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SURFACE VEHICLE RECOMMENDED PRACTICE

SAE J1859

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Test Procedures for Determining Air Brake Valve Input-Output Characteristics

1. ***Scope—***This SAE Recommended Practice establishes uniform test procedures for determining input-output characteristics for those pilot-operated and mechanically actuated, modulating-type valves and through-type valves used in the service brake control system.

1.1 Input-Output Characteristics:

a. Crack (opening) pressure or force
b. Pressure differential (input-output)
c. Hysteresis (increasing-decreasing pressure)

1.2 Pilot-Operated Modulating-Type Valves:

a. Relay Valve
b. Ratio relay valve
c. Decaying ratio relay valve
d. Booster relay valve

1.3 Mechanically Actuated Modulating-Type Valves

a. Dual service brake valve

1.4 Through-Type Valves

a. Quick release valve
b. Tractor protection valve
c. Limiting valve

1.5 Purpose—This document is intended as a guide toward standard practice but may be subject to frequent change to keep pace with experience and technical advances, and this should be kept in mind when considering its use. This document provides a uniform definition of input-output characteristics of pneumatic valves designed to operate in 862 kPa (125 psi) nominal pressure air brake systems and establishes uniform test procedures to determine these characteristics. This document serves as a supplement to SAE J1409.

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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 J844—Nonmetallic Air Brake System Tubing
SAE J1402—Automotive Air Brake Hose and Hose Assemblies
SAE J1409—Air Brake Valves Test Procedure
SAE J1410—Air Brake Valve—Performance Requirements

3. Definitions

3.1 Crack Pressure or Force—The increasing input pressure or input force to initiate an output pressure or flow resulting in a transducer reading.

3.2 Pressure Differential—The difference between the increasing input pressure and the increasing output pressure at pressures above the crack pressure.

3.3 Hysteresis—The difference in the input pressure between the increasing and decreasing output curve at a given output pressure.

3.4 Relay Valve—A pneumatically actuated valve used to remotely control the application and release of air pressure.

3.5 Ratio Relay Valve—A relay valve with a fixed ratio of output pressure to input pressure.

3.6 Decaying Ratio Relay Valve—A relay valve with a variable ratio of increased output pressure to the input pressure that decays in time to a one-to-one ratio.

3.7 Booster Relay Valve—A relay valve that initially sends the output pressure to one or more outlet ports faster than to the other ports but balances to equal pressure at all output ports.

3.8 Quick Release Valve—A valve which accelerates the release of air pressure.

3.9 Dual Service Brake Valve—A service brake valve that has a primary (No. 1) system that is mechanically actuated and a secondary (No. 2) system that is pneumatically actuated by the primary system or mechanically actuated in the event of the loss of primary system pressure. Each system has its own input and output circuit.

3.10 Tractor Protection Valve—A pneumatically actuated shutoff valve that controls the application and release of service and supply pressure to the towed vehicle.

3.11 Limiting Valve—A valve that reduces the amount of output pressure by a fixed percentage of the input pressure. This reduction may be for all input pressures or the output pressure may gradually blend back to the full input pressure.

4. General Notes

4.1 Temperature—Unless otherwise specified, all testing shall be conducted at a temperature of 12 to 30 °C (60 to 90 °F) inclusive.

4.2 Mounting—All testing shall be conducted with the valve mounted essentially as in service. The actual mounting position of each test shall be recorded.

4.3 Pressure Units—All pressure units are expressed as a gage pressure (above atmospheric pressure).

4.4 Supply Air—Unless otherwise specified, the supply air shall be clean and dry.

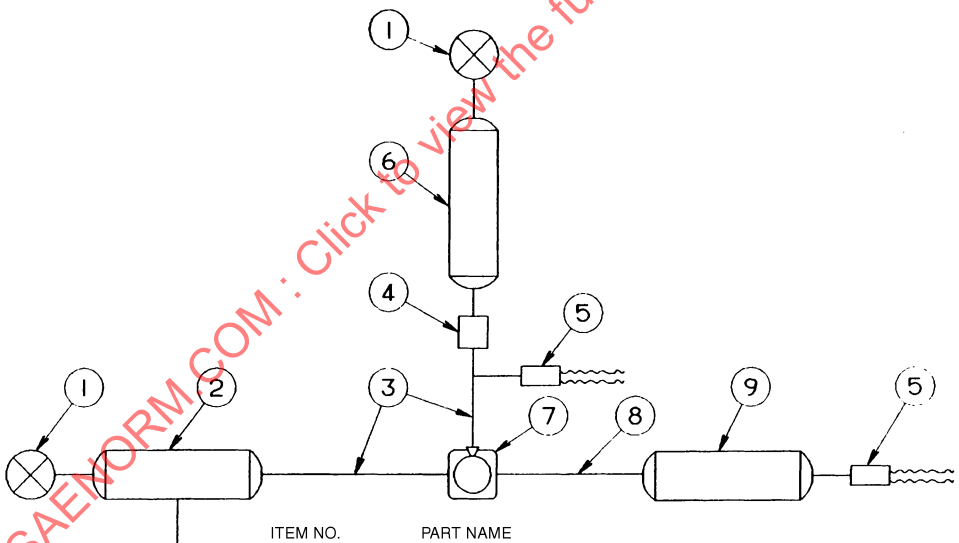
4.5 Leakage—No bubble leakage is permitted from any connection to the valve or the test apparatus. The valve to be tested must comply to SAE J1410 leakage requirements.

4.6 The line sizes for all test setups should be 13 mm (1/2 in) OD tube per SAE J844 or 9.5 mm (3/8 in) ID rubber hose per SAE J1402. The length of the lines as recommended in the respective figures are for standardization.

4.7 Instrumentation

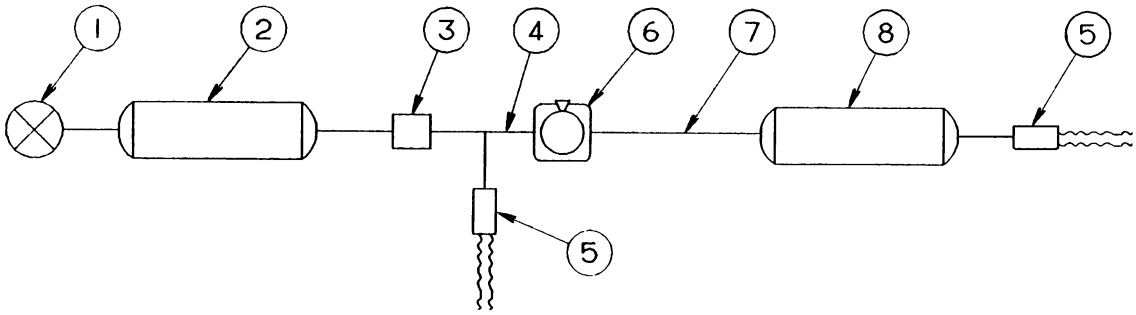
4.7.1 The instrumentation system accuracy, reference Figures 1, 2, and 3, is very critical to the results of this document. Specific instrumentation selection is at the discretion of the test engineer, therefore, the following overall instrumentation system output accuracies are specified. The dynamic response of the recorder used must be capable of those accuracies specified from zero to the maximum reading recorded.

a. The air pressure measurements shall be within ±2.5%.
b. The travel measurements shall be within ±2.5%.
c. The force measurements shall be within ±5.0%.



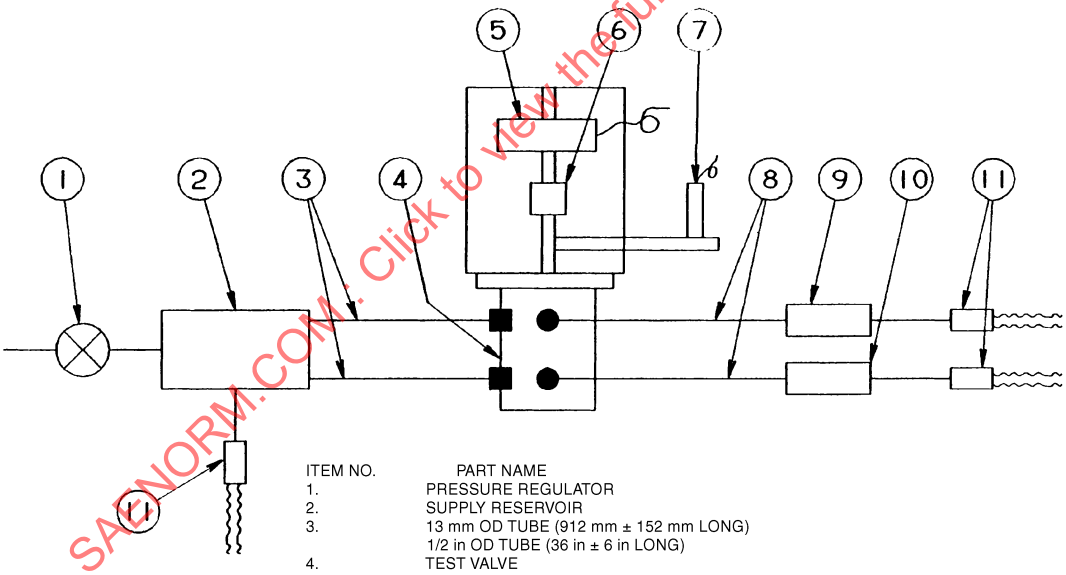
ITEM NO.	PART NAME
1.	PRESSURE REGULATOR
2.	SUPPLY RESERVOIR
3.	13 mm OD TUBE (912 mm ± 152 mm LONG) 1/2 in OD TUBE (36 in ± 6 in LONG)
4.	FLOW CONTROL VALVE
5.	PRESSURE TRANSDUCER
6.	CONTROL RESERVOIR
7.	TEST VALVE
8.	13 mm OD TUBE (152 mm ± 76 mm LONG) 1/2 in OD TUBE (6 in ± 3 in LONG)
9.	OUTPUT VOLUME(S)

FIGURE 1—TEST SETUP FOR PILOT-OPERATED MODULATING VALVES



ITEM NO.	PART NAME
1.	PRESSURE REGULATOR
2.	SUPPLY RESERVOIR
3.	FLOW CONTROL VALVE
4.	13 mm OD TUBE (912 mm ± 152 mm LONG) 1/2 in OD TUBE (36 in ± 6 in LONG)
5.	PRESSURE TRANSDUCER
6.	TEST VALVE
7.	13 mm OD TUBE (152 mm ± 76 mm LONG) 1/2 in OD TUBE (6 in ± 3 in LONG)
8.	OUTPUT VOLUME(S)

FIGURE 2—TEST SETUP FOR THROUGH VALVES



ITEM NO.	PART NAME
1.	PRESSURE REGULATOR
2.	SUPPLY RESERVOIR
3.	13 mm OD TUBE (912 mm ± 152 mm LONG) 1/2 in OD TUBE (36 in ± 6 in LONG)
4.	TEST VALVE
5.	LOAD CELL
6.	FORCE APPLICATOR
7.	TRAVEL TRANSDUCER
8.	13 mm OD TUBE (152 mm ± 76 mm LONG) 1/2 in OD TUBE (6 in ± 3 in LONG)
9.	OUTPUT VOLUME
10.	OUTPUT VOLUME
11.	PRESSURE TRANSDUCER

FIGURE 3—TEST SETUP FOR MECHANICALLY ACTUATED MODULATING VALVES

4.7.2 AIR PRESSURE INSTRUMENTATION—Calibration shall be verified and recorded by connecting all the measurement devices to a common plenum and recording all the readings. Calibration is to be done before and after the test is conducted. Records should be kept with the test results.

5. Crack Pressure, Pressure Differential, and Hysteresis Test Procedures

5.1 Pilot-Operated and Through Valves

5.1.1 Unless otherwise specified, the general test parameters are:

a. Supply Pressure—827 kPa ± 34 kPa (120 psi ± 5 psi)
b. Supply and Control Reservoir—16 400 cm^3 ± 164 cm^3 (1000 in^3 ± 100 in^3)
c. Output Port Volume(s)—820 cm^3 ± 82 cm^3 (50 in^3 ± 5 in^3)
d. Rate of Control Pressure—14 kPa/s (2 psi/s) Maximum (increasing and decreasing)

5.1.2 Install the valve in the test setup per Figure 1 or 2.

5.1.2.1 Unless otherwise specified, use one output volume and one supply volume and plug all the other unused ports.

5.1.2.2 Cycle the valve three times to the full delivery pressure.

5.1.3 Apply pressure to the control port and record the input and output pressures.

5.1.3.1 Record the input and output pressures continuously or in increments not to exceed 1.4 kPa (0.2 psi) for input pressures up to 140 kPa (20 psi) and 14 kPa (2 psi) for input pressures greater than 140 kPa (20 psi).

5.1.4 When input pressure reaches 827 kPa ± 34 kPa (120 psi ± 5 psi), maintain pressure to the valve for 1 s minimum or until output pressure stabilizes.

5.1.5 Release the pressure to the control port and record input and output pressures until input pressure decreases to 0 kPa (0 psi).

5.1.5.1 Record the input and output pressures continuously or in increments not to exceed 14 kPa (2 psi) for all input pressures.

5.2 Mechanically Actuated Valves

5.2.1 Unless otherwise specified, the general test parameters are:

a. Supply Pressure— 827 kPa ± 34 kPa (120 psi ± 5 psi)
b. Supply Reservoir—16 400 cm^3 ± 164 cm^3 (1000 in^3 ± 100 in^3)
c. Output Port Volume—820 cm^3 ± 82 cm^3 (50 in^3 ± 5 in^3)
d. Rate of Control Force—40 N/s (9 lb/s) ±10% as per 5.2.2.1 (increasing and decreasing)

5.2.2 Install the valve in the test setup per Figure 3.

5.2.2.1 It is recommended to test the valves without pedals, treadles, or mounting plates attached.

5.2.2.2 Cycle the valve three times to full delivery pressure.

5.2.3 Apply the input force to the valve.