**Technical specification code: MAT-E&C-NC-2021-0070-GIN**

Version no. 1 dated 21/12/2021

**Subject:** Global Infrastructure and Networks - GSCH012 Outdoor Terminations for High Voltage Cables.

**Application Areas**

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

## CONTENTS

**Technical specification code: MAT-E&C-NC-2021-0070-GIN**

Version no. 1 dated 21/12/2021

**Subject:** Global Infrastructure and Networks - GSCH012 Outdoor Terminations for High Voltage Cables.

**Application Areas**

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

---

THE HEAD OF NETWORK COMPONENTS
**Maurizio Mazzotti**

Technical specification code: MAT-E&C-NC-2021-0070-GIN
Version no. 1 dated 21/12/2021

**Subject:** Global Infrastructure and Networks - GSCH012 Outdoor Terminations for High Voltage Cables.

**Application Areas**

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

## 1. DOCUMENT AIMS AND APPLICATION AREA

The aim of this document is to provide technical requirements for the supply of outdoor terminations for high voltage cables to be used on transmission lines of the Enel Group Companies listed below:

| Country | Distribution Company |
|---|---|
| Argentina | Edesur |
| Brasil | Enel Distribuição Rio<br>Enel Distribuição Ceará<br>Enel Distribuição Goiás<br>Enel Distribuição São Paulo |
| Chile | Enel Distribución Chile |
| Colombia | Codensa |
| España | e-distribución redes digitales |
| Italia | e-distribuzione |
| Perú | Enel Distribución Perú |
| Romania | Enel Distributie Banat<br>Enel Distributie Dobrogea<br>Enel Distributie Muntenia |

**Table 1 - Distribution Companies**

### 1.1 RELATED DOCUMENTS TO BE IMPLEMENTED AT COUNTRY LEVEL

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

## 2. DOCUMENT VERSION MANAGEMENT

| Version | Date | Main changes description |
|---|---|---|
| 1 | 21/12/2021 | Issuing of “Global Infrastructure and Networks - GSCH012 Outdoor Terminations for High Voltage Cables” technical specification |

## 3. UNITS IN CHARGE OF THE DOCUMENT

Responsible for drawing up the document:

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

Responsible for authorizing the document:

- Global Infrastructure and Networks: Head of Network Components unit.
- Global Infrastructure and Networks: Head of Quality unit.

## 4. REFERENCES

- Code of Ethics of Enel Group;
- Enel Human Right Policy;
- The Enel Group Zero Tolerance of Corruption (ZTC) Plan;
- Organization and management model as per Legislative Decree No. 231/2001;
- RACI Handbook Infrastructure and Networks no. 06;
- Enel Global Compliance Program (EGCP);
- Integrated Policy of Quality, Health and Safety, Environment and anti-Bribery;
- Policy n. 332 Global Infrastructure and Networks Design and construction HV lines guidelines ;
- ISO 9001:2015 - Quality Management System - Requirements;
- ISO 14001:2015 - Environmental Management System - Requirements and user guide;
- ISO 45001:2018 - Occupational Health and Safety Management System - Requirements and user guide;
- ISO 50001:2018 - Energy management systems - Requirements with guidance for use;
- ISO 37001:2016 - Anti-bribery Management System - Requirements with guidance for use;
- HD 632 “Power cables with extruded insulation and their accessories for rated voltages above 36 kV (Um = 42 kV) up to 150 kV (Um = 170 kV)”
- IEC 60840 “Power cables with extruded insulation and their accessories for rated voltages above 30kV (Um=36kV) up to 150kV (Um=170kV) test method and requirements”
- IEC 62067 “Power cables with extruded insulation and their accessories for rated voltages above 150 kV (Um=170 kV) up to 500 kV (Um=550 kV) - Test methods and requirements”
- IEC 60228 “Conductor for insulated cable”

- IEC 60695-11-10: “Fire hazard testing - Part 11-10: Test flames - 50 W horizontal and vertical flame test methods”
- IEC 60857: “Electrical insulating materials used under severe ambient conditions - Test methods for evaluating resistance to tracking and erosion”
- IEC 60885-3: “Electrical test methods for electric cables - Part 3: Test methods for partial discharge measurements on lengths of extruded power cables”
- IEC 60230 “Impulse tests on cables and their accessories”.
- IEC 61238-1-3: “Compression and mechanical connectors for power cables - Part 1-3: Test methods and requirements for compression and mechanical connectors for power cables for rated voltages above 1 kV (Um = 1,2 kV) up to 30 kV (Um = 36 kV) tested on non-insulated conductors”
- 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 62217: “Polymeric HV insulators for indoor and outdoor use - General definitions, test methods and acceptance criteria”
- IEC TS 60815-1: “Selection and dimensioning of high-voltage insulators intended for use in polluted conditions - Part 1: Definitions, information and general principles”
- IEC TS 60815-3: “Selection and dimensioning of high-voltage insulators intended for use in polluted conditions - Part 3: Polymer insulators for a.c. systems”

## 5. ORGANIZATIONAL PROCESS POSITION IN THE PROCESS TAXONOMY

Value Chain/Process Area: Engineering & Construction

Macro Process: Devices and Components Development

Process: Standard Catalog Management

## 6. DEFINITIONS AND ACRONYMS

| Acronym and Key words | Description |
|---|---|
| **Distributed Temperature Sensing (DTS)** | A DTS system is composed by optoelectronic devices which measure temperatures by means of optical fibers functioning as |

| | |
|---|---|
| | linear sensors. Thus, temperature is measured as a continuous profile, not at points. |
| **Technical Conformity Assessment (TCA)** | A "conformity assessment"[a] with respect to "specified requirements"[b] consists in functional, dimensional, constructional and test characteristics required for a product (or a series of products) and quoted in technical specifications and quality requirements issued by Enel Group distribution companies. This also includes the verification of conformity with respect to local applicable regulation and laws and possession of relevant requested certifications |
| **XLPE-Cable** | Cable with insulation of cross-linked polyethylene |

## 7. DESCRIPTION

This standard specifies the electrical and mechanical characteristics and test requirements that must be accomplished by the outdoor terminations used with voltage cables included in Global Standard GSCH010, with rated voltage above 36 kV and in detail for $U_m$[c] equals to 52 kV, 72,5 kV, 145 kV, 170 kV and 245 kV. This standard replaces all the local standards used up to now by all the Distribution Companies, as long as local regulation allows it.

### 7.1 LIST OF COMPONENTS

This standard includes terminations for single-core cables with aluminum or copper conductor, XLPE insulation and metallic screen.

The list of terminals with the main requirements, which is an integral part of the present document, is reported in the GS Type Code List on Annex B, and their relationship with country codes is reported on the Common List on Annex C. In **Table 2** the list of terminals is shown.

| GSCH012 Type Code | $U_m$ [kV] | Conductor section [mm2] | Screen type | Pollution level |
|---|---|---|---|---|
| GSCH012/001 | 245 | 2500 | Tube | e: Very High |

[a] Definition 2.1 of ISO/IEC 17000
[b] Definition 3.1 of ISO/IEC 17000
[c] $U_m$: maximum r.m.s. power-frequency voltage between any two conductors for which cables and accessories are designed. It is the highest voltage that can be sustained under normal operating conditions at any time and at any point in a system. It excludes temporary voltage variations due to fault conditions and the sudden disconnection of large loads

| GSCH012 Type Code | $U_m$ [kV] | Conductor section [mm2] | Screen type | Pollution level |
|---|---|---|---|---|
| GSCH012/051 | 245 | 2500 | Wires | e: Very High |
| GSCH012/002 | 245 | 2000 | Tube | e: Very High |
| GSCH012/031 | 245 | 2000 | Wires | e: Very High |
| GSCH012/003 | 245 | 1600 | Tube | e: Very High |
| GSCH012/043 | 245 | 1600 | Wires | e: Very High |
| GSCH012/030 | 245 | 1200 | Wires | e: Very High |
| GSCH012/004 | 245 | 1000 | Tube | e: Very High |
| GSCH012/005 | 245 | 800 | Tube | e: Very High |
| GSCH012/006 | 170 | 1600 | Tube | e: Very High |
| GSCH012/016 | 170 | 1600 | Wires | e: Very High |
| GSCH012/007 | 170 | 1000 | Tube | e: Very High |
| GSCH012/017 | 170 | 1000 | Wires | e: Very High |
| GSCH012/008 | 170 | 630 | Tube | e: Very High |
| GSCH012/018 | 170 | 630 | Wires | e: Very High |
| GSCH012/041 | 145 | 2500 | Wires | e: Very High |
| GSCH012/046 | 145 | 2000 | Tube | e: Very High |
| GSCH012/034 | 145 | 2000 | Wires | e: Very High |
| GSCH012/047 | 145 | 1600 | Tube | e: Very High |
| GSCH012/033 | 145 | 1600 | Wires | e: Very High |
| GSCH012/009 | 145 | 1200 | Tube | e: Very High |
| GSCH012/019 | 145 | 1200 | Wires | e: Very High |
| GSCH012/048 | 145 | 1000 | Tube | e: Very High |
| GSCH012/037 | 145 | 1000 | Wires | e: Very High |
| GSCH012/010 | 145 | 800 | Tube | e: Very High |
| GSCH012/036 | 145 | 800 | Wires | e: Very High |
| GSCH012/011 | 145 | 630 | Tube | e: Very High |
| GSCH012/021 | 145 | 630 | Wires | e: Very High |
| GSCH012/045 | 145 | 500 | Wires | e: Very High |
| GSCH012/035 | 145 | 400 | Wires | e: Very High |
| GSCH012/029 | 72,5 | 2000 | Wires | e: Very High |
| GSCH012/027 | 72,5 | 1200 | Wires | e: Very High |
| GSCH012/012 | 72,5 | 1000 | Tube | e: Very High |
| GSCH012/023 | 72,5 | 1000 | Wires | e: Very High |
| GSCH012/024 | 72,5 | 800 | Wires | e: Very High |
| GSCH012/013 | 72,5 | 630 | Tube | e: Very High |
| GSCH012/028 | 72,5 | 630 | Wires | e: Very High |
| GSCH012/042 | 72,5 | 500 | Wires | e: Very High |
| GSCH012/014 | 52 | 800 | Tube | d: High |
| GSCH012/049 | 52 | 800 | Wires | d: High |
| GSCH012/015 | 52 | 400 | Tube | d: High |
| GSCH012/025 | 52 | 400 | Wires | d: High |

Table 2 – List of GSCH012 Type Codes for outdoor terminals

## 7.2 DESIGN AND MANUFACTURE

Outdoor terminal shall assure the integrity of cable system both electrical and mechanically, so they shall meet the requirement specified for cables on which they are installed. They must be designed to be used with cables included in ENEL's Global Standard GSCH010: Underground High Voltage Cables.
The design requirements common to all of them are:

- Provide electrical stress control for the cable insulation shield terminus
- Provide external insulation between the cable conductor and ground
- Provide a metallic connection to the cable screen, electrically insulated from earth potential to match the insulating integrity of the cable oversheath.
- Withstand nominal and short-circuit currents not smaller than those withstood by the cable.
- Protection against the ingress of water or any other element from the external environment.
- Protection against direct exposure to solar radiation, precipitation, and polluted environment.
- Made of corrosion resistant materials.
- Ability to withstand cable thermomechanical loads and/or external forces.
- Suitable for use with an inclination up to 30º to vertical.
- Maintenance-free product.

For terminals with $U_m$ equal or lower than 72,5 kV it is not allowed the use of fluid fillings as isolation.

Terminals with $U_m$ equal or greater than 145 kV must be of the self-supported type. For terminals with lower $U_m$ it is also allowed the use of flexible terminals.

### 7.2.1.Connector

The connection to the cable conductor should be of the compressed or bolted with shear-off screws type. The external connector or aerial lug is used for connecting the external conductor to the current-carrying parts of the cable termination.

The connector must be designed to be used with cooper or aluminum conductors and to meet the following requirements when in service:

- transports nominal current without overheating from the conductor
- maintain the resistance of the connection stable
- short circuit currents will not affect the performance of the connector
- ensure an acceptable mechanical performance for the connections to the cable conductors
- avoid galvanic corrosion in case of different material between cable conductor and aerial conductor.

The cross section of cables for whom are intended the joints involved by this standard are those included in **Table 3**. For every cross section, the minimum diameter range of conductors that must be compatible with the connector is indicated. Nevertheless, other diameters than those indicated could be specified on Local Sections or specific orders.

| | Compatible Conductor Diameter Range [mm] | |
|---|---|---|
| Cross section [mm²] | Minimum | Maximum |
| **400** | 22,6 | 24,6 |
| **500** | 25,3 | 27,6 |
| **630** | 28,7 | 32,5 |
| **800** | 33,6 | 36,0 |
| **1000** | 37,9 | 40,0 |
| **1200** | 41,7 | 45,1 |
| **1600** | 47,7 | 50,4 |
| **2000** | 52,5 | 56,7 |
| **2500** | 60,2 | 63,5 |

**Table 3 Conductor Cross Sections**

### 7.2.2. Main insulation body

For self-supported terminals the main insulation body should be prefabricated, usually formed by a single premoulded elastomeric sleeve, and tested in factory.

In case of self-supported terminals, it is allowed the use of a filling compound as long as the terminal will not be subjected to internal gas pressure in service.

For flexible joints (with a highest voltage for equipment equal to 52 or 72,5 kV) the main insulation body could use cold shrink technology, provided that they have the prior acceptance of Enel.

The rated voltages of reference to be withstood by the terminals are those included in **Table 4**.

| Network Nominal voltaje U [kV] | Highest voltage for equipment $U_m$ [kV] | Value of $U_0$ for determination of test voltages [kV] | Lightning impulse voltage test [kV] |
|---|---|---|---|
| **45** | 52 | 26 | 250 |
| **60 to 69** | 72,5 | 36 | 325 |
| **110 to 138** | 145 | 76 | 650 |
| **150** | 170 | 87 | 750 |
| **220** | 245 | 127 | 1.050 |

**Table 4 Test voltages**

The diameter over insulation of cables for whom are intended the joints involved by this standard are those included in **Table 5**. Nevertheless, other diameters over insulation could be specified on specific orders.

| | Compatible cable diameter over insulation [mm.] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| $U_m$ [kV] | 52 | | 72,5 | | 145 | | 170 | | 245 | |
| Cross section [mm²] | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. |
| 400 | 39,6 | 41,6 | - | - | 57,6 | 61,5 | - | - | - | - |
| 500 | - | - | 46,3 | 48,6 | 60,3 | 64,2 | - | - | - | - |
| 630 | - | - | 49,7 | 53,5 | 64,0 | 67,5 | 67,7 | 71,5 | - | - |
| 800 | 50,6 | 53 | 54,6 | 57 | 68,6 | 71 | - | - | 78,6 | 83 |
| 1000 | - | - | 58,9 | 61 | 72,9 | 75 | 74,9 | 77 | 82,9 | 85 |
| 1200 | - | - | 62,7 | 66,1 | 76,7 | 80,1 | - | - | 86,7 | 90,1 |
| 1600 | - | - | - | - | 82,7 | 86,4 | 82,7 | 86,4 | 92,7 | 95,4 |
| 2000 | - | - | 73,5 | 77,7 | 87,5 | 91,7 | - | - | 97,5 | 101,7 |
| 2500 | - | - | - | - | 95,2 | 98,5 | - | - | 105,2 | 108,5 |

**Table 5 Compatible cable diameter over insulation**

### 7.2.3. Metal screening, connection to cable screen

Terminals must provide a sectionalizing connection between ground and the cable screen. This connection must be insulated from earth potential to match the insulation integrity of the cable oversheath and shall ensure the circulation of currents in the cable screen, as well as short circuit currents without causing overheating nor any harmful deformation of cable or terminal insulation.

The minimum values of the currents that must be withstood by those connections during 0,5 s are those indicated in **Table 6**.

| $U_m$ [kV] | I (0,5s) [kA] |
|---|---|
| 52 | 11 |
| 72,5 | 41 |
| 145 | 41 |
| 170 | 41 |
| 245 | 63 |

**Table 6 Short circuit currents**

The connections to cable screens must be suitable for cables with aluminum tube screen or cables with wires screen. In case of cables with wires screen, there should be possible the use of aluminum and copper wires without any modification in the joint.

For self-supported terminals the metal base plate must be isolated from earth by mean of supporting insulator.

### 7.2.4. Termination housing

The outer envelope of the terminal is formed by a polymeric insulation with hydrophobic properties

That insulation housing, both sheath and sheds, must protect the terminal from external agents providing sealing and preventing the formation of a continuous film of water and shall provide the necessary creepage distance so that the required insulation of the surface is reached. They must present resistance to tracking and erosion class 1A 4,5 as indicated on IEC 60587.

The shape of the sheds must follow the IEC TS 60815-3 recommendations.

The color should be preferably gray.

Terminals will be designed to be used on placement with SPS[d] high (d) and very high (e).

The creepage distance for terminals must be equal or greater than those indicated on **Table 7**

| $U_m$ [kV] | SPS | Creepage distance [mm] |
|---|---|---|
| **52** | d | 1.300 |
| **72,5** | e | 2.245 |
| **145** | e | 4.495 |
| **170** | e | 5.270 |
| **245** | e | 7.595 |

**Table 7 Minimum creepage distances**

Greater creepage distances could be specified on specific orders in case of special necessities.

For self-supported terminal with composite insulators, the maximum mechanical load (MML) is indicated on **Table 8**.

| $U_m$ [kV] | MML [N] |
|---|---|
| **52** | 800 |
| **72,5** | 1000 |
| **145** | 1.575 |
| **170** | 2.000 |
| **245** | 2.500 |

**Table 8 Maximum mechanical load**

[d] SPS: Site pollution severity as defined on IEC TS 60815-1

### 7.2.5. Head armature and corona shield

The terminal must be protected against possible discharges, for example by means of a head armature made of aluminum or stainless steel.

Manufacturer must consider the radio interference level due to partial discharges in air when designing the termination. Whether it is necessary to reduce them, a corona shield and/or grading rings must be included on the supply of the terminal.

### 7.2.6. Overall dimensions

Usually, once the terminal is been installed, the overall dimension shall not surpass the dimensions indicated on the **Table 9**

| Highest voltage for equipment $U_m$ [kV] | **Total Length [mm]** |
|---|---|
| **52** | 1.100 |
| **72,5** | 1.300 |
| **145** | 2.000 |
| **170** | 2.200 |
| **245** | 3.000 |

**Table 9 Maximum overall dimensions**

Those dimensions are not compulsory, but to be used as a reference about maximum dimensions of any type of joint described herein.

### 7.2.7. Fiber optic treatment (optional)

If required, the terminal will include a fiber optics splice box to allow the use of distributed temperature sensing (DTS) systems.

The splice box must ensure reliable operation and resistance against direct exposure to solar radiation, precipitation, and polluted environment.

The splice box shall manage at least two steel pipes included on the cable wires screen with a minimum of 2 fiber optics each. So, the minimum capacity of that box shall be 4 splices.

### 7.2.8. Partial discharge measurement (optional)

If required, the terminal will include a system to allow the internal measurement of partial discharge for monitoring purposes.

## 7.3 TERMINAL DESIGNATION

Designation of the joint is formed by the following terms:

- "ENEL GSCH012"
- the code "OT" indicating Outdoor terminal.
- voltage level $U_m$ and "kV",
- section of the conductor (expressed in $mm^2$),
- "+" and a character representing the type of cable screen (H: for wires screen, T: for welded aluminum tube),
- FO (optional) in case there is integrated a fiber optics splice box.

Designation example for joint GSCH012/001 is:

*ENEL GSCH012 – OT - 245 kV - 2.500 $mm^2$ + T*

## 7.4 CONDITIONS OF SUPPLY

There shall be provided a complete set of assembly instructions together with drawings of the terminal. The instructions should include lists of all the components of the terminal including consumable materials, the specified assembly tools and the health and safety precautions.
For every step of the assembly instructions there must be available a video where it is shown that assemble step. Those videos could be storage on-line on the website of the supplier and referenced by a QR Code.
All documentation has to be provided in English and in the language of the country destiny of the supply.
Terminals shall be securely packaged to prevent any damage during loading, transport, storage and installation.
The packaged shall be suitable for sea transportation.
On the packing of the terminass there must be marked the following information:

a) GS Type Code and reference of this standard.
b) Rated voltages $U_0$ (Um).
c) Manufacturer or brand.
d) Order number or purchase order.
e) Year and month of manufacture.
f) Weights, tare and net.

## 7.5 TESTS

These tests shall be accomplished according to the requirements of this standard and those of Technical Conformity Assessment (TCA) procedures.

### 7.5.1. Test classification

#### i) Acceptance tests

Acceptance tests shall be carried out in the supplier's facilities and include:

- Visual examination. Checking the absence of defects, the appropriate packaging and the conformity with technical specification, list of components, instructions and documentation included in Technical Conformity Assessment Dossier stated in Enel Standard GSCG002.
- Routine tests in paragraph 7.5.2
- Sample tests in paragraph 7.5.3

If a terminal fails any of the sample tests, two further terminals of the same type shall be subjected to the same tests. If both additional terminals pass the tests, the other units shall be regarded as having complied. If either fails, this type of accessory shall be regarded as having failed to comply.

#### ii) Routine tests

Routine tests shall be performed at 100% of the main insulation of delivered terminals to demonstrate product integrity. There could be tested on accessories installed on cable, by using a host accessory into which a component of an accessory is substituted for test or by using a simulated accessory rig in which the electrical stress environment of a main insulation component is reproduced.

Routine tests do not apply to cold shrink terminals.

#### iii) Sample tests

Sample tests are carried out over samples taken from each batch (manufacturing series) in order to verify that the finished product meet the design specifications.

For every batch will be tested "n" terminals following the formula:

$$n = P^{1/3}$$

where "P" stands for the total number of terminals included in the batch.

#### iv) Type tests

Type tests shall be performed before supplying a type of terminal covered by this standard in order to demonstrate satisfactory performance characteristics to meet the intended application.

When type tests have been successfully performed on one or more terminals covered herein with one cable of specific cross-section, and of the same rated voltage and construction characteristics, the type approval could be accepted as valid for other accessories as long as all the following conditions are met:

- The rated voltage does not exceed that of the tested accessory.
- The cable with another conductor cross-section is within the range of type approval of the tested cable.

- Accessories have the same or similar construction as that of the tested accessory
- The calculated nominal electrical stresses within the main insulation parts of the accessory and at the cable and accessory interfaces do not exceed those of the tested accessory.

Accessories shall undergo type tests after having passed all the acceptance tests gathered in routine and sample tests lists.

One sample of each accessory type shall be tested, assembled on the cable in the manner specified by the manufacturer's instructions, with the grade and quantity of materials supplied, including lubricants, if any.

The accessories shall be installed before the firs partial discharge test.

The minimum length of free cable between accessories shall be 5 m.

**v) Prequalification tests**

Prequalification tests shall be performed before supplying a type of terminal covered by this standard in order to demonstrate satisfactory long term performance of the complete cable system.

The prequalification test shall be performed on cable systems where the calculated nominal electrical stresses at the conductor screen will be higher than 8,0 kV/mm and/or at the insulation screen higher than 4,0 kV/mm. The prequalification test shall be performed except if cable systems with the same construction and accessories of the same family have been prequalified for a higher rated voltage.

Prequalification test must be performed on a cable system, using a cable of a large conductor cross-section in order to cover thermos-mechanical aspects. General conditions for these tests and their extension are those indicated in IEC 62067 clause 13 for cable systems with $U_0 \geq 127$ kV and IEC 60840 clause 13 for cable systems with $U_0 \leq 127$ kV.

**vi) Development tests**

These are tests made during the development of a cable system design and shall be performed before supplying a type of terminal covered by this standard in order to demonstrate satisfactory performance of the complete cable system.

### 7.5.2. Routine Tests List

**i) Partial discharge test**

Requirements: No detectable discharge exceeding sensitivity of 5 pC or better at 1.5 $U_0$

Test method: IEC 60840 clause 9.2

**ii) Voltage routine test**

Requirements: No breakdown of the insulation shall occur.

Test method: IEC 60840 clause 9.3

Test voltage: 2.5 $U_0$

Duration: 30 min

### 7.5.3. Sample Test List

**i) Terminal examination**

Requirements: Conformity to constructive characteristics, installation instructions and drawings declared on TCA.

Test method: inspection by visual examination

**ii) Partial discharge test**

To be done just for terminals where the main insulation cannot be routine tested. In that cases shall be performed on one terminal per every 50 terminals provided.

Requirements: No detectable discharge exceeding sensitivity of 5 pC or better at 1.5 $U_0$

Test method: IEC 60840 clause 9.2

**iii) Voltage routine test**

To be done just for terminals where the main insulation cannot be routine tested. In that cases shall be performed on one terminal per every 50 terminals provided.

Requirements: No breakdown of the insulation shall occur.

Test method: IEC 60840 clause 9.3

Test voltage: 2.5 $U_0$

Duration: 30 min

### 7.5.4. Type Tests List

Prior to electrical type test of terminals, the insulation thickness of the cable used shall be measured and the test voltage values adjusted, if necessary, as stated in IEC 60840 paragraph 12.4.1

**i) Partial discharge test at ambient temperature**

Requirements: No detectable discharge exceeding sensitivity of 5 pC or better at 1.5 $U_0$

Test method: IEC 60840 clause 12.4.4

**ii) Heating cycle voltage test**

Requirements: A U-bend in the cable is not required

Test method:

IEC 62067 clause 12.4.6 for terminals with $U_0$=127 kV

IEC 60840 clause 12.4.6 for terminals with $U_0$<127 kV

**iii) Partial discharge test at ambient and high temperature**

This test shall be carried out after the final cycle of test in **ii)** or, alternatively, after the test in **iv)**

Requirements: No detectable discharge exceeding sensitivity of 5 pC or better at 1.5 $U_0$

Test method: IEC 60840 clause 12.4.4

**iv) Lightning impulse voltage test followed by a power frequency voltage test**

Requirements: No breakdown of the insulation or flashover shall occur

Test method:

IEC 62067 clause 12.4.7 for terminals with $U_0$=127 kV

IEC 60840 clause 12.4.7 for terminals with $U_0$<127 kV

Impulse lighting voltage value:

250 kV for terminals with $U_{max}$ = 52 kV.

325 kV for terminals with $U_{max}$ = 72.5 kV.

650 kV for terminals with $U_{max}$ = 145 kV.

750 kV for terminals with $U_{max}$ = 170 kV.

1.050 kV for terminals with $U_{max}$ = 245 kV.

Power frequency voltage value:

65 kV for terminals with $U_{max}$ = 52 kV.

90 kV for terminals with $U_{max}$ = 72.5 kV.

190 kV for terminals with $U_{max}$ = 145 kV.

218 kV for terminals with $U_{max}$ = 170 kV.

254 kV for terminals with $U_{max}$ = 245 kV.

**v) Partial discharge test at ambient and high temperature**

If not previously carried out after the final cycle of heating cycle voltage test in point **iii)**

Requirements: No detectable discharge exceeding sensitivity of 5 pC or better at 1.5 $U_0$

Test method: IEC 60840 clause 12.4.4

**vi) Test of termination with sheath sectionalizing**

Range of approval for this test according to IEC 60840 H.2.4

a) DC voltage withstand test between screen and earth

Test method: IEC 60840 sub-clause H.4.1

b) Lightning impulse voltage withstand test between screen and earth

Test method: IEC 60840 sub-clause H.4.2

Lighting impulse level metal screen to earth:

30 kV for terminals with $U_{max}$ = 52 kV.

30 kV for terminals with $U_{max}$ = 72.5 kV.

37,5 kV for terminals with $U_{max}$ = 145 kV.

37,5 kV for terminals with $U_{max}$ = 170 kV.

47,5 kV for terminals with $U_{max}$ = 245 kV.

**vii) Examination of terminals after completion of the above test**

Requirements: No signs of deterioration

Test method: IEC 60840 clause 12.4.8

viii) **Cantilever load test**

Requirements and Test method: IEC 61462 clause 8.5

ix) **Constant tracking voltage test**

For insulating polymeric materials exposed to outdoor

Requirements: 1A 4.5

Test method: IEC 60587 clause 5

x) **Hardness test**

Requirements and Test method: IEC 62217 clause 9.3.1

xi) **Accelerated weathering test (1.000 h UV)**

Requirements and Test method: IEC 62217 clause 9.3.2

xii) **Tracking and erosion test (1.000 h salt fog test)**

Requirements and Test method: IEC 62217 clause 9.3.3

xiii) **Flammability test**

Requirements: V1 as indicated on IEC 60695-11-10

Test method: IEC 62217 clause 9.3.4

### 7.5.5. Prequalification Test list

i) **Heating cycle voltage test**

Requirements: No breakdown shall occur.

Test voltage: 1,7 $U_0$

Cycles: ≥ 180

Test method:

IEC 62067 clause 13.2.4 for cable systems with $U_0$=127 kV

IEC 60840 clause 13.2.4 for cables systems with $U_0$<127 kV

ii) **Lightning impulse voltage test**

Requirements: withstand 10 positive and 10 negative voltage impulses without failure

Test voltage:

250 kV for cables systems with $U_{max}$ = 52 kV.

325 kV for cables systems with $U_{max}$ = 72.5 kV.

650 kV for cables systems with $U_{max}$ = 145 kV.

750 kV for cables systems with $U_{max}$ = 170 kV.

1.050 kV for cables systems with $U_{max}$ = 245 kV.

Test method:

IEC 62067 clause 13.2.5 for cables systems with $U_0$=127 kV

IEC 60840 clause 13.2.5 for cables systems with $U_0$<127 kV

iii) **Examination of the cable system after completion of the tests above**

Requirements: No signs of deterioration

Test method: IEC 60840 clause 13.2.6

### 7.5.6. Development tests list

i) **Corrosion at the accessories**

Requirements: IEC TR 61901 clause 4.2.3

Test method: IEC TR 61901 clause 4.2.3

ii) **Short circuit test**

The short circuit test shall be performed on cable systems including cable, connection to accessories, the accessories, the grounding connection, and the grounding cables.

Requirements: IEC TR 61901 clause 4.2.2

Test method: IEC TR 61901 clause 4.2.2

# 8. ANNEX

## ANNEX A – TECHNICAL CHECK LIST

The following chart indicates the minimum technical information that suppliers shall provide in technical offer during tenders and as part of the TCA Type A documentation:

| Item | Description | Unit | Required values | Offered values |
|---|---|---|---|---|
| **1** | **GENERAL INFORMATION** | | | |
| 1.1 | Supplier Name | - | | |
| 1.2 | Supplier CUI | | | |
| 1.3 | Factory | - | | |
| 1.4 | Location of factory | - | | |
| **2** | **MAIN FEATURES** | | | |
| 2.1 | ENEL Distribution Company and Country of supply | - | | |
| 2.2 | Country Code | - | | |
| 2.3 | GS Type Code | - | | |
| 2.4 | Enel designation | - | | |
| 2.5 | Highest voltage for equipment $U_m$ | [kV] | | |
| 2.6 | $U_0$ for determination of test voltages | [kV] | | |
| 2.7 | Power frequency withstand voltage (15 min) | [kV] | | |
| 2.8 | Lighting impulse voltage test | [kV] | | |
| 2.9 | Type of terminal | - | | |
| 2.10 | Supplier product designation | - | | |
| **3** | **CONNECTOR** | | | |
| 3.1 | Reference | - | | |
| 3.2 | Material | - | | |
| 3.3 | Assembly technique | - | | |
| 3.4 | Nominal cross-section of admissible conductor | [$mm^2$] | | |
| 3.5 | Minimum diameter of conductor | [mm] | | |
| 3.6 | Maximum diameter of conductor | [mm] | | |
| **4** | **EXTERNAL CONNECTING BOLT** | | | |
| 4.1 | Type | | | |
| 4.2 | Material | | | |
| 4.3 | Shape | - | | |
| 4.4 | Length | [mm] | | |
| 4.5 | Diameter (dimensions) of cross section | [mm] | | |

**Subject:** Global Infrastructure and Networks - GSCH012 Outdoor Terminations for High Voltage Cables.

**Application Areas**

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

| Item | Description | Unit | Required values | Offered values |
|---|---|---|---|---|
| **5** | **MAIN INSULATION BODY** | | | |
| 5.1 | Reference | - | | |
| 5.2 | Material | - | | |
| 5.3 | Number of pieces | - | | |
| 5.4 | Nominal thickness | [mm] | | |
| 5.5 | Minimum diameter of cable core | [mm] | | |
| 5.6 | Maximum diameter of cable core | [mm] | | |
| 5.7 | Maximum withstand electrical stress | [kV/mm] | | |
| 5.8 | Length of main body | [mm] | | |
| 5.9 | Filling material | - | | |
| 5.10 | Volume of filling material | [$dm^3$] | | |
| **6** | **HOUSING** | | | |
| 6.1 | Reference | | | |
| 6.2 | Type | | | |
| 6.3 | Material | | | |
| 6.4 | Nominal overall diameter | [mm] | | |
| 6.5 | Creepage distance | [mm] | | |
| 6.6 | Arcing distance | [mm] | | |
| 6.7 | Pollution level (IEC 6815-1) | - | | |
| 6.8 | Number of sheds | - | | |
| 6.9 | Diameter of shed | [mm] | | |
| 6.10 | Tracking and erosion class (IEC 60587) | | | |
| 6.11 | Fire resistance grade | | | |
| **7** | **METAL SCREENING** | | | |
| 7.1 | Earth cable type | - | | |
| 7.2 | Maximum cross-section of cable | [$mm^2$] | | |
| 7.3 | Minimum diameter of cable | [mm] | | |
| 7.4 | Maximum diameter of cable | [mm] | | |
| 7.5 | Type of connection | - | | |
| **8** | **BASE PLATE** | | - | |
| 8.1 | Material of base plate | | | |
| 8.2 | Dimension of base plate | [mm] | | |
| 8.3 | Fixing holes distance | [mm] | | |
| 8.4 | Type of supporting insulator | - | - | |
| 8.5 | Number of supporting insulators | - | - | |

**Subject:** Global Infrastructure and Networks - GSCH012 Outdoor Terminations for High Voltage Cables.

**Application Areas**

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

| Item | Description | Unit | Required values | Offered values |
|---|---|---|---|---|
| 8.6 | Supporting insulator length | [mm] | - | |
| 8.7 | Supporting insulator withstand voltage | [kV] | - | |
| **9** | **FIBER OPTIC SPLICE BOX** | | | |
| 9.1 | Integrated in terminal | [Yes/No] | | |
| 9.2 | Maximum number of steel pipes | - | | |
| 9.3 | Maximum number of fiber optic on every steel pipe | - | | |
| 9.4 | Maximum number of splices | - | | |
| **10** | **AMPACITY FEATURES** | | | |
| 10.1 | Rated withstand current in steady state condition | [A] | | |
| 10.2 | Maximum short circuit withstand current in the conductor (0,5 s) | [kA] | | |
| 10.3 | Maximum short circuit withstand current in the screen (0,5 s) | [kA] | | |
| **11** | **ADDITIONAL FEATURES** | | | |
| 11.1 | MML (Maximum mechanical load) | [N] | | |
| 11.2 | Maximum overall cable diameter | [mm] | | |
| 11.3 | Maximum inclination installed | [º] | | |
| 11.4 | Total length | [mm] | | |
| 11.5 | Total weight | [kg] | | |
| 11.6 | Maximum storage time | [months] | | |
| 11.7 | Estimated time of installation (without cable preparation) | [h] | | |
| 11.8 | Expected service life after installation | [years] | | |
| **12** | **TCA INFORMATION** | | | |
| 12.1 | TCA Available | [Yes/No] | Informative | |
| 12.2 | TCA Code | - | Informative | |
| **13** | **OBSERVATION** | | | |
| 13.1 | Any exception to what is required on GSCH012 | - | | |
| 13.2 | Additional comments | - | | |

## ANNEX B – GLOBAL TYPE CODES FOR OUTDOOR TERMINALS

| GS Type Code | Designation | Um [kV] | Conductor Section [mm²] | Screen Type | Nominal Icc (0,5 s) [kA] | Pollution Level | Creepage Distance |
|---|---|---|---|---|---|---|---|
| GSCH012/001 | OT-245 kV 2500 mm2 -T | 245 | 2500 | T | 63 | e: Very High | 7595 |
| GSCH012/002 | OT-245 kV 2000 mm2 -T | 245 | 2000 | T | 63 | e: Very High | 7595 |
| GSCH012/003 | OT-245 kV 1600 mm2 -T | 245 | 1600 | T | 63 | e: Very High | 7595 |
| GSCH012/004 | OT-245 kV 1000 mm2 -T | 245 | 1000 | T | 63 | e: Very High | 7595 |
| GSCH012/005 | OT-245 kV 800 mm2 -T | 245 | 800 | T | 63 | e: Very High | 7595 |
| GSCH012/006 | OT-170 kV 1600 mm2 -T | 170 | 1600 | T | 41 | e: Very High | 5270 |
| GSCH012/007 | OT-170 kV 1000 mm2 -T | 170 | 1000 | T | 41 | e: Very High | 5270 |
| GSCH012/008 | OT-170 kV 630 mm2 -T | 170 | 630 | T | 41 | e: Very High | 5270 |
| GSCH012/009 | OT-145 kV 1200 mm2 -T | 145 | 1200 | T | 41 | e: Very High | 4495 |
| GSCH012/010 | OT-145 kV 800 mm2 -T | 145 | 800 | T | 41 | e: Very High | 4495 |
| GSCH012/011 | OT-145 kV 630 mm2 -T | 145 | 630 | T | 41 | e: Very High | 4495 |
| GSCH012/012 | OT-72,5 kV 1000 mm2 -T | 72,5 | 1000 | T | 41 | e: Very High | 2247 |
| GSCH012/013 | OT-72,5 kV 630 mm2 -T | 72,5 | 630 | T | 41 | e: Very High | 2247 |
| GSCH012/014 | OT-52 kV 800 mm2 -T | 52 | 800 | T | 11 | d: High | 1300 |
| GSCH012/015 | OT-52 kV 400 mm2 -T | 52 | 400 | T | 11 | d: High | 1300 |
| GSCH012/016 | OT-170 kV 1600 mm2 -H | 170 | 1600 | H | 41 | e: Very High | 5270 |
| GSCH012/017 | OT-170 kV 1000 mm2 -H | 170 | 1000 | H | 41 | e: Very High | 5270 |
| GSCH012/018 | OT-170 kV 630 mm2 -H | 170 | 630 | H | 41 | e: Very High | 5270 |
| GSCH012/019 | OT-145 kV 1200 mm2 -H | 145 | 1200 | H | 41 | e: Very High | 4495 |
| GSCH012/021 | OT-145 kV 630 mm2 -H | 145 | 630 | H | 41 | e: Very High | 4495 |
| GSCH012/023 | OT-72,5 kV 1000 mm2 -H | 72,5 | 1000 | H | 41 | e: Very High | 2247 |
| GSCH012/024 | OT-72,5 kV 800 mm2 -H | 72,5 | 800 | H | 41 | e: Very High | 2247 |
| GSCH012/025 | OT-52 kV 400 mm2 -H | 52 | 400 | H | 11 | d: High | 1300 |
| GSCH012/027 | OT-72,5 kV 1200 mm2 -H | 72,5 | 1200 | H | 41 | e: Very High | 2247 |
| GSCH012/028 | OT-72,5 kV 630 mm2 -H | 72,5 | 630 | H | 41 | e: Very High | 2247 |
| GSCH012/029 | OT-72,5 kV 2000 mm2 -H | 72,5 | 2000 | H | 41 | e: Very High | 2247 |
| GSCH012/030 | OT-245 kV 1200 mm2 -H | 245 | 1200 | H | 63 | e: Very High | 7595 |
| GSCH012/031 | OT-245 kV 2000 mm2 -H | 245 | 2000 | H | 63 | e: Very High | 7595 |
| GSCH012/033 | OT-145 kV 1600 mm2 -H | 145 | 1600 | H | 41 | e: Very High | 4495 |
| GSCH012/034 | OT-145 kV 2000 mm2 -H | 145 | 2000 | H | 41 | e: Very High | 4495 |
| GSCH012/035 | OT-145 kV 400 mm2 -H | 145 | 400 | H | 41 | e: Very High | 4495 |
| GSCH012/036 | OT-145 kV 800 mm2 -H | 145 | 800 | H | 41 | e: Very High | 4495 |
| GSCH012/037 | OT-145 kV 1000 mm2 -H | 145 | 1000 | H | 41 | e: Very High | 4495 |
| GSCH012/041 | OT-145 kV 2500 mm2 -H | 145 | 2500 | H | 41 | e: Very High | 4495 |
| GSCH012/042 | OT-72,5 kV 500 mm2 -H | 72,5 | 500 | H | 41 | e: Very High | 2247 |
| GSCH012/043 | OT-245 kV 1600 mm2 -H | 245 | 1600 | H | 63 | e: Very High | 7595 |
| GSCH012/045 | OT-145 kV 500 mm2 -H | 145 | 500 | H | 41 | e: Very High | 4495 |
| GSCH012/046 | OT-145 kV 2000 mm2 -T | 145 | 2000 | T | 41 | e: Very High | 4495 |
| GSCH012/047 | OT-145 kV 1600 mm2 -T | 145 | 1600 | T | 41 | e: Very High | 4495 |

**Subject:** Global Infrastructure and Networks - GSCH012 Outdoor Terminations for High Voltage Cables.

**Application Areas**

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

| GS Type Code | Designation | Um [kV] | Conductor Section [mm²] | Screen Type | Nominal Icc (0,5 s) [kA] | Pollution Level | Creepage Distance |
|---|---|---|---|---|---|---|---|
| GSCH012/048 | OT-145 kV 1000 mm2 -T | 145 | 1000 | T | 41 | e: Very High | 4495 |
| GSCH012/049 | OT-52 kV 800 mm2 -H | 52 | 800 | H | 11 | d: High | 1300 |
| GSCH012/051 | OT-245 kV 2500 mm2 -H | 245 | 2500 | H | 63 | e: Very High | 7595 |

## ANNEX C – COMMON LIST

| COMMON LIST | | | | Proposed codes 13/12/2021 |
|---|---|---|---|---|
| **GS Type Code** | **Designation** | **Distribution Company and Country** | **Country Code** | **TAM Description** |
| GSCH012/009 | OT-145 kV 1200 mm2 -T | Enel Argentina | | |
| GSCH012/010 | OT-145 kV 800 mm2 -T | Enel Argentina | | |
| GSCH012/051 | OT-245 kV 2500 mm2 -H | Enel Argentina | | |
| GSCH012/001 | OT-245 kV 2500 mm2 -T | Enel Argentina | | |
| GSCH012/018 | OT-170 kV 630 mm2 -H | EDI Italy | | |
| GSCH012/017 | OT-170 kV 1000 mm2 -H | EDI Italy | | |
| GSCH012/016 | OT-170 kV 1600 mm2 -H | EDI Italy | | |
| GSCH012/008 | OT-170 kV 630 mm2 -T | EDI Italy | | |
| GSCH012/007 | OT-170 kV 1000 mm2 -T | EDI Italy | | |
| GSCH012/006 | OT-170 kV 1600 mm2 -T | EDI Italy | | |
| GSCH012/003 | OT-245 kV 1600 mm2 -T | EDI Italy | | |
| GSCH012/047 | OT-145 kV 1600 mm2 -T | Enel Romania | | |
| GSCH012/048 | OT-145 kV 1000 mm2 -T | Enel Romania | | |
| GSCH012/011 | OT-145 kV 630 mm2 -T | Enel Romania | | |
| GSCH012/033 | OT-145 kV 1600 mm2 -H | Enel Romania | | |
| GSCH012/037 | OT-145 kV 1000 mm2 -H | Enel Romania | | |
| GSCH012/021 | OT-145 kV 630 mm2 -H | Enel Romania | | |
| GSCH012/009 | OT-145 kV 1200 mm2 -T | EDRD España | | |
| GSCH012/011 | OT-145 kV 630 mm2 -T | EDRD España | | |
| GSCH012/012 | OT-72,5 kV 1000 mm2 -T | EDRD España | | |
| GSCH012/013 | OT-72,5 kV 630 mm2 -T | EDRD España | | |
| GSCH012/014 | OT-52 kV 800 mm2 -T | EDRD España | | |
| GSCH012/015 | OT-52 kV 400 mm2 -T | EDRD España | | |
| GSCH012/019 | OT-145 kV 1200 mm2 -H | EDRD España | | |
| GSCH012/021 | OT-145 kV 630 mm2 -H | EDRD España | | |
| GSCH012/023 | OT-72,5 kV 1000 mm2 -H | EDRD España | | |
| GSCH012/025 | OT-52 kV 400 mm2 -H | EDRD España | | |
| GSCH012/049 | OT-52 kV 800 mm2 -H | EDRD España | | |
| GSCH012/009 | OT-145 kV 1200 mm2 -T | Enel Brazil | | |
| GSCH012/010 | OT-145 kV 800 mm2 -T | Enel Brazil | | |
| GSCH012/011 | OT-145 kV 630 mm2 -T | Enel Brazil | | |
| GSCH012/012 | OT-72,5 kV 1000 mm2 -T | Enel Brazil | | |
| GSCH012/013 | OT-72,5 kV 630 mm2 -T | Enel Brazil | | |
| GSCH012/019 | OT-145 kV 1200 mm2 -H | Enel Brazil | | |
| GSCH012/021 | OT-145 kV 630 mm2 -H | Enel Brazil | | |
| GSCH012/023 | OT-72,5 kV 1000 mm2 -H | Enel Brazil | | |
| GSCH012/019 | OT-145 kV 1200 mm2 -H | Enel Brazil | | |
| GSCH012/033 | OT-145 kV 1600 mm2 -H | Enel Brazil | | |

**Subject:** Global Infrastructure and Networks - GSCH012 Outdoor Terminations for High Voltage Cables.

**Application Areas**

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

| COMMON LIST | | | | Proposed codes 13/12/2021 |
|---|---|---|---|---|
| **GS Type Code** | **Designation** | **Distribution Company and Country** | **Country Code** | **TAM Description** |
| GSCH012/034 | OT-145 kV 2000 mm2 -H | Enel Brazil | | |
| GSCH012/035 | OT-145 kV 400 mm2 -H | Enel Brazil | | |
| GSCH012/036 | OT-145 kV 800 mm2 -H | Enel Brazil | | |
| GSCH012/037 | OT-145 kV 1000 mm2 -H | Enel Brazil | | |
| GSCH012/033 | OT-145 kV 1600 mm2 -H | Enel Brazil | | |
| GSCH012/034 | OT-145 kV 2000 mm2 -H | Enel Brazil | | |
| GSCH012/041 | OT-145 kV 2500 mm2 -H | Enel Brazil | | |
| GSCH012/041 | OT-145 kV 2500 mm2 -H | Enel Brazil | | |
| GSCH012/045 | OT-145 kV 500 mm2 -H | Enel Brazil | | |
| GSCH012/001 | OT-245 kV 2500 mm2 -T | Enel Chile | | |
| GSCH012/002 | OT-245 kV 2000 mm2 -T | Enel Chile | | |
| GSCH012/003 | OT-245 kV 1600 mm2 -T | Enel Chile | | |
| GSCH012/004 | OT-245 kV 1000 mm2 -T | Enel Chile | | |
| GSCH012/009 | OT-145 kV 1200 mm2 -T | Enel Chile | | |
| GSCH012/011 | OT-145 kV 630 mm2 -T | Enel Chile | | |
| GSCH012/019 | OT-145 kV 1200 mm2 -H | Enel Chile | | |
| GSCH012/021 | OT-145 kV 630 mm2 -H | Enel Chile | | |
| GSCH012/034 | OT-145 kV 2000 mm2 -H | Enel Chile | | |
| GSCH012/033 | OT-145 kV 1600 mm2 -H | Enel Chile | | |
| GSCH012/035 | OT-145 kV 400 mm2 -H | Enel Chile | | |
| GSCH012/046 | OT-145 kV 2000 mm2 -T | Enel Chile | | |
| GSCH012/047 | OT-145 kV 1600 mm2 -T | Enel Chile | | |
| GSCH012/002 | OT-245 kV 2000 mm2 -T | Enel Perú | | |
| GSCH012/005 | OT-245 kV 800 mm2 -T | Enel Perú | | |
| GSCH012/029 | OT-72,5 kV 2000 mm2 -H | Enel Perú | | |
| GSCH012/024 | OT-72,5 kV 800 mm2 -H | Enel Perú | | |
| GSCH012/027 | OT-72,5 kV 1200 mm2 -H | Enel Perú | | |
| GSCH012/028 | OT-72,5 kV 630 mm2 -H | Enel Perú | | |
| GSCH012/029 | OT-72,5 kV 2000 mm2 -H | Enel Perú | | |
| GSCH012/030 | OT-245 kV 1200 mm2 -H | Enel Perú | | |
| GSCH012/031 | OT-245 kV 2000 mm2 -H | Enel Perú | | |
| GSCH012/042 | OT-72,5 kV 500 mm2 -H | Enel Perú | | |
| GSCH012/043 | OT-245 kV 1600 mm2 -H | Enel Perú | | |
| GSCH012/019 | OT-145 kV 1200 mm2 -H | Enel Colombia | | |

## GSCH012 - Terminales para cables HV tipo exterior (matriculas Perú)

| GS Type Code | Designation | |
|---|---|---|
| GSCH012/030 | Terminal exterior p. cable Cu 245 kV, 1200 mm2 - pantalla conductor (GSCH012/030) | Cu |
| GSCH012/043 | Terminal exterior p. cable Cu 245 kV, 1600 mm2 - pantalla conductor (GSCH012/043) | Cu |
| GSCH012/031 | Terminal exterior p. cable Cu 245 kV, 2000 mm2 - pantalla conductor (GSCH012/031) | Cu |
| GSCH012/005 | Terminal exterior p. cable Al 245 kV, 800 mm2 - pantalla tubo (GSCH012/005) | Al |
| GSCH012/002 | Terminal exterior p. cable Al 245 kV, 2000 mm2 - pantalla tubo (GSCH012/002) | Al |
| GSCH012/042 | Terminal exterior p. cable Cu 72,5 kV, 500 mm2 - pantalla conductor (GSCH012/042) | Cu |
| GSCH012/028 | Terminal exterior p. cable Cu 72,5 kV, 630 mm2 - pantalla conductor (GSCH012/028) | Cu |
| GSCH012/024 | Terminal exterior p. cable Cu 72,5 kV, 800 mm2 - pantalla conductor (GSCH012/024) | Cu |
| GSCH012/027 | Terminal exterior p. cable Cu 72,5 kV, 1200 mm2 - pantalla conductor (GSCH012/027) | Cu |
| GSCH012/029 | Terminal exterior p. cable Cu 72,5 kV, 2000 mm2 - pantalla conductor (GSCH012/029) | Cu |
| GSCH012/022 | Terminal exterior p. cable Al 72,5 kV, 2000 mm2 - pantalla conductor (GSCH012/022) | Al |

**para cables HV tipo exterior**
**iculas Perú)**

| Distribution Company and Country | Country Code | Tam Description |
|---|---|---|
| Enel Perú | 270348 | Terminal p. cable Cu 245kV, 1200mm2 |
| Enel Perú | 270347 | Terminal p. cable Cu 245kV, 1600mm2 |
| Enel Perú | 270346 | Terminal p. cable Cu 245kV, 2000mm2 |
| Enel Perú | 270345 | Terminal p. cable Al 245kV, 800mm2 |
| Enel Perú | 270344 | Terminal p. cable Al 245kV, 2000mm2 |
| Enel Perú | 270343 | Terminal p. cable Cu 72,5kV 500mm2 |
| Enel Perú | 270342 | Terminal p. cable Cu 72,5kV 630mm2 |
| Enel Perú | 270341 | Terminal p. cable Cu 72,5kV 800mm2 |
| Enel Perú | 270340 | Terminal p. cable Cu 72,5kV 1200mm2 |
| Enel Perú | 270339 | Terminal p. cable Cu 72,5kV 2000mm2 |
| Enel Perú | 270338 | Terminal p. cable Al 72,5kV 2000mm2 |

Enel Colombia 271068 Terminale XLPE 132 kV 1x1200 GSCH012/19

| MATERIAL | TYPE CODE | COUNTR | DESCRIPTION |
|---|---|---|---|
| 270370 | GSCH012/019 | BR | TERMINAL EXTERNO PARA CABO ISOLADO -145 kV 1200 mm² |
| 270366 | GSCH012/034 | BR | TERMINAL EXTERNO PARA CABO ISOLADO -145 kV 2000 mm2 |
| 270364 | GSCH012/041 | BR | TERMINAL EXTERNO PARA CABO ISOLADO -145 kV 2500 mm2 |