



Regione Abruzzo



Provincia Teramo



Comune di Roseto degli abruzzi

e-distribuzione

**PROGETTO PER LA REALIZZAZIONE
DI UN PARCO AGROVOLTAICO PER LA PRODUZIONE DI
ENERGIA ELETTRICA, DELLE OPERE CONNESSE E DELLE
INFRASTRUTTURE INDISPENSABILI**

Comuni di Roseto degli Abruzzi (TE)

PROGETTO DEFINITIVO

CODICE PRATICA:

324972405

**RELAZIONE TECNICA E
PARTICOLARI COSTRUTTIVI**

Proponente



Energia Ecosostenibile srl
Via Della Chimica, 103 - 85100 Potenza (PZ)

Formato

A4

Scala

-

Per approvazione


E-DISTRIBUZIONE SPA

_____ *firma*

Progettista

Ing. Pietro Valente

Revisione	Descrizione	Data	Preparato	Controllato	Approvato
00	Prima emissione	Gennaio 2023			

 Energia Ecosostenibile	IMPIANTO 324972405	Scala – A4
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		Relazione tecnica
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RELAZIONE TECNICA

Progetto: Impianto di rete per la connessione MT 20 kV di impianto di produzione di energia elettrica da fonte solare, con potenza richiesta in immissione di 5988 kW, nel Comune di Roseto degli Abruzzi (TE). Codice rintracciabilità 324972405 - "ENERGIA ECOSOSTENIBILE S.r.l." con sede in Via Della Chimica, 103 – 85100 Potenza (PZ).

1. PREMESSA

All'atto di accettazione del preventivo di connessione il produttore si è avvalso della facoltà di curare in proprio tutti gli adempimenti legati all'iter autorizzativo ed all'ottenimento di tutti i pareri necessari per la costruzione ed esercizio delle opere di rete per la connessione. Il produttore, inoltre, curerà tutti gli adempimenti necessari per l'acquisizione delle servitù di elettrodotto e di cabina elettrica.

2. SCOPO

Lo scopo dell'intervento costruttivo è la Costruzione dell'impianto di rete per la connessione di un impianto di produzione di energia da fonte solare, con potenza massima in immissione di 5988 kW, in agro di Roseto degli Abruzzi, per il quale il proponente ha effettuato regolare richiesta di connessione così come disposto dalle delibere dell'Autorità, ad E-Distribuzione Spa.

Secondo quanto previsto dal preventivo di connessione, il suddetto impianto di produzione, si dovrà connettere alla rete elettrica mediante nuova cabina di consegna collegata in antenna con la Cabina Primaria esistente denominata ROSETO (DJ001384641).

La soluzione progettuale rispetterà quanto riportato nel preventivo di connessione accettato, dunque i principali interventi sono la realizzazione di uno stallo MT in CP, una linea in cavo interrato, di una cabina di consegna e di cavi interrati per il collegamento alla cabina primaria e alla cabina di consegna.

3. GLOSSARIO

AT = Linea elettrica di terza classe (art. 1.2.07 norme CEI 11.4) a tensione superiore a 30.000 volt;

MT = Linea elettrica di seconda classe (art. 1.2.06 norme CEI 11.4) a 20.000 volt;

BT = Linea elettrica di prima classe (art. 1.2.05 norme CEI 11.4) a tensione inferiore a 1.000 volt;

PTP = Trasformazione da MT a BT posta su palo;



CAB = Trasformazione da MT a BT posta in locale chiuso;

CP = Trasformazione da AT a MT posta in luoghi protetti.

4. DENOMINAZIONE E CODICE PROGETTO

Il progetto è così denominato:

Impianto di rete per la connessione di un impianto di produzione da fonte solare, con potenza in immissione di 5988 kW, con **codice identificativo 324972405**.

5. LOCALIZZAZIONE DEL PUNTO DI CONNESSIONE ALLA CABINA SECONDARIA

Il punto di connessione sarà situato, in agro di Roseto degli Abruzzi (TE):

1. lungo la viabilità di servizio;
2. Cabina Primaria esistente AT/MT ROSETO (DJ001384641).

6. LEGGI E NORME TECNICHE DI RIFERIMENTO

L'impianto in progetto verrà realizzato nel pieno rispetto delle vigenti disposizioni di legge.

La vigilanza sulla corretta esecuzione è affidata esclusivamente, anche per le zone sismiche, all'autorità competente in materia.

Le Leggi e le Norme Tecniche di riferimento ai fini autorizzativi sono:

Per gli aspetti tecnici


Per quanto riguarda l'aspetto tecnico, le linee elettriche devono essere progettate, costruite ed esercite secondo le norme elaborate dal Comitato Tecnico 11 del Comitato Elettrotecnico Italiano che costituiscono disposizioni di legge.

I riferimenti legislativi sono:

- Legge dello Stato n. 339 28/06/1986 "Nuove norme per la disciplina della costruzione e dell'esercizio di linee elettriche aeree esterne"
- D.M. n. 449 del 21/3/1988 -"Approvazione delle norme tecniche per la progettazione, l'esecuzione e l'esercizio delle linee aeree esterne" -Norma Linee);
- D.M. n. 16/01/1991-"Aggiornamento delle norme tecniche per la disciplina della costruzione e dell'esercizio di linee elettriche aeree esterne"
- DM 05.08.1998"Aggiornamento delle norme tecniche per la progettazione, esecuzione ed esercizio delle linee elettriche aeree esterne"
- DM 24/11/1984"Norme di sicurezza antincendio per il trasporto, la distribuzione, l'accumulo e l'utilizzazione del gas naturale con densità non superiore a 0,8
- DPCM del 8/07/2003-"Fissazione dei limiti di esposizione, dei valori di attenzione e degli



- obiettivi di qualità per la protezione della popolazione dalle esposizioni ai campi elettrici e magnetici alla frequenza di rete (50 Hz”);
- D.M. 29/05/2008 –GU n. 156 del 05/07/2008-“Approvazione della metodologia di calcolo per la determinazione delle fasce di rispetto degli elettrodotti”
 - D.Lgs. n. 285/92-Codice della strada (successive modificazioni e relativo Regolamento di esecuzione e di attuazione);
 - Decreto Ministeriale 21 marzo 1988 e successivi aggiornamenti (DM 16/01/1991 e DM 05/08/1998): “Approvazione delle norme tecniche per la progettazione, l’esecuzione e l’esercizio delle Linee elettriche esterne”;
 - Decreto Legislativo 22 febbraio 2001 n° 36: “Legge quadro sulla protezione dalle esposizioni a campi elettrici, magnetici ed elettromagnetici”;
 - Norma CEI 11-4 settembre 1998: “Esecuzione delle linee elettriche aeree esterne”;
 - Norma CEI 11-17 luglio 1997: “Impianti di produzione, trasmissione e distribuzione di energia elettrica - linee interrate;
 - Norme del Ministero dell’Interno per quanto attiene le disposizioni di sicurezza antincendio;
 - Norma CEI 11-61 novembre 2000: “Guida all’inserimento ambientale delle Linee aeree esterne e delle stazioni elettriche”;
 - Norma CEI 11-8 dicembre 1989: “Impianti di produzione, trasmissione e distribuzione di energia elettrica – impianti di terra e successive varianti”;
 - Norma CEI 103-6 dicembre 1997: “Protezione delle linee di tele comunicazioni dagli effetti dell’induzione elettromagnetica provocata dalle linee elettriche vicine in caso di guasto”.
 - NORMA CEI EN 50341 2 13”.
 - CEI 11-17 “Impianti di produzione, trasmissione e distribuzione pubblica di energia elettrica -Linee in cavo”
 - CEI 0-16 “Regola tecnica di riferimento per la connessione di utenti attivi e passivi alle reti AT ed MT delle imprese distributrici di energia elettrica”
 - CEI 0-2 “Guida per la definizione della documentazione degli impianti elettrici”
 - CEI 106-11 “Guida per la determinazione delle fasce di rispetto per gli elettrodotti secondo le disposizioni del DPCM 8 luglio 2003 (Art. 6) Parte 1: Linee elettriche aeree e in cavo
 - CEI 211-4 Guida ai metodi di calcolo dei campi elettrici e magnetici generati da linee e stazioni elettriche;
 - CEI EN 50522 –CEI 99-3 -Messa a terra degli impianti elettrici a tensione superiore a 1 kV in c.a.
 - Norma CEI 11-46 "Strutture sotterranee polifunzionali per la coesistenza di servizi a rete diversi -Progettazione, costruzione, gestione e utilizzo -Criteri generali e di sicurezza”;

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- Norma CEI 11-47 "Impianti tecnologici sotterranei -Criteri generali di posa".

Per gli aspetti amministrativi

Essendo l'impianto di rete considerato accessorio dell'impianto di produzione, condizione sine qua non è che la procedura autorizzativa sia unica, ovvero comprenda: l'impianto di produzione, l'impianto di utenza per la connessione e l'impianto di rete per la connessione.

Previo ottenimento dei nulla-osta/autorizzazioni contemplati all'art. 120 di cui al Testo Unico delle disposizioni di legge sulle acque e impianti elettrici dell'11/12/1933.

L'impianto di rete per la connessione in autorizzazione è da considerarsi facente parte della rete di distribuzione del gestore di rete e quindi sarà utilizzata per l'attività di distribuzione/trasmissione dell'energia. Ricorrendo tale casistica, il titolo abilitativo non potrà contenere obblighi di dismissioni e rimozioni.

L'attività edilizia (opere murarie) di costruzione dei locali necessari all'alloggiamento delle apparecchiature elettriche per realizzare sezionamenti, smistamenti e trasformazioni (cabine elettriche) è subordinata all'ottenimento della concessione o autorizzazione edilizia nelle forme previste dalle Leggi dello Stato e dalle Leggi e/o regolamenti degli Enti Locali (Regione, Provincia, Comuni).

Nelle aree sottoposte a vincolo paesaggistico, l'attività costruttiva è subordinata all'ottenimento del nullaosta prescritto dalle leggi che tutelano gli aspetti ambientali e paesaggistici.

I riferimenti legislativi sono:

- D.L. 3 marzo 2001, n° 28;
- Regio Decreto 11/12/1933, n° 1775: "Testo Unico delle disposizioni di Legge sulle acque e impianti elettrici":
 - 1) Art. 119 – sul diritto di passaggio dell'elettrodotto;
 - 2) Art. 120 – indica le autorità territoriali chiamate ad esprimersi con nullaosta o con osservazioni sull'istanza avanzata dal richiedente;
 - 3) Art. 121, 122 e 123 – sulle servitù di elettrodotto.
- DPR 18 marzo 1965, n° 342: "Norme integrative" – art. 9;
- DPR 24 luglio 1977, n° 616: "Trasferimento e deleghe delle funzioni amministrative dello Stato";
- DL 11 luglio 1992, n° 333: "Amministrazione del patrimonio e contabilità dello Stato" – Art. 14 comma 4bis;



7. CARATTERISTICHE ELETTROMECCANICHE DELLA LINEA DI PROGETTO

Nella scelta tecnica per la realizzazione dell'impianto di rete si è tenuto conto principalmente dei seguenti fattori:

Soluzione tecnica prevista nel preventivo di connessione:

- TRASFORMATORE MT/BT 100KVA
- CAVO INTERRATO AL 185 mm² stesso scavo su asfalto 110m
- CAVO INTERRATO IN AL 185 mm² lunghezza 810 m (su terreno e su asfalto)
- FORNITURA E POSA SCOMPARTO DI CONSEGNA UTENTE IN NUOVA CABINA
- FORNITURA E POSA MONT. ELETTROMECCANICI DY900/1 (3L+T)
- RGDAT

Per canalizzazione si intende l'insieme del canale, delle protezioni e degli accessori indispensabili per la realizzazione di una linea in cavo sotterraneo (trincea, riempimenti, protezioni, segnaletica). La materia è disciplinata, eccezione fatta per i riempimenti, dalla Norma CEI 11-17. In particolare detta norma stabilisce che l'integrità dei cavi deve essere garantita da una robusta protezione meccanica supplementare, in grado di assorbire, senza danni per il cavo stesso, le sollecitazioni meccaniche, statiche e dinamiche, derivanti dal traffico veicolare (resistenza a schiacciamento) e dagli abituali attrezzi manuali di scavo (resistenza a urto). La protezione meccanica supplementare non è necessaria nel caso di cavi MT posati a profondità maggiore di 1,7 m. La profondità minima di posa per le strade di uso pubblico è fissata dal Nuovo Codice della Strada ad 1 m dall'estradosso della protezione; per tutti gli altri suoli e le strade di uso privato valgono i seguenti valori, dal piano di appoggio del cavo, stabiliti dagli standard tecnici Enel:

- 1,2 m (su terreno privato);
- 1,2 m (su terreno pubblico);

I cavidotti saranno realizzati con tubazione in corrugato PEAD a doppia parete di diametro pari a 200mm. La presenza dei cavi elettrici verrà segnalata con apposito nastro di segnalazione che verrà posato lungo lo scavo. I ripristini verranno eseguiti a regola d'arte secondo le prescrizioni imposte dall'Ente proprietario della strada.

Si procederà quindi, con:

- scavo in sezione ristretta,
- posizionamento allettamenti in sabbia di cava lavata,
- posa di n°1 tubi in polietilene con struttura corrugata,
- posa di uno o più nastri segnalatori,
- posa di n° 1 cavo cordato ad elica visibile in MT Al 185 mm²,



- rinterro.

Per gli standard tecnici del cavo da utilizzare si rimanda alla sezione degli allegati riportati.

8. CABINA DI CONSEGNA

Sarà installata una cabina di consegna del tipo “DG2092” Edizione 3, fornita e posta in opera dal produttore. La cabina sarà del tipo prefabbricato, e realizzata mediante una struttura monolitica in calcestruzzo armato vibrato autoportante, completa di porte di accesso e griglie di aerazione. Le dimensioni del vano consegna delle cabine di consegna seguiranno gli standard tecnici E- Distribuzione con caratteristiche desumibili dagli elaborati allegati, in ogni caso la lunghezza deve essere superiore e/o uguale a 6,70 m x 2,30 m. Le pareti sia interne che esterne, saranno di spessore non inferiore a 7-8 cm. Il tetto di spessore non inferiore 6-7 cm, sarà a corpo unico con il resto della struttura, impermeabilizzato con guaina bituminosa elastomerica applicata a caldo per uno spessore non inferiore a 4 mm e successivamente protetta. Il pavimento sarà dimensionato per sopportare un carico concentrato di 50 kN/ m2 ed un carico uniformemente distribuito non inferiore a 5 kN/m2.

Sul pavimento saranno predisposte apposite finestre per il passaggio dei cavi MT e BT, completo di botola di accesso al vano cavi.

L'armatura interna del monoblocco sarà elettricamente collegata all'impianto di terra, in maniera tale da formare una rete equipotenziale uniformemente distribuita su tutta la superficie.

I materiali da utilizzare per le porte e le griglie saranno in vetroresina stampata, o lamiera zincata (norma CEI 11-1 e DPR 547/55 art. 340), ignifughe ed autoestinguenti. La base della cabina sarà sigillata alla platea, secondo lo standard consolidato con E-Distribuzione, mediante l'applicazione di un giunto elastico tipo ECOACRIL 150, successivamente rinforzato mediante cemento anti- ritiro.

Anche le fondazioni della cabina sono prefabbricate e per l'alloggio dovrà essere realizzata un'apposita area con livellazione e costipamento del terreno e predisposizione di un letto di sabbia, previo uno scavo a sezione ampia per l'asportazione del terreno coltivo.

Il tutto come meglio evidenziato negli elaborati allegati.

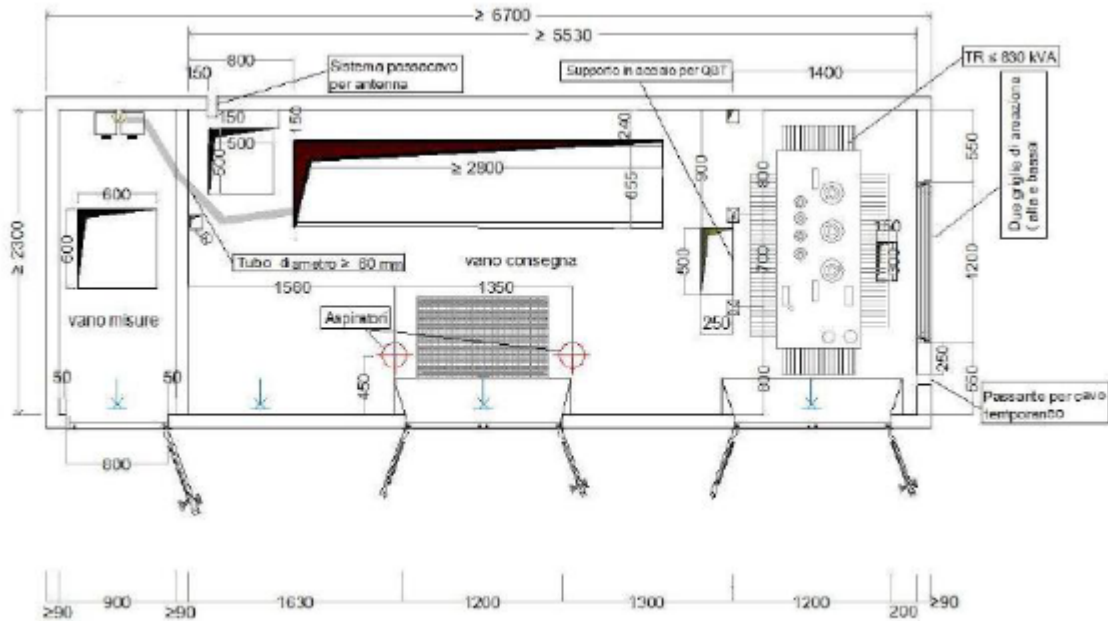
8.1 Aspetti ambientali relativi al rumore

Ai fini degli aspetti ambientali relativi all'impatto acustico, per cabine unificate in struttura prefabbricata box tipo DG2092 ed. 03 del 15/09/2016, con all'interno apparecchiature aventi tensione nominale di 20 kV, sulla base di rilievi sperimentali, si ritiene possa essere dichiarato un valore massimo di livello di potenza sonora ad un metro dalla cabina, pari a 54 dB (A)

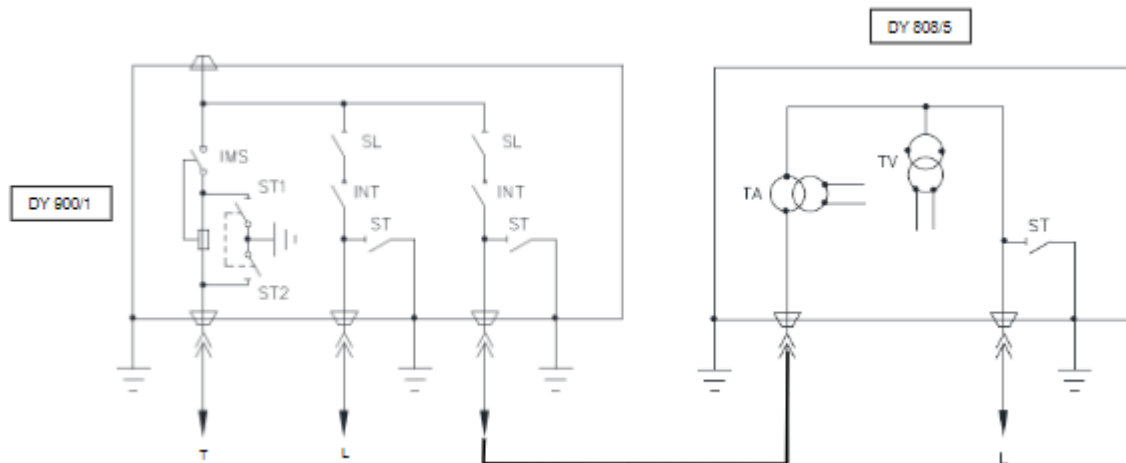


8.2 Dotazioni elettriche

Le dotazioni elettriche e la componentistica della cabina sono disposte secondo lo schema in pianta sotto riportato; le misure indicate sono quelle minime previste per la tipologia della cabina.



Dimensioni minime della cabina e schema elettrico funzionale

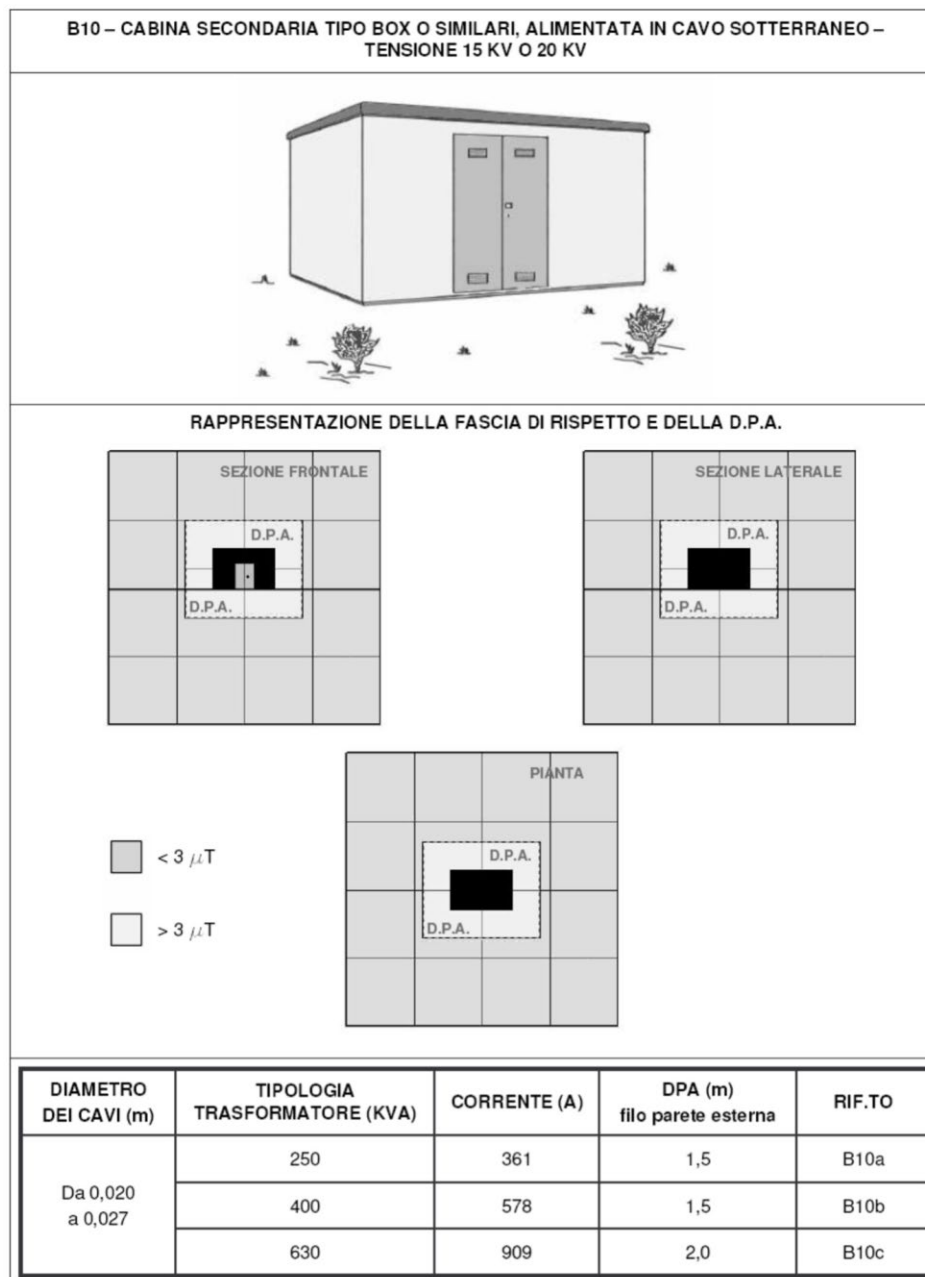


8.3 Limiti di campo elettrico e campo magnetico per la cabina

Per la nuova cabina di consegna si applicano le prescrizioni di cui all'art. 4 del D.P.C.M. 08/07/03 che fissa per il valore dell'induzione magnetica l'obiettivo di qualità di $3 \mu\text{T}$ in corrispondenza di aree di gioco per l'infanzia, ambienti abitativi, ambienti scolastici e luoghi adibiti a permanenze non inferiori a quattro ore giornaliere. Per quanto concerne il



campo elettrico il valore è inferiore al limite fissato in 5 kV/m dall'art. 3 del D.P.C.M. 08/07/03. Si evidenzia che ai fini del calcolo della DPA – Distanza di Prima Approssimazione, nel caso di cabine elettriche, ai sensi del § 5.2 dell'allegato al Decreto Ministeriale 29 maggio 2008 “Approvazione della metodologia di calcolo per la determinazione delle fasce di rispetto degli elettrodotti”(G.U. n. 156 del 5 luglio 2008) la fascia di rispetto calcolata in base ai dati sopra esposti è pari a 1,5 metri, filo parete esterna.



Cabina elettrica e DPA

9. CARATTERISTICHE DEL TERRITORIO ATTRAVERSATO DAL TRACCIATO

Il Territorio è di natura collinare, la coltura dei terreni attraversati dal tracciato è seminativo.



La definizione del tracciato è stata fatta comparando le esigenze della pubblica utilità dell'opera con gli interessi sia pubblici che privati ivi interferenti, in armonia con quanto dettato dall'art. 121 del Testo Unico 11/12/1933, n° 1775 ed in particolare:

- in modo tale da arrecare il minor sacrificio possibile alle proprietà private interessate, vagliando la situazione esistente sul fondo da asservire rispetto alle condizioni dei terreni serventi e contigui;
- in modo tale da interessare per lo più terreni di natura agricola a favore delle aree destinate allo sviluppo urbanistico e di particolare interesse paesaggistico ed ambientale;
- tenendo conto dell'intero sviluppo dell'elettrodotto, in ragione della sua imprescindibile caratteristica tecnica (l'andamento tendenzialmente rettilineo del tracciato consente di attraversare un ridotto numero di appezzamenti di terreno, con un sacrificio globale dei diritti dei proprietari delle aree interessate assai limitato);
- tenendo conto dei vincoli esistenti sul territorio.

10. AREE E OPERE ATTRAVERSATE

Le opere da realizzare sono compatibili con la destinazione urbanistica, non costituiscono unavariante della destinazione d'uso.

La nuova linea MT determinerà l'attraversamento di alcune infrastrutture come meglio indicate e rappresentate negli elaborati allegati.

11. VINCOLI PRESENTI ED INTERFERENZE

Si rimanda agli elaborati allegati al progetto.

12. ASPETTI AUTORIZZATIVI

La costruzione e l'esercizio delle opere di connessione e dell'impianto di produzione di energia elettrica da fonte solare, sono soggette ad "AUTORIZZAZIONE UNICA" (AU), ai sensi dell'Art. 12 del D.Lgs. 29 dicembre 2003 n. 387, come modificato dall'Art. 5 D.Lgs. 03/03/2011 n.28 - Attuazione della direttiva 2001/77/CE sulla promozione all'uso dell'energia da fonti rinnovabili, e s.m.i.. Qualora per la realizzazione dell'impianto di produzione trovi applicazione la Procedura Abilitativa Semplificata (di seguito PAS) di cui all'art. 6 D. Lgs. n. 28/2011 si esplicherà quanto segue:

- che la realizzazione di impianti alimentati a fonti rinnovabili e delle opere ed



infrastrutture connesse è da intendersi di interesse pubblico, indifferibile ed urgente ai sensi di quanto affermato dall'art. 1 comma 4 della legge 10/91 e ribadito dall'art. 12 comma 1 del Decreto Legislativo 387/2003;

- a costruzione avvenuta, le opere di rete per la connessione saranno ricomprese negli impianti del gestore di rete e saranno quindi utilizzate per l'espletamento del servizio pubblico di distribuzione/trasmissione;
- che il titolare dell'autorizzazione all'esercizio di tali opere sarà E-Distribuzione.
- che le opere di rete per la connessione, anche nel caso di dismissione dell'impianto di produzione, resteranno attive e per le stesse non esisterà l'obbligo di rimozione e di ripristino dei luoghi.

Per la costruzione e l'esercizio delle opere di connessione, inoltre saranno richiesti:

- **Atti di servitù di elettrodotto inamovibili, registrati e trascritti, costituiti su tutte le aree private, compresa quella dell'impianto di produzione di energia elettrica, interessate dal tracciato delle linee MT, o in alternativa provvedimento di asservimento coattivo rilasciato ai sensi del DPR 327/2001.**

13. CONCLUSIONI

Per tutto quanto non espressamente citato nella presente relazione si rimanda agli allegati grafici, alle specifiche tecniche di E-Distribuzione, ed alle normative di buona tecnica ed alle eventuali prescrizioni/indicazioni che E-Distribuzione vorrà fornire.



Energia Ecosostenibile

IMPIANTO 324972405

Scala – A4

Comune di Roseto degli Abruzzi (TE)

Relazione tecnica

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STANDARD COSTRUTTIVI

I quadri BT saranno posizionati su un supporto di acciaio (Fig.1 e Fig. 2) utilizzando i supporti distanziatori unificati DS 3055.

Per i quadri MT, il Costruttore dovrà assicurarne il bloccaggio all'interno della cabina durante il trasporto.

Le dimensioni della cabina e lo schema funzionale sono riportate in Fig. 1: "Pianta cabina consegna Utente, Locale misura ed il posizionamento delle apparecchiature elettriche". Nella figura di cui sopra sono riportate le dimensioni minime di riferimento della cabina e la disposizione ottimale delle apparecchiature. Lo schema elettrico di media tensione e quello di bassa può variare in base alle esigenze impiantistiche.

Per quanto su esposto il progetto architettonico e funzionale definitivo, costituito essenzialmente da un elaborato grafico, deve essere preventivamente approvato da e-distribuzione.

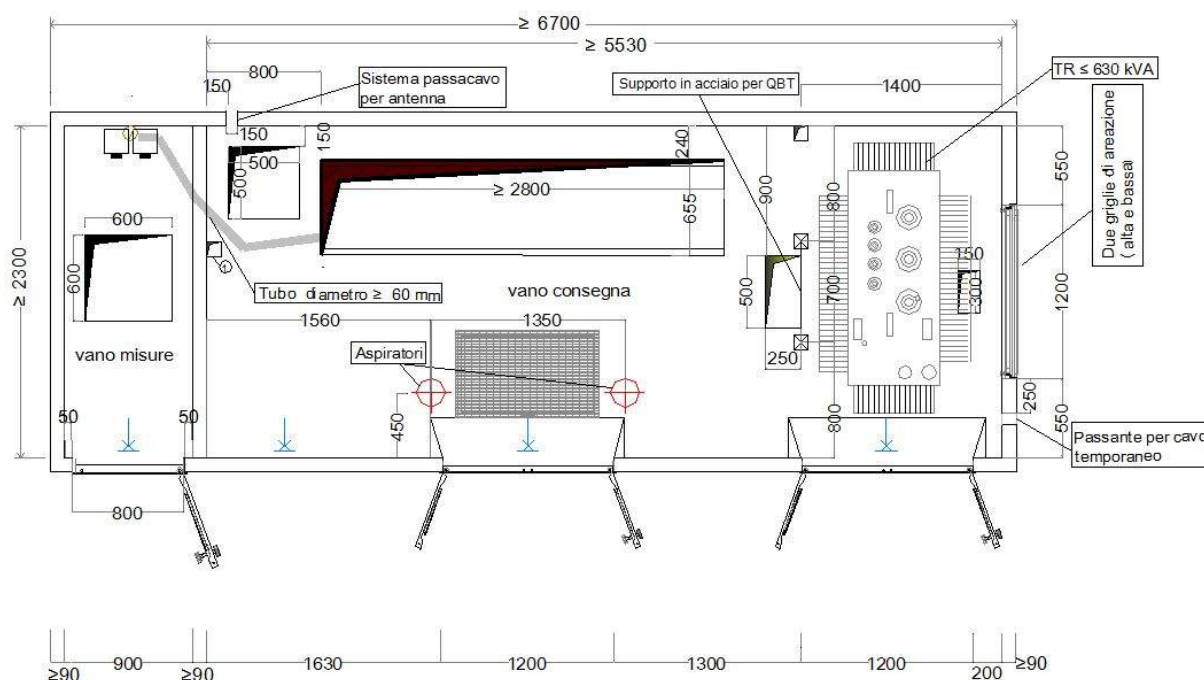


Fig. 1 – Pianta cabina consegna Utente

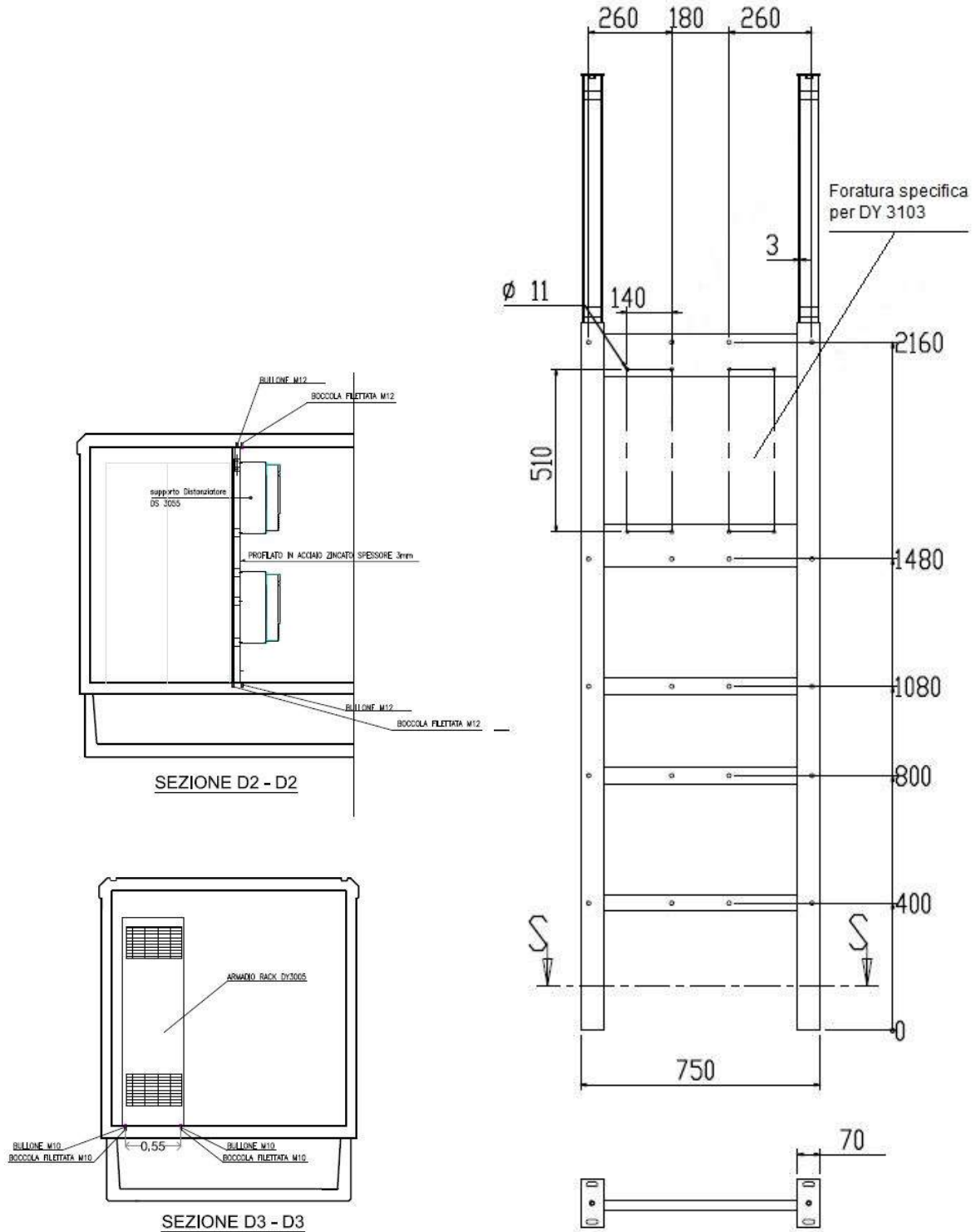
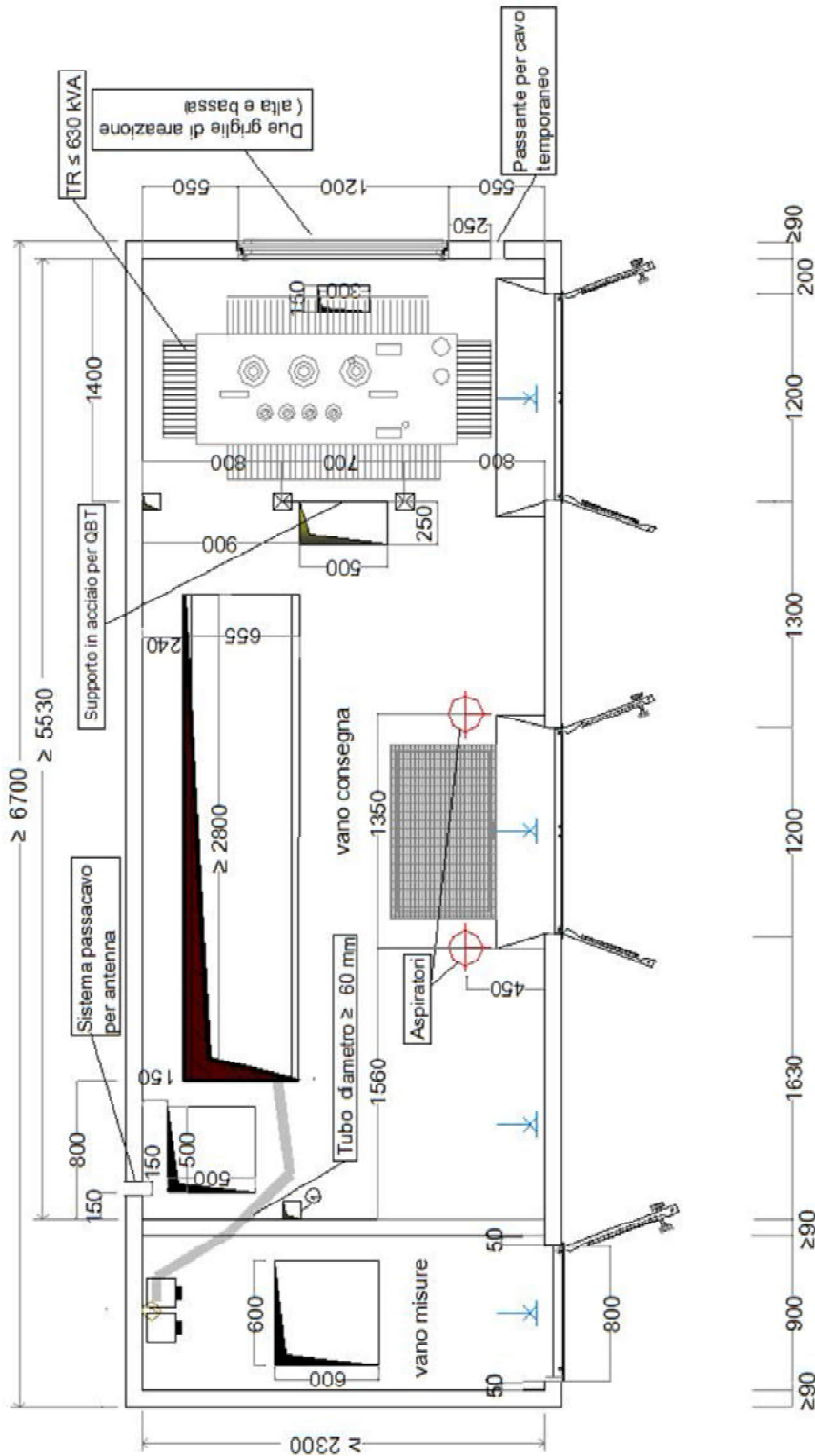
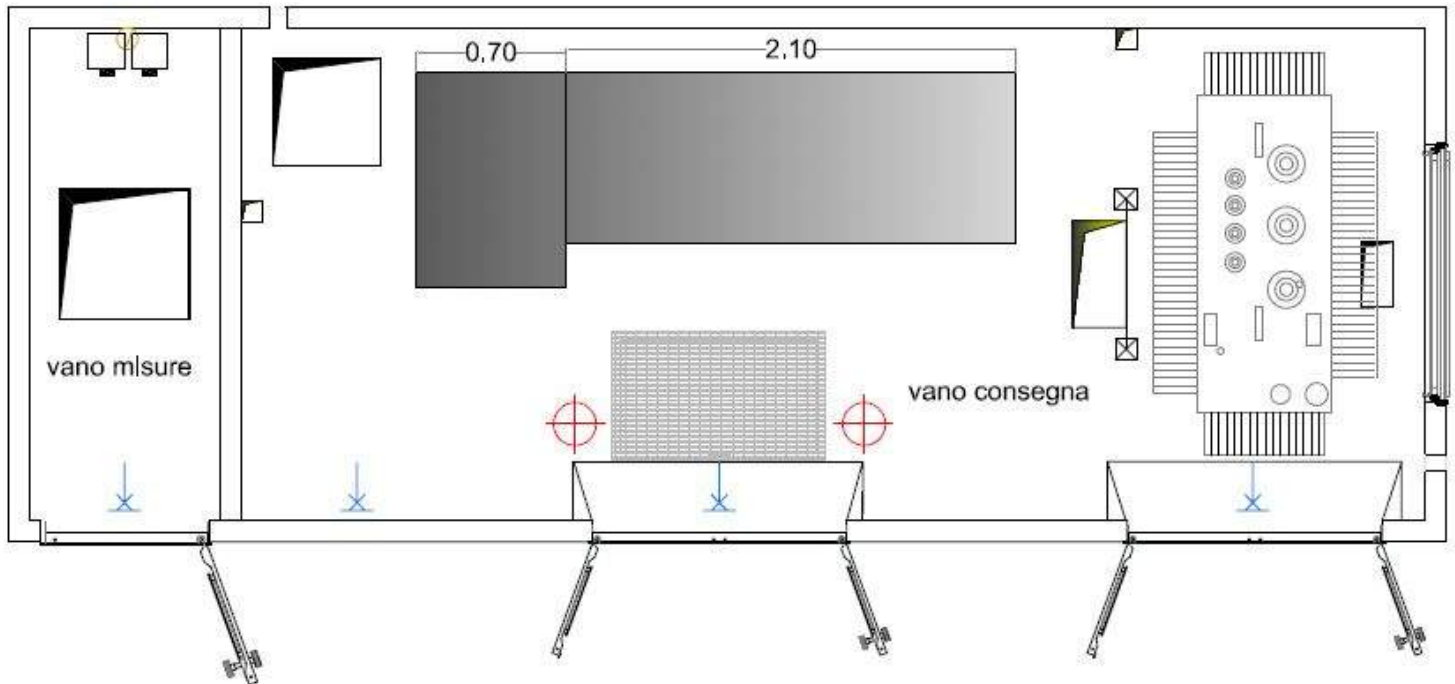


Fig 2- Telaio porta Quadri BT DY 3009 / Quadro rack DY3005/1

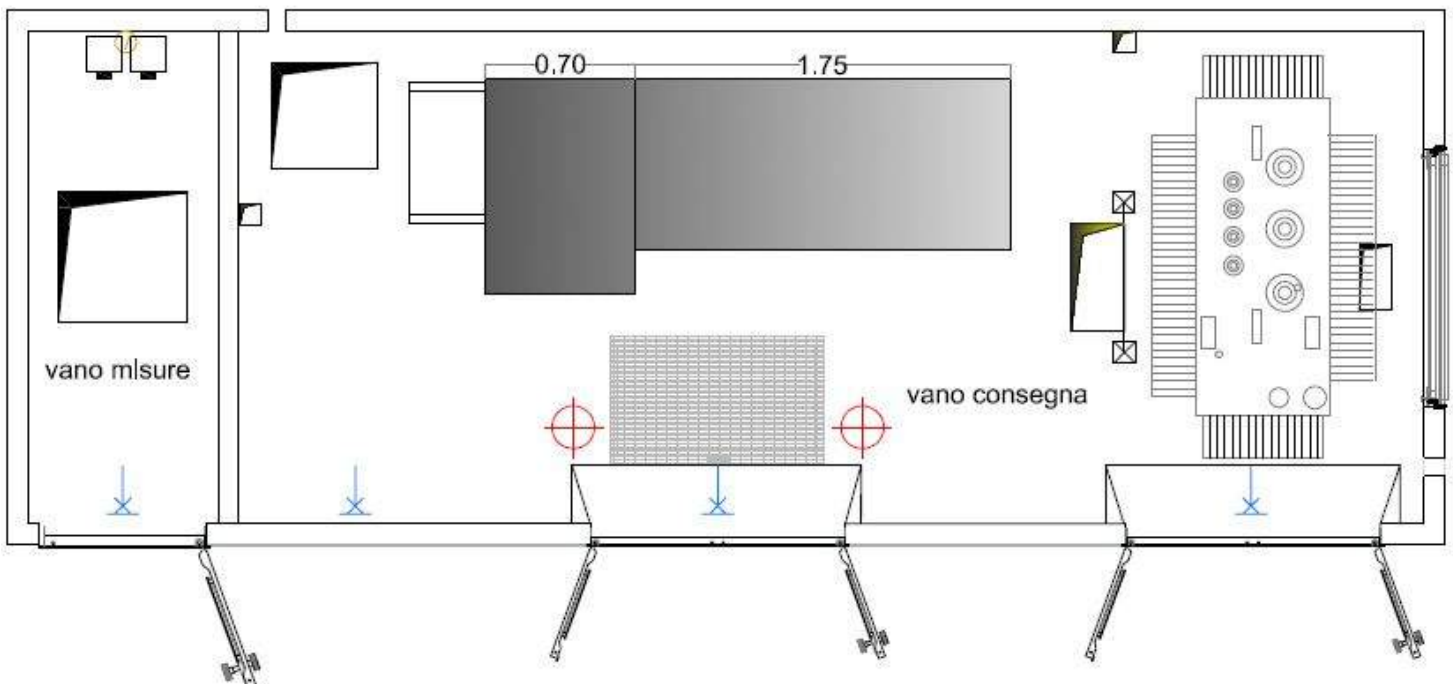
LAYOUT CABINA




RMU 4L+T / DY808



RMU 3L+T / DY808




Ipotesi layout con RMU+DY808

	GLOBAL STANDARD	Page 1 of 38
	TECHNICAL SPECIFICATION OF MEDIUM VOLTAGE CABLES WITH RATED VOLTAGE $U_0/U_c(U_m)$ 8,7/15(17,5) kV, 12/20(24) kV, 15/25(31) kV, 18/30(36) kV AND 20/34,5(37,95) kV	GSC001 Rev. 02 20/02/2015

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Revision	Data	List of modifications
00	06/11/2013	First emission
01	30/11/2014	Second emission
02	20/02/2015	Third emission

Enel Distribuzione			Endesa Distribución Eléctrica		
Emission	Verification	Approval	Emission	Verification	Approval
NT-NCS Italy	NT-NCS Italy	NT Italy	NT-NCS Spain	NT-NCS Spain	NT Spain
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LOCAL SECTION

- A LATAM: Ampla (Brazil), Chilectra (Chile), Codensa (Colombia), Coelce (Brazil), Edelnor (Perú), Edesur (Argentine)
- B ENDESA DISTRIBUCIÓN ELÉCTRICA (Spain)
- C ENEL DISTRIBUZIONE (Italy), ENEL DISTRIBUTIE: Banat, Dobrogea, Muntenia (Romania)

COMMON LIST OF MAIN REQUIREMENTS

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1 SCOPE

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

- | | |
|--------------------------------------|-----------|
| • Ampla (AM) | Brazil |
| • Chilectra (CH) | Chile |
| • Codensa (CD) | Colombia |
| • Coelce (CE) | Brazil |
| • Edelnor (EN) | Perú |
| • Edesur (ES) | Argentina |
| • Endesa Distribución Eléctrica (EE) | Spain |
| • Enel Distributie Banat (ER) | Romania |
| • Enel Distributie Dobrogea (ER) | Romania |
| • Enel Distributie Muntenia (ER) | Romania |
| • Enel Distribuzione (ED) | Italy |

This document specifies the features and tests that must be accomplished by the aluminium and copper cables of insulated Cross-Linked Polyethylene (XLPE) or High Performance Polypropilene Thermoplastic Elastomer (HPTE) with rated voltage $U/U_0(U_{max})$ 8,7/15(17,5) kV, 12/20(24) kV, 15/25 (31), 18/30(36) kV and 20/34.5(37.95) to be used in medium voltage distribution networks of Enel Group Distribution Companies.

Additional prescriptions or integration of the main common part are reported in Local Sections with the same corresponding clause or sub-clause number.

This standard replaces all the local standards used up to now by all the Distribution Companies.

2 LIST OF COMPONENTS

The list of components with the main requirements, which is an integral part of the present document, is reported in "Medium Voltage insulated cables (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 INTERNATIONAL STANDARDS

The following standards are needful for the application of this Global Standard.

- IEC 60502-2 ed2.0: 2005-03-08 Power cables with extruded insulation and their accessories for rated voltages from 1 kV ($U_m = 1,2$ kV) up to 30 kV ($U_m = 36$ kV) - Part 2: Cables for rated voltages from 6 kV ($U_m = 7,2$ kV) up to 30 kV ($U_m = 36$ kV)
- IEC 60228 ed-3.0 2004-11-02 Conductors of insulated cables

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- IEC 60811-100 ed1.0 2012 Electric and optical fibre cables - Test methods for non-metallic materials - Part 100: General
- IEC 60811-201 ed1.0 2012-03-12 Electric and optical fibre cables - Test methods for non-metallic materials - Part 201: General tests - Measurement of insulation thickness.
- IEC 60811-401 ed1.0 2012-03-12 Electric and optical fibre cables - Test methods for non-metallic materials - Part 401: Miscellaneous tests - Thermal ageing methods - Ageing in an air oven.
- IEC 60811-412 ed1.0 2012-03-12 Electric and optical fibre cables - Test methods for non-metallic materials - Part 412: Miscellaneous tests - Thermal ageing methods - Ageing in an air oven.
- IEC 60811-503 ed1.0 2012-03-13 Electric and optical fibre cables - Test methods for non-metallic materials - Part 503: Mechanical tests - Shrinkage test for sheaths.
- IEC 60811-606 ed1.0 2012-03-13 Electric and optical fibre cables - Test methods for non-metallic materials - Part 606: Physical tests - Methods for determining the density.
- IEC 60811-402 ed1.0 2012-03-12 Electric and optical fibre cables - Test methods for non-metallic materials - Part 402: Miscellaneous tests - Water absorption tests.
- IEC 60811-406 ed1.0 2012-03-12 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 60811-510 ed1.0 2012-03-13 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 ed1.0 2012-03-13 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 ed1.0 2012-03-13 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 60811-607 ed1.0 2012-03-13 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 60885-3 ed1.0: 1988 Electrical test methods for electric cables. Part 3: Test methods for partial discharge measurements on lengths of extruded power cables
- IEC 62230 ed1.0 2006-05-24 Electric cables - Spark-test method.
- HD620 S2 - January 2010 Distribution cables with extruded insulation for rated voltages from 3,6/6 (7,2) kV up to and including 20,8/36 (42) kV. Supersedes HD 620 S1:1996 + A1:2001 + A2:2003 + A3:2007 + corr. Dec.2007

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- IEC 60410 ed1.0 1973-01-1 Sampling Plans and Procedures for Inspection by attributes
- HD 605 S2:2008 Electric cables - Additional test methods

3.3 LOCAL STANDARDS

See Local Section.

3.4 REPLACED LOCAL STANDARDS

See Local Section.

Under any doubt or discrepancy prevail indication of the Standard Reference. Likewise, any change in the Reference Standards updates this document.

4 TECHNICAL REQUIREMENTS

The types of cable considered in this Global Standard are shown in figure 1. The following sections provides technical information about the parts of the cable.

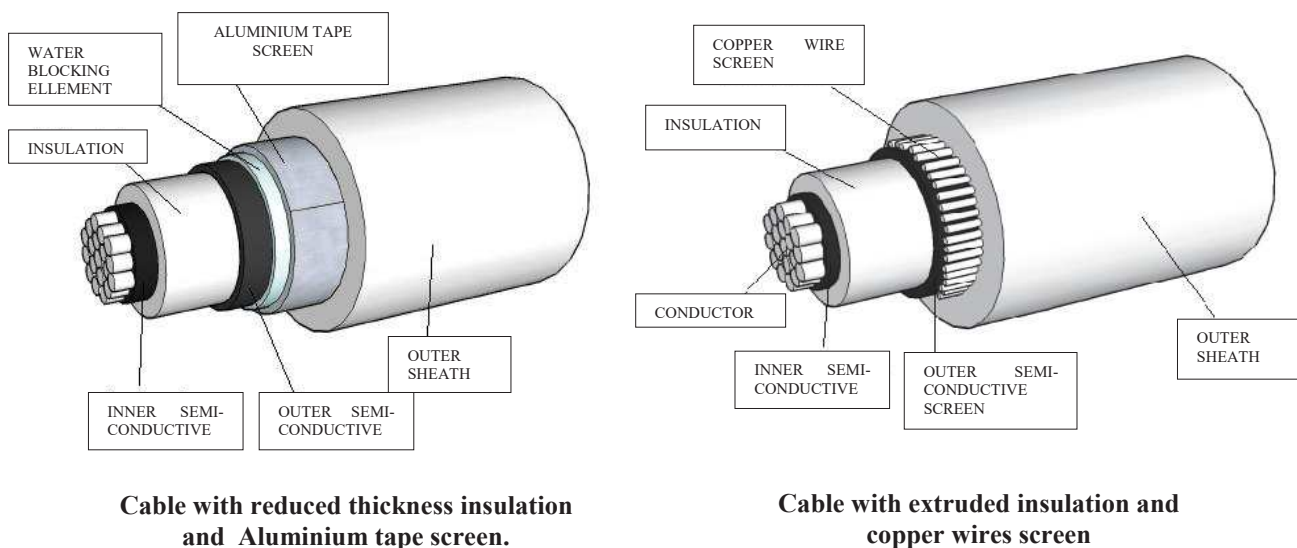


Figure 1: Layout of single conductor of insulated cables

Types of cables are defined in different sections and voltage level; the cables are single or three cores of aluminium or copper.


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Table 1: Type of Cables

Type of cable	Description
I	Single or Triplexed insulated cables of aluminium with cross-linked polyethylene (XLPE) reduced thickness insulation, aluminium tape screen and outer sheath of polyethylene high density DMP2.
II	Single insulated cable with aluminium cross-linked polyethylene (XLPE) reduced thickness insulation, aluminium tape screen and polyolefin sheath DMZ1
III	Single insulated cable with aluminium cross-linked polyethylene (XLPE) reduced thickness insulation, aluminium tape screen and outer sheath compound polyolefin-based thermoplastic flame resistant DMZ2.
IV	Single or Triplexed insulated cables High performance Polypropilene Thermoplastic Elastomer (HPTE) reduced thickness insulation, with aluminium tape screen and outer sheath of PE and DMP2
V	Single or Triplexed insulated cables of copper or aluminium with cross-linked polyethylene (XLPE) insulation, copper wire screen and outer sheath of polyethylene type ST7 or PVC type ST2.

Rated Voltage level

Table 2: Rated Voltage Level

types of voltage	Voltage level $U_0/U_c(U_{max})$ kV
A	8.7/15 (17.5)
B	12/20 (24)
C	15/25 (31) (*)
D	18/30 (36)
E	20/34,5 (37,95) (**)

This classification is exclusive to Enel group.

(*) Exclusive use for Chilectra. See Local Section "A", sub-clause 3.3

(**) Exclusive use for Codensa. See Local Section "A", sub-clause 3.3

5 DESIGN AND MANUFACTURE


5.1 CONDUCTOR

The conductor will be stranded compacted circular, class 2, (reference IEC 60228), and manufactured of aluminium wires (AAC -1350) or Soft Electrolytic Copper Wire.

5.2 INNER SEMI-CONDUCTIVE SCREEN

Extruded thermosetting semi-conducting screen bonded over the conductor, without causing damage to conductor or insulation.

Characteristics are shown in the section 6 clause 2, and specific characteristics are detailed in Common List.

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5.3 INSULATION

The insulation material shall be manufactured according to one of the following options:

- Cross-linked polyethylene (XLPE) without or with tree retardant (TR-XLPE) satisfying characteristics specified in IEC 60502-2, or
- High performance Polypropilene Thermoplastic Elastomer (HTPE) according to standard CEI 20-86.

The insulating layer, the semiconductor layer and the semi-conductive screen will be applied by a triple extrusion process, not being admitted any type of lacquer or other material between them.

The minimum insulation thickness shall not be less than 90% of the nominal value minus 0,1mm

$$(t_{min} \geq 0,9 \times t_n - 0,1)$$

Where: t_{min} : Minimum insulation thickness in millimetres

t_n : nominal thickness in millimetres

The insulation must allow maximum conductor temperatures of 90°C in normal operation and 250 °C in short circuit for 5 seconds at least.

Nominal thickness for normal and reduced cable insulation are detailed in Table 3 and Table 4 respectively.

Table 3: Extruded Insulation Thickness *

Types of Voltage	Voltage levels U ₀ /U (U _{max}) kV	Insulation Thickness	
		Nominal (t_n) (mm)	Minimum (t_{min}) (mm)
A	8.7/15 (17.5)	4.5	4.0
B	12/20(24) kV	5.5	4.9
C	15/25(31) kV	6.6	5.8
D	18/30(36) kV	8.0	7.1
E	20/34.5 (37.95)	8.0	--

Table 4: Reduced Insulation Thickness**

Types of Voltage	Voltage levels U ₀ /U (U _{max}) kV	Insulation Thickness	
		Nominal (t_n) (mm)	Minimum (t_{min}) (mm)
A	8.7/15 (17.5)	--	--
B	12/20(24) kV	4.9	4.3
C	15/25(31) kV	--	--
D	18/30(36) kV	7.25	6.4
E	20/34.5 (37.95)	--	--

* Applies to cable type V

** Applies to cables types I, II, III y IV


5.4 OUTER SEMI-CONDUCTIVE SCREEN

Over the insulation screen shall be laid a thermosetting semi-conducting screen manufactured of XLPE, compatible with insulation and temperatures in normal operation and in short circuit.

The semi-conductive screen must not be easy to remove (no easy stripping) for the cables type I and IV, and should be easily to for cables type II, III, and V.

In order to remove the screen must be used semiconductor tools.

Characteristics are shown in the section 6 clause 4, and specific characteristics are detailed in Common List.

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5.5 WATER BLOCKING ELEMENT

The Water swell material is made using a semi-conductive tape with a minimum overlap of 10%. Alternatively, this coating can be done with other method since it provides the same results and it had been expressly approved by the customer. It should meet the standard IEC 60502-2. "Water penetration test".

Specific characteristics are detailed in Local Section.

5.6 METALLIC SCREEN.

It must be copper wire screen or aluminium tape.

Specific characteristics are detailed in Local Section.

5.6.1 COPPER WIRE SCREEN

It shall be made of 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 before the screen.

Wires are regularly spaced over the external perimeter which is defined by the outer semi-conductive screen. It shall not require copper tape or band copper strip in order to mechanical clamping of copper strands.

Characteristics of the Screen are shown in Table 5; specific characteristics are detailed in Local Section.

Table 5: Electric Resistance of Copper Wire Screen

Wires screen section of copper (mm ²)	Maximum Electric resistance at 20 °C (Ω/km)
12	1.15
16	1.15
25	0.727
50	0.387

5.6.2 ALUMINIUM TAPE SCREEN

Aluminium tape screen of 0.3 mm minimum thickness forming a longitudinal pipe, overlapping glued edges 5 mm at least. This aluminium tape screen should be joined longitudinally and continuously to the outer sheath.

The Metallic screen should ensure to flow fault current and *prevent* radial spreading of water.


Specific characteristics are detailed in Local Section.

5.7 OUTER SHEATH

See Common List.

5.8 CONSTRUCTIVE ASPECTS

The longitudinal water blocking inside the conductor and/or under the outer sheath must at least meet the requirements of water penetration test described in Annex F of IEC 60502-2.

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If delivery is required of triplexed 3 core unarmoured cable it must be marked according to the labelling, and it will be twisted with a step less than or equal to 60 times the individual nominal diameter.

Specific characteristics are detailed in Local Section.

5.9 CURRENT - CARRYING CAPACITY OF CABLES

The Table 6 shows the resistance values of each section of aluminium cable and copper

Table 6: Resistance Conductors.

Nominal cross-sectional area (mm ²)	Copper Cables	Aluminium Cables
	Maximum resistance of conductor at 20°C (Ω/km)	Maximum resistance of conductor at 20°C (Ω / km)
35	0.524	0.868
50	--	0.641
70	0.268	0.443
95	--	0.320
120	0.153	0.253
150	0.124	0.206
185	--	0.164
240	0.0754	0.125
300	0.0601	0.100
400	0.047	0.0778
500	--	0.0605
630	--	0.0469

Current carrying - capacity (ampacity). See Local Section.

5.10 MARKING

5.10.1 CHARACTERISTICS

The marking must be indelible paint, easily legible and carried out by engraving or in relief on the outer sheath in a continuously way.


Specific characteristics are detailed in Local Section.

5.10.2 CABLE MARKING

See Local Section.


5.10.3 EXAMPLE OF CABLE MARKING

Example: See Local Section.

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6 CHARACTERISTICS (1/5)

Nº	Elements of cable	Type I	Type II	Type III	Type IV	Type V
1	Conductor					
1.1	Class	IEC 60228 class 2				
1.2	Material	IEC 60228 Aluminium o Copper				
1.3	Type	Stranded compacted circular conductors				
1.4	Dimension y resistance electric of conductor	IEC 60228:2005 Table 2 and Table C.2				
2	INNER SEMI-CONDUCTIVE SCREEN					
2.1	Material	Cross-linked polyethylene (XLPE)				
2.2	Thickness					
	Minimum	0,3 mm	0.3 mm	0.3 mm	0,3 mm	0,3 mm
	Medium	--	No less than nominal	No less than nominal	--	--
	Nominal	0,5 mm	0,5 mm	0.5 mm	0,5 mm	0.5 mm
3	Insulation					
3.1	Type of insulation	XLPE			HPTE	XLPE
	Mechanic Properties					
3.2	Before ageing on samples					
	Tensile strength, minimum	12,5 MPa	12,5 MPa	12,5 MPa	8.5 MPa	12,5 MPa
	Elongation-at-break, minimum	200%	200%	200%	350 %	200%
3.3	After ageing on samples					
	Temperature	135 °C	135 °C	135 °C	135 °C	135 °C
	Duration T1	168 h	168 h	168 h	240 h	168 h
	Tensile strength minimum					
	Variation maximum T1/T0	± 25%	± 25%	± 25%	8.5 MPa Medium, minimum value	± 25%
	Elongation-at-break minimum					
	Variation maximum T1/T0	± 25%	± 25%	± 25%	350% Medium, minimum value	± 25%

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6. - CHARACTERISTICS (2/5)


N°	Elements of cable	Type I	Type II	Type III	Type IV	Type V
3.4	After Ageing over complete cable (non contamination test)					
	Temperature	100 °C	100 °C	100 °C	100 °C	100 °C
	Duration T1	--	--	--	336 h	--
	Duration T2	168 h	168 h	168 h	1008 h	168 h
	Tensile strength minimum					
	Variation maximum T2/T0	± 25%	± 25%	± 25%	--	± 25%
	Variation maximum T2/T1	--	--	--	--	--
	Value Medium Final T1, minimum,	--	--	--	8.5 MPa	--
	Value Medium Final T2, minimum	--	--	--	8.5 MPa	--
	Elongation-at-break minimum					
	Variation maximum T2/T0	± 25%	± 25%	± 25%	350 %	± 25%
Value medium Final T1, minimum	---	---	---	350 %	---	
	Physical and Chemical properties					
3.5	Hot set test					
	Temperature	200 °C	200 °C	200 °C	---	200 °C
	Duration	15 min	15 min	15 min	---	15 min
	Mechanical stress	0,2 MPa	0,2 MPa	0,2 MPa	---	0,2 MPa
	Maximum elongation under load	175%	175%	175%	---	175%
Maximum residual elongation	15%	15%	15%	---	15%	
3.6	Water absorption					
	Temperature	85 °C	85 °C	85 °C	85°C ±3	85 °C
	Duration	336 h	336 h	336 h	336 h	336 h
	Maximum variation of mass	1 mg/cm ²	1 mg/cm ²	1 mg/cm ²	5 mg/cm ²	1 Mg/cm ²
3.7	Shrinkage test					
	Duration	1 h	1 h	1 h	1 h	1 h
	Temperature	130 °C	130 °C	130 °C	130°C	130 °C
	Maximum shrinkage	4%	4%	4%	4%	4%
3.8	Insulation resistance (min. Value)					
	Volume resistivity a 90°C	----	10 ¹² Ω- cm	10 ¹² Ω- cm	---	---
3.9	Thickness	See Table 4				See table 3

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6. - CHARACTERISTICS (3/5)

Nº	Elements of cable	Type I	Type II	Type III	Type IV	Type V
4	OUTER SEMI-CONDUCTIVE SCREEN	IEC 60502-2 Sub-clause 7.2 ***				
4.1	Material	Cross-Linked Polyethylene (XLPE)				
4.2	Application	bonded to Insulation	Easy stripping	Easy stripping	bonded to Insulation	Easy stripping
4.3	Thickness					See Common List.
	Minimum	0.5 mm	0.3 mm	0.3 mm	0.5 mm	
	Medium	--	No less than nominal	No less than nominal	--	
	Nominal	0.5 mm	0.5 mm	0.5 mm	0.5 mm	
4.4	Physical properties					
	Minimum load of breaking	7 N/mm ²				
	Minimum elongation of breaking	150%				
5	Water blocking element	Superimposed semiconductor tape at least 10%				
6	Metallic Screen	HD 620-1 Sub-clause 4.8				--
6.1	Material	Aluminium tape 0.3 mm thick.				Annealed copper wires, See table 5
6.2	Maximum electric resistance on the screen	--				See table 5
7	OUTER SHEATH	HD 620-1			CEI 20-86	IEC 60502-2
7.1	Denomination	DMP2	DMZ1	DMZ2	DMP2	PE ST7 o PVC ST2
	Type	PE	PO sheath	PO sheath	PE	PE ST7 o PVC ST2
	Maximum operating temperature of the conductor	90 °C	90 °C	90 °C	90 °C	90 °C
	Mechanical properties					
7.2	Before ageing on samples					
	Minimum tensile strength	18 MPa	15 MPa	12 MPa	18 MPa	12,5 MPa
	Minimum elongation at break	300 %	500 %	300 %	300 %	300% (PE ST7) ó 150% (o PVC ST2)
7.3	After ageing in air oven					
	Temperature	110 °C	110 °C	110 °C	110 °C	EC 60502-2 Table 20
	Duration	336 h	336 h	240 h	336 h	--
	Minimum elongation at break	300 %	300 %	--	300 %	IEC 60502-2 Table 20
	Maximum variation*	--	--	± 25 %	--	IEC 60502-2 Table 20

* Variation, difference between the median values obtained after aging and without aging, expressed as a percentage.


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6. - CHARACTERISTICS (4/5)

Nº	Elements of cable	Type I	Type II	Type III	Type IV	Type V
7.4	After ageing on cable (non contamination test)					
	Temperature	110 °C	110 °C	110 °C	110 °C	IEC 60502-2 Table 20
	Duration T1	168 h	168 h	168 h	168 h	--
	Minimum elongation at break	300 %	300 %	--	300 %	IEC 60502-2 Table 20
	Maximum variation*		--	± 25 %	--	IEC 60502-2 Table 20
Physical and Chemical properties						
7.5	- Pressure test at high temperature					
	Duration	4 / 6 h		6 h		6 h ⁽¹⁾ IEC 60502-2 Table 21 (ST2) table 22 (ST7)
	Temperature	115 °C		110 °C		115 °C
	Coefficient k	0,7		0,7		0,7 ⁽¹⁾
	Maximum depth of indentation	30 %		50 %		50 % ⁽²⁾
7.6	Carbon black content		--	--	---	2,5 ± 0,5 %
	Shore D-hardness Minimum	55	--	--	--	--
7.7	Stress break downing resistance					
	Request Duration	No breakdowns 1 000 h	--	--	--	--
7.8	- Loss of mass					(ST2)
	Duration	---	168 h	168 h	--	168 h
	Temperature Maximum weight loss	---	100 °C 0,5 mg/cm ²	100 °C 0,5 mg/cm ²	--	100 °C 0,5 mg/cm ²
7.9	- Low temperature test					(ST2)
	Elongation test at low temperature Temperature minimum elongation	---	-30 °C 20 %	-15 °C 20 %	--	-30 °C 20 %
7.10	- Tear resistance test					---
	Temperature Minimum resistance	---	20 ± 5 °C		--	---
			24 N/mm ²	12 N/mm ²		
7.11	- Shrinkage outer sheath					IEC 60811-503
	Duration	---	--	--	--	
	Temperature Maximum shrinkage	---	5 x 5 h 80 °C 7 %	5 x 5 h 80 °C 3 %	--	
7.12	- Abrasion test					---
	Temperature	---	20 ± 5 °C		--	---
	Mass	---	36 kg	20 kg	--	---
	Number of scratches	---	8		--	---
	Speed	---	0,3 ± 15 % m/s		--	---

¹ See IEC 60811-508 Annex A for diameters > 15 mm

² See IEC 60811-508 Sub-clause 4.3.2.6 for diameters > 15 mm

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* Variation, difference between the median values obtained after aging and without aging, expressed as a percentage.

6. - CHARACTERISTICS (5/5)

N°	Elements of cable	Type I	Type II	Type III	Type IV	Type V
7.13	- Water immersion test (gravimetric method)		--			
	Duration		336 h			
	Temperature	--	85 °C		--	--
	Maximum variation of mass		0,5 mg/cm ²	5,0 mg/cm ²		
7.14	- Heavy metal content					
	Lead	--	< 0.5 %		--	--
7.15	Low degree of acidity of gases evolved during combustion					
	pH: Minimum	--	4,3		4.3	--
	Maximum Conductivity	--	10 µS/mm		--	--
7.16	Resistance to UV rays					
	Minimum tensile strength	--	MPa		MPa	--
	Maximum variation T1/T0	--	15 %		15 %	--
	Minimum elongation at break	--	%		%	--
	Maximum variation T1/T0	--	15 %		15 %	--
	Decolouration	--	Poor		poor	--
7.17	Colour	See local section				
7.18	Thickness a) Nominal Value b) Minimum Value	See Common List				
7.19	Outer sheath	IEC-60502-2				

7 TEST


7.1 DEFINITIONS

Acceptance testing

Acceptance tests are normally carried out on each manufacturing place during delivery. They can be classified in routine tests and sample tests. The routine tests shall be carried out over whole the length of cable, and sample tests are carried out over samples taken from a complete cable.

Type Test

Type tests are needed for homologation of cables. When type tests have been successfully performed on a type of cable covered by this standard with a specific conductor cross-sectional area and rated voltage, type approval shall be accepted as valid for cables of the same type with other conductor cross-sectional areas and/or rated voltages, provided the following three conditions are all satisfied

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- The same materials, i.e. insulation and semi-conducting screens, and manufacturing process are used;
- The conductor cross-sectional area is not larger than that of the tested cable, with the exception that all cross-sectional areas up to and including 630 mm² are approved when the cross-sectional area of the previously tested cable is in the range of 95 mm² to 630 mm² inclusive;
- The rated voltage is not higher than that of the tested cable.

Approval shall be independent of the conductor material.

For the cable type IV, all tests will be applied under the CEI-20-85.

See Local section C (ENEL).

7.2 ROUTINE TEST


The routine test must be made at 100% the total of spools that are delivered

N°	TEST IN FINISHED CABLE	Type of cable					REQUIREMENTS	TEST METHOD
		I	II	III	IV	V		
1	Electric resistance of conductor	X	X	X	--	X	IEC 60228	IEC 60502-2, Sub-clause 16.2
2	Electric resistance on metallic screen	X	X	X	--	X	Sub-clause 6.6.2	IEC 60502-2, Sub-clause 16.2
3	Voltage test c.a. Voltage test 3,5 U ₀ Duration: 5 minutes	X	X	X	--	X	No Fault	HD 605 S2, Sub-clause 3.2.1 Assigned Voltage Test Voltage 12/20 kV 42 kV 18/30 kV 63 kV
4	Partial discharge test							IEC 60885-3 The measurement is performed at room temperature in all stages of the cable under voltage in a.c.
4.1	Discharge test in 2 U ₀	X	--	--	--	--	≤ 5 pC	The test voltage shall be applied between conductor and screen. The test voltage shall be raised gradually to and held at 2.3 U ₀ for a minute and then slowly reduced to 2 U ₀ .
4.2	Discharge test in 1,73 U ₀	-	X	X	--	X	≤ 10 pC	The test voltage shall be applied between conductor and screen. The test voltage shall be raised gradually to and held at 2 U ₀ for a minute and then slowly reduced to 1,73 U ₀ .
5	Outer sheath voltage test (spark-test)	X	X	X	--	--	No breakdown	IEC 60229 Test voltage c.a.: 15 kV c.a., ó Test voltage en c.c.: 25 kV c.c. Minimum time: 0,1 s

Legend: Fields marked with:
"X": The test method applies
"--": The test method does not apply

Note:


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7.3 SAMPLE TEST (1/2)

N°	SAMPLE TEST	TYPE OF CABLE					REQUIREMENTS	TEST METHOD
		I	II	III	IV	V		
1	Verification: - Marking - Colour - Number of conductor wires	X	X	X	X	X	Cable characteristics shall comply with those approved by the customer	Visual inspection and measurements
1.1	In case of triplexed cables: - Measurement of the effective length of the coils and the step helix	X	--	--	X	X	The effective cable length shall not be by less than 0,5 m from that declared by the manufacturer. This is valid for length \leq standard deliver length.	The test shall be carried out on 1 length from those submitted to "Electrical resistance measurement" test.
2	Conductor mass per unit length measurement	X	--	--	X	--	The value shall be recorded	A conductor piece approximately 1 m long shall be removed from one cable core and straightened. The length of the piece shall be measured with a tolerance not exceeding ± 1 mm. The conductor piece shall be weighed with accuracy not less than $\pm 0.1\%$ and the mass per unit length, expressed in g/m, shall be calculated, rounded to the first decimal point.
3	Conductor diameter measurement	X	X	X	X	X	IEC 60228 Table C2	IEC 60811-203
4	Semi-conducting layers thickness measurement	X	X	X	--	X	---	IEC 60811-201
4.1	Conductor screen	X	X	X	X	X	Section 6, Sub-clause 2-2.2	HD 605 S2, Sub-clause 2.1.10.2
4.2	Insulation screen	X	X	X	X	X	Section 6 Sub-clause 4-4.3	
4.3	Irregularities into the insulation							
	Irregularities $\geq 0,040$ mm	--	X	X	X	X	≤ 0.080 mm, the ratio between the width and height will be at least 3:1.	
	Irregularities $< 0,040$ mm	--	--	--	--	--	ignored	
4.4	Of the insulation into the conductor screen	--	X	X	--	--	$\leq 0,2$ mm	
5	Insulation thickness measurement	X	X	X	X	X	See Tables 3 and 4. As appropriate	IEC 60811-201
6	Outer semi-conductor stripping test.	---	X	X	--	X	Strength stripping between 0,5 and 2,5 daN	HD 605 S2, Sub-clause 2.2.8.2 method 2
7	Insulation diameter measurement	X	--	--	--	--		HD 605 S2, Sub-clause 2.1.11.1
	Diameter over the insulation screen – difference between the maximum and minimum diameter (in the same voltage level)	X	--	--	--	--	$\leq 0,5$ mm	HD 605 S2, Sub-clause 2.1.11.1
8	Insulation diameter measurement	X	--	--	--	--	--	HD 605 S2, Sub-clause 2.1.10.2

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7.3 SAMPLE TEST (2/2)

N°	SAMPLE TEST	TYPE OF CABLE					REQUIREMENTS	TEST METHOD
		I	II	III	IV	V		
9	Aluminium metallic screen thickness measuring	X	X	X	X	---	Sub-clause 6.6.1 Minimum 0,3 mm	5 measurements along the circumference an at a distance of 10 mm from each edge shall be taken by micrometer on a sample of the tape fully detached from the outer sheath (e.g. detachment may be done by immersion in acetic acid at 80°C or other suitable method)
10	Determination of overlap of aluminium screen	X	X	X	X	---	Minimum 5 mm	visual examination
11	Outer semi-conducting layer resistivity measurement 20 °C 90 C	X	X	X	X	X	< 5 000 Ω - cm	IEC 60502-2 Annex D
		X	X	X	X	X	< 25 000 Ω - cm	
12	Mechanical characteristics of insulation before ageing	X	X	X	X	X	Sub-clause 6.3.2	IEC 60811-501 Sub-clause 4.2
13	Insulation hot set test	--	--	--	--	X	Sub-clause 6.3.5	IEC 60811-507
14	Thermoplastic coating thickness	X	X	X	X	X	Sub-clause 6.7.18	IEC 60811-202
15	Mechanical properties of the thermoplastic shell before aging	X	X	X	X	X	Sub-clause 6.7.2	IEC 60811-501 Sub-clause 4.3
16	Overall diameter	X	--	--	X	X	Sub-clause 6.7.19	IEC 60811-203 Measurement shall be repeated in 3 different positions 0.5 m spaced, on both end of the cable
17	Rotor abrasion test	X	--	--	X	X	There shall be no short-circuit between the metal shield and the rotor before the 200 laps	HD 605 S2, Sub-clause 2.5.13
18	Sheath adhesion test to metal tape.	X	--	--	X	--		HD 605 S2, Sub-clause 2.4.17.1 method 1
19	Electrical properties of insulating - Test voltage 4h - Dielectric losses according to the voltage	--	X	X	--	--	UNE 211620 3.2	UNE 211620 3.2
20	Outer sheath physicochemical properties - Heat Shock Test - Pressure at elevated temperature - Tear strength of the other sheath - Percussion test	--	X	X	--	--	HD 620-1 Table 4C	IEC 60811-509 Sub-clause 4.4 HD 605 2.2.2.2 UNE 211620 Annex 3

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7.4 TYPE TEST (1/4)

N°	TYPE TEST	TYPE OF CABLE					REQUIREMENTS	TEST METHOD
		I	II	III	IV	V		
1	Volume resistivity of the insulation and insulation resistance constant at the maximum allowable temperature of the conductor (insulation resistance)	--	X	X	--	--	Sub-clause 6.3.8.	IEC 60502-2, Sub-clause 18.2.2 Insulation resistance measurement at maximum conductor temperature
2	Partial discharge measurement - Test voltage: 2 U ₀	X	X	X	X	X	≤ 5 pC	IEC 60885-3
3	Partial discharges measurement after folding a) bending test b) Discharge partial test	X	X	X	--	X	IEC-60502-2 Sub-clause 18.1.4	IEC 60502-2, Sub-clause 18.1.4
4	tan.δ measurement as a function of the voltage tgδ maximum a U ₀ Variation máx. tgδ between 0,5U ₀ y 2U ₀	X	X	X	X	X	0,004 0,002	HD 605 S2, Sub-clause 3.11.3.1
5	tan.δ measurement as a function of the temperature - Measured values	X	X	X	X	X	≤ 0,004	IEC 60502-2, Sub-clause 18.1.5 Increase the temperature continuously from ambient to a temperature between 95 ° C and 100 ° C. - Test voltage: 2 kV.
6	Thermal cycling test followed by partial discharges a) thermal cycling test b) Partial discharge test	X	X	X	X	X	≤ 5 pC	IEC 60502-2, Sub-clause 18.1.6 IEC 60502-2, Sub-clause 18.1.4
7	Impulse withstand voltage, followed by an alternating current test at power frequency (in ca) a) test of impulse withstand voltage: - Conditions: heating the sample until a temperature of between 95 ° C and 100 ° C. - Test voltage for 12/20 kV: 125 KV - Test voltage for 18/30 kV: 170 KV - Number of pulses 10 pulses positive 10 negative impulses b) a.c. voltage test: - Conditions: at room temperature - Test voltage: 3.5 U ₀ - duration: 5 min	X	X	X	X	X	No drilling No drilling	IEC 60502-2, Sub-clause 18.1.7 IEC 60230 HD 605 Sub-clause 3.2.1
8	Voltage test 4 hours	X	X	X	X	X	No drilling	IEC 60502-2, Sub-clause 18.1.8
9	Insulation mechanical characteristic after ageing	X	X	X	X	X	Sub-clause 6.3.3	IEC 60811-401


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7.4 TYPE TEST (2/4)

N°	TYPE TEST	TYPE OF CABLE					REQUIREMENTS	TEST METHOD
		I	II	III	IV	V		
10	Water absorption test for insulation	X	X	X	X	X	Sub-clause 6.3.6	IEC 60811-402
11	Adhesion test for the aluminium tape screen	X	--	--	X	--	Minima Resistencia > 12 N	HD 605 S2, Sub-clause 2.2.8.7
		--	X	X	--	--	≥ 20 N	HD 605 S2, Sub-clause 2.4.17.1 method 1
12	Longitudinal contraction test for isolation	X	X	X	X	X	Sub-clause 6.3.7	IEC 60811-502 (L = 200 mm)
13	Hot set elongation test for isolation	X	X	X	--	X	Sub-clause 6.3.5	IEC 60811-507
14	Longitudinal water penetration test	X	--	--	X	X	--	HD 605 S2 Sub-clause 2.4.9
		--	X	X	--	--		UNE 211620 Sub-clause 3.4.8
15	Verification of the cross linking degree in isolation by solvent extraction	X		--	X	X	≤ 20 %	HD 605 S2, Sub-clause 2.5.15
16	Material compatibility test on finished cable	X	--	--	X	--	--	HD 605 S2, Sub-clause 2.4.12.4
		--	X	X	--	--		UNE 211620 Sub-clause 3.4.7.1
		--	--	--	--	X		IEC 60502-2 Sub-clause 19.5.4
17	Mechanical properties of the thermoplastic cover after aging	X	X	X	X	X	Sub-clause 6.7.3	IEC 60811-401
18	Thermo pressure test for thermoplastic outer sheath	X	X	X	X	X	Sub-clause 6.7.5	IEC 60811-508, Sub-clause 4.4
19	Impact Test (Outer sheath)	X	--	--	X	--	--	HD 620 Part 1
		--	X	X	--	--		UNE 211620. Annex 3
20	Tear resistance test (Outer sheath)	--	X	X	--	--		HD 605 S2, Sub-clause 2.2.2.2
21	Dielectric properties of the outer sheath	--	X	X	--	--	No breakdown	IEC 60229, Sub-clause 3.1 (water insertion)
22	Test loss of mass for outer sheath	--	X	X	--	--	Sub-clause 6.7.8	IEC 60811-409 subclause 6
23	Elongation at low temperature of the outer sheath	--	X	X	--	--	Sub-clause 6.7.9	IEC 60811-505 subclause 4.3
24	Shrinkage of the outer sheath	--	X	X	--	--	Sub-clause 6.7.11 ≤ 7%	IEC 60811-503
		--	--	--	--	X	Sub-clause 6.7.11 ≤ 3%	
25	Breakdown resistance of the outer sheath	X	--	--	--	--	Sub-clause 6.7.7 No breakdown	IEC 60811.406: test B method but with a duration of 1 000 h
26	Measuring the Shore D hardness of the outer sheath	X	--	--	--	--	Sub-clause 6.7.6	HD 605 S2, Sub-clause 2.2.2.2(additional test)


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7.4 TYPE TEST (3/4)

N°	TYPE TEST	TYPE OF CABLE					REQUIREMENTS	TEST METHOD
		I	II	III	IV	V		
27	Water absorption of the outer sheath	--	X	X	--	--	Sub-clause 6.7.13	IEC 60811-402 Sub-clause 4.4
28	Climatic ageing test	--	X	X	--	--		UNE 211605 - Samples: outer sheath - Energetic radiation: 43 W/m ² - Number of cycles: 1 - Site temperature in phases 3 and 4 of the cycle: 55 °C - Maximum temperature of the black body: 70 °C
29	Water penetration test and corrosion test of the screen. Sample 2 m cable with seal caps on the ends.	--	X	X	--	X	After removing the outer sheath the screen shall not show aluminium corrosion, nor trace of water at a glance	HD 605 S2 Sub-clause 5.5
30	Hot stretching test for external semi-conductor	--	X	X	--	--	no fracture	IEC 60811-507
31	Aging features for full cable	--	X	X	--	--	Sub-clause 6.3.4	IEC 60811-501 IEC 60811-401, Sub-clause 4.2.3.4
32	External semi-conductor stripping test (at 0°, 20° and 40°)	--	X	X	--	X	Separation force between 0.5 and 2.5 daN	HD 605 S2, Sub-clause 2.2.8.2 method 2
33	Abrasion test with conic nosepiece (Outer sheath)	--	X	X	--	--	With a normal and correct vision without amplification shall not be possible to see the metal shield on the scraped zone	HD 605 S2, Sub-clause 2.4.22 Temperature: 20 ± 5 °C Mass: 36 kg Number: 8 Speed: 0,3 ± 15 % m/s
34	Mechanical characteristics of external semi-conductor	--	X	X	--	--		UNE 211620, Sub-clause 2.4.5
		--	X	X	--	--	Sub-clause 6.4.4	
35	Electrical resistance of the conductor	--	X	X	--	--	IEC 60228	IEC 60228
36	Electrical resistance of the metallic screen	--	X	X	--	--	UNE 211620 - 2.6.	HD 605 3.1.1
37	Resistivity semi-conducting screens	--	X	X	--	--	Less than 5000 Ω.cm a 20 °C 25000 Ω.cm a 90 °C	HD 605 3.9.1
38	Marks	--	X	X	--	--	UNE 211620 -. 2.11	
39	Number of wires and wire diameter	--	X	X	--	--	IEC 60228	IEC 60228
40	Insulation thickness	--	X	X	--	--	UNE 211620 Sub-clause 2.3.2	IEC60811-201
42	Semi-conductive screens thickness	--	X	X	--	--	UNE 211620 Sub-clause 2.2.4 y 2.4.4	IEC 60811-201 IEC 60811-202
43	Metallic Screen - Thickness of the screen - Measurement of the screen overlap	--	X	X	--	--	UNE 211620 Sub-clause 2.6	

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7.4 TYPE TEST (4/4)

N°	TYPE TEST	TYPE OF CABLE					REQUIREMENTS	TEST METHOD
		I	II	III	IV	V		
44	Outer sheath thickness	--	X	X	--	--	UNE 211620 Sub-clause 2.10	IEC 60811-202
45	Outer sheath physicochemical properties - Lead Content	--	X	X	--	--	HD 620-1 Table 4C	Spectrophotometer
46	Reaction to fire	--	X	X	--	--	UNE 211620 Sub-clause 3.4.9	EN 60332-1-2

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8 EQUIVALENTS STANDARDS:

IEC STANDARDS	EUROPEAN STANDARDS
IEC 60885-3	UNE EN 60885-3
IEC 60228	EN 60228
IEC 60502-2 Sub-clause 17.9.3	HD 605 Sub-clause 3.2.1.1
IEC 60502-2 Sub-clause 16.4	HD 605, Sub-clause 3.2.1.1 Annex 1, table 2
IEC 60811-100	UNE EN 60811-100
IEC 60811-201	UNE EN 60811-201
IEC 60811-202	UNE EN 60811-202
IEC 60811-203	UNE EN 60811-203
IEC 60811-401	UNE EN 60811-401
IEC 60811-412	UNE EN 60811-412
IEC 60811-501	UNE EN 60811-501
IEC 60811-503	UNE EN 60811-503
IEC 60811-505	UNE EN 60811-505
IEC 60811-507	UNE EN 60811-507
IEC 60811-508	UNE EC 60811-508
IEC 60811-605	UNE EC 60811-605

9 QUALITY REQUIREMENTS

The supplier should demonstrate that a Quality Assurance system has been implemented and is functioning in the factory, with programs and procedures documented in manuals, complying with the following Standard:

ISO 9001: Quality management systems – Model for quality assurance in design, production, installation and service.

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In addition, it should ideally have the following environmental control certification:

ISO 14001: Environmental management systems - Model for continuous improvement and pollution prevention, compliance with environmental regulations.

The Client reserves the right to verify procedures and documentation concerning transformer manufacture and the manufacturer is obliged to place this information at the Client's disposal.

10 ACCEPTANCE TEST

For accepting cable in factory routine tests and samples test shall be carry out at the facilities in the country of the manufacturer. The participation of representatives of the company in the experiments would be indicated in the bid request.

10.1 SAMPLING

Acceptance trials and tests shall be carried out based on an amount of samples proportional to the magnitude of the lot, as established in Table 7 and according to Standard IEC-60410 or similar standard.

10.2 ACCEPTABLE AND REJECTABLE QUALITY LEVEL

The lot size will be the total amount of spools delivered in each reception (partial or full). The acceptance level shall be determined according to the procedure described in standard IEC 60410 considering AQL 1,5%, level II, simple sampling; rejecting any "minor, major or critical" defect in the inspection. The costs of rejected materials will be charged to the bidder.

The approval or rejection of each one of the samples will be according to what is required in standard IEC 60410 for each one of the trials. Specifically, if a lot doesn't comply with what is required in the electric resistance test according to the approval requirements of the reference standard, the Inspector can carry out such test to the all the units that make up the lot.

Table 7: Samples and Grade of Acceptance to Each of the Trials

Amountof reels	Numbers of samples	Acceptable Level	Rejection Level
2 - 8	2	0	1
9 - 15	3	0	1
16 - 25	5	0	1
26 - 50	8	0	1
51 - 90	13	0	1
91 - 150	20	1	2
151 - 280	32	1	2
281 - 500	50	2	3
501 - 1200	80	3	4
1201 - 3200	125	5	6
3201 - 10000	200	7	8


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

11 GUARANTEE

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


12 CONDITIONS OF SUPPLY

See Local Section.


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	TECHNICAL SPECIFICATION OF MEDIUM VOLTAGE CABLES WITH RATED VOLTAGE $U_0/U_c(U_m)$ 8,7/15(17,5) kV, 12/20(24) kV, 15/25(31) kV, 18/30(36) kV AND 20/34,5(37,95) kV	GSC001 Rev. 02 20/02/2015

LOCAL SECTION A – LATAM: Ampla (Brazil), Chilectra (Chile), Codensa (Colombia), Coelce (Brazil), Edelnor (Perú), Edesur (Argentina)


ITEM	TITLE	DESCRIPTION
3.3	LOCAL STANDARDS	<p><u>Chilectra (Chile)</u></p> <ul style="list-style-type: none"> • ICEA S-93-693: 5 – 46 kV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy. <p><u>Codensa (Colombia)</u></p> <ul style="list-style-type: none"> • Resolución CREG No.024 – Comisión de Regulación de Energía y Gas (26 ABR. 2005), Por la cual se modifican las normas de calidad de la potencia eléctrica aplicables a los servicios de Distribución de Energía Eléctrica. (20/34,5/(37,95) kV) – Colombia. • Resolución CREG No.070 - Comisión de Regulación de Energía y Gas, Por la cual se establece el Reglamento de Distribución de Energía Eléctrica , como parte del Reglamento de Operación del Sistema Interconectado Nacional. (20/34,5/(37,95) kV). Colombia. • NTC1340 Tensiones y frecuencia nominales en sistemas de energía eléctrica en redes de servicio público. (20/34,5/(37,95) kV). Only apply for CODENSA – Colombia. <p><u>Edesur (Argentine)</u></p> <ul style="list-style-type: none"> • IRAM 2178 Cables de energía aislados con dieléctricos sólidos extruados para tensiones nominales de 1,1 kV a 33 kV.
3.4	REPLACED LOCAL STANDARDS	<p><u>Ampla (Brazil), Chilectra (Chile), Codensa (Colombia), Coelce (Brazil), Edelnor (Perú), Edesur (Argentina)</u></p> <p>This Global Standard GSC001 replaced the following of LATAM:</p> <ul style="list-style-type: none"> • Standard E-MT-002.
4	TECHNICAL REQUIREMENTS	<p><u>Ampla (Brazil)</u></p> <p>The cables will be in training preassembled (triplexed).</p> <p>Preassembled conductor (triplexed) should be flexible with radius of curvature equal to or less than 60 times the diameter of the individual cable.</p>
5.5	WATER BLOCKING ELEMENT	<p><u>Ampla (Brazil), Coelce (Brazil)</u></p> <p>For Ampla and Coelce longitudinal water blocking will be only over conductor.</p>
5.6.1	COPPER WIRE SCREEN	<p><u>Edesur (Argentine)</u></p> <p>To Edesur must be, consider copper tape for mechanical fixed screen wires features are detailed in the Common List.</p>

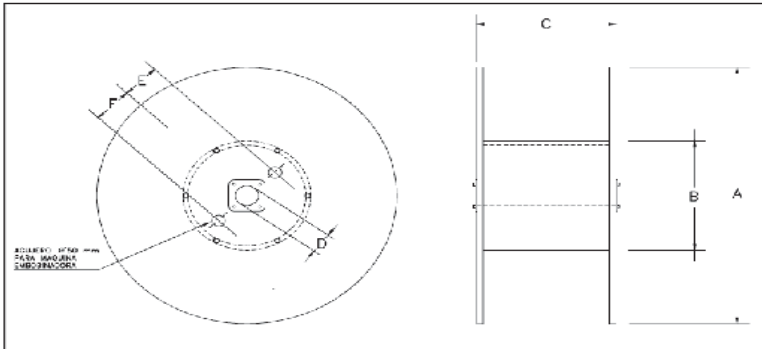
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	TECHNICAL SPECIFICATION OF MEDIUM VOLTAGE CABLES WITH RATED VOLTAGE $U_0/U_c(U_m)$ 8,7/15(17,5) kV, 12/20(24) kV, 15/25(31) kV, 18/30(36) kV AND 20/34,5(37,95) kV	GSC001 Rev. 02 20/02/2015


ITEM	TITLE	DESCRIPTION																																				
5.9	CURRENT - CARRYING CAPACITY OF CABLES	<p><u>Ampla (Brazil), Chilectra (Chile), Codensa (Colombia), Coelce (Brazil), Edelnor (Perú), Edesur (Argentina)</u></p> <p style="text-align: center;">Current-Carrying Capacity of Cables (ampacity)**</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th style="text-align: center;">Copper Cables</th> <th style="text-align: center;">Aluminium Cables</th> </tr> <tr> <th style="text-align: center;">Nominal cross-sectional area (mm²)</th> <th style="text-align: center;">Current - Carrying Capacity (A)</th> <th style="text-align: center;">Current - Carrying Capacity</th> </tr> </thead> <tbody> <tr><td style="text-align: center;">35</td><td style="text-align: center;">190</td><td style="text-align: center;">150</td></tr> <tr><td style="text-align: center;">50</td><td style="text-align: center;">--</td><td style="text-align: center;">174</td></tr> <tr><td style="text-align: center;">70</td><td style="text-align: center;">300</td><td style="text-align: center;">210</td></tr> <tr><td style="text-align: center;">120</td><td style="text-align: center;">380</td><td style="text-align: center;">300</td></tr> <tr><td style="text-align: center;">150</td><td style="text-align: center;">435</td><td style="text-align: center;">--</td></tr> <tr><td style="text-align: center;">185</td><td style="text-align: center;">--</td><td style="text-align: center;">380</td></tr> <tr><td style="text-align: center;">240</td><td style="text-align: center;">570</td><td style="text-align: center;">445</td></tr> <tr><td style="text-align: center;">300</td><td style="text-align: center;">--</td><td style="text-align: center;">450</td></tr> <tr><td style="text-align: center;">400</td><td style="text-align: center;">735</td><td style="text-align: center;">575</td></tr> <tr><td style="text-align: center;">630</td><td style="text-align: center;">--</td><td style="text-align: center;">755 *</td></tr> </tbody> </table> <p>* Ampla and Coelce, the Current -Carrying Capacity is 657 A.</p> <p>** These values are referential. Final values will be according to installation layout.</p> <p>Permanent current conduction capacity calculated as per the Standard IEC 60287 under the following conditions:</p> <ol style="list-style-type: none"> 1.- Group of three single-pole cables placed in horizontal position. 2.- Soil temperature: 20 °C. 3.- Environmental temperature: 35 °C. 4.- Depth of installation: 1 m. 5.- Distance between cables in horizontal formation: 70 mm + D. 6.- Thermal resistivity of the earth: 1.0 Km/W. 7.- Operation temperature of the cable: 90 °C. 8.- Configuration of the cable: Grounded on the ends. 9.- Sheath cross-section of 25 mm². For cables with sheath cross-section of 50 mm² the value indicated must be multiplied by 0.99. 		Copper Cables	Aluminium Cables	Nominal cross-sectional area (mm ²)	Current - Carrying Capacity (A)	Current - Carrying Capacity	35	190	150	50	--	174	70	300	210	120	380	300	150	435	--	185	--	380	240	570	445	300	--	450	400	735	575	630	--	755 *
	Copper Cables	Aluminium Cables																																				
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240	570	445																																				
300	--	450																																				
400	735	575																																				
630	--	755 *																																				
5.10.1	CHARACTERISTIC	<p><u>Ampla (Brazil), Chilectra (Chile), Codensa (Colombia), Coelce (Brazil), Edelnor (Perú), Edesur (Argentina)</u></p> <p>On each meter of length, the outer sheath of cable painted in white must show the following information:</p> <ul style="list-style-type: none"> • Distributor Name • Name of manufacturer • Year of manufacture • Cable description • Maximum operating voltage between phases • Material and type of insulation • Conductor size (in mm²) • Footage correlative / dialling sequence (when indicated in O / C). <p>In the case of the driver joined (triplexed, twisted, preassembled) phases should be identified with numbers, veins or stripes of colour. The dial colours are accepted for this</p>																																				

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	TECHNICAL SPECIFICATION OF MEDIUM VOLTAGE CABLES WITH RATED VOLTAGE $U_0/U_c(U_m)$ 8,7/15(17,5) kV, 12/20(24) kV, 15/25(31) kV, 18/30(36) kV AND 20/34,5(37,95) kV	GSC001 Rev. 02 20/02/2015


ITEM	TITLE	DESCRIPTION																								
		white, blue and red, except for Codensa to be yellow, blue and red and white for neutron. Quality Test Rubbed painted energetic drink meet with diluents. • Note: When naming joined type cables, Triplexed and strand refers to the same type, it makes a difference in every Distributed by use of local terminology.																								
5.10.3	EXAMPLE OF CABLE MARKING	<u>Ampla (Brazil), Chilectra (Chile), Codensa (Colombia), Coelce (Brazil), Edelnor (Perú), Edesur (Argentina)</u> <u>For Cables with Aluminium Screen</u> Distributor Name – Manufacture of NNN CA2-XR-TA03-PEA 185mm ² 12/20 kV 2012-07 Distributor Name – Manufacture for NNN Aluminium circular conductor, compact class 2. Insulation XLPE. Aluminium blinder tape de 0,3mm thickness. Outer sheath of Polyethylene coated aluminium extruded section 185mm ² , U ₀ /U 12/20 kV. Year of manufacture 2012, mes 07. <u>For Cables with Copper Wire Screen</u> Distributor Name – Manufacture NNN CA2-XR-HCO-PEA 185mm ² 12/20 kV 2012-07 Distribution Manufactured by NNN circular aluminium conductor, compact, Class 2. XLPE insulation. Copper wire screen. Polyethylene cover with aluminium extruded section 185mm ² , U ₀ / U 12/20 kV. Made the year 2012, month 07																								
6	2 INNER SEMI-CONDUCTIVE SCREEN	<u>Edesur (Argentina)</u> Specific characteristics are detailed in the Common List.																								
6	4 OUTER SEMI-CONDUCTIVE SCREEN	<u>Edesur (Argentina)</u> Specific characteristics are detailed in the Common List.																								
6	7.6 Carbon black content	<u>Ampla (Brazil), Coelce (Brazil)</u> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>N°</th> <th>Elements of cable</th> <th>Type V</th> </tr> </thead> <tbody> <tr> <td>7</td> <td colspan="2">OUTER SHEATH</td> </tr> <tr> <td></td> <td colspan="2">Physical and Chemical properties</td> </tr> <tr> <td>7.6</td> <td>Carbon black content</td> <td>IEC 60811-605</td> </tr> </tbody> </table>	N°	Elements of cable	Type V	7	OUTER SHEATH			Physical and Chemical properties		7.6	Carbon black content	IEC 60811-605												
N°	Elements of cable	Type V																								
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6	7.17 Colour	<u>Ampla (Brazil), Chilectra (Chile), Codensa (Colombia), Coelce (Brazil), Edelnor (Perú), Edesur (Argentina)</u> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Outer sheath conductor</th> <th>8.7/15 (17.5) (kV)</th> <th>12/20 (24) (kV)</th> <th>15/25 (31) (kV)</th> <th>18/30 (36) (kV)</th> <th>20/34,5 (37,95) (kV)</th> </tr> </thead> <tbody> <tr> <td>Black</td> <td>Ampla, Chilectra, Codensa Coelce</td> <td>Ampla Coelce</td> <td>--</td> <td>--</td> <td>Codensa</td> </tr> <tr> <td>Red</td> <td>Edesur Edelnor</td> <td>Edelnor</td> <td>--</td> <td>Edesur</td> <td>--</td> </tr> <tr> <td>Blue</td> <td>--</td> <td>--</td> <td>Chilectra,</td> <td></td> <td>--</td> </tr> </tbody> </table> For cables with red outer sheath shall be considered additives Anti-UV and additives colour protection.	Outer sheath conductor	8.7/15 (17.5) (kV)	12/20 (24) (kV)	15/25 (31) (kV)	18/30 (36) (kV)	20/34,5 (37,95) (kV)	Black	Ampla, Chilectra, Codensa Coelce	Ampla Coelce	--	--	Codensa	Red	Edesur Edelnor	Edelnor	--	Edesur	--	Blue	--	--	Chilectra,		--
Outer sheath conductor	8.7/15 (17.5) (kV)	12/20 (24) (kV)	15/25 (31) (kV)	18/30 (36) (kV)	20/34,5 (37,95) (kV)																					
Black	Ampla, Chilectra, Codensa Coelce	Ampla Coelce	--	--	Codensa																					
Red	Edesur Edelnor	Edelnor	--	Edesur	--																					
Blue	--	--	Chilectra,		--																					

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ITEM	TITLE	DESCRIPTION										
7.4	TYPE TEST (3/4)	<p><u>Ampla (Brazil), Coelce (Brazil)</u></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">N°</th> <th style="text-align: center;">TYPE TEST</th> <th style="text-align: center;">TYPE OF CABLE</th> <th style="text-align: center;">REQUIREMENTS</th> <th style="text-align: center;">TEST METHOD</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">32</td> <td style="text-align: center;">External semi-conductor stripping test</td> <td style="text-align: center;">X</td> <td style="text-align: center;">Separation force between 0,4 y 4,5 daN</td> <td style="text-align: center;">HD 605 S2, Sub-clause 2.2.8.2 method 2</td> </tr> </tbody> </table>	N°	TYPE TEST	TYPE OF CABLE	REQUIREMENTS	TEST METHOD	32	External semi-conductor stripping test	X	Separation force between 0,4 y 4,5 daN	HD 605 S2, Sub-clause 2.2.8.2 method 2
N°	TYPE TEST	TYPE OF CABLE	REQUIREMENTS	TEST METHOD								
32	External semi-conductor stripping test	X	Separation force between 0,4 y 4,5 daN	HD 605 S2, Sub-clause 2.2.8.2 method 2								
12	CONDITIONS OF SUPPLY	<p><u>Ampla (Brazil), Chilectra (Chile), Codensa (Colombia), Coelce (Brazil), Edelnor (Perú), Edesur (Argentina)</u></p> <p>Packaging and Labelling</p> <p>The cable shall be delivered by the manufacturer on a wooden or metal spool, which will not be returned, as per maximum and minimum dimensions indicated in Table 8 and in accordance with Figure 10.1.</p> <p>The total length of the cable supplied may not be less than that requested in the purchase order and shall not be longer by any more than 5%. In addition, there will be some special packaging requirements as indicated further ahead.</p> <p>The maximum gross weight of the packaged spool must not exceed 3500 kg. , For Coelce weigh up to 2500 kg.</p> <p>The ends of the cables on each spool must 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 the distance between the origin of manufacture and the purchaser's storage area involves only one means of transport and a distance of less than 200 km, the use of the internal helix will be required only on spools of conductors with a diameter greater than or equal to 120 mm²; this does not make them exempt from the moisture protection on both visible ends of the conductor, mechanical protection, and careful handling of the spools.</p> <p>Temporarily, some of the batches of cables can be requested restricting them to 2,000 m of maximum length per spool and/or pre-joined, as per the Purchase Order.</p> <p>The wooden spools 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 nor should they affect the physical characteristics of wood.</p> <p style="text-align: center;">Figure 10.1 Spool type</p> 										


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		<p style="text-align: center;">Table 8 Dimensions</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> <tr> <th style="text-align: center;">mm</th> <th style="text-align: center;">mm</th> <th style="text-align: center;">mm</th> <th style="text-align: center;">mm</th> <th style="text-align: center;">mm</th> </tr> </thead> <tbody> <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>Notes: (1) Maximum value (2) Minimum value (3) The double of the minimum curve radius of the cable for transport, as per the manufacturer's standards. (4) 300 or 180 mm according to spool type (large or small, respectively)</p> <p>The spools must: Have an external protection built with wooden strips (staves) fastened on the wooden spools and some equivalent for metal spools, being secured with tapes or straps. Indicate the correct rolling direction with an arrow on its side. Have a stainless steel plate for its identification on each side, each one of which must include at least the following information, in the language of the country where it will be used (Spanish or Portuguese): On each one of the parallel faces of the spools, a metal plate with the following information shall be installed:</p> <ul style="list-style-type: none"> ➤ Name of the manufacturer ➤ Country of origin of the item ➤ ENEL GROUP ➤ Purchase Order N° ➤ Maximum operation voltage between phases ➤ Insulation material and type ➤ Conductor caliber (en mm²) ➤ Number of the spool within the delivered batch. ➤ Net weight and gross weight in kg. ➤ Cable type ➤ Cable length, in meters. 	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)													
12	CONDITIONS OF SUPPLY	<u>Edesur (Argentina)</u> IRAM 9590-1 Standard															


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B LOCAL SECTION – ENDESA DISTRIBUCION ELECTRICA (Spain)


ITEM	TITLE	DESCRIPTION						
3.1	LAWS	<u>Endesa Distribución Eléctrica (Spain)</u> Real Decreto 223/2008de 15 de febrero, por el que aprueba el Reglamento sobre condiciones técnicas y garantías de seguridad en líneas eléctricas de alta tensión y sus instrucciones técnicas complementarias ITC-LAT 01 a 09 (R.L.A.T.)						
3.2	INTERNATIONAL STANDARDS	<u>Endesa Distribución Eléctrica (Spain)</u> <ul style="list-style-type: none"> Norma EN 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 Norma EN 60332-3-23 Tests on electric and optical fibre cables under fire conditions - Part 3-23: Test for vertical flame spread of vertically-mounted bunched wires or cables – Category B IEC 60811-4-1 - Common test methods for insulating and sheathing materials of electric cables - Part 4: Methods specific to polyethylene and polypropylene compounds - Section One - Resistance to environmental stress break downing - Wrapping test after thermal ageing in air - Measurement of the melt flow index – Carbon black and/or mineral content measurement in PE. 						
3.3	LOCAL STANDARDS	<u>Endesa Distribución Eléctrica (Spain)</u> UNE 211620: 2012. Distribution cables with extruded insulation and aluminium tape screen for rated voltages from 3,6/6 (7,2) kV to 20,8/36 (42) kV. <ul style="list-style-type: none"> UNE 211605: 2013. Climatic ageing test of outer covering cables. ISO 2859: Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection. UNE 21167: Bobinas de madera para cables aislados de transporte y distribución. 						
3.4	REPLACED LOCAL STANDARDS	<u>Endesa Distribución Eléctrica (Spain)</u> This Global Standard GSC001 replaced the following technical Standard of Endesa: <ul style="list-style-type: none"> DND020: Cables para la distribución subterránea de energía eléctrica a tensión $U_0/U = 12/20$ kV con aislamiento reducido y pantalla de tubo de aluminio. DND021: Cables instalados para redes subterráneas de alta tensión hasta 30kV, con aislamiento de espesor reducido y pantalla de aluminio. 						
5.7	OUTER SHEATH	<u>Endesa Distribución Eléctrica (Spain)</u> UNE 211620, Standard applied to: <table border="1" style="margin-left: 40px;"> <thead> <tr> <th>Description</th> <th>Thickness</th> </tr> </thead> <tbody> <tr> <td>Nominal value</td> <td>2.75 mm</td> </tr> <tr> <td>Minimum value</td> <td>The smallest value measured anywhere shall not fall below 80 % of the nominal value by more than 0.2 mm, i.e.: $t_m \geq 10,8t_n - 0,2$</td> </tr> </tbody> </table>	Description	Thickness	Nominal value	2.75 mm	Minimum value	The smallest value measured anywhere shall not fall below 80 % of the nominal value by more than 0.2 mm, i.e.: $t_m \geq 10,8t_n - 0,2$
Description	Thickness							
Nominal value	2.75 mm							
Minimum value	The smallest value measured anywhere shall not fall below 80 % of the nominal value by more than 0.2 mm, i.e.: $t_m \geq 10,8t_n - 0,2$							
5.9	CURRENT - CARRYING CAPACITY OF CABLE	<u>ENDESA DISTRIBUCION ELECTRICA (Spain)</u> No specified.						

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ITEM	TITLE	DESCRIPTION
5.10.1	CHARACTERISTICS	<p><u>ENDESA DISTRIBUCION ELECTRICA (Spain)</u> The marking shall be indelible, easily legible and be performed by incision or embossed on the outer sheath. The marking shall be:</p> <ul style="list-style-type: none"> • Manufacturer name and / or trademark, • The complete description of the cable • The last two digits of the year of manufacture. <p>The distance between the end of a mark and the beginning of the next one will be less than or equal to 300 mm.</p>
5.10.2	CABLE MARKING	<p><u>ENDESA DISTRIBUCION ELECTRICA (Spain)</u> Standard UNE 211620</p> <ol style="list-style-type: none"> 1) R = XLPE 2) H5 = Metallic screen Al 3) Z1 = polyolefin Composite 4) <u>Fire safety:</u> (Only for cables type III) the following characteristics: (S) = No flame propagation according to EN 60332-1-2 and low emission of smoke and corrosive gases and acids (Type 10E-7) (AS) = Fire retardant according to EN 60332-3-23 and low emission of smoke and corrosive gases and acids (Type 10E-8) 5) 1 (unipolar cable) X (nominal section in mm²) K (compacted circular) symbol Al
5.10.3	EXAMPLE OF CABLE MARKING	<p><u>ENDESA DISTRIBUCION ELECTRICA (Spain)</u> RH5Z1 12/20 kV 1 X 150 K Al (Cable 150 mm² 12/20 kV without fire characteristics) RH5Z1 (S) 18/30 kV 1 X 240 K Al (Cable 240 mm² 18/30 kV flame retardant)</p>
6	7.17 Colour	<p><u>ENDESA DISTRIBUCION ELECTRICA (Spain)</u> For type II cable, the outer sheath colour will be red. For cable type III, the colour will be red with two longitudinal stripes of gray colour.</p>
7	Test	<p><u>ENDESA DISTRIBUCION ELECTRICA (Spain)</u> Electric and non-electric homologation testing, for each type of cable shall be carried out over selected sections in agreement with Endesa, to the voltage levels $U_0/U_c = 12/20$ kV and 18/30 kV.</p>
12	CONDITIONS OF SUPPLY	<p><u>ENDESA DISTRIBUCION ELECTRICA (Spain)</u> They should be as Specifying the Standard UNE 21167 - Bobinas de Madera para cables aislados de transporte y Distribución.</p> <p>Technical report (TR) The technical report (TR) must consist of the documents described below. It is specified that some requirements in the following paragraphs are preceded by the word "Prescription", and others by the word "Indication. In the first case the requirements are normative and therefore satisfying them is a necessary (but not sufficient) condition for acceptance during the trial period. In the second case, however, the content of the required information is not binding for acceptance during the trial period.</p> <p>Technical document: Technical working drawing of the coil, including representation of the two sections (longitudinal and transversal) completed with all the dimensional measurements and with the points where the drum is anchored to the flanges highlighted (enlarged diagram</p>

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	TECHNICAL SPECIFICATION OF MEDIUM VOLTAGE CABLES WITH RATED VOLTAGE $U_0/U_c(U_m)$ 8,7/15(17,5) kV, 12/20(24) kV, 15/25(31) kV, 18/30(36) kV AND 20/34,5(37,95) kV	GSC001 Rev. 02 20/02/2015


		<p>of the part).</p> <p>The following dimensional characteristics must be provided: - parts in wood</p> <table border="1" style="margin-left: 40px;"> <tr> <td style="width: 30%;">For the flange</td> <td>Board width Diameter Thickness Diameter of axial hole Counter-flange thickness</td> </tr> <tr> <td>Coil width</td> <td></td> </tr> <tr> <td>For the Drum</td> <td>Board width diameter width Staves thickness</td> </tr> <tr> <td>For the tie rods</td> <td>Number diameter length</td> </tr> </table> <p>- metal parts dimensions and number of metal components (tie rods, support and fixing plates)</p> <p><u>· Photographic documentation:</u> a side view photo and a front view photo showing the empty coil, the coil with wound cable without external cover, the coil complete with external cover (for a total of at least 6 photos) and the detailed view of the identification plate where the coil and supply data are provided (at an enlargement level such as to allow the information photographed to be read).</p> <p>· Technical data sheet of the wood: Prescriptions: Wood species coming from conifers or other wood of documented equivalent performance characteristics must be used. The wood used must be free of fungi and insects; the boards must be without non-adherent (dead) chamfers and knobs Instructions: State the percentage of maximum humidity of the wood at the end of the coil fabrication process. Provide the description of any treatments that the wood undergoes</p> <p><u>· Technical data sheet of the metals:</u> Instructions: state the type of material used</p> <p><u>Construction methods</u> Prescriptions: The coil must not in any case have metallic projections of any kind (they could in fact cause cuts or injuries during handling) Any wooden parts must not be painted. The outer surface of the drum and that inside the flange must be planed and the boards forming the flanges must be put close to each other; the nailing of the boards for the flanges must be riveted on the outside and the nail head must penetrate inside the boards by riveting. The boards of the drum must have chamfered edges and be put close to each other; uneven boards or steps between two boards or between boards and metal tie rods are not allowed. Instructions: state the welding type/technique (if present) and the anti-oxidation treatments.</p> <p>Protections The cables must be protected in such a way as to prevent damage or tampering during transport and handling, also within the sphere of ENDESA. If the bidder plans to use a type of protection as an alternative to staves, it must not be made with materials that during disposal are classifiable as hazardous waste; in any case, all protections that are alternatives to staves must be explicitly approved by ENDESA during homologation or during the tender process. The free ends of the cable must be properly protected against the penetration of water and moisture during transport, storage (which may also be outdoors) and lying. The finished and inspected cable coils at the Constructor's facilities cannot be parked without staves or equivalent protections in zones exposed to bad weather (sun, rain, etc.) and to accidental impacts unless for the time necessary for their staving or similar</p>	For the flange	Board width Diameter Thickness Diameter of axial hole Counter-flange thickness	Coil width		For the Drum	Board width diameter width Staves thickness	For the tie rods	Number diameter length
For the flange	Board width Diameter Thickness Diameter of axial hole Counter-flange thickness									
Coil width										
For the Drum	Board width diameter width Staves thickness									
For the tie rods	Number diameter length									

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	TECHNICAL SPECIFICATION OF MEDIUM VOLTAGE CABLES WITH RATED VOLTAGE $U_0/U_c(U_m)$ 8,7/15(17,5) kV, 12/20(24) kV, 15/25(31) kV, 18/30(36) kV AND 20/34,5(37,95) kV	GSC001 Rev. 02 20/02/2015

		<p>protection. Unless otherwise provided in the purchase order letter, the protection (staving or other) of the coils must be executed 100%.</p> <p>The spacing between the external layer of the cable and the staving must be sufficient for preventing damage to the cable and in any case never less than 50 mm; to comply with said prescription, sizes of length reduced up to the minimum allowed can be preferred, if necessary.</p> <p>Labeling</p> <p>At least the following data must be shown in addition to what is required in the order on the external surface of at least one of the flanges of the transport coil, or on the packaging of every single skein, with clearly legible and indelible characters, if applicable:</p> <ul style="list-style-type: none"> - The ENDESA code of the cable; - The name or trademark of the company that owns the coil; - The name of the Constructor of the cable; - The code and formation of the cable; - The type and code of the coil; - The total gross weight (only for the sizes on coil) - The net weight; - The weight of one meter of cable; - The actual length of the size; - The details of the ENDESA order; - The number and date of notice of shipment or, for the skeins, the number of the production lot (job no.). <p>Note: The two external faces of the flanges for coils made of wood and the two opposing faces of the pallets, which can be used for shipping several types of cable, must bear the mark demonstrating that the wood used for their construction has been treated as required in directive 2000/29/EC, referred to in SECTION 8.2.7.2.</p> <p>Transport</p> <p>The coils must be placed on motor vehicles keeping the distance necessary for inserting the lifting means between the flanges, or in such a way as to allow unloading with suitable for handling equipment.</p>
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Note:

The standard reference for Endesa is the UNE 211620, so the data given in this document are for reference, under any doubt or discrepancy prevail indications of the Standard Reference. Likewise, any change in the Reference Standards updates this document.


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	TECHNICAL SPECIFICATION OF MEDIUM VOLTAGE CABLES WITH RATED VOLTAGE $U_0/U_c(U_m)$ 8,7/15(17,5) kV, 12/20(24) kV, 15/25(31) kV, 18/30(36) kV AND 20/34,5(37,95) kV	GSC001 Rev. 02 20/02/2015

C LOCAL SECTION– ENEL DISTRIBUZIONE (Italy), ENEL DISTRIBUTIE: Banat, Dobrogea, Muntenia (Romania)


ITEM	TITLE	DESCRIPTION																																																					
3.2	INTERNATIONAL STANDARDS	<u>Distribuzione Enel (Italy)</u> <ul style="list-style-type: none"> • Directiva 2000/29/CE medidas de protección contra la introducción en la Comunidad de organismos nocivos para los vegetales o para los productos vegetales y contra su difusión en la Comunidad. – Unión Europea. • ISO 2859: 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	<u>Distribuzione Enel (Italy)</u> <ul style="list-style-type: none"> • Standard UNI-CEI 2-1 and 2-2 (Type "A" - REUSABLE) • Standard UNI-CEI 2-1 and 2-2 (Type "B" - NOT REUSABLE) • CEI 20-86 Cavi Per Media Tensione Aventi Isolamento Estruso In Elastomero Termoplastico A Spessore Ridotto Con Schermo A Tubo Di Alluminio E Guaina Di Pe Cavi Con Tensione Nominale 12/20 kV. <u>Distribuzione Enel (Italy), Romania</u> <ul style="list-style-type: none"> • Standar PVR 006 Operational Note Vendor Rating Control: BARCODES Warranty and Traceability of Enel Distribution Materials 																																																					
3.4	REPLACED	<u>Distribuzione Enel (Italy)</u> This Global Standard GSC001 replaced the following technical standard of ENEL: - NCDC4384: Norma Común, Cables para la distribución subterránea de energía eléctrica a tensión $U_0/U = 12/20$ kV con aislamiento reducido y pantalla de tubo de aluminio.																																																					
5.9	CURRENT - CARRYING CAPACITY OF CABLES	<u>Distribuzione Enel (Italy), Romania</u> <p style="text-align: center;">Current-Carrying Capacity of Cables (ampacity)</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th rowspan="2">Nominal cross-sectional area</th> <th rowspan="2">Country Code</th> <th rowspan="2">Type of Cables</th> <th>Aluminium Cables</th> </tr> <tr> <th>Current - Carrying Capacity (A)</th> </tr> </thead> <tbody> <tr><td>35*</td><td>332262</td><td>I</td><td>140</td></tr> <tr><td>50*</td><td>332263</td><td>I</td><td>170</td></tr> <tr><td>95*</td><td>332264</td><td>I</td><td>255</td></tr> <tr><td>150*</td><td>332265</td><td>I</td><td>340</td></tr> <tr><td>95</td><td>332283</td><td>I</td><td>255</td></tr> <tr><td>95</td><td>332283</td><td>IV</td><td>255</td></tr> <tr><td>185</td><td>332284</td><td>I</td><td>360</td></tr> <tr><td>185</td><td>332284</td><td>IV</td><td>360</td></tr> <tr><td>185</td><td>332286</td><td>I</td><td>360</td></tr> <tr><td>185</td><td>332286</td><td>IV</td><td>360</td></tr> <tr><td>240</td><td>332285</td><td>I</td><td>490</td></tr> <tr><td>240</td><td>332285</td><td>IV</td><td>490</td></tr> </tbody> </table> <p style="text-align: center;">* Overhead cable installed in air</p> <p>The values shown is for the following conditions:</p>	Nominal cross-sectional area	Country Code	Type of Cables	Aluminium Cables	Current - Carrying Capacity (A)	35*	332262	I	140	50*	332263	I	170	95*	332264	I	255	150*	332265	I	340	95	332283	I	255	95	332283	IV	255	185	332284	I	360	185	332284	IV	360	185	332286	I	360	185	332286	IV	360	240	332285	I	490	240	332285	IV	490
Nominal cross-sectional area	Country Code	Type of Cables				Aluminium Cables																																																	
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35*	332262	I	140																																																				
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	TECHNICAL SPECIFICATION OF MEDIUM VOLTAGE CABLES WITH RATED VOLTAGE $U_0/U_c(U_m)$ 8,7/15(17,5) kV, 12/20(24) kV, 15/25(31) kV, 18/30(36) kV AND 20/34,5(37,95) kV	GSC001 Rev. 02 20/02/2015


ITEM	TITLE	DESCRIPTION
		<ul style="list-style-type: none"> • Laying direct buried at 1 m underground, • terrain temperature 20 °C and • terrain thermal resistivity 1°C m/W • Nominal Voltage 12/20 (24) kV
5.10.2	CABLE MARKING	<u>Distribuzione Enel (Italy)</u> Type of conductor - A: Aluminium R: Round Stranded Type of insulation. - E4: XLPE cross-linked polyethylene insulation P1: HPTE, thermoplastic insulation Type of screen. - H5: aluminium tape screen 0.3mm thickness Outer sheath Type. - E: PE or PE type DMZ1 DMP2 X: Kernels united visible Helix Example: For XLPE insulated cable: ARE4H5EX For thermoplastic insulated cable. ARP1H5EX
5.10.3	EXAMPLE OF CABLE MARKING	<u>Distribuzione Enel (Italy)</u> The outer sheath should be printed by printer with an inscription high aligned characters or contiguous, as shown in figure (insert figure) The distance between the end of a brand and the same brand successive must comply with the provisions of document HD-620-1011 2.11.2 and shall contain, in the order listed. The following inscriptions: a) - The property stands - The acronym of ENEL - Voltage between U_0 and U (kV) - Section. - The name or trademark of the manufacturer - The identification letter of the manufacturing - The index of the project - The year and month of manufacture - Identification of the phase, repeated at least 100 mm in the interval between two successive of entries The metric, only in phase 1; also supports sealed ink. Alternatively to the aforementioned method, you can put this stamp at a distance less than 1 meter Printing example core phase 1: ENEL ARE4H5EX 12/20kV 185 XXXXXX B 01 2007 12 0000 FASE 1 ... FASE 1 ..)
6	7.17 Colour	<u>Distribuzione Enel (Italy)</u> The colour of the outer sheath will be red

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ITEM	TITLE	DESCRIPTION																			
12	CONDITIONS OF SUPPLY	<p><u>Distribuzione Enel (Italy)</u></p> <p><u>12.1. Cable length:</u></p> <p>Number and dimensions:</p> <ul style="list-style-type: none"> - 3 wires (1 x 95) of 400 m - 3 wires (1 x 185) of 300 m <p>The admitted tolerance for a size is equal to $\pm 3\%$ of the length indicated in the order; shorter lengths are admitted up to a maximum of 10% of the sizes making up the delivery lot (same transport document), provided that each one is at least 100 m; in calculating the aforesaid 10%, the sample sizes whose length is reduced due to the acceptance tests are excluded.</p> <p>Packaging</p> <p>Due to the cable traceability in the network a bar code shall be applied on the drum. The bar code structure shall complying with technical specification PVR006.</p> <p>The coils to use for LV cable delivery can be:</p> <ul style="list-style-type: none"> - to UNI-CEI 2-1 and 2-2 standard (Type "A" - REUSABLE) - not to UNI-CEI 2-1 and 2-2 standard (Type "A" - NOT REUSABLE) <p>In addition to what is required in § 7.5 of this standard, the wording TYPE A" or "TYPE B must be put on the external wall of the flange.</p> <p>For both types, in the case of coils or wooden pallets produced outside the European Community, it is necessary that these packaging be made in observance of what is established in the 2000/29/EC directive and subsequent amendments, "Protective measures against the introduction into the Community of organisms harmful to plants or plant products and against their spread within the Community" and be compliant with note ISPM 15 of 18/03/2002.</p> <p><u>Coils to UNI-CEI 2-1 and 2-2 standard (Type "A" - REUSABLE)</u></p> <p>Coils compliant with the requirements of the UNI-CEI 2-1 and 2-2 standard and satisfying the requirements shown in TABLE A.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="4" style="text-align: center;">UNI-CEI 2-1 COILS</th> <th style="text-align: center;">LENGTH</th> <th rowspan="2" style="text-align: center;">CABLES</th> </tr> <tr> <th style="text-align: center;">Type (#)</th> <th style="text-align: center;">Minimum diameter of the cap (mm)</th> <th style="text-align: center;">Minimum diameter drum (mm)</th> <th style="text-align: center;">Maximum roll width (mm) (4)</th> <th style="text-align: center;">Maximum total length (m)</th> </tr> </thead> <tbody> <tr> <td rowspan="2" style="text-align: center;">22 (2)</td> <td rowspan="2"></td> <td rowspan="2" style="text-align: center;">1400</td> <td rowspan="2" style="text-align: center;">1400</td> <td style="text-align: center;">400</td> <td style="text-align: center;">3x(1 x 95)</td> </tr> <tr> <td style="text-align: center;">300</td> <td style="text-align: center;">3x(1 x 185)</td> </tr> </tbody> </table> <p>(#) The cables supply "short" as defined in Section 8.1 can also be performed in coils (dimension) below the minimum requirement, provided that the other requirements.</p> <p>(2) spiral coil provided on an inner face of the cap to bring the inner head of the cable to the outside</p>	UNI-CEI 2-1 COILS				LENGTH	CABLES	Type (#)	Minimum diameter of the cap (mm)	Minimum diameter drum (mm)	Maximum roll width (mm) (4)	Maximum total length (m)	22 (2)		1400	1400	400	3x(1 x 95)	300	3x(1 x 185)
UNI-CEI 2-1 COILS				LENGTH	CABLES																
Type (#)	Minimum diameter of the cap (mm)	Minimum diameter drum (mm)	Maximum roll width (mm) (4)	Maximum total length (m)																	
22 (2)		1400	1400	400	3x(1 x 95)																
				300	3x(1 x 185)																

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	TECHNICAL SPECIFICATION OF MEDIUM VOLTAGE CABLES WITH RATED VOLTAGE $U_0/U_c(U_m)$ 8,7/15(17,5) kV, 12/20(24) kV, 15/25(31) kV, 18/30(36) kV AND 20/34,5(37,95) kV	GSC001 Rev. 02 20/02/2015

		<p><u>Coils not to UNI-CEI 2-1 and 2-2 standard (Type "A" - NOT REUSABLE)</u></p> <p>As an alternative to type "A", coils not referable to the standard cited above can be used provided that a technical report (hereinafter "TR") structured according to the guidelines described below is presented to ENEL during the certification stage or during the tender procedure.</p> <p>The coils will be considered accepted on a trial basis for a period of six months starting from the date of first delivery. If ENEL does not require modifications to be introduced; the coils made in conformity with the TR shall be considered Approved.</p> <p>Otherwise, and in all cases of TR updating, the trial period will again start from the date of first delivery of the modified coils.</p> <p><u>Technical report (TR)</u></p> <p>The technical report (TR) must consist of the documents described below.</p> <p>It is specified that some requirements in the following paragraphs are preceded by the wording "Prescription", and others by the wording "Indication. In the first case the requirements are normative and therefore satisfying them is a necessary (not sufficient) condition for acceptance during the trial period. In the second case, on the other hand, the content of the required information is not binding for acceptance during the trial period.</p> <p><u>Technical document:</u></p> <p>Technical working drawing of the coil, including representation of the two sections (longitudinal and transversal) complete with all the dimensional measurements and with the points where the drum is anchored to the flanges highlighted (enlarged diagram of the part).</p> <p>The following dimensional characteristics must be provided: - parts in wood</p> <table border="1" style="margin-left: 40px;"> <tr> <td rowspan="4" style="text-align: center; vertical-align: middle;">For the flange</td> <td>Board width</td> </tr> <tr> <td>Diameter</td> </tr> <tr> <td>Thickness</td> </tr> <tr> <td>Diameter of axial hole</td> </tr> <tr> <td colspan="2" style="border-top: 1px solid black;">Coil width</td> </tr> <tr> <td rowspan="3" style="text-align: center; vertical-align: middle;">For the Drum</td> <td>Board width</td> </tr> <tr> <td>diameter</td> </tr> <tr> <td>width</td> </tr> <tr> <td rowspan="3" style="text-align: center; vertical-align: middle;">For the tie rods</td> <td>Staves thickness</td> </tr> <tr> <td>Number</td> </tr> <tr> <td>diameter</td> </tr> <tr> <td colspan="2" style="border-top: 1px solid black;">length</td> </tr> </table> <p>- metal parts dimensions and number of metal components (tie rods, support and fixing plates)</p> <p><u>- Photographic documentation:</u> a side view photo and a front view photo showing the empty coil, the coil with wound cable without external cover, the coil complete with external cover (for a total of at least 6 photos) and the detailed view of the identification plate where the coil and supply data are provided (at an enlargement level such as to allow the information photographed to be read).</p> <p>- Technical data sheet of the wood: Prescriptions: Wood species coming from conifers or other wood of documented equivalent performance characteristics must be used. The wood used must be free of fungi and insects; the boards must be without non-adherent (dead) chamfers and knobs</p> <p>Instructions: State the percentage of maximum humidity of the wood at the end of the coil fabrication process. Provide the description of any treatments that the wood undergoes</p>	For the flange	Board width	Diameter	Thickness	Diameter of axial hole	Coil width		For the Drum	Board width	diameter	width	For the tie rods	Staves thickness	Number	diameter	length	
For the flange	Board width																		
	Diameter																		
	Thickness																		
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Coil width																			
For the Drum	Board width																		
	diameter																		
	width																		
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	Number																		
	diameter																		
length																			

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		<p><u>Technical data sheet of the metals:</u> Instructions: state the type of material used</p> <p><u>Construction methods</u> Prescriptions: The coil must not in any case have metallic projections of any kind (they could in fact cause cuts or injuries during handling) Any wooden parts must not be painted. The outer surface of the drum and that inside the flange must be planed and the boards forming the flanges must be put close to each other; the nailing of the boards for the flanges must be riveted on the outside and the nail head must penetrate inside the boards by riveting. The boards of the drum must have chamfered edges and be put close to each other; uneven boards or steps between two boards or between boards and metal tie rods are not allowed. Instructions: state the welding type/technique (if present) and the anti-oxidation treatments.</p> <p><u>Protections</u> The cables must be protected in such a way as to prevent damage or tampering during transport and handling, also within the sphere of ENEL. If you plan to use a type of protection as an alternative to staves, it must not be made with materials that during disposal are classifiable as hazardous waste; in any case, all protections that are alternatives to staves must be explicitly approved by ENEL during certification or during the tender process. The free ends of the cable must be properly protected against the penetration of water and moisture during transport, storage (which may also be outdoors) and lying. The finished and inspected cable coils at the Constructor's plant cannot be parked without staves or equivalent protections in zones exposed to bad weather (sun, rain, etc.) and to accidental impacts unless for the time necessary for their staving or similar protection. Unless otherwise provided in the purchase order letter, the protection (staving or other) of the coils must be executed 100%. The spacing between the external layer of the cable and the staving must be sufficient for preventing damage to the cable and in any case never less than 50 mm; to comply with said prescription, sizes of length reduced up to the minimum allowed can be preferred, if necessary.</p> <p><u>Labeling</u> At least the following data must be shown in addition to what is required in the order on the external surface of at least one of the flanges of the transport coil, or on the packaging of every single skein, with clearly legible and indelible characters, if applicable: - The ENEL code of the cable; - The name or trademark of the company that owns the coil; - The name of the Constructor of the cable; - The code and formation of the cable; - The type and code of the coil; - The total gross weight (only for the sizes on coil) - The net weight; - The weight of one meter of cable; - The actual length of the size; - The details of the ENEL order; - The number and date of notice of shipment or, for the skeins, the number of the production lot (job no.). Note: The two external faces of the flanges for coils made of wood and the two opposing faces of the pallets, which can be used for shipping several types of cable, must bear the mark demonstrating that the wood used for their construction has been treated as required in directive 2000/29/EC, referred to in SECTION 8.2 7.2.</p> <p><u>Transport</u> The coils must be placed on motor vehicles keeping the distance necessary for inserting the lifting means between the flanges, or in such a way as to allow unloading with suitable for handling equipment.</p>
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GS Type Code	Distribution Company and Country	Country Code	Nominal Voltage (kV) (kV)	Sectional area (mm²)	Type of conductor (L, N, PE, Y)	Conductor Strands of copper or aluminum	Screen conductive screen material	Inner semi-conductive screen - nominal (mm)	Inner semi-conductive screen - Minimum (mm)	Insulation material	Insulation thickness (nominal) (mm)	Insulation minimum thickness (mm)	Outer semi-conductive screen	Outer semi-conductive screen thickness Nominal (mm)	Outer semi-conductive screen thickness Minimum (mm)	Steel braiding applied (Yes/No)	Metallic Screen	Metallic Screen (mm)	Dimension of metal wire diameter Nominal (mm)	Dimension of metal wire diameter minimum (mm)	Number of wires of screen - nominal	Screen metal thickness - Nominal (mm)	Screen metal thickness - Minimum (mm)	Outer sheath material	Outer sheath - Nominal (mm)	Outer sheath - Minimum (mm)	Outer sheath colour	Construction description
SSC001801	DN-Che	6750158	150(21)	70	V	COPPER	XLPE	0.5	0.3	XLPE w/FR-LXPE	6.6	5.8	XLPE	0.5	0.3	YES	Copper wires	25	1	0.5	No applicable	No applicable	No applicable	PE ST1 or PVC ST2	1.8	1.5	BLUE	Single-Core
SSC001802	DN-Che	6750159	150(21)	130	V	COPPER	XLPE	0.5	0.3	XLPE w/FR-LXPE	6.6	5.8	XLPE	0.5	0.3	YES	Copper wires	25	1	0.5	No applicable	No applicable	No applicable	PE ST1 or PVC ST2	2	1.6	BLUE	Single-Core
SSC001803	DN-Che	6750160	150(21)	240	V	COPPER	XLPE	0.5	0.3	XLPE w/FR-LXPE	6.6	5.8	XLPE	0.5	0.3	YES	Copper wires	50	1	0.5	No applicable	No applicable	No applicable	PE ST1 or PVC ST2	2.2	1.8	BLUE	Single-Core
SSC001804	DN-Che	4572162	150(21)	400	V	COPPER	XLPE	0.5	0.3	XLPE w/FR-LXPE	6.6	5.8	XLPE	0.5	0.3	YES	Copper wires	50	1	0.5	No applicable	No applicable	No applicable	PE ST1 or PVC ST2	2.5	2	BLUE	Single-Core
SSC001805	DN-Che	6750255	150(21)	120	V	AAC-1300	XLPE	0.5	0.3	XLPE w/FR-LXPE	6.6	5.8	XLPE	0.5	0.3	YES	Copper wires	25	1	0.5	No applicable	No applicable	No applicable	PE ST1 or PVC ST2	2	1.6	BLUE	Single-Core
SSC001806	DN-Che	6750256	150(21)	240	V	AAC-1300	XLPE	0.5	0.3	XLPE w/FR-LXPE	6.6	5.8	XLPE	0.5	0.3	YES	Copper wires	25	1	0.5	No applicable	No applicable	No applicable	PE ST1 or PVC ST2	2.2	1.8	BLUE	Single-Core
SSC001807	DN-Che	6750257	150(21)	400	V	AAC-1300	XLPE	0.5	0.3	XLPE w/FR-LXPE	6.6	5.8	XLPE	0.5	0.3	YES	Copper wires	50	1	0.5	No applicable	No applicable	No applicable	PE ST1 or PVC ST2	2.5	2	BLUE	Single-Core
SSC001808	DN-Che	6750254	150(21)	630	V	AAC-1300	XLPE	0.5	0.3	XLPE w/FR-LXPE	6.6	5.8	XLPE	0.5	0.3	YES	Copper wires	50	1	0.5	No applicable	No applicable	No applicable	PE ST1 or PVC ST2	2.7	2.2	BLACK	Single-Core
SSC001901	AM-Brazil	6773736	8.710(17.5)	70	V	AAC-1300	XLPE	0.5	0.3	XLPE	4.5	4.0	XLPE	0.8	0.6	NOT	Copper wires	12	1.0	0.5	30	--	--	PVC ST2 or PE ST7	1.8	1.46	BLACK	Single-Core
SSC001902	AM-Brazil	6773741	8.710(17.5)	185	V	AAC-1300	XLPE	0.5	0.3	XLPE	4.5	4.0	XLPE	1.0	0.8	NOT	Copper wires	25	1.0	0.5	30	--	--	PVC ST2 or PE ST7	2	1.6	BLACK	Single-Core
SSC001903	AM-Brazil	6780730	8.710(17.5)	400	V	AAC-1300	XLPE	0.5	0.3	XLPE	4.5	4.0	XLPE	1.4	1.2	NOT	Copper wires	50	1.0	0.5	30	--	--	PVC ST2 or PE ST7	2.3	1.84	BLACK	Single-Core
SSC001904	AM-Brazil	6758811	8.710(17.5)	630	V	AAC-1300	XLPE	0.5	0.3	XLPE	4.5	4.0	XLPE	1.4	1.2	NOT	Copper wires	50	1.0	0.5	30	--	--	PVC ST2 or PE ST7	2.5	2	BLACK	Single-Core
SSC001905	AM-Brazil	6759859	8.710(17.5)	70	V	AAC-1300	XLPE	0.5	0.3	XLPE	4.5	4.0	XLPE	0.8	0.6	NOT	Copper wires	12	1.0	0.5	30	--	--	PVC ST2 or PE ST7	1.8	1.46	BLACK	Triplexed
SSC001906	AM-Brazil	6773269	8.710(17.5)	185	V	AAC-1300	XLPE	0.5	0.3	XLPE	4.5	4.0	XLPE	0.8	0.6	NOT	Copper wires	25	1.0	0.5	30	--	--	PVC ST2 or PE ST7	2	1.6	BLACK	Triplexed
SSC001907	AM-Brazil	6758731	8.710(17.5)	400	V	AAC-1300	XLPE	0.5	0.3	XLPE	4.5	4.0	XLPE	1.4	1.2	NOT	Copper wires	50	1.0	0.5	30	--	--	PVC ST2 or PE ST7	2.3	1.84	BLACK	Triplexed
SSC001908	AM-Brazil	6758679	8.710(17.5)	630	V	AAC-1300	XLPE	0.5	0.3	XLPE	4.5	4.0	XLPE	1.4	1.2	NOT	Copper wires	50	1.0	0.5	30	--	--	PVC ST2 or PE ST7	2.5	2	BLACK	Triplexed
SSC0011001	SD-Romania	330283	120(24)	95	I	AAC-1300	XLPE	0.5	0.3	XLPE	4.9	4.3	XLPE	0.5	0.5	YES	Aluminum pipe	25.5	--	--	No applicable	0.3	--	PE type DMF2 or PE type DM21	-	2	RED	Triplexed
SSC0011002	SD-Romania	330283	120(24)	95	IV	AAC-1300	XLPE	0.5	0.3	HPFE	4.9	4.3	XLPE	0.5	0.5	YES	Aluminum pipe	25.5	--	--	No applicable	0.3	--	PE type DMF2 or PE type DM21	-	2	RED	Triplexed
SSC0011003	SD-Romania	330284	120(24)	185	I	AAC-1300	XLPE	0.5	0.3	XLPE	4.9	4.3	XLPE	0.5	0.5	YES	Aluminum pipe	30	--	--	No applicable	0.3	--	PE type DMF2 or PE type DM21	-	2	RED	Triplexed
SSC0011004	SD-Romania	330284	120(24)	185	IV	AAC-1300	XLPE	0.5	0.3	HPFE	4.9	4.3	XLPE	0.5	0.5	YES	Aluminum pipe	30	--	--	No applicable	0.3	--	PE type DMF2 or PE type DM21	-	2	RED	Triplexed
SSC0011005	SD-Romania	330282	120(24)	35	I	AAC-1300	XLPE	0.5	0.3	XLPE	4.9	4.3	XLPE	0.5	0.5	NOT	Aluminum pipe	11.25	--	--	No applicable	0.3	--	PE type DMPS	-	1.8	GREY	Triplexed
SSC0011006	SD-Romania	330283	120(24)	95	I	AAC-1300	XLPE	0.5	0.3	XLPE	4.9	4.3	XLPE	0.5	0.5	NOT	Aluminum pipe	12	--	--	No applicable	0.3	--	PE type DMPS	-	1.8	GREY	Triplexed
SSC0011007	SD-Romania	330284	120(24)	95	I	AAC-1300	XLPE	0.5	0.3	XLPE	4.9	4.3	XLPE	0.5	0.5	NOT	Aluminum pipe	13.5	--	--	No applicable	0.3	--	PE type DMPS	-	1.8	GREY	Triplexed
SSC0011008	SD-Romania	330285	120(24)	180	I	AAC-1300	XLPE	0.5	0.3	XLPE	4.9	4.3	XLPE	0.5	0.5	NOT	Aluminum pipe	15	--	--	No applicable	0.3	--	PE type DMPS	-	2	GREY	Triplexed