

# Method of Measuring and Reporting the Pressure Differential-Flow Characteristics of a Hydraulic Fluid Power Valve — SAE J1117 SEP80

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# METHOD OF MEASURING AND REPORTING THE PRESSURE DIFFERENTIAL-FLOW CHARACTERISTICS OF A HYDRAULIC FLUID POWER VALVE—SAE J1117 SEP80

## SAE Recommended Practice

Report of the Off-Road Machinery Technical Committee, approved June 1975, editorial change September 1980. (This recommended practice is substantially in agreement with NFPA T3.5.28.)

**1. Introduction**—As the flow passes through these valves, some power loss is experienced due to restrictions and directional changes of the fluid resulting in a differential pressure. Flow is passed through the valve through the ports and in positions as specified. Pressure is recorded at flow increments to produce a well defined curve. The tare loss of the test circuit is subtracted for final data presentation.

**2. Purpose**—To provide a uniform procedure for measuring and reporting the pressure losses associated with the significant flow paths in a hydraulic fluid power valve.

**3. Scope**—This procedure applies to hydraulic fluid power valves as applied to self-propelled work machines as referenced in SAE J1116.

**4. Terms and Definitions**—(For definitions of terms not herein defined, see References (paragraph 15.1)).

**4.1 Test Flow**—Any steady state flow rate required to conduct this test.

**4.2 Input Port**—Any port into which flow is directed for the purpose of this test.

**4.3 Output Port**—Any port from which flow exits for the purpose of this test.

**4.4 Tare Pressure**—The pressure loss between the pressure tapping points as generated by the test equipment exclusive of the test valve.

**4.5 Control**—Any externally adjustable feature integral with the test valve that varies the flow path and/or flow rate.

**4.6 Specified Data**—That basic information furnished in the request for the test as indicated in Section 8.

### 5. Units

**5.1** The International System of Units (SI) is used herein in accordance with Reference paragraph 15.2.

**5.2** Approximate SI conversion units appear before their "Customary U. S." counterparts.

**6. Graphic Symbols**—Graphic symbols herein are in accordance with References (paragraphs 15.3 and 15.4). Where References 15.3 and 15.4 are not in agreement, Reference 15.3 governs.

**7. Letter Symbols**—The following letter symbols are used in this document:

		SI Unit	U. S. Unit
$\Delta P$	Pressure differential (Pressure drop)	kPa (kilopascal)	psi
$\Delta P_m$	Measured pressure differential	kPa	psi
$\Delta P_t$	Tare pressure differential	kPa	psi
P1	Input pressure reading	kPa	psi
P2	Output pressure reading	kPa	psi
Q	Test flow	l/min	USGPM
Q <sub>m</sub>	Specified maximum flow	l/min	USGPM

### 8. Summary of Designated Information

**8.1** Specify the following information on all requests for this test:

- 8.1.1 A description of valve.
- 8.1.2 The type of fluid (if different than paragraph 13.1).
- 8.1.3 The fluid temperature (if different from the standardized values in paragraph 13.2).
- 8.1.4 The maximum flow for this test (Q<sub>m</sub>).
- 8.1.5 The input port(s).
- 8.1.6 The output port(s).
- 8.1.7 The control variable position(s).

### 9. General Procedure

**9.1** Conduct the test in accordance with the fixed values specified by the test request.

**9.2** Use only standardized values, shown in Section 13, for catalog information and sales literature.

**9.3** Test and report of subplate mounted valves may be run with the subplate included. Reports shall explicitly indicate how such valves were tested.

**10. Test Conditions Accuracy**—Maintain the test condition accuracy within the limits shown in the following table:

Test Condition	Maintain Within ±
Flow	2%
Pressure	2%
Pressure Differential	4%
Temperature	3°C (5°F)
Control Variable	2%

### 11. Test Procedure

**11.1** Install the test valve in the test circuit (Reference Fig. 1) using as input and output ports those indicated in the test request.

**11.2** Set the control variable(s) for the flow path indicated on the test request.

**11.3** Obtain enough data between zero flow and the specified maximum flow (Q<sub>m</sub>) to produce a well-defined curve as illustrated in Fig. 3. If data is measured manually, record on a chart similar to Fig. 2.

**11.4** Remove the test valve from the test circuit and connect the lines used in paragraph 9.1 to complete the test circuit without the test valve per Reference 13.5, and repeat paragraph 11.3.

**11.5** Determine the pressure differential ( $\Delta P$ ) by subtracting the tare pressure differential ( $\Delta P_t$ ) from the measured pressure differential ( $\Delta P_m$ ).

**11.6** Repeat the test procedure for other specified flow paths and control position.

### 12. Data Presentation

**12.1** Plot a curve(s) of the pressure differential ( $\Delta P$ ) versus flow rate (Q) using the data obtained as in paragraph 11.5.

**12.2** Use Fig. 3 as an example curve.

**12.3** Include the following information on the data plot:

- 12.3.1 Valve description
- 12.3.2 Type of fluid
- 12.3.3 Fluid temperature
- 12.3.4 Input port(s) and size
- 12.3.5 Output port(s) and size
- 12.3.6 Control position
- 12.3.7 Date of test
- 12.3.8 Testing agency
- 12.3.9 Output port pressure at maximum flow

### 13. Standardized Values

**13.1** A fluid with a viscosity of 21–26 mm<sup>2</sup>/s at 50°C (105–125 SUS at 122°F) and 6.6–7.4 mm<sup>2</sup>/s at 90°C (48–50 SUS at 194°F) should be used.

**13.2** Fluid temperature should be 50°C (122°F).

**13.3** Use the maximum size for ports if more than one size is available.

**14. Identification Statement**—Use the following statement in catalogs and sales literature when electing to comply with this voluntary standard: "Performance data obtained and presented in accordance with SAE Recommended Practice J1117 SEP80".

### 15. References

**15.1** American National Standard Glossary of Terms for Fluid Power, ANSI/B93.2–1971, and Supplements thereto. (ISO/TC 131/SC 1 (USA-2) 3).

**15.2** International Standard Rules for the Use of Units of the International System of Units and a selection of the Decimal Multiples and Sub-Multiples of SI Units, ISO/R 1000–1969.

**15.3** International Standard Graphical Symbols for Hydraulic and Pneumatic Equipment and Accessories for Fluid Power Transmissions, ISO/R 1219–1970. Agrees with ANSI/Y32, 10–1967.

**15.4** American National Standard Fluid Power Diagrams, ANSI/Y14.17–1966.

**15.5** Society of Automotive Engineers Aerospace Recommended Practice—Determination of Hydraulic Pressure Drop, SAE/ARP 24B–1968.

**15.6** American Society for Testing and Materials Standard Method of Test for Viscosity of Transparent and Opaque Liquids, ASTM/D445–1965.

