Firmato digitalmente da GIANLUCA BRUGNONI C: IT

COMUNI DI:
SAN GAVINO MONREALE
GONNASFANADIGA
GUSPINI

PROVINCIA: SUD SARDEGNA
REGIONE: SARDEGNA

FATTORIA SOLARE "*SA PEDRERA*" AGROFOTOVOLTAICO DI 48,177 MWp

IMPIANTO DI RETE PER LA CONNESSIONE 150 kV
PROGETTO DEFINITIVO

ELEMENTI TECNICI DELLE OPERE

Tipo Elaborato	Codice Elaborato	Cod. Rintracciabilità	Formato	Foglio / di	Scala
REL.	0121_R.E.11	T0738702	A4	1/272	-

PROPONENTE	SVILUPPO
EF AGRI SOCIETA' AGRICOLA a r.l. *Via Del Brennero, 111* *38121 - Trento (TN)*	SET SVILUPPO **SET SVILUPPO s.r.l.** *Corso Trieste, 19* *00198 - Roma (RM)*

PROGETTAZIONE

BRULLI service

IL DIRETTORE E RESPONSABILE TECNICO

Brugnoni

Bolognesi

Graziano

Rev.	Data	Descrizione	Redatto	Verificato	Approvato
00	23/11/2021	Prima Emissione	Graziano	Bolognesi	Brugnoni

1 APPARECCHIATURE E ISOLATORI AT

CODIFICA	DATA	OGGETTO
GSH002; DY107B	25/11/2016; 10/2006	Hybrid modules; Apparecchiature prefabbricate in involucro metallico di tipo mono stallo, con isolamento in gas, per tensioni fino a 245 kV, per cabine primarie con ingressi sia in linea aerea che in cavo e possibilità di ingresso in condotto
DY46	1/11/2007	Specifica tecnica – Trasformatori di tensione capacitivi 170 kV per Cabine Primarie
DY59	1/2005	Cabine Primarie – Scaricatori ad ossido metallico senza spinterometri per Cabine Primarie con tensione nominale 150 kV

2 CONDUTTORI E MORSETTERIA AT

CODIFICA	DATA	OGGETTO
LC5	1/1995	Conduttore in corda di alluminio crudo Ø 36
LC1302	3/1973	Collegamenti in corda Ø 36 a lunghezza variabile
LC1301	3/1973	Collegamenti in corda Ø 36 a lunghezza fissa
LC1050	3/1973	Conduttori rigidi in lega di alluminio per connessioni
LC1221	3/1973	Collegamenti in tubo Ø 100/90
LC1201	3/1973	Collegamenti in tubo Ø 40/30
DC11	2/1978	Conduttore in corda di lega di alluminio Ø 10,7 sezione 70 mm^2
LC111	3/1973	Cabine Primarie – Impianti di potenza 132 – 150 kV Impiego del conduttore in lega di alluminio Ø 10,7 come smorzatore di vibrazioni per sbarre in tubo Ø 100/90
LM1013	3/1973	Morsetto a “T” corda passante AL Ø 36 - Codolo
LM1020	3/1973	Morsetto diritto corda AL Ø 36 - Codolo
LM1034	3/1973	Morsetti portanti per giunzione diritta tubi lega AL
LM1035	3/1973	Morsetto portante con cerniera per giunzione diritta tubi lega AL Ø 100
LM1084	3/1973	Morsetti diritti tubo lega AL - Codolo
LM1085	3/1973	Morsetto a “T” giunzione diritta tubi lega AL Ø 40 - Codolo
LM1086	3/1973	Morsetti a “T” tubo passante lega AL – Tubo lega AL
LM1088	3/1973	Contrappeso per tubo Ø 100
LM991	3/1973	Capocorda a compressione diritto in alluminio per corda sez. 70 mm^2 – Attacco a perno filettato
LM992	3/1973	Dispositivo di fermo all’interno di tubi Ø int. 90
DM1004	10/2000	Attacchi a codolo per apparecchiature

3 CONDUTTORI E MORSETTERIA DI TERRA

CODIFICA	DATA	OGGETTO
LC1001	3/1973	Corda di terra in rame Ø 14,7 – Sezione 125 mm^2
LC1002	3/1973	Corda di terra in rame Ø 10,5 – Sezione 63 mm^2
DM1201	3/2003	Morsetti bifilari a compressione per corde in rame sez. 63 e 125 mm^2
DM1202	7/1981	Capocorda a compressione diritto per corda in rame sez. 125 mm^2
DM1206	7/1981	Paletti di terra in tondo di acciaio rivestito in rame o di acciaio zincato

4 QUADRI BT

CODIFICA	DATA	OGGETTO
DQ1901A2NCI	1/2007	Cabine Primarie – Telaio a rastrelliera tipo rack per supporto pannelli da 19”
DQ1907A2NCI	1/2007	Cabine Primarie – Armadio smistamento cavi linea AT morsettiere e collegamenti
DQ1992A2NCI	6/2007	Cabine Primarie – Collegamenti del dispositivo di monitoraggio impianto sul telaio (T13A) alle morsettiere e all’impianto
DQ2010A2	1/2007	Cabine Primarie – Collegamenti interni al telaio linea AT (T9) per due linee AT
DV7071	5/2008	Prescrizioni per la costruzione del Quadro servizi ausiliari per Cabina Primaria

5 CAVI BT

CODIFICA	DATA	OGGETTO
DV201	12/1998	Cavi per energia isolati con PVC non propaganti l’incendio. Cavi unipolari senza guaina, con conduttori flessibili. Tensione nominale Uo/U: 450/750V
DV202	12/1998	Cavi per energia. Isolati con PVC non propaganti l’incendio. Cavi unipolari senza guaina, con conduttori rigidi. Tensione nominale Uo/U: 450/750V
DV204	12/1998	Cavi per energia isolati con PVC non propaganti l’incendio. Cavi multipolari per posa fissa, con conduttori flessibili, con schermo, sotto guina di PVC. Tensione nominale Uo/U: 0,6/1kV
DV206	12/1998	Cavi per comandi e segnalazioni. Isolati con PVC non propaganti l’incendio. Cavi multipolari per posa fissa. Con conduttori flessibili, con schermo sotto guina di PVC. Tensione nominale Uo/U: 0,6/1kV
DV207	1/2000	Cavo schermato per impianti di telecontrollo nelle Cabine Primarie isolato in PVC sotto guaina di PVC
DV208	1/2003	Cavi per energia isolati con PVC non propaganti l’incendio. Cavi multipolari per posa fissa, con conduttori flessibili, con schermo in calza, sotto guaina di PVC. Tensione nominale Uo/U: 0,6/1kV
DV209	1/2003	Cavi per comandi e segnalazioni. Isolati con PVC non propaganti l’incendio. Cavi multipolari per posa fissa. Con conduttori flessibili, con schermo in calza sotto guaina di PVC. Tensione nominale Uo/U 0,6/1Kv
DC4141	9/2003	Cavi per bassa tensione unipolari con conduttore di rame isolati con gomma etilpropilenica ad alto modulo elastico, o con XLPE, sotto guaina di PVC

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REV.	DATA	REDATTO	VERIFICATO	APPROVATO	NOTE
III	OTTOBRE 2006	PETRONI	GRIMALDI	TRAMUTOLI	Aggiunto 72,5 kV.
II	APRILE 2005	PETRONI	GRIMALDI	TRAMUTOLI	
I	FEBBRAIO 2004	PETRONI	GRIMALDI	TRAMUTOLI	

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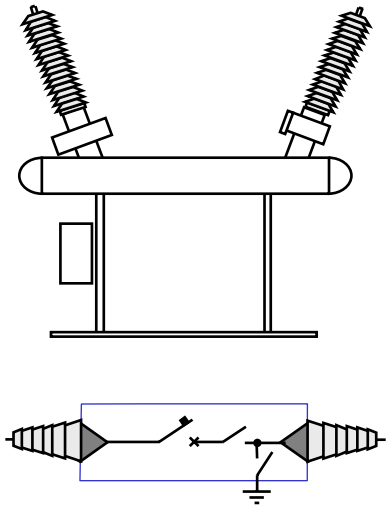
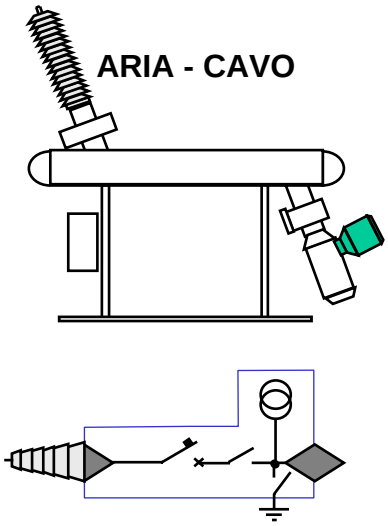
TIPO I TR

ARIA - ARIA



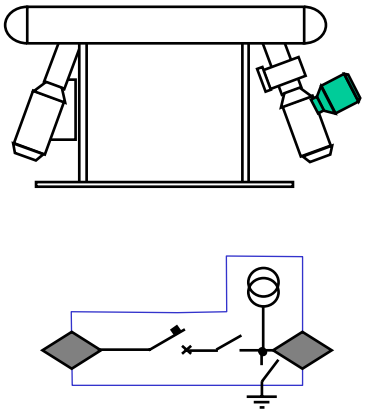
TIPO	Vn	MATRICOLA	COMANDO	TA	TV
DY 107/1	72,5	162351	UNIPOLARE	400-800/1	NO
	145-170	16 21 51			
	245	16 22 51		400-800-1600/1	
DY 107/2	72,5	162352	TRIPOLARE	200-400/1	NO
	145-170	16 21 52			
	245	16 22 52			

ARIA - CAVO



TIPO	Vn	MATRICOLA	COMANDO	TA	TV
DY 107/3	72,5	162353	UNIPOLARE	400-800/1	SI
	145-170	16 21 53			
	245	16 22 53		400-800-1600/1	
DY 107/4	72,5	162354	TRIPOLARE	200-400/1	SI
	145-170	16 21 54			
	245	16 22 54			

CAVO - CAVO (CONDOTTO – CAVO)



TIPO	Vn	MATRICOLA	COMANDO	TA	TV
DY 107/5	72,5	162355	UNIPOLARE	400-800/1	SI
	145-170	16 21 55			
	245	16 22 55		400-800-1600/1	
DY 107/6	72,5	162356	TRIPOLARE	200-400/1	SI
	145-170	16 21 56			
	245	16 22 56			

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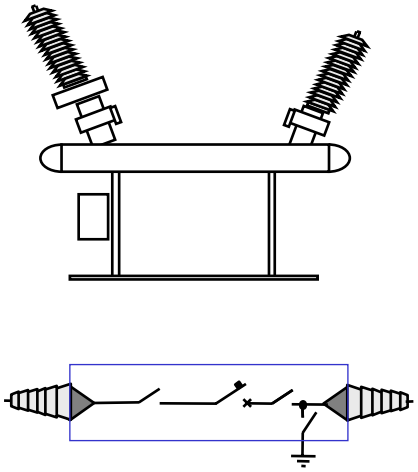
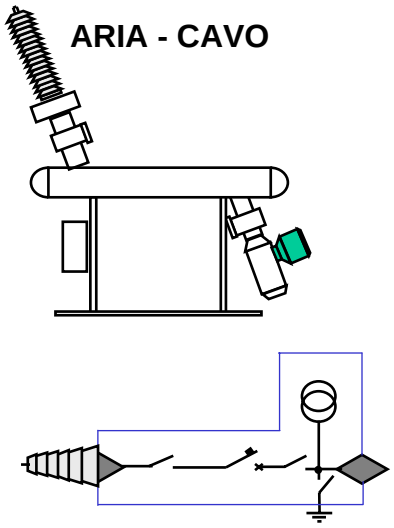
TIPO I L

ARIA - ARIA



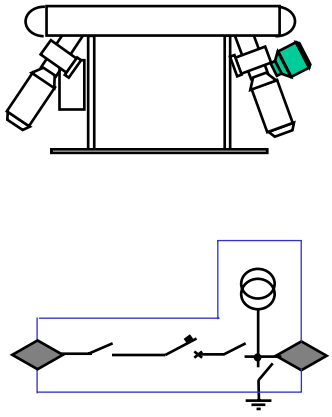
TIPO	Vn	MATRICOLA	COMANDO	TA	TV
DY 107/ 7	72,5	162357	UNIPOLARE	400-800/1	NO
	145-170	16 21 57			
	245	162257		400-800-1600/1	
DY 107/8	72,5	162358	TRIPOLARE	200-400/1	NO
	145-170	16 21 58			
	245	162258			

ARIA - CAVO



TIPO	Vn	MATRICOLA	COMANDO	TA	TV
DY 107/9	72,5	162359	UNIPOLARE	400-800/1	SI
	145-170	16 21 59			
	245	162259		400-800-1600/1	
DY 107/10	72,5	162360	TRIPOLARE	200-400/1	SI
	145-170	16 21 60			
	245	162260			

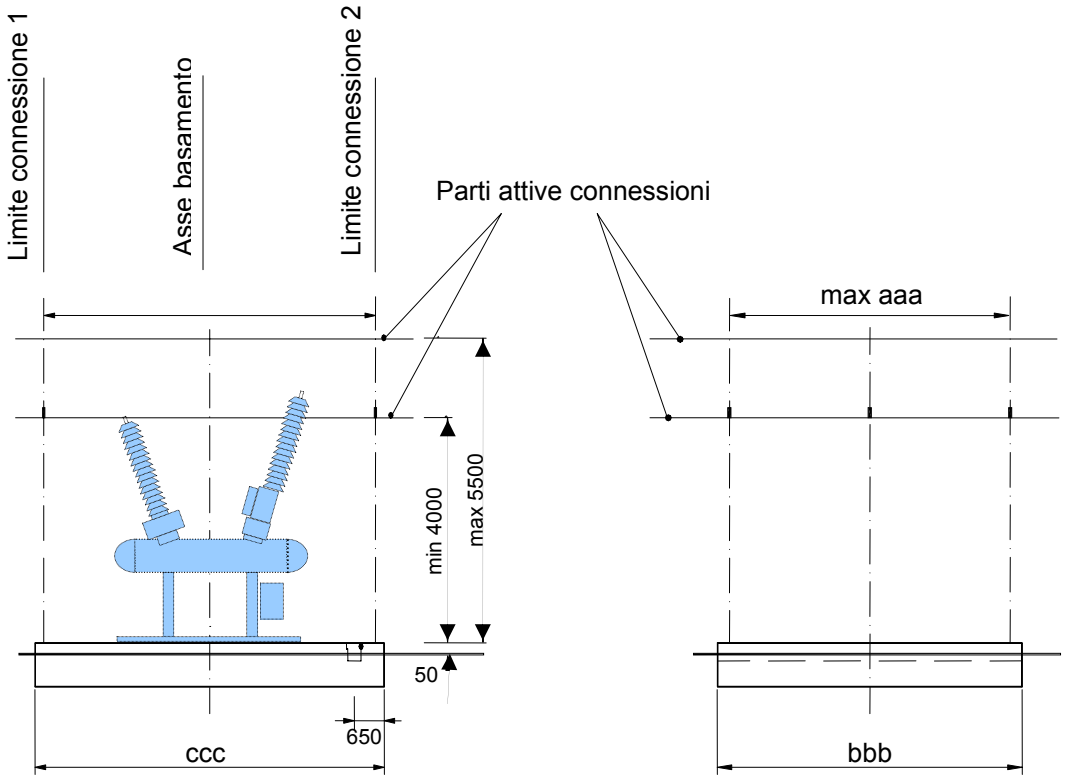
CAVO - CAVO (CONDOTTO – CAVO)



TIPO	Vn	MATRICOLA	COMANDO	TA	TV
DY 107/11	72,5	162361	UNIPOLARE	400-800/1	SI
	145-170	16 21 61			
	245	162261		400-800-1600/1	
DY 107/12	72,5	162362	TRIPOLARE	200-400/1	SI
	145-170	16 21 62			
	245	162262			

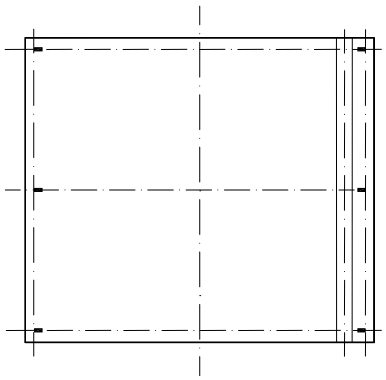
1. DIMENSIONI

1.1 MODULI IBRIDI MONOSTALLO A 72,5 kV



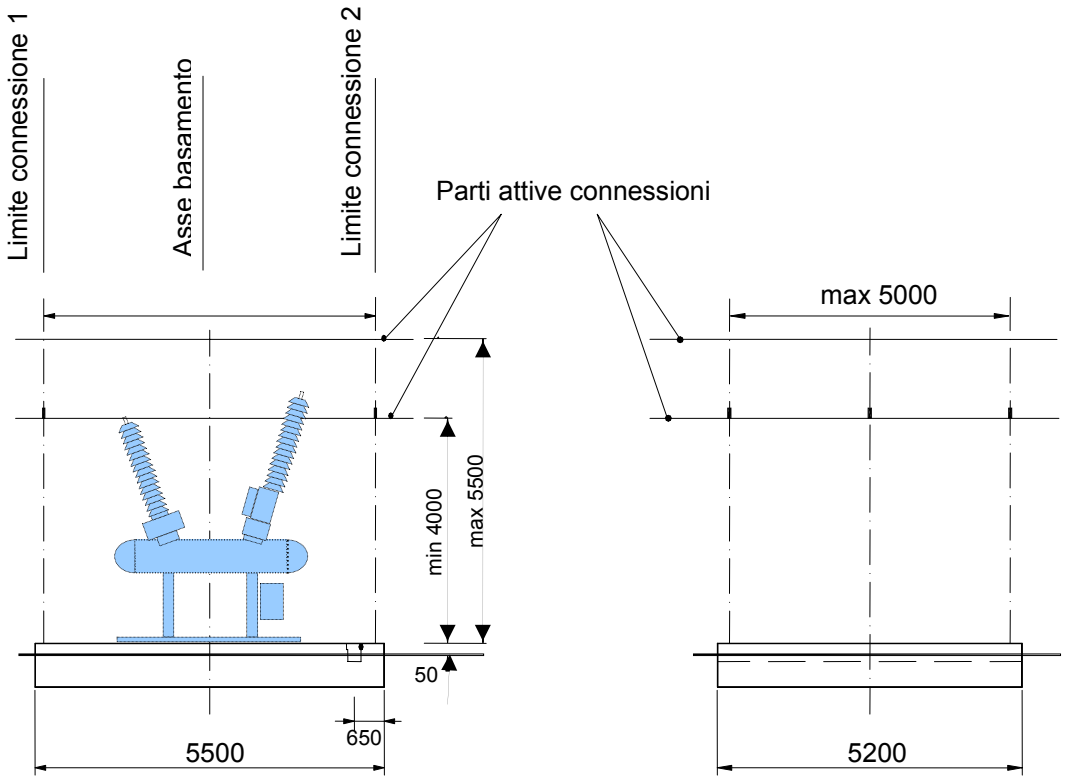
Sezione longitudinale

Sezione trasversale



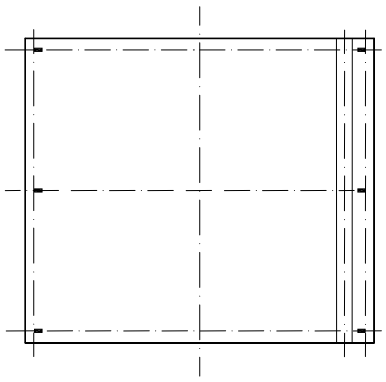
Pianta

1.2 MODULI IBRIDI MONOSTALLO A 145-170 kV



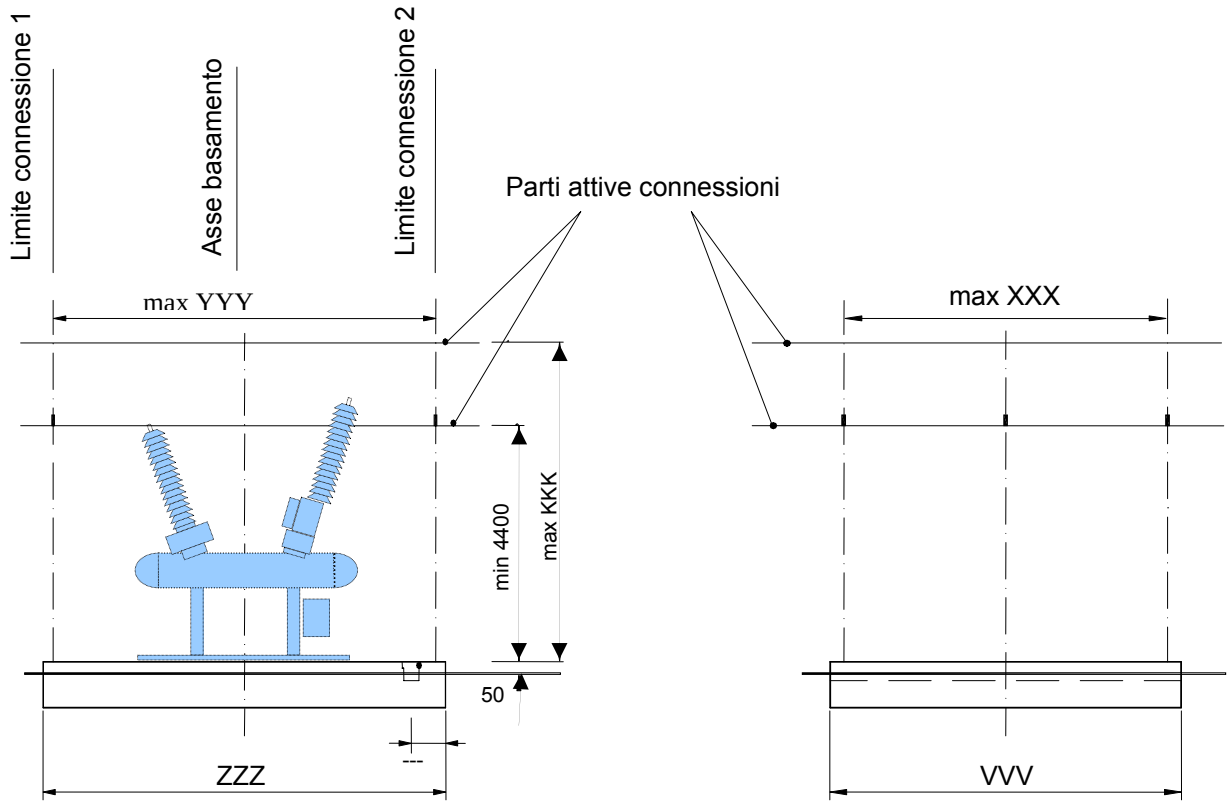
Sezione longitudinale

Sezione trasversale



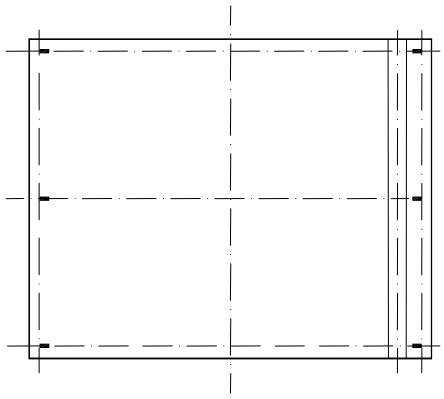
Pianta

1.3 MODULI IBRIDI MONOSTALLO A 245 kV



Sezione longitudinale

Sezione trasversale



Pianta

2.GRANDEZZE NOMINALI

2.1.Grandezze e valori comuni

Tensione nominale	kV	72,5	145-170	245
Tensione di lavoro	“	60	132-150	220
Frequenza	Hz	50		
Tensione nominale di tenuta di breve durata a f.i . (verso massa)	kVrms	140	275	360
Tensione nominale di tenuta ad impulso atmosferico (verso massa)	kVp	325	650	850
Corrente nominale in servizio continuo	A	1250		2000
Corrente nominale ammissibile di breve durata	kA	25	31,5	40
Valore di cresta della corrente ammissibile di breve durata	kAcr	60	80	100
Durata nominale del cortocircuito	s	1		
Grado di protezione dei contenitori dei circuiti di comando e segnalazione		IP44		
Tensione nominale di alimentazione:				
- dei circuiti di comando e segnalazione	Vcc	110		
- dei servomotori di comando	Vcc	110		
- dei circuiti di comando in c. a. e dei circuiti di alimentazione	Vca	220/380		

2.2.Interruttore

Tensione nominale	kV	72,5	145-170	245
Corrente di interruzione nominale in cortocircuito	kA	25	31,5	40
Potere di stabilimento nominale in corto circuito	KA	60	80	100
Durata meccanica	C-O	10000		
Sequenza nominale di manovra		O-0,3s-CO-1min-CO		
Massima non contemporaneità tra i poli (chiusura-apertura)	ms	5 – 3,3		

2.3.Sezionatori

Tipo: comando tripolare a motore con manovra manuale in emergenza e bloccaggio con chiave delle posizioni di AP e CH.

Per i moduli a tensione nominale	kV	72,5	145-170	245
Tensione nominale di tenuta di breve durata a f.i . (sul sezionamento)	kVrms	325	315	415
Tensione nominale di tenuta ad impulso atmosferico (sul sezionamento)	kVp	375	750	950
Durata meccanica	C-O	2000		

2.4.Sezionatore di terra

Tipo: con comando tripolare a motore.

2.5.Trasformatore di corrente toroidale

Installazione su passante o su cavo

Per i moduli a tensione nominale	kV	72,5	145-170	245
Rapporto di trasformazione nominale (Ipn/Isn) stallo Trasformatore	A	200-400/1		
Rapporto di trasformazione nominale (Ipn/Isn) stallo Linea	A	400-800/1		400-800-1600/1
Numero dei nuclei	n°	1		2
Corrente massima permanente		1,2 Ipn		
Prestazione	VA	15		
Classe di precisione		5P30		
Impedenza secondaria a 75 °C		< 0,4		
Reattanza secondaria a frequenza industriale		trascurabile		

2.6.Isolatori passanti SF6-aria

Tensione nominale	kV	72,5	145-170	245
Tensione nominale di tenuta di breve durata a f.i .	kVrms	140	325	395
Tensione nominale di tenuta ad impulso atmosferico	kVp	325	750	950
Linea di fuga minima secondo Norma CEI 60137	mm/kV	25	31	
Carico di tenuta alla flessione	kN	1		

2.7. Trasformatori di tensione

Tipo		Induttivo			
Tensione nominale	kV	72,5	145	170	245
Tensione primaria	“	60/√3	132/√3	150/√3	220/√3
Tensione secondaria	V	100/√3			
Prestazioni nominali in Classe 0,2	VA	15			
Fattore di tensione nominale (tempo 30 s)	1,5	1,5			

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3. CONDIZIONI NORMALI DI SERVIZIO

Tipo di installazione		all’esterno
Temperatura ambiente: massima media giornaliera massima minima	°C	 40 35 -25
Sovratemperatura corrispondente all’irraggiamento di	W/mq	1000
Pressione massima del vento	N/mq	700
Altitudine massima s.l.m.	m	1000

4. RESISTENZA AL SISMA

Severita’ AF 5

1. Prescrizioni per la costruzione: DY 1104 Ed III Ottobre 2006
2. Prescrizioni per il collaudo: DY 1105 Ed II Aprile 2005

Unità di misura: numero di esemplari (n)

Esempio di designazione abbreviata

I	B	R	I	D	O		M	O	N	O	S	T	A	L	L	O		1	4	5	-	1	7	0			2	4	5		k	V

HYBRID MODULES

Countries' I&N	Elaborated by
Brazil	**V. Robadey**
Chile	**D. A. Gonzalez**
Colombia	**J. C. Gomez**
Iberia	**C. Llovich**
Italy	**I. Gentilini**
Peru	**R. Sanchez**
Romania	**A. Musat**

	Elaborated by	Verified by	Approved by
Solution Development Center	**C. Llovich**	**C. Llovich**	**J. Gonzalez**
Global I&N – NT/NCS		**N. Cammalleri** **G. Egea**	**F. Giammanco**

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

INDEX

1 SCOPE

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

- 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)
- e-distribuzione (Italy)

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

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

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

2 COMPONENTS LIST

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

Some typical typologies are provided in chapter 5.

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

Base component code	Base component description			
GSH002/011	Lateral bay	With circuit-breaker	Air connection	72,5 kV
GSH002/012				145 kV
GSH002/013				170 kV
GSH002/014				245 kV
GSH002/021			Cable connection	72,5 kV
GSH002/022				145 kV
GSH002/023				170 kV
GSH002/024				245 kV
GSH002/031			Bus-duct connection	72,5 kV
GSH002/032				145 kV
GSH002/033				170 kV
GSH002/034				245 kV
GSH002/061		Without circuit-breaker	Air connection	72,5 kV
GSH002/062				145-170 kV
GSH002/063				245 kV
GSH002/071			Cable connection	72,5 kV
GSH002/072				145-170 kV
GSH002/073				245 kV
GSH002/081			Bus-duct connection	72,5 kV
GSH002/082				145-170 kV
GSH002/083				245 kV
GSH002/111	Central bay	Without circuit-breaker	Air connection	72,5 kV
GSH002/112				145-170 kV
GSH002/113				245 kV
GSH002/121			Cable connection	72,5 kV
GSH002/122				145-170 kV
GSH002/123				245 kV
GSH002/131			Bus-duct connection	72,5 kV
GSH002/132				145-170 kV
GSH002/133				245 kV

GSH002/211	Circuit-breaker drive mechanism	Single-pole	1°, 2° opening circuit	72,5 kV
GSH002/212				145-170 kV
GSH002/213				245 kV
GSH002/221			1°, 2°, 3° opening circuit	72,5 kV
GSH002/222				145-170 kV
GSH002/261		Three-pole	1°, 3° opening circuit	72,5 kV
GSH002/262				145-170 kV
GSH002/263				245 kV
GSH002/271			1°, 2°, 3° opening circuit	72,5 kV
GSH002/272				145-170 kV
GSH002/281			1°, 2° opening circuit	72,5 kV
GSH002/282				145-170 kV
GSH002/283				245 kV
GSH002/311	Disconnector	72,5 kV		
GSH002/312		145-170 kV		
GSH002/313		245 kV		
GSH002/321	Disconnector with earthing switch	72,5 kV		
GSH002/322		145-170 kV		
GSH002/323		245 kV		
GSH002/331	Disconnector with ability of Bus-transfer current switching	72,5 kV		
GSH002/332		145-170 kV		
GSH002/333		245 kV		
GSH002/411	Bushing SF6/air class “d”	72,5 kV		
GSH002/412		145-170 kV		
GSH002/413		245 kV		
GSH002/421	Bushing SF6/air class “e”	72,5 kV		
GSH002/422		145-170 kV		
GSH002/423		245 kV		
GSH002/461	Cable connection upward exit	72,5 kV		
GSH002/462		145-170 kV		
GSH002/463		245 kV		
GSH002/464	Cable connection downward exit	72,5 kV		
GSH002/465		145-170 kV		
GSH002/466		245 kV		

GSH002/481	Equipments for direct connection between bus-duct and power transf.	72,5 kV
GSH002/482		145-170 kV
GSH002/483		245 kV
GSH002/511	Bus-duct (1 linear meter x 3 poles)	72,5 kV
GSH002/512		145-170 kV
GSH002/513		245 kV
GSH002/521	Bus-duct curve	72,5 kV
GSH002/522		145-170 kV
GSH002/523		245 kV
GSH002/531	Bus-duct expansion compensator	72,5 kV
GSH002/532		145-170 kV
GSH002/533		245 kV
GSH002/541	Bus-duct joint	72,5 kV
GSH002/542		145-170 kV
GSH002/543		245 kV
GSH002/561	Partitioning with single-pole gas management (including relative equipments and control circuits)	72,5 kV
GSH002/562		145-170 kV
GSH002/563		245 kV
GSH002/564	Partitioning with three-pole gas management (including relative equipments and control circuits)	72,5 kV
GSH002/565		145-170 kV
GSH002/566		245 kV

GSH002/601	Current Transformer	72,5 kV
GSH002/602		
GSH002/603		
GSH002/604		145-170 kV
GSH002/605		
GSH002/606		
GSH002/607		245 kV
GSH002/608		
GSH002/611		
GSH002/612		
GSH002/620		
GSH002/621		
GSH002/622		
GSH002/623		
GSH002/700	EVDS - Electronic Voltage Detector System (capacitive dividers included)	
GSH002/701	Voltage Transformer	
GSH002/702		
GSH002/703		
GSH002/704		
GSH002/711		
GSH002/721		
GSH002/722		

GSH002/801	Support	e-distribuzione	Y1 type and Y2 type	72,5 kV
GSH002/802				145-170 kV
GSH002/803				245 kV
GSH002/804			Single-bay type	72,5 kV
GSH002/805				145-170 kV
GSH002/806				245 kV
GSH002/811		Enel Distributie	Y2 type	145 kV
GSH002/812			Single-bay type	145 kV
GSH002/821		Endesa Distribución	Y1 type	145 kV
GSH002/822			Y2 type	145 kV
GSH002/823			Single-bay type	145 kV
GSH002/824			Y1 type	72,5 kV
GSH002/825			Y2 type	72,5 kV
GSH002/826			Single-bay type	72,5 kV
GSH002/841		Edesur	Y1 type	145 kV
GSH002/842				245 kV
GSH002/843			Y2 type	145 kV
GSH002/844				245 kV
GSH002/845			Single-bay type	145 kV
GSH002/846				245 kV
GSH002/851		Edelnor	Y1 type	72,5 kV
GSH002/852				245 kV
GSH002/853			Y2 type	72,5 kV
GSH002/854				245 kV
GSH002/855			Single-bay type	72,5 kV
GSH002/856				245 kV
GSH002/861		Coelce	Y1 type	72,5 kV
GSH002/862			Y2 type	72,5 kV
GSH002/863			Single-bay type	72,5 kV
GSH002/871		Codensa	Y1 type	145 kV
GSH002/872			Y2 type	145 kV
GSH002/873			Single-bay type	145 kV
GSH002/881		Chilectra	Y1 type	145 kV
GSH002/882				245 kV
GSH002/883			Y2 type	145 kV
GSH002/884				245 kV

GSH002/885			Single-bay type	145 kV
GSH002/886				245 kV
GSH002/891		Ampla	Y1 type	72,5 kV
GSH002/892				145 kV
GSH002/893			Single-bay type	72,5 kV
GSH002/894				145 kV
GSH002/895			Single-bay type	72,5 kV
GSH002/896				145 kV

GSH002/901	Control Box	e-dstribuzione	Y1 type	
GSH002/902			Y2 type	
GSH002/903			Single-bay type	
GSH002/911		Enel Distributie	Y2 type	
GSH002/912			Single-bay type	
GSH002/921		Endesa Distribución	Y1 type	Line bay
GSH002/922				Transformer bay
GSH002/923			Single-bay type	Bus Coupler
GSH002/924				Line bay
GSH002/925				Transformer bay
GSH002/926			Y2 type	
GSH002/931		Latam	Y1 type	
GSH002/932			Y2 type	
GSH002/933			Single-bay type	

For local components codification see annex A.

3 REFERENCE LAWS AND STANDARDS

3.1 Laws

3.1.1 Latam

3.1.1.1 *Brasil*

NR-10 - segurança em instalações e serviços em eletricidade

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

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

Real Decreto Riesgo Eléctrico Real Decreto 614/2001.

Reglamento Electrotécnico para Baja Tensión, Real Decreto 842/2002.

Reglamento de puntos de Medida Real Decreto 1110/2007.

3.1.4 All European countries

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

3.2 Standards

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

3.2.1 Common standards

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

IEC 62271-205	High-voltage switchgear and controlgear - Part 205: Compact switchgear assemblies for rated voltages above 52 kV
IEC 62271-1	High-voltage switchgear and controlgear - Part 1: Common specifications
IEC 62271-203	High-voltage switchgear and controlgear - Part 203: Gas-insulated metal-enclosed switchgear for rated voltages above 52 kV
IEC 62271-100	High-voltage switchgear and controlgear – Part 100: Alternating current circuit-breakers
IEC 62271-102	High-voltage switchgear and controlgear – Part 102: High-voltage alternating current disconnectors and earthing switches
IEC 62271-207	High-voltage switchgear and controlgear - Part 207: Seismic qualification for gas-insulated switchgear assemblies for rated voltages above 52 kV
IEC 62271-209	High-voltage switchgear and controlgear - Part 209: Cable connections for gas-insulated metal-enclosed switchgear for rated voltages above 52 kV - Fluid-filled and extruded insulation cables - Fluid-filled and dry-type cable-terminations
IEC 62271-211	High-voltage switchgear and controlgear – Part 211: Direct connection between power transformers and gas-insulated metal-enclosed switchgear for rated voltages above 52 kV
IEC 60376	Specification of technical grade sulfur hexafluoride (SF6) for use in electrical equipment
IEC/TR 62271-301	High-voltage switchgear and controlgear – Part 301: Dimensional standardization of high-voltage terminals
IEC 62271-4	High-voltage switchgear and controlgear – Part 4: Handling procedures for sulphur hexafluoride (SF6) and its mixtures
IEC 60073	Basic and safety principles for man-machine interface, marking and identification – Coding principles for indicators and actuators
IEC 60447	Basic and safety principles for man-machine interface, marking and identification - Actuating principles
IEC 61869-1	Instrument transformers – Part 1: General requirements
IEC 61869-2	Instrument transformers – Part 2: Additional Requirements for Current Transformers
IEC 61869-3	Instrument transformers – Part 3: Additional Requirements for Inductive Voltage Transformers
IEC 61936-1	Power installations exceeding 1 kV a.c. - Part 1: Common rules
IEC/TS 60815-1	Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 1: Definitions, information and general principles
IEC/TS 60815-3	Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 3: Polymer insulators for a.c. systems
IEC 60137	Insulated bushings for alternating voltages above 1 000 V
IEC 60332-3-24	Tests on electric and optical fibre cables under fire conditions – Part 3-24: Test for vertical flame spread of vertically-mounted bunched wires or cables - Category C

IEC 60529	Degree of protection provided by enclosures (IP Code)
IEC 60068-2-17	Environmental testing – Part 2: Tests – Test Q: Sealing
ISO 1461	Hot dip galvanized coatings on fabricated iron and steel articles- Specifications and test methods
ISO 4126	Safety devices for protection against excessive pressure

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

NMC001 – Procedimiento para el conexionado de armarios cuadros y paneles

NNC007 – Cables de control multipolares

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

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 *e-distribuzione*

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

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

ENEL operative note PVR001 (guarantee management)

ENEL operative note PVR006 (bar code)

ENEL Global Standard GST002 Power Transformers

4 SERVICE CONDITIONS

4.1 General service conditions

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

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

4.2 Specific service conditions

4.2.1 Colombia

The reference altitude is 2.600 m[1].

4.2.2 Romania[2] (Enel Distributie)

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

4.2.3 Seismic qualification level

Chilectra	ETGI-1020
Codensa	Moderate (IEC 62271-207)
Edelnor	High (IEC 62271-207)
Enel Distributie	High (IEC 62271-207)
e-distribuzione	High (IEC 62271-207)

5 HYBRID MODULES COMPOSITION

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

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

5.1 Y1 type

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

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

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

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

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

5.2 Y2 type

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

5.3 Single-bay type

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

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

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

6 TECHNICAL CHARACTERISTICS

6.1 Common general ratings

Rated voltage *Ur* (kV)		**72,5**	**145**	**170**	**245**
Rated short-duration power-frequency withstand voltage *Ud* (kV rms):	Phase-to-earth, across open switching device and between phases	140	275		395
	Across the isolating distance	160	315		460
Rated lightning impulse withstand voltage *Up* (kVp):	Phase-to-earth, across open switching device and between phases	325	650		950
	Across the isolating distance	375	750		1050
Rated frequency *fr* (Hz)	Chilectra, Edesur, Endesa Distribución, Enel Distributie and e-distribuzione	50			
	Ampla, Codensa, Coelce and Edelnor	60			
Rated normal current *Ir* (A)		2000			
Rated short time withstand current *Ik* (kA)		31,5	40		
Degrees of protection provided by enclosures (IEC 60529)		IP 54[3]			

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

Rated supply voltage *Ua* (Vdc)	Enel Distributie and e-distribuzione	110
	Endesa Distribución Eléctrica, Ampla, Coelce, Chilectra, Codensa, Edelnor	125
	Edesur	220
D.C. maximum absorbed power, for each bay (W/bay)		2.000
Under-voltage release (if requested) – d.c. maximum absorbed power (W/coil)		100
Rated supply voltage for anti-condensation circuits (Vac)	Endesa Distribución, Enel Distributie and e-distribuzione	230
	Ampla, Coelce, Chilectra, Edelnor, Edesur	220
	Codensa	120
a.c. maximum absorbed power (VA)		600
Protection stage (tab. 4 EN 62271-203)		2
Auxiliary contact classes (Table 6 EN 62271-1)		1

6.2 Circuit-breakers

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

Rated voltage *Ur* (kV)	72,5	145	170	245
Rated short-circuit breaking current *Isc* (kA)	31,5	40		
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[4]			
Maximum break-time (ms)	60			
Circuit-breaker class	C2 – E1 – M2			
Rated line-charging breaking current *Il* (A)	10	50	63	125
Rated cable-charging breaking current *Ic* (A)	125	160		250
Rated out-of-phase making and breaking current *Id* (kA)	Clause 4.106 of IEC 62271-100			

6.3 Disconnectors and earthing switches

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

[4] 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.

Rated voltage *Ur* (kV)		72,5	145	170	245
Number of poles		3			
Opening (closing) time for motor operation (s)		≤15			
Disconnector mechanical endurance class *Mr*		M1			
Bus-transfer current switching by disconnectors (only if requested)	Rated bus-transfer current for disconnectors (A)	Clause B.4.106.1 of IEC 62271-102			
	Rated bus-transfer voltages for disconnectors (V)	Clause B.4.106.2 of IEC 62271-102 (referring to Air insulated disconnectors values)			
Earthing switches class		E0 – M1 – A			

6.4 SF6-air bushings

6.4.1 General requirements

The SF6-air bushings for the connections of Hybrid Modules terminations shall be compliant with IEC 60137, outdoor type, with internal SF6 insulation, composite type with glass fiber tube covered with silicone rubber. The color shall be light grey.

The complete Hybrid Module, bushing included, shall be designed to withstand static terminal load according to Table 14 of IEC 62271-100 (e.g. manufacturer shall demonstrate that stresses doesn't affect the proper CB and/or DS/ES functioning).

Bushings shall also be compliant with minimum values of cantilever withstand load provided by Table 1 of IEC 60137, Level I.

6.4.2 Bushing terminations

6.4.2.1 *Latam*

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

The terminals shall be rectangular shape with the following dimensions, according to fig. 3 (2x2 hole pattern) or fig. 4 (2x3 hole pattern) of IEC/TR 62271-301:

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

6.4.2.2 *Endesa Distribución Enel Distributie and e-distribuzione*

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

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

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

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

a) IEC 62271-211

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

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

6.6 Cable connections

IEC 62271-209 applies.

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

Usually the cable connection enclosure shall be suitable for the dry-type cable-termination (see figure 5 of IEC62271-209); only if requested it shall be for fluid-filled cable terminations (see figure 3 of IEC 62271-209).

In case of "plug-in" dry-type cable-terminations, they will be provided by Enel Group Distribution companies in order to be mounted by the manufacturer; if the Hybrid Module transportation is possible with components fully assembled in a single unit, it's required the female cone factory preassembly.

6.7 Current transformers

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

Base component code (see par. 2)	**GSH002/ 601 604**	**GSH002/ 602 605**	**GSH002/ 603 606**	**GSH002/ 607**	**GSH002/ 608**
Rated short-time thermal current I_{th} (kA)	40				
Rated continuous thermal current I_{cth} (kA)	120% of I_{pr}				
Rated transformation ratio k_r (A/A)	200-400/1	400-800/1	1.600/1	200-400/1/1	400-800-1.600/1/1
Core number	1	1	1	2	2
Accuracy class[5]	5P30	5P30	5P30	5P30	5P30
Rated burden (VA)	15	15	15	15	15
Maximum secondary winding resistance (R_{ct}) at 75 °C (Ω)	5	5	5	5	5

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

Base component code (see par. 2)	**GSH002/ 611**	**GSH002/ 612**	**GSH002/ 620**	**GSH002/ 621**	**GSH002/ 622**	**GSH002/ 623**
Rated short-time thermal current I_{th} (kA)	40					
Rated continuous thermal current I_{cth} (kA)	120% of I_{pr}					
Rated transformation ratio k_r (A/A)	200-400/1/1	400-800/5/1/1	1.000-2.000/5/5/5	1.000-2.000/5/1/1	400-800/5/5/5	1.000-2.000/5/5
Core number	2	3	3	3	3	2
Accuracy class[5]	5P30	0,2s - FS10	0,5 - 5P20	0,2s - FS10	0,5 - 5P20	5P20
	5P30	5P30	5P20	5P20	5P20	
	---	5P30	5P20	5P20	5P20	
Rated burden (VA)	15	15	30	30	30	30
Maximum secondary winding resistance (R_{ct}) at 75 °C (Ω)	5	5 (only for 1 A cores)	n.a.	n.a.	n.a.	n.a.

6.8 Voltage transformers

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

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

Base component code	**GSH002/ 711**	**GSH002/ 721**	**GSH002/ 722**
Highest voltage for equipment U_m (kV)	145	145	145
Rated Insulation levels	According to 6.1		
Rated transformation ratio k_r (kV/kV)	$\frac{120:\sqrt{3}}{0{,}1:\sqrt{3};100}$	$\frac{132:\sqrt{3}}{0{,}11:\sqrt{3}}$	$\frac{110:\sqrt{3}}{0{,}11:\sqrt{3}}$
Secondary windings	2	2	2
Rated voltage factor F_v	1,5 (rated time 30 s)		
Accuracy class	0,2	0,5 – 3P	0,5 – 3P
	0,2 – 3P	0,5 – 3P	0,5 – 3P
Rated burden (VA)	15	25	25

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

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

6.8.1 Specific requirements

6.8.1.1 *e-distribuzione*

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

7 CONSTRUCTION CHARACTERISTICS

7.1 General characteristics

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

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

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

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

Components identifications shall be performed by plates located close to them.

All the written tests (labels, synoptic etc.) shall be in the local language of destination.

The SF6 solid decomposition products shall not influence the insulation and the equipment operation.

The over-voltages caused by breaking or making of capacitive current shall not compromise dielectric insulation of components enclosed in the enclosure .

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

7.2 Enclosures and support structure

The enclosures shall be metallic and with the mechanical robustness necessary to ensure the correct operation of all internal mobile parts.

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

The enclosures and support structure disposition shall ensure that:

- all equipment parts are easily accessible for normal check operations; in particular disconnectors manual operations shall be easily performed from the ground (maximum height 1.900 mm) and with the equipment in service;
- it is possible to easily replace the complete pole elements without affect other poles;
- the maintenance or complete equipment/parts replacing are executable accessing with lifting vehicle.

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

7.2.1 Specific requirements

7.2.1.1 *Endesa Distribucion Electrica*

According to NNM001 all accessible parts for operation and maintenance (including disconnectors manual operation) shall be at ≥ 2.000 mm from HV terminals to avoid “Trabajos en Tensión” (as it’s defined on Real Decreto Riesgo Eléctrico 614/2001) on normal inspection and operation works.

7.3 Dielectric mean

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

The gas shall comply with EN 60376 standard. The manufacturer has to provide the necessary instructions for use and handling of SF6, in accordance with IEC 62271-4.

In alternative, non-fluorinated greenhouse gases and internal vacuum breaking unit are also acceptable.

7.4 Gas density control

The Hybrid Module is a closed pressure system. The relative leakage rate shall be *Frel* ≤ 0,5% per year. The value for the time between replenishments shall be at least 10 years (also valid for voltage transformers, if present).

It shall be possible to perform the SF6 replenishment with the equipment in service, avoiding the unwanted operation of the SF6 density control device.

Each pole shall have a distinct SF6 circuit, with a device for the density control.

Solely the gas control circuit of the voltage transformers (when present) can be three-pole. For the eventual partitions the criteria is the following:

- 3 single-pole circuits in case of partition including circuit breaker;
- 3 single-pole circuits in case of partition with gas volume over 3,5 m^3;
- 1 three-pole circuit in case of partition without circuit breaker and with gas volume up to 3,5 m^3.

Each SF6 circuit shall provide a connection element (type DILO VK/BG-03/8 or equivalent[6]), with a non-return valve, both for SF6 control device and for gas filling/replenishment, provided by not losable protection screw taps (located not higher than 1.900 mm from the ground level).

The SF6 circuit piping shall be performed using stainless steel or painted copper, in order to reduce the stealing risk. Alternative solutions can be considered if the manufacturer proves their similar visible effect and equivalent technical and ageing characteristics.

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

The SF6 density control device shall be:

- suitable to work in the provided temperature range;

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

- 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 verification 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 e-distribuzione**	**Latam**
Colored	Mandatory	Mandatory
Graduated	Forbidden	Mandatory

The SF6 density control device shall provide 2 operating levels independently adjustable (see details and specific requirements in 8.5):

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

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

7.5 Gas filling/replenishment device (Optional)

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

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

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

7.6 Partitioning

7.6.1 Common requirements

Generally the partitioning of each pole shall be unique. At request could be required to have other partitions: in this case the new partitions will be managed including in the electric scheme the additional functionalities of the interlocking, automatic openings and remote signaling.

The partitions shall have adequate mechanical resistance to static and dynamic stresses and to vibrations due to both normal and short circuit operation. The partitions shall be designed for the maximum differential pressure in case of vacuum performed in one of the sections.

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

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

7.6.2 Specific requirements

7.6.2.1 *e-distribuzione*

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

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

a) in case if one CB is used on Transformer bay, of the line bay partition;

b) in case of both CBs used on line bays, of one of them.

7.7 Earthing

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

At the base of each support upright shall be provided 2 earthing points, equipped with M12 stainless steel bolts (included in the supply).

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

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

7.8 Internal arc and overpression safety devices

In order to provide a high protection to workers, the external effects of an internal arc (pressure increase of gas and possible burn-through of enclosure) must be limited.

Referring to item 5.102.2 of IEC 62271-203 and the performance criteria – Table 104 – it is requested protection stage 2: no fragmentation (burn-through is acceptable).

All enclosures (VT included, if any) shall be equipped with safety devices against the internal overpressures compliant with ISO 4126 (alternative solutions could be evaluated if the manufacturer proves their adequacy) and properly calibrated over the maximum operating pressure, in order to avoid improper operations.

In case of overpressure safety valves operation, the expelled gas shall not run over people around the equipment and shall not damage Hybrid Module vital parts.

7.9 Current Transformers

The outdoor current transformers shall be manufactured in compliance to IEC 61869-1 and IEC 61869-2, toroidal type and suitable for exposed installation. They will be located close to the bushings (or to the cable or Bus-duct connections).

The secondary terminal box shall be located in order to be easily accessible.

Inside the Control Box shall be located a CT's terminal board, additional to the previous in the secondary terminal box, 6 mm^2 section. The terminal board inside the Control Box shall be short-circuitable on CT side and disconnectable on Control System side, with test sockets.

The connection cables between the secondary terminal boxes and the CT's terminal board shall be 2,5 mm^2 section if Isn =1 A or 4 mm^2 section if 5 A.

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

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

7.10 Voltage Transformers

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

7.11 Anti-condensation circuit

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

The anti-condensation circuit shall be one for the overall equipment, supplied in a.c (see table in chapter 6 for the supply rated voltage) and protected with a magnetothermic automatic circuit-breaker. It shall be controlled by an humidistat; thermostat is admitted in addiction if the manufacturer needs it to comply the minimum ambient temperature requirement. Both shall have fixed regulation (typical regulation values are 60% R.H. and + 5°C) and the contacts shall be connected in parallel.

The heating elements shall be connected in series in order to open the circuit in case of breaking of an element; a minimum current sensor shall detect and signal the anomaly (obviously not when circuit is OFF for environmental causes).

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

7.12 Protective treatments

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

On request the enclosures shall be painted in light gray color (RAL 7035). Painting is anyway admitted even if not expressly requested.

The external visible part of partitions, if any, shall be in orange color (RAL 2004).

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

Protective treatments alternative to the hot dip galvanization could be accepted if the manufacturer proves its adequacy.

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

7.13 Nameplate

7.13.1 Common requirements

The nameplates shall be in stainless steel. Alternative materials can be considered if the manufacturer proves the marking endurance respect to the ageing.

5.10 of IEC 62271-205 applies. Moreover the nameplate, placed on the external side of the Control Box door, shall include:

- reference to this Global Standard;
- composition type (Y1, Y2 or Single-bay);
- Assembly Type A documents list code;
- optional values, if any;
- composition of the assembly, consisting in a list of the base components indicating:
  - base component code (see chapter 2);
  - local codification (see Annex A);
- the rated filling pressure value at 20°C (relative value).

7.13.2 Latam specific requirements

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

7.13.3 European countries specific requirements

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

7.13.4 e-distribuzione specific requirements

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

7.14 Disconnector and earthing switches

7.14.1 Ampla and Coelce specific requirements

According to NR-10, moving contacts of disconnectors and earthing switches shall be visible.

8 FUNCTIONAL CHARACTERISTICS

8.1 Drive mechanisms

8.1.1 General requirements

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

Companies	Selector switches positions	Names	Key
Ampla, Coelce, Chilectra, Codensa, Edelnor, Edesur, Enel Distributie and e-distribuzione	2	Remote Local[7]	Not requested
Endesa Distribución Eléctrica	3	Manual Local Remoto	Requested (extractable only in manual position)

[7] the words "remote" and "local" have to be translated in all documents as:

These selector switches shall be located inside the Control Box.

In particular the following switches are necessary:

- for Y1, single-bay and double bus-bar types: n° 1;
- for Y2 type: n° 2 (one for bay 1 and 2 and one for bay 3 – see annex B).

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

In “local” position the enabling are the opposite.

In “manual” position (if required) all electric (local and remote) operations are disabled.

The switch operation shall not cause unwanted equipment operations.

The local operation of circuit-breakers (only three-pole operations, it shall not be possible to operate locally single-pole operations) and disconnectors/earthing switches shall be controlled by push-buttons located in the Control Box (see 8.2.1), with the following colors:

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

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

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

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

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

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

8.1.2 Circuit-breakers drive mechanism

8.1.2.1 *General requirements*

The Circuit-breakers drive mechanism shall be spring type, three-pole or single-pole type.

The drive energy storage shall be normally made by mean of d.c. electric motor (see table in chapter 6.1 for the supply rated voltage); when necessary it shall be possible to restore manually the

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

operating device energy, with a maximum effort below 250 N. The manual device shall exclude the motor operation, or in alterative 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 Circuit-breakers drive mechanism shall be able to perform the following cycles[8]:

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

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

8.1.2.2 *Release drive circuits*

Referring to the table in chapter 2, the release drive circuits typologies are:

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

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

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

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

The closing circuits shall be equipped with antipumping devices (1 for tripolar CBs and 3 for unipolar CBs) in order to inhibit further closing operations after the first one if an opening occurs during the initial closing request.

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

8.1.2.2.a) *Endesa Distribución and Latam 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 HV and d.c. supplies are off, i.e. due to a fault) by means of (safety located) hand operated levers or buttons.

8.1.2.2.b) *Enel Distributie and e-distribuzione specific requirements*

It shall be possible to manually lock/unlock the under-voltage release(s), both three-pole or single-pole type, by mean of a device provided of the “bloccato”/“sbloccato” indication. This device(s) shall be easily and safely accessible (shall not be necessary to open the part of the Operating Device Box where the operating devices are located) and shall be maneuverable from the ground level (maximum height 1.900 mm). It shall be possible to operate this device(s) with the CB in service and without causing an unwanted opening.

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

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

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

The CB closing consensus shall be interdict in case under-voltage release drive circuits are not supplied.

8.1.3 Disconnectors (DSs) and earthing switches (ESs) drive mechanism

The DSs and ESs operation shall be performed by three-pole motor-drive mechanisms with the possibility of emergency manual operation in case of need. It will consist of a gear motor (see table in paragraph 6.1 for the supply rated voltage) which will transmit its movement to the drive shaft of the disconnector. The same applies to earthing switch.

The motor drive system can be unique for DS and ES.

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

Position indicating devices of disconnectors and earthing switches shall comply IEC 62271 -102, annex A.

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

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

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

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

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

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

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

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

The manual emergency operation shall be enabled by a Consensus Electromagnetic Device (CED[9]):

- in case of 2 positions selector switch the hand-crank insertion is enabled only in “local” position, pressing a button[10] and in presence of all requested consensus conditions (see electric schemes);
- in case of 3 positions selector switch the hand-crank insertion is enabled only in “manual” position and in presence of all requested consensus conditions (see electric schemes).

The hand-crank for manual operation shall be withdrawable type; its insertion shall cause an anomaly remote signalization[11] and shall disable the electric operations, both local and remote.

The manual operation of DS and ES shall be compliant with IEC 60447.

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

All controls (remote, local and manual) shall be subject to the conditions described in paragraph 8.5 and represented in the electric scheme of annex D.

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[9] “DEC – Dispositivo Elettromagnetico Consenso” for Enel Distribuzione and Enel Distributie.

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

[11] “SNM – Sezionatore Non Manovrabile” for Enel Distribuzione and Enel Distributie.

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

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

8.1.3.2 *DS/ES mechanical locks and interlocks*

DS combined with ES as a single unit shall have a mechanical interlocking device that prevent the closure of ES when DS is closed and prevent closure of DS when ES is closed (not applicable in case of DS/ES for which it's not physically possible to have these conditions).

Electrical interlocks are described in paragraph 8.5.

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

- in case of motor-operation, to the strains produced by the motor starting torque;
- in case of manual-operation, to 3 times the maximum force required for manual operation (5.105 of 62271-102), or, if a strain limiting device is present, to 1,5 times its intervention rated value.

8.2 Control Box and Drive Mechanism Box

The requested cabinets are the followings:

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

8.2.1 Control Box

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

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

In addition to the IP requirement of table al chapter 6.1, the box protection degree with open doors shall be minimum IP2X.

In addition to the dimensions shown in annex C, the box base height respect to the ground shall be ≥ 400 mm and all HMI (Human Machine Interface) elements (controls and signalizations) shall be at ≤ 1800 mm.

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

All accessories (hand cranks, document pocket etc.) shall be accommodated In the internal part of the box door.

All electric equipment components shall be:

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

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

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

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

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

Inside the Control Box an internal collector (in copper, section ≥ 60 mm^2 and M5 regular interval threaded hole) shall be present for the earthing connection of all cable shields; the Manufacturer shall guarantee its effective connection to the Hybrid Module earthing system.

The entrance of cable coming from equipments and control system shall be from the Control Box bottom side, where a removable loophole (in aluminum, with useful dimension of 300x300 mm) shall be provided.

At about 200 mm below the Control Box shall be provided a removable horizontal crossbar, suitable for the anchorage of all the cables by mean of cable-fixers.

The Control Box shall include:

- selector switches;
- synoptic (see annex E) representing the HV electric scheme, with the equipments position (close or open), the partitioning (if any), the alarm/block signalization lamps and the lamps testing button ; the synoptic shall also include control buttons for CBs, DS and ES;
- gas density signalization lamps (for each gas circuit, yellow color about 1$_{st}$ minimum gas density level; red color about 2$_{nd}$ minimum gas density level).
- magnetothermic automatic circuit-breakers for the supplies protection (motors, lighting lamp, anti-condensation circuits – fuses are not admitted);
- interface terminal board for substation control system, including the CTs and VTs testing terminals (with correspondent automatic circuit-breakers, see par. 8.5);
- anti-condensation circuit;
- internal lighting lamp, with automatic switching in case of open door.

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

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

The terminals shall have section 4 mm² for control, signalization and anti-condensation circuits and section 10 mm² for the motors supply circuit.

The VTs (if any) terminals and protection circuit-breakers shall be located in the bottom part of the box, as close as possible to the cable entrance, in order to minimize the short circuit hazard.

Similarly also the CTs terminals shall be located in the bottom part of the box.

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

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

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

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

All provided electromechanical block keys (installed i.e. on transformer bay) shall be differently codified.

The earthing of a d.c. supply polarity is not admitted.

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

8.2.1.1 *e-distribuzione and Enel Distributie specific requirements*

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

8.2.1.2 *Endesa Distribución specific requirements*

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

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

8.2.2 Operating devices boxes

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

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

During normal operation, with enclosures and doors closed, the main contact position indication (close/open) and, for CBs, the spring loading condition signalization shall be visible from ground level.

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

In addition to the IP requirement of table at chapter 6, the box(es) protection degree with open doors or when using hand-crank (to charge CB's springs or manual operation on DS/ES) shall be minimum IP2X (unless the box can be opened only using tools).

All mechanical organs (included the motion transmission rods for three-pole CBs) shall be enclosed in metallic enclosures, IP2X, in order to prevent the access to parts in movement, unless they have slow motion (see par. 5.13.1 of IEC 62271-1) without cutting and crushing hazard.

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

8.3 Electronic Voltage Detector System EVDS

The EVDS detects the voltage presence in order to implement interlocks for preventing incorrect operation of disconnectors and earthing switches.

It is equipped with internal self-diagnostic.

It's a low performance electronic device, not for measuring purpose, made by 2 parts.

The first device part, self-supplied, is connected to a capacitive divider tern located on the Hybrid Module (on the line or busbar bay). It provides a digital information related to the presence or absence of the HV voltage; it pilots an optical fiber interface, one for each pole, making a galvanic separation.

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

The second device part includes relays and is supplied in d.c.; it receives and elaborates the optical fiber signals and it implements the requested interlocks.

The operation and hysteresis threshold shall provide that:

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

The EVDS is equipped with 2 electromechanical relays.

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

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

The voltage absence signalization and its restoration shall not be instantaneous but delayed of about 1 s.

The second relay is activated by the internal self-diagnostic.

This diagnostic relay, if not energized, provides:

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

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

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

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

As for the first EVDS part:

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

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

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

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

8.4 Electric schemes, controls and signalizations

8.4.1 General requirements

The electric schemes shall:

a) be represented in the reference conventional conditions:
   - a.1) CB, DS and ES (if any) in open position;
   - a.2) CED not energized;
   - a.3) absence of a.c. and d.c. auxiliary supplies;
   - a.3) absence of HV;
   - a.4) gas absence;
   - a.5) closing springs discharged;
   - a.6) remote/local selector switch(es) in remote position;
   - a.7) in case of micro-switches with the state dependent on the opening/closing of the boxes/carters of operating devices, they shall be represented disabled (that is with boxes/carters open).

a.8) unlocked under-voltage release (when requested) for CB.

b) report the following pressures values at 20°C (relative values):

b.1) rated filling pressure;

b.2) threshold setting pressure of the 1st minimum gas density level (alarm, replenishment necessary);

b.3) threshold setting pressure of the 2nd minimum gas density level (block or automatic opening with open position blocking).

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

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

8.4.2 Endesa specific requirements

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

8.4.3 e-distribuzione, Enel Distributie and Latam specific requirements

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

8.4.3.1 *Circuit-breakers*

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

8.4.3.2 *Disconnectors/Earthing switches*

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

8.4.3.3 *Motors and anti-condensation power supplies*

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

8.4.3.4 *Current and Voltage Transformers for e-distribuzione*

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

8.4.3.5 *Current and Voltage Transformers for Enel Distributie*

See the electric diagrams from page 110 to page 118.

8.5 Controls, signalizations, interlock and automatic openings

8.5.1 Endesa specific requirements

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

d.c. and a.c. supply

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

Current circuits

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

Voltage circuits

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

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

- 1st drive circuit of shunt closing release control. The requirements described in SF6 Gas and simultaneous operations shall apply.
- Anti-pumping circuit.
- 1st drive circuit of shunt opening release control. The requirements described in SF6 Gas and simultaneous operations shall apply. The drive circuit of shunt opening release shall be prepared to supervise the shunt opening release.
- 1st battery CB closing (K0E) and opening (K0A) auxiliary relays. These relays shall receive closing and opening commands from the pushbuttons located in the Control Box and from RTU, depending on the Manual-Local-Remote selector switch (hereinafter M-L-R selector switch) position. The auxiliary closing relay coil K0E energization shall be able to include the synchronism permission to local and remote command, in series with the closing command. For both, closing and opening relays, a normally open contact shall be used to activate the drive circuit of shunt closing and opening release.

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

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

DSs control (P12-N12)

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

Busbar differential relay

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

Interlocking between hybrid modules

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

Signals to RTU (P15-N15)

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

- Anti-condensation circuits d.c. supply MCB open signal, located in the Busbar 1 voltage control box, shall be reported. The signal shall be sent to the hybrid module control box by means of a normally closed contact (See Annex D – Terminals X21:13-14).
- Anti-condensation circuits d.c. supply MCB open signal, located in the Busbar 2 voltage control box, shall be reported. The signal shall be sent to the hybrid control box by means of a normally closed contact (See Annex D – Terminals X21:15-16).
- Busbar 1 voltage MCB open signal, located in busbar 1 voltage control box, shall be reported. The signal shall be sent to the module control box by means of a normally closed contact (See Annex D – Terminals X21:9-10).
- Busbar 2 voltage MCB open signal, located in busbar 2 voltage control box, shall be reported. The signal shall be sent to the module control box by means of a normally closed contact (See Annex D – Terminals X21:11-12).
- Manual position signal of M-L-R selector switch shall be reported by means of a closed contact when the selector is in that position (See Annex D – Terminal X21-4).
- Local position signal of M-L-R selector switch shall be reported by means of a closed contact when the selector is in that position (See Annex D – Terminal X21-5).
- The anti-pumping relay activation shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminals X1:53-54).
- SF6 CB alarm signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminals X1:55-56).
- SF6 CB block signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminals X1:57-58).
- Discharged springs signal shall be reported by means of a voltage-free contact connected to terminals. If this signal comes from an auxiliary relay, the auxiliary relay MUST NOT be a temporized one (See Annex D – Terminals X1:45-46).
- Operating time exceeded signal shall be reported by means of voltage-free contact connected to terminals (See Annex D – Terminals X2:53-54 and X3:53-54).
- SF6 busbar or module alarm signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminal X21-6).
- SF6 busbar or module block signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminal X21-7).

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

<u>d.c. and a.c. supply</u>

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

<u>Current circuits</u>

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

Voltage circuits

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

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

- 1st drive circuit of shunt closing release control. The requirements described in SF6 Gas and simultaneous operations shall be applied.
- Anti-pumping circuit.
- 1st drive circuit of shunt opening release control. The requirements described in SF6 Gas and simultaneous operations shall be applied. The drive circuit of shunt opening release shall be prepared to supervise the shunt opening release.
- 1st battery CB closing (K0E) and opening (K0A) auxiliary relays. These relays shall receive closing and opening commands from the pushbuttons located in the Control Box and from RTU, depending on the M-L-R selector switch position. The auxiliary closing relay coil K0E energization shall be able to include the synchronism permission to local and remote command, in series with the closing command. For both, closing and opening relays, a normally open contact shall be used to activate the drive circuit of shunt closing and opening release.
- A normally open voltage-free contact connected to terminals of K0E (auxiliary closing relay) shall be used to inform the main protection relay when a circuit breaker closing command occurs (See annex D – Terminals X20: 3-4).
- It shall be necessary to have a normally open voltage-free contact, connected to terminals of the opening auxiliary relay K0A in case of bays with distributed generation connected (See annex D – Terminals X20:7-8).
- It is necessary to have a contact in M-L-R selector switch (when it is in “LOCAL” position) to set the reclosing automatism out of service (See annex D – Terminals X20:1-2).
- The main protection relay shall be informed when F101 MCB is open. A normally closed voltage-free contact connected to terminals shall be used for this purpose (See annex D – Terminals X20: 9-10)
- Open and closed CB position shall be reported to the main protection relay (See annex D – Select terminals from X1 terminal block)

- Discharged springs signal shall be reported to the main protection relay by means of a voltage-free contact connected to terminals. These contacts shall be limit switch end position of circuit breaker discharged springs. If there are not enough available contacts, an auxiliary timing relay shall be used for this purpose (See annex D – Terminals X1: 45-46)
- SF6 circuit breaker block shall be reported to the main protection relay by means of a voltage-free contact connected to terminals (See annex D – Terminals X1: 57-58)

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

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

DS/ESs control (P12-N12)

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

Busbar differential relay

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

Interlocking between hybrid modules

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

Signals to RTU (P15-N15)

- Open and closed CB position shall be reported.(See Annex D – Select terminals from X1 terminal block)
- Open and closed DS/ESs positions shall be reported (See Annex D – Select terminals from X2, X3,X4 and X5 terminal blocks)
- Every motorized switchgear MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminals X1:51-52; X2:51-52; X3:51-52; X4:51-52 and X5:51-52)
- Anti-condensation circuit MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal X21-8)
- F101 MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal X21-9)
- F102 MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal X21-10)
- F103 MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal X21-11)
- "MANUAL" position signal of M-L-R selector switch shall be reported by means of a closed contact when the selector is in that position (See Annex D – Terminal X21-4)
- "LOCAL" position signal of M-L-R selector switch shall be reported by means of a closed contact when the selector is in that position (See Annex D – Terminal X21-5)
- The anti-pumping relay activation shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminals X1:53-54)
- SF6 CB alarm signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminals X1:55-56)
- SF6 CB block signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminals X1:61-62)
- Discharged springs signal shall be reported by means of a voltage-free contact connected to terminals. If this signal comes from an auxiliary relay, the auxiliary relay MUST NOT be a temporized one (See Annex D – Terminals X1:49-50)
- Operating time exceeded signal shall be reported by means of voltage-free contact connected to terminals (See Annex D – Terminals X2:53-54; X3:53-54; X4:53-54 and X5:53-54)
- SF6 busbar or module Alarm signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminal X21-6)
- SF6 busbar or module Block signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminal X21-7)

8.5.1.3 *Hybrid module Y1 type – used in Transformer bay*

<u>d.c. and a.c. supply</u>

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

power supply of the boxes associated to the VTs bay (if exists), installed by Endesa (See Annex D - Terminals X0:19-20).

Current circuits

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

Voltage circuits

- Terminal block for the VTs secondary terminals (See Annex D - Terminals X7:1-29)
- MCBs to protect circuits from X7 terminal block, associated with VTs bay. They shall be installed in the control box with the corresponding signal for each circuit breaker:
  - F101-MEASURE AND PROTECTION VOLTAGE: 1 tripolar+neutral MCB with 2 normally closed voltage-free contacts connected to terminals.
  - F102-PROTECTION VOLTAGE: 1 tripolar+neutral MCB with 2 normally closed voltage-free contacts connected to terminals.
  - F103-PROTECTION VOLTAGE: 1 tripolar+neutral MCB with 3 normally closed voltage-free contacts connected to terminals.
- Bus related to synchronism busbar voltage circuit (See Annex D - Terminals X0:21-30)
- Bus related to block selection caused by lack of busbar voltage (See Annex D - Terminals X0:32-38)

Regulation of measuring points (RD 1110/2007)

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

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

- 1st drive circuit of shunt closing release control. The requirements described in SF6 Gas and simultaneous operations shall be applied. In addition to this, there shall be two spare terminals in the closing circuit for including external interlockings.
- Anti-pumping circuit.
- 1st drive circuit of shunt opening release control. The requirements described in SF6 Gas and simultaneous operations shall be applied. The drive circuit of shunt opening release shall be prepared to supervise the shunt opening release.
- 1st battery CB closing (K0E) and opening (K0A) auxiliary relays. These relays shall receive closing and opening commands from the pushbuttons located in the control box and from RTU, depending on the M-L-R selector switch position. The auxiliary closing relay coil K0E energization shall be able to include the synchronism permission to local and remote command, in series with the closing command. For both, closing and opening relays, a normally open contact shall be used to activate the drive circuit of shunt closing and opening release.
- There shall be a contact in local position and a contact in remote position of M-L-R selector switch in order to deactivate the blocking trip relay located in the protection panel (See Annex D – Terminals X20: 1-2 and X20: 3-4).

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

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

DSs control (P12-N12)

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

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

Busbar differential relay

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

Interlocking between hybrid modules

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

Signals to the main protection relay (P15-N15)

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

Signals to RTU (P15-N15)

- Open and closed CB position shall be reported (See Annex D – Select terminals from X1 terminal block)
- Open and closed DSs positions shall be reported (See Annex D – Select terminals from X2 and X3 terminal blocks)
- Every motorized switchgear MCB open signal shall be reported by means of a normally closed, voltage-free contact connected to terminals (See Annex D – Terminals X1:51-52; X2:51-52 and X3:51-52)
- Anti-condensation circuit MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal X21-8)
- F101 MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal X21-9)
- F102 MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal X21-10)
- F103 MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal X21-11)
- Manual position signal of M-L-R selector switch shall be reported by means of a closed contact when the selector is in that position (See Annex D – Terminal X21-4)
- Local position signal of M-L-R selector switch shall be reported by means of a closed contact when the selector is in that position (See Annex D – Terminal X21-5)
- The anti-pumping relay activation shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminals X1:53-54)
- SF6 CB alarm signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminals X1:55-56)
- SF6 CB block signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminals X1:61-62)
- Discharged springs signal shall be reported by means of a voltage-free contact connected to terminals. If this signal comes from an auxiliary relay, the auxiliary relay MUST NOT be a temporized one (See Annex D – Terminals X1:49-50)

- Operating time exceeded signal shall be reported by means of voltage-free contact connected to terminals (See Annex D – Terminals X2:53-54 and X3:53-54)
- SF6 busbar or module alarm signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminal X21-6)
- SF6 busbar or module block signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminal X21-7)

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

d.c. and a.c. supply

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

Current circuits

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

Voltage circuits

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

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

- 1st drive circuit of shunt closing release control. The requirements described in SF6 Gas and simultaneous operations shall be applied.
- Anti-pumping circuit.
- 1st drive circuit of shunt opening release control. The requirements described in SF6 Gas and simultaneous operations shall be applied. The drive circuit of shunt opening release shall be prepared to supervise the shunt opening release.
- 1st battery CB closing (K0E) and opening (K0A) auxiliary relays. These relays shall receive closing and opening commands from the pushbuttons located in the control box and from RTU, depending on the M-R-L selector switch position. The auxiliary closing relay coil K0E energization shall be able to include the synchronism permission to local and remote command, in series with the closing command. For both, closing and opening relays, a normally open contact will be used to activate the drive circuit of shunt closing and opening release.
- A normally open voltage-free contact connected to terminals of K0E (auxiliary closing relay) shall be used to inform the main protection relay when a circuit breaker closing command occurs (See annex D – Terminals X20: 3-4).
- It shall be necessary to have a normally open voltage-free contact, connected to terminals of the opening auxiliary relay K0A in case of bays with distributed generation connected (See annex D – Terminals X20: 7-8).
- It is necessary to have a contact in M-L-R selector switch (when it is in “LOCAL” position) to set the reclosing automatism out of service (See annex D – Terminals X20: 1-2)
- The main protection relay shall be informed when MCB F101 is open. A normally closed voltage-free contact connected to terminals shall be used for this purpose (See annex D – Terminals X20: 9-10)
- Open and closed CB position shall be reported to the main protection relay (See annex D – Select terminals from X1 terminal block)
- Discharged springs shall be reported to the main protection relay by means of a voltage-free contact connected to terminals. These contacts shall be limit switch end position of circuit breaker discharged springs. If there are not enough available contacts, an auxiliary timing relay shall be used for this purpose (See annex D – Terminals X1: 45-46)
- SF6 circuit breaker block shall be reported to the main protection relay by means of a voltage-free contact connected to terminals (See annex D – Terminals X1: 57-58)

<u>2nd battery CB control and protection (P2-N2)</u>

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

<u>DS/ESs control (P12-N12)</u>

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

Signals to RTU (P15-N15)

- Open and closed CB position shall be reported.(See Annex D – Select terminals from X1 terminal block)
- Open and closed DS/ESs positions shall be reported (See Annex D – Select terminals from X2, X4 and X5 terminal blocks)
- Every motorized switchgear MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminals X1:51-52; X2:51-52; X4:51-52 and X5:51-52)
- Anti-condensation circuit MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal X21-8)
- F101 MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal X21-9)
- F102 MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal X21-10)
- F103 MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal X21-11)
- Manual position signal of M-L-R selector switch shall be reported by means of a closed contact when the selector is in that position (See Annex D – Terminal X21-4)
- Local position signal of M-L-R selector switch shall be reported by means of a closed contact when the selector is in that position (See Annex D – Terminal X21-5)
- The anti-pumping relay activation shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminals X1:53-54)
- SF6 CB alarm signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminals X1:55-56)
- SF6 CB block signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminals X1:61-62)
- Discharged springs signal shall be reported by means of a voltage-free contact connected to terminals. If this signal comes from an auxiliary relay, the auxiliary relay MUST NOT be a temporized one (See Annex D – Terminals X1:49-50)
- Operating time exceeded signal shall be reported by means of voltage-free contact connected to terminals (See Annex D – Terminals X2:53-54; X4:53-54 and X5:53-54)
- SF6 busbar or module Alarm signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminal X21-6)
- SF6 busbar or module block signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminal X21-7).

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

d.c. and a.c. supply

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

Current circuits

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

Voltage circuits

- Terminal block for the VTs secondary terminals (See Annex D - Terminals X7:1-29)
- MCBs for protecting circuits from X7 terminal block, associated with VTs bay. They shall be installed in the control box with the corresponding signal for each circuit breaker:
  - F101-MEASURE AND PROTECTION VOLTAGE: 1 tripolar+neutral MCB with 2 normally closed voltage-free contacts connected to terminals.
  - F102-PROTECTION VOLTAGE: 1 tripolar+neutral MCB with 2 normally closed voltage-free contacts connected to terminals.
  - F103-PROTECTION VOLTAGE: 1 tripolar+neutral MCB with 3 normally closed voltage-free contacts connected to terminals.
- Bus related to synchronism busbar voltage circuit (See Annex D - Terminals X0:21-26)
- Bus related to block selection caused by lack of busbar voltage (See Annex D - Terminals X0:27-29)

Regulation of measuring points (RD 1110/2007)

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

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

- 1st drive circuit of shunt closing release control. The requirements described in SF6 Gas and simultaneous operations shall be applied. In addition to this, there shall be two spare terminals in the closing circuit for including external interlockings.
- Anti-pumping circuit.
- 1st drive circuit of shunt opening release control. The requirements described in SF6 Gas and simultaneous operations shall be applied. The drive circuit of shunt opening release shall be prepared to supervise the shunt opening release.
- 1st battery CB closing (K0E) and opening (K0A) auxiliary relays. These relays shall receive closing and opening commands from the pushbuttons located in the Control Box and from RTU, depending on the M-L-R selector switch position. The auxiliary closing relay coil K0E energization shall be able to include the synchronism permission to local and remote command, in series with the closing

command. For both, closing and opening relays, a normally open contact will be used to activate the drive circuit of shunt closing and opening release.

- There shall be a contact in local position and a contact in remote position of M-L-R selector switch in order to deactivate the blocking trip relay located in the protection panel (See Annex D – Terminals X20: 1-2 and X20: 3-4).

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

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

DS control (P12-N12)

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

Signals to the main protection relay (P15-N15)

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

Signals to RTU (P15-N15)

- Open and closed CB position shall be reported.(See Annex D – Select terminals from X1 terminal block)
- Open and closed DSs positions shall be reported (See Annex D – Select terminals from X2 terminal block)
- Every motorized switchgear MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminals X1:51-52 and X2:51-52)
- Anti-condensation circuit MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal X21-8)
- F101 MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal X21-9)
- F102 MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal X21-10)
- F103 MCB open signal shall be reported by means of a normally closed voltage-free contact connected to terminals (See Annex D – Terminal X21-11)
- Manual position signal of M-L-R selector switch shall be reported by means of a closed contact when the selector is in that position (See Annex D – Terminal X21-4)
- Local position signal of M-L-R selector switch shall be reported by means of a closed contact when the selector is in that position (See Annex D – Terminal X21-5)
- The anti-pumping relay activation shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminals X1:53-54)
- SF6 CB alarm signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminals X1:55-56)
- SF6 CB block signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminals X1:61-62)

- Discharged springs signal shall be reported by means of a voltage-free contact connected to terminals. If this signal comes from an auxiliary relay, the auxiliary relay MUST NOT be a temporized one (See Annex D – Terminals X1:49-50)
- Operating time exceeded signal shall be reported by means of voltage-free contact connected to terminals (See Annex D – Terminals X2:53-54)
- SF6 busbar or module alarm signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminal X21-6)
- SF6 busbar or module block signal shall be reported by means of a voltage-free contact connected to terminals (See Annex D – Terminal X21-7)

8.5.1.6 *Automatic openings*

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

8.5.2 e-distribuzione, Enel Distributie and Latam specific requirements

8.5.2.1 *Terminal Boards for interface with the control system*

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

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

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

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

<u>Circuit-breakers</u>

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

<u>Disconnectors – Earthing Switches</u>

- drive circuit of shunt closing release control (DS: CH189”XY”; ES: CH189T”XY”; “XY” means the bay name i.e. L1, L2, TR, etc.)
- drive circuit of shunt opening release control (DS: AP189”XY”; ES: AP189T”XY”; “XY” means the bay name i.e. L1, L2, TR, etc.)

- close position (DS: ccX189”XY”; ES: ccX189T”XY”)
- open position (DS: caX189”XY”; ES: ccX189T”XY”)
- intervention of motor protection device and/or auxiliary supply missing (DS: 42RT189”XY”; ES: 42RT189T”XY”)
- motor maximum operation time (DS: BX189”XY; ES: 42RT189T”XY”)
- not-maneuverable DS (DS: SNM189”XY”; ES: 42RT189T”XY”)

Earthing Switches

Further specific control circuits, using signals from secondary terminals of on-site Inductive or Capacitive Voltage Transformers (see electric diagrams “VT/1” and “VT/2"), elaborate absence of voltage on HV line (and status ON/OFF of relative low voltage protection CBs) to enable the ES closing:

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

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

- 4P 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;
- K27A/L, K27B/L and K27ATL relays:

  Rated voltage = 100 V AC.

Disconnectors – special cases – codes “101” and “102”

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

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

Voltage transformers – codes “VT/1” and “VT/2”

(more details in “Earthing Switches”)

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

8.5.2.2 *Synoptic*

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

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

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

Line-bay and Bus-bar common signalizations

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

Transformer-bay common signalizations

- remote/local selector switch in local (P) position (43SP/TR-PROVA).
- 1st minimum gas density level (P1 GAS).
- 2nd minimum gas density level (P4 GAS).
- anti-condensation circuit anomaly (AnR)

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

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

8.5.2.3 *Interlocks*

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

The required operation locks are:

- specific of the single switchgear (locks);

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

There are two types of substation interlocks:

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

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

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

8.5.2.3.a) *Hybrid module Y1 type*

“Linea 1” bay – code “101” (or “Linea 2” – code “102”)

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

Circuit breaker bay

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

Specifically, the:

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

8.5.2.3.b) *Hybrid module Y2 type*[12]

"Linea 1" bay – code "201" and "202"

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

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

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

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

- CB 152TR and disconnector 189TR closing lock for 2nd minimum gas density level ("P4 gas");
- CB 152L1 closing lock for discharged springs;
- CB 152L1 closing lock for under-voltage release circuit not supplied;
- CB 152L1 closing lock for disconnectors 189TR and 189Sb(L2) incomplete operation;
- Impossibility to operate disconnector 189TR when CB 152TR is closed;
- Interlock between disconnector 189TR and his earthing switch 189TTR: impossibility to close the earthing switch if disconnector is closed and vice versa;
- Interlock between disconnector 189TR and earthing switch 89TTR on MV side of HV/MV transformer: impossibility to close the disconnector 189TR if earthing switch 89TTR is closed and vice versa. This function shall be achieved by means of a device containing an electromagnet, which is energized, by means of a push-button, by a discordant auxiliary contact of the disconnector 189 TR if the remote/local selector switch is in "Prova" position. The device shall allow the rotation and extraction of a key enabling the closing of the MV

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

earthing switch 89TTR.

- Interlock between earthing switch 189TTR and CB MV 52TR: impossibility to close the earthing switch 189TTR if CB MV 52TR is closed and vice versa.

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

Circuit-breaker bay

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

Specifically, the:

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

"Sbarra" bay – code "501" and "502"

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

8.5.2.4 *Automatic openings*

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

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

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

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

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

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

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

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

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

Y1 type

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

Y2 type

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

Single-bay type

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

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

Y1 type

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

b) if the fault has occurred in a VT of the CB bay, the CB opens;

Y2 type

a) if the fault has occurred in a VT of the CB bay, the CB opens;

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

Single-bay type

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

9 TESTING

9.1 General information

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

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

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

9.2 Type tests

9.2.1 General

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

Type tests are be classified in:

- tests on the complete assembly
- tests on base components

9.2.2 Type tests on the complete assembly

(6.1 of IEC 62271-205)

The tests listed in the following paragraphs shall be performed on a complete Hybrid Module manufactured in accordance with the present technical specification (the layout shall be suggested by the manufacturer and approved by user).

The applicability of a type test performed on one of the provided layouts to an equipment with a different layout shall be demonstrated by the manufacturer (by mean of a technical report) and approved by the user.

9.2.2.1 *Visual check and constructive characteristics check*

The Hybrid Module, complete of all accessories and fully assembled in operation layout, shall be subject to a visual inspection in order to verify its functional, dimensional and constructive compliance with this Global Standard and with technical documentation listed in paragraph 10.2.2.

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

9.2.2.2 *Dielectric tests*

(6.2 of IEC 62271-203)

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

(6.3 of IEC 62271-203)

Applicable only to SF6/air bushings.

9.2.2.4 *Measurement of the resistance of circuits*

(6.4 of IEC 62271-203)

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

9.2.2.5 *Temperature-rise tests*

(6.5 of IEC 62271-203)

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

(6.6 of IEC 62271-203)

9.2.2.7 *Verification of the protection*

(6.7 of IEC 62271-203)

9.2.2.8 *Tightness test*

(6.8 of IEC 62271-203)[13]

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

The initial gas concentration Co, with Hybrid Module filled at nominal density, shall be measured after at least 2 hours from pressurizing; the final concentration C1 shall be measured after more than 8 hours.

9.2.2.9 *Electromagnetic compatibility tests (EMC)*

(6.9 of IEC 62271-203)

[13] 6.102 quoted in this paragraph shall be intended as 9.2.2.12 of this document.

9.2.2.10 *Additional tests on auxiliary and control circuits*

(6.10 of IEC 62271-203)

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

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

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

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

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

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

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

9.2.2.11 *Verification of making and breaking capacities*

(6.101 of IEC 62271-203)

According with this requirement the manufacturer shall demonstrate that associated components excluded from this test or changed respect to the tested one don't affect the making and breaking performances.

9.2.2.12 *Mechanical and environmental tests*

6.101 of IEC 62271-205 applies with the following additional information.

The static terminal load test (6.101.5 of IEC 62271-205) shall be performed considering the requirements in 6.4.1 of this document.

9.2.2.12.a) *Tests on Circuit-breakers*

Mechanical and environmental tests

(IEC 62271-100 par. 6.101)

Humidity test is not required.

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

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

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

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

9.2.2.12.b) *Tests on disconnectors DS and earth switches ES*

IEC 62271-102 (and Annex E) applies with following additional information

Operating and mechanical endurance test

(IEC 62271-102 par. 6.102)

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

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

Operation under severe ice conditions

(IEC 62271-102 par. 6.103)

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

This test is mandatory.

Operation at the temperature limits

(IEC 62271-102 par. 6.104)

This test is mandatory.

9.2.2.13 *Proof tests for enclosures*

(6.103 of IEC 62271-203)

9.2.2.14 *Pressure test on partitions*

(6.104 of IEC 62271-203)

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

(6.105 of IEC 62271-203)

9.2.2.16 *Insulator tests*

(6.106 of IEC 62271-203)

9.2.2.17 *Corrosion test on earthing connections*

(6.107 of IEC 62271-203)

9.2.2.18 *Corrosion test on enclosures*

(6.108 of IEC 62271-203)

9.2.2.19 *Protective treatments*

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

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

9.2.2.20 *Seismic verification*

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

9.2.3 Type tests on base components

The type tests listed in the following paragraphs can be performed on the single base component or on a different assembly equipped with the same component used for the Hybrid Modules.

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

9.2.3.1 *Tests on Circuit-breakers*

IEC 62271-100 applies with the following additional information

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

(6.11 of IEC 62271-203)

Only in case of vacuum CBs.

9.2.3.1.b) *Critical current tests*

(IEC 62271-100 par. 6.107)

If applicable (see 6.107.1)

9.2.3.2 *Tests on disconnectors DS and earth switches ES*

IEC 62271-102 applies with the following additional information.

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

(IEC 62271-102 par. 6.105)

This test is mandatory.

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

(IEC 62271-102 par. 6.106)

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

9.2.3.2.c) *Induced current switching test*

(IEC 62271-102 par. 6.107)

This test is mandatory.

9.2.3.3 *Tests on toroidal Current Transformers*

(IEC 61869-2)

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

9.2.3.4 *Tests on Voltage Transformers*

(IEC 61869-3)

Test under conditions of arcing due to an internal fault is required

Manufacturer shall perform also the IEC 61869-3 par. 7.4.6 and 7.4.7 tests.

9.2.3.5 *Tests on SF6/air bushings, cable connections, transformer connections*

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

9.2.3.6 *Tests on EVDS*

Following checks shall be performed:

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

9.2.4 Specific requirements

9.2.4.1 *e-distribuzione*

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

9.3 Routine tests in factory

(IEC 62271-203 par. 7)

The Routine tests (also called acceptance tests) shall be made in the manufacturer's factory on each Hybrid module supplied, to ensure the product compliance with:

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

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

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

9.3.1 Dielectric test on the main circuit

(7.1 of 62271-203, partial discharge included)

Alternative methods for the partial discharge measurement can be proposed by the manufacturer and shall be approved by Enel Group Distribution companies.

9.3.2 Tests on auxiliary and control circuits

(IEC 62271-203 par. 7.2)

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

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

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

EVDS shall be disconnected before dielectric test.

9.3.3 Measurement of the resistance of the main circuit

(IEC 62271-203 par. 7.3)

To be performed after mechanical operating tests.

The ambient temperature influence can be neglected.

The test shall be performed also on ES.

9.3.4 Tightness test

(IEC 62271-203 par. 7.4)

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

Manufacturer shall provide the results of tests on subassemblies. Sniffing device may be used to check the joint between subassemblies.

9.3.5 Design and visual checks

(IEC 62271-203 par. 7.5)

Following items shall be verified:

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

9.3.6 Pressure tests of enclosures

(IEC 62271-203 par. 7.101)

Manufacturer shall provide the results of internal tests.

9.3.6.1 *e-distribuzione Specific requirements*

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

9.3.7 Mechanical operation tests

(IEC 62271-203 par. 7.102)

9.3.7.1 *Tests on Circuit-Breakers*

(IEC 62271-100 par.7.101)

The following items shall be recorded:

a. at Vmax, Vn, Vmin, closing (C) and opening (O) times, time spread (on each release);
a1. at Vmax, Vn, Vmin opening (O) times, time spread of under-voltage release coil (if present - see 9.2.2.12.a)) and it shall be verified its compliance with IEC 62271-1 par. 5.8.4;
b. at Vn, close-open (CO) time and open-close-open (O-t-CO) cycle;
c. at Vn, the operation time of one of each type (make and break) of auxiliary contacts, respect to the operation of main contacts on closing and on opening of CB;
d. no-load travel curves.

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

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

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

9.3.7.2 *Tests on disconnectors DS and earth switches ES*

(IEC 62271-102 par. 7-101)

The following items shall be verified:

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

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

(IEC 62271-203 par. 7.103)

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

Following items shall be verified:

- EVDS device (operation, interlocks with DS or ES, internal self-diagnostic) referring to its testing procedures;
- SF6 density control devices: the verification shall be performed at ambient temperature, in the real operating position, using nitrogen, with decreasing pressure values. SF6 can be used only in presence of recovery systems.
  Test reports issued by the density control device manufacturer shall be provided (test position shall be evidenced too).
- correct operation of all controls, interlocking, automatic openings and signalizations, including galvanic separation between the power supplies of various circuits;
- heating and/or anti-condensation circuit absorption.

9.3.9 Pressure test on partitions

(IEC 62271-203 par. 7.104)

Manufacturer shall provide the results of testing on partitions.

9.3.10 Tests on Current Transformers

(IEC 61869-2 par. 7.1.2, Table 10: Routine tests including par. 7.3.201; Sample Test, par. 7.5.2 when applicable).

The tests of CTs shall be repeated sampling at least one unit for each tern.

It shall be verified also:

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

9.3.10.1 *e-distribuzione Specific requirements*

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

9.3.11 Tests on Voltage Transformers

(IEC 61869-3 par. 7.1.2, Table 10: Routine tests par. 7.3).

The tests of VTs shall be repeated sampling one unit for each tern.

It shall be verified also:

a. the VTs compliance with approved documents;
b. no visible defects;
c. the presence of producer test reports of all VTs;
d. SF6 density control devices: 9.3.8 applies.

9.3.11.1 *e-distribuzione Specific requirements*

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

9.3.12 Bushing tests

(IEC 60137 par.9.6)

Test reports issued by insulator manufacturer shall be provided.

9.4 Commissioning tests

(IEC 62271-203 par. 10)

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

The manufacturer, at the end of the on-site tests, shall deliver the report containing the results of the measures and tests performed on the Hybrid Module. These measures shall include check of transportation pressure, to be performed before installation.

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

IEC 62271-1 Par. 10.2.1 is applicable.

9.4.1 Dielectric test on the main circuit

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

Dielectric test shall be performed on Hybrid Module, if disassembled in transport units and if stated in the approved technical documentation of the assembly specific layout to be supplied.

In alternative to test methods provided by par. 10.2.101.2.3 of IEC 62271-203, a test applying the grid rated voltage (see IEC - par. C.3.2.3) for 24 hours without energy transit can be performed.

9.4.2 Dielectric test on auxiliary circuits

(IEC 62271-203 par 10.2.101.3; IEC 62271-1 applies only par. 7.2.4)

Dielectric tests shall be performed applying 1 kV for 1 s.

EVDS shall be disconnected before dielectric test; others electronic devices, motors etc. can be excluded by dielectric test only if agreed during the conformity assessment (homologation, certification etc.) process.

9.4.3 Measurement of the resistance of the main circuit

(IEC 62271-203 par. 10.2.101.4)

To be performed after mechanical operating tests.

The ambient temperature influence can be neglected.

The test shall be performed also on ES.

9.4.4 Gas tightness test

(IEC 62271-203 par. 10.2.101.5)

To be performed at rated pressure.

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

Fittings, gas density control devices and piping shall be checked. Manufacturer shall verify all on-site assembled connections between transport units.

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

9.4.5 Checks and verifications

(IEC 62271-203 par. 10.2.101.6)

Following items shall be verified:

- assembly in accordance with the manufacturer’s drawings and instructions;
- control of damage absence;
- presence of accompanying required documentation and materials (see par. 10.3).

9.4.6 Mechanical operation tests

9.4.6.1 *Tests on Circuit-Breakers*

(IEC 62271-100 par. *10.2.102.2*)

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

The following items shall be recorded:

a. at Vmax, Vn, Vmin, closing (C) and opening (O) times, time spread (on each release);
a1. at Vmax, Vn, Vmin opening (O) times, time spread on under-voltage release coil (if present see 9.2.2.12.a)) and it shall be verified its compliance with IEC 62271-1 par. 5.8.4;
b. at Vn, close-open (CO) time and open-close-open (O-t-CO) cycle;
c. at Vn, the operation time of one of each type (make and break) of auxiliary contacts, respect the operation of main contacts on closing and on opening of CB.

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

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

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

9.4.6.2 *Tests on disconnectors DS and earth switches ES*

(IEC 62271-102 par. 7.101)

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

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

(IEC 62271-203 par. 7.103)

To be performed after dielectric test on auxiliary circuit.

The following items shall be verified:

- EVDS device (operation, interlocks with DS or ES, internal self-diagnostic) referring its testing procedures;
- all SF6 density control devices, including VT's ones - SF6 can be used only in presence of recovery systems; the verification shall be performed with the same modalities of the routine test (see 9.3.8), taking into account the ambient conditions (solar radiation, temperature) and comparing between them the intervention threshold pressure measured values;
- functional operations of whole circuit diagram (fault signals, switchgear automatic openings, interlocks etc. including from/to external ones);
- heating and/or anti-condensation circuit absorption.

9.4.8 Gas quality verifications

(IEC 62271-203 par. 10.2.101.7)

Manufacturer shall perform this verifications on Hybrid Module which have been object of vacuum treatment, i.e. in case of:

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

In this case the gas tightness checks shall be repeated.

10 SUPPLY REQUIREMENTS

10.1 Tender's technical documentation

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

10.2 Conformity assessment

10.2.1 Conformity assessment process

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

10.2.2 Conformity assessment documentation

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

a) "Specific Assembly Type A documents" (public, not confidential, referred to a specific assembly);
b) "General Type A documents" (public, not confidential, including common documents and base components type A documents);
c) "General Type B documents" (confidential, referred to each base components).

The documentation shall be collected separately for each Enel Group Distribution company, for each composition type (see par. 5) and for each rated voltage Ur (72.5, 145-170, 245 kV).

10.2.2.1 *Specific Assembly Type A documents*

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

1) Specific Assembly Type A documents list;
2) composition of the assembly, consisting in a list of the base components indicating:
   - base component code (see par. 2);
   - local codification (see Annex A);
   - base component description;

- corresponding supplier's model designation;

3) overall dimensions drawing (including the stresses transmitted to the foundations, the transport units, the partitions – if any – and their density control devices position);
4) overall Hybrid Module pictures or 3D drawings;
5) HV single-line diagram;
6) electric diagram (see par. 8.4.1-c), low voltage components list included);
7) Control Box layout drawing;
8) reference resistance values.

10.2.2.2 *General Type A documents*

The General Type A documentation shall consist at least in:

1) General Type A documents list, sub-divided into common documents and into each base component documents;
2) Operating Device Box(es) layout drawings;
3) Electric diagram of individual devices (CB, DS, ES);
4) Interconnection cables path (typical);
5) Nameplate (typical);
6) Installation, use and maintenance handbook/manual;
7) Routine and commissioning tests:
   a) test report form (two documents, one for factory tests and one for on-site tests);
   b) reference values table (with tolerances)[14];
   c) EVDS device - testing procedures;
   d) protective coatings description (typology, minimum thickness, reference standards);
8) documentation of safety device for protection against pole excessive pressure (ISO 4126, only if present);
9) list of documentation, materials and accessories supplied;
10) about gas:
   a) gas circuit(s) drawing with density control device positions;
   b) gas density control device characteristics and drawings;
   c) pressure/temperature table for rated density level, 1st minimum gas density level and 2nd minimum gas density level;
11) main sub-components suppliers list, subdivided into the various types of base components;
12) List of materials used including packaging and relevant quantities (for disposal purposes);
13) only for e-distribuzione, INAIL (ex ISPESL) Certification "Certificato di conformità del prototipo" - D.M. 01/12/1980.

10.2.2.3 *General Type B documents*

The General Type B documentation shall consist at least in:

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

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

10.3 Packaging, transport, storage and installation/testing

Par. 10.1 and 10.2 of IEC 62271-203 apply.

The package shall be suitable to guarantee:

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

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

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

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

1) the support structure;
2) anchor bolts to the civil works (optional supply, they shall be provided only if expressly requested. In this case they shall be stainless or hot dip galvanized steel, chemical type);
3) springs hand-crank (and other tools according to the manufacturer design);
4) list of documentation, materials and accessories supplied (“packing list”);
5) overall dimensions drawing;
6) electric diagram;
7) installation, use and maintenance handbook/manual;
8) routine and commissioning tests:
   a) routine (factory and commissioning) test reports;
   b) reference values table (with tolerances);
9) about gas:
   a) dielectric gas;
   b) pressure/temperature table for rated density level, 1st minimum gas density level and 2nd minimum gas density level;
10) one CD-Rom containing the whole type A documentation (pdf file format);
11) only for e-distribuzione: Manufacturer shall provide the “Certificazione di rispondenza” (see: D.M. 1/12/1980, Allegato A, Regola VSR.8.B.1, par. 5.2), including partitions, bushings and VTs (if any).

Only for e-distribuzione, items from 4) to 9) shall be also provided in electronic format together with the guarantee and barcode data requested by PVR001 and PVR006 (The file sending modalities will be discussed during the conformity assessment process).

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

10.3.1 Specific requirements for Spain

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

ANNEX A – LOCAL COMPONENTS CODIFICATION

Base component code	Latam	Italy	Romania	Spain
GSH002/011		162501	-	-
GSH002/012		-	616123	6711261
GSH002/013		162502	-	-
GSH002/014		162503	-	-
GSH002/021		162504	-	-
GSH002/022		-	616124	6711262
GSH002/023		162505	-	-
GSH002/024		162506	-	-
GSH002/031		162507	-	-
GSH002/032		-	616125	-
GSH002/033		162508	-	-
GSH002/034		162509	-	-
GSH002/061		162510	-	-
GSH002/062		162511	162511	6711263
GSH002/063		162512	-	-
GSH002/071		162513	-	-
GSH002/072		162514	162514	6711264
GSH002/073		162515	-	-
GSH002/081		162516	-	-
GSH002/082		162517	162517	-
GSH002/083		162518	-	-
GSH002/111		162519	-	-
GSH002/112		162520	162520	6711265
GSH002/113		162521	-	-
GSH002/121		162522	-	-
GSH002/122		162523	162523	6711266
GSH002/123		162524	-	-
GSH002/131		162525	-	-
GSH002/132		162526	162526	-
GSH002/133		162527	-	-
GSH002/211		162528	-	-
GSH002/212		162529	162529	-

GSH002/213		162530	-	-
GSH002/221		162531	-	-
GSH002/222		162532	162532	-
GSH002/261		162533	-	-
GSH002/262		162534	162534	-
GSH002/263		162535	-	-
GSH002/271		162536	-	-
GSH002/272		162537	162537	-
GSH002/281		162538	-	-
GSH002/282		162539	162539	6711267
GSH002/283		162540	-	-
GSH002/311		162541	-	-
GSH002/312		162542	162542	6711277
GSH002/313		162543	-	-
GSH002/321		162544	-	-
GSH002/322		162545	162545	6711268
GSH002/323		162546	-	-
GSH002/331		-	-	-
GSH002/332		-	-	6711269
GSH002/333		-	-	-
GSH002/411		-	-	-
GSH002/412		-	-	-
GSH002/413		-	-	-
GSH002/421		162547	-	-
GSH002/422		162548	162548	6711270
GSH002/423		162549	-	-
GSH002/461		162550	-	-
GSH002/462		162551	162551	-
GSH002/463		162552	-	-
GSH002/464		162553	-	-
GSH002/465		162554	162554	6711271
GSH002/466		162555	-	-
GSH002/481		162556	-	-
GSH002/482		162557	162557	-
GSH002/483		162558	-	-
GSH002/511		162559	-	-

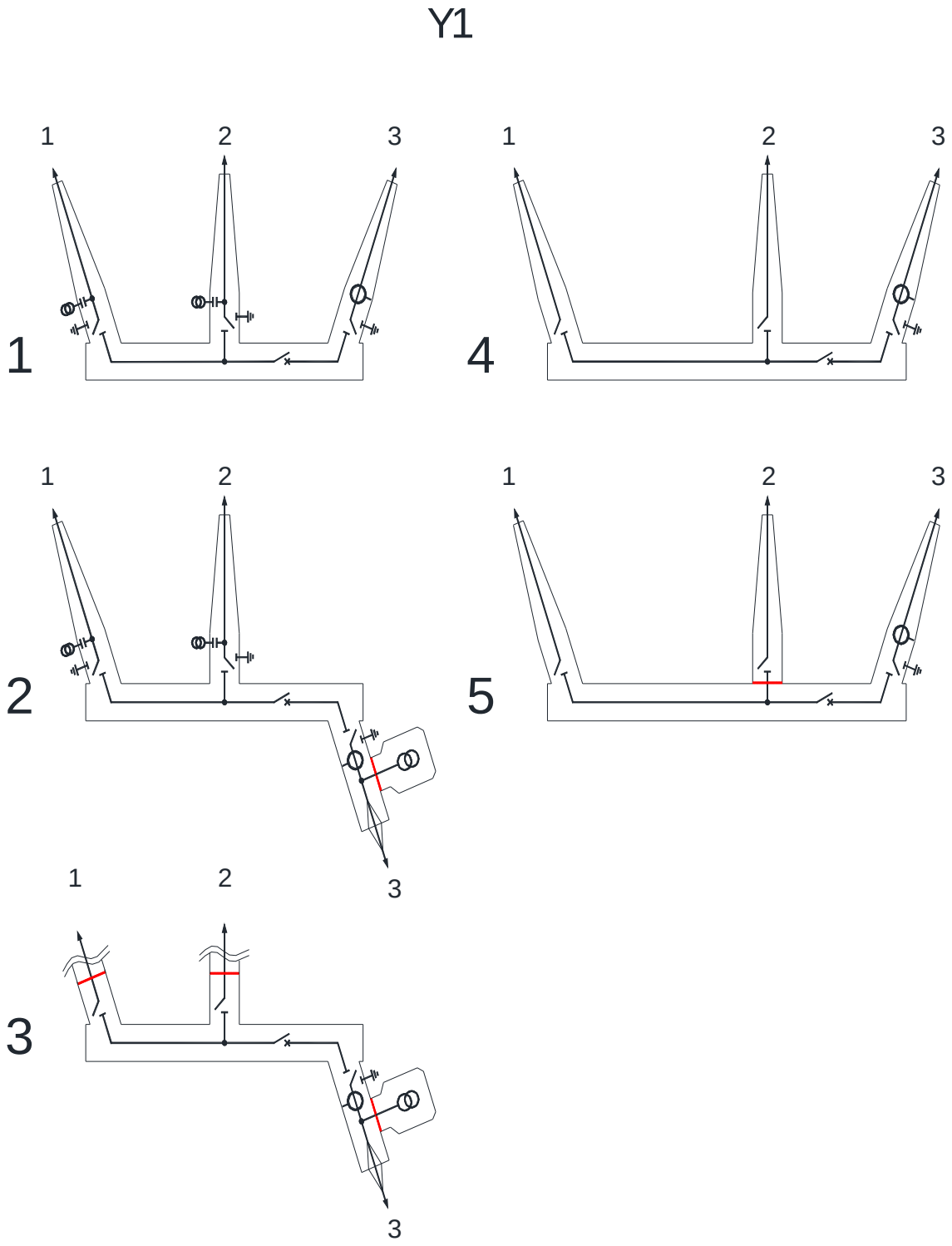
GSH002/512		162560	162560	-
GSH002/513		162561	-	-
GSH002/521		162562	-	-
GSH002/522		162563	162563	-
GSH002/523		162564	-	-
GSH002/531		162565	-	-
GSH002/532		162566	162566	-
GSH002/533		162567	-	-
GSH002/541		162568	-	-
GSH002/542		162569	162569	-
GSH002/543		162570	-	-
GSH002/561		162571	-	-
GSH002/562		162572	162572	-
GSH002/563		162573	-	-
GSH002/564		162574	-	-
GSH002/565		162575	162575	-
GSH002/566		162576	-	-
GSH002/601		162577	-	-
GSH002/602		162578	-	-
GSH002/603		162579	-	-
GSH002/604		162580	-	-
GSH002/605		162581	-	-
GSH002/606		162582	-	-
GSH002/607		162583	-	-
GSH002/608		162584	-	-
GSH002/611		-	616126	-
GSH002/612		-	616127	-
GSH002/613		-	-	-
GSH002/614		-	-	-
GSH002/621		-	-	6711272
GSH002/622		-	-	6711273
GSH002/623		-	-	6711274
GSH002/700		162585	162585	-
GSH002/701		162586	-	-
GSH002/702		162587	-	-
GSH002/703		162588	-	-

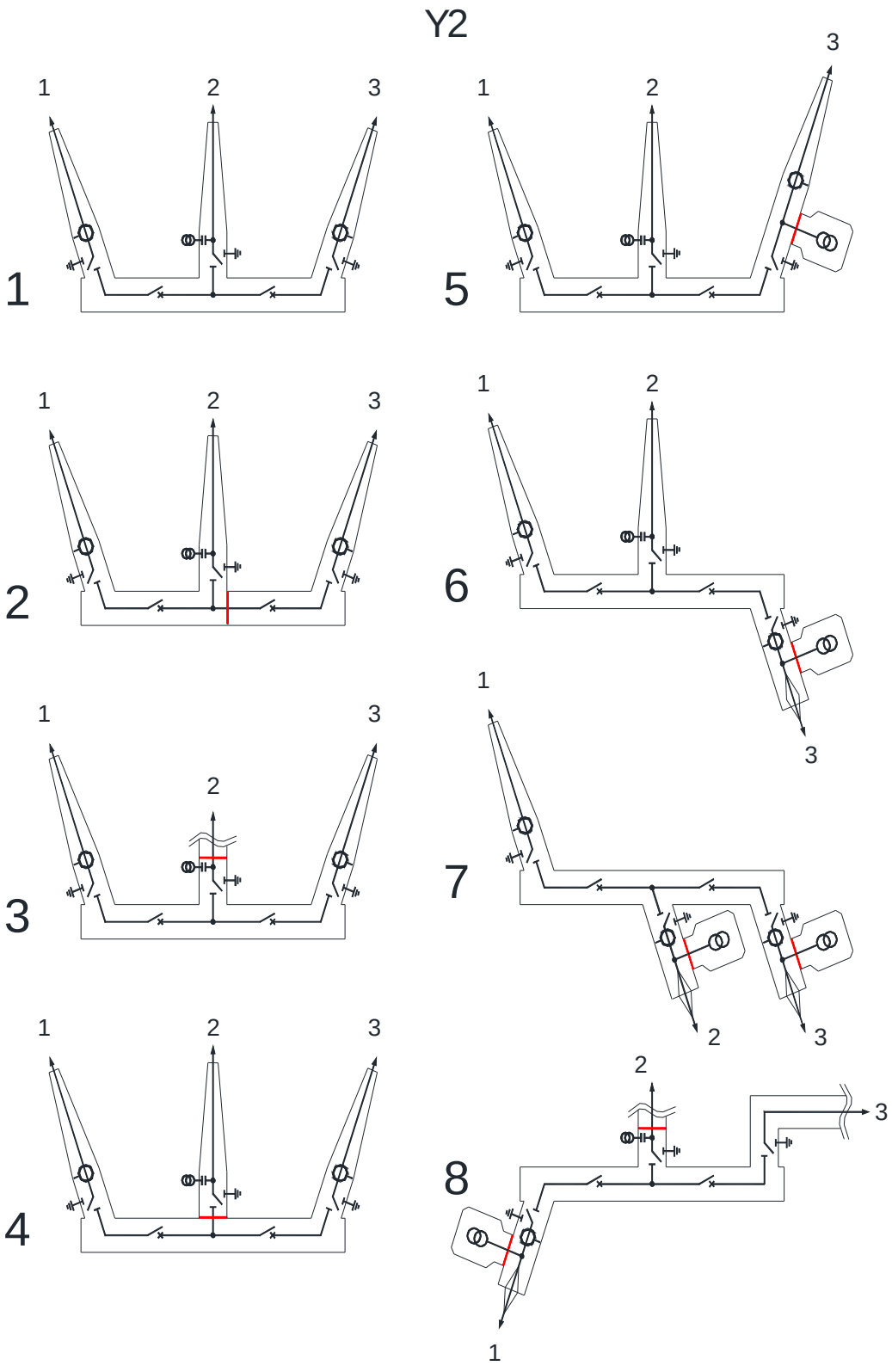
GSH002/704		162589	-	-
GSH002/711		-	616128	-
GSH002/721		-	-	6711275
GSH002/722		-	-	6711276
GSH002/801		162590	-	-
GSH002/802		162591	-	-
GSH002/803		162592	-	-
GSH002/804		162593	-	-
GSH002/805		162594	-	-
GSH002/806		162595	-	-
GSH002/811		-	616129	-
GSH002/812		-	616130	-
GSH002/821		-	-	6711279
GSH002/822		-	-	6711280
GSH002/823		-	-	-
GSH002/841		-	-	-
GSH002/842		-	-	-
GSH002/843		-	-	-
GSH002/844		-	-	-
GSH002/845		-	-	-
GSH002/846		-	-	-
GSH002/851		-	-	-
GSH002/852		-	-	-
GSH002/853		-	-	-
GSH002/854		-	-	-
GSH002/855		-	-	-
GSH002/856		-	-	-
GSH002/861		-	-	-
GSH002/862		-	-	-
GSH002/863		-	-	-
GSH002/871		-	-	-
GSH002/872		-	-	-
GSH002/873		-	-	-
GSH002/881		-	-	-
GSH002/882		-	-	-
GSH002/883		-	-	-

GSH002/884		-	-	-
GSH002/885		-	-	-
GSH002/886		-	-	-
GSH002/891		-	-	-
GSH002/892		-	-	-
GSH002/893		-	-	-
GSH002/894		-	-	-
GSH002/895		-	-	-
GSH002/896		-	-	-
GSH002/901		162596	-	-
GSH002/902		162597	-	-
GSH002/903		162598	-	-
GSH002/911		-	616131	-
GSH002/912		-	616132	-
GSH002/921		-	-	6711281
GSH002/922		-	-	6711282
GSH002/923		-	-	6711283
GSH002/924		-	-	6711284
GSH002/925		-	-	6711285
GSH002/926		-	-	6711286
GSH002/931		-	-	-
GSH002/932		-	-	-
GSH002/933		-	-	-

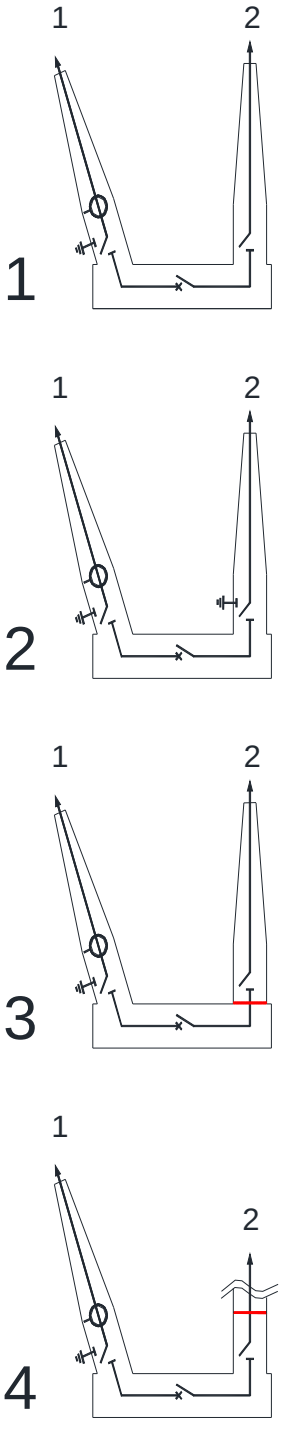
ANNEX B – LAYOUT EXAMPLES

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




Y2
1
1
2
3
5
1
2
3
2
1
2
3
6
1
2
3
3
1
2
3
7
1
2
3
4
1
2
3
8
2
3
1

Single bay



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

Y1 type – Annex B.1 fig. 4:

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

Note (referring Annex B1 drawings):

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

Y2 type – Annex B.1 fig. 1:

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

Note (referring Annex B1 drawings):

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

Single bay type – Annex B.2 fig. 1:

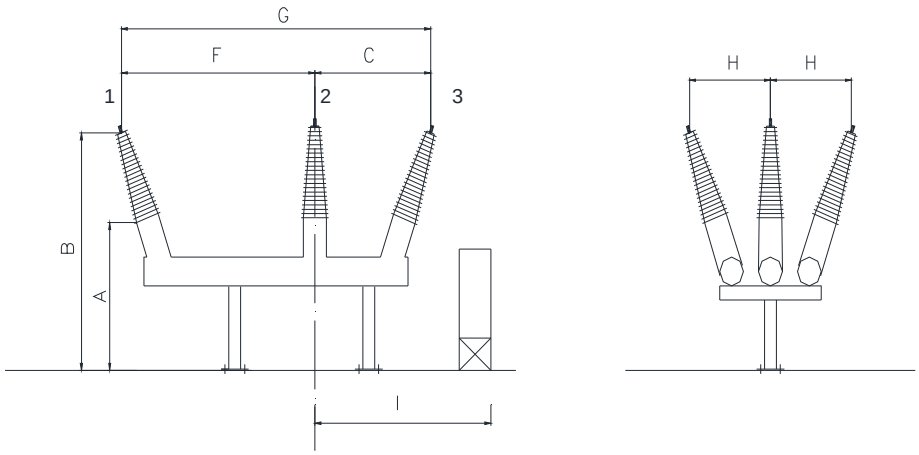
Base component description	BAY	Base component code GSH002/…	Nr (terns)
Lateral bay - With circuit-breaker - Air connection	1	012	1
Central bay - Without circuit-breaker - Air connection	2	112	1
Circuit-breaker drive mechanism - Three-pole	1	282	1
Disconnector with earthing switch	1	322	1
Disconnector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

Note (referring Annex B1 drawings):

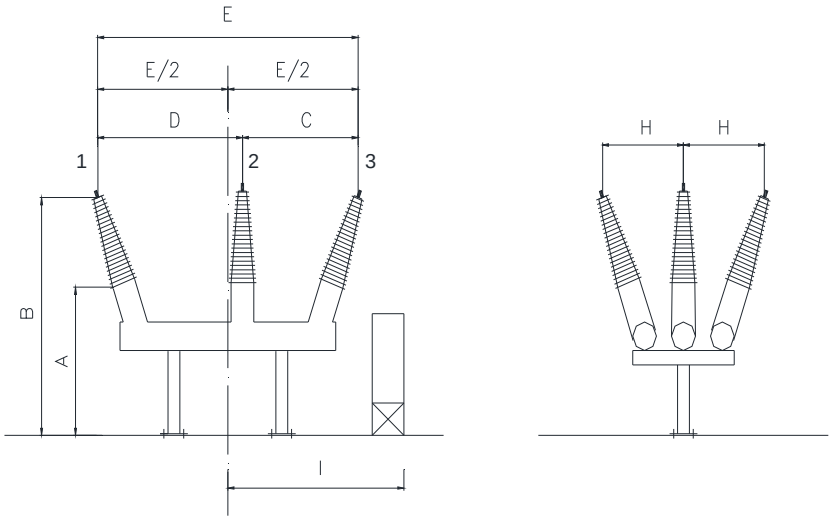
- BAY 1: Lateral Bay
- BAY 2: Central Bay

ANNEX C – DIMENSIONAL DRAWINGS

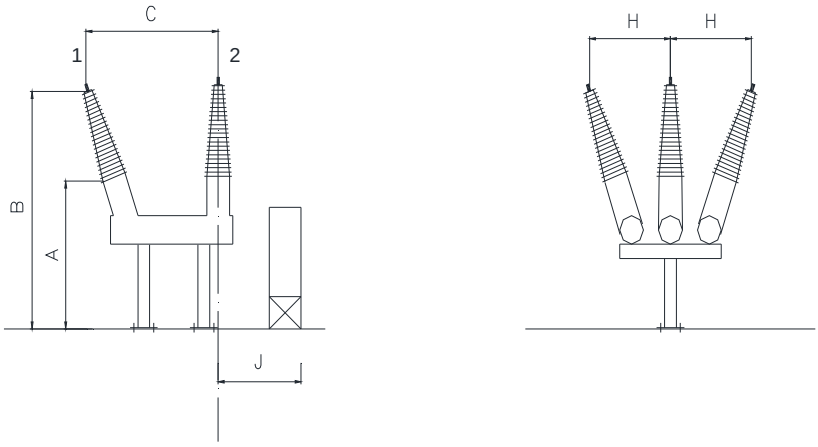
Y1



Y2



Single bay



Company	Ref. figure	A	B	C	D	E	F	G	H	I	J
Enel Distribuz. and Latam	Y1	≥ 2250[15]	≤ 3800	≥ 890	n.a.	n.a.	≥ 890	≤ 3000	≤ 1400	≤ 2200	n.a.
	Y2				≥ 890	≤ 3000	n.a.	n.a.			
	Single bay				n.a.	n.a.	n.a.	n.a.		n.a.	≤ 1300

Table 1 – Dimensions for 72,5 kV Hybrid Modules (mm)[16]

Company	Ref. figure	A	B	C	D	E	F	G	H	I	J
Endesa	Y1	≥ 2300[17]	≥3800 ≤4600	≥ 1725	n.a.	n.a.	≥ 1725	≤ 5000	≥ 1300	≤ 3000	n.a.
	Single bay				n.a.	n.a.	n.a.	n.a.		n.a.	≤ 1300
Enel Distribuz., Enel Distributie and Latam	Y1	≥ 2250[15]	≤ 4600	≥ 1725	n.a.	n.a.	≥ 1725	≤ 5000	≤ 2200	≤ 3000	n.a.
	Y2				≥ 1725	≤ 5000	n.a.	n.a.			
	Single bay				n.a.	n.a.	n.a.	n.a.		n.a.	≤ 1300

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

Company	Ref. figure	A	B	C	D	E	F	G	H	I	J
Enel Distribuz. and Latam	Y1	≥ 2250[15]	≤ 5500	≥ 2475	n.a.	n.a.	≥ 2475	≤ 6500	≤ 3200	≤ 3750	n.a.
	Y2				≥ 2475	≤ 6500	n.a.	n.a.			
	Single bay				n.a.	n.a.	n.a.	n.a.		n.a.	≤ 1300

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

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

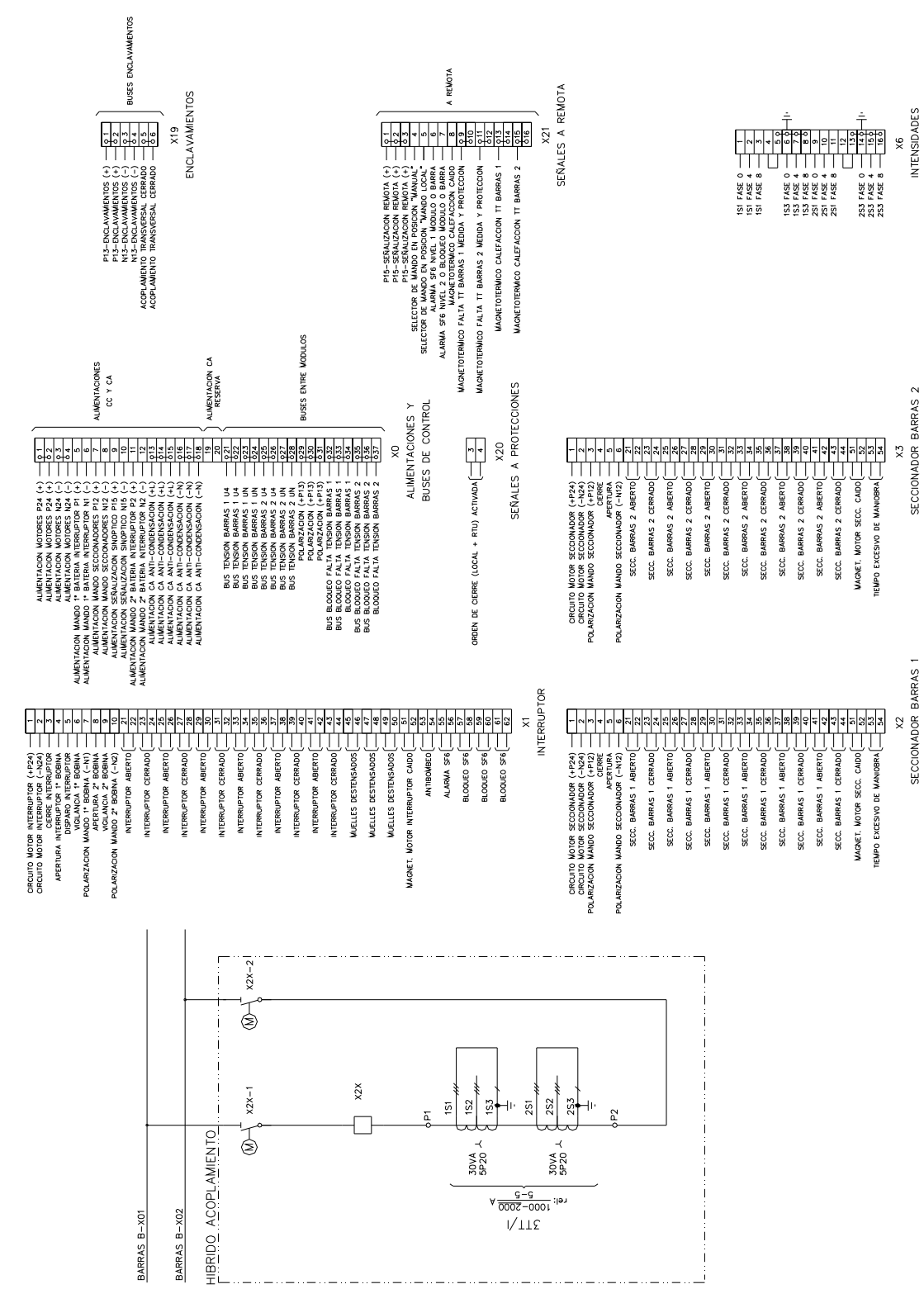
[16] Blank cell means that there isn't a mandatory requirement for that characteristic

[17] In accordance with Real Decreto Riesgo Eléctrico 614/2001

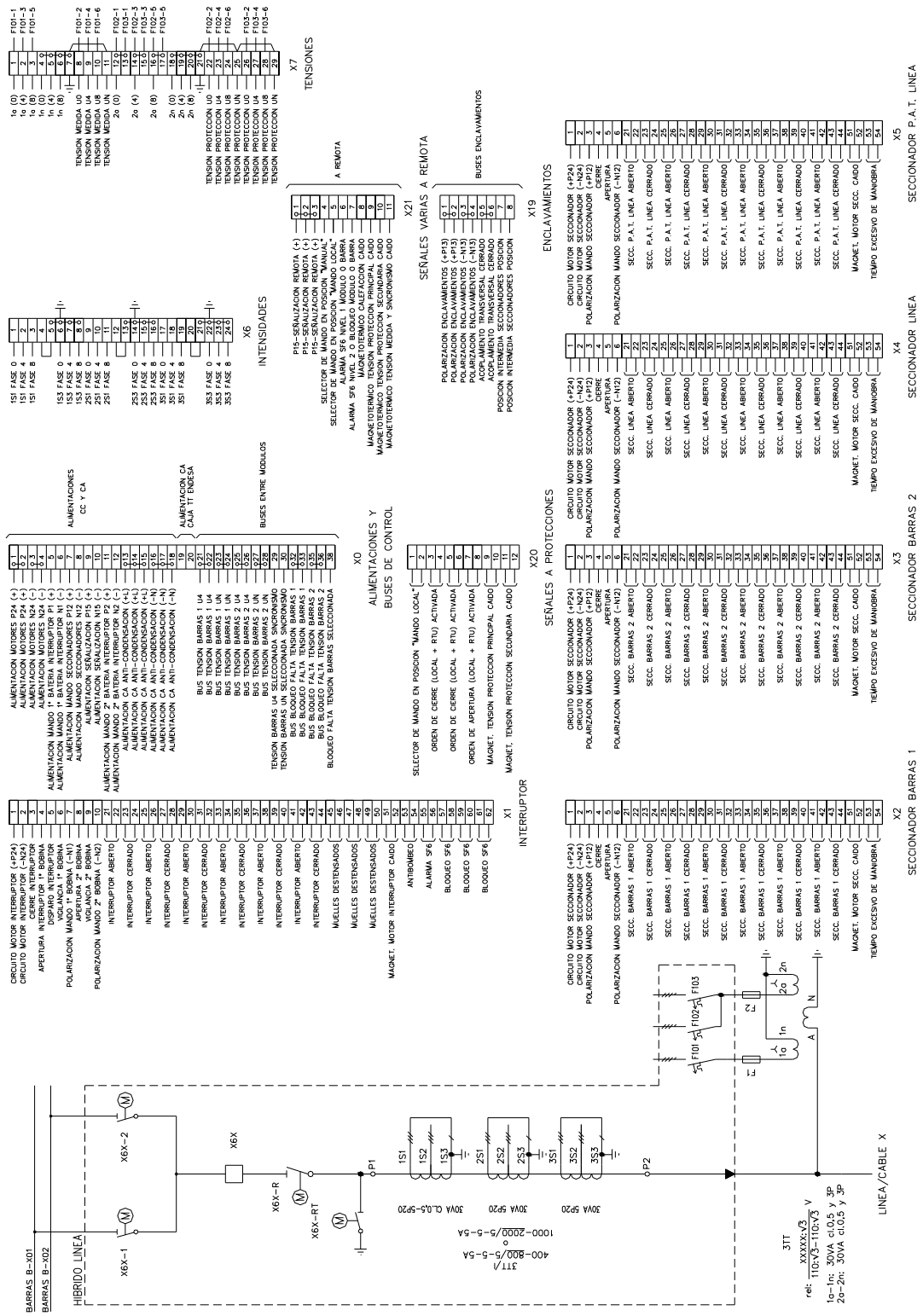
ANNEX D – ELECTRICAL SCHEMES

D.1 – ENDESA ELECTRICAL DIAGRAMS

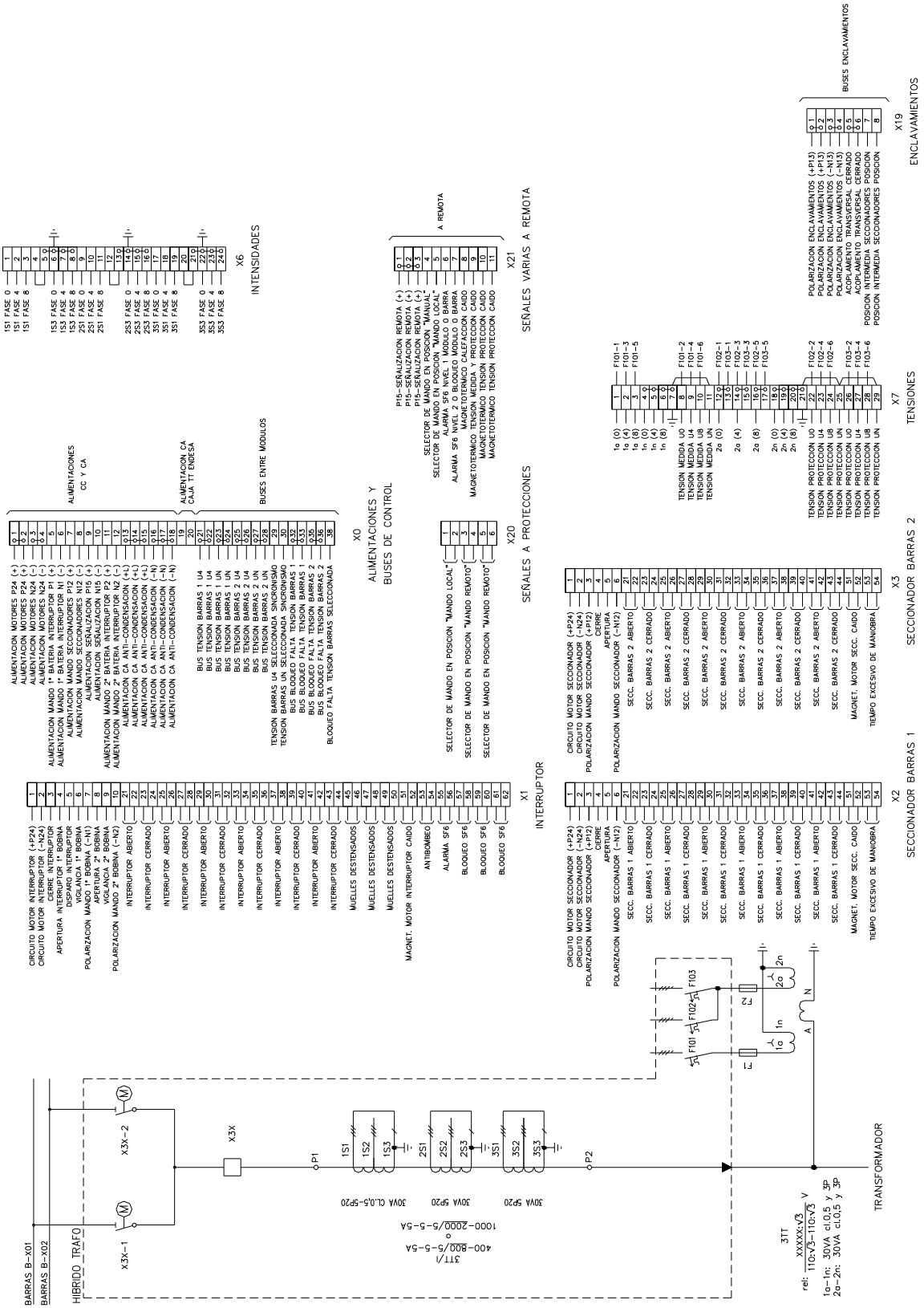
Hybrid module Single-bay type – used in Bus coupler bay


HIBRIDO ACOPLAMIENTO
BARRAS B-X01
BARRAS B-X02
X2X-1
X2X-2
X2X
P1
P2
1S1
1S2
1S3
2S1
2S2
2S3
30VA 5P20
30VA 5P20
3TT/1
ri: 1000-2000/5-5 A
X1 INTERRUPTOR
X2 SECCIONADOR BARRAS 1
X3 SECCIONADOR BARRAS 2
X0 ALIMENTACIONES Y BUSES DE CONTROL
X20 SEÑALES A PROTECCIONES
X21 SEÑALES A REMOTA
X19 ENCLAVAMIENTOS
X6 INTENSIDADES
ALIMENTACIONES CC Y CA
ALIMENTACION CA RESERVA
BUSES ENTRE MODULOS
BUSES ENCLAVAMIENTOS
A REMOTA
CIRCUITO MOTOR SECCIONADOR (+P24)
CIRCUITO MOTOR SECCIONADOR (-N24)
POLARIZACION MANDO SECCIONADOR (+P12)
CIERRE
APERTURA
POLARIZACION MANDO SECCIONADOR (-N12)
SECC. BARRAS 1 ABIERTO
SECC. BARRAS 1 CERRADO
SECC. BARRAS 2 ABIERTO
SECC. BARRAS 2 CERRADO
MAGNET. MOTOR SECC. CAIDO
TIEMPO EXCESIVO DE MANIOBRA
CIRCUITO MOTOR INTERRUPTOR (+P24)
CIRCUITO MOTOR INTERRUPTOR (-N24)
CIERRE INTERRUPTOR
APERTURA INTERRUPTOR 1ª BOBINA
DISPARO INTERRUPTOR
VIGILANCIA 1ª BOBINA
POLARIZACION MANDO 1ª BOBINA (+P1)
POLARIZACION MANDO 1ª BOBINA (-N1)
APERTURA 2ª BOBINA
VIGILANCIA 2ª BOBINA
POLARIZACION MANDO 2ª BOBINA (-N2)
INTERRUPTOR ABIERTO
INTERRUPTOR CERRADO
INTERRUPTOR ABIERTO
INTERRUPTOR CERRADO
INTERRUPTOR ABIERTO
INTERRUPTOR CERRADO
INTERRUPTOR ABIERTO
INTERRUPTOR CERRADO
INTERRUPTOR ABIERTO
INTERRUPTOR CERRADO
MUELLES DESTENSADOS
MUELLES DESTENSADOS
MAGNET. MOTOR INTERRUPTOR CAIDO
ANTIBOMBEO
ALARMA SF6
BLOQUEO SF6
BLOQUEO SF6
BLOQUEO SF6
ALIMENTACION MOTORES P24 (+)
ALIMENTACION MOTORES P24 (-)
ALIMENTACION MOTORES N24 (-)
ALIMENTACION MANDO 1ª BATERIA INTERRUPTOR P1 (+)
ALIMENTACION MANDO 1ª BATERIA INTERRUPTOR P1 (-)
ALIMENTACION MANDO SECCIONADORES P12 (+)
ALIMENTACION MANDO SECCIONADORES N12 (-)
ALIMENTACION SEÑALIZACION SINOPTICO P15 (+)
ALIMENTACION SEÑALIZACION SINOPTICO N15 (-)
ALIMENTACION MANDO 2ª BATERIA INTERRUPTOR N2 (+)
ALIMENTACION MANDO 2ª BATERIA INTERRUPTOR N2 (-)
ALIMENTACION CA ANTI-CONDENSACION (+L1)
ALIMENTACION CA ANTI-CONDENSACION (+L2)
ALIMENTACION CA ANTI-CONDENSACION (-N)
ALIMENTACION CA ANTI-CONDENSACION (-N)
BUS TENSION BARRAS 1 U4
BUS TENSION BARRAS 1 U4
BUS TENSION BARRAS 1 UN
BUS TENSION BARRAS 2 U4
BUS TENSION BARRAS 2 U4
BUS TENSION BARRAS 2 UN
BUS TENSION BARRAS 2 UN
POLARIZACION (+P13)
POLARIZACION (+P13)
POLARIZACION (-N13)
BUS BLOQUEO FALTA TENSION BARRAS 1
BUS BLOQUEO FALTA TENSION BARRAS 1
BLOQUEO FALTA TENSION BARRAS 1
BUS BLOQUEO FALTA TENSION BARRAS 2
BUS BLOQUEO FALTA TENSION BARRAS 2
BLOQUEO FALTA TENSION BARRAS 2
ORDEN DE CIERRE (LOCAL + RTU) ACTIVADA
P13-ENCLAVAMIENTOS (+)
P13-ENCLAVAMIENTOS (+)
N13-ENCLAVAMIENTOS (-)
N13-ENCLAVAMIENTOS (-)
ACOPLAMIENTO TRANSVERSAL CERRADO
ACOPLAMIENTO TRANSVERSAL CERRADO
P15-SEÑALIZACION REMOTA (+)
P15-SEÑALIZACION REMOTA (+)
P15-SEÑALIZACION REMOTA (+)
SELECTOR DE MANDO EN POSICION "MANUAL"
SELECTOR DE MANDO EN POSICION "MANDO LOCAL"
ALARMA SF6 NIVEL 1 O BLOQUEO MODULO O BARRA
ALARMA SF6 NIVEL 2 O BLOQUEO MODULO O BARRA
MAGNETOTERMICO CALEFACCION CAIDO
MAGNETOTERMICO FALTA TT BARRAS 1 MEDIDA Y PROTECCION
MAGNETOTERMICO FALTA TT BARRAS 2 MEDIDA Y PROTECCION
MAGNETOTERMICO CALEFACCION TT BARRAS 1
MAGNETOTERMICO CALEFACCION TT BARRAS 2
1S1 FASE 0
1S1 FASE 4
1S1 FASE 8
1S3 FASE 0
1S3 FASE 4
1S3 FASE 8
2S1 FASE 0
2S1 FASE 4
2S1 FASE 8
2S3 FASE 0
2S3 FASE 4
2S3 FASE 8

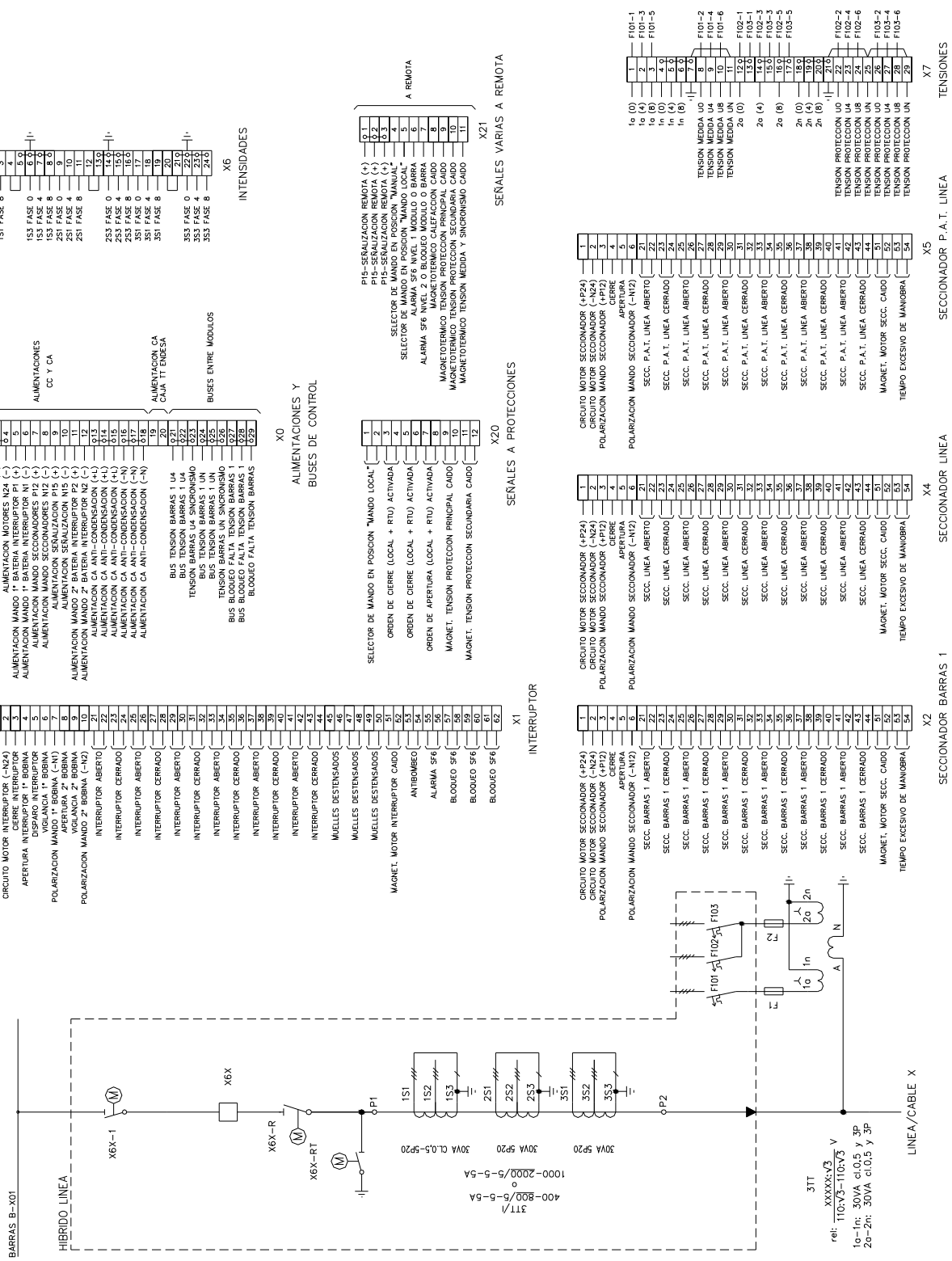
Hybrid module Y1 type – used in Line bay



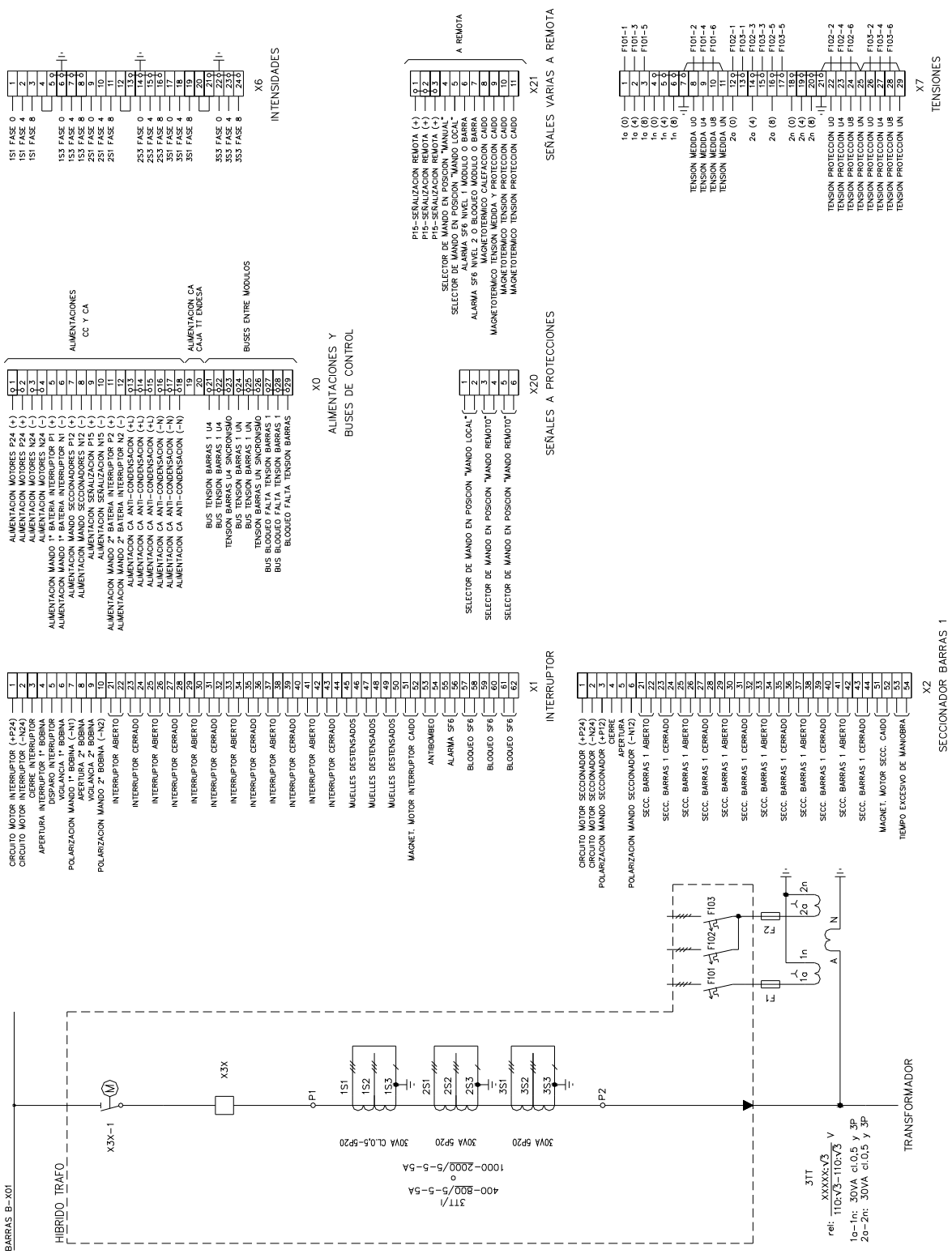
Hybrid module Y1 type – used in Transformer bay

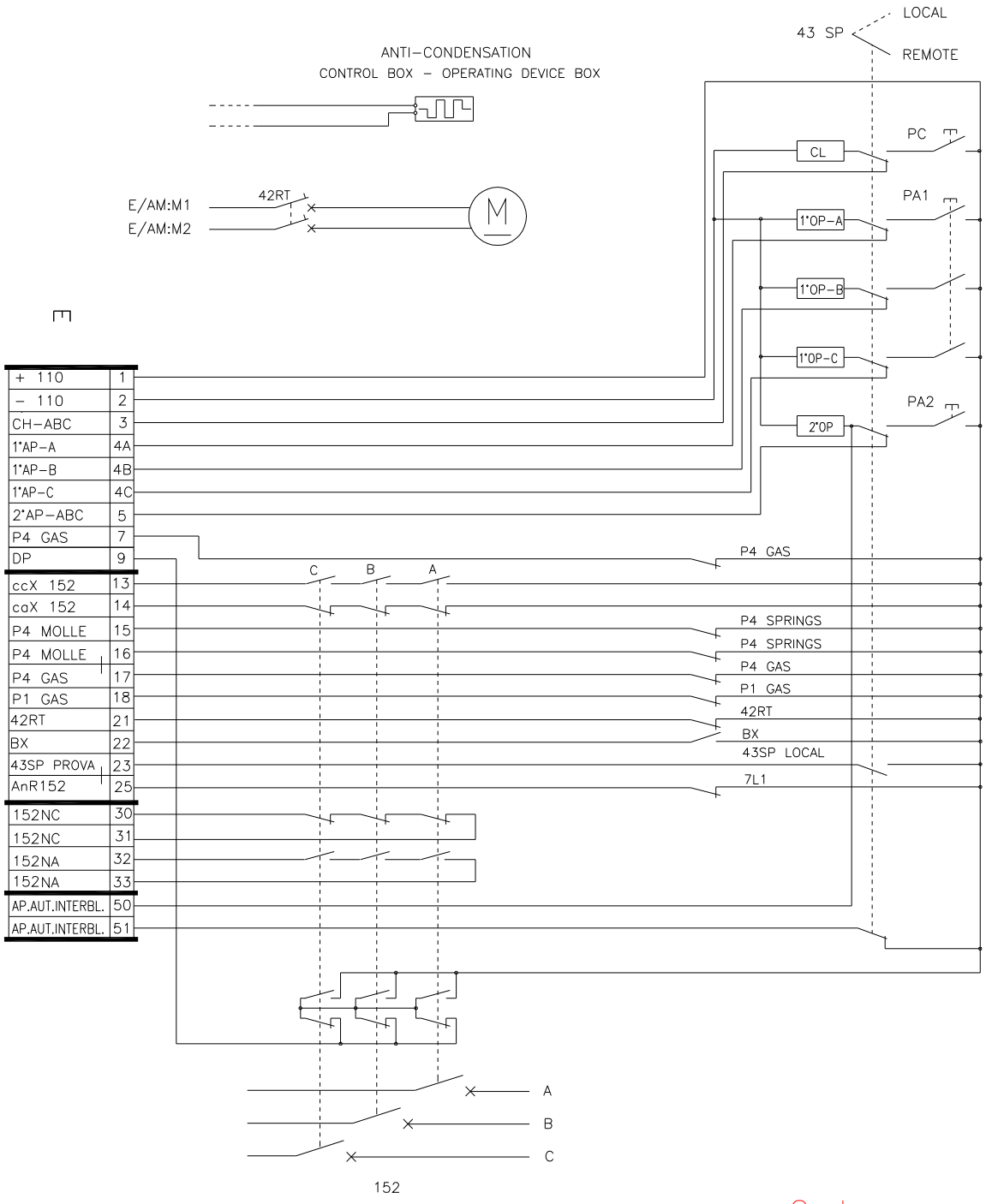


Hybrid module Single-bay type – used in Line bay



Hybrid module Single-bay type – used in Transformer bay




ANTI–CONDENSATION
CONTROL BOX – OPERATING DEVICE BOX
E/AM:M1
E/AM:M2
42RT
M
43 SP
LOCAL
REMOTE
PC
CL
PA1
1°OP–A
1°OP–B
1°OP–C
PA2
2°OP
+ 110 1
– 110 2
CH–ABC 3
1°AP–A 4A
1°AP–B 4B
1°AP–C 4C
2°AP–ABC 5
P4 GAS 7
DP 9
ccX 152 13
caX 152 14
P4 MOLLE 15
P4 MOLLE 16
P4 GAS 17
P1 GAS 18
42RT 21
BX 22
43SP PROVA 23
AnR152 25
152NC 30
152NC 31
152NA 32
152NA 33
AP.AUT.INTERBL. 50
AP.AUT.INTERBL. 51
C
B
A
P4 GAS
P4 SPRINGS
P4 SPRINGS
P4 GAS
P1 GAS
42RT
BX
43SP LOCAL
7L1
A
B
C
152

Code:
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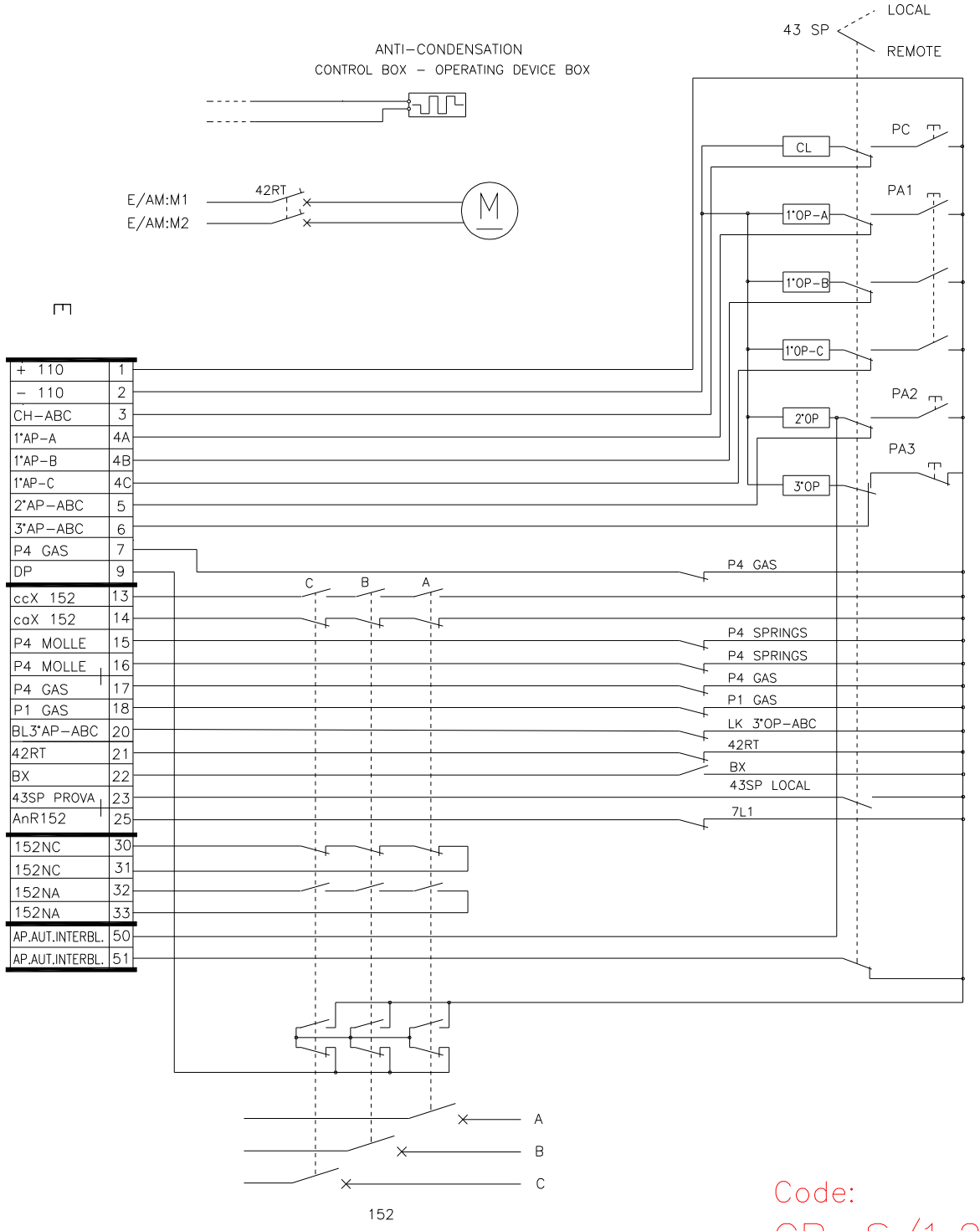
43 SP
LOCAL
REMOTE
ANTI–CONDENSATION
CONTROL BOX – OPERATING DEVICE BOX
E/AM:M1
E/AM:M2
42RT
M
PC
CL
PA1
1°OP–A
1°OP–B
1°OP–C
PA2
2°OP
PA3
3°OP
+ 110 1
– 110 2
CH–ABC 3
1°AP–A 4A
1°AP–B 4B
1°AP–C 4C
2°AP–ABC 5
3°AP–ABC 6
P4 GAS 7
DP 9
ccX 152 13
caX 152 14
P4 MOLLE 15
P4 MOLLE 16
P4 GAS 17
P1 GAS 18
BL3°AP–ABC 20
42RT 21
BX 22
43SP PROVA 23
AnR152 25
152NC 30
152NC 31
152NA 32
152NA 33
AP.AUT.INTERBL. 50
AP.AUT.INTERBL. 51
C
B
A
P4 GAS
P4 SPRINGS
P4 SPRINGS
P4 GAS
P1 GAS
LK 3°OP–ABC
42RT
BX
43SP LOCAL
7L1
A
B
C
152

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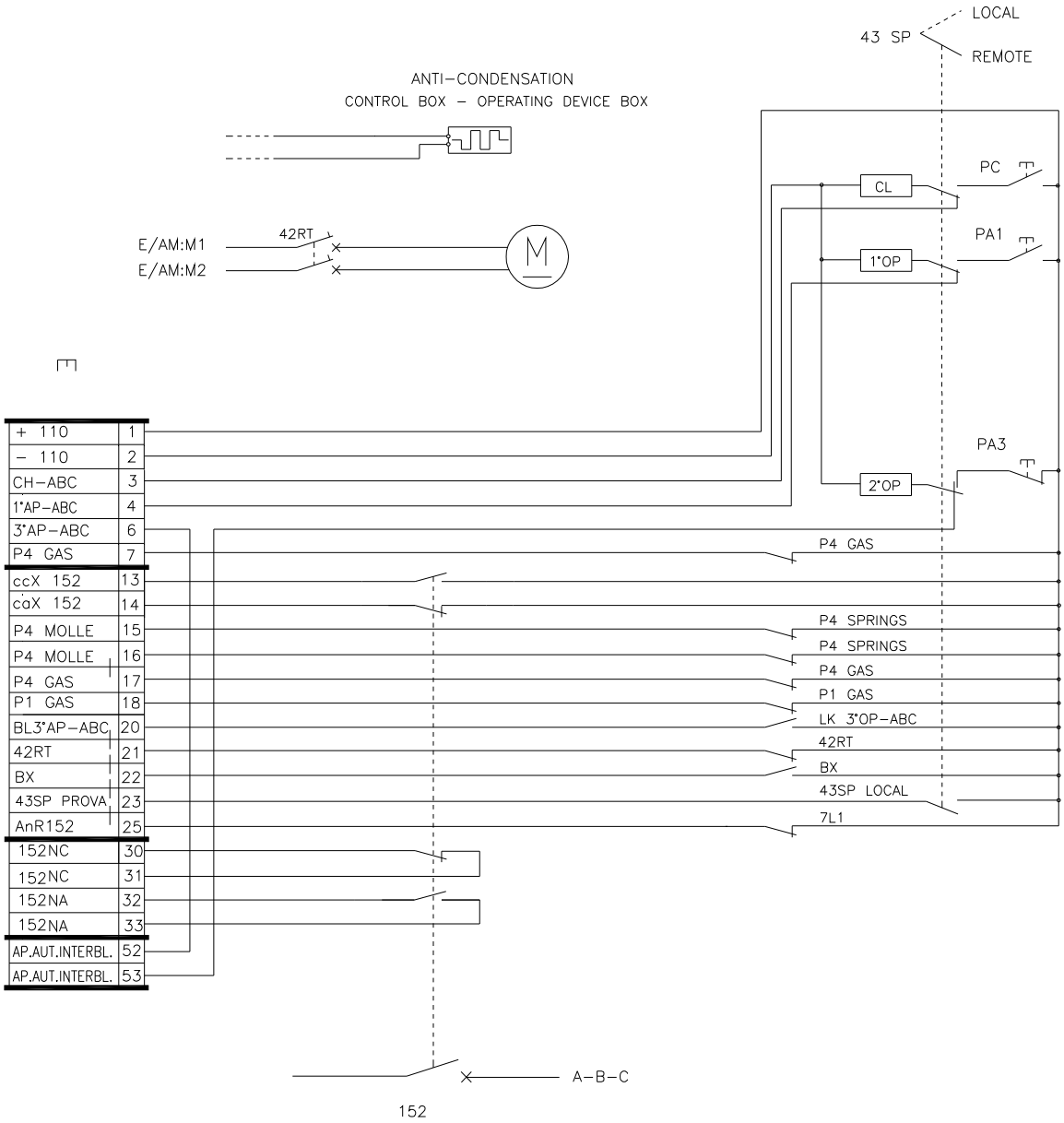
LOCAL
43 SP
REMOTE
ANTI-CONDENSATION
CONTROL BOX - OPERATING DEVICE BOX
E/AM:M1
E/AM:M2
42RT
M
CL
PC
1°OP
PA1
2°OP
PA3
+ 110 1
- 110 2
CH-ABC 3
1°AP-ABC 4
3°AP-ABC 6
P4 GAS 7
ccX 152 13
caX 152 14
P4 MOLLE 15
P4 MOLLE 16
P4 GAS 17
P1 GAS 18
BL3°AP-ABC 20
42RT 21
BX 22
43SP PROVA 23
AnR152 25
152NC 30
152NC 31
152NA 32
152NA 33
AP.AUT.INTERBL. 52
AP.AUT.INTERBL. 53
P4 GAS
P4 SPRINGS
P4 SPRINGS
P4 GAS
P1 GAS
LK 3°OP-ABC
42RT
BX
43SP LOCAL
7L1
A-B-C
152

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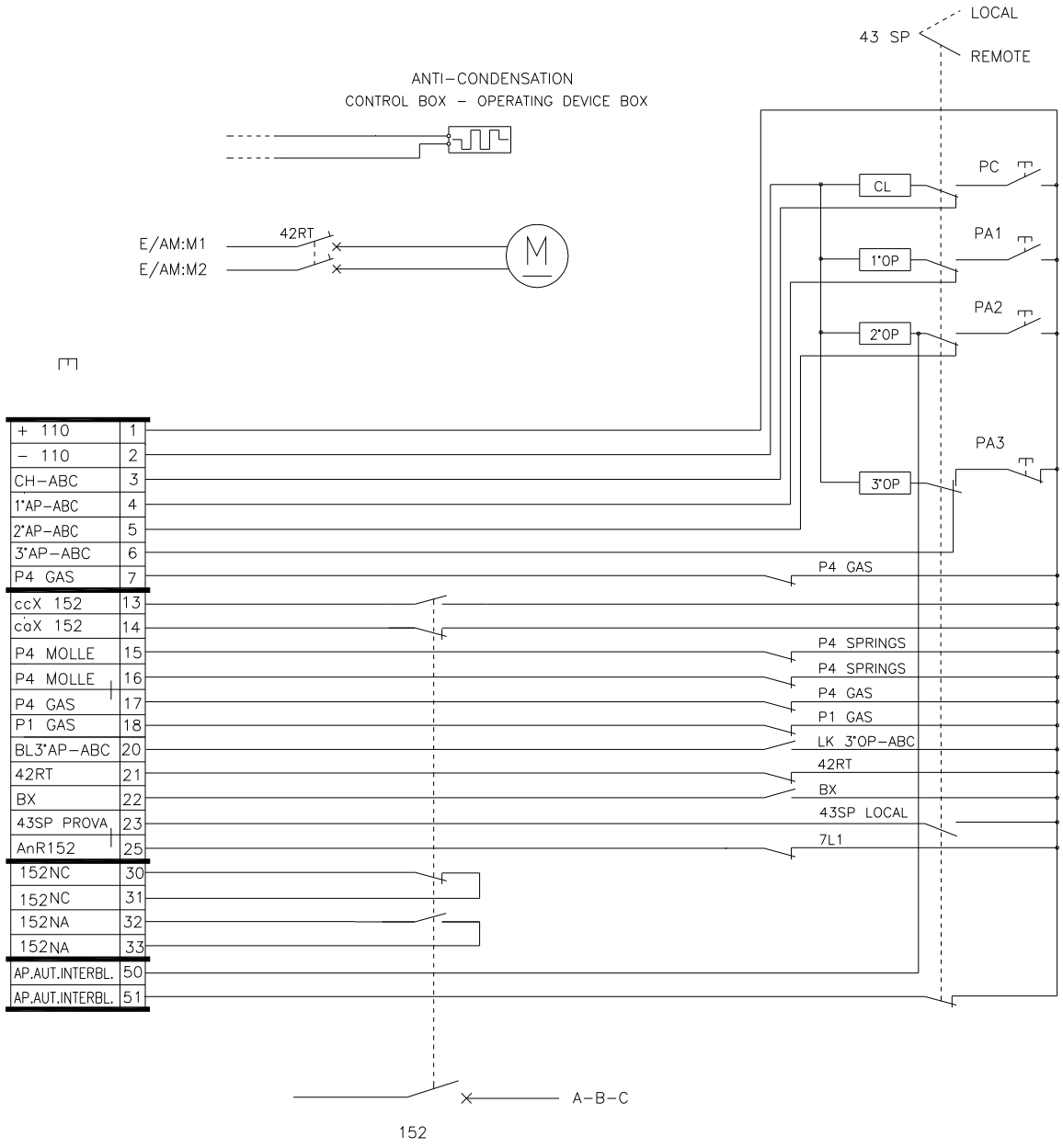
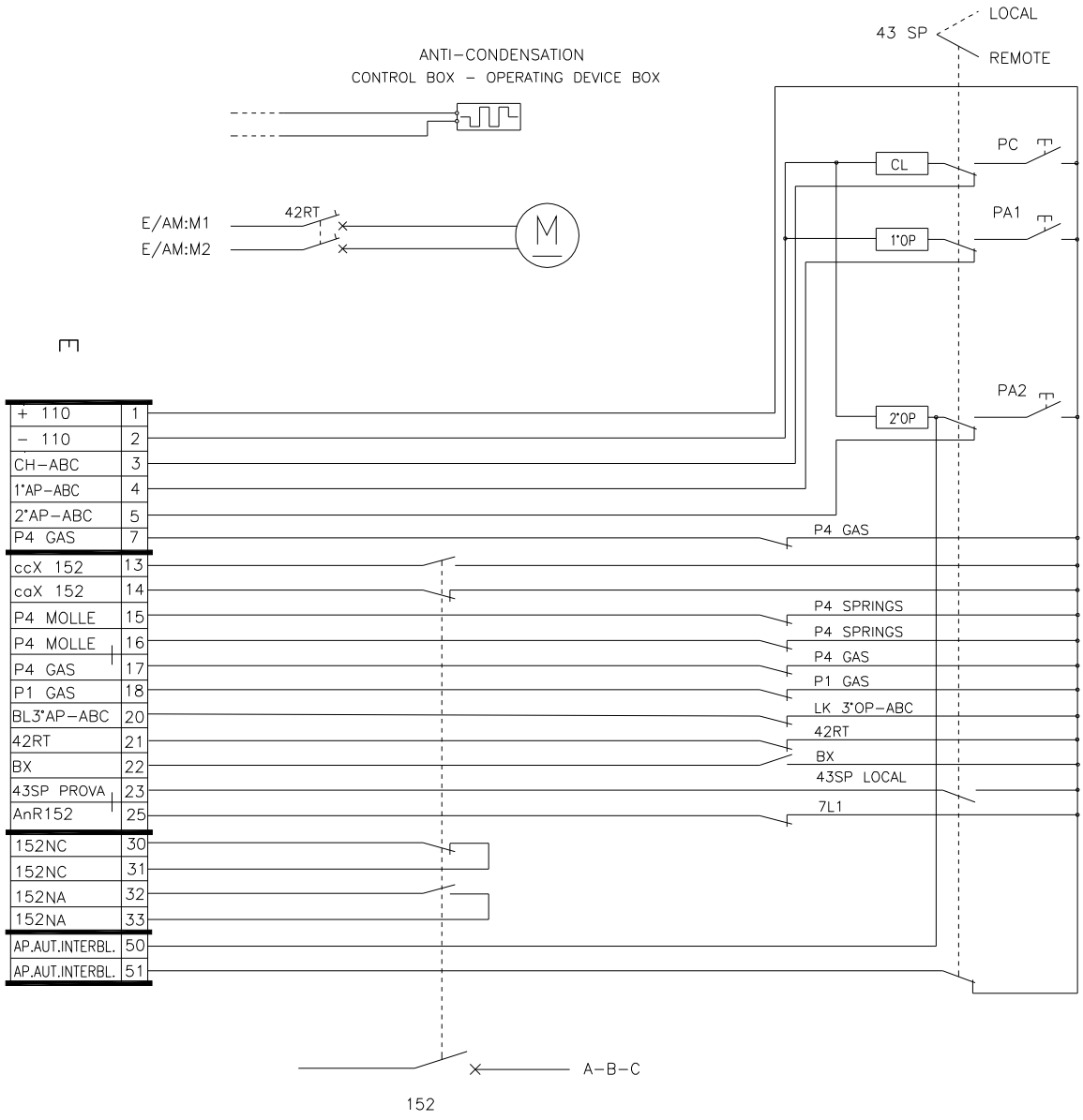
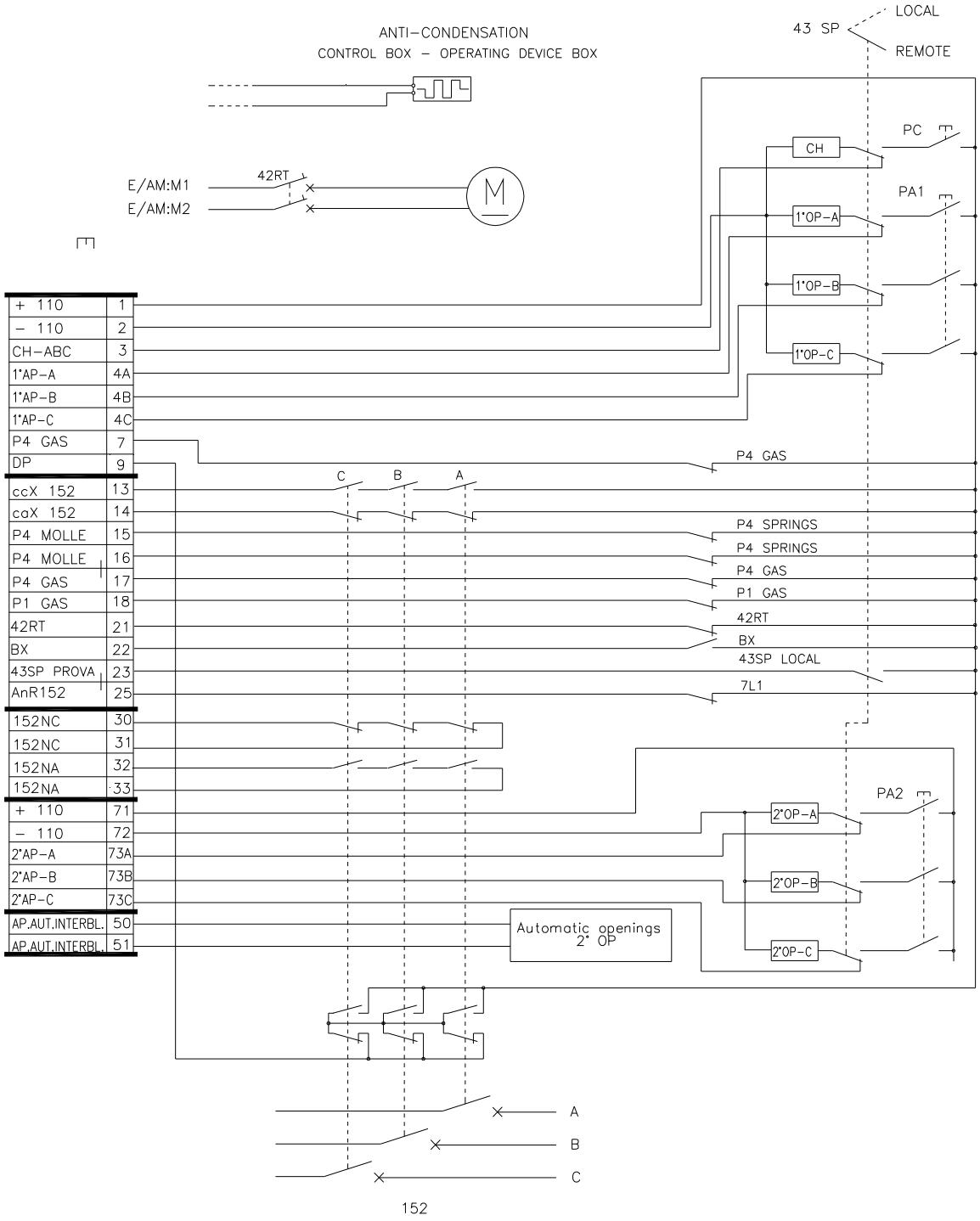

43 SP
LOCAL
REMOTE
ANTI–CONDENSATION
CONTROL BOX – OPERATING DEVICE BOX
E/AM:M1
E/AM:M2
42RT
M
PC
CL
PA1
1°OP
PA2
2°OP
PA3
3°OP
+ 110 1
– 110 2
CH–ABC 3
1°AP–ABC 4
2°AP–ABC 5
3°AP–ABC 6
P4 GAS 7
ccX 152 13
coX 152 14
P4 MOLLE 15
P4 MOLLE 16
P4 GAS 17
P1 GAS 18
BL3°AP–ABC 20
42RT 21
BX 22
43SP PROVA 23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

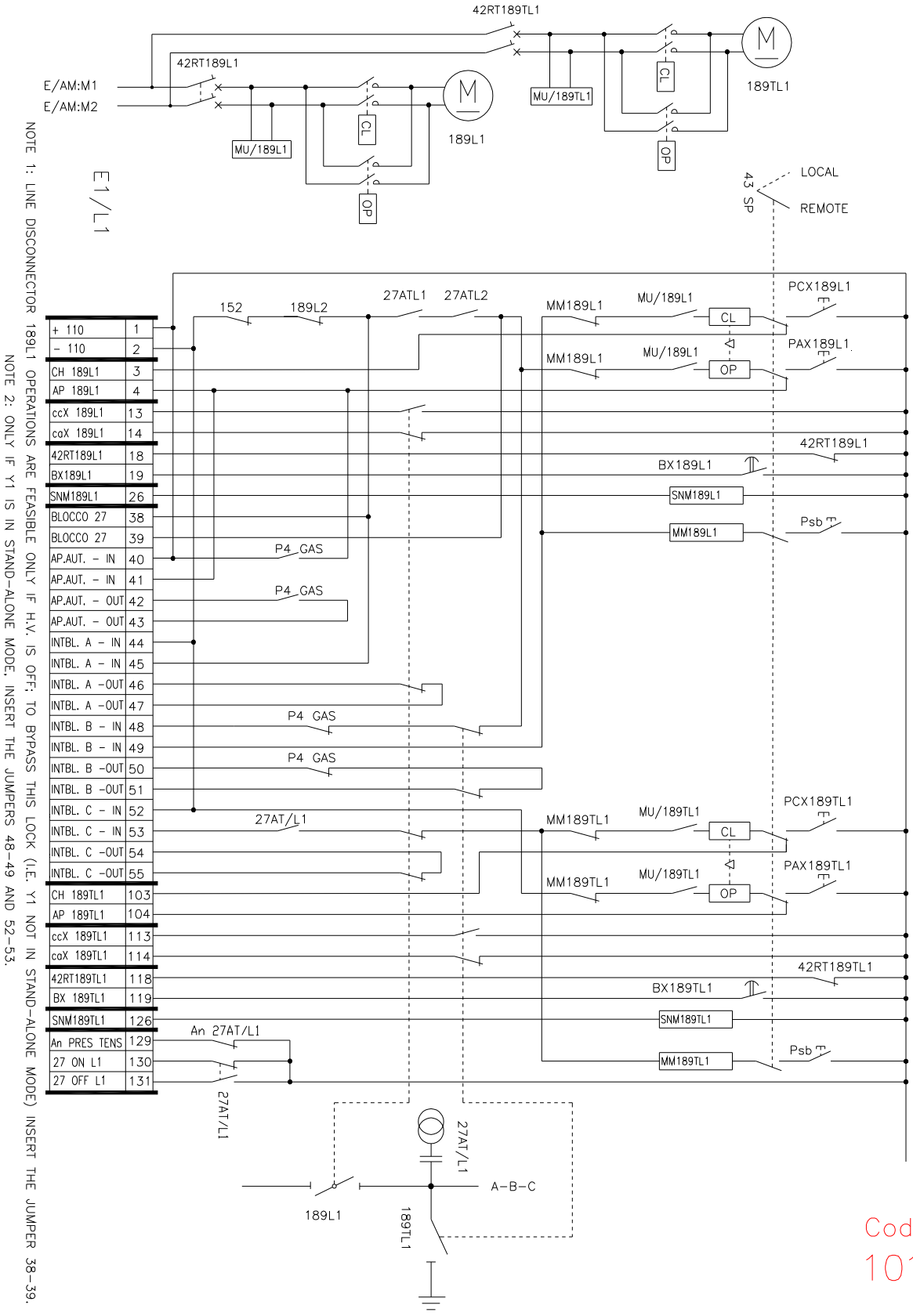
Code:
CB–T/1.2.3.


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

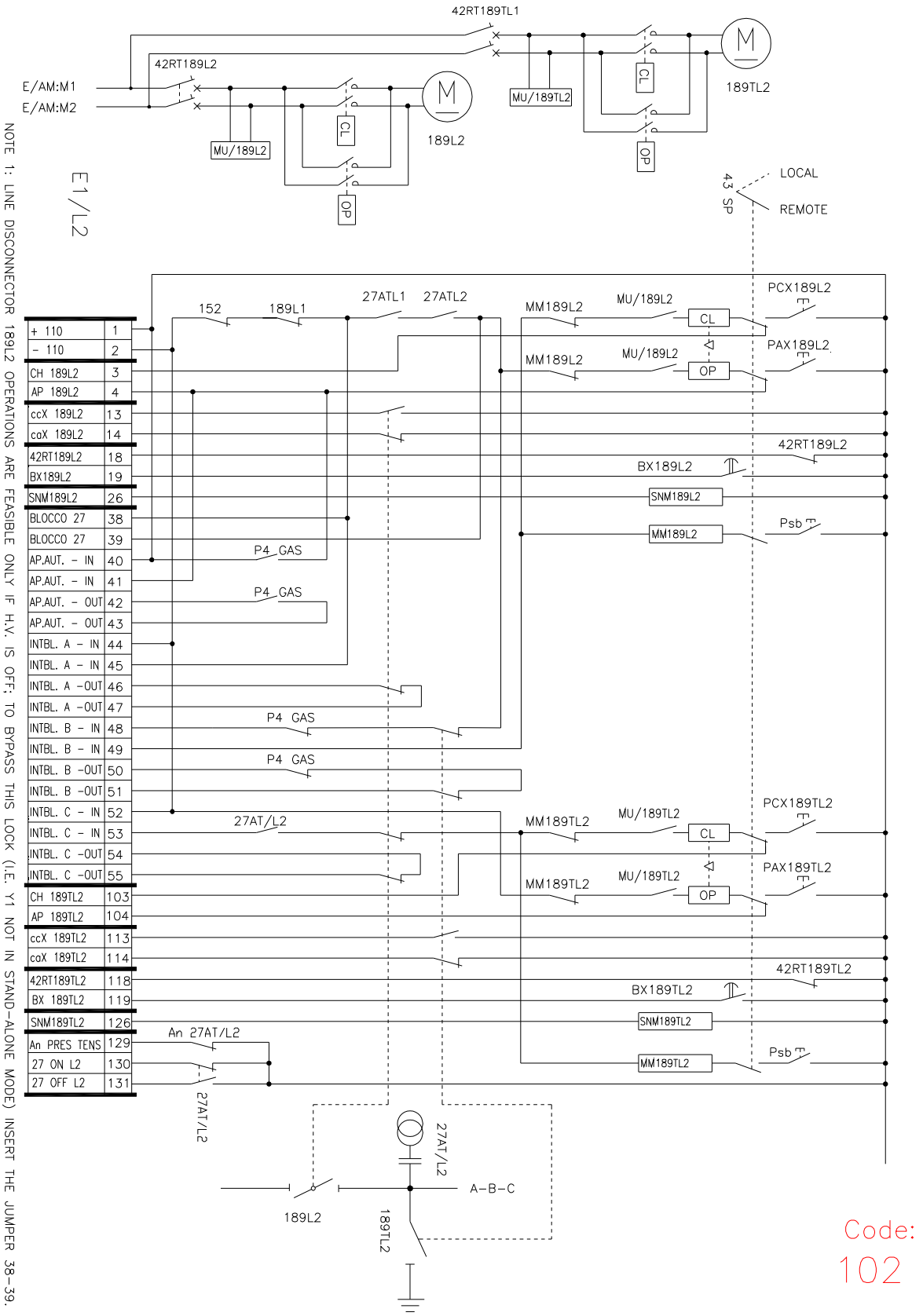
Code:
CB–T/1.2.



Code:
245 CB-S/1.2.


42RT189TL1
42RT189L1
E/AM:M1
E/AM:M2
MU/189L1
CL
OP
189L1
MU/189TL1
189TL1
E1/L1
43 SP
LOCAL
REMOTE
+ 110 1
- 110 2
CH 189L1 3
AP 189L1 4
ccX 189L1 13
coX 189L1 14
42RT189L1 18
BX189L1 19
SNM189L1 26
BLOCCO 27 38
BLOCCO 27 39
AP.AUT. - IN 40
AP.AUT. - IN 41
AP.AUT. - OUT 42
AP.AUT. - OUT 43
INTBL. A - IN 44
INTBL. A - IN 45
INTBL. A -OUT 46
INTBL. A -OUT 47
INTBL. B - IN 48
INTBL. B - IN 49
INTBL. B -OUT 50
INTBL. B -OUT 51
INTBL. C - IN 52
INTBL. C - IN 53
INTBL. C -OUT 54
INTBL. C -OUT 55
CH 189TL1 103
AP 189TL1 104
ccX 189TL1 113
coX 189TL1 114
42RT189TL1 118
BX 189TL1 119
SNM189TL1 126
An PRES TENS 129
27 ON L1 130
27 OFF L1 131
152
189L2
27ATL1
27ATL2
MM189L1
PCX189L1
PAX189L1
Psb
BX189L1
SNM189L1
MM189L1
P4 GAS
27AT/L1
An 27AT/L1
A-B-C
189L1
189TL1
NOTE 1: LINE DISCONNECTOR 189L1 OPERATIONS ARE FEASIBLE ONLY IF H.V. IS OFF; TO BYPASS THIS LOCK (I.E. Y1 NOT IN STAND-ALONE MODE) INSERT THE JUMPER 38-39.
NOTE 2: ONLY IF Y1 IS IN STAND-ALONE MODE, INSERT THE JUMPERS 48-49 AND 52-53.

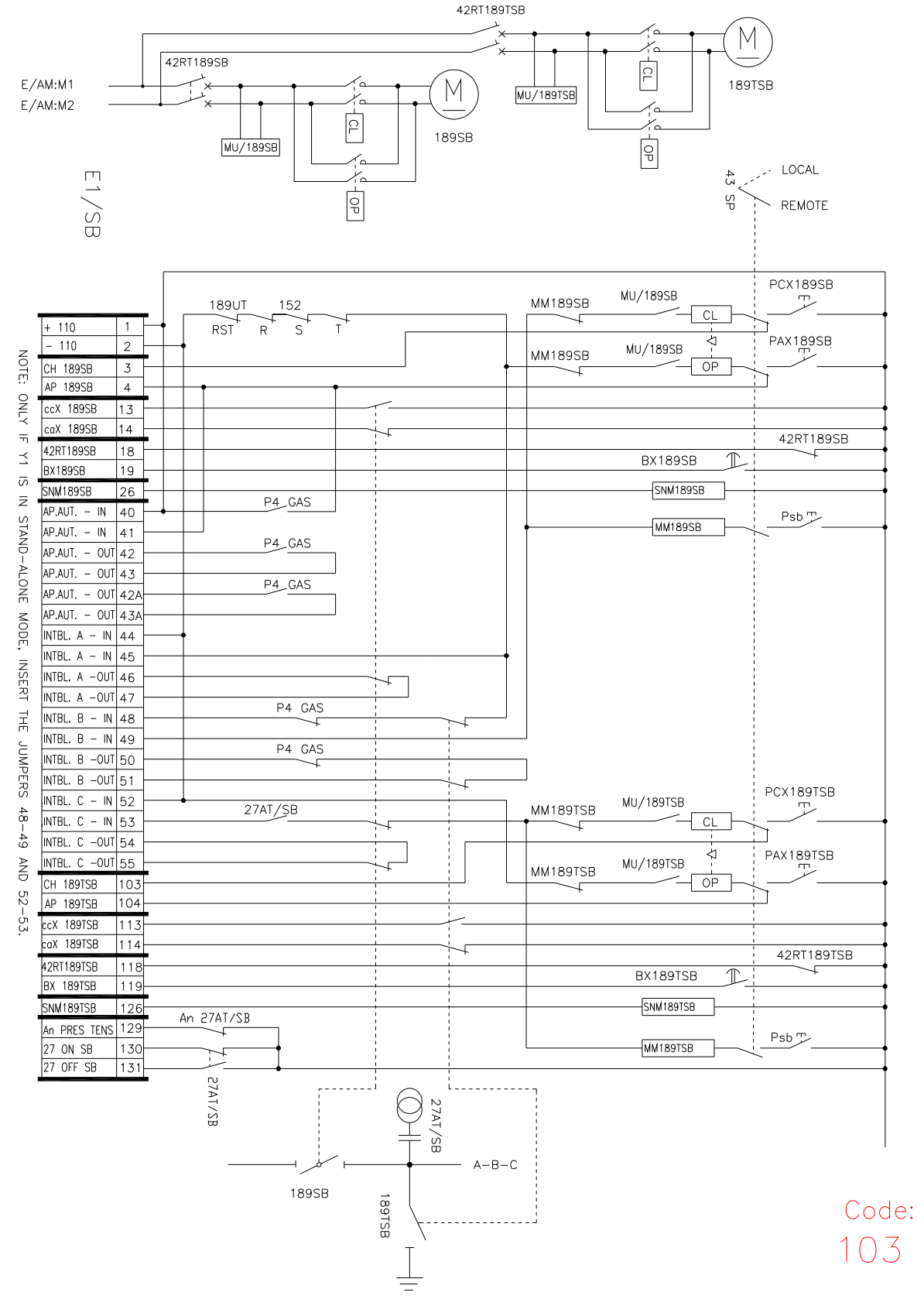
Code:
101

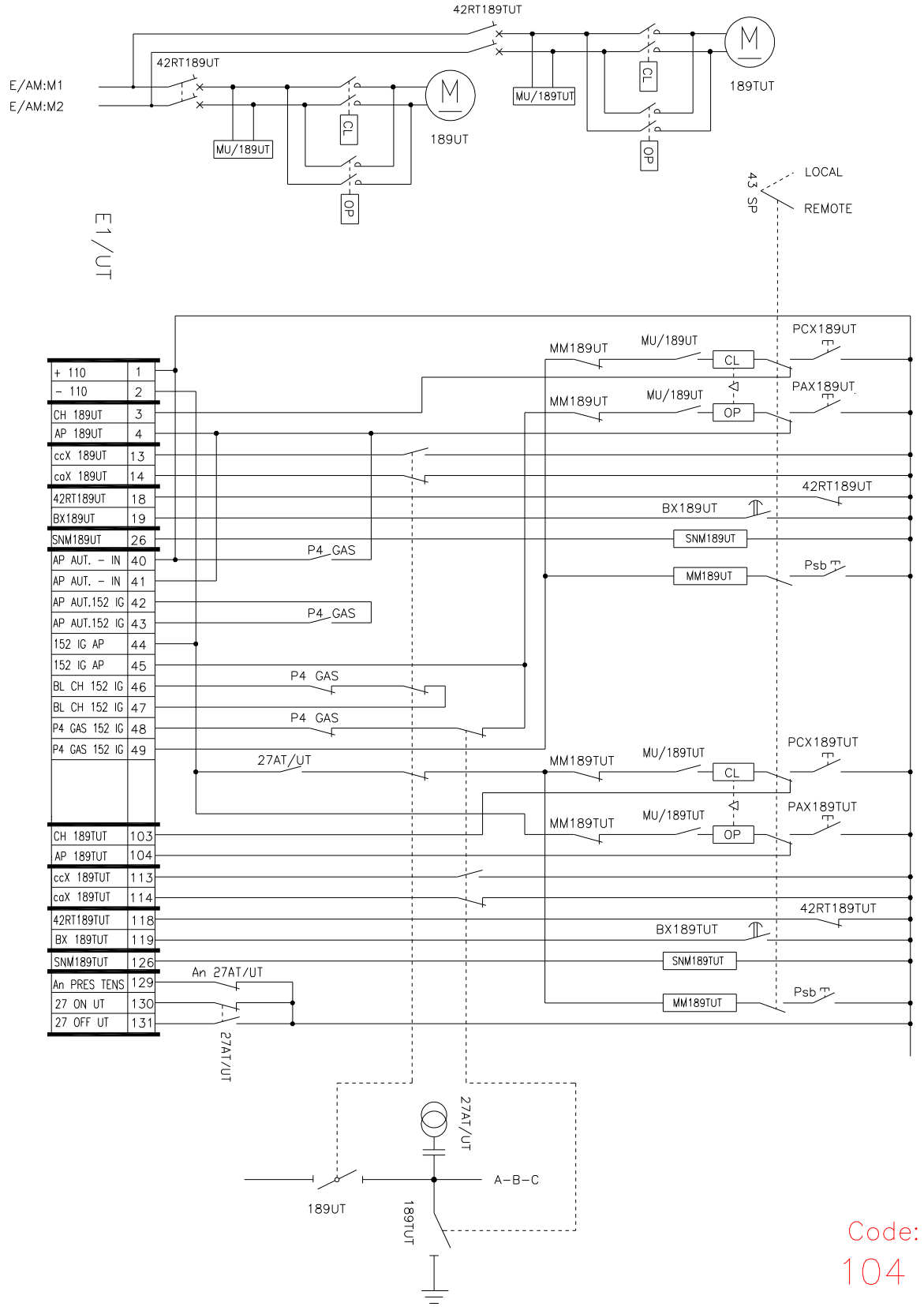


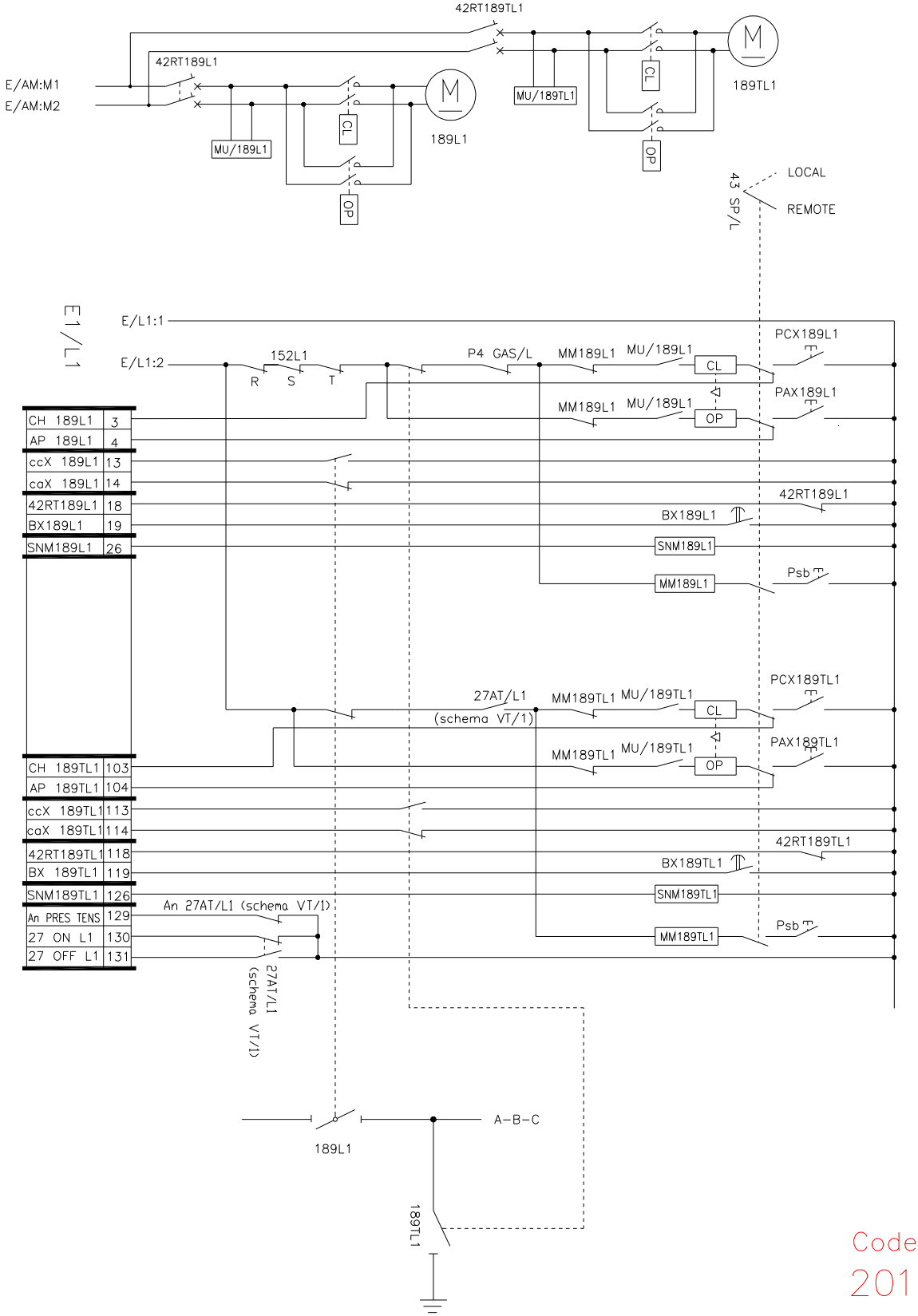
NOTE 1: LINE DISCONNECTOR 189L2 OPERATIONS ARE FEASIBLE ONLY IF H.V. IS OFF; TO BYPASS THIS LOCK (I.E. Y1 NOT IN STAND-ALONE MODE) INSERT THE JUMPER 38-39.

NOTE 2: ONLY IF Y1 IS IN STAND-ALONE MODE, INSERT THE JUMPERS 48-49 AND 52-53.

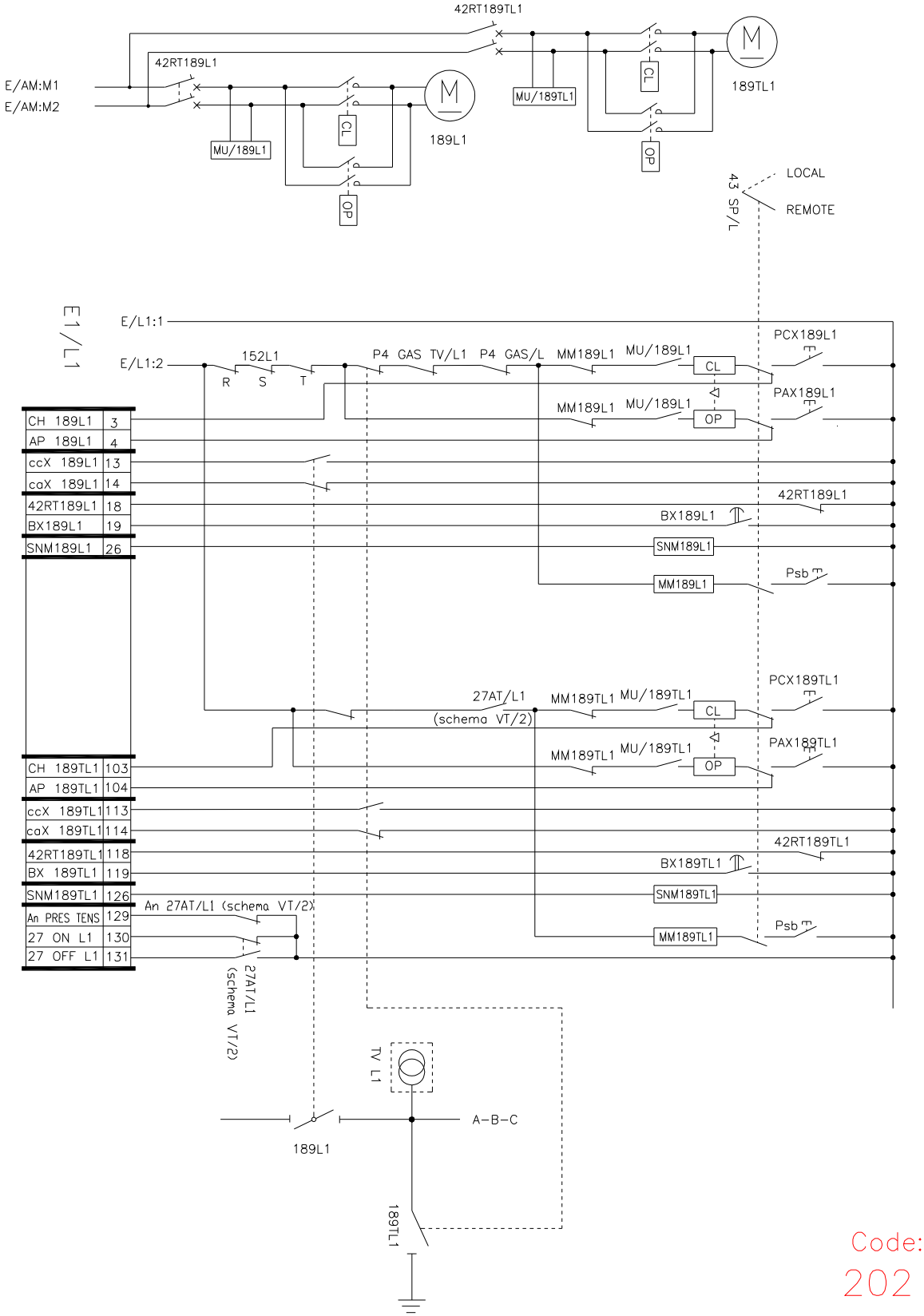
Code:
102


42RT189TSB
42RT189SB
E/AM:M1
E/AM:M2
MU/189SB
CL
189SB
MU/189TSB
189TSB
OP
E1/SB
43 SP
LOCAL
REMOTE
189UT
152
RST
R
S
T
MM189SB
MU/189SB
PCX189SB
PAX189SB
BX189SB
SNM189SB
Psb
P4 GAS
27AT/SB
MM189TSB
MU/189TSB
PCX189TSB
PAX189TSB
BX189TSB
SNM189TSB
An 27AT/SB
A-B-C
+ 110 1
- 110 2
CH 189SB 3
AP 189SB 4
ccX 189SB 13
caX 189SB 14
42RT189SB 18
BX189SB 19
SNM189SB 26
AP.AUT. - IN 40
AP.AUT. - IN 41
AP.AUT. - OUT 42
AP.AUT. - OUT 43
AP.AUT. - OUT 42A
AP.AUT. - OUT 43A
INTBL. A - IN 44
INTBL. A - IN 45
INTBL. A -OUT 46
INTBL. A -OUT 47
INTBL. B - IN 48
INTBL. B - IN 49
INTBL. B -OUT 50
INTBL. B -OUT 51
INTBL. C - IN 52
INTBL. C - IN 53
INTBL. C -OUT 54
INTBL. C -OUT 55
CH 189TSB 103
AP 189TSB 104
ccX 189TSB 113
caX 189TSB 114
42RT189TSB 118
BX 189TSB 119
SNM189TSB 126
An PRES TENS 129
27 ON SB 130
27 OFF SB 131
NOTE: ONLY IF Y1 IS IN STAND-ALONE MODE, INSERT THE JUMPERS 48-49 AND 52-53.
Code:
103

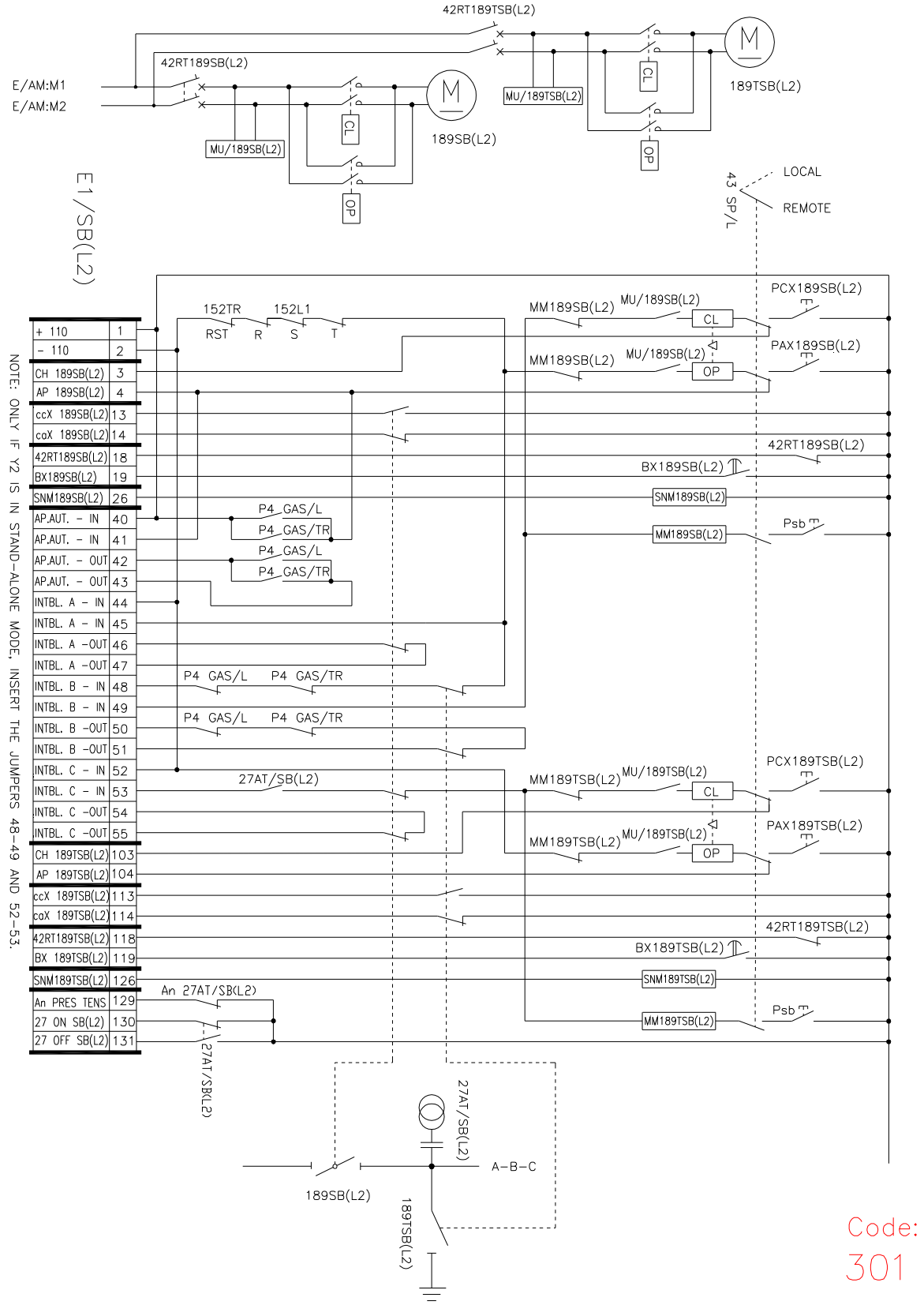

42RT189TUT
42RT189TUT
E/AM:M1
E/AM:M2
MU/189UT
CL
OP
189UT
MU/189TUT
189TUT
43 SP
LOCAL
REMOTE
E1/UT
+ 110 1
- 110 2
CH 189UT 3
AP 189UT 4
ccX 189UT 13
coX 189UT 14
42RT189UT 18
BX189UT 19
SNM189UT 26
AP AUT. - IN 40
AP AUT. - IN 41
AP AUT.152 IG 42
AP AUT.152 IG 43
152 IG AP 44
152 IG AP 45
BL CH 152 IG 46
BL CH 152 IG 47
P4 GAS 152 IG 48
P4 GAS 152 IG 49
CH 189TUT 103
AP 189TUT 104
ccX 189TUT 113
coX 189TUT 114
42RT189TUT 118
BX 189TUT 119
SNM189TUT 126
An PRES TENS 129
27 ON UT 130
27 OFF UT 131
P4 GAS
27AT/UT
An 27AT/UT
MM189UT
PCX189UT
PAX189UT
BX189UT
SNM189UT
Psb
A-B-C
Code:
104

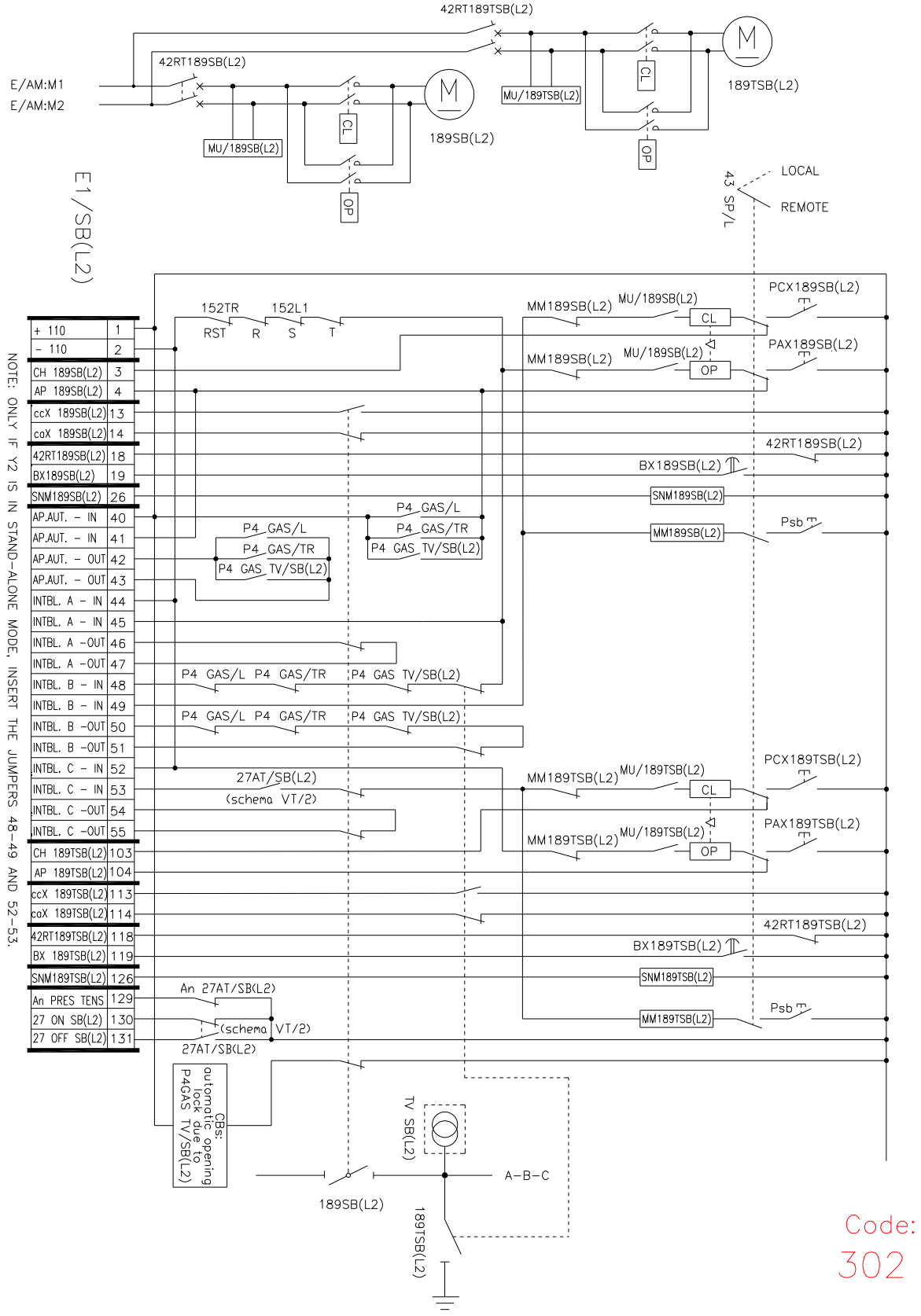

42RT189TL1
42RT189L1
E/AM:M1
E/AM:M2
MU/189L1
CL
OP
189L1
MU/189TL1
189TL1
LOCAL
43 SP/L
REMOTE
E1/L1
E/L1:1
E/L1:2
152L1
R S T
P4 GAS/L
MM189L1
MU/189L1
PCX189L1
PAX189L1
CH 189L1 3
AP 189L1 4
ccX 189L1 13
caX 189L1 14
42RT189L1 18
BX189L1 19
SNM189L1 26
BX189L1
SNM189L1
Psb
27AT/L1
(schema VT/1)
MM189TL1
CH 189TL1 103
AP 189TL1 104
ccX 189TL1 113
caX 189TL1 114
42RT189TL1 118
BX 189TL1 119
SNM189TL1 126
An PRES TENS 129
27 ON L1 130
27 OFF L1 131
An 27AT/L1 (schema VT/1)
A-B-C

Code:
201

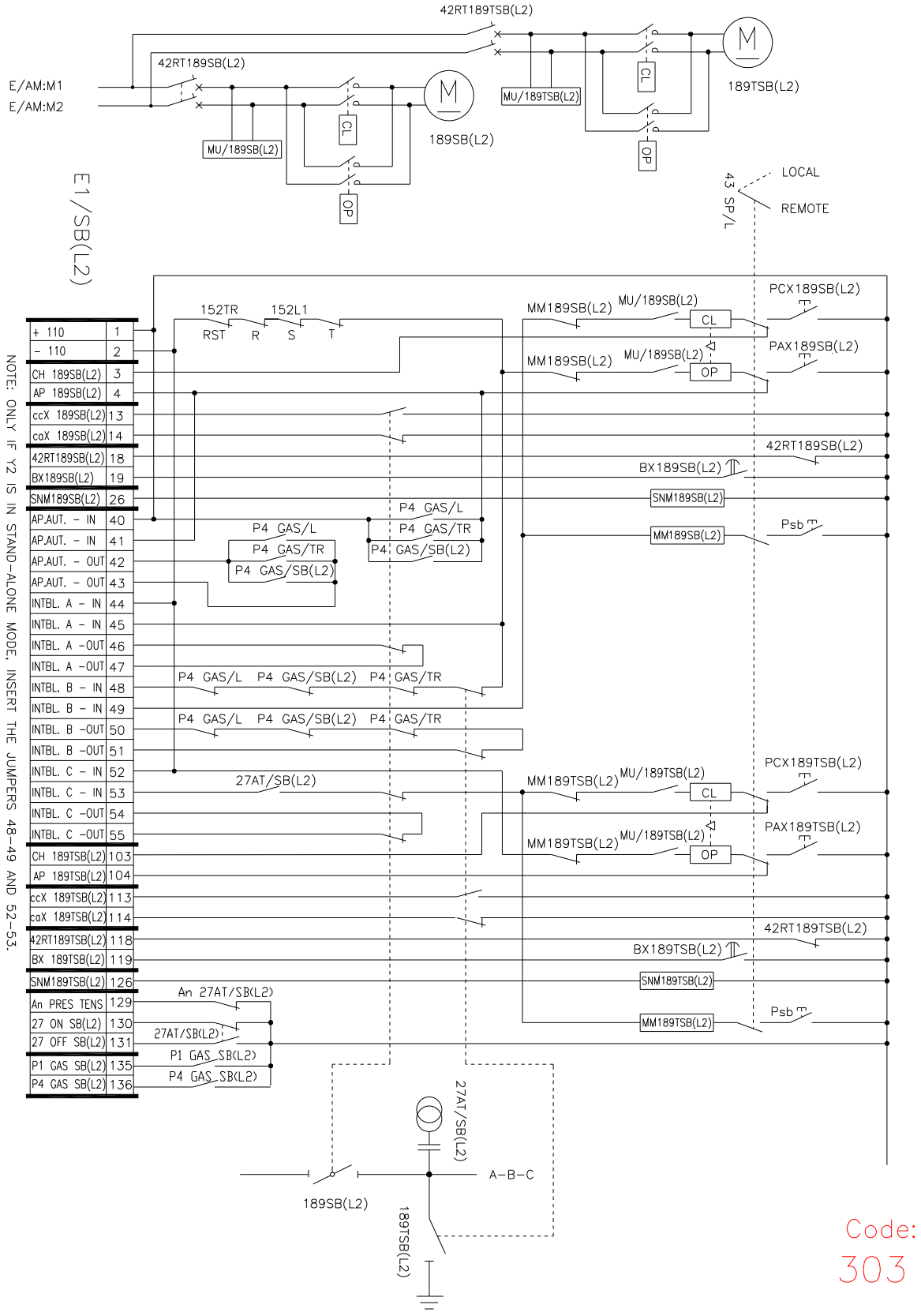

42RT189TL1
42RT189L1
E/AM:M1
E/AM:M2
MU/189L1
CL
OP
189L1
MU/189TL1
189TL1
43 SP/L
LOCAL
REMOTE
E1/L1
E/L1:1
E/L1:2
152L1
R S T
P4 GAS TV/L1
P4 GAS/L
MM189L1
MU/189L1
PCX189L1
PAX189L1
CH 189L1 3
AP 189L1 4
ccX 189L1 13
caX 189L1 14
42RT189L1 18
BX189L1 19
SNM189L1 26
Psb
27AT/L1
(schema VT/2)
CH 189TL1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

Code:
202

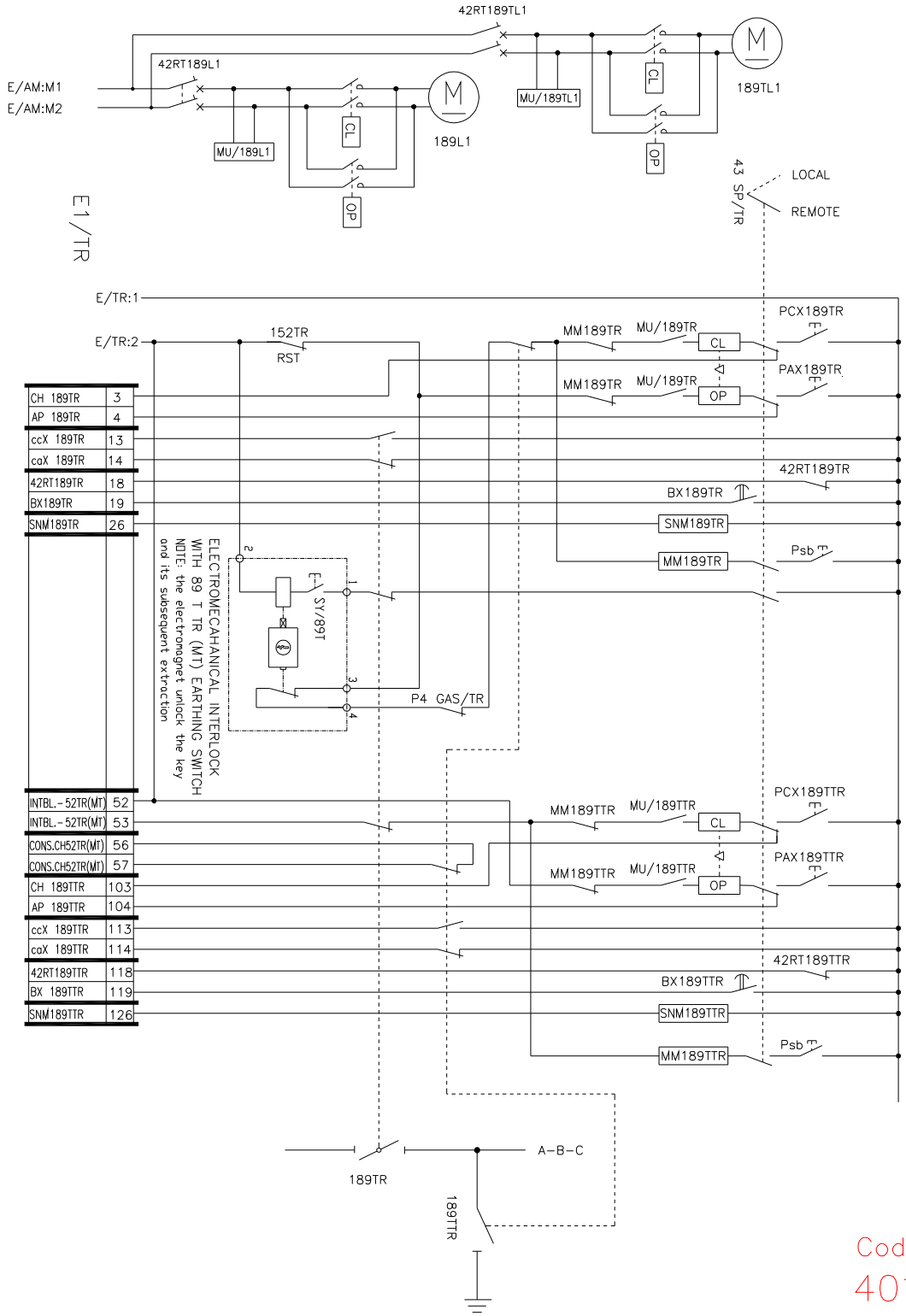

42RT189TSB(L2)
42RT189SB(L2)
E/AM:M1
E/AM:M2
MU/189SB(L2)
CL
OP
189SB(L2)
MU/189TSB(L2)
189TSB(L2)
E1/SB(L2)
43 SP/L
LOCAL
REMOTE
152TR
152L1
RST
R
S
T
MM189SB(L2)
PCX189SB(L2)
PAX189SB(L2)
42RT189SB(L2)
BX189SB(L2)
SNM189SB(L2)
Psb
P4 GAS/L
P4 GAS/TR
27AT/SB(L2)
MM189TSB(L2)
PCX189TSB(L2)
PAX189TSB(L2)
BX189TSB(L2)
An 27AT/SB(L2)
A-B-C
+ 110 1
- 110 2
CH 189SB(L2) 3
AP 189SB(L2) 4
ccX 189SB(L2) 13
coX 189SB(L2) 14
42RT189SB(L2) 18
BX189SB(L2) 19
SNM189SB(L2) 26
AP.AUT. - IN 40
AP.AUT. - IN 41
AP.AUT. - OUT 42
AP.AUT. - OUT 43
INTBL. A - IN 44
INTBL. A - IN 45
INTBL. A -OUT 46
INTBL. A -OUT 47
INTBL. B - IN 48
INTBL. B - IN 49
INTBL. B -OUT 50
INTBL. B -OUT 51
INTBL. C - IN 52
INTBL. C - IN 53
INTBL. C -OUT 54
INTBL. C -OUT 55
CH 189TSB(L2) 103
AP 189TSB(L2) 104
ccX 189TSB(L2) 113
coX 189TSB(L2) 114
42RT189TSB(L2) 118
BX 189TSB(L2) 119
SNM189TSB(L2) 126
An PRES TENS 129
27 ON SB(L2) 130
27 OFF SB(L2) 131
NOTE: ONLY IF Y2 IS IN STAND-ALONE MODE, INSERT THE JUMPERS 48-49 AND 52-53.
Code:
301


42RT189TSB(L2)
42RT189SB(L2)
E/AM:M1
E/AM:M2
MU/189SB(L2)
CL
OP
189SB(L2)
MU/189TSB(L2)
189TSB(L2)
E1/SB(L2)
43 SP/L
LOCAL
REMOTE
152TR
152L1
RST
R
S
T
MM189SB(L2)
PCX189SB(L2)
PAX189SB(L2)
P4 GAS/L
P4 GAS/TR
P4 GAS TV/SB(L2)
BX189SB(L2)
SNM189SB(L2)
Psb
27AT/SB(L2)
(schema VT/2)
MM189TSB(L2)
PCX189TSB(L2)
PAX189TSB(L2)
An 27AT/SB(L2)
CBs: automatic opening lock due to P4GAS TV/SB(L2)
TV SB(L2)
A-B-C
189SB(L2)
189TSB(L2)
+ 110 1
- 110 2
CH 189SB(L2) 3
AP 189SB(L2) 4
ccX 189SB(L2) 13
coX 189SB(L2) 14
42RT189SB(L2) 18
BX189SB(L2) 19
SNM189SB(L2) 26
AP.AUT. - IN 40
AP.AUT. - IN 41
AP.AUT. - OUT 42
AP.AUT. - OUT 43
INTBL. A - IN 44
INTBL. A - IN 45
INTBL. A -OUT 46
INTBL. A -OUT 47
INTBL. B - IN 48
INTBL. B - IN 49
INTBL. B -OUT 50
INTBL. B -OUT 51
INTBL. C - IN 52
INTBL. C - IN 53
INTBL. C -OUT 54
INTBL. C -OUT 55
CH 189TSB(L2) 103
AP 189TSB(L2) 104
ccX 189TSB(L2) 113
coX 189TSB(L2) 114
42RT189TSB(L2) 118
BX 189TSB(L2) 119
SNM189TSB(L2) 126
An PRES TENS 129
27 ON SB(L2) 130
27 OFF SB(L2) 131
NOTE: ONLY IF Y2 IS IN STAND-ALONE MODE, INSERT THE JUMPERS 48-49 AND 52-53.

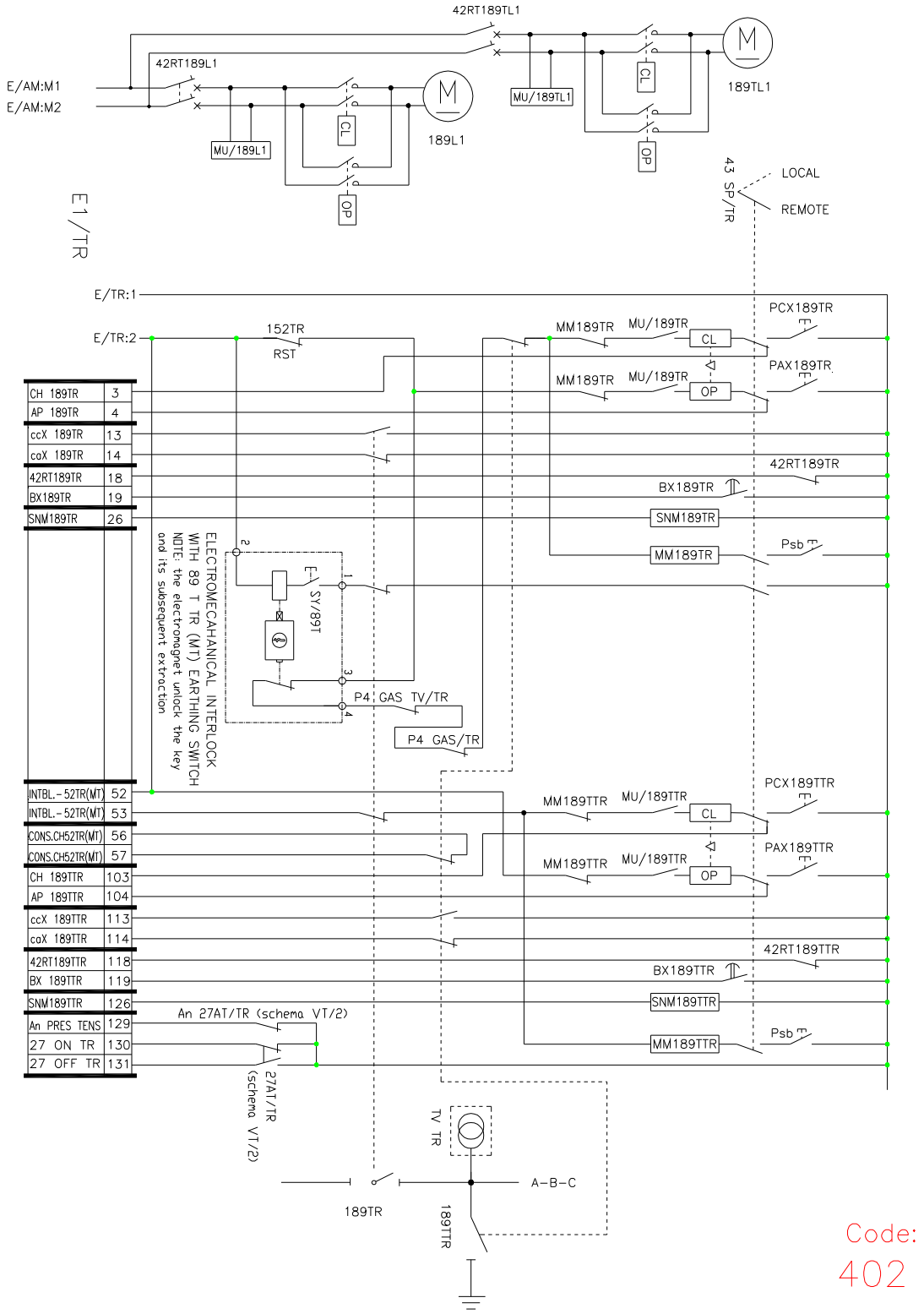
Code:
302


42RT189TSB(L2)
42RT189SB(L2)
E/AM:M1
E/AM:M2
MU/189SB(L2)
CL
OP
189SB(L2)
MU/189TSB(L2)
189TSB(L2)
E1/SB(L2)
43 SP/L
LOCAL
REMOTE
152TR
152L1
RST
R
S
T
MM189SB(L2)
PCX189SB(L2)
PAX189SB(L2)
BX189SB(L2)
SNM189SB(L2)
Psb
P4 GAS/L
P4 GAS/TR
P4 GAS/SB(L2)
27AT/SB(L2)
MM189TSB(L2)
PCX189TSB(L2)
PAX189TSB(L2)
An 27AT/SB(L2)
P1 GAS SB(L2)
A-B-C
NOTE: ONLY IF Y2 IS IN STAND-ALONE MODE, INSERT THE JUMPERS 48-49 AND 52-53.
+ 110 1
- 110 2
CH 189SB(L2) 3
AP 189SB(L2) 4
ccX 189SB(L2) 13
coX 189SB(L2) 14
42RT189SB(L2) 18
BX189SB(L2) 19
SNM189SB(L2) 26
AP.AUT. - IN 40
AP.AUT. - IN 41
AP.AUT. - OUT 42
AP.AUT. - OUT 43
INTBL. A - IN 44
INTBL. A - IN 45
INTBL. A -OUT 46
INTBL. A -OUT 47
INTBL. B - IN 48
INTBL. B - IN 49
INTBL. B -OUT 50
INTBL. B -OUT 51
INTBL. C - IN 52
INTBL. C - IN 53
INTBL. C -OUT 54
INTBL. C -OUT 55
CH 189TSB(L2) 103
AP 189TSB(L2) 104
ccX 189TSB(L2) 113
coX 189TSB(L2) 114
42RT189TSB(L2) 118
BX 189TSB(L2) 119
SNM189TSB(L2) 126
An PRES TENS 129
27 ON SB(L2) 130
27 OFF SB(L2) 131
P1 GAS SB(L2) 135
P4 GAS SB(L2) 136

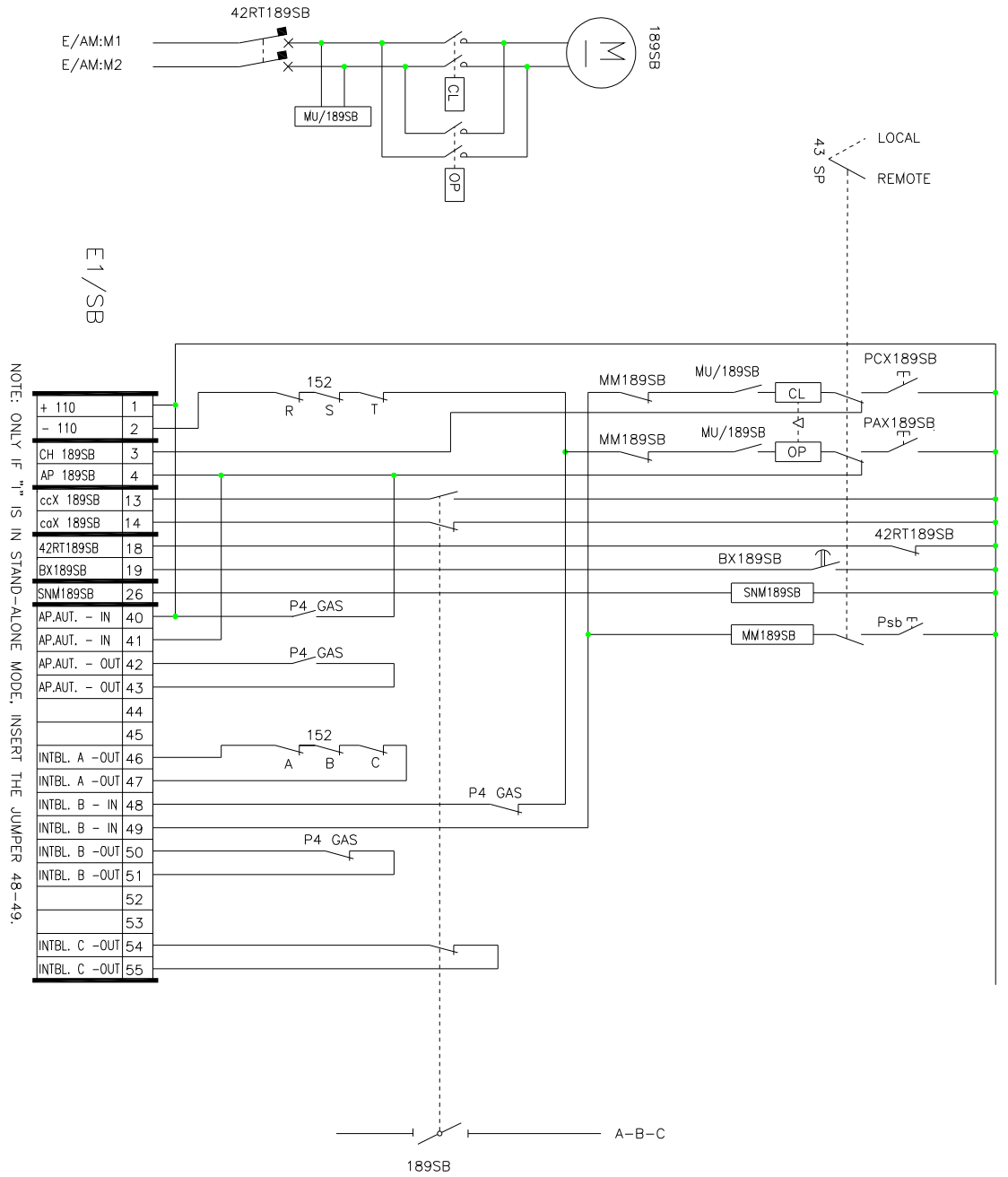
Code:
303


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

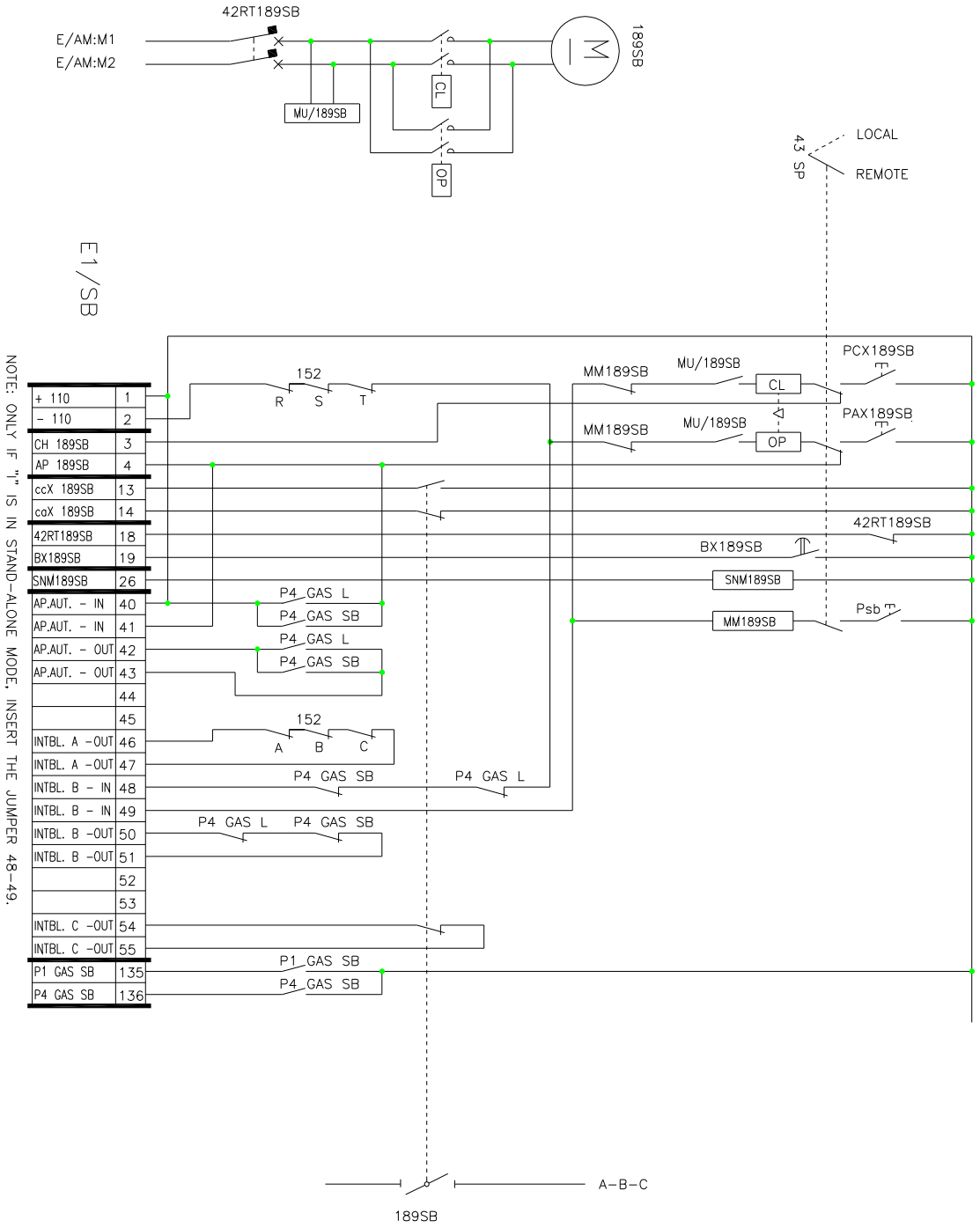
Code:
401


42RT189TL1
42RT189L1
E/AM:M1
E/AM:M2
MU/189L1
CL
OP
189L1
MU/189TL1
189TL1
43 SP/TR
LOCAL
REMOTE
E1/TR
E/TR:1
E/TR:2
152TR
RST
MM189TR
MU/189TR
PCX189TR
PAX189TR
42RT189TR
BX189TR
SNM189TR
Psb
CH 189TR 3
AP 189TR 4
ccX 189TR 13
caX 189TR 14
42RT189TR 18
BX189TR 19
SNM189TR 26
ELECTROMECAHANICAL INTERLOCK WITH 89 T TR (MT) EARTHING SWITCH
NOTE: the electromagnet unlock the key and its subsequent extraction
SY/89T
P4 GAS TV/TR
P4 GAS/TR
INTBL.-52TR(MT) 52
INTBL.-52TR(MT) 53
CONS.CH52TR(MT) 56
CONS.CH52TR(MT) 57
CH 189TTR 103
AP 189TTR 104
ccX 189TTR 113
caX 189TTR 114
42RT189TTR 118
BX 189TTR 119
SNM189TTR 126
An PRES TENS 129
27 ON TR 130
27 OFF TR 131
An 27AT/TR (schema VT/2)
27AT/TR (schema VT/2)
TV TR
A-B-C
189TR
189TTR

Code:
402


42RT189SB
E/AM:M1
E/AM:M2
MU/189SB
CL
OP
189SB
43 SP
LOCAL
REMOTE
E1/SB
NOTE: ONLY IF "I" IS IN STAND-ALONE MODE, INSERT THE JUMPER 48-49.
+ 110 1
- 110 2
CH 189SB 3
AP 189SB 4
ccX 189SB 13
caX 189SB 14
42RT189SB 18
BX189SB 19
SNM189SB 26
AP.AUT. - IN 40
AP.AUT. - IN 41
AP.AUT. - OUT 42
AP.AUT. - OUT 43
44
45
INTBL. A -OUT 46
INTBL. A -OUT 47
INTBL. B - IN 48
INTBL. B - IN 49
INTBL. B -OUT 50
INTBL. B -OUT 51
52
53
INTBL. C -OUT 54
INTBL. C -OUT 55
152
R S T
152
A B C
P4 GAS
P4 GAS
P4 GAS
P4 GAS
MM189SB
MU/189SB
CL
MM189SB
MU/189SB
OP
PCX189SB
PAX189SB
42RT189SB
BX189SB
SNM189SB
MM189SB
Psb
A-B-C
189SB

Code:
501


42RT189SB
E/AM:M1
E/AM:M2
MU/189SB
CL
OP
189SB
43 SP
LOCAL
REMOTE
E1/SB
NOTE: ONLY IF "i" IS IN STAND-ALONE MODE, INSERT THE JUMPER 48-49.
+ 110 1
- 110 2
CH 189SB 3
AP 189SB 4
ccX 189SB 13
coX 189SB 14
42RT189SB 18
BX189SB 19
SNM189SB 26
AP.AUT. - IN 40
AP.AUT. - IN 41
AP.AUT. - OUT 42
AP.AUT. - OUT 43
44
45
INTBL. A -OUT 46
INTBL. A -OUT 47
INTBL. B - IN 48
INTBL. B - IN 49
INTBL. B -OUT 50
INTBL. B -OUT 51
52
53
INTBL. C -OUT 54
INTBL. C -OUT 55
P1 GAS SB 135
P4 GAS SB 136
152
R S T
A B C
MM189SB
MU/189SB
CL
OP
PCX189SB
PAX189SB
42RT189SB
BX189SB
SNM189SB
MM189SB
Psb
P4 GAS L
P4 GAS SB
P1 GAS SB
A-B-C
189SB

Code:
502

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

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

E/AM

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

Code/Codice:
AM

SIDE: BUSBAR
LATO: SBARRA

P1

CT A POLE
TA POLO A

CT B POLE
TA POLO B

CT C POLE
TA POLO C

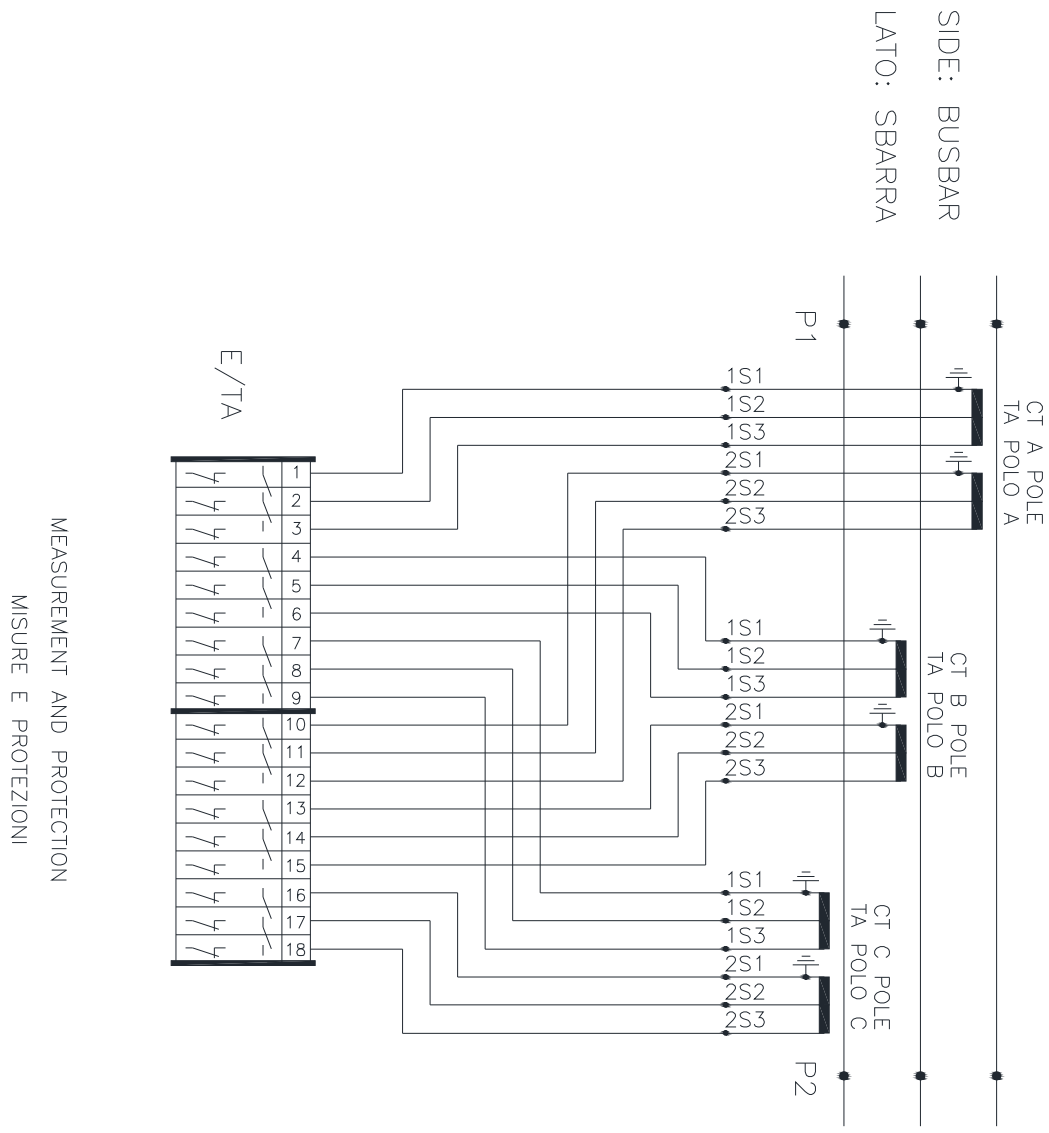
P2

E/TA

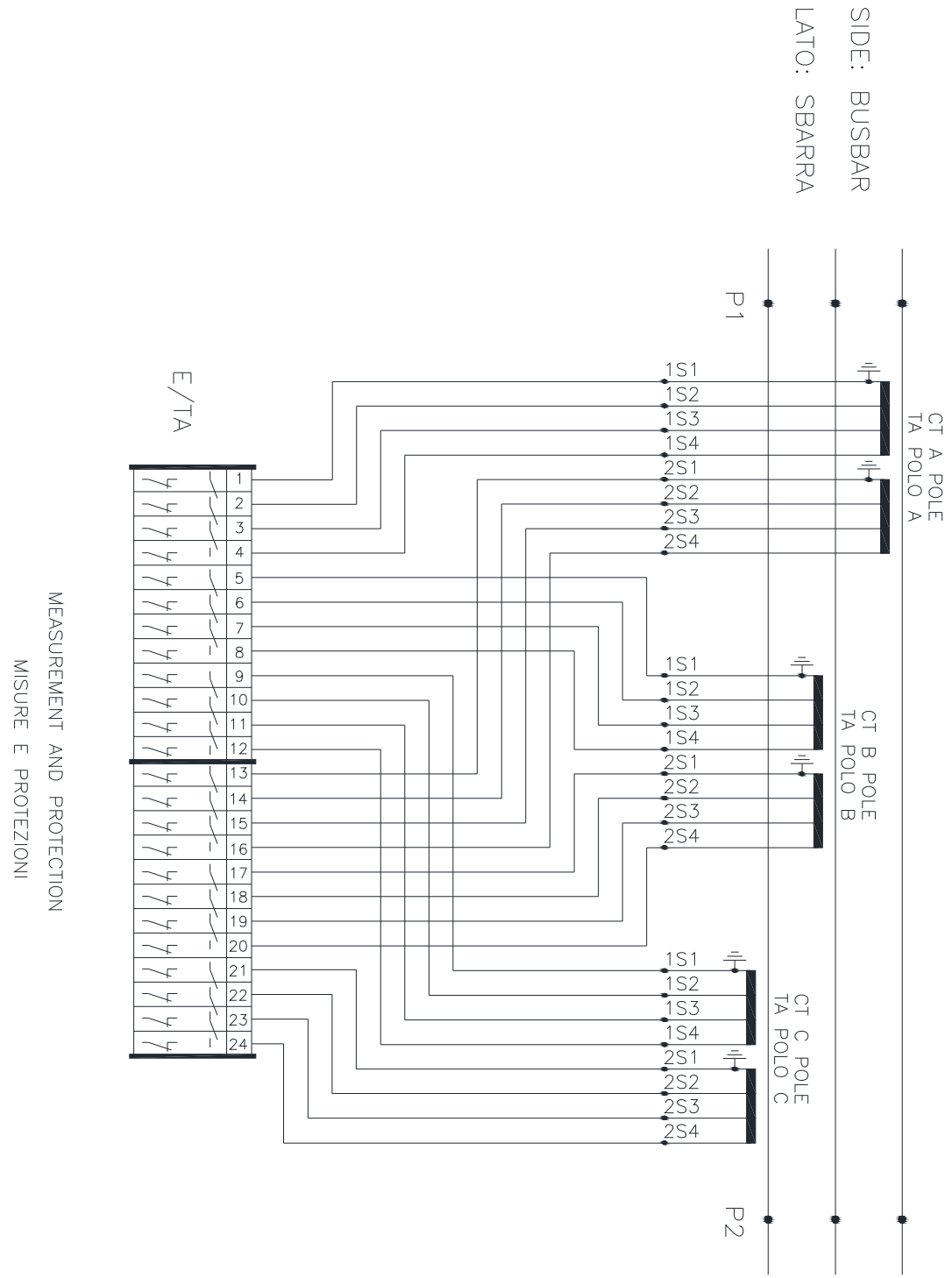
S1	1
S2	2
S3	3
S1	4
S2	5
S3	6
S1	7
S2	8
S3	9

MEASUREMENT AND PROTECTION
MISURE E PROTEZIONI

Code/Codice:
CT/1



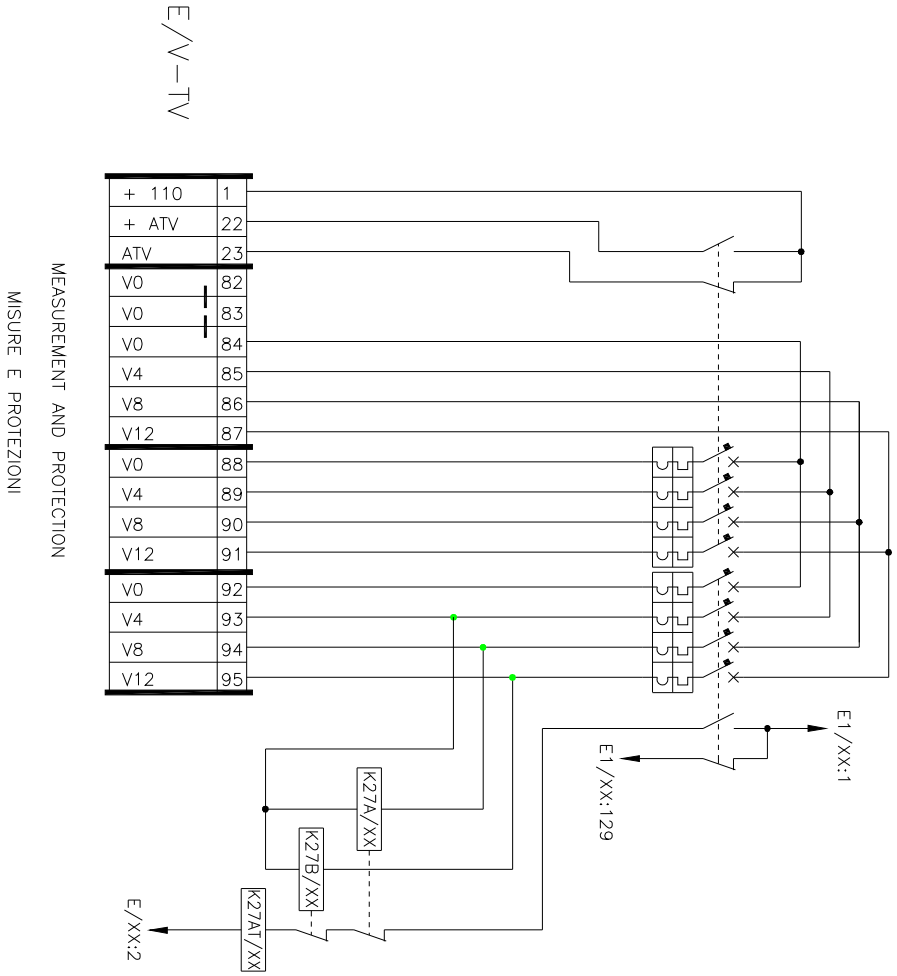
Code/Codice:
CT/2



Code/Codice:
CT/3

Inductive or Capacitor Voltage Transformers Version

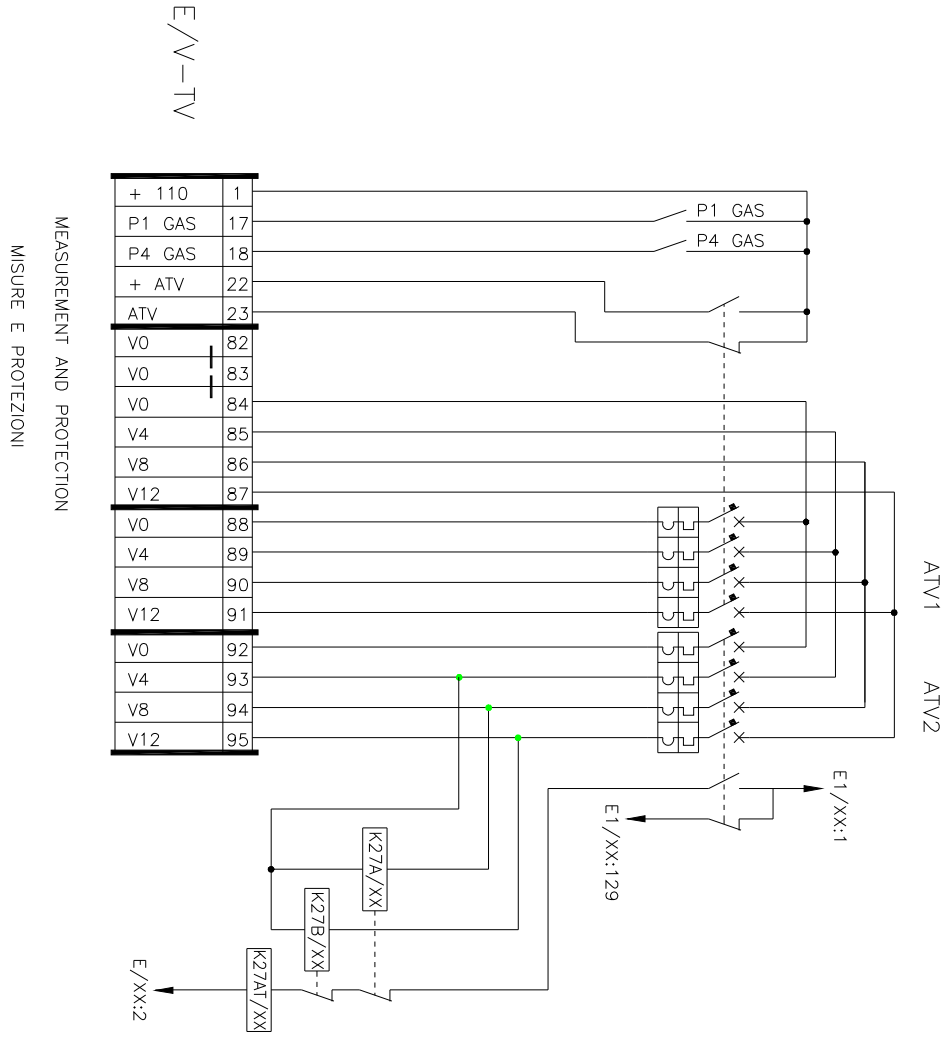
Versione con TV – TVC tradizionali esterni



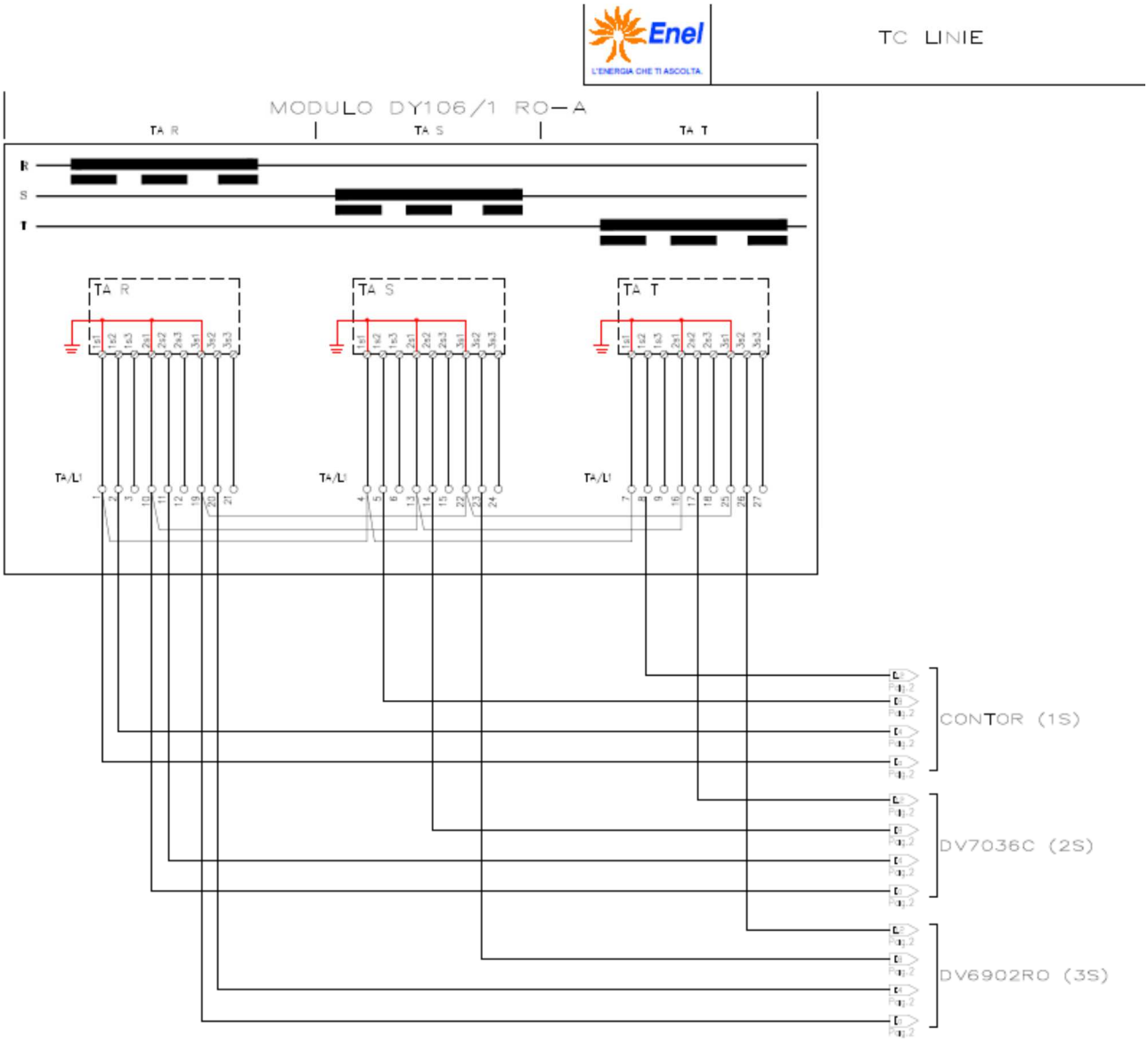
Code/Codice:
VT/1

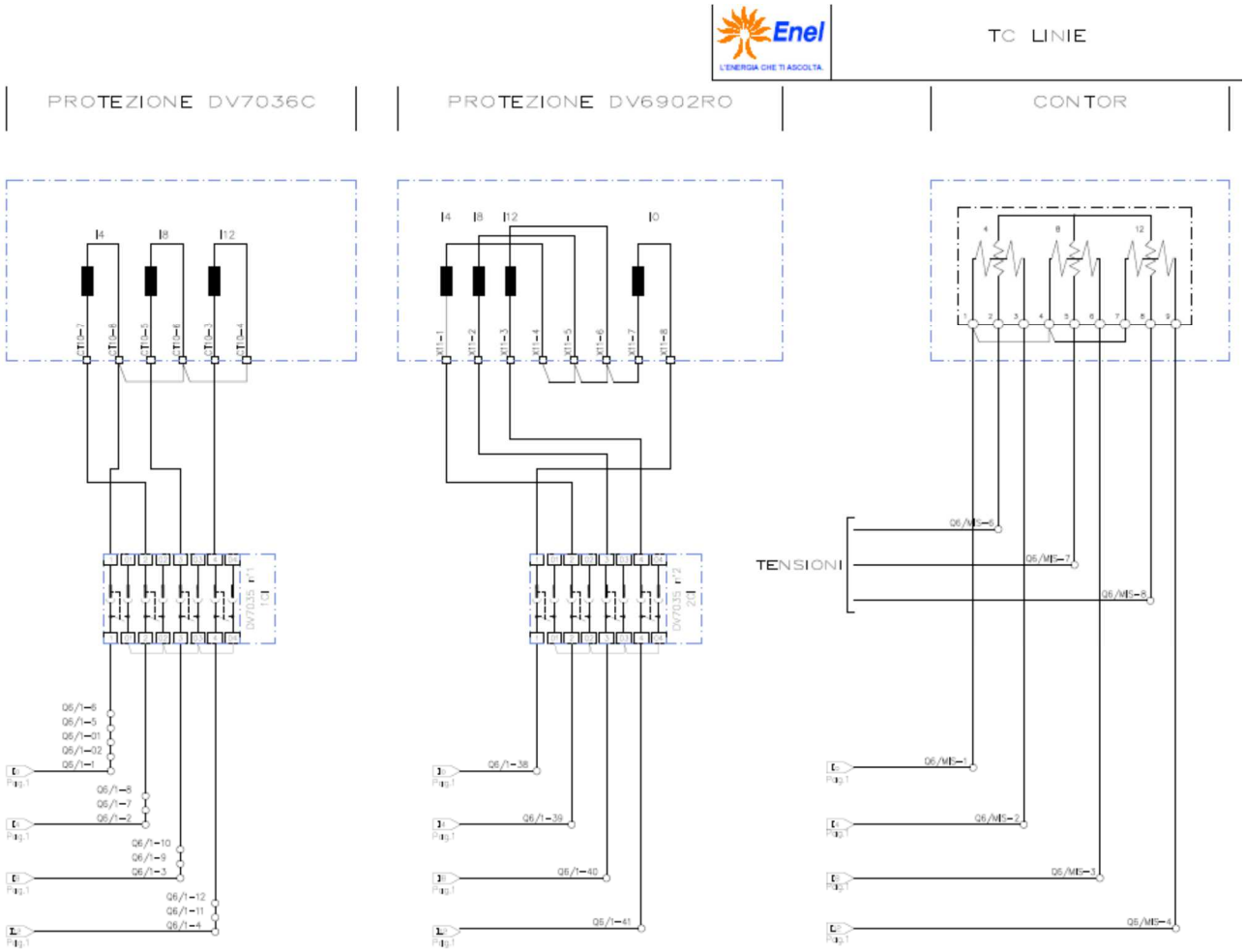
Gas insulated Inductive Voltage Transformers Version

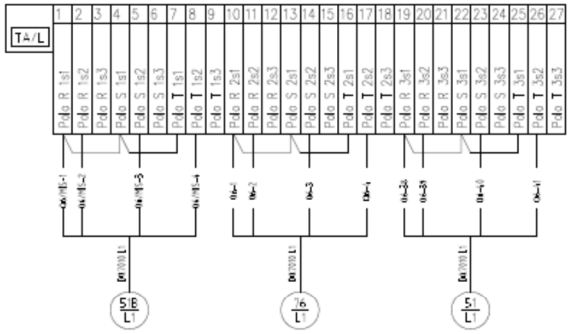
Versione con TV in SF6 e relativa compartimentazione

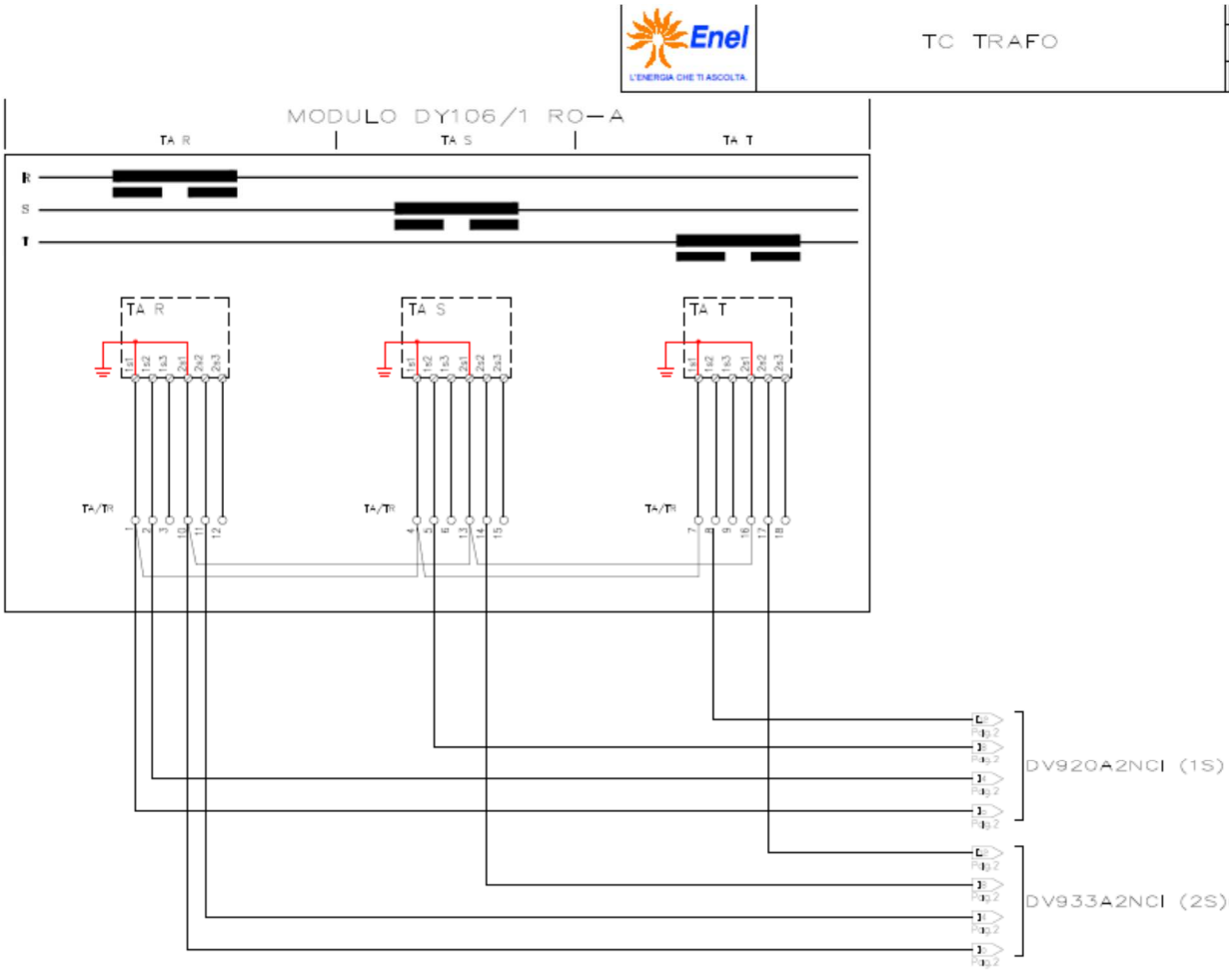


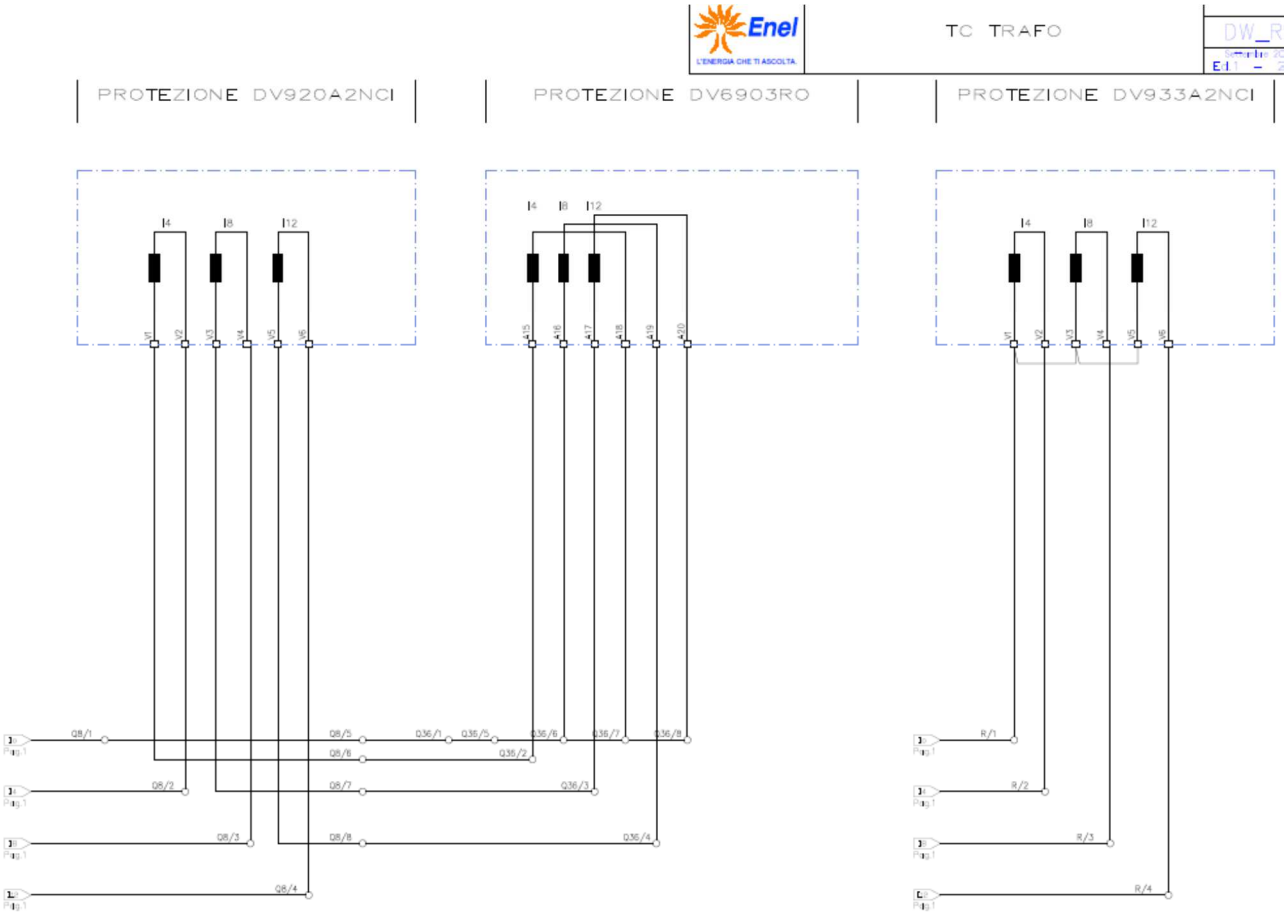
Code/Codice:
VT/2

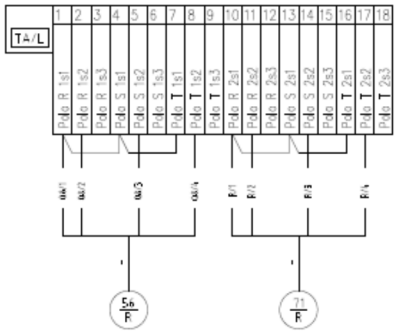

TC LINIE
MODULO DY106/1 RO—A
TA R
TA S
TA T
R
S
T
TA/LI
CONTOR (1S)
DV7036C (2S)
DV6902RO (3S)


TC LINIE
PROTEZIONE DV7036C
PROTEZIONE DV6902RO
CONTOR
TENSIONI

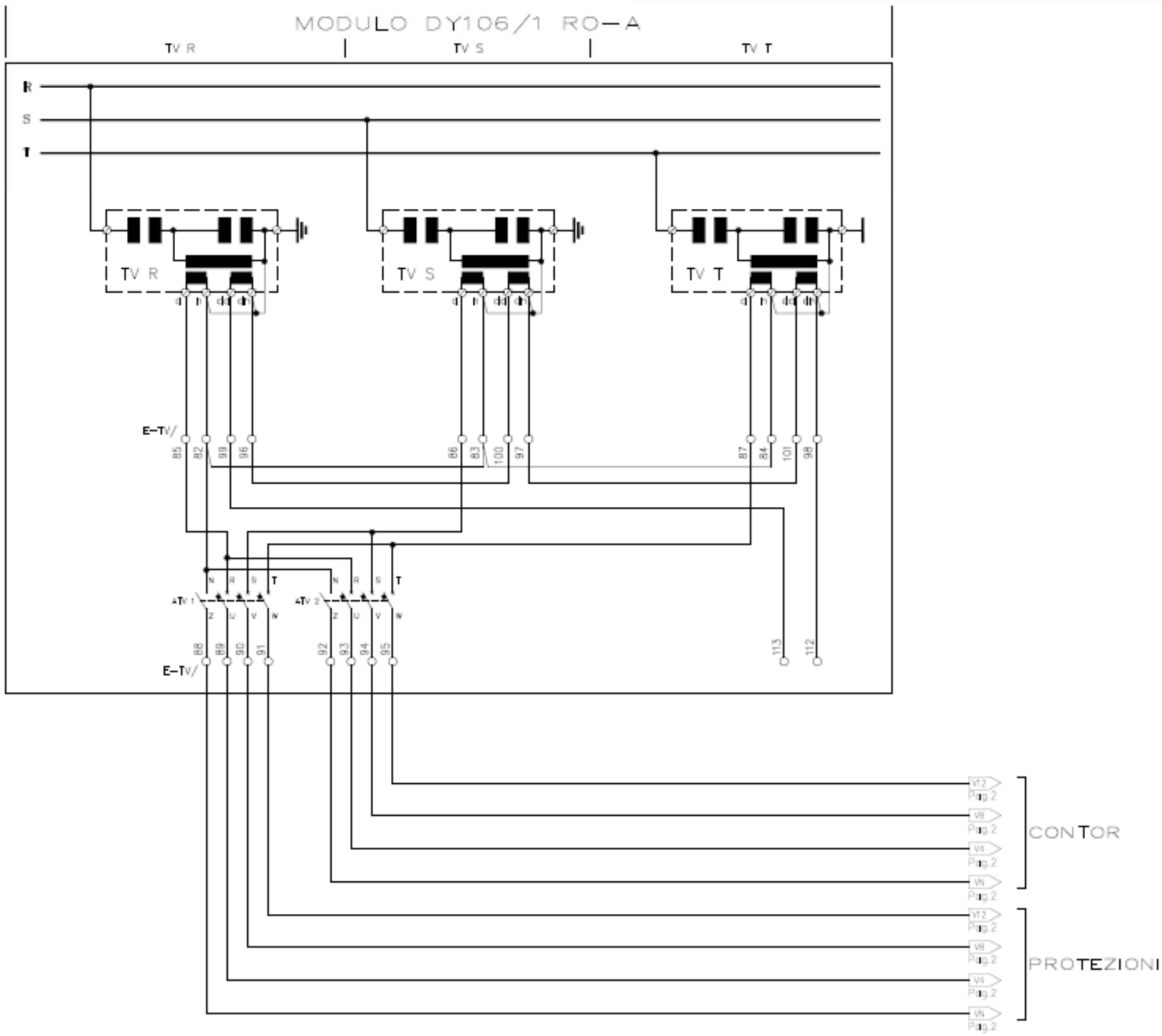

TA/L
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
Pde R 1s1
Pde R 1s2
Pde R 1s3
Pde S 1s1
Pde S 1s2
Pde S 1s3
Pde T 1s1
Pde T 1s2
Pde T 1s3
Pde R 2s1
Pde R 2s2
Pde R 2s3
Pde S 2s1
Pde S 2s2
Pde S 2s3
Pde T 2s1
Pde T 2s2
Pde T 2s3
Pde R 3s1
Pde R 3s2
Pde R 3s3
Pde S 3s1
Pde S 3s2
Pde S 3s3
Pde T 3s1
Pde T 3s2
Pde T 3s3

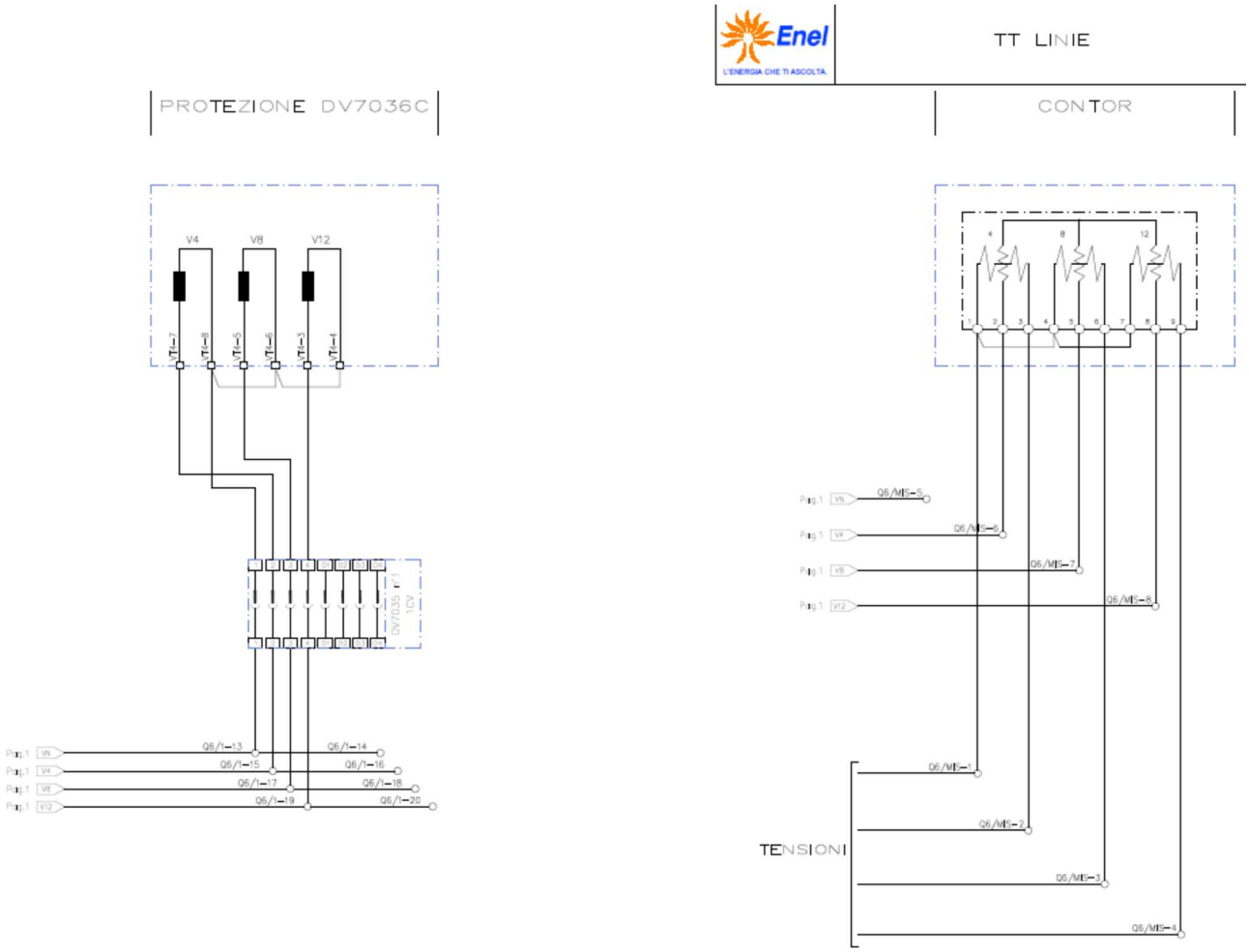

TC TRAFO
MODULO DY106/1 RO-A
TA R
TA S
TA T
R
S
T
TA/TR
DV920A2NCI (1S)
DV933A2NCI (2S)

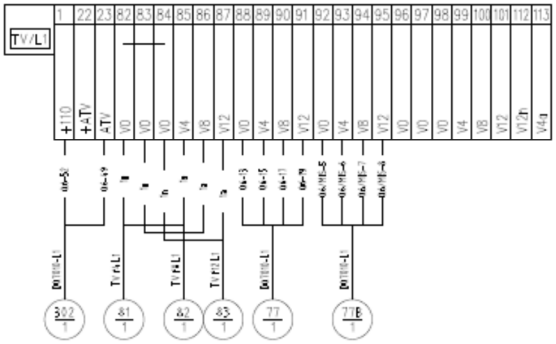

TC TRAFO
PROTEZIONE DV920A2NCI
PROTEZIONE DV6903RO
PROTEZIONE DV933A2NCI


TA/L
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
Pdo R 1s1
Pdo R 1s2
Pdo R 1s3
Pdo S 1s1
Pdo S 1s2
Pdo S 1s3
Pdo T 1s1
Pdo T 1s2
Pdo T 1s3
Pdo R 2s1
Pdo R 2s2
Pdo R 2s3
Pdo S 2s1
Pdo S 2s2
Pdo S 2s3
Pdo T 2s1
Pdo T 2s2
Pdo T 2s3
56
F
71
F

TT LINIE


MODULO DY106/1 RO—A
TV R
TV S
TV T
R
S
T
TV R
TV S
TV T
E—TV/
ATV 1
ATV 2
E—TV/
CONTOR
PROTEZIONI

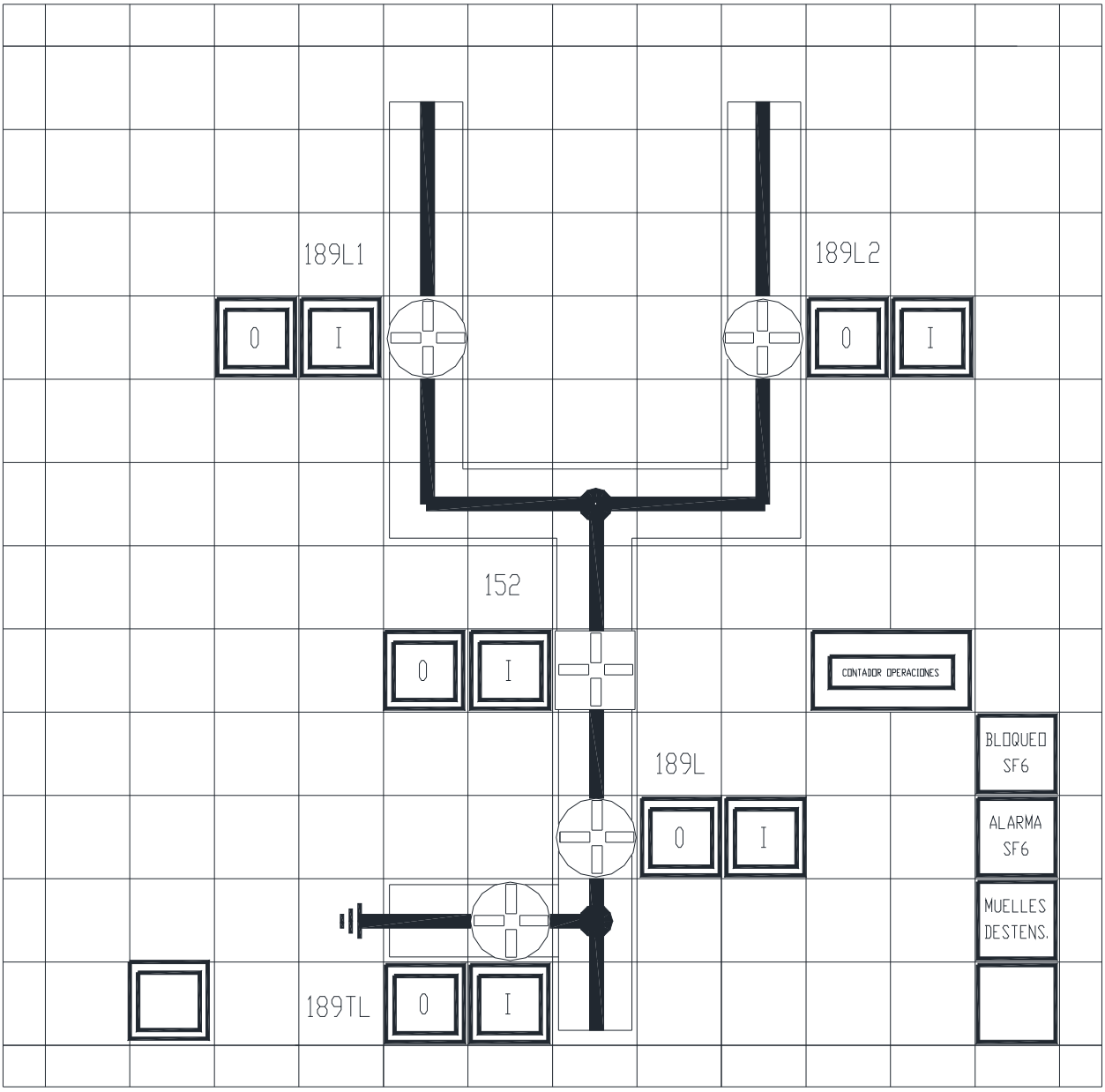

Enel
L'ENERGIA CHE TI ASCOLTA
TT LINIE
PROTEZIONE DV7036C
CONTOR
V4
V8
V12
TENSIONI


TV/LI
1 22 23 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 112 113
+110
+4TV
-4TV
V0
V0
V0
V4
V8
V12
V0
V4
V8
V12
V0
V4
V8
V12
V0
V0
V0
V4
V8
V12
V12h
V4-3
302
81
82
83
77
77B

ANNEX E – SYNOPTIC EXAMPLES

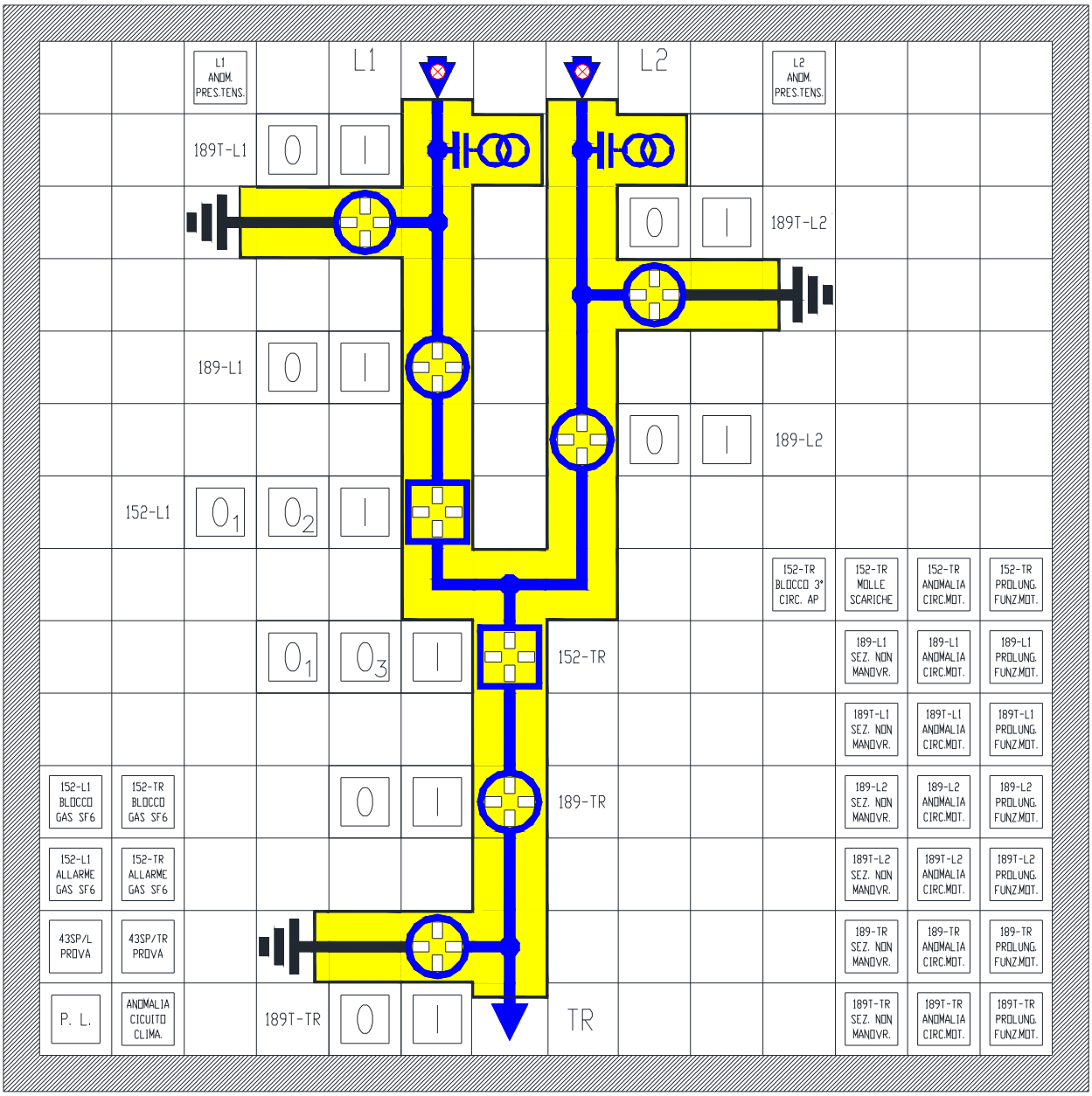
E.1 – ENDESA SYNOPTIC EXEMPLES

Example of Y1 type – used in Line bay

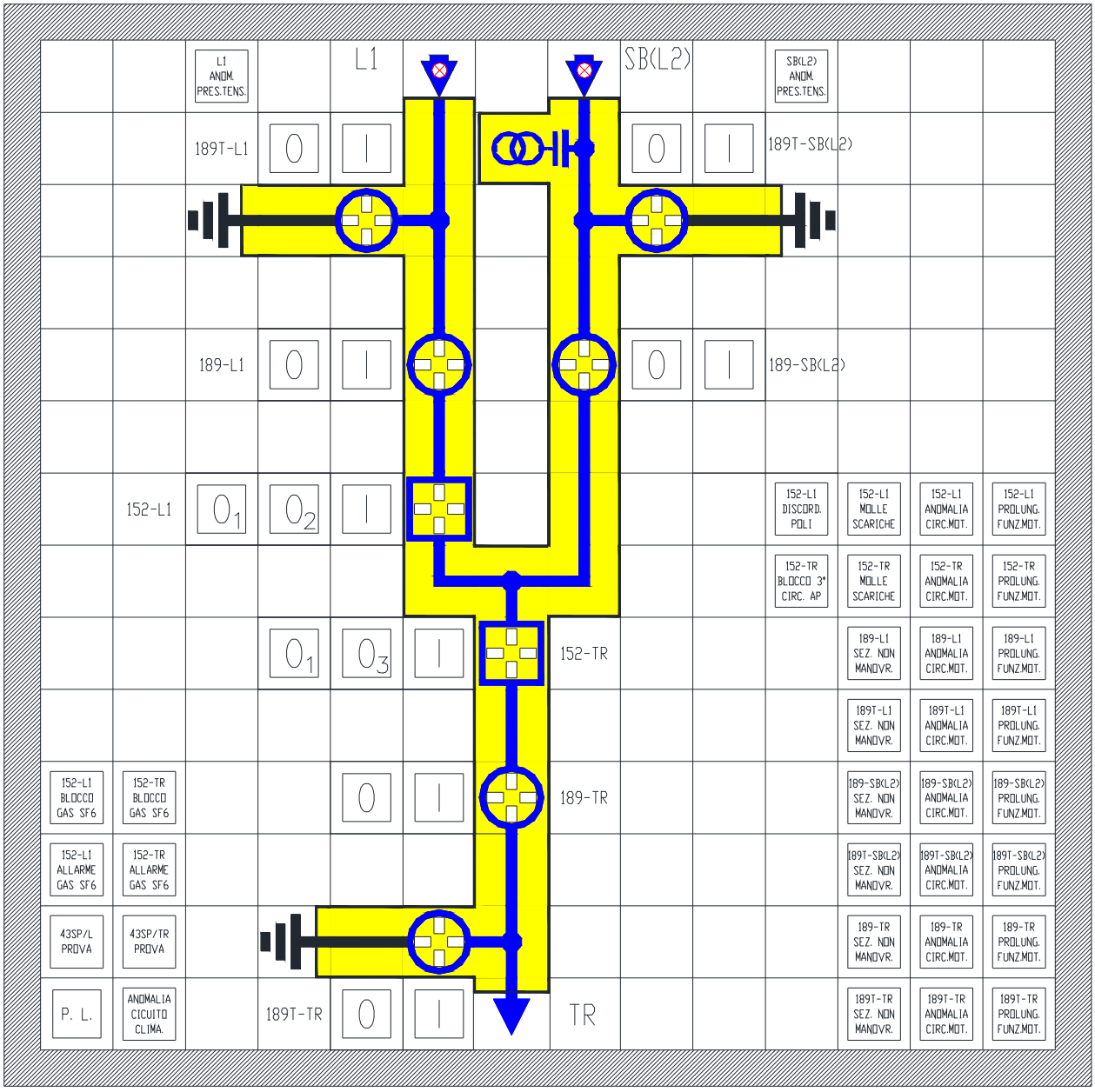


E.2 – ENEL DISTRIBUTIE, ENEL DISTRIBUZIONE AND LATAM SYNOPTIC EXEMPLES

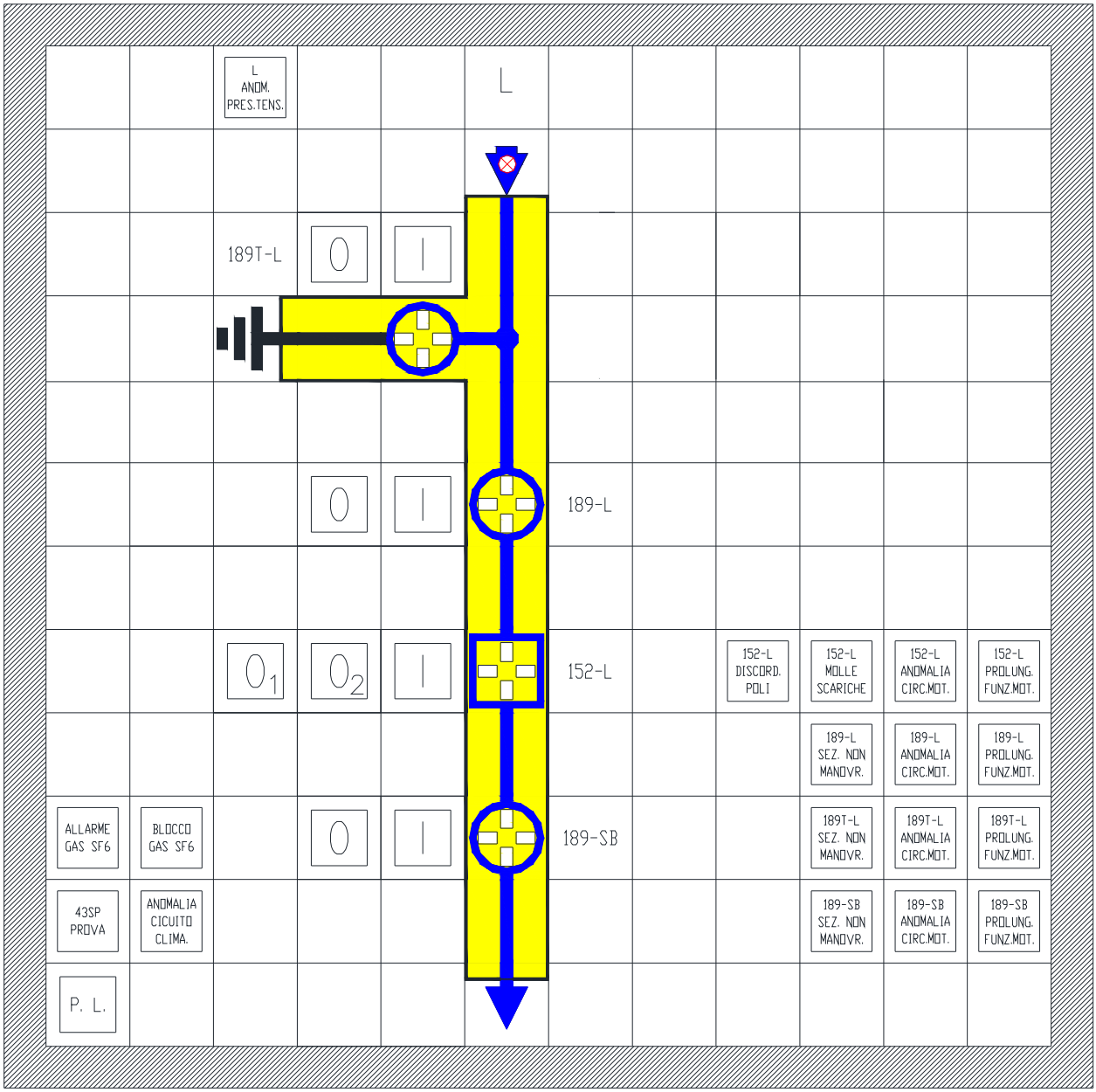
Example of Y1 type: Line 1 bay, Line 2 bay, Transformer bay



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



Example of Single-bay type: Line bay, Busbar bay



ANNEX F – TENDER'S TECHNICAL DOCUMENTATION

GLOBAL STANDARD: GSH002 – HYBRID MODULES		**TENDER:**	
SUPPLIER:		**FACTORY:**	
RATED VOLTAGE FOR EQUIPMENT Ur (kV):		**SUPPLIER MODEL:**	
TECHNICAL CHARACHTERISTIC		***STANDARD REQUIREMENT***	***SUPPLIER OFFER***
Service conditions			
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	
Common general ratings			
Rated short-duration power-frequency withstand voltage Ud (kV rms):	Phase-to-earth, across open switching device and between phases		
	Across the isolating distance		
Rated lightning impulse withstand voltage Up (kVp):	Phase-to-earth, across open switching device and between phases		
	Across the isolating distance		
Rated frequency fr (Hz)		50 and 60	
Rated normal current Ir (A)		2.000	
Rated short-time withstand current Ik (kA)			
Degrees of protection provided by enclosures (IEC 60529)		IP54	
Protection stage (tab. 104 EN 62271-203)		2	
Maximum SF6 leakage rate (% / year)		≤ 0,5%	
HV Single-line diagram			To enclose a HV single-line diagram for each one of the detailed layout examples in Annex B.2
Dimensions		See Annex C	To enclose an overall equipment drawing for each one of the detailed layout examples in Annex B.2
Circuit breakers			
Rated short-circuit breaking current Isc (kA)			
First-pole-to-clear factor kpp			
Rated operating sequence		O - 0,3 s- CO -1 min - CO	
Maximum break-time (ms)		60	

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	
Disconnectors and earthing switches			
Opening (closing) time for motor operation (s)		≤ 15	
Disconnector mechanical endurance class Mr		M1	
Bus-transfer current switching by disconnectors (only if requested)	Rated bus-transfer current for disconnectors (A)	Clause B.4.106.1 of IEC 62271-102	
	Rated bus-transfer voltages for disconnectors (V)	Clause B.4.106.1 of IEC 62271-102	
Earthing switches class		E0 – M1 – A	
SF6-air Bushings			
Insulators materials		Composite	
Bus ducts			To enclose an overall equipment drawing of a solution with bus-ducts
Cable connections			To enclose an overall equipment drawing of a solution with cable connections
Current transformers			
Rated short-time thermal current Ith (kA)		40	
Rated continuous thermal current Icth (kA)		120% of Ipr	
Core number		1 or 2	
Voltage transformers			
Secondary windings		1, 2 or 3	
Rated voltage factor Fv		1,5 (rated time 30 s)	

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 95kV
Tensione massima di riferimento per l'isolamento U_m	170 kV
Tensione nominale di tenuta a frequenza industriale	325 kV
Tensione nominale di tenuta ad impulso atmosferico	750 kV
Frequenza nominale	50 Hz
Rapporto di trasformazione nominale	$\frac{150.000}{\sqrt{3}} / \frac{100}{\sqrt{3}}$
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

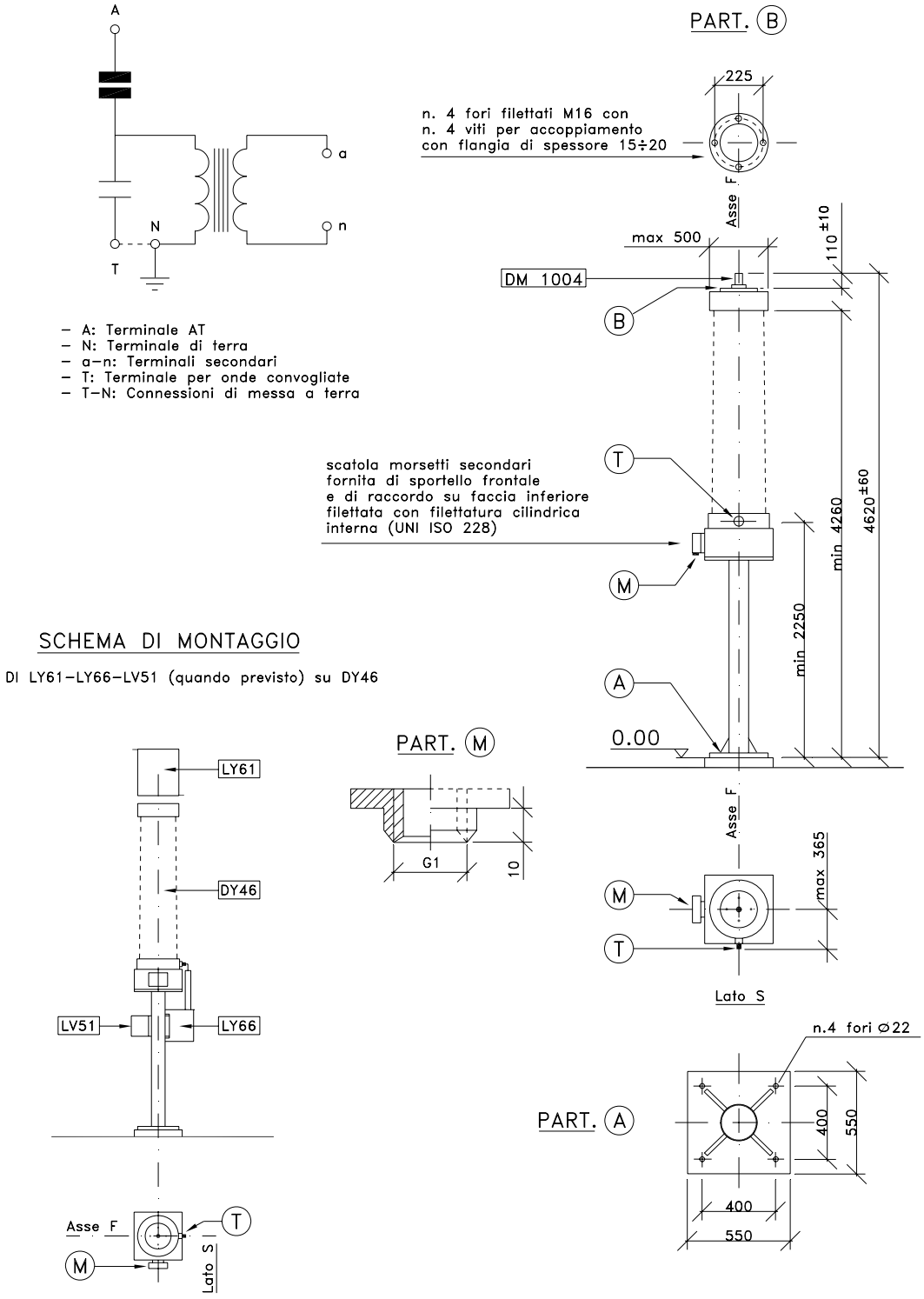
1 Le diciture "asse F" e "lato S" riportate nel disegno a pagina seguente saranno utilizzate per fornire le istruzioni per una corretta disposizione dell'apparecchio.
2 Gli apparecchi devono essere provvisti di sostegno
3 Norme e Prescrizioni di riferimento:
- Norma CEI EN 60044-5
- Prescrizione per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

4 Unità di misura: numero di esemplari (n)

2 DESCRIZIONE RIDOTTA

T	V		C	A	P	A	C		1	3	2	k	V		A		U	E														

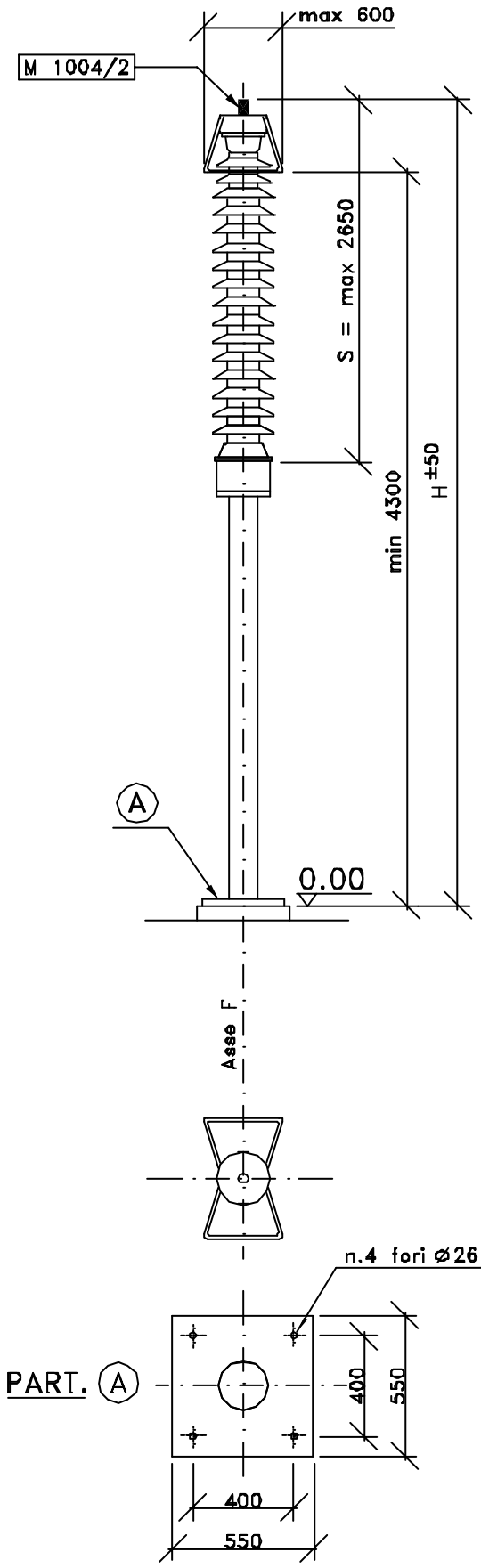
3 SCHEMA E DISEGNO DI INGOMBRO



SPECIFICA DI COSTRUZIONE

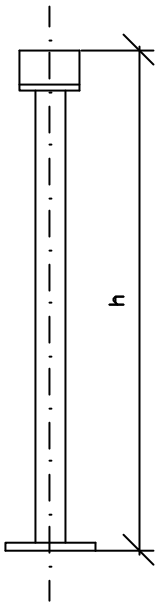
SCARICATORI AD OSSIDO METALLICO SENZA SPINTEROMETRI PER CABINE PRIMARIE CON TENSIONE NOMINALE 150 kV

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 150kV OSSIDO MET C/SOST CA XX NUE

MATRICOLA		17 01 35	17 01 36
TIPO		59/1	59/2
GRANDEZZE NOMINALI			
Tipo di isolamento		composito	porcellana
Salinità di tenuta alla tensione di 95 kV	(kg/m^3)	56	56
Tensione di servizio continuativo	(kV)	110	
Frequenza nominale	(Hz)	50	
Corrente nominale di scarica	(kAcr)	10	
Tensione temporanea per la durata di 1 s	(kV)	158	
Massima tensione residua alla corrente nominale di scarica (onda 8/20 μs)	(kVcr)	396	
Massima tensione residua all'impulso di corrente a fronte ripido (10 kAcr – fronte 1 μs)	(kVcr)	455	
Massima tensione residua all'impulso di corrente di manovra (500 Acr, 30/60 μs)	(kVcr)	318	
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	

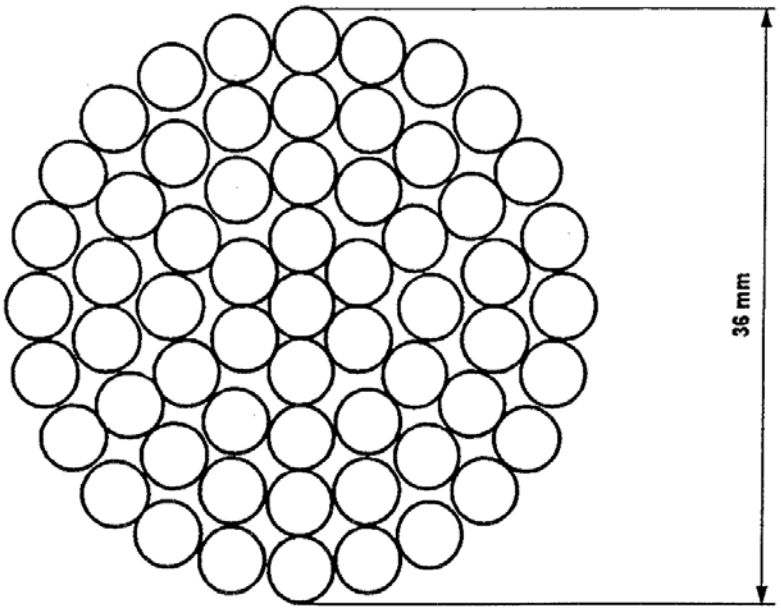
1 – La dicitura "Asse F" sarà utilizzata per fornire istruzioni per una corretta disposizione dell'apparecchio

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)

UNIFICAZIONE ENEL	CONDUTTORE A CORDA DI ALLUMINIO CRUDO Ø 36	31 42 A LC 5 Gennaio 1995 Ed.5 - 1/1



N. MATRICOLA	31 42 10

FORMAZIONE	61 x 4,00
SEZIONE TEORICA (mm^2)	766,5
MASSA TEORICA (kg/m)	2,118
RESISTENZA ELETTR. TEORICA A 20 °C (Ω/km)	0,03770
CARICO DI ROTTURA (daN)	10970
MODULO ELASTICO FINALE (N/mm^2)	55000
COEFFICENTE DI DILATAZIONE (1/°C)	23×10^{-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

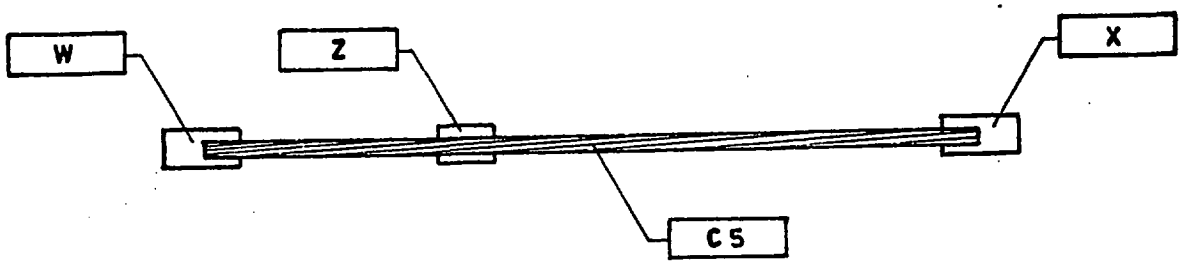
4 - Imballo e pezzature: bobine da 2.000 m (salvo diversa prescrizione in sede di ordinazione)

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

Descrizione ridotta: CORDA AL DIAM 36 UE

COLLEGAMENTI IN CORDA Ø 36 A LUNGHEZZA VARIABILE

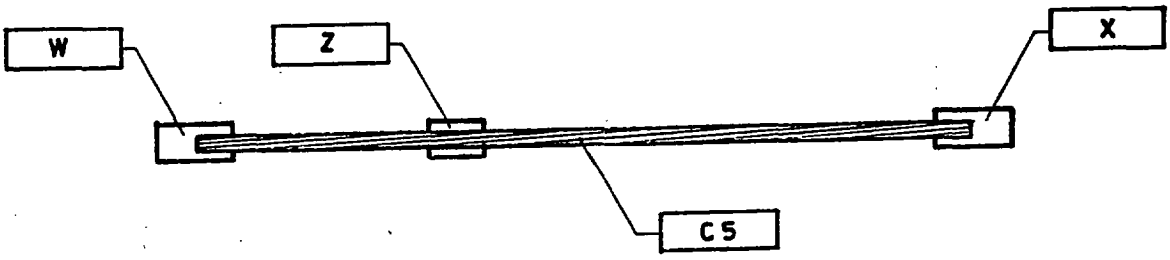
21 XX D
LC 1302
Marzo 1973
Ed. 1 - 1/1



TIPO	ELENCO MATERIALI					
	W	X	Z	C 5		
				m		kg
				min	max	max
1302/1	–	M1020	M1013	10,5	15,5	34
/2	–	M1020	–	9,0	15,0	33
/3	–	M1020	M1013	6,0	14,0	30
/4	–	M1020	M1013	4,0	5,0	11
/5	–	M1020	–	9,5	11,0	24
/6	–	M1020	M1013	10,0	14,0	30
/7	–	M1020	M1013	15,0	20,0	43
/8	–	M1020	–	13,5	19,5	42
/9	–	M1020	M1013	11,0	18,5	40
/10	–	M1020	M1013	10,0	11,0	24
/11	–	M1020	M1013	15,5	17,0	37
/12	–	M1020	M1013	16,0	19,5	42
/13	–	M1020	–	8,5	15,0	33
/14	–	M1020	–	11,5	21,0	45
/15	–	M1020	–	12,5	16,5	36
/16	–	M1020	–	14,5	23,0	50
/17	–	M1020	–	12,0	15,0	33
/18	–	M1020	–	15,0	21,5	47
/19	–	M1020	–	12,0	17,5	38
/20	–	M1020	–	14,5	24,0	52
/21	–	M1020	–	8,5	12,5	27
/22	–	M1020	–	12,0	19,0	41

COLLEGAMENTI IN CORDA Ø 36 A LUNGHEZZA FISSA

21 XX C
LC 1301
Marzo 1973
Ed. 1 - 1/1

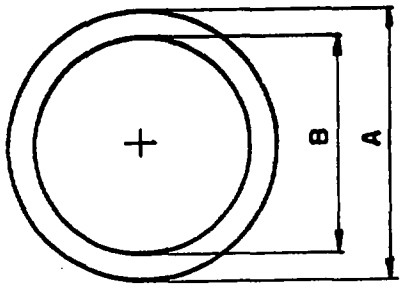


TIPO	ELENCO MATERIALI				
	W	X	Z	C 5	
				m	kg
1301/1	–	M1020	M1013	11,0	24
/2	–	M1020	–	11,5	25
/3	–	M1020	M1013	15,5	34
/4	–	M1020	–	17,5	38
/5	–	M1020	M1013	13,0	28
/6	–	M1020	–	12,0	26
/7	–	M1020	M1013	10,5	25
/8	–	M1020	M1013	16,0	35
/9	–	M1020	–	18,0	39
/10	–	M1020	M1013	15,0	33
/11	–	M1020	–	11,0	24
/12	–	M1020	M1013	13,0	28
/13	–	M1020	–	15,5	34
/14	–	M1020	M1013	19,0	41
/15	–	M1020	–	12,0	26
/16	–	M1020	M1013	13,5	29
/17	–	M1020	–	10,0	22
/18	–	M1020	–	16,0	35
/19	–	M1020	M1013	19,5	42
/20	–	M1020	–	14,5	32

La lunghezza di taglio del conduttore deve essere rilevata di volta in volta nell'impianto; la lunghezza riportata in tabella è approssimata per eccesso e definisce l'elenco materiali.

CONDUTTORI RIGIDI DI LEGA DI ALLUMINIO PER CONNESSIONI

31 57 A
LC 1050
Marzo 1973
Ed. 1 - 1/3



DIMENSIONI (mm)	A	40	70	100	100	150
	B	30	60	90	86	140
TOLLERANZE (mm) (UNI 3879)	SUL DIAMETRO ESTERNO	±0,5	±0.8	±1,0	±1,0	±1,3
	SULLO SPESSORE	±0,5	±0,5	±0,5	±0,7	±0,5
SEZIONE TEORICA (mm^2)		549,8	1021,0	1492,2	2045,1	2277,6
PESO TEORICO (kg/m)		1,48	2,76	4,03	5,52	6,15
RESISTENZA ELETTRICA A 20°C (Ω/km)		0,05911	0,03183	0,02178	0,01589	0,01427
MOMENTO D' INERZIA (cm^4)		8,59	54,24	168,8	222,4	599,3
MODULO DI ELASTICITA' (kg/mm^2)		6700				
COEFFICIENTE DI DILATAZIONE (1/°C)		$23 \cdot 10^{-6}$				

MATRICOLA	TIPO	DIMENSIONI (mm)			PESO TEORICO (kg)
		A	B	LUNGHEZZA (*)	
31 57 02	1050/1	40	30	1500^{+4}	2.22
31 57 03	1050/2			2200^{+4}	3.26
31 57 04	1050/4			2600^{+4}	3.85
31 57 09	1050/7			3600^{+4}	5.33
31 57 10	1050/9			3900^{+4}	5.77
31 57 13	1050/11			5600^{+6}	8.29
31 57 14	1050/13			6300^{+6}	9.32
		70	60		
31 57 55	1050/41	100	90	1200^{+4}	4.84
31 57 59	1050/43			3200^{+4}	12.90
31 57 62	1050/46			4600^{+6}	18.54
31 57 63	1050/48			5300^{+6}	21.36
31 57 64	1050/49			5600^{+6}	22.57
31 57 68	1050/53			9100^{+6}	36.68
31 57 70	1050/55			10100^{+6}	40.70
31 57 72	1050/58			10700^{+6}	43.12
31 57 73	1050/59			11000^{+6}	44.33
31 57 75	1050/60			12400^{+6}	49.98

MATRICOLA	TIPO	DIMENSIONI (mm)			PESO TEORICO (kg)
		A	B	LUNGHEZZA (*)	
31 57 42	1050/73	100	86	5500^{+6}	30.36
31 57 44	1050/76			8100^{+6}	44.72
31 57 47	1050/84			11100^{+6}	61.28
31 57 48	1050/86			11700^{+6}	64.59
31 57 82	1050/92	150	140	3950^{+5}	24.29
31 57 85	1050/96			8000^{+8}	49.20
31 57 86	1050/97			9500^{+8}	58.42
31 57 88	1050/99			14000^{+8}	86.10

(*) Unitamente alla lunghezza nominale è indicata la tolleranza ammessa in eccesso; in conformità alla tabella UNI 3879 non è ammessa tolleranza in difetto.

1 - Materiale : Lega Alluminio-Magnesio-Silicio primaria da lavorazione plastica P-Al Mg Si-UNI 3569-66-Stato TA 16.

2 - Prescrizioni per la fornitura ed il collaudo : Norme CEI 7-4

3 - L'Unità di misura con la quale deve essere espressa la quantità del materiale è il numero di esemplari (n)

Esempio di designazione abbreviata: TUBO LEGAL D150/140L3,95UE

UNIFICAZIONE

ENEL

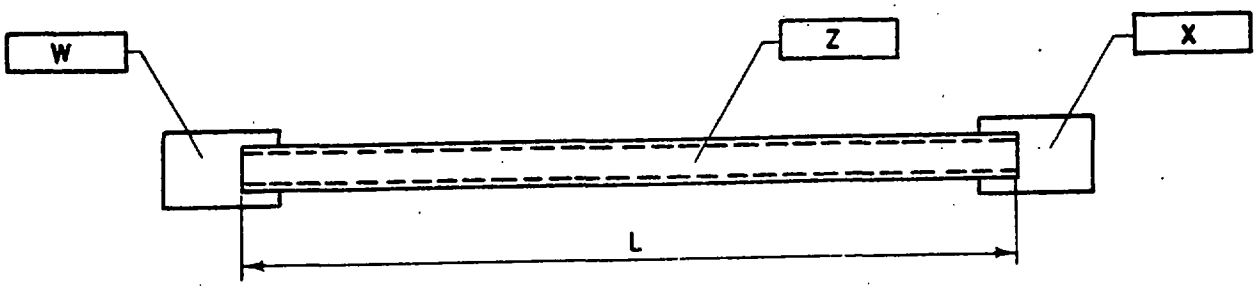
COLLEGAMENTI IN TUBO Ø 100/90

21 XX B

LC 1221

Marzo 1973

Ed. 1 - 1/1



TIPO	ELENCO MATERIALI			L (mm)
	W	X	Z	
1221/1	M1035	–	1050/59	11000
/2	M1032	M1035	/58	
/3	M1032	–	/48	
/4	M1035	M1033	/46	
/5	–	M1033	/55	
/6	M1032	M1031	/58	
/7	M1032	M1031	/48	
/8	M1031	M1032	/55	
/9	M1031	M1032	/46	
/10	M1033	M1035	/58	
/11	–	M1032	/55	
/12	M1033	–	/48	
/13	M1035	M1032	/46	
/14	M1032	M1032	/46	
/15	M1035	M1033	/53	
/16	M1035	–	/49	5500
/17	M1035	–	/53	9000
/18	M1033	M1035	/53	5550
/19	M1031	–	/49	
/20	M1035	M1032	/53	
/21	M1032	M1032	/53	
/22	M1032	M1032	/43	
/23	M1035	M1087	/53	8890
/24	M1035	–	/60	12400
/25	M1087	–	/43	2990
/26	M1033	–	/53	
/27	M1035	–	/55	9400
/28	–	M1088	/41	1200

In considerazione delle tolleranze ammesse sulle opere di fondazione, sui sostegni e sulle apparecchiature, è bene controllare di volta in volta l'esatta lunghezza di taglio del conduttore che puo differire da quella nominale indicata in tabella.

DIREZIONE DELLE COSTRUZIONI - CENTRO NAZIONALE STUDI E PROGETTI

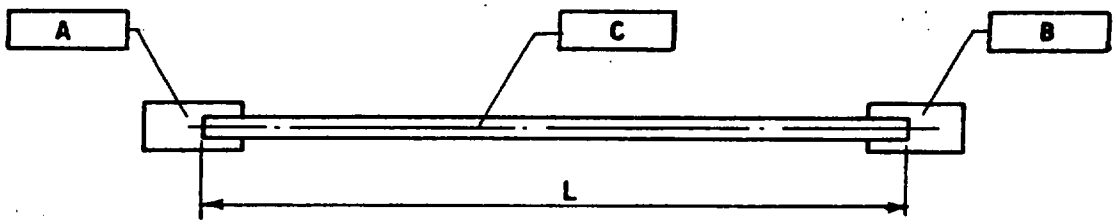
TIPO	SCHEMA	ELENCO MATERIALI			θ	DIMENSIONI (mm)					
		A	B	C		H	L	M	N	P	SVILUPPO
1201/1	a	M1086/1	M1086/2	1050/4	–	–	2345	–	–	–	2345
1201/2		M1084/1	M1084/1	1050/11	–	–	5530	–	–	–	5530
1201/3		M1084/1	M1084/1	1050/2	–	–	2080	–	–	–	2080
1201/4		M1085	M1034/1	1050/11	–	–	5500	–	–	–	5500
1201/21	b	M1084/1	–	1050/9	45°	2000	3015	370	370	2575	3820
1201/22		M1084/1	M1084/1	1050/7	60°	VAR	VAR	120	VAR	VAR	VAR
1201/23		M1084/1	M1084/1	1050/4	VAR	VAR	VAR	VAR	VAR	VAR	VAR
1201/41	c	M1086/1	M1084/1	1050/7	–	2500*	565	2090	245	–	2840
1201/42		M1085	M1084/1	1050/1	–	VAR	VAR	VAR	VAR	–	VAR
1201/61	d	M1086/1	M1084/1	1050/11	–	2500*	2765	350	705	2460	4020
1201/62		M1086/1	M1084/1	1050/13	–	2500*	4965	350	2905	2460	6220
1201/71	e	–	M1084/1	1050/7	–	–	–	–	–	–	VAR
1201/72		–	M1084/1	1050/7	–	–	–	–	–	–	VAR
1201/73		–	M1084/1	1050/7	–	–	–	–	–	–	VAR

Alcune dimensioni, relative a quei collegamenti che connettono apparecchiature per le quali non è definita la posizione dei codoli, sono variabili e sono pertanto indicate con la sigla VAR; le esatte dimensioni necessarie per sagomare questi collegamenti devono essere rilevate di volta in volta. In generale è anche bene effettuare di volta in volta un controllo delle dimensioni non variabili, poichè queste possono in pratica presentare qualche differenza rispetto ai valori reali in considerazione delle tolleranze ammesse sulle opere di fondazione, sui sostegni e, ancor più, sulle apparecchiature.

In particolare le dimensioni H segnate con asterisco sono sicuramente maggiori del necessario in quanto sono state calcolate ipotizzando freccia nulla per le sbarre da cui i collegamenti in questione si derivano.

In ogni caso negli elenchi materiali non vi sono casi di indeterminazione.

a)



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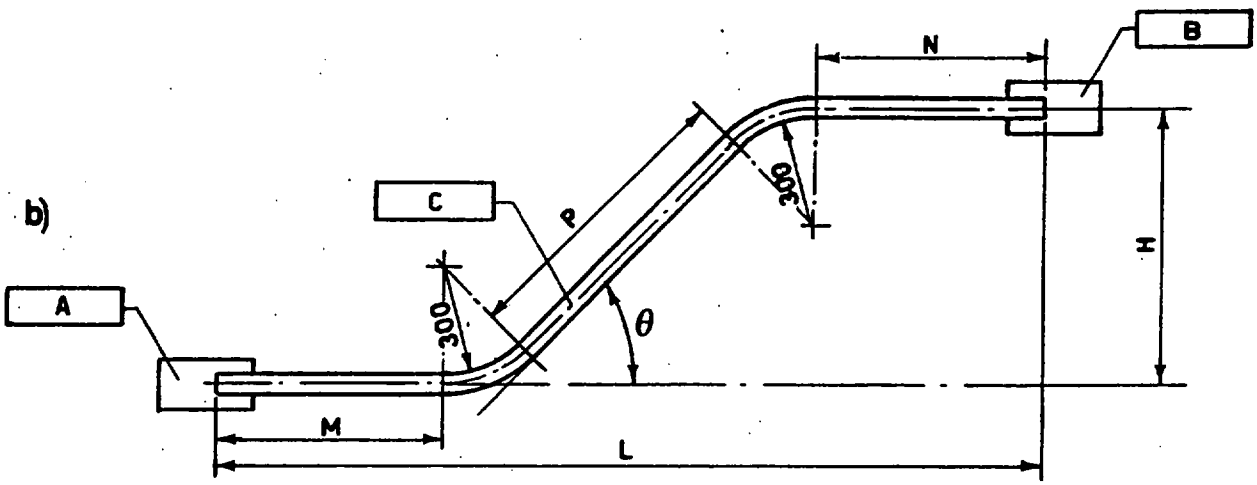
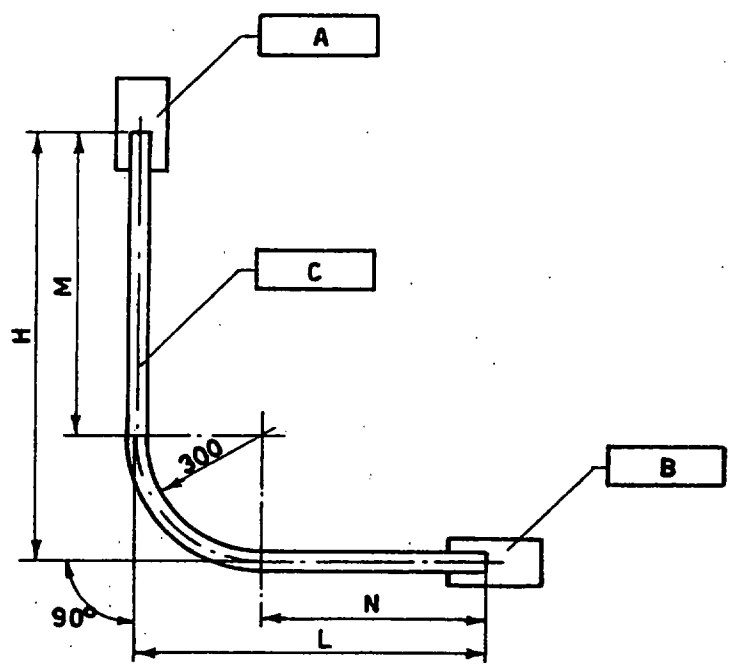


c)



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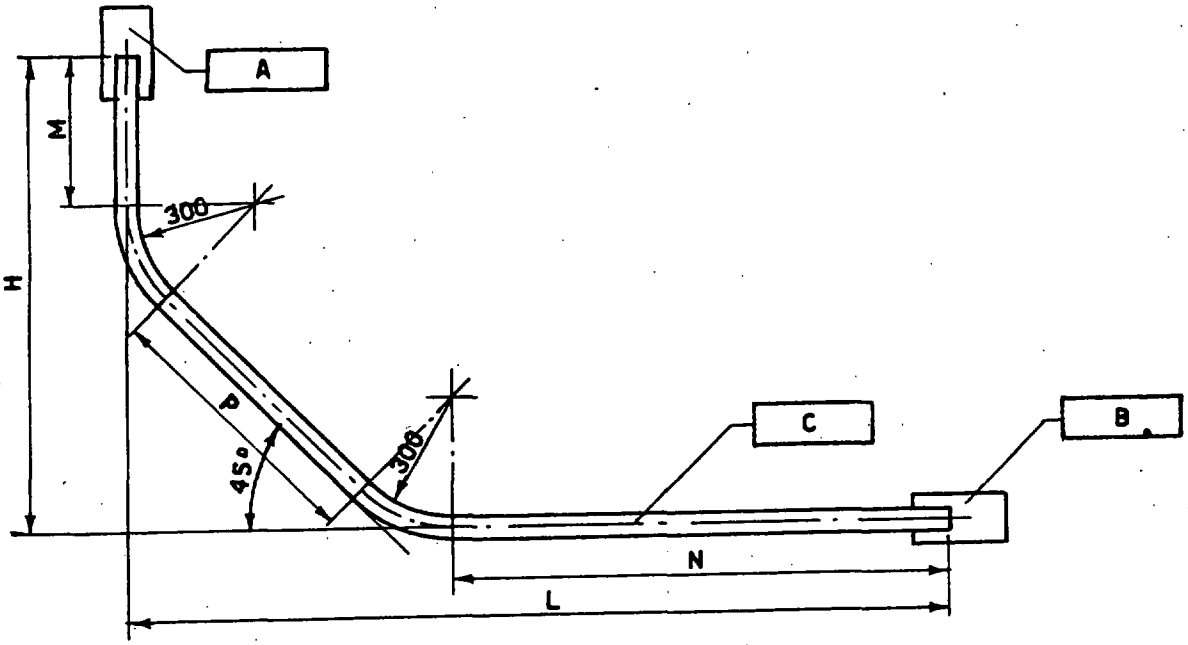

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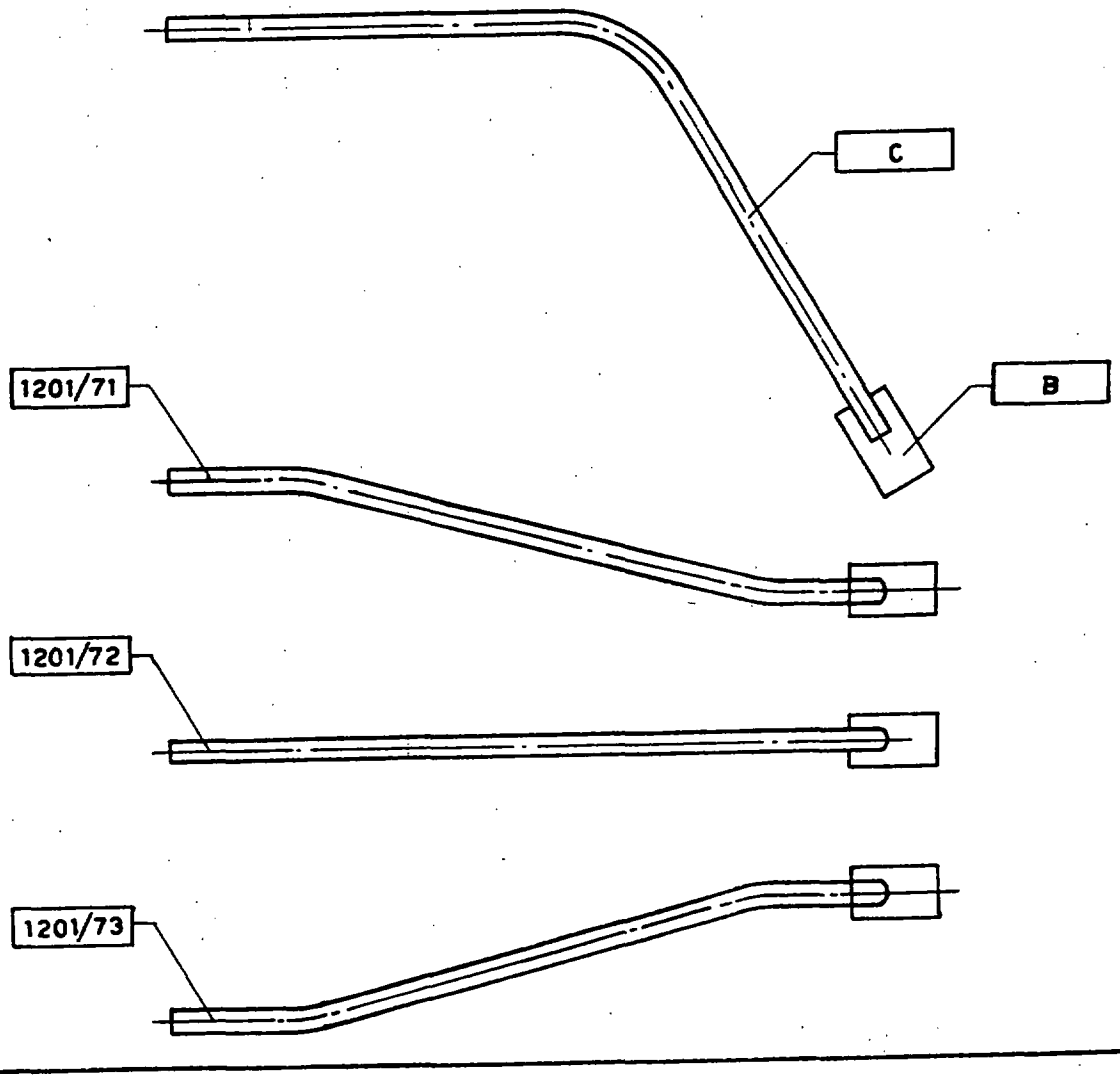


UNIFICAZIONE

ENEL

CONDUTTORE A CORDA DI LEGA DI ALLUMINIO ∅ 10,70 SEZIONE 70 mm²

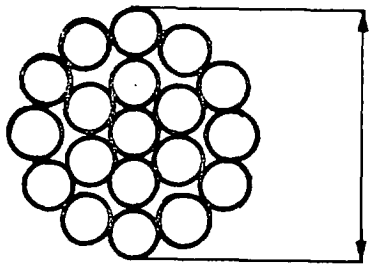
31 52 B

DC 11

Febbraio 1978

Ed. 2 - 1/1

La presente tabella sostituisce la tabella : L C 11 ed. 1



MATRICOLA	31 52 04

FORMAZIONE		19×2,14
SEZIONE TEORICA	(mm^2)	68,34
MASSA TEORICA	(kg/m)	0,1878
RESISTENZA ELETTRICA A 20°C	(Ω/km)	0,484
CARICO DI ROTTURA	(kg)	1985
MODULO DI ELASTICITA'	(kg/mm^2)	5700
COEFFICIENTE DI DILATAZIONE	($1/°C$)	$23×10^{-6}$

1 – Materiale : Lega alluminio–silicio–magnesio primaria per conduttori elettrici P – Al Si 0,5 Mg UNI 3570.

2 – Prescrizioni per la costruzione ed il collaudo : DC 3905.

3 – Prescrizioni per la fornitura : DC 3911.

4 – Imballo e pezzature : bobine da 3000 m

5 – L'unità di misura con la quale deve essere espressa la quantità del materiale è la massa in chilogrammi (kg).

Designazione abbreviata: CORDA LEGA AL DIAM 10,70 UE

DIREZIONE DELLA DISTRIBUZIONE - VICE DIREZIONE TECNICA - SETTORE INVESTIMENTI E PROGETTAZIONE

Nelle cabine primarie 132-150 kV il sistema di sbarre è realizzato con conduttori rigidi tubolari in lega di alluminio Ø 100/90 (cfr. C1050 e C1221); le lunghezze delle varie campate ed i loro possibili modi di combinarsi per costituire il sistema di sbarre, sono tali da non consentire, di norma, l'instaurarsi di vibrazioni nei conduttori.

Comunque se dopo il montaggio del sistema di sbarre conformemente a quanto indicato nei moduli della sezione D, si notano vibrazioni nei conduttori, esse potranno essere eliminate mediante l'impiego di un apposito smorzatore introdotto all'interno dei tubi Ø 100 e costituito da uno spezzone di corda in lega di alluminio Ø 10,7 corredato alle estremità da opportuni pezzi di morsetteria (fig. 1).

La dimensione l di fig. 1 è variabile a seconda della composizione del sistema di sbarre ed è pari alla somma delle lunghezze dei collegamenti 1221 presenti nel tronco di sbarra diminuita di 500 mm (cfr. fig. 2).

Il sistema di sbarre delle cabine primarie è diviso in due tronchi da un sezionatore che è connesso ai conduttori in tubo tramite un morsetto a cerniera elastica M 1087; all'altra estremità dei conduttori vi può essere un contrappeso (M1088) oppure un altro morsetto M 1087 se vi è una linea uscente di testa dalle sbarre.

Per installare lo smorzatore di vibrazioni occorre smontare i contrappesi M1088 (ovvero i morsetti M1087), introdurre lo smorzatore nel tubo Ø 100, bloccarlo come indicato in fig. 2 e rimontare i contrappesi M1088 (ovvero i morsetti M 1087).

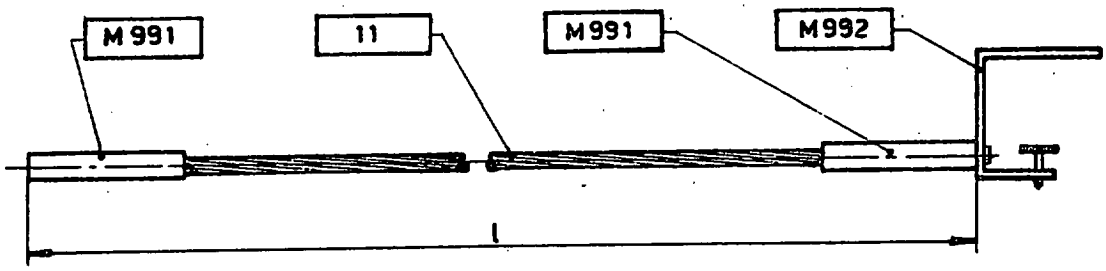


Fig. 1

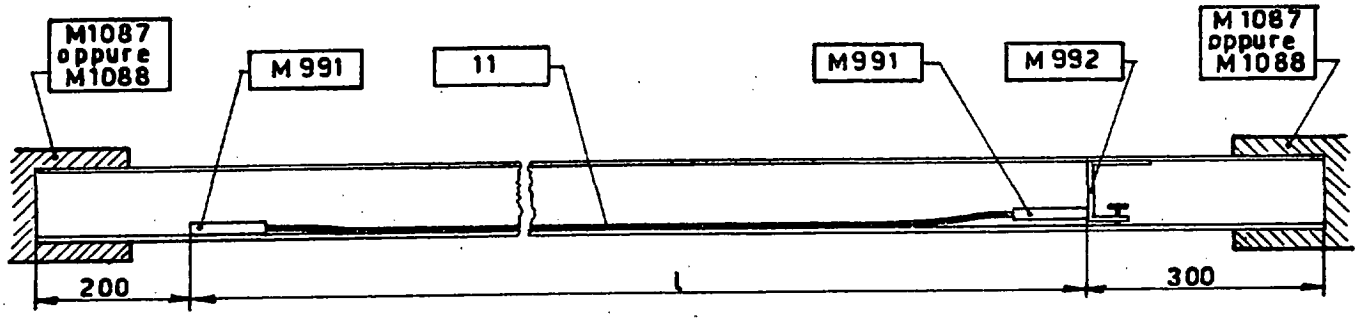
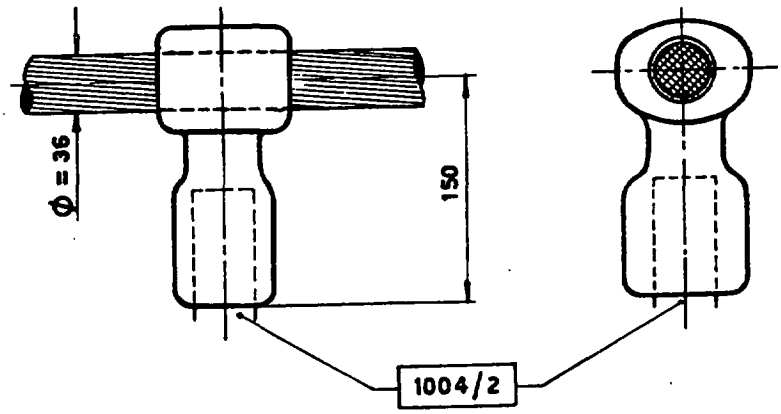
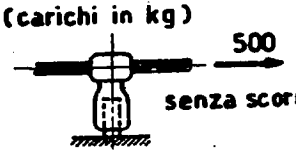
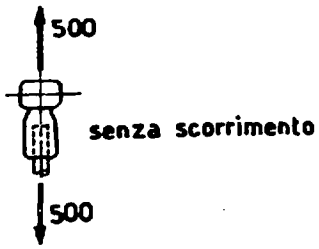


Fig. 2



SCHEMI DI PROVA MECCANICA
(carichi in kg)





MATRICOLA	CLASSE PROVA TERMICA
20 86 51	C

1 - Materiale: idoneo per assicurare una corretta connessione tra codolo di rame e corda di alluminio.

2 - Livello di radiodisturbo ammesso: 75 dB a 105 kV.

3 - Su ciascun esemplare dovrà essere marcata la classe di appartenenza e la sigla o il marchio di fabbrica della ditta fornitrice.

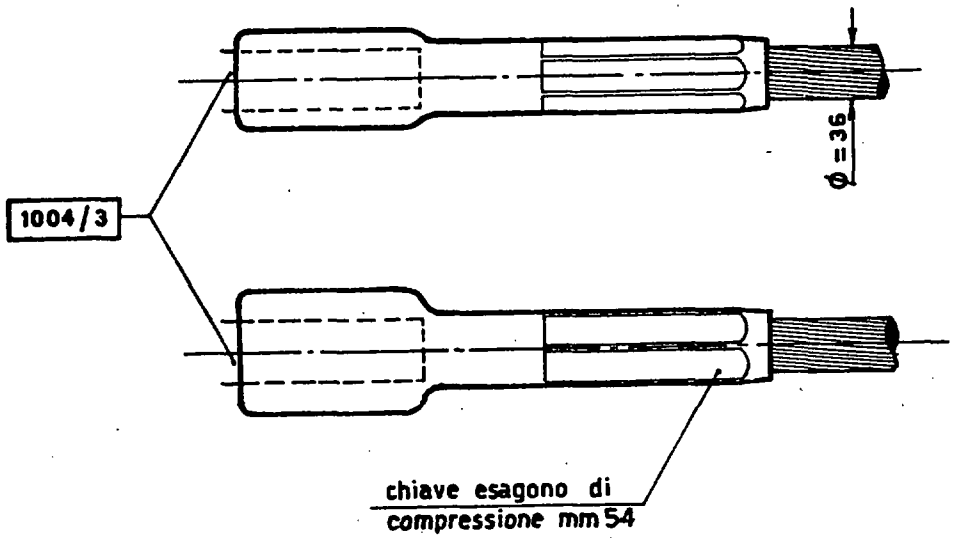
4 - Prescrizioni: per la costruzione Norme CEI 7-9 e prescrizioni ENEL M 2006; per il collaudo Norme CEI 7-9, con l'eccezione delle prove di tipo che saranno invece eseguite secondo le prescrizioni ENEL M 2001.

5 - L'unità di misura con la quale deve essere espressa la quantità del materiale è il numero di esemplari (n).

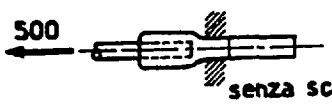
Designazione abbreviata: MORS T C 36 PASS/COD C UE

Riferimento: C5

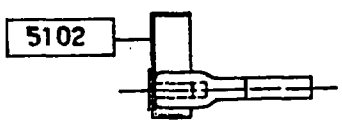
UNIFICAZIONE ENEL	MORSETTO DIRITTO CORDA AL Ø 36 - CODOLO	20 86 D **LM 1020** Marzo 1973 Ed. 2 - 1/1



SCHEMI DI PROVA MECCANICA
(carichi in kg)



VERIFICA DELL'INGOMBRO MASSIMO



MATRICOLA	CLASSE PROVA TERMICA
20 86 0[illegible]	B

1 - Materiale: idoneo per assicurare una corretta connessione tra codolo di rame e corda di alluminio.

2 - Livello di radiodisturbo ammesso: 75 dB a 270 kV.

3 - Durante le prove termiche, il codolo sarà all'interno del morsetto per una lunghezza non superiore a 80 mm.

4 - Su ciascun esemplare dovrà essere marcata la classe di appartenenza e la sigla o il marchio di fabbrica della ditta fornitrice.

5 - Prescrizioni: per la costruzione Norme CEI 7-9 e prescrizioni ENEL M 2006; per il collaudo Norme CEI 7-9, con l'eccezione delle prove di tipo che saranno invece eseguite secondo le prescrizioni ENEL M 2001.

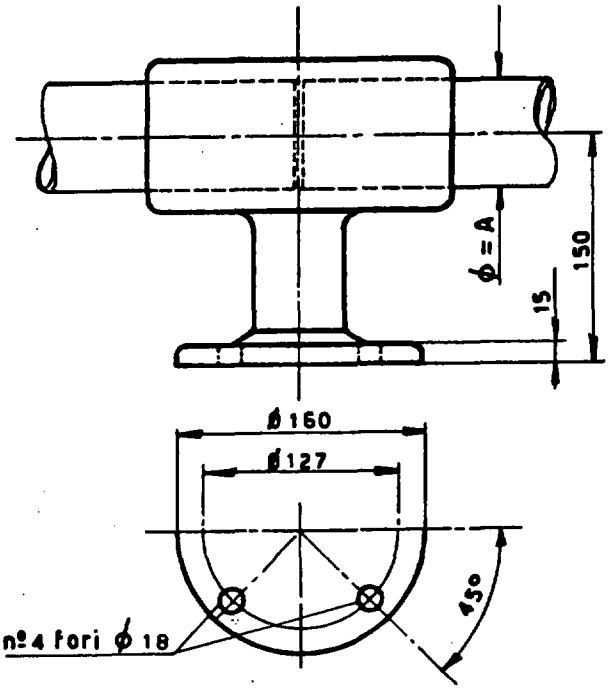
6 - L'unità di misura con la quale deve essere espressa la quantità del materiale è il numero di esemplari (n).

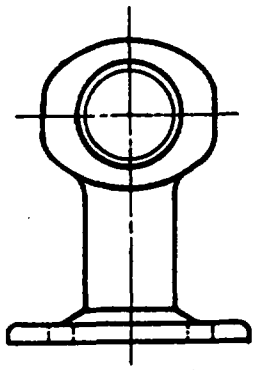
Designazione abbreviata: MORS DIR C36/COD B UE

Riferimento: C5

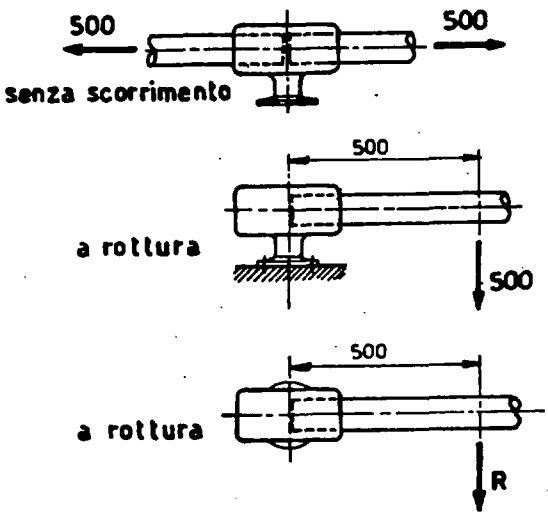
MORSETTI PORTANTI PER GIUNZIONE DIRITTA TUBI LEGA AL

20 64 C
LM 1034
Marzo 1973
Ed. 1 - 1/1





SCHEMI DI PROVA MECCANICA
(carichi in kg)



MATRICOLA	TIPO	A (mm)	CLASSE PROVA TERMICA	CARICO DI ROTTURA (kg) R
20 64 30	1034 /1	40	D	300
20 64 31	1034 /2	70	C	500

1 - Materiale alluminio o lega di alluminio - Bulloni in acciaio inossidabile o in lega di alluminio - Flangia in lega di alluminio o in ghisa o acciaio zincato a caldo.

2 - Livello di radiodisturbo ammesso 75 dB a 105 kV.

3 - Su ciascun esemplare dovrà essere marcata la classe di appartenenza e la sigla o il marchio di fabbrica della ditta fornitrice.

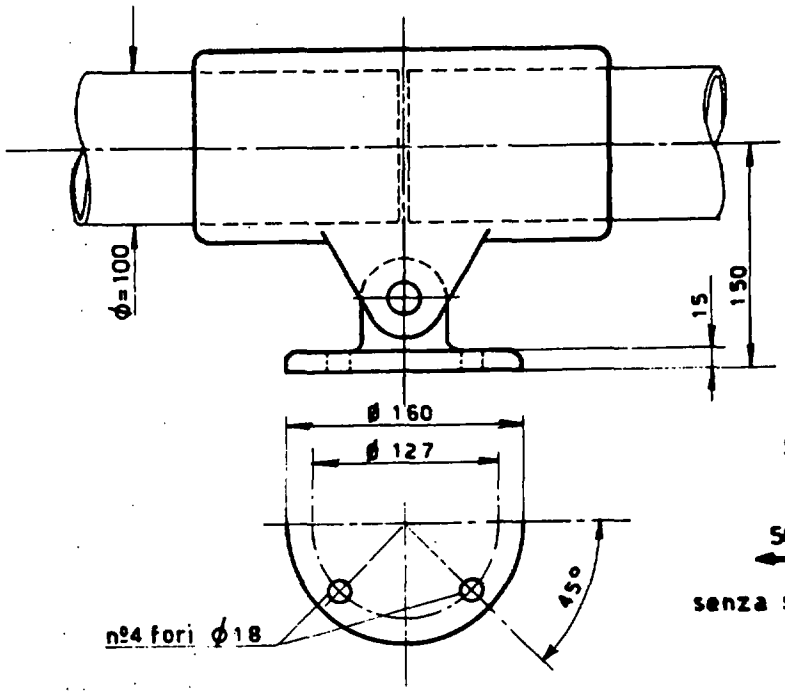
4 - Prescrizioni: per la costruzione Norme CEI 7-9 e prescrizioni ENEL M 2006; per il collaudo Norme CEI 7-9, con l'eccezione delle prove di tipo che saranno invece eseguite secondo le prescrizioni ENEL M 2001.

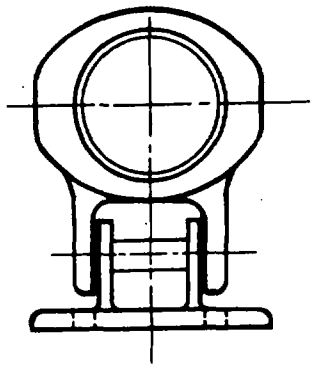
5 - L'unità di misura con la quale deve essere espressa la quantità del materiale è il numero di esemplari (n).

Esempio di designazione abbreviata: MORS POR GDIR T70/FLAN CUE

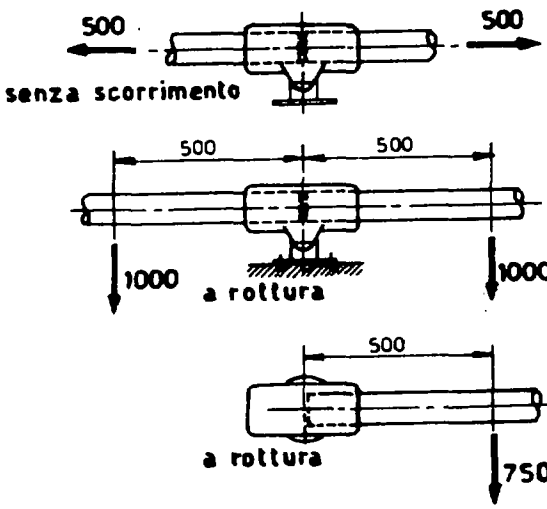
Riferimento: C 1050

UNIFICAZIONE ENEL	MORSETTO PORTANTE CON CERNIERA PER GIUNZIONE DIRITTA TUBI LEGA AL Ø 100	20 64 D **LM 1035** Marzo 1973 Ed. 1 - 1/1





SCHEMI DI PROVA MECCANICA
(carichi in kg)



MATRICOLA	CLASSE PROVA TERMICA
20 64 33	A

1 - Materiale alluminio o lega di alluminio - Bulloni in acciaio inossidabile o in lega di alluminio - Perno in acciaio inossidabile - Flangia in ghisa o acciaio zincato a caldo o in lega di alluminio.

2 - Livello di radiodisturbo ammesso: 75 dB a 270 kV.

3 - Su ciascun esemplare dovrà essere marcata la classe di appartenenza e la sigla o il marchio di fabbrica della ditta fornitrice.

4 - Prescrizioni: per la costruzione Norme CEI 7-9 e prescrizioni ENEL M 2006; per il collaudo Norme CEI 7-9, con l'eccezione delle prove di tipo che saranno invece eseguite secondo le prescrizioni ENEL M 2001.

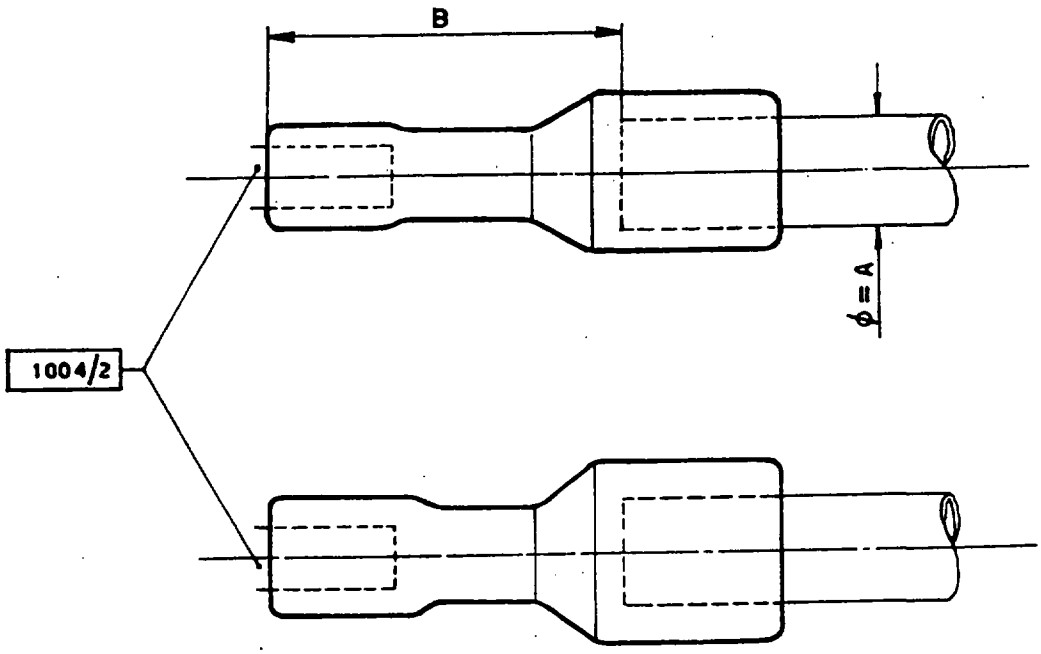
5 - L'unità di misura con la quale deve essere espressa la quantità del materiale è il numero di esemplari (n).

Designazione abbreviata: M O R P O R C E R G D T 1 0 0 / F L A U E

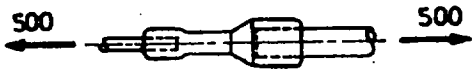
Riferimento: C1050

MORSETTI DIRITTI TUBO LEGA AL - CODOLO

20 86 M
LM 1084
Marzo 1973
Ed. 1 - 1/1

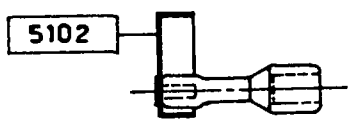


SCHEMA DI PROVA MECCANICA
(carichi in kg)



senza scorrimento

VERIFICA DELL' INGOMBRO MASSIMO



NUMERO MATRICOLA	TIPO	DIMENSIONI (mm)		CLASSE PROVA TERMICA	LIVELLO RADIODISTURBO AMMESSO
		A	B		
20 86 10	1084 /1	40	165	D	75 dB a 105 kV
—	1084 /2	70	allo studio	C	75 dB a 105 kV
—	1084 /3	100		B	75 dB a 270 kV

1 - Materiale: idoneo per assicurare una corretta connessione tra codolo di rame e tubo in lega di alluminio.

2 - Su ciascun esemplare dovrà essere marcata la classe di appartenenza e la sigla o il marchio di fabbrica della ditta fornitrice

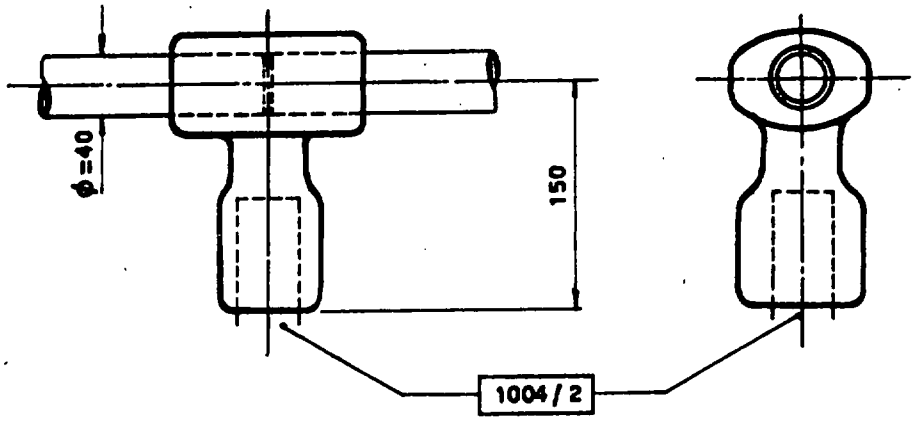
3 - Prescrizioni: per la costruzione Norme CEI 7 - 9 e prescrizioni ENEL M 2006; per il collaudo Norme CEI 7 - 9, con l'eccezione delle prove di tipo che saranno invece eseguite secondo le prescrizioni ENEL M 2001.

4 - L'unità di misura con la quale deve essere espressa la quantità del materiale è il numero di esemplari (n).

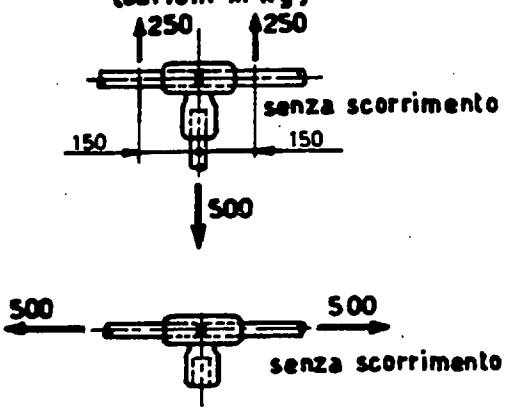
Esempio di designazione abbreviata: MORS DIR T40 / COD D UE

Riferimenti: C 1050

UNIFICAZIONE ENEL	MORSETTO A "T" GIUNZIONE DIRITTA TUBI LEGA AL Ø 40 - CODOLO	20 86 N **LM 1085** Marzo 1973 Ed. 1 - 1/1



SCHEMI DI PROVA MECCANICA
(carichi in kg)



MATRICOLA	CLASSE PROVA TERMICA
20 86 61	D

1 - Materiale idoneo per assicurare una corretta connessione tra codolo di rame e tubo in lega di alluminio

2 - Livello di radiodisturbo ammesso 75 dB a 105 kV.

3 - Su ciascun esemplare dovrà essere marcata la classe di appartenenza e la sigla o il marchio di fabbrica della ditta fornitrice.

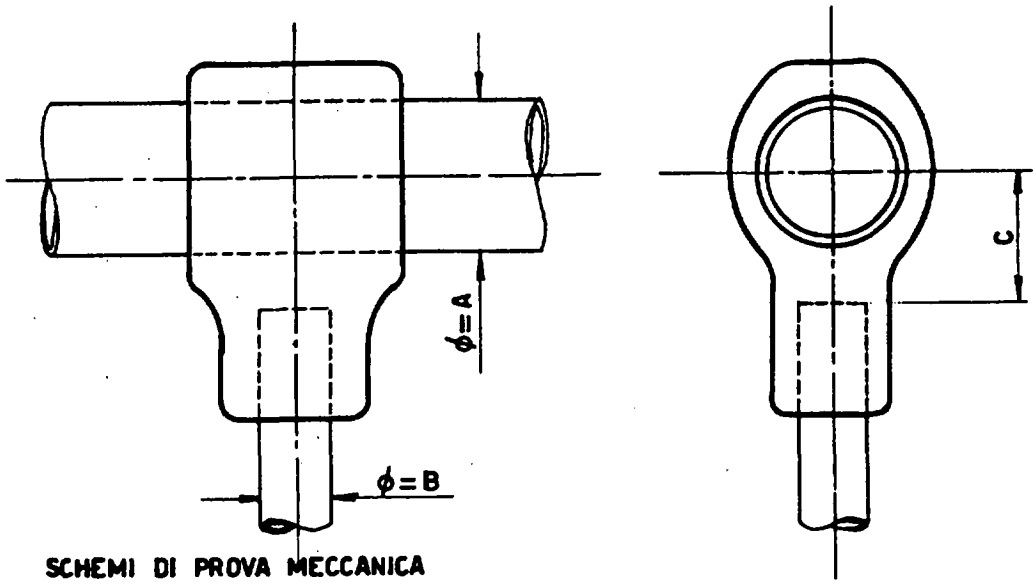
4 - Prescrizioni per la costruzione Norme CEI 7 - 9 e prescrizioni ENEL M 2006; per il collaudo Norme CEI 7 - 9, con l'eccezione delle prove di tipo che saranno invece eseguite secondo le prescrizioni ENEL M 2001.

5 - L'unità di misura con la quale deve essere espressa la quantità del materiale è il numero di esemplari (n).

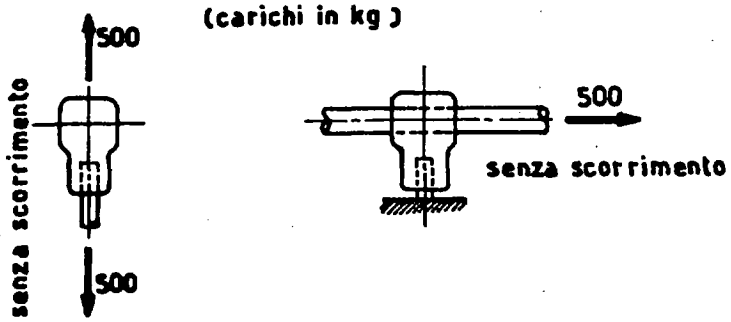
Designazione abbreviata: MORS T GDIR T40/COD D UE

Riferimento: C1050

MORSETTI A "T" TUBO PASSANTE LEGA AL - TUBO LEGA AL



SCHEMI DI PROVA MECCANICA
(carichi in kg)



MATRICOLA	TIPO	DIMENSIONI (mm)			CLASSE PROVA TERMICA
		A	B	C	
20 27 41	1086/1	100	40	90	D
20 27 40	1086/2	40	40	65	D

1 - Materiale: alluminio o lega di alluminio. Bulloni in acciaio inossidabile o in lega di alluminio.

2 - Livello di radiodisturbo ammesso: 75 dB a 105 kV.

3 - Su ciascun esemplare dovrà essere marcata la classe di appartenenza e la sigla o il marchio di fabbrica della ditta fornitrice.

4 - Prescrizioni: per la costruzione Norme CEI 7 - 9 e prescrizioni ENEL M 2006; per il collaudo Norme CEI 7 - 9, con l'eccezione delle prove di tipo che saranno invece eseguite secondo le prescrizioni ENEL M 2001.

5 - L'unità di misura con la quale deve essere espressa la quantità del materiale è il numero di esemplari (n).

Esempio di designazione abbreviata: M O R S T T 1 0 0 P A S S / T 4 0 D U E

Riferimento: C1050

UNIFICAZIONE

ENEL

CONTRAPPESO PER TUBO Ø 100

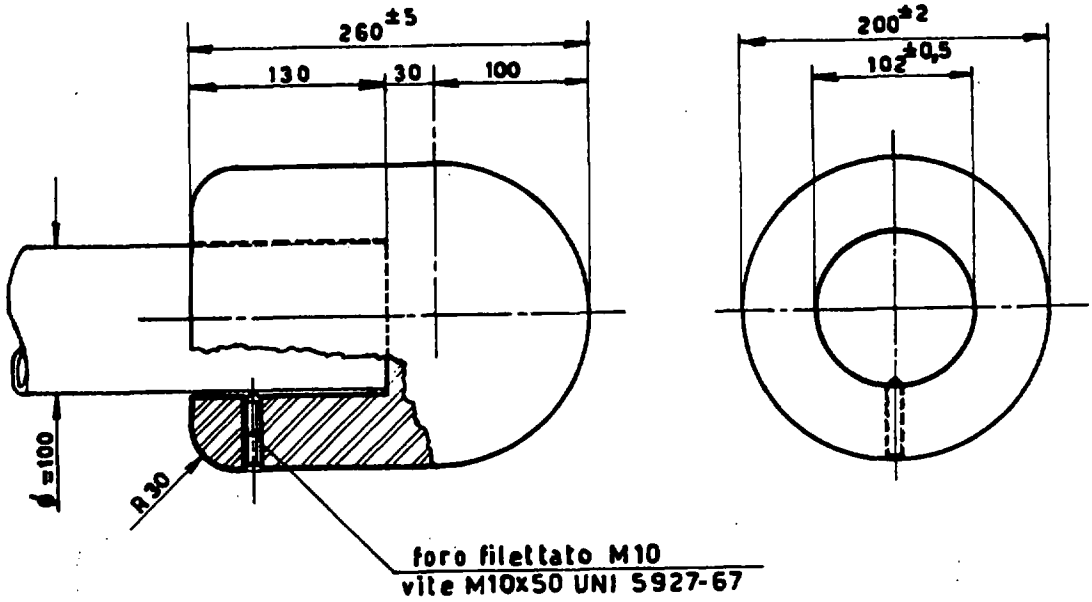
21 14 C

LM 1088

Marzo 1973

Ed. 1 - 1/1

DIREZIONE DELLE COSTRUZIONI - CENTRO NAZIONALE STUDI E PROGETTI



MATRICOLA	21 14 02

1 - Peso (kg) : 40 ± 3.

2 - Materiale ghisa zincata a caldo. Vite in acciaio zincato a caldo.

3 - Livello di radiodisturbo ammesso: 75 dB a 270 kV.

4 - Su ciascun esemplare dovrà essere marcata la sigla o il marchio di fabbrica della ditta fornitrice.

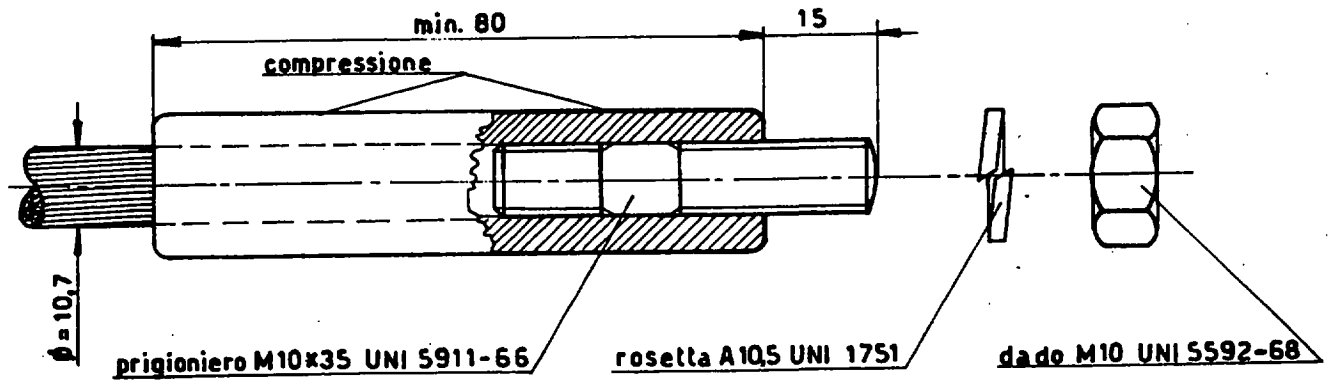
5 - Prescrizioni: per la costruzione Norme CEI 7 - 9 e prescrizioni ENEL M 2006; per il collaudo Norme CEI 7 - 9, con l'eccezione delle prove di tipo che saranno invece eseguite secondo le prescrizioni ENEL M 2001.

6 - L'unità di misura con la quale deve essere espressa la quantità del materiale è il numero di esemplari (n).

Designazione abbreviata: CONTRAPP PER TUB 100 40 KG U E

Riferimento: C 1050

UNIFICAZIONE ENEL	CAPOCORDA A COMPRESSIONE DIRITTO IN ALLUMINIO PER CORDA SEZ. 70 mm^2 – ATTACCO A PERNO FILETTATO	21 00 B **LM 991** Marzo 1973 Ed. 1 - 1/1



MATRICOLA	21 00 37

1 - Materiale: alluminio. Bulloneria in acciaio zincato.

2 - Su ciascun esemplare dovrà essere marcata la sigla o il marchio di fabbrica della ditta fornitrice.

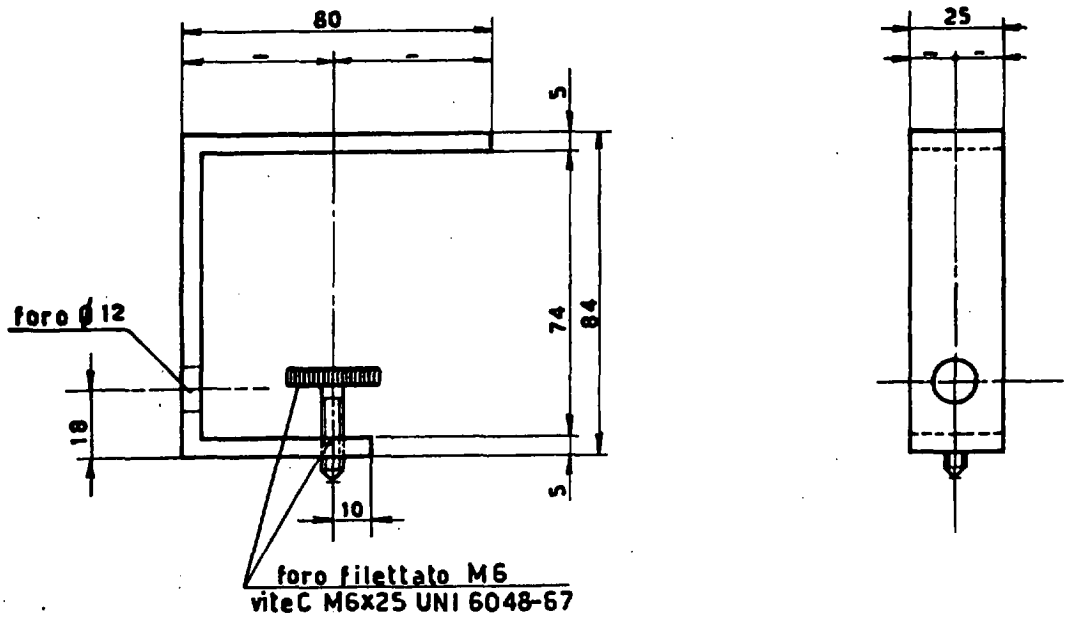
3 - Prescrizioni: per la costruzione Norme CEI 7-9 e prescrizioni ENEL M 2006; per il collaudo Norme CEI 7-9.

4 - L'unità di misura con la quale deve essere espressa la quantità del materiale è il numero di esemplari (n).

Designazione abbreviata: C A P C O D I R A L 7 0 / P E R N M 1 0 U S

Riferimento: C11

UNIFICAZIONE ENEL	DISPOSITIVO DI FERMO ALL'INTERNO TUBI Ø int. 90	21 14 A LM 992 Marzo 1973 Ed. 1 - 1/1



MATRICOLA	21 14 07

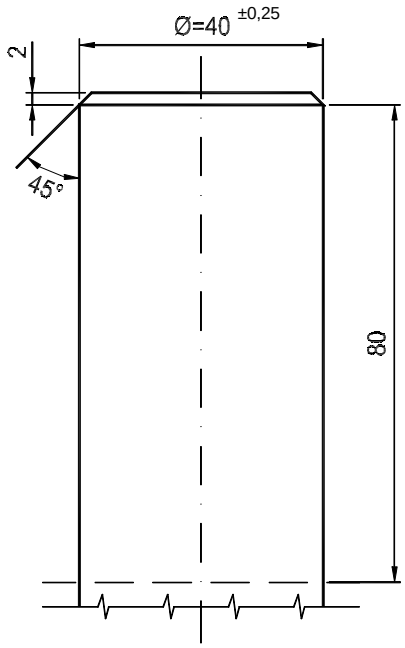
1 - Materiale: acciaio zincato a caldo.

2 - Su ciascun esemplare dovrà essere marcata la sigla o il marchio di fabbrica della ditta fornitrice.

3 - Prescrizioni: per la costruzione Norme CEI 7-9 e prescrizioni ENEL M 2006; per il collaudo Norme CEI 7-9.

4 - L'unità di misura con la quale deve essere espressa la quantità del materiale è il numero di esemplari (n).

Designazione abbreviata: D I S P F E R M O I N T T U B I D 9 0 U E

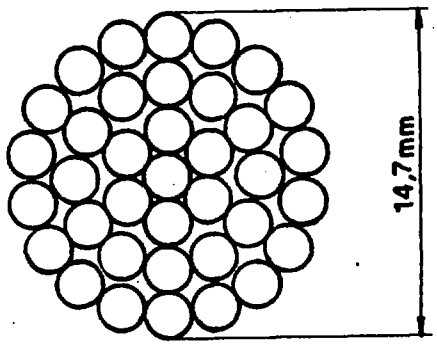


Materiale:

- alluminio o lega di alluminio
- rame o lega di rame

N.B.: tutti i materiali impiegati devono essere resistenti o resi resistenti alla corrosione. Gli attacchi a codolo realizzati in rame o lega di rame, devono essere adeguatamente trattati, per rendere possibile l'interfacciamento con morsetteria in alluminio o lega di alluminio

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



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

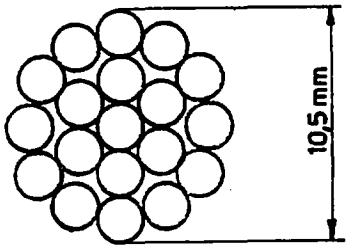
1 - Materiale : rame tipo CU-ETP UNI 5649-71 ricotto.

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 Ø 10,5 – SEZIONE 63 mm²	21 75 A LC 1002 Marzo 1973 Ed. 1 - 1/1



MATRICOLA	21 75 05

FORMAZIONE		19 x 2,10
SEZIONE TEORICA	(mm²)	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)

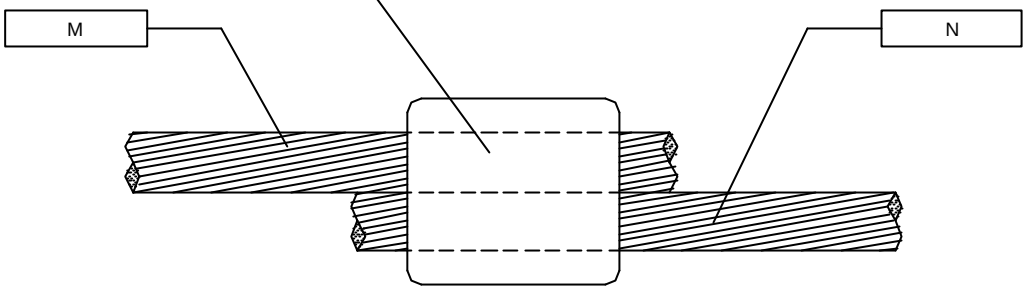
Designazione abbreviata: C O R D A T E R R A C U S E Z 6 3 U E

MORSETTI BIFILARI A COMPRESSIONE

PER CORDE IN RAME SEZ. 63 E 125 mm^2

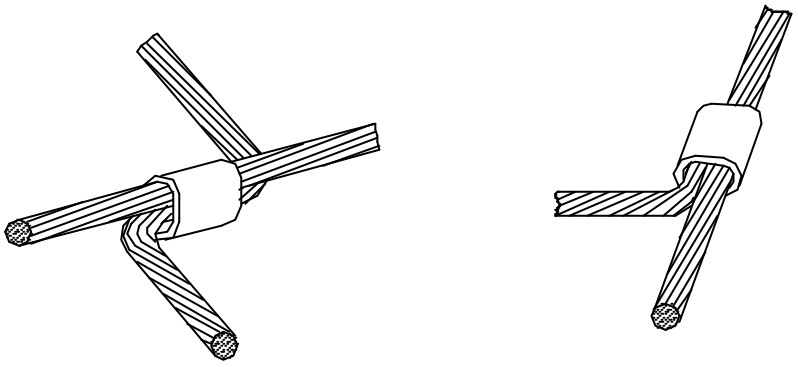
5	DDR/USA/UNI	Andreella	Speziali	Di Salvatore	Marzo 2003
Ed.	**Funzione/Unità**	**Redatto**	**Verificato**	**Approvato**	**Data**

MORSETTO A COMPRESSIONE DI TIPO APERTO PER L'UNIONE A SOVRAPPOSIZIONE DI DUE CORDE DI RAME



MATRICOLA	TIPO	M		N	
		ϕ (mm)	SEZ. (mm^2)	ϕ (mm)	SEZ. (mm^2)
26 24 12	1201/1	10,5	63	10,5	63
26 24 13	1201/2	10,5	63	14,7	125
26 24 14	1201/3	14,7	125	14,7	125

SCHEMI DI MONTAGGIO



1 - Materiale: rame.
2 - Corrente di breve durata (1 s) 31,5 kA.
3 - Su ciascun esemplare dovra` essere marcata la sigla o il marchio di fabbrica della ditta fornitrice ed il diametro dei conduttori.
4 - Prescrizioni: per la costruzione Norme CEI EN 61284 e prescrizioni LM 2007; per il collaudo Norme CEI EN 61284 e prescrizioni LM 2002; per la fornitura prescrizioni LM 2011.
5 - Per la realizzazione di impianti di messa a terra di rilevante estensione che richiedono connessioni a carattere ripetitivo, in alternativa al sistema a compressione, la giunzione di due corde di rame puo` essere realizzata mediante procedimento allumino-termico
6 - Unita` di misura: numero esemplari (n).

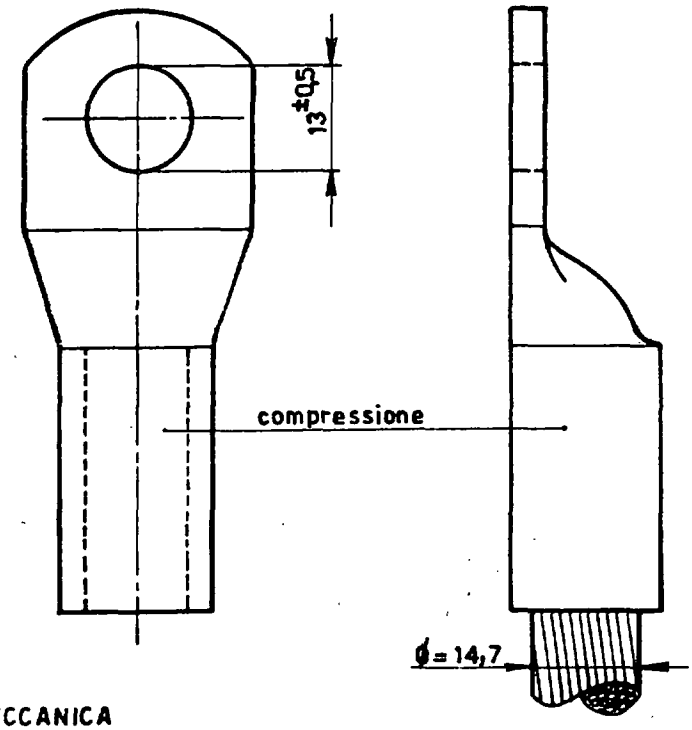
Riferimenti: LC1001, LC1002.

Esempio di designazione abbreviata:

M	**O**	**R**		**B**	**I**	**F**		**C**	**O**	**M**	**P**	**R**		**C**	**U**	**1**	**2**	**5**	**/**	**1**	**2**	**5**		**U**	**E**							

UNIFICAZIONE ENEL	CAPOCORDA A COMPRESSIONE DIRITTO PER CORDA IN RAME SEZ. 125 mm²	21 00 C DM 1202 Luglio 1981 Ed. 3 - 1/1

La presente tabella sostituisce la tabella:
LM 1202 Ed. 2



SCHEMA DI PROVA MECCANICA
(carico di rottura in kg)

MATRICOLA	CLASSE PROVA TERMICA
21 00 09	E

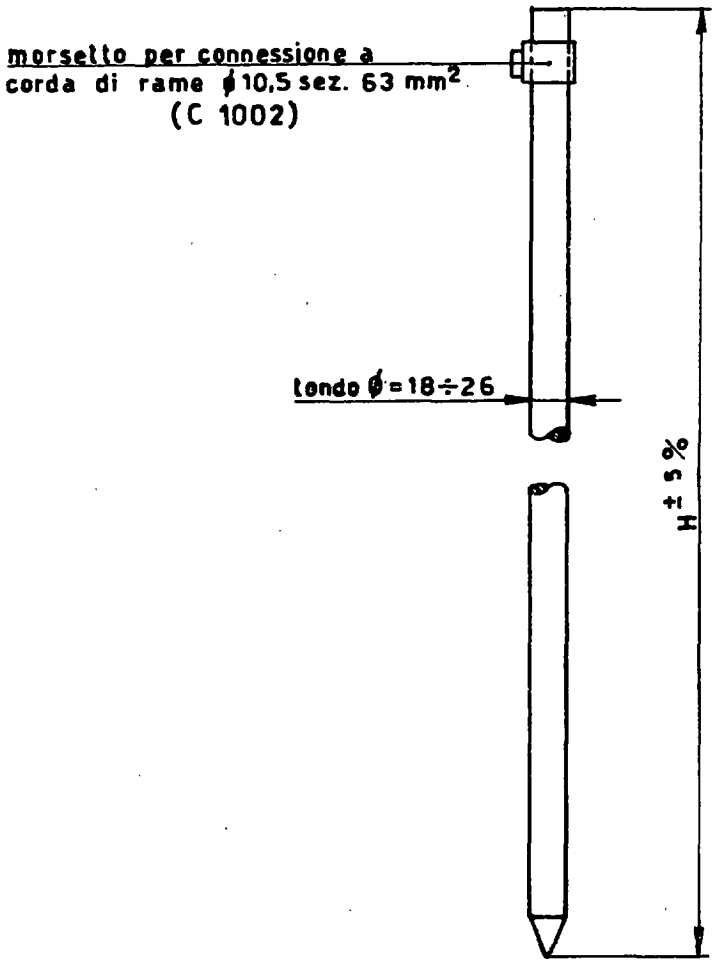
1 - Materiale: rame stagnato
2 - Su ciascun esemplare dovrà essere marcata la classe di appartenenza e la sigla o il marchio di fabbrica della ditta fornitrice.
3 - Prescrizioni: per la costruzione Norme CEI 7-9 e prescrizioni ENEL M 2006; per il collaudo Norme CEI 7-9, con l'eccezione delle prove di tipo che saranno invece eseguite secondo le prescrizioni ENEL M 2001.
4 - Unità di misura: numero di esemplari (n).
5 - Per la realizzazione di impianti di messa a terra di rilevante estensione che richiedono connessioni a carattere ripetitivo, in alternativa al sistema a compressione, la terminazione a capocorda può essere realizzata con piatto di rame forato connesso alla corda mediante procedimento allumino-termico.

Designazione abbreviata: C A P O C C O M P R D I R C U 1 2 5 E U E

Riferimento: C 1001.

PALETTI DI TERRA IN TONDO DI ACCIAIO RIVESTITO IN RAME O DI ACCIAIO ZINCATO

La presente tabella sostituisce la tabella:
LM 1206 Ed. 1



MATRICOLA	TIPO	H (m)
21 70 03	1206/1	3
21 70 04	1206/2	6
21 70 05	1206/3	9

1 - Materiale: acciaio zincato a caldo o acciaio rivestito in rame.
2 - I paletti devono essere realizzati con elementi componibili da 1,5 m.
3 - Su ciascun esemplare dovrà essere marcata la sigla o il marchio di fabbrica della ditta fornitrice.
4 - Prescrizioni: per la costruzione Norme CEI 7-9 e 11-8 e prescrizioni ENEL M 2006; per il collaudo Norme CEI 7-9.
5 - Unità di misura: numero di esemplari (n).
6 - Per la realizzazione di impianti di messa a terra di rilevante estensione che richiedono connessioni a carattere ripetitivo, in alternativa al sistema a compressione, la connessione della corda di rame al paletto di terra può essere realizzata mediante procedimento allumino-termico.

Designazione abbreviata: PAL TER ACC O CW L9000 UE

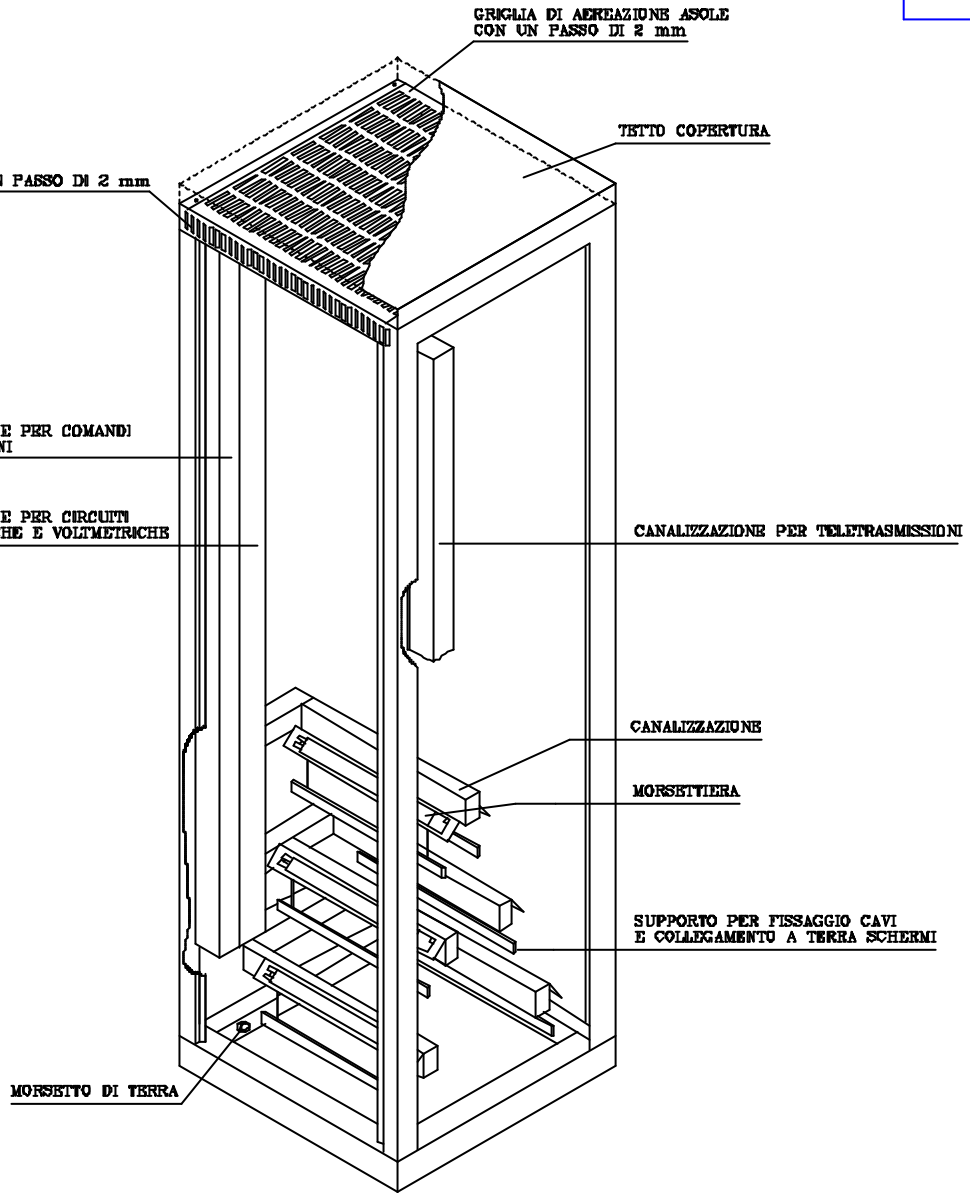
IR–ING–TEV

CABINE PRIMARIE
TELAIO A RASTRELLIERA TIPO RACK PER SUPPORTO PANNELLI DA 19"

MATRICOLA 160638

DQ1901A2NCI

Gennaio 2007
Ed.1 – 1/5



GOLFARI

– PER IL TRASPORTO DEL TELAIO VUOTO ANCHE SE PRESENTE DEL CABLAGGIO NON SONO NECESSARI I GOLFARI MA QUESTI OCCORRERANNO SE IL TELAIO STESSO VIENE UTILIZZATO PER QUALCHE APPLICAZIONE FINITA.

LE CARATTERISITCHE:

– LA PORTELLA POSTERIORE HA DUE GRATE DI AREAZIONE SUPERIORE E INFERIORE CON 720 ASOLE, CAPACITA' 57.600 mm2 DI CAMBIO D'ARIA;
– LA PORTELLA ANTERIORE HA UNA GRATA DI AREAZIONE INFERIORE CON 380 ASOLE, CAPACITA' 28.800 mm2 DI CAMBIO D'ARIA;
– IL MONTANTE SUPERIORE ANTERIORE E POSTERIORE HA UNA GRATA DI AREAZIONE CON 140+140 ASOLE, CAPACITA' 11.200 mm2+11.200 mm2DI CAMBIO D'ARIA;
– LA COPERTURA SUPERIORE HA UNA GRATA DI AREAZIONE CON 1.240 ASOLE, CAPACITA' 99.200 mm2 DI CAMBIO D'ARIA;
– LE ASOLE SONO AL PASSO DI 2 mm, LUNGHEZZA 40 mm E SPESSORE 2 mm, CIASCUNA ASOLA HA 80 mm2 D'ARIA;
– LA TAMPONATURA FRONTALE "1U" CON 80 ASOLE AL PASSO DI 2 mm, LUNGHEZZA 20 mm E SPESSORE 2 mm, CIASCUNA ASOLA HA 40 mm2 D'ARIA.

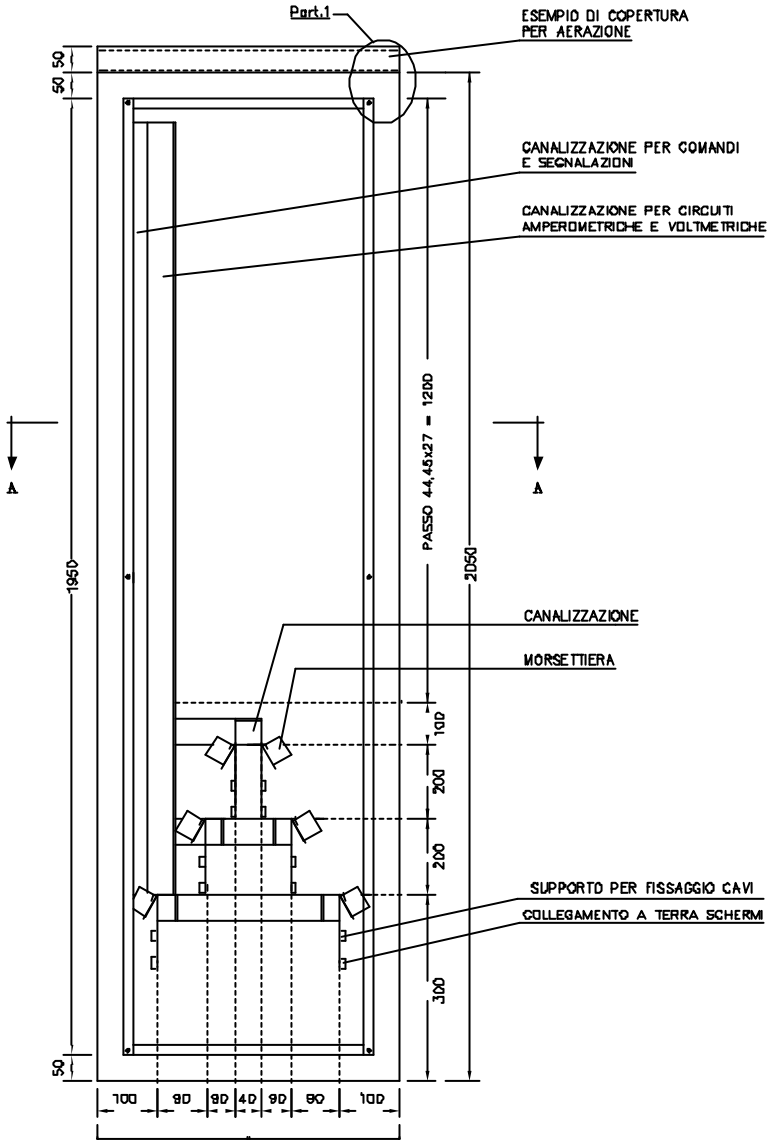
LA PRESENTE TABELLA CONTIENE IL DISEGNO INDICATIVO DEL TELAIO, MENTRE IL COSTRUTTIVO VERRA' STABILITO DA CIASCUN COSTRUTTORE, CON LA CONDIZIONE DI ASSICURARE LE SEGUENTI CARATTERISTICHE:

– I MONTANTI ANTERIORI DEVONO AVERE LA FORATURA PREVISTA DALLE NORME CEI 45–5 PER IL MONTAGGIO DEI PANNELLI DA 19";
– I TELAI DEVONO ESSERE EQUIPAGGIATI GUIDE DI TIPO FISSO SU CUI APPOGGIARE I DISPOSITIVI DI PROTEZIONE E CONTROLLO. NE DEVONO ESSERE PREVISTI Nø QUANTI SONO I DISPOSITIVI SUL TELAIO
– I TELAI DEVONO ESSERE MUNITI DI PORTA POSTERIORE CON FERITOIE PER LA CIRCOLAZIONE DELL'ARIA ED ESSERE PREDISPOSTI PER IL MONTAGGIO DELLA TAMPONATURA LATERALE;
– I TELAI QUANDO DEVONO ESSERE ASSIEMATI TRA LORO DEVE ESSERE PRESENTE ALMENO UNA TAMPONATURA LATERALE PER CONSENTIRE LA COMPARTIMENTAZIONE DI UN EVENTUALE INCENDIO;
– LA COPERTURA SUPERIORE DEL TELAIO DEVE CONSENTIRE LA CIRCOLAZIONE DELL'ARIA;
– LA DISPOSIZIONE DELLE MORSETTIERE SUI TELAI E' DEFINITA DALLE DIMENSIONI INDICATE NELLA PRESENTE TABELLA;
– IN RELAZIONE AL NUMERO E ALLE DIMENSIONI IN ALTEZZA DEI PANNELLI CONTENENTI LE APPARECCHIATURE, DEVONO ESSERE PREDISPOSTE OPPORTUNE TAMPONATURE (DI ALTEZZA SEMPRE MULTIPLA DI U) PER GLI EVENTUALI INTERSTIZI TRA PANNELLI E PER LA PARTE INFERIORE DEL TELAIO;
– DEVE ESSERE CONSENTITO L'ACCESSO ALLE MORSETTIERE ANCHE DAL FRONTE DEI TELAI.

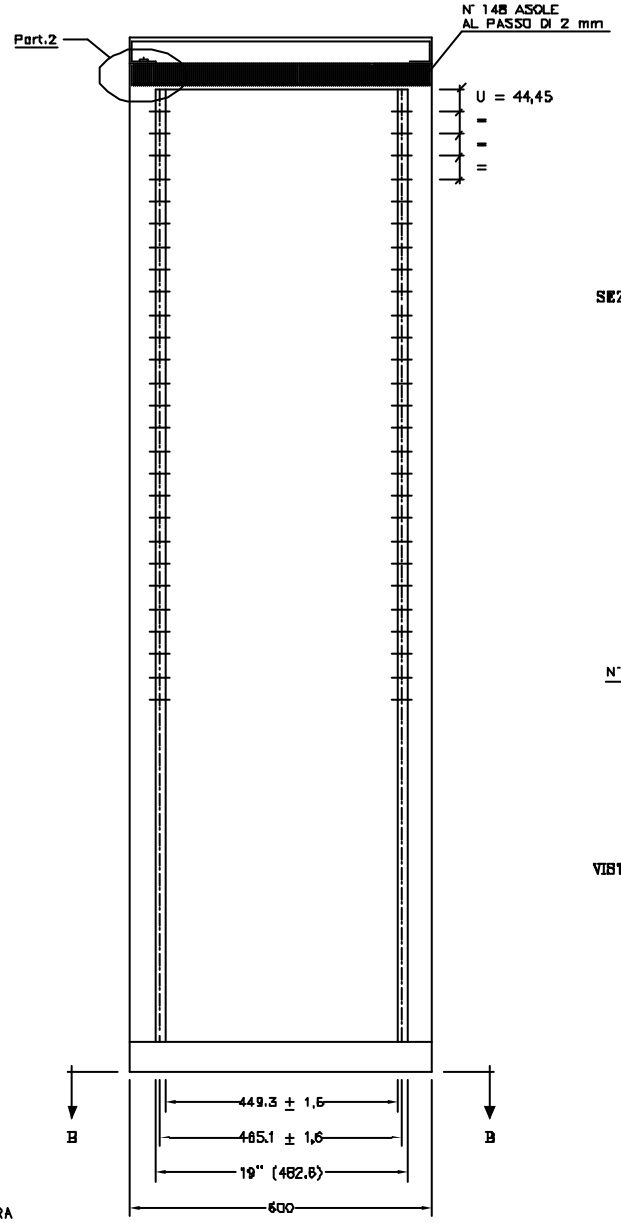
LA COMPOSIZIONE DELLE MORSETTIERE VA SCELTA TRA QUELLE ELENCATE NELLE TABELLE DQ 1975A2, DQ 1976A2 E DQ 1977A2, DQ 1978A2, ETC.. .
LE PRESCRIZIONI DI CABLAGGIO SONO RIPORTATE NELLA TABELLA Q 1986.
LA MESSA A TERRA DEI CAVI SCHERMATI DEVE ESSERE ESEGUITA COME INDICATO NEL DOCUMENTO V 1508.
LA VERNICIATURA DEVE ESSERE ESEGUITA IN COLORE GRIGIO NUMERO 7030 DELLA SCALA RAL–F2
PER LA COMPOSIZIONE DEL CICLO DI PITTURAZIONE SI RIMANDA ALLA TABELLA DY991.
LE ASOLE DI AEREAZIONE DEVONO RISPONDERE AL GRADO DI PROTEZIONE IP30.

IR-ING-TEV

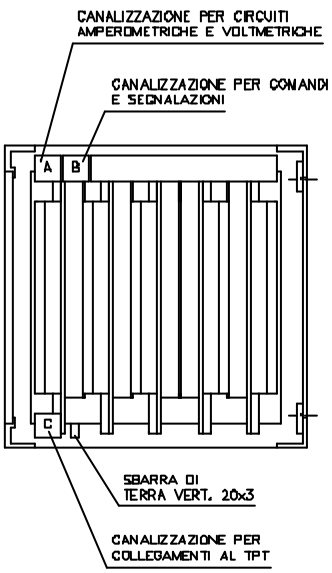
VISTA FIANCO



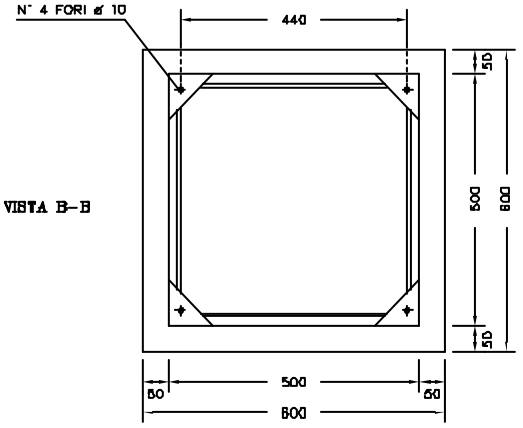
VISTA ANTERIORE SENZA PORTELLA



SEZ. A–A



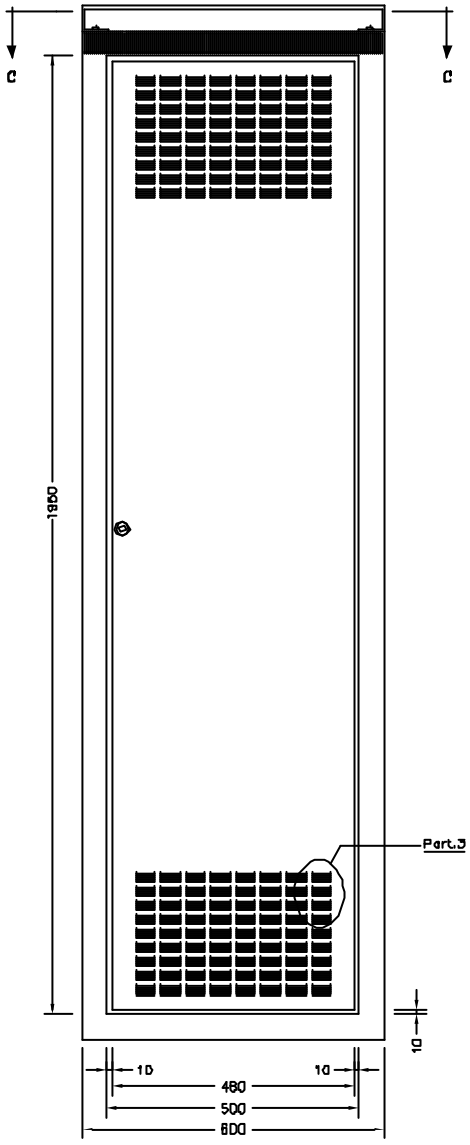
VISTA B–B



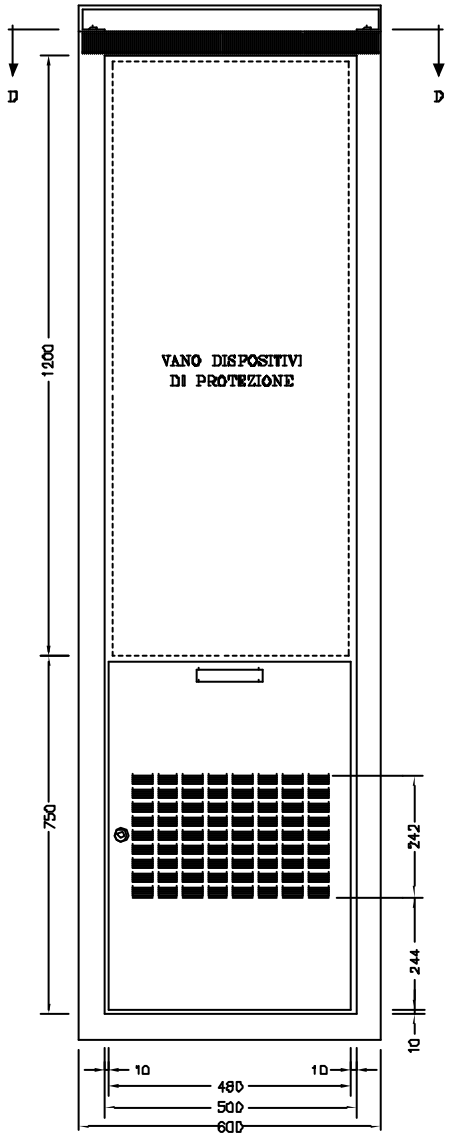
PANNELLO MORSETTIERE APRIBILE A CERNIERA

IR-INC-TEV

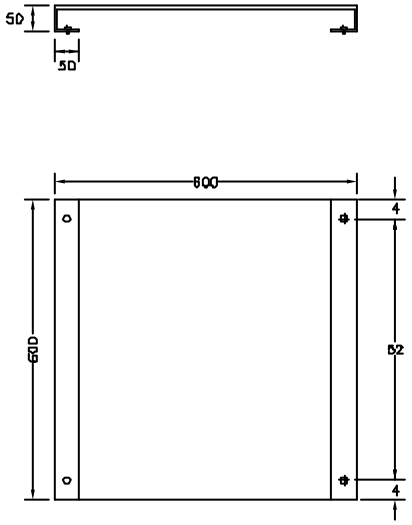
VISTA POSTERIORE CON PORTELLA



VISTA ANTERIORE CON PORTELLA

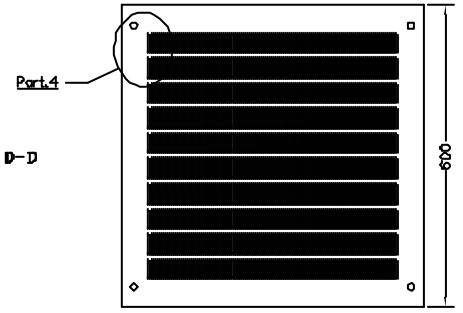


TETTO



SEZ. C-C

TETTO SUPERIORE



SEZ. D-D

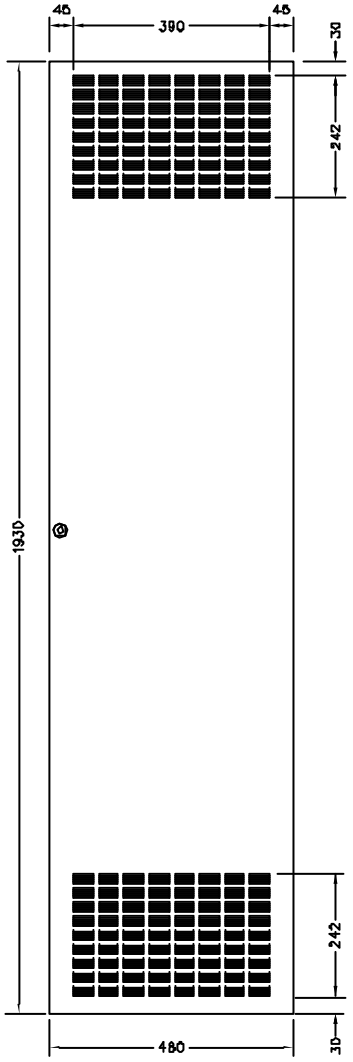
GRIGLIA DI AREAZIONE SUPERIORE

LA PORTA POSTERIORE E' NELL'INCASSO TRA I MONTANTI POSTERIORI

N.B. – CHIAVE DELLE PORTELLE DEVONO ESSERE DEL TIPO A QUADRELLO

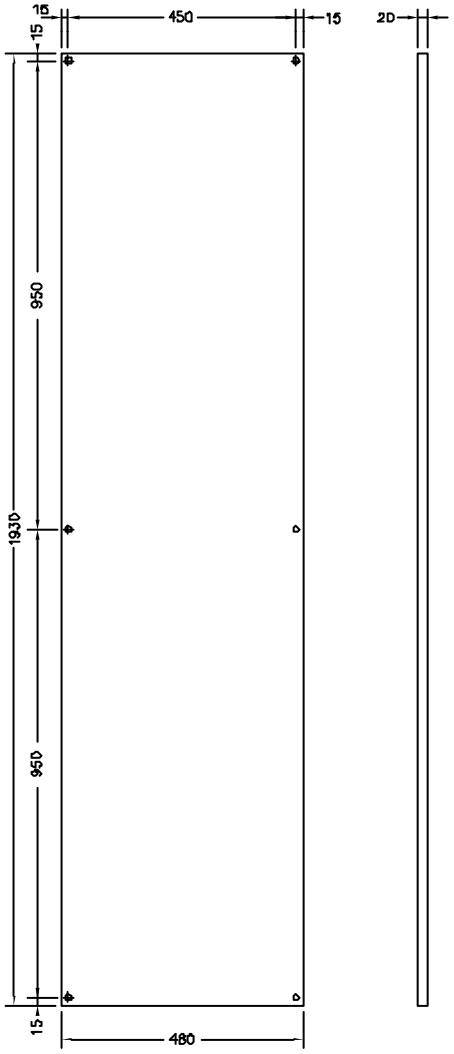
MATERIALE A CORREDO

PORTELLA POSTERIORE AREATA

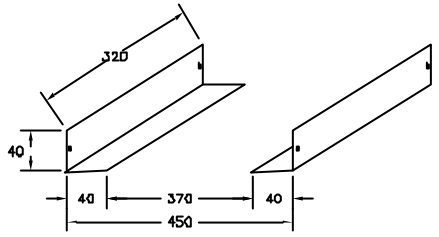


N.B. – LA GRATA DI AREAZIONE HA LE STESSE MISURE DELLA PORTELLA ANTERIORE

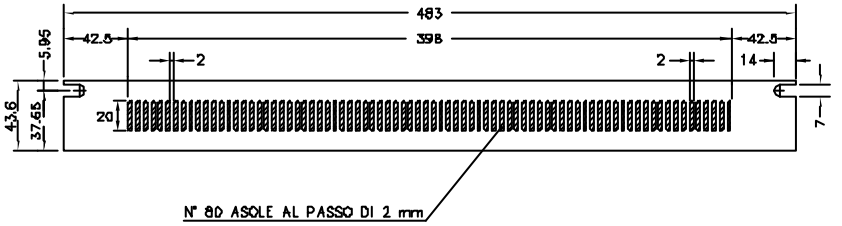
n°2 COPERTURE AD INCASSO LATERALE



GUIDA DI SUPPORTO CASSETTI

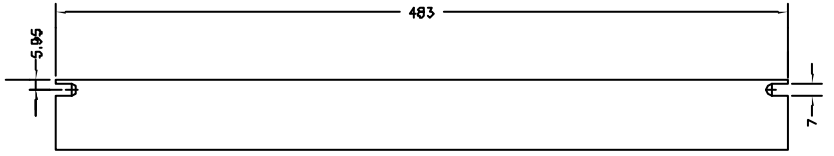


TAMPONATURA FRONTALE AREATO "1U"

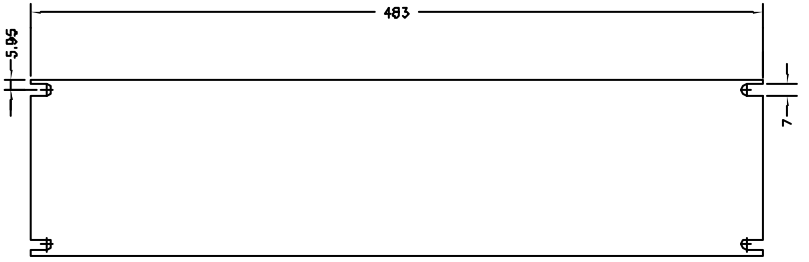


N° 80 ASOLE AL PASSO DI 2 mm

TAMPONATURA FRONTALE STANDART "1U"

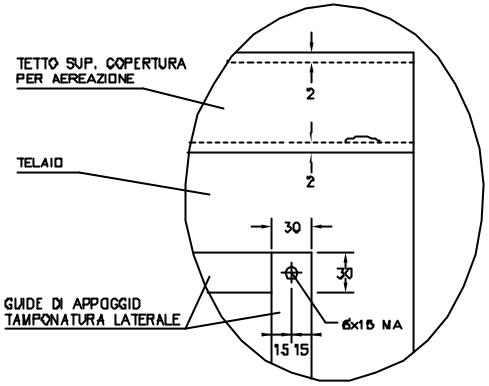


TAMPONATURA FRONTALE STANDART "3U"

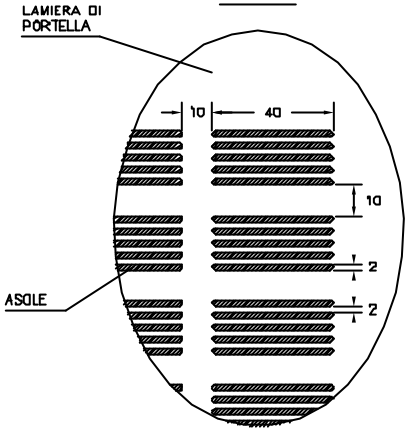


IR-ING-TEV

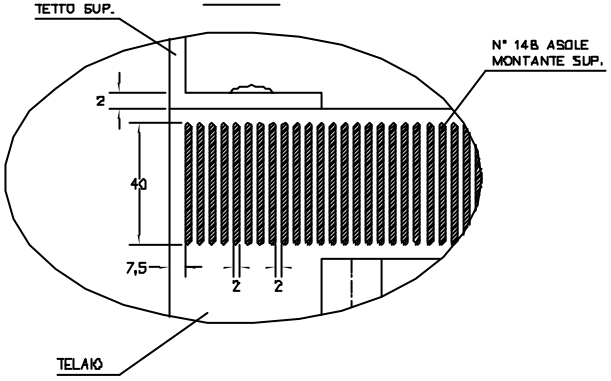
Part.1



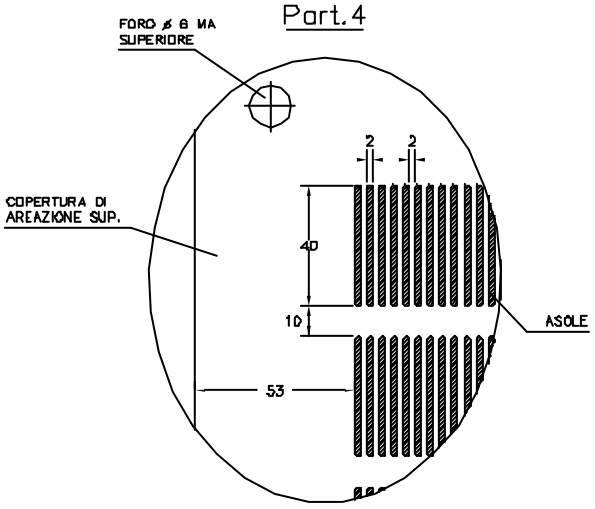
Part.3



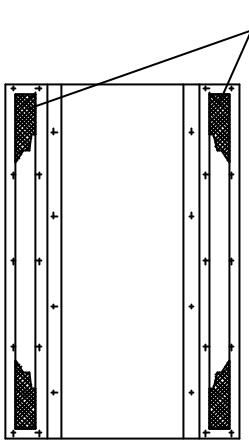
Part.2



Part.4

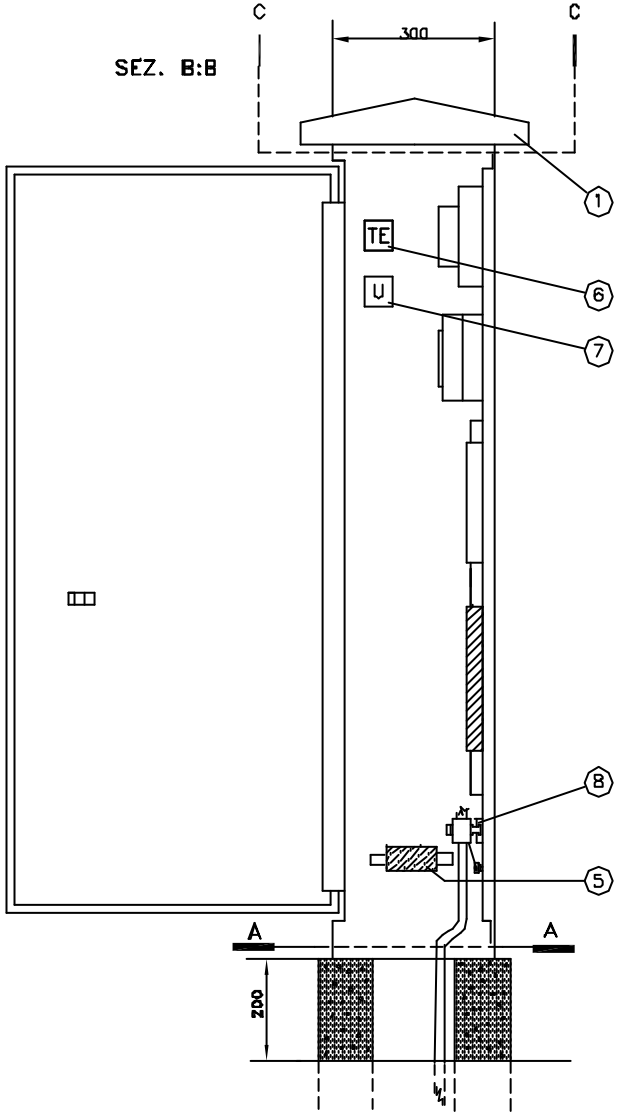


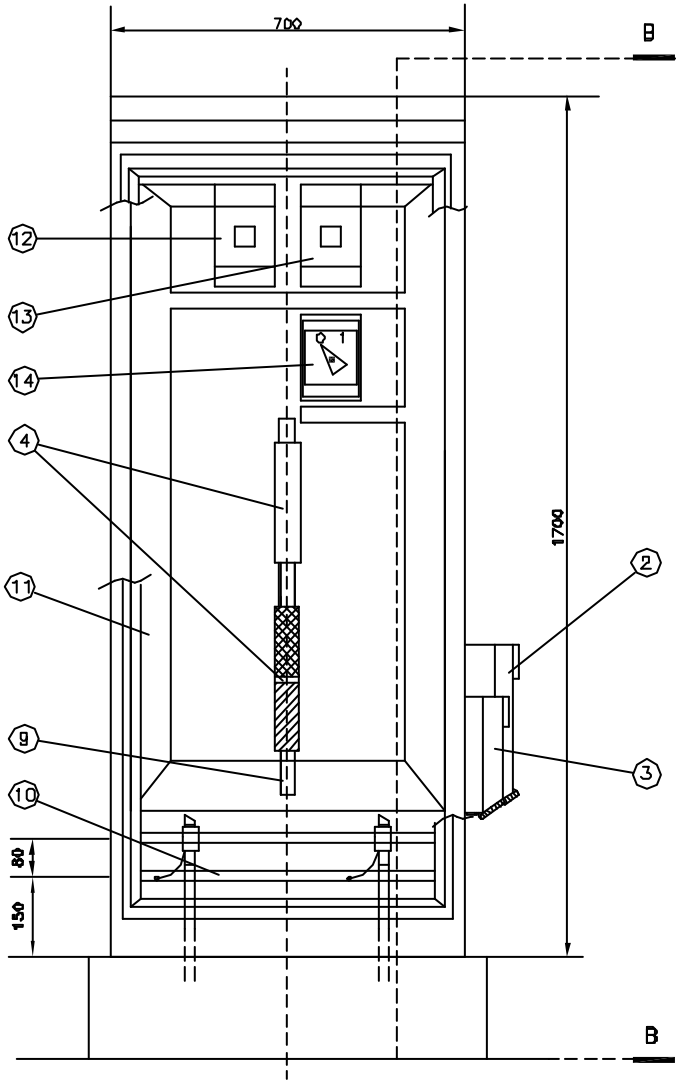
IR-ING-TEV



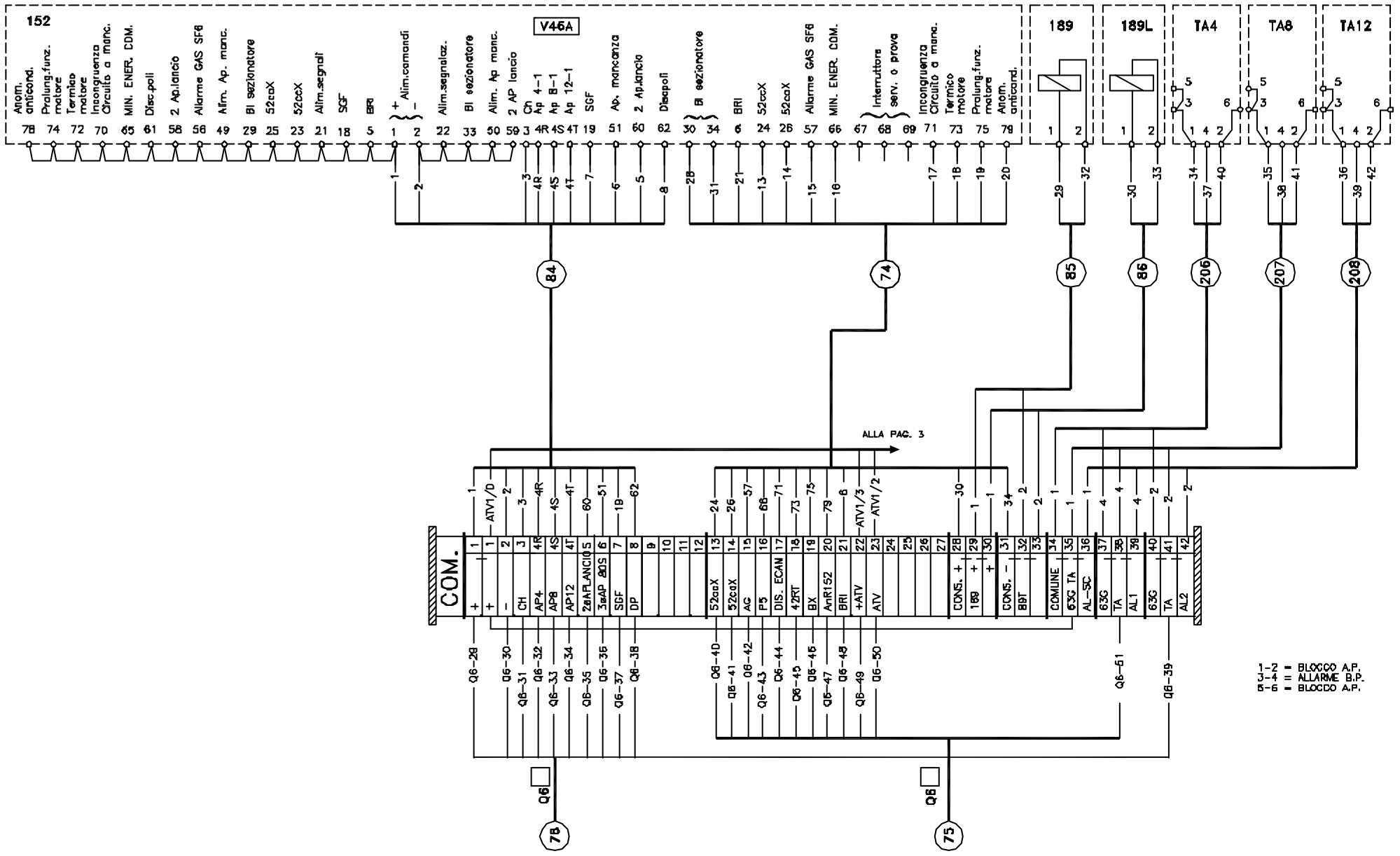
SEZ. C:C

SEZ. B:B



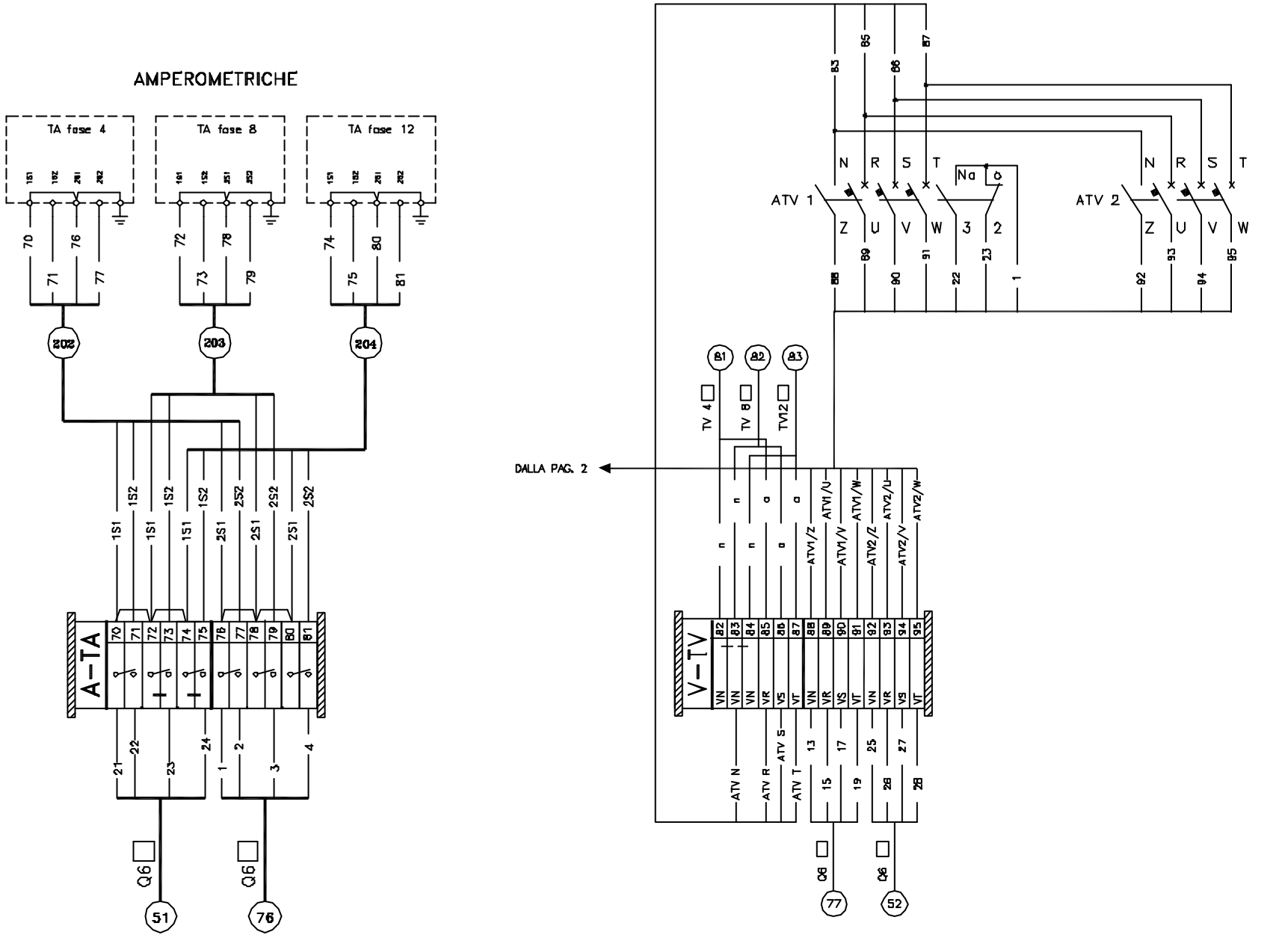


- MORSETTIERA CIRCUITI DI COMANDO
- MORSETTIERA TV
- MORSETTIERA S.A.

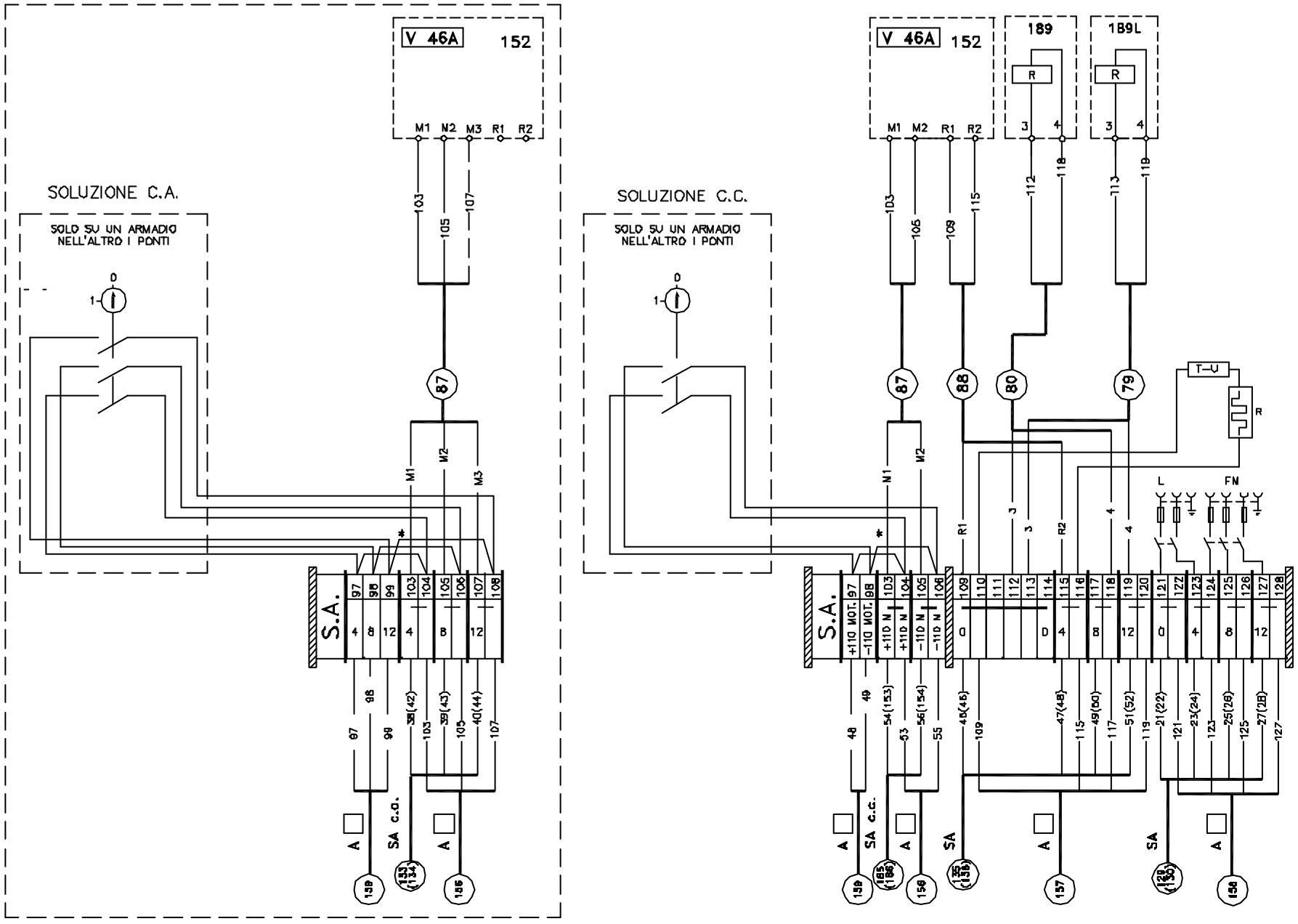

152
Anom. anticond.
Pralung.funz. motore
Termico motore
Incongruenza Circuito a manc.
MIN. ENER. COM.
Disc.poli
2 Ap.lancio
Allarme GAS SF6
Allm. Ap. manc.
BI sezionatore
52aaX
52ccX
Allm.segnali
SGF
BRI
Alim.comandi
Alim.segnalaz.
BI sezionatore
Alim. Ap manc.
2 AP lancio
V46A
Ap 4-1
Ap B-1
Ap 12-1
SGF
Ap. mancanza
2 Ap.lancio
Diespoli
BI sezionatore
BRI
52ccX
52aaX
Allarme GAS SF6
MIN. ENER. COM.
Interruttore serv. o prova
Incongruenza Circuito a manc.
Termico motore
Pralung.funz. motore
Anom. anticond.
189
189L
TA4
TA8
TA12
84
74
85
86
206
207
208
ALLA PAG. 3
COM.
ATV1/D
ATV1/3
ATV1/2
52aaX
52ccX
AG
P5
DIS. ECAN
42RT
BX
AnR152
BRI
+ATV
ATV
CONS. +
189 +
CONS. -
BBT
COMUNE
63G TA
AL-SC
63G
TA
AL1
63G
TA
AL2
Q6
Q6
78
75
1-2 = BLOCCO A.P.
3-4 = ALLARME B.P.
5-6 = BLOCCO A.P.

IR-ING-TEV

IR-ING-TEV


AMPEROMETRICHE
TA fase 4
TA fase 8
TA fase 12
202
203
204
A-TA
V-TV
ATV 1
ATV 2
N R S T Na
Z U V W 3 2
TV 4
TV 8
TV12
DALLA PAG. 2
Q6
51
76
77
52

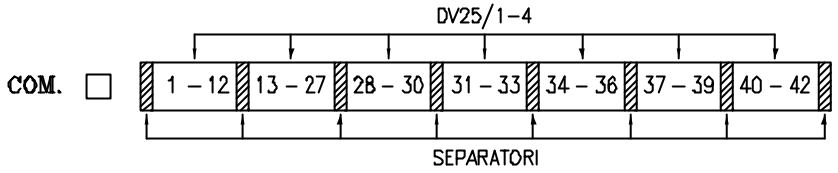
IR-ING-TEV

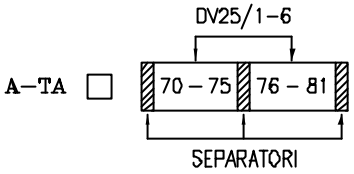


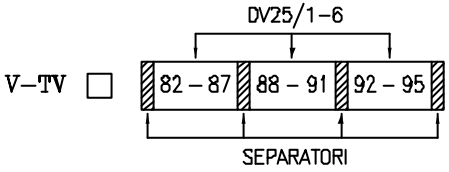
* – COLLEGAMENTI DA ESEGUIRE NELL'ARMADIO DELLA LINEA AT N°2

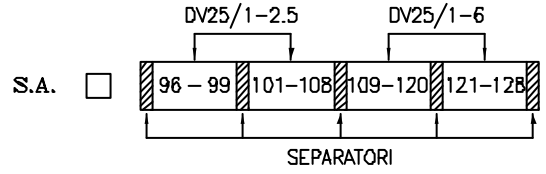
– I MORSETTI INDICATI CON IL NUMERO FRA PARENTESI SI RIFERISCONO ALLA SEZ. VERDE

IR-ING-TEV


COM.
DV25/1-4
1 – 12
13 – 27
28 – 30
31 – 33
34 – 36
37 – 39
40 – 42
SEPARATORI


A–TA
DV25/1-6
70 – 75
76 – 81
SEPARATORI


V–TV
DV25/1-6
82 – 87
88 – 91
92 – 95
SEPARATORI


S.A.
DV25/1-2.5
DV25/1-6
96 – 99
101-108
109-120
121-128
SEPARATORI

POS.	DESCRIZIONE APPARECCHIATURE	QUANTITA'
1	ARMADIO DI ACCIAO INOX AISI 316 spessore 20/10 Xha 1700 Xla 700 Xp300 L'armadio deve essere saldato con processo di saldatura continua in gas inerte La porta deve avere un grado di protezione IP44 A porte aperte ogni singolo apparecchio deve avere protezione IP20	1
2	PRESA DI CORRENTE TRIPOLARE CON INTERRUTTORE DI BLOCCO Montaggio a parete IP55 Tensione nominale 400 V Corrente nominale 32 A Poli 3+T Secondo Norme CEI 23-12 / CEI EN 60309-1 e CEI EN 60309-2	1
3	PRESA DI CORRENTE BIPOLARE CON INTERRUTTORE DI BLOCCO Montaggio a parete IP55 Tensione nominale 400 V Corrente nominale 16 A Poli 2+T Secondo Norme CEI 23-12 / CEI EN 60309-1 e CEI EN 60309-2	1
4	MORSETTIERA RISPONDENTE ALLA LV27 Tipo corazzato IP2X	1
5	RESISTENZA DI RISCALDAMENTO Tipo corazzato IP2X Tensione nominale 220 V Potenza nominale 400 W	1
6	TERMOSTATO AMBIENTE Campo di regolazione 10 - 30° Tipo FANTINI-COSMI tipo C40A o equivalente Corrente nominale 16 A Poli 2+T Secondo Norme CEI 23-12 / CEI EN 60309-1 e CEI EN 60309-2	1
7	DEUMIDOSTATO AMBIENTE Campo di regolazione 30 - 80 % della scala di umidita' Tipo FANTINI-COSMI tipo D40A o equivalente Corrente nominale 16 A Poli 2+T Secondo Norme CEI 23-12 / CEI EN 60309-1 e CEI EN 60309-2	1
8	PROFILATO APPOGGIO MORSETTI FISSACAVO Tipo Karner W8 - Carpaneto 2100F	1
9	PROFILATO PORTAMORSETTIERE RISPONDENTE ALLE CEI EN 50.022 O CEI EN 50.035	1
10	Piatto rame 30 X 3 stagnato con n°6 fori mm.7	1
11	Canalina in PVC autoestinguente (tipo forato) 60 X 60	1
12	INTERRUTTORE QUADRIPOLARE MAGNETOTERMICO Montaggio sporgente attacchi anteriori Tensione nominale 400 V Corrente nominale 3 A Curva d'intervento B n°1 contatto ausiliario discorde n°1 contatto ausiliario concorde anticipato in apertura e ritardato in chiusura Secondo Norme CEI 23-3 / EN 60898 Secondo Norme CEI EN 60947-2	1
13	INTERRUTTORE QUADRIPOLARE MAGNETOTERMICO Montaggio sporgente attacchi anteriori Tensione nominale 400 V Corrente nominale 3 A Curva d'intervento B n°1 contatto ausiliario discorde Secondo Norme CEI 23-3 / EN60898 Secondo Norme CEI EN 60947-2	1
14	INTERRUTTORE DI MANOVRA SEZIONATORE QUADRIPOLARE Montaggio sporgente attacchi anteriori Tensione nominale 400 V Corrente nominale 3 A Curva d'intervento B n°1 contatto ausiliario discorde n°1 contatto ausiliario concorde anticipato in apertura e ritardato in chiusura Secondo Norme CEI 23-3 / EN 60669-1 Secondo Norme CEI EN 60947-3 NB: DEVE ESSERE MONTATO SOLTANTO SU UN ARMADIO DELLE DUE LINEE AT	1

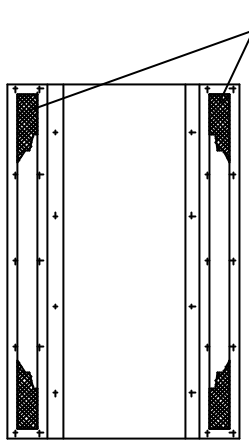
IR–ING–TEV

TABELLA CAVI

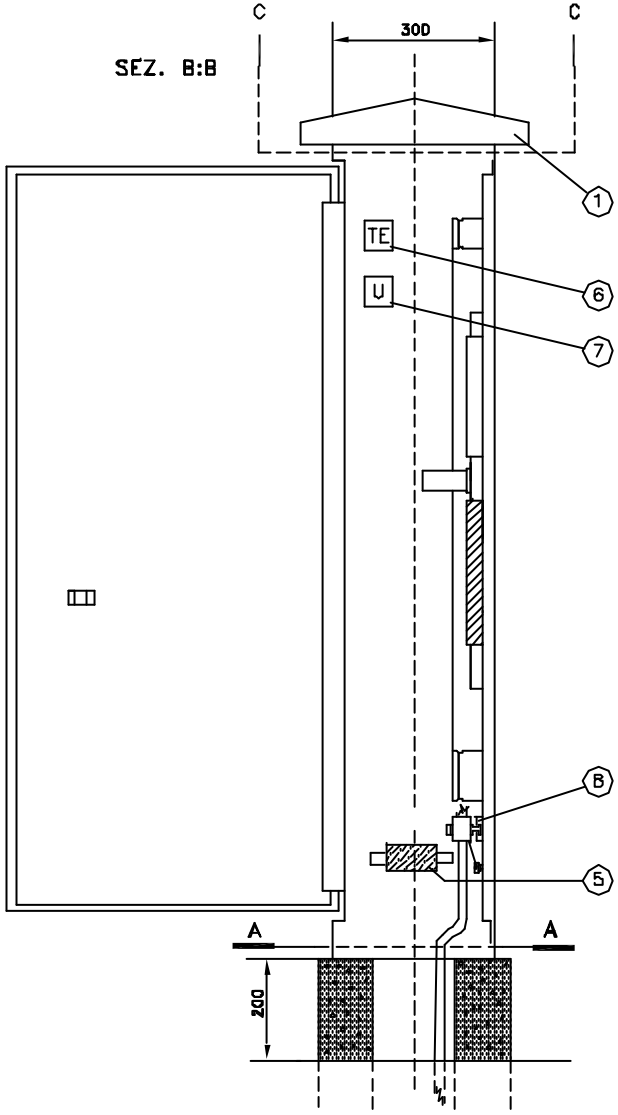
MODULO	DENOMINAZIONE N° CAVO	SIGLA DA	SIGLA A	FORMAZIONE CAVO SENZA SCHERMO	FORMAZIONE CAVO CON SCHERMO	LUNGHEZZA (m)	FUNZIONE	NOTE
	51	Q6	A–TA		4x4		CORRENTI MISURE	
	74	152	V–TV		16x2,5		SEGNALAZIONI INTERRUTTORE	
	75	Q6	COM.		16x2,5		SEGNALAZIONI INTERRUTTORE	
	76	Q6	A–TA		4x4		CORRENTI PROTEZIONE	
	77	Q6	V–TV		4x4		TENSIONI PROTEZIONI	
	78	Q6	COM.		16x2,5		COMANDI E SEGNALAZIONI INTERRUTTORE	
	79	189L	SA	2x2,5			RISCALDAMENTO BLOCCO SEZIONATORE	
	80	189	SA	2x2,5			RISCALDAMENTO BLOCCO SEZIONATORE	
	81	TV4	V–TV		2x4		TENSIONE FASE 4	
	82	TV8	V–TV		2x4		TENSIONE FASE 8	
	83	TV12	V–TV		2x4		TENSIONE FASE 12	
	84	152	COM.		12x2,5		COMANDI E SEGNALAZIONI INTERRUTTORE	
	85	189	COM.		2X2.5		BLOCCO SEZIONATORE DI SBARRA	
	86	189L	COM.		2x2,5		BLOCCO SEZIONATORE DI SBARRA	
	87	152	SA		3x2,5		ALIMENTAZIONE MOTORE INTERRUTTORE	
	88	152	SA		2x2,5		RISCALDAMENTO INTERRUTTORE	
	129	SA	SA		4x		PRESE FORZA MOTRICE TASSATA	
	133(134)	SAa.a.	SA		4x10		ALIMENTAZIONE MOTORI INTERRUTTORE AT IN CORRENTE ALTERNATA	
	135	SA	SA		4x		RISCALDAMENTO APPARECCHIATURE AT	
	156	A	COM.		4x10		ALIMENTAZIONE MOTORI INTERRUTTORE	
	157	A	SA		4x		RISCALDAMENTO APPARECCHIATURE	
	158	A	SA		4x		FORZA MOTRICE	
	159	A	SA		4x		PARALLELO ALIMENTAZIONE MOTORI INTERRUTTORI	
	185(186)	SAa.a.	SA		2x25		ALIMENTAZIONE MOTORE INTERRUTTORI AT IN CORRENTE CONTINUA	
	202	TA4	A–TA		4x4		CORRENTI FASE 4	
	203	TA8	A–TA		4x4		CORRENTI FASE 8	
	204	TA12	A–TA		4x4		CORRENTI FASE 12	
	206	TA4	COM.		4x4		SEGNALI ANOMALIE PRESSIONE GAS	
	207	TA8	COM.		4x4		SEGNALI ANOMALIE PRESSIONE GAS	
	208	TA12	COM.		4x4		SEGNALI ANOMALIE PRESSIONE GAS	

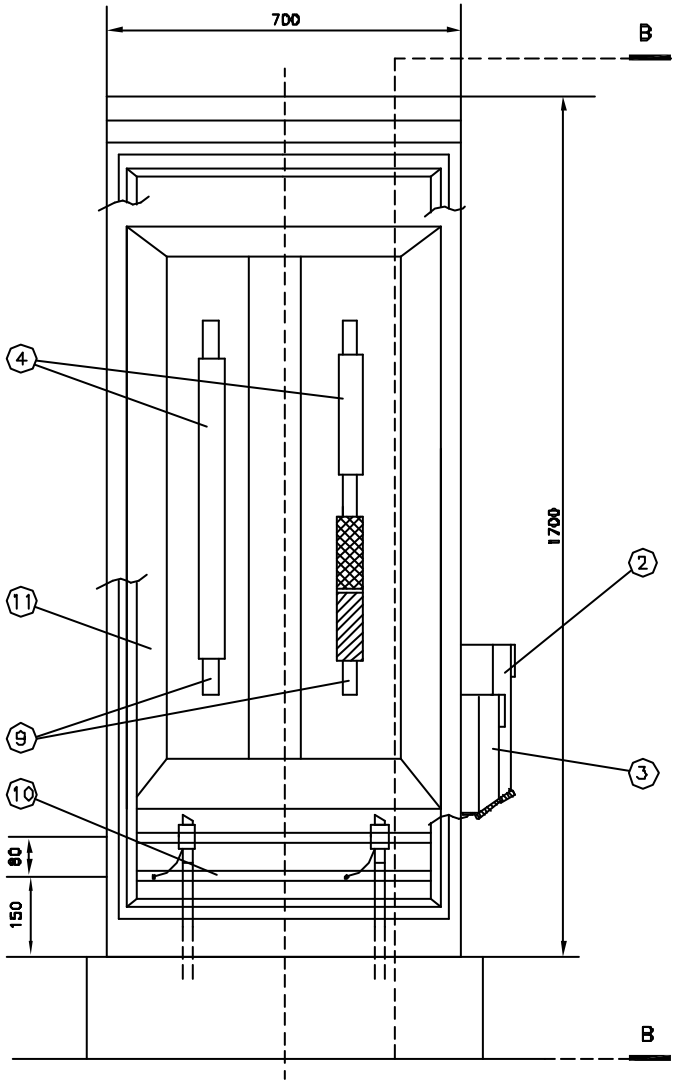
NOTE :

(1) – PRECISARE IL COLORE DELLA SBARRA "ROSSA O VERDE"
L' INDICAZIONE DI PROVENIENZA E DI ARRIVO DEI CAVI PONTE TRA I TELAI E TRA LE CELLE, VA COMPLETATA CON IL NUMERO DI TELAIO E LA SIGLA DELLA CELLA



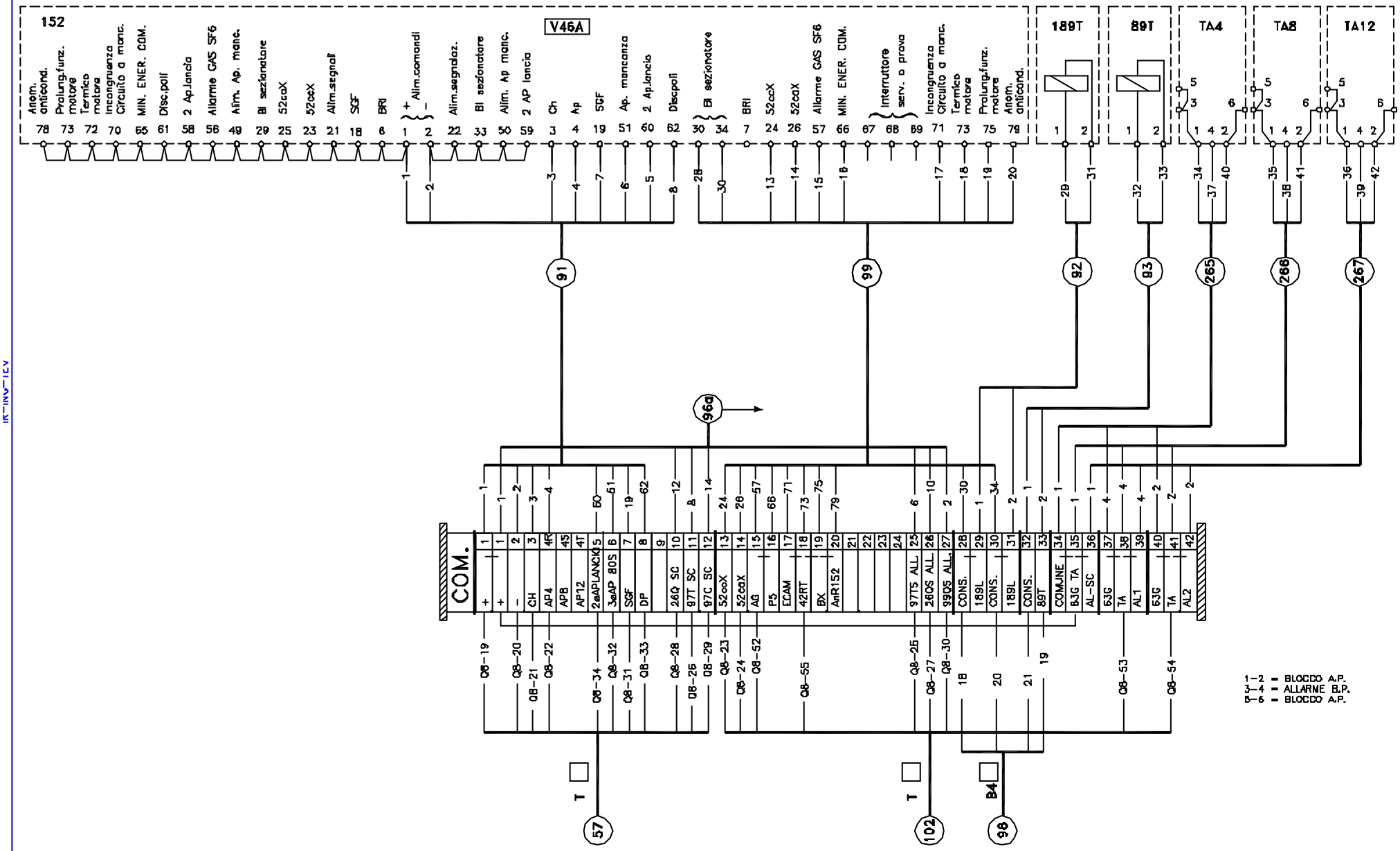
SEZ. C:C

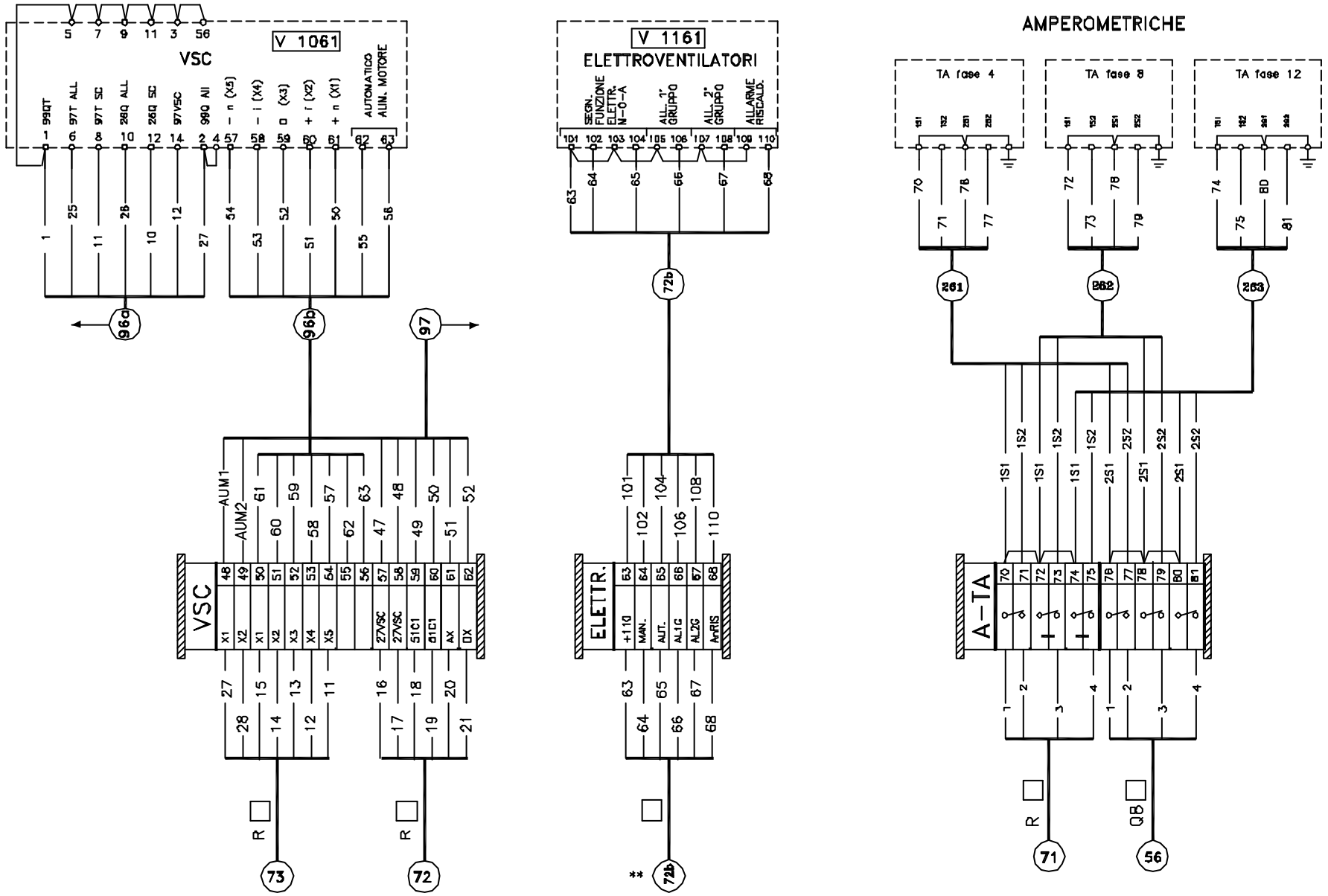




- MORSETTIERA CIRCUITI DI COMANDO
- MORSETTIERA TV
- MORSETTIERA S.A.

IR-ING-TEV

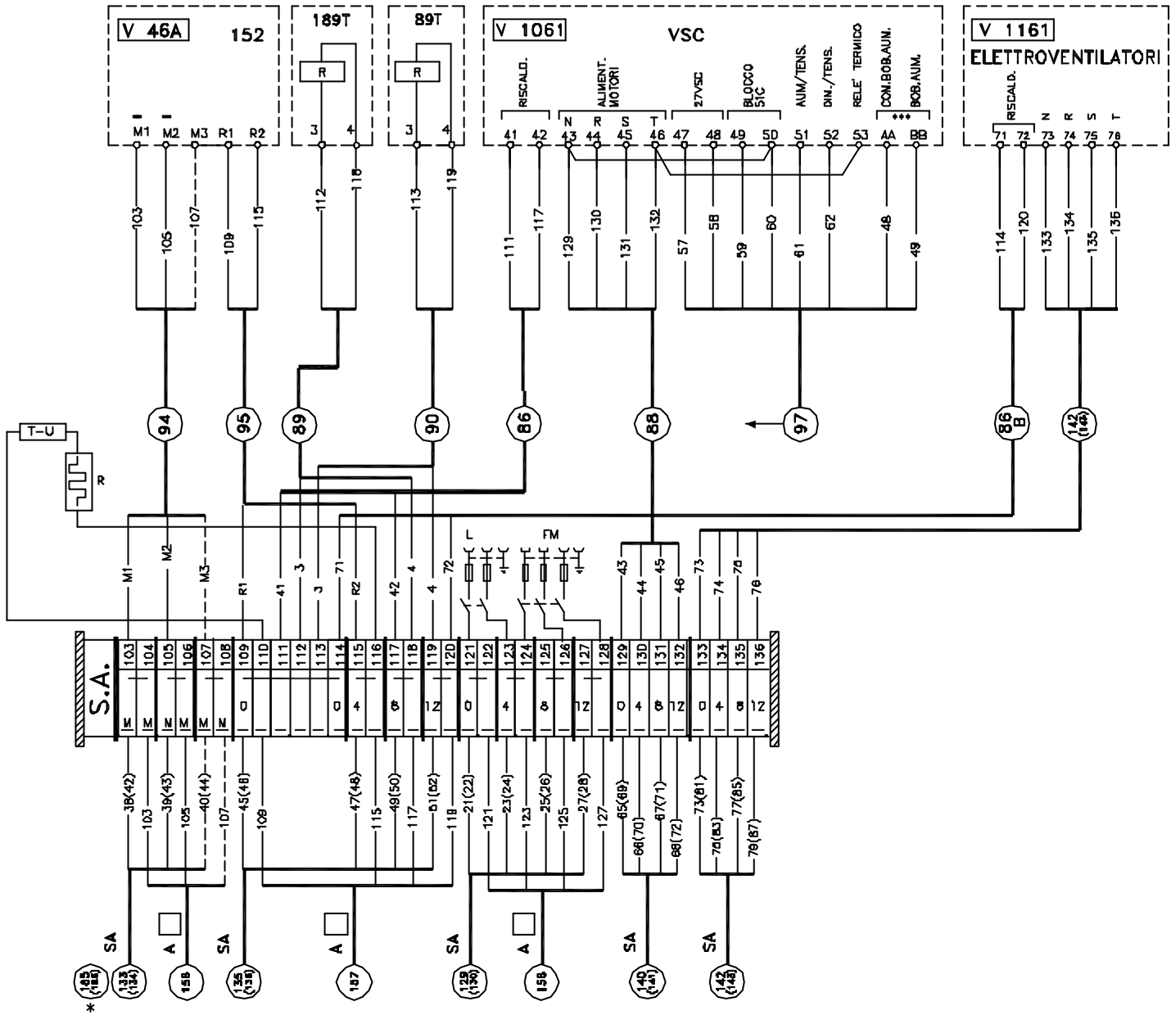

152
V46A
189T
89T
TA4
TA8
TA12
Anom. anticond.
Pralung.funz. motore
Termico motore
Incongruenza Circuito a manc.
MIN. ENER. COM.
Disc.poli
2 Ap.lancio
Allarme GAS SF6
Alim. Ap. manc.
Bl sezionatore
52aaX
52aeX
Allm.segnali
SGF
BRI
Alim.comandi
Alim.segnaloz.
Bl sezionatore
Alim. Ap manc.
2 AP lancio
Ch
Ap
SGF
Ap. mancanza
2 Ap.lancio
Diapoli
Bl sezionatore
BRI
52aaX
52aaX
Allarme GAS SF6
MIN. ENER. COM.
Interruttore serv. a prova
Incongruenza Circuito a manc.
Termico motore
Pralung.funz. motore
Anom. anticond.
91
99
92
93
265
266
267
96a
57
102
98
COM.
1-2 = BLOCCO A.P.
3-4 = ALLARME B.P.
5-6 = BLOCCO A.P.


V 1061
VSC
V 1161
ELETTROVENTILATORI
AMPEROMETRICHE
TA fase 4
TA fase 8
TA fase 12
A-TA
ELETTR.
AUM1
AUM2
R
QB
** – EVENTUALE PANNELLO AGGIUNTIVO SEGNALAZIONI ELETTROVENTILATORI

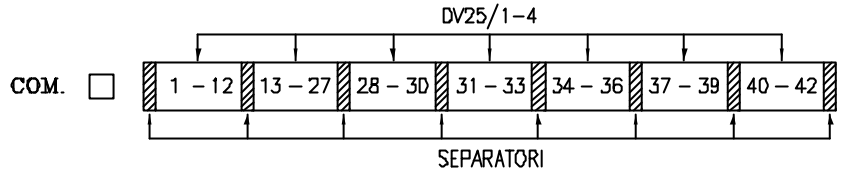
* CON ALIMENTAZIONE IN C.C.
– I MORSETTI INDICATI CON IL NUMERO FRA PARENTESI SI RIFERISCONO ALLA SEZ. VERDE
– PER COLLEGARE IL BLOCCO PER 59S1, SCONNETTERE IL FILO DI COMANDO SULLA BOBINA DI AUMENTA MORSETTO "AA" COLLEGARE QUINDI IL MORSETTO "BB" AL CAPO DELLA BOBINA STESSA

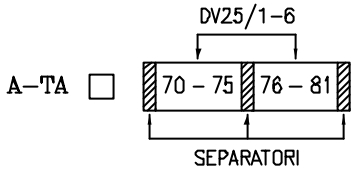
Enel Distribuzione

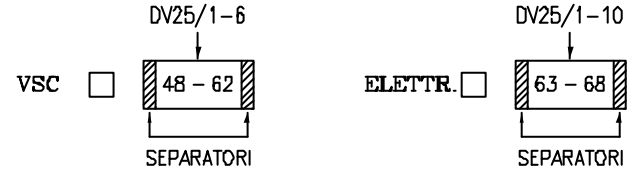
DQ1910A2NCI
Gennaio 2007
Ed.1 - 4 /7

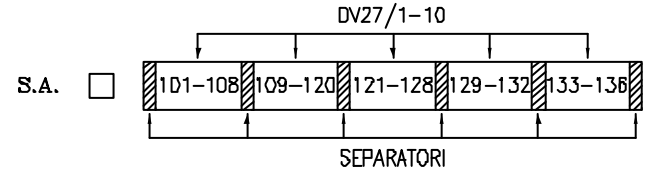


IR–ING–TEV


DV25/1–4
COM.
1 – 12
13 – 27
28 – 30
31 – 33
34 – 36
37 – 39
40 – 42
SEPARATORI


DV25/1–6
A–TA
70 – 75
76 – 81
SEPARATORI


DV25/1–6
VSC
48 – 62
SEPARATORI
DV25/1–10
ELETTR.
63 – 68
SEPARATORI


DV27/1–10
S.A.
101–108
109–120
121–128
129–132
133–136
SEPARATORI

POS.	DESCRIZIONE APPARECCHIATURE	QUANTITA'
1	ARMADIO DI ACCIAO INOX AISI 316 spessore 20/10 Xha 1700 Xla 700 Xp300 L'armadio deve essere saldato con processo di saldatura continua in gas inerte La porta deve avere un grado di protezione IP44 A porte aperte ogni singolo apparecchio deve avere protezione IP20	1
2	PRESA DI CORRENTE TRIPOLARE CON INTERRUTTORE DI BLOCCO Montaggio a parete IP55 Tensione nominale 400 V Corrente nominale 32 A Poli 3+T Secondo Norme CEI 23-12 / CEI EN 60309-1 e CEI EN 60309-2	1
3	PRESA DI CORRENTE BIPOLARE CON INTERRUTTORE DI BLOCCO Montaggio a parete IP55 Tensione nominale 400 V Corrente nominale 16 A Poli 2+T Secondo Norme CEI 23-12 / CEI EN 60309-1 e CEI EN 60309-2	1
4	MORSETTIERA RISPONDENTE ALLA LV27 Tipo corazzato IP2X	1
5	RESISTENZA DI RISCALDAMENTO Tipo corazzato IP2X Tensione nominale 220 V Potenza nominale 400 W	1
6	TERMOSTATO AMBIENTE Campo di regolazione 10 - 30° Tipo FANTINI-COSMI tipo C40A o equivalente Corrente nominale 16 A Poli 2+T Secondo Norme CEI 23-12 / CEI EN 60309-1 e CEI EN 60309-2	1
7	DEUMIDOSTATO AMBIENTE Campo di regolazione 30 - 80 % della scala di umidita' Tipo FANTINI-COSMI tipo D40A o equivalente Corrente nominale 16 A Poli 2+T Secondo Norme CEI 23-12 / CEI EN 60309-1 e CEI EN 60309-2	1
8	PROFILATO APPOGGIO MORSETTI FISSACAVO Tipo Karner W8 - Carpaneto 2100F	1
9	PROFILATO PORTAMORSETTIERE RISPONDENTE ALLE CEI EN 50.022 O CEI EN 50.035	1
10	Piatto rame 30 X 3 stagnato con n°8 fori mm.7	1
11	Canalina in PVC autoestinguente (tipo forato) 60 X 60	1

IR-ING-TEV

TABELLA CAVI

MODULO	DENOMINAZIONE N° CAVO	SIGLA DA	SIGLA A	FORMAZIONE CAVO SENZA SCHERMO	FORMAZIONE CAVO CON SCHERMO	LUNGHEZZA (m)	FUNZIONE	NOTE
	56	QB	A–TA		4x4		AMPEROMETRICHE PROTEZIONI	
	57	T	COM.		16x2,5		COMANDO E SEGNALAZIONE INTERRUTTORE	
	71	R	A–TA		4x4		AMPEROMETRICHE TENSIONI C.S.C.	
	72	R	A–TA		7x1,5		COMANDI C.S.C.	
	73	R	A–TA		7x1,5		POSIZIONE C.S.C.	
	86	VSC	SA		2x2,5		RISCALDAMENTO TRASFORMATORE	
	88	VSC	SA		4x2,5		ALIMENTAZIONE MOTORI	
	89	189T	SA		4x2,5		RISCALDAMENTO BLOCCO SEZIONATORE AT	
	90	89T	SA		2x2,5		RISCALDAMENTO BLOCCO SEZIONATORE MT	
	91	152	COM.		12x2,5		COMANDI E SEGNALAZIONI INTERRUTTORE AT	
	92	189T	COM.		2x2,5		BLOCCO SEZIONATORE AT	
	93	89T	COM.		2x2,5		BLOCCO SEZIONATORE MT	
	94	152	SA		3x2,5		ALIMENTAZIONE MOTORE	
	95	152	SA		2x2,5		RISCALDAMENTO	
	96	VSC	V–TV		16x2,5		SERVIZI DEL TRASFORMATORE	
	97	VSC			7x2,5		SERVIZI DEL TRASFORMATORE	
	98	84	COM.		4x2,5		BLOCCO MANOVRA SEZIONATORE	
	99	152	COM.		16x2,5		SEGNALAZIONI E ALLARME INTERRUTTORE AT	
	102	T	COM.		2x2,5		SEGNALAZIONI Anln E SGFSC	
	129	SA	SA		4x		PRESE FORZA MOTRICE TASSATA	
	133	SAc.a.	SA		4x		MOTORI INTERRUTTORE AT	
	135	SA	SA		4x		RISCALDAMENTO APPARECCHIATURE AT	
	140	SA	SA		4x		SERVIZI AUSILIARI TRASFORMATORE ROSSO	
	142	SA	SA		4x		SERVIZI AUSILIARI TRASFORMATORE VERDE	
	156	A	SA		4x		ALIMENTAZIONE MOTORI INTERRUTTORE	
	157	A	SA		4x		RISCALDAMENTO APPARECCHIATURE	
	158	A	SA		4x		FORZA MOTRICE	
	185	SAc.a.	SA		2x2,5		ALIMENTAZIONE MOTORE INTERRUTTORI AT SEMISBARRA ROSSA	
	261	TA4	A–TA		4x4		CORRENTI FASE 4	
	262	TA8	A–TA		4x4		CORRENTI FASE 8	
	263	TA12	A–TA		4x4		CORRENTI FASE 12	
	265	TA4	COM.		4x4		SEGNALI ANOMALIE PRESSIONE GAS	
	266	TA8	COM.		4x4		SEGNALI ANOMALIE PRESSIONE GAS	
	267	TA12	COM.		4x4		SEGNALI ANOMALIE PRESSIONE GAS	

NOTE :

(1) – PRECISARE IL COLORE DELLA SBARRA "ROSSA O VERDE"
L' INDICAZIONE DI PROVENIENZA E DI ARRIVO DEI CAVI PONTE TRA I TELAI E TRA LE CELLE. VA COMPLETATA CON IL NUMERO DI TELAIO E LA SIGLA DELLA CELLA

CABINE PRIMARIE
COLLEGAMENTI DEL DISPOSITIVO DI MONITORAGGIO IMPIANTO SUL TELAIO (T13A) ALLE MORSETTIERE E ALL'IMPIANTO

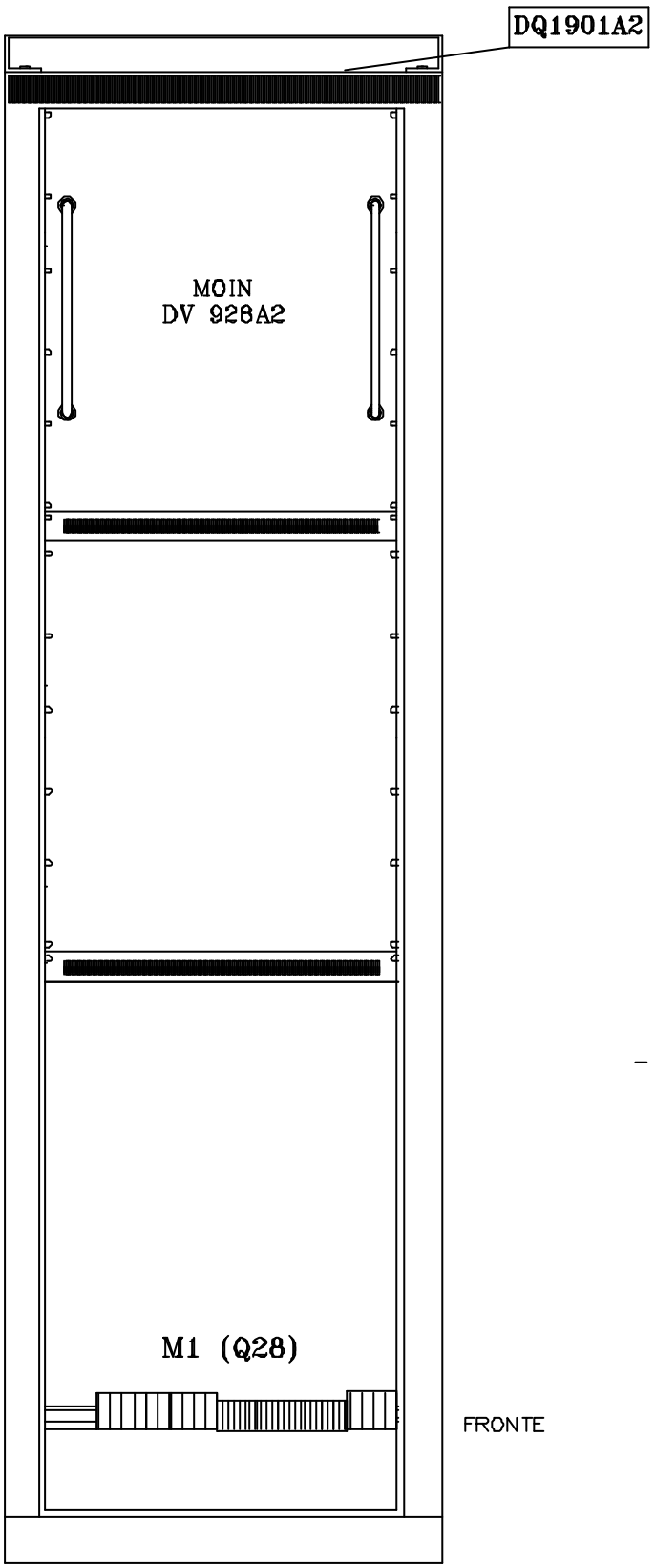
MATRICOLA 160838

DQ1992A2NCI

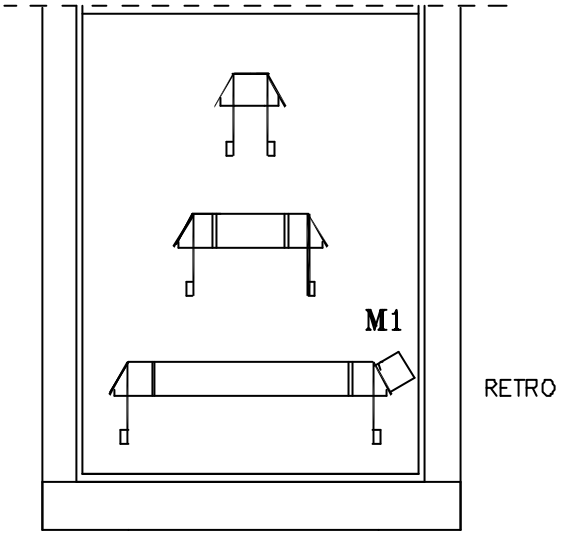
Giugno 2007

Ed.4 - 1/7

IR-ING-TEV

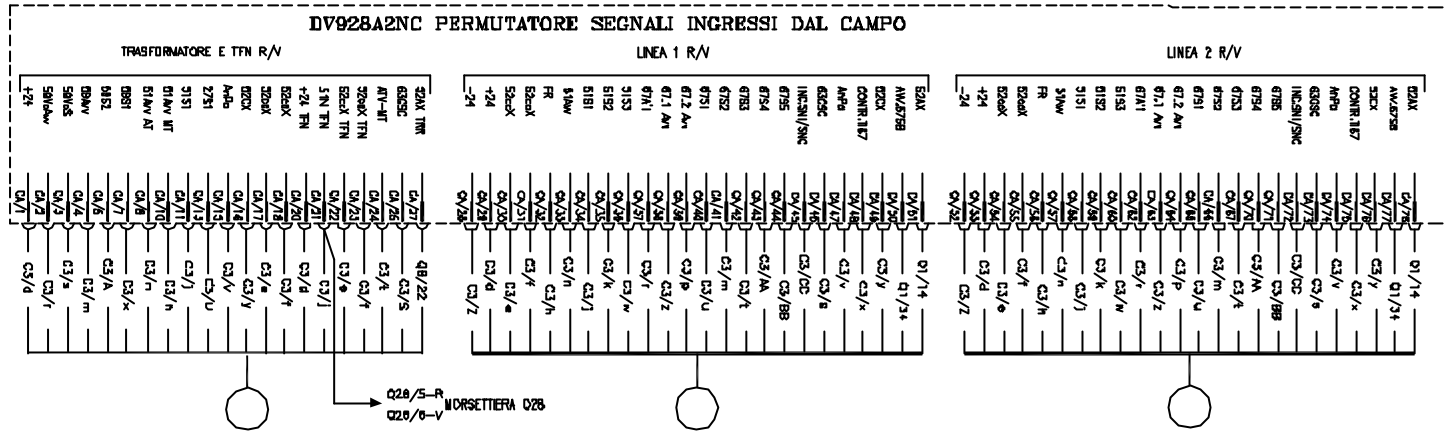


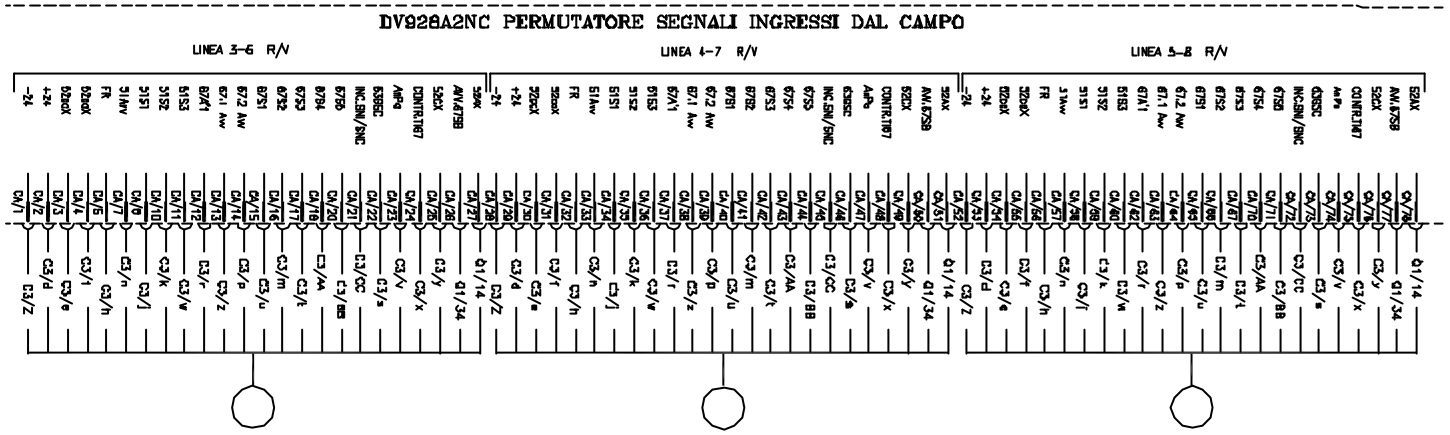
TELAIO DEVE ESSERE CORREDATO:
N° 2 TAMPONATURE FRONTALI AEREATE
N° 2 COPERTURE LATERALI AD INCASSO
N° 2 GUIDE DI SUPPORTO PANNELLI
N° 1 TAMPONATURA 15U

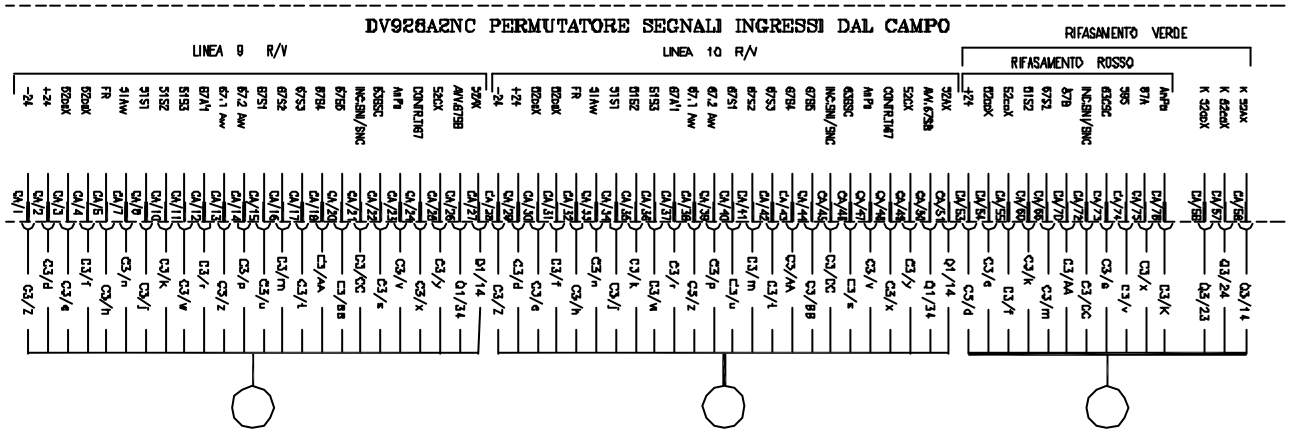


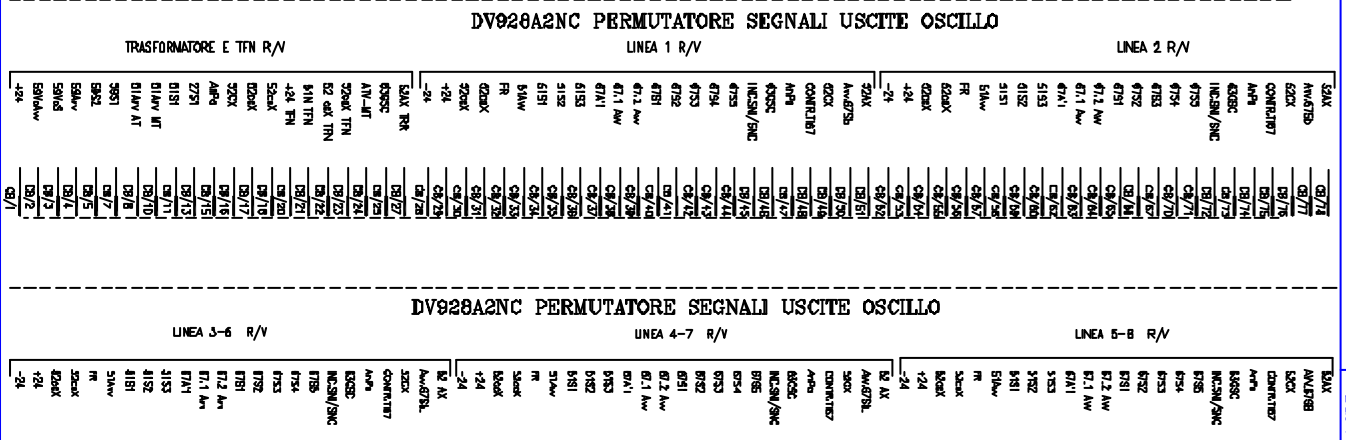
T13A

TELAIO A RASTRELLIERA PREDISPOSTO CON LE MORSETTIERE PER :
N°1 DISPOSITIVO DI MONITORAGGIO IMPIANTO


DV928A2NC PERMUTATORE SEGNALI INGRESSI DAL CAMPO
TRASFORMATORE E TFN R/V
LINEA 1 R/V
LINEA 2 R/V
Q28/5–R
Q28/6–V
MORSETTIERA Q28

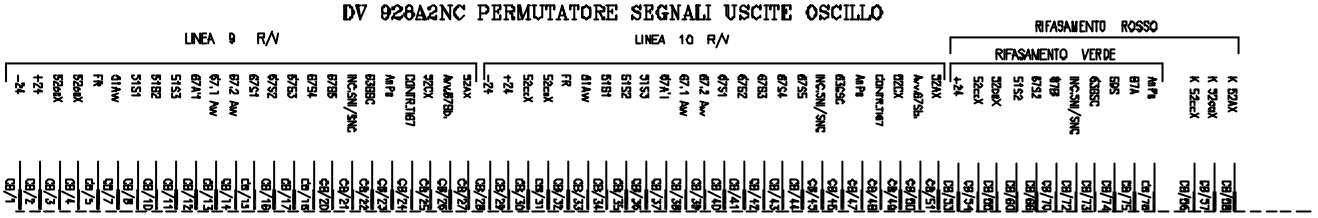

DV928A2NC PERMUTATORE SEGNALI INGRESSI DAL CAMPO
LINEA 3–6 R/V
LINEA 4–7 R/V
LINEA 5–8 R/V


DV928A2NC PERMUTATORE SEGNALI INGRESSI DAL CAMPO
LINEA 9 R/V
LINEA 10 R/V
RIFASAMENTO VERDE
RIFASAMENTO ROSSO

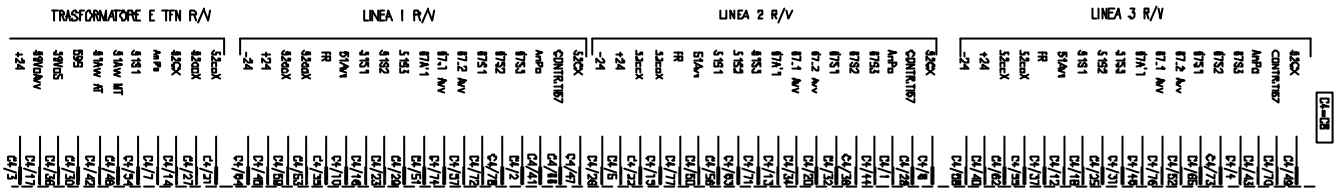

DV928A2NC PERMUTATORE SEGNALI USCITE OSCILLO
TRASFORMATORE E TFN R/V
LINEA 1 R/V
LINEA 2 R/V


DV928A2NC PERMUTATORE SEGNALI USCITE OSCILLO
LINEA 3–6 R/V
LINEA 4–7 R/V
LINEA 5–8 R/V

DV 928A2NC PERMUTATORE SEGNALI USCITE OSCILLO

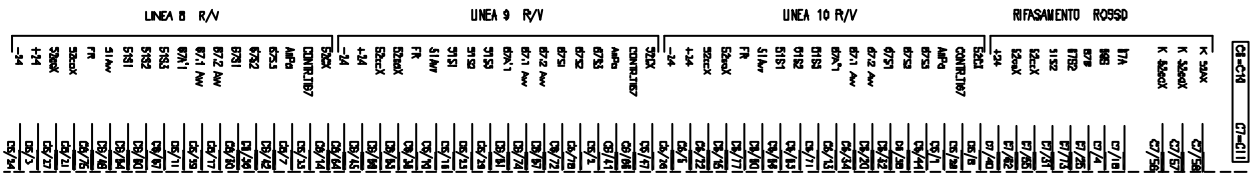


DV 928A2NC PERMUTATORE SEGNALI CIS – ITG

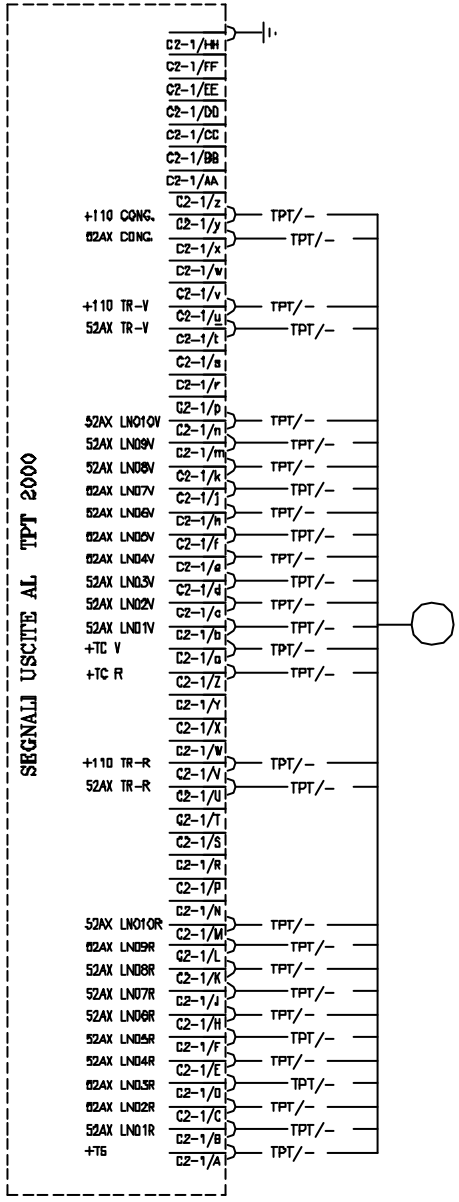


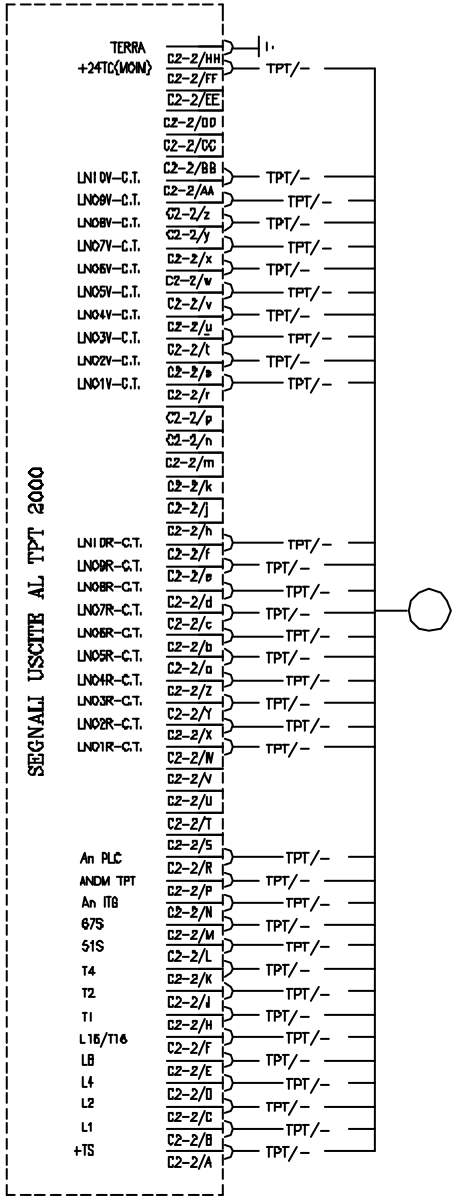
DV928A2NC PERMUTATORE SEGNALI USCITE PER CIS – ITG

DV928A2NC PERMUTATORE SEGNALI USCITE PER CIS – ITG

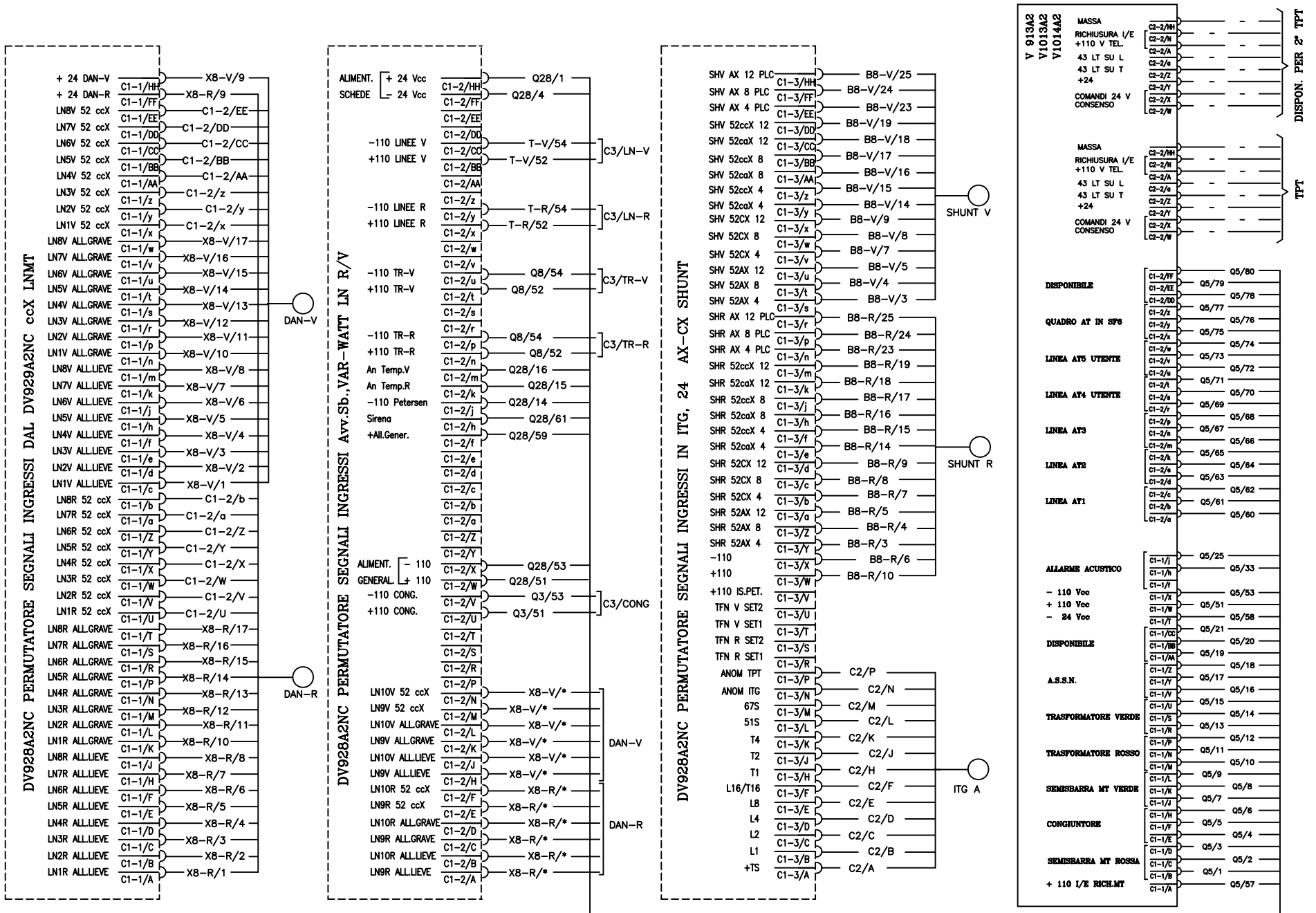


IR-ING-TEV


SEGNALI USCITE AL TPT 2000
C2-1/HH
C2-1/FF
C2-1/EE
C2-1/DD
C2-1/CC
C2-1/BB
C2-1/AA
C2-1/z
C2-1/y
C2-1/x
C2-1/w
C2-1/v
C2-1/u
C2-1/t
C2-1/s
C2-1/r
C2-1/p
C2-1/n
C2-1/m
C2-1/k
C2-1/j
C2-1/h
C2-1/f
C2-1/e
C2-1/d
C2-1/c
C2-1/b
C2-1/a
C2-1/Z
C2-1/Y
C2-1/X
C2-1/W
C2-1/V
C2-1/U
C2-1/T
C2-1/S
C2-1/R
C2-1/P
C2-1/N
C2-1/M
C2-1/L
C2-1/K
C2-1/J
C2-1/H
C2-1/F
C2-1/E
C2-1/D
C2-1/C
C2-1/B
C2-1/A
+110 CONG.
52AX CONG.
+110 TR-V
52AX TR-V
52AX LN010V
52AX LN09V
52AX LN08V
52AX LN07V
52AX LN06V
52AX LN05V
52AX LN04V
52AX LN03V
52AX LN02V
52AX LN01V
+TC V
+TC R
+110 TR-R
52AX TR-R
52AX LN010R
52AX LN09R
52AX LN08R
52AX LN07R
52AX LN06R
52AX LN05R
52AX LN04R
52AX LN03R
52AX LN02R
52AX LN01R
+T5
TPT/-


SEGNALI USCITE AL TPT 2000
TERRA
+24TC(MOM)
C2-2/HH
C2-2/FF
C2-2/EE
C2-2/DD
C2-2/CC
C2-2/BB
C2-2/AA
C2-2/z
C2-2/y
C2-2/x
C2-2/w
C2-2/v
C2-2/u
C2-2/t
C2-2/s
C2-2/r
C2-2/p
C2-2/n
C2-2/m
C2-2/k
C2-2/j
C2-2/h
C2-2/f
C2-2/e
C2-2/d
C2-2/c
C2-2/b
C2-2/a
C2-2/Z
C2-2/Y
C2-2/X
C2-2/W
C2-2/V
C2-2/U
C2-2/T
C2-2/S
C2-2/R
C2-2/P
C2-2/N
C2-2/M
C2-2/L
C2-2/K
C2-2/J
C2-2/H
C2-2/F
C2-2/E
C2-2/D
C2-2/C
C2-2/B
C2-2/A
LN10V-C.T.
LN09V-C.T.
LN08V-C.T.
LN07V-C.T.
LN06V-C.T.
LN05V-C.T.
LN04V-C.T.
LN03V-C.T.
LN02V-C.T.
LN01V-C.T.
LN10R-C.T.
LN09R-C.T.
LN08R-C.T.
LN07R-C.T.
LN06R-C.T.
LN05R-C.T.
LN04R-C.T.
LN03R-C.T.
LN02R-C.T.
LN01R-C.T.
An PLC
ANOM TPT
An ITG
67S
51S
T4
T2
T1
L16/T16
L8
L4
L2
L1
+T5
TPT/-

NB. LE POLARITA' FISSE DELLE RISPETTIVE ISOLE DI ALIMENTAZIONE VANNO PRELEVATE CON IL CAVO C3 mm.1,5



IR-ING-TEV

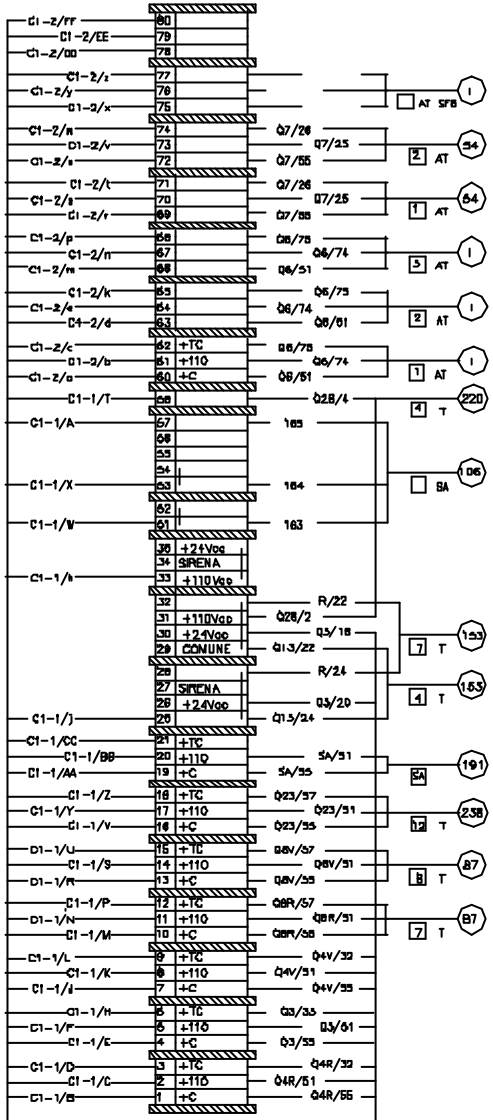
NB. LE POLARITA' FISSE DELLE RISPETTIVE ISOLE DI ALIMENTAZIONE VANNO PRELEVATE CON IL CAVO C3 mm.1,5

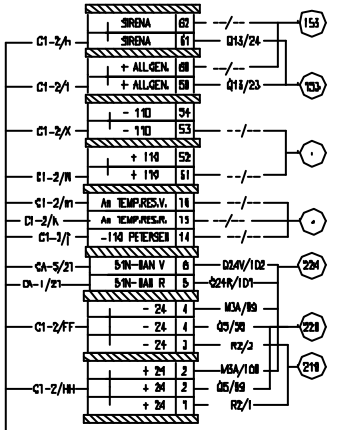
DQ1992A2NCI

Gennaio 2007

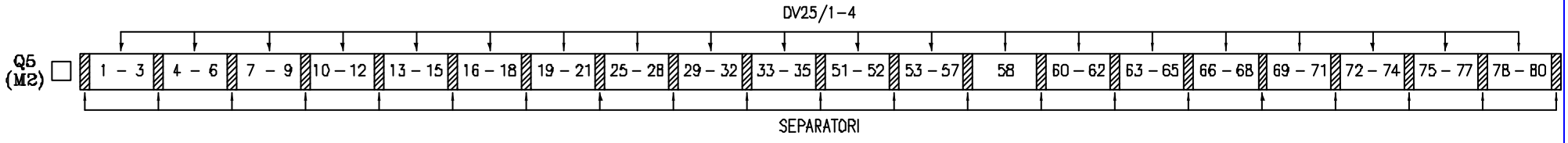
Ed.4 - 6/7

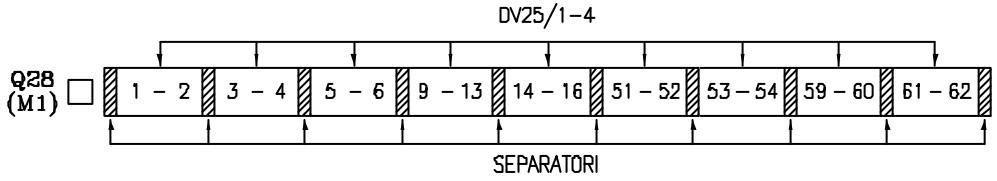
DOR-ING-TCV





MODULO	DENOMINAZIONE N° CAVO	SIGLA DA	SIGLA A	FORMAZIONE CAVO SENZA SCHERMO	FORMAZIONE CAVO CON SCHERMO	LUNGHEZZA (m)	FUNZIONE	NOTE
	54	Q5	AT		3x1,5		–	
	87	Q5	T		2x2,5		ALIMENTAZIONE MOTORE INTERRUTTORE	
	108	Q5	SA		2x4		ALIMENTAZIONI SEGNALAZIONI LOCALI	
	153	T	T		2x2,5		ALLARME ACUSTICO	
	219	Q28	SA		2x2,5		ALIMENTAZIONE 24 V c.c.	
	220	Q28	Q5		2x1,5		ALIMENTAZIONE –24 Vcc RELE' RT1	
	222(R/V)	Q28	Q23		7x1,5		CAVO SET 1 E SET2 AL DV822	
	224	Q28	M3A		3x1,5		MASSIMA CORRENTE OMOPOLARE DI TERRA SISTEMA R/V	
	238	Q5	T		3x1,5		ALIMENTAZIONE 110 Vcc CONTATTI RELE' OPERATIVI TPT	



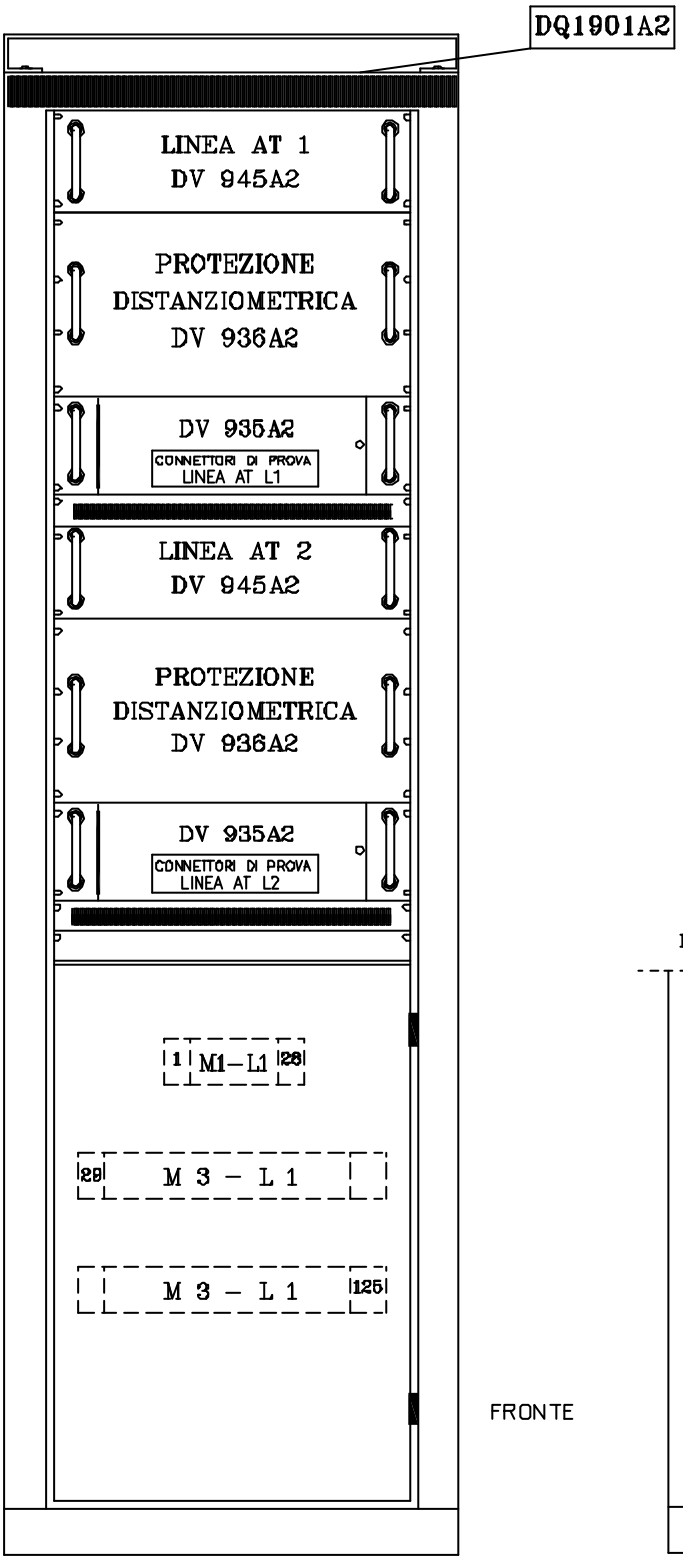


CABINE PRIMARIE
COLLEGAMENTI INTERNI AL TELAIO
LINEA AT(T9) PER DUE LINEE AT

MATRICOLA 160634

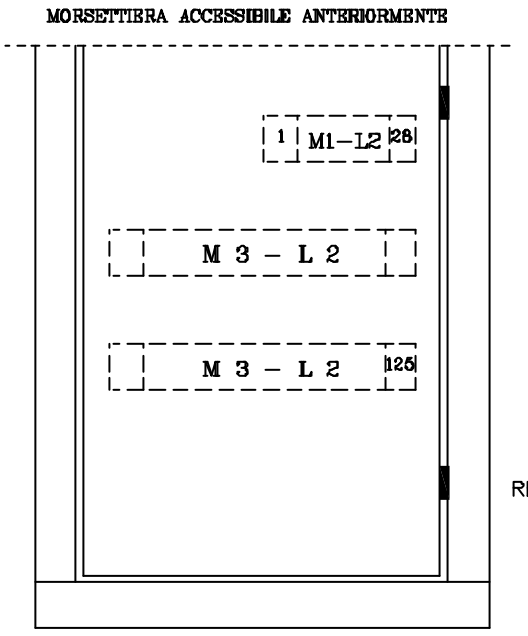
DQ2010A2

Gennaio 2007
Ed. 2 - 1/7



T9

TELAIO DEVE ESSERE CORREDATO:
N° 2 TAMPONATURE FRONTALI AEREATE
N° 2 COPERTURE LATERALI AD INCASSO
N° 12 GUIDE DI SUPPORTO PANNELLI
N° 1 TAMPONATURA 1U

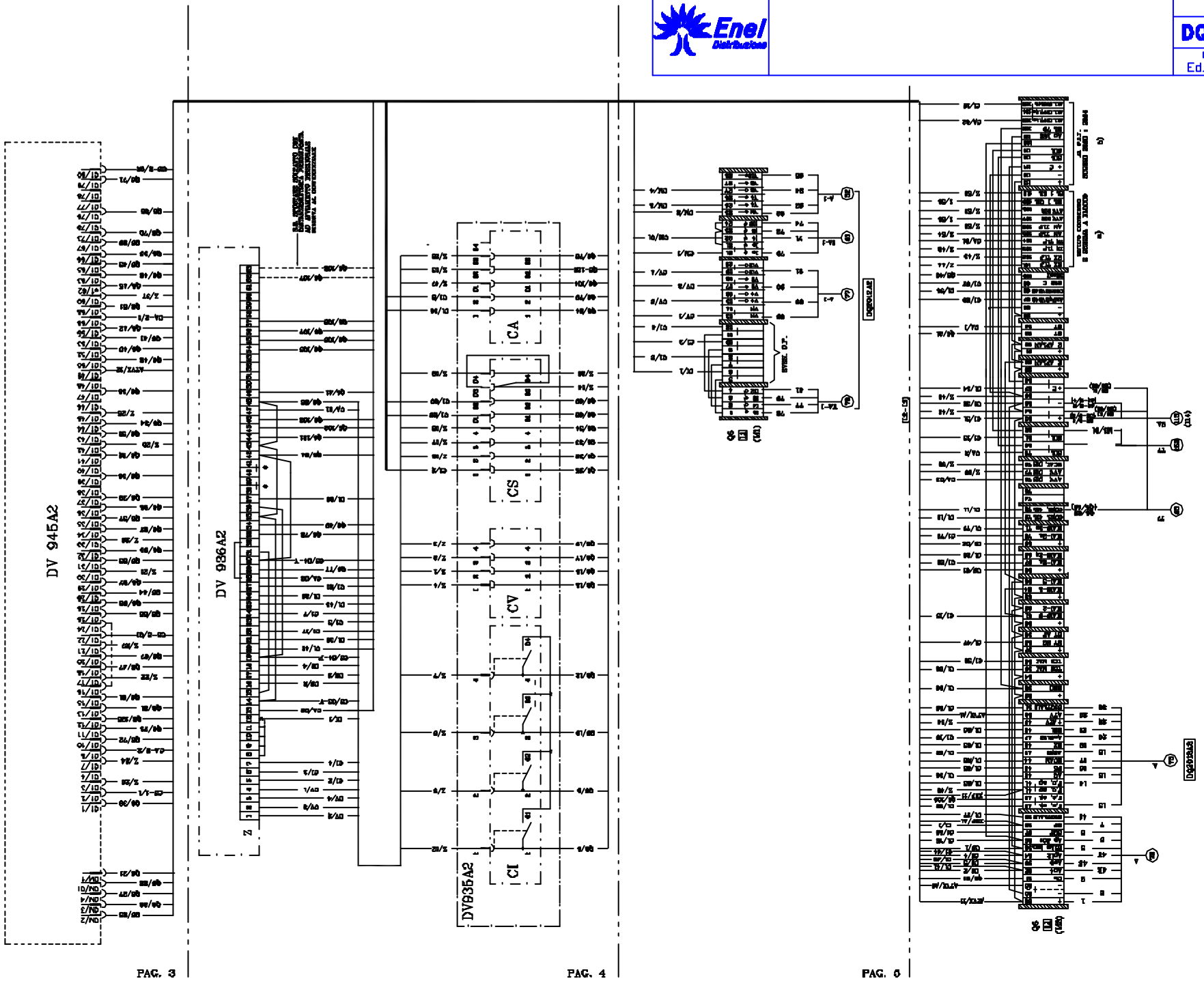


FRONTE

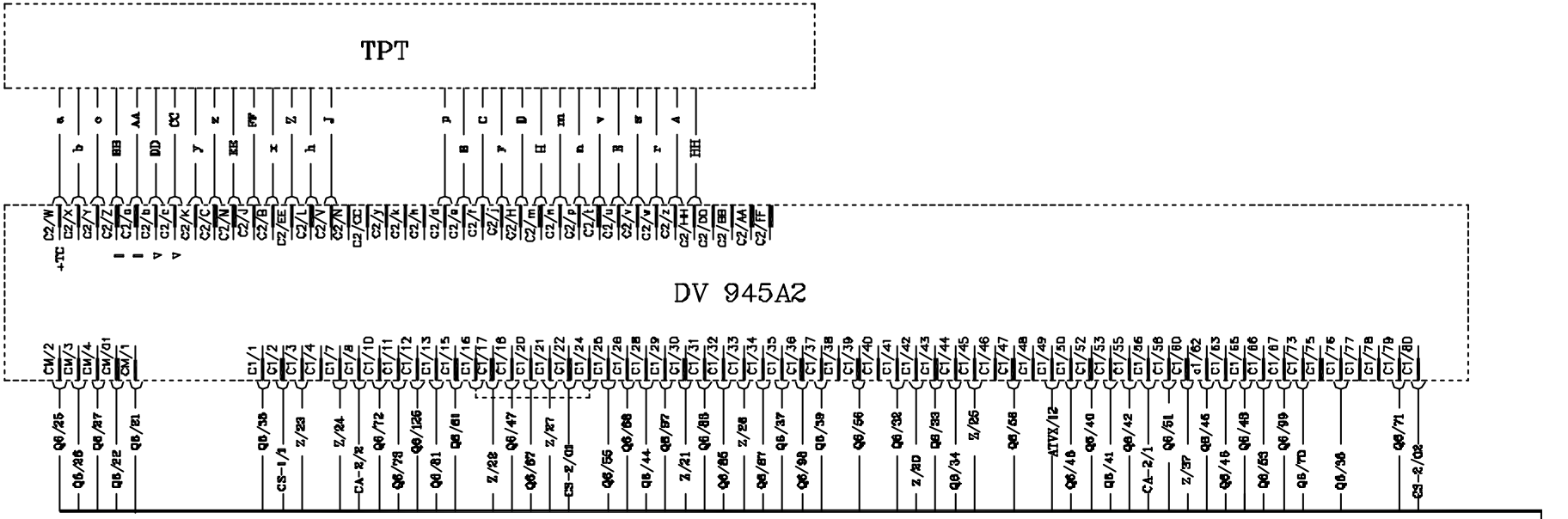
RETRO

TELAIO A RASTRELLIERA PREDISPOSTO CON LE MORSETTIERE PER:
N° 2 PANNELLI LINEA AT
N° 2 PANNELLI PROTEZIONE DISTANZIOMETRICA
N° 2 PANNELLI CONNETTORI DI PROVA DV 935A2

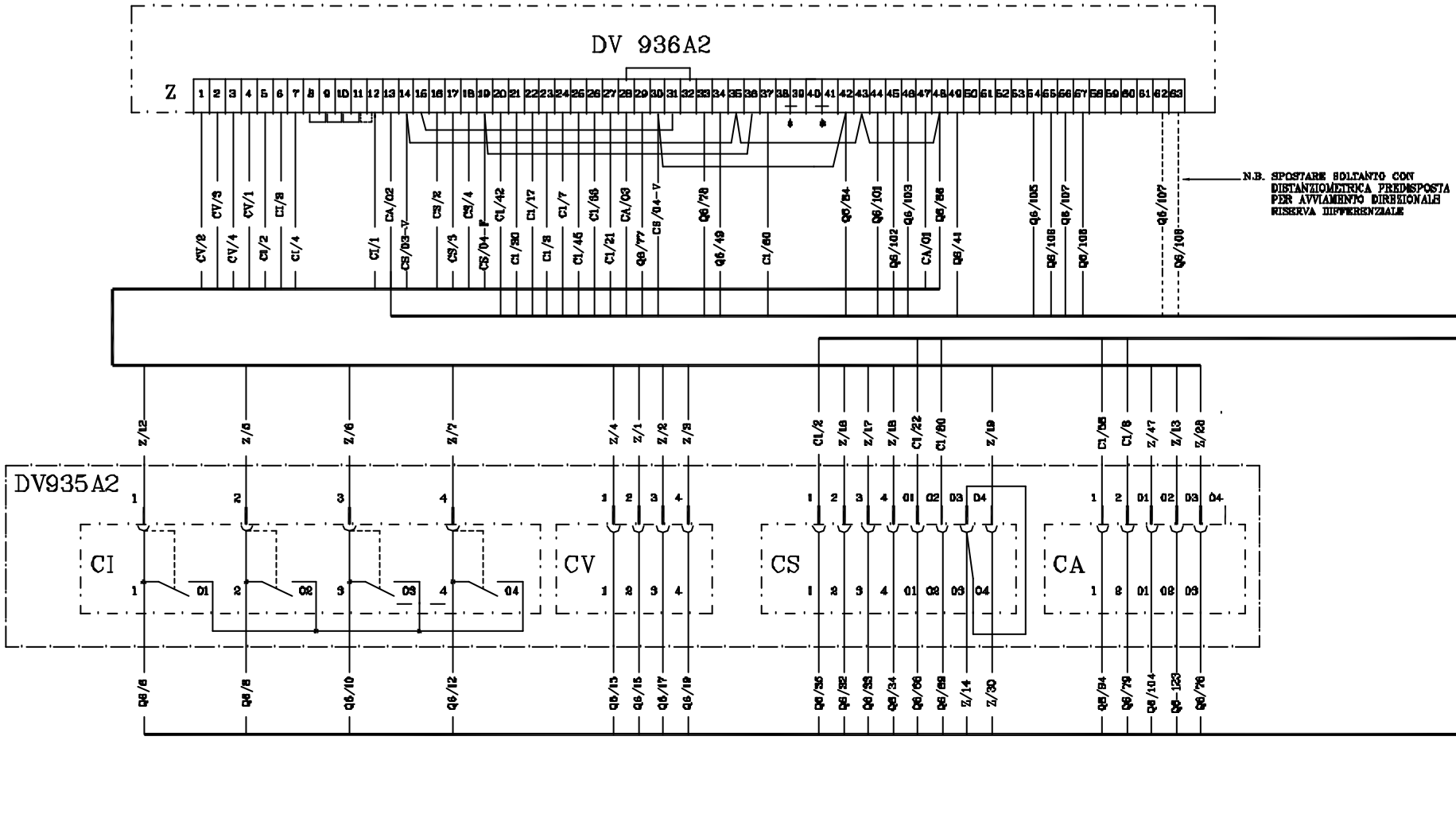
IR-ING-TEV


DV 945A2
DV 936A2
DV935A2
CA
CS
CV
CI
PAG. 3
PAG. 4
PAG. 5
PAG. 6

IR-ING-TEV



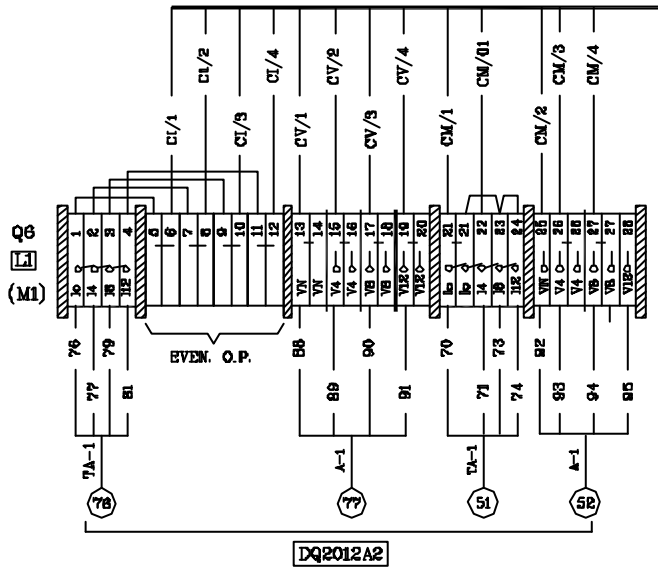
DALLA PAG. 3



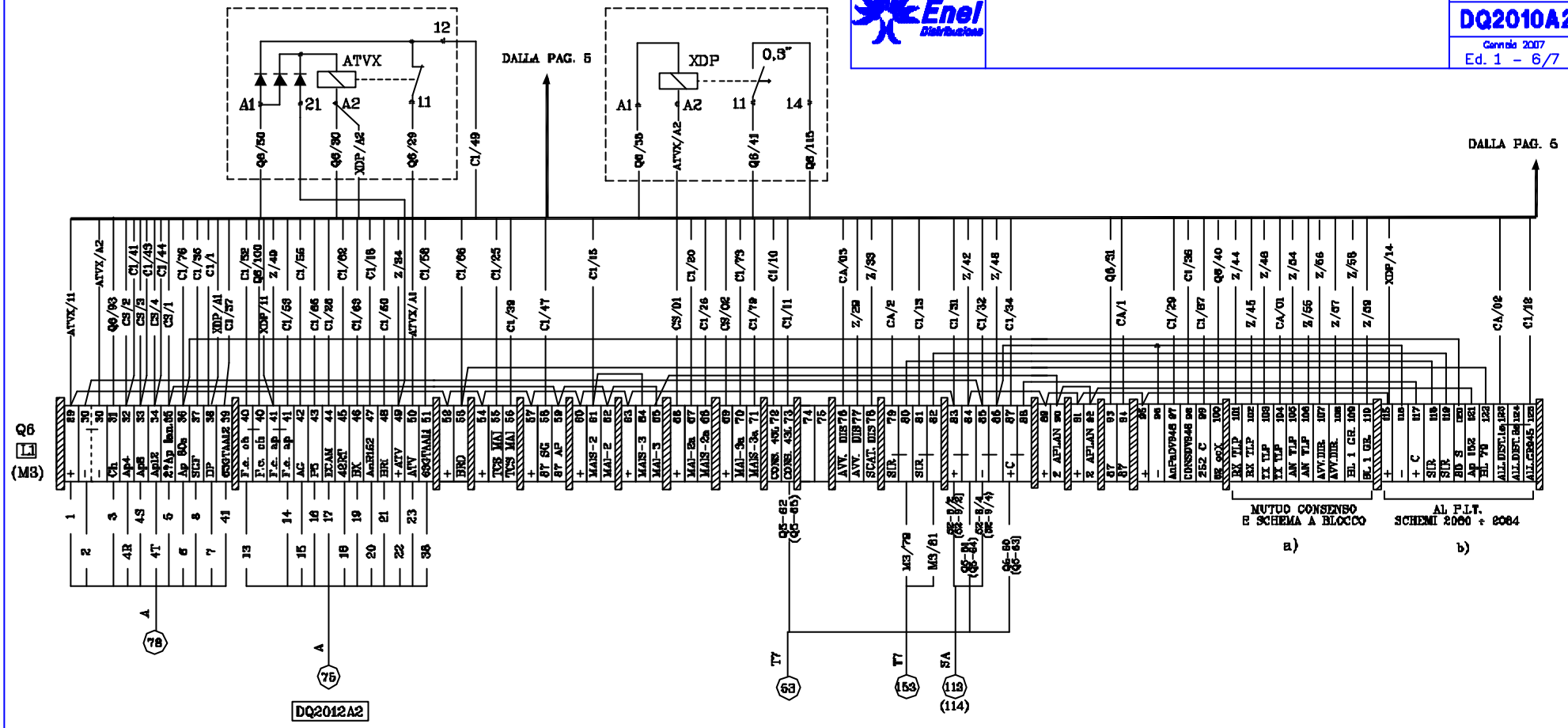
* – CAVALOTTI DA REALIZZARE SOLO PER DETERMINATE PROTEZIONI Ved. DW 2050A2

ALLA PAG. 5

DALLA PAG. 4



ALLA PAG. 6



N° CAVO	FORMAZIONE CAVO		FUNZIONE	NOTE
	SENZA SCHERMO	CON SCHERMO		
53		3x2,5	+11D COMANDI E +11D TELECOMANDI DAL COM. E SEGN.	
75		12x2,5	SEGNALAZIONI INTERRUTTORE AT	
78		12x2,5	COMANDI INTERRUTTORE	
113		2x4	ALIMENTAZIONE LINEA AT1	
114		2x4	ALIMENTAZIONE LINEA AT2	
153		2x2,5	CAVO PONTE ALLARME ACUSTICO	

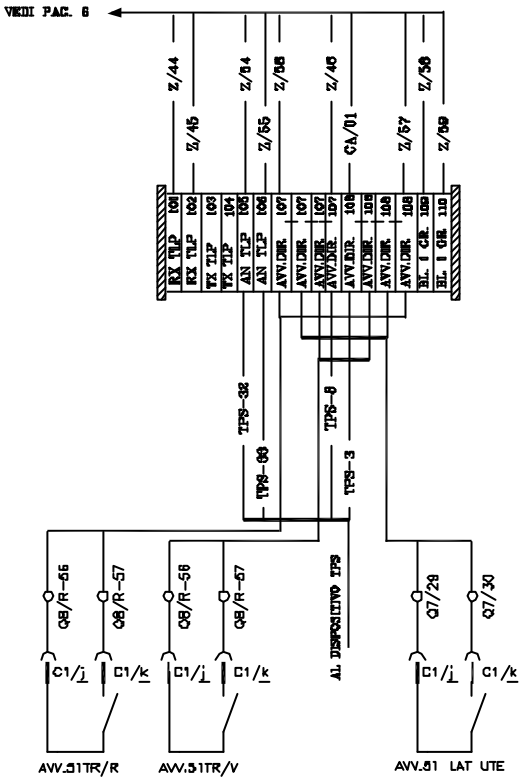
RELE' ATVX 1) – RELE' AMRA POK/2A DERIVATO DAL RELE' POK CONFORME ALLA TABELLA LV 15

DIN/ATM

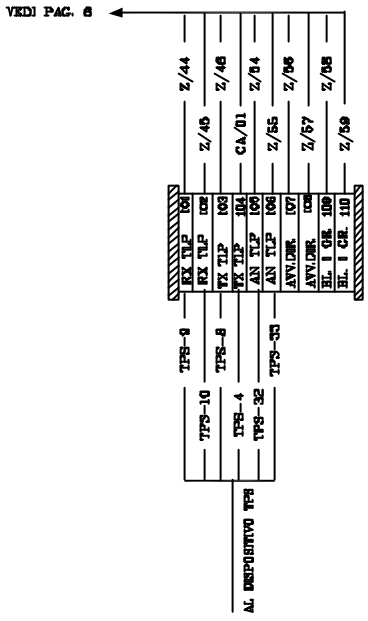
IR-ING-TEV

COLLEGAMENTO AL PANNELLO D'INTERFACCIA TELECONTROLLO E AI DISPOSITIVI DI TELESCATTO E TELEPILOTAGGIO PER IMPIANTI :

CON LINEA AT CORTA SCHEMA A BLOCCO	CON MUTUO CONSENSO DIREZIONALE	DDI AFFACCIATI A IMP. DDI IN SF6 SCHEMA GENERALE DQ2082	DDI IN SF6 AFFACCIATI A IMPIANTI DDI SCHEMA GENERALE DQ2083 - DQ2084



a')



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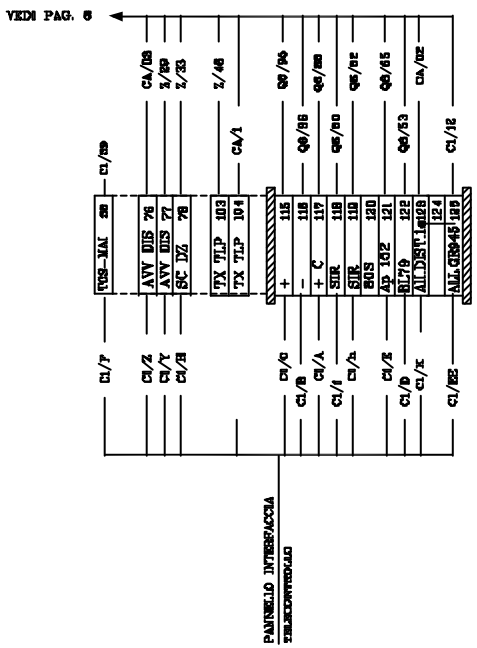
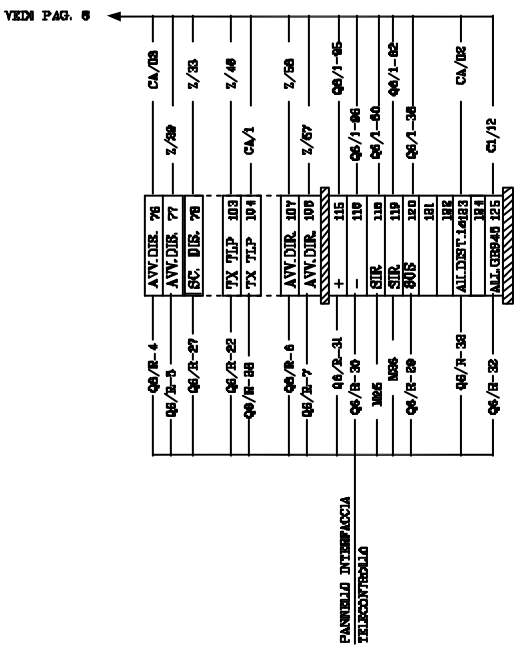


b')



b")

DIS – IUN - TEA

Prescrizioni per la Costruzione del Quadro dei Servizi Ausiliari per Cabina Primaria

ed	Funzione/Unità	Redatto	Verificato	Approvato	Data
4	DIR / IUN -TEA	B. Lapi	R. Calone	G. DiLembo	21-04.-08

DIS – IUN - TEA

INDICE

1. SCOPO DELLE PRESCRIZIONI

Le presenti prescrizioni hanno lo scopo di descrivere le caratteristiche generali funzionali e costruttive del quadro dei servizi ausiliari.

2. CAMPO DI APPLICAZIONE DELLE PRESCRIZIONI

Le presenti prescrizioni si applicano al quadro dei servizi ausiliari previsto nel nuovo progetto unificato delle Cabine Primarie.

3. NORME E PRESCRIZIONI RICHIAMATE NEL TESTO

CEI 17-43 CEI 17-52 CEI 23-67 CEI 17-78 CEI EN60439-1-3
CEI EN60529,A1 CEI EN60898-2 CEI EN 60947-4-1,A1,A2 CEI EN 60947-2
CEI EN 60947-3,A1,A2 CEI EN 61095 DV801A DQ1981 DQ7074
DV201 DV971 DV1500 DV1501A DV1901A2 DV1902A2
DW7074 DV25 UNI 2947 IEC 898 IEC 947-2 IEC 947-3
SCALA RAL-F2 Legge 186/68 Legge 791/77 DPR n°547 del 27-4-1955

4. CARATTERISTICHE COSTRUTTIVE DEL QUADRO

Il quadro dei Servizi Ausiliari deve essere conforme alle Norma CEI EN60439-1-3.

4.1 CARATTERISTICHE ELETTRICHE DELLA SEZIONE A CORRENTE ALTERNATA

- Tensione nominale di impiego 400 V
- Frequenza nominale 50 Hz
- Corrente nominale barratura principale e secondaria 250 A
- Tensione nominale d'isolamento a frequenza industriale 2000V/min.
- Tensione nominale d'impulso a frequenza industriale 6 kV.
- Corrente di cortocircuito trifase per 1 sec ≥15 kA

4.2 CARATTERISTICHE ELETTRICHE DELLA SEZIONE A CORRENTE CONTINUA 110Vcc

- Tensione nominale di impiego 110 Vcc
- Corrente nominale barratura principale e secondaria 250 A
- Tensione nominale d'isolamento a frequenza industriale 2000V/min.
- Corrente di cortocircuito per 1 sec 15 kA

4.3 STRUTTURA DEL QUADRO E DISPOSIZIONE APPARECCHIATURE

Il quadro è costituito da due telai, adibiti rispettivamente uno per la sezione a corrente continua e uno per la sezione alternata; detti armadi devono avere le superfici laterali lisce affinché possano essere affiancati ad altre apparecchiature al momento del montaggio in cabina primaria.

I telai sono costruiti in lamiera di acciaio pressopiegata (spessore 20/10) di dimensioni pari a:

- Altezza 2050 mm
- Larghezza 600 mm
- Profondità 600 mm

I telai devono essere inoltre muniti di una porta posteriore, alta quanto il quadro, nella parte superiore deve essere prevista una griglia di aerazione. Tale griglia deve avere un grado di protezione pari a IP 30, secondo la norma CEI EN 60529.

Le dimensioni di riferimento, con la sola esclusione delle dime di montaggio degli apparati, sono rappresentate nella tabella DV1901A2.

Anteriormente per detti telai deve essere prevista una porta costituita da apposito materiale trasparente autoestinguente.

Le porte devono essere apribili con angolo maggiore di 90°, provviste di cerniere interne, smontabili e munite di maniglia con serratura tipo cremonese. Ogni telaio, privo di lamiera sul fondo deve avere alla base n°4 fori ϕ 12 per il fissaggio a pavimento e n°4 golfari removibili (12 UNI 2947) sul telaio superiore.

Non è consentito l'uso di viti autofilettanti.

Deve essere previsto su ambedue le fiancate laterali, opportunamente distanziati tra loro, apposito profilato per il fissaggio dei cavi.

La disposizione di massima delle apparecchiature da montare a bordo dei due quadri è indicata nella tabella DQ 7071.

Lo schema funzionale della sezione a corrente alternata e della sezione in corrente continua è riportato nella tabella DW 7071.

4.4 COLLEGAMENTI DI POTENZA

Per la realizzazione del quadro S.A. c.a./c.c. devono essere utilizzati sistemi modulari di cablaggio sia per la barratura principale che per quella secondaria.

Per le barrature deve essere utilizzato il tipo rigido opportunamente isolata sia dal punto di vista elettrico che per contatti accidentali, mantenendo un grado di protezione IP20.

Tutti gli altri collegamenti di potenza all'interno del quadro devono essere realizzati con conduttori in cavo unipolare con tensione nominale d'isolamento Uo/U=450/750V, gli isolanti devono essere del tipo non propagante l'incendio.

Nella sezione a corrente alternata e/o continua in uscita da:

- I.M.S. 42-c.a. e tra quest'ultimo e la barratura di distribuzione porta interruttori.
- I.M.S. 42-110 Vc.c. e tra quest'ultimo e la barratura di distribuzione porta interruttori.
- I.M.S. 42-24 Vc.c. e tra quest'ultimo e la barratura di distribuzione porta interruttori.

Nella tabella di seguito riportata per il collegamenti tra TR/SA e Q.S.A., in riferimento alla potenza, alla corrente assorbita della macchina, sono la sezione e la tipologia del cavo da utilizzare :

kVA	A	mm^2	DV 201
100	144	50	/9
160	231	120	/11

Per realizzare i collegamenti di cui sopra, devono essere utilizzati capicorda a compressione, nello schema DW7071 sono rappresentati i collegamenti di potenza rispettivamente per le sezioni c.a. e c.c.

Le connessioni dei cavi in uscita verranno realizzate direttamente sull'uscita di ciascun interruttore modulare.

A protezione da contatti accidentali i codoli dei sezionatori 42-cc e 42-ca debbono essere corredati di una adeguata pezzatura di materiale termorestringente da utilizzare per i collegamenti da eseguire in fase di attivazione in Cabina Primaria.

4.5 COLLEGAMENTI AUSILIARI DEL QUADRO

Nella sezione c.a. e nella sezione c.c. il controllo di mancanza tensione sui singoli distributori, deve essere realizzato tramite opportuna scheda di acquisizione segnali che a sua volta è interfacciata con il dispositivo di controllo Servizi Ausiliari (DV971), tutto il cablaggio sia seriale che parallelo deve essere a cura del costruttore del quadro.

I collegamenti paralleli con la scheda di acquisizione segnali, devono essere realizzati con conduttore di rame del tipo flessibile con sezione di 1 mm^2, tensione nominale d'isolamento Uo/U=450/750V con isolanti del tipo non propagante l'incendio.
Le caratteristiche di questi conduttori sono riportate nella tabella DV 201.

I moduli devono essere collegati al pannello e tra loro tramite:

- cavo schermato tipo EIA INDUSTRIAL RS485 PLTC/CM
  2 PR 4x0.3 AWG22 – FHDPE SH PVC

il cavo schermato oggetto della presente fornitura deve essere collegato a terra

Tutti i collegamenti devono essere alloggiati in canalette di materiale plastico, indipendenti da quelli di potenza, e tra le varie sezioni C.A. – C.C., tali canalizzazioni devono rispondere alla norma CEI 23-22 con caratteristica V0.

Tutte le connessioni devono essere predisposte con opportuna ricchezza, contrassegnate da appositi segnafili facenti capo a puntalini a pressione del tipo preisolato.

Il cablaggio nel tratto tra schede raccolta segnali e connettore DV971 dovrà essere realizzato in opportuna guaina isolante autoestinguente.

4.6 COLLEGAMENTI PER LA MESSA A TERRA

Per il collegamento equipotenziale dei cavi schermati e delle apparecchiature con morsetto di terra è necessario prevedere, per ogni risalita laterale (destra e sinistra) dell'armadio S.A., una sbarra di terra in rame nudo di sezione 25x3 mm.

Tale sbarra deve essere connessa elettricamente alla struttura metallica in almeno cinque punti e deve essere munita di almeno un foro Φ13 nella estremità inferiore per la connessione alla rete di terra; inoltre sulla sbarra medesima devono essere previsti dei fori di ϕ 8 a passo costante di 20 mm. Le porte devono essere connesse elettricamente alla struttura mediante corda in rame flessibile con sezione non inferiore a $mm^2$16.

4.7. COMMUTATORE CONSENSO COMANDI LOCALE DISTANZA

Deve essere previsto un commutatore 20 vie, 2 posizioni, DC14, In 6A, con grado di protezione IP20 (tipo Comelectric) per consentire l'inclusione-esclusione dei comandi Locale o Distanza delle varie isole di alimentazione, lo schema applicativo è riportato nella tabella DQ-DW7071. Altresì deve essere previsto un pulsante luminoso, con un fronte luminoso ≥ 15mm, per segnalare lo stato "comandi in locale" e permettere tramite il pulsante integrato la tacitazione dell'allarme sirena.

4.8. COMMUTATORE ALLARME PRESENZA PERSONE

Deve essere previsto un commutatore 1 via, 2 posizioni, DC14, In 1A, con grado di protezione IP20 (tipo Comelectric) per consentire l'inclusione-esclusione del circuito di allarme presenza persone. Al fianco del commutatore un segnalino ottico per indicare l'allarme P.P. con un fronte luminoso ≥ 15mm.

5. COMPONENTI ELETTRICI

Ogni componente diversamente indicato deve essere sottoposto alle prove di accettazione previste nella tabella DL 100 "Prescrizioni per le prove di accettazione dei materiali non unificati della Distribuzione, ulteriori tabelle di riferimento per ciascun componente verrà indicato di volta in volta.

5.1 INTERRUTTORI

In testa ad ogni barra di distribuzione sia c.a. che c.c. deve essere previsto un interruttore di manovra sezionatore del tipo scatolato in esecuzione removibile, i medesimi devono essere conformi alle normative attualmente in vigore IEC 947-2 e CEI EN 60947-2, IEC 947-3 e CEI EN 60947-3.

Sulle barre di distribuzione devono essere utilizzati interruttori modulari, le cui caratteristiche sono riportate nelle tabelle di seguito esposte in cui sono indicate le targhette di identificazione di ciascun interruttore modulare, le caratteristiche elettriche ed i valori di taratura termici, i medesimi devono essere conformi alle normative attualmente in vigore IEC 898 e CEI EN 60898.

Là dove richiesto devono essere inseriti interruttori magnetotermici differenziali con soglia omopolare di terra con taratura fissa a 30 mA.

Sezione a Corrente Continua 24Vcc

UTENZA	Codice	Vn V	In A	Curva interv.	Icw kA	Po.in kA	In-Th A
Sezionatore Generale	42-24cc	125	63	---	4		s.p.
TPT	52-90	125		C		6	25
OCV1	52-91	125		C		6	15
OCV2	52-92	125		C		6	15
DV913-MOIM	52-93	125		C		6	25
Disponibile	52-94	125		C		6	15
Disponibile	52-95	125		C		6	25
Sezionatore Radd.Ausiliario	42-24-AUX	125		---	4		s.p.

Sezione a Corrente Continua 110Vcc

UTENZA	Codice	Vn V	In A	Curva interv.	Icw kA	Po.in kA	In-Th A
Sezionatore Generale	42-110cc	125	250	DC-23B	4		s.p.
Sezionatore Radd.Ausiliario	42-RD-AUX	125	250	DC-23B	4		s.p.
Apparecchiature S.A.	52-1	125		C		4	6
+110V richiusure MT	52-2	125		C		4	6
Segnalazioni locali	52-3	125		D		4	6
Motori AT TR-R / LAT1	52-4	125		D		4	16
Motori MT sbarra rossa	52-5	125		D		4	32
Linea AT 1 rossa	52-6	125		C		4	6
Trasformatore rosso	52-7	125		C		4	6
LN MT sbarra rossa	52-8	125		C		4	10
Isola Petersen	52-9	125		C		4	6
Alleggeritore di carico	52-10	125		C		4	3
Motori AT TR-V / LAT2	52-11	125		D		4	16
Motori MT sbarra verde	52-12	125		D		4	32
Linea AT 2 verde	52-13	125		C		4	6
Trasformatore verde	52-14	125		C		4	6
LN MT sbarra verde	52-15	125		C		4	10
Congiuntore e/o traslazione	52-16	125		C		4	6
Disponibile Linea AT 3 UTE	52-17	125		C		4	16
Motori Disponibile	52-18	125		D		4	32
Disponibile Linea AT 4 UTE	52-19	125		C		4	6
Motori Petersen	52-20	125		C		4	16

Sezione a Corrente Alternata

UTENZA	Codice	Vn V	In A	Curva interv.	Icw kA	Po.in kA	In-Th A	Poli N°
Sezionatore Generale	42-c.a.	500	250	AC-23B	4	10	s.p.	4
Alim.apparecchiature S.A.-TR.E.A.C.	52-41	400		C		10	6	4
Carica Batteria 110	52-42	400		MA		10	32	4
Motori AT TR-R / LAT1	52-43	400		D		10	20	4
Motori Variatore Sotto Carico rosso	52-44	400		D		10	6	4
Motori Aereotermo rosso	52-45	400		D		10	25	4
Motori Bobina di Petersen R/V	52-46	400		D		10	16	4
Carica Batteria 48	52-47	400		MA		10	25	4
Motori AT TR-V / LAT2	52-48	400		D		10	20	4
Motori Variatore Sotto Carico verde	52-49	400		D		10	6	4
Motori Aereotermo verde	52-50	400		D		10	25	4
Aereotermo Riscaldamento Edificio	52-51	400		D		10	63	4+D
Motori aspiratore TR MT R/V	52-52	400		D		10	16	4+D
Condizionatore A	52-53	400		C		10	25	4+D
Condizionatore B	52-54	400		C		10	25	4+D
Disponibile	52-55	400		C		10	32	4+D
Prese 32 A interne	52-56	400		C		10	32	4+D
Prese 32 A esterne	52-57	400		C		10	32	4+D
Riscaldamento esterno	52-58	400		C		10	20	4+D
Riscaldamento Quadro MT	52-59	400		C		10	25	4+D
Illuminazione esterna automatica	52-60	400		C		10	16	4+D
Illuminazione esterna manuale	52-61	400		C		10	20	4+D
Illuminazione sala MT	52-62	400		C		10	10	2+D
Illuminazione sala BT	52-63	400		C		10	10	2+D
Illuminazione prese servizi edificio	52-64	400		C		10	10	2+D
Illuminazione emergenza	52-65	400		C		10	10	2+D
Circuiti Aux 24 Vca	52-66	400		C		10	10	2+D
Disponibile	52-67	400		C		10	16	2+D
Disponibile	52-68	400		C		10	16	2+D

5.2 PRESA PER RADDRIZZATORE AUSILIARIO

Nella sezione a c.c. inoltre deve essere previsto un interruttore interbloccato con presa, disposto nella parte del fronte-inferiore per una alimentazione di riserva dei S.A..
Tale presa fornita della corrispettiva spina deve rispondere alla norma CEI EN60309-1 e CEI EN60309-2 ed avere le caratteristiche nominali di 63A – 250V

Tale alimentazione deve essere protetta da inversioni di alimentazione tramite un diodo con una corrente nominale di 150A – 250V.

5.3 CONTATTORE E FOTOCELLULA PER ILLUMINAZIONE ESTERNA AUTOMATICA

Il contattore quadripolare per l'illuminazione esterna "T2", deve essere conforme alla norma CEI EN 61095, categoria d'impiego ACI CEI 17-3, con le seguenti caratteristiche: In=20 A; Vn=500 V; Vni=4 kV; Icc=3kA; tensione di alimentazione bobina 220V.
Detto contattore deve essere comandato da fotocellula posta all'esterno del fabbricato, quest'ultima dovrà essere a corredo della fornitura.

5.4 CONTATTORI PER ILLUMINAZIONE INTERNA

Devono essere previsti due contattori "RPP1-RPP2" in esecuzione passo-passo per comandare l'accensione dell'illuminazione interna sia della sala MT che della sala Protezioni tramite linee di comando dedicate e composte da pulsanti. I medesimi devono avere le seguenti caratteristiche: In=10 A; Vn=500 V; Vni=4 kV; Icc=3kA; tensione di alimentazione bobina 220V.

5.5 TRASFORMATORE D'ISOLAMENTO

Deve essere previsto un trasformatore monofase 10 kV d'isolamento 220/24 V 50VA, 50 Hz in esecuzione protetta.

5.6 ALIMENTAZIONE DELL' ALLEGGERITORE DI CARICO

Per l'alimentazione dell'equilibratore automatico di carico deve essere altresì installato un trasformatore monofase dalle seguenti caratteristiche:

- tensione primaria 400V
- tensione secondaria a vuoto 100V
- tensione secondaria alla corrente nominale 95V
- potenza nominale 20VA
  rispondente alle norme CEI 14-6

5.7 CONTATTORE PER ANTICONDENSA INTERNA

Deve essere previsto un contattore "T1" per comandare l'accensione delle resistenze anticondensa tramite un gruppo di controllo termostato umidostato, lo stesso deve essere conforme alla norma CEI EN 61095, categoria d'impiego ACI CEI 17-3, con le seguenti caratteristiche: In=20 A; Vn=500 V; Vni=4 kV; Icc=3kA; tensione di alimentazione bobina 220V. Il gruppo termostato - umidostato deve essere a corredo della fornitura ed i rispettivi campi di taratura sono: Termostato 6°-30°; Umidostato 30%-90%. Detti accessori devono essere montati su apposita tavoletta di plastica delle dimensioni opportune e con codolo passacavo ϕ 20.

5.8 MORSETTIERE

Le morsettiere devono essere costituite da morsetti componibili adatti per il montaggio diretto su profilati di supporto CEI EN 50022 (CEI 17-18) e devono essere rispondenti alla tabella ENEL DV 25, ENEL DV 27.

La tipologia dei morsetti è indicata nella tabella DQ 1981 A.

I morsetti devono essere completi degli accessori necessari e devono garantire inoltre un grado di protezione IP20, secondo la norma CEI EN 60529.

6. MISURE

Nella sezione c.a. deve essere previsto un opportuno strumento digitale atto a visualizzare le correnti di fase, le tensioni di fase e concatenate, la potenza attiva e la potenza reattiva, la precisione del sistema non deve essere inferiore al 1%.

7. CARATTERISTICHE GENERALI

7.1 ALIMENTAZIONE A CORRENTE CONTINUA 110 VCC

Le caratteristiche dell'alimentazione a corrente continua sono le seguenti:

- tensione nominale 110 Vcc
- campo di variazione ± 20%
- componente alternata residua ≤ 1% Vn

7.2 ALIMENTAZIONE A CORRENTE ALTERNATA

Le caratteristiche dell'alimentazione a corrente alternata sono le seguenti:

- tensione nominale 400 Vca – 50 Hz
- campo di variazione -20% + 10%

7.3 ISOLAMENTO

Tutte le parte attive sia di potenza che ausiliarie devono essere protette contro i contatti accidentali anche mediante accessori isolanti termorestringenti e autoestinguenti classe V0.

8. PROVE

Per le prove di collaudo si fa riferimento alle tabelle DV 1500 e DV 1501A ad eccezione di quelle dove sono specificati altri riferimenti.

8.1 ESAME A VISTA

Per le modalità di esecuzione della prova si rimanda alle specifiche ENEL DV1501 paragrafo 6.1.

8.2 CONTROLLO DELLE CARATTERISTICHE GEOMETRICHE

Si deve verificare che lo schema e le dimensioni di ingombro del telaio siano rispondenti a quanto indicato nella Specifica Funzionale.

Per le modalità di esecuzione della prova si rimanda alle specifiche ENEL DV1501A paragrafo 6.2.

8.3 VERIFICA DI TUTTE LE FUNZIONI

Le prove di funzionalità si dividono principalmente in due modalità, senza dispositivo di controllo dei Servizi Ausiliari DV971 connesso e con la presenza di quest'ultimo.

Servizi Ausiliari senza il dispositivo di controllo connesso:

- Verifica della funzionalità dei circuiti accessori come, RPP1, RPP2, T1 e T2.
- Verifica della rispondenza dei circuiti di potenza.

Servizi Ausiliari con il dispositivo di controllo connesso:

- Verifica della Minima tensione 400 c.a.;
- Verifica della Minima tensione 110 c.c.;
- Verifica della Minima tensione 24 c.c.;
- Verifica della polarità positiva +110 Vcc a terra;
- Verifica della polarità negativa –110 Vcc a terra;
- Verifica della segnalazione su M.M.I. di tutti gli interruttori automatici dei S.A.
- Verifica di tutte le segnalazioni di allarme addotte al dispositivo DV971 come allarme temperatura sala Protezioni, allarme presenza persone, etc..

8.4 PROVE DI COMPATIBILITÀ CLIMATICA

Le prove devono essere eseguite secondo la specifica ENEL R CLI 01,esse sono divise in:

- prove ad apparecchiatura non alimentata (assestamento)

• prove con apparecchiatura funzionante (prima delle prove deve essere eseguita l'analisi termica)

I livelli di prova da applicare sono i seguenti:
• assestamento 4
• apparecchiatura funzionante 4

8.5 PROVE DI ISOLAMENTO

Le prove da eseguire secondo la tabella ENEL R EMC 01 sono le seguenti :

• tenuta ad impulso (GLI/01), livello di severità 4,dove non indicato
• rigidità dielettrica (GLI/02), livello di severità 4
• resistenza di isolamento GLI(EMC)03, livello di isolamento 4

8.6 PROVE DI COMPATIBILITÀ MECCANICA

Le prove devono essere eseguite secondo la specifica ENEL R MEC 01,sono divise in:
- prove di immunità alle vibrazioni di tipo sinusoidale (apparecchiatura funzionante)
- prove di resistenza alle sollecitazioni di trasporto e movimentazione (apparecchiatura non funzionante)

I requisiti da applicare sono i seguenti:

- immunità a vibrazioni sinusoidali **V.H. 3**
- resistenza alle sollecitazioni di trasporto e movimentazione **tipo di prova vibrazioni aleatorie a larga banda**

8.7PROVA PER LA DETERMINAZIONE DELLE SOVRATEMPERATURE

Dette prove devono essere rispondenti alla norme CEI 17-43.
Le misure di sovratemperatura devono essere effettuate in condizioni di regime termico facendo riferimento alla temperatura ambiente di 30 ^{o}C.
Le condizioni di funzionamento dei servizi ausiliari devono essere le seguenti:

• alimentazione c.a.	400 V +10%
• erogazione c.c	110 V 50 A

8.8 PROVA PER LA DETERMINAZIONE DELLA TENUTA AL CORTO CIRCUITO

La determinazione della tenuta al corto circuito deve rispondere alla normativa CEI 17-52.

9. PRESCRIZIONI ANTINFORTUNISTICHE

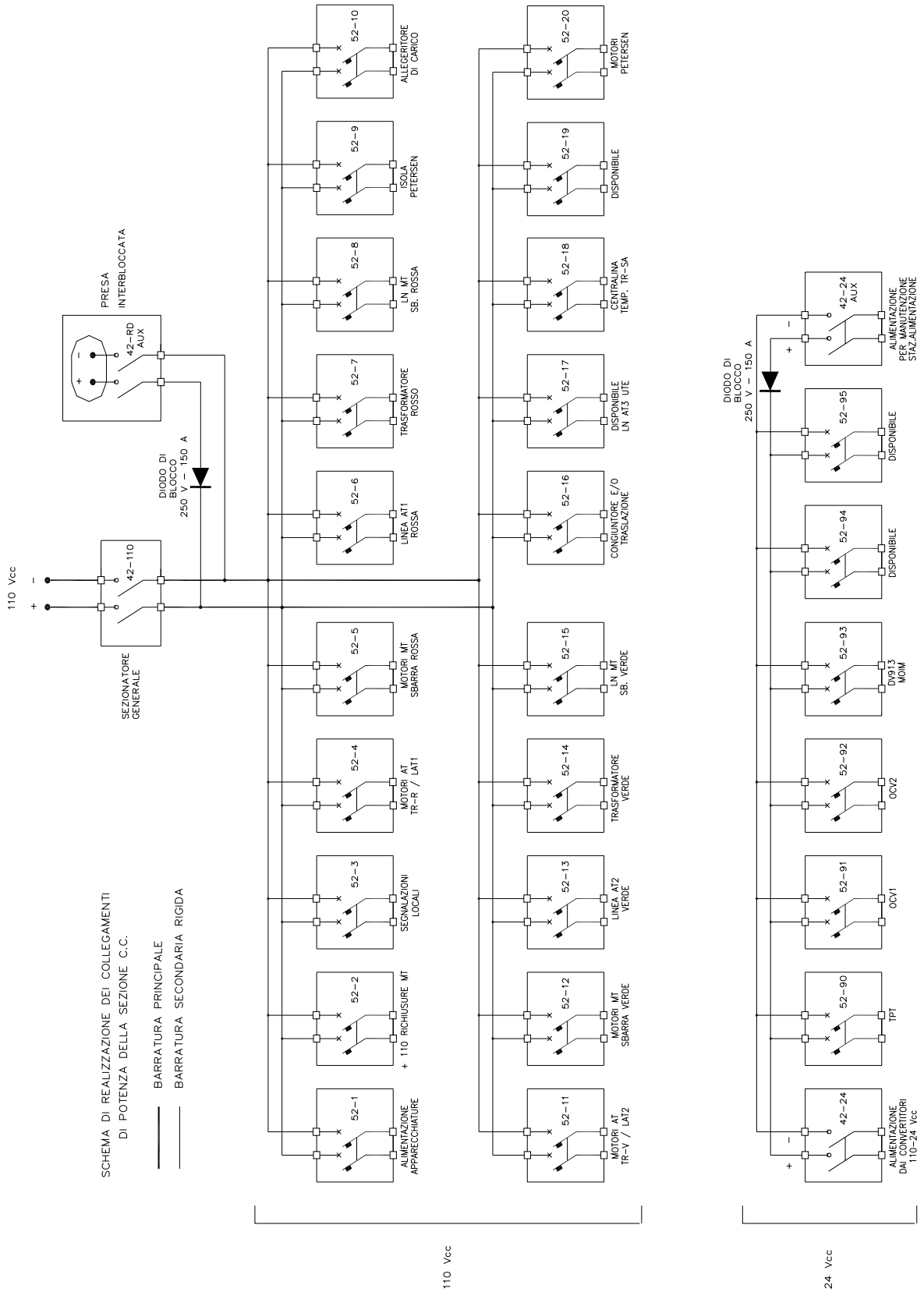
Il quadro dei servizi ausiliari deve rispondere ad ogni sua parte alla normative vigenti antinfortunistiche di cui al D.P.R. n°547 del 27-4-1955, Legge 186/68, Legge 791/77. Tutte le apparecchiature devono avere un grado di protezione non inferiore a IP20, secondo la norma CEI EN 60529, con la portella aperta.

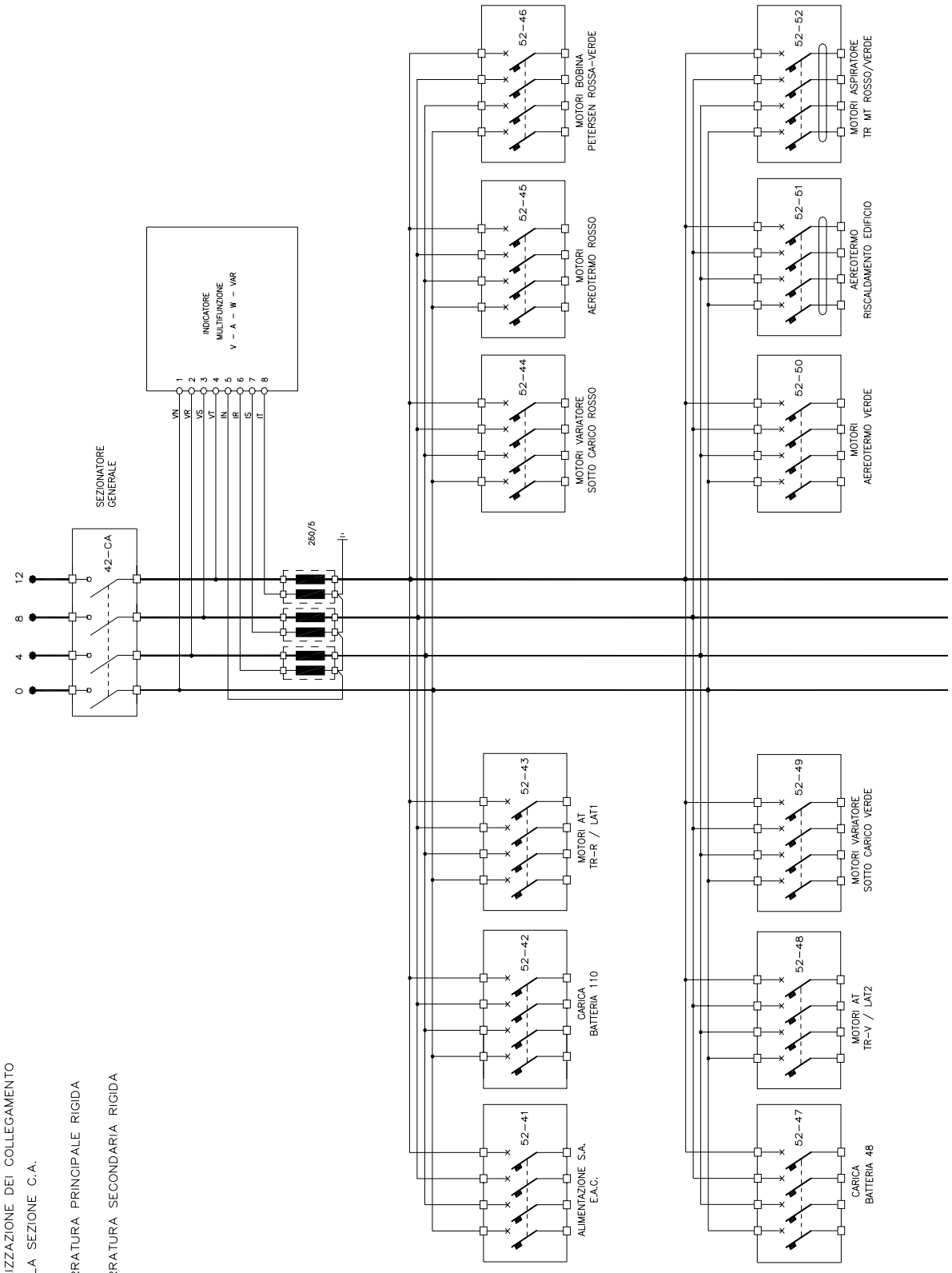
10. TARGHETTE DI IDENTIFICAZIONE

Tutte le apparecchiature dovranno essere etichettate mediante targhetta adesiva di materiale plastico in vedril, o analoga incisione bianca su fondo nero; per l'elenco delle scritte si rimanda lo schema nella pagina successiva.

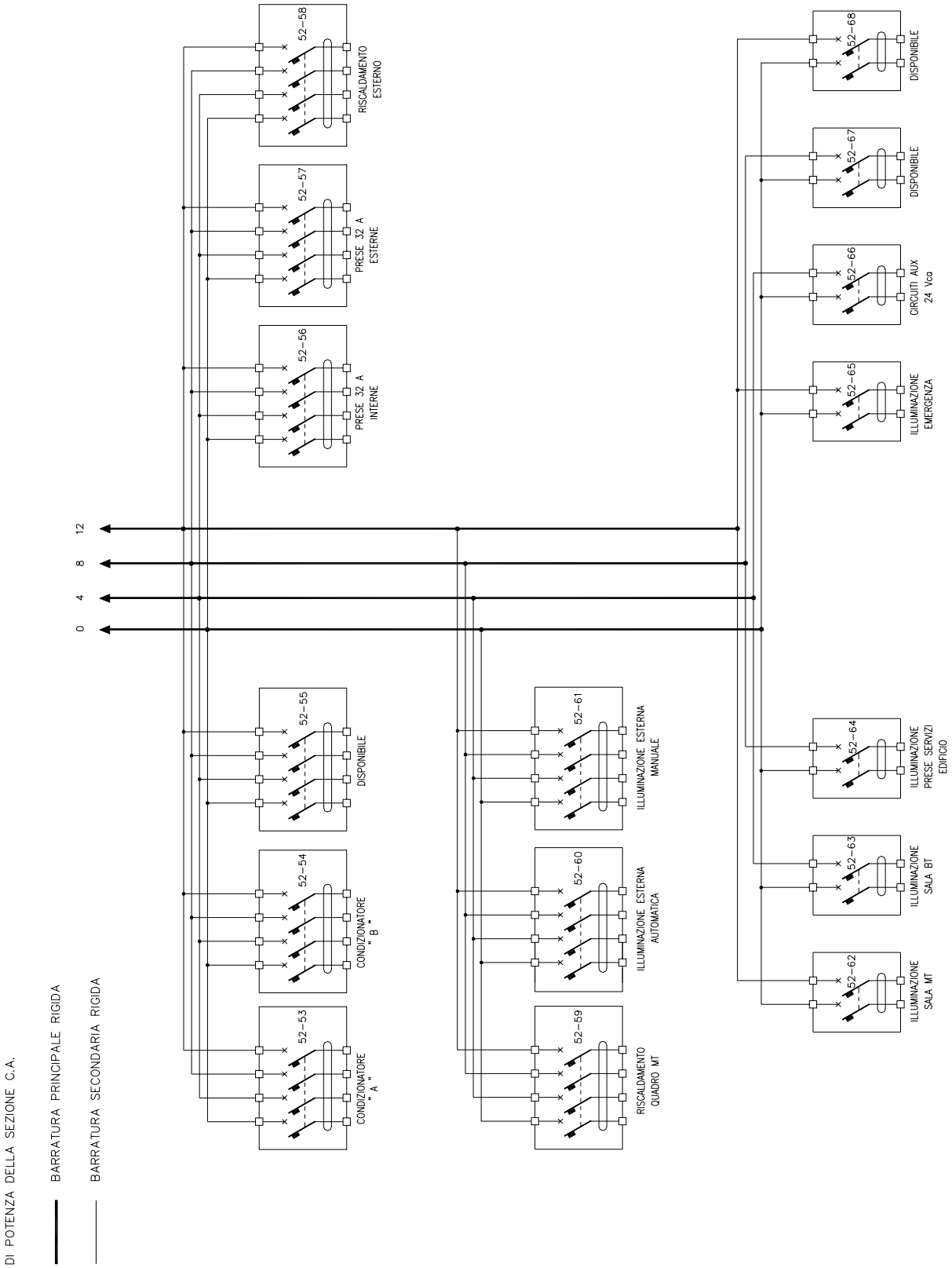
11. VERNICIATURA

Il colore del quadro deve essere grigio n°7030 della scala RAL-F2 e la verniciatura deve essere rispondente alla tabella DY 991/11.

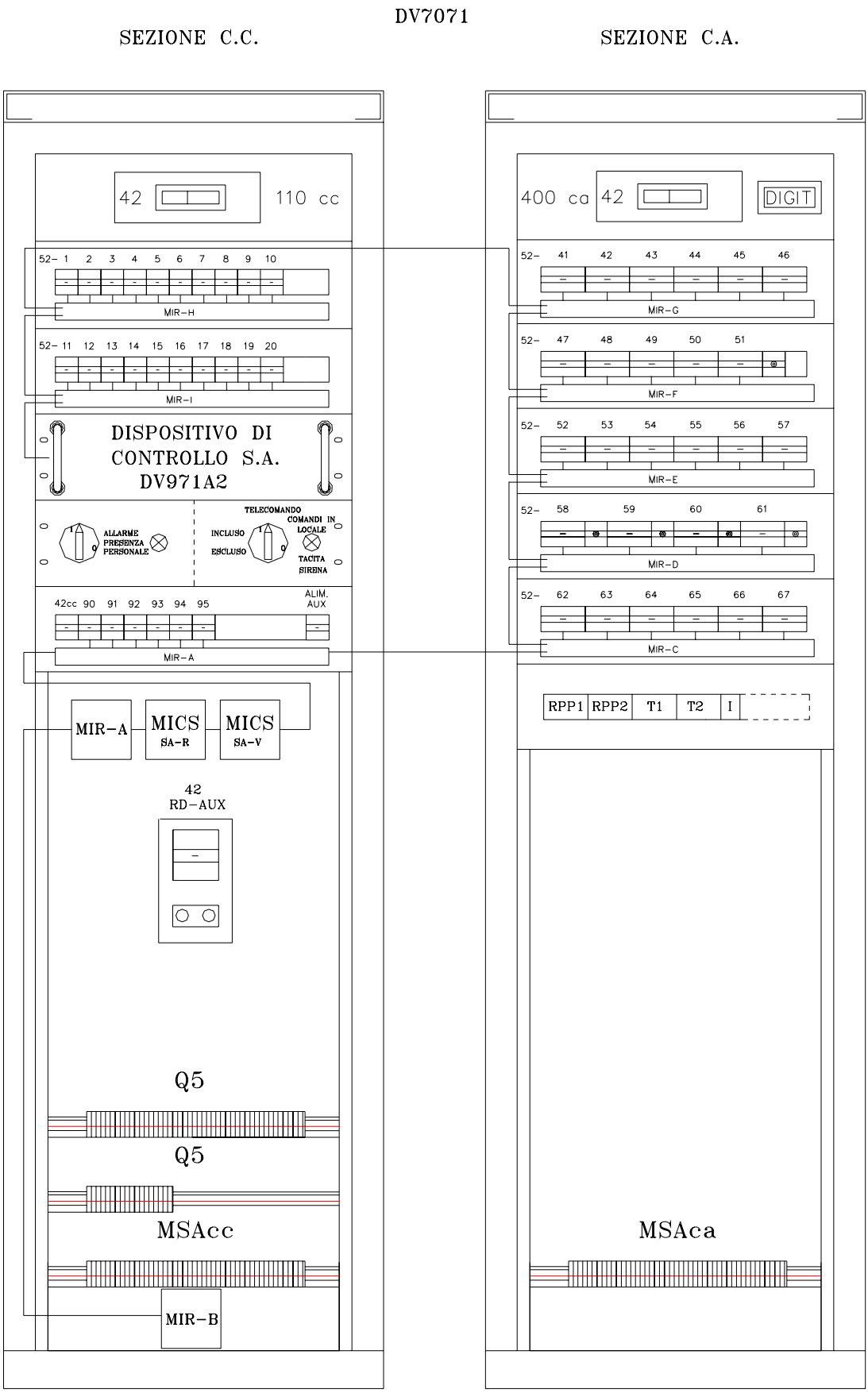

SCHEMA DI REALIZZAZIONE DEI COLLEGAMENTI
DI POTENZA DELLA SEZIONE C.C.
BARRATURA PRINCIPALE
BARRATURA SECONDARIA RIGIDA
110 Vcc
SEZIONATORE GENERALE
42-110
PRESA INTERBLOCCATA
42-RD AUX
DIODO DI BLOCCO 250 V – 150 A
52-1 ALIMENTAZIONE APPARECCHIATURE
52-2 + 110 RICHIUSURE MT
52-3 SEGNALAZIONI LOCALI
52-4 MOTORI AT TR-R / LAT1
52-5 MOTORI MT SBARRA ROSSA
52-6 LINEA AT1 ROSSA
52-7 TRASFORMATORE ROSSO
52-8 LN MT SB. ROSSA
52-9 ISOLA PETERSEN
52-10 ALLEGERITORE DI CARICO
52-11 MOTORI AT TR-V / LAT2
52-12 MOTORI MT SBARRA VERDE
52-13 LINEA AT2 VERDE
52-14 TRASFORMATORE VERDE
52-15 LN MT SB. VERDE
52-16 CONGIUNTORE E/O TRASLAZIONE
52-17 DISPONIBILE LN AT3 UTE
52-18 CENTRALINA TEMP. TR-SA
52-19 DISPONIBILE
52-20 MOTORI PETERSEN
110 Vcc
DIODO DI BLOCCO 250 V – 150 A
42-24 AUX
ALIMENTAZIONE PER MANUTENZIONE STAZ.ALIMENTAZIONE
52-90 TPT
52-91 OCV1
52-92 OCV2
52-93 DV913 MOIM
52-94 DISPONIBILE
52-95 DISPONIBILE
42-24 ALIMENTAZIONE DAI CONVERTITORI 110-24 Vcc
24 Vcc


SCHEMA DI REALIZZAZIONE DEI COLLEGAMENTO
DI POTENZA DELLA SEZIONE C.A.
BARRATURA PRINCIPALE RIGIDA
BARRATURA SECONDARIA RIGIDA
SEZIONATORE GENERALE
42-CA
0
4
8
12
260/5
INDICATORE MULTIFUNZIONE
V - A - W - VAR
1 VN
2 VR
3 VS
4 VT
5 IN
6 IR
7 IS
8 IT
52-41 ALIMENTAZIONE S.A. E.A.C.
52-42 CARICA BATTERIA 110
52-43 MOTORI AT TR-R / LAT1
52-44 MOTORI VARIATORE SOTTO CARICO ROSSO
52-45 MOTORI AEREOTERMO ROSSO
52-46 MOTORI BOBINA PETERSEN ROSSA-VERDE
52-47 CARICA BATTERIA 48
52-48 MOTORI AT TR-V / LAT2
52-49 MOTORI VARIATORE SOTTO CARICO VERDE
52-50 MOTORI AEREOTERMO VERDE
52-51 AEREOTERMO RISCALDAMENTO EDIFICIO
52-52 MOTORI ASPIRATORE TR MT ROSSO/VERDE

DIS – IUN - TEA


DI POTENZA DELLA SEZIONE C.A.
BARRATURA PRINCIPALE RIGIDA
BARRATURA SECONDARIA RIGIDA
0
4
8
12
52-53
CONDIZIONATORE " A "
52-54
CONDIZIONATORE " B "
52-55
DISPONIBILE
52-56
PRESE 32 A INTERNE
52-57
PRESE 32 A ESTERNE
52-58
RISCALDAMENTO ESTERNO
52-59
RISCALDAMENTO QUADRO MT
52-60
ILLUMINAZIONE ESTERNA AUTOMATICA
52-61
ILLUMINAZIONE ESTERNA MANUALE
52-62
ILLUMINAZIONE SALA MT
52-63
ILLUMINAZIONE SALA BT
52-64
ILLUMINAZIONE PRESE SERVIZI EDIFICIO
52-65
ILLUMINAZIONE EMERGENZA
52-66
CIRCUITI AUX 24 Vcc
52-67
DISPONIBILE
52-68
DISPONIBILE

DV7071



DIS – IUN - TEA

DIN / ATM

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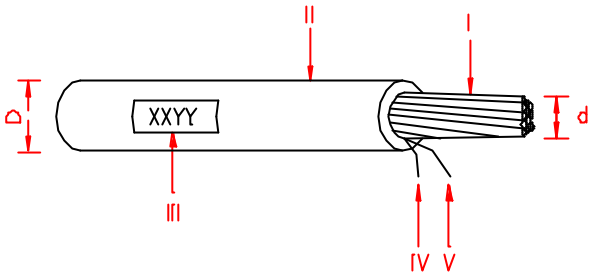

DIN / ATM

ESECUZIONE COMUNE

I – CONDUTTORE A CORDA FLESSIBILE DI RAME RICOTTO NON STAGNATO. (v. punto 2).

II – ISOLANTE DI POLIVINILCLORURO QUALITA' R2. (v. punto 2).

III – CONTRASSEGNO SPECIALE PER L'IDENTIFICAZIONE DELLE CARATTERISTICHE DI NON PROPAGAZIONE DELL'INCENDIO. (v. punto 4).

IV – CONTRASSEGNO DELL'IMQ. (v. punto 4)

V – CONTRASSEGNO DI RICONOSCIMENTO DEL FABBRICANTE
IN SOSTITUZIONE DEL FILO DI RICONOSCIMENTO, IL FABBRICANTE PUO' STAMPARE SULL' ISOLANTE DEL CAVO IL PROPRIO NOME O USARE ALTRI SEGNI DI RICONOSCIMENTO CONFORMEMENTE ALLA NORMA CEI 20-20.

Esempio Designazione abbreviata :

CAVO 1x1 N07V-K UE

1	2	3	4	5	6	7	8	9	10	11
MATRICOLA	TIPO	NUMERO CONDUTTORI PER SEZIONE	DIAMETRO FILI CONDUTT. (MAX)	DIAMETRO SUL CONDUTTORE d (v.p.1)	SPESSORE MEDIO ISOLANTE (MIN)	DIAMETRO ESTERNO D (MAX)	MASSA DEL CAVO	RESISTENZA ELETTRICA A 20° C MAX	PORTATA PER POSA IN TUBO O CONDOTTO IN ARIA (1)	CORRENTE TERMICA DI CORTO CIRCUITO (2)
		n° x mm²	mm	mm	mm	mm	Kg/km	Ω / km	A	kA
	201/A	(3) 1x 0,5	0,21	0,9	0,7	2,7	11	39,0	8	0,06
	201/1B	(3) 1x 0,75	0,21	1,1	0,7	2,9	14	26,0	10	0,09
34 90 21	201/1	1 x 1	0,21	1,3	0,7	3,2	16	19,5	12	0,11
34 90 22	201/2	1 x 1,5	0,26	1,6	0,7	3,5	20	13,3	15,5	0,17
34 90 23	201/3	1 x 2,5	0,26	2,0	0,8	4,2	32	7,98	21	0,28
34 90 24	201/4	1 x 4	0,31	2,6	0,8	4,8	48	4,95	28	0,46
34 90 25	201/5	1 x 6	0,31	3,4	0,8	6,3	68	3,3	36	0,69
34 90 26	201/6	1 x 10	0,41	4,4	1,0	7,6	135	1,91	50	1,1
34 90 27	201/7	1 x 16	0,41	5,7	1,0	8,8	195	1,21	68	1,8
34 90 28	201/8	1 x 25	0,41	6,9	1,2	11,0	295	0,78	89	2,8
34 90 30	201/9	1 x 50	0,41	9,8	1,4	14,5	565	0,386	134	5,7
34 90 32	201/10	1 x 95	0,51	13,3	1,6	19,0	1040	0,206	207	10,9
34 90 33	201/11	1 x 120	0,51	15,1	1,6	21,0	1310	0,161	239	13,8
34 90 34	201/12	1 x 150	0,51	16,8	1,8	23,5	1630	0,129	275	17,2
34 90 36	201/13	1 x 185	0,51	18,6	2,0	26,0	1990	0,106	314	21,2
34 90 38	201/14	1 x 240	0,51	21,4	2,2	29,5	2610	0,080	369	27,6

DIN / ATM

(1) 3 Cavi unipolari (v. CEI-UNEL 35024)

(2) I valori della corrente termica di corto circuito valgono nelle seguenti condizioni:
- durata del corto circuito 1s;
- temperatura iniziale dei conduttori pari alla temperatura massima ammissibile in regime permanente (70° C);
- temperatura finale del conduttore 160° C

(3) Cavo in attesa del certificato di ammissione al Marchio IMQ

1 TENSIONE NOMINALE DI ESERCIZIO Uo/U = 450/750 V

2 MATERIALI

- Conduttore a corda flessibile di rame ricotto non stagnato.
- Isolante: PVC di qualità R2, colore: nero, giallo/verde, blu, marrone, grigio, rosso.

3 IMBALLO E PEZZATURE

Rotoli da 100 m (compatibilmente con un peso massimo di 35 kg) oppure bobine.

4 NORME E PRESCRIZIONI PER LA COSTRUZIONE, IL COLLAUDO E LA FORNITURA

DIN / ATM

Norme CEI 20-20 (Terza edizione) Parte 3 - art.3, con le seguenti modifiche:

- le qualità meccaniche ed elettriche dell'isolante devono rispondere ai requisiti del "Foglio di Specifica del PVC isolante di qualità R2" di cui alle Norme CEI 20-11. Cap. IV, Sezione 5.

Il cavo deve superare le prove di non propagazione dell'incendio prescritte dalle Norme CEI 20-22, vigenti.

Sull'isolante deve essere stampigliato almeno ogni 0,5 m il contrassegno attestante la caratteristica di non propagazione dell'incendio : CEI 20-22 II.

Per le prescrizioni di fornitura vedere la tabella ENEL DV210.

Il cavo deve essere munito di contrassegno dell'Istituto Italiano del Marchio di Qualità e di quello di riconoscimento del costruttore.

l contrassegno dell'Istituto Italiano del Marchio di Qualità per i cavi formanti oggetto di questa unificazione è costituito da un filo tessile su cui sono stampate in alfabeto Morse le lettere MIQ e dalla sigla IEMMEQU stampigliata con continuità sull'isolante contiguamente all'indicazione "CEI 20-22 II".

5 CONDIZIONI DI IMPIEGO

Per le condizioni di impiego vedere Appendice 1 - art. 3 delle Norme CEI 20-20.

Per le portate di corrente in regime permanente, vedere anche tabella CEI-UNEL 35024 vigente.

Raggio minimo di curvatura: 4D

Sforzo di trazione nella posa: $\leq$ 50 N (~ 5 kg) per mm^2 di sezione del rame.

6 UNITA' DI MISURA

Metro (m).

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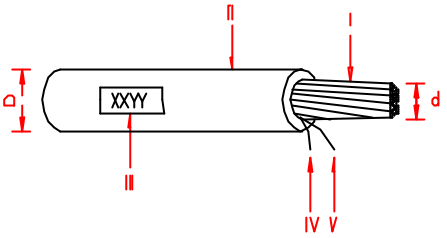
DIN / ATM



DIN / ATM

ESECUZIONE COMUNE:

I – CONDUTTORE A CORDA RIGIDO DI RAME RICOTTO NON STAGNATO (v. punto 2)

II – ISOLANTE DI POLIVINILCLORURO QUALITA' R2 (v. punto 2).

III – CONTRASSEGNO SPECIALE PER L'IDENTIFICAZIONE DELLE CARATTERISTICHE DI NON PROPAGAZIONE DELL'INCENDIO. (v. punto 4).

IV – CONTRASSEGNO DELL'IMQ (v. punto 4)

V – CONTRASSEGNO DI RICONOSCIMENTO DEL FABBRICANTE.
IN SOSTITUZIONE DEL FILO DI RICONOSCIMENTO, IL FABBRICANTE PUO' STAMPARE SULL' ISOLANTE DEL CAVO IL PROPRIO NOME O USARE ALTRI SEGNI DI RICONOSCIMENTO CONFORMEMENTE ALLA NORMA CEI 20-20.

Esempio Designazione abbreviata :

CAVO 1x10 N07V-R UE

1	2	3	4	5	6	7	8	9	10	11
MATRICOLA	TIPO	NUMERO CONDUTTORI PER SEZIONE n° x mm²	NUMERO DEI FILI DEL CONDUTT. (MIN) n	DIAMETRO SUL CONDUTTORE d (v.p..1) mm	SPESSORE MEDIO DELL' ISOLANTE S_1 (min) mm	DIAMETRO ESTERNO D (MAX) mm	MASSA CIRCA Kg/km	RESISTENZA ELETTRICA A 20° C MAX Ω / km	PORTATA PER POSA IN TUBO O CONDOTTO IN ARIA (1) A	CORRENTE TERMICA DI CORTO CIRCUITO (2) kA
34 90 06	202/1	1 X 10	6	3,9	1,0	6,8	125	1,83	50	1,1
34 90 07	202/2	1 X 16	6	4,9	1,0	8,0	180	1,15	68	1,8
34 90 08	202/3	1 X 25	6	6,2	1,2	9,8	285	0,727	89	2,8
34 90 10	202/4	1 X 50	6	8,5	1,4	13,0	515	0,387	134	5,7
34 90 12	202/5	1 X 95	15	12,1	1,6	17,0	1020	0,193	207	10,9
34 90 13	202/6	1 X 120	18	13,6	1,6	19,0	1290	0,153	239	13,8
34 90 14	202/7	1 X 150	18	15,1	1,8	21,0	1590	0,124	275	17,2
34 90 16	202/8	1 X 185	30	16,9	2,0	23,5	1980	0,0991	314	21,2
34 90 18	202/9	1 X 240	34	19,3	2,2	26,5	2580	0,0754	369	27,6

DIN / ATM

(1) 3 Cavi unipolari (v. CEI-UNEL 35024)

(2) I valori della corrente termica di corto circuito valgono nelle seguenti condizioni:
- durata del corto circuito 1s;
- temperatura iniziale dei conduttori pari alla temperatura massima ammissibile in regime permanente (70° C);
- temperatura finale del conduttore 160° C

1. TENSIONE NOMINALE DI ESERCIZIO Uo/U = 450/750 V

2. MATERIALI

- Conduttore a corda rigido di rame ricotto non stagnato.

- Isolante: PVC di qualità R2, colore: nero, giallo/verde, blu, marrone, grigio, rosso.

3. IMBALLO E PEZZATURE

Rotoli da 100 m (compatibilmente con un peso massimo di 35 kg) oppure bobine.

4. NORME E PRESCRIZIONI PER LA COSTRUZIONE, IL COLLAUDO E LA FORNITURA

DIN / ATM

Norme CEI 20-20 (Terza edizione) Parte 3 - art.2, con le seguenti modifiche:

- le qualità meccaniche ed elettriche dell'isolante devono rispondere ai requisiti del "Foglio di Specifica del PVC isolante di qualità R2" di cui alle Norme CEI 20-11. Cap. IV, Sezione 5.

Il cavo deve superare le prove di non propagazione dell'incendio prescritte dalle Norme CEI 20-22, vigenti.

Sull'isolante deve essere stampigliato almeno ogni 0,5 m il contrassegno attestante la caratteristica di non propagazione dell'incendio: CEI 20-22 II.

Per le prescrizioni di fornitura vedere la tabella ENEL DV 210.

Il cavo deve essere munito di contrassegno dell'Istituto Italiano del Marchio di Qualità e di quello di riconoscimento del Costruttore.

Il contrassegno dell'Istituto Italiano del Marchio di Qualità per i cavi formanti oggetto di questa unificazione è costituito da un filo tessile su cui sono stampate in alfabeto Morse le lettere MIQ e dalla sigla IEMMEQU stampigliata con continuità sull'isolante contiguamente all'indicazione "CEI 20-22 II".

5. CONDIZIONI DI IMPIEGO

Per le condizioni di impiego vedere Appendice 1 - art. 3 delle Norme CEI 20-20.

Per le portate di corrente in regime permanente, vedere anche tabella CEI-UNEL 35024 vigente.

Raggio minimo di curvatura: 6D

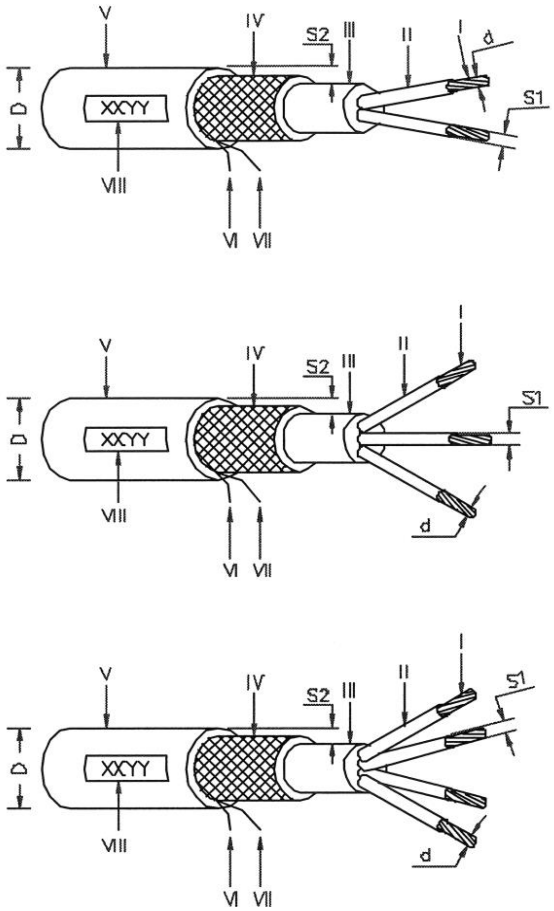
Sforzo di trazione nella posa: ≤ 50 N (~ 5 kg) per mm^2 di sezione del rame.

6. UNITA' DI MISURA

Metro (m).

DIN / ATM

INDICE



ESECUZIONE COMUNE:

I – CONDUTTORE A CORDA FLESSIBILE DI RAME RICOTTO NON STAGNATO. (v. punto 2).
II – ISOLANTE DI POLIVINILCLORURO QUALITA' R2. (v. punto 2).
III – GUAINETTA DI MATERIALE NON IGROSCOPICO. (v. punto 2).
IV – SCHERMO DI NASTRI DI RAME (v. punto 2)
V – GUAINA DI POLIVINICLORURO QUALITA' Rz. (v. punto 2).
VI – CONTRASSEGNO DELL'IMQ. (v. punto 4)
VII – CONTRASSEGNO DI RICONOSCIMENTO DEL FABBRICANTE.
IN SOSTITUZIONE DEL FILO DI RICONOSCIMENTO, IL FABBRICANTE PUO' STAMPARE IN RILIEVO SULLA GUAINA DEL CAVO IL PROPRIO NOME O USARE ALTRI SEGNI DI RICONOSCIMENTO SECONDO LA NORMA CEI 20–14
VIII – CONTRASSEGNO SPECIALE PER L'IDENTIFICAZIONE DELLE CARATTERISTICHE DI NON PROPAGAZIONE DELL'INCENDIO. (v. punto 4).

Esempio Designazione abbreviata :

CAVO 2x2,5 N1VC7V–K UE

DIN / ATM

1	2	3	4	5	6	7	8	9	10	11	12	13	14
MATRICOLA	TIPO	NUMERO CONDUT. PER SEZIONE NOMIN.	DIAMETR. DEI FILI DEL CONDUT. (MAX)	DIAMETRO SUL CONDUTT. (d)	SPESSORE MEDIO DELL' ISOLANTE S_1 (min)	SPESSORE MEDIO DELLA GUAINA DI PVC S_2 (min)	DIAMETRO STERNO D (MAX)	MASSA CIRCA	RESISTENE LETTR. A 20° C MAX	PORTATA PER POSA IN ARIA LIBERA A PARETE	PORTATA PER POSA IN TUBO O CONDOTT. IN ARIA	CORRENTE TERMICA DI CORTO CIRCUITO (1)	CORRENTE TERMICA DI CORTO CIRCUITO DELLO SCHERMO (2)
		n° x mm²	mm	mm	mm	mm	mm	kg/ km	Ω/ km	A	A	kA	kA
34 91 51	204/1A	2 x 1,5	0,26	1,6	0,8	1,8	15,0	250	13,7	19,5	17,5	0,17	0,6
34 91 52	204/1	2 x 2,5	0,26	2,0	0,8	1,8	16,0	300	8,21	26	24	0,28	0,6
34 91 53	204/2	2 x 4	0,31	2,6	1,0	1,8	18,0	390	5,09	35	32	0,46	0,6
34 91 54	204/3	2 x 6	0,31	3,4	1,0	1,8	19,0	450	3,39	46	41	0,69	0,6
34 91 55	204/4	2 x 10	0,41	4,4	1,0	1,8	21,0	600	1,95	63	57	1,1	0,6
34 91 56	204/5	2 x 16	0,41	5,7	1,0	1,8	25,0	800	1,24	85	76	1,8	0,6
34 91 57	204/6	2 x 25	0,41	6,9	1,2	1,8	26,5	1150	0,795	112	101	2,8	0,6
34 91 66	204/7A	3 x 1,5	0,26	1,.6	0,8	1,8	15,5	280	13,7	17,5	15,5	0,17	0,6
34 91 67	204/8	3 x 2,5	0,26	2,0	0,8	1,8	16,5	340	8,21	24	21	0,28	0,6
34 91 68	204/8A	3 x 4	0,31	2,6	1,0	1,8	18,5	440	5,09			0,46	0,6
34 91 69	204/8B	3 x 6	0,31	3,4	1,0	1,8	20,0	530	3,39			0,69	0,6
34 91 71	204/8C	3 x 16	0,41	5,7	1,0	1,8	24,0	960	1,24			1,84	0,6
34 91 81	204/8D	4 x 1,5	0,26	1,6	0,8	1,8	16,5	300	13,7	15,5	14	0,17	0,6
34 91 82	204/9	4 x 2,5	0,26	2,0	0,8	1,8	17,5	390	8,21	21	19	0,28	0,6
34 91 83	204/10	4 x 4	0,31	2,6	1,0	1,8	20,0	500	5,09	28	25	0,46	0,6
34 91 84	204/11	4 x 6	0,31	3,4	1,0	1,8	21,5	600	3,39	36	32	0,69	0,6
34 91 85	204/12	4 x 10	0,41	4,4	1,0	1,8	23,5	870	1,95	50	44	1,15	0,6
34 91 86	204/13	4 x 16	0,41	5,7	1,0	1,8	26,0	1200	1,24			1,84	0,6
34 91 87	204/14	4 x 25	0,41	6,9	1,2	1,8	30,5	1680	0,795			2,87	0,6

DIN / ATM

(1) I valori della corrente termica di corto circuito valgono nelle seguenti condizioni:

- durata del corto circuito 1s;
- temperatura iniziale dei conduttori pari alla temperatura massima ammissibile in regime permanente (70° C);
- temperatura finale del conduttore 160° C

(2) Durata del corto circuito nello schermo: 1s

1. TENSIONE NOMINALE DI ESERCIZIO Uo/U = 0,6/1 kV

2. MATERIALI

- Conduttore a corda flessibile di rame ricotto non stagnato.
- solante: PVC di qualità R2.
- Distinzione delle anime come da tabella UNEL 00722 nell'alternativa cavi senza conduttore di protezione per cavi tripolari e quadripolari.
- Anime riunite ad elica.
- Guainetta di materiale non igroscopico o fasciatura con nastro sintetico.
- Schermo costituito da due nastri di rame di spessore minimo 0,1mm avvolti a coprigimento o intercalari con resistenza di schermo $< 5\Omega$/km.
- Guaina: PVC di qualità Rz, colore di preferenza blu chiaro.

DIN / ATM

3. IMBALLO E PEZZATURE

Bobine da 500 m o 1000 m.

4. NORME E PRESCRIZIONI PER LA COSTRUZIONE, IL COLLAUDO E LA FORNITURA

Norme CEI 20-14, vigenti.

Il cavo deve superare le prove di non propagazione dell'incendio prescritte dalle Norme CEI 20-22, vigenti.

Sulla guaina del cavo deve essere stampigliato almeno ogni 0,5 m il contrassegno attestante la caratteristica di non propagazione dell'incendio: CEI 20-22 II.

Per le prescrizioni di fornitura vedere la tabella ENEL DV 210.

Il cavo deve essere munito di contrassegno dell'Istituto Italiano del Marchio di Qualità e di quello di riconoscimento del costruttore.

Il contrassegno dell'Istituto Italiano del Marchio di Qualità per i cavi formanti oggetto di questa unificazione è costituito da un filo tessile su cui sono stampate in alfabeto Morse le lettere MIQ e dalla sigla IEMMEQU stampigliata con continuità sulla guaina, contiguamente all'indicazione "CEI 20-22 II".

5. CONDIZIONI DI IMPIEGO

All'esterno; ammessa anche la posa interrata. All'interno in ambienti anche bagnati. Posa fissa su murature e strutture metalliche.

Per le portate di corrente in regime permanente, vedere anche tabella CEI-UNEL 35024 vigente, dove esistenti, le Norme CEI relative all'impiego specifico.

Raggio minimo di curvatura: 8 (D+d)

Sforzo di trazione nella posa: ≤ 60 N (~ 6 kg) per mm^2 di sezione del rame.

6 UNITA' DI MISURA

Metro (m).

DIN / ATM

INDICE

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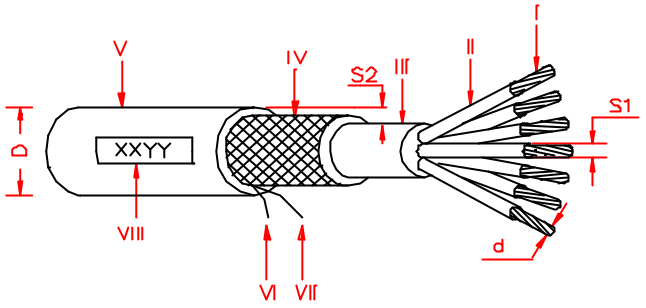
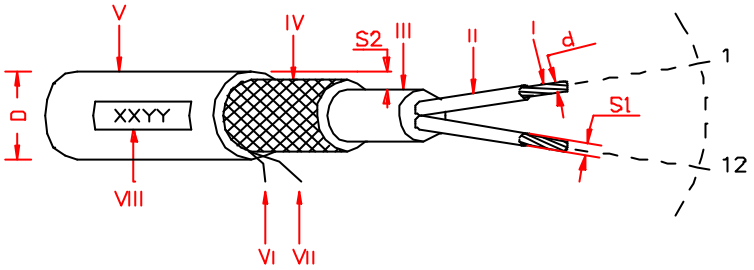
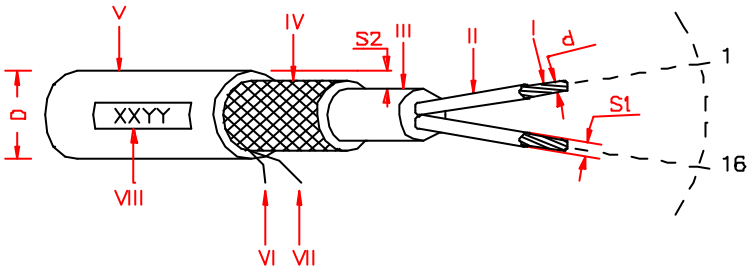






ESECUZIONE COMUNE:

I – CONDUTTORE A CORDA FLESSIBILE DI RAME RICOTTO NON STAGNATO. (v. punto 2).
II – ISOLANTE DI POLIVINILCLORURO QUALITA' R2. (v. punto 2)
III – GUAINETTA DI MATERIALE NON IGROSCOPICO. (v. punto 2).
IV – SCHERMO DI NASTRI DI RAME. (v. punto 2).
V – GUAINA DI POLIVINICLORURO QUALITA' Rz. (v punto 2).
VI – CONTRASSEGNO DELL'IMQ (v. punto 4)
VII – CONTRASSEGNO DI RICONOSCIMENTO DEL FABBRICANTE.
IN SOSTITUZIONE DEL FILO DI RICONOSCIMENTO, IL FABBRICANTE PUO' STAMPARE IN RILIEVO SULLA GUAINA DEL CAVO IL PROPRIO NOME O USARE ALTRI SEGNI DI RICONOSCIMENTO SECONDO LA NORMA CEI 20-14
VIII – CONTRASSEGNO SPECIALE PER L'IDENTIFICAZIONE DELLE CARATTERISTICHE DI NON PROPAGAZIONE DELL'INCENDIO. (v. punto 4).

Esempio Designazione abbreviata ·

CAVO 7x1,5 N1VC7V-K UE

1	2	3	4	5	6	7	8	9	10	11	12	13	14
MATRIC.	TIPO	NUMERO CONDUT. PER SEZIONE NOMIN.	DIAMETR. DEI FILI DEL CONDUT. (MAX)	DIAMETRO SUL CONDUTT. (d)	SPESSOR. MEDIO DELL' ISOLANTE S_1 (min)	SPESSOR MEDIO DELLA GUAINA DI PVC S_2 (min)	DIAMETR. ESTERNO D (MAX)	MASSA CIRCA	RESIST. ELETTR A 20° C (MAX) (3)	PORTATA PER POSA IN ARIA LIBERA A PARETE	PORTATA PER POSA IN TUBO O CONDOT. IN ARIA	CORRENTE TERMICA DI CORTO CIRCUITO (1)	CORRENTE TERMICA DI CORTO CIRCUITO DELLO SCHERMO (2)
		n° x mm²	mm	mm	mm	mm	mm	kg/ km	Ω/ km	A	A	kA	kA
35 10	206/1	7 X 1,5	0,26	1,6	0,8	1,8	16,5	400	13,3	10	9	0,17	0,6
35 10	206/2	7 X 2,5	0,26	2.0	0,9	1,8	18,6	460	7,98	11	10	0,28	0,6
35 10	206/4	12 X 2,5	0,26	2,0	0,9	2,0	24,3	850	8,06	11	10	0,28	0,6
35 10	206/5	16 X 2,5	0,26	2,0	0,9	2,0	26,4	1050	8,06	11	10	0,28	0,6

DIN / ATM

(1) I valori della corrente termica di corto circuito valgono nelle seguenti condizioni:

- durata del corto circuito 1s;
- temperatura iniziale dei conduttori pari alla temperatura massima ammissibile in regime permanente (70° C);
- temperatura finale del conduttore 160° C

(2) Durata del corto circuito nello schermo: 1s.

(3) I valori della resistenza elettrica, per numero di contatori > 7, risultano aumentati rispetto a quelli delle Norme CEI 20-29, per tenere conto delle maggiori perdite per cordatura.

1. TENSIONE NOMINALE DI ESERCIZIO Uo/U = 0,6/1 kV

2. MATERIALI

- Conduttore a corda flessibile di rame ricotto non stagnato.
- Isolante: PVC di qualità R2.
- Distinzione delle anime come da tabella UNEL 00722 nell'alternativa cavi senza conduttore di protezione.
- Anime riunite ad elica.
- Guainetta di materiale non igroscopico o fasciatura con nastro sintetico.
- Schermo costituito da due nastri di rame, di spessore minimo 0,1 mm avvolti a coprigiunto o intercalati con resistenza di schermo $\leq 5\ \Omega$/km
- Guaina: PVC di qualità Rz, colore di preferenza blu chiaro.

3. IMBALLO E PEZZATURE

Bobine da 500 m o 1000 m.

DIN / ATM

4. NORME E PRESCRIZIONI PER LA COSTRUZIONE, IL COLLAUDO E LA FORNITURA

Norme CEI 20-14, vigenti.

Il cavo deve superare le prove di non propagazione dell'incendio prescritte dalle Norme CEI 20-22, vigenti.

Sulla guaina del cavo deve essere stampigliato almeno ogni 0,5m il contrassegno attestante la caratteristica di non propagazione dell'incendio : CEI 20-22 II.

Per le prescrizioni di fornitura vedere la tabella ENEL DV 210.

Il cavo deve essere munito di contrassegno dell'Istituto Italiano del Marchio di Qualità e di quello di riconoscimento del costruttore.

Il contrassegno dell'Istituto Italiano del Marchio di Qualità per i cavi formanti oggetto di questa unificazione è costituito da un filo tessile su cui sono stampate in alfabeto Morse le lettere MIQ e dalla sigla IEMMEQU stampigliata con continuità sulla guaina, contiguamente all'indicazione "CEI 20-22 II".

5. CONDIZIONI DI IMPIEGO

All'esterno; ammessa anche la posa interrata. All'interno in ambienti anche bagnati. Posa fissa su murature e strutture metalliche.

Per le portate di corrente in regime permanente, vedere anche tabella CEI-UNEL 35024 vigente, dove esistenti, le Norme CEI relative all'impiego specifico.

Raggio minimo di curvatura: 8 (D+d)

Sforzo di trazione nella posa: $\leq$ 60 N ($\approx$ 6 kg) per mm^2 di sezione del rame.

6. UNITA' DI MISURA

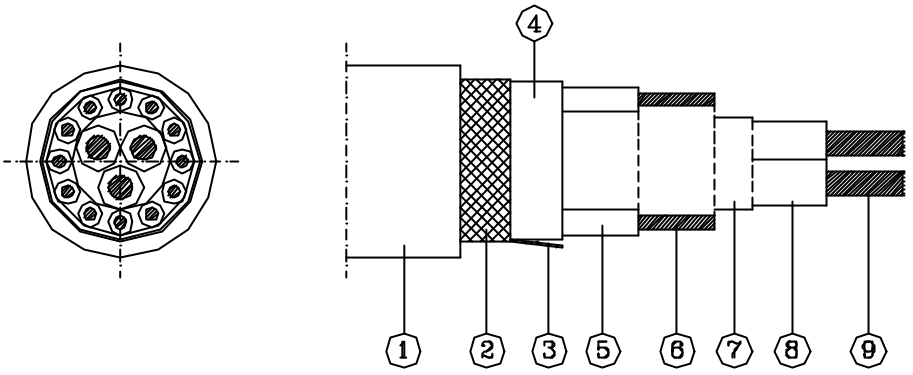
Metro (m).

INDICE

DIN / ATM

N.	TITOLO	FOGLI	MATRICOLA
X 1151/1	Cavo da 3 X 1,5 ÷ 12 X 0,5	4 - 4 - 5	332236
X 1151/2	Cavo da 6 X 1,5 ÷ 19 X 0,5	6 - 7 - 8	332237
X 1151/3	Cavo da 6 X 1,5 ÷ 25 X 0,5	9 - 1 - 11	332238

V 207/1 – CAVO DA 3x1,5 + 12x0,5



1. GUAINA ESTERNA
2. SCHERMATURA
3. CORDA DI CONTINUITA' DELLA SCHERMATURA
4. FASCIATURA
5. ISOLANTE DEL CONDUTTORE
6. CONDUTTORI DA 0,5 mm^2
7. GUAINETTA NON IGROSCOPICA
8. ISOLANTE DEL CONDUTTORE
9. CONDUTTORI DA 1, 5 mm^2

DIN / ATM

Il Cavo è del tipo "non propagante l'incendio" e risponde alle vigenti Norme CEI 20-22

CONDUTTORI

da 0,5 mm^2 (rif. **5** e **6**)

-	formazione del conduttore	16 x 0,20 mm
-	forma del conduttore	rotondo
-	isolante del conduttore	PVC tipo R2 (CEI-20-11)
-	diametro esterno dell'isolante di ciascun conduttore	≥ 2,1 mm
-	colore dell'isolante del conduttore	nero
-	numerazione sull'isolante dei conduttori	Progressiva da 1 a 12 ogni 4 cm
-	tensione nominale di lavoro del conduttore	24 Vcc

da 1,5 mm^2 (rif. **7** e **8**)

- formazione del conduttore	30 x 0,25 mm
- forma del conduttore	rotondo
- isolante del conduttore	PVC tipo R2 (CEI-20-11)
- diametro esterno dell'isolante di ciascun conduttore	≥ 2,9 mm
- colore dell'isolante del conduttore	bianco
- numerazione sull'isolante dei conduttori	Progressiva da 1 a 3 ogni 4 cm
- tensione nominale di lavoro del conduttore	110 Vcc

SCHERMATURA

- tipo	Treccia di rame rosso
- resistenza	≤ 5 O/km
- densità	≥ 80%
- corda di continuità	0,5 mm^2 realizzato con fili 16x0,20 mm

GUAINA ESTERNA

- tipo di guaina	PVC di qualità Rz (CEI-20-11)
- colore	Blu chiaro
- diametro massimo	16,5 mm
- contrassegni	Istituto Italiano del Marchio di Qualità (CEI-20-22)

La guaina deve riportare una stampigliatura, ripetuta almeno ogni metro, contenente la sigla ENEL, il nome del costruttore, l'anno e il trimestre di fabbricazione, e la dicitura "CEI 20-22-II" (esempio: ENEL DV 207- CEI 20-22-II)

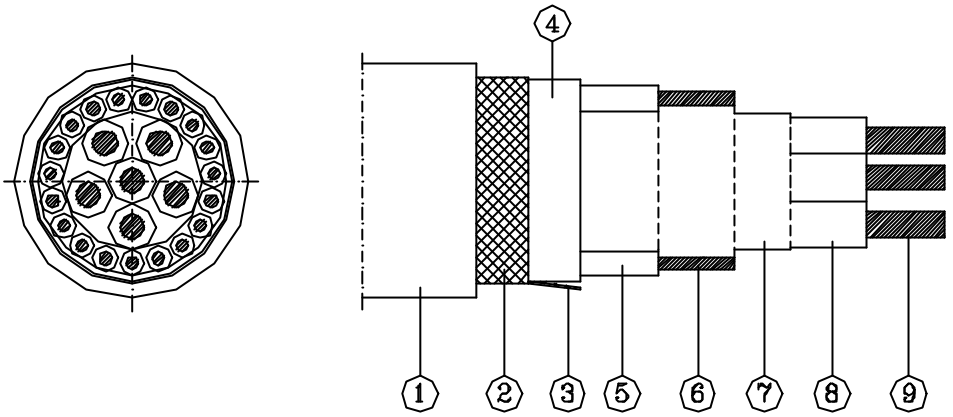
MASSA 350 kg/km

DIN / ATM

ISOLAMENTO

Tensione di prova di ciascun conduttore da 0,5 mm^2 e tutti gli altri collegati insieme, tensione di prova tra ciascun conduttore da 0,5 mm^2 e lo schermo	1500 V - 50 Hz per 1 minuto
Tensione di prova di ciascun conduttore da 1,5 mm^2 e gli altri collegati insieme, tensione di prova di ciascun conduttore da 1,5 mm^2 e lo schermo	2000 V - 50 Hz per 1 minuto
Resistenza di isolamento a 20° C tra ciascun conduttore e tutti gli altri collegati tra loro alla tensione di 500 Vcc dopo un minuto di elettrizzazione	100 MΩ

V 207/2 – CAVO DA 6x1,5 + 19x0,5



1. GUAINA ESTERNA
2. SCHERMATURA
3. CORDA DI CONTINUITA' DELLA SCHERMATURA
4. FASCIATURA
5. ISOLANTE DEL CONDUTTORE
6. CONDUTTORI DA 0,5 mm^2
7. GUAINETTA NON IGROSCOPICA
8. ISOLANTE DEL CONDUTTORE
9. CONDUTTORI DA 1, 5 mm^2

DIN / ATM

Il Cavo è del tipo "non propagante l'incendio" e risponde alle vigenti Norme CEI 20-22 fascicolo 351 e successiva variante 20 -22: V1-S-509

CONDUTTORI

da 0,5 mm^2 (rif. **5** e **6**)

-	formazione del conduttore	16 x 0,20 mm
-	forma del conduttore	rotondo
-	isolante del conduttore	PVC tipo R2 (CEI-20-11)
-	diametro esterno dell'isolante di ciascun conduttore	≥ 2,1 mm
-	colore dell'isolante del conduttore	nero
-	numerazione sull'isolante dei conduttori	Progressiva da 1 a 19 ogni 4 cm
-	tensione nominale di lavoro del conduttore	24 Vcc

da 1,5 mm^2 (rif. **7** e **8**)

- formazione del conduttore	30 x 0,25 mm
- forma del conduttore	rotondo
- isolante del conduttore	PVC tipo R2 (CEI-20-11)
- diametro esterno dell'isolante di ciascun conduttore	≥ 2,9 mm
- colore dell'isolante del conduttore	bianco
- numerazione sull'isolante dei conduttori	Progressiva da 1 a 6 ogni 4 cm
- tensione nominale di lavoro del conduttore	110 Vcc

SCHERMATURA

- tipo	Treccia di rame rosso
- resistenza	≤ 5 O/km
- densità	≥ 80%
- corda di continuità	0,5 mm^2 realizzato con fili 16x0,20 mm

GUAINA ESTERNA

- tipo di guaina	PVC di qualità Rz (CEI-20-11)
- colore	Blu chiaro
- diametro massimo	18 mm
- contrassegni	(CEI-20-22)

La guaina deve riportare una stampigliatura, ripetuta almeno ogni metro, contenente la sigla ENEL, il nome del costruttore, l'anno e il trimestre di fabbricazione, e la dicitura "CEI 20-22-II" (esempio: ENEL DV 207- CEI 20-22-II)

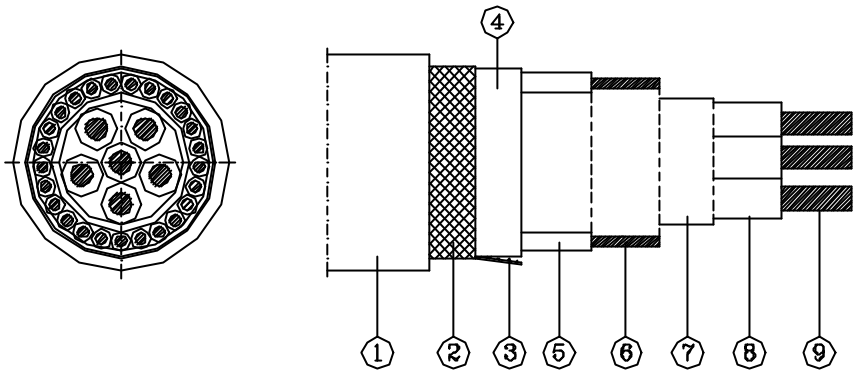
MASSA 470 kg/km

DIN / ATM

ISOLAMENTO

Tensione di prova di ciascun conduttore da 0,5 mm^2 e tutti gli altri collegati insieme, tensione di prova tra ciascun conduttore da 0,5 mm^2 e lo schermo	1500 V - 50 Hz per 1 minuto
Tensione di prova di ciascun conduttore da 1,5 mm^2 e gli altri collegati insieme, tensione di prova di ciascun conduttore da 1,5 mm^2 e lo schermo	2000 V - 50 Hz per 1 minuto
Resistenza di isolamento a 20° C tra ciascun conduttore e tutti gli altri collegati tra loro alla tensione di 500 Vcc dopo un minuto di elettrizzazione	100 MΩ

V 207/3 – CAVO DA 6x1,5 + 25x0,5



1. GUAINA ESTERNA
2. SCHERMATURA
3. CORDA DI CONTINUITA' DELLA SCHERMATURA
4. FASCIATURA
5. ISOLANTE DEL CONDUTTORE
6. CONDUTTORI DA 0,5 mm^2
7. GUAINETTA NON IGROSCOPICA
8. ISOLANTE DEL CONDUTTORE
9. CONDUTTORI DA 1, 5 mm^2

DIN / ATM

Il Cavo è del tipo "non propagante l'incendio" e risponde alle vigenti Norme CEI 20-22 fascicolo 351 e successiva variante 20-22: V1-S-509

CONDUTTORI

da 0,5 mm^2 (rif. **5** e **6**)

-	formazione del conduttore	16 x 0,20 mm
-	forma del conduttore	rotondo
-	isolante del conduttore	PVC tipo R2 (CEI-20-11)
-	diametro esterno dell'isolante di ciascun conduttore	≥ 2,1 mm
-	colore dell'isolante del conduttore	nero
-	numerazione sull'isolante dei conduttori	Progressiva da 1 a 25 ogni 4 cm
-	tensione nominale di lavoro del conduttore	24 Vcc

da 1,5 mm^2 (rif. **7** e **8**)

- formazione del conduttore	30 x 0,25 mm
- forma del conduttore	rotondo
- isolante del conduttore	PVC tipo R2 (CEI-20-11)
- diametro esterno dell'isolante di ciascun conduttore	≥ 2,9 mm
- colore dell'isolante del conduttore	bianco
- numerazione sull'isolante dei conduttori	Progressiva da 1 a 6 ogni 4 cm
- tensione nominale di lavoro del conduttore	110 Vcc

SCHERMATURA

- tipo	Treccia di rame rosso
- resistenza	≤ 5 O/km
- densità	≥ 80%
- corda di continuità	0,5 mm^2 realizzato con fili 16x0,20 mm

GUAINA ESTERNA

- tipo di guaina	PVC di qualità Rz (CEI-20-11)
- colore	Blu chiaro
- diametro massimo	18 mm
- contrassegni	Istituto Italiano del Marchio di Qualità (CEI-20-22)

La guaina deve riportare una stampigliatura, ripetuta almeno ogni metro, contenente la sigla ENEL, il nome del costruttore, l'anno e il trimestre di fabbricazione, e la dicitura "CEI 20-22-II" (esempio: ENEL DV 207- CEI 20-22-II)

MASSA (circa) 510 kg/km

DIN / ATM

ISOLAMENTO

Tensione di prova di ciascun conduttore da 0,5 mm^2 e tutti gli altri collegati insieme, tensione di prova tra ciascun conduttore da 0,5 mm^2 e lo schermo	4500 V - cc per 1 minuto
Tensione di prova di ciascun conduttore da 1,5 mm^2 e gli altri collegati insieme, tensione di prova di ciascun conduttore da 1,5 mm^2 e lo schermo	6000 V - cc per 1 minuto
Costante di isolamento a 20° C tra ciascun conduttore e tutti gli altri collegati tra loro alla tensione di 500 Vcc dopo un minuto di elettrizzazione	100 MΩ

1. TENSIONE NOMINALE DI ESERCIZIO

Uo/U = 0,6/1 kV

2. MATERIALI

- Conduttore a corda flessibile di rame ricotto non stagnato
- Isolante: PVC di qualità R2
- Distinzione delle anime come da tabella UNEL 00722 nell'alternativa cavi senza conduttore di protezione.
- Anime riunite ad elica
- Guainetta di materiale non igroscopico o fasciatura con nastro sintetico.
- Schermo costituito da treccia di rame rosso con percentuale di copertura $\leq 80\%$ con resistenza di schermo $\leq 5\Omega$/km
- Guaina: PVC di qualità Rz, colore di preferenza blu chiaro.

3. IMBALLO E PEZZATURE

Bobine da 500 m o 1000 m

DIN / ATM

4. NORME E PRESCRIZIONI PER LA COSTRUZIONE, IL COLLAUDO E LA FORNITURA

Norme CEI 20-14 vigenti

Il cavo deve superare le prove di non propagazione dell'incendio prescritte dalle Norme CEI 20-22 vigenti

Sulla guaina del cavo deve essere stampigliato almeno ogni 1 m il contrassegno attestante la caratteristica di non propagazione dell'incendio: CEI 20-22 II.

Per le prescrizioni di fornitura vedere la tabella ENEL DV 210

Il cavo deve essere munito di contrassegno dell'istituto italiano del marchio di qualità e di quello di riconoscimento del costruttore.

5. CONDIZIONI DI IMPIEGO

All'esterno; ammessa anche la posa interrata, All'interno in ambienti anche bagnati. Posa fissa su murature e strutture metalliche.

Per le portate di corrente in regime permanente, vedere anche tabella CEI-UNEL 35024 vigenti, dove esistenti, le Norme CEI relative all'impiego specifico.

Raggio minimo di curvatura: 8 (D+d)

Sforzo di trazione nella posa: ≤ 60 N (≈ 6 kg) per mm^2 di sezione del rame.

6. UNITA' DI MISURA

Metro (m)

INDICE

1. TENSIONE NOMINALE DI ESERCIZIO UO/U = 0,6/1 KV

2. MATERIALI

- Conduttore a corda flessibile di rame ricotto non stagnato.
- solante: PVC di qualità R2.
- Distinzione delle anime come da tabella UNEL 00722 nell'alternativa cavi senza conduttore di protezione per cavi tripolari e quadripolari.
- Anime riunite ad elica.
- Guainetta di materiale non igroscopico o fasciatura con nastro sintetico.
- Schermo costituito da una treccia a calza di fili di rame realizzato secondo la Norma CEI 24-14 e CEI 24-14 V1;

  resistenza di schermo <5Ω/km per sezioni ≥4 mm^2, comunque con una resistenza non inferiore al valore degli altri conduttori per sezioni ≤4 mm^2;

  l'angolo con cui deve essere avvolta la treccia ≥ 28°.

  la treccia della calza deve essere sormontata sul cavo con un percentuale ≥80%.

  Il diametro dei fili deve essere conforme a quanto riportato nella Variante 1 della CEI 24-14
- Guaina: PVC di qualità Rz, colore di preferenza blu chiaro.

3. IMBALLO E PEZZATURE

Bobine da 500 m o 1000 m.

4. NORME E PRESCRIZIONI PER LA COSTRUZIONE, IL COLLAUDO E LA FORNITURA

Norme CEI 20-14, vigenti.

Il cavo deve superare le prove di non propagazione dell'incendio prescritte dalle Norme CEI 20-22, vigenti.

Sulla guaina del cavo deve essere stampigliato almeno ogni 0,5 m il contrassegno attestante la caratteristica di non propagazione dell'incendio: CEI 20-22 II.

Per le prescrizioni di fornitura vedere la tabella ENEL DV 210.

Il cavo deve essere munito di contrassegno dell'Istituto Italiano del Marchio di Qualità e di quello di riconoscimento del costruttore.

Il contrassegno dell'Istituto Italiano del Marchio di Qualità per i cavi formanti oggetto di questa unificazione è costituito da un filo tessile su cui sono stampate in alfabeto Morse le lettere IMQ e dalla sigla IEMMEQU stampigliata con continuità sulla guaina, contiguamente all'indicazione "CEI 20-22 II".

5. CONDIZIONI DI IMPIEGO

All'esterno; ammessa anche la posa interrata. All'interno in ambienti anche bagnati. Posa fissa su murature e strutture metalliche.

Per le portate di corrente in regime permanente, vedere anche tabella CEI-UNEL 35024 vigente, dove esistenti, le Norme CEI relative all'impiego specifico.

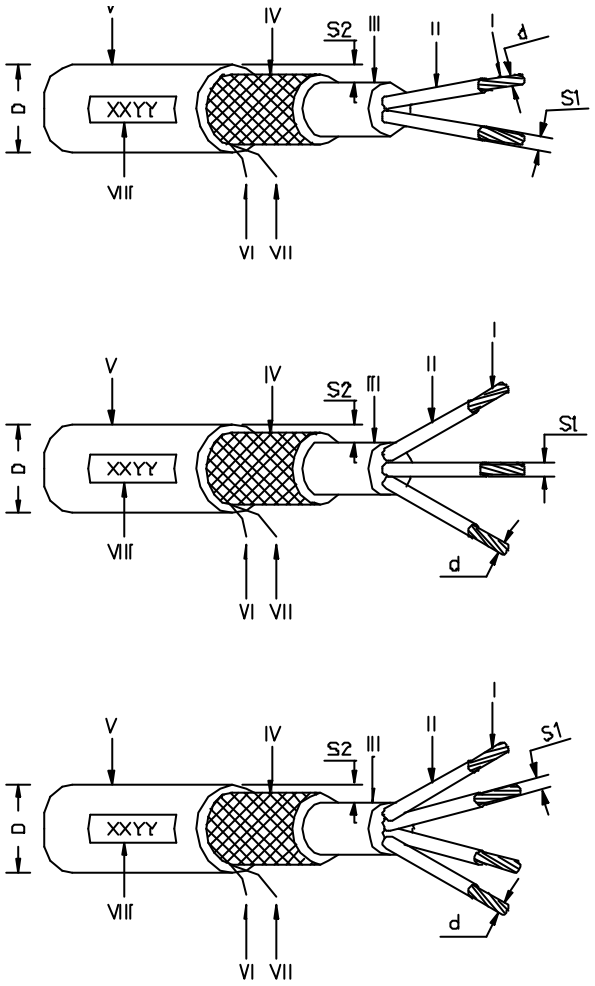
Raggio minimo di curvatura: 8 (D+d)

Sforzo di trazione nella posa: ≤ 60 N (~ 6 kg) per mm^2 di sezione del rame.

6 UNITA' DI MISURA

Metro (m).

8. ESEMPIO DEL CAVO PENTAPOLARE



ESECUZIONE COMUNE:

I – CONDUTTORE A CORDA FLESSIBILE DI RAME RICOTTO NON STAGNATO. (v. punto 2).
II – ISOLANTE DI POLIVINILCLORURO QUALITA' R2. (v. punto 2).
III – GUAINETTA DI MATERIALE NON IGROSCOPICO. (v. punto 2).
IV – SCHERMO DI FILI DI RAME. (v punto 2).
V – GUAINA DI POLIVINICLORURO QUALITA' Rz. (v. punto 2)
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IN SOSTITUZIONE DEL FILO DI RICONOSCIMENTO, IL FABBRICANTE PUO' STAMPARE IN RILIEVO SULLA GUAINA DEL CAVO IL PROPRIO NOME O USARE ALTRI SEGNI DI RICONOSCIMENTO SECONDO LA NORMA CEI 20-14
VIII – CONTRASSEGNO SPECIALE PER L'IDENTIFICAZIONE DELLE CARATTERISTICHE DI NON PROPAGAZIONE DELL'INCENDIO (v. punto 4).

Esempio Designazione abbreviata :

CAVO 2x2,5 N1VC4V-K UE

8. CARATTERISTICHE FISICHE ELETTRICHE

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MATRICOLA	TIPO	NUMERO CONDUT. PER SEZIONE NOMINALE	DIAMETR. DEI FILI DEL CONDUTORE (MAX)	DIAMETRO SUL CONDUTT. (d)	SPESSORE MEDIO DELL' ISOLANTE S_1 (min)	SPESSORE MEDIO DELLA GUAINA DI PVC S_2 (min)	DIAMETRO ESTERNO D(MAX)	MASSA CIRCA	RESISTEN ELETTR. A 20° C MAX	PORTATA PER POSA IN ARIA LIBERA A PARETE	PORTATA PER POSA IN TUBO O CONDOTTURE. IN ARIA	CORRENTE TERMICA DI CORTO CIRCUITO (1)	DIAMETRO DEI FILI DELLO SCHERMO	CORRENTE TERMICA DI CORTO CIRCUITO DELLO SCHERMO (2)
		nxmm^2	mm	mm	mm	mm	mm	kg/ km	Ω / km	A	A	kA	mm	kA
349121	208/1	2 x 1,5	0,26	1,6	0,8	1,8	15,0	250	13,3	19,5	17,5	0,17	0,15	0,6
349122	208/2	2 x 2,5	0,26	2,0	0,8	1,8	16,0	300	7,98	26	24	0,28	0,15	0,6
349123	208/3	2 x 4	0,31	2,6	1,0	1,8	18,0	390	4,95	35	32	0,46	0,15	0,6
349124	208/4	2 x 6	0,31	3,4	1,0	1,8	19,0	450	3,30	46	41	0,69	0,20	0,6
349125	208/5	2 x 10	0,41	4,4	1,0	1,8	21,0	600	1,91	63	57	1,1	0,20	0,6
349126	208/6	2 x 16	0,41	5,7	1,0	1,8	25,0	800	1,21	85	76	1,8	0,20	0,6
349127	208/7	2 x 25	0,41	6,9	1,2	1,8	26,5	1150	0,780	112	101	2,8	0,20	0,6
349141	208/8	4 x 1,5	0,26	1,6	0,8	1,8	16,5	300	13,3	15,5	14	0,17	0,15	0,6
349142	208/9	4 x 2,5	0,26	2,0	0,8	1,8	17,5	390	7,98	21	19	0,28	0,15	0,6
349143	208/10	4 x 4	0,31	2,6	1,0	1,8	20,0	500	4,25	28	25	0,46	0,15	0,6
349144	208/11	4 x 6	0,31	3,4	1,0	1,8	21,5	600	3,30	36	32	0,69	0,20	0,6
349145	208/12	4 x 10	0,41	4,4	1,0	1,8	23,5	870	1,91	50	44	1,15	0,20	0,6
349146	208/13	4 x 16	0,41	5,7	1,0	1,8	26,0	1200	1,21			1,84	0,20	0,6
349147	208/14	4 x 25	0,41	6,9	1,2	1,8	30,5	1680	0,780			2,87	0,20	0,6

(1) I valori della corrente termica di corto circuito valgono nelle seguenti condizioni:

- durata del corto circuito 1s;
- temperatura iniziale dei conduttori pari alla temperatura massima ammissibile in regime permanente (70° C);
- temperatura finale del conduttore 160° C

(2) Durata del corto circuito nello schermo: 1s

INDICE

1. TENSIONE NOMINALE DI ESERCIZIO UO/U = 0,6/1 KV

2. MATERIALI

- Conduttore a corda flessibile di rame ricotto non stagnato.
- Isolante: PVC di qualità R2.
- Distinzione delle anime come da tabella UNEL 00722 nell'alternativa cavi senza conduttore di protezione.
- Anime riunite ad elica.
- Guainetta di materiale non igroscopico o fasciatura con nastro sintetico.
- Schermo costituito da una treccia a calza di fili di rame realizzato secondo la Norma CEI 24-14 e CEI 24-14 V1;

  resistenza di schermo <5Ω/km per sezioni ≥4 mm^2, comunque con una resistenza non inferiore al valore degli altri conduttori per sezioni ≤4 mm^2;

  l'angolo con cui deve essere avvolta la treccia ≥ 28°.

  la treccia della calza deve essere sormontata sul cavo con un percentuale ≥80%.

  Il diametro dei fili deve essere conforme a quanto riportato nella Variante 1 della CEI 24-14
- Guaina: PVC di qualità Rz, colore di preferenza blu chiaro.

3. IMBALLO E PEZZATURE

Bobine da 500 m o 1000 m.

4. NORME E PRESCRIZIONI PER LA COSTRUZIONE, IL COLLAUDO E LA FORNITURA

Norme CEI 20-14, vigenti.

Il cavo deve superare le prove di non propagazione dell'incendio prescritte dalle Norme CEI 20-22, vigenti.

Sulla guaina del cavo deve essere stampigliato almeno ogni 0,5m il contrassegno attestante la caratteristica di non propagazione dell'incendio : CEI 20-22 II.

Per le prescrizioni di fornitura vedere la tabella ENEL DV 210.

Il cavo deve essere munito di contrassegno dell'Istituto Italiano del Marchio di Qualità e di quello di riconoscimento del costruttore.

Il contrassegno dell'Istituto Italiano del Marchio di Qualità per i cavi formanti oggetto di questa unificazione è costituito da un filo tessile su cui sono stampate in alfabeto Morse le lettere IMQ e dalla sigla IEMMEQU stampigliata con continuità sulla guaina, contiguamente all'indicazione "CEI 20-22 II".

5. CONDIZIONI DI IMPIEGO

All'esterno; ammessa anche la posa interrata. All'interno in ambienti anche bagnati. Posa fissa su murature e strutture metalliche.

Per le portate di corrente in regime permanente, vedere anche tabella CEI-UNEL 35024 vigente, dove esistenti, le Norme CEI relative all'impiego specifico.

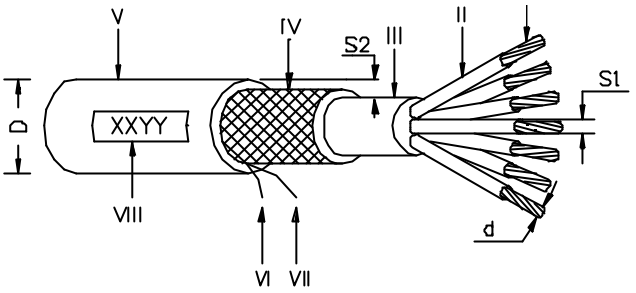
Raggio minimo di curvatura: 8 (D+d)

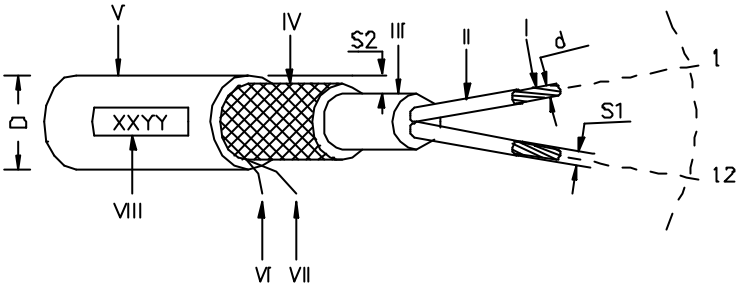
Sforzo di trazione nella posa: $\leq$ 60 N ($\approx$ 6 kg) per mm^2 di sezione del rame.

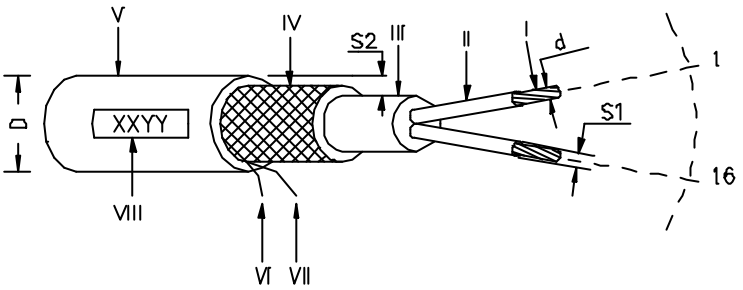
6. UNITA' DI MISURA

Metro (m).

8. ESEMPIO DEL CAVO PENTAPOLARE







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Esempio Designazione abbreviata :

CAVO 7x1,5 N1VC4V-K UE

8. CARATTERISTICHE FISICHE ELETTRICHE

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MATRIC.	TIPO	NUMERO CONDUT. PER SEZIONE NOMINALE n°x mm^2	DIAMETR. DEI FILI DEL CONDUT. (MAX) mm	DIAMETRO SUL CONDUTT. (d) mm	SPESSOR.MEDIO DELL' ISOLANTE S_1 (min) mm	SPESSOR MEDIO DELLA GUAINA DI PVC S_2 (min) mm	DIAMETR. ESTERNO D (MAX) mm	MASSA CIRCA kg/ km	RESIST. ELETTR A 20° C (MAX) (3) Ω / km	PORTATA PER POSA IN ARIA LIBERA A PARETE A	PORTATA PER POSA IN TUBO O CONDOT. IN ARIA A	CORRENTE TERMICA DI CORTO CIRCUITO (1) kA	DIAMETRO DEI FILI DELLO SCHERMO mm	CORRENTE TERMICA DI CORTO CIRCUITO DELLO SCHERMO (2) kA
351041	209/1	7 X 1,5	0,26	1,5	0,8	1,8	16,5	400	13,3	10	9	0,17	0,15	0,6
351042	209/2	12 X 1,5	0,26	1,5	0,8	1,8	16,5	400	13,3	10	9	0,17	0,15	0,6
351043	209/3	16 X 1,5	0,26	1,5	0,8	1,8	16,5	400	13,3	10	9	0,17	0,15	0,6
351044	209/4	7 X 2,5	0,26	2.5	0,9	1,8	18,6	460	7,98	11	10	0,28	0,20	0,6
351045	209/5	12 X 2,5	0,26	2,5	0,9	2,0	24,3	850	7,98	11	10	0,28	0,20	0,6
351046	209/6	16 X 2,5	0,26	2,5	0,9	2,0	26,4	1050	7,98	11	10	0,28	0,20	0,6

(1) I valori della corrente termica di corto circuito valgono nelle seguenti condizioni:

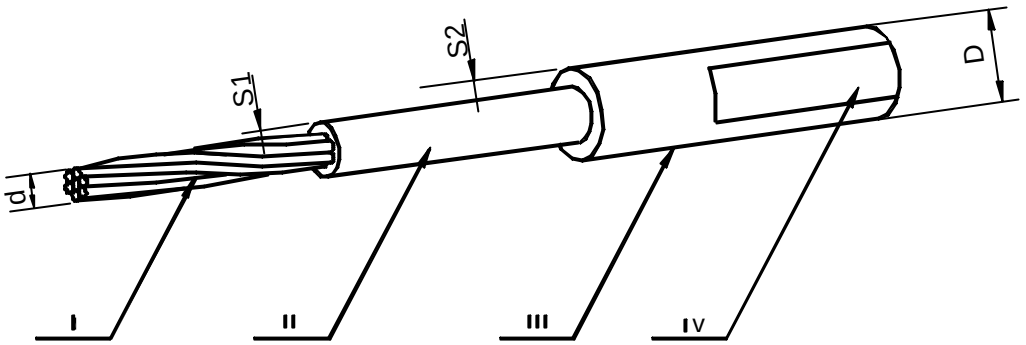
- durata del corto circuito 1s;
- temperatura iniziale dei conduttori pari alla temperatura massima ammissibile in regime permanente (70° C);
- temperatura finale del conduttore 160° C

(2) Durata del corto circuito nello schermo: 1s.

(3) I valori della resistenza elettrica, per numero di contatori > 7, risultano aumentati rispetto a quelli delle Norme CEI 20-29, per tenere conto delle maggiori perdite per cordatura.

CAVI PER BASSA TENSIONE UNIIPOLARI
CON CONDUTTORIE DI RAME
ISOLATI CON GOMMA ETILENPROPILENICA
AD ALTO MODULO ELASTICO, O CON XLPE, SOTTO GUAINA DI PVC

III	DRE/USM/UNI	------	Serricchio	Tramutoli	Settembre 2003
III	ING/UNI	------	Serricchio	Colloca	Agosto 2001
Ed.	**Funzione/Unità**	**Redatto**	**Verificato**	**Approvato**	**Data**



I - Conduttore **II** - Isolante **III** - Guaina **IV** – Stampigliatura

CARATTERISTICHE DEI CAVI

1	2	3	4	5	6	7	8	9	10	11
Matricola	Tipo	Isolante	Numero conduttori per sez. nominale (circa) (n° x mm²)	Diametro esterno del cavo D (1) (mm)	Massa (kg/km)	Portata (2) per posa				Corrente termica di c.c. (3) (kA)
						in aria libera (A)	in tubo in aria (A)	direttamente interrata (A)	in tubo interrato (A)	
33 00 02	**DC 4141/1 H** / DC 4141/8 X	**HEPR** / XLPE	**1 x 6**	**7**	**110**	**61**	**48**	**68**	**54**	**0,8**
33 00 03	**DC 4141/2 H** / DC 4141/9 X	**HEPR** / XLPE	**1 x 16**	**10**	**220**	**112**	**89**	**119**	**95**	**2,2**
33 00 04	**DC 4141/3 H** / DC 4141/10 X	**HEPR** / XLPE	**1 x 25**	**12**	**320**	**148**	**117**	**156**	**125**	**3,5**
33 00 05	**DC 4141/4 H** / DC 4141/11 X	**HEPR** / XLPE	**1 x 50**	**14**	**550**	**221**	**175**	**218**	**175**	**6,5**
33 00 06	**DC 4141/5 H** / DC 4141/12 X	**HEPR** / XLPE	**1 x 95**	**18**	**1050**	**342**	**269**	**322**	**258**	**13,0**
33 00 07	**DC 4141/6 H** / DC 4141/13 X	**HEPR** / XLPE	**1 x 150**	**22**	**1500**	**454**	**359**	**410**	**328**	**20,0**
33 00 08	**DC 4141/7 H** / DC 4141/14 X	**HEPR** / XLPE	**1 x 240**	**27**	**2400**	**610**	**481**	**545**	**436**	**32,0**

(1) **I valori esposti sono indicativi; quelli prescritti sono indicati nel documento ENEL DC 4908.**

(2) **I valori della portata valgono in regime permanente per quattro cavi a contatto con temperatura dei conduttori di 90°C ed inoltre:**

- **per posa in aria libera o in tubo in aria:**
  - **temperatura ambiente 30° C**
- **per posa direttamente interrata o in tubo interrato:**
  - **resistività termica del terreno: 1° C x m/W**
  - **temperatura del terreno: 20° C**
  - **profondità di posa: 0,8 m**

(3) **I valori della corrente termica di corto circuito valgono nelle seguenti condizioni:**

- **durata del corto circuito: 1 s,**
- **temperatura iniziale: pari alla temperatura massima ammissibile (v. nota 2),**
- **temperatura finale: 250° C.**

1. TENSIONE NOMINALE

U_0/U = 0,6/1 kV, per sistemi con tensione massima 1,2 kV.

2. PRESCRIZIONI COSTRUTTIVE

Le caratteristiche dei conduttori, dell'isolante e del rivestimento protettivo devono essere conformi alle prescrizioni della Tabella ENEL DC 4908, e/o a quanto di seguito precisato, modificato o integrato.

- **Conduttori,** di **rame ricotto**:
  - a filo **unico**, per il cavo 1 x 6;
  - a **corda** rigida compatta circolare, per i cavi delle altre sezioni.

  I conduttori devono essere regolari e privi di difetti superficiali.

- **Isolante:** di gomma etilenpropilenica ad alto modulo elastico (**HEPR)** del tipo CENELEC HD 603 - DIH 1, di colore **nero**, applicata con procedimento di estrusione in un unico strato; deve costituire un involucro cilindrico compatto e facilmente separabile dal conduttore.
  In alternativa può essere impiegato come isolante, previa approvazione da parte dell'ENEL, polietilene reticolato (**XLPE**) del tipo CENELEC HD 603 - DIX 3.
  Un **nastro separatore** non igroscopico può essere applicato sopra l'isolante.

- **Rivestimento protettivo:** guaina di polivinilcloruro (**PVC**) del tipo CENELEC HD 603 - DMV 13, di colore **grigio** RAL 7001; deve essere applicato all'isolante (ad esso aderente ma non appiccicato) in modo uniforme, compatto e privo di difetti superficiali.

3. STAMPIGLIATURE

Le caratteristiche delle stampigliature sul rivestimento protettivo del cavo sono indicate nella Tabella ENEL DC 4908.

Esempio di stampigliatura sulla guaina esterna del cavo:

ENEL RG7R-0,6/1 kV 25 XXXXX B 01 1999 12 0000 **per cavi isolati in HEPR**

ENEL RE4*R-0,6/1 kV 25 XXXXX B 01 1999 12 0000 **per cavi isolati in XLPE**

N.B. – Per l'uso dell'asterisco vedere il documento ENEL DC 4908.

4. IMBALLO E PEZZATURE

Le caratteristiche dell'imballo e la lunghezza delle pezzature di cavo sono indicate nella Tabella ENEL DC 4908.

5. NORME E PRESCRIZIONI PER LA COSTRUZIONE, IL COLLAUDO E LA FORNITURA

- Costruzione: Documento ENEL DC 4908
- Collaudo: Documento ENEL DC 4824
- Fornitura: Documento ENEL DC 4828

6. UNITA' DI MISURA

Metro.