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Test Procedure for Measuring Hydraulic Lift Capacity on Agricultural Tractors Equipped with Three-Point Hitch

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Submitted for Recognition as
an American National Standard

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OFF-HIGHWAY MACHINERY STANDARD

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TEST PROCEDURE FOR MEASURING HYDRAULIC LIFT CAPACITY ON AGRICULTURAL TRACTORS EQUIPPED WITH THREE-POINT HITCH

1. PURPOSE AND SCOPE:

1.1 The purpose of this document is to establish test procedures for measuring and recording lift capacity referred to in SAE J715 (Reference International Standard ISO 789/II, Test Code for Agricultural Tractors).

1.2 The lift capacity can be determined by section 4, Static Lift Force Test, and/or section 5, Dynamic Lift Capacity Test. When the results are recorded, the test method shall be identified.

2. DEFINITIONS:

2.1 The terms used in this document are defined in SAE J715.

3. GENERAL:

3.1 The accuracy of the measurements shall be as follows:

3.1.1 Time - ±2%

3.1.2 Temperature - ±2°C (4°F)

3.1.3 Pressure - ±2%

3.1.4 Mass (Weights) - ±1/2%

3.1.5 Distance - ±3 mm (1/8 in)

3.2 The hydraulic oil temperature shall be maintained at the value measured in the tractor during a 2 h maximum power PTO test. A hydraulic system oil temperature determined from maximum power drawbar operation shall be used when a PTO test cannot be conducted. These tests, if conducted, shall be in accordance with SAE J708.

3.3 Lift time, if required, shall be recorded as the average of three consecutive lift sequences.

3.4 Measurements and test data shall be recorded as shown in Fig. 2.

3.5 This same procedure shall be used to determine the hydraulic lift capacity of tractors equipped with a quick attaching coupler.

4. STATIC LIFT FORCE TEST:

4.1 With the lower links horizontal, set the mast to 457 mm (18 in) for Category I, to 483 mm (19 in) for Category II, to 559 mm (22 in) for Category III, and to 686 mm (27 in) for Category IV. With the lower links horizontal, adjust the upper link such that the mast is vertical (see Fig. 1).

4.2 A test frame shall be used which provides the mast height for each category in accordance with 4.1 and such that the lower hitch point spread is proper for the category being tested. [Category I, 681.0-684.3 mm (26.81-26.94 in); Category II, 822.5-825.5 mm (32.38-32.50 in); Category III, 963.7-966.7 mm (37.94-38.06 in); Category IV, 1165-1168 mm (45.87-45.99 in)]. The lift force application point shall be 610 mm (24 in) to the rear of the lower hitch point with the lower links horizontal. The construction angle (the angle between the mast and the test frame load arm) shall be 90 deg (see Fig. 1). The center of gravity shall be at a point 610 mm (24 in) to the rear of the hitch points, on a line at right angles to the mast and passing through the middle of the line joining the lower hitch points.

4.3 The tractor shall be rigidly supported at the height from ground level equivalent to the loaded radius of the largest R-1 rear tires and the corresponding largest front tires (see SAE J711). The tire sizes and loaded radii used shall be listed as part of the test data, Fig. 2. If the tractor tested cannot be conveniently supported at this radius, it is permissible to mathematically adjust the readings to the specified largest front and rear loaded radii.

4.4 The tractor should be operated at rated engine speed. The lift force capacity in this procedure shall be based upon the minimum specified system pressure. If the measured system pressure exceeds the value, mathematically adjust the lift force measured to the minimum specified system pressure level.

4.5 The hydraulic lift system's oil temperature shall be determined and maintained as specified in 3.2.

4.6 The tests shall be conducted so that lift force is measured throughout the total lift range as specified in SAE Standard J715. Since the minimum power range is less than the total lift range, links may be adjusted once during the tests to obtain lift force throughout the total lift range. If the links are readjusted to meet the specified lift range, this information shall be recorded.

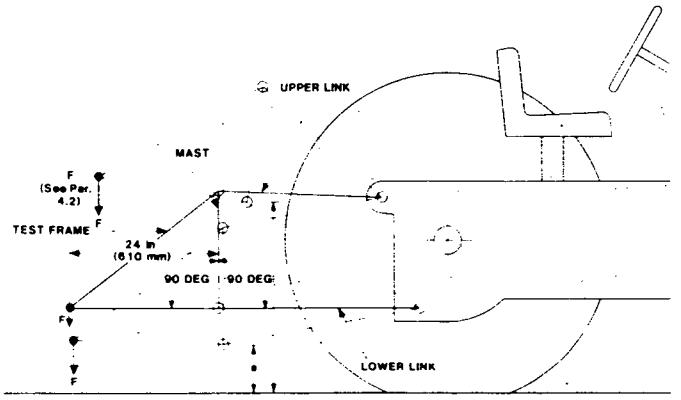

FIGURE 1 – Test Frame

AGRICULTURAL TRACTOR LIFT CAPACITY

1. Tractor Description and Test Conditions:

1.1 Make and Model: _____
1.2 Maximum Drawbar Power SAE J708: _____ kW
1.3 Loaded Radii per Paragraph 4.3: Rear _____ mm, Front _____ mm
1.4 Category of Three-Point Hitch: _____
1.5 Three-Point Hitch Hydraulic System Pressure Setting: _____ kPa
1.6 Three-Point Hitch Hydraulic System Oil Temperature: _____ °C
1.7 Rated Engine Speed: _____ r/min
1.8 Quick-Attaching Coupler Used? Yes _____ No _____

2. Static Lift Force:

2.1 Tractor Static Hydraulic Lift Force (Para. 4.8): _____
2.2 Lift Force per Unit of Drawbar Power (Line 2.1–Line 1.2): _____ N/kW
2.3 Force and Height Measurement (Para. 4.8):

Position of Hitch	Vertical Lift Force, N	Vertical Distance of Lower Hitch Point above Ground, mm
Lowest	_____ N	203 mm
1/5 Point	_____ N	___ mm
2/5 Point	_____ N	___ mm
3/5 Point	_____ N	___ mm
4/5 Point	_____ N	___ mm
Highest	_____ N	___ mm

3. Dynamic Lift Capacity:

	Lift Link at Minimum Length Setting	Lift Link at Maximum Length Setting
3.1 Mass Lifted:	_____ kg	_____ kg
3.2 Lift Time:	_____ s	_____ s
3.3 Height of Lower Hitch Point (Para. 5.5):		
3.3.1 Lowest Position:	_____ mm	_____ mm
3.3.2 Highest Position:	_____ mm	_____ mm

3.4 Linkage Settings Used: (Sketch if Required for Clarity of Hole Positions)
3.4.1 Upper Link Point Hole Position: _____
3.4.2 Lift Link Hole Position: _____
3.4.3 Lower Link Point Hole Position: _____
3.4.4 Lift Link Length Settings: Minimum _____ mm, Maximum _____ mm
3.4.5 Upper Link Length: _____

FIGURE 2 – Test Data

4.7 Tractors equipped with more than one upper link attaching point on the tractor should have the upper link attached to the category position recommended by the manufacturer for heavy draft implements such as mounted plows, etc.

4.8 Measure the vertical force, at static conditions, available from the 610 mm (24 in) point on the test frame and include the weight of the test frame. This vertical lift force shall be measured at not less than 6 points, equally spaced, including the maximum and the minimum points, throughout the total lift range.

4.9 The smallest value determined in 4.8 shall be the tractor static hydraulic lift force.

5. DYNAMIC LIFT CAPACITY TEST:

5.1 A test frame and tractor shall be used as described in 4.2 and 4.7.

5.2 The tractor shall be rigidly supported from ground level as described in 4.3.

5.3 A mass shall be mounted on the frame so that its center of gravity and the frame center of gravity are positioned as described in 4.2. The value determined in 4.8 can be used as a starting point.

5.4 The hydraulic lift system's oil temperature shall be determined and maintained as specified in 3.2.

5.5 The dynamic lift test shall be conducted so that the mass is lifted throughout the total lift range as specified in SAE J715. Since the minimum power range in SAE J715 is less than the total lift range, links may be adjusted once during the tests to assure the mass is capable of being lifted throughout the total lift range. If the links are readjusted to meet the specified lift range, this information shall be recorded in Fig. 2.

5.6 With the manually operated engine governor control set to provide rated engine speed, execute a lift sequence using the mass selected in 5.3. Adjust the mass as necessary to obtain the maximum mass which can be (a) fully lifted through the specified tractor lift range and (b) does not require more than 10 s to move through the minimum power range as specified in SAE J715.

6. CITED STANDARDS:

SAE J708 DEC84, Agricultural Tractor Test Code

SAE J715 JUN88, Three-Point Free-Link Hitch Attachment of Implements to Agricultural Wheeled Tractors

SAE J711 DEC84, Tire Selection Tables for Agricultural and Light Industrial Machines of Future Design

ISO/789/II, Test Code for Agricultural Tractors