



KINGDOM OF CAMBODIA  
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**ELECTRICITE DU CAMBODGE**

**TECHNICAL SPECIFICATION**

**EDC-DTS-LV001**

**LV Aerial Bundled Conductors and  
Mechanical Accessories**

November 2017





**ELECTRICITE DU CAMBODGE**

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# LV Aerial Bundled Conductors and Mechanical Accessories

## 1 Scope

This specification applies to Aerial Bundled Conductors (ABC) with aluminium or aluminium alloy core of nominal voltage  $U_0/U$  equal to 0.6/1 kV fitted with a cross link polyethylene insulating sheath, and all mechanical accessories designed to be used on the low voltage systems of Electricité du Cambodge.

The life expectancy of ABC and accessories shall not be less than 30 years.

## 2 Standards

IEC : International Electro-technical Commission

IEC 60104 : Aluminium-magnesium-silicon alloy wires for overhead line conductors

IEC 60889 : Hard Drawn Aluminium wires for overhead line conductors

IEC 61089 : Round wire concentric lay overhead electrical stranded conductors

IEC 60228 : Conductors of insulated cables

IEC 60287 : Electric cables – Calculation of the current rating

ISO : International Standard Organization

ISO 2063 : Metallic coating-protection of iron and steel against corrosion

ISO/IEC 17025 : General requirements for the competence of testing and calibration laboratories

ISO 9001 : Quality management systems – Requirements

EN : European Standards

EN 50 483-1 : Test requirements for low voltage aerial bundled cable accessories Part 1: generalities

EN 50 483-2 : Test requirements for low voltage aerial bundled cable accessories -- Part 2: Tension and suspension clamps for self-supporting system

EN 50 483-3 : Test requirements for low voltage aerial bundled cable accessories -- Part 3: Tension and suspension clamps for neutral messenger system

EN 50 483-6 : Test requirements for low voltage aerial bundled cable accessories - Part 6: Environmental testing

NF C : French Standard

NFC 33-209 : Insulated or protected cables for power systems – Insulated cable bundle for overhead distributions, of rated voltage 0.6/1 kV.



- NFC 33-040 : Insulated cables and their accessories for power systems –Suspension equipment for overhead distributions with bundle assembled cores, of rated voltage 0.6/1 kV
- NFC 33-041 : Insulated cables and their accessories for power systems –Anchoring devices for overhead distributions with bundle assembled cores, of rated voltage 0,6/1 kV
- NFC 33-042 : Insulated cables and their accessories for power systems –Anchoring devices for overhead services with insulated cables of rated voltage 0.6/1 kV
- NFC 33-043 : Insulated cables and their accessories for power systems – suspension equipment for overhead services with insulated cables of rated voltage 0.6/1 kV

Unless if standard year is specified, the latest version and all amendments of the above standards apply.

The supplier may propose alternative standards, provided it is demonstrated that they give an equivalent degree of quality as the referenced standard. Acceptability of any alternative standard is at the discretion of the EDC.

### 3 Definitions

The definitions of the relevant IEC, EN and NFC standards apply to this technical specification.

The following designation in this specification is the designation of NF C 33-209, NF C 33-040, NF C 33-041 and NF C 33-042.

- Neutral Messenger: *Neutral wire or conductor whose main mechanical function is to support whole the cable in aerial installations and which is an integral part of the cable it supports*

### 4 Testing and Inspection

#### 4.1 General Notes for Test

LV ABC and LV ABC mechanical accessories may be inspected at the manufacturer’s factory by EDC’s representatives.

The inspection and routine tests shall be carried out in accordance with the provisions of the relevant EN and NFC recommendations.

ABC and accessories for LV ABC shall be subjected to tests as specified below.

#### 4.2 Type Tests

All type tests required by the NF C 33-209, NF C 33-040, NF C 33-041 and 33-042. And EN standards shall be carried out.

Type test reports shall be carried out by internationally recognized electrical testing laboratories.

Full copies of type test reports shall be submitted within the bid of the manufacturer/supplier. Type test reports older than 15 years will not be accepted.



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If the manufacturer is certified by EDC, it is not necessary to submit type test reports for the considered equipment and in addition the manufacturer shall have all the facilities and bring evidence he can make the tests according to NF C 33-040, NF C 33-041 and NF C 33-042.

For all other cases the type tests must be supplied within the bid but in any case, not later than 8 days after bid opening date.

Nevertheless, in case the testing laboratory is not internationally recognized, the testing laboratory shall be mandatorily accredited ISO/IEC 17025 by an international or national accreditation body specialized in testing laboratories accreditation/acceptance. In that case, the testing laboratory shall prove mandatorily its capability/capacity to carry out all type tests mentioned in the type tests reports by supplying: Full description of all tests the laboratory can carry out, list of testing equipment with full characteristics, drawing of testing rooms with location of testing equipment, etc. supported by pictures and copy of the ISO/IEC 17025 accreditation certificate.

Acceptability of any accredited testing laboratory is at the discretion of the EDC.

### 4.3 Routine Test

EN and NFC standards mentioned in §2 apply.

### 4.4 Acceptance Tests

#### 4.4.1 ABC Cable

Even if the ABC cable manufacturer production process is ISO 9001 certified, the routine tests mentioned in ANNEX B (chapter B1) of NFC-33-209 shall be carried out.

In addition, a dielectric test as requested by chapter B2 of Annex B of NFC 33-209 shall also be executed.

#### 4.4.2 Specific Acceptance Test

In order to verify the compatibility of the neutral messenger and the anchor clamp as well as the mechanical and physical characteristics of the neutral insulation, the combined adhesion test with reference clamp on insulation similar to the one described in chapter 6.5.2 of NFC 33209 shall be carried out. The reference clamp shall be replaced by an anchor clamp strictly conform to the requirements of NFC 33-041. The number of sample shall be 3 and randomly selected on the drums to be delivered. The distance of the two insulations full cut on both side of the clamp shall be measured from the clamp wedges without taking into account the body length of the clamp. A tension effort is then applied as requested by NFC 33-209 standard and maintained during 5 minutes. The tension shall be:

- 1000 daN for 54.6 mm<sup>2</sup> neutral messenger
- 1500 daN for 70 mm<sup>2</sup> neutral messenger

The acceptance test is considered successful if:

- There is no insulation/core slippage
- There is only 1 insulation/core slippage which not reach the marking C on the 3 tested samples.

Acceptance tests results shall be recorded and mentioned on a routine/acceptance test made available to the EDC inspectors and send to EDC.



#### 4.4.3 ABC Mechanical Accessories

Acceptance tests of ABC mechanical accessories are those mentioned in the EN and NFC standards.

### 5 Quality Management

Design, development and production of the proposed equipment shall be ISO 9001 certified. The ISO 9001 certificate shall be submitted within the bid.

### 6 Ambient Conditions

Low voltage aerial bundled conductors and mechanical accessories shall be suitable to operate in the ambient conditions described here after:

Altitude	Sea level to 1,000 meters
Climate	Tropical
Annual Rainfall	1,300 mm. 140 days
Monsoon Period	June to November
Ambient Air Temperatures:	
Average	27.5°C
Minimum	13.3°C
Maximum	40.5°C
Relative Air Humidity	65-100%
Soil Thermal Resistivity:	
Average	1.20c m/W
Maximum	3.00c m/W
Solar Emissivity	0.8
Solar absorption	0.8
Wind Velocity:	
Average	37 km/h (10.3 m/s)
Maximum	72 km/h (20 m/s)



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## 7 Low Voltage Aerial Bundled Conductors (LV ABC)

### 7.1 Rated Voltages

The rated voltage of LV ABC is:

$$U_0 = 0.6 \text{ kV}, U = 1 \text{ kV}, U_m = 1.2 \text{ kV}$$

### 7.2 Dielectric Strength

Aerial bundled cables shall be designed to withstand the application of 10 kV voltage during 30 minutes between cores and water after water immersion of 24 hours without breakdown.

### 7.3 Impulse Withstand Voltage

Conductors shall be designed to withstand without breakdown a standard impulse voltage sequence 1.2/50  $\mu$ s of positive and negative polarity with a peak value equal to 20 kV.

### 7.4 Rated Currents

The ABC rated current shall be:

ABC	Rated current Open air, 30°C, No wind
2 x 16 mm <sup>2</sup>	93 A
4 x 16 mm <sup>2</sup>	83 A
2 x 25 mm <sup>2</sup>	122 A
4 x 25 mm <sup>2</sup>	111 A
2 x 35 mm <sup>2</sup>	144 A
4 x 35 mm <sup>2</sup>	135 A
1 x 50 mm <sup>2</sup> + 1 x 54.6 mm <sup>2</sup> N	180 A
3 x 50 mm <sup>2</sup> + 1 x 54.6 mm <sup>2</sup> N	168 A
3 x 70 mm <sup>2</sup> + 1 x 70 mm <sup>2</sup> N	213 A
3 x 150 mm <sup>2</sup> + 1 x 70 mm <sup>2</sup> N	344 A

### 7.5 Constitution

#### 7.5.1 Cores

The core of conductors shall be of class 2 circular cross-section. The strands of the **neutral messenger conductor shall be made of aluminium alloy, magnesium and silicon** defined by the characteristics in paragraph 6.5.1.2.



The conductor's core, other than the neutral messenger shall be made of pure aluminium strands and the **conductor can be compacted**. The presence of welds on the elementary strands of the cable core is tolerated, but when considering all the strands of the neutral messenger, two consecutive welds shall be located at least 50 m.

### 7.5.2 Insulating Sheath

The insulating sheath shall be an extruded sheath made of black cross-linked polyethylene (XLPE). It shall be easily removable and protected against UV rays and weather resistant. In the case neutral messenger conductor, a paper separator could be applied between core and insulation sheath. For phase conductors, the presence of a separator is optional, but if there is one, it must be mass coloured and it must be the same on all the cores of the LV ABC section.

### 7.5.3 Conductors Assembly

Conductors shall be bundle together for self-supported ABC and **shall be bundled around the neutral for neutral messenger ABC** as follow:

- Self-supported ABC
  - 2 x 16 mm<sup>2</sup> (service connections)
  - 4 x 16 mm<sup>2</sup> (service connections)
  - 2 x 25 mm<sup>2</sup> (service connections)
  - 4 x 25 mm<sup>2</sup> (service connections)
  - 2 x 35 mm<sup>2</sup> (service connections)
  - 4 x 35 mm<sup>2</sup> (service connections and main network)
- Neutral messenger ABC
  - 1 x 50 mm<sup>2</sup> + 1 x 54.6 mm<sup>2</sup> N (service connections and main network)
  - 3 x 50 mm<sup>2</sup> + 1 x 54.6 mm<sup>2</sup> N (service connections and main network)
  - 3 x 70 mm<sup>2</sup> + 1 x 70 mm<sup>2</sup> N (main network)
  - 3 x 150 mm<sup>2</sup> + 1 x 70 mm<sup>2</sup> N (main network)

Public lighting conductor (s) can be inserted in the ABC.

## 7.6 Core and Conductors Characteristics

### 7.6.1 Characteristics of Cores

#### 7.6.1.1 Phase conductors and neutral of self-supported ABC

The aluminium strands used to make the core of the phase conductors and the neutral of self-supported ABC must present before wiring, a tensile strength at least equal to 120 MPa.

Diameter of wires could vary according the reel conductor cross section.

#### 7.6.1.2 Neutral messenger

The aluminium alloy wires used for producing conductive core of neutral messenger must present before wiring the following characteristics:

- Nominal diameter of strands:
  - 3.25 mm for the 54.6 mm<sup>2</sup> messenger
  - 3.50 mm for the 70 mm<sup>2</sup> messenger
- Coefficient of linear expansion:  $23 \cdot 10^{-6} \text{ K}^{-1}$
- Modulus: 62,000 MPa



The conductive cores must meet the characteristics specified in the table here in after.

Furthermore, the conductive core of carrier neutral conductor must comply with the following requirements:

- the maximum strands lay length of the outer layer: 20 x (core diameter)
- direction of lay of external wiring strands: left "S"



1	2	3		4	5	6	7	8	9	10
Designation		Conductive cores						Conductor		
	Nominal cross section	Nb of wires	Wire dia.	Max linear resistance 20°C	Core diameter (mm)		Breaking load min.	Nominal thickness of insulation sheath	External Diameter (mm)	
	(mm <sup>2</sup> )			(Ω/km)	Min (mm)	Max (mm)	(daN)	(mm)	Min (mm)	Max (mm)
Phase or not messenger neutral	16	7	*	1.91	4.6	5.1	190	1.2	7.0	7.8
	25	7	*	1.20	5.8	6.3	300	1.4	8.6	9.4
	35	7	*	0.868	6.8	7.3	420	1.6	10.0	10.9
	50	7	*	0.641	7.9	8.4	630	1.6	11.1	12
	70	12	*	0.443	9.7	10.2	840	1.8	13.3	14.2
	150	19	*	0.206	13.9	15	1800	1.7	16.3	17.3
Neutral messenger	54.6	7	<b>3.15</b>	0.63	9.2	9.6	1660	1.6	12.3	13
	70	7	<b>3.50</b>	0.50	10	10.2	2050	1.5	12.9	13.6

\* the diameter of wire could vary according the real phase cross section. Nevertheless, the number of wires is mandatory.

### 7.6.2 Maximum Permissible Temperatures

The maximum permissible temperatures in the conductors are as follows:

- 90 °C during nominal operation
- 120 °C under a short duration overload (a total of 24 hours a year in separate periods of 3 hours at the most)
- 250 °C under multi-phase short-circuit conditions (5 seconds)

These temperatures are based on the intrinsic properties of the insulating materials. These values can only be used for calculating permissible current ratings.

## 7.7 Bundled Characteristics

### 7.7.1 Conductors Lay

The conductors shall be laid up with a left hand (S) lay by respecting the lays length (ratio) here after:



1	2	3	4	5
ABC without neutral messenger		ABC with neutral messenger		
Cross section (mm <sup>2</sup> )	Maximal lay length (cm)	Cross section of phase conductors (mm <sup>2</sup> )	Minimal lay length (cm)	Maximal lay length (cm)
16	40	50	-	90
25	45	70	-	110
35	50	150	115	130

## 7.8 Marking

The characters should have a minimum height of 5 mm and a minimum width of 2 mm.

### 7.8.1 Self-supported ABC

Markings shall be engraved or embossed as follow:

- Phase conductor: Figures 1, 2 or 3 and cross section spaced 200 mm. The Figures are placed longitudinally and upside down.
- Neutral: Manufacturer name, date of manufacturing, NFC 33-209 and cross section spaced 250 mm longitudinally and placed upside down. In addition, metric length shall be mentioned apart the above marking on the opposite side of the conductor. Supplier name must also be mentioned.

### 7.8.2 Neutral Messenger ABC

Markings shall be engraved or embossed as follow:

- Phase conductor: Figures 1, 2 or 3 and cross section spaced 200 mm apart and placed longitudinally and upside down;
- Neutral messenger: Manufacturer name, date of manufacturing, NFC 33-209, and cross section spaced 250 mm apart longitudinally and placed upside down. In addition, metric length shall be mentioned apart the above marking on the opposite side of the conductor. Supplier name must also be mentioned.

Additional marking by ink is tolerated.

**Ribs marking is not accepted.**

**Colour marking is not accepted because of the too bad ageing and UV withstand of the coloured XLPE.**

## 7.9 Delivery/Drums

LV ABC shall be delivered wound on strong wooden drums treated to an approved international standard by impregnation with copper-chrome-arsenate (CCA) preservative to resist rotting and termite and fungus attacks. Drums with an outside diameter exceeding 2.5 meters and outside width exceeding 1.4 meter shall not be used except with the EDC approval. The drum shall be no returnable.



The central hole of the drums shall be reinforced with a steel plate of thickness not less than 10mm to fit an axle of size 95 mm diameter.

The interior of the conductor drums shall be lined with bituminous paper to prevent the conductor from being in contact with the timber. Waterproof paper and felt lining shall overlap at seams by at least 20 mm, and the seams shall be sealed.

Drums shall be adequately protected by securely fastening substantial wooden battens around the periphery. These battens shall be secured by means of steel tap bindings.

Cables shall be securely fastened around the periphery of the drum. Cables shall be supplied with both ends properly capped, and protected against damage and penetration of water. Each drum shall bear label detailing manufacturer's name, drum number, contract number, specified voltage, type and length of conductor/cable indelibly mentioned on a secured plate or painted/printed directly on the drum. Cable drums shall be suitable for outside storage, for a minimum period of five years in the Cambodia climate, without undue deterioration.

The inner cable end attached to the drum shall be capped and sealed. All nails and metallic parts of the inner surfaces must be countersunk so that they cannot damage the conductor/cable.

The thread of bolts used to strengthen the cable drums shall be in such a way that the nut can be tightened but cannot readily removed.

Drums shall not be treated with chemicals injurious to the conductors.

ABC length per drum

- Self-supported ABC
  - 2 x 16 mm<sup>2</sup> : 2000 m ± 5 m
  - 4 x 16 mm<sup>2</sup> : 2000 m ± 5 m
  - 2 x 25 mm<sup>2</sup> : 2000 m ± 5 m
  - 4 x 25 mm<sup>2</sup> : 2000 m ± 5 m
  - 2 x 35 mm<sup>2</sup> : 2000 m ± 5 m
  - 4 x 35 mm<sup>2</sup> : 2000 m ± 5 m
- Neutral messenger ABC
  - 1 x 50 mm<sup>2</sup> + 1 x 54.6 mm<sup>2</sup> N : 1000 m ± 5 m
  - 3 x 50 mm<sup>2</sup> + 1 x 54.6 mm<sup>2</sup> N : 1000 m ± 5 m
  - 3 x 70 mm<sup>2</sup> + 1 x 70 mm<sup>2</sup> N : 1000 m ± 5 m
  - 3 x 150 mm<sup>2</sup> + 1 x 70 mm<sup>2</sup> N : 1000 m ± 5 m

Inner and outer ends of ABC shall be protected against water penetration inside cables cores.

Time between manufacturing and delivery shall not exceed one year.



## 8 ABC Mechanical Accessories

### 8.1 Generalities

All accessories shall be suitable for the whole range or part of the range of ABC, as well as for the conductor material used: 2 x 16, 4 x 16, 2 x 25, 4 x 25, 2 x 35, 4 x 35, 1 x 50 + 54.6N, 3 x 50 + 54.6N, 3 x 70 + 70N and 3 x 150+70N aluminium bundled conductors conform to NF C 33-209 standard.

All accessories shall be designed to meet the performance requirements of various sections of this specification and the related standards. They must be adequately rated for their intended application and retain this rating within their normal lifetime in outdoor environment.

All accessories shall be free from defects which could cause them to be incorrectly assembled or to perform unsatisfactorily in service. Finish shall be such that outer surface are free of sharp edges and burrs which could result in damage to adjacent material or persons.

Accessories comprising different component parts shall be designed so that they can be applied without disassembly. It shall be possible for one man working alone to do installation of all accessories.

### 8.2 Accessories Marking

All LV ABC accessories shall bear the following marking.

- Trade mark or manufacturer logo
- Equipment designation according the NF C standard,
- Batch reference or manufacturing date
- Factory code

This marking shall be indelible and subject to the verification of indelibility marking type test as requested by the relevant NF C standards.

### 8.3 Pole Dead-End Assembly for Neutral Messenger ABC

The dead-end assembly for neutral messenger ABC shall be designed to anchor LV ABC with insulated neutral messenger and be conform to the requirement of NF C 33-041. All type tests reports required by this standard shall be provided.

The Dead-end assembly shall correspond to the **EA 1500-2000 designation of the NFC 33-041 and tests requirements.**

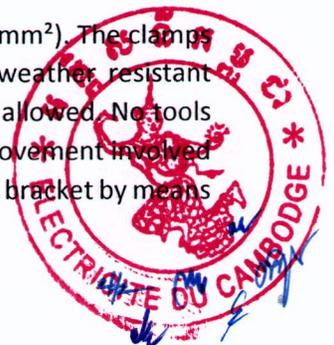
It shall be composed of:

- One clamp
- One anchoring bracket

Bracket and clamp are specified together in order to ensure compatibility of materials and reduce the wear on joint and articulation, either by vibration or oscillation, or by electrolytic corrosion, or by the combination of the different phenomena.

#### 8.3.1 Clamp

Clamps shall be designed to anchor ABC with neutral messenger (54.6 mm<sup>2</sup> and 70 mm<sup>2</sup>). The clamps shall be of self-adjustable wedge type. They shall be made of mechanical and weather resistant material. No bolt for clamping the neutral messenger and no losable parts shall be allowed. No tools shall be required for the installation of the clamp in the field. To ease the twisting movement involved in ABC system, the clamp must be supplied with a flexible attachment onto the above bracket by means



of a stainless steel flexible braid. Parts directly in contact with the neutral messenger shall be made of insulated materials to provide secondary insulation between conductors and metal parts.

The clamp shall consist of:

- An aluminium alloy corrosion resistant casted body or a thermoplastic body with very high mechanical and climatic resistance.
- An unlosable but openable stainless steel flexible bail equipped with a movable wear-resistant plastic saddle and two devices compressed on the ends to be locked on the clamp body. It is also accepted that this attaching device is made with an unlosable stainless-steel cable fitted with one closable (lock) hook and the other end locked to the clamp body.
- Two inner self adjusting insulating plastic wedges ensuring the clamping of the neutral messenger without damaging cable insulation.

The self-adjustable anchor clamps shall be used on 54.6 mm<sup>2</sup> and 70 mm<sup>2</sup> neutral insulated messenger as defined afore in LV ABC specification.

**The anchor clamp shall correspond to PA 1500-2000 designation of NFC 33-041 and tests requirements.**

### 8.3.2 Anchoring Bracket

Aluminium alloy anchoring bracket shall be used for fixing an ABC anchor clamp to a pole either in single anchorage (dead end) or double anchorage (angle) positions.

It shall be a single piece, made of high corrosion resistance aluminium alloy allowing single or double anchoring.

The bracket shall be fixed on pole either by two 14 mm or 16 mm diameter hot dip galvanised bolts with a total length of 30 cm and threaded length of 120 mm or by two 20 x 0.7 mm stainless steel straps.

**The anchoring bracket shall correspond to CA 1500-2000 designation of NFC 33-041 and tests requirements.**

### 8.3.3 Delivery

The anchor assembly components shall be delivered attached together in a card box containing several assembly.

## 8.4 Wall Dead-end Assembly for Neutral Messenger ABC

The wall dead end assembly for neutral messenger ABC shall be designed to anchor LV ABC with insulated neutral messenger and be conform to the requirement of NF C 33-041. All type tests reports required by this standard shall be provided.

The Dead-end assembly shall be designed and tested according to the NFC 33-041 standard.

It shall be composed of:

- One clamp (EA600)
- One anchoring bracket (CT 600)

Bracket and clamp are specified together in order to ensure compatibility of materials and reduce the wear on joint and articulation, either by vibration or oscillation, or by electrolytic corrosion, or by the combination of the different phenomena.



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### 8.4.1 Clamp

Clamps shall be designed to anchor ABC with neutral messenger (54.6 mm<sup>2</sup> and 70 mm<sup>2</sup>). The clamps shall be of self-adjustable wedge type. They shall be made of mechanical and weather resistant material. No bolt for clamping the neutral messenger and no losable parts shall be allowed. No tools shall be required for the installation of the clamp in the field. To ease the twisting movement involved in ABC system, the clamp must be supplied with a flexible attachment onto the above bracket by means of a stainless steel flexible braid. Parts directly in contact with the neutral messenger shall be made of insulated materials to provide secondary insulation between conductors and metal parts.

The clamp shall consist of:

- An aluminium alloy corrosion resistant casted body or a thermoplastic body with very high mechanical and climatic resistance.
- An unlosable but openable stainless steel flexible bail equipped with a movable wear-resistant plastic saddle and two devices compressed on the ends to be locked on the clamp body. It is also accepted that this attaching device is made with an unlosable stainless-steel cable fitted with one closable (lock) hook and the other end locked to the clamp body.
- Two inner self adjusting insulating plastic wedges ensuring the clamping of the neutral messenger without damaging cable insulation.

The self-adjustable anchor clamps shall be used on 54.6 mm<sup>2</sup> and 70 mm<sup>2</sup> neutral insulated messenger as defined afore in LV ABC specification.

The anchor clamp shall correspond to **EA 600** designation of NFC 33-041 and tests requirements.

### 8.4.2 Wall Anchoring Bracket

Aluminium alloy anchoring bracket shall be used for fixing an ABC anchor clamp onto a wall perpendicularly to wall front face for single anchorage of self-supported ABC.

It shall be a single piece, made of high corrosion resistance aluminium alloy allowing single anchoring with ABC.

The bracket shall be fixed against the wall with three 12 mm diameter bolts fitted with wall plug (not included in the supply).

The anchoring bracket shall correspond to **CT 600** designation of NFC 33-041 and tests requirements.

### 8.4.3 Delivery

The anchor assembly components shall be delivered attached together in a card box containing several assemblies.

## 8.5 Pole Double Anchorage Assembly

A pole double anchorage assembly is constituted of one anchoring bracket and two clamps as defined in 8.3.1 and 8.3.2.

The components of the double anchor assembly shall be delivered attached together in a card box containing several assembly.

## 8.6 Suspension Assembly for Neutral Messenger ABC

The suspension assembly for neutral messenger ABC shall be designed to support LV ABC with insulated neutral messenger on poles and be conform to the requirement of NF C 33-040. All type tests reports required by this standard shall be provided.



Suspension assembly shall correspond to the **ES 1500 designation of the NFC 33-040 and test requirements.**

The assembly shall be design to support neutral messenger ABC in straight position and in the maximum following angles:

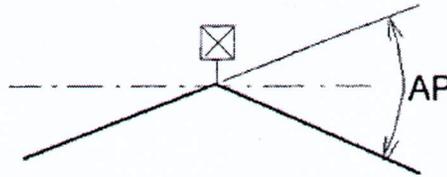


Fig. 1

With  $AP \leq 45^\circ$

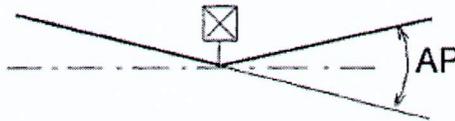


Fig. 2

With  $AP \leq 27^\circ$

The suspension assembly shall be composed of:

- One suspension clamp
- One articulated link between clamp and bracket
- One suspension bracket

Bracket, link and clamp are specified together in order to ensure compatibility of materials and reduce the wear on joint and articulation, either by vibration or oscillation, or by electrolytic corrosion, or by the combination of the different phenomena.

The bracket shall be fixed on pole either by one 14 mm or 16 mm diameter bolts mm diameter hot dip galvanised bolts with a total length of 30 cm and threaded length of 120 mm or by two 20 x 0.7 mm stainless steel straps or by two 20 x 0.7 mm stainless steel straps.

### 8.6.1 Suspension Clamp and Articulated Link

The suspension clamp and articulated link is a device where no bolt for tightening the neutral and no losable parts are allowed.

Clamping of the neutral messenger shall be of controlled slippage. This device must have the capacity for the suspension and tightening of a messenger of 54.6 mm<sup>2</sup> and/or 70 mm<sup>2</sup>.

Both suspension clamps and articulated link must be made entirely and exclusively of mechanical sound and weather proof material.



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The articulated link shall allow a transversal and longitudinal movement of the suspension body clamp. Parts directly in contact with the neutral messenger shall be made of insulated material to provide secondary insulation between conductors and metal parts.

No tool shall be required for installation of the clamp in the field and the neutral tightening inside the clamp shall be independent to the operator.

The open side of the clamp shall be located face to the pole.

**Suspension clamp and articulated link shall correspond respectively to PS 1500 and LM 1500 designations of NFC 33-040 and tests requirements.**

**8.6.2 Suspension Bracket**

Aluminium alloy suspension bracket shall be used for fixing the ABC suspension clamp and articulated link to a pole.

It shall be a single piece, made of high corrosion resistance aluminium alloy.

The bracket shall be fixed on pole either by one 14 mm or 16 mm diameter hot dip galvanised bolts with a total length of 25 cm and threaded length of 120 mm or by two 20 x 0.7 mm stainless steel straps.

**Suspension bracket shall correspond to CS 1500 designation of NFC 33-040 and tests requirements.**

**8.6.3 Delivery**

The suspension assembly components shall be delivered attached together in a card box containing several assembly.

**8.7 Stainless Steel Strap and Accessories**

Stainless steel shall be used for fixing brackets and other equipment on poles.

The dimensions shall be:

- Width = 20 mm
- Thickness = 0.7 mm

Strap shall be of 18 / 8 mat or brilliant stainless steel with a breaking strength comprised between 600 and 950 N / mm<sup>2</sup>. The breaking strength of the strap shall be proved by a type test carried out by the manufacturer. The maximal elongation shall be 40%.

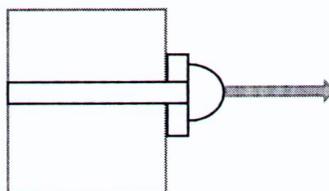
The four edges of the stainless-steel strap shall be mandatorily deburred in order to avoid cable or personal cutting. **Not deburred strap shall be rejected.**

Buckle shall be designed for tightening steel strap on pole by « looping ». Buckle shall be stainless steel made.

**8.7.1 Type Test**

The following type test shall be carried out and test report provided within the offer.

A metallic strong bracket shall be fixed on a round pole with one stainless steel strap and a tensile strength is applied on the bracket.



The stainless-steel strap shall withstand:

One lap	16,000 N
Two superposed laps	37,000 N

### 8.7.2 Protection Strap for Stainless Steel Strap

Stainless steel strap shall be used for attaching cables on poles. For this purpose, it shall be supplied protection strap to be inserted on the stainless-steel strap.

The protection strap shall be made of elastomer UV protected.

### 8.7.3 Insulated Bracket for Stainless Steel Strap

Insulated brackets for stainless steel strap shall be used for fixing cables or plastic pipe all along a pole. They shall be used with the stainless-steel strap (already installed or not) described above in this chapter.

They shall be made of high mechanical and climatic withstand insulating material and a specific device shall allow the locking of the bracket on the strap.

The following strap brackets shall be provided:

- For cable or PVC pipe with a diameter from 30 mm to 50 mm
- For cable or PVC pipe with a diameter from 50 mm to 90 mm

### 8.7.4 Cable Mechanical Protection

This cable mechanical protection shall be used at ABC/underground cable interface in order to protect cables against mechanical aggression from about 30 cm under ground level up to 2.4 m above ground level at a minimum.

The cable mechanical protection shall be made of PVC of grey colour with an Omega shape ( $\Omega$ ) and shall be attached on pole by using stainless steel strap or fixed against walls by screw and plugs.

The cable mechanical protection shall be designed for protection of a cable with a maximum diameter of 90 mm.

### 8.7.5 Delivery

Stainless steel strap shall be delivered in rolls of 50m inside a plastic container that allow an easy unwinding of the steel strap.

Buckles shall be delivered in bag or card box containing 100 pieces.

Protection strap shall be delivered in rolls of 10 meters length.

Insulated brackets for stainless steel strap shall be delivered in plastic bags or card box containing 50 brackets.

### 8.8 Insulated Supports for Main Network LV ABC Installed on Facade Walls.

Those insulated supports shall be made and type tested strictly in accordance with the requirement of NF C 33-040. All type tests reports required by this standard shall be provided.



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They shall be installed with a hammer and be of **BRPF 1 and BRPF 6 type as defined by the NF C 33-040 and type tests.**

The body shall be made of strong UV resistant insulating thermoplastic including:

- A cable supports
- a cable fixing tie
- an expansion plug (by nail)

The body shall allow the fixing of a second ABC later.

The nail used for fixing the body onto the wall shall be protected against the corrosion.

Insulated supports shall be used with the following ABC:

- Main LV network neutral messenger ABC:
  - 1 x 50 mm<sup>2</sup> + 54.6 mm<sup>2</sup> N
  - 3 x 50 mm<sup>2</sup> + 54.6 mm<sup>2</sup> N
  - 3 x 70 mm<sup>2</sup> + 70 mm<sup>2</sup> N
  - 3 X 150 mm<sup>2</sup> + 70 mm<sup>2</sup> N

**Only one insulated support reference shall support all neutral messenger ABC.**

## 8.9 Anchor Clamp for Self-Supported Service ABC

The anchor clamps for self-supported service ABC shall be made and type tested strictly in accordance with the requirement of NF C 33-042.

Type test reports shall be provided.

### 8.9.1 Description

Service clamps for 2 x 16, 4 x 16, 2 x 25, 4 x 25, 2 x 35, 4 x 35 aluminium core service ABC shall be designed to terminate bundled conductors at poles (associated with a pigtail bolt) and on building facades. The clamps shall be of self-adjustable wedge type. They shall be made of mechanical and weather UV resistant material. No bolt for clamping the bundled and parts easily lost or dismantled are allowed. Also, no tools shall be required for installation of the clamp in the field. Parts directly in contact with the bundled shall be made of insulated material in order to provide secondary insulation between conductors and metal parts. The clamp must be supplied with a braid or hook attachment made of aluminium or stainless steel or strong UV resistant material.

The minimum breaking load of anchor clamps shall not be less than 2000 N.

One anchor clamp reference shall accommodate all Service ABC here after:

- 2 x 16 mm<sup>2</sup>
- 4 x 16 mm<sup>2</sup>
- 2 x 25 mm<sup>2</sup>
- 4 x 25 mm<sup>2</sup>
- 2 x 35 mm<sup>2</sup>
- 4 x 35 mm<sup>2</sup>

## 8.10 Suspension Clamp for Service ABC

This suspension clamp for service self-supported ABC shall be used on pole for supporting ABC in straight line or small angle. It shall be used associated with a pigtail bolt.



They shall be made of mechanical and weather resistant material. No bolt for clamping the bundled and parts easily lost or dismantled are not allowed. Also, no tools shall be required for installation of the clamp in the field. Parts directly in contact with the bundled shall be made of insulated material in order to provide secondary insulation between conductors and metal parts if any.

One suspension clamp reference shall accommodate all Service ABC here after:

- 2 x 16 mm<sup>2</sup>
- 4 x 16 mm<sup>2</sup>
- 2 x 25 mm<sup>2</sup>
- 4 x 25 mm<sup>2</sup>
- 2 x 35 mm<sup>2</sup>
- 4 x 35 mm<sup>2</sup>

### 8.11 Anchoring/Straight Line Pig Tail Bolt on Pole

Pig tail bolt shall be used for anchoring or straight line self-supported **service ABC** on pole by mean of anchor clamp or suspension clamp for service ABC.

It shall be hot dip galvanized and supplied with two nuts and two large washers of 30 mm diameter. The zinc thickness shall not be less than 65 microns (µm). Thread inside the nuts shall not be galvanized but oiled.

Dimensions shall be:

- Diameter = 12 mm
- Threaded Length = M250 mm

### 8.12 Insulated Supports for Self-supported Service LV ABC Installed on Facade Walls.

Those insulated supports shall be made and type tested strictly in accordance with the requirement of NF C 33-043.

They shall be installed with a hammer and be of **BBPF type as defined by the NF C 33-043 and tests.**

The body shall be made of strong UV resistant insulating thermoplastic including:

- A cable supports
- a cable fixing collar
- an expansion plug (by nail)

The design body shall allow the fixing of a second service ABC latter.

The nail used for fixing the body onto the wall shall be protected against the corrosion or made of strong plastic.

Insulated service ABC supports shall be used with the following ABC:

- 2 x 16 mm<sup>2</sup>
- 4 x 16 mm<sup>2</sup>
- 2 x 25 mm<sup>2</sup>
- 4 x 25 mm<sup>2</sup>
- 2 x 35 mm<sup>2</sup>
- 4 x 35 mm<sup>2</sup>

Only one insulated support reference shall accommodate all service ABC mentioned above.



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### 8.13 Insulating Binding Tie

This cable binding tie made of black colour, UV and weather resistant polyamide shall be used for fixing phase conductors onto neutral messenger at suspension and anchor points, attaching tap cable on main ABC at connecting point and for attaching service cables together.

Made of Polyamide 12, they shall be oil, acid, grease resistant with a flammability rating of UL94-HB.

This tie shall be of notched type for good adjusting and it shall be possible to interconnect two ties if the length of one is too short.

The width shall be 8 mm or 9 mm and three lengths shall be provided: 175 mm, 250 mm and 340 mm for respective binding minimum/maximum diameters of 10/42 mm, 20/62 mm, 20/92 mm.

### 8.14 Universal Wall Anchoring Bracket

This small bracket made of Aluminium alloy, stainless steel, hot dip galvanized steel or composite material shall be used for attaching all types of **service anchor clamps for self-supported service ABC** on buildings or pole.

This bracket fitted with one hole allowing the anchor clamp attachment, shall be able to be fixed on a building by mean of either of them:

- 4 x 4.5 mm diameter wooden screws (not supplied),
- 4 x 4.5 mm diameter screws + 4 masonry expansion plug (not supplied),
- One 12 mm diameter bolt (not supplied),
- One stainless steel strap of 20 mm width (not supplied).



## 9 Technical Data Sheets

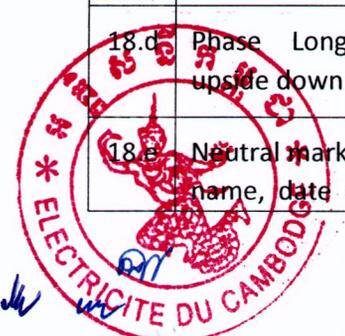
### 9.1 Neutral Messenger Main ABC 3-Phase + Neutral

No.	Description	Unit	Requirements	Supplier's Offer
1	Country		to be specified	
2	Manufacturer		to be specified	
3	Manufacturer's Reference		to be specified	
4	Applicable Standard		NFC 33-209	
5	Full type tests reports supplied		Yes as per NFC 33-209	
6	Rated Voltage			
	U <sub>0</sub>	kV	0.6	
	U	kV	1.0	
	U <sub>m</sub>	kV	1.2	
7	Dielectric Strength (type test)	kV	10 kV AC voltage during 30 minutes between cores and water after water immersion of 24 hours without breakdown.	
8	Impulse Withstand Voltage	kV	1.2/50 μs of positive and negative polarity with a peak value equal to 20 kV.	
9	Rated current (30°C open air, no wind)	A	<input type="checkbox"/> 3X50+1x54.6N: 168 A <input type="checkbox"/> 3x70+1x70N: 213 A <input type="checkbox"/> 3x150+1x70N: 344 A	
<b>10. Neutral Messenger Core</b>				
10.a	Metal alloy		Aluminium, magnesium silicon	
	Origin of alloy		To be mentioned	
10.b	Coefficient of linear expansion:		23. 10 <sup>-6</sup> K <sup>-1</sup>	
	Modulus:	MPa	62 000	

10.c	Cross section	mm <sup>2</sup>	<input type="checkbox"/> 54.6 <input type="checkbox"/> 70					
10.d	Diameter of wires <input type="checkbox"/> 54.6 mm <sup>2</sup> <input type="checkbox"/> 70 mm <sup>2</sup>	mm	3.15 3.50					
10.e	Number of wires		7					
10.f	Conductor Maximal diameter	mm	<input type="checkbox"/> 54.6 mm <sup>2</sup> = 9.6 <input type="checkbox"/> 70 mm <sup>2</sup> = 10.2					
10.g	Max linear resistance 20°C	Ω/km	<input type="checkbox"/> 54.6 mm <sup>2</sup> = 0.63 <input type="checkbox"/> 70 mm <sup>2</sup> = 0.50					
10.h	Minimum breaking load	daN	<input type="checkbox"/> 54.6 mm <sup>2</sup> = 1660 <input type="checkbox"/> 70 mm <sup>2</sup> = 2050					
10.i	Average XLPE insulation thickness	mm	<input type="checkbox"/> 54.6 mm <sup>2</sup> = 1.6 <input type="checkbox"/> 70 mm <sup>2</sup> = 1.5					
10.j	Max outer diameter	mm	<input type="checkbox"/> 54.6 mm <sup>2</sup> = 13 <input type="checkbox"/> 70 mm <sup>2</sup> = 13.6					
<b>11. Phase Core</b>								
11.a	Metal Origin of aluminium		Class A Pure Aluminium, To be mentioned					
11.b	Cross section	mm <sup>2</sup>	<input type="checkbox"/> 50	<input type="checkbox"/> 70	<input type="checkbox"/> 150	50	70	150
11.c	Real cross section	mm <sup>2</sup>	To be specified					
11.d	Number of wires		7	12	19			
11.e	Diameter of wire	mm	To be specified					
11.f	Conductor Maximal diameter	mm	8.4	10.2	15			
11.g	Max linear resistance 20°C	Ω/km	0.641	0.443	0.206			
11.h	Average insulation thickness	mm	1.8	1.8	1.7			
11.i	Max outer diameter	mm	12	14.2	18.6			



12	Maximum Permissible core temperatures						
12.a	nominal operation	°C	90				
12.b	short duration overload (a total of 24 hours a year in separate periods of 3 hours at the most)	°C	120				
12.c	Multi-phase short-circuits conditions	°C	250				
13	Black XLPE UV protected and weather resistant Insulating sheath		Yes				
14	Insulation minimal breaking resistance	Mpa	14.5				
15	Insulation minimal Elongation breaking	%	200				
16	Type tests according table 2 "tests for insulating sheath" of NFC 33-209 provided		Yes				
17	Conductors assembling						
17.a	Phases bundled around neutral messenger		Yes				
17.b	Maximal lay length	mm <sup>2</sup>	<input type="checkbox"/> 50	<input type="checkbox"/> 70	<input type="checkbox"/> 150		
		cm	90	110	130		
18	Marking						
18.a	Engraved or embossed		Yes				
18.b	Phase conductors: number 1, 2, 3		Yes				
18.c	Distance between marks on phase conductors	mm	200				
18.d	Phase Longitudinal marking upside down		Yes				
18.e	Neutral marking: Manufacturer name, date of manufacturing,						



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	NFC 33-209, and cross section + supplier		Yes	
18.f	Distance between marks on neutral messenger conductor	mm	250	
18.g	Neutral messenger Longitudinal marking upside down		Yes	
18.h	Metric length on the opposite side neutral marking conductor		Yes	
19	Drum Diameter/width	cm	To be mentioned	
20	Length of ABC	m	1000 ± 5	
21	Drum weight	kg	To be mentioned	

Supplier's offer column must be properly filled with the right figures. "Compliant, Yes, ", V, etc... " are not accepted.

**Deviation from the technical specification:**

The bidder shall list point after point and explain here in after all deviation from the requested technical specification.

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**Full technical information shall be supplied within the bid. If not the offer shall not be considered**

Bidder signature:



**9.2 Neutral Messenger Main ABC 1-Phase + Neutral: 1x50 mm<sup>2</sup> +54.6 mm<sup>2</sup> N**

No.	Description	Unit	Requirements	Supplier's Offer
1	Country		to be specified	
2	Manufacturer		to be specified	
3	Manufacturer's Reference		to be specified	
4	Applicable Standard		NFC 33-209	
5	Full type tests reports supplied		Yes as per NFC 33-209	
6	Rated Voltage			
	U <sub>0</sub>	kV	0.6	
	U	kV	1.0	
	U <sub>m</sub>	kV	1.2	
7	Dielectric Strength (type test)	kV	10 kV AC voltage during 30 minutes between cores and water after water immersion of 24 hours without breakdown.	
8	Impulse Withstand Voltage	kV	1.2/50 μs of positive and negative polarity with a peak value equal to 20 kV.	
9	Rated current (30°C open air, no wind)	A	1x50 mm <sup>2</sup> +54.6 mm <sup>2</sup> N = 180 A	
<b>10. Neutral messenger core</b>				
10.a	Metal alloy		Aluminium, magnesium silicon	
	Origin of alloy		To be mentioned	
10.b	Coefficient of linear expansion:		23. 10 <sup>-6</sup> K <sup>-1</sup>	
	Modulus:	MPa	62 000	
10.c	Cross section	mm <sup>2</sup>	54.6	
10.d	Diameter of wires	mm	3.15	

10.e	Number of wires		7	
10.f	Conductor Maximal diameter	mm	9.6	
10.g	Max linear resistance 20°C	$\Omega/\text{km}$	0.63	
10.h	Minimum breaking load	daN	1660	
10.i	Average insulation thickness	mm	1.6	
10.j	Max outer diameter	mm	13	
<b>11. Phase core</b>				
11.a	Metal Origin of aluminium		Class A pure Aluminium, To be mentioned	
11.b	Cross section	mm <sup>2</sup>	50	
11.c	Real cross section	mm <sup>2</sup>	To be specified	
11.d	Number of wires		7	
11.e	Diameter of wires		To be specified	
11.f	Conductor Maximal diameter	mm	8.4	
11.g	Max linear resistance 20°C	$\Omega/\text{km}$	0.641	
11.h	Average insulation thickness	mm	1.6	
11.i	Max outer diameter	mm	12	
12	Maximum Permissible core temperatures			
12.a	nominal operation	°C	90	
12.b	short duration overload (a total of 24 hours a year in separate periods of 3 hours at the most)	°C	120	
12.c	multi-phase short-circuits conditions	°C	250	
13	Black XLPE UV protected weather resistant Insulating sheath		Yes	



14	Insulation Minimal breaking resistance	Mpa	14.5	
15	Insulation Minimal Elongation breaking	%	200	
16	Type tests according table 2 "tests for insulating sheath" of NFC 33-209 provided		Yes	
17	Conductors assembling			
17.a	Phases bundled around neutral messenger		Yes	
17.b	Maximal lay length	cm	90	
18	Marking			
18.a	Engraved or embossed		Yes	
18.b	Phase conductors: number 1		Yes	
18.c	Distance between marks on phase conductors	mm	200	
18.d	Phase Longitudinal marking upside down		Yes	
18.e	Neutral marking: Manufacturer name, date of manufacturing, NFC 33-209, and cross section + supplier		Yes	
18.f	Distance between marks on neutral messenger conductor	mm	250	
18.g	Neutral messenger Longitudinal marking upside down		Yes	
18.h	Metric length on the opposite side neutral marking conductor		Yes	
19	Drum Diameter/width	cm	To be mentioned	
20	Length of ABC	m	1000 ± 5	
21	Drum weight	kg	To be mentioned	



Supplier's offer column must be properly filled with the right figures. "Compliant, Yes, ", V , etc..." are not accepted.

**Deviation from the technical specification:**

The bidder shall list point after point and explain here in after all deviation from the requested technical specification.

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**Full technical information shall be supplied within the bid. If not the offer shall not be considered**

Bidder signature:



### 9.3 Self-supported ABC 1-Phase + Neutral: 2x16 mm<sup>2</sup>, 2x25 mm<sup>2</sup>, 2x35 mm<sup>2</sup>

No.	Description	Unit	Requirements	Supplier's Offer
1	Country		to be specified	
2	Manufacturer		to be specified	
3	Manufacturer's Reference		to be specified	
4	Applicable Standard		NFC 33-209	
5	Full type tests reports supplied		Yes as per NFC 33-209	
6	Rated Voltage			
	U <sub>0</sub>	kV	0.6	
	U	kV	1.0	
	U <sub>m</sub>	kV	1.2	
7	Dielectric Strength	kV	10 kV AC voltage during 30 minutes between cores and water after water immersion of 24 hours without breakdown.	
8	Impulse Withstand Voltage	kV	1.2/50 μs of positive and negative polarity with a peak value equal to 20 kV.	
8	Rated current (30°C, open air, no wind)	A	<input type="checkbox"/> 2x16 mm <sup>2</sup> : 93 A <input type="checkbox"/> 2x25 mm <sup>2</sup> : 122 A <input type="checkbox"/> 2x35 mm <sup>2</sup> : 144 A	
<b>10. Phase and neutral core</b>				
10.a	Metal Origin of aluminium		Class A pure Aluminium, To be mentioned	
10.b	Cross section	mm <sup>2</sup>	<input type="checkbox"/> 16 <input type="checkbox"/> 25 <input type="checkbox"/> 35	16    25    35
10.c	Real cross section		To be specified	
10.d	Number of wires		7    7    7	
10.e	Diameter of wires		To be specified	



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10.f	Conductor Maximal diameter	mm	5.1	6.3	7.3			
10.g	Max linear resistance 20°C	Ω/km	1.91	1.20	0.868			
10.h	Average insulation thickness	mm	1.2	1.4	1.6			
10.i	Max outer diameter	mm	7.8	9.4	10.9			
11	Maximum Permissible core temperatures							
11.a	nominal operation	°C		90				
11.b	short duration overload (a total of 24 hours a year in separate periods of 3 hours at the most)	°C		120				
11.c	multi-phase short-circuits conditions	°C		250				
12	Black XLPE UV protected Insulating sheath			Yes				
13	Insulation Minimal breaking resistance	Mpa		14.5				
14	Insulation Minimal Elongation breaking	%		200				
15	Type tests according table 2 "tests for insulating sheath" of NF C 33-209 provided			Yes				
16	Conductors assembling							
16.a	Conductors bundle together			Yes				
16.b	Maximal lay length	mm <sup>2</sup> cm	<input type="checkbox"/> 16 40	<input type="checkbox"/> 25 45	<input type="checkbox"/> 35 50			
17	Marking							
17.a	Engraved or embossed			Yes				
17.b	Phase conductors : number 1,			Yes				
17.c	Distance between marks on phase conductors	mm		200				



17.d	Phase Longitudinal marking upside down		Yes	
17.e	Neutral marking: Manufacturer name, date of manufacturing, NFC 33-209, cross section and supplier		Yes	
17.f	Distance between marks on neutral messenger conductor	mm	250	
17.g	Neutral Longitudinal marking upside down		Yes	
17.h	Metric length on the opposite side neutral marking conductor		Yes	
18	Drum Diameter/width	cm	To be provided	
19	Length of ABC	m	2000±5	
20	Drum weight	kg	To be provided	

Supplier's offer column must be properly filled with the right figures. "Compliant, Yes, ", V , etc..." are not accepted.

**Deviation from the technical specification:**

The bidder shall list point after point and explain here in after all deviation from the requested technical specification.

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**Full technical information shall be supplied within the bid. If not the offer shall not be considered**

Bidder signature:



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**9.4 Self-supported ABC 3 Phase + Neutral: 4x16 mm<sup>2</sup>, 4x25 mm<sup>2</sup>, 4x35 mm<sup>2</sup>**

No.	Description	Unit	Requirements	Supplier's Offer
1	Country		to be specified	
2	Manufacturer		to be specified	
3	Manufacturer's Reference		to be specified	
4	Applicable Standard		NFC 33-209	
5	Full type tests reports supplied		Yes as per NFC 33-209	
6	Rated Voltage			
	U <sub>0</sub>	kV	0.6	
	U	kV	1.0	
	U <sub>m</sub>	kV	1.2	
7	Dielectric Strength	kV	10 kV AC voltage during 30 minutes between cores and water after water immersion of 24 hours without breakdown.	
8	Impulse Withstand Voltage	kV	1.2/50 μs of positive and negative polarity with a peak value equal to 20 kV.	
9	Rated current (30°C, open air, no wind)		<input type="checkbox"/> 4x16 mm <sup>2</sup> : 83 A <input type="checkbox"/> 4x25 mm <sup>2</sup> : 111 A <input type="checkbox"/> 4x35 mm <sup>2</sup> : 135 A	
<b>10. Phase and neutral core</b>				
10.a	Metal Origin of aluminium		Class A pure Aluminium, To be mentioned	
10.b	Cross section	mm <sup>2</sup>	<input type="checkbox"/> 16 <input type="checkbox"/> 25 <input type="checkbox"/> 35	16    25    35
10.c	Real cross section	mm <sup>2</sup>	To be specified	
10.d	Number of wires		7    7    7	
10.e	Diameter of wires		To be specified	



10.f	Conductor Maximal diameter	mm	5.1	6.3	7.3			
10.g	Max linear resistance 20°C	Ω/km	1.91	1.20	0.868			
10.h	Average insulation thickness	mm	1.2	1.4	1.6			
10.i	Max outer diameter	mm	7.8	9.4	10.9			
11	Maximum Permissible core temperatures							
11.a	nominal operation	°C	90					
11.b	short duration overload (a total of 24 hours a year in separate periods of 3 hours at the most)	°C	120					
11.c	multi-phase short-circuits conditions	°C	250					
12	Black XLPE UV protected Insulating sheath		Yes					
13	Insulation Minimal breaking resistance	Mpa	14.5					
14	Insulation Minimal Elongation breaking	%	200					
15	Type tests according table 2 "tests for insulating sheath" of NF C 33-209 provided		Yes					
16	Conductors assembling							
16.a	Conductors bundle together		Yes					
16.b	Maximal lay length	mm <sup>2</sup>	<input type="checkbox"/> 4x16	<input type="checkbox"/> 4x25	<input type="checkbox"/> 4X35			
		cm	40	45	50			
17	Marking							
17.a	Engraved or embossed		Yes					
17.b	Phase conductors : number 1, 2 and 3		Yes					
17.c	Distance between marks on phase conductors	mm	200					



17.d	Phase Longitudinal marking upside down		Yes	
17.e	Neutral marking: Manufacturer name, date of manufacturing, NFC 33-209, cross section and Supplier		Yes	
17.f	Distance between marks on neutral messenger conductor	mm	250	
17.g	Neutral Longitudinal marking upside down		Yes	
17.h	Metric length on the opposite side neutral marking conductor		Yes	
18	Drum Diameter/width	cm	To be specified	
19	Length of ABC	m	2000 ±5	
20	Drum weight	kg	To be specified	

Supplier's offer column must be properly filled with the right figures. "Compliant, Yes, ", V , etc..." are not accepted.

**Deviation from the technical specification:**

The bidder shall list point after point and explain here in after all deviation from the requested technical specification.

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**Full technical information shall be supplied within the bid. If not the offer shall not be considered**

Bidder signature:



### 9.5 Dead End and Double Anchorage Assembly for Neutral Messenger ABC

No.	Description	Unit	Requirements	Supplier's Offer
1	Country		to be specified	
2	Manufacturer		to be specified	
3	Manufacturer's Reference		to be specified	
4	Applicable Standard		NF C 33-041 EN 50 483-3	
5	Full type tests reports supplied		Yes as per NF C 33-041/ EN 50 483-3	
6	Designation		EA 1500-2000 of the NFC 33-041 and tests requirements for Dead end assembly	
6.a	Dead end assembly include one clamp and one bracket		<input type="checkbox"/> Yes	
6.b	Double anchorage assembly include two clamps and one bracket		<input type="checkbox"/> Yes	
7	Used on NFC 33-209 neutral messenger ABC		Yes	
8	Bracket and clamp (s) are specified together in order to ensure compatibility of materials and reduce the wear on joint and articulation, either by vibration or oscillation, or by electrolytic corrosion, or by the combination of the different phenomena.		Yes	
9	<b>Clamp</b>			
9.1	Designation		PA 1500-2000 of NFC 33-041 and tests requirements.	
9.2	Designed to anchor ABC with neutral messenger (54.6 and 70 mm <sup>2</sup> ).		Yes	
9.3	Self-adjustable wedge type		Yes	
9.4	Made of mechanical and UV weather resistant material.		Yes	



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No.	Description	Unit	Requirements	Supplier's Offer
9.5	No bolt for clamping the neutral messenger		Yes	
9.6	no parts able to be lost		Yes	
9.7	No tools required for the installation of the clamp in the field		Yes	
9.8	Supplied with a flexible attachment onto the bracket by means of a stainless steel flexible braid		Yes	
9.9	Parts directly in contact with the neutral messenger made of insulated materials		Yes	
9.10	Clamp body		Aluminium alloy corrosion resistant casted body or Thermoplastic body with very high mechanical and climatic resistance.	
9.11	Two inner self adjusting insulating plastic wedges ensuring the clamping of the neutral messenger <b>without damaging cable insulation.</b>		Yes	
9.12	Minimum breaking load or neutral slipping With 54.6 mm <sup>2</sup> Neutral With 70 mm <sup>2</sup> Neutral	daN daN	<input type="checkbox"/> 1500 <input type="checkbox"/> 1950	
9.13	Minimum dielectric withstands as per NFC 33-041 type test	kV/ 1mn	6	
9.14	Length	mm	To be mentioned	
9.15	weight	g	To be mentioned	
<b>10. Bracket</b>				
10.1	Metal		Aluminium alloy	
10.2	Single piece, made of high corrosion resistance aluminium alloy		Yes	



No.	Description	Unit	Requirements	Supplier's Offer
10.3	Designation		CA 1500-2000 of NFC 33-041 and tests requirements	
10.4	Usable for		Single anchorage (dead end) or double anchorage (angle) positions.	
10.5	Pole fixation		Either by two 14 or 16 mm diameter bolts or by two 20 x 0.7 mm stainless steel straps.	
10.6	Minimum breaking load (combined forces)	daN	1950	
10.7	weight	g	To be mentioned	

Supplier's offer column must be properly filled with the right figures. "Compliant, Yes, ", V , etc..." are not accepted.

Deviation from the technical specification:

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Bidder signature:



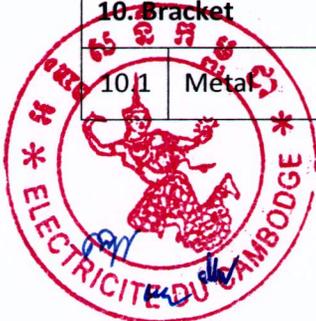
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**9.6 Wall Dead End Assembly for Neutral Messenger ABC**

No.	Description	Unit	Requirements	Supplier's Offer
1	Country		to be specified	
2	Manufacturer		to be specified	
3	Manufacturer's Reference		to be specified	
4	Applicable Standard		NF C 33-041 EN 50 483-3	
5	Full type tests reports supplied		Yes, as per NF C 33-041/ EN 50 483-3	
6	Designation		EA 600 of the NFC 33-041 and tests requirements	
6.a	Dead end assembly include one clamp and one bracket		Yes	
7	Used on NFC 33-209 neutral messenger ABC		Yes	
8	Bracket and clamp (s) are specified together in order to ensure compatibility of materials and reduce the wear on joint and articulation, either by vibration or oscillation, or by electrolytic corrosion, or by the combination of the different phenomena.		Yes	
9	<b>Clamp</b>			
9.1	Designation		EA 600 of NFC 33-041 and tests requirements.	
9.2	Designed to anchor ABC with neutral messenger (54.6 mm <sup>2</sup> and 70 mm <sup>2</sup> ).		Yes	
9.3	Self-adjustable wedge type		Yes	
9.4	Made of mechanical and UV/weather resistant material.		Yes	



9.5	No bolt for clamping the neutral messenger		Yes	
9.6	no parts able to be lost		Yes	
9.7	No tools required for the installation of the clamp in the field		Yes	
9.8	Supplied with a flexible attachment onto the bracket by means of a stainless steel flexible braid		Yes	
9.9	Parts directly in contact with the neutral messenger made of insulated materials		Yes	
9.10	Clamp body		Aluminium alloy corrosion resistant casted body  Thermoplastic body with very high mechanical and climatic resistance.	
9.11	Two inner self adjusting insulating plastic wedges ensuring the clamping of the neutral messenger <b>without damaging cable insulation.</b>		Yes	
9.12	Minimum breaking load or neutral slipping  With 54.6 mm <sup>2</sup> Neutral  With 70 mm <sup>2</sup> Neutral	daN  daN	<input type="checkbox"/> 600  <input type="checkbox"/> 600	
9.13	Minimum dielectric withstands as per NFC 33-041 type test	kV/ 1mn	6	
9.14	Length	mm	To be mentioned	
9.15	weight	g	To be mentioned	
<b>10. Bracket</b>				
10.1	Material		Aluminum alloy	



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10.2	Single piece, made of high corrosion resistance aluminium alloy		Yes	
10.3	Designation		CT 600 of NFC 33-041 and tests requirements.	
10.4	Usable for		Single anchorage (dead end) on wall	
10.5	fixation		3 x M10 bolts	
10.6	Minimum breaking load (combined forces)	daN	625	
10.7	weight	g	To be mentioned	

Supplier's offer column must be properly filled with the right figures. "Compliant, Yes, ", V , etc..." are not accepted.

**Deviation from the technical specification:**

The bidder shall list point after point and explain here in after all deviation from the requested technical specification.

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Bidder signature:



**9.7 Suspension Assembly for Neutral Messenger ABC**

No.	Description	Unit	Requirements	Supplier's Offer
1	Country		to be specified	
2	Manufacturer		to be specified	
3	Manufacturer's Reference		to be specified	
4	Applicable Standard		NF C 33-040 EN 50 483-3	
4.a	Full type tests reports supplied		Yes, as per NF C 33-040 requirements	
5	Designation		ES 1500 of the NFC 33-040 and tests requirements	
6	Used on NFC 33-209 neutral messenger ABC		Yes	
7	Suspension assembly include one suspension clamp, on articulated link and one bracket		Yes	
8	Bracket, articulated link and clamp are specified together in order to ensure compatibility of materials and reduce the wear on joint and articulation, either by vibration or oscillation, or by electrolytic corrosion, or by the combination of the different phenomena.		Yes	
<b>9. Suspension Clamp and articulated link</b>				
9.1	Designation		PS 1500 and LM 1500 of NFC 33-040 and tests requirements.	
9.2	Designed to suspend ABC with neutral messenger (both 54.6 and 70 mm <sup>2</sup> ).		Yes	



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9.3	Clamping of the neutral messenger is of controlled slippage type		Yes	
9.4	Made of synthetic mechanical and weather resistant material.		Yes	
9.5	No bolt for clamping the neutral messenger		Yes	
9.6	no parts able to be lost		Yes	
9.7	No tools required for the installation of the suspension clamp in the field		Yes	
9.8	Neutral tightening inside the clamp is independent to the operator.		Yes	
9.9	Parts directly in contact with the neutral messenger made of insulated materials		Yes	
9.10	Clamp and articulated link materials		To be mentioned	
9.11	The open side of the clamp is located face to the pole.		Yes	
9.12	Minimum breaking load of PS 1500 + LM 1500 sub-assembly	N	12 000	
9.13	Minimum dielectric withstands of PS 1500 + LM 1500 sub-assembly	kV/ 1mn	6	
9.14	weight	g	To be mentioned	
<b>10. Bracket</b>				
10.1	Metal		Aluminium alloy	
10.2	Single piece, made of high corrosion resistance aluminium alloy		Yes	
10.3	CS 1500 designation of NFC 33-040 and tests requirements.		Yes	



10.4	Adapted and usable for		1 Suspension clamp and 1 articulated link only	
10.5	Pole fixation		Either by two 14 or 16 mm diameter bolts or by two 20 x 0.7 mm stainless steel straps.	
10.6	Minimum breaking load (combined forces)	N	13 125	
10.7	weight	g	To be mentioned	

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**Deviation from the technical specification:**

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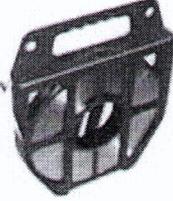


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**9.8 Stainless Steel Strap and Accessories**

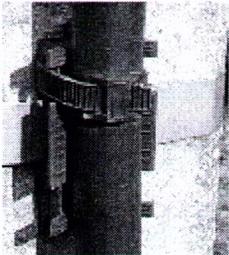
No.	Description	Unit	Requirements	Supplier's Offer
1	Country		to be specified	
2	Manufacturer		to be specified	
3	Manufacturer's Reference		to be specified	
4	Applicable Standard		To be specified	
5	Type tests reports supplied as per technical specification withstand: One lap: Two superposed laps	N N	To be provided 16 000 37 000	
6	Used for fixing brackets and other equipment on poles.		Yes	
7	Made of 18 / 8 mat or brilliant stainless steel		Yes	
8	Width	mm	20 mm	
9	Thickness	mm	0.7	
10	Breaking strength comprised between :	N/mm <sup>2</sup>	600 and 950	
11	The breaking strength proved by a type test carried out by the manufacturer.		Yes To be provided	
12	The four edges of the stainless steel strap are deburred in order to avoid cable or personal cutting		Certified and guaranteed	
13	Delivered inside a plastic dispenser container by length of :	m	50	



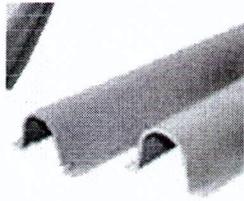
FOR SAMPLE ONLY				
<b>Buckle</b>				
14	Buckle designed for tightening steel strap on pole by « looping		Yes	
15	Buckle made of stainless steel		Yes	
16	Delivered in plastic bag or card box containing	pcs	100	
FOR SAMPLE ONLY				
<b>Protection for Stainless steel strap</b>				
17	Protection for fixing cable		Yes	
18	Perfectly suitable for the strap		Yes	
19	Made of UV protected elastomer		Yes	
20	Delivered in roll of	m	10	
FOR SAMPLE ONLY				
<b>Insulated bracket for stainless steel strap</b>				
21	Specifically designed for stainless steel strap and used for fixing cables or plastic pipe all along a pole.		Yes	
22	They are used with the stainless steel strap already installed or not.		Yes	



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23	They are made of high mechanical and climatic withstand insulating material.		Yes		
24	A specific device allows the locking of the bracket on the strap.		Yes		
25	Fixing collar (tie)		supplied		
26	Cable Sizes	mm	30 to 50	50 to 90	
27	Delivered by bag or card box containing	pcs	50		
FOR SAMPLE ONLY					
<b>Cable mechanical protection</b>					
27	To be used at ABC/ underground cable interface		Yes		
28	For cable protection against mechanical aggression from about 30 cm under ground level up to 2.4 m above ground level at a minimum.		Yes		
29	Made of PVC of grey colour		Yes		
30	Omega shape ( $\Omega$ )		$\Omega$		
31	Attached on pole by using stainless steel strap or fixed against walls by screw and plugs.		Yes		
32	Maximum cable diameter	mm	90		



FOR SAMPLE ONLY	
Supplier's offer column must be properly filled with the right figures. "Compliant, Yes, ", V , etc..." are not accepted.	
<p style="text-align: center;">Deviation from the technical specification:</p> <p style="text-align: center;">The bidder shall list point after point and explain here in after all deviation from the requested technical specification.</p> <p>1/ 2/ 3/ x/</p> <p style="text-align: center;"><b>Full technical information shall be supplied within the bid. If not the offer shall not be considered</b></p> <p style="text-align: center;">Bidder signature:</p>	



### 9.9 Insulated Supports for Main Network LV ABC Installed on Facade Walls.

No.	Description	Unit	Requirements	Supplier's Offer
1	Country		to be specified	
2	Manufacturer		to be specified	
3	Manufacturer's Reference		to be specified	
4	Applicable Standard		NF C 33-040	
5	Type tests reports		To be provided	
6	To be installed with a hammer		Yes	
7	Designation		<input type="checkbox"/> BRPF 1 and <input type="checkbox"/> BRPF 6 as defined by the NF C 33-040 and type tests.	
8	Body made of strong UV resistant insulating thermoplastic including: <ul style="list-style-type: none"> <li>• A cable supports</li> <li>• a cable fixing tie</li> <li>• an expansion plug (by nail)</li> </ul>		Yes  Yes Yes Yes	
9	The body allow the fixing of a second ABC later		Yes	
10	The nail used for fixing the body onto the wall is protected against the corrosion.		Yes	
11	Only one insulated support reference for -1 × 50 mm <sup>2</sup> + 1×54.6 mm <sup>2</sup> N -3 × 70 mm <sup>2</sup> + 1×70 mm <sup>2</sup> N -3 × 150 mm <sup>2</sup> + 1×70 mm <sup>2</sup> N		Yes	
12	Distance between wall and cable	cm	<input type="checkbox"/> BRPF1 1 <input type="checkbox"/> BRPF6 6	
13	Delivered by bags of	pcs	100	



FOR SAMPLE ONLY	BRPF 1 	BRPF 6 
<p>Supplier's offer column must be properly filled with the right figures. "Compliant, Yes, ", V , etc..." are not accepted.</p>		
<p style="text-align: center;"><b>Deviation from the technical specification:</b></p> <p>The bidder shall list point after point and explain here in after all deviation from the requested technical specification.</p> <p>1/ 2/ 3/ x/</p> <p style="text-align: center;"><b>Full technical information shall be supplied within the bid. If not the offer shall not be considered</b></p> <p style="text-align: center;">Bidder signature:</p>		



**9.10 Anchor Clamp for Self-supported Service ABC**

No.	Description	Unit	Requirements	Supplier's Offer
1	Country		to be specified	
2	Manufacturer		to be specified	
3	Manufacturer's Reference		to be specified	
4	Applicable Standard		NF C 33-042	
5	Type tests reports		To be provided	
6	Designed to anchor bundled conductors on poles (associated with a pigtail bolt) and on building facades		Yes	
7	Self-adjustable wedge type		Yes	
8	Made of mechanical and weather UV resistant material		Yes	
9	No bolt for clamping the bundled		Yes	
10	No parts easily lost or dismantled		Yes	
11	No tools required for installation of the clamp in the field		Yes	
12	Parts directly in contact with the bundled made of insulated material.		Yes	
13	Supplied with a braid or hook attachment		Yes	
13.a	Attachment material		aluminium or stainless steel or strong UV resistant material	
13.b	Minimum breaking load	N	2 000	
13.c	One anchor clamp reference accommodates: 2 x 16 mm <sup>2</sup> , 4 x			



	16 mm <sup>2</sup> , 2 x 25 mm <sup>2</sup> , 4 x 25 mm <sup>2</sup> , 2 x 35 mm <sup>2</sup> , 4 x 35 mm <sup>2</sup> Service ABC		Yes	
14	Delivered by bag or card box of	pcs	10	
FOR SAMPLE ONLY				

Supplier's offer column must be properly filled with the right figures. "Compliant, Yes, ", V , etc..." are not accepted.

**Deviation from the technical specification:**

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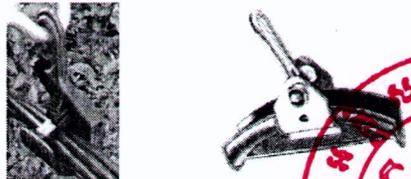
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**Full technical information shall be supplied within the bid. If not the offer shall not be considered**

Bidder signature:



**9.11 Suspension Clamp for Service ABC**

No.	Description	Unit	Requirements	Supplier's Offer
1	Country		to be specified	
2	Manufacturer		to be specified	
3	Manufacturer's Reference		to be specified	
4	Applicable Standard		To be specified	
5	To be used on pole for supporting service ABC in straight line or small angle.		Yes	
6	To be used associated with a pigtail bolt.		Yes	
7	Made of mechanical and weather resistant material		Yes	
8	No bolt for clamping the bundled		Yes	
9	No parts easily lost or dismantled		Yes	
10	No tools shall be required for installation of the clamp in the field.		Yes	
11	Parts directly in contact with the bundled shall be made of insulated material		Yes	
12	One suspension clamp reference accommodates: 2 x 16 mm <sup>2</sup> , 4 x 16 mm <sup>2</sup> , 2 x 25 mm <sup>2</sup> , 4 x 25 mm <sup>2</sup> , 2 x 35 mm <sup>2</sup> , 4 x 35 mm <sup>2</sup> Service ABC		Yes	
13	Delivered in bags of	Pcs	10	
FOR SAMPLE ONLY				
Supplier's offer column must be properly filled with the right figures. "Compliant, Yes, ", V , etc..." are not accepted.				



Deviation from the technical specification:

The bidder shall list point after point and explain here in after all deviation from the requested technical specification.

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Bidder signature:



**9.12 Anchoring/Straight Line Pig Tail Bolt on Pole for Service ABC**

No.	Description	Unit	Requirements	Supplier's Offer
1	Country		to be specified	
2	Manufacturer		to be specified	
3	Manufacturer's Reference		to be specified	
4	Applicable Standard		To be specified	
5	To be used for anchoring or straight line service ABC on pole by mean of anchor clamp or suspension clamp for service ABC.		Yes	
6	Hot dip galvanized		Yes	
7	Minimum zinc thickness	μm	65	
8	Supplied with two nuts and two large washers of 30 mm diameter		Yes	
9	Thread inside the nuts are not galvanized.		Yes	
10	Diameter	mm	M12	
11	Threaded Length	mm	250	
12	Weight	g	To be provided	

Supplier's offer column must be properly filled with the right figures. "Compliant, Yes, ", V , etc..." are not accepted.

**Deviation from the technical specification:**

The bidder shall list point after point and explain here in after all deviation from the requested technical specification.

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**Full technical information shall be supplied within the bid. If not the offer shall not be considered**

Bidder signature:



**9.13 Insulated Supports for Service LV ABC Installed on Facade Walls.**

No.	Description	Unit	Requirements	Supplier's Offer
1	Country		to be specified	
2	Manufacturer		to be specified	
3	Manufacturer's Reference		to be specified	
4	Applicable Standard		NF C 33-043	
5	Type tests		To be provided	
6	To be installed with a hammer		Yes	
7	Designation		BBPF type as defined by the NF C 33-043 and type tests	
8	The body is made of strong UV resistant insulating thermoplastic including: cable support, cable fixing collar, expansion plug (by nail)		Yes Yes	
9	The body shall allow the fixing of a second service ABC latter.		Yes	
10	The nail used for fixing the body onto the wall shall be protected against the corrosion or made of strong plastic.		Yes Description	
11	Only one insulated support reference shall accommodate: 2 x 16 mm <sup>2</sup> , 4 x 16 mm <sup>2</sup> , 2 x 25 mm <sup>2</sup> , 4 x 25 mm <sup>2</sup> , 2 x 35 mm <sup>2</sup> , and 4 x 35 mm <sup>2</sup> service ABC		Yes	
12	Fixing collar		supplied	
13	Delivered in bag or card box of	pcs	100	
Supplier's offer column must be properly filled with the right figures. "Compliant, Yes, ", V , etc..." are not accepted.				



Deviation from the technical specification:

The bidder shall list point after point and explain here in after all deviation from the requested technical specification.

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**Full technical information shall be supplied within the bid. If not the offer shall not be considered**

Bidder signature:



## 9.14 Insulating Biding Tie

No.	Description	Unit	Requirements			Supplier's Offer		
1	Country		to be specified					
2	Manufacturer		to be specified					
3	Manufacturer's Reference		to be specified					
4	Applicable Standard		To be specified					
5	black colour, UV and weather resistant		Yes					
6	Grease, acid, oil resistant		Yes					
7	Type of polyamide		12					
8	Halogen free.		Yes					
9	Melting temperature	°C	250					
10	Flame retardance		UL94HB					
11	Temperature using	°C	-50 to +50					
12	Notched type for good adjusting		Yes					
13	Possible to interconnect two ties if the length of one is to short.		Yes					
14	Width	mm	8 or 9					
15	Length (about)	mm	<input type="checkbox"/> 175	<input type="checkbox"/> 250	<input type="checkbox"/> 340			
16	Max diameter	mm	40	60	90			
17	Min diameter	mm	10	20	20			
18	Delivered in bag or card box of	pcs	100					
FOR SAMPLE ONLY								
Supplier's offer column must be properly filled with the right figures. "Compliant, Yes, ", V , etc..." are not accepted.								



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Deviation from the technical specification:

The bidder shall list point after point and explain here in after all deviation from the requested technical specification.

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**Full technical information shall be supplied within the bid. If not the offer shall not be considered**

Bidder signature:



## 9.15 Universal Wall Anchoring Bracket

No.	Description	Unit	Requirements	Supplier's Offer
1	Country		to be specified	
2	Manufacturer		to be specified	
3	Manufacturer's Reference		to be specified	
4	Applicable Standard		To be specified	
5	Used for attaching all types of service anchor clamps for service ABC on buildings or pole.		Yes	
6	Made of		Aluminium alloy stainless steel, hot dip galvanized steel composite material	
7	Bracket fitted with one hole allowing the anchor clamp attachment		Yes	
8	*Suitable to be fixed on a building by mean of either of them: -4 x 4.5 mm diameter wooden screws (not supplied), -4 x 4.5 mm diameter screws + 4 masonry expansion plug (not supplied), -one 12 mm diameter bolt (not supplied), -one stainless steel straps of 20 mm width (not supplied).		Yes Yes Yes Yes	
9	Weight	g	To be provided	
10	Delivered in bag or card box of	pcs	100	
FOR SAMPLE ONLY				



Supplier's offer column must be properly filled with the right figures. "Compliant, Yes, ", V , etc..." are not accepted.

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Bidder signature:

