ANSI/AIAA S-080A-2018
(Revision of AIAA S-080-1998)

Standard

Space Systems – Metallic Pressure Vessels, Pressurized Structures, and Pressure Components

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American National Standard

Space Systems—Metallic Pressure Vessels, Pressurized Structures, and Pressure Components

Sponsored by

American Institute of Aeronautics and Astronautics

Approved 12 March 2018

American National Standards Institute

Approved 20 March 2018

Abstract

This standard establishes baseline requirements for the design, analysis, fabrication, test, operation, and maintenance of metallic pressure vessels, pressurized structures, batteries, heat pipes, and cryostats, dewars, sealed containers, accumulators, and pressure components such as lines, fittings, hoses, and bellows made of metals. These components are used for pressurized, hazardous, or nonhazardous liquid or gas storage in space systems including spacecraft and launch vehicles.

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Published by
American Institute of Aeronautics and Astronautics
12700 Sunrise Valley Drive, Suite 200, Reston, VA 20191

Printed in the United States of America

ISBN 978-1-62410-541-8

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Foreword

This version of S-080 was developed as an industry consensus to represent accepted practices for the design, analysis, fabrication, test, inspection, operation, and maintenance of metallic pressure vessels, pressurized structures, batteries, heat pipes, cryostats, dewars, sealed containers, accumulators, and pressure components such as lines, fittings, hoses, and bellows in space systems.

This version of S-080 was developed in collaboration with manufacturers, launch-site operators, range safety authorities, and individuals affiliated with universities and government entities.

The key elements in the revised version of this standard are as follows:

- Reformatted the requirements to align with ANSI/AIAA S-081B-2018, *Space Systems—Composite Overwrapped Pressure Vessels*
- Updated the requirements for design and verification including damage tolerance life (formerly referred to as safe life) and leak before burst
- Articulated the responsibility of the owner, manufacturer, and procuring authority
- Organized the requirements into separate sections for design, analysis, and test
- Added a design requirements verification matrix
- Added sections to identify the manufacturing, quality assurance , and operations and maintenance requirements
- Added requirements for maximum mass and required volume
- Expanded the requirements for stability and included a higher safety factor when verification is performed by analysis only
- Added requirements to address scenarios with significant combined loads
- Added an alternate set of requirements for lines and/or fittings with 1.5 inches (38 mm) outside diameter or greater
- Added requirements for quantifiable reliability and a failure modes and effects analysis
- Identified requirements associated with reuse
- Aligned sections to better identify the separate requirements for metallic pressure vessels, pressurized structures, batteries, heat pipes, cryostats, dewars, sealed containers, and pressure components such as lines, fittings, and hose made of metal
- Removed the thermal vacuum testing requirement for batteries and battery cases because they will be included in ANSI/AIAA S-136-201x, *Battery Safety Standard for Space Applications*
- Articulated requirements for data documentation
- Incorporated loading spectra into the service life

The AIAA Aerospace Pressure Vessels (APV) Committee on Standards (CoS) was initially formed in March 1996 as a working group within the AIAA Structures Committee on Standards with an emphasis on inclusion of aerospace prime companies, pressure vessel suppliers, and all applicable government agencies. Deliberations focused on adapting the standard to address commercial procurement of aerospace composite pressure vessels.

The current members of the AIAA APV CoS appreciate the valuable input from several original members, and express their gratitude to past committee members and reviewers whose contributions over many years have resulted in an improved standard. At the time of approval of this document, members of the APV CoS were:

Michael Kezirian, Chair	University of Southern California
Nathanael Greene, Co-Chair	NASA Johnson Space Center
Alejandro Vega, Co-Chair	U.S. Air Force

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NOTE Names marked with an asterisk participated as Observer, nonvoting member.

The above consensus body approved this document in December 2017.

The AIAA Standards Executive Council (Allen Arrington, Chairperson) accepted the document for publication in March 2018.

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1 Scope

This standard establishes baseline requirements for the design, analysis, manufacturing, test, and operation of metallic pressurized hardware used for aerospace systems such as spacecraft and launch vehicles.

Requirements for metallic pressurized hardware levied from other authorities (such as Range Safety, FAA, DOT, etc.) may also be applicable. Specific applications, particularly those involving human spaceflight, may have additional requirements. There may also be additional requirements for hardware elements that are not addressed by this document, such as the presence of a propellant management device or diaphragm. The full set of these requirements should be identified before the design process begins and should be addressed through all stages of the lifecycle.

1.1 Purpose

These requirements are intended to assure the safety and enhance the success of the operation of metallic pressurized hardware in an aerospace system.

1.2 Applicability

This standard is applicable to metallic pressurized hardware. Included are metallic pressure vessels, pressurized structures, batteries, heat pipes, cryostats, dewars, sealed containers, accumulators, and pressure components such as lines, fittings, hoses, and bellows.

A companion standard, ANSI/AIAA S-081B Space Systems—Composite Overwrapped Pressure Vessels, is applicable to spaceflight composite overwrapped pressure vessels (COPVs).

1.3 Designation of Responsibilities

This section identifies the responsibilities for the key agents: owner, procuring authority, and manufacturer.

It is noted that the owner and procuring authority may be the same entity.

The procuring authority and the manufacturer may also be the same entity, in which case additional consideration should be given regarding independent oversight.

1.3.1 Owner

The owner establishes the system level requirements. The owner develops the aerospace system incorporating the metallic pressurized hardware to meet these system level requirements. The owner performs the system analysis on the aerospace system to identify the operational envelope, establishing the design requirements. The owner is responsible for determining the criticality of the aerospace system.

The owner is responsible for reviewing and approving any tailoring of requirements including the use of a document revision other than what is specified in Section 3.

The owner specifies options provided in the standard before contracting with the manufacturer. For example, the burst factor (Section 5.2.1) and design safety factor (Section 5.2.4) are established. In addition, for the conditions established in Section 5.1, there may be options for the design and verification approach (Section 6).

The owner has the responsibility for approving engineering source approved (ESA) processes and subsequent changes. The owner should solicit engineering input prior to accepting ESA process changes.

The owner may delegate any of the above authority and decision making responsibility to a procuring authority (typically an intermediate contractor or a consultant) but remains responsible for the overall system.