**Material Specification code: GRI-GRI-MAT-E&C-0027**
Version no. 0 dated 10/2023
**Subject:** GSCC030 PROTECTIVE DEVICES TO AVOID THE RISK OF ELECTROCUTION OF BIRDS
**Application Areas**
Perimeter: *Global*
Staff Function: -
Service Function: -
Business Line: Enel Grids

**CONTENTS**


**1. DOCUMENT AIMS AND APPLICATION AREA ..... 3**
1.1 RELATED DOCUMENTS TO BE IMPLEMENTED AT COUNTRY LEVEL ..... 3
**2. DOCUMENT VERSION MANAGEMENT ..... 4**
**3. UNITS IN CHARGE OF THE DOCUMENT ..... 4**
**4. REFERENCES ..... 4**
**5. ORGANIZATIONAL PROCESS POSITION IN THE PROCESS TAXONOMY ..... 6**
**6. DEFINITIONS AND ACRONYMS ..... 6**
**7. DESCRIPTION ..... 7**
7.1 LIST OF COMPONENTS ..... 7
7.2 APPLCABLE LAWS AND REFERENCE STANDARDS ..... 10
**7.2.1. GLOBAL STANDARDS ..... 10**
**7.2.2. LOCAL STANDARDS ..... 10**
**7.2.3. INTERNATIONAL STANDARD ..... 10**
**7.2.4. REPLACED LOCAL STANDARDS ..... 11**
7.3 SERVICE CONDITIONS ..... 12
**7.3.1. GENERAL SERVICE CONDITIONS ..... 12**
***7.3.2.* SPECIFIC SERVICE CONDITIONS ..... 12**
7.4 TECHNICAL CHARACTERISTICS ..... 12
**7.4.1. PROTECTION TYPES AND EQUIPMENT ..... 12**
7.5 CONSTRUCTION CHARACTERISTICS ..... 14
**7.5.1. TYPE I ..... 14**
**7.5.2. TYPE II ..... 15**
7.6 MARKING AND DESIGNATION ..... 15
7.6.1. **DESIGNATION ..... 15**
**7.6.2. MARKING ..... 15**
7.7 TESTING ..... 15
**7.7.1. TYPE TEST ..... 15**
**7.7.2. ACCEPTANCE TESTS ..... 22**
7.8 TECHNICAL CONFORMITY ASSESSMENT ..... 25
**7.8.1. GENERAL CONDITIONS ..... 25**
**7.8.2. ACKNOWLEDGEMENT OF TCA FOR PREVIOUS REVISION OF THE STANDARD. ..... 25**
**8. LOCAL SECTION ..... 26**
**9. DESCRIPTION OF EVIDENCE ..... 49**

9.1 CHECK LIST TYPE I.....49
9.2 CHECK LIST TYPE II.....50

**THE HEAD OF GLOBAL NETWORK COMPONENTS**
**Fabrizio Gasbarri**

# 1. DOCUMENT AIMS AND APPLICATION AREA

The purpose of this document is to provide the technical requirements for the provision of material to safeguard bird life. The protections also serve to ensure the proper functioning of the network.

These Global Standard applies to the Distribution Companies of Enel Group listed below:

| Country | Distribution Company |
|---|---|
| Brazil | Enel Distribuição Rio (RJ)<br>Enel Distribuição Ceará (CE)<br>Enel Distribuição São Paulo (SP) |
| Chile | Enel Distribución Chile |
| Colombia | Codensa |
| Iberia | E-distribución |
| Italy | E-distribuzione |
| Perú | Enel Distribución Perú |
| Romania | E-distributie Banat<br>E-distributie Dobrogea<br>E-distributie Muntenia |

**Table 1** Distribution Companies.

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

## 1.1 RELATED DOCUMENTS TO BE IMPLEMENTED AT COUNTRY LEVEL

This document doesn’t require implementation of further documents.

## 2. DOCUMENT VERSION MANAGEMENT

| Version | Date | Main changes description |
|---|---|---|
| 0 | 17/10/2023 | First emission of "GSCC030 PROTECTIVE DEVICES TO AVOID THE RISK OF ELECTROCUTION OF BIRDS" Material Specification. |

**Table 2** Version management.

## 3. UNITS IN CHARGE OF THE DOCUMENT

Responsible for drawing up the document:

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

Responsible for authorizing the document:

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

## 4. REFERENCES

- Enel Human Rights Policy;
- Enel Group Code of Ethics;
- The Enel Group Zero Corruption Tolerance (ZCT) Plan;
- Enel Global Compliance Program (EGCP);
- Stop Work Policy;
- Integrated Policy for Quality, Health and Safety, Environment, anti-Bribery and Information security;
- ISO 9001- Quality Management System – Requirements;
- ISO 14001 - Environmental Management System - Requirements with guidance for use;
- ISO 45001 - Occupational Health and Safety Management System - Requirements with guidance for use;
- ISO 37001 - Anti-bribery Management System - Requirements with guidance for use;

- ISO 27001 - Information Security Management System – Requirements
- MAT-O&M-NCS-2021-0033-EGIN version 3 “Global Infrastructure and Networks – GSCG002 Technical Conformity Assessment”.
- Contractual Requirements for Components and Materials Quality management.
- CNS-O&M-S&L-2021-0032-EGIN “Global Infrastructure and Networks Barcode specification”.
- Packaging, transport, and delivery requirements rev.2.
- GRI-GRI-GTS-O&M-0001 “Material Category of Merchandise Group”
- GRI-GRI-WKI-O&M-0020 “Contractual Requirements for Components and Materials Quality Management”.

**Enel Grids countries Reference standards**

- Reference documents listed below (amendments included) shall be the edition in-force at the contract date.
- ISO/IEC 17000 Conformity assessment – Vocabulary and general principles.
- ISO/IEC 17020 General criteria for the operation of various types of bodies performing inspection.
- ISO/IEC 17025 General requirements for the competence of testing and calibration laboratories
- ISO/IEC 17050-1 Conformity assessment - Supplier’s declaration of conformity - Part 1: General requirements (ISO/IEC 17050-1:2004, corrected version 2007-06-15)
- ISO/IEC 17050-2 Conformity assessment - Supplier’s declaration of conformity - Part 2: Supporting documentation (ISO/IEC 17050-2:2004).
- ISO/IEC 17065 Conformity assessment – Requirements for bodies certifying products, processes and services.

**Group Pillar References**

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

## 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 |
|---|---|
| **Acceptable Quality Level (AQL)** | The maximum percentage of malfunctions that can be detected during a sample inspection and can still be considered satisfactory |
| **Low Voltage (LV)** | Any set of nominal voltage levels in the range 0,5 to 1 kV AC or 120 to 1500 V DC |
| **Medium Voltage (MV)** | System with a nominal operative voltage between the phases higher than 1 kV to 35 kV included. NOTE: The boundary value between medium voltage and high voltage depends on local and historical circumstances or on common usage. Nevertheless for internal standardization purposes, medium voltage is defined as a system with a nominal operative voltage between the phases higher than 1 kV to 35 kV included". |
| **Technical Conformity Assessment (TCA)** | A "conformity assessment"with respect to "specified requirements"[1] 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 |

**Table 3**

## 7. DESCRIPTION

### 7.1 LIST OF COMPONENTS

| Guards to protect birds from direct contact with our power lines (Type I) | | | | | |
|---|---|---|---|---|---|
| **GS Type code** | **Serial number** | **Country** | **Material** | **Description** | **Voltage U_max [kV]** |
| GSCC030/1 | 300019 | ES | Polymeric material | Insulation kit for GS1-GS2 suspension assembly and conductor up to 16mm diameter | 30 |
| GSCC030/2 | 300025 | ES | Polymeric material | Insulation kit for GS3 suspension and conductor up to 18mm diameter | 30 |
| GSCC030/3 | 300100 | ES | Polymeric material | Insulation kit for GA1-GA2 dead-end assembly and conductor up to 16mm diameter | 30 |
| GSCC030/4 | 300023 | ES | Polymeric material | Insulation kit for GA3 dead-end assembly and conductor up to 18mm diameter | 30 |
| GSCC030/5 | 300018 | ES | Polymeric material | Insulation kit, rigid insulator and conductor up to 14 mm Ø | 30 |
| GSCC030/6 | 300013 | ES | Polymeric material | Conductor cover up to 16 mm diameter | 30 |
| GSCC030/7 | 300012 | ES | Polymeric material | Conductor cover up to 18 mm diameter | 30 |
| GSCC030/8 | 300002 | ES | Polymeric material | Conical tapping lining. Conductor up to 18 mm diameter | 30 |
| GSCC030/9 | 300041 | ES | Polymeric material | Conductor cover up to 12 mm diameter | 30 |
| GSCC030/10 | 300030 | ES | Polymeric material | Insulation kit, M.V. cable terminations | 30 |
| GSCC030/11 | 300034 | ES | Polymeric material | Insulation kit, cut out fuse basis | 30 |
| GSCC030/12 | 300027 | ES | Polymeric material | Insulation kit for GS1 suspension assembly and conductor up to 12 mm diameter | 30 |
| GSCC030/13 | 300026 | ES | Polymeric material | Insulation kit for GA1 dead-end assembly and conductor up to 12 mm diameter | 30 |
| GSCC030/14 | 300048 | ES | Polymeric material | Insulation kit for RGDAT sensor plate | 30 |
| GSCC030/15 | 300046 | ES | Polymeric material | Insulation kit for connection conductor to IS (longitudinal connection) | 30 |
| GSCC030/16 | 300049 | ES | Polymeric material | Insulation kit for connection conductor to IS (angle connection) | 30 |
| GSCC030/17 | 300059 | ES | Polymeric material | Insulation kit for double yoke plate 300x85 | 30 |
| GSCC030/18 | 860001 | ES | Polymeric material | Wedge connector cover. Conductor up to 14 mm Ø | 30 |
| GSCC030/19 | 686116 | RO | PVC | Electro-insulating sheath 1000 mm long for normal rod, single/double support connections in alignment/neck | 20 |
| GSCC030/20 | 686117 | RO | PVC | Electro-insulating sheath 1000 mm long for rotating beacon, single/double stretch connections on support insulators | 20 |
| GSCC030/21 | 686118 | RO | PVC | Electro-insulating sheathing, for single/double stretch connections on support insulators, length 500 mm | 20 |
| GSCC030/22 | 686119 | RO | PVC | Electro-insulating sheath, for single/double stretch connections on support insulators/insulator chain, length 3000 mm | 20 |
| GSCC030/23 | 270453 | PE | Polymeric material | ANTI BIRD PROTECTIVE COVER FOR AIRWAYS. INSULATOR LINE POST. 20 kV | 20 |
| GSCC030/24 | 270452 | PE | Polymeric material | PROTECTIVE COVERING FOR OVERHEAD LINES 50 TO 150 mm2 10 kV and 20 kV | 20 |
| GSCC030/25 | 270451 | PE | Polymeric material | PROTECTIVE COVERING FOR OVERHEAD LINES 180 TO 240 mm2 20 kV | 20 |
| GSCC030/26 | 270033 | IT | Polymeric material | Insulation kit for rigid insulator and conductor up to 16,5 mm Ø, suitable for conductors up to 150 mm2 cross section. | 20 |
| GSCC030/27 | 270032 | IT | Polymeric material | Insulation kit for tie chain and conductor up to 16,5 mm Ø, suitable for conductors up to 150 mm2 cross section. | 20 |
| GSCC030/28 | 270031 | IT | Polymeric material | Insulation kit for tension clamp | 20 |
| GSCC030/29 | 270030 | IT | Polymeric material | Insulation for conductor up to 16,5 mm diameter, suitable for conductors up to 150 mm2 | 20 |

| Guards to protect birds from direct contact with our power lines (Type I) | | | | | |
|---|---|---|---|---|---|
| **GS Type code** | **Serial number** | **Country** | **Material** | **Description** | **Voltage U_max [kV]** |
| GSCC030/30 | 860196 | CO | Polymer material (NO silicone rubber) | [FLEXIBLE TUBULAR CABLE 2/0-605 AWG 36kV] | 36 |
| GSCC030/31 | 860190 | CO | Polymer material (NO silicone rubber) | [Cubiert flexible cable desn2/0-605AWG 17,5kV] | 17,5 |
| GSCC030/32 | 275897 [Enel Ceará e Rio] | BR | EPR rubber covered with a thermally stable mastic layer for sealing and adhering for sealing | Cover for connectors and splices. [A=400mm; B=210±2 mm] | 25 |
| GSCC030/33 | 337907 [Enel São Paulo] | BR | EPR rubber covered with a thermally stable mastic layer for sealing and adhering for sealing | Cover for connectors and splices. [A=140mm; B=200±2 mm] | 25 |
| GSCC030/34 | 337908 [Enel São Paulo] | BR | EPR rubber covered with a thermally stable mastic layer for sealing and adhering for sealing | Cover for connectors and splices. [A=400mm; B=200±2 mm] | 25 |
| GSCC030/35 | 337909 [Enel São Paulo] | BR | EPR rubber covered with a thermally stable mastic layer for sealing and adhering for sealing | Cover for connectors and splices. [A=550mm; B=200±2 mm] | 25 |
| GSCC030/36 | 337910 [Enel São Paulo] | BR | EPR rubber covered with a thermally stable mastic layer for sealing and adhering for sealing | Cover for connectors and splices. [A=550mm; B=550±2 mm] | 34,5 |
| GSCC030/36 | 270421 [Enel Ceará e Rio] | BR | EPR rubber covered with a thermally stable mastic layer for sealing and adhering for sealing | Cover for connectors and splices. [A=550mm; B=550±2 mm] | 34,5 |
| GSCC030/37 | 251901 | BR | High-density polyethylene | Bracket and live line clip protection [50 up to 185 ($mm^2$); Ø: 13,7 up to 26,9 (mm)] | 36,2 |
| GSCC030/38 | 329705 (FPM) | BR | High-density polyethylene | Bracket and live line clip protection [70 ($mm^2$); Ø: 17,5 up to 20,1 (mm)] | 36,2 |
| GSCC030/39 | 329701 | BR | High-density polyethylene | Bracket and live line clip protection [185 up to 300 ($mm^2$); Ø: 23,3 up to 31,5 (mm)] | 36,2 |
| GSCC030/40 | 250041 | BR | High-density polyethylene | Bracket and live line clip protection [95 up to 300 ($mm^2$); Ø: 26,8 up to 40 (mm)] | 36,2 |
| GSCC030/41 | 275133 | BR | Polypropylene | Wedge connector protective cover with bracket | 15 |
| GSCC030/42 | 274702 | BR | Polypropylene | Wedge connector protective cover with bracket | 15 |
| GSCC030/43 | 600449 | BR | Polypropylene | Wedge connector protective cover with bracket | 15 |
| GSCC030/44 | 164564 | BR | Polypropylene | Wedge connector protective cover with bracket | 15 |
| GSCC030/45 | 329619 | BR | Black polyethylene | Wedge connector cover - [Dimensions [mm]: A=151; B=57; C=35] | 1 |
| GSCC030/46 | 252863 | BR | Black polyethylene | Wedge connector cover - [Dimensions [mm]: A=65; B=29; C=16,5] | 1 |
| GSCC030/47 | 252634 | BR | Black polyethylene | Wedge connector cover - [Dimensions [mm]: A=53; B=26; C=16] | 1 |
| GSCC030/48 | 6792559 | BR | Black polyethylene | Wedge connector cover - [Dimensions [mm]: A=51; B=23; C=12,5] | 1 |
| GSCC030/49 | 300927 | BR | High-density polyethylene | Insulating pin cover | 36,2 |
| GSCC030/50 | 270176 | CL | Polymeric material | Protective conductor sheath [diam int 11mm] | 25 |
| GSCC030/51 | 270187 | CL | Polymeric material | Protective conductor sheath [diam int 22mm] | 25 |
| GSCC030/52 | 270186 | CL | Polymeric material | Protective conductor sheath [diam int 30mm] | 25 |
| GSCC030/53 | 270185 | CL | Low-density polyethylene | Rigid Insulator Coating 35kV | |

| Guards to protect birds from direct contact with our power lines (Type I) | | | | | |
|---|---|---|---|---|---|
| **GS Type code** | **Serial number** | **Country** | **Material** | **Description** | **Voltage U_max [kV]** |
| GSCC030/54 | 270175 | CL | Dielectric silicone | Flexible insulator cladding 12kV | |
| GSCC030/55 | 270184 | CL | Dielectric silicone | Flexible insulator cladding 23kV | |
| GSCC030/56 | 270183 | CL | Low-density polyethylene | Protector final red 16-24m | |
| GSCC030/57 | 270182 | CL | Low-density polyethylene | Protector final red 25-33mm | |

| Guards to protect animals from direct contact with station equipment (e.g., transformers) (Type II) | | | | | |
|---|---|---|---|---|---|
| **GS Type code** | **Serial number** | **Country** | **Material** | **Description** | **Voltage U_max [kV]** |
| GSCC030/58 | 275620 | BR | High-density polyethylene | Distribution transformer bushing protection | 15 |
| GSCC030/59 | 986739 | BR | High-density polyethylene | Distribution transformer bushing protection | 15 |
| GSCC030/60 | 270301 | BR | High-density polyethylene | Distribution transformer bushing protection | 36 |
| GSCC030/61 | 201220 | CO | Polymer material (NO silicone rubber) | Heat shrink cover for busbar MT 50 MM | 36 |
| GSCC030/62 | 201221 | CO | Polymer material (NO silicone rubber) | Heat shrink cover for busbar MT 25 MM | 36 |
| GSCC030/63 | 860189 | CO | Polymer material (NO silicone rubber) | Heat shrink cover for busbar MT-15kV | 15 |
| GSCC030/64 | 860193 | CO | Polymer material (NO silicone rubber) | SHUNT CONNECTION COVER. BUSBAR 400MM | 36 |
| GSCC030/65 | 860195 | CO | Polymer material (NO silicone rubber) | COVER FOR DERIVATION BUSBAR 600 MM | 36 |
| GSCC030/66 | 300040 | ES | Polymeric material | Insulation kit for, M.V. bushings for pole-mounted transformers | 30 |
| GSCC030/67 | 300029 | ES | Polymeric material | Insulation kit for, lightning arrester terminals | 30 |
| GSCC030/68 | 300028 | ES | Polymeric material | Insulation kit, for single-pole disconnectors | 30 |
| GSCC030/69 | 300039 | ES | Polymeric material | Insulation kit, expulsion fuses, disconnecting switches | 30 |

**Table 4** List of components, main characteristics.

## 7.2 APPLCABLE LAWS AND REFERENCE STANDARDS

### 7.2.1.Global Standards

- *GST-001 MV/LV TRANSFORMERS*

### 7.2.2.Local Standards

*Brazil*

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

*Chile*

- *NSEG 5 En.71 Reglamento de Instalaciones Eléctricas de Corrientes Fuertes.*

*Colombia*

- *RETIE, Reglamento Técnico de Instalaciones Eléctricas.*
- *Código Eléctrico Colombiano, NTC 2050.*

*Peru*

- *Código Nacional de Electricidad – Suministro 2011.*
- *Norma Técnica de Calidad de los servicios eléctricos (NTCSE).*

*Romania*

- *NTE007/08/00 Normativ pentru proiectare și executarea rețelelor de cabluri electrice.*

*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.*
- *REAL DECRETO 842/2002, de 2 de agosto, por el que se aprueba el Reglamento Electrotécnico para Baja Tensión e Instrucciones Técnicas Complementarias (R.E.B.T.)*
- *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.*

### 7.2.3.International standard

- *IEC 60243 “Dielectric strength”*

- *ISO 2859-1 "Sampling procedures for inspection by attributes. Part 1: Sampling plans for inspection lot by lot, tabulated according to acceptable quality limit (AQL)"*
- *UNE 211605 "Climatic ageing test of cable covering materials"*
- *ISO 868 "Plastics and ebonite. Determination of indentation hardness using a durometer (Shore hardness)"*
- *IEC 60243-1 "Dielectric strength of insulating materials. Test methods. Part 1: Industrial frequency testing (ratified by AENOR in October 2013)"*
- *IEC 60695-2-11 "Fire hazard testing. Part 2-11: Glow wire test method. Flammability tests for finished products"*
- *IEC 60811-403 "Electrical and fibre optic cables. Test methods for non-metallic materials. Part 403: Miscellaneous tests. Ozone resistance tests on elastomeric compounds"*
- *IEC 60811-501 "Electrical and fibre-optic cables. Test methods for non-metallic materials. Part 501: Mechanical tests. Tests to determine the mechanical properties of insulation and sheathing mixtures"*
- *HD 605 "Electrical Cables. Additional test methods"*
- *ABNT NBR 6535 - Signalling of Aerial Power Transmission Lines with a View to the Safety of Aerial Inspection;*
- *ABNT NBR 7276 - Warning Signs on Aerial Power Transmission Lines;*
- *EA 0058 - Protection conduits against electrocution of birdlife on overhead power distribution lines.*

### 7.2.4.Replaced local standards

- Spain:

BNA001 4ª EDICION

- Colombia:

ET-AT-927 RECUBRIMIENTOS PARA SALIDAS DE TRANSFORMADORES

- Romania:

FT-239_MAT_-Teci_electroizolante_LEA_MT-M

- Peru:

MAT-OYM-NDS-18-206-ESP_0

MAT-OYM-NDS-18-213-ESP_0

- Brazil:

MAT-PMCB-EeA-21-2044-EDBR (PM-Br 780.06.1)

MAT-PMCB-EeA-21-2045-EDBR (PM-Br 550.02.1)

PM-R 2271 R-00

PM-Br 722.54.0

PM-Br 722.60,0

PM-Br 220.11.1

- Chile:

ESP-0237 REV. 1

## 7.3 SERVICE CONDITIONS

### 7.3.1. General service conditions

As per IEC 60721-2-1.

### *7.3.2.* Specific service conditions

Colombia (Enel Distribución Colombia): the reference altitude is 2.700 m.

## 7.4 TECHNICAL CHARACTERISTICS

### 7.4.1. Protection types and equipment

The material defined to protect bird life covered in this specification can be divided into two types depending on the function as described in Table 5.

| TYPE | DESCRIPTION |
|---|---|
| I | Guards to protect birds from direct contact with power lines. |
| II | Guards to protect animals from direct contact with station equipment. |

**Table 5**

The function of Type I guards is to insulate the connection between conductor and support, to avoid the electrocution caused by direct contact of the bird.

The function of Type II guards is to insulate the connection between conductor and station equipment (e.g., transformers), to avoid the electrocution caused by direct contact of the bird.

The equipment and protections, adopted along the line and for the station equipment, are illustrated in Figure 1 and Figure 2.

**Figure 1** *Insulating sleeves Type I.*

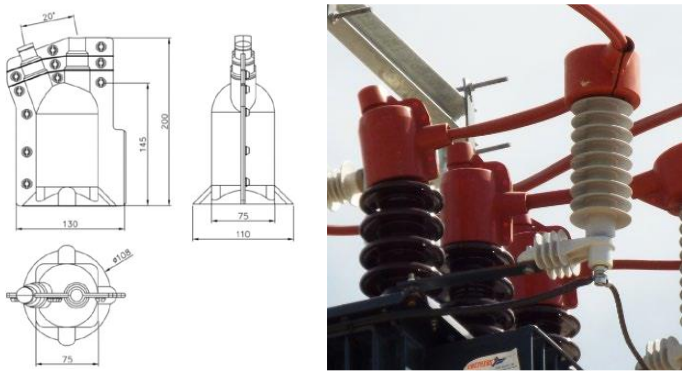


**Figure 2** *Distribution transformer bushing protection Type II.*

**Note: Figures are for illustrative purposes only.**

## 7.5 CONSTRUCTION CHARACTERISTICS

Birds face two threat factors related to the presence of power lines: the risk of electrocution and the risk of collision against overhead cables. Electrocution is one of the anthropogenic causes of mortality for many bird species, especially those with a medium to large wingspan. Medium-voltage (MV) power lines are responsible for the vast majority of electrocution episodes in birds, which can occur when two parts of a bird's body touch two conducting elements or a conductor and a grounded structure (e.g. the pole crossarm). The latter is the case that occurs most frequently.

The materials described in this technical specification are designed to avoid these episodes.

### 7.5.1.Type I

Type I components are designed to insulate the connection between the conductor and the elements from the overhead lines in order to avoid electrocution caused by direct contact with the bird.

These liners, designed in such a way that they can be re-opened after being closed without the use of additional non-reusable materials (ex tapes), are intended for the insulation of uninsulated electrical conductors and all other connecting elements of the conductor. They are installed in the area where the conductor is attached to the pole. Their design must ensure their position in the event of adverse environmental conditions.

Generally, they are made of a polymer material that can withstand environmental conditions and UV radiation. To facilitate the drainage of water accumulated inside them, especially in wet areas, they have a perforated or partially open underside. The design shall avoid the access of small birds.

As there are many different configurations, the material is best described in the local section.

### 7.5.2.Type II

The function of Type II guards is to insulate the connection between conductor and station equipment, to avoid the electrocution caused by direct contact of the bird. Type II components include enclosures used in primary substations to cover the exposed parts of devices such as:

- Power transformers (in accordance with GST-001);
- Busbars;
- Surge arresters;
- Others.

The surfaces of the materials from which these components are made must be smooth and of as uniform a thickness as possible, free of bubbles and burrs, sharp projections, cracks and inclusions.

It must not allow rainwater to accumulate inside. See local section for a better description of the material.

## 7.6 MARKING AND DESIGNATION

### 7.6.1.Designation

Each electrically material must be marked with the following wording:

- The name of the manufacturer
- The name and product code given by the manufacturer
- The maximum system voltage in which an insulating sleeve can be used
- Date of manufacture (month/year)
- Serial and batch number
- For conductor linings: Maximum conductor cross-section to which the insulating sleeve can be applied

### 7.6.2.Marking

The marking must be indelible, easily legible and carried out by engraving or in relief above the surface of the outer sheath in a continuous way.

## 7.7 TESTING

### 7.7.1.Type test

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

When the design, materials or manufacturing process are changed (which might affect the performance characteristics of the material), the relevant type tests shall be repeated.

7.7.1.1. *List of type tests for Type I and Type II*

| **Description of the trials** | **Section** |
|---|---|
| **Material testing:** | |
| Hardness test | a) |
| Tensile strength and elongation at break testing | b)* |
| Tear strength test | c) |
| Flammability test | d) |
| Dielectric strength test | e)* |
| Climatic ageing test | f) |
| Ozone resistance test | g) |
| **Tests on the complete lining:** | |
| Verification of constructive characteristics | h) |
| Shape and dimensions | i) |
| Appearance and finish | j) |
| Marking | k) |
| Low temperature mechanical test | l) |
| Mechanical testing of the lining | m) |
| Dielectric test and measurement of leakage current | n) |
| (*) Pay attention to the acceptance criteria described for each country. | |

**a) Hardness testing**

Test to determine the penetration hardness of the material used to manufacture coatings.

Procedure

A sample of the material used in the linings to be tested must be available, with the appropriate size, shape and thickness according to the method for measuring hardness, as indicated in Standard ISO 868. The ambient temperature during the tests must be measured and recorded, as well as the hardness of the samples in accordance with the provisions of this standard, using a type A Shore hardness tester.

Acceptance Criteria

The hardness of each sample must not be less than 50 (Shore A).

**b) Tensile strength and elongation at break test**

Tests to determine the maximum tensile load borne by the material used to manufacture the coatings and the increase in length produced at break.

Procedure

The test shall be carried out in accordance with the provisions of Standard IEC 60811-501 on 5 samples of the material used for the manufacture of the linings.

Acceptance Criteria

The minimum breaking strain of all tested specimens shall be 4 N/mm2 (For Peru 10 N/mm2).

The minimum elongation at break of all specimens tested shall be 200% (For Peru 300%, for Chile 250%).

**c) Tear strength test**

Test to determine the tear strength of the material used in the manufacture of linings.

Procedure

This test shall be carried out in accordance with section 2.2.2.2 of Standard HD 605, on 3 samples of the material used.

Acceptance Criteria

The minimum tear strength allowed for all samples tested shall be 10 N/mm.

**d) Flammability test**

Test to verify the ignition behavior and self-extinguishing properties of the lining material.

Procedure

The test shall be carried out in accordance with the provisions of Standard IEC 60695-2-11 on a sample of the material used for the manufacture of the linings. The test temperature shall be 650 ºC.

Acceptance Criteria

Conformity shall be verified according to chapter 10 of the IEC 60695-2-11 Standard.

**e) Dielectric strength test**

Test to determine the maximum voltage that the insulating material used for the manufacture of linings can withstand without perforation.

Procedure

This test shall be carried out on 5 samples of 60 mm x 60 mm according to paragraph 10.2 Test for 20 s steps of EN 60243-1. The test medium shall be liquid (transformer oil) and equal electrodes of 25 mm diameter shall be used.

Acceptance Criteria

The test is considered passed if the dielectric strength value is greater than 18 kV/mm (For Peru 13kV/mm).

**f) Climatic ageing test**

Test to evaluate the behaviour of the material used for the manufacture of linings subjected over a long period of time to the action of solar radiation and weathering (humidity, water spray, cold and heat).

Procedure

This test shall be carried out in accordance with Standard UNE 211605 on 1 sample of lining from which 5 specimens of 6 cm x 6 cm shall be obtained. To carry out the test, the following shall be considered:

- Energy radiation: 43 W/m2.
- Number of climatic cycles: 6.
- Temperature of the enclosure for phases 3 and 4 of the climatic cycle: (70±3) ºC.

Acceptance Criteria

The test is considered to have been passed if the characteristics of hardness and dielectric strength do not vary by more than 15% with respect to the initial value, guaranteeing in any case compliance with the minimum values initially required.

The specimens on which these tests are carried out shall be taken from the area exposed to radiation.

**g) Ozone resistance test**

Type test to assess the resistance of the lining material to surface cracking caused by ozone.

Procedure

The test shall be carried out on a lining sample in accordance with Standard IEC 60811-403 and under the following conditions:

- Temperature: (25±2) ºC.
- Ozone concentration: 250±25 ppm.
- Exposure time: 30 h.

Acceptance Criteria

The test is considered satisfactory if the lining does not show any appreciable crack in the visual inspection carried out at the end of the test.

**h) Verification of constructive characteristics**

Compliance with the constructive characteristics indicated in Local sections must be verified.

**i) Shape and dimensions**

The shape of the cladding and water evacuation system must be checked by visual inspection and comparison with the product drawings provided by the manufacturer.

The dimensions of the sample must also be checked by comparison with the product drawings provided by the manufacturer. The specified tolerances must be taken into account. For dimensional measurements, the test sample must not be subjected to mechanical stress.

**j) Appearance and finish**

The appearance and finish of the test sample must be verified by visual inspection.

**k) Marking**

The markings must remain legible after wiping them successively with a cloth soaked in soapy water for 1 min. and then with a cloth soaked in isopropyl alcohol for 1 min.

**l) Low temperature mechanical test**

Test to assess the cold mechanical impact resistance of linings.

Procedure

A lining shall be tested using the apparatus shown in Figure 1.

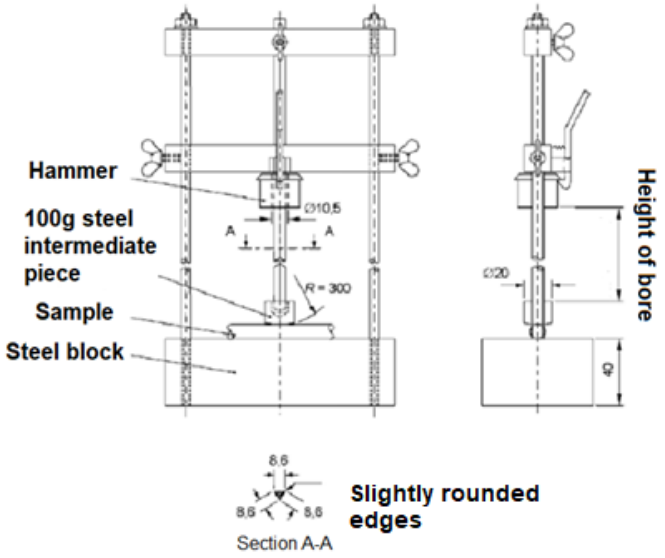



**Figure 3** Impact test apparatus.

The test apparatus shall be placed on a block of foam rubber or elastic rubber material and, together with the sample, shall be placed in a refrigerator at the test temperature -25 °C ± 2 °C.

When the sample has reached the specified temperature, or after 2 h, whichever is longer, it shall be placed on the steel base in the position shown in the figure. The hammer is dropped on the weakest point or part of the lining but never within 5 mm of the edge. The energy to be applied in this test shall be 20 J, therefore, the mass of the hammer shall be 6,8 kg ± 1 per cent and it shall be dropped from a height of 300 mm ± 1 per cent.

After the test, the lining is allowed to reach approximately room temperature and is then examined.

Acceptance Criteria

The sample shall be rejected if it shows any sign of cracking or fracture.

**m) Mechanical testing of the lining**

Test intended to verify the guarantee offered by the lining sealing system.

Procedure

A tensile test shall be carried out using a universal machine. For this purpose, two slings or straps shall be passed through the openings of the linings and fixed in the jaws of this machine. A force of 50 N shall then be exerted between the jaws.

Acceptance Criteria

The lining shall be considered to have passed the test if, when this tensile stress is applied, the lining latch mechanism is not damaged and the lining does not open.

**n) Dielectric test and measurement of leakage current**

Electrical test to be carried out taking into account the following.

Conditioning

The test sample shall be cleaned with isopropyl alcohol and air dried for at least 15 min before being subjected to the dielectric test.

It shall then be subjected to pre-test conditioning for moisture absorption by immersing the sample in distilled water at room temperature for not less than 30 min. Afterwards, it shall be removed from the water and the surface liquid shall be dried with a clean absorbent cloth.

The test enclosure shall be maintained at normal atmospheric conditions (18-28 °C, 45-75 % relative humidity).

Test set-up

The lining to be tested shall be installed simulating service conditions, covering the elements for which it has been designed (metallic conductors, clamps, suspension clamps, insulators, transformer terminals, etc.) and following the instructions provided by the manufacturer. If the same lining is designed to cover different live elements, it shall be tested with each of them; in cases where the element to be covered has a range of several sizes, it shall be tested with the largest size. In this way, a given lining will be valid for the type and reference of the elements with which it has been tested. The extension of the validity of the tests for other elements to be covered in medium voltage networks shall be the subject of an agreement between the manufacturer and ENEL.

The test position of the lining must coincide with the usual position in service. The assembly shall be carried out in such a way that the test voltage is applied to the live element in service conditions, with the surface of the lining susceptible to contact connected to earth through a metallic electrode.

The metal electrode shall consist of a tinned copper braided mesh which shall enclose the entire surface of the shell to be tested. The distance between the mesh and the entry mouth of the conductor shall be 50 mm or more. This distance shall be extended beyond 50 mm if necessary to avoid contouring between the conductor and the mesh itself, this extension being the minimum necessary to avoid contouring.

The mesh shall be wound around the openings leading to the lining, making the necessary turns to cover these openings completely and respecting the above-mentioned distance. In the central body of the lining, the mesh shall be crossed over, wrapping around the lining, so that the overlap of the crossing is centered on the body; the mesh shall be crossed as many times as possible to cover the largest possible area (see figure 2 for guidance).

The metal braid shall be at least 1,5 mm thick and 20 mm wide. The length shall be such as is necessary to encircle the lining as described above.

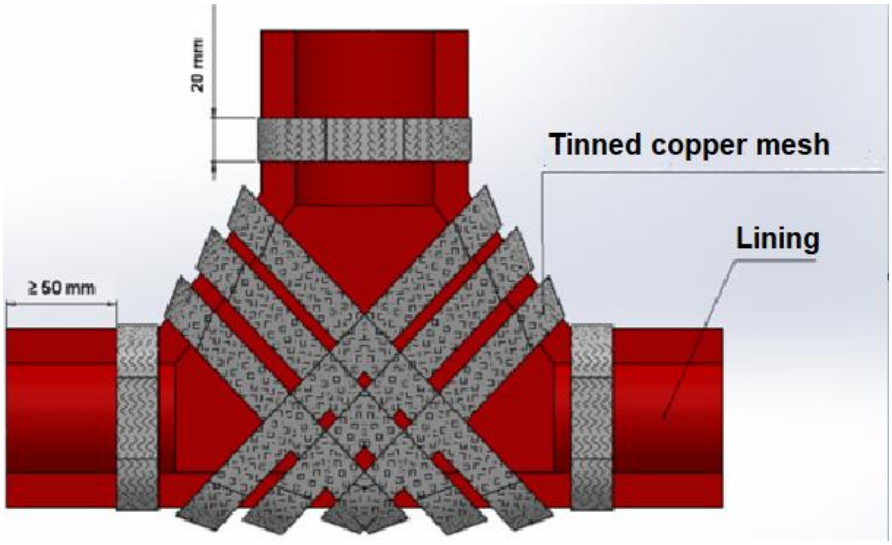
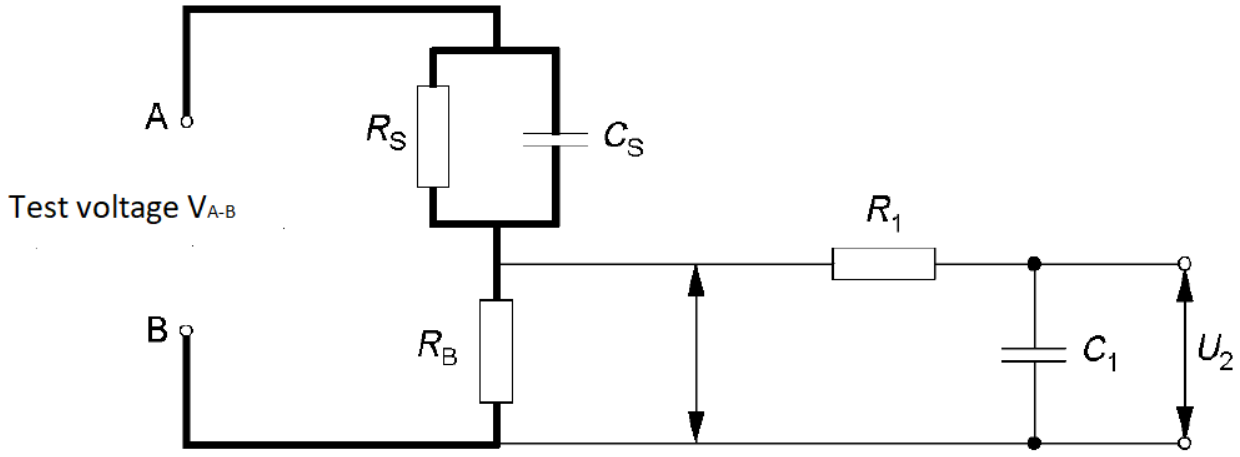



**Figure 4** Example of arrangement of the metal electrode on the liner.

The grounding of this electrode must be done through the measuring quadrupole defined in figure 6:

**Figure 5** Measuring quadrupole.




$R_S = 1500\ \Omega$
$R_B = 500\ \Omega$
$C_S = 0{,}22\ \mu F$

$R_S = 10\ k\Omega$
$C_1 = 0{,}022\ \mu F$
$U_2 = Rising\ voltage$

The test voltage can take on 2 different values:

- $1 \leq U_{max} \leq 24$

$$\boldsymbol{V_{A-B} = \frac{24}{\sqrt{3}} = 13{,}86\ kV}$$

- $24 \leq U_{max} \leq 36{,}2$

$$\boldsymbol{V_{A-B} = \frac{36}{\sqrt{3}} = 20{,}785\ \text{kV}}$$

NOTE: $U_{max}$ is indicated in table 4.

Performance of the test

The test voltage to be applied shall be the single voltage to be applied for 1 min simulating actual service conditions. The leakage current through the metal electrode shall be measured.

Acceptance Criteria

There shall be no arc piercing, arc striking or contouring, and the value of the measured leakage current shall be less than 2 mA.

### 7.7.2.Acceptance tests

The aim of the Acceptance Tests is to verify the conformity of the products to the standards defined in this document and to the prototype approved during the TCA, whose characteristics and type test results are set out in the TCA Dossier which must be made available to the Inspector (Enel or Appointee) during the FAT.

Acceptance tests must be performed before the delivery and must be carried out at the Supplier's plants or laboratory approved by Enel.

The acceptance tests depending on the type of material and the corresponding sampling are listed in the following Table 6.

| n° | Test | Type | | Description / Note |
|---|---|---|---|---|
| | | I | II | |
| 1 | Visual inspection | X | X | Visual verification of compliance with the requirements set out in paragraphs 7.5. & 8 and with the approved prototype during the TCA process (see TCA dossier). |
| 2 | Verification of Marking | X | X | Visual verification of the presence and conformity of markings with the requirements of Section 7.6. and the approved prototype during the TCA process (see TCA dossier) |
| 3 | Verification of Accessories | X | X | Verification of the presence, conformity and completeness of any accessory kits if any included in the approved prototype during the TCA process (see TCA dossier) |
| 4 | Packaging & Barcode | X | X | Verification of compliance with the specifications referred to in the contract, if any, and with the approved prototype during the TCA process (see TCA dossier). |
| 5 | Documentary verification | X | X | Verification of certificates of origin of raw materials. |

**Table 6** Acceptance tests list.

7.7.2.1. *During the acceptance tests performed autonomously by the supplier:*

The supplier must perform all tests listed in Table 6 with the following sampling criteria, **15% of the lot with a minimum of 3 pieces and a maximum of 15 pieces** considering that:

- The quantities are always referred to each type of material code prepared for testing;
- The acceptance number will be always 0, and the rejection number will be always 1;
- The costs of rejected materials will be charged to the supplier.

The reports of the tests carried out shall be made available in case of repetition of the acceptance tests at the presence of an Inspector (Enel or Appointee).

Tests performed during the production process on semi-finished products may also be considered valid, as acceptance test, if:

- The tests are performed as required by the relevant technical specifications and technical standards;
- The sampling plans adopted by the Supplier are in compliance with the aforementioned ones;

- The performed test results are properly recorded;
- The supplier demonstrates that the components/materials features don't vary during further production phases after the test.

In this case, the Dielectric Test (n°5) must be performed only on 1 sample for each material code, but, in case of a negative result, repeated on 2 further samples.

7.7.2.2. *During the repetition of the acceptance tests at the presence of the Enel or designated inspector:*

In this case all the test listed in Table 6 shall be carried out on a sample chosen randomly from the lot already successfully tested by the supplier with the following reduced sampling criteria, **10% of the lot with a minimum of 2 pieces and a maximum of 10 pieces** *considering that:*

- The quantities are always referred to each type of material code prepared for testing;
- The acceptance number will be always 0, and the rejection number will be always 1;
- The costs of rejected materials will be charged to the supplier.

In this case, the Dielectric Test (n°5) must be performed only on 1 sample for each material code, but, in case of a negative result, repeated on 1 further sample.

## 7.8 TECHNICAL CONFORMITY ASSESSMENT

### 7.8.1. General conditions

The manufacturer shall provide personnel and equipment necessary to carry out type tests and acceptance tests described herein. Otherwise, the supplier could hire the service to a laboratory previously accepted by the customer and assume the cost. The product shall comply with the requirements of GSCG002 regarding the Technical Conformity Assessment.

The equipment should be properly calibrated by a laboratory certified or approved by the client. The manufacturer shall possess up to date calibration certificates (to turn over) at the time of inspection.

### 7.8.2. Acknowledgement of TCA for previous revision of the standard.

Products with TCA in force under the ENEL local standards will be recognized as homologated material for the present technical specification.

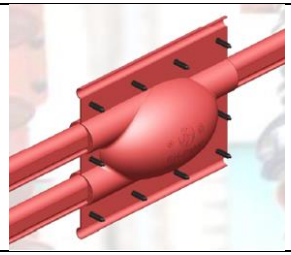
Enel, therefore, reserves the right to check that the conditions of supply, the type codes, the country codes etc. shall comply with the requirements of this technical specification.

## 8. LOCAL SECTION

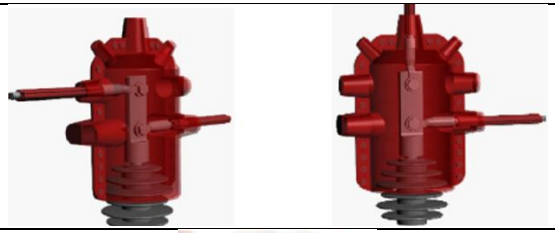
LOCAL SECTION A – ENDESA DISTRIBUCIÓN ELÉCTRICA (Spain)

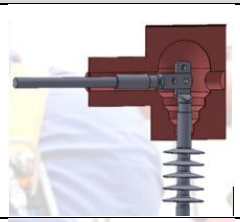
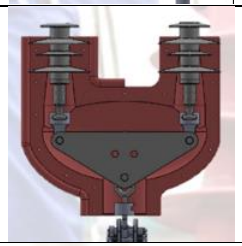
<table>
<tr><th colspan="4">Type I</th></tr>
<tr><th>MATERIAL CODE</th><th>DESCRIPTION</th><th>ELEMENTS OF THE KIT</th><th>COMMENT</th></tr>
<tr><td>300019</td><td>Insulation kit for GS1-GS2 suspension assembly and conductor up to 16mm diameter, suitable for conductors up to 119AL 1/28-A20 SA (LARL 145 E).</td><td>– 1 Clamp cover;<br>– 3 m of conductor lining;<br>– Auxiliary accessories.<br>  </td><td rowspan="3">The class of the linings, according to the rated voltage of the network, must be of Class 0, according to EA 0058 and must be designed in such a way that:<br>• They must have a water evacuation system that avoids its accumulation inside.<br>• They must remain in the same position under all reasonably foreseeable environmental conditions, avoiding the accumulation of water in the interior and avoiding movement due to the effects of wind, movement of the conductor, etc.<br>wind, movement of the driver, etc.<br>• Its dimensions are adjusted as much as possible to the parts to be covered.<br>Temperature range of application<br>The linings must be able to be used in a temperature range between -25ºC and 105ºC.<br>The linings must be accompanied by the manufacturer’s installation instructions, as well as the elements, accessories or devices that allow their correct installation according to these instructions.<br>The kits must include at least 3 m of conductor sheathing per phase in the case of suspension or 5 m of sheathing in the case of anchor.</td></tr>
<tr><td>300025</td><td>Insulation kit for GS3 suspension and conductor up to 18mm diameter, suitable for conductors up to 147AL 1/34-A20 SA (LARL 180).</td><td>– 1 Clamp cover;<br>– 3 m of conductor lining;<br>– Auxiliary accessories.<br>  </td></tr>
<tr><td>300100</td><td>Insulation kit for GA1-GA2 dead-end assembly and conductor up to 16mm diameter, suitable for conductors up to 119AL 1/28-A20 SA (LARL 145 E).</td><td>– 2 Clamp cover;<br>– 5 m of conductor lining;<br>– Auxiliary accessories.<br>  </td></tr>
</table>

<table>
<tr><th colspan="4">Type I</th></tr>
<tr><th>MATERIAL CODE</th><th>DESCRIPTION</th><th>ELEMENTS OF THE KIT</th><th>COMMENT</th></tr>
<tr><td>300023</td><td>Insulation kit for GA3 dead-end assembly and conductor up to 18mm diameter, suitable for conductors up to 147AL 1/34-A20 SA (LARL 180).</td><td>– 2 Clamp covers;<br>– 5 m of conductive lining;<br>– Auxiliary accessories.<br>  </td><td rowspan="3">The class of the linings, according to the rated voltage of the network, must be of Class 0, according to EA 0058 and must be designed in such a way that:<br>• They must have a water evacuation system that avoids its accumulation inside.<br>• They must remain in the same position under all reasonably foreseeable environmental conditions, avoiding the accumulation of water in the interior and avoiding movement due to the effects of wind, movement of the conductor, etc.<br>wind, movement of the driver, etc.<br>• Its dimensions are adjusted as much as possible to the parts to be covered.<br>Temperature range of application<br>The linings must be able to be used in a temperature range between -25ºC and 105ºC.<br>The linings must be accompanied by the manufacturer’s installation instructions, as well as the elements, accessories or devices that allow their correct installation according to these instructions.<br>The kits must include at least 3 m of conductor sheathing per phase in the case of suspension or 5 m of sheathing in the case of anchor.</td></tr>
<tr><td>300018</td><td>Insulation kit, rigid insulator and conductor up to 14 mm Ø, suitable for conductors up to 94AL 1/22-ST1A (LA 110).</td><td>– 1 Staple covers;<br>– 3 m of conductor lining;<br>– Auxiliary accessories.<br>  </td></tr>
<tr><td>300013</td><td>Conductor cover up to 16 mm diameter, suitable for conductors up to 119AL 1/28-A20 SA (LARL 145 E).</td><td>  </td></tr>
</table>

| Type I | | | |
|---|---|---|---|
| **MATERIAL CODE** | **DESCRIPTION** | **ELEMENTS OF THE KIT** | **COMMENT** |
| **300012** | Conductor cover up to 18 mm diameter, suitable for conductors up to 147AL 1/34-A20 SA (LARL 180). |  | The class of the linings, according to the rated voltage of the network, must be of Class 0, according to EA 0058 and must be designed in such a way that:<br>• They must have a water evacuation system that avoids its accumulation inside.<br>• They must remain in the same position under all reasonably foreseeable environmental conditions, avoiding the accumulation of water in the interior and avoiding movement due to the effects of wind, movement of the conductor, etc.<br>wind, movement of the driver, etc.<br>• Its dimensions are adjusted as much as possible to the parts to be covered.<br>Temperature range of application<br>The linings must be able to be used in a temperature range between -25ºC and 105ºC.<br>The linings must be accompanied by the manufacturer's installation instructions, as well as the elements, accessories or devices that allow their correct installation according to these instructions.<br>The kits must include at least 3 m of conductor sheathing per phase in the case of suspension or 5 m of sheathing in the case of anchor. |
| **300002** | Conical tapping lining. Conductor up to 18 mm diameter, suitable for conductors up to 147AL 1/34-A20 SA (LARL 180). |  | |
| **300041** | Conductor cover up to 12 mm diameter, suitable for conductors up to 47AL 1/8-ST1A (LA 56). |  | |

| Type I | | | |
|---|---|---|---|
| **MATERIAL CODE** | **DESCRIPTION** | **ELEMENTS OF THE KIT** | **COMMENT** |
| **300030** | Insulation kit, M.V. cable terminations |  | |
| **300034** | Insulation kit, cut out fuse basis | 1 or 2 units per phase, depending on design.  | |
| **300027** | Insulation kit for GS1 suspension assembly and conductor up to 12 mm diameter, suitable for conductors up to 47AL 1/8-ST1A (LA 56). | – 1 Clamp cover;<br>– 3 m of conductor lining;<br>– Auxiliary accessories.  | |

| Type I | | | |
|---|---|---|---|
| **MATERIAL CODE** | **DESCRIPTION** | **ELEMENTS OF THE KIT** | **COMMENT** |
| **300026** | Insulation kit for GA1 dead-end assembly and conductor up to 12 mm diameter for conductors up to 47AL 1/8-ST1A (LA 56). | – 2 Staple covers;<br>– 5 m of conductive lining;<br>– Auxiliary accessories.<br>  | |
| **300048** | Insulation kit for RGDAT sensor plate, suitable for sensors from 47-AL 1/8-ST1A (LA 56) to 147-AL 1/34-ST1A (LA 180). Terminal Standard NNZ015. |  | |
| **300046** | Insulation kit for connection conductor to IS (longitudinal connection) |  | |

| Type I | | | |
|---|---|---|---|
| **MATERIAL CODE** | **DESCRIPTION** | **ELEMENTS OF THE KIT** | **COMMENT** |
| **300049** | Insulation kit for connection conductor to IS (angle connection) |  | |
| **300059** | Insulation kit for double yoke plate 300x85. |  | |
| **860001** | Wedge connector cover. Conductor up to 14 mm Ø |  | |

| **Type II** | | | |
|---|---|---|---|
| **MATERIAL CODE** | **DESCRIPTION** | **ELEMENTS OF THE KIT** | **COMMENT** |
| **300040** | Insulation kit for, M.V. bushings for pole-mounted transformers up to 160 kVA. |  | |
| **300029** | Insulation kit for, lightning arrester terminals |  | |
| **300028** | Insulation kit, for single-pole disconnectors [Please consult single pole disconnectors specification] |  | |
| **300039** | Insulation kit, expulsion fuses, disconnecting switches [Pleas check expulsion fuses disconnecting switches specification] |  | |
| **Note: Figures are for illustrative purposes only.** | | | |

LOCAL SECTION B – e-distributie (Romania)

| **Type I** | | | |
|---|---|---|---|
| **MATERIAL CODE** | **DESCRIPTION** | **ELEMENTS OF THE KIT** | **COMMENT** |
| **686116** | Electro-insulating sheath 1000 mm long for normal rod, single/double support connections in alignment/neck |  | For mounting on the insulator, the sheathing shall have a cut-out on the outer edges, in the median or marginal plane, depending on the type of connections it protects. The outer closing edges of the sheath shall be provided with circular holes, with a maximum diameter of 4,5 mm, to close and secure the sheath to the insulator and the conductor by means of clamps.<br>Each sheath shall be provided with the necessary number of clamps for its assembly. The clamps supplied shall be made of electrically insulating material, with a service life equal to that of the electrically insulating sheath. The length of the collars shall be a minimum of 9 cm.<br>Main technical characteristics:<br>• wall thickness: maximum 3,5 mm<br>• informative mass: maximum 1 kg/ml<br>• nominal voltage of use: 20kV<br>• test dielectric strength: min 22 kV<br>• ambient temperature of use: - 30°C+ 70°C<br>• storage and transport temperature: - 15°C+ 40°C<br>• climatic conditions: N2 temperate continental. |
| **686117** | Electro-insulating sheath 1000 mm long for rotating beacon, single/double stretch connections on support insulators |  | |
| **686118** | Electro-insulating sheathing, for single/double stretch connections on support insulators, length 500 mm |  | |
| **686119** | Electro-insulating sheath, for single/double stretch connections on support insulators/insulator chain, length 3000 mm |  | |
| * For Romania, the electrically insulating sheaths will be made of PVC (polymer) material, will have a one-piece structure with a high degree of maneuverability and an almost cylindrical cross-section with closure at the generators by the two outer edges, one I-shaped and the other U-shaped, to ensure good protection of the conductor at both the bottom and top (Figure 1). | | | |
| **Note: Figures are for illustrative purposes only.** | | | |

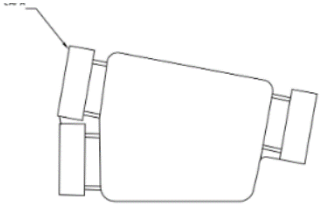
LOCAL SECTION C – Enel distribución (Perú)

| **Type I** | | | |
|---|---|---|---|
| **MATERIAL CODE** | **DESCRIPTION** | **ELEMENTS OF THE KIT** | **COMMENT** |
| **270453** | ANTI BIRD PROTECTIVE COVER FOR AIRWAYS. INSULATOR LINE POST. 20 kV. |   | The design shall allow for the removal and reuse of the sheath. It must be able to be installed on bare copper or greased aluminum alloy conductors, fixed online post insulators and with the following characteristics:<br>• 4 to 20 mm diameter conductors.<br>• Porcelain 56.2 and polymeric insulators with various types of collars.<br>Use in 10 y 20 kV.<br>• Must be a non-marking insulating material.<br>• Rated for temperatures from 0 C to 105 C.<br>• Shall be impact and abrasion resistant.<br>• Must not spread flame.<br>• Must be chemically resistant to grease from conductors.<br>• Must be chemically resistant to fungi.<br>• In addition, it must have the following characteristics.<br>• Minimum dimensions: 600 mm long and 1.5 mm thick.<br>• Minimum dielectric strength: 130 kV/cm.<br>• Thermal resistance: 105 ºC<br>• Tensile strength: 10 Mpa<br>• Elongation: 300 %.<br>• Flexible material, shall not be rigid<br>The material must be supplied with four UV-resistant straps to be used as fasteners or with any other system that ensures its correct fixing to the conductor. |

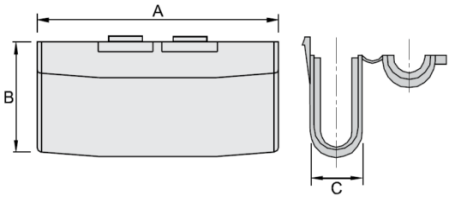
| Type I | | | |
|---|---|---|---|
| **MATERIAL CODE** | **DESCRIPTION** | **ELEMENTS OF THE KIT** | **COMMENT** |
| **270452** | PROTECTIVE COVERING FOR OVERHEAD LINES 50 TO 150 mm2 10 kV and 20 kV |  | It is used as a sheath for bare conductors in 10 kV y 20 kV overhead lines, placed continuously wrapping the conductor along the span.<br>The sheath shall permit to be installed hot (energized line) and using a tool that can be operated manually or automatically. This tool shall be included in the supply in the quantity of 4 units.<br>The presentation is rolls on reels or spools, 30 metres in length.<br>The cross-sections of bare overhead conductors to be protected are from 50 to 150 mm2. |
| **270451** | PROTECTIVE COVERING FOR OVERHEAD LINES 180 TO 240 mm2 20 kV | | It is used as a sheath for bare conductors in 10 kV y 20 kV overhead lines, placed continuously wrapping the conductor along the span.<br>The sheath shall permit to be installed hot (energized line) and using a tool that can be operated manually or automatically. This tool shall be included in the supply in the quantity of 4 units.<br>The presentation is rolls on reels or spools, at least 30 metres in length.<br>The cross-sections of bare overhead conductors to be protected are from180 to 240 mm2. |
| **Note: Figures are for illustrative purposes only.** | | | |

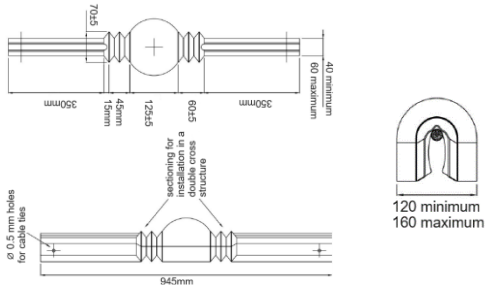
LOCAL SECTION D – Enel Distribuição (Brasile)

| **Type I** | | | |
|---|---|---|---|
| **MATERIAL CODE** | **DESCRIPTION** | **ELEMENTS OF THE KIT** | **COMMENT** |
| **251901** [Enel Ceará, Goiás e Rio] | Bracket and live line clip protection; Voltage class: 15/25 kV; |  | Applicable spiral cable (mm²): 50 to 185; Applicable diameter (mm):13,7 to 26,9; |
| **329705** [Enel São Paulo] | Bracket and live line clip protection; Voltage class: 25 kV; | | Applicable spiral cable (mm²): 70; Applicable diameter (mm): 17,5 to 20,1; |
| **329701** [Enel São Paulo] | Bracket and live line clip protection; Voltage class: 25 kV; | | Applicable spiral cable (mm²): 185 to 300; Applicable diameter (mm): 23,3 to 31,5; |
| **250041** [Enel Ceará Goiás e Rio] | Bracket and live line clip protection; Voltage class: 36 kV; | | Applicable spiral cable (mm²): 95 to 300; Applicable diameter (mm): 26,8 to 40; |

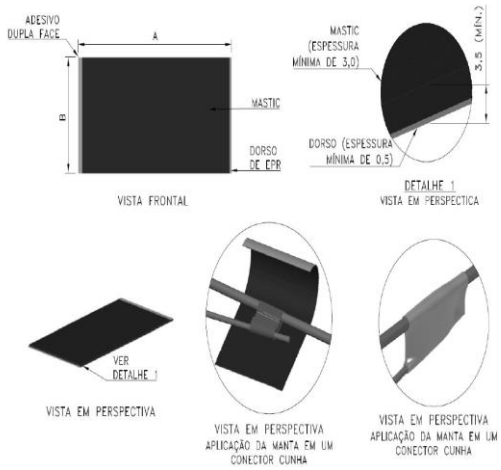
| Type I | | | |
|---|---|---|---|
| **MATERIAL CODE** | **DESCRIPTION** | **ELEMENTS OF THE KIT** | **COMMENT** |
| **275133** | Protective cover of wedge connector with bracket. Only used in networks with a voltage up to 15 Kv. |  | Main (MCM/AWG):1/0; Bypass (MCM/AWG): 1/0; Bracket (mm): '-'; |
| **274702** | Protective cover of wedge connector with bracket. Only used in networks with a voltage up to 15 kV. | | Main (MCM/AWG): 336.4; Bypass (MCM/AWG): 1/0 – 336.4; Bracket (mm): "-"; |
| **600449 (6792144)** | Protective cover of wedge connector with bracket. Only used in networks with a voltage up to 15 kV. |  | Main (MCM/AWG):1/0; Bypass (MCM/AWG): '-'; Bracket (mm):59; |
| **164564** | Protective cover of wedge connector with bracket. Only used in networks with a voltage up to 15 kV. | | Main (MCM/AWG):336.4; Bypass (MCM/AWG): "-"; Bracket (mm): 77.5; |

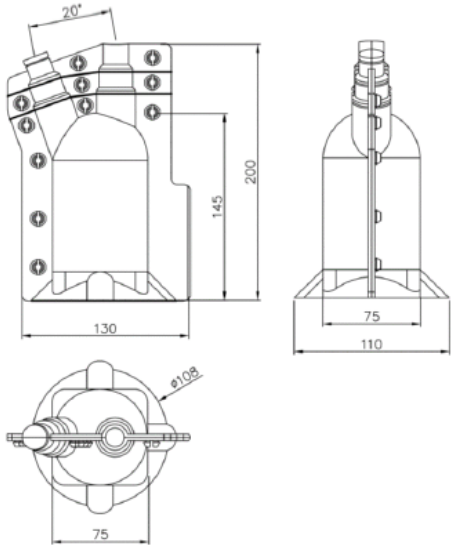
**Application Areas**
Perimeter: *Global*
Staff Function: -
Service Function: -
Business Line: Enel Grids

<table>
<tr><th colspan="4">Type I</th></tr>
<tr><th>MATERIAL CODE</th><th>DESCRIPTION</th><th>ELEMENTS OF THE KIT</th><th>COMMENT</th></tr>
<tr><td>329619</td><td>Low-voltage wedge connector cover</td><td rowspan="4"> 

<table>
<tr><th rowspan="2">CÓDIGOS</th><th rowspan="2">Indicado para os conectores</th><th colspan="3">DIMENSÕES (mm)</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>329619</td><td>caDc série azul (200/300/350)</td><td>151</td><td>57</td><td>35</td></tr>
<tr><td>T270372</td><td>cDcr-I-ci / cDcr-VII-VmB</td><td>65</td><td>29</td><td>16,5</td></tr>
<tr><td>6792558</td><td>cDcr-II-Vd</td><td>53</td><td>26</td><td>16</td></tr>
<tr><td>6792559</td><td>cDcr-III-Vm / cDcr-IV-az / cDcr-V-am</td><td>51</td><td>23</td><td>12,5</td></tr>
</table>
 </td><td>Suitable for connectors: caDc série azul (200/300/350);<br>Dimensions [mm]: A=151; B=57; C=35;</td></tr>
<tr><td>252863 (6792558)</td><td>Low-voltage wedge connector cover</td><td>Suitable for connectors: cDcr-I-ci / cDcr-VII-VmB;<br>Dimensions [mm]: A=65; B=29; C=16,5;</td></tr>
<tr><td>252634 (T270372)</td><td>Low-voltage wedge connector cover</td><td>Suitable for connectors: cDcr-II-Vd;<br>Dimensions [mm]: A=53; B=26; C=16;</td></tr>
<tr><td>6792559</td><td>Low-voltage wedge connector cover</td><td>Suitable for connectors: cDcr-III-Vm / cDcr-IV-az / cDcr-V-am;<br>Dimensions [mm]: A=51; B=23; C=12.5;</td></tr>
<tr><td>300927<br>[Enel Rio]</td><td>Insulating pin cover</td><td> 
</td><td>The material can be applied to conductors with a diameter between 6.35 mm and 16.90 mm.<br>  </td></tr>
</table>

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

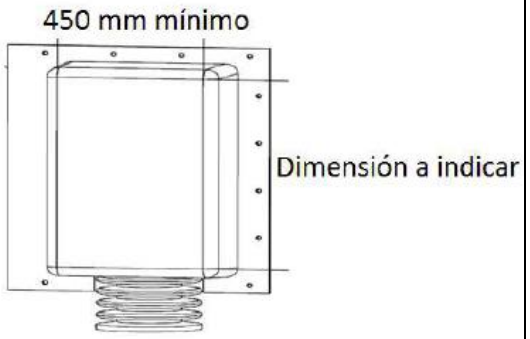
<table>
<tr><th colspan="4">Type I</th></tr>
<tr><th>MATERIAL CODE</th><th>DESCRIPTION</th><th>ELEMENTS OF THE KIT</th><th>COMMENT</th></tr>
<tr><td>275897*<br>[Enel Ceará e Rio]</td><td>Lining of connectors and splices for 25 kV voltage level networks.</td><td rowspan="6"> 
</td><td rowspan="6">Each code shall have the respective dimensions:<br><table>
<tr><th rowspan="2">Item</th><th colspan="3">Espessura mínima (mm)</th><th rowspan="2">A</th><th rowspan="2">B</th><th rowspan="2">Capacidade de Isolação (kV)</th><th rowspan="2">Código (CE e RJ)</th><th rowspan="2">Código (SP)</th></tr>
<tr><th>Mastic</th><th>Dorso</th><th>Total</th></tr>
<tr><td>1</td><td rowspan="5">3,00</td><td rowspan="4">0,76</td><td rowspan="4">3,76</td><td>400</td><td>210±2</td><td>25</td><td>275897</td><td>-</td></tr>
<tr><td>2</td><td>140</td><td>200±2</td><td>25</td><td>-</td><td>337907</td></tr>
<tr><td>3</td><td>400</td><td>200±2</td><td>25</td><td>-</td><td>337908</td></tr>
<tr><td>4</td><td>550</td><td>200±2</td><td>25</td><td>-</td><td>337909</td></tr>
<tr><td>5</td><td>1,20</td><td>4,20</td><td>550</td><td>550±2</td><td>34,5</td><td>270421</td><td>337910</td></tr>
</table></td></tr>
<tr><td>337907*<br>[Enel São Paulo]</td><td>Lining of connectors and splices for 25 kV voltage level networks.</td></tr>
<tr><td>337908*<br>[Enel São Paulo]</td><td>Lining of connectors and splices for 25 kV voltage level networks.</td></tr>
<tr><td>337909*<br>[Enel São Paulo]</td><td>Lining of connectors and splices for 25 kV voltage level networks.</td></tr>
<tr><td>337910*<br>[Enel São Paulo]</td><td>Lining of connectors and splices for 34,5 kV voltage level networks.</td></tr>
<tr><td>270421*<br>[Enel Ceará e Rio]</td><td>Lining of connectors and splices for 34,5 kV voltage level networks.</td></tr>
<tr><td colspan="4">* For Brazil, the covers consist of an EPR rubber backing covered with a layer of thermally stable sealing mastic.</td></tr>
</table>

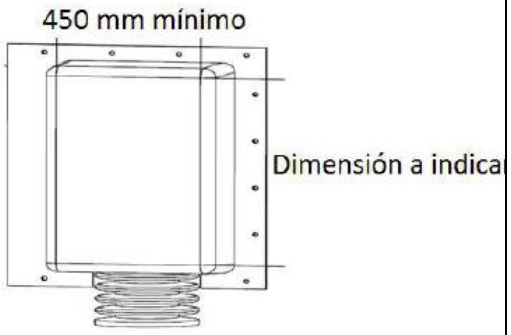
| Type II | | | |
|---|---|---|---|
| **MATERIAL CODE** | **DESCRIPTION** | **ELEMENTS OF THE KIT** | **COMMENT** |
| **275620** [Enel Ceará, Rio, e Goiás] | Distribution transformer bushing protection for voltage class 15 kV. |  | • Use: On distribution transformer bushings in accordance with GST-001, to protect the connections.<br>• The surfaces of the material must be smooth and of uniform thickness, free of blisters and burrs, sharp protrusions, cracks, inclusions and cutting edges.<br>• The protector must have a minimum thickness of 2 mm and be manufactured in gray or black.<br>• The protector must not allow rainwater to accumulate inside. |
| **986739** [Enel São Paulo] | Distribution transformer bushing protection for voltage class 15 kV. | | |
| **270301** | Distribution transformer bushing protection for voltage class 36 kV. | | |
| **Note: Figures are for illustrative purposes only.** | | | |

LOCAL SECTION E – Enel Codensa (Colombia)

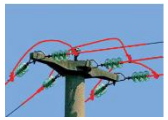
| **Type I** | | | |
|---|---|---|---|
| **MATERIAL CODE** | **DESCRIPTION** | **ELEMENTS OF THE KIT** | **COMMENT** |
| **860196** | FLEXIBLE cover for CABLE 2/0-605 AWG 36KV | | |
| **860190** | FLEXIBLE cover for CABLE desn2/0-605AWG 17.5 kV | | |

| Type II | | | |
|---|---|---|---|
| **MATERIAL CODE** | **DESCRIPTION** | **ELEMENTS OF THE KIT** | **COMMENT** |
| **201220** | Heat shrink cover for busbar MT 50 MM, for electrical networks from 17.5 kV to 36 kV. | | The tape shall be easily removable in case it is necessary to remove it to modify a connection on the medium voltage busbar.<br>When applying the tape, ensure that the area covered by the tape is completely sealed. |
| **201221** | Heat shrink cover for busbar MT 25 MM, for electrical networks from 17.5 kV to 36 kV. | | |
| **860189** | Heat shrink cover for busbar MT-15kV | | |

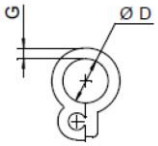
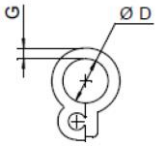
| Type II | | | |
|---|---|---|---|
| **MATERIAL CODE** | **DESCRIPTION** | **ELEMENTS OF THE KIT** | **COMMENT** |
| **860193** | SHUNT CONNECTION COVER. BUSBAR 400MM, for electrical networks from 17.5 kV to 36 kV. | **Figure 1**<br>  <br> | Covers for busbar tapping connections (tubular/leaf) to cables or similar elements shall allow for cover heights from 400 mm to 600 mm.<br>Separate references are available for each height, which can be specified.<br>Dimensionally they shall cover a range of two connectors up to four connectors in series (approx. 450 mm wide) and shall cover a range of two to four connectors in series (approx. 450 mm wide).<br>(approx. 450 mm wide) and shall allow installation with nominal voltages from 17,5 kV to 36 kV.<br>Figure 1 shows the approximate dimensions of these elements, as well as the tolerances to be considered for the covers.<br>The cover must be able to protect both the connectors and the exposed part of the busbar between the connection points. |

| **Type II** | | | |
|---|---|---|---|
| **MATERIAL CODE** | **DESCRIPTION** | **ELEMENTS OF THE KIT** | **COMMENT** |
| **860195** | COVER FOR DERIVATION BUSBAR 600 MM, para redes eléctricas de 17,5 kV a 36 kV. | **Figure 1**<br>  <br> | Covers for busbar tapping connections (tubular/leaf) to cables or similar elements shall allow for cover heights from 400 mm to 600 mm.<br>Separate references are available for each height, which can be specified.<br>Dimensionally they shall cover a range of two connectors up to four connectors in series (approx. 450 mm wide) and shall cover a range of two to four connectors in series (approx. 450 mm wide).<br>(approx. 450 mm wide) and shall allow installation with nominal voltages from 17,5 kV to 36 kV.<br>Figure 1 shows the approximate dimensions of these elements, as well as the tolerances to be considered for the covers.<br>The cover must be able to cover both the connectors and the exposed part of the busbar between the connection points. |
| **Note: Figures are for illustrative purposes only.** | | | |

LOCAL SECTION F – E-distribuzione (Italia)

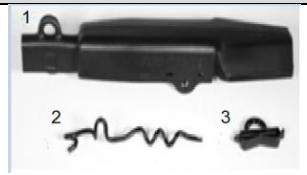
| **Type I** | | | |
|---|---|---|---|
| **MATERIAL CODE** | **DESCRIPTION** | **ELEMENTS OF THE KIT** | **COMMENT** |
| **270033** | Insulation kit for rigid insulator and conductor up to 16,5 mm Ø, suitable for conductors up to 150 mm2 cross section. |  • 1 insulator head cover;<br>• 3 m of conductor lining;<br>• Auxiliary accessories. | |
| **270032** | Insulation kit for tie chain and conductor up to 16,5 mm diameter, suitable for conductors up to 150 mm2 cross section. |  <br>  • 2 Clamp cover;<br>• 5 m of conductor lining;<br>• Auxiliary accessories. | |
| **270031** | Insulation kit for tension clamp |  | |
| **270030** | Insulation for conductor up to 16,5 mm diameter, suitable for conductors up to 150mm2 cross section |  | The presentation is rolls on reels or spools, 30 metres in length. |
| **Note: Figures are for illustrative purposes only.** | | | |

LOCAL SECTION G – Enel Distribución Chile

| **Type I** | | | |
|---|---|---|---|
| **MATERIAL CODE** | **DESCRIPTION** | **ELEMENTS OF THE KIT** | **COMMENT** |
| **270176** | Protective conductor sheath [diam int 11mm] |    | <u>Testing</u><br>For all applications, the pipe must conform to the tests defined in ASTM D 1050-05:<br>• Geometrical analysis<br>• Industrial frequency stress resistance<br>• Industrial frequency stress contouring<br>• Ozone resistance<br>In addition, the following conditions must be met:<br>• Voltage class 25kV<br>• The material must be delivered in rolls of 50 metres.<br>• Resistance to environmental ageing factors.<br>• Protection against UV exposure<br>• Hardness of 75 shore A<br>• Elongation at break of 250%.<br>• Markings: manufacturer's trademark or logo, model, month/year of production, batch.<br><br><u>Reception test:</u><br>Visual inspection: general observation of material characteristics and random dimensional analysis. |
| **270187** | Protective conductor sheath [diam int 22mm] |    | |
| **270186** | Protective conductor sheath [diam int 30mm] |    | |

| Type I | | | |
|---|---|---|---|
| **MATERIAL CODE** | **DESCRIPTION** | **ELEMENTS OF THE KIT** | **COMMENT** |
| **270185 (*)** | Rigid Insulator Coating 35kV |  | Size:<br>• Rigid: 1.9 m approx. |
| **270175 (*)** | Flexible insulator cladding 12kV |  | Size:<br>• Flexible: 0.5 m approx.<br><br>Flexible blanket-type silicone protectors must comply with the requirements of ASTM D1048-14, taking into account that they are defined as covers for voltages of 12kV (class 1 for phase-to-ground voltage of 7kV) and 23kV (class 2 for phase-to-ground voltage of 17kV). |
| **270184 (*)** | Flexible insulator cladding 23kV |  | |
| (*)The inside diameter of the protector must allow the use of bare conductors, must be between 15 and 30 mm to fit any conductor cross-section, and must be suitable for any type of conductor. | | | |

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

<table>
<tr><th colspan="4">Type I</th></tr>
<tr><th>MATERIAL CODE</th><th>DESCRIPTION</th><th>ELEMENTS OF THE KIT</th><th>COMMENT</th></tr>
<tr><td>270183</td><td>Protector final red 16-24m - Cond. ≤240mm2</td><td rowspan="2"> 

<u>1: Main body</u><ul><li>UV-resistant</li><li>Low-temperature impact resistant</li><li>Quick installation without special tools</li></ul><u>2: Preformed tie</u><ul><li>Ensures the cover stays on the snap-on hardware</li><li>Proven helical design</li><li>All dielectrics</li><li>Proven PVC material for long service life</li></ul><u>3. Locking pin:</u><ul><li>Prevents the sheath cover from lifting off the conductor and hardware 4.</li><li>Adds redundant support to hold the cover firmly on the conductor</li></ul></td><td rowspan="2">The device is made of linear low-density polyethylene and must meet at least the following specifications:<ul><li>Colour: grey or black</li><li>Marks: manufacturer (brand or logo), model, month/year of manufacture, batch</li><li>Length ≈ 750 mm</li><li>Discrete appearance</li><li>Covers a wide range of conductors and fastening hardware</li><li>Long service life without material deterioration</li><li>Dielectric strength greater than 25.8kV</li><li>Easily installed by hand or with a pole</li><li>Includes pigtail and locking block for fixing to the grid</li><li>Permanent fastening to the conductor-insulator assembly must be ensured by a suitable fastening mechanism.</li></ul>  </td></tr>
<tr><td>270182</td><td>Protector final red 25-33mm</td></tr>
<tr><td colspan="4">Note: Figures are for illustrative purposes only.</td></tr>
</table>

# 9. DESCRIPTION OF EVIDENCE

## 9.1 CHECK LIST TYPE I

| Item | Description | Unit | Required |
|---|---|---|---|
| **1** | **GENERAL INFORMATION** | | |
| 1.1 | Supplier | - | |
| 1.2 | CUI | | |
| 1.3 | Qualified for FELC16 | | YES |
| 1.4 | Factory Address | - | Qualified Factory Address |
| **2** | **MAIN FEATURES** | | |
| 2.1 | Global Standard | | GSCC030 |
| 2.2 | Country code | - | According to country |
| 2.3 | "Key" Type Code | | GSCC030/X |
| 2.4 | Nominal Voltage Uo/U (Umax) | [kV] | |
| 2.5 | Type I or Type II | - | Type I |
| 2.6 | Disposition | | |
| **3** | **DESCRIPTION** | | |
| 3.1 | Material | - | |
| 3.2 | Element to be protected | | |
| 3.3 | Kit elements | - | |
| **4** | **DESIGN** | | |
| 4.1 | Drawing or photo | | |

## 9.2 CHECK LIST TYPE II

| Item | Description | Unit | Required |
|---|---|---|---|
| **1** | **GENERAL INFORMATION** | | |
| 1.1 | Supplier | - | |
| 1.2 | CUI | | |
| 1.3 | Qualified for FELC16 | | YES |
| 1.4 | Factory Address | - | Qualified Factory Address |
| **2** | **MAIN FEATURES** | | |
| 2.1 | Global Standard | | GSCC030 |
| 2.2 | Country code | - | According to country |
| 2.3 | "Key" Type Code | | GSCC030/X |
| 2.4 | Nominal Voltage Uo/U (Umax) | [kV] | |
| 2.5 | Type I or Type II | - | Type II |
| 2.6 | Disposition | | |
| **3** | **DESCRIPTION** | | |
| 3.1 | Material | - | |
| 3.2 | Element to be protected | | |
| 3.3 | Kit elements | - | |
| **4** | **DESIGN** | | |
| 4.1 | Drawing or photo | | |