

Subject: E&C – GSCT015 – HV CAPACITOR VOLTAGE TRANSFORMERS (CP)

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 HV Capacitor Voltage Transformers of the Enel Group Distribution Companies, listed below:

Country	Distribution Company
Argentina (AR)	Edesur
Brazil (BR)	Enel Distribuição Rio Enel Distribuição Ceará Enel Distribuição São Paulo
Colombia (CO)	Enel Colombia
Italy (IT)	e-distribuzione
Peru (PE)	Enel Distribución Perú
Romania (RO)	Enel Distributie Banat Enel Distributie Dobrogea Enel Distributie Muntenia
Spain (ES)	e-distribución

Table 1CP
1.1 RELATED DOCUMENTS TO BE IMPLEMENTED AT COUNTRY LEVEL

Additional prescriptions or integration to the main **Common Part (CP)** are reported in the respective **Local Sections** with the same corresponding clause or sub-clause number, providing the specific requirements of each Enel Group Distribution Company at country level.

Please, note that in case of unclear information or contradictions, the Local Section prevails over the Common Part.

Anyway, each Enel Grids Company can issue, under the supervision of Enel Grids Global Network Components a detailed document, according to the provisions of the present document and in case of specific needs.

2 DOCUMENT VERSION MANAGEMENT

Version	Date	Main changes description
01	30/06/2023	Issuing of Global E&C – GSCT015 – HV CAPACITOR VOLTAGE TRANSFORMERS

3 UNITS IN CHARGE OF THE DOCUMENT

Responsible for drawing up the document:

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- Enel Grids: Engineering & Construction/Network Components Unit

Responsible for authorizing the document:

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

4 REFERENCES

- *Integrated Policy for Quality, Health and Safety, Environment, Anti-Bribery, and Information Security.*
- *Stop Work Policy.*
- *GSCG002 - TECHNICAL CONFORMITY ASSESSMENT (Enel's Global Standard).*

Group Pillar 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).*

4.1 ENEL GRIDS INTERNATIONAL LAWS

Here below is reported the list of applicable reference laws applicable for European countries:

- *Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC and amending Regulation (EC) No 1907/2006.*
- *Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control).*
- *Commission Directive 98/98/EC, of 15 December 1998 adapting to technical progress for the 25th time Council Directive 67/548/EEC on the approximation of the laws, regulations and administrative provisions relating to the classification, packaging, and labelling of dangerous substances.*
- *Directive 2008/98/EC of the European Parliament and of the council of 19 November 2008 on waste and repealing certain Directives.*
- *Council Directive 1999/13/EC, of 11 March 1999, on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations.*
- *CE Marking (Directive 2006/42/EC)*

4.2 ENEL GRIDS COUNTRY REFERENCE LAWS

3.2.1. Argentina

- *Ley 19587: - Higiene y seguridad en el trabajo.*
- *Law No. 19587, on Hygiene and Safety at Work and its Regulatory Decree 351/79.*
- *Ley 24051: - Residuos peligrosos*

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3.2.2. Brazil

- *NR-10 – Segurança em instalações e serviços em eletricidade.*
- *RESOLUÇÃO ANP Nº 900, DE 18 DE NOVEMBRO DE 2022 - DOU DE 23-11-2022.*
- *RESOLUÇÃO ANP Nº 834, DE 26 DE NOVEMBRO DE 2020*

3.2.3. Colombia

- *RETIE – Reglamento Técnico de Instalaciones Eléctricas.*
- *Ley 400 de 1997 (Modificada Ley 1229 de 2008).*
- *Decreto 926 del 19 de marzo de 2010.*
- *NSR – 10 (Reglamento Colombiano De Construcción Sismo Resistente).*

3.2.4. Italy

- *“D.lgs. n. 81 of the 9 of April 2008 -Testo unico in materia di sicurezza sul lavoro” and subsequent modifications.*
- *Nota Operativa PVR001 – Rev. 2 – Ott. 2012 - Gestione Garanzie dei materiali di ENEL Distribuzione.*
- *GUI 101 “Caratteristiche generali e prescrizioni di impiego del pallet in legno da utilizzare per imballo di trasporto”.*
- *D.lgs. n. 52/1997 n. 52 - Classificazione, imballaggio ed etichettatura delle sostanze pericolose*
- *D.lgs. n. 209/1999 “Attuazione della direttiva 96/59/CE relativa allo smaltimento dei policlorodifenili e dei policlorotrifenili”*
- *D.M. 11/10/2001 “Condizioni per l'utilizzo dei trasformatori contenenti PCB in attesa della decontaminazione o dello smaltimento”.*
- *D.M. 28/04/1997 “Attuazione dell'art. 37, commi 1 e 2, del decreto legislativo 3 febbraio 1997, n. 52, concernente classificazione, imballaggio ed etichettatura delle sostanze pericolose”.*
- *Direttiva 98/98/CE recante venticinquesimo adeguamento al progresso tecnico della direttiva 67/548/CEE del Consiglio concernente il ravvicinamento delle disposizioni legislative, regolamentari ed amministrative relative alla classificazione, all'imballaggio e all'etichettatura delle sostanze pericolose.*
- *“Decreto legislativo 3 dicembre 2010, n. 205 recante Disposizioni di attuazione della direttiva 2008/98/CE del Parlamento europeo e del Consiglio del 19 novembre 2008 relativa ai rifiuti” and subsequent modifications/integrations.*

3.2.5. Peru
3.2.6. Romania

- *Prescriptia Energetica PE 101/85 – Normativ pentru construcția instalațiilor electrice de conexiuni și transformare cu tensiuni peste 1 kV.*
- *GUI 101RO "Caracteristicile generale și cerințele de utilizare ale paletului de lemn care urmează să fie utilizat pentru ambalarea de transport.*
- *L 319/2006 – Occupational health and safety act, as amended and supplemented.*

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- *L 265/2006 - Environmental Protection Act, as amended and supplemented.*

3.2.7. Spain

- *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;*
- *R.D. 337/2014, de 9 de mayo, por el que se aprueban el Reglamento sobre condiciones técnicas y garantías de seguridad en instalaciones eléctricas de alta tensión y sus Instrucciones Técnicas Complementarias ITC-RAT 01 a 23.*
- *Real Decreto 679/2006, de 2 de junio, que regula la gestión de los aceites industriales usados - SIGAUS: Sistema Integrado de Gestión (SIG) de Aceites Usados (AUS), que garantiza la recogida y correcto tratamiento del aceite industrial usado de toda España.*

4.3 ENEL GRIDS INTERNATIONAL REFERENCE STANDARDS

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

IEC 61869-1	Instrument transformers - Part 1: General Requirements
IEC 61869-5:	Instrument transformers - Part 5: Additional Requirement for Capacitor Voltage Transformers
IEC 60270	High-voltage test techniques – Partial Discharge Measurements
IEC 60068-3-3	Environmental testing - Part 3-3: Supporting documentation and guidance - Seismic test methods for equipment.
IEC 60071-1	Insulation co-ordination – Part 1: Definitions, principles, and rules
IEC 60071-2	Insulation co-ordination - Part 2: Application guidelines
IEC 60507	Artificial pollution tests on high-voltage ceramic and glass insulators to be used on A.C. systems.
IEC 60695-2-10	Fire hazard testing - Part 2-10: Glowing/hot-wire based test methods - Glow-wire apparatus and common test procedure.
IEC 62155	Hollow pressurized and unpressurized ceramic and glass insulators for use in electrical equipment with rated voltages greater than 1 000 V
IEC 60137	Insulated bushings for alternating voltages above 1000 V
IEC 61462	Composite hollow insulators - Pressurized and unpressurized insulators for use in electrical equipment with rated voltage greater than 1 000 V - Definitions, test methods, acceptance criteria and design recommendations
IEC 60529	Degrees of protection provided by enclosures (IP Code)
IEC 60815	Guide for the selection and dimensioning of high-voltage insulators for polluted conditions
IEC 60296	Fluids for electrotechnical applications - Unused mineral insulating oils for transformers and switchgear.
IEC 62770	Fluids for electrotechnical applications - Unused natural esters for transformers and similar electrical equipment.
IEC 61099	Insulating liquids - Specifications for unused synthetic organic esters for electrical purposes

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IEC 60422	Mineral insulating oils in electrical equipment - Supervision and maintenance guidance
IEC 60599	Mineral oil impregnated in electrical equipment in service - Guide to the interpretation of dissolved and free gases analysis.
IEC 61198	Mineral insulating oils - Methods for the determination of 2-furfural and related compounds.
IEC 60666	Detection and determination of specified additives in mineral insulating oils.
IEC 62535	Insulating liquids - Test method for detection of potentially corrosive sulphur in used and unused insulating oil.
IEC 60721-2-1	Classification of environmental conditions - Part 2-1: Environmental conditions appearing in nature - Temperature and humidity.
---o---	
ISO 12944 series	Paints and varnishes - Corrosion protection of steel structures by protective paint systems.
ISO 19840	Paints and varnishes - Corrosion protection of steel structures by protective paint systems - Measurement of, and acceptance criteria for, the thickness of dry films on rough surfaces.
ISO 8501	Preparation of steel substrates before application of paints and related products - Visual assessment of surface cleanliness.
ISO 2178	Non-magnetic coatings on magnetic substrates - Measurement of coating thickness - Magnetic method.
ISO 14713 -1&2	Zinc coatings - Guidelines and recommendations for the protection against corrosion of iron and steel in structures -
ISO 1461	Hot dip galvanized coatings on fabricated iron and steel articles. Specifications and test methods.
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.
ISO 27001	Information Security Management System – Requirements.
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

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ASTM A123	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM 1275-15	Standard Test Method for Corrosive Sulphur in Electrical Insulating Liquids
---0---	
EN 60068-3-3	Environmental testing - Part 3: Guidance - Seismic test methods for equipment.
---0---	
IEEE Std. C57.13	Standard Requirements for Instrument Transformers
IEEE Std. 693	Recommended Practice for Seismic Design of Substations

When the date of issue is not mentioned in the list above, the date to be taken as reference is that of the standard in force when the present document has been issued.

4.4 ENEL GRIDS COUNTRY REFERENCE STANDARDS AND OTHER RELEVANT DOCUMENTS

3.4.1. Argentina

The equipment and/or materials will therefore be designed to operate in a tropical climate and where the atmosphere has medium level contamination, according to table I of the IRAM 2405 and IEC 60815 standards.

- IRAM 2289 Cables agrupados en haces.
- IRAM 2405 Aisladores para uso en condiciones de contaminación ambiental.
- IRAM 5106 Arandelas de presión comunes.
- IRAM 5107 Arandelas planas redondas.
- IRAM 5139 Tuercas hexagonales con rosca métrica ISO.
- IRAM 5305 Tornillos de cabeza hexagonal totalmente roscados.
- IRAM 9590 Carretes de madera para cables.
- IRAM-DEF D 1054 Carta de colores para pinturas de acabado brillante y mate

3.4.2. Brazil

- ABNT NBR 5426. Planos de amostragem e procedimentos na inspeção por atributos.
- ABNT NBR 6855. Transformador de potencial indutivo - especificação e ensaios.
- ABNT NBR 7397. Produto de aço e ferro fundido galvanizado por imersão a quente - determinação da massa do revestimento por unidade de área - método de ensaio.
- ABNT NBR 7398. Produto de aço ou ferro fundido galvanizado por imersão a quente - verificação da aderência do revestimento - método de ensaio.
- ABNT NBR 7399. Produto de aço ou ferro fundido galvanizado por imersão a quente - verificação da espessura do revestimento por processo não destrutivo – método de ensaio.

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- ABNT NBR 7400. Galvanização de produtos de aço ou ferro fundido por imersão a quente - verificação da uniformidade do revestimento - método de ensaio.
- ABNT NBR 10576. Óleo mineral isolante de equipamentos elétricos - diretrizes para supervisão e manutenção.
- ABNT NBR 11003. Tintas – Determinação da aderência.
- ABNT NBR 11388. Sistemas de pintura para equipamentos e instalações de subestações elétricas.
- ABNT NBR 13882. Líquidos isolantes elétricos - determinação do teor de bifenilas policloradas (PCB).
- ABNT NBR 15218. Critérios para qualificação e certificação de inspetores de pintura industrial.
- ABNT NBR 15422. Óleo vegetal isolante para equipamentos elétricos.
- ABNT NBR IEC 60270: Técnicas de ensaios elétricos de alta-tensão - Medição de descargas parciais.
- ABNT NBR IEC 60529. Graus de proteção providos por invólucros (códigos IP).
- ABNT NBR IEC 62271-1. Manobra e comando de alta tensão – Parte 1: Especificações comuns para equipamentos de manobra e comando em corrente alternada.
- Fornecimento de Energia Elétrica – Tensão de Subtransmissão 88/138 kV, da ELETROPAULO.
- Especificação Técnica EST-027 – Código de Barras para Equipamentos de Medição, da ELETROPAULO.
- TES-EM-002 – TC e TP – Distância de Segurança.

3.4.3. Colombia

- Resolución CREG038 de 2014: Código de Medida.
- Reglamento Colombiano de Construcción Sismo Resistente (NSR-10. Norma Sismo Resistente).

3.4.4. Italia
3.4.5. Peru
3.4.6. Romania

The capacitor voltage transformers shall comply with the provisions of the "Official list of measuring instruments subject to mandatory state metrological control" approved by the Order of the Romanian Bureau of Legal Metrology in force and will have the model approval obtained from BRML.

Since capacitor voltage transformers are an integral part of a measurement group classified according to art. 7 of the Electricity Measurement Code, the accuracy class of the measurement windings shall comply with the specific provisions.

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3.4.7. Spain

- UNE 23727. Ensayos de reacción al fuego de los materiales de construcción. Clasificación de los materiales utilizados en la construcción.
- UNE-EN 60085. Aislamiento eléctrico. Evaluación y designación térmica.
- UNE-EN 60505. Evaluación y calificación de los sistemas de aislamiento eléctrico.

Note:

For items not covered by the above-mentioned standards and technical specification, the SUPPLIER may adopt other standards provided that these documents be indicated explicitly in the proposal, which shall be submitted for approval to the purchaser.

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

6 DEFINITIONS AND ACRONYMS

Acronym and Key Words	Description
IEC	International Electrotechnical Commission.
ISO	International Organization for Standardization.
IEEE	Institute of Electrical and Electronics Engineers.
ASTM	American Society for Testing and Materials.
AQL	Acceptable Quality Limit.
IP	Ingress Protection.
IRAM	Argentinian technical standard and certification institute.
ABNT	Brazilian technical standard association.
NBR	Brazilian standard.
SIS	Swedish institute for standards.
NTE	Technical local standard of DSO: AES ELETROPAULO.
List of Components	List of devices intended to provide an easy component selection of technicians.
Datasheets	Document containing the data of a specific component of the standard.
Check List	A form, associated to the datasheet for these components, to be filled out by the manufacturer as a Technical Offer or specific Supplier-Datasheet.
Capacitor Voltage Transformer (CVT)	Voltage transformer comprising a capacitor divider unit and an electromagnetic unit so designed and interconnected that the secondary voltage of the electromagnetic unit is substantially proportional to the primary voltage, and differs in phase from it by an angle which is approximately zero for an appropriate direction of the connections.



Material Specification code: GRI-GRI-MAT-E&C-0049

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Acronym and Key Words	Description
Rated Primary Voltage	Value of the primary voltage on which the performance of the transformer is based.
Rated Secondary Voltage	Value of the secondary voltage on which the performance of the transformer is based.



Material Specification code: GRI-GRI-MAT-E&C-0049

Version no. 01 dated 30/06/2023

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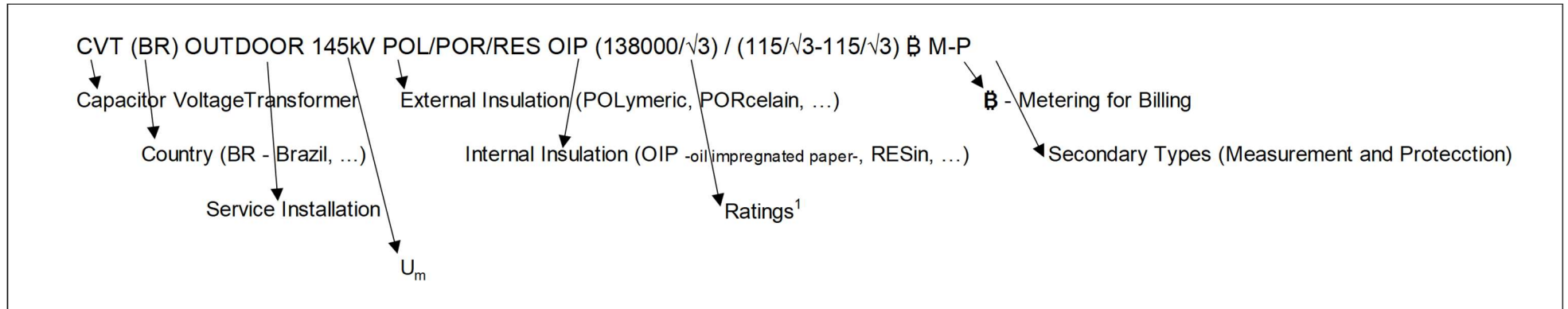
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Short description adopted for this technical specification (Datasheets & Check List):



¹ Ratings Symbology

/ Indicates the rated current ratios

| Indicates the fact that there are several primary currents by changing secondary turns.

: Indicates the rated current ratio (for CO, BR)

- Indicates current ratios achieved by changing primary turns -series, parallel, both-

x To join cores with the same rating or several primary currents by changing primary turns -series, parallel, both-

& To join different cores

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7 DESCRIPTION (COMMON PART – (CP))

This Common Part (CP) compiles the main common technical characteristics that apply to the components under this technical specification.

This standard is structured as follows:

- The “Common Part” with the common requirements for all the Enel Group Distribution Companies.
- The “List of Components” (Annex A) with the Type Code/GS Code for each transformer of the Enel Group Distribution Companies. The “List of Components” corresponding to each Local Section may be revised without revision of this Standard.”
- The “Datasheets” (information at Annex B) with the main ratings and requirements of each transformer type. Datasheets for the required transformers are attached to the Local Sections.
- The “Local Sections” with the specific requirements of each Enel Group Distribution Company for every country.

7.1 DOCUMENT/SECTION SCOPE

The scope of this section/part is to define the Common Part to provide the technical standard requirements for the Capacitor Voltage Transformers of ENEL GRIDS.

7.2 LIST OF COMPONENTS

For the List of Components, please refer to ANNEX A

7.3 SERVICE CONDITIONS

Unless otherwise specified the normal service conditions defined in IEC 61869-1 apply with the exceptions indicated in the following *Table 3CP*.

The Humidity level shall follow the Standard IEC 60721-2-1.

Country / DSO	Max Altitude (m)	Pollution level (IEC 60815)	RUSCD (mm/kV)	Seismic Req ⁽¹⁾ (g)	Network Frequency (Hz)	Ambient Temp. (Min/Max) (°C)	Corrosivity (ISO 12944)
Argentina	-	Medium	34,7	-	50	-10 / +40	C3
Brazil/Ceará	-	Very Heavy	53,7	-	60	0 / +40	C5
Brazil/Rio	-	Very Heavy	53,7	-	60	0 / +40	C5
Brazil/São Paulo	-	Medium	34,7	-	60	0 / +40	C3
Colombia	2650 ⁽²⁾	Medium	34,7	0,5	60	-10 / +40	C3
Italy	-	Heavy	43,3	0,5	50	-25 / +40	C4
Peru	-	Very Heavy	53,7	0,5	60	0 / +40	C5
Romania	-	Heavy	43,3	0,5	50	-30 / +40	C4
Spain	-	Heavy Very Heavy ⁽³⁾	43,3 53,7 ⁽³⁾	-	50	-25 / +40	C4 C5 ⁽³⁾

Table 2CP

Note:

⁽¹⁾ Indications of the specific seismic qualification are given in local sections.

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(2) The creepage distance of the instrumentation transformers specified for Enel Colombia will have a correction factor according to IEC 60137 (k_a), taking 1000 meters above sea level (m.a.s.l.) as a reference.

(3) Balearic and Canary Islands.

7.4 TECHNICAL CHARACTERISTICS

For definitions see IEC-61698-1 and IEC-61698-5 or IEEE Std. C57.13 whenever required in Local Sections.

6.4.1. Type of Capacitor Voltage Transformers

This document is applicable for single-phase capacitor voltage transformers connected between line and ground for system voltages $U_m \geq 72,5$ kV at power frequencies from 15 Hz to 100 Hz. They are intended to supply a low voltage for measurement, control and protective functions

See Datasheets.

6.4.2. Number of Cores and Windings

See Datasheets.

6.4.3. Rated Insulation Levels

See Datasheets.

6.4.4. Rated Output

See Datasheets.

6.4.5. Rated Accuracy Class CVT

See Datasheets.

6.4.6. Rated Primary Voltage U_{Pr}

See Datasheets.

6.4.7. Rated Secondary Voltage U_{Sr}

See Datasheets.

6.4.8. Rated Voltage Factor F_V

See Datasheets.

6.4.9. Rated Capacitance of a Capacitor C_r

See Datasheets.

6.4.10. High Voltage Capacitor C_1

See Datasheets.

6.4.11. Intermediate Voltage Capacitor C_2

See Datasheets.

6.4.12. Static Withstand Load (F_R)

See Datasheets.

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6.4.13. Installation

See Datasheets.

6.4.14. Temperature Rise

See IEC-61698-1 and IEC-61698-5 or IEEE Std. C57.13 whenever required in Local Sections.

6.4.15. Seismic Qualification

See Local Sections.

6.4.16. Ferro-resonance

See Local Sections.

6.4.17. Requirements For Transient Response

See Local Sections.

6.4.18. Short Circuit Withstand Capability and Secondary Current

See Local Sections.

6.4.19. Drain Coil's Technical Parameters

See Local Sections.

7.5 CONSTRUCTION CHARACTERISTICS.

The active part of the instrumentation transformers shall be placed in the metal bodies.

For further design details see Local Sections.

6.5.1. Internal Insulation

The internal insulating medium of the HV voltage transformers shall be in liquid and paper or proper resin material for transformers for outdoor installation. Other types of insulation shall be subject to ENEL approval.

Liquid-insulated equipment shall be provided with a metal liquid expansion chamber with metal bellows, in order to absorb thermal contractions and expansions of the liquid.

The insulating liquid used shall be mineral oil naphthenic-based, without inhibitors or additives, free of PCBs and shall comply with the requirements of the IEC-60296 Standard. Absence of corrosive sulfur shall be verified according to ASTM 1275 and IEC 62535.

Alternatively insulating liquids, as natural and synthetic ester, can be specified, according to IEC 62770 or IEC 61099. In such a case, it is possible to reference to IEC 60076-14. Any part of the transformer which is in contact with the insulating liquid shall be compatible with it.

The solid insulation material used shall comply to class "A" of IEC 60085 or higher. The evaluation of the material should be carried out in accordance with the IEC 60641-2.

Further specific requirements are requested in Local Sections.

6.5.2. External Insulation

The external materials for the bushings of the Instruments Transformers shall be porcelain or composite material.

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Composite insulators shall be made of light grey inorganic composite material, with HTV (High Temperature Vulcanization) or LSR (Liquid Silicone Rubber) silicone rubber, without EPDM or other organic rubber, in accordance with IEC 61462 for mechanical testing and IEC 61109 for dielectric testing and electrical-environmental accelerated ageing test.

Other types of insulation will be subject to ENEL approval.

The creepage distance of the bushings shall be in accordance with the level of pollution requested by ENEL.

For further details see Local Sections.

6.5.3. Overall Dimensions and Layouts

See Local Sections.

6.5.4. Metal Surface Treatment

The non-energized metallic surfaces of the Instruments Transformers shall be made of painted iron, hot dip galvanized steel, stainless steel or aluminum.

The external painting of transformers and metallic components made of iron materials, shall use paints and varnishes according to ISO 12944 (standardized paint systems) or powder coating (guaranteed equivalent corrosivity and durability).

For different pollution levels please follow the next table:

Pollution Levels	Corrosivity	Durability	Painting Category
Medium	C3	Medium	C3M
Heavy	C4	Medium-High	C4M or C3H
Very Heavy	C5	Medium- High	C5M or C4H

Table 3CP

The thicknesses of galvanized surface shall comply with the provisions of the respective standards (very high contamination) for different sheet thicknesses and environmental conditions.

All painted surfaces shall be prepared by manufacturer with a suitable sandblasting or chemical cleaning (degreasing) treatments, specific for the painting cycle adopted. The effectiveness of surface preparation work shall be assessed using standards from series ISO 8501: "Preparation of steel substrates before application of paints and related products – Visual assessment of surface cleanliness ".

The paint shall be free of lead oxides or chromates. The safety and technical data sheets of the painting shall be provided by the Manufacturer.

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The color to be used is prescribed in Local Section.

The Coating System/Painting cycle shall be:

- Totally defined in terms of products, typologies, and processes.
- Certified with the reference to tests carried out by independent laboratories, in compliance to ISO 12944, with a clear indication of Corrosivity and Durability levels.

6.5.5. Accessories

See Local Sections for details.

6.5.5.1. Primary Outer Terminals

See Local Sections.

Terminals shall have clearly distinguishable polarity markings.

6.5.5.2. Secondary Terminals

Secondary Terminals (secondary terminal boxes) should be preferably equipped with overvoltage protection devices proposed by the manufacturers, in order to abate the electrocution risks for operators. Enel reserves the right to evaluate the feasibility and suitability of solutions proposed.

Terminals should have clearly distinguishable polarity markings.

See Local Sections.

6.5.5.3. Grounding Terminals

The manufacturer shall supply terminals to connect the CVTs to the substation ground system. For further details see Local Sections.

6.5.5.4. CVT Support Base

See Local Sections.

6.5.5.5. Secondary Terminals Box

See Local Sections.

6.5.5.6. Liquid Level Gauge

See Local Sections.

6.5.5.7. Overpressure Relief Device

See Local Sections.

6.5.5.8. Liquid Sampling Device

See Local Sections.

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6.5.5.9. Lifting Lugs

Placed to facilitate lifting of CVT.

6.5.5.10. Rating Plate

A stainless-steel rating plate in local language shall be included.

This plate shall follow the IEC 61869 Standards, a plate with the connection diagram of the windings shall also be included.

The rating plate with indelible indication shall have also the following information (located on the L.V. side of the tank):

- ENEL code
- Weight (kg), brand and type of insulating liquid

The rating plate on each voltage transformer shall be in local languages of the country of destination of the voltage transformer.

The rating plates shall be resistant to atmospheric conditions and made of waterproof material.

The connection diagram shall be indelibly printed.

Likewise, the rating plate shall support the service conditions indicated in the section and will be printed with the name of ENEL.

For further details see Local Sections.

6.5.5.11. Terminal Markings

See local sections.

6.5.5.12. Capacitive Tap

See local sections.

6.5.5.13. Capacitor Voltage Divider

See local sections.

6.5.5.14. Electromagnetic Unit

See local sections.

6.5.5.15. Carrier-Frequency Accessories & High Frequency Signals Characteristics

See Local Sections.

7.6 TESTING

6.6.1. Type Test

Required tests are indicated in section 7 of IEC 61869-1 and IEC 61869-5.

They are those that shall be carried out only once in the product approval process and which are listed in *Table 4CP* below:

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TYPE TESTS	Subclause IEC 61869-1 IEC 61869-5
Temperature rise test	7.2.2
Chopped Impulse Test	7.4.1
Impulse voltage withstand test on primary terminals	7.2.3
Wet test for outdoor type transformers	7.2.4
Electromagnetic compatibility test	7.2.5
Test for accuracy	7.2.6
Verification test of the degree of protection of the enclosures	7.2.7
Enclosure tightness test at ambient temperature	7.2.8
Short-circuit withstand capability test	7.2.502
Ferro-resonance test	7.2.503
Transient response test (for protective capacitive transformers)	7.2.504
Type tests for carrier frequency accessories	7.2.505

Table 4CP

In addition to the above tests, a compliance check to the specification requirements shall be done.

For further details see Local Sections.

6.6.2. Routine/Acceptance test

Required tests are indicated in section 7 of IEC 61869-1 and IEC 61869-5.

The routine tests shall be performed on each voltage transformer, and they are listed in the below (*Table 5CP*):

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Staff Function: -

Service Function: -

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ROUTINE TESTS	Subclause IEC 61869-1 IEC 61869-5
Power-frequency voltage withstand tests on primary terminals	7.3.1
Partial discharge measurement	7.3.2
Power-frequency voltage withstand tests between sections	7.3.3
Power-frequency voltage withstand test on secondary terminals	7.3.4
Test for accuracy	7.3.5
Verification of markings	7.3.6
Capacitance and tan δ measurement at power frequency	7.2.501
Enclosure tightness test at ambient temperature	7.3.7.2
Ferro-resonance check	7.3.501
Routine tests for carrier frequency accessories	7.3.502
Visual and Dimensional checks (including VT base support)	-
Painting check	-

Table 5CP

In addition to the above tests the checking of the correspondence with the approved prototype shall be done.

For further details see Local Sections.

6.6.3. Special test

Required tests are indicated in section 7 of IEC 61869-1 and IEC 61869-3.

These tests shall be exceptionally required in the product approval process, and they are listed in *Table 6CP*, below:

SPECIAL TESTS	Subclause IEC 61869-1 IEC 61869-5
Transmitted overvoltage test	7.4.4
Mechanical tests	7.4.5
Corrosion test	7.4.9
Fire hazard test	7.4.10
Determination of the temperature coefficient (TC)	7.4.501
Tightness design test of capacitor units	7.4.502

Table 6CP

For further details see Local Sections.

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6.6.4. Sample Tests

In order to monitor the required adequacy of the production series, the manufacturer should define, execute and document the sample test program according to the production quantities (e.g., every 300 units of the same type defined by the same type test reports).

Generally, the recommended sample test is the lightning impulse test on the primary terminals and some other tests are listed in *Table 7CP*, below:

SAMPLE TESTS	Subclause IEC 61869-1
Lightning impulse test on the primary terminals	Annex D

Table 7CP

7.7 CONDITIONS OF SUPPLY

6.7.1. Warranty

The technical guarantee will be five (5) years, counted from the date of delivery to Enel's warehouses.

The expenses involved in any failure that occurs in the Instrument Transformer, due to manufacturing defects, will be fully covered by the manufacturer. At the end of this period of guarantee, there it shall not be rust on more than 1% of the entire painted surface; this compares to a rusting level not above the Ri3 (see ISO 4628-3).

6.7.2. Reception Control

The protocols of the acceptance tests indicated in section 7.6.2 will be delivered with each lot.

6.7.3. Technical Information Required

The technical data sheets are reproducible and shall be properly and completely filled out, signed, stamped, and included for the offer, as well as to keep a proper description of the specific device of every supplier for the TCA process.

The drawings and diagrams of the equipment described in this document will be provided in PDF, AutoCAD and IFC formats, for their subsequent implementation in BIM modeling.

- Guaranteed technical data of the equipment and its components, describing its characteristics, dimensions, performance, and technical operating parameters, in Excel and pdf format.
- Convenient scale plans, plan, elevation, and perspective of the equipment.

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- Descriptive memory of the equipment, construction details, materials used, form of installation, maintenance, possibility of replacement of different components and other specifications.
- Good resolution photographic record of the equipment.
- Additional information that you consider provides an explanation for your design (drawings, details, operating characteristics, dimensions, and weights of the equipment offered).
- Updated original catalog of the equipment offered.

6.7.4. Packaging and Transport

According to IEC 61869-1, Annex B.

The packaging for the transport of the measuring instruments shall be carried out in a manner suitable for the type of product and the type of transport according to the manufacturer's instructions.

For further details see Local Sections.

It is essential that the transportation, storage, and installation of Instruments Transformers, as well as their operation and maintenance in service, be carried out in accordance with the instructions given by the manufacturer.

Consequently, the manufacturer shall provide timely instructions for the transportation, storage, installation, operation, and maintenance of instrument transformers.

The supplier will carry out the appropriate packaging of the transformers to ensure their protection during transport by sea, land, or air.

In the packaging, filling material will be used to ensure good protection in case the boxes containing the materials suffer blows or damage during the loading and unloading maneuvers.

To protect the materials from moisture, airtight covers or bags containing hygroscopic material should be used.

Each drawer shall have the following information printed:

- Type of material and quantity
- Net and gross weight
- Date

The supplier will be responsible for transporting the transformers to ENEL's warehouses, unless otherwise indicated in the purchase order.

6.7.5. Installation, Operation, Maintenance and Disassembling

According to IEC 61869-1, Annex B.

For each type of Instruments Transformer, the installation instructions provided by the manufacturer shall include at least the items listed below:

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- Information required for safe unpacking and lifting
- Assembly diagram and marking of the parts
- Instructions for the assembly of measuring transformers, auxiliary and operating devices
- Instructions for connecting conductors, auxiliary circuits, liquid systems, grounding connections and the manufacturer's recommendation of the type of cable to be connected to the secondary terminals
- Provide instructions for inspection and tests to be performed after the instrument transformer has been installed and all connections have been completed.
- Instruction for disassembling

6.7.6. Technical Conformity Assessment (TCA)

Technical compliance is issued by Enel and shall be supported by carrying out all the, Type, Routine tests and some Special tests indicated for each type of instrument transformer.

Type tests and some Special tests are performed once, during the TCA process.

The Enel's Global Standard: GSCG002 - TECHNICAL CONFORMITY ASSESSMENT shall manage the TCA for such components. The detailed documents to be presented for the TCA Dossier and the process to be followed is indicated in the procedure document issued by Enel.



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ANNEX A – LIST OF COMPONENTS (ENEL CODES)

GS CODE	Country Code	COUNTRY	Highest Voltage (Um) [kV]	Power Frequency Voltage primary winding (AC) [kV]	Lightning Impulse (LI) [kV]	Rated Frequency [Hz]	Rated primary voltage (UPr) [V]	Rated secondary voltage (USr) [V]	Rated voltage ratio (Kv = Upr / Usr)	Metering for Billing (€)	Secondaries Features
GSCT015/001	531944	BRAZIL	145	275	650	60	138000/√3	115/√3-115/√3	(138000/√3) / (115/√3-115/√3)	X	M (50 VA - 0,2) P (50 VA - 3P)
GSCT015/002	536721	ITALY	145	275	650	50	132000/√3	100/√3	(132000/√3) / (100/√3)	X	M&P (30 VA - 0VA - 30VA / 0,2 - 3PT1)
GSCT015/003	536731	ITALY	170	325	750	50	150000/√3	100/√3	(150000/√3) / (100/√3)	X	M&P (30 VA - 0VA - 30VA / 0,2 - 3PT1)
GSCT015/004	531086	PERU	72,5	140	325	60	60000/√3	110/√3-110/√3	(60000/√3) / (110/√3-110/√3)	X	M (20 VA - 0,2) P (20 VA - 3P)
GSCT015/005	530996	PERU	245	460	1050	60	220000/√3	200/√3	(220000/√3) / (200/√3)	X	M (50 VA - 0,2)
GSCT015/006	531044	PERU	245	460	1050	60	220000/√3	110/√3-110/√3	(220000/√3) / (110/√3-110/√3)	X	M (30 VA - 0,2) P (30 VA - 3P)
GSCT015/007	653201	ROMANIA	123	230	550	50	110000/√3	100/√3-100/√3-100	(110000/√3) / (100/√3-100/√3-100)	X	M (50 VA - 0,2) P (100 VA - 0,5-3P) P (100 VA - 3P)
GSCT015/008	530586	SPAIN	145	275	650	50	110000/√3	110/√3-110/3	(110000/√3) / (110/√3-110/3)	-	M&P (75 VA - 0,5-3P) P (10 VA - 6P)
GSCT015/009	530589	SPAIN	145	275	650	50	110000/√3	110/√3-110/√3	(110000/√3) / (110/√3-110/√3)	-	M&P (30 VA - 0,5-3P) P (30 VA - 0,5-3P)
GSCT015/010	530580	SPAIN	145	275	650	50	132000/√3	110/√3-110/3	(132000/√3) / (110/√3-110/3)	-	M&P (75 VA - 0,5-3P) P (10 VA - 6P)
GSCT015/011	530595	SPAIN	145	275	650	50	132000/√3	110/√3-110/√3	(132000/√3) / (110/√3-110/√3)	-	M&P (30 VA - 0,5-3P) P (30 VA - 0,5-3P)
GSCT015/012	530607	SPAIN	72,5	140	325	50	55000/√3	110/√3-110/3	(55000/√3) / (110/√3-110/3)	-	M&P (75 VA - 0,5-3P) P (10 VA - 6P)
GSCT015/013	530619	SPAIN	72,5	140	325	50	55000/√3	110/√3-110/√3	(55000/√3) / (110/√3-110/√3)	-	M&P (30 VA - 0,5-3P) P (30 VA - 0,5-3P)
GSCT015/014	530604	SPAIN	72,5	140	325	50	66000/√3	110/√3-110/3	(66000/√3) / (110/√3-110/3)	-	M&P (75 VA - 0,5-3P) P (10 VA - 6P)
GSCT015/015	530613	SPAIN	72,5	140	325	50	66000/√3	110/√3-110/√3	(66000/√3) / (110/√3-110/√3)	-	M&P (30 VA - 0,5-3P) P (30 VA - 0,5-3P)
GSCT015/016	531259	COLOMBIA	145	650	275	60	115000/√3	115-115-115/√3	(115000/√3) / (115-115-115/√3)	-	P (10 VA - 3P) M (10 VA - 0,2) P (10 VA - 3P)
GSCT015/017	Pending	ARGENTINA	145	550	230	50	132000/√3	110/√3	(132000/√3) / (110/√3)	-	M&P (200 VA - 0,5)
GSCT015/018	Pending	ARGENTINA	145	550	230	50	132000/√3	110/√3-110/√3	(132000/√3) / (110/√3-110/√3)	X	M (50 VA - 0,2) P (100 VA - 3P)
GSCT015/019	Pending	ARGENTINA	245	950	395	50	220000/√3	110/√3-110/√3	(220000/√3) / (110/√3-110/√3)	-	M (200 VA - 0,5) P (200 VA - 5P)
GSCT015/020	Pending	ARGENTINA	245	950	395	50	220000/√3	110/√3-110/√3	(220000/√3) / (110/√3-110/√3)	-	M (10 VA - 0,5) P (20 VA - 3P)
GSCT015/021	Pending	ARGENTINA	145	550	230	50	132000/√3	110/√3-110/√3	(132000/√3) / (110/√3-110/√3)	-	M (10 VA - 0,5) P (10 VA - 3P)
GSCT015/022	Pending	ARGENTINA	145	550	230	50	132000/√3	110/√3-110/√3	(132000/√3) / (110/√3-110/√3)	X	M (50 VA - 0,2) P (50 VA - 0,5 3P)
GSCT015/023	Pending	ARGENTINA	245	950	395	50	220000/√3	110/√3-110/√3	(220000/√3) / (110/√3-110/√3)	X	M (20 VA - 0,2) M (200 VA - 0,5)

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GSCT015/024	Pending	ARGENTINA	145	550	230	50	$132000/\sqrt{3}$	$110/\sqrt{3}$	$(132000/\sqrt{3}) / (110/\sqrt{3})$	-	M&P (300 VA - 0,5)
GSCT015/025	Pending	ARGENTINA	145	550	230	50	$132000/\sqrt{3}$	$110/\sqrt{3}-110/\sqrt{3}$	$(132000/\sqrt{3}) / (110/\sqrt{3}-110/\sqrt{3})$	X	M (300 VA - 0,2) P (300 VA - 3P)
GSCT015/026	Pending	ARGENTINA	245	950	395	50	$220000/\sqrt{3}$	$110/\sqrt{3}$	$(220000/\sqrt{3}) / (110/\sqrt{3})$	-	M&P (100 VA - 0,5 - 3P)
GSCT015/027	Pending	ARGENTINA	145	550	230	50	$132000/\sqrt{3}$	$110/\sqrt{3}-110/\sqrt{3}$	$(132000/\sqrt{3}) / (110/\sqrt{3}-110/\sqrt{3})$	-	M (200 VA - 0,5) M&P (50 VA - 0,5 3P)



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ANNEX B – DATASHEET AND CHECK LIST (EXAMPLE)

COMPONENT ID	ENEL REQUIREMENT	SUPPLIER DATA
Type of Instrument Transformer	CVT - Capacitor Voltage Transformer	
Country		
GS Code		
Country Code		
Old Country Reference Code		
SERVICE CONDITIONS		
Installation Conditions		
Service Conditions Type		
Temperature category	[°C]	
Daily Average Amb. Temperature	[°C]	
Altitude (maximum)	[m]	
Seismic Qualification Level according to IEC 60068-3-3		
RUSCD (Reference Unified Specific Creepage Distance)	[mm/kV]	
ELECTRICAL RATINGS		



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Highest voltage for equipment (U_m)	[kV]		
Rated lightning impulse withstand voltage	[kV]		
Rated power frequency withstand voltage	[kV]		
Rated frequency (f_R)	[Hz]		
Metering for Billing (B)			
Rated (Total) Capacitor $C_R = (C_1 \cdot C_2 / (C_1 + C_2))$	[Pf]		
Capacitor C_1	[Pf]		
Capacitor C_2	[Pf]		
Rated Voltage Factor (VF)			
Number of Secondaries	[nr.]		
REQUIREMENTS FOR CARRIER-FREQUENCY ACCESORIES			
Drain Coil (YES/NO)			
Drain Coil impedance			
Drain Coil voltage drop			
High Frequency Range (HF)			
Capacitance & Parasitic Conductance (HF Terminal)			
High Frequency tolerance for Capacitors			



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<i>Secondary Winding #1</i>		
Function		
Primary Voltage - Secondary Winding #1	[V]	
Rated secondary Voltage	[V]	
Rated output (S _r)	[VA]	
Accuracy class		
<i>Secondary Winding #2</i>		
Function		
Primary Voltage - Secondary Winding #2	[V]	
Rated secondary Voltage	[V]	
Rated output (S _r)	[VA]	
Accuracy class		
<i>Secondary Winding #3</i>		
Function		
Primary Voltage - Secondary Winding #3	[V]	
Rated secondary Voltage	[V]	
Rated output (S _r)	[VA]	
Accuracy class		



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COMPONENT GENERAL REQUIREMENTS		
External Insulation	[POLymeric, RESin, PORcelain, OTHer]	
Internal Insulation	[OIP, RESin, SF6, OTHers]	
Arc Distance	[mm]	To be indicated by supplier
Creepage Distance (ka=1; IEC 60137)	[mm]	
Overall Dimensions (hxxwxxl)	[mm]	
Fixing holes - Diameter	[mm]	
Fixing holes - Distances (wxxl)	[mm]	
Total Weight	[kg]	
Internal Insulation Class	[Oil, Cycloaliphatic Resin, SF ₆ GAS]	To be indicated by supplier
Internal Insulation (Type & Manufacturer)		To be indicated by supplier
Internal Insulation Weight or Volume	[kg] or [liters]	To be indicated by supplier
Oil Level Indicator/Gas Pressure indicator	[YES, NO, NA]	
Pressure Relief system	[YES, NO, NA]	
Oil Sampling tap	[YES, NO, NA]	
Primary Terminal Type		
Secondary Terminal Type		
Earthing Terminal Type		



Material Specification code: GRI-GRI-MAT-E&C-0049

Version no. 01 dated 30/12/2022

Subject: E&C – GSCT015 – HV CAPACITOR VOLTAGE TRANSFORMERS (CP)

Application Areas

Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Enel Grids*

MECHANICAL REQUIREMENTS		
Static withstands test load (Fr)	[N]	
Specific Horizontal force applied (in a specific area)	[N]	
Specific Vertical force applied (in a specific area)	[N]	
ADDITIONAL REQUIREMENTS/COMMENTS		
DRAWINGS (OVERALL/DETAILED INDICATIONS)		

Application Areas

Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Enel Grids*

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Staff Function: -

Service Function: -

Business Line: *Enel Grids*

ANNEX LOCAL SECTION ARGENTINA (AR)**7.1 DOCUMENT/SECTION SCOPE**

The scope of this Local Section is to integrate the Common Part to provide the technical standard requirements for the capacitors voltage transformers of Edesur transmission network.

The purpose of this document is to establish the conditions that inductive voltage transformers shall satisfy for their construction and testing, intended for measurement and/or protection, from 33 kV to 220 kV. The transformers that are the subject of this Technical Specification are installed in the Transformer Substations of the Edesur transmission network. This document applies to Enel Grids Argentina. In accordance with all applicable laws, regulations, and corporate governance standards, including the provisions related to the stock market or the separation of assets, which in any case prevail over the provisions contained in this document.

7.2 LIST OF COMPONENTS

See ANNEX A.

7.3 SERVICE CONDITIONS

They are used in permanent service and with variable load.

The installation can be inside or outside.

The climate is hot and humid, unfavourable for the conservation of insulating materials.

The external temperature in the shade varies between -5 °C and 40 °C and the humidity of the air frequently reaches saturation values.

The equipment and/or materials shall therefore be designed to operate in a tropical climate and where an atmosphere has a medium level contamination, according to the IEC 60815-1 standards; 60815-2; 60815-3 and 60815-4, "Selection and sizing of high-voltage insulators intended for use in polluted conditions - Part 1, 2, 3 and 4.

Insulating oil in transformers shall not contain PCBs (polychlorinated biphenyls), PCTs (polychlorinated triphenyls) and PBBs (polybrominated biphenyls).

Waste substances and articles that contain or are contaminated with the aforementioned fluids, labelled as Y10 in Law 24051 on "Hazardous Waste", Chapter XI, Article 64, Annex 1, as a Category subject to Control, are not accepted as insulating liquids of the transformers acquired by Edesur, regardless of their mode of use.

7.4 TECHNICAL CHARACTERISTICS

For definitions IEC 61869-1, IEC 61869-5 apply.

7.4.1. Type of Capacitor Voltage Transformers

See Datasheets.

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Staff Function: -

Service Function: -

Business Line: *Enel Grids*

7.4.2. Number of Cores and Windings

See Datasheets.

7.4.3. Rated Insulation Levels

See Datasheets.

7.4.4. Rated Output

See Datasheets.

7.4.5. Rated Accuracy Class CVT

See Datasheets.

7.4.6. Rated Primary Voltage U_{pr}

See Datasheets.

7.4.7. Rated Secondary Voltage U_{sr}

See Datasheets.

7.4.8. Rated Voltage Factor F_v

See Datasheets.

7.4.9. Rated Capacitance of a Capacitor C_r

See Datasheets.

7.4.10. High Voltage Capacitor C_1

See Datasheets.

7.4.11. Intermediate Voltage Capacitor C_2

See Datasheets.

7.4.12. Static Withstand Load (F_R)

See Datasheets.

7.4.13. Installation

The type of installation can be indoor or outdoor.

See Datasheets.

7.4.14. Temperature Rise

See IEC-61698-1 and IEC-61698-5.

7.4.15. Seismic Qualification

A seismic certification is required for the severity level AF5 according to IEC 60068-3-3, for VT and support assembled.

The seismic certification can be based on the calculations according to the above-mentioned standard.

Application Areas

Perimeter: *Global*

Staff Function: -

Service Function: -

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7.4.16. Ferro-resonance

7.4.17. Requirements For Transient Response

According to IEC 61869-5

7.4.18. Short Circuit Withstand Capability and Secondary Current

According to IEC 61869-5.

7.4.19. Drain Coil's Technical Parameters

7.5 CONSTRUCTION CHARACTERISTICS

The transformers must be insulated in oil or ester, in addition for 33 kV they can be encapsulated in cast synthetic resin (cycloaliphatic epoxy), with non-hygroscopic and self-extinguishing characteristics.

Devices with the same characteristics, as well as parts with the same denomination included in the construction of the transformers, must be interchangeable with each other, in such a way that a reserve set can be used without distinction, regardless of the place where it shall be installed.

All the parts in which it is necessary to avoid oxidation or corrosion must be made with pieces of stainless steel, bronze, aluminium, or suitable alloys or have anticorrosive protection of ferrous surfaces by zinc plating, according to the equivalent method.

7.5.1. Internal Insulation

The internal insulating liquid used (oil or ester) shall comply with the requirements indicated in the Data Sheet included in Annex B.

In case of mineral oil use, it shall be free of polychlorinated biphenyls (PCBs) and meet the requirements of the IEC 60296 Standard.

In case of ester use, it shall meet the requirements of the IEC 62770 Standard

7.5.2. External Insulation

Each external bushing shall be built in a single piece, that is, without glued joints; Insulators are only allowed to be joined through metal flanges. They shall meet the requirements of IEC 62155 "Hollow pressurized and unpressurized ceramic and glass bushings for use in electrical equipment with rated voltages greater than 1000 V". It should preferably have a capacitive tap for measuring the dissipation factor ($\text{tg } \delta$).

7.5.3. Overall Dimensions and Layout

7.5.4. Metal Surface Treatment

7.5.5. Accessories

7.5.5.1. Primary outer Terminals

They shall be of the cylindrical bolt type, copper or bronze, preferably with one of the dimensions indicated in the corresponding guaranteed data sheets. They shall be

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Business Line: *Enel Grids*

identified by stainless steel or bronze plates, riveted and with the inscription in low relief.

All capacitor voltage transformers shall have a clear and clearly visible identification of their terminals, using the letter "A" for the high voltage terminal and the letter "N" for the neutral terminal, which must be connected to service grounding for normal operation.

The neutral terminal shall be isolated from the tank and withstand a non-permanent voltage of 10 kV at industrial frequency for testing purpose.

In addition, the "A" terminal and its counterpart, and the "P1" (or K) terminal and its counterpart shall be marked with a clearly visible dot.

7.5.5.2. Secondary Terminals

They shall be made up of screws of suitable length, diameter and materials. Each terminal shall have at least 2 (two) washers and 2 (two) nuts, also bronze.

The transformers shall carry a clear and clearly visible identification of these terminals, using the letters "a" and "n" for capacitor voltage transformers.

The terminals shall be separated enough so that the eyelet connectors of the interconnection cables with the substation have a distance of at least 3 mm.

The different cores shall be numbered correlatively, so the measurement cores shall be designated with the first numbers and the protection ones with the following.

For example, the terminals of a voltage transformer should bear the following markings: "a1" (measurement core), "a2" (protection core) and "n".

7.5.5.3. Grounding Terminals

Capacitor voltage transformers shall have a safety grounding terminal to which they are connected: the tank, the metallic base, the rating plate and any other identification plate when applicable.

It should be located in such a way that once the transformer is installed it is easily visible from ground level. The dimensions of the terminals shall be suitable for connecting copper bars or cables of the following sections:

RATING VOLTAGE (kV)	COPPER IRON (mm)		CABLE SECTION (mm ²)
	SAFETY	DUTY	

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33	25 x 5	25 x 5	1 x 120
132	25 x 5	25 x 5	1 x 120
220	25 x 5	40 x 5	1 x 240

Table 1AR

7.5.5.4. CT Support Base

7.5.5.5. Secondary Terminals Box

The box shall have a degree of mechanical protection IP 54. To open or close the lid that covers it, the use of any type of special tool shall not be required.

The box shall have a through grounding terminal on one of its sides and the terminal block shall be provided with a link-type copper plate with a minimum section of 70 mm², for each secondary winding, so that it can be connected to the aforementioned grounding terminal.

Any change from this technical specification is subject to Edesur's approval.

7.5.5.6. Liquid Level Gauge

Fluid-insulated transformers shall have a level indicator at the top that allows reading it with the naked eye, from a distance of approximately 9 meters. The transparent window shall be made of glass or polycarbonate; any other type of material is subject to the approval of Edesur. Said window is mechanically fixed, not glued. In case of using cork float, it shall be protected on the surface in such a way that it does not lose its buoyancy.

7.5.5.7. Overpressure Relief Device

A hermetic closing device (membrane or bellows) to compensate the volume variations of the insulating oil of the Transformer (if applicable) shall be a metallic bellows or a synthetic rubber membrane with or without internal reinforcement of synthetic fabric impregnated with the same rubber. Any other system is subject to Edesur's approval.

7.5.5.8. Liquid Sampling Device

Liquid-insulated transformers shall have a plug for filling and another that allows emptying. Likewise, liquid-insulated transformers shall have a means for taking oil samples, consisting of a valve or a quick coupling and finally a closing plug that prevents possible liquid leaks, or another similar device that fulfills the function required.

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7.5.5.9. Lifting Lugs

7.5.5.10. Rating Plate

In addition to the data required in the corresponding specifications, the following shall be indicated on the same rating plate or on others:

- The manufacturing VT model and serial number
- The diagram of the primary and secondary windings. This sheet shall be located close to the terminal block, so that the diagram can be easily compared with the actual layout of the terminals.
- The electrical resistance of the secondary winding(s) referred to 75°C
- The dissipation factor (tg δ) maximum admissible in service
- The sentence: "Contains PCB-free mineral oil", with the following table:

30
1270

Table 2AR

7.5.5.11. Terminal Marking

In accordance with IEC 61869-5.

Transformers that have double ratio, both shall be achieved by varying the location of mobile plates.

In no case should the connection plates of each relationship overlap the indications that the corresponding primary terminals had engraved. In the case of an unused plate (for one of the ratios), it should be located in the transformer itself.

The ratio shall be indicated with numbers and letters at least 20 mm high, painted on two opposite sides of the appliance and not covered by the rating plate.

This requirement does not replace the indication of the transformation ratio that shall appear on the rating plate.

7.5.5.12. Capacitive Tap

In capacitor voltage transformers where its design allows it, the magnetic core and the internal screens shall be at earth potential, not connected internally to the tank, but rather coming out of it through external insulators and jumpers that allow their connection to the safety ground, in normal operation. These bridges shall be removable, made of copper, and the insulators shall withstand a non-permanent

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voltage of 10 kV at industrial frequency for the purposes of carrying out tests to verify the dissipation factor ($\text{tg } \delta$).

7.5.5.13. Capacitor Voltage Divider**7.5.5.14. Electromagnetic Unit****7.5.5.15. Carrier-Frequency Accessories & High Frequency Signals Characteristics****7.6 TESTING****7.6.1. Type Tests**

According to clause 7.6.1 Common Part.

7.6.2. Routine/Acceptance Tests

According to clause 7.6.2 Common Part.

In addition the following tests shall be performed:

- Verification of the physical-chemical characteristics, chromatography and absence of PCBs of the insulating oil, according to ASTM D 4059 "Standard Test Method for Analysis of Polychlorinated Biphenyls in Insulating Liquids by Gas Chromatography".
- Visual inspection
- No load curve (with voltage range between 10% and 200% of the rated voltage)
- Capacitance and $\text{tan } \delta$ measurement

7.6.3. Special Tests

According to clause 7.6.3 Common Part.

7.6.4. Sample Tests

According to clause 7.6.4 Common Part

7.7 CONDITIONS OF SUPPLY**7.7.1. Warranty****7.7.2. Reception Control****7.7.3. Technical Information Required****7.7.4. Packaging and Transport****7.7.5. Installation, Operation, Maintenance and Disassembling**

Manual for installation, operation, maintenance, and disassembling shall be provided in Spanish.

7.7.6. Technical Conformity Assessment (TCA)

Application Areas

Perimeter: *Global*

Staff Function: -

Service Function: -

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Staff Function: -

Service Function: -

Business Line: *Enel Grids*

ANNEX LOCAL SECTION BRASILE (BR)**7.1 DOCUMENT/SECTION SCOPE**

The scope of this Local Section is to integrate the Common Part to provide the technical standard requirements for the Capacitor Voltage transformers (VT) of Enel Distribuição Rio, Enel Distribuição Ceará and Enel Distribuição São Paulo.

This document applies to Brazilian Distribution Infrastructures and Networks.

7.2 LIST OF COMPONENTS

See ANNEX A.

7.3 SERVICE CONDITIONS

The CVT shall be single phase, for outdoor use and immersed in insulating mineral oil as per ABNT NBR 10576 or immersed in insulating vegetable oil as per ABNT NBR 15422. The electrical system to which the Capacitor Voltage transformers shall be connected is solidly grounded.

7.4 TECHNICAL CHARACTERISTICS

For definitions IEC 61869-1, IEC 61869-5 apply.

The capacitor voltage transformers shall be designed to withstand the maximum voltage between lines, without saturation.

The absence of saturation shall be determined by measuring the magnetization current for maximum voltage between lines.

This value shall not be more than twice the rated voltage.

7.4.1. Type of Capacitor Voltage Transformers

Voltage transformers intended to be connected to HV grid for measuring and protection scope.

7.4.2. Number of Cores and Windings

See Datasheets.

7.4.3. Rated Insulation Levels

See Datasheets.

7.4.4. Rated Output

See Datasheets.

7.4.5. Rated Accuracy Class CVT

See Datasheets.

7.4.6. Rated Primary Voltage U_{pr}

See Datasheets.

7.4.7. Rated Secondary Voltage U_{sr}

See Datasheets.

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7.4.8. Rated Voltage Factor F_v

See Datasheets.

7.4.9. Rated Capacitance of a Capacitor C_r

See Datasheets.

7.4.10. High Voltage Capacitor C_1

See Datasheets.

7.4.11. Intermediate Voltage Capacitor C_2

See Datasheets

7.4.12. Static Withstand Load (F_R)

See Datasheets.

7.4.13. Installation

The type of installation can be indoor or outdoor.

See Datasheets.

7.4.14. Temperature Rise

See IEC-61698-1 and IEC-61698-5.

7.4.15. Seismic Qualification**7.4.16. Ferro-resonance****7.4.17. Requirements For Transient Response****7.4.18. Short Circuit Withstand Capability and Secondary Current**

The CVT shall be designed and built to withstand without any damage when energized at rated voltage, mechanical and thermal stresses caused by external short circuits with a duration of 1 second.

7.4.19. Drain Coil's Parameters**7.5 CONSTRUCTION CHARACTERISTICS**

CVT shall be designed to be coupled with carrier-line frequency accessories. When requested all accessories shall supplied for all and any number of coupling capacitors and shall include the following equipment:

- Drain coil
- Surge Arrester
- Suitable and independent mechanisms to short-circuit power circuits and power line carrier communication circuits. These mechanisms shall be designed to be accessible from external part of CVTs. An appropriate interlock shall be provided to limit access to CVT and PLC accessories only when the relative mechanism is properly short-circuited.

A suitable equipment to connect PLC, including cable gland for cable RG11 75 Ohms, shall be provided.

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CVT shall be designed to carry out capacitance measurements by means of external accessories to be connected to the capacitor divider's earthing terminal.

The manufacturer shall describe in his proposal the principle of operation and the performance of power line carrier communication system (signal blocking or spurious signal generation during transient conditions).

7.5.1. Internal Insulation

Equipment insulated in oil and ester shall be provided with a fluid expansion chamber with metal bellows, in order to absorb thermal contractions and expansions of the fluid. The oil used shall be without inhibitors or additives, be free of polychlorinated biphenyls (PCBs) and shall meet the requirements of the IEC 60296 Standard. Its main characteristics shall be indicated, its typical composition, indicating the percentage of aromatics, isoparaffins and naphthenics.

The ester used shall meet the requirements of the IEC 62770 Standard.

7.5.2. External Insulation

The external insulation of the instrumentation transformers shall be porcelain, resin, or silicone rubber. Creepage distance of the bushings shall be in accordance with the pollution level indicated in Table 3 (par. 7.3, Common Part).

The active part of the Voltage transformers shall be located in the metal bodies (upper or lower, as the case may be).

Design with active part located inside the porcelain shall not be accepted.

Application Areas

Perimeter: *Global*

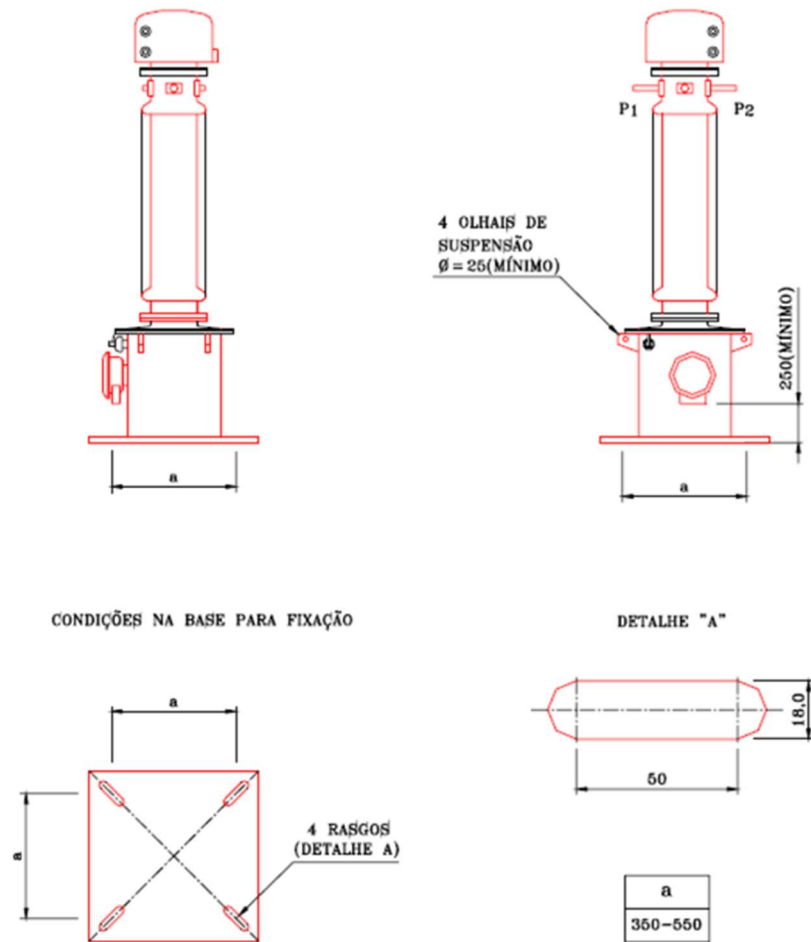
Staff Function: -

Service Function: -

Business Line: *Enel Grids*

7.5.3. Overall Dimensions and Layout

Detalhes de Fixação dos Transformadores de Corrente de 72,5 kV tipos C1, C2, C3 e C4.



NOTA: Dimensões em milímetros.

Figure 1BR

7.5.4. Metal Surface Treatment

Painting and galvanization shall be suitable for the environmental conditions indicated in Table 3 (par 7.3, Common Part).

Thickness of galvanization shall be conformed to the following Table 1BR:

Tipo de Tanque	Pintura interna	Pintura externa				
		Metalização	Wash-primer	Epoxi-poliamina	Tinta de acabamento	Total
Aço galvanizado com zinco (à quente)	30 µm	80 µm	10-15 µm	70 µm	70 µm	230 µm

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Table 1BR

The non-energized metal surfaces of Voltage transformers shall be made of steel and/or hot dip galvanized or painted.

Moreover, all De-energized metal surfaces, such as tanks, secondary terminal boxes and other components, shall meet the following requirements:

- a) all welds must be performed in such a way as to ensure complete fusion with the base metal.
- b) welds shall not be cracked, discontinuous and corrosion-free.
- c) elimination of all weld spatter, slag and burrs.
- d) sharp edges and corners shall be rounded.
- e) degreasing of all plates and supports.
- f) blasting with clean sand or shot, free of salts, moisture, oil or any other foreign component. The blasting must completely eliminate rust and rolling scale, reaching the Sa 3 degree of SIS 05 5900-67. The blast profile shall be between 40 and 60 µm.
- g) thermal spraying of all sheets and supports immediately after blasting. The zinc layer shall meet the requirements of ISO-R 2063/1971 with a minimum layer thickness of 80 µm (Zn 80).

At the stage of performing the painting, the VT's supplier shall keep in his plant, full-time, a qualified industrial paint inspector, according to ABNT NBR 15218.

The qualified inspector shall record, in a painting report, all the results of the steps and observations performed, as well as fill out a report of nonconformities. The paint shall meet the NBR 11388 standard. The finishing paint shall be light grey, MUNSELL notation 6.5. Every surface to be energized should be red, according to MUNSELL 5R4/14.

7.5.5. Accessories

7.5.5.1. Primary Outer Terminals

The primary terminals can be made of aluminum, tinned copper or silver. The terminal type can be the flat bar type (2N) or (4N) as shown in Figure 1.

Terminals shall have clearly distinct terminal and polarity markings. The supplier must inform in his proposal the characteristics of the terminals of the offered equipment.

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Service Function: -

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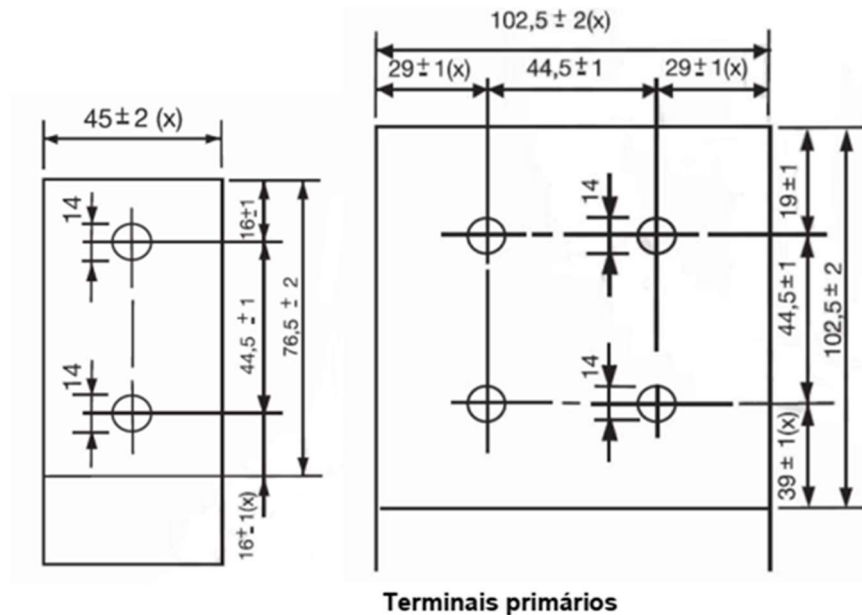


Figure 2BR

7.5.5.2. Secondary Terminals

The secondary terminals must be phosphorous bronze and shall be connected to the terminals located inside a box. This box should be suitable for outdoor use, with protection grade IP54 according to IEC 60529 and allow external cable connections from the bottom or side of the box.

All terminals shall be eyelet type and clearly marked. The terminals of the secondary winding must be protected by weatherproof housing with devices for sealing seal placement, with a hole of 50 mm in diameter and area required for connection of 2" bushings and washers.

Voltage transformers shall have a separate connection box for all metering cores to be sealed by the purchaser. The supplier shall provide an antifraud terminal block with a plate made of transparent insulating material, installed on top of the terminals with a place where affix a seal, subject to customer approval.

Suitable thermal-magnetic circuit breakers with alarm auxiliary contacts shall be provided to protect control circuits.

7.5.5.3. Grounding Terminals

The manufacturer shall provide terminals to connect the Voltage transformers to the grounding system substation. The connections to the ground mesh shall be made through a copper cable with a section between 70 and 240 mm² or a 3x40 mm copper

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Staff Function: -

Service Function: -

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plate. The housing grounding terminal shall be provided with a connector from 35 mm² to 150 mm² copper cable.

7.5.5.4. CVT Support Base

The supplier shall provide all necessary technical information to design the support base to fix the CVT structure, as well as the bolts, nuts and adjustment washers, necessary for this purpose.

The minimum distances between live parts on primary side and support base of the transformer shall ensure the safety distance as specified in the publication "Electric Power Supply - Sub transmission Voltage 88/138 kV" of ELETROPAULO.

The minimum distance from the bottom of the secondary terminal box to the mounting base shall be 300 mm. If the manufacturer's design does not meet this Item, a subbase shall be provided for the specified minimum distance.

Fixing base shall respect the dimensions indicated in the following picture:

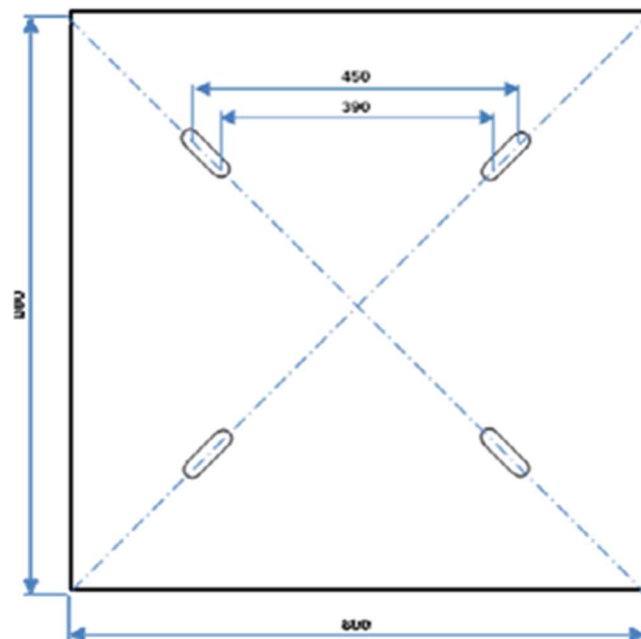


Figure 3BR (Dimensions in mm)

7.5.5.5. Secondary Terminals Box

7.5.5.6. Liquid Level Gauge

The device for checking the liquid level shall indicate whether the liquid level is within the operating range, during operation and must be clearly readable from ground.

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Staff Function: -

Service Function: -

Business Line: *Enel Grids***7.5.5.7. Overpressure Relief Device**

The mechanical protective action can be performed by liquid expansion chamber. CVT shall be designed in such a way that if an internal failure occurs in the main insulation, any overpressure originating in the internal part can be only released upwards, avoiding the breakage and projection of the porcelain.

7.5.5.8. Liquid Sampling Device

VT shall be equipped with a following valves:

- Drain valve with a hermetic liquid sampling device.
- A valve for oil filling in the upper part of CVT.

Note: For CVT hermetically sealed the two above mentioned valves are not requested.

7.5.5.9. Lifting Lugs

Placed to facilitate lifting of CVT.

7.5.5.10. Rating Plate

Rating plate shall be made of stainless steel with minimum thickness of 0,5mm in Portuguese and all information shall be marked in an indelible manner.

In addition to the markings defined in IEC 61869-1 and IEC 61869-5, the following minimum information shall be indicated in the rating plate:

- a) Normas segundo as quais o TPC é construído e ano da edição
- b) A expressão: "TRANSFORMADOR DE POTENCIAL CAPACITIVO".
- c) Nome ou marca do fabricante.
- d) Ano e local de fabricação (ANO).
- e) Número de série (Nº).
- f) Tipo ou modelo (TIPO).
- g) Número do manual de instruções (MANUAL).
- h) Uso: para interior ou para exterior (USO).
- i) Frequência nominal (f), em Hz.
- j) Tensão(ões) primária(s) ou secundária(s) nominal(is) (Up ou Us) em V.
- k) Tensão máxima do equipamento (U_{max}), em kV.
- l) Nível de isolamento (NI____/____/____), em kV.
- m) Potência térmica nominal (P_{term}) em VA.
- n) Exatidão: classe e carga (EXATIDÃO).
- o) Grupo de ligação (GRUPO).
- p) Diagrama de ligações.
- q) Capacitâncias da alta tensão, intermediária e total.

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- r) Fator de perdas dielétricas.
- s) Ajuste do dispositivo de proteção.
- t) Número de série das unidades capacitivas compreendendo a pilha de capacitores.
- u) Massa total (Mtotal), em kg.
- v) Tipo, massa e volume do óleo isolante.
- z) Número do contrato de fornecimento de material (CFM).

“NOTA: Para Enel SP devem ser fornecidas placas de identificação com código de barras no padrão EAN 128, conforme imagens 4BR abaixo”.



Figure 4BR

7.5.5.11. Terminal Marking

All terminals shall be permanently marked according to as ABTN NBR-6855.

7.5.5.12. Capacitive Tap

7.5.5.13. Capacitor Voltage Divider

The capacitor divider shall be sealed and not allow any contact of the insulating liquid with the atmosphere. The internal insulation can be either mixed (paper and polypropylene film) or single type polypropylene film; however, it shall be immersed in an insulating liquid.

7.5.5.14. Electromagnetic Unit

The electromagnetic unit shall be tight at a constant volume in the full temperature working range and shall be equipped with an oil level indicator.

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7.5.5.15. Carrier-Frequency Accessories & High Frequency Signals Characteristics**7.6 TESTING****7.6.1.Type Tests**

They are those that will be carried out only once in the product approval process and on the same unit.

In addition to the tests detailed on clause 7.6.1 Common Part, the following tests shall be performed:

- Measurement of series equivalent resistance and capacitance.
- Measurement of windings resistance.
- No load current and no load losses.
- Short circuit impedance.

7.6.2. Routine/Acceptance Tests¹

All these tests shall be performed in accordance with ABTN NBR 61869-1 and ABNT NBR 61899-5.

In addition to the tests detailed on clause 7.6.2 Common Part, the following tests shall be performed:

- Surge arresters check and adjustment.
- Painting checks according to par. 7.5.4.
- Check of zinc coating protection according to ABTN NBR 7398 (Aderência) – 7399 (Espessura) – 7400 (Uniformidade).
- Insulating oil tests: Water content, breakdown voltage, DDF, interfacial tension and total acidity.
- Insulating mineral oil tests according to *Resolução ANP Nº 900, De 18 De Novembro De 2022 - Dou De 23-11-2022*.
- Insulating ester oil tests according to ABNT NBR 15422.
- Measurement of capacitance and dielectric dissipation factor.
- Measurement of windings resistance for TV with $U_m \geq 72,5kV$.

7.6.3. Special Tests

These tests shall be required exceptionally in the product approval process. All these tests shall be performed in accordance with ABTN NBR 61869-1 and ABNT NBR 61899-5.

¹ Test for accuracy shall be carried out after all other tests.

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7.6.4. Sample Tests**7.7 CONDITIONS OF SUPPLY****7.7.1. Warranty****7.7.2. Reception Control****7.7.3. Technical Information Required****7.7.4. Packaging and Transport**

The supplier will carry out the appropriate packaging of the Voltage transformers to ensure their protection during transport by sea, land or air. In the packaging, padding material will be used to ensure good protection in the event that the boxes containing the materials are hit or damaged during loading and unloading maneuvers.

To protect materials from moisture, airtight covers or bags containing hygroscopic material shall be used.

Each drawer shall have the following information printed on it:

- Net and gross weight
- Date
- Type of material and quantity

The supplier will be responsible for transporting the transformers to ENEL's warehouses, unless otherwise indicated in the purchase order.

Each package shall contain only one unit. Packaging must be suitable to support operations.

Like normal loading, unloading and eventual stacking of different packages.

Each package must include facilities to lift it by means of belts.

For export maritime transport, the manufacturer shall obtain the approval of the packaging by the transport companies before dispatching the equipment from the factory.

All packaging shall contain all necessary details about identification and handling, clearly and indelibly, related to the contents and the Purchase Order.

The type of packaging and its identification shall be submitted for the client's or his representative approval before dispatch from the factory. If not all of the specified conditions are compiled the request for dispatching may be rejected.

The SUPPLIER shall issue a Packing list for all the supplied equipment and components. A copy must accompany the invoice, a second copy must be placed inside the packaging and a

Third copy must be protected with plastic casing on the outside of the package, indicating only the materials of the package.

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After the inspection, a copy of the packing list must be issued for checking and approval by the purchaser, before dispatching.

7.7.5. Installation, Operation, Maintenance and Disassembling

Manual for installation, operation, maintenance and disassembling shall be provided in Portuguese.

The instruction manual shall contain at least the following items:

- General Index.
- Provide an overview of the equipment and all its components along with their operating principle.
- Indicate the basics of the equipment and its components related to the activities like "commissioning, operation and maintenance", such as:
 - Information that characterizes and identifies the equipment, such as: manufacturer, serial number, type, code, model, lot, Purchase order, etc., including alternatives from other accepted manufacturers in the project.
 - Design characteristic of equipment and accessories, such as: weight, dimensions, fixing point, illustrative drawings, materials, etc.
 - Electrical characteristics of the main equipment and its components such as: voltage, Voltage, frequency, diagrams electrical schematics, interconnection and block diagram, points connection, etc.
- Any and all necessary graphics.
- Drawings:
 - All final and revised drawings as manufactured, including drawings and technical characteristics of all gaskets used.
- Test reports:
 - All test results requested in this specification.
- Spare Parts:
 - A material list containing the list of parts or components of the equipment, recommended as a spare part and the one supplied with the equipment, duly specified, indicating its basic characteristics, reference number and its location on the equipment.
- Instructions for assembly:
 - Assembly of equipment and accessories.
 - Lifting and movement of the parts.
- Instructions for commissioning and operation:

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- Recommendations for commissioning.
- Permissible Long and short duration overload.
- Inspections and verifications.
- Adjustments and measurements.
- Cleaning and lubrication.
- Tests.
- Instructions for maintenance:
 - Recommendations for transport and storage.
 - Recommendations for disassembly and assembly.
 - Torques table for all flanges.
 - Preventive maintenance.
 - Equipment and instruments required for maintenance.
 - Tests and verifications.
 - Maintenance frequency.
 - Cleaning.
 - Care to be taken with painting and retouching instructions.
- Photos of the equipment during the manufacturing process.
- Copy of the Packing list.

7.7.6. Technical Conformity Assessment (TCA)

Application Areas

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Staff Function: -

Service Function: -

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ANNEX LOCAL SECTION COLOMBIA (CO)

7.1 DOCUMENT/SECTION SCOPE

The scope of this Local Section is to integrate the Common Part to provide the technical standard requirements for the capacitor voltage transformers (CVTs) of Enel Colombia.

7.2 LIST OF COMPONENTS

See ANNEX A.

7.3 SERVICE CONDITIONS

7.4 TECHNICAL CHARACTERISTICS

For definitions IEC 61869-1, IEC 61869-5 apply.

7.4.1. Type of Capacitor Voltage Transformers

CVTs with Um 145kV and 245kV are most of the time capacitor type.

Capacitor Voltage transformers shall be single primary winding, while up to two shall be allowed secondary windings.

For more details see Datasheets

7.4.2. Number of Cores and Windings

See Datasheets.

7.4.3. Rated Insulation Levels

See Datasheets.

7.4.4. Rated Output

Rated output shall be 25 VA.

For details see Datasheets.

7.4.5. Rated Accuracy Class VT

Excepting for CODENSA, winding accuracy may be specified in the following three ways:

- Class 0.5%: For windings intended for measurement (accuracy class for VTs intended for billing purpose shall be 0,2% or 0,5%)
- Class 3P: For windings intended for protection.
- Class 0,5/3P: For windings intended for protection and/or measurement (preferably capacitive).

For CODENSA winding accuracy may be specified in the following two ways:

- Class 0,2% for windings intended for measurement
- Class 3P: for windings intended for protection.

The accuracy class shall be specified according to IEC 61689-1 & IEC 61689-5, whereby the supplier shall ensure winding accuracy between 80% and 120% of the nominal primary voltage,

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for measurement; and between 0.5% and 120% of the nominal primary voltage, for protection. In case the winding is intended for both functions, supplier shall ensure the accuracy of both.

Supplier shall ensure that the equipment maintains its accuracy for the environmental conditions defined in the *Table 3CP* of the document GSCT0015 – CVTs – *Common Part*. If the Customer's requirement is a transformer for energy billing, the supplier shall ensure that the accuracy class equipment is maintained during the life of the transformer.

For details see Datasheets.

7.4.6. Rated Primary Voltage U_{pr}

See Datasheets.

7.4.7. Rated Secondary Voltage U_{sr}

See Datasheets.

7.4.8. Rated Voltage Factor F_v

See Datasheets.

7.4.9. Rated Capacitance of a Capacitor C_r

See Datasheets.

7.4.10. High Voltage Capacitor C_1

CVTs for EDELNOR shall be designed with $C_1 = 17.834$ pF

See Datasheets.

7.4.11. Intermediate Voltage Capacitor C_2

CVTs for EDELNOR shall be designed with $C_2 = 36.867$ pF

See Datasheets.

7.4.12. Static Withstand Load (F_R)

See Datasheets.

7.4.13. Installation

The type of installation can be indoor or outdoor.

See Datasheets.

7.4.14. Temperature Rise

See IEC-61698-1 and IEC-61698-5.

7.4.15. Seismic Qualification

The equipment supplied to Enel Colombia shall comply with the seismic requirements indicated in the Colombian standard NSR 10.

7.4.16. Ferro-resonance

The transient and ferroresonance response characteristics of CVT transformers shall be in accordance with IEC61869-5.

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7.4.17. Requirements For Transient Response

According to IEC 61869-5.

7.4.18. Short Circuit Withstand Capability and Secondary Current

According to IEC 61869-5.

7.4.19. Drain Coil's Technical Parameters**7.5 CONSTRUCTION CHARACTERISTICS****7.5.1. Internal Insulation**

The internal insulation of HV voltage transformers shall be oil, ester, paper or resin or some composite material. In case of indoor application, the insulation will preferably be resin or oil/paper. Other types of insulation will be subject to customer approval.

Internal insulation may be of paper and/or polypropylene.

Equipment insulated in oil and ester shall be provided with a fluid expansion chamber with metal bellows, in order to absorb thermal contractions and expansions of the fluid. The oil used shall be without inhibitors or additives, be free of polychlorinated biphenyls (PCBs) and shall meet the requirements of the IEC 60296 Standard. Its main characteristics shall be indicated, its typical composition, indicating the percentage of aromatics, isoparaffins and naphthenics.

The ester used shall meet the requirements of the IEC 62770 Standard.

7.5.2. External Insulation

The external insulation of the voltage transformers shall be porcelain, resin, or silicone rubber.

The active part of the voltage transformers shall be located in the metallic bodies (upper or lower, as appropriate). Designs with the active part located inside the porcelain will not be accepted.

7.5.3. Overall Dimensions and Layout**7.5.4. Metal Surface Treatment**

Painting and galvanization shall be suitable for the environmental conditions indicated in Common Part, clause 7.3, *Table 3CP*. The thicknesses of the galvanized parts shall comply with Annex B for the different thicknesses of sheets and environmental conditions. The non-energized metallic surfaces of the voltage transformers shall be made of steel hot-dip galvanized and/or painted or aluminum, as indicated in Annex B. The painting and galvanization processes described in this specification shall not be applied to the composite material insulators of voltage transformers.

7.5.5. Accessories**7.5.5.1. Primary Outer Terminals**

The primary terminals of the voltage transformers shall be made of aluminum, tinned or silver-plated copper. The type of terminal can be plate (4N) or cylinder without wire,

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as indicated in Annex B. Terminals shall have clearly distinguishable terminal and polarity markings. The supplier shall inform in his proposal the characteristics of the terminals of the offered equipment.

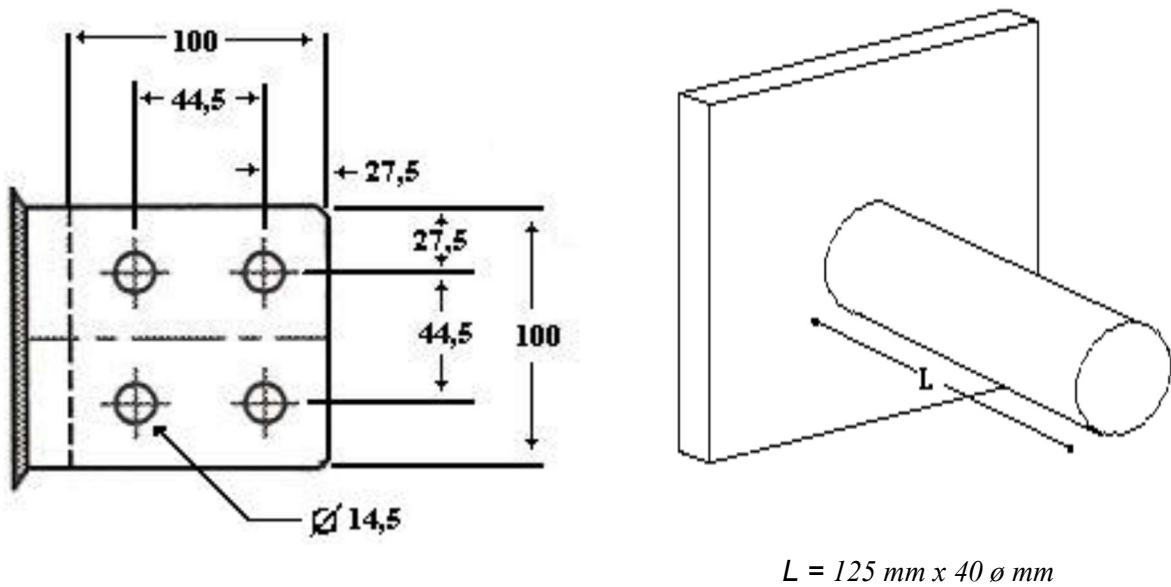


Figure 1CO

The VT for Edesur shall bear the following identification: the letter "A" for the high voltage terminal and the letter "N" for the neutral terminal.

The manufacturer shall inform in his proposal the characteristics of the terminals of the equipment offered.

7.5.5.2. Secondary Terminals

In case of outdoor application, the secondary terminals shall be made of phosphor bronze, and they shall be wired to terminal blocks located inside a box. This box shall be suitable for outdoor use, with a protection degree IP54, according to the IEC standard, and shall allow external cable connections from below or laterally. Secondary terminals shall have clearly distinguishable terminal and polarity markings.

The VT for Edesur shall bear the following identification: the letters "a" and "n".

Edesur does not require the installation of ultrafast thermomagnetic switches in the transformers, as they are installed in separate boxes and at the height of an operator located at floor level.

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7.5.5.3. Grounding Terminals

The manufacturer shall supply terminals to connect the voltage transformers to the substation ground system. The connections to the ground mesh shall be cable type made of tinned copper with a section between 70 and 240 mm², or copper plate type with a section of 3 x 40 mm.

Where their design permits, the magnetic core and the internal screens will be at ground potential, not connected to the tank internally, but they shall be grounded by means of external insulators and bridges for safety grounding connection, during normal operation. Such bridges shall be copper made and removable while the bushings shall withstand a non-permanent voltage of 10 kV at industrial frequency for testing purpose.

7.5.5.4. CVT Support Base**7.5.5.5. Secondary Terminals Box****7.5.5.6. Liquid Level Gauge**

This element shall have a maximum and minimum level indication and shall be easily readable for an operator standing on the floor.

7.5.5.7. Overpressure Relief Device**7.5.5.8. Liquid Sampling Device**

The voltage transformer shall have a pad lockable device to take liquid samples.

7.5.5.9. Lifting Lugs**7.5.5.10. Rating Plate**

A stainless steel or aluminum rating plate shall be included in Spanish. This rating plate shall comply with the provisions of IEC 61869-1 & IEC 61869-3 standards. Moreover, a plate shall be included with the winding connection diagram.

7.5.5.11. Terminal Marking

In accordance with IEC 61869-3.

7.5.5.12. Capacitive Tap**7.5.5.13. Capacitor Voltage Divider****7.5.5.14. Electromagnetic Unit****7.5.5.15. Carrier-Frequency Accessories & High Frequency Signals Characteristics**

CVTs shall be equipped with a suitable device for PLC, with the following accessories:

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- Drain Coil
- Surge Arrester
- Carrier Earthing Switch

Optionally for EDELNOR, when requested by ENEL during offer stage, the CVTs shall be equipped with an adapter suitable to install a line trap.



Figure 2CO (Line Trap)

7.6 TESTING

All voltage transformers included in the supply shall be tested by the manufacturer, in the presence of the client or his representative.

The manufacturer of voltage transformers shall submit test protocols applied to the bushings used in their equipment.

The test method and acceptance criteria of the bushings will be described in the IEC 62155 or 61462 standard. If any voltage transformer does not meet any of the specified tests, the manufacturer shall take the necessary actions to detect the failures and correct them. Once the necessary corrections have been put in place, the manufacturer shall repeat all the tests to demonstrate that the said transformer fully complies with the specifications. All such events shall be recorded in a failure test report. Once all the

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acceptance tests have been carried out, the manufacturer shall deliver a complete and certified report of the same. This report will be submitted for final approval to the client.

7.6.1. Type Tests

According to clause 7.6.1 Common Part.

7.6.2. Routine/Acceptance Tests

According to clause 7.6.2 Common Part.

The routine tests indicated in the IEC standard, and those indicated below, will be part of the acceptance tests:

- Measurement of capacitance and dielectric dissipation factor.
- Verification of painting and galvanizing.
- Visual inspection.

7.6.3. Special Tests**7.6.4. Sample Tests****7.7 CONDITIONS OF SUPPLY****7.7.1. Warranty****7.7.2. Reception Control****7.7.3. Technical Information Required****7.7.4. Packaging and Transport****7.7.5. Installation, Operation, Maintenance and Disassembling**

Manual for installation, operation, maintenance, and disassembling shall be provided in Spanish. Each voltage transformer and its accessories shall be packed appropriately for sea and land transportation, in order to prevent damages (blows, corrosion, moisture absorption, etc.) and theft.

Each package shall just contain one unit.

The packaging shall be adequate to support the normal operations of loading, unloading, and the eventual stacking of one package on top of another. Each of the packages shall include facilities to lift it by means of straps.

For export maritime transport, the manufacturer shall obtain the approval of the packaging by the transport companies before dispatching the equipment from the factory.

All packages shall bear the necessary identification and handling details, clearly and indelibly, both of their content and of the details of the purchase order especially of the recipient company.



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The type of packaging and its identification shall be submitted for the client's or his representative approval before dispatch from the factory. If not all of the specified conditions are complied, the request for dispatching may be rejected.

7.7.6. Technical Conformity Assessment (TCA)

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ANNEX LOCAL SECTION ITALY (IT)

7.1 DOCUMENT/SECTION SCOPE

The scope of this Local Section is to integrate the Common Part to provide the technical standard requirements for the current transformers of e-distribuzione.

7.2 LIST OF COMPONENTS

See ANNEX A.

7.3 SERVICE CONDITIONS

The CVT shall be single phase, for outdoor use and immersed in insulating mineral oil.

7.4 TECHNICAL CHARACTERISTICS

For definitions IEC 61869-1, IEC 61869-5 apply.

7.4.1. Type Of Capacitor Voltage Transformers

Capacitor Voltage transformers intended to be connected to HV grid for measuring and protection scope with U_m 145kV or 170 kV.

7.4.2. Number of Cores and Windings

See Datasheets.

7.4.3. Rated Insulation Levels

See Datasheets.

7.4.4. Rated Output

See Datasheets.

7.4.5. Rated Accuracy Class CVT

See Datasheets.

7.4.6. Rated Primary Voltage U_{pr}

See Datasheets.

7.4.7. Rated Secondary Voltage U_{sr}

See Datasheets.

7.4.8. Rated Voltage Factor F_v

See Datasheets.

7.4.9. Rated Capacitance of a Capacitor C_r

See Datasheets.

7.4.10. High Voltage Capacitor C_1

See Datasheets.

7.4.11. Intermediate Voltage Capacitor C_2

See Datasheets

Subject: E&C – GSCT015 – HV CAPACITOR VOLTAGE TRANSFORMERS (IT)**Application Areas**Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Enel Grids*

7.4.12. Static Withstand Load (F_R)

See Datasheets.

7.4.13. Installation

The type of installation can be indoor or outdoor.

See Datasheets.

7.4.14. Temperature Rise

See IEC-61698-1 and IEC-61698-5.

7.4.15. Seismic Qualification

A seismic certification is required for the severity level AF5 according to IEC 60068-3-3, for CVT and support assembled.

The seismic certification can be based on the calculations according to the above-mentioned standard.

7.4.16. Ferro-resonance

According to IEC 61869-5.

7.4.17. Requirements For Transient Response

According to IEC 61869-5.

7.4.18. Short Circuit Withstand Capability and Secondary Current

According to IEC 61869-5.

7.4.19. Drain Coil's Technical Parameters**7.5 CONSTRUCTION CHARACTERISTICS****7.5.1. Internal Insulation****7.5.2. External Insulation**

Insulators shall comply to IEC 62217, and they are made of exclusively light grey inorganic composite material, with HTV (High Temperature Vulcanization) or LSR (Liquid Silicone Rubber) silicone rubber, without EPDM or other organic rubber, in accordance with IEC 61462 for mechanical testing and IEC 61109 for dielectric testing and electrical-environmental accelerated ageing test. The Tracking and erosion test shall be performed on the complete bushing according to IEC 62217 Annex B (multiple stress 5000 hours).

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Application Areas

Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Enel Grids*

7.5.3. Overall Dimensions and Layout

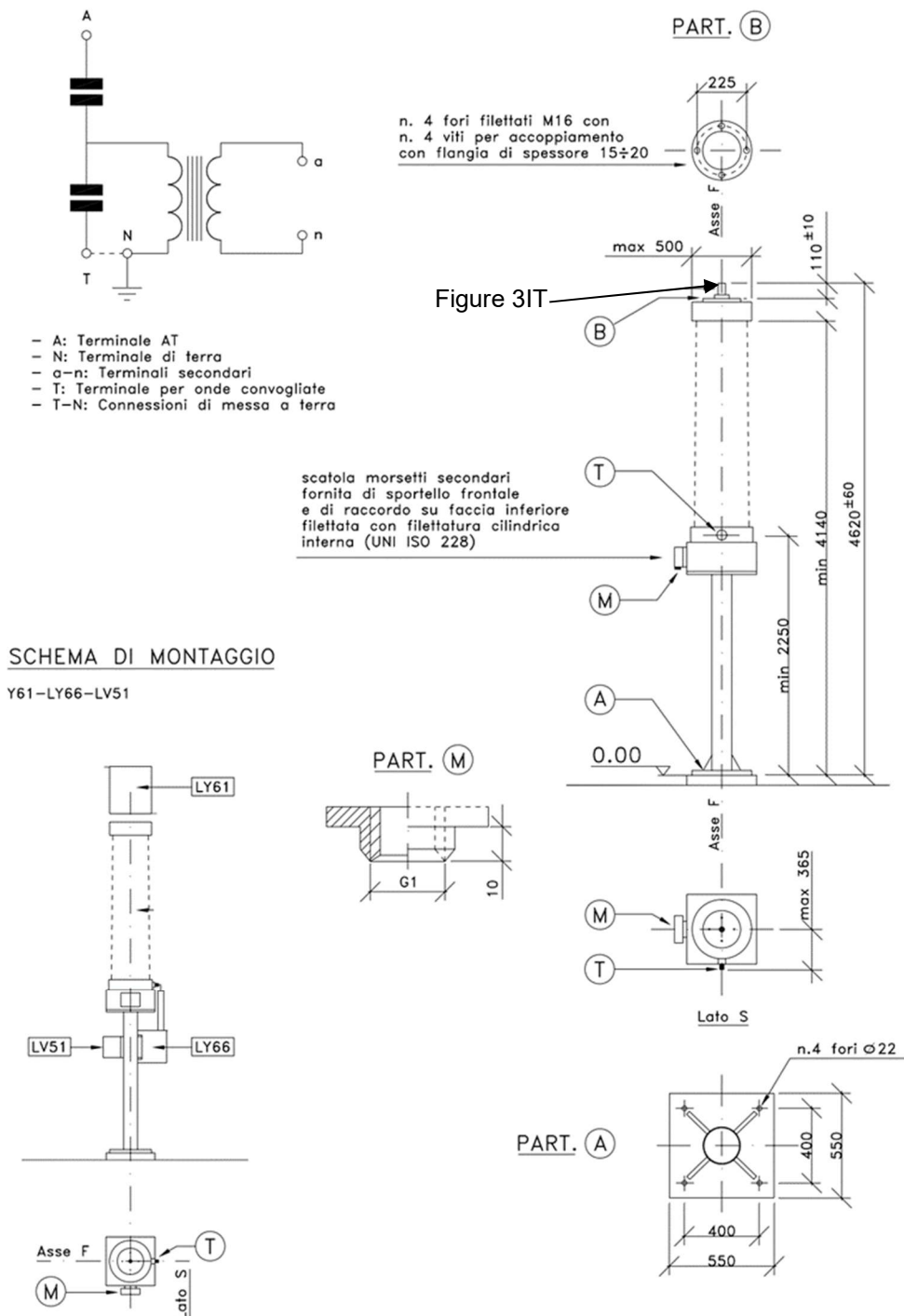


Figure 1IT (CVT U_m 145 kV)

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Application Areas

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

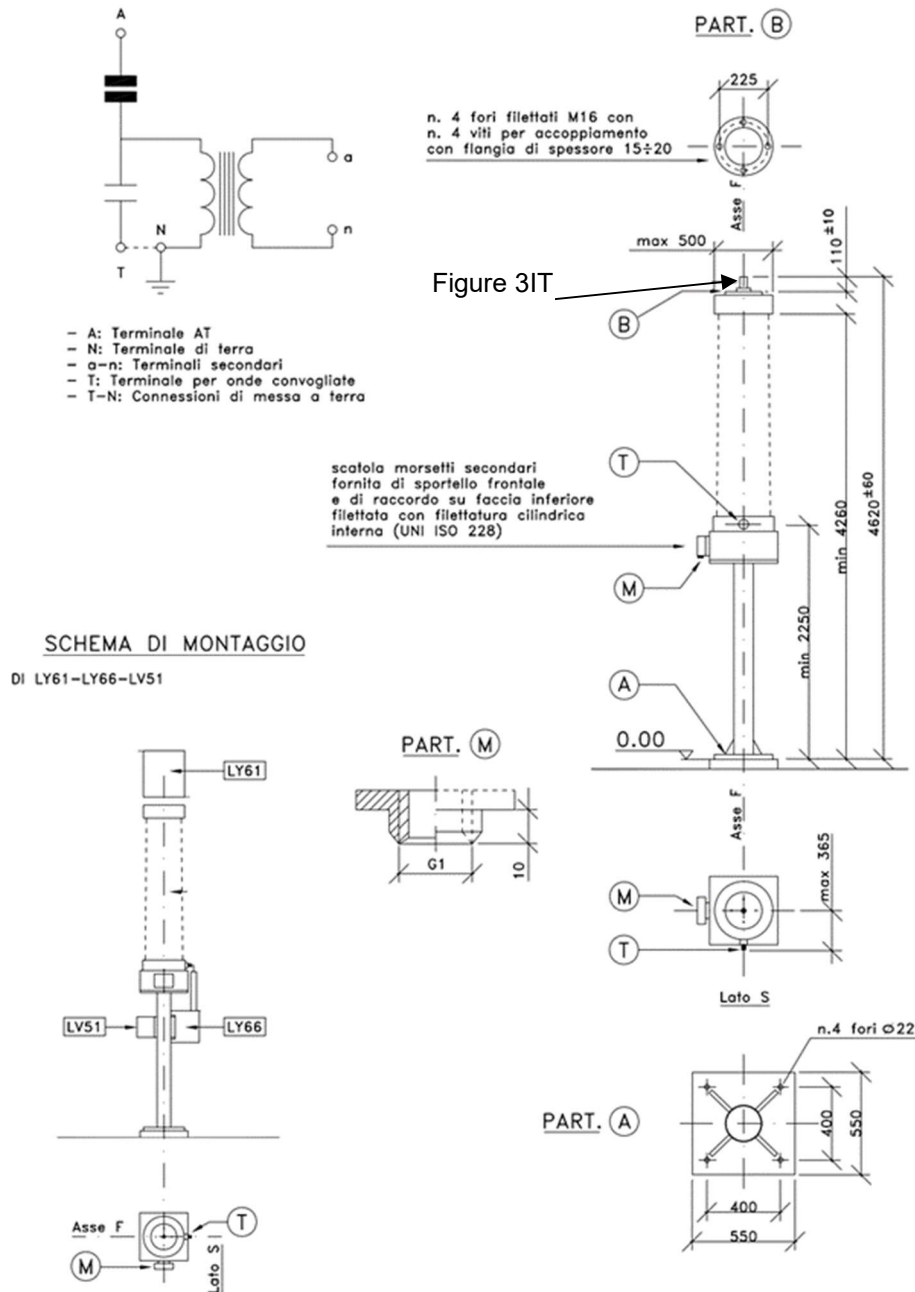


Figure 2IT (CVT U_m 170 kV)

7.5.4. Metal Surface Treatment

All parts made of iron that come into direct contact with the atmosphere shall be hot-dip galvanized (EN ISO 1461); bolts with $\varnothing < 8$ mm, nuts, and screws for assembling of the electrical and mechanical components shall be made of stainless steel AISI 304 or higher quality.

Application Areas

Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Enel Grids*

7.5.5. Accessories

7.5.5.1. Primary Outer Terminals

The CVT's primary outer terminal features are detailed in the following picture:

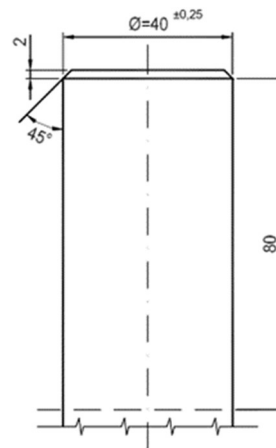


Figure 3IT (Primary Terminal)

Material can be aluminum, aluminum alloy, copper, or copper alloy.

All materials used shall be resistant or made corrosion resistant. Outer terminal made of copper or copper alloy shall be properly treated, to connect with aluminum or aluminum alloy fittings. For mechanical load IEC 61869 shall be applied.

7.5.5.2. Secondary Terminals

Secondary terminals shall be suitable for connecting cable lugs M6/M8, or with cage clamps (screw clamps) up to 6mm².

7.5.5.3. Grounding Terminals

For transformer grounding a 14 mm hole shall be provided in a suitable position to allow easy connection, equipped with a stainless steel M12 bolt included in the supply. For grounding connection of secondary winding, a bolt shall be provided inside secondary terminals box and suitable to connect cable lugs with M6/M8. This connection shall be directly connected to above-mentioned transformer grounding connection.



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Application Areas

Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Enel Grids*

7.5.5.4. CVT Support Base

Every Voltage transformer shall be supplied with his own support, adjustable in height to obtain a suitable height to connect CVT's primary outer terminal with HV connection lead. For details see the following drawing:

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Application Areas

Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Enel Grids*

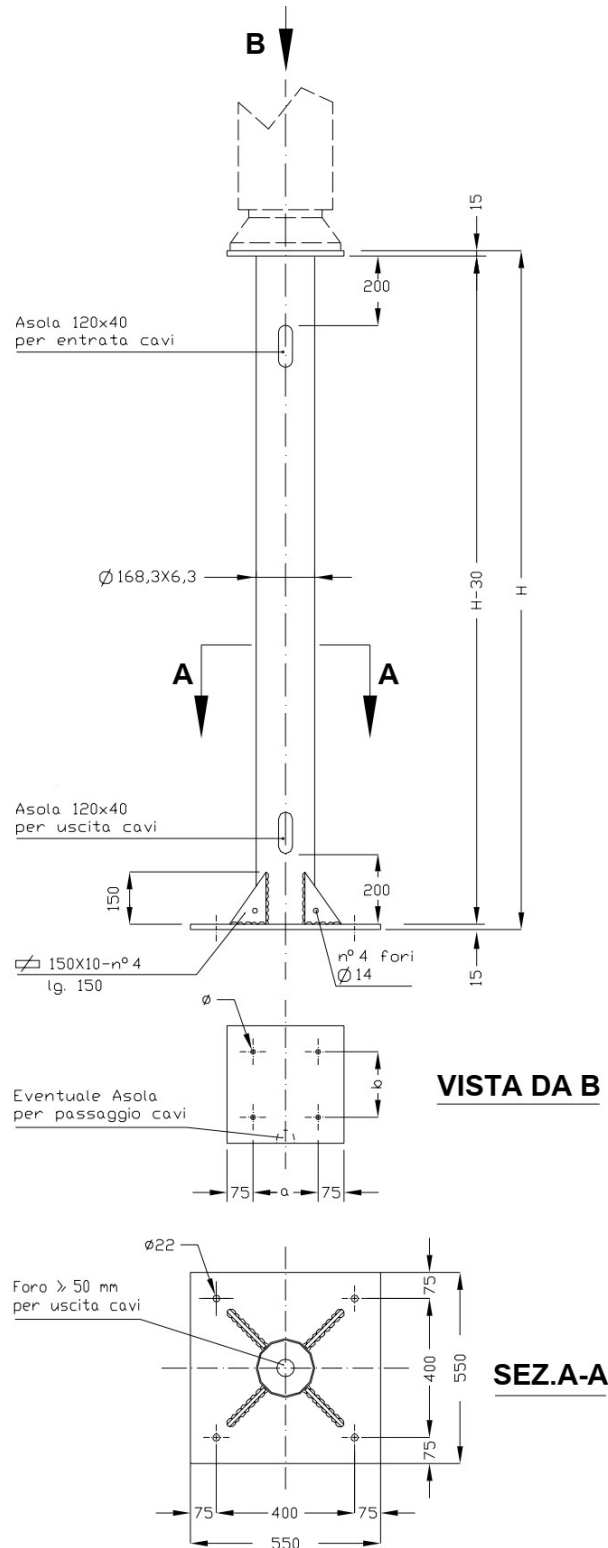


Figure 4IT

Subject: E&C – GSCT015 – HV CAPACITOR VOLTAGE TRANSFORMERS (IT)**Application Areas**Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Enel Grids*

With reference to the above drawing, the following manufacturing details shall be implemented:

- Provide suitable loops for entry and exit of cables, equipped with special metal closures and waterproof material resistant to corrosion from weathering and suitable to be drilled on-site for the placement of cable glands.
- Provide the hole for the cable outlet at the bottom of the base plate at the inner circumference of the tube which will limit the maximum size allowed.
- If necessary, to facilitate the passage of cables from the component to the cable entry of the support, a buttonhole shall be placed on the upper plate.
- The materials to be used for manufacturing foot (tubes) are of S355JR UNI EN 10025 quality.
- The materials to be used for manufacturing of gusset plates are of S275JR UNI EN 10025 quality.
- Welding will be done with electrodes E52 quality class 3 according to UNI 5132-74 or with automatic/semi-automatic qualified procedure.
- Manufacturing tolerances on dimensions of semi-finished products (diameter of tubes and similar) according to UNI EN 10216 -2005.
- Manufacturing tolerances on overall dimensions: $\pm 2\text{mm}$.
- Manufacturing tolerances on interaxle spacing and drilling pitches, and in general on geometric dimensions of all coupling elements with other components: $\pm 1\text{mm}$.
- Machining tolerances on planarity: $\pm 1/100$.
- Machining tolerances on holes: $\pm 1\text{mm}$.
- Hot dip galvanization according to EN ISO 1461.

7.5.5.5. Secondary Terminals Box

It shall be located in an easy position to allow connections and have the following features:

- be equipped with a front door and fully sealable (the various fastening systems such as hinges, screws, etc., shall not be accessible from the outside, or alternatively be sealable).

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Application Areas

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Staff Function: -

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- be equipped with a fitting as indicated in the Figura 1IT and Figura 2IT (“*particolare M*”), or alternatively with a 27 mm hole (suitable for fastening G1 pipe threaded with a ring nut), however positioned at the bottom part.
- have a protection degree not lower than IP 44 (IEC 60529).
- be equipped with a ground collector connected directly to CVT's earthing point.
- be fitted with an aeration system to prevent condensation and corrosion. Openings shall be fitted with anti-insect screens.
- have, inside, indelibly reported, the connection diagrams of the sections, primary and secondary windings.

7.5.5.6. Liquid Level Gauge

The device for checking the liquid level shall indicate whether the liquid level is within the operating range, during operation and must be clearly readable from ground.

7.5.5.7. Overpressure Relief Device

The mechanical protective action can be performed by liquid expansion conservator. The conservator shall be watertight to the external environment and designed to exclude condensation and stagnation of water, to prevent damages at low temperatures.

7.5.5.8. Liquid Sampling Device

7.5.5.9. Lifting Lugs

Placed to facilitate lifting of CVT.

7.5.5.10. Rating Plate

In accordance with IEC 61869-1 & IEC 61869-5. Rating plate shall be supplied in Italian language and all information shall be marked in an indelible manner. Material shall be aluminum.

7.5.5.11. Terminal Marking

All terminals shall be permanently marked according to IEC 61689-5.

7.5.5.12. Capacitive Tap

7.5.5.13. Capacitor Voltage Divider

The capacitor divider shall be sealed and not allow any contact of the insulating liquid with the atmosphere. The internal insulation can be either mixed (paper and polypropylene film) or single type polypropylene film; however, it shall be immersed in an insulating liquid.

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Staff Function: -

Service Function: -

Business Line: *Enel Grids*

7.5.5.14. Electromagnetic Unit

The electromagnetic unit shall be tight at a constant volume in the full temperature working range and shall be equipped with an oil level indicator.

7.5.5.15. Carrier-Frequency Accessories & High Frequency Signals Characteristics

Line-trap is not included in the scope of supply. However, the CVTs shall be designed to support and connect a Line-Trap. For the assembly and connection of any Line-Trap accessories, the manufacturer shall supply 4 threaded holes (several screws supplied) on the upper flange for fastening the line trap (see drawing LY 61 for further details). The CVT shall be supplied with the low voltage terminal connected to the ground firmly and safely. This connection will preferably be made by means of a bar and in any case with an equivalent copper section not less than 40 mm²; it must also be easily removable (for example by screws) in case of connection to a line trap.

Drain coil is not included in the scope of supply. However, the CVTs shall be designed to connect a drain coil. For this scope a low voltage terminal (T) for the connection of the tuning device shall be supplied (see drawing LY 66 for further details). This terminal shall be nickel-plated copper alloy with dimensions M12 x 30

7.6 TESTING**7.6.1. Type Tests****7.6.2. Routine/Acceptance Tests****7.6.3. Special Tests**

In addition to the mechanical tests required by IEC 61869-1 on the primary terminal, an additional mechanical test of the CVT's upper flange shall be performed as indicated below:

Horizontal and vertical forces shall be applied contemporarily at a height of 600mm above the CVT's upper flange for 60 sec (see Common List for specific force values).

The instrument transformer shall be considered to have passed the test if there is no evidence of damage (deformation, rupture or leakage).

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Application Areas

Perimeter: *Global*

Staff Function: -

Service Function: -

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7.6.4. Sample Tests

7.7 CONDITIONS OF SUPPLY

7.7.1. Warranty

7.7.2. Reception Control

7.7.3. Technical Information Required

7.7.4. Packaging and Transport

After the inspection, a copy of the packing list must be issued for checking and approval by the purchaser, before dispatching.

7.7.5. Installation, Operation, Maintenance and Disassembling

Manual for installation, operation, maintenance and disassembling shall be provided in Italian.

7.7.6. Technical Conformity Assessment (TCA)

Application Areas

Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Enel Grids*

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Staff Function: -

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ANNEX LOCAL SECTION PERÙ (PE)**7.1 DOCUMENT/SECTION SCOPE**

The scope of this Local Section is to integrate the Common Part to provide the technical standard requirements for the capacitor voltage transformers (CVTs) of Infrastructure and Networks of Enel Distribución Perú S.A.A.

7.2 LIST OF COMPONENTS

See ANNEX A.

7.3 SERVICE CONDITIONS

The equipment of this specification will be designed for an installation at a maximum height above sea level of 1000 m and severe environmental pollution and a marine environment.

7.4 TECHNICAL CHARACTERISTICS

For definitions IEC 61869-1, IEC 61869-5 apply.

7.4.1. Type Of Capacitor Voltage Transformers

See Datasheets.

7.4.2. Number of Cores and Windings

See Datasheets.

7.4.3. Rated Insulation Levels

See Datasheets.

7.4.4. Rated Output

See Datasheets.

7.4.5. Rated Accuracy Class CVT

See Datasheets.

7.4.6. Rated Primary Voltage U_{pr}

See Datasheets.

7.4.7. Rated Secondary Voltage U_{sr}

See Datasheets.

7.4.8. Rated Voltage Factor F_v

See Datasheets.

7.4.9. Rated Capacitance of a Capacitor C_r

See Datasheets.

7.4.10. High Voltage Capacitor C_1

See Datasheets.

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Staff Function: -

Service Function: -

Business Line: *Enel Grids*

7.4.11. Intermediate Voltage Capacitor C₂

See Datasheets.

7.4.12. Static Withstand Load (F_R)

See Datasheets.

7.4.13. Installation

The type of installation can be indoor or outdoor.

See Datasheets.

7.4.14. Temperature Rise

See IEC-61698-1 and IEC-61698-5.

7.4.15. Seismic Qualification

A seismic certification is required for the severity level AF5 according to IEC 60068-3-3, for VT and support assembled.

The seismic certification can be based on the calculations according to the above-mentioned standard.

7.4.16. Ferro-resonance

According to IEC 61869-5.

7.4.17. Requirements For Transient Response

According to IEC 61869-5.

7.4.18. Short Circuit Withstand Capability and Secondary Current

According to IEC 61869-5.

7.4.19. Drain Coil Technical Parameters**7.5 CONSTRUCTION CHARACTERISTICS****7.5.1. Internal Insulation**

The internal insulating of HV CVTs shall be oil, ester and paper for transformers for outdoor installation and epoxy resin for transformers for indoor installation. Other types of insulation will be submitted to the approval of ENEL.

Equipment insulated in oil or ester shall be provided with a fluid expansion chamber with a metal bellows, in order to absorb thermal contractions and expansions of the fluid. The oil used shall be naphthenic-based, without inhibitors or additives, free of PCBs and shall meet the requirements of the IEC 60296 Standard.

The ester used shall meet the requirements of the IEC 62770 Standard.

7.5.2. External Insulation

The external insulation of the VTs shall be porcelain or silicone rubber for external installation and epoxy resin or silicone rubber for internal installation. Other types of insulation will be

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submitted to ENEL's approval. The creepage distance of the insulators shall be in accordance with the level of pollution requested by ENEL.

The active part of the CVTs shall be located in the metallic bodies (upper or lower, as appropriate). Designs with the active part located inside the porcelain will not be accepted.

7.5.3. Overall Dimensions and Layout

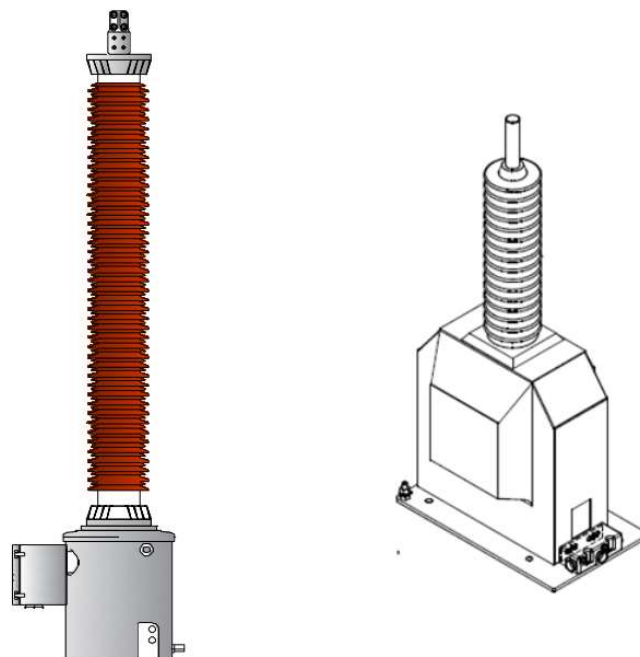


Figure 1PE (Outdoor application) Figure 2PE (Indoor application)

CVTs use is limited to outdoor installation for Power Line Carrier (PLC) applications as requested in the guaranteed technical data sheets. In case of indoor installation VTs they shall be inductive type.

7.5.4. Metal Surface Treatment

Painting and galvanization shall be suitable for the environmental conditions indicated in clause 7.3, *Table 3CP* (Common Part).

The thicknesses of the galvanized parts shall comply with Annex B for the different thicknesses of sheets and environmental conditions. The non-energized metallic surfaces of the capacitor voltage transformers shall be made of steel hot-dip galvanized and/or painted or aluminum, as indicated in Annex B. The painting and galvanization processes described in this specification shall not be applied to the composite material insulators of capacitor voltage transformers.

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Staff Function: -

Service Function: -

Business Line: *Enel Grids*

7.5.5. Accessories**7.5.5.1. Primary outer Terminals**

The primary terminals of the VTs for outdoor installation shall be made of silver aluminum. The terminal shall be plate type (NEMA 4N).

The distances between terminal holes shall be 44,5 mm x 44,5 mm according to NEMA 4N.

In case of capacitor voltage transformers for indoor installation, the terminals shall be flat, silver-plated copper material; a specific distance between terminal holes is not required. Terminals shall have clearly distinguishable polarity markings.

7.5.5.2. Secondary Terminals

In case of VTs for outdoor use, the secondary terminals shall be made of phosphor bronze, and they shall be wired to terminal blocks located inside a box. This box shall be suitable for outdoor use, with an IP55 degree of protection and will allow external cable connections from below.

In case of indoor installation transformers, the secondary terminal box will allow external cable connections laterally. Secondary terminals shall have clearly distinguishable terminal and polarity markings.

The manufacturer shall include appropriate sectionable terminals in the terminal box where the cables of the measured and protected cores voltage signals will be connected, which shall contain thermomagnetic switches with an auxiliary contact only for outdoor measuring transformers.

7.5.5.3. Grounding Terminals

The manufacturer shall supply terminals to connect the VTs to the ground system of the substation. The connections to the ground mesh shall be plate type with a section of 3 x 40 mm.

7.5.5.4. CVT Support Base**7.5.5.5. Secondary Terminals Box**

An MCB thermomagnetic switch with auxiliary contact for signaling will be installed in the LV junction box of the outdoor type of instrument transformers; the secondary voltage output of the instrument transformer will be connected to the MCB.

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Application Areas

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Staff Function: -

Service Function: -

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7.5.5.6. Liquid Level Gauge

This element shall have a maximum and minimum level indication and be easy to read for an operator standing on the floor through a UV-resistant visor.

7.5.5.7. Overpressure Relief Device

7.5.5.8. Liquid Sampling Device

Capacitor voltage transformers shall have a device to be able to take samples of the liquid, which shall be adequately ensured, preserving the tightness of the equipment. Its location should be in the base below that team.

7.5.5.9. Lifting Lugs

7.5.5.10. Rating Plate

A stainless steel or aluminum rating plate in Spanish language, shall be included. This rating plate shall comply with what is indicated in the IEC 61869 Standards, a plate with the winding connection diagram shall also be included.

The rating plate with indelible indication shall have at least the following characteristics (located on the LV side of the tank):

- *Nombre del fabricante y marca por la cual pueda ser identificado.*
- *Año de fabricación, número de serie y tipo de designación.*
- *Frecuencia Nominal.*
- *Tensión más alta del equipo.*
- *Nivel de aislamiento nominal.*
- *Potencia nominal continua.*
- *Tensiones.*
- *Corrientes.*
- *Temperatura ambiente considerada para el diseño.*
- *Peso (kg), marca y tipo de aceite.*
- *Peso de la parte activa (kg).*
- *Peso total (kg).*
- *Normas de fabricación*

The rating plate shall support the service conditions indicated in the document GSCT0015 Common Section and will have the name of ENEL printed on it.

7.5.5.11. Terminal Marking

In accordance with IEC 61869-5.

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Staff Function: -

Service Function: -

Business Line: *Enel Grids*

7.5.5.12. Capacitive Tap**7.5.5.13. Capacitor Voltage Divider****7.5.5.14. Electromagnetic Unit****7.5.5.15. Carrier-Frequency Accessories & High Frequency Signals Characteristics**

CVTs shall be equipped with a suitable device for PLC, with the following accessories:

- Drain Coil
- Surge Arrester
- Carrier Earthing Switch

Optionally, when requested by ENEL during offer stage, the CVTs shall be equipped with an adapter suitable to install a line trap.

7.6 TESTING**7.6.1. Type Tests**

According to clause 7.6.1 Common Part.

7.6.2. Routine/Acceptance Tests

According to clause 7.6.2 Common Part.

In addition the following tests shall be performed:

- Measure of the paint thickness and adherence, ASTM 3359 (for tank and rating plate, if applicable).
- Insulating oil or ester test, according to IEC 60296 or IEC 62770.

7.6.3. Special Tests

According to clause 7.6.3 Common Part.

In addition the following tests shall be performed:

- Test for vegetable oil, according to Mexican Standard NMX-J-628-ANCE.
- Mechanical bending tests on fixing support.

7.6.4. Sample Tests

According to clause 7.6.4 Common Part

Subject: E&C – GSCT015 – HV CAPACITOR VOLTAGE TRANSFORMERS (PE)**Application Areas**Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Enel Grids*

7.7 CONDITIONS OF SUPPLY**7.7.1. Warranty****7.7.2. Reception Control****7.7.3. Technical Information Required****7.7.4. Packaging and Transport**

It is essential that the transport, storage and installation of capacitor voltage transformers, as well as their operation and maintenance in service, be carried out in accordance with the instructions given by the manufacturer. Consequently, the manufacturer shall provide timely instructions for the transportation, storage, installation, operation and maintenance of capacitor voltage transformers.

The supplier will carry out the appropriate packaging of the capacitor voltage transformers to ensure their protection during transport by sea, land or air. In the packaging, padding material will be used to ensure good protection in the event that the boxes containing the materials are hit or damaged during loading and unloading maneuvers.

To protect materials from moisture, airtight covers or bags containing hygroscopic material shall be used.

Each drawer shall have the following information printed on it:

- Type of material and quantity
- Net and gross weight
- Date

The supplier will be responsible for transporting the transformers to ENEL's warehouses, unless otherwise indicated in the purchase order.

For each type of capacitor voltage transformer, the installation instructions provided by the manufacturer shall include at least the items listed below:

- Information required for safe unpacking and lifting
- Diagram of assembly and marking of the parts
- Instructions for the assembly of capacitor voltage transformers, auxiliary and operating devices
- Instructions for connecting conductors, auxiliary circuits, liquid systems, connections to earth and the manufacturer's recommendation for the type of cable to be connected to the secondary terminals

Provide instructions for inspection and testing to be performed after the capacitor voltage transformer has been installed and all connections have been completed



Material Specification code: GRI-GRI-MAT-E&C-0049

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Subject: E&C – GSCT015 – HV CAPACITOR VOLTAGE TRANSFORMERS (PE)

Application Areas

Perimeter: *Global*

Staff Function: -

Service Function: -

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7.7.5. Installation, Operation, Maintenance and Disassembling

Manual for installation, operation, maintenance, and disassembling shall be provided in Spanish.

7.7.6. Technical Conformity Assessment (TCA)

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Staff Function: -

Service Function: -

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Application Areas

Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Enel Grids*

ANNEX LOCAL SECTION ROMANIA (RO)

7.1 DOCUMENT/SECTION SCOPE

The scope of this Local Section is to integrate the Common Part to provide the technical standard requirements for the capacitor voltage transformers of Enel Distribuție Banat, Enel Distribuție Dobrogea and Enel Distribuție Muntenia.

7.2 LIST OF COMPONENTS

See ANNEX A.

7.3 SERVICE CONDITIONS

The CVT shall be single phase, for outdoor use and immersed in insulating mineral oil.

7.4 TECHNICAL CHARACTERISTICS

For definitions IEC 61869-1, IEC 61869-5 apply.

7.4.1. Type Of Capacitor Voltage Transformers

Single-phase Capacitor Voltage transformers with three secondary winding located at the bottom part of the unit, intended to be connected to HV grid for measuring and protection scope with U_m 123kV.

7.4.2. Number of Cores and Windings

See Datasheets.

7.4.3. Rated Insulation Levels

See Datasheets.

7.4.4. Rated Output

See Datasheets.

7.4.5. Rated Accuracy Class CVT

See Datasheets.

7.4.6. Rated Primary Voltage U_{pr}

See Datasheets.

7.4.7. Rated Secondary Voltage U_{sr}

See Datasheets.

7.4.8. Rated Voltage Factor F_v

See Datasheets.

7.4.9. Rated Capacitance of a Capacitor C_r

See Datasheets.

7.4.10. High Voltage Capacitor C_1

See Datasheets.

Subject: E&C – GSCT015 – HV CAPACITOR VOLTAGE TRANSFORMERS (RO)**Application Areas**Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Enel Grids*

7.4.11. Intermediate Voltage Capacitor C₂

See Datasheets

7.4.12. Static Withstand Load (F_R)

See Datasheets.

7.4.13. Installation

The type of installation can be indoor or outdoor.

See Datasheets.

7.4.14. Temperature Rise

See IEC-61698-1 and IEC-61698-5.

7.4.15. Seismic Qualification

A seismic certification is required for the severity level AF5 according to IEC 60068-3-3, for CVT and support assembled.

The seismic certification can be based on the calculations according to the above-mentioned standard.

7.4.16. Ferro-resonance

According to IEC 61869-5.

7.4.17. Requirements For Transient Response

According to IEC 61869-5.

7.4.18. Short Circuit Withstand Capability and Secondary Current

According to IEC 61869-5.

7.4.19. Drain Coil's Technical Parameters**7.5 CONSTRUCTION CHARACTERISTICS**

CVT shall be designed to ensure that constant oil pressure is maintained if the specified temperature range is exceeded.

Measures shall be taken to achieve effective shielding between primary and secondary windings.

The supplier shall show the features required for the support and the mounting element.

Each voltage transformer shall be supplied with:

- fixing materials.
- clamps necessary for connection of the transformer to the external power circuit.
- clamps, terminals or earthing screws.
- gland plates for incoming cables (number and size will be determined according to specific requirements).

Subject: E&C – GSCT015 – HV CAPACITOR VOLTAGE TRANSFORMERS (RO)**Application Areas**Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Enel Grids***7.5.1. Internal Insulation**

The internal insulating fluid of both capacitive divider and electromagnetic unit shall be biodegradable and compatible with the environment. The absence of PCB shall be guaranteed. The manufacturer shall demonstrate that the oil used does not contain PCB.

7.5.2. External Insulation

Insulators shall be porcelain or light grey inorganic composite material, with HTV (High Temperature Vulcanization) or LSR (Liquid Silicone Rubber) silicone rubber, without EPDM or other organic rubber, in accordance with IEC 61462 for mechanical testing and IEC 61109 for dielectric testing and the electrical-environmental accelerated ageing test.

The external insulation shall be made of one piece. The shape of the sheds and the length of the total escape line of the insulator shall guarantee the strength of the surface insulation to the salinity and voltage values indicated in the prescribed environmental conditions.

7.5.3. Overall Dimensions and Layout**7.5.4. Metal Surface Treatment**

All parts made of iron that come into direct contact with the atmosphere shall be hot-dip galvanized (EN ISO 1461); bolts, nuts, and screws for assembling of the electrical and mechanical components shall be made of stainless steel AISI 304 or higher quality. External protective coatings are not required for stainless steel parts.

7.5.5. Accessories**7.5.5.1. Primary Outer Terminals**

The high-voltage primary terminal shall be suitable for connecting a conductor with section of 300 mm².

Material can be aluminum, aluminum alloy, copper, or copper alloy.

All materials used shall be resistant or made corrosion resistant. Outer terminal made of copper or copper alloy shall be properly treated, to connect with aluminum or aluminum alloy fittings. For mechanical load IEC 61869 shall be applied.

7.5.5.2. Secondary Terminals

The secondary terminals shall be suitable for connecting cables with a 4-10 mm² section.

7.5.5.3. Grounding Terminals

Transformers shall be equipped with suitable terminals to make the following grounding connections:

Subject: E&C – GSCT015 – HV CAPACITOR VOLTAGE TRANSFORMERS (RO)

Application Areas

Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Enel Grids*

- for primary winding, a hole $\varnothing 14$ mm shall be provided on the base metal structure.
- for secondary windings, a terminal shall be provided inside the secondary terminal box.

7.5.5.4. CVT Support Base

7.5.5.5. Secondary Terminals Box

It shall be located in an easy position to allow connections and have the following features:

- Protection degree IP 54 (IEC 60529).
- Measures shall be taken to avoid condensation and corrosion. Appropriate ventilation holes equipped with insect screens shall be provided. The cover of the closing device shall be provided with sealing option.
- All iron material in contact with the atmosphere shall be hot galvanized according to EN ISO 1461. Bolts shall be of stainless or hot galvanized steel. External protective coatings are not required for stainless steel parts.
- Gland plates for input cables.
- On the inside of the secondary terminal box cover an internal wiring diagram label with primary and secondary terminals marking shall be provided.

7.5.5.6. Liquid Level Gauge

The device for checking the liquid level shall indicate whether the liquid level is within the operating range, during operation and must be clearly readable from ground.

7.5.5.7. Overpressure Relief Device

The mechanical protective action can be performed by liquid expansion conservator. The conservator shall be watertight to the external environment and designed to exclude condensation and stagnation of water, to prevent damages at low temperatures.

7.5.5.8. Liquid Sampling Device

7.5.5.9. Lifting Lugs

Placed to facilitate lifting of CVT.

7.5.5.10. Rating Plate

In accordance with IEC 61869-1 & IEC 61869-5. Rating plate shall be supplied in Romanian and all information shall be marked in an indelible manner.

Subject: E&C – GSCT015 – HV CAPACITOR VOLTAGE TRANSFORMERS (RO)**Application Areas**Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Enel Grids*

All fixed bolts, screws, and nuts shall be made of non-corrosive material. Plate shall be made of aluminium.

7.5.5.11. Terminal Marking

All terminals shall be permanently marked according to IEC 61689-5.

7.5.5.12. Capacitive Tap**7.5.5.13. Capacitor Voltage Divider**

The capacitor divider shall be sealed and not allow any contact of the insulating liquid with the atmosphere. The internal insulation can be either mixed (paper and polypropylene film) or single type polypropylene film; however, it shall be immersed in an insulating liquid.

7.5.5.14. Electromagnetic Unit

The electromagnetic unit shall be tight at a constant volume in the full temperature working range and shall be equipped with an oil level indicator.

7.5.5.15. Carrier-Frequency Accessories & High Frequency Signals Characteristics**7.6 TESTING**

The measurement transformers shall have all tests and checks in accordance with the international standards in force. General certificates issued for a wide range of basic parameters shall not be considered valid.

Measurement transformers shall be subjected to type and individual tests in test laboratories not belonging to the manufacturer/supplier. Certificates of all tests carried out shall be required.

The Testing lab shall be certified according to the standard SR EN ISO/IEC 17025.

7.6.1. Type Tests

In addition to the tests required in par. 7.6.1 of GSCT0015 Common Part, the IEC 60358 shall be applied for the requirements and tests for capacitor voltage transformers regarding the high-frequency characteristics. Moreover, visual and dimensional checks shall be performed.

Note: The sequence of those tests and the possibility of using multiple units of the same type to perform the tests shall be agreed with the persons responsible for the SC Enel Distributie Dobrogea S.A. In any case, all dielectric type tests shall be carried out on the same unit.

7.6.2. Routine/Acceptance Tests

In addition to the tests required in par. 7.6.2 of GSCT0015 Common Part, painting checks shall be performed.

Subject: E&C – GSCT015 – HV CAPACITOR VOLTAGE TRANSFORMERS (RO)**Application Areas**Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Enel Grids*

7.6.3. Special Tests**7.7 CONDITIONS OF SUPPLY****7.7.1. Warranty****7.7.2. Reception Control****7.7.3. Technical Information Required****7.7.4. Packaging and Transport**

Equipment shall be prepared for delivery so that it can be handled easily and also to prevent any damage during transport.

Each transformer will be packaged alone in a box or a pallet. A properly installed shock recorder shall be provided to record shocks during transport. Manufacturer shall provide a report of the shock recorder after delivery of the equipment.

Each package shall be marked with indelible paint that will not be wiped off in the rain or discoloured due to solar radiation, and the following information shall be indicated:

- The manufacturing plant.
- The ENEL code and the serial number, shall be clearly visible in relation to the other information and with a height of at least 20 mm.
- The weight.
- The position of the centre of gravity.
- The warning signs for fragile product.
- The order number of the package within the supply.

Transport shall be done by rail or road. During transport, the package shall be fixed securely to the truck without overlapping with other objects.

The manufacturer shall take special measures to protect the insulation during transport, storage, and installation so as to avoid moisture absorption before putting the VCT in operation.

7.7.5. Installation, Operation, Maintenance and Disassembling

All equipment documentation shall be in Romanian, complete and detailed; the technical documentation of the equipment is part of the delivery.

The manufacturer shall deliver the instructions for transport, storage, installation, operation and maintenance written in Romanian.

The shipping and storage instructions shall be provided in a timely manner prior to delivery and the instructions for installation, operation and maintenance shall be provided at a later date with the delivery of the product.

Subject: E&C – GSCT015 – HV CAPACITOR VOLTAGE TRANSFORMERS (RO)**Application Areas**Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Enel Grids*

Operating instructions shall be in a different manual than installation and maintenance instructions.

The measurement transformers will comply with the Romanian legislation in force on the introduction into operation and commissioning of the equipment used in commercial transactions.

The transformers delivered will be accompanied, in accordance with the provisions of the Law on Safety and Health at work no.319/2006, by certificates on safety and health at work. The certificates will be issued after the transformers have been subjected to tests according to the methodology contained in GD 1425/2006.

7.7.6. Technical Conformity Assessment (TCA)

Subject: E&C – GSCT015 – HV CAPACITOR VOLTAGE TRANSFORMERS (SP)

Application Areas

Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Enel Grids*

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Application Areas

Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Enel Grids*

ANNEX LOCAL SECTION SPAIN (SP)

7.1 DOCUMENT/SECTION SCOPE

The scope of this Local Section is to integrate the Common Part to provide the technical standard requirements for the capacitor voltage transformers of e-distribución.

7.2 LIST OF COMPONENTS

See ANNEX A.

7.3 SERVICE CONDITIONS

The CVT shall be single phase, for outdoor use and immersed in insulating mineral oil.

7.4 TECHNICAL CHARACTERISTICS

For definitions IEC 61869-1, IEC 61869-5 apply.

7.4.1. Type Of Capacitor Voltage Transformers

Capacitor Voltage transformers for outdoor applications, intended to be connected to new HV grid substations with U_{pr} 55kV, 66kV, 110 kV and 132 kV and with the two simultaneous functions: voltage reduction for measurement and protection, and high frequency signal coupling for communications.

7.4.2. Number of Cores and Windings

See Datasheets.

7.4.3. Rated Insulation Levels

See Datasheets.

7.4.4. Rated Output

See Datasheets.

7.4.5. Rated Accuracy Class CVT

See Datasheets.

7.4.6. Rated Primary Voltage U_{pr}

See Datasheets.

7.4.7. Rated Secondary Voltage U_{sr}

See Datasheets.

7.4.8. Rated Voltage Factor F_v

See Datasheets.

7.4.9. Rated Capacitance of a Capacitor C_r

See Datasheets.

7.4.10. High Voltage Capacitor C_1

See Datasheets.

Subject: E&C – GSCT015 – HV CAPACITOR VOLTAGE TRANSFORMERS (SP)**Application Areas**Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Enel Grids***7.4.11. Intermediate Voltage Capacitor C₂**

See Datasheets

7.4.12. Static Withstand Load (F_R)

Capacitive voltage transformers shall be able to withstand the following mechanical stresses:

- Horizontal traction force of 1000 N (CVT with $U_m \geq 123$ kV) or 500 N (CVT with $U_m \leq 72,5$ kV) in any direction, applied in the center of the HV terminal.
- Forces produced by winds of 120 km/h, with top-mounted line-trap. The maximum dimensions of said coil shall be: 1300 mm in diameter (CVT with $U_m \geq 123$ kV) or 1000 mm (CVT with $U_m \leq 72,5$ kV), 1185 mm in height (CVT with $U_m \geq 123$ kV) or 1000 mm (CVT with $U_m \leq 72,5$ kV), mounted on a pedestal of 500 mm and with a total weight not exceeding 350 kg (CVT with $U_m \geq 123$ kV) or 200 kg (CVT $U_m \leq 72,5$ kV).

See Datasheets.

7.4.13. Installation

The type of installation can be indoor or outdoor.

See Datasheets.

7.4.14. Temperature Rise

See IEC-61698-1 and IEC-61698-5.

7.4.15. Seismic Qualification**7.4.16. Ferro-resonance**

When energized at 50Hz by a suitable power circuit (short circuit power much higher than the instrument transformer's one) the CVT shall comply with the following requirements:

- At 120% of the rated voltage and after short-circuiting the secondary terminals for at least 100ms, the peak value of the secondary voltage shall return, after 200ms, to a value less than or equal to 10% of the value existing before the short circuit is established. This test shall be performed at least 30 times.
- At 150% of the rated voltage and after short-circuiting the secondary terminals for at least 100ms, the ferroresonance shall persist for not more than 2s. This test shall be performed 10 times.

7.4.17. Requirements For Transient Response

Following a short circuit of the supply between the high-voltage terminal A and the low voltage terminal N connected to earth, the secondary voltage of a capacitor voltage transformer shall decay, within a period or less of the assigned frequency, to a value less than 10% of the peak voltage before application of the short circuit.

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Staff Function: -

Service Function: -

Business Line: *Enel Grids*

7.4.18. Short Circuit Withstand Capability and Secondary Current

According to IEC 61869-5. Moreover, the CVT design or an additional safety device shall avoid explosive rupture of the transformer's tank, in case of prolonged short circuit conditions or other internal malfunction.

Short circuit current in the secondary winding when this is short-circuited shall be less than or equal to 75A.

7.4.19. Drain Coil's Technical Parameters

When the transformer is supplied at 120% of the rated voltage, the voltage drop across the drain coil shall be less than 6V.

Drain coil impedance shall be higher than 9600Ω in the frequency range 40÷260 kHz.

7.5 CONSTRUCTION CHARACTERISTICS

The capacitor voltage transformer scope of this standard shall be supplied with all the elements showed in Figure1SP, according to the following list:

- Voltage divider C1 & C2, consisting of a series of capacitors, supplied along with a HV bushing, an intermediate voltage terminal, a LV terminal and an additional terminal for the high frequency terminal.
- Voltage inductive transformer with all accessories needed to assemble and connect the elements, along with ferro-resonance suppression device, connected between the intermediate voltage bushing and the earthing bushing "N". VTI shall be supplied with two secondary windings.
- Carrier-line frequency accessories, consisting in a drain coil, a surge arrester and a carrier earthing switch.

Subject: E&C – GSCT015 – HV CAPACITOR VOLTAGE TRANSFORMERS (SP)

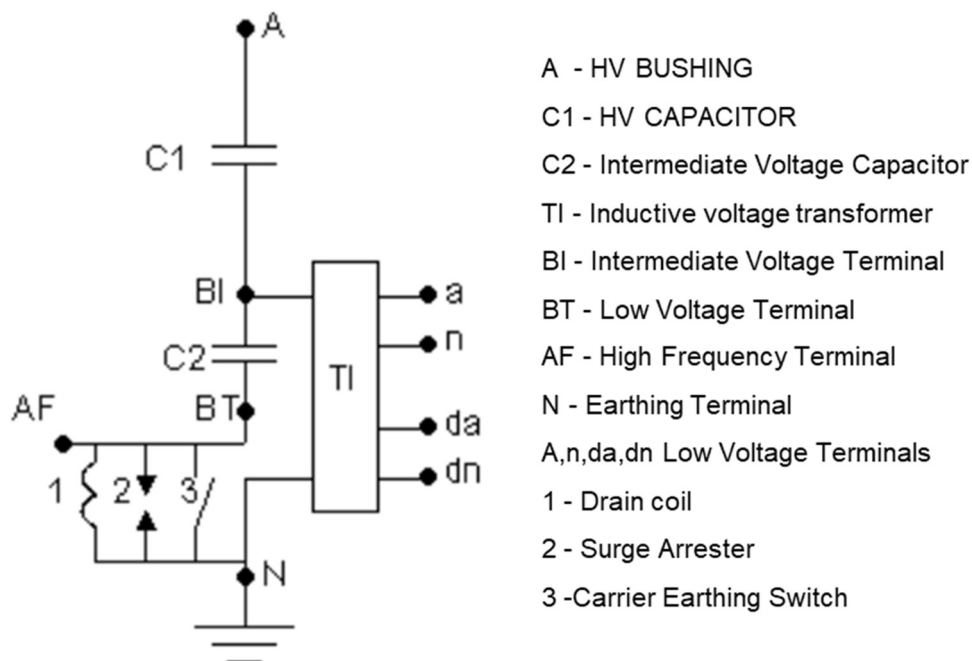
Application Areas

Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Enel Grids*



- A - HV BUSHING
- C1 - HV CAPACITOR
- C2 - Intermediate Voltage Capacitor
- TI - Inductive voltage transformer
- BI - Intermediate Voltage Terminal
- BT - Low Voltage Terminal
- AF - High Frequency Terminal
- N - Earthing Terminal
- A,n,da,dn Low Voltage Terminals
- 1 - Drain coil
- 2 - Surge Arrester
- 3 -Carrier Earthing Switch

Figure 1SP

Note: The drain coil, the surge arrester, and the carrier earthing switch shall be an integrated assembly, inseparably from the capacitor voltage transformer.

7.5.1. Internal Insulation

7.5.2. External Insulation

Insulators shall be made exclusively of light grey inorganic composite material, with HTV (High Temperature Vulcanization) or LSR (Liquid Silicone Rubber) silicone rubber, without EPDM or other organic rubber, in accordance with IEC 61462 for mechanical testing and IEC 61109 for dielectric testing and electrical-environmental accelerated ageing test.

Subject: E&C – GSCT015 – HV CAPACITOR VOLTAGE TRANSFORMERS (SP)

Application Areas

Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Enel Grids*

7.5.3. Overall Dimensions and Layout

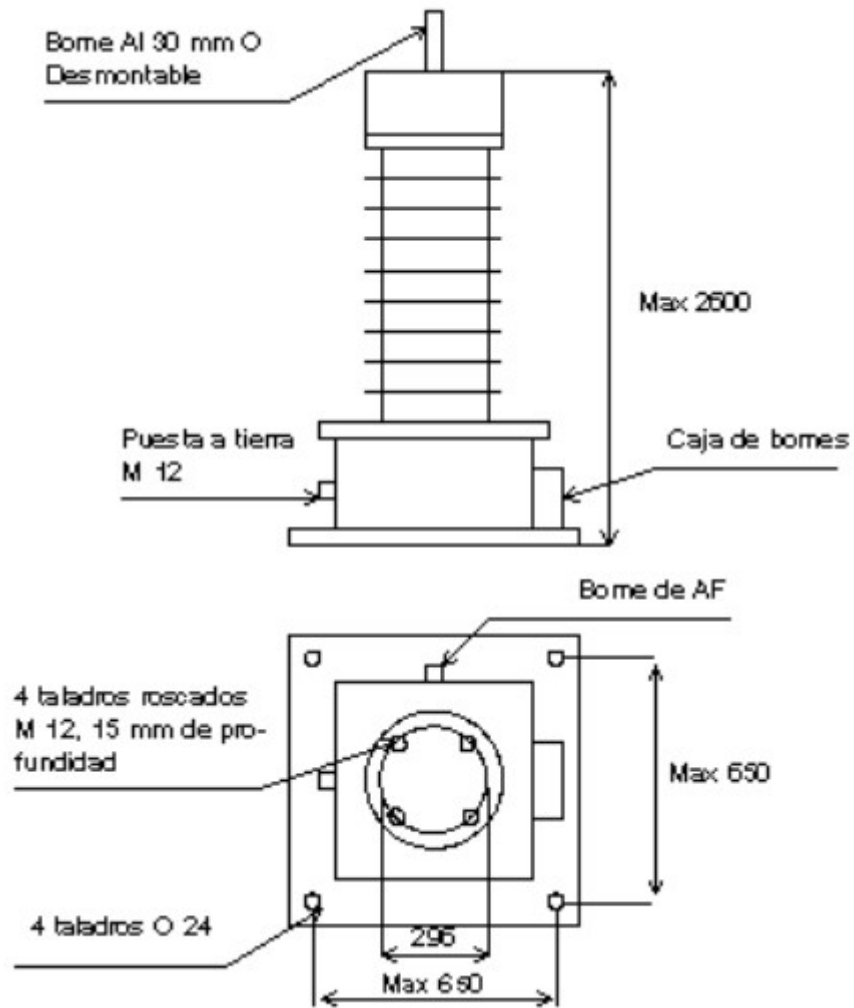


Figure 2SP (CVT 110 & 132kV)

Subject: E&C – GSCT015 – HV CAPACITOR VOLTAGE TRANSFORMERS (SP)

Application Areas

Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Enel Grids*

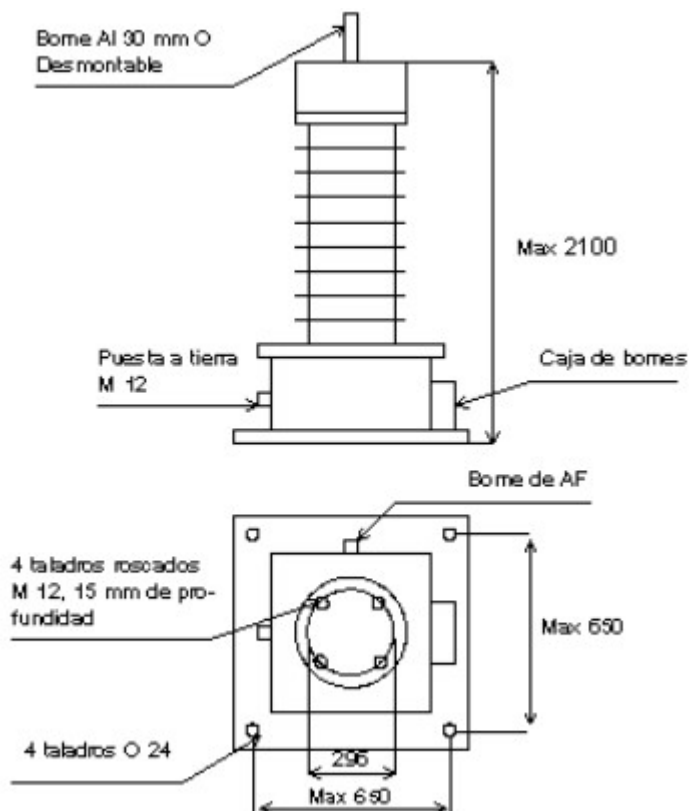


Figure 3SP (CVT 55 & 66kV)

Note: Only dimensions of interchangeability indicate in the above figure are mandatory.

7.5.4. Metal Surface Treatment

The VT tank and all of its accessories and the other metallic iron parts shall be protected by a zinc coating in accordance with the standard UNE 36.310.

7.5.5. Accessories

7.5.5.1. Primary Outer Terminals

The CVT's primary outer terminal features are detailed in the above figures 2SP and 3SP. The threaded flange shall be suitable to connect a line-trap. The threaded holes shall be equipped with suitable caps to prevent water entrance.

The outer terminal material shall be aluminum with dimensions 30x80 mm (ϕ xh).

All materials used shall be resistant or made corrosion resistant. Outer terminal made of copper or copper alloy shall be properly treated, to connect with aluminum or aluminum alloy fittings. For mechanical load IEC 61869 shall be applied.

Subject: E&C – GSCT015 – HV CAPACITOR VOLTAGE TRANSFORMERS (SP)**Application Areas**Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Enel Grids***7.5.5.2. Secondary Terminals**

Secondary terminals shall be suitable for connecting cable lugs preferably M8, or screw clamps DIN type, suitable to connect a 6 mm² copper conductor.

7.5.5.3. Grounding Terminals

For transformer grounding a 14 mm hole shall be provided in a suitable position to allow easy connection, equipped with a stainless steel M12 bolt included in the supply and indelibly marked.

7.5.5.4. CVT Support Base**7.5.5.5. Secondary Terminals Box**

It shall be located in an easy position to allow connections and have the following features:

- three outlet holes for diameters Pg 16, two of them blocked by a plug and the third one fitted with a cable entry washer, the position of which may be swapped.
- suitable vents protected against the entry of insects and be fitted with an aeration system to prevent condensation and corrosion. Openings shall be fitted with anti-insect screens.
- shall earthed through the grounding terminal without affecting the secondary terminals.
- there will be no internal devices for earthing the terminals, which is to be done externally.
- A M8 earthing terminal of the same characteristics as the rest of the standard colour terminal strip for the earthing of the cable screens shall be available to connect the terminal box to the secondary terminals. It shall allow the connection of four cables from the different screens.

7.5.5.6. Liquid Level Gauge

The device for checking the liquid level shall indicate whether the liquid level is within the operating range, during operation and must be clearly readable from ground.

7.5.5.7. Overpressure Relief Device

The mechanical protective action can be performed by liquid expansion conservator.

CVT shall be designed in such a way that if an internal failure occurs in the main insulation, any overpressure originating in the internal part can be only released upwards, avoiding the breakage and projection of the porcelain.

Subject: E&C – GSCT015 – HV CAPACITOR VOLTAGE TRANSFORMERS (SP)

Application Areas

Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Enel Grids*

7.5.5.8. Liquid Sampling device

CVT shall be equipped with a liquid sampling device plug-in type or similar.

7.5.5.9. Lifting Lugs

Placed to facilitate lifting of CVT.

7.5.5.10. Rating Plate

In accordance with IEC 61869-1 & IEC 61869-5. Rating plate shall be supplied in Spanish and all information shall be marked in an indelible manner. Material shall be aluminum.

7.5.5.11. Terminal Marking

All terminals for new substations shall be permanently marked according to the following drawings:

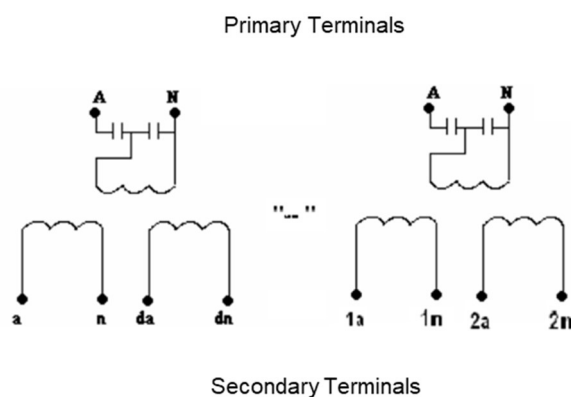


Figure 4SP

Note: the following table show a comparison between new and old terminal marking.

New Terminal Marking	Old Terminal Marking
A	P1
N	P2
a	1S1
n	1S2
da	2S1
dn	2S2
1a	1S1
1n	1S2
2a	2S1
2n	2S2

Table 1SP

Subject: E&C – GSCT015 – HV CAPACITOR VOLTAGE TRANSFORMERS (SP)**Application Areas**Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Enel Grids***7.5.5.12. Capacitive Tap****7.5.5.13. Capacitor Voltage Divider**

The capacitor divider shall be sealed and not allow any contact of the insulating liquid with the atmosphere. The internal insulation can be either mixed (paper and polypropylene film) or single type polypropylene film; however, it shall be immersed in an insulating liquid.

7.5.5.14. Electromagnetic Unit

The electromagnetic unit shall be tight at a constant volume in the full temperature working range and shall be equipped with an oil level indicator.

7.5.5.15. Carrier-Frequency Accessories & High Frequency Signals Characteristics

Additional requirements to the IEC 61869-5 for the complete coupling device are specified in the following list:

- High frequency range is 40÷260 kHz.
- High frequency capacitance, within the frequency range above specified and measured within the relevant temperature range, shall be not different from $\pm 15\%$ of the average value at 50Hz.
- High frequency losses, within the frequency range above specified and measured within the relevant temperature range, shall be less than an equivalent ohmic loss produced by a resistance of 40 Ω .
- Frequency resonance of the capacitor shall be designed to avoid any influence within the above specified frequency range.
- The capacitance and parasitic conductance between the AF terminal and the earth terminal measured at any frequency in the high frequency range shall not exceed 200 pF and 20 micro siemens, respectively.
- A drain coil is included in the scope of supply and the CVTs shall be designed to connect a drain coil.

7.6 TESTING

All the tests related to high-frequencies shall be performed in the frequency range 40÷260 kHz.

7.6.1. Type Tests

In addition to the tests specified at par. 7.6.1. of the Common Part, the following additional tests shall be performed as Type Test:

- Visual and dimensional inspection
- Completeness of rating plate after tests

Subject: E&C – GSCT015 – HV CAPACITOR VOLTAGE TRANSFORMERS (SP)**Application Areas**Perimeter: *Global*

Staff Function: -

Service Function: -

Business Line: *Enel Grids*

- Painting checks

7.6.2. Routine/Acceptance Tests

In addition to the tests specified at par. 7.6.2. of the GSCT0015 - Common Part, the following additional tests shall be performed as Type Test:

- Visual and dimensional inspection
- Completeness of rating plate after tests
- Painting checks

7.6.3. Special Tests**7.6.4. Sample Tests**

On a sample of 10% of the total transformer per order, with a minimum of two units, the following tests shall be performed:

- Measurement of drain coil's voltage drop
- Measurement of drain coil's actual impedance at 40 and 260 kHz.

7.7 CONDITIONS OF SUPPLY**7.7.1. Warranty****7.7.2. Reception Control****7.7.3. Technical Information Required****7.7.4. Packaging and Transport****7.7.5. Installation, Operation, Maintenance and Disassembling**

Manual for installation, operation, maintenance, and disassembling shall be provided in Spanish.

7.7.6. Technical Conformity Assessment (TCA)