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ELECTRICAL CONTROL PANEL AUXILIARY SERVICES OF SECONDARY SUBSTATIONS

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1. SCOPE

The scope of this document is to provide the technical requirements for the supply of the electrical control panel for auxiliary services of secondary substations of the Enel Group Global Infrastructure and Networks Countries listed below:

Country	Distribution Company
Argentina	Edesur
Brasil	Ampla Coelce
Chile	Chilectra
Colombia	Codensa
Iberia	Endesa Distribucion Electrica
Italy	Enel Distribuzione
Peru	Edelnor
Romania	Enel Distributie Banat Enel Distributie Dobrogea Enel Distributie Muntenia

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

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

2. APPLICATION FIELD

This document shall be used for the purchasing process and for the conformity and quality verification.

3. UNIT OF MEASUREMENT

The unit of measurement for this component is the number of specimens.

4. REFERENCE LAWS AND STANDARDS

4.1 Laws

LATAM

4.1.1.1 Brazil

NR-10 – Security Facilities into Electricity.

4.1.1.2 Chile

NSEG 5. E.n.71 - Reglamento de Instalaciones Eléctricas de Corrientes Fuertes

NCH Elec 4/2003 – Instalaciones de consumo en baja tensión.

4.1.1.3 Colombia

RETIE - Reglamento Técnico de Instalaciones Eléctricas.

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4.1.1.4 Perú

CNE – Suministro - Código Nacional de Electricidad – Suministro 2011

Italy – Romania - Spain

Directive 2006/95/EC of the European Parliament and of the Council of 12 December 2006.

Directive 2004/108/EC electromagnetic compatibility.

Italy

D.Lgs n. 81 of the 9th of April 2008 and subsequent modifications.

Spain

R.D. 3275/1982 de 12 de noviembre. Reglamento sobre condiciones técnicas y garantías de seguridad en centrales eléctricas, subestaciones y centros de transformación e instrucciones técnicas complementarias.

R.D. 614/2001, de 8 de junio, sobre disposiciones mínimas para la protección de la salud y seguridad de los trabajadores frente al riesgo eléctrico.

4.2 Standards

4.2.1 Common standards

The below listed reference documents shall be intended in the in-force edition at the contract date (amendments included). Unless otherwise specified, these documents are valid until the new editions replace them.

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

Standards	Edition
IEC 61439-1	2009-01
IEC 61439-2	2009-01
IEC 60068-2-30	2006-10
IEC 60068-2-11	2000-11
IEC 60068-2-2	2008-11
IEC 62262	2002-02
IEC 529	1989-11
IEC 60947-2	2006-05
IEC 60947-7-1	2009-04
IEC 61558-2-4	2009-03
IEC 60695-2-12	2000-10
EN 60898-1	2002-09
IEC 60297-3-100	2008-11

4.2.2 Specific standards

Unless otherwise specified, these standards are valid until the new editions replace them.

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4.2.2.1 Enel Distribuzione

Standards	Edition
DY3005	1
DC4122	4
PVR001	2
Packaging, transport and delivery requirements	2

5. IDENTIFICATION COMPONENTS

The control panel is only used for the power supply and the protection of the LV electrical users in the secondary substation.

Currently the electrical users are the follows: the electric illumination plant and the LV power supply socked of the substation, Remote Terminal Unit RTU (hereinafter referred to as UP), the equipments of data transmission, the concentrator for remote control of the meters.

There are three different versions, two for the wall installation and one in a drawer execution for the installation on the rack 19”.

TYPE	DESCRIPTION
GSCL001/1 e 4	ELECTRICAL CONTROL PANEL FOR AUXILIARY SERVICES WITH INSULATION TRANSFORMER FOR WALL INSTALLATION
GSCL001/2 e 5	ELECTRICAL CONTROL PANEL FOR AUXILIARY SERVICES WITHOUT INSULATION TRANSFORMER FOR WALL INSTALLATION
GSCL001/3	ELECTRICAL CONTROL PANEL FOR AUXILIARY SERVICES WITH INSULATION TRANSFORMER FOR RACK 19” INSTALLATION

In ENEL group the various models are identified by the following codes:

Enel Group Distribution	GSCL001/1	GSCL001/2	GSCL001/3	GSCL001/4	GSCL001/5
Ampla (Brazil)	6812460	6812461	6812462	For contries with isolated neutral	
Chilectra (Chile)	?	?	Not provided		
Codensa (Colombia)	?	?	Not provided		
Coelce (Brazil)	6812460	6812461	6812462		
Edelnor (Perú)	Not provided	Not provided	Not provided	?	?
Edesur (Argentina)	?	?	Not provided	For contries with isolated neutral	
Endesa Distribución Eléctrica (Spain)	?	?	Not provided		
Enel Distributie Banat (Romania)	160145	160146	160147		
Enel Distributie Dobrogea (Romania)	160145	160146	160147		
Enel Distributie Muntenia (Romania)	160145	160146	160147		
Enel Distribuzione (Italy)	160145	160146	160147		

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the five models are:

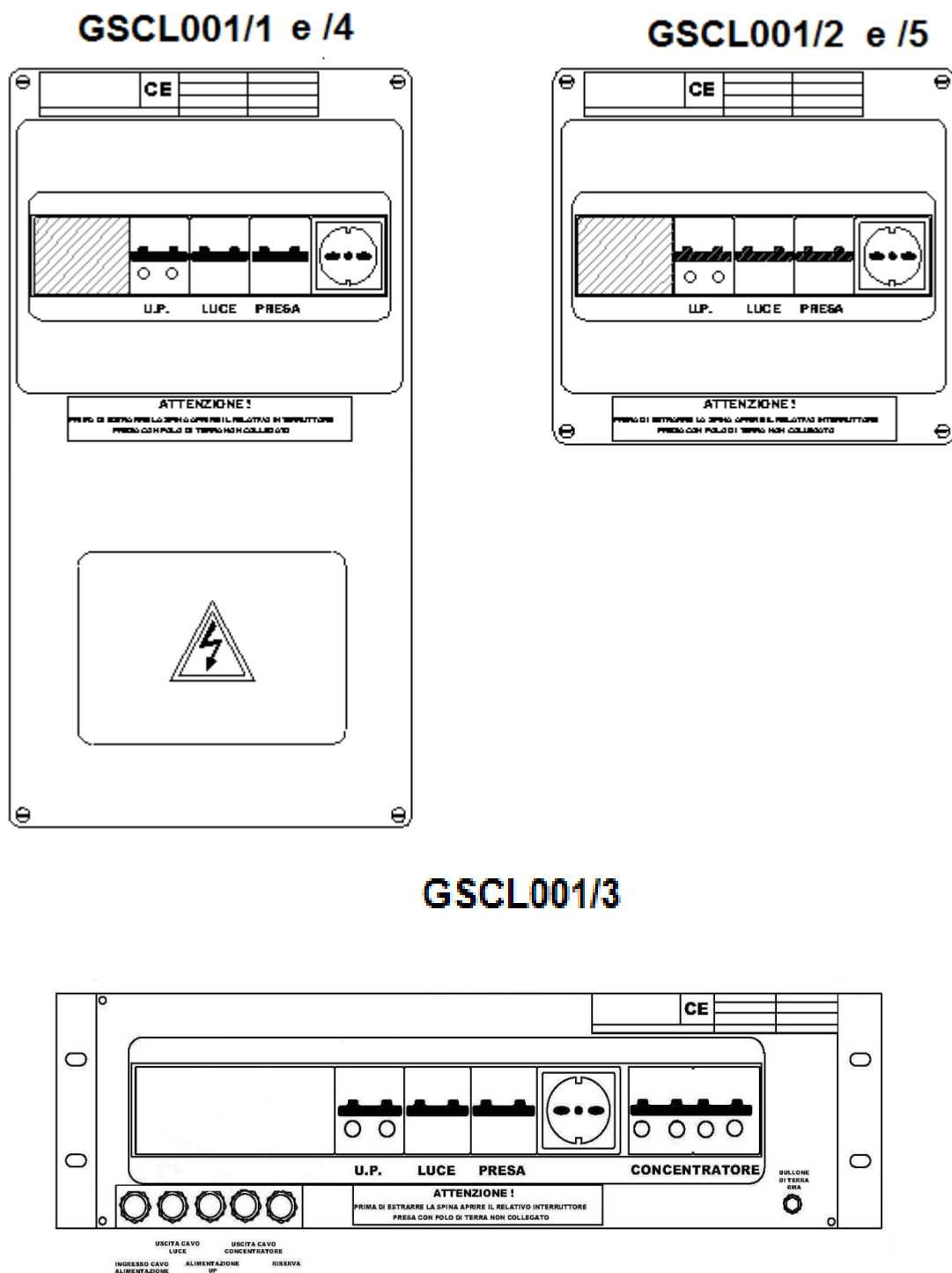


Fig. 1 - Type Models

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These models, as well as for the type of installation, differ in the type of equipment installed on them and in the functions performed:

GSCL001/1 e /4 – Control panel for wall installation, with an insulation transformer for the power supply of UP. This type is usually designed for the installation in secondary substations inserted in networks exposed to atmospheric overvoltages (MV and/or LV overhead lines) and where the the neutral conductor of the LV system is not connected to the earthing system of the substation

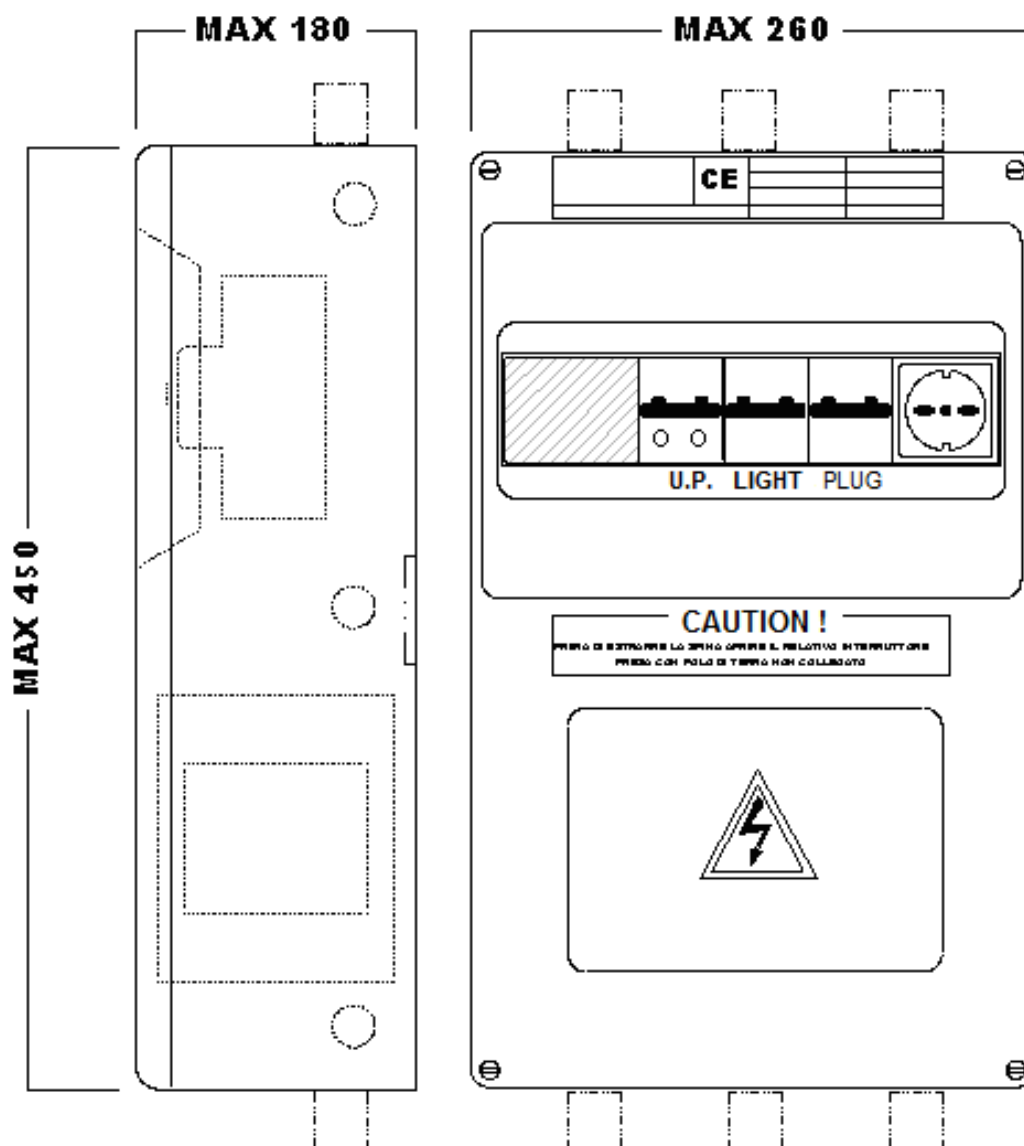


Fig. 2 - Control panel for Auxiliary Service GSCL001/1 e /4

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GSCL001/2 e /5 – Control panel for wall installation, without insulation transformer. This type is usually designed for the installation in secondary substations inserted in networks not exposed to atmospheric overvoltages (MV and/or LV underground cable).

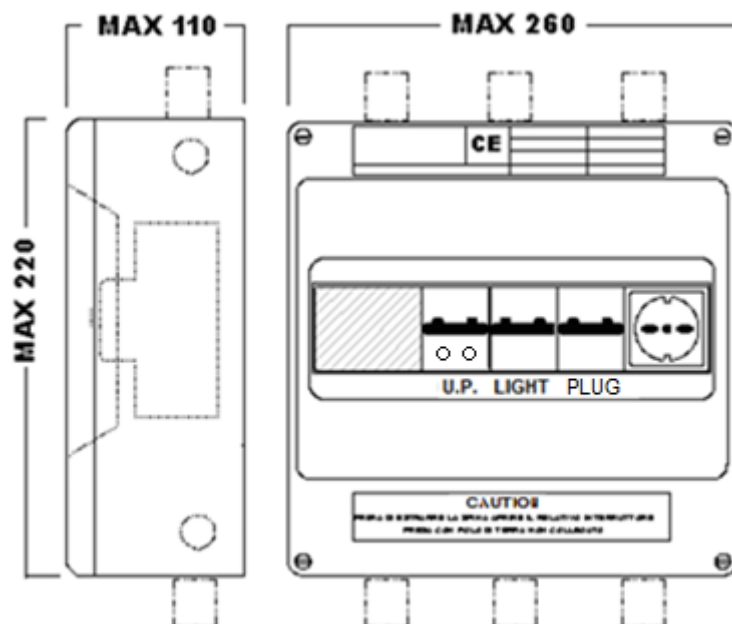


Fig. 3 - Control panel for Auxiliary Service GSCL001/2 e /5

GSCL001/3 – Control panel with an equivalent circuit to the one of DY3016/1 implemented with a tetrapolar disconnector for the electrical supply of the concentrator; the control panel is for installation on a 19" rack.

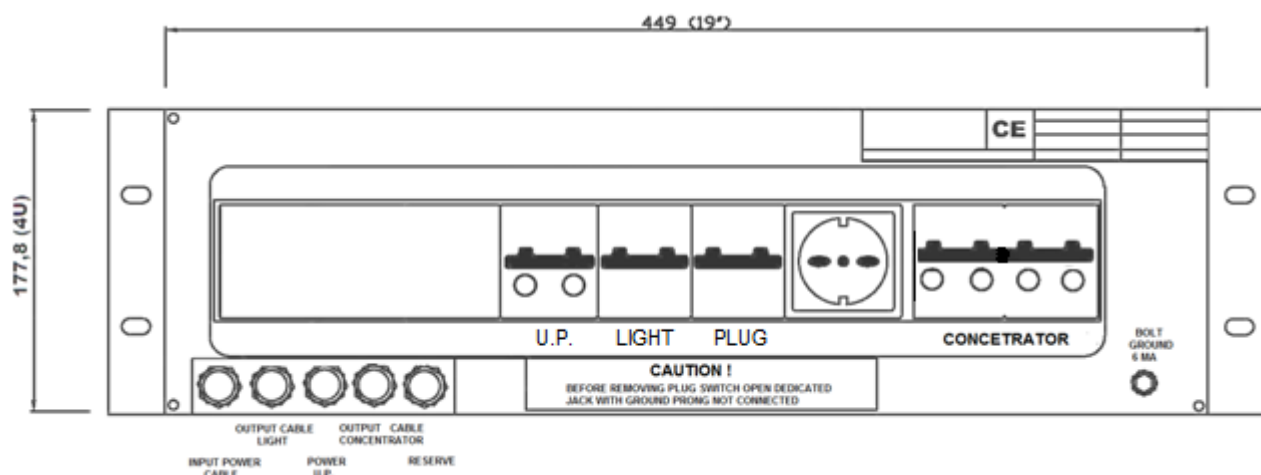


Fig. 4 - Control panel for Auxiliary Service GSCL001/3

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6. TECHNICAL FEATURES

The control panel shall be suitable for the use in conditions corresponding to a temperature of $-20/+60^{\circ}\text{C}$ and to a humidity of 95% for internal installation in a Pollution Degree 3.

The control panels, realized with the components expected and fully assembled, shall have the following electrical features (the electrical features of each components can be observed in the subchapter 7.3):

- Rated frequency (f_n): 50 Hz
- Rated insulation voltage (U_i): 500 V
- Rated voltage (3F+N) (U_e): 400 V
- Rated impulse withstand voltage of the components (except transformer) (U_{imp}): 6 kV_{cr}
- Rated impulse withstand voltage of the equipment (with transformer) (U_{imp}): 8 kV_{cr}
- Rated current (I_n): 32 A
- Rated short circuit current (I_{cc}): $\geq 16\text{kA}$

The insulation transformer, equipped with protective screen, reported to the earthing system, between the windings, shall have the following characteristics of insulation:

- Primary winding (to the screen/ground and secondary winding)
- Rated atmospheric impulse withstand voltage 20 kV_{cr}
 - Rated withstand voltage (industrial frequency, 1 min) 10 kV

- Secondary winding (to the screen/ground and primary winding)
- Rated atmospheric impulse withstand voltage 8 kV_{cr}
 - Rated withstand voltage (industrial frequency, 1 min) 3 kV

The screen of the isolation transformer shall be connected to the support plate of the transformer and shall have a connection point for the earthing system conductor. This connection shall be realized with a threaded insert M6 and with a suitable bolt for the tightening of an eyelet terminal.

7. CONSTRUCTION CHARACTERISTICS

7.1. Construction feature GLCL001/1, GLCL001/2, GLCL001/4 and GLCL001/5

The container of the control panel shall be realized in an organic insulating material, have an adequate thermal stability to withstand to a force of 5 N at a temperature of 70°C , withstand to the abnormal heat and to the fire (temperature of the incandescent wire $\geq 650^{\circ}\text{C}$), withstand to saline solution, mineral oil and diluted acids. Also, the control panel shall be in low emission of smoke and toxic and corrosive gases (ref. IEC 60695-2-10); it shall have a light gray colour RAL 7035, with a degree of external protection IP 40, without front door (ref. IEC 60529), it shall have an insulation class II and an impact resistance ≥ 10 joule (ref. IEC 62262, code IK 09) at room temperature under normal conditions of use.

The control panel shall be made, preferably, with a single container as shown in Figure 3 and 4; in which are housed the terminal board, circuit breakers, the socket, and the isolation transformer (only for type GSCL001/1 and /4) described in the next section 7.3.

The control panel shall provide protection against indirect contacts through double insulation according to IEC 61140.

This container shall be provided with a suitable pre-trenching, for input / output cables arranged as indicated in next Fig 6.

As alternative to the pre-trenching can be practiced holes; in this case they shall be closed with rigid stoppers, stably fixed, removable only with the aid of tool.

The structure of the container shall be of modular type with capacity of 12 modules EN 50022. The container, in the version GSCL001/1 or /4 shall be equipped with attachment points dedicated to accommodate the isolation transformer directly or through a support plate.

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The isolation transformer shall be fixed inside the container in order to have no metal parts, connected to its structure, communicating with the outside. The transformer shall be able to be replaced from the front.

The maximum dimensions of the control panel shall be (see figure 3 and 4):

Type GSCL001/1 and /4: height 450 mm, width 260 mm, depth 180 mm.

Type GSCL001/2 and /5: height 220 mm, width 260 mm, depth 110 mm

The container shall ensure the dissipation of the heat produced by the isolation transformer in the conditions of maximum load at ambient temperature.

7.2. Construction feature GLCL001/3

The drawer type container, suitable to be assembled inside a metal container-type rack (normalized casing 19 "- IEC 60297-3-100) as described in the technical specification DY3005 Ed. 1; shall be realized in painted metal sheet (gray color RAL 7030) or an equivalent material from the point of view of electromagnetic compatibility and rigidity.

The dimensions of the drawer shall be (see Figure 4):

height 177.8 mm (4U), width 449 mm, depth max: 350 mm

The drawer is supported on the rack only by fixing screws on the front bezel; it shall ensure a degree of protection IP40, according to IEC 60529.

The drawer has two handles for the handling from the rack container; on the front side is provided with bolt 6MA (located on the right side) for the earthing system.

The drawer shall accommodate a container of modular type with a capacity of 20 modules EN 50022 on which are fixed the equipment and the connection terminal boards. The access to the wires terminal board occurs removing a frontal panel using the 5 fairleads fixed on the casing of the panel. The container shall be equipped with attachment points dedicated to accommodate the isolation transformer directly or through a support plate.

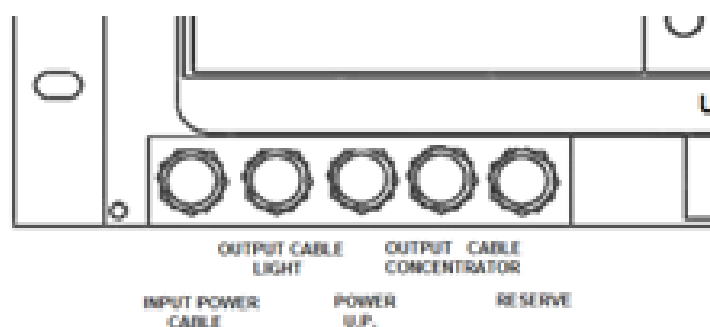


Fig. 5 - Control panel for Auxiliary Service GSCL001/3 – Access wires

The isolation transformer shall be fixed inside the drawer container in order to have no metal parts, connected to the structure of the drawer itself, communicating with the outside. The transformer shall be replaced by removing the small panel on the back of the drawer removed from the rack

The drawer container shall ensure the dissipation of the heat produced by the isolation transformer in maximum load conditions at the maximum temperature of use expected.

In the case of using of sheet metal the painting of the drawer (inside and outside) shall be realized according to the painting cycle DY991/11.

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7.3. Electrical components

The control panel for auxiliary services shall be made with the equipments listed below, according to the circuit diagrams of Fig. 7A - 7B - 7C - 7D and 7E, respectively, for the models GSCL001/1, GSCL001/2, GSCL001/3, GSCL001/4 and GSCL001/5.

The equipments are:

- a group of terminals of quadripolar distribution: cage terminal, for entrance and exit, suitable to accommodate conductors of nominal cross-section of 6 mm², equipped with insulating dividers between the phases (ref. IEC 60947-7-1);
- 4 reserve modules EN 50022 for future users (only for the model GSCL001/3)
- a bipolar fuseholder disconnecter (named UP), $I_n = 6A$, with cylindrical fuses of delayed type (phase and neutral) with dimensions 10.3 x 38, $U_n \geq 400 V$, $I_n = 10 A$, the line power unit device (with or without the use of isolation transformer);
- a magnetothermal bipolar circuit breaker (called LIGHT), with two protected poles, $U_n \geq 400 V$, $I_u = 6 A$, breaking capacity $I_{cu} \geq 16 kA$, ref. CEI EN 60947-2, $I_{cs} \geq 6000 A$ and operation curve "C", ref. CEI EN 60898, for the power supply of the lighting system of the substation;
- a magnetothermal bipolar circuit breaker (named PLUG), with two protected poles, $U_n \geq 400 V$, $I_u = 6 A$, breaking capacity $I_{cu} \geq 16 kA$, ref. CEI EN 60947-2, $I_{cs} \geq 6000 A$ and operation curve "C", ref. IEC 60898, to protect the power socket of LV panel of auxiliary services;
- a plug 2P + T with lateral and central earthing system (UNEL standard Italian / German) (trivalent) 10/16 A, 250 V with alveoli protected;
- a tetrapolar fuseholder disconnecter (named CONCENTRATOR) with $I_{cc} = 16kA$, $U_n 500V$ e $I_n=32A$ with handle for simultaneous disconnection, or an equivalent system, size of 4 modules EN 50022, complete with 2A fast-acting fuses, cylinder size 10,3 x 38, for the power supply of the line C-LV. The cage terminals of the disconnecter shall accommodate the entrance and exit of the wires of section 6 mm², rigid and flexible type, (only for the model GSCL001/3);
- an insulation transformer with a screen between primary and secondary circuit for continuous operation with low iron losses, protected against Class I direct contact, power 250 VA, frequency 50/60 Hz, transformation ratio of 230/230 V, to tropical, class thermal insulation "F", ambient operating temperature 40 ° C (ref. IEC 96-1, IEC 61558-2-4), equipped with suitable cage terminals for entrance/exit with nominal section 4 mm² (ref. IEC 60947-7-1). For the insulation characteristics of the transformer see previous section. The use of this transformer is provided only under version GSCL001/1, GSCL001/4 and GSCL001/3.

The wiring of the various components shall be made according to the single-line diagrams of Figure 7A, 7B, 7C, 7D and 7E, according to the model of the control panel, using unipolar wires with copper flexible conductors, flame retardant, type N07V-K, for voltages up 1000 V AC and nominal cross-section between 2.5 and 6 mm² (ref. CEI 20-22; CEI UNEL 35752), the conductors shall not be banded (fascettato), but arranged in an orderly manner, the conductors of the internal wiring shall be equipped of pre-insulated ferrules. Bridges between the switches are not allowed.

An example for the model GSCL001/1 is shown in Figure 6.

The power supply circuit of the primary circuit of the transformer (cable and terminals) shall be adequately protected in order to satisfy the required insulation level.

The terminal board shall have the following features: $U_i = 500 V$, $U_e = 3F + N / 400 V$, $I_u = 32 A$ (ref. IEC 60947-7-1); the entrance and exit terminals shall be suitable to accommodate conductors of nominal cross-section of 6 mm². The terminals shall be installed on an omega bar in the position shown in Figure 6 and coupled together in order to provide for each pole four cages connection. The terminals shall be labeled upstream and downstream with the letters R, S, T, N, also they shall be equipped with insulation dividers between phases, firmly fixed (see Figure 6), the neutral conductor N shall be BLUE LIGHT, the phase conductors shall be colored BROWN for R phase, GRAY for S phase and BLACK for T phase.

All components of the auxiliary services panel shall be marked with the CE mark in accordance with the following Standards:

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- For magnetothermal circuit breakers the conformity certification IEC 60898. The IMQ mark is the title of certification.
- For the isolation transformer is required CE marking, a declaration of conformity with CEI 96-1, IEC 61558-2-4 and the implementation of the manufacturer of the transformer of a quality system certificate ISO 9002.
- The IMQ mark is the title of certification. A minimum degree of protection IP20, after removing the front cover, shall be guaranteed.

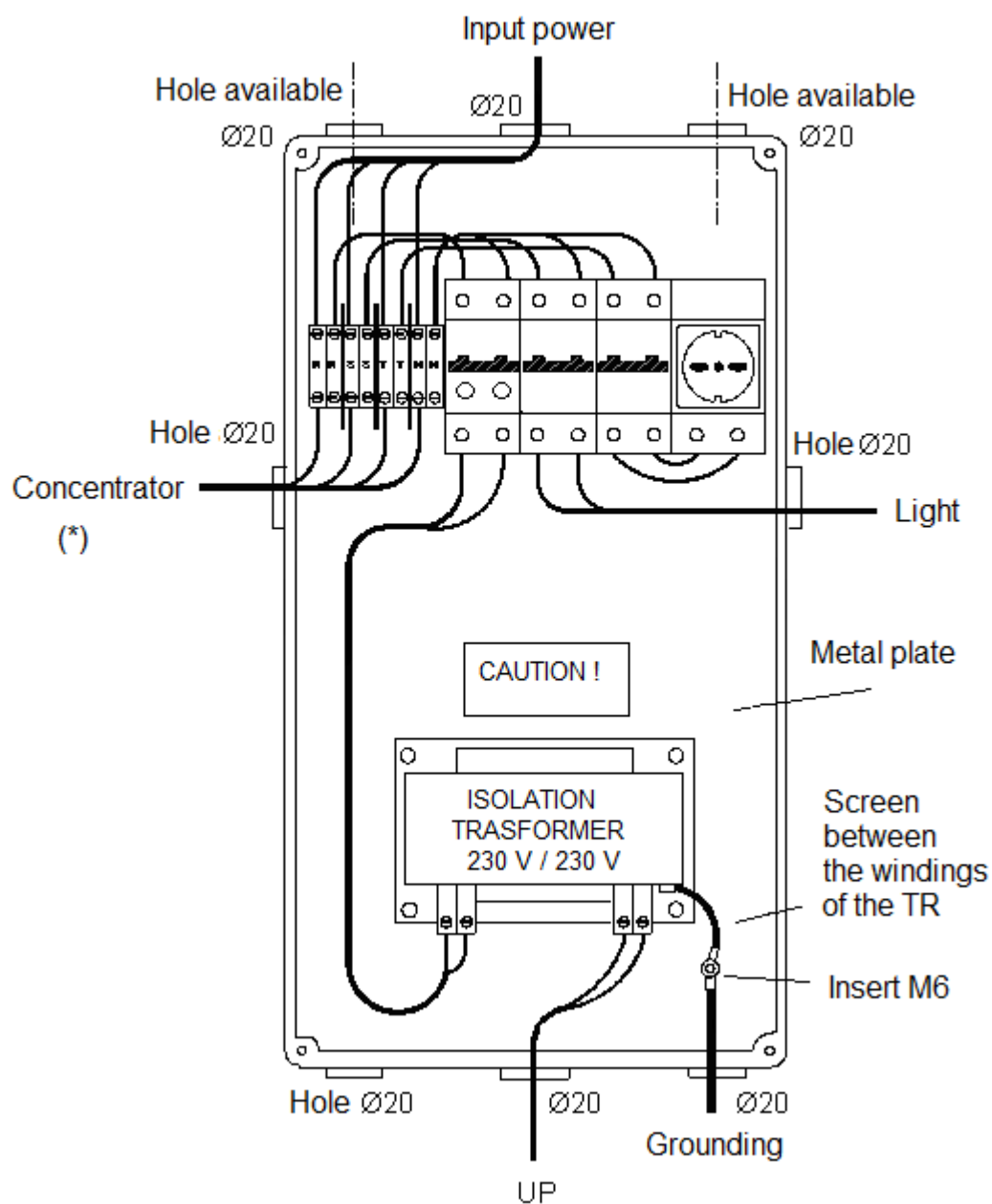
It is mandatory for the manufacturer to provide auxiliary services panels equipped with circuit breakers / disconnectors of the same brand and the same type of model.

In support of each specimen of the panel models GSCL001/1 /2, /4 and 5 shall be provided 4 pipe/ boxes junctions, with IP $\geq$ 44, suitable for pipe diameters of 20 mm or equivalent system.

For the GSCL001/3 model shall be provided 5 fairleads to connect the internal terminal board of the panel to the various users to supply and protect.

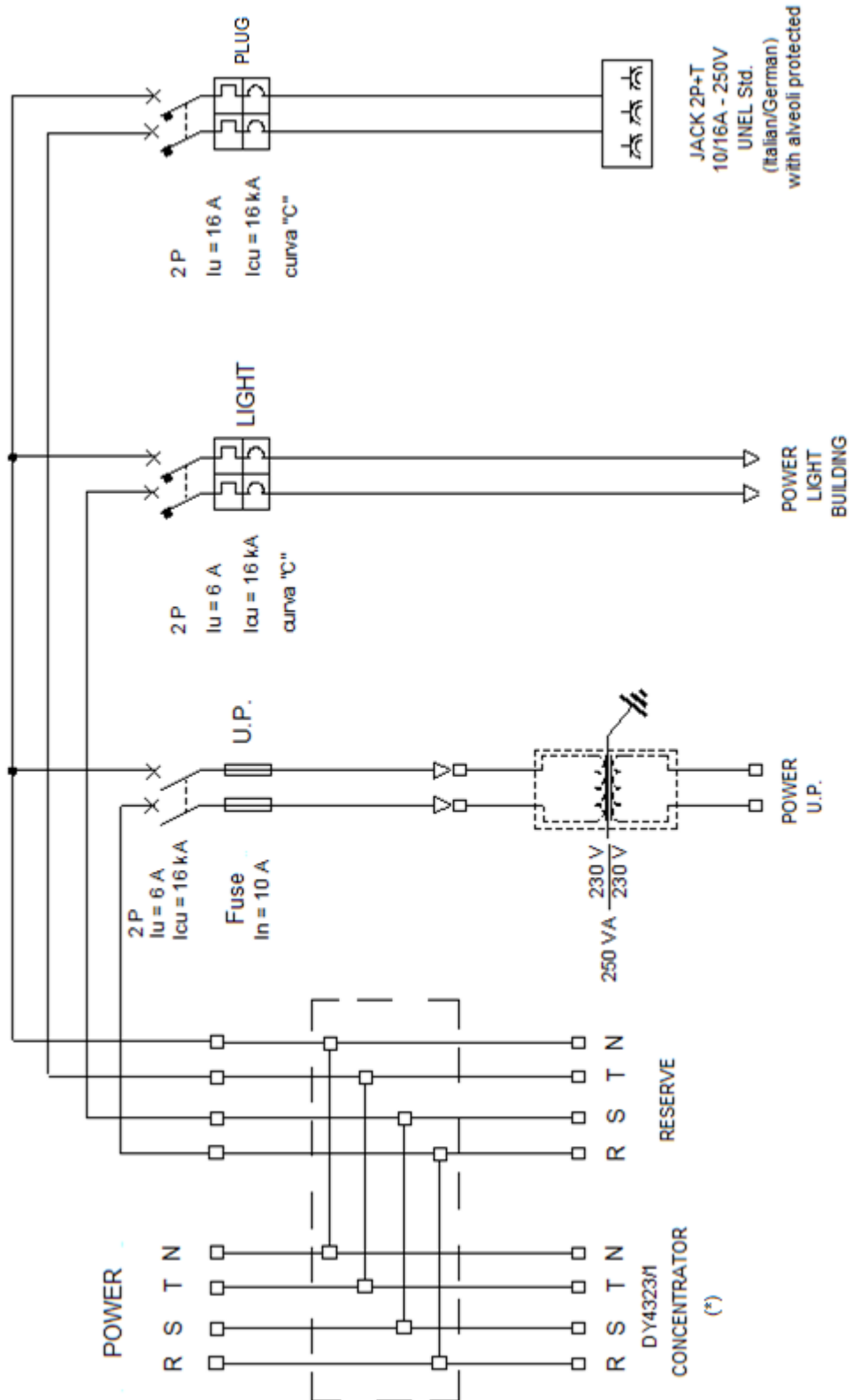
For each model must be provided the necessary accessories to install the panels in the secondary substation as more fully explained hereafter.

FRONT - PANEL OPEN



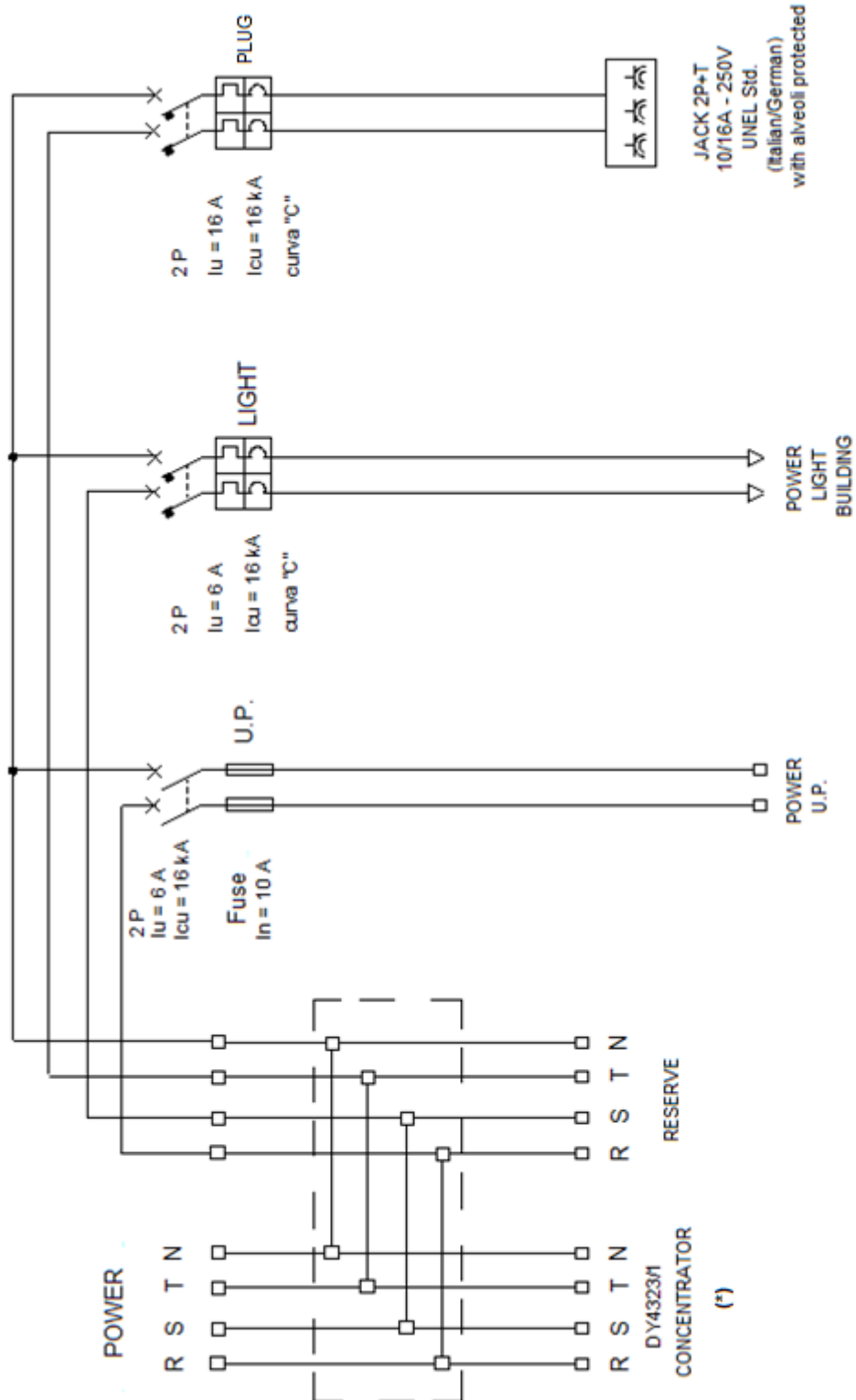
(*) Only for Italy, Brasile, Romania.

Figure 6 – Auxiliary services control panel GSCL001/1 – Example of external and internal wiring



(*) Only for Italy, Brasile, Romania.

Figure 7A – Auxiliary services control panel GSC001/1 – Electrical diagram



(*) Only for Italy, Brasile, Romania.

Figure 7B – Auxiliary services control panel GSCL001/2 – Electrical diagram

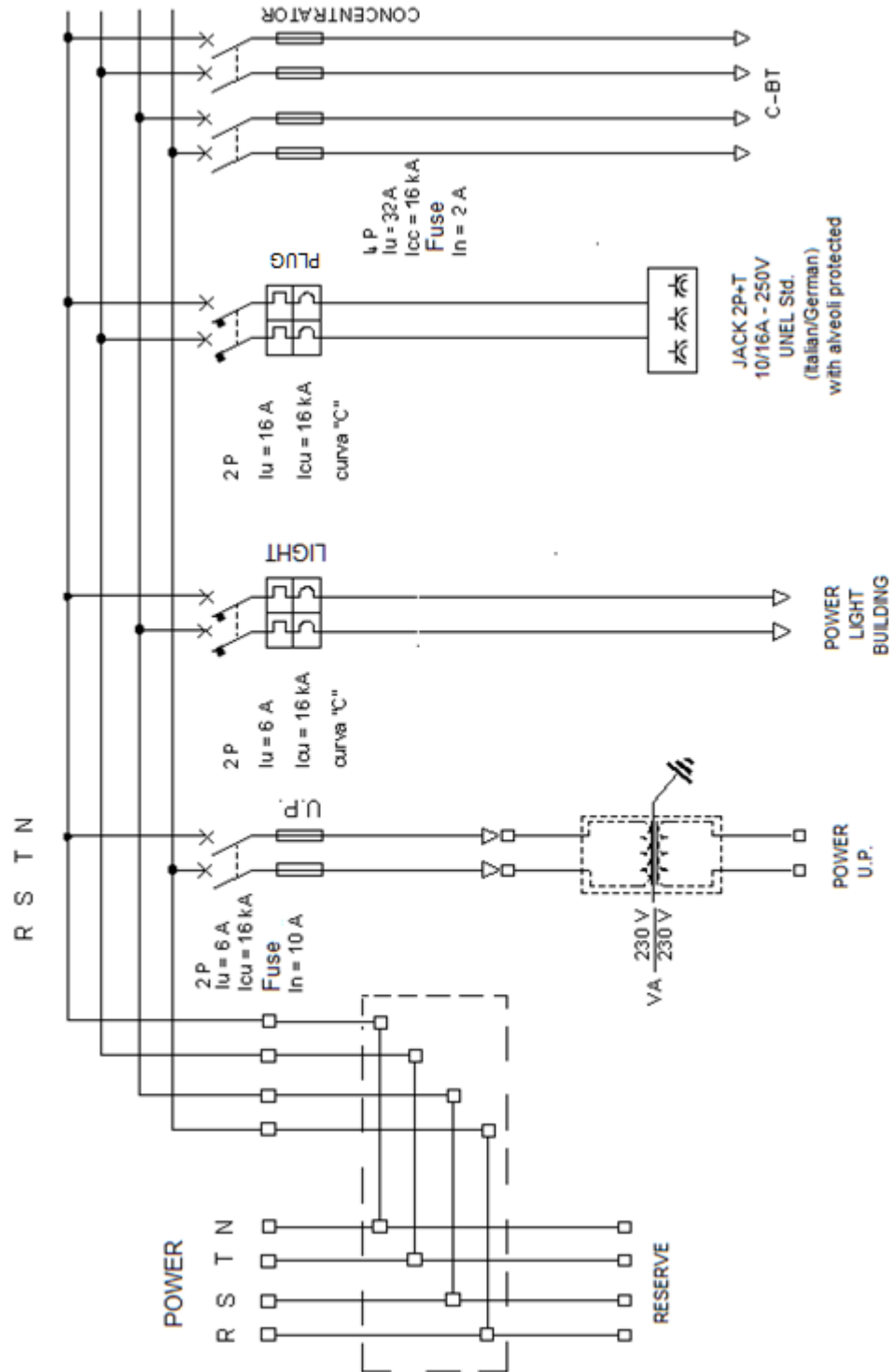


Figure 7C – Auxiliary services control panel GSC001/3 – Electrical diagram

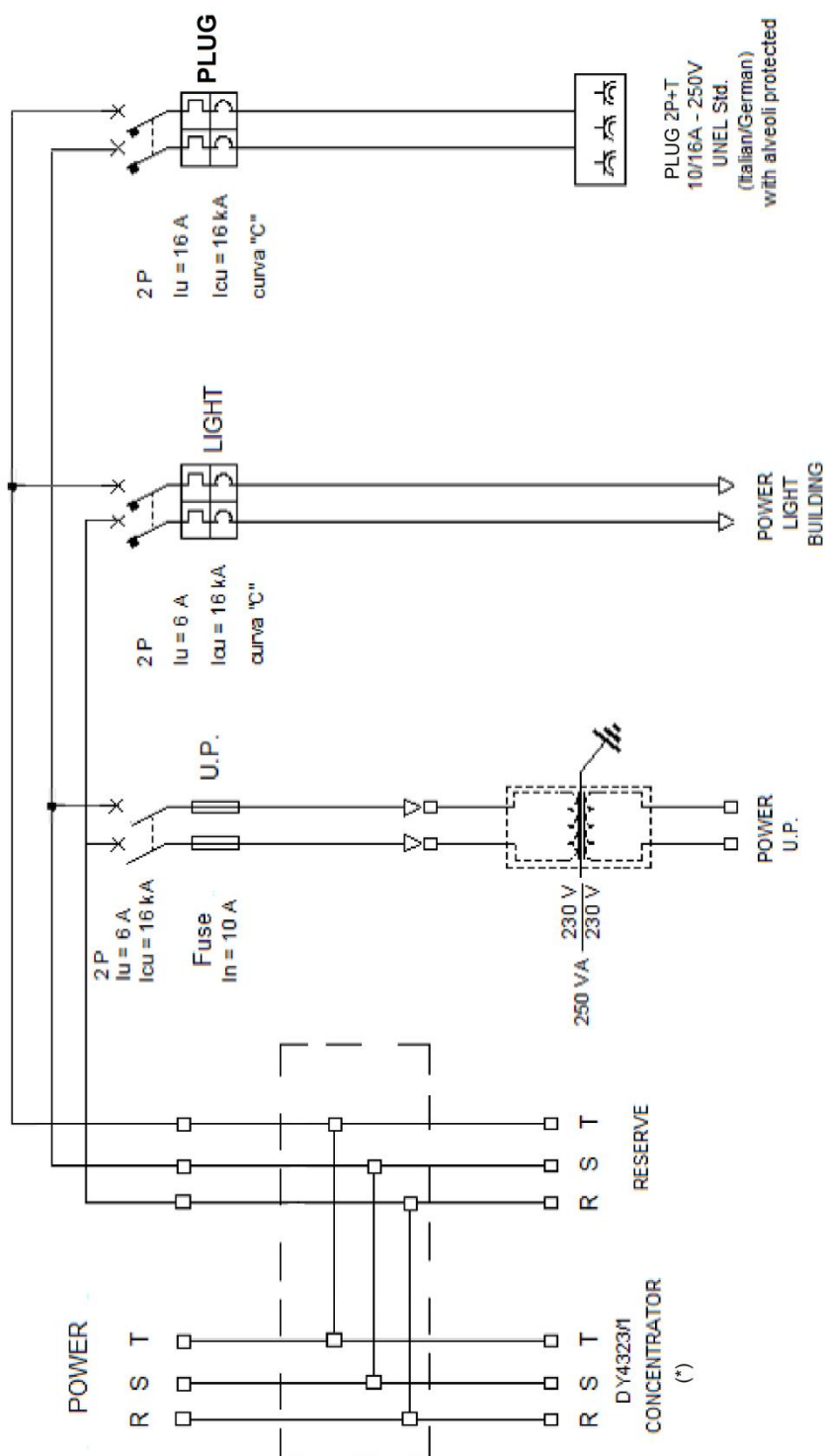


Figure 7D – Auxiliary services control panel GSC001/4 (only Perù) – Electrical diagram

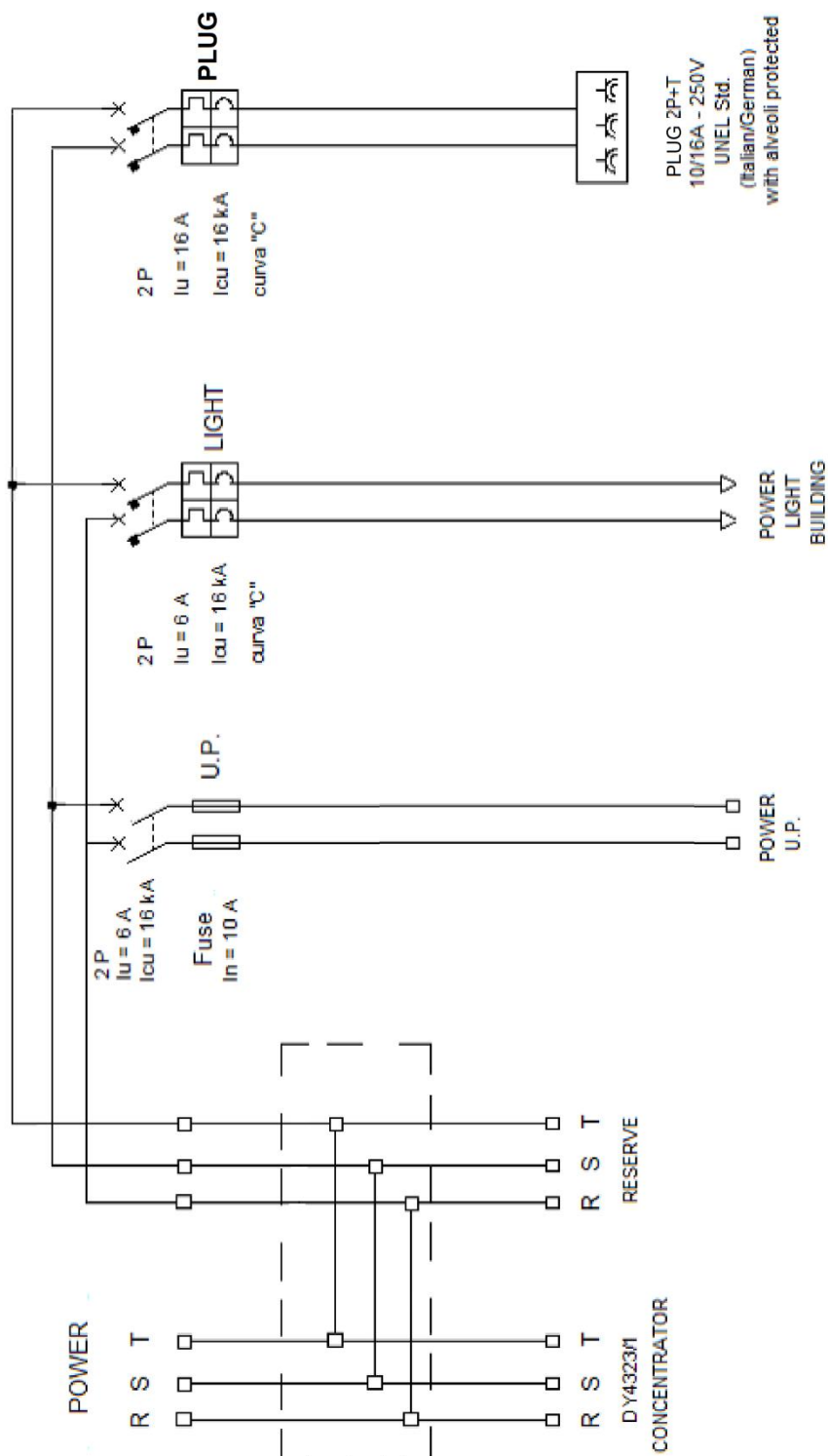


Figure 7E – Auxiliary services control panel GSC001/5 (only Perù) – Electrical diagram

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7.4. Connection and installation auxiliary services control panel

The control panel of the auxiliary services is powered (3F + N) by a cable 3x6+6C, of the unified type DC4122/1-7, or with unipolar flexible conductors with equivalent features that stood on the terminal set up.

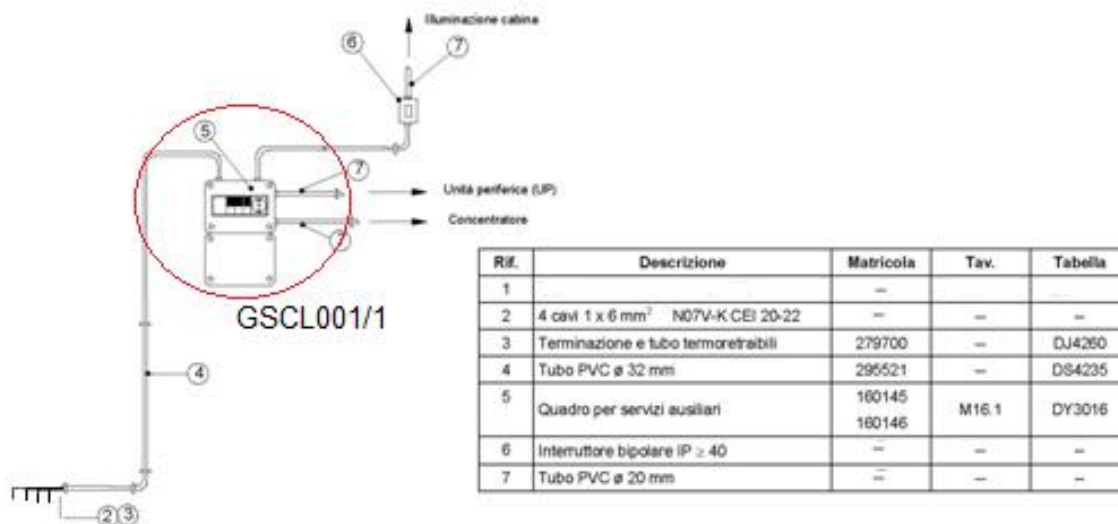


Figure 8A – Supplier Control panel GSCL001/1 of switch LV

In pictured 8B shows an example of the power cable provided in Italy and Romania using IMS DY3200 prepared the LV panel substation:

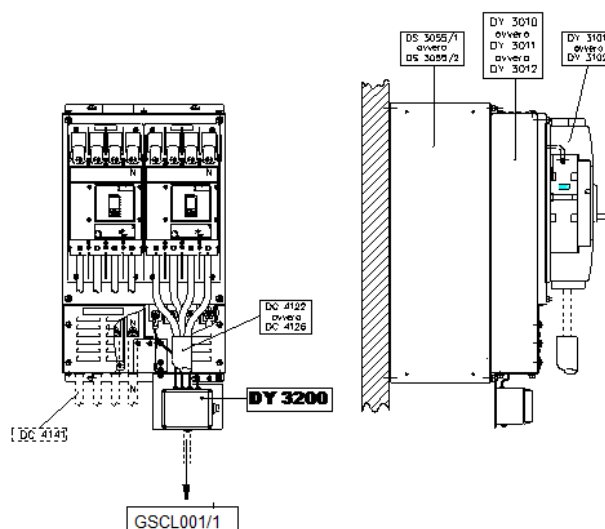


Figure 8B – Supplier Control panel of DY3200 (only Italy/Romania)

For the control panel models GSCL001/1 /2, 4 and 5, the installation is expected to wall, in secondary substations MV/LV at a height of 1500 mm, between the top surface of the control panel and the walking surface, using the 4 wall plugs supplied by the manufacturer and for the model GSCL001/3 the panel will be placed in the 19 "(rack container DY3005) using the 4 screws supplied by the manufacturer.

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7.5. Plates for identification, function, warning and danger

On the control panel, for all the models, a plate shall be affixed on which are impressed, clearly and indelibly the data prescribed by the IEC 61439-2: name and logo of the manufacturer of the control panel realized, ENEL group type, ENEL serial number and acronym for the manufacturer identification, electrical features and year of realization. The plate, represented in Figure 9, shall be made in aluminum stably fixed on the panel.

The control panel shall be equipped with additional adhesive plates, realized in high quality plastic material, self-extinguishing. These plates are listed and described below:

- Circuit breakers identification plates, affixed on the front panel at the circuit breaker (see Figure 9 Part. A), minimum size 108 x 10 mm, indicating: U.P., LIGHT, PLUG, CONCENTRATOR with black written (Arial font) on a white background (for all the types GSCL001/1/2/3/4/5).
- Function and warning plate, to be placed on the front panel (see Figure 9 Part. B), minimum size 160 x 28 mm, indicating the phrase: "CAUTION ! Before removing the plug, open the corresponding circuit breaker / Jack with earthing pole not connected. with white written (Arial font) on a red background (for all versions types GSCL001/1/2/3/4/5).
- Warning plate, to be placed inside the container of the isolation transformer, near to it (see .fig.9 part.C), minimum size 120 x 28 mm, indicating the phrase: "CAUTION! Before operate the transformer open the corresponding circuit breaker, with white written (Arial font) on a red background, (only for the type GSCL001/1 /3 and 4).
- Monitor triangular adhesive, yellow with black lightning, with side length not less than 48 mm, to be placed on the front of the housing containing an isolation transformer (see Fig. 9 part.D) (version GSCL001/1 /3 and 4).

The proposed material for the realization of the adhesive plates shall satisfy the permanence and inalterability conditions during the time, for use in closed places with degree of pollution 3, resistant to saline solution, dilute acids and mineral oils.



(ALUMINIUM PLATE)

Logo manufacture	IEC	GSCLO01/X	Ui= 500V
		ENEL Number	Icc 16 kA
		IEC 61439-2	IP 20 INT./IP 40 EST.
AUXILIARY SERVICES CONTROL PANEL		Iu 32 A	Serial Number:
		Ue 400 V 3F+N	Year Manufacture:

(A)

U.P. LIGHT PLUG

(B)

CAUTION !

Before removing the plug, open the corresponding circuit breaker
Jack with earthing pole not connected



(D)

(C)

CAUTION !

Before operate the transformer
open the corresponding
circuit breaker

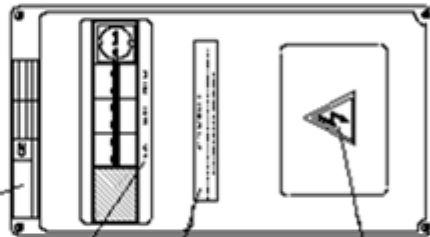
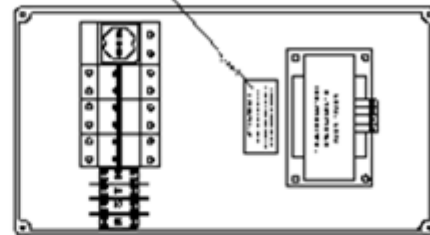


Figure 9 – Auxiliary services control panel – Plates

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8. REQUIREMENTS FOR THE SUPPL

The auxiliary services control panels shall be provided in individual packages, in “one wave” cardboard boxes, such as to ensure a suitable protection during transport and storage. The box containing the control panel shall include all elements and accessories required in the supply, in particular, each package should contain:

- The control panel fully assembled according to the model;
- Envelope containing n. 4 wall plugs, Ø 6mm, with screws and washers compatible with the connections provided on the container used for Model GSCL001/1 /2 /4 and 5;
- Envelope containing n. 4 screws and washers, for installation on the 19" rack for Model GSCL001/3;
- N. 4 pipe / box fittings, with $\geq$ IP 44, suitable for pipe diameters of 20 mm or equivalent for the model GSCL001/1 /2 /4 and 5;
- Instructions for installation (commissioning), operation (with the electrical diagram) and maintenance in the appropriate language;
- Declaration of conformity to the IEC 61439-2;

On each transport packaging, on two adjacent faces, shall be reported, with readable characters:

- Name of the distribution ENEL Group
- Name of the supplier
- Product Description
- Designation given by the manufacturer
- ENEL type and serial number of the product
- Gross weight of a single package

For shipping and handling in storage ENEL Group must be used packaging complies with “Packaging, transport and delivery requirements” Rev. 2.

9. GENERAL INFORMATION

The control panels must conform to the type shown in the previous chapter 6 and chapter 7 and the requirements of chapter 4 .

For the technical definitions, see the standard CEI EN 61439-1 and CEI EN 61439-2.

It defines "batch" all the control panels of the same type (number), ready for acceptance testing at the manufacturer at the same time.

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10. DESCRIPTION AND CLASSIFICATION OF TESTS

The tests are divided into:

- **Type tests** - are designed to ensure the total conformity of an exemplary production (prototype) with the requirements contained in this document during the activities of approval / certification.
- **Evidence of compliance with type** - are intended to verify the compliance of specimens randomly selected during the supply, compared to document of Approval / Certification.
- **Acceptance tests** - should be performed on all production lots sample prior to shipment and have the purpose of examining some characteristics of the material; They have the aim to verify the main features of the materials prepared.

10.1 List of type tests

Building

- Visual inspection;
- Strength of materials and parts of the control panel;
- Degree of protection provided by enclosures;
- Insulation distance and creepage;
- Protection against electric shock and integrity of protective circuits;

Performance

- Verification of dielectric properties;
- Verification temperature rise;
- Verification of the continuity of the grounding between the masses and the protection circuit;
- Short-circuit withstand;
- Mechanical operation;

10.2 List of acceptance tests

- Verification the panels in testing with the certification documents which have passed type tests;
- Visual inspection;
- Mechanical operation;
- Dielectric Tests;
- Degree of protection provided by enclosures;
- Verification of the continuity of the grounding between the masses and the protection circuit;
- Verification of the requirements of supply.

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11. REQUIREMENTS FOR PERFORMANCE TESTS

Unless otherwise specified in the following paragraphs, the panels must be subjected to the design verifications given in chapter 10 of the standards IEC 61439-1 and IEC 61439-2.

For the evidence cited in the following document, in brackets are the corresponding paragraph numbers of test related to IEC 61439-1.

12. TYPE TESTS

12.1 Visual inspection (8.5)

A pannel for such must be inspected, to verify that the switching devices installed comply with the requirements listed in this specification, in particular should be checked:

- the maximum dimensions of space;
- the presence of all identification plates, function, warning and danger (prg. 7.5);
- the presence of all components required and their compliance with IEC reference (IEC 61439-1 par. 8.5.3);
- compliance of the circuits and their internal wiring to the requirements of the project and the IEC 61439-1 par. 8.6;
- the conformity of terminals for external conductors with the requirements of the progetto and the IEC 61439-1 par. 8.8.

12.2 Strength of materials and parts of the control panel (10.2)

The suitability of mechanical, electrical and thermal processing of building materials and parts of the pannels are considered proven with the checks on its construction and performance described below (IEC 61439-1 par. 10.2). If you use an empty shell, made in accordance with the IEC 62208, does not require the repetition of tests on the casing, it is satisfied with the presentation of the documentation certifying the design characteristics set out in paragraph 7.1 and 7.2, issued by a certification body accredited EA.

- Check for corrosion resistance with test Severity A (10.2.2.2) to be performed only on the template DY3016 / 3 (built in metal casing);
- Check of the thermal stability of the casings (10.2.3.1) to be performed only on the paintings with casing of insulating material;
- Verification of resistance of insulating material to normal heat (10.2.3.2);
- Verification of resistance of materials to abnormal heat and fire that occurs to the internal effects of electrical origin (10.2.3.3). To be performed according to IEC 60695-2-10: glow-wire test to 650 ° C;
- Verification of the degree of protection against external mechanical impacts (10.2.6). The pannels must withstand an impact of 10 joules with IK 09 seconds CEI EN 62262;
- Marking (10.2.7)

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12.3 Degree of protection provided by enclosures (10.3)

The pannels (by type) fully equipped must undergo the verification of the degree of protection (IEC 61439-1 par. 10.3) in accordance with standard IEC 60529; the degree to check is IP40 (without cover); with front cover removed must be guaranteed minimum IP20 degree.

12.4 Insulation distance and creepage (10.4)

You must check that the insulation distances and creepage comply with IEC 61439-1 par. 10.4. In particular they must be respected insulation clearance and creepage distances specified in Annex F of IEC 61439-1 Pollution Degree 3.

12.5 Verification of dielectric properties (10.9)

For the leak test of the insulation (solid and surface of the insulating substrate and air between bare parts at different potential) than the temporary and transient surges, the boards must be submitted respectively to the following dielectric tests:

- a) Check the rated voltage tight pulse (10.9.3.2).

The test shall be performed on the panel fully wired in the following conditions:

- pannels firmly fixed on a metal plate connected to ground,
- all input circuits must be connected in short circuit between them and all the switches must be closed and the fuses inserted;
- il secondary circuit of the insulation transformer, when present, must be connected in short circuit and ground.

Must be applied between the input circuit and the metal plate above mentioned 5 positive pulses and 5 negative, at intervals of at least 1 s between one pulse and the next, with waveform 1.2/50µs, and crest value of the nominal = 8 kV (see IEC 61439-1 - tab. 10 for the determination of the peak value to be applied according to the actual altitude of the place of trial).

- b) Check the voltage required to frequency of 50 Hz (10.9.2).

Under the test conditions indicated in the preceding paragraph must be applied, for a time of 5 s, a voltage at the operating frequency of rms value equal to 1890 V (IEC 61439-1, tab. 8, $U_i = 500V$).

- c) Check the enclosures made of insulating material (10.9.4)

For wraps insulating material must perform a dielectric test additional, applying the test voltage AC between a metal foil placed outside the enclosure and the parts connected to the masses located within, the test voltage must be equal to 1.5 times control tab. 8 of IEC 61439-1.

The following tests, d) to g), should only be made on the isolation transformer, if present.

- d) Verification of rated voltage tight pulse on the isolation transformer.

- insulation test voltage lightning impulse on the primary value of the test $V_{imp} = 20 \text{ kVcr}$; application of the test voltage between short-circuited primary winding and the secondary short-circuited and connected to ground along the screen;

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- insulation test voltage lightning impulse with value on the secondary test $V_{imp} = 8 \text{ kV}$; application of the test voltage between the primary and secondary winding short-circuited short-circuited and connected to ground along the screen;

e) Check the rated voltage at power frequency transformer isolation.

- Application of the test voltage $U_i = 10 \text{ kV}$ for one minute between short-circuited primary winding and the secondary short-circuited and connected to ground along the screen;

- application of the test voltage $U_i = 3 \text{ kV}$ for one minute between primary and secondary winding shorted shorted and grounded with the screen.

During the tests there must be no perforations or flashovers.

f) Relief overvoltage transferred impulsive

Assuming to call the terminals 1A and 1B of the primary winding and 2a and 2b the terminals of the secondary winding; perform the following sequence:

- Applying a pulse with polarity both positive and negative between the terminal 1A and 1B (connected to ground) and detect the overvoltage transferred across the secondary winding (2a-2b) closed on a resistor of 260Ω (equal to the impedance U_P) and to earth.
- Apply the pulse with both positive and negative polarity between the terminal 1A and 1B (grounded) and detect the voltage across the secondary transferred (2a-2b) closed on a resistor 260Ω and to ground.

Pulse Characteristics: 500 V and waveform $1.2/50\mu\text{s}$.

The purpose of the test is to determine the transfer characteristics of the transient overvoltages impulsive type on the secondary winding which must not be such as to damage the power supply of the U_P (minimum required reduction coefficient > 3.5).

g) induced overvoltage rated frequency

Power to the primary winding with rated voltage and frequency with the secondary winding open. Measure the voltage applied to the terminals of 1A-1B that one induced across the secondary winding 1a-1b. Gradually increase (in small steps), the voltage applied to the primary (paying attention not to reach values of harmful voltage for the transformer) by measuring the respective voltage induced on the secondary. The purpose of the test is to detect that the voltage value is the saturation of the core.

12.6 Verification temperature rise (10.10.2)

You must verify by testing with current, which does not exceed the limits specified in Table overtemperature. 6 of IEC 61439-1.

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12.7 Verification of the continuity of the grounding between the masses and the protection circuit (10.5.2)

Only the framework DY 3016/3, you must check the connection to the terminal to the protective earth of all the masses of the framework, such connection must have a resistance $\leq 0.1 \Omega$.

12.8 Short-circuit withstand (10.11)

Each type of pannel must be tested for tightness c.to c.to exclusively by proof provided in paragraph 10.11.5 of IEC 61439-1. The test is deemed passed if it complies with the results shown in par. 10.11.5.5. and 10.11.5.6.2.

12.9 Protection against electric shock and integrity of protective circuits (10.5)

Overcoming the above tests indicated in par. 10.7 and 10.8 proves the suitability of the paintings to performing a service of protection against electric shock provided.

12.10 Mechanical operation (10.13)

It must be checked on every type of picture which, after assembly of all components, the mechanical operation of the various installed equipment is not compromised.

13. FINAL DOSSIER

At the end of the process of certification, it must be made a collection of documentation (Final Dossier) thet contains the technical description of the pannels and all certification of the test reports; the minimum documentation consist of the following list; each document of the dossier must be stamped and signed by manufacturet and by Certification Authority in the case of certification:

- Reports of type test (with reference to the sections of this specification);
- List of documents in the dossier;

Doc. A-type

- Drawing together the pannels (listed) with different views);
- Photo of the pannels;
- List the components used;
- Technical documentation supporting the components used;
- Drawings of the identification plates (plate data and positioning of the same on the panels);
- Instruction manual for the installation and assembly (in original language);
- Documentation contained in each package.

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14. ACCEPTANCE TESTS

Of each pannels product, before being presented to the acceptance testing Enel, they must be completed by the supplier, all the tests prescribed at par. 11 of IEC 61439; tests result should be recorded on dedicated test report. On the occasion of the acceptance testing provided by the contract in the presence of representatives of Enel, they must be repeated acceptance testing under par. 10.2 of this specification. All tests except the 14.1 and 14.2 described below, must be made on a representative sample of the lot, as prescribed in the UNI ISO 2859-1 for sampling plan simple reduced AQL = 0.65%. To define the size of the sample to be taken reference must be made to the level of testing current I, considering as reference batch the set of pannels of the same type presented to testing. Evidence 14.1 "Conformity to the prototype that has passed the type tests carried out for the approval / certification" must be performed on a sample for each batch submitted to testing and proof 14.2 "Visual inspection" must be performed on all samples making up the lot.

14.1 Verification the panels in testing with the certification documents which have passed type tests

The check must be carried out by checking the correspondence of the pannels in the test (and all components installed in it) to the documents described in the Dossier approval / certification (available for viewing at the same manufacturer) that exceeded Type Tests

14.2 Visual inspection

It must be verified:

- The installation of all components provided in this specification;
- Wiring electrical circuits;
- The presence and the conformity of the license plates and markings specified in paragraph XX;
- the effective connection of the different masses of the painting to the terminal for the protective earth (only panel DY3016 / 3).

14.3 Mechanical operation

It must be checked for correct operation of switching devices and the presence of the fuses.

14.4 Dielectric Tests

The pannels fully assembled and wired, they must carry out tests required under par. 12.5.b) and 12.5.c) but with a duration of 1 s.

14.5 Degree of protection provided by enclosures

The pannels fully assembled and wired to be performed the test described in the previous paragraph. 14.3.

14.6 Verification of the continuity of the grounding between the masses and the protection circuit

It must be performed the test described in the previous paragraph. 14.7.

14.7 Verification of the requirements of supply

You must check in every single box is present to refer to Chapter 8 of this specification.