Hydraulic Excavator Lift Capacity Rating — SAE J1097

SAE STANDARD

APPROVED FEBRUARY 1975

SOCIETY OF AUTOMOTIVE ENGINEERS, INC.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

LAND
SEA
AIR
SPACE

Report of the Construction and Industrial Machinery Technical Committee approved February 1975.

1. PURPOSE - The purpose of this standard is to provide a uniform method of rating mobile hydraulic excavator lift capacities.

2. SCOPE - This standard applies to hydraulic excavators which are either crawler or rubber-tire mounted, with or without outrigger members. (An excavator is defined as "a self-propelled machine with an upper structure capable of continuous rotation and which digs, elevates, swings, and dumps material by action of the boom and arm or telescoping boom with bucket.")

3. DEFINITIONS

3.1 GENERAL ITEMS

3.1.1 Load Point - That point specified by the manufacturer on the moveable linkage or bucket to which a load may be attached for lifting purposes. If more than one Load Point is provided, the one having the greatest Load Radius shall be used for rating lift capacities. The Load Point location(s) shall be identified on the Load Rating Chart.

3.1.2 Load Point Height - The vertical distance from thel Load Point to the groundline.

3.1.3 Load Radius - The horizontal distance from the centerline of rotation before loading to the center of the vertical hoist line or tackle with load applied.

3.1.4 Rated Load Bucket Position - That bucket attitude having a vertical line projected from the Load Point tangent, or as near to tangent as the bucket linkage allows, to the back side of the bucket (see Fig. 1). Other Load Point locations and/or bucket attitudes shall be defined.

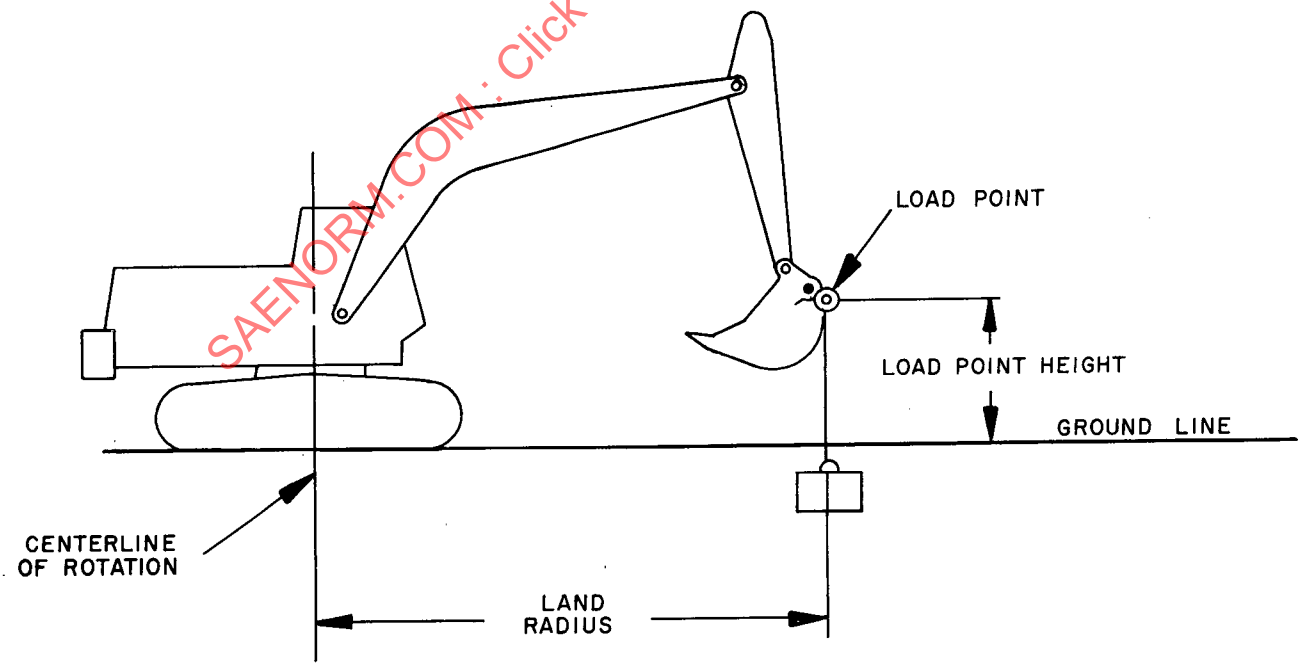

FIG. 1

3.2 TIPPING LOAD - The maximum load that can be lifted from the Load Point with the bucket in the Rated Load Bucket Position and achieve a balance between the load moment acting to overturn the machine and the moment of the machine available to resist overturning.

3.2.1 Side Tipping Line - The tipping line to be used for side tipping calculations on vehicles with crawler undercarriages shall be defined by the pivot points between support rollers and track elements (such as links or guides) at the condition of tipping (see Figs. 2a, 2b, 2c, and 3d). The tipping line to be used for side tiping calculations on vehicles with rubber-tired carrier mountings shall be the centerline of the tires at groundline (see Figs. 2d and 3a) or midpoint between dual tires at groundline when so equipped (see Figs. 2e and 3a).

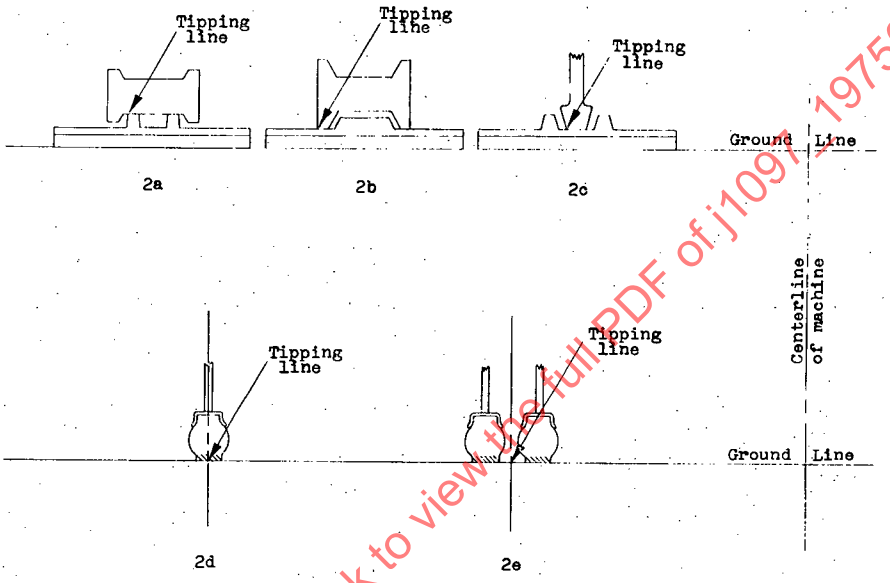

FIG. 2

3.2.2 End Tipping Line - The tipping line to be used for calculation of lift capacities over the front and rear ends of vehicles with rubber-tired carrier mountings shall be the axle centerline, bogie axle centerline, or centerline of outrigger pads as shown in Figs. 3a, 3b, and 3c. For vehicles with crawler undercarriages it shall be the centerline of support idlers, sprockets, or track rollers (see Fig. 3d).

3.2.3 Rated Stability Capacity - 75% of the Tipping Load at any specific position (identified by Load Radius, Load Point Height, and working area), when a balance is achieved about a tipping line. The upper structure shall be rotated such that the horizontal distance from the Load Point to the Tipping Line shall be maximum; and, its rotation shall be specified by identifying the working area (such as: over idlers, over end (b), over LH track, over outriggers one and two, etc.) (See Figs. 3a, 3b, 3c, and 3d). Effective tipping lines for other configurations must be based on vehicle characteristics.

The tipping line for an excavator with oscillating axle shall be a line through the axle pivot point and one other rigid ground support point (see Fig. 3c).

If ratings are based upon a blocked axle, this condition must be clearly defined on the Load Rating Charts and diagrams. Other tipping lines used for side tipping calculations may pass through outrigger pads (see Figs. 3b and 3c). When defined through pivoted outrigger supports, they shall be at groundline directly below the centerlines of the support=to=pad pivots. When defined through rigid outrigger pads, they shall be at groundline through centroids of the pad ground contact areas.

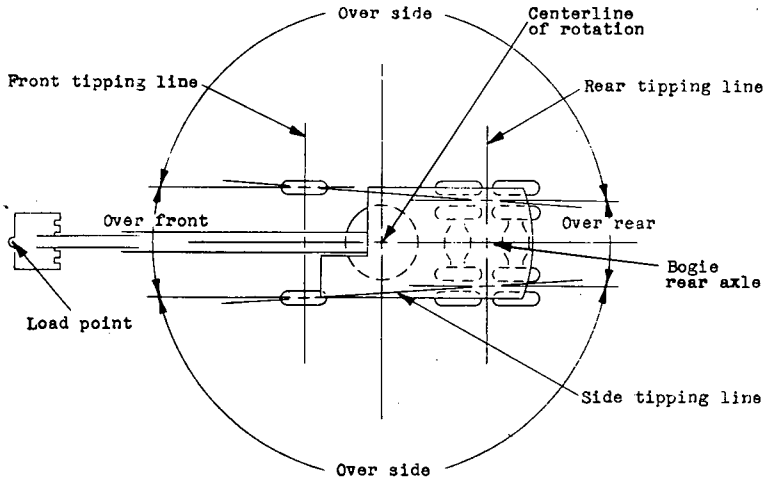

FIG. 3a - RUBBER-TIRED CARRIER, RIGID AXLES

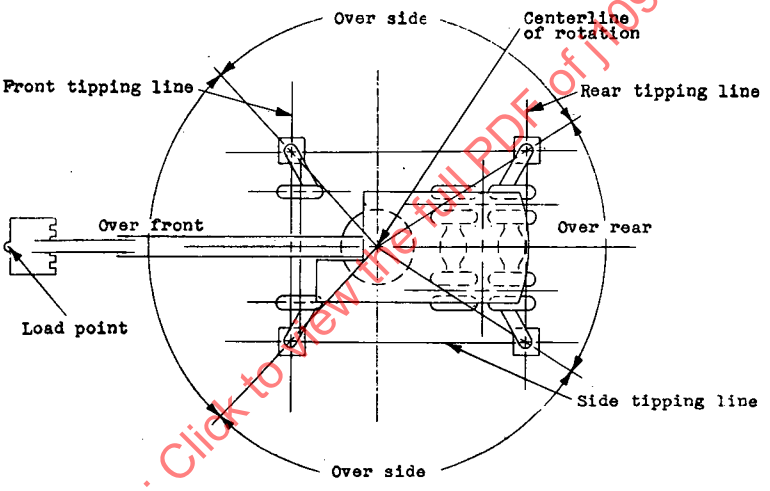

FIG. 3b - RUBBER-TIRED CARRIER, FRONT AND REAR OUTRIGGERS

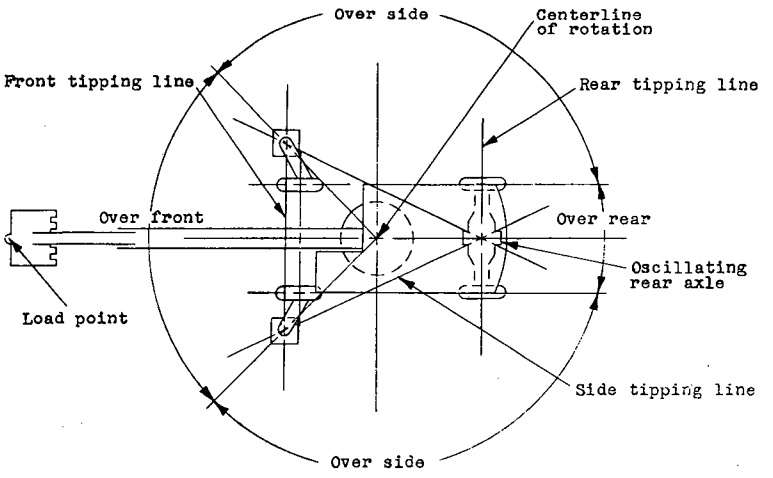

FIG. 3c - RUBBER-TIRED CARRIER, FRONT OUTRIGGERS, REAR OSCILLATING AXLE

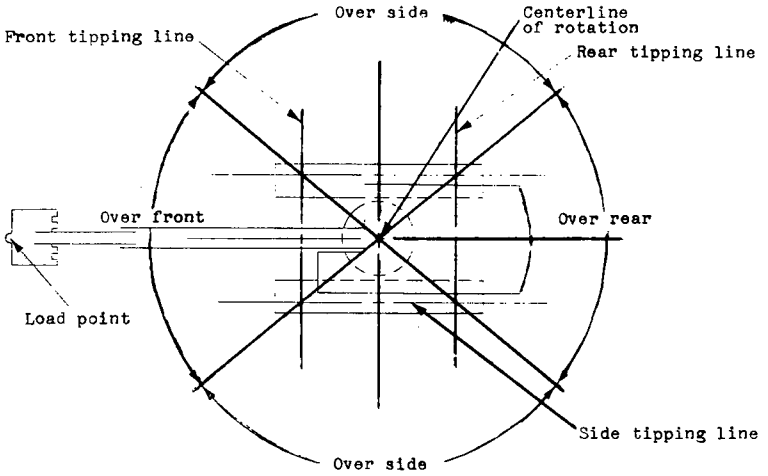

FIG. 3d - CRAWLER UNDERCARRIAGE

3.3 HYDRAULIC LIFT CAPACITY - The maximum load that can be lifted from the Load Point with the bucket in the Rated Load Bucket Position, when applying, in any combination, working relief hydraulic pressures to their respective cylinders. Any implement circuit capable of imposing vertical motion on the Load Point must be able to raise the load a finite distance. Working relief pressure(s) may not be exceeded in any circuit.

3.3.1 Rated Hydraulic Lift Capacity - 87% of the Hydraulic Lift Capacity ay any specific position (identified by Load Point Height and Load Radius).

3.4 RATED LIFT CAPACITY - The smaller of either the Rated Stability Capacity (paragraph 3.2.3) or the Rated Hydraulic Lift Capacity (paragraph 3.3.1). Where the actual hydraulic lift capacity is less than the actual tipping capacity, it shall be so identified by a suitable mark.

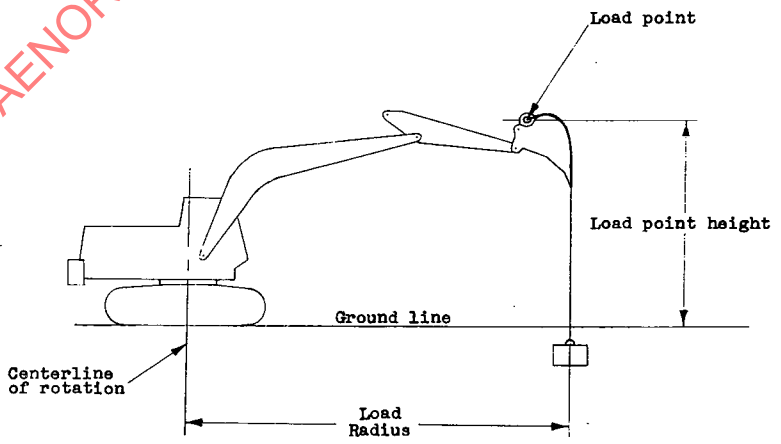

FIG. 4

3.5 MAXIMUM LOAD RADIUS LIFT CAPACITY- that lift capacity determined in the same manner as Rated Lift Capacity; except using a different bucket position. This position shall be one in which the bucket has been opened (permitting the hoise line or tackle to wrap smoothly around the back of the bucket) until the cutting edge is vertical, or as near to vertical as the bucket linkage allows, before the hoise line or tackle has come in contact with any sharp projection on the back of the bucket.

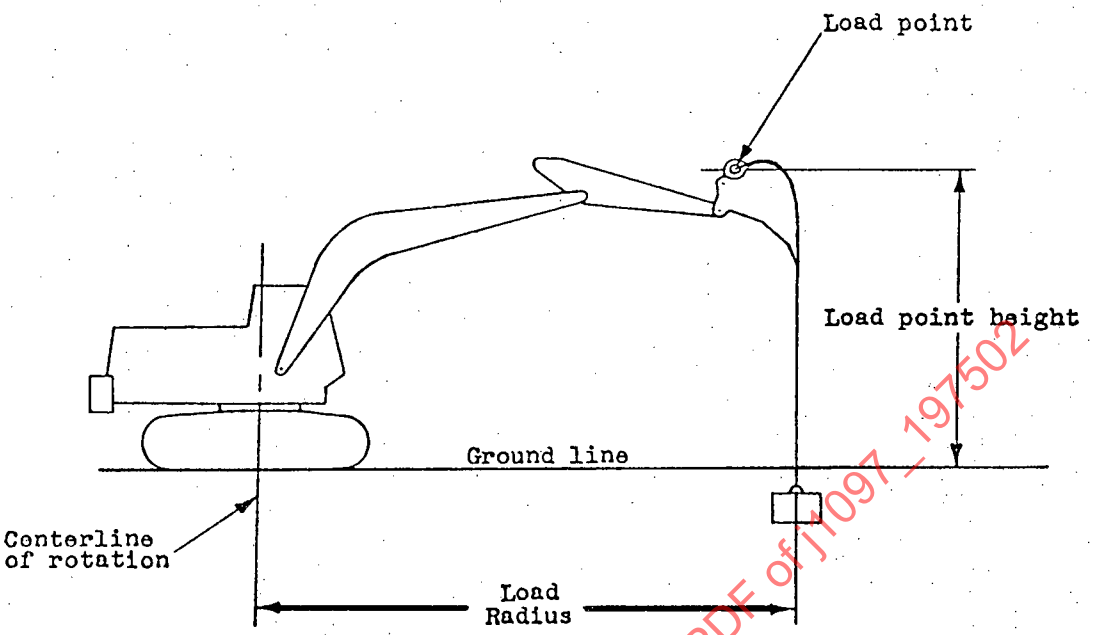

FIG. 5 - LOAD RATING CHART

4. CONDITIONS

4.1 The equipment on the basic excavator shall be specified by the manufacturer on the Load Rating Chart. This same equipment is to be used for digging forces, range diagrams, and other standard specifications.

4.2 If the machine is equipped with any extendable or adjustable support members, their position shall be stated.

4.3 If optional outrigger pads are used, this shall be stated.

4.4 Permissable Variations - Because of the large number of attachment options and other machine variations available, the manufacturer must publish revised Load Rating Charts if these variations would decrease the machine's Rated Lift Capacity by more than 5%.

4.5 All lift capacities shall be determined with the machine level on a firm supporting surface.

4.6 Fuel tank(s) shall be no more than half full.

4.7 The structure of the entire machine must be able to withstand all Rated Lift Capacities with adequate strength margin.

5. LOAD RATING CHARG

5.1 A Load Rating Chart shall be mounted inside the excavator cab, and available to the operator from his position at the controls.

5.1.1 Rated Lift Capacity values shall be tabulated for intersections of the Load Point with a 5 ft (1525 mm) or 10 f (3050 mm) vertically and horizontally spaced grid placed over the excavator's working range with bucket attitude maintained in the Rated Load Bucket Position.

The maximum and minimum Load Radii may also be included even though not located on a grid point. The origin of the grid shall be at the intersection of the groundline and the centerline of rotation.

5.1.2 The Rated Lift Capacities shall be shown on a Load Rating Chart similar to that shown in Fig. 5.

5.1.3 Over-end lift capacities must be determined over the least stable end, and any deviation from this must be clearly marked on the chart and/or graph as a warning to the operator.

5.1.4 Over-the-side lift capacities must be determined over the least stable side, and any deviation from this must be clearly marked on the chart and/or graph as a warning to the operator.

5.1.5 The manufacturer must be able to verify published Rated Lift Capacities by actual tests, with the resulting Rated Lift Capacities determined from test exceeding 95% of the published values.