SAE Aerospace
An SAE International Group

AEROSPACE INFORMATION REPORT

SAE AIR4728

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References, Spacecraft and Spacecraft Servicing, Fluid System Components (Abbreviations, Acronyms, Definitions, Applicable Documents and Environmental Conditions)

RATIONALE

AIR4728 has been reaffirmed to comply with the SAE five-year review policy.

1. SCOPE:

   This SAE Aerospace Information Report (AIR) presents reference information for use in preparing detailed specifications and other documents. The intent is to have a master reference document containing frequently required tabulations of information, such as the meaning of abbreviations, the spelled out wording of acronyms, the definition of terms, etc. so that such tabulations need not be repeated in recommended practice documents describing how to prepare technical documents.

   This document is intended to provide references in the field of fluid system components for space applications. Space applications include spacecraft, such as satellites, space stations, launch vehicles and space shuttles, and servicing equipment and components used for ground systems and launching and for servicing in space. Fluid system components include couplings, fittings, hose and tubing assemblies.

2. CONTENTS:

   This document contains the following sections:

   a. Applicable and reference documents
   b. Abbreviations and acronyms
   c. Definitions
   d. Environmental conditions

   These sections may be revised and expanded and new sections may be added to cover other information within the scope of this document.

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http://www.sae.org/technical/standards/AIR4728

2.1 Abbreviations and Acronyms:

Information for this section was provided by members of the NASA Space Assembly and Servicing Working Group Fluid Interface Standards Committee.

ATP - acceptance test procedure
BTU - British Thermal Unit
C - Celsius
CH4 - methane
cm - centimeters
cc - cubic centimeters
db - decibel
EMI - electromagnetic interference
EVA - Extra Vehicular Activity
F - Fahrenheit
FISC - Fluid Interface Standards Committee
g - acceleration of gravity
GHE - gaseous helium
g - gram
GN2- gaseous nitrogen
H20 - water
Hz - hertz
ISC - Interface Standard Committee
J - joule
JSC - Johnson Space Center
K - Kelvin
kg - kilogram
kPa - kilopascal
L - liter
LH2 - liquid hydrogen
LN2 - liquid nitrogen
L02 - liquid oxygen
Lpm - liters per minute
m - meter
MJ - megajoule
mm - millimeter
MMH - monomethylhydrazine
MOP - maximum operating pressure
MSFC - Marshall Space Flight Center
N - Newton
NASA - National Aeronautics and Space Administration
N2H4 - hydrazine
NHB - NASA handbook
Nm - newton-meter
NSTS - National Space Transportation System
NTO - nitrogen tetroxide
phm - per hundred million
psi - pounds per square inch

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2.1 (Continued):

psia	- pounds per square inch absolute
psid	- pounds per square inch differential
psig	- pounds per square inch gage
rad	- radians
rms	- root mean square
SASWG	- Space Assembly and Servicing Working Group
SCCS	- Standard Cubic Centimeters Per Second
SCD	- Specification Control Document/Drawing
sec	- Second
SSF	- Space Station Freedom
SSP	- Space Shuttle Program
T	- temperature
Torr	- 1/760 of standard atmospheric pressure
TBD	- To be determined
W	- watt

2.2 Definitions::

Information for this section was provided by members of the NASA Space Assembly and Servicing Working Group Fluid Interface Standards Committee.

COUPLING, FLUID: A quick disconnect fluid connector, consisting of a tanker half and spacecraft half, which when mated by some external means permits fluid flow across the interface.

ELECTROMAGNETIC INTERFERENCE: Interference, generally at frequencies that are generated inside the system, as contrasted to frequency interference coming from sources outside the system.

FAILURE: The inability of a system, subsystem component or part to perform its required function under specified conditions for a specified duration.

FAILURE TOLERANCE: The basic safety requirement that shall be used to control most payload hazards. The payload must tolerate a minimum number of credible failures and/or operator errors determined by the hazard level. This criterion applies when the loss of a function or the inadvertent occurrence of a function results in a hazardous event.

FLUID, REFEREE: Is a substitute fluid used for testing and/or cleaning.

FORCE, DISENGAGEMENT: Force required to demate the couplings.

FORCE, ENGAGEMENT: Force required to mate the couplings to permit fluid flow.

HAZARD, CRITICAL: A hazard that could result in serious injury to personnel, and/or damage to flight or ground equipment which would cause mission abort or a significant program delay (one or more days).

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2.2 (Continued):

INHIBIT: An inhibit is a physical barrier or device that constrains fluid flow. Examples of inhibits are valves and seals.

LEAKAGE FLOW: Flow thru a passage which is in a nominally closed position or at a location which normally should permit no flow, and usually of relatively small magnitude.

MISALIGNMENT, ANGULAR: The maximum included angle between the two axes of the coupling halves.

MISALIGNMENT, LATERAL OFFSET: The maximum distance between the two centerlines of the coupling halves.

OFFGASSING/OUTGASSING: The emanation of volatile matter of any kind from materials into habitable areas.

PRESSURE, ABSOLUTE: Pressure as related to a complete vacuum (psia).

PRESSURE, BURST: The minimum pressure at which a component may exhibit rupture or failure, typically stated as a percentage of rated pressure.

PRESSURE DIFFERENTIAL: The difference in pressure between two designated points in a system (psid).

PRESSURE DROP: The reduction in fluid pressure due to flow.

PRESSURE, GAGE: Pressure as related to ambient atmospheric pressure (psig).

PRESSURE, PROOF: The pressure which a component shall withstand as a production inspection test without damage, typically stated as a percentage of rated pressure.

PRESSURE, RATED: The maximum input or operating procedure.

SAFE: A general term denoting an acceptable level of risk, relative freedom from, and possibility of: personnel injury; fatality; damage to property; or loss of the function of critical equipment.

SAFING: Actions which eliminate or control hazards.

SPACECRAFT: The spacecraft is the system receiving the fluid(s).

TANKER: The tanker is the system supplying the fluid(s).

TYPE: Type designation is used to differentiate between the supply coupling half (Type I, Tanker) and the receiver coupling half (Type II, Spacecraft).

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2.3 Applicable Documents and References:

2.3.1 Specifications:

2.3.1.1 Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

ARP598 The Determination of Particulate Contamination in Liquids by the Particle Count Method

2.3.1.2 National Aeronautics and Space Administration:

JSC-09604	JSC Government Furnished Equipment (GFE) Materials Selection List and Materials Documentation Procedures
JSC-17481	Safety Requirements Document for JSC Space Shuttle Flight Equipment, dated 28 Sept 1984, Paragraph 5.1
JSC 19211	Satellite Services Catalog: Tools and Equipment, dated Sept 1983
JSC 19212	Satellites Services Handbook Interface Guidelines
JSC 19652	Instructions for the Preparation of Stress Analysis Report
MSFC-HDBK-527	Materials Selection List for Space Hardware Systems
NASA-STD-3000	Manned Systems Integration Standards (Standard on All Manned Spacecraft)
NHB-5300.4(ID-2)	Safety, Reliability, Maintainability, and Quality Provisions for the Space Shuttle Program
NHB-5300.4(3A-1)	Requirements for Soldered Electrical Connections
NHB-6000.1	Requirements for Packaging, Handling, and Transportation for Aeronautical and Space Systems Equipment and Associated Components
NHB 8060.1	Flammability, Odor, Offgassing, and Compatibility Requirements and Test Procedures for Materials in Environments that Support Combustion
NSTS 07700	NASA Shuttle Orbiter/Cargo Standard Interfaces
NSTS 07700 Vol. XIV	EVA System Description and Design Data Appx 7
NSTS-1700.7	Safety Policy and Requirements for Payloads Using the Space Transportation System
NSTS-22206	Instructions for the Preparation of Failure Modes and Effect Analysis and Critical Items List
SE-G-0020	Leakage Measurement of Helium and Nitrogen Tests
SE-S-0073	Specification, Space Shuttle Fluid Procurement and Use Control
SL-E-002	NASA Space Shuttle Program Specification, Electromagnetic Interference Characteristics Requirements for Equipment
SSP-30233	Space Station Requirements for Materials and Processes with Minimal Tailoring to Eliminate Requirements Exclusive to Space Station Freedom
SW-E-0002	Space Shuttle, Ground Support Equipment, General Design Requirements

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2.3.1.3 U.S. Government Publications: Available from Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-HDBK-5	Metallic Materials and Elements for Aerospace Vehicles
TT-I-735	Isopropyl Alcohol
BB-F-1421	Fluorocarbon Refrigerants
O-A-445	Anhydrous Ammonia Technical
DOD H4-1	Federal Supply Code of Manufacturers Name to Code
DOD-D-1000	Drawings, Engineering and Associated Lists
FED-STD-H28	Screw Thread Standards for Federal Services
FED-STD-101	Test Procedures for Packaging Materials
FED-STD-209	Clean Room and Work Station Requirements, Controlled Environment
MIL-B-5087	Bonding, Electrical and Lightning Protection for Aerospace System
MIL-C-45662	Calibration System Requirements
MIL-C-81302	Cleaning Compound, Solvent, Trichlorotrifluoroethane
MIL-I-26860	Indicator, Humidity Plug-Color Change
MIL-P-25508	Propellant Oxygen
MIL-P-26536	Propellant, Hydrazine
MIL-P-26539	Propellant, Nitrogen, Tetroxide
MIL-P-27201	Propellant Hydrogen
MIL-P-27401	Propellant, Nitrogen, Pressurizing
MIL-P-27404	Propellant, Monomethylhydrazine
MIL-P-27407	Propellant Pressurizing Agent, Helium, Liquid Type II
MIL-T-8808	Tubing, Steel, Corrosion-Resistant (18-8 Stabilized), Aircraft Hydraulic Quality
MIL-W-22759	Teflon Insulated Wire
MIL-STD-12	Abbreviations for Use on Drawings, Specifications, Standards, and in Technical Documents
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-130	Identification Marking on U.S. Military Property
MIL-STD-143	Standards and Specifications, Order of Precedence for the Section of
MIL-STD-202	Test Methods for Electronic and Electrical Component Parts
MIL-STD-280	Definitions of Item Levels, Item Exchangeability, Models, and Related Terms
MIL-STD-453	Inspection, Radiographic
MIL-STD-454	Workmanship
MIL-STD-461	Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference
MIL-STD-794	Parts and Equipment, Procedures for Packaging of
MIL-STD-810	Environmental Test Methods and Engineering Guidelines
MIL-STD-831	Test Reports, Preparation of
MIL-STD-889	Dissimilar Metals
MIL-STD-1472	Human Engineering Design Criteria for Military Systems, Equipment, and Facilities
MIL-STD-1540	Test Requirements for Space Vehicles
MIL-STD-1686	Electrostatic Discharge Control Program for Protection or Electrical and Electronic Parts, Assemblies and Equipment
MIL-STD-6866	Inspection, Penetrant Method

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2.3.1.4 ANSI Publications: Available from American National Standards Institute, 11 West 42nd Street, New York, NY 10036.

ANSI Y14.5M	Dimensioning and Tolerancing
ANSI/ASME B46.1	Surface Texture

2.3.1.5 National Aerospace Standards: Available from Aerospace Industries Association, 1250 Eye Street NW, Washington, DC 20005.

NAS 850	General Packaging Standard

2.3.1.6 American Society of Testing and Materials: Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM D 2109	Nonvolatile Matter in Halogenated Organic Solvents and their Admixtures

2.4 Environmental Conditions:

Information for this section was provided by members of the NASA Space Assembly and Servicing Working Group Fluid Interface Standards Committee. The environmental conditions are presented in Table 1 and Table 2:

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TABLE 1 - Shock Conditions

Bench Handling	Type of Drop: Free Fall Pivotal	Drop Height: 25.4 mm 102 mm
Shuttle Cargo Bay		
Pyrotechnic Shock:		
A single acceleration transient along each of three orthogonal axes, the positive and negative spectra of which shall equal or exceed that shown in Figure 1.		
Atlas Launch Vehicle		
One shock each direction of 100 g from 100 to 700 Hz in each of three mutually perpendicular axes.		
Delta Launch Vehicle		
Transportation:	65 g shock of sawtooth form for 15 msec, applied three times on each of six sides.	
Operational Shock:	10 g amplitude 17 msec terminal peak sawtooth pulse, one application in each direction of three orthogonal axes for a total of six pulses.	
Titan Launch Vehicle		
Bench Handling:	Three drops free fall 102 mm	
Operational Shock:	Three shocks each direction of vertical axis, 100 g per Figure 2	

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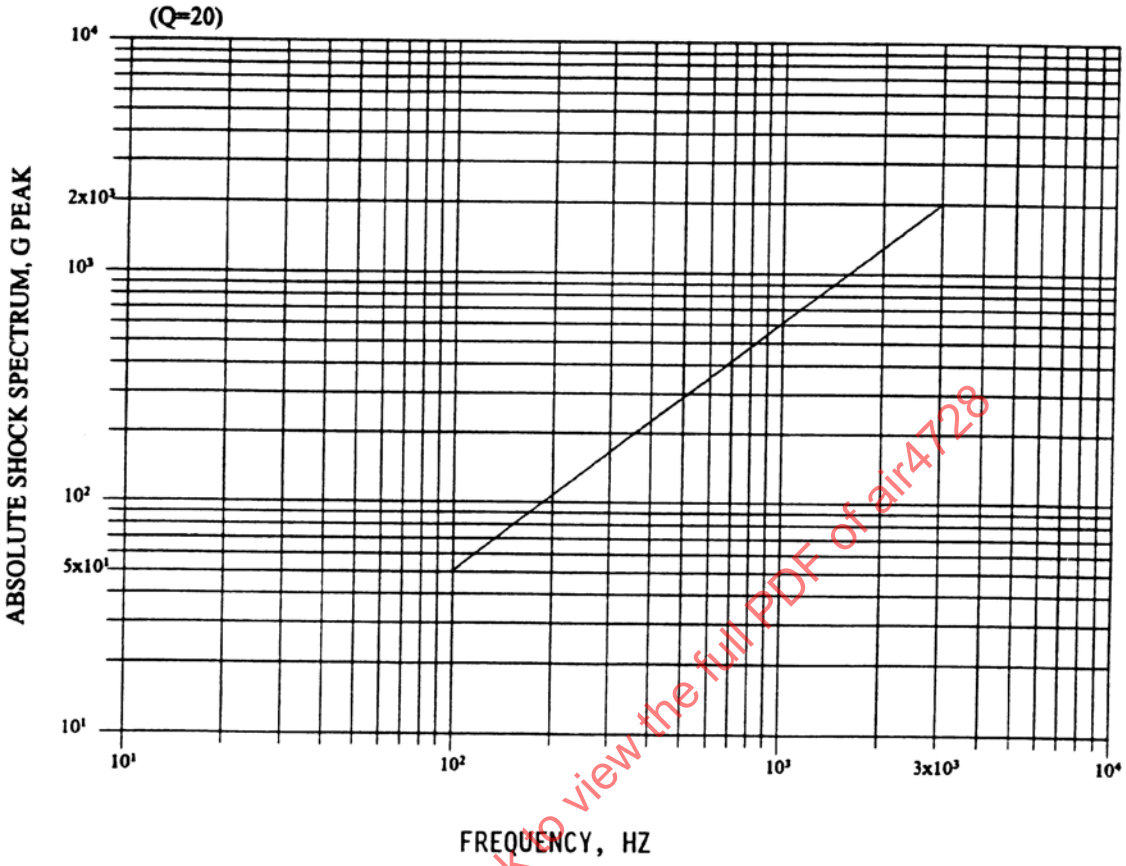

FIGURE 1 - Qualification Shock Spectrum for Pyrotechnic Separation Shock

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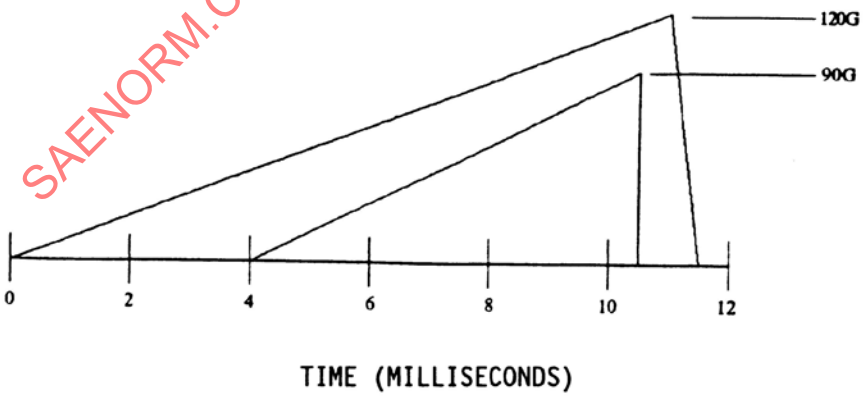

FIGURE 2 - Operation Shock Profile