



## Bucket Rating Hydraulic Excavators

The following method of calculating the capacity of Buckets for Hydraulic Excavators is representative of the method used by most O.E.M. Heavy Equipment Manufacturers. Similar methods are used for Rating Buckets for Wheel Loaders.

Our page, Buckets for Hydraulic Excavators shows samples of some of the many different shapes and style of buckets. Our section Hydraulic Excavator Bucket Terminology defines some of the many terms used in discussing these products.

The Society of Automotive Engineers publishes standards that define Bucket Capacities for Wheel Loaders and other machines. For detailed information contact *SAE* directly on their Web site and ask for:

- **SAE Standard J296 - "Excavator Hoe Bucket Rating"**

### EXCAVATOR HOE BUCKET RATING

1. Purpose – The purpose of this standard is to provide a uniform method for determining the SAE rated capacity for hoe buckets. The calculations are based on the inside physical dimensions for the bucket only, without use of optional side cutters, spill guards, teeth, or other accessories and without regard to bucket action provided by any specific machine.

2. Scope – This standard applies to hoe buckets on all excavators with a hoe attachment.

#### 3. Definitions

3.1 SAE struck capacity is the volume of the bucket after it has been struck at the strike plane. The strike plane shall pass through the top back edge of the bucket and the cutting edge. (See Fig.1.)

Variance (whether angular or curved protrusions) of side plates leading edge beyond the strike plane, dimension  $C_1$ , shall not be used to increase volume  $V_S$  shall be that bounded by the strike plane and the inside contour of the bucket. If the bucket is open between the mounting holes, this opening shall not be a factor in determining the volume. (See Fig.1)

Variance (whether angular or curved indentations) of the side leading edge from the strike plane, dimension  $C_2$ , should be no greater than  $D/12$  for the purpose of calculating capacity where "D" represents the bucket opening. (See Fig.1)

If dimensions  $C_2$  is greater than  $D/12$ , the volume  $V_g$  must be calculated by using the actual volume

of the bucket when it has been struck across the strike surface. (See Fig.2)

3.2 SAE rated capacity is the sum of the SAE struck capacity and the material heaped on the bucket at a 1:1 angle of repose. (See Fig. 1 and 2.) This in no way implies that the hoe must carry the bucket oriented in this attitude, or that all material will naturally have a 1:1 angle of repose.

$$V_R = V_S + V_E$$

3.3 Definitions of terms used in the equations:

$V_S$  = SAE struck capacity

$V_R$  = SAE rated capacity

$V_E$  = excess material heaped at 1:1 angle of repose

D = bucket opening

3.4 SAE struck capacity shall be according to the following table:

Range of Rated Sizes		Increments	
English	Metric	English	Metric
Under 7 ft <sup>3</sup>	Under 0.2m <sup>3</sup>	.05 ft <sup>3</sup>	0.01 m <sup>3</sup>
7 ft <sup>3</sup> up to 0.5 yd <sup>3</sup>	0.2 up to 0.4 m <sup>3</sup>	1 ft <sup>3</sup>	0.02 m <sup>3</sup>
0.5 up to 3 yd <sup>3</sup>	0.4 up to 2.3 m <sup>3</sup>	0.125 yd <sup>3</sup>	0.1 m <sup>3</sup>
3 yd <sup>3</sup> and over	2.3 m <sup>3</sup> and over	0.25 yd <sup>3</sup>	0.2 m <sup>3</sup>

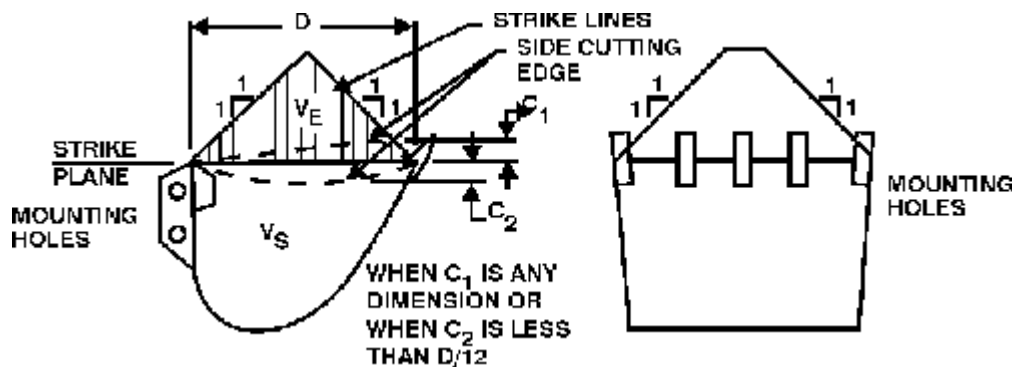
The SAE rated capacity shall be in the same range of rated sizes and increments as for the SAE struck capacity.

If the calculated capacity falls below a rated size by more than 2%, use the next lower rated size.

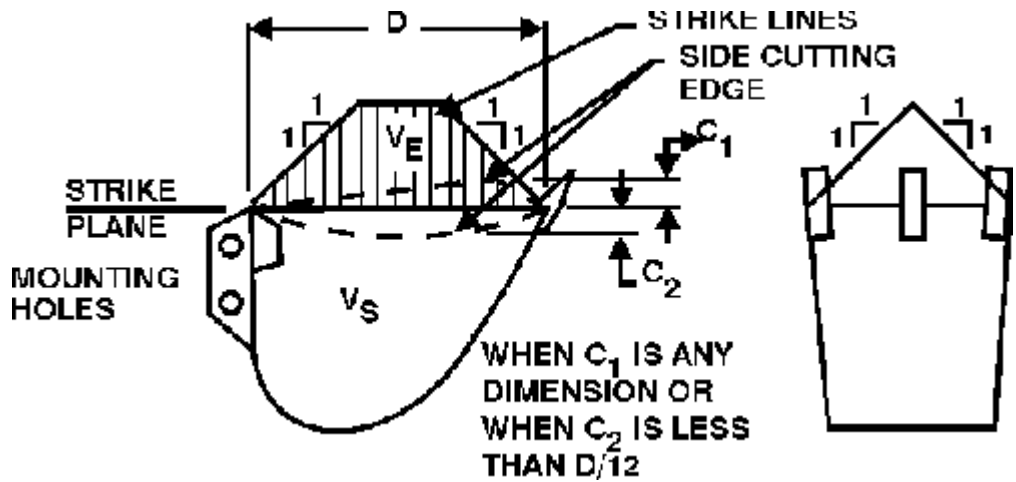
4. Width – When bucket width is specified, both a "bucket width" and a "cutting width" should be stated.

4.1 The "bucket width" is measured over the sides of the bucket at the lower lip without teeth or side cutters attached. (See  $W_B$ , Fig. 3.)

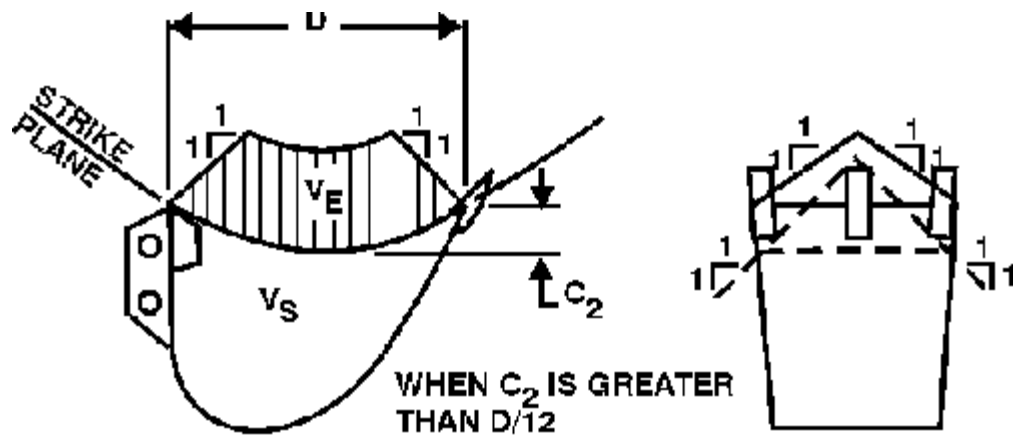
4.2 The "cutting width" is measured over the teeth or side cutters. (See  $W_C$ , Fig. 3.)

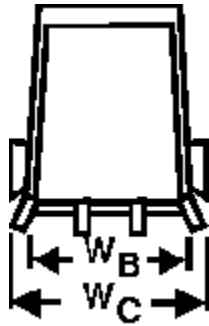


**Fig. 1 - BUCKET CAPACITY, TYPE A**



**Fig. 2 - BUCKET CAPACITY, TYPE B**





**Fig. 3 - BUCKET WIDTH**

## BUCKET PAYLOAD

An excavator's bucket payload (actual amount of material in the bucket on each digging cycle) is dependent on bucket size, shape, curl force, and certain soil characteristics, i.e., the fill factor for that soil. Fill factors for several types of material are listed below.

Average Bucket Payload = (Heaped Bucket Capacity) 2 (Bucket Fill Factor)

<b>Material</b>	<b>Fill Factor Range (Percent of heaped bucket capacity)</b>
Moist Loam or Sandy Clay	<b>A</b> — 100-110%
Sand and Gravel	<b>B</b> — 95-110%
Hard, Tough Clay	<b>C</b> — 80-90%
Rock — Well Blasted	60-75%
Rock — Poorly Blasted	40-50%

**NOTE:** For bucket fill factors for hydraulic excavators, see Bucket Rating - Wheel Loaders section.

