



SURFACE VEHICLE STANDARD



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Air Brake Actuator Test Performance Requirements—Truck and Bus

RATIONALE

The minimum pressure response is too sensitive to the size of the chamber to define a recommended range that can be applied for all sizes. The minimum pressure response recommended range was removed. The minimum pressure response is to be measured and recorded and made available upon customer request.

TABLE OF CONTENTS

1.	SCOPE.....	2
1.1	Purpose.....	2
2.	REFERENCES.....	2
2.1	Applicable Publications.....	2
2.1.1	SAE Publications.....	2
2.1.2	U. S. Government Publications.....	3
3.	DEFINITIONS.....	3
4.	LEAK RATE—PARKING AND SERVICE CHAMBER.....	3
5.	CHAMBER VOLUME—PARKING AND SERVICE CHAMBER.....	3
5.2	Parking Chamber.....	3
5.3	Service Chamber.....	3
6.	RELEASE AND HOLD-OFF PRESSURE—PARKING CHAMBER.....	3
7.	PRESSURE RESPONSE—SERVICE CHAMBER.....	4
8.	FORCE OUTPUT AND STROKE—PARKING CHAMBER.....	4
9.	FORCE OUTPUT AND STROKE—SERVICE CHAMBER.....	4
10.	LOW TEMPERATURE LEAKAGE—PARKING AND SERVICE CHAMBER.....	7
11.	LOW TEMPERATURE MAXIMUM RELEASE AND HOLD-OFF PRESSURE.....	7

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12.	LOW TEMPERATURE FORCE OUTPUT—PARKING CHAMBER.....	7
13.	LOW TEMPERATURE OPERATIONAL TEST—SERVICE CHAMBER.....	7
14.	CORROSION RESISTANCE-COMBINATION, PARKING, AND SERVICE ACTUATORS.....	7
15.	MECHANICAL BACK-OFF RELEASE MECHANISM	8
16.	PROOF PRESSURE TEST—PARKING AND SERVICE CHAMBER.....	8
16.2	Parking Chamber	8
16.3	Service Chamber	8
17.	CYCLE TEST—PARKING CHAMBER.....	8
18.	CYCLE TEST—SERVICE CHAMBER	9
19.	ELEVATED TEMPERATURE CYCLE TEST—PARKING AND SERVICE CHAMBER	9
19.2	Parking Chamber	9
19.3	Service Chamber	9
20.	VIBRATION TEST.....	9
20.3	Mounting Nut Torque	9
20.4	Leakage Test	9
20.5	Performance Test.....	10
20.6	Structural.....	10
21.	NOTES.....	10
21.1	Marginal Indicia.....	10

1. SCOPE

This procedure provides test performance requirements for service, spring applied parking, and double diaphragm combination air brake actuators with respect to durability, function, and environmental performance when tested in accordance to SAE J1469.

1.1 Purpose

This SAE recommended procedure provides uniform minimum requirements for air brake actuators used in air brake systems for trucks, truck-tractor, bus, and trailers.

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 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 724-776-4970 (outside USA), www.sae.org.

SAE J1469 Air Brake Actuator Test Procedure, Truck-Tractor, Bus, and Trailers

2.1.2 U. S. Government Publications

Available from the Document Automation and Production Service (DAPS), Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-6257, <http://assist.daps.dla.mil/quicksearch/>.

FMVSS 121 Air Brake Systems, 49 CFR Parts 571.121

3. DEFINITIONS

Refer to SAE J1469, Section 3.

4. LEAK RATE—PARKING AND SERVICE CHAMBER

For allowable leak rate, refer to Table 1.

4.1 Ref: SAE J1469 Test Procedure 4.

TABLE 1 - LEAK RATE - PARKING AND SERVICE CHAMBERS

Chamber Tested	Maximum Allowable Leakage Rate (Calculated)	Alternate Test Procedure Maximum Allowable Pressure Change	Applicable SAE J1469 Test Procedure
Parking Chamber	23 cc/min (1.40 in ³ /min)		4.1.2
		10.34 kPa (1.5 psig)	4.1.3
Service Chamber	23 cc/min (1.40 in ³ /min)		4.2.1
		10.34 kPa (1.5 psig)	4.2.3
Caliper Flange/ Pushrod Boot Seal		0.07kPa (0.1 psig)	4.3.2

5. CHAMBER VOLUME—PARKING AND SERVICE CHAMBER

5.1 Ref: SAE J1469 Test Procedure 5.

5.2 Parking Chamber

Per FMVSS121 air reservoir sizes are calculated from the service chamber volumes, therefore it is not required to provide recommended parking chamber volumes.

5.3 Service Chamber

Service chamber volumes should be in compliance with FMVSS 121 section 5.1.2.1 for trucks and buses and section 5.2.2.1 for trailers which references Table V – “Brake Chamber Rated Volumes”.

6. RELEASE AND HOLD-OFF PRESSURE—PARKING CHAMBER

6.1 Ref: SAE J1469 Test Procedure 6.

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

7. PRESSURE RESPONSE—SERVICE CHAMBER

7.1 Ref: SAE J1469 Test Procedure 7.

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

8. FORCE OUTPUT AND STROKE—PARKING CHAMBER

8.1 Ref: SAE J1469 Test Procedure 8.

8.2 Parking force output requirements for the most common standard and long-stroke diaphragm actuated parking chambers are given in Table 2 for reference purposes only. Forces given are nominal $\pm 10\%$. Parking chamber force output is measured for a complete (tandem) actuator after the power spring has been fully caged¹ for 24 hours. Test procedures other than SAE J1469 may require the spring be fully caged for 56 days or some other time period. The forces given in Table 2 are only applicable to test procedure SAE J1469.

8.3 There are various levels of parking forces for the same type (size) parking chambers, only the most common forces are given in Table 2. It is therefore incumbent upon OEM vehicle manufacturers to assure each vehicle meets grade holding or draw bar holding requirements, as well as, required stopping distances in accordance to FMVSS 121 for the specified parking chamber.

TABLE 2 - PARKING CHAMBER FORCE OUTPUT @ STROKE⁽¹⁾
(Nominal Forces Given $\pm 10\%$)

Type/Size	Rated Stroke										
	mm (inches)	mm (inches)	25.4 (1.00)	31.8 (1.25)	38.1 (1.50)	44.3 (1.75)	50.8 (2.00)	57.1 (2.25)	63.5 (2.50)	69.9 (2.75)	76.2 (3.00)
16	44.5 (1.75)	N (Lbf)	4515 (1015)	4213 (940)	3803 (855)	2224 (500)	-	-	-	-	-
	57.1 (2.25)	N (Lbf)	5694 (1280)	5382 (1210)	5115 (1150)	4804 (1080)	4448 (1000)	3736 (840)	-	-	-
24	63.5 (2.50)	N (Lbf)	5694 (1280)	5382 (1210)	5115 (1150)	4804 (1080)	4448 (1000)	3736 (840)	2758 (620)	-	-
	63.5 (2.50)	N (Lbf)	6717 (1510)	6316 (1420)	6005 (1350)	5694 (1280)	5293 (1190)	4715 (1060)	3981 (895)	-	-
30	76.2 (3.00)	N (Lbf)	6783 (1525)	6365 (1431)	6005 (1350)	5636 (1267)	5271 (1185)	4893 (1100)	4448 (1000)	4065 (914)	3665 (824)
	63.5 (2.50)	N (Lbf)	9119 (2050)	8874 (1995)	8452 (1900)	8096 (1820)	7784 (1750)	7228 (1625)	6806 (1530)	-	-
36	76.2 (3.00)	N (Lbf)	9119 (2050)	8874 (1995)	8452 (1900)	8096 (1820)	7784 (1750)	7228 (1625)	6806 (1530)	6227 (1400)	5138 (1155)

1. Table 2 - For Reference Purposes Only

9. FORCE OUTPUT AND STROKE—SERVICE CHAMBER

9.1 Ref: SAE J1469 Test Procedure 9.

9.2 Service chamber force output versus stroke at applied air pressures are given in the following tables:

Table 3 – Service Chamber Force Output

Table 4 – Rotochamber Force Output – Service at Stroke

¹ Cage – power spring restrained at its most compressed position within the parking chamber.

Data given is for the most common type (size) clamp band/sealed design service chambers and service side of tandem (combination) spring brake actuators. The forces charted are for double diaphragm actuators, as well as for Rotochambers - service.

NOTE: The intent of these tables is to provide industry minimum service application forces for the purpose of engineering calculations. There may however, be some variations to these values due to manufacturers design differences.

TABLE 3 - SERVICE CHAMBER FORCE OUTPUT @ STROKE⁽¹⁾

Type/Size	bar (psi)	1.38 (20)	2.76 (40)	4.14 (60)	5.52 (80)	6.59 (100)
9	N	801	1588	2455	3269	4110
	(Lbf)	(180)	(357)	(552)	(735)	(924)
12	N	841	1855	2856	3866	4857
	(Lbf)	(189)	(417)	(642)	(869)	(1092)
14	N	865	1979	3410	4635	5820
	(Lbf)	(195)	(445)	(767)	(1042)	(1309)
16	N	890	2104	3963	5405	6784
	(Lbf)	(200)	(473)	(891)	(1215)	(1525)
18	N	1106	2572	4328	5889	7433
	(Lbf)	(249)	(578)	(973)	(1324)	(1671)
20	N	1323	3040	4693	6374	8082
	(Lbf)	(298)	(684)	(1055)	(1433)	(1817)
22	N	1507	3371	5185	7060	8865
	(Lbf)	(339)	(758)	(1166)	(1587)	(1993)
24	N	1690	3701	5677	7746	9648
	(Lbf)	(380)	(832)	(1276)	(1741)	(2169)
30	N	2235	4751	7340	9888	12411
	(Lbf)	(503)	(1068)	(1650)	(2223)	(2790)
36	N	2709	5814	8830	11863	14808
	(Lbf)	(609)	(1307)	(1985)	(2667)	(3329)
33% to 90% rated stroke	Max Tol	+10%	5%	5%	5%	5%
33% to 67% rated stroke	Min Tol	-15%	-5%	-5%	-5%	-5%
@ 90% rated Stroke	Min Tol	-30%	-20%	-15%	-15%	-15%

1. Table 3 - For Reference Purposes only

2. Minimum allowable force is a linear progression from the Minimum value at 67% of rated stroke to the Minimum value at 90% of rated stroke

10. LOW TEMPERATURE LEAKAGE—PARKING AND SERVICE CHAMBER

For allowable leakage, refer to Table 5.

10.1 Ref: SAE J1469 Test Procedure 10.

TABLE 5 - LOW TEMPERATURE LEAKAGE - PARKING AND SERVICE CHAMBER

Chamber Tested	Maximum Allowable Leakage Rate (Calculated)	Alternate Test Procedure Maximum Allowable Pressure Change	Applicable SAE J1469 Test Procedure
Parking Chamber	30 cc/min (1.83 in ³ /min)		9.1.2
		13.79 kPa (2.0 psig)	9.1.3
Service Chamber	30 cc/min (1.83 in ³ /min)		9.2.2
		13.79 kPa (2.0 psig)	9.2.3
Caliper Flange Pushrod Boot Seal		0.07 KPa (0.1 psig)	

11. LOW TEMPERATURE MAXIMUM RELEASE AND HOLD-OFF PRESSURE

11.1 Ref: SAE J1469 test procedure 11.

11.2 Same as Section 6.

12. LOW TEMPERATURE FORCE OUTPUT—PARKING CHAMBER

12.1 Ref: SAE J1469 Test Procedure 12.

12.2 Same as Section 8.

13. LOW TEMPERATURE OPERATIONAL TEST—SERVICE CHAMBER

13.1 Ref: SAE J1469 Test Procedure 13.1.

13.2 The service chamber diaphragm shall return to within 6.4 mm (0.25 in) of zero stroke within 60 s without assistance.

13.3 Upon disassembly there shall be no visual damage or cracking to the diaphragm.

13.4 Ref: SAE J1469 Test Procedure 13.2.

13.5 Same as Section 7.

14. CORROSION RESISTANCE-COMBINATION, PARKING, AND SERVICE ACTUATORS

14.1 Ref: SAE J1469 Test Procedure 14.

14.2 After units have been air dried, they shall meet the following minimum requirements:

14.2.1 Output Force for Parking Chamber of a Combination Actuator

Same as Section 8.

14.2.2 Release Pressure for a Parking Chamber of a Combination Actuator

Same as Section 6.

14.2.3 Leakage—Parking Chamber

Same as Section 10.

14.2.4 Leakage—Service Chamber

Same as Section 10.

14.2.5 Mechanical Back-Off Release Mechanism for Spring Brake Actuators with Integral Release Mechanisms

Same as 15.2.

15. MECHANICAL BACK-OFF RELEASE MECHANISM

15.1 Ref: SAE J1469 Test Procedure 15.

15.2 The running torque shall not be greater than 67.8 N·m (50 lb-ft) to manually cage (compress) the power spring for all 5 applications.

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

16. PROOF PRESSURE TEST—PARKING AND SERVICE CHAMBER

16.1 Ref: SAE J1469 Test Procedure 16.

16.2 Parking Chamber

16.2.1 Leakage

Same as Section 10.

16.2.2 Unit shall have no structural failure.

16.3 Service Chamber

16.3.1 Leakage

Same as Section 10.

16.3.2 Unit shall have no structural failure.

17. CYCLE TEST—PARKING CHAMBER

17.1 Ref: SAE J1469 Test Procedure 17.

17.2 Test unit must complete a minimum of 200 000 cycles.

17.2.1 Leakage

Same as Section 10.