Three-Point Free-Link Hitch Attachment of Implements to Agricultural Wheeled Tractors-SAE J715 SEP83

SAE Standard
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PREPRINT

THREE-POINT FREE-LINK HITCH ATTACHMENT OF IMPLEMENTS TO AGRICULTURAL WHEELED TRACTORS—SAE J715 SEP83

SAE Standard

Report of the Tractor Technical Committee, approved April 1959, last revised by the Agricultural Tractor Technical Committee September 1983. Conforms to report of FIEI Advisory Engineering Committee, Chicago, Illinois. Corresponds to ASAE S217.10. This standard is functionally equivalent to ISO 730.

1. Scope—This specification sets forth requirements for the attachment of three-point hitch implements or equipment to the rear of agricultural wheeled tractors by means of a three-point free-link in association with a power lift.

In order to assure proper performance of certain implements, standard dimensions for mast height, mast pitch adjustment, and implement leveling adjustment are included. Location of link attachment points is not restricted and is, therefore, left to the discretion of the tractor designer.

If draft links are used for trailing power take-off implements, a means shall be included for locking the draft links in a fixed position, and a draw-bar hitch point shall be positioned in conformance with power take-off standards.

Dimensions comprising the standard specifications are divided into four ϕ categories:

Category	Maximum Drawbar Power, kW[a]	ϕ
ϕ I	15–35 (20–45 hp)	
ϕ II	30–75 (40–100 hp)	
ϕ III and III-N[b]	60–168 (80–225 hp)	
ϕ IV and IV-N[b]	135–300 (180–400 hp)	

[a] Based on SAE J708, paragraph 2.5.
[b] Refer to Special Hitch Categories, Section 3.

The ϕ symbol is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. If the symbol is next to the report title, it indicates a complete revision of the report.

2. Definition of Terms

2.1 Linkage—The combination of one upper link and two lower links, each articulated to the tractor and the implement at opposite ends in order to connect the implement to the tractor.

2.2 Upper Link, Lower Link—Element in the linkage.

2.3 Hitch Point—The articulated connection between a link and the implement. For geometrical analysis, the hitch point is established as the center of the articulated connection between a link and the implement.

2.4 Link Point—The articulated connection between a link and the tractor. For geometrical analysis, the link point is established as the center of the articulated connection between a link and the tractor.

2.5 Upper Hitch Point—The articulated connection between the upper link and the implement.

2.6 Upper Link Point—The articulated connection between the upper link and the tractor.

2.7 Lower Hitch Point—The articulated connection between a lower link and the implement.

2.8 Lower Link Point—The articulated connection between a lower link and the tractor.

2.9 Upper Hitch Pin—The pin that connects the upper link to the implement.

2.10 Upper Link Pin—The pin that connects the upper link to the tractor.

2.11 Lower Hitch Stud or Pin—The stud or pin, attached to the implement, on which a lower link is secured.

2.12 Linchpin—The retaining pin used in the hitch pins or studs.

2.13 Mast—The member that provides attachment of the upper link to the implement.

2.14 Mast Height—The perpendicular distance between the upper hitch point and common axis of the lower hitch points.

2.15 Mast Adjustment—The usable range of movements of the mast in a vertical plane. It is measured as the maximum and minimum heights of the lower hitch points above the ground between which a mast of standard height can be adjusted to any inclination between the vertical and 5 deg from the vertical towards the rear.

Adjustment of the mast controls the pitch of the implement. Specifying the mast adjustment to be provided enables the tractor designer to determine the minimum acceptable adjustment of the length of the top link in relation to the point of attachment of the linkage; it also permits the implement designer to determine the range of operating depths of the implement over which pitch adjustment can be obtained.

2.16 Leveling Adjustment—The adjustment of the lower links so that one lower hitch point may be moved vertically with respect to the other lower hitch point to provide an inclination of the implement.

2.17 Lower Hitch Point Spread—The distance between lower hitch points measured at the base of the lower hitch stud, or the distance between the innermost restraining means provided on the implement.

2.18 Linchpin Hole Distance—The distance between the linchpin hole centerline and the lower link stud base.

2.19 Lift Linkage—The connecting linkage that transmits force to the lower links for raising and lowering.

2.20 Lift Range—The range of movement of the lower hitch points utilizing the extent of manual adjustment provided in the lift linkage in conjunction with the power range, expressed as the maximum and minimum possible heights of the lower hitch points above ground level, the lower hitch point axis being maintained horizontal to the ground.

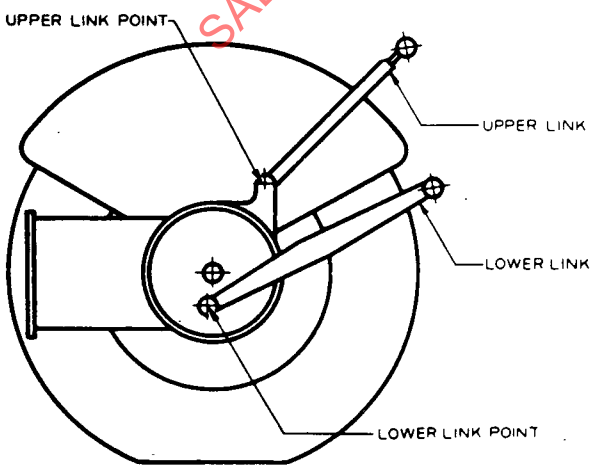

FIG. 1—TRACTOR LINKAGE

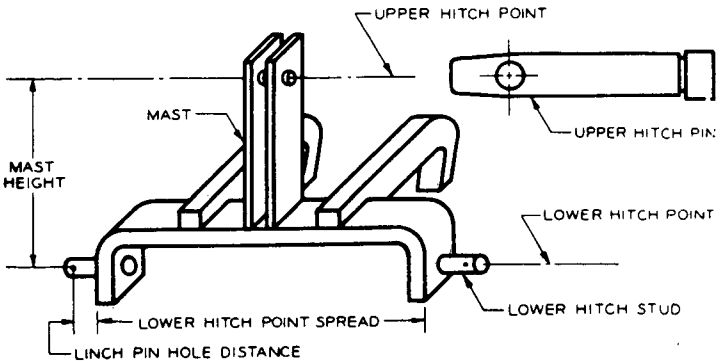

FIG. 2—DIMENSIONS ASSOCIATED WITH IMPLEMENT

2.21 Power Range—The total vertical movement of the lower hitch point excluding any adjustment in the linkage or lift linkage.

2.22 Lower Hitch Point Tire Clearance—Clearance expressed as a radial dimension from the lower hitch point to the outside diameter of the tire with the implement in raised position and all side sway removed from the links.

2.23 Lower Hitch Point Tractor Clearance—The horizontal dimension between the rearmost parts of the tractor in the area between the two draft links and the horizontal line through the two lower hitch points throughout the range of vertical movement of the hitch points. See Fig. 4. The power take-off master shield may be removed, if necessary, to meet this dimension.

3. Special Hitch Categories—Certain farming operations require dual rear wheels and narrow spacing. Experience has shown that some large implements used in these circumstances require a special Category Narrow Hitch.

3.1 Special Category III Narrow Hitch (III-N)—This special hitch differs from the Category III Hitch in only one dimension; namely, the "Lower Hitch Point Spread" is 822.5 mm (32.38 in)/825.5 mm (32.50 in) (same as Category II). All other dimensions for the Category III-N Three Point Free-Link Hitch are the same as Category III in Tables 1 and 2.

3.2 Special Category IV Narrow Hitch (IV-N)—This special hitch differs from the Category IV hitch in the following dimensions. "Lower Hitch Point Spread" is 919 mm (36.18 in)/922 mm (36.30 in). "Leveling Adjustment" is same as Category III. All other dimensions for the Category IV-N Three-Point Free-Link Hitch are the same as Category IV in Tables 1 and 2.

4. Tractor Lift Force Capacity

4.1 Tractors shall have the following minimum lift force available throughout the power range, at a distance of 610 mm (24 in) to the rear of the lower hitch points, when tested in accordance with J283, "Test Procedure for Measuring Lift Force Capacity on Agricultural Tractors Equipped with Three-Point Hitch."

4.1.1 Through 65 kW maximum drawbar power—310 N/kW drawbar power.

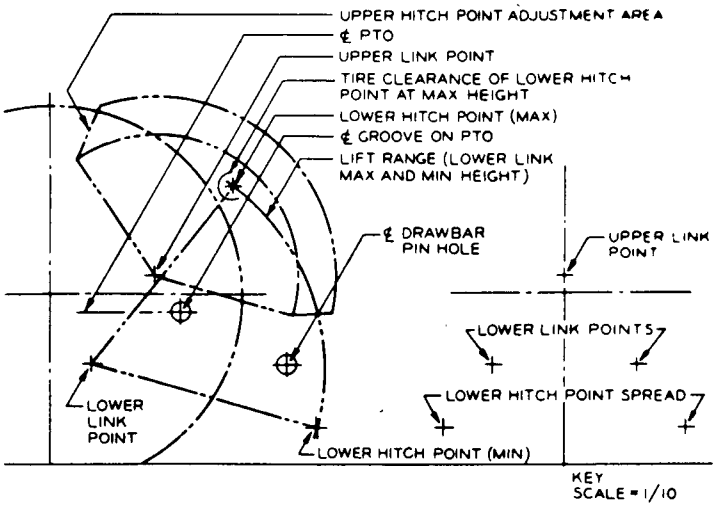

FIG. 3—DIMENSIONS ASSOCIATED WITH TRACTOR

ϕ 4.1.2 Above 65 kW maximum drawbar power—20.15 kN plus 155 N/kW drawbar power above 65 kW drawbar power.

ϕ **4.2** In customary inch units, the expressions for paragraphs 4.1.1 and 4.1.2 are:

4.2.2 Through 85 maximum drawbar horsepower—52 lb/drawbar ϕ horsepower.

4.2.3 Above 85 maximum drawbar horsepower—4420 lb plus 26 lb/ ϕ drawbar horsepower above 85 drawbar horsepower.

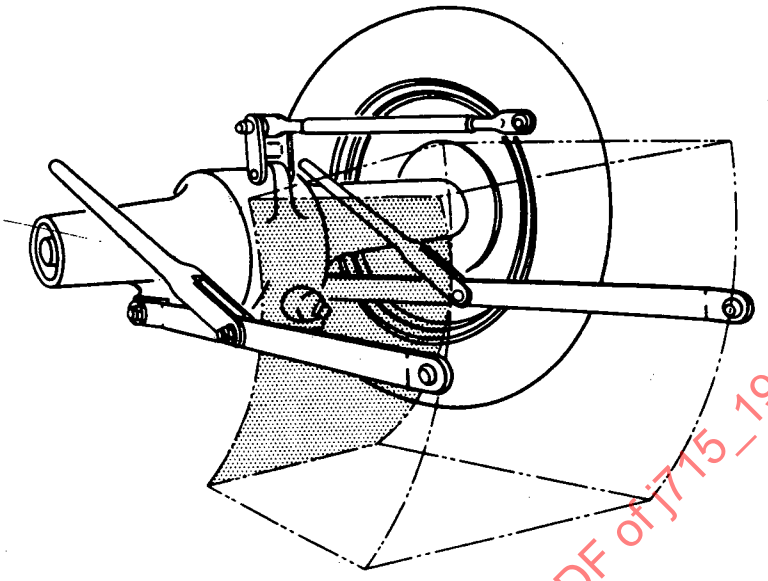

FIG. 4—LOWER HITCH POINT TRACTOR CLEARANCE

TABLE 1—DIMENSIONS ASSOCIATED WITH IMPLEMENT

	Category I				Category II				Category III[e]				Category IV[e]			
	mm		in		mm		in		mm		in		mm		in	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Upper Hitch Point																
Width inside	44.5	—	1.75	—	52.3	—	2.06	—	52.3	—	2.06	—	65	—	2.56	—
Width outside	—	85.9	—	3.38	—	95.3	—	3.75	—	95.3	—	3.75	—	132	—	5.20
Clearance radius for upper link[a,b]	57.2	—	2.25	—	57.2	—	2.25	—	57.2	—	2.25	—	76.2	—	3.00	—
Hitch pin hole diameter	19.3	19.56	0.76	0.77	26.65	25.91	1.01	1.02	32.0	32.26	1.26	1.27	45.2	45.5	1.78	1.79
Lower Hitch Point																
Stud diameter	21.84	22.10	0.86	0.87	28.19	28.45	1.11	1.12	36.32	36.58	1.43	1.44	49.7	50.8	1.96	2.00
Linchpin hole distance[a,b]	38.86	—	1.53	—	48.52	—	1.91	—	48.52	—	1.91	—	68	—	2.68	—
Linchpin hole diameter	11.68	12.19	0.46	0.48	11.68	12.19	0.46	0.48	11.68	12.19	0.46	0.48	17.5	18	0.69	0.71
Lower hitch point spread	681.0	684.3	26.81	26.94	822.5	825.5	32.38	32.50	963.7	966.7	37.94	38.06	1165	1168	45.87	45.99
Clearance radius for lower link[a,b]	63.5	—	2.50	—	73.2	—	2.88	—	82.6	—	3.25	—	82.6	—	3.25	—
Implement encroachment in front of lower hitch point if implement extends laterally behind tire	—	12.7	—	0.5	—	12.7	—	0.5	—	12.7	—	0.5	—	12.7	—	0.5
Implement Mast Height[c,d]	457		18		483		19		559		22		686		27	

[a] Some tractors with quick-attachable connectors require 140 mm (5.50 in) space for clearance above the upper hitch point and below the lower hitch points.

[b] Refer to standard for attachment of implements to agricultural wheel tractors equipped with quick-attaching coupler for three-point free link hitch.

Tractor equipped with a standard category quick-attaching coupler for the three-point free-link hitch requires an auxiliary attaching pin on the implement mast located 76 mm (3.0 in) for Categories I and III, and 101.6 mm (4.0 in) for Category II, below the standard upper hitch point. To facilitate attachment and detachment of the implement, a clearance zone must be maintained 76 mm (3.0 in) rearward from and extending 104 mm (4.10 in) above and 216 mm (8.50 in) below this pin. In addition, a clearance zone must be maintained 94 mm (3.70 in) rearward from and extending 25 mm (1.0 in) above and 211 mm (8.30 in) below each lower hitch point.

To facilitate the attachment and detachment of the implement with tractors equipped with a standard Category IV-N or IV quick-attaching coupler for the three-point free-link hitch, a clearance zone must be maintained 85 mm (3.35 in) rearward from and extending 120 mm (4.72 in) above and 252 mm (9.92 in) below the standard upper hitch point on the implement mast. In addition, a clearance zone must be maintained 94 mm (3.7 in) rearward from and extending 32 mm (1.26 in) above and 272 mm (10.71 in) below each lower hitch point. (The above dimension addition is relative to the H dimension in Table 1 of SAE J909b.)

[c] The mast height is not necessarily a mechanical dimension on the implement itself. It is a figure used in design and if properly used for design of both implement and tractor, a well performing interchangeable implement and tractor combination will be achieved. This standard makes it possible to produce tractors and implements that will give good performance in any combination; therefore, consideration to hitch geometry is essential. This makes it desirable to establish a standard mast height and a standard mast adjustment within a working range, because these items influence the position of hitch points that are common to both the implement and the tractor.

Mast height is one of the essential factors in establishing the virtual hitch point of the free-link system, draft signal for the draft-responsive system, loads on the linkage and hitch points, changes in implement pitch corresponding to changes in working depth, implement pitch when the implement is in transport position, clearance of the implement with the tractor, especially in transport position and clearance of the hitch links with the implement or with the tractor, especially in the transport position.

When an implement mast height is made different than standard to accomplish some specific performance feature, care should be exercised to insure that the desired performance is secured with tractors likely to operate the implement.

[d] Some Category II tractors are designed to accommodate a 559 mm (22 in) mast height for optimum performance. In the design of implements for use on these tractors care should be taken to investigate the need for providing a 559 mm (22 in) mast height. Tractors that are designed only for use with 559 mm (22 in) mast height must be properly identified.

[e] See Section 3 for Category IV-N or III-N, Narrow Hitch, dimensions. ϕ