

# INTERNATIONAL STANDARD



Overhead lines – Requirements for greases for aluminium, aluminium alloy and  
steel bare conductors

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

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**OVERHEAD LINES –  
REQUIREMENTS FOR GREASES FOR ALUMINIUM,  
ALUMINIUM ALLOY AND STEEL BARE CONDUCTORS**

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International Standard IEC 61394 has been prepared by IEC technical committee 7: Overhead electrical conductors.

This first edition of IEC 61394 cancels and replaces the first edition of technical specification IEC/TS 61394 published in 1997. It constitutes a technical revision and now has the status of an International Standard.

The text of this standard is based on the following documents:

FDIS	Report on voting
7/609/FDIS	7/613/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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A bilingual version of this publication may be issued at a later date.

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# OVERHEAD LINES – REQUIREMENTS FOR GREASES FOR ALUMINIUM, ALUMINIUM ALLOY AND STEEL BARE CONDUCTORS

## 1 Scope

This International Standard specifies the requirements and tests of greases designed for corrosion protection of bare overhead conductors.

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60068-2-11:1981, *Basic environmental testing procedures – Part 2-11: Tests – Test Ka: Salt mist*

ISO 2137:2007, *Petroleum products and lubricants – Determination of cone penetration of lubricating greases and petrolatum*

ISO 2176:1995, *Petroleum products – Lubricating grease – Determination of dropping point*

## 3 Designation system

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Greases shall be designated  $\theta_1 A \theta_2$  or  $\theta_1 B \theta_2$  where *A* and *B* define the type of grease as follows:

- type *A*: products generally applied in the cold state, for example greases: semi-solid or solid products consisting essentially of a stabilized mixture of mineral or synthetic oil and thickeners such as metal soaps or inorganic compounds;
- type *B*: products generally applied in the hot state, for example petrolatum: semi-solid, or solid products made up essentially of microcrystalline waxes associated with small quantities of mineral oil and organic additives;
- $\theta_1$  is the lowest temperature in °C below 0 °C at which the grease will perform the requirement of protection of the conductor from atmospheric corrosion;
- $\theta_2$  is the highest temperature, in °C, at which the grease will perform to this requirement (achieve specified drop point or high temperature stability).

Examples:

- 20A150 type *A* grease with a temperature  $\theta_1$  of -20 °C and  $\theta_2$  of 150 °C.
- 20B110 type *B* grease with a temperature  $\theta_1$  of -20 °C and  $\theta_2$  of 110 °C.

The grease supplier shall provide a unique identifier for its grease, and shall retain details of its composition for future reference. The composition shall include manufacturing tolerance and shall remain unchanged while the grease is marketed under this specific identifier.

## 4 Requirements for grease

The grease shall protect overhead bare conductors from atmospheric corrosion in service and in storage. The grease shall remain in the conductor for the specified conditions of operation. The grease shall meet the requirements as described in this standard.

## 5 Tests

### 5.1 Classification of tests

#### 5.1.1 Type tests

Type tests are intended to verify the main characteristics of a grease which depend mainly on its composition. They are carried out once for a supplier's specific product and then subsequently repeated when the composition of the grease has changed.

#### 5.1.2 Sample tests

Sample tests are intended to guarantee the quality of the grease and compliance with the requirements of this standard.

**Table 1 – Classification of tests**

Test	Type tests		Sample tests	
	Type A	Type B	Type A	Type B
Drop point	X	X	X	X
High temperature stability	X		X	
Penetrability	X	X	X	X
Low temperature adherence	X	X		
Acidity/alkalinity		X		
Ageing	X	X		
Corrosion test	X	X		
Stability on conductor (high temperature)	a	a		
Stability on conductor (short circuit)	a	a		

<sup>a</sup> If requested by the purchaser.

### 5.2 Preconditioning of samples

#### 5.2.1 Type A products

Type A grease delivered with an excess of oil on the surface shall not be acceptable. Excess oil on the surface of the product after storage shall be removed. If necessary, the product shall be mixed prior to carrying out the measurements.

#### 5.2.2 Type B products

The product shall be heated between 10 °C to 20 °C above the temperature at which melting occurs, and maintained at this temperature for 30 min. The quantity necessary for carrying out the tests shall be poured into the test containers and allowed to cool at ambient temperature for a period of at least 24 h.

#### 5.2.3 Products taken from a conductor

When the product to be tested is taken from a conductor, no preconditioning is allowed.



### 5.3 Drop point

**5.3.1** The determination of the drop point shall be made using the method given in ISO 2176.

**5.3.2** When tested in accordance with 5.3.1, the minimum value of 5 determinations shall be greater than or equal to  $\theta_2$ . Type A products may not have a well defined drop point, in which case the tests shall be stopped when the temperature reaches  $(\theta_2 + 20)$  °C.

### 5.4 High temperature stability (Type A products only)

**5.4.1** The oil separation shall be determined using the method given in IP 121, after 1 h at a temperature of  $\theta_2$ .

**5.4.2** When tested in accordance with 5.4.1, the maximum quantity of oil separated shall not exceed 0,2 % by mass.

### 5.5 Penetrability test

**5.5.1** A sample of grease shall be tested using the method given in ISO 2137, using a full scale cone, at a temperature of 25 °C.

#### 5.5.1.1 Type A products

When the type A product is tested in accordance with 5.5.1, the mean value obtained for a type test shall be greater than or equal to 70 units  $\times 0,1$  mm. Results obtained from sample tests shall not vary from the value obtained from the type test by more than  $\pm 20$  %.

#### 5.5.1.2 Type B products

When the type B product is tested in accordance with 5.5.1, the value obtained for a type test shall be between 120 and  $180 \times 0,1$  mm. Results obtained from sample tests shall not vary from the value obtained from the type test by more than  $\pm 20$  %.

### 5.6 Low-temperature adherence

**5.6.1** An aluminium coupon measuring 100 mm  $\times$  100 mm  $\times$   $(1 \pm 0,1)$  mm shall be coated with a  $(0,50 \pm 0,05)$  mm thick film of the product on one side and then maintained, along with a 25 mm mandrel, at a temperature less or equal to  $\theta_1$  for 1 h.

**5.6.2** The coupon with the coated side outside of the mandrel shall then be immediately bent to an angle between 100 ° and 120 ° around the mandrel. The folding time of the coupon is 5 s.

**5.6.3** When tested in accordance with 5.6.1 and 5.6.2, the product shall remain adhering to the coupon with no evidence of cracking or flaking when examined by the naked eye or with normal corrective lenses.

### 5.7 Acidity/alkalinity (type B grease only)

**5.7.1** The test set-up and method is described in Annex A.

**5.7.2** When tested in accordance with 5.7.1, the acidity or alkalinity of the sample before ageing shall be less than or equal to 2,0.

## 5.8 Ageing

### 5.8.1 Preconditioning

#### 5.8.1.1 Type A grease

No preconditioning is required for Type A grease.

#### 5.8.1.2 Type B grease

A suitable quantity of grease shall be heated to a temperature of 20 °C above the temperature at which melting occurs, and maintained for 168 h.

**5.8.2** Sample preparation shall be in accordance with the procedure described in Annex B. After ageing, the metal coupons with grease shall be subjected to the corrosion test. The grease in the cups shall be subjected to the penetrability test as described in 5.5, as well as the acidity/alkalinity as described in 5.7.

**5.8.3** When tested in accordance with 5.8.2, the mean penetrability value shall not differ from the type test mean value by more than  $\pm 20$  %. The acidity/alkalinity index shall be less than or equal to 2,5.

## 5.9 Corrosion tests

**5.9.1** The coupons shall be prepared in accordance with 5.8. They shall be positioned with an angle of  $(20 \pm 2)^\circ$  in a suitable chamber and then be subjected to the following:

- seven 24 h cycles in a sulphurous atmosphere. For the first 8 h of each cycle, the chamber shall have a relative humidity greater than 90 % and shall contain 0,067 % of sulphur dioxide by volume, at a temperature of  $(40 \pm 3)^\circ\text{C}$ . For the remaining 16 h, the chamber door shall be open to the laboratory atmosphere.
- 168 h in a water spray solution with 5 % of NaCl by mass at a temperature of  $(35 \pm 1)^\circ\text{C}$  in accordance with IEC 60068-2-11.

**5.9.2** The coupons shall be examined after the grease has been removed using a suitable solvent and the coupons with the lowest and highest degree of corrosion in the evaluation area (see Annex B) shall both be discarded. There shall only be a limited number of pits and a limited spread of corrosion from these pits in the central part of the remaining coupon.

**5.9.3** The degree of corrosion on the remaining coupon is assessed by means of a grading index based on the corrosion coupons shown in Figure 1.

**5.9.4** When tested in accordance with 5.9.1, the coupon shall have a grading index greater than or equal to 8.

## 5.10 Stability of grease on conductor at high temperature

**5.10.1** This test is performed at the request of the purchaser only.

**5.10.2** A sample of conductor, selected by the user, shall be filled with grease in accordance with the appropriate IEC conductor specification. The sample shall be subjected to the test procedure as described in Annex C. The maximum operating temperature,  $\theta_3$ , shall be defined by the purchaser.

**5.10.3** When tested in accordance with 5.10.2, the temperature  $\theta_A$ , as defined in Annex C, shall be not less than  $\theta_3$ .

**5.11 Stability of grease on conductor under short-circuit**

**5.11.1** This test is performed at the request of the purchaser only.

**5.11.2** A sample of conductor, selected by the user, shall be filled with grease in accordance with the appropriate IEC conductor specification. The sample shall be subjected to the test procedure as described in Annex D. The withstand temperature,  $\theta_4$ , shall be defined by the purchaser.

**5.11.3** When tested in accordance with 5.11.2, the sample shall meet the acceptance criteria as agreed upon before the test between the supplier and the purchaser.

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