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AEROSPACE STANDARD

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THERMAL SENSITIVE INFLATION PRESSURE RELEASE DEVICES FOR TUBELESS AIRCRAFT WHEELS

1. SCOPE:

This standard establishes minimum design, installation, qualification, and operational requirements for thermally actuated, pressure release devices for use only in tubeless tire type aircraft wheels. These devices are designed to completely release the contained inflation pressure from a tubeless tire and wheel assembly when brake generated heat causes the assembly to exceed a safe temperature operating level. The objective is to prevent tire or wheel rupture due to brake generated heat which could cause serious personnel injuries or serious aircraft operational hazards.

2. DESIGN REQUIREMENTS:

2.1 Materials and Finish: Materials and finishes shall be of aircraft quality, and shall be electrolytically and thermally compatible with the wheel material. If fusible materials are used, it is desirable that they be of eutectic type.

2.2 Wheel Deflection: The installation and fit between the wheel and the device shall be such as to allow for wheel deflections under all static and dynamic operating conditions. The clearance and strength of the thermal sensitive pressure release device shall be sufficient to allow cyclic deflections of the wheel without leading to failure, impairment of function, or leakage of the device or its associated seal.

2.3 Environment: The devices shall be capable of withstanding the same environmental conditions as are imposed on the wheel.

2.4 Function: The devices shall be designed to function consistently within ±10°F of their setting or rating at any tire inflation pressure from low to rated loaded pressure. This setting and tolerance shall include the effects of heat, and variations in rates of temperature change. When the installed device reaches the selected temperature level as a result of absorbed heat, it shall function to completely release the contained inflation pressure of the tire. The installation shall be such that the device functions properly and consistently prior to the tire bead seat exceeding critical rim or tire temperatures. When the temperature setting has been reached, the device shall melt cleanly, at all pressures. There shall be no partial melts, or pin hole leaks.

2.5 Identification: Each device shall be identified with regard to rated temperature either by part number, code number, color code, or other permanent type marking as established by the manufacturer. It is desirable that this marking be visible for inspection with the tire installed on the wheel.

2.6 Design Considerations: The design and location of the devices shall be such as to permit inspection without removal of the tire from the wheel. However, changing the device with or without removal of the tire shall be a procuring agency option. The location and temperature setting of the release devices shall be selected so that a release of tire inflation pressure occurs before a tire bead or wheel rim temperature critical to safe operation of the wheel and tire assembly is reached. The devices shall be approximately equally spaced around the wheel. Restrictions around the orifice shall not cause deflation times to exceed allowables. If the device expels material when it releases pressure, it shall be located to assure that any expelled material will not strike personnel in the vicinity of the aircraft or any vulnerable equipment in the aircraft or wheel assembly. The devices shall be located in such a manner that damage from normal handling does not occur.

2.7 Orifice: The orifice in each device shall be sufficiently large to assure a steady decrease in tire pressure under all conditions, in particular, during the time that the wheel is being overheated. The size of each orifice shall be such as to permit the tire inflation pressure to decrease to 50% of its initial value in not more than 2 min when only one device functions.

2.8 Wheel Interface: Consideration shall be given to the installation of the device in the wheel at a location which minimizes the effect on fatigue life of the wheel structure. A wheel with an odd number of brake drive keys should have a minimum of three fusible release devices installed equally spaced around the wheel. A wheel with an even number of brake drive keys should have four devices equally spaced around the wheel. The number of fusible release devices should be minimized to achieve maximum installation reliability consistent with demonstration of wheel and tire thermal protection requirements for specific wheel designs. Details of installation of the devices shall receive approval of the procuring agency.

2.9 Usage: The release devices shall be used only with the wheels they are qualified for.

3. QUALIFICATION TESTING:

3.1 General: The devices, when installed in the wheel assembly, shall be capable of satisfying the tests specified below. These tests shall be conducted and the requirements met for the purpose of demonstrating satisfactory performance of the release devices. In all such tests, the device shall function per the intended design allowing deflation at the rate described in 2.7. In addition, the release device shall be subjected to the entire wheel and brake qualification tests or equivalent tests based on the original qualification test requirements. All tests shall meet the applicable requirements of 2.4.

3.2 Release Temperature Test: The manufacturer shall demonstrate and provide substantiating data that the release device functions consistently within ±10°F (±6°C) of its rating at any authorized operating tire inflation pressure. This setting and tolerance shall include the effects of heat, and variations in rates of temperature change. The wheel manufacturer shall demonstrate that the device shall release tire contained gas following any brake usage condition where the tire temperature at the bead seat has reached 410°F (210°C). This temperature may be revised with the introduction of new wheel alloys or tire materials, or both.

3.3 Low Pressure Test: The device shall be installed in a fixture which dimensionally duplicates the fit specified for production. A pressure of 50 psi shall be applied and temperature increased at a rate no greater than 10°F/min (6°C/min) until the pressure releases. The device shall function per the intended design.

3.4 Rate of Flow Test: A tire shall be mounted and the wheel assembled in the normal manner. After the tire has been inflated to the rated inflation pressure, one release device shall be thermally actuated. The inflation pressure shall decrease at the rate specified in 2.7.

3.5 Static Leakage Test: When subjected to a pressure to 1.5 times its rated operation pressure, there shall be no evidence of leakage from any device as evidenced by bubbles when immersed in water for 10 minutes.

3.6 Extreme Temperature Leakage Test: The device shall be installed in a fixture which dimensionally duplicates the fit specified for production. The fit should be near the extreme end of the tolerance, that is, largest diameter hole with the smallest diameter fuse plug). A constant pressure equal to the pressure rating of the tire shall be applied while thermally cycling the fixture and installed device alternately between an elevated temperature 20°F (11°C) below the rated temperature of the device and the low temperature specified for the application. The rate of temperature change shall not be greater than 10°F/minute (6°C/minute). This cycle shall be repeated five times. The test fixture and release device shall then be heated to the upper test limit and the pressure adjusted to 1.5 times the rated pressure of the device or its application pressure, whichever is greater. The temperature shall be maintained for 72 hours. Upon completion of the elevated temperature leakage check, the fixture and device shall again be subjected to the low test temperature extreme. The pressure shall be adjusted to 1.5 times the rated pressure of the device or its application pressure, whichever is greater and the temperature maintained for a period of 24 hours. There shall be no leakage at or through the device during all portions of these tests. An alternate test procedure using a wheel and tire may be used, provided that prior approval is obtained from the procuring agency. Appropriate allowance should be made for the diffusion rate through the tire when establishing the amount of leakage permissible for this alternate procedure.

3.7 Dynamic Pressure Test: (Reference) The tire and wheel, with the release devices installed in the normal manner, shall be rolled for a distance of 25 miles under the wheel rated load and tire rated inflation pressure, adjusted for testing. After test completion, the pressure loss shall not exceed 5 psi (34 kPa) when measured with the wheel and tire assembly at a temperature no higher than existed at the start of the test. The temperatures measured at the beginning and end of the test shall be of the tire contained gas.

3.8 Dynamic Brake Test: (Reference) (a) Single Stop Tests: The wheel, with the release devices installed in the normal manner, shall be used during the entire dynamic torque test of the brake assembly. The devices shall not function to release tire pressure at a wheel temperature associated with the design landing or overload landing energy stops. However, the device shall function to release tire pressure prior to the wheel or tire attaining a temperature which would result in explosive failure of the tire or wheel after completion of a high energy stop. The wheel-tire assembly shall remain landed during demonstration of the pressure release. The wheel orientation, after the stop, should expose one of the fusible plugs to the most critical temperature possible.