SAE International	SURFACE VEHICLE RECOMMENDED PRACTICE	SAE J1118 DEC2012
		Issued 1993-06 Stabilized 2012-12 Superseding J1118 AUG2002

Hydraulic Valves for Motor Vehicle Brake Systems Test Procedure

RATIONALE

The use of hydraulic valves had decreased with the advent of electronic controls so this standard should be stabilized.

STABILIZED NOTICE

This document has been declared "Stabilized" by the SAE Hydraulic Brake Components Standards Committee and will no longer be subjected to periodic reviews for currency. Users are responsible for verifying references and continued suitability of technical requirements. Newer technology may exist.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: http://www.sae.org

1. ***Scope***—The SAE Recommended Practice specifies the test procedure to assure valve assemblies which are satisfactory for vehicle usage, and it is applicable to new valve assemblies for commercial production. It covers such valves where they are employed in passenger car and light truck brake systems utilizing motor vehicle hydraulic brake fluids. This procedure and requirements (SAE J1137) was developed for brake fluids conforming to SAE J1703 and FMVSS 116 (DOT 3); however, it may be utilized for valves which use DOT 4 or DOT 5 brake fluid.

These procedure specifications were developed for base brake operation and do not consider the effects of ABS (anti-lock brake systems) or traction control systems which may have a significant effect on the valve. Careful analysis of the particular type ABS and/or traction control (if included in the system) should be made and additional tests are required which are not included in this document. Provisions for ABS and traction control will be incorporated in a future revision or covered in a separate document.

The minimum performance requirements are specified in SAE J1137.

1.1 Purpose—This document applies to valve assemblies used in hydraulically operated brake systems of highway vehicles. It is applicable for differential warning, metering hold-off, bypass function, or proportioning type valves or any combination thereof.

2. *References*

2.1 Applicable Publications—The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

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

SAE J1137—Hydraulic Valves for Motor Vehicle Brake Systems—Performance Requirements
SAE J1703—Motor Vehicle Brake Fluid

2.1.2 FMVSS PUBLICATION—Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

FMVSS 116—Motor Vehicle Brake Fluids

3. ***Test Apparatus*—**The basic apparatus shall be that shown and as arranged in Figure 1. All hydraulic lines and fittings shall be of actual size and design similar to, or equivalent to, the representative vehicle installation.

3.1 Hydraulic Pressure Actuating Mechanism—The pressure actuating mechanism should be a dual master cylinder capable of a rate of pressure application and retraction to the valve of 3448 kPa/s ± 345 kPa/s (500 psi/s ± 50 psi/s), unless otherwise specified.

3.1.1 For single stroke operation, the actuating mechanism must be capable of generating pressures to the valve from 138 to 20 685 kPa (20 to 3000 psi) at a uniform apply and release rate and it must have adjustments such that the pressures can be held statically after they are achieved.

3.1.2 For cyclic operation the mechanism must be capable of generating pressures up to 6900 kPa (1000 psi) at a uniform apply and release rate. The actuating mechanisms, when releasing, must permit the full release of hydraulic pressure.

3.2 Load Fixture (Displacement for Foundation Brake Simulation)—The displacement devices need to simulate the pressure versus displacement curves for the actual vehicle within ±10%. If it is not known, use Figure 3 for total rear brake system and connect to the valve outlet to the rear brakes. Use Figure 4 for each front brake corner and connect to each valve outlet to front brakes.

NOTE—It is recommended that the largest size actual brake assemblies for the manufacturers' intended valve usage be used in place of fixtures. In this case, it is not necessary to measure or meet the requirements of Figure 3 or Figure 4, but need to be plumbed as required for the particular vehicle for intended usage. Use large enough m/cylinder (bore size and stroke) to provide at least the required amount of brake fluid supply to each brake system.

3.3 Instrumentation—Hydraulic pressure measuring devices with a range to 20 685 kPa (3000 psi) are required and shall have accuracy of ±0.5%. An X-Y-Y plotter or equivalent (for functional testing) and a counter shall be used to record number of strokes during cyclic operation. A 12 VDC power source is required and connected to the warning lamp switch to indicate contact.

A leak trap shall be provided for each sealing point on the valve assembly as required for the various tests that require measuring leakage including the connections. They shall have minimum exposed area to minimize evaporation.

3.4 Environmental Equipment

3.4.1 OZONE CHAMBER—An ozone chamber as described in ASTM D 1149. It must maintain 50 pphm by volume at 37.7 °C ± 3 °C (100 °F ± 5 °F) ozone concentration.

3.4.2 HEATED AIR CHAMBER—An insulated oven or cabinet having sufficient capacity to house test valve. A suitable thermostatically controlled heating system is required to maintain a uniform and forced air circulation temperature of 120 °C ± 3 °C (248 °F ± 5 °F). It shall be such that the valves can be checked and operated without removal. Heaters shall be shielded to prevent direct radiation to valve assembly.

3.4.3 COLD CHAMBER—A cold chamber shall be provided having sufficient capacity to house test valve. It shall be such that valves can be checked and operated without removal, and it shall be capable of maintaining a uniform atmosphere of cold air at −40 to −42.8 °C (−40 to −45 °F) temperature.

3.5 Fluid and Test Fittings—Use brake fluid conforming to SAE J1703 and FMVSS 116 (DOT 3) or the recommended DOT brake fluid. The hydraulic tubing connections to the valve assembly shall be of the type intended for the particular vehicle for intended usage and shall be torqued to recommended specifications.

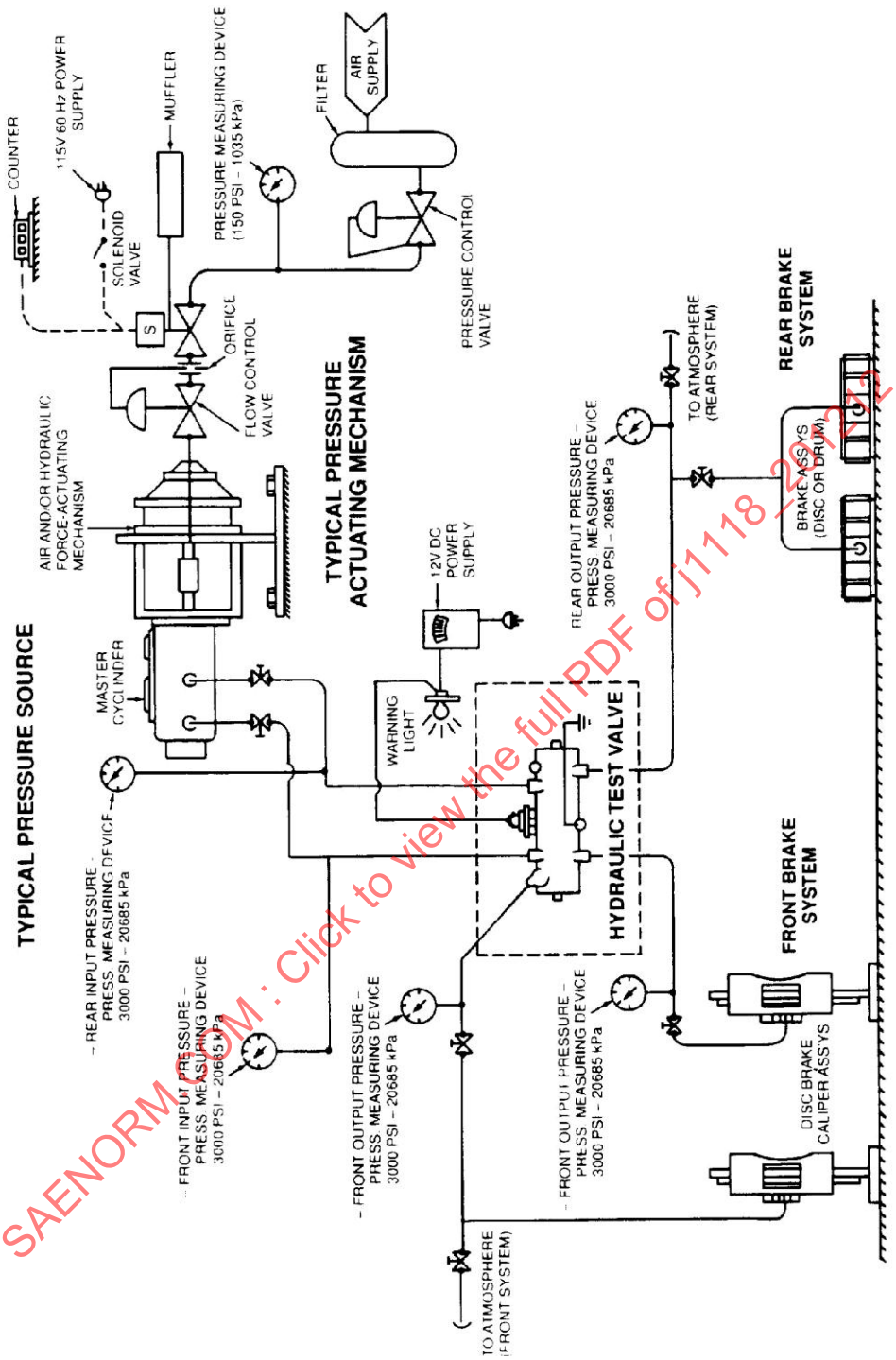

FIGURE 1—TEST APPARATUS

***4. Test Set-Up and Procedures*—**All tests shall be conducted with the valve and fluid at room temperature 15 to 32 °C (60 to 90 °F) except where otherwise specified. Valve assemblies may be disassembled after the tests are completed unless otherwise specified or testing is discontinued.

4.1 Functional Characteristics—Connect hydraulic lines per Figure 1 and tighten all connections to nominal torque specified by the vehicle manufacturer. Fill the test setup with new brake fluid and bleed the system as necessary to remove all air. Using a X-Y-Y plotter or equivalent, set X as the front inlet pressure (when measuring fronts) or as rear inlet pressure (when measuring rears), and Y1 the front brake outlet pressure (either front outlet port) and Y2 the rear brake outlet pressure, and conduct the performance test.

4.1.1 PERFORMANCE TEST—Apply pressure to the inlet port at the rate described in 3.1 to 6900 kPa +345, –0 kPa (1000 psi +50, –0 psi). Plot the performance of apply and release (reference Figure 2). Analyzing the input-output curves will determine the metering performance (holdoff and blendback), proportioner performance (knee and percent slope), and hysteresis (difference of curves between apply and release).

4.1.1.1 Record holdoff of front metering pressure (point A, Figure 2 on the apply curve where the inlet pressure increases with no increase in output pressure).

4.1.1.2 Record the point where the metering pressure starts to increase again after the holdoff (point B, Figure 2).

4.1.1.3 Record blendback of metering pressures (point C, Figure 2 on the apply curve where the outlet and inlet pressures have returned to within 138 kPa [20 psi]).

4.1.1.4 Record the metering outlet pressure on apply and on release at 6900 kPa (1000 psi).

4.1.1.5 Record knee pressure of the proportioner (point on the apply curve where the rear outlet pressure departs from the inlet pressure curve).

4.1.1.6 Calculate percent slope of proportioner performance (divide the total increase of outlet pressure after the knee point by the total increase of inlet pressure after the knee point).

4.1.2 PROPORTIONER LEAKUP CHECK—Reapply to 6900 kPa (1000 psi) and hold for 30 s at the static pressure.

4.1.2.1 Record initial and final pressure (5 s stabilization time permitted).

4.2 Differential Warning Activation—Open front system outlet to atmosphere. The 12 to 14 V DC electrical circuit shall be connected to the warning lamp switch to indicate switch contact (reference Figure 1). Switch shall be open before applying pressure. The X of the plotter is to be set for measuring rear inlet pressure (change to front inlet when measuring front inlet pressure). Apply pressure at the prescribed rate to the rear system inlet port to 6895 kPa +345, –0 kPa (1000 psi +50, –0 psi) and hold for 30 s (5 s stabilization time permitted).

4.2.1 Record rear inlet pressure to activate warning lamp.

4.2.2 Record rear outlet pressure at 6900 kPa (1000 psi) inlet pressure after the differential piston has shuttled and the warning lamp is activated (bypass feature check).

4.2.3 Record the rear initial and final inlet and outlet pressures after 30 s.

4.2.4 Release pressure, close front outlet to atmosphere, and rebleed if air ingestion is suspected, being careful not to recenter the shuttle piston.

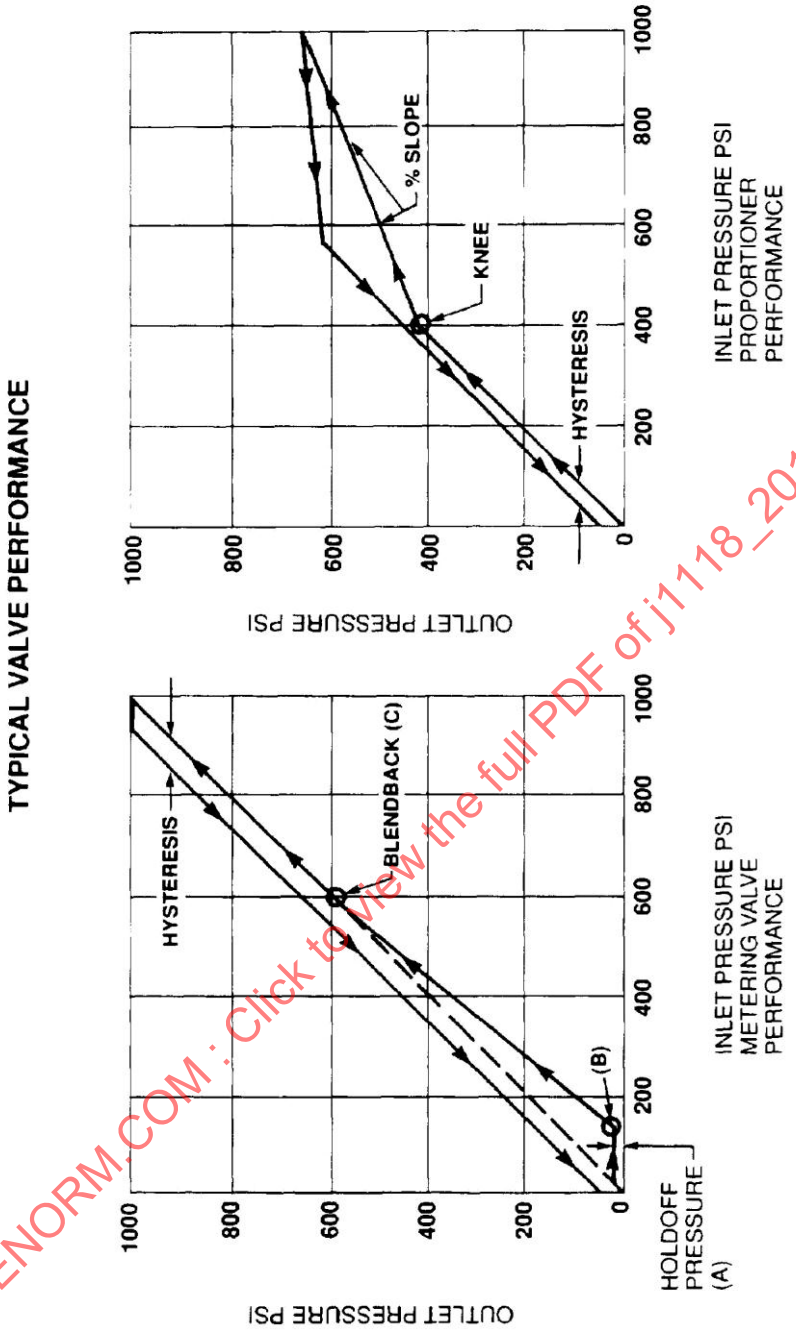

FIGURE 2—TYPICAL VALVE PERFORMANCE

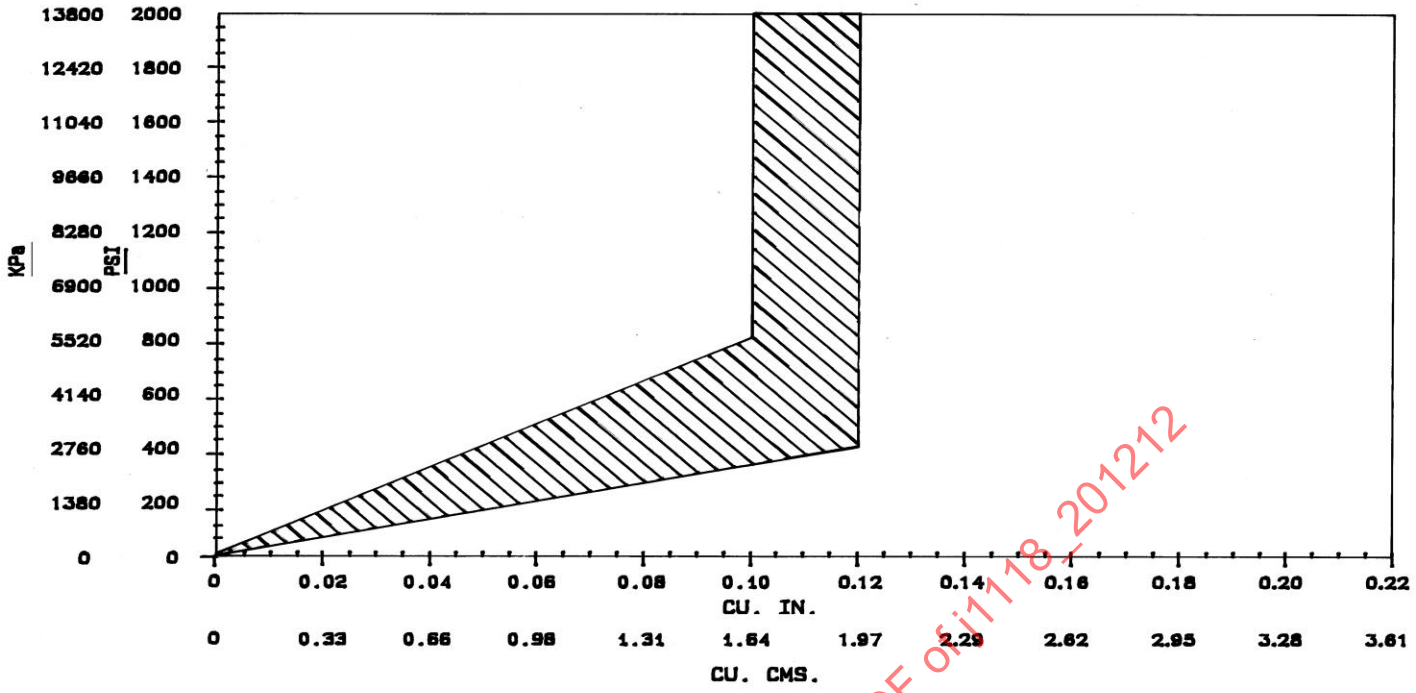

FIGURE 3—REAR BRAKES

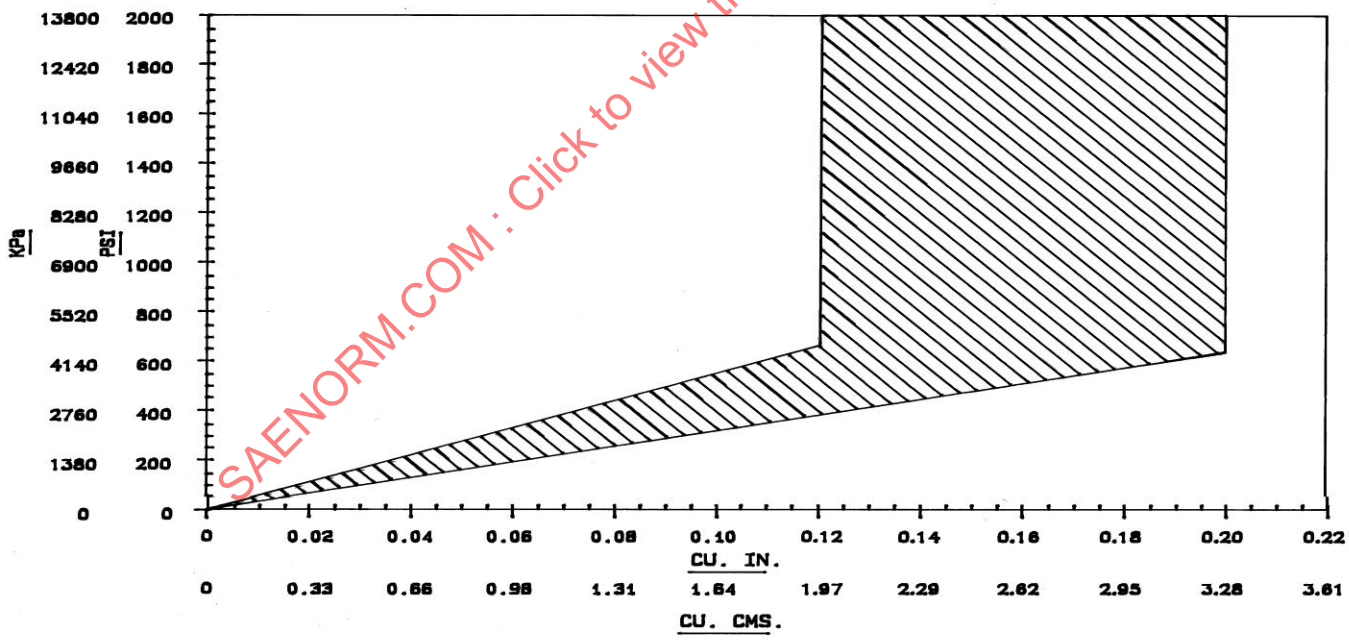

FIGURE 4—EACH FRONT BRAKE

4.2.5 Reapply pressure to both valve inlet ports at the prescribed rate and record the pressure to recenter the differential piston by noting the pressure at which the warning lamp breaks contact.

4.2.6 Repeat this entire section (4.2) except open rear outlet system to atmosphere, change X on plotter to the front inlet, and apply pressure to the front inlet port.

4.3 Reverse Flow Tests—Reverse the valve connections so that the valve inlet lines are open to atmosphere and the master cylinder is supplying fluid to the valve outlets (check each front separately). Place a measuring beaker under each valve inlet port to measure the amount of fluid discharged. Apply 344 kPa ± 68 kPa (50 psi ± 10 psi) pressure to the outlet ports.

4.3.1 Measure the time at 344 kPa ± 68 kPa (50 psi ± 10 psi) and amount of fluid obtained from the inlet ports and calculate flow rate (cc/min).

4.3.2 Connect back to normal Figure 1 setup with the master cylinder connected to the inlet ports. Open the valve outlet lines to atmosphere.

4.3.3 Apply 344 kPa ± 68 kPa (50 psi ± 10 psi) to the valve inlet ports. Measure the time at pressure and amount of fluid obtained from the outlet ports and calculate flow rate (cc/min).

4.4 Pressure Leak and Physical Strength Test—Using the normal setup (master cylinder to inlet ports per Figure 1) and using recommended outlet connections. Shut off beyond the connection (load fixtures not to be included for any leak or physical strength tests). Tighten all connections to nominal torque specified by the manufacturer. Fill the test setup with new brake fluid and bleed at all points in the system as necessary to remove air. Use the same valves for all leak and physical strength tests.

4.4.1 LOW-PRESSURE LEAK TEST—Apply pressure to build 138 kPa ± 35 kPa (20 psi ± 5 psi) pressure simultaneously in front and rear brake systems of valve assembly. Close shut-off valve to pressure source, and release pressure source.

Allow pressure to valve assembly to stabilize for 15 to 20 s and then record pressure at beginning and end of a 30 s ± 1 s interval. Also record any amount of leakage. It may be necessary to remove any dust covers or boots to aid leak detection.

4.4.2 HIGH-PRESSURE LEAK TEST—Apply 13 790 kPa ± 345 kPa (2000 psi ± 50 psi) pressure simultaneously in front and rear brake systems of valve assembly. Close shut-off valves to pressure source, and release pressure source.

Allow pressure to hydraulic valve assembly to stabilize for 15 to 20 s and then record pressure at beginning and end of a 30 s ± 1 s interval. Also record any amount of leakage. It may be necessary to remove any dust covers or boots to aid leak detection.

4.4.3 PHYSICAL STRENGTH TEST—Apply pressure to build up 20 685 kPa ± 690 kPa (3000 psi ± 100 psi) simultaneously in front and rear brake system of valve assembly. Hold pressure for 15 s ± 5 s and then release.

Observe pressure gage during test and visually inspect valve assembly for signs of leakage or structural failure.

4.4.4 Repeat 4.1 and 4.2 of functional characteristics on all valves tested for leak and physical strength.