



AEROSPACE RECOMMENDED PRACTICE

ARP5542™**REV. A**

Issued 2004-08
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Reaffirmed 2022-05

Superseding ARP5542

(R) Hand Held Aircraft Tire Inflation Pressure Gauges

RATIONALE

ARP5542A has been reaffirmed to comply with the SAE Five-Year Review policy.

1. SCOPE

This SAE Aerospace Recommended Practice (ARP) covers the design, construction, performance and testing requirements for hand held aircraft tire inflation pressure gauges with valve stem attachment chuck to be used with all aircraft types. The ground-based gauges in this specification are those which are designed to read the tire inflation pressure from a position adjacent to the tire.

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.

2.1 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.

AS1241 Fire Resistant Phosphate Ester Hydraulic Fluid for Aircraft

2.2 ANSI Publications

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

ANSI/NCSL Z540-1 General Requirements for Calibration Laboratories and Measuring and Test Equipment

ISO 10012-1 Quality Assurance Requirements for Measuring Equipment

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For more information on this standard, visit
<https://www.sae.org/standards/content/ARP5542A/>

2.3 U. S. Government Publications

Available from the Document Automation and Production Service (DAPS), Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-9495, <https://assist.daps.dla.mil/quicksearch/>.

Airworthiness Directive 87-08-09 Nitrogen Inflation Requirements

Federal Specification A-A-59503 Commercial Item Description Nitrogen, Technical

2.4 Other Industry Standards

Tire and Rim Association (T&RA) Standards, as noted (Annual Publication) available from the Tire and Rim Association web site <http://www.us-tra.org/publications.html>.

International Electrotechnical Commission (IEC) Publication 60529 - Degrees of Protection provided by Enclosures (IP Code) available from IEC web site <http://webstore.iec.ch/>.

3. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA) 250, ENCLOSURES FOR ELECTRICAL EQUIPMENT (1000 VOLTS MAXIMUM) AVAILABLE BY DIRECT LINK FROM THE NEMA WEB SITE TO SUPPLIER PARTNERS <http://www.nema.org/standards/about-standards/pages/how-to-purchase-a-nema-standard.aspx>

3.1 Intended Use

The gauge should be designed for use with all aircraft wheel and tire assemblies.

3.2 Operation Media

The gauge is intended for use with dry nitrogen on braked, or dry, clean air, where applicable, on unbraked wheels. Nitrogen shall conform to Federal Specification A-A-59503 Commercial Item Description Nitrogen, Technical.

3.3 Finishes

Paint or other material, including shock-absorbing material, may be applied. The exterior material should, in its final condition, resist all climatic and chemical conditions of its usual environment. Requirements are further defined in the testing section of this specification.

3.4 Gauge Assembly

The gauge assembly should include a gauge, a chuck which is capable of connecting to a valve stem, a hose or tube connecting the two, and a method of releasing pressure from the unit. The gauge and hose volume should be minimized to minimize the amount of gas lost when taking a pressure reading. The gauge and hose should not hold any residual pressure between readings. The gauge should be designed to fail in an obvious manner to prevent a false but believable reading. The gauge should withstand the manufacturer specified dropping and rough treatment without affecting calibration. The housing integrity should be specified such as IEC 60529 IP Code or NEMA 250 enclosure type.

3.5 Mechanical Gauge Pointer and Face Markings

3.5.1 The pointer position, pressure numerals, pressure graduation marks and units should be legible from not less than 2 ft. Adequate contrast should be provided between the markings, pointer and background to permit easy reading of the gauge with a flashlight during hours of darkness. Red color should not be used for either markings or background unless the customer request specifies it. The gauge should be designed to prevent misreadings from parallax.

- 3.5.2 Mechanical gauges should be designed and manufactured in two different operating ranges. The recommendations for normal operational ranges are 0 to 300 psi (0 to 20.7 bar) and 200 to 500 psi (13.8 to 34.5 bar). The 0 to 300 psi (0 to 20.7 bar) range should be marked in 2 psi (0.1 bar) increments, maximum, and should sweep a circular arc of not less than 270 degrees. The 200 to 500 psi (13.8 to 34.5 bar) range should be marked in 5 psi (0.3 bar) increments, maximum, and should sweep a circular arc of not less than 270 degrees.
- 3.5.3 The pointer tip should overlay the applicable pressure graduation mark at all pressure readings.
- 3.5.4 Pressure zones should NOT be color-coded. Changes in recommended tire pressures over time render color codes ineffective and can be confusing.
- 3.5.5 The dial face should be mechanically attached to the gauge to prevent movement.
- 3.5.6 Either a pointer stop should not be provided at the high-pressure end of the gauge face because it can bend the pointer if the gauge is over pressurized and cause subsequent erroneous pressure readings or if a full scale stop is used then an overpressure should easily bend the needle such that it is obvious damage has occurred that may cause an erroneous reading.
- 3.5.7 The gauge assembly may be part of an inflation assembly, if desired by the gauge manufacturer or customer. If so, the gauge should continuously display tire inflation pressure, including those times at which inflation or deflation is being done.
- 3.6 Digital Display
- 3.6.1 An electronic digital readout may be used in place of the mechanical pointer in 3.5. The digital display and pressure units should be legible from not less than 3 ft in direct sunlight, if self-illuminating, or with a flashlight during hours of darkness.
- 3.6.2 The digital display must display in 1 unit increments, maximum.
- 3.6.3 The batteries which power the digital units should be located in a readily accessible compartment
- 3.6.4 A low battery shall not allow an error in indicated pressure and should disable the device.
- 3.6.5 To preserve battery life, a push to read button, or equivalent, may be installed.
- 3.6.6 Digital measuring equipment should be constructed such that normal ground operation of the aircraft electrical systems should not interfere with proper display and accuracy, nor should the digital measuring system interfere with any active aircraft system.
- 3.6.7 The manufacturer should specify any EMI (Electromagnetic Interference) compliance and, the specification and levels required as well as proof of compliance and/or qualification.
- 3.7 Lens (Crystal or Cover Glass)
- 3.7.1 The lens should be transparent, impact resistant, scratch resistant and not be affected by extraneous fluids or the operating environment.
- 3.7.2 The lens should be designed to minimize the intrusion of dust, dirt, moisture, fluids or other substances which may obscure the gauge face. Hermetic sealing is not recommended.
- 3.8 Identification

Each production part should be marked with the manufacturer's part number, manufacturer's name and/or logo, serial number, date of manufacture, calibration date, and appropriate markings, as applicable.

3.9 Chuck

The chuck should accept the valve stem used and shall conform to the applicable Tire and Rim Association (T&RA) standard. The chuck should be capable of accepting either the regular size valve stem or the large valve stem. Adapters are available to convert the large stem to the small stem. A single design which will accept both is preferable.

4. PERFORMANCE AND CONDITIONS

4.1 Pressures

4.1.1 Operational Inflation Pressure Range

The gauge should be designed for an operational pressure range from either 0 to 300 psi (0 to 20.7 bar) or from 200 to 500 psi (13.8 to 34.5 bar).

4.1.2 Proof and Burst Pressure

The 0 to 300 psi (0 to 20.7 bar) gauge should not be damaged by a proof pressure of 450 psi (31.0 bar) which is applied in 1 s and sustained for 5 min. The pressure sensing parts may deform but should not rupture at a minimum pressure of 500 psi (34.5 bar), which is applied in 1 s and sustained for 3 min. The 200 to 500 psi (13.8 to 34.5 bar) gauge should not be damaged by a proof pressure of 750 psi (51.7 bar) which is applied in 1 s and sustained for 5 min. The pressure sensing parts may deform but should not rupture at a minimum pressure of 1000 psi (68.9 bar) which is applied in 1 s and sustained for 3 min. When the gauge is burst tested, the gauge shall be taken to failure to establish that a benign failure mode exists if the gauge is accidentally over pressurized.

4.2 Gauge Response

The gauge pointer (or display) should instantaneously respond to increases or decreases in operational pressure due to filling and deflating or fluctuations in tire pressure, if part of an inflation assembly.

4.3 Ambient (Atmospheric) Temperatures

4.3.1 Mechanical gauges should be designed to function in ambient temperatures from -65 °F (-54 °C) to 160 °F (71 °C).

4.3.2 Electronic gauges with liquid crystal displays (LCD) or other technology should clearly state their operating temperature range. Cold temperature adversely affects the contrast of LCD displays and LCD gauges may have slow response at cold temperatures. Manufacturers should state the temperature where the response time exceeds 1 s.

4.4 Extraneous Fluids

Gauge operational performance and external surfaces, including the lens, and any seals or sealants, should not be affected by AS1241 hydraulic fluid, MIL-PRF-5606 fluids, QPL-7808 fluids, MIL-PRF-83282 fluids, MIL-PRF-87257 fluids, phosphate ester base materials, greases, lubricants, fuels, water and cleaning solvents. It should also be resistant to ozone and ultraviolet light.

4.5 Gauge Error (Accuracy)

The gauge error or tolerance should not exceed those values shown for the pressures and temperatures shown in Section 6.

5. TESTING

5.1 Test Units

The gauges selected for testing should be identical to the production configuration and construction. The tests specified should be run on two units.

5.2 Test Conditions

5.2.1 Unless otherwise noted, clean dry air or nitrogen (nitrogen is preferred) should be used when gauge pressurization is required.

5.2.2 Unless otherwise noted, tests should be conducted at room temperature ($70^{\circ}\text{F} \pm 10^{\circ}\text{F}$ or $21^{\circ}\text{C} \pm 5.5^{\circ}\text{C}$).

5.2.3 Unless otherwise specified, tests may be performed in any sequence.

5.3 Preliminary to Testing

Prior to running the tests specified, the gauge should be examined, inspected, measured and weighed to assure conformity with those specified properties which can be visually determined.

5.4 Performance Tests

5.4.1 Surge Pressure Test

The gauge should withstand a surge impulse pressure from 0 to the maximum gauge pressure reading. The unit should comply with the acceptance performance tests in 5.7 after the conclusion of this test.

5.4.2 Low Temperature Test

5.4.2.1 Mechanical gauges should be exposed to an ambient temperature of -65°F (-54°C) for 4 h minimum prior to testing. The gauge should then be tested for gauge error at -65°F (-54°C), and then repeated at room temperature. The gauge error should not exceed the values in Section 6.

5.4.2.2 LCD equipped electronic gauges should be tested as in 5.4.2.1 except at a temperature of 32°F (0°C).

5.4.3 High Temperature Test

The gauge should be subjected to ambient temperature as follows: Uniformly raise the temperature to 160°F (71°C) and hold for 20 min. Perform the gauge error tests. They should not exceed the tolerances in Section 6.

5.4.4 Shock Tests

The gauge should be dropped from a height of 3 ft above a concrete floor 100 times. Calibration of the unit should not be affected.

5.5 Endurance Test

The gauge should be cycled from $10\text{ psi} \pm 10\text{ psi}$ ($0.7\text{ bar} \pm 0.7\text{ bar}$) to $300\text{ psi} \pm 15\text{ psi}$ ($20.7\text{ bar} \pm 1\text{ bar}$) or from $200\text{ psi} \pm 10\text{ psi}$ ($13.8\text{ bar} \pm 0.7\text{ bar}$) to $500\text{ psi} \pm 50\text{ psi}$ ($34.5\text{ bar} \pm 3.4\text{ bar}$) (depending upon what scale range the gauge has) using hydraulic fluid or gas for 40 000 cycles. One cycle should consist of going from 0 to 300 psi (0 to 20.7 bar) and returning to 0 psi (0 bar) or 200 to 500 psi (13.8 to 34.5 bar) and returning to 200 psi (13.8 bar) (depending on the scale range that the gauge has) at a rate not to exceed 20 cpm. Upon completion, the test gauge should meet the acceptance performance tests (5.7).