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INTERNATIONAL
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SURFACE VEHICLE STANDARD

SAE J1790

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Self-Propelled Sweepers and Scrubbers Steering Requirements Single-Circuit Hydraulic Servo-Assisted Systems

1. ***Scope***—The SAE Standard applies to self-propelled, driver-operated sweepers and scrubbers as defined in SAE J2130.

1.1 **Purpose**—The purpose of this document is to establish the minimum requirements for a steering mechanism that is of a single-circuit hydraulic servo-assisted system without any mechanical linkage to the road wheels, as typically depicted in Figure 1.

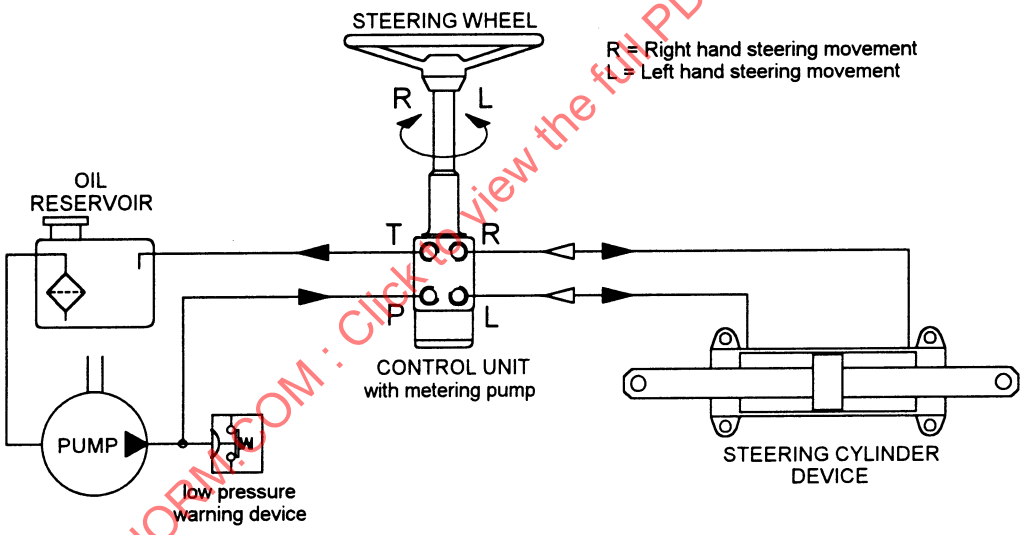

FIGURE 1—GENERAL LAYOUT OF SYSTEM

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2. References

2.1 Applicable Publication—The following publication forms a part of the specification to the extent specified herein. Unless otherwise indicated the latest revision of SAE publications shall apply.

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

SAE J2130—Self-Propelled Sweepers

2.2 Related Publications—The following publications are provided for information purposes only and are not a required part of this document.

2.2.1 SAE PUBLICATION—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J1511/ISO 5010:1994—Steering for Off-Road Rubber-Tired Machines

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

ISO 789-11:1996—Agricultural tractors—Test procedures—Part 11: Steering capability of wheeled tractors
ISO 5010:1992—Earth-moving machinery—Rubber-tired machines—Steering requirements
ISO 10998:1995—Agricultural wheeled tractors—Steering requirements

3. Definitions

3.1 Steering Mechanism—All equipment needed to steer the machine.

3.2 Hydraulic Servo-Assisted System—A system that meter's a pressurized flow of fluid from an energy source (e.g., pump) to a steering device (e.g., cylinder) that is linked to the steered road wheels. The metered fluid output will also be proportional to the movement of a steering control (e.g., wheel). Additionally, the system will be able to pump fluid to the steering device by manual effort in the event of failure of the fluid power energy source.

3.3 Steering Wheel—Type of steering control that is generally round and alters the direction of movement by rotary motion.

3.4 Steered Road Wheels

3.4.1 Wheels, the alignment of which may be altered in relation to the machine in order to obtain a change in the direction of movement of the machine.

3.4.2 All wheels of an articulated machine.

3.5 Fluid Power Energy Source—A hydraulic pump means to power the steering system. The pump may be arranged to serve only the steering system (dedicated) or arranged to serve not only the steering system but other hydraulic duties as well (shared).

3.6 Single Circuit—A hydraulic circuit where there is only one fluid power energy source and one pressure conduit from it to the metering control unit as depicted in Figure 1.

3.7 Steering Device—A fluid power cylinder or actuator that is mechanically linked to the steered road wheels in order to alter the direction of movement.

3.8 Turning Radius—Radius of the circular path described by the center of tire contact with the surface of the test site of the wheel describing the largest circle.

3.9 Non Reactive—A system where there is no feed-back from the steering function.

3.10 Reactive—A system where feed-back from the steering function may be felt in the steering wheel.

4. Special Requirements

4.1 The steering wheel shall be easy to use and grip. It shall be designed in such a way as to permit gradual deflection. The direction of movement of the top of the steering wheel shall correspond to the desired change in the direction of the machine.

4.2 Steering wheel play or lash within the steering control unit shall not exceed 8 degrees from the neutral position to a position where perceptible road wheel movement is observed.

4.3 With the fluid power energy source inert, rotary motion of the steering wheel under the influence of manual effort shall alter the direction of machine movement by supplying a metered supply of pressurized fluid to the steering device.

4.4 One or more pressure limitation devices shall protect the whole or parts of the fluid power circuit against excess pressure. At all times, protection shall be afforded to individual components and conduits.

4.5 The burst pressure ratings of fluid conduits shall be four (4) times the maximum operating pressure permitted by the pressure limitation devices. The fluid conduits shall be protected and arranged in such a way that risks from damage by impact or interference are reduced to a minimum.

4.6 The fluid power energy source shall be active whenever the machine's prime mover power source is active.

4.7 For vehicles with speeds greater than 20 km/h, a warning device shall be provided to indicate a failure of the fluid power energy source, e.g., loss of fluid and/or pressure loss. The device shall be audible or visual or both. In the case of a common reservoir being used to serve the steering pump and other hydraulic services, a low-pressure warning device shall be installed to indicate pressure loss in the event of a failure. This warning device shall also be applied in the case of the steering pump performing other hydraulic duties as in a shared system.

4.8 In systems where the steering pump performs other hydraulic duties as in a shared system as well as steering, priority shall be given to the steering system.

5. Performance Requirements

5.1 Steering Control—The steering system may be of the following styles

a. Non-reactive system, preventing external shock forces reacting in the steering system to move the steering wheel
b. Reactive system allowing shock forces to react in the steering system.

Both circuit system are shown typically in Figure 2.

NOTE—In the cases of reactive systems, the displacement of the steering device shall be equal in each direction, shown typically in Figure 2.

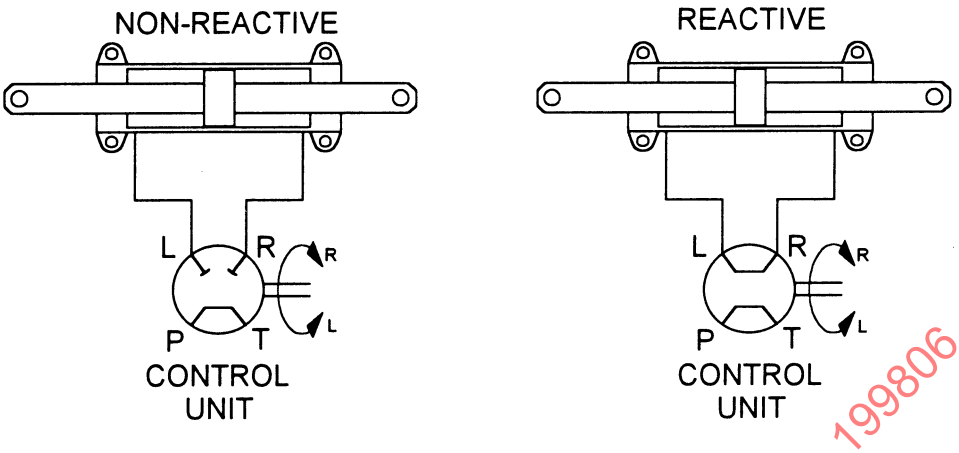

FIGURE 2—REACTIVE AND NON-REACTIVE SYSTEMS

5.2 Steering Effort—The machine, from a straight ahead direction, shall be able to execute a steering maneuver when negotiating the test course shown in the diagram (see Figure 3) between Point A and B within the limits given in 5.2.1 and 5.2.2. Point A is when the machine leaves the straight-ahead direction and point B is where it has achieved a 12.0 m turning radius. The speed for performing the maneuver shall be 10 km/h ± 2 km/h. In the case of machines with a maximum speed of less than 10 km/h, then speed shall be the maximum attainable.

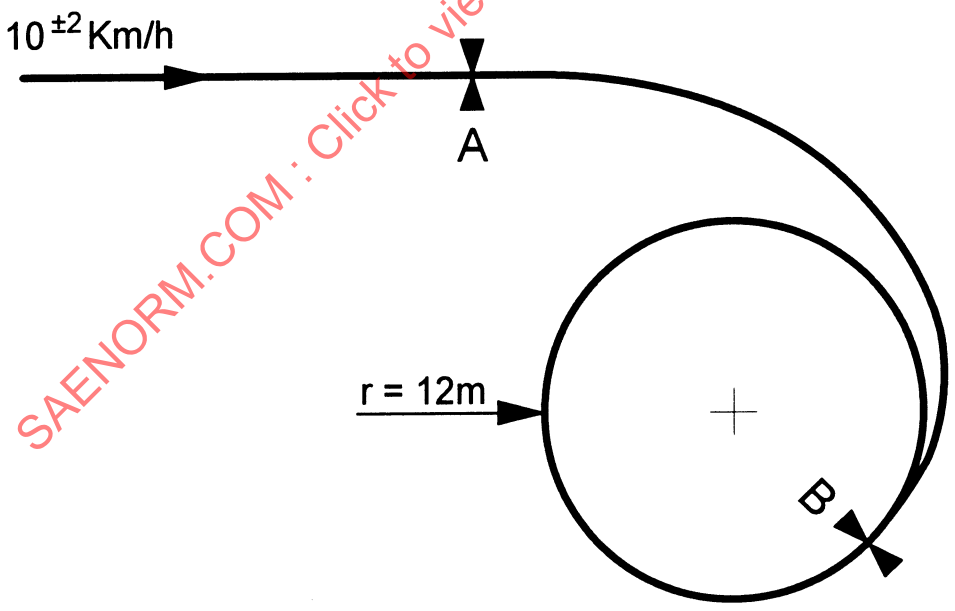

FIGURE 3—TEST COURSE

5.2.1 Under normal working conditions, the steering effort required to perform the maneuver shall not exceed 250 N and the duration to achieve the specified turning radius shall not exceed 4 s for machines capable of over 25 km/h. For speeds of 25 km/h and less, the duration shall not exceed 5 s.