Technical specification code: MAT-E&C-NC-2021-0049-EGIN

Version no. 1 dated 13/07/2021

Subject: Global Infrastructure and Networks GSCH010 HV Underground cable

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

CONTENTS

THE HEAD OF NETWORK COMPONENTS
Maurizio Mazzotti

1. DOCUMENT AIMS AND APPLICATION AREA

The aim of this document is to provide technical requirements for the supply of high voltage underground cables to be used in the Enel Group Distribution Companies, listed below:

Country	Distribution Company
Argentina	Edesur
Brasil	Enel Distribuição Rio Enel Distribuição Ceará Enel Distribuição Goiás 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 Enel Distributie Dobrogea 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	13/07/2021	Issuing of “Global Infrastructure and Networks - GSCH010 HV Underground cable” technical specification.

3. UNITS IN CHARGE OF THE DOCUMENT

Responsible for drawing up the document:

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

Responsible for authorizing the document:

- Global Infrastructure and Networks: Head of Engineering and Construction unit
- Global Infrastructure and Networks: Head of Health, Safety, Environment and Quality unit.

4. REFERENCES

- Code of Ethics of Enel Group;
- Enel Human Right Policy;
- The Enel Group Zero Tolerance of Corruption (ZTC) Plan;
- Organization and management model as per Legislative Decree No. 231/2001;
- RACI Handbook Infrastructure and Networks no. 06;
- Enel Global Compliance Program (EGCP);
- Integrated Policy of Quality, Health and Safety, Environment and anti-Bribery;

5. ORGANIZATIONAL PROCESS POSITION IN THE PROCESS TAXONOMY

Value Chain/Process Area: Networks Management

Macro Process: Materials management

Process: Network Components Standardization

6. DEFINITIONS AND ACRONYMS

Acronym and Key words	Description
Manufacturer Product	Component manufactured by a Supplier in accordance with a technical specification

Technical Conformity Assessment (TCA)	A "conformity assessment"[1] with respect to "specified requirements"[2] 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

7. DESCRIPTION

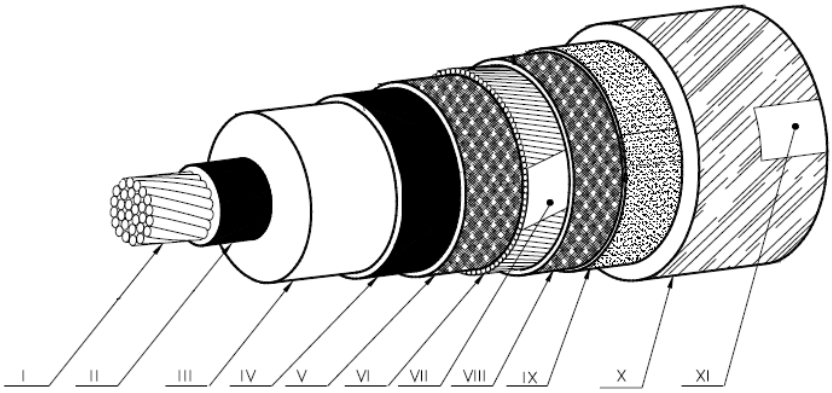
This standard specifies the construction, dimensions and test requirements that must be accomplished by high voltage cables with rated voltage above 36 kV to be used in distribution systems of Enel Group Distribution Companies mentioned above.

7.1 LIST OF COMPONENTS

This standard includes single-core cables with aluminum or copper conductor, cross-linked polyethylene (XLPE) insulation, an earth screen and a polyolefin outer sheath with flame propagation features and halogen free, of one of the following types:

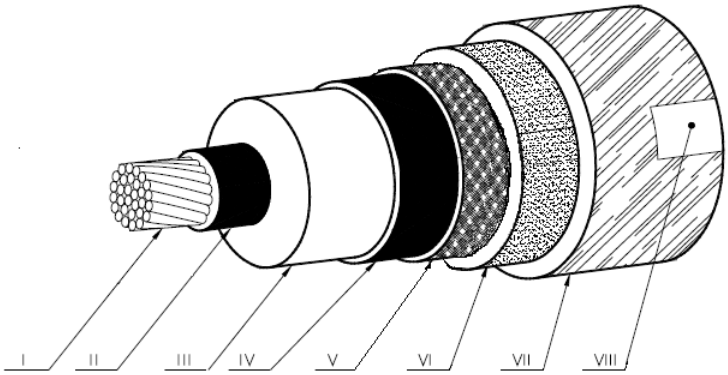
- **Type I**: Single-core cables, with aluminium/copper compacted conductor class 2, cross-linked polyethylene (XLPE), copper or aluminium wires plus aluminium tape earth screen and polyolefin outer sheath with flame propagation features and halogen free.
- **Type II**: Single-core cables, with aluminium/copper compacted conductor class 2, cross-linked polyethylene (XLPE), smooth aluminium sheath earth screen and polyolefin outer sheath with flame propagation features and halogen free

[1] Definition 2.1 of ISO/IEC 17000
[2] Definition 3.1 of ISO/IEC 17000



I – Conductor	IV – Insulation screen	VII – equalizer tape	X - Outer sheath
II – Conductor screen	V – watertight layer	VIII - watertight layer	XI – Marking
III – Insulation	VI – wires earth screen	IX - aluminum foil	

Figure 1 Type I single-core cable with copper or aluminum wires earth screen



I –Conductor	IV – Insulation screen	VII - Outer sheath
II – Conductor screen	V - watertight layer	VIII – Marking
III –Insulation	VI- smooth aluminium sheath	

Figure 2 Type II single-core cable with smooth aluminium sheath earth screen

Those types of cables are intended for their use in the rated voltages included in Table 2 and detailed characteristics are described in paragraph 7.4.

	Network Nominal Voltage U [kV]									
	220	150	138	132	115	110	69	66	60	45
I&N Argentina	X			X						
I&N Brazil			X				X			
I&N Chile	X					X				
I&N Colombia					X					
I&N España				X		X		X		X
I&N Italia	X	X		X						
I&N Perú	X							X	X	
I&N Romania						X				
Cable rated vol. U_0 Cable highest vol. U_m	127 245	87 170	76 145				36 72,5			26 52
	Argentina Chile Italia Perú	Italia	Argentina Brazil Chile Colombia España Romania				Brazil España Perú			España

Table 2 Rated Voltage Cable

The list of cables 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 the following table are shown a brief of those requirements:

GS Type Code	Code Word	Um [kV]	Conductor section [mm2]	Conductor Material	XLPE Thickness [mm]	Cable Type	Screen Section Al (Cu) [mm2]
GSCH010/001	245kV 2500Al + T363	245	2500	Al	21	II	363
GSCH010/002	245kV 2000Al + T363	245	2000	Al	21	II	363
GSCH010/003	245kV 1600Al + T363	245	1600	Al	21	II	363
GSCH010/004	245kV 1000Al + T363	245	1000	Al	21	II	363
GSCH010/005	245kV 800Al + T363	245	800	Al	21	II	363
GSCH010/006	170kV 1600Al + T242	170	1600	Al	16	II	242
GSCH010/007	170kV 1000Al + T242	170	1000	Al	17	II	242
GSCH010/008	170kV 630Al + T242	170	630	Al	18	II	242
GSCH010/009	145kV 1200Al + T242	145	1200	Al	16	II	242
GSCH010/010	145kV 800Al + T242	145	800	Al	16	II	242
GSCH010/011	145kV 630Al + T242	145	630	Al	16	II	242
GSCH010/012	72,5kV 1000Al + T144	72,5	1000	Al	9	II	144
GSCH010/013	72,5kV 630Al + T144	72,5	630	Al	9	II	144
GSCH010/014	52kV 800Al + T76	52	800	Al	7	II	76

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GS Type Code	Code Word	Um [kV]	Conductor section [mm2]	Conductor Material	XLPE Thickness [mm]	Cable Type	Screen Section Al (Cu) [mm2]
GSCH010/015	52kV 400Al + T76	52	400	Al	7	II	76
GSCH010/016	170kV 1600Al + H95	170	1600	Al	16	I	144 (95)
GSCH010/017	170kV 1000Al + H95	170	1000	Al	17	I	144 (95)
GSCH010/018	170kV 630Al + H95	170	630	Al	18	I	144 (95)
GSCH010/019	145kV 1200Al + H240	145	1200	Al	16	I	363 (240)
GSCH010/020	145kV 1200Al + H120	145	1200	Al	16	I	182 (120)
GSCH010/021	145kV 630Al + H120	145	630	Al	16	I	182 (120)
GSCH010/022	72,5kV 2000Al + H240	72,5	2000	Al	9	I	363 (240)
GSCH010/023	72,5kV 1000Al + H95	72,5	1000	Al	9	I	144 (95)
GSCH010/024	72,5kV 800Al + H240	72,5	800	Al	9	I	363 (240)
GSCH010/025	52kV 400Al + H50	52	400	Al	7	I	76 (50)
GSCH010/026	145kV 630Cu + H160	145	630	Cu	16	I	242 (160)
GSCH010/027	72,5kV 1200Cu + H240	72,5	1200	Cu	9	I	363 (240)
GSCH010/028	72,5kV 630Cu + H240	72,5	630	Cu	9	I	363 (240)
GSCH010/029	72,5kV 2000Cu + H240	72,5	2000	Cu	9	I	363 (240)
GSCH010/030	245kV 1200Cu + H240	245	1200	Cu	21	I	363 (240)
GSCH010/031	245kV 2000Cu + H240	245	2000	Cu	21	I	363 (240)
GSCH010/032	145kV 1200Cu + H120	145	1200	Cu	16	I	182 (120)
GSCH010/033	145kV 1600Cu + H120	145	1600	Cu	16	I	182 (120)
GSCH010/034	145kV 2000Cu + H120	145	2000	Cu	16	I	182 (120)
GSCH010/035	145kV 400Al + H120	145	400	Al	16	I	182 (120)
GSCH010/036	145kV 800Al + H120	145	800	Al	16	I	182 (120)
GSCH010/037	145kV 1000Al + H120	145	1000	Al	16	I	182 (120)
GSCH010/038	145kV 1600Al + H120	145	1600	Al	16	I	182 (120)
GSCH010/039	145kV 2000Al + H120	145	2000	Al	16	I	182 (120)
GSCH010/040	145kV 400Cu + H120	145	400	Cu	16	I	182 (120)
GSCH010/041	145kV 2500Cu + H120	145	2500	Cu	16	I	182 (120)
GSCH010/042	72,5kV 500Cu + H240	72,5	500	Cu	9	I	363 (240)
GSCH010/043	245kV 1600Cu + H240	245	1600	Cu	21	I	363 (240)
GSCH010/044	145kV 2500Al + H120	145	2500	Al	16	I	182 (120)
GSCH010/045	145kV 500Al + H120	145	500	Al	16	I	182 (120)
GSCH010/046	145kV 2000Cu + T242	145	2000	Cu	16	II	242
GSCH010/047	145kV 1600Al + T242	145	1600	Al	16	II	242
GSCH010/048	145kV 1000Al + T242	145	1000	Al	16	II	242
GSCH010/049	52kV 800Al + H50	52	800	Al	7	I	76 (50)
GSCH010/050	245kV 2500Cu + T363	245	2500	Cu	21	II	363
GSCH010/051	245kV 2500Cu + H240	245	2500	Cu	21	I	363 (240)

Table 3 – List of GS Type Codes

7.2 APPLICABLE LAWS, REFERENCE STANDARD AND LIST OF REPLACED STANDARDS

The list of reference standards used to develop this specification and that shall be used as test method are mentioned below in this document. There shall be used the edition in-force at the contract date.

7.2.1.Laws and Enel Policy

Laws: See Local Sections.

Policy n. 332 Global Infrastructure and Networks Design and construction HV lines guidelines

7.2.2. European & International Standards

- 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 60840:2020 “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 of insulated cable”
- IEC 60229. “Electric cables. Tests on extruded oversheaths with a special protective function.
- IEC 60332-1-2 “Tests on electric and optical fibre cables under fire conditions - Part 1-2: Test for vertical flame propagation for a single insulated wire or cable - Procedure for 1 kW pre-mixed flame
- IEC 60754-1 ”Test on gases evolved during combustion of materials from cables - Part 1: Determination of the halogen acid gas content”
- IEC 60754-2 ”Test on gases evolved during combustion of materials from cables - Part 2: Determination of acidity (by pH measurement) and conductivity”
- IEC 60811-201 “Electric and optical fibre cables - Test methods for non-metallic materials - Part 201: General tests - Measurement of insulation thickness”.
- IEC 60811-202: “Electric and optical fibre cables - Test methods for non-metallic materials - Part 202: General tests - Measurement of thickness of non-metallic sheath”.
- IEC 60811-203: “Electric and optical fibre cables - Test methods for non-metallic materials - Part 203: General tests - Measurement of overall dimensions”.

- IEC 60811-401: “Electric and optical fibre cables - Test methods for non-metallic materials - Part 401: Miscellaneous tests – Thermal ageing methods- Ageing in an air oven”.
- IEC 60811-501 “Electric and optical fibre cables - Test methods for non-metallic materials - Part 501: Mechanical tests - Tests for determining the mechanical properties of insulating and sheathing compounds”.
- IEC 60811-502: “Electric and optical fibre cables - Test methods for non-metallic materials - Part 502: Mechanical tests – Shrinkage tests for insulations”.
- IEC 60811-503: “Electric and optical fibre cables - Test methods for non-metallic materials - Part 503: Mechanical tests – Shrinkage tests for sheaths”.
- IEC 60811-507: “Electric and optical fibre cables - Test methods for non-metallic materials - Part 507: Mechanical tests - Hot set test for cross-linked materials
- IEC 60811-508: “Electric and optical fibre cables - Test methods for non-metallic materials - Part 508: Mechanical tests – Pressure test at high temperature for insulation and sheaths”
- IEC 60811-605: “Electric and optical fibre cables - Test methods for non-metallic materials - Part 605: Physical tests - Measurement of carbon black and/or mineral filler in polyethylene compounds”
- IEC 60885-3: “Electrical test methods for electric cables - Part 3: Test methods for partial discharge measurements on lengths of extruded power cables”
- EN 13501-6 “Fire classification of construction products and building elements - Part 6: Classification using data from reaction to fire tests on electric cables”.
- HD 605 S2 “Electric cables - Additional test methods”.
- IEC 60230 “Impulse tests on cables and their accessories”.
- IEC 60794-1-21 – “Optical fibre cables - Part 1-21: Generic specification - Basic optical cable test procedures - Mechanical tests methods”
- IEC TR 61901:2016 “Tests recommended on cables with a longitudinally applied metal foil for rated voltages above 30 kV (Um = 36 kV) up to and including 500 kV (Um = 550 kV)”

7.3 TERMINOLOGY

In addition to IEC 60050-461 terminology, the following ones shall be noted:

U_0: Rated r.m.s. power-frecuency voltage between each conductor and screen or sheath for which cables and accessories are designed.

U: rated r.m.s. power-frequency voltage between any two conductors for which cables and accessories are designed

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

U_p: peak value of the lightning impulse withstand voltage (and switching, where applicable) between each conductor and screen or sheath for which cables and accessories are designed

LSHF: acronym for low smoke halogen free.

DTS: acronym for Distributed Temperature Sensing. 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.

7.4 DESIGN AND MANUFACTURE

7.4.1. Aluminium conductors

The aluminum conductors shall be stranded compacted circular class 2, complying all the features specified herein and in standard IEC 60228. Conductor material shall be AAC-1350, i.e. 99,5% aluminum content.

In Table 4 aluminum conductors' cross-sectional areas for cables specified in this document are depicted.

U_m	245 kV	170 kV	145 kV	72.5 kV	52 kV
Cross section Al [mm²]					400*
			500*		
		630	630	630	
	800		800	800	800
	1000	1000	1000	1000	
			1200		
	1600	1600	1600		
	2000		2000	2000	
	2500*				

* Sections not included in Policy Nº332

Table 4 Standardized aluminum conductor cross-sectional areas

Longitudinal water barriers must be applied to all conductors to avoid water penetration.

Conductors of cross section higher than 1000 mm^2 must be of the Milliken segmental type with a minimum of four segments.

7.4.2. Copper conductors

The copper conductors shall be stranded compacted circular class 2, complying all the features specified herein and in standard IEC 60228. Copper purity shall not be less than 99,9%

In Table 5 copper conductors' cross-sectional areas for cables specified in this document are depicted.

U_m	245 kV	145 kV	72.5 kV
Cross section Cu [mm^2]		400	
		500	
		630	630
	1200	1200	1200
	1600	1600	
	2000	2000	2000
	2500	2500	

Table 5 Standardized copper conductor cross-sectional areas

Longitudinal water barriers must be applied to all conductors to avoid water penetration.

Conductors of cross section higher than 1000 mm^2 must be of the Milliken segmental type with a minimum of four segments.

7.4.3. Maximum Electric resistance at 20 °C

Electrical resistance in direct current at 20ºC of every conductor, measured as indicated on IEC-60228:2004 Annex A, shall be equal or smaller than the values specified in Table 6.

	Maximum Electric Resistance at 20 °C [W/Km]	
Cross section [mm^2]	**Aluminium**	**Copper**
400	**0,0778**	***0,0470***
500	**0,0605**	**0,0366**
630	**0,0469**	**0,0283**
800	**0,0367**	*0,0221*
1000	**0,0291**	*0,0176*
1200	**0,0247**	**0,0151**
1600	**0,0186**	***0,0113***
2000	**0,0149**	***0,0090***
2500	**0,0127**	***0,0072***

Table 6 Stranded circular conductor characteristics

7.4.4. Conductor screen

It shall consist of a fully bonded layer of black semi-conductive cross-linked compound. It shall be extruded over the conductor to provide a smooth surface without causing any damage to the conductor or insulation and ensuring material compatibility.

The conductor screen nominal thickness shall be 1,5 mm.

The conductor screen minimum thickness measured and accepted at any point shall not be less than 1,2 mm.

In addition, the average of all the measures shall not be less than the nominal thickness (1,5 mm).

The resistivity of extruded semi-conducting screens applied over the conductor shall not exceed 1.000 Ω·m.

7.4.5. Insulation

The insulation shall be applied by a suitable extrusion process and shall form a compact and homogenous body. In addition, it shall be possible to remove it without creating any damage to the conductor.

The insulating material shall be cross-linked polyethylene; compliant with the characteristics required herein this document. Such XLPE compound complies all the characteristics described in Standard IEC 60502-2 and standard HD 620 S2 part 1 for DIX 3 compound.

The XLPE insulation must allow maximum conductor temperatures of 90 °C in normal operation and 250 °C under short circuit condition by at least 0,5 seconds.

The insulation minimum thickness measured and accepted at any point of the cable shall not be less than 90% of the nominal value

$$t_{min} \geq 0{,}9\ t_n$$

And:

$$\frac{tmax - tmin}{tmax} \leq \begin{cases} 0.10\ for\ cables\ with\ U_0 = 127\ kV \\ 0.15\ for\ cables\ with\ U_0 < 127\ kV \end{cases}$$

Where:

t_{min}: minimum insulation thickness in millimeters

t_{max}: maximum insulation thickness in millimeters

t_n : nominal thickness in millimeters

In Table 7 nominal and minimum thickness for XLPE insulated cables are shown.

Rated Voltage Uo/(Um) [kV]	Insulation thickness	
	Nominal (t_n) [mm]	Minimum (t_{min}) [mm]
26 / (52)	7	6,3
36 / (72.5)	9	8,1
76 / (145)	16	14,4
87 / (170)	18*	16,2
127 / (245)	21	18,9

Table 7 Insulation thickness values

* For 87/150 (170) kV cables, nominal and minimum thickness could be smaller for conductor sections larger than 630 mm^2, for accurate values see GS Type Codes List in Annex B.

7.4.6.Insulation screen

A black layer of cross-linked semi-conductive compound shall be applied over the insulation. Such layer shall be compatible with insulation temperatures in normal operation and during short circuit.
The insulation screen shall be adhered to the insulation.
Unless otherwise indicated in the Local Sections, the insulation screen minimum thickness measured and accepted at any point shall not be less than 1,2 mm. In addition, the average of all the measures shall not be less than the nominal thickness (1,5 mm).
The resistivity of extruded semi-conducting screen applied over the insulation shall not exceed 500 Ω·m.

7.4.7. Conductor screen, Insulation, and Insulation screen application

The conductor screen, the insulation and the insulation screen shall be extruded in one operation, i.e. triple extrusion process. It is not permitted using any type of lacquer or other material between these layers.

7.4.8.Longitudinal water-tightness swelling tape

A swelling tape made of suitable semi-conductive material shall be applied between the insulation screen and the earth screen in order to achieve longitudinal water-tightness. Such tape shall be applied without harming the adjacent layers and could work as additional separator layer as well. The swelling tape shall be applied with a minimum overlap same as 10%.

7.4.9.Earth screen

For **Type I** cables a copper wire screen with equalizer copper tape shall be applied over the overlapped semi-conductive swelling tape. The copper screen shall be made with a continuous crown of annealed copper wires arranged in a helix with an equalizer tape with a minimal nominal section of 1 mm^2 and with step not greater than 4 times the crown diameter. It shall be used at least 50 wires distributed evenly over the circumference.
The total section of the copper wires and their maximum electric resistance at 20ºC shall be one of those indicated in Table 8.
A swelling tape made of suitable semi-conductive material shall be applied over the earth screen in an open helix to make possible the contact between earth screen and aluminum tape.
About the relationship between screen short circuit current and screen cross section at different voltages refers to the chart of Annex B.
For special cases according to the project it is possible to use screens of greater section than those indicated in Table 8.
As an alternative, aluminum could be used instead of cooper in order to made the wires screen and equalizer tape indicated before. The maximum electric resistances remain the same, so the minimum aluminum sections are those indicated in Table 8.

For **Type II** cables an aluminum tape screen forming a butt welded longitudinal pipe bonded to the oversheath shall be applied over the overlapped semi-conductive swelling tape. The maximum electric resistance at 20ºC shall be the same as those of Type I cables so the total section of aluminum tube shall be equal or greater than one of those indicated in Table 8.
For Type II cables, the aluminum tube prevents radial water propagation and there is no necessity of the aluminum tape indicated in paragraph 7.4.12.

Copper Section [mm^2]	Maximum Electric Resistance at 20 °C [W/Km]	Equivalent Al section [mm^2]
240	0,0745	363
160	0,216	242
120	0,149	182
95	0,188	144
50	0,357	76

Table 8 Screen Sections

7.4.10. Alternatives screens

Other kinds of metallic screen with equivalent functional characteristics may be used as an alternative in each of the codes included in this standard, provided that they have the prior acceptance of Enel.

Specifically, when a corrugated aluminium earth screen is used, the following instruction have to be fulfilled:

- Material shall be aluminium of 99.6% minimum purity having an elongation of 16% minimum.
- The corrugated sheath shall be of uniform thickness, homogeneous construction, seamless, free from defects, porosity and intercrystalline fracture. A layer of bitumen or other suitable compound, incorporating corrosion inhibitors, shall be applied over the aluminium sheath for corrosion protection and to provide a moisture seal with the oversheath.
- Nominal thickness of aluminium sheath must be equal or greater than 2.0 mm.
- The minimum thickness of the corrugated aluminium sheath measured and accepted at any point of the cable shall not be less than 85% of the nominal value minus 0,1 mm..

$$t_{min} \geq 0{,}85\ t_n - 0{,}1$$

Where:

t_{min}: minimum thickness in millimeters

t_n: nominal thickness in millimeters

- The maximum electric resistance at 20ºC shall be the same as those of Type II cables so the total section of aluminum tube shall be equal or greater than those indicated in Table 8.

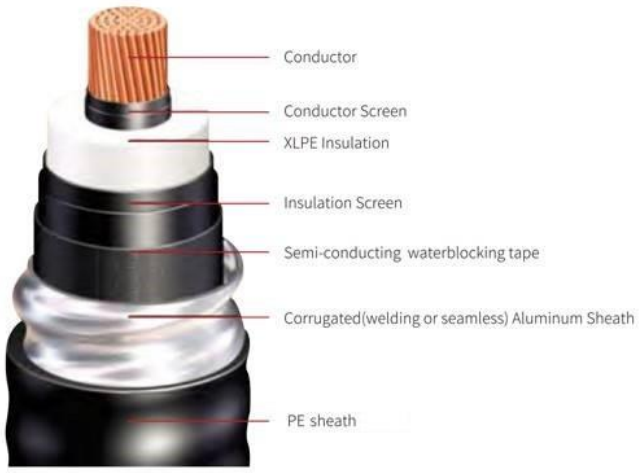


Figure 3 Single-core cable with corrugated aluminium sheath earth screen

7.4.11. Optical element for temperature monitoring (optional)

If required, for Type I cables, there will be included two stainless steel tubes among the wires forming the earth screen. Each tube will contain at least two multimode optic fiber type G.651 for distributed temperature sensing (DTS).

7.4.12. Radial water tightness

Just for Type I cables. A longitudinally applied aluminum laminate foil with minimum thickness of 0.1 mm shall be applied bonded to the outer sheath against radial water-tightness. A suitable overlap shall be glued to avoid sheath damages.

There must be electrical contact between this aluminum tape and the wires of the earth screen.

7.4.13. Outer Sheath

The outer sheath shall be resistant to moisture, abrasion, and UV.

Unless otherwise indicated the outer sheath color shall be black RAL 9005.

The material shall be a polyolefin type ST7 with some additive to give flame retardant features or a ST12 (low smoke halogen free material).

The minimum thickness of the outer sheath measured and accepted at any point of the cable shall not be less than 85% of the nominal value minus 0,1 mm..

$$t_{min} \geq 0{,}85\ t_n - 0{,}1$$

Where:

t_{min}: minimum thickness in millimeters
t_n: nominal thickness in millimeters

In Table 9 rated and minimum thickness at any point of the polyolefin outer sheath are shown.

Cross-section [mm²]	Sheath nominal thickness [mm]	Sheath minimum thickness [mm]
400	3,5	2,88
500	3,5	2,88
630	3,5	2,88
800	3,8	3,13
1000	4	3,3
1200	4	3,3
1600	4,5	3,73
2000	4,5	3,73
2500	4,5	3,73

Table 9 Type I and Type II PO outer sheath thickness

There must exist an extruded semi-conductive layer on the oversheath to assist in electrical tests. This layer could be substituted with a graphite coating.

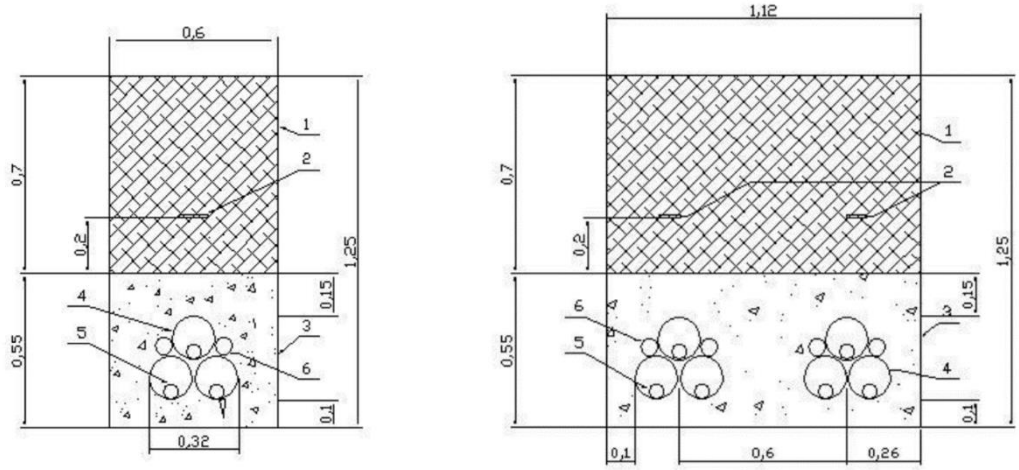
7.4.14. Anti-termite additives (optional).

If required, there will be used an additive in the oversheath compound to avoid damaged due to termites. This additive will not diminish any mechanical or electrical characteristic of the oversheath.

7.4.15. Ampacity and Short-circuit rating

The ampacity and short-circuit rating **estimated** values shall be given for network design purposes.
Unless otherwise indicated in local sections, such ampacity values shall be calculated in steady state condition, for single core laying and triplex laying, when installed in open air, directly buried and buried in duct using the following operational conditions:

- Maximum conductor temperature 90 °C
- Ambient air temperature 40 °C
- Ground temperature 20 °C
- Depth of laying 1,5 m
- Soil thermal resistivity 1,5 K m/W
- Both end bonding



1 – Compacted soil
2 – Signaling band
3 – Concrete
4 – Corrugated polyethylene pipe
5 – HV cables
6 – Auxiliary polyethylene pipes (FO, single point earth)

Figure 4 Buried in duct samples for simple circuit and doble circuit trench

Estimated values of steady state ampacity of single circuits directly buried of cable types included in this standard are depicted in Annex D.

Regarding short-circuit rating adiabatic and non-adiabatic values shall be calculated using the following conditions:

- Conductor initial temperature 90 °C
- Conductor final temperature ≤ 250 °C
- Tape foil screen initial temperature 75 °C
- Tape foil screen final temperature ≤ 150 °C
- Copper wires screen initial temperature 80 °C
- Copper wires screen final temperature ≤ 180 °C
- Short-circuit duration: 0,5 s and 1 s

For reference values see local section.

7.4.16. Cable designation

If not specified otherwise in Local Section, designation of the cable is formed by the following terms:

- "ENEL GSCH010".
- Voltage level U_0/(Um) and "kV",
- "XLPE",
- "1X" and section of the conductor (expressed in mm^2), and its material (Cu or Al),
- + a character representing the type of cable (H: for Type I, T: for Type II)
- Nominal section of screen (expressed in mm^2),
- "Al", (just for cable type II screen made of aluminium wires),

Designation example for cable GSCH010/01:

ENEL GSCH010 – 127 / (245) kV - XLPE - 1x2500 Al + T363

7.4.17. Marking

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

Durability shall be checked by the test given in sub-clause 4.4 of standard IEC 60794-1-21.

If not specified otherwise in Local Section, marking should include the following information:

- Designation of the cable as indicated in paragraph 7.4.16.
- Manufacturer's name and trademark,
- Year of production,
- Number of production batch.
- Metric.

The print will be made every 0.5 meters and with a font size of not less than 10 mm

Marking example for cable GSCH010/01:

ENEL GSCH010 – 127 / (245) kV - XLPE - 1x2500 Al + T363 - Manufacturer - 2021- Nº P.B. - 0000

7.5 CONDITIONS OF SUPPLY

The samples needed for tests shall be taken from additional lengths of the same batch included in the supply order. Thereby, the lengths in any contract could not be diminished in order to perform any test. The allowed tolerance of the cable length provided on each drum is -0%, +1% of the nominal length required.
The cable will be provided with caps on its ends to ensure tightness.
If not specifically indicated otherwise, the cable will be issued in metal drums and with staves of the same material or wood. Both treated to avoid corrosion.
Drums shall be designed to bear the weight of the cable corresponding to its length without any deformation that could damage the cable inside.
Special care shall be taken to design the drums taking into account the operator's safety in field during installation and handling.
The drawings of the drums shall be provided to Enel for approval.
The drums shall be marked with the following information:

a) Destination.
b) Order number or purchase order.
c) Manufacturer or brand.
d) Country of origin.
d) Length of the cable in the coil.
e) Type and size of the conductor.
f) Thickness and type of insulation.
g) Nominal voltage.
h) Weights, tare and net.
i) Year of manufacture.

For further details see the local sections

7.6 GUARANTEE

Requirement of warranty will be indicated in the request for bids, indicating periods and standards.

7.7 TESTS

7.7.1.Test classification

i) Acceptance tests

Acceptance tests (routine tests and sample tests) shall be carried out in the Supplier's facilities.

ii) Routine tests

Routine tests shall be performed at 100% of delivered spools to demonstrate product integrity.

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.

iv) Type tests

Type tests shall be performed before supplying a type of cable 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 type of cable covered herein with a specific cross-section, rated voltage and construction characteristics, the type approval could be accepted as valid for as long as the following conditions are met:

- The conductor cross-section is not larger than that of the tested cable.
- The cable has similar constructions as that of the tested cable, i.e. utilizes same materials, (conductor, screens, insulation, earth screen, outer sheath) and the same manufacturing process.
- The rated voltage does not exceed that of the tested cable.
- The calculated nominal electrical stress and the impulse voltage stress calculated using nominal dimensions at the cable conductor screen do not exceed the respective calculated stresses of the tested cable by more than 10 %.
- The calculated nominal electrical stress at the cable insulation screen and the impulse voltage stress calculated using nominal dimensions do not exceed the respective calculated stresses of the tested cable.

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

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

All samples needed for the type tests shall be taken from the same production length.

The type tests shall comprise the electrical tests on the complete cable system and the non-electrical test on cable components and complete cable as specified in 7.7.5 and 7.7.6. For cables with $U_{max} \leq 170$ kV, calculated nominal electrical stress at the conductor screen not higher than 8,0 kV/mm and calculated nominal electrical stress at the insulation screen not higher than 4,0 kV/mm the electrical tests should be performed on cables alone.

The type tests on cable components only need to be carried out on samples from cables of different voltage ratings and/or conductor cross-sectional areas if different materials and/or different manufacturing processes are used to produce them. However, repetition of the ageing tests on pieces of completed cable

to check compatibility of materials may be required if the combination of materials applied over the screened core is different from that of the cable on which type tests have been carried out previously.

v) Prequalification tests

Prequalification tests shall be performed before supplying a type of cable 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 thermo-mechanical aspects. General conditions for these tests and their extension are those indicated in IEC 62067 clause 13 for cables with U_0=127 kV and IEC 60840 clause 13 for cables with U_0<127 kV.

vi) Development tests

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

7.7.2. Sampling and acceptance criteria

The sample tests shall be carried out on one length from each batch (manufacturing series) of the same type and cross-section of cable, but shall be limited to not more than 10 % of the number of lengths in any contract, rounded to the nearest whole number.

If the sample from any length selected for the tests fails in any of the tests, further samples shall be taken from two further lengths of the same batch and subjected to the same tests as those in which the original sample failed. If both additional samples pass the tests, the other cables in the batch from which they were taken shall be regarded as having complied with the requirements of this standard. If either fails, this batch of cables shall be regarded as having failed to comply

7.7.3. Routine test list

i) Partial discharge test

Requirements: No detectable discharge exceeding sensitivity of 10 pC or better at 1.5 U_0

Test method: IEC 60840 clause 9.2

ii) Voltage 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

iii) Electrical test on oversheath of the cable

Requirements: No breakdown.

Test method: IEC 60229 clause 3

Test voltage: 25 kV DC

Duration: 1 min

iv) Measurement of electrical resistance of conductor and metal screen

Requirements: ≤ nominal value

Test method: IEC 60840 clause 10.5

v) Measurement of capacitance

Requirements: ≤ 1.08 declared nominal value

Test method: IEC 60840 clause 10.10

7.7.4.Sample Test list

i) Cable examination

Requirements: Conformity to constructive characteristics, i.e.: marking, colors, number of conductor wires, insulation and outer sheath application, etc.

Test method: inspection by visual examination

ii) Measurement of thickness of cable insulation and oversheath

Requirements:

Insulation: Clause 7.4.5.

Oversheath: Clause 7.4.13.

Test method: IEC 60811-201, IEC 60811-202

iii) Measurement of thickness of metal sheath

Requirements: declared nominal value.

Test method: IEC 608410 clause 10.7.2

iv) Measurement of diameters

Requirements: declared nominal value for conductor, over insulation and overall diameter.

Test method: IEC 60811-203

v) Hot set test for XLPE insulation

Treatment:

Air Temperature: 200 ºC ± 3 K

Time under load: 15 min

Mechanical stress: 0,2 MPa

Requirements:

Maximum elongation under load: 175%

Maximum permanent elongation after cooling: 15%

Test method: IEC 60811-507

vi) Lightning impulse voltage test

For cables with U_0=127 kV or with a nominal electric conductor stress > 8,0 kV/mm

Frequency: one test for contracts with a cable length between 4 km and 20 km and two tests for contracts with longer cable lengths

Requirements: No breakdown of the insulation shall occur

Test method: IEC 62067 clause 10.12

Impulse lighting voltage value:

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

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

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

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

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

vii) Water penetration test

Frequency: one test for contracts with a cable length between 4 km and 20 km and two tests for contracts with longer cable lengths

Requirements and test method:

IEC 62067 Annex E for cables with U_0=127 kV

IEC 60840 Annex E for cables with U_0<127 kV

viii) Tests on components of cables with a longitudinally applied metal tape or foil, bonded to the oversheath

Tests included:

Visual examination

Adhesion strength of metal foil

Peel strength of overlapped metal foil

Requirements and test method: IEC 60840 Annex F

ix) Measurement of thickness of conductor and insulation screens

Requirements:

Conductor screen: Clause 7.4.4.

Insulation screen: Clause 7.4.6.

Test method: IEC 60811-202

x) Mechanical properties of XLPE insulation

Requirements:

Minimum tensile strength: 12,5 MPa

Minimum elongation at break: 200%

Test method: IEC 60811-501

xi) Mechanical properties of sheath

Requirements:

Minimum tensile strength: 12.5 MPa

Minimum elongation at break: 300%

Test method: IEC 60811-501

xii) Abrasion resistance of cable markings

Requirements:

The marking shall be legible after 500 cycles of Method 2 with an applied force of 15 N

Test method: IEC 60794-1-21 sub clause 4.4

7.7.5.Electrical Type Test list

i) Bending test

The following sequence shall be carried out:

a) Bending test on the cable

Test method: IEC 60840 sub-clause 12.4.3

b) Installation of accessories

For electrical type tests on cables alone accessories could be just the test terminations

c) 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 62067 sub-clause 12.4.4

ii) Tan δ measurement

Requirements: Tan $\delta \leq 10 \cdot 10^{-4}$

Test method: IEC 60840 clause 12.4.5

iii) Heating cycle voltage test

Requirements:

Test method:

IEC 62067 clause 12.4.6 for cables with U_0=127 kV

IEC 60840 clause 12.4.6 for cables with U_0<127 kV

iv) Partial discharge test at ambient and high temperature

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

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

Test method: IEC 60840 clause 12.4.4

v) 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 12.4.7.2 for cables with U_0=127 kV

IEC 60840 clause 12.4.7 for cables with U_0<127 kV

Impulse lighting voltage value:

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

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

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

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

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

Power frequency voltage value:

65 kV for cables with U_{max} = 52 kV.

90 kV for cables with U_{max} = 72.5 kV.

190 kV for cables with U_{max} = 145 kV.

218 kV for cables with U_{max} = 170 kV.

254 kV for cables with U_{max} = 245 kV.

vi) 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

vii) Examination of cable

Requirements: No signs of deterioration

Test method: IEC 60840 clause 12.4.8

viii) Resistivity of cable semi-conducting screens

This test shall be made on a separate sample

Requirements: Resistivity, before and after ageing, shall not exceed the values in 7.4.4. and 7.4.6.

Test method: IEC 60840 clause 12.4.9

7.7.6. Non-Electrical Type Test list

i) Check of cable construction

Requirements: Conformity to declared values

Test method: IEC 60840 clause 12.5.1

ii) Mechanical properties of insulation before and after ageing

Requirements:

Without ageing:

Minimum tensile strength: 12,5 N/mm^2

Minimum elongation at break: 200%

After ageing in air oven at 135ºC ± 3K during 168 h:

Maximum variation tensile strength: ±25%

Maximum variation elongation at break: ±25%

Test method: IEC 60840 clause 12.5.2

Sampling, conditioning and mechanical tests: IEC 60811-501.

Ageing treatment: IEC 60811-401.

iii) Mechanical properties of oversheath before and after ageing

Requirements:

Without ageing:

Minimum tensile strength: 12,5 N/mm^2

Minimum elongation at break: 300%

After ageing in air oven at 110ºC ± 2K during 240 h:

Minimum elongation at break: 300%

Test method: IEC 60840 clause 12.5.3

Sampling, conditioning and mechanical tests: IEC 60811-501.

Ageing treatment: IEC 60811-401.

iv) Ageing tests on pieces of complete cable to check compatibility of materials

Treatment:

Air oven temperature: 100 ºC ± 2 K

Duration: 7 X 24 hours

Requirements: IEC 60840 clause 12.5.4.5

Test method: IEC 60840 clause 12.5.4

Sampling, conditioning and mechanical tests: IEC 60811-501.

Ageing treatment: IEC 60811-401.

v) Pressure test at high temperature on oversheath

Requirements: IEC 60811-508

Test method: IEC 60811-508 with test temperature 110ºC ± 2K

vi) Test for LSHF oversheaths at low temperature.

Requirements: Elongation greater than 20% (IEC 60811-505) and no cracks (IEC 60811-506)

Test method: IEC 60811-505 and IEC 60811-506 with test temperature -15ºC ± 2K

vii) Hot set test for XLPE insulation

Treatment:

Air Temperature: 200 ºC ± 3 K

Time under load: 15 min

Mechanical stress: 0,2 MPa

Requirements:

Maximum elongation under load: 175%

Maximum permanent elongation after cooling: 15%

Test method: IEC 60811-507

viii) Measurement of carbon black content of black PE oversheaths

The extruded semi-conductive layer must be excluded

Requirements: 2,5 ± 0,5 %.

Test method: IEC 60811-605

ix) Test under fire conditions

Requirements: Flame retardant

Test method: IEC 60332-1-2

x) Water penetration

Requirements and test method:

IEC 62067 Annex E for cables with U_0=127 kV

IEC 60840 Annex E for cables with U_0<127 kV

xi) Tests on components of cables with a longitudinally applied metal tape or foil, bonded to the oversheath

Tests included:

Visual examination

Adhesion strength of metal foil

Peel strength of overlapped metal foil

Requirements and test method: IEC 60840 clause 12.5.15

xii) Shrinkage test for XLPE insulation

Requirements:

Distance L between marks: 200 mm.

Temperature: 130 ºC ± 3 K

Duration: 6 h.

Maximum permissible shrinkage 4,5%

Test method: IEC 60811-502

xiii) Shrinkage test for PE and LSHF oversheaths

Requirements:

Test Temperature: 80 ºC ± 2 K

Duration: 5 h.

Number of heating cycles: 5

Maximum permissible shrinkage: 3%

Test method: IEC 60811-503

xiv) Oversheath halogen acid content

Requirements: < 5 mg./g.

Test method: IEC 60754-1

7.7.7. 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 cables with U_0=127 kV

IEC 60840 clause 13.2.4 for cables 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 with U_{max} = 52 kV.

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

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

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

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

Test method:

IEC 62067 clause 13.2.5 for cables with U_0=127 kV

IEC 60840 clause 13.2.5 for cables 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

7.7.8. Development Test list

i) Impact test

Requirements: IEC TR 61901 clause 4.1.1

Type I cables: no cracks or separation of the aluminum foil of laminated protective coverings or harmful damage to other parts of the cable

Height: 1 m.

Weight: 5 kg.

Radius: 2 mm.

Number of impacts per location: 1.

Number of locations: 5.

Type II cables: There should be no puncture at the points of impact and the semi-conductive screen should not be deformed by more than 1 mm and should not show a deflection having a sharp angle into the insulation at the point of impact.

Height: 0,27 m.

Weight: 27 kg.

Radius: 1 mm.

Number of impacts per location: 4.

Number of locations: 2

Test method: IEC TR 61901 clause 4.1.1

ii) Sidewall loading test

This test shall be carried out if the quotient between maximum pulling force and minimum bending radius during installation could be greater than the one indicated below:

For Type I cables: 1.000 daN/m.

For Type II cables: 2.500 daN/m.

Requirements: IEC TR 61901 clause 4.1.3

Visual inspection should reveal no cracks or separation of protective coverings or harmful damage to any parts of the cable.

Test method: IEC TR 61901 clause 4.1.3

iii) Long term ageing of adhesive bonds of components of laminated covering

Requirements: IEC TR 61901 clause 4.1.4

Test method: IEC TR 61901 clause 4.1.4

iv) Mechanical properties of the welding

Just for Type II cables.

Requirements: IEC TR 61901 clause 4.1.5

Test method: IEC TR 61901 clause 4.1.5

v) 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 4.1.5

Test method: IEC TR 61901 clause 4.1.5

7.8 LOCAL SECTIONS

7.8.1.LOCAL SECTION A – ENEL DISTRIBUCIÓN ARGENTINA

Conductor

Watertight round stranded and compacted conductor.

Ampacity and Short-circuit rating

The ampacity and short-circuit rating **estimated** values shall be given for network design purposes.

For Argentina, such ampacity values shall be calculated using the following operational conditions:

- Ground temperature: 25 °C
- Depth of laying: 2 m
- Soil thermal resistivity: 1 K°m/W
- Screens connection: Cross bonding and single point,,

7.8.2.LOCAL SECTION B – ENEL DISTRIBUCION COLOMBIA

Local Standard.

RETIE: Reglamento técnico de instalaciones eléctricas

Installation conditions for Colombia.

Item	Codensa
Altitud Máxima (m)	2850
T° Mínima (°C)	-5°
T° Maxima (°C)	40°
T° Media (°C)	30°
Profundidad de la instalación (m)	1.5/2.0
Nivel de humedad (%)	96
Humedad relativa media (%)	75
Nivel de contaminación (IEC 60815)	Medio
Radiación solar máxima (Wb/m^2)	1000

7.8.3.LOCAL SECTION C – ENEL DISTRIBUCION PERU

Ampacity and Short-circuit rating

For Peru, the following operation conditions apply:

- Maximum conductor temperature 90 °C
- Maximum ambient air temperature 40 °C
- Minimum ambient air temperature -5 °C
- Medium ambient air temperature 30 °C
- Ground temperature XXXXX
- Depth of laying 1,7 m
- Soil thermal resistivity 1,5 K m/W
- directly underground
- humidity 100%
- maximum wind pressure 700 N/m2
- level of pollution, very high
- maximum solar radiation, 1000 Wb/m2
- seismic conditions,
- Both end bonding

Regarding short-circuit rating adiabatic and non-adiabatic values shall be calculated using the following conditions:

- Conductor initial temperature 90 °C

- Conductor final temperature 250 °C
- Tape foil screen initial temperature 75 °C
- Tape foil screen final temperature 150 °C
- Copper wires screen initial temperature 80 °C
- Copper wires screen final temperature 180 °C
- Short-circuit duration: 0,5 s and 1 s

Cable designation and marking

Cable designation is formed by the following characters:

CU: copper conductor
R: round stranded
E4: XLPE cross-linked poliethylene insulation
H1: cooper wires earth screen
PO: Polyolefin
Rated Voltage: Uo/U (Umax)
Conductor section: 1x XXX mm2

Example:

CURE4H1PO 36/66(72.5) 1x500MM2

The outer sheath should be marked with high aligned characters.
The distance between the end of a brand and the same brand successive must comply with the provisions of document HD-620-10I2 2.11.2 and shall contain, in the order listed.
The following information shall be marked:

- Name of Distribution Company (Enel Distribución Peru)
- Name of the Manufacturer (XXXX)
- Cable designation
- The year and month of manufacture
- the metric could be indicated at a distance less than 1 meter

In addition:

- size of letters should be ≥ 10 mm.
- between each marking there must be a distance no greater than 0.5 m

Printing example

ENEL DISTRIBUCIÓN PERU (XXXX) CURE4H1PO 36/66(72.5) 1x500MM2 2017 12 0000

Conditions of supply

Longitud de entrega de cables:

El cable se entregará en los largos de fabricación de acuerdo a cada proyecto de obra, teniendo en cuenta su propio peso por metro, de manera que no supere en ningún caso el esfuerzo máximo de tiro garantizado por el fabricante.

Sólo se permitirá una tolerancia de ± 5% de la longitud solicitada en el proyecto,

En ningún caso de tomará muestras para los ensayos del lote del proyecto.

The coils will be according to the following information:

ITEM	**DESCRIPCION**	**UNIDAD**	**SOLICITADO** **60 kV**	**OFRECIDO**	**OBS.**
1	Nombre del fabricante	-			(*)
2	Modelo (designación de la fábrica)	-	Inf. Fabricante		(*)
3	País de origen	-	Inf. Fabricante		(*)
4	Norma de construcción y ensayo	-	Inf. Fabricante		(*)
5	Diámetro exterior del carrete	mm	Máx. 3900		(**)
6	Diámetro interior del carrete	mm	Inf. Fabricante		(*)
7	Diámetro del buje	mm	150		(**)
8	Ancho del carrete	mm	Inf. Fabricante		(*)
9	Material del carrete		Hierro		(**)
10	Masa del carrete vacío	kg	Inf. Fabricante		(**)
11	Masa del carrete con la longitud nominal del cable	kg	Inf. Fabricante		(**)

(*) Concepto a indicar por el oferente
(**) Concepto de cumplimiento obligatorio

7.8.4.LOCAL SECTION D – ENEL DISTRIBUCION CHILE

Marking

The cable must have at least the following information about the pod with the following writing:

Name of the distributor:
Voltage level: xx kV
Cable type: Type I or Type II.
Conductor section (mm2):
Conductor material (Cu / Al):
Name of the manufacturer:
Year of production:
Purchase order number:

The print will be made every 0.5 meters and with a font size of not less than 10 mm

7.8.5.LOCAL SECTION E – ENEL DISTRIBUIÇÃO CEARÁ, RIO, GOIÁS AND ELETROPAULO

Marking

The cable must have at least the following information about the pod with the following writing:

Name of the distributor:
Voltage level: xx kV
Cable type: Type I or Type II.
Conductor section (mm2):
Conductor material (Cu / Al):
Name of the manufacturer:
Year of production:
Purchase order number:

The print will be made every 0.5 meters and with a font size of not less than 10 mm.

Ampacity and Short-circuit rating

The ampacity rating **estimated** values shall be given for network design purposes.

For Eletropaulo, such ampacity values shall be calculated in steady state condition.

Following operational conditions:

- Maximum conductor temperature 90 °C
- Ambient air temperature -10°C +40 °C
- Ground temperature minimum 5 °C , maximum 25 °C
- Depth of laying minimum 1,5 m, maximum 2 m
- Soil thermal resistivity 1 K°m/W
- screens connected to the system (cross bonding, single point bonding and both ends)

Regarding short-circuit rating adiabatic and non-adiabatic values shall be calculated using the following conditions:

- RATED VOLTAGE: 138kV
- SHORT-CIRCUIT DURATION: 1 s
- THREE-PHASE SHORT CIRCUIT CURRENT 40 KA
- PHASE-GROUND SHORT CIRCUIT CURRENT 21 KA
- FREQUENCY 60HZ
- LOAD FACTOR 0,77
- BASIC ISOLATION LEVEL 650 KV

Design

All cables have to be provided with two loose tube with optical fiber for temperature control.
For all cables it is needed a special sheath with anti-termite protection.
For Type I cables, the minimum thicknes of the aluminium laminate foil described in paragraph 7.4.7 is 0.2 mm.

7.8.6. LOCAL SECTION F – E-DISTRIBUZIONE, E-DISTRIBUTIE BANAT, DOBROGEA AND MUNTENIA.

Laws

NTE 007/08/00 Normativ pentru proiectarea și execuția rețelelor de cabluri electrice

Ampacity and Short-circuit rating

The ampacity and short-circuit rating **estimated** values shall be given for network design purposes.
For Romania, such ampacity values shall be calculated in steady state condition, for single core laying and triplex laying, when installed in open air, directly buried and buried in duct using the following operational conditions:

- Maximum conductor temperature 90 °C
- Ambient air temperature -30°C +40 °C
- Ground temperature minimum 5 °C , maximum 25 °C
- Depth of laying minimum 1m, maximum 1,5 m
- Soil thermal resistivity 1 K° m/W
- screens connected to the system ,,cross bonding,,

- At the squad the cables are in contact
- At the layout, the distance between the cables is 50 mm

Regarding short-circuit rating adiabatic and non-adiabatic values shall be calculated using the following conditions:

- Conductor initial temperature 90 °C
- Conductor final temperature 250 °C
- Tape foil screen initial temperature 75 °C
- Tape foil screen final temperature 150 °C
- Copper wires screen initial temperature 80 °C
- Copper wires screen final temperature 180 °C
- Short-circuit duration: 0,5 s

Cable designation and marking

Cable designation

Sigla ARE4H1H5E 87/150 kV

Marking

On the exterior mantle, there must be a re-embossed printing at least one meter away, in the order indicated, the following inscriptions:

Property sigla followed by:

- ENEL Sigla
- the conductor section
- Manufacturer's name and trademark
- the letter identifying the construction site
- project indices
- year and month of manufacture

Example bookmark:

ENEL ARE4H1H5E 87/150 kV 1000xxxx B00 2018 02

Conditions of supply

At the nominal length required on each drum (depending on the cable destination) a tolerance of + 1% of the length

7.8.7.LOCAL SECTION G – E-DISTRIBUCION REDES DIGITALES

Legislación

En España es de obligado cumplimiento el Reglamento sobre condiciones técnicas y garantías de seguridad en líneas eléctricas de alta tensión y sus instrucciones técnicas complementarias ITC-LAT 01 a 09 aprobado según Real Decreto 223/2008 de 15 de febrero.

Dimensiones

Tanto el diámetro nominal del conductor como el diámetro sobre el aislamiento deberán ajustarse al indicado en la tabla siguiente y, en cualquier caso, estarán comprendidos en los márgenes de tolerancias que se indican para garantizar la compatibilidad dimensional del cable con los accesorios (empalmes y terminales).

Tensión U	Sección del conductor	Diámetro nominal del conductor	Tolerancias del diámetro del conductor	Diámetro nominal sobre aislamiento	Tolerancias del diámetro sobre aislamiento
45 kV	400 mm^2 Al	23,5 mm	23,2 – 23,9 mm	40,0 mm	39,4 – 41,0 mm
	800 mm^2 Al	34,0 mm	33,6 – 34,6 mm	50,5 mm	49,5 – 51,0 mm
66 kV	630 mm^2 Al	30,5 mm	30,1 – 30,9 mm	52,0 mm	51,5 – 53,0 mm
	1000 mm^2 Al	38,5 mm	38,0 – 38,9 mm	60,5 mm	60,0 – 61,5 mm
132 kV	630 mm^2 Al	30,5 mm	30,1 – 30,9 mm	65,5 mm	64,5 – 66,5 mm
	1200 mm^2 Al	43,5 mm	43,0 – 44,0 mm	79,0 mm	78,0 – 80,2 mm

Tabla 1-LSG: Valores de diámetros nominales y tolerancias del conductor y sobre aislamiento para garantizar la compatibilidad con los accesorios

Sobre la cubierta debe existir una capa extruida semiconductora que facilite la realización de los ensayos eléctricos.

Consideraciones frente al fuego

El cable será no propagador de la llama, conforme a la Norma UNE-EN 60332-1-2, requiriéndose para ello el ensayo y características descritos en esta norma.

Se comprobará mediante métodos espectrofotométricos que el contenido de metales pesados de la cubierta es inferior a 0,5 %

La clase mínima de reacción al fuego es Eca

Ensayos de tipo adicionales

Además de los ensayos de tipo incluidos en el cuerpo principal, se deberán realizar los siguientes ensayos con los requerimientos y métodos indicados en la norma UNE-211632-1:

- Ensayo de resistencia al desgarro del material de cubierta
- Ensayo especial de resistencia a la abrasión con ensayos eléctricos de la cubierta
- Ensayo de absorción de agua del material de cubierta
- Determinación del contenido de metales pesados en el material de la cubierta
- Ensayo de envejecimiento climático
- Ensayo de absorción de agua del material del aislamiento
- Ensayos de reacción al fuego.

Marcaje e Identificación del Cable

Sobre la cubierta del cable debe estar marcado y ser fácilmente legible lo siguiente:

- ENEL GSCH010.
- Nombre del fabricante,
- RHZ1-RA-2OL (S)
- Tensión asignada U_0/U (Um) en kV,
- 1X Sección nominal del conductor en mm^2,
- K(forma compacta redonda) o M(conductor Miliken) y el símbolo Al
- + Tipo de pantalla (H: alambres, T: Tubo)
- Sección (en mm^2) de la pantalla,
- Al, (solo si el material de los alambres de la pantalla es Al),
- Clase de reacción al fuego.
- Año de fabricación (dos últimas cifras),

Además, el metraje del cable irá marcado metro a metro en la cubierta.

El marcaje se debe realizar sobre la cubierta exterior por impresión en relieve sobre dos generatrices diametralmente opuestas. La distancia entre el final de una leyenda de marcado y el principio de la siguiente debe ser menor o igual a 300 mm y la altura mínima de los caracteres deberá ser de 4 mm.

Por ejemplo, un cable Type I, de 132 kV y 1200 mm^2 de sección de aluminio y con pantalla de 120 mm^2, fabricado en el año 2018 irá marcado de la siguiente manera:

ENEL GSCH010 - Fabricante – RHZ1-RA-2OL (S) 76/132(145) kV - 1x1200 Al + H120 Al E_{ca} *– 21*

Marcaje e Identificación de las Bobinas del Cable

Sobre la bobina del cable debe estar marcado lo siguiente:

- Destino de la bobina
- Número de pedido
- Número de la bobina
- Nombre del fabricante o marca.
- País de origen
- Código de designación del cable (según punto 5.11.1)
- Clase de reacción al fuego según la Norma EN 50575, apartado 4.1
- Año de fabricación (dos últimas cifras),
- Número de orden de fabricación,
- Longitud de cable en la bobina, en metros,
- Dirección de rotación de la bobina (con una flecha),
- Peso bruto y neto de la bobina.

8. ANNEX

ANNEX A – TECHNICAL CHECK LIST

The following chart indicates the minimum technical information that suppliers shall provide on their offer during tenders:

Item	Description	Unit	Required values	Ofered values
1	**GENERAL INFORMATION**			
1.1	Supplier Name	-		
1.2	Suplier CUI			
1.3	Factory	-		
1.4	Location of factory	-		
2	**MAIN FEATURES**			
2.1	Distribution Company and Country	-		
2.2	Country Code	-		
2.3	GS Type Code	-		
2.4	Nominal Voltage Uo/U (Umax)	[kV]		
2.5	System frecuency	[Hz]		
2.6	Type I or Type II	-		
2.7	Designation	-		
3	**CONDUCTOR PROPERTIES**			
3.1	Material	-		
3.2	Nominal cross-section	[mm2]		
3.3	Stranding Type	-		
3.4	Minimum diameter of conductor	[mm]		
3.5	Maximum diameter of conductor	[mm]		
3.6	Number of wires of conductor	-		
3.7	Nominal diameter of wires	[mm]		
3.8	Conductor DC resistance at 20°C	[Ω/ km]		
3.9	Watertightness measures	-		
3.10	Measures taken to reduce skin effect	-		
4	**CONDUCTOR SCREEN**			
4.1	Material			
4.2	Nominal thickness	[mm]		
4.3	Minimum thickness	[mm]		
4.4	Volume resistivity	[Ω · m]		
4.5	Calculated nominal electrical stress	[kV/mm]		

Item	Description	Unit	Required values	Ofered values
5	**INSULATION**			
5.1	Material	-		
5.2	Nominal thickness	[mm]		
5.3	Minimum thickness	[mm]		
5.4	Nominal inner diameter	[mm]		
5.5	Nominal outer diameter	[mm]		
5.6	Color	-		
5.7	Special additives	-		
6	**INSULATION SCREEN**			
6.1	Material			
6.2	Nominal thickness	[mm]		
6.3	Minimum thickness	[mm]		
6.4	Volume resistivity	[Ω · m]		
6.5	Calculated nominal electrical stress	[kV/mm]		
7	**MANUFACTURING PROCESS FOR INSULATION SYSTEM**			
7.1	Type of extrusion			
7.2	Type of extrusion line			
7.3	Identification of extrusion line			
7.4	Curing means			
7.5	Cooling means			
8	**LONGITUDINAL WATER-TIGHNESS SWELLING TAPE**			
8.1	Material			
8.2	Nominal thickness	[mm]		
8.3	Nominal width	[mm]		
8.4	Overlapping	[%]		
9	**EARTH SCREEN (Type I cables)**			
9.1	Material of wires / tapes			
9.2	Number of wires			
9.3	Nominal wires diameter	[mm]		
9.4	Helix pitch	[mm]		
9.5	Number of tapes			
9.6	Thickness and width of tape	[mm]		
9.7	Nominal cross-section	[mm2]		
9.8	External diameter	[mm]		
9.9	DC resistance at 20°C	[Ω/ km]		

Item	Description	Unit	Required values	Ofered values
9.10	Semiconductive swellling tape material			
9.11	Semiconductive swellling tape thickness	[mm]		
9.12	Semiconductive swellling tape width	[mm]		
9.13	Aluminum foil bonded to oversheath nominal thickness	[mm]		
10	**EARTH SCREEN (Type II cables)**			
10.1	Material			
10.2	Manufacturing process			
10.3	Nominal thickness	[mm]		
10.4	Minimum thickness	[mm]		
10.5	Nominal cross-section	[mm2]		
10.6	External diameter	[mm]		
10.7	Maximum DC resistance at 20°C	[Ω/ km]		
11	**OUTER SHEATH**			
11.1	Sheat material			
11.2	Nominal thickness			
11.3	Minimum thickness			
11.4	Color			
11.5	Material designation			
11.6	Semiconductive extruded skin thickness	[mm]		
11.7	Graphite coating applied			
11.8	Marking			
12	**AMPACITY AND SHORT CIRCUIT RATING***			
12.1	Steady state ampacity for single circuit laying			
12.2	- directly buried	[A]		
12.3	- buried in duct	[A]		
12.4	- open air installation	[A]		
12.5	Steady state ampacity for doble circuit laying			
12.6	- directly buried	[A]		
12.7	- buried in duct	[A]		
12.8	- open air installation	[A]		
12.9	Monophasic short circuit			
12.10	Admissible short circuit current during 0,5 s	[kA]		
12.11	Admissible short circuit current during 1 s	[kA]		
12.12	Triphasic short circuit			
12.13	Admissible short circuit current during 0,5 s	[kA]		

Item	Description	Unit	Required values	Ofered values
12.14	Admissible short circuit current during 1 s	[kA]		
13	**ADDITIONAL FEATURES**			
13.1	Nominal overall diameter of the cable	[mm]		
13.2	Minimum radius of curvature during laying	[mm]		
13.3	Minimum radius of curvature not tractioned	[mm]		
13.4	Maximum permissible pulling force	[daN]		
13.5	Total weight	[kg/m]		
13.6	Fire retardant (IEC 60332-1-2)			
13.7	Fire reaction Class (EN 50575 if apply)			
13.8	Anti-termite treatment			
13.9	Multimode Fiber Optic for DTS in earth screen			
14	**TCA**			
14.1	There is an active TCA for this reference	YES/NO		
14.2	In case 14.1 answer is YES, indicate TCA Code	-		
15	**COMMENTS**			
15.1	Any exception to what is required in GSCH010	-		
15.2	Additional comments	-		

*For calculated values of ampacity, the conditions indicated in paragraph 7.4.15 or local sections must be used.

ANNEX B – GLOBAL TYPE CODES

GS Type Code	Code Word	U_0 [kV]	U_m [kV]	Conductor section [mm2]	Conductor Material	XLPE nominal thickness [mm]	Cable Type	Screen Section Al (Cu) [mm2]	Sheath nominal thickness [mm]	Icc 0,5s [kA]
GSCH010/001	245kV2500Al + T363	127	245	2500	Al	21	II	363	4,5	41
GSCH010/002	245kV2000Al + T363	127	245	2000	Al	21	II	363	4,5	41
GSCH010/003	245kV1600Al + T363	127	245	1600	Al	21	II	363	4,5	41
GSCH010/004	245kV1000Al + T363	127	245	1000	Al	21	II	363	4	41
GSCH010/005	245kV800Al + T363	127	245	800	Al	21	II	363	3,8	41
GSCH010/006	170kV1600Al + T242	87	170	1600	Al	16	II	242	4,5	31,5
GSCH010/007	170kV1000Al + T242	87	170	1000	Al	17	II	242	4	31,5
GSCH010/008	170kV630Al + T242	87	170	630	Al	18	II	242	3,5	31,5
GSCH010/009	145kV1200Al + T242	76	145	1200	Al	16	II	242	4	31,5
GSCH010/010	145kV800Al + T242	76	145	800	Al	16	II	242	3,8	31,5
GSCH010/011	145kV630Al + T242	76	145	630	Al	16	II	242	3,5	31,5
GSCH010/012	72,5kV1000Al + T144	36	72,5	1000	Al	9	II	144	4	20
GSCH010/013	72,5kV630Al + T144	36	72,5	630	Al	9	II	144	3,5	20
GSCH010/014	52kV800Al + T76	26	52	800	Al	7	II	76	3,8	9,3
GSCH010/015	52kV400Al + T76	26	52	400	Al	7	II	76	3,5	9,3
GSCH010/016	170kV1600Al + H95	87	170	1600	Al	16	I	144 (95)	4,5	20
GSCH010/017	170kV1000Al + H95	87	170	1000	Al	17	I	144 (95)	4	20
GSCH010/018	170kV630Al + H95	87	170	630	Al	18	I	144 (95)	3,5	20
GSCH010/019	145kV1200Al + H240	76	145	1200	Al	16	I	363 (240)	4	41
GSCH010/020	145kV1200Al + H120	76	145	1200	Al	16	I	182 (120)	4	23
GSCH010/021	145kV630Al + H120	76	145	630	Al	16	I	182 (120)	3,5	23
GSCH010/022	72,5kV2000Al + H240	36	72,5	2000	Al	9	I	363 (240)	4,5	41
GSCH010/023	72,5kV1000Al + H95	36	72,5	1000	Al	9	I	144 (95)	4	20
GSCH010/024	72,5kV800Al + H240	36	72,5	800	Al	9	I	363 (240)	3,8	41
GSCH010/025	52kV400Al + H50	26	52	400	Al	7	I	76 (50)	3,5	9,3
GSCH010/026	145kV630Cu + H160	76	145	630	Cu	16	I	242(160)	3,5	31,5
GSCH010/027	72,5kV1200Cu + H240	36	72,5	1200	Cu	9	I	363 (240)	4	41
GSCH010/028	72,5kV630Cu + H240	36	72,5	630	Cu	9	I	363 (240)	3,5	41
GSCH010/029	72,5kV2000Cu + H240	36	72,5	2000	Cu	9	I	363 (240)	4,5	41
GSCH010/030	245kV1200Cu + H240	127	245	1200	Cu	21	I	363 (240)	4	41
GSCH010/031	245kV2000Cu + H240	127	245	2000	Cu	21	I	363 (240)	4,5	41
GSCH010/032	145kV1200Cu + H120	76	145	1200	Cu	16	I	182 (120)	4	31,5
GSCH010/033	145kV1600Cu + H120	76	145	1600	Cu	16	I	182 (120)	4,5	31,5
GSCH010/034	145kV2000Cu + H120	76	145	2000	Cu	16	I	182 (120)	4,5	31,5
GSCH010/035	145kV400Al + H120	76	145	400	Al	16	I	182 (120)	3,5	31,5
GSCH010/036	145kV800Al + H120	76	145	800	Al	16	I	182 (120)	3,8	31,5
GSCH010/037	145kV1000Al + H120	76	145	1000	Al	16	I	182 (120)	4	31,5
GSCH010/038	145kV1600Al + H120	76	145	1600	Al	16	I	182 (120)	4,5	31,5
GSCH010/039	145kV2000Al + H120	76	145	2000	Al	16	I	182 (120)	4,5	31,5
GSCH010/040	145kV400Cu + H120	76	145	400	Cu	16	I	182 (120)	3,5	31,5
GSCH010/041	145kV2500Cu + H120	76	145	2500	Cu	16	I	182 (120)	4,5	31,5
GSCH010/042	72,5kV500Cu + H240	36	72,5	500	Cu	9	I	363 (240)	3,5	41
GSCH010/043	245kV1600Cu + H240	127	245	1600	Cu	21	I	363 (240)	4,5	41
GSCH010/044	145kV2500Al + H120	76	145	2500	Al	16	I	182 (120)	4,5	31,5
GSCH010/045	145kV500Al + H120	76	145	500	Al	16	I	182 (120)	3,5	31,5
GSCH010/046	145kV2000Cu + T242	76	145	2000	Cu	16	II	242	4,5	31,5

Subject: Global Infrastructure and Networks GSCH010 HV Underground cable

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

GS Type Code	Code Word	U_0 [kV]	U_m [kV]	Conductor section [mm2]	Conductor Material	XLPE nominal thickness [mm]	Cable Type	Screen Section Al (Cu) [mm2]	Sheath nominal thickness [mm]	Icc 0,5s [kA]
GSCH010/047	145kV1600Al + T242	76	145	1600	Al	16	II	242	4,5	31,5
GSCH010/048	145kV1000Al + T242	76	145	1000	Al	16	II	242	4	31,5
GSCH010/049	52kV800Al + H50	26	52	800	Al	7	I	76 (50)	3,8	9,3
GSCH010/050	245kV2500Cu + T363	127	245	2500	Cu	21	II	363	4,5	41
GSCH010/051	245kV2500Cu + H240	127	245	2500	Cu	21	I	363 (240)	4,5	41

ANNEX C – COMMON LIST

COMMON LIST				Rev.01 13/07/2021
GS Type Code	**Code Words**	**Distribution Company and Country**	**Country Code**	**TAM Description**
GSCH010/009	145kV 1200Al+T242	Enel Argentina	0101-0470	CABLE AT AL 132KV 1X1200MM² XLPE C/VN CU
GSCH010/010	145kV 800Al+T242	Enel Argentina	0101-0485	CABLE ALTA TENSIÓN, DE ALUMINIO, UNIPOLA
GSCH010/051	245kV 2500Cu+H240	Enel Argentina	0101-0514	CABLE AT CU 220KV 1X2500MM² XLPE C/VN CU
GSCH010/050	245kV 2500Cu+T363	Enel Argentina	0101-0515	CABLE AT CU 220KV 1X2500MM² XLPE C/VN AL
GSCH010/018	170kV 630Al+H95	EDI Italy	330001	CAVO 150KV 1X630 AL XLPE TIPO I
GSCH010/017	170kV 1000Al+H95	EDI Italy	330009	CAVO 150KV 1X1000 AL XLPE TIPO I
GSCH010/016	170kV 1600Al+H95	EDI Italy	330010	CAVO 150KV 1X1600 AL XLPE TIPO I
GSCH010/008	170kV 630Al+T242	EDI Italy	330011	CAVO 150KV 1X630 AL XLPE TIPO II
GSCH010/007	170kV 1000Al+T242	EDI Italy	330012	CAVO 150KV 1X1000 AL XLPE TIPO II
GSCH010/006	170kV 1600Al+T242	EDI Italy	330013	CAVO 150KV 1X1600 AL XLPE TIPO II
GSCH010/003	245kV 1600Al+T363	EDI Italy	330014	CAVO 220KV 1X1600 AL XLPE TIPO II
GSCH010/047	145kV 1600Al+T242	Enel Romania	330029	GSCH010/047 CABLU SUBTERAN IT XLPE 76/138(145)kV 1600mm2 Al + 242mm2 Al
GSCH010/048	145kV 1000Al+T242	Enel Romania	330030	GSCH010/048 CABLU SUBTERAN IT XLPE 76/138(145)kV 1000mm2 Al + 242mm2 Al
GSCH010/011	145kV 630Al+T242	Enel Romania	330031	GSCH010/011 CABLU SUBTERAN IT XLPE 76/138(145)kV 630mm2 Al + 242mm2 Al
GSCH010/038	145kV 1600Al+H120	Enel Romania	330032	GSCH010/038 CABLU SUBTERAN IT XLPE 76/138(145)kV 1600mm2 Al + 120mm2 Cu
GSCH010/037	145kV 1000Al+H120	Enel Romania	330033	GSCH010/037 CABLU SUBTERAN IT XLPE 76/138(145)kV 1000mm2 Al + 120mm2 Cu
GSCH010/021	145kV 630Al+H120	Enel Romania	330034	GSCH010/021 CABLU SUBTERAN IT XLPE 76/138(145)kV 630mm2 Al + 120mm2 Cu
GSCH010/009	145kV 1200Al+T242	EDRD España	330056	CABLE SUBTERRÁNEO 76/132 KV 1200 MM AL
GSCH010/011	145kV 630Al+T242	EDRD España	330055	CABLE SUBTERRÁNEO 76/132 KV 630 MM AL
GSCH010/012	72,5kV 1000Al+T144	EDRD España	330054	CABLE SUBTERRÁNEO AT 36/66 K 1000 MM2 AL
GSCH010/013	72,5kV 630Al+T144	EDRD España	330053	CABLE SUBTERRÁNEO AT 36/66 KV 630MM AL
GSCH010/014	52kV 800Al+T76	EDRD España	330038	CABLE SUBTERRÁNEO AT 26/45 KV 800 MM AL
GSCH010/015	52kV 400Al+T76	EDRD España	330057	CABLE SUBTERRÁNEO AT 26/45 KV 400 MM AL
GSCH010/020	145kV 1200Al+H120	EDRD España	330052	CABLE SUBTERRÁNEO 76/132 KV 1200 MM AL
GSCH010/021	145kV 630Al+H120	EDRD España	330050	CABLE SUBTERRÁNEO 76/132 KV 630 MM AL
GSCH010/023	72,5kV 1000Al+H95	EDRD España	330049	CABLE SUBTERRÁNEO 36/66 KV 1000 MM AL
GSCH010/025	52kV 400Al+H50	EDRD España	330039	CABLE SUBTERRÁNEO AT 26/45 KV 400 MM2 AL
GSCH010/049	52kV 800Al+H50	EDRD España	330059	CABLE SUBTERRÁNEO AT 26/45 KV 800 MM AL
GSCH010/009	145kV 1200Al+T242	Enel Brazil	330070	CABO,SUBT,UNIP,AL,138kV,1200MM2,GSCH10/9
GSCH010/010	145kV 800Al+T242	Enel Brazil	330071	CABO,SUBT,UNIP,AL,138kV,800MM2,GSCH10/10
GSCH010/011	145kV 630Al+T242	Enel Brazil	330072	CABO,SUBT,UNIP,AL,138kV,630MM2,GSCH10/11
GSCH010/012	72,5kV 1000Al+T144	Enel Brazil	330069	CABO,SUBT,UNIP,AL,69kV,1000MM2,GSCH10/12
GSCH010/013	72,5kV 630Al+T144	Enel Brazil	330068	CABO,SUBT,UNIP,AL,69kV,630MM2,GSCH010/13
GSCH010/020	145kV 1200Al+H120	Enel Brazil	990334	CABO 138 kV XLPE 1200 MM2 AL/CU GSCH010
GSCH010/021	145kV 630Al+H120	Enel Brazil	990333	CABO 138 kV XLPE 630 MM2 AL/CU GSCH010
GSCH010/023	72,5kV 1000Al+H95	Enel Brazil	330067	CABO,SUBT,UNIP,AL,69kV,1000MM2,GSCH10/23
GSCH010/032	145kV 1200Cu+H120	Enel Brazil	990329	CABO 138 kV XLPE 1200 MM2 CU/CU GSCH010
GSCH010/033	145kV 1600Cu+H120	Enel Brazil	990328	CABO 138 kV XLPE 1600 MM2 CU/CU GSCH010
GSCH010/034	145kV 2000Cu+H120	Enel Brazil	990332	CABO 138 kV XLPE 2000 MM2 CU/CU GSCH010
GSCH010/035	145kV 400Al+H120	Enel Brazil	990331	CABO 138 kV XLPE 400 MM2 AL/CU GSCH010
GSCH010/036	145kV 800Al+H120	Enel Brazil	990330	CABO 138 kV XLPE 800 MM2 AL/CU GSCH010

Subject: Global Infrastructure and Networks GSCH010 HV Underground cable

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

COMMON LIST				Rev.01 13/07/2021
GS Type Code	**Code Words**	**Distribution Company and Country**	**Country Code**	**TAM Description**
GSCH010/037	145kV 1000Al+H120	Enel Brazil	990327	CABO 138 kV XLPE 1000 MM2 AL/CU GSCH010
GSCH010/038	145kV 1600Al+H120	Enel Brazil	990326	CABO 138 kV XLPE 1600 MM2 AL/CU GSCH010
GSCH010/039	145kV 2000Al+H120	Enel Brazil	330066	CABO,138kV,XLPE,2000MM2,AL/CU,GSCH010/39
GSCH010/041	145kV 2500Cu+H120	Enel Brazil	330065	CABO,138kV,XLPE,2500MM2,CU/CU,GSCH010/41
GSCH010/044	145kV 2500Al+H120	Enel Brazil	990324	CABO 138 kV XLPE 2500 MM2 AL/CU GSCH010
GSCH010/045	145kV 500Al+H120	Enel Brazil	990325	CABO 138 kV XLPE 500 MM2 AL/CU GSCH010
GSCH010/001	245kV 2500Al+T363	Enel Chile	330053	Cable AT 2500mm2 Al 220kV GSCH010/001
GSCH010/002	245kV 2000Al+T363	Enel Chile	330054	Cable AT 2000mm2 Al 220kV GSCH010/002
GSCH010/003	245kV 1600Al+T363	Enel Chile	330055	Cable AT 1600mm2 Al 220kV GSCH010/003
GSCH010/004	245kV 1000Al+T363	Enel Chile	330056	Cable AT 1000mm2 Al 220kV GSCH010/004
GSCH010/009	145kV 1200Al+T242	Enel Chile	330063	Cable AT 1200mm2 Al 132kV GSCH010/009
GSCH010/011	145kV 630Al+T242	Enel Chile	330062	Cable AT 630mm2 Al 132kV GSCH010/011
GSCH010/020	145kV 1200Al+H120	Enel Chile	330061	Cable AT 1200mm2 Al 132kV GSCH010/020
GSCH010/021	145kV 630Al+H120	Enel Chile	330064	Cable AT 630mm2 Al 132kV GSCH010/021
GSCH010/034	145kV 2000Cu+H120	Enel Chile	330060	Cable AT 2000mm2 Cu 132kV GSCH010/034
GSCH010/038	145kV 1600Al+H120	Enel Chile	330059	Cable AT 1600mm2 Al 132kV GSCH010/038
GSCH010/040	145kV 400Cu+H120	Enel Chile	330041	Cable Cu 400 mm2 110 KV GSCH010/040
GSCH010/046	145kV 2000Cu+T242	Enel Chile	330058	Cable AT 2000mm2 Cu 132kV GSCH010/046
GSCH010/047	145kV 1600Al+T242	Enel Chile	330057	Cable AT 1600mm2 Al 132kV GSCH010/047
GSCH010/002	245kV 2000Al+T363	Enel Perú	330047	CABL.SUBT AT127/245kV-XLPE-1x2000AL+T363
GSCH010/005	245kV 800Al+T363	Enel Perú	330043	CABLE.SUBT AT127/245kV-XLPE-1x800AL+T363
GSCH010/022	72,5kV 2000Al+H240	Enel Perú	330050	CABL.SUBT AT36/72,5kV-XLPE-1x2000AL+H240
GSCH010/024	72,5kV 800Al+H240	Enel Perú	330052	CABL.SUBTE AT36/72,5kV-XLPE-1x800AL+H240
GSCH010/027	72,5kV 1200Cu+H240	Enel Perú	330049	CABL.SUBT AT36/72,5kV-XLPE-1x1200CU+H240
GSCH010/028	72,5kV 630Cu+H240	Enel Perú	330045	CABLE SUBT AT36/72,5kV-XLPE-1x630CU+H240
GSCH010/029	72,5kV 2000Cu+H240	Enel Perú	330051	CABL.SUBT AT36/72,5kV-XLPE-1x2000CU+H240
GSCH010/030	245kV 1200Cu+H240	Enel Perú	330044	CABL.SUBT AT127/245kV-XLPE-1x1200CU+H240
GSCH010/031	245kV 2000Cu+H240	Enel Perú	330046	CAB.SUBT AT 127/245kV-XLPE-1x2000CU+H240
GSCH010/042	72,5kV 500Cu+H240	Enel Perú	330042	CABLE.SUBT AT36/72,5kV-XLPE-1x500CU+H240
GSCH010/043	245kV 1600Cu+H240	Enel Perú	330048	CABL.SUBT AT127/245kV-XLPE-1x1600CU+H240

ANNEX D – STEADY STATE AMPACITY.

As an example, those are the estimated values for the ampacity of directly buried single circuits for some GS Type Codes.

GS Type Code	Code Word	Rated Voltage	Solid bonding		Single point bonding	
			50 Hz (A)	60 Hz (A)	50 Hz (A)	60 Hz (A)
GSCH010/001	245kV2500Al + T363	220 kV	830	764	1126	1091
GSCH010/002	245kV2000Al + T363	220 kV	791	733	1047	1020
GSCH010/003	245kV1600Al + T363	220 kV	742	692	948	928
GSCH010/004	245kV1000Al + T363	220 kV	642	608	728	704
GSCH010/005	245kV800Al + T363	220 kV	589	562	656	639
GSCH010/006	170kV1600Al + T242	150 kV	772	716	947	923
GSCH010/007	170kV1000Al + T242	150 kV	658	622	729	706
GSCH010/008	170kV630Al + T242	150 kV	545	524	584	573
GSCH010/009	145kV1200Al + T242	132 kV	700	658	826	810
GSCH010/010	145kV800Al + T242	132 kV	601	572	657	641
GSCH010/011	145kV630Al + T242	132 kV	544	523	584	573
GSCH010/012	72,5kV1000Al + T144	69 kV	680	645	737	717
GSCH010/013	72,5kV630Al + T144	69 kV	556	537	588	579
GSCH010/014	52kV800Al + T76	45 kV	640	620	666	655
GSCH010/015	52kV400Al + T76	45 kV	445	438	455	452
GSCH010/016	170kV1600Al + H95	150 kV	812	757	957	934
GSCH010/017	170kV1000Al + H95	150 kV	679	645	735	713
GSCH010/018	170kV630Al + H95	150 kV	557	538	586	577
GSCH010/019	145kV1200Al + H240	132 kV	659	620	811	797
GSCH010/020	145kV1200Al + H120	132 kV	712	670	826	811
GSCH010/021	145kV630Al + H120	132 kV	549	529	584	573
GSCH010/022	72,5kV2000Al + H240	69 kV	758	702	1029	1002
GSCH010/023	72,5kV1000Al + H95	69 kV	672	636	732	711
GSCH010/024	72,5kV800Al + H240	69 kV	569	542	640	622
GSCH010/025	52kV400Al + H50	45 kV	442	435	453	451
GSCH010/026	145kV630Cu + H160	132 kV	644	608	715	691
GSCH010/027	72,5kV1200Cu + H240	69 kV	734	679	992	965
GSCH010/028	72,5kV630Cu + H240	69 kV	607	573	697	671
GSCH010/029	72,5kV2000Cu + H240	69 kV	825	752	1218	1165
GSCH010/030	245kV1200Cu + H240	220 kV	759	705	1006	980
GSCH010/031	245kV2000Cu + H240	220 kV	857	783	1234	1183
GSCH010/032	145kV1200Cu + H120	138 kV	794	730	1008	976
GSCH010/033	145kV1600Cu + H120	138 kV	857	779	1143	1096
GSCH010/034	145kV2000Cu + H120	138 kV	904	814	1246	1184
GSCH010/035	145kV400Al + H120	138 kV	429	419	450	445
GSCH010/036	145kV800Al + H120	138 kV	597	569	652	635
GSCH010/037	145kV1000Al + H120	138 kV	653	617	724	700
GSCH010/038	145kV1600Al + H120	138 kV	762	707	943	919
GSCH010/039	145kV2000Al + H120	138 kV	817	751	1044	1011