

Ship Systems and Equipment - Hydraulic System Design Criteria for Marine Vehicles

RATIONALE

J1779 has been reaffirmed to comply with the SAE five year review policy.

FOREWORD—This recommended practice is intended as a guide toward a standard practice. Because it covers such a wide variety of marine vehicles, it is intended for use as a guide in the development of a detailed system specification or as a supplement to a design specification.

1. Scope

1.1 Scope—The marine environment differs greatly from other environments in which hydraulics are used. This Recommended Practice provides hydraulic design considerations and criteria for the marine environment and is applicable to commercial vessels, military ships, and submersible vehicles. This document may be used for manned and un-manned vehicles.

2. References

2.1 Applicable Publications—The following publications form a part of the specification to the extent specified herein. Unless otherwise indicated the latest revision of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001, www.sae.org, telephone 724-776-4970.

AMS4943—Titanium Alloy Tubing, Seamless, Hydraulic, 3.0AI - 2.5V, Annealed (UNS R56320)

AMS4944—Titanium Alloy Tubing, Seamless, Hydraulic, 3.0AI - 2.5V Cold Worked, Stress Relieved (UNS R56320)

AMS4945—Titanium Alloy Tubing, Seamless, Hydraulic, 3.0AI - 2.5V, Controlled Contractile Strain Ratio, Cold Worked, Stress Relieved (UNS R56320)

ARP994—Recommended Practice for the Design of Tubing Installations for Aerospace Fluid Power Systems

AS19692—Pumps, Hydraulic, Variable Delivery; General Specifications for

J1273—Recommended Practices for Hydraulic Hose Assemblies

J1776—Marine Vehicles - Hydraulic Pumps - Design and Specification Guide

J1777—General Environmental Considerations for Marine Vehicles

J1778—Ship Systems and Equipment - Recommended Practice for Hydraulic Fluid Selection

J1780—Diagrams and Associated Tables for Hydraulic Systems of Marine Vehicles

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J1781—Materials for Fluid Systems of Marine Vehicles
J1782—Ship Systems and Equipment - Hydraulic Systems - Noise Control
J1783—Ship Systems and Equipment - Selection of Hydraulic Directional Control Valves
J1942—Hose and Hose Assemblies for Marine Applications
J2321—Ship Systems and Equipment - General Specification for Filter Elements - Hydraulic and Lube Oil Service
J2333—Ship Systems and Equipment - Hydraulic System Filters - Selection Parameters
J2470—Hydraulic Fluid Power - Valves - Methods for Assessing Lock Sensitivity to Contaminants
J24714—Fluid Systems - Connector Tubes - General Specification and Part Standard

2.1.2 ASTM PUBLICATIONS—Available from American Society for Testing and Materials, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, www.astm.org, telephone 610-832-4585.

ASTM D 6304—Standard Test Method for Determination of Water in Petroleum Products, Lubricating Oils, and Additives by Coulometric Karl Fisher Titration

2.1.3 ISO PUBLICATIONS—Available from International Organization for Standardization, 1 rue de Varembe, 1211 Geneva 20, Switzerland. (Also available from American National Standards Institute, 11 West 42nd Street, New York, NY 10036 and National Fluid Power Association, 3333 North Mayfair Road, Milwaukee, WI 53222-3219.)

ISO 4406—Hydraulic fluid power - Fluids - Method of coding level of contamination by solid particles
ISO 4413—Hydraulic fluid power - General rules relating to systems
ISO 5598—Fluid Power Systems and Components - Vocabulary
ISO18413—Hydraulic Fluid Power - Cleanliness of parts and components - Inspection document and principles related to sample collection, sample analysis, and data reporting

2.1.4 NATIONAL FLUID POWER ASSOCIATION (NFPA) PUBLICATIONS—Available from the National Fluid Power Association, Inc., 3333 North Mayfair Road, Milwaukee, WI 53222-3219, www.nfpa.com, telephone 414-607-3345.

NFPA T2.6.1—Method for Verifying the Fatigue and Establishing the Burst Pressure Ratings of the Pressure Containing Envelope of a Metal Fluid Power Component
NFPA T2.9.15—Hydraulic Fluid Power - Cleanliness of Components - Inspection document and methods of sample collection, sample analysis, and data reporting
NFPA T2.24.1—Hydraulic Fluid Power - Systems Standard for Stationary Industrial Machinery Supplement to ISO 4413; 1998 - Hydraulic Fluid Power - General Rules Relating to Systems to be Used in Conjunction with ISO 4413; 1998
NFPA T3.4.9—Recommended practice - Hydraulic fluid power - Application guideline for accumulators

2.1.5 DEPARTMENT OF DEFENSE PUBLICATIONS—Available from Standardization Documents Order Desk, Building 4D, 700 Robbins Ave., Philadelphia, PA 19111-5094, <http://assist.daps.mil>, telephone 215-697-2179.

2.1.5.1 *Military Standards*

MIL-STD-167-1—Mechanical Vibrations of Shipboard Equipment (Type I - Environmental and Type II - Internally Excited)
MIL-STD-438—Schedule of Piping, Valves, Fittings and Associated Piping Components for Submarine Service
MIL-STD-777—Schedule of Piping, Valves, Fittings, and Associated Piping Components for Naval Surface Ships
MS 18282—Relief Valve Operating Characteristics Versus Maximum Operating Pressure for Liquid Service

2.1.5.2 *Military Specifications*

MIL-S-901—Shock Tests, H.I. (High Impact) Shipboard Machinery, Equipment, and Systems, Requirements for
MIL-P-17869—Pumps and Motors, Power, Oil Hydraulic (Naval Shipboard Use)
MIL-PRF-83282—Hydraulic Fluid, Fire Resistant, Synthetic Hydrocarbon Base, Aircraft

2.1.5.3 *Military Handbooks*

MIL-HDBK-2193—Hydraulic System Components, Ship

2.1.5.4 *Other Defense Publications*

“Handbook of Fluid-Filled, Depth/Pressure Compensating Systems for Deep Ocean Applications” by Thomas H. Mehnert, compiled by the David Taylor Naval Ship Research and Development Center, Annapolis, Maryland (DTIC No. AD 894-795)
“Handbook of Hydraulic Systems for Deep Ocean Applications” by William E. Schneider and John Sasse, compiled by David Taylor Naval Ship Research and Development Center, Annapolis, Maryland (DTIC No. ADB062-769L)
SS800-AG-MAN-010/P-9290—“System Certification Procedures and Criteria for Deep Submergence Systems” Available from the Naval Sea Systems Command (Request from the appropriate contracting officer)

2.1.6 OTHER PUBLICATIONS

American Bureau of Shipping, Rules for Building and Classing Underwater Vehicles, Systems, and Hyperbaric facilities, 1990; ABS Plaza, 16855 Northcase Drive, Houston TX 77060 USA
American Bureau of Shipping, Rules for Building and Classifying Steel Vehicles; ABS Plaza, 16855 Northcase Drive, Houston TX 77060 USA
Det Norske Veritas: Rules for Classification of Ships, Veritasveien 1, N-1233 Høvik, Norway; www.dnv.com
Lloyd’s Register: Rules and Regulations for the Classification of Ships, 71 Fenchurch Street, London, EC3M 4BS; www.lr.org

3. **Definitions**—Refer to ISO5598 for definitions not listed below.

- 3.1 Fatigue Pressure Rating**—The maximum pressure that a component’s pressure containing envelope has been verified to sustain a rated number of pressure cycles using pressure excursions derived from rated pressure, without failure.
- 3.2 System Proof Pressure Test**—The system proof pressure is the hydrostatic test pressure to which components and piping are subjected after system installation to verify integrity and the absence of leaks.
- 3.3 System Tightness Test**—A system tightness test is a hydrostatic test up to the nominal system operating pressure and is meant to verify that there is no leakage from mechanical joints.
- 3.4 Heat Recoverable Couplings**—Heat recoverable couplings are cryogenically cooled fittings that shrink to form an interference fit when warmed to ambient temperature.
- 3.5 Critical**—Critical, as used in this document, refers to the importance of the component/system’s function in the ship. Those components/systems that are essential to the safety of the ship, its crew, and its passengers are defined as critical. The procuring activity may broaden this definition as appropriate [e.g., mission critical components/systems are those that are required for the ship/vehicle to complete its mission.]