



SURFACE VEHICLE RECOMMENDED PRACTICE

J2902™

DEC2020

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Superseding J2902 OCT2014

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

RATIONALE

SAE J2902 has been reaffirmed to comply with the SAE Five-Year Review policy.

1. SCOPE

This SAE recommended practice provides procedures and methods for testing service, spring applied parking and combination brake actuators for air disc brake applications. Methods and recommended samples for testing durability, function and environmental performance are listed in 1.1 and 1.2.

1.1 Test Procedures

Leak rate-parking and service chambers (Section 4)
Maximum release and hold-off pressure - parking chamber (Section 5)
Minimum Pressure Response - Service Chambers (Section 6)
Force output and stroke - parking and service chambers (Section 7)
Low temperature leakage (Arctic option included) - parking and service chambers (Section 8)
Low temperature maximum release and hold-off pressure (Section 9)
Low temperature force output - parking chamber (Section 10)
Low temperature operational tests - service chamber (Section 11)
Chamber volume - service chambers (Section 12)
Corrosion resistance - parking and service chamber (Section 13)
Mechanical back-off release mechanism (Section 14)
Elevated temperature cycle test - parking and service chambers (Section 15)
Cycle test - parking and service chambers (Section 16)
Proof pressure test-parking and service chambers (Section 17)
Vibration test (Section 18)

1.2 Test Sequence Chart

The test sequence, as charted in the "Test Sequence Chart", shall be mandatory except where indicated as optional (see Figure 1).

1.3 Purpose

This document provides uniform procedures and methods for laboratory testing of brake actuators used in heavy duty vehicles equipped with air disc brakes.

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Documents
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TEST DESCRIPTION		TEST PROCEDURE SECTION NO.	TESTS FOR SERVICE CHAMBERS ONLY						TESTS FOR PARK CHAMBERS ONLY						TESTS FOR COMBINATIONS					
			TEST UNIT DESIGNATION						TEST UNIT DESIGNATION						TEST UNIT DESIGNATION					
			A	B	C	D	E	F	A	B	C	D	E	F	A	B	C	D	E	F
Leakage Rate	Park	4.1							X	X	X	X	X	X	X	X	X	X	X	X
	Service	4.2	X	X	X	X	X	X							X	X	X	X	X	X
	Boot	4.3	X	X	X	X	X	X							X	X	X	X	X	X
Max Release and Hold-Off		5							X						X					
Min. Pressure Response		6	X												X					
Force Output and Stroke	Park	7.1							X	X	X	X	X	X	X	X	X	X	X	X
	Service	7.2	X	X	X	X	X	X							X	X	X	X	X	X
Low Temp Leakage	Park	8.1							X						X					
	Service	8.2	X												X					
Low Temp Max Release and Hold-Off		9							O						O					
Low Temp Force Output	Park	10							O						O					
Low Temp Operational		11	X												X					
Chamber Volume	Service	12	X												X					
Corrosion		13						X						X						X
Mechanical Back-Off Release		14							X	X					X	X				
Elevated Temp Test	Park	15.1											X						X	
	Service	15.2					X												X	
Cycle Test	Park	16.1								X	X		X			X	X		X	
	Service	16.2		X	X		X									X	X		X	
Proof Pressure	Park	17.1										X						X		
	Service	17.2				X												X		
Vibration		18	O						X						X					
Items marked with "O" are optional, to be performed only as required by the vehicle manufacturer or customer.																				

FIGURE 1 - TEST SEQUENCE CHART

2. REFERENCES

2.1 Applicable Publication

The following publication forms a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 ASTM Publication

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org

ASTM B 117 Method of Salt Spray (Fog) Testing

3. DEFINITIONS

3.1 HOLD-OFF PRESSURE

A decrease of parking chamber air pressure for parking brake application (extend power spring).

3.2 RELEASE PRESSURE

An increase of parking chamber air pressure to release the parking brake (compress power spring).

3.3 PARKING CHAMBER APPLY

Extend power spring.

3.4 PARKING CHAMBER RELEASE

Compress power spring.

3.5 FULL STROKE

Maximum stroke of a unit.

3.6 RATED STROKE

Minimum design stroke of a unit.

3.7 SERVICE BRAKE ACTUATOR

Air activated actuator for applying the foundation brake.

3.8 PARKING BRAKE ACTUATOR

Mechanically applied actuator for applying the foundation brake.

3.9 COMBINATION BRAKE ACTUATOR

Combined service and parking section actuator.

3.10 ZERO STROKE

Brake actuator push rod must be in fully retracted position.

3.11 FULLY CAGED POWER SPRING

Power spring retracted in its most compressed position within the brake actuator.

NOTE: This may be accomplished either pneumatically or mechanically per the manufacturer's recommended procedure.

4. LEAK RATE - PARKING AND SERVICE CHAMBERS

4.1 Leakage - Parking Chamber

4.1.1 Conditions

4.1.1.1 27 ± 11 °C (80 ± 20 °F) ambient temperature.

4.1.1.2 Limit the stroke to $75\% \pm 5\%$ of rated stroke.

4.1.1.3 Parking chamber is to be uncaged.

4.1.2 Test Procedure

4.1.2.1 Preconditioning Cycle

a. Pneumatically actuate the parking chamber from fully applied to fully released and back to fully applied three times using 620 kPa to 830 kPa (90 lbf/in² to 120 lbf/in²) (gage) air pressure.

4.1.2.2 Pressurize the parking chamber with air 860 to 896 kPa (125 lbf/in² to 130 lbf/in²) (gage).

4.1.2.3 Stabilize the air pressure for a minimum of 5 minutes.

4.1.2.4 Establish air pressure at $896 \text{ kPa} \pm 7 \text{ kPa}$ ($130 \text{ lbf/in}^2 \pm 1 \text{ lbf/in}^2$) (gage).

4.1.2.5 Measure leakage rate with a flow meter.

4.1.2.6 Record leakage rate.

4.1.3 Alternate Test Procedure

4.1.3.1 Preconditioning cycles per 4.1.2.1.

4.1.3.2 Connect the parking chamber to a $20\,485 \text{ cm}^3 \pm 820 \text{ cm}^3$ ($1250 \text{ in}^3 \pm 50 \text{ in}^3$) air tank. U.S. 5 Gallon tank is an acceptable alternative.

4.1.3.3 Connect a pressure gage (or equivalent device) to measure pressure change.

4.1.3.4 Pressurize the parking chamber and air tank 860 kPa to 896 kPa (125 lbf/in² to 130 lbf/in²) (gage) air pressure.

4.1.3.5 Stabilize the air pressure in the parking chamber and tank for a minimum of 5 minutes.

4.1.3.6 Establish a pressure of $896 \text{ kPa} \pm 7 \text{ kPa}$ ($130 \text{ lbf/in}^2 \pm 1 \text{ lbf/in}^2$) (gage) in the parking chamber and air tank and close shut-off valve at the air tank inlet.

4.1.3.7 Record the pressure change after $10 \text{ min} \pm 0.1 \text{ min}$.

4.2 Leakage - Service Chamber

4.2.1 Conditions

4.2.1.1 27 ± 11 °C (80 ± 20 °F) ambient temperature.

4.2.1.2 Limit the stroke to $75\% \pm 5\%$ of rated stroke.

4.2.1.3 Maintain the parking chamber at 860 kPa to 896 kPa (125 lbf/in² to 130 lbf/in²) (gage) - if applicable.

4.2.2 Test Procedure

4.2.2.1 Precondition Cycles

- a. Cycle the service chamber three times pneumatically by applying 620 to 830 kPa (90 lbf/in² to 120 lbf/in²) (gage) from zero stroke to 75% ± 5% stroke and back to zero stroke position.

4.2.2.2 Pressurize the service chamber with 860 kPa to 896 kPa (125 lbf/in² to 130 lbf/in²) (gage) air pressure.

4.2.2.3 Stabilize the air pressure for a minimum of 5 min.

4.2.2.4 Establish a pressure of 896 kPa ± 7 kPa (130 lbf/in² ± 1 lbf/in²) (gage) in the service chamber.

4.2.2.5 Measure leakage rate with a flow meter.

4.2.2.6 Record leakage rate.

4.2.3 Alternate Test Procedure

4.2.3.1 Preconditioning cycles per 4.2.2.1.

4.2.3.2 Connect the service chamber to a 20 485 cm³ ± 820 cm³ (1250 in³ ± 50 in³) air tank. U.S. 5 Gallon tank is an acceptable alternative.

4.2.3.3 Connect a pressure gage (or equivalent device) to measure pressure change.

4.2.3.4 Pressurize the service chamber and air tank 860 kPa to 896 kPa (125 lbf/in² to 130 lbf/in²) (gage).

4.2.3.5 Stabilize the air pressure in the service chamber and tank for a minimum of 5 minutes.

4.2.3.6 Establish a pressure of 896 kPa ± 7 kPa (130 lbf/in² ± 1 lbf/in²) (gage) in the service chamber and air tank then close shut-off valve at the air tank inlet.

4.2.3.7 Record the pressure change after 10 min ± 0.1 min.

4.3 Leakage - Disc Brake Caliper Flange Seal / Pushrod Boot Seal

4.3.1 Conditions

4.3.1.1 27° C ± 11° C (80° F ± 20° F) ambient temperature

4.3.1.2 Maintain the parking chamber at 860 kPa to 896 kPa (125 lbf/in² to 130 lbf/in²) (gage)—if applicable.

4.3.1.3 Caliper flange test fixture should simulate the actual air disc brake caliper with regard to sealing flange of the internal rubber boot, surface conditions, finish and rigidity. See Figure 2. Calipers to be used with the actuator should be considered.

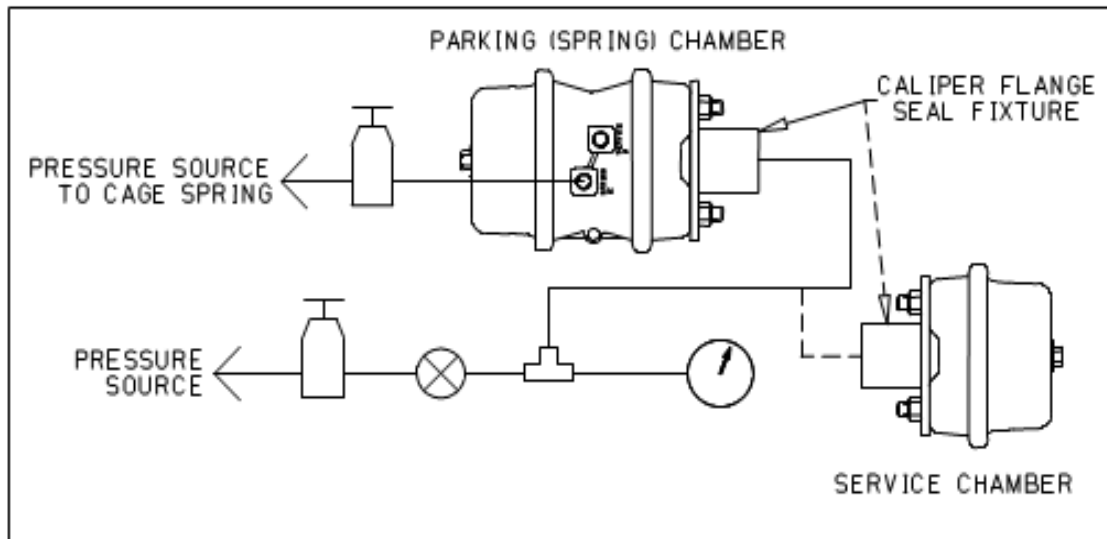


FIGURE 2 - DISC BRAKE CALIPER FLANGE
LEAKAGE TEST SCHEMATIC

4.3.2 Test Procedure

- 4.3.2.1 Apply $21.0 \text{ kPa} \pm 3.0 \text{ kPa}$ ($3.0 \text{ lbf/in}^2 \pm 0.5 \text{ lbf/in}^2$) (gage) air pressure to the caliper flange test fixture. Allow to stabilize for a minimum of five (5) minutes, then close air valve.
- 4.3.2.2 Record the pressure change after $10 \text{ min} \pm 0.1 \text{ min}$.
- 4.3.2.3 Apply vacuum of $-21.0 \text{ kPa} \pm 3.0 \text{ kPa}$ ($-3.0 \text{ lbf/in}^2 \pm 0.5 \text{ lbf/in}^2$) (gage) air pressure to the caliper flange test fixture. Allow to stabilize for a minimum of five (5) minutes, then close air valve.
- 4.3.2.4 Record the pressure change after $10 \text{ min} \pm 0.1 \text{ min}$.

5. MAXIMUM RELEASE AND HOLD-OFF PRESSURE - PARKING CHAMBER

5.1 Conditions

- 5.1.1 $27 \text{ }^\circ\text{C} \pm 11 \text{ }^\circ\text{C}$ ($80 \text{ }^\circ\text{F} \pm 20 \text{ }^\circ\text{F}$) ambient temperature.

5.2 Test Procedure

5.2.1 Power Spring Preset - Parking Brake

- 5.2.1.1 Fully cage the power spring in the parking chamber either pneumatically or mechanically as specified by the manufacturer.
- 5.2.1.2 Maintain the power spring in the caged position for 24 h minimum.

- 5.2.1.3 Release the power spring to a full stroke position after the required preset period.
- 5.2.1.4 Apply preconditioning cycles per 4.1.2.1.
- 5.2.1.5 On the third cycle, measure and record stroke versus air pressure in the apply and release direction for the full stroke of the brake actuator. It is recommended measurements be taken in 5.0 mm (0.20 in) increments or as otherwise specified.

6. MINIMUM PRESSURE RESPONSE - SERVICE CHAMBERS

6.1 Conditions

- 6.1.1 27 ± 11 °C (80 ± 20 °F) ambient temperature
- 6.1.2 Maintain the parking chamber at 860 kPa to 896 kPa (125 lbf/in² to 130 lbf/in²) (gage) - if applicable.

6.2 Test Procedure

- 6.2.1 Slowly apply air pressure to the Service Chamber port. Measure and record air pressure value at which the pushrod extends to 5 ± 0.5 mm (0.20 ± 0.02 in). This is the Service Chamber Response Pressure. See test apparatus as shown in Figure 3.

6.3 Alternate Test Procedure

- 6.3.1 Record plot of chamber pressure vs. stroke from fully released to fully applied position. See test apparatus as shown in Figure 3. Pressurize chamber slowly such that the test time is 30 seconds, push rod travel speed should be approximately 152 mm (6") per minute. Service Chamber Response Pressure shall be the pressure recorded at 5 mm (0.20 in.) stroke.

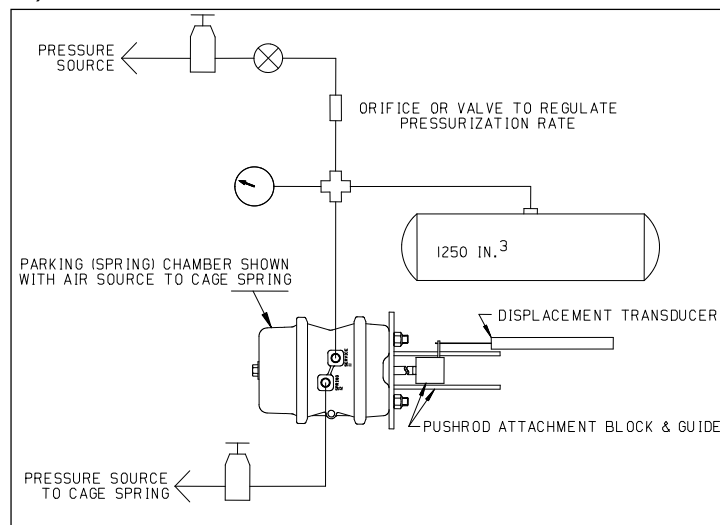


FIGURE 3 - MINIMUM PRESSURE RESPONSE TEST SCHEMATIC