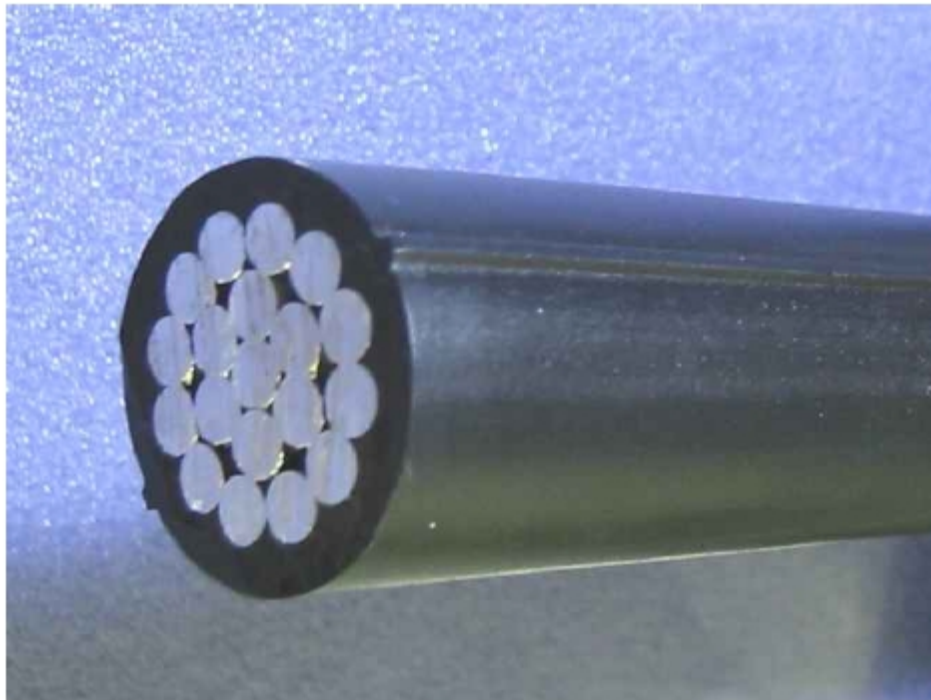


6A-33 SN-HAl-OC wire  
(A rank)



July, 1972 (Establishment)

June 15, 2011 (revised 06)

July 15, 2011 (Enforcement)

Distribution Department  
Tokyo Electric Power Company, Incorporated

## 1. Scope of application

This specification mainly applies to wires of high voltage overhead distribution lines.

## 2. Related standards

### 2.1 Japanese industrial standards

JIS C 3002 (1992)	Electrical copper and aluminum wire testing methods
JIS C 3005 (2000)	Test methods for rubber and plastic insulation wires
JIS C 2110 (2009)	Electrical aluminum metal

### 2.2 Standards for electric power

C-107	Outdoor cross-linked polyethylene insulated wire (OC)
C-251	Outdoor aluminum conductor cross-linked polyethylene insulated wire (A1-OC)
C-2024	Anti-snow-insulated wire

## 3. Types

2 Types are shown by the cross-sectional area of conductors and the presence or absence of recycled materials, as listed in Table 1.

(Note) SN means	Snow Accretion less
HAI means	Hard drawn Aluminum Conductor
OC means	Outdoor Cross-linked Polyethylene Insulated Wire
/R means	abbreviations for Recycle

Table 1

Symbol	Nominal cross-sectional area	Remarks
SN-HAI-OC	240mm <sup>2</sup>	
SN-HAI-OC/R	240mm <sup>2</sup>	In the case of using recycle materials for insulators

## 4. Structure and materials

### 4.1 General matters

This product is a 6600 V anti-snow-shaped outdoor cross-linked polyethylene insulated wire (hereinafter 'wire') consisting of conductors isolated by cross-linked polyethylene resin compounds (hereinafter 'cross-linked polyethylene').

### 4.2 Conductors

Conductors shall be made of hard aluminum strands or equivalent kinds of these that are materials matched to JIS H 2110 (electrical aluminum metal), and their structure is shown as in the attached table 1. Also, they shall have sufficient flexibility. In the case when recycled materials are used for conductors, hard aluminum wires shall consist of the mixture of new aluminum ore and recycled materials, and they shall meet the standard in JIS H 2110 (electrical aluminum

metal). However, in terms of pollution accumulation and electrical conductivity of recycled aluminum rough drawing wires, the mixing rate of recycled materials shall be 50% or less, and the rate shall be clearly specified on a production specification and a quality management process diagram.

[Commentary]

'Have sufficient flexibility' means that from a conventional knowledge a conductor pitch of the outermost layer is 20 times or less than the layer core diameter or something equivalent.

### 4.3 Insulators

As for insulators, conductors shall be covered concentrically with weather resistant black polyethylene whose thickness is shown as in the attached table 1, two fins whose dimensions are indicated in the attached figure 1 shall be installed at symmetrical positions of the outer circumference of insulators, and those fins shall be twisted along a longitudinal direction in an opposite direction of the conductors. Their twisting pitch shall be  $6000 \pm 600$ (mm). If necessary, suitable black separators or semiconductive layers shall be installed on conductors, and their thickness shall be included as the thickness of insulators.

The average thickness of insulators shall be within  $\pm 10\%$  of the tolerances value in the attached table 1, and the minimum measurement value shall have 80% or more of the value of the attached table 1. Also, the size of a fin shall be as in a value of the attached table 1, and its tolerance shall be within  $\pm 20\%$  of the value. The outer peripheral and bottom parts shall be made round indicated in the attached figure 1.

Furthermore, thermoplastic materials by using removed cross-linked polyethylene generated from power distribution facilities of our company (in the rest, we called them as XLPE recycled materials) can be used for insulators. However, the mixing rate of XLPE recycled materials shall be 15-25%, and the rate shall be clearly specified in the production specification and a quality management process diagram.

(The section below is intentionally left blank)

## 5. Performance

### 5.1 General matters

When a test method in Section 7.2 are applied, the performance of electrical wires shall be based on Table 2 and the attached table 1.

Table 2

Item		Performance	Test method applied section
Resistance of conductors		Values in the attached table 1 or less	7.3
Withstand voltage		The test voltage can be tolerated for 1 minute.	7.4
Resistance of insulators		Values in the attached table 1 or more	7.5
Tracking resistance		The current more than 0.5 A shall not flow during 101 times of spraying. Also, the fire shall not be flared up.	7.6
Tensile strength of insulating materials		10 MPa or more	7.7
Elongation of insulators		350% or more	
Thermal resistance	Tensile strength	80% or more of a value before heating	7.8
	Elongation	80% or more of a value before heating	
Thermal deformation resistance		Thickness reduction rate is 40% or less	7.9
Tensile load for conductors		Values in the attached table 1 or more	7.10
Cross-linking degree (XLPE recycled materials)		40% or less	7.11

## 6. Display

On the surface of wires, display continuously by embossing the following items at the interval of 600 mm or less.

Furthermore, names are based on Section 3 as a standard.

- (1) Nominal voltage      6600 V
- (2) Name                      Example: SN-HAI -OC/R
- (3) Name of a manufacturer or its abbreviation
- (4) Year of production    Example: 2011
- (5) Display of a spiral fin shape    SP

## 7. Test method

### 7.1 Appearance test

An appearance test is performed based on Section 4.1 of JIS C 3005.

### 7.2 Structure test

A structure test is performed based on Section 4.3 of JIS C 3005.

### 7.3 Conductor resistance test

A conductor resistance test is performed based on Section 4.4 of JIS C 3005.

### 7.4 Withstand voltage test

A withstand voltage test is performed based on Section 4.6 a) of JIS C 3005. Furthermore, a test voltage shall be 12000 V, and a voltage application time shall be 1 minute.

### 7.5 Insulation resistance test

An insulation resistance test is performed based on Section 4.7.1a) of JIS C 3005.

### 7.6 Tracking resistance test

An insulation resistance test is performed based on Section 4.13 of JIS C 3005.

### 7.7 Insulator tensile test

A tensile test is performed based on Section 4.16 of JIS C 3005. A tensile speed is based on Table 4-B from Section 4.16 of JIS C 3005.

### 7.8 Heating test of insulators

A tensile test is performed based on Section 4.17 of JIS C 3005. A heating temperature and a heating time are based on Table 5-E from Section 4.17 of the JIS C 3005.

### 7.9 Heat deformation test

A heat deformation test shall be performed by Section 4.23 of JIS C 3005. Here, specimens are 30 mm-long cable samples, a heating temperature is  $120\pm 3^{\circ}\text{C}$ , and a load is 39.2N.

### 7.10 Conductor tensile test

A conductor tensile test shall be performed by Section 5 of JIS C 3002.

### 7.11 Test for the degree of cross-linking

When XLPE recycled materials are used for insulators, a cross-linking degree test for XLPE recycled materials shall be performed based on Section 4.25 of JIS C 3005.

## 8. Test and inspection types

Section 8.2 Model test, Section 8.3 Manufacturing process inspection and Section 8.4 Acceptance inspection shall be performed by using Section 7 Test method, and these products must pass all the above provisions in Sections 3-6 and Section 9.

### 8.1 General matters

(1) Except for items prescribed in this specification, necessary items to satisfy product performance and

functionality shall be determined after consultation with our company.

- (2) This specification can be changed with our company's approval if substantial profits are expected for use and in manufacturing by changing a part of it.
- (3) When deemed necessary by our company, process on-site and material inspections, etc. can be performed.

## 8.2 Model test

To confirm manufacturer's quality standards, a model test is carried out as in the following test items. Furthermore, a sample shall be a finished product having a standard length, and three or more test specimens shall be taken for each test.

- (1) Appearance test
- (2) Structure test
- (3) Conductor resistance test
- (4) Withstand voltage test
- (5) Insulation resistance test
- (6) Tracking resistance test
- (7) Insulator tensile test
- (8) Heating test of insulators
- (9) Heat deformation test
- (10) Conductor tensile test
- (11) Test for the degree of cross-linking (in the case of using XLPE recycled materials)
- (12) Workability evaluation

## 8.3 Manufacturing process inspection

During mass production, to confirm that the exactly same product as a model test product is ready to be produced in a production process, inspections of materials in use, quality management items of each production process, quality control methods, etc. shall be carried out.

## 8.4 Acceptance inspection

Acceptance inspection shall be performed by a method described in Section 8.2 Model test under supervision if it is directed by our company. Also, specific test items and a sampling rate are consulted with customers at delivery destinations.

If the acceptance inspection is carried out without any supervision, manufacturers shall perform an in-house test predetermined after consultation with our company and submit a test report to customers at delivery destinations.

## 9. Workability verification

Work verification shall be based on operation procedures of our company and carried out in the following as a standard. Details shall be predetermined after consultation with our company and executed after performing mutual confirmation.

## (1) Working conditions

- a. Wire a sample between column diameters and remove it. (Simulation of an actual work state)
- b. Keep a sample in a thermostatic bath for 0-1 hour, take it out quickly, and rip off an insulator with a knife.

## (2) Operators and construction equipments

Operators and construction equipments designated by our company are allowed.

## (3) Main verification contents

In ripping work of an insulator, there is no obstruction for safety and workability such that a knife is slippery since the insulator is hard, too much labor is required unnecessarily, etc.

There is no other obstruction in actual work.

## (4) Others

As a result of work verification, in the case when our improvement deemed necessary, an applicant shall improve subject matters quickly.

## 10. Others

### 10.1 Packing

- (1) During transportation, suitable packing is necessary to prevent from being damaged by wrapping with plastic drums or wooden drums whose dimensions are indicated in the attached table 1. Furthermore, in the case of plastic drums, ones specified by our company shall be used, and in the case of wooden drums, ones by the Japanese Electric Wire & Cable Makers' Association (JCS) shall be used.
- (2) A label confirming to one shown in the attached figure 2 should be attached on a plastic drum.
- (3) The following items shall be displayed on the side of a wooden drum in an appropriate way that they cannot be erased easily. Furthermore, a name is based on Section 3 as a standard.
  - a. Example of a name : SN-HAI -OC SP
  - b. Example of a nominal cross-sectional area : 240mm<sup>2</sup>
  - c. Length (m)
  - d. Net mass (kg)
  - e. Total mass (kg)
  - f. Name of a manufacturer or its abbreviation
  - h. Example of indicating a production date : 2011.5

### 10.2 Load of testing products

A product used for testing, specimens and implementation costs shall be paid by the deliverers.

### 10.3 Documents to be submitted

#### 10.3.1 Production specification

In order that our company evaluates compliance with this specification, the following necessary items and others shall be stated in a production specification specifically. Also, technical references according to the production specification shall be attached if necessary.

- (1) Conductor: Materials, configurations, outer diameter, performance, pitch
- (2) Tape on a conductor: Whether to use or not, Tape thickness and materials only in the case of using a tape
- (3) Insulator: Guarantee limit of materials, performance, scratches and bubbles on the surface of coating, etc.
- (4) Display: Display method
- (5) Finished outer diameter: Wire core outer diameter
- (6) Packing: Method, dimension, display

### 10.3.2 Test result list

A model test described in Section 8.2 shall be carried out, and its result and test conditions shall be stated.

### 10.3.3 Quality management report

Contents concerning to materials used, quality control items for each production process, quality control methods, defect countermeasures, quality management systems, etc. shall be specifically described. (QC process diagram and outsources process shall be included.)

### 10.3.4 Technical references

The following technical references shall be submitted to our company.

- (1) Technical back data about long-period weather resistance of insulators
- (2) In the case of using recycled materials for conductors, the technical description of the following items shall be reported.
  - (i) Rationale behind the mixing ratio of recycled materials
  - (ii) Quality assurance in the case of recycling repeatedly
- (3) Details of a manufacturing method for spiral fins
- (4) In the case of using XLPE recycling materials for insulators, the technical description of the following items shall be reported.
  - (i) Conditions for thermoplasticity
  - (ii) Rationale behind the mixing ratio of recycled materials
  - (iii) Quality assurance after repeatedly recycling
  - (iv) Technical references on removing foreign substances and impurities of recycled materials and quality control methods

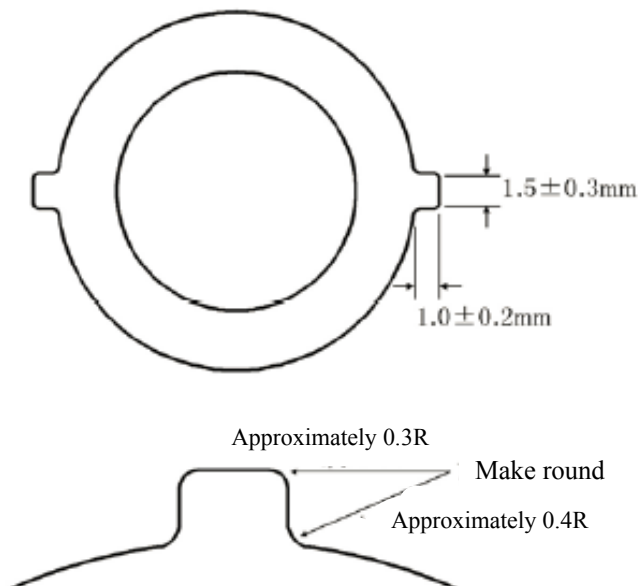
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Attached table 1

Conductor	Nominal cross-sectional area (mm <sup>2</sup> )		240
	Strand configuration(The number of strands/mm)		19/4.0
	Direction of an outermost layer		Right (S) twisting
	Outer diameter (mm)		20.0
Thickness of a cross-linked polyethylene insulator (mm)			3.0
Dimension of a fin part (height × width)			1.0×1.5
Twisting pitch of a fin (m)			6.0
Finished outer diameter (Reference value) (mm)			26×28
Approximate mass (kg/km)			870
The maximum resistance of a conductor at 20°C(Ω/km)			0.124
Test voltage (V/min)			12000/1
Insulation resistance at 20 ° c (MΩ·km)			1000
Tensile load for a conductor (kN)			30.597
Remarks	Standard strip length (m)		420
	Packing	Plastic drum (company designation)	RP8-6
		Wooden drum (the Japanese Electric Wire & Cable Makers' Association standard)	L8-6

Attached Figure 1



- (Note) 1. Fins shall be installed at symmetrical positions.  
2. The outer circumference of a fin and its bottom part shall be rounded.

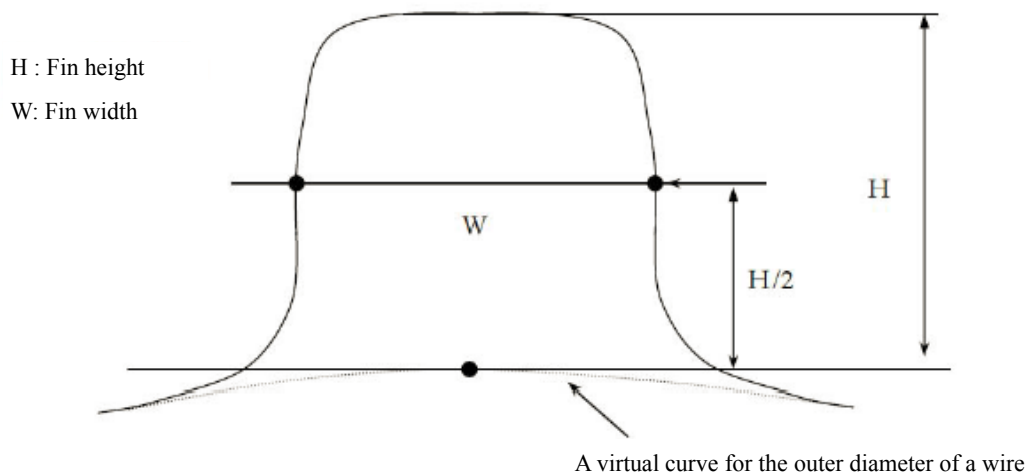
Attached Figure 2

100mm			
東京電力用品(2T830)			
品名	SN-HAI-OC		
サイズ	240mm <sup>2</sup>		
製造年月	2011. 5	条長	420m
質量	kg	総質量	kg
公称電圧		認可番号	
製造No.	14567	No.	1
〇〇〇〇株式会社			

100mm

- (Note)
1. Both sides of a drum shall be labeled.
  2. The color of a label shall be blue.
  3. Even though a drum is left outside for three months after delivery, the color and display of a label can be identified without coming off, and such a label shall be used.

Attached Figure 3



- (1) Fin height A virtual curve for the outer diameter of a wire and the shortest part of the top of a fin shall be measured.
- (2) Fin width Width shall be measured at the half of the fin height measured in (1).

