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SURFACE VEHICLE STANDARD

SAE J1309

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Submitted for recognition as an American National Standard

(R) TRAVEL PERFORMANCE AND RATING PROCEDURE, CRAWLER MOUNTED HYDRAULIC EXCAVATORS, MATERIAL HANDLERS, KNUCKLE BOOM LOG LOADERS, AND CERTAIN FORESTRY EQUIPMENT

***Foreword*—**This Document has not changed other than to put it into the new SAE Technical Standards Board Format.

1. ***Scope*—**This SAE Standard describes a uniform method to calculate and specify travel performance characteristics of hydraulic excavators, material handlers, knuckle boom log loaders, delimbers, feller bunchers, harvesters, processors, and other knuckle boom material handlers. It establishes definitions and specifies machine conditions for calculations and tests. This document applies to crawler mounted machines such as hydraulic excavators as defined in SAE J1057 and ISO 7135, and knuckle boom log loaders as defined in SAE J1209 and SAE J2055. This document also applies to certain forestry equipment defined in SAE J1209 and ISO 6814 that have crawler mountings such as delimbers, feller bunchers, harvesters, and processors. Included in the definition of hydraulic excavators are also front shovel, clamshell, and telescoping boom excavators.

1.1 Purpose—The purpose of this document is to establish a consistent, repeatable means of determining and specifying the travel performance for the types of equipment contained therein.

2. ***References***

2.1 Applicable Publications—The following publications form a part of this specification to the extent specified herein. Unless otherwise specified, the latest issue of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J745—Hydraulic Power—Pump Test Procedure
SAE J746—Hydraulic Motor Test Procedure
SAE J872—Drawbar Test Procedure for Construction, Forestry, and Industrial Machines
SAE J897—Machine Slope Operation Test Code
SAE J1057—Identification Terminology of Earthmoving Machines
SAE J1193—Nomenclature and Dimensions for Hydraulic Excavators
SAE J1209—Identification Terminology of Mobile Forestry Machines
SAE J1349—Engine Power Test Code—Spark Ignition and Compression Ignition Net Power Rating
SAE J2055—Identification Terminology and Component Nomenclature—Knuckle Boom Log Loader

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2.1.2 ISO PUBLICATIONS—Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.

ISO 6814—Machinery for forestry—Mobile and self-propelled machinery—Identification vocabulary
ISO 7135—Earth-moving machinery—Hydraulic excavators—Terminology and commercial specifications

3. Definitions

3.1 Undercarriage—Track gage V_1 (Retracted), and V_2 (Extended), width of crawler track shoe, Y, nominal distance between centerlines of drive sprockets and idlers, J_2, and nominal overall length of track assembly, J_4, as used in this document are defined in SAE J1193, and are specified in millimeters. See Figure 1.

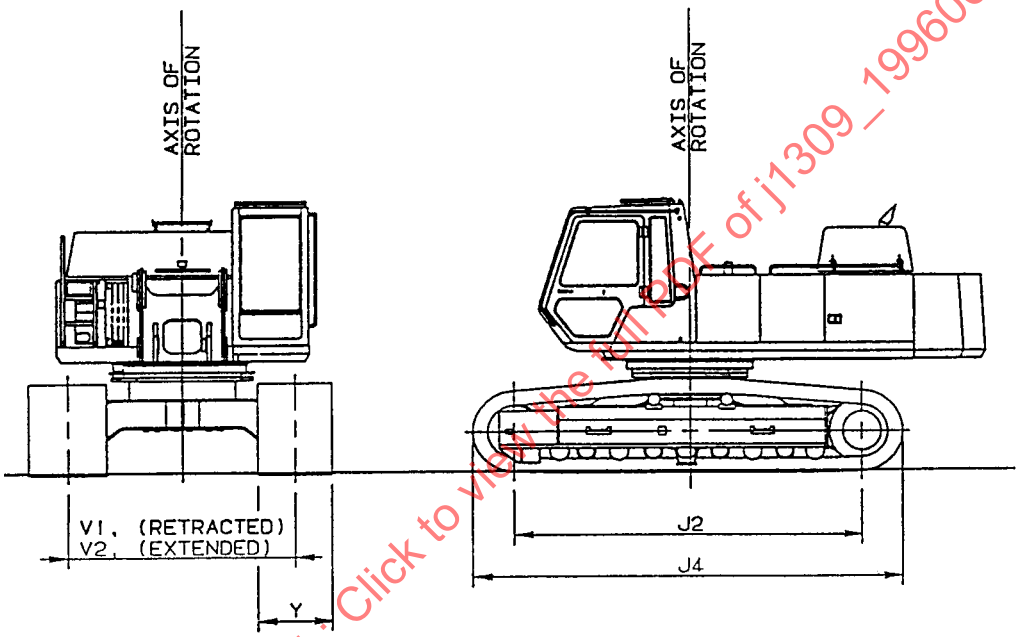

FIGURE 1—UNDERCARRIAGE DIMENSIONS

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3.2 Rated Engine Speed, N_r—As defined in SAE J1349 and specified in revolutions per minute.

3.3 Rolling Resistance, R_R—The force, in Newtons, required to sustain track rotation over a given level surface. It includes losses caused by soil deformation, track chain motion, and the drive sprocket. For the purpose of developing uniform ratings within this document, a value of 6% of the operating mass should be used. This represents a relatively firm soil surface, flexing some under load. R_R shall be determined using Equation 1:

(Eq. 1)

$$R_R = 0.06W$$

where:

W = Operating weight as defined in 3.11

3.4 Pitch Radius, R_P—The pitch radius of the driving sprockets determined using Equation 2:

(Eq. 2)

$$R_P = \frac{(P)(n)}{2\,\Pi}$$

where:

P = Track chain pitch in millimeters
n = Number of track chain pitches advanced past any fixed point on the machine during one revolution of the sprocket.

Pitch radius is specified in millimeters.

3.5 Travel Motor Torque, T_M—The maximum output torque, in Newton-meters, of each hydraulic drive motor, at stall pressure and determined according to SAE J746.

3.6 Hydraulic Pump Delivery, Q_P—The combined output flow, in liters per minute, with the engine at rated engine speed, N_r, of all the pumps supplying oil to hydraulic travel motors, as determined according to SAE J745 and at the hydraulic-pressure differential required to sustain travel motion on a level surface having a rolling resistance equal to that specified in 3.3.

3.7 Travel Motor Speed, S_M—The output shaft rotational velocity, in revolutions per minute, as determined according to SAE J746 at the hydraulic-pressure differential required to sustain travel motion on a level surface having a rolling resistance equal to that specified in 3.3 and with the hydraulic pump delivery, Q_P, divided appropriately among the travel motors.

3.8 Gear Efficiency, E_g—That proportion of power, expressed as a percentage, transmitted through the total gear system. For the purpose of developing uniform ratings within this document an efficiency no greater than 98% should be used for each spur gear mesh or planetary set. E_g is the multiple of all individual gear set and mesh efficiencies.

3.9 Gear Reduction Ratio, R_G—The total gear reduction ratio between the travel motor and the drive sprocket.

3.10 Operating Mass, M—The total mass, specified in kilograms, of a machine equipped and ready to perform its intended function, in standard configuration as defined by the manufacturer. Included in the operating mass is a 75 kg allowance for the operator, full fuel tank, the mass of all oils and greases necessary to fill oil reservoirs and lubrication compartments to the specified levels and the mass of the standard bucket, magnet, grapple, or processing head.

3.11 Operating Weight, W—The weight of the machine, specified in units of force, Newtons, where:

$$W = 9.807M$$

4. Travel Performance Calculations

4.1 Rated Travel Speed, S_N—The travel Speed, at Rated Engine Speed, N_r, for hydrostatically driven machines determined using Equation 3 and specified in kilometers per hour:

(Eq. 3)

$$S_N = \frac{(0.00012\Pi)(S_M)(R_p)}{R_G}$$

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4.2 Rated Drawbar Pull, DBP—The Drawbar Pull for hydrostatically driven machines having two travel motors determined using Equation 4 and specified in Newtons:

(Eq. 4)

$$DBP = \frac{(2000)\,(T_M)\,(R_G)\,(E_g / 100)}{R_p} - R_R$$

Appropriate adjustments must be made to Equation 4 for machines having other than two travel motors.

4.3 Average Ground Bearing Pressure, P_g—The ground bearing pressure determined using Equation 5 and specified in kilopascals:

(Eq. 5)

$$P_g = \frac{(500)\,W}{(Y)\,[J_2 + 0.35\,(J_4 - J_2)]}$$

Equation 5 makes allowance for some penetration into the supporting soft surface and the resulting increase in support area.

4.4 Turnability Index, T—A dimensionless number determined using Equation 6:

(Eq. 6)

$$T = \frac{(OTP)\,(V_1 \text{ or } V_2)}{W\,(J_2)}$$

where:

OTP = One Track Pull in Newtons

The maximum track pull that can be produced by one track while turning machines is generally one half the DBP for hydrostatically driven machines.

4.4.1 On machines where track gage, V_1 and V_2, can be retracted or extended, the position(s) used for the calculation of the Turnability Index shall be specified.

4.4.2 Published Turnability Index values must be accompanied by a statement which acknowledges that the actual ability to turn will depend upon track shoe type and size and surface condition.

4.5 Drawbar Pull to Weight Ratio, D_w—The Drawbar Pull to Operating Weight Ratio shall be determined using Equation 7 and is specified as a dimensionless number:

(Eq. 7)

$$D_w = \frac{DBP}{W}$$

4.6 Gradeability, G_A

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