INTERNATIONAL STANDARD

ISO 7451

Second edition
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Earth-moving machinery — Volumetric ratings for hydraulic excavator buckets and backhoe loader buckets

Engins de terrassement — Évaluations volumétriques des godets de pelles hydrauliques travaillant en rétro

Reference number
ISO 7451:1997(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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 7451 was prepared by Technical Committee ISO/TC 127, *Earth-moving machinery*, Subcommittee SC 1, *Test methods relating to machine performance.*

This second edition cancels and replaces the first edition (ISO 7451:1983), which has been technically revised.

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Earth-moving machinery — Volumetric ratings for hydraulic excavator buckets and backhoe loader buckets

1 SCOPE

This International Standard specifies a method for estimating the volume of materials which a hoe-type bucket of an excavator or backhoe loader can normally contain (see figure 1). The volume assessments are based on the internal dimensions of the bucket and on the representative volumes at the top of the bucket.

The method employs the technique of dividing the complex shape of the material in the bucket into simple geometric shapes.

This method of assessment is intended to provide a conventional means of comparing bucket capacities. It is not intended to be used to define true capacities.

This International Standard is not applicable to buckets of rope-operated excavators.

2 DEFINITIONS AND SYMBOLS

2.1 bucket components: Components as shown in figure 2.

2.2 *X* dimension: Distance between the cutting edge (or face) of the leading edge and the contact edge of the horizontal plane on the backsheet (see figures 6 and 7).

2.3 *Y* dimension: Maximum depth of the indentation, perpendicular to the horizontal plane.

2.4 strike plane: Horizontal plane extending over the width of the bucket from the face of the leading edge to the contact edge between the horizontal plane and the backsheet (see figure 6).

2.5 strike surface: Cylindrical surface of radius *R* which traverses the edges of the strike plane (face of the leading edge and contact edge of the backsheet) and which is tangential to a plane parallel to the strike plane and at a distance *Y* (see figure 7).

2.6 struck volume, V_s: Volume which lies beneath the strike plane or the strike surface.

2.7 top volume, V_t: Volume of the material with a 1:1 inclination which is situated above the strike plane.

2.8 volumetric rating, V_r: Volume determined by the method detailed in this International Standard which provides a means of comparing the capacities of buckets.

2.9 W **dimension:** Internal width at the centre of gravity of the bucket section in question.

2.10 W_4 **dimension:** The mean between the width of the backsheet level with the edge in contact with the horizontal plane and the inside width of the leading edge increased by twice the thickness of the sides.

3 RESTRICTIONS AND LIMITATIONS

The effect of the volumes of projecting parts such as tooth supports, removable tips, side height extensions, side cutters, and holes or gussets shall be ignored.

The shielding of the leading edge shall be taken into consideration when calculating the volume of the bucket, taking into account the true indentation (see figure 3).

The V values of the leading edge shall be taken into consideration for an h value corresponding to the centre of gravity of the projecting surface (see figure 4), taking into account the true indentation.

The bucket shall be positioned in such a manner that the plane defined by the cutting edge (or face) of the leading edge and the contact edge of the backsheet is horizontal (see figure 5).

4 CALCULATION

4.1 Struck volume, V_S

The struck volume is calculated as follows.

When the ratio X/Y is ≥ 12 the strike plane is used, and then

$$V_s = S_1 \cdot W_1 \quad \text{(see figure 8)}$$

When the ratio X/Y is < 12 the strike surface is used. This provides a penalisation of the struck volume so as to take the indentation into account. Then,

$$V_s = S_1 \cdot W_1 \, (1 - Y/X) \quad \text{(see figure 9)}$$

4.2 Top volume, V_t

The Y indentation shall not be taken into consideration for the calculation. The width W_4 shall be taken into consideration for the calculation.

The top volume is calculated as follows.

For narrow buckets where $X \geq W_4$ (see figure 11)

$$V_t = W_4^3/6 + (W_4^2/4)\,(X - W_4)$$

For wide buckets where $X < W_4$ (see figure 11)

$$V_t = X^3/6 + (X^2/4)\,(W_4 - X)$$

5 EXPRESSION OF THE VOLUMETRIC RATINGS

5.1 Volumetric ratings of a bucket

This is the sum of the volume of the bucket and that of the top:

$$V_r = V_s + V_t$$

The volumetric rating shall be expressed, according to preference, in cubic metres or in litres and published as a rated capacity in accordance with this International Standard.

5.2 Designation of the commercial capacity

It shall not exceed an interval of ± 3 % in comparison with the calculated value.

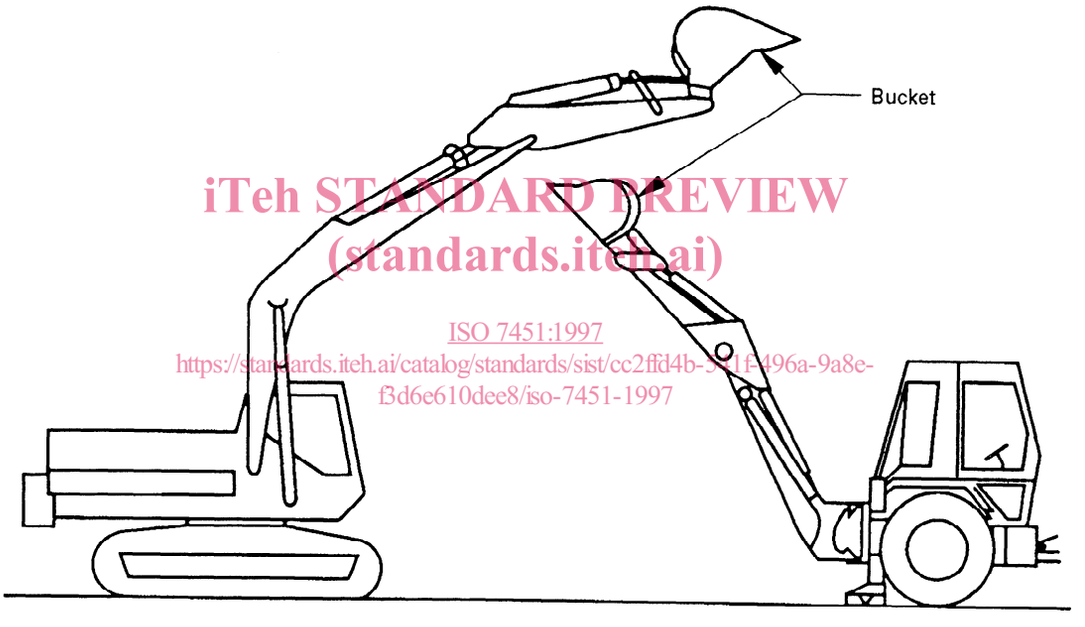


Figure 1 — Hoe-type hydraulic excavator and backhoe loader

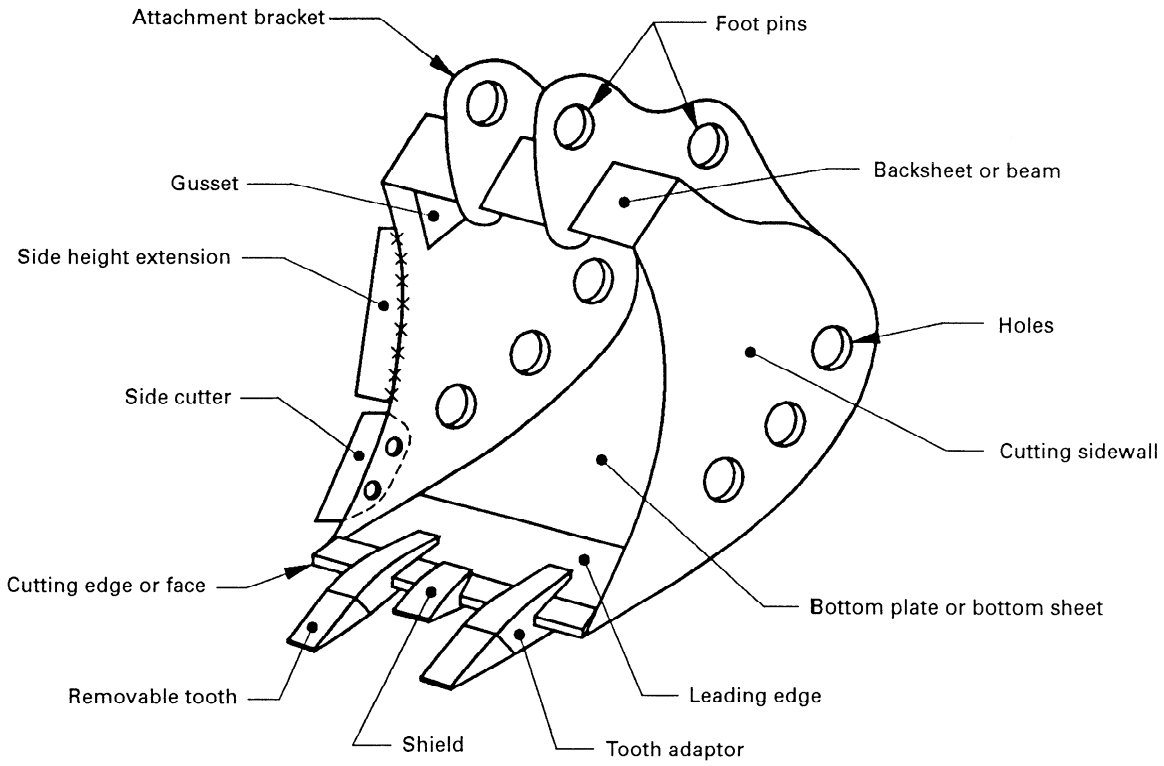


Figure 2 — Terminology of bucket components

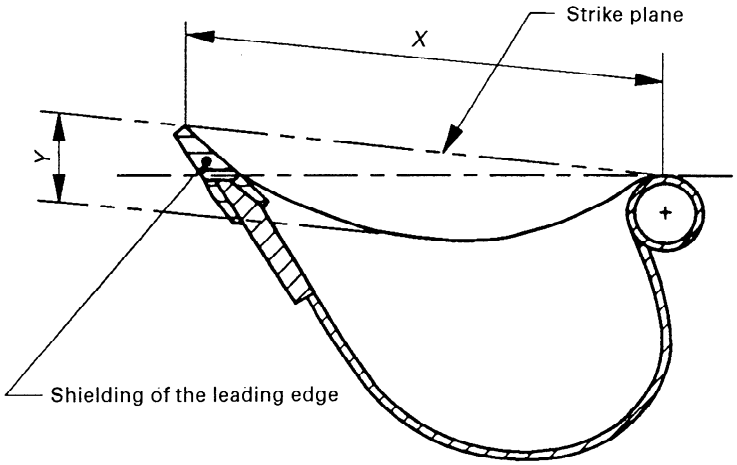


Figure 3 — Relationship between shielding of leading edge and strike plane

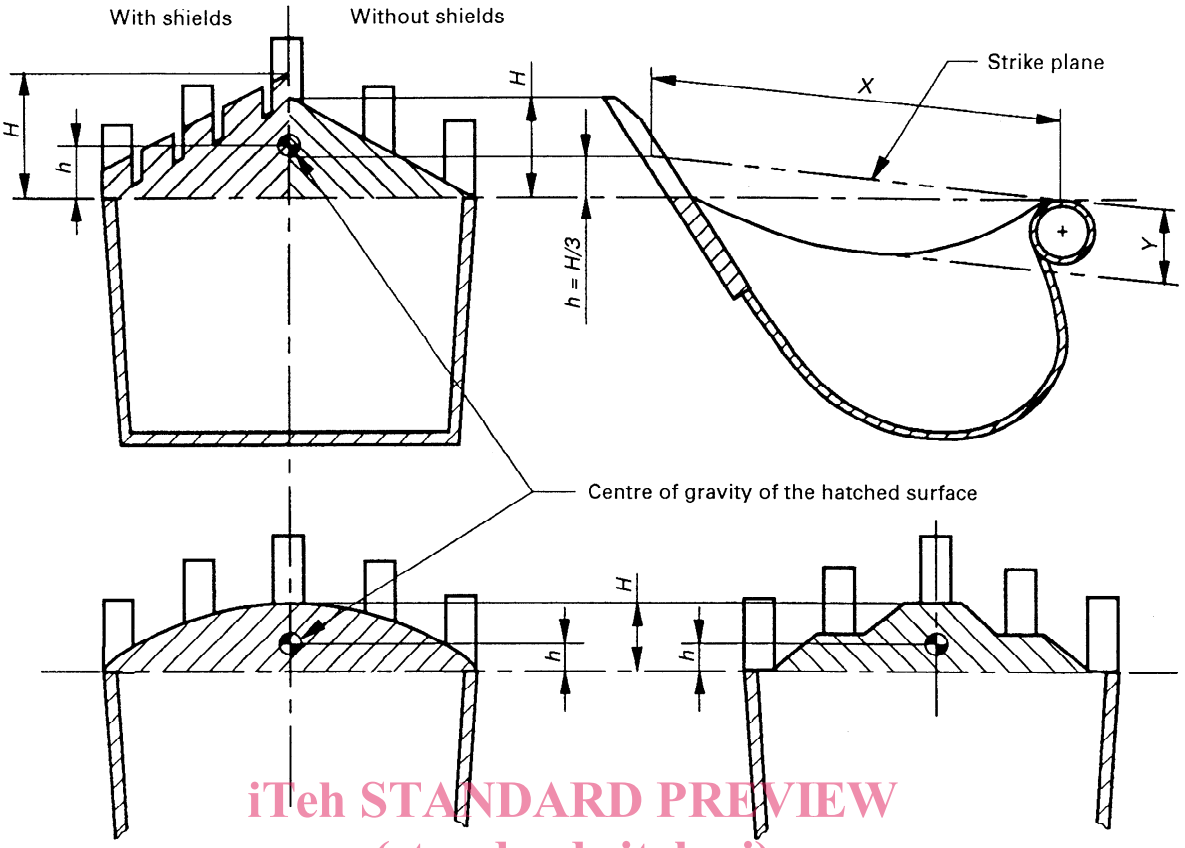


Figure 4 — Effect of leading edge shape on h value

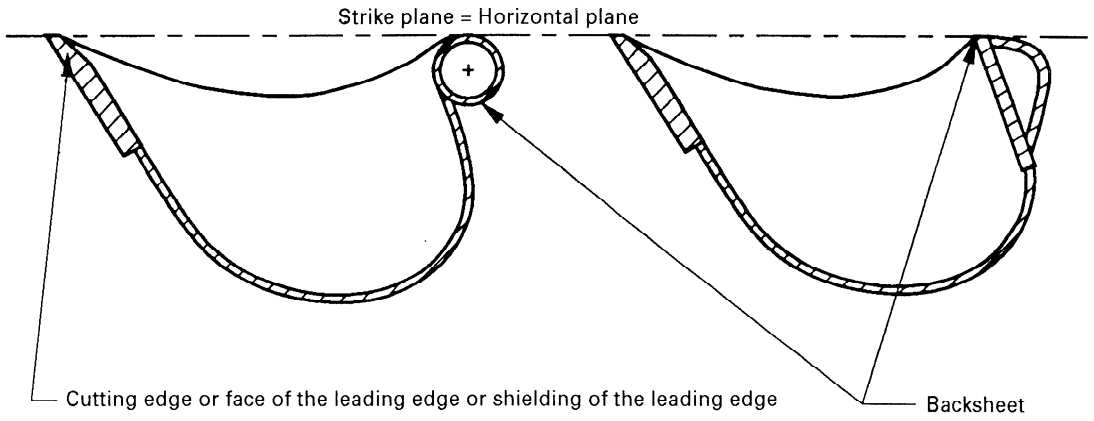
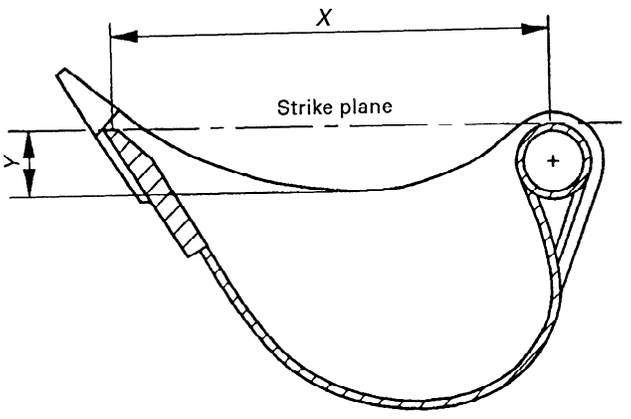
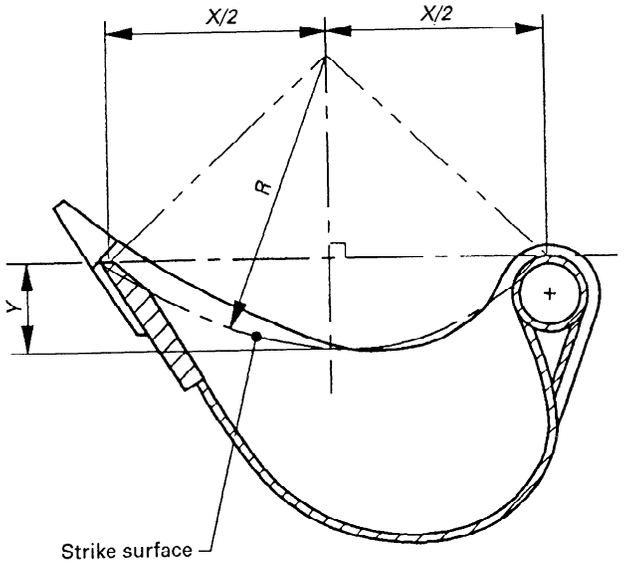


Figure 5 — Establishment of bucket position relative to the horizontal plane



$$\frac{X}{Y} \geqslant 12$$

Figure 6 — Location of the X dimension



$$R = \frac{1}{2}Y + \frac{X^2}{8Y}$$

Figure 7 — Location of the Y dimension

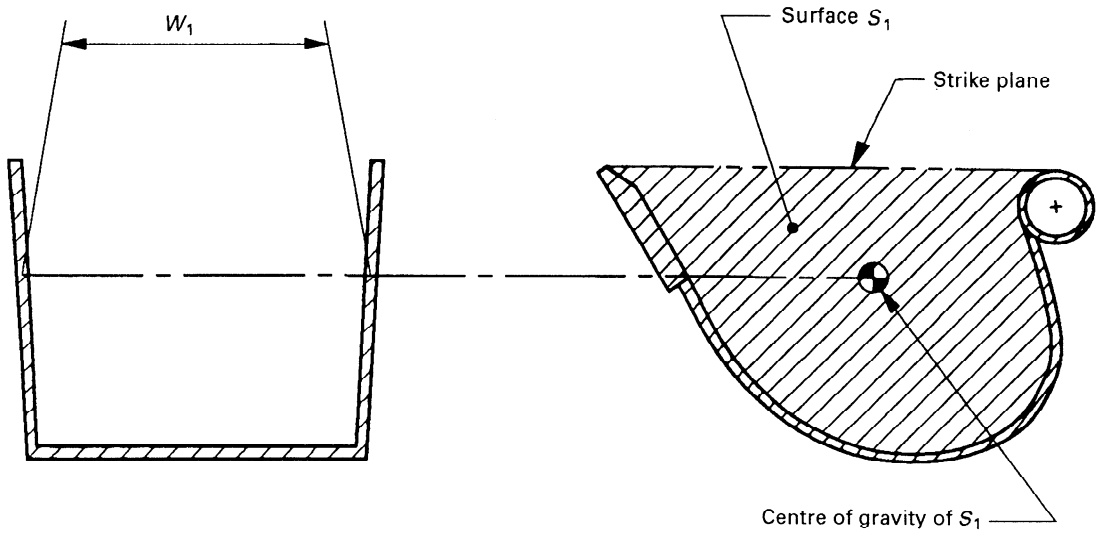


Figure 8 — Establishment of the W dimension when $\frac{X}{Y} \geqslant 12$

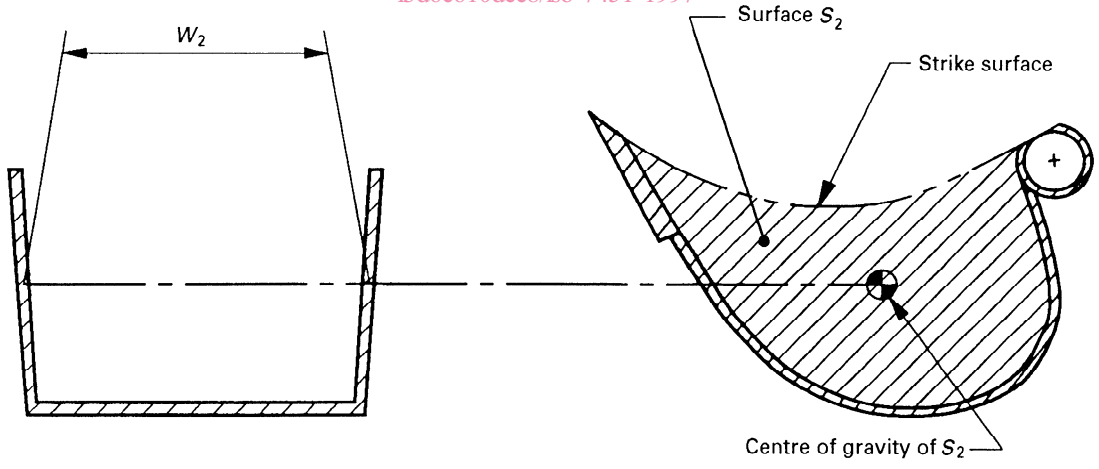


Figure 9 — Establishment of the W dimension when $\frac{X}{Y} < 12$