# INTERNATIONAL STANDARD 2767

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# Surface treatments of metals — Anodic oxidation of aluminium and its alloys — Specular reflectance at 45° — Total reflectance — Image clarity



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## 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 2767 was drawn up by Technical Committee ISO/TC 79, *Light metals and their alloys,* and circulated to the Member Bodies in April 1972.



It has been approved by the Member Bodies of the following countries :



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| Austria | Ireland | Sweden |
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Japan



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# Surface treatments of metals — Anodic oxidation of aluminium and its alloys — Specular reflectance at 45° — Total reflectance — Image clarity

## 1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies a method of non-destructive measurement of specular reflectance at 45°, of total reflectance and of image clarity of all flat surfaces obtained by anodizing on aluminium and its alloys.

## 2 MEASUREMENT OF SPECULAR REFLECTANCE AT 45°, USING THE GLOSS HEAD

The method is applicable to bright surfaces and to surfaces which are less bright.

### 2.1 Apparatus

The arrangement of the optical system of the gloss head is shown in Figure 1.

The light from a frosted 3 W bulb, energized by a constant voltage source, illuminates a 1,5 mm diameter aperture at the focus of the lens. The resulting parallel beam of light is reflected from the surface of the specimen held flat against the base of the instrument. Angles of incidence and reflection are 45°. The reflected light is brought to a focus by a second lens, forming an image of the illuminated aperture on a hole in an orifice plate. The light emerging falls on a photoelectric cell and its intensity is measured with a galvanometer the sensitivity of which may be adjusted by a variable shunt.

The lenses are cemented achromatic doublets, of a relative aperture not exceeding *f*/3.

The photoelectric cell shall be mounted sufficiently far from the orifice plate for the illuminated area to be about 19 mm diameter.

The position of the illuminated aperture shall be adjustable for proper focussing and alignment. If, as shown in the Figure 1, this aperture is a hole in a cylindrical cap over the bulb, the base of the lampholder shall have three adjustment screws.

### 2.2 Preliminary adjustment

Adjust the illuminating system to provide an evenly illuminated, sharply focussed circular spot of light at 3 m distance.

Place a sheet of plain glass on the base of the instrument. Through this sheet the orifice plate can be observed and the aperture aligned so that its image exactly coincides with the hole in the orifice plate.

Adjust the aperture with each screw in turn to obtain maximum indication of the galvanometer.

### 2.3 Calibration

The reference surface is the hypotenuse face of a 45° right-angle prism with total internal reflection. The absolute specular reflectance must be known, say *n* %[1].

To carry out the calibration, the hypotenuse face of the prism shall be placed in contact with a plane sheet of anodized aluminium, and the gloss head placed over the prism (without touching it). The galvanometer sensitivity shall be adjusted to give an indication of *n* units on the scale.

### 2.4 Measurement

The reflectance of the sample shall be measured by placing the gloss head in contact with the surface under test. Note the galvanometer reading. Take at least four readings on each specimen, two each in two directions at right angles, and record the mean value.

### 2.5 Accuracy

Repeated mean readings on the same surface shall not differ by more than ± 1%.

### 2.6 Extension of the method to surfaces which are less bright

In this case, substitute for the prism with total internal reflection a reference sample agreed between the interested parties.

## 3 TOTAL REFLECTANCE MEASUREMENT WITH THE P.R.S. HEAD (Photometric Reflectivity System)

The method is applicable to bright surfaces and to surfaces which are less bright.



1) Dimensions of a suitable prism are : 25 mm × 25 mm × 35,3 mm. It shall be of hard crown glass, with a refractive index within the range 1,5 to 1,52 and an absorption for visible light of 1,5 to 2 % over a path length of 25 mm. Its specular reflectance factor shall be within the range 89,5 to 90,5 %, which may be taken as 90 %, an acceptable figure for the precision of the apparatus.

### 3.1 Apparatus

The instrument, illustrated in Figure 2, consists essentially of a circular photoelectric cell (about 45 mm diameter), with a central hole about 8 mm diameter, which is held parallel to the test surface and a short distance away, about 5 mm, by means of a suitable mounting. The circular aperture is illuminated by means of a 3 W lamp, energized by a source of constant voltage, and a diffusing screen. The photoelectric cell is connected to a suitable galvanometer fitted with a variable shunt.

In the original instrument, various filters may be interposed between the lamp and the diffusing screen by means of a rotating wheel. For this measurement, it is recommended to use a neutral filter to avoid overloading the galvanometer.

### 3.2 Calibration

After switching on the lamp, the instrument shall be placed on a freshly-scraped block of pure magnesium carbonate; the galvanometer sensitivity shall be adjusted to 100 units on the scale. Alternatively, a surface of white vitreous enamel or opal glass of known total reflectance may be employed as a secondary standard. The galvanometer reading shall be adjusted to the appropriate value. These secondary standards shall be checked periodically against a magnesium carbonate block.

### 3.3 Measurement

The instrument shall be placed on the flat test surface, and the total reflectance read directly as a percentage of that of magnesium carbonate. Take four readings at different points on the surface, and record the mean value.

### 3.4 Accuracy

Repeated mean readings on the same surface shall not differ by more than ± 1 %.

### 3.5 Expression of results

The specular reflectance at 45° and the total reflectance, measured with a gloss head and with a P.R.S. head, shall not be less than a value to be agreed between the interested parties with reference to a previously agreed sample.

## 4 IMAGE CLARITY TEST WITH THE GARDAM GRID

The method is applicable only to bright surfaces.

### 4.1 Apparatus

The apparatus, illustrated in Figure 3, consists of a Gardam grid in the form of an oblong box open at one side which can be filled in with a glazed screen suitably squared in black. This is illuminated by a strip light of frosted or pearl glass.

Two grids may be used, one a coarse grid of 9,5 mm pitch, the other a fine grid of 3,2 mm pitch. The latter is preferable for specimens of good image clarity, the former for those having bad image clarity.

The measurement of the image clarity can be carried out also by a photographic method.



### 4.2 Procedure

The operator shall hold the surface to be examined in his hand and move away from the grid until he can no longer clearly resolve the grid pattern as reflected in the surface of the specimen. (The operator must have normal eyesight or corrected normal vision.) Then measure the distance from the operator to the grid. This distance is proportional to the image clarity of the specimen.



### 4.3 Expression of results

The image clarity, measured by means of the Gardam grid or an instrument of similar design, shall not be less than a minimum value agreed between the interested parties with reference to a previously agreed sample.

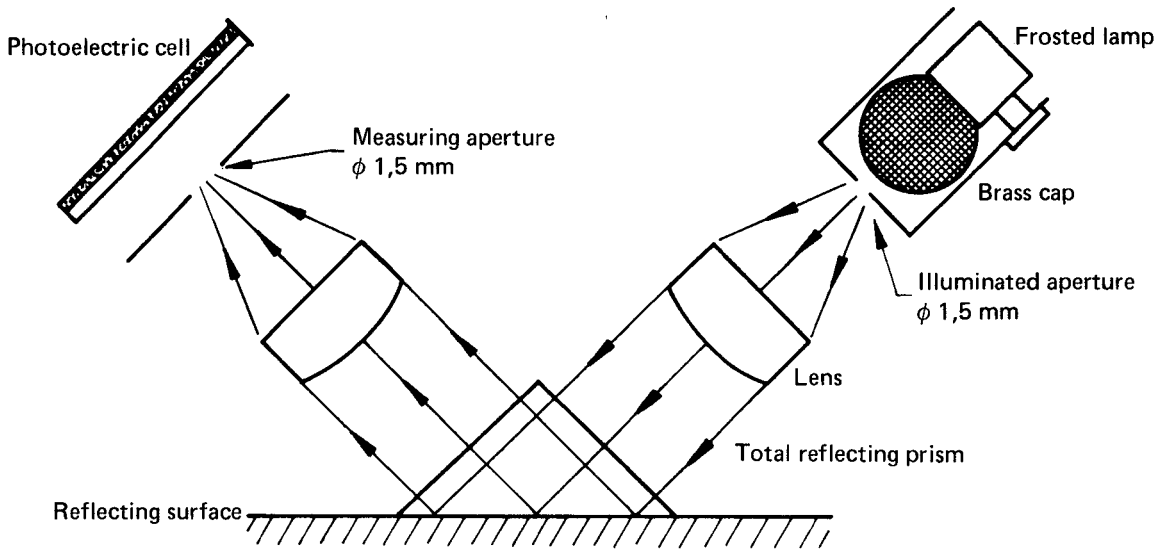



FIGURE 1 – **Layout of the optical system of the gloss head**



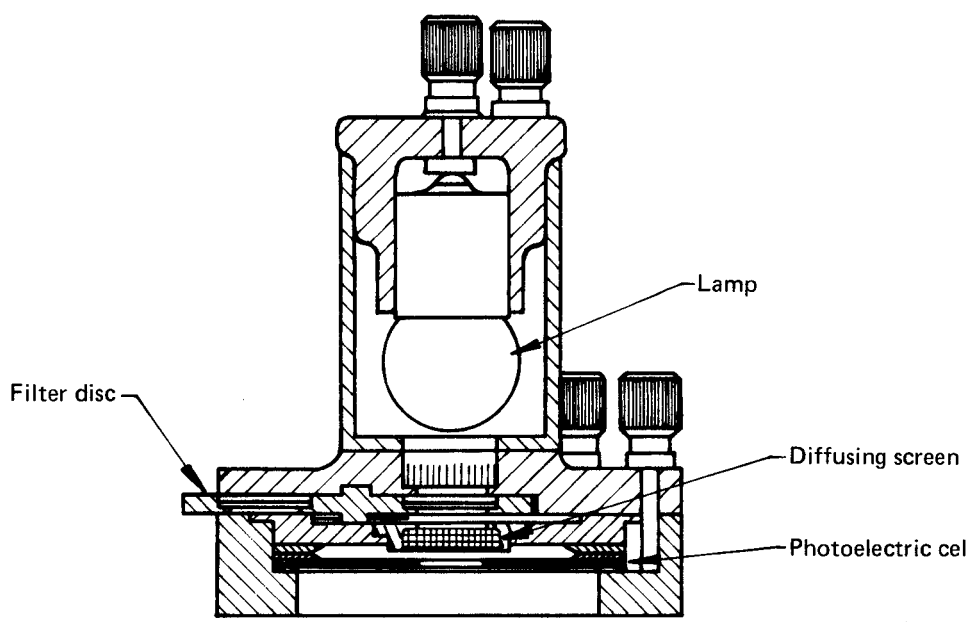
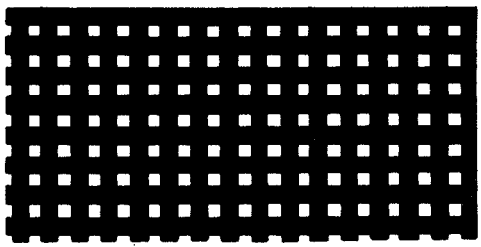
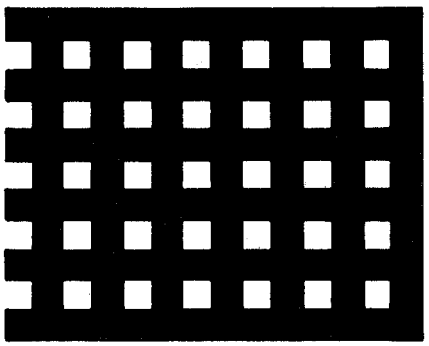



FIGURE 2 – **P.R.S. head**



3,2 mm grid



9,5 mm grid

Dimensions in millimetres

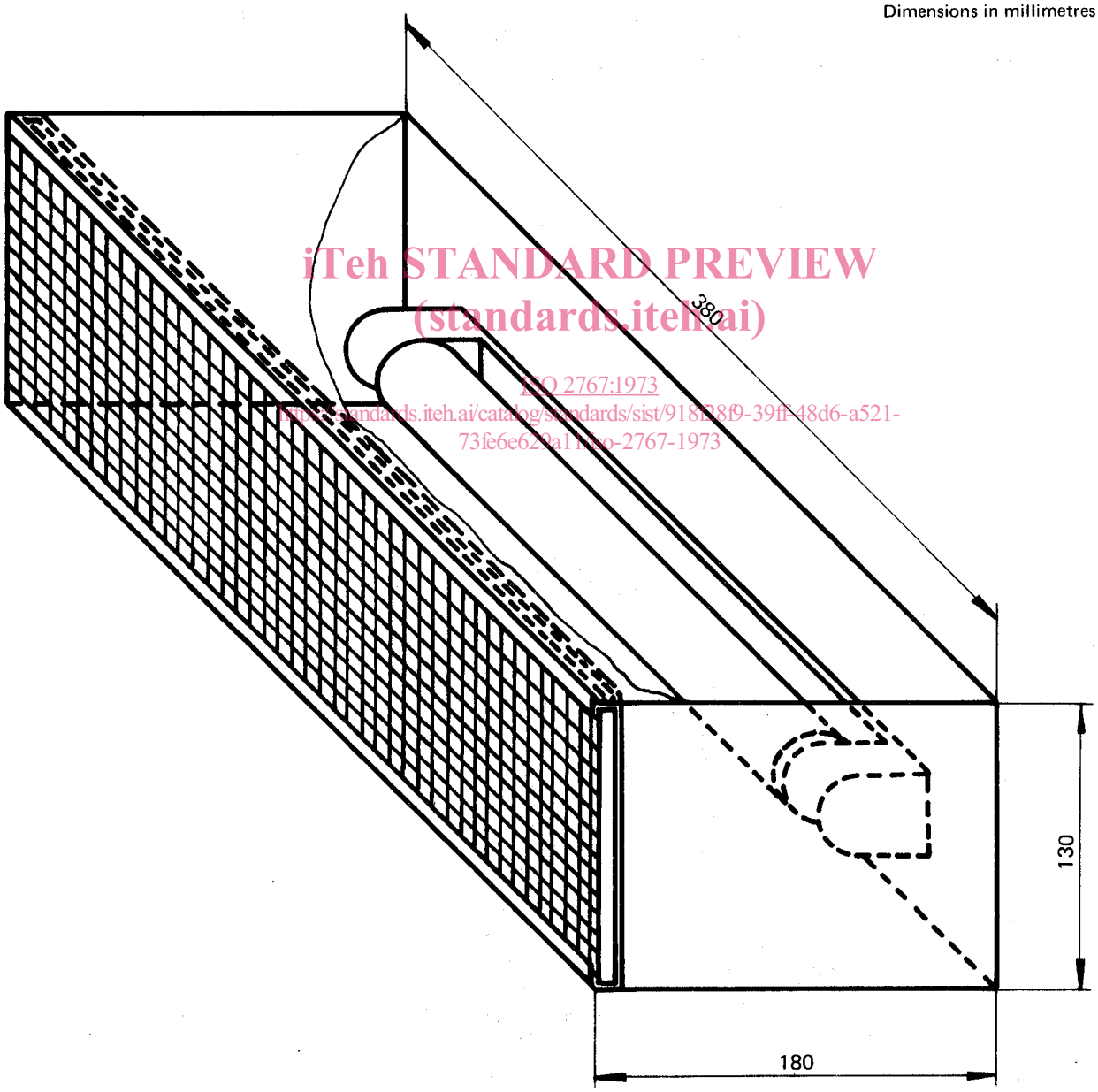





FIGURE 3 — **Gardam grid**