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Subject: GSCH007 – High Temperature Bare Conductor.

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

CONTENTS

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THE HEAD OF GLOBAL NETWORK COMPONENTS
Fabrizio Gasbarri

1. DOCUMENT AIMS AND APPLICATION AREA

The aim of this document is to provide technical requirements for the supply of high temperature bare conductor to be used in the high voltage overhead lines of the Enel Group 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

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 does not require implementation of further documents. Anyway, each Enel Grids Company can issue, under the supervision of Enel Grids Global Network Components detailed documents, according to the provisions of the present document and in case of specific needs.

2. DOCUMENT VERSION MANAGEMENT

Version	Date	Main changes description
3	09/09/2022	Issuing of “GSCH007 High Temperature Bare Conductors” technical specification

3. UNITS IN CHARGE OF THE DOCUMENT

Responsible for drawing up the document:

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

Responsible for authorizing the document:

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

4. REFERENCES

- Code of Ethics of Enel Group;
- Enel Human Right Policy;
- The Enel Group Zero Tolerance of Corruption (ZTC) Plan;
- Organization and management model as per Legislative Decree No. 231/2001;
- Enel Global Compliance Program (EGCP);
- Integrated Policy of Quality, Health and Safety, Environment, anti-Bribery and Information security;
- ISO 9001:2015 - Quality Management System - Requirements;
- ISO 14001:2015 - Environmental Management System - Requirements and user guide;
- ISO 45001:2018 - Occupational Health and Safety Management System - Requirements and user guide;
- ISO 37001:2016 - Anti-bribery Management System - Requirements with guidance for use;
- ISO 27001:2017 - Information Security Management System – Requirements;
- RACI Handbook Infrastructure and Networks no. 06;
- Guideline GRI-GRI-GUI-E&C-0011 “Design and Construction HV lines Guidelines”;
- ASTM B416 - Standard Specification Concentric-Lay-Stranded Aluminum-Clad Steel Conductors.
- ASTM B502: Standard Specification for Aluminum Clad Steel Core Wire for aluminum conductors
- ASTM B609: Standard specification for Aluminum 1350 wire, annealed and intermediate tempers, for electrical purposes

- ASTM B803: Standard specification for High Strength Zinc-5% Aluminum-Mischmetal Alloy-Coated Steel Core wire for aluminum and aluminum-alloy conductors, steel reinforced.
- ASTM B856: Standard Specification for Concentric-Lay-Stranded Aluminum Conductors Steel Supported (ACSS)
- ASTM B857: Standard Specification for Shaped Wire Compact Concentric-Lay-Stranded Aluminum Conductors Steel Supported (ACSS/TW)
- ASTM B941 Standard Specification for Heat Resistant Aluminum-Zirconium Alloy Wire for Electrical Purposes
- ASTM B958 Standard draft specification for Extra-High_and Ultra-High Strength Zinc-5% Aluminum-Mischmetal Alloy-Coated Steel Core wire for aluminum and aluminum-alloy conductors, steel reinforced.
- ASTM B976: Standard Specification for Fiber Reinforced Aluminum Matrix Composite (AMC) Core Wire for Aluminum Conductors, Composite Reinforced (ACCR)
- ASTM B978: Standard Specification for Concentric-Lay-Stranded Aluminum Conductors, Composite Reinforced (ACCR)
- ASTM B987 Standard Specification for Carbon Fiber Composite Cores
- IEC 60468 Method of measurement of resistivity of metallic materials
- IEC 61284:1997 Overhead lines- Requirements and tests for fittings.
- IEC-TR 61597 Overhead electrical conductors - Calculation methods for stranded bare conductors
- EN 50182 - Conductors for overhead lines - Round wire concentric lay stranded conductors
- EN 50326 Conductors for overhead lines. Characteristics of greases
- EN 50540 Conductors for overhead lines. Aluminum conductors steel supported (ACSS)
- UNE-207009:2019 Herrajes y elementos de fijación y empalme para líneas eléctricas aéreas de alta tensión.
- IEC 62420 Concentric lay stranded overhead electrical conductors containing one or more gap(s)
- IEC 62641:2022 Conductors for overhead lines - Aluminium and aluminium alloy wires for concentric lay stranded conductors
- IEC 63248:2022 Conductors for overhead lines - Coated or cladded metallic wire for concentric lay stranded conductors

5. ORGANIZATIONAL PROCESS POSITION IN THE PROCESS TAXONOMY

Value Chain/Process Area: Engineering & Construction

Macro Process: Devices and Components Development

6. DEFINITIONS AND ACRONYMS

Acronym and Key words	Description
High Temperature Low Sag Conductors (HTLS)	Conductors that can withstand high operating temperatures without losing mechanical properties and with low sag characteristics due to low coefficient of thermal expansion and high Young's modulus.
Technical Conformity Assessment (TCA)	A "conformity assessment"[a] with respect to "specified requirements"[b] consists in functional, dimensional, constructional and test characteristics required for a product (or a series of products) and quoted in technical specifications and quality requirements issued by Enel Group distribution companies. This also includes the verification of conformity with respect to local applicable regulation and laws and possession of relevant requested certifications

7. DESCRIPTION

This standard specifies the functional and construction characteristics and test requirements that must be accomplished by concentric stranded bare conductors with a high permissible continuous operating temperature (greater than 100ºC) to be used on high voltage overhead lines with rated voltage above 36 kV.
In addition, at those high temperatures these conductors maintain a sag smaller to that of conventional technologies (they are known as HTLS conductors), thus carrying higher power compared to conventional conductors.
This characteristic makes of HTLS a very suitable alternative for repowering a line or for spans with special requirements for sag or strength.
It is recommended a study for each project in order to confirm the chosen conductor cross section or to propose the most appropriate one in terms of technical and economical requirements. This type of study should consider the required ampacity, the ambient conditions (temperature, sun radiation, wind speed, etc.) and the characteristics from the line (actual towers, distances, etc.).

[a] Definition 2.1 of ISO/IEC 17000
[b] Definition 3.1 of ISO/IEC 17000

This standard replaces all the local standards used up to now by all the Distribution Companies, as long as local regulation allows it.

7.1 LIST OF COMPONENTS

This standard includes the types of technologies for high temperature bare conductors selected for the high voltage lines of Enel Group Distribution Companies shown in **Table 2**.

The list of chosen conductors with the main requirements, which is an integral part of the present document, is reported in the Global Type Code List on Annex A, and their relationship with country codes is reported on the Common List on Annex E.

GSCH007 Type	Technology Type	Material for core	Material for envelope wires
GS Type I	Aluminum Conductor PMC Core	Polymer Matrix Composite Core (single or multi-wires)	Fully annealed Aluminum or thermal resistant aluminum Alloy wires
GS Type II	Aluminum Conductor MMC Core	Metal Matrix Composite Core wires	Thermal resistance Aluminum Alloy wires
GS Type III	Aluminum Conductor Steel Supported	Zn95Al5 Coated Steel wires	Aluminum fully annealed trapezoidal wires
GS Type IV	GAP Type conductor	Al Clad Steel Core wires	Thermal resistance Aluminum Alloy trapezoidal & round wires

Table 2 – List of GSCH007 Type Codes for high temperature conductors

7.2 DESIGN AND MANUFACTURE

The selected conductors have all of them an appropriate behavior against pollution adverse conditions due to its technical characteristics.

In case of extreme conditions, it will be useful to analyze the site with each supplier in order to have a better estimation for the expected life of the conductor.

As these conductors works at very high temperatures, the design of accessories (specially clamps and dead-ends) must be prepared to withstand high temperatures. On the other hand, these conductors sometimes are made of materials not used in conventional conductors, such as composites. So, the accessories must be specific for every particular material.

As a consequence, this type of conductor must be treated with all their accessories as a whole system.

Regarding accessories, the reference standard is IEC-61284:1997 and paragraph 6.1.101 from UNE-207009:2019

7.2.1. GS Type I: Conductors with polymeric composite core (PMC)

This chapter describes the aluminum conductors (annealed or thermal resistant) with polymeric composite core.

The polymer matrix composite core is formed by carbon fibers embedded in epoxy resin matrix.

It can be formed by a single wire or multiple wires stranded.

Single wire cores are protected by a glass fiber layer or an aluminum tube.

Multi wires cores are protected by an aluminum tube.

Attached are the proposed technologies:

Technology Type	Type Denomination	Material for core	Material for envelope wires
Type I: Aluminum Conductor PMC Core	PMC-I	Carbon fiber in epoxy resin matrix protected by glass fiber	Aluminum fully annealed T wires
	PMC-II	Carbon fiber in epoxy resin matrix (single wire) protected by aluminum	Aluminum fully annealed or thermal resistant aluminum zirconium alloy T or Z wires
	PMC-III	Carbon fiber in epoxy resin matrix (multiple wires) protected by aluminum	Aluminum fully annealed or thermal resistant aluminum zirconium alloy T or Z wires
	PMC-IV	Carbon fiber in epoxy resin matrix, pretensioned and encapsulated in aluminum	Aluminum fully annealed T wires

Table 3 Type I: PMC Conductors

7.2.1.1. Polymer Matrix Composite core

Core made of carbon fibers embedded in high-temperature epoxy resin matrix.

This core can be protected in different ways:

- Glass fibers to improve flexibility and toughness. It also prevents galvanic corrosion (PMC-I).
- Aluminum, which prevents thermal-oxidation and mechanic and chemical damage. Core protected by aluminum could be formed by one single wire (PMC-II) or multiple wires stranded inside the aluminum protection (PMC-III). The multiple wires core distributes the breakage risk from one to more elements, furthermore a multiple wires core is more flexible compared to a single wire core.
- Encapsulated Aluminum (PMC-IV). Core is pretensioned and encapsulated to eliminate any corrosion. Pre-tensioning provides toughness to the conductor during installation and during the utilization of the conductor.

7.2.1.2. Annealed Aluminum Trapezoidal Wires

Conductive layers are formed by fully annealed aluminum trapezoidal wires, aluminum AL0 or 1350-O, which keeps his characteristics at high temperature and also improves conductivity and fatigue resistance.

Reference Standard for the material: EN 50540 and/or ASTM B609[c].

The different layers of aluminum wires are twisted around the composite core alternatively in one direction and another such that the outer layer rotates clockwise.

7.2.1.3. Thermal resistance Aluminum Alloy Trapezoidal, Z-shape or round Wires

Conductive layers are formed by Zirconium-Aluminum alloy. Zirconium confers a better mechanical behavior at higher operating temperatures and prevents the aluminum from becoming annealed when operating at high temperatures.

Reference Standard for the material: IEC 62641 and/or ASTM B941.

The different layers of aluminum wires are twisted around the core alternatively in one direction and another such that the outer layer rotates clockwise.

7.2.2. GS Type II: Conductors with Metal Matrix Composite core (MMC)

Note: It is described the only option included in the standard (MMC)

7.2.2.1. Aluminum Matrix Composite Core Wires

The core is formed by round wires made of Aluminum oxide continuous fibres embedded in pure aluminum. It is a very high strength material with a very low thermal expansion coefficient.

7.2.2.2. Thermal resistance Aluminum Alloy Trapezoidal or round Wires

Conductive layers wires are formed by Aluminum-Zirconium alloy. Zirconium confers a better mechanical behavior at higher operating temperatures and prevents the aluminum from becoming annealed when operating at high temperatures.

Reference Standard for the material: IEC 62641 and/or ASTM B941.

The different layers of aluminum wires are twisted around the core alternatively in one direction and another such that the outer layer rotates clockwise.

7.2.3. GS Type III: Aluminum Conductors Steel Supported (ACSS/TW)

Reference Standard for the conductor: EN50540 and/or ASTM B857.

[c] After stranding, the trapezoidal aluminum wires shall conform to the requirements of ASTM B609 except for the shape and the diameter tolerance.

7.2.3.1. Aluminum-Zinc Coated Steel Core Wires[d]

The core is formed by round wires made of steel coated with Aluminum-Zinc alloy (95% Zinc-5% Aluminum), with an excellent mechanical behaviour at high temperature (steel type EHST).

Reference Standard for the material: EN 50540.

7.2.3.2. Annealed Aluminum Trapezoidal Wires

Conductive layers trapezoidal wires are formed by fully annealed aluminum, type AL0 or 1350-O, which doesn't lose its properties at high temperatures and improves conductivity and fatigue resistance. Alternatively, it may be used round wires if it is more convenient.

Reference Standard for the material: EN 50540[e] and/or ASTM B609[f].

The different layers of aluminum wires are twisted around the core composite alternatively in one direction and another such that the outer layer rotates clockwise.

7.2.4. GS Type IV: Conductor containing one gap (GZTACSR)

Reference Standard for the conductor: IEC 62420.

7.2.4.1. Aluminum cladded Steel Core Wires

The core is formed by round wires made of aluminum-clad steel, for a better behavior before corrosion (steel type 14EHSA).

Reference Standard for the material: EN50540 and/or ASTM B502.

7.2.4.2. Thermal resistance Aluminum alloy Trapezoidal wires

Conductive layer wires are formed by Aluminum-Zirconium alloy (aluminum alloy type AT3). Zirconium confers an excellent mechanical behavior at higher operating temperatures and prevents the aluminum from becoming annealed when operating at high temperatures. It can be used aluminum alloy type AT1, with less thermal resistance, then the conductor is known as GTACSR and it has an inferior maximum continuous operating temperature.

Reference Standard for the material: IEC 62641 and/or ASTM B941.

The first layer will be formed with trapezoidal wires, creating a gap which will be filled with high thermal resistance grease.

The other layers could be made of round or trapezoidal wires and they are twisted around the core alternatively in one direction and another such that the outer layer rotates clockwise

[d] ACCS conductor core can be designed with different materials. It has been chosen this one because of his good behavior at high temperature.
[e] Chapter 5.
[f] After stranding, the trapezoidal aluminum wires shall conform to the requirements of ASTM B609 except for the shape and the diameter tolerance.

7.3 CONDITIONS OF SUPPLY

7.3.1. Conductor packing

The conductor shall be properly protected against damage which may occur in ordinary handling and shipping.

The reels must support the conductor weight without deformations. The reel design shall respect the minimum bend radio and it will allow cranes to manipulate them.

The reel diameter will be at least 30 times the conductor diameter or 60 times the core diameter, the maximum of both values. In the case of composite core conductors, the reel diameter shall be at least 50 times the conductor or 150 times the core diameter, the maximum of both values.

For more sensitive conductors, such as fully annealed aluminum designs, it is recommended a special care: protection inside the reel, use of staves, paper between layers of conductors or similar.

Both ends of the conductor shall be secured to the spools and they will remain accessible, preventing accidental unrolling.

7.3.2. Conductor marking

Each reel shall be identified with an indelible and easily legible plate on the external face and in the inside, with the name of the final Enel Group distribution company.

The plate shall include the following information:

a) Manufacturer name or brand.
b) Supplier product designation as indicated on TCA.
c) Conductor type
d) Weights, tare and net.
e) Conductor length in meters
f) Order number or purchase order.
g) Year and month of manufacture.
h) Reel number
i) Direction of rotation of the reel (with an arrow)
j) Unwinding direction (if the reel is packed)

Note: The manufacturer shall use length measurement equipment with an accuracy of ± 1%

7.4 TESTS

These tests shall be accomplished according to the requirements of this standard and those of TCA procedures.

7.4.1. Type Tests

Type test shall be carried out over the conductor in order to verify its main characteristics, which depend on its design.

Each manufacturer shall make this test once to obtain the technical assessment for each conductor, and they should be repeated only when the design or manufacturing process has been modified.

7.4.2. Sample Tests

Sample test shall be carried out over final product samples to guarantee the quality of the conductors and compliance with the requirements of this standard.

Sample test will be carried out on at least 10% of the reels, being tested all the wires.

If the supplier demonstrates ability to exceed the requirements, the sample can be reduced even until 10% of wires, although the size of the sample must assure the quality control of the batch.

7.4.3. Tests description

Type Test and Sample test for complete conductor of any GS Type are those indicated on **Table 4**

Description	Type Test	Sample Test	Standard/paragraph	Observation
Surface condition	X	X	EN 50540 p. 6.4.1	
Conductor diameter	X	X	EN 50540 p. 6.4.2	
Lay inalterability	X	X	EN 50540 p. 6.4.3	
Lay ratio and direction ratio	X	X	EN 50540 p. 6.4.4	
Number and type wire	X	X	EN 50540 p. 6.4.5	
Aluminum cross section	X	X	EN 50540 p. 6.4.6	
Mass per unit length	X	X	EN 50540 p. 6.4.7	
Resistivity (DC)	X	-	EN 50540 p. 6.4.8	
Stress-strain curve	X	-	EN 50540 p. 6.4.9	
Tensile test	X	-	EN 50540 p. 6.4.10	
Laying test	X	-	EN 50540 p. 6.4.11	
Gaps	X	-	EN 62420 p. 6.2.3	Just for GS Type IV
Creep curve	X	-	EN 62420 p. 6.2.6	Just for GS Type IV

Table 4 Test for complete conductor

Type and Sample Tests for complete cores of conductors GS Type I and II are those indicated on **Table 5**

GS Type	Description	Type Test	Sample Test	Standard/paragraph
PMC Composite core *GS Type I*	Appearance	X	X	ASTM B987 method a
	Dimension	X	X	ASTM B987 method b
	Tensile test	X	X	ASTM B987 method c
	Glass transition temperature test	X	X	ASTM B987 method d
	Density	X	-	ASTM B987 method e

	Bending test	X	-	ASTM B987 method f
	Dye penetrant testing after bending test	X	-	ASTM B987 method g
	Tensile test after bending test	X	-	ASTM B987 method h
	Heat exposure test	X	-	ASTM B987 method i
	Heat/stress test	X	-	ASTM B987 method j
	Galvanic protection barrier layer thickness	X	-	ASTM B987 method k
MMC Composite core *GS Type II*	Appearance	X	X	ASTM B976
	Dimension	X	X	ASTM B976
	Mass per unit length	X	X	ASTM B976
	Strength	X	X	ASTM B976

Table 5 Test for complete cores

Type and Sample Tests for individual wires of conductors of any GS Type are those indicated on **Table 6**

	Description	Type Test	Sample Test	Standard/paragraph
Aluminum Wires *GS Type I and III*	Appearance	X	X	EN 50540 / ASTM B609
	Diameter	X	X	EN 50540 / ASTM B609
	Strength	X	X	EN 50540 / ASTM B609
	Elongation	X	X	EN 50540 / ASTM B609
	Resistivity	X	X	EN 50540 / ASTM B193
	Cross-section	X	X	EN 50540
	Wrapping test	X	X	ISO 7802
	Welding	X	-	IEC 50182 p. 6.5.3
Heat resistant Aluminum-Zr Wires *GS Type I, II and IV*	Appearance	X	X	IEC 62641 p. 6.4.1 / ASTM B941
	Diameter	X	X	IEC 62641 p. 6.4.2 / ASTM B941
	Strength	X	X	IEC 62641 p. 6.4.3 / ASTM B941
	Elongation	X	X	IEC 62641 p. 6.4.4 / ASTM B941
	Resistivity	X	X	IEC 62641 p. 6.4.7 / ASTM B941
	Thermal resistance	X	X	IEC 62641 p. 6.4.8 / ASTM B941
	Wrapping	X	X	IEC 62641 p. 6.4.5 / ASTM B941
	Bending	X	-	IEC 62641 p. 6.4.6 / ASTM B941
Aluminum Cladded Steel Wires *GS Type IV*	Condition	X	X	EN 50540 p.6.5.2 / IEC 63248 p. 7.4.1
	Diameter	X	X	EN 50540 p.6.5.2 / IEC 63248 p. 7.4.2
	Strength	X	X	EN 50540 p.6.5.2 / IEC 63248 p. 7.4.3
	Elongation	X	X	EN 50540 p.6.5.2 / IEC 63248 p. 7.4.3
	Torsion	X	X	EN 50540 p.6.5.2 / IEC 63248 p. 7.4.4
	Aluminum thickness	X	X	EN 50540 p.6.5.2 / IEC 63248 p. 7.4.5
	Resistivity	X	X	EN 50540 p.6.5.2 / IEC 63248 p. 7.4.7
	Stress 1% extension	X	X	EN 50540 p.6.5.2 / IEC 63248 p. 7.4.3
Aluminum - Zinc Coated Steel Wires *GS Type III*	Diameter	X	X	EN 50540 p.6.5.2
	Strength	X	X	EN 50540 p.6.5.2
	Elongation or torsion	X	X	EN 50540 p.6.5.2
	Zinc mass	X	X	EN 50540 p.6.5.2
	Zinc immersion test	X	X	EN 50540 p.6.5.2
	Zinc coating adhesion test	X	X	EN 50540 p.6.5.2

Table 6 Test for individual wires

8. ANNEX

ANNEX A – TECHNICAL CHECK LIST

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

Item	Description	Unit	Required Values	Offered Values
1	**GENERAL INFORMATION**			
1.1	Supplier	-		
1.2	Supplier 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	Type	-		
2.5	Code Word	-		
2.6	International standard of reference	-		
2.7	Designation	-		
3	**CONDUCTOR PROPERTIES**			
3.1	Total diameter	[mm]		
3.2	Core diameter	[mm]		
3.3	Total cross-sectional area	[mm^2]		
3.4	Core cross-sectional area	[mm^2]		
3.5	Total Weight	[kg/km]		
3.6	Aluminum Weight	[kg/km]		
3.7	DC Resistance at 20ºC	[Ω/ km]		
3.8	AC Resistance at 75ºC	[Ω/ km]		
3.9	Ultimate Tensile Strength	[daN]		
3.11	Modulus of elasticity	[KN/mm^2]		
3.10	Coefficient of thermal expansion	[10^{-6}/ºC]		
3.9	Maximum Operating Temperature (MOT)	[ºC]		
3.8	Maximum Emergency Temperature (MET)	[ºC]		
3.7	AC Resistance at MOT	[Ω/ km]		
4	**EXTERNAL LAYERS**			
4.1	Designation	-		

Item	Description	Unit	Required Values	Offered Values
4.2	Wires number	-		
4.3	Wire diameter	[mm]		
4.4	Cross-sectional area	[mm²]		
4.5	Weight	[kg/km]		
4.6	Direction of lay of external layer	-		
4.7	Modulus of Elasticity	[KN/mm²]		
4.8	Coefficient of Thermal Expansion	[10^{-6}/ºC]		
4.9	Aluminum Heat Capacity	[W/m°C]		
5	**CORE**			
5.1	Designation	-		
5.2	Wires number	-		
5.3	Wire diameter	[mm]		
5.4	Cross-sectional area	[mm²]		
5.5	weight	[kg/km]		
5.6	Rated Strength of Core	[daN]		
5.7	Modulus of Elasticity	[KN/mm²]		
5.8	Coefficient of Thermal Expansion	[10^{-6}/ºC]		
5.9	Core Heat Capacity	[W/m°C]		
6	**AMPACITY as IEC TR 61597 (Ta: 40ºC; perpendicular wind speed: 0,6 m/s; Solar radiation: 1 kW/m²)**			
6.1	Absorptivity	-		
6.2	Emissivity	-		
6.3	Ampacity Tc=75ºC	[A]		
6.4	Ampacity Tc=MOT	[A]		
6.5	Ampacity Tc=MET	[A]		
6.6	Maximum time at MET	[h]		
7	**TCA**			
7.1	There is an active TCA for this reference	YES/NO		
7.2	In case 7.1 answer is YES, indicate TCA Code	-		
8	**COMMENTS**			
8.1	Any exception to what is required in GSCH007	-		
8.2	Additional comments	-		

ANNEX B – GLOBAL TYPES CODES FOR HIGH TEMPERATURE BARE CONDUCTORS •

Data for complete conductor

GS Type Code	Standard	Type	Code Words	Size (mm²)	Overall diam. (mm)	Mass (kg/km)	Rated strength (kN)	DC resist. 20°C (Ω/km)
GSCH007/001	N/A	Type I (PMC-I) CFCC	ROVINJ	217,3	17,1	576	60,4	0,1487
GSCH007/002			LINNET	245,9	18,29	655	60,4	0,1319
GSCH007/003			CASABLANCA	313,3	20,5	834	85,7	0,1024
GSCH007/004			LISBON	349,6	21,79	931	85,7	0,0887
GSCH007/005			DOVE	408,6	23,55	1083	101,7	0,0771
GSCH007/006			GROSBEAK	468,1	25,15	1245	112	0,0672
GSCH007/007			WARSAW	567,8	27,72	1519	130,2	0,0553
GSCH007/008			DRAKE	590,6	28,14	1565	153,8	0,0536
GSCH007/009			HAMBURGO	606,7	28,63	1627	130,2	0,0514
GSCH007/010			SAN ANTONIO	822,4	33,4	2211	162,1	0,0375
GSCH007/015	N/A	Type I (PMC-II) CFCC	AMPERE	216,3	17,1	570	79,1	0,1476
GSCH007/016			KIRCHHOFF	246	18,3	650	80,8	0,128
GSCH007/017			LENZ	308,7	20,5	818	100	0,1014
GSCH007/018			FARADAY	348,3	21,8	926	102,3	0,0886
GSCH007/019			MAXWELL	408,3	23,5	1084	124,3	0,076
GSCH007/020			VOLTA	465	25,1	1235	139,6	0,0666
GSCH007/021			WHEATSTONE	567,7	27,7	1515	177	0,0551
GSCH007/022			PACINOTTI	583,7	28,14	1557	182,2	0,0537
GSCH007/023	N/A	Type I (PMC-II) CFCC	186-AT1/28	224,7	18	591	65,5	0,1506
GSCH007/024			289-AT1/38	339,5	21,8	898	94,9	0,102
GSCH007/025			377-AT1/64	465,6	25,4	1219	139,4	0,0738
GSCH007/026			459-AT1/64	548,1	27,7	1450	152,6	0,0611
GSCH007/027			574-AT1/64	662,7	30,4	1769	170,8	0,0494
GSCH007/028	N/A	Type I (PMC-II) CFCC	THOMSON	232,8	18	604	86,5	0,1502
GSCH007/029			OHM	340,1	21,8	895	108,9	0,0983
GSCH007/030			FERRARIS	460,8	25,4	1220	136	0,071
GSCH007/031			HENRY	544,1	27,6	1452	157,7	0,0601
GSCH007/032			MARCONI	658,2	30,4	1770	172,4	0,0485
GSCH007/070	N/A		CURIE	301,3	20,5	801	85	0,1074
GSCH007/071			GALVANI	341,2	21,8	910	91,4	0,0937

GS Type Code	Standard	Type	Code Words	Size (mm^2)	Overall diam. (mm)	Mass (kg/km)	Rated strength (kN)	DC resist. 20°C (Ω/km)
GSCH007/072			FERMI	393,1	23,5	1057	99,6	0,0806
GSCH007/073			HACK	464,4	25,1	1232	135,4	0,0701
GSCH007/074		Type I (PMC-III) CFCC	PLANCK	464,2	25,4	1231	134,2	0,0701
GSCH007/075			DIRAC	546,8	27,6	1467	148,8	0,0588
GSCH007/076			MEUCCI	583,4	28,2	1543	184	0,0572
GSCH007/077			GAUSS	666,4	30,3	1776	197,3	0,0495
GSCH007/100			PENGUIN-4	152,5	14,3	406	43	0,2608
GSCH007/101			PARTRIDGE-5	198,7	16,3	525	65	0,2091
GSCH007/102			ROVINJ-5.5	218,6	17,1	574	77	0,2091
GSCH007/103			MERLIN-5.5	228,9	17,5	603	78	0,1897
GSCH007/104			LINNET-6	250,2	18,3	658	91	0,1897
GSCH007/105			LINNET-5.5	249,5	18,3	660	79	0,1653
GSCH007/106			GDANSK-5.5	274,5	19,2	730	80	0,1653
GSCH007/107			HAWK-6	352,8	21,8	941	97	0,1167
GSCH007/108		Type I (PMC-IV) CFCC	OSLO-6	373,7	22,4	997	98	0,1167
GSCH007/109	N/A		PEACOCK-6.5	434,8	24,2	1161	115	0,0925
GSCH007/110			GROSBEAK-6.5	468,7	25,1	1256	117	0,0925
GSCH007/111			FLAMINGO-7	478,9	25,4	1278	132	0,0842
GSCH007/112			LUBBOCK-7	517,3	26,4	1384	134	0,0842
GSCH007/113			WARSAW-7.5	569,5	27,7	1522	152	0,0706
GSCH007/114			DUBLIN-7.5	587,1	28,1	1571	154	0,0706
GSCH007/115			CARDINAL-8.0	685,9	30,4	1837	175	0,0586
GSCH007/116			GRACKLEL-8.0	716,8	31,1	1923	177	0,0586
GSCH007/117			BASIN-9.5	827,7	33,4	2211	240	0,037
GSCH007/118			PARIS-9.5	865,4	34,2	2315	242	0,0352
GSCH007/040			297-T16	175	17,2	501	53,8	0,1826
GSCH007/042			HAWK 477TW	281	20	801	85,148	0,1134
GSCH007/043	N/A	Type II MMC	OSWEGO	390	23,6	1111	115,02	0,0814
GSCH007/044			WABASH	449	25,2	1280	139,09	0,0705
GSCH007/045			CURLEW 1033 TW	590	28,8	1672	158,706	0,0531
GSCH007/061		Type III ACSS/TW	ACSS/TW-198	197,9	16,82	686	64	0,161
GSCH007/062			ACSS/TW-280	280,9	20,04	974	88,2	0,1134

GS Type Code	Standard	Type	Code Words	Size (mm²)	Overall diam. (mm)	Mass (kg/km)	Rated strength (kN)	DC resist. 20°C (Ω/km)
GSCH007/063	EN50540 ASTM B857		ACSS/TW-364	364	22,62	1215	97,3	0,0853
GSCH007/064			ACSS/TW-455	454,9	25,24	1519	119,8	0,683
GSCH007/065			ACSS/TW-546	546	27,53	1822	143,8	0,0569
GSCH007/081	IEC 62420	Type IV GAP	GZTACSR-186	186,47	16,8	634	60,55	0,1794
GSCH007/082			GZTACSR-293	292,95	22	1000	96,76	0,1146
GSCH007/083			GZTACSR-385	384,5	25,24	1273	113,21	0,0856
GSCH007/084			GZTACSR-462	462,1	27,6	1521	135,2	0,0711
GSCH007/085			GZTACSR-553	553,25	30,47	1828	164,53	0,0595

- Data for core and for envelope wires

			Conductor Core			Conductor envelope			
GS Type Code	Type	Code Words	Material	Description	Cross section (mm²)	Material envelope wires	Description envelope wires	Cross section envelope (mm²)	Standard
GSCH007/001	Type I (PMC-I) CFCC	ROVINJ	Polimeric Matrix Composite (PMC-I)	Hybrid carbon and glass fiber composite	28	Aluminium fully annealed AL0/1350-O	Trapezoidal wires	187,8	EN50540 ASTM B609
GSCH007/002		LINNET			28			218,1	
GSCH007/003		CASABLANCA			39,7			273,6	
GSCH007/004		LISBON			39,7			309,9	
GSCH007/005		DOVE			47,1			361,5	
GSCH007/006		GROSBEAK			51,9			416,2	
GSCH007/007		WARSAW			60,3			507,5	
GSCH007/008		DRAKE			71,3			519,7	
GSCH007/009		HAMBURGO			60,3			546,4	
GSCH007/010		SAN ANTONIO			75,1			747,3	
GSCH007/015	Type I (PMC-II) CFCC	AMPERE	Polimeric Matrix Composite (PMC-II)	Carbon fibers in polymeric matrix coated with aluminum tube	50,5		Trapezoidal or z-shaped wires	165,9	EN50540
GSCH007/016		KIRCHHOFF			50,5			195,1	
GSCH007/017		LENZ			58,9			249,8	
GSCH007/018		FARADAY			58,9			289,3	
GSCH007/019		MAXWELL			68,8			339,5	
GSCH007/020		VOLTA			75,1			390	

Subject: GSCH007 – High Temperature Bare Conductor.

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

			Conductor Core			Conductor envelope			
GS Type Code	**Type**	**Code Words**	**Material**	**Description**	**Cross section (mm²)**	**Material envelope wires**	**Description envelope wires**	**Cross section envelope (mm²)**	**Standard**
GSCH007/021		WHEATSTONE			91,2			476,6	
GSCH007/022		PACINOTTI			93,4			490,4	
GSCH007/023		186-AT1/28			38,6			185,9	
GSCH007/024		289-AT1/38			50,6			289	
GSCH007/025	(PMC-II) CFCC	377-AT1/64			88,7	Thermal resistance Al Zr Alloy AT1	Z-shape wires	376,8	ASTM B941
GSCH007/026		459-AT1/64			88,7			459,4	
GSCH007/027		574-AT1/64			88,7			574	
GSCH007/028		THOMSON			65,7			167,1	
GSCH007/029	Type I (PMC-II) CFCC	OHM			71,8		Trapezoidal or Z-shaped wires	268,3	
GSCH007/030		FERRARIS			79,4			381,3	IEC 62641
GSCH007/031		HENRY			87,8			456,3	
GSCH007/032		MARCONI			84,4			573,8	
GSCH007/070		CURIE			54,4			246,9	
GSCH007/071		GALVANI			54,4			286,8	
GSCH007/072		FERMI	Polimeric Matrix Composite Multiwire (PMC-III)	Carbon fiber in epoxy resin matrix (multiple wires) protected by aluminum	54,4	Thermal resistance Al Zr Alloy AT1	Trapezoidal or Z-shaped wires	338,8	
GSCH007/073	Type I (PMC-III) CFCC	HACK			77,6			386,8	IEC 62641
GSCH007/074		PLANCK			77,6			386,6	
GSCH007/075		DIRAC			77,6			469,2	
GSCH007/076		MEUCCI			109			474,3	
GSCH007/077		GAUSS			109			557,4	
GSCH007/100		PENGUIN-4			12,6			130,97	
GSCH007/101		PARTRIDGE-5			19,6			179,04	
GSCH007/102		ROVINJ-5.5			23,8			184,85	
GSCH007/103		MERLIN-5.5		Carbon fiber in epoxy resin matrix, pretensioned and encapsulated in aluminum	23,8	Aluminium fully annealed AL0/1350-O	Trapezoidal wires	205,12	
GSCH007/104	Type I (PMC-IV) CFCC	LINNET-6	Polimeric Matrix Composite Encapsulated (PMC-IV)		28,3			221,96	EN50540 ASTM B609
GSCH007/105		LINNET-5.5			23,8			225,76	
GSCH007/106		GDANSK-5.5			23,8			250,73	
GSCH007/107		HAWK-6			28,3			324,57	
GSCH007/108		OSLO-6			28,3			345,41	
GSCH007/109		PEACOCK-6.5			33,2			401,57	
GSCH007/110		GROSBEAK-6.5			33,2			435,45	

Subject: GSCH007 – High Temperature Bare Conductor.

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

			Conductor Core			Conductor envelope			
GS Type Code	**Type**	**Code Words**	**Material**	**Description**	**Cross section (mm²)**	**Material envelope wires**	**Description envelope wires**	**Cross section envelope (mm²)**	**Standard**
GSCH007/111		FLAMINGO-7			38,5			440,41	
GSCH007/112		LUBBOCK-7			38,5			478,86	
GSCH007/113		WARSAW-7.5			44,2			525,32	
GSCH007/114		DUBLIN-7.5			44,2			542,93	
GSCH007/115		CARDINAL-8.0			50,3			635,63	
GSCH007/116		GRACKLEL-8.0			50,3			666,47	
GSCH007/117		BASIN-9.5			70,9			756,87	
GSCH007/118		PARIS-9.5			70,9			794,47	
GSCH007/040	Type II MMC	297-T16 HAWK	Metal Matrix Composite (MMC)	Aluminum oxid fibers within pure Aluminum wires	25	Thermal resistance Al Zr Alloy AT3	Round wires	150	ASTM B976 IEC 62641 ASTM B941
GSCH007/042		477TW			39		Trapezoidal wires	242	
GSCH007/043		OSWEGO			53			337	
GSCH007/044		WABASH			62			387	
GSCH007/045		CURLEW 1033 TW			67			523	
GSCH007/061	Type III ACSS	ACSS/TW-198	Al-Zn coated steel wires	EHST wires (Zn95Al5 coated steel)	27,7	Aluminium fully annealed AL0/1350-O	Trapezoidal wires	170,2	EN50540 ASTM B609
GSCH007/062		ACSS/TW-280			39,3			241,6	
GSCH007/063		ACSS/TW-364			41,8			322,2	
GSCH007/064		ACSS/TW-455			52,2			402,7	
GSCH007/065		ACSS/TW-546			62,6			483,4	
GSCH007/081	Type IV GAP	GZTACSR-186	Al Clad Steel wires	14EHSA steel wires	23,1	Thermal resistance Al Zr Alloy AT3	Trapezoidal & round wires	163,37	EN50540 ASTM B502 / IEC62641 ASTM B941
GSCH007/082		GZTACSR-293			37,17			255,78	
GSCH007/083		GZTACSR-385			40			344,5	
GSCH007/084		GZTACSR-462			47,81			414,3	
GSCH007/085		GZTACSR-553			58,07			495,18	

ANNEX C – OPERATING TEMPERATURES AND AMPACITY RELATED

The maximum temperature at what every type of conductors can operate continuously and the maximum temperature during an emergency are those of the Table:

GS Type	Type Denomination	Maximum continuous operating temperature (°C)	Maximum emergency temperature (°C)
Type I	PMC-I	180	200
	PMC-II	150	180
	PMC-III	150	180
	PMC-IV	180	200
Type II	MMC	210	240
Type III	ACSS/TW	210	250
Type IV	GAP	210	240

Ampacity at usual and maximum operating temperature are:

GS Type Code	Type	Size (mm²)	Code Words	Ampacity @ usual operation T (75°C)	Max. Cont. T	Ampacity @ T max cont.
GSCH007/001	Type I (PMC-I)	217,3	ROVINJ	448	180	880
GSCH007/002	Type I (PMC-I)	245,9	LINNET	602	180	1014
GSCH007/003	Type I (PMC-I)	313,3	CASABLANCA	564	180	1120
GSCH007/004	Type I (PMC-I)	349,6	LISBON	611	180	1226
GSCH007/005	Type I (PMC-I)	408,6	DOVE	826	180	1410
GSCH007/006	Type I (PMC-I)	468,1	GROSBEAK	898	180	1537
GSCH007/007	Type I (PMC-I)	567,8	WARSAW	824	180	1673
GSCH007/008	Type I (PMC-I)	590,6	DRAKE	1036	180	1786
GSCH007/009	Type I (PMC-I)	606,7	HAMBURGO	1061	180	1834
GSCH007/010	Type I (PMC-I)	822,4	SAN ANTONIO	1302	180	2408
GSCH007/015	Type I (PMC-II)	216,5	AMPERE	454	150	773
GSCH007/016	Type I (PMC-II)	247	KIRCHHOFF	495	150	845
GSCH007/017	Type I (PMC-II)	311,1	LENZ	570	150	980
GSCH007/018	Type I (PMC-II)	350,2	FARADAY	618	150	1066
GSCH007/019	Type I (PMC-II)	408,3	MAXWELL	678	150	1175

Subject: GSCH007 – High Temperature Bare Conductor.

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

GS Type Code	Type	Size (mm²)	Code Words	Ampacity @ usual operation T (75°C)	Max. Cont. T	Ampacity @ T max cont.
GSCH007/020	Type I (PMC-II)	467,9	VOLTA	739	150	1284
GSCH007/021	Type I (PMC-II)	568,5	WHEATSTONE	829	150	1449
GSCH007/022	Type I (PMC-II)	585,5	PACINOTTI	842	150	1473
GSCH007/023	Type I (PMC-II)	224,7	186-AT1/28	450	150	820
GSCH007/024	Type I (PMC-II)	339,5	289-AT1/38	540	150	1040
GSCH007/025	Type I (PMC-II)	465,6	377-AT1/64	658	150	1270
GSCH007/026	Type I (PMC-II)	548,1	459-AT1/64	750	150	1430
GSCH007/027	Type I (PMC-II)	662,7	574-AT1/64	875	150	1625
GSCH007/028	Type I (PMC-II)	232,8	THOMSON	452	150	771
GSCH007/029	Type I (PMC-II)	340,1	OHM	586	150	1010
GSCH007/030	Type I (PMC-II)	460,8	FERRARIS	714	150	1243
GSCH007/031	Type I (PMC-II)	544,1	HENRY	791	150	1382
GSCH007/032	Type I (PMC-II)	658,2	MARCONI	898	150	1578
GSCH007/070	Type I (PMC-III)	54,4	CURIE	552	150	948
GSCH007/071	Type I (PMC-III)	54,4	GALVANI	600	150	1035
GSCH007/072	Type I (PMC-III)	54,4	FERMI	659	150	1141
GSCH007/073	Type I (PMC-III)	77,6	HACK	717	150	1247
GSCH007/074	Type I (PMC-III)	77,6	PLANCK	719	150	1251
GSCH007/075	Type I (PMC-III)	77,6	DIRAC	799	150	1397
GSCH007/076	Type I (PMC-III)	109	MEUCCI	814	150	1425
GSCH007/077	Type I (PMC-III)	109	GAUSS	890	150	1564
GSCH007/100	Type I (PMC-IV)	152,5	PENGUIN-4	368	180	717
GSCH007/101	Type I (PMC-IV)	198,7	PARTRIDGE-5	430	180	843
GSCH007/102	Type I (PMC-IV)	218,6	ROVINJ-5.5	454	180	893
GSCH007/103	Type I (PMC-IV)	228,9	MERLIN-5.5	468	180	922
GSCH007/104	Type I (PMC-IV)	250,2	LINNET-6	492	180	973
GSCH007/105	Type I (PMC-IV)	249,5	LINNET-5.5	496	180	980
GSCH007/106	Type I (PMC-IV)	274,5	GDANSK-5.5	529	180	1048
GSCH007/107	Type I (PMC-IV)	352,8	HAWK-6	619	180	1238
GSCH007/108	Type I (PMC-IV)	373,7	OSLO-6	643	180	1289
GSCH007/109	Type I (PMC-IV)	434,8	PEACOCK-6.5	706	180	1423
GSCH007/110	Type I (PMC-IV)	468,7	GROSBEAK-6.5	741	180	1498
GSCH007/111	Type I (PMC-IV)	478,9	FLAMINGO-7	749	180	1518
GSCH007/112	Type I (PMC-IV)	517,3	LUBBOCK-7	784	180	1593
GSCH007/113	Type I (PMC-IV)	569,5	WARSAW-7.5	832	180	1696
GSCH007/114	Type I (PMC-IV)	587,1	DUBLIN-7.5	850	180	1738
GSCH007/115	Type I (PMC-IV)	685,9	CARDINAL-8.0	933	180	1918
GSCH007/116	Type I (PMC-IV)	716,8	GRACKLEL-8.0	955	180	1972
GSCH007/117	Type I (PMC-IV)	827,7	BASIN-9.5	1033	180	2153

Subject: GSCH007 – High Temperature Bare Conductor.

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

GS Type Code	Type	Size (mm²)	Code Words	Ampacity @ usual operation T (75ºC)	Max. Cont. T	Ampacity @ T max cont.
GSCH007/118	Type I (PMC-IV)	865,4	PARIS-9.5	1068	180	2226
GSCH007/040	Type II (MMC)	175	297-T16	402	210	863
GSCH007/042	Type II (MMC)	281	HAWK 477TW	530	210	1148
GSCH007/043	Type II (MMC)	390	OSWEGO	650	210	1427
GSCH007/044	Type II (MMC)	449	WABASH	709	210	1564
GSCH007/045	Type II (MMC)	590	CURLEW 1033 TW	841	210	1885
GSCH007/061	Type III (ACSS/TW)	197,9	ACSS/TW-198		210	
GSCH007/062	Type III (ACSS/TW)	280,9	ACSS/TW-280		210	
GSCH007/063	Type III (ACSS/TW)	364	ACSS/TW-364		210	
GSCH007/064	Type III (ACSS/TW)	454,9	ACSS/TW-455		210	
GSCH007/065	Type III (ACSS/TW)	546	ACSS/TW-546		210	
GSCH007/081	Type IV (GAP)	186,47	G(Z)TACSR-186	440	210	860
GSCH007/082	Type IV (GAP)	292,95	G(Z)TACSR-293	540	210	1180
GSCH007/083	Type IV (GAP)	384,5	G(Z)TACSR-385	640	210	1420
GSCH007/084	Type IV (GAP)	462,1	G(Z)TACSR-462	720	210	1610
GSCH007/085	Type IV (GAP)	553,25	G(Z)TACSR-553	800	210	1750

Conditions: 40 ºC ambient temperature, wind 0,61m/s, elevation 0m, sun radiation 1033W/m², emissivity and absorption, 0,5

ANNEX D – COMPARATIVE TABLES

Due to similarities of the technologies included in Type I conductors (PMC), it is possible to find sections from different technologies with very similar overall characteristics. Furthermore, it could be possible to choose anyone of them to fulfil the mechanical requirements of the same project, based on availability and needed ampacity.

Equivalents sections are presented in the following table based on similar outside diameter:

	Equivalents GS Type Codes					
Outside diameter (mm)	**PMC-I**	**PMC-II**	**PMC-II**	**PMC-II**	**PMC-III**	**PMC-IV**
17,1	GSCH007/001 ROVINJ	GSCH007/015 AMPERE				GSCH007/102 ROVINJ-5.5
18			GSCH007/023 186-AT1/28	GSCH007/028 THOMSON		
18,29-18,3	GSCH007/002 LINNET	GSCH007/016 KIRCHHOFF				GSCH007/105 LINNET-5.5
20,5	GSCH007/003 CASABLANCA	GSCH007/017 LENZ			GSCH007/070 CURIE	
21,79-21,8	GSCH007/004 LISBON	GSCH007/018 FARADAY	GSCH007/024 289-AT1/38	GSCH007/029 OHM	GSCH007/071 GALVANI	GSCH007/107 HAWK-6
23,5	GSCH007/005 DOVE	GSCH007/019 MAXWELL			GSCH007/072 FERMI	
25,1	GSCH007/006 GROSBEAK	GSCH007/020 VOLTA			GSCH007/073 HACK	GSCH007/110 GROSBEAK-6.5
25,4			GSCH007/025 377-AT1/64	GSCH007/030 FERRARIS	GSCH007/074 PLANCK	GSCH007/111 FLAMINGO-7
27,6-27,72	GSCH007/007 WARSAW	GSCH007/021 WHEATSTONE	GSCH007/026 459-AT1/64	GSCH007/031 HENRY	GSCH007/075 DIRAC	GSCH007/113 WARSAW-7.5
28,1-28,2	GSCH007/008 DRAKE	GSCH007/022 PACINOTTI			GSCH007/076 MEUCCI	GSCH007/114 DUBLIN-7.5
30,3-30,4			GSCH007/027 574-AT1/64	GSCH007/032 MARCONI	GSCH007/077 GAUSS	GSCH007/115 CARDINAL-8.0
33,4	GSCH007/010 SAN ANTONIO					GSCH007/117 BASIN-9.5

ANNEX E – COMMON LIST

COMMON LIST					09/09/2022
GS Type Code	**Type**	**Code Words**	**Distribution Company and Country**	**Country Code**	**TAM Description**
GSCH007/001	PMC-I	ROVINJ	Enel Brazil	T310454	CABO,217,3MM,ROVINJ,ACCC, 69/138,GSCH7/1
GSCH007/002	PMC-I	LINNET	Enel Brazil	T310072	CONDUTOR ALUMINIO ACCC LINNET 218,1mm², 69/138 kV, ALUMINIO 1350 COM ALMA DE FIBRA DE CARBONO,GSCH007/2
GSCH007/004	PMC-I	LISBON	Enel Brazil	T310453	CABO, 349,6MM,LISBON,ACCC, 69/138, GSCH7/4
GSCH007/005	PMC-I	DOVE	Enel Brazil	T310452	CABO,408,6MM,DOVE,ACCC, 69/138,GSCH7/5
GSCH007/008	PMC-I	DRAKE	Enel Brazil	T310451	CABO,590,6MM,DRAKE,ACCC, 69/138,GSCH7/8
GSCH007/015	PMC-II	AMPERE	Enel Brazil	T310450	CABO,216,5MM,AMPERE,ACCS, 69/138,GSCH7/15
GSCH007/016	PMC-II	KIRCHHOFF	Enel Brazil	T310449	CABO,247MM,KIRCHHOF,ACCS, 69/138,GSCH7/16
GSCH007/018	PMC-II	FARADAY	Enel Brazil	T310448	CABO,350MM,FARADAY,ACCS, 69/138,GSCH7/18
GSCH007/019	PMC-II	MAXWELL	Enel Brazil	T310447	CABO,408MM,MAXWELL,ACCS, 69/138,GSCH7/19
GSCH007/022	PMC-II	PACINOTTI	Enel Brazil	T310446	CABO,585MM,PACINOTT,ACCS, 69/138,GSCH7/22
GSCH007/023	PMC-II	186-AT1/28	Enel Brazil	T310445	CABO,224,7MM,AT1/28,ACPR, 69/138,GSCH7/23
GSCH007/024	PMC-II	289-AT1/38	Enel Brazil	T310444	CABO,339,5MM,AT1/38,ACPR, 69/138,GSCH7/24
GSCH007/026	PMC-II	459-AT1/64	Enel Brazil	T310443	CABO,548,1MM,AT1/64,ACPR, 69/138, GSCH7/26
GSCH007/028	PMC-II	THOMSON	Enel Brazil	T310442	CABO,232MM,THOMSON,TACCS ,69/138,GSCH7/28
GSCH007/029	PMC-II	OHM	Enel Brazil	T310441	CABO,340,1MM,OHM,T-ACCS, 69/138,GSCH7/29
GSCH007/031	PMC-II	HENRY	Enel Brazil	T310440	CABO,544MM,HENRY,T-ACCS, 69/138,GSCH7/31
GSCH007/040	MMC	297-T16	Enel Brazil	T310439	CABO,175MM,291T16,ACCRTW,69/138,GSCH7/40
GSCH007/042	MMC	HAWK 477 TW	Enel Brazil	T310173	CABO,281MM,HAWK,ACCR/TW,69/138,GSCH7/42
GSCH007/043	MMC	OSWEGO	Enel Brazil	T310172	CABO,390MM,OSWEG,ACCR/TW,69/138,GSCH7/43
GSCH007/045	MMC	CURLEW 1033 TW	Enel Brazil	T310171	CABO,590MM,CURLE,ACCR/TW,69/138,GSCH7/45
GSCH007/061	ACSS	ACSS/TW-198	Enel Brazil	T310170	CABO,197,9MM,ACCR/TW198,69/138,GSCH7/61
GSCH007/062	ACSS	ACSS/TW-280	Enel Brazil	T310169	CABO,280,9MM,ACCR/TW,69/138, GSCH7/62
GSCH007/063	ACSS	ACSS/TW-364	Enel Brazil	T310168	CABO,364MM,ACCR/TW,69/138, GSCH7/63
GSCH007/065	ACSS	ACSS/TW-546	Enel Brazil	T310167	CABO,546MM,ACCR/TW,69/138, GSCH7/65
GSCH007/081	GAP	GZTACSR-186	Enel Brazil	T310166	CABO,186,47MM,GZTACSR,69/138,GSCH7/81
GSCH007/082	GAP	GZTACSR-293	Enel Brazil	T310165	CABO,292,95MM,GZTACSR,69/138,GSCH7/82
GSCH007/084	GAP	GZTACSR-462	Enel Brazil	T310164	CABO,462,1MM,GZTACSR,69/138, GSCH7/84
GSCH007/004	PMC-I	LISBON	Edistribución España	310008	CONDUCTOR ALTA CAPACIDAD ACCC LISBON SEGUN NORMA GSCH007 (GSCH007/004)
GSCH007/040	MMC	297-T16	Edesur Argentina	0101-0493	Conductor de alta capacidad (ACCR) - 175 mm2
GSCH007/042	MMC	HAWK 477 TW	Edesur Argentina	0101-0494	Conductor de alta capacidad (ACCR) - 281 mm2
GSCH007/044	MMC	WABASH	Edesur Argentina	0101-0495	Conductor de alta capacidad (ACCR) - 449 mm2

Technical specification code: GRI-GRI-MAT-E&C-0001

Version no. 3 dated 09/09/2022

Subject: GSCH007 – High Temperature Bare Conductor.

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

COMMON LIST					09/09/2022
GS Type Code	**Type**	**Code Words**	**Distribution Company and Country**	**Country Code**	**TAM Description**
GSCH007/004	PMC-I	LISBON	Codensa Colombia	310003	Conductor de alta capacidad ACCC 349.6 mm2 (Lisbon)
GSCH007/007	PMC-I	WARSAW	Codensa Colombia	310004	Conductor de alta capacidad ACCC 567.8 mm2 (warsaw)
GSCH007/020	PMC-II	VOLTA	Codensa Colombia	310002	Conductor de alta capacidad ACCS 467.9 mm2 (Volta)
GSCH007/002	PMC-I	LINNET	Enel Chile	310008	CONDUCTOR ACCC LINNET 245,9 MM2
GSCH007/006	PMC-I	GROSBEAK	Enel Chile	310005	CONDUCTOR ACCC GROSBEAK 481,1 MM2
GSCH007/009	PMC-I	HAMBURGO	Enel Chile	310006	CONDUCTOR ACCC HAMBURGO 606,7 MM2
GSCH007/010	PMC-I	SAN ANTONIO	Enel Chile	310007	CONDUCTOR ACCC SAN ANTONIO 822,4 MM2