



AEROSPACE INFORMATION REPORT	AIR1749™	REV. A
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Superseding AIR1749		
Aircraft Fuel System Pressure Definitions		

RATIONALE

The word “pressure” can be combined with a dozen of different words to define a wide range of technical definitions; this AIR is intended to present a list of such definitions in order to assist the industry's work.

The SAE Five-Year Review process identified that the reference section needed updating and some pressure definitions could be improved. The revision also has been considered beneficial because the document was in the old format (typewriter created).

Sections 4 and 5 have been added to the document as the committee has considered important and were absent in the original document

1. SCOPE

The information in this document is limited to aircraft engine fuel feed, refueling, and transfer components (see 2.1). It is assumed that isothermal, liquid fluid conditions exist, herein referred to as fuel. Where applicable and allowable, it is understood that a referee fluid may be substituted for fuel.

1.1 Purpose

The purpose of this document is to define commonly used pressure terms relating to aircraft engine fuel feed, refueling, and transfer components. It is not intended to exclude other pressure terms which may also be appropriate.

2. REFERENCES

2.1 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AIR1408 Aerospace Fuel System Specifications and Standards

AIR4783 Glossary of Terms - Aircraft Ground Refueling

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<https://www.sae.org/standards/content/AIR1749A/>

AIR6510	Fuel System Definitions and Glossary of Terms
ARP868	Method - Pressure Drop Tests for Fuel System Components
ARP1665	Definition of Pressure Surge Test and Measurement Methods for Receiver Aircraft
ARP4386	Terminology and Definitions for Aerospace Fluid Power, Actuation and Control Technologies
ARP5794	Centrifugal Aircraft Fuel Pump Requirements, Design and Testing, Aerospace Standard
ARP8615	Fuel System Components: General Specification for

2.1.2 U.S. Government Publications

Copies of these documents are available online at <https://quicksearch.dla.mil>.

JSSG-2009A with amendment 1 (Appendix E for fuel system)

MIL-F-17874 Fuel Systems, Aircraft, Installation of

MIL-P-5238 Pump Centrifugal, Fuel Booster, Aircraft General Specification for

3. PRESSURE TERMS

3.1.1 STATIC PRESSURE

Static pressure is defined as pressure exerted by the fuel at rest on its surroundings or exerted normal to its direction of flow.

3.1.2 RATED INLET PRESSURE

Rated inlet pressure is defined as pressure at the inlet fuel connection(s) of a component, at which its flow performance rating is established.

3.1.3 CASE DRAIN/BODY PRESSURE

Case drain pressure is defined as pressure in the case or body passages of a component by which internal fuel leakage is returned independently to the reservoir, return circuit, overboard, etc.

3.1.4 RATED DISCHARGE PRESSURE

Rated discharge pressure is defined as pressure against which a component flow performance rating is established.

3.1.5 MAXIMUM TRANSIENT PRESSURE

Maximum transient pressure is defined as the peak pressure of a pressure-time function, usually taken from a high-frequency response pressure transducer and data logger, or similar instrument capable of recording rapid variations of fuel pressure.

3.1.6 OPERATING PRESSURE

Operating pressures are defined as a range or variation in the pressure which may exist at the fuel connections of a component during system operation. The component or subsystem is required to operate at these pressures without malfunction.

The value of operating pressures are usually defined by the OEM as a result of a customer/certification requirement, a standard, or the own OEM's experience.

3.1.7 OPERATING PRESSURE, MAXIMUM

Maximum operating pressure is defined as the maximum pressure within a component or subsystem which will occur during normal operation of the subsystem. The maximum operating pressure is the reference for proof and burst pressure definitions.

Known approaches used to define the maximum operation pressure value are:

1. The maximum steady state pressure seen by the component or subsystem.
2. The maximum transient pressure regularly seen by the component or subsystem.

3.1.8 PROOF PRESSURE

Proof pressure is defined as pressure higher than the maximum operating pressure applied to the fuel connections of a component for a specified time during acceptance or qualification proof pressure tests. Proof pressure is usually 1.5 to 2 times the maximum operating fuel pressure.

Proof pressure testing includes but is not limited to inspection for possible external fuel leakage, permanent deformation, damage to connection or components, and conditions preventing proper operation. The application of proof pressure shall not affect the subsequent performance of the component when it is operated at normal fuel pressures, unless otherwise stated in the specification.

The component or subsystem is not required to operate when subjected to proof pressure; however, the component or subsystem are required to operate after proof pressure removal.

3.1.9 BACK PRESSURE

Back pressure is defined as pressure applied to specified fuel connection(s) of a component during normal operation, or during tests for the purpose of evaluating possible effects on performance, etc.

3.1.10 SURGE PRESSURE

Surge pressure is defined as a sudden change in fuel pressure, usually resulting from system start-up, shut-down, or the operating of valves, cylinders, or other components connected to the same system.

3.1.11 BURST PRESSURE

Burst pressure is defined as pressure higher than proof pressure applied to the fuel connections of a component for a specified duration during the qualification burst tests. Burst pressure is 2.5 to 3 times the maximum operating fuel pressure.

Permanent deformation of the component is allowable as a result of burst pressure tests; however, no external leakage is permitted.

The component is not required to operate during or after the burst test and the component shall be identified to avoid being used in any air vehicle, unless otherwise stated in the specification.

Burst pressure test is a destructive test but no external leakage is allowed after pressure removal. A post-test disassembly is accomplished for evaluation of damages.

3.1.12 PRESSURE LOSS

Pressure loss is defined as a reduction in fuel pressure due to flow through a component or restriction. This loss may be measured between specified fuel connections at given flow rate(s). Refer to ARP868.

NOTE: Care should be taken to evaluate additional losses if restrictive fittings are installed in order to perform the test measurement.

3.1.13 CRACKING PRESSURE

Cracking pressure is defined as the differential pressure at which a closed valve allows a specified flow rate to occur.

3.1.14 RESEAT PRESSURE

Reseat pressure is defined as the differential pressure at which an open valve will revert to a specified flow rate condition when closed.

3.1.15 ABSOLUTE PRESSURE

Absolute pressure is defined as pressure referenced to absolute zero (vacuum).

3.1.16 GAUGE PRESSURE

Gauge pressure is defined as pressure referenced to local barometric pressure, or the pressure surrounding the gauge, if these are different.

3.1.17 DYNAMIC PRESSURE

Dynamic pressure is defined as the pressure equivalent of directed kinetic energy of the fuel.

3.1.18 TOTAL PRESSURE

Total pressure is defined as the sum of static and dynamic fuel pressures.

3.1.19 HEAD PRESSURE

Head pressure or pressure head is defined as static pressure exerted on the fuel as a result of elevation (gravity effect).

3.1.20 BAROMETRIC PRESSURE

Barometric pressure is defined as the pressure of the local atmosphere.

4. CONSIDERATIONS ABOUT AMERICAN AND SI UNITS

The American unit for pressure measurement is psi (pound per square inch) while the SI unit is Pa (Pascal). Bar is a metric unit (non American, non SI) that is also used for pressure measurement.

The conversion factor is

- 1 psi = 6894.8 Pa = 0.068948 bar
- 1 Pa = 0.000145037738 psi = 0.00001 bar

American units system provides specific abbreviations to address absolute, gauge, and differential pressures. They are psia, psig, and psid, respectively.

5. CONSIDERATION FOR CIVIL CERTIFICATION

It is important to remark that civil certification requirements may lead to pressures higher than those pressures obtained from the pure system analysis. A typical requirement of the FAA 14 CFR and EASA CS to be considered is the § 25.979(d) which addresses system ultimate loads based upon system maximum pressures.