



SURFACE VEHICLE RECOMMENDED PRACTICE

J2932™

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Air Disc Brake Actuator Test Requirements

RATIONALE

Piston spring brakes are becoming increasingly common in North America with the continued adoption of air disc brake. This update defines the performance requirements for these types of spring brakes. This update also harmonizes the T18 service force output with SAE J2318 and removes the reference to DIN 74060-3 2002 for this size.

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1. SCOPE

This SAE Recommended Practice provides test performance requirements for air disc brake actuators for service and combination service parking brake actuators with respect to function, durability, and environmental performance when tested according to SAE J2902.

1.1 Purpose

This SAE Recommended Practice provides recommended uniform minimum requirements for air disc brake actuators used in brake systems for truck, truck-tractor, bus, and trailer applications.

2. REFERENCES

2.1 Applicable Documents

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 International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J2902 Air Disc Brake Actuator Test Procedure, Truck-Tractor, Bus, and Trailer

2.1.2 U.S. Government Publications

Copies of these documents are available online at <https://quicksearch.dla.mil>.

FMVSS 121 Air Brake Systems, 49 Code of Federal Regulations Parts 571.121

2.1.3 DIN Publications

Available from the Standardization Committee of Motor Vehicles (FAKRA) in the DIN German Institute for Standardization.

DIN 74060-3 2002 Compressed Air Brakes, Pneumatic Cylinder, Part 3 - Diaphragm Cylinder, Characteristic Data for Disc Brakes

3. DEFINITIONS

Refer to SAE J2902, Section 3.

3.1 DOUBLE DIAPHRAGM SPRING BRAKE (DDSB)

Consisting of a diaphragm on the service side and a separate diaphragm on the parking side.

3.2 PISTON PARKING CHAMBER

Spring brake consisting of a diaphragm on the service side and a separate piston with a dynamic seal on the parking side.

4. LEAK RATE - PARKING AND SERVICE CHAMBERS

Refer to SAE J2902, Test Procedure 4

For allowable leak rate, see Table 1.

Table 1 - Leak rate parking chamber, service chamber, and caliper flange seal

Chamber Tested	Maximum Allowable Leakage Rate (Calculated)	Alternate Test Procedure Maximum Allowable Pressure Change	Applicable SAE J2902 Test Procedure
DDSB Parking Chamber	23 cc/min (1.40 in ³ /min)	10.34 kPa (1.5 psig)	4.1.2
			4.1.3
Piston Parking Chamber	30 cc/min (1.83 in ³ /min)		4.1.2
Service Chamber	23 cc/min (1.40 in ³ /min)	10.34 kPa (1.5 psig)	4.2.2
			4.2.3
Caliper Flange Seal		0.7 kPa (0.1 psig)	4.3.2

5. RELEASE AND HOLD-OFF PRESSURE - PARKING CHAMBER

Refer to SAE J2902, Test Procedure 5

Hold-off pressure (pressure decreasing) is typically measured at 5 mm (0.20 inch) stroke of the DDSB parking chamber from the actuator zero stroke position. A maximum target hold-off pressure of 483 kPa (70 psig) will, in most applications, ensure the brakes do not drag. This requirement may vary depending on a vehicle air brake system, which may allow higher hold-off pressure or require lower hold-off pressure. A low hold-off pressure is preferred to ensure brakes do not drag.

Release pressure (pressure increasing) is typically measured at 5 mm (0.20 inch) stroke of the piston parking chamber from the actuator zero stroke position. The maximum release pressure varies with the chamber size and force output. The requirements are listed in Table 2. (Note that piston chambers may not meet FMVSS 121 S5.8.3 automatic application of parking brakes, 70 psi no brake retardation requirement for trailers.)

Table 2 - Release pressure

Chamber Size (Stroke)	Max Release Pressure at 5 mm (0.20 inch)
14 (40 mm, 1.58 inches)	6 bar (87 psi)
16 (57 mm, 2.25 inches)	5.5 bar (80 psi)
24 (57 to 64 mm, 2.25 to 2.50 inches)	5.4 bar (78 psi)
24 HF (57 to 64 mm, 2.25 to 2.50 inches)	5.8 bar (84 psi)
24 HFL3 (64 mm, 2.50 inches)	6.4 bar (93 psi)

6. MINIMUM PRESSURE RESPONSE - SERVICE CHAMBERS

Refer to SAE J2902, Test Procedure 6.

The response pressure is to be measured, recorded and made available upon customer request.

Measured response pressure shall be no greater than 0.34 bar (5 psig).

7. FORCE OUTPUT AND STROKE - PARKING AND SERVICE CHAMBERS

7.1 Parking Chamber

Refer to SAE J2902, Test Procedure 7.1.

Parking force output for the most common diaphragm actuated air disc brake parking chambers are given in Table 2 for reference purposes only. Force values given are nominal $\pm 10\%$. Various application differences may require other spring forces by size (type). Parking chamber force output is measured for a new complete combination actuator assembly after the power spring has been fully caged for 24 hours. Test procedures other than SAE J2902 may require the spring to be caged for a longer period. The forces given in Table 2 are only applicable to the test procedure in SAE J2902.

Some parking chamber sizes may be offered with various parking forces to accommodate different applications and customer requirements; only the most common diaphragm parking chamber forces are given in Table 2.

Table 3 - Diaphragm parking chamber force output at stroke⁽¹⁾

	Chamber Size	Rated Stroke Millimeters (Inches)	Units	33% of Rated Stroke	90% of Rated Stroke	Max (Allowable Increase Over Min)
				Min	Min	
DDSB	24	57.2 (2.25)	N (lbf)	5413 (1217)	3975 (894)	+1335 N (+300 lbf)
	24	63.5 (2.50)	N (lbf)	5371 (1207)	3363 (756)	
	30		N (lbf)	6297 (1416)	4244 (954)	
Piston	14	40 (1.58)	N (lbf)	5231 (1176)	4456 (1002)	+890 N (+200 lbf)
	16	57 (2.25)	N (lbf)	6215 (1397)	3428 (771)	+1335 N (+300 lbf)
	24	57 (2.25)	N (lbf)	8117 (1825)	5678 (6346)	
	24 HF	57 (2.25)	N (lbf)	9630 (2165)	7707 (1732)	
	24	64 (2.50)	N (lbf)	7949 (1787)	5221 (1174)	
	24 HF	64 (2.50)	N (lbf)	9494 (2134)	7334 (1649)	
	24 HFL3	64 (2.50)	N (lbf)	10878 (2445)	8543 (1920)	

⁽¹⁾ Table 3: For reference only.

7.2 Service Chamber

Refer to SAE J2902, Test Procedure 7.2.

Service chamber force outputs versus stroke at applied air pressures are given in Table 4.

**Table 4 - Service chamber force output at stroke
(for reference purposes only)**

Type/Size	Nominal Rated Stroke Millimeters (Inches)	Nominal Force at Pressure N (lbf)			
		1.38 bar (20 psig)	4.14 bar (60 psig)	6.59 bar (100 psig)	8.96 bar (130 psig)
10 ⁽¹⁾	57.2 (2.25)	523 (118)	2182 (490)	3654 (821)	5076 (1141)
12		841 (189)	2856 (642)	4857 (1092)	6344 (1426)
14		865 (189)	3410 (767)	5820 (1309)	7598 (1708)
15 ⁽¹⁾		897 (202)	3486 (784)	5785 (1300)	8012 (1801)
16		890 (200)	3963 (891)	6784 (1525)	8853 (1990)
18		1106 (249)	4328 (973)	7433 (1671)	9593 (2157)
18 ⁽¹⁾	63.5 (2.50)	1106 (249)	4328 (973)	7433 (1671)	9593 (2157)
20		1323 (298)	4693 (1055)	8082 (1817)	10644 (2393)
22		1507 (339)	5185 (1166)	8865 (1993)	11573 (2602)
24		1690 (380)	5677 (1276)	9648 (2169)	12501 (2810)
27 ⁽¹⁾		1909 (429)	6524 (1467)	10621 (2388)	14591 (3280)
30		2235 (503)	7340 (1650)	12411 (2790)	16196 (3641)
Max Tol: 33-90% Nom Rated Stroke		+10%	+5%	+5%	+5%
Min Tol: 33-67% Nom Rated Stroke		-15%	-5%	-5%	-5%
Min Tol: at 90% Nom Rated Stroke		-30%	-15%	-15%	-15%

⁽¹⁾ Minimum tolerance is a linear progression from the minimum value at 67% of nominal rated stroke to the minimum value at 90% of rated stroke.

8. LOW TEMPERATURE LEAKAGE - PARKING AND SERVICE CHAMBERS

Refer to SAE J2902, Test Procedure 8.

Allowable leakage is shown in Table 5 for test performed at -40 °C (-40 °F). Arctic leakage testing at -54 °C ± 1 °C (-65 °F ± 2 °F) is an optional test and requirements shall be agreed to with the vehicle manufacture or customer.

**Table 5 - Low temperature leak rate
parking chamber and service chamber**

Chamber Tested	Maximum Allowable Leakage Rate (Calculated)	Alternate Test Procedure Maximum Allowable Pressure Change	Applicable SAE J2902 Test Procedure
DDSB Parking Chamber	30 cc/min (1.83 in ³ /min)	13.79 kPa (2.0 psig)	8.1.2
			8.1.3
Piston Parking Chamber	1,500 cc/min (91.5 in ³ /min)		8.1.2
Service Chamber	30 cc/min (1.83 in ³ /min)	13.79 kPa (2.0 psig)	8.2.2
			8.2.3

9. LOW TEMPERATURE MAX RELEASE AND HOLD-OFF - PARKING CHAMBER

Refer to SAE J2902, Test Procedure 9.

Optional test, only if required by vehicle manufacturer or customer, requirements same as Section 5.

10. LOW TEMPERATURE FORCE OUTPUT - PARKING CHAMBER

Refer to SAE J2902, Test Procedure 10.

Optional test, only if required by vehicle manufacturer or customer, requirements same as 7.1.

11. LOW TEMPERATURE OPERATIONAL TESTS - SERVICE CHAMBER

11.1 Low Temperature Service Return Test

Refer to SAE J2902, Test Procedure 11.1.

The service chamber diaphragm shall return to within 6.4 mm (0.25 inch) of zero stroke position within 60 seconds without assistance.

11.2 Low Temperature Minimum Response Test, Service Chamber

Refer to SAE J2902, Test Procedure 11.2.

Same as Section 6.

11.3 Brittle Failure Check

Upon disassembly (after completion of Section 18, Test Unit A) there shall be no evidence of cracking or brittle failure of the diaphragm or the caliper flange seal boot.

12. CHAMBER VOLUME - SERVICE CHAMBERS

12.1 Service Chamber

Refer to SAE J2902, Test Procedure 12.1.

Service chamber volumes should be recorded. These values may need to be used to comply with FMVSS 121 section 5.1.2.1 for trucks and buses and section 5.2.2.1 for trailers. The sizes listed in Table 4 are not all listed in FMVSS121 Table V - "Brake Chamber Rated Volumes."

13. CORROSION RESISTANCE - PARKING AND SERVICE CHAMBER

Refer to SAE J2902, Test Procedure 13.

After assemblies have been air dried, they shall meet the following minimum requirements.

13.1 Output Force for a Parking Chamber of a Combination Actuator

Same as 7.1.

13.2 Leakage - DDSB Parking Chamber

Same as Section 8, Table 5. Piston chamber: 50 cc/min (3.05 in³/min).

13.3 Leakage - Service Chamber

Same as Section 8, Table 4.

13.4 Leakage - Caliper Flange Pushrod Boot Seal

Same as Section 4, Table 1.

13.5 Mechanical Back-Off Release Mechanism

Same as Section 14.

14. MECHANICAL BACK-OFF RELEASE MECHANISM

Refer to SAE J2902, Test Procedure 14.3.

The running torque of the release mechanism shall not be greater than 67.8 N·m (50 lb-ft) during the manual caging cycle (manual spring compression cycle) for the power spring for two applications.

No evidence of galling of the threads of any internal or external threaded parts is permitted.

15. ELEVATED TEMPERATURE CYCLE TEST - PARKING AND SERVICE CHAMBERS

15.1 Parking Chamber

Refer to SAE J2902, Test Procedure 15.1.

15.1.1 Leakage, DDSB Chamber

Same as Section 8, Table 5. Piston chamber: 200 cc/min (12.20 in³/min).

15.2 Service Chamber

Refer to SAE J2902, Test Procedure 15.2.

15.2.1 Leakage

Same as Section 8, Table 4.

15.3 Component Failure

There shall be no component failure.

16. CYCLE TEST - PARKING AND SERVICE CHAMBERS

16.1 Parking Chamber

Refer to SAE J2902, Test Procedure 16.1.

DDSB test assemblies must complete 200000 cycles. Piston chambers must complete 500000 cycles.

After completion of cycle testing, the assemblies shall meet the following requirements.

16.1.1 Leakage Parking Chamber

DDSB same as Section 8, Table 4. Piston Chamber 200 cc/min (12.20 in³/min).