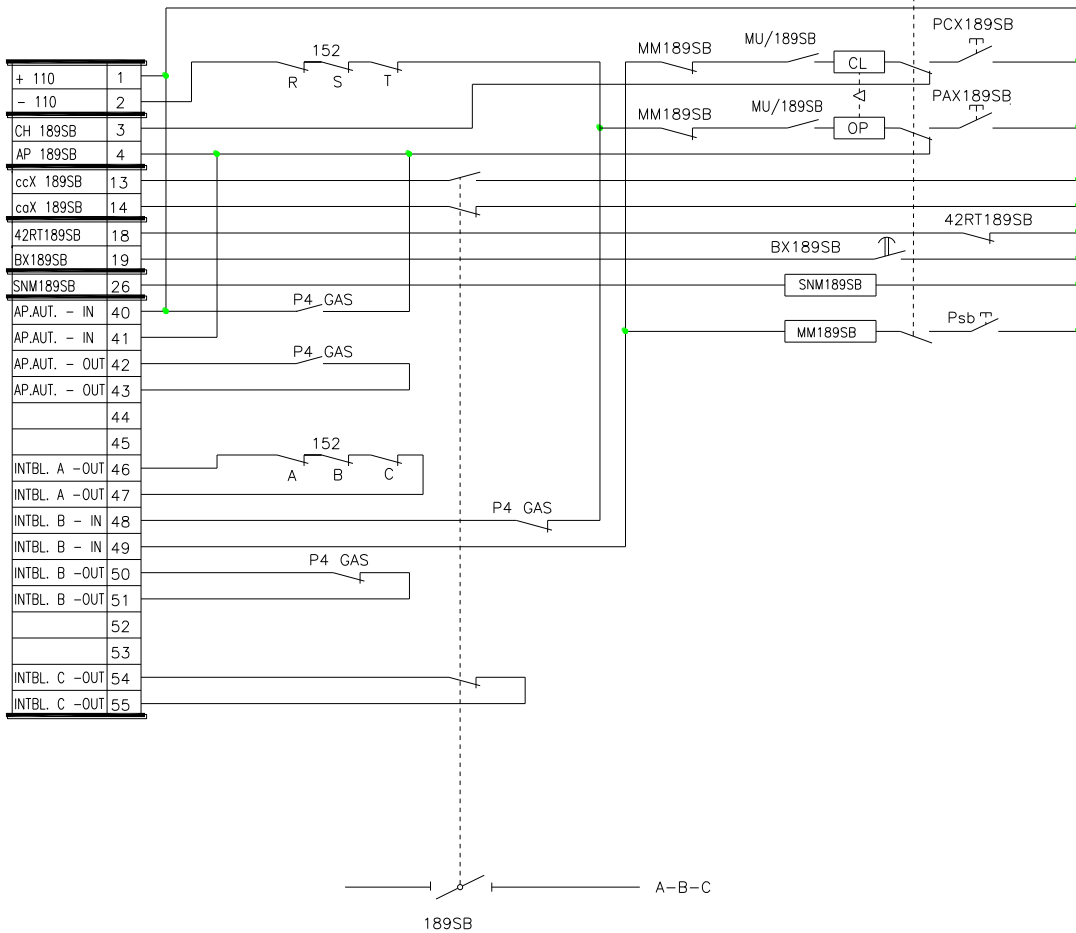


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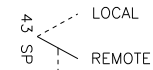
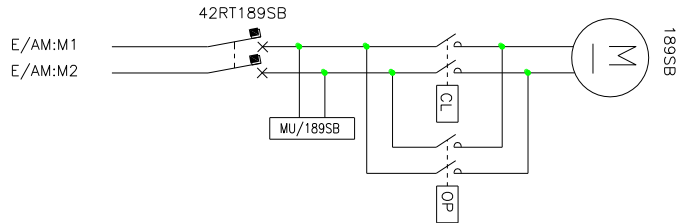


E1/SB

NOTE: ONLY IF "I" IS IN STAND-ALONE MODE, INSERT THE JUMPER 48-49.

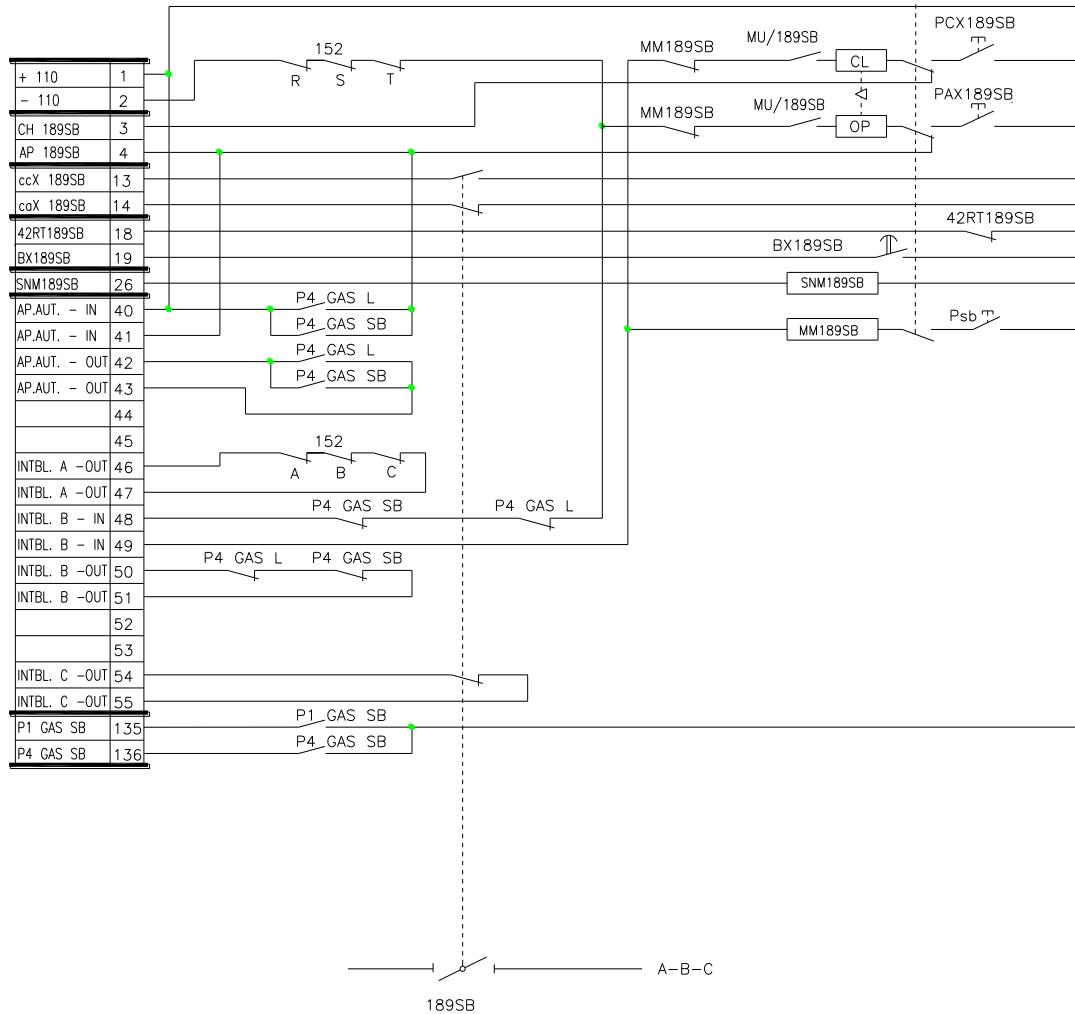


Code:
501



E1/SB

NOTE: ONLY IF "I" IS IN STAND-ALONE MODE, INSERT THE JUMPER 48-49.



Code:
502



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GSH002

Rev. 03

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Code/Codice:
AM

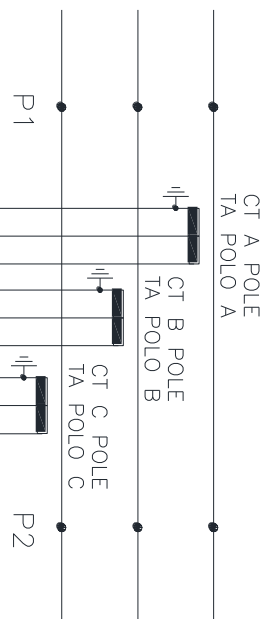
MOTORS (D.C.) AND
ANTI-CONDENSATION (A.C.)
POWER SUPPLIES

ALIMENTAZIONI MOTORI (C.C.)
E ANTICONDENSA (C.A.)

E/AM

ANTICOND.	R0
SUPPLY	R0
ANTICOND.	R4
SUPPLY	R4
+MOTORS	M1
+MOTORS	M1
+MOTORS	M1
-MOTORS	M2
-MOTORS	M2
-MOTORS	M2

SIDE: BUSBAR
LATO: SBARRA



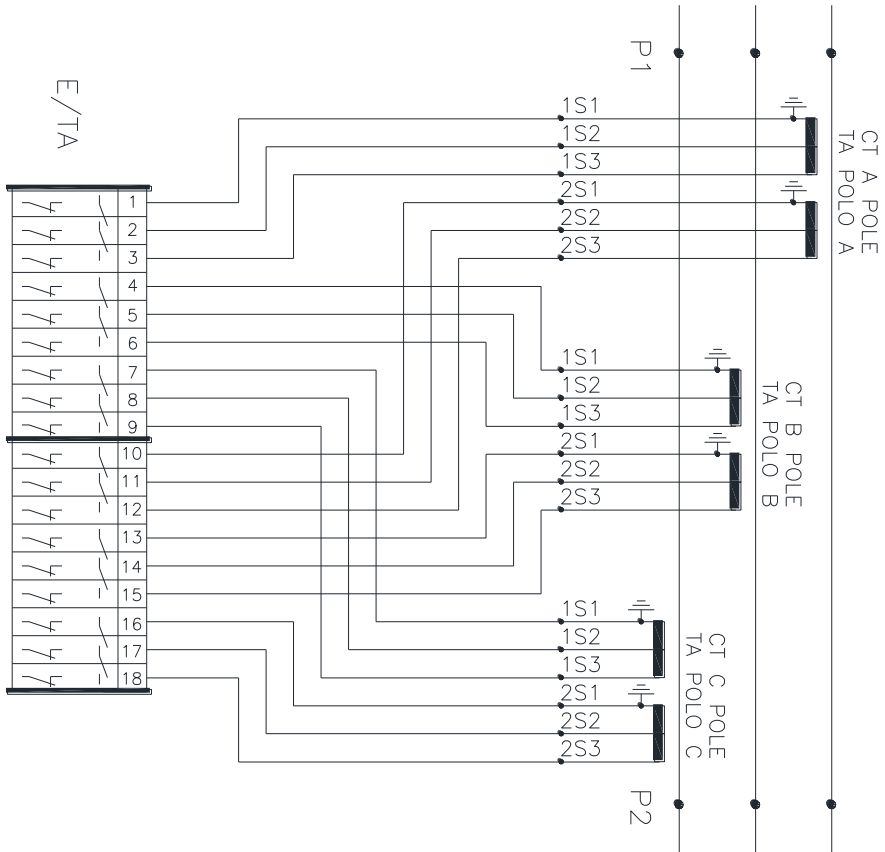
Code/Codice:
CT/1

E/TA

1	Y
2	Y
3	Y
4	Y
5	Y
6	Y
7	Y
8	Y
9	Y

MEASUREMENT AND PROTECTION
MISURE E PROTEZIONI

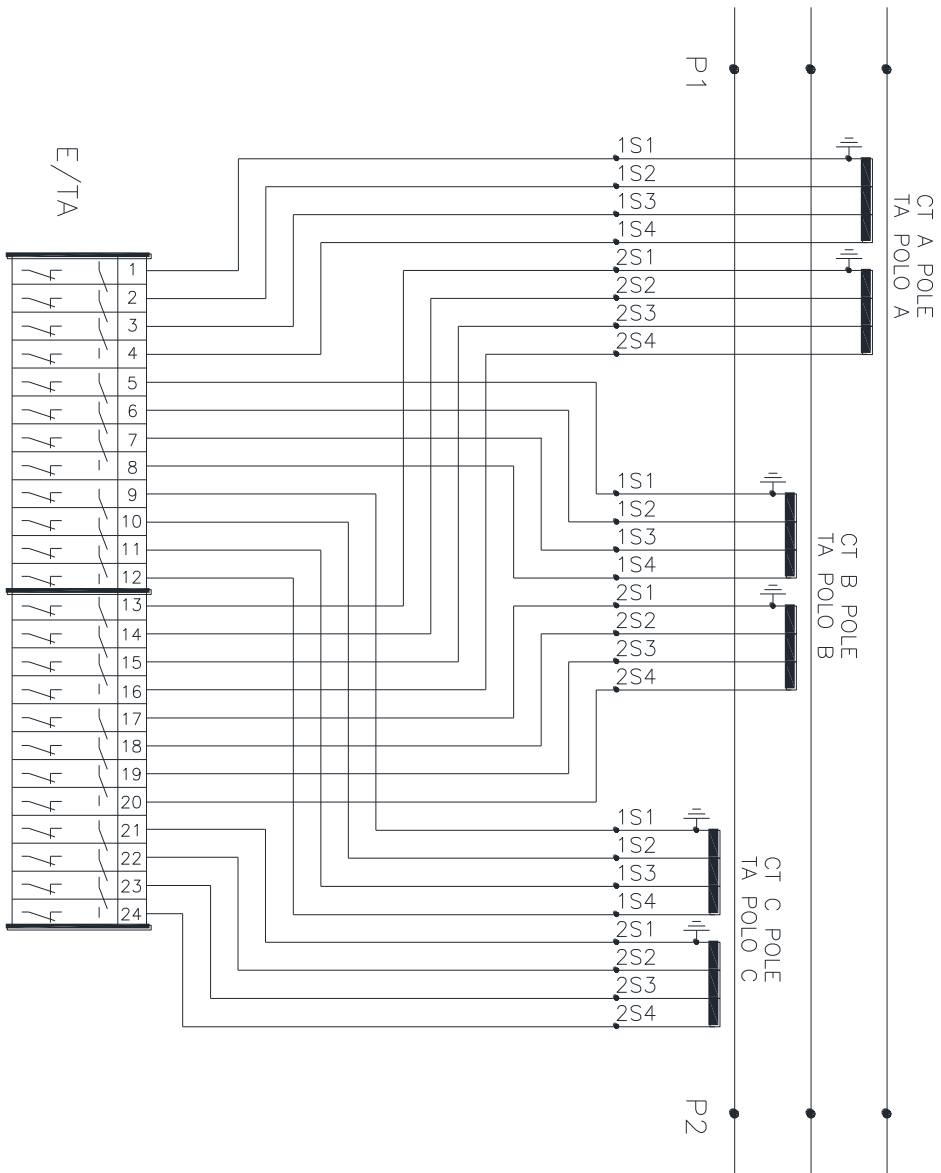
SIDE: BUSBAR
LATO: SBARRA



MEASUREMENT AND PROTECTION
MISURE E PROTEZIONI

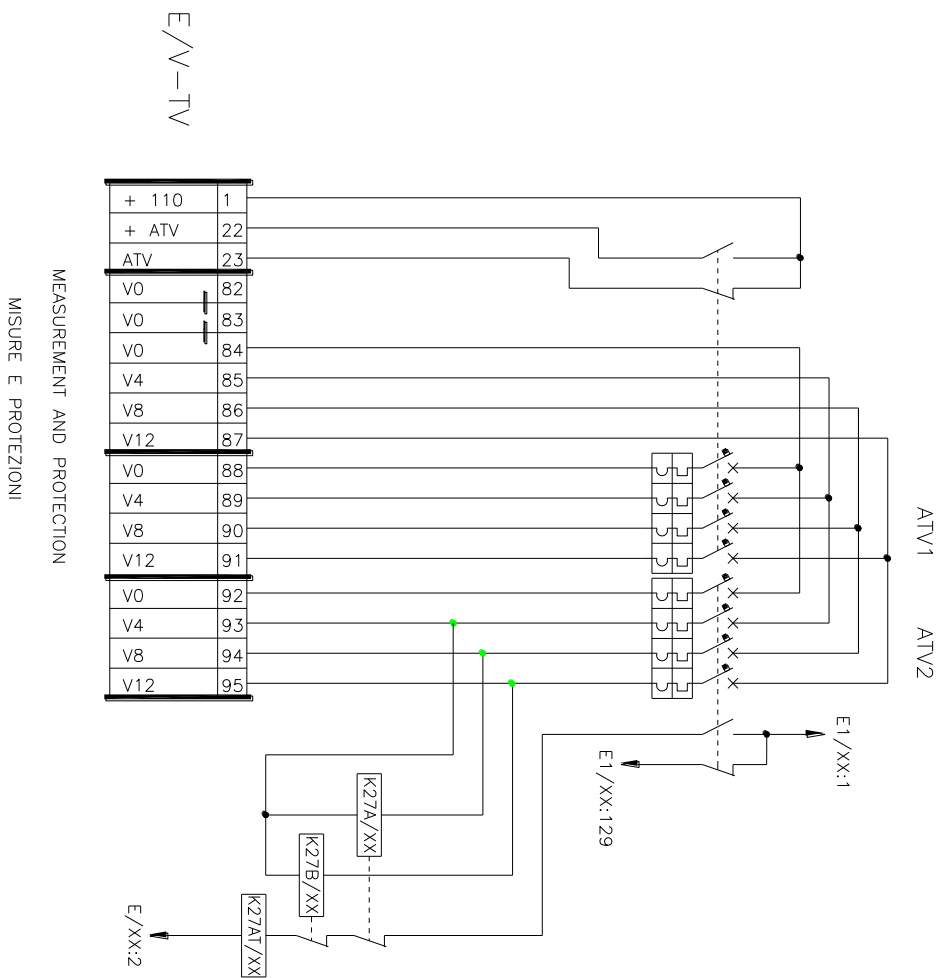


SIDE: BUSBAR
LATO: SBARRA



MEASUREMENT AND PROTECTION
MISURE E PROTEZIONI

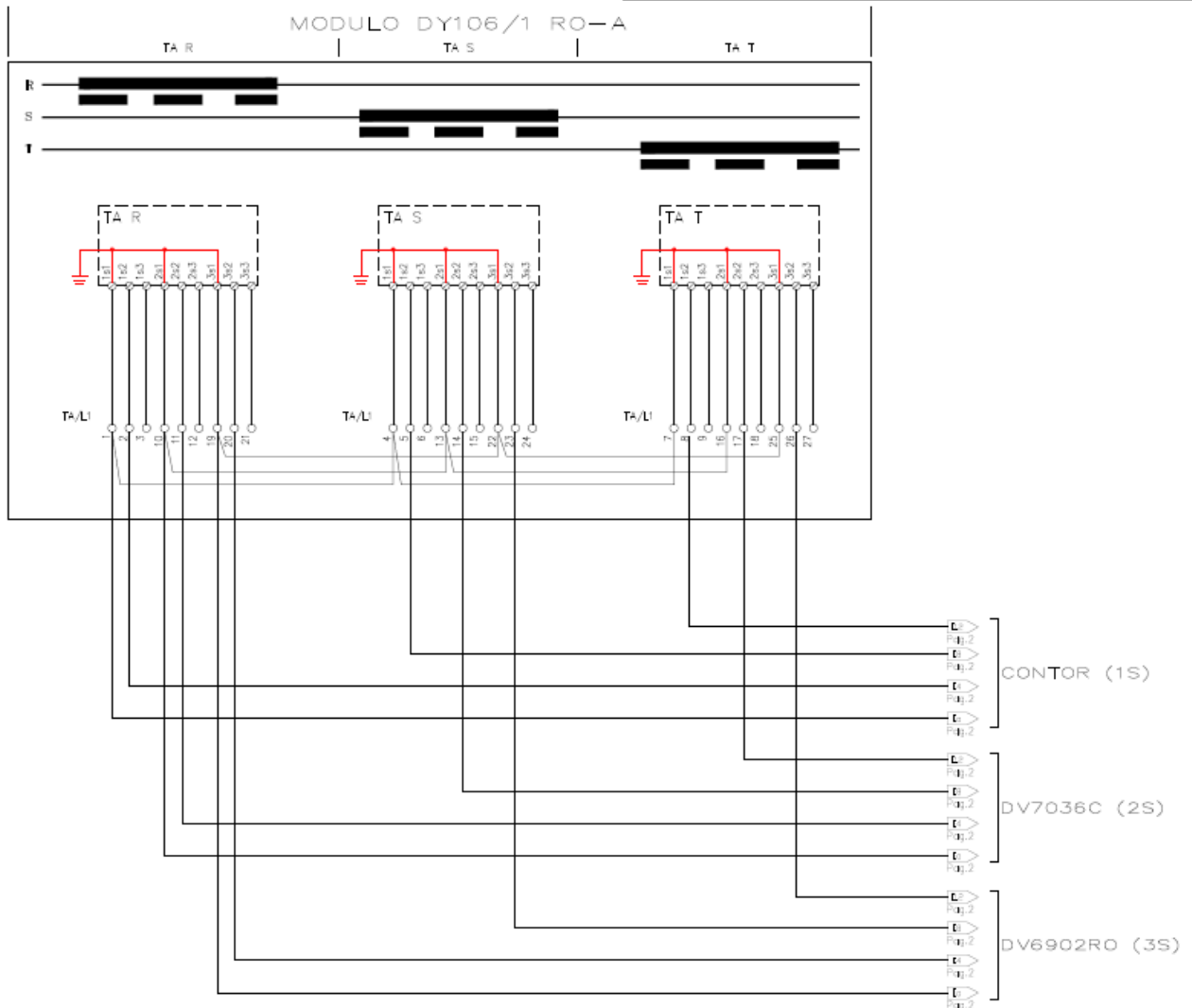
Inductive or Capacitor Voltage Transformers Version
 Versione con TV – TVC tradizionali: esterni



Code/Codice:
 VT/1



TC LINEE



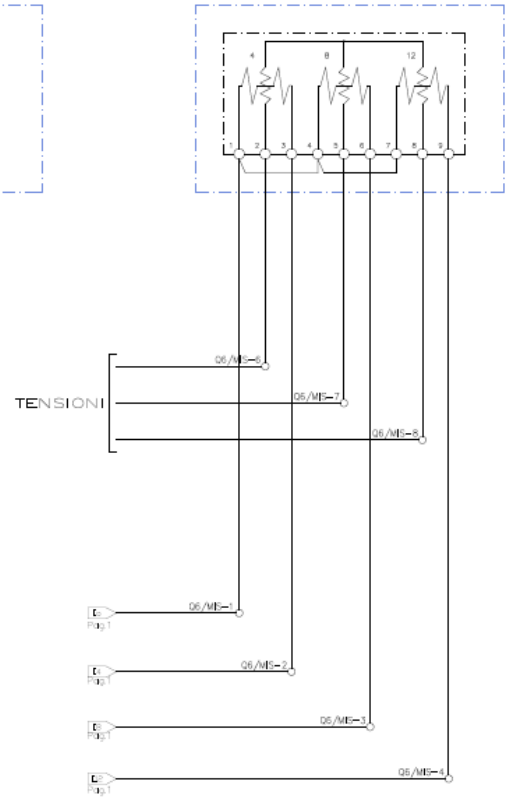
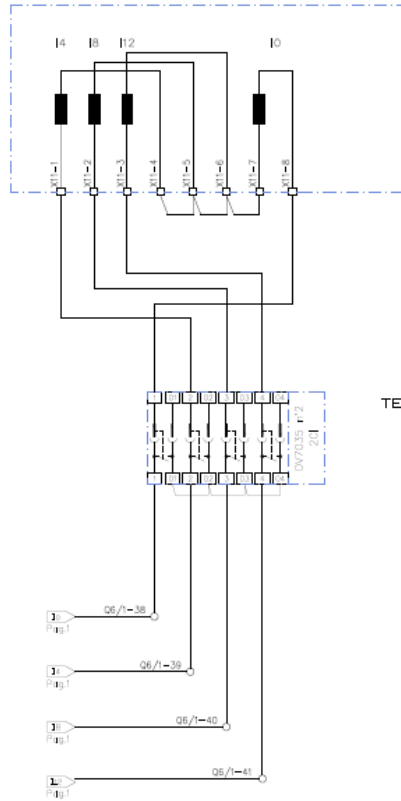
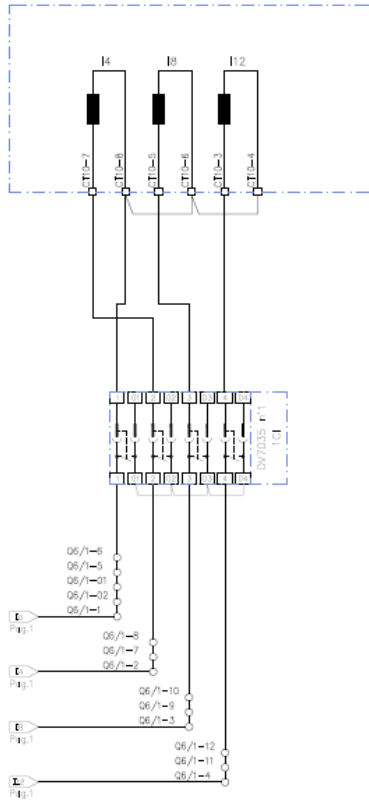


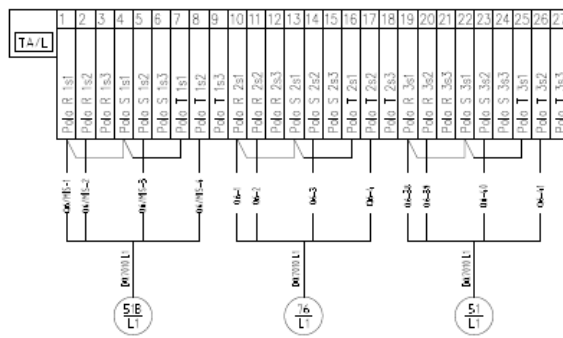
TC LINEE

PROTEZIONE DV7036C

PROTEZIONE DV6902RO

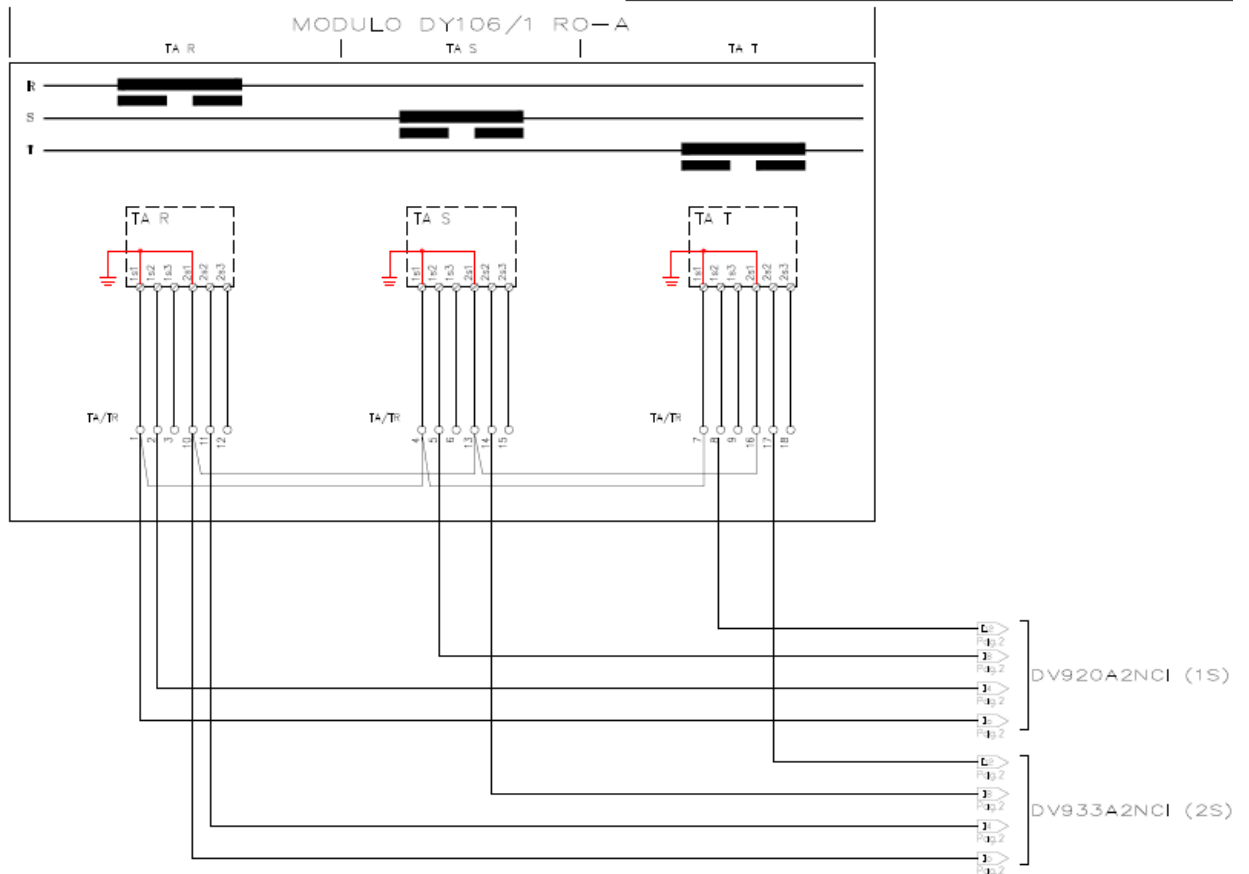
CONTOR







TC TRAF0





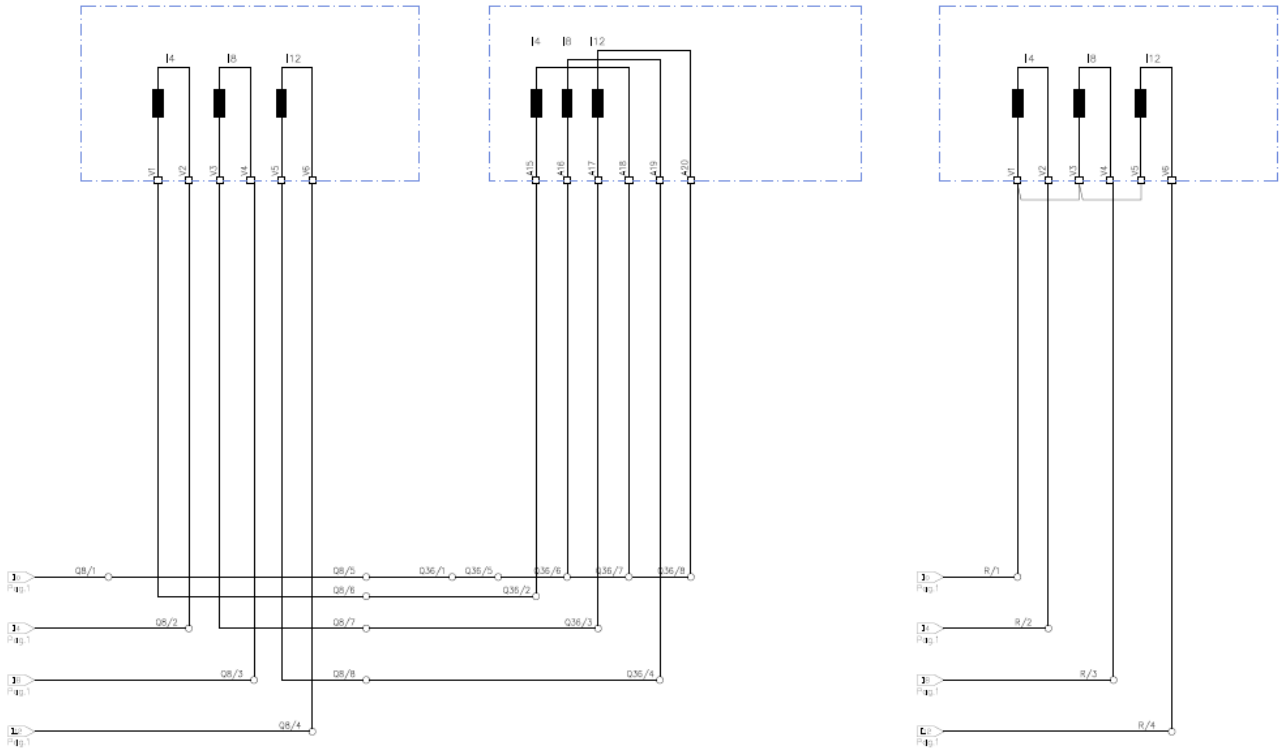
TC - TRAF0

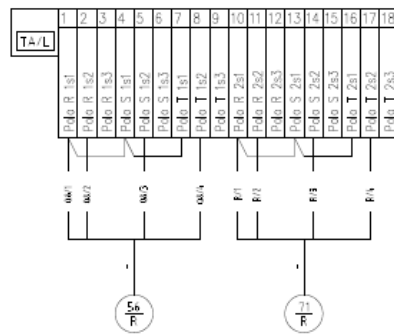
DW_R
SEMPRE IN
 EIT - 0

PROTEZIONE DV920A2NCI

PROTEZIONE DV6903RO

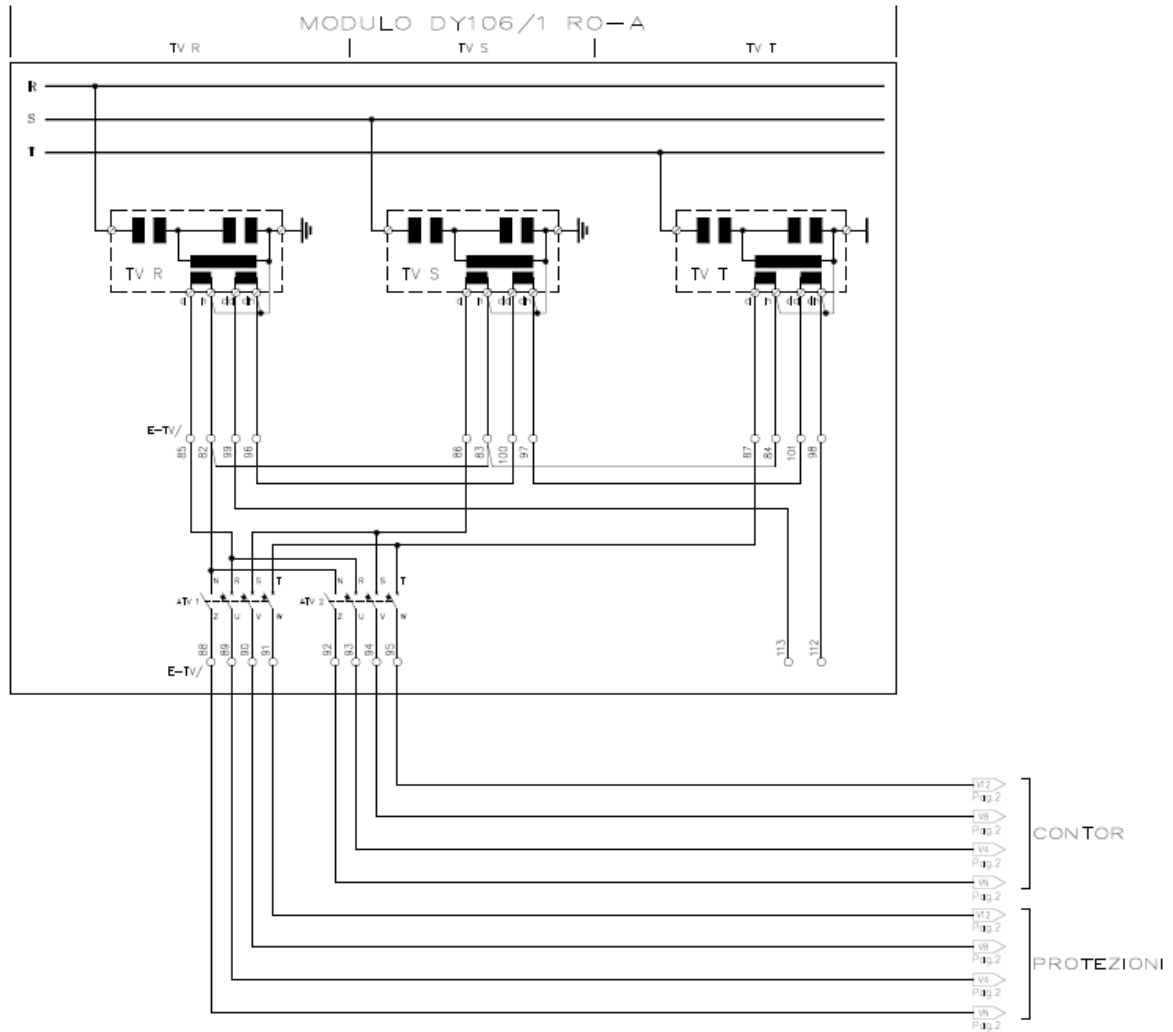
PROTEZIONE DV933A2NCI







TT LINEE

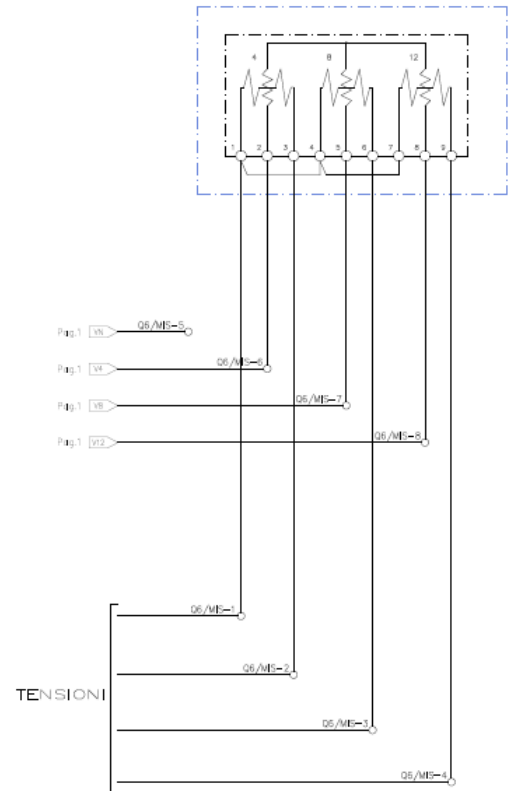
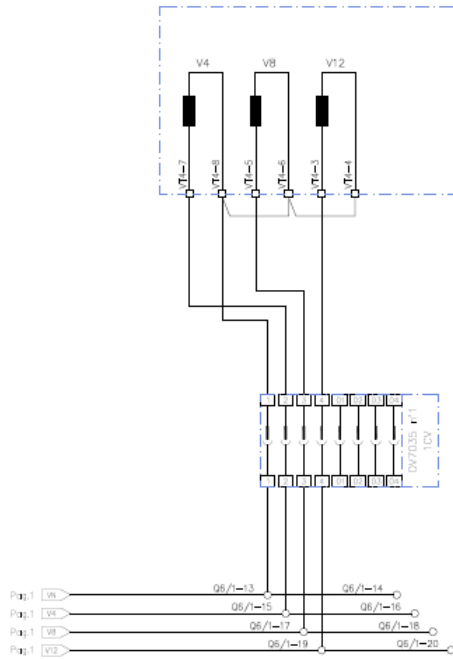


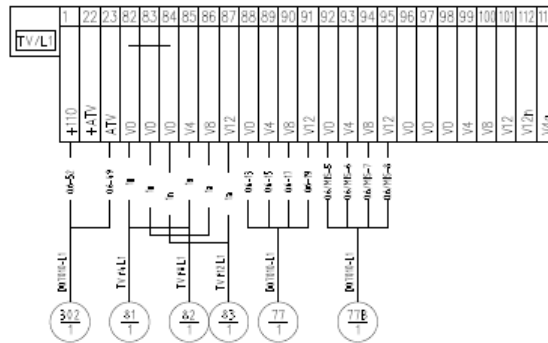


TT LINEE

CONTOR

PROTEZIONE DV7036C

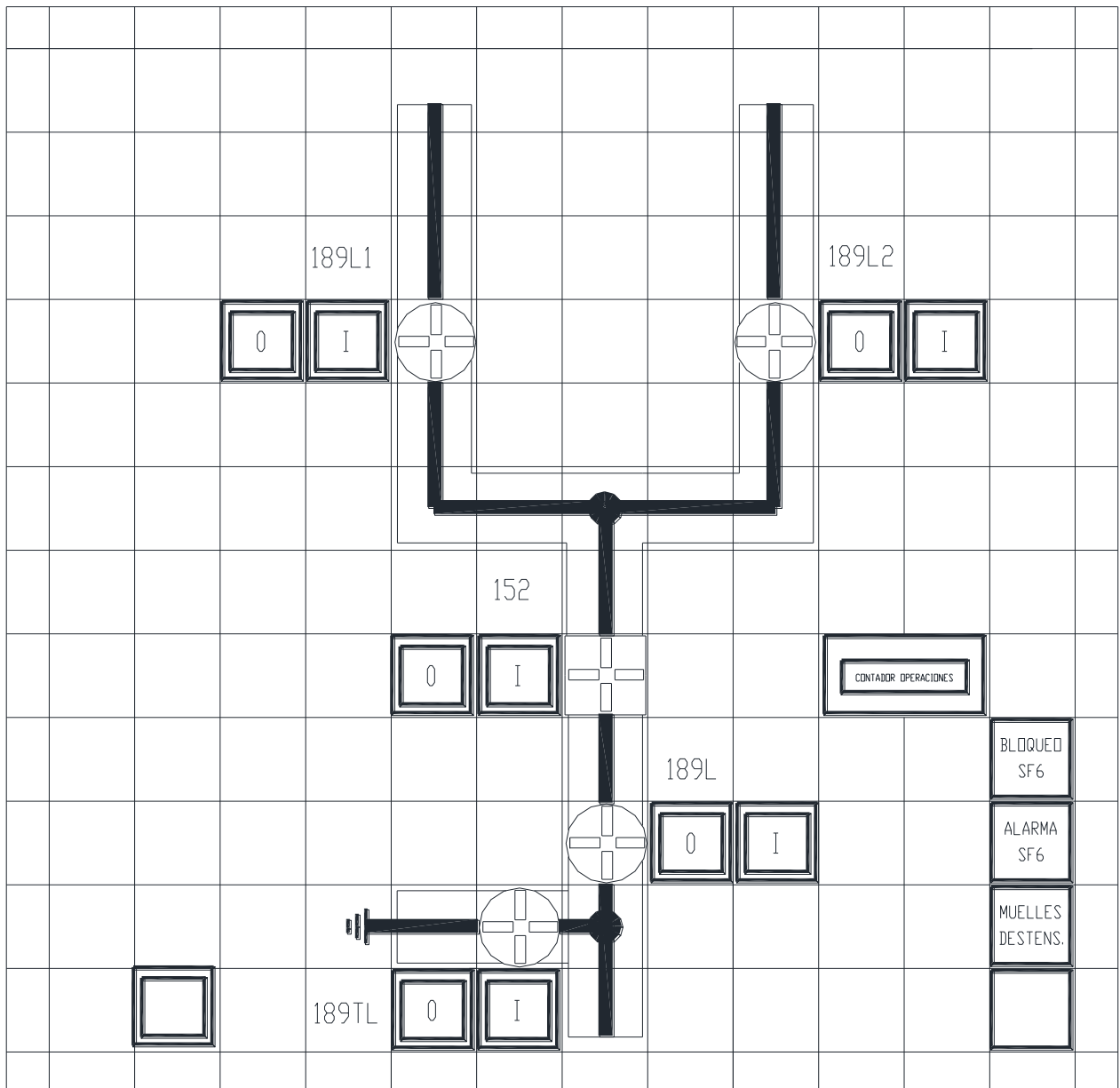




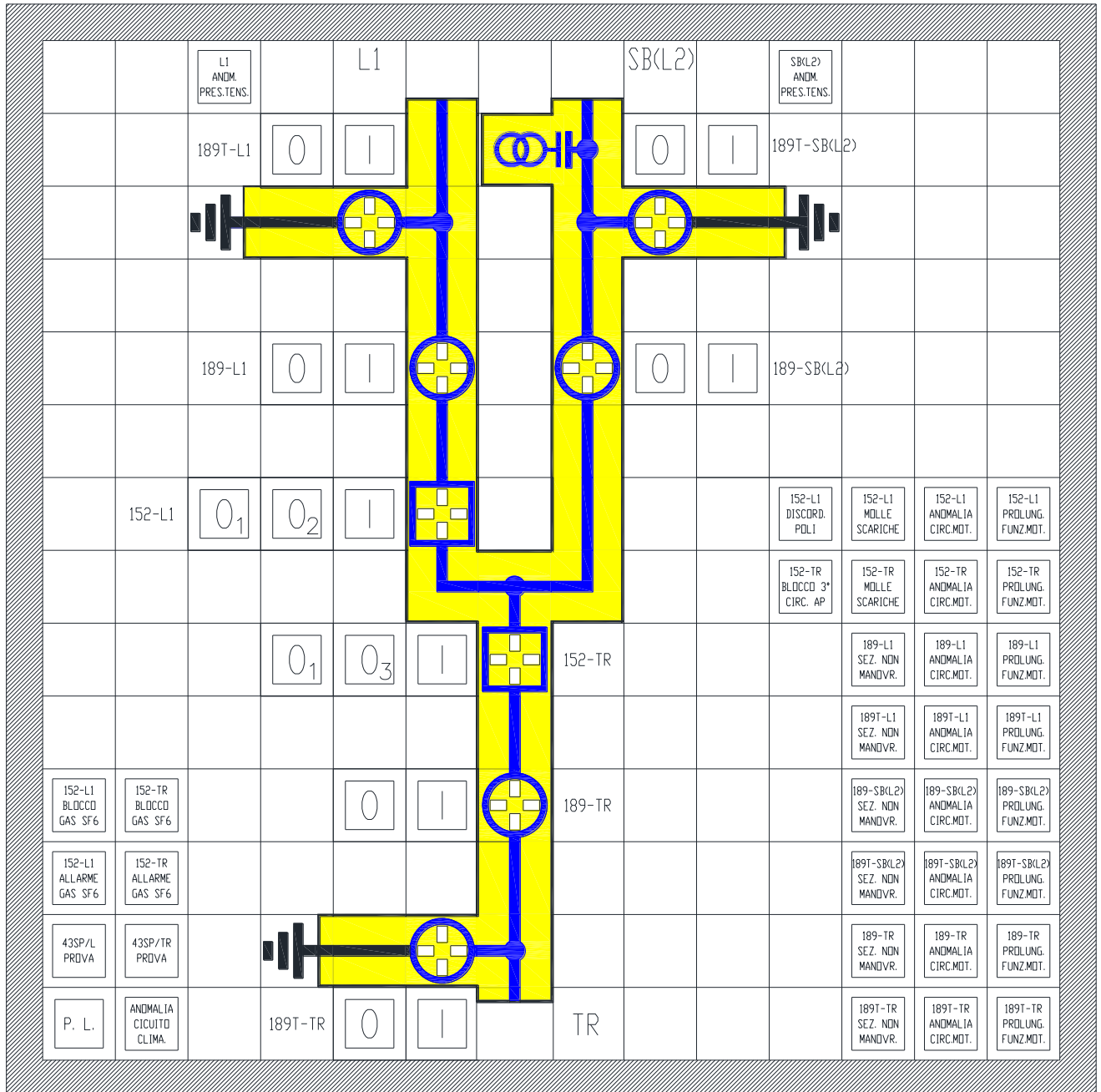
ANNEX E – SYNOPTIC EXAMPLES


E.1 – ENDESA AND LATAM SYNOPTIC EXEMPLES

Example of Y1 type – used in Line bay




Example of Y2 type: Line bay, Busbar (or Line bay), Transformer bay



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ANNEX F – TENDER’S TECHNICAL DOCUMENTATION

GLOBAL STANDARD: GSH002 – HYBRID MODULES		TENDER:	
SUPPLIER:		FACTORY:	
RATED VOLTAGE FOR EQUIPMENT U_r (kV):		SUPPLIER MODEL:	
TECHNICAL CHARACTERISTIC	STANDARD REQUIREMENT	SUPPLIER OFFER	
<u>Service conditions</u>			
Service conditions	outdoor normal service conditions of IEC 62271-1		
Reference altitude (m)	≤ 1.000 (2.600 for Colombia)		
Minimum ambient air temperature (°C)	- 25 (- 30 for Romania)		
SPS Class (IEC/TS 60815 series)	d) or e)		
Ice coating (mm)	10 (22 for Romania)		
Seismic qualification level	See table in 4.2.3		
<u>Common general ratings</u>			
Rated short-duration power-frequency withstand voltage U_d (kV rms):	Phase-to-earth, across open switching device and between phases		
	Across the isolating distance		
Rated lightning impulse withstand voltage U_p (kVp):	Phase-to-earth, across open switching device and between phases		
	Across the isolating distance		
Rated frequency f_r (Hz)	50 and 60		
Rated normal current I_r (A)	2.000		
Rated short-time withstand current I_k (kA)			
Degrees of protection provided by enclosures (IEC 60529)	IP54		
Protection stage (tab. 104 EN 62271-203)	2		
Maximum SF6 leakage rate (% / year)	≤ 0,5%		
HV Single-line diagram		To enclose a HV single-line diagram for each one of the detailed layout examples in Annex B.2	
Dimensions	See Annex C	To enclose an overall equipment drawing for each one of the detailed layout examples in Annex B.2	
<u>Circuit breakers</u>			
Rated short-circuit breaking current I_{sc} (kA)			
First-pole-to-clear factor k_{pp}			
Rated operating sequence	O - 0,3 s- CO -1 min - CO		

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Maximum break-time (ms)		60	
Circuit-breaker class		C2 – E1 – M2	
Rated line-charging breaking current I_l (A)			
Rated cable-charging breaking current I_c (A)			
Rated out-of-phase making and breaking current I_d (kA)		Clause 4.106 of IEC 62271-100	
<u>Disconnectors and earthing switches</u>			
Opening (closing) time for motor operation (s)		≤ 15	
Disconnecter mechanical endurance class M_r		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	
	Rated bus-transfer voltages for disconnectors (V)	Clause B.4.106.1 of IEC 62271-102	
Earthing switches class		E0 – M1 – A	
<u>SF6-air Bushings</u>			
Insulators materials		Composite	
<u>Bus ducts</u>			To enclose an overall equipment drawing of a solution with bus-ducts
<u>Cable connections</u>			To enclose an overall equipment drawing of a solution with cable connections
<u>Current transformers</u>			
Rated short-time thermal current I_{th} (kA)		40	
Rated continuous thermal current I_{cth} (kA)		120% of I_{pr}	
Core number		1 or 2	
<u>Voltage transformers</u>			
Secondary windings		1, 2 or 3	
Rated voltage factor F_v		1,5 (rated time 30 s)	