COMUNE DI RAVENNA

PROVINCIA DI RAVENNA

COMMITTENTE : **AGRENERGY SRL**

PROGETTISTA : **ING. MINORCHIO MASSIMILIANO**

OGGETTO : **PTO SAVIO**

INGEGNERIA INTEGRATA

INGEGNERIA INTEGRATA Srl StP

Ing. Minorchio Massimiliano
Cell: 347/9126620
e-mail: inorchio.massimiliano@gmail.com
Sede: Via Ugo la Malfa, 10 - 40026 Imola (BO)
Ufficio Tecnico tel. 0542/644055

N° ELABORATO	ELABORATO
E0115013919RT	Caratteristiche dei componenti opere di rete

SCALA	PRATICA N°	REVISIONE 1	16/12/2020
1:100	0001_2020_FV	REVISIONE 2	
DATA	DISEGNATORE	REVISIONE 3	
16/12/2020	MM	REVISIONE 4	

UNIFICAZIONE

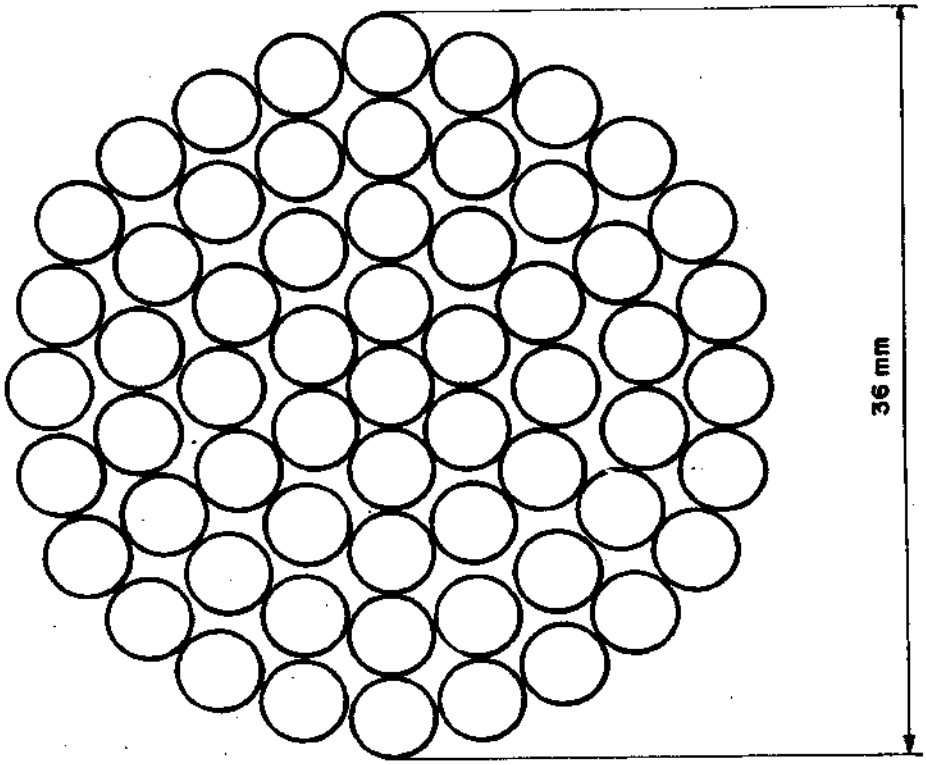
ENEL

CONDUTTORE A CORDA DI ALLUMINIO CRUDO Ø 36

31 42 A

LC 5

Luglio 1983
Ed. 4 – 1/1



N° MATRICOLA	31 42 10

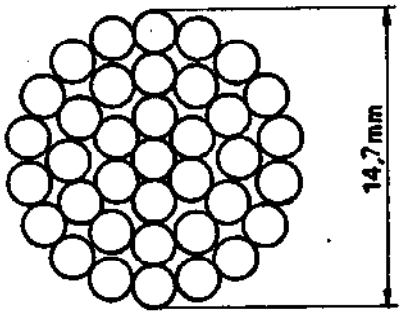
FORMAZIONE		61 x 4,00
SEZIONE TEORICA	(mm²)	766,5
MASSA TEORICA	(kg/m)	2,118
RESISTENZA ELETT. TEORICA A 20°C	(Ω/km)	0,03770
CARICO DI ROTTURA (Kg)	(daN)	10970 (1118?)
MODULO ELASTICO FINALE	(N/mm²) (Kg/mm²)	55000 5607
COEFFICIENTE DI DILATAZIONE	(1/°C)	23 x 10⁻⁶

1 — Materiale : alluminio ALP E 99,5 UNI 3950.
2 — Prescrizioni per la costruzione ed il collaudo : DC 3905.
3 — Prescrizioni per la fornitura : DC 3911.
4 — Imballo e pezzature : bobine di 2.000 m (salvo diversa prescrizione in sede di ordinazione).
5 — L'unità di misura con la quale deve essere espressa la quantità del materiale è la massa in chilogrammi (Kg).

Designazione abbreviata: C O R D A A L D I A M 3 6 U E

UNIFICAZIONE ENEL	CORDA DI TERRA IN RAME ø 14,7 – SEZIONE 125 mm²	21 75 B LC 1001 Marzo 1973 Ed. 1 - 1/1

DIREZIONE DELLE COSTRUZIONI - CENTRO NAZIONALE STUDI E PROGETTI



MATRICOLA	21 75 07

FORMAZIONE		37 x 2,10
SEZIONE TEORICA	(mm^2)	128,2
PESO TEORICO	(kg/m)	1,179
RESISTENZA ELETTRICA A 20°C	(Ω/km)	0,1392

1 - Materiale : rame tipo CU-ETP UNI 5649-71 ricotto.

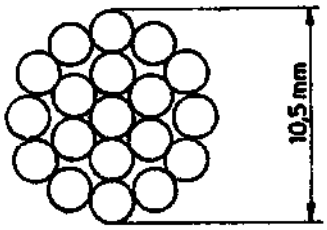
2 - Prescrizioni per la fornitura ed il collaudo : Norme CEI 7-1

3 - L'unità di misura con la quale deve essere espressa la quantità del materiale è il peso in chilogrammi (Kg)

Designazione abbreviata: C O R D A T E R R A C U S E Z 1 2 5 U E

UNIFICAZIONE ENEL	CORDA DI TERRA IN RAME ∅ 10,6 – SEZIONE 63 mm²	21 75 A LC 1002 Marzo 1973 Ed. 1 - 1/1

DIREZIONE DELLE COSTRUZIONI - CENTRO NAZIONALE STUDI E PROGETTI



MATRICOLA	21 75 05

FORMAZIONE		19 x 2,10
SEZIONE TEORICA	(mm^2)	65,81
PESO TEORICO	(kg/m)	0,6026
RESISTENZA ELETTRICA A 20° C	(Ω/km)	0,2698

1 – Materiale : rame tipo CU-ETP UNI 5649-71 ricotto.

2 – Prescrizioni per la fornitura ed il collaudo : Norme CEI 7-1

3 – L'unità di misura con la quale deve essere espressa la quantità del materiale è il peso in chilogrammi (Kg)

Designazione abbreviata: CORDA TERRA CU SEZ 63 UE

INDICE

Revisione	Natura della modifica
03	Terza emissione

	Emissione	Collaborazioni e verifiche			Approvazione
Ente	**DIR-IUN-UML**	**DIR-IUN-UML**			**DIR-IUN**
Firmato	**F. Mauri**	**R. Grimaldi**			**E. Di Marino**

1. DATI NOMINALI

TIPO	44/2
MATRICOLA	53 67 21
GRANDEZZE NOMINALI	
Livello di inquinamento	Antisale 25 mm/kV
Salinità di tenuta (alternativa al livello di inquinamento)	56 kg/m^3 a 84kV
Tensione massima di riferimento per l'isolamento U_m	145 kV
Tensione nominale di tenuta a frequenza industriale	275 kV
Tensione nominale di tenuta ad impulso atmosferico	650 kV
Frequenza nominale	50 Hz
Rapporto di trasformazione nominale	$\frac{132.000}{\sqrt{3}} / \frac{100}{\sqrt{3}}$
Capacità nominale Cn	4000 pF
Prestazioni nominali e classi di precisione sull'avvolgimento a-n (misura e protezione)	7,5 VA/0,2-3PT1 – Burden range I 30 VA/0,2-3PT1 – Burden range II
Fattore di tensione nominale	1,5 per 30 s
CONDIZIONI NORMALI DI SERVIZIO	
Categoria di temperatura	-25/40
Condizione del neutro della rete	efficacemente a terra
SFORZI MECCANICI NOMINALI	
Sul terminale primario: Sulla flangia: - orizzontale (applicato 600 mm sopra la flangia B) - verticale (applicato alla flangia B)	1000 N 2000 N 5000 N
FUNZIONAMENTO PER ONDE CONVOGLIATE	Conforme Annex C di CEI EN 60044-5
RESISTENZA AL SISMA	Severità AF5

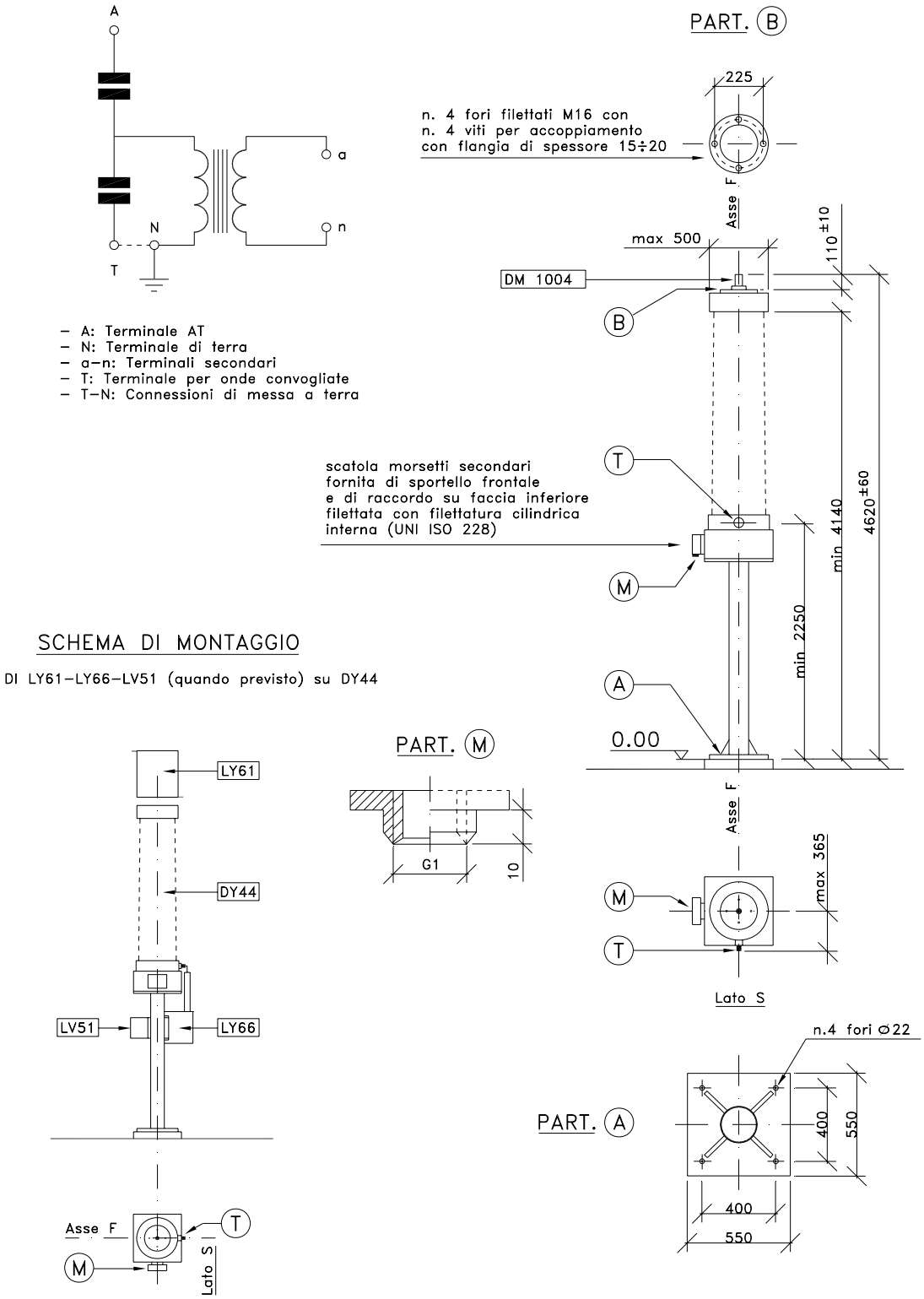
1 Le diciture "asse F" e "lato S" riportate nel disegno a pagina seguente saranno utilizzate per fornire le istruzioni per una corretta disposizione dell'apparecchio.
2 Gli apparecchi devono essere provvisti di sostegno
3 Norme e Prescrizioni di riferimento:
- Norma CEI EN 60044-5
- Prescrizione per la costruzione: DY 2041
- Prescrizione per le prove: DY 2042
- Prescrizione per la costruzione e fornitura del sostegno: DY 43

4 Unità di misura: numero di esemplari (n)

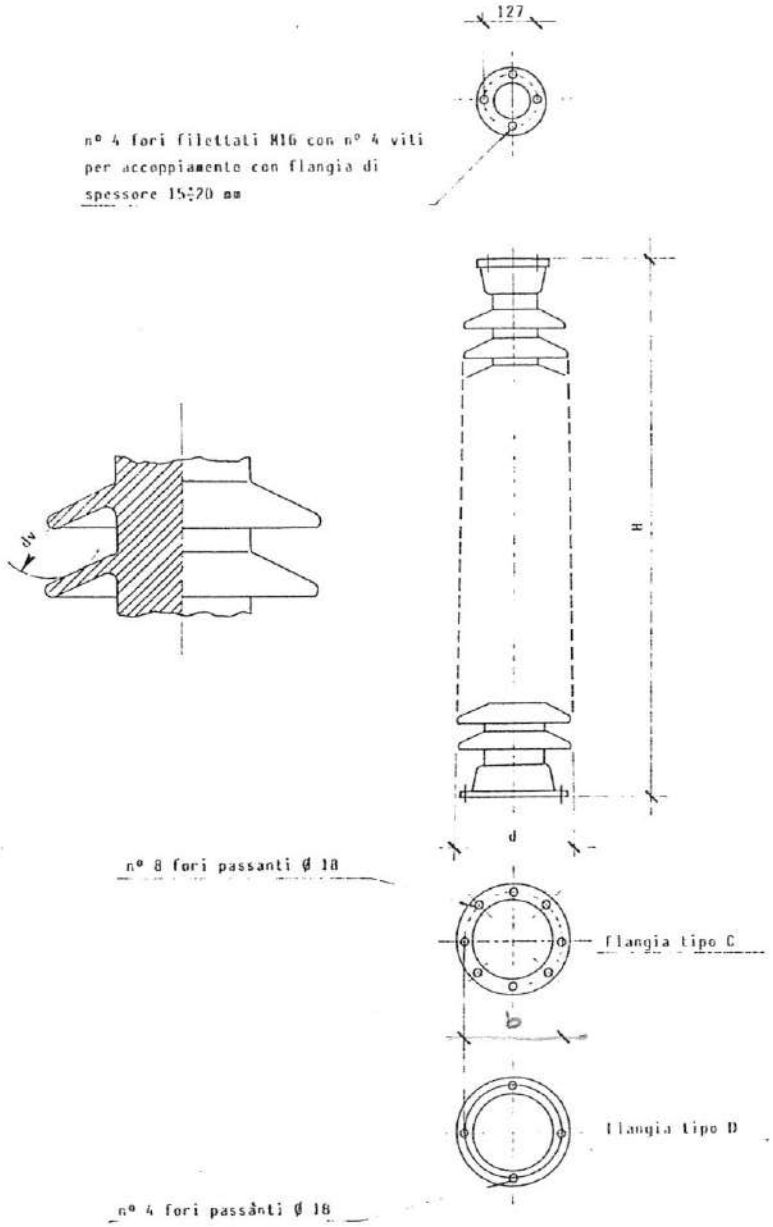
2 DESCRIZIONE RIDOTTA

TV CAPAC 132kV AUE

3 SCHEMA E DISEGNO DI INGOMBRO



ISOLATORI PORTANTI CILINDRICI PER ESTERNO TIPO "ANTISALE" IN PORCELLANA PER TENSIONE NOMINALE ⩾ 145 kV



MATRICOLA		30 40 63	30 40 62	30 40 43	30 40 42	30 40 23
TIPO		1002/1	1002/2	1002/3	1002/4	1002/5
Comportamento in nebbia salina	Salinità di tenuta (Kg/m3)	40		40		56
	Tensione di prova (kV)	243		142		95
Tensione di tenuta alle sovratensioni di manovra sottopioggia (kV)		1050		-		-
Tensione di tenuta a f.i. sottopioggia (kV)		----		460		-
Lunghezza nominale minima linea di fuga (mm)		8500		5650		3350
Altezza totale H (mm)		3350±4,5		2300±3,5		1500±2,5
Diametro nominale max parte isolante d (mm)		450		450		350
$\sum$ dv minimo (mm)		----		----		850
Freccia statica massima (mm)		28,3		19,9		13,5
Carico di rottura a flessione Po (daN)		1250	800	1250	600	600
Carico di rottura a torsione (daN.m)		600	400	600	300	300
Momento flettente di rottura in testa (daN.m)		500	500	500	300	300
Flangia di base	Tipo	C		C	D	D
	b (mm)	325	275	275	225	200
Freccia massima di flessione sotto carico (mm)	20% Po	27	27	16	14	7
	50% Po	52	52	28	24	14
	70% Po	67	67	40	35	20

1 - Materiale : flange in ghisa meccanica o malleabile zincata o acciaio zincato, viti in acciaio zincato o inossidabile.

2 - La dicitura "isolatori portanti cilindrici" conformemente a quanto indicato nella Pubblicazione IEC 273, si riferisce ugualmente per estensione agli isolatori di forma tronconica, ma non comprende gli isolatori portanti a cappa e base.

3 - Prescrizioni : per il collaudo ENEL LJ 1302 ; per la fornitura ENEL DJ 1552.

4 - Su ciascun isolatore o elemento costituente deve essere marcata la sigla o il marchio di fabbrica della ditta costruttrice, il carico di rottura a flessione, la sigla assegnata dal costruttore ad ogni serie di isolatori uguali e l'anno di fabbricazione.

5 - Unità di misura : numero di esemplari (n).

Esempio di designazione abbreviata: I S O L P O R C H 3 3 0 0 D N 1 3 5 0 A U E

Ediz.	Data	Descrizione
2	10/04/02	verifica quantità
1	16/11/00	Nuovo numero sost. gemr16

Enel Distribuzione

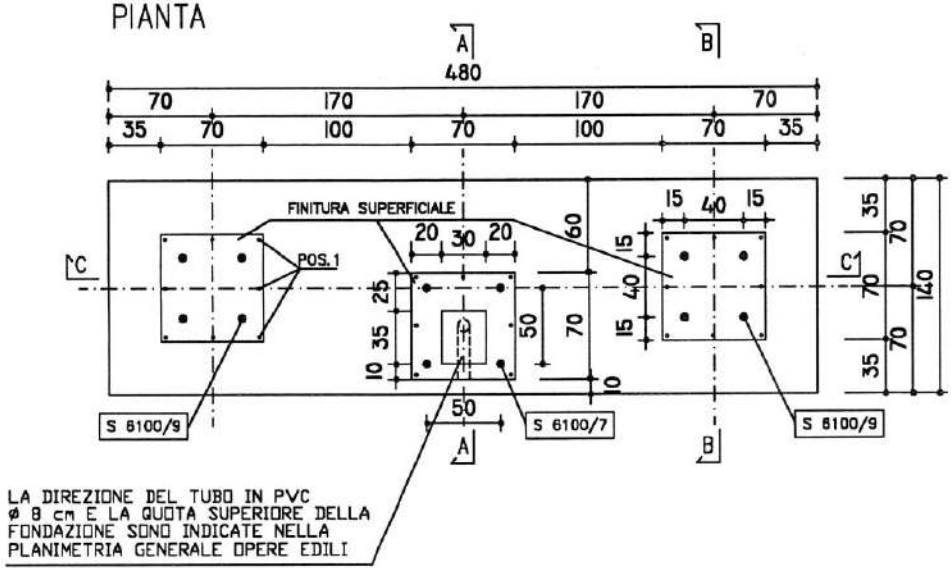
DIREZIONE EMILIA ROMAGNA
Ingegneria

CABINA PRIMARIA 132/15kV DI:

FONDAZIONE SEZIONATORE AT

SCALA PLOT: 1:5	SCALA	N. GER 116	FOGLIO
NOME FILE: GER116-2	1:50		1/1
DATA 10/04/02			

PIANTA



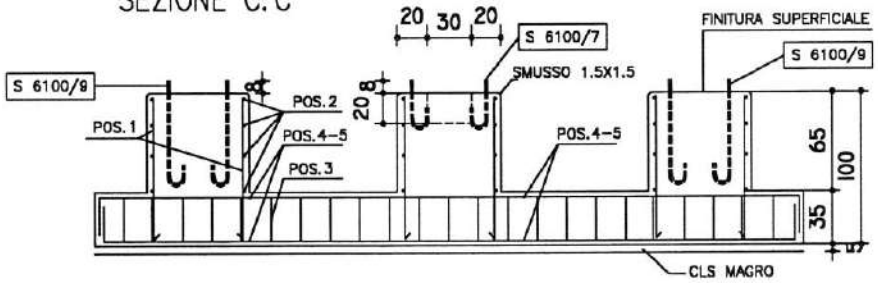
LA DIREZIONE DEL TUBO IN PVC
ø 8 cm E LA QUOTA SUPERIORE DELLA
FONDAZIONE SONO INDICATE NELLA
PLANIMETRIA GENERALE OPERE EDILI

VOLUME CALCESTRUZZO MAGRO m³	VOLUME CALCESTRUZZO CLASSE R 250 m³	PESO FERRI DI ARMATURA kg	TIRAFONDI			
			RIF.	N.	ø	L.mm.
0.33	3.31	167.30	S 6100/9	8	20	680
			S 6100/7	4	16	330

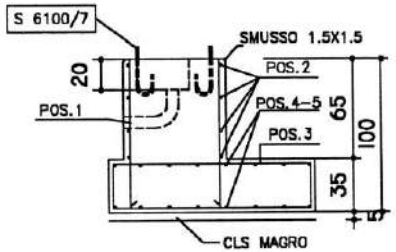
FERRI DI ARMATURA FEB44K
CONTROLLATO IN STABILIMENTO

POS.	N.	ø	TAGLIO ML.	PESO KG.
1	24	16	1.05	39.77
2	12	10	2.80	20.73
3	25	10	3.50	53.99
4	8	10	5.35	26.41
5	8	10	5.35	26.41

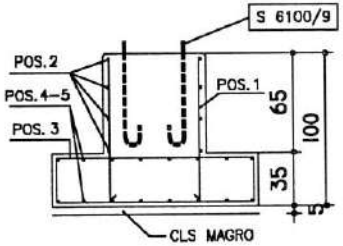
SEZIONE C:C

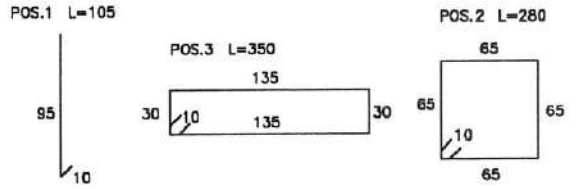


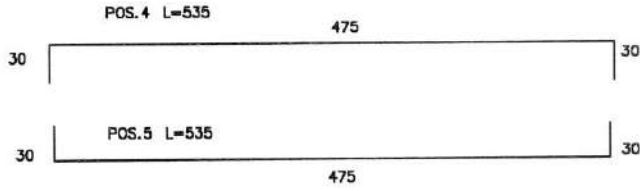
SEZIONE A:A



SEZIONE B:B







N.B. - LA FINITURA SUPERFICIALE DEI MANUFATTI, CHE RESTERANNO A VISTA, DOVRA' ESSERE TIRATA A FRATTAZZO FINE CONTEMPORANEAMENTE ALLA FASE DI GETTO DEL BASAMENTO

Revision	Data	List of modifications
00	30/09/2013	First emission
01	17/01/2014	• New Type Codes in Component List of Chilectra and Ampla • Renumbered the Type Code for all items in Component List • Editorial corrections • Raised a.c. max absorbed power (VA)
02	16/06/2014	• Added new columns in table in chapter 5 • Introduction of alternative materials in nameplates (6.10) • Added a new requirement in 7.1.1 for centre-break DSs • Corrected 7.3.2.2, Closing block, b) • Added information about low voltage components in 7.3.4 • Updated paragraph 7.4.1 • Deleted sentence about measuring of resistance of earthing switch in 8.2.6 • Modified requirement in 9.3 • Updated fig. A.2.6 • Annex A3: added electric schemes for Ampla and Edesur • Added a note in the 2nd figure of Annex B.2 • Added a sentence at the beginning of Annex B.4 • Added 2 notes in Annex D and the codes GSH3/506..509 (EDELNOR) • Added in 3.1.2. a new law for Spain • Added 9.3.1 Specific requirement for Endesa

Enel Distribuzione			**Endesa Distribución Eléctrica**		
Emission	**Verification**	**Approval**	**Emission**	**Verification**	**Approval**
DIS/IUN/UML	**DIS/IUN/UML**	**DIS/IUN/UML**	**EDE/PyE**	**EDE/PyE**	**EDE/PyE**
A. Dori	**I. Gentilini**	**R. Lama**	**C. Llovich**	**T. González**	**F. Giammanco**
Latam			**Enel Distributie**		
Emission	**Verification**	**Approval**	**Emission**	**Verification**	**Approval**
Tecnica Latam	**Tecnica Latam**	**Tecnica Latam**	**-**	**Birou Standardizare**	**Director Dezvoltare Retea**
M. Garcia **K. Camara**	**M. Del Valle** **W. Sciutto**	**R. Castañeda**	**-**	**V. Obrejan**	**A. Pascu**

INDEX

1 SCOPE

The scope of this document is to provide technical requirements for the supply of HV disconnectors (hereinafter DS) and earthing switches (hereinafter ES) with rated voltage from 72.5 kV to 245 kV in the Enel Group Distribution companies, listed below:

- Ampla (Brazil)
- Chilectra (Chile)
- Codensa (Colombia)
- Coelce (Brazil)
- Edelnor (Perù)
- Edesur (Argentine)
- Endesa Distribución Eléctrica (Spain)
- Enel Distributie Banat (Romania)
- Enel Distributie Dobrogea (Romania)
- Enel Distributie Muntenia (Romania)
- Enel Distribuzione (Italy)

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

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

2 COMPONENTS LIST

The HV DS and, in required, ES are composed by two or three columns per each pole.

Two main typologies are provided:

- Three columns per each pole (double-break)
- Two columns per each pole (centre-break)

The complete list of the equipment with their main characteristics is in Annex D (Common List of HV DS/ESs).

Other types occasionally could be required in special situations. The requirements will be indicated properly and opportunely.

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

3.1.2 Spain

Real Decreto Riesgo Eléctrico 614/2001

Reglamento sobre condiciones técnicas y garantías de seguridad en instalaciones eléctricas de alta tensión, Real Decreto 337/2014.

3.2 Standards

The below listed reference documents shall be intended in the in-force edition at the contract date (amendment 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 62271-1	High voltage switchgear and controlgear. Part 1: Common specifications.
IEC 62271-102	Alternating current disconnectors and earthing switches
IEC 60273	Characteristic of indoor and outdoor post insulators for systems with nominal voltages greater than 1000 V
IEC 62231	Composite station post insulators for substations with a.c. voltages greater than 1 000 V up to 245 kV - Definitions, test methods and acceptance criteria
IEC 60168	Tests on indoor and outdoor post insulators of ceramic material or glass for systems with nominal voltages greater than 1 000 V
IEC 60507	Artificial pollution tests on high-voltage insulators to be used on a.c. systems
IEC/TR 62271-300	High-voltage switchgear and controlgear – Part 300: Seismic qualification of alternating current circuit breakers
IEC/TR 62271-301	High-voltage switchgear and controlgear – Part 301: Dimensional standardization of high-voltage terminals
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/TS 60815-1	Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 1: Definitions, information and general principles
IEC/TS 60815-2	Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 2: Ceramic and glass insulators for a.c. systems
IEC/TS 60815-3	Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 3: Polymer insulators for a.c. systems
IEC 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
ISO 1461	Hot dip galvanized coatings on fabricated iron and steel articles- Specifications and test methods

3.2.2 Specific standards

3.2.2.1 *Latam*

3.2.2.1.a) *Chilectra*

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

3.2.2.1.b) *Edelnor*

E-SE-10 – Especificación Técnica - Acción sísmica en Equipos Eléctricos y Mecánicos

3.2.2.2 *Endesa Distribución Eléctrica*

UNE-EN 60332 Métodos de ensayo para cables eléctricos y cables de fibra óptica sometidos a condiciones de fuego. Parte 1-1: Ensayo de resistencia a la propagación vertical de la llama para un conductor individual aislado o cable.

UNE 50267 Métodos de ensayo comunes para cables sometidos al fuego. Ensayo de los gases desprendidos durante la combustión de materiales procedentes de los cables

3.2.2.3 *Enel Distribuzione*

CEI 20-22/2 – Prove di incendio su cavi elettrici – Parte 2: Prova di non propagazione dell'incendio

LS6016 Specifica Tecnica Enel – Sostegni per sezionatori tripolari 132 – 150 kV

4 SERVICE CONDITIONS

4.1 General service conditions

The reference service conditions are the outdoor normal service conditions of IEC 62271-1 (par. 2.1.2), with the further indications in Annex D.

4.2 Specific service conditions

4.2.1 Colombia

The reference altitude is 2.600 m[1].

4.2.2 Seismic qualification level

Chilectra	ETGI-1020
Codensa	AF3 (IEC/TR 62271-300)
Edelnor	E-SE-010
Enel Distributie	AF5 (IEC/TR 62271-300)
Enel Distribuzione	AF5 (IEC/TR 62271-300)

[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.

5 TECHNICAL CHARACTERISTICS

DISCONNECTOR/EARTHING SWITCH												
Rated voltage Ur (kV)		**72,5**		**123**	**145**				**170**	**245**		
Rated short-time withstand current Ik (kA)		25/31,5	31,5/40	31,5/40	31,5	31,5/40	31,5/40/50	31,5/40/50	31,5	40	40	40
Rated short-duration power-frequency withstand voltage *Ud*	Common value	140		230	275				275	460		
	Across the isolating distance	160		265	315				315	530		
Rated lightning impulse withstand voltage *Up* (kVp)	Common value	325		550	650				650	1050		
	Across the isolating distance	375		630	750				750	1200		
Rated frequency *fr* (Hz)	Chilectra, Edesur, Endesa Distribución, Enel Distributie and Enel Distribuzione	50										
	Ampla, Codensa, Coelce and Edelnor	60										
Opening (closing) time if motor-operated (s)		≤ 15										
Degrees of protection provided by enclosures		IP 54										
Rated supply voltage Ua (Vdc)	Enel Distributie and Enel Distribuzione	110										
	Endesa Distribución Eléctrica, Ampla, Coelce, Chilectra, Codensa, Edelnor	125										
	Edesur	220										
d.c. maximum absorbed power (W)		1000										
Rated supply voltage for anti-condensation circuits (Vac)	Endesa Distribución, Enel Distributie and Enel Distribuzione	230										
	Ampla, Coelce, Chilectra, Edelnor, Edesur	220										
	Codensa	120										
a.c. max absorbed power (VA)	Manual operated DS/ES	50 (only for anti-condensation circuit)										
	Motor operated DS/ES, dc motor (Enel Distribuzione and Latam)	250 (only for anti-condensation circuit)										
	Motor operated DS/ES, ac motor (Endesa Distribución Eléctrica and Enel Distributie)	1750 (400 Vac 3-phase)										
Auxiliary contact classes (table 6 IEC 62271-1)		1										
DISCONNECTOR:												
Rated normal current Ir (A)		1250	2000	1250	800	1250	2000	3150	1250	800	2000	3150
Rated static mechanical terminal load:	Straight load F_{a1} and F_{a2} (N)	400	400	500	600	600	800	1000	600	800	1000	1500
	Cross load F_{b1} and F_{b2} (N)*	130	130	170	200*	200*	250*	330*	200	270*	330*	500*
	Vertical force F_c (N)	500	500	1000	1000	1000	1000	1250	1000	1000	1250	1500
Mechanical endurance class Mr		M1										
Bus-transfer current switching by disconnectors (only if requested)	Rated bus-transfer current for disconnectors (A)	Clause B.4.106.1 of IEC 62271-102										
	Rated bus-transfer voltages for disconnectors (V)	Clause B.4.106.2 of IEC 62271-102										
EARTHING SWITCH:												
Earthing switches class		E0 – M0 – A										

*Edesur 500N

6 CONSTRUCTION CHARACTERISTICS

6.1 General characteristics

The DS/ESs shall be manufactured in accordance with IEC 62271-102.

The manufacturer will provide all tubes, extensions, bearings and the rest of the necessary materials in order to assemble it properly and adapt it to the support standardized by each company.

The driving mechanism of the DS and of the ES will be manual-operated or motor-operated.

The upgrading from manual-operated type to motor-operated type shall be possible by retrofit on site, without need of intervention on power contacts, main regulations or on the movement transmission shafts.

The manual-operation of DS and ES (both for motor-operated and for manual-operated DS/ES) shall be compliant with IEC 60447.

All DSs and ESs shall be equipped with mechanical stops for position limits.

6.2 DS/ES Mechanical interlocking

DS combined with ES as a single unit will have a mechanical interlocking device that prevent the closure of the ES while DS is closed and prevent closure DS while closed ES. Electrical interlockings are described in chapter 7.

The mechanical interlocks shall be designed to withstand, preventing damages and without need of maintenance:

- in case of motor-operation, to the strains produced by the other DS/ES motor starting torque;
- on 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.

6.3 Insulators

The insulators could be requested by Enel Group Distribution companies in ceramic or composite materials.

In case of ceramic insulators, they shall be in brown color and compliant with IEC 60273.

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

6.3.1 Specific requirements for Chile

Chile requires insulator with mechanical classification of type C8 for 145kV and type C10 for 245 kV.

6.3.2 Specific requirements for Endesa

The creepage distance must comply with IEC 60815-2 and IEC 60815-3 part 9.7 with no deviations.

6.4 HV terminals

6.4.1 Latam

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

The terminals shall be rectangular shape with the following dimensions, according to fig. 3 (2x2 hole pattern) or fig. 4 (2x4 hole pattern) of IEC/TR 62271-301:

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

6.4.2 Endesa Distribución

The HV terminals shall be compliant with fig. 1 (Ø 40x125 mm) of IEC/TR 62271-301.

6.4.3 Enel Distributie and Enel Distribuzione

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

The HV terminals shall have Ø 40 ±0,25 X 80 min (mm) (fig. 1 of IEC/TR 62271-301) dimensions.

6.5 Grounding

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

Inside the Control Box an internal collector (in tin-plated or nickel-plated copper, section ≥ 60 mm2 and with M5 regular interval threaded hole) shall be present for the grounding connection of all cable shields; the manufacturer shall guarantee its effective connection to the DS+ES grounding system.

6.5.1 Specific requirements for Latam

For Brazil is required a clamp grounding connector for range 70-120 mm2 on each base plate and operating mechanism. The connector material shall be copper Alloy (maximum 5% Zinc).

6.6 Control and Operating device Box(es)

The control box and the drive mechanisms with its control devices shall be included in one or two cabinets.

In addition to the IP requirement of table at chapter 5, the box protection degree with open doors shall be minimum IP2X.

The entrance of all cables shall be from the Control Box bottom side, where a removable loophole (in aluminum, with useful dimension of 150x100 mm) shall be provided.

A proper anti-condensation system shall be provided in order to prevent humidity damages and to ensure a proper air replacement.

The anti-condensation circuit, controlled by a thermostat with fixed regulation at 25 °C (box internal temperature), shall be unique for the overall equipment, supplied in a.c. (see table in chapter 5 for the supply rated voltage) and protected with a magneto-thermic automatic circuit breaker.

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

In parallel connection case, the manufacturer shall assure a correct fault detection and distance anomaly signaling in case of failure of an element, properly evaluating the tolerances of the supply voltage and of the components resistance.

The box interior shall be accessible from the front by mean of a door provided of handle and lock, hinged and equipped with an anti-wind system. It shall be possible to open the door over 90°.

In case of motor-operated DS/ES all accessories (hand-crank, document pocket etc.) shall be accommodated in the internal part of the box door. In case of manual-operated DS/ES is admitted to locate the hand-crank/swing lever outside the box.

All electric equipments components shall be:

- compliant with the respective IEC standards;
- equipped with an identification label indicating the codification used in the functional electric schemes;
- easily accessible for maintenance or substitution operations.

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

The box internal wiring shall be performed with conductors with adequate section (always ≥ 1mm2), flexible type, compliant with IEC 60332-3-24 and insulated at Uo/U = 450/750 V.

The cable ends shall be provided of pre-insulated compression type terminals, suitable for the clamps where they have to be connected.

In case of motor-operated DS/ES, the Control Box(es) shall include:

- remote/local selector switch (and/or relay);
- control buttons, with the following colors:

Operation	**Chilectra, Codensa, Edelnor, Edesur, Endesa Distribución Eléctrica, Enel Distributie and Enel Distribuzione** (according with IEC 60073)	**Ampla, Coelce** (according with NR10)
Closing	White	White "L" on Red white background
Opening	Black	White "D" on Green white background

- magneto-thermic automatic circuit breakers for the supplies protection (motors, lighting lamp, anti-condensation circuits – fuses are not admitted);
- interface terminal board for substation control system;
- internal lighting lamp (incandescent type are not admitted), with automatic switching in case of open door.

The grounding of a dc supply polarity is not admitted.

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

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

The cable trunks close to the interface terminal boards shall be used for the control system wiring and cannot be used for the internal wiring.

In addition to the dimensions shown in Annex B, 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 hand-crank/swing lever connection point shall be at ≤1000 mm respect to the ground.

The main contacts position auxiliary contacts can be located in the control box or, in alternative, in a separated external box, providing a proper anti-condensation resistance.

6.6.1 Enel Distribuzione specific requirements

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

In case of "S/P" relay presence, a white lamp to indicate its activation (Lamp on in case of "P" status) shall be located in the DS Control Box.

6.6.2 Endesa Distribución specific requirements

The insulation material may be thermostable (Z) corresponding to the cable harmonized H07Z-K, or thermoplastic (Z1) for the 07Z1-K Cable and comply with the following requirements:

- Test for resistance to flame propagation conductors individual, according to UNE-EN 60332-1-1:2005
- Testing of no fire propagation according to UNE-EN 60332-3-23:2009, category C
- Testing of the gases evolved during combustion: No emission of halogen gases (UNE EN 50267-1) and the weighted value of conductivity is not exceed 10 µS/mm (UNE EN 50267-2)
- Test for determining the cable smoke density, according to standard UNE 50267 Parts 1 and 2, the level of light transmittance will be higher than 60%. The color of insulation is light gray except for earthing protection circuits which will be green-yellow color.

6.6.3 Latam specific requirements

The internal wiring must be of flexible copper with an operating temperature of 90°C.

All conductors must arrive at terminal blocks and must have indelible marks indicating the place of Origin / Destination. Only one conductor will be accepted per terminal.

The terminals shall be stackable, suitable for placing its corresponding identification numbers.

The manufacturer must provide a minimum of 20% of reserve terminal blocks for the Client's use.

The piping inside the cabinets must be run using plastic cable trays. The conductors shall be grouped and attached by means of non-metallic fasteners, suitable for protecting its insulation and support the weight of the cables.

On the lower face of the control box , the connection of 2" diameter ducts must be allowed for low-voltage circuits cables

All the wiring external to the control box must be protected against mechanical damage with rigid or flexible metal conduits.

6.7 Protective treatments

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

All iron parts (e.g. support, Control Box, bolts etc.) shall be in non-corrosive material or hot dip galvanized in compliance with ISO 1461. All processing shall be completed before the protective treatments.

Protective treatments alternative to the hot dip galvanization could be accepted if the manufacturer prove its fitness.

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

6.8 Dimensional characteristics

Specific dimensional requirements are shown in Annex B.

6.9 Support

The support is an optional supply.

6.9.1 Enel Distribuzione specific requirements

If requested, the DS/ES support shall be compliant with LS6016.

The Control Box and Operating device Box(es) support, on the contrary, is a mandatory supply always included in the DS/ES supply.

6.10 Nameplates

The nameplates shall be in stainless steel. Alternative materials can be considered if the manufacturer proves the marking endurance respect to the ageing (this solution shall be approved by Enel Distribution companies).

Par. 5.10 of IEC 62271-102 apply, specifying that both DS/ES nameplate and control box nameplates shall include:

- the optional values;
- the Enel Group type code (see Common List) and the local components codification.

For traceability purpose, in the internal part of the driving mechanism (if any) door shall be located a self-adhesive nameplate with the following information:

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

6.10.1 Latam specific requirements

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

7 FUNCTIONAL CHARACTERISTICS

7.1 Common requirements

7.1.1 General characteristics

The drive mechanism of the disconnectors and the earthing switchs (if any), must guarantee the simultaneous operation of the poles.

The drive mechanism shall operate on a highly reliable transmission system, in order to avoid any interruptions.

The turns number for a complete manual operation shall not exceed 50.

Centre-break DSs shall have the 2 movable contacts moving in the same direction.

7.1.2 Motor-operated disconnectors and earthing switches

The DSs and ESs operation shall be performed by tripolar motor-drive mechanisms with the possibility of emergency manual operation in case of necessity. It will consist of a gear motor (see table in chapter 5 for the supply rated voltage) which will transmit its movement to the drive shaft of the disconnector. The same for the earthing switch.

The motor circuit will be protected by a motor protector for short-circuits and overloads.

DS and ES shall be each one provided of the following circuits:

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

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

The ongoing operations shall be completed even in case of opposite operation request.

The operation requests persistence after the operation conclusion shall not produce effects.

In case of a DS/ES operation is not completed, any previously received operation requests shall not remain stored. In case of motor supply outage during a DS/ES operation, the drive mechanism shall ensure:

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

The operations shall not be carried out if the request signal duration is shorter than 3 ms.

The hand-crank for manual operation shall be withdrawable type; its insertion shall disable the electric operations, both local and remote.

Further characteristics are specified in local specific requirements.

7.1.3 Manual-operated disconnectors and earthing switches

The characteristics are specified in local specific requirements.

7.1.4 Electric schemes, controls and signalizations

The electric schemes shall:

a) be represented in the reference conventional conditions:

a.1) DS/ES (if any) in open position;

a.2) DBST not inserted (only for Enel Distribuzione);

a.3) DEC not energized (only for Enel Distribuzione);

a.4) absence of a.c. and d.c. auxiliary supplies;

a.5) remote/local selector switch in remote position (or relay, only for Enel Distribuzione);

a.6) in case of micro-switches with the state dependent on the opening/closing of the boxes/carters of operating devices, they shall be represented disable (that is with boxes/carters open).

b) contain the functional scheme, all information useful to identify the single wires and cables, the equipments wiring schemes (auxiliary contacts, relays etc.), the topographic schemes for interconnections between boxes, the topographic schemes about all the electric components in Control box/Operating device box(es), the anti-mistake coding.

The principle electric schemes of the different DS/ES typologies are represented in Annex A, including the interface terminal board for substation control system and the auxiliary signalling contacts characteristics.

7.2 Endesa and Enel Distributie functional characteristics

7.2.1 Disconnectors

The manual drive mechanism will have a signalling box with 6 closing contacts and 6 opening contacts, potential free.

7.2.2 Earthing switch

The drive mechanism of the earthing switches (if any) will be manual-operated or motor-operated.

Characteristics of the motor-operated drive mechanism are defined in section 7.1.2.

The manual-operated drive mechanism will have a signalling box with 4 closing contacts and 4 opening contacts, potential free, whose characteristics are defined in section 6.6 of this Standard.

7.2.3 Motor-operated disconnectors and earthing switches

All electric equipments components shall be compliant with the respective IEC standards.

All disconnectors and earthing switches shall be equipped with mechanical stops for position limits. Moreover it shall be possible to lock them at operation limits by mean of padlocks with Ø = 10 mm pin.

The set of auxiliary contacts designed for the control of the switchings typical of the DS/ES and the sets of additional auxiliary contacts will be actuated by the actuation mechanism.

The electric diagram appears in Annex A.

7.3 Enel Distribuzione functional characteristics

7.3.1 DS/ESs applications

Application descriptions of the different DS/ES typologies and the relative reference electric schemes are listed in the following table:

Type Code (see Annex D)	Enel Distribuzione codification (see Annex D)	Application description	Reference electric schemes (see Annex A.2)
GSH003/001	156110	Line DS+ES motor-operated	Fig. A.2.1 + Fig. A.2.6
GSH003/002	156111	Line DS+ES manual-operated	Fig. A.2.2 + Fig. A.2.6
GSH003/003	156112	Busbar DS (line bay) manual-operated	Fig. A.2.3
GSH003/004	156113	Busbar DS (transformer bay) manual-operated	Fig. A.2.4
GSH003/005	156114	Conjoint busbar DS manual-operated	Fig. A.2.5

7.3.2 Motor-operated DS and ES

7.3.2.1 *Control circuits of motor-operated DS and ES*

DS local controls (motor or manual) shall be enabled by consensus ("Prova") coming from line bay Circuit Breakers, working on the "S/P" relay (servizio/prova), located in its control box.

Usually the remote controls are enabled and the local controls are inhibited; with the "Prova" consensus it's the opposite.

Earthing switch local controls (motor or manual) shall be subject to the remote/local switch ("Servizio/Prova") located in its control box.

7.3.2.2 *Blocking devices/circuits of motor-operated DS and ES*

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

Closing block

The closing operation block (motor and manual) shall work when occurring at least one of the following conditions:

a) DS
   - Circuit Breaker closed
   - ES closed

b) ES
   - DS closed
   - line voltage presence

Opening block

The opening operation block (motor and manual) shall work when occurring at least one of the following conditions:

a) DS
   - Circuit Breaker closed

c) ES
   - line voltage presence
   - DBST inserted

7.3.2.3 *Manual operation of motor-operated DS and ES*

The manual emergency operation shall be enabled by a Consensus Electromagnetic Device (DEC – "Dispositivo Elettromagnetico di Consenso") (three if ES is present, one for DS, one for ES and

one for DBST); with this device the hand-crank insertion is enabled pressing a button[2] and in presence of external consensus "Prova" and of all requested conditions (see electric schemes).

The DEC shall be immune to possible malfunctions due to the residual magnetism.

The DEC status (energized/de-energized) shall be clearly visible.

With the hand-crank insertion an anomaly remote signalization (SNM) shall be sent.

7.3.2.4 *ES blocking device (DBST)*

The motor-operated ES shall be provided of a device for the earthing switch locking (DBST - "Dispositivo Elettromeccanico di Blocco Sezionatore di Terra"), subject to the ES remote/local switch ("Servizio/Prova") located in its control box.

All requirements of clauses 7.1.2 and 7.3.2.3 are entirely applicable to the DBST ("SNM" signalization becomes "DBST NM").

The DBST operation (motor or manual) shall be subjected to the ES in closed position; its insertion shall operate mechanically (operating directly on the mechanical transmission system) and electrically on the ES, avoiding its opening (motor or manual) and interrupting the motor supply.

The DBST operating device shall be preferably located in the ES operating device box.

The DBST insertion/exclusion circuits shall be electrically interlocked between them.

The access to internal part of DBST shall inhibit operations and shall generate a remote signal ("Blocco Violato").

The inserted/not inserted DBST signalizations ("DBST INSERITO", "DBST DISINSERITO") shall be provided by mechanically independent auxiliary contacts, directly actuated by extreme position limits of the lock unit.

7.3.3 Manual-operated DS and ES

7.3.3.1 *Control circuits of manual-operated DS and ES*

DS manual operation shall be enabled by consensus ("Prova") coming from the correspondent bay Circuit Breakers (line bay or transformer bay), working on the "S/P" relay (servizio/prova), located in its control box. This consensus is not present for Conjoint busbar DS.

7.3.3.2 *Blocking devices/circuits of manual-operated DS and ES*

The manual-operation block (opening/closing) shall work when occurring the following conditions:

a) Line DS+ES manual-operated:

a1) DS
- Circuit Breaker closed
- ES closed

a2) ES
- DS closed
- Line voltage presence

b) Busbar DS (line bay) "189SB(L)":
- Circuit Breaker closed

c) Busbar DS (transformer bay) "189TR":
- It shall be realized a key interlock between the DS "189 TR" and the earthing switch on the MV side of the HV/MV transformers "89 T TR", in order to make impossible the DS "189 TR" closing with the MV side earthing switch "89 T TR" closed, and viceversa.

[2] Different designs with the same functional results can be evaluated by Enel.

This function shall be realized with an electromagnetic device enabling rotation and extraction of a key, to which is combined another key enabling closing of the MV side earthing switch "89 T TR".
The device, with its button activated, is energized with DS "189 TR" open in presence of "Prova" external consensus coming from transformer bay Circuit Breaker.

d) Conjoint busbar DS "189SB":

- the operation shall be enabled only if all Circuit Breakers of one of the 2 semi-busbars are open (absence of energy flowing between the two HV semi-busbars).

7.3.3.3 *Manual operation of manual-operated DS and ES*

The manual operation shall be enabled by a Consensus Electromagnetic Device (DEC) (two if ES is present, one for DS and one for ES); with this device the hand-crank insertion (or the swing lever operation) is enabled pressing a button[3] and in presence of all requested conditions (see electric schemes). In case of swing lever operation the DEC blocking system shall be designed to withstand 3 times the maximum force required for manual operation (5.105 of 62271-102).

The DEC shall be immune to possible malfunctions due to the residual magnetism.

The DEC status (energized/de-energized) shall be clearly visible.

If closing or opening operation is not fully completed an anomaly remote signalization (MNC – "Manovra Non Completata") shall be sent.

Moreover, with the hand-crank insertion an anomaly remote signalization shall be sent using MNC signalization (not represented in the electric scheme, because not necessary in case of swing lever with an operation enabling).

7.3.4 Controls and signalizations

The contacts referred to the following controls and signalizations shall be reported in the terminal board, when they are necessary:

a) drive circuit of shunt closing release control (CH, for DS and ES)
b) drive circuit of shunt opening release control (AP, for DS and ES)
c) drive circuit of DBST insertion control (INS)
d) drive circuit of DBST de-insertion control (DIS)
e) consensus "P" (Prova) to local operations
f) remote/local selector switch in local (P) position (43SP-Prova)
g) intervention of motor protection device and/or auxiliary supply missing (42RT)
h) motor maximum operation time (BX)
i) not-maneuverable DS (SNM, only in case of motor-operated, for DS and ES)
j) not completed manual operation (MNC) (only in case of manual-operated, for DS and ES)
k) close position (ccX189, for DS and ES)
l) open position (caX189, for DS and ES)
m) anti-condensation circuit anomaly (AnR189)
n) consensus from on-site switchgears CBs (152), DS and ES (189).

Further specific control circuits, using signals from secondary terminals of on-site Inductive or Capacitive Voltage Transformers (see electric diagrams), elaborate absence of voltage on HV line (and status ON/OFF of relative low voltage protection CBs) to enable the ES closing:

a) voltage presence (27ON)

[3] Different designs with the same functional results can be evaluated by Enel.

b) voltage absence (27OFF)

c) voltage presence anomaly (An PRES TENS)

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

a) 3P+N circuit-breaker for protection of secondary VT circuits:

Ue = 400 V ac; In = 3A; Electromagnetic over current release - short circuit current setting: 12 A ("B-type"); Icu ≥ 25 kA;

b) K27A/L, K27B/L and K27ATL relays:

Rated voltage = 100 V AC.

7.4 Latam functional characteristics

7.4.1 Operating mechanisms. General characteristics

For 3-column disconnectors, the rotation blades opening will be clockwise direction (seen from above).

7.4.2 Motor-operated and manual-operated disconnectors and earthing switches

It shall be possible to lock them at operation limits by mean of padlocks with Ø = 10 mm pin, operating from ground level, even in presence of high voltage.

In case the motor-operated, the manual emergency operation shall be enabled by a Consensus Electromagnetic Device (DEC) (two if ES is present, one for DS and one for ES); with this device the handcrank insertion is enabled pressing a button[4] and in presence of all requested conditions. With the handcrank insertion an anomaly remote signalization (SNM) shall be sent.

A switch shall be to permit the selection of operation mode to 3 positions: "local, locked, remote" with auxiliary contacts that indicate the position. In the position, "local," the electric remote control shall be inoperable. In the position, "remote," the local electric control shall be inoperable. In the position, "locked," local and remote electric operations must be blocked.

In the case of motor-operated, must include an operations meter for the disconnector.

The set of control contacts designed for the control of the switchings typical of the disconnector and the sets of additional auxiliary contacts will be actuated by the actuation mechanism.

The DS and ES, both manual and motorized, shall have auxiliary contacts for remote indication of their position. Microcontact auxiliary schemes inserted in the electronic cards will not be accepted.

The DS and ES shall have a running switch limit to indicate the open or closed position of the blades. These must allow an adjustment of ± 10°.

For manual-operated, the contacts shall be included in a metal box appropriate for outdoor. In all cases, the auxiliary contacts shall be operated directly by the disconnector's drive shaft.

The quantities of auxiliary contacts: normally open (NO) and normally close (NC) are indicated in the following table for DS and ES:

[4] Different designs with the same functional results can be evaluated.

Company	72,5 [kV]		145 [kV]		245 [kV]	
	DS	ES	DS	ES	DS	ES
Ampla	6NO/6NC	4NO/4NC	6NO/6NC	4NO/4NC	-	
Chilectra	-		6NO/6NC	4NO/4NC	6NO/6NC	4NO/4NC
Codensa	-		6NO/6NC	4NO/4NC	6NO/6NC	4NO/4NC
Coelce	6NO/6NC	4NO/4NC	-		-	
Edelnor	8NO/8NC	4NO/4NC	-		8NO/8NC	4NO/4NC
Edesur	-		10NO/10NC	6NO/6NC	10NA/10NC	6NA/6NC

Further requirements are specified in next paragraphs and in the electric scheme in Annex A.

8 TESTING

8.1 General information

The tests will be performed according to Standards IEC 62271-1 and IEC 62271-102.

The tests to be performed on DS/ESs are divided in:

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

8.2 Type tests

8.2.1 Visual inspection

The DS/ES, 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.

8.2.2 Dielectric tests

(IEC 62271-102 par. 6.2)

8.2.3 Radio interference voltage (r.i.v.) tests

(IEC 62271-102 par. 6.3)

Not applicable for 72,5 kV DS/ES.

8.2.4 Measurement of the resistance of the main circuit

(IEC 62271-102 par. 6.4)

8.2.5 Temperature-rise tests

(IEC 62271-102 par. 6.5)

8.2.6 Short-time withstand current and peak withstand current tests

(IEC 62271-102 par. 6.6)

8.2.7 Verification of the degree of protection

(IEC 62271-102 par. 6.7)

8.2.8 Electromagnetic compatibility (EMC) tests

(IEC 62271-102 par. 6.9)

8.2.9 Additional tests on auxiliary and control circuits

(IEC 62271-1 par. 6.10)

For this verification the manufacturer shall provide a paper copy of the DS/ES electric schemes.

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

The absorption curves of the motors, taking note of the maximum values (inrush excluded), shall be registered in the following situations:

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

8.2.10 Operating and mechanical endurance tests

(IEC 62271-102 par. 6.102)

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

8.2.11 Operation under severe ice conditions

(IEC 62271-102 par. 6.103)

This test is mandatory in case of ice coating higher than 1 mm.

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

8.2.12 Operation at the temperature limits.

(IEC 62271-102 par. 6.104)

This test is mandatory.

8.2.13 Bus-transfer current switching tests

(IEC 62271-102 par. 6.106)

Tests is mandatory only for Disconnectors for which this characteristic is requested (see Annex D).

8.2.14 Induced current switching tests

(IEC 62271-102 par. 6.107)

This test is mandatory.

8.2.15 Seismic qualification

If requested, DS/ES (including the support) shall be compliant with seismic qualification, according with standards listed in 4.2.2.

8.2.16 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.

8.2.17 Tests on insulators

The ceramic insulators shall be tested in accordance with IEC 60168 and IEC 60507.

The composite insulators shall be tested in accordance with IEC 62231.

8.3 Routine Tests

The Routine tests (also called acceptance tests) shall be made in the manufacturer's factory on each apparatus supplied, to ensure the product compliance with the sample approved during the conformity

assessment (homologation, certification etc.) process and on which the type tests have been performed.

In principle it's acceptable to limit the mounting for testing to subassemblies consisting in the single poles fully mounted. Only for the first routine tests of each new contract, the first motor-operated DS/ES and the first manual-operated DS/ES shall be fully assembled in factory in order to perform all routine tests, mechanical operating tests included.

If for a DS/ES the erection and commissioning tests assistance are requested to be performed by the manufacturer, the fully assembling in factory is not required even if it's the first sample; in this case the fully assembling in factory is postponed to the first sample for which the manufacturer's erection and commissioning tests assistance is not requested.

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

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

8.3.1 Dielectric test on the main circuit

(IEC 62271-102 par. 7.1)

Accordingly with 7.1 of 62271-1 the test is fulfilled with the test in 8.3.4.

8.3.2 Tests on auxiliary and control circuits

(IEC 62271-102 par. 7.2)

To be performed if auxiliary and control circuits are present.

The possibility to perform this test without connecting the Control Box(es) to the power kinematic chain shall be approved during conformity assessment process, considering the specific manufacturer design (fully functional tests will be performed on the completely assembled DS/ES on site).

Functional tests (par. 7.2.2 of IEC 62271-1) shall be done only at rated voltage.

Dielectric tests (par. 7.2.4 of IEC 62271-1) shall be done applying 1 kV for 1 s.

Electronic devices, motors etc. can be excluded by dielectric test only if agreed during the conformity assessment (homologation, certification etc.) process.

8.3.3 Measurement of the resistance of the main circuit

(IEC 62271-102 par. 7.3)

The ambient temperature influence can be neglected.

8.3.4 Design and visual checks

(IEC 62271-102 par. 7.5)

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

8.3.5 Mechanical operating tests

(IEC 62271-102 par. 7.101)

8.3.6 Protective treatments

The thickness of the protective coatings shall be verified according with 8.2.16.

8.4 Commissioning tests

The manufacturer shall indicate in the manual the checks and tests to be done after the erection (see 10.2.5 of 62271-1), consisting at least in:

a) Visual check;
b) Tests on auxiliary and control circuits (if any);
c) Measurement of the resistance of the main circuit (after mechanical operating tests);

d) Mechanical operating tests.

In case of erection and commissioning tests performed by Enel group personnel, if any problem occurs or any commissioning test has negative result, the manufacturer shall intervene in field to verify and solve the problem.

9 SUPPLY REQUIREMENTS

9.1 Tender's technical documentation

For each DS/ES typology offered in the tender the supplier shall provide the Annex C properly filled.

9.2 Conformity assessment

9.2.1 Conformity assessment process

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

9.2.2 Conformity assessment documentation

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

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

The Type A documentation shall consist at least in:

1) Type A documents list;
2) Type B documents list;
3) Annex C properly filled;
4) Overall dimensions drawing;
5) Insulators drawings and characteristics;
6) Electric diagram (see 7.1.4-b), low voltage components list included;
7) Control Box (if any) layout drawings;
8) Overall DS/ES and Control Box (with open/closed doors) pictures;
9) Nameplate and labels drawings;
10) DS/ES installation, use and maintenance handbook/manual;
11) Routine and commissioning tests:
    a) Test report form (two documents, one for factory tests and one for on-site tests);
    b) Reference values table (with tolerances);
    c) Protective coatings (typology, minimum thickness, reference standards);
12) List of documentation, materials and accessories supplied;
13) Main sub-components suppliers list;
14) Only for Enel Distribuzione, Manufacturing and Control Plan (PFC).

9.3 Packaging, transport, storage and installation/testing

Par. 10.1 and 10.2 of IEC 62271-102 applies.

In order to limit the on-site mounting operations the DS/ES shall be transported in subassemblies consisting in the single poles fully mounted (this requirement is not mandatory for 245 kV DSs).

DS/ESs' package shall be suitable to guarantee:

- the protection during transport (including by ship, if necessary);

- an elevation from the ground at least of 100 mm;
- the external storage for at least three months.

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

1) manufacturer name;
2) manufacturing year/month;
3) manufacturer designation type;
4) manufacturer serial number;
5) Enel component codification (i.e.: GSH003/1 - XXXXX);
6) contract number;
7) destination substation;
8) total weight;
9) lifting information (showing the points and the correct method of lifting);
10) only for Enel Distribuzione, the bar code, in accordance with PVR006.

With each DS/ES the following items shall be supplied in the local language of destination (items from 4 to 8 on paper):

1) the support structure (only if requested) with its anchor bolts to the civil works (stainless or hot dip galvanized steel, chemical or expansion type);
2) bolts to assembly the DS/ES poles to support structure;
3) hand-crank or swing lever and Control Box(es) support with its anchor bolts to the civil works;
4) list of documentation, materials and accessories supplied;
5) overall dimensions drawing;
6) electric diagram;
7) DS/ES installation, use and maintenance handbook/manual;
8) routine and commissioning tests:
   a) routine (factory) test reports;
   b) reference values table (with tolerances);
9) one CD-Rom containing the whole type A documentation (pdf file format).

If on-site assembly is performed by the manufacturer, waste (including packaging) shall be disposed by him.

9.3.1 Specific requirement for Endesa

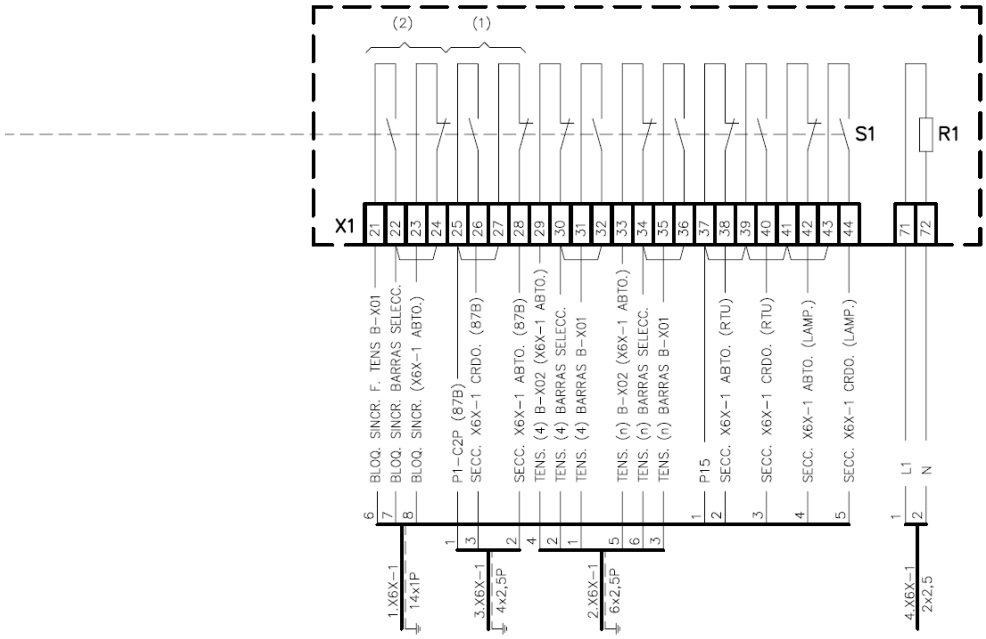
The manufacturer must present the declaration of conformity in compliance with ITC-RAT 03 of the “Reglamento sobre condiciones técnicas y garantías de seguridad en instalaciones eléctricas de alta tensión, Real Decreto 337/2014.”

ANNEX A – ELECTRICAL SCHEMES

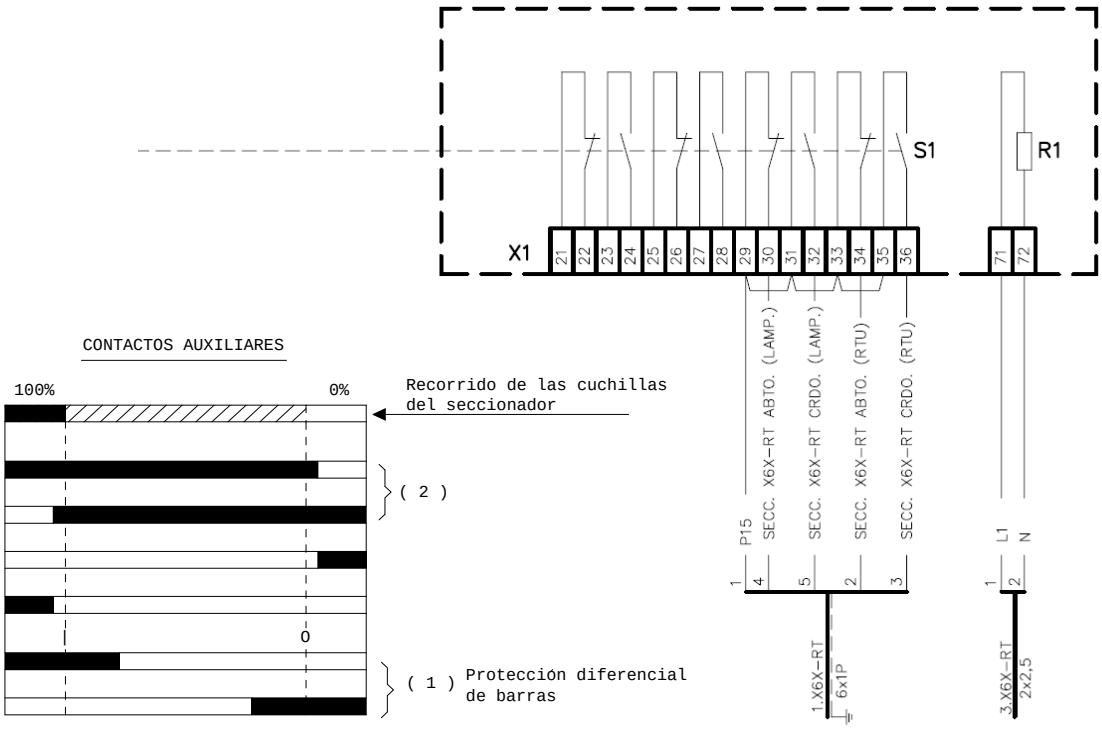
A.1 – ENDESA AND ENEL DISTRIBUTIE ELECTRICAL SCHEMES

FINAL TERMINAL STRIP MANUAL DRIVING DEVICE (Applicable to ENDESA)

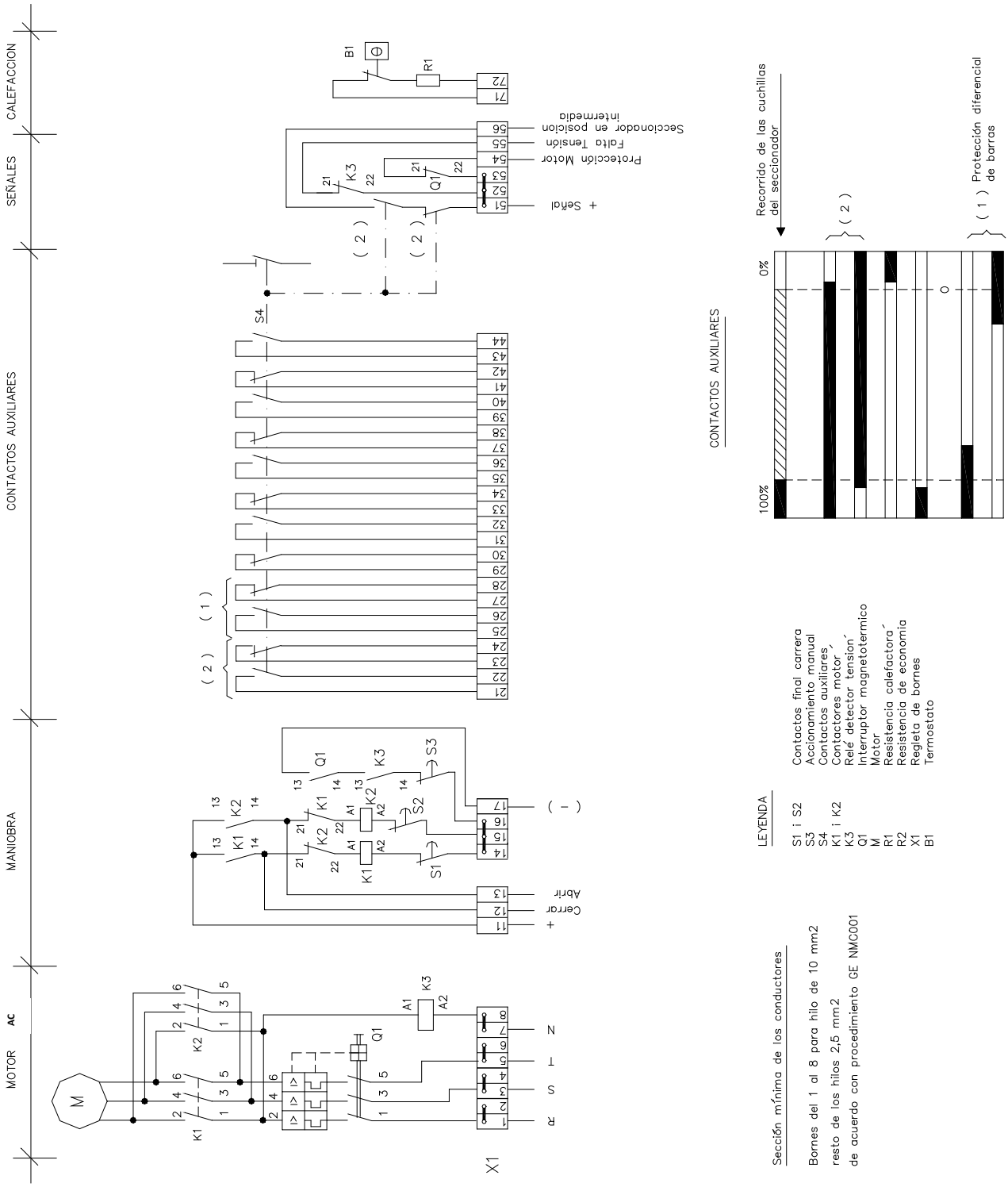
CAJA CONTACTOS AUXILIARES SECCIONADOR (CUCHILLAS PRINCIPALES)



CAJA CONTACTOS AUXILIARES SECCIONADOR (CUCHILLAS DE PUESTA A TIERRA)



SCHEME AND FINAL TERMINAL STRIP ELECTRIC DRIVING DEVICE (Applicable to ENDESA and ENEL DISTRIBUTIE)



A.2 – ENEL DISTRIBUZIONE ELECTRICAL SCHEMES

Fig. A.2.1 (motor-operated line DS+ES electrical scheme pag. 1/2)

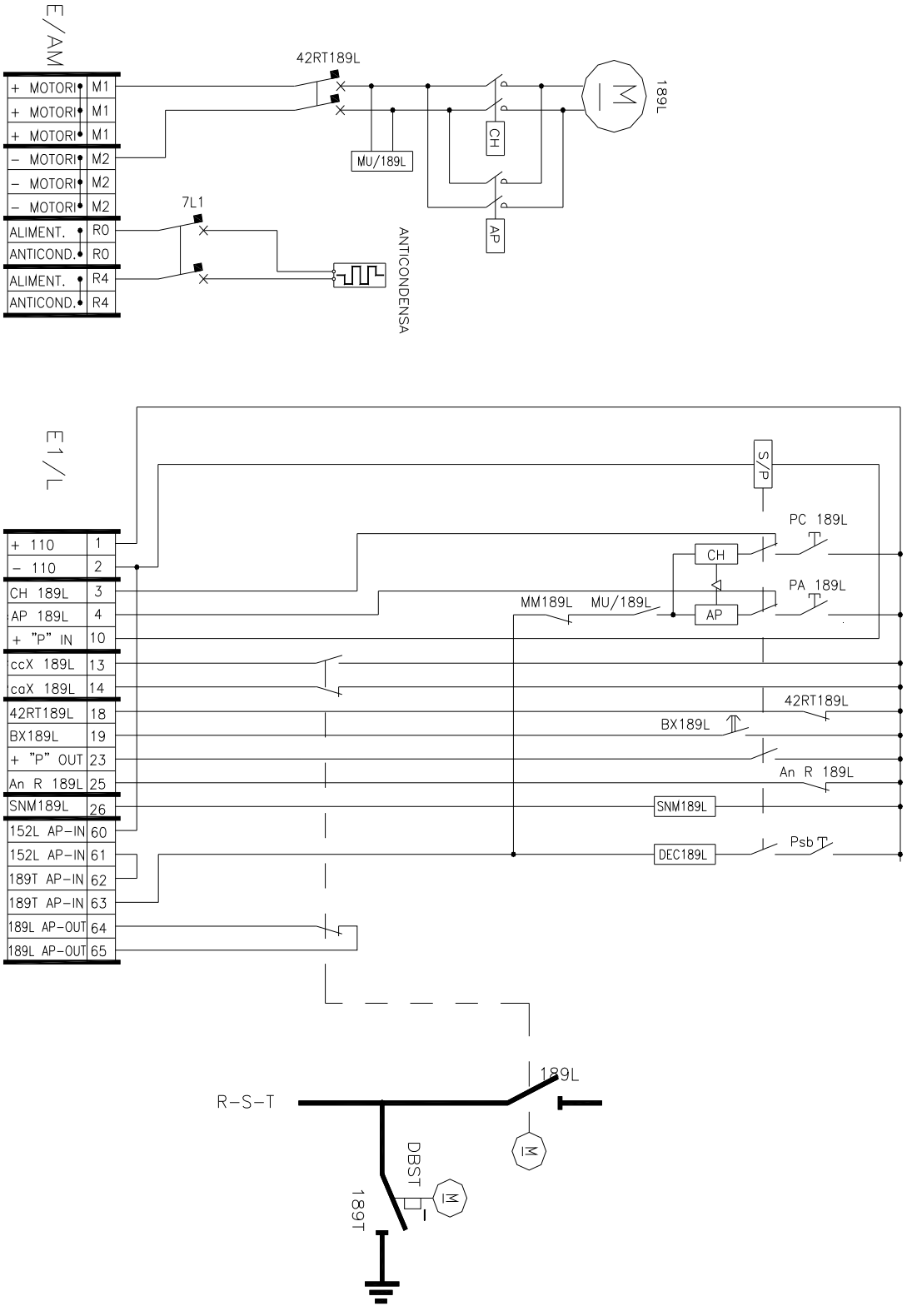


Fig. A.2.1 (motor-operated line DS+ES electrical scheme pag. 2/2)

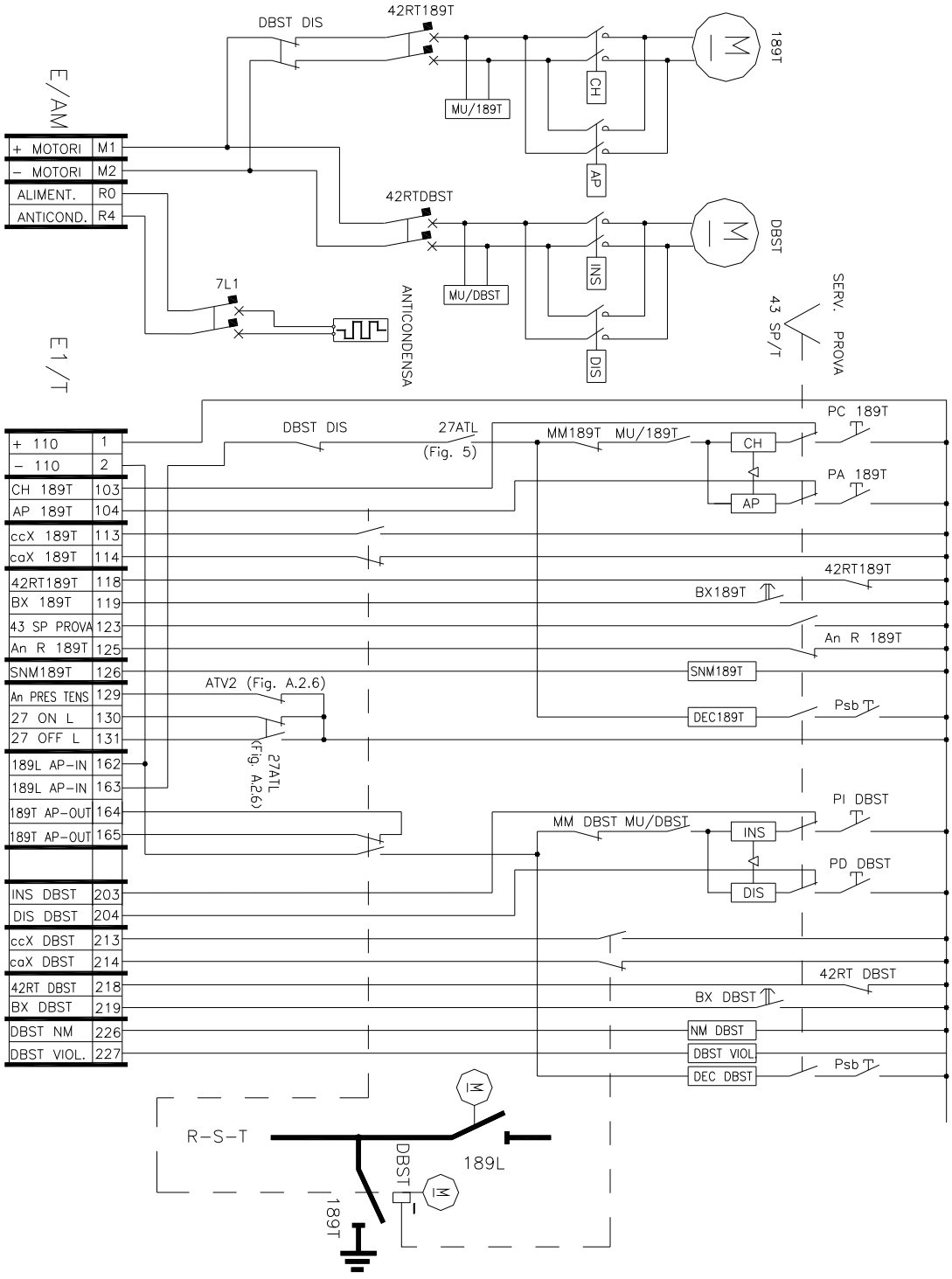


Fig. A.2.2 (manual-operated line DS+ES electrical scheme pag. 1/2)

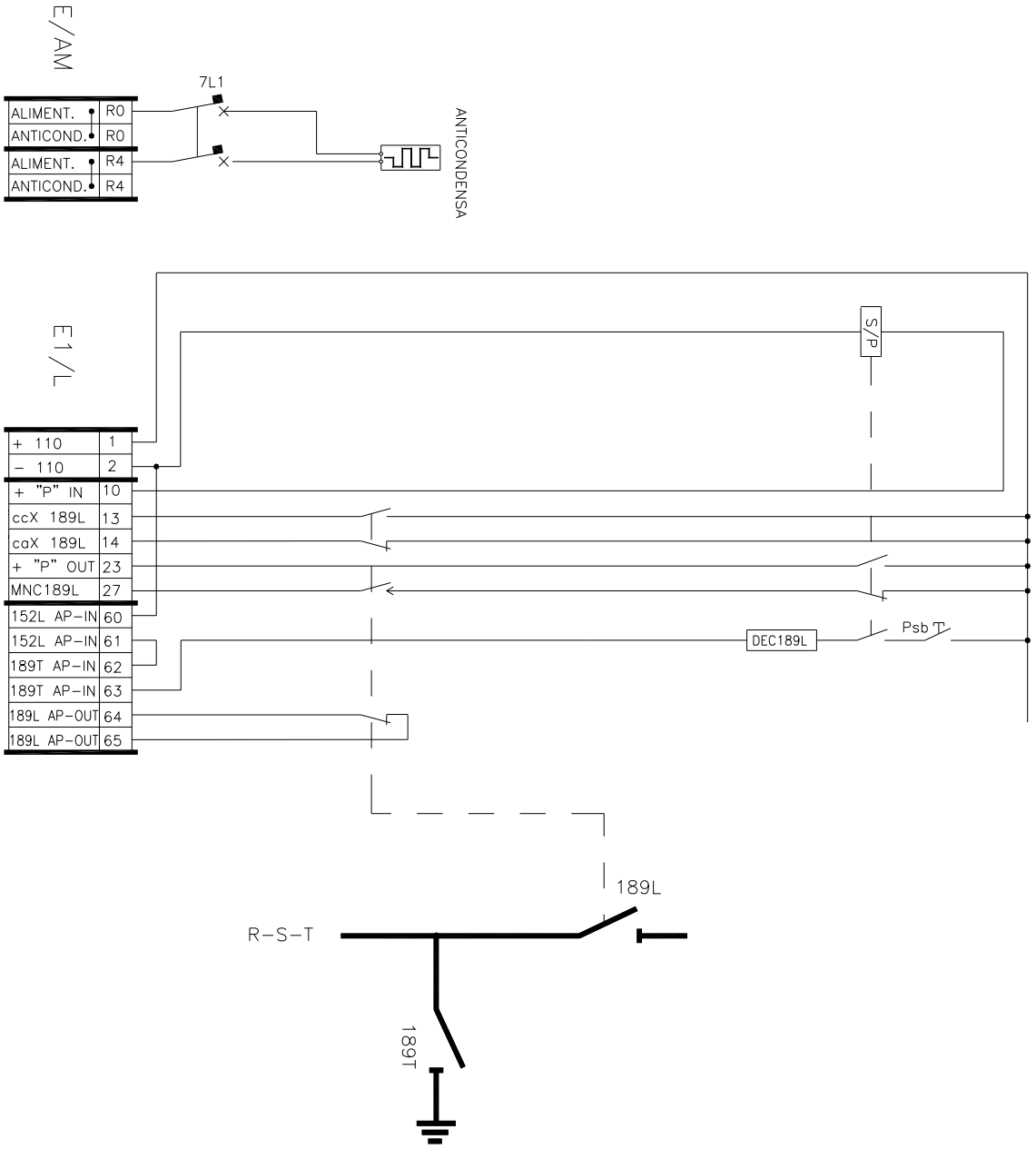


Fig. A.2.2 (manual-operated line DS+ES electrical scheme pag. 2/2)

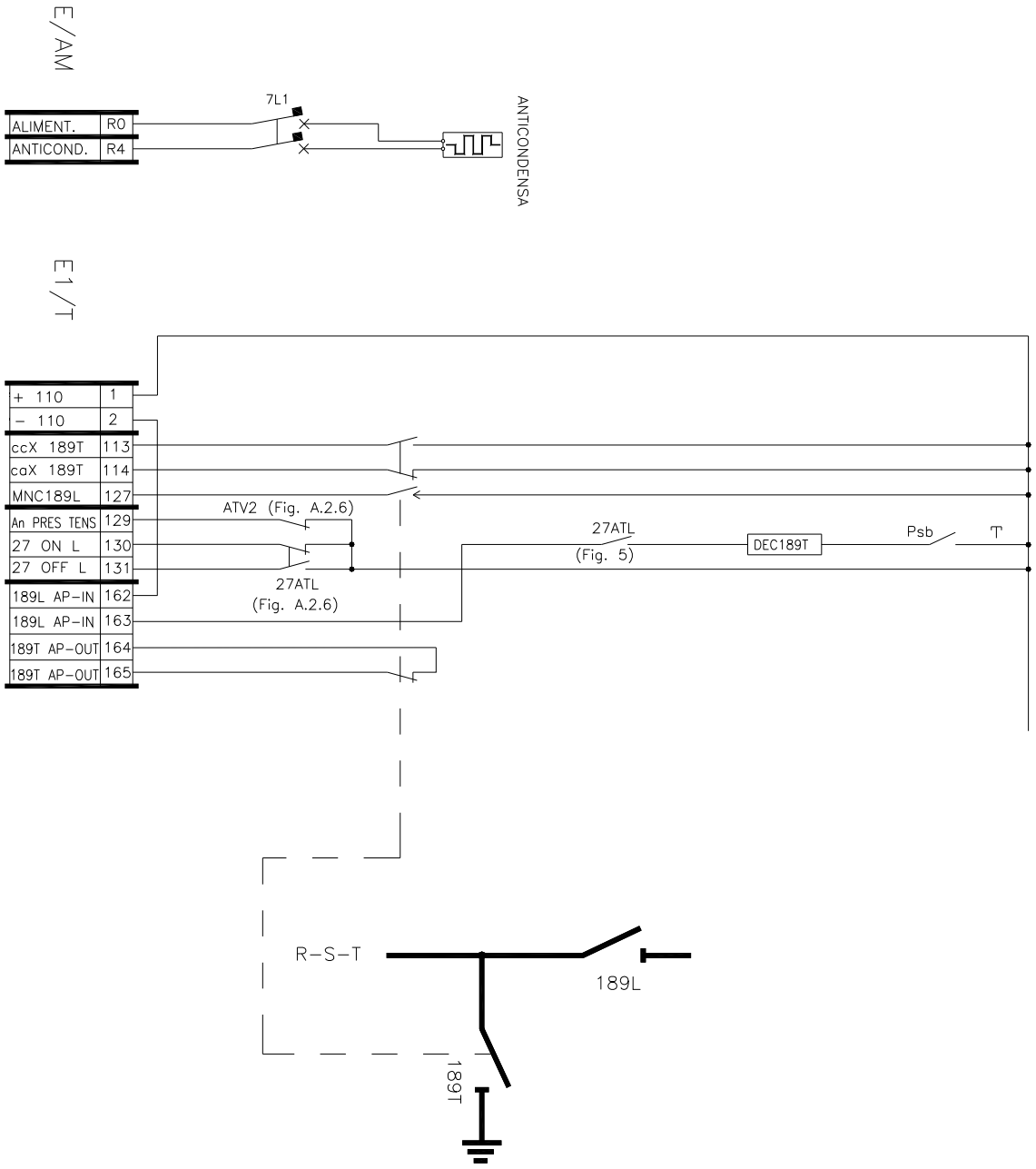


Fig. A.2.3 (manual-operated Busbar DS (line bay) electrical scheme)

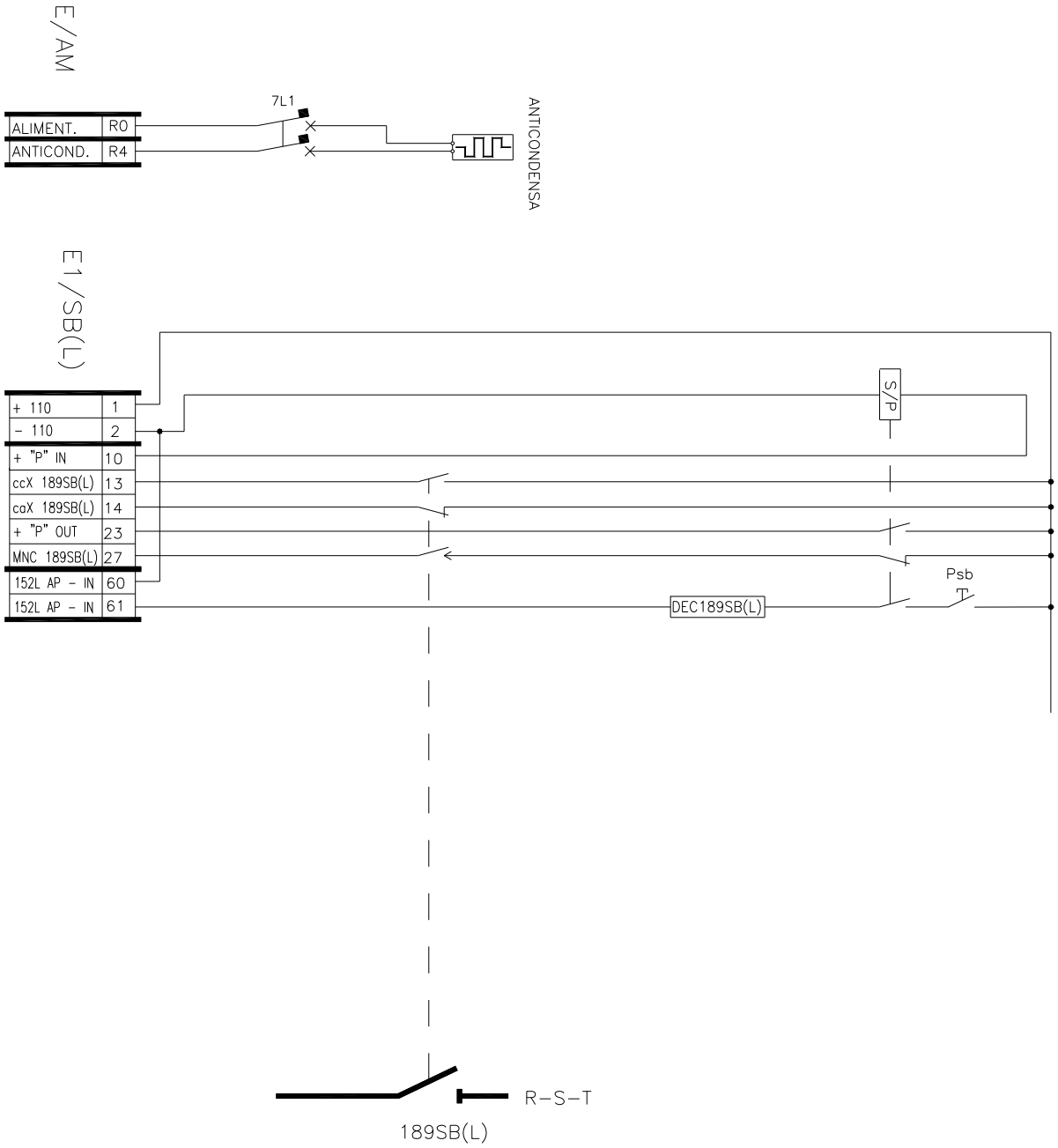


Fig. A.2.4 (manual-operated Busbar DS (transformer bay) electrical scheme)

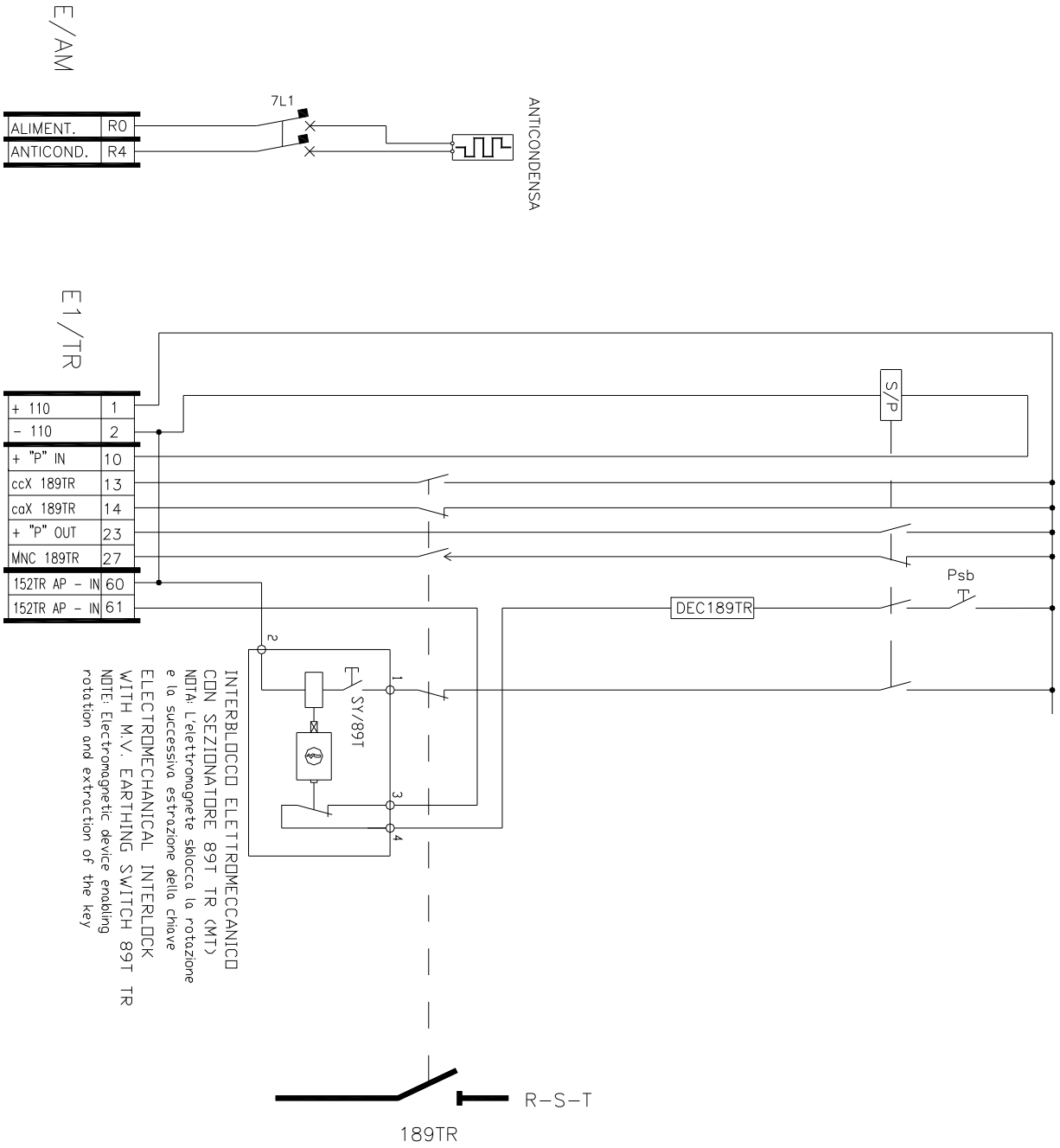


Fig. A.2.5 (manual-operated Conjont busbar DS electrical scheme)

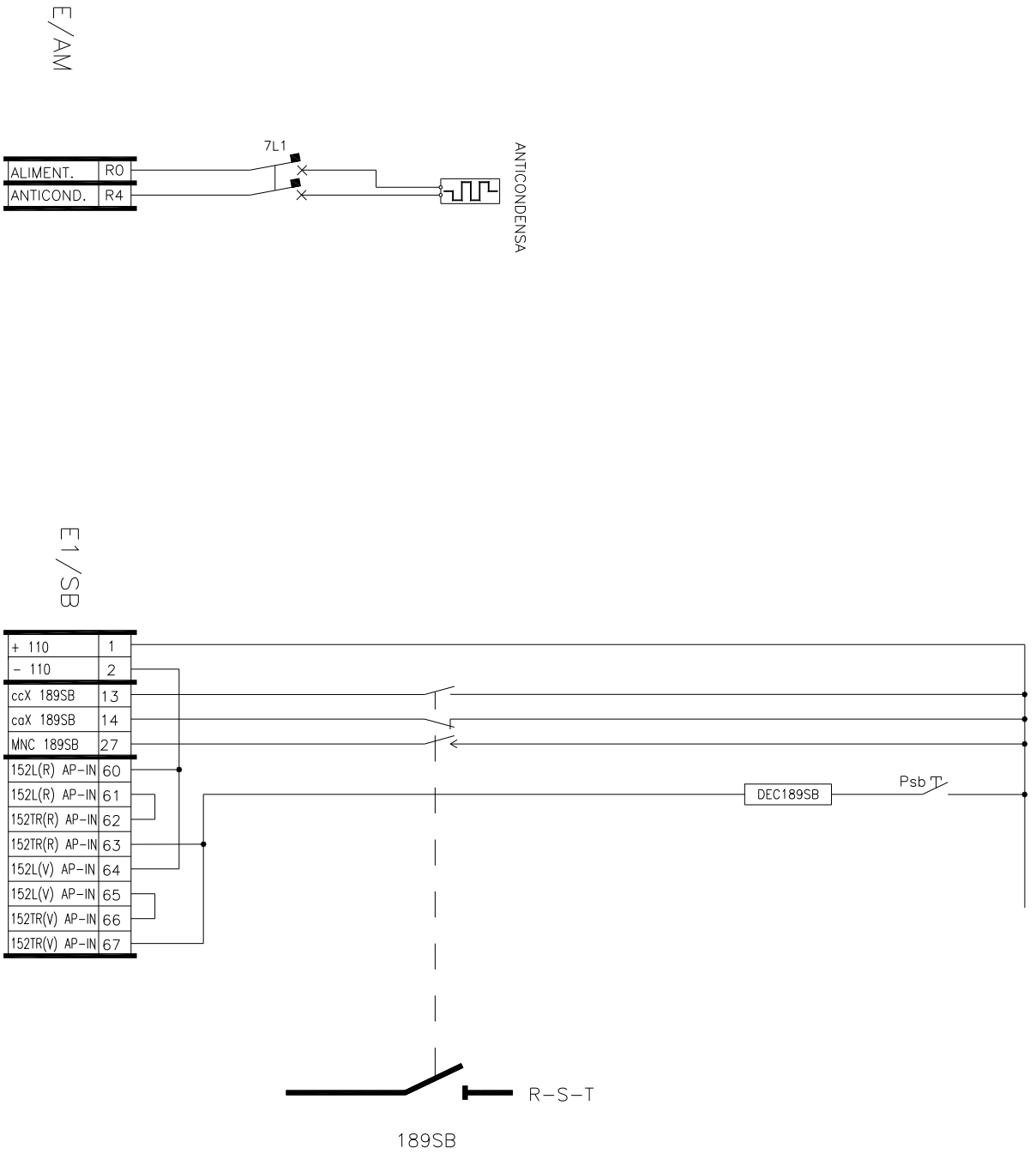
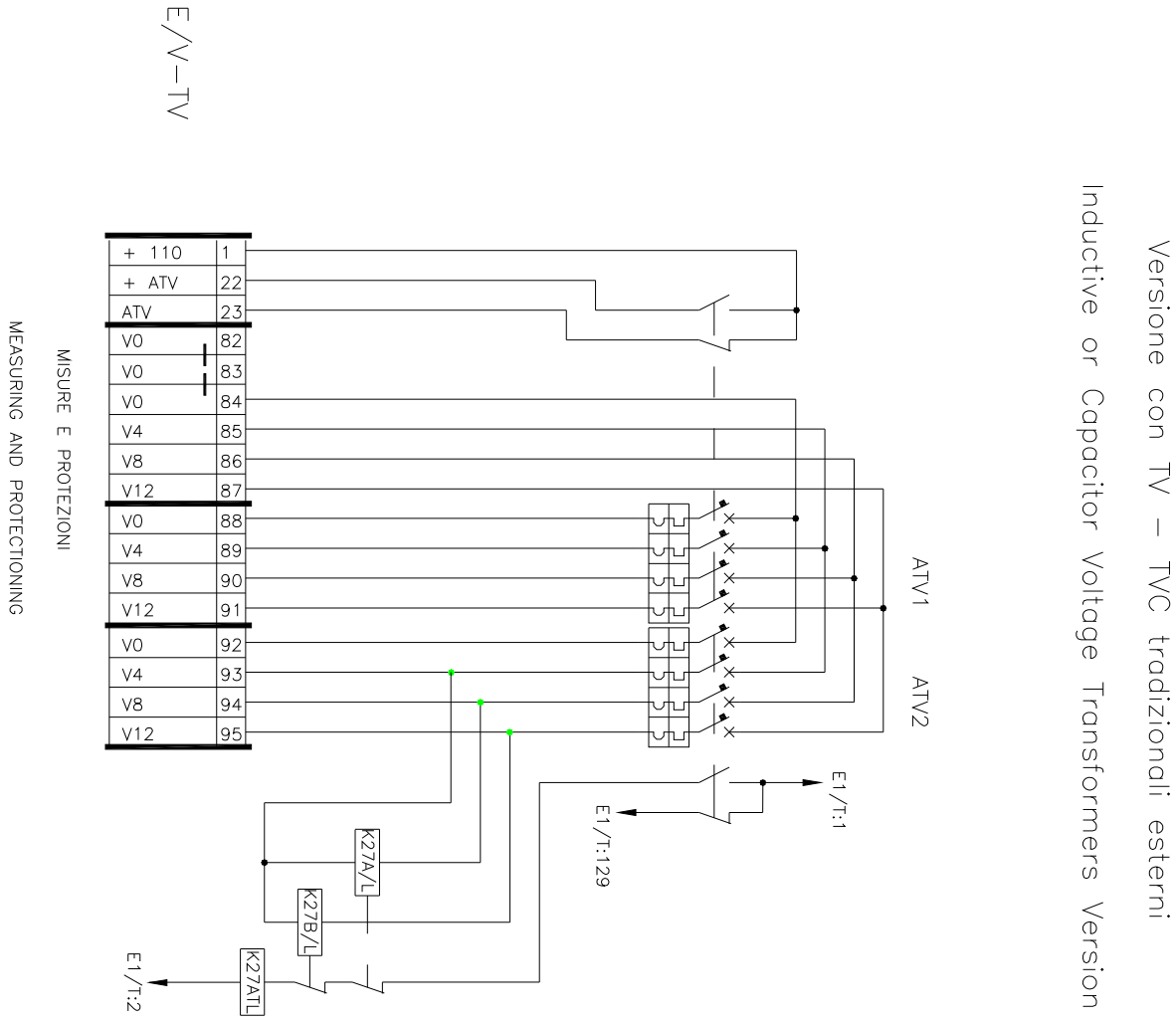
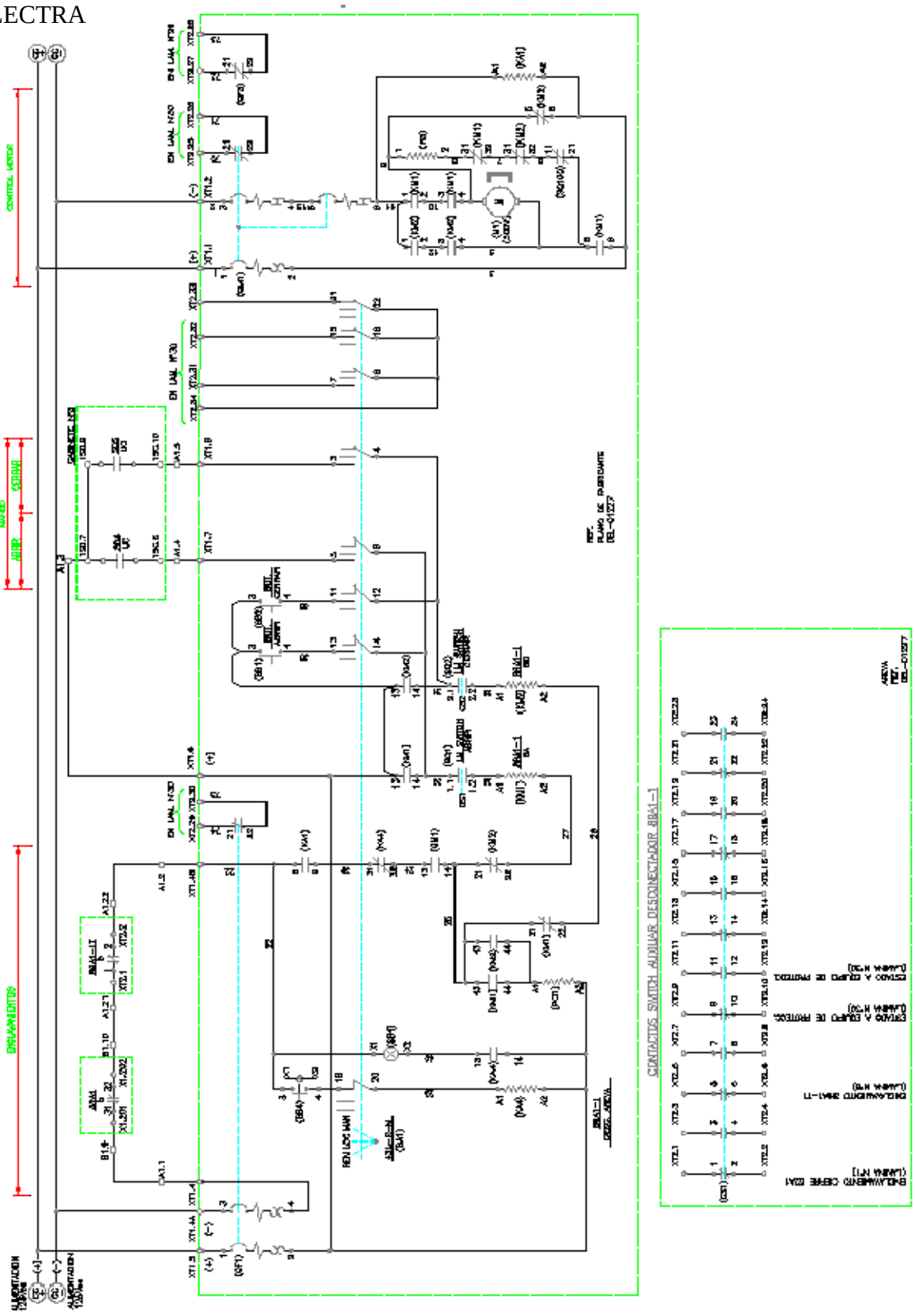


Fig. A.2.6 (VTs connection)

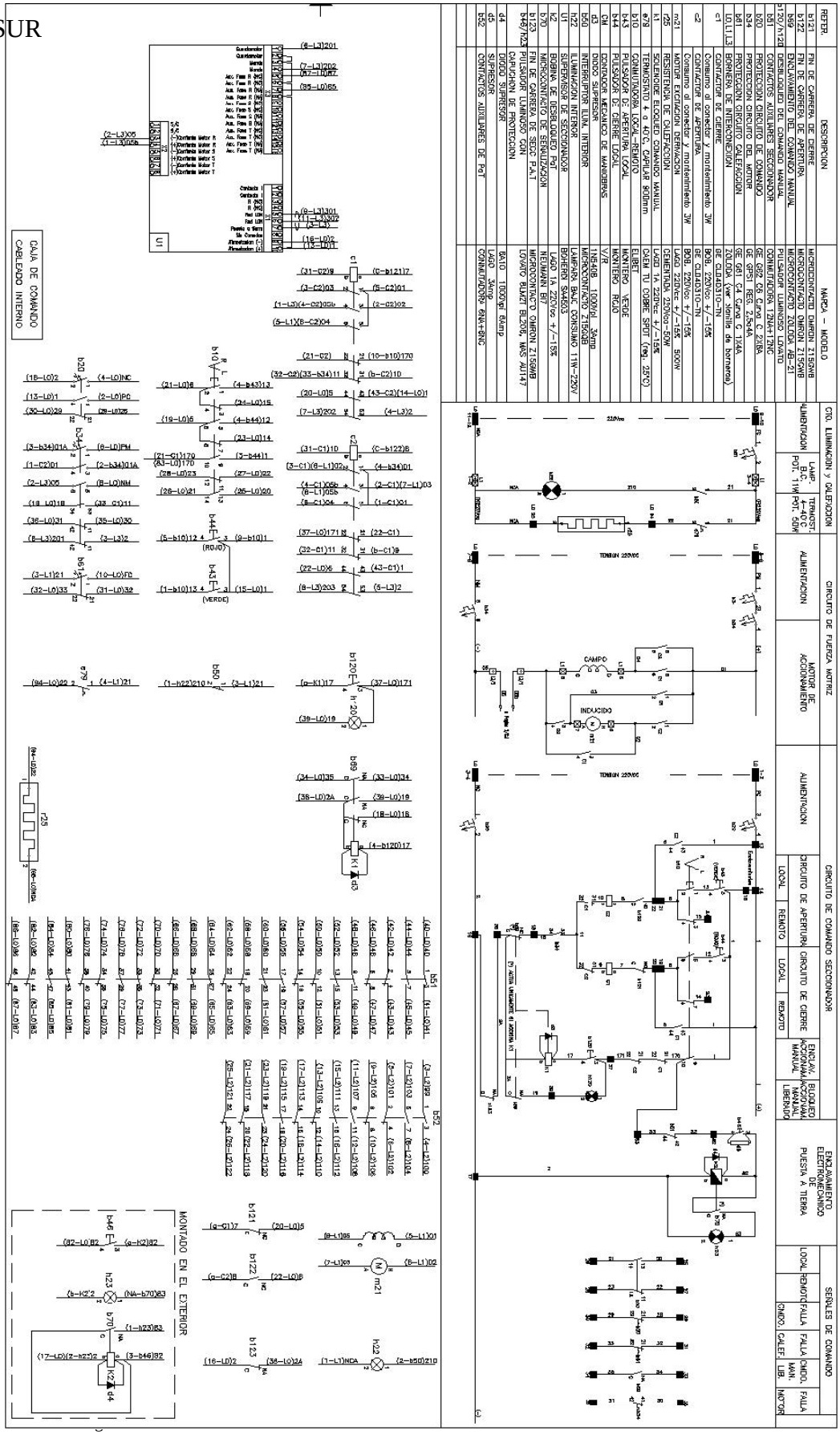


A.3 – LATAM ELECTRICAL SCHEMES

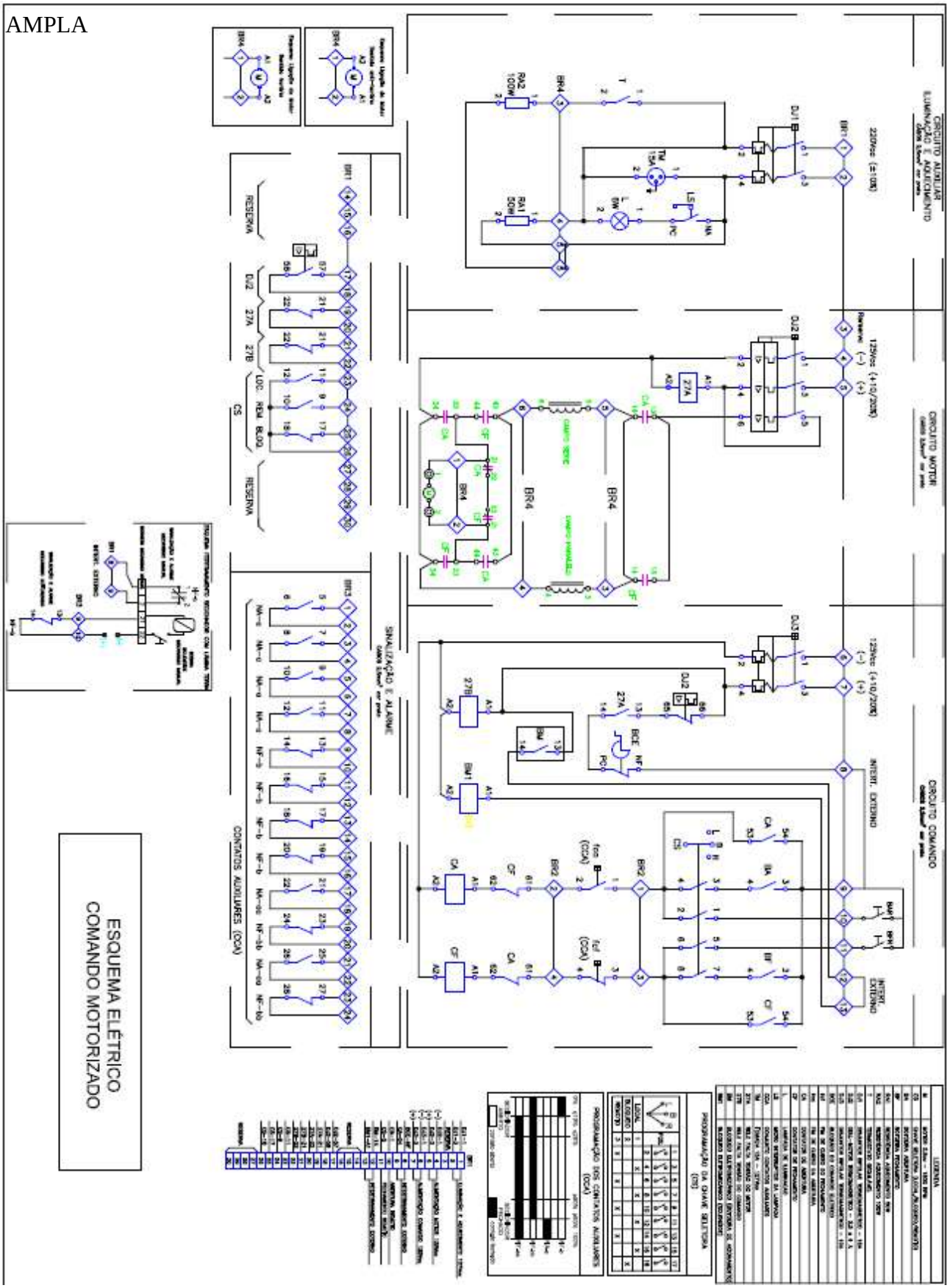
CHILECTRA



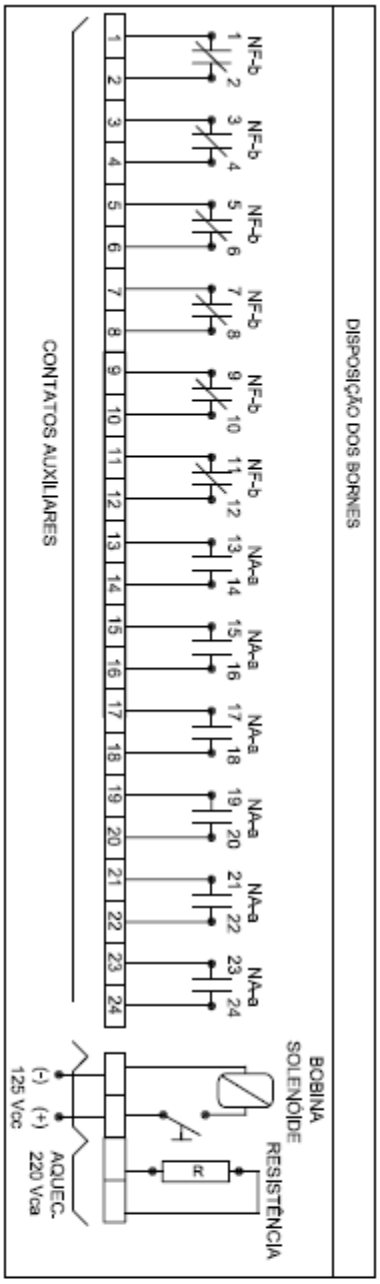
EDESUR

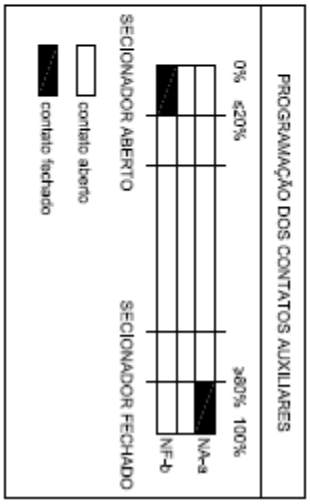

CAJA DE COMANDO
CABLEADO INTERNO
MONTADO EN EL EXTERIOR
CIRCUITO DE FUERZA MOTRIZ
CIRCUITO DE COMANDO SECCIONADOR
SEÑALES DE COMANDO
CTO. LUMINACION y CALEFACCION
CIRCUITO DE APERTURA
CIRCUITO DE CIERRE
ENCLAV. ACCIONAMIENTO MANUAL
BLOQUEO ACCIONAMIENTO MANUAL
ENCLAVAMIENTO ELECTROMECANICO DE PUESTA A TIERRA
ALIMENTACION
MOTOR DE ACCIONAMIENTO
TENSION 220VCC
CAMPO
INDUCIDO
LOCAL
REMOTO
FALLA
MOTOR

AMPLA



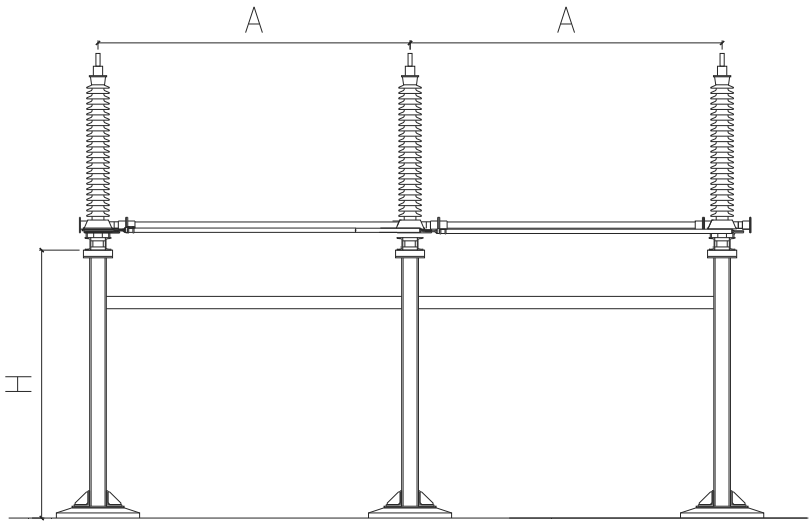
CONTATOS AUXILIARES-COMANDO MANUAL





ANNEX B – DIMENSIONAL DRAWINGS

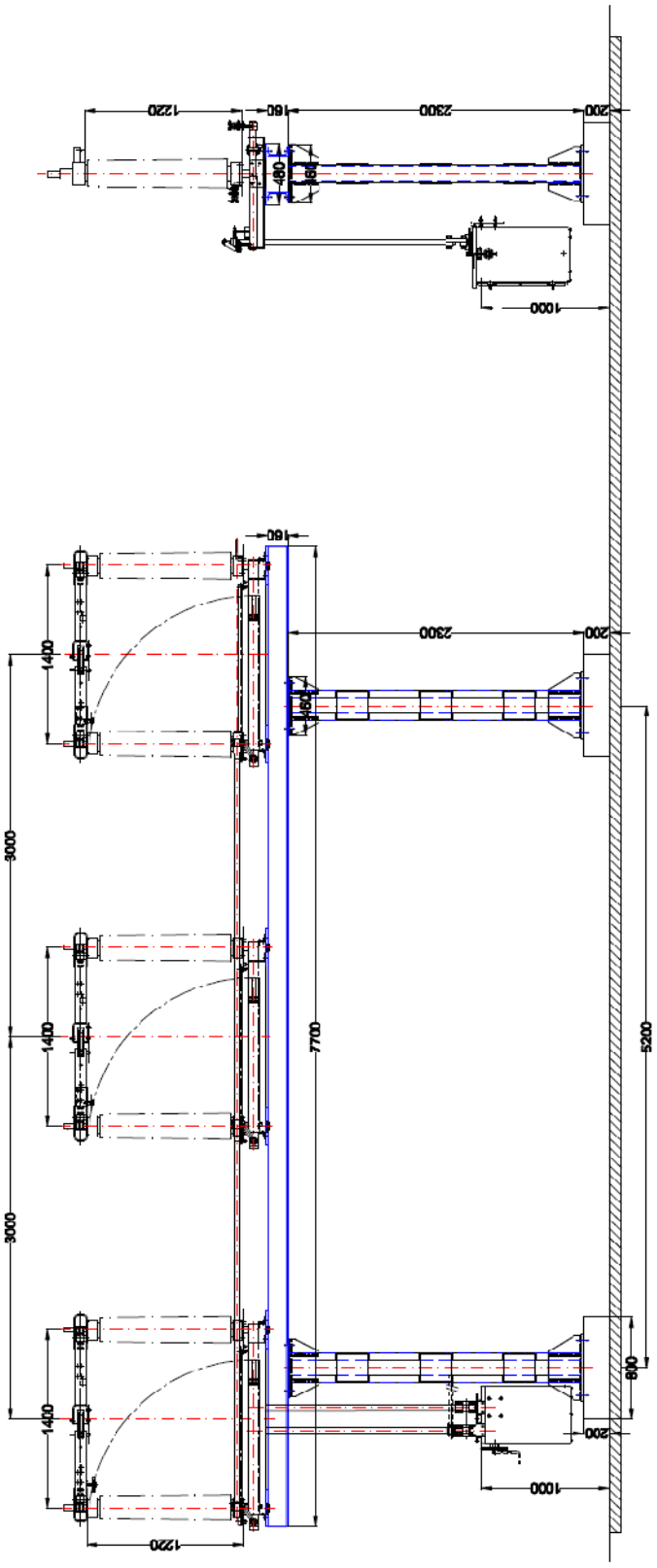
B.1 – ENDESA DIMENSIONAL DRAWING



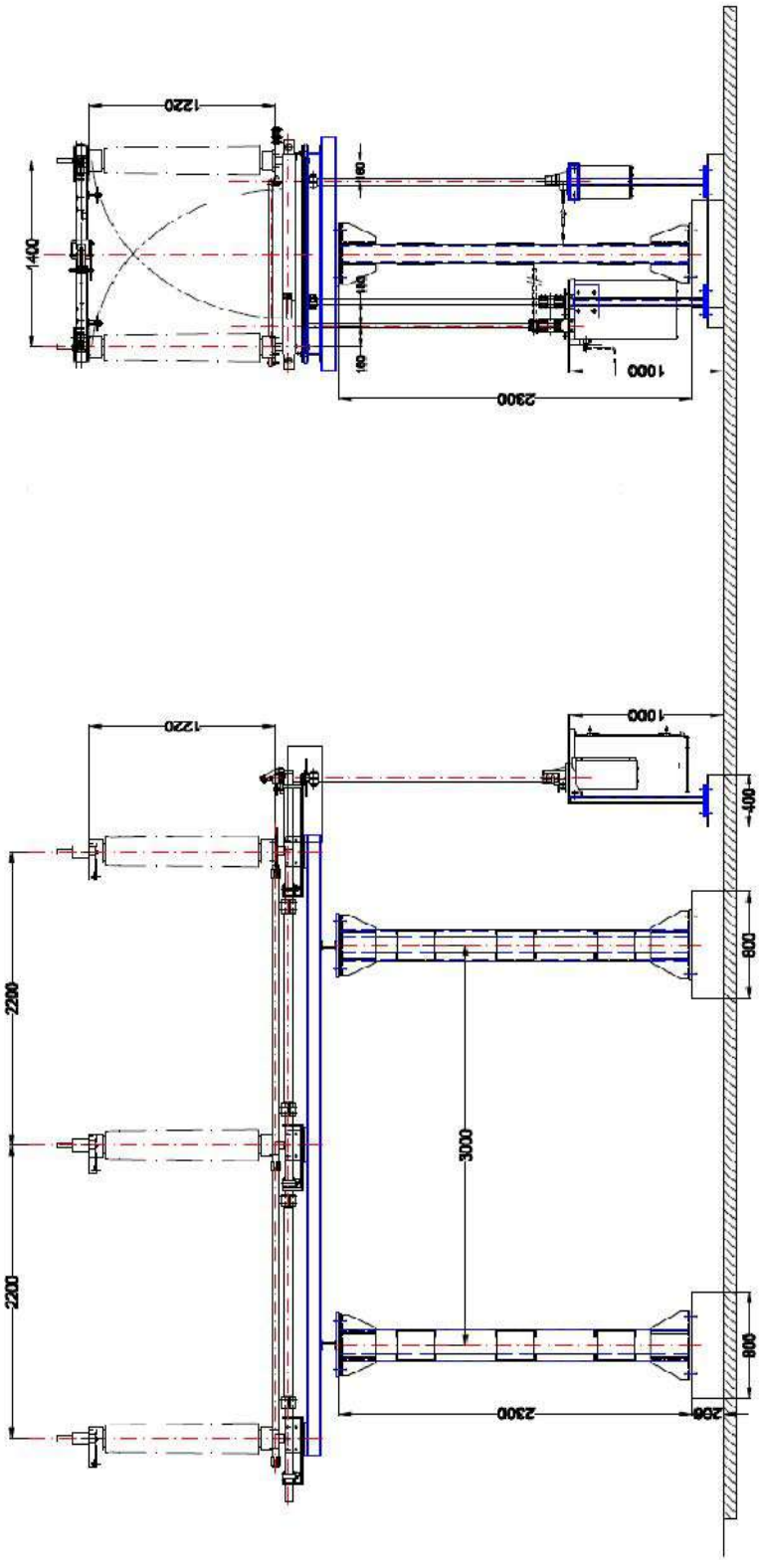
Dimensions (mm)	72 kV	145 kV
H	2600	2600
A	1500	3000

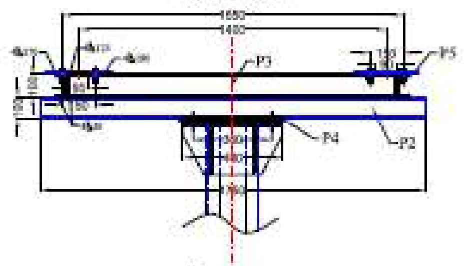
B.2 – ENEL DISTRIBUTIE DIMENSIONAL DRAWINGS

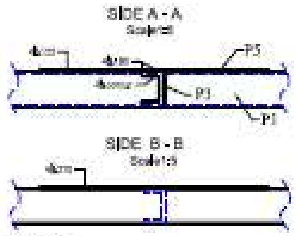
HORIZONTAL IN LINE TYPE (support in the second page)



HORIZONTAL PARALLEL TYPE (support in the second page)

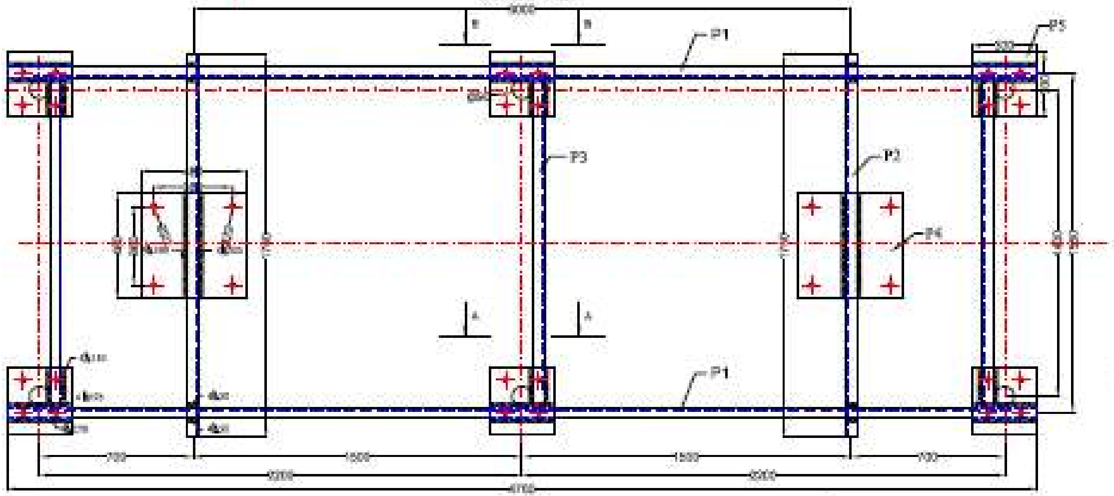




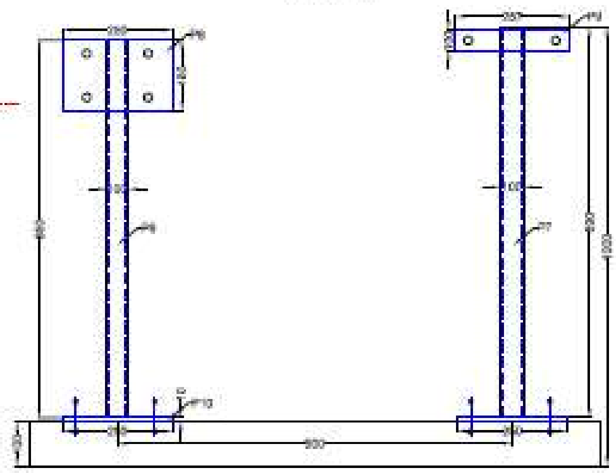


Note:
The racking is designed to be performed entirely of common OL 52-2K steel.
– This rack requires protective painting in common urban, rural and industrial areas.
In polluted industrial areas or in continuous moisture conditions of the exposed surfaces and areas specifically for the chemical industry, it is recommended that when choosing the protective materials to consult specialized companies.
– Welds shall be performed only by certified welders. For cross head steels basic coated electrodes shall be used.

SCALE 1:20



METALLIC ACTUATOR
separator assembly parallel
SCALE 1:10

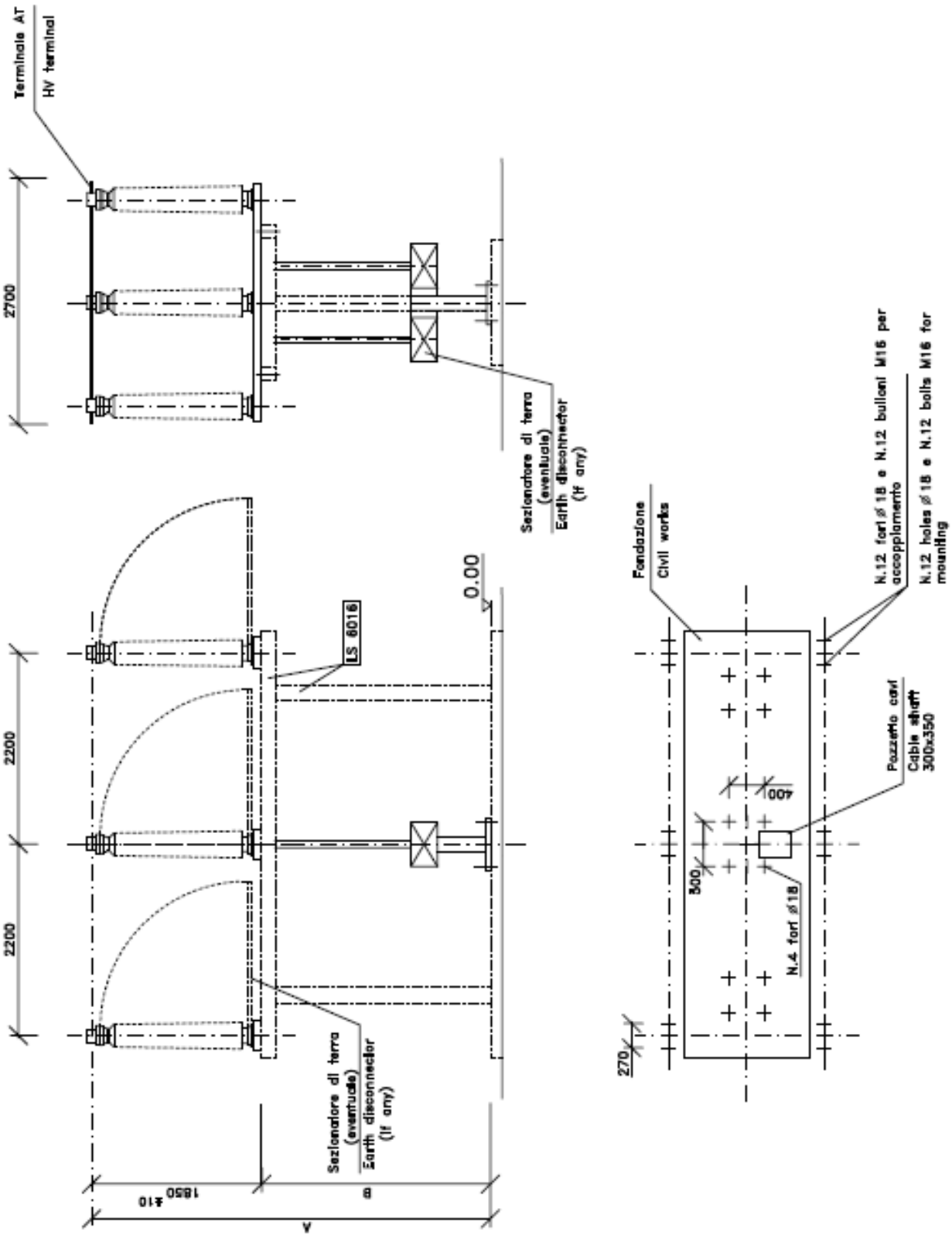


Pos.	Name	Material	Dimensions	Items	Weight [kg]
P1	Steel U	OL-52-2K STAS 500/2-80	U10 - 4650	2	10,8x4,7x2=99,64
P2	Steel U	OL-52-2K STAS 500/2-80	U10 - 1750	2	10,8x1,75x2=37,1
P3	Steel U	OL-52-2K STAS 500/2-80	U10 - 1500	3	10,8x1,50x3=47,7
P4	Fine grain steel sheet for welded construction	OCS-52-2a STAS 9021/80	8x480x480	2	64x0,234x2=29,952
P5	Fine grain steel sheet for welded construction	OL-52-2K STAS 500/2-80	8x300x300	6	64x0,09x6=34,56
P6	Steel U	OL-52-2K STAS 500/2-80	U10 - 860	1	10,8x0,86x1=9,116
P7	Steel U	OL-52-2K STAS 500/2-80	U10 - 890	1	10,8x0,89x1=9,434
P8	Fine grain steel sheet for welded construction	OL-52-2K STAS 500/2-80	8x250x160	1	64x0,04x1=2,56
P9	Fine grain steel sheet for welded construction	OL-52-2K STAS 500/2-80	8x257x100	1	64x0,0257x1=1,65
P10	Fine grain steel sheet for welded construction	OL-52-2K STAS 500/2-80	10x250x50	2	80x0,125x2=10

Separator three-pole rack with parallel assembly

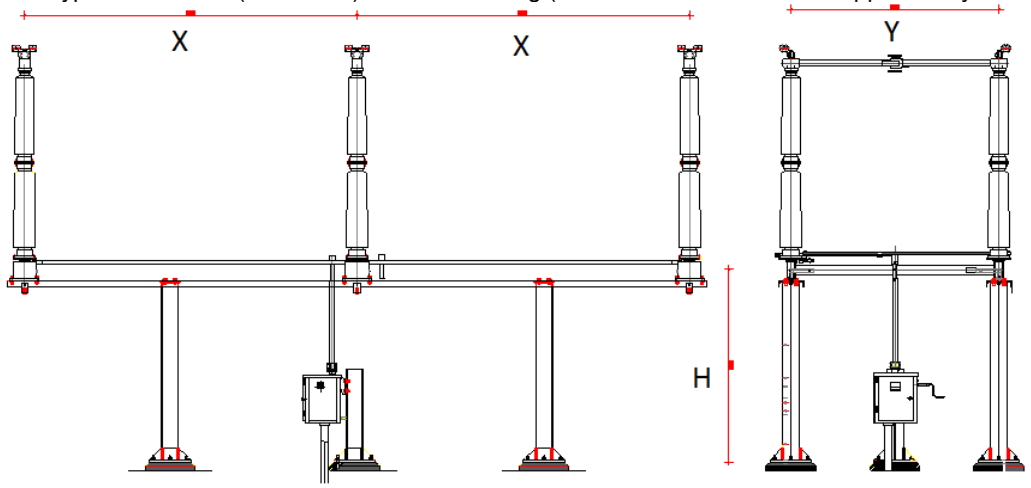
Note.- SJ355 according to EN 10025-2 is aceptable in substitution of OL52-2K.

B.3 – ENEL DISTRIBUZIONE DIMENSIONAL DRAWING



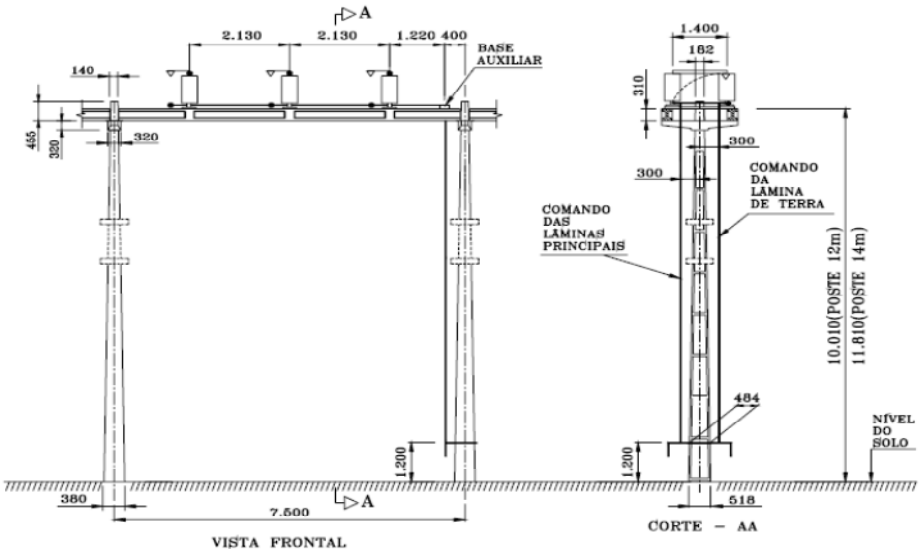
B.4 – LATAM DIMENSIONAL DRAWINGS

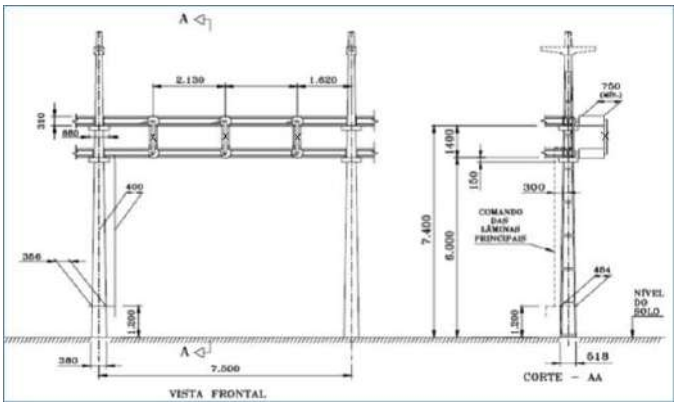
The typical distances (referential) are the following (different solutions shall be approved by Enel Distribution companies):

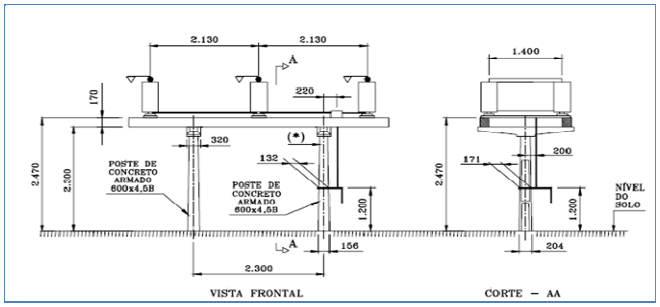


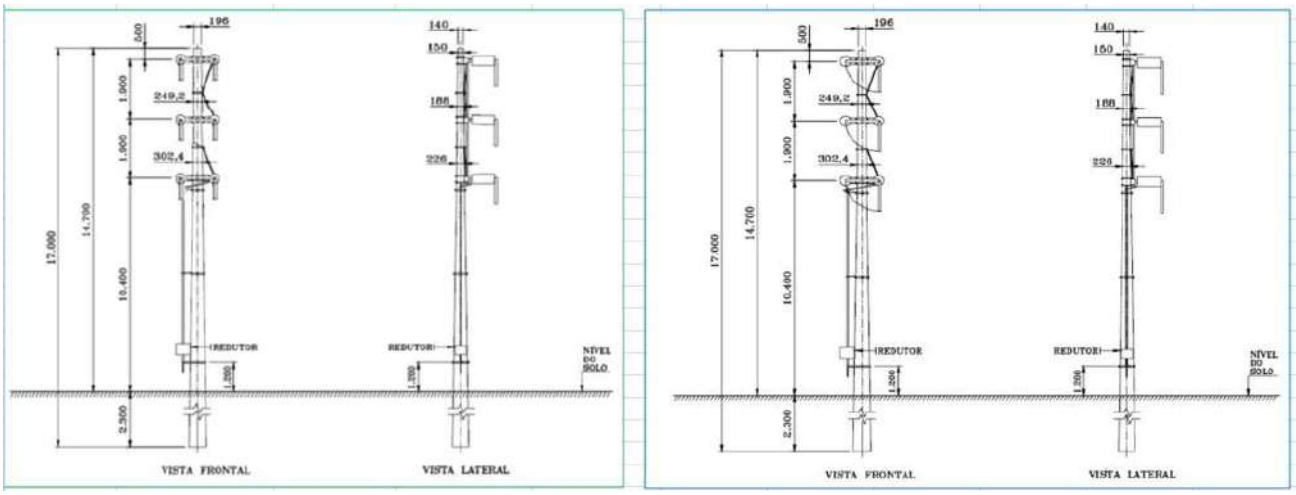
Empresa	Tensión	X[mm]	Y[mm]	H [mm]
Ampla	72,5	2100		See Common List
	145	2600		See Common List
Coelce	72,5	1900	1400	See Common List
Edelnor	245	4000		See Common list
	72,5	1500		See common list
Chilectra	145	3000		See common list
	245	4000		See Common list
Codensa	145	2480		See Common List
Edesur	145			See Common List
	245			See Common List

Assembly examples:
Coelce

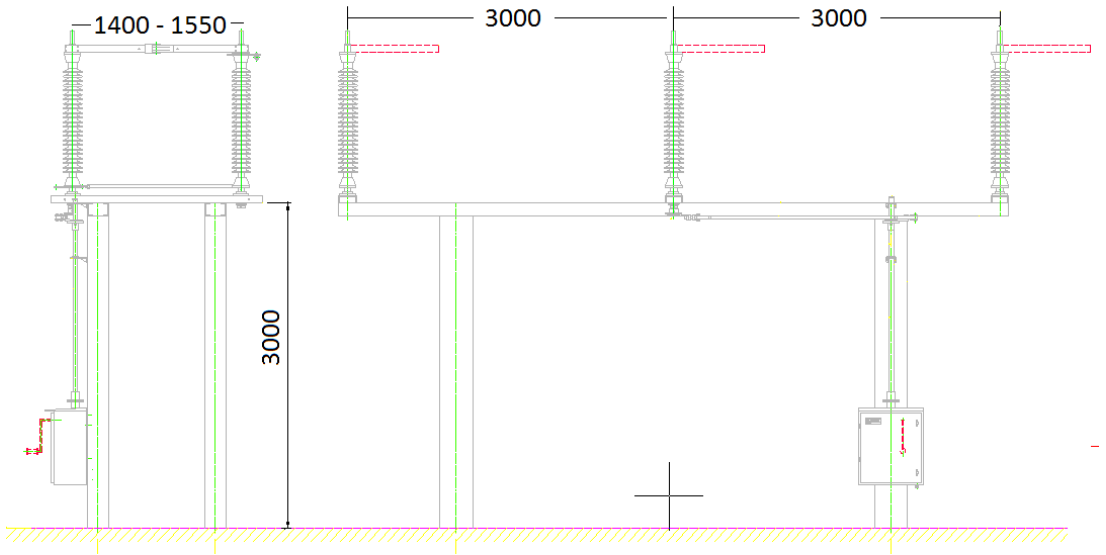




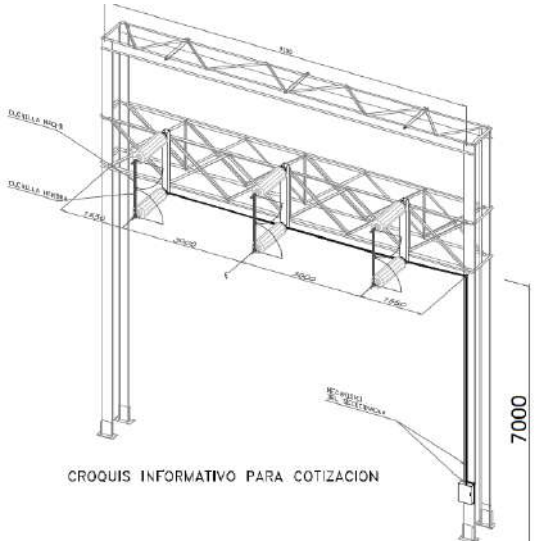


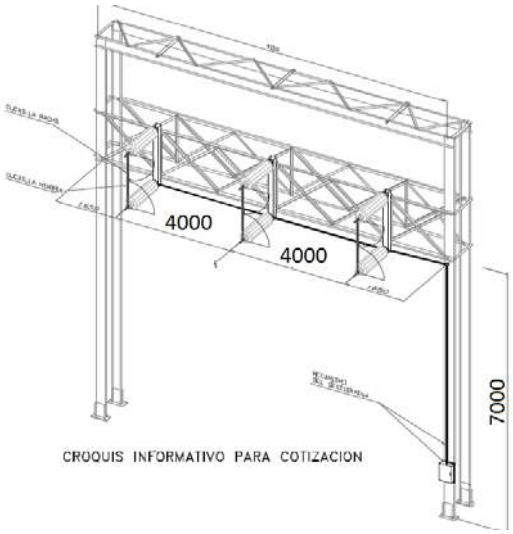


Chilectra / Horizontal

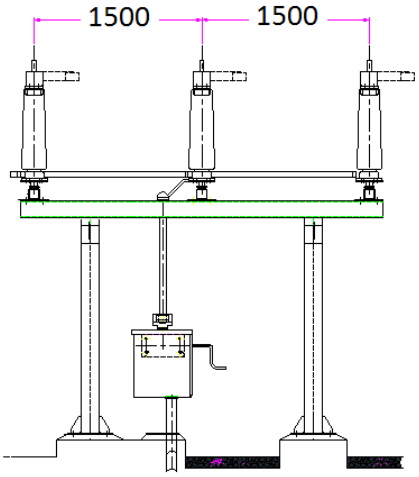


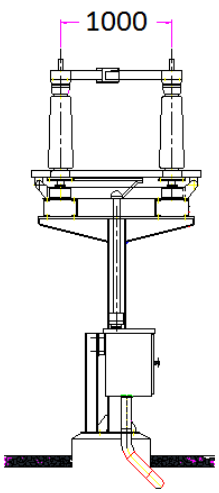
Chilectra / Vertical 145kV and 245kV





Edelnor





ANNEX C – TENDER'S TECHNICAL DOCUMENTATION

GLOBAL STANDARD: GSH003 – HV DS/ESs		**TENDER:**	
SUPPLIER:		**FACTORY:**	
ENEL GROUP TYPE CODE: GSH003/__		**SUPPLIER MODEL:**	
TECHNICAL CHARACHTERISTIC		***STANDARD REQUIREMENT***	***SUPPLIER OFFER***
Service conditions		outdoor normal service conditions of IEC 62271-1	
Reference altitude (m)		< 1.000 (2.600 for Colombia)	
Minimum ambient air temperature (°C)		See Annex D	
SPS Class (IEC/TS 60815 series)		See Annex D	
Ice coating (mm)		See Annex D	
Seismic qualification level		See table in 4.2.2	
Rated short-time withstand current Ik (kA)		See Annex D	
Rated short-duration powerfrequency withstand voltage Ud (kV rms)	*Common value*	See table in 5	
	Across the isolating distance	See table in 5	
Rated lightning impulse withstand voltage Up (kVp)	*Common value*	See table in 5	
	Across the isolating distance	See table in 5	
Rated frequency fr (Hz)		50 or 60	
Opening (closing) time if motor-operated (s)	*DS*	≤ 15	
	ES	≤ 15	
Degrees of protection provided by enclosures		IP 54	
Rated supply voltage Ua (Vdc)		See table in 5	
d.c. max absorbed power (W)		1.000	
Rated supply voltage for heating and anti-condensation circuits (Vac)		See table in 5	
a.c. max absorbed power (VA)		50 (250 if motor-operated)	
Auxiliary contact classes		1	
DS Rated normal current Ir (A)		See Annex D	
DS Mechanical endurance class Mr		M1	
Bus-transfer current switching by disconnectors	*Rated bus-transfer current for disconnectors (A)*	See Annex D and table in 5	
	Rated bus-transfer voltages for disconnectors (V)	See Annex D and table in 5	
Earthing switches class Er		E0 – M0 – A	
Insulators materials		Composite or ceramic	
Dimensions			To enclose an overall equipment drawing for each Enel Group Distribution Company

ANNEX D – COMPONENT LIST

TYPE CODE	COMPANY	COMPANY CODE	N° Column s/pole	Type opening	Ur	Ir	Ik	ES	DS operation	ES operation	SPS class	Bus bar transfer	Minimum ambient air temperature (°C)	Ice coating (mm)	ASSEMBLY	Installation height (mm)
GSH003/900	AMPLA	4545883	2	Centre-break	72,5	1250	25	Y	MANUAL	MANUAL	d	N	-10	1	Vertical	< 10000
GSH003/901	AMPLA	4545884	2	Centre-break	72,5	1250	25	Y	MANUAL	MANUAL	d	N	-10	1	Horizontal paralel	< 6000
GSH003/902	AMPLA	4545894	2	Centre-break	72,5	1250	25	Y	MANUAL	MANUAL	d	N	-10	1	Horizontal paralel	> 10000
GSH003/903	AMPLA	4545875	2	Centre-break	72,5	1250	25	N	MANUAL	-	d	N	-10	1	Horizontal paralel	> 10000
GSH003/904	AMPLA	4545893	2	Centre-break	72,5	1250	25	N	MANUAL	-	d	N	-10	1	Vertical	< 10000
GSH003/905	AMPLA	4545888	2	Centre-break	72,5	1250	25	N	MANUAL	-	d	N	-10	1	Horizontal paralel	< 6000
GSH003/906	AMPLA	4545891	2	Centre-break	72,5	1250	25	Y	MOTOR	MANUAL	d	N	-10	1	Horizontal paralel	< 6000
GSH003/907	AMPLA	4545890	2	Centre-break	72,5	1250	25	N	MANUAL	MANUAL	d	N	-10	1	Horizontal paralel	< 10000
GSH003/908	AMPLA	4545882	2	Centre-break	72,5	1250	25	Y	MOTOR	MANUAL	d	N	-10	1	Horizontal paralel	> 10000
GSH003/909	AMPLA	4545889	2	Centre-break	72,5	1250	25	N	MOTOR	-	d	N	-10	1	Horizontal paralel	< 6000
GSH003/910	AMPLA	4545917	2	Centre-break	72,5	1250	25	N	MOTOR	-	d	N	-10	1	Horizontal paralel	< 10000
GSH003/911	AMPLA	4545886	2	Centre-break	72,5	1250	25	N	MOTOR	-	d	N	-10	1	Horizontal paralel	> 10000
GSH003/912	AMPLA	4545872	2	Centre-break	145	1250	40	Y	MANUAL	MANUAL	d	N	-10	1	Horizontal paralel	< 10000
GSH003/913	AMPLA	4545887	2	Centre-break	145	1250	40	Y	MANUAL	MANUAL	d	N	-10	1	Vertical	< 10000
GSH003/914	AMPLA	4545869	2	Centre-break	145	1250	40	Y	MANUAL	MANUAL	d	N	-10	1	Horizontal paralel	> 10000
GSH003/915	AMPLA	4545868	2	Centre-break	145	1250	40	N	MANUAL	-	d	N	-10	1	Horizontal paralel	< 6000
GSH003/916	AMPLA	4545916	2	Centre-break	145	1250	40	N	MANUAL	-	d	N	-10	1	Horizontal paralel	< 10000
GSH003/917	AMPLA	4545948	2	Centre-break	145	1250	40	N	MANUAL	-	d	N	-10	1	Vertical	< 10000
GSH003/918	AMPLA	4545960	2	Centre-break	145	1250	40	Y	MOTOR	MANUAL	d	N	-10	1	Horizontal paralel	< 6000
GSH003/919	AMPLA	4545961	2	Centre-break	145	1250	40	N	MOTOR	-	d	N	-10	1	Horizontal paralel	< 10000
GSH003/920	AMPLA	4545955	2	Centre-break	145	1250	40	Y	MOTOR	MANUAL	d	N	-10	1	Horizontal paralel	>10000
GSH003/921	AMPLA	4584354	2	Centre-break	145	1250	40	N	MOTOR	-	d	N	-10	1	Horizontal paralel	< 6000
GSH003/922	AMPLA	4545855	2	Centre-break	145	1250	40	N	MOTOR	-	d	N	-10	1	Vertical	< 10000
GSH003/923	AMPLA	4545874	2	Centre-break	145	1250	40	N	MOTOR	-	d	N	-10	1	Horizontal paralel	> 10000
GSH003/924	AMPLA	6806423	2	Centre-break	72,5	1250	25	N	MOTOR	-	d	N	-10	1	Vertical	< 10000
GSH003/925	AMPLA	6806426	2	Centre-break	72,5	1250	25	N	MANUAL	-	d	N	-10	1	Vertical	> 10000
GSH003/926	AMPLA	6806427	2	Centre-break	145	1250	40	N	MANUAL	-	d	N	-10	1	Vertical	> 10000
GSH003/600	COELCE	4544141	2	Centre-break	72,5	1250	31,5	Y	MANUAL	MANUAL	e	N	-10	1	Horizontal paralel	10010mm
GSH003/601	COELCE	6771461	2	Centre-break	72,5	1250	31,5	N	MANUAL	-	e	N	-10	1	Horizontal paralel	10010mm
GSH003/602	COELCE	6771466	2	Centre-break	72,5	2000	31,5	Y	MANUAL	MANUAL	e	N	-10	1	Horizontal paralel	10010mm
GSH003/603	COELCE	6771467	2	Centre-break	72,5	2000	31,5	N	MANUAL	-	e	N	-10	1	Horizontal paralel	10010mm
GSH003/604	COELCE	6771465	2	Centre-break	72,5	1250	31,5	N	MANUAL	-	e	N	-10	1	Vertical	6000mm
GSH003/605	COELCE	6771469	2	Centre-break	72,5	2000	31,5	N	MANUAL	-	e	N	-10	1	Vertical	6000mm
GSH003/606	COELCE	6771462	2	Centre-break	72,5	1250	31,5	N	MANUAL	-	e	N	-10	1	Horizontal paralel	2470mm
GSH003/607	COELCE	6771468	2	Centre-break	72,5	2000	31,5	N	MANUAL	-	e	N	-10	1	Horizontal paralel	2470mm
GSH003/608	COELCE	6783064	2	Lateral-break	72,5	1250	31,5	N	MANUAL	-	e	N	-10	1	Vertical	10400mm
GSH003/500	EDELNOR	6792662	2	Centre-break	72,5	2000	40	N	MOTOR	-	e	Y	-10	1	Horizontal paralel	2300 mm
GSH003/501	EDELNOR	6792646	2	Centre-break	72,5	2000	40	Y	MOTOR	MANUAL	e	Y	-10	1	Horizontal paralel	2300 mm
GSH003/502	EDELNOR	6760960	2	Centre-break	72,5	1250	31,5	N	MOTOR	-	e	N	-10	1	Horizontal paralel	2300 mm
GSH003/503	EDELNOR	6757158	2	Centre-break	72,5	1250	31,5	Y	MOTOR	MANUAL	e	N	-10	1	Horizontal paralel	2300 mm
GSH003/504	EDELNOR	6798993	2	Centre-break	245	2000	40	N	MOTOR	--	e	Y	-10	1	Horizontal paralel	2300 mm
GSH003/505	EDELNOR	6798994	2	Centre-break	245	2000	40	Y	MOTOR	MOTOR	e	Y	-10	1	Horizontal paralel	2300 mm
GSH003/506	EDELNOR	6806310	2	Vertical-break	72,5	1250	31,5	N	MOTOR	--	e	Y	-10	1	Vertical	4200 mm
GSH003/507	EDELNOR	6806311	2	Vertical-break	72,5	1250	31,5	Y	MOTOR	MANUAL	e	N	-10	1	Vertical	4200 mm
GSH003/508	EDELNOR	6761914	2	Vertical-break	72,5	1250	31,5	Y	MOTOR	MANUAL	e	N	-10	1	Vertical	4200 mm
GSH003/509	EDELNOR	6761915	2	Vertical-break	72,5	1250	31,5	N	MOTOR	--	e	Y	-10	1	Vertical	4200 mm
GSH003/700	CODENSA	6788913	2	Centre-break	145	2000	40	N	MANUAL	MANUAL	c	N	-10	10	Horizontal paralel	2150 mm
GSH003/701	CODENSA	6787659	2	Centre-break	145	2000	40	Y	MANUAL	MANUAL	c	N	-10	10	Horizontal paralel	2150 mm
GSH003/702	CODENSA	6801955	2	Centre-break	145	2000	40	N	MOTOR	MANUAL	c	N	-10	10	Horizontal paralel	2150 mm
GSH003/703	CODENSA	6801956	2	Centre-break	145	2000	40	Y	MOTOR	MANUAL	c	N	-10	10	Horizontal paralel	2150 mm
GSH003/400	EDESUR	0104-0049	3	Centre-break	145	2000	31,5	N	MOTOR	--	c	N	-10	10	Horizontal paralel	2250 mm
GSH003/401	EDESUR	0104-0367	2	Centre-break	145	800	31,5	N	MOTOR	--	c	N	-10	10	Horizontal paralel	2250 mm
GSH003/402	EDESUR	0104-0361	2	Centre-break	145	800	31,5	N	MOTOR	--	c	N	-10	10	Horizontal in line	2250 mm
GSH003/403	EDESUR	0104-0048	2	Centre-break	145	800	31,5	Y	MOTOR	MANUAL	c	N	-10	10	Horizontal paralel	2250 mm
GSH003/404	EDESUR	0104-0424	2	Centre-break	145	800	31,5	Y	MOTOR	MANUAL	d	N	-10	10	Horizontal paralel	2250 mm
GSH003/405	EDESUR	0104-0366	2	Centre-break	145	2000	31,5	N	MOTOR	--	c	N	-10	10	Horizontal in line	2250 mm
GSH003/406	EDESUR	0104-0401	2	Centre-break	145	2000	31,5	Y	MOTOR	MANUAL	c	N	-10	10	Horizontal paralel	2250 mm
GSH003/407	EDESUR	0104-0382	2	Centre-break	145	3150	31,5	N	MOTOR	--	c	N	-10	10	Horizontal in line	2250 mm
GSH003/408	EDESUR	0104-0362	2	Centre-break	245	800	40	N	MOTOR	--	c	N	-10	10	Horizontal in line	2250 mm
GSH003/409	EDESUR	0104-0363	2	Centre-break	245	2000	40	N	MOTOR	--	c	N	-10	10	Horizontal in line	2250 mm
GSH003/410	EDESUR	0104-0364	2	Centre-break	245	2000	40	Y	MOTOR	MANUAL	c	N	-10	10	Horizontal paralel	2250 mm
GSH003/411	EDESUR	0104-0386	2	Centre-break	245	3150	40	Y	MOTOR	MANUAL	c	N	-10	10	Horizontal paralel	2250 mm
GSH003/412	EDESUR	0104-0394	2	Centre-break	245	3150	40	N	MOTOR		c	N	-10	10	Horizontal paralel	2250 mm
GSH003/413	EDESUR	0104-0385	2	Centre-break	245	3150	40	N	MOTOR		c	N	-10	10	Horizontal in line	2250 mm

TYPE CODE	COMPANY	COMPANY CODE	Nº Column s/pole	Type opening	Ur	Ir	Ik	ES	DS operation	ES operation	SPS class	Bus bar transfer	Minimum ambient air temperature (°C)	Ice coating (mm)	ASSEMBLY	Installation height
GSH003/800	CHILECTRA		2	Centre-break	245	2000	40	N	MOTOR	-	c	-	-10	10	Horizontal paralel	3000 mm
GSH003/801	CHILECTRA		2	Centre-break	245	2000	40	Y	MOTOR	MOTOR	c	-	-10	10	Horizontal paralel	3000 mm
GSH003/802	CHILECTRA		2	Centre-break	245	3150	40	N	MOTOR	-	c	-	-10	10	Horizontal paralel	3000 mm
GSH003/803	CHILECTRA		2	Centre-break	245	3150	40	Y	MOTOR	MOTOR	c	-	-10	10	Horizontal paralel	3000 mm
GSH003/804	CHILECTRA		2	Centre-break	145	2000	40	N	MOTOR	-	c	-	-10	10	Horizontal paralel	3000 mm
GSH003/805	CHILECTRA		2	Centre-break	145	2000	40	Y	MOTOR	MOTOR	c	-	-10	10	Horizontal paralel	3000 mm
GSH003/806	CHILECTRA		2	Centre-break	145	2000	40	N	MOTOR	-	c	-	-10	10	Vertical	7000 mm
GSH003/807	CHILECTRA		2	Centre-break	145	2000	40	Y	MOTOR	MOTOR	c	-	-10	10	Vertical	7000 mm
GSH003/808	CHILECTRA		2	Centre-break	145	3150	40	N	MOTOR	-	c	-	-10	10	Horizontal paralel	3000 mm
GSH003/809	CHILECTRA		2	Centre-break	145	3150	40	Y	MOTOR	MOTOR	c	-	-10	10	Horizontal paralel	3000 mm
GSH003/810	CHILECTRA		2	Centre-break	145	2000	50	N	MOTOR	-	c	-	-10	10	Horizontal paralel	3000 mm
GSH003/811	CHILECTRA		2	Centre-break	145	2000	50	Y	MOTOR	MOTOR	c	-	-10	10	Horizontal paralel	3000 mm
GSH003/812	CHILECTRA		2	Centre-break	145	2000	50	N	MOTOR	-	c	-	-10	10	Vertical	7000 mm
GSH003/813	CHILECTRA		2	Centre-break	145	2000	50	Y	MOTOR	MOTOR	c	-	-10	10	Vertical	7000 mm
GSH003/814	CHILECTRA		2	Centre-break	145	3150	50	N	MOTOR	-	c	-	-10	10	Horizontal paralel	3000 mm
GSH003/815	CHILECTRA		2	Centre-break	145	3150	50	Y	MOTOR	MOTOR	c	-	-10	10	Horizontal paralel	3000 mm
GSH003/816	CHILECTRA		2	Centre-break	145	2000	40	N	MANUAL	-	c	-	-10	10	Horizontal paralel	3000 mm
GSH003/817	CHILECTRA		2	Centre-break	145	2000	40	Y	MANUAL	MANUAL	c	-	-10	10	Horizontal paralel	3000 mm
GSH003/818	CHILECTRA		2	Centre-break	145	2000	40	N	MANUAL	-	c	-	-10	10	Vertical	7000 mm
GSH003/819	CHILECTRA		2	Centre-break	145	2000	40	Y	MANUAL	MANUAL	c	-	-10	10	Vertical	7000 mm
GSH003/820	CHILECTRA		2	Centre-break	145	2000	50	N	MANUAL	-	c	-	-10	10	Horizontal paralel	3000 mm
GSH003/821	CHILECTRA		2	Centre-break	145	2000	50	Y	MANUAL	MANUAL	c	-	-10	10	Horizontal paralel	3000 mm
GSH003/822	CHILECTRA		2	Centre-break	145	2000	50	N	MANUAL	-	c	-	-10	10	Vertical	7000 mm
GSH003/823	CHILECTRA		2	Centre-break	145	2000	50	Y	MANUAL	MANUAL	c	-	-10	10	Vertical	7000 mm
GSH003/824	CHILECTRA		2	Centre-break	245	2000	40	N	MOTOR (1 ø)	-	c	-	-10	10	Horizontal paralel	3000 mm
GSH003/825	CHILECTRA		2	Centre-break	245	2000	40	Y	MOTOR (1 ø)	MOTOR	c	-	-10	10	Horizontal paralel	3000 mm
GSH003/826	CHILECTRA		2	Centre-break	145	3150	40	N	MOTOR (1 ø)	-	c	-	-10	10	Horizontal paralel	3000 mm
GSH003/827	CHILECTRA		2	Centre-break	145	3150	40	Y	MOTOR (1 ø)	MOTOR	c	-	-10	10	Horizontal paralel	3000 mm
GSH003/828	CHILECTRA		2	Centre-break	145	3150	50	N	MOTOR (1 ø)	-	c	-	-10	10	Horizontal paralel	3000 mm
GSH003/829	CHILECTRA		2	Centre-break	145	3150	50	Y	MOTOR (1 ø)	MOTOR	c	-	-10	10	Horizontal paralel	3000 mm
GSH003/200	EDE	6701206	2	Centre-break	72,5	2000	31,5	Y	MANUAL	MANUAL	d	N	-25	10	Horizontal paralel	3000 mm
GSH003/201	EDE	6701207	2	Centre-break	72,5	2000	31,5	N	MANUAL	-	d	N	-25	10	Horizontal paralel	3000 mm
GSH003/202	EDE	6701208	2	Centre-break	72,5	1250	31,5	Y	MANUAL	MANUAL	d	N	-25	10	Horizontal paralel	3000 mm
GSH003/203	EDE	6701209	2	Centre-break	72,5	1250	31,5	N	MANUAL	-	d	N	-25	10	Horizontal paralel	3000 mm
GSH003/204	EDE	6707698	2	Centre-break	72,5	2000	31,5	Y	MANUAL	MANUAL	e	N	-25	10	Horizontal paralel	3000 mm
GSH003/205	EDE	6707699	2	Centre-break	72,5	2000	31,5	N	MANUAL	-	e	N	-25	10	Horizontal paralel	3000 mm
GSH003/206	EDE	6707700	2	Centre-break	72,5	1250	31,5	Y	MANUAL	MANUAL	e	N	-25	10	Horizontal paralel	3000 mm
GSH003/207	EDE	6707701	2	Centre-break	72,5	1250	31,5	N	MANUAL	-	e	N	-25	10	Horizontal paralel	3000 mm
GSH003/208	EDE	6701204	2	Centre-break	145	1250	31.5	N	MANUAL	-	d	N	-25	10	Horizontal paralel	3000 mm
GSH003/209	EDE	6707696	2	Centre-break	145	1250	31.5	N	MANUAL	-	e	N	-25	10	Horizontal paralel	3000 mm
GSH003/210	EDE	6701205	2	Centre-break	145	1250	31.5	Y	MANUAL	MANUAL	d	N	-25	10	Horizontal paralel	3000 mm
GSH003/211	EDE	6707697	2	Centre-break	145	1250	31.5	Y	MANUAL	MANUAL	e	N	-25	10	Horizontal paralel	3000 mm
GSH003/212	EDE	6710771	2	Centre-break	145	1250	31.5	N	MOTOR	-	d	N	-25	10	Horizontal paralel	3000 mm
GSH003/213	EDE	6710772	2	Centre-break	145	1250	31.5	N	MOTOR	-	e	N	-25	10	Horizontal paralel	3000 mm
GSH003/214	EDE	6710773	2	Centre-break	145	1250	31.5	Y	MOTOR	MANUAL	d	N	-25	10	Horizontal paralel	3000 mm
GSH003/215	EDE	6710774	2	Centre-break	145	1250	31.5	Y	MOTOR	MANUAL	e	N	-25	10	Horizontal paralel	3000 mm
GSH003/216	EDE	6701203	2	Centre-break	145	2000	31.5	N	MANUAL	-	d	N	-25	10	Horizontal paralel	3000 mm
GSH003/217	EDE	6707695	2	Centre-break	145	2000	31.5	N	MANUAL	-	e	N	-25	10	Horizontal paralel	3000 mm
GSH003/218	EDE	6701202	2	Centre-break	145	2000	31.5	Y	MANUAL	MANUAL	d	N	-25	10	Horizontal paralel	3000 mm
GSH003/219	EDE	6707694	2	Centre-break	145	2000	31.5	Y	MANUAL	MANUAL	e	N	-25	10	Horizontal paralel	3000 mm
GSH003/220	EDE	6710775	2	Centre-break	145	2000	31.5	N	MOTOR	-	d	N	-25	10	Horizontal paralel	3000 mm
GSH003/221	EDE	6710776	2	Centre-break	145	2000	31.5	N	MOTOR	-	e	N	-25	10	Horizontal paralel	3000 mm
GSH003/222	EDE	6710777	2	Centre-break	145	2000	31.5	Y	MOTOR	MANUAL	d	N	-25	10	Horizontal paralel	3000 mm
GSH003/223	EDE	6710778	2	Centre-break	145	2000	31.5	Y	MOTOR	MANUAL	e	N	-25	10	Horizontal paralel	3000 mm
GSH003/001	ENEL DISTR.	156110	3	Double-break	170	1250	31.5	Y	MOTOR	MOTOR	d	N	-25	10	Horizontal paralel	2650 mm
GSH003/002	ENEL DISTR.	156111	3	Double-break	170	1250	31.5	Y	MANUAL	MANUAL	d	N	-25	10	Horizontal paralel	2650 mm
GSH003/003	ENEL DISTR.	156112	3	Double-break	170	1250	31.5	N	MANUAL	-	d	N	-25	10	Horizontal paralel	2650 mm
GSH003/004	ENEL DISTR.	156113	3	Double-break	170	1250	31.5	N	MANUAL	-	d	N	-25	10	Horizontal paralel	2650 mm
GSH003/005	ENEL DISTR.	156114	3	Double-break	170	1250	31.5	N	MANUAL	-	d	N	-25	10	Horizontal paralel	5150 mm
GSH003/100	ENEL RO	615204	2	Centre-break	123	1250	40	N	MANUAL	-	d	N	-30	22	Horizontal paralel	2300 mm
GSH003/101	ENEL RO	615205	2	Centre-break	123	1250	40	N	ELECTRIC	-	d	N	-30	22	Horizontal paralel	2300 mm
GSH003/102	ENEL RO	615206	2	Centre-break	123	1250	40	Y	MANUAL	MANUAL	d	N	-30	22	Horizontal paralel	2300 mm
GSH003/103	ENEL RO	615207	2	Centre-break	123	1250	40	Y	ELECTRIC	ELECTRIC	d	N	-30	22	Horizontal paralel	2300 mm
GSH003/104	ENEL RO	615208	2	Centre-break	123	1250	40	YY (2ESs)	MANUAL	MANUAL	d	N	-30	22	Horizontal paralel	2300 mm
GSH003/105	ENEL RO	615209	2	Centre-break	123	1250	40	YY (2ESs)	ELECTRIC	ELECTRIC	d	N	-30	22	Horizontal paralel	2300 mm
GSH003/106	ENEL RO	615210	2	Centre-break	123	1250	40	N	MANUAL	-	d	N	-30	22	Horizontal in line	2300 mm
GSH003/107	ENEL RO	615211	2	Centre-break	123	1250	40	N	ELECTRIC	-	d	N	-30	22	Horizontal in line	2300 mm
GSH003/108	ENEL RO	615212	2	Centre-break	123	1250	40	Y	MANUAL	MANUAL	d	N	-30	22	Horizontal in line	2300 mm
GSH003/109	ENEL RO	615213	2	Centre-break	123	1250	40	Y	ELECTRIC	ELECTRIC	d	N	-30	22	Horizontal in line	2300 mm
GSH003/110	ENEL RO	615214	2	Centre-break	123	1250	40	YY (2ESs)	MANUAL	MANUAL	d	N	-30	22	Horizontal in line	2300 mm
GSH003/111	ENEL RO	615215	2	Centre-break	123	1250	40	YY (2ESs)	ELECTRIC	ELECTRIC	d	N	-30	22	Horizontal in line	2300 mm

- Note: “MOTOR (1 ø)” means 3 motors, 1 for each phase
- Note: “YY (2 EEs)” means 2 earthing switches, located on the opposite ends of the disconnector

N.B. - LA FINITURA SUPERFICIALE DEI MANUFATTI, CHE RESTERANNO A VISTA, DOVRA' ESSERE TIRATA A FRATTAZZO FINE CONTEMPORANEAMENTE ALLA FASE DI GETTO DEL BASAMENTO
LA POSIZIONE DEI TIRAFONDI SARA' STABILITA DALLA D.L. IN BASE AL TIPO DI INTERRUTTORE
VEDERE LA PLANIMETRIA GENERALE OPERE EDILI PER L'ORIENTAMENTO E QUOTA SUPERIORE DELLA FONDAZIONE

Enel Distribuzione

DIREZIONE EMILIA ROMAGNA
Ingegneria

CABINA PRIMARIA 132/15kV DI:

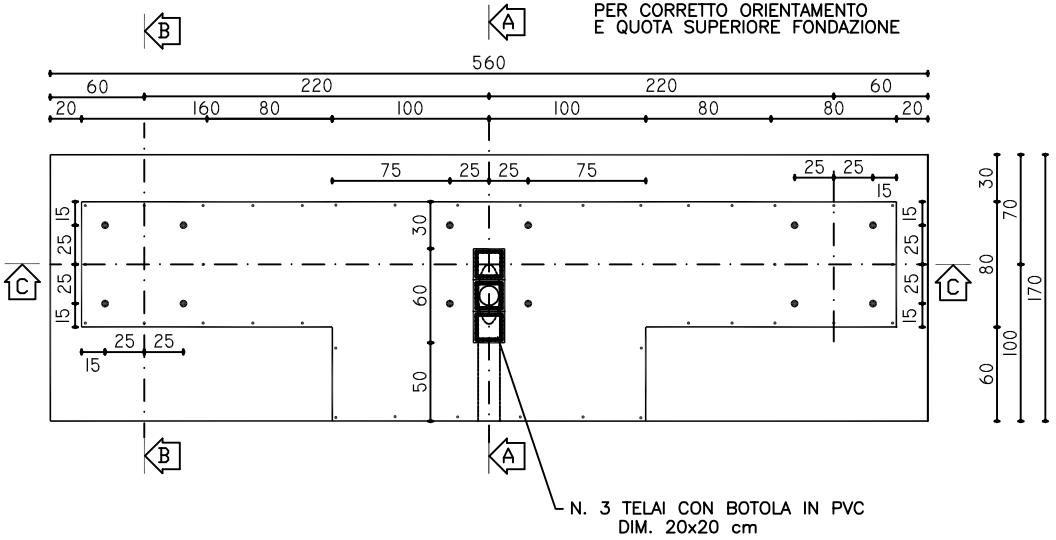
FONDAZIONE INTERRUTTORE AT

SCALA PLOT: 1:10	SCALA	N. GER 106	FOGLIO
NOME FILE: GER106-3	1:50		1/1
DATA 14/08/02			

Ediz.	Data	Descrizione
3	14/08/02	modifica interasse sostegni
2	10/04/02	verifica quantità
1	16/11/00	Nuovo numero sost. gemr6

PIANTA

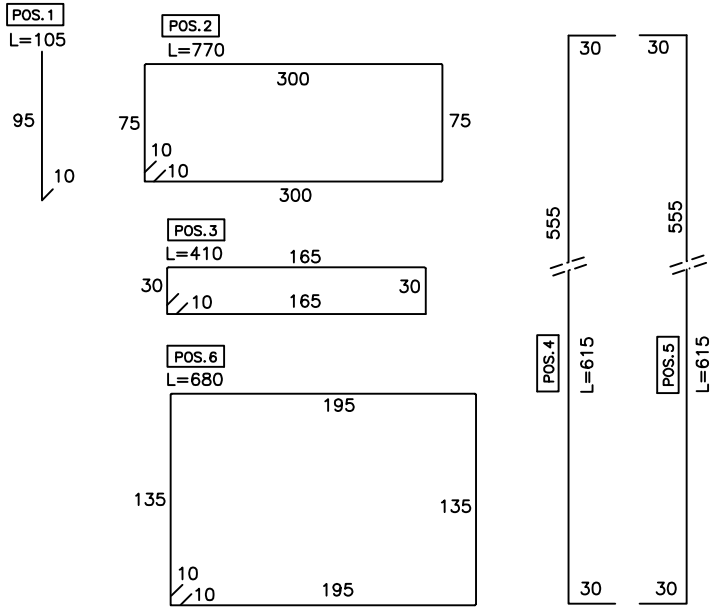
SCALA 1:50

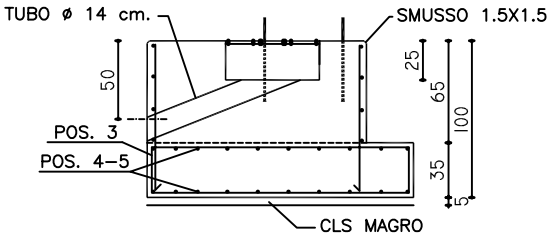


DIMENSIONI IN CM.

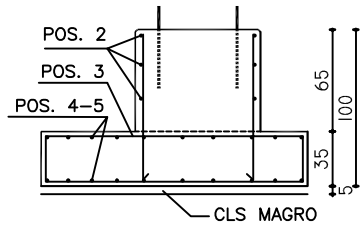
VOLUME CLS MAGRO MC.	VOLUME CLS CLASSE R 250 MC.	PESO FERRI DI ARMATURA KG.	TIRAFONDI		
			RIF.	N.	ø
0.48	6.82	225.54	S 6102/24	12	24

SCALA 1:50

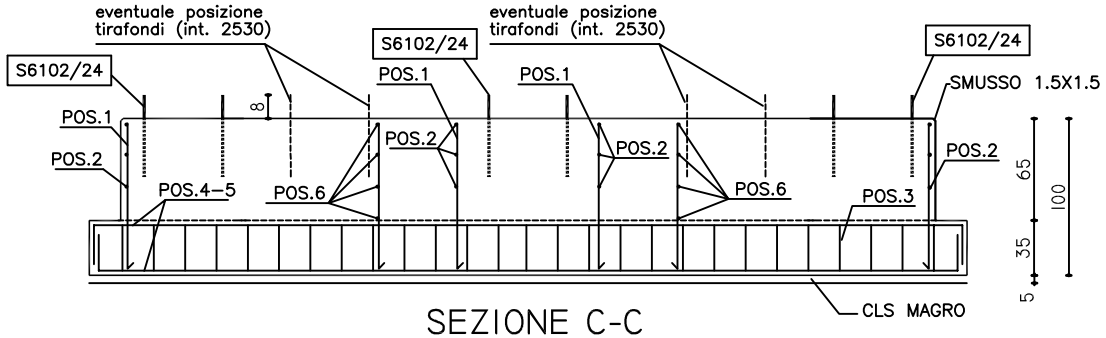




SEZIONE A-A



SEZIONE B-B



SEZIONE C-C

FERRI DI ARMATURA
FEB 44 K CONTROLLATO IN STABILIMENTO

POS.	N.	ø	TAGLIO ML.	PESO KG.
1	38	16	1.05	62.96
2	6	10	7.70	28.51
3	29	10	4.10	73.36
4	8	10	6.15	30.36
5	8	10	6.15	30.36
6	4	10	6.80	16.78

INDICE

Revisione	Natura della modifica
03	Terza emissione

	Emissione	Collaborazioni e verifiche			Approvazione
Ente	**DIR-IUN-UML**	**DIR-IUN-UML**	**DIR-IUN-UML**	**IR-IUN**	**DIR-IUN**
Firmato	**L. Rossetti**	**R. Grimaldi**	**F. Mauri**	**S. Cheli**	**E. Di Marino**

1. SCOPO E CAMPO DI APPLICAZIONE

Le presenti prescrizioni hanno lo scopo di definire le caratteristiche costruttive di prova e dimensionali dei sostegni in tubo per Cabine Primarie.
Queste prescrizioni si applicano ai sostegni per le apparecchiature unipolari, con tensione nominale 132 kV e 150 kV (Um 145 kV e 170 kV), utilizzati in Cabina Primaria.

2. NORME E PRESCRIZIONI RICHIAMATE NEL TESTO

UNI EN 10216 - UNI EN 10025 - UNI 5132-74 - CEI 7-6

3. PRESCRIZIONI COSTRUTTIVE

Con riferimento al disegno riportato in 5. devono essere previste

- Le asole per l'entrata e l'uscita cavi, munite di apposite chiusure metalliche stagne di materiale resistente alla corrosione per agenti atmosferici e adatte per essere forate in opera per il posizionamento di pressacavi.
- Il foro per l'uscita cavi nella parte inferiore della piastra di base in corrispondenza della circonferenza interna del tubo che ne limiterà le dimensioni massime consentite.
- Qualora necessaria per agevolare il passaggio cavi dal componente all'entrata cavi del sostegno, dovrà essere prevista una asola opportunamente posizionata sulla piastra superiore.

Materiali

- I materiali da utilizzare per la costruzione dei piedritti (i tubi) sono di qualità S355JR UNI EN 10025 (era Fe 52-B)
- I materiali da utilizzare per la costruzione delle piastre e dei fazzoletti sono di qualità S275JR UNI EN 10025 (era Fe 42-B)
- Le saldature saranno eseguite con elettrodi E52 classe di qualità 3 secondo UNI 5132-74 o con procedimento automatico/semiautomatico comunque qualificato.

Tolleranze di lavorazione

- Sulle dimensioni dei semilavorati (diametro dei tubi e simili) UNI EN 10216 -2005
- Sulle dimensioni geometriche d'ingombro: ± 2mm
- Sugli interassi e sui passi di foratura, ed in generale sulle dimensioni geometriche di tutti gli elementi di accoppiamento con altri componenti: ± 1mm
- Sulle complanarità in generale: ± 1/100
- Sulle forature: ± 1mm

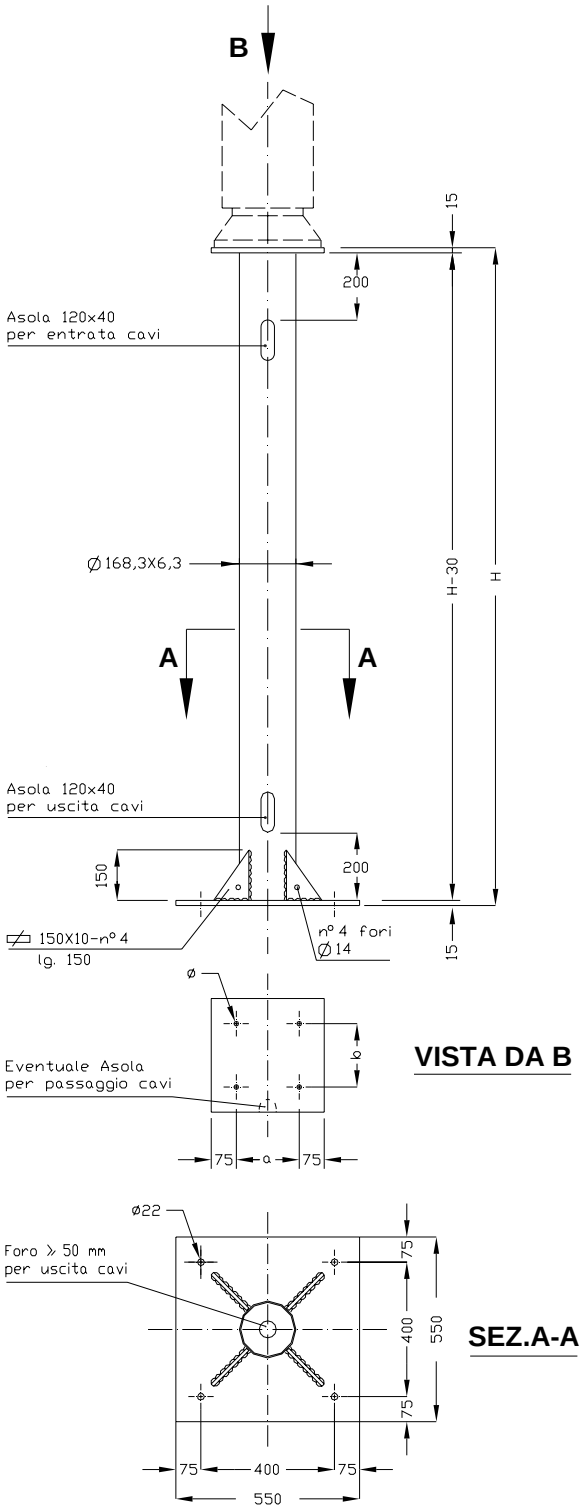
Zincatura

- Secondo CEI 7-6

4. PRESCRIZIONI PER L'ACCETTAZIONE

Devono essere verificate le caratteristiche dimensionali e la zincatura.
Inoltre, deve essere verificata la presenza dell'auto-certificazione del fornitore di conformità a quanto richiesto nella presente specifica.

5. DISEGNO DI INGOMBRO



SPECIFICA TECNICA
CABINE PRIMARIE
INTERRUTTORI TRIPOLARI CON TA ACCORPATI O INCORPORATI CON TENSIONE NOMINALE 145 kV E 170 kV

Revisione	Natura della modifica
04	Aggiornamento dei riferimenti normativi Inserimento tipologia con TA incorporato nell'interruttore Uniformate le distanze minime da terra delle parti in tensione con le tipologie DY6 e DY7 Inserimento di indicazioni circa la posizione del pozzetto per il passaggio dei cavi al sistema di controllo e delle uscite delle trecce di rame per il collegamento alla maglia di terra dell'impianto Diverse modifiche di carattere editoriale
03	Eliminazione tipologie con isolamento normale e re-introduzione interruttore con comando unipolare con selettore per servizio linea / trasformatore Adeguamento formato alla specifica di redazione PSS-1.04.50 del 18/12/2006.
02	Edizione precedente

	Emissione	Collaborazioni		Verifiche		Approvazione
Ente	**DIR-IUN**	**DIR-QSA**		**DIR-IUN**		**DIR-IUN**
Firmato	**A. Cammarota**	**A. Dori**		**R. Grimaldi**		**E. Di Marino**

INDICE

1. SCOPO

Le presenti prescrizioni hanno lo scopo di definire le caratteristiche tecniche degli interruttori tripolari con tensione nominale 145-170 kV con TA accorpato (installato sulla stessa struttura di supporto dell'interruttore) o incorporato (inserito nel corpo dell'interruttore) da installare all'aperto nelle Cabine Primarie della rete elettrica di Enel Distribuzione S.p.A., in seguito denominata Enel.

2. CAMPO DI APPLICAZIONE

Il documento viene utilizzato per l'espletamento delle gare di acquisto e per le verifiche tecniche di conformità e qualità.

3. IDENTIFICAZIONE COMPONENTI E DEFINIZIONI

Gli interruttori di cui alla presente specifica sono identificati come di seguito indicato:

MATRICOLA	TIPO ENEL	SERVIZIO	MECCANISMO	COMANDO
15 01 71	DY6/4 + DY34/2	Linea – Trasformatore	Unipolare	Uni-Tripolare
15 01 72	DY6/6 + DY34/2	Trasformatore	Tripolare	Tripolare
15 01 76	DY7/4 + DY35/2	Linea – Trasformatore	Unipolare	Uni-Tripolare
15 01 77	DY7/6 + DY35/2	Trasformatore	Tripolare	Tripolare

Esempio di descrizione ridotta:

I	N	T		3	P	+	T	A		X	X	X	K	V		U	E		C	O	M		T	R	I

Per le definizioni si rimanda a quanto indicato nelle Norme CEI EN di riferimento e nelle specifiche DY6 e DY7.

4. PRESCRIZIONI RICHIAMATE NEL TESTO

DY6	DY7	DY2061
DM1004	DY34	DY35

RQUPTA001

I documenti richiamati sono da intendersi nella edizione in vigore al momento della emissione del contratto, varianti incluse.

5. UNITÀ DI MISURA

L'unità di misura è espressa in numero di esemplari.

6. CARATTERISTICHE TECNICHE

Per le caratteristiche tecniche ed i valori relativi alle normali condizioni di servizio degli apparecchi oggetto della presente specifica si deve fare riferimento alle specifiche DY6, DY7, DY34 e DY35.

Nella tabella seguente si riportano, inoltre, le tensioni di tenuta dielettrica tra le parti metalliche (F) ed (M) e tra le parti metalliche (E) ed (F) con interruttore aperto (cfr. figure 1 e 2):

	Tipologie a 145 kV	Tipologie a 170 kV
Tensione nominale di tenuta ad impulso atmosferico	650 kV	750 kV
Tensione nominale di tenuta a 50 Hz	275 kV	325 kV

7. CARATTERISTICHE COSTRUTTIVE

Per le prescrizioni del presente paragrafo si rimanda a quanto indicato nelle specifiche UE DY2061 ed RQUPTA001 (quest'ultima, per quanto applicabile per interruttori con TA incorporato).

In figura 1 è rappresentato un disegno con le principali dimensioni (espresse in mm) degli interruttori con TA accorpato.
In figura 2 è rappresentato un disegno con le principali dimensioni (espresse in mm) degli interruttori con TA incorporato.

Nei disegni è anche raffigurata l'interfaccia con il basamento (comprensivo delle uscite delle trecce di rame per i collegamenti all'impianto di terra e del pozzetto per il passaggio dei cavi al sistema di controllo, quest'ultimo posizionato in corrispondenza del polo centrale). Il sostegno dell'interruttore deve essere tale da garantire un corretto interfacciamento con i basamenti esistenti nelle Cabine Primarie di Enel ed un idoneo collegamento delle trecce di rame per la connessione all'impianto di terra. Nel caso fosse necessario impiegare delle piastre di interfacciamento (incluse nella fornitura), le stesse devono essere preventivamente sottoposte all'approvazione di Enel.

8. PRESCRIZIONI PER LA FORNITURA

Per le prescrizioni del presente paragrafo si rimanda a quanto indicato nella specifica UE DY2061.

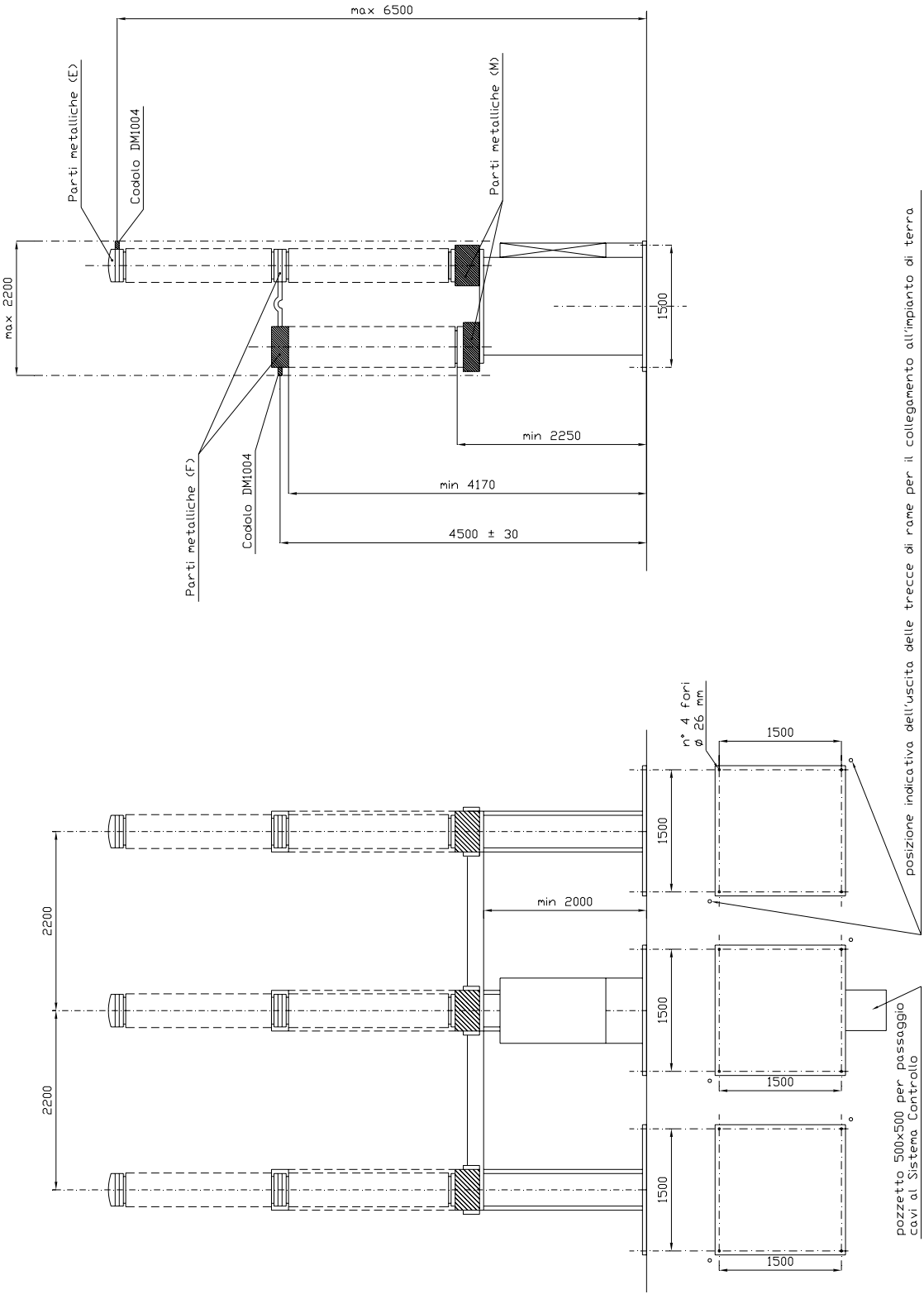


Figura 1 – Dimensioni principali degli interruttori con TA accorpato

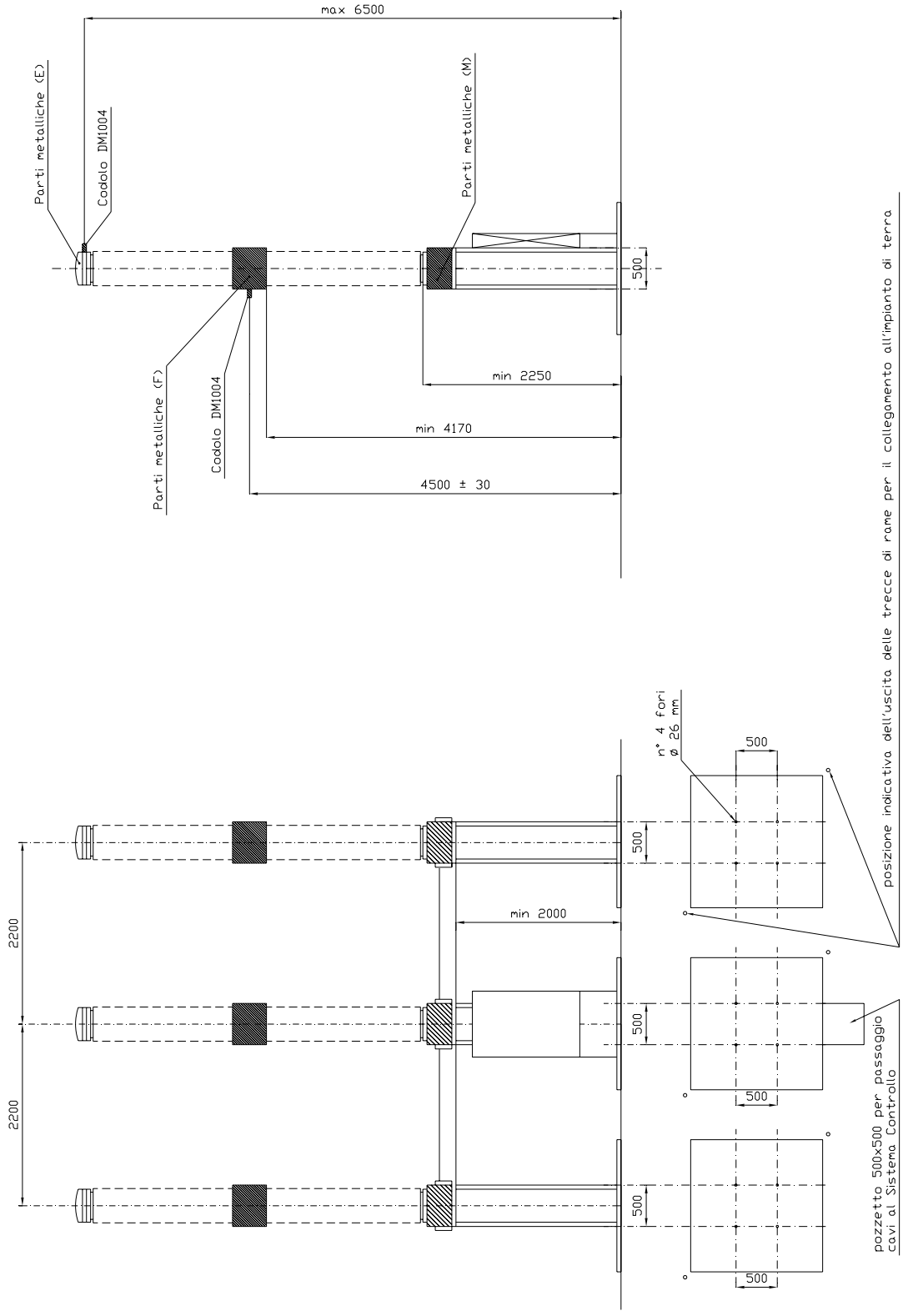


Figura 2 – Dimensioni principali degli interruttori con TA incorporato

Revision	Data	List of modifications
00	26/07/2013	First emission

Enel Distribuzione			**Endesa Distribución Eléctrica**		
Emission	**Verification**	**Approval**	**Emission**	**Verification**	**Approval**
DIS/IUN/UML	**DIS/IUN/UML**	**DIS/IUN/UML**	**EDE/PyE**	**EDE/PyE**	**EDE/PyE**
A. Dori	**I. Gentilini**	**R. Lama**	**C. Llovich**	**T. González**	**F. Giammanco**
Latam			**Enel Distributie**		
Emission	**Verification**	**Approval**	**Emission**	**Verification**	**Approval**
Tecnica Latam	**Tecnica Latam**	**Tecnica Latam**	**-**	**Birou Standardizare**	**Director Dezvoltare Retea**
M. Garcia **K. Sampaio**	**M. Del Valle** **W. Sciutto**	**R. Castañeda**	**-**	**V. Obrejan**	**A. Pascu**

INDEX

1 SCOPE

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

- Ampla (Brazil)
- Chilectra (Chile)
- Codensa (Colombia)
- Coelce (Brazil)
- Edelnor (Perú)
- Edesur (Argentine)
- Endesa Distribución Eléctrica (Spain)
- Enel Distributie Banat (Romania)
- Enel Distributie Dobrogea (Romania)
- Enel Distributie Muntenia (Romania)
- Enel Distribuzione (Italy)

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

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

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

2 COMPONENTS LIST

The following CBs are covered by this global standard:

Type code	Rated voltage U_r (kV)	Rated normal current I_r (A)	Rated short-circuit breaking current I_{sc} (kA)	Type of operation
GSH001/1	72,5	2000	31,5	Three-pole
GSH001/2	72,5	2000	40	Three-pole
GSH001/3	145	2000	40	Single-pole
GSH001/4	145	2000	40	Three-pole
GSH001/5	145	3150	40	Three-pole
GSH001/6	145	3150	50	Three-pole
GSH001/7	170	2000	40	Single-pole
GSH001/8	170	2000	40	Three-pole
GSH001/9	245	2000	40	Single-pole
GSH001/10	245	2000	40	Three-pole
GSH001/11	245	3150	40	Single-pole
GSH001/12	245	3150	40	Three-pole

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

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 membrature miste di materiale isolante e di materiale metallico, contenenti parti attive di apparecchiature elettriche".*

3.1.3 Spain

Real Decreto Riesgo Eléctrico 614/2001

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

3.2.1 Common standards

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

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 62271-1	High-voltage switchgear and controlgear - Part 1: Common specifications
IEC 62271-100	High-voltage switchgear and controlgear – Part 100: Alternating current circuit-breakers
IEC/TR 62271-300	High-voltage switchgear and controlgear - Part 300: Seismic qualification of alternating current circuit-breakers
IEC/TR 62271-301	High-voltage switchgear and controlgear – Part 301: Dimensional standardization of high-voltage terminals
IEC/TR 62271-303	High-voltage switchgear and controlgear - Part 303: Use and handling of sulphur hexafluoride (SF6)
IEC 60376	Specification of technical grade sulfur hexafluoride (SF6) for use in electrical equipment
IEC 60073	Basic and safety principles for man-machine interface, marking and identification – Coding principles for indicators and actuators
IEC 60447	Basic and safety principles for man-machine interface, marking and identification - Actuating principles
IEC 61936-1	Power installations exceeding 1 kV a.c. - Part 1: Common rules
IEC/TS 60815-1	Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 1: Definitions, information and general principles
IEC/TS 60815-2	Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 2: Ceramic and glass insulators for a.c. systems
IEC/TS 60815-3	Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 3: Polymer insulators for a.c. systems
IEC 62155	Hollow pressurized and unpressurized ceramic and glass insulators for use in electrical equipment with rated voltage greater than 1000 V
IEC 61462	Composite hollow insulators – Pressurized and unpressurized insulators for use in electrical equipment with rated voltage greater than 1000 V – Definitions, test methods, acceptance criteria and design recommendations
IEC 60332-3-24	Tests on electric and optical fibre cables under fire conditions – Part 3-24: Test for vertical flame spread of vertically-mounted bunched wires or cables - Category C
IEC 60947-7-1	Low-voltage switchgear and controlgear – Part 7-1: Ancillary equipment - Terminal blocks for copper conductors
IEC 60947-7-2	Low-voltage switchgear and controlgear – Part 7-2: Ancillary equipment - Protective conductor terminal blocks for copper conductors
IEC 60068-2-17	Environmental testing – Part 2: Tests – Test Q: Sealing
ISO 1461	Hot dip galvanized coatings on fabricated iron and steel articles-Specifications and test methods
ISO 2178	Non-magnetic coatings on magnetic substrates - Measurement of coating thickness -Magnetic method
ISO 4126	Safety devices for protection against excessive pressure

ISO 9223	Corrosion of metals and alloys -- Corrosivity of atmospheres -- Classification, determination and estimation
ISO 12944	Paints and varnishes -- Corrosion protection of steel structures by protective paint systems

3.2.2 Specific standards

3.2.2.1 *Latam*

3.2.2.1.a) *Chilectra*

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

3.2.2.2 *Endesa Distribución Eléctrica*

NNM001 – Normas de operación definiciones

3.2.2.3 *Enel Distributie*

Prescriptia Energetica PE 101/85 – Normativ pentru construcţia instalaţiilor electrice de conexiuni şi transformare cu tensiuni peste 1 kV

3.2.2.4 *Enel Distribuzione*

CEI 20-22/2 – Prove di incendio su cavi elettrici – Parte 2: Prova di non propagazione dell'incendio

UNI 11144 – Bombole trasportabili per gas – Valvole per bombole per pressioni di esercizio 250 bar – Connessioni: forme e dimensioni

ENEL operative note PVR001 (bar code)

LM 1023 (double cable 245 kV clamp)

LM 1026 (single cable 245 kV clamp)

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 (℃)	-25	
SPS Class (IEC/TS 60815 series)	d (Heavy)	e (Very Heavy)
RUSCD (mm/kV)	43,3	53,7
Ice coating (mm)	10	

4.2 Specific service conditions

4.2.1 Colombia (Codensa)

The reference altitude is 2.600 m.

4.2.2 Romania[1] (Enel Distributie)

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

4.2.3 Seismic qualification level

Chilectra	ETGI-1020
Codensa	AF2 (IEC/TR 62271-300)
Edelnor	AF5 (IEC/TR 62271-300)
Enel Distributie	AF5 (IEC/TR 62271-300)
Enel Distribuzione	AF5 (IEC/TR 62271-300)

5 TECHNICAL CHARACTERISTICS

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

Rated voltage *Ur* (kV)		**72,5**	**145**	**170**	**245**
Rated short-duration power-frequency withstand voltage *Ud* (kV rms):		140	275	325	460
Rated lightning impulse withstand voltage *Up* (kVp):		325	650	750	1050
Rated frequency *fr* (Hz)	Chilectra, Edesur, Endesa Distribución, Enel Distributie and Enel Distribuzione	50			
	Ampla, Codensa, Coelce and Edelnor	60			
Rated normal current *Ir* (A)		See table in chapter 2			
Rated short-circuit breaking current *Isc* (kA)		See table in chapter 2			
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[2]			
Maximum break-time (ms)		60			
Circuit breaker class		C2 - E1 - M2			
Rated line-charging breaking current *Il* (A)		10	50	63	125
Rated cable-charging breaking current *Ic* (A)		125	160		250
Rated out-of-phase making and breaking current *Id* (kA)		Clause 4.106 of IEC 62271-100			

[1] In accordance with Prescriptia Energetica PE 101/85

[2] 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.

Degrees of protection provided by enclosures		IP 54[3]
Rated supply voltage *Ua* (Vdc)	Enel Distributie and Enel Distribuzione	110
	Endesa Distribución Eléctrica, Ampla, Coelce, Chilectra, Codensa, Edelnor	125
	Edesur	220
d.c. maximum absorbed power (W)		2000
Undervoltage release (if requested) - d.c. maximum abs. power (W/coil)		100
Rated supply voltage for anti-condensation circuits (Vac)	Endesa Distribución, Enel Distributie and Enel Distribuzione	230
	Ampla, Coelce, Chilectra, Edelnor, Edesur	220
	Codensa	120
a.c. maximum absorbed power (VA)		250
Auxiliary contact classes (Table 6 IEC 62271-1)		1

6 CONSTRUCTION CHARACTERISTIC

6.1 General characteristics

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

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

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

The support, quoted separately, shall be always supplied when a seismic qualification level is required (see 4.2.3), otherwise it's an optional supply.

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

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

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

[3] Applicable also to the Control Box and to the Operating Device Box(es).

6.2 Insulators

The insulators could be requested by Enel Group Distribution companies in ceramic or composite materials.

In case of ceramic insulators, they shall be in brown color and compliant with IEC 62155.

In case of composite insulators, they shall be in light grey color and compliant with IEC 61462. The envelope shall be made of silicone rubber, HTV type (High Temperature Vulcanized) or LSR type (Liquid Silicone Rubber) and completely free of EPDM or other organic rubbers.

6.3 Additional requirements for vacuum CBs

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

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

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

6.4 Additional requirements for gas CBs

6.4.1 Additional requirements for SF6 gas CBs

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

The gas SF6 shall comply with IEC 60376 standard. The manufacturer has to provide the necessary instructions for use and handling of SF6, in accordance with Technical Report IEC IEC/TR 62271-303.

In case of single-poles CB's a distinct SF6 circuit and connection for each pole is required.

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

CB's rated voltage (kV)	**Number of SF6 circuits**			
	Latam	**Endesa Distribución Eléctrica**	**Enel Distributie**	**Enel Distribuzione**
72,5	Unique for the 3 poles			
145	Unique for the 3 poles	One for each pole		
170	One for each pole			
245	One for each pole			

Each SF6 circuit shall provide a connection elements (type DILO VK/BG-03/8 or equivalent), with a non-return valve, both for SF6 control device and for gas filling/replenishment, provided by not-losable protection screw taps (located not higher than 1.800 mm from the ground level).

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

6.4.2 Additional requirements for non-fluorinated greenhouse gases CBs

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

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

In case of three-pole CB's the number of gas circuits and consequent connections is the same of SF6 gas CBs (see table in 6.4.1).

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

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

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

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

Each gas circuit (1 or 3, see 6.4.1 or 6.4.2) shall have a device for the gas density control.

The alarm threshold calibration has to take into account the leakage rate. The block threshold calibration shall be at least 0,02 MPa lower respect to the alarm threshold.

The gas density control device shall be:

- suitable to work in the provided temperature range;
- located in order to avoid the solar radiation influence on the external temperature measuring;
- insensitive to the vibration produced by the equipments operation;
- manufactured with stainless materials;
- realized in order to allow the functionality verify and the substitution with the poles under pressure;
- with the following scale(s) for a visible indication of gas density level:

Type of scale	**Endesa Distribución Eléctrica, Enel Distributie and Enel Distribuzione**	**Latam**
Colored	Mandatory	Mandatory
Graduated	Forbidden	Mandatory

The gas density control device shall provide 2 operating levels with contacts independently adjustable:

- 1st minimum gas density level: alarm (replenishment necessary) with 1 contacts;
- 2nd minimum gas density level: block (to get out of service) with 2 contacts working separately on 2 opening circuits (depending on specific requirements in chapter 7).

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

6.4.4 Overpressure safety devices

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

The devices shall be compliant with ISO 4126 and shall be properly calibrated over the maximum operating pressure, in order to avoid improper operations.

In case of overpressure safety valves operation, the expelled gas shall not run over people around the equipment.

6.4.5 Gas filling/replenishment device *(Optional)*

At request the manufacturer shall supply a device for the gas replenishment.

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

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

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

6.5 Control Box and Operating Device Box(es)

The requested cabinets are the followings:

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

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

6.5.1 Control Box

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

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

In addition to the IP requirement of table at chapter 5, the box protection degree with open doors shall be minimum IP2X.

In addition to the dimensions shown in Annex B, 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 from the front by mean of a door provided of handle and lock. The door (simple or double), hinged and equipped with an anti-wind system, shall be provided with a window in order to make visible from outside the signalization lamps. It shall be possible to open the door over 90°.

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

All electric equipments components shall be:

- compliant with the respective IEC standards;
- equipped with an identification label indicating the codification used in the functional electric schemes;
- easily accessible for maintenance or substitution operations.

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

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

The cable ends shall be provided of pre-insulated compression type terminals, suitable for the clamps where they have to be connected.

The connection cable from the Control Box to the equipments shall be of adequate section (≥ 1,5 mm^2), shielded, flexible, compliant with IEC 60332-3-24 and insulated at Uo/U = 0,6/1 kV.

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

The entrance of all cables (both CB's cables and control system cables) shall be from the Control Box bottom side, where a removable loophole (in aluminum, with useful dimension of 150x100 mm) shall be provided.

The Control Box shall include:

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

Operation	**Chilectra, Codensa, Edelnor, Edesur, Endesa Distribución Eléctrica, Enel Distributie and Enel Distribuzione** (according with IEC 60073)	**Ampla, Coelce** (according with NR10)
Closing	White	White "L" on Red white background
Opening	Black	White "D" on Green white background

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

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

The grounding of a dc supply polarity is not admitted.

The terminal boards shall be made with modular terminals. In particular, the terminals of control system interface terminal board shall have section 4 mm² for control, signalization and anti-condensation circuits and section 10 mm² for the motors supply circuit.

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

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

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

The cable trunks close to the interface terminal boards shall be used for the control system wiring and cannot be used for the internal wiring.

6.5.1.1 *Latam specific requirements*

The remote/local selector switch shall have auxiliary contacts.

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

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

The control box shall also include auxiliary switch contacts to indicate the CB position. The quantities of auxiliary contacts available (NO-Normally Open or NC-Normally Closed) for the different companies is indicated in Annex C.3.

6.5.1.2 *Enel Distribuzione specific requirements*

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

6.5.2 Operating Device Box(es)

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

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

Position	**Chilectra, Codensa, Edelnor, Edesur, Endesa Distribución Eléctrica, Enel Distributie and Enel Distribuzione** (according with IEC 60073)	**Ampla, Coelce** (according with NR10)
Close	Black "I" on white background	White "L" on Red white background
Open	White "O" on black background	White "D" on Green white background

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

In order to allow the verification, during maintenance activity, of the unchanged characteristics of the no-load travel curve (see note in 9.2.2-11b), manufacturer shall provide the measuring points, properly machined.

In addition to the IP requirement of table at chapter 5, the box(es) protection degree with open doors or when using hand-crank (to charge CB's springs) shall be minimum IP2X (unless the box can be opened only using tools).

All mechanical organs (included the motion transmission rods for three-pole CBs) shall be enclosed in metallic casings, IP2X, in order to prevent the access to parts in movement (see par. 5.13.1 of IEC 62271-1).

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

6.5.2.1 *Latam specific requirements*

The operation counter can be mechanical or electromechanical.

6.5.3 Nameplates

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

- the optional values;
- the Enel Group type code (see table in chapter 2) and the local components codification (see Annex A).

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

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

6.5.3.1 *Latam specific requirements*

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

6.5.3.2 *European countries specific requirements*

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

6.6 HV terminals

6.6.1 Latam

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

The terminals shall be rectangular shape with the following dimensions, according to fig. 3 (2x2 hole pattern) or fig. 4 (2x4 hole pattern) of IEC/TR 62271-301:

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

6.6.2 Endesa Distribución

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

6.6.3 Enel Distributie and Enel Distribuzione

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

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

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

6.7 Grounding

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

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

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

6.8 Anti-condensation circuit

Inside all boxes a proper anti-condensation system shall be provided in order to prevent humidity damages and to ensure a proper air replacement.

The anti-condensation circuit, controlled by a thermostat with fixed regulation at 25 ℃ (box internal temperature), shall be unique for the overall equipment, supplied in a.c. (see table in chapter 5 for the supply rated voltage) and protected with a magneto-thermic automatic circuit breaker.

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

In parallel connection case, the manufacturer shall assure a correct fault detection and distance anomaly signaling in case of failure of an element, properly evaluating the tolerances of the supply voltage and of the components resistance.

6.9 Protective treatments

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

All iron parts (e.g. support, Control Box, Operating Device Box(es), bolts etc.) shall be in non-corrosive material or hot dip galvanized in compliance with ISO 1461. All processing shall be completed before the protective treatments.

Protective treatments alternative to the hot dip galvanization could be accepted if the manufacturer prove its fitness.

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

6.9.1 Latam specific requirements

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

7 FUNCTIONAL CHARACTERISTIC

7.1 Operating Devices

7.1.1 General requirements

The CB controls shall be realized in order to be managed both remotely and locally. For this purpose a selector switch shall be located in the Control Box for the operation type choice: remote or local (hereinafter “remote/local selector switch”[4]).

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

The switch operation shall not cause unwanted equipment operations.

The local operation of circuit breakers (three-pole operations, it shall not be possible to operate locally single-pole operations) shall be controlled by the push-buttons located in the Control Box (see 6.5.1).

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

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

The operating device energy storage shall be normally made by mean of a d.c. electric motor (see table in chapter 5 for the supply rated voltage); when necessary it shall be possible to restore manually the operating device energy, with a maximum effort below 250 N. The manual device shall exclude the motor operation, or in alternative shall be designed excluding its possible movement in case of unexpected spring operation.

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

The CBs operating device shall be able to perform the following cycles[5]:

[4] the words “remote” and “local” have to be translated in all documents as:

- Italian language: *“Servizio”* (S) and *“Prova”* (P)
- Spanish language: *“Remoto”* and *“Local”*
- Romanian language: *“In functiune”* and *“Probe”*
- Portuguese language: *“Remoto”* and *“Local”*

- 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 being in the same position (closed or open).

7.1.2 Release drive circuits

7.1.2.1 *General requirements*

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

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

It shall be possible to request the CB opening acting both on a single circuit at a time and concurrently on any combination of the different opening circuits.

If during an operation an opposite operation request is received, the consent to the last operation shall be given only after the completion of on-going operation (in this case, only for single-pole CBs, the discrepancy between poles can be over the required limits).

The closing circuit shall be equipped with anti-pumping devices (1 for three-pole CBs and 3 for single-pole CBs) in order to inhibit further closing operations after the first one if an opening occurs during the initial closing request.

The main contacts position shall be assured stably and surely in the open and closed position. The CBs shall not operate in case of accidental auxiliary circuits supply interruption or in case of supply restore (excluding the drive circuit of under-voltage release).

7.1.2.2 *Latam specific requirements*

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

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

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

For Ampla: capacitive source for circuit breaker opening.

Other requirements for different companies are in Annex C.3.

7.1.2.3 *Endesa Distribución specific requirements*

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

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

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

7.1.2.4 *Enel Distributie and Enel Distribuzione specific requirements*

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

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

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

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

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

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

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

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

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

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

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

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

7.1.3 Interlocking devices

7.1.3.1 *General requirements*

All operations shall be dependent to the internal CB interlockings.

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

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

Further details are in the specific requirements.

7.1.3.2 *Latam specific requirements*

For the interlocking requirements refer to the annex C.3.

7.1.3.3 *Endesa Distribución specific requirements*

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

7.1.3.4 *Enel Distributie and Enel Distribuzione specific requirements*

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

The following interlockings are requested:

a) Closing block (enabled in both positions of the remote/local selector switch)

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

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

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

7.1.3.4.a) *Closing block*

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

a) 2nd minimum gas density level (only in case of gas CBs);

b) discharghed closing springs (at least one of the three springs in case of single-pole CBs).

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

a) drive circuit of under-voltage release not supplied;

b) under-voltage release mechanically locked (at least one of the three releases in case of single-pole CBs).

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

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

7.1.3.4.b) *Opening block*

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

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

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

The automatic openings operate in the same time:

a) for three-pole CBs, on the shunt release and on the under-voltage release;

b) for single-pole CBs, only on the shunt releases.

7.2 Electric schemes, controls and signalizations

7.2.1 General requirements

The electric schemes shall:

a) be represented in the reference conventional conditions:

a.1) CB in open position;

a.2) absence of a.c. and d.c. auxiliary supplies;

a.3) gas absence (only for gas insulated CBs – SF6 or non-fluorinated greenhouse gases);

a.4) closing springs discharged;

a.5) remote/local selector switch in remote position;

a.6) in case of micro-switches with the state dependent on the opening/closing of the

boxes/carters of operating devices, they shall be represented disable (that is with boxes/carters open).

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

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

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

7.2.2 Latam specific requirements

The details of the requirements are in the annex C.3.

7.2.3 Endesa Distribucion specific requirements

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

7.2.4 Enel Distributie and Enel Distribuzione specific requirements

7.2.4.1 *Electric schemes*

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

Further reference conventional conditions are:

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

7.2.4.2 *Controls*

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

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

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

7.2.4.3 *Signalizations*

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

a) single-pole CBs

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

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

7.2.4.4 *Specific requirements for 245 kV CBs*

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

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

8 TESTING

8.1 General information

IEC 62271-100 applies.

The tests to be performed on CBs are divided in:

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

8.2 Type tests

8.2.1 Visual inspection

The CB, complete of all accessories and fully assembled in operation layout, shall be subject to a visual inspection in order to verify its functional, dimensional and constructive compliance with this Global Standard.

8.2.2 Dielectric tests

(IEC 62271-100 par. 6.2)

8.2.3 Radio interference voltage (r.i.v.) tests

(IEC 62271-100 par. 6.3)

Not applicable for 72,5 kV CBs.

8.2.4 Measurement of the resistance of the main circuit

(IEC 62271-100 par. 6.4)

It shall be measured the contact resistance between each HV terminal and the correspondent CB plate: the measured value shall be ≤ 10 μΩ.

8.2.5 Temperature-rise tests

(IEC 62271-100 par. 6.5)

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

8.2.6 Short-time withstand current and peak withstand current tests

(IEC 62271-100 par. 6.6)

8.2.7 Verification of the degree of protection

(IEC 62271-100 par. 6.7)

8.2.8 Tightness tests

(IEC 62271-100 par. 6.8)

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

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

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

8.2.9 Electromagnetic compatibility (EMC) tests

(IEC 62271-100 par. 6.9)

8.2.10 Additional tests on auxiliary and control circuits

(IEC 62271-100 par. 6.10)

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

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

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

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

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

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

8.2.11 Mechanical and environmental tests

(IEC 62271-100 par. 6.101)

Humidity test is not required.

A new definition for operation with under-voltage release is added, similar to “opening time”, IEC 62271-100 par. 3.7.133 a):

“The opening time with under-voltage release is the time interval between the instant when the voltage drops suddenly to zero, the circuit breaker being in closed position, and the instant when the arcing contact are separated in all poles.”

In case of the under-voltage release is requested, its characteristics shall be verified in accordance with IEC 62271-1 (par. 5.8.4) at ambient temperature.

Moreover, for routine tests and commissioning tests purpose, the reference values and their tolerance at 110%, 100% and 70% of the rated voltage shall be provided.

8.2.12 Short-circuit current making and breaking tests

(IEC 62271-100 par. 6.102 to 6.106)

8.2.13 Critical current tests

(IEC 62271-100 par. 6.107)

If applicable (see 6.107.1)

8.2.14 Single-phase and double-earth fault tests

(IEC 62271-100 par. 6.108)

8.2.15 Short-line fault tests

(IEC 62271-100 par. 6.109)

8.2.16 Out-of-phase making and breaking tests

(IEC 62271-100 par. 6.110)

8.2.17 Capacitive current switching tests

(IEC 62271-100 par. 6.111)

8.2.18 X-radiation test procedure for vacuum interrupters

(IEC 62271-1 par. 6.11)

Only in case of vacuum CBs.

8.2.19 Seismic qualification

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

8.2.20 Protective treatments

Hot dip galvanized coatings on iron and steel components shall be verified in accordance with ISO 1461 by mean of magnetic flux equipments, performing at least 5 measures on each component, in uniform manner on the various surfaces, avoiding edges and angular parts.

The verification of other protective coatings shall be performed considering their characteristics: the manufacturer will indicate the minimum thickness allowed and the others characteristics.

8.2.21 Tests on insulators

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

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

8.2.22 Specific type tests

8.2.22.1 *Enel Distribuzione*

8.2.22.1.a) *Tests to verify the encloses endurance to gas internal pressure*

Only in case of gas CBs.

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

8.3 Routine tests

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

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

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

8.3.1 Dielectric test on the main circuit

(IEC 62271-100 par. 7.1)

8.3.2 Tests on auxiliary and control circuits

(IEC 62271-100 par. 7.2)

Functional tests (par. 7.2.2 of IEC 62271-1) shall be done only at rated voltage. About density meters, the verification shall be performed at ambient temperature, in the real operating position, using nitrogen and no SF6, with decreasing pressure values.

Dielectric tests (par. 7.2.4 of IEC 62271-1) shall be done applying 1 kV for 1 s.

Electronic devices, motors etc. can be excluded by dielectric test only if agreed during the conformity assessment (homologation, certification etc.) process.

8.3.3 Measurement of the resistance of the main circuit

(IEC 62271-100 par. 7.3)

It shall be performed after mechanical operating tests.

The ambient temperature influence can be neglected.

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

8.3.4 Tightness test

(IEC 62271-100 par. 7.4)

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

8.3.5 Design and visual checks

(IEC 62271-100 par. 7.5)

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

8.3.6 Mechanical operating tests

(IEC 62271-100 par. 7.101)

It shall be recorded:

a. at Vmax, Vn, Vmin, closing (C) and opening (O) times, time spread (on each release);
   a1. at Vmax, Vn, Vmin, opening (O) times, time spread of under-voltage release(if present – see 8.2.11) and it shall be verified its compliance with IEC 62271-1 par. 5.8.4;
b. at Vn, close-open (CO) time and open-close-open (O – t - CO) cycle;
c. at Vn, the operation time of one of each type (make and break) of auxiliary contacts, respect to the operation of main contacts on closing and on opening of CB;
d. no-load travel curves.

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

8.3.7 Protective treatments

The thickness of the protective coatings shall be verified according with 8.2.20.

8.3.8 Specific routine tests

8.3.8.1 *Enel Distribuzione*

8.3.8.1.a) *Tests to verify the encloses endurance to gas internal pressure*

Only in case of gas CBs.

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

8.4 Commissioning tests

(IEC 62271-100 par. 10.2)

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

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

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

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

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

Functionality tests of the auxiliary and control circuits shall be performed after dielectric tests. About density meters, the verification shall be performed with the same modalities of the routine test (see 8.3.2), paying attention to the ambient conditions (solar radiation, temperature) and, in case of three density meters, comparing between them the intervention threshold pressure measured values.

8.4.2 Mechanical Operating Tests

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

It shall be recorded:

a. at Vmax, Vn, Vmin, closing (C) and opening (O) times, time spread (on each release);
   a1. at Vmax, Vn, Vmin, opening (O) times, time spread of under-voltage release (if present – see 8.2.11) and it shall be verified its compliance with IEC 62271-1 par. 5.8.4;
b. at Vn, close-open (CO) time and open-close-open (O – t - CO) cycle;
c. at Vn, the operation time of one of each type (make and break) of auxiliary contacts, respect to the operation of main contacts on closing and on opening of CB.

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

8.4.3 Dielectric tests to the auxiliary and control circuits

Dielectric tests (par. 7.2.4 of IEC 62271-1) shall be performed applying 1 kV for 1 s.

Electronic devices, motors etc. can be excluded by dielectric test only if agreed during the conformity assessment (homologation, certification etc.) process.

8.4.4 Measurement of resistance to the main circuit

It shall be performed after mechanical operating tests.

The ambient temperature influence can be neglected.

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

It shall also be measured the contact resistance between each HV terminal and the correspondent CB plate: the measured value shall be ≤ 10 μΩ.

8.4.5 Tightness test

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

It shall be performed at rated pressure.

The test have to be done using test Qm, method 2 “Probing Test”, IEC 60068-2-17, after all the other tests, eight hours after the gas filling (for example one night is enough).

Fittings, gas density control devices and piping shall be checked (HV insulators have been checked in manufacturer’s factory).

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

9 SUPPLY REQUIREMENTS

9.1 Tender’s technical documentation

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

9.2 Conformity assessment

9.2.1 Conformity assessment process

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

9.2.2 Conformity assessment documentation

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

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

The Type A documentation shall consist at least in:

1) type A documents list;
2) type B documents list;
3) Annex D properly filled;
4) overall dimensions drawing, including the stresses transmitted to the foundations;
5) insulators drawings and characteristics;
6) electric diagram (see 7.2.1-c), low voltage components list included);
7) Control Box and Operating Device Box(es) layout drawings;

8) overall CB, Control Box and Operating Device Box(es) (with open/closed doors) pictures;
9) nameplate and labels drawings (Control Box and Operating Device Box(es), poles, coils etc.);
10) CBs installation, use and maintenance handbook/manual;
11) routine and commissioning tests:
    a) test report form (two documents, one for factory tests and one for on-site tests);
    b) reference values table (with tolerances);

       Note: specific detailed instructions to verify the no-load travel curves during maintenance activity shall be included in CB's manual;
    c) protective coatings (typology, minimum thickness, reference standards);
12) documentation of safety device for protection against pole excessive pressure (ISO 4126, only if present);
13) list of documentation, materials and accessories supplied;
14) only for gas CBs:
    a) gas circuit(s) drawing;
    b) gas density control device characteristics and drawings;
    c) pressure/temperature table for rated density level, 1st minimum gas density level and 2nd minimum gas density level;
15) main sub-components suppliers list;
16) only for Enel Distribuzione, INAIL (ex ISPESL) Certification "Certificato di conformità del prototipo" - D.M. 01/12/1980;
17) only for Enel Distribuzione, Manufacturing and Control Plan (PFC).

9.3 Packaging, transport, storage and installation/testing

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

CB's package shall be suitable to guarantee:

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

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

1) manufacturer name;
2) manufacturing year/month;
3) manufacturer designation type;
4) manufacturer serial number;
5) Enel component codification (see Annex A; i.e.: GSH001/1 - XXXXX);
6) contract number;
7) destination substation;
8) total weight;
9) lifting information (showing the points and the correct method of lifting);
10) only for Enel Distribuzione, the bar code, in accordance with PVR006.

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

1) the support structure (only if requested, including any interface plates if necessary) and the anchor bolts to the civil works (stainless or hot dip galvanized steel, chemical or expansion type);
2) springs hand-crank (and other tools according to the manufacturer design);
3) list of documentation, materials and accessories supplied;

4) overall dimensions drawing;
5) electric diagram;
6) CB installation, use and maintenance handbook/manual;
7) routine and commissioning tests:
   a) routine (factory) test reports;
   b) reference values table (with tolerances);
8) only for gas CBs:
   a) dielectric gas;
   b) pressure/temperature table for rated density level, 1st minimum gas density level and 2nd minimum gas density level;
9) one CD-Rom containing the whole type A documentation (pdf file format).

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

ANNEX A – LOCAL COMPONENTS CODIFICATION

Type code	Edesur	Ampla	Coelce	Chilectra	Codensa	Enel Distribuz.	Edelnor	Enel Distributie	Endesa D.E.
GSH001/1		4544579	6771180				6783145		6710641
GSH001/2							6792645		
GSH001/3						150126		150126	6710642
GSH001/4		6777842			6781265	150127		150127	6710643
GSH001/5	0103-2500								6710644
GSH001/6									
GSH001/7						150186			
GSH001/8						150187			
GSH001/9						150196			
GSH001/10					6801822	150197	6797232		
GSH001/11	0103-0303								
GSH001/12									

ANNEX B – DIMENSIONAL DRAWINGS

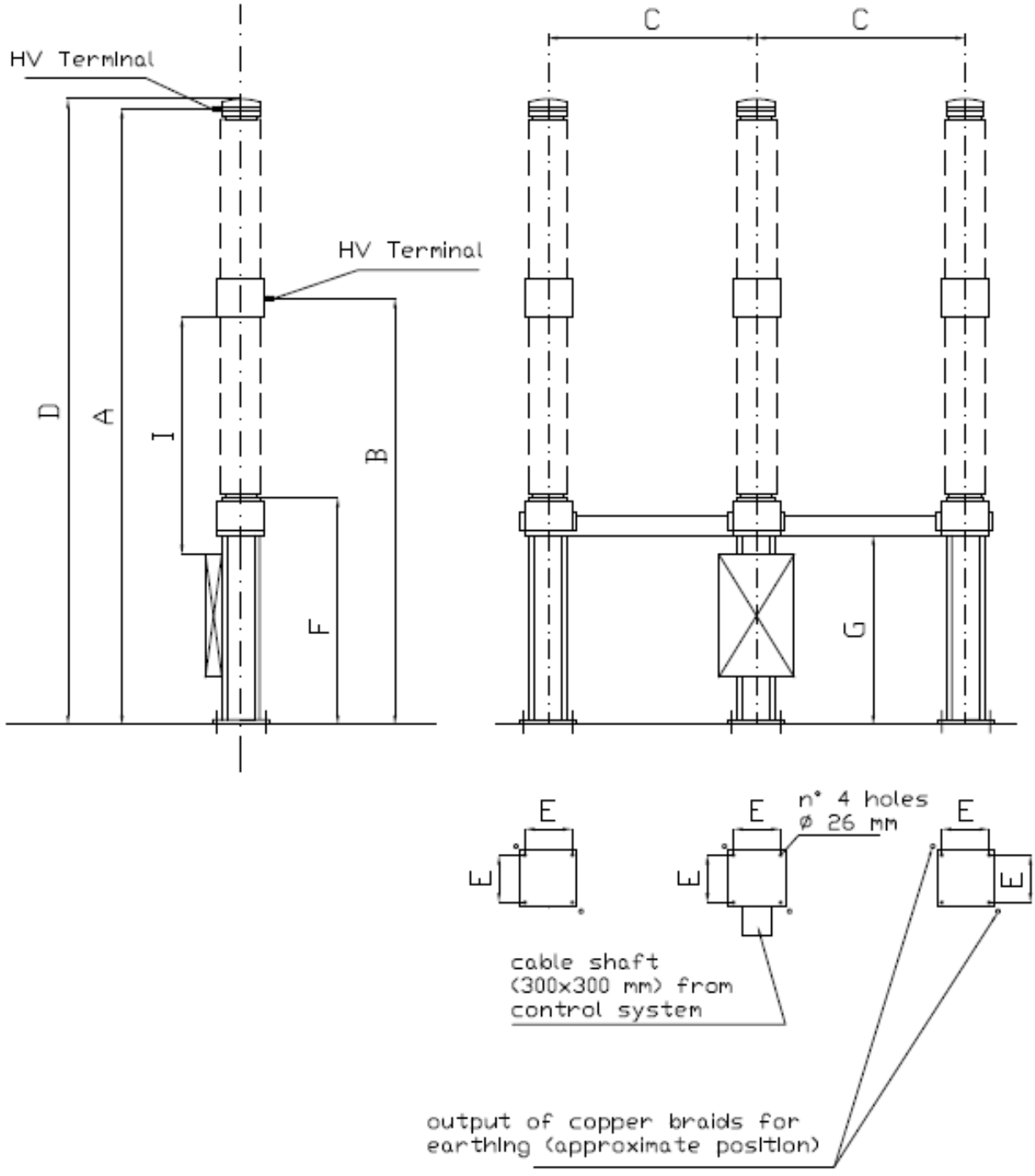


Figure 1

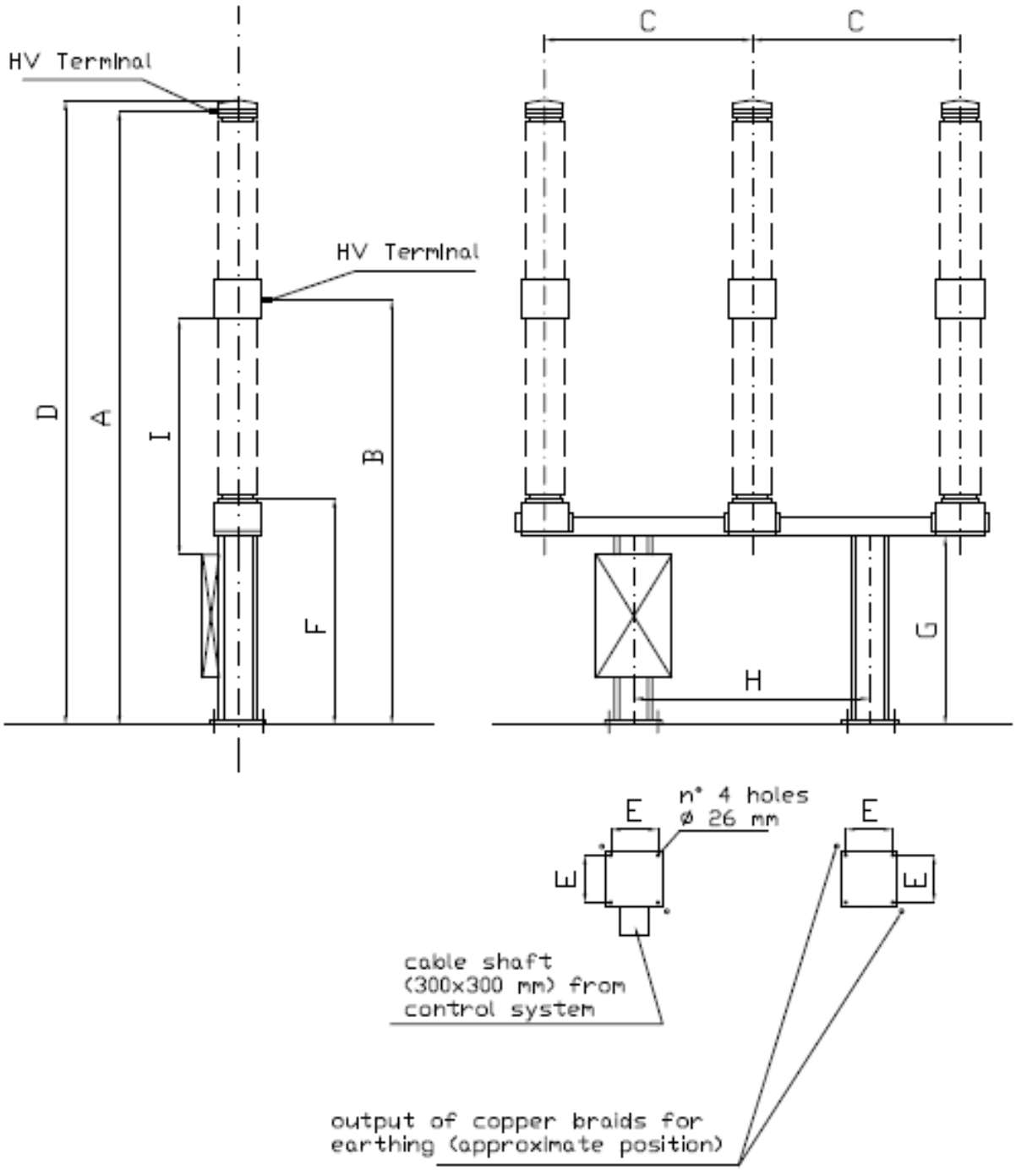


Figure 2

Company	Ref. figure	A	B	C	D	E	F	G	H	I
Ampla	2		≥ 3200	790 a 1050	≤ 4300		≥2250[6]	1700		
Coelce	2		≥ 3200	790 a 1050	≤ 4300		≥2250[6]	1700		
Edelnor							≥2250[6]			
Endesa	2		≥ 3130	≥630			≥2300[7]			≥1400[7]

Table 1 – Dimensions for 72,5 kV CBs (in mm)[8]

Company	Ref. figure	A	B	C	D	E	F	G	H	I
Ampla	2		≥3600	≤1630	≤5200		≥2250[6]	2530		
Chilectra			≥ 3500	≥ 1750	≤ 7000	400	≥2250[6]			
Codensa	2	≥ 5180	≥ 3630	≥ 1750	≥ 5480	370 x 230	≥2250[6]	2530		
Edesur			≥3700				≥2250[6]			
Endesa	2		≥ 3800	≥1300			≥2300[7]			≥2000[7]
Enel Distributie	1	≤6500	4500 ±30	2000	≤6500	50	≥2250[6]			
Enel Distribuz.	1	≤6500	4500 ±30	2200	≤6500	50	≥2250[6]			

Table 2 – Dimensions for 145 kV CBs (in mm)[8]

[6] In accordance with par. 7.2.4 of IEC 61936-1

[7] In accordance with Real Decreto Riesgo Eléctrico 614/2001 and NNM001.- Normas de operación definiciones

[8] Blank cell means that there isn't a mandatory requirement for that characteristic

Company	Ref. figure	A	B	C	D	E	F	G	H	I
Enel Distribuz.	1		4500 ±30	2200	≤6500	50	≥2250[6]			

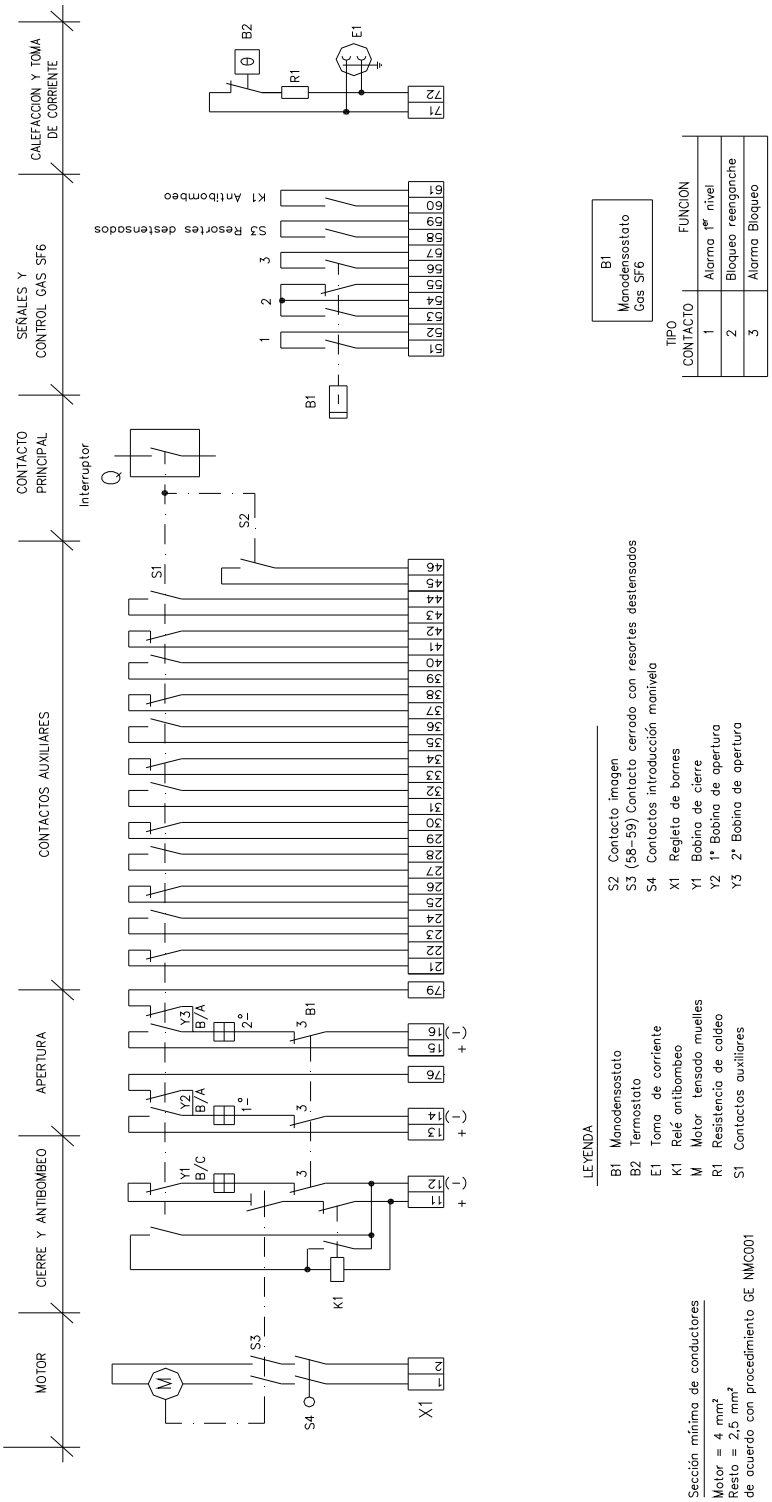
Table 3 – Dimensions for 170 kV CBs (in mm)[8]

Company	Ref. figure	A	B	C	D	E	F	G	H	I
Chilectra	1		≥4600	≥3500	≤8500	400	≥2250[6]			
Codensa							≥2250[6]			
Edelnor							≥2250[6]			
Edesur			≥4600				≥2250[6]			
Enel Distribuz.	1	≤6500	5300 ±30	3200		50	≥2250[6]			

Table 4 – Dimensions for 245 kV CBs (in mm)[8]

ANNEX C – ELECTRICAL SCHEMES

C.1 – ENDESA ELECTRICAL SCHEMES



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

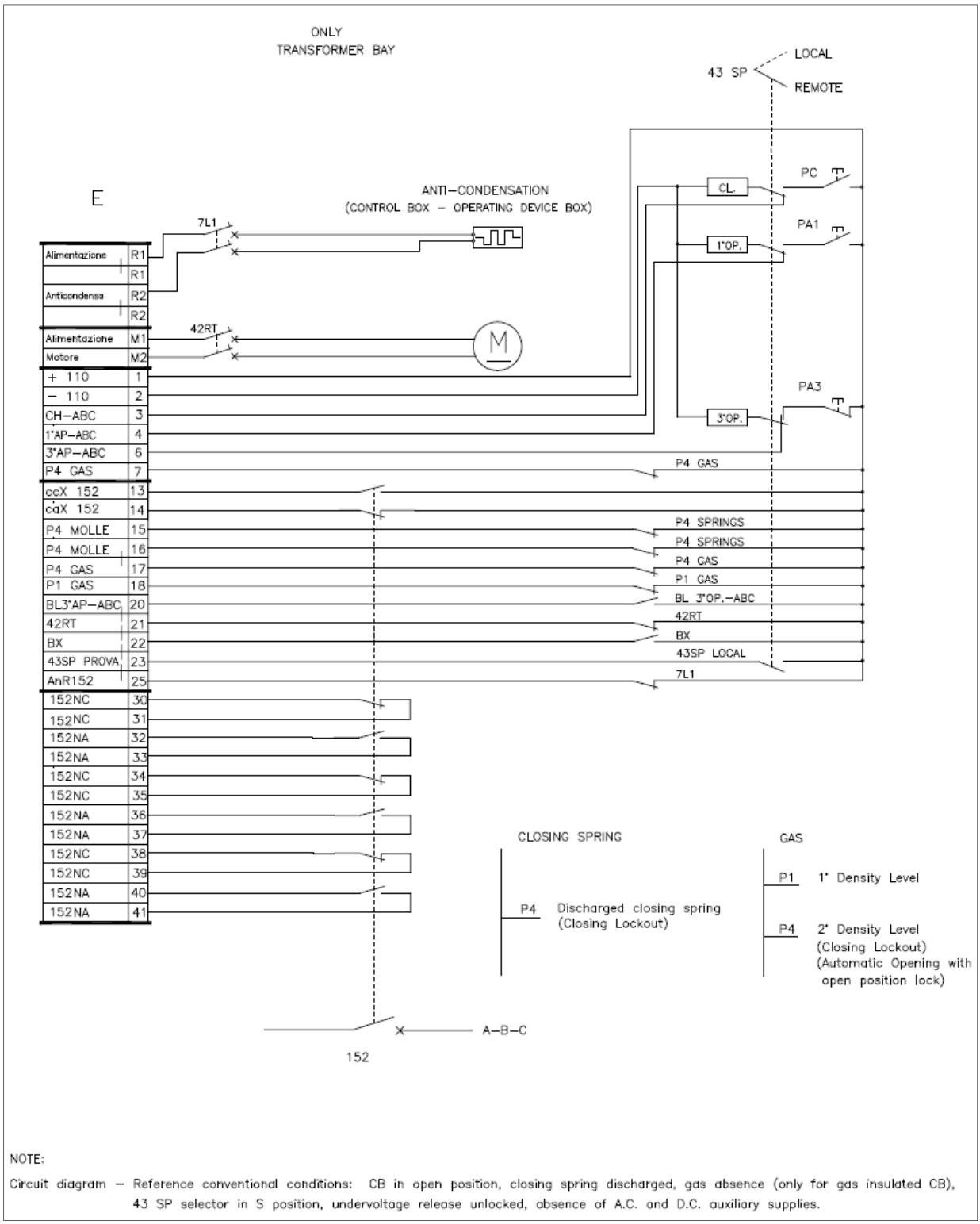


Figure 3 (three-pole CBs electrical scheme)

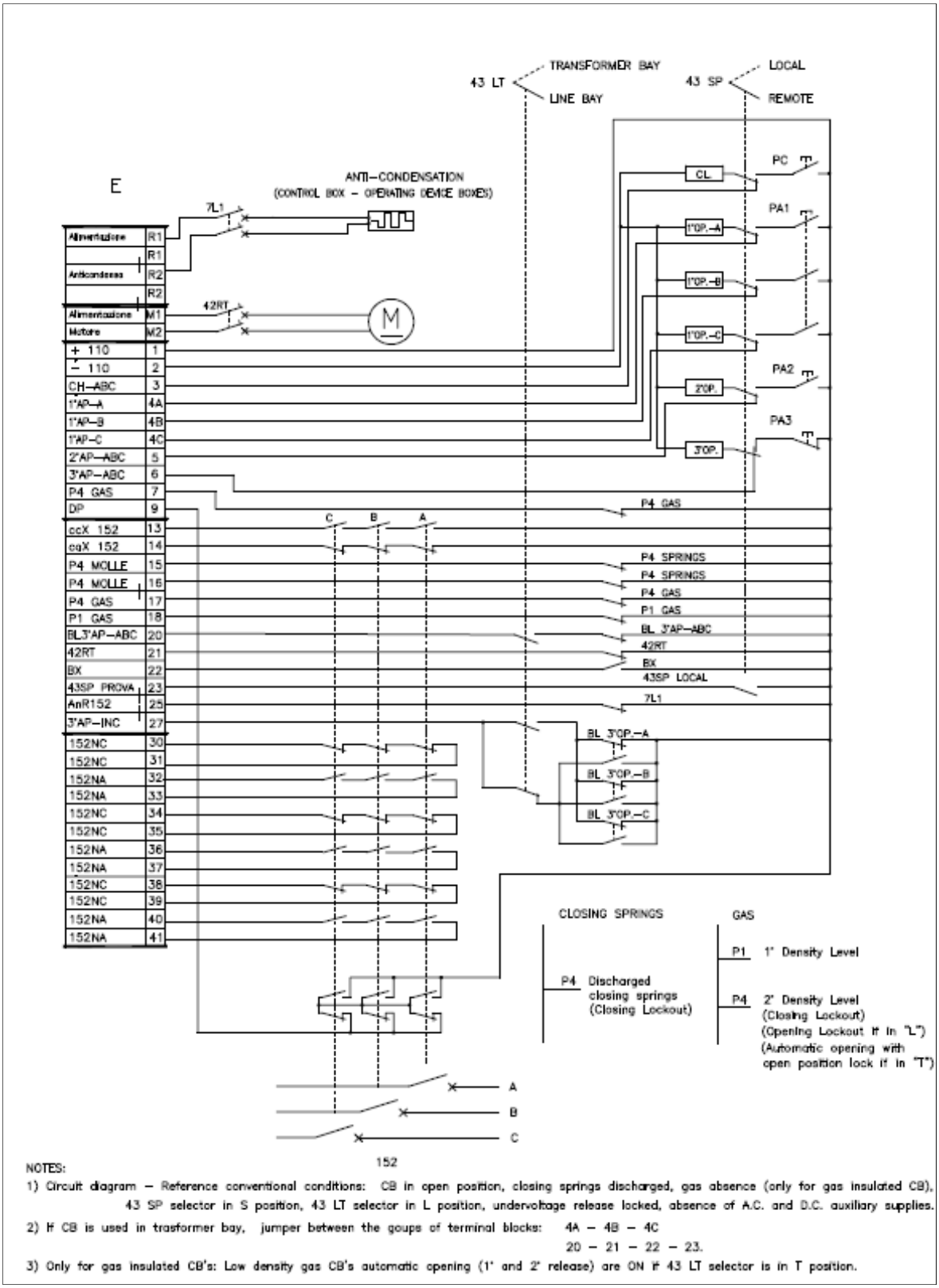
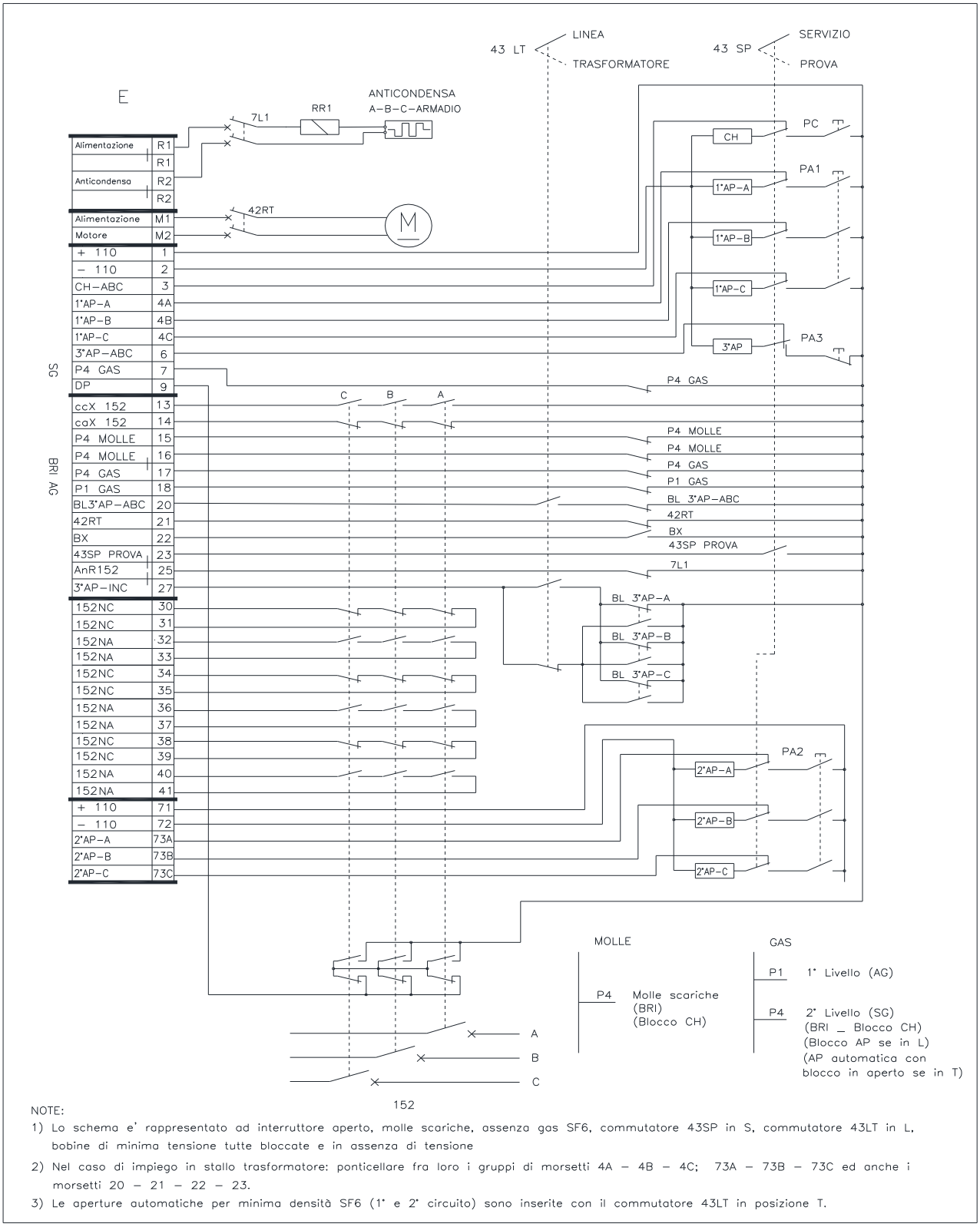


Figure 4 (72,5 ÷ 170 kV single-pole CBs electrical scheme)

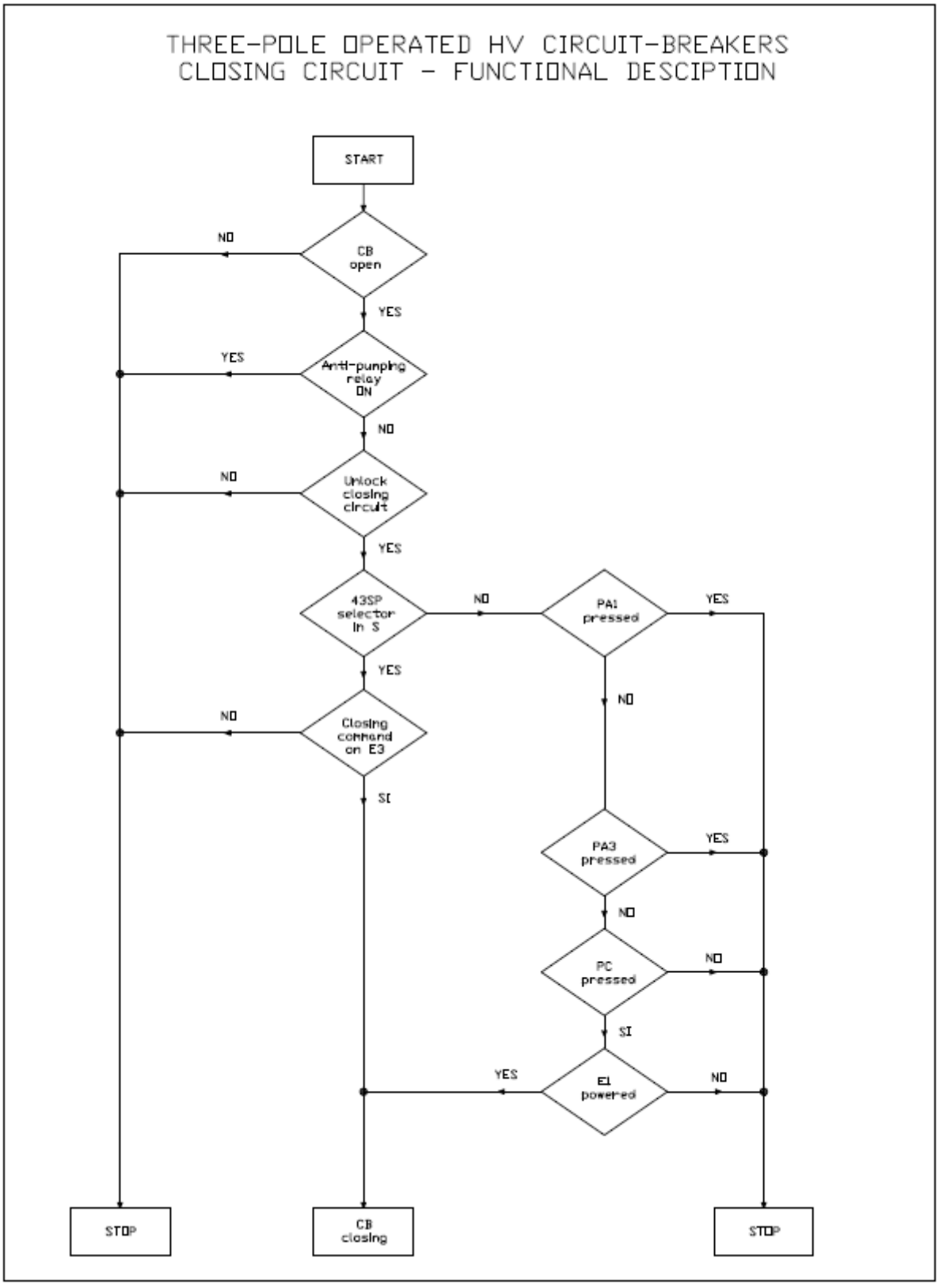


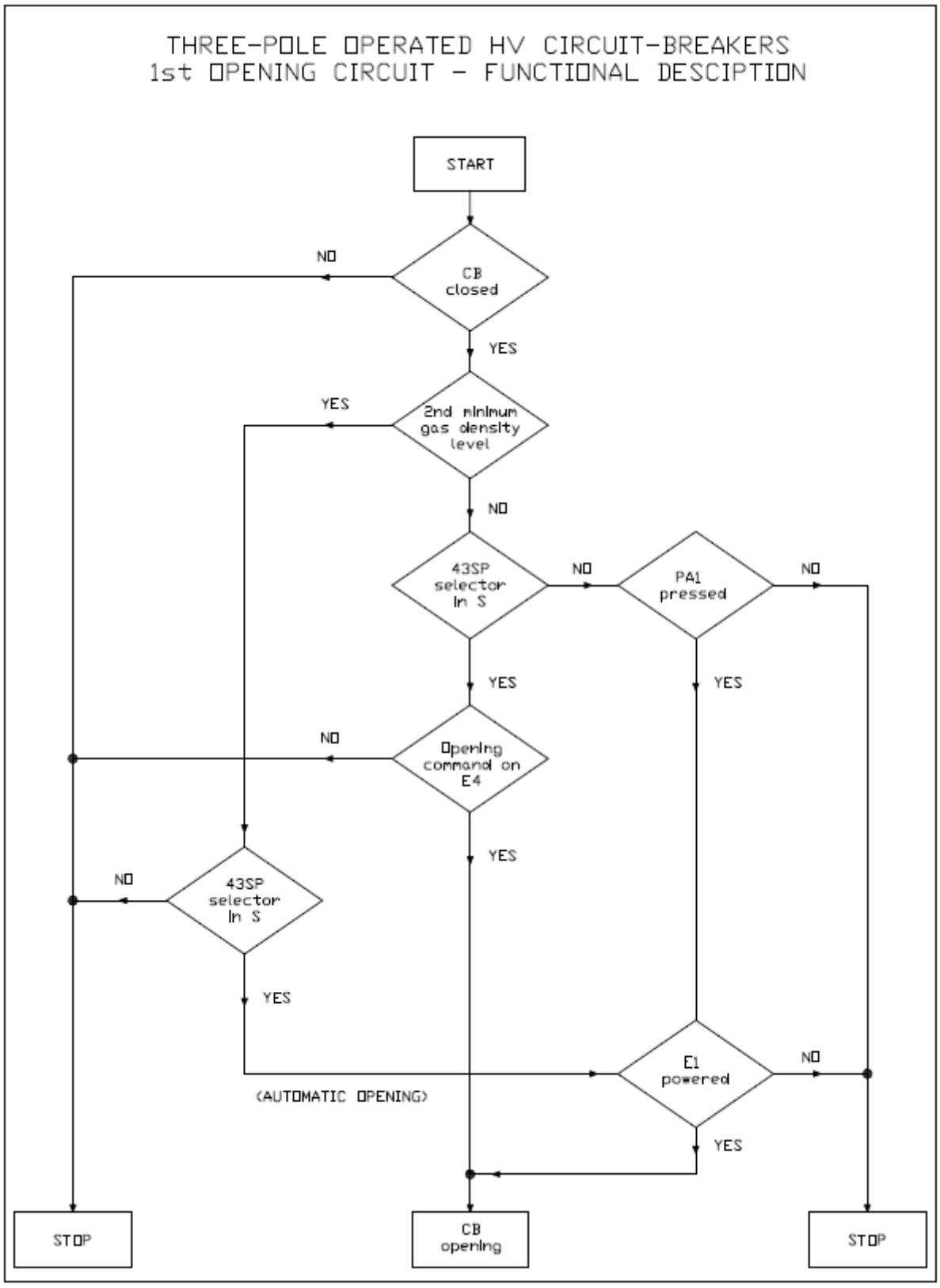
NOTE:

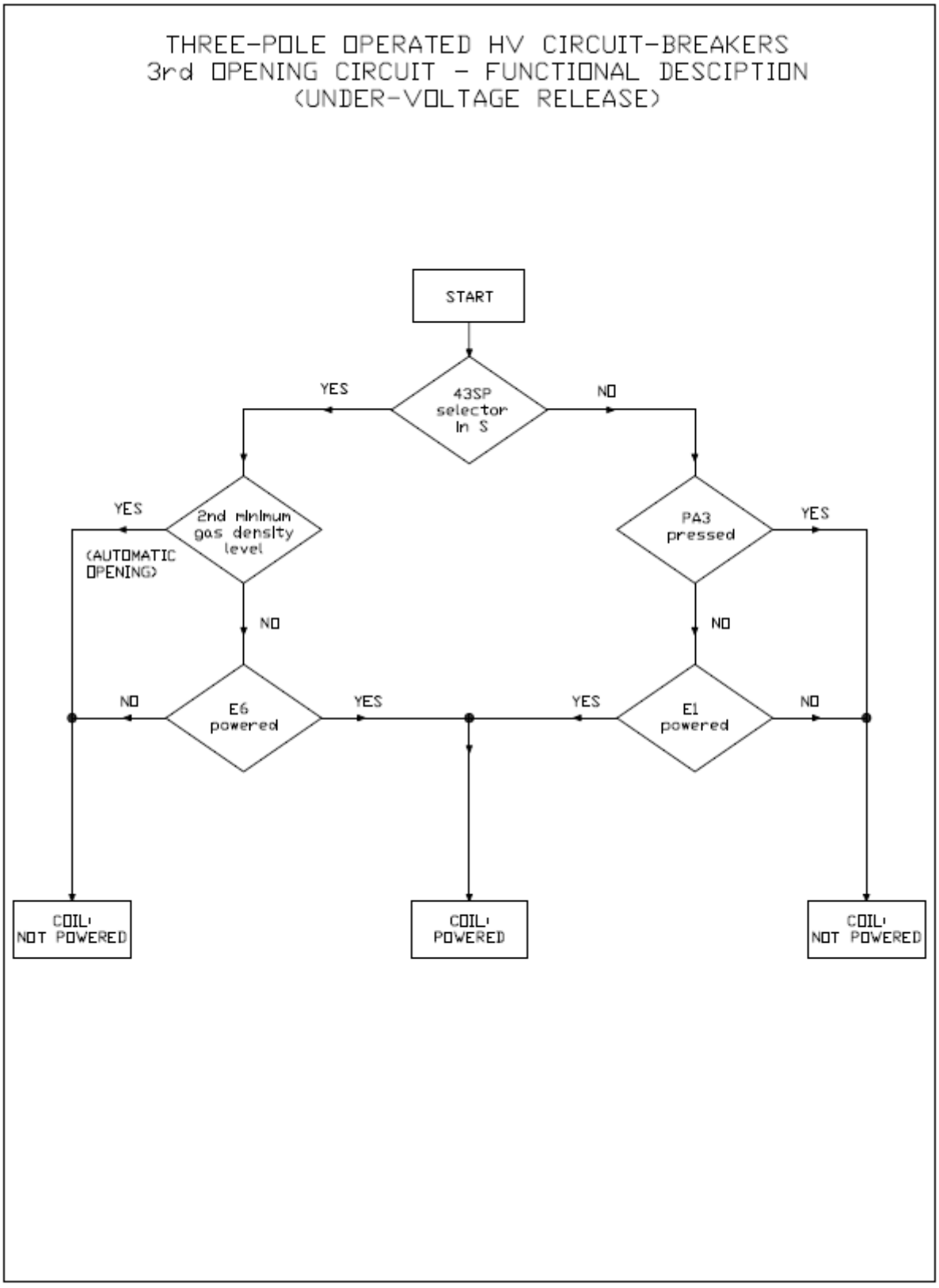
1) Lo schema e' rappresentato ad interruttore aperto, molle scariche, assenza gas SF6, commutatore 43SP in S, commutatore 43LT in L, bobine di minima tensione tutte bloccate e in assenza di tensione
2) Nel caso di impiego in stallo trasformatore: ponticellare fra loro i gruppi di morsetti 4A – 4B – 4C; 73A – 73B – 73C ed anche i morsetti 20 – 21 – 22 – 23.
3) Le aperture automatiche per minima densità SF6 (1° e 2° circuito) sono inserite con il commutatore 43LT in posizione T.

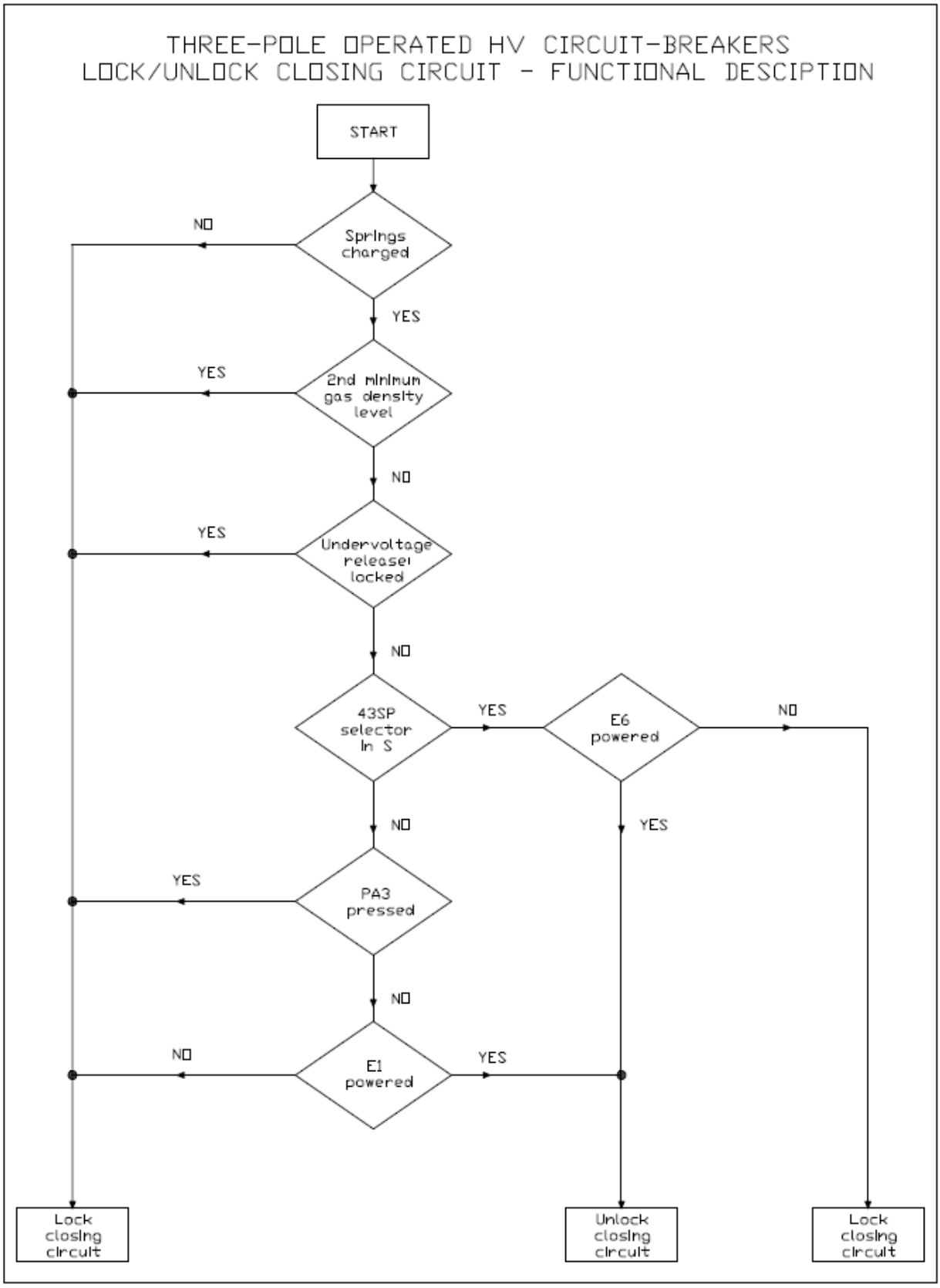
Figure 5 (245 kV single-pole CBs electrical scheme)

THREE-POLE CIRCUIT BREAKERS FLOWCHARTS:

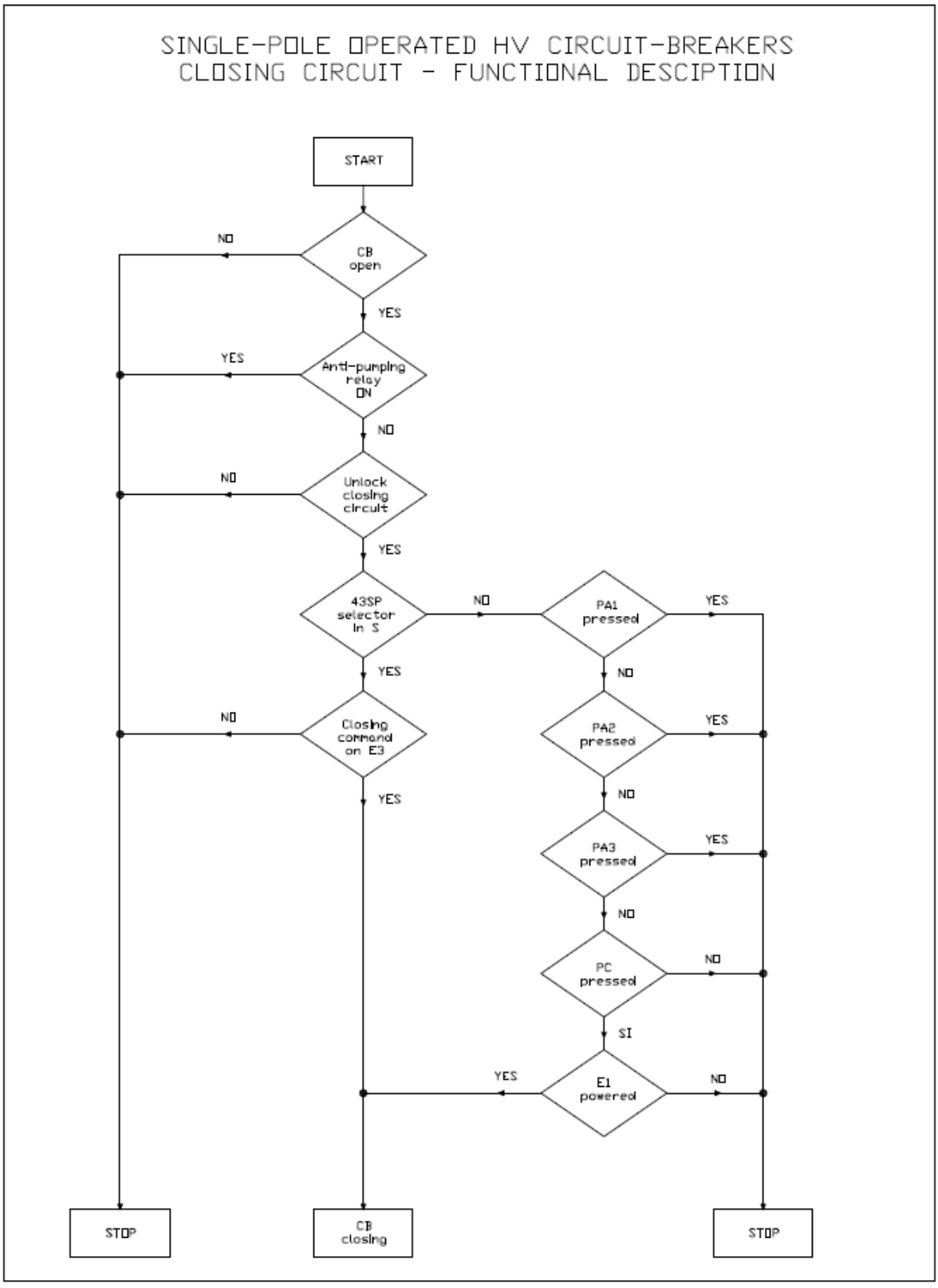


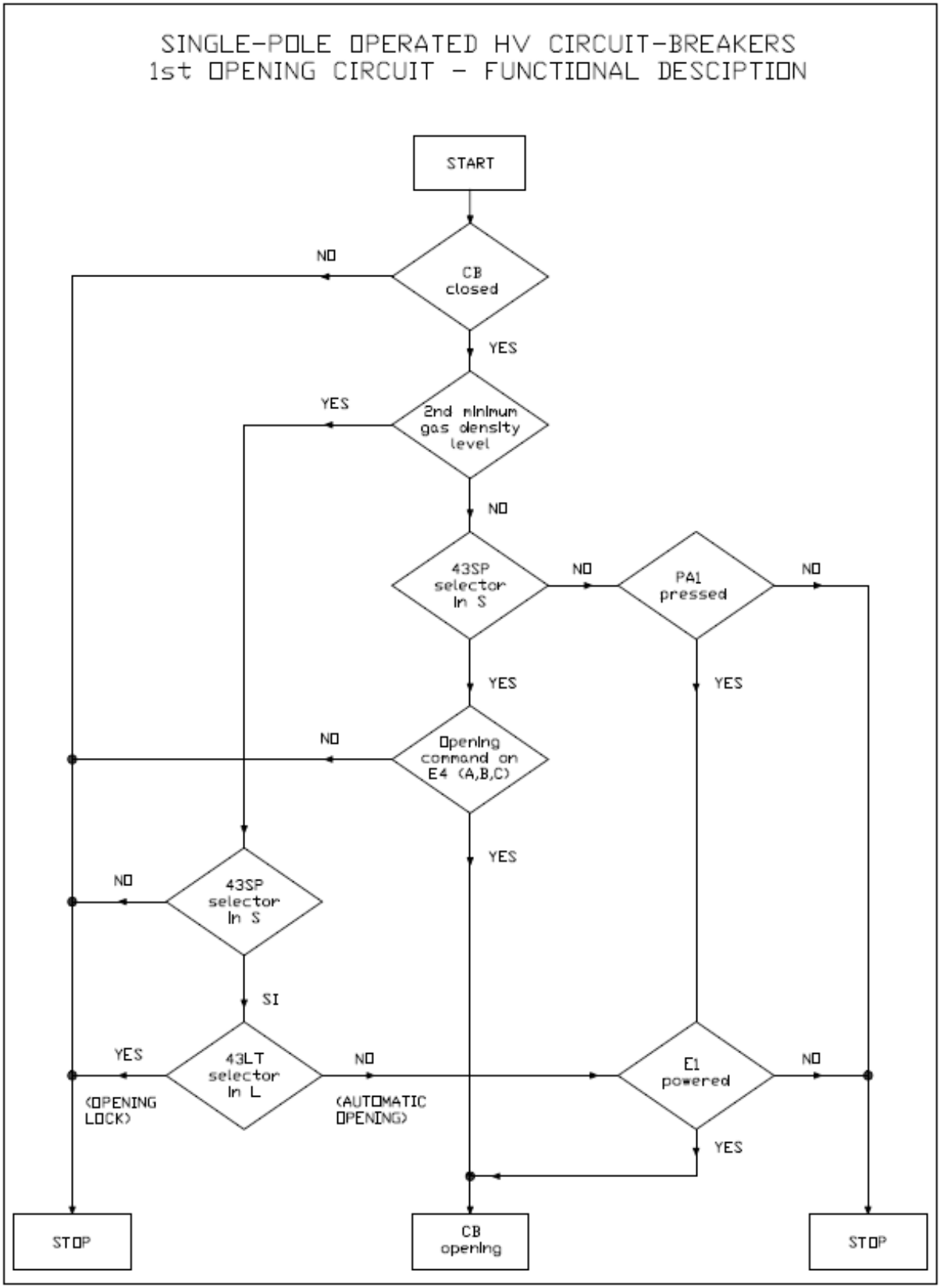


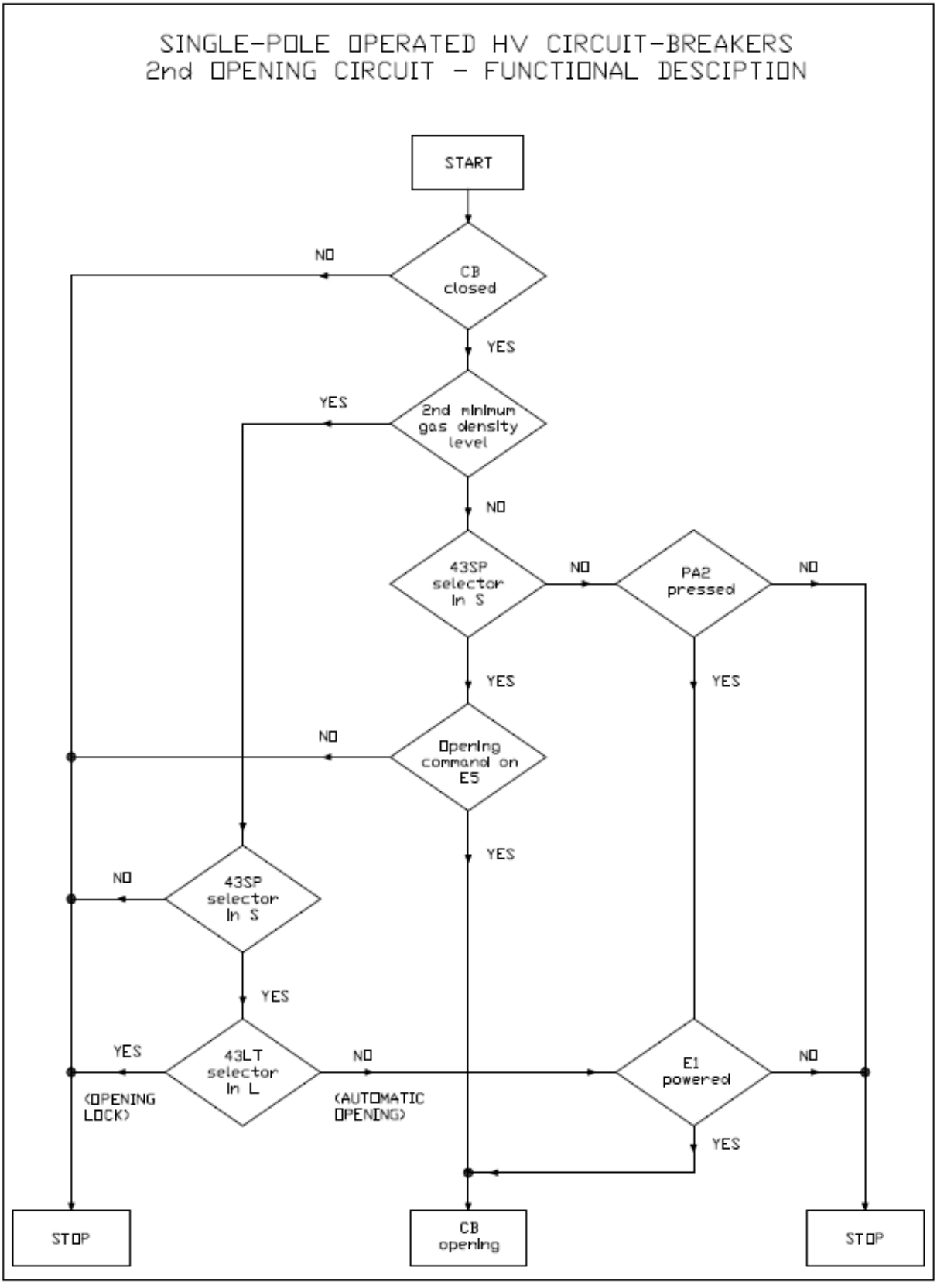


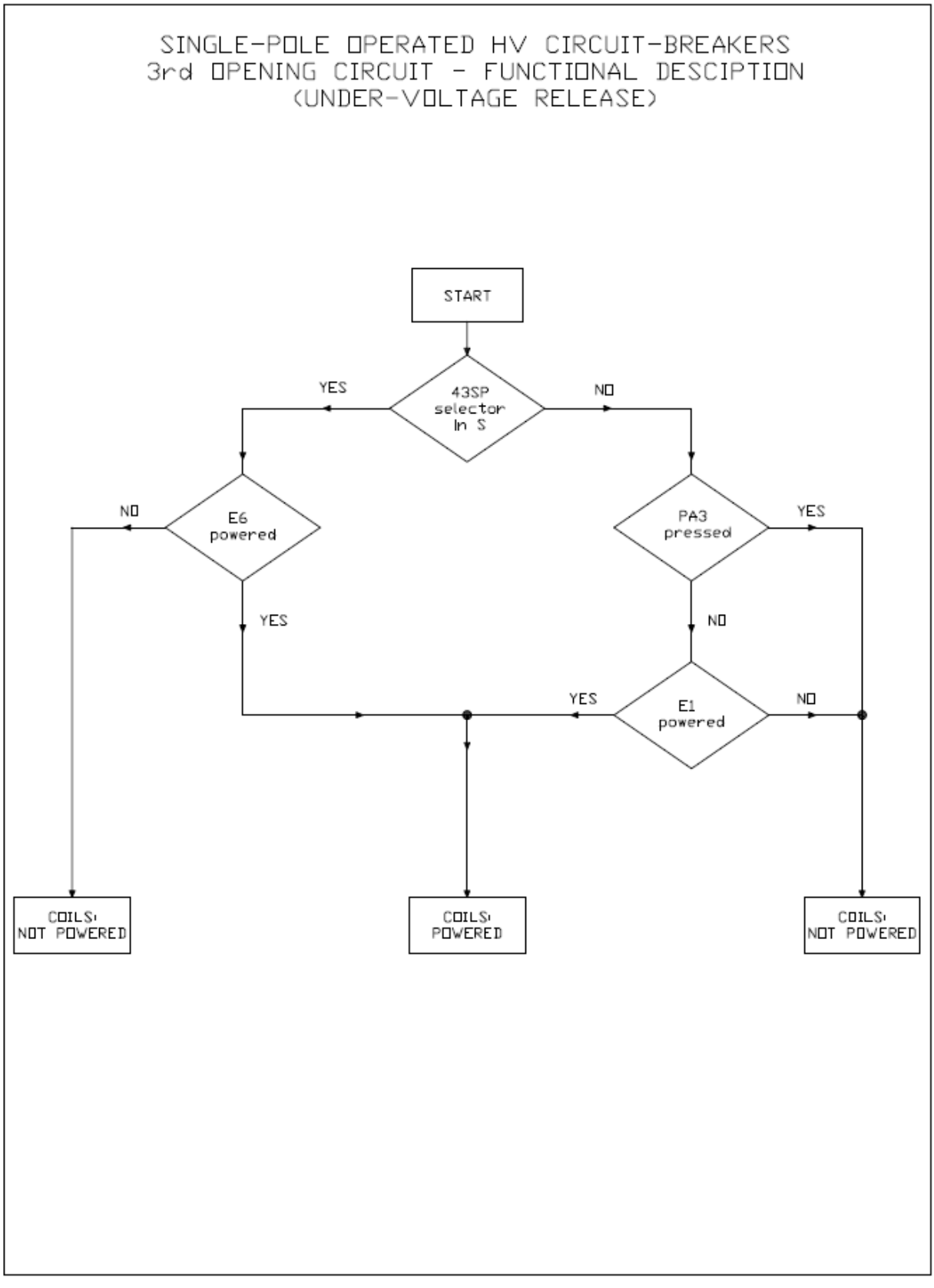


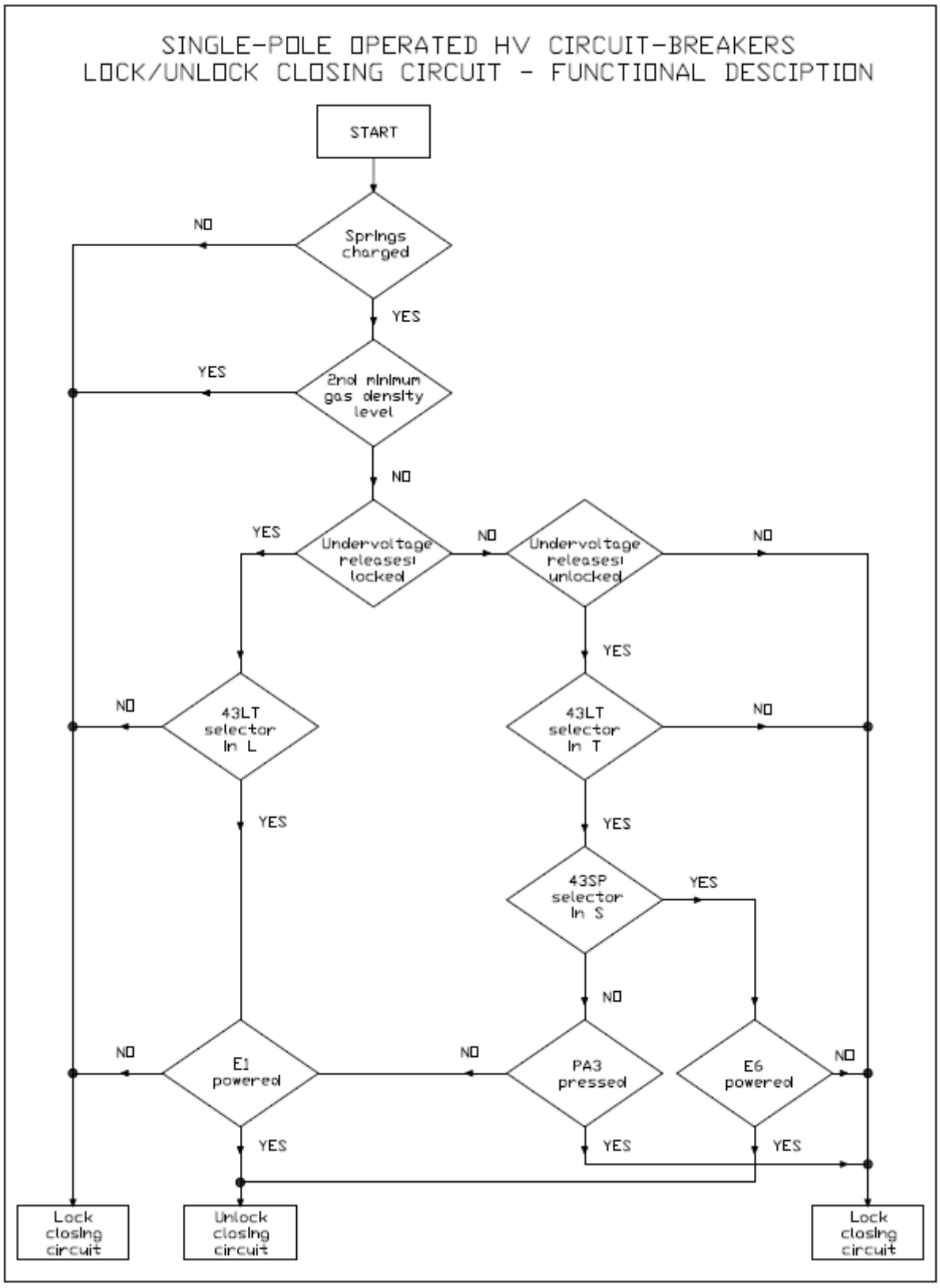
SINGLE-POLE CIRCUIT BREAKERS FLOWCHARTS:





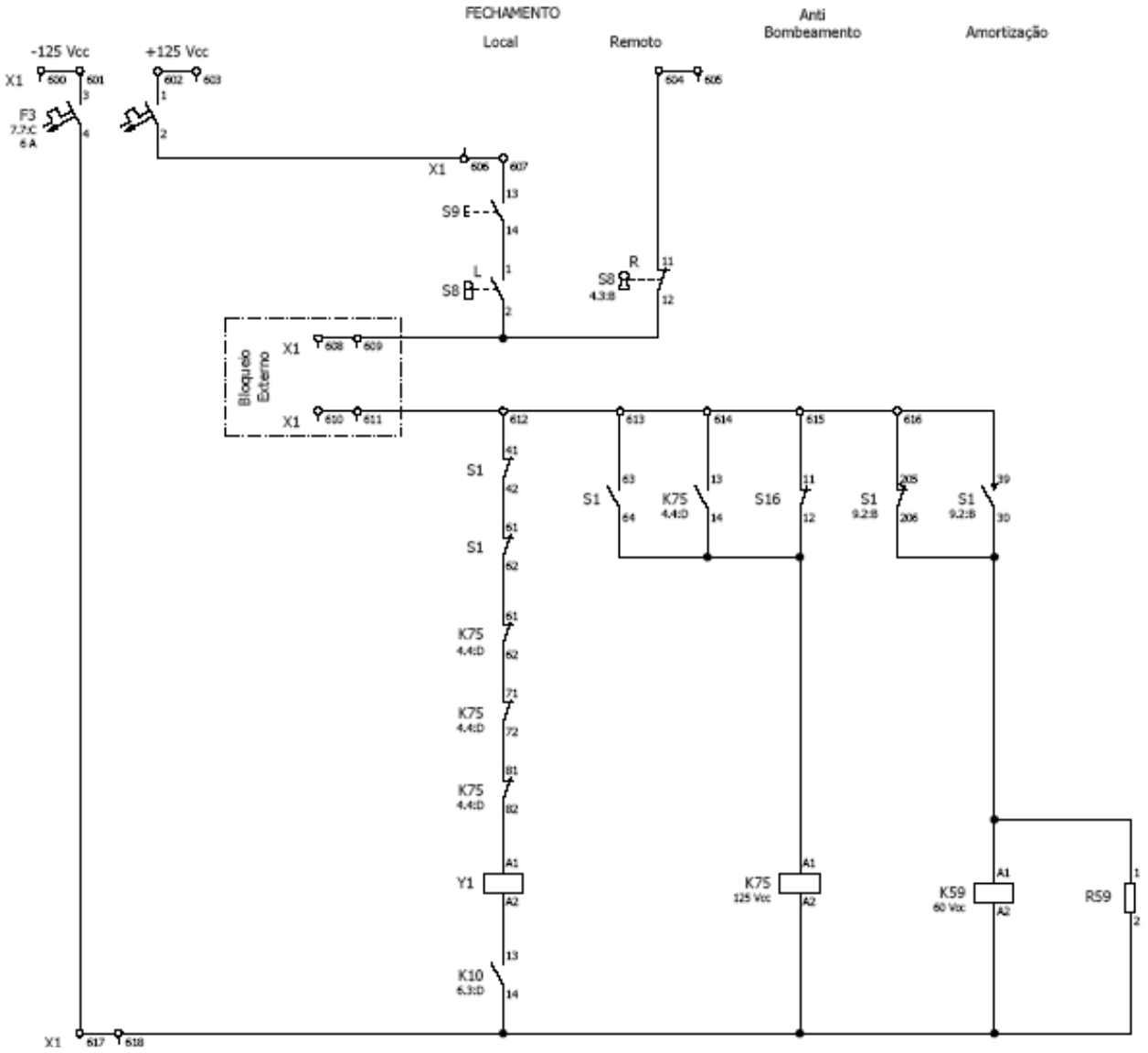


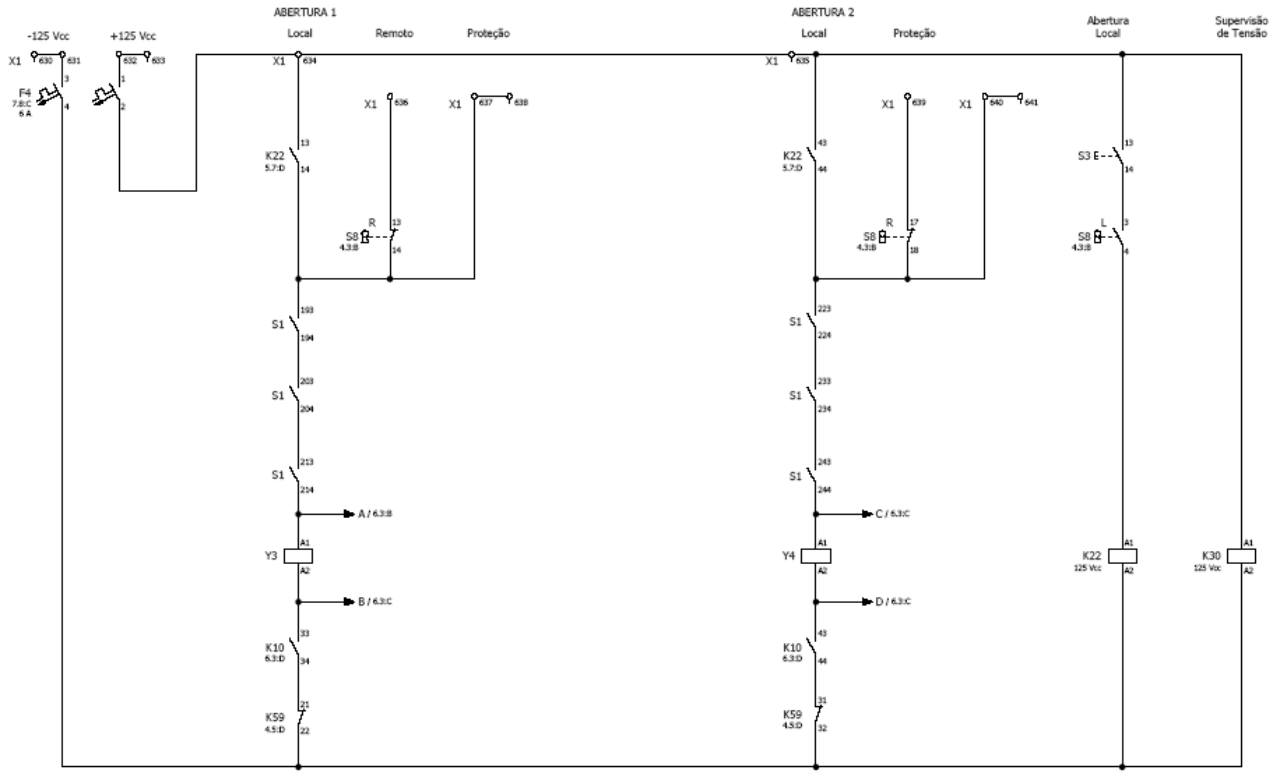


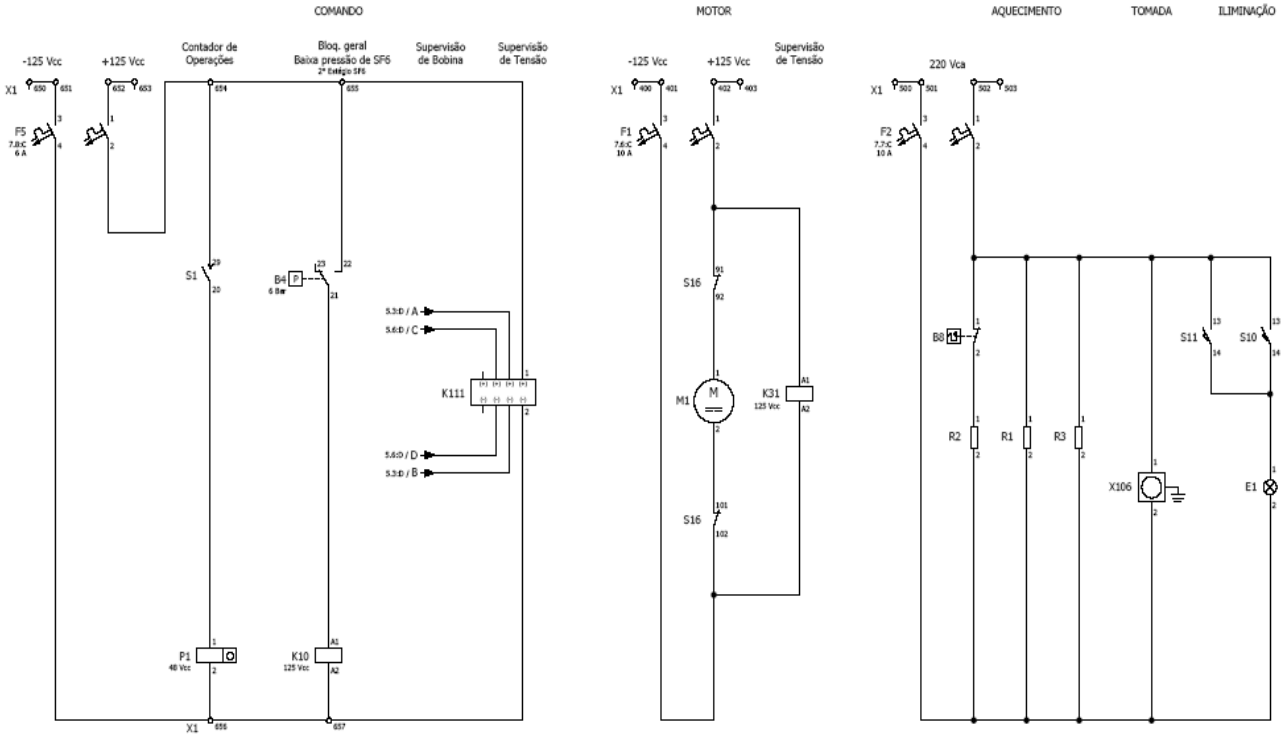


C.3 – LATAM ELECTRICAL SCHEMES

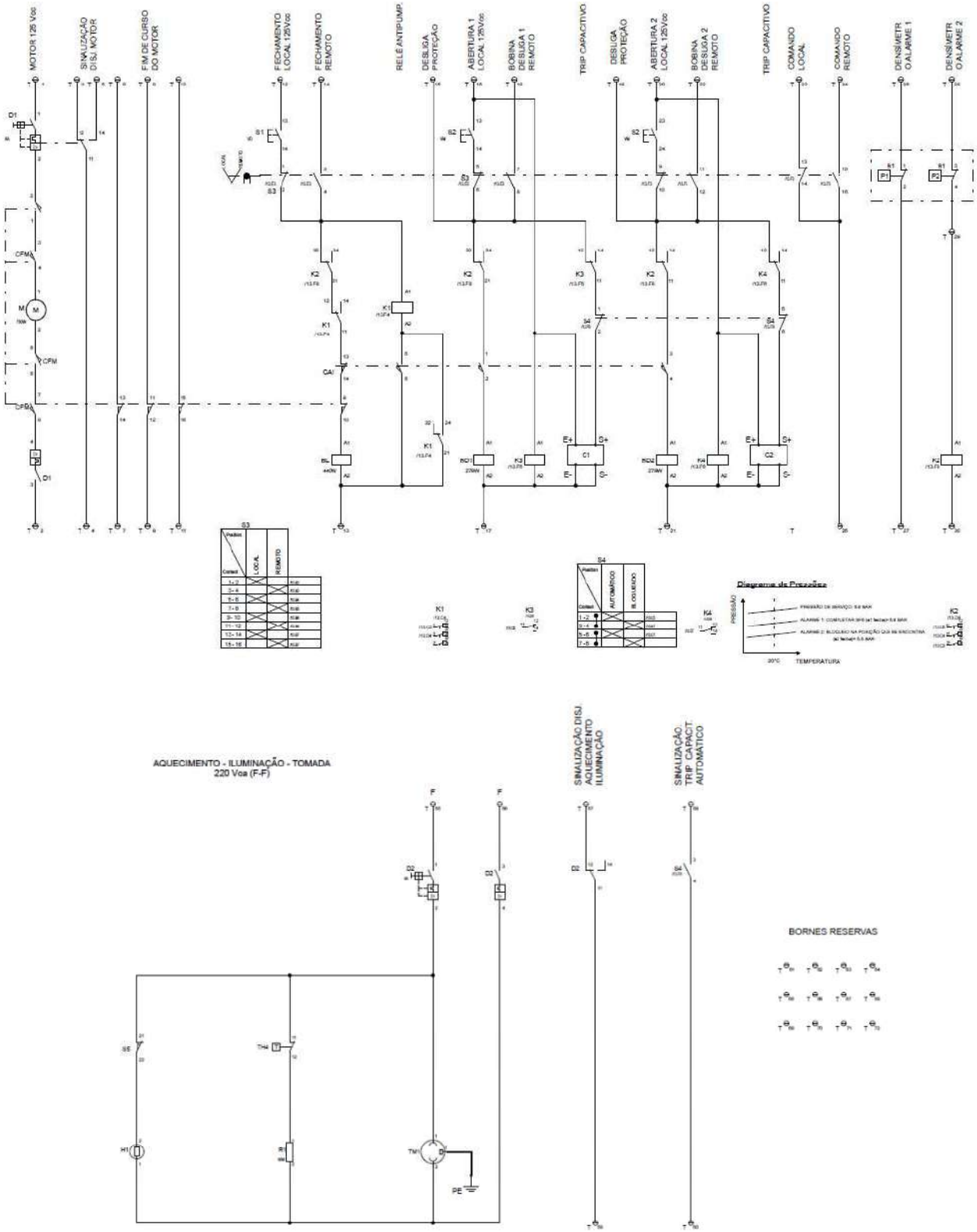
COELCE:

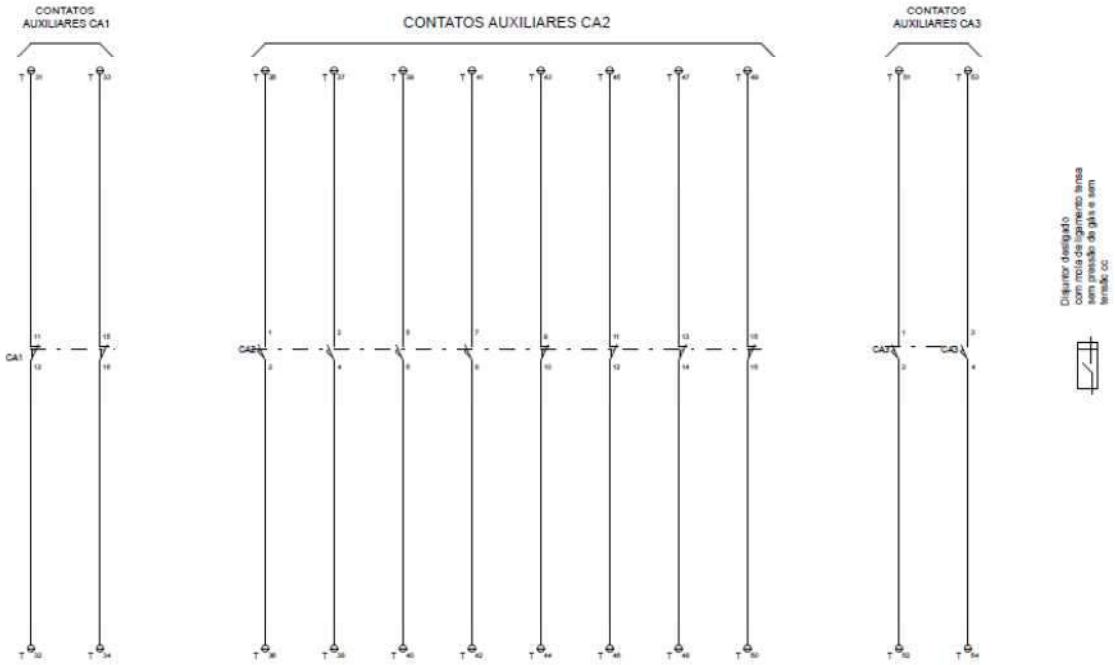




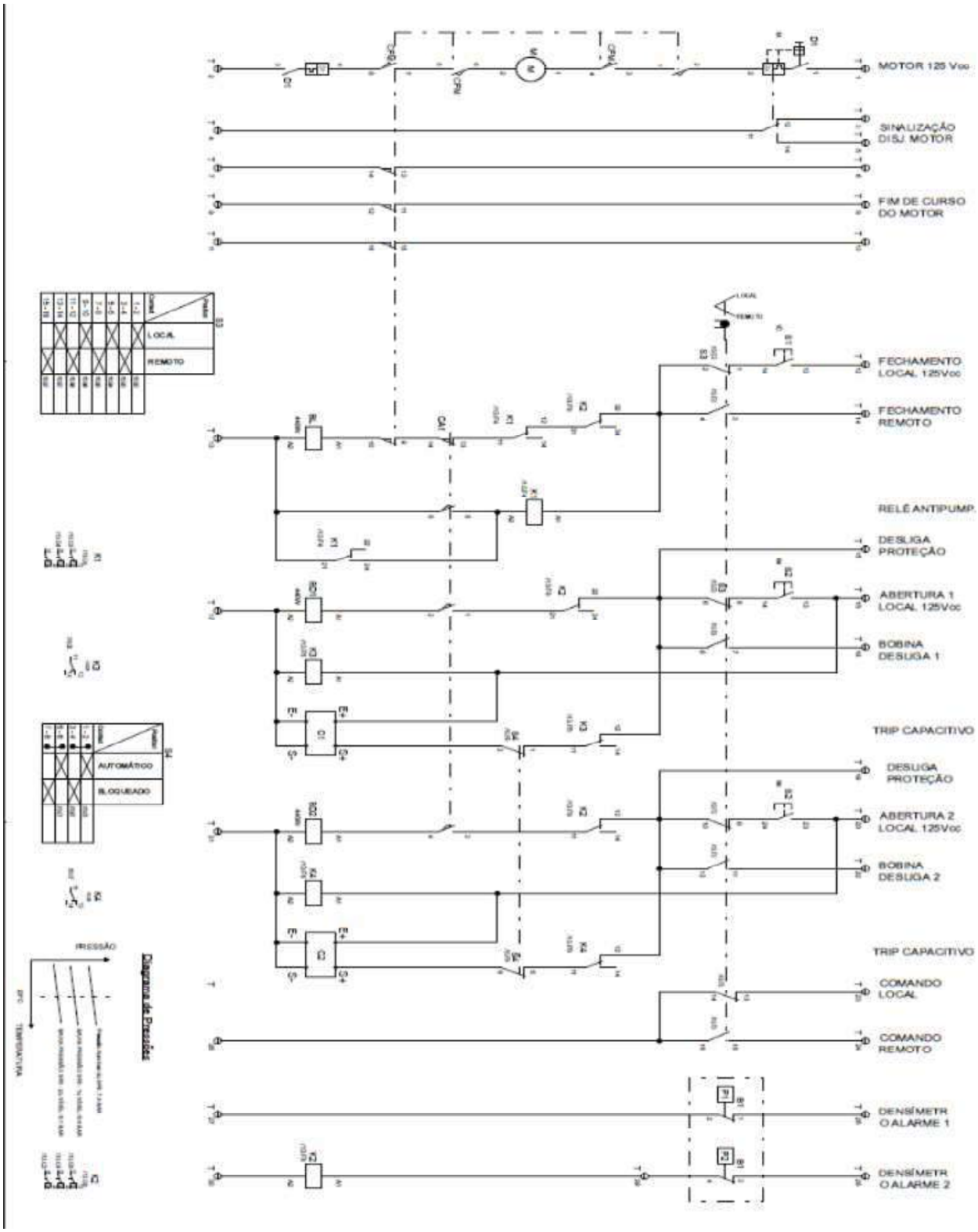


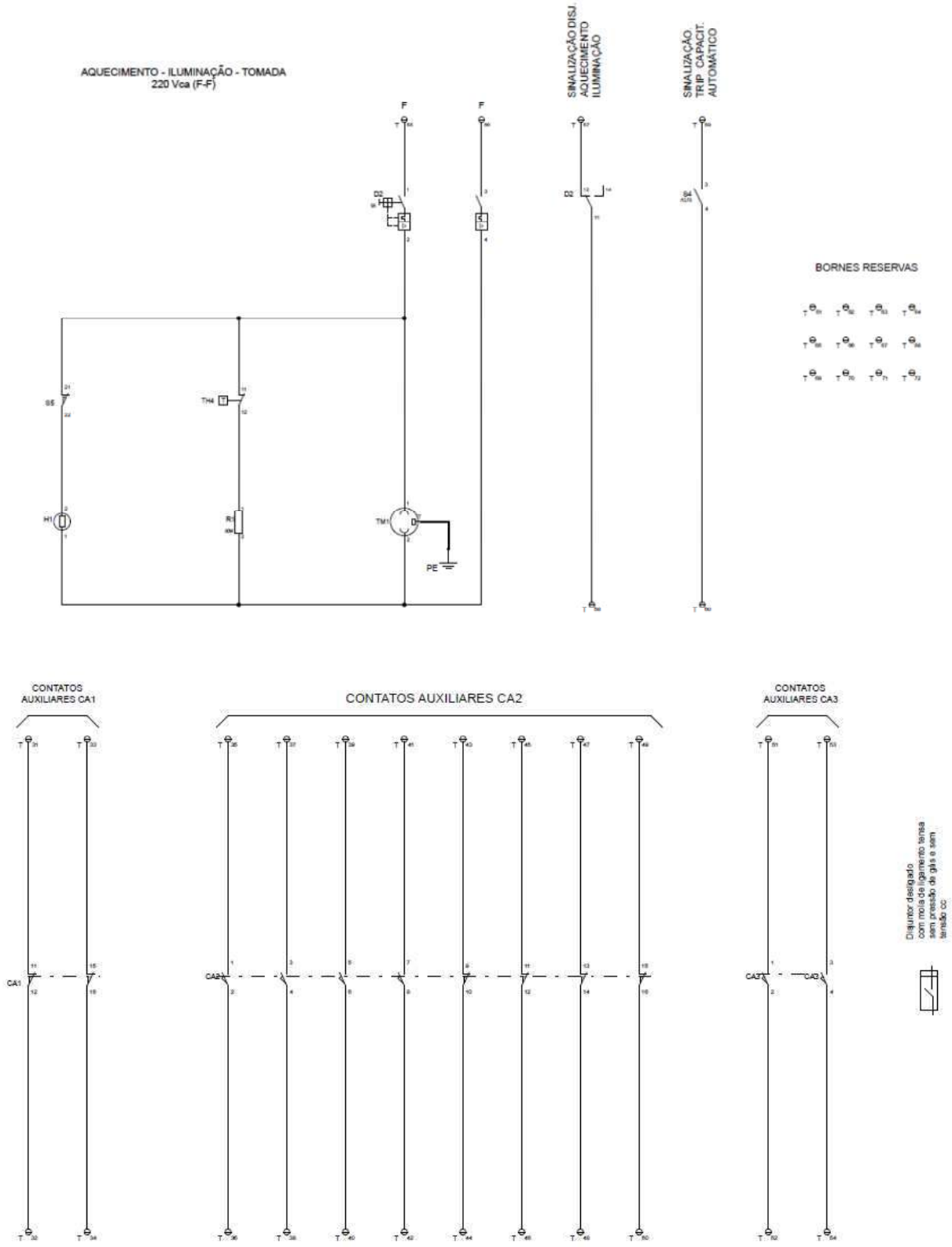
AMPLA – 72,5 kV:



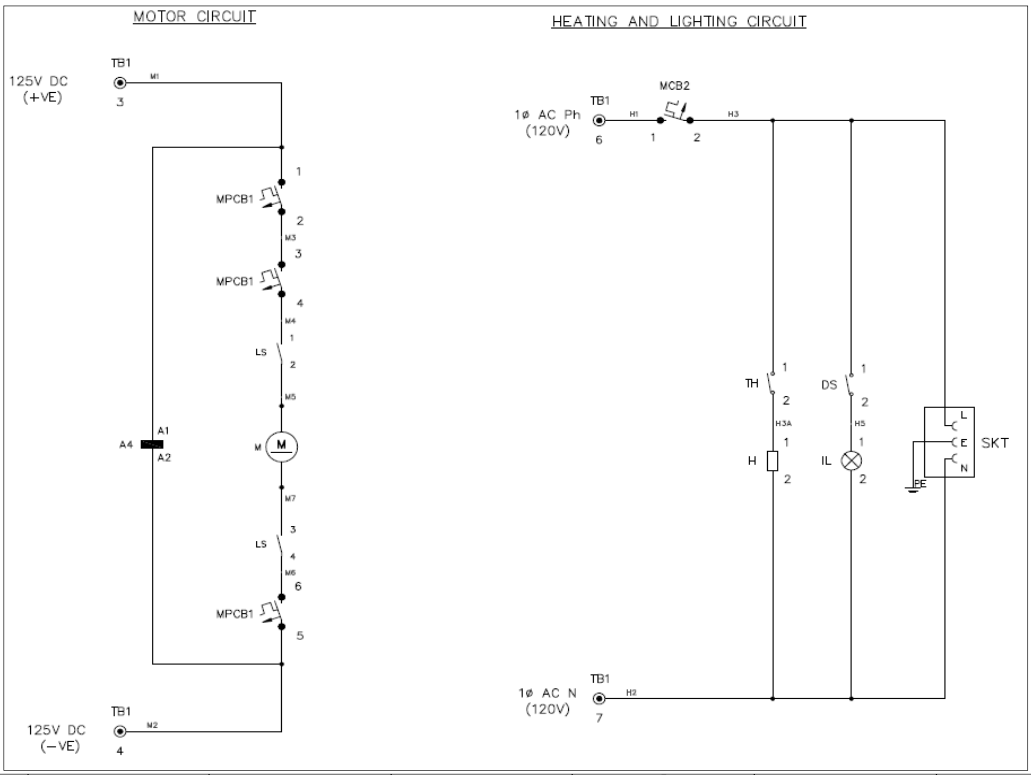


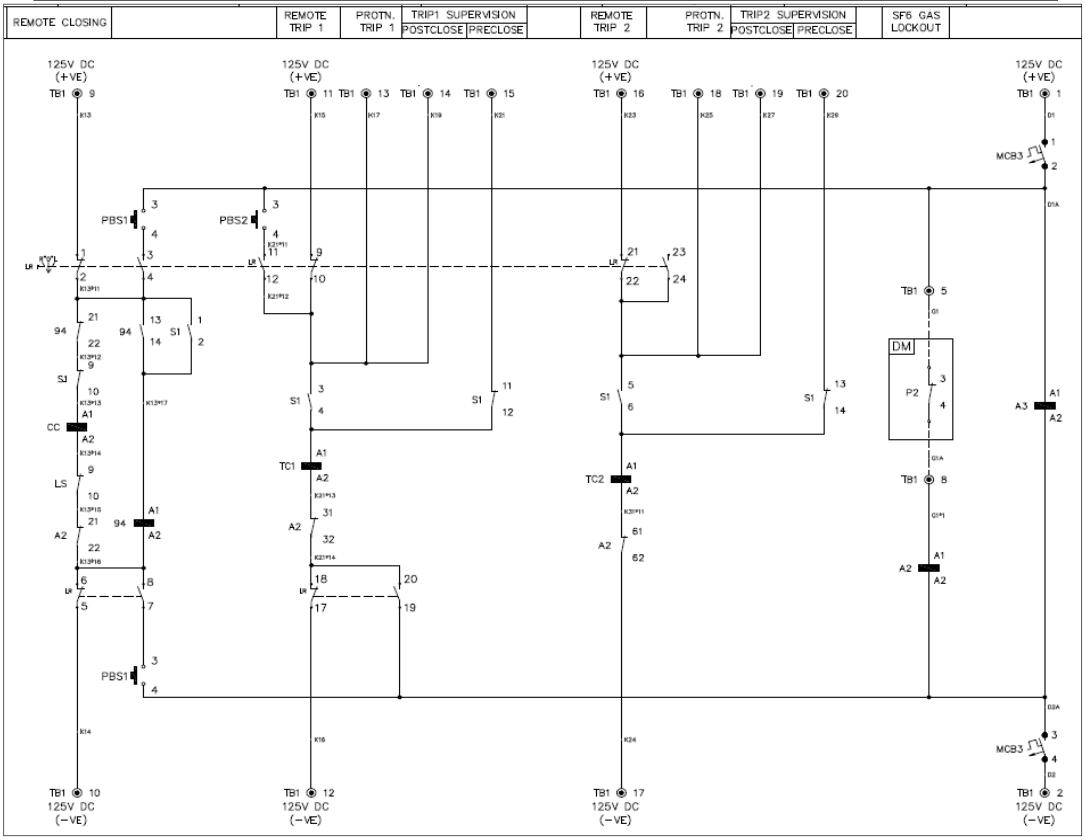
AMPLA 145 kV:

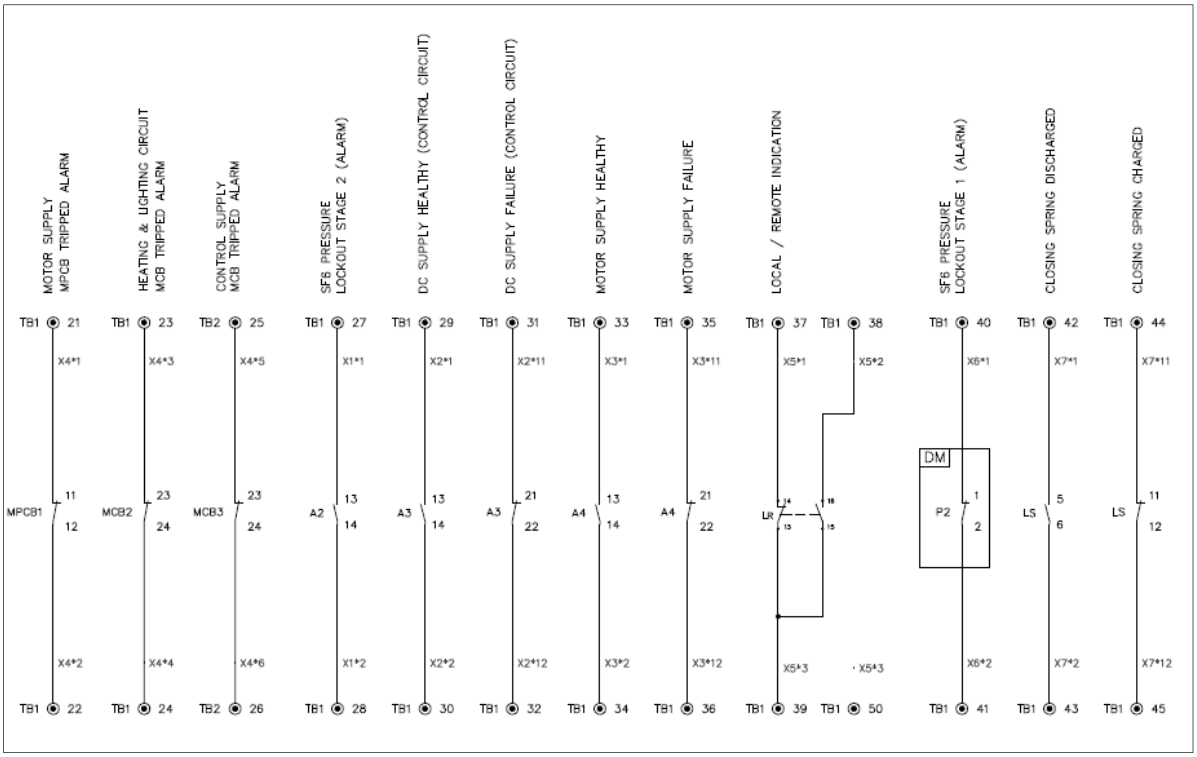


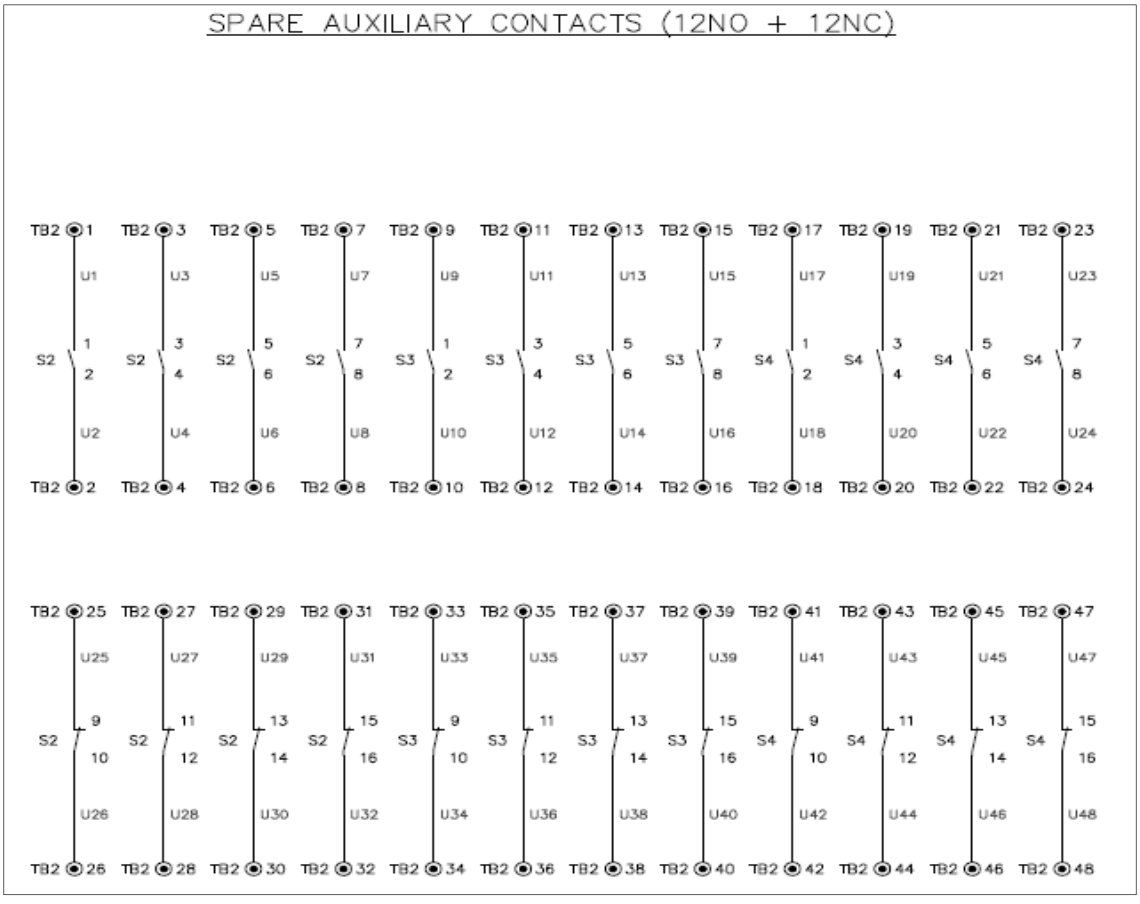


CODENSA:

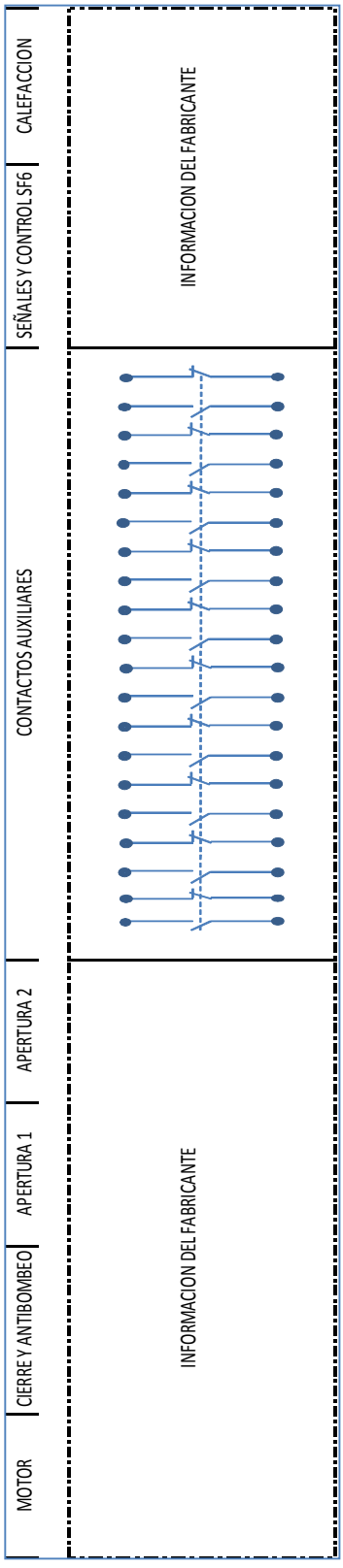




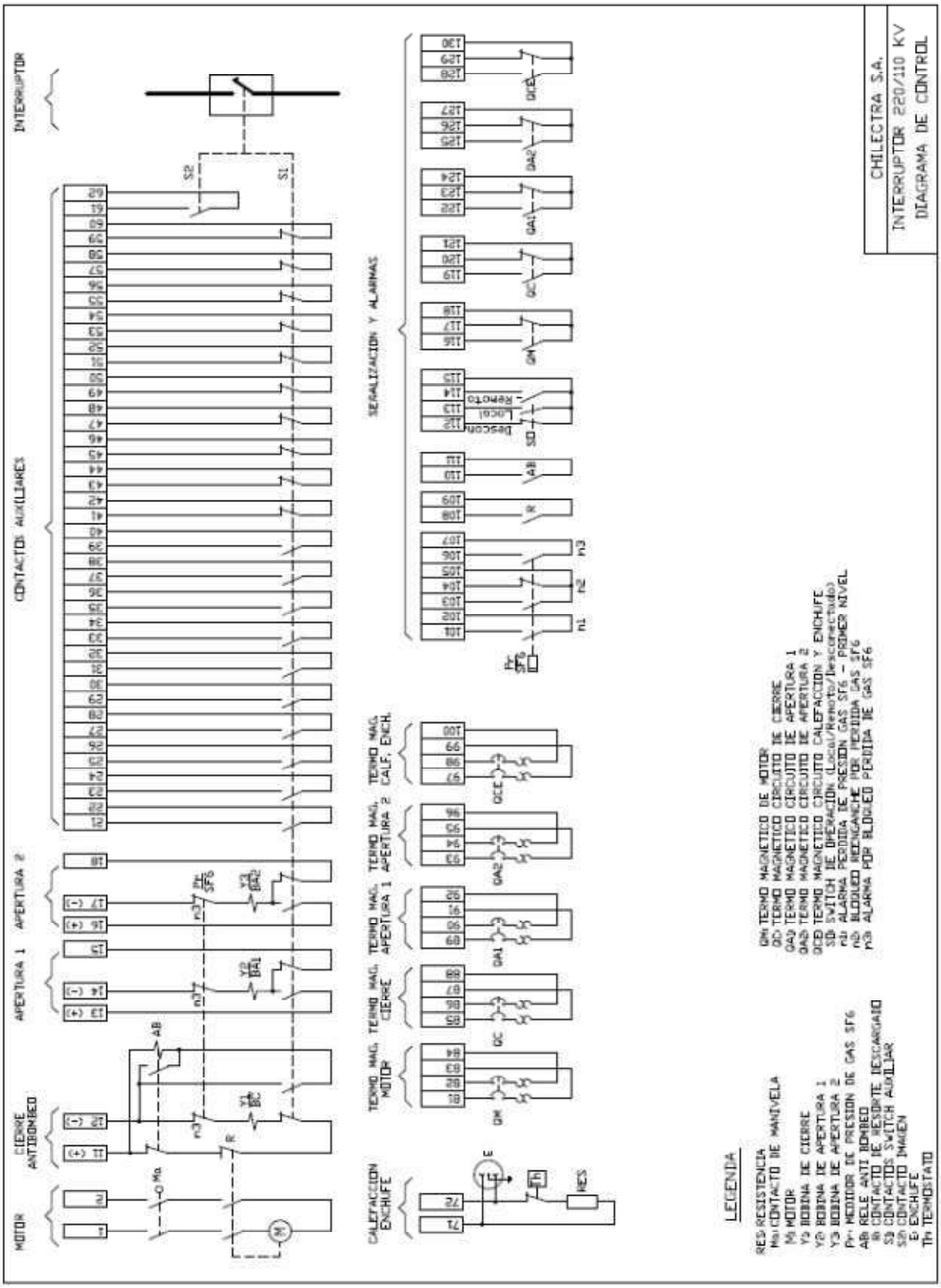




EDELNOR:



CHILECTRA:



ANNEX D – TENDER'S TECHNICAL DOCUMENTATION

GLOBAL STANDARD: GSH001 – HV Circuit Breakers	**TENDER:**	
SUPPLIER:	**FACTORY:**	
ENEL GROUP TYPE CODE: GSH001/__	**SUPPLIER MODEL:**	
TECHNICAL CHARACHTERISTIC	***STANDARD REQUIREMENT***	***SUPPLIER OFFER***
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	
Arc-suppression medium	SF6, non-fluorinated greenhouse gases or vacuum	
Rated short-duration power-frequency withstand voltage Ud (kV rms)		
Rated lightning impulse withstand voltage Up (kVp)		
Rated frequency fr (Hz)	50 or 60	
Rated normal current Ir (A)		
Rated short-circuit breaking current Isc (kA)		
Type of operation		
First-pole-to-clear factor k_{pp}		
Rated operating sequence	O - 0,3 s - CO - 1 min – CO	
Maximum break-time (ms)	60	
Rated opening time (ms)	-	
Rated closing time (ms)	-	
Circuit breaker class	C2 - E1 - M2	
Rated line-charging breaking current Il (A)		
Rated cable-charging breaking current Ic (A)		
Rated out-of-phase making and breaking current Id (kA)	Clause 4.106 of IEC 62271-100	
Auxiliary contact classes (Table 6 IEC 62271-1)	1	
Dimensions	See Annex A	To enclose an overall equipment drawing for each Enel Group Distribution Company
Insulators materials	Composite or ceramic	

Enel Distribuzione

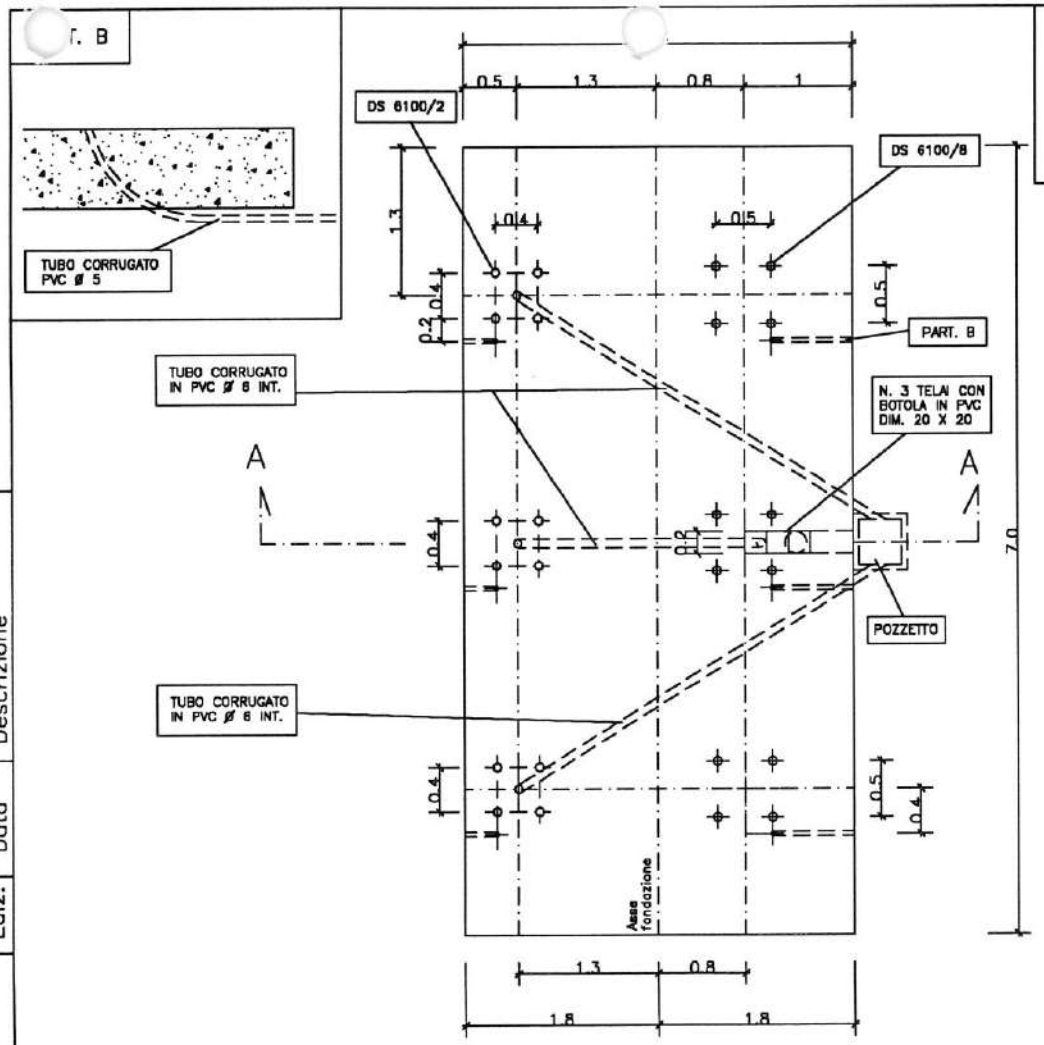
DIREZIONE EMILIA ROMAGNA
Ingegneria

CABINA PRIMARIA 132/15kV DI:

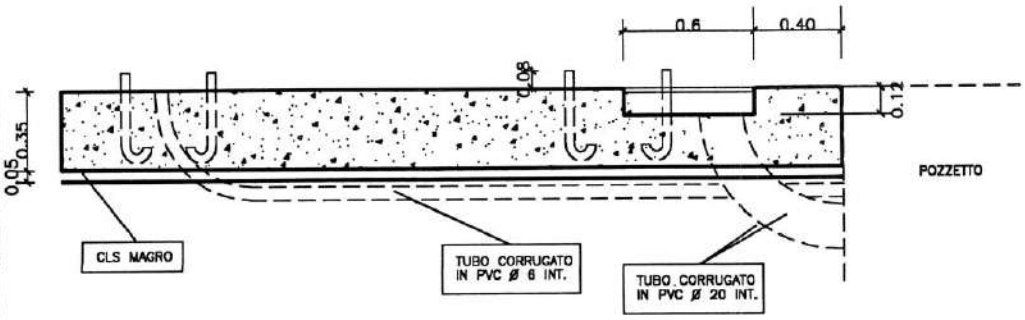
FONDAZIONE INTERRUTTORE CON TA

SCALA PLOT:		SCALA	N. GER66-3	FOGLIO
NOME FILE: GER663-5		Varie		1/1
DATA	10/04/02			

Ediz.	Data	Descrizione
5	10/4/02	verifica quantità
4	05/5/00	Ferri d'armatura

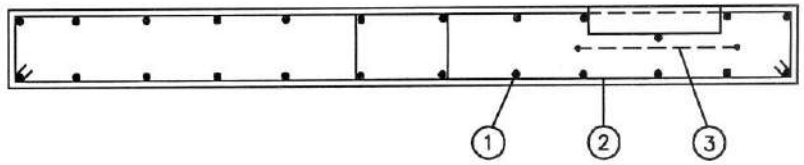


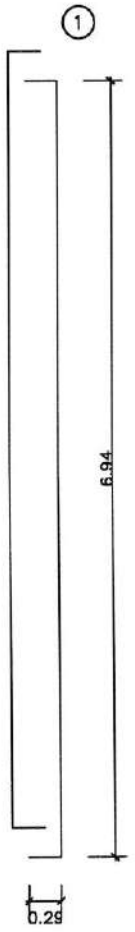
SEZIONE A-A

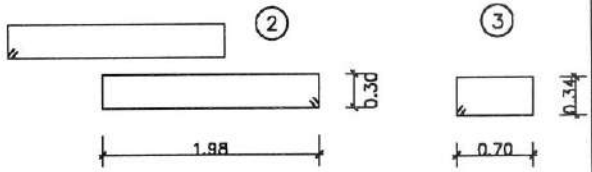


SEZIONE A-A (scala 1:25)

Montaggio armature







POS.	N.	DIAM.	TAGLIO m.	PESO Kg.
1	24	10	7,52	111,8
2	42	10	4,66	120,8
3	2	10	2,20	2,7

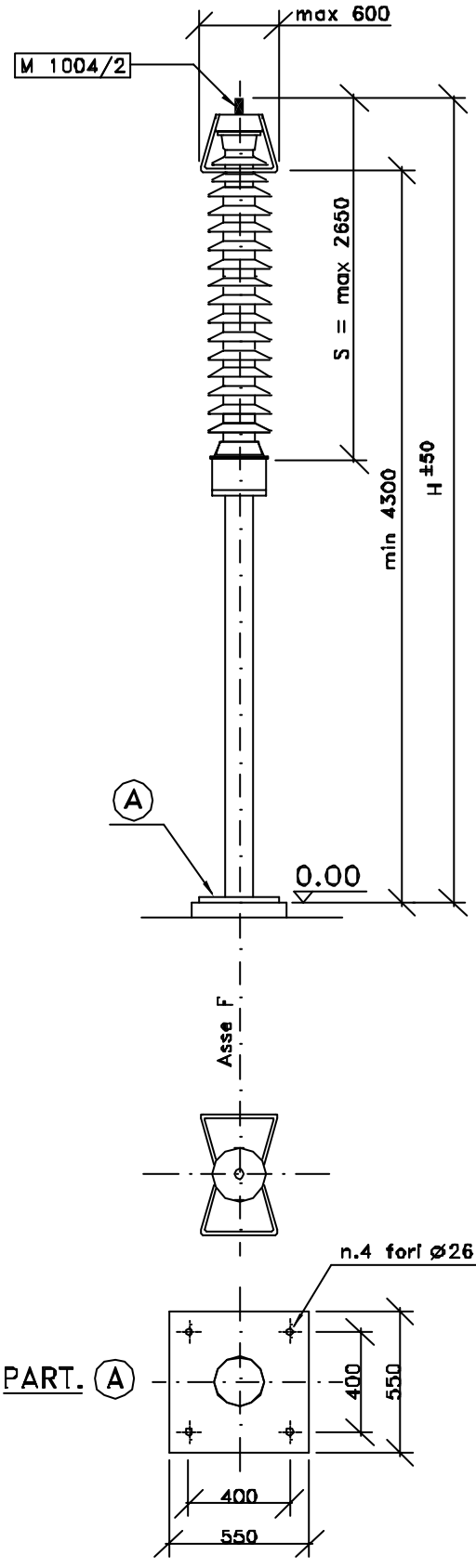
VOLUME CLS MAGRO	m3 1,26	
VOLUME CALCESTRUZZO	m3 8,82	
PESO ARMATURA	Kg 235	
TIRAFONDI	DS 6100/2 DS 6100/8	n.12 n.12

CALCESTRUZZO Rck 250
FERRI DI ARMATURA: FEB 44 K
CONTROLLATO IN STABILIMENTO

SPECIFICA DI COSTRUZIONE

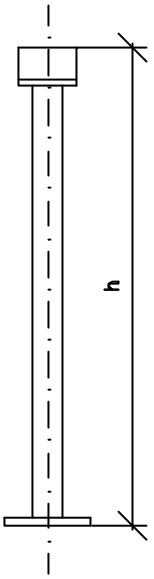
SCARICATORI AD OSSIDO METALLICO SENZA SPINTEROMETRI PER CABINE PRIMARIE CON TENSIONE NOMINALE 132 kV

2	DRE/USM	Rossetti -	Emma	Tramutoli	Gennaio 2005
Ed..	**Funzione/Unità**	**Redatto**	**Verificato**	**Approvato**	**Data**



SOSTEGNO SCARICATORE

MATRICOLA	22 12 80	H = 5530	h = H−S
MATRICOLA	22 12 81	H = 6430	h = H−S



DRE - USM

Esempio di designazione abbreviata:

SCARIC 132kV OSSIDO MET C/SOST CA XX NUE

MATRICOLA		17 01 05	17 01 06
TIPO		58/1	58/2
GRANDEZZE NOMINALI			
Isolatore		composito	porcellana
Salinità di tenuta alla tensione di 84 kV	(kg/m^3)	56	56
Tensione di servizio continuativo	(kV)	94	
Frequenza nominale	(Hz)	50	
Corrente nominale di scarica	(kAcr)	10	
Tensione temporanea per la durata di 1 s	(kV)	132	
Massima tensione residua alla corrente nominale di scarica (onda 8/20 μs)	(kVcr)	336	
Massima tensione residua all'impulso di corrente a fronte ripido (10 kAcr – fronte 1 μs)	(kVcr)	386	
Massima tensione residua all'impulso di corrente di manovra (500 Acr, 30/60 μs)	(kVcr)	270	
Impulso di forte corrente per la prova di esercizio	(kAcr)	100	
Classe di scarica della linea		2	
Corrente elevata per la prova del dispositivo di sicurezza contro le esplosioni	(kA)	31,5	
Carico per la prova di resistenza meccanica a flessione	(N)	2000	
CONDIZIONI NORMALI DI SERVIZIO			
Temperatura ambiente:			
– massima	(°C)	40	
– media giornaliera massima	(°C)	35	
– minima	(°C)	–25	
Pressione massima del vento	(N/m^2)	700	
Altitudine massima s.l.m.	(m)	1000	
RESISTENZA AL SISMA (Severità)		AF5	

1 – La dicitura "Asse F" sarà utilizzata per fornire istruzioni per una corretta disposizione dell'apparecchio

2 – Prescrizioni ENEL: per la costruzione DY 2051, per il collaudo DY 2052

3 – Sostegno: Prescrizioni ENEL S 6501 e disegno costruttivo P 502/D 105

4 – Unità di misura: numero di esemplari (n)

Enel Distribuzione

DIREZIONE EMILIA ROMAGNA
Ingegneria

SOSTEGNO PER SCARICATORE

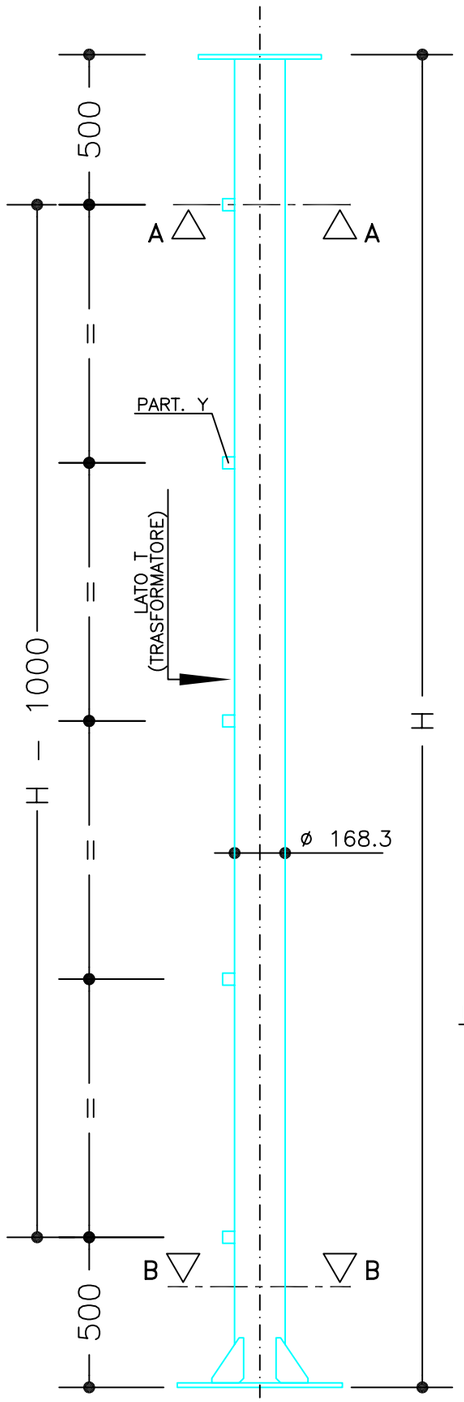
132 – 150 kV

PER–54

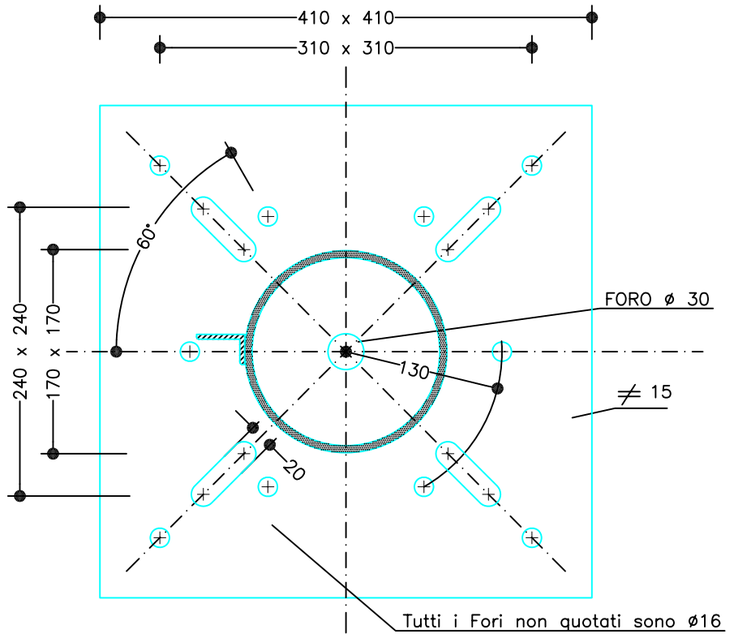
Ed.15 09/05

PER54–15 | modificato EMR

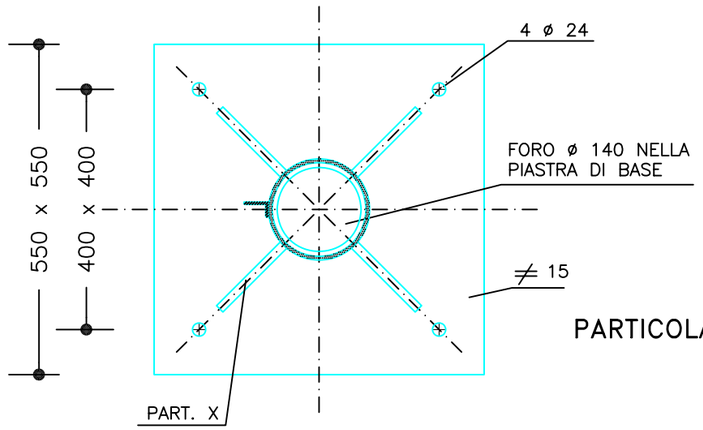
PROSPETTO (Scala 1:20)



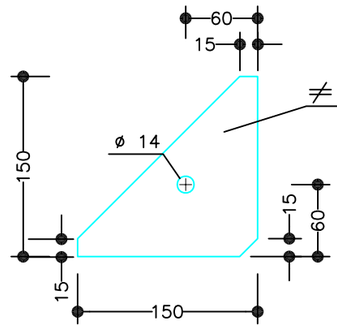
SEZ. A – A (Scala 1:5)



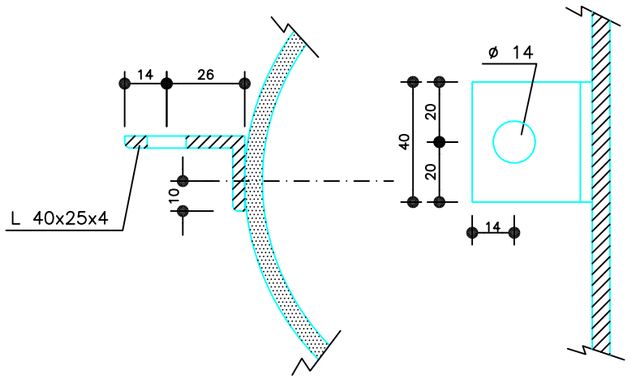
SEZ. B – B (Scala 1:10)



PARTICOLARE X (Scala 1:5)



PARTICOLARE Y (Scala 1:2)



– PRESCRIZIONI PER LA FORNITURA, COSTRUZIONE E COLLAUDO: SER 03

– TRATTAMENTO: ZINCATO A CALDO

PROFILO	PESO
TUBO ø 168.3 sp. 5.9 UNI ISO 4200–89	23.6 Kg/m
PIASTRA sp. 15 UNI EN 10029–92 (inferiore)	33.8 Kg
PIASTRA sp. 15 UNI EN 10029–92 (superiore)	17.8 Kg
4 FAZZOLETTI sp. 10 UNI EN 10029–92	3.5 Kg
SUPPORTI CAVO L 40x25x4 UNI EU 57–79	0.4 Kg
BULLONERIA E SALDATURE	~ 1 Kg

TIPO SOSTEGNO PER 54/..	H CONDUTTORI (mm)	APPARECCHIATURA CASA COSTRUTTRICE	SIGLA	PESO (Kg)	ANNO COSTR.	Altezza (mm) H	PESO SOST. (Kg.)	PESO COMPRESO ZINCATURA (Kg.)	NOTE
1	6690	ASEA	126BSXAF			4000	150	154	
2	6700	SIEMENS	3EP2			4900	172	176	
	6390	ABB	EXLIM Q120–EH145			4900			
3	6500	PASSONI & VILLA	SCB145	80	98	5140	177	182	
4	5490	Come al punto 1		„		2800	123	126	Da utilizzarsi in impianti compatti
5	5800	Come al punto 2				4000	150	154	
	5480								
6	5280	Come al punto 3							

Aggiornamenti

	data
Ed.15 – Foratura per ABB	09/05
Ed.14 – Revisione distinta base	01/02
Ed.13 – Foratura per tirafondi DS6100/9	02/01
Ed.12 – Modificato nome file	05/00

Enel Distribuzione

DIREZIONE EMILIA ROMAGNA
Ingegneria

RECINZIONE TIPO 1

INSIEME GENERALE

SER–31

Pag. 1/5

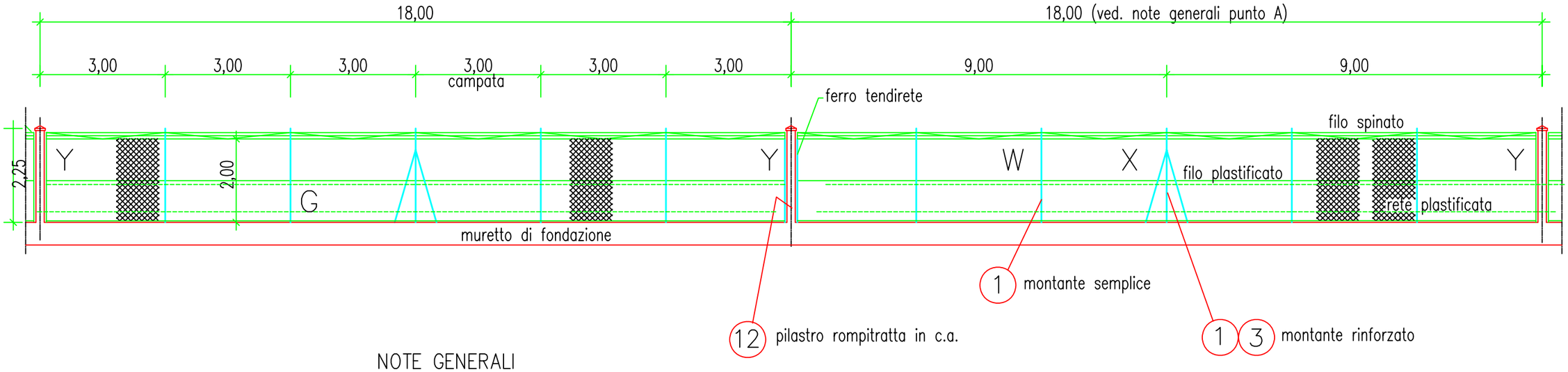
Ed. 6 07/08

SER31–6

(scala 1:100)
[quote in m]

RECINZIONE TIPO 1

Prospetto tipico



NOTE GENERALI

A – L'interasse di due pilastri rompitratta (rif.Y–pos.12) consecutivi viene solitamente indicato nelle planimetrie specifiche d'impianto; in alternativa si consideri la quota del presente dis.

B – Tutta la carpenteria della recinzione dovrà essere accuratamente zincata a caldo secondo le normative vigenti in materia (CEI7–6 ed.III 04/97)

C – Solitamente il filo esterno del muretto di recinzione viene posizionato sul confine di proprietà; diversamente la sua posizione sarà specificata nel progetto esecutivo

D – In sostituzione dei pilastri rompitratta in c.a. potranno essere prescritti in progetto rompitratta in acciaio (rif.Z–pos.2/3–pag.4)

E – Su indicazioni della DL, il filo spinato posato sulla parte superiore della recinzione potrà essere sostituito da filo zincato plastificato ø 3,6 mm (pos.5)

F – Le caratteristiche del muretto di fondazione sono indicate negli elaborati specifici d'impianto; in alternativa si dovrà fare riferimento al dis. GER–31

G – Fili elettrici antintrusivi: Fili metallici plastificati costituiti dai medesimi fili della recinzione

Ved. Pos. su distinta materiali p. 5/5

Aggiornamenti

data	
07/08	Ed. 6 – Fili antintrusivi Ed. 5A – Inezie
03/05	Ed. 5 – Revisione generale
01/02	Ed. 4 – Iserito rompitratta "Z"

Enel Distribuzione

DIREZIONE EMILIA ROMAGNA

Ingegneria

RECINZIONE TIPO 1

PARTICOLARI

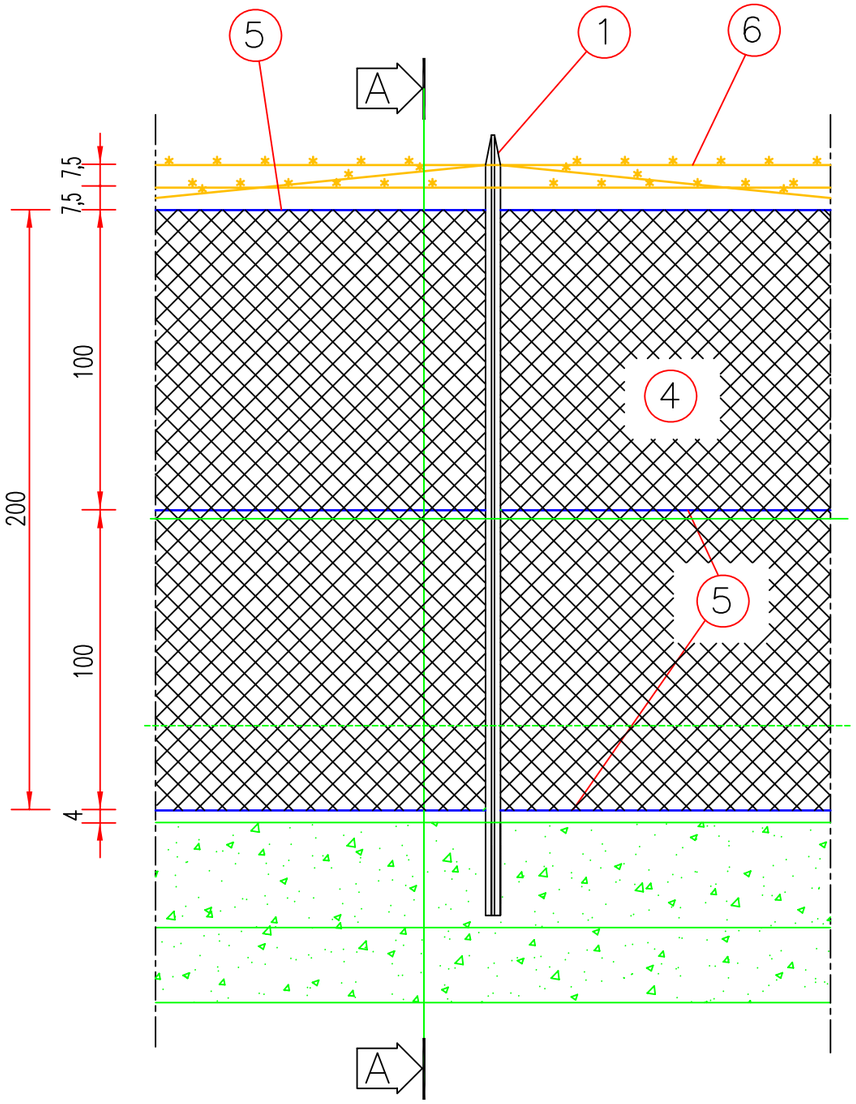
SEZIONI

SER–31

(scala 1:20)
[quote in cm]

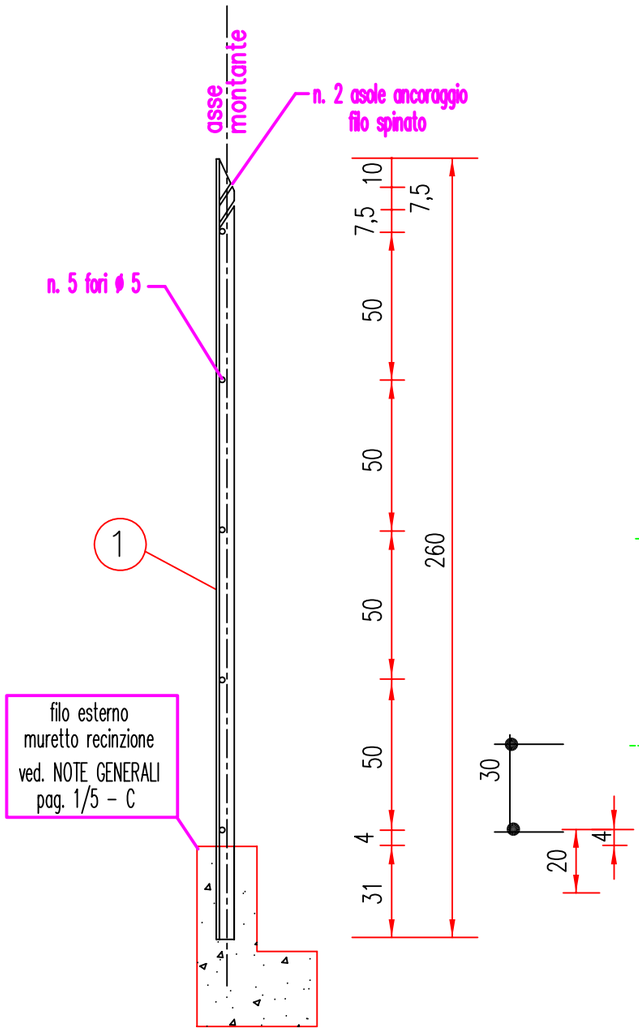
Montante semplice (rif.W)

VISTA DALL'INTERNO



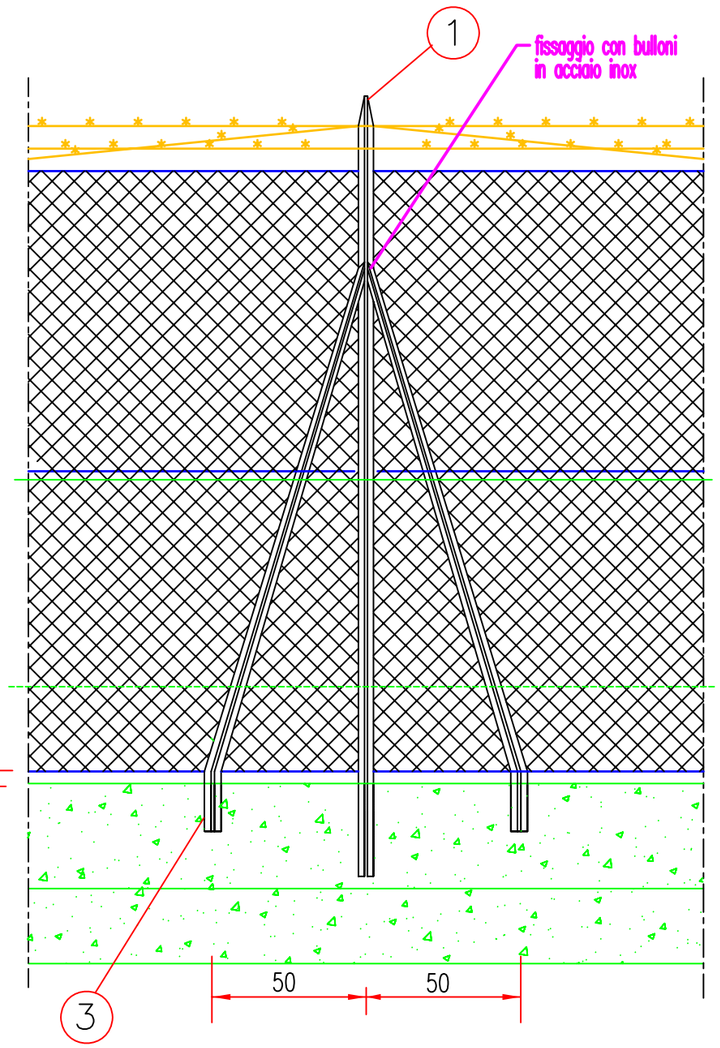
Peso montante zincato 11,9 kg

Sez. A–A



Montante rinforzato (rif.X)

VISTA DALL'INTERNO



Peso montante zincato 21,5 kg

Ved. Pos. su distinta materiali p. 5/5

Enel Distribuzione
DIREZIONE EMILIA ROMAGNA
Ingegneria

RECINZIONE TIPO 1

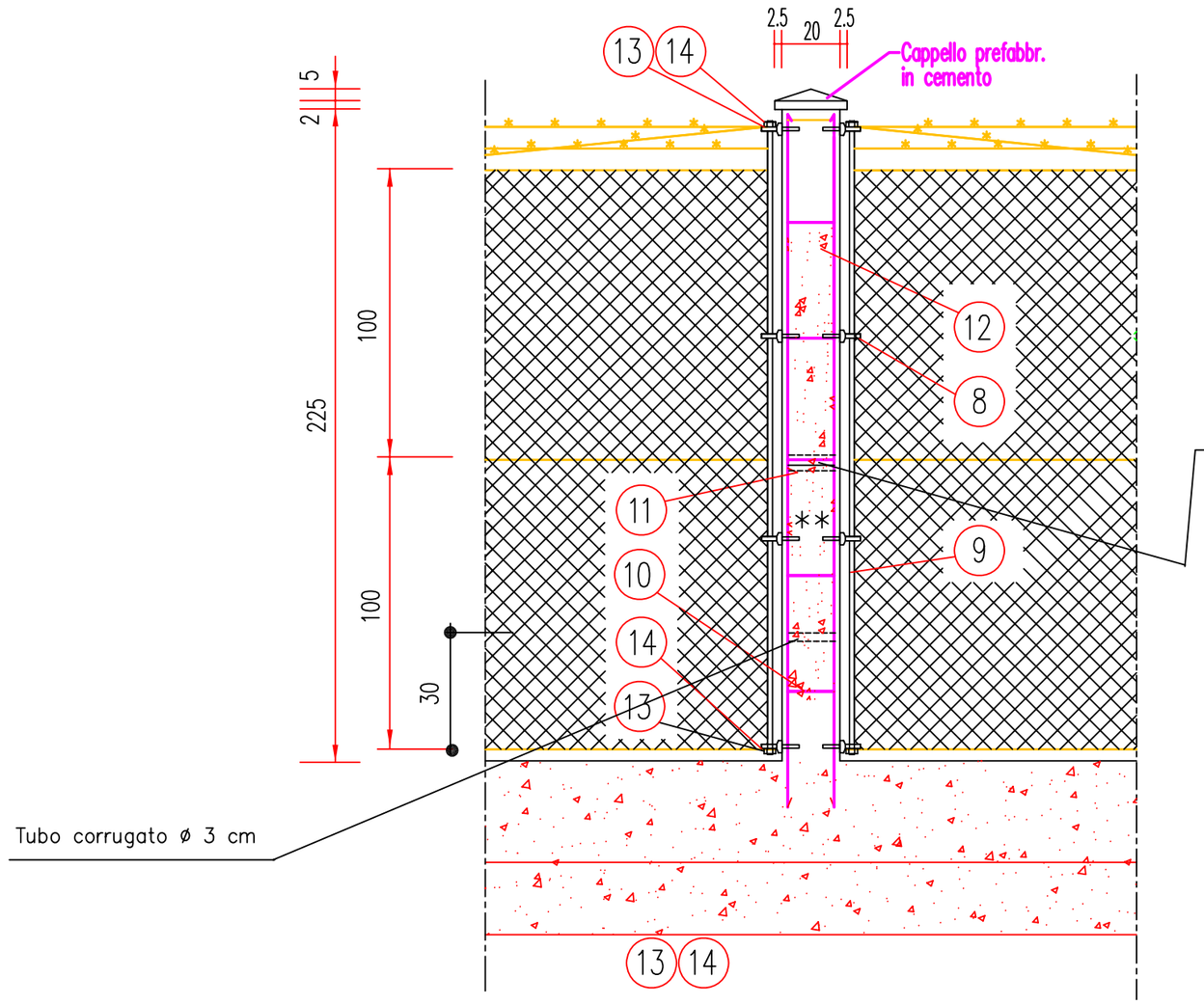
PARTICOLARI

SER–31

Pag. 3/5

(scala 1:20)
[quote in cm]

Pilastro rompitratta in c.a. (rif.Y)

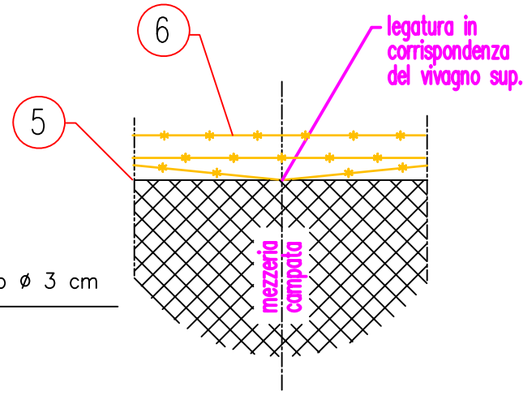


Peso ferri tendirete zincati 7,2 kg

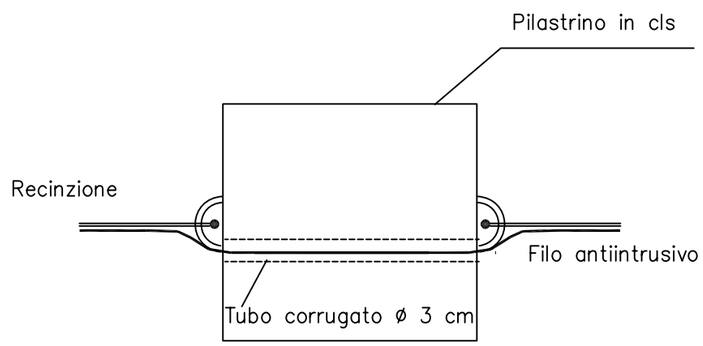
**

La distanza tra due zanche di fissaggio corrispondenti dovrà essere maggiore di 10 cm,
le zanche non dovranno essere in contatto con i ferri di armatura del pilastro;
in alternativa alle zanche potranno essere utilizzati ancoraggi ad espansione
aventi uguali caratteristiche di tenuta

Particolare collegamento filo spinato a vivagno superiore rete



Particolare passaggio fili elettrici antintrusivi nei pilastrini



Ved. Pos. su distinta materiali p. 5/5

Enel Distribuzione

DIREZIONE EMILIA ROMAGNA

Ingegneria

RECINZIONE TIPO 1

PARTICOLARI

SEZIONI

SER–31

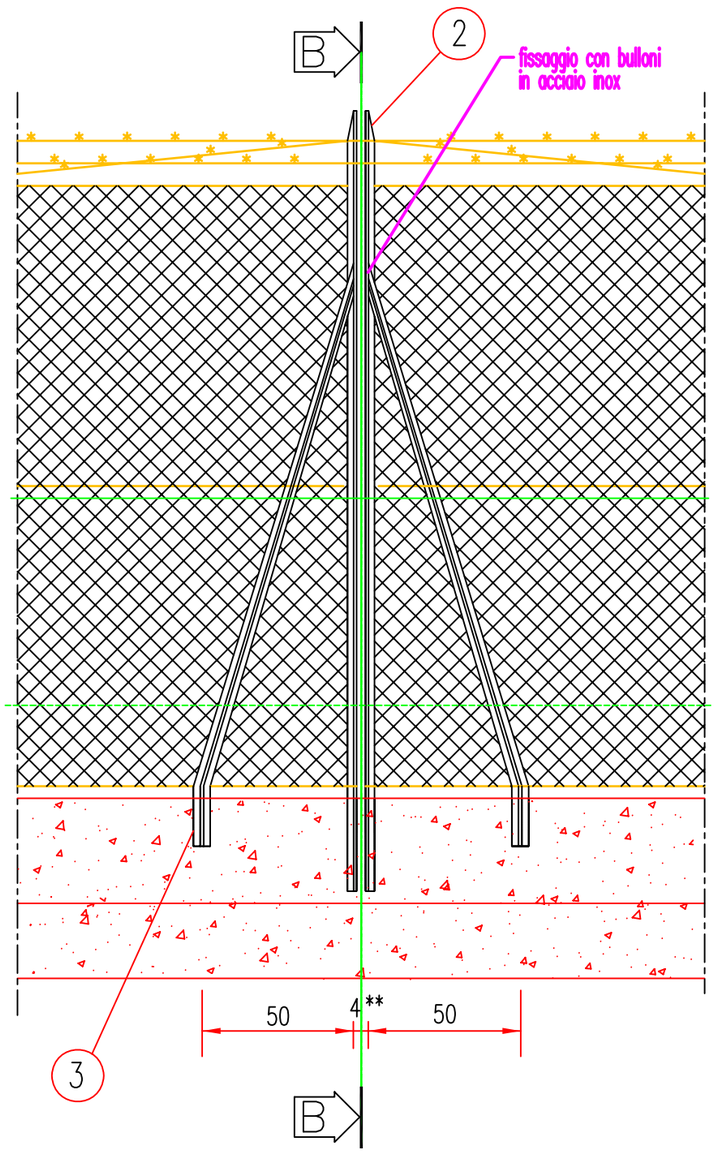
(scala 1:20) [quote in cm]

(scala 1:2) [quote in mm]

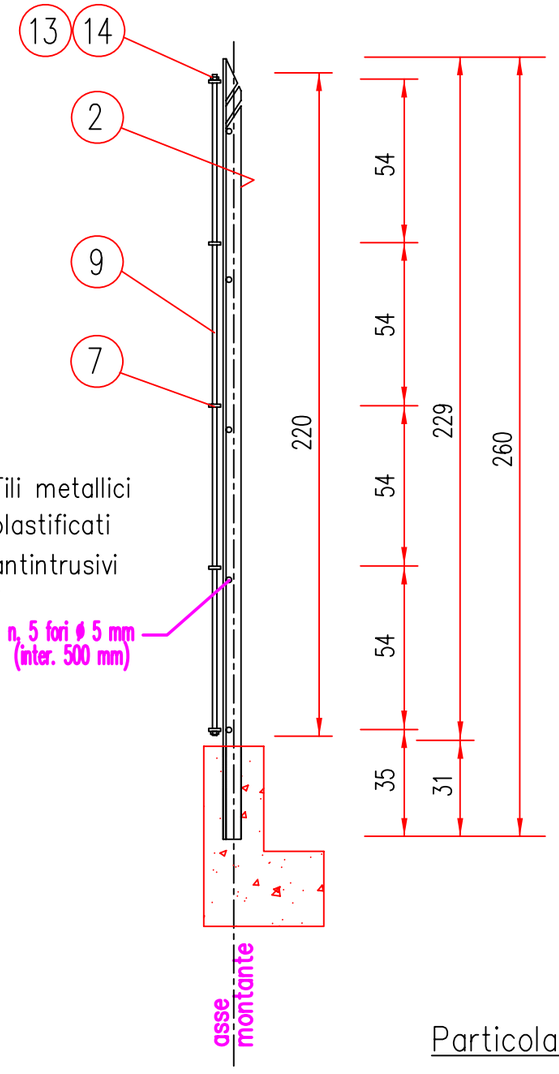
(scala 1:1) [quote in mm]

Rompitratta in acciaio (rif.Z)

VISTA DALL'INTERNO

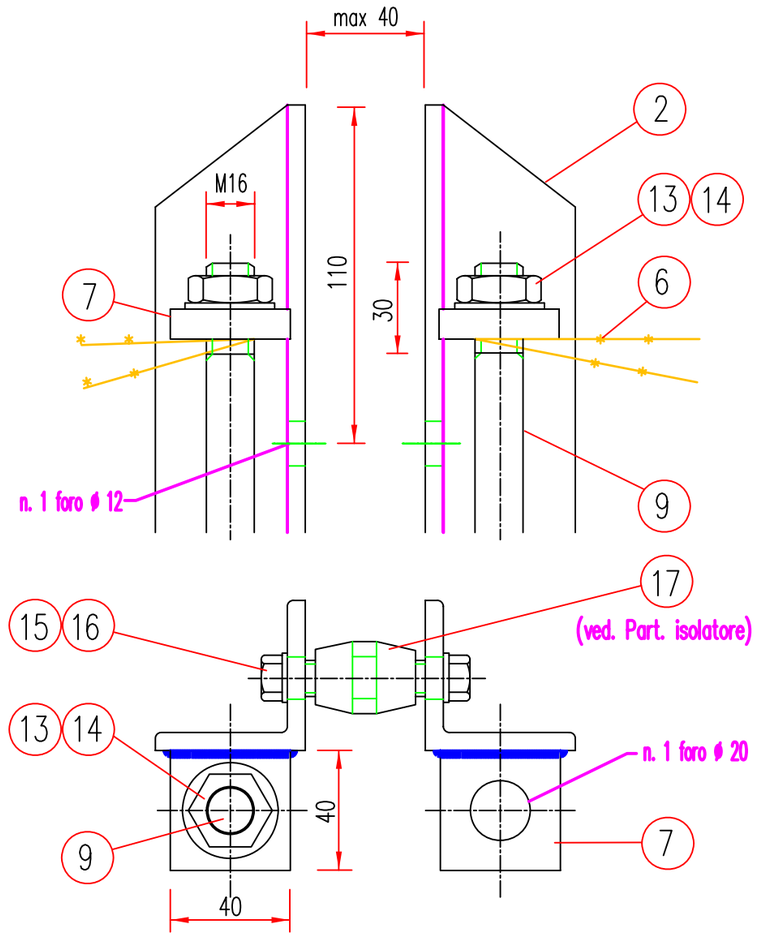


Sez. B–B

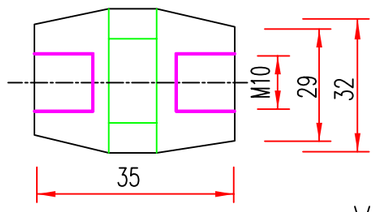


Particolare separazione galvanica

VISTA DALL'ESTERNO



Particolare isolatore



Peso rompitratta zincato 33,4 kg

Peso ferri tendirete zincati 7,2 kg

** Distanza tra i due montanti che ne garantisce la separazione galvanica (ved. Part. a lato)

Ved. Pos. su distinta materiali p. 5/5

DISTINTA MATERIALI

POS.	DESCRIZIONE	NORME UNI	Q.TA'*	NOTE
1	MONTANTE A "T" 50 x 50 x 6 mm – LG. 2,6 m – ZINCATURA A CALDO	UNI EU 55-81	4	pesi: 11,9 x 4 = 47,6 kg (compresa zincatura)
2	MONTANTE A "L" 50 x 50 x 6 mm – LG. 2,6 m – ZINCATURA A CALDO	UNI EU 56-84	2 **	pesi: 11,9 x 2 = 23,8 kg (compresa zincatura)
3	SAETTA A "T" 35 x 35 x 4,2 mm – LG. 2,0 m – ZINCATURA A CALDO	UNI EU 55-81	2	pesi: 4,8 x 2 = 9,6 kg (compresa zincatura)
4	RETE IN FILO ZINCATO PLASTIFICATO ø 2,2 mm ø EST. TOT. 3,2 mm – MAGLIA 50 x 50 mm – H = 2,0 m	--	36 mq	pesi: 1,4 x 36 = 50,4 kg – rivestimento in PVC colore verde
5	FILO ZINCATO PLASTIFICATO ø 2,6 mm ø EST. TOT. 3,6 mm	--	90 m	n. 3 fili distinti + 2 fili antiintrusivi
6	FILO SPINATO ZINCATO PLASTIFICATO ø 2,2 mm ø EST. TOT. 3,2 mm	--	54 m	n. 3 fili distinti
7	PIASTRINA SUPPORTO FERRI TENDIRETE 40 x 40 x 10 mm – ZINCATURA A CALDO	--	10	n. 5 per ogni ferro tendirete
8	ANCORAGGIO ø 12 mm AD ANELLO ø INT. 20 mm CON ZANCA PER CLS – ZINCATURA A CALDO	--	8	
9	FERRO TONDO TENDIRETE ø 16 mm – LG. 2,2 m – ZINCATURA A CALDO	UNI 10233/2-93	2	pesi: 3,6 x 2 = 7,2 kg (compresa zincatura)
10	STAFFE DI ARMATURA PILASTRO – ø 6/35 – LG. 80 cm	UNI ENV 10080-97	6	peso tot. 1,1 kg – acciaio tipo FeB44K ad aderenza migliorata certificato
11	FERRI DI ARMATURA PILASTRO – 4 ø 12 – LG. 2650 mm	UNI ENV 10080-97	4	peso tot. 9,3 kg – acciaio tipo FeB44K ad aderenza migliorata certificato
12	PILASTRO ROMPITRATTA IN C.A. 20 x 20 cm – LG. 2,25 m	--	1	volume cls 0,22 mc – classe Rck 300 – compreso cappello prefabbricato in cemento
13	DADO M16	UNI EN 24032-93	4	acciaio inox A2-70
14	ROSETTA 17 x 30	UNI 6592-97	4	acciaio inox A2-70
15	VITE T.E. M10 x 20	UNI EN 24017-93	2 **	acciaio inox A2-70
16	ROSETTA 10,5 x 21	UNI 6592-97	2 **	acciaio inox A2-70
17	ISOLATORE IN RESINA POLIESTERE – TENSIONE DI ESERCIZIO 1000V	--	1 **	colore rosse RAL 3002 – inserto metallico femmina filett. metrica UNI 4534-64

materiali per n. 1 pilastro

Tubo corrugato Pvc diameto 3 cm m 0,50 per ogni pilastrino

** QUANTITA' PREVISTE NEL "PROSPETTO TIPICO" TRA DUE PILASTRI IN C.A. CONSECUTIVI – PAG. 1*

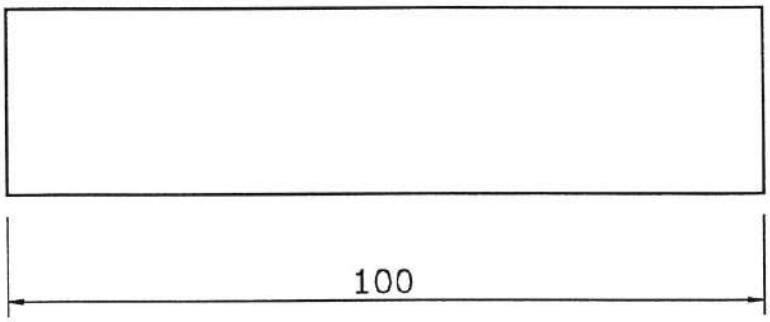
*** SOLO SE PREVISTO ROMPITRATTA IN ACCIAIO ANZICHE' PILASTRO IN C.A.*

ENEL
DIREZIONE DISTRIBUZIONE
EMILIA ROMAGNA
Ingegneria

CORDOLO DI DELIMITAZIONE

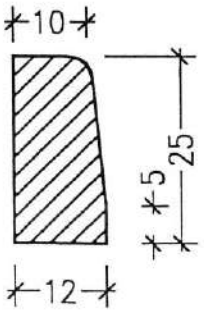
GER 89
Ed. 1 09/97
GER89–1
modificato DER

MATERIALE: CLS PREFABBRICATO



data	Aggiornamenti

CORDOLO 25 x 12 cm



LO SMUSSO DEVE ESSERE SUL LATO ASFALTO

Enel DISTRIBUZIONE

DIREZIONE EMILIA ROMAGNA–MARCHE
CAT–COS–CP

TUBI PER FOGNATURE E PER SCARICO OLIO

GER 57

Ed.5 01/03 Pag.1/3

GER57–5

Modificato EMR

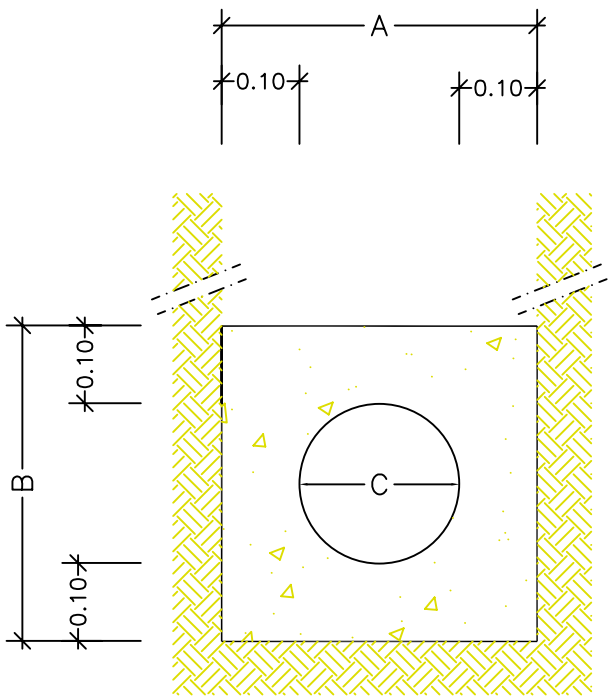
DATA

EDIZ.

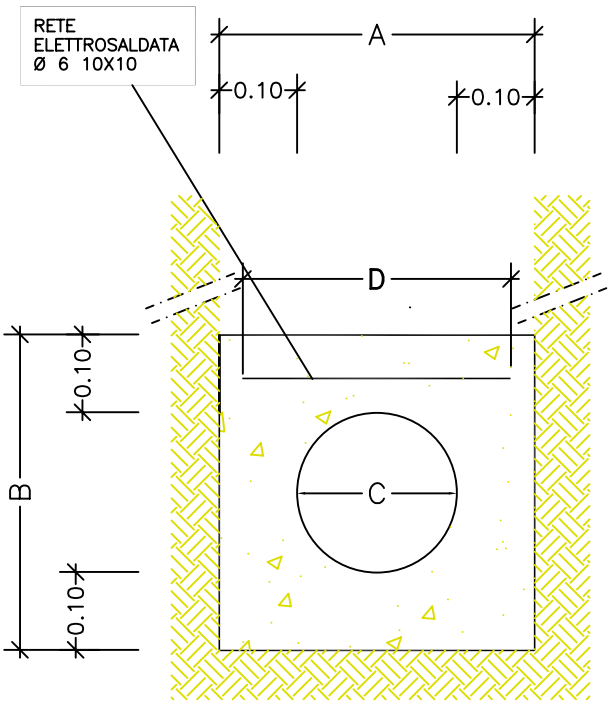
AGGIORNAMENTI

CARATTERISTICHE			QUANTITA' DI LAVORO				
POS.	DIAMETRO TUBO - C mm.	TIPO DI TUBAZIONE	DIMENSIONI A cm	DIMENSIONI B cm	VOLUME CLS m³/m	RETE ELETTROSALDATA Kg/m	RETE ELETTROSALDATA D (cm)
1	110	P.V.C. UNI EN 1401-1 - SN4/SDR41	31	31	0,085	1,39	25
2	125	P.V.C. UNI EN 1401-1 - SN4/SDR41	32	32	0,092	1,44	26
3	160	P.V.C. UNI EN 1401-1 - SN4/SDR41	36	36	0,109	1,62	30
4	200	P.V.C. UNI EN 1401-1 - SN4/SDR41	40	40	0,129	1,80	34
5	315	P.V.C. UNI EN 1401-1 - SN4/SDR41	51	51	0,180	2,29	45
21	100	FIBROCEMENTO UNI EN 12763	30	30	0,082	1,37	24
22	150	FIBROCEMENTO UNI EN 12763	35	35	0,107	1,59	29
23	200	FIBROCEMENTO UNI EN 12763	40	40	0,129	1,80	34
41	100	GRES UNI EN 295	30	30	0,082	1,37	24
42	150	GRES UNI EN 295	35	35	0,107	1,59	29
43	200	GRES UNI EN 295	40	40	0,129	1,80	34

POSA NORMALE (N)



POSA RINFORZATA (R) PER ZONE SOGGETTE AL TRANSITO DI VEICOLI



CLS Rck : 20 N/mm2 – 200 Kg/cm2

Enel DISTRIBUZIONE

DIREZIONE EMILIA ROMAGNA–MARCHE
CAT–COS–CP

TUBI PER CANALIZZAZIONE CAVI E SERVIZI

GER 57

Ed.5 01/03 Pag.2/3

GER57–5

Modificato EMR

DATA

EDIZ.

AGGIORNAMENTI

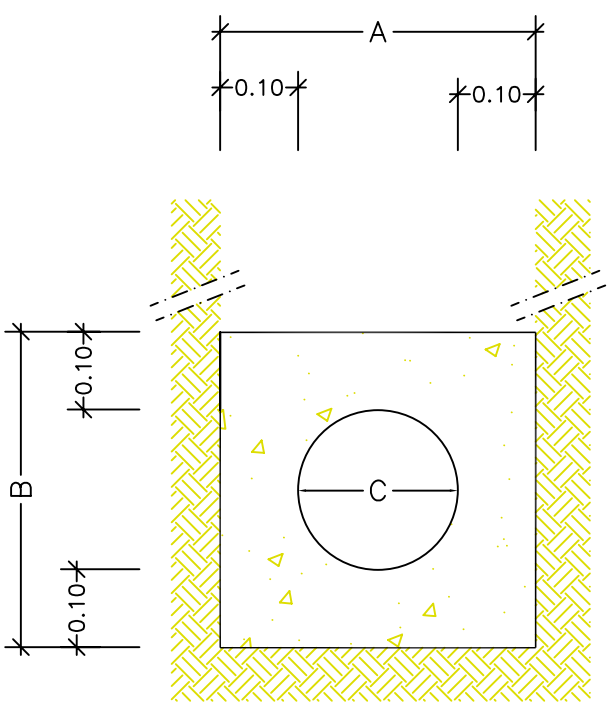
CARATTERISTICHE — QUANTITA' DI LAVORO

POS.	DIAMETRO TUBO - C mm.	TIPO DI TUBAZIONE	DIMENSIONI A cm	DIMENSIONI B cm	VOLUME CLS m³/m	RETE ELETTROSALDATA Kg/m	RETE ELETTROSALDATA D (cm)
11	80	P.V.C. UNI EN 1329-1 - BD	28	28	0,073	1,26	22
12	100	P.V.C. UNI EN 1329-1 - BD	30	30	0,082	1,36	24
13	125	P.V.C. UNI EN 1329-1 - BD	32	32	0,092	1,44	26
14	140	P.V.C. UNI EN 1329-1 - BD	34	34	0,101	1,53	28
15	160	P.V.C. UNI EN 1329-1 - BD	36	36	0,109	1,62	30
16	200	P.V.C. UNI EN 1329-1 - BD	40	40	0,129	1,80	34
17	250	P.V.C. UNI EN 1329-1 - BD	45	45	0,152	2,02	39
18	315	P.V.C. UNI EN 1329-1 - BD	51	51	0,180	2,29	45

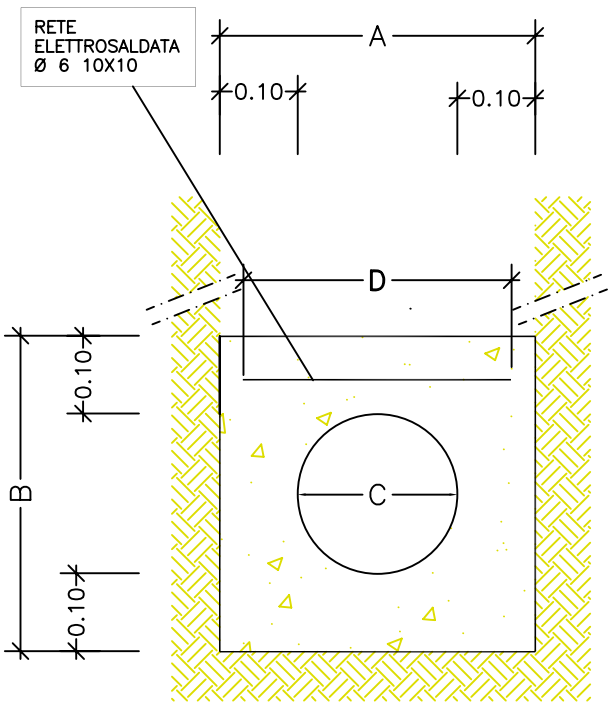
N.B.: I TUBI SOPRA INDICATI POSSONO, ALL'OCCORRENZA, ESSERE SOSTITUITI O RACCORDATI CON TUBI SPIRALATI DI DIAMETRO INTERNO UGUALE AL DIAMETRO ESTERNO DEL TUBO RIGIDO.

N.B.: ALL'OCCORRENZA POSSONO ESSERE AFFIANCATI 2 O PIU' TUBI MANTENENDO UNA DISTANZA MINIMA TRA LORO DI 10 cm.

POSA NORMALE (N)



POSA RINFORZATA (R) PER ZONE SOGGETTE AL TRANSITO DI VEICOLI



CLS Rck : 20 N/mm2 – 200 Kg/cm2

Enel DISTRIBUZIONE

DIREZIONE EMILIA ROMAGNA–MARCHE
CAT–COS–CP

COLLETTORE PER CAVI E SERVIZI

GER 57

ric. da GER 50

Ed.5 01/03 Pag.3/3

GER57–5

Modificato EMR

DATA | EDIZ. | AGGIORNAMENTI

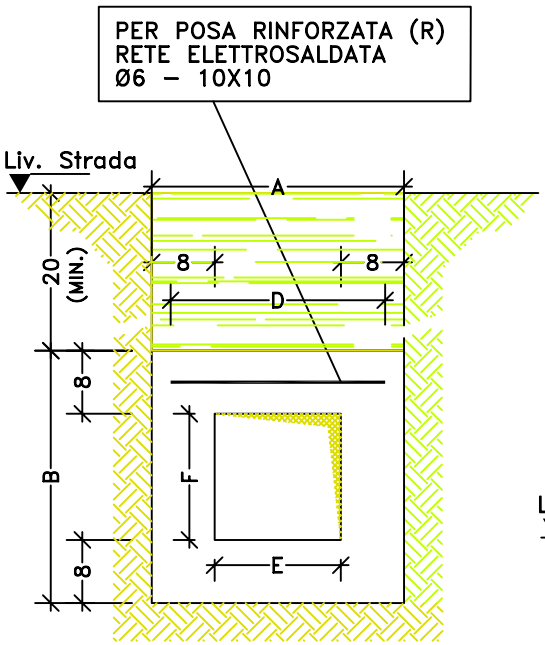
SOSTITUISCE GER 50 (H3 – H6)

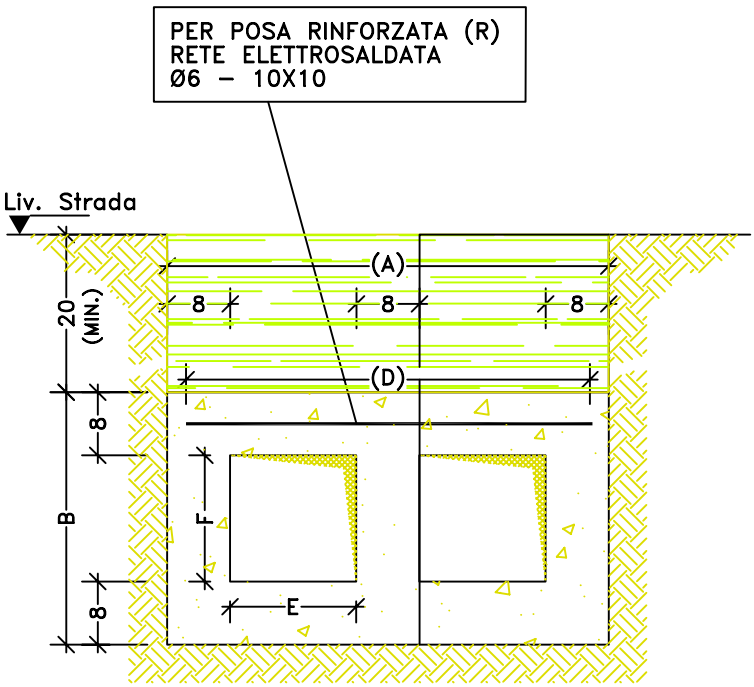
CARATTERISTICHE — QUANTITA' DI LAVORO

POS.	DENOM. ABBREV.	DIMENSIONI CANNE (cm) E X F	TIPO DI TUBAZIONE	DIMENSIONI (2) A cm	DIMENSIONI (2) B cm	VOLUME CLS m³/m	RETE ELETTROSALDATA Kg/m	RETE ELETTROSALDATA D cm
31	H2(H2R)	20X20	CANNA IN FIBROCEMENTO (1)	40	40	0,12	1,53	34
32	H3(H3R)	30X20	CANNA IN FIBROCEMENTO (1)	50	40	0,14	1,98	44
31(2)	H4(H4R)	2X20X20	CANNA IN FIBROCEMENTO (1)	70	40	0,20	2,88	64
32(2)	H6(H6R)	2X30X20	CANNA IN FIBROCEMENTO (1)	90	40	0,24	3,78	84

(1): IN ALTERNATIVA AL FIBROCEMENTO POSSONO ESSERE UTILIZZATE CANNE IN PVC DI UGUALI DIMENSIONI

NELLA POSA DI 2 CANNE AFFIANCATE LASCIARE 10 cm. DI DISTANZA TRA LE STESSE





CLS Rck : 20 N/mm2 – 200 Kg/cm2

Esempio di designazione tipica: pozzetto 50x50 cm interni, telaio e coperchio in ghisa, chiusino cieco.

P 5 G C

CLASSE POZZETTO

P

Pozzetto in CLS (R250) posato su massetto in ghiaia, spessore 15 cm.

K

Canale grigliato con vasca in cls, griglia in ghisa sferoidale classe minima C250 norma UNI–EN 124.

DIMENSIONI E PRESCRIZIONI

- La sigla indica le dimensioni interne tra quelle possibili, che sono 40x40, 50x50, 70x70, spess. min 4 cm.
- La quota chiusino, il diametro dei tubi, le quote di fondo tubo sono indicate nel dis. specifico relativo alle fognature (...112).
- La profondità dipende dalla quota dei tubi contenuti; dovrà essere almeno di 20 cm sotto la quota di fondo tubo.
- La larghezza netta del chiusino non deve essere inferiore di oltre 5 cm rispetto alle dimensioni interne del pozzetto.
- Per le tipologie speciali P9, P10, P11, P12, vedere le pagine seguenti.

MATERIALI

C Chiusino e telaio in c.a. prefabbricato (Per carichi pedonali)

Cr Chiusino e telaio in c.a. prefabbricato rinforzato (Per carichi carrabili)

G Chiusino e telaio in ghisa sferoidale classe C250, norma UNI–EN 124 (Per carichi carrabili)

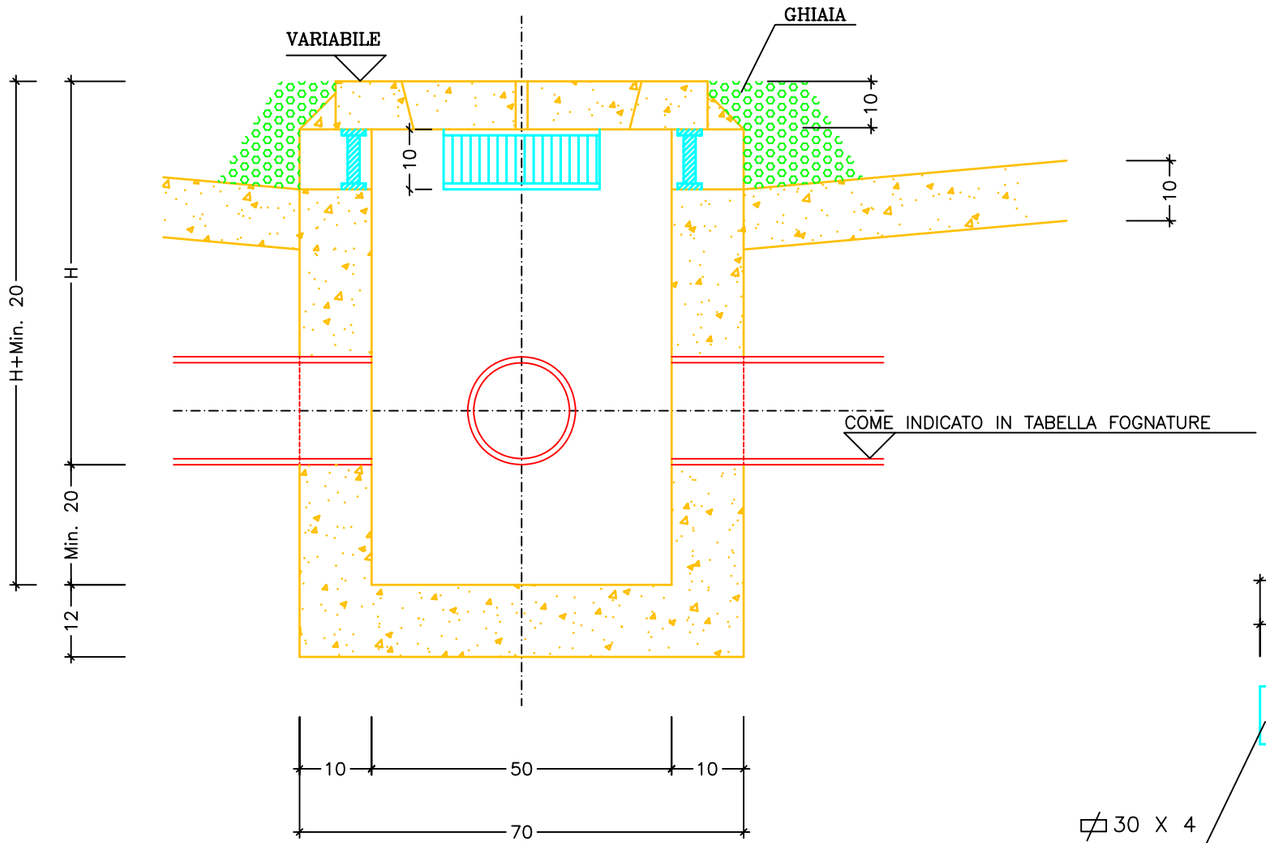
TIPO CHIUSINI

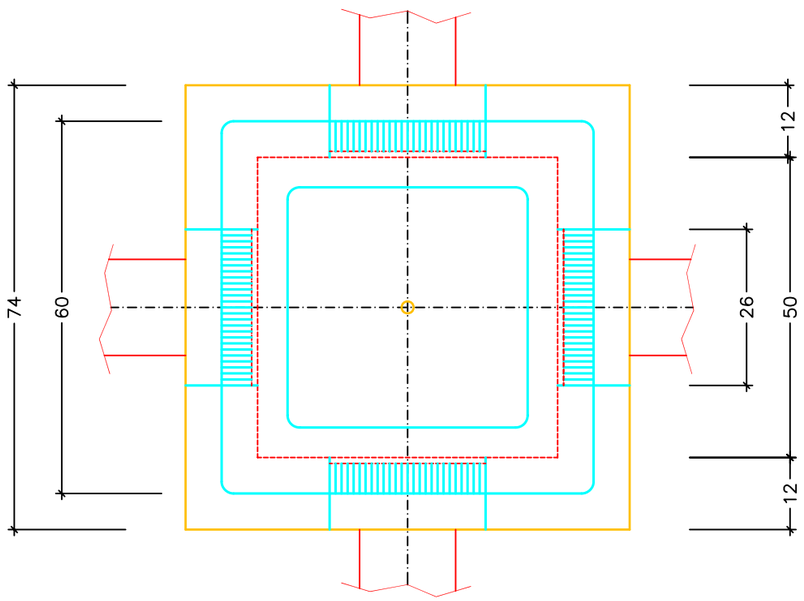
C Chiusino cieco (botola)

G Chiusino grigliato (caditoia)

Caratteristiche grigliato
Aggiornamenti
11/01 data

Tale lavorazione viene solitamente eseguita per gli interventi
di manutenzione su impianti esistenti, per la realizzazione
di zone tipo 1 o per la trasformazione di queste in aree pavimentate

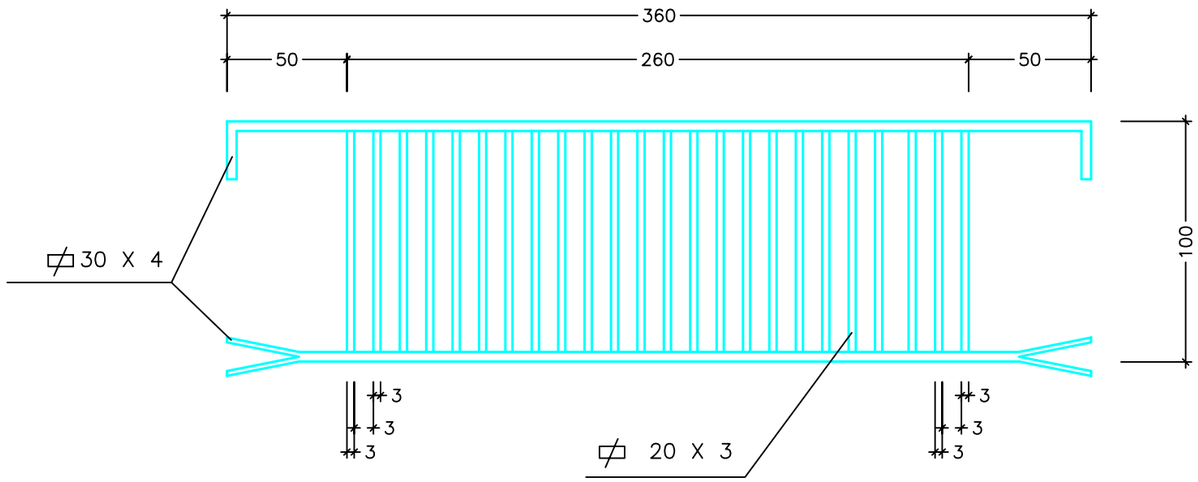




PARTICOLARE GRIGLIA

SCALA 1:5 (quote in mm)

ZINCATA A CALDO



Enel Distribuzione DIREZIONE EMILIA ROMAGNA Ingegneria	POZZETTI PER FOGNATURE Pozzetto P9	GER 56 Pag. 2	
	Dimensioni in centimetri	GER56-6	modificato EMR

data	Aggiornamenti

Enel Distribuzione

DIREZIONE EMILIA ROMAGNA
Ingegneria

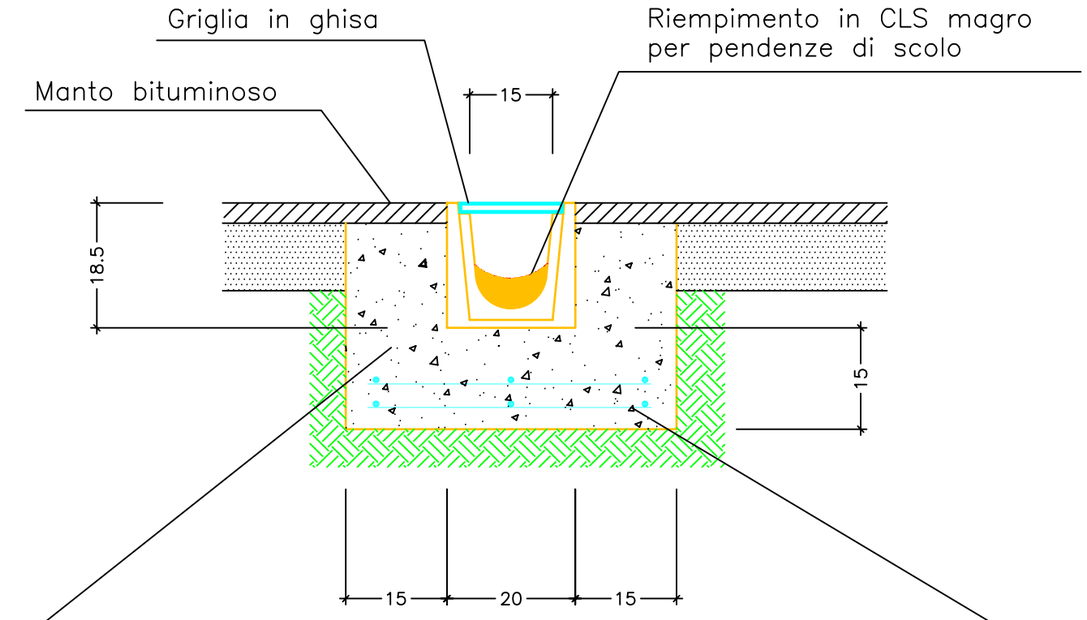
POZZETTI PER FOGNATURE
Canale K e pozz. P10

GER 56

Dimensioni in centimetri | GER56–6 | modificato EMR

CANALE GRIGLIATO " K "

Il manufatto è costituito da un canale prefabbricato modulare in CLS con portata carrabile minima tipo C250 (UNI–EN 124).



Soletta di riempimento in CLS Rck 200 Kg/cm2

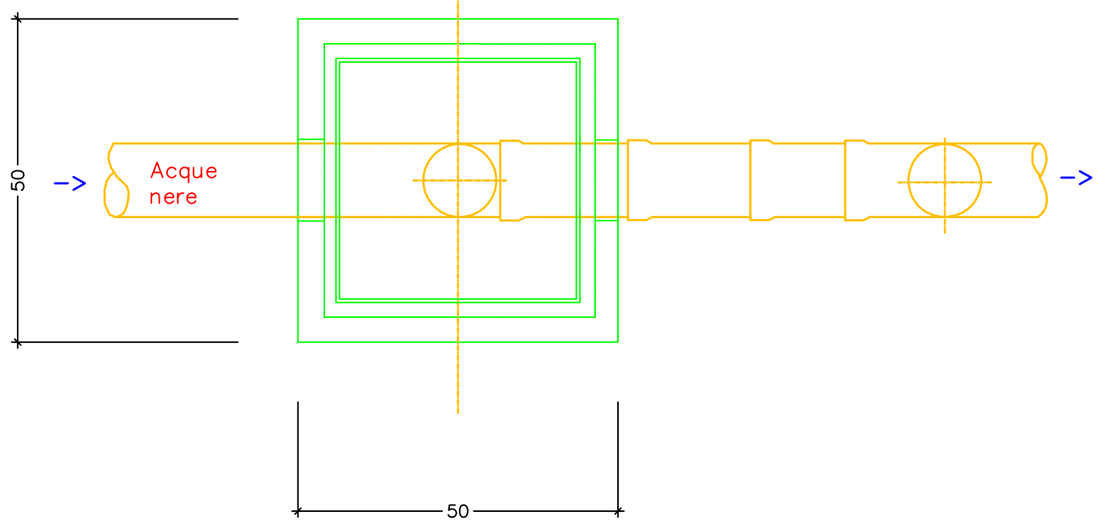
Doppia rete elettrosaldata ø8 20x20

Esempio di designazione: K250 (canale gricliato con portata C250).

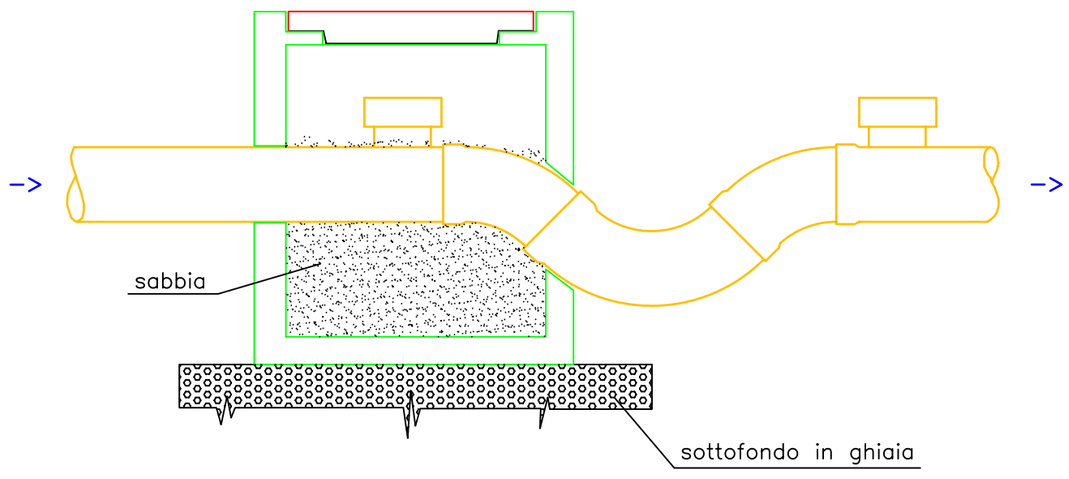
COMPLESSO " P10"

E' costituito da un sifone "Firenze" (per il diametro ved. dis. .....112) e da un pozzetto (chiusino specificato sul dis. .....903) per consentire l'ispezione e la manutenzione dal tappo a monte.

PIANTA



SEZIONE



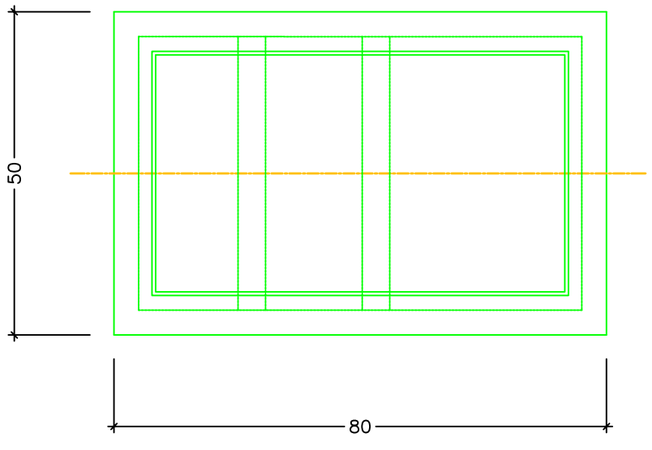
data

Aggiornamenti

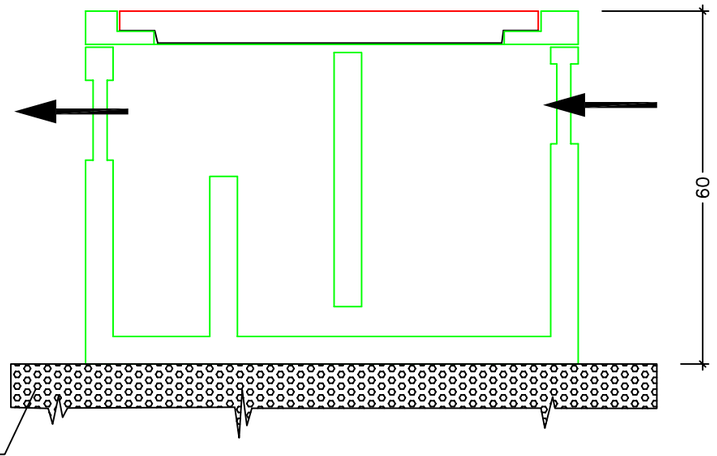
COMPLESSO DEGRASSATORE tipo "P11"

E' costituito da un pozzetto in cls o vetroresina (chiusino specificato sul dis. .....903) per consentirne l'ispezione e la manutenzione (dim. minime).

PIANTA



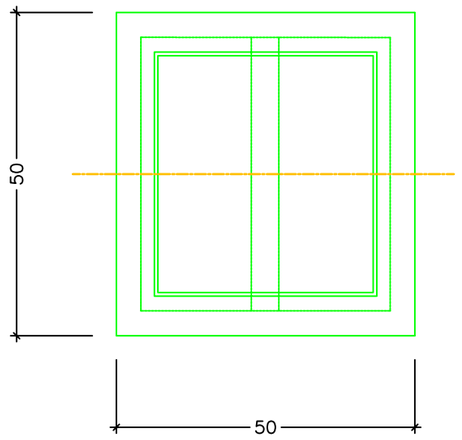
SEZIONE



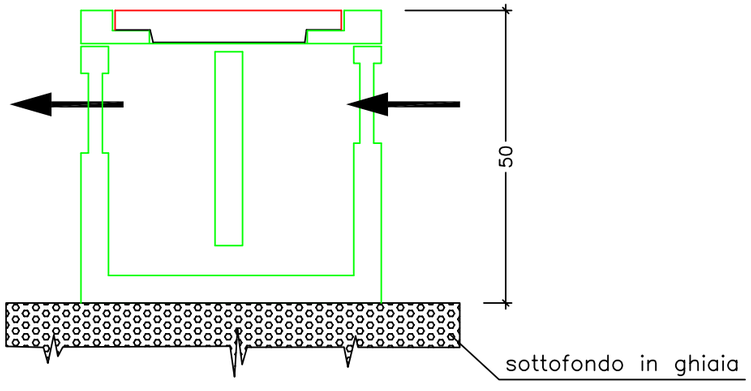
COMPLESSO DI CAMPIONAMENTO tipo "P12"

E' costituito da un pozzetto in cls (chiusino specificato sul dis. .....903) per consentirne l'ispezione, il campionamento e la manutenzione (dim. minime).

PIANTA



SEZIONE



N.B.: per entrambi i casi il chiusino andrà posato a raso della pavimentazione circostante, dovrà essere a + 3 cm nel caso di posa in terreno naturale.

Aggiornamenti | data

Enel

DIREZIONE DISTRIBUZIONE
EMILIA ROMAGNA
Ingegneria

PARTICOLARI CIVILI DI:

ZONE TIPO 1, 2, 3, 3R e 4
PASSATOIE E PIAZZOLE

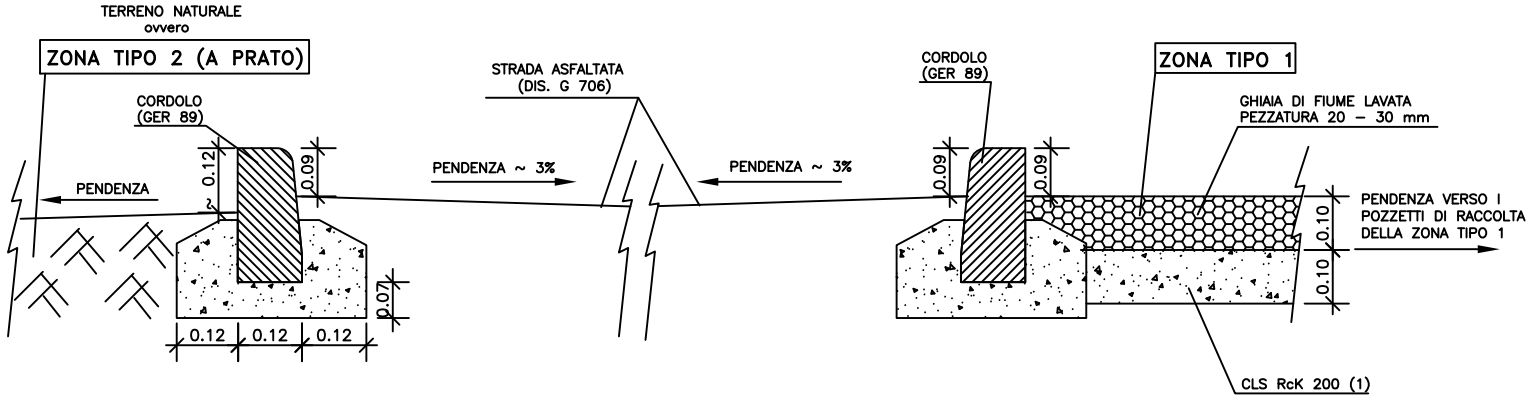
GER 53

Foglio 1/2

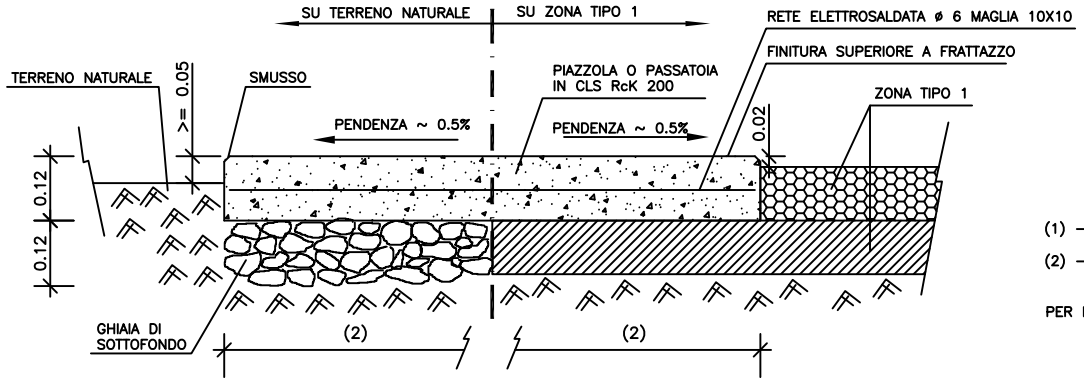
GER53[3]–2 Ed.3 09/01

data	Aggiornamenti
09/01	Rete elettrosaldata zona tipo 3R
03/01	Rete elettrosaldata in zona tipo 4

ZONE TIPO 1 E 2 (SEZIONE)
(SCALA 1:10)



PIAZZOLE E PASSATOIE (SEZIONE)
(SCALA 1:10)



NOTE

(1) – PREVEDERE OPPORTUNI GIUNTI DI DILATAZIONE

(2) – LE MISURE IN PIANTA SONO RIPORTATE SUI DISEGNI SPECIFICI

PER LE QUOTE ALTIMETRICHE DI PROGETTO VEDERE DISEGNI SPECIFICI

Enel

DIREZIONE DISTRIBUZIONE
EMILIA ROMAGNA
Ingegneria

PARTICOLARI CIVILI DI:

ZONE TIPO 1, 2, 3, 3R e 4

PASSATOIE E PIAZZOLE

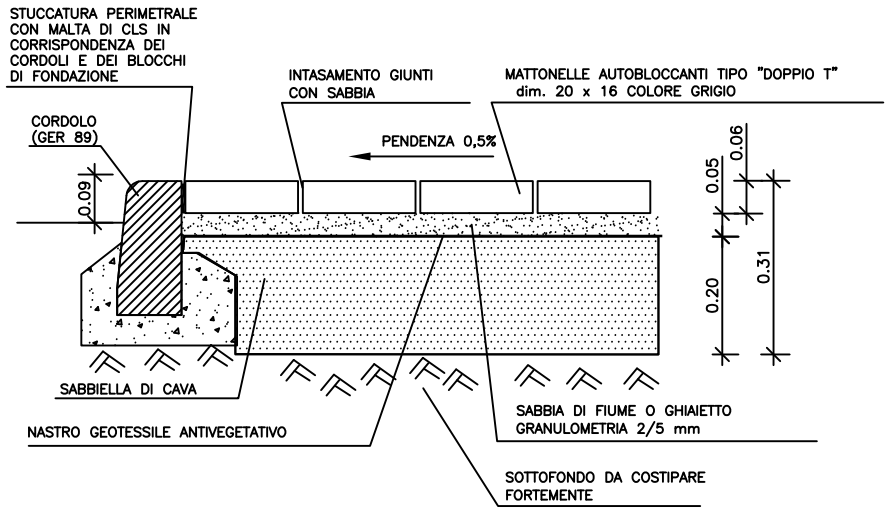
GER 53

Foglio 2/2

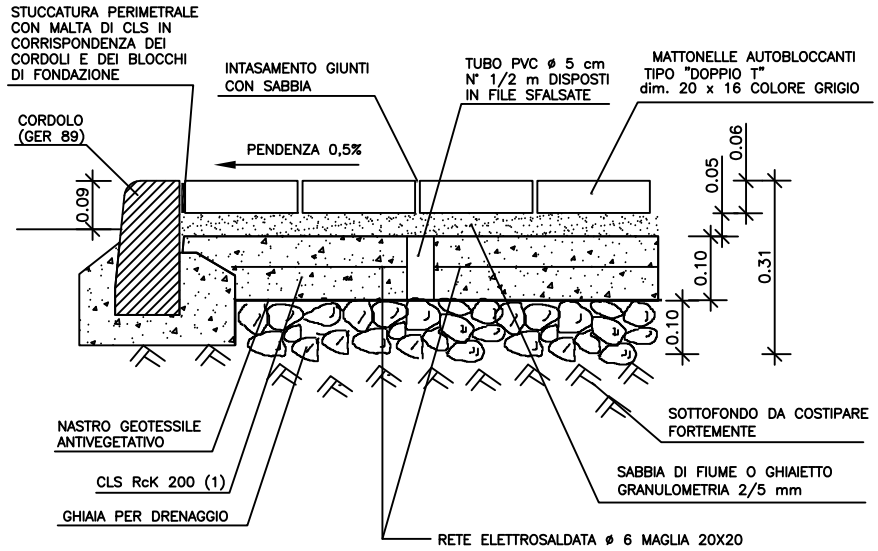
GER53[3]–2 | Ed.3 09/01

Aggiornamenti	data
Rete elettrosaldata zona tipo 3R	09/01
Rete elettrosaldata in zona tipo 4	03/01

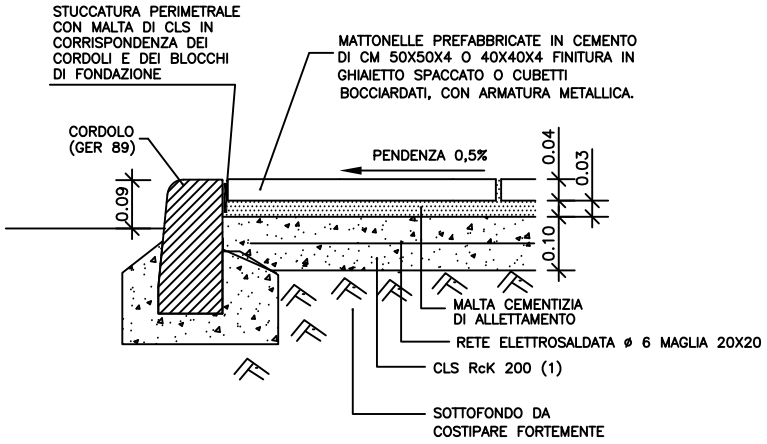
ZONA TIPO 3 (SEZIONE)
(SCALA 1:10)



ZONA TIPO 3R (SEZIONE)
(SCALA 1:10)



ZONA TIPO 4 (SEZIONE)
(SCALA 1:10)



NOTE

(1) – PREVEDERE OPPORTUNI GIUNTI DI DILATAZIONE

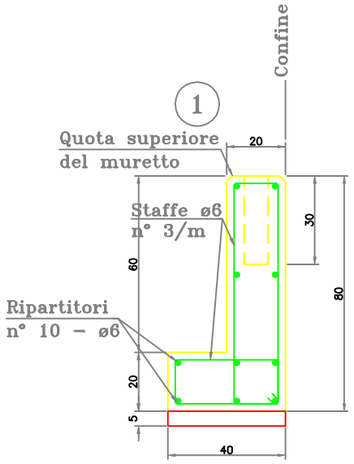
PER LE QUOTE ALTIMETRICHE DI PROGETTO VEDERE DISEGNI SPECIFICI

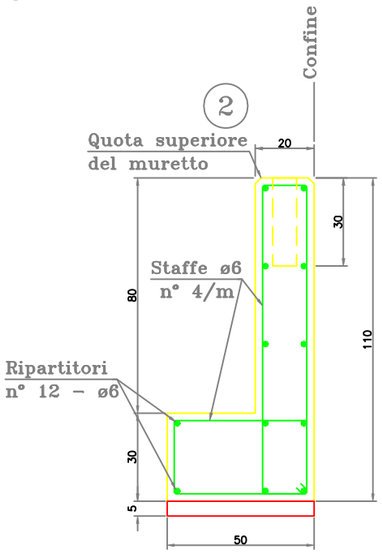
DATA	AGGIORNAMENTI

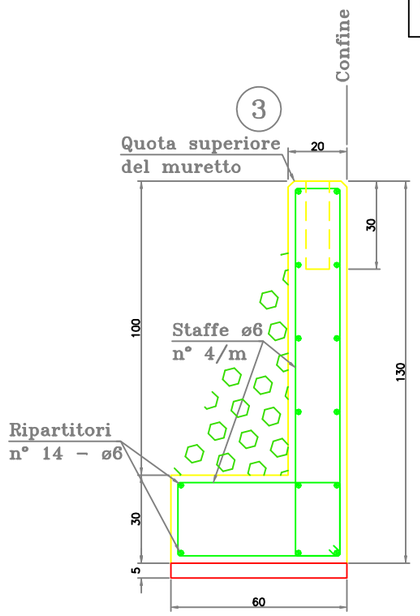
CALCESTRUZZO RCK 250

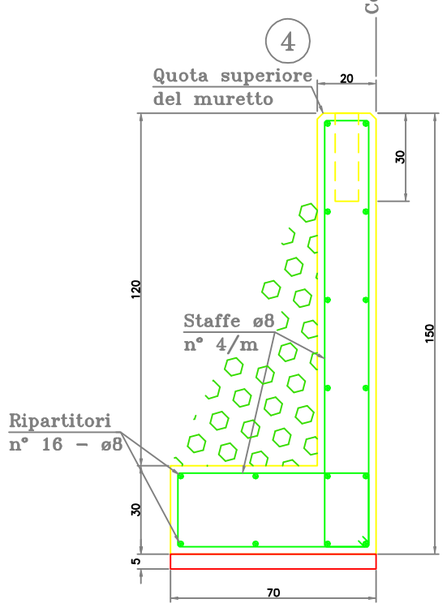
COPRIFERRO 2,5 cm

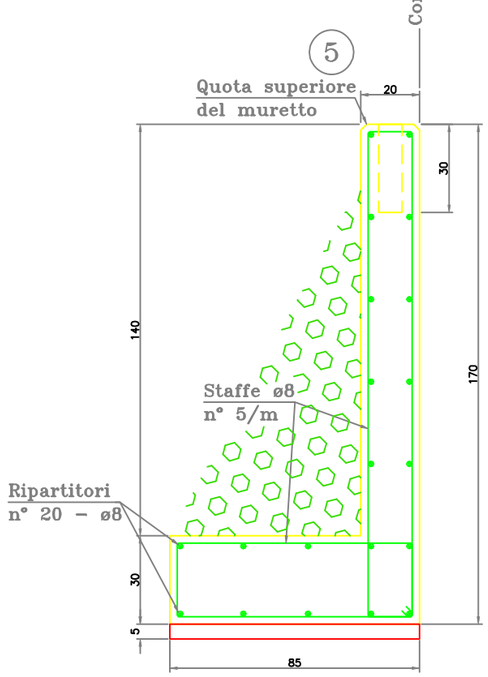
FERRO DI ARMATURA Feb44K

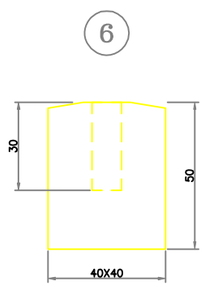












Enel DISTRIBUZIONE DIREZIONE EMILIA ROMAGNA INGEGNERIA	FONDAZIONI PER RECINZIONE E PER CARTELLI MONITORI	N°: GER–31 Ric. da Ed.3 09/01 Pag.1/1
	GER31-3	B.V. Modificato EMR

TIPO	Dislivello terreno (m) da	Dislivello terreno (m) a	Volume scavo (m³/m) da	Volume scavo (m³/m) a	Volume sottof. (m³/m)	Volume CLS (m³/m)	Peso ferro (Kg/m)	Massicciata laterale di drenaggio (m³/m)	Tubi di drenaggio (n°/m)
GER31/1	0,00	0,20	0,18	0,26	0,02	0,20	4,35	--	--
GER31/2	0,00	0,40	0,275	0,475	0,025	0,31	6,40	--	--
GER31/3	0,00	0,60	0,33	0,69	0,03	0,38	7,37	0,22	1
GER31/4	0,00	0,80	0,385	0,945	0,035	0,45	14,85	0,26	1
GER31/5	0,00	1,00	0,467	1,318	0,0425	0,535	19,95	0,30	2
GER31/6	--	--	--	0,08*	--	0,09	--	--	--

* : è da intendersi come volume di scavo di un solo blocchetto.

NOTE:

Le fondazioni tipo 1 e 2 sono calcolate per sopportare il terrapieno da entrambi i lati.
I tipi 3, 4 e 5 sono invece idonei solo per terrapieni lato plinto di fondazione.

Realizzare giunti di dilatazione ad incastro ogni 10 m circa.

Nelle fondazioni tipo 1, 2, 3, 4, e 5 la parte superiore del muretto deve essere leggermente pendente verso l'interno della Cabina Primaria.

Nelle fondazioni tipo 3, 4, e 5 vanno inseriti dei tubi in PVC ø25 mm con funzione di drenaggio

La massicciata laterale di drenaggio è costituita da ghiaia lavata di opportuna pezzatura.

Tutti i muretti devono essere realizzati in calcestruzzo a vista.

I vari tipi di recinzione da montare sulle fondazioni sono indicati nella planimetria di impianto

UNIFICAZIONE

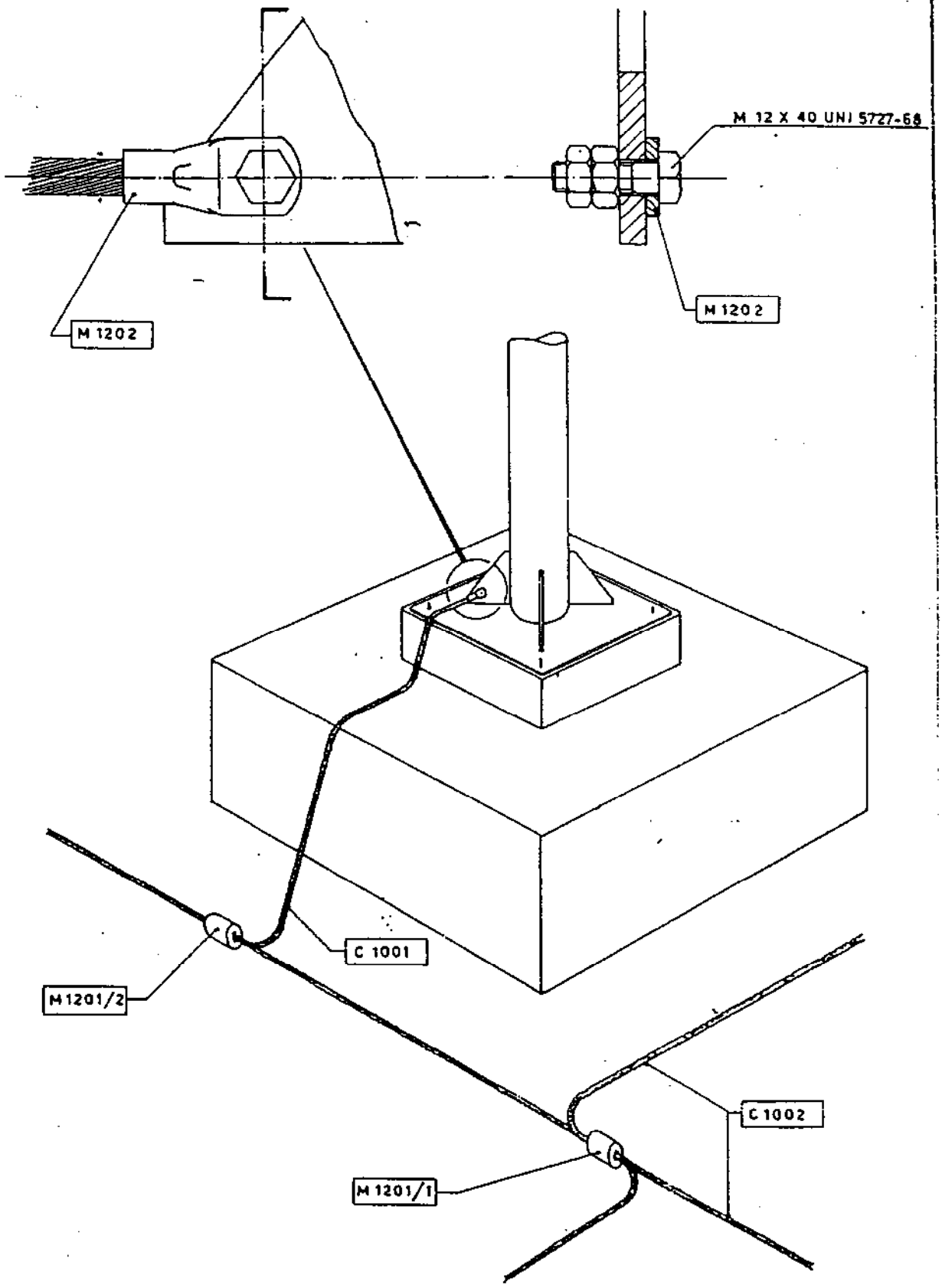
ENEL

COLLEGAMENTO APPARECCHIATURE RETE DI TERRA

LR 3

Marzo 1973

Ed. 1 - 1/1



DIREZIONE DELLE COSTRUZIONI - CENTRO NAZIONALE STUDI E PROGETTI