



400 Commonwealth Drive, Warrendale, PA 15096-0001

SURFACE VEHICLE STANDARD

SAE J721

REV.
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Superseding J721 MAY87

Submitted for recognition as an American National Standard

(R) OPERATING REQUIREMENTS FOR TRACTORS AND POWER TAKE-OFF DRIVEN IMPLEMENTS

1. Scope

- 1.1 This SAE Standard was prepared to assist manufacturers of tractors and implements in providing suitable means of transmitting power from the tractor power take-off to the implement and satisfactory hitching of the implement to the tractor.
- 1.2 SAE J1170 provides dimensions relating to the tractor power take-off shaft and PTO shield; provides specifications for the splined power take-off shaft and the mating connector; and establishes and defines power take-off types I, II, and III.
- 1.3 SAE J715 sets forth requirements for the attachment of three-point hitch implements or equipment to the rear of agricultural wheel tractors.
- 1.4 SAE J1548 provides dimensions for the drawbar location and relation to the tractor power take-off shaft.
- 1.5 The successful performance of all tractor and implement combinations likely to be met in field service requires consideration of factors other than the dimensional relationship provided in the aforementioned SAE Standards.

2. References

- 2.1 **Applicable Documents**—The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply.

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

SAE J208 AUG86—Safety for Agricultural Tractors

SAE J708 DEC84—Agricultural Tractor Test Code

SAE J715 OCT88—Three-Point Free-Link Attachment for Hitching Implements to Agricultural Wheel Tractors

SAE J1170 FEB93—Rear Power Take-Off for Agricultural Tractors

SAE J1548 FEB93—Drawbars—Agricultural Wheel Tractors

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

ISO 500—Agricultural Tractors, Power Take-Off and Drawbar

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2.2 Definitions

- 2.2.1 POWER TAKE-OFF (PTO)**—An external shaft on the rear of the tractor to provide rotational power to the implements.
- 2.2.2 IMPLEMENT INPUT DRIVELINE (IID)**—Two universal joints and their connection member(s) and fastening means for transmitting rotational power from the tractor PTO to the implement input connection. A double Cardan, constant velocity is considered a single joint. The IID also includes Integral shielding (guarding) where provided.
- 2.2.3 IMPLEMENT INPUT CONNECTION (IIC)**—The shaft or other connecting means to which the rear joint of the IID is attached on the implement.
- 2.2.4 DRIVELINE CLEARANCE PLANE**—The imaginary, horizontal plane which establishes the uppermost permissible limit of protrusion of the drawbar hitch assembly or any component thereof, when the tractor and implement are parked on a common horizontal plane.

3. Instructions for the Operator

- 3.1** The implement manufacturer shall provide a sign in a prominent place on the implement specifying the required tractor drawbar hitch point location and/or implement hitch adjustments.
- 3.2** The operator's manual for the implement shall also include the previous information.
- 3.3** If a conversion assembly is made available for changing tractors or implements from 540 to 1000 rpm or from 1000 to 540 rpm, these conversion assemblies shall include a sign specifying the power take-off speed and the corresponding drawbar adjustments.
- 3.4** For recommended safety instructions, refer to SAE J208.

4. Implement Input Driveline and Hitch Requirements

- 4.1 Driveline Clearance Plane**—The location of the drawbar hitch and IIC shaft shall be in relationship as set forth in Figure 1 and Table 1.
- 4.2** Provision should be made in the IID, IIC, and hitch of the implement to prevent any of the following during the normal operation when attached to any tractor which conforms to SAE J1170, SAE J715, and SAE J1548 and operated according to the instructions of the implement manufacturer:
- 4.2.1** The universal joints in the IID from reaching a locking angle.
- 4.2.2** The telescoping section of the implement driveline from separating beyond the point where there is sufficient bearing to provide for proper operation.
- 4.2.3** The IID from sustaining damage from telescoping to a solid position.
- 4.2.4** The IID or its shields from sustaining damage due to contacting the implement hitch, hitch pins, or any tractor parts such as PTO shield or three-point hitch linkage.
- 4.3** Vertical loads on drawbars shall conform to SAE J1548.

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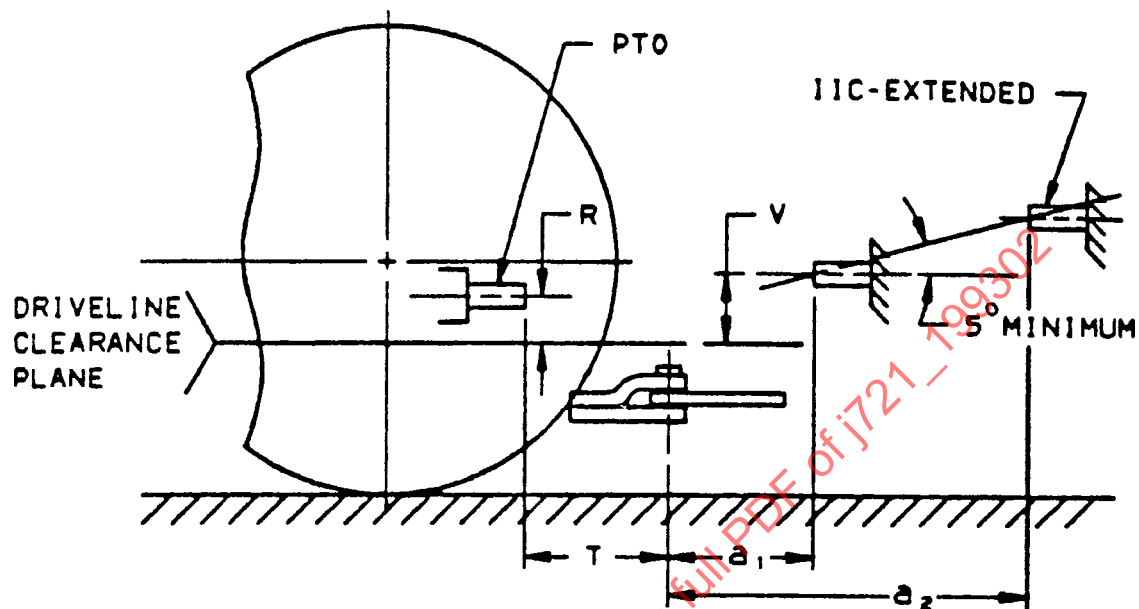


FIGURE 1—POSITION OF IIC FOR TRAILING IMPLEMENTS

TABLE 1 - DIMENSIONS RELATING TO POSITIONING OF IIC FOR TRAILED IMPLEMENTS (MM)

PTO Type	T	a_1 +100 -0	R	Vertical Location of IIC Extended	V
1	See SAE J1548	356	See SAE J1548	For a_2 greater than a_1 , the IIC distance above the drawbar shall increase at a 5° (min) angle from the IIC position established by a_1 .	Equal to or greater than R
2	See SAE J1548	400	See SAE J1548		
3	See SAE J1548	500	See SAE J1548		

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5. Maximum Bending Load Limitations for Power Take-Off Shaft Drives Employing V-Belts or Chains

5.1 The PTO shaft of tractors is designed primarily to transmit torsional loads. The total static bending load imposed on the tractor PTO shaft by V-belt or chain drives should not be in excess of values shown in Table 2:

TABLE 2—MAXIMUM BENDING LOAD LIMITATIONS FOR POWER TAKE-OFF SHAFT DRIVES EMPLOYING V-BELTS OR CHAINS

Position of load application	Type I Power Take-Off kN	Type II, III Power Take-Off kN
At the end of the PTO shaft	2.22	3.56
Between the PTO shaft rear bearing and/or at the groove in the outside diameter of the PTO shaft splines	2.67	4.45

The tractor PTO shaft and bearing mountings should successfully withstand this magnitude of bending loads as in Table 2.

6. Torsional Load Considerations

6.1 Because of the large amount of kinetic energy available at the PTO shaft, instantaneous torsional loads and fluctuating operating loads in excess of the average rated power of the tractor may be transmitted.

7. PTO Shaft and Implement Input Driveline Thrust Load Limitations

7.1 The tractor PTO shall be designed to accept IID telescoping thrust force values in Table 3 based on PTO power at rated engine speed as established per SAE J708. A properly maintained implement at its designed power shall not impose IID telescoping thrust forces upon the tractor PTO in excess of the values in Table 3, recognizing that instantaneous thrust forces may exceed those values.