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# International Standard



# 7331

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## **Ski-poles for alpine skiing — Safety requirements and test methods**

*Bâtons de skis alpins — Exigences de sécurité et méthodes d'essai*

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Descriptors : sports equipment, alpine skis, accessories, specifications, tests, safety requirements.

## Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 7331 was developed by Technical Committee ISO/TC 83, *Sports and recreational equipment*, and was circulated to the member bodies in September 1982.

It has been approved by the member bodies of the following countries:

Austria	India	South Africa, Rep. of
Egypt, Arab Rep. of	Japan	Spain
France	New Zealand	USA
Germany, F.R.	Poland	USSR

The member body of the following country expressed disapproval of the document on technical grounds:

Italy

# Ski-poles for alpine skiing — Safety requirements and test methods

## 1 Scope and field of application

This International Standard specifies the minimum requirements for safety in ski-poles for alpine skiing and gives test methods to check conformity with these requirements.

It applies to ski-poles for alpine skiing (special designs, for example for racing, are not included) in the following ranges of nominal length,  $l_N$  (see clause 3):

- group A,  $l_N \geq 1\ 100$  mm (adults' poles)
- group B,  $1\ 100$  mm  $> l_N > 700$  mm (junior poles)
- group C,  $l_N < 900$  mm (children's toy-poles)

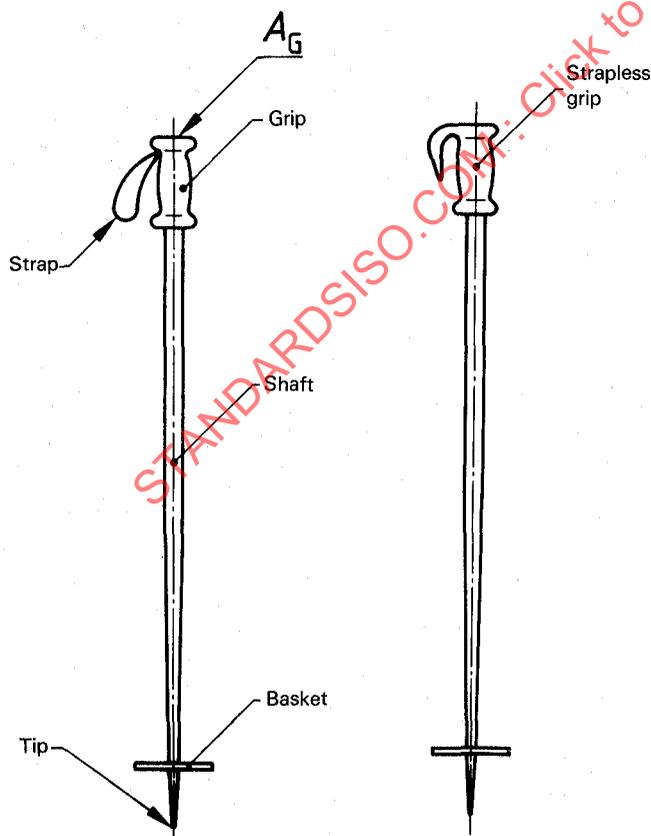


Figure 1 — Ski-pole — Terms

## 2 Reference

ISO 554, *Standard atmosphere for conditioning and/or testing — Specifications.*

## 3 Terms, symbols and units

### 3.1 Terms

Terms used to designate the different parts of a ski-pole are given in figure 1.

There are two types of grips for ski-poles:

- grips with a strap;
- strapless grips.

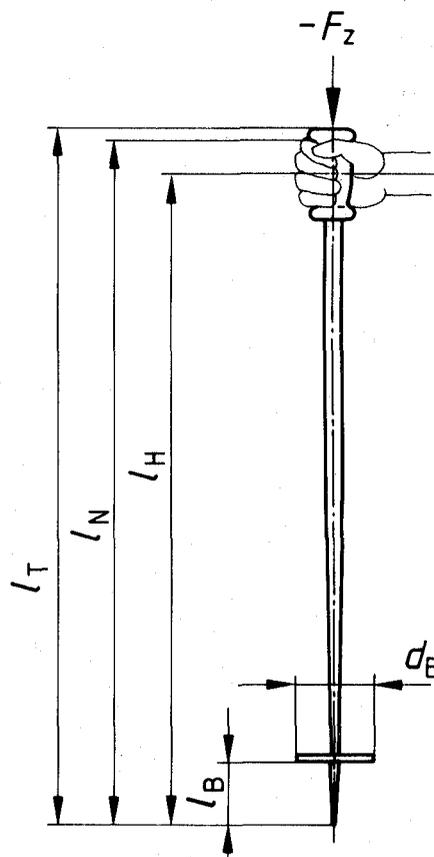


Figure 2 — Centre of rotation and dimensions

### 3.2 Symbols and units

The symbols used in figure 2 relate to the following concepts, which shall be expressed in the units given:

$A_g$  = upper surface of the grip, in square centimetres (impact area)

$-F_z$  = compressive force in the axis of the ski-pole, in newtons

$l_T$  = total length in millimetres

$l_N$  = nominal or effective length measured from the tip to the upper surface of the fist, in millimetres

$l_H$  = length measured from the tip to the middle of the hand, in millimetres

$l_B$  = length measured from the tip to the lower surface of the basket, in millimetres

$d_B$  = maximum diameter of the basket, in millimetres

The nominal length  $l_N$  shall be marked on the ski-pole (see clause 8).

The lengths  $l_N$  and  $l_H$  are determined by means of an average hand, with a width of

group A: 93 mm

group B: 73 mm

group C: 57 mm.

### 4 Materials

The materials used shall meet the requirements prescribed in this International Standard.

### 5 Test conditions

Unless otherwise specified, the test shall be carried out as a type test at the standard atmosphere as indicated in ISO 554 with reduced tolerances.

The reference value for the quasi-static structure of force is

$$\frac{dF}{dt} < 100 \text{ N/s}$$

The test equipment shall be such that all measurable variables such as forces, temperatures, angles, lengths, surfaces, weights and time of oscillation can be measured or determined to the following accuracies:

Forces, weights	± 2 %
Temperatures	± 2 °C
Angles	± 1°
Lengths of poles	± 1 mm
Radii and other lengths	± 0,2 mm

### 6 Test sample

For the test, three poles each from the longest and from the shortest lengths of one group shall be submitted to the testing establishment.

One long and one short pole shall be selected for the tests in accordance with 7.2 to 7.9.2.

If one test sample fails these tests, the tests may be repeated with two further test poles, both of which then have to pass the tests.

## 7 Technical requirements for safety and methods of test

No.	Property	Requirement	Method of test
7.1	Nominal length	The nominal length $l_N$ shall not vary from the given length by more than $\pm 10$ mm. Furthermore the lengths of one pair of ski-poles shall not differ by more than 7 mm.	Determine lengths of all test samples indicated in clause 6.
7.2	Outward design	Sharp design (except the tip) and rough surfaces, which might cause injury, shall be avoided.	Check visually.
7.3	Anti-catching design	The ski-pole shall be so designed that no dangerous strain can be transmitted to the wrist and arm of the skier, should the pole get caught during skiing. This requirement can be met by a design according to 7.6.3 or 7.8.4, or by a strapless grip.	Test according to 7.6.3 or 7.8.4, or visual and functional test.
7.4	Release mechanism	If so equipped a release mechanism shall be manufactured so that correct functioning is guaranteed at environmental conditions encountered during skiing.	<p>Determine the release force at room temperature five times per function on one test sample and calculate the mean value.</p> <p>Store the release mechanism at a temperature of <math>-20</math> °C until this temperature is reached.</p> <p>Then determine the release force once and compare it with the mean value at <math>20</math> °C.</p> <p>Again determine the release force at room temperature five times on one test sample and calculate the mean value.</p> <p>Spray the vertically placed ski-pole with water of <math>10</math> °C or more for 1 min from a distance of 1 m, and then store the pole vertically at <math>-20</math> °C until it reaches this temperature.</p> <p>Then determine the release force once and compare it with the mean value at <math>20</math> °C.</p> <p>Carry out 100 releases on each release mechanism; compare the mean value of the first five releases with the mean value of the last five.</p>
7.4.1	Temperature and ice conditions	<p>If a release mechanism is provided in the shaft, the compressive force in the axis of the pole necessary to cause the release at a temperature of <math>-20</math> °C and icy conditions, and at a temperature of <math>20</math> °C shall not vary by more than 30 %.</p> <p>In addition, the release force at <math>-20</math> °C and in icy conditions shall not exceed values given in 7.6.3.</p>	
7.4.2	Fatigue conditions	The release mechanisms shall be protected against wear so that they still function correctly after 100 releases. The release forces shall not vary by more than 20 % after the fatigue test.	
7.5	Grip		
7.5.1	Shape	The shape of the grip shall be designed to facilitate good control of the pole, i.e. the grip shall be shaped to the hand and not be slippery. With all grips, whether straps are included or not, the shape of the moulded portion shall not be such as to force the thumb outward or upward, beyond the edge of the impact area $A_G$ of the top of the handle/grip.	Visual and manual testing.

No.	Property	Requirement	Method of test
7.5.2	Impact area	The impact area $A_G$ shall be group A: at least 25 cm <sup>2</sup> group B: at least 18 cm <sup>2</sup> group C: at least 16 cm <sup>2</sup>	Designate the largest section, taken from the outer contour at a level between 0 and 10 mm from the upper edge of the grip and at a slope of between 0 and 10° to the perpendicular; this shall be the impact area.  In the case of deformable surfaces of the grip, this measurement can be carried out at a compressive force of 400 N.
7.5.3	Edges	Edges on the grip which could cause injury shall have a radius of at least 2,0 mm.	Visual and dimensional testing.
7.5.4	Piercing resistance	The piercing resistance of the impact area $A_G$ to the top of the shaft, that is the force necessary for the shaft to pierce the impact area upwards, shall be higher by at least 100 % than the maximum compressive force, or than the maximum release force of poles with a release mechanism.	Press a test sample against a fixed abutment by means of a plate (see figure 3).  When the double compressive force, determined according to 7.7.2 is applied, the shaft shall not pierce the end of the grip. The test shall be carried out quasi-statically.

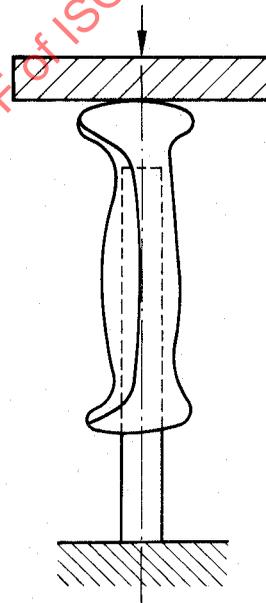


Figure 3 — Test arrangement for the piercing arrangement

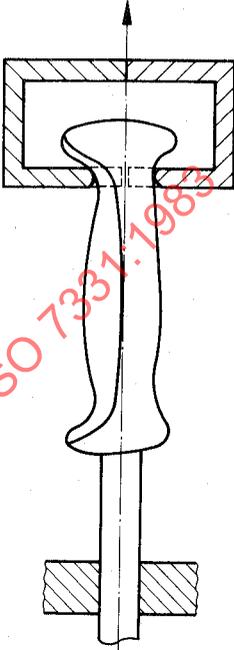
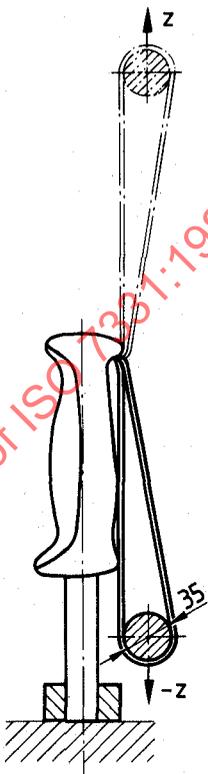
No.	Property	Requirement	Method of test
7.5.5	<b>Pulling-off force</b>	The force needed to pull the grip from the shaft shall be  group A: at least 500 N group B: at least 400 N group C: at least 300 N	Carry out the test on a test sample in accordance with figure 4.  The test shall be carried out quasi-statically.  
7.5.6	<b>Strapless grips</b>	The bow of strapless grips shall be designed in such a way that catching or twisting the wrist is avoided.	Check visually.
7.6 7.6.1	<b>Straps Width</b>	Straps with a supporting function shall have the following width where near the hand:  group A: at least 16 mm group B: at least 14 mm group C: at least 12 mm	Visual and dimensional test.

Figure 4 – Test arrangement for pulling-off force

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No.	Property	Requirement	Method of test
7.6.2	<p><b>Minimum strain in support direction</b></p>	<p>Straps with a supporting function (i.e., groups A and B) shall withstand a force in the loading direction <math>-z</math> of at least 350 N.</p> <p>Straps in group C have no supporting function.</p>	<p>Carry out the test quasi-statically according to figure 5 by applying the force in the direction <math>-z</math>.</p> <p style="text-align: right;">Dimension in millimetres</p>  <p style="text-align: center;"><b>Figure 5 — Test arrangement for the strap</b></p>
7.6.3	<p><b>Release function</b></p>	<p>Straps with a release function shall have the following range of release values in the direction <math>z</math> within a range of temperature from 20 °C to -5 °C:</p> <p style="margin-left: 20px;">group A: 80 to 240 N group B: 60 to 180 N</p> <p>NOTE — Further evaluation of accident statistics is needed to determine more extensive requirements concerning the direction of strap release from different types of fall, etc.</p>	<p>Determine release forces in direction <math>z</math> quasi-statically according to 7.4 and figure 5.</p>

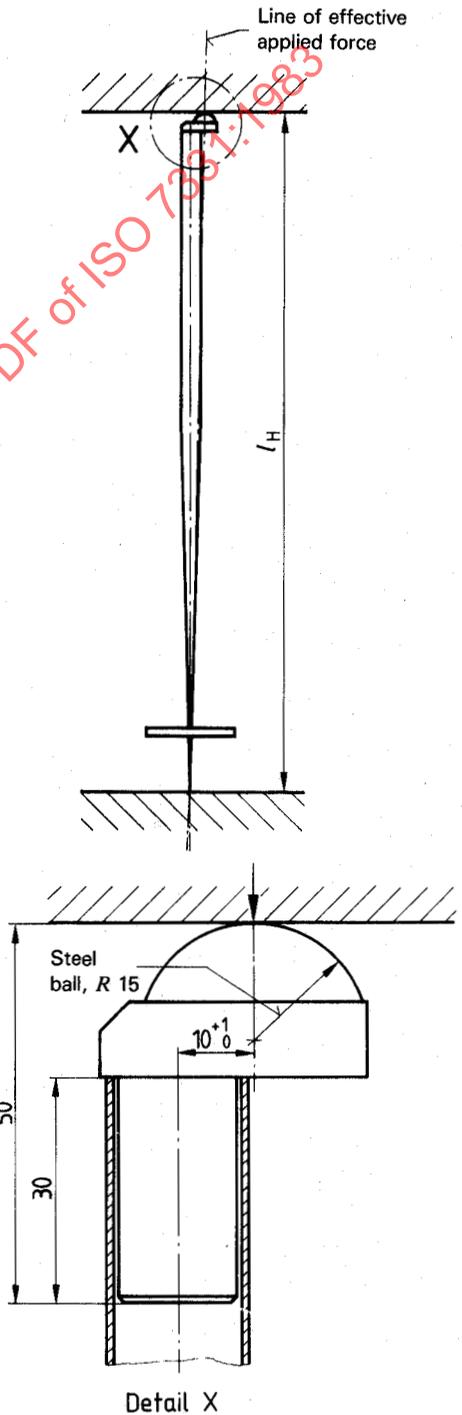
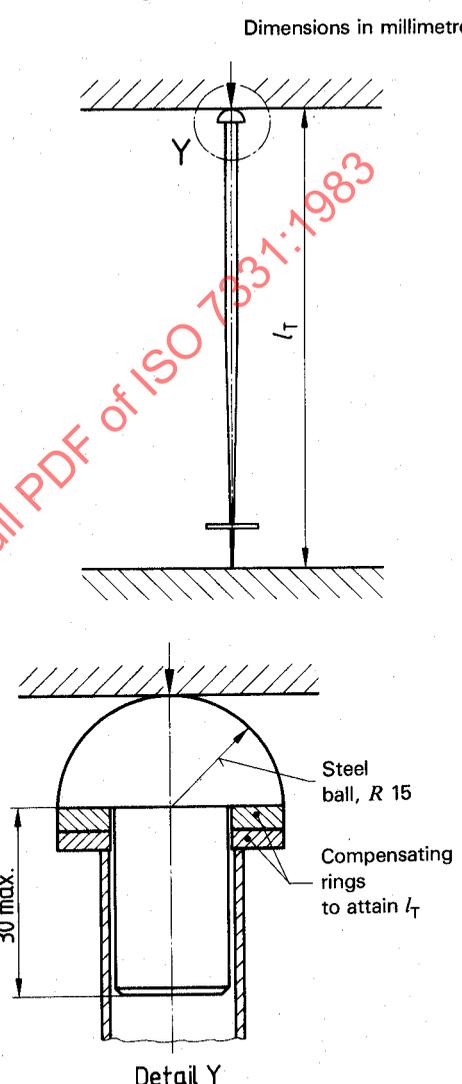
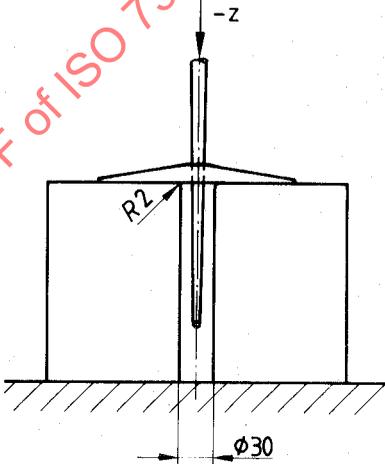
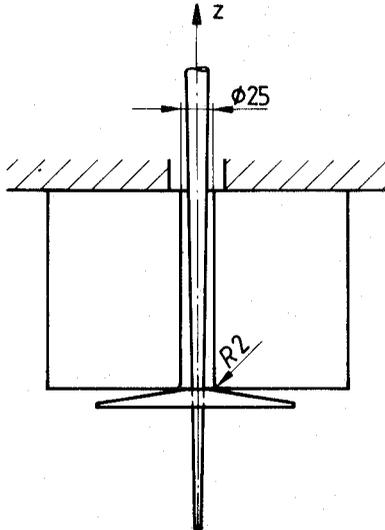
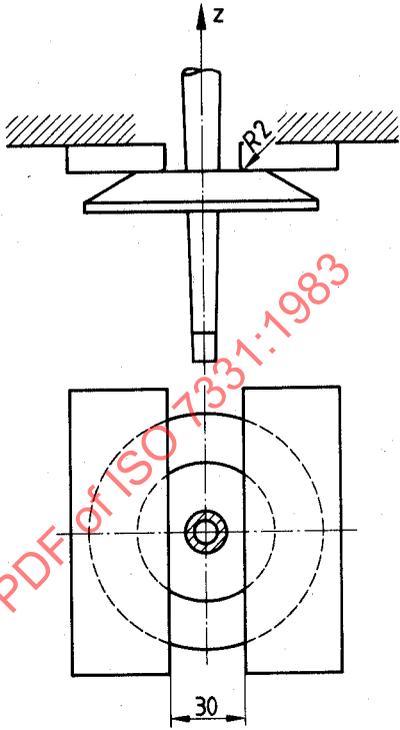
No.	Property	Requirement	Method of test
7.7	Shaft		
7.7.1	Minimum compressive force	<p>The shaft shall be designed to withstand compressive forces and bending moments occurring during all aspects of skiing without plastic deformation or fracture.</p> <p>No permanent deformation shall occur when loading the pole with a compressive force in the axis of the pole of</p> <p>group A: 500 N; group B: 450 N; group C: 300 N.</p>	<p>Test the longest ski-pole of one series, taking <math>l_H</math> as the test length. Carry out the test quasi-statically between two parallel plates and with the pole fixed off-centre (see figure 6). Test bent poles in such a way that buckling is promoted.</p> <p>Dimensions in millimetres</p>  <p>Line of effective applied force</p> <p>X</p> <p><math>l_H</math></p> <p>Steel ball, R 15</p> <p>50</p> <p>30</p> <p>10<sup>+1/0</sup></p> <p>Detail X</p>

Figure 6 — Test arrangement for the determination of the minimum compressive force

No.	Property	Requirements	Method of test
7.7.2	Maximum compressive force	<p>For group A, to obtain the best possible protection against injury to a skier falling on the impact area <math>A_G</math>, ski-pole shall buckle on its axis under a maximum compressive force of 937 N<sup>1)</sup>, or shall be so designed as to glance off upon impact with the body of a skier. In the case of higher compressive forces the impact area shall be increased so that a surface pressure of 37,5 N/cm<sup>2</sup> is not exceeded.</p> <p>For group B, a surface pressure of 37,5 N/cm<sup>2</sup> is permissible.</p> <p>For group C, no requirement is specified.</p>	<p>Test the shortest ski-pole of one series, taking <math>l_T</math>, as the test length.</p> <p>Carry out the test quasi-statically between two parallel plates, and with the pole fixed centrally, to a tolerance of <math>\pm 2</math> mm (see figure 7).</p> <p style="text-align: right;">Dimensions in millimetres</p>  <p style="text-align: center;">Detail Y</p> <p><b>Figure 7 – Test arrangement for the determination of the maximum compressive force</b></p> <p>In the case of ski-poles with other safety features to glance off the direction of fall, determine the maximum compressive force on the end surfaces of the test samples at the moment of impact from a released falling weight.</p>

1) Racing poles are excluded (see clause 1).

No.	Property	Requirement	Method of test
7.7.3	Point of buckling	In the test the ski-pole shall neither break into two parts nor splinter dangerously when compressed to $\frac{2}{3} l_H$ .	Test in accordance with figure 6.
7.8	Basket	<p data-bbox="586 466 913 541">The dimensions of <math>d_B</math> and <math>l_B</math> (see figure 2) shall be chosen to fulfill 7.9.2.</p> <p data-bbox="586 570 913 696">The basket on the ski-pole shall withstand without fracture a surface force corresponding to the following forces in the direction <math>-z</math> at a temperature of <math>-20\text{ }^\circ\text{C}</math>:</p> <p data-bbox="606 712 762 763">group A: 750 N; group B: 600 N.</p>	<p data-bbox="944 466 1094 493">Test as in 7.9.2.</p> <p data-bbox="944 570 1456 674">Carry out the test quasi-statically at a temperature of <math>-20\text{ }^\circ\text{C}</math> on one test sample each in accordance with figure 8 (direction <math>-z</math>) and figure 9 (direction <math>z</math>) in the case of 7.8.3.</p> <p data-bbox="1213 703 1456 725">Dimensions in millimetres</p>  <p data-bbox="967 1223 1421 1300"><b>Figure 8 – Test arrangement for the basket and basket fixing in the direction of compression</b></p>
7.8.3	Basket fixing	<p data-bbox="582 1322 907 1448">The fixing of the basket shall withstand forces according to 7.8.2 without fracture in both directions <math>z</math> and <math>-z</math> at a temperature of <math>-20\text{ }^\circ\text{C}</math>.</p> <p data-bbox="582 1464 907 1537">During the resistance test the movement of the basket on the shaft shall not exceed <math>\pm 3\text{ mm}</math>.</p>	<p data-bbox="1213 1331 1456 1353">Dimensions in millimetres</p>  <p data-bbox="931 1913 1444 1968"><b>Figure 9 – Test arrangement for the basket fixing in the direction of the tensile force</b></p>

No.	Property	Requirement	Method of test
7.8.4	Anti-catching design of basket	<p>If there is neither a strapless grip nor a release function strap it shall be possible to pass the basket through a gap with a maximum force according to 7.6.3 at <math>-20\text{ }^{\circ}\text{C}</math> (see figure 10).</p> <p>The basket pattern shall be designed to avoid catching.</p>	<p style="text-align: right;">Dimensions in millimetres</p>  <p style="text-align: center;">Figure 10 – Gap for testing the basket</p>
7.9 7.9.1	<p>Tip</p> <p>Minimum area</p>	<p>To reduce the danger of penetration, the section of the tip of the pole, measured perpendicular to the axis of the ski pole at a distance of</p> <ul style="list-style-type: none"> <li>group A: 2 mm;</li> <li>group B: 2 mm;</li> <li>group C: 1 mm;</li> </ul> <p>for the extreme point, shall have a minimum area of <math>50\text{ mm}^2</math></p>	<p>Dimensional test.</p>

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