SAE Aerospace
An SAE International Group

AEROSPACE RECOMMENDED PRACTICE

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Overpressurization Release Devices

RATIONALE

This document has been reaffirmed to comply with the SAE 5-Year Review policy.

FOREWORD

Changes in this revision are format/editorial only.

1. SCOPE:

This SAE Aerospace Recommended Practice (ARP) specifies the minimum design and test recommendations for aircraft tubeless tire and wheel overpressurization release devices to protect from possible explosive failure of the contained air chamber due to overinflation. This device will not protect against flash fire explosive conditions within the air chamber which may occur due to extremely overheated brakes. To protect against this condition, nitrogen or other inert gas should be used for inflation.

1.1 Purpose:

This document recommends minimum requirements for aircraft tubeless tire and wheel overpressurization release devices.

1.2 Classification:

Overpressurization Release Devices shall be furnished in a range of sizes to accommodate the sizes and inflation pressure requirements of tubeless tires and wheels used on aircraft.

2. APPLICABLE DOCUMENTS:

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

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2.1 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MS33649
MIL-S-8879
MIL-STD-838

3. GENERAL REQUIREMENTS:

3.1 Materials:

Materials used in the construction of the devices shall be suitable for the purpose intended. All metals shall be corrosion resistant unless suitably plated or treated to resist corrosion during stocking and normal service life use. The use of dissimilar metals, especially brass, copper, or steel in contact with aluminum, magnesium, or alloys thereof, shall be avoided where practicable. Where the use of dissimilar metals cannot be avoided, they shall be insulated from contact with each other.

3.2 Workmanship:

Workmanship and finish shall be in accordance with highgrade aircraft accessory manufacturing practice and be free of defects which affect proper functioning in service.

3.3 Identification:

The Overpressurization Release Device shall be plainly marked as follows:

a. Assembly No.
b. Manufacturer's Name
c. Nominal Release Pressure

Devices too small to carry the complete identification on the part shall be suitably tagged or stored in suitable sealed containers which have been clearly marked. The device shall carry as a minimum the manufacturer's assembly number and the nominal release pressure in .06 inch (1.5 mm) metal stamped or etched characters.

4. PERFORMANCE REQUIREMENTS:

4.1 General:

The Overpressurization Release Device shall be designed to release pressure from the tubeless tire at one of the nominal release pressures listed in Table 1. To the maximum extent practicable all such devices shall be designed to preclude the inadvertent installation of any unit having a different Nominal Release Pressure than the one intended.

4.2 Release Device:

The Overpressurization Release Device mounted in the wheel may be furnished as either a part of the inflation valve or as a separate unit.

4.2.1 Each device shall release at its rated nominal release pressure within ±15%. If the device is the reseatable type, it shall reseat at more than 100 psig (689 kPa), except in the case of devices set at 200 psig (1379 kPa) or less, which shall reseat at more than 50 psig (344 kPa). If the device is neither the bypass nor reseatable type, but similar to the blowout plug type, it must be capable of letting the excessive pressure out of the tire at a greater rate than can be forced into the tire through the inflation valve with the core removed, using a 3000 psi (20,700 kPa) unlimited supply source.

4.2.2 Deflation shall be accomplished with no malfunction from the formation of ice crystals during pressure reduction.

4.2.3 Leakage or bleeding shall not occur due to pressure buildup when tire is bottomed or heated to maximum operating temperature.

4.3 Operating Medium:

The unit shall function as specified herein when used with either air, nitrogen (N_2), or other inert gas with any content of water vapor from zero to saturation at the operating temperatures and pressures.

4.4 Contamination Acceptance:

The unit shall not malfunction due to normal contamination of the inflation media.

4.5 Operating Environment:

The unit shall function as specified herein when subjected to ambient temperatures from -65 to 150 °F (-54 to 65.5 °C) and ambient pressure altitudes from -1000 feet (-305 m) to +15,000 feet (+4580 m). The unit shall not leak or show other evidence of malfunction as a result of exposure to temperatures up to 250 °F (121 °C) or pressure altitudes to 80,000 feet (24,400 m).

5. DESIGN AND CONSTRUCTION:

5.1 Interface:

The Overpressurization Release Device shall be designed as a complete assembly to fit a threaded boss in accordance with MS33649 machined in the wheel. Table 1 lists the boss thread size to be used with the specified nominal release pressure and the associated normal tire inflation pressure range if the device is part of the inflation valve. If the device is the blowout plug type, it shall be sized in accordance with meeting the requirements of 4.2.1.

TABLE 1

Operating Tire Pressure Psig	Operating Tire Pressure kPa	Nominal Release Pressure Psig	Nominal Release Pressure kPa	Boss Thread Per MIL-S-8879
80-129	552-889	200	1379	.5625-18-UNJF-3B
130-199	896-1372	310	2137	.5000-20-UNJF-3B
200-284	1379-1958	460	3172	.4375-20-UNJF-3B
285-399	1965-2751	640	4413	.3750-24-UNJF-3B
400-579	2758-3992	930	6412	.3125-24-UNJF-3B

5.2 Lubrication:

The Overpressurization Release Device shall conform to MIL-STD-838 for any lubrication necessary.

5.3 Sealing:

All components of the Overpressurization Release Device shall be sealed against dust, dirt, moisture, and water insofar as is practical.

5.4 Installation:

Location of the device in the wheel shall be in a protected area to prevent damage during wheel assembly and during service. The device should be replaceable without removing the tire from the wheel. In the event the release pressure is reached, then flying particles from the device must not be hazardous to personnel.

6. QUALIFICATION TESTS:

Individual units in each Nominal Release Pressure setting may be used to perform the following tests. However, in order to reduce the number of test units required, it is recommended test specimens be subjected to qualification tests performed in the order shown.

a. Bypass or Reseatable Type: (3 specimens required)

1. Test Unit No. 1

6.5 Mud Test
6.2.1 Pressure Release Function
6.3 High Temperature Test
6.2.1 Pressure Release Function
6.4 Low Temperature and Icing Test
6.2.1 Pressure Release Function
6.6 Pressure Endurance Test

2. Test Unit No. 2

6.9 Shock Test
6.10 Vibration Test
6.2.1 Pressure Release Function
6.1 Pressure Impulse Cycling
6.2.1 Pressure Release Function

3. Test Unit No. 3

6.7 Dynamometer Test
6.8 In-Flight Braking Test
6.2.1 Pressure Release Function

b. Blowout Plug Type: (5 specimens required)

1. Test Unit No. 1

6.6 Pressure Endurance Test
6.5 Mud Test
6.2.2 Pressure Release Function

2. Test Unit No. 2

6.3 High Temperature Test
6.2.2 Pressure Release Function

6. (Continued):

3. Test Unit No. 3

6.4 Low Temperature and Icing Test
6.2.2 Pressure Release Function

4. Test Unit No. 4

6.7 Dynamometer Test
6.8 In-Flight Braking Test
6.2.2 Pressure Release Function

5. Test Unit No. 5

6.9 Shock Test
6.10 Vibration Test
6.1 Pressure Impulse Cycling
6.2.2 Pressure Release Function

c. Inflation Valve Type: (3 specimens required)

1. Test Unit No. 1

6.5 Mud Test
6.2.3 Pressure Release Function
6.3 High Temperature Test
6.2.3 Pressure Release Function
6.4 Low Temperature and Icing Test
6.2.3 Pressure Release Function
6.6 Pressure Endurance Test

2. Test Unit No. 2

6.9 Shock Test
6.10 Vibration Test
6.2.3 Pressure Release Function
6.1 Pressure Impulse Cycling
6.2.3 Pressure Release Function

3. Test Unit No. 3

6.7 Dynamometer Test
6.8 In-Flight Braking Test
6.2.3 Pressure Release Function
6.11 Proof Test
6.12 Burst Test

6.1 Pressure Impulse Cycling:

The test unit shall be installed in a suitable manifold to represent a wheel and tire. The manifold pressure shall be cycled from a low pressure of 5 psig (34.5 kPa) maximum to a maximum pressure at least equal to 75 percent of the Nominal Release Pressure for the unit. During each cycle, the pressure shall be increased from the minimum to the maximum value in no more than 2 seconds. The maximum pressure shall be sustained for at least 3 seconds and then released. The test shall be continued for a minimum of 25 cycles without leakage from the unit as evidenced by a bubble test. Bubble test means to indicate leakage by use of soap solution or other bubble forming liquid. If the unit is the blow out plug or rupture diaphragm type, the test shall be continued for a minimum of 5000 cycles without leakage.

6.2 Pressure Release Function:

The unit shall be subjected to one of the following tests appropriate for the particular type of unit.

6.2.1 Bypass or Reseatable Type: The test unit shall be installed in a suitable manifold to represent a wheel and tire. The pressure at the inlet connection to the manifold shall be rapidly increased to at least 120 percent of the Nominal Release Pressure for the unit and inlet shall be shut off. The unit shall begin to release the manifold pressure at the Nominal Release Pressure within plus or minus 15 percent, and shall reseat and retain at least 100 psig (689 kPa) pressure in the manifold. (Units rated for 200 psig (1379 kPa) shall reseat and retain at least 50 psig (344 kPa) in the manifold.) Within 10 seconds of reseating, the unit shall exhibit no leakage in the following minute as evidenced by a bubble test. This test shall be repeated for a total of at least 5 cycles.

6.2.2 Blow Plug Type: The test unit shall be installed in a suitable manifold to represent a wheel and tire. The manifold shall be pressurized by means of a standard tire inflation valve. Pressure applied at the inflation valve shall be at least 2000 psig (13,790 kPa) throughout the test. The device shall release manifold pressure at the Nominal Release Pressure plus or minus 15 percent. With 2000 psig (13,790 kPa) minimum pressure maintained at the inflation valve, the manifold pressure shall not increase above the pressure at which release occurred during 3 seconds following release.

6.2.3 Inflation Valve Type: The test unit shall be installed in a suitable manifold having a total volume of approximately 750 $inch^3$ (0.0123 m^3) to represent a wheel and tire. Pressure at the inflation port of the test unit shall be rapidly increased to at least 2000 psig (13,790 kPa) and maintained at this value until the manifold pressure, as measured by a recorder, has been stabilized for at least 3 seconds, at which time the inflation port shall be blocked. The device shall release at a manifold pressure equal to the Nominal Release Pressure plus or minus 15 percent. During the cycle, the manifold pressure shall not exceed 115 percent of the Nominal Release Pressure. After the inflation port is blocked, the device shall reseat and retain at least 100 psig (689 kPa) pressure in the manifold. (Units rated for 200 psig (1379 kPa) shall reseat and retain at least 50 psig (344 kPa) in the manifold.) Within 10 seconds of reseating the unit shall exhibit no leakage in the following one minute as evidenced by a bubble test. This test shall be repeated for a total of at least 5 cycles. If leakage should occur due to failure of the valve core, it is permissible to eliminate the leakage by installation of the valve cap or other mechanical means.

6.3 High Temperature Test:

The test unit shall be installed in a suitable manifold and maintained at a temperature of at least 250 °F (121 °C) for 24 hours. The manifold pressure shall be maintained at 75 plus or minus 5 percent of the Nominal Release Pressure for the unit. After 24 hours the unit shall be cooled to not less than 150 °F (65.5 °C), and while at this temperature shall be subjected to the test of 6.2.

6.4 Low Temperature and Icing Test:

The test unit shall be installed in a suitable manifold and submerged in water at room temperature for at least 4 hours. A standard valve cap may be installed for this test if the unit is of the Inflation Valve Type. Immediately upon removal from the water the unit shall be rapidly cooled to -65 °F (-54 °C) and held at this temperature for at least 6 hours. The unit shall then be subjected to the test of 6.2 while still at a temperature no higher than -50 °F (-45.5 °C).

6.5 Mud Test:

The test unit shall be installed in a suitable manifold to represent a wheel and tire. The manifold pressure shall be maintained at 75 plus or minus 5 percent of the Nominal Release Pressure for the unit. The test unit shall be dipped in liquid mud and left to dry. A standard valve cap may be installed for this test if the unit is of the Inflation Valve Type. When dry the unit shall be subjected to the test of 6.2.

6.6 Pressure Endurance Test:

The test unit shall be installed in a suitable manifold to represent a wheel and tire. The manifold pressure shall be maintained at 75 plus or minus 5 percent of the Nominal Release Pressure for the unit. During a period of 10 days at room temperature, the unit shall exhibit no leakage as evidenced by a bubble test.

6.7 Dynamometer Test:

The test unit shall be installed in the wheel used during qualification testing of the brake assembly on the dynamometer. The test of paragraph 6.8 may be conducted at any time during this period. The test unit shall exhibit no evidence of leakage or other malfunction during the brake test program. Upon completion of the brake test program, the unit shall be subjected to the test of 6.2.

6.8 In-Flight Braking Test:

The test unit shall be subjected to the following test to simulate an in-flight application of brakes during the dynamometer testing described above. With the wheel spinning freely at a speed corresponding to the maximum ground speed specified for qualification of the brake assembly, brake pressure shall be applied to bring the wheel to a full stop in no more than 0.5 seconds.