

	<b>TECHNICAL DESCRIPTION</b> <b>SINGLE LADDERS 3M MADE OF FIBERGLASS</b>	<b>CODE:</b> 802000033
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## 1. SCOPE

This specification determines the general design features, the test methods and the requirements for the Industrial-Extra Heavy ladders (1A,ANSI) consisting of one part only, of a length of 3m, designed for a maximum working load of 140kgr. (300lbs) and made of fiberglass.

## 2. DESCRIPTORS

Occupational safety, ladder, fiberglass

## 3. LADDERS' USE AND PROPERTIES

These ladders will be used by electricians' groups for out-doors works.

Principally, they will be used for the climbing on electric poles, and on buildings' walls for works that will take place at electric networks or at low or middle voltage installations.

## 4. REGULATIONS - SPECIFICATIONS

- EN 131 - 1/91 Ladders, vocabulary, schematic presentation, dimensions.
- EN 131 -2/91 Ladders, Requirements, Testing, Marking.
- ANSI A 14.5/92 Ladders, Portable Reinforced Plastic, Safety Requirements.
- ELOT EN 59/82 Glass reinforced plastics. Measurement of hardness by means of a Barcol impressor.
- EN 62/77 Glass Reinforced Plastics standard atmospheres for conditioning and testing.

## 5. DESCRIPTION

### 5.1. Schematic presentation and dimensions

The ladder should be constituted from the followings:

- the stiles
- the rungs
- the anti-slip devices

The schematic presentation and the dimensions of the ladder are shown in fig. 1.

#### 5.1.1 Stiles

The stile should be of a double T shape with dimensions 80mm x 30mm (+3%), rectangular, or of another shape that reassures equal safety and usability.

#### 5.1.2 Rungs

The rung conjunction to the stile of the ladder should be realised with the insertion of two washers, externally and internally, before the pressing. Ladders, the rungs of which will be joined to the stile in a different way, should be acceptable on condition that the units shall show no indication of test failure during the repeated stile loading tests according to ANSI A 14.5 (§ 8.7) or another equivalent National Standard.

All rungs should be made of aluminum, they should be of non-slip type, of a round or rectangular shape with rounded edges and with dimensions 30+ 2mm.

The dimensions should be the dimensions provided in EN 131-1 and more definitely:

- The minimum inner width for the base section should be 30cm and the distance between the outer sides of the stiles should not exceed the 43cm.
- The distance between two successive rungs and between the bottom edge of the ladder and the lowest rung should be 25-30cm for each rung
- The distance from the top rung to the upper edge of the ladder should be 35 + 5 cm.
- The distance between the top rung and the next rung should be such as the top rung not to be adjacent to the pole, when the ladder is in the safe position of use (inclination 4:1)

#### 5.1.3 Anti-slip devices

For the better position of the ladder on the ground, the bottom-ends of the ladder should be provided with skid proof shoes. The anti-skid coating of the shoes should be cleated.

The upper part of the ladder should be provided with the following anti-slip devices:

Above the top rung of the ladder there will be a wire-rope provided with plastic rollers, of a cylindrical shape, for securing the ladder to the electric poles.

Besides, at the upper part of the ladder there will be a cleated anti-skid top cup of a length of 10cm, at least, for its supporting on the wall.

## 5.2 Materials' Technical characteristics

### 5.2.1 Stiles

The stiles shall be made of fiberglass and their external finish shall be well done. The surface of the stiles shall be of an unvarying colour and smooth without protruding plastic fibers. The stiles' surface shall also be free from foreign bodies, conductive components, holes, strokes, blanks, scrapings, ruffles or blisters. The glass fibers shall be equally allocated as not to be any density variation. The fiberglass physical and mechanical properties shall be in accordance with the provisions of the § 6.2.2.1.3

### 5.2.2 Rungs

The rungs shall be made of aluminum. They shall be of an anti-skid type and shall have such a shape that will ensure a safe and easy ascent or descent.

### 5.2.3 Anti-skid coatings

The anti-skid coatings shall be made of neopren or other appropriate material, in IPTO's judgment.

## 5.3 Weight

The total weight of the ladder won't exceed the 8 kgr.

## 6. TESTS

### 6.1. Design tests

Not necessary

### 6.2. Type tests

#### 6.2.1 Visual test

The shape and the dimensions of the ladders shall comply with what it is described in § 5.

#### 6.2.2 Laboratory tests

##### 6.2.2.1 Test of the stile material

##### 6.2.2.1.1 Test of hardness

The material's hardness shall be, at least, of 50 degrees, on the Barcol scale, in accordance with the ELOT EN-59.

##### 6.2.2.1.2 Drilling test (ANSI A.14.5/92 § 7.8)

The material shall be capable of being bored, punched and riveted without splitting or delaminating. For this aim, shall take place a drilling test with a pin tapered to 1,04 times the hole diameter.

##### 6.2.2.1.3 Test of physical and mechanical properties

The test piece of fiberglass shall have the following properties:

- Density 0,065 lb/in<sup>3</sup> (1,8gr/cm<sup>3</sup>) with a tolerance of + 10 %
- Water absorption 0,75 % max in accordance with ASTM D 299/91.
- The material must comply with the requirements presented in table 1 when it is conditioned according to ASTM D 709/78, when it is immersed for two hours in boiling distilled water and then in water that is at room temperature, as well as when it is heated up to 150°F (66°C). (Table 6 according to ANSI A. 14.5-92).

Table 1

Minimum values of fiberglass mechanical properties

Material Property – Test Conditions	According to ASTM D 709/78	Wet	66° C	Weathering
Flexural Strength (PSi)	35.000	26.000	26.000	28.000
Flexural Modulus (10 <sup>6</sup> PSi)	1,8	1,4	1,4	1,4
Tensile Strength (PSi)	30.000	23.000	21.000	23.000
Tensile Modulus (10 <sup>6</sup> PSi)	2,0	1,5	1,4	1,5
Compressive Strength (PSi)	28.000	21.000	19.000	22.000
Compressive Modulus (10 <sup>6</sup> PSi)	2,0	1,5	1,4	1,6
Ultimate Bearing Strength (PSi)	30.000	---	---	---

##### 6.2.2.1.4 Accelerating weathering test

The material shall be submitted to an accelerating weathering test with a xenon-arc-type device for 1000 hours according to ANSI 14.5 § 7.9.5.1 (3). After the test, shall be evaluated the changes in fiberglass surface appearance (factor 8), in apparent color (factor 5), in gloss lost (factor 1) as follows:

Degree of Change	Rating
None	0
Trace	1
Slight	2
Medium	3
Heavy	4
Severe	5

The test shall be satisfactory if the sum of the products that come from the multiplications of the factor by the rating, is less than 35. Besides, the mechanical properties of the ladder, after the accelerating weathering test, shall comply with the table 1.

#### 6.2.2.1.5 Dielectric strength

The material shall have a dielectric strength of 25 KV when tested according to ASTM D 149/91.

#### 6.2.2.2 Complete ladder's tests

##### 6.2.2.2.1 Bending test of the ladder (EN 131-2 § 4.3)

The ladder shall be positioned, as it is shown in fig. 2.

A pre-load of 100N shall be applied for the duration of one minute. The position of the ladder after removal of the pre-load is the origin for measurement. A test load F of 750N shall be applied vertically on the centre of the ladder for a duration of at least one minute. Thereby the maximum permissible deflection  $f_{max}$ . as a function of the distance l between the supports ladder.

##### 6.2.2.2.2 Lateral deflection test of the ladder (EN 131-2 § 4.4)

The ladder shall be placed in lateral position, as it is shown in fig. 3.

A pre-load of 100N shall be applied for the duration of one minute. The position of the ladder after removal of the pre-load is the origin for measurement.

A load F of 250N shall be applied to the lower stile equidistant from the supports. The deflection is measured equidistant from the supports one minute after the removal of the load. Thereby the maximum permissible deflection  $f_{max}$ . shall be  $f_{max} < 0,005 l$  in mm.

##### 6.2.2.2.3 Bending test of steps (EN 131-2 § 4.6)

A pre-load of 200N shall be applied for the duration of one minute. The position of the step after removal of the pre-load is the origin for measurement (fig.4).

In the position of use of the ladder a test load F of 2600N shall be applied vertically on the midpoint of the weakest rung of any design evenly distributed over a width of 100mm and for the duration of one minute.

The maximum permanent deformation after removal of the test-load shall be 0,5% of the inner width of the step.

##### 6.2.2.2.4 Strength test of the ladder (EN 131 - 2 § 4.2)

The test shall be carried out on the complete ladder, as it is shown in fig. 5. A pre - load of 500N shall be applied for a duration of one minute. The position of the ladder after removal of the pre-load is the origin for measurement.

A test load F of 1000N shall be applied for a duration of one minute. The measurement shall be taken one minute after removal of the test load. The permanent deformation F of the ladder must not exceed 1‰ of the distance l between the supports.

##### 6.2.2.2.5 Test method of the bottom stile ends (EN 131 - 2, § 4,5)

The ladder is to be placed with the lower stile in a horizontal position, as it is shown in fig. 6.

A load block, 50mm wide, shall rest on the stile and shall effect the whole width of the stile. The lateral deflection of the stile end is measured at the foot of the ladder. A vertical force F of 900N is placed in the middle of the load block and is maintained for one minute. The permanent deflection after removal of the test load together with damages, if any, are reported.

As a variation the test can also be conducted after the inversion of the ladder.

The permanent deflection (change of dimension l) must not exceed 2mm. Neither fractures nor visible cracks are allowed.

##### 6.2.2.2.6 Torsion test of steps (EN 131 - 2 § 4.7)

A torque M of 50 Nm shall be applied on the mid-point of the step via a 100mm wide clamping device.

The torque shall be applied alternately 10 times in clockwise and 10 times in counter-clockwise direction for a period of 10 seconds each. During testing there shall be no relative movement in the connection between stile and step. After the test a permanent deformation shall be + 1° at maximum.

The ladder shall be placed in such a position, so that the one stile to be fixed steadily and a force applicator to be clamped to the unsupported stile. This loading device shall develop a bending moment of 0.18 Kpm

(4.800pi). The relative movement of the two stiles shall not exceed a total excursion of 18mm. The ladder should be subjected to 10.000 cycles, at a frequency of 10-15 cycles/min. without any evidence of test failure.

#### 6.2.2.3 Anti-slip cup tests

The neopren shall be submitted to chemical analysis

### 6.3. Sample tests

All the type tests shall be done so as the first production lot to be acceptable. As far as the following production lots are concerned, all the type tests or part of them should also take place, in the inspectors' judgment. The visual test as well as the hardness test of the material are necessary.

### 6.4. Routine tests

Not necessary

## 7. LABELING - MARKING

Each ladder shall be clearly and permanently marked with the followings:

- The IPTO's initials
- The manufacturer's firm
- The date of manufacture (at least month and year)
- The contract number
- The indication 3 m
- The indication: «Maximum working load 140 kgr» (on the first rung)

There will also be a self-sticking label with information about the safe use, the maintenance and the storage of ladders.

## 8. PACKAGE

Each ladder should be packed in a plastic packing.

## 9. Samples and information submitted with the offer

Each supplier should submit with his offer:

- a ladder similar or somewhat similar to the specified one, to the unit that IPTO will define, so as IPTO to form a complete opinion about the ladder that is offered. IPTO, if it is worthwhile, should demand the valuation of the supplier's manufacturing capability
- Materials' manufacturing designs
- Certificates