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SINGLE PHASE MEDIUM VOLTAGE CABLES FOR PRIMARY SUBSTATIONS AND SPECIAL APPLICATIONS

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1 SCOPE

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

<i>Enel Codensa</i>	<i>Colombia</i>
<i>Enel distribución Perú</i>	<i>Perú</i>
<i>Edesur</i>	<i>Argentina</i>
<i>e-distributie Banat</i>	<i>Romania</i>
<i>e-distributie Dobrogea</i>	<i>Romania</i>
<i>e-distributie Muntenia</i>	<i>Romania</i>
<i>e-distribuzione</i>	<i>Italy</i>
<i>Enel distribución Chile</i>	<i>Chile</i>
<i>Enel Distribuição Ceará</i>	<i>Brazil</i>
<i>Enel Distribuição Rio</i>	<i>Brazil</i>
<i>Enel Distribuição Goiás</i>	<i>Brazil</i>
<i>Enel Distribuição Sao Paulo</i>	<i>Brazil</i>

This standard specifies the construction, dimensions and test requirements that must be accomplished by medium voltage cables with rated voltage $U_0/U (U_{max}) = 12/20(24)$ kV and $18/30(36)$ kV to be used in primary substations and other special applications by the utilities mentioned above.

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

2 LIST OF COMPONENTS

The list of components with the main requirements, which is an integral part of the present document, is reported in the common list attached.

3 REFERENCE LAWS AND STANDARDS


The list of reference laws and standards are mentioned below in this document.

3.1 Laws


See Local Sections.

3.2 European & International Standards

- EN 50575 “Power, control and communication cables - Cables for general applications in construction works subject to reaction to fire requirements”.
- EN 13501-6 “Fire classification of construction products and building elements - Part 6: Classification using data from reaction to fire tests on electric cables”.

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- HD 605 S2 “Electric cables - Additional test methods”.
- HD 620 S2 “Distribution cables with extruded insulation for rated voltages from 3,6/6 (7,2) kV up to and including 20,8/36 (42) kV.
- IEC 60228 “Conductors of insulated cables”.
- IEC 60230 “Impulse tests on cables and their accessories”.
- 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 60502-2 “Power cables with extruded insulation and their accessories for rated voltages from 1 kV (Um = 1,2 kV) up to 30 kV (Um = 36 kV) - Part 2: Cables for rated voltages from 6 kV (Um = 7,2 kV) up to 30 kV (Um = 36 kV)”.
- 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 60811-100 “Electric and optical fibre cables - Test methods for non-metallic materials - Part 100: General”.
- 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 60811-401 “Electric and optical fibre cables - Test methods for non-metallic materials - Part 401: Miscellaneous tests - Thermal ageing methods - Ageing in an air oven”.
- IEC 60811-402 “Electric and optical fibre cables - Test methods for non-metallic materials - Part 402: Miscellaneous tests - Water absorption tests”.
- IEC 60811-406 “Electric and optical fibre cables - Test methods for non-metallic materials - Part 406: Miscellaneous tests - Resistance to stress cracking of polyethylene and polypropylene compounds”.
- IEC 60811-412 “Electric and optical fibre cables - Test methods for non-metallic materials - Part 412: Miscellaneous tests - Thermal ageing methods - Ageing in an air bomb”
- 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 test for insulations”.

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- IEC 60811-503 “Electric and optical fibre cables - Test methods for non-metallic materials - Part 503: Mechanical tests - Shrinkage test for sheaths”.
- IEC 60811-505: “Electric and optical fibre cables - Test methods for non-metallic materials - Part 505: Mechanical tests - Elongation at low temperature for insulations and 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 60811-509: “Electric and optical fibre cables - Test methods for non-metallic materials - Part 509: Mechanical tests - Test for resistance of insulations and sheaths to cracking (heat shock test)”.
- IEC 60811-510 “Electric and optical fibre cables - Test methods for non-metallic materials - Part 510: Mechanical tests - Methods specific to polyethylene and polypropylene compounds - Wrapping test after thermal ageing in air”.
- IEC 60811-511 “Electric and optical fibre cables - Test methods for non-metallic materials - Part 511: Mechanical tests - Measurement of the melt flow index of polyethylene compounds”.
- 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 60811-606 “Electric and optical fibre cables - Test methods for non-metallic materials - Part 606: Physical tests - Methods for determining the density”.
- IEC 60811-607 “Electric and optical fibre cables - Test methods for non-metallic materials - Part 607: Physical tests - Test for the assessment of carbon black dispersion in polyethylene and polypropylene”.
- IEC 60885-2 “Electrical test methods for electric cables -- Part 2: Partial discharge tests”.
- IEC 60885-3 “Electrical test methods for electric cables. Part 3: Test methods for partial discharge measurements on lengths of extruded power cables”.
- IEC 61034-2 “Measurement of smoke density of cables burning under defined conditions -- Part 2: Test procedure and requirements”.
- IEC 62230 “Electric cables - Spark-test method”.
- ISO 2859-1 “Sampling procedures for inspection by attributes -- Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection”.

3.3 Local Standards

See Local Section.

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3.4 Replaced Local Standards

See Local Section.

4 CABLES CLASSIFICATION

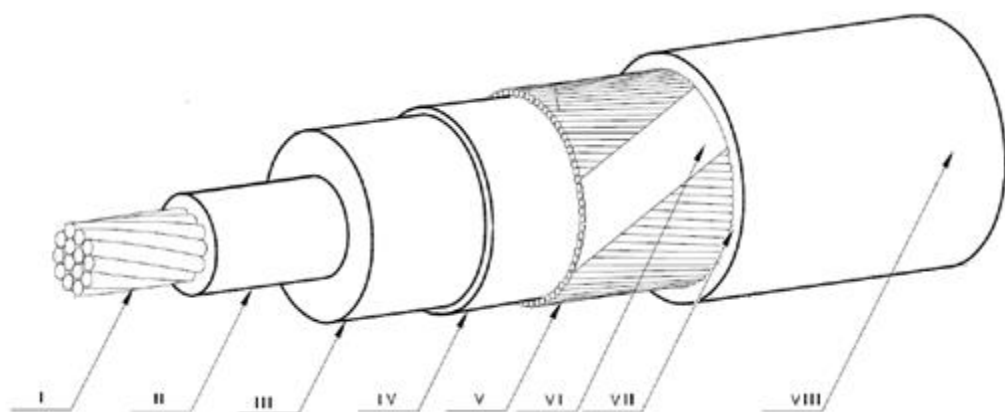
In Table 1 a general description of types of cables depicted in this standard are summarized.

Detailed characteristics are described in section 5.

DESCRIPTION
Single-core cables, with copper conductor, high modulus ethylene propylene rubber (HEPR) insulation, copper wires earth screen and polyolefin outer sheath.

Table 1 Type of cables


Typical lay-out of type of cables in single core configuration are shown in Figure 1.



- | | | |
|-----------------------|-------------------------------|-----------------------------------|
| I – Conductor | IV – Insulation screen | VII – Longitudinal watertightness |
| II – Conductor screen | V – Copper wires earth screen | VIII – Outer sheath |
| III – Insulation | VI – Copper equalizing tape | |

Figure 1 Type I

Note: Figure is for illustrative purposes only.

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5 DESIGN AND MANUFACTURE

5.1 Conductor

5.1.1 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 2 copper conductors for cables specified in this document are depicted

Nominal cross-section [mm ²]	Minimum number of wires	Diameter of conductors [mm]		Maximum resistance of conductor at 20°C [Ω/km]
		Minimum	Maximum	
150	15	13,7	15,0	0,124
240	34	17,6	19,2	0,0754
400 ¹	53	22,3	24,6	0,0470
630	53	28,7	32,5	0,0283
1000 ²	53	35	41	0,0176

Table 2 Stranded compacted copper conductors characteristics

5.2 Conductor screen

It shall consist of a fully bonded layer of black semi-conductive thermosetting 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 minimum thickness measured and accepted at any point shall not be less than 0,3 mm. In addition, the average of all the measures shall not be less than the nominal thickness (0,5 mm).

5.3 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 high modulus ethylene propylene rubber (HEPR), compliant with the characteristics required herein this document. Such HEPR compound can comply all the characteristics described in HD 620 S2 part 1 for DIH 2 compound.

HEPR insulation compound shall allow maximum conductor temperatures of 105 °C in normal operation and 250 °C under short circuit condition by at least 5 seconds.

¹ to be used only for extraordinary cases to cover maintenance and replacement activities on existing plants

² to be used only for extraordinary cases to cover maintenance and replacement activities on existing plants

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The insulation minimum thickness measured and accepted at any point of the cable shall not be less than 90% of the nominal value minus 0,1 mm.

$$t_{\min} \geq 0,9 \cdot t_n - 0,1$$

and additionally:

$$\frac{t_{\max} - t_{\min}}{t_{\max}} \leq 0,15$$

Where:

t_{\max} : maximum insulation thickness in millimeters

t_{\min} : minimum insulation thickness in millimeters

t_n : nominal thickness in millimeters

In Table 3 nominal and minimum thickness are shown.

Note: t_{\max} and t_{\min} are measured at the same cross section.

Rated Voltage U _o /U (U _{max}) [kV]	Nominal thickness [mm]	Minimum thickness [mm]
12/20 (24)	5,5	4,9
18/30 (36)	8,0	7,1

Table 3 Insulation thickness values.

5.4 Insulation screen

A black layer of semi-conductive thermosetting 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 easily strippable without using tools or heat. The compound mechanical properties before ageing are: minimum tensile strength same as 7 N/mm² and a minimum elongation at break same as 150%.

Unless otherwise indicated in the Common List, the insulation screen minimum thickness measured and accepted at any point shall not be less than 0,3 mm. In addition, the average of all the measures shall not be less than the nominal thickness (0,5 mm).

5.5 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 this layers.

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5.6 Longitudinal water-tightness (Only when requested)

A tape made of suitable semi-conductive material shall be applied in order to achieve longitudinal water-tightness in the region of the metal layers according to IEC 60502-2 §19.24. 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%.

Hygroscopic powder without supporting elements is not allowed.

5.7 Earth screen

The earth screen shall be made with a continuous crown of annealed copper wires, with diameter between 0,5 and 1,0 mm, arranged in an open helix with step not greater than 20 times the cable diameter below the metallic screen.. Maximum separation of 4 mm between two adjacent wires. A clearance between 4 and 8 mm is admissible in 5 % of the interstices between the wires (the lower whole number to be rounded). Total geometric cross-section of the screen wires shall be 16 mm² minimum.

For equalizing purposes an annealed copper binder tape of at least 1 mm² shall be applied over the copper wires crown. The pitch of such tape shall not be higher than four times the diameter below the binder tape.

The mechanical clamping of the copper wires shall be ensured without the copper binder tape.

If necessary, the continuity of the wires of the earth screen shall be obtained by means of weld.

Minimum Cross-section [mm ²]	Maximum resistance at 20 °C [Ω/km]	Wires diameter [mm]
16	1,15	0,5-1,0

Table 4 - copper wires screen main characteristics

5.8 Outer Sheath

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

The material shall be polyolefin compliant with the characteristics required herein. Such Polyolefin compound can comply all the characteristics described in HD 620 S2 part 1 for DMZ2 compound.

The outer sheath shall be free from heavy metal, halogens and hydrocarbons.


Unless otherwise indicated in local sections, 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 0,15 mm.

$$t_{min} \geq 0,85 t_n - 0,15$$

Where:

t_{min} : minimum thickness in millimeters

t_n : nominal thickness in millimeters

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Cross-section [mm ²]	Nominal thickness [mm]	Minimum thickness [mm]
150	2,2	1,7
240	2,2	1,7
400	2,75	2,2
630	2,75	2,2
1000	3,2	2,6

Table 5 – DMZ2 outer sheath thickness

The outer sheath color shall be red with two grey longitudinal stripes. The width of the colored stripes shall be between 5 mm and 10 mm, being laid at 180° each other.

The minimum fire reaction class shall be **Eca**³.

5.9 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 105 °C
- Ambient air temperature 40 °C
- Ground temperature 20 °C
- Depth of laying 0,8 m
- Soil thermal resistivity 1,5 K m/W
- Earthenware ducts thermal resistivity 1,2 K m/W

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

- Conductor initial temperature 105 °C
- Conductor final temperature 250 °C
- Copper wires screen initial temperature 95 °C
- Copper wires screen final temperature 200 °C

³ For countries not belonging to the EU, the classified class is not required but the cable shall be compliant with: "Test for vertical flame propagation for a single insulated wire or cable - Procedure for 1 kW pre-mixed flame" (IEC 60332-1-2)

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- Short-circuit duration: 0,5 s and 1 s

For reference values see local section.

5.10 Cable designation and marking

5.10.1 Cable designation

See Local Section.

5.10.2 Marking

The marking shall 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 2.5.4 of standard HD 605.

Specific characteristics are detailed in Local Section.

6 TESTS

6.1 Test classification

6.1.1 Acceptance tests

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

6.1.2 Routine tests

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

6.1.3 Sample test

Sample tests are carried out over samples taken from a complete cable (See Table 9 in sub-clause 6.2 for sampling) in order to verify that the finished product meet the design specifications.

6.1.4 Type test


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 cable covered herein with a specific cross-section, rated voltage and construction characteristics, the type approval could be accepted as valid as long as the following conditions are met:

- The conductor cross-section is not larger than that of the tested cable.
- The cable as 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 not exceeds that of the tested cable.

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

Cables shall undergo type tests and acceptance tests for type approval.

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6.2 Sampling and acceptance criteria

The supplier shall perform the sampling tests following a single sampling plan for normal inspection, AQL=1,5%, Level I in compliance with standard ISO 2859-1, as long as the resulting minimum number of samples (8) does not exceed 25% of the total lot size. In such case, the number of samples shall be 25% of the total lot size rounded down to the nearest unit.

The routine tests shall be performed at 100% of delivered spool.

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

- the tests are performed as required by the relevant technical specifications and technical Standards;
- the sampling plans adopted by the Supplier are in compliance with the aforementioned ones;
- the performed test results are properly recorded;
- the supplier demonstrates that the components/materials features do not vary during further production phases after the test.

The reports of the acceptance tests performed by the supplier shall be prepared and retained, for a possible verification by Enel inspectors.

The supplier shall be available to repeat the tests in the presence of Enel's Inspector, on a "reduced" sample of the supply lot, defined as follows:


- routine test: the minimum between a single sampling plan for normal inspection, AQL=1%, Level I and 1/3 of the total number of delivered spools (rounded down to the nearest unit);
- sample test: 1/2 of the sampling (rounded down to the nearest unit) already adopted for the sample test independently performed by the supplier (Enel inspector can choose to perform the test on spools already tested by the Supplier or on others from the lot).

In case of repetition of routine test attended by Enel Inspector, the spark test is not applicable.

The negative result of a single test will result in the rejection of the lot or, when possible, in the repetition of the test on all the units, in order to accept only the compliant ones.


If only a single spool is purchased, it shall be tested according to what is indicated for a single sample.

On a spool among those subjected to the electrical resistance measurement, shall be performed the verification of the total length of the cable, that shall be not shorter than that declared by the supplier by more than 0,5 m.

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6.3 Routine tests list

N°	Test	Requirements	Test method
1	Voltage Test Test voltage Test duration Test Result	3,5 U _o 5 min No breakdown	IEC 60502-2 sub-clause 16.4
2	Conductor electrical resistance measurement	See sub-clause 5.1	IEC 60502-2 sub-clause 16.2
3	Earth Screen electrical resistance measurement	See sub-clause 5.7	IEC 60502-2 sub-clause 16.2
4	Partial discharge test Applied voltage before test Applied voltage duration Max. discharge magnitude Sensitivity level	After Voltage test N°1 2 U _o ≤ 60 s 5 pC ≤ 3 pC	IEC 60885-3
5	Outer sheath voltage test (spark test) Test result Test voltage DC AC	No breakdown 25 kV 15 kV	IEC 62230

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6.4 Sample tests list

N°	Test	Requirements	Test method
1	Conformity to the approved type e.g.: marking, colors, number conductor wires, insulation and outer sheath application.	Cables shall comply characteristics described herein	Constructive characteristics, i.e. marking, number of conductor wires, colors shall be inspected by visual examination.
2	Cable mass per unit length	The value shall be recorded	HD 605 sub-clause 2.1.13.1
3	Conductor diameter measurement	See sub-clause 5.1	IEC 60811-203
4	Number of conductor wires	See sub-clause 5.1	Visual examination
5	Conductor screen thickness measurement	See sub-clause 5.2	IEC 60811-201
6	Insulation thickness measurement	See sub-clause 5.3	IEC 60811-201
7	Insulation mechanical properties Before ageing on sample Minimum tensile strength Minimum elongation at break Minimum elastic modulus at 150% elongation	8,5 MPa 200% 4,5 MPa	IEC 60811-501
8	Insulation hot set test Temperature Duration Mechanical stress Maximum elongation under load Maximum residual elongation	250 °C 15 min 0,20 MPa 100 % 10 %	IEC 60811-507
9	Insulation screen thickness measurement	See sub-clause 5.4	IEC 60811-202
10	Insulation screen strippability test (at 20 °C) - only before ageing Min. force required Max. force required	4 N 45 N	IEC 60502-2 sub-clause 19.23
11	Voltage Test (Complete cable) ⁴ Test voltage Test duration Sample length Test Result	4 U _o 4 h > 5 m No breakdown	IEC 60502-2 sub-clause 17.9

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N°	Test	Requirements	Test method
12	Copper wires screen Cross-sectional area Minimum number of wires Clearance between wires Pitch of wires and binder tape	See sub-clause 5.7	HD 605 sub clause 2.1.4.3
13	Sheath thickness measurement	See sub-clause 5.8	IEC 60811-202
14	Sheath mechanical properties Before ageing on sample Minimum tensile strength Minimum elongation at break	12,5 MPa 300%	IEC 60811-501


⁴ when repeated by Enel inspector the test shall be performed only in one phase of each sample

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6.5 Type tests list

N°	Test	Requirements	Test method
1	Sequential electrical tests Sample	15 m of cable 15 to 20 m	
1.1	Partial discharge test Test Voltage Discharge magnitude	2 U ₀ ≤ 5 pC	IEC 60885-3
1.2	Partial discharge measurement after bending test Cycles Test cylinder Discharge magnitude	3 20(d+D)±5% ≤ 5 pC	IEC 60502-2 sub-clause 18.2.4
1.3	Tan δ measurement as a function of the temperature Test voltage Tan δ at (90 ± 3) °C Tan δ at (130 ± 5) °C	U ₀ ≤ 0,015 ≤ 0,020	IEC 60502-2 sub-clause 18.2.6
1.4	Thermal cycle test followed by partial discharge test Discharge magnitude	≤ 5 pC	IEC 60502-2 sub-clause 18.2.7
1.5	Impulse test followed by a voltage test ⁵ Test result	No breakdown	IEC 60502-2 sub-clause 18.2.8
1.6	High voltage test A.C test voltage Duration test Test result	4 U ₀ 4 h No breakdown	IEC 60502-2 sub-clause 18.2.9


⁵ For cables type with rated voltage 18/30(36) U₀/U (U_m) (kV) the rated impulse withstand voltage (kV) shall be 200 kV peak.

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N°	Test	Requirements	Test method
2	Insulation resistance at 105°C Volume resistivity [MΩ·km]	5,00	IEC 60502-2 sub-clause 18.3.3
3	Insulation mechanical properties After ageing in air oven on sample Temperature Duration T1 <i>Minimum Tensile strength</i> Maximum variation T1/T0 <i>Minimum elongation at break</i> Maximum variation T1/T0	150 °C 168 h ±30% ±30%	IEC 60811-501 IEC 60811-401
4	Insulation water absorption test (Gravimetric method) Temperature Duration Maximum variation of mass	100°C 24 h 3 mg/cm ²	IEC 60811-402
5	Insulation mechanical properties After ageing in air bomb at 0,55 Mpa (on sample) Temperature Duration T1 <i>Minimum Tensile strength</i> Maximum variation T1/T0 <i>Minimum elongation at break</i> Maximum variation T1/T0	127 °C 40 h ±30% ±30%	IEC 60811-501 IEC 60811-412
	Insulation screen mechanical properties Minimum tensile strength Minimum elongation at break	7 MPa 150%	IEC 60811-501 sub clause 4.3
	Insulation screen strippability test (at 0 °C, 20 °C, 40 °C) Min. force required Max. force required	4 N 45 N	IEC 60502-2 sub-clause 19.23

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N°	Test	Requirements	Test method
10	Sheath mechanical properties After ageing on sample Temperature Duration T1 Minimum Tensile strength Maximum variation T1/T0 Minimum elongation at break Maximum variation T1/T0	 110°C 240 h -±25% - ±25%	 IEC 60811-501 IEC 60811-401
11	Sheath pressure test at high temperature Duration Temperature coefficient k Maximum depth of indentation	 6 h 110±5 °C 0,7 50%	 IEC 60811-508
12	Test at low temperature (Sheath) Elongation test at low temperature Temperature Minimum elongation	 -15±2 °C 20%	 IEC 60811-505
13	Sheath shrinkage test Cycles Duration Temperature Maximum shrinkage	 5 5 h 80±2 °C 3%	 IEC 60811-503
14	Sheath abrasion resistance test Temperature Mass Speed Number of scratches	 20±5 °C 20 kg 0,3 ±15% m/s 8	 HD 605 Sub-clause 2.4.22

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N°	Test	Requirements	Test method
15	Sheath water absorption test Temperature Duration Maximum variation of mass	(Gravimetric method) 85±2 °C 336 h 5 mg/cm ²	IEC 60811-402
16	Sheath UV ray resistance test Tensile strength max variation Elongation at break max variation Discoloration	15% 15% Poor	HD 605 Sub clause 2.4.23
17	Test under fire conditions (Complete cable)	The cable shall be classified Minimum class Eca ⁶ IEC 60332-1-2 50 mm – 540 mm	EN 50575 sub-clause 4.1
18	Non contamination test (Complete cable) HEPR Insulation Temperature Duration T2 <i>Tensile strength</i> max variation T2/T0 <i>Elongation at break.</i> Max variation T2/T0 PO Sheath Temperature Duration T1 <i>Elongation at break</i> Maximun variation T1/T0	110 °C 168 h ±30% ±30% 110 °C 168 h ±25%	IEC 60811-501 IEC 60811-401 sub-clause 4.2.3.4
19	Longitudinal water-tightness test	IEC 60502-2 Annex F	IEC 60502-2 Annex F
20	Tear resistance test Temperature Minimum resistance	20±5 °C 12 MPa	HD605 sub-clause 2.2.2.2
21	Heavy metal content lead	<0,5	spectrophotometer
22	Low degree of acidity of gases evolved during combustion pH: minimum conductivity: maximum	4,3 pH 10 µS/mm	IEC 60754-2

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7 GUARANTEE

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

8 CONDITIONS OF SUPPLY

See Local Section


⁶ For countries not belonging to the EU, the classified class is not required but the cable shall be compliant with: "Test for vertical flame propagation for a single insulated wire or cable - Procedure for 1 kW pre-mixed flame" (IEC 60332-1-2)

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9 TECHNICAL CHECK-LIST

The following chart indicates the minimum technical information that suppliers shall give in the tender.

Item	Description	Unit	Required	Offered
1	GENERAL INFORMATION			
1.1	Supplier	-		
1.2	Factory	-		
1.3	Supplier Product Designation	-		
2	MAIN FEATURES			
2.1	Distribution Company and Country	-		
2.2	Country Code	-		
2.3	GS Type Code			
2.4	Rated Voltage U ₀ /U (U _{max})	[kV]		
2.6	Disposition	[n x mm ²]		
3	CONDUCTOR			
3.1	Material	-		
3.2	Nominal cross-section	[mm ²]		
3.3	Minimum number of wires of conductor	-		
3.4	Minimum diameter	[mm]		
3.5	Maximum diameter	[mm]		
3.6	Maximum resistance of conductor at 20°C	[Ω/ km]		
3.7	Stranding Type	-		
4	CONDUCTOR SCREEN			
4.1	Material			
4.2	Nominal thickness	[mm]		
4.3	Minimum thickness	[mm]		
4.4	Maximum potential gradient at U ₀	[kV/mm]		
5	INSULATION			
5.1	Material	-		
5.2	Nominal thickness	[mm]		
5.3	Minimum thickness	[mm]		
5.4	Color	-		
6	INSULATION SCREEN			
6.1	Material			
6.2	Nominal thickness	[mm]		
6.3	Minimum thickness	[mm]		
6.4	Maximum potential gradient at U ₀	[kV/mm]		

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Item	Description	Unit	Required	Offered
7	LONGITUDINAL WATER-TIGHTNESS			
7.1	Material			
7.2	Nominal thickness	[mm]		
7.3	Minimum overlap	[%]		
8	EARTH SCREEN			
8.1	Copper wires screen cross-section nominal	[mm ²]		
8.2	Maximum resistance at 20°C	[Ω/ km]		
8.3	Wires diameter	[mm]		
8.4	Minimum Number of wires			
9	OUTER SHEATH			
9.1	Material			
9.2	Nominal thickness	[mm]		
9.3	Minimum thickness	[mm]		
9.4	Color			
10	ADDITIONAL FEATURES			
10.1	Maximum total diameter	[mm]		
10.2	Drum Type			
10.3	Total length in one drum	[m]		
10.4	One phase weight	[kg/km]		
10.5	Total weight	[kg/km]		
10.6	Ampacity (see clause 5.9 for conditions)	[A]		
10.7	Conductor SC current (see clause 5.9)	[kA]		
10.8	Earth screen SC current (see clause 5.9)	[kA]		
10.10	Fire reaction Class (EN 50575 if apply)			
10.11	Positive sequence reactance	[Ω/ km]		
10.12	Positive sequence capacitance	[μF/km]		
10.13	Zero sequence resistance at 20 °C	[Ω/ km]		
10.14	Zero sequence reactance	[Ω/ km]		
10.15	Zero sequene capacitance	[μF/km]		
10.16	Minimum bending radius	[mm]		
10.17	Maximum pulling tension	[kg]		
10.18	Min. admissible installation temperature	[°C]		

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9.1 Technical check-list examples

9.1.1 12/20(24) kV 1x630 mm²

Item	Description	Unit	Required	Offered
1	GENERAL INFORMATION			
1.1	Supplier	-		
1.2	Factory	-		
1.3	Supplier Product Designation	-		
2	MAIN FEATURES			
2.1	Distribution Company and Country	-	ED-Peru	
2.2	Country Code	-	330020	
2.3	GS Type Code		GSCC023/04	
2.4	Nominal Voltage U ₀ /U (U _{max})	[kV]	12/20(24)	
2.5	Type I	-	Type I	
2.6	Disposition	[n x mm ²]	1x630	
3	CONDUCTOR			
3.1	Material	-	Copper	
3.2	Nominal cross-section	[mm ²]	630	
3.3	Minimum number of wires of conductor	-	53	
3.4	Minimum diameter	[mm]	28,7	
3.5	Maximum diameter	[mm]	32,5	
3.6	Maximum resistance of conductor at 20°C	[Ω/ km]	0,0283	
3.7	Stranding Type	-	Circular Compacted Class 2	
4	CONDUCTOR SCREEN			
4.1	Material		Informative	
4.2	Nominal thickness	[mm]	0,5	
4.3	Minimum thickness	[mm]	0,3	
4.4	Maximum potential gradient at U ₀	[kV/mm]	Informative	
5	INSULATION			
5.1	Material	-	HEPR	
5.2	Nominal thickness	[mm]	5,5	
5.3	Minimum thickness	[mm]	4,9	
5.4	Color	-	Informative	
6	INSULATION SCREEN			
6.1	Material		informative	
6.2	Nominal thickness	[mm]	0,5	
6.3	Minimum thickness	[mm]	0,3	
6.4	Maximum potential gradient at U ₀ (info)	[kV/mm]	Informative	
7	LONGITUDINAL WATER-TIGHTNESS			

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7.1	Material		Informative	
7.2	Nominal thickness	[mm]	Informative	
7.3	Minimum overlap	[%]	10	
Item	Description	Unit	Required	Offered
8	EARTH SCREEN			
8.1	Copper wires screen cross-section	[mm ²]	16	
8.2	Maximum resistance at 20°C	[Ω/ km]	1,15	
8.3	Wires diameter	[mm]	0,5-1,0	
8.4	Minimum Number of wires		30	
9	OUTER SHEATH			
9.1	Material		PO	
9.2	Nominal thickness	[mm]	2,75	
9.3	Minimum thickness	[mm]	2,2	
9.4	Color		red with two grey longitudinal stripes	
10	ADDITIONAL FEATURES			
10.1	Maximum total diameter	[mm]	Informative	
10.2	Drum Type		Informative	
10.3	Total length in one drum	[m]	Informative	
10.4	One phase weight	[kg/km]	Informative	
10.5	Total weight	[kg/km]	Informative	
10.6	Ampacity (see clause 5.9 for conditions)	[A]	Calculated	
10.7	Conductor SC current (see clause 5.9)	[kA]	Informative	
10.8	Earth screen SC current (see clause 5.9)	[kA]	Informative	
10.10	Fire reaction Class (EN 50575 if apply)		No	
10.11	Positive sequence reactance	[Ω/ km]	Informative	
10.12	Positive sequence capacitance	[μF/km]	Informative	
10.13	Zero sequence resistance at 20 °C	[Ω/ km]	Informative	
10.14	Zero sequence reactance	[Ω/ km]	Informative	
10.15	Zero sequence capacitance	[μF/km]	Informative	
10.16	Minimum bending radius	[mm]	Informative	
10.17	Maximum pulling tension	[kg]	Informative	
10.18	Min. admissible installation temperature	[°C]	Informative	

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LOCAL SECTION A – Codensa


N°	TITLE	DESCRIPTION
3.3	Local Standards	<ul style="list-style-type: none"> • RETIE- Reglamento técnico de instalaciones eléctricas. • Resolución CREG No.024 – Comisión de Regulación de Energía y Gas • Resolución CREG No.070 - Comisión de Regulación de Energía y Gas • NTC1340 Tensiones y frecuencia nominales en sistemas de energía eléctrica en redes de servicio público. (20/34,5/(37,95) kV).
5.10.1	Cable designation	<p>R: Round Stranded copper conductor G7: HEPR H1: Copper wires screen E: Polyolefin outer sheath U₀/U (U_{max}) = Rated voltage in kV Cross-section [mm²] Example of designation code: RG7H1E 12/20 (24) kV 1x630 mm² Single core 630 mm² round compact copper conductors, insulated with HEPR, with a copper wires earth screen, and polyethylene outer sheath</p>
5.10.2	Marking	<p>Markings shall be indelible spaced from each other 1 meter maximum. The following information shall be marked: Manufacturer name or trademark (XXXX)Enel Condensa Month and Year of manufacture Purchase Order N° Rated Voltage U₀/U(U_{max}) Insulation material Cable cross-section [mm²] Metric marking Marking example: ENEL CODENSA ORDEN NUMBER XXXXX RG7H1E 12/20 (24) kV 1x630 mm² 09/2020 0000m</p>
8	CONDITIONS OF SUPPLY	<p>Packaging and Labelling Cables shall be delivered on spools made of wood or metal, such spool will not be returned. Characteristics are indicated in Figure A, dimensions are depicted in Table A. The total length of the supplied cable shall not be less than that requested in the purchase order and shall not be longer by any more than 5%. The maximum gross weight of the packaged spool shall not exceed 3500 kg.</p>



LOCAL SECTION A – Codensa


N°	TITLE	DESCRIPTION
8	CONDITIONS OF SUPPLY	<p>The ends of the cables on each spool shall be protected with caps or hoods that prevent the entry of moisture. These ends internally secured to the spools, shall be mechanically protected against possible damages resulting from handling and transportation of each spool, leaving both ends accessible through the use of an internal helix or reel on each spool. The distance between the outer layer of the cable and the spool shall be more than 50 mm.</p> <p>When distance between manufacturing facilities and Enel Codensa storage center is less than 200 km and is necessary only one mean of transportation,</p> <p>It is mandatory to use internal helix for cables cross-section greater of equal to 120 mm². However, moisture protection on both visible ends of the cables, mechanical protection, and careful handling shall be applied.</p> <p>Some Purchase orders could request 2,000 m of maximum length per spool and/or pre-joined cables.</p> <p><u>The supplier shall process RETIE certification in order to deliverer the order.</u></p> <p>The supplier shall process the RETIE Product Compliance Certificate with the follow-up audits and expiration date in force after the estimated date of deliver.”</p> <p>Spools made of wood shall be treated according to the international requirements for the control of plant disease, avoiding the compounds “Pentachlorophenol” and “Creosote”. The treatment must include, at least: highly toxic to xylophagous organisms, high penetration and holding power, chemical stability, non-corrosive substances to metals that could affect the physical characteristics of wood.</p> <div data-bbox="427 1467 1468 2038" style="text-align: center;"> </div>

Figure A

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LOCAL SECTION A – Codensa

N°	TITLE	DESCRIPTION															
8	CONDITIONS OF SUPPLY	<p><u>Dimensions:</u></p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">A⁽¹⁾</th> <th style="text-align: center;">B</th> <th style="text-align: center;">C⁽¹⁾</th> <th style="text-align: center;">D⁽²⁾</th> <th style="text-align: center;">E</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">mm</td> <td style="text-align: center;">mm</td> <td style="text-align: center;">mm</td> <td style="text-align: center;">mm</td> <td style="text-align: center;">mm</td> </tr> <tr> <td style="text-align: center;">2000</td> <td style="text-align: center;">(3)</td> <td style="text-align: center;">1120</td> <td style="text-align: center;">80</td> <td style="text-align: center;">(4)</td> </tr> </tbody> </table> <p style="text-align: center;">Table A</p> <p>Notes:</p> <p>(1) Maximum value. (2) Minimum value. (3) Two times the minimum bending radius indicated by the supplier. (4) 300 or 180 mm according to spool type (large or small, respectively)</p> <p>The spools shall contain:</p> <ul style="list-style-type: none"> • An external protection built with wooden flanges fixed on the wooden spools or some equivalent for metal spools, being secured with tapes or straps. • Indication with an arrow of the rolling direction. • A stainless steel plate for identification purposes. Such plate shall be applied in both flanges and shall have the following information (in Spanish): <ol style="list-style-type: none"> 1) Manufacturer name 2) Country of origin 3) Enel Codensa 4) Purchase order N° 5) Rated Voltage U₀/U (U_{max}) 6) Insulation material 7) Cable cross-section [mm²] 8) Spool number of the corresponding delivered batch 9) Net and gross weight [kg] 10) Configuration type (unipolar, triplex, quadruplex). 11) Cable length [m] 	A ⁽¹⁾	B	C ⁽¹⁾	D ⁽²⁾	E	mm	mm	mm	mm	mm	2000	(3)	1120	80	(4)
A ⁽¹⁾	B	C ⁽¹⁾	D ⁽²⁾	E													
mm	mm	mm	mm	mm													
2000	(3)	1120	80	(4)													
9	TECHNICAL CHECK-LIST	Besides all technical information provided according the common part, ISO certifications, Certification of conformity with this Global Standard and RETIE certification shall be indicated.															

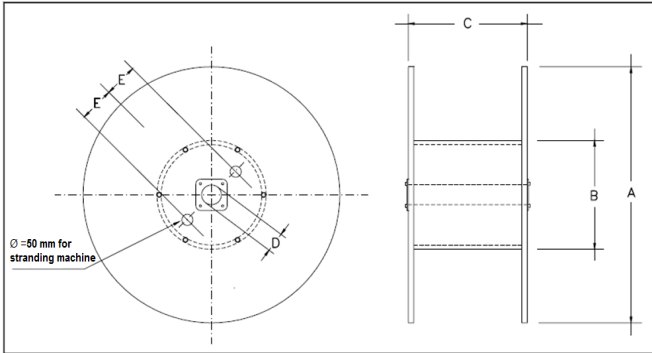
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LOCAL SECTION B – Enel distribución Perú

N°	TITLE	DESCRIPTION
3.3	Local Standards	<ul style="list-style-type: none"> • CÓDIGO NACIONAL DE ELECTRICIDAD (CNE) – SIMINISTRO – 2011 • NORMA TÉCNICA DE CALIDAD DE LOS SERVICIOS ELECTRICOS
3.4	Replaced Local Standards	<ul style="list-style-type: none"> • MAT-OYM-NDS-20-024-ESP_0
5.10.1	Cable designation	<p>R: Round Stranded G7: HEPR (high modulus ethylene propylene rubber) H1: Copper wires screen E: Polyolefin outer sheath Uo/U (Umax) = Rated voltage in kV Corss-section [mm²] Example of designation code: RG7H1E 12/20 (24) kV 1x630 mm² Single core 630 mm² round compact copper conductors, insulated with HEPR, with a copper wires earth screen, and polyethylene outer sheath.</p>
5.10.2	Marking	<p>The outer sheath should be marked with high aligned characters. The distance between the end of a mark and the beginning of the next one will be less than or equal to 1 m and shall contain, in the order listed the following inscriptions:</p> <ul style="list-style-type: none"> • Name of Distribution Company • Name of the Manufacturer (XXXXXX) • Cable designation • The year and month of manufacture • The metric could be indicated at a distance less than 1 meter. <p>Marking example: ENEL DISTRIBUCIÓN PERU XXXX RG7H1E 12/20 (24) kV 1x630 mm² 2020 09 0000</p>

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LOCAL SECTION B – Enel distribución Perú

N°	TITLE	DESCRIPTION
8	CONDITIONS OF SUPPLY	<p>Packaging and Labelling</p> <p>Cables shall be delivered on spools made of wood or metal, such spool will not be returned. Characteristics are indicated in Figure A, dimensions are depicted in Table A.</p> <p>The total length of the supplied cable shall not be less than that requested in the purchase order and shall not be longer by any more than 5%.</p> <p>The maximum gross weight of the packaged spool shall not exceed 2000 kg.</p> <p>The ends of the cables on each spool shall be protected with caps or hoods that prevent the entry of moisture. These ends internally secured to the spools, must be mechanically protected against possible damages resulting from handling and transportation of each spool, leaving both ends accessible through the use of an internal helix or reel on each spool.</p> <p>When distance between manufacturing facilities and Enel Distribución Perú storage center is less than 200 km and is necessary only one mean of transportation, It is mandatory to use internal helix for cables cross-section greater of equal to 120 mm². However, moisture protection on both visible ends of the cables, mechanical protection, and careful handling shall be applied.</p> <p>Spools made of wood shall be treated according to the international requirements for the control of plant disease, avoiding the compounds “Pentachlorophenol” and “Creosote”. The treatment shall include, at least: highly toxic to xylophagous organisms, high penetration and holding power, chemical stability, non-corrosive substances to metals that could affect the physical characteristics of wood.</p> <div style="text-align: center;">  </div> <p style="text-align: center;">Figure A</p>


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LOCAL SECTION B – Enel distribución Perú

N°	TITLE	DESCRIPTION															
8	CONDITIONS OF SUPPLY	<p><u>Dimensions:</u></p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">A⁽¹⁾</th> <th style="text-align: center;">B</th> <th style="text-align: center;">C⁽¹⁾</th> <th style="text-align: center;">D⁽²⁾</th> <th style="text-align: center;">E</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">mm</td> <td style="text-align: center;">mm</td> <td style="text-align: center;">mm</td> <td style="text-align: center;">mm</td> <td style="text-align: center;">mm</td> </tr> <tr> <td style="text-align: center;">2000</td> <td style="text-align: center;">(3)</td> <td style="text-align: center;">1120</td> <td style="text-align: center;">80</td> <td style="text-align: center;">(4)</td> </tr> </tbody> </table> <p style="text-align: center;">Table A</p> <p>Notes:</p> <p>(1) Maximum value. (2) Minimum value. (3) Two times the minimum bending radius indicated by the supplier. (4) 300 or 180 mm according to spool type (large or small, respectively)</p> <p>The spools shall contain:</p> <ul style="list-style-type: none"> • An external protection built with wooden flanges fixed on the wooden spools or some equivalent for metal spools, being secured with tapes or straps. • Indication with an arrow of the rolling direction. • A plate/label (stainless or polyethylene) shall be applied in both flanges and shall have the following information (in Spanish): <ol style="list-style-type: none"> 1) Enel Distribución Peru 2) Name of the manufacturer 3) Country of origin of the item 4) Country code 5) Description of item 6) Year and month of manufacture 7) Number of the spool within the delivered batch. 8) the metric initial (m) 9) the metric final (m) 10) Cable length, in meters 11) Cross-section (mm²) 12) Cable type / insulation material 13) Manufacture standard 14) Rated Voltage 12/20(24) kV 15) Purchase Order N° 16) Net weight and gross weight in kg. 17) Weight of the coil in kg 18) Weight of one meter of cable in kg 19) Coil dimension in mm 20) Gross weight (kg) 	A ⁽¹⁾	B	C ⁽¹⁾	D ⁽²⁾	E	mm	mm	mm	mm	mm	2000	(3)	1120	80	(4)
A ⁽¹⁾	B	C ⁽¹⁾	D ⁽²⁾	E													
mm	mm	mm	mm	mm													
2000	(3)	1120	80	(4)													




N°	TITLE	DESCRIPTION																																								
8	CONDITIONS OF SUPPLY	<p>Note: The plate/label used shall be resistant to UV ray, tearing, chemical substances. The dimension will be at least: Height: 230 mm Width: 140 mm. The size of the letters should be: Width: 4.5 mm; Height: 10 mm. An example is given in the following figure.</p> <div data-bbox="453 757 1257 2114" style="border: 1px solid black; padding: 10px;"><p style="text-align: center;">NOMBRE DEL PROVEEDOR</p><table border="1" style="width: 100%;"><tr><td style="width: 50%;">Cliente</td><td style="width: 50%;"></td></tr><tr><td>Fabricante</td><td></td></tr><tr><td>País de Origen</td><td></td></tr><tr><td>Código de País</td><td></td></tr><tr><td>Descripción</td><td></td></tr><tr><td>Mes/Año de</td><td></td></tr><tr><td>Matricula de Carrete</td><td></td></tr><tr><td>Punta Inicial</td><td></td></tr><tr><td>Punta Final</td><td></td></tr><tr><td>Cantidad (m)</td><td></td></tr><tr><td>Sección del Conductor (mm²)</td><td>Fase:</td></tr><tr><td>Tipo de Cable / Aislamiento</td><td></td></tr><tr><td>Norma de Fabricación</td><td></td></tr><tr><td>Tensión U_o/U (U_{max})</td><td></td></tr><tr><td>Orden de Compra</td><td></td></tr><tr><td>Peso Neto (kg)</td><td></td></tr><tr><td>Peso metro de cable</td><td></td></tr><tr><td>Peso de carrete (kg)</td><td></td></tr><tr><td>Dimensiones de</td><td></td></tr><tr><td>Peso Bruto (kg)</td><td></td></tr></table></div>	Cliente		Fabricante		País de Origen		Código de País		Descripción		Mes/Año de		Matricula de Carrete		Punta Inicial		Punta Final		Cantidad (m)		Sección del Conductor (mm ²)	Fase:	Tipo de Cable / Aislamiento		Norma de Fabricación		Tensión U _o /U (U _{max})		Orden de Compra		Peso Neto (kg)		Peso metro de cable		Peso de carrete (kg)		Dimensiones de		Peso Bruto (kg)	
Cliente																																										
Fabricante																																										
País de Origen																																										
Código de País																																										
Descripción																																										
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Dimensiones de																																										
Peso Bruto (kg)																																										

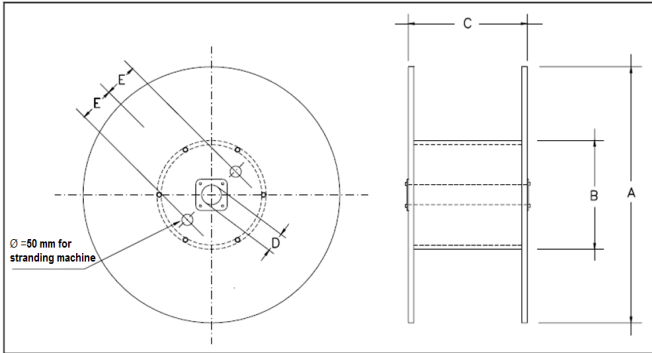
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LOCAL SECTION C – Enel distribución Chile

N°	TITLE	DESCRIPTION
3.3	Local Standards	<ul style="list-style-type: none"> • PLIEGO TÉCNICO NORMATIVO: RPTD N° 01. TENSIONES Y FRECUENCIAS NOMINALES • PLIEGO TÉCNICO NORMATIVO: RPTD N° 04. CONDUCTORES
5.10.21	Cable designation	<p>R: Round Stranded G7: HEPR H1: Copper wires screen E: Polyolefin outer sheath U₀/U (U_{max}) = Rated voltage in kV Corss-section [mm²] Example of designation code: RG7H1E 18/30 (36) kV 1x630 mm² Single core 630 mm² round compact copper conductors, insulated with HEPR, with a copper wires earth screen, and polyethylene outer sheath</p>
5.10.2	Marking	<p>The outer sheath should be marked with high aligned characters. The distance between the end of a mark and the beginning of the next one will be less than or equal to 1 m and shall contain, in the order listed the following inscriptions: Property Name Manufacturer name or trademark (NNN) Cable designation Cross-section [mm²] Rated Voltage U₀/U(U_{max}) Year of manufacture Metric marking Phase identification with numbers, veins or stripes of color. Marking Example: Enel distribucion Chile NNN RG7H1E 1x630 mm² 18/30 (36) kV 2020-09 0000 Single-core cable stranded compact Class 2 copper conductor, HEPR insulation, copper wires screen and polyolefin outer sheath 630 mm², U₀/U 18/30 kV, manufactured in 2020, month 09.</p>

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LOCAL SECTION C – Enel distribución Chile

N°	TITLE	DESCRIPTION
8	CONDITIONS OF SUPPLY	<p>Packaging and Labelling</p> <p>Cables shall be delivered on spools made of wood or metal, such spool will not be returned. Characteristics are indicated in Figure A, dimensions are depicted in Table A.</p> <p>The total length of the supplied cable shall not be less than that requested in the purchase order and shall not be longer by any more than 5%.</p> <p>The maximum gross weight of the packaged spool shall not exceed 3500 kg.</p> <p>The ends of the cables on each spool shall be protected with caps or hoods that prevent the entry of moisture. These ends internally secured to the spools, shall be mechanically protected against possible damages resulting from handling and transportation of each spool, leaving both ends accessible through the use of an internal helix or reel on each spool.</p> <p>When distance between manufacturing facilities and Enel Distribución Chile storage center is less than 200 km and is necessary only one mean of transportation, It is mandatory to use internal helix for cables cross-section greater of equal to 120 mm². However, moisture protection on both visible ends of the cables, mechanical protection, and careful handling shall be applied.</p> <p>Spools made of wood shall be treated according to the international requirements for the control of plant disease, avoiding the compounds “Pentachlorophenol” and “Creosote”. The treatment shall include, at least: highly toxic to xylophagous organisms, high penetration and holding power, chemical stability, non-corrosive substances to metals that could affect the physical characteristics of wood.</p> <div style="text-align: center;">  </div> <p style="text-align: center;">Figure A</p>

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LOCAL SECTION C – Enel distribución Chile

N°	TITLE	DESCRIPTION															
8	CONDITIONS OF SUPPLY	<p><u>Dimensions:</u></p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">A⁽¹⁾</th> <th style="text-align: center;">B</th> <th style="text-align: center;">C⁽¹⁾</th> <th style="text-align: center;">D⁽²⁾</th> <th style="text-align: center;">E</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">mm</td> <td style="text-align: center;">mm</td> <td style="text-align: center;">mm</td> <td style="text-align: center;">mm</td> <td style="text-align: center;">mm</td> </tr> <tr> <td style="text-align: center;">2000</td> <td style="text-align: center;">(3)</td> <td style="text-align: center;">1120</td> <td style="text-align: center;">80</td> <td style="text-align: center;">(4)</td> </tr> </tbody> </table> <p style="text-align: center;">Table A</p> <p>Notes: (1) Maximum value. (2) Minimum value. (3) Two times the minimum bending radius indicated by the supplier. (4) 300 or 180 mm according to spool type (large or small, respectively)</p> <p>The spools shall contain:</p> <ul style="list-style-type: none"> • An external protection built with wooden flanges fixed on the wooden spools or some equivalent for metal spools, being secured with tapes or straps. • Indication with an arrow of the rolling direction. • A stainless steel plate for identification purposes. Such plate shall be applied in both flanges and shall have the following information (in Spanish): <ol style="list-style-type: none"> 1) Manufacturer name 2) Country of origin 3) Enel distribución Chile 4) Purchase order N° 5) Rated Voltage U₀/U (U_{max}) 6) Cable designation 7) Cable cross-section [mm²] 8) Spool number of the corresponding delivered batch 9) Net and gross weight [kg] 10) Configuration type (unipolar, triplex, quadruplex). 11) Cable length [m] 12) Year and month of manufacture 13) Weight of the coil [kg] 14) Cable type 15) Coil dimensions [mm] 	A ⁽¹⁾	B	C ⁽¹⁾	D ⁽²⁾	E	mm	mm	mm	mm	mm	2000	(3)	1120	80	(4)
A ⁽¹⁾	B	C ⁽¹⁾	D ⁽²⁾	E													
mm	mm	mm	mm	mm													
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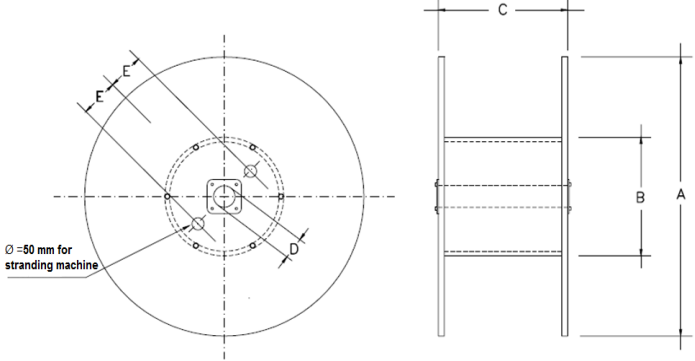
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LOCAL SECTION D – Enel Distribuição Ceará, Goiás, Rio and São Paulo

N°	TITLE	DESCRIPTION
3.1	Laws	NR10 - Safety in Electrical Installations and Services
5.10.1	Cable designation	<p>R: Round Stranded G7: HEPR H1: Copper wires screen E: Polyolefin outer sheath U₀/U (U_{max}) = Rated voltage in kV Corss-section [mm²] Example of designation code: RG7H1E 12/20 (24) kV 1x630 mm² Single core 630 mm² round compact copper conductors, insulated with HEPR, with a copper wires earth screen, and polyethylene outer sheath</p>
5.10.2	Marking	<p>The distance between the end of a mark and the beginning of the next one will be less than or equal to 1 m and shall contain, in the order listed the following inscriptions:</p> <ul style="list-style-type: none"> • The property stands • Cable designation • The name or trademark of the manufacturer • The identification letter of the manufacturing • The year and month of manufacture • The metric also supports sealed ink. Alternatively to the aforementioned method, it could be stamped at a distance less than 1 meter. <p>Example: Enel Distribuição Rio RG7H1E 12/20 (24) kV 1x630 mm² XXXXXX 2017 12 0000</p>

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LOCAL SECTION D – Enel Distribuição Ceará, Goiás, Rio and São Paulo

N°	TITLE	DESCRIPTION
8	CONDITIONS OF SUPPLY	<p>Packaging and Labelling</p> <p>Cables shall be delivered on spools made of wood or metal, such spool will not be returned. Characteristics are indicated in Figure A, dimensions are depicted in Table A.</p> <p>The total length of the supplied cable shall not be less than that requested in the purchase order and shall not be longer by any more than 5%.</p> <p>The maximum gross weight of the packaged spool shall not exceed 3500 kg.</p> <p>The ends of the cables on each spool shall be protected with caps or hoods that prevent the entry of moisture. These ends internally secured to the spools, shall be mechanically protected against possible damages resulting from handling and transportation of each spool, leaving both ends accessible through the use of an internal helix or reel on each spool.</p> <p>When distance between manufacturing facilities and distribution company storage center is less than 200 km and is necessary only one mean of transportation, It is mandatory to use internal helix for cables cross-section greater of equal to 120 mm². However, moisture protection on both visible ends of the cables, mechanical protection, and careful handling shall be applied.</p> <p>Spools made of wood shall be treated according to the international requirements for the control of plant disease, avoiding the compounds “Pentachlorophenol” and “Creosote”. The treatment shall include, at least: highly toxic to xylophagous organisms, high penetration and holding power, chemical stability, non-corrosive substances to metals that could affect the physical characteristics of wood.</p> <div style="text-align: center;">  </div> <p style="text-align: center;">Figure A</p>

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LOCAL SECTION D – Enel Distribuição Ceará, Goiás, Rio and São Paulo

N°	TITLE	DESCRIPTION															
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A ⁽¹⁾	B	C ⁽¹⁾	D ⁽²⁾	E													
mm	mm	mm	mm	mm													
2000	(3)	1120	80	(4)													

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LOCAL SECTION E – e-distribuzione

N°	TITLE	DESCRIPTION
3.3	Local Standards	<ul style="list-style-type: none"> • GUI 102/GUI 120 RO “Bobine per il trasporto di cavi elettrici, cavi ottici e conduttori per linee elettriche di media e bassa tensione” • PVR 006 “Operational Note Vendor Rating Control: BARCODES Warranty and Traceability of Enel Distribution Materials”.
5.10.1	Cable designation	<p>R: Round Stranded G7: HEPR H1: Copper wires screen E: Polyolefin outer sheath Uo/U (Umax) = Rated voltage in kV Cross-section [mm²] Example of designation code: RG7H1E 12/20 (24) kV 1x630 mm² Single core 630 mm² round compact copper conductors, insulated with HEPR, with a copper wires earth screen, and polyethylene outer sheath</p>
5.10.2	Marking	<p>The distance between the end of a mark and the beginning of the next one will be less than or equal to 1 m and shall contain, in the order listed the following inscriptions:</p> <ul style="list-style-type: none"> • The property stands: e-distribuzione, • Cable designation (see 5.11.2) • Rated voltage Uo/U [kV] (12/20 Kv) • Cross-section. (185) • Reaction to fire class (CPR) • The name or trademark of the manufacturer (XXXXXX) • The identification letter of the manufacturing (B) • The index of the project: to choose exponentially (01, 02, 03...) this index shall be modified with every construction variation of the single core (phase or neutral) • The year and month of manufacture (2017 12) • The metric indicated only in phase 1; also supports sealed ink. Alternatively to the aforementioned method, it could be stamped at a distance less than 1 meter. <p>Marking example e-distribuzione RG7H1E 12/20 (24) kV 1x630 mm² CPR XXXXXX B 01 2020 09 0000</p>

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LOCAL SECTION E – e-distribuzione

N°	TITLE	DESCRIPTION															
8	CONDITIONS OF SUPPLY	<p>Cable length and type of coil.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">Formation [n° x mm²]</th> <th style="text-align: center;">Maximum Length [m]</th> <th style="text-align: center;">Coil Type (GUI 102)</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1x150</td> <td style="text-align: center;">500</td> <td style="text-align: center;">20</td> </tr> <tr> <td style="text-align: center;">1x240</td> <td style="text-align: center;">500</td> <td style="text-align: center;">20</td> </tr> <tr> <td style="text-align: center;">1x400</td> <td style="text-align: center;">500</td> <td style="text-align: center;">20</td> </tr> <tr> <td style="text-align: center;">1x630</td> <td style="text-align: center;">350</td> <td style="text-align: center;">20</td> </tr> </tbody> </table> <p>The far end of the cables shall be protected against the moisture.</p> <p>Due to traceability in the network a bar code shall be applied on the flanges of the drum. Such bar code shall be in compliance with technical specification PVR006.</p> <p>Drum characteristics shall be in compliance with the standard GUI102.</p> <p>Following standard EN 50575, the CE marking and labelling shall be in accordance with the general principles set out in Article 30 of regulation (EC) No. 765/2008 and shall be affixed visibly, legibly and indelibly to the product labels affixed to the reels, coils or drums.</p> <p>In compliance with standard EN 50575 in particular annex V of the EU Construction Products Regulation n° 305/2011 (CPR) the supplier shall elaborate a Declaration of performance (DoP) and shall dispose a CE marking in function of the assessment and verification of constancy of performance (AVCP).</p>	Formation [n° x mm ²]	Maximum Length [m]	Coil Type (GUI 102)	1x150	500	20	1x240	500	20	1x400	500	20	1x630	350	20
Formation [n° x mm ²]	Maximum Length [m]	Coil Type (GUI 102)															
1x150	500	20															
1x240	500	20															
1x400	500	20															
1x630	350	20															

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LOCAL SECTION F – e-distributie Banat, Dobrogea and Muntenia.

N°	TITLE	DESCRIPTION
3.3	Local Standards	<ul style="list-style-type: none"> GUI 102/GUI 120 RO “Bobine per il trasporto di cavi elettrici, cavi ottici e conduttori per linee elettriche di media e bassa tensione” PVR 006 “Operational Note Vendor Rating Control: BARCODES Warranty and Traceability of Enel Distribution Materials”.
5.10.1	Cable designation	<p>R: Round Stranded G7: HEPR H1: Copper wires screen E: Polyolefin outer sheath Uo/U (Umax) = Rated voltage in kV Corss-section [mm²] Example of designation code: RG7H1E 12/20 (24) kV 1x630 mm² Single core 630 mm² round compact copper conductors, insulated with HEPR, with a copper wires earth screen, and polyethylene outer sheath</p>
5.10.2	Marking	<p>The distance between the end of a mark and the beginning of the next one will be less than or equal to 1 m and shall contain, in the order listed the following inscriptions:</p> <ul style="list-style-type: none"> The property stands: e-distributie Banat, e-distributie Dobrogea e-distributie Muntenia Cable designation (see 5.11.2) Rated voltage Uo/U [kV] (12/20 Kv) Cross-section. (185) Reaction to fire class (CPR) The name or trademark of the manufacturer (XXXXXX) The identification letter of the manufacturing (B) The index of the project: to choose exponentially (01, 02, 03...) this index shall be modified with every construction variation of the single core (phase or neutral) The year and month of manufacture (2017 12) The metric indicated only in phase 1; also supports sealed ink. Alternatively to the aforementioned method, it could be stamped at a distance less than 1 meter. <p>Marking example e-distributie RG7H1E 12/20 (24) kV 1x630 mm² CPR XXXXXX B 01 2020 09 0000</p>

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LOCAL SECTION E – e-distributie Banat, Dobrogea and Muntenia.

N°	TITLE	DESCRIPTION															
8	CONDITIONS OF SUPPLY	<p>Cable length and type of coil.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">Formation [n° x mm²]</th> <th style="text-align: center;">Maximum Length [m]</th> <th style="text-align: center;">Coil Type (GUI 102)</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1x150</td> <td style="text-align: center;">500</td> <td style="text-align: center;">20</td> </tr> <tr> <td style="text-align: center;">1x240</td> <td style="text-align: center;">500</td> <td style="text-align: center;">20</td> </tr> <tr> <td style="text-align: center;">1x400</td> <td style="text-align: center;">500</td> <td style="text-align: center;">20</td> </tr> <tr> <td style="text-align: center;">1x630</td> <td style="text-align: center;">350</td> <td style="text-align: center;">20</td> </tr> </tbody> </table> <p>The far end of the cables shall be protected against the moisture.</p> <p>Due to traceability in the network a bar code shall be applied on the flanges of the drum. Such bar code shall be in compliance with technical specification PVR006.</p> <p>Drum characteristics shall be in compliance with the standard GUI102.</p> <p>Following standard EN 50575, the CE marking and labelling shall be in accordance with the general principles set out in Article 30 of regulation (EC) No. 765/2008 and shall be affixed visibly, legibly and indelibly to the product labels affixed to the reels, coils or drums.</p> <p>In compliance with standard EN 50575 in particular annex V of the EU Construction Products Regulation n° 305/2011 (CPR) the supplier shall elaborate a Declaration of performance (DoP) and shall dispose a CE marking in function of the assessment and verification of constancy of performance (AVCP).</p>	Formation [n° x mm ²]	Maximum Length [m]	Coil Type (GUI 102)	1x150	500	20	1x240	500	20	1x400	500	20	1x630	350	20
Formation [n° x mm ²]	Maximum Length [m]	Coil Type (GUI 102)															
1x150	500	20															
1x240	500	20															
1x400	500	20															
1x630	350	20															

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COMMON LIST

GS Type Code	Distribution Company and Country	Country Code	Rated Voltage U _o /U ₁ (U _{max}) [kV]	Cross-section [mm ²]	Conductor material	Conductor screen nominal thickness [mm]	Conductor screen minimum thickness [mm]	Insulation material	Nominal insulation thickness [mm]	Minimum insulation thickness [mm]	Insulation Screen Nominal thickness [mm]	Insulation Screen Minimum thickness [mm]	Longitudinal watertightness (Yes/Not)	Earth Screen type	Copper wires screen cross-section [mm ²]	Outer sheath material	Sheath nominal thickness [mm]	Sheath minimum thickness [mm]	Minimum fire class reaction
GSCC023/001	ED- Romania	330017	12/20(24)	150	COPPER	0,5	0,3	HEPR	5,5	4,9	0,3	0,5	YES	COPPER	16	PO	2,2	1,7	Eca
GSCC023/001	ED-Italy	330015	12/20(24)	150	COPPER	0,5	0,3	HEPR	5,5	4,9	0,3	0,5	YES	COPPER	16	PO	2,2	1,7	Eca
GSCC023/002	ED- Romania	330018	12/20(24)	240	COPPER	0,5	0,3	HEPR	5,5	4,9	0,3	0,5	YES	COPPER	16	PO	2,2	1,7	Eca
GSCC023/002	ED-Italy	330016	12/20(24)	240	COPPER	0,5	0,3	HEPR	5,5	4,9	0,3	0,5	YES	COPPER	16	PO	2,2	1,7	Eca
GSCC023/002	RJ/CE/GO/SP-BRASIL	T330490	12/20(24)	240	COPPER	0,5	0,3	HEPR	5,5	4,9	0,3	0,5	YES	COPPER	16	PO	2,2	1,7	
GSCC023/003	ED-Italy	330017	12/20(24)	400	COPPER	0,5	0,3	HEPR	5,5	4,9	0,3	0,5	YES	COPPER	16	PO	2,75	2,2	Eca
GSCC023/004	ED- Romania	330019	12/20(24)	630	COPPER	0,5	0,3	HEPR	5,5	4,9	0,3	0,5	YES	COPPER	16	PO	2,75	2,2	Eca
GSCC023/004	ED-Italy	330018	12/20(24)	630	COPPER	0,5	0,3	HEPR	5,5	4,9	0,3	0,5	YES	COPPER	16	PO	2,75	2,2	Eca
GSCC023/004	CD-Colombia	330039	12/20(24)	630	COPPER	0,5	0,3	HEPR	5,5	4,9	0,3	0,5	YES	COPPER	16	PO	2,75	2,2	-
GSCC023/004	ED-Chile	330034	12/20(24)	630	COPPER	0,5	0,3	HEPR	5,5	4,9	0,3	0,5	YES	COPPER	16	PO	2,75	2,2	-
GSCC023/004	RJ/CE/GO/SP-BRASIL	T330489	12/20(24)	630	COPPER	0,5	0,3	HEPR	5,5	4,9	0,3	0,5	YES	COPPER	16	PO	2,75	2,2	-
GSCC023/004	ES-Argentina	0101-0510	12/20(24)	630	COPPER	0,5	0,3	HEPR	5,5	4,9	0,3	0,5	YES	COPPER	16	PO	2,75	2,2	-
GSCC023/004	ED-Perù	330020	12/20(24)	630	COPPER	0,5	0,3	HEPR	5,5	4,9	0,3	0,5	YES	COPPER	16	PO	2,75	2,2	-
GSCC023/005	CD-Colombia	330040	18/30(36)	240	COPPER	0,5	0,3	HEPR	8	7,1	0,3	0,5	YES	COPPER	16	PO	2,2	1,7	-
GSCC023/005	RJ/CE/GO/SP-BRASIL	T330488	18/30(36)	240	COPPER	0,5	0,3	HEPR	8	7,1	0,3	0,5	YES	COPPER	16	PO	2,2	1,7	-
GSCC023/006	ED-Chile	330033	18/30(36)	630	COPPER	0,5	0,3	HEPR	8	7,1	0,3	0,5	YES	COPPER	16	PO	2,75	2,2	-
GSCC023/006	RJ/CE/GO-BRASIL	T330487	18/30(36)	630	COPPER	0,5	0,3	HEPR	8	7,1	0,3	0,5	YES	COPPER	16	PO	2,75	2,2	-
GSCC023/007	RJ/CE/GO/SP-BRASIL	T330486	12/20(24)	1000	COPPER	0,5	0,3	HEPR	5,5	4,9	0,3	0,5	YES	COPPER	16	PO	3,2	2,6	-