

Subject: Switchgears for LV distribution networks

Application Areas Perimeter: *Global* Staff Function: -Service Function: -Business Line: *Enel Grids*

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1. DOCUMENT AIMS AND APPLICATION AREA

The aim of this document is to provide technical requirements for the supply of Switchgears for LV distribution networks to be used in the Low Voltage distribution networks of Enel Group Distribution Companies, listed below:

Country	Distribution Company
	Enel Distribuição Rio
D	Enel Distribuição Ceará
Brazii	Enel Distribuição Goiás Enel
	Enel Distribuição São Paulo
Chile	Enel Distribución Chile
Italy	e-distribuzione
Peru	Enel Distribución Perú
	E-Distributie Banat
Romania	E-Distributie Dobrogea
	E-Distributie Muntenia

Table 1 - Distribution Companies

This document shall be implemented and applied to the extent possible within the Enel Grids Business Line 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 DOCUMENTS TO BE IMPLEMENTED AT COUNTRY LEVEL

This document does not require implementation of further documents. Anyway, each Enel Grids Company can issue, under the supervision of Enel Grids Global Network Components detailed documents, according to the provisions of the present document and in case of specific needs.

2. DOCUMENT VERSION MANAGEMENT

Version	Date	Main changes description
00	21/12/2022	Issuing of "Switchgears for LV distribution networks"

3. UNITS IN CHARGE OF THE DOCUMENT

Responsible for drawing up the document:



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• Enel Grids: Engineering and Construction / Components and Devices Design unit / Network Components unit.

Responsible for authorizing the document:

- Enel Grids: Head of Network Components unit.
- Enel Grids: Head of Quality unit.

4. **REFERENCES**

- Code of Ethics of Enel Group.
- Enel Human Right Policy.
- The Enel Group Zero Tolerance of Corruption (ZTC) Plan.
- Organization and management model as per Legislative Decree No. 231/2001.
- Enel Global Compliance Program (EGCP).
- Integrated Policy of Quality, Health and Safety, Environment and anti-Bribery and Information security.
- ISO 9001:2015 Quality Management System Requirements.
- ISO 14001:2015 Environmental Management System Requirements with guidance for use.
- ISO 45001:2018 Occupational Health and Safety Management System Requirements with guidance for use.
- ISO 37001:2016 Anti-bribery Management System Requirements with guidance for use.
- MAT-O&M-NCS-2021-0033-EGIN version 3 "Global Infrastructure and Networks GSCG002 Technical Conformity Assessment.
- ISO 27001:2017 Information Security Management System Requirements.
- Packaging, transport, and delivery requirements rev.2.

Group Pillar References:

- The Code of Ethics of Enel Group;
- The Enel Group Zero Corruption Tolerance Plan (ZTC);
- Human Rights Policy;
- Organization and Management Model as per Legislative Decree No. 231/2001;
- Enel Global Compliance Program (EGCP).

International technical references related with the material:

- EN 61439-1
- EN 61439-5
- EN 60695-2-10/12



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- IEC 60695-11-10
- IEC 60112
- EN 12164

Country laws

Brazil

• NR-10 - Segurança em Instalações e Serviços em Eletricidade.

Chile

• Reglamento de seguridad de las instalaciones eléctricas destinadas a la producción, transporte, prestación de servicios complementarios, sistemas de almacenamiento y distribución de energía eléctrica y todos sus Pliegos Técnicos.

Perú

• CNE - Código Nacional de Electricidad - Suministro 2011.

Italy

- D.Lgs n. 81 of the 9th of April 2008 and subsequent modifications.
- Nota Operativa PVR001 Rev. 2 Ott. 2012 Gestione Garanzie dei materiali di ENEL Distribuzione.

Romania

 Legea securității și sănătății în muncă nr. 319/2006, cu modificările și completările ulterioare. (con successive modifiche e integrazioni.)

Local replaced standards

- Brazil N/A
- Chile N/A
- Italy DS 4535, DS4534, DS4533
- Perú N/A
- Romania RO DS 4535, RO DS4534, RO DS4533

5. ORGANIZATIONAL PROCESS POSITION IN THE PROCESS TAXONOMY

Value Chain/Process Area: Engineering and Construction

Macro Process: Devices and components development

Process: Standard Catalog Management



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6. DEFINITIONS AND ACRONYMS

Acronym and Key words	Description
Low Voltage (LV)	Any set of nominal voltage levels exceeding 50 V and up to 1 kV a.c. or 1,5 kV d.c.
Technical Conformity Assessment (TCA)	A "conformity assessment" with respect to "specified requirements" consists in functional, dimensional, constructional and test characteristics required for a product (or a series of products) and quoted in technical specifications and quality requirements issued by Enel Group distribution companies. This also includes the verification of conformity with respect to local applicable regulation and laws and possession of relevant requested certifications.
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.



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7. DESCRIPTION

7.1 LIST OF COMPONENTS

GS Type Code	Country	Country Code	Nominal section of cables [mm2]	Minimum withstand tightening torque of terminals for cable clamping [Nm]	In - Rated current [A]	lcw - rated short-time withstand current ¹ [kA@1s]	Un - Rated voltage [kV]	Uimp - Rated impulse withstand voltage [kV]	Minimum protection degree ² (IP)
GSCC025/01	IT	160113	10 ÷ 50	20	140	6,5	0,6/1,0	4	20
GSCC025/02	IT	160114	10 ÷ 150	40	318	13,8	0,6/1,0	4	20
GSCC025/03	IT	160115	10 ÷ 240	40	407	20	0,6/1,0	4	20
GSCC025/01	BR	161953	10 ÷ 50	20	140	6,5	0,6/1,0	4	20
GSCC025/02	BR	161952	10 ÷ 150	40	318	13,8	0,6/1,0	4	20
GSCC025/03	BR	161951	10 ÷ 240	40	407	20	0,6/1,0	4	20
GSCC025/01	CL	161960	10 ÷ 50	20	140	6,5	0,6/1,0	4	20
GSCC025/02	CL	161959	10 ÷ 150	40	318	13,8	0,6/1,0	4	20
GSCC025/03	CL	161958	10 ÷ 240	40	407	20	0,6/1,0	4	20
GSCC025/01	RO	160052	10 ÷ 50	20	140	6,5	0,6/1,0	4	20
GSCC025/02	RO	160053	10 ÷ 150	40	318	13,8	0,6/1,0	4	20
GSCC025/03	RO	160054	10 ÷ 240	40	407	20	0,6/1,0	4	20
GSCC025/01	PE	161930	10 ÷ 50	20	140	6,5	0,6/1,0	4	20
GSCC025/02	PE	161929	10 ÷ 150	40	318	13,8	0,6/1,0	4	20
GSCC025/03	PE	161928	10 ÷ 240	40	407	20	0,6/1,0	4	20

Table 2

7.2 SERVICE CONDITIONS

LV Switchgears for distribution networks shall be installed inside the street box or wall box. The reference of outdoor environments conditions in the different countries where Enel operates are:

- Maximum Ambient Air Temperature: + 50 °C.
- Minimum Ambient Air Temperature: 10 °C.
- Maximum relative humidity: 100%.
- Maximum height, 2.700 m.
- Maximum solar radiation: 1.000 W/m2
- Pollution degree (IEC 60664-1): 4

¹ Duration of the short circuit: 1 s

² With protective cover installed



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For Peru, operation in an area with environmental classification climate category type C5-M "Very High" (coastal areas with high salinity) according to ISO 9223 and EN ISO 12944-2 must be considered.

7.3 TECHNICAL CHARACTERISTICS

7.3.1.General requirements

The nominal characteristics for each type of switchgears are listed in Table 2.

The switchgears can be used to branch and disconnect cables with copper and aluminum conductors installed on Enel distribution networks, according to the cross-sections provided for each type and with rated insulation voltage U0/U = 0.6/1 kV.

The switchgear must provide a total number of circuits (input and output) of 16: 4 three-phase and neutral or 16 single-phase. For Enel Peru neutral is not required (Insulated neutral distribution system).



Figure 1 – Global Type GCC025/01



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Figure 2 – Global Type GCC025/02 (design update under evaluation)



Figure 3 – Global Type GCC025/03



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The design solutions illustrated in the figures of this document are to be understood as practical examples of possible implementation. The switchgear must be suitable for accommodating in enclosures as shown in Table 3. The fixing points and minimum dimensions required for proper installation and maintenance of the connecting cables must be observed.

The Manufacturer may present alternative construction solutions that are functionally equivalent, such solutions must be approved in advance by ENEL Grids-E&C. In any case, proposals for modifications presented after the award of a tender by the Manufacturer and during the validity of an order shall not be taken into consideration.

Country	Type of switchgear	Type of enclosure
IT	GCC025/01	DS 4525
IT	GCC025/02	DS 4522, DS4523 and DS 4549
IT	GCC025/03	DS 4522 and DS 4549
RO	GCC025/01	DS 4525
RO	GCC025/02	DS 4522, DS4523 and DS 4549
RO	GCC025/03	DS 4522 and DS 4549
BR	GCC025/01	DS 4525
BR	GCC025/02	DS 4522, DS4523 and DS 4549
BR	GCC025/03	DS 4522 and DS 4549
CL	GCC025/01	na
CL	GCC025/02	na
CL	GCC025/03	na
PE	GCC025/01	na
PE	GCC025/02	na
PE	GCC025/03	na

Table 3

7.3.2.Dimensions

The dimensions are shown in figure 1, figure 2 and figure 3. Tolerances shall be in accordance with the UNI ISO 2768 standard, applying class 'm'.

7.3.3.Bus bars, sectioning jumpers and connections

For Global Type GCC025/01:

 Bus bars and sectioning jumper shall be made of electrolytic copper with minimum conductivity same as 95% IACS at 20 °C and tinned with 8 μm minimum thickness.

There shall be 4 sectioning jumpers between the input and output circuits (see Figure 1).

For Global Types GCC025/02 and GCC025/03:

Bus bars, connections and sectioning jumper shall be made of electrolytic copper with minimum conductivity same as 95% IACS at 20 °C and tinned with 8 μm minimum thickness or Aluminum alloy with minimum conductivity same as 54% IACS at 20 °C and tinned with 5 μm minimum thickness. In



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addition, for these two Global types, the connection bars between the phases (R-R) (S-S) (T-T) (N-N) must be insulated with resin or self-extinguishing PVC sheaths at least 2 mm thickness.

There shall be one sectioning jumper for each phase/neutral (16 sectioning jumpers in total) (see Figures 2 and 3).

For Global Types GCC025/01, GCC025/02 and GCC025/03:

- The material making up the bus bars, sectioning jumpers and connections, if made of aluminum, must be constructed using at least 20 percent recycled aluminum.
- For each type of bolt and screw that can be tightened, the manufacturer must indicate the relative nominal tightening torque and tolerance.
- For all aluminum elements, the tinning process can be replaced by the Trivalent-chromium anticorrosive passivating process. In this case, equivalent functional performance and resistance to corrosion must be guaranteed compared to the tinning process. These characteristics must be demonstrated by performing the tests described in this document in addition to performance equivalence tests on the coated products.

7.3.4.Housing

The housing shall be made in fiberglass reinforced polyester resin, moulded, anti-tracking (PTI 500 - IEC 60112), resistance to fire (glow wire 960°C EN 60695-2-10/12), self-extinguishing (V0 - IEC 60695-11-10), colour red. The fixing of the active parts to the base must be made on pins embedded in the material during the moulding of the base itself. The phase separation fins must have a protrusion \geq 10 mm throughout their profile, relative to the live parts.

The constituent material of the housing shall be constructed using at least 15% recycled fiberglass reinforced polyester resin.

7.3.5. Terminals for cable clamping

For Global Type GCC025/01:

- The body and clamping screw of terminals must be made of brass CW612N according to UNI EN 12164 tinned with 5 μm minimum thickness.
- The terminals shall be designed to accommodate Class 1 and Class 2 conductors made of aluminium or copper with cross-section from 10 mm2 up to 50 mm2.
- Terminals must be provided with a hole (depth ≥ 20 mm Ø 8+0.2 -0 mm) for the connection of the earthing and short circuit device for LV cables.
- The manufacturer shall declare the value and tolerance of the nominal tightening torque of the bolt heads of terminal blocks.
- The tightening torque data shall be stated on a self-adhesive plate placed on the protective shield.
- The bolt heads of the neutral terminals shall be painted light blue.

For Global Type GCC025/02 and GCC025/03:

- The body and bolt of terminals shall be made of brass CW612N according to EN 12164 tinned with 5 µm minimum thickness, for Global Type GCC025/02 the body of terminals can be also made of alluminium alloy tinned with 5 µm minimum thickness, in this case the bolt shall be made of stainless steel.
- The terminals shall be designed to accommodate Class 1 and Class 2 conductors made of aluminium or copper:
 - \circ $\,$ with cross-section from 10 mm2 up to 150 mm2 for Global Type GCC025/02 $\,$
 - with cross-section from 10 mm2 up to 240 mm2 for Global Type GCC025/03.



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- Terminals must be provided with a hole (depth ≥ 20 mm Ø 8+0.2 -0 mm) for the connection of the earthing and short circuit device for LV cables and shall withstand a minimum tightening torque of 40 Nm.
- The tightening torque data shall be declared by the manufacturer and stated on a self-adhesive plate placed on the protective shield.
- The bolt heads of the neutral terminals shall be painted light blue.
- Terminals where connection is made through the direct contact between a screw and the peeled conductor are not permitted. Leaf springs or similar must be placed between the cable gland plate and the clamping screw to compensate for the expansion of the conductor. For reference, see the figure 4.
- The material making up the terminals, if made of aluminum, must be constructed using at least 20 percent recycled aluminum.

For Global Types GCC025/01, GCC025/02 and GCC025/03:

Bolts, nuts, washers, screws shall be made of stainless steel.

For all aluminium elements, the tinning process can be replaced by the Trivalent-chromium anticorrosive passivating process. In this case, equivalent functional performance and resistance to corrosion must be guaranteed compared to the tinning process. These characteristics must be demonstrated by performing the tests described in this document in addition to performance equivalence tests on the coated products.







Figure 4 - Bolt-Spring-plate terminal system

7.3.6.Transparent protective cover

All three Global Types must be supplied with a removable protective cover.

The protective cover must be made of transparent, non-flammable polycarbonate fixed to the base with knurledhead threaded bushings or an equivalent solution.

The cover must also be provided with holes for the access of test leads for electrical measurements and for the connection of the earthing device, so these must be made in correspondence with the holes required for the cable clamps, specified in the previous paragraph.



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7.4 MARKING

7.4.1.Characteristics plate

The base of the housing must be indelibly and clearly stamped with the name or trademark of the manufacturer, month year of manufacture and the abbreviation of the material used for the housing of the switchgears. In addition, both on the base housing and on the protective cover, in correspondence with each terminal, the following letters must be stamped: R, S, T, N.

In the centre of the protective cover, the black and yellow triangle with the hazardous voltage graphic must be applied (ref. fig. 5). A self-adhesive, long-lasting and clearly legible label must also be affixed to the protective cover, which must specify the maximum capacity of the switchgears, the value and relative tolerance of the nominal torque of the terminal blocks, as indicated by the Manufacturer. A dual code must also be applied to allow the product manual to be downloaded.



Figure 5 - Risk of electric shock symbol



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7.5 TESTING

7.5.1.Type Tests

Type tests are listed in the following table (Table 4) and they must be performed on 2 samples

N°	Test	Requirement
1	Visual inspection	The surfaces of the terminal box base and cover must be smooth and homogenous free of roughness and discolouration.
2	Dimensional verification	Compliance with the dimensions shown on the construction drawings must be verified.
3	Power-frequency withstand voltage	IEC 61439-1 sub-clause 10.9.2
4	Verification of temperature rise	IEC 61439-1 sub-clause 10.10. With overtemperature not exceeding 50° C.
5	Short-circuit withstand strength	IEC 61439-1 sub-clause 10.11
6	Comparative tracking index (CTI) of housing material	IEC 60112 ≥ 500 V
7	Resistance to fire and self-extinguishing properties of housing material	IEC 60695-1-1/2 (glow wire 960°C) IEC 60695-11-10 (Value V0)
8	Verification of correct tightening of screws and bolts	The correct tightening of screws and bolts should be verified according to the values provided by the manufacturer.
9	Verification of nominal tightening torque of terminals for cable clamping	Verification of the nominal tightening torque of the terminals for cable clamping must be carried out. The verification must be carried out with cable having a minimum and maximum cross section, according to the type of switchgears.
10	Verification of the breaking load of the phase separation fins	The breaking load of the separation fins must be verified by a percussion force applied to the end of the fins equal to 1.5 joules.
11	Verification of breaking torque of terminals for cable clamping	Verification of the breaking torque of the terminals for cable clamping must be carried out.

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7.5.2. Acceptance tests

Acceptance tests shall be performed during the delivery and shall be carried out in the Supplier's facilities. The acceptance tests list is indicated in following the Table 5 and the test method and requirement are the same as detailed in section 7.5.1 (Type Tests)

Ν.	Test	Test Method
1	Visual inspection	7.5.1.1
2	Dimensional verification	7.5.1.2
3	Power-frequency withstand voltage	7.5.1.3
8	Verification of correct tightening of screws and bolts	7.5.1.8
9	Verification of nominal tightening torque of terminals for cable clamping	7.5.1.9
10	Verification of the breaking load of the phase separation fins	7.5.1.10

Table 5

During the acceptance tests carried out independently, the supplier must apply the following sampling criteria of ISO 2859-1 Ed V 2007:

- Tests 1, 2: Single sampling plan for normal inspection, level S3, AQL of 2,5%

Batch size	Sample size	Ac	Rc
2 - 500	5	0	1
501 - 35.000	20	1	2
35.001 - 500.000	32	2	3
500.001 and over	50	3	4

Table 6

- Tests 3, 4, 5, 6: Single sampling plan for normal inspection, level S3, AQL of 1,5%

Batch size	Sample size	Ac	Rc
2 - 3.200	8	0	1
3.201 - 500.000	32	1	2
500.001 and over	50	2	3

Table 7

During the repetition of the acceptance tests at the presence of the Enel or designated inspector, the tests must be carried out on a reduced sample chosen randomly from the batch already successfully tested by the supplier applying the contractually agreed reduction criteria with a minimum of one piece for each type of material:

- Tests 1, 2: 50% of the Required Sampling

Batch size	Sample size	Ac	Rc
2 - 500	2	0	1
501 - 35.000	10	1	2
35.001 - 500.000	16	2	3
500.001 and over	25	3	4



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- Tests 3, 4, 5, 6: 25% of the Required Sampling

Batch size	Sample size	Ac	Rc
2 - 3.200	2	0	1
3.201 - 500.000	8	1	2
500.001 and over	12	2	3

Table 9

7.6 TECHNICAL CONFORMITY ASSESMENT

Technical conformity assessment shall be done according to Enel's procedure described in GSCG002. Documents type A shall include the description of the weight of raw materials and including the percentage of recycled material if any.

7.7 GUARANTEE

Requirement of warranty will be indicated in the request for bids, indicating periods and standards, although any material will be warrantied 24 months as a minimum.

7.8 CONDITIONS OF SUPPLY

Manufacturers shall provide appropriate instructions, documents showing acceptance tests and information covering general conditions during transport, storage, and installation of the switchgears. The instructions shall include the appropriated indications for the disassembly and recycle of the material, reporting the weight in kg of each raw material. The documents must be in English and in the local language of the destiny country. Enel will have the power to verify that the instructions given are in line with the standard practices in the sector.

The instructions shall also include the information about how to treat the device at the end of its life.

The requirements regarding dimensions for delivery to ENEL deposits are reported in packaging, transport, and delivery requirements.

In addition:

- for global type GSCC025/01, the switchgears shall be supplied in single package, assembled, with all related accessories including: No 4 M6 screws for fixing in DS 4525 enclosures
- for global type GSCC025/02 and GSCC025/03, the switchgears shall be supplied in single package, assembled, with all related accessories including: No 4 M8 screws for fixing in DS 4522 and DS 4549 enclosures

The name and trademark of the Manufacturer, country code, year and month of packaging, rated current in A, maximum and minimum cross-section of the cables that can be used shall be marked on the packaging. Each package must contain all elemental parts and what is necessary for proper assembly.



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7.9 TECHNICAL CHECK LIST

The following table 13 indicates the minimum technical information that suppliers shall provide. Data for the global type GSCC025/02 are entered in the following table as an example.

Item	Description	Unit	Required	Offered
1	GENERAL INFORMATION			
1.1	Supplier	-	Informative	
1.2	Factory	-	Informative	
1.3	Supplier Product Designation	-	Informative	
2	MAIN FEATURES			
2.1	Distribution Company and Country	-	Informative	-
2.2	Country Code	-	Informative	
2.3	GS Type Code		Informative	
2.4	Rated voltage (Un)	[kV]	0,6/1,0	
2.5	Rated current (InA)	[A]	318	
2.6	Rated short-time withstand current (Icw)	[kA@s]	13,8 kA @ 1 s	
2.7	Rated impulse withstand voltage (Uimp)	[kV]	4,0	
2.8	IP code	-	IP20	
2.9	Housing material	-	fiberglass reinforced polyester resin with 15% minimum recycled	
2.10	Material for busbar and sectioning jumpers and connections	-	Cu 8 µm tinned or Al (with 20% minimum recycled) 5 µm tinned	
2.11	Material of the terminals for cable clamping (body)		Brass CW612N 5 µm tinned or AI (with 20% minimum recycled) 5 µm tinned	
2.12	Material of the terminals for cable clamping (bolt)		Brass CW612N 5 µm tinned or Stainless steel	
2.13	Material for bolts, nuts, washers, screws		Stainless steel	
2.14	Type of terminals for cable clamping		Bolt-spring-plate	
2.15	Nominal section of cables of terminals for cable clamping	[mm2]	10 ÷ 150	
2.16	Minimum withstand tightening torque of terminals for cable clamping	[Nm]	40	





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7.10 COUNTRY CODE CONVERSION TO OLD SPECIFICATIONS

The following table shows the association codes for materials that have changed code from previous specification revisions with equivalent characteristics. Other alternatives could be evaluated on a case-by-case basis.

GS Type Code GSS003 rev.1	Country	Old Description	Country Code	Replace code in previous standards
GSCC025/01	IT	DS4535	160113	286020
GSCC025/02	IT	DS4533	160114	286021
GSCC025/03	IT	DS4534	160115	286022
GSCC025/01	RO	RO DS4535	160052	286020
GSCC025/02	RO	RO DS4533	160053	286021
GSCC025/03	RO	RO DS4534	160054	286022

Table 11