# INTERNATIONAL STANDARD

ISO
1146

First edition
1988-02-01

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
ORGANISATION INTERNATIONALE DE NORMALISATION
МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ

# Pyrometric reference cones for laboratory use — Specification

*Cônes pyroscopiques de référence pour emploi en laboratoire — Spécifications*

STANDARDSISO.COM : Click to view the full PDF of ISO 1146:1988

Reference number
ISO 1146 : 1988 (E)

## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

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. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 1146 was prepared by Technical Committee ISO/TC 33, *Refractories.*

It cancels and replaces ISO Recommendation R 1146 : 1969, of which it constitutes a technical revision.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

STANDARDSISO.COM : Click to view the full PDF of ISO 1146:1988

© **International Organization for Standardization, 1988** ●

Printed in Switzerland

# Pyrometric reference cones for laboratory use — Specification

## 1 Scope and field of application

**1.1** This International Standard specifies the characteristics of a standard series of pyrometric reference cones, which are used for determining the pyrometric cone equivalent (refractoriness) of refractory materials, over the temperature range 1 500 to 1 800 °C.

**1.2** The pyrometric reference cones specified in this International Standard are suitable for use in the procedure described in ISO 528, excluding determinations at 1 500 and 1 800 °C.

## 2 Reference

ISO 528, *Refractory products — Determination of pyrometric cone equivalent (refractoriness).*

## 3 Definitions

For the purpose of this International Standard, the following definitions apply.

**3.1 pyrometric reference cone:** A blunt-tipped skew triangular pyramid with sharp edges, of specified shape and dimensions and of such composition that, when mounted and heated under specified conditions, it bends in a known manner with reference to the temperature (see 3.2).

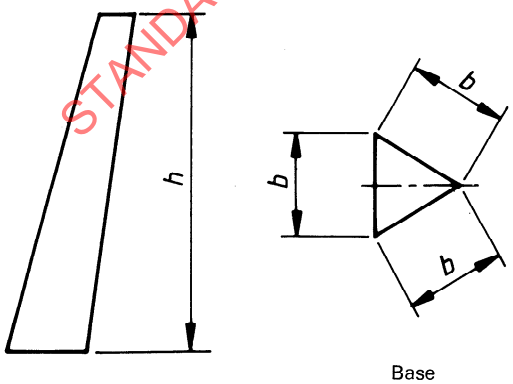
**3.2 reference temperature; temperature of collapse:** The temperature at which the tip of a pyrometric reference cone reaches the level on which the base of the cone is mounted when the cone is heated at a specified rate under specified conditions.

## 4 Dimensions and shape of cones

**4.1** The nominal dimensions of a cone shall be as shown in figure 1.

**4.2** The shape of a cone shall be as indicated in figures 2 or 3.

**4.3** A cone may lean in the direction of an edge, as in figure 2, or in the direction of a face, as in figure 3. The angle to the vertical to be made by the leading edge or face when the cone is mounted, shall be 8 ± 1°.




$h$ = 30 mm
$b$ = 8,5 mm

Figure 1

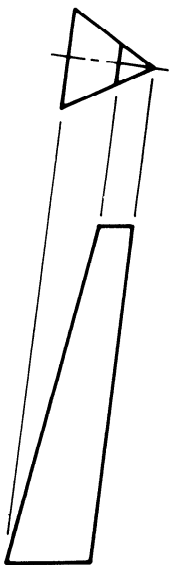


Figure 2

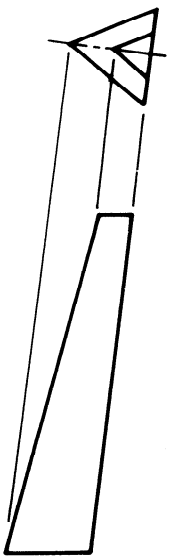


Figure 3

STANDARDSISO.COM : Click to view the full PDF of ISO 1146:1988

## 5 Reference temperatures

Each reference cone shall be of such composition that the temperature of collapse is one of the temperatures shown in table 1, with a tolerance of ± 5 K.

## 6 Rate of heating

Each pyrometric reference cone conforming to this International Standard shall be suitable for heating to its reference temperature at a rate of 2,5 K/min.

**Table 1 — Reference temperatures and cone designations**

| Cone designation | Temperature °C | Cone designation | Temperature °C |
|---|---|---|---|
| ISO 150 | 1500 | ISO 166 | 1660 |
| ISO 152 | 1520 | ISO 168 | 1680 |
| ISO 154 | 1540 | ISO 170 | 1700 |
| ISO 156 | 1560 | ISO 172 | 1720 |
| ISO 158 | 1580 | ISO 174 | 1740 |
| ISO 160 | 1600 | ISO 176 | 1760 |
| ISO 162 | 1620 | ISO 178 | 1780 |
| ISO 164 | 1640 | ISO 180 | 1800 |

## 7 Verification of temperature of collapse

The reference temperature of each batch of cones having the same nominal reference temperature shall be verified for conformity to clause 5 by carrying out the procedure specified in ISO 528 on a sample of the batch. The temperature of collapse shall be determined by a calibrated thermocouple. The sample, to be taken at random from the batch, shall consist of 2 % of the batch with a minimum of two cones.

## 8 Marking

Each reference cone conforming to this International Standard shall be marked with the appropriate cone designation as shown in table 1.

STANDARDSISO.COM : Click to view the full PDF of ISO 1146:1988

# Annex

## Comparison of the properties of different brands of pyrometric reference cones

(This annex does not form an integral part of the Standard.)

**Table 2 — Summary of reference temperatures and cone designations of ISO, Seger, Orton and H.P.C. pyrometric reference cones**

| Reference temperature °C | Seger | H.P.C. | Reference temperature °C | ISO | Seger | Orton | H.P.C. | Reference temperature °C | ISO | Seger | Orton | H.P.C. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 605 | 022 | 022 | 1 315 | | 9 | — | 11 | 1 665 | | | 30 | 30 |
| 650 | 021 | 021 | 1 330 | | 10 | — | — | 1 680 | 168 | 30 | 31 | |
| 675 | 020 | 020 | 1 340 | | — | 12 | — | 1 690 | | | — | 31 |
| 695 | 019 | 019 | 1 350 | | 11 | 13 | 12 | | | | | |
| 715 | 018 | 018 | | | | | | 1 700 | 170 | 31 | 31½ | |
| 735 | 017 | 017 | 1 375 | | 12 | — | 13 | 1 710 | | 32 | | 32 |
| 760 | 016 | 016 | 1 395 | | 13 | 14 | — | | | | | |
| 785 | 015a | 015a | | | | | | 1 720 | 172 | 32½ | 32½ | |
| 815 | 014a | 014a | 1 410 | | 14 | — | 14 | | | | | |
| 835 | — | 013a | | | | | | | | | | |
| 845 | 013a | — | 1 430 | | — | 15 | 15 | 1 730 | — | 33 | — | 33 |
| 855 | — | 012a | | | | | | | | | | |
| 880 | — | 011a | | | | | | | | | | |
| 890 | 012a | — | 1 440 | | 15 | — | — | 1 740 | 174 | 33½ | 33 | — |
| | | | 1 460 | | — | — | 16 | | | | | |
| 900 | 011a | 010a | 1 470 | | 16 | — | — | | | | | |
| | | | 1 480 | | — | — | 17 | 1 750 | | | | 34 |
| 925 | 010a | 09a | 1 490 | | — | 16 | — | 1 760 | 176 | 34 | 34 | — |
| 940 | 09a | 08a | 1 500 | 150 | 17 | — | 18 | | | | | |
| | | | | | | | | 1 770 | | | | 35 |
| 965 | 08a | 07a | 1 510 | — | — | 17 | — | 1 780 | 178 | 35 | | |
| 975 | 07a | 06a | 1 520 | 152 | 18 | 18 | 19 | 1 785 | | | 35 | 36 |
| | | | | | | | | 1 800 | 180 | 36 | 36 | |
| 995 | 06a | 05a | 1 530 | — | — | — | 20 | | | | | |
| 1 010 | 05a | — | 1 540 | 154 | 19 | 19 | — | | | | | |
| 1 020 | — | 04a | | | | | | | | | | |
| 1 040 | — | 03a | | | | | | | | | | |
| 1 055 | 04a | 02a | | | | | | 1 820 | | | 37 | 37 |
| 1 070 | 03a | | 1 560 | 156 | 20 | 20 | — | 1 830 | | 37 | | |
| 1 080 | — | 01a | | | | | | | | | | |
| 1 100 | 02a | 1a | | | | | | 1 835 | | | 38 | |
| | | | | | | | | 1 850 | | | | 38 |
| 1 125 | 01a | 2a | 1 580 | 158 | 26 | — | 26 | 1 860 | | 38 | 39 | |
| 1 145 | 1a | 3a | 1 600 | 160 | 27 | — | — | | | | | |
| 1 165 | 2a | 4a | 1 605 | — | — | 23 | 27 | 1 880 | | 39 | 40 | 39 |
| 1 185 | 3a | 5a | 1 620 | 162 | 27½ | 26 | — | | | | | |
| 1 200 | — | 6a | | | | | | | | | | |
| 1 220 | 4a | — | | | | | | 1 900 | | 40 | | |
| | | | 1 630 | — | — | — | 28 | 1 920 | | | | 40 |
| 1 230 | 5a | 7 | 1 640 | 164 | 28 | 27 | — | 1 940 | | 41 | | |
| 1 250 | — | 8 | | | | | | 1 960 | | | | 41 |
| 1 260 | 6a | — | 1 646 | — | — | 28 | 29 | 1 970 | | | 41 | |
| 1 270 | 7 | — | | | | | | 1 980 | | 42 | | |
| 1 280 | — | 9 | | | | | | 2 000 | | | | 42 |
| 1 295 | 8 | 10 | 1 660 | 166 | 29 | 29 | — | 2 015 | | | 42 | |

STANDARDSISO.COM : Click to view the full PDF of ISO 1146:1988

This page intentionally left blank

STANDARDSISO.COM : Click to view the full PDF of ISO 1146:1988