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TECHNICAL DESCRIPTION

ND-425/.....

## MV COVERED CONDUCTORS

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## MV COVERED CONDUCTORS

### 1. SCOPE

The present Technical Description (TD) determines the construction and testing requirements of covered conductors of rated voltage  $U_o/U (U_m)$  equal to 12/20 (24) kV, which are intended for use in overhead medium voltage distribution lines. Covered conductors specified in this TD consist of either ACSR (Aluminium-conductor steel-reinforced) or AAAC (All Aluminium Alloy Conductor), with an integrated element for longitudinal watertightness, semi-conductive conductor screen, XLPE inner covering and an HDPE outer protective covering with resistance to UV radiation and tracking.

Covered conductors consist of a conductor surrounded by a covering made of insulating material as protection against accidental contacts with other covered conductors and with grounded parts such as tree branches, etc. In comparison with insulated conductors, this covering has reduced properties, but is able to withstand the phase-to-earth voltage temporarily.

Since covered conductors are unscreened, they are not touch-proof, i.e. they must be treated as bare conductors with respect to electric shock.

### 2. KEY - WORDS

Covered Conductors, Medium Voltage (MV), Overhead Distribution Network, ACSR or AAAC Conductor, XLPE Insulation, 12/20 (24) kV.

### 3. OPERATING CONDITIONS

#### 3.1. System characteristics

The covered conductors are intended for use in a three-phase distribution network system, with a grounded MV neutral node at the HV/MV transformers via a resistor that limits the maximum fault current to earth to 1.000 A, with the following characteristics:

- |                                   |                          |
|-----------------------------------|--------------------------|
| - Rated voltage $U_o/U$           | : 12/20 kV               |
| - Maximum operation voltage       | : 24 kV                  |
| - Frequency                       | : 50 Hz                  |
| - Short-circuit level             | : 350 MVA                |
| - Impulse withstand voltage (BIL) | : 125 kV, 1,2/50 $\mu$ s |

#### 3.2. Environmental conditions

The covered conductors shall be capable of withstanding the combined effects of sun, rain, ice, snow, chemical pollution and calcification.

## 4. STANDARDS – SPECIFICATION/DEFINITIONS

### 4.1. Standards - Specifications

4.1.1. In writing of the present Technical Description, the following Standards and Specifications have been taken into account (newer versions apply):

- EN 50397-1 : Covered conductors for overhead lines and the related accessories for rated voltages above 1 kV AC and not exceeding 36 kV AC.  
Part 1: Covered conductors
- EN 50182 : Conductors for overhead lines – Round wire concentric lay stranded conductors
- EN 60811 series : Electric and optical fibre cables – Test methods for non-metallic materials
- HD 605 : Electric cables – Additional test methods
- EN IEC 62641 : Conductors for overhead lines – Aluminium and aluminium alloy wires for concentric lay stranded conductors
- EN IEC 63248 : Conductors for overhead lines – Coated or clad metallic wire for concentric lay stranded conductors
- EN 50183 : Conductors for overhead lines – Aluminium-magnesium-silicon alloy wires
- IEC 60502-2 : 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)

**NOTE:** The text of the present Technical Description is predominant and its requirements prevail against any other Standard or Specification.

### 4.2. Definitions

**Conductor:** The part of the covered conductor intended to carry the current.

**Covered conductor:** The combination of the conductor and its covering.

**Longitudinal watertightness element:** Suitable hygroscopic material, which is integrated in the conductor, in order to ensure its longitudinal watertightness.

**Covering:** Layer over the conductor made of suitable insulating material.

**Rated voltage  $U_o$ :** It is the voltage (rms value, 50 Hz) between each conductor and the earth, for which the covered conductor has designed.

**Rated voltage  $U$ :** It is the voltage (rms value, 50 Hz) between any two phase conductors, for which the covered conductor has designed.

**Maximum rated voltage  $U_m$ :** It is the maximum value of the voltage (rms value, 50 Hz) between two phase conductors, for which the covered conductor and its components have designed.

## 5. DESCRIPTION

### 5.1. General

The covered conductor shall consist of the following layers (see Drawing 1 of par.9.2.1):

1. Aluminium-Conductor Steel-Reinforced (ACSR) or All Aluminium Alloy Conductor (AAAC)
2. Extruded hygroscopic (water-blocking) material integrated in the conductor, which provides longitudinal watertightness
3. Semi-conductive conductor screen by extruded material
4. XLPE inner covering
5. Protective outer covering (jacket) made of HDPE, with resistance to UV radiation and tracking.

### 5.2. Conductor

The nominal cross-sections of the conductors standardized by this TD are:

- 99 mm<sup>2</sup> for ACSR and AAAC conductors (99-AL1/ST1A & 99-AL7) and
- 241 mm<sup>2</sup> for AAAC conductors (241-AL7).

It is noted that the above cross-sections are not copper equivalents. The conductors shall be non-compacted and shall comply with EN 50182.

The non-compacted conductor shall be of circular cross-section and shall consist of round wires stranded in concentric layers. The AAAC conductor shall consist of AL7 aluminium alloy round wires according to EN 50183. The ACSR conductor shall consist of AL1 hard drawn aluminium round wires according to EN IEC 62641, stranded around an ST1A zinc coated steel round wire according to EN IEC 63248.

Adjacent wire layers shall be stranded with reverse lay directions. The direction of lay of the outer layer shall be right hand (Z).

The main characteristics of the conductors are shown in Table 1 of Appendix 1.

### 5.3. Longitudinal watertightness of conductor (symbol W)

The conductor shall have an extruded, longitudinal hygroscopic (water-blocking) layer internally and between its wires that shall ensure the longitudinal watertightness of the conductor. This layer shall be applied by extrusion during the construction phase of the conductor and shall be of adequate mass in order to fill all the gaps between the wires. The layer shall be compatible with the conductor material and the covering material.

The water-blocking layer shall be a single mass, integrated into the conductor and shall not be dust or swellable powder.

### 5.4. Semi-conductive conductor screen (symbol S)

The semi-conductive screen of the conductor shall be made of a composite material suitable to withstand the maximum temperatures allowed for the conductor, which are mentioned in paragraph 5.9 of the present Technical Description.

This layer shall be produced by the triple extrusion method (see paragraph 5.5), shall be firmly attached to the conductor along its entire circumference and shall not have a harmful effect on both the conductor and the insulation.

The extruded conductor screen shall be durable firmly bonded to the closest layer of insulation.

The nominal thickness of the semi-conductive layer is 0,3 mm (see Table 1 of Annex 1).

The resistivity of the semi-conductive material shall neither be greater than 5000 ohm.cm at 20 °C nor greater than 25000 ohm.cm at 80 °C (typical operating temperature).

### 5.5. Inner XLPE covering (symbol X)

The inner covering shall consist of a layer of cross-linked polyethylene (XLPE) placed on the conductor by the method of triple extrusion, that is, the simultaneous extrusion during the production process of the semi-conductive screen of the conductor, the inner covering and the outer covering.

The nominal thickness of the inner covering shall be as given in Table 1 of Annex 1.

The minimum thickness of the inner covering measured at any place shall not be less than the nominal value by more than (0,1 mm + 10% of the nominal value). The mean value of the thickness of the inner covering shall not exceed the nominal value by more than (0,1 mm + 10% of the nominal value).

The thickness of the semi-conductive layer shall not be measured as covering thickness.

The mechanical characteristics of the inner covering (XLPE) are given in EN 50397-1, specifically:

- Before aging:
    - Tensile strength  $\geq 12,5$  MPa
    - Elongation during break  $\geq 200$  %
  - After aging in air oven at a temperature of 135 °C for 7 days (168 h):
    - Change in tensile strength  $\leq + 25\%$ .
    - Change in elongation  $\leq + 25\%$ .
- The insulation shall be removed without damaging the conductor.

### 5.6. HDPE outer covering (jacket)

The outer protective covering shall be made of high-density polyethylene (HDPE), manufactured using the triple extrusion method (see paragraph 5.5), and shall have high resistance to UV radiation and tracking.

The colour of the outer covering shall be light grey for better resistance to coastal corrosion.

Resistance to UV radiation of the outer covering shall be achieved by suitable chemical process and not by the use of carbon black as a content of the outer covering compound. The use of carbon black is not allowed, due to its conductivity which can contribute to the creation of tracking. Resistance to UV radiation shall be proven by the test of par. 6.2.4.2 of the present TD.

The nominal thickness of the outer covering shall be as given in Table 1 of Annex 1.

The minimum thickness of the outer covering measured at any place shall not be less than the nominal value by more than (0,1 mm + 10% of the nominal value). The mean value of the thickness of the outer covering shall not exceed the nominal value by more than (0,1 mm + 10% of the nominal value).

The manufacturer shall declare the mechanical characteristics of the material of construction of the outer covering which shall document the use of high density polyethylene (HDPE). Typical density values for HDPE are 0,93 - 0,97 kg/dm<sup>3</sup>.

### 5.7. Combined thickness of the covering

The nominal combined thickness of the covering (combined thickness of inner and outer covering) shall be 2,3 mm (according to EN 50397-1).

The minimum combined thickness of the covering (inner + outer) at any place shall not be less than the nominal value by more than (0,1 mm + 10 % of the nominal value). The mean value of the combined thickness of the covering (inner + outer) shall not exceed the nominal value by more than (0,1 mm + 10 % of the nominal value). It is noted that the combined thickness of the covering shall comply with the above limits for proper cooperation of the covered conductor with its accessories (tension clamp, piercing connectors, etc.).

The semi-conductive conductor screen shall not be measured as covering thickness.

### 5.8. Code designation

According to EN 50397-1, the following symbol code is used:

- CC : Covered conductor, generally
- S : Indicates the existence of semi-conductive shielding in the conductor
- X : Indicates the presence of XLPE insulation
- W : Indicates the existence of a watertight element.

Therefore, the covered conductors standardized by the present Technical Description are: CCSX 99 ACSR W 20 kV, CCSX 99 AAAC W 20 kV and CCSX 241 AAAC W 20 kV.

## 5.9. Maximum temperatures

The maximum temperatures are as follow:

Conductor : 80 °C during normal operation,  
120 °C under short-term overload (total overload duration 24 h per year in different periods up to 3 h duration),  
250 °C under three-phase short-circuit conditions.

## 6. TESTS

In general, the tests provided by EN 50397-1 standard shall be performed (a summary of the performed tests is provided in Table 3 of Annex 1).

### 6.1. Design Tests

Not applicable.

### 6.2. Type Tests

These tests are carried out at the beginning of a Contract and can be repeated at the absolute discretion of HEDNO at any time during the execution of the Contract in cases of changes to the design or the production process. At the absolute discretion of HEDNO, it is possible to accept Certificates issued by PPC/DKK (formerly KDEP) or by another recognized laboratory.

#### 6.2.1. Electrical tests

##### 6.2.1.1. Conductor resistance

The test shall be carried out in accordance with HD 605 S3:2019, par. 3.1.1.

##### 6.2.1.2. High voltage test

The test shall be carried out in accordance with HD 605, par. 3.2.2.2, with the requirements of EN 50397-1 for screened conductor. Specifically:

1 specimen of covered conductor with a minimum length of 5 m, with a minimum duration of 1 h immersion in water at a temperature of  $(20 \pm 5)$  °C, shall be subjected to a voltage test at 1 U for a duration of 48 h. No breakdown shall be recorded.

##### 6.2.1.3. Leakage current

The test shall be carried out in accordance with EN 50397-1:2020, Annex A. Test voltage: AC 0.7 U, maximum leakage current 1 mA.

#### 6.2.2. Construction and dimensions

##### 6.2.2.1. Compliance with the design requirements

The test shall be carried out by visual inspection.

##### 6.2.2.2. Thickness of inner, outer and combined covering

The test shall be carried out in accordance with EN 60811-201.

### **6.2.3. Construction and mechanical properties of the conductor**

#### **6.2.3.1. Rated Tensile Strength (RTS)**

The test shall be carried out in accordance with the requirements of EN 50182.

#### **6.2.3.2. Construction and dimensions**

Shall be checked in accordance with the paragraph 5.2 of the present Technical Description

### **6.2.4. Non-electrical tests on the covering**

#### **6.2.4.1. Testing of mechanical properties of semi-conductive conductor screen, inner and outer covering**

This test shall be carried out in accordance with EN 60811-501:2012, par. 4.2 before aging and with EN 60811-401:2012, par. 4.2.3.2 after aging.

#### **6.2.4.2. Resistance to UV rays**

This test shall be carried out according to EN 50397-1:2020, Annex D.

### **6.2.5. Test of compatibility**

#### **6.2.5.1. Aging of complete product sample**

This test shall be carried out in accordance with EN 60811-401:2012+A1:2017, par. 4.2.3.4 (concerns covered conductors with longitudinal watertightness).

### **6.2.6. Thermal properties of the covering**

#### **6.2.6.1. Shrinkage test**

This test shall be carried out in accordance with EN 60811-502. The distance "L" between the marks shall be  $(200 \pm 5)$  mm.

#### **6.2.6.2. Hot-set-test**

This test is for XLPE inner covering and shall be carried out in accordance with EN 60811-507.

#### **6.2.6.3. Pressure test at high temperature**

This test is for the HDPE outer covering of the conductor and shall be carried out in accordance with EN 60811-508:2012+A1:2017, par. 4.3.

### **6.2.7. Further tests on the covering**

#### **6.2.7.1. Gravimetric water absorption test**

This test shall be carried out in accordance with EN 60811-402.

#### **6.2.7.2. Shore D hardness**

This test is about the thermoplastic polyethylene of the outer covering and shall be carried out in accordance with HD 605, paragraph 2.2.1.

### **6.2.8. Test for the longitudinal watertightness**

#### **6.2.8.1. With heat cycle**

This test shall be performed according to IEC 60502-2:2014, Annex F. Number of specimen: 1, specimen length: 3 m, test duration: 24 h, bending radius: 20 D.  
No leakage shall occur.

#### **6.2.8.2. Without heat cycle**

This test shall be carried out in accordance with IEC 60502-2:2014, Annex F (with water column connected to one end of the specimen by means of an appropriate fitting). Number of tests: 1, test length: 1 m, test duration: 1 h.  
No leakage shall occur.

### **6.2.9. Marking**

#### **6.2.9.1. Content, legibility**

This test shall be carried out by visual inspection.

#### **6.2.9.2. Durability**

This test shall be performed in accordance with HD 605 S3:2019, par. 2.5.4.

### **6.3. Sample tests**

Sample tests are part of the acceptance process of the material and shall be performed, in the presence of a HEDNO Inspector, either at the manufacturer's factory or at the laboratories of HEDNO's acceptance. From each lot to be delivered, a random sample shall be taken, which shall be subjected to the tests in question with the sampling program referred to in IEC 60502-2. In case of failure of any of the tests in question, it shall be repeated according to what is mentioned in IEC 60502-2.

#### **6.3.1. High voltage test**

This test shall be carried out in accordance with paragraph 6.2.1.2 of the present TD, but with a duration of 4 h.

#### **6.3.2. Compliance with design requirements**

This test shall be carried out by visual inspection.

#### **6.3.3. Thickness of inner, outer and combined covering**

This test shall be carried out in accordance with EN 60811-201.

#### **6.3.4. Conductor construction and dimensions**

Shall be checked in accordance with the paragraph 5.2 of the present Technical Description

#### **6.3.5. Hot-set-test**

This test is for XLPE inner covering and shall be carried out in accordance with EN 60811-507.



### **6.3.6. Longitudinal water tightness test without heating cycle**

This test shall be carried out in accordance with IEC 60502-2:2014, Annex F (with a column of water attached to the one end of the specimen through a suitable fitting pattern). Number of tests: 1, test length: 1 m, test duration: 1 h.

No leakage should occur.

### **6.3.7. Marking Test - Content, legibility of marking**

This test shall be carried out by visual inspection.

## **6.4. Routine tests**

Routine tests shall be performed at the manufacturers' factory during the materials' production procedure.

Protocols with detailed recording of the data, which shall be evaluated by the Inspector, shall be kept for all the Routine Tests below:

### **6.4.1. Spark test**

This test shall be carried out according to EN 62230. The HDPE covering is subjected to a dielectric strength test during the production phase with a dry probe, with which is possible to test the entire outer surface of the covering, applying a voltage of either AC 0,7 U or DC 1 U, with a minimum duration of 0,1 s.

No splitting should occur.

### **6.4.2. Compliance with design requirements**

This test shall be carried out by visual inspection.

### **6.4.3. Thickness inner, outer and combined covering**

The test shall be carried out in accordance with EN 60811-201.

### **6.4.4. Marking Test - Content, legibility of marking**

This test shall be carried out by visual inspection.

## **6.5. Special tests**

Not applicable

## **7. NAMEPLATES - MARKING**

### **7.1. Nameplates**

There are no nameplates on the material. For the nameplate on the drum, see paragraph 8.

### **7.2. Marking**

On the surface of the outer covering (HDPE) there shall be an indelibly printed marking. Digits and numbers shall be placed along the covered conductor. The sizes of digits or numbers shall be at least 6 mm high and 3 mm wide (digit 1 and number 1 shall be 1 mm wide). The distance between the end of one marking and the beginning of the next shall not exceed 1000 mm. The marking shall include the following information:

- Manufacturer's name or trademark / Year of manufacture

- Symbol of the conductor, e.g. CCSX 99 ACSR W 20 kV, CCSX 99 AAAC W 20 kV or CCSX 241 AAAC W 20 kV
- HEDNO/Contract Number
- Meter marking, the details of which shall also be written on the drum nameplate.

## 8. PACKAGING

Packaging of the covered conductor shall be implemented in suitable wooden drums. Each drum shall have the characteristics provided in Table 2 of Annex 1 and shall carry a single piece of conductor of the defined length and with a length tolerance of  $\pm 5\%$ .

Receipts of reduced lengths are undesirable and shall therefore be the subject of a special Buyer-Seller negotiation, outside the scope of the Contract and for a very limited quantity.

On each side of the drum there shall be two anti-diametrical holes, each shall have 50 mm in diameter and at a distance from the axis of the drum that not exceeding 325 mm, to take the braking torque when unwinding and tensioning the cable. The wooden drums shall be of durable construction and shall have strong steel swivels. The distance between the covered conductor and the ground shall be at least 50 mm in order to avoid damage to the covered conductor. On top of each drum there shall be a fixed metal or plasticized nameplate, on which shall be marked the following information:

- Drum No
- Manufacturer's name or trademark / Year of manufacture
- HEDNO/Contract Number
- HEDNO code number
- Exact length of covered conductor contained in the drum and details of the meter marking
- Gross and net weight in kg

Drums shall have lagging of a reinforced plastic cover of sufficient thickness to protect the covered conductors from damage during transport and storage.

On delivery, the two free ends of the covered conductor shall be sealed to prevent moisture ingress during transport and storage. These two free ends shall be firmly fastened to the drum, in such a manner as to indicate that the drum contains the full length of covered conductor indicated on the nameplate.

## 9. ANNEXES - DRAWINGS

### 9.1. Annexes

#### 9.1.1 Annex 1: Tables

Table 1: Basic characteristics of MV covered conductors.

Table 2: Basic dimensions of packaging drums.

Table 3: Performing tests.

#### 9.1.2 Annex 2

Data to be submitted with the Offer.

### 9.2. DRAWINGS

9.2.1. DRAWING No 1: Indicative sectional drawing of a MV covered conductor.

**ANNEX No 1**

(Paragraph 9.1.1 of the TD ND-425)

**TABLE 1**

**Basic characteristics of MV covered conductors**

Covered Conductor type	CCSX 99 ACSR W	CCSX 99 AAAC W	CCSX 241 AAAC W
Rated voltage (kV)	20 (24)	20 (24)	20 (24)
Number x nominal diameter (mm) of conductor wires <sup>1)</sup>	(1 + 6) x 4,25	7 x 4,25	19 x 4,02
Symbol of the wire's construction material <sup>2)</sup>	AL1/ST1A	AL7	AL7
Conductor diameter (mm)	12,75 ± 1 %	12,75 ± 1 %	20,1 ± 1 %
Maximum conductor dc resistance at 20 °C (ohm/km)	0,327	0,316	0,132
Nominal thickness of semi-conductive conductor screen (mm) <sup>3)</sup>	0,3	0,3	0,3
Inner covering material	XLPE	XLPE	XLPE
Nominal thickness of inner covering (mm) <sup>3)</sup>	1,2	1,2	1,2
Outer covering material	HDPE	HDPE	HDPE
Nominal thickness of outer covering (mm) <sup>3)</sup>	1,1	1,1	1,1
Diameter of the conductor above covering (mm)	17,4 - 18,8	17,4 - 18,8	24,7 - 26,2
Minimum tensile strength of the conductor (daN)	2920	2530	6150

**Notes:**

1. The stranded wires shall comply with the requirements of EN 50182. The conductor shall be non-compacted.
2. For the mechanical and electrical characteristics of the wires, the following standards apply:
  - Hard drawn aluminium wires AL1 according to EN IEC 62641
  - Aluminium alloy wires AL7 according to EN 50183
  - Zinc coated steel wire ST1A according to EN IEC 63248.
3. The nominal thickness of the combined covering (inner + outer) shall be 2,3 mm (EN 50397-1). The semi-conductive conductor screen shall not be measured as covering thickness.

ANNEX No 1

(Paragraph 9.1.1 of the TD ND-425)

TABLE 2

Basic dimensions of packaging drums

Covered Conductor type	CCSX 99 ACSR W	CCSX 99 AAAC W	CCSX 241 AAAC W
Length of conductor in drum (m)	1600	1600	1200
Maximum gross weight (kg)	950	950	1350
Maximum outer diameter (m)	1,4	1,4	1,6
Minimum inner diameter of the drum (m)	0,6	0,6	0,95
Maximum external width of the drum (m)	1,1	1,1	1,1

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**ANNEX No 1**

(Paragraph 9.1.1 of the TD ND-425)

**TABLE 3**

**Performing tests**

No	Test title	Paragraph of the present TD	Reference	Type tests (T)	Sample tests (S)	Routine tests (R)
<b>1.</b>	<b>Electrical tests</b>					
1.1	Conductor resistance measurement	6.2.1.1	HD 605, paragraph. 3.1.1	√		
1.2	High voltage test	6.2.1.2	HD 605, paragraph. 3.2.2.2	√	√	
1.2	Spark test	6.4.1	EN 62230			√
1.4	Leakage current	6.2.1.3	EN 50397-1: 2020, Annex A	√		
<b>2.</b>	<b>Construction and dimensions</b>					
2.1	Compliance with design requirements	6.2.2.1		√	√	√
2.2	Thickness of inner, outer and combined covering	6.2.2.2	EN 60811-201	√	√	√
<b>3.</b>	<b>Conductor construction and mechanical characteristics</b>					
3.1	Characteristic Tensile Strength (RTS)	6.2.3.1	EN 50182	√		
3.2	Construction and dimensions	6.2.3.2	Paragraph 5.2	√	√	
<b>4.</b>	<b>Non-electrical tests on cover</b>					
4.1	Testing of mechanical properties of semi-conductive conductor screen, inner and outer covering	6.2.4.1	a) EN 60811-501:2012, 4.2 before aging b) EN 60811-401:2012, 4.2.3.2 after aging	√		
4.2	Resistance to UV rays	6.2.4.2	EN 50397-1: 2020, Annex D	√		
<b>5.</b>	<b>Compatibility test</b>					
5.1	Aging in finished product test	6.2.5.1	EN 60811-401:2012+A1: 2017, 4.2.3.4	√		
<b>6.</b>	<b>Thermal properties of the covering</b>					
6.1	Shrinkage test	6.2.6.1	EN 60811-502	√		
<b>No</b>	<b>Test title</b>	<b>Paragraph of the present TD</b>	<b>Reference</b>	<b>Type tests (T)</b>	<b>Sample tests (S)</b>	<b>Routine tests (R)</b>
6.2	Hot-set-test	6.2.6.2	EN 60811-507	√	√	
6.3	Pressure test at high temperature	6.2.6.3	EN 60811-508:2012+A1: 2017, 4.3	√		

<b>7.</b>	<b>Additional tests on the covering</b>					
7.1	Gravimetric water absorption test	6.2.7.1	EN 60811-402	√		
7.2	Shore D hardness	6.2.7.2	HD 605, par. 2.2.1	√		
<b>8.</b>	<b>Longitudinal watertightness test</b>					
8.1	With heating cycle	6.2.8.1	EN 60502-2: 2014, Annex F	√		
8.2	Without heating cycle	6.2.8.2	EN 60502-2: 2014, Annex F	√	√	
<b>9.</b>	<b>Marking test</b>					
9.1	Content, legibility of labeling	6.2.9.1		√	√	√
9.2	Durability	6.2.9.2	HD 605 S3: 2019, paragraph. 2.2.1	√		

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ANNEX No 2

(Paragraph 9.1.2 of the TD ND-425)

Data to be submitted with the offer

The offers of economic entities participating in a tender for the supply of MV covered conductors have to contain the following information:

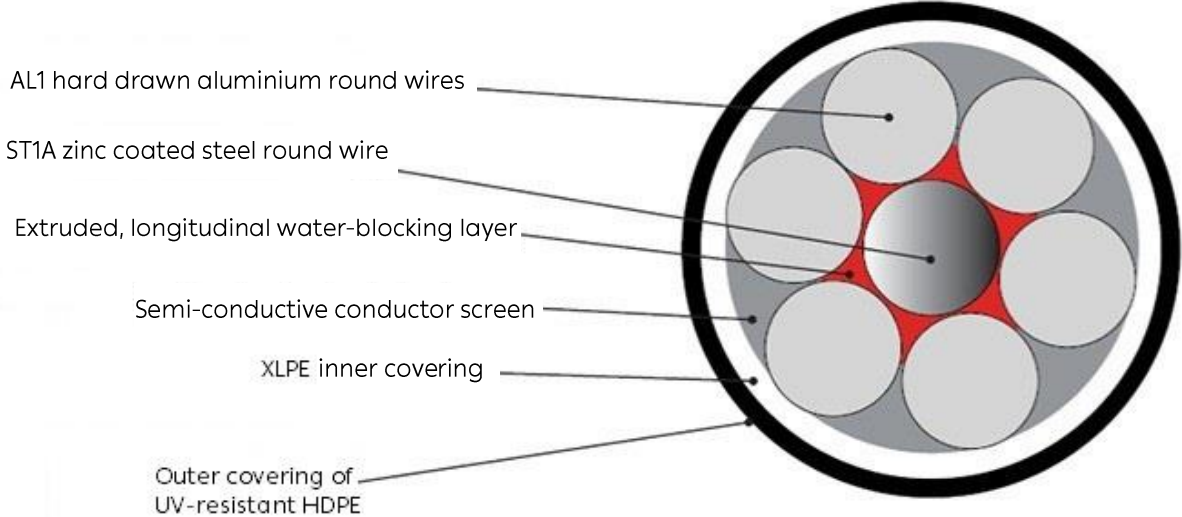
1. Cross-sectional drawing of the covered conductor, per cross-section and per construction material of the conductor, where the arrangement and dimensions of the various layers shall be shown in detail.
2. Nominal and actual cross-section of the conductor (mm<sup>2</sup>).
3. Number and diameter of conductor wires (No. of wires x mm).
4. Conductor diameter (nominal, minimum, maximum), in mm.
5. Type of water-blocking material placed between the wires of the conductor.
6. Thickness of semi-conductive conductor screen (mm).
7. Thickness of XLPE inner covering and its characteristics (type, regulations, properties).
8. Thickness of HDPE outer covering and its characteristics (type, regulations, properties, density).
9. Outer diameter of covered conductor (nominal, minimum, maximum) in mm.
10. Permissible (minimum) bending radius of the covered conductor in mm.
11. Weight of finished covered conductor (kg/km).
12. Weight of aluminum (kg/km).
13. Weight of steel (kg/km).
14. Ohmic resistance of conductor in direct current at 20 °C (ohm/km).
15. Ohmic resistance of conductor in alternating current at 90 °C (ohm/km).
16. Mean inductance (mH/km), for a horizontal arrangement of 3 conductors at distances of 1,4 and 0,9 m.
17. Operating capacitance (nF/km).
18. Capacitive current (charging current) (A/km).
19. Maximum permissible current of continuous operation (A).
20. Short-circuit withstand for 1 s (kA).
21. Insulation constant at 20 and 90 °C (Mohm.km).
22. Minimum tensile strength of the conductor (daN).

23. Description of the production method of the insulation (peroxides in steam or nitrogen or other) and the method of extrusion of the covering and the semiconductor shielding of the conductor (triple extrusion).
24. Reference to this Technical Description ND-425 and deviations from it, if any.

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**TECHNICAL DESCRIPTION**  
**ND-425**  
**(paragraph 9.2.1)**



Notes:

1. The conductor shall be non-compacted.
2. The number of wires in the conductor is indicative (it refers to 99 ACSR conductor).
3. The construction materials of the wires refer to ACSR conductor. In case of AAAC conductor, all strands shall be of the same construction material (AL7 aluminium alloy round wires).

DRAWING TITLE	DRAWING
INDICATIVE SECTIONAL DRAWING OF MV COVERD CONDUCTOR	1