



AEROSPACE INFORMATION REPORT

SOCIETY OF AUTOMOTIVE ENGINEERS, Inc.

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AEROSPACE HYDRAULIC AND PNEUMATIC SPECIFICATIONS AND STANDARDS

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SAE Technical Board rules provide that: "All technical reports, including standards approved and practices recommended, are advisory only. Their use by anyone engaged in industry or trade is entirely voluntary. There is no agreement to adhere to any SAE standard or recommended practice, and no commitment to conform to or be guided by any technical report. In formulating and approving technical reports, the Board and its Committees will not investigate or consider patents which may apply to the subject matter. Prospective users of the report are responsible for protecting themselves against liability for infringement of patents."

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1. SCOPE - This report lists military and industry specifications and standards which are used in aerospace hydraulic and pneumatic systems. It is intended as a supplement to specifications MIL-H-5440 and MIL-P-5518. Only those hardware standards which have been specifically designed for hydraulic or pneumatic use are listed. Revisions and amendments which are current for these specifications and standards are not listed.
- 1.1 Listing Documents - Attention is called to the following documents which list specifications and standards and are used as a basis for this report.
 - 1.1.1 Military Standards - Department of Defense, Index of Specifications and Standards; prepared by the Standardization Division, Armed Forces Supply Support Center, Washington 25, D.C. This document is published annually, with monthly cumulative supplements.
 - 1.1.2 Society of Automotive Engineers, Inc. Standards - SAE Aerospace Standards, Recommended Practices, Information Reports (AS, ARP, AIR) Index and AMS Index. These documents are published annually by SAE, Inc., 485 Lexington Avenue, New York, N. Y. 10017.

2. SPECIFICATIONS

2.1 Federal Specifications

C-F-206	Felt, Sheet, Wool, Pressed
VV-P-236	Petrolatum, Technical
WW-T-787	Tube, Aluminum Alloy, Round, Square, Rectangular, and Other-Shapes, Drawn, Seamless, 5052

2.2 Military Specifications

2.2.1 System and Subsystem Specifications

MIL-F-4960	Flight Control Subsystem, Air Weapons Systems, Requirements for Preparation of Specifications for
MIL-H-5440	Hydraulic Systems, Aircraft, Types I and II, Design, Installation, and Data Requirements for
MIL-P-5518	Pneumatic Systems, Aircraft, Design, Installation and Data Requirements for
MIL-S-6644	Specifications, Equipment, Contractor Prepared, Instructions for Preparation of
MIL-B-8075	Brake Control Systems, Anti Skid, Aircraft Wheels, Instructions for Preparation of Specifications for
MIL-B-8584	Brake Systems, Wheel, Aircraft, Design of
MIL-S-8812	Steering System; Aircraft, General Specification for
MIL-H-8891	Hydraulic Systems, Manned Flight Vehicles, Type III, Design, Installation and Data Requirements for
MIL-F-9490	Flight Control Systems, Design, Installation, and Test of, General Specification for
MIL-F-18372	Flight Control Systems; Design, Installations and Tests of, Aircraft, (General Specification for)

MIL-A-18717	Arresting Hook Installations, Aircraft
MIL-H-25475	Hydraulic Systems, Missile, Design, Installation, Tests, and Data Requirements (General Requirements for)

2.2.2 Design Details and Test Specifications

MIL-B-5087	Bonding, Electrical, and Lighting Protection, for Aerospace Systems
MIL-E-5272	Environmental Testing, Aeronautical and Associated Equipment, General Specification for
MIL-P-5514	Packings; Installation and Gland Design, Hydraulic, General Specification for
MIL-P-5517	Plastic Parts in Aircraft Hydraulic Equipment; General Tests for
MIL-T-5522	Test Procedure for Aircraft Hydraulic and Pneumatic Systems, General
MIL-C-6021	Castings, Classification and Inspection of (for Aeronautical Applications)
MIL-T-6053	Tests, Impact, Shock Absorber, Landing Gear, Aircraft
MIL-I-6181	Interference Control Requirements Aircraft Equipment
MIL-I-6866	Inspection, Penetrant Method of
MIL-I-6868	Inspection Process, Magnetic Particle
MIL-P-7105	Pipe Threads, Taper, Aeronautical National Form, Symbol ANPT, General Requirements for
MIL-S-7742	Screw Threads, Standard, Optimum Selected Series, General Specification for
MIL-S-8879	Screw Thread, Controlled Radius Root with Increased Minor Diameter, General Specification for
MIL-D-23615	Design and Evaluation of Cartridge Actuated Devices
MIL-R-27542	Reliability Program Requirements for Aero-Space Systems, Subsystems and Equipment

2.2.3 Component Specifications

2.2.3.1 General Component Specifications

MIL-W-5013	Wheel and Brake Assemblies; Aircraft
MIL-C-5503	Cylinders, Aeronautical, Hydraulic Actuating, General Requirements for
MIL-J-5513	Joints, Hydraulic Swivel
MIL-R-5520	Reservoirs, Aircraft, Hydraulic, Non-Separated Type
MIL-V-5525	Valves; Aircraft Power Brake
MIL-P-5954	Pump Unit, Hydraulic, Electric Motor Driven, Fixed Displacement
MIL-P-5994	Pump, Hydraulic, Electric-Motor-Driven, Variable Delivery
MIL-C-6026	Control Unit, Pressure Generating, Manually Operated, Aircraft Hydraulic Brake System
MIL-C-6388	Compressor Unit, Air, Aircraft, Shaft Power Driven, General Specification for
MIL-C-6591	Compressor Unit, Aircraft, Electric Motor Driven, General Specification for
MIL-T-7101	Transmission, Power, Constant Speed, 60/25 KW
MIL-V-7909	Valves, Hydraulic, Pressure Reducer
MIL-V-7915	Valves, Hydraulic, Directional Control, Slide Selector
MIL-C-7979	Cylinders; Hydraulic Brake, Master, Power Assisted
MIL-M-7997	Motors, Aircraft Hydraulic, Constant Displacement
MIL-C-8215	Compressor Unit, Air, Aircraft, Hydraulic Motor Driven General Specification for

MIL-C-8216	Compressor Unit, Air, Aircraft, Hydraulic Motor Driven, Model Specification for, Outline and Instructions for Preparation of
MIL-G-8402	Gages, Pressure, Dial Indicating, General Specification for
MIL-S-8552	Strut; Aircraft Shock Absorber (Air - Oil Type)
MIL-P-8564	Pneumatic Components, Aeronautical, General Specification for
MIL-R-8573	Reservoirs, Air, Nonshatterable Steel
MIL-H-8775	Hydraulic System Components, Aircraft and Missiles, General Specification for
MIL-C-8838	Cylinder, Pneumatic Actuating, Aircraft Utility System, General Specification for
MIL-H-8890	Hydraulic Components, Type III, (-65 Deg. to +450 Deg. F.) General Specification for
MIL-R-8931	Reservoirs, Aircraft and Missile, Hydraulic, Separated Type
MIL-S-8959	Spring, Hydraulic, General Specification for
MIL-V-19593	Valve - Control, Aircraft Pneumatic 28 Volt D-C Solenoid Operated
MIL-P-19692	Pumps, Hydraulic, Variable Delivery, General Specification for
MIL-T-25363	Tank, Pneumatic Pressure, Aircraft, Glass Fiber
MIL-C-26805	Compressor Units, Air, General Requirements for
MIL-V-27162	Valves, Servo Control, Electric-Hydraulic, General Specification for

2.2.3.2 Detail Component Specifications

MIL-A-5498	Accumulators, Aircraft Hydropneumatic Pressure
MIL-F-5504	Filters and Filter Elements, Fluid Pressure, Hydraulic Micronic Type
MIL-F-5508	Fuses; Aircraft, Automatic Quantity Measuring, Hydraulic
MIL-P-5515	Pump, Hydraulic Ram, Hand Driven
MIL-V-5519	Valves; Aircraft Hydraulic Unloading
MIL-V-5523	Valve; Relief, Hydraulic Pressure
MIL-V-5524	Valves; Check, Hydraulic, Aircraft, Type I Systems
MIL-V-5527	Valves; Aircraft, Hydraulic Thermal Expansion Relief
MIL-V-5528	Valves; Hydraulic Controllable Check
MIL-V-5529	Valves; Hydraulic Directional Control, Rotary Selector
MIL-V-5530	Valves; Aircraft Hydraulic Shuttle
MIL-I-6839	Indicator, Position, Landing Gear
MIL-I-7084	Indicator, Pressure, Hydraulic, 0-4000 PSI
MIL-T-7610	Test Stand, Hydraulic System, Electric Motor Driven, Type D-6A
MIL-T-7612	Test Stand, Hydraulic System, Gasoline Engine Driven, Type D-5A
MIL-G-7734	Gages, Pressure, Engine and Utility, Aircraft
MIL-P-7858	Pump, Hydraulic, Power Driven, Fixed Displacement
MIL-C-7905	Cylinders, Compressed Gas, Nonshatterable
MIL-G-8348	Gage Assemblies, Air Testing, High Pressure, Chuck Type, Self Contained, Aircraft
MIL-V-8566	Valves, Aircraft Hydraulic Flow Regulator
MIL-R-8572	Reducers, Pneumatic Pressure, Aircraft
MIL-V-8628	Valve, Pneumatic Check
MIL-V-8813	Valves; Aircraft, Hydraulic Pressure Relief, Type II Systems
MIL-F-8815	Filter and Filter Elements, Fluid Pressure, Hydraulic Line, 15 Micron Absolute, Type II Systems
MIL-A-8897	Accumulators, Hydraulic, Cylindrical, 3000 PSI, Type II

MIL-V-19067	Valves, Check, Controllable, Hydraulic, Aircraft, Type II Systems
MIL-V-19068	Valves, Shuttle, Hydraulic, Aircraft, Type II Systems
MIL-V-19069	Valves, Check, Hydraulic, Aircraft, Type II Systems
MIL-V-19593	Valve-Control, Aircraft, Pneumatic 28-Volt D-C Solenoid Operated
MIL-T-25307	Transmitter, Pressure, Hydraulic, Type MJ1
MIL-G-25308	Gages, Pressure, Dial Indicating, Hydraulic, Type ME-1
MIL-C-25427	Couplings, Aircraft Hydraulic Self-Sealing Quick-Disconnect
MIL-V-25517	Valve, Aircraft Hydraulic Restrictor
MIL-I-25540	Indicator, Pressure, Hydraulic, 0-4000 PSI, Type MT1
MIL-V-25675	Valves, Check, Hydraulic, Aircraft and Missile, Type III Systems
MIL-F-25682	Filter and Filter Element, Fluid Pressure, Hydraulic, Absolute, 25 Micron, Minus 65 Deg. to Plus 459 and Plus 600 Deg. F.
MIL-G-25867	Gage, Pressure, Dial Indicating, Pneumatic
MIL-T-26398	Test Stand, Aircraft Hydraulic System, Trailer-Mounted, A/M27T-2, Electric-Motor-Driven, Triple System
MIL-S-26874	Stand, Test, Aircraft Hydraulic System, Gasoline-Engine-Driven, Type MJ-1
MIL-S-26877	Stand, Test, Aircraft Hydraulic System, Gasoline-Engine-Driven, Type MJ-2A
MIL-V-26880	Valve, Diaphragm Actuated, Hydraulically Operated, Pressure Reducing and Check
MIL-I-27190	Indicator Pressure AGU-3-A, Hydraulic, 0-4000 psi
MIL-F-27656	Filter, Fluid, Pressure, Absolute 25 Micron, Hydraulic
MIL-P-38027	Pressure Indicating System, Hydraulic A/A27J-1

2.2.4 Part Specifications

MIL-S-4040	Solenoid, Electrical, General Specification for
MIL-P-4861	Packing, Preformed, Rubber, Packaging of
MIL-S-5049	Scrapers; Piston Rod
MIL-A-5070	Adapter, Hose to Tube, Pipe and Flange, Reuseable, Hydraulic, Pneumatic, Fuel and Oil Lines
MIL-C-5499	Cores, Aircraft High Pressure Air Valve
MIL-C-5500	Caps; High Pressure Air Valve
MIL-C-5501	Caps and Plugs, Protective, Dust and Moisture Seal
MIL-F-5506	Fittings, Method of Testing, Tube
MIL-F-5509	Fittings; Fluid Connection
MIL-G-5510	Gasket; Straight Thread Tube Fitting, Boss
MIL-P-5516	Backings and Gaskets, Preformed, Petroleum Hydraulic Fluid Resistant
MIL-R-5521	Rings; Aircraft Hydraulic Packing Back-up
MIL-H-5593	Hose, Aircraft Low Pressure Flexible
MIL-V-6164	Valve; Aircraft, Air, High Pressure
MIL-P-6906	Plates - Identification
MIL-C-8603	Clamps, Tube Support, Loop Type
MIL-H-8788	Hose, Aircraft Hydraulic and Pneumatic, High Pressure
MIL-H-8789	Fitting End, Attachable, Hydraulic and Pneumatic, High Pressure Hose
MIL-H-8790	Hose Assemblies, Aircraft, Hydraulic and Pneumatic, High Pressure (3000 PSI)
MIL-R-8791	Retainer, Packing, Hydraulic, and Pneumatic, Tetrafluoroethylene Resin
MIL-H-8794	Hose, Rubber, Aircraft, Hydraulic and Pneumatic, Fuel and Oil Resistant
MIL-H-8795	Hose Assemblies, Rubber, Aircraft, Hydraulic, Pneumatic, Fuel and Oil Resistant
MIL-F-8839	Fittings, Lubrication, Drive Type
MIL-D-9898	Drawings, Tube Bend
MIL-F-18280	Fittings, Flareless, Fluid Connection

MIL-H-25579	Hose Assembly, Tetrafluoroethylene, High Temperature, Power Plant, Aircraft
MIL-P-25732	Packing, Preformed, Petroleum Hydraulic Fluid Resistant, 275° F
MIL-H-26666	Hose Assembly, Pneumatic High Pressure
MIL-H-27267	Hose, Tetrafluoroethylene, High Temperature, Medium Pressure
MIL-H-27272	Fitting, Hose, Tetrafluoroethylene, High Temperature, Medium Pressure, General Requirements for
MIL-H-27462	Hose Assembly, Pneumatic, High Pressure (8500 PSI)
MIL-H-38360	Hose Assembly, Tetrafluoroethylene, High Temperature, High Pressure, Hydraulic and Pneumatic
MIL-H-38390	Hose Assembly, Tetrafluoroethylene, Pneumatic, High Pressure

2.2.5 Materials, Processes and Miscellaneous Specifications

MIL-F-3541	Fittings, Lubrication
MIL-G-4343	Grease, Pneumatic System
MIL-C-5541	Chemical Films for Aluminum and Aluminum Alloys
MIL-H-5606	Hydraulic Fluid, Petroleum Base, Aircraft and Ordnance
MIL-H-6002	Marking; Standard Hose, Aircraft
MIL-H-6083	Hydraulic Fluid, Petroleum Base, Preservative
MIL-T-6845	Tubing, Steel, Corrosion-Resistant (304), Aerospace Vehicle Hydraulic System, 1/8 Hard Condition
MIL-I-6869	Impregnants for Aluminum Alloy and Magnesium Alloy Castings
MIL-T-7081	Tubing, Aluminum Alloy, Seamless, Round, 6061, Aircraft Hydraulic Quality
MIL-H-7083	Fluid; Hydraulic Nonflammable, Hydrolube, Aircraft
MIL-F-7179	Finishes and Coatings, General Specification for Protection of Aircraft and Aircraft Parts
MIL-H-8446	Hydraulic Fluid, Nonpetroleum Base, Aircraft
MIL-I-8474	Inspection of Aluminum Alloy Parts, Anodizing Process for
MIL-T-8504	Tubing, Steel, Corrosion-Resistant (18-8) Annealed, Aircraft Hydraulic System
MIL-A-8625	Anodic Coatings, for Aluminum and Aluminum Alloys
MIL-T-8808	Tubing, Steel, Corrosion-Resistant (18-8 Stabilized) Aircraft Hydraulic Quality
MIL-T-10727	Tin Plating Electrodeposited or Hot Dipped for Ferrous and Non-ferrous Metals
MIL-T-25456	Tester, Hose Assemblies, Hydraulic, Pneumatic, Fuel, and Oil, Aircraft
MIL-R-25897	Rubber, High Temperature, Fluid Resistant
MIL-R-25988	Rubber, Silicone, Oil and Fuel Resistant
MIL-C-26074	Coating, Nickel Phosphorous Electroless Nickel, Requirements for
MIL-H-46004	Hydraulic Fluid, Petroleum Base, Missile
MIL-H-81019	Hydraulic Fluid, Petroleum Base, Ultra-Low, Temperature
MIL-S-81087	Silicone Fluid, Chlorinated Phenyl Methyl Polysiloxane
QQ-N-290	Nickel Plating (Electrodeposited)
QQ-C-320	Chromium Plating (Electrodeposited)
QQ-Z-325	Zinc Coating (Electrodeposited)
QQ-S-365	Silver Plating (Electrodeposited)
AMS 2419	Cadmium - Titanium Alloy Plating

2.3 Industry Specifications

2.3.1 Society of Automotive Engineers Specifications

ARP 219	Procedure and Method for Conducting Test of Hydraulic Components in Contamination Controlled System
AS 227	Wheels and Brakes, Minimum Requirements for Civil Aircraft Applications
AS 408	Pressure Instruments - Fuel, Oil, and Hydraulic (Reciprocating Engine Powered Aircraft)
AS 483	Skid Control Equipment
ARP 490	Electrohydraulic Flow Control Servovalves
ARP 560	Missile Hydraulic Pumps
ARP 575	Procedure and Method, Evaluation of Filter Patch Testing for Aircraft Hydraulic Pumps
AS 595	Aircraft Variable Delivery Hydraulic Pump
ARP 597	Wheels and Brakes, Supplementary Criteria for Design Endurance - Civil Transport Aircraft
ARP 598	Procedure for the Determination of Particulate Contamination of Hydraulic Fluids by the Particle Count Method
ARP 599	A Dynamic Test Method for Determining the Degree of Cleanliness of the Downstream Side of Filter Elements
ARP 600	Torque Determination, Method of, for Tube or Hose End Fitting Connections, Flared, Flareless or Miscellaneous Screw Thread Style
ARP 601	Hose Assemblies, Flexible Metal, Aeronautical, Low Pressure
ARP 602	Hose Assemblies, Flexible Metal, Aeronautical, Medium Pressure
ARP 603	Impulse Test Equipment for Testing Hydraulic System Components
ARP 604	Hose Assemblies; Aircraft and Missiles, High Temperature, High Pressure (250,000 Cycles)
AS 608	High Pressure Compressed Gas Hose Assemblies for Aircraft and Missile Ground Support Equipment
ARP 609	Hose Assemblies; Pneumatic, Aircraft and Missiles, High Temperature, Medium Pressure
ARP 610	Synthetic or Natural Rubber Lined Pneumatic Hose Assemblies, Aircraft
ARP 611	Tetrafluoroethylene Hose Assembly Cleaning Methods
ARP 614	Hose Assemblies; Aircraft and Missiles, High Temperature (450F), High Pressure (4000 psi)
ARP 615	Hose Assemblies; Pneumatic, Aircraft and Missiles, High Temperature, High Pressure
ARP 620	High-Temperature Hose Assembly, Convolute - Tetrafluoroethylene, for Aircraft
ARP 664	Aircraft Compressor Lubricating Oil
ARP 683	Installation Procedures and Torques for Fluid Connections
ARP 696	Aircraft Constant Displacement Hydraulic Motor
AS 714	Aircraft Hydraulic Starters
ARP 719	Gas Motor
ARP 739	Gas Power Servos and Reaction Control Systems
ARP 743	Procedure for the Determination of Particulate Contamination of Air in Dust Controlled Spaces by the Particle Count Method

AIR 744	Standby Auxilliary Power Sources for Tactical Missiles
ARP 745	Explosively Actuated Valves
ARP 763	Accumulators, Ground, Hydropneumatic Pressure
ARP 765	Elastomer, Synthetic Compounds, High and Low Temperature, Fuel and Oil Resistant
ARP 777	Gas Actuators (Linear and Vane Rotary Type)
ARP 785	Procedure for the Determination of Particulate Contamination in Hydraulic Fluids by the Control Filter Gravimetric Procedure
AIR 787	Filter Element Cleaning Methods
ARP 820	Physical and Performance Tests for Type II (-65 to +275F) O-Ring Packings, 3000 psi Hydraulic Service
ARP 824	Hose Assemblies, Flexible Metal, High Pressure and High Temperature
AIR 839	Recommended Materials and Practices for Use with Cryogenic Propellants
AIR 867	Long Term Storage for Missile Hydraulic Control Systems - Design and Operational Practices Guide

2.3.2 National Aerospace Standards Committee Specifications

NAS 810	Protection of Fluid Lines and Equipment
NAS 1095	Flareless Fitting Connections Fabrication and Assembly
NAS 1613	Packing, O-Ring, Phosphate Ester Resistant
NAS 1629	O-Ring Elongation Modulus Test

3. DESIGN STANDARDS

3.1 Military Standards (MIL-STD)

MIL-STD-9	Screw Thread Conventions and Methods of Specifying
MIL-STD-17	Mechanical Symbols Part No. 1
MIL-STD-17	Mechanical Symbols for Aeronautical, Aerospacecraft, Part No. 2 and Spacecraft Use
MIL-STD-29	Springs, Mechanical, Drawing Requirements for
MIL-STD-105	Sampling Procedure and Tables for Inspection by Attributes
MIL-STD-143	Specifications and Standards, Order of Precedence for the Selection of
MIL-STD-177	Rubber Products, Terms for Visible Defects of
MIL-STD-186	Protective Finishing Systems for Rockets, Guided Missiles, Support Equipment and Related Materials
MIL-STD-190	Identification Marking of Rubber Products
MIL-STD-276	Impregnation of Porous Nonferrous Metal Castings
MIL-STD-407	Visual Inspection Guide for Rubber Molded Items
MIL-STD-413	Visual Inspection Guide for Rubber O-Rings
MIL-STD-810	Environmental Test Methods for Aerospace and Ground Equipment
MIL-STD-847	Preparation of Technical Reports
MIL-STD-1247	Identification of Pipe, Hose, and Tube Lines for Aircraft, Missile, and Space Systems

3.1.1 Specification Bulletins

USAF Spec. Bulletin 528 Fitting, Hose, Tetrafluoroethylene, High Temperature, Medium Pressure, Classification of Defects

3.2 Military Standards (MS)

MS-18084	Design Standard for Assembly of Tetrafluoroethylene Hose Fittings
MS-21931	Fitting Installation, Cluster
MS-21932	Fitting End, Bolt Cluster Fitting End, Bolt Cluster Fitting, Single Port
MS-21933	Fitting End, Bolt Cluster Fitting, Single Port Through, Flareless
MS-21934	Fitting End, Bolt Cluster Fitting, Double Port
MS-21935	Fitting End, Bolt Cluster Fitting, Double Port, Through, Flareless
MS-21936	Contour and Mounting End, Cluster Fitting Body, Semi-Finished
MS-21947	Fitting End - Bolt Cluster Fitting Single Port Through Flare
MS-21948	Fitting End - Bolt Cluster Fitting Double Port Through - Flare
MS-24385	Fitting End, Flared Tube Connection and Gasket Seal, Precision Type, Standard Dimensions
MS-24386	Fitting End, Bulkhead Flared Tube Connection and Gasket Seal, Precision Type, Standard Dimensions
MS-33514	Fitting End, Standard Dimensions for Flareless Tube Connection and Gasket Seal
MS-33515	Fitting End, Standard Dimensions for Bulkhead Flareless Tube Connections
MS-33524	Recommended Port Sizes for Hydraulic Pumps, Aircraft
MS-33566	Fittings, Installation of Flareless Tube, Straight-Threaded Connectors
MS-33583	Tubing End, Double Flare, Standard Dimensions for
MS-33584	Tubing End, Standard Dimensions for Flared
MS-33586	Metals, Definition of Dissimilar
MS-33611	Tube End Radii
MS-33620	Chart, Hose Selection
MS-33651	Boss and Installations - Air Connection
MS-33656	Fitting End, Standard Dimensions for Flared Tube Connection and Gasket Seal
MS-33657	Fitting End, Standard Dimensions for Bulkhead Flared Tube Connections
MS-33658	Fitting End, Hose Connection, Standard Dimensions for
MS-33660	Tubing End, Hose Connection, Standard Dimensions for
MS-33666	Packing, Preformed - Aeronautical, Elastomeric, Range of Sizes
MS-33668	Packing, Preformed - Tube Fitting, Elastomeric, Range of Sizes
MS-33675	Ring, Wiper, Installation and Gland Design
MS-33786	Fitting Installation, Flared Tube and Hose, Swivel
MS-33790	Bend Data, Minimum, Hydraulic, Pneumatic, Fuel and Oil Hose

3.3 Air Force/Navy Design Standards (AND)

AND 10050	Bosses, Standard Dimensions for Gasket Seal Straight Thread
AND 10059	Fittings - Styles of Pipe Threaded, Flared Tube and Hose
AND 10064	Fittings - Installation of Flared Tube, Straight Threaded Connectors
AND 10067	Valve Installation - Hydraulic Bleeder, Standard Dimensions for
AND 10071	Boss and Installation - Air Connection
AND 10074	Boss - Spacing - Hydraulic
AND 10080	Fittings - Installation of Universal Elbow

AND 10104	Tubing, Steel, Corrosion-Resistant, Round, Standard Dimensions for
AND 10106	Tubing - Standard Sizes for Aluminum Alloy (52SO)Round
AND 10230	Reference Chart, Aircraft Engine Accessory Drive
AND 10260	Flange - Type X Accessory Mounting
AND 10261	Flange - Type XI Accessory Mounting
AND 10262	Flange - Type XII Accessory Mounting
AND 10302	Installation Clearance - IX Drive
AND 10313	Relief Valve Installation Clearance - Hydraulic
AND 10331	Installation Clearance - Type XII-J Drive (Fluid Power Pump)
AND 10338	Installation Clearance - Type XII-K (Fluid Power Pump)
AND 10375	Colors - Fluid Line Identification
AND 20000	Drive - Type X Engine Accessory
AND 20001	Drive - Type XI Engine Accessory
AND 20002	Drive - Type XII Engine Accessory

3.4 American Standards Association Documents

ASA-B46.1 Surface Texture

3.5 Industry Design Standards

3.5.1 Society of Automotive Engineers Standards

AS 468	Drive - Accessory, 5" Bolt Circle
AS 469	Drive - Accessory, 8" Bolt Circle
AS 470	Drive - Accessory, 10" Bolt Circle
AS 471	Flange - Accessory, 5" Bolt Circle
AS 472	Flange - Accessory, 8" Bolt Circle
AS 473	Flange - Accessory, 10" Bolt Circle
ARP 568	Uniform Dash Numbering System for O-Rings
ARP 584	Coiled Tubing
AS 666	Cavity Design and O-Ring Selection for Static Seal Use in Aircraft Tubeless Tire Wheels
ARP 674	Metal Ring Seal Groove Design
AS 756	Fitting End Assembly, Universal
AS 757	Boss, Straight Thread Gasket Seal - Standard Dimensions for
AS 758	Fittings, Installation of Straight Threaded Boss
AS 759	Fittings, Universal or Internally Threaded, Flared and Flareless

3.5.2 National Aerospace Standards Committee Standards

NAS 550	Fitting - Installation of Universal Elbow
NAS 1638	Cleanliness Requirements of Parts used in Hydraulic Systems

4. STANDARD COMPONENTS

4.1 Military Standard Components

MS-24333	Coupling Assembly, Hydraulic, Self-Sealing, Quick Disconnect, Flared Fitting to Internal Thread Boss
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MS-24334 Coupling Assembly, Hydraulic, Self-Sealing, Flareless Fitting To Internal Thread Boss

MS-24335 Flange, Bulkhead Mounting, Hydraulic Self-Sealing Coupling

MS-24352 Valve, Aircraft Hydraulic Restrictor, One-Way, Filtered

MS-24353 Valve, Aircraft Hydraulic Restrictor, Two-Way, Filtered

MS-24418 Valve, Aircraft Hydraulic Restrictor, One-Way, Unfiltered

MS-24419 Valve, Aircraft Hydraulic Restrictor, Two-Way, Unfiltered

MS-24423 Valve, Check-Hydraulic, Minus 65 Deg. F. to Plus 450 Deg. F., 3000 PSI, Flareless Tube

MS-24427 Filter, Fluid, Pressure-Hydraulic, 3000 PSI, Absolute 25 Micron, Style A, Minus 65 Deg. to Plus 450 Deg. F.

MS-24428 Filter, Fluid, Pressure-Hydraulic, 3000 PSI, Absolute 25 Micron, Style B, Minus 65 Deg. to Plus 450 Deg. F.

MS-24429 Filter, Fluid, Pressure-Hydraulic, 3000 PSI, Absolute 25 Micron, Style A, Minus 65 Deg. to Plus 600 Deg. F.

MS-24430 Filter, Fluid, Pressure-Hydraulic, 3000 PSI, Absolute 25 Micron, Style B, Minus 65 Deg. to Plus 600 Deg. F.

MS-24431 Filter Element, Fluid, Pressure-Hydraulic, 3000 PSI, Absolute 25 Micron, Style A, Minus 65 Deg. to Plus 6000 Deg. F.

MS-24432 Filter Element, Fluid, Pressure-Hydraulic, 3000 PSI, Absolute 25 Micron, Style B, Minus 65 Deg. to Plus 6000 Deg. F.

MS-24478 Gage, Single 1 Inch Dial, Pneumatic Pressure

MS-24593 Valve, Check-Hydraulic, Minus 65 Deg. F. to Plus 450 Deg. F., 3000 PSI, Flared Tube

MS-27201 Tank, Pneumatic Pressure, Aircraft, Glass Fiber Sphere

MS-28005 Transmitters, Pressure, Synchro, Aircraft

MS-28016 Valve - Hydraulic Dual Thermal Expansion Relief

MS-28061 Gages, Pressure, Engine and Utility, 2-Inch, Flange Mounted, Back Ports

MS-28063 Gages, Pressure, Engine and Utility, 2-Inch, Flange or Port Mounted, Bottom Port

MS-28700 Accumulator - Cylindrical, 3000 PSI

MS-28720 Filter, Aircraft Hydraulic Line Type, 3000 PSI

MS-28764 Valve, Check, Controllable, Rotary Action, Hydraulic, 3000 PSI, Type II Systems

MS-28765 Valve, Check, Hydraulic, Internal Ports, 3000 PSI, Type II Systems

MS-28766 Valve, Shuttle, Hydraulic, Direct Mounting, 3000 PSI, Type II Systems

MS-28767 Valve, Shuttle, Hydraulic, Internal-Thread, Tube Fitting Outlet, 3000 PSI, Type II Systems

MS-28768 Valve, Check, Controllable, Plunger-Type, Hydraulic, 3000 PSI, Type II Systems

MS-28771 Valve, Check, Hydraulic, Flared, 3000 PSI, Type II Systems

MS-28797 Accumulator, Hydraulic, Cylindrical, 3000 PSI, Type II

MS-28880 Valve - Controllable Hydraulic Check, Rotating Action, 3000 PSI

MS-28881 Valve - Hydraulic, Directional Control, Slide Selector 4 Way, 3000 PSI

MS-28886 Valve, Aircraft Hydraulic Flow Regulator

MS-28888 Valve, Pneumatic Check

MS-28889 Valve, Air, High-Pressure Charging

MS-28890 Valve, Hydraulic Check, 3000 PSI, Flareless, Type II Systems

MS-28891 Valve, Shuttle, Hydraulic, 3000 PSI, Direct Mounting

MS-28892 Valve, 3000 PSI Hydraulic Check, Flareless, Type II Systems

MS-28893	Valve, Hydraulic Relief, Cylindrical, Type II Systems
MS-28895	Filter, Fluid, Pressure, Hydraulic Line, 3000 PSI, Absolute 15 Micron, Style A, By Pass, 275 Deg. F.
MS-28896	Filter, Fluid, Pressure, Hydraulic Line, 3000 PSI, Absolute 15 Micron, Style B, Non By Pass, 275 Deg. F.
MS-28897	Filter Element, Fluid, Pressure, Hydraulic Line, 3000 PSI, Absolute 15 Micron, 275 Deg. F.

4.2 Air Force/Navy Standard Components

AN 4146	Pump - 1/2GPM at 3000 PSI Power Driven Hydraulic
AN 4147	Pump - 1GPM at 3000 PSI Power Driven Hydraulic
AN 4149	Pump - 3GPM at 3000 PSI Power Driven Hydraulic
AN 6201	Pump - Hydraulic Hand
AN 6204	Valve, Hydraulic Bleeder
AN 6207	Valve - 1500 PSI Hydraulic Check
AN 6234	Filter - Hydraulic Replaceable Element Line Type
AN 6235	Filter Element - Hydraulic Replaceable Micronic Line Type
AN 6236	Filter Element - Hydraulic Replaceable Micronic Reservoir Type
AN 6237	Filter Element - Hydraulic Replaceable Micronic Vent Type
AN 6238	Gasket - Hydraulic Replaceable Reservoir Type Filter Element
AN 6240	Filter - Hydraulic Replaceable Vent Type
AN 6245	Valve - Hydraulic Thermal Expansion Relief
AN 6247	Valve - Controllable Check, Rotating Action
AN 6248	Pump - Hydraulic Hand, Type 3000
AN 6249	Valve, 3000 PSI Hydraulic Check
AN 6250	Pump - 1 GPM at 1500 PSI Power Driven Hydraulic
AN 6251	Pump - 2 GPM at 1500 PSI Power Driven Hydraulic
AN 6252	Pump - 3 GPM at 1500 PSI Power Driven Hydraulic
AN 6277	Valve - Hydraulic Shuttle, 3000 PSI, Internal Thread Tube Fitting Outlet
AN 6278	Valve - Hydraulic Shuttle, 3000 PSI, Universal and Internal Thread Fitting Outlet
AN 6280	Valve - 3000 PSI Hydraulic Check Internal Ports
AN 6281	Fuse - Hydraulic Quantity Measuring, Class 3000, Type 1
AN 6282	Fuse - Hydraulic Quantity Measuring, Class 3000, Type 2
AN 6293	Valve - 4-Way Rotary Selector, 3000 PSI, Non-Interflow
AN 6294	Valve - 4-Way Rotary Selector, 3000 PSI, Interflow
AN 6295	Regulator - 10 GPM Hydraulic Pressure
AN 6296	Valve, Controllable Check, Plunger Type, 3000 PSI

5. HYDRAULIC AND PNEUMATIC FITTINGS

5.1 Military Standard Fittings (MS)

MS-9015	Plug - Straight Thread, "O" Ring Seal
MS-20819	Sleeve, Flared Tube Fitting
MS-21900	Adapter, Flareless Tube to AN Flared Tube
MS-21901	Adapter, Flareless Tube for 3/8 Bulkhead and Universal to AN Flared Tube
MS-21902	Union, Flareless Tube
MS-21903	Union, Flareless Tube, 3/8 Bulkhead and Universal
MS-21904	Elbow, Flareless Tube, 90 Degree

MS-21905	Tee, Flareless Tube
MS-21906	Cross, Flareless Tube
MS-21907	Elbow, Flareless Tube and Universal 45 Degree
MS-21908	Elbow, Bulkhead Universal 90 Degree, Flareless Tube
MS-21909	Tee, Bulkhead and Universal, Flareless Tube
MS-21910	Tee, Flareless Tube, Internal Thread on Run
MS-21911	Tee, Flareless Tube, Internal Thread on Side
MS-21912	Tee, Flareless Tube with Bulkhead on Run
MS-21913	Plug, Flareless Tube
MS-21914	Cap, Pressure Seal, Flareless Tube Fitting
MS-21915	Bushing, Screw-Thread Expander, Flareless Tube Connection
MS-21916	Reducer, External Thread, Flareless Tube
MS-21917	Nut-Sleeve Coupling Flareless
MS-21921	Nut, Sleeve Coupling Flareless
MS-21922	Sleeve Coupling Flareless
MS-21923	Adapter, Flareless Tube, Bulkhead and Universal to Flared Tube
MS-21924	Union, Flareless Tube, Bulkhead and Universal
MS-21925	Elbow, 90 Degree Universal, Flareless Tube, High Profile
MS-21926	Elbow, 90 Degree Universal, Flareless Tube, Low Profile
MS-21937	Nut, Cluster Fitting, Retainer
MS-21938	Bolt, Cluster Fitting, Single Port, Flareless
MS-21939	Bolt, Cluster Fitting, Single Port, Through, Flareless
MS-21940	Bolt, Cluster Fitting, Double Port, Flareless
MS-21941	Bolt, Cluster Fitting, Double Port, Through, Flareless
MS-21942	Body, Cluster Fitting, One Way, Flareless
MS-21943	Body, Cluster Fitting, Two Way, 90 Degree, Flareless
MS-21944	Body, Cluster Fitting, Two Way, 180 Degree, Flareless
MS-21945	Body, Cluster Fitting, Three Way, Flareless
MS-21946	Body, Cluster Fitting, One Way, Internal Boss
MS-21949	Bolt - Cluster Fitting Single Port - Flare
MS-21950	Bolt - Cluster Fitting Single Port Through - Flare
MS-21951	Bolt - Cluster Fitting Double Port - Flare
MS-21952	Bolt - Cluster Fitting Double Port Through - Flare
MS-21953	Body - Cluster Fitting One Way - Flare
MS-21954	Body - Cluster Fitting Two Way 90 Degree - Flare
MS-21955	Body - Cluster Fitting Two Way 180 Degree - Flare
MS-21956	Body - Cluster Fitting Three Way - Flare
MS-21958	Body - Cluster Fitting, Two Way 180 Degree, Internal Boss
MS-21959	Body - Cluster Fitting, Two Way, 90 Degree, Internal Boss
MS-21960	Body - Cluster Fitting, Three Way, Internal Boss
MS-24387	Bolt, Flared Tube Fitting End Universal, Precision Type
MS-24388	Tee, Flared Tube, Internal Thread on Side, Precision Type
MS-24389	Tee, Flared Tube, Internal Thread on Run, Precision Type
MS-24390	Tee, Flared Tube, with Bulkhead on Run, Precision Type
MS-24391	Plug-Bleeder, Screw Thread, Precision Type
MS-24392	Union, Flared Tube, Precision Type
MS-24393	Union, Flared Tube 3/8 Bulkhead and Universal, Precision Type
MS-24394	Elbow, Flared Tube Bulkhead and Universal, 90 Degree, Precision Type
MS-24395	Tee, Bulkhead and Universal Flared Tube, Precision Type

MS-24396	Elbow, Flared Tube and Universal 45 Degree, Precision Type
MS-24397	Bushing, Screw Thread Reducer, Precision Type
MS-24398	Bushing, Screw Thread Expander, Precision Type
MS-24399	Reducer, External Thread Flared Tube, Precision Type
MS-24400	Nut, Flared Tube, Bulkhead and Universal Fitting, Precision Type
MS-24401	Elbow, Flared Tube, 90 Degree, Precision Type
MS-24402	Tee, Flared Tube, Precision Type
MS-24403	Cross, Flared Tube, Precision Type
MS-24404	Plug, Flared Tube, Precision Type
MS-24405	Adapter, Flareless Tube to AN Flared Tube, Precision Type
MS-24487	Union - Tube, Flared, Universal
MS-24651	Elbow, Tube - 90 Degree, Bulkhead, Flareless Tube Universal to Flared Tube
MS-24652	Elbow, Tube - 90 Degree, Bulkhead, Flared Tube Universal To Flareless Tube
MS-24653	Elbow, Tube - 45 Degree, Bulkhead, Flared Tube Universal To Flareless Tube
MS-24654	Elbow, Tube - 45 Degree, Bulkhead, Flareless Tube Universal to Flared Tube

5.2 Air Force/Navy Standard Fittings (AN)

AN 774	Bolt - Flared Tube Fitting End Universal
AN 775	Bolt - Universal Fitting
AN 776	Elbow - Universal 90 Degree
AN 777	Elbow - Universal 75 Degree
AN 778	Elbow - Universal 45 Degree
AN 779	Tee - Universal Fitting
AN 783	Tee, Flared Tube, Internal Thread on Side
AN 784	Tee, Flared Tube, Internal Thread on Run
AN 804	Tee, Flared Tube with Bulkhead on Run
AN 806	Plug - Flared Tube
AN 814	Plug and Bleeder - Flared Tube
AN 815	Union - Flared Tube
AN 817	Nut - Sleeve, Coupling
AN 818	Nut - Coupling
AN 821	Elbow - Flared Tube, 90 Degree
AN 824	Tee - Flared Tube
AN 827	Cross - Flared Tube
AN 832	Union - Flared Tube 3/8 Bulkhead and Universal
AN 833	Elbow - Flared Tube and Bulkhead Universal 90 Degree
AN 834	Tee - Bulkhead and Universal Flared Tube
AN 837	Elbow - Flared Tube and Universal, 45 Degree
AN 871	Flange - Straight Thread Boss Welding
AN 893	Bushing - Screw Thread Reducer
AN 894	Bushing - Screw Thread Expander
AN 919	Reducer - External Thread Flared Tube
AN 924	Nut - Flared Tube Bulkhead and Universal Fitting
AN 929	Cap Assembly, Pressure Seal Flared Tube Fitting
AN 937	Cross - Internal Screw Thread
AN 938	Tee - Internal Screw Thread
AN 939	Elbow - Internal Screw Thread, 90 Degree
AN 941	Elbow - Internal Screw Thread, 45 Degree
AN 6289	Nut - Flared Tube Universal Fitting

5.3 Industry Standard Fittings

5.3.1 Society of Automotive Engineers Standards

AS 872	Nut, Sleeve Coupling, Flareless Tube
AS 1000	Cap Assembly - Pressure Seal, Flareless Tube Fittings
AS 1001	Tee, Reducer, Bulkhead on Run, Internal Port on Side, Flareless Tube
AS 1002	Tee, Reducer, Bulkhead and Internal Port on Run, Flareless Tube
AS 1003	Tee, Reducer, Bulkhead on Run, Flareless Tube
AS 1004	Elbow, 90 Degree, Reducer, Flareless Tube
AS 1005	Tee, Reducer, Flareless Tube
AS 1006	Cross, Reducer, Flareless Tube
AS 1007	Union, Reducer, Bulkhead, Flareless Tube
AS 1008	Elbow, 90 Degree, Reducer, Bulkhead, Flareless Tube
AS 1009	Tee, Reducer, Bulkhead on Side, Flareless Tube
AS 1010	Elbow, 45 Degree, Reducer, Flareless Tube
AS 1011	Fitting End; Attachable, Male for 37 Degree Flared Tube Connection Flexible Metal Hose - Straight, 45 Degree Elbow and 90 Degree Elbow Styles
AS 1012	Fitting End; Attachable, Swivel Female 37 Degree Machined Flare, Flexible Metal Hose - Straight, 45 Degree Elbow and 90 Degree Elbow Styles
AS 1013	Fitting End; Attachable, Swivel Female 37 Degree Flared Tube, Flexible Metal Hose - Straight, 45 Degree Elbow and 90 Degree Elbow Styles
AS 1014	Fitting End; Attachable, Swivel Flange, Flexible Metal Hose - Straight, 45 Degree Elbow and 90 Degree Elbow Styles
AS 1015	Fitting End; Attachable, Female Flareless, Machined Nipple, Flexible Metal Hose - Straight, 45 Degree Elbow and 90 Degree Elbow Styles
AS 1016	Fitting End; Attachable, Flareless Male, Flexible Metal Hose - Straight, 45 Degree Elbow and 90 Degree Elbow Styles
AS 1017	Union Assembly - Adjustable Flareless
AS 1018	Nut - Adjustable Flareless Union Assembly
AS 1019	Bulkhead Union Assembly - Adjustable Flareless
AS 1020	Screw, Adjustable Union Flareless
AS 1021	Nut, Adjustable Flareless Bulkhead Union Assembly
AS 1022	Bulkhead Union Assembly - Adjustable Flared
AS 1023	Nut - Adjustable Flared Bulkhead Union Assembly
AS 1024	Union Assembly - Adjustable Flared
AS 1025	Screw, Union Adjustable- Flared
AS 1026	Nut - Adjustable Flared Union Assembly
AS 1027	Nut - Drilled Jam
AS 1028	Nut, Coupling, Flared Tube, with Lockwire Holes
AS 1031	Reducer Tee - Bulkhead on Run, Internally Threaded Side Port, Flared Tube
AS 1032	Reducer Tee - Bulkhead and Internally Threaded Port on Run, Flared Tube
AS 1033	Reducer Tee - Bulkhead on Run, Flared Tube
AS 1034	Reducer Elbow 90 Degree - Flared Tube
AS 1035	Reducer Tee - Flared Tube
AS 1036	Reducer Cross - Flared Tube
AS 1037	Reducer Bulkhead - Flared Tube
AS 1038	Reducer Bulkhead Elbow 90 Degree - Flared Tube

AS 1039	Reducer Bulkhead Tee - Flared Tube
AS 1040	Reducer Bulkhead Elbow 45 Degree - Flared Tube
AS 1041	Nut, Sleeve Coupling, Flareless Tube, with Lockwire Holes
ARP 1042	Precision Sleeve, Coupling Flareless
AS 1043	Lockwire Hole, Standard Dimension for Non-Removable Hose Assembly Swivel Nuts (Flared)

5.3.2 National Aerospace Standards Committee Standards

NAS 424	Coupling - Fittings Internal Screw Thread
NAS 551	Bolt - Universal Fitting
NAS 552	Elbow - Universal 90 Degree
NAS 553	Elbow - Universal 15 Degree
NAS 554	Elbow - Universal 45 Degree
NAS 555	Tee - Universal
NAS 1236	Bolt - Universal, Tube End - Flareless
NAS 1237	Elbow - Universal 90 Degree - Flareless
NAS 1238	Elbow - Universal 75 Degree - Flareless
NAS 1239	Elbow - Universal 45 Degree - Flareless
NAS 1240	Tee - Universal - Flareless
NAS 1367	Fittings - Coated Lubricant and Sealant

6. UTILITY PARTS AND HARDWARE STANDARDS

6.1 Military Standard Parts (MS)

MS-9058	Ring - Back-Up, Boss Connection, AMS 3651
MS-18085	Fitting End - Tetrafluoroethylene Hose Medium Pressure, Swivel Nut, Corrosion Resistant Steel
MS-18086	Fitting End - Tetrafluoroethylene Hose Medium Pressure, 45 Degree Swivel Nut, Corrosion Resistant Steel
MS-18087	Fitting End - Tetrafluoroethylene Hose Medium Pressure, 90 Degree Swivel Nut, Corrosion Resistant Steel
MS-18088	Fitting End - Tetrafluoroethylene Hose Medium Pressure, Swivel Flange, Corrosion Resistant Steel
MS-18089	Fitting End - Tetrafluoroethylene Hose Medium Pressure, 45 Degree, Swivel Flange, Corrosion Resistant Steel
MS-18090	Fitting End - Tetrafluoroethylene Hose Medium Pressure, 90 Degree Swivel Flange, Corrosion Resistant Steel
MS-20756	Flange, Swivel, Retaining
MS-20757	Connector, Fixed Flange, to Hose
MS-20760	Connector, Fixed Flange, to Flared Tube
MS-20813	Cap, High-Pressure Air Valve
MS-20995	Wire, Lock
MS-21919	Clamp, Cushioned, Support, Loop-Type, Aircraft
MS-24587	Adapter, Straight, Tube to Hose-Reusable, Hydraulic, Pneumatic, Fuel and Oil Lines
MS-24588	Nipple, Adapter, Hose to Tube, Reusable, Hydraulic, Pneumatic, Fuel and Oil Lines 3/16 through 3/4 Inch Tubing Size