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Superseding J1117 SEP80

**METHOD OF MEASURING AND REPORTING THE PRESSURE DIFFERENTIAL-FLOW  
CHARACTERISTICS OF A HYDRAULIC FLUID POWER VALVE**

**Foreword**—This Reaffirmed Document has been changed only to reflect the new SAE Technical Standards Board Format.

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.

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

**1.1 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.

**2. References**

**2.1 Applicable Publications**—The following publications form 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 PUBLICATIONS**—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE ARP 24B—Determination of Hydraulic Pressure Drop

SAE J1116—Categories of Off-Road Self-Propelled Work Machines

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

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

ANSI B93.2-1971—American National Standard Glossary of Terms for Fluid Power, and Supplements thereto (ISO/TC 131/SC1 (USA-2)3)

ANSI Y14.17-1966—American National Standard Fluid Power Diagrams

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- 2.1.3 ASTM PUBLICATION—Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.  
 ASTM D445-1965—American Society for Testing and Materials Standard Method of Test for Viscosity of Transparent and Opaque Liquids
- 2.1.4 ISO PUBLICATION—Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.  
 ISO/R 1000-1969—International Standard Rules for the Use of Units of the International System of Units and a Selection of the Decimal Multiples and Submultiples of SI Units  
 ISO/R 1219-1970—International Standard Graphical Symbols for Hydraulic and Pneumatic Equipment and Accessories for Fluid Power Transmissions (Agrees with ANSI Y32.10-1967)
3. **Definitions**—For definitions of terms not herein defined, see ANSI B93.2-1971.
- 3.1 **Test Flow**—Any steady state flow rate required to conduct this test.
- 3.2 **Input Port**—Any port into which flow is directed for the purpose of this test.
- 3.3 **Output Port**—Any port from which flow exits for the purpose of this test.
- 3.4 **Tare Pressure**—The pressure loss between the pressure tapping points as generated by the test equipment exclusive of the test valve.
- 3.5 **Control**—Any externally adjustable feature integral with the test valve that varies the flow path and/or flow rate.
- 3.6 **Specified Data**—That basic information furnished in the request for the test as indicated in Section 7.
4. **Units**
- 4.1 The International System of Units (SI) is used herein in accordance with ISO/R 1000-1969.
- 4.2 Approximate SI conversion units appear before their "Customary U.S." counterparts.
5. **Graphic Symbols**—Graphic symbols herein are in accordance with ISO/R 1219-1970 and ANSI/Y14.17-1966. Where ANSI/Y32.10-1967 and ANSI/Y14.7-1966 are not in agreement, ANSI/Y14.7-1966 governs.
6. **Letter Symbols**—The following letter symbols are used in this document:

**TABLE 1—**

		<b>SI Unit</b>	<b>U.S. Unit</b>
$\Delta P$	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
Qm	Specified maximum flow	L/min	USGPM

**7. Summary Of Designated Information:**

7.1 Specify the following information on all requests for this test:

- 7.1.1 A description of valve.
- 7.1.2 The type of fluid (if different than paragraph 12.1).
- 7.1.3 The fluid temperature (if different from the standardized values in paragraph 12.2).
- 7.1.4 The maximum flow for this test ( $Q_m$ ).
- 7.1.5 The input port(s).
- 7.1.6 The output port(s).
- 7.1.7 The control variable position(s).

**8. General Procedure**

- 8.1 Conduct the test in accordance with the fixed values specified by the test request.
  - 8.2 Use only standardized values, shown in Section 12, for catalog information and sales literature.
  - 8.3 Test and report of subplate mounted valves may be run with the subplate included. Reports shall explicitly indicate how such valves were tested.
9. **Test Conditions Accuracy**—Maintain the test condition accuracy within the limits shown in the following table:

TABLE 2—

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

**10. Test Procedure**

- 10.1 Install the test valve in the test circuit (see Figure 1) using as input and output ports those indicated in the test request.
- 10.2 Set the control variable(s) for the flow path indicated on the test request.
- 10.3 Obtain enough data between zero flow and the specified maximum flow ( $Q_m$ ) to produce a well-defined curve as illustrated in Figure 3. If data is measured manually, record on a chart similar to Figure 2.
- 10.4 Remove the test valve from the test circuit and connect the lines used in paragraph 8.1 to complete the test circuit without the test valve per SAE/ARP 24B-1968 and repeat paragraph 10.3.

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

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

### **11. Data Presentation**

**11.1** Plot a curve(s) of the pressure differential ( $\Delta P$ ) versus flow rate ( $Q$ ) using the data obtained as in paragraph 10.5.

**11.2** Use Figure 3 as an example curve.

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

11.3.1 Valve description

11.3.2 Type of fluid

11.3.3 Fluid temperature

11.3.4 Input port(s) and size

11.3.5 Output port(s) and size

11.3.6 Control position

11.3.7 Date of test

11.3.8 Testing agency

11.3.9 Output port pressure at maximum flow.

### **12. Standardized Values**

**12.1** 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.

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

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

**13. 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".

