MILITARY STANDARD

STANDARD GENERAL REQUIREMENTS FOR SAFE DESIGN AND OPERATION OF PRESSURIZED MISSILE AND SPACE SYSTEMS

TO ALL HOLDERS OF MIL-STD-1522A (USAF)

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2. RETAIN THIS NOTICE AND INSERT BEFORE TABLE OF CONTENTS.

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SECTION 6
PRESSURIZED SYSTEM REQUIREMENTS

Requirements which apply to all types of pressurized systems are in section 6.1. Additional detail requirements applicable to specific system types are in the sections following.

6.1 GENERAL PRESSURIZED SYSTEM REQUIREMENTS

6.1.1 Design Features

6.1.1.1 Assembly. Design components so that, during the assembly of parts, sufficient clearance exists to permit assembly of the components without damage to O-rings or backup rings where they pass threaded parts or sharp corners.

6.1.1.2 Routing. Avoid straight tubing and piping runs between two rigid connection points. Where such straight runs are necessary, provisions shall be made for expansion joints, motion of the units, or similar compensation to insure that no excessive strains will be applied to the tubing and fittings. Use line bends to ease stresses induced in tubing by alignment tolerances and vibration.

6.1.1.3 Seperation. Physically separate redundant pressure components and systems from main systems for maximum safety advantage in case of damage or fire.

6.1.1.4 Shielding. Shield pressure systems from other systems when required to minimize all hazards caused by proximity to combustible gases, heat sources, electrical equipment, etc. Any failure in any such adjacent system shall not result in combustion or explosion of pressure fluids or components. Shield or separate lines, drains, and vents from other high-energy systems; for example, heat, high voltage, combustible gases, and chemicals. Drain and vent lines will not be connected to any other lines in any way that could generate a hazardous mixture in the drain/vent line, or allow feedback of hazardous substances to the components being drained or vented. Shield or isolate pressure fluid reservoirs from combustion apparatus or other heat sources.

6.1.1.5 Grounding. Electrically ground hydraulic system components and lines to metallic structures.

6.1.1.6 Handling. Provide fixtures for safe handling and hoisting with coordinated attachment points in the system structure, for equipment that cannot be hand-carried. Handling and hoisting loads shall be in accordance with MIL-S-8512.

6.1.1.7 Special Tools. Design safety critical pressure systems so that special tools shall not be required for removal and replacement of components unless it can be shown that the use of special tools is unavoidable.

6.1.1.8 Test Points. Provide test points if required, such that disassembly for test is not required. The test points shall be easily accessible for attachment of ground test equipment.

6.1,1.9 Common-Plug Test Connectors. Common-plug test connectors for pressure and return sections shall be designed to require positive removal of the pressure connection prior to unsealing the return connections.

6.1.1.10 Individual Pressure nad Return Test Connectors. Individual pressure and return test connectors shall be designed to positively prevent inadvertent cross-connections.

6.1.1.11 Threaded Parts. All threaded parts in safety critical components shall be securely locked to resist uncoupling forces by acceptable safe design methods. Safety wiring and self-locking nuts are examples of acceptable safe design. Torque for threaded parts in safety critical components shall be specified.

6.1.1.12 Friction Locking Devices. Avoid friction-type locking devices in safety critical applications. Star washers and jam nuts shall not be used as locking devices.

6.1.1.13 Internally Threaded Bosses. Internal The design of internally threaded bosses shall preclude the possibility of damage to the component or the boss threads because of screwing universal fittings to excessive depths in the bosses.

6.1.1.14 Retainer or Snap Rings. Retainer or snap rings shall not be used in pressure systems where failure of the ring would allow connection failures or blow-outs caused by internal pressure.

6.1.1.15 Snubbers. Snubbers shall be used with all Bourdon type pressure transmitters, pressure switches, and pressure gages, except air pressure gages.

6.1.1.16 Drains ans Sumps. When lines are required for draining liquid explosive, flammable liquids or explosive waste, they shall be free of pockets or low spots so that a positive flow is achieved at all points in the drain line. The slope shall not be less than 1/4 inch per foot at any point on the drain line. The drain system shall include a sump or basin where the fluid can safely collect. This sump or basin shall be designed so that it can be easily cleaned, and drainage easily removed.

6.1.2.1 Connections. Design or select components to assure that hazardous disconnections or reverse installations within the subsystem are not possible. Color codes, labels, and directional arrows, are not acceptable as the primary means for preventing incorrect installation.

6.1.12.2 Restraining Devices. Design flexhose installation which are six feet long or greater so that restraint is provided on both the hose and adjacent structure at no greater than six-foot intervals and at each end to prevent whiplash in the event of a burst. Restraining devices shall be designed and demonstrated to contain a force not less than 1.5 X openline pressure force. (See Table IV) The design safety factor shall be not less than 3. Sand or shot bags placed on top of flexible hose is not an acceptable restraint. Do not use hose clamp type restraining devices.

6.1.12.3 Flexhose Stress. Design flexhose installations that shall not produce stress or strain of any nature in the hard lines or components. Include stresses induced because of dimensional changes caused by Pressure or temperature variations, or torque forces induced in the flexhose.

6.1.12.4 Temporary Installations. Temporary installations using chains or cables anchored to substantial fixed points, lead ingots or other weights, are acceptable providing they meet the requirements of paragraph 6.1.12.1. Protect flexhose from kinking or abrasive chafing from the restraining device or damage from adjacent structure or moving parts that may cause reduction in strength.

TABLE IV. Open Line Force Calculation Factor

DIAMETER OPENING (INCH)	CALCULATED FORCE FACTOR FOR EACH PSI OF SOURCE PRESSURE (LB)
1/8	0.18506
1/4	0.2832
3/8	0.3814
1/2	0.4796
5/8	0.5777
3/4	0.6759
7/8	0.7741
1	0.8723
NOTE:	To calculate the force acting on line opening, select applicable diameter and multiply righthand column by the source pressure (psi).

6.2 HYDRAULIC SYSTEM REQUIREMENTS

6.2.1 Hydraulic System Components

6.2.1.1 Component Integrity. When the system pressure profile is indeterminate, perform safety tests at pressure no lower than 67 percent of the maximum allowable working pressure for components rated up to 3000 psig and no lower than 80 percent of the maximum allowable working pressure for components rated above 3000 psig.

6.2.1.1.1 Component Section. Select components which are compatible with and rated for the viscosity of the hydraulic fluid to be used.

6.2.1.2 Cycling. Cycling capability for safety critical components shall be not less than 400% of the total number of expected cycles, including system tests, but not less than 2000 cycles. For service above a temperature of 160'F, an additional cycling capability equivalent to the above shall be required as a maximum.

6.2.1.3 Actuators. Safety critical hydraulic actuators shall have positive mechanical stops at the extremes of safe motion.

6.2.1.4 Shutoff Valves. Hydraulic fluid reservoirs and supply tanks shall be equipped with shutoff valves, operable from a relatively safe location in the event of a hydraulic system emergency.

6.2.1.5 Variable Response. Do not use shuttle valves in safety critical hydraulic systems where the event of a force balance on both inlet ports may occur, thus causing the shuttle valve to restrict flow from the outlet port.

6.2.1.6 Fire Resistant Fluids. Where system leakage can expose hydraulic fluid to potential ignition sources or is adjacent to a potential fire zone and the possibility of flame propagation exists, fire resistant or flame proof hydraulic fluid shall be used.

6.2.1.7 Accumulators. Hydraulic systems incorporating accumulators shall be interlocked to either vent or isolate accumulator fluid pressure when power is shutoff.

6.2.1.8 Adjustable Orifices. Do not use adjustable orifice restrictor valves in safety critical hydraulic systems.

6.3.1.2 Configuration - The configuration of pneumatic components shall permit bleeding of entrapped moisture, lubricants, particulate material, or other foreign matter hazardous to this system.

6.3.1.3 Compressors. Select compressors which are designed to sustain not less than 2.5 X delivery pressure, after allowance for loss of strength of the materials equivalent to not less than that caused by 1000 hours aging at 275'F.

6.3.1.4 Actuators. Safety critical pneumatic actuators shall have positive mechanical stops at the extremes of safe motion.

6.3.1.5 Adjustable Orifice Restrictors. Adjustable orifice restrictor valves shall not be used in safety critical pneumatic systems.

6.3.2.1 Manual Takeover. Provide for automatic disengagement or by-pass for pneumatic systems that provide for manual takeover in the event of a hazardous situation. Provide positive indication of disengagement.

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