Technical Specification code: MAT-I&I-TD-2021-0077-GIN
Version no.02 dated 14/02/2022

Subject: **GSTZ112 -** Global Infrastructure and Networks Global Standard Power Switchgear and Controlgear assembly (PSC) for HV/MV Substation

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

CONTENTS

THE HEAD OF TECHNOLOGY DEVELOPMENT
Gianni Ceneri

Technical Specification code: MAT-I&I-TD-2021-0077-GIN
Version no.02 dated 14/02/2022

Subject: **GSTZ112 -** Global Infrastructure and Networks Global Standard Power Switchgear and Controlgear assembly (PSC) for HV/MV Substation

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

1. DOCUMENT AIMS AND APPLICATION AREA

This document standardizes the functional, construction and testing requirements of the Power Switchgear and Controlgear assembly (PSC) for auxiliary DC and AC power source in the HV/MV Substation.

The PSC work in conjunction with the Power Supply Station (PSS) defined in the GSTZ111. For the electrical diagrams, refer to GSTZ111_A1 and GSTZ112_A1.

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

1.1 RELATED ORGANIZATIONAL DOCUMENTS TO BE IMPLEMENTED AT COUNTRY LEVEL

This document applies to both Enel Global Infrastructure and Networks Srl Company and to Infrastructure and Networks Business Line perimeter when each Company does not have to issue further documents.

2. DOCUMENT VERSION MANAGEMENT

Version	Date	Main changes description
01	[31/03/2020]	Issuing of Global Infrastructure and Networks Global Standard – Power Switchgear and Controlgear assembly (PSC) for HV/MV Substation
02	[14/02/2022]	List of modifications: - RIO devices added - Improved GSTZ112_A1 electrical diagram

3. UNITS IN CHARGE OF THE DOCUMENT

Responsible for drawing up the document:

- Global Infrastructure and Networks: Innovation and Industrialization / Technology Development

Responsible for authorizing the document:

- Global Infrastructure and Networks: Head of Technology Development unit;
- Global Infrastructure and Networks: Head of Quality unit;

4. REFERENCES

- Code of Ethics of Enel Group;
- Enel Human Rights Policy;
- The Enel Group Zero Tolerance of Corruption (ZCT) Plan;
- Organizational and management model as per Legislative Decree no. 231/2001;
- Policy 49: Global Infrastructure and Networks HV/MV Substation Design Technical Criteria

- ISO 9001:2015 - Quality Management System - Requirements;
- ISO 14001:2015 - Environmental Management System - Requirements and user guide;
- ISO 45001:2018 - Occupational Health and Safety Management System - Requirements and user guide;
- ISO 50001:2018 - Energy management systems - Requirements with guidance for use;
- ISO 37001:2016 - Anti-bribery Management System - Requirements with guidance for use.
- IEC 60068-2-1: Environmental testing - Part 2-1: Tests - Test A: Cold
- IEC 60068-2-11: Basic environmental testing procedures - Part 2-11: Tests - Test Ka: Salt mist
- IEC 60068-2-14: Environmental testing - Part 2-14: Tests - Test N: Change of temperature
- IEC 60068-2-2: Environmental testing - Part 2-2: Tests - Test B: Dry heat
- IEC 60068-2-27: Environmental testing - Part 2-27: Tests - Test Ea and guidance: Shock
- IEC 60068-2-30: Environmental testing - Part 2-30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle)
- IEC 60068-2-78: Environmental testing - Part 2-78: Tests - Test Cab: Damp heat, steady state
- IEC 60068-3-1: Environmental testing - Part 3-1: Supporting documentation and guidance - Cold and dry heat tests
- IEC 60068-3-4: Environmental testing - Part 3-4: Supporting documentation and guidance - Damp heat tests
- IEC 60204-1: Safety of machinery - Electrical equipment of machines - Part 1: General requirements
- IEC 60255-26: Measuring relays and protection equipment - Part 26: Electromagnetic compatibility requirements
- IEC 60255-27: Measuring relays and protection equipment - Part 27: Product safety requirements
- IEC 60255-5: Electrical Relays - Part 5: Insulation coordination for measuring relays and protection equipment - Requirements and tests
- IEC 60309-1: Plugs, socket-outlets, and couplers for industrial purposes - Part 1: General requirements
- IEC 60309-2: Plugs, socket-outlets, and couplers for industrial purposes - Part 2: Dimensional interchangeability requirements for pin and contact-tube accessories
- IEC 60529: Degrees of protection provided by enclosures (IP Code)

- IEC 60695-2-10: Fire hazard testing - Part 2-10: Glowing/hot-wire based test methods - Glow-wire apparatus and common test procedure
- IEC 60695-2-11: Fire hazard testing – Part 2-11: Glowing/hot-wire based test methods – Glow-wire flammability test method for end-products (GWEPT)
- IEC 60865: Short-circuit currents - Calculation of effects - Part 1: Definitions and calculation methods
- IEC 60947-1: Low-voltage switchgear and controlgear - Part 1: General rules
- IEC 60947-2: Low-voltage switchgear and controlgear - Part 2: Circuit-breakers
- IEC 60947-3: Low-voltage switchgear and controlgear - Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units
- IEC 60947-4-1: Low-voltage switchgear and controlgear - Part 4-1: Contactors and motor-starters - Electromechanical contactors and motor-starters
- IEC 61010-1: Safety requirements for electrical equipment for measurement, control and laboratory use – Part 1: General requirements
- IEC 61140: Protection against electric shock – Common aspects for installation and equipment
- IEC 61204-6: Low-voltage power supplies, DC output - Part 6: Requirements for low-voltage power supplies of assessed performance
- IEC 61204-7: Low-voltage switch mode power supplies - Part 7: Safety requirements
- IEC 61439-1: Low-voltage switchgear and controlgear assemblies - Part 1: General rules
- IEC 61439-2: Low-voltage switchgear and controlgear assemblies - Part 2: Power switchgear and controlgear assemblies
- IEC 61439-3: Low-voltage switchgear and controlgear assemblies - Part 3: Distribution boards intended to be operated by ordinary persons (DBO)
- IEC 61810-1: Electromechanical elementary relays - Part 1: General and safety requirements
- IEC 61810-2: Electromechanical elementary relays - Part 2: Reliability
- IEC 61810-7: Electromechanical elementary relays - Part 7: Test and measurement procedures
- IEC 61000-4-3: Electromagnetic compatibility (EMC) - Part 4-3 : Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test
- IEC 61000-4-4: Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test
- IEC 61000-4-5: Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test

- IEC 61000-4-6: Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields
- IEC 61000-4-8: Electromagnetic compatibility (EMC) - Part 4-8: Testing and measurement techniques - Power frequency magnetic field immunity test
- IEC 61000-4-10: Electromagnetic compatibility (EMC) - Part 4-10: Testing and measurement techniques - Damped oscillatory magnetic field immunity test
- IEC 61000-4-11: Electromagnetic compatibility (EMC) - Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests
- IEC 61000-4-12: Electromagnetic Compatibility (EMC) - Part 4-12: Testing and measurement techniques - Ring wave immunity test
- IEC 61000-4-16: Electromagnetic compatibility (EMC) - Part 4-16: Testing and measurement techniques - Test for immunity to conducted, common mode disturbances in the frequency range 0 Hz to 150 kHz
- IEC 61000-4-29: Electromagnetic compatibility (EMC) - Part 4-29: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations on DC input power port immunity tests
- IEC 61000-6-5: Electromagnetic compatibility (EMC) - Part 6-5: Generic standards - Immunity for equipment used in power station and substation environment
- IEC 61000-6-4: Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments
- IEC 62271-207: High-voltage switchgear and controlgear - Part 207: Seismic qualification for gas-insulated switchgear assemblies for rated voltages above 52 kV
- IEC TS 60815-1: Selection and dimensioning of high-voltage insulators intended for use in polluted conditions - Part 1: Definitions, information and general principles
- GSTZ111: Power Supply Station (PSS) for HV/MV Substation
- GSTZ111_A1: Electrical Diagrams for the Power Supply Station (PSS) for HV/MV Substation
- GSTZ112_A1: Electrical Diagrams for the Power switchgear and controlgear assembly (PSC) for HV/MV Substation

4.1 FOR EU COUNTRIES

- EN 55011: Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement
- EU directive 2006/95/CEE: Low Voltage directive
- EU directive 93/68/CEE: CE marking directive
- NSR-10: Reglamento colombiano de construcción sismo resistente

- RETIE: Reglamento técnico de instalaciones eléctricas
- NR-10: Segurança em instalações e serviços em eletricidade
- NBR-5410: Instalações Elétricas de Baixa Tensão
- ETGI-1020: Especificaciones técnicas generales - Requisitos de diseño sísmico para equipo electrico

5. ORGANIZATIONAL PROCESS POSITION IN THE PROCESS TAXONOMY

Value Chain /Process Area: Networks Management

Macro process: Materials management

Process: Network components standardization

6. DEFINITIONS AND ACRONYMS

Acronym and Key words	Description
Alternating Current (AC)	Pertaining to alternating electric quantities such as voltage or current, to devices operated with these, or to quantities associated with these devices.
Electromagnetic Compatibility (EMC)	Ability of electronic equipment not to cause or react to electromagnetic interference from other electronic equipment.
Global Standard (GS)	Enel Group Technical Specification
Nominal Voltage (Vn)	Nominal Voltage for circuit breaker or auxiliary equipments

7. DESCRIPTION

7.1 LIST OF COMPONENTS, PRODUCT FAMILY OR SOLUTIONS TO WHICH THE GS APPLIES

The Power switchgear and controlgear assembly (PSC) described in this GS can be classified in the product family provided in Table 1:

Global Product Family Code	Description	Reference Global Standard
PSC	Power switchgear and controlgear assembly (PSC) for auxiliary DC and AC power source	GSTZ112

Table 1 – GSTZ11X product family and description

The Power switchgear and controlgear assembly (PSC) is equipped with the accessories provided in Table 2:

Accessories	Connected Device	Description	Reference Global Standard	Included in the Supply
RIO1	PSC	Remote Input Output 1	GSTP102	Yes
RIO2	PSC	Remote Input Output 2	GSTP102	Yes

Table 2 – Accessories of the PSC according to GSTP102

7.2 MAIN REQUIRMENTS

The IEC 61439-1 gives all rules and requirements of a general nature applicable to low-voltage switchgear and controlgear assemblies in order to obtain uniformity of requirements and verification.

The IEC 61439-2 defines the specific requirements of power switchgear and controlgear assemblies for use in connection with the generation, transmission, distribution and conversion of electric energy, and for the control of electric energy consuming equipment.

This document and the attached electrical diagram do not constitute an original project as defined by IEC 61439-1 but only a description of the functions and components that must be provided in the PSC.

With reference to the standard, the role of “Original manufacturer” and “Assembly manufacturer” remains the responsibility of the supplier that assumes responsibility for the finished controlgear assembly.

a. Original manufacturer: is the organization that has carried out the original design and the associated verification of an assembly in accordance with the relevant assembly standard.
b. Assembly manufacturer: is the organization taking the responsibility for the completed assembly. The assembly manufacturer may be a different organization to the original manufacturer.

The switchboard system or cubicle manufacturer bears also the responsibility for routine verification

Enel, as defined in the IEC 61439-1 standard, assumes the role of “user”:

c. User: is the party who will specify, purchase, use and/or operate the assembly, or someone acting on their behalf.

7.3 GENERAL CHARACTERISTICS

The PSC must feed the components of the HV/MV substation with the following voltage levels:

a. DC1: Vndc1 110/125Vdc (according by Vndc1 indicated in the Table 6)

b. DC2: Vndc2 24Vdc/48Vdc (according by Vndc1 indicated in the Table 6)

c. AC: Vnac (according by Vn indicated in the Table 5).

The PSC configuration is in a rack containing:

a. Circuit breakers for AC distribution

b. Circuit breakers for DC1 distribution

c. Circuit breakers for DC2 distribution

d. Terminal board for cable connection

e. Relays an auxiliary equipment

Figure 1 shows the illustrative diagram:

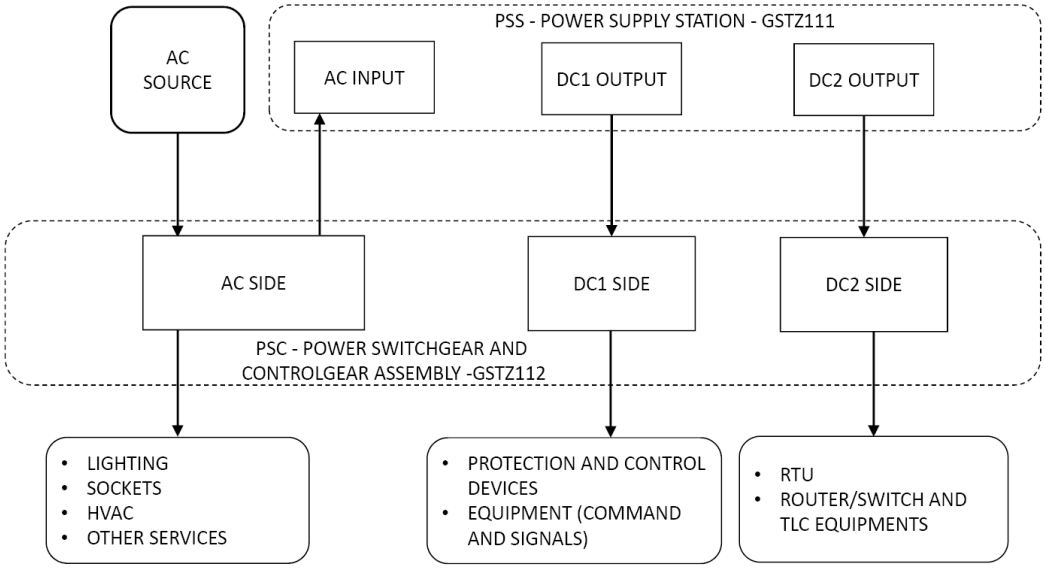

Figure 1 - Illustrative Diagram

In according to the local standards of the various countries, the “AC SOURCE” can be:

a. single with 1 MV/LV transformer
b. Double with 2 MV / LV transformers powered one by a MV busbar and one by an external network
c. Double with 2 MV / LV transformers each powered by a MV busbar

In the second and third cases it is necessary to provide an external automatic switching system (mounted inside an outdoor cabinet) not included in this Global Standard. Should the power supply of the PSC of the main source disappear, the system must switch the supply of the PSC from the main source to secondary source. When the voltage returns to the main source, the system must automatically restore the power source from the main source, regardless of the presence of voltage on the secondary source.

7.4 OPERATING CONDITIONS

Exact conditions depend from installation site, during the procurement process (Par. 7.9.2) the information about the operating conditions will be shared.

PV-IES type	Operating range	On storage and transport range
Temperature	-25 °C ÷ 70 °C	-40 °C ÷ 80 °C
Humidity	0 % ÷ 95% RH, non condensing	
Atmospheric pressure	860 hPa ÷ 1060 hPa	
Altitude	0 m ÷ 2700 m	
Pollution degree (IEC TS 60815-1)	Very Heavy	
Seismic qualification (IEC 62271-207)	AF5 response spectrum	

Table 3 – PSC reference environmental conditions

The operating ranges are applicable at the PSC perimeter, the on storage and transport ranges must be applied at each PSC component.

The design and the characterization of the seismic protection of the PSC must be done using the AF5 response spectrum provided by the IEC 62271-207 usually adopted to qualify the high-voltage switchgear and control gear in seismic prone areas; the PSC must stay fully operative and maintaining the previous operating mode in continuity before, during and after the earthquake.

7.5 ENVIRONMENTAL REQUIRMENTS

7.5.1 Rack

The PSC consists in two racks 19”, one for AC circuits and one for the two DC1 and DC2 direct current circuits. All the equipment must be mounted on a rack 19” with the follow dimensions and characteristic:

a. Height: Industry standard rack cabinet 42U tall; internal rack unit ≥42U

b. Width: 600 mm

c. Depth: 600 mm

d. The PSC must guarantee IP3X while maintaining natural ventilation. Cooling grids on the sides are not allowed because the PSC must be mounted next to other protection cabinets. The PSC must have a rubber profile around the perimeter of the side panels, the ceiling and the cabinet door to prevent the entry of dust

e. IK code resistance to shocks (by according to IEC 62262): IK08

The rack must be entirely of sheet steel press-folded 20/10 mm thick. The external coating must be made to obtain excellent resistance to wear according to the following cycle:

a. sheet washing;

b. phosphating based on non-crystalline iron salts (amorphous);

c. drying in tunnel at 100 ° C;

d. internal and external painting with electrostatic application of enamel in thermosetting powder with epoxy-polyester binders, RAL 7032 color, total thickness 70 µm.

e. Polymerization in oven at 180 ° C.

The access at the element of PSC must be both on the front and on the rear side of the rack 19”.

The rack must be supplied complete with a front door and a rear door; the doors must have a maximum opening of 130° (in any case above 90°) and must be equipped with a keyless handle.

Especially the front door must be made of a special self-extinguishing transparent material.

A document holder for the manufacturer's wiring diagram and user manual must be mounted on the rear door.

Each rack, without sheet metal on the bottom, must have on the base n° 4 holes ø12 for fixing to the floor and n° 4 removable eyebolts on the upper frame. The sides of the cabinets must not have protrusions.

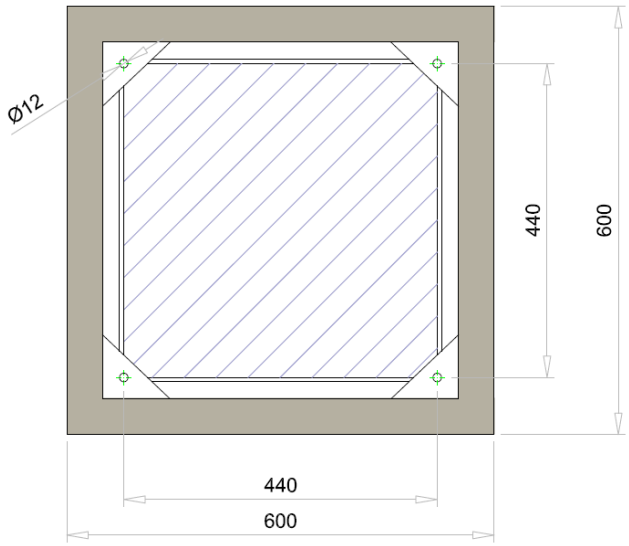

Figure 2 - Holes on the base

The two racks that compose the PSC must be able to be transported separately to be subsequently assembled. It is therefore necessary to provide special assembly systems between them.

The protection against direct contacts of live dangerous internal parts during maintenance or updating must be performed, where not possible the furnisher must provide for the isolation of all the active parts.

Protection against direct contact of live points (bar systems) must be protected with mica transparent.

The input of the electric connection cables is in the lower part, therefore it is necessary to provide cable ducts, terminal blocks guides for fixing cables and terminal holder rails (DIN type); it is also necessary to provide a grounding bar for the cable shields.

The input of the electric connection cables is in the lower part; due to the connection of cables through the floor, the PSC must have a sealed system that prevents access to the animals

With reference to the layout of rack, Enel must previously approve any solution.

An example of the layout is shown in Figure 3:

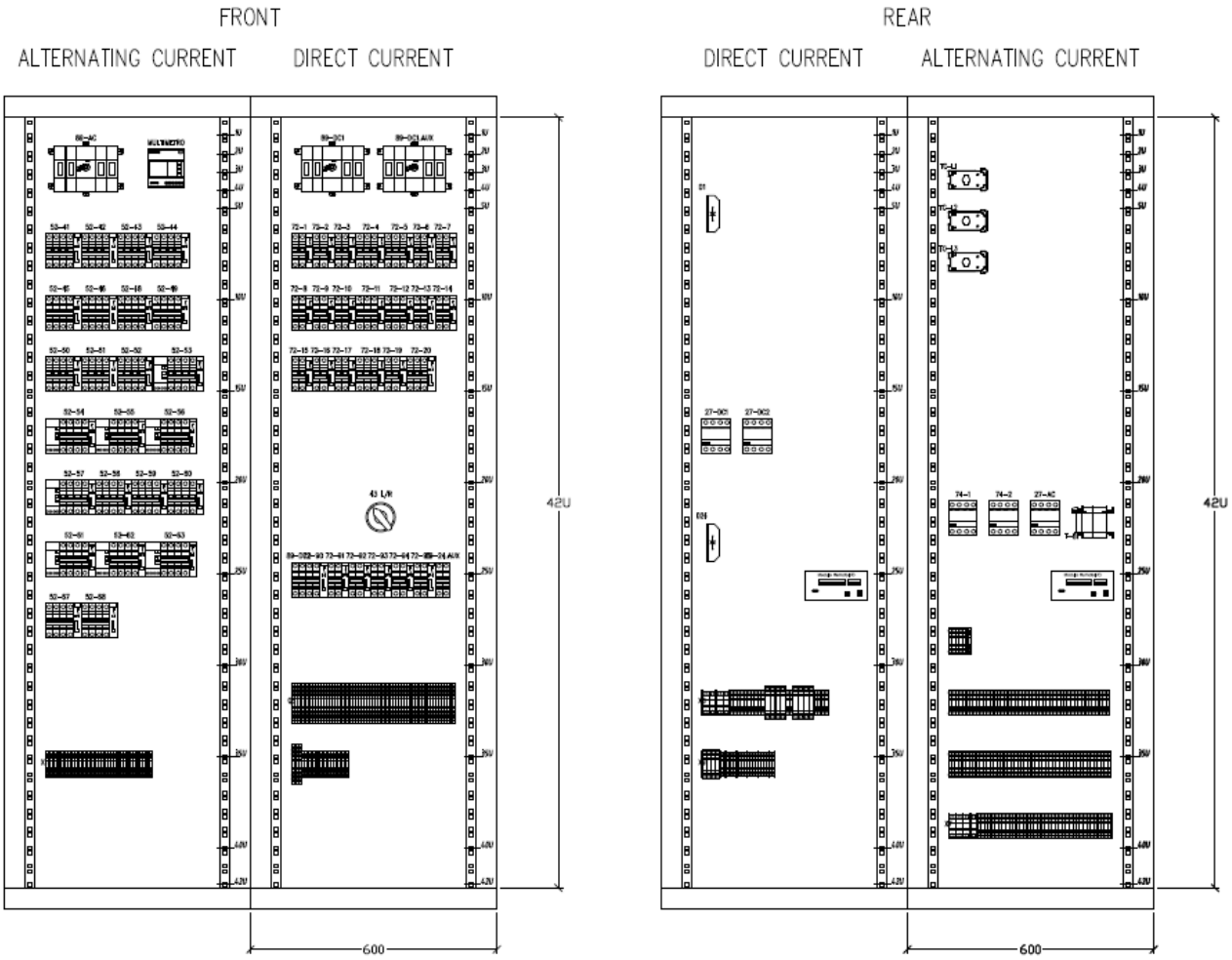

Figure 3 – PSC example layout (front)

7.6 ELECTRICAL CHARACTERISTICS

7.6.1 Electrical connections

The electrical connections must have the following characteristics:

Type of circuit	Phase	Color	Section
AC power circuits	L1		≥ 6 mm^2
	L2		≥ 6 mm^2
	L3		≥ 6 mm^2
	N		≥ 6 mm^2
DC power circuits	+		≥ 6 mm^2
	-		≥ 6 mm^2
Auxiliary connections			≥ 1,5 mm^2
Ground connections			≥ 4 mm^2

Table 4 - Characteristics of the electrical connections

The colors of the cables must comply with what is indicated by local regulations and by the requirements of each Country (phase, neutral, DC1+, DC1-, DC2+, DC2-, auxiliary and ground connections).

The PSC must be able to power a three-phase network with the following characteristics

V_{nac}	400/230Vac ± 20% - 50 Hz 380/220Vac ± 10% - 50 Hz 380/220Vac ± 20% - 60 Hz 220/127Vac ± 20% - 60 Hz 208/120Vac ± 20% - 60 Hz
V_i	690V – 50/60Hz
V_{imp}	6kV
I_{nac}	250A
short-circuit current (AC)	15kA

Table 5 – Electrical Characteristics

The PSC must be able to power a DC network with the following characteristics

V_{nDC1}	110Vdc 125Vdc
I_{nDC1}	250A
V_{nDC2}	24Vdc 48Vdc
I_{nDC2}	80A
short-circuit current (DC)	10kA

Table 6 – Electrical Characteristics for DC circuits

AC, DC1 and DC2 values depends from installation site: during the procurement process, the information about the operating conditions will be shared. (Par. 7.9.2).

All connections must be housed in plastic conduits, separating the power circuits from the auxiliary circuits and the AC-DC circuits.

7.6.2 Electromechanical components

With reference to the electromechanical components indicated in the following chapters, Enel must previously approve all the components proposed by the manufacturer.

All the LV components are shown in the electrical diagram (Par. 7.9.7)

7.6.3 LV circuit breakers and switches

LV AC Circuit Breakers are signed with 52-XX, LV DC Circuit Breakers are signed with 72-XX and LV switches are signed 89-XX.

Automatic modular thermal-magnetic circuit breakers and modular switches must be used on the distribution bars. Where required, type AC differential circuit breakers with sensitivity of 30 or 300 mA must be installed.

Each circuit breaker must have the respective auxiliary contact to signal the status of open or closed.

The electrical characteristics of LV switches and LV circuit breakers are indicated in the attached wiring diagram. These characteristics can be changed with respect to the type of HV/MV substation where the PSC will be installed. Any needs will be communicated during the procurement phase (Par. 7.9.2).

However, the design and verification of the PSC remains the responsibility of the manufacturer as indicated in Par. 7.2.

7.6.4 Relays and contactors

Under voltage relays are signed 27-AC for alternating current, 27-DC1 for DC1 circuit and 27-DC2 for DC2 circuit.

Contactors and relays are signed 74-XX.

The under-voltage relays must be mounted to pick up the respective bus voltages. Type of relays, model and technical features, will be approved by Enel on a proposal from the manufacturer.

Auxiliary Power Supply of relays and contactors depends from installation site: during the procurement process, the information about the operating conditions will be shared. (Par. 7.9.2).

7.6.5 Control & Selector Switch

Considering the differences of management philosophy of the power supply and control system of the various countries where the PSC will be used, the assembly and connection of a selector with the following characteristics may be required:

a. 24-way selector (signed 43 L/R), 2 positions (LOC; REM), In 20A, IP20; similar selector of equal characteristics can be accepted, will be approved by Enel on a proposal from the manufacturer.
   This selector manage the choice of:
   - LOC: Enable Local Commands for the complete HV/MV substation
   - REM: Enable Remote Commands for the complete HV/MV substation

During the procurement process, the information about the selector will be shared (Par. 7.9.2).

7.6.6 Auxiliary Connections

The auxiliary circuits for the connection between the equipment and the terminal blocks will be made with single-core cables, with a minimum cross-section of 1,5 mm^2, rated voltage Uo / Uc = 450 / 750V, fire-retardant type H07V2-K or similar. Type of the cables must comply with what is indicated by local regulations and by the requirements of each Country.

Each conductor will be identifiable at the two ends with a suitable cross-reference marking showing the numbering indicated on the electrical diagram (Par.7.9.7).

7.6.7 Ground connections

The PSC must be equipped by a copper ground electric bar bolted to the metal structure with a minimum cross-section of 100 mm2, and in any case according to the sections foreseen by the standard for the short circuit.

The copper bar must be electrically connected to the metal structure in at least five points and must be equipped with at least a 13 mm hole in the lower end for connection to the earth network; moreover, on the bar there must be 8 mm holes with a constant pitch of 20 mm.

All the structure and the metallic elements must be connected to each other by means of screws, to guarantee a good electrical contact between the parts.

The doors must be connected to the metal structure by means of flexible copper traces, minimum section of 16mm2.

All the main components not provided with double or reinforced insulation must be connected to the ground.

7.6.8 Terminal boards

The terminal boards must be mounted on a DIN rail, in an accessible position and must be easily identified.

The position of the terminal boards is mandatory and it is possible to use clamps screw-type, spring-type or push in-type, according to the indications of each Country.

For more information on the composition of the terminal blocks and their position refer to the electrical diagram (chapter 7.9.7).

7.6.9 Measurement

In the AC section there must be a digital multimeter with a backlit graphic LCD display (at least 128x80 pixel) in modular execution for mounting on a DIN rail with CT measurement 250/5A – 10VA

Measurement	Note
Frequency	
Voltage L1-N, L2-N, L3-N	True RMS
Voltage L1-L2, L2-L3, L1-L3	True RMS
Current	True RMS
Power	P, Q.S
Active, reactive and apparent energy of each single phase and of the three-phase system, phase sequence	
Harmonic voltage and current distortion THD for each single phase	
Voltage and current harmonics	up to 31[a]

Table 7 – Multimeter characteristics

7.6.10 Accessories

Thermostat, humidistat and twilight relay are included in the PSC and supplied as accessories, but they must not be mounted.

7.6.11 Bars

The main connections inside the PSC must be made in cable or with bars. The bars must be made of electrolytic copper, sized according to the nominal current values, and be stiffened by suitable supports made of insulating material.

The neutral bar must be sized with a flow not less than 50% of the phase flow.

Moreover, the bars and their supports will have such dimensions as to withstand the electrodynamic stresses caused by the short-circuit currents.

All other power connections will be in single-core cable with rated voltage Uo / Uc = 450/750 V fire-retardant type H07V2-K or similar. Type of the cables must comply with what is indicated by local regulations and by the requirements of each Country.

Each conductor will be identifiable at the two ends with a suitable cross-reference marking showing the numbering indicated on the electrical diagram (Par.7.9.7).

7.6.12 Warning labels

A series of warning labels, written in the local language of the destination Countries, must be provided on the PSC.

In particular, in correspondence of the DC1 circuit-breakers signed 72-7 and 72-14 the following label must be reported:

a. in case of activation of the 3rd circuit "<U" on the circuit-breakers, the opening of this switch generates the automatic tripping of the circuit-breakers and disconnection of the HV/MV transformer.

If present (see chapter 7.6.5), in correspondence of the selector switch signed 43 L/R the following label must be reported:

- LOC: Local Commands for the complete HV/MV substation
- REM: Remote Commands for the complete HV/MV substation

In addition, the labels indicating the LV circuits in AC, DC1 and DC2 indicated in the electrical diagram must be drawn up in the local language of the destination Countries.

7.6.13 Electrical connections to the control device

All the alarms generated by relays, switches and protection devices are managed through electrical connections to the control devices (Remote Input / Output module RIO). These connections must be predisposed through the use of connectors according to the electrical diagram (Par.7.9.7).

7.7 PSC ALARMS MANAGEMENT

This paragraph describes how the alarms and the status of the circuit breakers, coming from the power supply station and the power switchgear and controlgear assembly (PSC) respectively, are handled.

Two remote input/output (RIO) devices, according to GSTP102, are used to acquire the alarms and the logical status of the circuit breakers. This information will be communicated, according to the communication profile IEC61850, to the RTU of the HV/MV Substation. In particular:

- RIO1 will manage the alarms related to the DC side, according to the electrical diagram GSTZ112_A1
- RIO2 will manage the alarms related to the AC side, according to the electrical diagram GSTZ112_A1

The two Remote Input / Output modules (RIO) will be connected, in switch mode, with an RJ45 connector in order to provide a single digital connection to the RTU, according to the following logical diagram (Figure 4):

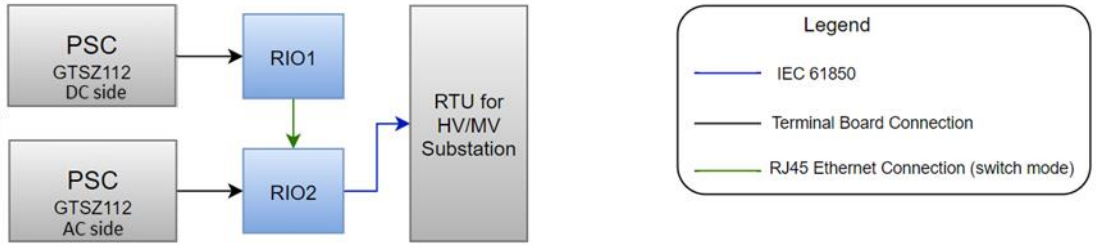

Figure 4 – RIOs connection logical diagram

In order to provide the connection between the RIOs, the modules must be equipped with an Ethernet port compliant with the RJ45 connectors..

The RIO2 module will communicate with the RTU on optical fiber by means of the LC connector.

The two RIOs modules, that will be supplied with the PSC, will be mounted on DIN rails, according to GSTP102, inside the rack of the PSC.

7.8 TECHNICAL CONFORMITY ASSESSMENT

All the requirements from this chapter must be respected. ENEL has the right to ask a prototype for any kind of verification testing. These tests must be performed in the provider factory or third party laboratories (by according to ENEL or relevant standards provision), with no cost participation by ENEL.

The PSC will be subjected to an ENEL Technical Conformity Assessment (TCA) process, by according to GSCG002 that is intended to verify if the supplied device meets regulatory standards and specifications.

7.8.1 Overview Technical Conformity Assessment (TCA) Process

The information of this paragraph is only indicative and may change by according with ENEL TCA management; final TCA organization will be discussed during the TCA kick off meeting.

7.8.2 TCA documents

The ENEL technical organization unit in charge of the Technical Conformity Assessment of the PSC will supervise the technical documentation and the execution of the tests required to receive the “Statement of Conformity”, according to GSCG002 prescriptions.

All the technical documentation required during that process shall be in English or in the local language of ENEL technical organization unit in charge of the TCA.

The TCA documents that shall be delivered include:

a. Type A documentation (Not confidential documents used for product manufacturing and management from which it is possible to verify the product conformity to all technical specification requirements, directly or indirectly).

b. Type B documentation (Confidential documents used for product manufacturing and management where all product project details are described, in order to uniquely identify the product object of the TCA). This type of documentation must be delivered only to the ENEL technical organization unit in charge of the TCA

c. TCA dossier (Set of final documents delivered by the Supplier for the TCA)

d. The supplier shall provide the TCA Dossier on digital support.

7.8.3 Quality

During the TCA, the supplier shall provide the technical documentation listed in ENEL Quality Specification for Electronic Assemblies.

7.8.4 Safety warnings on Plate

The safety warnings required in the plate of the PSC and its components must be written in the local language of the destination Countries.

7.8.5 Tests required to complete the TCA

The manufacturer must have a valid and product specific homologation before he may supply PSCs to ENEL. In compliance with this technical specification, the manufacturer must satisfactorily pass, within a maximum period of 6 months after contract award, all the tests described in the following sections.

Once these tests have been successfully completed, an approved manufacturer's PSC will be subject to ad-hoc reception tests.

In addition, ENEL reserves the right to request the repetition of the type tests at any time to ensure that the PSC continue to meet the standards achieved by the initial testing and certification programs at the time the contact was awarded.

Type tests will be carried out in Official Laboratories or Laboratories recognized by ENEL, or in the workshops of the manufacturer. ENEL reserves the right to attend any or all of these tests and must be kept informed of the manufacturer's testing programs, schedules and result.

The manufacturer will bear the cost for type tests and for pilot installation tests

7.8.6 Type test list

The tests below refer to IEC 61439-1 and IEC 61439-2 standards.

a. Visual examination and control of geometric characteristics,

b. Strength of materials and parts:

   b.1. Resistance to corrosion,

   b.2. Properties of insulating materials,

   b.3. Thermal stability,

   b.4. Resistance of insulating materials to abnormal heat and fire due to internal electrical effects,

   b.5. Resistance to ultra-violet (UV) radiation,

   b.6. Lifting,

   b.7. Mechanical impact,

   b.8. Marking,

c. Degree of IP degree provided by enclosures,

d. Clearance and creepage distance,

e. Protection against electric shock and integrity of protective circuits:

e.1. Effective continuity between the exposed conductive parts of the assembly and the protective circuit,

e.2. Short-circuit withstand strength of the protective circuit,

f. Incorporation of connection devices and components,

g. Internal electrical circuits and connections,

h. Terminals for external conductors,

i. Dielectric properties:

i.1. Power frequency withstand voltage,

i.2. Impulse withstand voltage,

j. Temperature rise limits,

k. Short-circuit withstand strength,

l. Electromagnetic compatibility (EMC) according to IEC 61000-6-4 and IEC 61000-6-5,

m. Mechanical operation,

The supplier must retain all the documentation proving the successful results of the type tests and all data must be made available to ENEL in real time.

At ENEL's discretion, these tests may be completely or partially repeated during the lifetime of the contract as continuing evidence of type conformity.

7.8.7 Acceptance tests

The acceptance tests are those indicated in Par.7.8.6 points a, e.1, f, i.1, g, and m.

7.8.8 Visual inspection

It is mandatory to verify the absence of visible manufacturing defects, the highest build-quality and precision of manufacture, the compliance of the rack/box dimensions with those indicated in the present specification.

7.8.9 Certifications and self-certifications

About the compliance of all the requirements/standards recalled in this GS, a certificate or self-certificate must be provided.

Regional laws or standards may require additional certifications or self-certifications.

Certifications and self-certifications must be made according to the relevant standards or laws (including the template format).

7.9 MISCELLANEOUS

This chapter include further requirements, recommendations, and additional information.

7.9.1 Required documentation

The following documents (in pdf format) must be provided:

a. PSC data sheet;
b. Installation, operation and maintenance manuals, with instructions on the installation and interfacing procedures;
c. Maintenance procedures;
d. Quick installation and set-up guide;
e. Parts list;
f. Recommended Tool List;
g. One-wire diagrams (also in DWG/DXF formats);
h. Electrical diagrams (also in DWG/DXF formats);
i. Mechanical diagrams (also in DWG/DXF formats);

These documents must be made according to IEC 61010-1 and they must be approved by ENEL.

7.9.2 Clarification during procurement process

By summarizing, during the procurement process the following clarification will be provided to the supplier:

a. Auxiliary Power Supply (Table 5);
b. DC1 and DC2 level (Table 6);
c. Clarification about operating conditions (Table 3);
d. electrical components characteristics (chapters 7.6.3 and 7.6.4);
e. selector option (chapter 7.6.5);
f. Language for documentations and labels;
g. Details about unique serial identifier, serial code and other labeling.

7.9.3 Procurement management

The information of this paragraph is only indicative and may change by according with ENEL procurement management; final procurement approach will be issued by entrusted ENEL units.

Within 30 days of receiving the present specification, the manufacturer must send the following documentation, in English, along with the technical proposal:

a. Layout and weight of the PSC,
b. Detailed diagrams of the PSC,
c. Lists of references,
d. Exceptions to this specification,
e. Instructions for the installation and commissioning of the PSC,
f. Instructions for checking and maintenance.

If the manufacturer fails to provide any or all of the above information within 30 days of receipt of this specification, he will be disqualified as supplier, for ENEL, of the product standardized in this Technical Specification.

7.9.4 Receipt of material

The information of this paragraph is only indicative and may change by according with ENEL product management; final procurement approach will be issued by entrusted ENEL units.

7.9.5 Reception tests

Part of the process of accepting delivery of a manufacturer's devices will include the proof of having successfully passed previously performed acceptance tests (Par. 7.8.7).

Then, the reception tests will be carried out in Official Laboratories or Laboratories accredited by ENEL, or in the workshops of the manufacturer. ENEL reserves the right to attend any or all of these tests and must be kept informed of the manufacturer's testing programs, schedules and results. If the assistance of an ENEL representative is not available, the provisional reception procedure will be conducted when tests protocols are received.

In the event the documentation has undergone modifications with reference to the actual devices delivered, the manufacturer must provide the updated documentation before the reception procedure will be deemed to have been completed.

7.9.6 Warranty

The manufacturer will commit to providing a guarantee of the PSC for a minimum period of 24 months, which will commence immediately following a successful reception.

The guarantee will be legally binding for any device/component faults and/or defects that occur within the guarantee period: accordingly, the PSC and/or components will be replaced. Further, the manufacturer will undertake to continue, free of charge, the software and firmware development and provide the updates to ENEL for the lifetime of the devices.

If during the contract term, the manufacturer fails to address in a prompt and timely manner any functional anomalies or defects in the device behavior or manufacture (hardware or firmware).

ENEL reserves the right to block the necessary positions on the contract, staged payments and/or alter the payment schedules as necessary until the anomalies have been resolved to the complete satisfaction of ENEL.

7.9.7 Electrical Diagrams

For the electrical diagrams, please refer to GSTZ112_A1 Electrical Diagrams for the Power switchgear and controlgear assembly (PSC) for HV/MV Substation.