

Subject: Global Infrastructure and Networks – GSCT004 Outdoor Voltage Transformers up to U_m 36 kV

Application AreasPerimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Infrastructure & Networks***CONTENTS**

1	DOCUMENT AIMS AND APPLICATION AREA	2
1.1	RELATED DOCUMENTS TO BE IMPLEMENTED AT COUNTRY LEVEL	2
2	DOCUMENT VERSION MANAGEMENT	2
3	UNITS IN CHARGE OF THE DOCUMENT	3
4	REFERENCES	3
5	ORGANIZATIONAL PROCESS POSITION IN THE PROCESS TAXONOMY	3
6	DEFINITIONS AND ACRONYMS	4
6.1	ENEL GLOBAL INFRASTRUCTURE AND NETWORKS COUNTRIES REFERENCE STANDARDS	4
7	DESCRIPTION	5
7.1	LIST OF COMPONENTS	5
7.2	APPLICABLE LAWS AND REFERENCE STANDARDS	5
7.3	MAIN CHARACTERISTICS	7
7.4	DESIGN AND CONSTRUCTION REQUIREMENTS	8
7.5	OVERALL DIMENSIONS	9
7.6	LIST OF TESTS	10
7.7	DOCUMENTATION	12
8	ANNEXES	13
8.1	CHECK LIST FOR TENDER	13

The Head of Network Components

Maurizio Mazzotti

Subject: Global Infrastructure and Networks – GSCT004 Outdoor Voltage Transformers up to U_m 36 kV

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1 DOCUMENT AIMS AND APPLICATION AREA

This document prescribes the technical characteristics, the performance and the testing methods for outdoor Voltage Transformers (VT) to be used to provide energy to MV remote switching points in the distribution network up to 36 kV of the Enel Group Distribution Companies located in the countries listed below:

Country	Distribution Company
Argentina	Edesur
Brazil	Enel Distribuição Rio Enel Distribuição Ceará Enel Distribuição Goiás Enel Enel Distribuição São Paulo
Chile	Enel Distribución Chile
Colombia	Codensa
Iberia	e-distribución
Italy	e-distribuzione
Peru	Enel Distribución Perú
Romania	Enel Distributie Banat Enel Distributie Dobrogea Enel Distributie Muntenia

1.1 Related 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
00	21/01/2016	First emission
01	22/04/2016	Modification of the main characteristics and updating of the whole document
02	24/11/2016	4.3 Added particular local seismic requirements - 5 Updated names of local DSOs, weights as indicative values and local specific seismic requirements – 7.2.7 Added the type test for local seismic requirements by analytic demonstration - 7.4.3 Updated reference standard for ageing test
03	05/07/2021	Issuing of “Global Infrastructure and Networks – GSCT004 Outdoor Voltage Transformers up to U_m 36 kV” technical specification. New Enel types added - Update of characteristics - Simplified test procedures

Subject: Global Infrastructure and Networks – GSCT004 Outdoor Voltage Transformers up to U_m 36 kV

Application AreasPerimeter: *Global*

Staff Function: -

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Business Line: *Infrastructure & Networks*

3 UNITS IN CHARGE OF THE DOCUMENT

Responsible for drawing up the document:

- Global Infrastructure and Networks: Engineering and Construction / Components and Devices Design / Network Components unit

Responsible for authorizing the document:

- Global Infrastructure and Networks: Head of Engineering and Construction unit
- Global Infrastructure and Networks: Head of Health, Safety, Environment and 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;
- RACI Handbook Infrastructure and Networks no. 06;
- Enel Global Compliance Program (EGCP);
- Integrated Policy of Quality, Health and Safety, Environment and anti-Bribery;

5 ORGANIZATIONAL PROCESS POSITION IN THE PROCESS TAXONOMY

Value Chain/Process Area: Networks Management

Macro Process: Materials management

Process: Network components standardization

Subject: Global Infrastructure and Networks – GSCT004 Outdoor Voltage Transformers up to U_m 36 kV

Application Areas

Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Infrastructure & Networks*

6 DEFINITIONS AND ACRONYMS

Acronym and Key words	Description
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.

6.1 Enel Global Infrastructure and Networks countries Reference standards

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

ISO/IEC 17000	Conformity assessment – Vocabulary and general principles
ISO/IEC 17020	General criteria for the operation of various types of bodies performing inspection
ISO/IEC 17025	General requirements for the competence of testing and calibration laboratories
ISO/IEC 17050-1	Conformity assessment - Supplier’s declaration of conformity - Part 1: General requirements (ISO/IEC 17050-1:2004, corrected version 2007-06-15)
ISO/IEC 17050-2	Conformity assessment - Supplier’s declaration of conformity - Part 2: Supporting documentation (ISO/IEC 17050-2:2004)
ISO/IEC 17065	Conformity assessment – Requirements for bodies certifying products, processes and services

Subject: Global Infrastructure and Networks – GSCT004 Outdoor Voltage Transformers up to U_m 36 kV

Application Areas

Perimeter: *Global*

Staff Function: -

Service Function: -

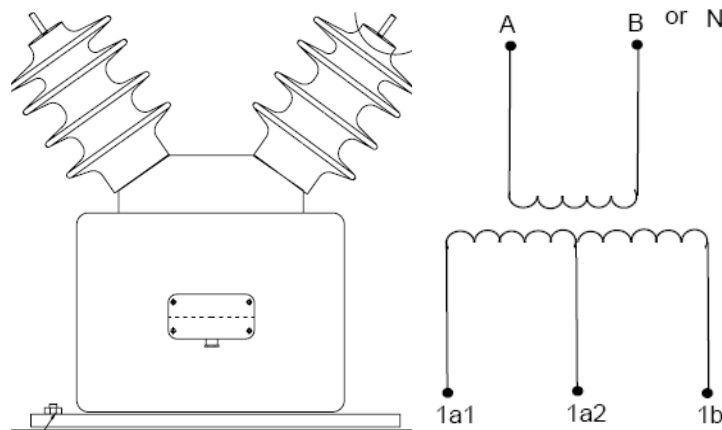
Business Line: *Infrastructure & Networks*

7 DESCRIPTION

7.1 List of Components

The components are identified with the Global Types indicated in the table reported in clause 7.3 of this document.

Global types are associated with Country codes (identification numbers) for the relevant country of application. The cable for the connection of secondary terminals indicated in the following is included in the supply.



Examples of Voltage Transformer and electrical scheme

7.2 Applicable laws and reference standards

7.2.1.Laws

7.2.1.1. **Argentina**

Norma IRAM

7.2.1.2. **Brazil**

NR-10 - segurança em instalações e serviços em eletricidade.

7.2.1.3. **Chile**

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

7.2.1.4. **Colombia**

RETIE - Reglamento Técnico de Instalaciones Eléctricas.

Ley 400 de 1997.

7.2.1.5. **Perú**

Código Nacional de Electricidad Suministro.

Subject: Global Infrastructure and Networks – GSCT004 Outdoor Voltage Transformers up to U_m 36 kV

Application Areas

Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Infrastructure & Networks*

7.2.2. Standards

The reference documents listed below shall be intended as the edition in force.

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

Standards
IEC 61869-1
IEC 61869-3
IEC 60660
IEC 60529 + AMD1 + AMD2
IEC TS 60815

7.2.3. Particular local seismic requirements

7.2.3.1. Chile

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

DMAD-0184 - Poste de hormigón armado 13,5 m.

7.2.3.2. Colombia

NSR – 10 - Norma Sismo Resistente Colombiana

7.2.3.3. Peru

E-SE-010 - Acción sísmica en equipos eléctricos y mecánicos

Subject: Global Infrastructure and Networks – GSCT004 Outdoor Voltage Transformers up to U_m 36 kV

Application Areas

Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Infrastructure & Networks*

7.3 Main characteristics

Global types associated with country codes, main ratings, requirements and service conditions prescribed are indicated in the following:

GLOBAL TYPE	GSCT004/31	GSCT004/32	GSCT004/34	GSCT004/35	GSCT004/36	GSCT004/37	GSCT004/38	GSCT004/39	GSCT004/40
COUNTRY CODE	990362	990361	531271	530052	530051	530053	530054	0102-1937	0102-1936
COUNTRY	Brazil	Brazil	Colombia	Chile	Chile	Perù	Perù	Argentina	Argentina
Rated Primary Voltage (kV)	13,8 - 11,4	34,5	13,2 - 11,4	23	12	20	10	13,2	33
Rated Secondary Voltage (kV)	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11	0,11
Insulation level $U_m/AC/LI$	17,5 / 38 / 95	36 / 70 / 170	17,5 / 38 / 95 (*)	36 / 70 / 170	17,5 / 38 / 95	24 / 50 / 125	12 / 28 / 75	17,5 / 38 / 95	36 / 70 / 170
Rated Frequency	60	60	60	50	50	60	60	50	50
Rated power / Accuracy class	250VA/3 - to be referred to both voltage ratios, if any								
Thermal limiting output (VA)	450 VA								
Rated Voltage Factor	1,2 continuous and 1,5 x 30 sec								
Degree of protection	IP 44 - IEC 60529								
Pollution IEC/TS 60815 - SPC Class	e (very h.)	e (very h.)	c(medium)	c(medium)	c(medium)	e (very h.)	e (very h.)	c(medium)	c(medium)
RUSCD (mm/kV)	53,7	53,7	34,7	34,7	34,7	53,7	53,7	34,7	34,7
Relative humidity	98%	98%	98%	98%	98%	98%	98%	98%	98%
Ambient air temperature (°C)	-10/50	-10/50	-10/50	-10/50	-10/50	-10/50	-10/50	-10/50	-10/50
Altitude a. s. l. (m)	1000	1000	2700	1000	1000	1000	1000	1000	1000
Specific seismic requirements			YES	YES	YES	YES	YES		
Overall dimensions	Up to U_m 24: max 320 x 550 h 600 mm - up to U_m 36: max 350 x 600 h 700 mm								
Fixing dimensions	Slots interaxis: 200 x 270 mm (see relevant clause)								
Weight (indicative values)	Up to U_m 24: 60 kg - up to U_m 36: 70 kg								
Primary terminal connections	Clamp type								

(*) These values shall be guaranteed at 2700 m above sea level or at $U_m / 86,2 / 209,4$ kV for GSCT004/33 and at $U_m / 46,8 / 117$ kV for GSCT004/34 at 1000 m

(*) *These values shall be guaranteed at 2700 m above sea level or at $U_m / 46,8 / 117$ kV for GSCT004/34 at 1000 m*

Network neutral system: can be isolated, resonant earthed, solidly earthed or earthed by resistance or impedance

Ferroresonance: to prevent ferroresonance phenomena a Voltage Factor of 1,5 x 30 s is prescribed and moreover the induction value shall be $\leq 1,3$ Wb/m² at the rated primary voltage or at the higher one in case of dual voltage.

Dumping resistor for ferroresonance can be additionally requested

Dual Voltage: to be made by a tap on the secondary winding

Notes: - To take into account the influence of special service conditions prescribed in the above reported table correction factors shall apply in accordance to the international standard.

- The manufacturer can make the same component to cover more than one global types taking into account an extended range of frequency, service conditions and terminal clamping.

Subject: Global Infrastructure and Networks – GSCT004 Outdoor Voltage Transformers up to U_m 36 kV

Application Areas

Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Infrastructure & Networks*

7.4 Design and construction requirements

7.4.1. General

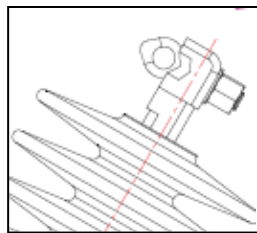
Outdoor Voltage Transformers are generally insulated with cycloaliphatic epoxy resin moulded in one single process under vacuum. The VT shall be provided with proper earth connecting point.

7.4.2. Primary terminals

Primary terminals of the VT shall be made in anticorrosion material and must be suitable for the connection of naked conductors.

Clamp type

Made in anticorrosion material (tinned) with a clamp adapter of bi-metallic anticorrosion material and suitable for conductor of $16 \div 70 \text{ mm}^2$.



7.4.3. Secondary terminals

The secondary terminals shall be realized with M6 screws, suitable for conductors of $2,5 \div 16 \text{ mm}^2$.

7.4.4. Mechanical resistance of terminals

Primary and secondary terminals fixed on the resin shall be designed to withstand the mechanical stresses indicated in the following table:

Thread diameters (M)	Tightening torque (Nm)
6	3,0
10	10,0
12	15,0

7.4.5. Box of the secondary terminals

The terminals box must have a level of protection not lower than IP 44 according to IEC 60529 and it shall be equipped with a cable gland for passage and locking of a cable with outer diameter of 16 mm. Secondary terminals shall be provided with clear and visible identification.

7.4.6. External ferrous material

External ferrous material, if any, shall be galvanized in accordance with relevant international standard.

7.4.7. Rating plate

The nameplate shall include all the indications required by the IEC.

Subject: Global Infrastructure and Networks – GSCT004 Outdoor Voltage Transformers up to U_m 36 kV

Application Areas

Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Infrastructure & Networks*

7.4.8. Primary terminal markings

According to IEC 61869-3.

7.4.9. Secondary terminal markings

According to IEC 61869-3.

7.4.10. Electrical scheme

According to IEC 61869-3.

7.4.11. Cable for the connection of secondary terminals

The VT shall be provided with a cable for the connections of secondary terminals.

This cable shall be included in the supplying and shall have the following characteristics: 2 x 2,5 mm², length 15 m, double insulation level 0,6 - 1 kV, suitable for outdoor installation.

7.4.12. Manual and packaging

For each VT the manual for installation and operation, in the language of the Country to be delivered, shall be provided. It shall also include the procedures to be adopted for storage, transportation and dismantling.

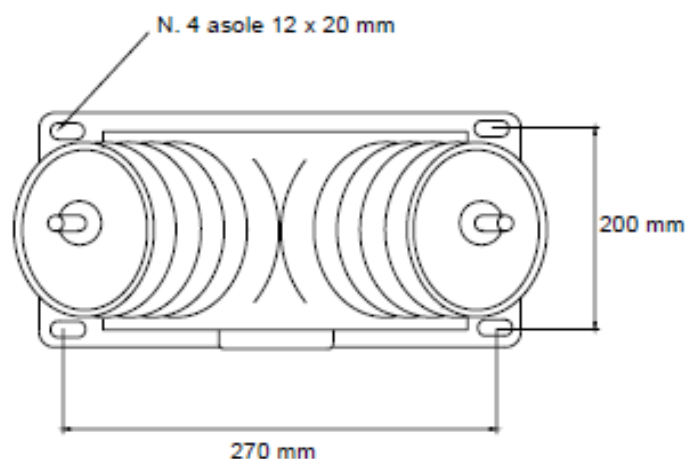
Packing for transportation and storage (which does not take part in the homologation process) shall be compliant to the documents referring of each Country.

The primary terminal bushings shall be protected in a suitable way to protect them from impacts that may damage them.

7.5 Overall dimensions

The overall dimensions are reported in the table with the main characteristics. The fixing dimensions are detailed in the following drawings.

The indicative weights are reported in table of clause 7.3.



Subject: Global Infrastructure and Networks – GSCT004 Outdoor Voltage Transformers up to U_m 36 kV

Application AreasPerimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Infrastructure & Networks*

7.6 List of tests

7.6.1. General

Type, routine and special tests shall be performed in accordance to IEC 61869-1 and IEC 61869-3 with the additional special tests prescribed in the following, if not otherwise stated.

7.6.2. Type tests

7.6.2.1. Verification of the compliance to this technical specification

The characteristics of the components, including ratings and design requirements, shall be in compliance with this technical specification.

The visual inspection shall be performed to verify the absence of imperfections and defects.

7.6.2.2. Temperature rise test

The test shall be performed in accordance with IEC 61869-3 and the prescribed rated power values.

7.6.2.3. Impulse voltage withstand test on primary terminals

The test shall be performed in accordance with IEC 61869-3.

7.6.2.4. Wet test for outdoor type transformers

The test shall be performed in accordance with IEC 61869-3.

7.6.2.5. Test for accuracy

The test shall be performed in accordance with IEC 61869-3.

Moreover a magnetizing current graph shall be measured to determine the B/H graph in order to verify the requirement on the induction value (by referring to design data).

7.6.2.6. Short-circuit withstand capability test

The test shall be performed in accordance with IEC 61869-3.

7.6.2.7. Verification of local seismic requirements

The local seismic requirements indicated in table of clause 7.3 shall be demonstrated with an appropriate calculation in accordance with the local requirements specified in 7.2.3.

7.6.2.8. Mechanical test on terminals

The stresses prescribed in this specification shall be applied without any breaking or deformation on the terminal parts.

7.6.3. Routine tests

7.6.3.1. Visual inspection

The visual inspection shall verify the compliance with this technical specification and the approved prototype and the absence of imperfections and defects.

Subject: Global Infrastructure and Networks – GSCT004 Outdoor Voltage Transformers up to U_m 36 kV

Application AreasPerimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Infrastructure & Networks*

7.6.3.2. Power-frequency voltage withstand tests on primary terminals

The test shall be performed in accordance with IEC 61869-3.

7.6.3.3. Partial discharge measurement

The test shall be performed in accordance with IEC 61869-3.

7.6.3.4. Power-frequency voltage withstand tests between sections

The test shall be performed in accordance with IEC 61869-3.

7.6.3.5. Power-frequency voltage withstand tests on secondary terminals

The test shall be performed in accordance with IEC 61869-3.

7.6.3.6. Test for accuracy

The test shall be performed in accordance with IEC 61869-3.

The error at F_v 1,5 shall be checked on each voltage transformer.

7.6.3.7. Verification of markings

The test shall be performed in accordance with IEC 61869-3.

7.6.3.8. Verification of the coating of the external ferrous material

The coating of external ferrous material, if any, shall be verified in accordance with relevant international standard.

7.6.4. Special tests**7.6.4.1. Fire test**

The test shall be performed in compliance to IEC 60660 on a sample to verify the self-extinguishing of the solid insulating material.

Test according to the previous version of this Specification will be considered.

7.6.4.2. Accelerated environmental - electric ageing test

The test shall be conducted on VT prototypes according to the standard IEC 61109, with the following indications.

A first prototype of VT shall be arranged with the primary circuit energized for a period of 1000 h and with range of ambient air temperature +20°C +50°C according the following cycle diagram:

Subject: Global Infrastructure and Networks – GSCT004 Outdoor Voltage Transformers up to U_m 36 kV

Application Areas

Perimeter: *Global*

Staff Function: -

Service Function: -

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Humidification																							
Heating 50°C																							
Demineralized rain																							
Salt fog: 7 kg/m3																							
Solar radiation simulation																							
Voltage: $U_m / \sqrt{3}$ kV																							
	2	4	6	8	10	12	14	16	18	20	22	24	Time										

The test is successfully if no discharge occurs during test and the VT is able to withstand a power frequency voltage on primary terminals at a value of 80% of the rated power frequency voltage.

A second VT prototype shall be arranged without energization, for a period of 500 h, at the range of ambient air temperature $-30^{\circ}\text{C} + 50^{\circ}\text{C}$ according to the following cycle diagram:

Temperature $-30^{\circ}\text{C} + 50^{\circ}\text{C}$																							
Time (Hour)	6	12	18	24																			

The test is successful if not evident external damages are visible and the VT is able to withstand a power frequency voltage test on primary terminals at a value of 80% of the rated power frequency voltage.

Test according to the previous version of this Specification will be considered.

7.7 Documentation

The documentation for the approval of the prototypes shall be arranged in accordance with the specific procedure for the TCA - Technical Conformity Assessment.

For delivering generally the VT shall be supplied with the following documentation:

- Drawings of the VT with overall dimensions, primary and secondary terminals arrangement
- Rating plate
- Tests report
- Declaration of conformity to this technical specification and IEC 61869-1 and IEC 61869-3
- Manual for installation and operation with clear indication for the secondary terminals connections, particularly in case of dual ratio



Technical Specification code: MAT-E&C-NC-2021-0046-EGIN

Version no. 3 dated 05/07/2021

Subject: Global Infrastructure and Networks – GSCT004 Outdoor Voltage Transformers up to U_m 36 kV

Application Areas

Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Infrastructure & Networks*

8 ANNEXES

8.1 Check list for tender

Example of check list to be used for tender

Subject: Global Infrastructure and Networks – GSCT004 Outdoor Voltage Transformers up to U_m 36 kV

Application Areas

 Perimeter: *Global*

Staff Function: -

Service Function: -

 Business Line: *Infrastructure & Networks*

Global Standard:		To be filled by the Supplier
GSCT004		
Enel Type:	CSCT004/31	Supplier code:
Enel Code:	T530132	.....
Enel Company:	.....	Supplier Name:
Country:	Brazil	.....
Description	Required value	Offered value:
Type of installation	Outdoor	.....
Insulation type and constructive solution	Cycloaliphatic epoxy resin moulded in one single process under vacuum or other equivalent solutions	.....
Rated Primary Voltage (kV)	13,8-11,4	.....
Rated Secondary Voltage (kV)	0,11	.....
Insulation level $U_m/AC/LI$ (kV)	17,5/38/95	.....
Rated Frequency (Hz)	60	.....
Rated power / Accuracy class	250VA/3	.....
Thermal limiting output (VA)	450	.....
Induction value for higher primary voltage	$\leq 1,3 \text{ Wb/m}^2$	.....
Rated Voltage Factor	1,2 continuous and 1,5 x 30 s	.....
Degree of protection	IP44 - IEC 60529	.....
Pollution IEC/TS 60815 SPC Class	e (very h.)	.....
RUSCD (mm/kV)	53,7	.....
Relative humidity	98%	.....
Ambient air temperature (°C)	-10/50	.....
Altitude a.s.l. (m)	1000	.....
Specific seismic requirements	NO	.....
Overall dimensions	Max 320 x 550 h x 600 mm	.....
Fixing dimensions	200 x 270 mm	.....
Max weight (indicative values)	60 kg	.....
Primary terminal connections	Clamp type according to GSCT004 p. 6.2	.....
Documentation		.....
Drawing with overall dimensions, primary and secondary terminals arrangement and fixing dimensions (ref. GSCT004 p. 9)	to be attached	.....
Drawing of rating plate and electrical scheme	to be attached	.....
List of deviations to technical specifications	No / List attached	.....