

	SURFACE VEHICLE RECOMMENDED PRACTICE	SAE J2470 JAN2009
		Issued 1999-10 Revised 2009-01
		Superseding J2470 NOV2006
Hydraulic Fluid Power—Valves—Method for Assessing the Lock Sensitivity to Contaminants		

RATIONALE

The primary reasons for this revision are to identify current sources for the carbonyl iron contaminant and to update the requirements to reflect the currently available carbonyl iron contaminants. The sources of all test contaminants and the listing of laboratories with capability to conduct the test have also been updated.

FOREWORD

NOTE: Some Test Procedures are potentially dangerous. SAE Technical Reports do not purport to address all of the safety problems, if any, associated with their use. It is the responsibility of the user of an SAE Technical Report to establish and employ appropriate safety practices. Only individuals who have been properly trained in the test procedure and who are aware of any hazards that may be present should conduct the tests. Appropriate safety and health precautions must be employed when conducting any test.

1. SCOPE

- 1.1 This SAE Recommended Practice defines a procedure, which will aid in assessing the contaminant sensitivity of hydraulic valves. The approach taken defines a test procedure with flexibility for testing valves in a wide range of contamination levels. The user of this procedure must establish the contamination levels for testing. Three levels are suggested which should cover the range for most valve applications. This procedure does not establish the contaminant sensitivity requirements for any valve. The user of this procedure needs to be aware of the system contamination level that the valve will operate in and select test contamination levels significantly higher than the operating level to assess the suitability of the valve. The test procedure permits a valve to be tested without disassembly and therefore permits protection of proprietary design information.
- 1.2 This procedure assesses the contamination sensitivity of valves by contaminant lock. The procedure indicates the sensitivity of valves by contaminant lock due to various sizes of contaminants. The test is designed to assess the contaminant sensitivity of valves in tests of relatively short duration. See Appendix A for guidance as to how the tests and their results may be used.
- 1.3 The tests are purposely designed to be severe in order to be applicable to a wide range of contaminated environments. The use of valves in many applications and for various purposes results in differing levels of acceptable performance. That is, the same valve may be unacceptable — in relation to operation in a contaminated environment — in one application and be acceptable in another. The user must make that decision based on a review of the expected level of the specific application and the test results obtained.

NOTE: See 7.2 if document is to be contractually invoked.

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2. REFERENCES

2.1 Applicable Publications

The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of the documents shall be used except in those cases where an invitation for bid or procurement contract specifically identifies the issues in effect on a particular date.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

SAE ARP490 Electrohydraulic Servovalves

SAE ARP785 Aerospace—Procedure for the Determination of Particulate Contamination in Hydraulic Fluids by the Control Filter Gravimetric Procedure

2.1.2 ISO Publications

Publisher: International Organization for Standardization, 1 rue de Varembe, CH-1211 Geneva 20, Switzerland. Available from American National Standards Institute (ANSI) www.ansi.org or from the National Fluid Power Association (NFPA) www.nfpa.com.

ISO 1219-1 Graphic symbols for conventional use and data-processing applications

ISO 4021 Hydraulic fluid power—Particulate contamination analysis—Extraction of fluid samples from lines of an operating system

ISO 4405 Hydraulic fluid power—Fluid contamination—Determination of particulate contamination by the gravimetric method

ISO 4406 Hydraulic fluid power—Method for coding the level of contamination by solid particles

ISO 5598 Fluid power systems and components—Vocabulary

ISO 6403 Hydraulic fluid power—Valves controlling flow and pressure—Test methods

ISO 10770-1 Hydraulic fluid power—Electrically modulated hydraulic control valves—Part 1: Test methods for four-way directional flow control valves

ISO 10770-2 Hydraulic fluid power—Electrically modulated hydraulic control valves—Part 2: Test methods for three-way directional flow control valves

ISO 11500 Hydraulic fluid power—Determination of the particulate contamination level of a liquid sample by automatic particle counting using the light-extinction principle

ISO 12103-1 Road vehicles—Test dust for filter evaluation—Part 1: Arizona test dust

ISO 16889 Hydraulic fluid power—Filters—Multi-pass method for evaluating filtration performance of a filter element

3. DEFINITIONS

For definitions of other terms, see ISO 5598.

3.1 Contaminant Lock/Silt Lock

The process of restricting movement by contaminant buildup between two surfaces which move in relation to each other, such as spool/bore or spool/sleeve assemblies.

3.2 Contaminant Sensitivity

The change in valve performance caused by particulate contaminants in the fluid.

4. TEST REQUIREMENTS

4.1 Test Equipment

4.1.1 The test system shall consist of a hydraulic test circuit, as illustrated in Figure 1, comprising of a reservoir, a pumping unit, an injection system, a heat exchanger, a flow-meter, pressure gauges, a temperature indicator, a relief valve, a control valve, and cleanup control filters. Select components for the test circuit that are of a design known to function satisfactorily with contaminated fluid.

4.1.2 Construct the reservoir with a conical bottom having an included angle of less than 90 degrees to ensure sufficient fluid agitation. Diffuse the hydraulic fluid entering the reservoir below the surface of the fluid.

4.1.3 Construct an injection chamber, which will ensure that no contaminant is trapped in the injection chamber. A chamber with a volume of approximately 500 mL, with a length to diameter ratio of approximately 10 and having a conical bottom with an included angle of less than 90 degrees, is recommended.

4.1.4 Use a heat exchanger that does not constitute a contaminant trap.

NOTE: It is recommended that either a one or two-pass unit be used and mounted vertically with the hydraulic fluid entering the heat exchanger from the bottom. It is also recommended that the hydraulic fluid be circulated through the tube side and the water through the shell side.

4.1.5 Use a flowmeter that is insensitive to contaminant and is accurate to within 2% of full value.

4.1.6 Use control filters which are capable of providing a contaminant background of less than or equal to 40 particles/mL greater than 5 μm size and less than or equal to 10 particles/mL greater than 15 μm size.

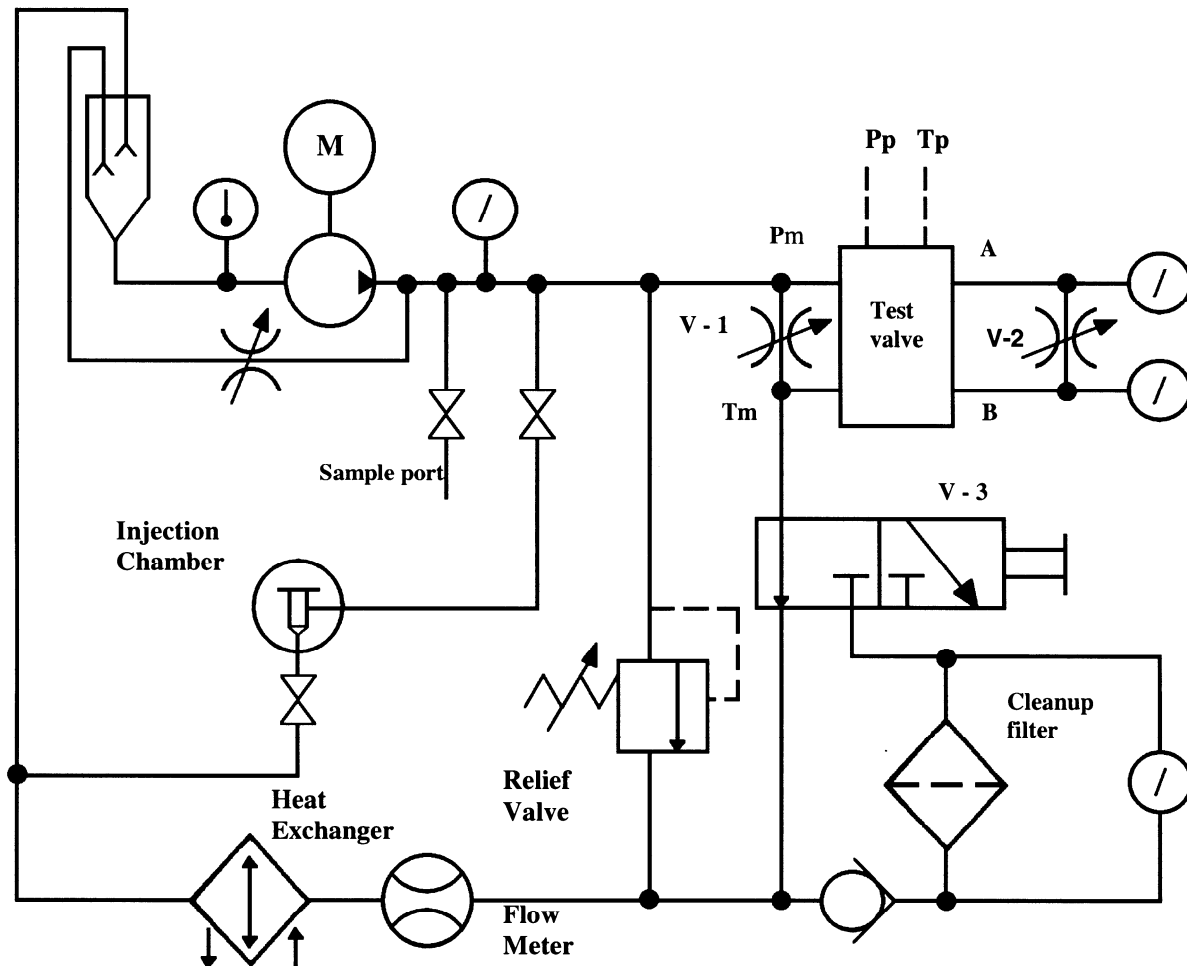
4.1.7 Provide a facility for gravimetric measurement of the contamination level of the fluid in accordance with SAE ARP785 or ISO 4405.

4.1.8 The test circuit requires one or more bypass throttling valves to maintain flow and pressure. When the test valve is in a position that permits flow through the test valve, the throttling bypass valve V-1 shall be closed and V-2 adjusted to maintain the required pressure. The test circuit may require slight modifications to suit the particular valve being tested. For valves with one or more external pilots, a pilot line will be required. Unless otherwise specified, pilot lines shall be subjected to the same contaminant source as the rest of the test valve. A relief valve or rupture disc may be incorporated into the system to protect the pump, however, no fluid should pass through it during the testing of the valve at selected positions. (Flow through the relief at time of shifting is permissible for blocked center valves and valves with blocked crossover.)

V - 1 Throttling bypass valve to maintain flow in test circuit if test valve is closed.

V - 2 Throttling bypass valve to maintain pressure in test circuit when there is flow through the test valve.

V-3 Clean-up filter selector valve -shown in contaminant test position.



Note: Symbols are in accordance with ISO 1219-1 except for the injection chamber.

FIGURE 1 - TYPICAL VALVE CONTAMINANT SENSITIVITY TEST CIRCUIT

4.2 Test Fluid and Volume

4.2.1 Use a mineral oil ISO viscosity grade 32 fluid, unless the customer identifies a specific fluid. Report the fluid specification, brand name, supplier, and batch identification.

4.2.2 A test system (exclusive of the system cleanup filter circuit) with a fluid volume that is numerically equal to one-fourth to one-half the designated test volume flow per minute is recommended. In some valve positions, there will only be leakage flow through the valve. However, flow must be kept relatively high to keep the contaminant in suspension in order to qualify the system. In other valve positions, the force to shift the valve may be a function of the flow rate and operating pressures and the maximum shift forces may occur at specific flow and pressure conditions. The fluid volume shall be recorded.