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|  | <b>SURFACE<br/>VEHICLE<br/>STANDARD</b> | <b>SAE</b> J2318                  | REV.<br>JAN2008 |
|                                                                                  |                                         | Issued 2002-01<br>Revised 2008-01 |                 |
|                                                                                  |                                         | Superseding J2318 JAN2002         |                 |
| Air Brake Actuator Test Performance Requirements—Truck and Bus                   |                                         |                                   |                 |

## RATIONALE

SAE J2318 provides test performance requirements for SAE J1469, "Air Brake Actuator Test Procedure, Truck-Tractor, Bus, and Trailers". This revision reflects the revisions made in SAE J1469, namely to include the special needs of an actuator when mounted to a disc brake caliper. In addition, modifications were made to the parking force table format and service force table format for improved standardization and ease of use. The service force table also included corrections to the data values and added some sizes that are commonly used with disc brakes. Finally, a revision to provide the minimum acceptable vibration performance was added and the requirement to meet "out of box" force requirement cycle testing parking springs 200K cycles was rescinded.

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## 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, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), [www.sae.org](http://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 Superintendent of Documents, U.S. Government Printing Office, Mail Stop: SSOP, Washington, DC 20402-9320, [www.access.gpo.gov/nara](http://www.access.gpo.gov/nara).

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<br>(1.40 in <sup>3</sup> /min)    |                                                            | 4.1.2                               |
|                                      |                                             | 10.34 kPa<br>(1.5 psig)                                    | 4.1.3                               |
| Service Chamber                      | 23 cc/min<br>(1.40 in <sup>3</sup> /min)    |                                                            | 4.2.1                               |
|                                      |                                             | 10.34 kPa<br>(1.5 psig)                                    | 4.2.3                               |
| Caliper Flange/<br>Pushrod Boot Seal |                                             | 0.07kPa<br>(0.1 psig)                                      | 4.3.2                               |

## 5. CHAMBER VOLUME—PARKING AND SERVICE CHAMBER

5.1 Ref: 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: J1469 Test Procedure 7.

7.2 Pressure Response (pressure increasing) is typically measured at 5 mm (0.20 in) stroke of the service chamber from the actuator zero stroke position. A minimum target Pressure Response of 13.8 kPa (2 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 lower pressure responses. When comparing against valve crack pressure compatibility, both the brake back pressure and service chamber pressure response must be considered.

## 8. FORCE OUTPUT AND STROKE—PARKING CHAMBER

8.1 Ref: 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 caged<sup>1</sup> 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<sup>(1)</sup>  
(Nominal Forces Given  $\pm 10\%$ )

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

1. Table 2 - For Reference Purposes Only

## 9. FORCE OUTPUT AND STROKE—SERVICE CHAMBER

9.1 Ref: 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

<sup>1</sup> 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<sup>(1)</sup>

| Type/Size               | bar<br>(psi) | 1.38<br>(20) | 2.76<br>(40) | 4.14<br>(60) | 5.52<br>(80) | 6.59<br>(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

[illegible][illegible]

## 10. LOW TEMPERATURE LEAKAGE—PARKING AND SERVICE CHAMBER

For allowable leakage, refer to Table 5.

10.1 Ref: 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<br>(1.83 in <sup>3</sup> /min)    |                                                            | 9.1.2                               |
|                                     |                                             | 13.79 kPa<br>(2.0 psig)                                    | 9.1.3                               |
| Service Chamber                     | 30 cc/min<br>(1.83 in <sup>3</sup> /min)    |                                                            | 9.2.2                               |
|                                     |                                             | 13.79 kPa<br>(2.0 psig)                                    | 9.2.3                               |
| Caliper Flange<br>Pushrod Boot Seal |                                             | 0.07 KPa<br>(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.