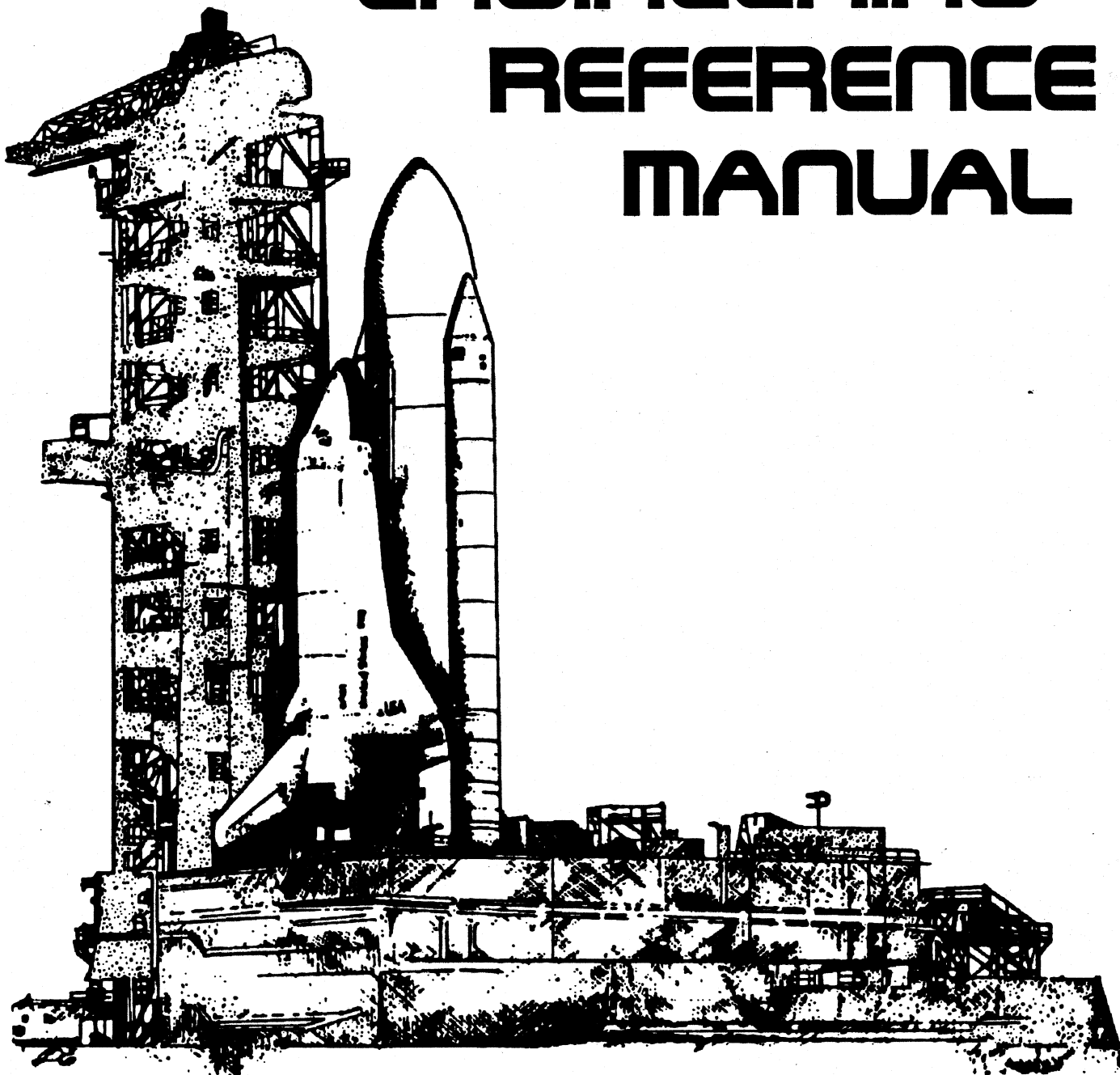


PROCESS ENGINEERING REFERENCE MANUAL



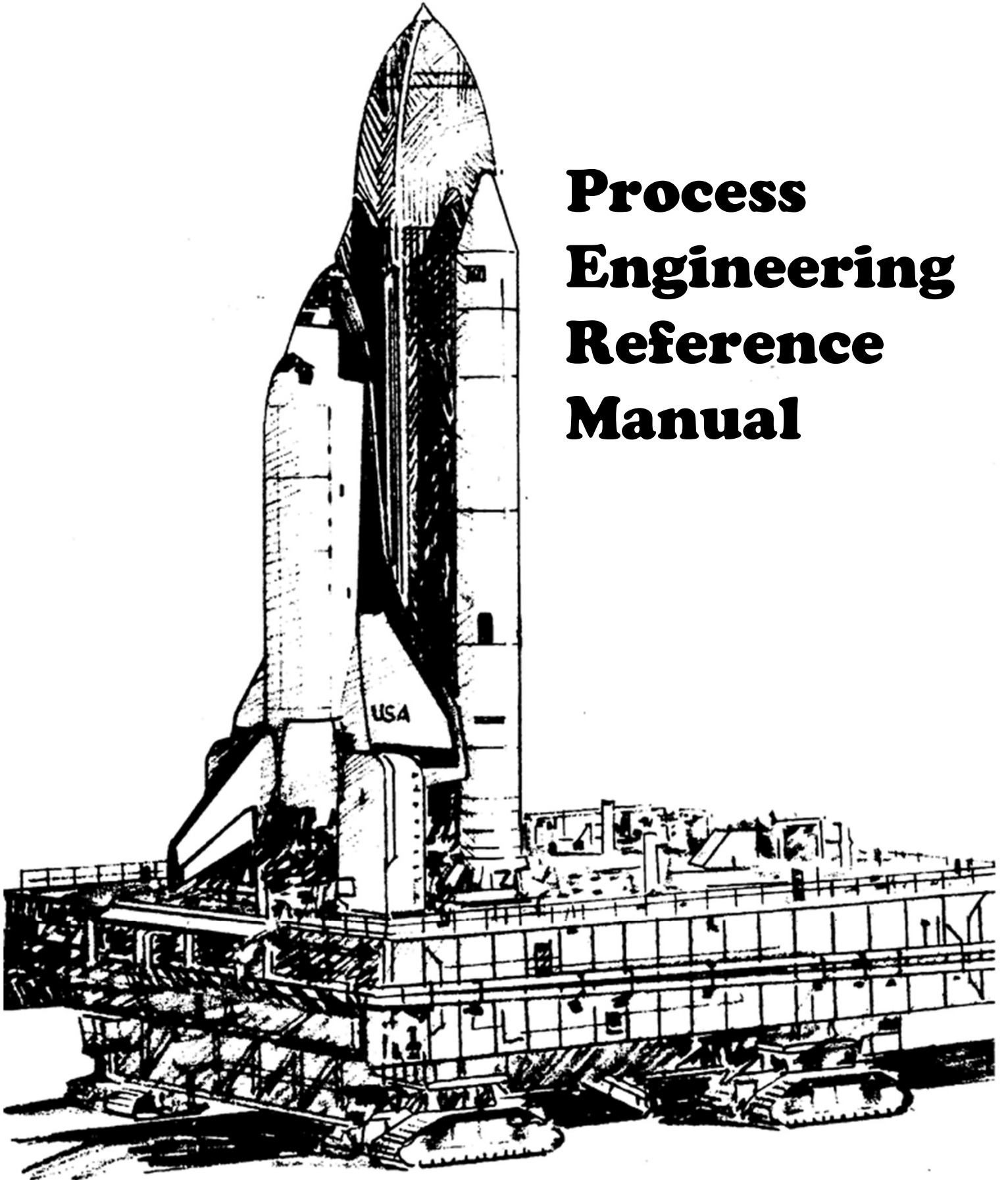
MANUAL NUMBER:
REVISION:

LSOC-000272-1750
BASIC

PROCESS ENGINEERING REFERENCE MANUAL (PERM)

 **Lockheed**
Space Operations Company

Process Engineering Reference Manual



PREFACE

THIS MANUAL IS INTENDED TO ASSIST THE ENGINEER IN DETAILING BY NATIONAL STOCK NUMBER (NSN) ITEMS COMMONLY USED IN THE DISPOSITION OF PR'S AND DEVELOPMENT OF THE MATERIALS, EQUIPMENT, AND SPECIAL TOOLS PORTION OF TPS'S/OMI'S.

THE USE OF NSN'S WILL HELP PROCESS AND EXPEDITE EQUIPMENT/MATERIAL NEEDED IN SUPPORT OF PERFORMING WORK STEPS IN SCHEDULED WADS. WE HOPE YOU WILL FIND THIS MANUAL USEFUL IN MAINTAINING THE HIGH DEGREE OF ENGINEERING EXCELLENCE REQUIRED TO SUPPORT ORBITER PROCESSING AND MEET OUR ENGINEERING OBLIGATION TO THE OTHER SUPPORTING DIRECTORATES WHICH COMPOSE THE LOCKHEED SPACE OPERATIONS COMPANY.

H. L. Lamberth

H. L. Lamberth, Director
Shuttle and Ground Support Engineering

JTE:pb

CHANGES TO THE ADDENDUM SECTION OF THE MANUAL SHOULD BE DIRECTED TO THE PROCESS ENGINEERING REFERENCE MANUAL (PERM) COORDINATOR, D/1750, LSO-198.

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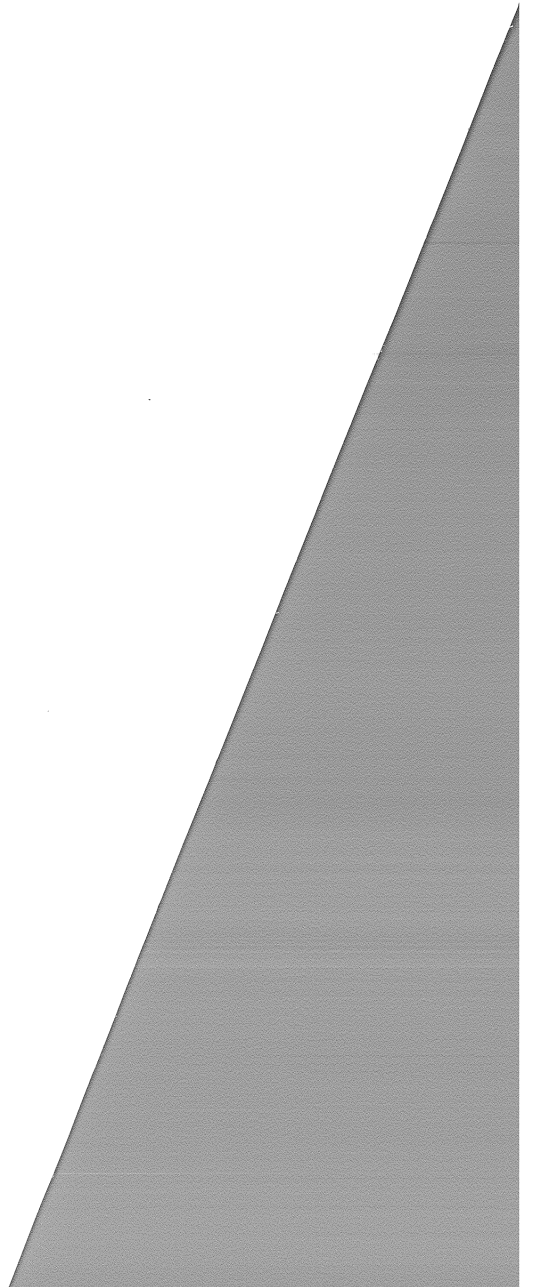
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 2. STANDARD FOR ELECTRICAL POWER RECEPTACLES AND PLUGS
 3. ENGINEERING STANDARDS (KC FITTINGS)
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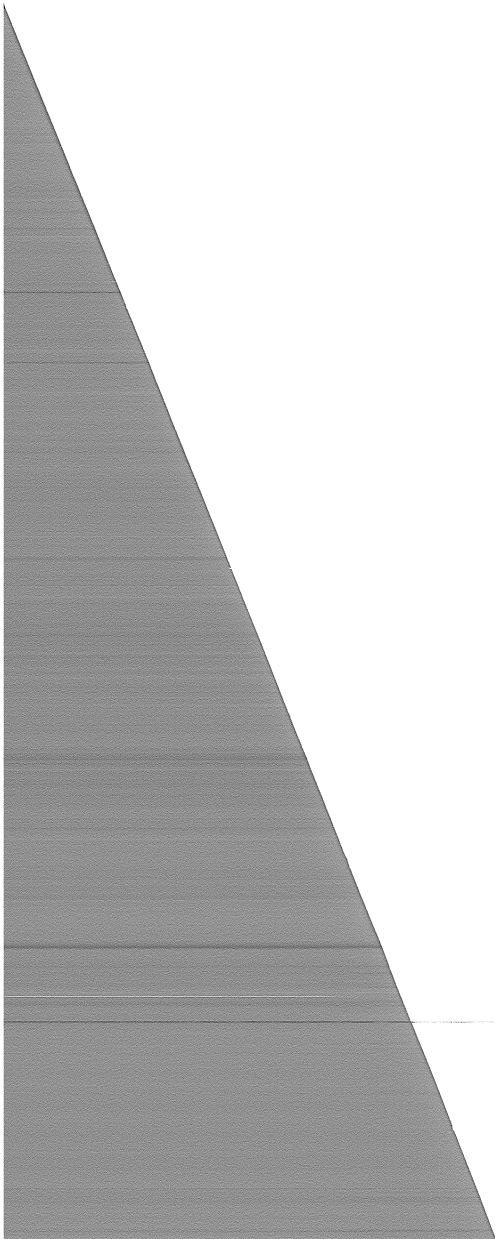
ADDENDUM

- A. COMMONLY USED EQUIPMENT LIST
- B. FLEX HOSES:

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AEROQUIP CORP	79K80264

SECTION 1 - INDEX OF KSC SPECIFICATIONS AND STANDARDS





new

GP - 364

Revision #11

March 4, 1988

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Supersedes all
previous editions

INDEX OF

KSC SPECIFICATIONS AND STANDARDS

National Aeronautics and
Space Administration

John F. Kennedy Space Center

NASA



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NOTE: KSC DTI's (Design Technical Instructions) were cancelled
April 1978.

GP-364 is prepared by the KSC Library, Specifications and Standards
Department. Mail Code: NWSI-S, Phone 305/867-3603



KSC SPECIFICATIONS

NUMBER	TITLE	DATE
KSC-C-109	Capacitors, Fixed, Tantalum (Polarized, Etched Foil) (Style KCL31)	Rev. A 3/10/66
KSC-C-110	Capacitors, Fixed, Tantalum (Polarized, Etched Foil) (Style KCL33)	Rev. A 3/10/66
KSC-C-111	Capacitors, Fixed, Solid, Tantalum (Style KSC13)	Rev. A 3/10/66
KSC-C-113	Capacitors, Fixed, Polarized, Tantalum Foil (Style KCL51 and KCL53)	Aug. 24, 1964
KSC-C-123	Surface Cleanliness of Fluid Systems, Spec for	Rev F 10/19/79 Amd. 1 12/10/80 Amd. 2 4/16/84
KSC-C-133	Capacitors, Fixed, Tantalum (Polarized, Sintered-Slug) (Style KCL65)	Mar. 10, 1966
-C-182	Gas Cleanliness Requirements for Operational Gaseous Nitrogen, Helium, and Hydrogen Systems at Complex 39, Specification for	June 7, 1966
KSC-DTI	KSC DTI's cancelled 4/78 NOT SUPERCEDED	
KSC-E-165	Electrical Ground-Support Equipment Fabrication, Specification For	Rev C 4/1/82
KSC-E-166	Installation and Assembly, Electrical Ground-Support Equipment, Specification For	Rev A 3/18/74
KSC-E-1004	Technical spec for Refurbishment of Geodesic Dome K7-1205G KSC	3/85
KSC-F-124	Fittings (Pressure Connections), Flared Tube, spec for	Rev C 7/5/77
	<u>GP 425 CONTAINS ALL KC FITTINGS Rev. E</u>	11/1/83
KSC-KC-103C	Seal Ring	Dec. 1, 1975
KSC-KC-104C	Fitting End, Standard Dimensions for Bulkhead Flared Tube Connection for Seal Ring	Nov. 3, 1975

KSC-KC-105C	Fitting End, Standard Dimensions for Flared Tube Connection for Seal Ring	Nov. 3, 1975
KSC-KC-106D	Reducer-Adapter, Conical End Fitting and Flared for Seal Ring	Nov. 3, 1975
KSC-KC-107D	Tee-Assy, Flared Tube Female Swivel End on Run, for Seal Ring	Dec. 1, 1975
KSC-KC-108E	Elbow Assy, 90 degree, Flared Tube and Male Adjustable End for Seal Ring	July 13, 1976
KSC-KC-109D	Tee-Assy, Flared Tube, Female Swivel End on Outlet for Seal Ring	Dec. 1, 1975
KSC-KC-110E	Tee-Assy, Flared Tube, Male Adjustable End on Run for Ring Seal	July 13, 1976
KSC-KC-111E	Tee-Assy, Flared Tube, Male Adjustable End on Outlet for Seal Ring	July 13, 1976
KSC-KC-112D	Adapter, Flared Tube & Boss for Seal Ring	Nov. 3, 1975
KSC-KC-113E	Elbow-Flared Tube Bulkhead Universal 90 degree for Seal Ring	Nov. 3, 1975
KSC-KC-114D	Tee-Flared Tube Bulkhead on Run, for Seal Ring	Nov. 3, 1975
KSC-KC-115C	Bushing, Screw Thread Expander for Seal Ring	Nov. 3, 1975
KSC-KC-116D	Nipple-Flared Tube & Pipe Thread for Seal Ring	Sept. 30, 1975
KSC-KC-117D	Cross-Flared Tube, for Seal Ring	Sept. 30, 1975
KSC-KC-118C	Elbow-Flared Tube, 90 degree, for Seal Ring	Sept. 30, 1975
KSC-KC-119D	Tee-Flared Tube, Internal Thread on Run for Seal Ring	Sept. 30, 1975
KSC-KC-120D	Tee-Flared Tube Internal Thread on Side for Seal Ring	Nov. 3, 1975
KSC-KC-121D	Tee-Flared Tube w/Pipe Thread on Run for Seal Ring	Nov. 3, 1975

KSC-KC-122C	Tee-Flared Tube w/Pipe Thread on Side for Seal Ring	Nov. 3, 1975
KSC-KC-123C	Tee-Flared Tube for Seal Ring	Nov. 3, 1975
KSC-KC-124E	Union-Flared Tube 3/8 Bulkhead & Universal for Seal Ring	July 13, 1976
KSC-KC-125D	Reducer-External Thread Flared Tube for Seal Ring	Feb. 6, 1976
KSC-KC-126C	Union-Flared Tube for Seal Ring	Nov. 3, 1975
KSC-KC-127D	Tee-Bulkhead & Universal Flared Tube for Seal Ring	Nov. 3, 1975
KSC-KC-128D	Elbow-Flared Tube & Universal, 45 degree for Seal Ring	Nov. 3, 1975
KSC-KC-129D	Elbow Assy, 45 degree, Flared Tube & Male Adjustable End for Seal Ring	Nov. 3, 1975
KSC-KC-130D	Plug, Flared Tube for Seal Ring	Nov. 3, 1975
KC-131D	Elbow Assy, 90 degree, Flared Tube & Female Swivel End for Seal Ring	Dec. 1, 1975
KSC-KC-132C	Elbow Assy, 45 degree, Flared Tube & Female Swivel End	Dec. 1, 1975
KSC-KC-133D	Reducer-Adapter Flared Tube & Boss for Seal Ring	Sept. 30, 1975
KSC-KC-134D	Adapter, Flared Tube 3/8 Bulkhead & Boss for Seal Ring	Nov. 3, 1975
KSC-KC-135D	Expander-Adapter, Flared Tube to Boss w/Seal Ring	Sept. 17, 1975
KSC-KC-136E	Standard Dimensions for Fitting End, Straight Thread	Nov. 3, 1975
KSC-KC-137A	Fitting End, Swivel Flared Tube Connector, Standard Dimensions for	Jan. 21, 1976
KSC-KC-138C	Fitting End, Adjustable Flared Tube Connector, Standard Dimensions for	Oct. 27, 1975
KSC-KC-139B	Swivel Nut, Flared Tube Fitting	Nov. 3, 1975
KSC-KC-140E	Washer, Flared Tube Fitting,	Jan. 21, 1976

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KSC-KC-141C	Conical End, Standard Dimensions for	Jan. 21, 1976
KSC-KC-142B	Nut, Coupling	Jan. 21, 1976
KSC-KC-143B	Sleeve, Flared Tube Fitting	July 13, 1976
KSC-KC-144D	Reducer-Flared Tube 3/8 Bulkhead & Universal for Seal Ring	Nov. 3, 1975
KSC-KC-150C	Cap, Cap Assembly, Pressure Seal,	Jan. 21, 1976
KSC-KC-154B	Tubing, Flared, Standard Dimensions for	Dec. 1, 1975
KSC-KC-155C	Clamp Assembly	Sept. 19, 1975
KSC-KC-156C	Elbow, 90 degree	Sept. 19, 1975
KSC-KC-157C	Tee	Sept. 19, 1975
KSC-KC-158C	Cross	Sept. 19, 1975
KSC-KC-159C	Hub, Butt Weld	Sept. 19, 1975
KSC-KC-160D	Hub, Blind	July 27, 1983
KSC-KC-161A	Dimension Tolerances for Flange Fittings	Sept. 19, 1975
KSC-KC-162D	Ring, Seal	Sept. 19, 1975
KSC-KC-163B	Pipe Connection, Installation of	Nov. 3, 1975
KSC-KC-164C	Bushing, Screw Thread Reducer w/Seal Ring	July 27, 1983
KSC-KC-165	Wire, Retaining Swivel Nut	Dec. 1, 1975
KSC-KC-166A	Hub, Tapped Blind	Dec. 15, 1977
KSC-KC-167A	Hub, Tapped	Feb. 6, 1976
KSC-KC-168B	Hub, Pressure Tapped	July 27, 1983
KSC-KC-169	Coupling Assy., Blkhd. Super Pressure Part	July 13, 1976
KSC-KC-174	PLUG, HEX HEAD	AUGUST 21, 1975

SC-M-117	Motors, Alternating Current Integral Horsepower for Ground Support Equipment	March 31, 1965
SC-M-125	Ground Support Equipment Manual for Drafting & Design, Preparation and Maintenance of, Spec for	June 1, 1966
SC-P-116	Packaging and Marking for Cables and Harnesses, Procedure for	Oct. 1, 1964
SC-P-127	Packaging, Packing, Marking, for Shipment and Storage of Ground Support Equipment	July 1, 1966
SC-P-127/1	Packing, Marking for Shipment and Storage of Motors and Motor Drive Sets, Detail Specification	July 1, 1966
SC-P-127/2	Packaging, Marking and Storage of Racks, Consoles, Panels, and Dis- tributors	Dec. 1, 1965
SC-R-102	Resistors, Fixed, Film (High Stability) (Styles KRN55/60/65/70C)	Aug. 24, 1964
SC-R-103	Resistors, Fixed, Film, General Purpose (Styles KRL07/20/32/42)	Aug. 24, 1964
SC-R-104	Resistor, Fixed, Power, Wirewound (Chassis Mount) (Style KRE65/70/75)	Aug. 24, 1964
SC-R-105	Resistors, Fixed, Wirewound (Power Type) (Style KRW67/68/69)	Rev. A 3/10/66
SC-R-148	Resistors, Composition Carbon (Styles KRC07/20/32/42)	Mar. 10, 1966
SC-RS09SV01A	Project Spec, Identification & Description for Launch Complex 39	May 11, 1972
SC-S-101	Replaced by Mil S-19500	
SC-S-126	Sealing of Electrical Components and Enclosures, Specification for	Feb. 15, 1965
SC-S-178	Soldering, Automatic Wave, of Printed Circuit Assemblies, Procedure for	July 1, 1966
SC-SO-901 arsedes	Specification for Burst Disc Assembly, 6,000 psig Working	Sept. 24, 1970

KSC-ML65-901)	Pressure, 9/16 Inch Gaseous Nitrogen and Helium Service	
KSC-SO-902 (Supersedes KSC-ML65-902)	Specification for Burst Disc Assembly, 10,000 psig Working Pressure, 9/16 Inch Gaseous Nitrogen and Helium Service	Sept. 24, 1970
KSC-SO-903 (Supersedes KSC-ML65-903)	Specification for Burst Disc Assembly, 15,000 psig Working Pressure, 9/16 Inch Gaseous Nitrogen and Helium Service	Sept. 24, 1970
KSC-SO-CP-1	Procurement of 50% Caustic Soda Solution	May 17, 1974
KSC-SO-H-3 (KSC-ML65-H-3)	Specification for Hose, 10,000 Nitrogen and Helium Service	Oct. 20, 1970
KSC-SO-H-5	Specification for Hose, 10,000 psig, Flexible Metallic, Gaseous Oxygen Service	Rev A 2/26/73
KSC-SO-S-3A	Specification for Heater, Gaseous Nitrogen	Rev A 4/2/71
KSC-SO-S-4	Specification for Retest and Refurbishment of Type "K" Compressed Gas Cylinders for Gaseous Air, Helium, Hydrogen, Nitrogen, and Oxygen Service	Rev C 3/5/82
KSC-SO-S-6	Refurbishment of Liquid Tankers, Spec for	Rev A 1/23/81
KSC-SO-S-7	Repair of Elevator Roller Guides, Spec for	Oct. 12, 1971
KSC-SO-S-9	Retest & Refurbishment of Compressed Gas Trailers	Rev. D 12/17/80
KSC-SO-S-10	Refurbishment of Liquid Hydrogen Railcars	Feb. 9, 1981
KSC-SO-S-11	Liquid Hydrogen Vacuum-Jacketed NASA/AF Bayonet Adapter	May 11, 1981
KSC-SO-S-12	Refurbishment of Fuel Servicing Tank Truck Chassis	1/28/82
KSC-SO-13	Refurbishment of Fuel Servicing Tank Truck Refueler Progress Model 726	2/22/82

KSC-SO-S-14	Protective Coating of Propellant Equipment	3/26/82
KSC-SO-S-15	Refurbishment of Liquid Tanker LT-32	9/21/82
KSC-SO-16	Retest & Refurbishment of Compressed Gas Trailers, Type I. Manufactured by Douglas Aircraft Corp.	9/21/82
KSC-SO-CC-0005	External Cleaning & Corrosion Control of Propellants Mobile Equipment.	No Date
KSC-SO-SC-0001	Hose Assemblies, Flexible, Metal Reinforced	Sept. 29, 1977
KSC-SO-SE-4316	Liquid Oxygen Tanker	May 31, 1977
KSC-SP-89-Q	Quality Requirements for Calibration Systems	July 15, 1965
KSC-SPEC-C-0001	Cancelled and Superseded by KSC-STD-C-0001	
KSC-SPEC-E-0001	Application of Coating, Conformal Assemblies	A Rev. 3/18/74
KSC-SPEC-E-0002 (Supersedes KSC-E-153)	Modular Enclosures (Cabinets, Consoles) & Accessories, Radio Frequency Interference Shielded, Spec for	Mar. 15, 1967
KSC-SPEC-E-0004	Semiconductor Devices; Cancelled 1/31/75--Superseded by MIL-S-19500	May 22, 1967
KSC-SPEC-E-0007 (Supersedes KSC-C-106)	Capacitor, Fixed, Glass Dielectric, High Reliability (Styles KCYFR 10/15/20/30), Specification for	May 22, 1967
KSC-SPEC-E-0008	Capacitors, Fixed Paper or Paper-Plastic (Style KCPV09) Cancelled use Mil C-19978	
KSC-SPEC-E-0009 (Supersedes KSC-C-108)	Capacitors, Fixed, Tantalum, Nonpolar, Etched Foil (Style KCL23). Specification for	May 22, 1967
KSC-SPEC-E-0010 (Supersedes)	Capacitors, Fixed, Plastic Dielectric, Nonmetallic Case (Style	May 27, 1967

KSC-C-112)	KCTM), Specification for	
KSC-SPEC-E-0011 (Supersedes KSC-C-107)	Capacitors, Fixed, Tantalum, Polarized, Etched Foil (Style KCL21), Specification for	May 22, 1967
KSC-SPEC-E-0012 (Supersedes 75M12110D)	Heat and Blast Protection Coating Materials for Electrical Cables, Specification for	April 1, 1968
KSC-SPEC-E-0016	CANCELLED SEE KSC-SPEC-E-0018 THRU KSC-SPEC-E-0023	
KSC-SPEC-E-0017	Electrical Power Cables, Installation of, Specification for	Rev. B 2/3/77
KSC-SPEC-E-0018	A.C. Power Wire, General Purpose, Single Conductor 600 Volt, 60 Hertz Procurement of, Specification for	Rev. A 9/27/77
KSC-SPEC-E-0018/1	Specification Sheet for Electrical Wire, Type TW	Sept. 27, 1977
KSC-SPEC-E-0018/2	Specification Sheet for Electrical Wire, Type THW	Sept. 27, 1977
KSC-SPEC-E-0018/3	Specification Sheet for Electrical Wire, THWN	Sept. 27, 1977
KSC-SPEC-E-0018/4	Specification Sheet for Electrical Wire, Type RHW	Sept. 27, 1977
KSC-SPEC-E-0018/5	Specification Sheet for Electrical Wire, Type USE	Sept. 27, 1977
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KSC-SPEC-E-0018/7	Specification Sheet for Electrical Wire, Type SA	Sept. 27, 1977
KSC-SPEC-E-0018/8	Specification Sheet for Electrical Wire, Type TFE	Sept. 27, 1977
KSC-SPEC-E-0019	A.C. Power Cable, General Purpose, Multi-Conductor 600 Volt, 60 Hertz Procurement of, Specification for	Rev. A 9/27/77
KSC-SPEC-E-0019/1	Specification Sheet for Electrical Cable Type SO	Sept. 27, 1977

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KSC-SPEC-E-0023	A.C. Power Cable, 15,000 volt, 60 Hertz, Procurement of, Spec for	Rev. B 2/29/84
KSC-SPEC-E-0024	Cable, Electrical, Shielded, Jacketed for Harness Assemblies	April 15, 1970
KSC-SPEC-E-0024/1	Cable, Electrical, Shielded, Jacketed, Type SSI	April 15, 1970
KSC-SPEC-E-0024/2	Cable, Electrical, Shielded, Jacketed, Type PTSI	April 15, 1970
KSC-SPEC-E-0024/3	Cable, Electrical, Shielded, Jacketed, Type TTSI	April 15, 1970
KSC-SPEC-E-0024/4	Cable, Electrical, Shielded, Jacketed, Type QTSI	April 15, 1970
KSC-SPEC-E-0024/5	Cable, Electrical, Shielded, Jacketed, Type STSI	April 15, 1970
KSC-SPEC-E-0024/6	Cable, Electrical, Shielded, Jacketed, 6TSI	April 15, 1970
KSC-SPEC-E-0025	Headset, Microphone & Cord Assembly	Feb. 12, 1971

KSC-SPEC-E-0026 (Supersedes KSC-STD-3A)	Electrical Facilities Installation	Rev A 4/2/80
KSC-SPEC-E-0028	Elevator Electric Traveling Cable, Procurement of	June 10, 1974
KSC-SPEC-E-0029	Compound, Potting & Molding Elastomeric	April 21, 1972
KSC-SPEC-F-0002	Converter Compressor Operations Building, LC 39	April 29, 1967
KSC-SPEC-F-0003	Pre-Cleaning Laboratory Addition Fluid Test Support Building (M7-1061)	April 1967
KSC-SPEC-F-0005	Spec for Fabrication, Installation & Testing of Emergency Braking Safety Mechanisms for Platforms No. 1 & 2, LC-39 Mobile Service Structure	Nov. 6, 1967
KSC-SPEC-F-0006	Heat & Blast Protection Coating Materials	Rev. A 6/2/6 Amend 1 11/4/80
KSC-SPEC-F-0006- AMPL-5	Products Approved under KSC Spec KSC-SPEC-F-0006	Aug. 4, 1978
KSC-SPEC-F-0007	Spec for 25,000 & 35,000 Pumps, Piping, & Flap Gates	July 11, 1968
KSC-SPEC-F-0009	Design, Fabrication & Erection of Signs at JFK Space Center	June 1, 1976
KSC-SPEC-F-0011	Spec for Ordnance Operations Facility	undated
KSC-SPEC-F-0015	Honeycomb Panelling for MSS Floors, Walkways, & Roofs	April 11, 1969
KSC-SPEC-F-0018	Specs for Security Gates & Fencing for Beach Road & Railroad, LC 39, Kennedy Space Center, Fl	Undated
KSC-SPEC-F-0019	CIF M6-342 Built-Up Roof Repair	Dec. 29, 1969
KSC-SPEC-F-0020	Cancelled and superseded by KSC-STD-C-0001	

KSC-SPEC-F-0020- PM-1	Cancelled and superseded by KSC-STD-C-0001	
KSC-SPEC-G-0001	Cancelled see NHB 4200.1	
KSC-SPEC-G-0002	Compiling Construction Cost Estimates	Rev. B 7/1/86
KSC-SPEC-G-0003	Ground Support Equip. Cost Estimating	July 5, 1977
KSC-SPEC-H-002	An Ultraviolet Flame Detector, Purchase Spec	Sept 25, 1967 Rev. 2
KSC-SPEC-M-0001	Low Frequency Accelerometer Performance/Design & Product Configuration Requirements	Nov. 6, 1967 Rev 1
KSC-SPEC-M-0004	A Vibration Data Acquisitions System (LC-39)	Mar. 30. 1967
KSC-SPEC-M-0005	Multiplex Transmission & Receiving System Spec	April 10, 1967
KSC-SPEC-M-0006	Line Driving Amplifier	May 12, 1967
KSC-SPEC-M-0007	Lightning Instrumentation Systems at KSC	Rev. B. 2/20/76
KSC-SPEC-M-0008	Cryogenic Strain Gage Pressure Transducer	Rev. A 7/1/69
KSC-SPEC-M-0009	Self-Powered Thermocouple Reference Junction	Rev. B 1/5/72
KSC-SPEC-M-0010	Standard Strain Gage Pressure Transducer	Rev B 11/5/70
KSC-SPEC-M-0012	Platinum Temperature Transducer	Rev. B 2/15/72
KSC-SPEC-M-0013	Measurement Systems Division Instrumentation at the Meteorological Prediction Center	Jan. 11, 1968
KSC-SPEC-M-0014	Spec for a Low Frequency Low "G" Accelerometer	Jan. 23, 1968
KSC-SPEC-M-0015	Strip Chart Recorder, Two Pen, Potentiometric	Jan. 30, 1968
KSC-SPEC-M-0016	Hydrogen Hazards Analog, LC 39	Feb. 13, 1968 Amend 1 3/5/68

KSC-SPEC-M-0017 (Supersedes KSC-PC-11-SF017)	Discrete Function Transmission System	Sept. 15, 1968 Amend 1 3/15/69
KSC-SPEC-M-0018	Data Digitizing System, Mobile Instrumentation Van	Oct. 31, 1968
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KSC-SPEC-M-0020	Dual Pen Null Balance Analog Strip Chart Recorder	Jan. 31, 1969
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KSC-SPEC-M-0023	Remote Calibrate & Remote Gain Change Amplifier System	Jan. 31, 1970
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KSC-SPEC-M-0025	Meteorological Instrumentation Systems at KSC	March 25, 1974
KSC-SPEC-P-0001	Design, Fabrication, & Test of Compartment Cooling Unit for S-IVB Instrument Unit, Project Apollo, Performance Spec for	Jan. 3 1967 Rev 1 1/12/67 Rev 2 11/30/67
KSC-SPEC-P-0002	(Cryogenic Accelerometer & Impedance Unit), Performance/Design & Product Configuration Requirements	Mar. 3, 1967
KSC-SPEC-P-0003	(Medium Frequency Accelerometer & Impedance Unit), Performance/Design & Product Configuration Requirements	Mar. 3, 1967
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KSC-SPEC-P-0005	Long Form Spare Parts Provisioning	May 15, 1968
KSC-SPEC-P-0006	Air Conditioning Unit - Portable, Trailer Mounted, Electrically Driven, Self-Contained, Nominal 40	Undated

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KSC-SPEC-P-0008	Specs for Repainting of 500 Foot Weather Tower J6-490A	Feb. 17, 1970
KSC-SPEC-P-0009	Pavement Markings	Dec. 20, 1974
KSC-SPEC-P-0010	Roadway Rehabilitation Asphaltic Concrete Leveling & Surface Courses	Mar. 11, 1971
KSC-SPEC-P-0012	Refractory Concrete	April 25, 1979
KSC-SPEC-P-0011	Particulate Screening on Space Shuttle Ground Systems	Aug. 5, 1981
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KSC-SPEC-P-0015	Hazardous Operations Cleanroom Garment Specifications	6/86
KSC-SPEC-P-0016	KSC Garment Snap Fasteners Specifications	6/86
KSC-SPEC-Q-0001B	Coating, Conformal, Protective, Assemblies	Rev. B 3/18/74
KSL-SPEC-U-0001	Event Monitor System Multiplexer, Design Criteria, Specification for	March 10, 1969 Amend 1 7/23/69
KSC-SPEC-U-0002	Event Monitor System Multiplexer, Gantry Test Rack, Design Criteria, Specification for	July 31, 1969
KSC-SPEC-U-0003	Complex 36 Analog Multiplexer, Design Criteria, Specification for	July 15, 1970
KSC-SPEC-U-0004	400 Hertz Analog Multiplexer, Design Criteria, Specification for	July 15, 1970
KSC-SPEC-Z-0001	Specification for Pipe, 36% Nickle, Iron-Base (Invar 36)	Rev. A 9/22/75 Amd. 1 8/30/76
KSC-SPEC-Z-0002 (Supersedes KSC-W-180 and 75M09946A)	Welding, Aluminum Alloy Pipe, Tubing and Associated Fittings, Specification for	Rev A 7/5/72 Amend 1 3/19/75 Amend 2 2/22/78
KSC-SPEC-Z-0003 Supersedes	Welding of Austenitic, Stainless Steel & Low Expansion Alloy Pipe, Tubing	Rev B 1/28/83

KSC-W-179 and 75M09470A)	& Associated Fittings, Spec for	
KSC-SPEC-Z-0004 (Supersedes 10509306, 10509308, 76K02415, and 76K02416)	Welding, Structural, Carbon Steel, Stainless Steel, Low Alloy Steel, and Aluminum Alloys, Spec for	Rev B 2/3/81
KSC-SPEC-Z-0005 (Supersedes 75M09473)	Brazing, Steel, Copper, Aluminum, Nickel, and Magnesium Alloys, Specification for	June 21, 1968 Amend 2 3/19/75
KSC-SPEC-Z-0006	Induction Brazing, Aerospace Tubing, Fittings, Specification for	June 21, 1968
KSC-SPEC-Z-0007	Tubing, Steel, Corrosion Resistant, Types 304 and 316, Seamless, Annealed, Specification for	Rev. C 3/15/78
KSC-SPEC-Z-0008	Fabrication and Installation of Flared Tube Assemblies and Installation of Fittings and Fitting Assemblies, Spec for	Rev. C 6/13/78
KSC-SPEC-Z-0009	Lubrication, Thread, Corrosion Resistant Steel Tube Fittings, Specification for	Jan. 20, 1978
KSC-SPEC-Z0010	Welding of Extra High Strength (\geq 90KSIUTS) Quenched and Tempered Low- Alloy Steels, Spec for	Rev. C 8/23/83
KSC-SPEC-Z-0011	Application of Silicone Rubber Ablative Material to Ground Support Equipment, Specification for	A Rev. 6/15/82
KSC-SPEC-Z-0012	Coveralls, Toxic Fuel Handlers', specification for	Mar. 3, 1970
KSC-SPEC-Z-0013	Penetrant, Magnetic Particle and Ultrasonic Inspection, Requirements for, Specification for	Sept. 30, 1969
KSC-SPEC-Z-0014	Valve, Relief, Toxic Fuel Handlers' Coveralls, Spec for	Apr. 23, 1970 Chg Note #1 - 5/19/70
KSC-SPEC-Z-0016	Automatic Welding, Stainless Steel Pipe and Tubing, Invar 36 Pipe, Carbon Steel Pipe, Aluminum Pipe,	June 2, 1969 Amd. 1 12/22/78

KSC-SPEC-Z-0017	Specification for Resuscitator, Miniature, Spec for	Rev. A 11/10/78
KSC-SPEC-Z-0019	Age Control of Elastomeric Parts, Specification for	Rev C 11/6/79
KSC-W-151DP	SOLDERLESS WRAP PROCESS, SPEC FOR	REV. A 7/6/64
KSC-W-167	WIRING PROGRAMMING SYSTEMM PATCH- BOARDS, PROCEDURE FOR	REV. A 3/18/74

SECTION II

Numerical Listing of KSC Standards

KSC STANDARDS

<u>NUMBER</u>	<u>TITLE</u>	<u>DATE</u>
KSC-STD-1	Demountable Partitions	April 19, 1965
KSC-STD-2	Elevated Floor System	May 10, 1965
KSC-STD-4	Office Directories, Organizational & Name Signs	Feb. 3, 1965
KSC-STD-6	Card Holder Attachments & Room Numbers	REV.A 11/87
KSC-STD-9	Packing Area Engineering Design Standard & Guide Spec. Parts I, II	Feb. 28, 1966
KSC-STD-11	Physical Security Standards Parts I, II, & III.	July 11, 1966
KSC-STD-118 (D)	Failure Mode & Effects Analysis & Single Failure Point Analysis, Standard for the Preparation of	Rev. C 6/30/86
KSC-STD-122	Determining Criticality Numbers for Priority I, II, & III Components	May 15, 1966
KSC-STD-128	Test Reports, Preparation of	June 5, 1965 Amd. 1 10/10/68
KSC-STD-129	Test Procedure, Preparation of	Oct. 5, 1965
KSC-STD-132	Potting & Molding Electrical Cable Assembly Terminations	Rev B 3/22/82
KSC-STD-137	Recording of Time & Cycle Sensitive Component Part Data (Proposed)	Aug. 9, 1966
KSC-STD-141	Cable (Lifting) Identification Band & Data Marking	April 28, 1966
KSC-STD-152-1	Graphical Symbols for Drawing Part I: Architectural & Engineering Drawings	Rev A 9/16/77
KSC-STD-152-2	Graphical Symbols for Drawing Part II: For GSE/Vehicle Support Systems	Rev. A 9/16/77
KSC-STD-164	Environmental Test Methods for Ground Support Equipment	Rev. D 9/17/64

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<p>KSC-STD-C-0001 Supersedes: KSC-STD-F-0001 KSC-SPEC-C-0001 KSC-SPEC-F-0020 & PM-1</p>	<p>Protective Coating of Carbon Steel, Stainless Steel & Aluminum on Launch Structures & Ground Support Equipment Standard for</p>	<p>Rev. B 7/87</p>
<p>KSC-STD-CV-0001</p>	<p>Software Standards for Application Software for the real time data subsystem</p>	<p>1/30/84</p>
<p>KSC-STD-E-0001 (formerly KSC-STD 146)</p>	<p>Design of Electrical Control & Monitor Equipment & Panels</p>	<p>Rev A 1/31/75</p>
<p>KSC-STD-E-0002 Supersedes KSC-SP-80-D & DTI-E-7</p>	<p>Hazard Proofing of Electrically Energized Equipment</p>	<p>Rev A 8/24/76</p>
<p>KSC-STD-E-0004 Supersedes KSC-STD-131</p>	<p>Pneumatic & Hydraulic Mechanical Components & parts, Electrical</p>	<p>May 28, 1969</p>
<p>KSC-STD-E-0005</p>	<p>AC Power-Motor Starting Equipment</p>	<p>Sept. 6, 1968</p>
<p>KSC-STD-E-0006</p>	<p>Instrumentation & Communication Cable Applicants</p>	<p>A Rev. 9/23/77</p>
<p>KSC-STD-E-0007</p>	<p>Superseded by KSC-STD-E-0014, KSC-SPEC-E0017 & KSC-SPEC-E0026</p>	
<p>KSC-STD-E-0009</p>	<p>KSC Communications Cable Numbering, Outside Plant Portion, Fixed Wire Communications System</p>	<p>A rev. 11/15/69</p>
<p>KSC-STD-E-0010</p>	<p>Soldering of Electrical Connections, (Hand or Machine)</p>	<p>Dec. 1, 1968</p>
<p>KSC-STD-E-0011 (Supersedes Schedule IV of KSC-STD-3)</p>	<p>Electrical Power Receptacles</p>	<p>Rev. E 5/1/80</p>
<p>KSC-STD-E-0012 (Supersedes KSC-STD-140A, KSC-B-155, & DTI-E-4)</p>	<p>Bonding & Grounding</p>	<p>Rev A 3/1/74 Amd 1 9/29/78</p>
<p>KSC-STD-E-0013</p>	<p>Lightning Protection</p>	<p>Rev A 3/21/75</p>

7-STD-E-0014	Standard for Wire & Cable Applications 60 Hertz AC Power	Rev A 1/4/77
KSC-STD-E-0015 (Supersedes KSC-STD-169D)	Marking of Ground Support Equipment	Apr. 1, 1969
KSC-STD-E-0016	Electrical Hookup Wire Applications	Apr. 29, 1970
KSC-STD-E-0017	Elevator Electric Traveling Cable Applications	June 10, 1974
KSC-STD-F-0001	Cancelled Superseded by KSC-SPEC-C-0001	
KSC-STD-F-0002	Coating of Marine Equipment	Mar. 20, 1968
KSC-STD-F-0003	Protective Coating of Identification of High Pressure Gas Mobile Equipment	Feb. 1, 1969
KSC-STD-F-0004	Fire Protection Design for Facilities	Rev B 3/84
KSC-STD-G-0003	Launch Support & Facility Components Qualification for	Rev A 4/21/78
TD-P-0001	Prep. of Equipment Procurement/Performance Specs	Nov. 14, 1975 Chg 1 3/16/76
KSC-STD-P-0002	Prep. of Component/Performance Specs	May 26, 1976 Chg 1 7/9/76
KSC-STD-P-0004	Prep. of Process Specs	June 24, 1976
KSC-STD-P-0005	Prep. of Material Specs	Aug. 13, 1976
SC-STD-Q-0001	Identification Marking for Metals	Mar. 29, 1968 Amend 2 7/22/68
SC-STD-S-0001B	<u>Superseded by KSC-STD-SF-0001</u>	
SC-STD-S-0002	<u>Superseded by KSC-STD-SF-0002</u>	
SC-STD-S-0003	Color Code for Shop Machinery & Equipment	Feb 21, 1967
SC-STD-S-0004 Supersedes SC-STD-5)	<u>Superseded by KSC-STD-SF-0004</u>	

KSC-STD-S-0005	<u>Superseded by KSC-STD-SF-0005</u>	
KSC-STD-SF-0001	Lifting Devices & Equipment, Safety Standards	Rev D 12/5/80 Chg. 1 3/30/81
KSC-STD-SF-0002	Safety Standard for Compressed Gas Cylinders	June 17, 1982
KSC-STD-SF-0004	Safety Standard for Ground Piping Systems Color Coding & Identification	Rev. B 9/1/82
KSC-STD-SF-0005	Safety Standards for Forklift Trucks	Rev. A 9/1/82
KSC-STD-SP-0001	Shuttle Provisioning Procedure, Std. for	Sept. 14, 1976
KSC-STD-SP-0002	Provisioning Technical Documentation Detail Std. for	Sept. 14, 1976
KSC-STD-Z-0002	Design Requirements for Lifting and Hoisting Equipment, Std. for	Rev B 1/12/82
KSC-STD-Z-0003	Integrity of Structures, Establishing and Maintaining, Std. for	Sept. 8, 1972
KSC-STD-Z-0004	Design of Structural Steel	April 12, 1973
KSC-STD-Z-0005	Design of Pneumatic Ground-Support Equipment	Rev A 9/21/77
KSC-STD-Z-0006	Design of Hypergolic Propellants Ground Support Equipment	June 29, 1973
KSC-STD-Z-0007	Design of Hydrocarbon Fuel Ground Support Equipment	June 29, 1973
KSC-STD-Z-0008	Design of Ground Life Support Systems and Equipment	A Rev. 3/84
KSC-STD-Z-0009	Design of Cryogenic Ground Support Equipment	Rev A 5/25/83
KSC-STD-Z-0010	Design of Environmental Control Systems, Coolant Servicing Systems, and Ground Support Equipment, Std. for	Rev. A 9/1/83
KSC-STD-Z-0011	Trailer/Equipment Tie-Downs	Mar. 24, 1975
KSC-STD-Z-0012	Flame Deflector Design, Std. for	Mar. 3, 1980



ALPHA LISTING OF KSC SPECIFICATIONS AND STANDARDS

KSC-SPEC-Z-0011	Ablative Material, Silicone Rubber Application of to Ground Support Equipment, Specification for	Rev A 6/15/82
KSC-SPEC-P-0003	Accelerometer & Impedance Unit, Medium Frequency, Performance/Design & Product Configuration Requirements	Mar. 3, 1967
KSC-SPEC-P-0002	Accelerometer and Impedance Unit, Cryogenic, Performance/Design and Product Configuration Requirements	Mar. 3, 1967
KSC-SPEC-M-0001	Accelerometer, Low Frequency, Performance/Design & Product Configuration Requirements	Nov. 6, 1967 Rev 1
KSC-SPEC-M-0014	Accelerometer, Spec for a Low Frequency Low "G"	Jan. 23, 1968
KSC-KC-172	Adapter, Swival Nut	Nov. 1, 1983
KSC-KC-112D	Adapter, Flared Tube & Boss for Seal Ring	Nov. 3, 1975
KSC-KC-134D	Adapter, Flared Tube 3/8 Bulkhead & Boss for Seal Ring	Nov. 3, 1975
KSC-SO-S-11	Adapter, Bayonet Liquid Hydrogen Vacuum Jacketed NASA/AF	5/11/81
KSC-SPEC-P-0006	Air Conditioning Unit - Portable, Trailer Mounted, Electrically Driven, Self-Contained, Nominal 40 Ton Capacity	Undated
KSC-SPEC-M-0023	Amplifier System, Remote Calibrate and Remote Gain Change	Jan. 31, 1970
KSC-SPEC-M-0006	Amplifier, Line Driving	May 12, 1967
KSC-STD-E-0012	Bonding & Grounding	Rev A 3/1/74 Amd 1 9/29/78
KSC-SPEC-F-0005	Braking Safety Mechanisms, Emergency, for Platforms No. 1&2, LC-39 Mobile Service Structure, Spec for Fabrication Installation	Nov. 6, 1967

and Testing

KSC-SPEC-Z-0006	Brazing, Induction, Aerospace Tubing, Fittings, Specification for	June 21, 1968
KSC-SPEC-Z-0005	Brazing, Steel, Copper, Aluminum, Nickle, and Magnesium Alloys, Specification for	June 21, 1968 Amend 2 3/19/75
KSC-STD-Z-0004	Buildings & Framework, Structural Steel, Design of	April 12, 1973
KSC-SO-902	Burst Disc Assembly, 10,000 psig Working Pressure, 9/16 Inch Gaseous Nitrogen and Helium Service, Specification for	Sept. 24, 1970
KSC-SO-903	Burst Disc Assembly, 15,000 psig Working Pressure, 9/16 Inch Gaseous Nitrogen and Helium Service, Specification for	Sept. 24, 1970
KSC-SO-901	Burst Disc Assembly, 6,000 psig Working Pressure, 9/16 Inch Gaseous Nitrogen and Helium Service, Specification for	Sept. 24, 1970
KSC-KC-115C	Bushing, Screw Thread Expander for Seal Ring	Nov. 3, 1975
KSC-KC-104C	Bushing, Screw Thread Reducer w/Seal Ring	July 27, 1983
KSC-STD-141	Cable (Lifting) Identification Band & Data Marking	April 28, 1966
KSC-SPEC-E-0023	Cable, A.C. Power, 15,000 Volt, 60 Hertz, Procurement of, Specification for	Rev. B 2/29/84
KSC-SPEC-E-0022	Cable, A.C. Power, 5,000 Volt, 60 Hertz Procurement of, Spec for	Rev. A 9/27/77
KSC-SPEC-E-0019	Cable, A.C. Power, General Purpose, Multi-Conductor 600 Volt, 60 Hertz Procurement of, Specification for	Rev. A 9/27/77
KSC-SPEC-E-0021	Cable, A.C. Power, Interlocked Armored 600 Volt, 60 Hertz Procurement of, Specification for	Rev. A 9/27/77
KSC-SPEC-E-0020	Cable, A.C. Power, Mineral Insulated, 600 Volt, 60 Hertz,	Rev. B 9/27/77

Procurement or, Spec. for

KSC-SPEC-E-0016	CANCELLED SEE KSC-SPEC-E0018 THRU KSC-SPEC-E-0023	
KSC-SPEC-E-0017	Cable, Electrical Power, Installation of, Specification for	Rev. B 2/3/77
KSC-SPEC-E-0022/2	Cable, Electrical, 5,000 Volt Type LCPC, Specification Sheet for	Sept. 27, 1977
KSC-SPEC-E-0022/1	Cable, Electrical, 5,000 Volt, Type CLP, Specification Sheet for	Sept. 27, 1977
KSC-SPEC-E-0012	Cable, Electrical, Heat and Blast Protection Coating Materials for, Specification for	April 1, 1968
KSC-SPEC-E-0024/2	Cable, Electrical, Shielded, Jacketed, Type PTSI	April 15, 1970
KSC-SPEC-E-0024/1	Cable, Electrical, Shielded, Jacketed, Type SSI	April 15, 1970
KSC-SPEC-E-0024/3	Cable, Electrical, Shielded, Jacketed, Type TTSI	April 15, 1970
KSC-SPEC-E-0024/6	Cable, Electrical, Shielded, Jacketed, Type 6TSI	April 15, 1970
KSC-SPEC-E-0024/4	Cable, Electrical, Shielded, Jacketed, Type QTSI	April 15, 1970
KSC-SPEC-E-0024	Cable, Electrical, Shielded, Jacketed for Harness Assemblies	April 15, 1970
KSC-SPEC-E-0024/5	Cable, Electrical, Shielded, Jacketed, Type 5TSI	April 15, 1970
KSC-SPEC-E-0019/4	Cable, Electrical, Type G, Specification Sheet for	Sept. 27, 1977
KSC-SPEC-E-0019/1	Cable, Electrical, Type SO, Specification Sheet for	Sept. 27, 1977
KSC-SPEC-E-0019/2	Cable, Electrical, Type ST0, Specification Sheet for	Sept. 27, 1977
KSC-SPEC-E-0019/5	Cable, Electrical, Type USE, Specification Sheet for	Sept. 27, 1977

KSC-SPEC-E-0019/3	Cable, Electrical, Type W, Specification Sheet for	Sept. 27, 1977
KSC-SF-89-Q	Calibration Systems. Quality Requirements for,	July 15, 1965
KSC-KC-150C	Cap, Cap Assembly, Pressure Seal, Flared Tube Fitting	Jan. 21, 1976
KSC-SPEC-E-0007	Capacitor, Fixed, Glass Dielectric, High Reliability (Styles KCYFR 10/15/20/30), Specification for	May 22, 1967
KSC-SPEC-E-0010	Capacitors, Fixed, Plastic Dielectric, Nonmetallic Case (Style KCTM), Specification for	May 27, 1967
KSC-C-113	Capacitors, Fixed, Polarized, Tan- tulum Foil (Style KCL51 and KCL53)	Aug. 24, 1964
KSC-C-111	Capacitors, Fixed, Solid, Tantalum (Style KSC13)	Rev. A 3/10/66
C-C-133	Capacitors, Fixed, Tantalum (Polar- ized, Sintered-Slug) (Style KCL65)	Mar. 10, 1966
KSC-C-109	Capacitors, Fixed, Tantalum (Polar- ized, Etched Foil) (Style KCL31)	Rev. A 3/10/66
KSC-C-110	Capacitors, Fixed, Tantalum (Polar- ized, Etched Foil) (Style KCL33)	Rev. A 3/10/66
KSC-SPEC-E-0009	Capacitors, Fixed, Tantalum, Nonpolar, Etched Foil (Style KCL23). Specification for	May 22, 1967
KSC-SPEC-E-0011	Capacitors, Fixed, Tantalum, Polarized, Etched Foil (Style KCL21), Specification for	May 22, 1967
KSC-STD-6	Card Holder Attachments & Room Numbers	REV A NOV. 87
KSC-SO-CP-1	Caustic Soda, 50% Solution	May 17, 1974
KSC-KC-155C	Clamp Assembly	Sept. 19, 1975
KSC-C-123	Cleanliness, Surface or Fluid Systems, Spec for	Rev F 10/19/79 Amd 1 12/10/80
K-STD-F-0002	Coating of Marine Equipment	Mar. 20, 1968

KSC-SPEC-Q-0001B	Coating, Conformal, Protective Assemblies	Rev. B 3/18/74
KSC-SPEC-F-0020	Cancelled see KSC-STD-C-0001	
KSC-SO-S-14	Coating, Protective, of Propellant Equipment	March 26, 1982
KSC-SPEC-C-0001 (superseded KSC-STD-F-0001)	Cancelled and Superseded by KSC-STD-C-0001	
KSC-STD-C-0001	Coating, Protective of Carbon Steel, Stainless Steel & Aluminum on Launch Structures & Ground Support Equipment	B Rev. 7/87
KSC-STD-F-0003	Coating, Protective of Identification of High Pressure Gas Mobile Equipment	Feb. 1, 1969
KSC-STD-S-0003	Color Code for Shop Machinery & Equipment	Feb. 21, 1967
KSC-STD-SF-0004	Color Coding & Identification of Ground Piping Systems	9/1/82
KSC-STD-S-0004	Superseded by KSC-STD-SF-0004	
KSC-STD-E-0009	Communications Cable Numbering, Outside Plant Portion, Fixed Wire Communications System, KSC	Rev. A 11/15/68
KSC-STD-P-0002	Component/Performance Specs, Prep. of	May 26, 1976 Chg 1 7/9/76
KSC-STD-122	Components, Priority I, II, & III, Determining Critically Numbers for	May 15, 1966
KSC-STD-SF-0002	Compressed Gas Cylinders Safety Standard for. <u>Supersedes KSC-STD-S-0002A</u>	6/17/82
KSC-SPEC-P-0012	Concrete, Refractory	April 25, 1979
KSC-KC-141C	Conical End, Standard Dimensions for	Jan. 21, 1976
KSC-SPEC-G-0002	Construction Cost Estimates, Compiling	Rev. B 7/1/86
KSC-SPEC-F-0002	Converter Compressor Operations Building, LC 39	April 29, 196

KSC-SPEC-P-0001	Cooling Unit, Compartment for S-IVB Instrument Unit, Project Apollo, Design, Fabrication & Test of; Performance Spec for	Jan. 3, 1967 Rev. 1 1/12/67 Rev. 2 11/30/67
KSC-SPEC-M-0022	Corona Current Detector	Jan. 15, 1970
KSC-KC-169	Coupling Assy., Blkhd Super Pressure Part	July 13, 1976
KSC-KC-173	Coupling, Tube	Nov. 1, 1983
KSC-SPEC-Z-0012	Coveralls, Toxic Fuel Handlers'. Specification for	March 3, 1970
	<u>Cranes, Slings, Hoists, Hooks, Safety Standards SEE LIFTING DEVICES</u>	
KSC-KC-158C	Cross	Sept. 19, 1975
KSC-KC-117D	Cross-Flared Tube, for Seal Ring	Sept. 30, 1975
KSC-STD-Z-0009	Cryogenic Ground Support Equipment Design of	Rev. A 5/25/83
SO-S-4	Cylinders, Type "K" Compressed Gas for Gaseous Air, Helium, Hydrogen, Nitrogen, and Oxygen Service; Specification for Retest and Refurbishment	Rev C 3/5/82
	DAS see Data Acquisition System	
KSC-SPEC-M-0019A	Data Acquisition System Operation & Tape Format Verification System	Aug. 31, 1969
KSC-SPEC-M-0024	Data Acquisition System, Portable Including Incrementing Tape Recorder Writing Computer Compatible Magnetic Tape, Spec for	April 15, 1971
KSC-SPEC-M-0018	Data Digitizing System, Mobile Instrumentation Van	Oct. 31, 1968
KSC-KC-161A	Dimension Tolerances for Flange Fittings	Sept. 19, 1975
KSC-SPEC-M-0017	Discrete Function Transmission System	Sept. 15, 1968 Amend 1 3/15/69

KSC-SPEC-Z-0019	Elastomeric Parts, Age Control of,	Rev C 11/6/79
KSC-KC-129D	Elbow Assy, 45 degree, Flared Tube & Male Adjustable End for Seal Ring	Nov. 3, 1975
KSC-KC-132C	Elbow Assy, 45 degree, Flared Tube & Female Swivel End	Dec. 1, 1975
KSC-KC-108E	Elbow Assy, 90 degree, Flared Tube and Male Adjustable End for Seal Ring	July 13, 1976
KSC-KC-131D	Elbow Assy, 90 degree, Flared Tube & Female Swivel End for Seal Ring	Dec. 1, 1975
KSC-KC-156C	Elbow, 90 degree	Sept. 19, 1975
KSC-KC-128D	Elbow-Flared Tube & Universal, 45 degree for Seal Ring	Nov. 3, 1975
KSC-KC-113E	Elbow-Flared Tube Bulkhead Universal 90 degree for Seal Ring	Nov. 3, 1975
KSC-KC-118C	Elbow-Flared Tube, 90 degree, for Seal Ring	Sept. 30, 1975
KSC-STD-E-0001	Electrical Control & Monitor Equipment and Panels, Design of	Rev A 1/31/75
KSC-SPEC-E-0026	Electrical Facilities Installation	Rev A 4/2/80
KSC-E-165	Electrical Ground Support Equipment Fabrication	Rev C 4/1/82
KSC-STD-E-0017	Elevator Electric Traveling Cable Applications	June 10, 1974
KSC-SPEC-E-0028	Elevator Electric Traveling Cable, Procurement of	June 10, 1974
KSC-SO-S-7	Elevator Roller Guides, Repair of, Spec for	Oct. 12, 1971
KSC-GP-425	Engineering Standards, CONTAINS ALL KC FITTINGS	
KSC-STD-Z-0010	Environmental Control Systems, Ground Coolant systems and ground support Equipment Design Standard for	A rev. 9/1/83
KSC-STD-164	Environmental Test Methods for	Rev. D 9/17/83

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KSC-STD-P-0001	Equipment, Prep. of Procurement/Performance Specs	Nov. 14, 1975 Chg 1 3/16/76
KSC-KC-135D	Expander-Adapter, Flared Tube to Boss w/Seal Ring	Sept. 17, 1975
KSC-STD-118 (D)	Failure Mode & Effects Analysis & Single Failure Point Analysis Standard for the Preparation of	Rev. C 6/30/86
KSC-STD-F-0004	Fire Protection Design for Facilities	Rev B 3/84
KSC-KC-138C	Fitting End, Adjustable Flared Tube Connector, Standard Dimensions for	Oct. 27, 1975
KSC-KC-105C	Fitting End, Standard Dimensions for Flared Tube Connection for Seal Ring	Nov. 3, 1975
F -KC-104C	Fitting End, Standard Dimensions for Bulkhead Flared Tube Connection for Seal Ring	Nov. 3, 1975
KSC-KC-137A	Fitting End, Swivel Flared Tube Connector, Standard Dimensions for	Jan. 21, 1976
KSC-F-124	Fittings (Pressure Connectors) Flared Tube, Spec for	Rev C 7/5/77
KSC-STD-Z-0012	Flame Deflector Design	July 3, 1975
KSC-SPEC-H-002	Flame Detector, Ultraviolet, Purchase Spec	Sept 25, 1967 Rev. 2
KSC-STD-2	Floor System, Elevated	May 10, 1965
KSC-SPEC-F-0003	Fluid Test Support Building, (M7-1061) Pre-Cleaning Laboratory Addition	April 1967
KSC-STD-S-0005	Cancelled & Superseded by KSC-STD-SF-0005	
KSC-STD-SF-0005	Forklift Trucks, Safety Standard For	9/1/82
KSC-SPEC-P-0016	Garment Snap Fasteners Specifications	June 1986
F . SPEC-P-0015	Garment Specifications Hazardous	June 1986

KSC-SPEC-P-0014	Garment Specifications Hazardous	June 1986
KSC-C-182	Gas Cleanliness Requirements for Operational Gaseous Nitrogen, Helium, and Hydrogen Systems at Complex 39, Specification for	June 7, 1966
KSC-SPEC-F-0018	Gates & Fencing, Security, for Beach Road & Railroad, LC 39,	Undated
KSC-SPEC-P-0007	Glass, Laminated, Flat, Tinted	Jan. 6, 1970
KSC-STD-152-1	Graphical Symbols for Drawing Part I: Architectural & Engineering Drawings	Rev A 9/16/77
KSC-STD-152-2	Graphical Symbols for Drawing Part II: For GSE/Vehicle Support Systems	Rev. A 9/16/77
KSC-SPEC-G-0003	Ground Support Equip. Cost Estimating	July 5, 1977
KSC-M-125	Ground Support Equipment Manual for Drafting & Design, Preparation and Maintenance of, Spec for	June 1, 1966
KSC-STD-E-0015	Ground Support Equipment, Marking of	Apr. 1, 1969
KSC-STD-E-0002	Hazard Proofing of Electrically Energized Equipment	Rev A 8/24/76
KSC-SPEC-E-0025	Headset, Microphone & Cord Assembly	Feb. 12, 1971
KSC-SPEC-F-0006	Heat & Blast Protection Coating Materials	Rev. A 6/2/69 Amend 1 11/4/70
KSC-SO-S-3A	Heater, Gaseous Nitrogen, Specification for	Rev A 4/2/71
KSC-SPEC-F-0015	Honeycomb Panelling for MSS Floors, Walkways, & Roofs	April 11, 1969
KSC-SO-SC-0001	Hose Assemblies, Flexible, Metal Reinforced	Sept. 29, 1977
KSC-SO-H-5	Hose, 10,000 psid, Flexible Metallic, Gaseous Oxygen Service Specification for	Rev A 2/26/73
KSC-SO-H-3	Hose, 10,000 psig, Flexible	Oct. 20, 197

	Metallic, Gaseous Nitrogen and Helium Service, Specification for	
KSC-KC-160D	Hub, Blind	July 27, 1983
KSC-KC-159C	Hub, Butt Weld	Sept. 19, 1975
KSC-KC-168B	Hub, Pressure Tapped	July 27, 1983
KSC-KC-167A	Hub, Tapped	Feb. 6, 1976
KSC-KC-166A	Hub, Tapped Blind	Dec. 15, 1977
KSC-STD-Z-0007	Hydrocarbon Fuel Ground Support Equipment, Design of	June 29, 1973
KSC-SPEC-M-0016	Hydrogen Hazards Analog, LC 39	Feb. 13, 1968 Amend 1 3/5/68
KSC-STD-Q-0001	Identification Marking for Metals	Mar. 29, 1968 Amend 2 7/22/68
KSC-STD-E-0006	Instrumentation & Communication Cable Applicants	A Rev. 9/23/74
STD-Z-0003	Integrity of Structures, Establishing & Maintaining	Sept. 8, 1972
KSC-STD-G-0003	Launch Support & Facility Components Qualification for	Rev A 4/21/78
KSC-STD-Z-0008	Life-Support Systems, Ground and Equipment, Design of	A Rev. 3/84
KSC-STD-Z-0002	Lifting and Hoisting Equipment Standard for Design Requirements for	Rev B 1/12/82
KSC-STD-SF-0001	Lifting Devices & Equipment Safety Standards	Rev. D 12/5/80 Chg. 1 3/30/81
KSC-SPEC-M-0007	Lightning Instrumentation Systems at KSC	Rev. B. 2/20/76
KSC-STD-E-0013	Lightning Protection	Rev A 3/21/75
KSC-SPEC-M-0021	Lightning Warning System Data Processor	Rev. A 12/4/73
KSC-STD-P-0005	Material Specs, Prep of	Aug. 13, 1976
SPEC-M-0013	Measurement Systems Division	Jan. 11, 1968

Instrumentation at the
 Meterological Prediction Center

KSC-SPEC-M-0025	Meterological Instrumentation Systems at KSC	March 25, 1974
KSC-SPEC-E-0002	Modular Enclosures (Cabinets, Consoles) & Accessories, Radio Frequency Interference Shielded, Spec for	Mar. 15, 1967
KSC-STD-E-0005	Motor, AC Power Starting Equipment	Sept. 6, 1968
KSC-M-117	Motors, Alternating Current Integral Horsepower for Ground Support Equipment	March 31, 1965
KSC-SPEC-M-0005	Multiplex Transmission & Receiving System Spec	April 10, 1967
KSC-SPEC-U-0004	Multiplexer, 400 Hertz Analog, Design Criteria, Specification for	July 15, 1970
KSC-SPEC-U-0003	Multiplexer, Complex 36 Analog, Design Criteria, Specification for	July 15, 1976
KSC-SPEC-U-0001	Multiplexer, Event Monitor System, Design Criteria, Specification for	March 10, 1969 Amend 1 7/23/69
KSC-SPEC-U-0002	Multiplexer, Event Monitor System, Gantry Test Rack, Design Criteria, Specification for	July 31, 1969
KSC-KC-116D	Nipple-Flared Tube & Pipe Thread for Seal Ring	Sept. 30, 1975
KSC-KC-142B	Nut, Coupling	Jan. 21, 1976
KSC-SPEC-F-0011	Ordnance Operations, Facility Spec for	undated
KSC-P-116	Packaging and Marking for Cables and Harnesses, Procedure for	Oct. 1, 1964
KSC-P-127/2	Packaging, Marking and Storage of Racks, Consoles, Panels, and Distributors	Dec. 1, 1965
KSC-P-127	Packaging, Packing, Marking, for Shipment and Storage of Ground Support Equipment	July 1, 1966

KSC-STD-9	Packing Area Engineering Design Standard & Guide Spec. Parts I, II	Feb. 28, 1966
KSC-P-127/1	Packing, Marking for Shipment and Storage of Motors and Motor Drive Sets, Detail Specification	July 1, 1966
KSC-SPEC-P-0011	Particulate Screening Reverification Sample Requirements on Space Shuttle Ground Systems	Aug. 5, 1981
KSC-STD-1	Partitions, Demountable	April 19, 1965
KSC-W-167	Patchboards, Wiring Programming System, Procedure for	Rev. A 3/18/74
KSC-SPEC-P-0009	Pavement Markings	Dec. 20, 1974
KSC-SPEC-Z-0013	Penetrant, Magnetic Particle and Ultrasonic Inspection, Requirements for, Specification for	Sept. 30, 1969
KC-163B	Pipe Connection, Installation of	Nov. 3, 1975
KSC-SPEC-Z-0001	Pipe, 36% Nickle, Iron-Base (Invar 36) Specification for	Rev. A 9/22/75 Amd. 1 8/30/76
KSC-KC-130D	Plug, Flared Tube for Seal Ring	Nov. 3, 1975
KSC-KC-174	Plug, Hex Head	REV. A 8/21/86
KSC-STD-E-0004	Pneumatic & Hydraulic Mechanical Components & parts, Electrical	May 28, 1969
KSC-STD-Z-0005	Pneumatic Ground-Support Equipment Design of	Rev A 9/21/77
KSC-STD-132	Potting & Molding Electrical Cable Assembly Terminations	Rev B 3/22/82
KSC-SPEC-E-0029	Potting and Molding, Compound Elastomeric	April 21, 1972
KSC-STD-E-0011	Power Receptacles, Electrical	Rev. E 5/1/80
KSC-SPEC-E-0001	Printed Circuit Assemblies, Application of Coating, Conformal (Polyurethane)	A Rev. 3/18/74
STD-P-0004	Process Specs, Prep of Procurement of	June 24, 1976

KSC-SPEC-F-0020-PM1	CANCELLED see KSC-STD-C-0001	
KSC-SPEC-F-0006-AMPL-5	Products Approved under KSC Spec KSC-SPEC-F-0006	Aug. 4, 1978
KSC-RS09SV01A	Project Spec, Identification & Description for Launch Complex 39	May 11, 1972
KSC-SO-CC-0005	Propellants Mobile Equipment, External Cleaning and Corrosion Control of	No Date
KSC-STD-Z-0006	Propellants, Hypergolic, Ground Support Equipment, Design of	June 29, 1973
KSC-STD-SP-0002	Provisioning Technical Documentation Detail Standard	Sept. 14, 1976
KSC-SPEC-F-0007	Pumps, Piping, & Flap Gates, 25,000 & 35,000, Spec for	July 11, 1968
KSC-KC-133D	Reducer-Adapter Flared Tube & Boss for Seal Ring	Sept. 30, 1975
KSC-KC-106D	Reducer-Adapter, Conical End Fitting and Flared for Seal Ring	Nov. 3, 1975
KSC-KC-125D	Reducer-External Thread Flared Tube for Seal Ring	Feb. 6, 1976
KSC-KC-144D	Reducer-Flared Tube 3/8 Bulkhead & Universal for Seal Ring	Nov. 3, 1975
KSC-SPEC-F-0012	Refractory Concrete, Spec for	April 25, 1979
KSC-SO-S-10	Refurbishment of Liquid Hydrogen Railcars	Feb. 9, 1981
KSC-SO-S-12	Refurbishment of Fuel Servicing Tank Truck Chassis	Jan. 28, 1982
KSC-SO-S-13	Refurbishment of Fuel Servicing Tank Truck Refueler Progress Model 72G	Feb. 22, 1982
KSC-R-104	Resistor, Fixed, Power, Wirewound (Chassis Mount) (Style KRE65/70/75)	Aug. 24, 1964
KSC-R-148	Resistors, Composition Carbon (Styles KRC07/20/32/42)	Mar. 10, 1966
KSC-R-105	Resistors, Fixed Wirebound (Power	Rev. A 3/10/E

	Type) (Style KRW67/68/69)	
KSC-R-102	Resistors, Fixed, Film (High Stability) (Styles KRN55/60/65/70C)	Aug. 24, 1964
KSC-R-103	Resistors, Fixed, Film, General Purpose (Styles KRL07/20/32/42)	Aug. 24, 1964
KSC-SPEC-Z-0017	Resuscitator, Miniature, Spec for	Rev. A 11/10/73
KSC-KC-162D	Ring, Seal	Sept. 19, 1975
KSC-SPEC-P-0010	Roadway Rehabilitation Asphaltic Concrete Leveling & Surface Courses	Mar. 11, 1971
KSC-SPEC-F-0019	Roof Repair, CIF M6-342 Built up	Dec. 29, 1969
KSC-KC-103C	Seal Ring	Dec. 1, 1975
KSC-S-126	Sealing of Electrical Components and Enclosures, Specification for	Feb. 15, 1965
K' -STD-11	Security, Physical, Standards Parts I, II, & III	July 11, 1966
K -STD-SP-0001	Shuttle Provisioning Procedure	Sept. 14, 1976
KSC-SPEC-F-0009	Signs at JFK Space Center, Design, Fabrication & Erection of	June 1, 1976
KSC-STD-4	Signs, Office Directories, Organizational and Name	Feb. 3, 1965
KSC-KC-143B	Sleeve, Flared Tube Fitting	July 13, 1976
KSC-STD-CV-0001	Software standards for application software for real time data subsystem	Jan 30, 1984
KSC-STD-E-0010	Soldering of Electrical Connections, (Hand or Machine)	Dec. 1, 1968
KSC-S-178	Soldering, Automatic Wave, of Printed Circuit Assemblies, Procedure for	July 1, 1966
KSC-W-151 (DP)	Solderless Wrap Process, Electrical Connections, Spec. for	Rev. A 7/6/64
KSC-SPEC-P-0004	Spare Parts Provisioning, Short Form	May 7, 1968
KSC-SPEC-P-0005	Spare Parts Provisioning, Long Form	May 15, 1968

Specification for

KSC-KC-136E	Standard Dimensions for Fitting End, Straight Thread	Nov. 3, 1975
KSC-SPEC-M-0020	Strip Chart Recorder, Dual Pen Null Balance Analog	Jan. 31, 1969
KSC-SPEC-M-0015	Strip Chart Recorder, Two Pen, Potentiometric	Jan. 30, 1968
KSC-KC-139B	Swivel Nut, Flared Tube Fitting	Nov. 3, 1975
KSC-SO-SE-4316	Tanker, Liquid Oxygen	May 31, 1977
KSC-SO-S-6	Tankers, Liquid, Refurbishment of Spec for	Rev A 1/23/81
KSC-KC-157C	Tee	Sept. 19, 1975
KSC-KC-107D	Tee-Assy, Flared Tube Female Swivel End on Run, for Seal Ring	Dec. 1, 1975
KSC-KC-109D	Tee-Assy, Flared Tube, Female Swivel End on Outlet for Seal Ring	Dec. 1, 1975
KSC-KC-110E	Tee-Assy, Flared Tube, Male Adjustable End on Run for Ring Seal	July 13, 1976
KSC-KC-111E	Tee-Assy, Flared Tube, Male Adjustable End on Outlet for Seal Ring	July 13, 1976
KSC-KC-127D	Tee-Bulkhead & Universal Flared Tube for Seal Ring	Nov. 3, 1975
KSC-KC-114D	Tee-Flared Tube Bulkhead on Run, for Seal Ring	Nov. 3, 1975
KSC-KC-123C	Tee-Flared Tube for Seal Ring	Nov. 3, 1975
KSC-KC-120D	Tee-Flared Tube Internal Thread on Side for Seal Ring	Nov. 3, 1975
KSC-KC-121D	Tee-Flared Tube w/Pipe Thread on Run for Seal Ring	Nov. 3, 1975
KSC-KC-122C	Tee-Flared Tube w/Pipe Thread on Side for Seal Ring	Nov. 3, 1975
KSC-KC-119D	Tee-Flared Tube, Internal Thread on Run for Seal Ring	Sept. 30, 1975

KSC-STD-129	Test Procedure, Preparation of	Oct. 5, 1965
KSC-STD-128	Test Reports, Preparation of	June 5, 1965 Amd. 1 10/10/65
KSC-SPEC-M-0009	Thermocouple, Reference Junction, Self-Powered	Rev. B 1/5/72
KSC-STD-Z-0011	Trailer/Equipment Tie-Downs	Mar. 24, 1975
KSC-SO-S-9	Trailers, Compressed Gas, Retest and Refurbishment of	Rev. D 12/17/80
KSC-SO-S-16	Trailers, Compressed Gas, Type I Manufactured by Douglas Aircraft Corp. Retest & Refurbishment	9/21/82
KSC-SPEC-M-0008	Transducer, Cryogenic Strain Gage Pressure	Rev. A 7/1/69
KSC-SPEC-M-0010	Transducer, Standard Strain Gage Pressure	Rev B 11/5/70
KSC-SPEC-M-0012	Transducer, Temperature, Platinum	Rev. B 2/15/72
KSC-SPEC-Z-0009	Tube Fitting, Corrosion Resistant Steel, Lubrication, Thread Specification for	Jan. 20, 1972
KSC-SPEC-Z-0008	Tube, Flared Assemblies and Installation of Fittings and Fitting Assemblies, Fabrication & Installation of, Spec for	Rev. C 6/13/78
KSC-KC-154B	Tubing, Flared, Standard Dimensions for	Dec. 1, 1975
KSC-SPEC-Z-0007	Tubing, Steel, Corrosion Resistant, Types 304 and 316, Seamless, Annealed, Specification for	Rev. C 3/15/78
KSC-KC-170	Union, Adjustable End	Nov. 1, 1983
KSC-KC-171	Union, Assembly Double Swivel Nut	Nov. 1, 1983
KSC-KC-124E	Union-Flared Tube 3/8 Bulkhead & Universal for Seal Ring	July 13, 1976
KSC-KC-126C	Union-Flared Tube for Seal Ring	Nov. 3, 1975
KSC-SPEC-Z-0014	Valve, Relief, Toxic Fuel	Apr. 23, 1970

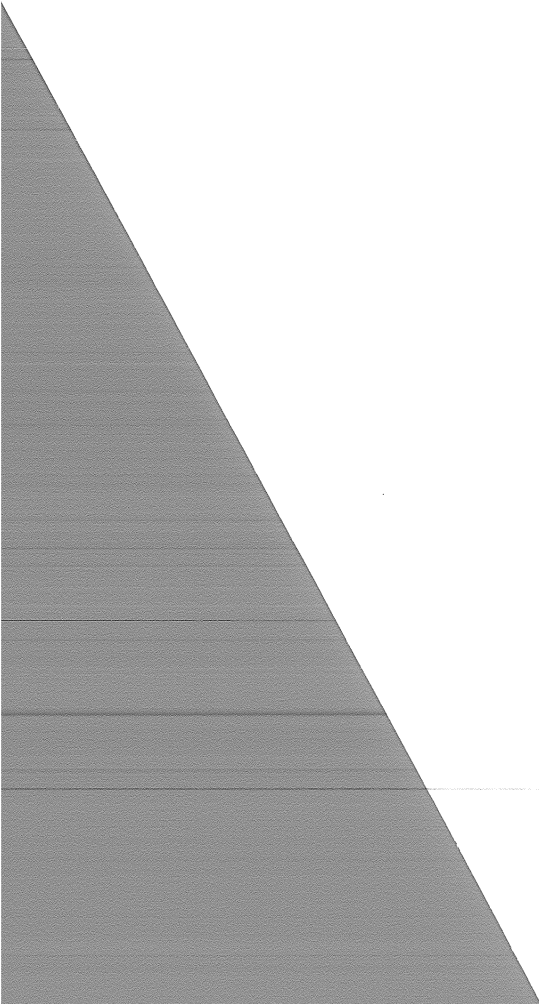
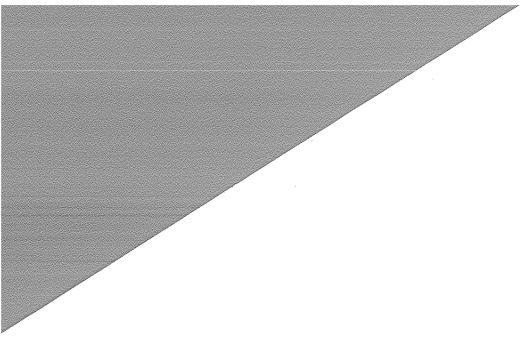
	Handlers' Coveralls, Spec for	Chg Note #1 - 5/19/70
KSC-SPEC-M-0004	Vibration Data Acquisitions System (LC-39)	Mar. 30. 1967
KSC-KC-140E	Washer, Flared Tube Fitting, Adjustable End	Jan. 21, 1976
KSC-SPEC-P-0008	Weather Tower, J6-490A, 500 Foot Specs for Repainting of	Feb. 17, 1970
KSC-SPEC-Z-0002	Welding, Aluminum Alloy Pipe, Tubing and Associated Fittings, Specification for	Rev A 7/5/72 Amend 1 3/19/75 Amend 2 2/22/78
KSC-SPEC-Z-0016	Welding, Automatic, Stainless Steel Pipe and Tubing, Invar 36 Pipe, Carbon Steel Pipe, Aluminum Pipe, Specification for	June 2, 1969 Amd. 1 12/22/78
KSC-SPEC-Z-0003	Welding of Austenitic, Stainless Steel & Low Expansion Alloy Pipe, Tubing, & Associated Fittings, Spec For	Rev B 1/28/83
KSC-SPEC-Z-0004	Welding, Structural, Carbon Steel, Stainless Steel, Low Alloy Steel, and Aluminum Alloys, Spec for	Rev B 2/3/81
KSC-SPEC-Z0010	Welding of Extra High Strength ()90KSIUTS) Type B Structural Steels Quenched and Tempered Low-Alloy Steels Spec for	Rev. C 8/23/83
KSC-STD-E-0014	Wire and Cable Applications 60 Hertz AC Power, Standard for	Rev A 1/4/77
KSC-SPEC-E-0018	Wire, A.C. Power, General Purpose, Single Conductor 600 Volt, 60 Hertz Procurement of, Specification for	Rev. A 9/27/77
KSC-STD-E-0016	Wire, Electrical Hookup Applications	Apr. 29, 1970
KSC-SPEC-E-0018/6	Wire, Electrical, Type RHH, Specification Sheet for	Sept. 27, 1977
KSC-SPEC-E-0018/4	Wire, Electrical, Type RHW, Specification Sheet for	Sept. 27, 1977
KSC-SPEC-E-0018/7	Wire, Electrical, Type SA,	Sept. 27, 1977

Specification Sheet for

KSC-SPEC-E-0018/2	Wire, Electrical, Type THW Specification Sheet for	Sept. 27, 1977
KSC-SPEC-E-0018/3	Wire, Electrical, Type THWN, Specification Sheet for	Sept. 27, 1977
KSC-SPEC-E-0018/1	Wire, Electrical, Type TW, Specification Sheet for	Sept. 27, 1977
KSC-SPEC-E-0018/5	Wire, Electrical, Type USE, Specification Sheet for	Sept. 27, 1977
KSC-SPEC-E-0018/8	Wire, Electrical, Type, TFE, Specification Sheet for	Sept. 27, 1977



SECTION 2 - STANDARD FOR ELECTRICAL POWER RECEPTACLES AND PLUGS



46
KSC-STD-E-0011E

May 1, 1980

SUPERSEDES
KSC-STD-E-0011D
AUGUST 29, 1978

STANDARD FOR
ELECTRICAL POWER RECEPTACLES
AND PLUGS

DESIGN ENGINEERING DIRECTORATE

National Aeronautics and
Space Administration

John F. Kennedy Space Center

NASA



KSC-STD-E-0011E
May 1, 1980
SUPERSEDES
KSC-STD-E-0011D

STANDARD FOR
ELECTRICAL POWER RECEPTACLES
AND PLUGS

Approved:

Henry C. Paul

Raymond L. Clark

for

Director of Design Engineering
Facilities Engineering

JOHN F. KENNEDY SPACE CENTER, NASA



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JOHN F. KENNEDY SPACE CENTER, NASA
STANDARD FOR
ELECTRICAL POWER RECEPTACLES AND PLUGS

1. SCOPE

This standard is to be used by Kennedy Space Center (KSC) design and maintenance organizations for internal operations and as a technical document to specify requirements in KSC design contracts. It identifies those electrical power receptacles that shall be used when designing new or modifying existing facilities; it also identifies receptacles that shall be used for installation on portable ground support equipment; it establishes a standard for symbols to be used on drawings; and it provides pertinent data for each receptacle. Receptacles included are the 60-hertz (Hz), 400-Hz, and direct-current applications in hazardous and nonhazardous areas. Receptacles for 400-Hz and direct-current applications on fixed ground support equipment are not covered by this standard. The term "receptacle" in this sense shall be understood to include plugs, which are also identified by this standard.

2. APPLICABLE DOCUMENTS

The following documents of the issue in effect on date of invitation for bids or request for proposal form a part of the standard to the extent specified herein.

2.1 Governmental.

NHB 5300.4(1C) Inspection System Provisions for Aeronautical and
Space System Materials, Parts, Components, and
Services

(Copies of publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the Contracting Officer.)

2.2 Non-Governmental.

American National Standards Institute (ANSI)

ANSI C73 Plugs and Receptacles

(Application for copies should be addressed to the American National Standards Institute, 1430 Broadway, New York, N.Y. 10018.)

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National Fire Protection Association (NFPA)

NFPA No. 70

National Electrical Code (NEC)

(Application for copies should be addressed to the National Fire Protection Association, 470 Atlantic Avenue, Boston, Massachusetts 02210.)

National Electrical Manufacturers' Association (NEMA)

NEMA WD-1

General Purpose Wiring Devices

NEMA WD-5

Specific Purpose Wiring Devices

(Application for copies should be addressed to the National Electrical Manufacturers' Association, 155 East 44th Street, New York, N.Y. 10017.)

3. REQUIREMENTS

3.1 Grouping. The receptacles have been grouped by intended application, as follows:

- a. Nonhazardous areas - Table I
- b. Hazardous areas Class I, Division 1, Groups B, C, and D - Table II
- c. Hazardous areas Class I, Division 1, Groups C and D - Table III

3.2 Utilization of Tables. To properly utilize the above-referenced tables, the following explanatory information is given. Note that the voltage rating shown in table heading may be lower than the manufacturer's stated voltage.

3.2.1 Service. The application tables have been subdivided to indicate the service for which each group of receptacles were selected. This service is indicated by voltage, frequency, and number of phases, wires, and poles.

3.2.2 Rating. The information shown in this column is the maximum allowable ampacity of each receptacle, plus other applicable data.

3.2.3 Symbol. The figure shown in this column applies only to facility receptacles and shall be shown on the drawing and in the legend with rating and type. The legend shall also include all requirements of this standard and referenced documents. As an alternate method, the requirements of this standard may be included in the contract specification, in which case the contract shall be referenced in the legend.

3.2.4 Wiring Diagram - Facility

3.2.4.1 Receptacle. The devices shown in this column will normally be installed in or on the wall of a fixed structure and fed from a load center or substation. Therefore, this receptacle is normally energized and shall be a female device. The diagrams in this column show pin arrangement and assigned function such as ground, neutral, phase, etc.

3.2.4.2 Plug. The devices shown in this column will mate with the corresponding facility receptacle(s). The diagrams in this column show pin arrangement and assignment.

3.2.5 Wiring Diagram - Ground Support Equipment (GSE).

3.2.5.1 Plug. These devices will usually be installed on the same cable as the plug listed under Wiring Diagram - Facility. This cable and the plugs will serve as an interface between the facility power source and the GSE load. If the facility plug is mated with the facility receptacle the contacts of the GSE plug will be energized; therefore, this device must be female. The diagrams in this column show pin arrangement and assignment.

3.2.5.2 Receptacle. The devices shown in this column will be installed on GSE and will serve as the connection point for power cables. Since the contacts of these receptacles are not exposed while energized, this device is male. The diagrams in this column show pin arrangement and assignment.

3.2.6 Catalog Number. Receptacles and plugs are identified by listing one or more catalog numbers, however, all catalog numbers available for a specific insert configuration are not necessarily listed. The manufacturer's catalog should be consulted for technical information on the available configurations of threaded hubs for the listed receptacles and cable diameters for the listed plugs. Receptacle and plug configuration other than those listed in this standard may be utilized as determined by specific application. However, no change is permitted in receptacle mating, pin arrangement, and keying for a particular service as listed in this standard by catalog number.

3.2.7 Pin Representation. The pins on male receptacles and plugs are represented by shaded areas; the pins on female receptacles and plugs are represented by unshaded areas.

3.2.8 Reverse Service. In situations where the exposed pins of a plug selected for facility use would be energized when the receptacle and plug are disconnected, reverse-service connectors shall be used. The normal-usage symbol with a subscript letter "R" indicates reverse-service requirement. The plugs and receptacles for GSE use were selected to prevent the exposure of "energized" pins when the plugs and receptacles are not mated. The letters "S" and "P" appear frequently in part numbers. "S" indicates that the plug or receptacle is female and the pins are not exposed when this device is not mated to its counterpart. "P" indicates that the plug or receptacle is male and the pins are exposed when the device is not mated to its counterpart.

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3.2.9 Limitations. Receptacles and plugs with metallic shells that do not have a ground pin that is bonded to the receptacle shell shall not be utilized for design purposes. The applicable receptacles have been noted "not to be utilized for design" in the receptacle application tables. The receptacles that are so noted are existing at KSC, but should not be used for maintenance replacement purposes unless the use of the appropriate receptacle would present prohibitive cost or operational impact.

3.3 Abbreviations. Listed below are the abbreviations used in the tables.

AP	Appleton
RS	Russell and Stoll
HU	Hubbell
CH	Crouse Hinds
PN	Pyle National
WT	Watertight
WP	Weatherproof
NCL	Not Catalog Listed
NEMA	National Electrical Manufacturers Association

3.4 Request for Waivers. The requirements set forth in this standard are not intended to be totally restrictive. The purpose is to achieve standardization of receptacles and plugs throughout KSC. Receptacles and plugs not listed in this standard, that are electrically and physically interchangeable with those identified in this standard, may be substituted if they are approved in writing by properly executed waivers. Requests for waivers of any requirements of this standard must be supported by technical justification.

3.4.1 KSC Organizations shall direct requests to:

Design Engineering Directorate Facilities Engineering Division, DD-FED
John F. Kennedy Space Center, NASA
Kennedy Space Center, Florida 32899

3.4.2 KSC construction contractors shall direct requests to the responsible administrative contracting officer:

Procurement Office, AD-PRO
John F. Kennedy Space Center, NASA
Kennedy Space Center, Florida 32899

3.5 Ordering Data. When this standard is referenced in a technical document in a KSC contract, the title and number of this standard shall be specified as a part of that document. Where NEMA configurations are shown, these devices shall be specification grade as manufactured by Hubbell, Pass and Seymour, Arrow-Hart, and Bryant.

4. QUALITY ASSURANCE PROVISIONS

Designers preparing design specifications shall include inspection and test requirements to ensure that the provisions of the specifications conform to all the applicable requirements of this standard. Both the supplier and the contractor shall establish a quality-control system to perform sufficient inspection and tests of all items of work to ensure compliance with this standard, NHB 5300.4(1C), NEMA standards, and ANSI standards with respect to materials, workmanship, construction, and functional performance. When receptacles are purchased under the provisions of this standard, the following minimum inspection and test requirements shall apply.

4.1 Supplier. The supplier shall:

- a. Inspect finished work for size, pin arrangement, and quality of workmanship.
- b. Provide protection and controls necessary to prevent damage or deterioration prior to packaging and shipping.
- c. Ensure that the quality of the fabricated articles is maintained and that damage, deterioration, loss, and substitution are prevented.
- d. Package and mark the finished articles in a manner to ensure safe arrival and ready identification at destination.

4.2 Contractor. The installation contractor shall:

- a. Upon receipt, inspect to detect damage in transit.
- b. Inspect for completeness and proper type, size, and pin configuration.
- c. Provide the protection, periodic inspection, and controls necessary to prevent damage or deterioration during handling or storage.
- d. Conduct operating tests after the receptacle installation is complete and at such time as the Contracting Officer may direct. These tests shall include (but not be limited to) a continuity test between the receptacle grounding pin and earth ground (or objects known to be adequately grounded to the earth) by a path independent of the power neutral.
- e. Verify phase rotation for each three-phase receptacle by testing with a phase-rotation meter. The phase rotation for all three-phase receptacles shall be as shown on the wiring diagram using the ground pin or the neutral pin as a reference.

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5. PREPARATION FOR DELIVERY

There are no applicable requirements.

6. NOTES

6.1 Definitions. The following definitions are applicable to this standard.

6.1.1 Explosionproof. A receptacle or enclosure that is designed and constructed to withstand an explosion of a specified liquid, gas, vapor, or dust within the receptacle or enclosure and to prevent the ignition of the specified gas or vapor surrounding the receptacle or enclosure by sparks, flashes, or explosions of the specified liquid, gas, vapor, or dust that may occur within the enclosure. The receptacle or enclosure must operate at such an external temperature that a surrounding flammable atmosphere will not be ignited thereby. Flameproof may be considered a synonym of explosionproof.

6.1.2 Hazardous Location. An area where ignitable vapors or dust may cause a fire or explosion created by energy emitted from lightning or other electrical equipment or by electrostatic generation.

6.1.3 Hazardous Area, Class I, Division 1. Locations in which hazardous concentrations of flammable gases or vapors exist continuously, intermittently, or periodically under normal operating conditions; locations in which hazardous concentrations of such gases or vapors may exist frequently because of repair or maintenance operations or because of leakage; or locations in which breakdown or faulty operation of equipment or processes, which might release hazardous concentrations of flammable gases or vapors, might also cause simultaneous failure of electrical equipment.

6.1.3.1 Hazardous Area Group B. Atmospheres containing hydrogen, gases, or vapors of equivalent hazard such as manufactured gas.

6.1.3.2 Hazardous Area Group C. Atmospheres containing vapors of ethyl ether, ethylene, cyclopropane, or unsymmetrical dimethyl hydrazine (a hypergolic propellant).

6.1.3.3 Hazardous Area Group D. Atmospheres containing natural gas or vapors of gasoline, hexane, naphtha, benzine, butane, propane, alcohol, acetone, benzol, or lacquer-solvent. Specific hazards encountered at KSC are kerosene (RP-1), hypergolic oxidizer propellants, solid propellants, paint, oil, and lubricants (POL). In addition, although not defined as a hazardous material by the NEC, it is considered that oxygen concentrations (LOX and GOX) provide a hazard because of the increased flammability of materials exposed to oxygen.

6.1.4 Raintight. So constructed or protected that exposure to a beating rain will not result in the entrance of water.

6.1.5 Watertight (NEMA/Waterproof). So constructed that there shall be no leakage of water into the enclosure when subjected to a stream from a hose with a 1-inch nozzle and delivering at least 65 gallons per minute, with the water directed at the enclosure from a distance of not less than 10 feet for a period of 5 minutes. During this period the water may be directed in one or more directions as required.

6.1.6 Weatherproof (NEMA)/Weathertight). So constructed or protected that exposure to weather hazards such as rain, snow, or sleet will not interfere with successful operation.

6.2 Intended Use. This standard is intended for use in the selection of plugs and receptacles for new installation by KSC design and maintenance organizations and by designers performing under KSC contracts. It is not intended that existing plugs and receptacles be modified for the sole purpose of conforming to this standard.

NOTICE: When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

Custodian:

NASA - John F. Kennedy Space Center
Kennedy Space Center, Florida 32899

Preparing Activity:

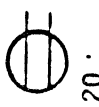

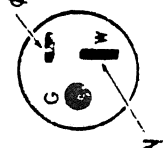
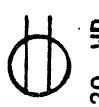

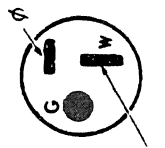

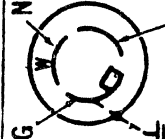
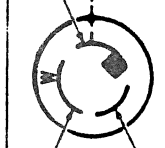
John F. Kennedy Space Center
Design Engineering Directorate
Facilities Engineering Division

Table I. Nonhazardous Area (Indoor/Outdoor) Receptacles

RATING	FACILITY SYMBOL	WIRING DIAGRAM - FACILITY		WIRING DIAGRAM - GSE	
		RECEPTACLE	PLUG	PLUG	RECEPTACLE
15A duplex (indoor only)		 NEMA 5-15R, duplex	 NEMA 5-15P	 NEMA 5-15R	 NEMA 5-15P
15A duplex weatherproof (hinged flap cover)		 NEMA 5-15R, duplex	 NEMA 5-15P	N/A	N/A
15A flush floor outlet (indoor only)		 NEMA 5-15R with mounting strap	 NEMA 5-15P	N/A	N/A


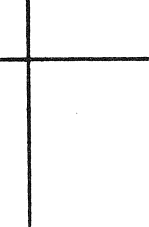
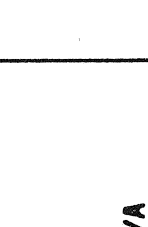


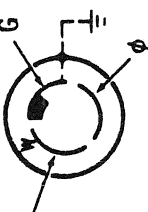

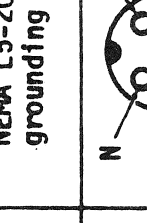
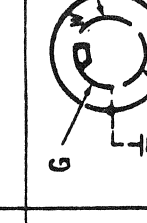
FACE VIEW OF RECEPTABLES AND PLUGS SHOWN

Table I. Nonhazardous Area (Indoor/Outdoor) Receptacles (cont)

RATING	FACILITY SYMBOL	WIRING DIAGRAM - FACILITY		WIRING DIAGRAM - GSE	
		RECEPTACLE	PLUG	PLUG	RECEPTACLE
20A duplex (indoor only)	 20	 NEMA 5-20R, duplex	 NEMA 5-20P	N/A	N/A
20A duplex weatherproof (hinged flap cover)	 20 WP	 NEMA 5-20R, duplex	 NEMA 5-20P	N/A	N/A
15A duplex (indoor only), locking	 15	 NEMA L5-15R, duplex	 NEMA L5-15P	N/A	N/A

FACE VIEW OF RECEPTABLES AND PLUGS SHOWN

Table I. Nonhazardous Area (Indoor/Outdoor) Receptacles (cont)

		120V, 60 Hz, single phase, 3 wire, 2 pole (cont)		WIRING DIAGRAM - GSE	
RATING	FACILITY SYMBOL	WIRING DIAGRAM - FACILITY		PLUG	RECEPTACLE
		RECEPTACLE	PLUG		
20A waterproof		 <p>RS No. 3743</p>	 <p>RS No. 3720</p>	N/A	N/A
20A locking (indoor only)		 <p>NEMA L5-20R, grounding type</p>	 <p>NEMA L5-20P</p>	N/A	N/A
30A weather- tight		 <p>RS No. 3753 (WP) RS No. 3756 (WT), (Long Delivery Time) Replaces RS 3113W</p>	 <p>RS No. 3750 (WP) RS No. 3829 (WT), (Long Delivery Time) Replaces RS 3117W</p>	N/A	N/A

FACE VIEW OF RECEPTACLES AND PLUGS SHOWN

Table I.- Nonhazardous Area (Indoor/Outdoor) Receptacles (cont)

		120V, 60 Hz, single phase, 3 wire, 2 pole (cont)			
RATING	FACILITY SYMBOL	WIRING DIAGRAM - FACILITY		WIRING DIAGRAM - GSE	
		RECEPTACLE	PLUG	PLUG	RECEPTACLE
30A waterproof		<p>RS No. 3753</p>	<p>RS No. 3750</p>	<p>CH RPC121-150-S04AR RPC121-151-S04AR</p>	<p>CH RPC221-127-P04AR</p>
30A, 2-pole weather- tight		<p>* RS No. 3113W See RS 3756</p>	<p>* RS No. 3117W See RS 3829</p>	N/A	N/A
30A locking general purpose (indoor only), use F symbol for floor mounting		<p>NEMA L5-30R</p>	<p>NEMA L5-30P</p>	N/A	N/A

FACE VIEW OF RECEPTACLES AND PLUGS SHOWN * NOT TO BE UTILIZED FOR DESIGN
 SEE PARAGRAPH 3.2.8

Table I. Nonhazardous Area (Indoor/Outdoor) Receptacles (cont)

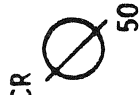

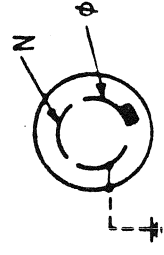
120V, Single Phase, 60 Hz, 2 Pole, 3 Wire					
RATING	FACILITY SYMBOL	WIRING DIAGRAM - FACILITY		WIRING DIAGRAM - GSE	
		RECEPTACLE	PLUG	PLUG	RECEPTACLE
50A TWIST-LOK, CORROSION RESISTANT	CR  50			N/A	N/A
		HU NO. 63CM70	HU NO. 63CM61		

Table I. Nonhazardous Area (Indoor/Outdoor) Receptacles (cont)

RATING	FACILITY SYMBOL	120V and 208V, 60 Hz, single phase, 3 wire, 2 pole		208V, 60 Hz, single phase, 3 wire, 2 pole	
		RECEPTACLE	PLUG	RECEPTACLE	PLUG
15A combination (indoor only)				Combination of NEMA 5-15R and 6-15R	NEMA 5-15P NEMA 6-15P
15A (indoor only)				NEMA 6-15R	NEMA 6-15P
30A (indoor only)				NEMA 6-30R, grounding	NEMA 6-30P, grounding

FACE VIEW OF RECEPTABLES AND PLUGS SHOWN

Table I. Nonhazardous Area (Indoor/Outdoor) Receptacles (cont)

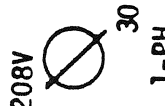
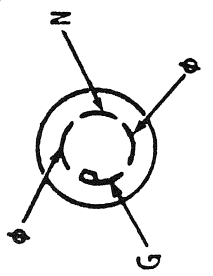
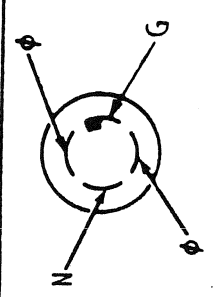

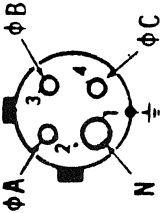
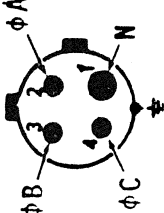

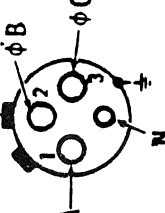
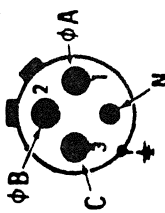

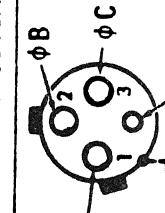
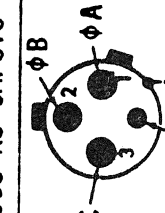
208V 60 Hz, Single Phase, 4 Wire, 2 Pole					
RATING	FACILITY SYMBOL	WIRING DIAGRAM - FACILITY		WIRING DIAGRAM - GSE	
		RECEPTACLE	PLUG	PLUG	RECEPTACLE
30A, LOCKING	208V  30 1-PH	 NEMA L14-30R, GROUNDING	 NEMA L14-30P, GROUNDING	N/A	N/A

Table I. Nonhazardous Area (Indoor/Outdoor) Receptacles (cont)

RATING	FACILITY SYMBOL	120/208V, 60 Hz, 3 phase, 4 wire, 4 pole		WIRING DIAGRAM - GSE	
		RECEPTACLE	PLUG	PLUG	RECEPTACLE
30A weather-tight	 WT			N/A	N/A
60A weather-tight	 WT			N/A	N/A
100A weather-tight	 WT			N/A	N/A

*RS No. 3118W
See RS 3MP516

*RS No. 3114W
See RS 3F0516AB

*RS No. 3128W
See RS 6MP516

*RS No. 3124W
See RS 6F0516AB

*RS No. 3138W
See RS 10MP516

*RS No. 3134W
See RS 10F0516AB

* NOT TO BE UTILIZED FOR DESIGN
SEE PARAGRAPH 3.2.8

FACE VIEW OF RECEPTABLES AND PLUGS SHOWN

Table I. Nonhazardous Area (Indoor/Outdoor) Receptacles (cont)

RATING	FACILITY SYMBOL	120/208V, 60 Hz, 3 phase, 4 wire, 4 pole (cont)		120/208V, 60 Hz, 3 phase, 5 wire, 4 pole	
		RECEPTACLE	PLUG	RECEPTACLE	PLUG
200A weather-right	② WT			N/A	N/A
		*RS No. 3144W See RS DS2516FRAB	*RS No. 3148W See RS DS25161P		
30A (indoor only)	☐			N/A	N/A
30A weather-tight	☯			CH RPC133-153-S02AR RPC133-388-S02AR RPC133-389-S02AR	CH RPC233-127-P02AR

FACE VIEW OF RECEPTABLES AND PLUGS SHOWN

* NOT TO BE UTILIZED FOR DESIGN SEE PARAGRAPH 3.2.8

▲ KEYING IS SET AT FACTORY BASED ON VOLTAGE ASSIGNMENT NUMBERS RECEPTABLES AND PLUGS HAVE NONMETALLIC SHELLS


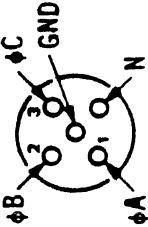
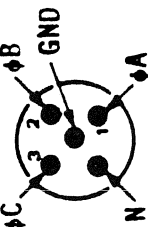

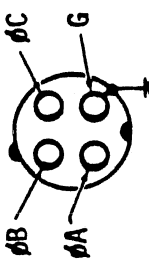
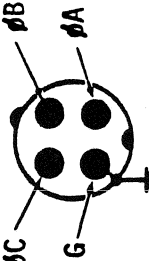
Table I. Nonhazardous Area (Indoor/Outdoor) Receptacles (cont)

RATING	FACILITY SYMBOL	120/208V, 60 Hz, 3 phase, 5 wire, 4 pole (cont)	
		WIRING DIAGRAM - FACILITY	WIRING DIAGRAM - GSE
60A		<p>▲ RS No. 6MP516 Replaces RS 3128W</p>	<p>PN ZPLML-2220-38SR ZPLML-2420-38SR</p>
		<p>▲ RS No. 10MP516 Replaces RS 3138W</p>	<p>PN ZPLML-32C24-49SR ZPLML-34C24-49SR</p>
100A		<p>▲ RS No. 6F0516AB Replaces RS 3124W</p>	<p>PN ZRLP-20-38PR</p>
		<p>▲ RS No. 10F0516AB Replaces RS 3134W</p>	<p>PN ZRLP-C24-49PR</p>

FACE VIEW OF RECEPTABLES AND PLUGS SHOWN

▲ KEYING IS SET AT FACTORY BASED ON VOLTAGE ASSIGNMENT NUMBERS RECEPTABLES AND PLUGS HAVE NONMETALLIC SHELLS

Table I. Nonhazardous Area (Indoor/Outdoor) Receptacles (cont)

120/208V, 60 Hz, 3 phase, 5 wire, 4 pole (cont)					
RATING	FACILITY SYMBOL	WIRING DIAGRAM - FACILITY		WIRING DIAGRAM - GSE	
		RECEPTACLE	PLUG	PLUG	RECEPTACLE
200A		 <p>▲ RS No. DS2516FRAB Replaces RS 3144W</p>	 <p>▲ RS No. DS2516MP Replaces RS 3148W</p>	N/A	N/A
480V, 60 Hz, 3 phase, 4 wire, 3 pole					
20A weather-tight		 <p>RS No. 8031</p>	 <p>RS No. 8014</p>	N/A	N/A

FACE VIEW OF RECEPTABLES AND PLUGS SHOWN

▲ KEYING IS SET AT FACTORY BASED ON VOLTAGE ASSIGNMENT NUMBERS RECEPTABLES AND PLUGS HAVE NONMETALLIC SHELLS

Table I. Nonhazardous Area (Indoor/Outdoor) Receptacles (cont.)

RATING	FACILITY SYMBOL	480V, 60 Hz, 3 phase, 4 wire, 3 pole (cont.)		WIRING DIAGRAM - GSE	
		RECEPTACLE	PLUG	RECEPTACLE	PLUG
30A weather-tight 45° angle flap cover		<p>RS No. 7114 (keys @ 0° & 225°)</p>	<p>RS No. 7118</p>	<p>PN ZRLP-12-22PR</p>	<p>PN ZPLML-1412-22SR ZPLML-1512-22SR</p>
60A weather-tight 45° angle flap cover		<p>RS No. 7124 (keys @ 0° & 227°)</p>	<p>RS No. 7128</p>	<p>PN ZRLP-16-38PR</p>	<p>PN ZPLML-2016-38SR ZPLML-2216-38SR</p>
100A weather-tight 45° angle flap cover		<p>*RS No. 7134W (keys @ 0° & 108°) See RS 7134-72</p>	<p>*RS No. 7138W See RS 7138-72</p>	N/A	N/A

FACE VIEW OF RECEPTACLES AND PLUGS SHOWN

* NOT TO BE UTILIZED FOR DESIGN
 SEE PARAGRAPH 3.2.8

Table I. Nonhazardous Area (Indoor/Outdoor) Receptacles (cont)

RATING	FACILITY SYMBOL	480V, 60 Hz, 3 phase, 4 wire, 3 pole (cont)		WIRING DIAGRAM - GSE	
		RECEPTACLE	PLUG	RECEPTACLE	PLUG
100A weathertight 45° angle flap cover		<p>RS No. 7134-72 (keys @ 0° & 280°) Replaces RS 7134W</p>	<p>RS No. 7138-72 Replaces RS 7138W</p>	<p>PN ZRLP-C20-40PR</p>	<p>PN ZPLML-28C20-40SR ZPLML-30C20-40SR</p>
200A weathertight 45° angle flap cover		<p>*RS No. 7144W (keys @ 0° & 75°) See RS 7144</p>	<p>*RS No. 7148W See RS 7148</p>	N/A	N/A
200A weathertight 45° angle flap cover		<p>*RS No. 7144MR (keys @ 0° & 75°) See RS 7144R</p>	<p>*RS No. 7148MR See RS 7148R</p>	N/A	N/A

FACE VIEW OF RECEPTABLES AND PLUGS SHOWN * NOT TO BE UTILIZED FOR DESIGN SEE PARAGRAPH 3.2.8

Table I. Nonhazardous Area (Indoor/Outdoor) Receptacles (cont)

RATING	FACILITY SYMBOL	480V, 60 Hz, 3 phase, 4 wire, 3 pole (cont)		WIRING DIAGRAM - GSE	
		RECEPTACLE	PLUG	PLUG	RECEPTACLE
200A weather-tight 20° angle flap cover		<p>RS No. 7144 (keys @ 0° & 75°) Replaces RS 7144W</p>	<p>PN ZPLML-36C24-26SR ZPLML-38C24-26SR</p>	<p>PN ZRLP-C24-26PR</p>	N/A
200A weather-tight 45° angle flap cover		<p>RS No. 7148R Replaces RS 7148WR</p>	<p>RS No. 7148R Replaces RS 7148WR</p>	N/A	N/A
400A weather-tight		<p>CH No. AREX4042210 AREX4042212 STYLE 2</p>	<p>CH No. AP404610 AP404612 STYLE 2</p>	N/A	N/A

FACE VIEW OF RECEPTACLES AND PLUGS SHOWN

Table I. Nonhazardous Area (Indoor/Outdoor) Receptacles (cont)



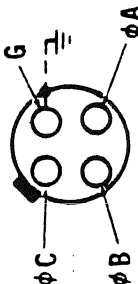

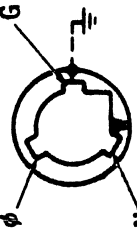
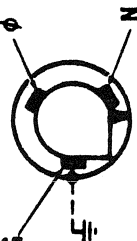

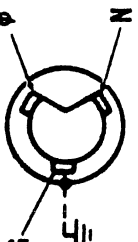
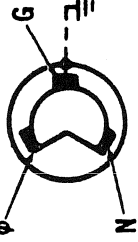
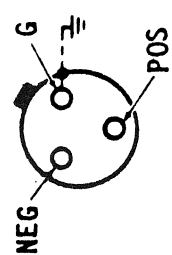
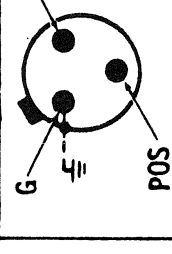
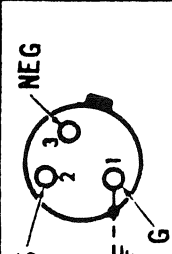


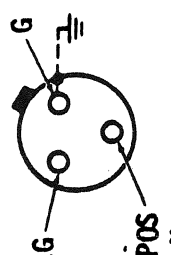

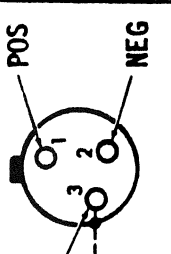


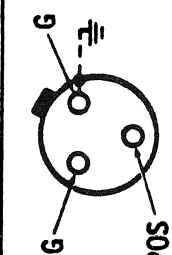
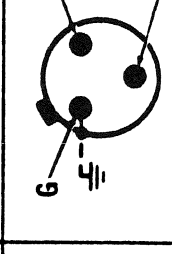
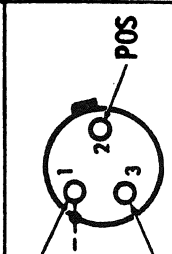
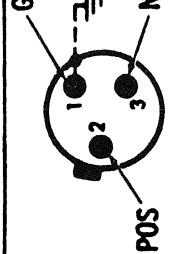

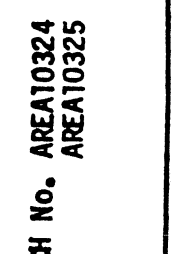
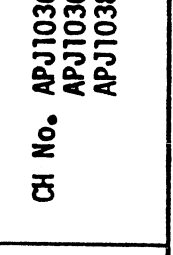
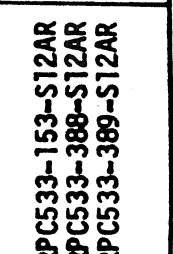
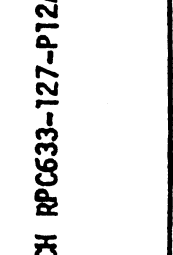

		480V, 60 Hz, 3 phase, 4 wire, 3 pole (cont)		120V, 400 Hz, single phase, 3 wire, 2 pole	
RATING	FACILITY SYMBOL	WIRING DIAGRAM - FACILITY		WIRING DIAGRAM - GSE RECEPTACLE	
		RECEPTACLE	PLUG	PLUG	RECEPTACLE
400A weather-tight	 R	 <p>CH No. AREX4042210 AREX4042212 STYLE 2 (SUFFIX S22)</p>	 <p>CH No. AP404610 AP404612 STYLE 2 (SUFFIX S22)</p>	N/A	N/A
20A		 <p>HU No. 23030</p>	 <p>HU No. 23034</p>	N/A	N/A
20A	 20	 <p>HU No. 23000G</p>	 <p>HU No. 23006G</p>	N/A	N/A

Table I. Nonhazardous Area (Indoor/Outdoor) Receptacles (cont.)

RATING	FACILITY SYMBOL	120V, 400 Hz, single phase, 3 wire, 2 pole (cont.)		120/208V, 400 Hz, 3 phase, 4 wire, 4 pole		120/208V, 400 Hz, 3 phase, 5 wire, 4 pole	
		RECEPTACLE	PLUG	RECEPTACLE	PLUG	RECEPTACLE	PLUG
30A							
		CH RPC221-127-S04BR	CH RPC121-150-P04BR RPC121-151-P04BR	CH RPC233-127-S02BR Replaces HU No. 25403	CH RPC133-153-S02BR RPC133-388-P02BR RPC133-389-P02BR Replaces HU NO. 25415	CH RPC221-127-P04BR	CH RPC121-150-S04BR RPC121-151-S04BR	CH RPC233-127-P02BR
30A						N/A	N/A
30A				N/A	N/A		


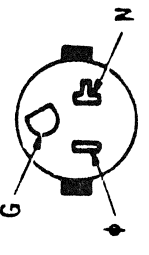








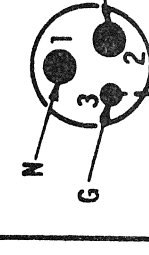
FACE VIEW OF RECEPTACLES AND PLUGS SHOWN * NOT TO BE UTILIZED FOR DESIGN
 SEE PARAGRAPH 3.2.8

Table I. Nonhazardous Area (Indoor/Outdoor) Receptacles (cont)

RATING	FACILITY SYMBOL	28V dc, 3 wire, 2 pole			WIRING DIAGRAM - GSE	
		RECEPTACLE	PLUG	RECEPTACLE	PLUG	RECEPTACLE
30A raintight	30	 <p>CH No. ARE3322 ARRC3323 ARE3323 ARRH3322 ARRC3322 ARRH3323</p>	 <p>CH No. APJ3363 APJ3365 APJ3385</p>	 <p>CH RPC221-127-P04CR</p>	 <p>PN ZPLML-1816-51SR ZPLML-2016-51SR</p>	 <p>CH RPC633-127-P12AR</p>
		 <p>CH No. APJ6363 APJ6365 APJ6385</p>	 <p>CH No. APJ10365 APJ10367 APJ10387</p>	 <p>CH RPC533-153-S12AR RPC533-388-S12AR RPC533-389-S12AR</p>		
60A raintight	60	 <p>CH No. AREA10324 AREA10325</p>				
						


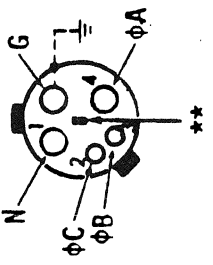
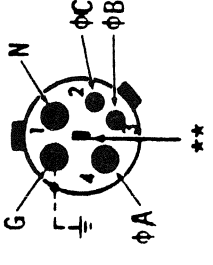
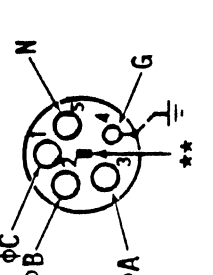
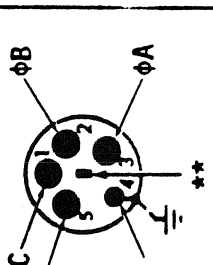

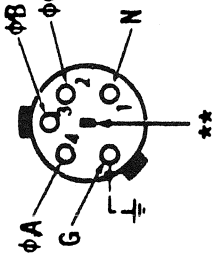
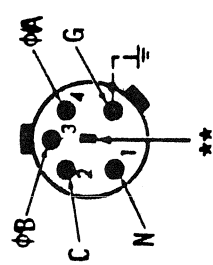
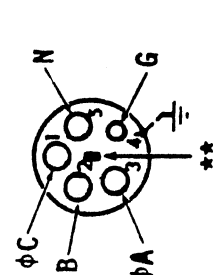
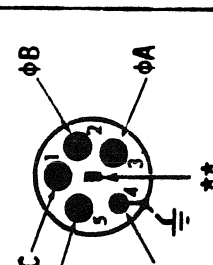

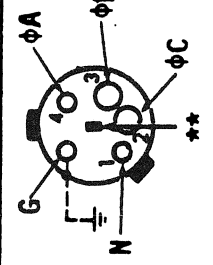
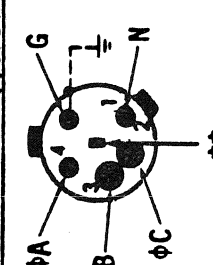
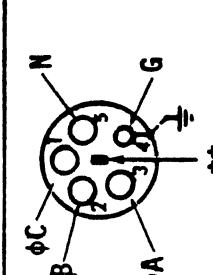
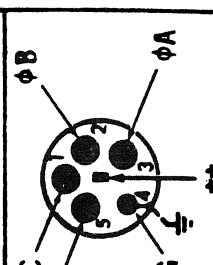
FACE VIEW OF RECEPTABLES AND PLUGS SHOWN

Table II. Hazardous Area, Class 1, Division 1, Group B, C, D Explosionproof Receptacles

120V, 60 Hz, single phase, 3 wire, 2 pole		WIRING DIAGRAM - FACILITY		WIRING DIAGRAM - GSE	
RATING	FACILITY SYMBOL	RECEPTACLE	PLUG	PLUG	RECEPTACLE
20A switch inter- locked				N/A	N/A
	E (BCD)	AP No. EFSCB175-2023	AP No. ECP-2023 ECP-1523		
20A use switch inter- locked (30A actual rating of receptacle				N/A	N/A
	E (BCD)	CH No. FSQC2320-GB FSQC3320-GB	CH No. APJ3363(NCL) APJ3365 APJ3385		
30A switch inter- locked					
	E (BCD)	CH No. FSQC2320-GB-S4 FSQC3320-GB-S4	CH No. APJ3365-S4	PN GB-1016-51SL-16	PN GB-B1716-51PL

FACE VIEW OF RECEPTABLES AND PLUGS SHOWN
(NCL) NOT CATALOG LISTED, AVAILABLE

Table II. Hazardous Area, Class 1, Division 1, Group B, C, D Explosionproof Receptacles (cont)

RATING	FACILITY SYMBOL	WIRING DIAGRAM - FACILITY		WIRING DIAGRAM - GSE			
		RECEPTACLE	PLUG	PLUG	RECEPTACLE		
30A switch inter- locked	 E (BCD)	120/208V, 60 Hz, 3 phase, 5 wire, 4 pole					
						CH No. BHR3583BW BHR3584BW	CH No. BHP3583BW BHP3585BW	PN GB-1020-36SL-18	PN GB-B1720-36PL
60A switch inter- locked	 E (BCD)	120/208V, 60 Hz, 3 phase, 5 wire, 4 pole					
						CH No. BHR6584DW BHR6585DW	CH No. BHP6585DW BHP6587DW	PN GB-1024-29SL-24	PN GB-B1724-29PL
100A switch inter- locked	 E (BCD)	120/208V, 60 Hz, 3 phase, 5 wire, 4 pole					
						CH No. BHR10585CW BHR10586CW	CH No. BHP10585CW BHP10587CW	PN GB-1028-23SL-32	PN GB-B1728-23PL

FACE VIEW OF RECEPTACLES AND PLUGS SHOWN
 **OPERATING LEVER FOR SWITCH INTERLOCK

Table I. Hazardous Area, Class 1, Division 1, Group B, C, D Explosionproof Receptacles (cont)


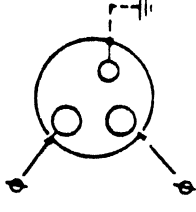
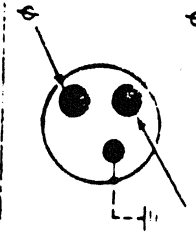

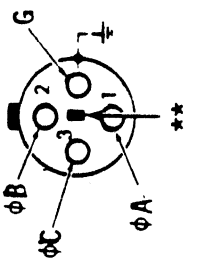
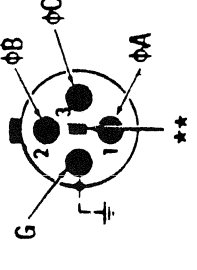

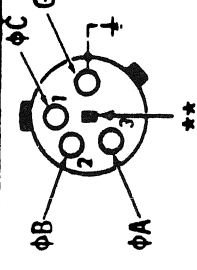
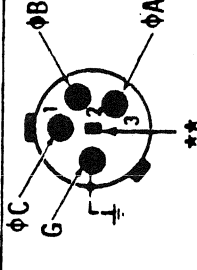
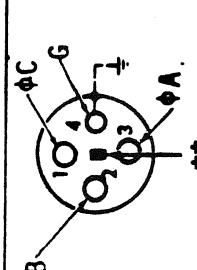
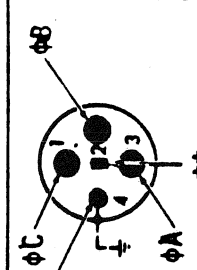

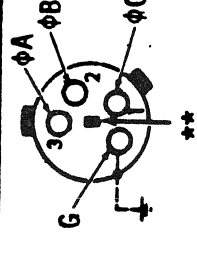
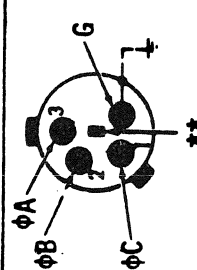
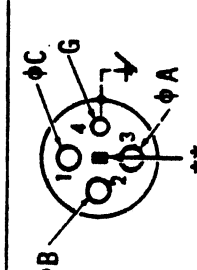
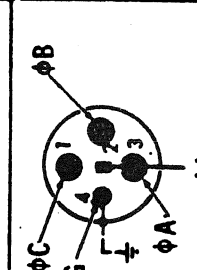

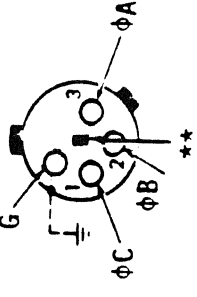
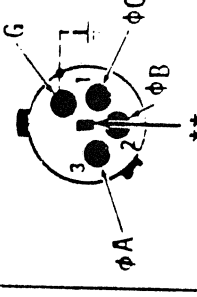
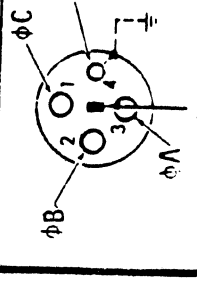
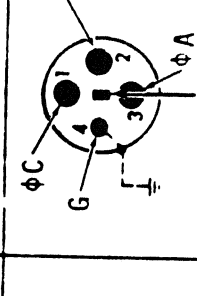

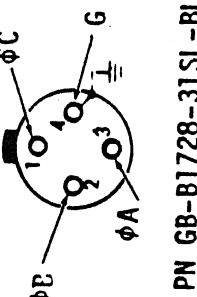
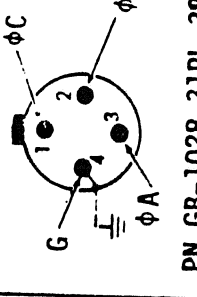
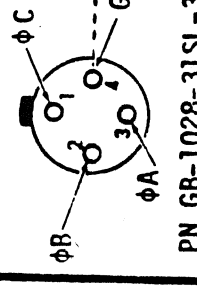
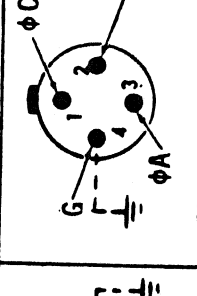

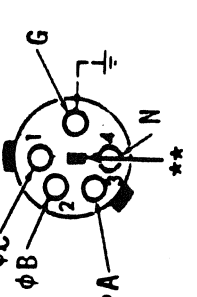
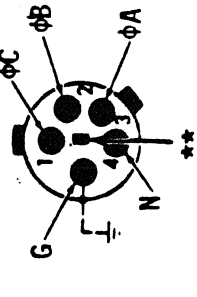
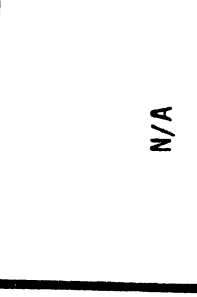
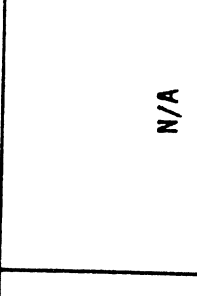
208V, 60 Hz, Single Phase, 3 Wire, 2 Pole			
RATING	FACILITY SYMBOL	WIRING DIAGRAM - FACILITY	
		RECEPTACLE	PLUG
30A	208V  E (BCD)		
		PN NO. GB-B1716-51SL- AF	PN NO. GB-1016-51PL- 12
		PLUG	RECEPTACLE
		N/A	N/A

Table II. Hazardous Area, Class 1, Division 1, Group B, C, D Explosionproof Receptacles (cont)
 480V, 60 Hz, 3 phase, 4 wire, 3 pole

RATING	FACILITY SYMBOL	WIRING DIAGRAM - FACILITY		WIRING DIAGRAM - GSE	
		RECEPTACLE	PLUG	PLUG	RECEPTACLE
20A use, switch interlocked (30A actual manufacturer's rating)	 E (BCD)		 CH No. APJ3485 APJ3463(NCL) APJ3465	N/A	N/A
30A switch interlocked	 E (BCD)		 CH No. BHP3483D BHP3485D		 PN GB-1016-23SL-16 PN GB-B1716-23PL
60A switch interlocked	 E (BCD)		 CH No. BHC6484D BHC6485D		 PN GB-1020-40SL-22 PN GB-B1720-40PL

FACE VIEW OF RECEPTACLES AND PLUGS SHOWN
 **OPERATING LEVER FOR SWITCH INTERLOCK (NCL) NOT CATALOG LISTED, AVAILABLE

Table II. Hazardous Area, Class 1, Division 1, Group B, C, D Explosionproof Receptacles (cont)
 480V, 60 Hz, 3 phase, 4 wire, 3 pole (cont)

RATING	FACILITY SYMBOL	WIRING DIAGRAM - FACILITY		WIRING DIAGRAM - GSE	
		RECEPTACLE	PLUG	PLUG	RECEPTACLE
100A switch inter- locked	 E (BCD)				
		CH No. BHR C10485D BHR C10486D	CH No. BHP10485D BHP10487D	PN GB-B1728-31SL-BL	PN GB-1024-39SL-30 (NCL), LONG DELIVERY	PN GB-B1724-39PL (NCL), LONG DELIVERY
200A	 E (BCD)				
		CH No. BHR C3583DW BHR C3584DW	CH No. BHP3583DW BHP3585DW	PN GB-B1728-31PL-38	PN GB-1028-31SL-38	PN GB-B1728-31PL
30A switch inter- locked	 E (BCD)				
		CH No. BHR C3583DW BHR C3584DW	CH No. BHP3583DW BHP3585DW			N/A

120/208V, 400 Hz, 3 phase, 5 wire, 4 pole

FACE VIEW OF RECEPTABLES AND PLUGS SHOWN
 **OPERATING LEVER FOR SWITCH INTERLOCK

Table II. Hazardous Area, Class 1, Division 1, Group B, C, D, Explosionproof Receptacles (cont)


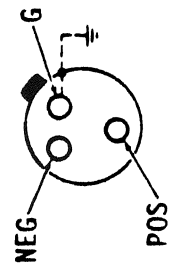
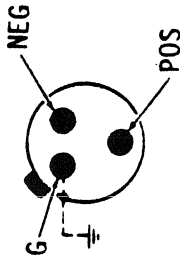
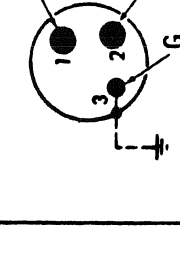
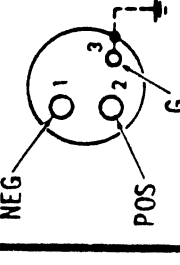

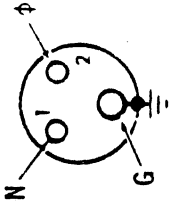
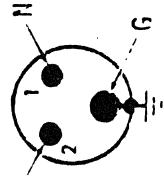

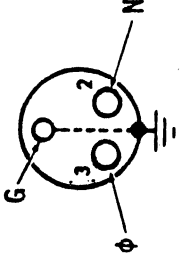
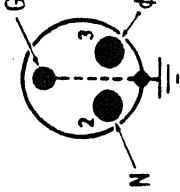

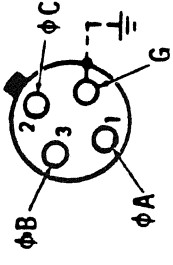
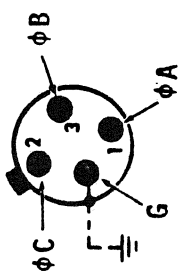
RATING	FACILITY SYMBOL	28V dc, 3 wire, 2 pole		WIRING DIAGRAM - GSE	
		RECEPTACLE	PLUG	RECEPTACLE	PLUG
30A circuit breaker inter- locked	 E (BCD)				
		CH No. EPCB43632 WT30HFA-2	CH No. APJ3363 APJ3365 APJ3385	PN GB-B1716-51PL01	PN GB-1016-51SL01-14
		FACE VIEW OF RECEPTABLES AND PLUGS SHOWN			

Table III. Hazardous Area, Class I, Division 1, Group C, D. Explosionproof Receptacles

RATING	FACILITY SYMBOL	120V, 60 Hz, single phase, 3 wire, 2 pole		120V, 60 Hz, single phase, 3 wire, 2 pole	
		WIRING DIAGRAM - FACILITY RECEPTACLE	PLUG	WIRING DIAGRAM - FACILITY PLUG	RECEPTACLE
20A	 E (CD)	 RS No. 4464	 RS No. 4466	N/A	N/A
30A	 E (CD)	 RS No. 4233BC	 RS No. 4237BC	N/A	N/A
30 A use (60A actual manufacturer's rating)	 E (CD)	 CH. No. DRE6424-S4	 APJ6485-S4 CH No. APJ6463-S4(NCL) APJ6465-S4(NCL)	N/A	N/A

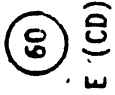
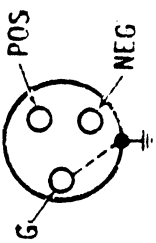
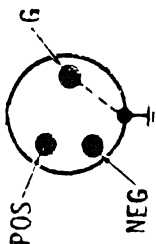
31 FACE VIEW OF RECEPTACLES AND PLUGS SHOWN (NCL) NOT CATALOG LISTED, AVAILABLE

Table III. Hazardous Area, Class I, Division 1, Group C, D., Explosionproof Receptacles (cont)

RATING	FACILITY SYMBOL	480V, 60 Hz, 3 phase, 4 wire, 3 pole (cont)		WIRING DIAGRAM - FACILITY		WIRING DIAGRAM - GSE	
		RECEPTACLE	PLUG	PLUG	RECEPTACLE	PLUG	RECEPTACLE
60A							N/A
		CH No. DRE6424	APJ6485 CH No. APJ6463 (NCL) APJ6465				
200A inter- locked circuit breaker combina- tion (Group D only)							N/A
		CH No. EPC 604-2042- WT 200-3 CH No. EPC 605-2042- TT 200-3	CH No. DP20468				
28V dc, 3 wire, 2 pole							
30A							N/A
		RS No. F19070	RS No. F19071				

FACIE VIEW OF RECEPTACLES AND PLUGS SHOWN (NCL) NOT CATALOG LISTED, AVAILABLE

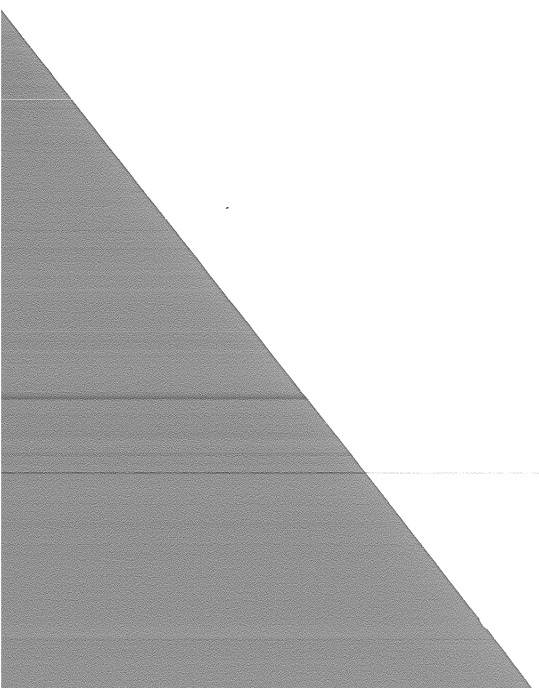
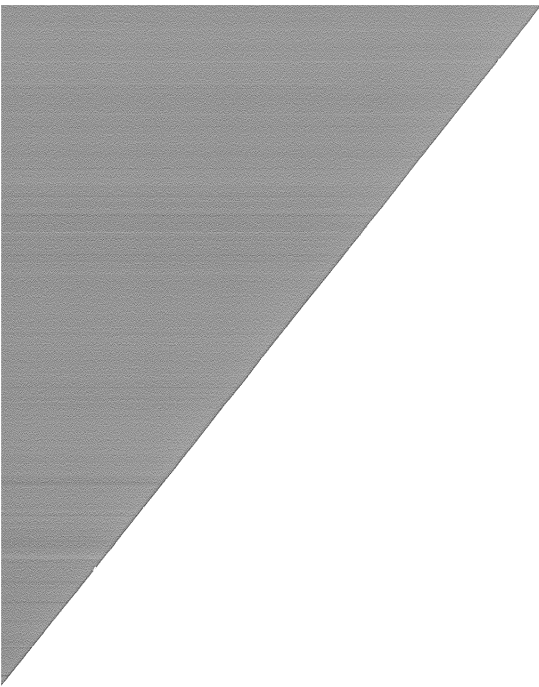
Table III. Hazardous Area, Class I, Division 1, Group C, D, Explosionproof Receptacles (cont)

RATING	FACILITY SYMBOL	28Y dc, 3 wire, 2-pole (cont)		WIRING DIAGRAM - GSE	
		WIRING DIAGRAM - RECEPTACLE	PLUG	PLUG	RECEPTACLE
60A				N/A	N/A
		RS No. 4263BC	RS No. 4257BC		

FACE VIEW OF RECEPTABLES AND PLUGS SHOWN



SECTION 3 - ENGINEERING STANDARDS (KC FITTINGS)

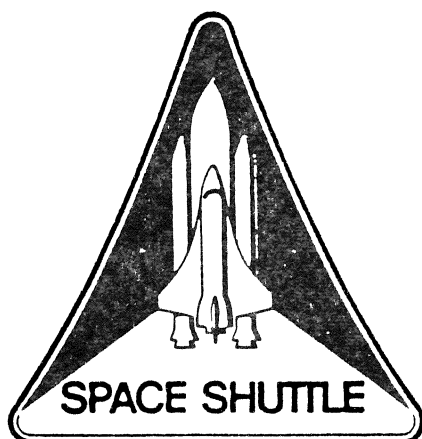


Includes UMD. 1

GP-425E
Revised November 1, 1983
REV. E

ENGINEERING STANDARDS

This Document Supersedes All
Previous Editions of GP-425



ENGINEERING DEVELOPMENT DIRECTORATE

National Aeronautics and
Space Administration

John F. Kennedy Space Center

NASA



ENGINEERING STANDARDS

Prepared:

Roger D. Hall
Roger D. Hall
DD-MED-42

Approved:

W. I. Moore 3/7/84
W. I. Moore
Chief, Propellants and
Gases Branch

The standards shown in this document are mandatory for use by
KSC Engineering Development Directorate and associated contractors.

This Document Supersedes All
Previous Editions of GP-425

Revised November 1, 1983

JOHN F. KENNEDY SPACE CENTER, NASA



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INTRODUCTION

1. SCOPE

The purpose of these engineering standards is to provide engineers and designers and associated personnel with engineering standards applicable to the operation of space projects.

The use of these standards will tend to accomplish the following objectives:

- a. Increase component interchangeability and reliability.
- b. Simplify procurement, storage, inspections, and environmental limitations.
- c. Expedite design by eliminating time spent on routine items for which design has been accomplished.

2. CONTENTS

These engineering standards are a compilation of standard parts and design standards.

3. RECOGNITION

Standards originated for use at the Kennedy Space Center are identified by a "KC" standard drawing number prefix. The coordination status for these standards is indicated at the lower left portion of the page. KC standards shall consist of both standard parts and design standards.

KC Fitting Is A "AN" Fitting
With Allowance For Morse Seal.

NUMERICAL INDEX

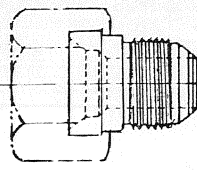
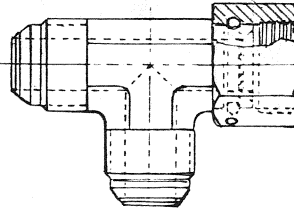
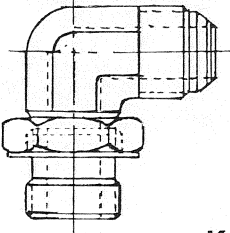
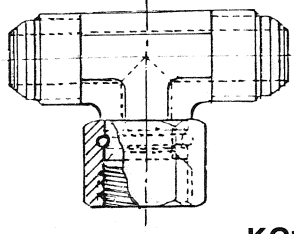
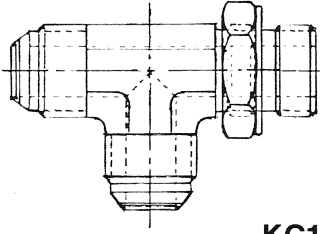
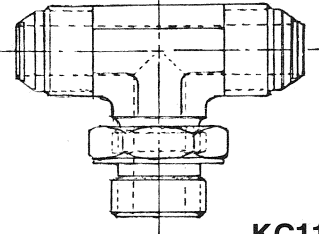
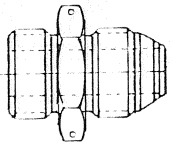
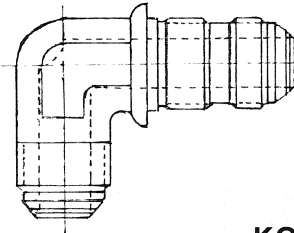
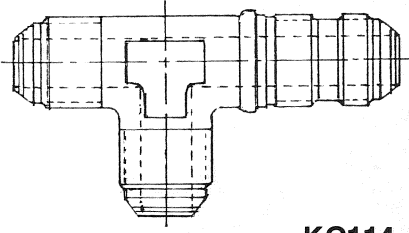
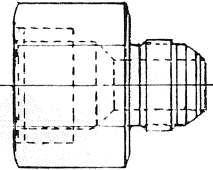
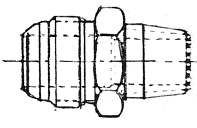
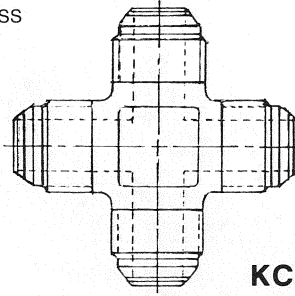
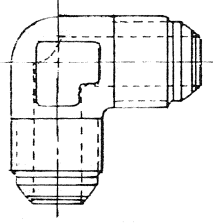
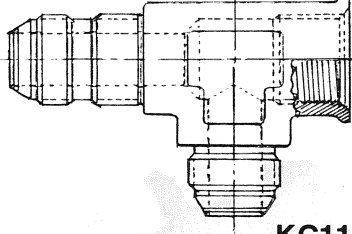
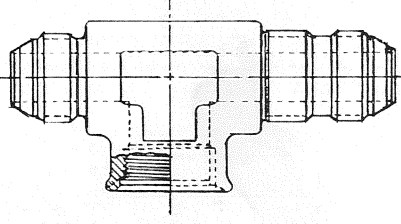
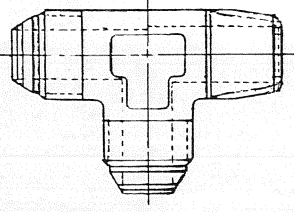
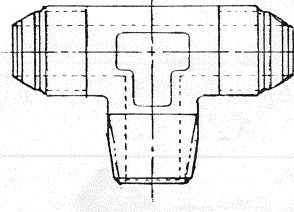
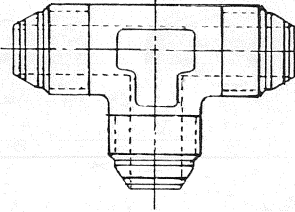
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 KC155 CLAMP ASSEMBLY
 KC156 ELBOW, 90°
 KC157 TEE
 *KC158 CROSS
 KC159 HUB, BUTT WELD
 KC160 HUB, BLIND

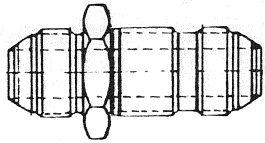
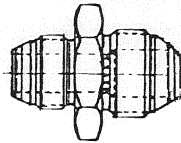
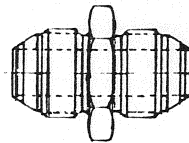
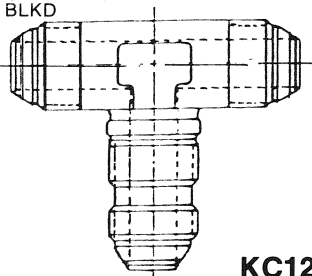
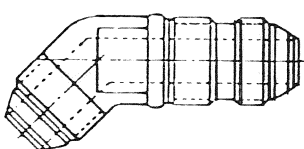
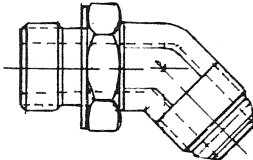
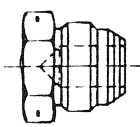
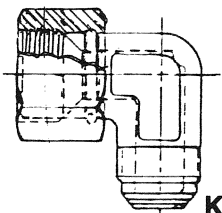
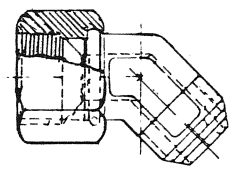
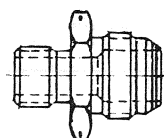
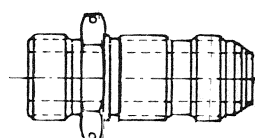
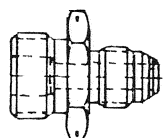
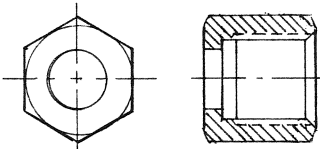
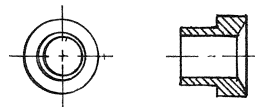
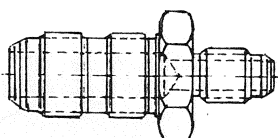
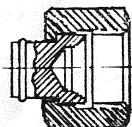
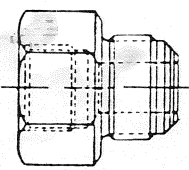
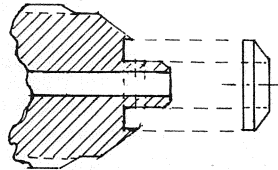
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KC164 BUSHING, SCREW THREAD REDUCER
KC165 WIRE, RETAINING, SWIVEL NUT
KC166 HUB, TAPPED BLIND
KC167 HUB, TAPPED
KC168 HUB, PRESSURE TAPPED
KC169 COUPLING ASSEMBLY, BLKHD SUPER PRESSURE PORT
KC170 UNION, ADJUSTABLE END
KC171 UNION ASSEMBLY, DOUBLE SWIVEL NUT
KC172 ADAPTER, SWIVEL NUT
KC173 COUPLING, TUBE
KC174 PLUG, HEX HEAD

*INACTIVE FOR NEW DESIGN



<p>REDUCER - ADAPTER</p>  <p>KC106</p>	<p>TEE - FEMALE SWIVEL</p>  <p>KC107</p>	<p>EL - ADJUSTABLE</p>  <p>KC108</p>
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<p>TEE - PIPE THD ON RUN</p>  <p>KC121</p>	<p>TEE - PIPE THD ON SIDE</p>  <p>KC122</p>	<p>TEE</p>  <p>KC123</p>

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<p>CAP ASSY.</p>  <p>KC150</p>	<p>BUSHING - REDUCER</p>  <p>KC164</p>	<p>RING, SEAL</p>  <p>KC103</p>

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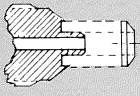
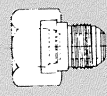
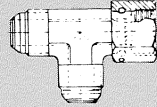
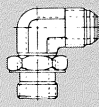
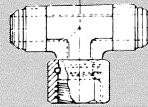
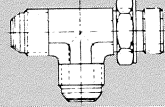
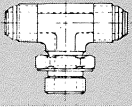

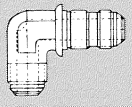
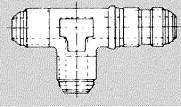
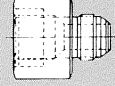

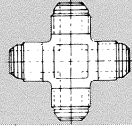
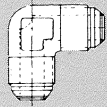
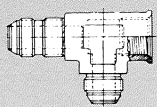
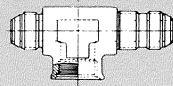
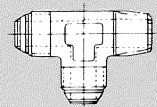
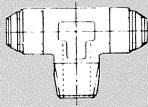
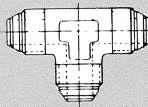
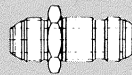


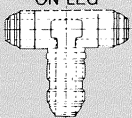
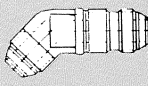
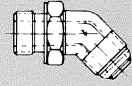

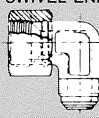
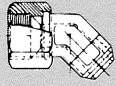

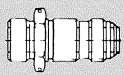

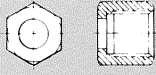

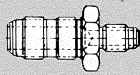
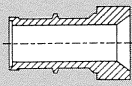
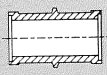
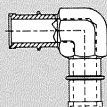
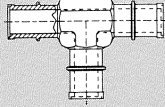
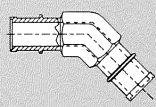
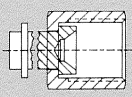
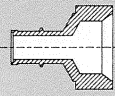
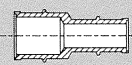
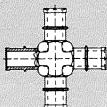
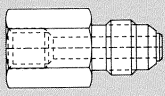
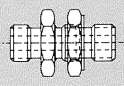
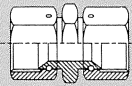
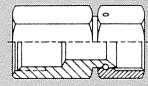
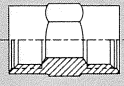

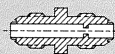
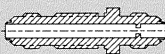
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NORTH HOLLYWOOD, CALIF. 91609

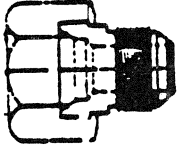
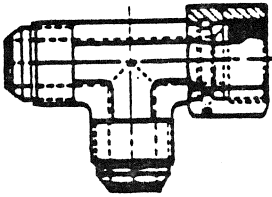
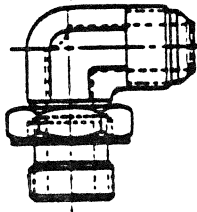
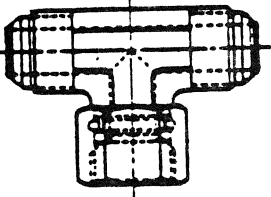
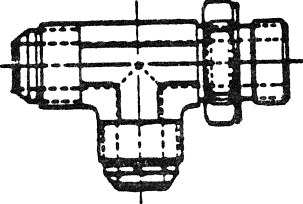
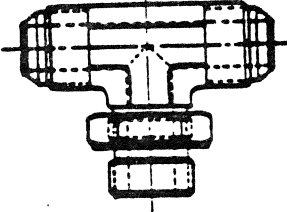
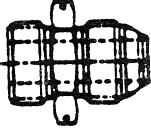
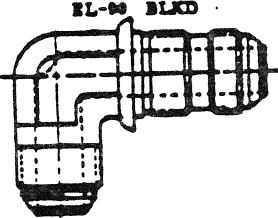
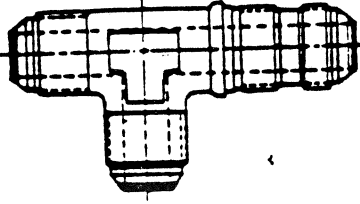
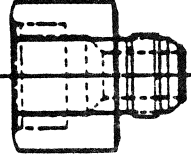
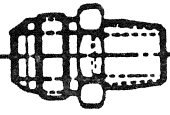
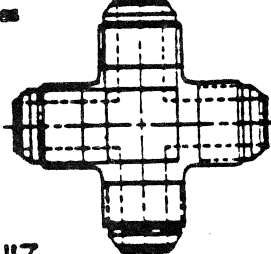
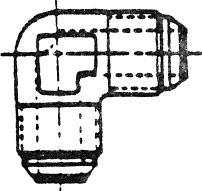
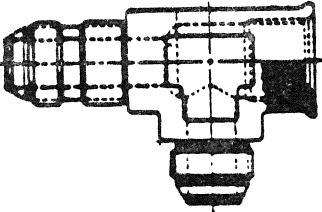
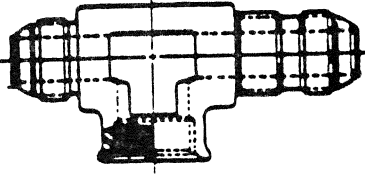
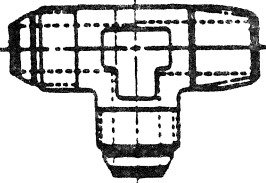
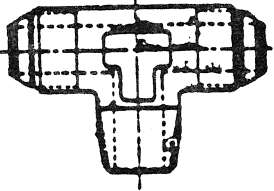
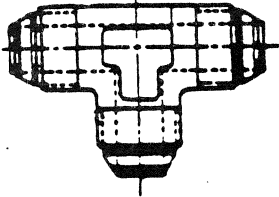
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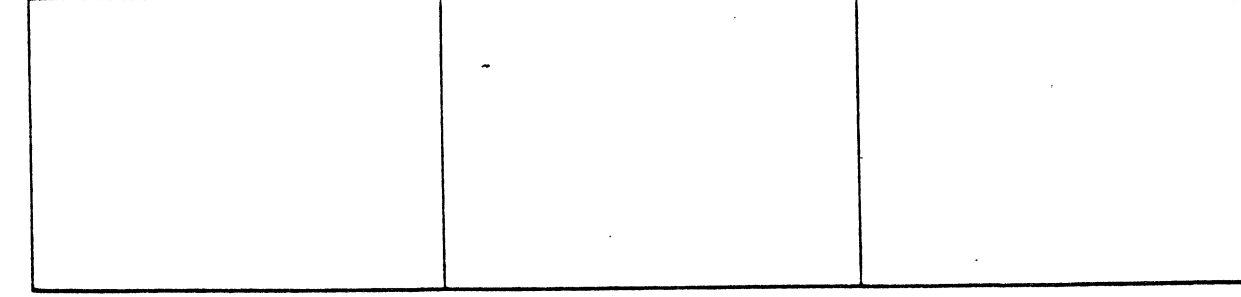
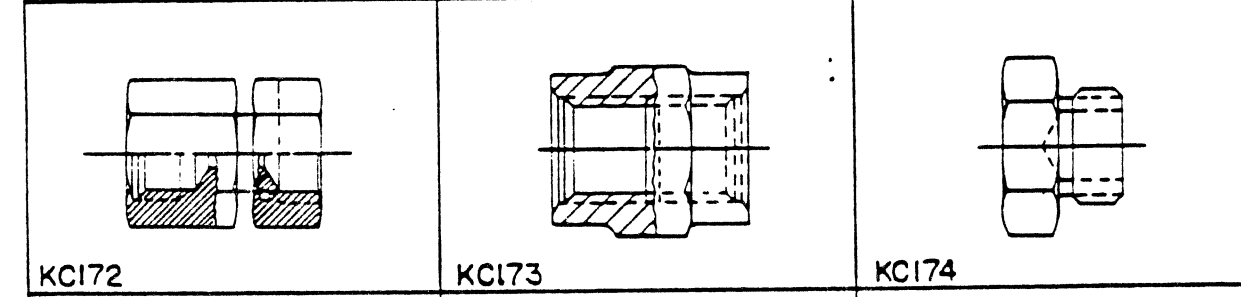
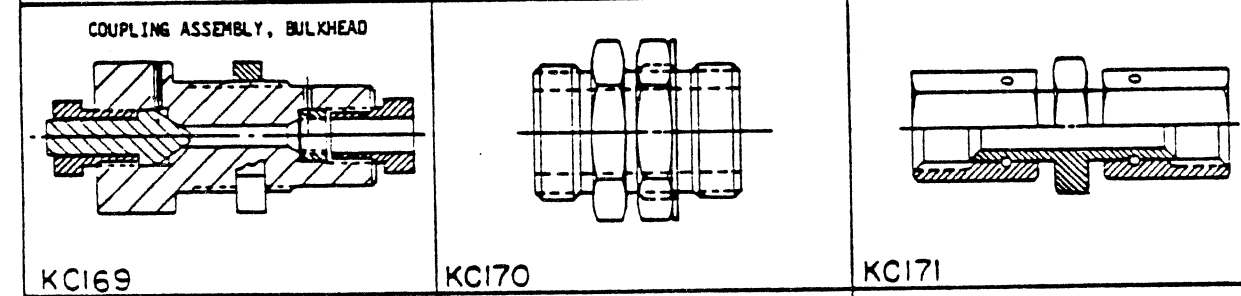
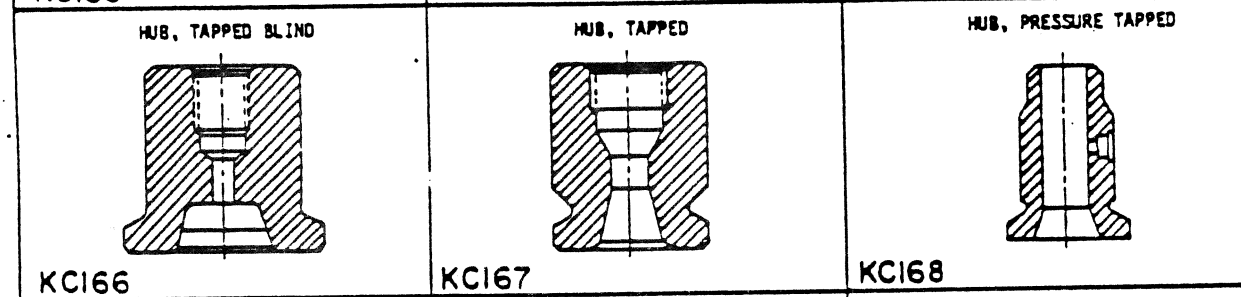
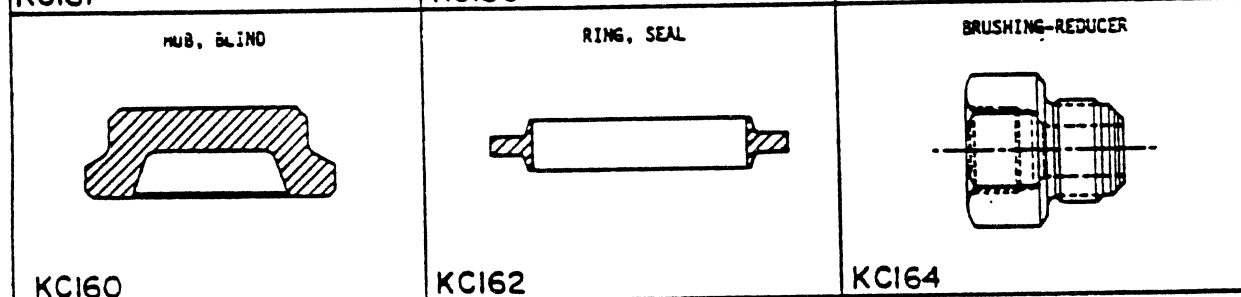
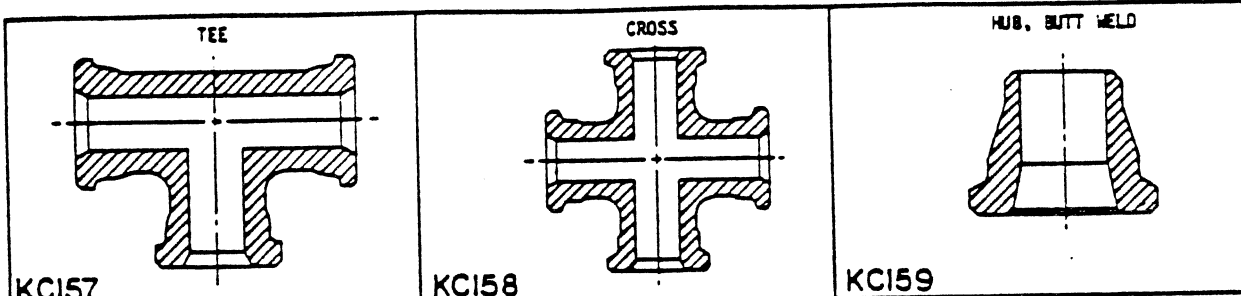
KC Fittings

<p>KC103 RING, SEAL</p> 	<p>KC106 REDUCER - ADAPTER</p> 	<p>KC107 TEE - FEMALE SWIVEL ON RUN</p> 	<p>KC108 ELBOW - 90° ADJ MALE END</p> 	<p>KC109 TEE - FEMALE SWIVEL ON LEG</p> 	<p>KC110 TEE - ADJ MALE END ON RUN</p> 	<p>KC111 TEE- ADJ MALE END ON LEG</p> 
<p>KC112 ADAPTER - BOSS TO TUBE</p> 	<p>KC113 ELBOW - 90° BULKHEAD</p> 	<p>KC114 TEE - BULKHEAD ON RUN</p> 	<p>KC115 BUSHING - EXPANDER</p> 	<p>KC116 NIPPLE - TUBE TO PIPE</p> 	<p>KC117 CROSS</p> 	<p>KC118 ELBOW - 90°</p> 
<p>KC119 TEE - INTERNAL THREAD ON RUN</p> 	<p>KC120 TEE - INTERNAL THREAD ON LEG</p> 	<p>KC121 TEE - PIPE THREAD ON RUN</p> 	<p>KC122 TEE - PIPE THREAD ON LEG</p> 	<p>KC123 TEE</p> 	<p>KC124 UNION - 3/8" BULKHEAD</p> 	<p>KC125 REDUCER</p> 
<p>KC126 UNION</p> 	<p>KC127 TEE - BULKHEAD ON LEG</p> 	<p>KC128 ELBOW - 45° BULKHEAD</p> 	<p>KC129 ELBOW - 45° ADJ MALE END</p> 	<p>KC130 PLUG</p> 	<p>KC131 ELBOW - 90° SWIVEL END</p> 	<p>KC132 ELBOW - 45° SWIVEL END</p> 
<p>KC133 REDUCER - ADAPTER AND BOSS</p> 	<p>KC134 ADAPTER - 3/8" BULKHEAD AND BOSS</p> 	<p>KC135 EXPANDER - ADAPTER BOSS TO TUBE</p> 	<p>KC142 NUT, COUPLING</p> 	<p>KC143 SLEEVE, FLARED TUBE FITTING</p> 	<p>KC144 REDUCER - 3/8" BULKHEAD</p> 	<p>KC145 SPUD, BUTTWELD</p> 
<p>KC146 UNION, BUTTWELD</p> 	<p>KC147 ELBOW - 90° BUTTWELD</p> 	<p>KC148 TEE - BUTTWELD</p> 	<p>KC149 ELBOW - 45° BUTTWELD</p> 	<p>KC150 CAP ASSEMBLY</p> 	<p>KC151 SPUD, REDUCER-ADAPTER BUTTWELD</p> 	<p>KC152 UNION, REDUCER BUTTWELD</p> 
<p>KC153 CROSS - BUTTWELD</p> 	<p>KC164 BUSHING - REDUCER</p> 	<p>KC170 UNION, MALE - ADJ MALE END</p> 	<p>KC171 UNION - DOUBLE FEMALE SWIVEL</p> 	<p>KC172 ADAPTER, FEMALE BOSS TO SWIVEL</p> 	<p>KC173 COUPLING - TUBE</p> 	<p>KC174 PLUG - HEX HEAD</p> 
<p>KC175 ORIFICE, UNION</p> 	<p>KC176 ORIFICE, UNION BULKHEAD</p> 					

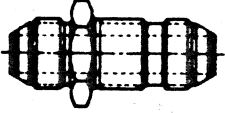
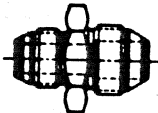
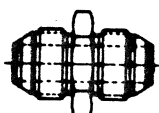
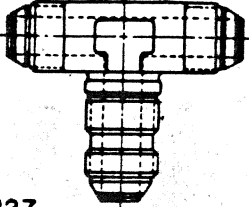
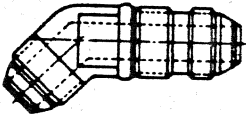
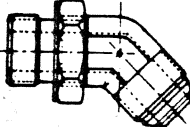
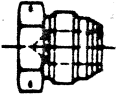
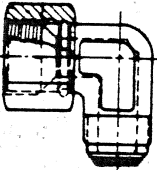
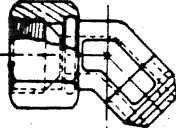
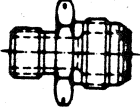
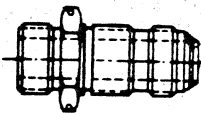
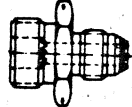
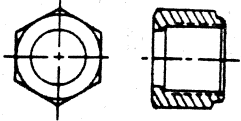

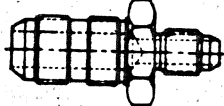
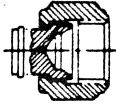
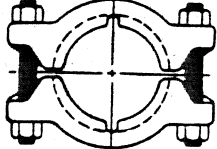
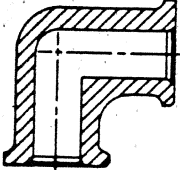
PICTORIAL INDEX

<p>REDUCER-ADAPTER</p>  <p>KC 106</p>	<p>TEE-FEMALE SWIVEL</p>  <p>KC 107</p>	<p>EL-ADJUSTABLE</p>  <p>KC 108</p>
<p>TEE-FEMALE SWIVEL</p>  <p>KC 109</p>	<p>TEE-MALE ADJ.</p>  <p>KC 110</p>	<p>TEE MALE ADJ.</p>  <p>KC 111</p>
<p>ADAPTER-BOSS-TO-TUBE</p>  <p>KC 112</p>	<p>EL-90° BLKD</p>  <p>KC 113</p>	<p>TEE-BLKD</p>  <p>KC 114</p>
<p>BUSHING-EXPANDER</p>  <p>KC 115</p>	<p>NEPPL-PIPE TO PIPE</p>  <p>KC 116</p>	<p>CROSS</p>  <p>KC 117</p>
<p>EL-90°</p>  <p>KC 118</p>	<p>TEE-INTERNAL THD ON RUN</p>  <p>KC 119</p>	<p>TEE-INTERNAL THD ON SIDE</p>  <p>KC 120</p>
<p>TEE-PIPE THD ON RUN</p>  <p>KC 121</p>	<p>TEE-PIPE THD ON SIDE</p>  <p>KC 122</p>	<p>TEE</p>  <p>KC 123</p>

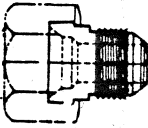
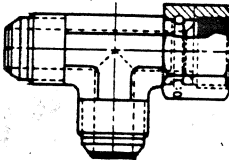
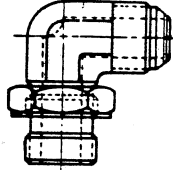
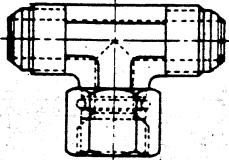
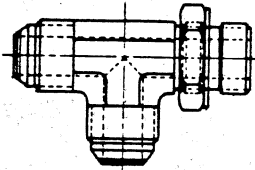
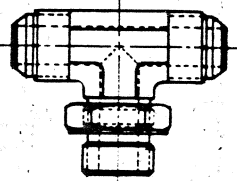
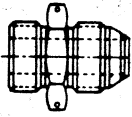
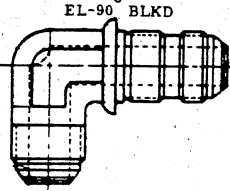
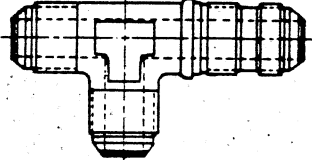
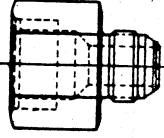
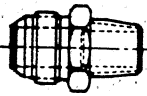
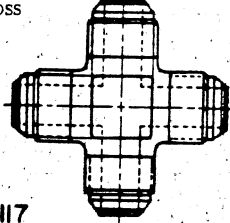
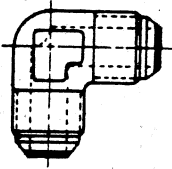
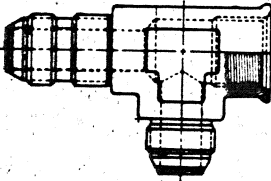
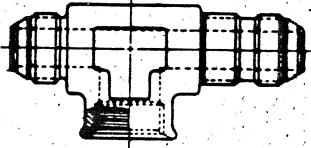
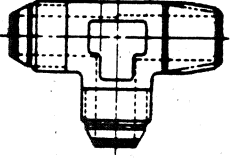
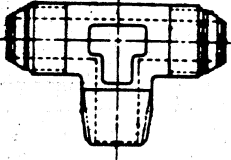
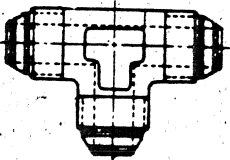
PICTORIAL INDEX



PICTORIAL INDEX

<p>UNION-3/8 BLKD</p>  <p>KC124</p>	<p>REDUCER</p>  <p>KC125</p>	<p>UNION</p>  <p>KC126</p>
<p>TEE BLKD</p>  <p>KC127</p>	<p>EL-45°</p>  <p>KC128</p>	<p>EL-45°, MALE ADJ.</p>  <p>KC129</p>
<p>PLUG</p>  <p>KC130</p>	<p>EL-90°, SWIVEL END</p>  <p>KC131</p>	<p>EL-45°, SWIVEL END</p>  <p>KC132</p>
<p>REDUCER-ADAPTER AND BOSS</p>  <p>KC133</p>	<p>ADAPTER-3/8 BLKD & BOSS</p>  <p>KC134</p>	<p>EXPANDER-ADAPTER BOSS-TO-TUBE</p>  <p>KC135</p>
<p>NUT, COUPLING</p>  <p>KC142</p>	<p>SLEEVE, FLARED TUBE FITTING</p>  <p>KC143</p>	<p>REDUCER-3/8 BLKD</p>  <p>KC144</p>
<p>CAP ASBY.</p>  <p>KC150</p>	<p>CLAMP ASSEMBLY</p>  <p>KC155</p>	<p>ELBOW, 90°</p>  <p>KC156</p>

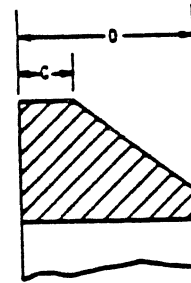
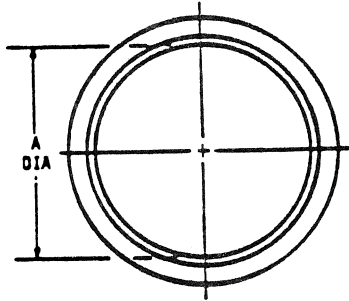
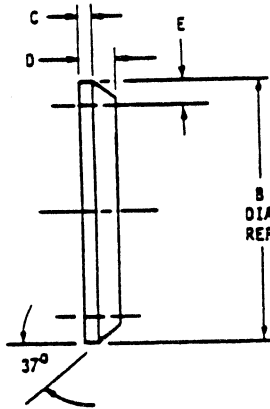
PICTORIAL INDEX

<p>REDUCER-ADAPTER</p>  <p>KC 106</p>	<p>TEE-FEMALE SWIVEL</p>  <p>KC 107</p>	<p>EL-ADJUSTABLE</p>  <p>KC 108</p>
<p>TEE-FEMALE SWIVEL</p>  <p>KC 109</p>	<p>TEE-MALE ADJ.</p>  <p>KC 110</p>	<p>TEE MALE ADJ.</p>  <p>KC 111</p>
<p>ADAPTER-BOSS-TO-TUBE</p>  <p>KC 112</p>	<p>EL-90° BLKD</p>  <p>KC 113</p>	<p>TEE-BLKD</p>  <p>KC 114</p>
<p>BUSHING-EXPANDER</p>  <p>KC 115</p>	<p>NIPPLE-TUBE TO PIPE</p>  <p>KC 116</p>	<p>CROSS</p>  <p>KC 117</p>
<p>EL-90°</p>  <p>KC 118</p>	<p>TEE-INTERNAL THD ON RUN</p>  <p>KC 119</p>	<p>TEE-INTERNAL THD ON SIDE</p>  <p>KC 120</p>
<p>TEE-PIPE THD ON RUN</p>  <p>KC 121</p>	<p>TEE-PIPE THD ON SIDE</p>  <p>KC 122</p>	<p>TEE</p>  <p>KC 123</p>



National Aeronautics and
Space Administration
John F. Kennedy Space Center
Kennedy Space Center Florida 32894
AC 305 867 2468

FED SUP CLASS
5330



ENLARGED SECTION

DASH NO.	TUBE OD REF	NOTE 2				
		A DIA	B DIA REF	C DIM ±.0015	D DIM +.003 - .001	E DIM ±.001
-4	1/4	.210	.251	.0364	.0523	.013
-6	3/8	.326	.391			
-8	1/2	.440	.505			
-10	5/8	.545	.610	.0335	.0673	.030
-12	3/4	.670	.735			
-16	1	.953	1.018			
-20	1-1/4	1.180	1.261	.0256	.070	.038
-24	1-1/2	1.430	1.511			
-28	1-3/4	1.660	1.765			
-32	2	1.910	2.015	.0319	.0890	.048

MATERIAL: ----- Tetrafluoroethylene Resin (Teflon)
 FINISH: -----
 INSPECTION: ----- } Per MIL-R-8791
 PACKAGING & MARKING: ----- }

- NOTES:
1. Dimensions are in inches, tolerances as specified, and angle $\pm 1/2^\circ$.
 2. Dimensions are free state dimensions.
 3. Referenced documents shall be of the issue in effect on the date of invitation for bid.
 4. This standard takes precedence over documents specified herein.

EXAMPLE OF PART NO. KC103-4-Seal Ring for -4 Fitting End

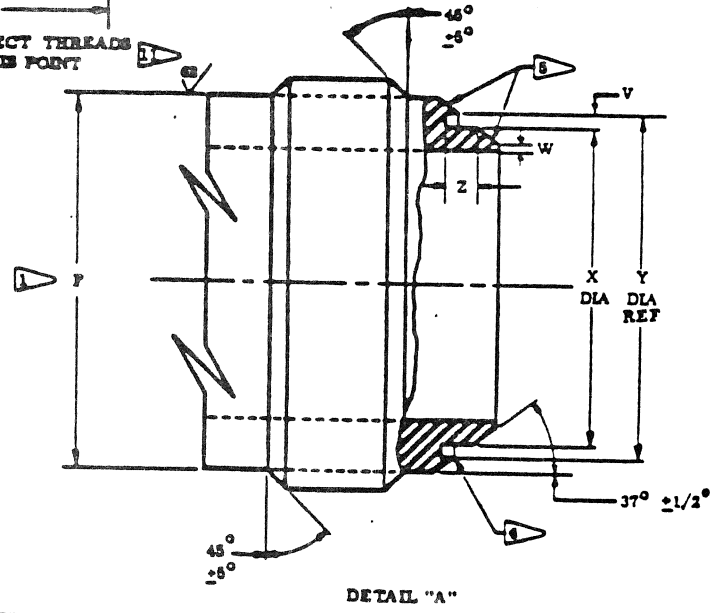
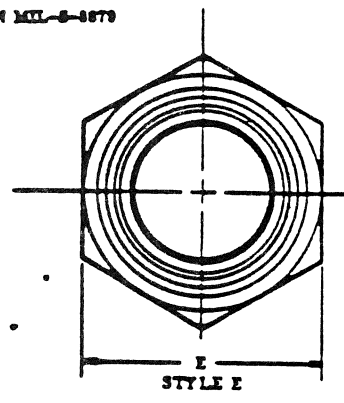
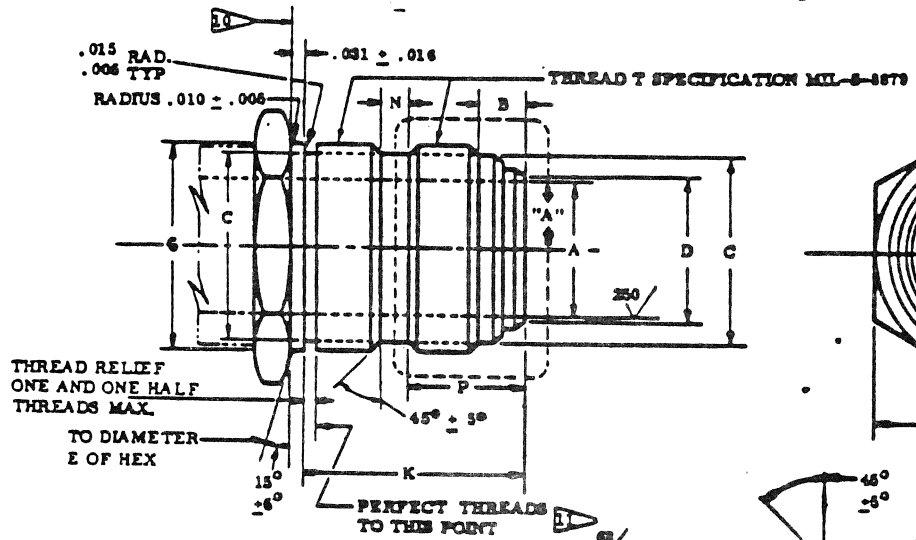
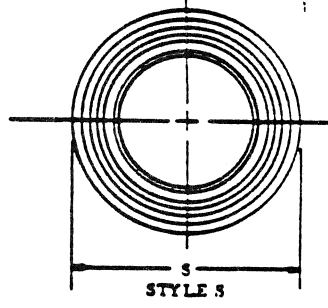
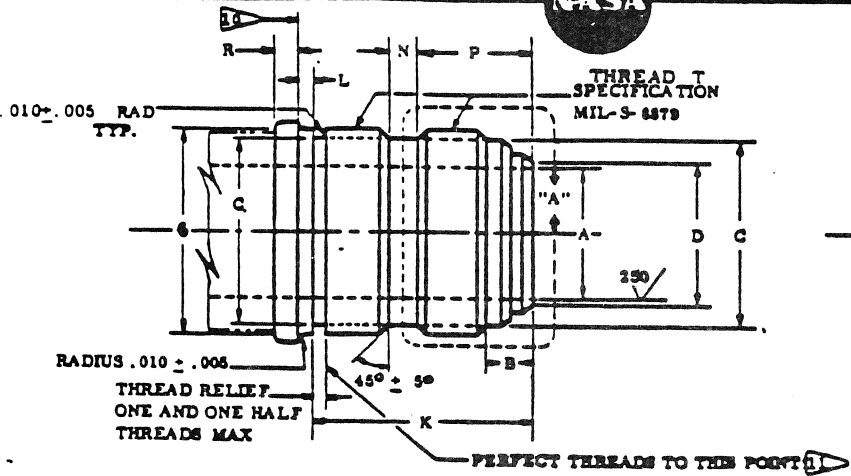
CUSTODIAN		JOHN F. KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION	TITLE	STANDARD PART	
See Notes	SEAL RING	KC103	
COORDINATION STATUS		SHEET 1 OF 1	
KSC DE			

APPROVED: 5-10-65
 REVISED: 11-8-67 (A) 12-18-68 (B) 3-25-75 (C) 12-1-75

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FED SUP CLASS
NONE



APPROVED 8-10-65 REVISED (A) 12-20-66 (B) 1-15-68 (C) 11-3-75

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CUSTODIAN JOHN F. KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION NONE	TITLE FITTING END, STANDARD DIMENSIONS FOR BULKHEAD FLARED TUBE CONNECTION FOR SEAL RING.
COORDINATION STATUS KSC DE	DESIGN STANDARD KC104
	SHEET 1 OF 1

NOTICE: When Gov't data, specs., or other data are used for any purpose other than in connection with a definitely related Gov't. procurement operation, the U. S. Gov't. thereby incurs no responsibility, nor any obligation whatsoever; and the fact that the Gov't. may have furnished, furnished, or in any way supplied the said data, specs., or other data is not to be regarded as an implication or otherwise as in any manner licensing the holder or any other person or corp., or conveying any rights or permission to manufacture, use, or sell any patented invention that may be in any way be related thereto.

EQUIV-TUBE ALENT TUBE SIZE DASH NO.	THREAD T MIL-S-8879	A DIA	B + .000 - .045 DIA	C + .003 - .005 DIA	D + .003 - .003 DIA	E	G		K + .000 - .045	L + .016 - .000	N + .010 - .000	P + .000 - .045	R + .016	S DIA + .016	V + .0015 - .0010	W MIN	X REF	Y REF	Z + .001
							MAX	MIN											
-4	1/4 4375-20-UNJF-3A	.172 + .003 - .004	.208 + .000 - .045	.359 + .000 - .005	.193 + .003 - .003	.488	.438 + .002 - .003	.428 + .002 - .003	.026	.094	.140	.448 + .000 - .045	.125 + .016	.562 + .016	.020	.0075	.220	.261	.533
-6	3/8 5625-18-UNJF-3A	.287	.213 + .000 - .045	.476 + .000 - .005	.318 + .003 - .003	.813 + .003 - .004	.481 + .002 - .003	.554 + .002 - .003	1.104		.156	.481 + .000 - .045	.141 + .016	.688 + .016		.007	.336	.401	.683
-8	1/2 7500-16-UNJF-3A	.391 + .004	.268 + .000 - .045	.654 + .000 - .005	.426 + .003 - .003	1.000	.660 + .002 - .003	.741 + .002 - .003	1.280		.187	.670 + .000 - .045	.156 + .016	.875 + .016		.014	.450	.515	.683
-10	5/8 8750-14-UNJF-3A	.484	.281 + .000 - .045	.767 + .000 - .005	.539 + .003 - .003	1.125	.773 + .002 - .003	.865 + .002 - .003	1.401		.219	.628 + .000 - .045	.172 + .016	1.000 + .016	.032	.024	.560	.625	.683
-12	3/4 1.0625-12-UNJ-3A	.608 + .005	.330 + .007 - .005	.938 + .007 - .005	.664 + .003 - .003	1.375	.945 + .002 - .003	1.062 + .002 - .003	1.572		.334	.737 + .000 - .045		1.188 + .016		.023	.685	.750	.683
-16	1 1.3125-12-UNJ-3A	.844 + .007 - .005		1.188 + .007 - .005	.913 + .003 - .003	1.625	1.195 + .002 - .003	1.312 + .002 - .003		.125				1.438 + .016	.020	.966	1.033	.683	
-20	1-1/4 1.4250-12-UNJ-3A	1.078 + .008	.382 + .008	1.508 + .008	1.147 + .008	1.875	1.507 + .008	1.625 + .008	1.819			.789	.188	1.750 + .016	.029	.200	1.281	.071	
-24	1-1/2 1.8750-12-UNJ-3A	1.312 + .005	.393 + .005	1.750 + .005	1.381 + .005	2.125	1.750 + .005	1.884 + .005	1.933			.800		2.000 + .016	.029	1.450	1.531	.071	
-28	1-3/4 2.2500-12-UNJ-3A	1.547 + .010	.468 + .010	2.125 + .010	1.646 + .010	2.500	2.131 + .010	2.230 + .010	1.791			.873		2.375 + .016	.044	1.690	1.780	.090	
-32	2 2.5000-12-UNJ-3A	1.781 + .005	.478 + .005	2.375 + .005	1.880 + .005	2.750	2.381 + .005	2.489 + .005	1.918			.893		2.625 + .016	.044	1.940	2.040	.090	

- NOTES:
- Groove formed shall be smooth and free of all thread marks.
 - On style B fitting and the L dimension provides for a washer to form backing face against bulkhead and a .031 inch land for positioning in bulkhead. On style Z fitting and no washer is required.
 - Remove all burrs and slivers. Break sharp edges unless otherwise noted.
 - Dimensions in inches unless otherwise specified.
 - This surface shall be free of burrs, longitudinal and spiral tool marks and shall be smooth, except that annular tool marks will be allowed to 64 microinches AA max.
 - Leave groove corners and edges .005 max. radius. Finish groove to 64 microinches AA max.
 - Dimensions C, D, F, and X shall be concentric with each other and with all elements of the 37° angle conical surface measured and calculated as included angles within .005 T.I.R.
 - Note Cancelled.
 - T (thread pitch dia.) shall be concentric to dimension "C" within .015 T.I.R.
 - Squareness between thread pitch diameter and face of hex on style Z or face of shoulder on style B fitting ends shall not exceed .005 for sizes dash 10 and smaller or .008 for larger sizes, when measured at the outer diameter of the face.
 - Chamfer 45° ± 5° optional.
 - Roughness of machined surfaces shall be 125AA max. per ANSI B46.1 unless otherwise specified.

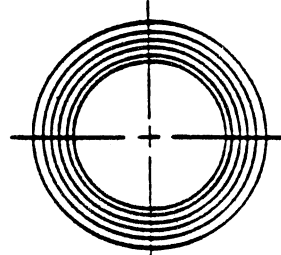
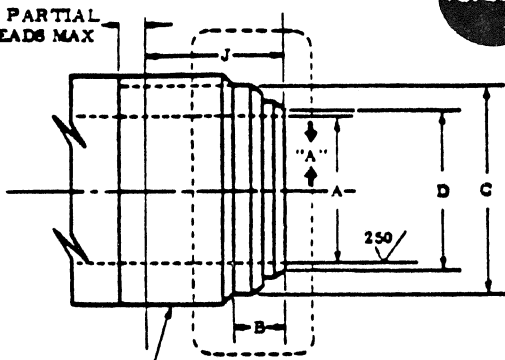
REVISION: C 11-3-75

APPROVED: 5-16-65

CUSTODIAN: JOHN F. KENNEDY SPACE CENTER		DESIGN STANDARD	
PROCUREMENT SPECIFICATION: NONE	TITLE: FITTING END, STANDARD DIMENSIONS FOR BULKHEAD FLARED TUBE CONNECTION FOR SEAL RING.		KC104
COORDINATION STATUS: KSC DE			SHEET 2 OF 3

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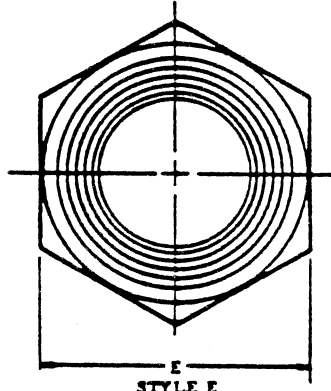
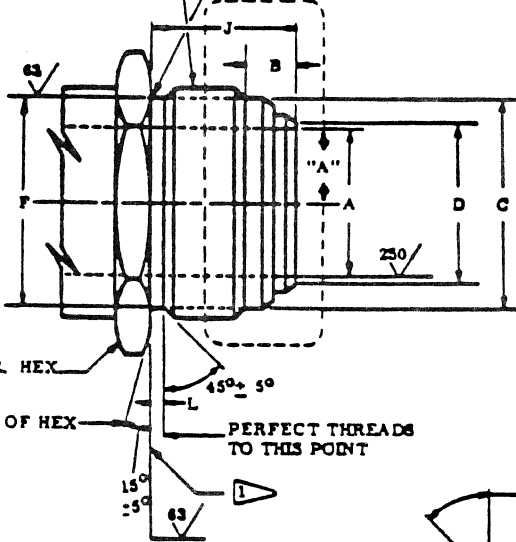
TWO PARTIAL
THREADS MAX



STYLE G

THREAD T
SPECIFICATION
MIL-S-8879

.031 \pm .000 RAD
.018

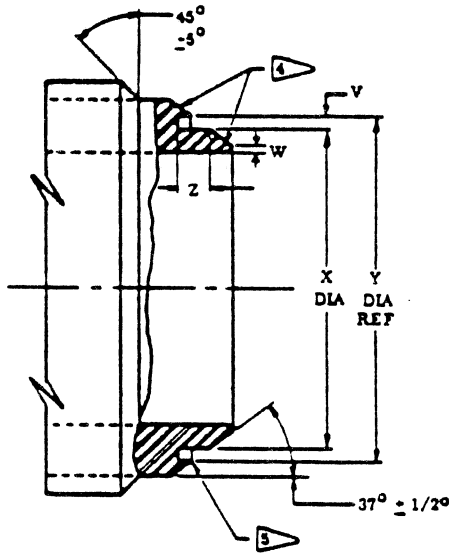


STYLE E

SHOULDER, HEX
OR BODY

TO DIA E OF HEX

PERFECT THREADS
TO THIS POINT



DETAIL "A"

FED SUP CLASS
NONE

APPROVED 5-10-85 REVISED A 12-20-88 B 1-16-89 C 11-3-75

CUSTODIAN

JOHN F. KENNEDY SPACE CENTER

PROCUREMENT SPECIFICATION
NONE

TITLE FITTING END, STANDARD
DIMENSIONS FOR FLARED TUBE
CONNECTION FOR SEAL RING

DESIGN STANDARD

KC105

COORDINATION STATUS

KSC DE

SHEET 1 OF 2

FED SUP CLASS
NONE

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EQUIV- ALENT TUBE SIZE DASH NO.	TUBE OD REF	THREAD T MIL-S-8878	A DIA	B	C DIA	D DIA	E	F	J	L	V	W	X	Y	Z
-4	1/4	.4375-20-UNJF-3A	.172 +.003 -.004	.208	.359	.193	.686	.364	.565	.075	.020	.0075	.220	.261	.0533
-6	3/8	.5625-18-UNJF-3A	.297	.213	.476	.318	.813	.481	.571	.083		.007	.336	.401	
-8	1/2	.7500-16-UNJF-3A	.391 +.004	.288	.654	.426	1.006 +.003 -.004	.660	.872	.094	.032	.014	.456	.515	.0643
-10	5/8	.8750-14-UNJF-3A	.484	.281	.787	.539	1.125	.773	.773	.107		.024	.560	.625	
-12	3/4	1.0625-12-UNJ-3A	.609 +.005	.336	.938	.864	1.375	.945	.879			.023	.685	.750	
-16	1	1.3125-12-UNJ-3A	.844 +.007 -.005	.382	1.188	.913	1.625 +.016	1.195	.926				.868	1.033	
-20	1-1/4	1.6250-12-UNJ-3A	1.078 +.008	.393	1.601	1.147	1.875	1.507	.973	.135	.046	.029	1.200	1.281	.071
-24	1-1/2	1.8750-12-UNJ-3A	1.312 +.010	.466	1.760	1.381	2.125	1.756	1.098				1.450	1.531	
-28	1-3/4	2.2500-12-UNJ-3A	1.547 +.010	.476	2.125	1.646	2.600 +.020	2.131	1.223				1.608	1.790	.090
-32	2	2.5000-12-UNJ-3A	1.781 +.005	.476	2.375	1.880	2.750	2.381	1.348			.044	1.940	2.040	

NOTE: 1. Squariness between thread pitch diameter and face of hex shall not exceed .005 for sizes dash 10 and smaller or .008 for larger sizes, when measured at the outer diameter of the face.

2. Break sharp edges unless otherwise noted. Remove burrs and slivers.

3. Dimensions in inches, unless otherwise specified.

4. This surface shall be free of burrs, longitudinal and spiral tool marks and shall be smooth except that annular tool marks will be allowed to 64 microinches AA max.

5. Leave groove corners and edges .006 max radius. Finish groove to 64 microinches AA max.

6. Dimensions G, D, F, and X shall be concentric with each other, and with all elements of the 37° angle conical surface measured and calculated as included angles within .005 T.L.R.

7. Note cancelled.

8. T (thread pitch dia.) shall be concentric to dimension "C" within .015 T.L.R.

9. Roughness of machined surfaces shall be 125 AA max per ANSI B46.1 unless otherwise specified.

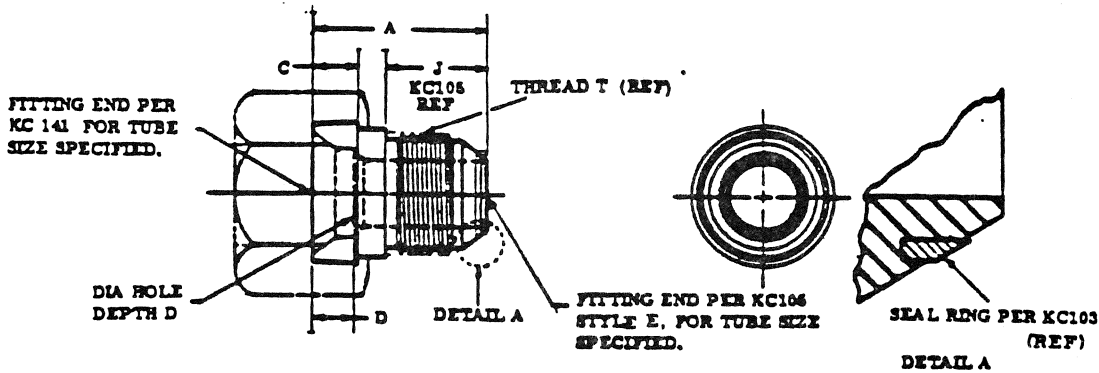
CUSTODIAN: JOHN F. KENNEDY SPACE CENTER		DESIGN STANDARD	
PROCUREMENT SPECIFICATION TITLE	FITTING END, STANDARD DIMENSIONS FOR FLARED TUBE CONNECTION FOR SEAL RING		KC 105
NONE	COORDINATION STATUS		SHEET 2 OF 2
KSC DE			

REVISED: (C) 11-3-75

APPROVED: 5-10-65



FED SUP CLASS
4730



BASE NUMBER	CONICAL END MATES WITH FITTING FOR		TUBE END		A +.000 -.075	C REF	D REF
	CRS STEEL	AL ALLOY	TUBE OD	TUBE OD THREAD T REF			
C8-4	D8-4	3/8	1/4	7/16-20	.974	.172	.219
C8-4	D8-4	1/2	3/8	9/16-18	1.006	.219	.313
C10-4	D10-4	5/8	1/2	1-1/16-12	1.036	.234	.281
C12-4	D12-4	3/4	1/4	7/16-20	1.069	.264	.313
C12-4	D12-4		3/8	9/16-18			
C12-8	D12-8	1	1/2	3/4-16	1.133	.281	.344
C16-8	D16-8		3/4	1-1/16-12	1.474		
C20-4	D20-4	1-1/4	1/2	3/4-16	1.411	.313	.438
C20-12	D20-12		3/4	1-1/16-12	1.536		.375
C20-16	D20-16	1-1/2	1	1-5/16-12	1.599	.364	.438
C24-12	D24-12		3/4	1-1/16-12	1.630		.406
C24-16	D24-16	2	1	1-5/16-12	1.663	.464	.500
C24-20	D24-20		1-1/4	1-5/8-12			1.784	.469
C32-16	D32-16	2	1	1-5/16-12	1.784	.464	.531
C32-20	D32-20		1-1/4	1-5/8-12			1.911	.531

MATERIAL: See Procurement Specification; Aluminum Alloy, Code "D";
Corrosion Resistant Steel (Class 316, Code "C").

FINISH: See Procurement Specification

SCREW THREAD: See Procurement Specification

NOTES:
1. Remove Burrs and Slivers. Break sharp edges unless otherwise noted.
2. Dimensions in inches unless otherwise specified.

3. For design feature purposes, this drawing takes precedence over procurement documents referenced herein.

4. Referenced documents shall be of the issues in effect on date of invitation for bid.

5. Marking of fittings shall be consistent with procurement specification using applicable KC Standard and part number designations as shown on this drawing.

EXAMPLE OF PART NOS. KC106C8-4 CRS Reducer-Adapter - For 1/2 OD Tube Conical Fitting End To 3/8 O D Tube

KC106D12-4 AL ALLOY Reducer-Adapter - For 3/4 O D Tube Conical Fitting End to 1/4 O D Tube.

CUSTODIAN JOHN F. KENNEDY SPACE CENTER		STANDARD PART	
PROCUREMENT SPECIFICATION KSC-F-124	REDUCER-ADAPTER, CONICAL END FITTING AND FLARED FOR SEAL RING	KC106	
COORDINATION STATUS KSC DE		SHEET 1 OF 1	

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APPROVED: 8-10-65
REVISED: A 8-12-68 B 8-16-67 C 4-15-68 D 11-3-75

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DASH NO. CRE AL STEEL ALLOY		TUBE OD REF	THREAD T REF	A DDM +.000 -.063	B DDM +.000 -.031	C DDM REF	R RAD ±.03	F PAD DDM	SWIVEL NUT		RETAINING WIRE
									FOR CRE STEEL ASSY	FOR AL ALLOY ASSY	
C4	D4	1/4	7/16-20	.906	.704	1.000	.063	.438	KC139C4	KC139D4	KC166-4
C8	D8	3/8	9/16-18	1.078	.891	1.260	.064	.563	KC139C8	KC139D8	KC166-8
C9	D9	1/2	3/4-16	1.266	.969	1.378	.128	.750	KC139C9	KC139D9	KC166-9
C10	D10	5/8	7/8-14	1.469	1.141	1.628		.878	KC139C10	KC139D10	KC166-10
C12	D12	3/4	1-1/16-12	1.672	1.264	1.750		1.063	KC139C12	KC139D12	KC166-12
C18	D18	1	1-6/16-12	1.820	1.422	2.000		1.313	KC139C18	KC139D18	KC166-18
C20	D20	1-1/4	1-5/8-12	2.078	1.704	2.313		1.628	KC139C20	KC139D20	KC166-20
C24	D24	1-1/2	1-7/8-12	2.344	1.878	2.594		1.878	KC139C24	KC139D24	KC166-24
C28	D28	1-3/4	2-1/4-12	2.866	2.063	2.900	2.266	KC139C28	KC139D28	KC166-28	
C32	D32	2	2-1/2-12	3.078	2.484	3.378	.188	2.500	KC139C32	KC139D32	KC166-32

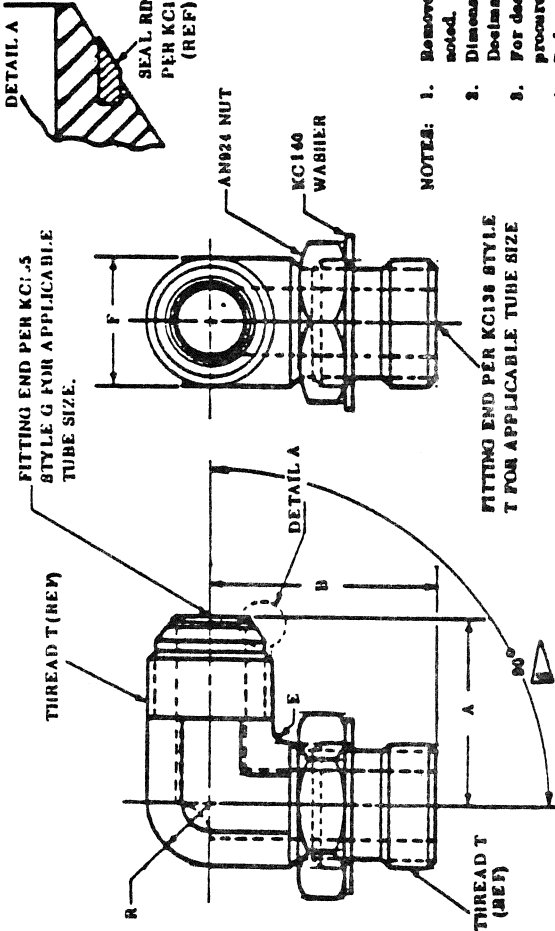
CUSTODIAN: JOHN F. KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION	TITLE
KSC-P-124	TEE -ASSY, FLARED TUBE
COORDINATION STATUS	FEMALE SWIVEL END ON RUN,
KSC DE	FOR SEAL RING
STANDARD PART	
KC107	
SHEET 2 OF 2	

APPROVED: 6-10-45 REVISED: (D) 12-1-75

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FED SUP CLASS
4730



MATERIAL: See Procurement Specification
Aluminum Alloy, Code "1P", Corrosion Resistant Steel (Class 316), Code "C"
AN924 CRES nuts may be either 304 or 316.

FINISH: See Procurement Specification

SCREW THREAD: See Procurement Specification

EXAMPLE OF KC108C4 - CRE STEEL, ELBOW - Assy for 1/4" OD Tubing.

PART NOS. KC108D18 - AL ALLOY, ELBOW - Assy for 1" OD Tubing.

- NOTES:**
1. Remove Burrs and Shivers. Break sharp edges unless otherwise noted.
 2. Dimensions in inches. Unless otherwise specified, tolerance Decimals $\pm .005$, Angles $\pm 1/2^\circ$
 3. For design feature purposes, this drawing takes precedence over procurement documents referenced herein.
 4. Referenced documents shall be of the issue in effect on date of invitation for bid.
 5. Marking of fittings shall be consistent with procurement specifications using applicable KC Standard and part number designations as shown on this drawing.
- ∇ Sizes up to and including -0 also $\pm 3 1/2^\circ$, above $-0 \pm 1 1/2^\circ$

CUSTODIAN: JOHN F. KENNEDY SPACE CENTER		STANDARD PART	
PROCUREMENT SPECIFICATION KSC-P-124	TITLE ELBOW ASSY, 90°, FLARED TUBE & MALE ADJUSTABLE END, FOR SEAL RING	KC108	
COORDINATION STATUS KSC DE		SHEET 1 OF 3	

APPROVED: 8-10-66
REVISED: A 8-12-66 B 8-18-67 C 4-15-68 D 12/11/68 E 11-3-75 F 7-13-76

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DASH NUMBER		TUBE OD REF	THREAD T REF.	A	B	E	R	F	BULKHEAD NUT		WASHER	
CHE STEEL	AL ALLOY			DTM. +.000 -.063	DDM. +.000 -.063	±.03	±.03	PAD DEM. ±.016	FOR CHE STEEL ASSY *	FOR AL ALLOY ASSY	FOR CHE STEEL ASSY	FOR AL ALLOY ASSY
C4	D4	1/4	7/16-20	.906	L.063	.063	.242	.438	AN934K4	AN934D4	KCI40C4	KCI40D4
C8	D8	3/8	9/16-18	L.078	L.261	.094	.317	.563	AN934K8	AN934D8	KCI40C8	KCI40D8
C8	D8	1/2	3/4-16	L.266	L.488		.414	.750	AN934K8	AN934D8	KCI40C8	KCI40D8
C10	D10	5/8	7/8-14	L.469	L.738	.125	.484	.878	AN934K10	AN934D10	KCI40C10	KCI40D10
C12	D12	3/4	1-1/8-12	L.673	L.969		.806	L.063	AN934K12	AN934D12	KCI40C12	KCI40D12
C16	D16	1	1-5/8-12	L.828	2.078		.719	L.328	AN934K16	AN934D16	KCI40C16	KCI40D16
C20	D20	1-1/4	1-5/8-12	2.078	2.281		.878	L.628	AN934K20	AN934D20	KCI40C20	KCI40D20
C24	D24	1-1/2	1-7/8-12	2.344	2.488	L.631	L.878	AN934K24	AN934D24	KCI40C24	KCI40D24	
C28	D28	1-3/4	2-1/4-12	2.866	2.873	L.128	2.200	AN934K28	AN934D28	KCI40C28	KCI40D28	
C32	D32	2	2-1/2-12	3.078	2.928	.180	L.263	2.909	AN934K32	AN934D32	KCI40C32	KCI40D32

CUSTODIAN		JOHN F. KENNEDY SPACE CENTER	
PROUREMENT SPECIFICATION KSC-P-124	TITLE	ELBOW ASSY, 90°, FLARED TUBE & MALE ADJUSTABLE END, FOR SEAL RING	
COORDINATION STATUS KSC DE	STANDARD PART	KCI08	
	SHEET	2 OF 2	

APPROVED: 6-10-65 REVISED (E) 11-3-75 (F) 7-13-76

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MATERIAL: See Procurement Specification, Aluminum Alloy, Code "J", Corrosion Resistant Steel (Class 316), Code "C"

FINISH: See Procurement Specification

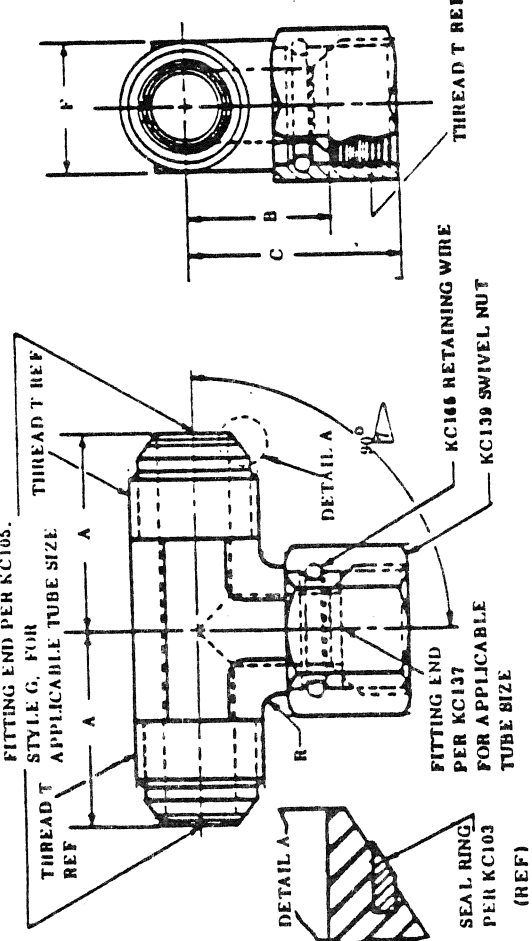
SCREW THREAD: See Procurement Specification

NOTES:

1. Remove burrs and Silvers. Break sharp edges unless otherwise noted.
2. Dimensions in inches. Unless otherwise specified, tolerance, Decimals ± .016.
3. For design feature purposes, this drawing takes precedence over procurement documents referenced herein.
4. Referenced documents shall be of the issue in effect on date of invitation for bid.
5. Marking of fittings shall be consistent with procurement specification using applicable KC Standard and part number designations as shown on this drawing.
6. When required Lockwire Holes per MC144, Style E.

REFERENCE UP TO AND INCLUDING -0.5 ± 3-1/2°, above -0 ± 1-1/2°.

"W" after dash number indicates nut with Lockwire holes. See Note 6.



EXAMPLE OF PART NOS. KC109C4 = CRE STEEL, TEE - Assy for 1/4" OD Tubing. KC109D16W = AL ALLOY, TEE - Assy for 1" OD Tubing. With Nut Drilled for Lockwire.

CODE:



FED SUP CLASS 4730

CUSTODIAN JOHN F. KENNEDY SPACE CENTER		STANDARD PART	
PROCUREMENT SPECIFICATION TITLE KSC-F-124 TEE ASSY, FLARED TUBE, FEMALE SWIVEL END ON OUTLET, FOR SEAL RING	KC109		
COORDINATION STATUS KSC DR	SHEET 1 OF 2		

APPROVED: 8-10-68 REVISED (A) 9-12-66 (B) 6-16-67 (C) 4-16-68 (D) 12-1-76



National Aeronautics and
Space Administration
John F. Kennedy Space Center
Kennedy Space Center Florida 32899
AC 315 367 2468

FED SUP CLASS
4730

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DASH NO.		TUBE OD REF.	THREAD T REF.	A DIM +.000 -.043	B DIM +.000 -.031	C DIM REF	R RAD +.03	F PAD DIM.	SWIVEL NUT		RETAINING WIRE
CRE STEEL	AL ALLOY			FOR CRE STEEL ASSY	FOR AL ALLOY ASSY						
C4	D4	1/4	7/16-20	.906	.704	1.000	.063	.438	KC139C4	KC139D4	KC165-4
C6	D6	3/8	9/16-18	1.078	.891	1.250	.094	.563	KC139C6	KC139D6	KC165-6
C8	D8	1/2	3/4-16	1.266	.949	1.375		.750	KC139C8	KC139D8	KC165-8
C10	D10	5/8	7/8-14	1.449	1.141	1.625	.125	.875	KC139C10	KC139D10	KC165-10
C12	D12	3/4	1-1/16-12	1.672	1.204	1.750		1.063	KC139C12	KC139D12	KC165-12
C16	D16	1	1-5/16-12	1.828	1.422	2.000		1.313	KC139C16	KC139D16	KC165-16
C20	D20	1-1/4	1-5/8-12	2.078	1.704	2.313		1.625	KC139C20	KC139D20	KC165-20
C24	D24	1-1/2	1-7/8-12	2.344	1.875	2.594		1.875	KC139C24	KC139D24	KC165-24
C28	D28	1-3/4	2-1/4-12	2.660	2.063	2.900		2.250	KC139C28	KC139D28	KC165-28
C32	D32	2	2-1/2-12	3.078	2.454	3.375	.188	2.500	KC139C32	KC139D32	KC165-32

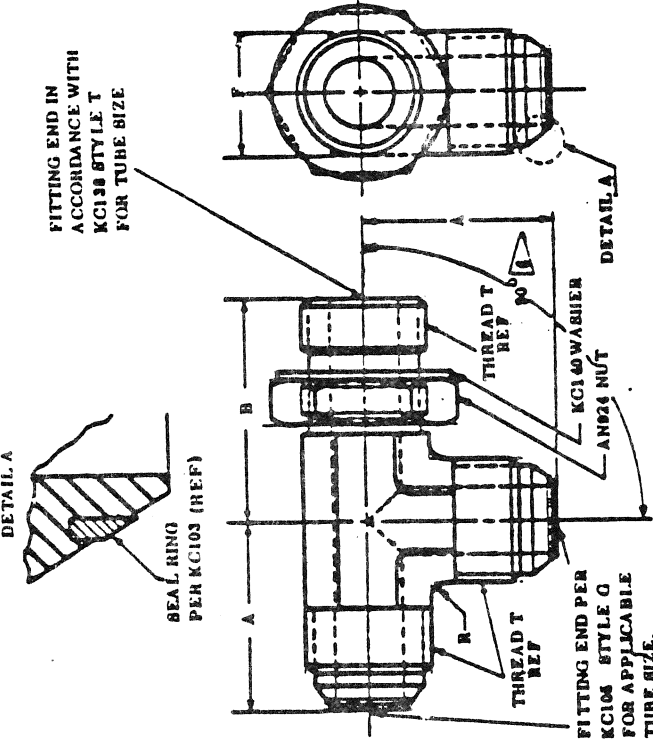
APPROVED: 5-10-65 REVISED: 12-1-75

CUSTODIAN		JOHN F. KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION	TITLE	TEE ASSY, FLARED TUBE, FEMALE SWIVEL END ON OUTLET, FOR SEAL RING	
KSC-F-124			
COORDINATION STATUS		STANDARD PART	
KSC DE		KC109	
		SHEET 2 OF 2	



FED SUP CLASS
4730

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MATERIAL: See Procurement Specification

Aluminum Alloy, Code "D"
Corrosion Resistant Steel (Class 316), Code "C"
• AN924 CHES nuts may be either 304 or 316.

FINISH: See Procurement Specification

SCREW THREAD: See Procurement Specification

NOTE:

1. Remove Burrs and Slivers. Break sharp edges unless otherwise noted.
2. Dimensions in inches unless otherwise specified.
3. For design feature purposes, this drawing takes precedence over procurement documents referenced herein. Referenced documents shall be of the issue in effect on date of invitation for bid.
4. Marking of fittings shall be consistent with procurement number designations as shown on this drawing.
5. Tolerances up to and including -6 also ± 1-1/2", above -6 also ± 1-1/2".

EXAMPLE OF PART NOS.

KCI10C4 - CHE STEEL, TEE Assy for 1/4" OD Tubing.
KCI10D16 - AL-ALLOY, TEE Assy for 1" OD Tubing.

CUSTODIAN: JOHN F. KENNEDY SPACE CENTER		STANDARD PART	
PROCUREMENT SPECIFICATION KSC-P-124	TITLE TEE-ASSY, FLARED TUBE MALE ADJUSTABLE END ON RUN, FOR RING SEAL		KCI10
COORDINATION STATUS KSC DE-			SHEET 1 OF 2

KJN-62-OT 1-28-64

APPROVED: 8-10-65
REVISED: (A) 8-15-67 (B) 6-16-67 (C) 4-16-66 (D) 12-31-66 (E) 11-3-75 (F) 7-13-76

13



National Aeronautics and Space Administration

John F. Kennedy Space Center
Kennedy Space Center Florida 32899
AC 306 887-2466

FED SUP CLASS
4730

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DASH NO.		TUBE OD REF	THREAD T REF.	A DIM. +.000 -.063	B DIM. +.000 -.063	R RAD ±.03	F PAD DIM. ±.016	BULKHEAD NUT		WASHER		
CRE STEEL	AL ALLOY							FOR CRE STEEL ASSY. *	FOR AL ALLOY ASSY.	FOR CRE STEEL ASSY.	FOR AL ALLOY ASSY.	
C4	D4	1/4	7/16-20	.966	1.063	.063	.438	AN924K4	AN924D4	KC140C4	KC140D4	
C8	D8	3/8	9/16-18	1.078	1.281	.094	.563	AN924K8	AN924D8	KC140C8	KC140D8	
C8	D8	1/2	3/4-18	1.266	1.466		.750	AN924K8	AN924D8	KC140C8	KC140D8	
C10	D10	5/8	7/8-14	1.460	1.736	.125	.875	AN924K10	AN924D10	KC140C10	KC140D10	
C12	D12	3/4	1-1/16-12	1.672	1.969		1.063	AN924K12	AN924D12	KC140C12	KC140D12	
C16	D16	1	1-5/16-12	1.828	2.079		1.313	AN924K16	AN924D16	KC140C16	KC140D16	
C20	D20	1-1/4	1-5/8-12	2.078	2.281		1.625	AN924K20	AN924D20	KC140C20	KC140D20	
C24	D24	1-1/2	1-7/8-12	2.344	2.422		1.875	AN924K24	AN924D24	KC140C24	KC140D24	
C28	D28	1-3/4	2-1/4-12	2.660	2.813		2.250	AN924K28	AN924D28	KC140C28	KC140D28	
C32	D32	2	2-1/2-12	3.078	3.228		.188	2.500	AN924K32	AN924D32	KC140C32	KC140D32

APPROVED: 5-10-65 REVISED: E II-3-75 (F) 7-13-76

CUSTODIAN JOHN F. KENNEDY SPACE CENTER		STANDARD PART	
PROCUREMENT SPECIFICATION TITLE KSC-F-124	TEE-ASSY, FLARED TUBE MALE ADJUSTABLE END ON RUN, FOR RING SEAL		KC110
COORDINATION STATUS KSC DE			SHEET 2 OF 2



FED SUP CLASS
4730

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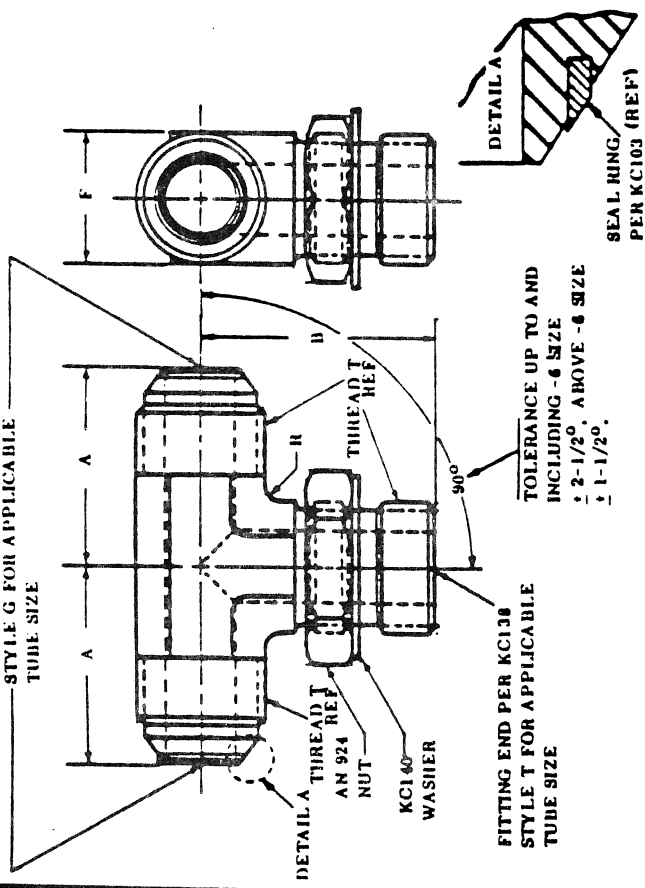
MATERIAL: See Procurement Specification; Corrosion Resistant Steel (Class 316), Code "C"; Aluminum Alloy, Code "D"

FINISH: AN921 (REF) nuts may be either 304 or 316. See Procurement Specification

SCREW THREAD: See Procurement Specification

- NOTES:**
1. Remove burrs and slivers. Break sharp edges unless otherwise noted.
 2. Dimensions in inches. Unless otherwise specified, tolerance Decimals $\pm .005$.
 3. For design feature purposes, this drawing takes precedence over procurement documents referenced herein.
 4. Referenced documents shall be of the issue in effect on date of invitation for bid.
 5. Marking of fittings shall be consistent with procurement specification using applicable KC Standard and Part number designations as shown on this drawing.

EXAMPLE OF PART NOS.
KC111C4 = Adj. End on Outlet TEE for 1/4 OD Tubing, Corrosion Resistant Steel
KC111D4 = Adj. End on Outlet TEE for 1/4 OD Tubing, Aluminum Alloy



CUSTODIAN JOHN F. KENNEDY SPACE CENTER		STANDARD PART	
PROCUREMENT SPECIFICATION KSC-F-124	TITLE TEE ASSY, FLARED TUBE MALE ADJUSTABLE END ON OUTLET, FOR SEAL RING	KC 111	
COORDINATION STATUS		SHEET 1 OF 2	
KSC DB			

APPROVED 8-10-65 REVISED (A) 9-12-66 (B) 6-16-67 (C) 4-1-68 (D) 12-31-68 (E) 11-3-75 (F) 7-13-76

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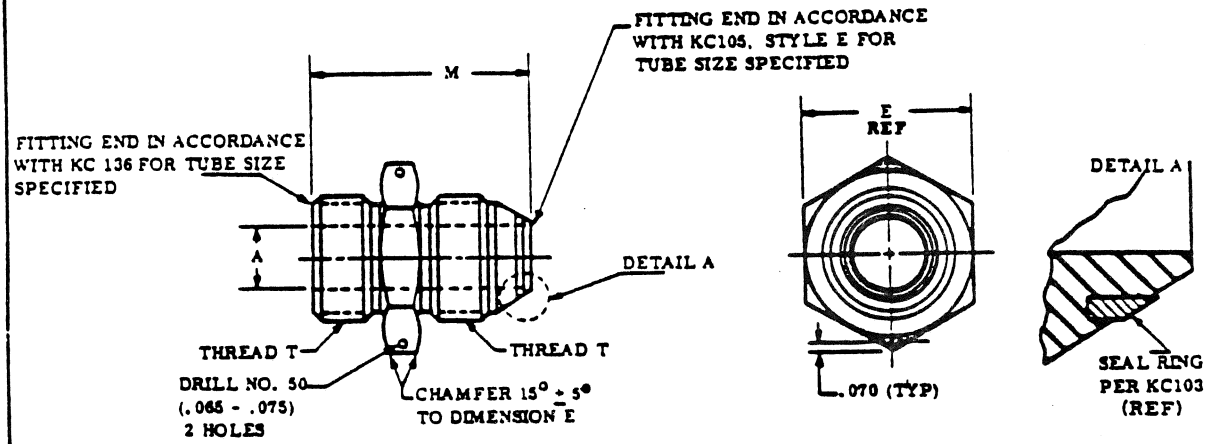
DASH NO.		TUBE OD REF	THREAD T REF.	A DEM. +.000 -.063	B DEM +.000 -.063	R RAD +.03	F PAD DEM +.016	BULKHEAD NUT		WASHER		
CRE STEEL	AL ALLOY							FOR CRE STEEL ASSY*	FOR AL ALLOY ASSY	FOR CRE STEEL ASSY	FOR AL ALLOY ASSY	
C4	D4	1/4	7/16-20	.906	1.063	.063	.438	AN924K4	AN924D4	KC140C4	KC140D4	
C6	D6	3/8	9/16-18	1.078	1.281	.094	.563	AN924K6	AN924D6	KC140C6	KC140D6	
C8	D8	1/2	3/4-16	1.266	1.485		.750	AN924K8	AN924D8	KC140C8	KC140D8	
C10	D10	5/8	7/8-14	1.469	1.735	.125	.875	AN924K10	AN924D10	KC140C10	KC140D10	
C12	D12	3/4	1 1/16-12	1.672	1.969		1.063	AN924K12	AN924D12	KC140C12	KC140D12	
C16	D16	1	1-5/16-12	1.828	2.078		1.313	AN924K16	AN924D16	KC140C16	KC140D16	
C20	D20	1-1/4	1-5/8-12	2.078	2.281		1.625	AN924K20	AN924D20	KC140C20	KC140D20	
C24	D24	1-1/2	1-7/8-12	2.344	2.422		1.875	AN924K24	AN924D24	KC140C24	KC140D24	
C28	D28	1-3/4	2-1/4-12	2.860	2.813		2.250	AN924K28	AN924D28	KC140C28	KC140D28	
C32	D32	2	2-1/2-12	3.078	2.922		.188	2.500	AN924K32	AN924D32	KC140C32	KC140D32

APPROVED: 5 10-65 REVISED: E 11 3-75 (F) 7-13-76

CUSTODIAN: JOHN F. KENNEDY SPACE CENTER		STANDARD PART	
PROCUREMENT SPECIFICATION KSC-F-124	TITLE TEE ASSY, FLARED TUBE MALE ADJUSTABLE END ON OUTLET, FOR SEAL RING	KC III	
COORDINATION STATUS KSC DE		SHEET 2 OF 2	



FED SUP CLASS
4730



DASH NO.		TUBE OD REF	THREAD T REF	A (REF)	E (REF)	M
CRE STEEL	AL ALLOY					
C4	D4	1/4	7/16-20	.172	.688	1.234
C6	D6	3/8	9/16-18	.297	.813	1.328
C8	D8	1/2	3/4-16	.391	1.000	1.516
C10	D10	5/8	7/8-14	.484	1.125	1.687
C12	D12	3/4	1-1/16-12	.609	1.375	1.922
C16	D16	1	1-5/16-12	.844	1.625	1.999
C20	D20	1-1/4	1-5/8-12	1.078	1.875	2.094
C24	D24	1-1/2	1-7/8-12	1.312	2.125	2.266
C28	D28	1-3/4	2-1/4-12	1.546	2.500	2.547
C32	D32	2	2-1/2-12	1.780	2.750	2.766

MATERIAL: See Procurement Specification
 Aluminum Alloy, Code "D"
 Corrosion Resistant Steel (Class 316), Code "C"

FINISH: See Procurement Specification

SCREW THREAD: See Procurement Specification

NOTES:

1. Remove Burrs and Slivers. Break sharp edges unless otherwise noted.
2. Dimensions in inches. Unless otherwise specified, tolerance Decimals ± .005.
3. For design feature purposes, this drawing takes precedence over procurement documents referenced herein.
4. Referenced documents shall be of the issue in effect on date of invitation for bid.
5. Marking of fittings shall be consistent with procurement specification using applicable KC Standard and part number designations as shown on this drawing.

EXAMPLE OF PART NOS. KC112C4 = Adapter, 1/4 OD Tubing, Corrosion Resistant Steel
 KC112D8 = Adapter, 1/2 OD Tubing, Aluminum Alloy

CUSTODIAN JOHN F. KENNEDY SPACE CENTER		STANDARD PART	
PROCUREMENT SPECIFICATION KSC-F-124	TITLE ADAPTER, FLARED TUBE & BOSS FOR SEAL RING	KCI12	
COORDINATION STATUS		SHEET 1 OF 1	
KSC DE			

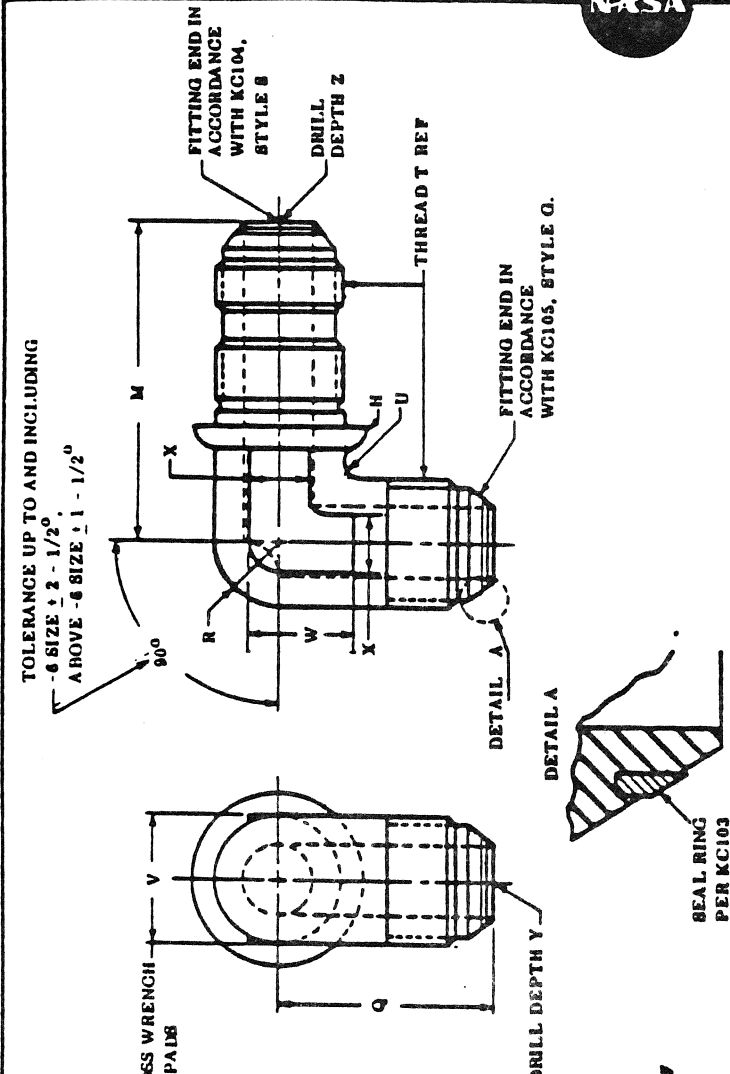
REVISED: (A) 9-12-66 (B) 6-16-67 (C) 4-15-68 (D) 11-3-75
 APPROVED 8-10-65

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FED SUP CLASS
4730



MATERIAL: See Procurement Specification
Aluminum Alloy, Code "J"
Corrosion Resistant Steel
(Class 316), Code "C"

FINISH: See Procurement Specification

SCREW THREAD: See Procurement Specification

NOTES:

1. Remove Burrs and Silvers. Break sharp edges unless otherwise noted.
2. Dimensions in inches. Unless otherwise specified, tolerance Decimals ±.016.
3. For design feature purposes, this drawing takes precedence over procurement documents referenced herein.
4. Referenced documents shall be of the issue in effect on the date of invitation for bid.
5. Markings of fittings shall be consistent with procurement specification using applicable KC Standard and part number designations as shown on this drawing.
6. Installation to be in accordance with AND1004

EXAMPLE OF KC113C8 Elbow 1/8 OD Tubing. CRES
PART NOS. KC113D8 Elbow 1/8 OD Tubing. Al Alloy

DASH NO.	AL ALLOY	TUBE OD REF	THREAD T (REF)	M RAD	Q	R RAD	U RAD	V	W APPROX.	X APPROX.	Y	Z
C4	D4	1/4	7/16-20	.043	1.028	.810	.003	.438	.876	.259	+.047 -.000	+.047 -.000
C6	D6	3/8	9/16-16		1.844	.861	.004	.543	.600	.313	1.109	1.020
C8	D8	1/2	3/4-16		2.141	1.391	.375	.760	.635	.438	1.375	2.125
C10	D10	5/8	7/8-14		2.432	1.584	.438	.875	.750	.500	1.641	2.469
C12	D12	3/4	1-1/16-12	.004	2.703	1.813	.531	1.003	.875	.500	1.859	2.750
C16	D16	1	1-5/16-12		2.928	1.969	.656	1.313	1.003	.625	2.016	2.875
C20	D20	1-1/4	1-5/8-12		3.156	2.203	.813	1.635	1.250	.750	2.201	3.234
C24	D24	1-1/2	1-7/8-12		3.493	2.375	.938	1.875	1.438	.875	2.484	3.609
C28	D28	1-3/4	2-1/4-12		3.828	2.641	1.125	2.250	1.750	1.063	2.701	4.063
C32	D32	2	2-1/2-12		4.141	2.923	1.350	2.643	1.938	1.188	2.938	4.453

CUSTOMER: JOHN F. KENNEDY SPACE CENTER

PROCUREMENT SPECIFICATION TITLE: **ELBOW, FLARED TUBE BULKHEAD UNIVERSAL 90° FOR SEAL RING.**

KSC-F-124

COORDINATION STATUS

KSC DE

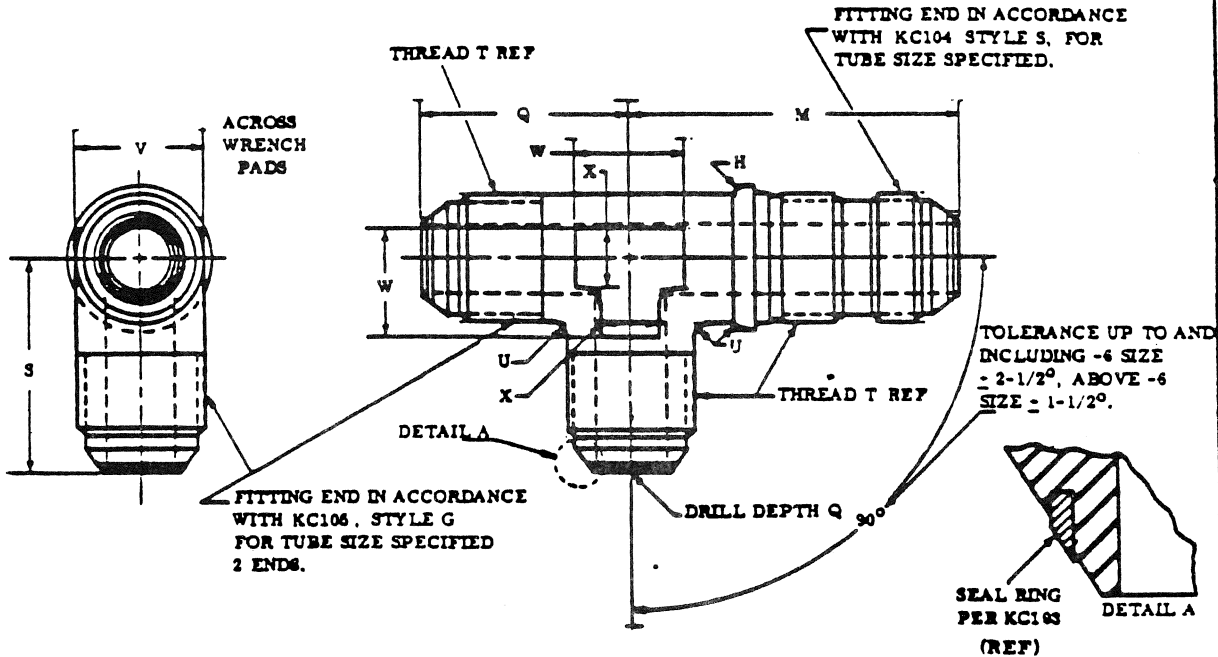
STANDARD PART: **KC113**

SHEET 1 OF 1

APPROVED 5-10-66 REVISED (A) 9-12-67 (B) 6-16-67 (C) 10-23-67 (D) 4-15-68 (E) 11-3-75



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4730



DASH NO.		TUBE OD REF	THREAD T REF	H RAD	M +.000 -.047	Q +.000 -.047	S +.047 -.000	U RAD	V	W MIN	X MIN
CRE STEEL	AL ALLOY										
C4	D4	1/4	7/16-20	.063	1.625	.922	.953	.063	.438	.375	.250
C6	D6	3/8	9/16-12	.094	1.844	1.109	1.078	.094	.563	.500	.313
C8	D8	1/2	3/4-16		2.141	1.297	1.344		.750	.625	.438
C10	D10	5/8	7/8-14		2.428	1.500	1.547	.078	.781		
C12	D12	3/4	1-1/16-12		2.703	1.703	1.766	.126	1.063	.906	.500
C16	D16	1	1-5/16-12		2.928	1.889	1.922		1.313	1.094	.625
C20	D20	1-1/4	1-5/8-12		3.166	2.100	2.156	.188	1.626	1.313	.750
C24	D24	1-1/2	1-7/8-12		3.453	2.375	2.328		1.575	1.500	.875
C28	D28	1-3/4	2-1/4-12		3.828	2.869	2.594	2.250	1.781	1.063	
C32	D32	2	2-1/2-12		4.141	3.100	2.875	2.563	2.031	1.188	

MATERIAL: See Procurement Specification: Aluminum Alloy, Code "D", Corrosion Resistant Steel (Class 316), Code "C"

FINISH: See Procurement Specification

SCREW THREAD: See Procurement Specification

EXAMPLE OF PART NOS. KC114C8 = TEE, 1/2 Tubing, Corrosion Resistant Steel
KC114D6 = TEE, 1/2 Tubing, AL ALLOY

- NOTES:**
1. Remove Burrs and Slivers. Break sharp edges unless otherwise noted.
 2. Dimensions in inches. Unless otherwise specified, tolerance Decimals ± .016
 3. For design feature purposes, this drawing takes precedence over procurement documents referenced herein.
 4. Referenced documents shall be of the issue in effect on date of invitation for bid.
 5. Marking of fittings shall be consistent with procurement specification using applicable KC Standard and part number designations as shown on this drawing.

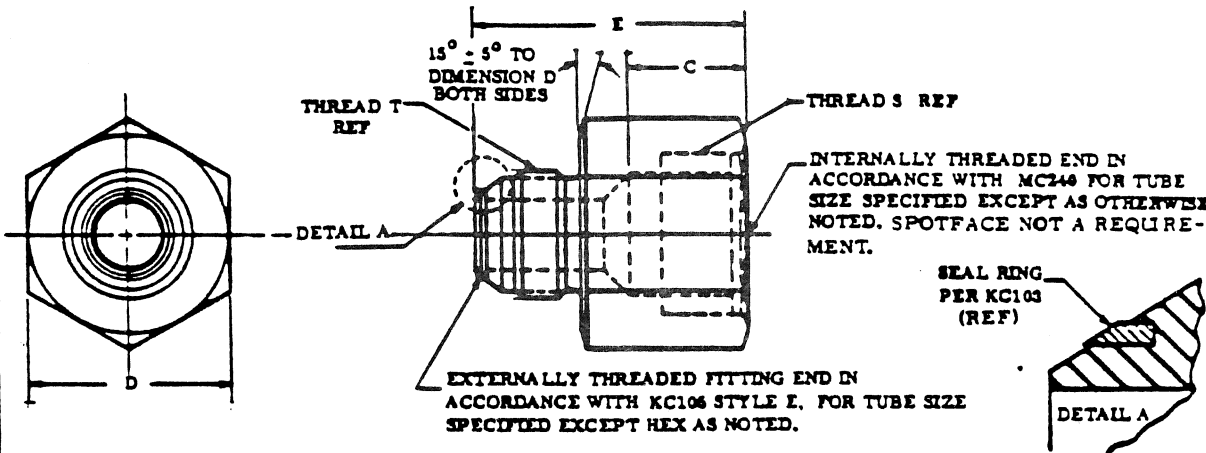
CUSTODIAN JOHN F. KENNEDY SPACE CENTER		STANDARD PART	
PROCUREMENT SPECIFICATION KSC-F-124	TITLE TEE-FLARED TUBE BULKHEAD ON RUN, FOR SEAL RING.	KC114	
COORDINATION STATUS KSC DE		SHEET 1 OF 1	

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REVISED: (A) 9-12-66 (B) 10-23-67 (C) 4-16-68 (D) 11-3-75
APPROVED: 6-16-65



FED SUP CLASS
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DASH NO.		INTERNALLY THREADED END			EXTERNALLY THREADED END		OVERALL	
CRE STEEL	ALUMINUM ALLOY	TUBING OD	THREAD S REF	C	TUBING OD	THREAD T REF	D	E + .000 - .075
C8-4	D8-4	3/8	9/16-18	.609	1/4	7/16-20	.813	1.406
C8-4	D8-4	1/2	3/4-18	.734	1/4	7/16-20	1.000	1.394
C8-6	D8-6				3/8	9/16-18		1.362
C10-4	D10-4	5/8	7/8-14	.797	1/4	7/16-20	1.125	+ .003 - .004 1.687
C10-6	D10-6				3/8	9/16-18		1.656
C10-8	D10-8				1/2	3/4-18		1.766
C12-6	D12-6				3/8	9/16-18		1.329
C12-8	D12-8	3/4	1-1/16-12	.923	1/2	3/4-18	1.375	1.937
C12-10	D12-10				5/8	7/8-14		2.031
C16-6	D16-6	1	1-5/16-12	.953	3/8	9/16-18	1.625	1.937
C16-8	D16-8				1/2	3/4-18		2.047
C16-10	D16-10				5/8	7/8-14		2.125
C16-12	D16-12				3/4	1-1/16-12		2.219
C20-8	D20-8	1-1/4	1-5/8-12	1.000	1/2	3/4-14	1.875	+ .016 - .016 2.187
C20-10	D20-10				5/8	7/8-14		2.266
C20-12	D20-12				3/4	1-1/16-12		2.344
C20-16	D20-16				1	1-5/16-12		2.312

MATERIAL: See Procurement Specification;
Corrosion Resistant Steel (Class 316), Code "C"
Aluminum Alloy, Code "D"

FINISH: See Procurement Specification

SCREW THREAD: See Procurement Specification

- NOTES:**
- Remove Burrs and Slivers. Break sharp edges unless otherwise noted.
 - Dimensions in inches. Unless otherwise specified, tolerance Decimals $\pm .016$.
 - For design feature purposes, this drawing takes precedence over procurement documents referenced herein.
 - Referenced documents shall be of the issue in effect on date of invitation for bid.
 - Marking of fittings shall be consistent with procurement specification using applicable KC Standard and part number designations as shown on this drawing.
6. Not recommended for new design.

EXAMPLE OF PART NOS.

KC115C8-6 = BUSHING; 1/2 tubing, for internal threads, and 3/8 tubing, for external threads; Corrosion Resistant Steel

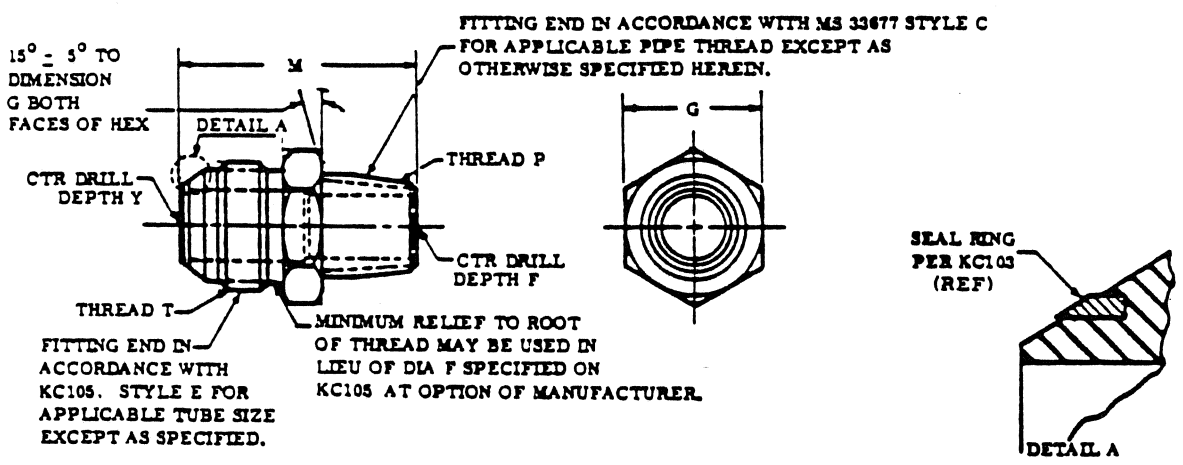
CUSTODIAN		JOHN F. KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION	TITLE	STANDARD PART	
KSC-F-124	BUSHING, -SCREW THREAD EXPANDER FOR SEAL RING	KC115 6	
COORDINATION STATUS		SHEET 1 OF 1	
KSC DR			

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REVISED (U) 10-3-66 (C) 11-3-75 APPROVED 8-10-66



FED SUP CLASS
4730



15° - 5° TO DIMENSION G BOTH FACES OF HEX

FITTING END IN ACCORDANCE WITH MS 33677 STYLE C FOR APPLICABLE PIPE THREAD EXCEPT AS OTHERWISE SPECIFIED HEREIN.

CTR DRILL DEPTH Y

THREAD P

CTR DRILL DEPTH F

SEAL RING PER KC105 (REF)

THREAD T
FITTING END IN ACCORDANCE WITH KC105. STYLE E FOR APPLICABLE TUBE SIZE EXCEPT AS SPECIFIED.

MINIMUM RELIEF TO ROOT OF THREAD MAY BE USED IN LIEU OF DIA F SPECIFIED ON KC105 AT OPTION OF MANUFACTURER.

DETAIL A

CRE STEEL	AL ALLOY	TUBE OD REF	THREAD T REF	TRD P ANPT	F	G	M +.000 -.075	Y		
C4-2	D4-2	1/4	7/16-20	1/8-27	.468	.500	+.003 -.004	1.125		
C4-4	D4-4			1/4-18	.688	.563			1.391	
C6-2	D6-2	3/8	9/16-18	1/8-27	.688	.625	±.004	1.203		
C6-4	D6-4			1/4-18				1.391		
C6-6	D6-6			3/8-18		1.422				
C6-8	D6-8			1/2-14		.875		.875	1.641	
C8-4	D8-4	1/2	3/4-18	1/4-18	.875	.813	±.004	.844		
C8-6	D8-6			3/8-18					.688	1.516
C8-8	D8-8			1/2-14					.875	.875	1.735
C10-8	D10-8	5/8	7/8-14	1/2-14	.906	.938	±.004	1.544		
C10-12	D10-12			3/4-14				1.959		
C12-8	D12-8	3/4	1-1/16-12	1/2-14	1.063	1.125	±.005	1.969		
C12-12	D12-12			3/4-14				.906	1.063	
C12-16	D12-16			1-11 1/2				1.063	1.375	2.203
C16-12	D16-12	1	1-5/16-12	3/4-14	1.125	1.375	±.016	1.094		
C16-16	D16-16			1-11 1/2				1.125	2.234	
C20-20	D20-20	1-1/4	1-5/8-12	1-1/4	1.188	1.688	±.016	2.375		
C20-16	D20-16			-11 1/2				1.188	1.250	
C24-20	D24-20	1-1/2	1-7/8-12	1-1/4	1.250	2.000	±.020	1.344		
C28-24	D28-24			-11 1/2				1.250	2.562	
C32-32	D32-32	2	2-1/2-12	2	1.438	2.625	±.020	1.438		

CUSTODIAN: JOHN F. KENNEDY SPACE CENTER

PROUREMENT SPECIFICATION: KSC-F-124

TITLE: NIPPLE - FLARED TUBE & PIPE THREAD FOR SEAL RING

COORDINATION STATUS: KSC DE

STANDARD PART: KC116

SHEET 1 OF 2

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REVISED: (A) 9-12-66 (B) 16-67 (C) 4-15-68 (D) 9-30-75



FED SUP CLASS
4730

MATERIAL: See Procurement Specification

Corrosion Resistant Steel (Class 316), Code "C"
Aluminum Alloy, Code "D"

FINISH: See Procurement Specification

SCREW THREAD: See Procurement Specification

- NOTES:**
1. Remove Burrs and Slivers. Break sharp edges unless otherwise noted.
 2. Dimensions in inches. Unless otherwise specified, tolerance Decimals
± .016.
 3. For design feature purposes, this drawing takes precedence over procurement documents referenced herein.
 4. Referenced documents shall be of the issue in effect on date of invitation for bid.
 5. Marking of fittings shall be consistent with procurement specification using applicable KC Standard and part number designations as shown on this drawing.
 6. CTR drill is only from the end of the larger drill. At the option of the manufacturer the smaller diameter may be drilled through the fitting from end to end.
 7. Not recommended for new design.

EXAMPLE OF PART NOS.

KC116C4 = Nipple, 1/4 OD Tubing to 1/8 Pipe, Corrosion Resistant Steel
KC116D6-2 = Nipple, 3/8 OD Tubing to 1/8 Pipe, Aluminum Alloy

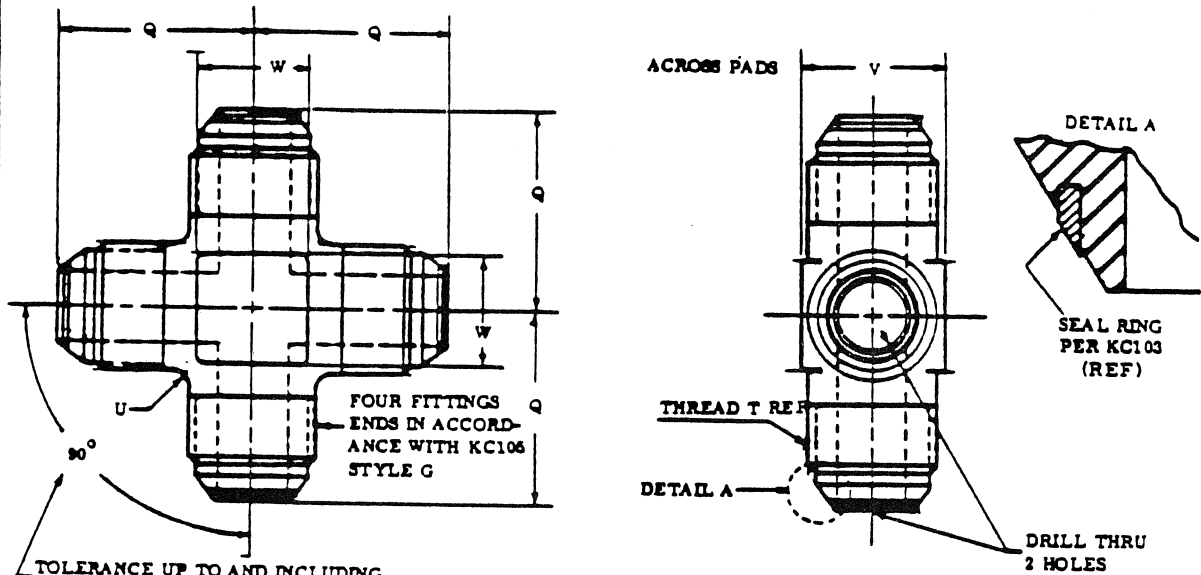
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REVISED (C) 4 15 68 (D) 9-30-75
APPROVED 5-10-65

CUSTODIAN		JOHN F KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION	TITLE	STANDARD PART	
KSC-F-124	NIPPLE - FLARED TUBE & PIPE THREAD FOR SEAL RING	KC116	
COORDINATION STATUS		SHEET 2 OF 2	
KSC DE			



FED SUP CLASS
4730



TOLERANCE UP TO AND INCLUDING
-6 SIZE - 2-1/2°. ABOVE -6 SIZE
= 1-1/2°.

DASH NO.		TUBE OD REF	THREAD T REF	Q +.000 -.045	U RAD	V	W APPROX
CRE STEEL	AL ALLOY						
C4	D4	1/4	7/16-20	.905	.063	.438	.375
C8	D6	3/8	9/16-18	1.077	.094	.563	.500
C8	D6	1/2	3/4-16	1.264		.750	.688
C10	D10	5/8	7/8-14	1.467	.125	.375	.791
C12	D12	3/4	1-1/16-12	1.671		1.063	.906
C16	D16	1	1-5/16-12	1.827		1.313	1.094
C20	D20	1-1/4	1-5/8-12	2.077		1.625	1.313
C24	D24	1-1/2	1-7/8-12	2.342		1.875	1.500
C28	D28	1-3/4	2-1/4-12	2.627		2.250	1.781
C32	D32	2	2-1/2-12	3.077	.199	2.563	2.563

MATERIAL: See Procurement Specification; Aluminum Alloy, Code "D"; Corrosion Resistant Steel (Class 316), Code "C"

FINISH: See Procurement Specification

SCREW THREAD: See Procurement Specification

- NOTES:
1. Remove Burrs and Slivers. Break sharp edges unless otherwise noted.
 2. Dimensions in inches. Unless otherwise specified, tolerance Decimals $\pm .016$.
 3. For design feature purposes, this drawing takes precedence over procurement documents referenced herein.
 4. Referenced documents shall be of the issue in effect on date of invitation for bid.
 5. Marking of fittings shall be consistent with procurement specification using applicable KC Standard and part number designations as shown on this drawing.

EXAMPLE OF
PART NOS.

- KC117D4 = Cross, 1/4 Tubing OD, AL ALLOY
KC117C4 = Cross, 1/4 Tubing OD, Corrosion Resistant Steel

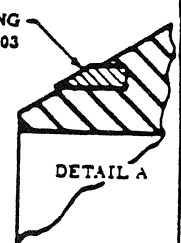
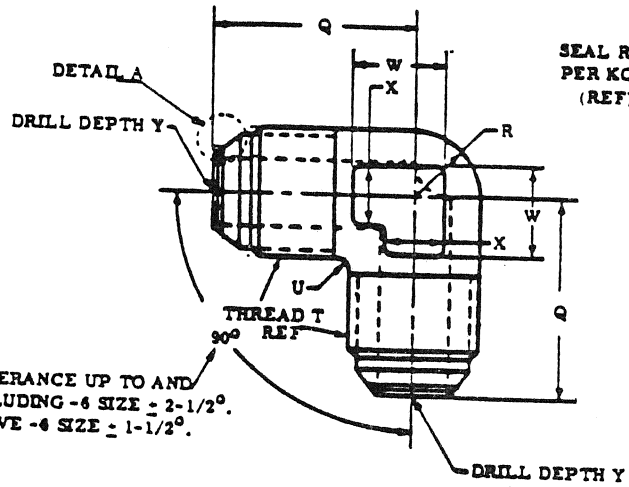
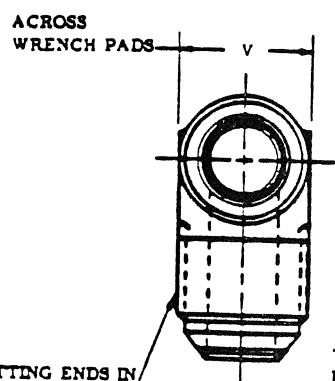
CUSTODIAN:		JOHN F. KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION	TITLE	CROSS-FLARED TUBE, FOR SEAL RING	STANDARD PART
KSC-P-124			KC117
COORDINATION STATUS			SHEET 1 OF 1
KSC DE			

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REVISED 9-12-66 (B) 16-67 (C) 15-68 (D) 9-30-75
 APPROVED 8-10-68



FED SUP CLASS
4730



FITTING ENDS IN ACCORDANCE WITH KC105, STYLE C, FOR APPLICABLE TUBE SIZE 2 ENDS

TOLERANCE UP TO AND INCLUDING -6 SIZE $\pm 2-1/2^\circ$. ABOVE -6 SIZE $\pm 1-1/2^\circ$.

DASH NO.		TUBE OD REF	THREAD T REF	Q +.000 -.047	R RAD	U RAD	V	W APPROX	X APPROX	Y +.047 -.000
CRE STEEL	AL ALLOY									
C4	D4	1/4	7/16-20	.936	.219	.063	.438	.375	.250	.937
C6	D6	3/8	9/16-18	1.108	.281	.094	.563	.300	.313	1.125
C8	D8	1/2	3/4-16	1.296	.375		.750	.625	.438	1.312
C10	D10	5/8	7/8-14	1.480	.438		.375	.750		1.515
C12	D12	3/4	1-1/16-12	1.702	.531	.125	1.063	.975	.500	1.719
C16	D16	1	1-5/16-12	1.858	.656		1.313	1.063	.625	1.937
C20	D20	1-1/4	1-5/8-12	2.108	.813		1.625	1.250	.750	2.157
C24	D24	1-1/2	1-7/8-12	2.374	.938	.188	1.875	1.438	.975	2.484
C28	D28	1-3/4	2-1/4-12	2.858	1.125		2.250	1.750	1.063	2.937
C32	D32	2	2-1/2-12	3.108	1.250		.250	2.563	2.000	1.188	3.250

MATERIAL: See Procurement Specification; (Class 316), Code "C". Aluminum Alloy, Code "D"; Corrosion Resistant Steel

FINISH: See Procurement Specification.

SCREW THREAD: See Procurement Specification.

- NOTES:
1. Remove Burrs and Slivers. Break sharp edges unless otherwise noted.
 2. Dimensions in inches. Unless otherwise specified, tolerance Decimals $\pm .016$.
 3. For design feature purposes, this drawing takes precedence over procurement documents referenced herein.
 4. Referenced documents shall be of the issue in effect on date of invitation for bid.
 5. Marking of fittings shall be consistent with procurement specification using applicable KC Standard and part number designations as shown on this drawing.

EXAMPLE OF PART NOS.
 KC118C8 = ELBOW, 1/2 TUBING. CORROSION RESISTANT STEEL.
 KC118D8 = ELBOW, 1/2 TUBING. AL ALLOY.

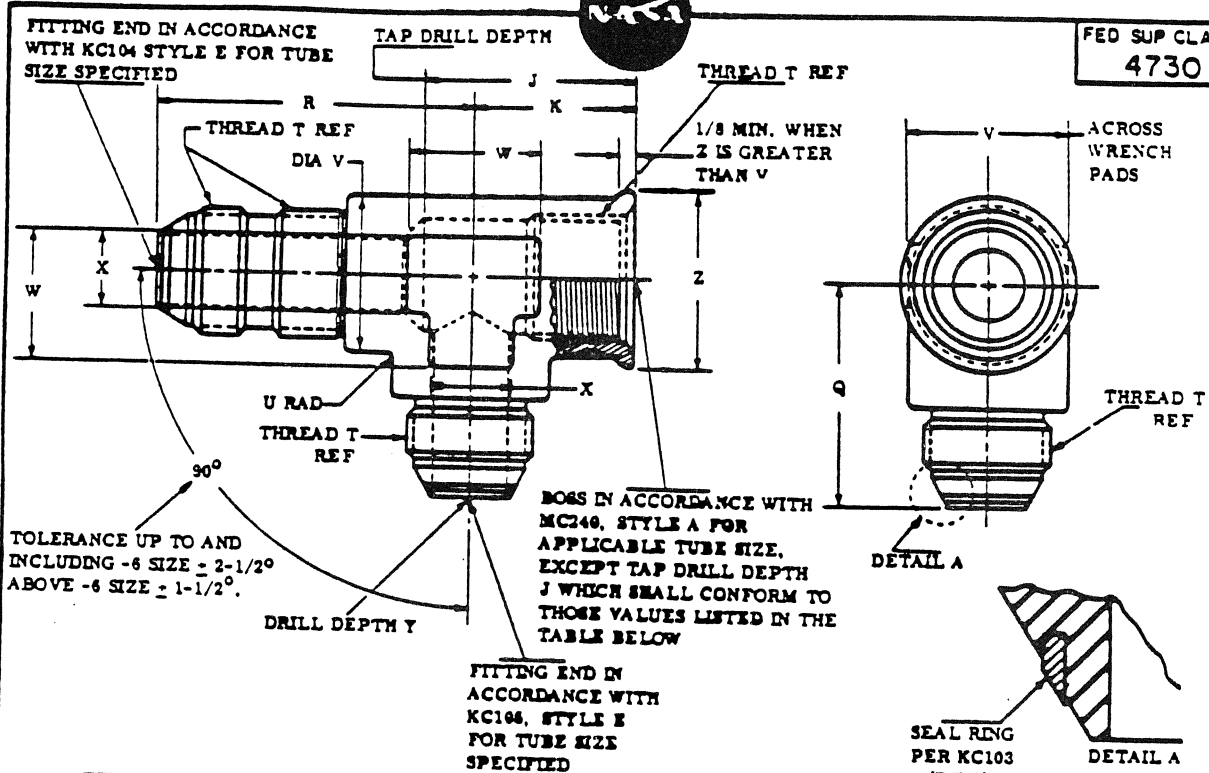
CUSTODIAN: JOHN F. KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION: KSC-F-124	TITLE: ELBOW - FLARED TUBE 90°, FOR SEAL RING
COORDINATION STATUS: KSC DE	STANDARD PART: KC118
	SHEET 1 OF 1

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REVISED 11-8-67 (B) 4-15-68 (C) 9-30-75
 APPROVED 6-10-66



FED SUP CLASS
4730



DASH NO.		TUBE	THREAD T	J	K	Q	R	U	V	W	X	Y	Z
CRE	AL	OD	REF.	+ .047	+ .000	+ .009	+ .000	RAD	M	MIN	MIN	+ .047	DIA
STEEL	ALLOY	REF		- .000	- .047	- .047	- .047					- .000	
C4	D4	1/4	7/16-20	.896	.797	1.233	1.797	.094	.750	.688		1.188	.750
C6	D6	3/8	9/16-18	1.031	.880	1.297	2.047		.875	.781	.438	1.281	.875
C8	D8	1/2	3/4-16	1.250	1.047	1.485	2.283		1.063	.906	.500	1.469	1.063
C10	D10	5/8	7/8-14	1.488	1.293	1.672	2.483	.125	1.313	1.094	.625	1.750	1.188
C12	D12	3/4	1-1/16-12	1.750	1.391	1.860	2.672		1.625	1.313	.750	1.875	1.438
C16	D16	1	1-5/16-12	2.043	1.578	2.110	2.881		1.875	1.250	.875	2.094	1.688
C20	D20	1-1/4	1-5/8-12	2.313	1.788	2.297	3.078		1.875	1.250	.875	2.250	2.000

MATERIAL: See Procurement Specification: Aluminum Alloy, Code "D"; Corrosion Resistant Steel (Class 316), Code "C"

FINISH: See Procurement Specification

SCREW THREAD: See Procurement Specification

- NOTES:**
1. Remove Burrs and Slivers. Break sharp edges unless otherwise noted.
 2. Dimensions in inches. Unless otherwise specified, tolerance Decimals ± .016.
 3. For design feature purposes, this drawing takes precedence over procurement documents referenced herein.
 4. Referenced documents shall be of the issue in effect on date of invitation for bid.
 5. Marking of fittings shall be consistent with procurement specification using applicable KC Standard and part number designations as shown on this drawing.
- ⑥ This fitting not recommended for new design.

EXAMPLE OF PART NOS.
 KC119C8 = TEE, 1/2 OD Tubing, Corrosion Resistant Steel
 KC119D8 = TEE, 1/2 OD Tubing, Aluminum Alloy

CUSTODIAN: JOHN F. KENNEDY SPACE CENTER

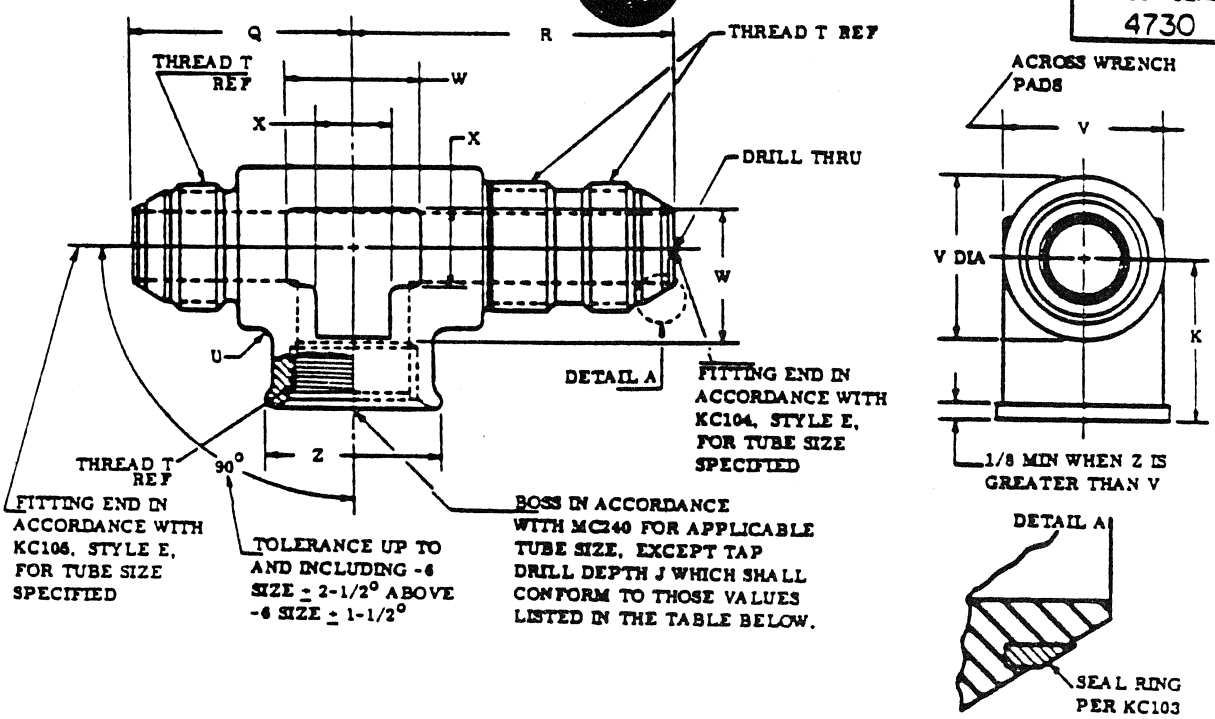
PROCUREMENT SPECIFICATION TITLE	TEE, - FLARED TUBE, INTERNAL THREAD ON RUN, FOR SEAL RING	STANDARD PART
KSC-F-124		KC119 ⑥
COORDINATION STATUS		SHEET 1 OF 1
KSC DR		

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REVISED A 9-12-66 B 10-23-67 C 4-15-68 D 9-30-75
 APPROVED 8-18-65



FED SUP CLASS
4730



DASH NO.		TUBE OD REF	THREAD T REF	J	K	Q	R	U RAD	V	W MIN	X MIN	Z DIA
CRE STEEL	AL ALLOY			+.047 -.000	+.000 -.047	+.000 -.047	+.000 -.047					
C4	D4	1/4	7/16-20	.750	.797	1.235	1.797	.094	.750	.688	.438	.750
C8	D8	3/8	9/16-18	.813	.860	1.297	2.047	.125	.875	.781		.875
C8	D8	1/2	3/4 -16	1.000	1.047	1.485	2.283		1.063	.906	.500	1.063
C10	D10	5/8	7/8 -14	1.156	1.203	1.672	2.422		1.313	1.094	.625	1.438
C12	D12	3/4	1-1/16-12	1.344	1.391	1.860	2.672		1.625	1.313	.750	1.688
C16	D16	1	1-5/16-12	1.531	1.578	2.110	2.891		1.875	1.500	.875	2.000
C20	D20	1-1/4	1-5/8-12	1.719	1.766	2.297	3.078					

MATERIAL: See Procurement Specification: Aluminum Alloy, Code "D"; Corrosion Resistant Steel (Class 316), Code "C"

FINISH: See Procurement Specification

SCREW THREAD: See Procurement Specification

- NOTES:**
1. Remove Burrs and Slivers. Break sharp edges unless otherwise noted.
 2. Dimensions in inches. Unless otherwise specified, tolerance Decimals $\pm .016$.
 3. For design feature purposes, this drawing takes precedence over procurement documents referenced herein.
 4. Referenced documents shall be of the issue in effect on date of invitation for bid.
 5. Marking of fittings shall be consistent with procurement specification using applicable KC Standard and part number designations as shown on this drawing.
- ⚠ This Fitting is not recommended for New Design

EXAMPLE OF PART NOS. KC120C8 - CRE STEEL, Tee, 1/2 OD Tubing
KC120D8 - AL ALLOY, Tee, 1/2 OD Tubing

CUSTODIAN JOHN F. KENNEDY SPACE CENTER		STANDARD PART	
PROCUREMENT SPECIFICATION KSC-F-124	TITLE TEE-FLARED TUBE INTERNAL THREAD ON SIDE FOR SEAL RING	KC120 ⚠	
COORDINATION STATUS KSC DE	SHEET 1 OF 1		

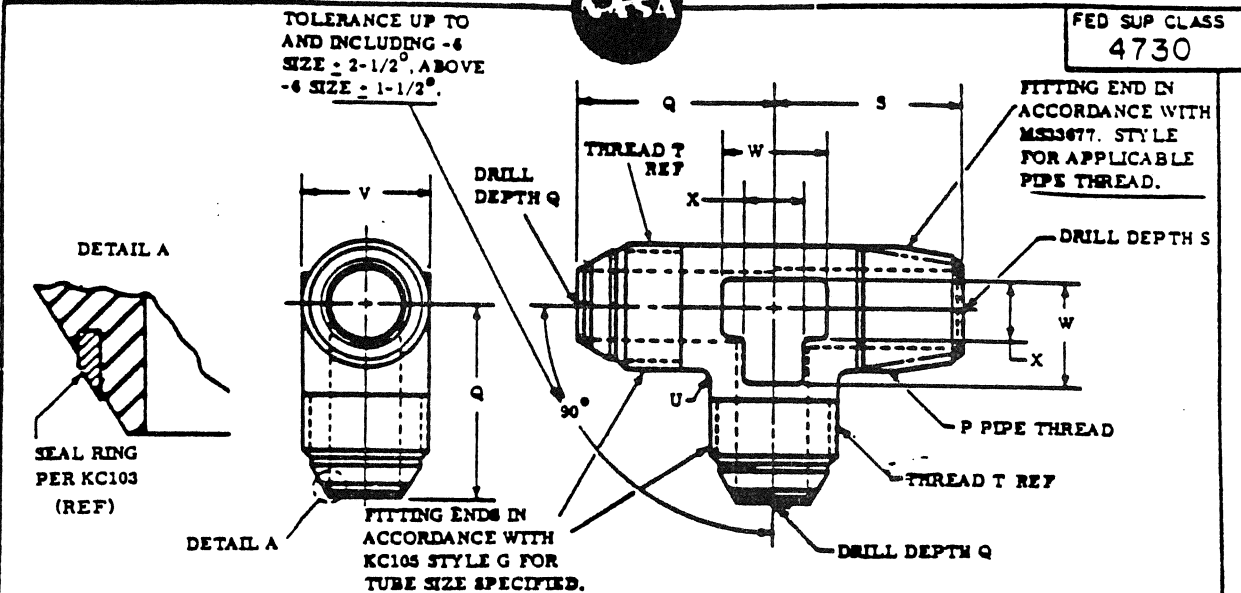
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REVISED A 9-12-66 B 10-23-67 C 4-25-68 D 11-3-75
APPROVED 8-10-66

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4730



DASH NO		TUBE OD REF	THREAD T REF	PIPE THD END		Q	S	U	V	W APPROX	X APPROX	
CRE STEEL	AL ALLOY			THD P ANPT	MSS3677 STYLE							
C4-2	D4-2	1/4	7/16-20	1/8-27	A	.906	.797	.064	.438	.375	.250	
C6-4	D6-4	3/8	9/16-18	1/4-18		1.078	1.309		.563	.563	.313	
C8-6	D8-6	1/2	3/4-16	3/8-16		1.206	1.234		.750	.688		
C10-8	D10-8	5/8	7/8-14	1/2-14		1.469	1.484		.875	.750	.438	
C12-12	D12-12	3/4	1-1/16-12	3/4-14		1.672	1.600		1.063	.875		
C16-12	D16-12	1	1-5/16-12			1.826	1.734		1.313	1.063	.500	
C16-16	D16-16	1		1-11 1/2		B	1.984		1.225	1.125	.625	
C20-20	D20-20	1-1/4	1-5/8-12	1 1/2-11 1/2			A		2.078	2.301	1.625	1.313	.750
C20-16	D20-16	1-1/4		1-11 1/2		2.141			.125	1.875	1.438	.875
C24-20	D24-20	1-1/2	1-7/8-12	1 1/2-11 1/2		2.344	2.516		1.875	1.438	.875	
C28-24	D28-24	1-3/4	2-1/4-12	1 1/2-11 1/2	2.826	2.799	.188	2.350	1.625	1.062		
C32-32	D32-32	2	2-1/2-12	2-11 1/2	3.078	3.016	.250	2.562	1.875	1.158		

MATERIAL: See Procurement Specification: Aluminum Alloy, Code "D"; Corrosion Resistant Steel (Class 316), Code "C"

FINISH: See Procurement Specification

SCREW THREAD: See Procurement Specification

NOTES:

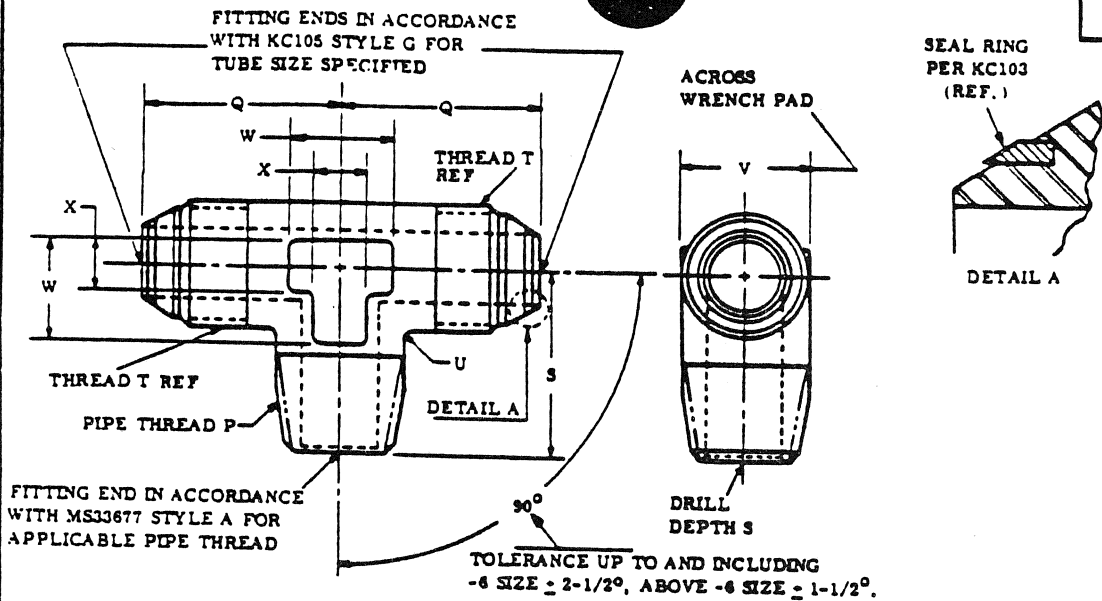
- At the option of the manufacturer, the smaller diam. may be drilled through the fitting from port to port.
- Remove Burrs and Slivers. Break sharp edges unless otherwise noted.
- Dimensions in inches. Unless otherwise specified, tolerance Decimals = .016.
- For design feature purposes, this drawing takes precedence over procurement documents referenced herein.
- Referenced documents shall be of the issue in effect on date of invitation for bid.
- Marking of fittings shall be consistent with procurement specification using applicable KC Standard and part number designations as shown on this drawing.

⚠ This Fitting is not recommended for New Designs

EXAMPLE OF PART NOS. KC121C4 = CRE STEEL, Tee 1/4 Tube OD and 1/8 Pipe Thd
 KC121D8 = AL ALLOY, Tee 1/2 Tube OD and 3/8 Pipe Thd

CUSTODIAN JOHN F. KENNEDY SPACE CENTER		STANDARD PART	
PROCUREMENT SPECIFICATION KSC-F-124	TITLE TEE - FLARED TUBE WITH PIPE THREAD ON RUN, FOR SEAL RING	KC121 ⚠	
COORDINATION STATUS KSC DE	SHEET 1 OF 1		

REVISED: A 9-12-66, B 6-16-67, C 4-15-68, D 11-3-75
 APPROVED 6-10-65



MATERIAL: See Procurement Specification: Corrosion Resistant Steel (Class 316) Code "C"
Aluminum Alloy, Code "D"

FINISH: See Procurement Specification

SCREW THREAD: See Procurement Specification

- NOTES:**
- At the option of the manufacturer, the smaller diam. may be drilled through the fitting from port to port.
 - Remove Burrs and Slivers. Break sharp edges unless otherwise noted.
 - Dimensions in inches. Unless otherwise specified, tolerance Decimals ±.016.
 - For design feature purposes, this drawing takes precedence over procurement documents referenced herein.
 - Referenced documents shall be of the issue in effect on date of invitation for bid.
 - Marking of fittings shall be consistent with procurement specification using applicable KC Standard and part number designations as shown on this drawing.
7. This fitting is not recommended for new design

EXAMPLE OF PART NOS. KC122C4 = TEE, 1/4 OD Tubing and 1/8 Pipe Thread, Corrosion Resistant Steel
KC122D8 = TEE, 1/2 OD Tubing and 3/8 Pipe Thread, Aluminum Alloy

DASH NO.		TUBE OD REF	THREAD T REF	PIPE THD END		Q +.000 -.047	S +.000 -.047	U RAD	V	W APPROX	X APPROX				
CRE STEEL	AL ALLOY			THD P ANPT	MS33677										
C4-2	D4-2	1/4	7/16-20	1/8-27	A	.966	.797	.063	.438	.375	.250				
C6-4	D6-4	3/8	9/16-18	1/4-18		1.078	1.116		.563	.563	.313				
C8-6	D6-6	1/2	3/4-16	3/8-18		1.266	1.235		.750	.688					
C10-8	D10-8	5/8	7/8-14	1/2-14		1.469	1.485		.875	.750	.438				
C12-12	D12-12	3/4	1-1/16-12	3/4-14		1.672	1.610		1.063	.875					
C16-12	D16-12	1	1-5/16-12	1-11 1/2		B	1.828		1.735	1.313	1.063	.500			
C16-16	D16-16						1.985		1.125		.625				
C20-20	D20-20	1-1/4	1-5/8-12	1-1/4-11 1/2			2.078		2.391		.125	1.625	1.313	.750	
C20-16	D20-16						2.235		1.875			1.438	.875		
C24-20	D24-20	1-1/2	1-7/8-12	1-1/4-11 1/2			2.344		2.516			1.875	1.438	.875	
C28-24	D28-24	1-3/4	2-1/4-12	1-1/2-11 1/2			2.828		2.797			.188	2.250	1.812	1.062
C32-32	D32-32	2	2-1/2-12	2-11 1/2			3.078		2.743			.250	2.562	2.094	1.188

CUSTODIAN: JOHN F. KENNEDY SPACE CENTER

PROCUREMENT SPECIFICATION TITLE: TEE - FLARED TUBE WITH PIPE THREAD ON SIDE FOR SEAL RING

KSC-F-124

COORDINATION STATUS: KSC DE

STANDARD PART: KC122

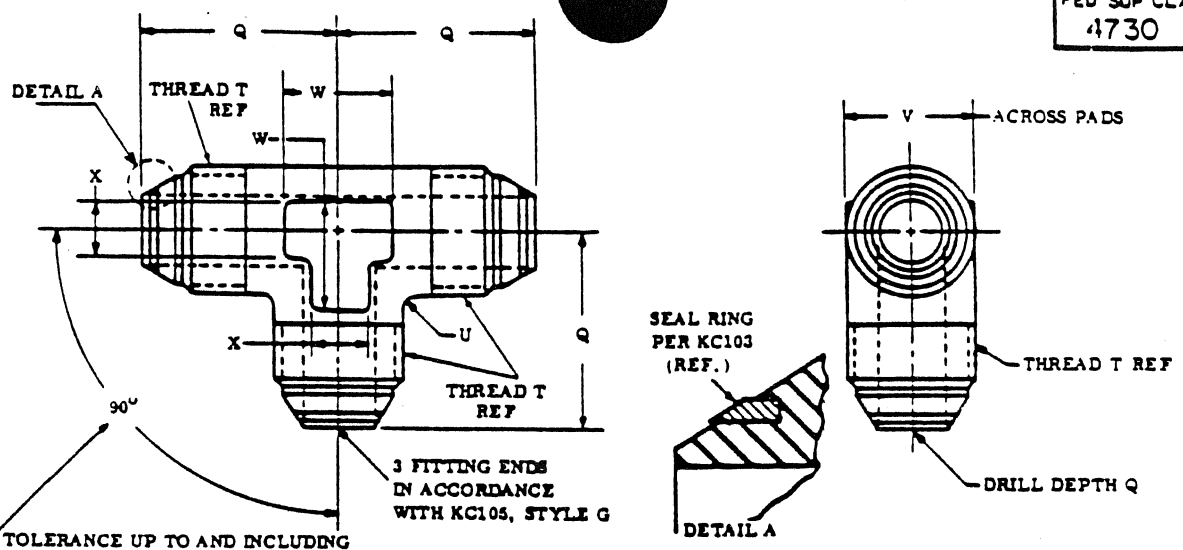
SHEET 1 OF 1

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REVISED (A) 9-19-67 (B) 4-15-68 (C) 11-3-75 APPROVED 5-10-65



FED SUP CLASS
4730



DASH NO.		TUBE OD REF	THREAD T REF	Q +.000 -.047	U RAD	V	W APPROX	X APPROX
CRE STEEL	AL ALLOY							
C4	D4	1/4	7/16-20	.308	.043	.438	.375	.350
C5	D4	3/8	9/16-18	1.077	.094	.563	.500	.313
C8	D8	1/2	3/4-16	1.364		.750	.688	.438
C10	D10	5/8	7/8-14	1.467	.125	.875	.781	
C12	D12	3/4	1-1/16-12	1.671		1.063	.906	.500
C16	D16	1	1-5/16-12	1.837		1.313	1.094	.625
C20	D20	1-1/4	1-5/8-12	2.077		1.635	1.313	.750
C24	D24	1-1/2	1-7/8-12	2.342		1.875	1.500	.875
C28	D28	1-3/4	2-1/4-12	2.827	2.250	1.781	1.063	
C32	D32	2	2-1/2-12	3.077	.186	2.563	2.031	1.188

MATERIAL: See Procurement Specification
Aluminum Alloy, Code "D"
Corrosion Resistant Steel (Class 316), Code "C"

FINISH: See Procurement Specification

SCREW THREAD: See Procurement Specification

NOTES:

1. Remove Burrs and Slivers. Break sharp edges unless otherwise noted.
2. Dimensions in inches. Unless otherwise specified, tolerance Decimals ±.016.
3. For design feature purposes, this drawing takes precedence over procurement documents referenced herein.
4. Referenced documents shall be of the issue in effect on date of invitation for bid.
5. Marking of fittings shall be consistent with procurement specification using applicable KC Standard and part number designations as shown on this drawing.

EXAMPLE OF PART NOS. KC123C4 = TEE, 1/4 OD Tubing, Corrosion Resistant Steel
KC123D4 = TEE, 1/4 OD Tubing, Aluminum Alloy

CUSTODIAN: JOHN F. KENNEDY SPACE CENTER

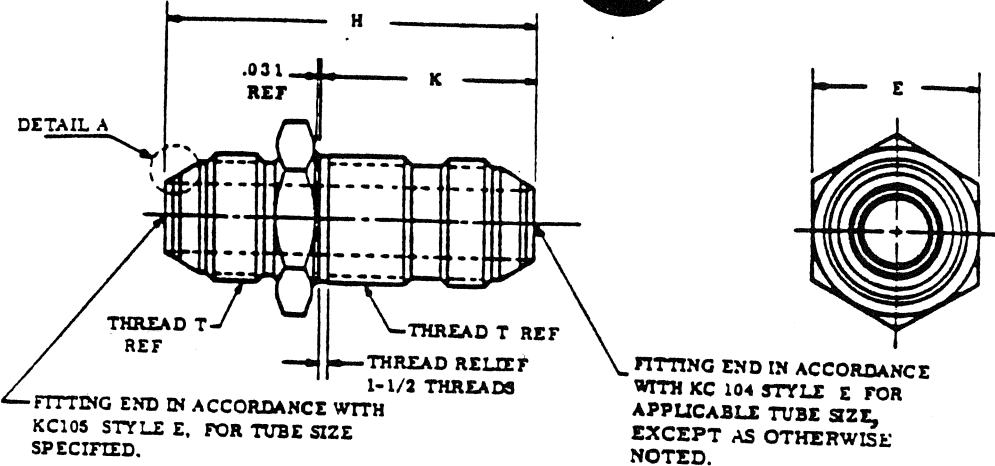
PROCUREMENT SPECIFICATION KSC-F-124	TITLE TEE - FLARED TUBE FOR SEAL RING	STANDARD PART KC123
COORDINATION STATUS		SHEET 1 OF 1
KSC DE		

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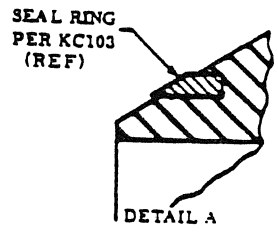
REVISED (A) 11-8-67 (B) 4-16-68 (C) 11-3-76
APPROVED 5-10-65



FED SUP CLASS
4730



DASH NO.		TUBE OD REF	THREAD T REF	E REF	H	K
CRE STEEL	AL ALLOY				+ .000	- .000
C4	D4	1/4	7/16-20	.688	2.062	1.219
C8	D8	3/8	9/16-18	.813	2.234	1.297
C8	D8	1/2	3/4-16	1.000	2.460	1.453
C10	D10	5/8	7/8-14	1.125	2.734	1.594
C12	D12	3/4	1-1/16-12	1.375	3.047	1.766
C16	D16	1	1-5/16-12	1.625	3.094	
C20	D20	1-1/4	1-5/8-12	1.875	3.172	1.812
C24	D24	1-1/2	1-7/8-12	2.125	3.328	1.828
C28	D28	1-3/4	2-1/4-12	2.500	3.584	1.984
C32	D32	2	2-1/2-12	2.750	3.844	2.110



MATERIAL:

See Procurement Specification
Corrosion Resistant Steel (Class 316), Code "C"
Aluminum Alloy, Code "D"

FINISH:

See Procurement Specification

SCREW THREAD:

See Procurement Specification

NOTES:

1. Remove Burrs and Slivers. Break sharp edges unless otherwise noted.
2. Dimensions in inches. Unless otherwise specified, tolerance Decimals $\pm .005$.
3. For design feature purposes, this drawing takes precedence over procurement documents referenced herein.
4. Referenced documents shall be of the issue in effect on date invitation for bid.
5. Marking of fittings shall be consistent with procurement specification using applicable KC Standard and part number designations as shown on this drawing.
6. Note deleted.

EXAMPLE OF PART NOS.

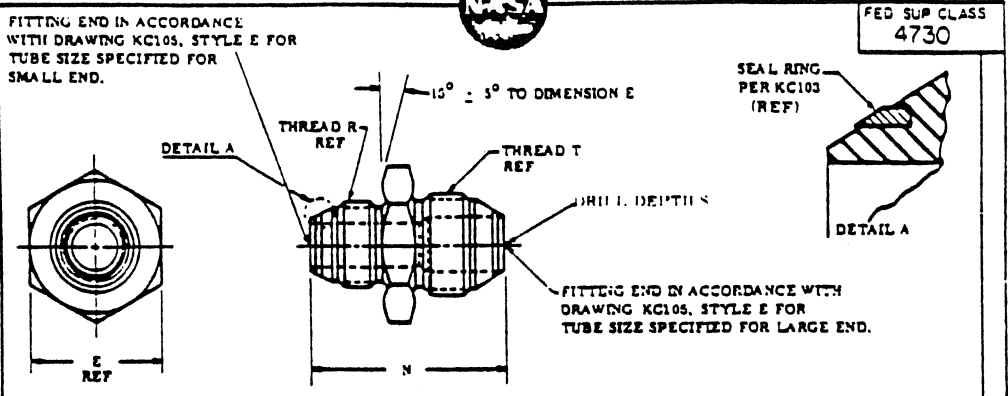
KC124C3 = Union, 1/2 OD Tubing, Corrosion Resistant Steel
KC124D8 = Union, 1/2 OD Tubing, Aluminum Alloy

CUSTODIAN: JOHN F. KENNEDY SPACE CENTER		STANDARD PART	
PROCUREMENT SPECIFICATION: KSC-F-124	TITLE: UNION - FLARED TUBE 3/8 BULKHEAD & UNIVERSAL FOR SEAL RING	KC124	
COORDINATION STATUS: KSC DE	SHEET 1 OF 1		

NOTICE: When Gov't dsgns., specs., or other data are used for any purpose other than in connection with a definitely related Gov't. procurement operation, the U. S. Gov't. thereby incurs no responsibility, nor any obligation whatsoever, and the fact that the Gov't. may have furnished, furnished, or in any way supplied the said dsgns., specs., or other data is not to be regarded by any person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may be

REVISED: A 9-12-66 B 6-16-67 C 4-15-68 D 5-8-68 E 11-3-75 F 7-13-76
APPROVED 8-10-65

NOTICE: When Gov't, spec., space, or other data are used for any purpose other than in connection with a definitely related Gov't. procurement operation, the U. S. Gov't, thereby incurs no obligation whatsoever, and the fact that the Gov't, may have furnished, furnished, or in any way supplied the said spec., space, or other data is not to be regarded as an indication or endorsement or otherwise as in any manner licensing the holder or any other person or corp., or conveying any rights of permission to manufacture, use, or sell any patented invention that may in any way be related thereto.



FED SUP CLASS
4730

DASH NO.		LARGE END		SMALL END		E REF	N + .000 - .090	S MAX 7
CRE STEEL	ALUMINUM ALLOY	TUBE OD	THREAD T REF	TUBE OD	THREAD R REF.			
C8-4	D8-4	3/8	9/16-18	1/4	7/16-20	.813	1.422	.457
C8-4	D8-4	1/2	3/4-16	1/4	7/16-20	1.000	1.547	.538
C8-6	D8-6			3/8	9/16-18			
C10-4	D10-4	5/8	7/8-14	1/4	7/16-20	1.125	1.872	.618
C10-6	D10-6			3/8	9/16-18			
C10-8	D10-8	3/4	1-1/16-12	1/2	3/4-16	1.375	1.907	.703
C12-4	D12-4			3/8	7/8-14			
C12-6	D12-6	1	1-5/16-12	1/2	3/4-16	1.625	2.043	.741
C12-8	D12-8			3/4	1-1/16-12			
C12-10	D12-10	1-1/4	1-5/8-12	3/4	1-1/16-12	1.875	2.266	.778
C16-4	D16-4			1/4	7/16-20			
C16-6	D16-6	1-1/2	1-7/8-12	1/2	3/4-16	2.125	2.375	.878
C16-10	D16-10			5/8	7/8-14			
C16-12	D16-12	1-1/4	1-5/8-12	3/4	1-1/16-12	2.125	2.422	
C20-4	D20-4			1/4	7/16-20			
C20-12	D20-12	1	1-5/16-12	1	1-5/16-12	2.125	2.375	.878
C20-16	D20-16			3/4	1-1/16-12			
C24-16	D24-16	1-1/2	1-7/8-12	1-1/4	1-5/8-12	2.125	2.422	
C24-20	D24-20			1-1/4	1-5/8-12			

See Com't on next sheet

APPROVED 3-10-65
 REVISED (A) 9 12 66 (B) 10 67 (C) 4-13-68 (D) 11-3-75 (E) 2-6-76

CUSTODIAN		JOHN F. KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION	TITLE	STANDARD PART	
KSC-P-124	REDUCER - EXTERNAL THREAD FLARED TUBE FOR SEAL RING	KC125	
COORDINATION STATUS		SHEET 1 OF 2	
KSC DE			

A

B



FED SUP CLASS
4730

MATERIAL: See Procurement Specification

Corrosion Resistant Steel (Class 316), Code "C"
Aluminum Alloy, Code "D"

FINISH: See Procurement Specification

SCREW THREAD: See Procurement Specification

- NOTES:**
1. Remove Burrs and Slivers. Break sharp edges unless otherwise noted.
 2. Dimensions in inches. Unless otherwise specified, tolerance Decimals $\pm .005$.
 3. For design feature purposes, this drawing takes precedence over procurement documents referenced herein.
 4. Referenced documents shall be of the issue in effect on date of invitation for bid.
 5. Marking of fittings shall be consistent with procurement specification using applicable KC Standard and part number designations as shown on this drawing.
 6. None deleted.
 7. At the option of the manufacturer, the smaller inside diameter dimension may be drilled from port to port.

EXAMPLE OF PART NOS. KC125C10 - Reducer, 1/2 OD to 1/4 OD Tubing, Corrosion Resistant Steel
KC125D10 - Reducer, 1/2 OD to 1/4 OD Tubing, Aluminum Alloy

DASH NO.	LARGE END			SMALL END		E REF	N + .000 - .000	S MAX
	CRE STEEL	ALUMINUM ALLOY	TUBE OD	THREAD T REF	TUBE OD				THREAD R REF
C28-20	D28-20	1-3/4	2-1/4-12	1-1/4	1-5/8-12	2.500	2.598	.978
C28-24	D28-24			1-1/2	1-7/8-12		2.723	
C32-24	D32-24	2	2-1/2-12	1-1/2	1-7/8-12	2.750	2.848	1.078
C32-28	D32-28			1-3/4	2-1/4-12		2.973	

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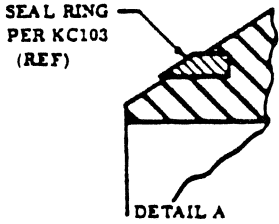
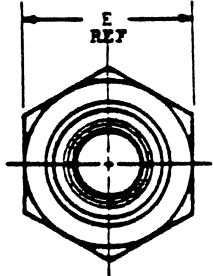
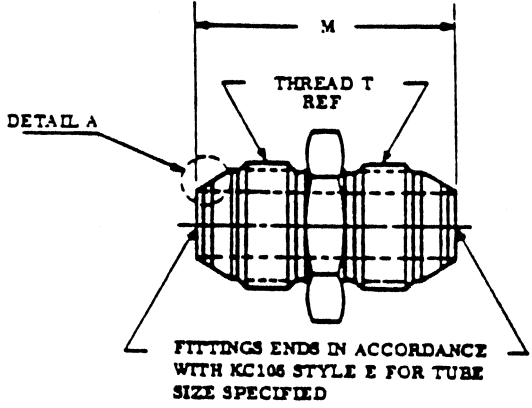
REVISED (C) 4-15-68 (D) 11-3-75 (E) 2-6-76
APPROVED 8-10-65

CUSTODIAN		JOHN F KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION	TITLE	STANDARD PART	
KSC-P-124	REDUCER - EXTERNAL THREAD FLARED TUBE FOR SEAL RING	KC125	
COORDINATOR STATUS		SHEET 2 OF 2	
KSC DE			

KN-42-OT 1-28-64



FED SUP CLASS
4730



DASH NO.		TUBE OD REF	THREAD T REF	E REF	M
CRE STEEL	AL ALLOY				
C4	D4	1/4	7/16-20	.688	1.266
C6	D6	3/8	9/16-18	.813	1.391
C8	D8	1/2	3/4 -16	1.000	1.578
C10	D10	5/8	7/8 -14	1.125	1.844
C12	D12	3/4	1-1/16-12	1.375	2.125
C16	D16	1	1-5/16-12	1.625	2.203
C20	D20	1-1/4	1-5/8-12	1.875	2.297
C24	D24	1-1/2	1-7/8-12	2.125	2.547
C28	D28	1-3/4	2-1/4-12	2.500	2.828
C32	D32	2	2-1/2-12	2.750	3.078

MATERIAL: See Procurement Specification

Corrosion Resistant Steel (Class 316), Code "C"
Aluminum Alloy, Code D

FINISH: See Procurement Specification

SCREW THREAD: See Procurement Specification

- NOTES:
1. Remove Burrs and Slivers. Break sharp edges unless otherwise noted.
 2. Dimensions in inches. Unless otherwise specified, tolerance Decimals $\pm .005$.
 3. For design feature purposes, this drawing takes precedence over procurement documents referenced herein.
 4. Referenced documents shall be of the issue in effect on date of invitation for bid.
 5. Marking of fittings shall be consistent with procurement specification using applicable KC Standard and part number designations as shown on this drawing.

EXAMPLE OF PART NOS. KC126C8 = Union, 1/2 OD Tubing, Corrosion Resistant Steel
KC126D8 = Union, 1/2 OD Tubing, Aluminum Alloy

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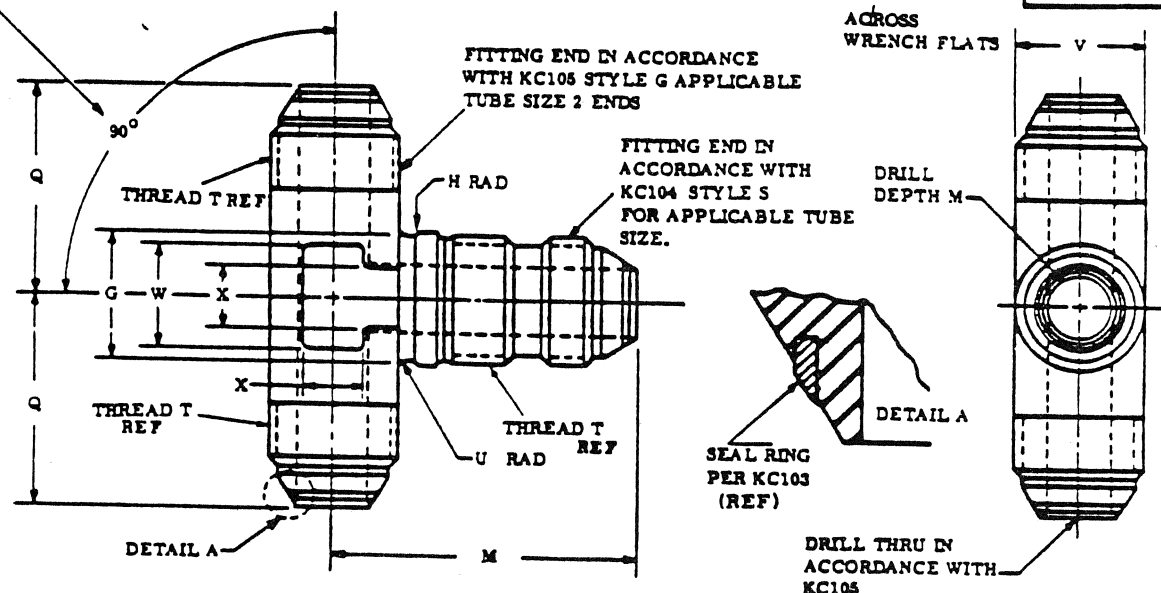
REVISED: (A)11-8-67 (D)4-15-68 (C)11-3-75
 APPROVED 5-10-65

CUSTODIAN		JOHN F. KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION	TITLE	STANDARD PART	
KSC-F-124	UNION - FLARED TUBE FOR SEAL RING	KC126	
COORDINATION STATUS		SHEET 1 OF 1	
KSC DE			



FED SUP CLASS
4730

TOLERANCE UP TO AND INCLUDING
-6 SIZE = 2-1/2° ABOVE -6 SIZE = 1-1/2°.



CRE STEEL	AL ALLOY	TUBE OD REF	THREAD T REF.	G DIA	H RAD	M +.000 -.047	Q +.000 -.047	U RAD	V	W APPROX	X APPROX
C4	D4	1/4	7/16-20	.438	.063	1.625	1.000	.063	.438	.375	.250
C8	D8	3/8	9/16-18	.563	.094	1.844	1.125	.094	.563	.500	.313
C8	D8	1/2	3/4-16	.750		2.141	1.391		.750	.625	.438
C10	D10	5/8	7/8-14	.875		2.423	1.594		.875	.750	.500
C12	D12	3/4	1-1/16-12	1.063		2.703	1.813		1.063	.875	.625
C16	D16	1	1-5/16-12	1.313		2.820	1.960		1.313	1.063	.625
C20	D20	1-1/4	1-5/8-12	1.625		3.154	2.203		1.625	1.250	.750
C24	D24	1-1/2	1-7/8-12	1.875		3.463	2.375		1.875	1.438	.875
C28	D28	1-3/4	2-1/4-12	2.250		3.820	2.641		2.250	1.750	1.063
C32	D32	2	2-1/2-12	2.500		4.141	2.923		2.543	1.938	1.188

MATERIAL See Procurement Specification

Corrosion Resistant Steel (Class 316), Code "C"
Aluminum Alloy, Code "D"

FINISH: See Procurement Specification

SCREW THREAD: See Procurement Specification

- NOTES:
1. Remove Burrs and Slivers. Break sharp edges unless otherwise noted.
 2. Dimensions in inches. Unless otherwise specified, tolerance Decimals ±.016
 3. For design feature purposes, this drawing takes precedence over procurement documents referenced herein.
 4. Referenced documents shall be of the issue in effect on date of invitation for bid.
 5. Marking of fittings shall be consistent with procurement specification using applicable KC Standard and part number designations as shown on this drawing.
 6. When used against bulkhead use washer AN960 to form backing face.

EXAMPLE OF PART NOS. KC127C4 = TEE, 1/4 OD Tubing, Corrosion Resistant Steel
KC127D4 = TEE, 1/4 OD Tubing, Aluminum Alloy

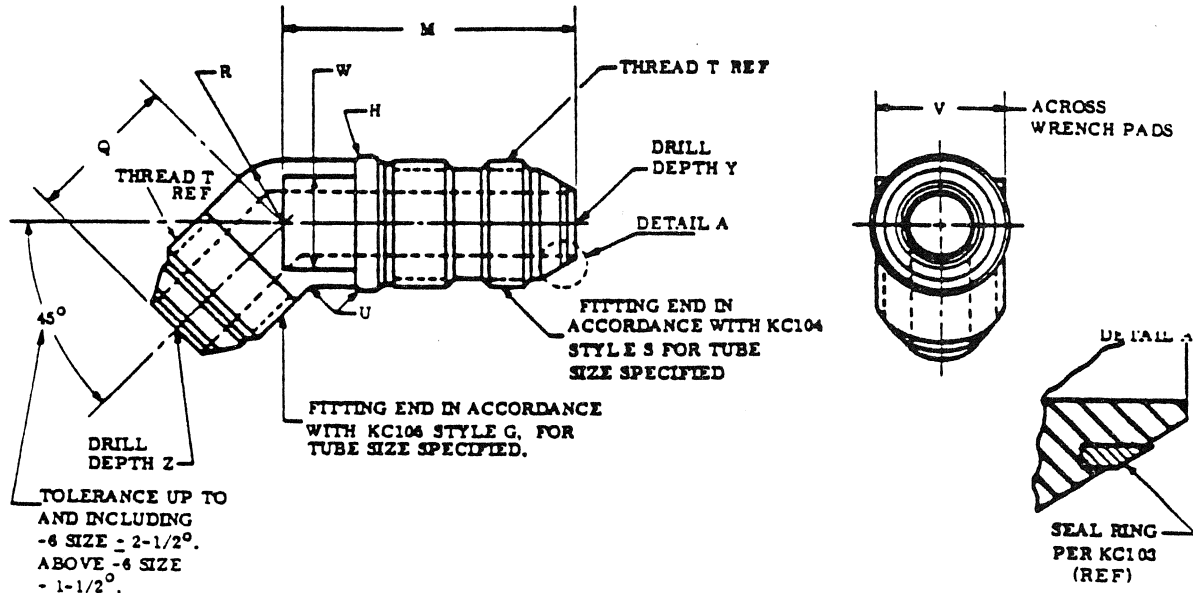
CUSTODIAN: JOHN F. KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION KSC-P-124	TITLE TEE - BULKHEAD & UNIVERSAL FLARED TUBE FOR SEAL RING
COORDINATION STATUS KSC DE	STANDARD PART KC127
SHEET 1 OF 1	

NOTE: When Gov't specs. or other data are used for any purpose other than in connection with a definitely related Gov't procurement, the contractor shall assume responsibility, not any obligation whatsoever, and the fact that the Gov't. may have formulated, furnished, or in any way supplied the said data, specs., or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corp., or conveying any rights or permission to manufacture, use, or sell any patented invention that may be in any way related thereto.

REVISION (A) 9-12-66 (U) 10-23-67 (C) 4-15-67 (U) 11-3-76
 APPROVED 8-10-68



FED SUP CLASS
4730



DASH NO.		TUBE OD REF	THREAD T REF	H RAD	M +.000 -.047	Q +.000 -.047	R RAD	U RAD	V	W	Y +.047 -.000	Z +.047 -.000
CRE STEEL	AL ALLOY											
C4	D4	1/4	7/16-20	.063	1.578	.750	.319	.063	.438	.313	1.594	.786
C6	D6	3/8	9/16-18	.094	1.719	.860	.281	.094	.563	.375	1.750	.891
C8	D8	1/2	3/4-16		1.965	1.016	.375		.750	.500	2.031	1.063
C10	D10	5/8	7/8-14		2.219	1.141	.438		.875	.625	2.281	1.203
C12	D12	3/4	1-1/16-12		2.485	1.313	.531	1.063	.813	2.563	1.391	
C16	D16	1	1-5/16-12		2.610	1.500	.656	1.313	1.000	2.734	1.625	
C20	D20	1-1/4	1-5/8-12		2.763	1.635	.813	1.625	1.250	2.875	1.797	
C24	D24	1-1/2	1-7/8-12		2.719	1.813	.938	1.875	1.500	2.938	2.031	
C28	D28	1-3/4	2-1/4-12		2.797	2.000	1.125	2.250	1.750	3.078	2.266	
C32	D32	2	2-1/2-12		2.953	2.250	1.250	2.563	2.000	3.031	2.578	

MATERIAL: See Procurement Specification: Corrosion Resistant Steel (Class 316) Code "C"; Aluminum Alloy, Code "D".

FINISH: See Procurement Specification

SCREW THREAD: See Procurement Specification

NOTES:

1. Remove Burrs and Slivers. Break sharp edges unless otherwise noted.
2. Dimensions in inches. Unless otherwise specified, tolerance Decimals = .016.
3. For design feature purposes, this drawing takes precedence over procurement documents referenced herein.
4. Referenced documents shall be of the issue in effect on date of invitation for bid.
5. Marking of fittings shall be consistent with procurement specification using applicable KC Standard and part number designations as shown on this drawing.

EXAMPLE OF PART NOS. KC128C8 = Elbow, 1/2 OD Tubing, Corrosion Resistant Steel
 KC128D8 = Elbow, 1/2 OD Tubing, Aluminum Alloy

CUSTODIAN		JOHN F. KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION	TITLE	ELBOW - FLARED TUBE & UNIVERSAL, 45°, FOR SEAL RING	STANDARD PART
KSC-F-124			KC128
COORDINATION STATUS			SHEET 1 OF 1
KSC DE			

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APPROVED 6-10-66 REVISED (A) 9-12-66 (D) 10/23/67 (C) 4-15-68 (E) 11-3-75

NOTE: When Gov't designs, specs., or other data are used for any purpose other than in connection with a definitely related Gov't. procurement operation, the U. S. Gov't. thereby incurs no responsibility, nor any obligation whatsoever, and the fact that the Gov't. may have furnished, furnished, or in any way supplied the said designs, specs., or other data is not to be regarded as implication or otherwise as in any manner licensing the holder or any other person or corp., or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.



FED SUP CLASS
4730

MATERIAL: See Procurement Specification; Aluminum Alloy, Code "J", Corrosion Resistant Steel (Class 316), Code "C" • AN24; CRES nuts may be either 304 or 316

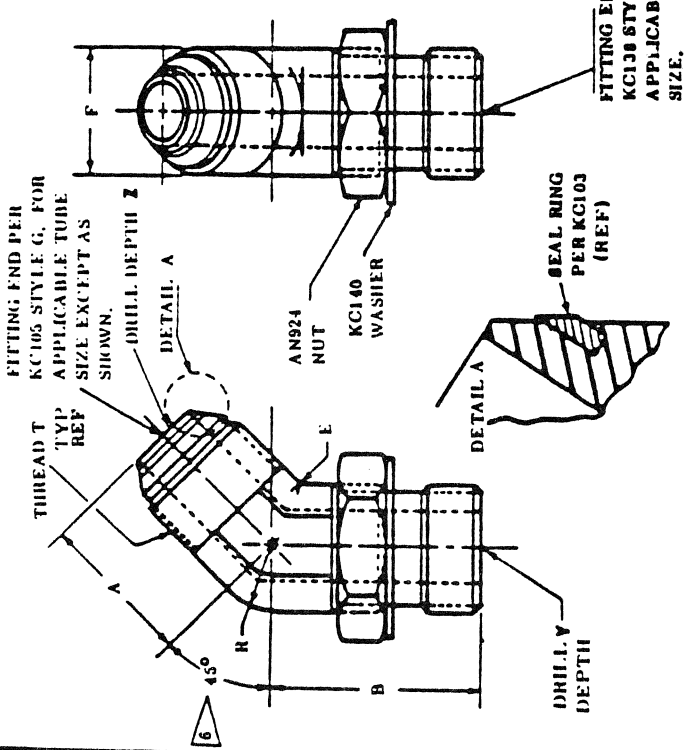
FINISH: See Procurement Specification

SCREW THREAD: See Procurement Specification

- NOTES:**
1. Remove Burrs and Shivers. Break sharp edges unless otherwise noted.
 2. Dimensions in inches. Unless otherwise specified, tolerance $\pm .005$.
 3. For design feature purposes, this drawing takes precedence over procurement documents referenced herein.
 4. Referenced documents shall be of the issue in effect on date of invitation for bid.
 5. Marking of fittings shall be consistent with procurement specification using applicable KC Standard and part number designations as shown on this drawing.

B Tolerance up to and including -6 size $\pm 2-1/2^\circ$; above -6 size $\pm 1-1/2^\circ$.

EXAMPLE OF PART NOS.
KC129C1 - CRE STEEL, 45° Elbow Assy for 1/4 OD Tubing.
KC129D16 - AL ALLOY, 45° Elbow Assy for 1 OD Tubing.



CUSTODIAN JOHN F. KENNEDY SPACE CENTER		STANDARD PART	
PROCUREMENT SPECIFICATION KSC-F-124	TITLE ELBOW ASSY, 45°, FLARED TUBE & MALE ADJUSTABLE END FOR SEAL RING	KC129	
COORDINATION STATUS KSC DE		SHEET 1 OF 2	

APPROVED 5-10-65 (A) 7-11-68 (B) 12/11/68 (C) 11-3-75



FED SUP CLASS
4730

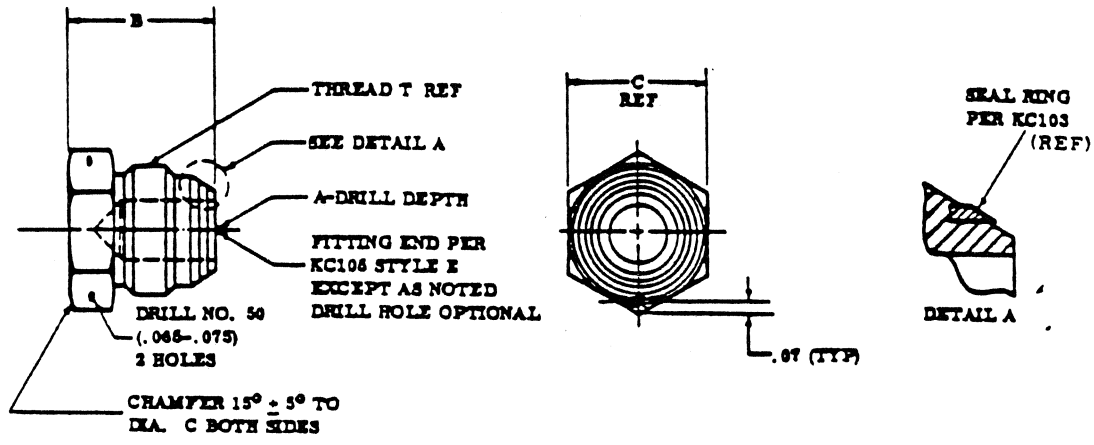
DASH NO.		TUBE OD REF	THREAD T REF	A	B	E	R	F	BULKHEAD NUT		WASHER	
CRE STEEL	AL ALLOY			DOM. +.000 -.063	DOM. +.000 -.063	RAD ±.03	RAD ±.03	PAD DOM. ±.016	FOR CRE STEEL ASSY *	FOR AL ALLOY ASSY	FOR CRE STEEL ASSY	FOR AL ALLOY ASSY
C4	D4	1/4	7/16-20	.750	1.078	.063	.262	.438	AN924K4	AN924D4	KC140C4	KC140D4
C6	D6	3/8	9/16-18	.860	1.172	.084	.317	.563	AN924K6	AN924D6	KC140C6	KC140D6
C8	D8	1/2	3/4-16	1.016	1.328		.414	.750	AN924K8	AN924D8	KC140C8	KC140D8
C10	D10	5/8	7/8-14	1.141	1.547	.125	.484	.875	AN924K10	AN924D10	KC140C10	KC140D10
C12	D12	3/4	1-1/16-12	1.313	1.766		.588	1.063	AN924K12	AN924D12	KC140C12	KC140D12
C16	D16	1	1-5/16-12	1.500	1.891		.719	1.313	AN924K16	AN924D16	KC140C16	KC140D16
C20	D20	1-1/4	1-5/8-12	1.625	1.838		.875	1.625	AN924K20	AN924D20	KC140C20	KC140D20
C24	D24	1-1/2	1-7/8-12	1.813		1.063	1.875	1.875	AN924K24	AN924D24	KC140C24	KC140D24
C28	D28	1-3/4	2-1/4-12	2.000	1.891	1.125	2.250	AN924K28	AN924D28	KC140C28	KC140D28	
C32	D32	2	2-1/2-12	2.250		.188	1.383	2.500	AN924K32	AN924D32	KC140C32	KC140D32

DASH NO.	TUBE OD REF.	Y +.047 -.000	Z +.047 -.000
-4	1/4	1.094	.766
-6	3/8	1.203	.891
-8	1/2	1.375	1.063
-10	5/8	1.609	1.203
-12	3/4	1.844	1.391
-16	1	2.016	1.625
-20	1-1/4	2.109	1.797
-24	1-1/2	2.156	2.031
-28	1-3/4	2.016	2.264
-32	2		2.578

responsibility, nor any obligation whatsoever, and the fact that the Gov't. may have furnished, furnished, or in any way supplied the said data, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corp., or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

CUSTODIAN		JOHN F. KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION	TITLE	STANDARD PART	
KSC-F-124	ELBOW ASSY, 45°, FLARED TUBE & MALE ADJUSTABLE END FOR SEAL RING	KC129	
COORDINATION STATUS		SHEET 2 OF 2	
KSC DE			

APPROVED 3-28-68 REVISED (D) 11-3-75



DASH NO.	TUBE OD REF	THREAD T REF	A	B		C REF
				+ .000	- .045	
C4	D4	1/4	7/16-20	.531	.750	.688
C8	D8	3/8	9/16-18	.543	.828	.813
C8	D8	1/2	3/4-16	.625	.953	1.000
C10	D10	5/8	7/8-14	.766	1.125	1.125
C12	D12	3/4	1-1/16-12	.813	1.219	1.375
C16	D16	1	1-5/16-12		1.297	1.625
C20	D20	1-1/4	1-5/8-12	.750	1.375	1.875
C24	D24	1-1/2	1-7/8-12	.813	1.500	2.125
C28	D28	1-3/4	2-1/4-12	.781	1.625	2.500
C32	D32	2	2-1/2-12	.828	1.750	2.750

MATERIAL:

See Procurement Specification
 Aluminum Alloy, Code "D"
 Corrosion Resistant Steel (Class 316). Code "C"

FINISH:

See Procurement Specification

SCREW THREAD:

See Procurement Specification

NOTES:

1. Remove Burrs and Slivers. Break sharp edges unless otherwise noted.
2. Dimensions in inches. Unless otherwise specified, Tolerance Decimals ± .016.
3. For design feature purposes, this drawing takes precedence over procurement documents referenced herein.
4. Referenced documents shall be of the issue in effect on date of invitations for bid.
5. Marking of fittings shall be consistent with procurement specification using applicable KC Standard and part number designations as shown on this drawing.

EXAMPLE OF PART NOS.

KC130C8 = Cree Seal Plug for 1/2 OD Tubing
 KC130D12 = Al Alloy Plug for 3/4 OD Tubing

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APPROVED 8-12-65
 REVISED (A) 9-12-66 (B) 1-16-67 (C) 4-15-68 (D) 11-3-75

CUSTODIAN JOHN F. KENNEDY SPACE CENTER		STANDARD PART	
PROCUREMENT SPECIFICATION TITLE KSC-F-124	PLUG, FLARED TUBE FOR SEAL RING		KC130
COORDINATION STATUS KSC DE			SHEET 1 OF 1

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CUSTODIAN: JOHN F. KENNEDY SPACE CENTER		FED SUP CLASS 4730	
PROCUREMENT SPECIFICATION TITLE KSC-F-124	STANDARD PART KC131	SHEET 1 OF 2	
COORDINATION STATUS KSC DE	ELBOW ASSEMBLY, 90°, FLARED TUBE AND FEMALE SWIVEL END FOR SEAL RING		

MATERIAL: See Procurement Specification.
Aluminum Alloy, Code "D";
Corrosion Resistant Steel (Class 316), Code "C"

FINISH: See Procurement Specification

SCREW THREAD: See Procurement Specification

"W" after dash number indicates nut with Lockwire Holes. See Note 6.

EXAMPLE OF PART NOS.
KC131CW - CRE STEEL, SWIVEL END- Elbow for 1/2 OD Tubing, Drilled for Lockwire
KC131DM - AL ALLOY, SWIVEL END- Elbow for 1 OD Tubing.

NOTES:

1. Remove Burrs and Slivers. Break sharp edges unless otherwise noted.
2. Dimensions in inches. Unless otherwise specified, tolerance Decimals ±.015
3. For design feature purposes, this drawing takes precedence over procurement documents referenced herein.

4. Reference documents shall be of the issue in effect on date of invitation for bid.
5. Marking of fittings shall be consistent with procurement specification using applicable KG Standard and part number designations as shown on this drawing.
6. When required Lockwire Holes per MC144, Style E.
 - △ Tolerance up to and including - 6 size ± 2-1/2° above - 6 ± 1-1/2°.

APPROVED 8-12-65

REVISED (A) 9-12-66 (B) 6-16-67 (C) 4-15-68 (D) 12-1-76

NASA



National Aeronautics and Space Administration

John F. Kennedy Space Center
Kennedy Space Center Annex Building 3300M
AC 315 467 3446

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4730

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DASH NO.	CRE STEEL	AL ALLOY	REF TUBE OD	THREAD T REF	A DIM +.000 -.003	B +.000 -.001	C DIM REF	D RAD +.03	R RAD +.03	E PAD DIM	F +.007 -.011	G +.016 -.011	SWIVEL NUT KC 139		RETAINING WIRE
													CRE STEEL	AL ALLOY	
C4	D4	D4	1/4	7/16-20	.906	.704	1.000	.063	.242	.438	.906	.734	C4	D4	KC165-4
C6	D6	D6	3/8	9/16-18	1.076	.891	1.250		.317	.563	1.094	.923	C6	D6	KC165-6
C8	D8	D8	1/2	3/4-16	1.266	.969	1.376	.094	.414	.750	1.281	1.016	C8	D8	KC165-8
C10	D10	D10	5/8	7/8-14	1.469	1.141	1.635		.484	.875	1.484	1.188	C10	D10	KC165-10
C12	D12	D12	3/4	1-1/16-12	1.672	1.204	1.750		.566	1.063	1.688	1.250	C12	D12	KC165-12
C16	D16	D16	1	1-5/16-12	1.828	1.422	2.000	.185	.719	1.313	1.904	1.631	C16	D16	KC165-16
C20	D20	D20	1-1/4	1-5/8-12	2.078	1.704	2.313		.875	1.625	2.156	1.812	C20	D20	KC165-20
C24	D24	D24	1-1/2	1-7/8-12	2.344	1.875	2.594	.188	1.031	1.875	2.609	2.172	C24	D24	KC165-24
C28	D28	D28	1-3/4	2-1/4-12	2.660	2.063	2.900		1.188	2.250	2.931	2.212	C28	D28	KC165-28
C32	D32	D32	2	2-1/2-12	3.078	2.454	3.376	.250	1.383	2.500	3.219	2.673	C32	D32	KC165-32

CUSTODIAN

JOHN F. KENNEDY SPACE CENTER

PROCUREMENT SPECIFICATION

TITLE

KSC-F-124

ELBOW ASSEMBLY, 90°,
FLARED TUBE AND FEMALE
SWIVEL END FOR SEAL RING

STANDARD PART

KC131

COORDINATION STATUS

KSC DE

SHEET 2 OF 2

REVISION 12 1 75

APPROVED: 8-12-65



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MATERIAL: See Procurement Specification-
Use:
Aluminum Alloy, Code "D";
Corrosion Resistant Steel
(Class 316), Code "C"

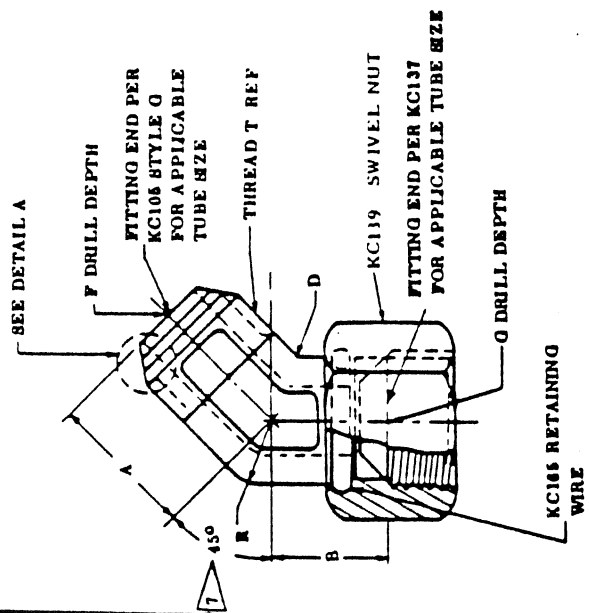
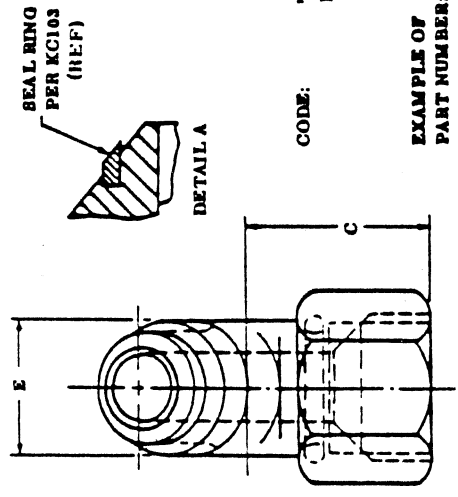
FINISH: See Procurement Specification-
Use

SCREW THREAD: See Procurement Specification

CODE: "W" after dash number indicates nut with Lockwire Holes. See Note 6.

EXAMPLE OF PART NUMBER:
KC132C10W - CRES. STEEL, SWIVEL.
END 45° ELBOW FOR 5/8 OD Tubing
Drilled for Lockwire

KC132D12 - AL. ALLOY, SWIVEL.
END, 45° Elbow for 3/4 OD Tubing.



- NOTES:**
1. Remove Burrs and Slivers. Break sharp edges unless otherwise noted.
 2. Dimensions in inches. Unless otherwise specified, tolerance Decimals $\pm .016$.
 3. For design feature purposes, this drawing takes precedence over procurement documents referenced herein.
 4. Reference documents shall be of the issue in effect on date of invitation for bid.
 5. Marking of fittings shall be consistent with procurement specification using applicable KC Standard and part number designations as shown on this drawing.
 6. When required Lockwire Holes per MC144, Style E.
 7. Tolerance up to and including $\frac{1}{8}$ size $\pm 1/8$; above $\frac{1}{8}$ size $\pm 1/4$.

CUSTODIAN JOHN F. KENNEDY SPACE CENTER		STANDARD PART	
PROCUREMENT SPECIFICATION KSC-F-124	TITLE ELBOW ASSEMBLY, 45°, FLARED TUBE AND FEMALE SWIVEL END	KC132	
COORDINATION STATUS KSC DE		SHEET 1 OF 2	

APPROVED 8-12-65 REVISED (A) 9-18-66 (B) 6-16-67 (C) 12-1-75



National Aeronautics and Space Administration

John F. Kennedy Space Center

Space Shuttle Operations Office, 1414 S.W. 13th Ave., MS 875 3357-2146

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DASH NO		TUBE OD REF	THREAD T REF	A DIM + .000 - .063	B DIM + .000 - .031	C DIM REF	D RAD ± .03	R RAD ± .03	E PAD DIM	F + .047 - .016	G	SWIVEL NUT KC 139		RETAINING WIRE
CRE STEEL	AL ALLOY											CRE STEEL	AL ALLOY	
C4	D4	1/4	7/16-20	.750	.610	.938	.063	.242	.438	.766	.656	C4	D4	KC165-4
C6	D6	3/8	9/16-18	.860	.766	1.125	.094	.317	.563	.891	.828	C6	D6	KC165-6
C8	D8	1/2	3/4-18	1.016	.875	1.281		.414	.750	1.063	.953	C8	D8	KC165-8
C10	D10	5/8	7/8-14	1.141	.954	1.438	.125	.484	.875	1.263	1.047	C10	D10	KC165-10
C12	D12	3/4	1-1/16-12	1.313	.954	1.506		.566	1.063	1.391	1.063	C12	D12	KC165-12
C16	D16	1	1-5/8-12	1.500	1.172	1.750		.719	1.313	1.625	1.328	C16	D16	KC165-16
C20	D20	1-1/4	1-5/8-12	1.625	1.422	2.031		.875	1.625	1.797	1.625	C20	D20	KC165-20
C24	D24	1-1/2	1-7/8-12	1.813	1.532	2.250		1.031	1.875	2.031	1.781	C24	D24	KC156-24
C28	D28	1-3/4	2-1/4-12	2.000	1.766	2.619		1.125	2.250	2.266	2.031	C28	D28	KC165-28
C32	D32	2	2-1/2-12	2.250	1.985	2.906	.188	1.383	2.500	2.578	2.313	C32	D32	KC165-32

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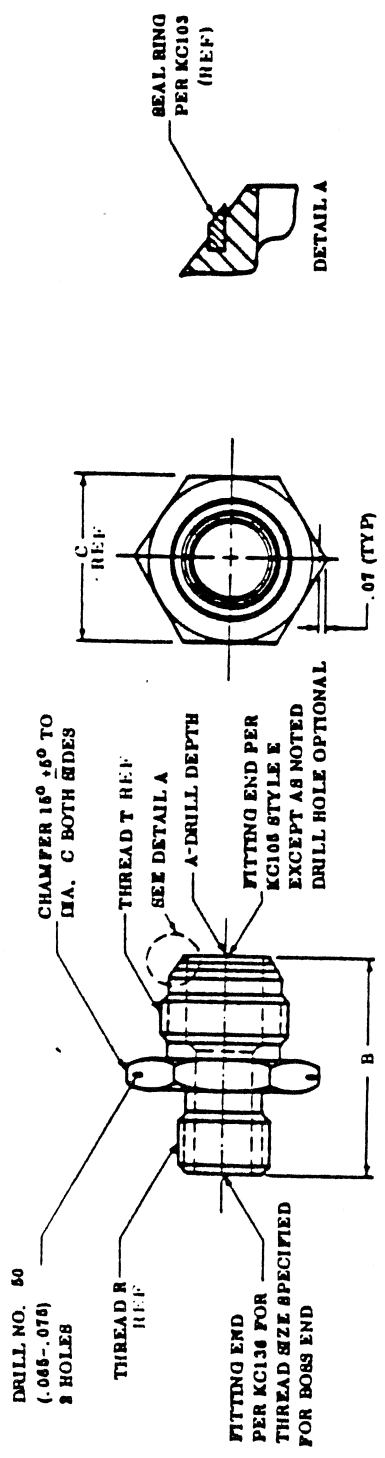
APPROVED: 8 11 65 REVISED: 12 1 75

CUSTODIAN JOHN F. KENNEDY SPACE CENTER		STANDARD PART KC132	
PROCUREMENT SPECIFICATION KSC-F-124	TITLE ELBOW ASSEMBLY, 45°, FLARED TUBE AND FEMALE SWIVEL END	SHEET 2 OF 2	
COORDINATION STATUS KSC DE			

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FED SUP CLASS
4730



MATERIAL: See Procurement Specifications
Aluminum Alloy, Code "D"
Corrosion Resistant Steel (Class 316), Code "C"

FINISH: See Procurement Specifications

SCREW THREAD: See Procurement Specifications

- NOTES:**
1. Remove Burrs and Slivers. Break sharp edges unless otherwise noted.
 2. Dimensions in inches. Unless otherwise specified, tolerance Decimals ±.005.

3. For design feature purposes, this drawing takes precedence over procurement documents referenced herein.

4. Referenced documents shall be of the issue in effect on date of invitation for bid.

5. Marking of fittings shall be consistent with procurement specification using applicable KC Standard and part number designations as shown on this drawing.

6. At the option of the manufacturer, the smaller inside diameter dimension may be drilled from part to part.

EXAMPLE OF: KC133C8-1 = CRES STEEL REDUCER-ADAPTER FOR 1/2 TUBE FITTING TO 3/16 TUBE (3/8 BOSS).
PART NOS. KC133D12-8 = AL ALLOY REDUCER-ADAPTER FOR 3/4 TUBE FITTING TO 1/2 TUBE (3/4 BOSS).

CUSTODIAN: JOHN F KENNEDY SPACE CENTER		STANDARD PART	
PROCUREMENT SPECIFICATION KSC-P-124	TITLE REDUCER-ADAPTER FLARED TUBE AND BOSS, FOR SEAL RING	KCI33	
COORDINATION STATUS		SHEET 1 OF 2	
KSC DE			

APPROVED 8-12-65 REVISED (B) 11-16-67 (C) 4-15-68 (D) 11-3-75



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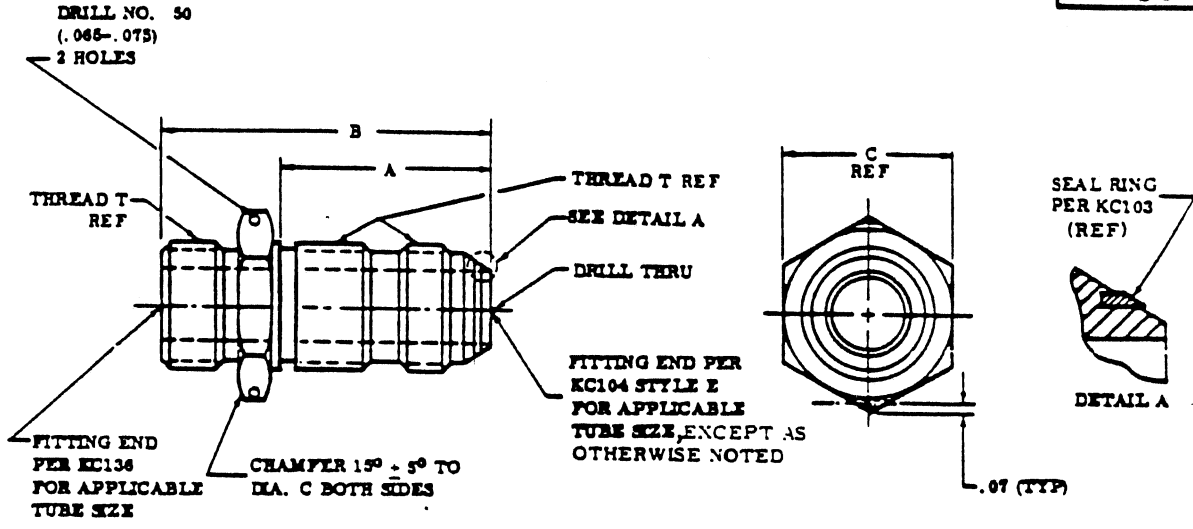
Dash No.		Flared Tube End		Boss End		A MAX	B +.000 -.040	C REF
C&E Boss	AL Alley	Tube OD Ref	Thread T Ref	TUBE OD REF	Thread R Ref			
C4-2	D4-2	1/4	7/16-20	1/8	5/16-24	.452	1.100	.525
C4-3	D4-3			3/16	3/8-24		1.068	
C8-2	D8-2	3/8	9/16-18	1/8	5/16-24	.457	1.242	.813
C8-3	D8-3			3/16	3/8-24		1.208	
C8-4	D8-4			1/4	7/16-20		1.335	
C8-6	D8-5			5/16	1/2-20			
C8-2	D8-2	1/2	3/4-16	1/8	5/16-24	.538	1.357	1.000
C8-3	D8-3			3/16	3/8-24		1.323	
C8-4	D8-4			1/4	7/16-20		1.450	
C8-5	D8-6			5/16	1/2-20		1.445	
C8-6	D8-6			3/8	9/16-18			
C10-4	D10-4	5/8	7/8-14	1/4	7/16-20	.618	1.533	1.125
C10-6	D10-4			3/8	9/16-18		1.528	
C10-8	D10-8			1/2	3/4-16		1.567	
C12-4	D12-4	3/4	1-1/16-12	1/4	7/16-20	.703	1.686	1.375
C12-5	D12-6			5/16	1/2-20		1.681	
C12-6	D12-6			3/8	9/16-18		1.719	
C12-8	D12-8			1/2	3/4-16		1.816	
C12-10	D12-10			5/8	7/8-14			
C16-4	D16-4	1	1-5/16-12	1/4	7/16-20	.741	1.722	1.625
C16-6	D16-8			1/2	3/4-16		1.809	
C16-10	D16-10			5/8	7/8-14		1.852	
C16-12	D16-12			3/4	1-1/16-12		1.912	
C20-4	D20-4	1-1/4	1-5/8-12	1/4	7/16-20	.778	1.945	1.875
C20-12	D20-12			3/4	1-1/16-12		2.202	
C20-16	D20-16			1	1-5/16-12			
C24-16	D24-16	1-1/2	1-7/8-12	1-1/4	1-6/8-12	.878	2.159	2.125
C24-20	D24-20						2.154	
C28-20	D28-20	1-3/4	2-1/4-12	1-1/2	1-7/8-12	.978	2.373	2.500
C28-24	D28-24						2.404	
C32-24	D32-24	2	2-1/2-12	1-3/4	2-1/4-12	1.078	2.529	2.750
C32-28	D32-28						2.684	

REVISED (A) 9-12-66 (C) 4-15-68 (D) 11-3-75
 APPROVED 8-12-65

CUSTOMER JOHN F. KENNEDY SPACE CENTER		STANDARD PART	
PROCUREMENT SPECIFICATION KSC-P-134	TITLE REDUCER-ADAPTER FLARED TUBE AND BOSS, FOR SEAL RING	KCI33	
COORDINATION STATUS KSC DE		SHEET 2 OF 2	



FED SUP CLASS
4730



DASH NO.		TUBING OD	THREAD T REF	A +.000 -.045	B +.000 -.060	C REF
CRE STEEL	AL ALLOY					
C4	D4	1/4	7/16-20	1.213	1.881	.688
C6	D6	3/8	9/16-18	1.291	2.078	.813
C8	D8	1/2	3/4-16	1.447	2.312	1.000
C10	D10	5/8	7/8-14	1.588	2.523	1.125
C12	D12	3/4	1-1/16-12	1.760	2.797	1.375
C16	D16	1	1-5/16-12		2.834	1.625
C20	D20	1-1/4	1-5/8-12	1.807	2.956	1.875
C24	D24	1-1/2	1-7/8-12	1.822	3.018	2.125
C28	D28	1-3/4	2-1/4-12	1.979	3.314	2.500
C32	D32	2	2-1/2-12	2.104	3.467	2.750

MATERIAL: See Procurement Specification
 Aluminum Alloy, Code "D"
 Corrosion Resistant Steel (Class 316), Code "C"

FINISH: See Procurement Specification

SCREW THREAD: See Procurement Specification

- NOTES:**
1. Remove Burrs and Slivers. Break sharp edges unless otherwise noted.
 2. Dimensions in inches. Unless otherwise specified, tolerance Decimals ±.005.
 3. For design feature purposes, this drawing takes precedence over procurement documents referenced herein.
 4. Referenced documents shall be of the issue in effect on date of invitation for bid.
 5. Marking of fittings shall be consistent with procurement specification using applicable KC Standard and part number designations as shown on this drawing.

EXAMPLE OF PART NOS. KC134C8 - CRE STEEL ADAPTER FOR 1/2 BOSS
 KC134D16 - AL ALLOY ADAPTER FOR 1 BOSS

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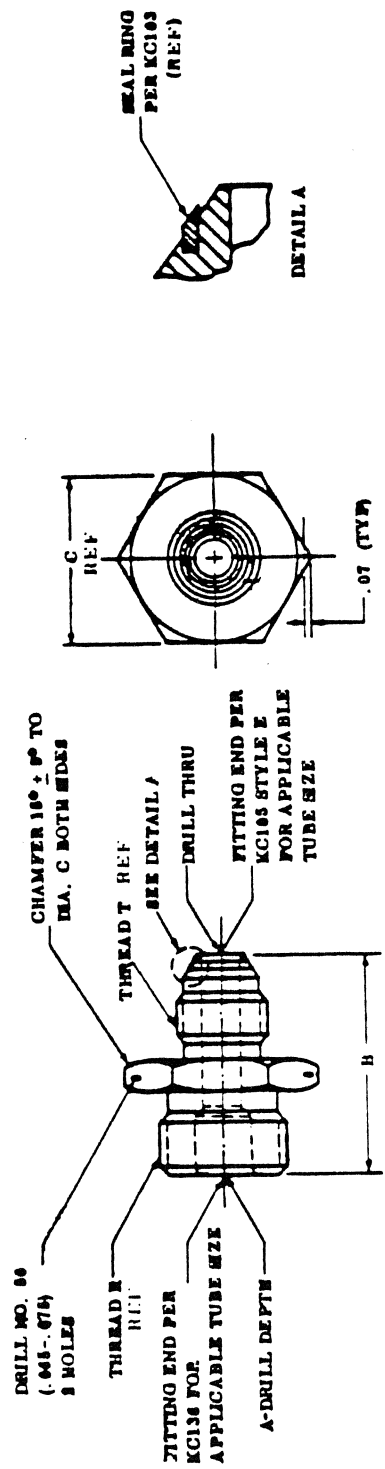
APPROVED 8-12-65
 REVISED: (A) 9 12 66 (B) 6-16-67 (C) 4-15-68 (D) 11-3-75

CUSTODIAN JOHN F. KENNEDY SPACE CENTER		STANDARD PART	
PROCUREMENT SPECIFICATION KSC-P-124	TITLE ADAPTER, FLARED TUBE 3/8 BULKHEAD AND BOSS FOR SEAL RING	KC134	
COORDINATION STATUS KSC DE	SHEET 1 OF 1		

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FED SUP CLASS
4730



MATERIAL: See Procurement Specification
Aluminum Alloy, Code "D"
Corrosion Resistant Steel (Class 316), Code "G"

FINISH: See Procurement Specification

SCREW THREAD: See Procurement Specification

NOTES:

- Remove Burrs and Filers. Break sharp edges unless otherwise noted.
- Dimensions in inches. Unless otherwise specified, tolerance Decimals ±.0015
- For design feature purposes, this drawing takes precedence over procurement documents referenced herein.
- Referenced documents shall be of the issue in effect on date of invitation for bid.
- Marking of fittings shall be consistent with procurement specification using applicable KC Standard and part number designations as shown on this drawing.

At the option of the manufacturer, the smaller inside diameter dimension may be drilled from part to part.

EXAMPLE OF PART NOS

KC136C6-8 - Gro Steel Expander-Adapter for 3/8 Tube Size flared end and 1/2 Tube Size Boss end

KC136DM-10 - Al Alloy Expander-Adapter for 1/2 Tube Size flared end and 5/8 Tube Size Boss end.

CUSTODIAN: JOHN F KENNEDY SPACE CENTER		STANDARD PART	
PROCUREMENT SPECIFICATION TITLE KSC-F-124	EXPANDER-ADAPTER, FLARED TUBE TO BOSS, FOR SEAL RING		KC135
COORDINATION STATUS			SHEET 1 OF 2

APPROVED 8-12-65 REVISED 8-11-67 (C) 4 11-68 (D) 9-30-75



FED SUP CLASS
4730

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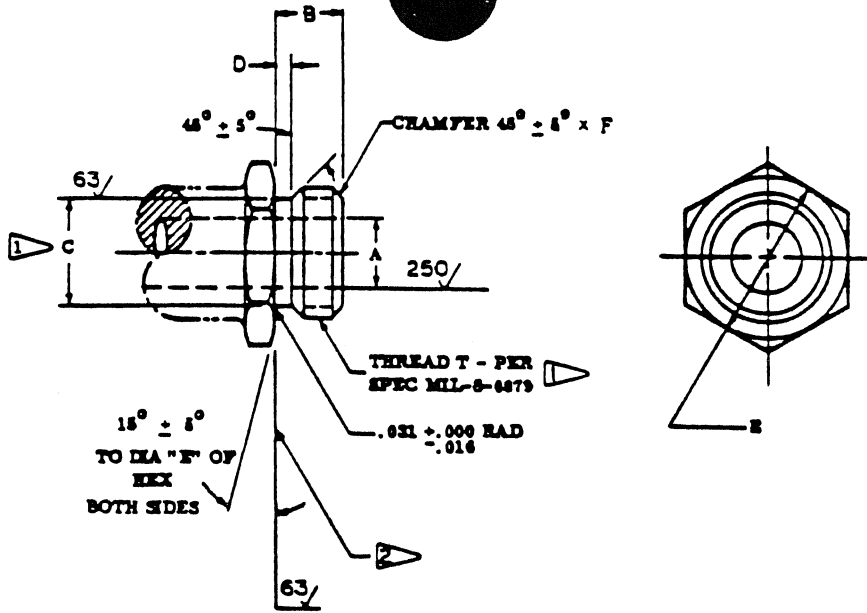
DASH NO	CREB STEEL	AL ALLOY	FLARED TUBE END		TUBE OD REF	BOSS END THREAD R REF	A MAX	H .0000 .0001	C HET
			TUBE REF OD	THREAD T REF					
C2-4		D2-4	1/8	9/16-24	1/4	7/16-20	.311	1.081	.000
C3-4		D3-4	3/16	3/8-24				1.115	
C2-8		D2-8	1/8	5/16-24				1.161	
C3-8		D3-8	3/16	3/8-24	3/8	9/16-16	.316	1.194	.013
C4-4		D4-4	1/4	7/16-20				1.265	
C6-4		D6-4	5/16	1/2-20				1.285	
C2-8		D2-8	1/8	5/16-24				1.315	
C3-8		D3-8	3/16	3/8-24	1/8	3/4-16	.417	1.390	1.000
C4-8		D4-8	1/4	7/16-20				1.392	
C6-8		D6-8	5/16	1/2-20				1.460	1.136
C8-8		D8-8	3/8	9/16-18	5/8	7/8-14	.454	1.560	
C4-10		D4-10	1/4	7/16-20				1.567	1.376
C8-10		D8-10	3/8	9/16-18				1.668	
C8-10		D8-10	3/8	9/16-18				1.769	
C4-12		D4-12	1/4	3/4-16				1.597	
C8-12		D8-12	3/8	7/8-14				1.603	
C8-12		D8-12	3/8	9/16-18				1.704	1.058
C8-12		D8-12	3/8	9/16-18				1.805	
C8-12		D8-12	3/8	9/16-18				1.911	
C4-16		D4-16	1/4	7/16-20				1.691	
C8-16		D8-16	3/8	9/16-18				2.007	1.875
C8-16		D8-16	3/8	9/16-18				2.054	
C8-16		D8-16	3/8	9/16-18				2.095	2.125
C8-16		D8-16	3/8	9/16-18				2.142	
C8-16		D8-16	3/8	9/16-18				2.217	2.500
C8-16		D8-16	3/8	9/16-18				2.412	
C24-12		D24-12	1-1/2	1-7/8-12	2	2-1/2-12	.782	2.516	2.750
C24-12		D24-12	1-3/4	2-1/4-12				2.611	

APPROVED 8-12-65 REVISED 9-12-66 C 7-15-68 D 9-30-75

CUSTODIAN JOHN F. KENNEDY SPACE CENTER		STANDARD PART	
PROCUREMENT SPECIFICATION TITLE KSC-7-124 EXPANDER-ADAPTER, FLARED TUBE TO BOSS, FOR SEAL RING		KCI35	
COORDINATION STATUS KSC DE		SHEET 2 OF 2	



FED SUP CLASS
NONE



DASH NO.	TUBE OD (REF)	1 THREAD T MIL-8-8879	A DIA	B DIM +.000 -.015	C DIA +.002 -.003	D DIM +.015 -.000	E DIA	F							
								MIN	MAX						
-2	1/8	.3125-24UNJF-3A	.062	+.004	.351	.250	+.003 -.004	.583	.081	.052					
-3	3/16	.3750-24UNJF-3A	.125		.355	.312					.063	.625			
-4	1/4	.4375-20UNJF-3A	.172		.389	.364					.075	.588			
-5	5/16	.5000-20UNJF-3A	.234		.411	.426					.075	.750			
-6	3/8	.5625-18UNJF-3A	.297		.429	.481					.083	.813			
-8	1/2	.7500-16UNJF-3A	.391		.521	.660					.094	1.000			
-10	5/8	.8750-14UNJF-3A	.484		.567	.773					.107	1.125			
-12	3/4	1.0625-12UNJ-3A	.609		+.005	.636					.945	1.375	+.016		
-16	1	1.3125-12UNJ-3A	.844			.672					1.195	.125				1.625
-20	1-1/4	1.6250-12UNJ-3A	1.078		+.008 -.005	.720					1.507 1.756	1.875	+.020	.063	.104
-24	1-1/2	1.8750-12UNJ-3A	1.312	2.125											
-28	1-3/4	2.2500-12UNJ-3A	1.547	+.010 -.006	.772	2.131	2.500								
-32	2	2.5000-12UNJ-3A	1.781				.887				2.381	2.750			

- NOTES:
- 1 Diameter C and T thread (pitch diameter) shall be concentric within .015 full indicator reading.
 - 2 Squareness between thread T pitch diameter and Face of Hex shall not exceed .005 for sizes dash 10 and smaller or .008 for larger sizes, when measured at the outer diameter of the face.
 3. None cancelled.
 4. Dimensions in inches, Tolerances noted.
 5. Roughness of machined surfaces shall be 125 AA max per ANSI B46.1 unless other wise specified.
 6. Break all sharp edges unless otherwise noted. Remove burrs and slivers.
 7. This standard takes precedence over documents referenced herein.

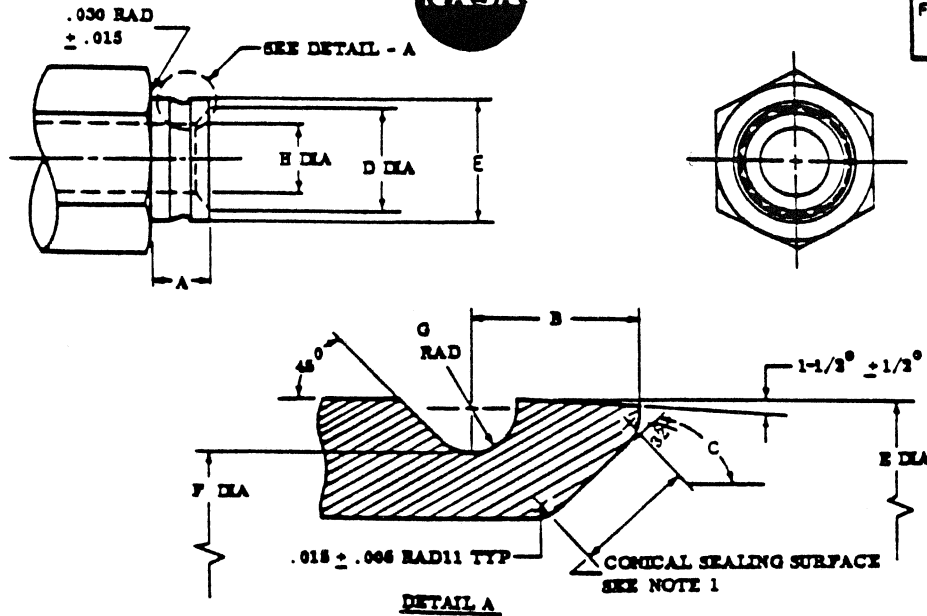
CUSTODIAN		JOHN F. KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION		TITLE	
NONE		STANDARD DIMENSIONS FOR FITTING END, STRAIGHT THREAD	
COORDINATION STATUS				DESIGN STANDARD
KSC DE		KC136	
		SHEET 1 OF 1	

APPROVED 8-12-65 REVISED (A) 9-12-60 (B) 1-27-68 (C) 1-15-68 (D) 5-8-66 (E) 11-3-75

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FED SUP CLASS
NONE



DASH NO.	TUBE O. D.	A ± .016	B	C DIEG ± 30'	D DIA	E DIA +.000 -.006	F DIA +.000 -.006	G RAD +.005 -.003	H DIA
-4	1/4	.344	.140	39 1/2	.286	.363	.278	.044	.172 +.003 -.004
-4	3/8		.156		.436	.502	.397		.297
-8	1/2	.438	.188		.572	.662	.545	.050	.391 ± .004
-10	5/8				.689	.797	.681		.484
-12	3/4	.484	.219	37	.869	.972	.834	.066	.609 ± .006
-16	1	.543	.250		1.078	1.234	1.072		.844 +.007 -.005
-20	1-1/4	.656	.344		1.410	1.536	1.382		1.078 ± .008
-24	1-1/2		.381		1.625	1.786	1.636		1.312 ± .006
-28	1-3/4		.394		2.034	2.178	2.027		1.546 ± .010
-32	2	.813	.406		2.284	2.411	2.262		1.781 ± .005

NOTES:

1. The Conical Sealing Surface shall be concentric with E DIA within .006 full indicator reading.
2. Machined surface roughness, unless otherwise specified, shall not exceed 63/ per ANSI B46.1.
3. Dimensions in inches unless otherwise specified; Decimals ± .005
Angles ± 5'.
4. This standard takes precedence over documents referenced herein.
5. Break all sharp edges unless otherwise noted. Remove Burrs and Slivers.

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CUSTODIAN: JOHN F KENNEDY SPACE CENTER

PROCUREMENT SPECIFICATION TITLE
NONE

COORDINATION STATUS
KSC DE

FITTING END, SWIVEL FLARED
TUBE CONNECTOR, STANDARD
DIMENSIONS FOR

DESIGN STANDARD

KCI37

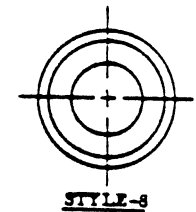
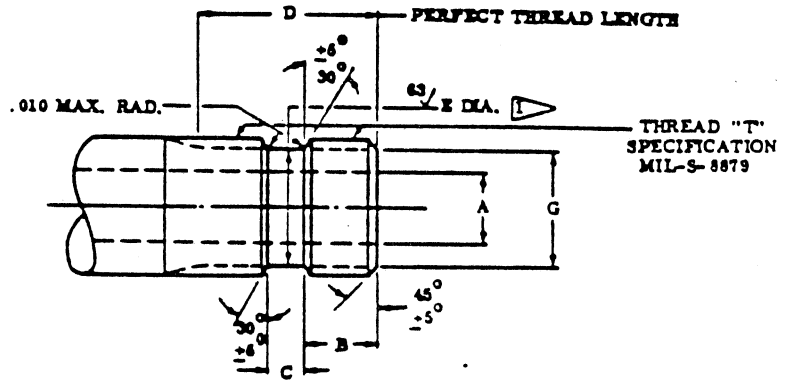
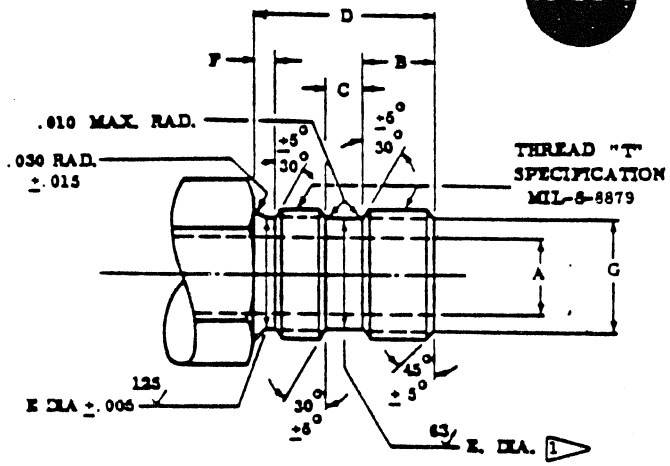
SHEET 1 OF 1

REVISED (A) 11-3-75 (B) 1-21-76

APPROVED 11-12-65



FED SUP CLASS
NONE



DASH NO.	TUBE O. D. REF	THREAD T MIL-S-8879	A DIA	B DIM	C ±.010 -.000	D DIM ±.016	E ±.002 -.003	F ±.015 -.000	G DIA ±.016	
-4	1/4	.4375-20UNJF-3A	.172	±.003	.281	.140	.703	.384	.075	.359
-4	3/8	.5625-18UNJF-3A	.287	±.004	.312	.184	.766	.482	.083	.484
-8	1/2	.7500-16UNJF-3A	.381		.344	.187	.875	.600	.094	.656
-10	5/8	.9750-14UNJF-3A	.484		.381	.218	1.016	.773	.107	.766
-12	3/4	1.0625-12UNJ-3A	.609	±.005	.489	.234	1.156	.948	.125	.938
-16	1	1.3125-12UNJ-3A	.844	±.007 -.005				1.196		1.195
-20	1-1/4	1.6250-12UNJ-3A	1.078	±.008 -.006				1.507		1.500
-24	1-1/2	1.8750-12UNJ-3A	1.312	1.756				1.750		
-28	1-3/4	2.2500-12UNJ-3A	1.547	2.131				2.125		
-32	2	2.5000-12UNJ-3A	1.781	±.010 -.005				2.381		2.375

- NOTES:
1. "E" Diameter groove shall be smooth and free of all thread marks.
 2. Surface finish of drilled hole shall be 125/ per ANSI B46.1.
 3. Machined surface roughness, unless otherwise specified, shall not exceed 100/ per ANSI B46.1.
 4. Dimensions in inches, unless otherwise specified, tolerances: Decimals ±.005.
 5. This standard takes precedence over documents referenced herein.

CUSTODIAN: JOHN F. KENNEDY SPACE CENTER

PROCUREMENT SPECIFICATION TITLE: NONE

COORDINATION STATUS: KSC DE

DESIGN STANDARD: KCI38

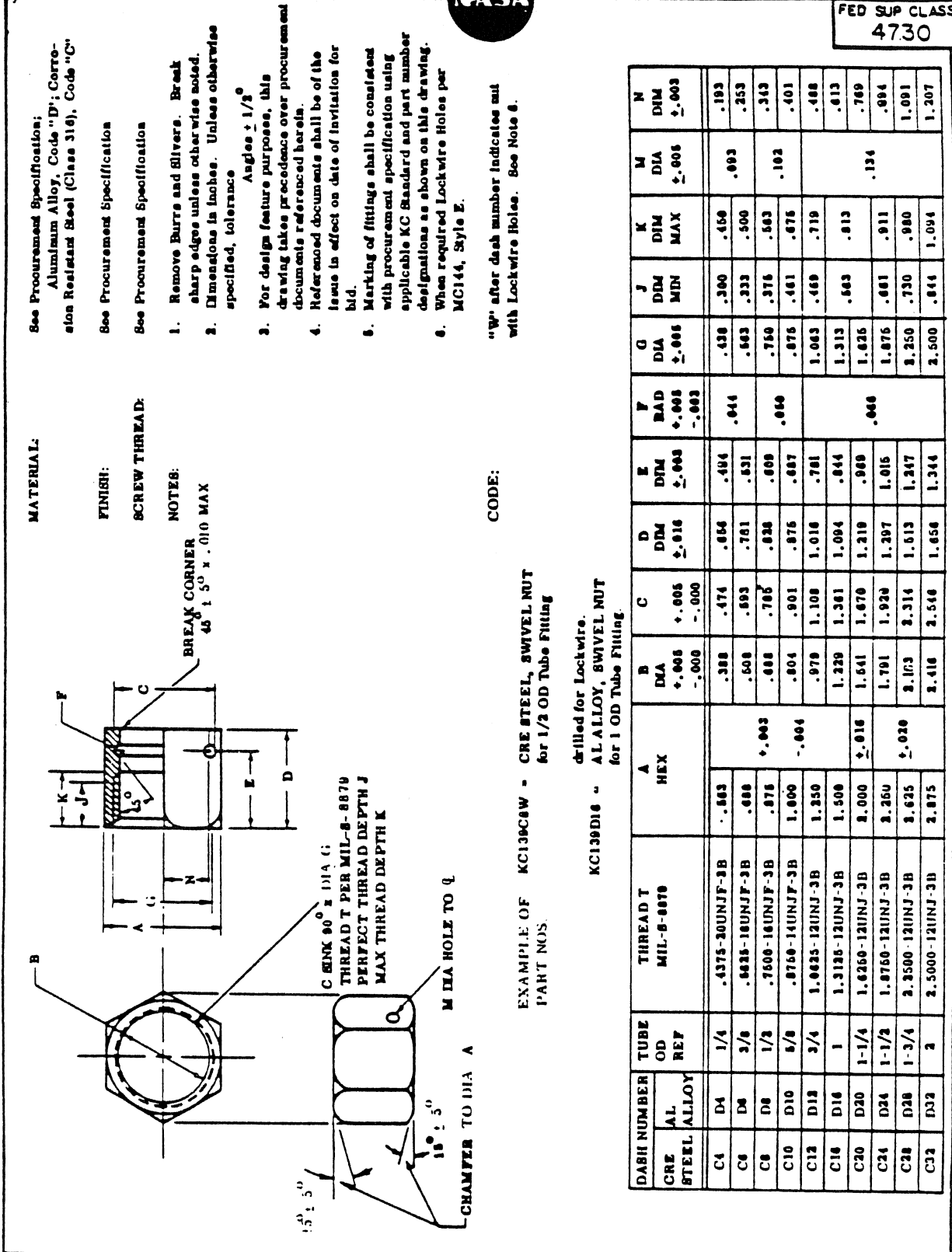
SHEET 1 OF 1

FITTING END, ADJUSTABLE FLARED TUBE CONNECTOR, STANDARD DIMENSIONS FOR

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REVISED 9-12-60 (A) 2-30-60 (B) 11-19-74 (C) 10-27-75
 APPROVED 8-12-65

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MATERIAL:

See Procurement Specification;
Aluminum Alloy, Code "D"; Corro-
sion Resistant Steel (Class 316), Code "C"

FINISH:

See Procurement Specification

SCREW THREAD:

See Procurement Specification

NOTES:

1. Remove Burrs and Slivers. Break sharp edges unless otherwise noted.
2. Dimensions in inches. Unless otherwise specified, tolerance
Angles ± 1/8°
3. For design feature purposes, this drawing takes precedence over procurement documents referenced hereto.
4. Referenced documents shall be of the issue in effect on date of invitation for bid.
5. Marking of fittings shall be consistent with procurement specification using applicable KC Standard and part number designations as shown on this drawing.
6. When required Lockwire Holes per MC144, Style E.

CODE:

"W" after dash number indicates nut with Lockwire Holes. See Note 6.

EXAMPLE OF KC139CW - CRE STEEL, SWIVEL NUT
PART NOS. for 1/2 OD Tube Fitting

drilled for Lockwire.
KC139D16 - AL ALLOY, SWIVEL NUT
for 1 OD Tube Fitting.

DASH NUMBER	TUBE OD REF	THREAD T	A	B	C	D	E	F	G	J	K	M	N
C4	D4	1/4	-.883	.388	.474	.656	.484	.044	.438	.390	.456	.093	.193
C6	D6	3/8	.688	.508	.593	.781	.531	.044	.583	.333	.500	.093	.253
C8	D8	1/2	.760	.608	.705	.828	.609	.044	.750	.375	.583	.102	.343
C10	D10	5/8	1.000	.804	.901	.875	.687	.044	.875	.481	.675	.102	.401
C12	D12	3/4	1.250	.978	1.108	1.016	.781	.044	1.063	.459	.719	.102	.488
C16	D16	1	1.509	1.229	1.361	1.094	.844	.044	1.313	.563	.813	.134	.613
C20	D20	1-1/4	2.000	1.541	1.670	1.219	.989	.044	1.625	.681	.911	.134	.769
C24	D24	1-1/2	2.250	1.791	1.920	1.297	1.015	.044	1.875	.681	.911	.134	.804
C28	D28	1-3/4	2.625	2.103	2.314	1.613	1.247	.044	2.250	.730	.980	.134	1.091
C32	D32	2	2.875	2.416	2.566	1.656	1.344	.044	2.500	.844	1.094	.134	1.207

FED SUP CLASS
4730

CUSTODIAN: JOHN F. KENNEDY SPACE CENTER

PROCUREMENT SPECIFICATION TITLE: SWIVEL NUT, FLARED TUBE FITTING

COORDINATION STATUS: KSC DE

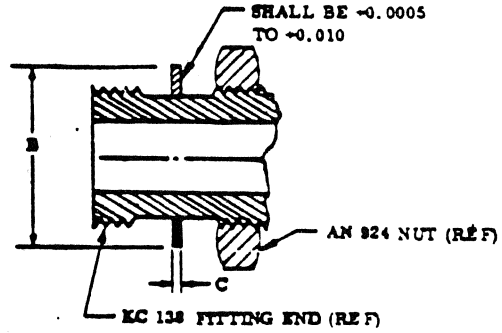
STANDARD PART: KC139

SHEET 1 OF 1



FED SUP CLASS
NONE

WASHER DIAMETRAL
CLEARANCE TO FITTING
SHALL BE -0.0005
TO $+0.010$



DASH NUMBER		C DIM STOCK THK $\pm .003$	FINAL ASSY. DIM. FOR B $\pm .015$	FLATNESS TOL "D" 5
COR STEEL	AL ALLOY			
C4	D4	.031	.650	.015
C6	D6		.794	
C8	D8		1.010	
C10	D10	.040	1.155	.020
C12	D12		1.444	
C16	D16		1.732	
C20	D20		2.165	
C24	D24		2.454	
C28	D28		2.868	
C32	D32		3.160	

MATERIAL:

Aluminum Alloy, Code "D"; Type 2024-T3 of specification QQ-A-365; Corrosion Resistant Steel (Class 302) Condition A of Specification QQ-8-766

NOTES:

1. Remove Burrs and Slivers. Break sharp edges unless otherwise noted.
 2. Dimensions in inches; Tolerances noted.
 3. For design feature purposes, this drawing takes precedence over procurement documents referenced herein.
 4. Referenced documents shall be of the issue in effect on date of invitation for bid.
5. Washer shall be flat within "D" after installation on fitting end.

**EXAMPLE OF
PART NOS.**

- KC140C4 = Corrosion Resistant Steel Washer for 1/4 O. D. Tube ADJ end fitting
 KC140D8 = Al Alloy washer for 1/2 O. D. Tube ADJ end fitting.

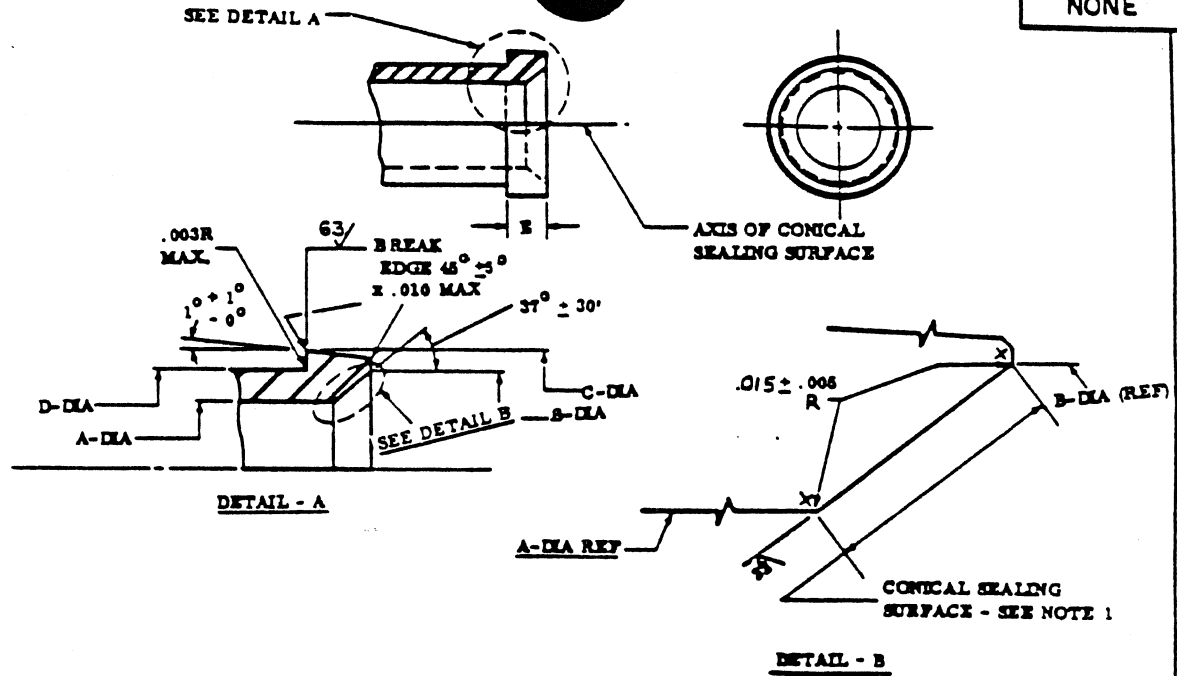
REVISED (A) 4-15-68 (B) 12/30/68 (C) 12-23-70 (D) 3-4-71 (E) 10-27-75 (F) 1-21-76
APPROVED 8-12-65

CUSTODIAN:		JOHN F. KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION	TITLE	DESIGN	STANDARD
None	WASHER FLARED TUBE FITTING ADJUSTABLE END	KC140	
COORDINATION STATUS		SHEET 1	OF 1
KSC DE			

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FED SUP CLASS
NONE



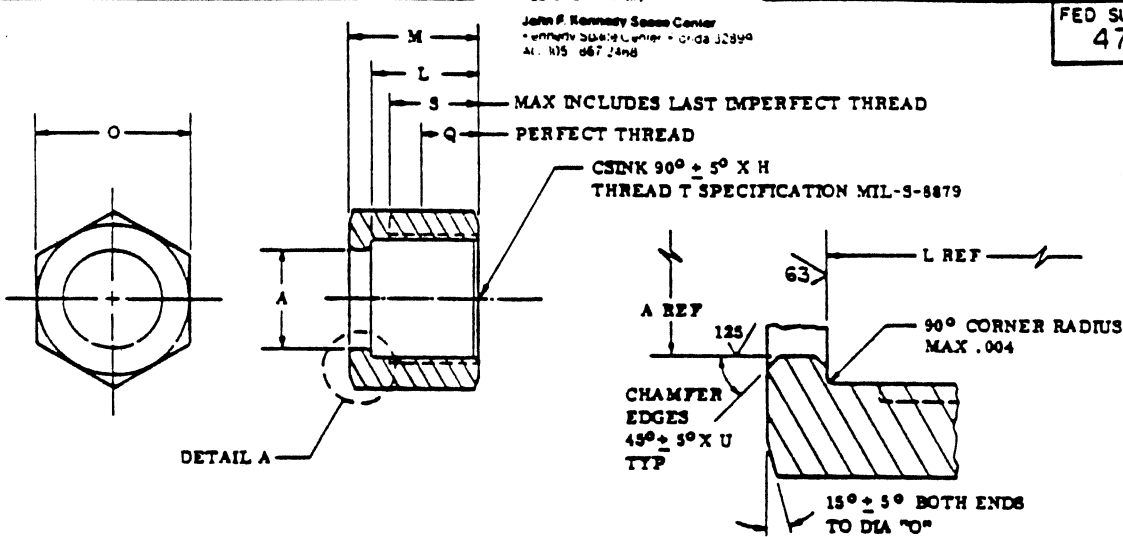
DASH NO.	TUBE O. D. REF	A DIA ± .005	B DIA ± .005	C DIA ± .003 -.000	D DIA ± .001	E DIM
-4	1/4	.162	.302	.380	.236	.141 +.005
-6	3/8	.286	.442	.499	.431	.171 +.007
-8	1/2	.388	.582	.679	.541	.218 ± .010
-10	5/8	.474	.720	.794	.669	.234
-12	3/4	.583	.862	.969	.825	.266 ± .015
-16	1	.786	1.110	1.219	1.040	.281
-20	1-1/4	1.036	1.428	1.533	1.338	.312
-24	1-1/2	1.281	1.685	1.783	1.608	.344
-28	1-3/4	1.578	2.073	2.166	1.961	.375
-32	2	1.754	2.345	2.408	2.186	.406

- NOTES:
1. The Conical sealing surface shall be concentric with D DIA within .005 full indicator reading.
 2. Machined surface roughness, unless otherwise specified, shall not exceed 63μ per ANST B46.1.
 3. Dimensions in inches unless otherwise specified; Angles $\pm 5^\circ$.
 4. This standard takes precedence over documents referenced herein.
 5. Break all sharp edges unless otherwise noted. Remove Burrs and Slivers.

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APPROVED N-12-65
REVISED (A) 3-27-68 (B) 4-15-69 (C) 12-1-75 (D) 1-21-76

CUSTODIAN JOHN F KENNEDY SPACE CENTER		DESIGN STANDARD	
PROCUREMENT SPECIFICATION NONE	TITLE CONICAL END, STANDARD DIMENSIONS FOR	KCI41	
COORDINATION STATUS KSC DE		SHEET 1 OF 1	



DETAIL A

DASH NO.		TUBE OD REF	THREAD T MIL-S-8879	A DIA +.003 -.000	H DIA ±.005	L ±.005	M ±.005	O	Q MIN	S MAX	U +.005 -.000	
CRE STEEL	AL ALLOY											
C4	D4	1/4	.4375-20UNJF-3B	.305	.438	.532	.620	.563	.300	.450	.005	
C6	D6	3/8	.5625-18UNJF-3B	.440	.563	.603	.729	.608				
C8	D8	1/2	.7500-16UNJF-3B	.570	.750	.723	.854	.875	+.003	.375	.563	.010
C10	D10	5/8	.8750-14UNJF-3B	.698	.875	.817	.979	1.000	-.004			
C12	D12	3/4	1.0625-12UNJ-3B	.834	1.063	.868	1.036	1.250	.563	.813	.015	
C16	D16	1	1.3125-12UNJ-3B	1.089	1.313	.962	1.136	1.500				±.016
C20	D20	1-1/4	1.6250-12UNJ-3B	1.347	1.625	1.017	1.229	2.000	.641	.911	.015	
C24	D24	1-1/2	1.8750-12UNJ-3B	1.617	1.875	1.170	1.417	2.250				±.020
C28	D28	1-3/4	2.2500-12UNJ-3B	1.890	2.250	1.316	1.563	2.625	.730	.920	.015	
C32	D32	2	2.5000-12UNJ-3B	2.167	2.500	1.462	1.734	2.875				.844	1.094

MATERIAL: See Procurement Specifications; Aluminum Alloy. Code "D"; Corrosion Resistant Steel (Class 316). Code "C"

FINISH: See Procurement Specification

SCREW THREAD: See Procurement Specification

CODE: "W" after dash number indicates nut with Lockwire Holes. See Note 7.

NOTES:

1. Remove Burrs and Slivers. Break sharp edges unless otherwise noted.
2. Dimensions in inches. Unless otherwise specified, tolerance Decimals ±.005
3. For design feature purposes, this drawing takes precedence over procurement documents referenced herein.
4. Referenced documents shall be of the issue in effect on date of invitation for bid.
5. Marking of fittings shall be consistent with procurement specification using applicable KC Standard and part number designations as shown on this drawing.
6. Dimension A and Thread T (Pitch Diameter) to be concentric within .005 full indicator reading.
7. When required lockwire holes per MC144 Style C.

EXAMPLE OF PART NOS. KC142CW = CRE STEEL. Nut Coupling for 1/2 OD Tubing. Drilled for Lockwire.
 KC142D8 = AL ALLOY. Nut Coupling. for 1/2 OD Tubing

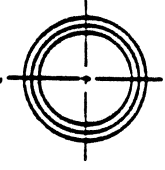
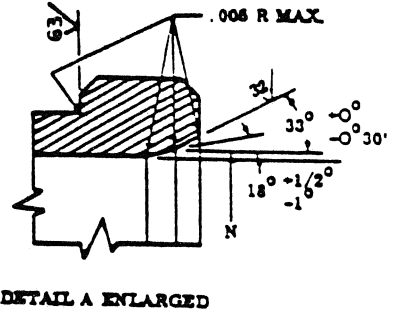
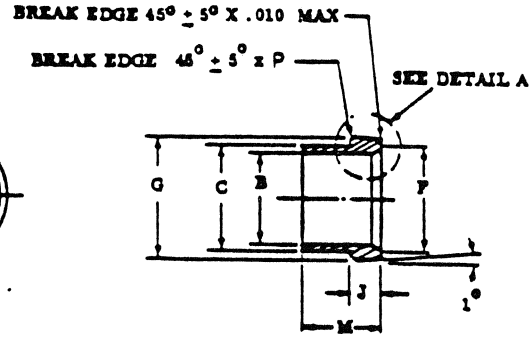
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APPROVED: 8-12-65
 REVISED: (A) 11 8 67 (B) 11 3 75 (C) 1-21-76

CUSTODIAN JOHN F. KENNEDY SPACE CENTER		STANDARD PART	
PROCUREMENT SPECIFICATION TITLE KSC-F-124	NUT, COUPLING		KC142
COORDINATION STATUS KSC DE			SHEET | OF |



FED SUP CLASS
4730



DASH NO.	CRES STEEL	AL ALLOY	TUBING O. D. REF	B	C	F	G	J	M	N	P	
				DEA +.003 -.000	DEA +.000 -.003	DEA ±.002	DEA +.000 -.003	±.005	±.010	DEA +.000 -.005	MAX	MIN
C4	D4	1/4	.288	.287	.315	.363	.141	.406	.280	.015	.005	.010
C8	D8	3/8	.380	.432	.441	.502	.172	.500	.406	.010		
C8	D8	1/2	.506	.562	.580	.682	.219	.582	.538			
C10	D10	5/8	.621	.690	.705	.797	.234	.686	.643			
C12	D12	3/4	.756	.828	.890	.972	.266	.828	.784			
C16	D16	1	1.006	1.041	1.130	1.222	.281	.781	1.060	.015		
C20	D20	1-1/4	1.266	1.339	1.412	1.534	.312	.906	1.310			
C24	D24	1-1/2	1.610	1.609	1.630	1.784	.344	1.126	1.564			
C28	D28	1-3/4	1.762	1.882	1.945	2.159	.375	1.125	1.818			
C32	D32	2	2.014	2.159	2.195	2.409	.406	1.188	2.070			

MATERIAL:

See Procurement Specification; Aluminum Alloy, Code "D"; Corrosion Resistant Steel (Class 316), Material per ASTM-A269 or QQ -5- 763.

FINISH:

See Procurement Specification

NOTES:

1. Dimensions B, C, F, and G concentric within .005 full indicator reading for Tube Size up to and including 3/4 inch, and .010 full indicator reading for sizes one inch and above.
2. Remove Burrs and Slivers. Break sharp edges unless otherwise noted.
3. Dimensions in inches. Unless otherwise specified, Tolerance: Decimals ± .005, Angles ± 1/2°.
4. Identification marking not required on this part.
5. For design feature purposes this standard takes precedence over procurement documents referenced herein.
6. Referenced documents shall be of the issue in effect on date of invitation to bid.
7. Surface roughness values not indicated on drawing shall not exceed 63 per ANSI B46.1.

EXAMPLE OF PART NOS.

KC143C3 = Cres Steel Sleeve, for 1/2 O. D. Tubing
KC143D10 = Al Alloy Sleeve, for 5/8 O. D. Tubing

CUSTODIAN JOHN F. KENNEDY SPACE CENTER		STANDARD PART	
PROCUREMENT SPECIFICATION TITLE KSC-F-124	SLEEVE, FLARED TUBE FITTING		KC143
COORDINATION STATUS KSC DE			SHEET 1 OF 1

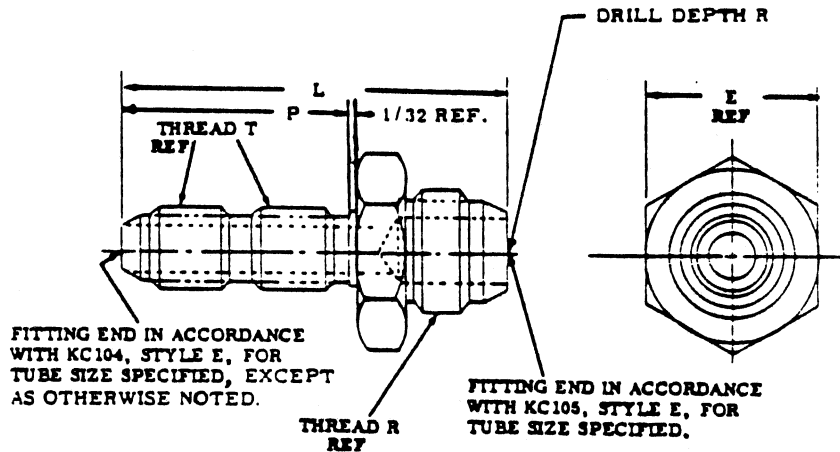
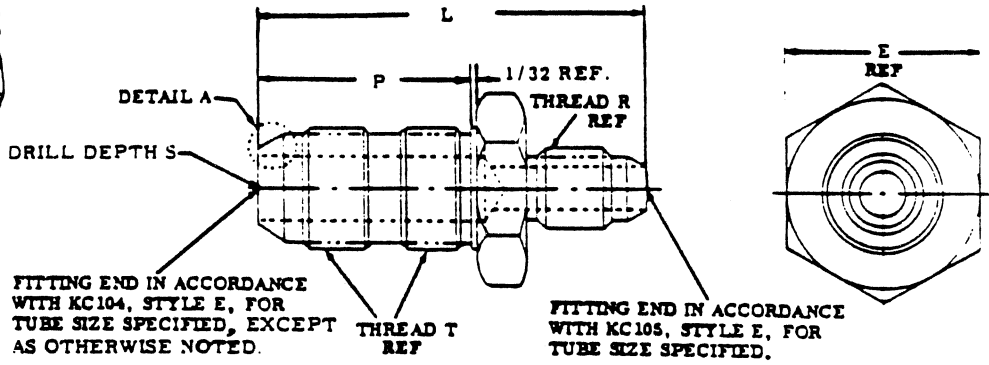
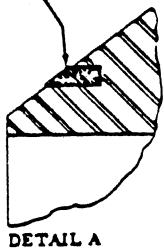
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APPROVED 8-12-65
REVISED (A) 9-9-68 (B) 11-3-75 (C) 1-21-76 (D) 7-13-76



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SEAL RING
PER KC103 (REF)



MATERIAL: See Procurement Specification

Aluminum Alloy, Code "D"
Corrosion Resistant Steel (Class 316), Code "C"

FINISH: See Procurement Specification
SCREW THREAD: See Procurement Specification

NOTES:

- At the option of the manufacturer, the smaller diam. may be drilled through the fitting from port to port.
- Remove Burrs and Slivers. Break sharp edges unless otherwise noted.
- Dimensions in inches. Unless otherwise specified, tolerances Decimals $\pm .005$.
- For design feature purposes, this drawing takes precedence over procurement documents referenced herein.
- Referenced documents shall be of the issue in effect on date of invitation for bid.
- Marking of fittings shall be consistent with procurement specification using applicable KC Standard and part number designations as shown on this drawing.

EXAMPLE OF
PART NOS.

KC144C10-6 = REDUCER, BULKHEAD END; 5/8 TUBING; SHORT END; 3/8 TUBING, CORROSION RESISTANT STEEL

KC144D12-6 = REDUCER, BULKHEAD END; 3/4 TUBING; SHORT END; 1/2 TUBING, ALUMINUM ALLOY.

CUSTODIAN: JOHN F KENNEDY SPACE CENTER

PROCUREMENT SPECIFICATION
KSC-F-124

TITLE
**REDUCER - FLARED TUBE
3/8 BULKHEAD & UNIVERSAL
FOR SEAL RING.**

STANDARD PART

KC144

COORDINATION STATUS

KSC DE

SHEET 1 OF 2

REVISED 5/29/68 (1) 11-3-75
APPROVED 8-12-65

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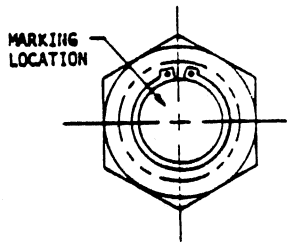
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Dash No.		Bulkhead End		Short End		E REF	L +.000 -.090	S MAX	R MAX	P +.000 -.045
CRE Steel	AL Alloy	Tube OD Ref	Thread T Ref	Tube OD Ref	Thread R Ref					
C4-6	D4-6	1/4	7/16-20	3/8	9/16-18	.813	2.147		.457	1.208
C4-8	D4-8			1/2	3/4-16	1.000	2.225		.538	
C4-10	D4-10			5/8	7/8-14	1.125	2.350		.618	
C4-12	D4-12			3/4	1-1/16-12	1.375	2.491		.703	
C4-16	D4-16			1	1-5/16-12	1.625	2.538		.741	
C4-20	D4-20			1-1/4	1-5/8-12	1.875	2.549		.778	
C6-4	D6-4	3/8	9/16-18	1/4	7/16-20	.813	2.219	.883		1.286
C6-6	D6-6			1/2	3/4-16	1.000	2.303		.538	
C6-10	D6-10			5/8	7/8-14	1.125	2.428		.618	
C6-12	D6-12			3/4	1-1/16-12	1.375	2.569		.703	
C8-4	D8-4	1/2	3/4-16	1/4	7/16-20	1.000	2.352	1.006		1.442
C8-6	D8-6			3/8	9/16-18	1.000	2.358	1.006		
C8-10	D8-10			5/8	7/8-14	1.125	2.584		.618	
C8-12	D8-12			3/4	1-1/16-12	1.375	2.725		.703	
C8-16	D8-16			1	1-5/16-12	1.625	2.772		.741	
C10-4	D10-4	5/8	7/8-14	1/4	7/16-20	1.125	2.517	1.121		1.583
C10-6	D10-6			3/8	9/16-18	1.125	2.523	1.121		
C10-8	D10-8			1/2	3/4-16	1.125	2.624	1.121		
C10-12	D10-12			3/4	1-1/16-12	1.375	2.846		.703	
C10-16	D10-16			1	1-5/16-12	1.625	2.913		.741	
C12-4	D12-4	3/4	1-1/16-12	1/4	7/16-20	1.375	2.723	1.258		1.755
C12-6	D12-6			3/8	9/16-18	1.375	2.729	1.258		
C12-8	D12-8			1/2	3/4-16	1.375	2.830	1.258		
C12-10	D12-10			5/8	7/8-14	1.375	2.931	1.258		
C12-16	D12-16			1	1-5/16-12	1.625	3.084		.741	
C12-20	D12-20			1-1/4	1-5/8-12	1.875	3.115		.778	
C16-4	D16-4	1	1-5/16-12	1/4	7/16-20	1.625	2.723	1.258		1.802
C16-6	D16-6			1/2	3/4-16	1.625	2.830	1.258		
C16-10	D16-10			5/8	7/8-14	1.625	2.931	1.258		
C16-12	D16-12			3/4	1-1/16-12	1.625	3.037	1.258		
C16-20	D16-20			1-1/4	1-5/8-12	1.875	3.115		.778	
C16-24	D16-24			1-1/2	1-7/8-12	2.125	3.258		.878	
C20-4	D20-4	1-1/4	1-5/8-12	1/4	7/16-20	1.875	2.754	1.295		1.817
C20-12	D20-12			3/4	1-1/16-12	1.875	3.048	1.295		
C20-16	D20-16			1	1-5/16-12	1.875	3.015	1.295		
C20-24	D20-24			1-1/2	1-7/8-12	2.125	3.303		.878	
C24-16	D24-16	1-1/2	1-7/8-12	1	1-5/16-12	2.125	3.147	1.308		1.973
C24-20	D24-20			1-1/4	1-5/8-12	2.125	3.194	1.308		
C28-20	D28-20	1-3/4	2-1/4-12	1-1/4	1-5/8-12	2.500	3.379	1.433		2.098
C28-24	D28-24	1-3/4	2-1/4-12	1-1/2	1-7/8-12	2.500	3.504	1.433		
C32-24	D32-24	2	2-1/2-12	1-1/2	1-7/8-12	2.750	3.629	1.533		2.098
C32-28	D32-28	2	2-1/2-12	1-3/4	2-1/4-12	2.750	3.754	1.533		

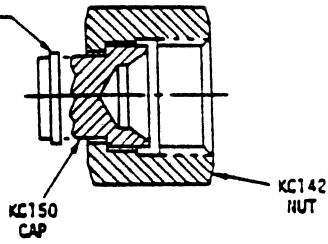
REVISED (A) 9-12-66 (B) 4-18-68 (C) 11-3-75
 APPROVED 8-12-65

CUSTODIAN		JOHN F. KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION	TITLE	STANDARD PART	
KSC-F-124	REDUCER - FLARED TUBE 3/8 BULKHEAD & UNIVERSAL FOR SEAL RING.	KCI44	
COORDINATION STATUS		SHEET 2 OF 2	
KSC DE			

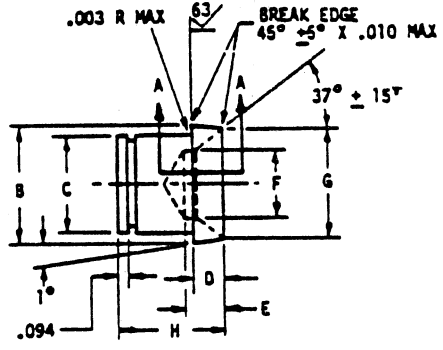
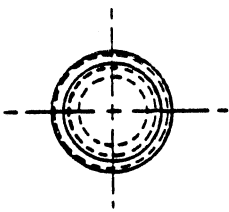
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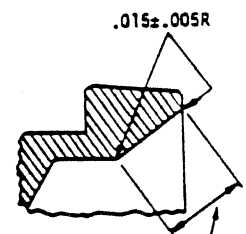
MS16624 RETAINING RING (GROOVE PER MS16624)



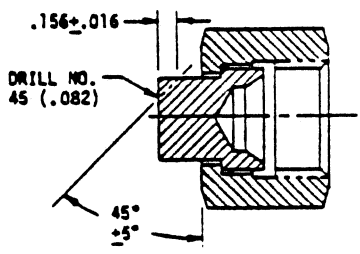
BASIC CAP ASSEMBLY



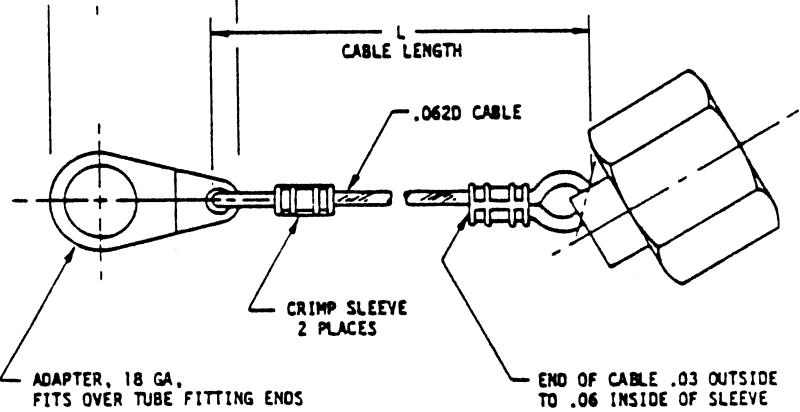
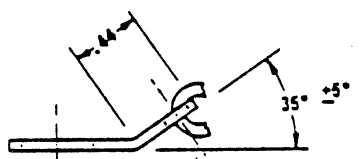
KC150 CAP DETAILS



CONICAL SEALING SURFACE SEE NOTE 1
 SECTION A-A



CABLE HOLE DETAILS FOR ALTERNATE CAP ASSY



ALTERNATE CAP ASSEMBLY

APPROVED: 3-23-66
 REVISED: A 10-4-68 B 12-30-68 C 11-3-75 D 1-21-76 E 3-1-77

CUSTODIAN		JOHN F. KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION	TITLE	STANDARD PART	
KSC-F-124	CAP, CAP ASSEMBLY	KC150	
COORDINATION STATUS	PRESSURE SEAL	SHEET X OF X	
KSC	DE	FLARED TUBE FITTING	



NASA APPROVAL 1 AND
100% APPROVAL

John F. Kennedy Space Center
Kennedy Space Center, Florida 32894
AC 305 967 24nd

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DASH NO.	TUBING OD REF	B DIA +.000 -.003	C DIA +.000 -.003	D DIM	E DIM ±.016	F DIA ±.016	G DIA	H DIM ±.016	L CABLE LENGTH ±.25	KC142 NUT CRE STL	MS16624 RETAINING RING DASH NO.
C4	1/4	.383	.297	.141	.125	.172	.315	.531	7	C4	-4028
C6	3/8	.502	.432	.172	.156	.297	.441	.625		C6	-4043
C8	1/2	.682	.562	.219	.172	.391	.589	.750		C8	-4056
C10	5/8	.797	.590	.234	.250	.438	.705			C10	-4068
C12	3/4	.972	.826	.266	.313	.563	.880	.875		C12	-4081
C16	1	1.222	1.081	.281		.813	1.130			C16	-4106
C20	1-1/4	1.534	1.339	.312	1.078	1.412	1.800	9	C20	-4131	
C24	1-1/2	1.784	1.609	.344	.375	1.313	1.630		1.125	C24	-4162
C28	1-3/4	2.159	1.882	.375	.375	1.547	1.945	1.375	11	C28	-4187
C32	2	2.409	2.159	.406	.500	1.781	2.195	1.438		C32	-4215

MATERIAL: Cap Assembly material to be Corrosion Resistant Steel (Class 316) per the Procurement Specification. All other parts on the Alternate Cap Assembly to be 300 Series Corrosion Resistant Steel.

FINISH: See Procurement Specification

- NOTES:
- The Conical Sealing Surface shall be concentric with G Dia. within .005 full indicator reading.
 - Diameters B, C, and G to be concentric within .005 full indicator reading for tube size up to and including 3/4 OD and .010 full indicator reading for 1 inch OD and above.
 - Cap Assembly shall consist of a KC142 Nut, a retaining device for the basic Cap Assembly only, and a cap.
 - Break all sharp edges unless otherwise noted. Remove burrs and slivers.
 - Machined surface roughness, unless otherwise specified, shall not exceed 125 per ANSI B46.1.
 - Dimensions in inches unless otherwise specified; Decimals ±.005, angles ±1/2°.
 - For design feature purposes, this drawing takes precedence over procurement documents referenced herein.
 - Reference documents shall be of the issue in effect on date of invitation for bid.
 - Marking of fittings shall be consistent with procurement specification using applicable KC Standard and part number designations as shown on this drawing.
 - Note deleted.
 - Note deleted.

CODE: "A" after dash number indicates Alternate Cap Assembly with drilled cap and retaining cable.

EXAMPLE OF

PART NOS: KC150C8 = Cap Assembly for 1/2 OD Tube Fitting, Corrosion Resistant Steel.
KC150C24A = Alternate Cap Assembly for 1-1/2 OD Tube Fitting, Corrosion Resistant Steel.

CUSTODIAN		JOHN F. KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION	TITLE	STANDARD PART	
KSC-F-124	CAP, CAP ASSEMBLY PRESSURE SEAL FLARED TUBE FITTING	KC150	
COORDINATION STATUS		SHEET 2 OF 2	
KSC DE			

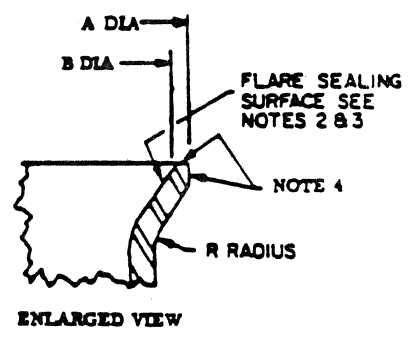
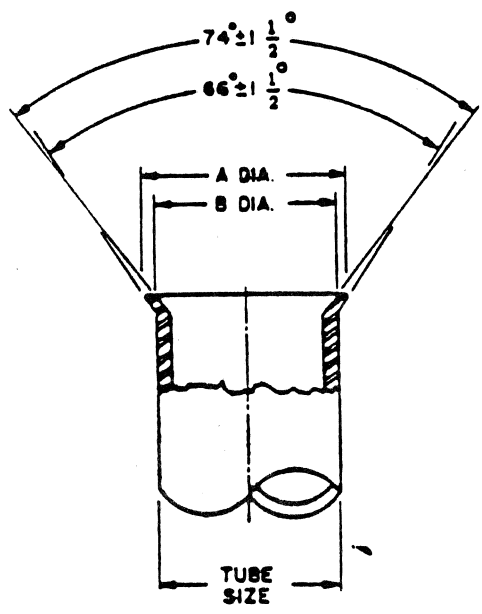
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APPROVED: 3-23-66
REVISED: Q11-3-75 D1-21-76 E1-3-77



FED SUP CLASS
NONE

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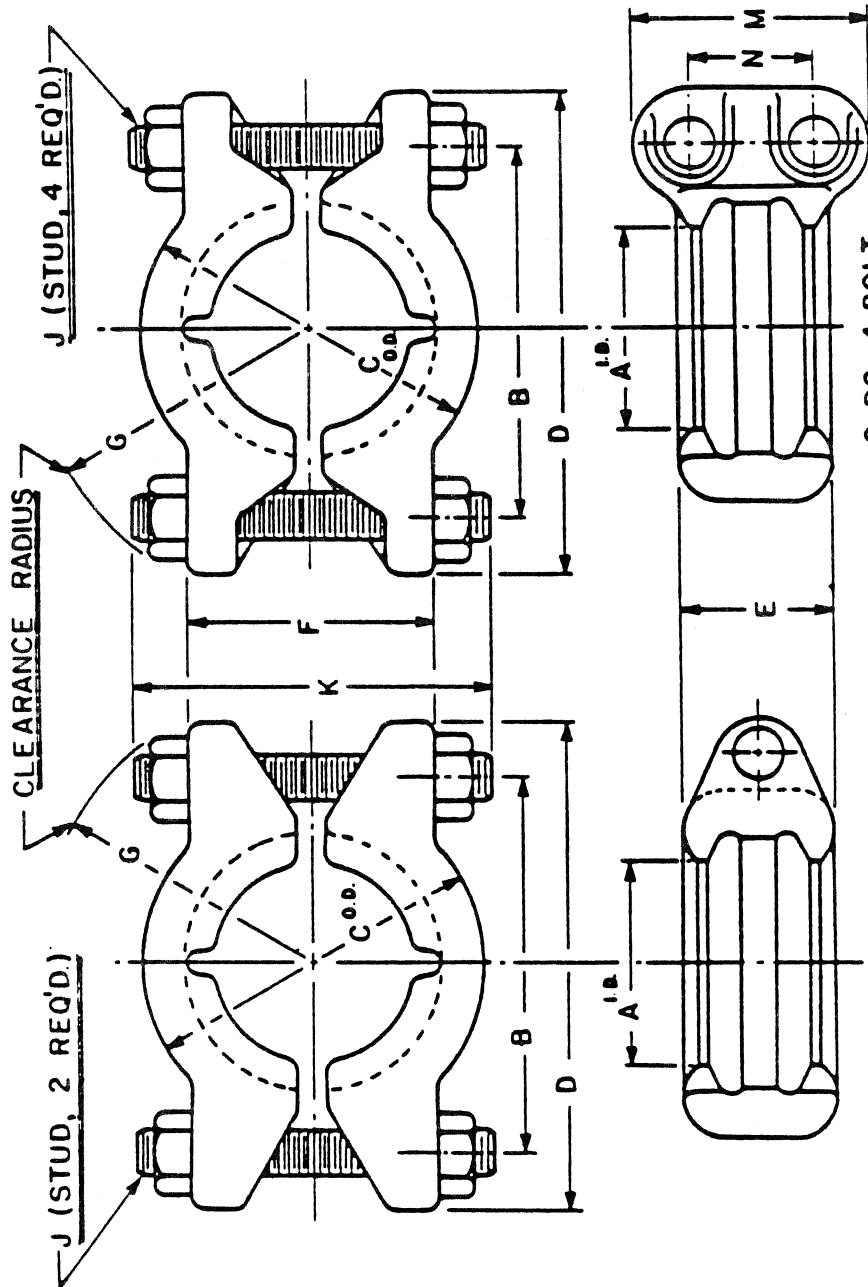
TUBING OD	A DIA	B DIA MIN	R TOL.	R RADIUS
1/4	.359	.300	± .015	.032
3/8	.484	.440		.046
1/2	.654 ± .010	.555		.062
5/8	.781	.648		
3/4	.937	.800		.078
1	1.187	1.080	+ .020 - .010	.093
1-1/4	1.500	1.400		
1-1/2	1.721 ± .015	1.600		.109
1-3/4	2.106	1.850		
2	2.354	2.100		

- NOTES:
1. This design standard establishes dimensions governing the forming of tube flares that are to be used with standard flared tube fittings with seal ring.
 2. The diameter A and minimum flare sealing surface as defined by diameter B and $74^\circ \pm 1/2^\circ$ cone shall be concentric with the outside diameter of the tube within .007 full indicator reading.
 3. The flare sealing surface shall not exhibit concave areas exceeding .001 or convex areas exceeding .002. Surface roughness shall not exceed $63 \sqrt{\text{in}}$ in accordance with ANSI B46.1.
 4. Deburr edges of tubing before flaring; radius or chamfer edge of ID .010 max. and edge of OD 20% to 50% of tubing wall thickness. Edges to be free of chatter marks.
 5. Dimensions are in inches.

APPROVED 3-23-66
 REVISION (A) 11-4-60 (B) 12-1-76

CUSTODIAN: JOHN F. KENNEDY SPACE CENTER		DESIGN STANDARD
PROUREMENT SPECIFICATION TITLE	TUBING, FLARED STANDARD DIMENSIONS FOR	KC154
NONE		
COORDINATION STATUS		SHEET 1 OF 1
KSC DX		

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CUSTODIAN		JOHN F. KENNEDY SPACE CENTER	
PROUREMENT SPECIFICATION	TITLE	STANDARD PART	
NONE	CLAMP ASSEMBLY	KCI55	
COORDINATION STATUS		SHEET 1 OF 3	
RSC DE			

APPROVED 9-14-67 REVISED 9-19-75

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NOTES:

1. All materials are per ASTM specifications.
2. All dimensions in inches.
3. TOLERANCES: See KC 161.
4. A Clamp assembly will consist of 2 clamp halves, 4 studs, and 8 nuts, except 2 pc. 2 Bolt assemblies which have 2 studs and 4 nuts.
5. For torque requirements, see KC 163.
6. Passive stainless steel clamps per MIL-S-5002.
7. Hub sizes 1/2GR 4/5, 3/4 GR4/5, and 1GR11 are not to be used for new design.
8. Material codes B and C for 5" clamp size are SA351-CF9M (4 Bolt)(#48003). SA-193-F316 Clamps are non-stock special order items and shall not be used for new design.
9. 1-1 1/2" Clamp size (Dash No. 2) is not interchangeable with 1" clamp size (Dash No. 8).
10. Material code B for 1" clamp size is SA351-CA15. Material code C for 1" clamp size is SA-351-CF9M.

GENERAL INFORMATION:
MATERIAL CODE:

See Sheet 2.

Clamp Halves	See Table Sheet 3		
Studs	SA-193-B7	SA-193-B8	SA-193-B6
Nuts	SA-194-GR2	SA-194-GR8	SA-194-GR8

TEMPERATURE RANGE:
EXAMPLE OF PART NO.

See Material Specs.
 Basic Part No.

KC155-3A
 Material Code
 Dash No.

ENGINEERING INFORMATION:
USE LIMITATIONS:

1. Deleted
2. Do not use this standard for items which cannot be identified by the limitations contained herein.
3. For design feature purposes, this standard takes precedence over documents referenced herein.

PROCUREMENT INFORMATION:
REFERENCED DOCUMENTS:
SOURCE DATA:

Referenced documents shall be of the issue in effect on date of invitation for bids.

APPROVED SOURCES:

Commercial parts can be purchased from: Gray Tool Co., Grayloc Sales Div.,
 P.O. Box 2291, Houston, Texas 77001.

APPROVED: 9 11 67
 REVISED: (A) 10 1 68 (B) 1 16 69 (C) 9 19 75

CUSTODIAN		JOHN F. KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION	TITLE	STANDARD PART	
NONE	CLAMP ASSEMBLY	KC155	
COORDINATION STATUS		SHEET 2 OF 3	
KSC DE			

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DASH NO.	HUB/GRIP	CLAMP SIZE	DIMENSIONS													MATERIAL CODE		
			A	B	C	D	E	F	G	M	J	K	N	(A)	(B)	(C)		
1	1/2 GR 4 1/2 GR 5 3/4 GR 4 3/4 GR 5	1/2 - 3/4	1.188	2.026	2.812	3.426	1.000	2.126	2.250	1.000	3/8	3		50019	SA-268 CL. III NORM.	SA-182 F 318 F-304	48500	
2	1 GR 11 1 1/2 GR 14	1 - 1 1/2	2.687	5.090	4.500	6.500	2.000	3.250	4.000	3.126	5/8	5	1.026	48506		48533	48501	
3	2 GR 14 2 GR 20	3	3.187	5.760	5.062	7.500	2.000	3.825	4.500	3.500	3/4	5 1/4	1.812	48501		48534	48502	
4	3 1/2 GR 20 3 1/2 GR 25 3 GR 26 3 GR 27	3 1/2 - 3	4.376	7.500	6.876	9.350	2.375	4.500	4.350	2.500	3/4	6	1.812	48502		48536	48503	
5	4 GR 31 4 GR 34 4 GR 40	4	5.376	8.500	8.126	10.500	2.375	5.350	6.000	4.002	7/8	7	2.002	48503		48536	48504	
6	5 GR 33 5 GR 44 5 GR 50	5	6.876	10.350	9.760	12.376	3.000	6.126	7.376	6.438	1	8	2.312	50314		48003	48003	
7	6 GR 33 6 GR 43	6	8.376	12.826	12.000	15.000	3.500	6.825	8.760	6.812	1 1/8	9 3/8	2.437	48508		48537	48506	
8	IGH 4. IGRS. IGH 7. IGRU	1	1.687	2.187	2.812	4.250	1.375	2.750	2.625	2.313	1/2	3 1/2	1.250	49760			49761	

CUSTOMER: JOHN F. KENNEDY SPACE CENTER

PROCURMENT SPECIFICATION TITLE: CLAMP ASSEMBLY

COORDINATION STATUS: NONE

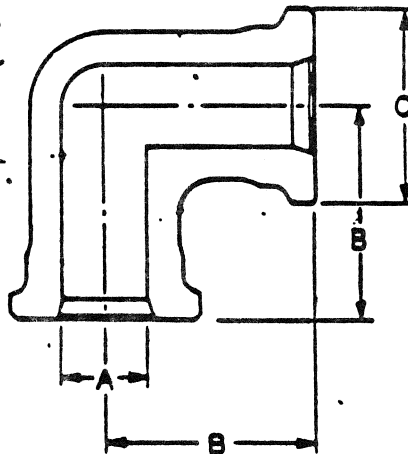
STANDARD PART: KCI55 63

APPROVED 9-14-67 REVISED A 7-10-68 C 9-19-75

PAGE 3 OF 3



FED SUP CLASS
4730



NOTES:

1. All dimensions are in inches.
2. TOLERANCE: See KC 161.
3. Passivate stainless steel ends per MIL-S-6002.
4. All materials are per ASTM specifications.
5. The configuration of the forged fitting will not conform to that pictured, however, the basic dimensions will be the same.

GENERAL INFORMATION:

MATERIAL CODE:
TEMPERATURE RANGE:
EXAMPLE OF PART NO:

See Sheet 2.
See material specs.
Basic Part No. KC156-3A

Material Code
Dash No.

ENGINEERING INFORMATION:

USE LIMITATIONS:

- 1.
2. Do not use this standard for items which cannot be identified by the limitations contained herein.
3. For design feature purposes, this standard takes precedence over documents referenced herein.

PROCUREMENT INFORMATION:

REFERENCED DOCUMENTS:
SOURCE DATA:

Referenced documents shall be of the issue in effect on date of invitation for bids.

APPROVED SOURCES:

Commercial parts can be purchased from: Gray Tool Co., Grayloc Sales Div., P. O. Box 2291, Houston, Texas 77001.

REVISED 10-4-68 (D) 1-16-69 (C) 9-19-75
APPROVED 9-19-67

NOTICE: When Gov't design, specs., or other data are used in connection with a definite operation, the U. S. Gov't, thereby incurs no responsibility, nor any obligation whatsoever; and the contractor, by using the said design, specs., or other data is not to be regarded by the U. S. Gov't as having formulated, furnished, or in any way approved, or conveying any rights or permission to manufacture, use, or sell any patented invention that may be incorporated therein or any other person or corp., or conveying any rights or permission to manufacture, use, or sell any patented invention that may be incorporated therein.

CUSTODIAN		JOHN F. KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION	TITLE	STANDARD PART	
HOWE	ELBOW 90°	KC156	
COOPERATION STATUS		SHEET 1 OF 2	
RSC DE			

FED SUP CLASS
4730

NOTICE: When Gov't drawings, specs., or other data are used for any purpose other than in connection with a definitely related Gov't. procurement operation, the U. S. Gov't, thereby incurs no responsibility, nor any obligation whatsoever; and the fact that the Gov't. may have furnished, furnished, or in any way supplied the said drawings, specs., or other data is not to be regarded as an implication or otherwise as in any manner licensing the holder or any other person or corp., or conveying any rights of permission to manufacture, use, or sell any patented invention that may be patented or otherwise as in any way be related thereto.

▽▽▽▽

DASH NO.	PIPE SIZE	HUB SIZE	B ±1/32	A	C	MATERIAL CODE	
						(A) SA-105 GR II	(B) SA-182-F316
						STOCK NO.	STOCK NO.
1	1/2	1/2-3/4 GR 5	2.000	.625	1.562	54106	54152
2	1/2	1/2-3/4 GR 4	2.000	.500	1.562	54102	54149
3	3/4	3/4 GR 5	2.000	.625	1.562	54105	54152
4	3/4	3/4 GR 4	2.000	.500	1.562	54102	54149
5	1	1 - 1 1/4 - 1 1/2 GR 11	4.000	1.125	3.125	54106	54153
6	1 1/2	1 1/4 - 1 1/2 GR 14	4.000	1.610	3.125	54107	54156
7	2	2 GR 20	4.000	2.063	3.625	54117	54129
8	2	2 GR 14	4.000	1.610	3.625	54114	54162
9	2 1/2	2 1/2 GR 25	5.375	2.672	5.000	54119	54145
10	2 1/2	2 1/2 GR 20	5.375	2.063	5.000	54118	54163
11	3	3 GR 27	5.375	3.063	5.000	54123	54146
12	3	3 GR 25	5.375	2.672	5.000	54119	54145
13	4	4 GR 40	6.000	4.063	6.000	54125	54174
14	4	4 GR 34	6.000	3.688	6.000	54126	54172
15	4	4 GR 31	6.000	3.250	6.000	54127	54168
16	5	5 GR 52	8.000	5.313	7.500	54144	54213
17	5	5 GR 46	8.000	4.750	7.500	54382	54391
18	5	5 GR 40	8.000	4.063	7.500	54123	54147
19	6	6 GR 62	9.000	6.065	9.250	54130	54182
20	6	6 GR 52	9.000	5.313	9.250	54131	54181
						SA-148 GR 90/60	SA-351 CF 8M
21	1/2, 3/4	1 GR 4	3.000	.500	2.000	54798	54804
22	1/2, 3/4, 1	1 GR 5	3.000	.625	2.000	54799	54805
23	3/4, 1	1 GR 7	3.000	.906	2.000	54800	54414
24	1	1 GR 11	3.000	1.125	2.000	54801	54807
						SA-105 GR II	SA-182-F316

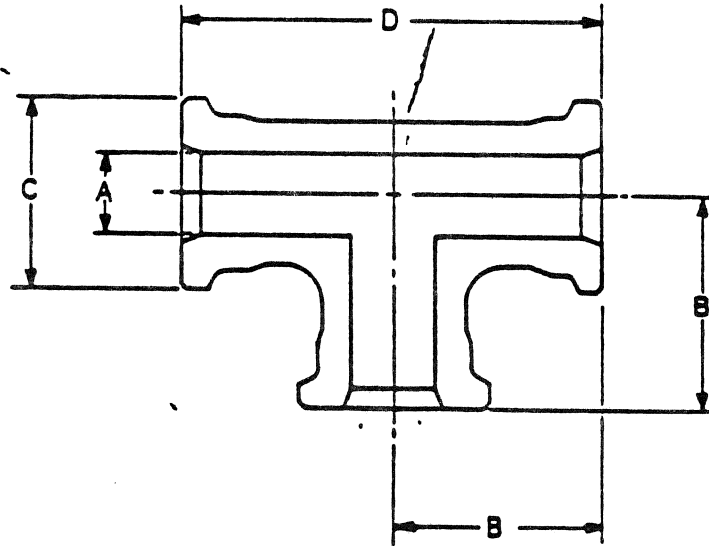
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APPROVED 9-18-67
REVISED A 7-10-68
C 9-19-75

CUSTODIAN JOHN F. KENNEDY SPACE CENTER		STANDARD PART	
PROCUREMENT SPECIFICATION NONE	TITLE ELBOW 90°	KC156	
COORDINATION STATUS		SHEET 2 OF 2	
KSC DE			



FED SUP CLASS
4730



NOTES:

1. All dimensions are in inches.
2. TOLERANCE: See KC 161
3. Passivate stainless steel tee per MIL-S-5002.
4. All materials are per ASTM specifications.
5. The configuration of the forged fitting will not conform to that pictured, however, the basic dimensions will be the same.

GENERAL INFORMATION:

MATERIAL CODE:
TEMPERATURE RANGE:
EXAMPLE OF PART NO.

▴ Dash Numbers 1 to 5 are not to be used for new design. See Dash Numbers 21 to 24.
See Sheet 2.
See material Specs.
Basic Part No. KC157-3A

Material Code
Dash No.

ENGINEERING INFORMATION:

USE LIMITATIONS:

2. Do not use this standard for items which cannot be identified by the limitations contained herein.
3. For design feature purposes, this standard takes precedence over documents referenced herein.

PROCUREMENT INFORMATION:

REFERENCED DOCUMENTS:
SOURCE DATA:

Referenced documents shall be of the issue in effect on date of invitation for bids.

APPROVED SOURCES:

Commercial parts can be purchased from: Gray Tool Co., Grayloc Sales Div., P.O. Box 2291, Houston, Texas 77001.

NOTICE: When Gov't Acgt., specs., or other data are used for any purpose other than in connection with a definitely related Gov't. procurement operation, the U. S. Gov't. thereby incurs no responsibility, nor any obligation whatsoever; and the fact that the Gov't. may have formulated, furnished, or in any way supplied the said Acgt., specs., or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corp., or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

REVISED 10-4-68 (A) 1-16-69 (C) 9-19-75
APPROVED 9-19-67

CUSTODIAN		JOHN F. KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION	TITLE	STANDARD PART	
NSC DE	TEE	KC157	
COORDINATION STATUS		SHEET 1 OF 2	

66

FED SUP CLASS
4730

NOTICE: When Gov't Augs., specs., or other data are used for any purpose other than in connection with a definitely related Gov't. procurement operation, the U. S. Gov't. thereby incurs no responsibility, nor any obligation whatsoever; and the fact that the Gov't. may have formulated, furnished, or in any way supplied the said Augs., specs., or other data is not to be regarded as an implication or otherwise in any manner increasing the holder or any other person or corp., or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

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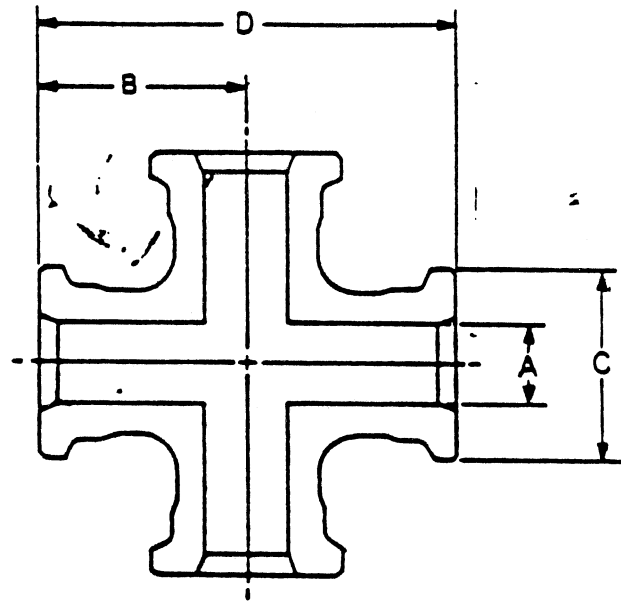
DASH NO.	PIPE SIZE	HUB SIZE	D ±1/16	B ±1/32	A	C	MATERIAL CODE	
							(A) SA-105 GR II	(B) SA-182- F316 SS
1	1/2	1/2 - 3/4 GR 5	4.000	3.000	.625	1.562	54167	54239
2	1/2	1/2 - 3/4 GR 4	4.000	3.000	.500	1.562	54164	54238
3	3/4	3/4 GR 5	4.000	3.000	.625	1.562	54167	54239
4	3/4	3/4 GR 4	4.000	3.000	.500	1.562	54164	54238
5	1	1 - 1 1/4 - 1 1/2 GR 11	8.000	4.000	1.125	3.125	54169	54241
6	1 1/2	1 1/4 - 1 1/2 GR 14	8.000	4.000	1.610	3.125	54173	54242
7	2	2 GR 20	8.000	4.000	2.063	3.625	54179	54244
8	2	2 GR 14	8.000	4.000	1.610	3.625	54178	54243
9	2 1/2	2 1/2 GR 25	10.750	5.375	2.672	5.000	54196	54246
10	2 1/2	2 1/2 GR 20	10.750	5.375	3.063	5.000	54180	54245
11	3	3 GR 27	10.750	5.375	3.063	5.000	54197	54247
12	3	3 GR 25	10.750	5.375	2.672	5.000	54196	54246
13	4	4 GR 40	12.000	6.000	4.063	6.000	54358	54352
14	4	4 GR 34	12.000	6.000	3.688	6.000	54357	54316
15	4	4 GR 31	12.000	6.000	3.250	6.000	54356	54354
16	5	5 GR 52	16.000	8.000	5.313	7.500	54232	54373
17	5	5 GR 48	16.000	8.000	4.750	7.500	54363	54372
18	5	5 GR 40	16.000	8.000	4.063	7.500	54228	54333
19	6	6 GR 62	18.000	9.000	6.045	9.250	54206	54254
20	6	6 GR 52	18.000	9.000	5.313	9.250	54203	54253
							SA-148 GR 90/60	SA-351 CF 88F
21	1/2, 3/4	1 GR 4	6.000	3.000	.500	2.000	54791	54795
22	1/2, 3/4, 1	1 GR 5	6.000	3.000	.625	2.000	54792	54796
23	3/4, 1	1 GR 7	6.000	3.000	.906	2.000	54793	54412
24	1	1 GR 11	6.000	3.000	1.125	2.000	54794	54797
							SA-105 GR II	SA-182- F316 SS

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FORGED

REVISED A 7-10-58 (C) 9-19-75
APPROVED 9-19-67

CUSTODIAN		JOHN F. KENNEDY SPACE CENTER	
PROCURMENT SPECIFICATION	TITLE	STANDARD PART	
NOTE	TEE	KC157	
COORDINATION STATUS		SHEET 2 OF 2	
NSC DE			

67



NOTES:

1. All dimensions are in inches.
 2. TOLERANCE: See EC 161.
 3. Passivate stainless steel crosses per MIL-S-5002.
 4. All materials are per ASTM specifications.
 5. The configuration of the forged fitting will not conform to that pictured, however, the basic dimensions will be the same.
- ⚠ This fitting is not to be used for new design.

GENERAL INFORMATION:

MATERIAL CODE:
TEMPERATURE RANGE:
EXAMPLE OF PART NO.

See Sheet 2.
See material specs.
Basic Part No. KC158-1A
Material Code
Dash No.

ENGINEERING INFORMATION:

USE LIMITATIONS:

2. Do not use this standard for items which cannot be identified by the limitations contained herein.
3. For design feature purposes, this standard takes precedence over documents referenced herein.

PROCUREMENT INFORMATION:

REFERENCED DOCUMENTS: Referenced documents shall be of the same in effect on date of invitation for bids.

SOURCE DATA:

APPROVED SOURCES:

Commercial parts can be purchased from: Gray Tool Co., Grayloc Sales Div., P. O. Box 2291, Houston, Texas 77001.

REVISED 10-4-68 (C) 1-16-69 (C) 9-19-75
APPROVED 9-19-67

NOTICE: When Gov't desigs., specs., or other data are used for any purpose other than in connection with a directly related Gov't. procurement operation, the U. S. Gov't, thereby incurs no responsibility, nor any obligation whatsoever; and the fact that the Gov't. may have formulated, furnished, or in any way supplied the said desigs., specs., or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corp., or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

CUSTODIAN		JOHN F. KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION	TITLE	STANDARD PART	
None	CROSS	KC158 ⚠	
COORDINATION STATUS		SHEET 1 OF 2	
RSC DE			



FED SUP CLASS
4730

NOTES: When Gov't specs., or other data are used for any purpose other than in connection with a definitely related Gov't. procurement operation, the U. S. Gov't. thereby incurs no responsibility, nor any obligation whatsoever; and the fact that the Gov't. may have formulated, furnished, or in any way supplied the said specs., or other data is not to be regarded as an implication or otherwise as in any manner licensing the holder or any other person or corp., or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

DASH NO.	PIPE SIZE	HUB SIZE	D	B	A	C	MATERIAL CODE (A)	MATERIAL CODE (B)
							SA-106 GR II FORGED	SA-102-F316 FORGED
							GRAYLOC STOCK NO.	GRAYLOC STOCK NO.
1	1/2	1/2-3/4 GR 5	4.000	2.000	.625	1.542	54212	54282
2	1/2	1/2-3/4 GR 4	4.000	2.000	.500	1.542	54207	54287
3	3/4	3/4 GR 5	4.000	2.000	.625	1.542	54212	54282
4	3/4	3/4 GR 4	4.000	2.000	.500	1.542	54207	54287
5	1	1-1 1/4 GR 11	8.000	4.000	1.125	3.125	50208	54283
6	1-1/2	1-1/4- 1/2 GR14	8.000	4.000	1.610	3.125	54209	54284
7	2	2 GR 20	8.000	4.000	2.042	3.625	54210	54288
8	2	2 GR 14	8.000	4.000	1.610	3.625	54211	54287
9	2-1/2	2-1/2 GR 25	10.750	5.375	2.672	5.000	54221	54272
10	2-1/2	2-1/2 GR 20	10.750	5.375	2.042	5.000	54216	54289
11	3	3 GR 27	10.750	5.375	3.042	5.000	54228	54273
12	3	3 GR 25	10.750	5.375	2.672	5.000	54221	54272
13	4	4 GR 40	12.000	6.000	4.042	6.000	54225	54279
14	4	4 GR 34	12.000	6.000	3.646	6.000	54226	54278
15	4	4 GR 31	12.000	6.000	3.250	6.000	54227	54274
16	5	5 GR 52	16.000	8.000	5.312	7.500	54219	54307
17	5	5 GR 46	16.000	8.000	4.750	7.500	A. O.	A. O.
18	5	5 GR 40	16.000	8.000	4.042	7.500	54214	54222
19	6	6 GR 62	18.000	9.000	6.046	9.250	54230	54285
20	6	6 GR 52	18.000	9.000	5.312	9.250	54231	54282
A. O. on application only							A-148 GR 90/60	A-351 CF8M

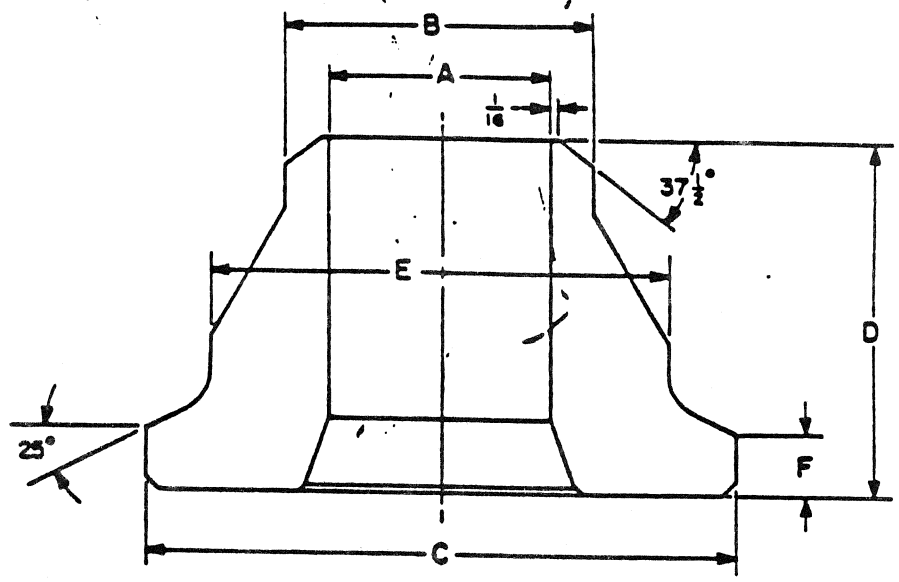
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REVISED A 7-10-68 (C) 9-19-75 APPROVED 9-19-67

CUSTODIAN		JOHN F. KENNEDY SPACE CENTER	
PROUREMENT SPECIFICATION	TITLE	STANDARD PART	
NO.:	CROSS	KC158	
COORDINATION STATUS		SHEET 2 OF 2	
HSC DE			



FED SUP CLASS
4730



NOTES:

- 1.
 2. All materials are per ASTM specifications.
 3. All dimensions are in inches.
 4. TOLERANCE: See KC 161.
 5. KC Dash No. 1A and 2A may be SA-107-61T Grade 1030 instead of SA-105-GR11.
- ⑥ Dash Numbers 1 to 4 are not to be used for new design. See dash numbers 13 to 15.
 Add A after Dash No. to denote SA-105-GR11.
 Add B after Dash No. to denote SA-182-F316L. (Do not use for new design).

GENERAL INFORMATION:
MATERIAL CODE:

SCHEDULE CODE:

TEMPERATURE RANGE:
EXAMPLE OF PART NO.

Add D after Dash No. to denote SA-182-F316.
 Add J after Material Code to denote Schedule 40.
 Add K after Material Code to denote Schedule 80.
 Add L after Material Code to denote Schedule 160.
 Add M after Material Code to denote Schedule XX.
 See material specs.
 Basic Part No. KC159-3AJ

┌── Schedule Code
 └── Material Code
 └── Dash No.

ENGINEERING INFORMATION:
USE LIMITATIONS:

2. Do not use this standard for items which cannot be identified by the limitations contained herein.
3. For design feature purposes, this standard takes precedence over documents referenced herein.

PROCUREMENT INFORMATION:
REFERENCED DOCUMENTS:
SOURCE DATA:

Referenced documents shall be of the issue in effect on date of invitation for bids.

APPROVED SOURCES:

Commercial parts can be purchased from: Gray Tool Co., Grayloc Sales Div., P.O. Box 2291, Houston, Texas 77001.

NOTICE: When Gov't design, specs., or other data are used for any purpose other than in connection with a definitely related Gov't. procurement operation, the U. S. Gov't, thereby incurs no responsibility, nor any obligation whatsoever; and the fact that the Gov't. may have formulated, furnished, or in any way supplied the said design, specs., or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corp., or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

APPROVED 9-19-67 REVISED 10-9-68 1-16-69 9-19-75

CUSTODIAN		JOHN F. KENNEDY SPACE CENTER	
PROUREMENT SPECIFICATION	TITLE	STANDARD PART	
NONE	HUB, BUTT WELD	KC159	
COORDINATION STATUS		SHEET 1 OF 2	
KSC	DE		



National Aeronautics and Space Administration

John F. Kennedy Space Center
Kennedy Space Center Florida 32899
AC J05 867248

FED SUP CLASS
4730

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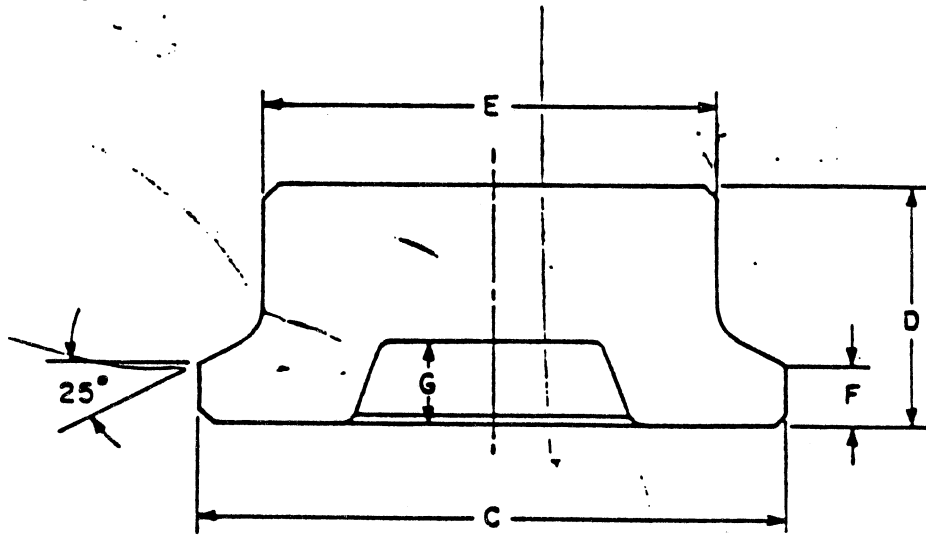
DASH NO.	PIPE SIZE	ASA SCHEDULE	HUB SIZE	DIMENSIONS						GRAYLOC STK. NO.	GRAYLOC STK. NO.	GRAYLOC STK. NO.
				A	B	C	D	E	F			
1	1/2	40	1/2 GR 5	0.622	0.840	1.562	1.500	1.063	0.133	52076	52796	52666
		90	1/2 GR 5	0.546						52077	52797	52667
		160	1/2 GR 4	0.466						52078	52798	52668
1.5	3/4	XX	1/2 GR 4	0.452	0.840	1.562	1.500	1.063	0.133	52079	52800	52669
		40	3/4 GR 5	0.614						52080	52801	52670
		XX	3/4 GR 4	0.434						52084	52804	52674
2	1	40	1 GR 11	1.049	1.315	3.125	2.375	2.375	0.500	52108	52805	52700
		90	1 GR 11	0.927						52109	52806	52701
		160	1 GR 11	0.817						52110	52807	52702
3	1-1/4	XX	1 GR 11	0.799	1.660	3.125	2.375	2.375	0.437	52111	52808	52703
		40	1-1/4 GR 14	1.350						52126	52809	52708
		90	1-1/4 GR 14	1.274						52099	52810	52706
4	1-1/2	160	1-1/4 GR 14	1.160	1.660	3.125	2.375	2.375	0.500	52127	52811	52707
		XX	1-1/4 GR 11	0.896						52094	52812	52709
		40	1-1/2 GR 14	1.610						52100	52813	52710
5	2	90	1-1/2 GR 14	1.500	1.900	3.125	2.375	2.375	0.437	52101	52814	52711
		160	1-1/2 GR 14	1.337						52102	52815	52712
		XX	1-1/2 GR 14	1.190						52103	52816	52713
6	2	40	2 GR 20	2.067	2.375	3.625	2.750	2.875	0.437	52104	52821	52721
		90	2 GR 20	1.939						52105	52822	52722
		160	2 GR 20	1.889						52117	52823	52723
7	2-1/2	XX	2 GR 14	1.500	2.375	3.625	2.750	2.375	0.437	52118	52824	52724
		40	2-1/2 GR 20	2.469						52215	52825	52730
		90	2-1/2 GR 20	2.325						52216	52826	52731
8	3	160	2-1/2 GR 20	2.125	2.875	5.000	3.250	4.000	0.500	52218	52827	52732
		XX	2-1/2 GR 20	1.771						52219	52828	52733
		40	3 GR 27	3.066						52204	52844	52740
9	3	90	3 GR 27	2.900	3.500	5.000	3.250	4.000	0.500	52205	52843	52741
		160	3 GR 25	2.621						52226	52846	52742
		XX	3 GR 25	2.400						52227	52847	52743
10	3-1/2	40	4 GR 34	3.548	4.000	6.000	3.625	5.000	0.500	52240	52838	52738
		90	4 GR 34	3.364						52241	52839	52739
		160	4 GR 34	3.125						52243	52841	52741
11	4	XX	4 GR 31	2.723	4.000	6.000	3.625	5.000	0.500	52302	52851	52750
		40	4 GR 40	4.026						52303	52852	52751
		90	4 GR 40	3.826						52311	52853	52752
12	6	160	4 GR 34	3.434	4.500	6.000	3.625	5.000	0.500	52314	52854	52753
		XX	4 GR 31	3.102						52330	52867	52760
		40	5 GR 42	4.037						52331	52868	52761
13	8	90	5 GR 40	4.015	5.063	7.500	4.375	6.500	0.625	52335	52871	52764
		160	5 GR 40	4.063						52383	52870	52763
		XX	5 GR 40	4.063						52400	52874	52763
14	1	40	6 GR 62	6.055	6.625	9.250	4.625	7.750	0.750	52401	52875	52764
		90	6 GR 62	5.861						52413	52876	52765
		160	6 GR 62	5.689						52414	52877	52766
15	1/2	XX	6 GR 62	5.697	6.625	9.250	4.625	7.750	0.812	52192	52955	52766
		40	1 GR 5	0.526						52193	52959	52766
		90	1 GR 4	0.498						52194	52958	52766
16	3/4	160	1 GR 4	0.452	0.840	2.000	1.750	1.500	0.313	52195	52957	52766
		XX	1 GR 4	0.434						52196	52958	52766
		40	1 GR 7	0.524						52233	52955	52766
17	1	90	1 GR 7	0.514	1.000	2.000	1.750	1.500	0.313	52198	52954	52766
		160	1 GR 7	0.434						52199	52957	52766
		XX	1 GR 11	1.049						52225	52951	52766
18	1	40	1 GR 11	0.927	1.315	3.125	2.375	2.375	0.500	52226	52952	52766
		90	1 GR 11	0.817						52227	52953	52766
		160	1 GR 7	0.514						52228	52954	52766
19	1	XX	1 GR 7	0.434	1.315	3.125	2.375	2.375	0.500	52229	52955	52766
		40	1 GR 11	1.049						52230	52956	52766
		90	1 GR 11	0.927						52231	52957	52766

REVISED: (C) 9-19-75
APPROVED: 9-19-67

CUSTODIAN		JOHN F. KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION	TITLE	STANDARD PART	
NONE	HUB, BUTT WELD	KCI59	
COORDINATION STATUS		SHEET 2 OF 2	
KSC DE			



FED SUP CLASS
4730



NOTES:

1. Note deleted.
2. All of the above blind hubs may be tapped I.L.P.T., MC-240, MS33649, or with size of tap being limited by dimension D minus G and bore of compatible seal ring.
3. Stock numbers for the tapped hubs will not correspond to stock numbers for blind hubs above.
4. All dimensions in inches.
5. TOLERANCE: See KC 161

GENERAL INFORMATION:
MATERIAL CODE:

TEMPERATURE RANGE:
EXAMPLE OF PART NO.

ENGINEERING INFORMATION:
USE LIMITATIONS:

6. All materials are per ASTM specifications.
 7. Dash Numbers 1 to 3 are not to be used for new design. See dash numbers 13 to 21. Add A after Dash No. to denote SA-105 GR H. Add B after Dash No. to denote SA-102-F316.
- See material specs.
Basic Part No. KC160-SA
- Material Code
Dash No.

PROCUREMENT INFORMATION:

REFERENCED DOCUMENTS: Referenced documents shall be of the issue in effect on date of invitation for bids.

SOURCE DATA:

APPROVED SOURCES: Commercial parts can be purchased from: Gray Tool Co., Grayloc Sales Div., P.O. Box 2291, Houston, Texas 77001.

REVISED A 10-4-68 B 1-16-69 C 9-19-75 D 7-27-83
APPROVED 9-19-67

CUSTODIAN: JOHN F. KENNEDY SPACE CENTER		STANDARD PART	
PROCURMENT SPECIFICATION	TITLE	KC160	
NONE	HUB, BLIND	SHEET 1 OF 2	
COORDINATION STATUS			
N/C	DE		

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FED SUP CLASS
4730

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▽▽▽

MATERIAL CODE
(A) SA-105⁰ GR II
(B) SA-182 F 316

DASH NO.	HUB SIZE	DIMENSIONS					GRAY LOC STOCK NO.	GRAY LOC STOCK NO.
		C	D	E	F	G		
1	1/2-3/4 GR 4	1.843	1.250	1.063	0.133	0.438	58046	58378
2	1/2-3/4 GR 5	1.843	1.250	1.063	0.133	0.438	58047	58380
3	1-1 1/4 GR 11 & 1 1/2"	3.125	2.125	2.375	0.800	0.563	58050	58300
4	1 1/4-1 1/2 GR 14	3.125	2.125	2.375	0.437	0.688	58000	58305
5	2 GR 14	3.625	2.250	2.875	0.437	0.688	58053	58310
6	2 GR 20	3.625	2.250	2.875	0.437	0.688	58002	58315
7	2 1/2 GR 20	5.000	2.500	4.000	0.500	0.888	58022	58320
8	2 1/2-3 GR 25	5.000	2.500	4.000	0.500	0.888	58020	58325
9	3 GR 27	5.000	2.500	4.000	0.500	0.938	58006	58330
10	4 GR 31	6.000	2.875	5.000	0.500	0.938	58024	58345
11	4 GR 34	6.000	2.875	5.000	0.500	1.063	58060	58340
12	4 GR 40	6.000	2.125	5.000	0.500	1.000	58010	58335
13	5 GR 53	7.500	2.875	6.500	.625	1.000	58992	58354
14	5 GR 48	7.500	2.875	6.500	.625	1.000	58148	58279
15	5 GR 40	7.500	3.500	6.500	.625	1.000	58990	58347
16	6 GR 53	8.250	3.500	7.750	0.813	1.000	58064	58350
17	6 GR 63	8.250	2.875	7.750	0.750	1.000	58014	58348
18	1 GR 4	2.000	1.750	1.500	0.313	0.438	58955	58497
19	1 GR 5						58922	58525
20	1 GR 7					0.563	58915	58523
21	1 GR 11						58582	58524

* 1/2" and 3/4" sizes may be furnished from SA-107-GR 1030 unless otherwise specified.

REVISED A 7 10 68
C 9-19-75
D 7-27-81
APPROVED 10-67

CUSTODIAN		JOHN F. KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATIONS	TITLE	STANDARD PART	
HOWE	HUB, BLIND	KC160	
COORDINATION STATUS		SHEET 2 OF 2	
RSC DE			

GRAYLOC CLAMPS

Dimension	Size	Tolerance
A	1/2" thru 3"	±.031
	4" thru 6"	±.063
B	1/2" thru 6"	±.063
C	FOR REFERENCE ONLY	
D	1" thru 3"	±.250
	4" thru 6"	±.375
E	1/2" thru 3"	±.250
	4" thru 6"	±.375
F, G, J, K	FOR REFERENCE ONLY	
M	1/2" thru 3"	±.250
	4" thru 6"	±.375
N	1/2" thru 6"	±.031

GRAYLOC HUBS

Dimension	Size	Tolerance
A	1/2" thru 3"	±.031
	4" thru 6"	±.063
B	1/2" thru 5"	+0.094-.031
	6"	+0.154-.031
C	1/2" thru 6"	±.063
D	Butt Weld 1/2" thru 6"	±.063
	Blind 1/2" thru 5"	±.063
	Blind 6"	±.125
E	1/2" thru 6"	±.063
F	1/2" thru 6"	±.031
G	1/2" thru 6"	+0.125-.063
(25° Clamping Surface on Hub) (1/2 thru 6")		±1°
Butt Weld Bevel in accordance with ANSI B16.25		

GRAYLOC SEAL RINGS

Dimension	Size	Tolerance
A	4 thru 34	±.031
	40 thru 62	±.063
C	4 thru 34	±.031
	40 thru 62	±.125
D	FOR REFERENCE ONLY	
E	4 thru 62	±.016
F	4 thru 34	+0.031-.000
	40 thru 62	+0.063-.000

GRAYLOC FITTINGS

Dimensions	Size	Tolerance
A	1/2" thru 3"	±1/32
	4" thru 6"	±1/16
B	1/2" thru 6"	±1/32
C	1/2" thru 6"	±1/16
D	1/2" thru 6"	±1/16

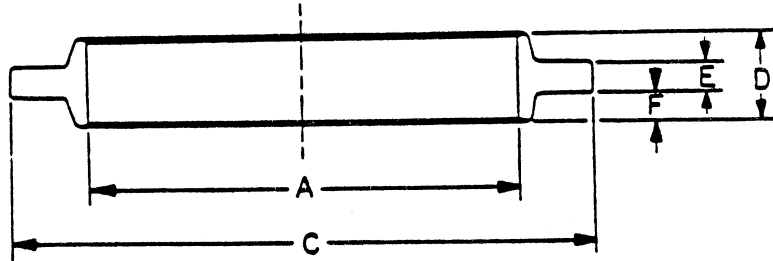
NOTE: Tolerance on angles, where applicable shall be ±1°

CUSTODIAN		JOHN F. KENNEDY SPACE CENTER	
PROUREMENT SPECIFICATION	TITLE	STANDARD PART	
NONE	DIMENSION TOLERANCES FOR FLANGE FITTINGS	KC161	
COORDINATION STATUS		SHEET 1 OF 1	
KSC DE			

APPROVED 1 6 75 REVISED 4 3 75

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NOTES:

1. Stock numbers for uncoated rings or for rings with different coatings than specified below will not correspond to stock numbers for standard rings.
2. Parts made from ANSI 1018-1030 are Teflon coated 0.001 to 0.003 thick, service temperature -50°F to +350°F.
3. Parts made from 17-4PH silver plated, are for service at temperatures of -452°F to +500°F.
4. All dimensions in inches.
5. TOLERANCE: See KC 161.
6. All materials are per AISI specifications.

GENERAL INFORMATION

MATERIAL CODE:

TEMPERATURE RANGE:
EXAMPLE OF PART NO.

Add A after Dash No. to denote ANSI 1018 thru 1030 Teflon coated.
Add B after Dash No. to denote Type 316S.3 Silver Plated. Do not specify for new design.
Add D after Dash No. to denote ANSI 630 Type 17-4PH, Teflon coated.
See notes 2 and 3.
Basic Part No. KC162-1A



ENGINEERING INFORMATION:

USE LIMITATIONS:

2. Do not use this standard for items which cannot be identified by the limitations contained herein.
3. For design feature purposes, this standard takes precedence over documents referenced herein.

PROCUREMENT INFORMATION:

REFERENCED DOCUMENTS:
SOURCE DATA:

Referenced documents shall be of the issue in effect on date of invitation for bids.

APPROVED SOURCES:

Commercial parts can be purchased from: Gray Tool Co., Grayloc Sales Div., P.O. Box 2291, Houston, Texas 77001.

APPROVED: 9-19-67 REVISED: (A) 7-10-68 (B) 10-4-66 (C) 1-16-69 (D) 9-19-75

CUSTODIAN		JOHN F. KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION	TITLE	STANDARD PART	
NONE	RING, SEAL	KC162	
COGNOMINATION STATUS		SHEET 1 OF 2	
KSC DE			

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DASH NO.	RING SIZE	DIMENSIONS					MAT. CODE A	MAT. CODE B	MAT. CODE D
		A	C	D	E	F	GRAYLOCK STOCK NO.	GRAYLOCK STOCK NO.	GRAYLOCK STOCK NO.
1	4	.500	1.000	.375	.125	.125	50654	50800	51230
2	5	.625	1.094	.375	.125	.125	50543	50801	51231
3	7	.906	1.375	.375	.125	.125	50701	50802	51232
4	11	1.125	1.734	.375	.125	.125	50551	50803	51233
5	13	1.500	2.375	.375	.125	.125	50698	50837	51234
6	14	1.610	2.625	.543	.250	.154	50553	50804	51235
7	20	2.063	3.250	.75	.250	.250	50557	50807	51236
8	25	2.672	4.000	.75	.250	.250	50570	50810	51237
9	27	3.063	4.250	.750	.250	.250	50623	50811	51238
10	31	3.250	4.500	.75	.250	.250	50661	50812	51239
11	34	3.688	5.000	.75	.250	.250	50542	50813	51240
12	40	4.063	5.500	1.000	.250	.375	66040	50814	51241
13	46	4.750	6.188	1.000	.250	.375	66041	66376	51245
14	52	5.313	6.625	1.000	.250	.375	50623	50815	51242
15	62	6.065	7.375	1.375	.375	.500	50666	50816	51243
16	23	2.375	3.500	.750	.250	.250	50569	66375	66175

APPROVED: 9-19-67 (D) 1-16-69 (D) 9-19-75

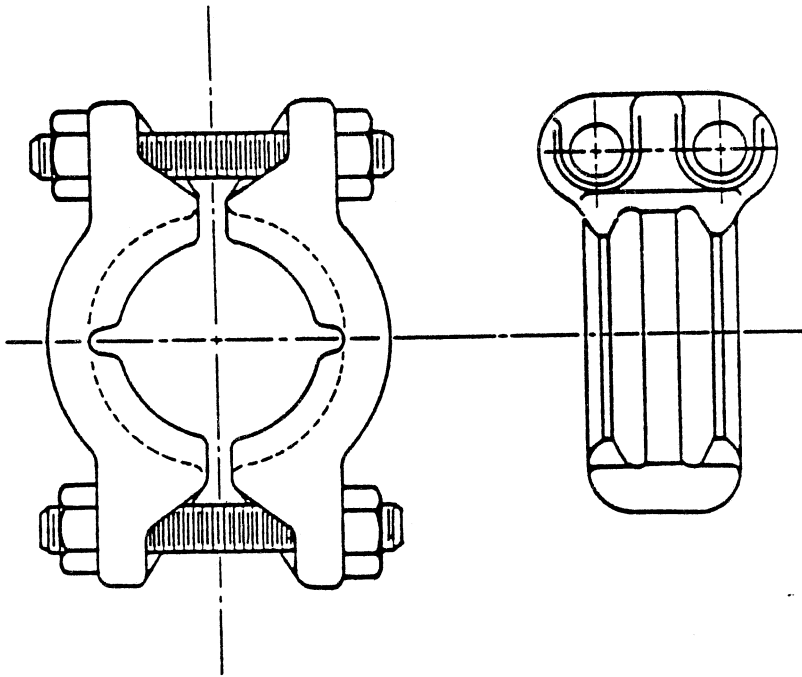
CUSTODIAN		JOHN F. KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION	TITLE	STANDARD PART	
NONE	RING, SEAL	KC 162	
COORDINATION STATUS		SHEET 2 OF 2	
KSC DE			



National Aeronautics and
Space Administration

John F. Kennedy Space Center
Kennedy Space Center Florida 32899
AC 305 467-2468

FED SUP CLASS
NONE



GENERAL NOTES:

1. A complete KC163 pipe connection assembly consists of the following components:
 - (a) Two KC hubs or a combination hub and fitting.
 - (b) One KC162 seal ring.
 - (c) One KC155 clamp assembly, 4 bolt, or 2 bolt.
2. Extreme caution should be exercised to prevent any tightening of the stud bolts while the assembly is under pressure or mechanical loads.
3. Special care should be exercised during assembly of the connection so that no damage occurs to the sealing surfaces.
4. No welding is recommended on the clamps or seal rings. The seal surface of the KC hubs should be protected during welding to avoid weld spatter and other damage. During stress relieving the seal surfaces of the carbon steel hubs should be protected against scaling with a high temperature graphite paste, similar to key-paste.
5. This is a design standard and shall not be used as a part number.
- 6 & 7. NOTES DELETED

ASSEMBLY NOTES:

8. Grayloc sizes 1/2 GR 4/5, 3/4 GR 4/5, 1 GR 11, 1 1/4 GR 14, and 1 1/4 GR 11 are not to be used for new design.
1. All protective coatings and foreign matter must be cleaned from all sealing surfaces before installation.
2. KC connections shall be made up with no lubrication applied to hubs, fittings, seal rings or clamps. Lubrication shall be applied to bolts only. Care shall be taken to prevent lube from entering connection.
3. The hubs should be aligned before assembly to the extent that the clamp segments can pull the mating hubs uniformly against the ring rib using the recommended bolt preload shown in Table I.
4. When tightening, the spacing between the clamp ears should be approximately the same.
5. To properly preload the KC connection against fluid pressure and gasket loads, the following torque values are recommended for the various sizes of studs as listed in Table I for approximately 20,000 psi tensile stress in the studs.
6. The torque values listed in Table I are for well lubricated studs only.

REVISED: (A) 1-16-69 (B) 9-19-75

APPROVED: 9-14-67

CUSTODIAN		JOHN F. KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION	TITLE	STANDARD PART	
NONE	PIPE CONNECTION ASSY INSTALLATION OF	KC163	
COORDINATION STATUS		SHEET 1 OF 3	
KSC DE			

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

John F. Kennedy Space Center
 Kennedy Space Center, Florida 32899
 AC 205 467 2468

FED SUP CLASS
 NONE

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PIPE SIZE (INCHES)	SCHEDULE	GRA YLOC SIZE	KC159 BUTTWELD HUB	KC160 BLIND HUB	KC162 SEAL RING	KC156 ELBOW	KC157 TEE	KC158 CROSS	KC155 CLAMP
3/4	40	1/2 GR 5	-1	-2	-2	-1	-1	-1	-1
	50	1/2 GR 5							
	160	1/2 GR 4							
	XX	1/2 GR 4							
3/4	160	3/4 GR 5	-2	-2	-2	-3	-3	-3	-1
	XX	3/4 GR 5							
1	ALL	1 GR 11	-3	-3	-4	-5	-5	-5	-2
1/2	40	1 GR 5	-13	-19	-2	-22	-22	-	-8
	50	1 GR 5							
	160	1 GR 4							
	XX	1 GR 4							
3/4	40	1 GR 7	-14	-20	-3	-23	-23	-	-8
	50	1 GR 7							
	160	1 GR 5							
	XX	1 GR 4							
1	40	1 GR 11	-15	-21	-4	-24	-24	-	-8
	50	1 GR 11							
	160	1 GR 7							
	XX	1 GR 5							
1 1/4	40	1 1/4 GR 14	-4	-4	-6	-6	-6	-6	-2
	50	1 1/4 GR 14							
	160	1 1/4 GR 11							
	XX	1 1/4 GR 11							
1 1/2	ALL	1 1/2 GR 14	-5	-4	-6	-6	-6	-2	
2	40	2 GR 20	-6	-6	-7	-7	-7	-7	-3
	50	2 GR 20							
	160	2 GR 20							
	XX	2 GR 14							
2 1/2	40	2 1/2 GR 25	-7	-8	-8	-9	-9	-9	-4
	50	2 1/2 GR 25							
	160	2 1/2 GR 20							
	XX	2 1/2 GR 20							
3	40	3 GR 27	-8	-9	-9	-11	-11	-11	-4
	50	3 GR 27							
	160	3 GR 25							
	XX	3 GR 25							
3 1/2	40	4 GR 34	-9	-11	-11	-14	-14	-14	-5
	50	4 GR 34							
	160	4 GR 31							
	XX	4 GR 31							
4	40	4 GR 40	-10	-12	-12	-13	-13	-13	-5
	50	4 GR 40							
	160	4 GR 34							
	XX	4 GR 31							
5	40	5 GR 52	-11	-13	-14	-16	-16	-16	-6
	50	5 GR 52							
	160	5 GR 46							
	XX	5 GR 40							
6	40	6 GR 62	-12	-17	-15	-19	-19	-19	-7
	50	6 GR 62							
	160	6 GR 52							
	XX	6 GR 52							

APPROVED: 9-14-67 REVISED: 9-19-75

CUSTODIAN		JOHN F. KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION	TITLE	STANDARD PART	
NONE	PIPE CONNECTION ASSY INSTALLATION OF	KC163	
COORDINATION STATUS		SHEET 2 OF 3	
KSC DE			



National Aeronautics and
Space Administration

John F. Kennedy Space Center
Kennedy Space Center Florida 32899
AC 305 867 2468

FED SUP CLASS
NONE

TABLE 1
KC155 CLAMP ASSEMBLY, 4 BOLT

TORQUE REQUIREMENTS	
STUD SIZE	TORQUE RANGE (FT LBS)
1/2	15-20
3/8	30-40
1/2	70-90
7/8	90-105
1	120-165
1 1/8	140-215

TABLE 2
KC155 CLAMP ASSEMBLY, 2 BOLT

TORQUE REQUIREMENTS	
STUD SIZE	TORQUE RANGE (FT LBS)
3/8	6-8

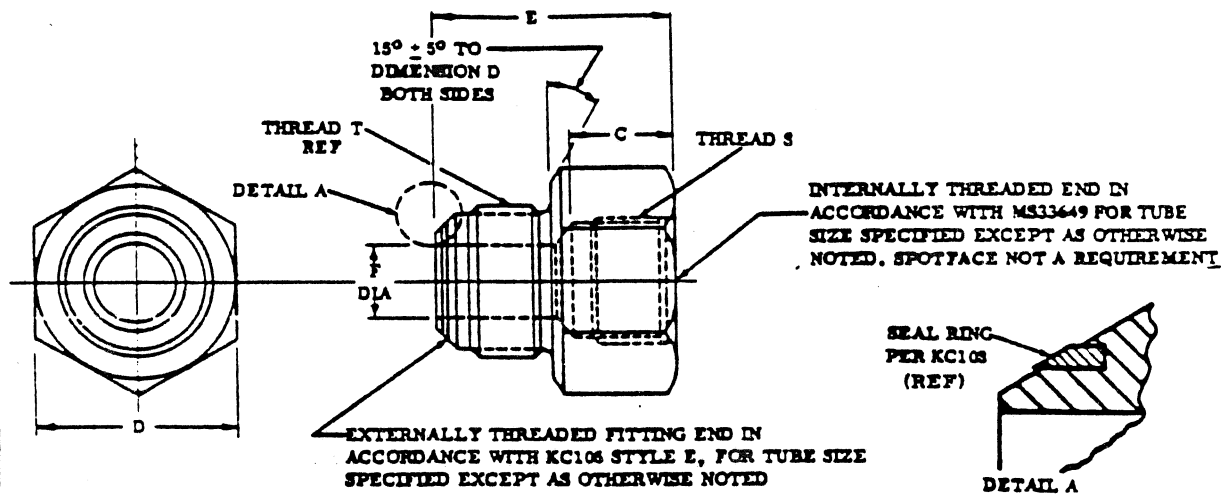
ABOVE VALUES ARE FOR LUBRICATED STUDS

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REVISED: (B) 9-19-75

APPROVED: 9-14-67

CUSTODIAN		JOHN F. KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION	TITLE	STANDARD PART	
NONE	PIPE CONNECTION ASSY INSTALLATION OF	KC163	
COORDINATION STATUS		SHEET 3 OF 3	
KSC DE			



DASH NO.		INTERNALLY THREADED END			EXTERNALLY THREADED END		D (HEX)	E +.000 -.002	F DIA
CRE STEEL	ALUM. ALLOY	TUBING OD	THREAD S REF	C ±.018	TUBING OD	THREAD T REF			
C4-8	D4-8	1/4	7/16-28	.609	1/2	3/4-16	1.000 +.003	1.016	.172
C6-12	D6-12	3/8	9/16-18		3/4	1-1/16-12	1.375 -.004	1.266	.297
C8-12	D8-12	1/2	3/4-16	.734	1	1-5/16-12	1.625 ±.016	1.641	.391
C3-16	D8-16							1.633	
C12-16	D12-16	3/4	1-1/16-12	.923			1.922	.609	

MATERIAL: See Procurement Specification: Aluminum Alloy, Code "D"; Corrosion Resistant Steel (Class 316), Code "C".

FINISH: See procurement Specification

SCREW THREAD: See Procurement Specification

NOTES:

1. Remove Burrs and Slivers. Break sharp edges unless otherwise noted.
2. Dimensions in inches. Unless otherwise specified, tolerance Decimals ± .005
3. For design feature purposes, this drawing takes precedence over procurement documents referenced herein.
4. Referenced documents shall be of the issue in effect on date of invitation for bid.
5. Marking of fittings shall be consistent with procurement specification using applicable KC Standard and part number designations as shown on this drawing.

⚠ Not Recommended for New Design.

EXAMPLE OF PART NOS.

KC164D 4-8 = BUSHING, 1/4 tubing for internal threads, and 1/2 tubing, for external threads; Aluminum

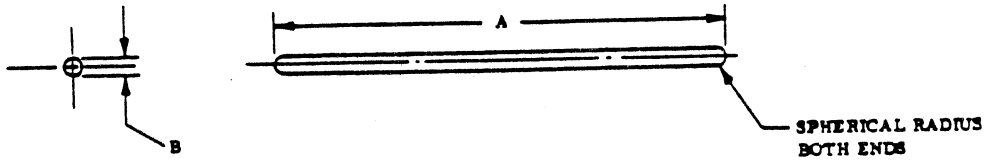
KC164C4-8 = BUSHING, 1/4 tubing, for internal threads, and 1/2 tubing, for external threads; Corrosion Resistant Steel

CUSTODIAN		JOHN F. KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION	TITLE	STANDARD PART	
KSC-F-124	BUSHING, SCREW THREAD REDUCER FOR SEAL RING	KC164 ⚠	
COORDINATION STATUS		SHEET 1 OF 1	
KSC DE			

NOTICE: When this drawing is used for any purpose other than in connection with a definitely related Gov't. procurement, the U.S. Gov't. shall assume no responsibility, nor any obligation whatsoever, and the fact that the Gov't. may have furnished, furnished, or in any way supplied the said design, specification, or other data is not to be regarded as an implication or otherwise as in any manner licensing the holder or any other person or corp., or conveying any rights or permission to manufacture, use, or sell any patented invention that may be in any way be related thereto.

APPROVED 4-12-66
 REVISED 10-24-68
 H-3-76
 7-27-81

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DASH NO.	A DIM ±.016	B DIA. (STOCK TOLERANCES)
-4	1.094	.080
-6	1.453	
-8	2.000	.091
-10	2.328	
-12	2.859	.125
-14	3.750	
-20	4.750	
-24	5.500	
-28	6.750	
-32	7.500	

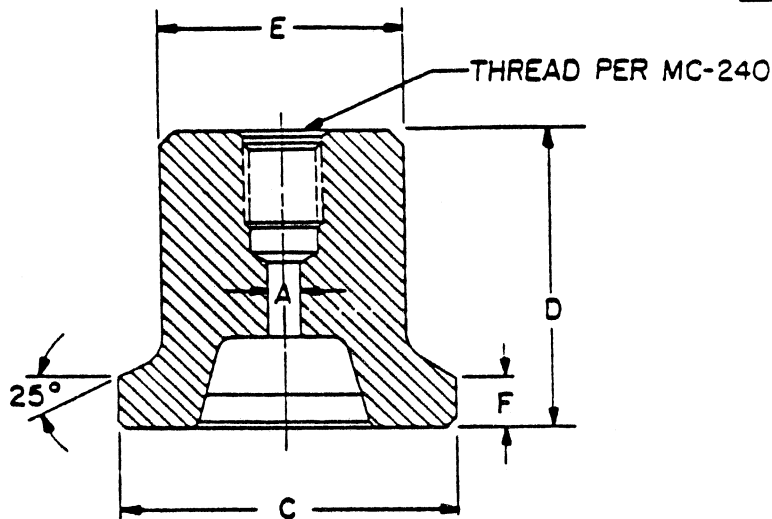
- NOTES:
- MC219 dash numbers are interchangeable with KC164 dash numbers
 - Dimensions are in inches. Unless otherwise specified, tolerance decimals ±.016.
 - For design feature purposes, this drawing takes precedence over procurement documents referenced herein.
 - Reference documents shall be of the issue in effect on date of invitation for bid.

Material: Corrosion resistant steel wire, type 302; Annealed Per QQ-W-423
 FINISH: NONE
 CODE: NONE

Example of PART NO.: KC165-4 Retaining Wire for 1/4 O.D. Tube Swivel Fitting

Approved: 12-1-75 REVERED

CUSTODIAN		JOHN F. KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION	TITLE	STANDARD PART	
KSC-F-124	WIRE, RETAINING, SWIVEL NUT	KC165	
COORDINATION STATUS		SHEET 1 OF 1	
KSC DE			



NOTES:

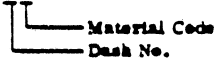
1. All materials are per ASTM specifications.
2. All dimensions are in inches. For tolerances, See KC181.

MATERIAL CODE:

Add A after Dash No. to denote SA-106 (Carbon Steel).
 Add B after Dash No. to denote F-316 (Stainless Steel).

EXAMPLE OF PART NO:

Basic Part No. KC166-3A



TEMPERATURE RANGE:

See material specs.

USE LIMITATIONS:

1. Do not use this standard for items which cannot be identified by limitations contained herein.
2. For design feature purposes, this standard takes precedence over documents referenced herein. Referenced documents shall be of the issue in effect on date of invitation for bids.
3. Hub pressure rating is the lower of either the vendor's pressure limit on the Hub or KSC's pressure limit on the fitting which screws into the threaded hole.
4. This size is not to be used for new design. See KC167 for new design.

APPROVED SOURCES:

Commercial parts can be purchased from: Gray Tool Co., P. O. Box 2291, Houston, Texas 77001

APPROVED: 2-6-76 Revised: (A) 12-15-77

CUSTODIAN			JOHN F. KENNEDY SPACE CENTER		
PROCUREMENT SPECIFICATION	TITLE		STANDARD PART		
NONE	HUB, TAPPED BLIND		KC166		
COORDINATION STATUS			SHEET 1 OF 2		
KSC DE					

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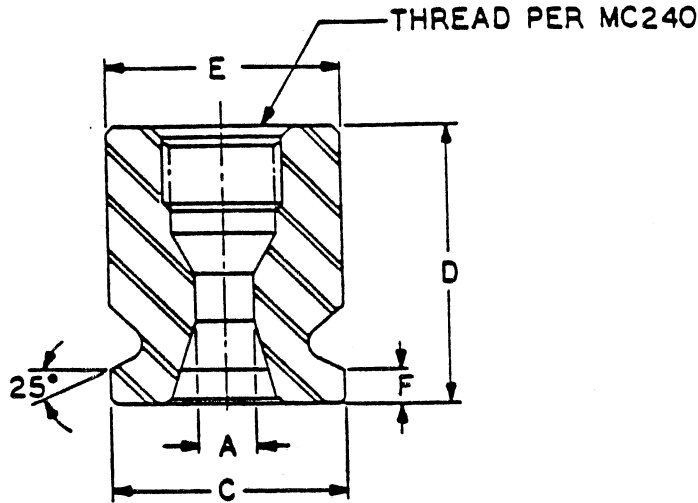
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4730

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DASH NO.	HUB SIZE	MC240 THREAD SIZE	OPERATING PRESSURE RATING (PSIG)		DIMENSIONS				MATERIAL CODE		
			MAT'L CODE		A	C	D	E	F	(A)	(B)
			(A)	(B)						SA-105	F-316
-1	1GR4	-4	9.600	9.600	.172	2.000	1.750	1.500	.313	GRAY TOOL STOCK NO.	GRAY TOOL STOCK NO.
-2		-6	6.900	6.900	.297					I-4708-1	I-4709-1
-3		-8	7.400	7.400	.391					I-4708-5	I-4709-5
4 -4		-12	4.900	4.900						I-4708-9	I-4709-9
-5	1GR5	-4	9.600	9.600	.172					I-4708-13	I-4709-13
-6		-6	9.600	9.600	.297					I-4708-2	I-4709-2
-7		-8	7.400	7.400	.391					I-4708-6	I-4709-6
4 -8		-12	4.900	4.900						I-4708-10	I-4709-10
-9	1GR7	-4	8.430	6.395	.172					I-4708-14	I-4709-14
-10		-6	6.900	6.395	.297					I-4708-3	I-4709-3
-11		-8	7.400	6.395	.391					I-4708-7	I-4709-7
4 -12		-12	4.900	4.900						I-4708-11	I-4709-11
-13	1GR11	-4	4.190	4.325	.172					I-4708-15	I-4709-15
-14		-6	4.190	4.325	.297					I-4708-4	I-4709-4
-15		-8	4.190	4.325	.391					I-4708-8	I-4709-8
4 -16		-12	4.190	4.325						I-4708-12	I-4709-12
										I-4708-16	I-4709-16

CUSTODIAN JOHN F. KENNEDY SPACE CENTER		STANDARD PART	
PROCUREMENT SPECIFICATION NONE	TITLE HUB, TAPPED BLIND	KC166	
COORDINATION STATUS KSC DE		SHEET 2 OF 2	

APPROVED: 2-6-76 Revised: (A) 12-15-77



NOTES:

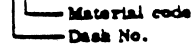
1. All materials are per ASTM specifications.
2. All dimensions are in inches. For tolerances see KC161.

MATERIAL CODE:

Add A after Dash No. to denote SA-105 (Carbon Steel).
 Add B after Dash No. to denote F-316 (Stainless Steel).

EXAMPLE OF PART NO.:

Basic Part No. KC167-3A



TEMPERATURE RANGE

See material specs.

USE LIMITATIONS:

1. Do not use this standard for items which cannot be identified by limitations contained herein.
2. For design feature purposes this standard takes precedence over documents referenced herein. Referenced documents shall be of the issue in effect on date of invitation for bids.

3 See KC166 for preferred configuration of Hubs tapped with thread sizes MC240-4, -6, and -8.

4 Hub pressure rating is the lower of either the vendor's pressure limit on the Hub or KSC's pressure limit on the fitting which screws into the threaded hole.

APPROVED SOURCES:

Commercial parts can be purchased from Gray Tool Co., P.O. Box 2291, Houston, Texas 77001.

APPROVED: 2-6-76 Revised: 12-15-77

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CUSTODIAN		JOHN F. KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION	TITLE	STANDARD PART	
NONE	HUB, TAPPED	KC167	
COORDINATION STATUS		SHEET 1 OF 3	
KSC DE			



National Aeronautics and
Space Administration

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DASH NO.	HUB SIZE	THREAD SIZE	OPERATING PRESSURE RATING (PSIG)		DIMENSIONS					MATERIAL CODE	
			MATERIAL CODE		A	C	D	E	F	SA-106	F-316
			(A)	(B)								GRAY TOOL STOCK NO.	GRAY TOOL STOCK NO.
-1	1 GR4	-4	9,600	9,600	.172	2.000	3.000	2.000	.313	I-4695-7	I-4725-7
-2		-6	6,900	6,900	.297					I-4695-1	I-4725-1
-3		-8	7,400	7,400	.391					I-4695-3	I-4725-3
-4		-12	6,500	6,500	.500					I-4695-5	I-4725-5
-5		-16	5,300	5,300	.500					I-4695-21	I-4725-21
-6	1 GR5	-4	9,600	9,600	.172					I-4695-8	I-4725-8
-7		-6	6,900	6,900	.297					I-4695-2	I-4725-2
-8		-8	7,400	7,400	.391					I-4695-4	I-4725-4
-9		-12	6,500	6,500	.609					I-4695-6	I-4725-6
-10		-16	5,300	5,300	.625					I-4695-23	I-4725-23
-11	1 GR7	-4	9,600	9,600	.172					I-4695-9	I-4725-9
-12		-6	6,900	6,900	.297					I-4695-11	I-4725-11
-13		-8	7,400	6,395	.391					I-4695-13	I-4725-13
-14		-12	6,500	6,395	.609					I-4695-19	I-4725-19
-15		-16	5,300	5,300	.844					I-4695-23	I-4725-23
-16	1 GR11	-4	4,190	4,325	.172					I-4695-10	I-4725-10
-17		-6	4,190	4,325	.297					I-4695-12	I-4725-12
-18		-8	4,190	4,325	.391					I-4695-14	I-4725-14
-19		-12	4,190	4,325	.609					I-4695-20	I-4725-20
-20		-16	4,190	4,325	.844					I-4695-24	I-4725-24
-21	1 1/2 GR14	-4	7,080	6,785	.172					I-4695-25	I-4725-25
-22		-6	6,900	6,785	.297					I-4695-26	I-4725-26
-23		-8	7,080	6,785	.391					I-4695-27	I-4725-27
-24		-12	6,500	6,500	.609					I-4695-29	I-4725-29
-25		-16	5,300	5,300	.844					I-4695-30	I-4725-30

CUSTODIAN		JOHN F. KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION	TITLE	STANDARD PART	
NONE	HUB, TAPPED	KC167	
COORDINATION STATUS		SHEET 2 OF 3	
KSC DE			

APPROVED: 3 15 76 Revised: (A) 12-15-77

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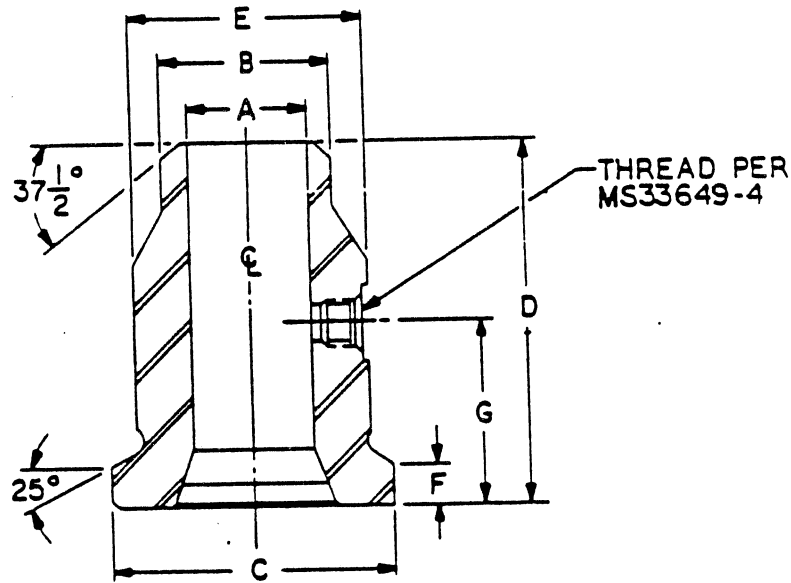
DASH NO.	HUB SIZE	THREAD SIZE	OPERATING PRESSURE RATING (PSIG)		DIMENSIONS					MATERIAL CODE	
			MATERIAL CODE		A	C	D	E	F	(A)	(B)
			(A)	(B)						AS-105	F-316
										GRAY TOOL STOCK NO.	GRAY TOOL STOCK NO.
-26	2 GR20	-4	6195	4970	.172	3.625	3.500	3.625	.437	I-4695-31	I-4725-31
-27		-6	6195	4970	.297					I-4695-32	I-4725-32
-28		-8	6195	4970	.391					I-4695-33	I-4725-33
-29		-12	6195	4970	.609					I-4695-35	I-4725-35
-30		-16	5300	4970	.844					I-4695-36	I-4725-36
-31		-20	5200	4970	1.078					I-4695-55	I-4725-55
-32		-24	4600	4970	1.312					I-4695-56	I-4725-56
-33		-32	4600	4600	1.781					I-4695-58	I-4725-58
-34		3 GR25	-4	7895	6550					.172	5.000	4.250	5.000	.500	I-4695-37	I-4725-37
-35	-6		6900	6550	.297	I-4695-38	I-4725-38				
-36	-8		7400	6550	.391	I-4695-39	I-4725-39				
-37	-12		6500	6500	.609	I-4695-41	I-4725-41				
-38	-16		5300	5300	.844	I-4695-42	I-4725-42				
-39	-20		5200	5200	1.078	I-4695-59	I-4725-59				
-40	-24		4600	4600	1.312	I-4695-60	I-4725-60				
-41	-32		4600	4600	1.781	I-4695-62	I-4725-62				
-42	4 GR31	-4	8710	6340	.172	6.000	5.000	6.000	.500	I-4695-43	I-4725-43
-43		-6	6900	6340	.297					I-4695-44	I-4725-44
-44		-8	7400	6340	.391					I-4695-45	I-4725-45
-45		-12	6500	6340	.609					I-4695-47	I-4725-47
-46		-16	5300	5300	.844					I-4695-48	I-4725-48
-47		-20	5200	5200	1.078					I-4695-63	I-4725-63
-48		-24	4600	4600	1.312					I-4695-64	I-4725-64
-49		-32	4600	4600	1.781					I-4695-66	I-4725-66
-50	6 GR52	-4	6135	4195	.172	9.250	5.500	9.250	.812	I-4695-49	I-4725-49
-51		-6	6135	4195	.297					I-4695-50	I-4725-50
-52		-8	6135	4195	.391					I-4695-51	I-4725-51
-53		-12	6135	4195	.609					I-4695-53	I-4725-53
-54		-16	5300	4195	.844					I-4695-54	I-4725-54
-55		-20	5200	4195	1.078					I-4695-67	I-4725-67
-56		-24	4600	4195	1.312					I-4695-68	I-4725-68
-57		-32	4600	4195	1.781					I-4695-70	I-4725-70

Revised: A 12-15-77

CUSTOMER	JOHN F. KENNEDY SPACE CENTER	STANDARD PART
PROCUREMENT SPECIFICATION FILE	HUB, TAPPED	KC167
NONE		
COORDINATION STATUS		
DE		SHEET 3 OF 3

PSA

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NOTES:

1. All materials are per ASTM specifications.
2. All dimensions are in inches. For tolerances, See KC161.

MATERIAL CODE:

Add A after Dash No. to denote SA-106 (Carbon Steel).
Add B after Dash No. to denote F-316 (Stainless Steel).

EXAMPLE OF PART NO:

Basic Part No. KC168-3A
 └── Material Code
 └── Dash No.

TEMPERATURE RANGE:

See material specs.

USE LIMITATIONS:

1. Do not use this standard for items which cannot be identified by limitations contained herein.
 2. For design feature purposes, this standard takes precedence over documents referenced herein. Referenced documents shall be of the issue in effect on date of invitation for bids.
3. Hub pressure rating is the lower of either the vendor's pressure limit on the Hub or KSC's pressure limit on the fitting which screws into the threaded hole.
4. This pipe size does not have a standard vendor hub.

APPROVED SOURCES:

Commercial parts can be purchased from: Gray Tool Co., P.O. Box 2291, Houston, Texas 77001.

APPROVED: 2-6-78 REVISED: (A) 4/15/77 (B) 7/27/83

CUSTODIAN		JOHN F. KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION	TITLE	STANDARD PART	
NONE	HUB, PRESSURE TAPPED	KC168	
COORDINATION STATUS		SHEET 1 OF 3	
KSC DE			

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NASA

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

John F. Kennedy Space Center
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DASH NO.	NOMINAL PIPE SIZE	PIPE SCHED.	HUB SIZE	OPERATING PRESSURE RATING (PSTG)	DIMENSIONS							MATERIAL CODE				
					A	B	C	D	E	F	G	(A)		(B)		
												SA-105 DASH NO.	GRAY TOOL DASH NO.	SA-316 DASH NO.	GRAY TOOL DASH NO.	
-1		40	1GR5	9600	0.622								A1	B1	F-316	
-2	1 1/2	80		9600	0.546	0.840							A2	B2		
-3		160	1GR4		0.466								A3	B3		
-4		XX			0.252								A4	B4		
-5		40	1GR7	8340	0.824								A5	B5		
-6	3/4	80			0.742	1.050	2.000	2.6875	0.313	2.1875			A6	B6		
-7		160	1GR5		0.614								A7	B7		
-8		XX	1GR4	9600	0.434			4.3125					A8	B8		
-9		40	1GR11	4190	1.049								A9	B9		
-10	1	80			0.957	1.315							A10	B10		
-11		160	1GR7	8340	0.815								A11	B11		
-12		XX	1GR5	9600	0.599								A12	B12		
-13		40			1.610	1.900	3.125			2.3125			A17	B17	1-4839	
-14	1 1/2	80	1 GR14	7080	1.500								A18	B18		
-15		160			1.338								A19	B19		
-16		XX			1.100								A20	B20		
-17		40			2.067				0.437				A21	B21		
-18		80	2GR20	6195	1.939	2.375	3.625	4.500					A22	B22		
-19	2	160			1.689								A23	B23		
-20		XX	2GR14	9600	1.503								A24	B24		
-21		40	2 1/2 - 3GR25	7895	2.469								A25	B25		
-22		80			2.323								A26	B26		
-23	2 1/2	160	2 1/2 - 3GR20	9600	2.125	2.875	5.000	5.000	5.000				A27	B27		
-24		XX			1.771								A28	B28		

CUSTODIAN JOHN F. KENNEDY SPACE CENTER

PROCUREMENT SPECIFICATION TITLE

NONE
COORDINATION STATUS
KSC DE

HUB, PRESSURE TAPPED

STANDARD PART

KC168

SHEET 1 OF 2

APPROVED: 2/6/76 REVISED: (A) 4/15/77 (B) 7/27/83



National Aeronautics and Space Administration

John F. Kennedy Space Center
Kennedy Space Center Florida 32899
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DASH NO.	NOMINAL PIPE SIZE	PIPE SCHED.	HUB SIZE	OPERATING PRESSURE RATING (PSIG)	DIMENSIONS											MATERIAL CODE			
																SA-105		F-316	
					A	B	C	D	E	F	G	GRAY TOOL DASH NO.	GRAY TOOL DASH NO.						
-25		40	2 1/2 - 3GR27	4075	3605	3.068	3.500	5.000	5.000	5.000	2.375					A29	B29		
-26	3	80		7895	6550	2.900	3.500	5.000	5.000	5.000	2.375				A30	B30			
-27		160	2 1/2 - 3GR25			2.626									A31	B31			
-28		XX				2.300									A32	B32			
-29		40	4GR34			3.548	4.000	5.375	6.000	0.500					A33	B33			
-30	3 1/2	80				3.364	4.000	5.375	6.000	0.500					A34	B34			
-31		XX	4GR27			2.728	4.500	6.000	6.000	2.6875					A35	B35			
-32		40	4GR40	2770	2505	4.026	4.500	5.000	5.000	2.6875					A36	B36			
-33	4	80		5495	4670	3.826									A37	B37			
-34		160	4GR34			3.438									A38	B38			
-35		XX	4GR31	8710		3.152	4.500	5.375	5.375						A39	B39			
-36		40	5GR52			5.047									A40	B40			
-37		80				4.813	5.563	7.500	7.500	0.625	2.9375				A41	B41			
-38	5	160	5GR46			4.313									A42	B42			
-39		XX	5GR40			4.063									A43	B43			
-40		40	6GR62	3375	2915	6.065	6.625	9.250	6.000	0.750	3.250				A44	B44			
-41	6	80				5.761	6.625	9.250	6.625	0.812					A45	B45			
-42		160	6GR52	6135	4195	5.189									A46	B46			
-43		XX				4.897									A47	B47			

CUSTODIAN JOHN F. KENNEDY SPACE CENTER		STANDARD PART	
PROCUREMENT SPECIFICATION NONE	TITLE HUB, PRESSURE TAPPED	KCI68	
COORDINATION STATUS KSC DE		SHEET 3 OF 3	

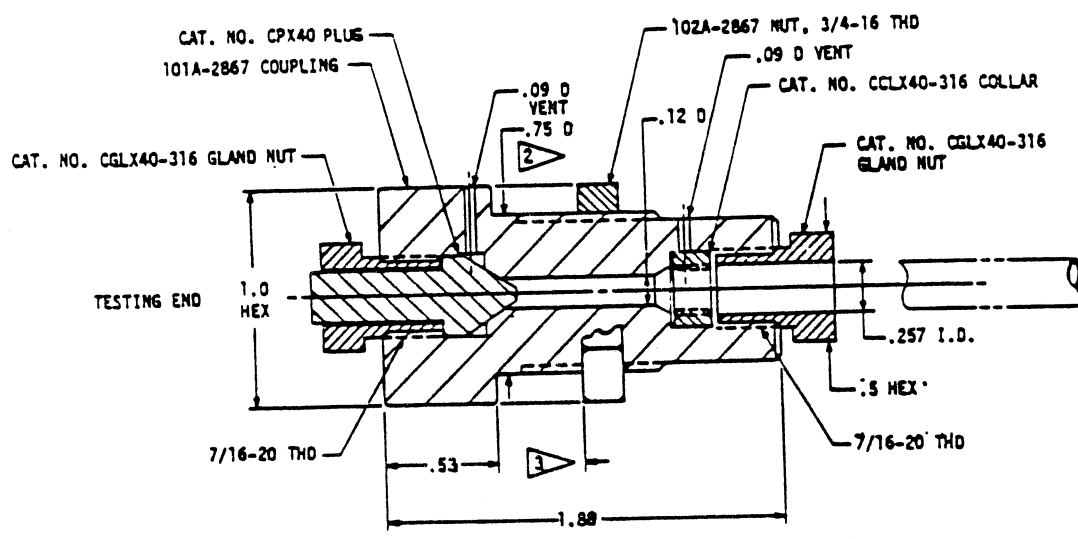
APPROVED: 2/6/76 REVISED: (A) 4/15/77 (B) 7/27/83



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NOTES:

1. ALL DIMENSIONS ARE REFERENCE ONLY.
2. 13/16 D HOLE REQUIRED FOR PANEL MOUNTING.
3. 0.38 MAXIMUM PANEL THICKNESS.
4. TORQUE GLAND NUTS TO 20 FT LBS.
5. CONFIGURATION SHOWN IS THAT OF TEST PORT BUT ASSEMBLY MAY BE USED AS HIGH PRESSURE BULKHEAD COUPLING.
6. WHEN COUPLING IS USED AS TEST PORT, FLUID PRESSURE IS BLED DOWN THRU VENT BY LOOSENING GLAND NUT NOT MORE THAN ONE TURN.
7. ASSEMBLY WEIGHT FOR KC169 IS APPROX 0.30 LBS.
8. COUPLING ASSEMBLY IS SIMILAR TO AUTOCLAVE ENGINEERS INC. CAT. NO. 20BFX4466-316 EXCEPT FOR PLUG. THIS STANDARD INCLUDES ALL PARTS ILLUSTRATED ABOVE.

MATERIAL: ALL MATERIAL 316 SS.

FINISH: PASSIVATE.

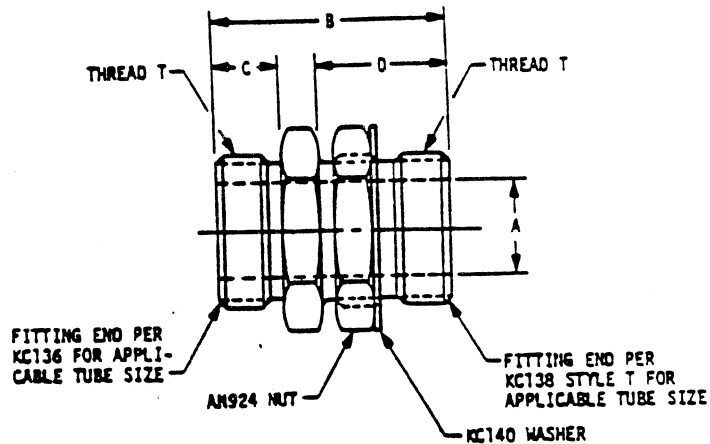
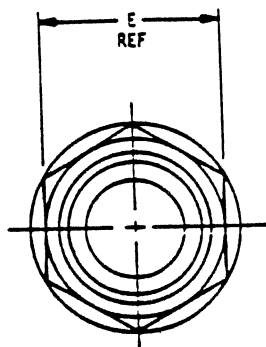
- USE LIMITATIONS:
1. 20,000 PSIG MAXIMUM PRESSURE.
 2. TO BE USED WITH 1/4 O.D. X 0.109 I.D. SS TUBING

SUGGESTED SOURCE: COMMERCIAL PARTS CAN BE PURCHASED FROM AUTOCLAVE ENGINEERS, 2930 WEST 22ND ST., P.O. BOX 4007 ERIE, PA 16512

APPROVED: 7-13-76 REVISED:

CUSTODIAN JOHN F. KENNEDY SPACE CENTER		STANDARD PART	
PROCUREMENT SPECIFICATION NONE	TITLE COUPLING ASSEMBLY, BLKHD SUPER PRESSURE PORT	KC169	
COORDINATION STATUS KSC DE		SHEET 1 OF 1	

Multiple. When Gov't draws, specs., or other data are used for any purpose other than in connection with a definitely related Gov't. procurement operation, the U. S. Gov't, thereby incurs no responsibility, nor any obligation whatsoever, and the fact that the Gov't. may have furnished, furnished, or in any way supplied the said drawings, specs., or other data is not to be regarded by any person as an implied or otherwise as in any manner licensing the holder or any other person or corp., or conveying any rights or permission to manufacture, use, or sell any patented invention that may be patented, or to use any trade name, or to do any other act that may be prohibited by law.



DASH NO.		TUBE OD REF	THREAD T REF	A REF	B +.000 -.060	C +.000 -.015	D ±.016	E REF
CRE STEEL	AL ALLOY							
C4	D4	1/4	7/16-20	.172	1.219	.359	.703	.563
C6	D6	3/8	9/16-18	.297	1.406	.391	.766	.688
C8	D8	1/2	3/4-16	.391	1.562	.438	.875	.875
C10	D10	5/8	7/8-14	.484	1.812	.500	1.063	1.000
C12	D12	3/4	1-1/16-12	.609	2.125	.594	1.156	1.250
C16	D16	1	1-5/16-12	.844	2.125	.594	1.156	1.500
C20	D20	1-1/4	1-5/8-12	1.078	2.125	.594	1.156	1.875
C24	D24	1-1/2	1-7/8-12	1.312	2.125	.594	1.156	2.125
C32	D32	2	2-1/2-12	1.781	2.125	.594	1.156	2.750

MATERIAL: See Procurement Specification
 Aluminum Alloy, Code "D"
 Corrosion Resistant Steel (Class 316), Code "C"
FINISH: See Procurement Specification
SCREW THREAD: See Procurement Specification

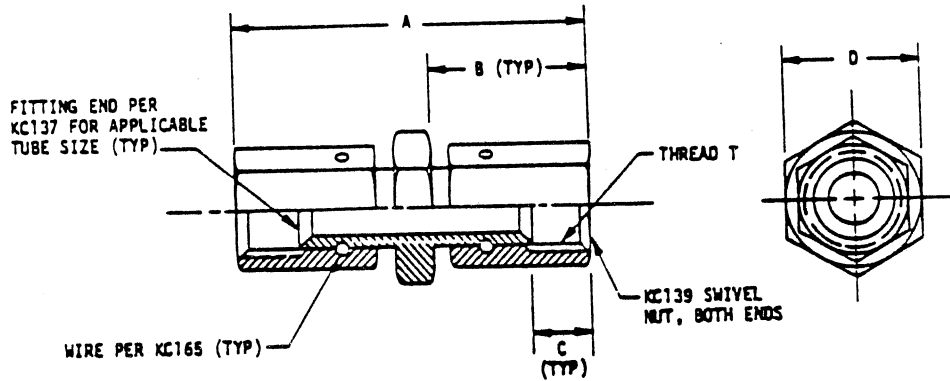
- NOTES:**
- Remove burrs and slivers. Break sharp edges unless otherwise noted.
 - Dimensions in inches. Unless otherwise specified decimal tolerance is $\pm .005$.
 - For design feature purposes, this drawing takes precedence over procurement documents referenced.
 - Referenced documents shall be of the issue in effect on date of invitation of bid.
 - Marking of fittings shall be consistent with procurement specification using applicable KC standard and part number designations as shown on this drawing.

EXAMPLE OF PART NOS:
 KC170C4 = Union, Adjustable End, 1/4 OD Tubing, Corrosion Resistant Steel
 KC17008 = Union, Adjustable End, 1/2 OD Tubing, Aluminum Alloy

CUSTODIAN		JOHN F. KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION	TITLE	DESIGN STANDARD	
KSC-F-124	UNION, ADJUSTABLE END	KC170	
COORDINATION STATUS		SHEET 1 OF 1	
KSC	DE		

APPROVED: 11-1-83

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DASH NO.		TUBE OD REF	THREAD T REF	A +.000 -.062	B +.000 -.031	C REF	D REF	SWIVEL NUT		RETAINING WIRE
CRE STEEL	AL ALLOY							FOR CRE STEEL ASSY	FOR AL ALLOY ASSY	
C4	04	1/4	7/16-20	1.720	.780	.36	11/16	KC139C4	KC13904	KC165-4
C6	06	3/8	9/16-18	2.080	.910	.39	13/16	KC139C6	KC13906	KC165-6
C8	08	1/2	3/4-16	2.160	.950	.44	1	KC139C8	KC13908	KC165-8
C10	010	5/8	7/8-14	2.310	1.000	.51	1-1/8	KC139C10	KC139010	KC165-10
C12	012	3/4	1-1/16-12	2.590	1.140	.58	1-3/8	KC139C12	KC139012	KC165-12
C16	016	1	1-5/16-12	2.810	1.220	.61	1-5/8	KC139C16	KC139016	KC165-16
C20	020	1-1/4	1-5/8-12	3.050	1.340	.64	1-7/8	KC139C20	KC139020	KC165-20
C24	024	1-1/2	1-7/8-12	3.190	1.420	.65	2-1/8	KC139C24	KC139024	KC165-24
C32	032	2	2-1/2-12	3.970	1.780	.95	2-3/4	KC139C32	KC139032	KC165-32

MATERIAL: SEE PROCUREMENT SPECIFICATION
 CORROSION RESISTANT STEEL (CLASS 316), CODE C
 ALUMINUM ALLOY, CODE D

FINISH: SEE PROCUREMENT SPECIFICATION

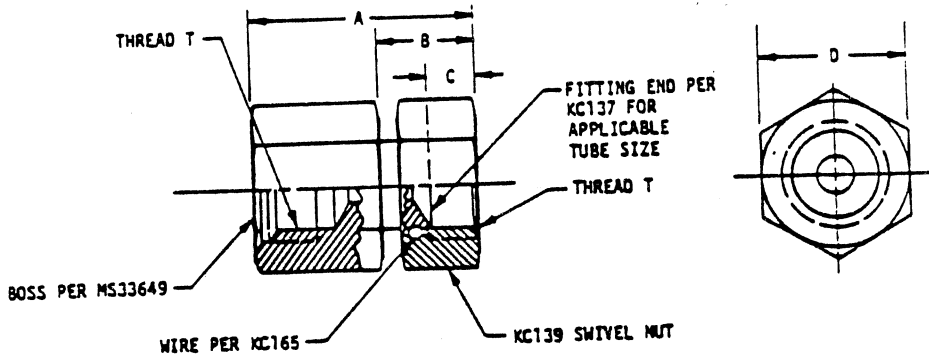
SCREW THREAD: SEE PROCUREMENT SPECIFICATION

- NOTES:**
1. REMOVE BURRS AND SLIVERS. BREAK SHARP EDGES.
 2. DIMENSIONS IN INCHES, UNLESS OTHERWISE NOTED, TOLERANCE DECIMALS +.005.
 3. FOR DESIGN FEATURE PURPOSES, THIS DRAWING TAKES PRECEDENCE OVER PROCUREMENT DOCUMENTS REFERENCED HEREIN.
 4. REFERENCED DOCUMENTS SHALL BE THE ISSUE IN EFFECT ON DATE OF INVITATION FOR BID.
 5. MARKING OF FITTINGS SHALL BE CONSISTANT WITH PROCUREMENT SPECIFICATION USING APPLICABLE KC STANDARD AND PART NUMBER DESIGNATIONS AS SHOWN ON THIS DRAWING.

EXAMPLE OF PART NUMBERS: KC171C4 = UNION ASSEMBLY, 1/4 OD TUBING, CORROSION RESISTANT STEEL
 KC171D8 = UNION ASSEMBLY, 1/2 OD TUBING, ALUMINUM ALLOY

CUSTODIAN		JOHN F. KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION	TITLE	STANDARD PART	
KSC-F-124	UNION ASSEMBLY, DOUBLE SWIVEL NUT	KC171	
COORDINATION STATUS		SHEET 1 OF 1	
KSC DE			

APPROVED: 11-1-83



DASH NO.		TUBE OD REF	THREAD T REF	A +.000 -.031	B REF	C REF	D REF	SWIVEL NUT		RETAINING WIRE
CRE STEEL	AL ALLOY							FOR CRE STEEL ASSY	FOR AL ALLOY ASSY	
C4	04	1/4	7/16-20	1.580	.730	.36	11/16	KC139C4	KC13904	KC165-4
C6	06	3/8	9/16-18	1.690	.850	.39	13/16	KC139C6	KC13906	KC165-6
C8	08	1/2	3/4-16	1.930	.900	.44	1	K139C8	K13908	KC165-8
C10	010	5/8	7/8-14	2.090	.970	.51	1-1/8	KC139C10	KC139010	KC165-10
C12	012	3/4	1-1/16-12	2.350	1.090	.58	1-3/8	KC139C12	KC139012	KC165-12
C16	016	1	1-5/16-12	2.560	1.190	.61	1-5/8	KC139C16	KC139016	KC165-16
C20	020	1-1/4	1-5/8-12	2.780	1.310	.64	2	KC139C20	KC139020	KC165-20
C24	024	1-1/2	1-7/8-12	3.000	1.370	.65	2-1/4	KC139C24	KC139024	KC165-24
C32	032	2	2-1/2-12	3.820	1.780	.95	2-7/8	KC139C32	KC139032	KC165-32

MATERIAL: SEE PROCUREMENT SPECIFICATION
 CORROSION RESISTANT STEEL (CLASS 316), CODE C
 ALUMINUM ALLOY, CODE D

FINISH: SEE PROCUREMENT SPECIFICATION

SCREW THREAD: SEE PROCUREMENT SPECIFICATION

- NOTES:
1. REMOVE BURRS AND SLIVERS. BREAK SHARP EDGES.
 2. DIMENSIONS IN INCHES. UNLESS OTHERWISE NOTED, TOLERANCE DECIMALS $\pm .016$.
 3. FOR DESIGN FEATURE PURPOSES, THIS DRAWING TAKES PRECEDENCE OVER PROCUREMENT DOCUMENTS.
 4. REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATION FOR BID.
 5. MARKING OF FITTINGS SHALL BE CONSISTANT WITH PROCUREMENT SPECIFICATION USING APPLICABLE KC STANDARD AND PART NUMBER DESIGNATIONS AS SHOWN ON THIS DRAWING.

EXAMPLE OF PART NUMBERS: KC172C4 = ADAPTER, SWIVEL NUT, FOR 1/4" OD TUBING, CORROSION RESISTANT STEEL
 KC172D16 = ADAPTER, SWIVEL NUT, FOR 1" OD TUBING, ALUMINUM ALLOY

APPROVED: 11-1-83

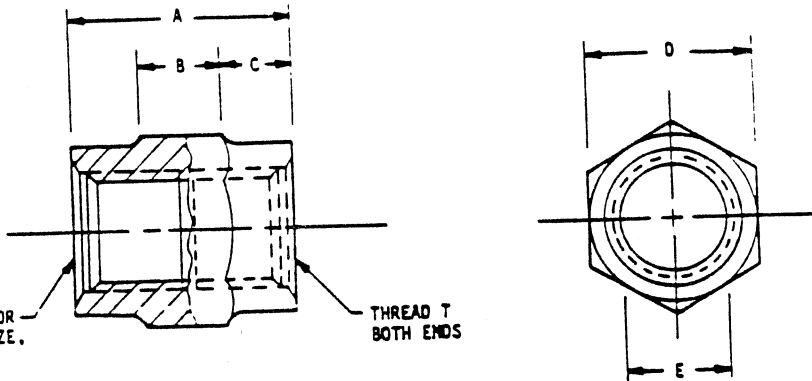
CUSTODIAN		JOHN F. KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION		STANDARD PART	
KSC-F-124		KC172	
COORDINATION STATE		SHEET OF	
KSC	DE	ADAPTER, SWIVEL NUT	

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BOSS PER MS33649 FOR APPLICABLE TUBE SIZE, BOTH ENDS.

THREAD T BOTH ENDS

DASH NO.	CRE STEEL	AL ALLOY	TUBE OD REF	THREAD T REF	A +.030 -.000	B	C ±.010	D	E		
C4		D4	1/4	7/16-20	1.188	.375	.406	.688	±.003	.386	+.006 -.001
C6		D6	3/8	9/16-18	1.188	.375	.406	.813		.500	
C8		D8	1/2	3/4-16	1.434	.437	.500	1.000	-0.004	.688	+.008 -.001
C12		D12	3/4	1-1/16-12	1.813	.625	.594	1.375		.972		±.010 -.001
C16		D16	1	1-5/16-12	1.875	.687	.594	1.625	±.016	1.222	
C20		D20	1-1/4	1-5/8-12	2.000	.750	.625	2.000		±.020		1.534	+.012 -.001
C24		D24	1-1/2	1-7/8-12	2.250	.812	.719	2.250	1.784		
C32		D32	2	2-1/2-12	2.750	1.000	.875	3.000		2.409	

MATERIAL: SEE PROCUREMENT SPECIFICATION
CORROSION RESISTANT STEEL (CLASS 316) CODE C
ALUMINUM ALLOY CODE D

FINISH: SEE PROCUREMENT SPECIFICATION

SCREW THREAD: SEE PROCUREMENT SPECIFICATION

- NOTES:
1. REMOVE BURRS AND SLIVERS. BREAK SHARP EDGES.
 2. DIMENSIONS ARE IN INCHES. UNLESS OTHERWISE NOTED, TOLERANCE DECIMALS ±.016.
 3. FOR DESIGN FEATURE PURPOSES, THIS DRAWING TAKES PRECEDENCE OVER PROCUREMENT DOCUMENTS.
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 5. MARKING OF FITTINGS SHALL BE CONSISTANT WITH PROCUREMENT SPECIFICATION USING APPLICABLE KC STANDARD AND PART NUMBER DESIGNATIONS AS SHOWN ON THIS DRAWING.

EXAMPLE OF PART NUMBERS: KC173C4 = COUPLING, TUBE, FOR 1/4" OD TUBING, CORROSION RESISTANT STEEL
KC173D16 = COUPLING, TUBE, FOR 1" OD TUBING, ALUMINUM ALLOY

APPROVED: 11-1-01

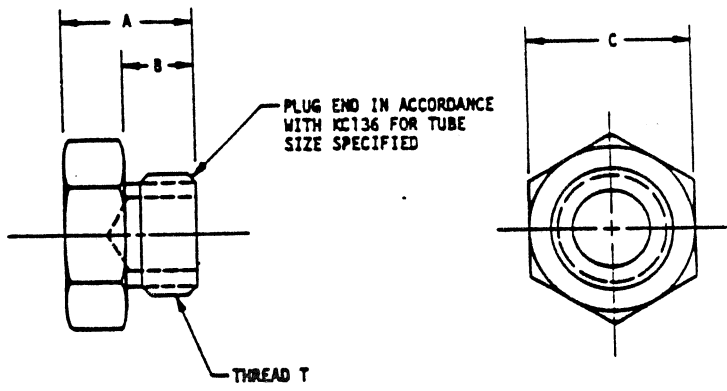
CUSTODIAN		JOHN F. KENNEDY SPACE CENTER	
PROCUREMENT SPECIFICATION TITLE	KSC-F-124	COUPLING, TUBE	STANDARD PART
			KC173
COORINATION STATUS	KSC DE		SHEET 1 OF 1

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Kennedy Space Center, Florida 32814
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DASH NO.		TUBE OD REF	THREAD T REF	A	B REF	C
CRE STEEL	AL ALLOY					
C4	D4	1/4	7/16-20	.67	.389	11/16
C6	D6	3/8	9/16-18	.73	.420	13/16
C8	D8	1/2	3/4-16	.80	.521	1
C12	D12	3/4	1-1/16-12	1.09	.636	1-3/8
C16	D16	1	1-5/16-12	1.12	.672	1-5/8
C20	D20	1-1/4	1-5/8-12	1.20	.672	1-7/8
C24	D24	1-1/2	1-7/8-12	1.27	.720	2-1/8
C32	D32	2	2-1/2-12	1.43	.887	2-3/4

MATERIAL: SEE PROCUREMENT SPECIFICATION
CORROSION RESISTANT STEEL (CLASS 316) CODE C
ALUMINUM ALLOY CODE D

FINISH: SEE PROCUREMENT SPECIFICATION

SCREW THREAD: SEE PROCUREMENT SPECIFICATION

- NOTES:**
1. REMOVE BURRS AND SLIVERS. BREAK SHARP EDGES.
 2. DIMENSIONS ARE IN INCHES. UNLESS OTHERWISE NOTED, TOLERANCE DECIMALS ±.016.
 3. FOR DESIGN FEATURE PURPOSES, THIS DRAWING TAKES PRECEDENCE OVER PROCUREMENT DOCUMENTS.
 4. REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATION FOR BID.
 5. MARKING OF FITTINGS SHALL BE CONSISTANT WITH PROCUREMENT SPECIFICATION USING APPLICABLE KC STANDARD AND PART NUMBER DESIGNATIONS AS SHOWN ON THIS DRAWING.

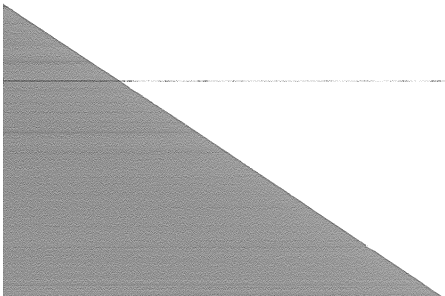
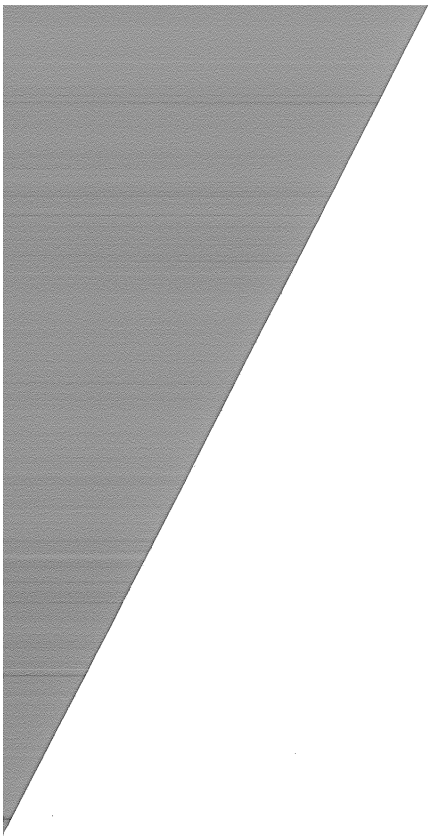
EXAMPLE OF PART NUMBERS: KC174CA = PLUG, HEX HEAD, FOR 1/4" OD TUBING, CORROSION RESISTANT STEEL
KC174016 = PLUG, HEX HEAD, FOR 1" OD TUBING, ALUMINUM ALLOY

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APPROVED: 11-1-83 REV A B-21-86

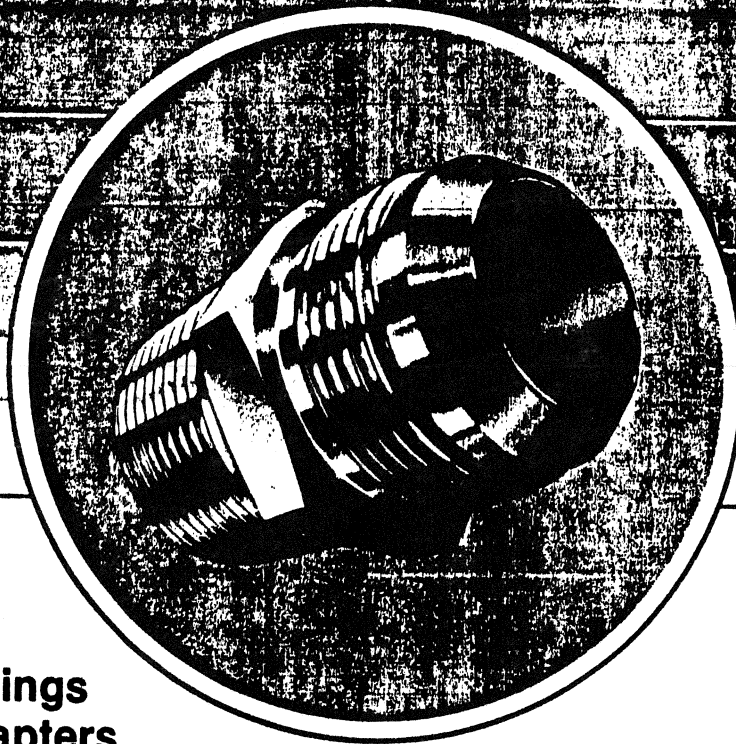
CUSTODIAN JOHN F. KENNEDY SPACE CENTER		STANDARD PART	
PROCUREMENT SPECIFICATION KSC-F-124	TITLE PLUG, HEX HEAD	KC174	
COORDINATION STATUS KSC DE		SHEET 1 OF 1	

SECTION 4 - ALLAN AIRCRAFT FLARED TUBE FITTING
CATALOG/INTERCHANGEABILITY LIST

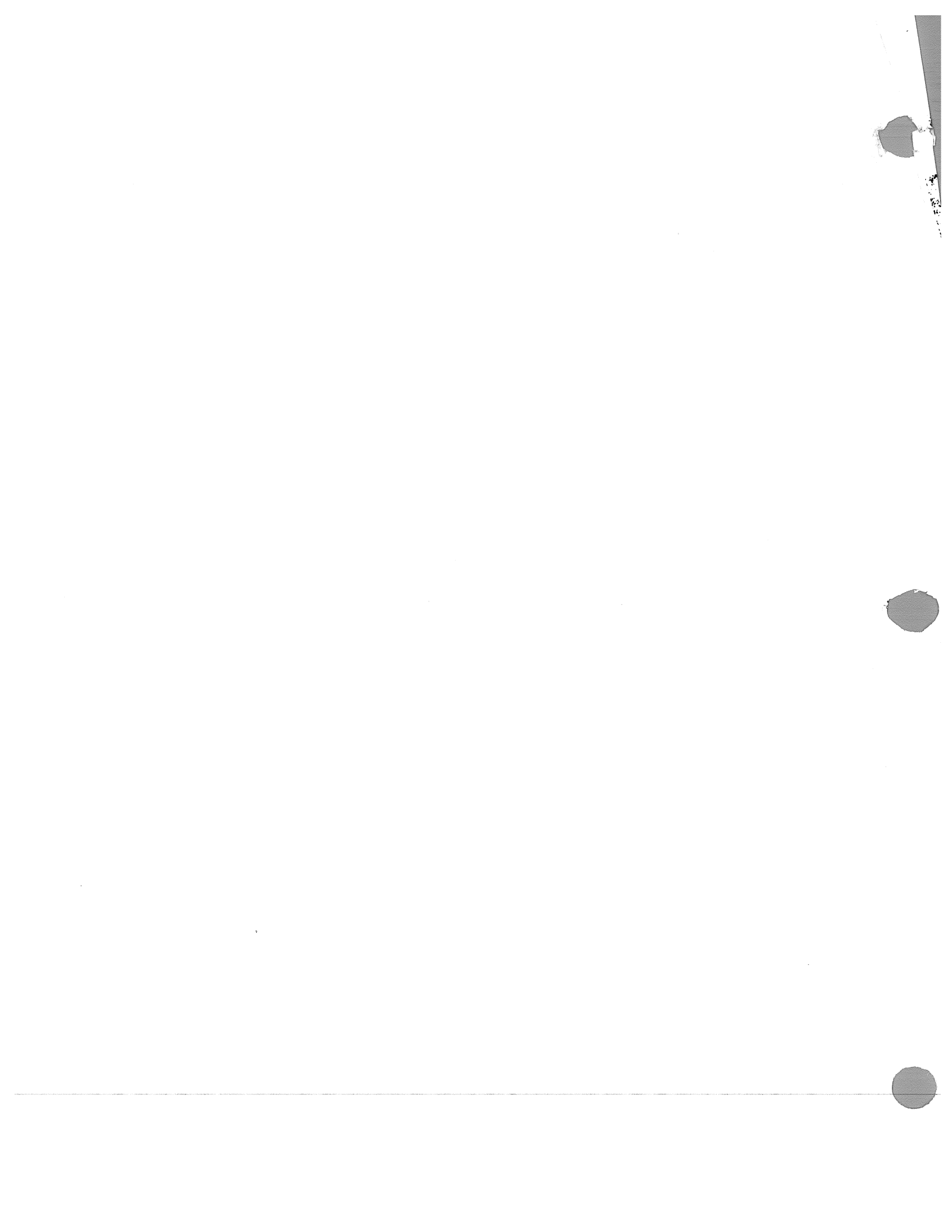


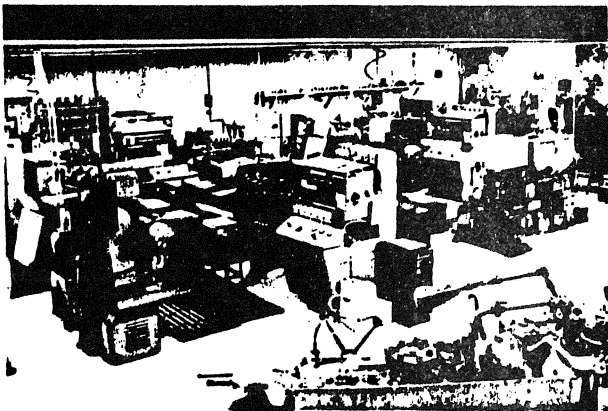
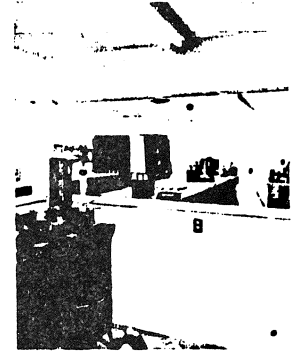
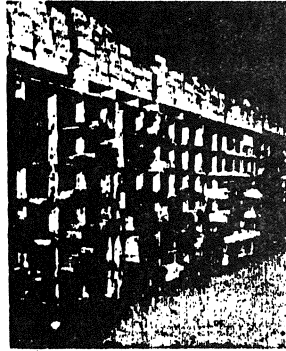
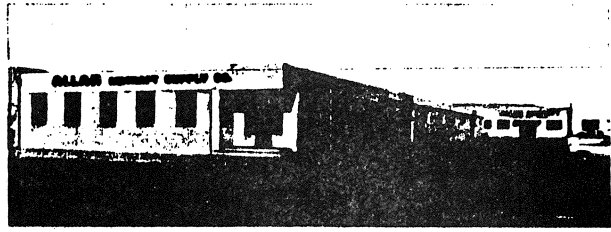


ALLAN AIRCRAFT SUPPLY COMPANY



Manufacturers of:
37° Flared Tube Fittings
Straight Thread Adapters
Pipe Thread Adapters
Weld End Fittings
Orifice Fittings



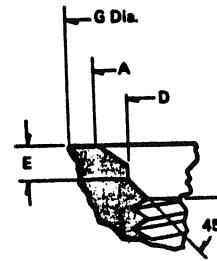
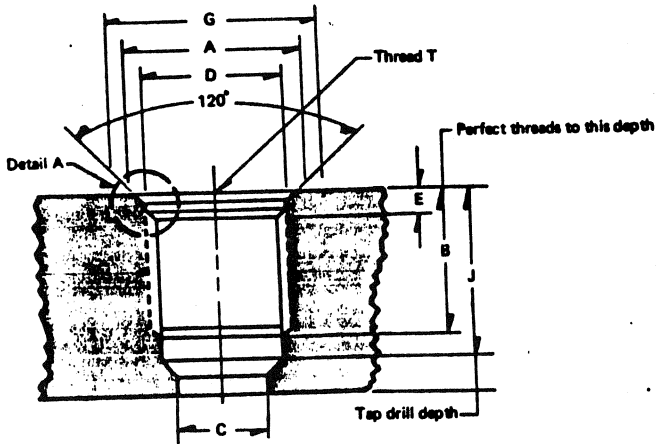


LEONARD MELDEAU
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At Allan Aircraft Supply Company our rigid quality control procedures and inspection laboratory are assurance of high quality fittings produced on a cost effective, competitive basis.

MS33649 internal straight thread BOSS
(Corresponds AND 10050)

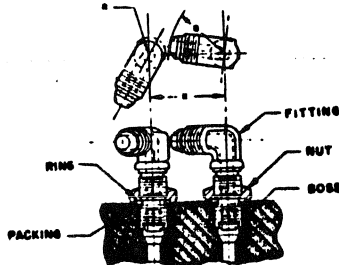


Detail A

TUBE O.D.	THREAD	A	D	E	B	C	T
1/8	1/8-24	.438	.482	.062	.328	.063	.602
3/16	3/16-24	.500	.538	.125	.390	.063	.665
1/4	1/4-20	.562	.568	.172	.454	.075	.728
5/16	5/16-20	.625	.568	.234	.517	.075	.790
3/8	3/8-18	.688	.568	.297	.580	.083	.852
1/2	1/2-16	.875	.714	.391	.769	.094	1.040
5/8	5/8-14	1.000	.802	.484	.896	.107	1.165
3/4	3/4-12	1.234	.877	.609	1.088	.125	1.415
1	1-12	1.487	.877	.844	1.336	.125	1.665
1 1/4	1 1/4-12	1.800	.877	1.078	1.648	.125	1.978
1 1/2	1 1/2-12	2.050	.877	1.312	1.898	.125	2.228
1 3/4	1 3/4-12	2.426	.877	1.547	2.273	.125	2.602
2	2-12	2.626	.907	1.781	2.624	.125	2.852

Extracted from MS33649. Illustrations and tables for descriptive purposes only. Detailed specifications supplied upon request.

DESIGN STANDARD FOR HYDRAULIC BOSS SPACING

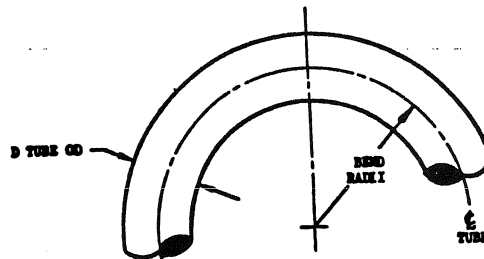


DASH NO REF	R	Q	K MIN. (1)
2	0.181	0.828	1.040
3	0.225	0.893	1.149
4	0.252	0.957	1.240
5	0.296	1.022	1.349
6	0.322	1.089	1.442
8	0.434	1.360	1.825
10	0.489	1.569	2.089
12	0.586	1.795	2.412
16	0.727	1.973	2.731
20	0.894	2.229	3.154
24	1.034	2.428	3.493
28	1.243	2.720	3.994
32	1.375	2.905	4.311

(1) DIMENSION K = R + Q + .031

WHEN DIFFERENT SIZE BOSSES ARE USED, MAINTAIN MINIMUM SPACING EQUAL TO R OF SMALL FITTING PLUS Q OF LARGE FITTING PLUS .031 DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED (Extracted from MS21343)

RECOMMENDED BEND RADII FOR HYDRAULIC TUBING



TUBE O.D.	3D	4D
1/8	0.375	0.500
3/16	0.563	0.750
1/4	0.750	1.000
5/16	0.938	1.250
3/8	1.125	1.500
1/2	1.312	1.750
5/8	1.500	2.000
3/4	1.875	2.500
1	2.250	3.000
1 1/4	3.000	4.000
1 1/2	3.750	5.000
1 3/4	4.500	6.000
2	6.000	8.000

(Extracted from MS33611)

STAINLESS STEEL TORQUING VALUES

NUT O.D. INCHES	TORQUE FOR TIGHTENING AAS732 NUT (POUND INCH)	
	MINIMUM	MAXIMUM
-2	1/8	75
-3	3/16	95
-4	1/4	135
-5	5/16	170
-6	3/8	270
-8	1/2	450
-10	5/8	650
-12	3/4	900
-16	1	1200
-20	1 1/4	1520
-24	1 1/2	1900
-28	1 3/4	2300
-32	2	2660

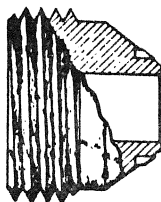
The values listed above are for standard applications only. Do not use this table for dry film lubricated threads, or other materials.

HYDRAULIC TUBING INFORMATION

INSIDE DIAMETERS OF STANDARD SIZE TUBING

Tube O.D.	Wall Thick.	Tube I.D.	Tube O.D.	Wall Thick.	Tube I.D.	Tube O.D.	Wall Thick.	Tube I.D.	Tube O.D.	Wall Thick.	Tube I.D.
1/8	.028	.069	.035	.043	.049	.049	.077	1 1/4	.120	.1010	
	.032	.061	.042	.046	.058	.058	.075				
	.035	.055	.049	.042	.065	.065	.0745		.065	1.370	
			.058	.042	.072	.072	.0731		.072	1.356	
3/16	.032	.1235	.065	.034	.083	.083	.0709	1 1/2	.083	1.310	
	.035	.1175	.072	.035	.095	.095	.0685		.095	1.282	
			.083	.034	.109	.109	.0657		.109	1.260	
	.035	.180	.035	.555	.049	.049	.902		.065	1.620	
1/4	.042	.166	.042	.541	.058	.058	.884		.072	1.606	
	.049	.152	.049	.527	.065	.065	.870		.072	1.606	
	.058	.134	.058	.509	.072	.072	.856		.063	1.584	
	.065	.120	.065	.495	.083	.083	.834	1 3/4	.095	1.560	
			.072	.481	.085	.085	.810		.109	1.532	
	.035	.2425	.083	.459	.109	.109	.782		.120	1.510	
5/16	.042	.2285	.095	.435	.120	.120	.760		.134	1.482	
	.049	.2145									
	.058	.1965	.049	.652	.049	1.152			.065	1.870	
	.065	.1825	.058	.634	.058	1.134			.072	1.856	
			.065	.620	.065	1.120			.083	1.834	
3/8	.042	.291	.072	.606	.072	1.106			.095	1.810	
	.049	.277	.083	.584	.083	1.084	1	2	.109	1.782	
	.058	.259	.095	.560	.095	1.060			.120	1.760	
	.065	.245	.109	.532	.109	1.032			.134	1.732	

Ring Seal Tube Fittings



PROVIDE SUPERIOR PROTECTION AGAINST LEAKAGE
IN DIFFICULT TO SEAL APPLICATIONS

TO ACHIEVE THIS SUPERIOR SEALING CAPABILITY,
A GROOVE IS MACHINED INTO THE 37° FLARE, AND AN
O-RING (USUALLY TEFLON) IS INSERTED. WHEN ASSEMBLED
WITH TUBING, THE PRIMARY SEAL IS TEFLON TO METAL.
A SECONDARY SEAL IS STILL METAL TO METAL.

ASK FOR RING SEAL LITERATURE.

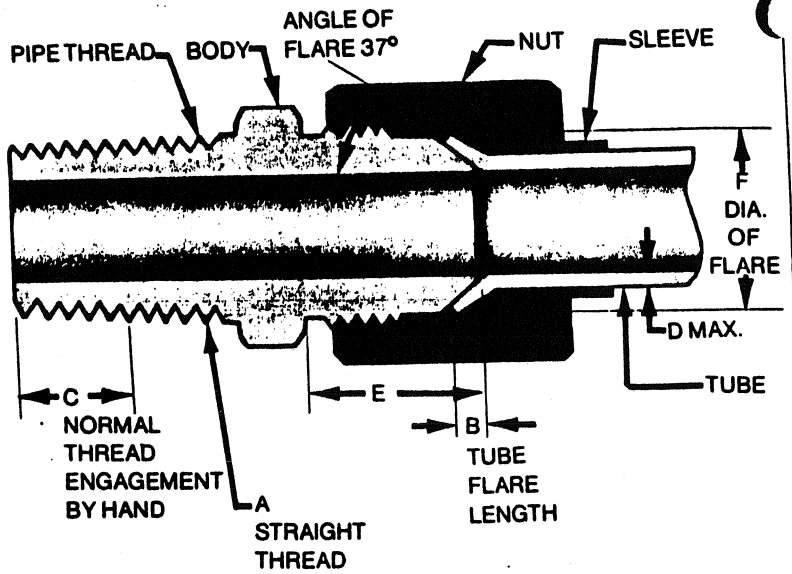
Pipe Information

Nom. Pipe Size	Actual Pipe O.D.	Nominal Pipe Wall Thickness and Nominal Pipe Inside Diameter											
		Schedule 5S		Schedule 10S		Schedule 40 & Standard		Schedule 80 & Extra Strong		Schedule 160		Double Extra Strong	
		Wall	I.D.	Wall	I.D.	Wall	I.D.	Wall	I.D.	Wall	I.D.	Wall	I.D.
1/4	0.540	---	---	0.065	0.410	0.088	0.364	0.119	0.302	---	---	---	---
1/2	0.840	0.065	0.710	0.083	0.674	0.109	0.622	0.147	0.546	0.188	0.464	0.294	0.252
3/4	1.050	0.065	0.920	0.083	0.884	0.113	0.824	0.154	0.742	0.219	0.612	0.308	0.434
1	1.315	0.065	1.185	0.109	1.097	0.133	1.049	0.179	0.957	0.250	0.815	0.358	0.599
1 1/4	1.660	0.065	1.530	0.109	1.442	0.140	1.380	0.191	1.278	0.250	1.160	0.382	0.896
1 1/2	1.900	0.065	1.770	0.109	1.682	0.145	1.610	0.200	1.500	0.281	1.338	0.400	1.100
2	2.375	0.065	2.245	0.109	2.157	0.154	2.067	0.218	1.939	0.344	1.687	0.436	1.503
2 1/2	2.875	0.083	2.709	0.120	2.635	0.203	2.469	0.276	2.323	0.375	2.125	0.552	1.771
3	3.500	0.083	3.334	0.120	3.260	0.216	3.068	0.300	2.900	0.438	2.624	0.600	2.300
3 1/2	4.000	0.083	3.834	0.120	3.760	0.226	3.548	0.318	3.364	---	---	---	---
4	4.500	0.083	4.334	0.120	4.260	0.237	4.026	0.337	3.826	0.531	3.438	0.674	3.152

(Portions of this table were extracted from standards ANSI B16.5 and ASA B36.19)

Flared Tube Connections

		.062	1/16-24	.09	.26	.035	.45	.224	
	1/16	.125	1/8-24	.09	.26	.035	.48	.290	
	1/8	.172	1/8-20	.11	.26	.065	.55	.359	
	1/4	.172	1/8-20	.11	.40	.065	.55	.359	
4-6	1/4	.172	1/8-20	.11	.53	.065	.55	.359	
4-8	1/4	.172	1/8-20	.11	.26	.065	.55	.421	
5	1/8	.234	1/2-20	.11	.40	.065	.55	.421	
5-4	1/8	.234	1/2-20	.11	.40	.065	.55	.421	
6	1/4	.297	1/4-18	.13	.40	.065	.56	.484	
6-2	1/4	.297	1/4-18	.13	.26	.065	.56	.484	
6-6	1/4	.297	1/4-18	.13	.40	.065	.56	.484	
6-8	1/4	.297	1/4-18	.13	.53	.065	.56	.484	
8	1/2	.391	3/8-16	.16	.40	.083	.66	.656	
8-4	1/2	.391	3/8-16	.16	.40	.083	.66	.656	
8-8	1/2	.391	3/8-16	.16	.53	.083	.66	.656	
8-12	1/2	.391	3/8-16	.16	.54	.083	.66	.656	
8-16	1/2	.391	3/8-16	.16	.68	.083	.66	.656	
10	3/8	.484	1/2-14	.19	.53	.095	.76	.781	
10-6	3/8	.484	1/2-14	.19	.40	.095	.76	.781	
10-12	3/8	.484	1/2-14	.19	.54	.095	.76	.781	
12	1/2	.609	1 1/4-12	.22	.54	.109	.86	.937	
12-4	1/2	.609	1 1/4-12	.22	.40	.109	.86	.937	
12-6	1/2	.609	1 1/4-12	.22	.40	.109	.86	.937	
12-8	1/2	.609	1 1/4-12	.22	.53	.109	.86	.937	
12-16	1/2	.609	1 1/4-12	.22	.68	.109	.86	.937	
16	1	.844	1 1/2-12	.22	.68	.120	.91	1.187	
16-8	1	.844	1 1/2-12	.22	.53	.120	.91	1.187	
16-12	1	.844	1 1/2-12	.22	.54	.120	.91	1.187	
20	1 1/4	1.078	1 3/4-12	.25	.70	.120	.96	1.500	
20-16	1 1/4	1.078	1 3/4-12	.25	.68	.120	.96	1.500	
24	1 1/2	1.312	1 3/4-12	.25	.72	.120	1.08	1.721	
24-20	1 1/2	1.312	1 3/4-12	.25	.70	.120	1.08	1.721	
28	1 3/4	1.547	2 1/4-12	.31	.72	.120	1.21	2.106	
32	2	1.781	2 1/2-12	.34	.75	.134	1.33	2.356	



How To Order

ORDER ALLAN AIRCRAFT FITTINGS BY PART NUMBER AS LISTED IN THIS CATALOG

EXAMPLE: Fitting needed - 316 stainless steel tube union for 1" O.D. tube with mating "B" nuts and sleeves, grooved for seal ring.

PART NUMBER:

AA67001-16KAL G

Allan Aircraft Industrial Fitting
Featuring 3 piece design incorporating body, nut and free floating sleeve.

Body Pattern Designator
001 = 37° flared union. Body designs available from stock include adapters, unions, elbows, tees, crosses.

Connection Size
-16 = 1" O.D. tube. Connection tube and pipe sizes stocked from -2 through -32 (tube sizes are determined by the number of sixteenths of an inch in the tube O.D. Pipe sizes by the number of eighths of an inch.)

Material
Type 316 stainless steel. Most fittings can be supplied in the following alloys:

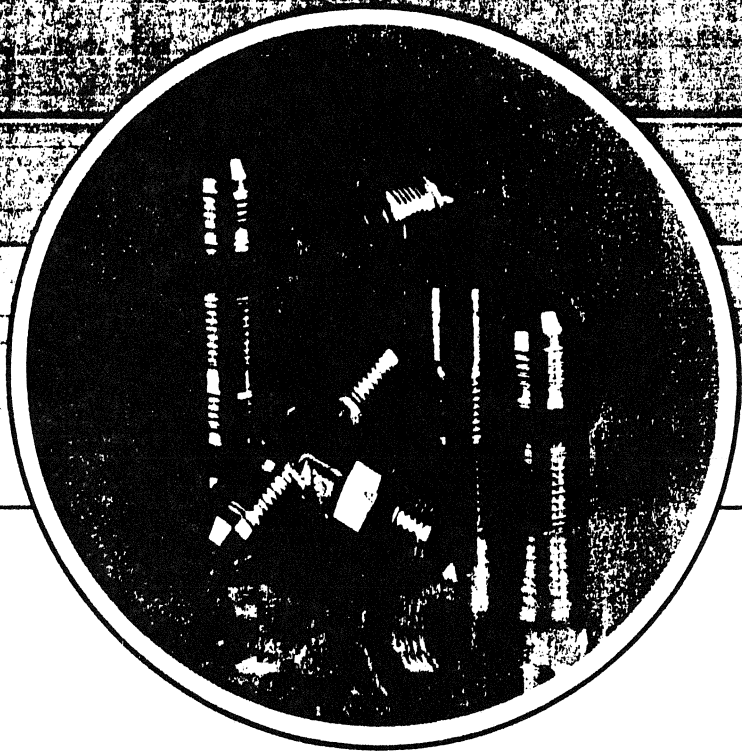
J - 304ss M - Monel
K - 316ss T - Titanium
S - 347ss D - Aluminum

Assembly
With Mating "B" Nuts And Sleeves
Omit "A" to order fitting body only

Lockwire Holes
"B" Nut And Swivel Nut Drilled For Lockwire

Groove for Seal Ring
Sealing cone grooved for installation of Teflon ring seal. (see page 3)

37° FLARED TUBE FITTINGS



Fitting Locator

SPECIFICATIONS:

Allan Aircraft fittings conform to standards set by:

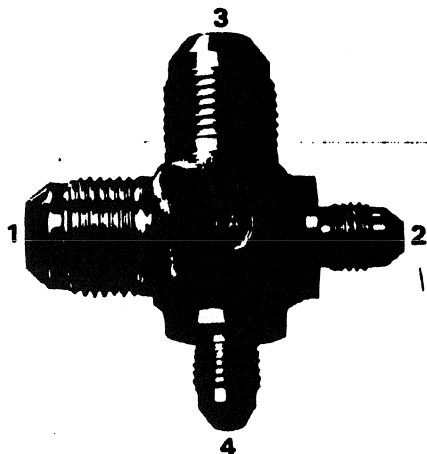
- Society of Automotive Engineers
- J.I.C. — Joint Industry Conference on Hydraulic Standards
- MIL-F-5506 — Performance Standards
- MIL-F-18866 — "Fittings, Flared Tube, 37° Degree," approved by the Department of Defense for use by the Departments of the Army, the Navy, and the Air Force.

THREADS:

- Straight threads — unified class 2A and 2B
- Pipe threads — Dryseal American (National) Standard Taper (N.P.T.F.)

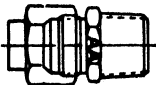
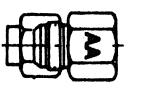



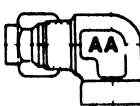
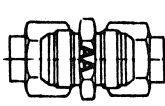
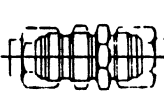
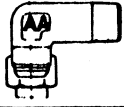
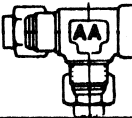
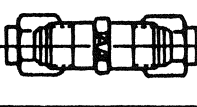
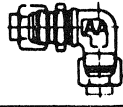
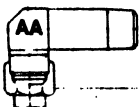

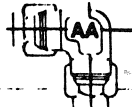


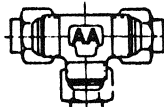
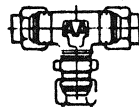

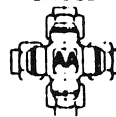
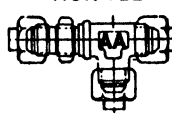
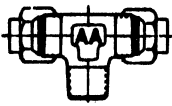
SPECIAL FITTINGS:

Fittings in various materials or size combinations can be manufactured for your needs.





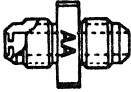
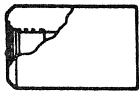
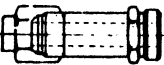



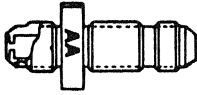
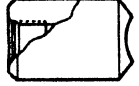
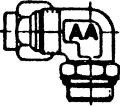

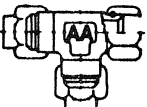



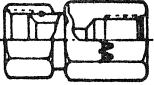


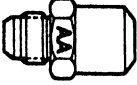
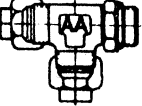
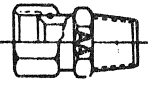
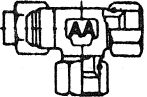





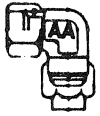
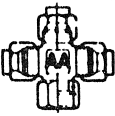
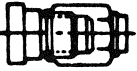

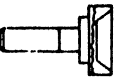


When ordering fittings with reduced ends, dash number sequence is left to right on the run legs, then top to bottom on the branch legs.

To avoid costly confusion, submit a sketch with special fitting orders.

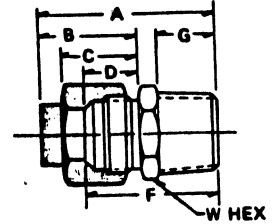
37° FLARE TO MALE PIPE	37° FLARE TO FEMALE PIPE	37° FLARE TO 37° FLARE	37° FLARE BULKHEAD
AA67006 P.8 MALE CONNECTOR 	AA67013 P.12 FEMALE CONNECTOR 	AA67000 P.13 UNION 	AA67039 P.12 FEMALE BULKHEAD CONNECTOR 
AA67007 P.9 MALE ELBOW 	AA67014 P.12 FEMALE ELBOW 	AA67001 P.14 LARGE HEX UNION 	AA67017 P.16 BULKHEAD UNION 
AA67008 P.9 LONG MALE ELBOW 	AA67015 P.13 FEMALE RUN TEE 	AA67002 P.15 LONG UNION 	AA67018 P.16 BULKHEAD ELBOW 
AA67009 P.10 EXTRA LONG MALE ELBOW 	AA67016 P.13 FEMALE BRANCH TEE 	AA67003 P.15 UNION ELBOW 	AA67019 P.17 BULKHEAD 45° ELBOW 
AA67010 P.10 MALE 45° ELBOW 		AA67004 P.15 UNION TEE 	AA67020 P.17 BULKHEAD BRANCH TEE 
AA67011 P.11 MALE RUN TEE 		AA67005 P.16 UNION CROSS 	AA67021 P.17 BULKHEAD RUN TEE 
AA67012 P.11 MALE BRANCH TEE 			

* Asterisk in tables indicates reference dimension.

90° FLARE TO O-RING	SWIVEL NUT FITTING	SWIVEL NUT FITTING	37° FLARE COMPONENTS	37° FLARE ORIFICE	WELD ENDS
AA67022 P.18 STRAIGHT THREAD CONNECTOR 	AA67081 P.20 SWIVEL NUT UNION 	AA67111 P.23 SWIVEL NUT ELBOW 	AA67032 P.26 NUT 	AA1634 P.29 UNION ORIFICE 	AAB1001 P.30 WELD BOSS PORT TO BLANK 
AA67023 P.18 STRAIGHT THREAD LONG CONNECTOR 	AA67082 P.20 DOUBLE SWIVEL NUT UNION 	AA67029 P.23 SWIVEL NUT 45° ELBOW 	AA67033 P.26 SLEEVE 	AA1635 P.29 BULKHEAD UNION ORIFICE 	AAB1001R P.30 WELD BOSS PORT TO SADDLE 
AA67024 P.19 STRAIGHT THREAD ELBOW 	AA67086 P.21 SWIVEL NUT UNION 	AA67030 P.23 SWIVEL NUT RUN TEE 	AA67035 P.26 PLUG 		AAB1002 P.30 WELD BOSS PORT TO BUTT WELD 
AA67025 P.19 STRAIGHT THREAD 45° ELBOW 	AA67108 P.21 SWIVEL NUT ADAPTER 	AA67031 P.24 SWIVEL NUT BRANCH TEE 	AA67036 P.27 CAP 		AAB1004 P.30 WELD ADAPTER TUBE TO BUTT WELD 
A67026 P.19 STRAIGHT THREAD RUN TEE 	AA67109 P.21 SWIVEL NUT UNION 	AA67084 P.24 DOUBLE SWIVEL NUT TEE 	AA67051 P.27 BULKHEAD LOCKNUT 		
AA67027 P.20 STRAIGHT THREAD BRANCH TEE 	AA67110 P.22 SWIVEL NUT UNION 	AA67095 P.24 TRIPLE SWIVEL NUT TEE 	AA67073 P.27 TUBE COUPLING 		
	AA67028 P.22 SWIVEL NUT ELBOW 	AA67113 P.25 SWIVEL NUT CROSS 	AA67034 P.28 TUBE END REDUCER 		
	AA67083 P.22 DOUBLE SWIVEL NUT ELBOW 		AA67037 P.28 MOUNTIE 		

37° Flared Tube Fittings

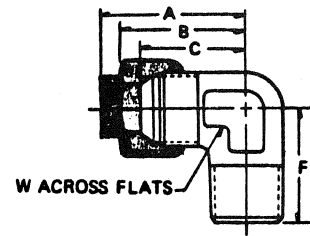
AA67006
MALE CONNECTOR
 flared tube end-
 male pipe end



PART NUMBER +	TUBE O.D.	MALE PIPE THREAD	A	B	C	D	E	F	G	W HEX
AA67006-2KA	1/8	1/8	1.42	.76	.64	.45	1.04	.38	7/16	
AA67006-3KA	3/16	1/8	1.50	.85	.73	.48	1.06	.38	7/16	
AA67006-4KA	1/4	1/8	1.58	.91	.74	.55	1.12	.38	1/2	
AA67006-4-4KA	1/4	1/4	1.76	.91	.74	.55	1.36	.57	9/16	
AA67006-4-6KA	1/4	3/8	1.82	.91	.74	.55	1.41	.59	3/4	
AA67006-4-8KA	1/4	1/2	2.04	.91	.74	.55	1.63	.75	7/8	
AA67006-5KA	5/16	1/8	1.63	.96	.85	.55	1.15	.38	9/16	
AA67006-5-4KA	5/16	1/4	1.83	.96	.85	.55	1.36	.57	9/16	
AA67006-6KA	3/8	1/4	1.90	1.03	.84	.56	1.37	.57	5/8	
AA67006-6-2KA	3/8	1/8	1.72	1.03	.84	.56	1.19	.38	5/8	
AA67006-6-6KA	3/8	3/8	1.90	1.03	.84	.56	1.40	.59	3/4	
AA67006-6-8KA	3/8	1/2	2.15	1.03	.84	.56	1.62	.75	7/8	
AA67006-8KA	1/2	3/8	2.03	1.16	.97	.66	1.48	.59	13/16	
AA67006-8-4KA	1/2	1/4	2.03	1.16	.97	.66	1.48	.57	13/16	
AA67006-8-8KA	1/2	1/2	2.28	1.16	.97	.66	1.72	.75	7/8	
AA67006-8-12KA	1/2	3/4	2.35	1.16	.97	.66	1.77	.78	1 1/8	
AA67006-8-16KA	1/2	1	2.53	1.16	.97	.66	1.98	.96	1 3/8	
AA67006-10KA	5/8	1/2	2.53	1.41	1.14	.76	1.82	.75	1 5/16	
AA67006-10-6KA	5/8	3/8	2.34	1.41	1.14	.76	1.63	.59	1 5/16	
AA67006-10-12KA	5/8	3/4	2.59	1.41	1.14	.76	1.86	.78	1 1/8	
AA67006-12KA	3/4	3/4	2.67	1.47	1.22	.86	1.97	.78	1 1/8	
AA67006-12-4KA	3/4	1/4	2.52	1.47	1.22	.86	1.84	.57	1 1/8	
AA67006-12-6KA	3/4	3/8	2.54	1.47	1.22	.86	1.86	.59	1 1/8	
AA67006-12-8KA	3/4	1/2	2.67	1.47	1.22	.86	1.97	.75	1 1/8	
AA67006-12-16KA	3/4	1	2.86	1.47	1.22	.86	2.18	.96	1 3/8	
AA67006-16KA	1	1	3.05	1.66	1.29	.91	2.23	.96	1 3/8	
AA67006-16-8KA	1	1/2	2.80	1.66	1.29	.91	2.01	.75	1 3/8	
AA67006-16-12KA	1	3/4	2.86	1.66	1.29	.91	2.04	.78	1 3/8	
AA67006-20KA	1 1/4	1 1/4	3.18	1.75	1.36	.96	2.37	1.00	1 7/8	
AA67006-20-16KA	1 1/4	1	3.15	1.75	1.36	.96	2.34	.96	1 7/8	
AA67006-24KA	1 1/2	1 1/2	3.73	2.13	1.58	1.08	2.59	1.01	2	
AA67006-24-20KA	1 1/2	1 1/4	3.70	2.13	1.58	1.08	2.56	1.00	2	
AA67006-28KA	1 3/4	1 1/2	3.90	2.28	1.78	1.21	2.83	1.01	2 1/4	
AA67006-32KA	2	2	4.19	2.41	1.90	1.33	3.09	1.04	2 1/2	

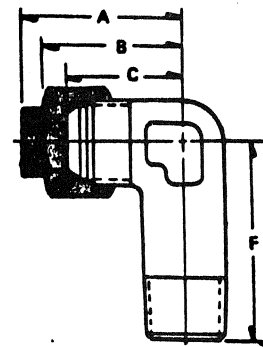
+Material K 316SS. • See page 4 for ordering information. • Additional sizes available. • Omit "A" from part no. to order body only.

PART NUMBER	TUBE O.D.	MALE PIPE THREAD	A*	B*	C	F	W
AA67007-2KA	1/8	1/8	1.08	.96	.77	.72	5/16
AA67007-3KA	3/16	1/8	1.20	1.08	.83	.72	3/8
AA67007-4KA	1/4	1/8	1.25	1.08	.89	.78	7/16
AA67007-4-4KA	1/4	1/4	1.41	1.24	1.05	1.09	9/16
AA67007-5KA	5/16	1/8	1.36	1.25	.95	.78	1/2
AA67007-5-4KA	5/16	1/4	1.46	1.35	1.05	1.09	9/16
AA67007-6KA	3/8	1/4	1.53	1.34	1.06	1.09	9/16
AA67007-6-2KA	3/8	1/8	1.53	1.34	1.06	.88	9/16
AA67007-6-6KA	3/8	3/8	1.61	1.43	1.18	1.22	3/4
AA67007-6-8KA	3/8	1/2	1.74	1.56	1.31	1.44	7/8
AA67007-8KA	1/2	3/8	1.75	1.56	1.25	1.22	3/4
AA67007-8-4KA	1/2	1/4	1.75	1.56	1.25	1.21	3/4
AA67007-8-8KA	1/2	1/2	1.84	1.65	1.35	1.47	7/8
AA67007-8-12KA	1/2	3/4	1.92	1.73	1.40	1.59	1 1/16
AA67007-10KA	5/8	1/2	2.10	1.83	1.45	1.47	7/8
AA67007-10-6KA	5/8	3/8	2.10	1.83	1.45	1.30	7/8
AA67007-10-12KA	5/8	3/4	2.18	1.91	1.53	1.59	1 1/16
AA67007-12KA	3/4	3/4	2.27	2.02	1.66	1.59	1 1/16
AA67007-12-8KA	3/4	1/2	2.27	2.02	1.66	1.56	1 1/16
AA67007-12-16KA	3/4	1	2.46	2.19	1.78	1.93	1 5/16
AA67007-16KA	1	1	2.56	2.21	1.81	1.97	1 5/16
AA67007-16-12KA	1	3/4	2.56	2.21	1.81	1.72	1 5/16
AA67007-20KA	1 1/4	1 1/4	2.86	2.48	2.06	2.38	1 5/8
AA67007-20-16KA	1 1/4	1	2.86	2.48	2.06	2.38	1 5/8
AA67007-24KA	1 1/2	1 1/2	3.38	2.85	2.26	2.57	1 7/8
AA67007-24-20KA	1 1/2	1 1/4	3.38	2.85	2.26	2.50	1 7/8
AA67007-28KA	1 3/4	1 1/2	3.88	3.38	2.81	2.78	2 1/4
AA67007-32KA	2	2	4.14	3.65	3.06	3.00	2 5/8



AA67007
MALE ELBOW
 flared tube end-male pipe end

PART NUMBER	TUBE O.D.	MALE PIPE THREAD	A*	B*	C	F
AA67008-2KA	1/8	1/8	1.08	.96	.77	1.00
AA67008-3KA	3/16	1/8	1.20	1.08	.83	1.03
AA67008-4KA	1/4	1/8	1.25	1.08	.89	1.19
AA67008-5KA	5/16	1/8	1.36	1.25	.95	1.22
AA67008-6KA	3/8	1/4	1.53	1.34	1.06	1.56
AA67008-8KA	1/2	3/8	1.75	1.56	1.25	1.78
AA67008-10KA	5/8	1/2	2.10	1.83	1.45	2.16
AA67008-12KA	3/4	3/4	2.27	2.02	1.66	2.41
AA67008-16KA	1	1	2.56	2.21	1.81	2.97
AA67008-20KA	1 1/4	1 1/4	2.86	2.48	2.06	3.66
AA67008-24KA	1 1/2	1 1/2	3.38	2.85	2.33	4.06
AA67008-28KA	1 3/4	1 1/2	3.88	3.38	2.81	4.47
AA67008-32KA	2	2	4.14	3.65	3.06	4.81

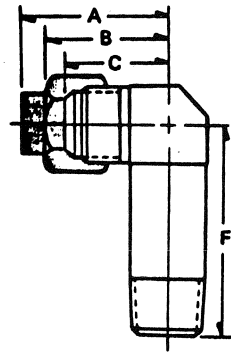


AA67008
LONG MALE ELBOW
 flared tube end-long male pipe end

+Material K 316SS. • See page 4 for ordering information. • Additional sizes available. • Omit "A" from part no. to order body only.

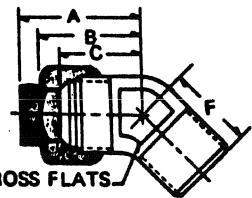
FLARED TUBE FITTINGS

PART NUMBER	TUBE O.D.	MALE PIPE THREAD	A*	B*	C	F
AA67009-2KA	1/8	1/8	1.08	.96	.77	1.28
AA67009-3KA	3/16	1/8	1.20	1.08	.83	1.34
AA67009-4KA	1/4	1/8	1.25	1.08	.89	1.59
AA67009-5KA	5/16	1/8	1.36	1.25	.95	1.66
AA67009-6KA	3/8	1/4	1.53	1.34	1.06	2.03
AA67009-8KA	1/2	3/8	1.75	1.56	1.25	2.34
AA67009-10KA	5/8	1/2	2.10	1.83	1.45	2.84
AA67009-12KA	3/4	3/4	2.27	2.02	1.66	3.22
AA67009-16KA	1	1	2.56	2.21	1.81	3.97
AA67009-20KA	1 1/4	1 1/4	2.86	2.48	2.06	4.94
AA67009-24KA	1 1/2	1 1/2	3.38	2.85	2.33	5.50
AA67009-28KA	1 3/4	1 1/2	3.88	3.38	2.81	6.16
AA67009-32KA	2	2	4.14	3.65	3.06	6.63



AA67009
EXTRA LONG MALE ELBOW
flared tube end-extra long male pipe end

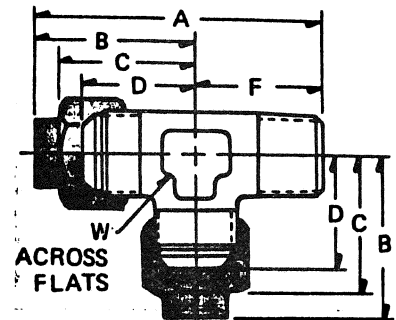
PART NUMBER	TUBE O.D.	MALE PIPE THREAD	A*	B*	C	F	W
7010-2KA	1/8	1/8	.97	.85	.66	.52	5/16
AA67010-3KA	3/16	1/8	1.03	.91	.66	.52	3/8
AA67010-4KA	1/4	1/8	1.08	.91	.72	.64	7/16
AA67010-4-4KA	1/4	1/4	1.19	1.02	.83	.86	9/16
AA67010-5KA	5/16	1/8	1.18	1.07	.77	.64	1/2
AA67010-5-4KA	5/16	1/4	1.24	1.09	.80	.86	5/8
AA67010-6KA	3/8	1/4	1.30	1.11	.83	.86	9/16
AA67010-6-2KA	3/8	1/8	1.30	1.11	.83	.69	5/8
AA67010-6-6KA	3/8	3/8	1.41	1.22	.94	.95	3/4
AA67010-6-8KA	3/8	1/2	1.53	1.34	1.02	1.17	7/8
AA67010-8KA	1/2	3/8	1.48	1.29	.98	.95	3/4
AA67010-8-4KA	1/2	1/4	1.48	1.29	.98	.94	3/4
AA67010-8-8KA	1/2	1/2	1.63	1.44	1.08	1.17	7/8
AA67010-8-12KA	1/2	3/4	1.71	1.51	1.21	1.20	1 1/16
AA67010-10KA	5/8	1/2	1.76	1.49	1.11	1.17	7/8
AA67010-10-6KA	5/8	3/8	1.76	1.49	1.11	1.16	7/8
AA67010-10-12KA	5/8	3/4	1.76	1.49	1.11	1.18	1 1/16
AA67010-12KA	3/4	3/4	1.89	1.64	1.28	1.20	1 1/16
AA67010-12-8KA	3/4	1/2	1.89	1.64	1.28	1.19	1 1/16
AA67010-16KA	1	1	2.22	1.87	1.47	1.48	1 5/16
AA67010-16-12KA	1	3/4	2.22	1.87	1.47	1.25	1 5/16
AA67010-20KA	1 1/4	1 1/4	2.39	2.01	1.59	1.67	1 7/8
AA67010-20-16KA	1 1/4	1	2.39	2.01	1.59	1.53	1 7/8
AA67010-24KA	1 1/2	1 1/2	2.83	2.30	1.78	1.72	1 7/8
AA67010-24-20KA	1 1/2	1 1/4	2.83	2.30	1.78	1.65	1 7/8
7010-28KA	1 3/4	1 1/2	3.02	2.52	1.95	2.00	2 1/8
7010-32KA	2	2	3.30	2.81	2.22	2.11	2 5/16



AA67010
MALE 45° ELBOW
flared tube end-male pipe end

+ Material K 316SS. • See page 4 for ordering information. • Additional sizes available. • Omit "A" from part no. to order body only.

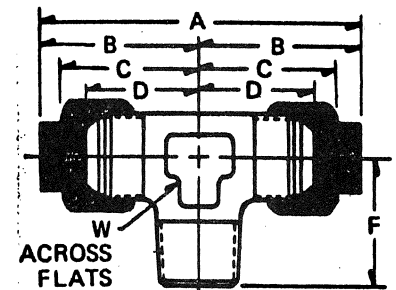
PART NUMBER +	TUBE O.D.	MALE PIPE THREAD	A*	B*	C*	D	F	W
AA67011-2KA	1/8	1/8	1.80	1.08	.96	.77	.72	5/16
AA67011-3KA	3/16	1/8	1.92	1.20	1.08	.83	.72	3/8
AA67011-4KA	1/4	1/8	2.03	1.25	1.08	.89	.78	7/16
AA67011-4-4KA	1/4	1/4	2.33	1.33	1.15	.96	1.10	9/16
AA67011-5KA	5/16	1/8	2.14	1.36	1.25	.95	.78	1/2
AA67011-6KA	3/8	1/4	2.62	1.53	1.33	1.06	1.09	9/16
AA67011-8KA	1/2	3/8	2.97	1.75	1.56	1.25	1.22	3/4
AA67011-10KA	5/8	1/2	3.57	2.10	1.83	1.45	1.47	7/8
AA67011-12KA	3/4	3/4	3.86	2.27	2.02	1.66	1.59	1 1/16
AA67011-16KA	1	1	4.53	2.56	2.21	1.81	1.97	1 5/16
AA67011-16-12KA	1	3/4	4.24	2.56	2.21	1.81	1.68	1 5/16
AA67011-20KA	1 1/4	1 1/4	5.24	2.86	2.48	2.06	2.38	1 5/8
AA67011-20-16KA	1 1/4	1	5.04	2.86	2.48	2.06	2.18	1 5/8
AA67011-24KA	1 1/2	1 1/2	5.91	3.38	2.85	2.33	2.53	1 7/8
AA67011-24-20KA	1 1/2	1 1/4	5.84	3.38	2.85	2.33	2.46	1 7/8
AA67011-28KA	1 3/4	1 1/2	6.63	3.88	3.38	2.78	2.75	2 1/4
AA67011-32KA	2	2	7.14	4.14	3.65	3.06	3.00	2 9/16



AA67011
MALE RUN TEE

flared tube end-male pipe end-
flare tube outlet

PART NUMBER +	TUBE O.D.	MALE PIPE THREAD	A*	B*	C*	D	F	W
AA67012-2KA	1/8	1/8	2.16	1.08	.96	.77	.72	5/16
AA67012-3KA	3/16	1/8	2.40	1.20	1.08	.83	.72	3/8
AA67012-4KA	1/4	1/8	2.50	1.25	1.08	.89	.78	7/16
AA67012-4-4KA	1/4	1/4	2.66	1.33	1.15	.96	1.10	9/16
AA67012-5KA	5/16	1/8	2.72	1.36	1.25	.95	.78	1/2
AA67012-6KA	3/8	1/4	3.06	1.53	1.33	1.06	1.09	9/16
AA67012-8KA	1/2	3/8	3.50	1.75	1.56	1.25	1.22	3/4
AA67012-10KA	5/8	1/2	4.20	2.10	1.83	1.45	1.47	7/8
AA67012-12KA	3/4	3/4	4.54	2.27	2.02	1.66	1.59	1 1/16
AA67012-16KA	1	1	5.12	2.56	2.21	1.81	1.97	1 5/16
AA67012-16-12KA	1	3/4	5.12	2.56	2.21	1.81	1.68	1 5/16
AA67012-20KA	1 1/4	1 1/4	5.72	2.86	2.48	2.06	2.38	1 5/8
AA67012-20-16KA	1 1/4	1	5.72	2.86	2.48	2.06	2.18	1 5/8
AA67012-24KA	1 1/2	1 1/2	6.76	3.38	2.85	2.33	2.53	1 7/8
AA67012-24-20KA	1 1/2	1 1/4	6.76	3.38	2.85	2.33	2.46	1 7/8
AA67012-28KA	1 3/4	1 1/2	7.76	3.88	3.38	2.78	2.75	2 1/4
AA67012-32KA	2	2	8.28	4.14	3.65	3.06	3.00	2 9/16



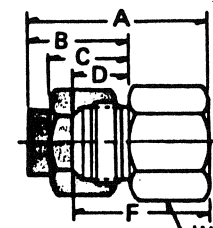
AA67012
MALE BRANCH TEE

flared tube end-flared tube end-
male pipe branch

+Material K 316SS. • See page 4 for ordering information. • Additional sizes available. • Omit "A" from part no. to order body only.

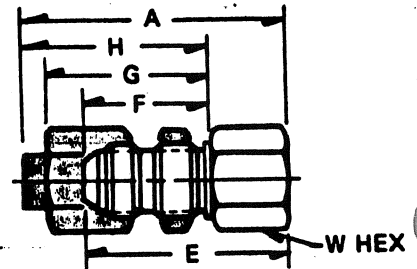
57 Flared Tube Fittings

PART NUMBER	TUBE O.D.	FEMALE PIPE THREAD	A*	B*	C*	D	F	W
AA67013-2KA	1/8	1/8	1.43	.76	.64	.45	1.12	9/16
67013-3KA	3/16	1/8	1.50	.85	.73	.48	1.13	9/16
.67013-4KA	1/4	1/8	1.55	.91	.74	.55	1.19	9/16
AA67013-4-4KA	1/4	1/4	1.74	.91	.74	.55	1.39	3/4
AA67013-5KA	5/16	1/8	1.58	.96	.85	.55	1.17	9/16
AA67013-5-4KA	5/16	1/4	1.75	.96	.85	.55	1.39	3/4
AA67013-6KA	3/8	1/4	1.87	1.03	.84	.56	1.40	3/4
AA67013-6-6KA	3/8	3/8	1.88	1.03	.84	.56	1.46	7/8
AA67013-8KA	1/2	3/8	2.06	1.16	.97	.66	1.56	7/8
AA67013-8-4KA	1/2	1/4	2.05	1.16	.97	.66	1.55	7/8
AA67013-8-8KA	1/2	1/2	2.25	1.16	.97	.66	1.79	1 1/8
AA67013-10KA	5/8	1/2	2.54	1.41	1.14	.76	1.89	1 1/8
AA67013-12KA	3/4	3/4	2.67	1.47	1.22	.86	2.06	1 3/8
AA67013-12-8KA	3/4	1/2	2.52	1.47	1.22	.86	2.05	1 1/8
AA67013-16KA	1	1	3.10	1.66	1.29	.91	2.35	1 5/8
AA67013-20KA	1 1/4	1 1/4	3.32	1.75	1.36	.96	2.49	2
AA67013-24KA	1 1/2	1 1/2	3.67	2.13	1.58	1.08	2.62	2 3/8
AA67013-28KA	1 3/4	1 1/2	3.58	2.28	1.78	1.21	2.50	2 3/8
AA67013-32KA	2	2	4.05	2.41	1.90	1.33	2.97	2 3/8



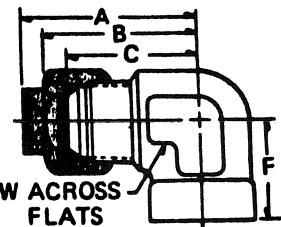
AA67013 W HEX
FEMALE CONNECTOR
flared tube end- female pipe end

PART NUMBER	TUBE O.D.	FEMALE PIPE THREAD	A*	E	F	G*	H*	W
AA67039-4KA	1/4	1/8	2.20	1.84	1.23	1.42	1.59	1 1/8
AA67039-5KA	5/16	1/8	2.25	1.84	1.23	1.53	1.64	3/4
AA67039-6KA	3/8	1/4	2.53	2.06	1.31	1.59	1.78	1 3/8
AA67039-8KA	1/2	3/8	2.85	2.34	1.47	1.78	1.97	1
67039-10KA	5/8	1/2	3.30	2.66	1.61	1.99	2.26	1 1/8
.67039-12KA	3/4	3/4	3.52	2.91	1.78	2.14	2.39	1 3/8
AA67039-16KA	1	1	3.84	3.09	1.78	2.17	2.53	1 3/8
AA67039-20KA	1 1/4	1 1/4	4.01	3.20	1.83	2.23	2.62	2



AA67039
FEMALE BULKHEAD CONNECTOR
flared tube end- female pipe end

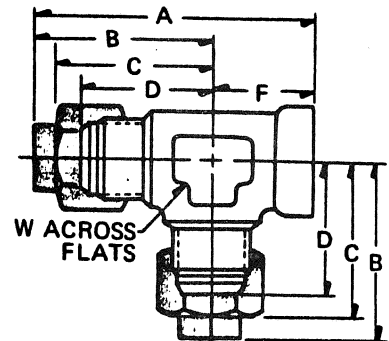
PART NUMBER	TUBE O.D.	FEMALE PIPE THREAD	A*	B*	C	F	W
AA67014-2KA	1/8	1/8	1.31	1.19	1.00	.66	9/16
AA67014-3KA	3/16	1/8	1.40	1.28	1.03	.66	9/16
AA67014-4KA	1/4	1/8	1.44	1.27	1.08	.66	9/16
AA67014-4-4KA	1/4	1/4	1.58	1.41	1.22	.88	3/4
AA67014-5KA	5/16	1/8	1.49	1.38	1.08	.66	9/16
AA67014-5-4KA	5/16	1/4	1.63	1.52	1.22	.88	3/4
AA67014-6KA	3/8	1/4	1.70	1.51	1.23	.88	3/4
AA67014-6-2KA	3/8	1/8	1.53	1.34	1.06	.66	9/16
AA67014-6-6KA	3/8	3/8	1.78	1.59	1.31	1.02	7/8
AA67014-8KA	1/2	3/8	1.92	1.73	1.42	1.02	7/8
AA67014-8-4KA	1/2	1/4	1.75	1.56	1.25	.88	3/4
AA67014-8-8KA	1/2	1/2	1.92	1.73	1.42	1.23	1 1/8
AA67014-10KA	5/8	1/2	2.29	2.02	1.64	1.23	1 1/8
AA67014-12KA	3/4	3/4	2.50	2.25	1.89	1.36	1 1/8
AA67014-12-8KA	3/4	1/2	2.27	2.02	1.66	1.23	1 1/8
AA67014-16KA	1	1	2.92	2.57	2.17	1.62	1 3/8
AA67014-20KA	1 1/4	1 1/4	3.13	2.75	2.33	1.70	1 3/8
AA67014-24KA	1 1/2	1 1/2	3.94	3.41	2.89	2.08	2 3/8
.67014-28KA	1 3/4	1 1/2	4.07	3.57	3.00	2.08	2 3/8
.A67014-32KA	2	2	4.38	3.89	3.30	2.39	2 3/8



AA67014
FEMALE ELBOW
flared tube end- female pipe end

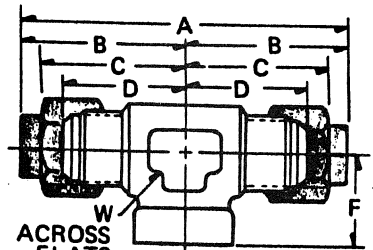
+Material K 316SS. • See page 4 for ordering information. • Additional sizes available. • Omit "A" from part no. to order body only.

PART NUMBER	TUBE O.D.	FEMALE PIPE THREAD	A*	B*	C*	D	F	W
AA67015-2KA	1/8	1/8	1.97	1.31	1.19	1.00	.66	7/16
AA67015-3KA	3/16	1/8	2.06	1.40	1.28	1.03	.66	7/16
AA67015-4KA	1/4	1/8	2.10	1.44	1.27	1.08	.66	7/16
AA67015-5KA	5/16	1/8	2.15	1.49	1.38	1.08	.66	7/16
AA67015-6KA	3/8	1/4	2.58	1.70	1.51	1.23	.88	3/4
AA67015-8KA	1/2	3/8	2.94	1.92	1.73	1.42	1.02	7/8
AA67015-10KA	5/8	1/2	3.52	2.29	2.02	1.64	1.23	1 1/16
AA67015-12KA	3/4	3/4	3.86	2.50	2.25	1.89	1.36	1 5/16
AA67015-16KA	1	1	4.54	2.92	2.57	2.17	1.62	1 5/8
AA67015-20KA	1 1/4	1 1/4	4.83	3.13	2.75	2.33	1.70	1 7/8
AA67015-24KA	1 1/2	1 1/2	6.02	3.94	3.41	2.89	2.08	2 1/16
AA67015-28KA	1 3/4	1 1/2	6.15	4.07	3.57	3.00	2.08	2 1/8
AA67015-32KA	2	2	6.77	4.38	3.89	3.30	2.39	2 13/16



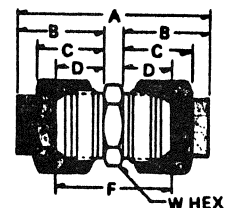
AA67015
FEMALE RUN TEE
flared tube end- female pipe end-
flared tube outlet

PART NUMBER	TUBE O.D.	FEMALE PIPE THREAD	A*	B*	C*	D	F	W
AA67016-2KA	1/8	1/8	2.62	1.31	1.19	1.00	.66	7/16
AA67016-3KA	3/16	1/8	2.80	1.40	1.28	1.03	.66	7/16
AA67016-4KA	1/4	1/8	2.88	1.44	1.27	1.08	.66	7/16
AA67016-5KA	5/16	1/8	2.98	1.49	1.38	1.08	.66	7/16
AA67016-6KA	3/8	1/4	3.40	1.70	1.51	1.23	.88	3/4
AA67016-8KA	1/2	3/8	3.84	1.92	1.73	1.42	1.02	7/8
AA67016-10KA	5/8	1/2	4.58	2.29	2.02	1.64	1.23	1 1/16
AA67016-12KA	3/4	3/4	5.00	2.50	2.25	1.89	1.36	1 5/16
AA67016-16KA	1	1	5.84	2.92	2.57	2.17	1.62	1 5/8
AA67016-20KA	1 1/4	1 1/4	6.26	3.13	2.75	2.33	1.70	1 7/8
AA67016-24KA	1 1/2	1 1/2	7.88	3.94	3.41	2.89	2.08	2 1/16
AA67016-28KA	1 3/4	1 1/2	8.14	4.07	3.57	3.00	2.08	2 1/8
AA67016-32KA	2	2	8.77	4.38	3.89	3.30	2.39	2 13/16



AA67016
FEMALE BRANCH TEE
flared tube end- flared tube end-
female pipe branch

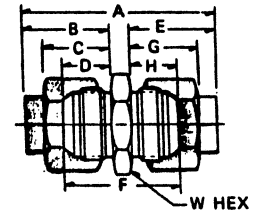
PART NUMBER	TUBE O.D.	A*	B*	C*	D	F	W
AA67000-2KA	1/8	1.79	.76	.64	.45	1.17	7/16
AA67000-3KA	3/16	1.97	.85	.73	.48	1.23	7/16
AA67000-4KA	1/4	2.09	.91	.74	.55	1.37	1/2
AA67000-5KA	5/16	2.19	.96	.85	.55	1.37	9/16
AA67000-6KA	3/8	2.35	1.03	.84	.56	1.41	5/8
AA67000-8KA	1/2	2.62	1.16	.97	.66	1.62	13/16
AA67000-10KA	5/8	3.18	1.41	1.14	.76	1.88	1 5/16
AA67000-12KA	3/4	3.38	1.47	1.22	.86	2.16	1 1/8
AA67000-16KA	1	3.75	1.66	1.29	.91	2.25	1 3/8
AA67000-20KA	1 1/4	3.89	1.75	1.36	.96	2.43	1 7/8
AA67000-24KA	1 1/2	4.85	2.13	1.58	1.08	2.75	2
AA67000-28KA	1 3/4	4.97	2.28	1.78	1.21	2.83	2 3/8
AA67000-32KA	2	5.48	2.41	1.90	1.33	3.40	2 5/8



AA67000
UNION
flared tube ends

+Material K 316SS. • See page 4 for ordering information. • Additional sizes available. • Omit "A" from part no. to order body only.

37 Flared Tube Fittings

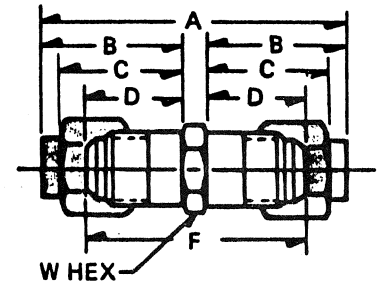


AA67001
LARGE HEX UNION -
REDUCING UNION
 flared tube ends

Part No.	Tube 1	Tube 2	W	H	A	B	C	D	E	F	G	H	I	J
AA67001-2KA	1/8	1/8	1.79	.76	.64	.45	.76	1.20	.64	.45	9/16			
AA67001-3KA	3/16	3/16	1.97	.85	.73	.48	.85	1.23	.72	.48	9/16			
AA67001-4KA	1/4	1/4	2.09	.91	.74	.55	.91	1.27	.74	.55	11/16			
AA67001-4-2KA	1/4	1/8	1.95	.91	.74	.55	.76	1.25	.64	.45	11/16			
AA67001-4-3KA	1/4	3/16	2.04	.91	.74	.55	.85	1.28	.73	.48	11/16			
AA67001-5KA	5/16	5/16	2.19	.96	.85	.55	.96	1.27	.85	.55	3/4			
AA67001-5-4KA	5/16	1/4	2.19	.96	.85	.55	.91	1.36	.74	.55	3/4			
AA67001-6KA	3/8	3/8	2.35	1.03	.84	.56	1.03	1.39	.84	.56	13/16			
AA67001-6-4KA	3/8	1/4	2.30	1.03	.84	.56	.91	1.41	.74	.55	13/16			
AA67001-8KA	1/2	1/2	2.62	1.16	.97	.66	1.16	1.58	.97	.66	1			
AA67001-8-4KA	1/2	1/4	2.48	1.16	.97	.66	.91	1.53	.74	.55	1			
AA67001-8-6KA	1/2	3/8	2.57	1.16	.97	.66	1.03	1.53	.84	.56	1			
AA67001-10KA	5/8	5/8	3.18	1.41	1.14	.76	1.41	1.84	1.14	.76	1 1/8			
AA67001-10-4KA	5/8	1/4	2.72	1.41	1.14	.76	.91	1.66	.74	.55	1 1/8			
AA67001-10-6KA	5/8	3/8	2.81	1.41	1.14	.76	1.03	1.66	.84	.56	1 1/8			
AA67001-10-8KA	5/8	1/2	2.96	1.41	1.14	.76	1.16	1.75	.97	.66	1 1/8			
AA67001-12KA	3/4	3/4	3.38	1.47	1.22	.86	1.47	2.12	1.22	.86	1 3/8			
AA67001-12-4KA	3/4	1/4	2.88	1.47	1.22	.86	.91	1.80	.74	.55	1 3/8			
AA67001-12-6KA	3/4	3/8	2.97	1.47	1.22	.86	1.03	1.80	.84	.56	1 3/8			
AA67001-12-8KA	3/4	1/2	3.12	1.47	1.22	.86	1.16	1.89	.97	.66	1 3/8			
AA67001-16KA	1	1	3.75	1.66	1.29	.91	1.66	2.20	1.29	.91	1 5/8			
AA67001-16-4KA	1	1/4	3.02	1.66	1.29	.91	.91	1.84	.74	.55	1 5/8			
AA67001-16-6KA	1	3/8	3.33	1.66	1.29	.91	1.03	2.06	.84	.56	1 5/8			
AA67001-16-8KA	1	1/2	3.49	1.66	1.29	.91	1.16	2.16	.97	.66	1 5/8			
AA67001-16-12KA	1	3/4	3.62	1.66	1.29	.91	1.47	2.16	1.22	.86	1 5/8			
AA67001-20KA	1 1/4	1 1/4	3.89	1.75	1.36	.96	1.75	2.30	1.36	.96	1 7/8			
AA67001-20-4KA	1 1/4	1/4	3.17	1.75	1.36	.96	.91	1.89	.74	.55	1 7/8			
AA67001-20-8KA	1 1/4	1/2	3.41	1.75	1.36	.96	1.16	1.98	.97	.66	1 7/8			
AA67001-20-12KA	1 1/4	3/4	3.81	1.75	1.36	.96	1.47	2.25	1.22	.86	1 7/8			
AA67001-20-16KA	1 1/4	1	3.91	1.75	1.36	.96	1.66	2.25	1.29	.91	1 7/8			
AA67001-24KA	1 1/2	1 1/2	4.85	2.13	1.58	1.08	2.13	2.55	1.58	1.08	2 1/8			
AA67001-24-16KA	1 1/2	1	4.24	2.13	1.58	1.08	1.66	2.36	1.29	.91	2 1/8			
AA67001-24-20KA	1 1/2	1 1/4	4.39	2.13	1.58	1.08	1.75	2.41	1.36	.96	2 1/8			
AA67001-28KA	1 3/4	1 3/4	4.97	2.28	1.78	1.21	2.28	2.83	1.78	1.21	2 1/2			
AA67001-32KA	2	2	5.48	2.41	1.90	1.33	2.41	3.08	1.90	1.33	2 3/4			
AA67001-32-16KA	2	1	4.53	2.41	1.90	1.33	1.66	2.61	1.29	.91	2 3/4			
AA67001-32-24KA	2	1 1/2	5.02	2.41	1.90	1.33	2.13	2.78	1.58	1.08	2 3/4			

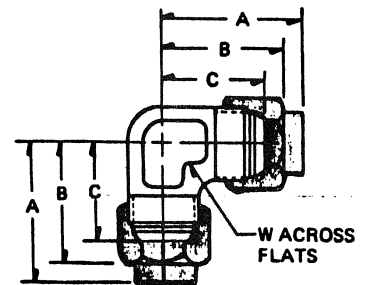
+Material K 316SS. • See page 4 for ordering information. • Additional sizes available. • Omit "A" from part no. to order body only.

PART NUMBER	TUBE O.D.	A*	B*	C*	D	F	W
AA67002-2KA	1/8	2.15	.95	.83	.64	1.53	7/16
AA67002-3KA	3/16	2.40	1.07	.95	.70	1.66	7/16
AA67002-4KA	1/4	2.50	1.13	.96	.77	1.78	1/2
AA67002-5KA	5/16	2.73	1.24	1.13	.83	1.91	9/16
AA67002-6KA	3/8	3.06	1.39	1.20	.92	2.12	5/8
AA67002-8KA	1/2	3.50	1.61	1.42	1.11	2.50	13/16
AA67002-10KA	5/8	4.21	1.93	1.66	1.28	2.91	15/16
AA67002-12KA	3/4	4.53	2.06	1.81	1.45	3.31	1 1/8
AA67002-16KA	1	5.13	2.36	2.00	1.61	3.63	1 3/8
AA67002-20KA	1 1/4	5.70	2.60	2.23	1.81	4.13	1 7/8
AA67002-24KA	1 1/2	6.76	3.08	2.53	2.03	4.66	2
AA67002-28KA	1 3/4	7.74	3.68	3.18	2.62	5.62	2 3/8
AA67002-32KA	2	8.31	3.78	3.28	2.70	6.13	2 5/8



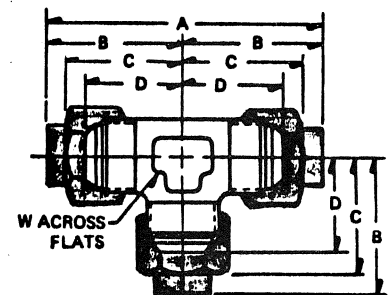
AA67002
LONG UNION
flared tube ends

PART NUMBER	TUBE O.D.	A*	B*	C	W
AA67003-2KA	1/8	1.08	.96	.77	5/16
AA67003-3KA	3/16	1.20	1.08	.83	3/8
AA67003-4KA	1/4	1.25	1.08	.89	7/16
AA67003-5KA	5/16	1.36	1.25	.95	1/2
AA67003-6KA	3/8	1.53	1.34	1.06	9/16
AA67003-8KA	1/2	1.75	1.56	1.25	3/4
AA67003-10KA	5/8	2.10	1.83	1.45	7/8
AA67003-12KA	3/4	2.27	2.02	1.66	1 1/16
AA67003-16KA	1	2.56	2.21	1.81	1 1/8
AA67003-20KA	1 1/4	2.85	2.48	2.06	1 1/8
AA67003-24KA	1 1/2	3.38	2.85	2.33	1 1/8
AA67003-28KA	1 3/4	3.88	3.38	2.81	2 1/4
AA67003-32KA	2	4.14	3.65	3.06	2 9/16



AA67003
UNION ELBOW
flared tube ends

PART NUMBER +	TUBE O.D.	A*	B*	C*	D	W
AA67004-2KA	1/8	2.16	1.08	.96	.77	5/16
AA67004-3KA	3/16	2.40	1.20	1.08	.83	3/8
AA67004-4KA	1/4	2.50	1.25	1.08	.89	7/16
AA67004-5KA	5/16	2.72	1.36	1.25	.95	1/2
AA67004-6KA	3/8	3.06	1.53	1.34	1.06	9/16
AA67004-8KA	1/2	3.50	1.75	1.56	1.25	3/4
AA67004-10KA	5/8	4.20	2.10	1.83	1.45	7/8
AA67004-12KA	3/4	4.54	2.27	2.02	1.66	1 1/16
AA67004-16KA	1	5.12	2.56	2.21	1.81	1 1/8
AA67004-20KA	1 1/4	5.72	2.86	2.48	2.06	1 1/8
AA67004-24KA	1 1/2	6.76	3.38	2.85	2.33	1 1/8
AA67004-28KA	1 3/4	7.76	3.88	3.38	2.81	2 1/4
AA67004-32KA	2	8.28	4.14	3.65	3.06	2 9/16

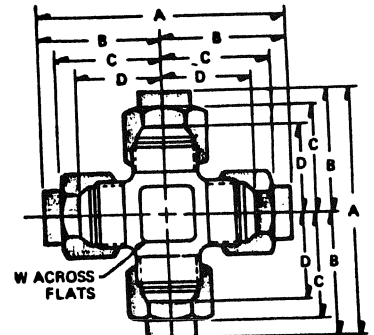


AA67004
UNION TEE
flared tube ends

+Material K 316SS. • See page 4 for ordering information. • Additional sizes available. • Omit "A" from part no. to order body only.

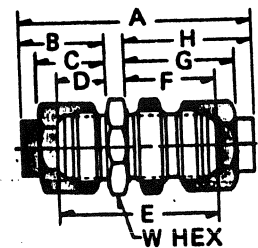
37° Flared Tube Fittings

PART NUMBER	TUBE O.D.	A	B	C	D	E
AA67005-2KA	1/8	2.16	1.08	.96	.77	5/16
AA67005-3KA	3/16	2.40	1.20	1.08	.83	3/8
AA67005-4KA	1/4	2.50	1.25	1.08	.89	7/16
AA67005-5KA	5/16	2.72	1.36	1.25	.95	1/2
AA67005-6KA	3/8	3.06	1.53	1.34	1.06	9/16
AA67005-8KA	1/2	3.50	1.75	1.56	1.25	3/4
AA67005-10KA	5/8	4.20	2.10	1.83	1.45	7/8
AA67005-12KA	3/4	4.54	2.27	2.02	1.66	1 1/16
AA67005-16KA	1	5.12	2.56	2.21	1.81	1 3/16
AA67005-20KA	1 1/4	5.72	2.86	2.48	2.06	1 5/8
AA67005-24KA	1 1/2	6.76	3.38	2.85	2.33	1 7/8
AA67005-28KA	1 3/4	7.76	3.88	3.38	2.81	2 1/4
AA67005-32KA	2	8.28	4.14	3.65	3.06	2 5/8



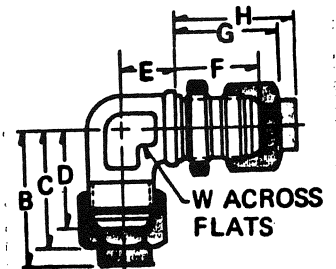
AA67005
UNION CROSS
flared tube ends

PART NUMBER	TUBE O.D.	A	B	C	D	E	F	G	H
AA67017-2KA	1/8	2.43	.76	.64	.45	1.81	1.14	1.33	1.45
AA67017-3KA	3/16	2.58	.85	.73	.48	1.84	1.14	1.39	1.51
AA67017-4KA	1/4	2.72	.91	.74	.55	2.02	1.23	1.42	1.59
AA67017-5KA	5/16	2.82	.96	.85	.55	2.02	1.23	1.53	1.64
AA67017-6KA	3/8	3.06	1.03	.84	.56	2.19	1.31	1.59	1.78
AA67017-8KA	1/2	3.40	1.16	.97	.66	2.43	1.47	1.78	1.97
AA67017-10KA	5/8	3.98	1.41	1.14	.76	2.69	1.61	1.99	2.26
AA67017-12KA	3/4	4.26	1.47	1.22	.86	3.03	1.78	2.14	2.39
AA67017-16KA	1	4.57	1.66	1.29	.91	3.07	1.78	2.16	2.53
AA67017-20KA	1 1/4	4.81	1.75	1.36	.96	3.18	1.83	2.23	2.60
AA67017-24KA	1 1/2	5.55	2.13	1.58	1.08	3.33	1.84	2.34	2.89
AA67017-28KA	1 3/4	5.71	2.28	1.78	1.21	3.57	2.00	2.57	3.07
AA67017-32KA	2	6.28	2.41	1.90	1.33	3.85	2.12	2.69	3.20



AA67017
BULKHEAD UNION
flared tube ends

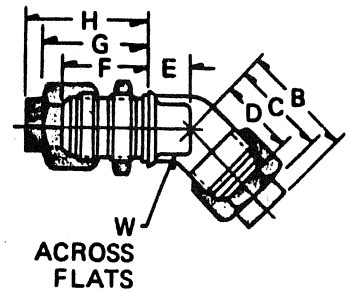
PART NUMBER	TUBE O.D.	B*	C*	D	E	F	G*	H*	W
AA67018-2KA	1/8	1.15	1.03	.84	.40	1.02	1.21	1.33	5/16
AA67018-3KA	3/16	1.28	1.16	.91	.43	1.02	1.27	1.39	3/8
AA67018-4KA	1/4	1.33	1.16	.97	.48	1.11	1.30	1.47	7/16
AA67018-5KA	5/16	1.44	1.33	1.03	.51	1.11	1.41	1.52	1/2
AA67018-6KA	3/8	1.56	1.37	1.09	.62	1.19	1.47	1.66	9/16
AA67018-8KA	1/2	1.86	1.67	1.36	.73	1.38	1.69	1.88	3/4
AA67018-10KA	5/8	2.21	1.94	1.56	.87	1.52	1.90	2.17	7/8
AA67018-12KA	3/4	2.39	2.14	1.78	.98	1.69	2.05	2.30	1 1/16
AA67018-16KA	1	2.69	2.32	1.94	1.11	1.69	2.09	2.44	1 1/8
AA67018-20KA	1 1/4	2.94	2.57	2.17	1.39	1.73	2.13	2.51	1 1/4
AA67018-24KA	1 1/2	3.39	2.84	2.34	1.67	1.75	2.25	2.80	1 3/8
AA67018-28KA	1 3/4	3.66	3.16	2.59	1.87	1.91	2.48	2.98	1 7/8
AA67018-32KA	2	3.97	3.46	2.89	2.08	2.03	2.60	3.11	2 1/8



AA67018
BULKHEAD ELBOW
flared tube ends

+Material K 316SS. • See page 4 for ordering information. • Additional sizes available. • Omit "A" from part no. to order body only.

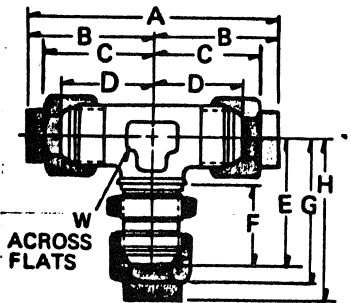
PART NUMBER	TUBE O.D.	A*	B*	C*	D	E	F	G	H	W
AA67019-2KA	1/8	.95	.83	.64	.36	1.02	1.21	1.33	5/16	
AA67019-3KA	3/16	1.01	.89	.64	.36	1.02	1.27	1.39	3/8	
AA67019-4KA	1/4	1.06	.89	.70	.42	1.11	1.30	1.47	7/16	
AA67019-5KA	5/16	1.16	1.05	.75	.42	1.11	1.41	1.52	1/2	
AA67019-6KA	3/8	1.28	1.09	.81	.48	1.19	1.47	1.66	9/16	
AA67019-8KA	1/2	1.47	1.28	.97	.56	1.38	1.69	1.88	3/4	
AA67019-10KA	5/8	1.74	1.47	1.09	.66	1.52	1.90	2.17	7/8	
AA67019-12KA	3/4	1.88	1.63	1.27	.75	1.69	2.05	2.30	1 1/16	
AA67019-16KA	1	2.20	1.83	1.45	.88	1.69	2.09	2.44	1 5/16	
AA67019-20KA	1 1/4	2.36	1.99	1.58	.92	1.73	2.13	2.50	1 5/8	
AA67019-24KA	1 1/2	2.82	2.27	1.77	.92	1.75	2.25	2.80	1 7/8	
AA67019-28KA	1 3/4	3.02	2.52	1.95	.86	1.91	2.48	2.98	2 1/4	
AA67019-32KA	2	3.28	2.77	2.20	.88	2.03	2.60	3.11	2 9/16	



ACROSS FLATS

AA67019
BULKHEAD 45° ELBOW
flared tube ends

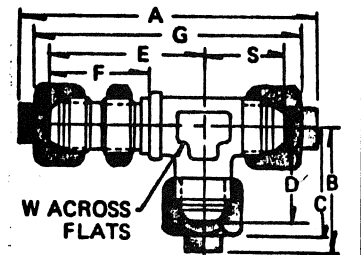
PART NUMBER	TUBE O.D.	A*	B*	C*	D	E	F	G	H	W
AA67020-2KA	1/8	2.28	1.14	1.02	.83	1.41	1.02	1.58	1.72	5/16
AA67020-3KA	3/16	2.56	1.28	1.14	.89	1.44	1.02	1.64	1.81	3/8
AA67020-4KA	1/4	2.62	1.31	1.14	.95	1.58	1.11	1.80	1.98	7/16
AA67020-5KA	5/16	2.86	1.43	1.32	1.02	1.61	1.11	1.86	2.04	1/2
AA67020-6KA	3/8	3.10	1.55	1.36	1.08	1.80	1.19	2.09	2.29	9/16
AA67020-8KA	1/2	3.68	1.84	1.65	1.34	2.09	1.38	2.43	2.64	3/4
AA67020-10KA	5/8	4.40	2.20	1.93	1.55	2.38	1.52	2.78	3.04	7/8
AA67020-12KA	3/4	4.76	2.38	2.13	1.77	2.66	1.69	3.07	3.34	1 1/16
AA67020-16KA	1	5.34	2.67	2.32	1.92	2.78	1.69	3.23	3.56	1 5/16
AA67020-20KA	1 1/4	5.90	2.95	2.58	2.16	3.11	1.73	3.60	3.99	1 5/8
AA67020-24KA	1 1/2	6.76	3.38	2.85	2.33	3.41	1.75	3.98	4.51	1 7/8
AA67020-28KA	1 3/4	7.32	3.66	3.16	2.59	3.78	1.91	4.36	4.85	2 1/4
AA67020-32KA	2	7.92	3.96	3.47	2.88	4.09	2.03	4.73	5.23	2 9/16



ACROSS FLATS

AA67020
BULKHEAD BRANCH TEE
flared tube ends -

PART NUMBER	TUBE O.D.	A*	B*	C*	D	E	F	G*	S	W
AA67021-2KA	1/8	2.80	1.14	1.02	.83	1.41	1.02	2.56	.77	5/16
AA67021-3KA	3/16	3.01	1.26	1.14	.89	1.44	1.02	2.77	.83	3/8
AA67021-4KA	1/4	3.19	1.31	1.14	.95	1.58	1.11	2.85	.89	7/16
AA67021-5KA	5/16	3.38	1.43	1.32	1.02	1.61	1.11	3.16	.95	1/2
AA67021-6KA	3/8	3.80	1.55	1.36	1.08	1.80	1.19	3.42	1.06	9/16
AA67021-8KA	1/2	4.34	1.84	1.65	1.34	2.09	1.38	3.96	1.25	3/4
AA67021-10KA	5/8	5.13	2.20	1.93	1.55	2.38	1.52	4.59	1.45	7/8
AA67021-12KA	3/4	5.54	2.39	2.13	1.77	2.66	1.69	5.04	1.66	1 1/16
AA67021-16KA	1	6.09	2.67	2.32	1.92	2.78	1.69	5.39	1.81	1 5/16
AA67021-20KA	1 1/4	6.75	2.95	2.58	2.16	3.11	1.73	6.01	2.06	1 5/8
AA67021-24KA	1 1/2	7.84	3.38	2.85	2.33	3.41	1.75	6.74	2.33	1 7/8
AA67021-28KA	1 3/4	8.73	3.66	3.16	2.59	3.78	1.91	7.73	2.81	2 1/4
AA67021-32KA	2	9.31	3.96	3.47	2.88	4.09	2.03	8.33	3.06	2 9/16



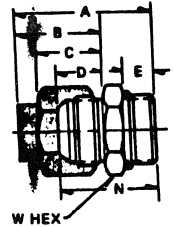
W ACROSS FLATS

AA67021
BULKHEAD RUN TEE
flared tube ends

+ Material K 316SS. • See page 4 for ordering information. • Additional sizes available. • Omit "A" from part no. to order body only.

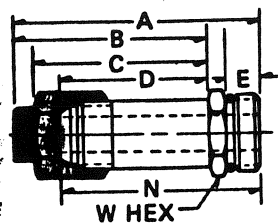
37° Flare to Straight Thread

PART NUMBER	TUBE O.D.	STRAIGHT THREAD	A*	B*	C*	D	E	N	W
AA67022-2KA	1/8	5/16-24	1.37	.76	.64	.45	.30	1.06	7/16
AA67022-3KA	3/16	3/8-24	1.47	.85	.73	.48	.30	1.10	1/2
AA67022-4KA	1/4	7/16-20	1.59	.91	.74	.55	.36	1.23	9/16
AA67022-4-5KA	1/4	1/2-20	1.59	.91	.74	.55	.36	1.23	5/8
AA67022-4-6KA	1/4	9/16-18	1.66	.91	.74	.55	.39	1.30	11/16
AA67022-4-8KA	1/4	3/4-16	1.73	.91	.74	.55	.44	1.37	7/8
AA67022-5KA	5/16	1/2-20	1.64	.96	.85	.55	.36	1.23	3/8
AA67022-6KA	3/8	9/16-18	1.77	1.03	.84	.56	.39	1.30	11/16
AA67022-6-4KA	3/8	7/16-20	1.68	1.03	.84	.56	.36	1.18	11/16
AA67022-6-8KA	3/8	3/4-16	1.85	1.03	.84	.56	.44	1.38	7/8
AA67022-6-10KA	3/8	7/8-14	1.97	1.03	.84	.56	.50	1.50	1
AA67022-8KA	1/2	3/4-16	1.98	1.16	.97	.66	.44	1.48	7/8
AA67022-8-6KA	1/2	9/16-18	2.00	1.16	.97	.66	.39	1.44	13/16
AA67022-8-10KA	1/2	7/8-14	2.10	1.16	.97	.66	.50	1.60	1
AA67022-8-12KA	1/2	1 1/16-12	2.26	1.16	.97	.66	.59	1.76	1 1/4
AA67022-10KA	5/8	7/8-14	2.35	1.41	1.14	.76	.50	1.70	1
AA67022-10-8KA	5/8	3/4-16	2.25	1.41	1.14	.76	.44	1.60	15/16
AA67022-10-12KA	5/8	1 1/16-12	2.51	1.41	1.14	.76	.59	1.86	1 1/4
AA67022-12KA	3/4	1 1/16-12	2.58	1.47	1.22	.86	.59	1.97	1 1/4
AA67022-12-8KA	3/4	3/4-16	2.39	1.47	1.22	.86	.44	1.78	1 1/8
AA67022-12-10KA	3/4	7/8-14	2.44	1.47	1.22	.86	.50	1.83	1 1/8
AA67022-12-16KA	3/4	1 5/16-12	2.61	1.47	1.22	.86	.59	2.00	1 1/2
AA67022-16KA	1	1 5/16-12	2.79	1.66	1.29	.91	.59	2.04	1 1/2
AA67022-16-8KA	1	3/4-16	2.63	1.66	1.29	.91	.44	1.88	1 1/2
AA67022-16-12KA	1	1 1/16-12	2.76	1.66	1.29	.91	.59	2.01	1 3/8
AA67022-16-20KA	1	1 5/8-12	2.87	1.66	1.29	.91	.59	2.12	1 7/8
AA67022-20KA	1 1/4	1 5/8-12	2.96	1.75	1.36	.96	.59	2.17	1 7/8
AA67022-20-16KA	1 1/4	1 5/16-12	3.12	1.75	1.36	.96	.59	2.33	1 11/16
AA67022-20-24KA	1 1/4	1 1/8-12	3.03	1.75	1.36	.96	.59	2.24	2 1/8
AA67022-24KA	1 1/2	1 7/8-12	3.42	2.13	1.58	1.08	.59	2.37	2 1/8
AA67022-24-32KA	1 1/2	2 1/2-12	3.58	2.13	1.58	1.08	.59	2.53	2 3/4
AA67022-32KA	2	2 1/2-12	3.86	2.41	1.90	1.33	.59	2.78	2 3/4
AA67022-32-12KA	2	1 1/16-12	3.58	2.41	1.90	1.33	.55	2.50	2 3/4



AA67022
STRAIGHT THREAD
CONNECTOR
flared tube end -
straight thread

PART NUMBER	TUBE O.D.	STRAIGHT THREAD	A*	B*	C*	D	E	N	W
AA67023-2KA	1/8	5/16-24	2.10	1.48	1.36	1.17	.30	1.79	7/16
AA67023-3KA	3/16	3/8-24	2.24	1.62	1.50	1.25	.30	1.87	1/2
AA67023-4KA	1/4	7/16-20	2.44	1.75	1.58	1.39	.36	2.08	9/16
AA67023-5KA	5/16	1/2-20	2.55	1.86	1.75	1.45	.36	2.14	5/8
AA67023-6KA	3/8	9/16-18	2.78	2.03	1.84	1.56	.39	2.31	11/16
AA67023-8KA	1/2	3/4-16	3.20	2.38	2.19	1.88	.44	2.70	7/8
AA67023-10KA	5/8	7/8-14	3.69	2.47	2.74	2.09	.50	3.04	1
AA67023-12KA	3/4	1 1/16-12	4.22	3.11	2.86	2.50	.59	3.61	1 1/4
AA67023-16KA	1	1 5/16-12	4.73	3.59	3.22	2.84	.59	3.98	1 1/2
AA67023-20KA	1 1/4	1 5/8-12	5.44	4.24	3.87	3.47	.59	4.69	1 1/8
AA67023-24KA	1 1/2	1 7/8-12	6.22	4.93	4.39	3.88	.59	5.17	2 1/8
AA67023-32KA	2	2 1/2-12	7.37	5.92	5.41	4.84	.59	6.29	2 3/4

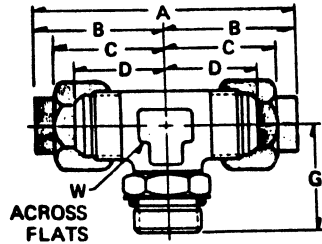


AA67023
STRAIGHT THREAD
LONG CONNECTOR
flared tube end -
straight thread

+Material K 316SS. • See page 4 for ordering information. • Additional sizes available. • Omit "A" from part no. to order body only.

37° Flare to Straight Inread

PART NUMBER	TUBE O.D.	STRAIGHT THREAD	A*	B*	C*	D	G	W
AA67027-2KA	1/8	5/16-24	2.16	1.08	.96	.77	.91	5/16
AA67027-3KA	3/16	3/8-24	2.40	1.20	1.08	.83	.94	3/8
AA67027-4KA	1/4	7/16-20	2.50	1.25	1.08	.89	1.03	7/16
AA67027-5KA	5/16	1/2-20	2.72	1.36	1.25	.95	1.09	1/2
AA67027-6KA	3/8	9/16-18	3.06	1.53	1.34	1.06	1.25	9/16
AA67027-8KA	1/2	3/4-16	3.50	1.75	1.56	1.25	1.45	3/4
AA67027-10KA	5/8	7/8-14	4.20	2.10	1.83	1.45	1.70	7/8
AA67027-12KA	3/4	1 1/16-12	4.54	2.27	2.02	1.66	1.94	1 1/16
AA67027-16KA	1	1 1/8-12	5.12	2.56	2.21	1.81	2.05	1 5/16
AA67027-20KA	1 1/4	1 5/8-12	5.70	2.85	2.48	2.06	2.25	1 5/8
AA67027-24KA	1 1/2	1 7/8-12	6.76	3.38	2.85	2.33	2.39	1 7/8
AA67027-32KA	2	2 1/2-12	8.28	4.14	3.65	3.06	2.89	2 5/8

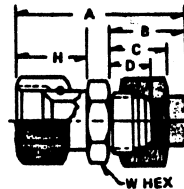


AA67027
STRAIGHT THREAD
BRANCH TEE

flared tube end - flared tube end -
straight thread for adjustable
positioning

Swivel Nut Fittings

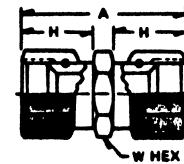
PART NUMBER +	TUBE O.D.	A*	B*	C*	D	H*	W
AA67081-4KA	1/4	1.79	.91	.74	.55	.69	1 1/16
AA67081-6KA	3/8	2.11	1.03	.84	.56	.81	1 3/16
AA67081-8KA	1/2	2.32	1.16	.97	.66	.86	1
AA67081-10KA	5/8	2.69	1.41	1.14	.76	.94	1 1/8
AA67081-12KA	3/4	2.97	1.47	1.22	.86	1.05	1 3/8
AA67081-16KA	1	3.21	1.66	1.29	.91	1.16	1 5/8
AA67081-20KA	1 1/4	3.45	1.75	1.36	.96	1.31	1 7/8
AA67081-24KA	1 1/2	4.09	2.13	1.58	1.08	1.37	2 1/8
AA67081-32KA	2	4.85	2.41	1.90	1.33	1.78	2 3/4



AA67081
SWIVEL NUT UNION

flared tube end - swivel nut to
mate with 37° cone

PART NUMBER +	TUBE O.D.	A*	H*	W
AA67082-4K	1/4	1.53	.69	1 1/16
AA67082-6K	3/8	1.88	.81	1 3/16
AA67082-8K	1/2	1.97	.86	1
AA67082-10K	5/8	2.19	.94	1 1/8
AA67082-12K	3/4	2.47	1.05	1 3/8
AA67082-16K	1	2.69	1.16	1 5/8
AA67082-20K	1 1/4	3.51	1.31	1 7/8
AA67082-24K	1 1/2	3.63	1.37	2 1/8
AA67082-32K	2	4.45	1.78	2 3/4



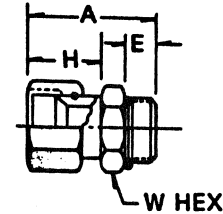
AA67082
DOUBLE SWIVEL NUT UNION

swivel nut - swivel nut to
mate with 37° cone

+Material K 316SS. • See page 4 for ordering information. • Additional sizes available. • Omit "A" from part no. to order body only.

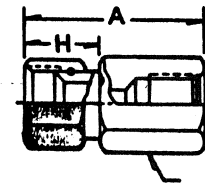


PART NUMBER	TUBE O.D.	STRAIGHT TUBE THREAD	A*	H*	W	W
AA67086-2K	1/8	5/16-24	1.37	.30	.74	5/16
AA67086-3K	3/16	3/8-24	1.31	.30	.74	5/8
AA67086-4K	1/4	7/16-20	1.24	.36	.73	1 1/16
AA67086-5K	5/16	1/2-20	1.29	.36	.77	3/4
AA67086-6K	3/8	9/16-18	1.51	.39	.85	1 3/16
AA67086-8K	1/2	3/4-16	1.58	.44	.90	1
AA67086-10K	5/8	7/8-14	1.78	.50	.97	1 1/8
AA67086-12K	3/4	1 1/16-12	1.99	.59	1.09	1 3/8
AA67086-16K	1	1 1/16-12	2.15	.59	1.19	1 5/8
AA67086-20K	1 1/4	1 5/8-12	2.26	.59	1.31	1 7/8
AA67086-24K	1 1/2	1 7/8-12	2.22	.59	1.37	2 1/8
AA67086-32K	2	2 1/2-12	2.78	.59	1.78	2 3/4



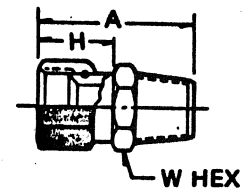
AA67086
SWIVEL NUT UNION
 straight thread - swivel nut to
 mate with 37° cone

PART NUMBER	BOSS TUBE O.D.	SWIVEL TUBE O.D.	A*	H*	W
AA67108-4K	1/4	1/4	1.58	.73	1 1/16
AA67108-6K	3/8	3/8	1.69	.85	1 3/16
AA67108-6-4K	3/8	1/4	1.57	.73	1 3/16
AA67108-8K	1/2	1/2	1.93	.90	1
AA67108-8-4K	1/2	1/4	1.76	.73	1
AA67108-8-6K	1/2	3/8	1.88	.85	1
AA67108-10K	5/8	5/8	2.09	.97	1 1/8
AA67108-12K	3/4	3/4	2.35	1.09	1 3/8
AA67108-12-8K	3/4	1/2	2.16	.90	1 3/8
AA67108-16K	1	1	2.56	1.19	1 5/8
AA67108-16-8K	1	1/2	2.27	.90	1 5/8
AA67108-16-12K	1	3/4	2.46	1.09	1 5/8



AA67108
SWIVEL NUT ADAPTER
 MS boss - swivel nut to mate
 with 37° cone

PART NUMBER	TUBE O.D.	MALE PIPE THREAD	A*	H*	W
AA67109-4K	1/4	1/8	1.40	.73	1/2
AA67109-4-4K	1/4	1/4	1.58	.73	5/16
AA67109-6K	3/8	1/4	1.72	.85	5/8
AA67109-8K	1/2	3/8	1.77	.90	1 3/16
AA67109-8-4K	1/2	1/4	1.77	.90	1 3/16
AA67109-8-8K	1/2	1/2	2.02	.90	3/4
AA67109-10K	5/8	1/2	2.09	.97	1 5/16
AA67109-12K	3/4	3/4	2.29	1.09	1 1/8
AA67109-16K	1	1	2.58	1.19	1 3/8

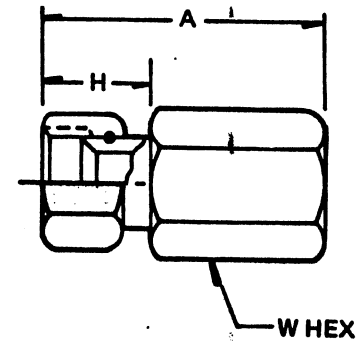


AA67109
SWIVEL NUT UNION
 male pipe end - swivel nut to
 mate with 37° cone

+Material K 316SS. • See page 4 for ordering information. • Additional sizes available.

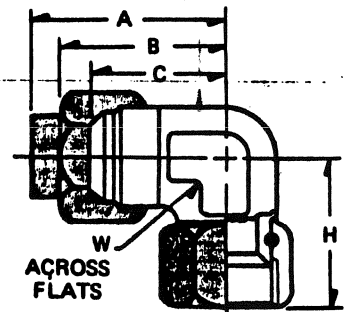
Swivel Nut Fittings

PART NUMBER	TUBE O.D.	TUBE I.D.	W	D	H
AA67110-4K	1/4	1/8	1.37	.73	3/8
AA67110-4-4K	1/4	1/4	1.56	.73	3/8
AA67110-6K	3/8	1/4	1.69	.85	3/8
AA67110-8K	1/2	3/8	1.80	.90	7/8
AA67110-8-4K	1/2	1/4	1.79	.90	7/8
AA67110-8-8K	1/2	1/2	1.99	.90	1 1/8
AA67110-10K	5/8	1/2	2.10	.97	1 1/8
AA67110-12K	3/4	3/8	2.29	1.09	1 3/8
AA67110-16K	1	1	2.63	1.19	1 5/8



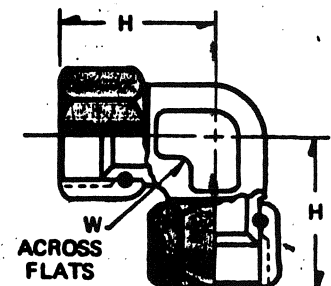
AA67110
SWIVEL NUT UNION
 female pipe thread - swivel nut to
 mate with 37° cone

PART NUMBER	TUBE O.D.	TUBE I.D.	W	D	H
AA67028-2KA	1/8		1.08	.96	.77
AA67028-3KA	3/16		1.20	1.08	.83
AA67028-4KA	1/4		1.25	1.08	.89
AA67028-5KA	5/16		1.38	1.25	.95
AA67028-6KA	3/8		1.53	1.34	1.06
AA67028-8KA	1/2		1.75	1.56	1.25
AA67028-10KA	5/8		2.10	1.83	1.45
AA67028-12KA	3/4		2.27	2.02	1.66
AA67028-16KA	1		2.56	2.21	1.81
AA67028-20KA	1 1/4		2.85	2.48	2.06
AA67028-24KA	1 1/2		3.38	2.85	2.33
AA67028-32KA	2		4.14	3.65	3.06



AA67028
SWIVEL NUT ELBOW
 flared tube end - swivel nut to
 mate with 37° cone

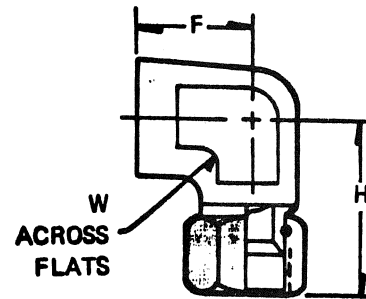
PART NUMBER	TUBE O.D.	TUBE I.D.	W
AA67083-4K	1/4		1.00
AA67083-6K	3/8		1.25
AA67083-8K	1/2		1.38
AA67083-10K	5/8		1.62
AA67083-12K	3/4		1.75
AA67083-16K	1		2.00
AA67083-20K	1 1/4		2.31
AA67083-24K	1 1/2		2.59
AA67083-32K	2		3.38



AA67083
DOUBLE SWIVEL NUT ELBOW
 swivel nut - swivel nut to
 mate with 37° cone

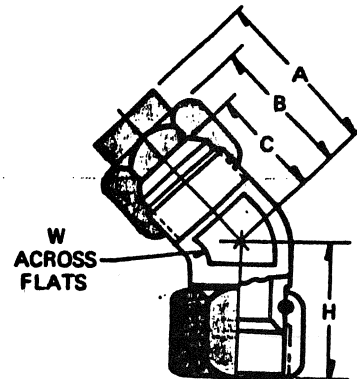
+Material K 316SS. • See page 4 for ordering information. • Additional sizes available. • Omit "A" from part no. to order body only.

PART NUMBER	TUBE O.D.	MALE PIPE THREAD	A*	B*	C*	D	H*	W
AA67111-4K	1/4	1/8	.63	1.16	1/16			
AA67111-4-4K	1/4	1/4	.92	1.21	3/16			
AA67111-6K	3/8	1/4	.92	1.42	3/16			
AA67111-8K	1/2	3/8	1.02	1.54	7/16			
AA67111-8-4K	1/2	1/4	.88	1.37	3/16			
AA67111-8-8K	1/2	1/2	1.23	1.54	1 1/16			
AA67111-10K	5/8	1/2	1.23	1.71	1 1/16			
AA67111-12K	3/4	3/4	1.36	1.95	1 5/16			
AA67111-16K	1	1	1.62	2.28	1 5/8			



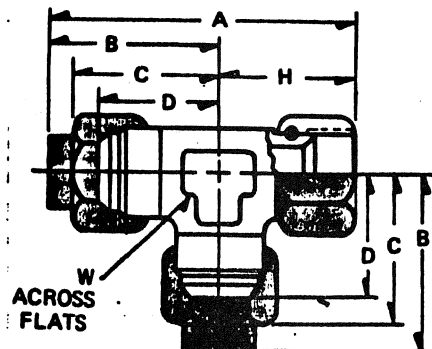
AA67111
SWIVEL NUT ELBOW
 female pipe thread - swivel nut to mate with 37° cone

PART NUMBER	TUBE O.D.	A*	B*	C*	D	H*	W
AA67029-2KA	1/8	.97	.85	.66	.94	5/16	
AA67029-3KA	3/16	1.03	.91	.66	.94	3/8	
AA67029-4KA	1/4	1.08	.91	.72	.94	1/2	
AA67029-5KA	5/16	1.18	1.07	.77	1.00	1/2	
AA67029-6KA	3/8	1.30	1.11	.83	1.12	5/8	
AA67029-8KA	1/2	1.48	1.29	.98	1.28	3/4	
AA67029-10KA	5/8	1.76	1.49	1.11	1.44	7/8	
AA67029-12KA	3/4	1.89	1.64	1.28	1.50	1 1/16	
AA67029-16KA	1	2.22	1.87	1.47	1.75	1 5/16	
AA67029-20KA	1 1/4	2.39	2.01	1.59	2.03	1 5/8	
AA67029-24KA	1 1/2	2.83	2.30	1.78	2.25	1 7/8	
AA67029-32KA	2	3.30	2.81	2.22	2.91	2 5/16	



AA67029
SWIVEL NUT 45° ELBOW
 flared tube end - swivel nut to mate with 37° cone

PART NUMBER	TUBE O.D.	A*	B*	C*	D	H*	W
AA67030-2KA	1/8	2.05	1.08	.96	.77	.97	5/16
AA67030-3KA	3/16	2.20	1.20	1.08	.83	1.00	3/8
AA67030-4KA	1/4	2.25	1.25	1.08	.89	1.00	3/8
AA67030-5KA	5/16	2.42	1.36	1.25	.95	1.06	1/2
AA67030-6KA	3/8	2.78	1.53	1.34	1.06	1.25	5/8
AA67030-8KA	1/2	3.13	1.75	1.56	1.25	1.38	3/4
AA67030-10KA	5/8	3.72	2.10	1.83	1.45	1.62	7/8
AA67030-12KA	3/4	4.02	2.27	2.02	1.66	1.75	1 1/16
AA67030-16KA	1	4.56	2.56	2.21	1.81	2.00	1 5/16
AA67030-20KA	1 1/4	5.16	2.85	2.48	2.06	2.31	1 5/8
AA67030-24KA	1 1/2	5.97	3.38	2.85	2.33	2.59	1 7/8
AA67030-32KA	2	7.52	4.14	3.65	3.06	3.38	2 5/16

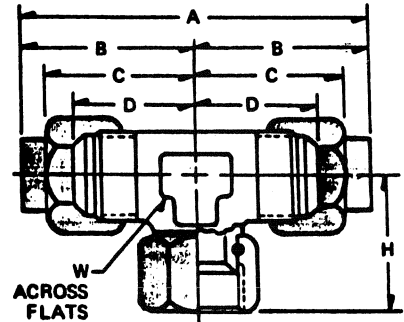


AA67030
SWIVEL NUT RUN TEE
 flared tube end - swivel nut on run to mate with 37° cone - flared tube end

*Material K 316SS. • See page 4 for ordering information. • Additional sizes available. • Omit "A" from part no. to order body only.

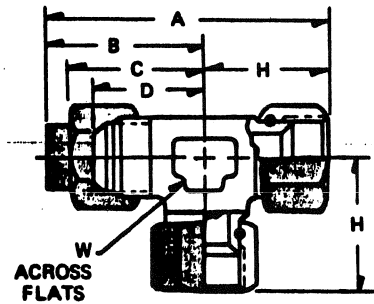
Swivel Nut Fittings

PART NUMBER	TUBE D.D.	A*	B*	C*	D*	H*	W
AA67031-2KA	1/8	2.16	1.08	.96	.77	.97	5/16
AA67031-3KA	3/16	2.40	1.20	1.08	.83	1.00	3/8
AA67031-4KA	1/4	2.50	1.25	1.08	.89	1.00	7/16
AA67031-5KA	5/16	2.72	1.36	1.25	.95	1.06	1/2
AA67031-6KA	3/8	3.06	1.53	1.34	1.06	1.25	9/16
AA67031-8KA	1/2	3.50	1.75	1.56	1.25	1.38	3/4
AA67031-10KA	5/8	4.20	2.10	1.83	1.45	1.62	7/8
AA67031-12KA	3/4	4.54	2.27	2.02	1.66	1.75	1 1/16
AA67031-16KA	1	5.12	2.56	2.21	1.81	2.00	1 1/8
AA67031-20KA	1 1/4	5.70	2.85	2.48	2.06	2.31	1 1/8
AA67031-24KA	1 1/2	6.76	3.38	2.85	2.33	2.59	1 1/8
AA67031-32KA	2	8.28	4.14	3.65	3.06	3.38	2 1/8



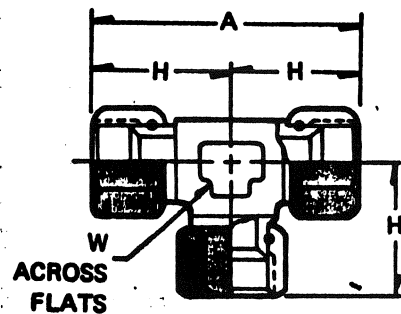
AA67031
SWIVEL NUT BRANCH TEE
 flared tube - flared tube -
 swivel nut on branch to mate with
 37° cone

PART NUMBER	TUBE D.D.	A*	B*	C*	D*	H*	W
AA67084-2KA	1/8	2.09	1.08	.96	.77	1.01	5/16
AA67084-3KA	3/16	2.24	1.20	1.08	.83	1.04	3/8
AA67084-4KA	1/4	2.28	1.25	1.08	.89	1.03	7/16
AA67084-5KA	5/16	2.41	1.36	1.25	.95	1.05	1/2
AA67084-6KA	3/8	2.81	1.53	1.34	1.06	1.28	9/16
AA67084-8KA	1/2	3.16	1.75	1.56	1.25	1.41	3/4
AA67084-10KA	5/8	3.74	2.10	1.83	1.45	1.64	7/8
AA67084-12KA	3/4	4.05	2.27	2.02	1.66	1.78	1 1/16
AA67084-16KA	1	4.58	2.56	2.21	1.81	2.02	1 1/8
AA67084-20KA	1 1/4	5.18	2.85	2.48	2.06	2.33	1 1/8
AA67084-24KA	1 1/2	6.04	3.38	2.85	2.33	2.66	1 1/8
AA67084-32KA	2	7.54	4.14	3.65	3.06	3.40	2 1/8



AA67084
DOUBLE SWIVEL NUT TEE
 flared tube end - swivel nut -
 swivel nut - to mate with 37° cone

PART NUMBER	TUBE D.D.	A*	H*	W
AA67095-2K	1/8	2.02	1.01	5/16
AA67095-3K	3/16	2.08	1.04	3/8
AA67095-4K	1/4	2.06	1.03	7/16
AA67095-5K	5/16	2.10	1.05	1/2
AA67095-6K	3/8	2.56	1.28	9/16
AA67095-8K	1/2	2.82	1.41	3/4
AA67095-10K	5/8	3.28	1.64	7/8
AA67095-12K	3/4	3.56	1.78	1 1/16
AA67095-16K	1	4.04	2.02	1 1/8
AA67095-20K	1 1/4	4.66	2.33	1 1/8
AA67095-24K	1 1/2	5.32	2.66	1 1/8
AA67095-32K	2	6.80	3.40	2 1/8

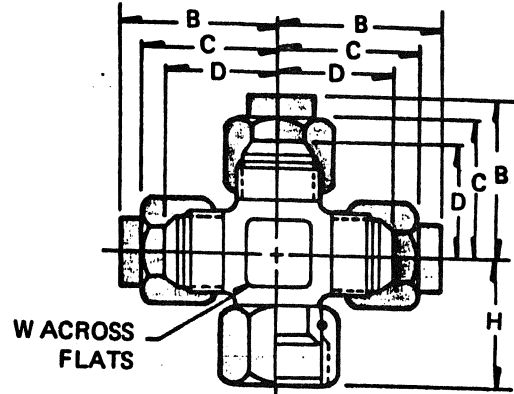


AA67095
SWIVEL NUT TEE
 swivel nut - swivel nut - swivel nut
 to mate with 37° cone

+ Material K 316SS. • See page 4 for ordering information. • Additional sizes available. • Omit "A" from part no. to order body only.

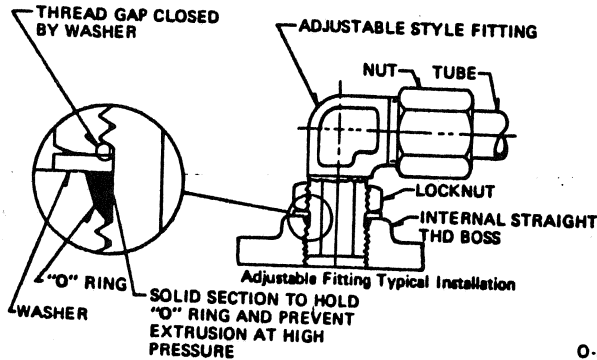
ART NUMBER	TUBE ID	D	D	D	D	T
AA67113-2KA	1/8	1.08	.96	.77	1.01	5/16
AA67113-3KA	3/16	1.20	1.08	.83	1.04	3/8
AA67113-4KA	1/4	1.25	1.08	.89	1.03	7/16
AA67113-5KA	5/16	1.36	1.25	.95	1.05	1/2
AA67113-6KA	3/8	1.53	1.34	1.06	1.28	9/16
AA67113-8KA	1/2	1.75	1.56	1.25	1.41	3/4
AA67113-10KA	5/8	2.10	1.83	1.45	1.64	7/8
AA67113-12KA	3/4	2.27	2.02	1.66	1.78	1 1/8
AA67113-16KA	1	2.56	2.21	1.81	2.02	1 5/8
AA67113-20KA	1 1/4	2.86	2.48	2.06	2.33	1 5/8
AA67113-24KA	1 1/2	3.38	2.85	2.33	2.66	1 7/8
AA67113-32KA	2	4.14	3.65	3.06	3.40	2 1/8

Other Swivel End to 37° Flare Combinations may be ordered.

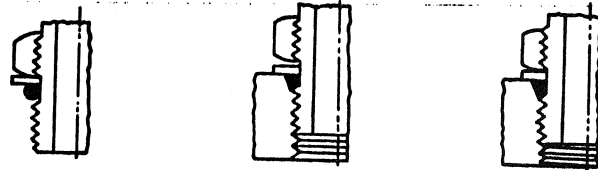


AA67113
SWIVEL NUT CROSS
 flared tube – flared tube –
 flared tube – swivel nut –
 to mate with 37° cone

ASSEMBLY INSTRUCTIONS FOR ADJUSTABLE STYLE FITTINGS IN STRAIGHT THREAD "O" RING BOSSES



Adjustable end fittings provide LEAK-PROOF CONNECTIONS, EXACT POSITIONING in desired direction, ELIMINATES CRACKING or DISTORTING due to overtightening, and may be used with SAE or AND style boss.

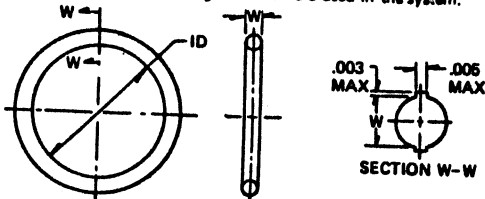


O-ring and back-up washer should be on undercut unthreaded section nearest to locknut. (Lubrication of O-ring is recommended.)

STEP 1 – Screw fitting by hand into straight thread boss until back-up washer contacts face of boss.

STEP 2 – To position fitting, unscrew as far as necessary (up to one full turn), hold fitting in desired position and tighten locknut with wrench.

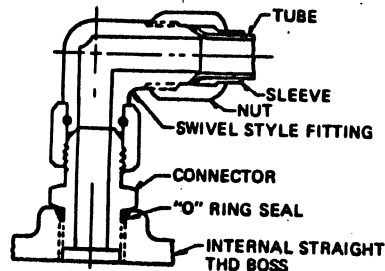
Lubrication – When assembling "O" rings with "O" ring style fittings lubricate the "O" ring with the fluid used in the system.



HYDRAULIC "O" RING

TUBE O.D.	W, WIDTH, DIA	INSIDE DIA
1/8	0.064 ± 0.003	0.239 ± 0.006
3/16	0.064 ± 0.003	0.301 ± 0.006
1/4	0.072 ± 0.003	0.361 ± 0.006
5/16	0.072 ± 0.003	0.414 ± 0.006
3/8	0.078 ± 0.003	0.468 ± 0.006
1/2	0.087 ± 0.003	0.644 ± 0.006
5/8	0.097 ± 0.003	0.755 ± 0.006
3/4	0.116 ± 0.004	0.924 ± 0.006
1	0.116 ± 0.004	1.171 ± 0.008
1 1/4	0.118 ± 0.004	1.475 ± 0.010
1 1/2	0.118 ± 0.004	1.720 ± 0.010
2	0.118 ± 0.004	2.337 ± 0.010

Swivel nut fittings are for use with straight connectors when space limitations in installation will not permit full rotation of the normally used straight thread fitting.

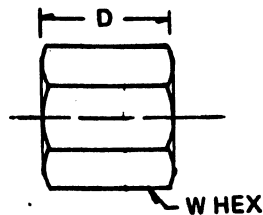


Swivel End Fitting Typical Installation

* Asterisk in tables indicates reference dimension.

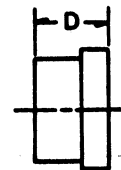
37° Flare Components

PART NUMBER	TUBE O.D.	L	W
AA67032-2K	1/8	.54	3/8
AA67032-3K	3/16	.60	7/16
AA67032-4K	1/4	.61	9/16
AA67032-5K	5/16	.67	5/8
AA67032-6K	3/8	.72	11/16
AA67032-8K	1/2	.84	7/8
AA67032-10K	5/8	.97	1
AA67032-12K	3/4	1.02	1 1/4
AA67032-16K	1	1.12	1 1/2
AA67032-20K	1 1/4	1.22	2
AA67032-24K	1 1/2	1.41	2 1/4
AA67032-28K	1 3/4	1.56	2 5/8
AA67032-32K	2	1.74	2 7/8



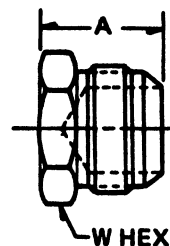
**AA67032
NUT**

PART NUMBER	TUBE O.D.	L
AA67033-2K	1/8	.34
AA67033-3K	3/16	.39
AA67033-4K	1/4	.41
AA67033-5K	5/16	.44
AA67033-6K	3/8	.50
AA67033-8K	1/2	.56
AA67033-10K	5/8	.66
AA67033-12K	3/4	.68
AA67033-16K	1	.78
AA67033-20K	1 1/4	.91
AA67033-24K	1 1/2	1.12
AA67033-28K	1 3/4	1.12
AA67033-32K	2	1.19



**AA67033
SLEEVE**

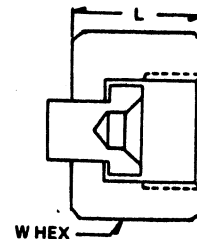
PART NUMBER	TUBE O.D.	A	W
AA67035-2K	1/8	.66	7/16
AA67035-3K	3/16	.69	7/16
AA67035-4K	1/4	.75	7/16
AA67035-5K	5/16	.78	1/2
AA67035-6K	3/8	.83	9/16
AA67035-8K	1/2	.94	3/4
AA67035-10K	5/8	1.10	7/8
AA67035-12K	3/4	1.22	1 1/8
AA67035-16K	1	1.30	1 3/8
AA67035-20K	1 1/4	1.37	1 7/8
AA67035-24K	1 1/2	1.50	2
AA67035-28K	1 3/4	1.62	2 3/8
AA67035-32K	2	1.75	2 5/8



**AA67035
PLUG**

+Material K 316SS. • See page 4 for ordering information. • Additional sizes available.

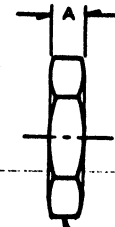
PART NUMBER	TUBE O.D.		
AA67036-2K	1/8	.54	3/8
AA67036-3K	3/16	.60	7/16
AA67036-4K	1/4	.61	9/16
AA67036-5K	5/16	.67	5/8
AA67036-6K	3/8	.72	11/16
AA67036-8K	1/2	.84	7/8
AA67036-10K	5/8	.97	1
AA67036-12K	3/4	1.02	1 1/4
AA67036-16K	1	1.12	1 1/2
AA67036-20K	1 1/4	1.22	2
AA67036-24K	1 1/2	1.41	2 1/4
AA67036-28K	1 3/4	1.56	2 5/8
AA67036-32K	2	1.74	2 7/8



W HEX

**AA67036
CAP**

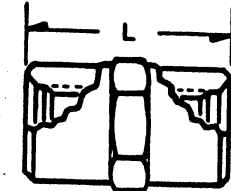
PART NUMBER	TUBE O.D.		
AA67051-2K	1/8	.22	9/16
AA67051-3K	3/16	.22	5/8
AA67051-4K	1/4	.25	11/16
AA67051-5K	5/16	.25	3/4
AA67051-6K	3/8	.27	13/16
AA67051-8K	1/2	.31	1
AA67051-10K	5/8	.36	1 1/8
AA67051-12K	3/4	.41	1 1/4
AA67051-16K	1	.41	1 5/8
AA67051-20K	1 1/4	.41	1 7/8
AA67051-24K	1 1/2	.41	2 1/8
AA67051-28K	1 3/4	.41	2 1/4
AA67051-32K	2	.41	2 5/8



W HEX

**AA67051
BULKHEAD LOCKNUT**

PART NUMBER	TUBE O.D.	STRAIGHT THREAD		
AA67073-2K	1/8	5/16-24	1.00	5/8
AA67073-3K	3/16	3/8-24	1.00	5/8
AA67073-4K	1/4	7/16-20	1.18	11/16
AA67073-5K	5/16	1/2-20	1.18	3/4
AA67073-6K	3/8	9/16-18	1.18	13/16
AA67073-8K	1/2	3/4-16	1.43	1
AA67073-10K	5/8	7/8-14	1.56	1 1/8
AA67073-12K	3/4	1 1/8-12	1.81	1 1/8
AA67073-16K	1	1 5/8-12	1.87	1 5/8
AA67073-20K	1 1/4	1 7/8-12	2.00	2
AA67073-24K	1 1/2	1 7/8-12	2.25	2 1/4
AA67073-28K	1 3/4	2 1/4-12	2.50	2 5/8
AA67073-32K	2	2 1/2-12	2.75	3



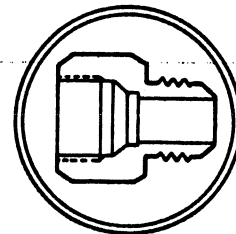
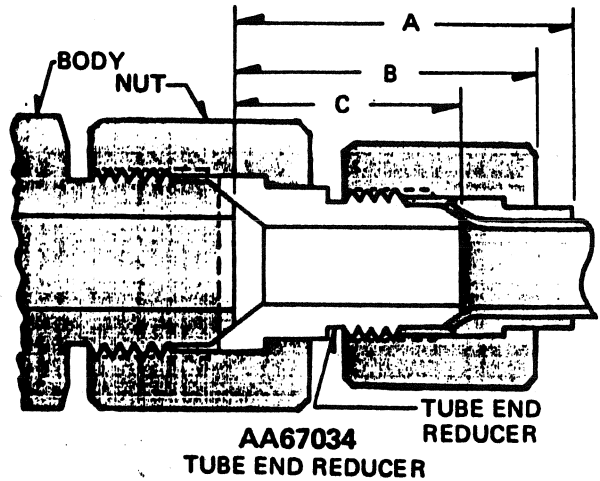
W HEX

**AA67073
TUBE COUPLING**

Material K 316SS. • See page 4 for ordering information. • Additional sizes available.

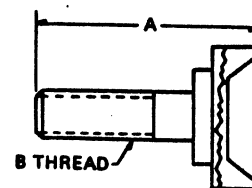
Tube Components

PART NUMBER	TUBE		A	B	C
	SIZE	OD			
AA67034-4-2KA	1/4	1/8	1.02	.89	.72
AA67034-6-4KA	3/8	1/4	1.25	1.08	.89
AA67034-8-4KA	1/2	1/4	1.25	1.08	.89
AA67034-8-6KA	1/2	3/8	1.36	1.17	.89
AA67034-10-4KA	5/8	1/4	1.28	1.11	.92
AA67034-10-6KA	5/8	3/8	1.39	1.20	.92
AA67034-10-8KA	5/8	1/2	x	x	x
AA67034-12-4KA	3/4	1/4	1.31	1.14	.95
AA67034-12-6KA	3/4	3/8	1.42	1.23	.95
AA67034-12-8KA	3/4	1/2	1.55	1.36	1.05
AA67034-12-10KA	3/4	5/8	x	x	x
AA67034-16-4KA	1	1/4	1.61	1.43	1.21
AA67034-16-6KA	1	3/8	1.49	1.29	1.00
AA67034-16-8KA	1	1/2	1.68	1.47	1.13
AA67034-16-12KA	1	3/4	1.94	1.69	1.33
AA67034-20-4KA	1 1/4	1/4	1.73	1.55	1.33
AA67034-20-6KA	1 1/4	3/8	1.75	1.55	1.26
AA67034-20-8KA	1 1/4	1/2	1.77	1.56	1.22
AA67034-20-10KA	1 1/4	5/8	1.78	1.57	1.23
AA67034-20-12KA	1 1/4	3/4	1.95	1.70	1.34
AA67034-20-16KA	1 1/4	1	2.17	1.84	1.40
AA67034-24-4KA	1 1/2	1/4	1.89	1.71	1.49
AA67034-24-6KA	1 1/2	3/8	1.89	1.69	1.40
AA67034-24-8KA	1 1/2	1/2	1.98	1.77	1.43
AA67034-24-10KA	1 1/2	5/8	2.12	1.86	1.46
AA67034-24-12KA	1 1/2	3/4	2.09	1.82	1.42
AA67034-24-16KA	1 1/2	1	2.19	1.86	1.42
AA67034-24-20KA	1 1/2	1 1/4	2.33	1.94	1.48
AA67034-32-12KA	2	3/4	2.47	2.20	1.80
AA67034-32-16KA	2	1	2.46	2.13	1.69
AA67034-32-20KA	2	1 1/4	2.47	2.08	1.62
AA67034-32-24KA	2	1 1/2	2.79	2.25	1.69



X SPECIAL ONE PIECE DESIGN

PART NUMBER	TUBE O.D.	A	B
AA67037-4K	1/4	.72	1/4 - 20
AA67037-6K	3/8	.80	1/4 - 20
AA67037-8K	1/2	.98	5/16 - 18

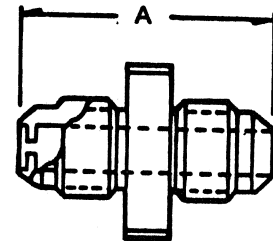


**AA67037
MOUNTIE**

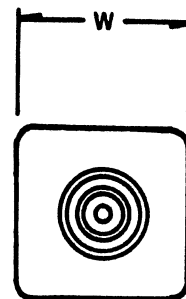
Mountie stud, used in place of sleeve,
plug port when B nut is drawn up and
provided threaded end (of stud)
make tee or cross fitting self mounting.

+Material K 316SS. • See page 4 for ordering information. • Additional sizes available. • Omit "A" from part no. to order body only.

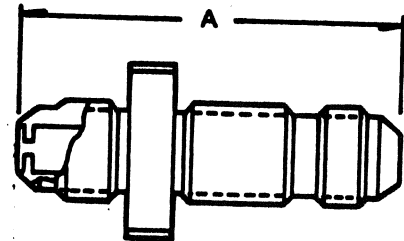
PART NUMBER	TUBE O.D.	A	W
AA1634-4	1/4	1.23	1 1/8
AA1634-6	3/8	1.36	1 3/8
AA1634-8K	1/2	1.55	1
AA1634-12	3/4	2.09	1 3/8
AA1634-16	1	2.17	1 5/8



AA1634
UNION - ORIFICE



PART NUMBER	TUBE O.D.	A	W
AA1635-4	1/4	2.03	1 1/8
AA1635-6	3/8	2.20	1 3/8
AA1635-8	1/2	2.44	1
AA1635-12	3/4	3.02	1 3/8
AA1635-16	1	3.06	1 5/8



AA1635
BULKHEAD UNION - ORIFICE

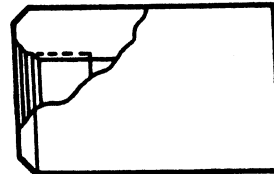
FITTING SIZES: 1/4" thru 2" tube O.D.
ORIFICE SIZES: As small as .0055
FLOW: Bi-Directional
CONSTRUCTION: One piece, square stock
MATERIAL: 300 Series Stainless Steel
OPERATING PRESSURE: 3000 P.S.I.

HOW TO ORDER:
 Union 1/4" - Orifice
 AA1634 - 4 - .030
 Union 1/4" - Orifice Blank
 AA1634 - 4 - .000

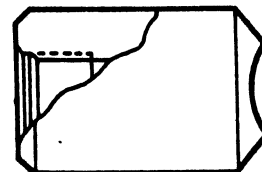
Weld Ends

PART NUMBER	TUBE O.D.	DIAMETERS AND DIMENSIONS
AAB1001-2	1/8	Part length and pipe end diameters and dimensions are governed by pipe size and pipe schedule.
AAB1001-3	3/16	
AAB1001-4	1/4	
AAB1001-5	5/16	
AAB1001-6	3/8	
AAB1001-8	1/2	
AAB1001-10	5/8	
AAB1001-12	3/4	
AAB1001-16	1	
AAB1001-20	1 1/4	
AAB1001-24	1 1/2	
AAB1001-28	1 3/4	
AAB1001-32	2	

AAB1001
WELD BOSS – PORT TO BLANK
MS33649 boss – blank pipe end

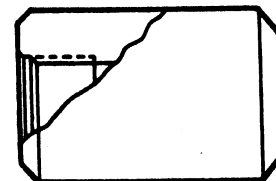


AAB1001-R
WELD BOSS – PORT TO SADDLE
MS33649 boss – radius pipe end



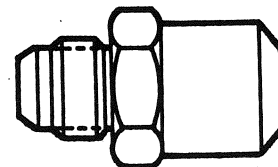
PART NUMBER	TUBE O.D.	DIAMETERS AND DIMENSIONS
AAB1002-2	1/8	Part length and pipe end diameters and dimensions are governed by pipe size and pipe schedule.
AAB1002-3	3/16	
AAB1002-4	1/4	
AAB1002-5	5/16	
AAB1002-6	3/8	
AAB1002-8	1/2	
AAB1002-10	5/8	
AAB1002-12	3/4	
AAB1002-16	1	
AAB1002-20	1 1/4	
AAB1002-24	1 1/2	
AAB1002-28	1 3/4	
AAB1002-32	2	

AAB1002
WELD BOSS – PORT TO BUTT WELD
MS33649 boss – butt pipe end



PART NUMBER	TUBE O.D.	DIAMETERS AND DIMENSIONS
AAB1004-2	1/8	Part length and pipe end diameters and dimensions are governed by pipe size and pipe schedule.
AAB1004-3	3/16	
AAB1004-4	1/4	
AAB1004-5	5/16	
AAB1004-6	3/8	
AAB1004-8	1/2	
AAB1004-10	5/8	
AAB1004-12	3/4	
AAB1004-16	1	
AAB1004-20	1 1/4	
AAB1004-24	1 1/2	
AAB1004-28	1 3/4	
AAB1004-32	2	

AAB1004
WELD ADAPTER – TUBE TO BUTT WELD
flared tube end – butt pipe end



HOW TO ORDER

AAB1001 Port to Blank = Boss 3/4" 347SS
AAB1001 - 12 S

AAB1001-R Port to Saddle = Boss 1" - 304SS - Pipe Size - Schedule - Radius
AAB1001 - 16 J - 2.000 4Q R

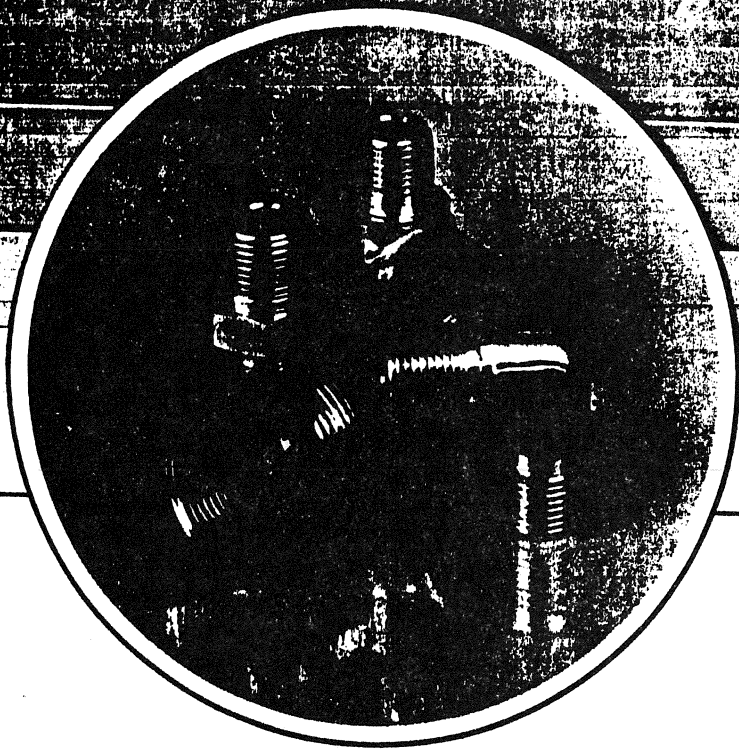
AAB1002 Port to Butt Weld = Boss 1/4" - 304SS - Pipe Size - Schedule
AAB1002 - 4 J - .750 - 160

AAB1004 Tube to Butt Weld = Fitting 1/2" - Pipe Size - Schedule - 316SS
AAB1004 - 8 - 1.500 - 160 K
















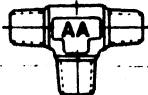
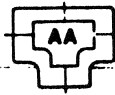




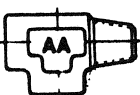




See page 2 for boss detail.

See page 3 for pipe information.

INDUSTRIAL PIPE FITTINGS & STRAIGHT THREAD ADAPTERS



Fitting Locator

MALE PIPE	FEMALE PIPE	MALE PIPE TO FEMALE PIPE	PLUGS	STRAIGHT THREAD ADAPTERS
AA67041 P.33 PIPE NIPPLE 	AA67040 P.34 PIPE CONNECTOR 	AA67052 P.35 REDUCING CONNECTOR 	AA67043 P.37 SQUARE HEAD PLUG 	AA67054 P.39 FEMALE PIPE ADAPTER 
AA67074 P.33 LONG PIPE NIPPLE 	AA67046 P.34 FEMALE PIPE ELBOW 	AA67044 P.35 STREET ELBOW 	AA67049 P.37 HOLLOW HEX PIPE PLUG 	AA67055 P.39 FEMALE 90° ELBOW 
AA67075 P.33 MALE PIPE ELBOW 	AA67076 P.34 FEMALE PIPE ELBOW 45° 	AA67045 P.35 STREET ELBOW 45° 	AA67050 P.37 HEX HEAD PIPE PLUG 	AA67056 P.39 LONG FEMALE 90° ELBOW 
AA67079 P.33 MALE PIPE TEE 	AA67047 P.34 FEMALE PIPE TEE 	AA67077 P.36 MALE BRANCH TEE 	AA67038 P.38 HEX HEAD PLUG 	AA67058 P.40 REDUCER EXPANDER 
	AA67048 P.35 FEMALE PIPE CROSS 	AA67078 P.36 STREET TEE 	AA67080 P.38 LARGE HEX HEAD PLUG 	AA67057 P.40 UNION 
		AA67042 P.36 PIPE THREAD REDUCER 	AA67053 P.38 HOLLOW HEX PLUG 	

THREADS

Straight threads — unified class 2A and 2B
Pipe threads — Dryseal American (National)
Standard Taper (N.P.T.F.)

MATERIAL:

Fittings supplied in 316 stainless steel.
Other materials may be available as shown
on page 4.

SPECIAL FITTINGS:

Fittings in various material or size combinations can be manufactured for your needs.

STRAIGHT THREAD DATA

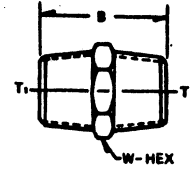
SIZE	TUBE O.D.	STRAIGHT THREAD
2	1/8	1/8-24
3	3/16	3/16-24
4	1/4	1/4-20
5	5/16	5/16-20
6	3/8	3/8-18
8	1/2	1/2-16
10	5/8	5/8-14
12	3/4	3/4-12
16	1	1-12
20	1 1/4	1 1/4-12
24	1 1/2	1 1/2-12
28	1 3/4	1 3/4-12
32	2	2-12

PIPE THREAD DATA

SIZE	PIPE THREAD
1	1/8
2	1/4
3	3/8
4	1/2
6	3/4
8	1
10	1 1/4
12	1 1/2
16	2

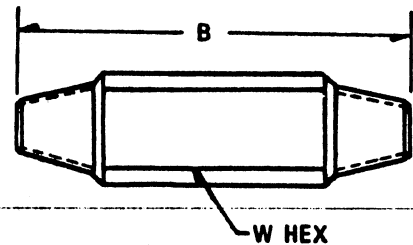
PART NUMBER +	PIPE THREAD 1	PIPE THREAD 2	B	W
AA67041-1K	1/8	1/8	1.00	3/16
AA67041-2K	1/4	1/4	1.45	5/16
AA67041-2-1K	1/4	1/8	1.25	5/16
AA67041-3K	3/8	3/8	1.45	3/4
AA67041-3-1K	3/8	1/8	1.27	3/4
AA67041-3-2K	3/8	1/4	1.45	3/4
AA67041-4K	1/2	1/2	1.87	15/16
AA67041-4-2K	1/2	1/4	1.70	15/16
AA67041-4-3K	1/2	3/8	1.87	15/16
AA67041-6K	3/4	3/4	1.94	1 1/8
AA67041-6-4K	3/4	1/2	1.97	1 1/8
AA67041-8K	1	1	2.34	1 3/8
AA67041-10K	1 1/4	1 1/4	2.37	1 3/4
AA67041-10-8K	1 1/4	1	2.45	1 3/4
AA67041-12K	1 1/2	1 1/2	2.63	2
AA67041-16K	2	2	2.78	2 1/2

AA67041
PIPE NIPPLE
male pipe thread



PART NUMBER +	MALE PIPE THREAD	B	W
AA67074-1K	1/8	•	3/16
AA67074-2K	1/4	•	5/16
AA67074-3K	3/8	•	3/4
AA67074-4K	1/2	•	15/16

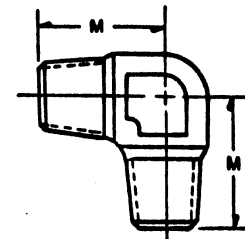
AA67074
LONG PIPE NIPPLE
male pipe thread



SPECIFY LENGTH

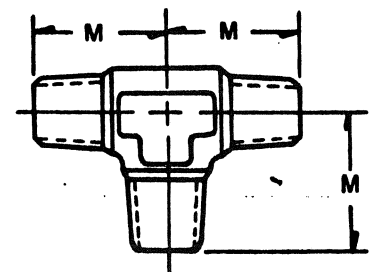
PART NUMBER +	MALE PIPE THREAD	M
AA67075-1K	1/8	1.78
AA67075-2K	1/4	1.09
AA67075-3K	3/8	1.22
AA67075-4K	1/2	1.47
AA67075-6K	3/4	1.59
AA67075-8K	1	1.97
AA67075-10K	1 1/4	2.38
AA67075-12K	1 1/2	2.64
AA67075-16K	2	3.00

AA67075
MALE PIPE ELBOW
male pipe thread



PART NUMBER +	MALE PIPE THREAD	M
AA67079-1K	1/8	.78
AA67079-2K	1/4	1.09
AA67079-3K	3/8	1.22
AA67079-4K	1/2	1.47
AA67079-6K	3/4	1.59
AA67079-8K	1	1.97
AA67079-10K	1 1/4	2.38
AA67079-12K	1 1/2	2.64
AA67079-16K	2	3.00

AA67079
MALE PIPE TEE
male pipe thread

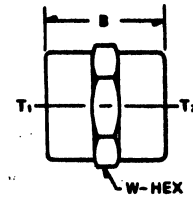


+Material K 316SS. • See page 4 for ordering information. • Additional sizes available.

Industrial Pipe Fittings

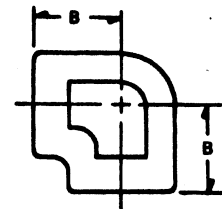
PART NUMBER +	PIPE THREAD T1	PIPE THREAD T2	B	W
67040-1K	1/8	1/8	.81	1/8
67040-2K	1/4	1/4	1.13	1 1/8
AA67040-2-1K	1/4	1/8	.94	1 1/8
AA67040-3K	3/8	3/8	1.18	1 5/8
AA67040-3-1K	3/8	1/8	1.03	1 5/8
AA67040-3-2K	3/8	1/4	1.13	1 5/8
AA67040-4K	1/2	1/2	1.56	1 7/8
AA67040-4-2K	1/2	1/4	1.38	1 7/8
AA67040-4-3K	1/2	3/8	1.50	1 7/8
AA67040-6K	3/4	3/4	1.59	1 7/8
AA67040-6-4K	3/4	1/2	1.88	1 7/8
AA67040-8K	1	1	1.90	1 3/4
AA67040-10K	1 1/4	1 1/4	1.94	2 1/8
AA67040-10-8K	1 1/4	1	1.94	2 1/8
AA67040-12K	1 1/2	1 1/2	2.65	2 1/2
AA67040-16K	2	2	2.65	2 3/4

AA67040
PIPE CONNECTOR
female pipe thread



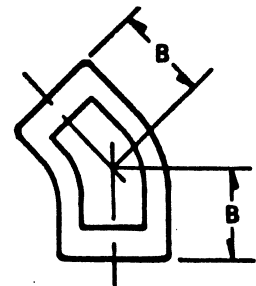
PART NUMBER +	FEMALE PIPE THREAD	B
AA67046-1K	1/8	.66
AA67046-2K	1/4	.89
AA67046-3K	3/8	1.01
AA67046-4K	1/2	1.23
AA67046-6K	3/4	1.36
AA67046-8K	1	1.63
67046-10K	1 1/4	1.70
67046-12K	1 1/2	2.03
AA67046-16K	2	2.39

AA67046
FEMALE PIPE ELBOW
female pipe thread



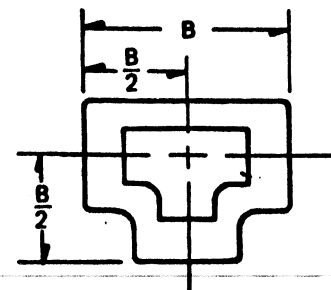
PART NUMBER +	FEMALE PIPE THREAD	B
AA67076-1K	1/8	.50
AA67076-2K	1/4	.69
AA67076-3K	3/8	.75
AA67076-4K	1/2	.94
AA67076-6K	3/4	1.00
AA67076-8K	1	1.19
AA67076-10K	1 1/4	1.44
AA67076-12K	1 1/2	1.46
AA67076-16K	2	1.59

AA67076
FEMALE PIPE ELBOW 45°
female pipe thread



PART NUMBER +	FEMALE PIPE THREAD	B
AA67047-1K	1/8	1.31
AA67047-2K	1/4	1.78
AA67047-3K	3/8	1.98
AA67047-4K	1/2	2.47
AA67047-6K	3/4	2.72
AA67047-8K	1	3.25
67047-10K	1 1/4	3.41
67047-12K	1 1/2	4.06
AA67047-16K	2	4.78

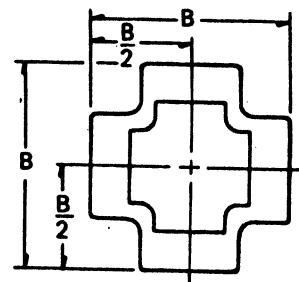
AA67047
FEMALE PIPE TEE
female pipe threads



+ Material K 316SS. • See page 4 for ordering information. • Additional sizes available.

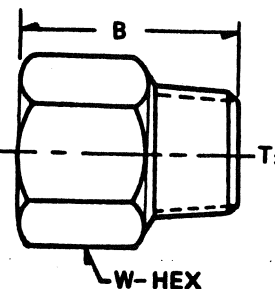
PART NUMBER +	FEMALE PIPE THREAD	B
AA67048-1K	1/8	1.31
AA67048-2K	1/4	1.78
AA67048-3K	3/8	1.98
AA67048-4K	1/2	2.47
AA67048-6K	3/4	2.72
AA67048-8K	1	3.25
AA67048-10K	1 1/4	3.41
AA67048-12K	1 1/2	4.03
AA67048-16K	2	4.60

AA67048
FEMALE PIPE CROSS
female pipe thread



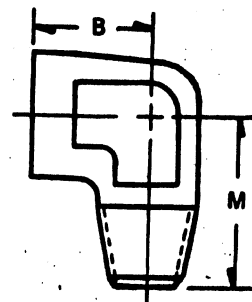
PART NUMBER +	FEMALE PIPE THREAD T1	MALE PIPE THREAD T2	B	M
AA67052-2-1K	1/8	1/8	1.22	3/4
AA67052-3-2K	3/8	1/4	1.44	7/8
AA67052-4-1K	1/2	1/8	1.50	1 1/8
AA67052-4-2K	1/2	1/4	1.69	1 1/8
AA67052-4-3K	1/2	3/8	1.69	1 1/8
AA67052-6-2K	3/4	1/4	1.78	1 1/8
AA67052-6-4K	3/4	1/2	1.94	1 1/8
AA67052-8-4K	1	1/2	2.16	1 1/8
AA67052-8-6K	1	3/4	2.19	1 1/8
AA67052-10-8K	1 1/4	1	2.47	2
AA67052-12-10K	1 1/2	1 1/4	2.50	2 3/8
AA67052-16-12K	2	1 1/2	2.63	2 7/8

AA67052
REDUCING CONNECTOR
female pipe thread
male pipe thread



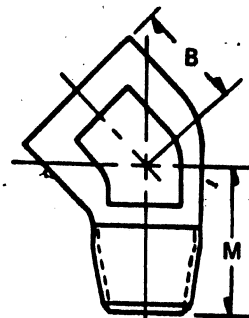
PART NUMBER +	PIPE THREAD	B	M
AA67044-1K	1/8	.65	.85
AA67044-2K	1/4	.88	1.21
AA67044-3K	3/8	.98	1.29
AA67044-4K	1/2	1.22	1.60
AA67044-6K	3/4	1.36	1.73
AA67044-8K	1	1.63	2.10
AA67044-10K	1 1/4	1.75	2.30
AA67044-12K	1 1/2	2.03	2.64
AA67044-16K	2	2.39	3.00

AA67044
STREET ELBOW
male pipe thread-
female pipe thread



PART NUMBER +	PIPE THREAD	B	M
AA67045-1K	1/8	.47	.72
AA67045-2K	1/4	.63	1.05
AA67045-3K	3/8	.72	1.06
AA67045-4K	1/2	.91	1.34
AA67045-6K	3/4	.97	1.38
AA67045-8K	1	1.13	1.72
AA67045-10K	1 1/4	1.20	1.87
AA67045-12K	1 1/2	1.69	2.06
AA67045-16K	2	2.22	2.16

AA67045
STREET ELBOW 45°
male pipe thread-
female pipe thread

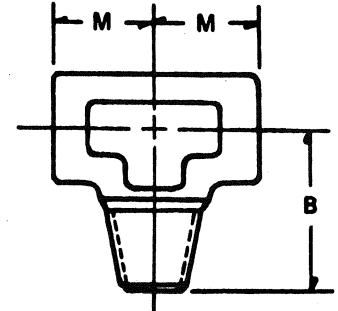


Material K 316SS. • See page 4 for ordering information. • Additional sizes available.

Industrial Pipe Fittings

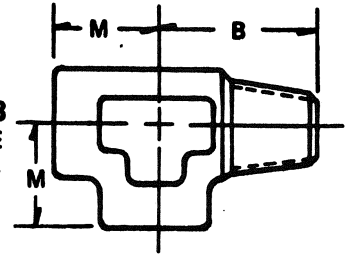
PART NUMBER	PIPE THREAD	B	T
AA67077-1K	1/8	.78	.66
AA67077-2K	1/4	1.09	.88
AA67077-3K	3/8	1.22	1.02
AA67077-4K	1/2	1.47	1.23
AA67077-6K	3/4	1.59	1.36
AA67077-8K	1	1.97	1.62
AA67077-10K	1 1/4	2.38	1.70
AA67077-12K	1 1/2	2.64	2.08
AA67077-16K	2	3.00	2.39

AA67077
MALE BRANCH TEE
female pipe thread-
male pipe thread



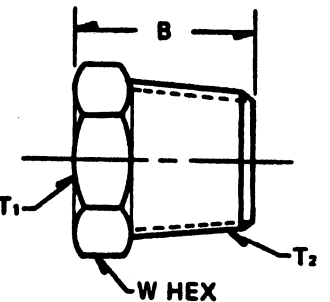
PART NUMBER	PIPE THREAD	B	T
AA67078-1K	1/8	.78	.66
AA67078-2K	1/4	1.09	.88
AA67078-3K	3/8	1.22	1.02
AA67078-4K	1/2	1.47	1.23
AA67078-6K	3/4	1.59	1.36
AA67078-8K	1	1.97	1.62
AA67078-10K	1 1/4	2.38	1.70
AA67078-12K	1 1/2	2.64	2.08
AA67078-16K	2	3.00	2.39

AA67078
STREET TEE
female pipe thread-
male pipe thread



PART NUMBER	MALE PIPE THREAD T2	FEMALE PIPE THREAD T1	B	T
AA67042-1K	1/4	1/2	.81	3/8
AA67042-2K	3/8	1/4	.81	3/8
AA67042-3K	3/8	1/8	.81	3/8
AA67042-4K	1/2	3/8	1.05	1 1/8
AA67042-5K	1/2	1/4	1.05	1 1/8
AA67042-6K	1/2	1/8	1.05	1 1/8
AA67042-7K	3/4	1/2	1.09	1 1/4
AA67042-8K	3/4	3/8	1.09	1 1/4
AA67042-9K	3/4	1/4	1.09	1 1/4
AA67042-10K	1	3/4	1.28	1 3/8
AA67042-10-6K	1 1/4	3/4	1.31	1 3/4
AA67042-10-8K	1 1/4	1	1.37	1 3/4
AA67042-11K	1	1/2	1.28	1 3/8
AA67042-12K	1	3/8	1.28	1 3/8
AA67042-12-4K	1 1/2	1/2	1.31	2
AA67042-12-6K	1 1/2	3/4	1.31	2
AA67042-12-8K	1 1/2	1	1.31	2
AA67042-12-10K	1 1/2	1 1/4	1.37	2
AA67042-16-8K	2	1	1.50	2 1/2
AA67042-16-10K	2	1 1/4	1.50	2 1/2
AA67042-16-12K	2	1 1/2	1.50	2 1/2

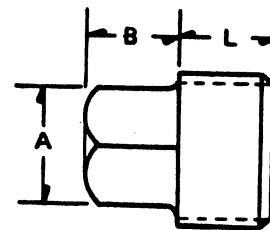
AA67042
PIPE THREAD REDUCER
male pipe thread-T₁
female pipe thread



+Material K 316SS. • See page 4 for ordering information. • Additional sizes available.

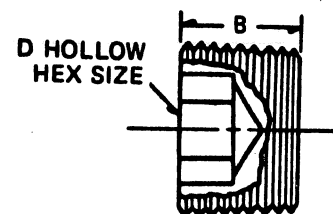
PART NUMBER	MALE PIPE THREAD	B SQUARE	D	L
AA67043-1K	1/8	9/32	.25	.34
AA67043-2K	1/4	7/16	.28	.50
AA67043-3K	3/8	7/16	.31	.50
AA67043-4K	1/2	9/16	.38	.64
AA67043-6K	3/4	5/8	.45	.66
AA67043-8K	1	13/16	.51	.81
AA67043-10K	1 1/4	1 1/8	.56	.84
AA67043-12K	1 1/2	1 1/8	.63	.84
AA67043-16K	2	1 5/8	.69	.86

AA67043
SQUARE HEAD PLUG
male pipe thread



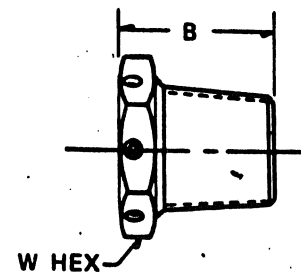
PART NUMBER	MALE PIPE THREAD	B	D
AA67049-1K	1/16	.28	5/32
AA67049-2K	1/8	.28	3/16
AA67049-3K	1/4	.42	1/4
AA67049-4K	3/8	.42	5/16
AA67049-5K	1/2	.54	3/8
AA67049-6K	3/4	.55	9/16
AA67049-7K	1	.69	5/8
AA67049-8K	1 1/4	.71	3/4

AA67049
HOLLOW HEX PIPE PLUG
male pipe thread



PART NUMBER	MALE PIPE THREAD	B	W
AA67050-1K	1/8	.61	7/16
AA67050-2K	1/4	.83	5/8
AA67050-3K	3/8	.91	3/4
AA67050-4K	1/2	1.09	1 1/8
AA67050-6K	3/4	1.17	1 1/8
AA67050-8K	1	1.39	1 3/8
AA67050-10K	1 1/4	1.42	1 3/4
AA67050-12K	1 1/2	1.44	2
AA67050-16K	2	1.47	2 1/2

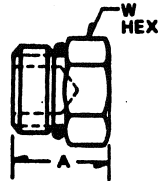
AA67050
HEX HEAD PIPE PLUG
male pipe thread



+Material K 316SS. • See page 4 for ordering information. • Additional sizes available.

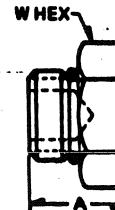
Straight Thread Adapters

PART NUMBER +	TUBE O.D.	STRAIGHT THREAD	A	W
AA67038-2K	1/8	5/16-24	.60	7/16
AA67038-3K	3/16	3/8-24	.60	1/2
AA67038-4K	1/4	7/16-20	.67	9/16
AA67038-5K	5/16	1/2-20	.67	5/8
AA67038-6K	3/8	9/16-18	.73	11/16
AA67038-8K	1/2	3/4-16	.80	7/8
AA67038-10K	5/8	7/8-14	.93	1
AA67038-12K	3/4	1 1/16-12	1.09	1 1/4
AA67038-16K	1	1 5/16-12	1.12	1 1/2
AA67038-20K	1 1/4	1 5/8-12	1.20	1 7/8
AA67038-24K	1 1/2	1 7/8-12	1.27	2 1/8
AA67038-28K	1 3/4	2 1/4-12	1.35	2 1/2
AA67038-32K	2	2 1/2-12	1.43	2 3/4



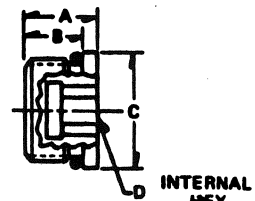
**AA67038
HEX HEAD PLUG**

PART NUMBER +	TUBE O.D.	STRAIGHT THREAD	A	W
A67080-2K	1/8	5/16-24	.53	9/16
AA67080-3K	3/16	3/8-24	.53	5/8
AA67080-4K	1/4	7/16-20	.60	11/16
AA67080-5K	5/16	1/2-20	.60	3/4
AA67080-6K	3/8	9/16-18	.68	13/16
AA67080-8K	1/2	3/4-16	.75	1
AA67080-10K	5/8	7/8-14	.81	1 1/8
AA67080-12K	3/4	1 1/16-12	1.00	1 3/8
AA67080-16K	1	1 1/8-12	1.00	1 5/8
AA67080-20K	1 1/4	1 5/8-12	1.00	1 7/8
AA67080-24K	1 1/2	1 7/8-12	1.00	2 1/8
AA67080-28K	1 3/4	2 1/4-12	1.00	2 1/2
AA67080-32K	2	2 1/2-12	1.00	2 3/4



**AA67080
LARGE HEX HEAD PLUG**

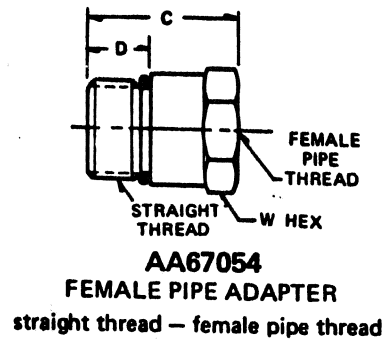
PART NUMBER +	TUBE O.D.	STRAIGHT THREAD	A	B	C	D
AA67053-2K	1/8	5/16-24	.38	.30	.44	1/8
AA67053-3K	3/16	3/8-24	.38	.30	.50	1/8
AA67053-4K	1/4	7/16-20	.45	.36	.56	3/16
AA67053-5K	5/16	1/2-20	.45	.36	.63	3/16
AA67053-6K	3/8	9/16-18	.48	.39	.69	1/4
AA67053-8K	1/2	3/4-16	.56	.44	.88	5/16
AA67053-10K	5/8	7/8-14	.63	.50	1.00	3/8
AA67053-12K	3/4	1 1/16-12	.75	.59	1.25	9/16
AA67053-16K	1	1 5/16-12	.75	.59	1.50	5/8
AA67053-20K	1 1/4	1 5/8-12	.75	.59	1.88	3/4



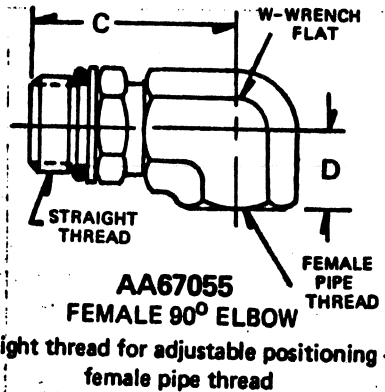
**AA67053
HOLLOW HEX PLUG**

+ Material K 316SS. • See page 4 for ordering information. • Additional sizes available.

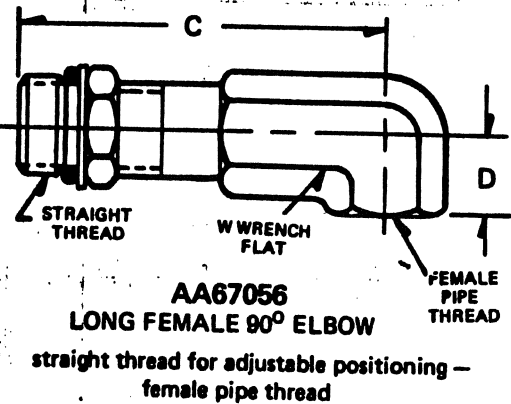
PART NUMBER +	TUBE O.D.	STRAIGHT THREAD	FEMALE PIPE THREAD	C	D	W
AA67054-6K	3/8	1/8-18	1/4	1.09	.391	3/8
AA67054-8K	1/2	3/4-16	3/8	1.22	.438	7/8
AA67054-8-4K	1/2	3/4-16	1/4	1.06	.440	7/8
AA67054-8-8K	1/2	3/4-16	1/2	1.44	.440	1 1/8
AA67054-10K	5/8	7/8-14	1/2	1.50	.500	1 1/8
AA67054-10-4K	5/8	7/8-14	1/4	.81	.500	1
AA67054-10-6K	5/8	7/8-14	3/8	1.25	.500	1
AA67054-10-12K	5/8	7/8-14	3/4	1.63	.500	1 3/8
AA67054-12K	3/4	1 1/8-12	3/4	1.66	.594	1 3/8
AA67054-12-8K	3/4	1 1/8-12	1/2	1.34	.594	1 1/4
AA67054-16K	1	1 5/8-12	1	1.88	.594	1 5/8
AA67054-16-8K	1	1 5/8-12	1/2	1.00	.594	1 1/2
AA67054-16-12K	1	1 5/8-12	3/4	1.50	.594	1 1/2
AA67054-20K	1 1/4	1 5/8-12	1 1/4	1.94	.594	2
AA67054-20-16K	1 1/4	1 5/8-12	1	1.00	.594	1 7/8
AA67054-24K	1 1/2	1 5/8-12	1 1/2	2.00	.594	2 1/4
AA67054-24-16K	1 1/2	1 5/8-12	1	1.00	.594	2 1/8
AA67054-24-20K	1 1/2	1 5/8-12	1 1/4	1.00	.594	2 1/4
AA67054-32K	2	2 1/2-12	2	2.06	.594	2 7/8
AA67054-32-16K	2	2 1/2-12	1	1.00	.594	2 3/4
AA67054-32-20K	2	2 1/2-12	1 1/4	1.00	.594	2 3/4
AA67054-32-24K	2	2 1/2-12	1 1/2	1.00	.594	2 3/4



PART NUMBER +	TUBE O.D.	STRAIGHT THREAD	FEMALE PIPE THREAD	C	D	W
AA67055-4K	1/4	7/16-20	1/8	1.36	.64	5/8
AA67055-6K	3/8	1/2-18	1/4	1.36	.59	3/4
AA67055-8K	1/2	3/4-16	3/8	1.47	.63	7/8
AA67055-10K	5/8	7/8-14	1/2	1.81	.75	1 1/8
AA67055-12K	3/4	1 1/8-12	3/4	2.00	.81	1 3/8
AA67055-16K	1	1 5/8-12	1	2.25	1.00	1 5/8



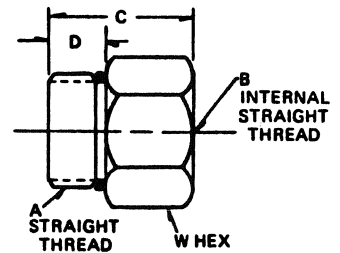
PART NUMBER +	TUBE O.D.	STRAIGHT THREAD	FEMALE PIPE THREAD	C	D	W
AA67056-4K	1/4	7/16-20	1/8	2.00	.64	5/8
AA67056-6K	3/8	1/2-18	1/4	2.44	.59	3/4
AA67056-8K	1/2	3/4-16	3/8	2.94	.63	7/8
AA67056-10K	5/8	7/8-14	1/2	3.56	.75	1 1/8
AA67056-12K	3/4	1 1/8-12	3/4	4.13	.81	1 3/8
AA67056-16K	1	1 5/8-12	1	4.63	1.00	1 5/8



+ Material K 316SS. • See page 4 for ordering information. • Additional sizes available.

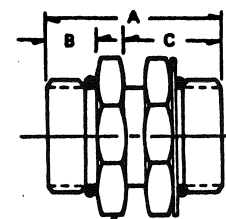
Straight Thread Adapters

PART NUMBER +	TUBE O.D. A	TUBE O.D. B	STRAIGHT THREAD A	STRAIGHT THREAD B	C	D	W
AA67058-4-5K	1/4	5/8	7/16-20	1/2-20	1.27	.360	3/4
AA67058-4-6K	1/4	3/8	7/16-20	9/16-18	1.16	.360	13/16
AA67058-6-4K	3/8	1/4	9/16-18	7/16-20	1.09	.406	13/16
AA67058-6-8K	3/8	1/2	9/16-18	3/4-16	1.38	.390	1
AA67058-8-6K	1/2	3/8	3/4-16	9/16-18	1.15	.453	1
AA67058-8-10K	1/2	5/8	3/4-16	7/8-14	1.56	.430	1 1/8
AA67058-10-6K	5/8	3/8	7/8-14	9/16-18	1.20	.515	1 1/8
AA67058-10-8K	5/8	1/2	7/8-14	3/4-16	1.36	.515	1 1/8
AA67058-10-12K	5/8	3/4	7/8-14	1 1/16-12	1.81	.500	1 3/8
AA67058-12-8K	3/4	1/2	1 1/16-12	3/4-16	1.32	.594	1 3/8
AA67058-12-10K	3/4	5/8	1 1/16-12	7/8-14	1.39	.594	1 3/8
AA67058-12-16K	3/4	1	1 1/16-12	1 1/16-12	1.88	.575	1 3/8
AA67058-16-8K	1	1/2	1 5/16-12	3/4-16	.98	.594	1 5/8
AA67058-16-12K	1	3/4	1 5/16-12	1 1/16-12	1.59	.594	1 5/8
AA67058-16-20K	1	1 1/4	1 5/16-12	1 5/8-12	1.97	.594	1 7/8
AA67058-20-10K	1 1/4	5/8	1 5/8-12	7/8-14	1.00	.594	1 7/8
AA67058-20-12K	1 1/4	3/4	1 5/8-12	1 1/16-12	.98	.594	1 7/8
AA67058-20-16K	1 1/4	1	1 5/8-12	1 5/16-12	1.36	.594	1 7/8
AA67058-20-24K	1 1/4	1 1/2	1 5/8-12	1 7/8-12	1.97	.594	2 1/4
AA67058-24-12K	1 1/2	3/4	1 7/8-12	1 1/16-12	1.00	.594	2 1/8
AA67058-24-16K	1 1/2	1	1 7/8-12	1 5/16-12	1.00	.594	2 1/8
AA67058-24-20K	1 1/2	1 1/4	1 7/8-12	1 5/8-12	1.59	.594	2 1/8
AA67058-32-16K	2	1	2 1/2-12	1 5/16-12	1.00	.594	2 3/4
AA67058-32-20K	2	1 1/4	2 1/2-12	1 5/8-12	1.00	.594	2 3/4
AA67058-32-24K	2	1 1/2	2 1/2-12	1 7/8-12	1.00	.594	2 3/4



AA67058
REDUCER EXPANDER
straight thread -
internal straight thread

PART NUMBER +	TUBE O.D.	STRAIGHT THREAD	A	B	C	W
AA67057-2K	1/8	5/16-24	1.22	.30	.61	7/16
AA67057-3K	3/16	3/8-24	1.16	.30	.61	1/2
AA67057-4K	1/4	7/16-20	1.22	.36	.70	9/16
AA67057-5K	5/16	1/2-20	1.22	.36	.70	5/8
AA67057-6K	3/8	9/16-18	1.41	.39	.77	1 1/16
AA67057-8K	1/2	3/4-16	1.56	.44	.88	7/8
AA67057-10K	5/8	7/8-14	1.81	.50	1.02	1
AA67057-12K	3/4	1 1/16-12	2.13	.59	1.16	1 1/4
AA67057-16K	1	1 5/16-12	2.13	.59	1.16	1 1/2
AA67057-20K	1 1/4	1 5/8-12	2.13	.59	1.16	1 3/4
AA67057-24K	1 1/2	1 7/8-12	2.13	.59	1.16	2 1/8
AA67057-32K	2	2 1/2-12	2.13	.59	1.16	2 3/4



AA67057
UNION
straight thread - straight thread
for adjustable positioning

+ Material K 316SS. • See page 4 for ordering information. • Additional sizes available.

Fraction/Decimal Chart

Fractions of One Inch and Decimal Equivalents

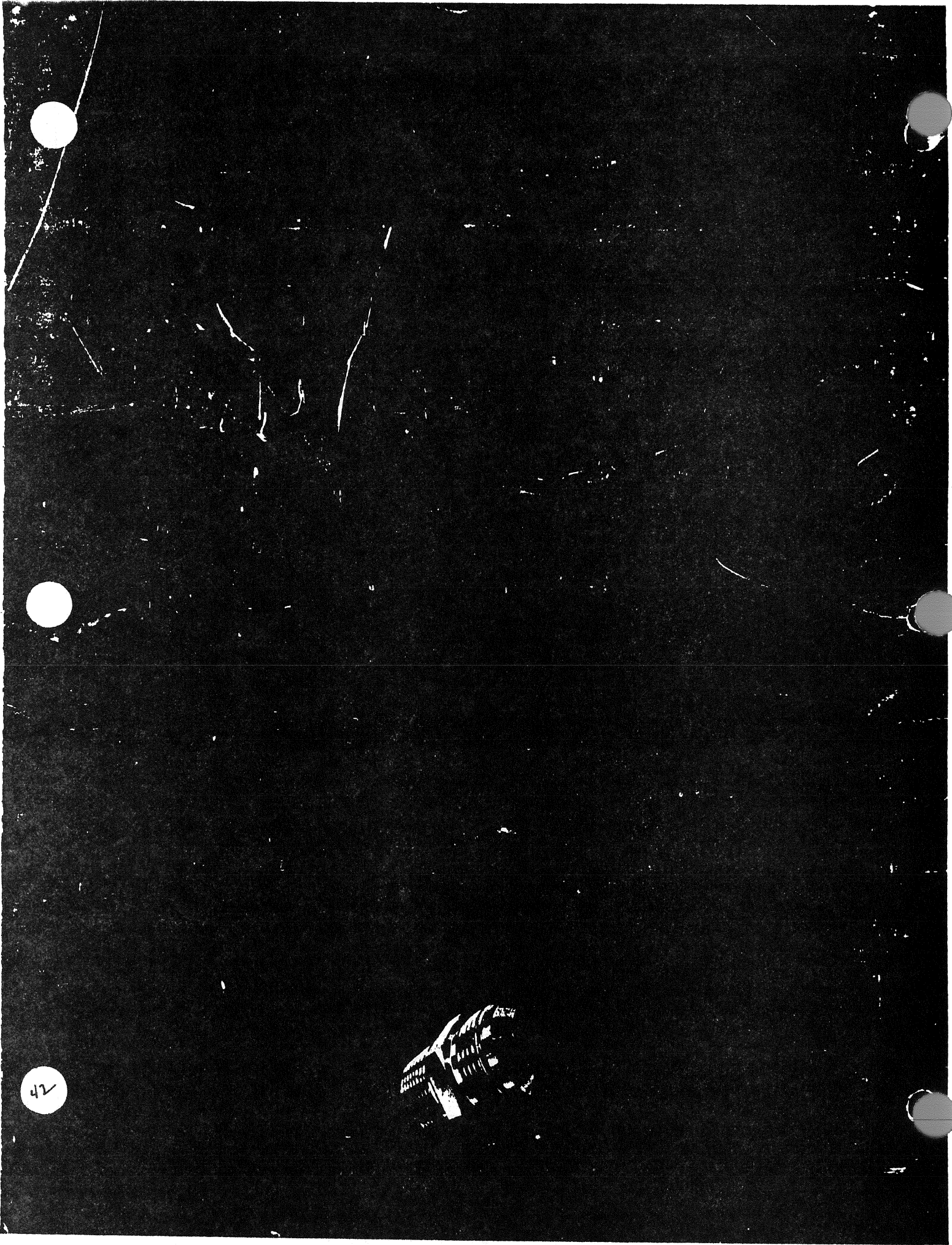
Fractional Inches	Decimal Inches	Fractional Inches	Decimal Inches	Fractional Inches	Decimal Inches
1/64	.015625	23/64	.359375	45/64	.6875
1/32	.03125	25/64	.390625	47/64	.734375
3/64	.046875	13/32	.40625	23/32	.71875
1/16	.0625	27/64	.421875	3/4	.750
5/64	.078125	7/16	.4375	49/64	.765625
3/32	.09375	29/64	.453125	25/32	.781250
7/64	.109375	15/32	.46875	51/64	.796875
1/8	.125	31/64	.484375	13/16	.8125
9/64	.140625	33/64	.515625	53/64	.828125
5/32	.15625	35/64	.53125	27/32	.84375
11/64	.171875	37/64	.546875	55/64	.859375
3/16	.1875	39/64	.5625	7/8	.8750
13/64	.203125	19/32	.578125	57/64	.890625
7/32	.21875	39/64	.59375	29/32	.90625
15/64	.234375	41/64	.609375	59/64	.921875
1/4	.250	43/64	.625	15/16	.9375
17/64	.265625	21/32	.640625	61/64	.953125
9/32	.28125		.65625	31/32	.96875
19/64	.296875		.671875	63/64	.984375
5/16	.3125				
328125					
.34375					

Stainless Steel Weight Chart

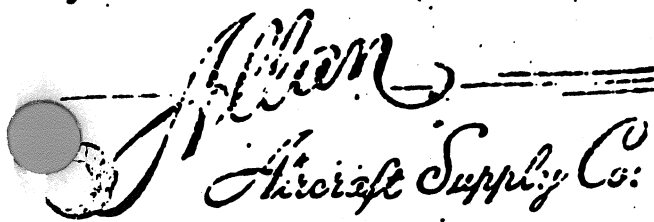
Weights shown in table are for individual fitting parts. To get total weight of assembled fitting, add nut and sleeve weights to body weight.

APPROXIMATE WEIGHTS (in pounds)

SIZE NO	AA57008	AA57013	AA57020	AA57021	AA57027	AA57010	AA57011	AA57023	AA57011	AA57012	AA57015	AA57018	AA57024	AA57025	AA57017	AA57018	AA57019	AA57024	AA57025	AA57025	AA57022	AA57023
2	.022	.042	.027	.036	.030	.022	.067	.029	.039	.030	.064	.108	.030	.060	.037	.066	.064		.011	.014	.008	.0018
3	.028	.046	.030	.042	.033	.025	.070	.037	.047	.042	.086	.110	.045	.070	.045	.087	.086		.014	.017	.014	.0023
4	.030	.049	.034	.042	.047	.033	.075	.050	.064	.070	.098	.112	.067	.112	.070	.078	.078		.026	.024	.025	.0035
4-4	.042	.090			.059	.063	.156															
5	.036	.047	.041	.060	.056	.047	.075	.067	.072	.081	.103	.118	.095	.120	.081	.100	.099		.032	.031	.030	.0041
5-4	.048	.093			.067	.069																
6	.047	.093	.056	.072	.087	.081	.150	.078	.081	.120	.189	.218	.098	.115	.114	.123	.111		.040	.044	.037	.006
6-2	.047				.078	.062	.088															
6-4																						
6-6	.070	.138			.101	.107	.218												.025			
6-8	.095				.126	.156																
8	.100	.156	.113	.134	.183	.117	.234	.192	.117	.238	.276	.318	.120	.323	.207	.277	.244		.069	.073	.061	.013
8-4	.092				.180	.127	.162															
8-6																			.037			
8-8	.157				.260	.200	.397												.037			
8-12	.194				.365	.303																
10	.168	.266	.176	.204	.263	.179	.398	.289	.361	.360	.468	.539	.378	.495	.319	.394	.341		.104	.132	.087	.017
10-6	.154				.274	.208																
12	.266	.406	.296	.365	.400	.316	.550	.436	.540	.554	.755	.868	.604	.786	.481	.458	.549		.060			
12-4																						
12-6																				.075		
12-8	.241				.375	.300	.390													.077		
16	.397	.533	.398	.467	.658	.470	1.125	.659	.868	.868	1.375	1.432	.826	1.080	.865	.946	.775		.094			
16-12	.333				.813	.460																
20	.610	.907	.608	.669	1.008	.644	1.375	1.162	1.470	1.260	1.790	2.063	1.420	1.830	.926	1.265	1.164		.141			
1	.880	1.000	.827	.874	1.415		3.480	1.528	1.629	1.960	4.350	5.000	1.696	2.520	1.282	1.890	1.738		.085	.470	.506	.086
28	.896		1.424	1.484	1.980	1.316		2.150	2.608	2.296			2.567	4.750	1.990	3.710	3.413		1.117	1.100	.936	.183
32	1.176		1.939	2.100	2.324	1.624		2.794	3.080	2.716			2.996	6.900	2.360	4.303	3.595		1.721	1.430	1.383	.246



42



MANUFACTURERS AN. MS AND SPECIAL FITTINGS
"SPECIALISTS IN STAINLESS STEEL"

11643 11644 11645 11646 11647 11648 11649 11650 11651 11652 11653 11654 11655 11656 11657 11658 11659 11660 11661 11662 11663 11664 11665 11666 11667 11668 11669 11670 11671 11672 11673 11674 11675 11676 11677 11678 11679 11680 11681 11682 11683 11684 11685 11686 11687 11688 11689 11690 11691 11692 11693 11694 11695 11696 11697 11698 11699 11700 11701 11702 11703 11704 11705 11706 11707 11708 11709 11710 11711 11712 11713 11714 11715 11716 11717 11718 11719 11720 11721 11722 11723 11724 11725 11726 11727 11728 11729 11730 11731 11732 11733 11734 11735 11736 11737 11738 11739 11740 11741 11742 11743 11744 11745 11746 11747 11748 11749 11750 11751 11752 11753 11754 11755 11756 11757 11758 11759 11760 11761 11762 11763 11764 11765 11766 11767 11768 11769 11770 11771 11772 11773 11774 11775 11776 11777 11778 11779 11780 11781 11782 11783 11784 11785 11786 11787 11788 11789 11790 11791 11792 11793 11794 11795 11796 11797 11798 11799 11800 11801 11802 11803 11804 11805 11806 11807 11808 11809 11810 11811 11812 11813 11814 11815 11816 11817 11818 11819 11820 11821 11822 11823 11824 11825 11826 11827 11828 11829 11830 11831 11832 11833 11834 11835 11836 11837 11838 11839 11840 11841 11842 11843 11844 11845 11846 11847 11848 11849 11850 11851 11852 11853 11854 11855 11856 11857 11858 11859 11860 11861 11862 11863 11864 11865 11866 11867 11868 11869 11870 11871 11872 11873 11874 11875 11876 11877 11878 11879 11880 11881 11882 11883 11884 11885 11886 11887 11888 11889 11890 11891 11892 11893 11894 11895 11896 11897 11898 11899 11900 11901 11902 11903 11904 11905 11906 11907 11908 11909 11910 11911 11912 11913 11914 11915 11916 11917 11918 11919 11920 11921 11922 11923 11924 11925 11926 11927 11928 11929 11930 11931 11932 11933 11934 11935 11936 11937 11938 11939 11940 11941 11942 11943 11944 11945 11946 11947 11948 11949 11950 11951 11952 11953 11954 11955 11956 11957 11958 11959 11960 11961 11962 11963 11964 11965 11966 11967 11968 11969 11970 11971 11972 11973 11974 11975 11976 11977 11978 11979 11980 11981 11982 11983 11984 11985 11986 11987 11988 11989 11990 11991 11992 11993 11994 11995 11996 11997 11998 11999 12000

EQUIVALENT PART NUMBERS FOR PARKER
TRIPLE-LOK 37° FLARED TUBE FITTING SERIES

BTX	AA67032	PNTX	AA67035
CBTX	AA67007	RBTX	AA67011
CCBTX	AA67008	R5BX	AA67026
CCCBTX	AA67009	R6BX	AA67030
C5BX	AA67024	SBTX	AA67012
C6BX	AA67028	S5BX	AA67027
D3TX	AA67014	S6BX	AA67031
EBTX	AA67003	TRBTX	AA67034
FBTX	AA67006	TX	AA67033
FF5BX	AA67023	T22X	AA67037
FNTX	AA67036	VBTX	AA67010
F5BX	AA67022	V5BX	AA67025
GBTX	AA67013	V6BX	AA67029
HBTX	AA67000	WBTX	AA67017
HHBTX	AA67002	WEBTX	AA67018
JBTX	AA67004	WGBTX	AA67039
KBTX	AA67005	WJBTX	AA67020
LHDTX	+ AA67001	WJJBTX	AA67021
MBTX	AA67015	WLH	AA67051
OBTX	AA67016	WNBTX	AA67019


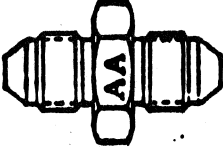
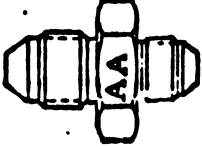
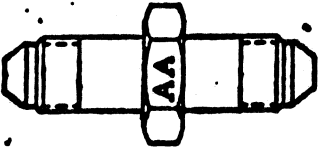
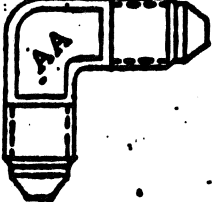
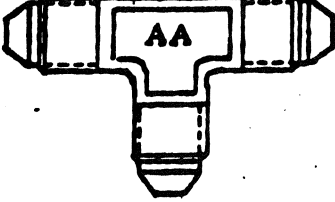
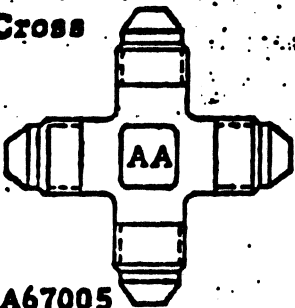
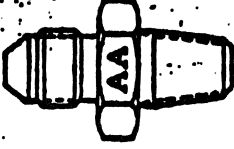
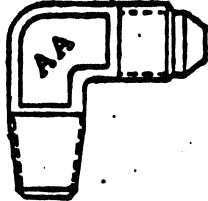
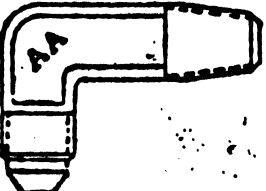
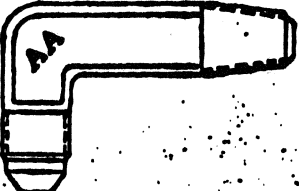
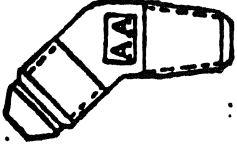
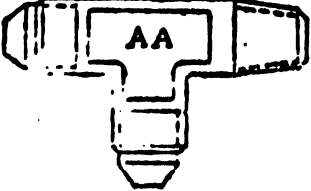
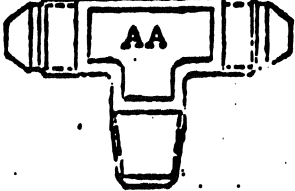
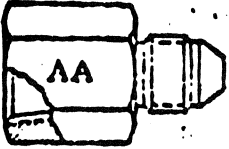


MANUFACTURERS AN, MS AND SPECIAL FITTINGS
"SPECIALISTS IN STAINLESS STEEL"

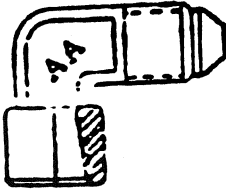
11643 VANOWEN ST. • NORTH HOLLYWOOD, CALIF. 91609 • TELEPHONE 677-6741 • 765-4992 • TVX 713-55289

EQUIVALENT PART NUMBERS FOR PARKER
ADAPTER FITTINGS - PIPE & STRAIGHT THREAD

CD	AA67044	PTR	AA67042
CD45°	AA67045	SHP	AA67043
DD	AA67046	AEG	AA67055
FF	AA67041	AE4G	AA67056
FG	AA67052	F5F5	AA67057
GG	AA67040	F5G	AA67054
HHP	AA67049	F5G5	AA67058
KMM00	AA67048	HP5N	AA67053
MMO	AA67047	P5N	AA67038

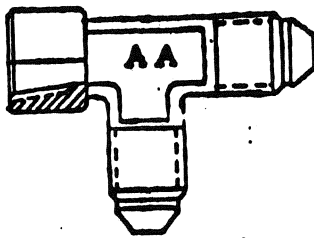
<p>Union - Small Hex</p>  <p>AA67000</p>	<p>Union - Large Hex</p>  <p>AA67001 Sheet 1</p>	<p>Union - Reducer</p>  <p>AA67001 Sheet 2</p>
<p>Union - Long</p>  <p>AA67002</p>	<p>Elbow - 90°</p>  <p>AA67003</p>	<p>Tee</p>  <p>AA67004</p>
<p>Cross</p>  <p>AA67005</p>	<p>Nipple - Tube to Pipe</p>  <p><i>ANSI-M-</i> AA67006</p>	<p>Elbow - Tube to Pipe</p>  <p>AA67007</p>
<p>Elbow-90°, Tube to Long Pipe</p>  <p>AA67008</p>	<p>Elbow-90°, Tube to Extra Long Pipe</p>  <p>AA67009</p>	<p>Elbow-45° Tube to Pipe</p>  <p>AA67010</p>
<p>Tee - Tube to Pipe</p>  <p>AA67011</p>	<p>Tee - Tube to Pipe</p>  <p>AA67012</p>	<p>Connector - Tube to Pipe</p>  <p>AA67013</p>

Elbow-
Tube to Pipe



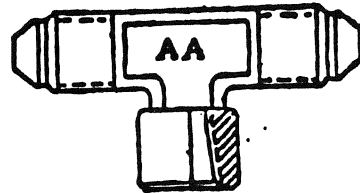
AA67014

Tee - Tube to Pipe



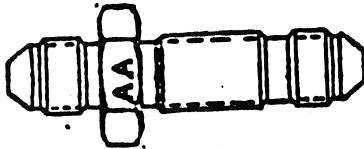
AA67015

Tee - Tube to Pipe



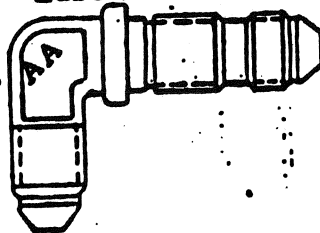
AA67016

Union
Tube to Bulkhead



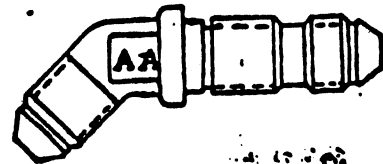
AA67017

Elbow, 90° -
Tube to Bulkhead



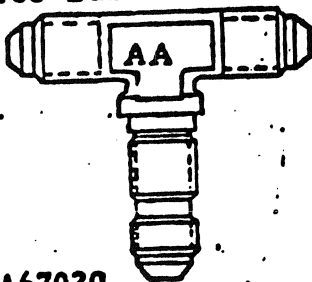
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Elbow, 45° -
Tube to Bulkhead



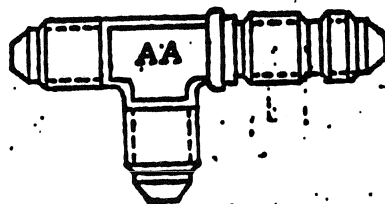
AA67019

Tee-Tube to Bulkhead



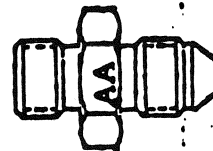
AA67020

Tee-Tube to Bulkhead



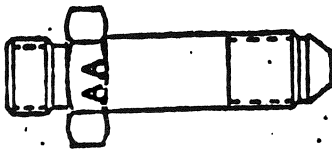
AA67021

Union - Tube, to
Short Boss Entry



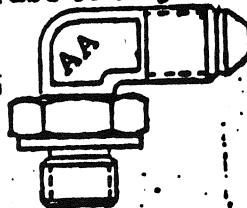
AA67022

Connector - Long
Straight Thread



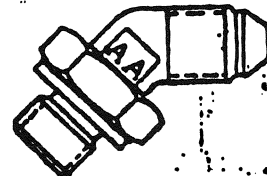
AA67023

Elbow Assy, 90° -
Tube to Adj. End



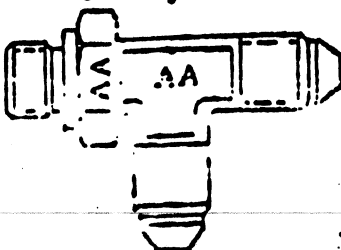
AA67024

Elbow Assy, 45° -
Tube to Adj. End



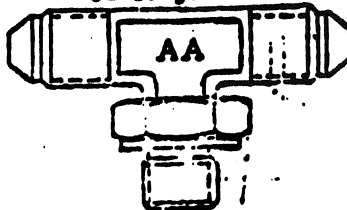
AA67025

Tee Assy - Tube
to Adj. End



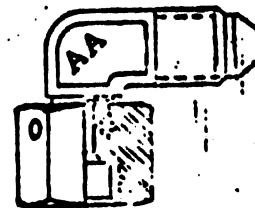
AA67026

Tee Assy - Tube
to Adj. End


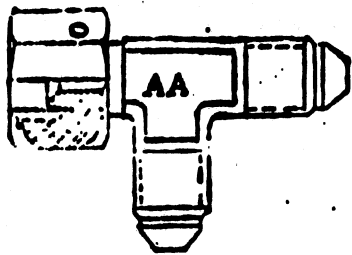
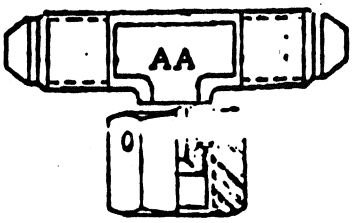



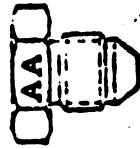
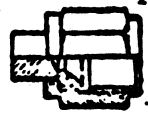



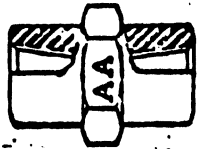
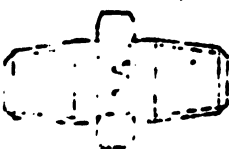




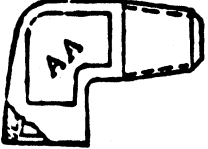
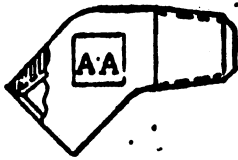
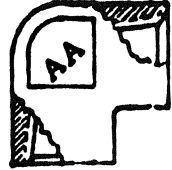
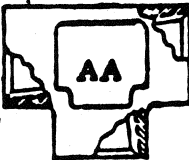
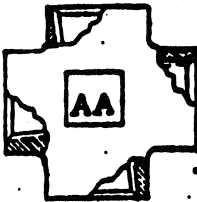

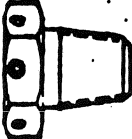

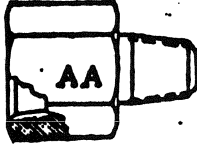

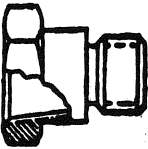

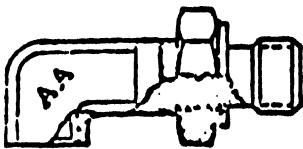
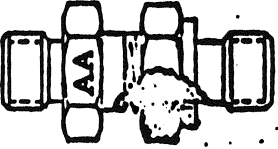
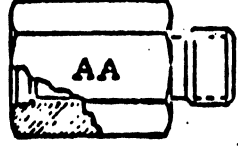
AA67027

Elbow, 90° - Swivel



AA67028

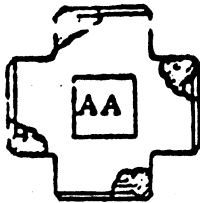
<p>Elbow, 45°, Swivel</p>  <p>AA67029</p>	<p>Tee - Swivel</p>  <p>AA67030</p>	<p>Tee - Swivel</p>  <p>AA67031</p>
<p>Nut - Coupling</p>  <p>AA67032</p>	<p>Sleeve</p>  <p>AA67033</p>	<p>Reducer - Tube</p>  <p>AA67034</p>
<p>Plug - Tube</p>  <p>AA67035</p>	<p>Cap Assembly</p>  <p>AA67036</p>	<p>Mounting Stud</p>  <p>AA67037</p>
<p>Plug - Screw Thread</p>  <p>AA67038</p>	<p>Connector - Tube Bulkhead to Pipe</p>  <p>AA67039</p>	<p>Coupling - Pipe Thread</p>  <p>AA67040</p>
<p>Nipple - Pipe Thread</p>  <p>AA67041</p>	<p>Bushing - Reducer</p>  <p>AA67042</p>	<p>Plug, Square Head - Pipe Thread</p>  <p>AA67043</p>

<p>Elbow, 90° - Pipe Thread</p>  <p>AA67044</p>	<p>Elbow, 45° - Pipe Thread</p>  <p>AA67045</p>	<p>Elbow, 90° - Pipe Thread</p>  <p>AA67046</p>
<p>Tee - Pipe Thread</p>  <p>AA67047</p>	<p>Cross - Pipe Thread</p>  <p>AA67048</p>	<p>Plug - Pipe Thread Hex Socket</p>  <p>AA67049</p>
<p>Plug - Pipe</p>  <p>AA67050</p>	<p>Bulkhead Nut</p>  <p>AA67051</p>	<p>Connector - Reduced Male Pipe</p>  <p>AA67052</p>
<p>Plug - Hex Socket</p>  <p>AA67053</p>	<p>Adaptor - Straight Thread to Pipe</p>  <p>AA67054</p>	<p>Elbow - Pipe to Adj. End</p>  <p>AA67055</p>
<p>Elbow - Pipe to Extra Long Adj. End</p>  <p>AA67056</p>	<p>Union - Adj. End</p>  <p>AA67057</p>	<p>Expander - Reducer Straight Thread</p>  <p>AA67058</p>

**ALLAN AIRCRAFT
SUPPLY CO.**

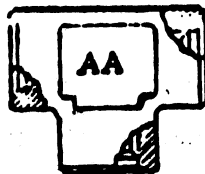
NORTH HOLLYWOOD
CALIFORNIA

**Cross - Straight
Thread**



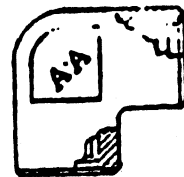
AA67059

**Tee - Straight
Thread**



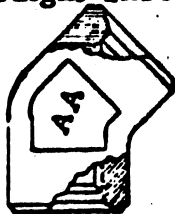
AA67060

**Elbow, 90° -
Straight Thread**



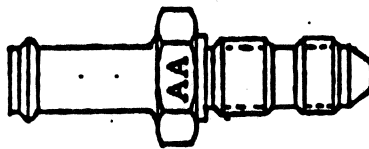
AA67061

**Elbow, 45° -
Straight Thread**



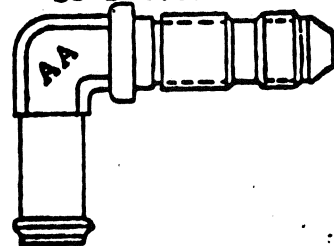
AA67062

**Adapter - Hose
to Universal**



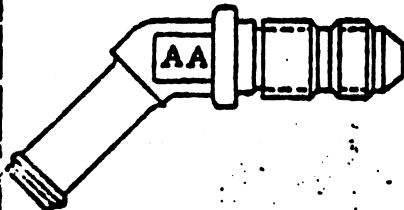
AA67063

**Elbow, 90° - Hose
to Universal**



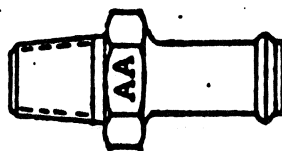
AA67064

**Elbow, 45° - Hose
to Universal**



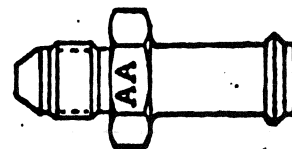
AA67065

**Adapter - Hose
to Pipe**



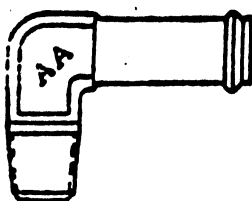
AA67066

**Adapter - Hose
to Tube**



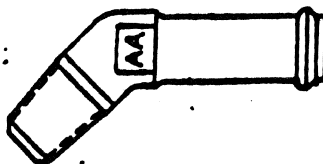
AA67067

**Elbow, 90° - Hose
to Pipe**



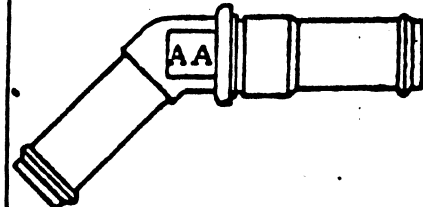
AA67068

**Elbow, 45° - Hose
to Pipe**



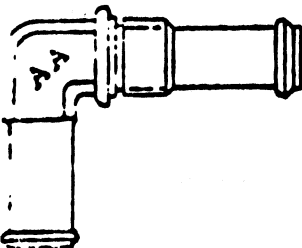
AA67069

**Elbow, 45°
Hose Bulkhead**



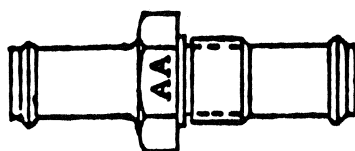
AA67070

**Elbow, 90°
Hose Bulkhead**



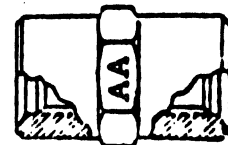
AA67071

**Connector - Hose,
Bulkhead**



AA67072

Coupling - Tube

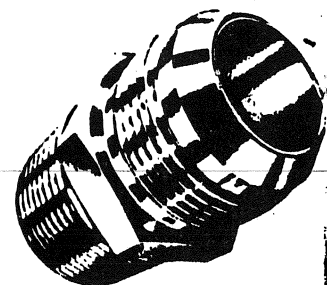


AA67073

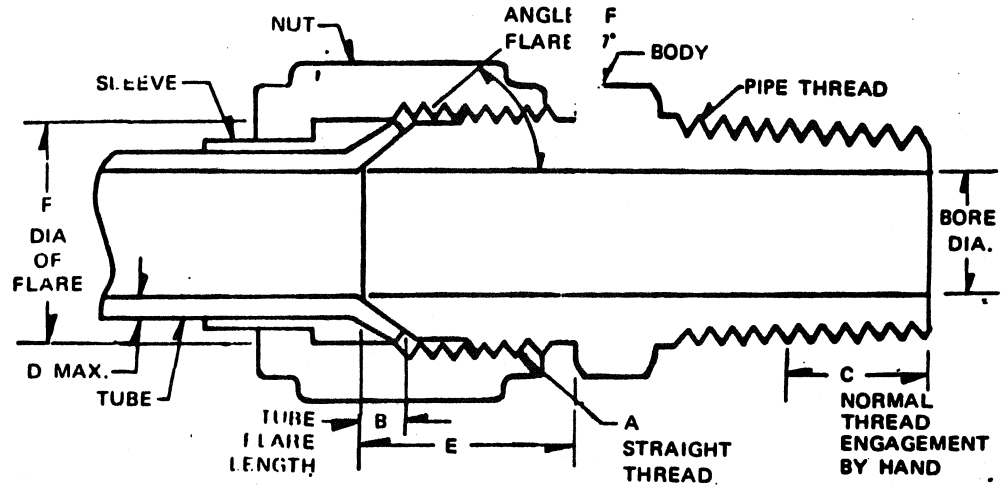


Pipe Thread Adapters Straight Thread Adapters

ALLAN AIRCRAFT	PARKER HANNIFIN	NUM. ATHERHEAD	DESCRIPTION
AA67040	GG	3321	PIPE CONNECTOR
AA67041	FF	3081	PIPE NIPPLE
AA67042	PTR	3121	PIPE THREAD REDUCER
AA67043	SHP	—	SQUARE HEAD PLUG
AA67044	CD	3421	STREET ELBOW
AA67045	CD45°	3371	STREET ELBOW 45°
AA67046	DD	3521	FEMALE PIPE ELBOW
AA67047	MMO	3721	FEMALE PIPE TEE
AA67048	KMMOO	3971	FEMALE PIPE CROSS
AA67049	HHP	—	HOLLOW HEX PIPE PLUG
AA67050	HP	—	HEX HEAD PIPE PLUG
AA67052	FG	3221	REDUCING CONNECTOR
AA67054	F5G	—	FEMALE PIPE ADAPTER
AA67055	AEG	—	FEMALE 90° ELBOW
AA67056	AE4G	—	LONG FEMALE 90° ELBOW
AA67057	F5F5	—	UNION
AA67058	F5G5	—	REDUCER EXPANDER
AA67073	—	—	TUBE COUPLING
AA67074	FFF	—	LONG PIPE NIPPLE
AA67075	CR	—	MALE PIPE ELBOW
AA67076	DD45°	—	FEMALE PIPE ELBOW 45°
AA67077	MMS	—	MALE BRANCH TEE
AA67078	MRO	—	STREET TEE
AA67079	RRS	—	MALE PIPE TEE
AA67096	F5F	—	ADAPTER





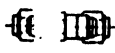
















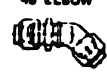











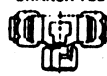











































FLARE TUBE CONNECTION



SIZE	TUBE O.D.	FLARE O.D.	BORE DIA.	THREAD	B	C	D	E	F
2	1/8	1/8	.062	5/16-24	.09	.26	.035	.45	.224
3	3/16	1/8	.125	3/8-24	.09	.26	.035	.48	.290
4	1/4	1/8	.172	1/2-20	.11	.26	.065	.55	.359
4-4	1/4	1/4	.172	1/2-20	.11	.40	.065	.55	.359
4-6	1/4	3/8	.172	1/2-20	.11	.40	.065	.55	.359
4-8	1/4	1/2	.172	1/2-20	.11	.53	.065	.55	.359
5	5/16	1/8	.234	1/2-20	.11	.26	.065	.55	.421
5-4	5/16	1/4	.234	1/2-20	.11	.40	.065	.55	.421
6	3/8	1/4	.297	5/8-18	.13	.40	.065	.56	.484
6-2	3/8	1/8	.297	5/8-18	.13	.26	.065	.56	.484
6-6	3/8	3/8	.297	5/8-18	.13	.40	.065	.56	.484
6-8	3/8	1/2	.297	5/8-18	.13	.53	.065	.56	.484
8	1/2	3/8	.391	3/4-16	.16	.40	.083	.66	.656
8-4	1/2	1/4	.391	3/4-16	.16	.40	.083	.66	.656
8-8	1/2	1/2	.391	3/4-16	.16	.53	.083	.66	.656
8-12	1/2	3/4	.391	3/4-16	.16	.54	.083	.66	.656
8-16	1/2	1	.391	3/4-16	.16	.68	.083	.66	.656
10	5/8	1/2	.484	7/8-14	.19	.53	.095	.76	.781
10-6	5/8	3/8	.484	7/8-14	.19	.40	.095	.76	.781
10-12	5/8	3/4	.484	7/8-14	.19	.54	.095	.76	.781
12	3/4	3/4	.609	1 1/8-12	.22	.54	.109	.86	.937
12-4	3/4	1/4	.609	1 1/8-12	.22	.40	.109	.86	.937
12-6	3/4	3/8	.609	1 1/8-12	.22	.40	.109	.86	.937
12-8	3/4	1/2	.609	1 1/8-12	.22	.53	.109	.86	.937
12-16	3/4	1	.609	1 1/8-12	.22	.68	.109	.86	.937
16	1	1	.844	1 5/8-12	.22	.68	.120	.91	1.187
16-8	1	1/2	.844	1 5/8-12	.22	.53	.120	.91	1.187
16-12	1	3/4	.844	1 5/8-12	.22	.54	.120	.91	1.187
20	1 1/4	1 1/4	1.078	1 5/8-12	.25	.70	.120	.96	1.500
20-16	1 1/4	1	1.078	1 5/8-12	.25	.68	.120	.96	1.500
24	1 1/2	1 1/2	1.312	1 7/8-12	.25	.72	.120	1.08	1.721
24-20	1 1/2	1 1/4	1.312	1 7/8-12	.25	.70	.120	1.08	1.721
28	1 3/4	1 1/2	1.547	2 1/4-12	.31	.72	.120	1.21	2.106
32	2	2	1.781	2 1/2-12	.34	.75	.134	1.33	2.356

FITTING LOCATOR

CATALOG 4753

AA87000 UNION  PAGE 5	AA87001 LARGE HEX UNION  PAGE 4	AA87002 LONG UNION  PAGE 5	AA87003 UNION ELBOW  PAGE 5	AA87004 ION TEE  PAGE 6	AA87005 UNION CROSS  PAGE 6	AA87006 MALE CONNECTOR  PAGE 7
AA87007 MALE ELBOW  PAGE 8	AA87008 LONG MALE ELBOW  PAGE 8	AA87009 EXTRA LONG MALE ELBOW  PAGE 9	AA87010 MALE 45° ELBOW  PAGE 9	AA87011 MALE RUN TEE  PAGE 10	AA87012 MALE BRANCH TEE  PAGE 10	AA87013 FEMALE CONNECTOR  PAGE 11
AA87014 FEMALE ELBOW  PAGE 11	AA87015 FEMALE RUN TEE  PAGE 12	AA87016 FEMALE BRANCH TEE  PAGE 12	AA87017 BULKHEAD UNION  PAGE 12	AA87018 BULKHEAD ELBOW  PAGE 13	AA87019 BULKHEAD 45° ELBOW  PAGE 13	AA87020 BULKHEAD BRANCH TEE  PAGE 14
AA87021 BULKHEAD RUN TEE  PAGE 14	AA87022 STRAIGHT THREAD CONNECTOR  PAGE 15	AA87023 STRAIGHT THREAD LONG CONNECTOR  PAGE 14	AA87024 STRAIGHT THREAD ELBOW  PAGE 15	AA87025 STRAIGHT THREAD 45° ELBOW  PAGE 16	AA87026 STRAIGHT THREAD RUN TEE  PAGE 16	AA87027 STRAIGHT THREAD BRANCH TEE  PAGE 16
AA87028 SWIVEL NUT ELBOW  PAGE 17	AA87029 SWIVEL NUT 45° ELBOW  PAGE 17	AA87030 SWIVEL NUT RUN TEE  PAGE 17	AA87031 SWIVEL NUT BRANCH TEE  PAGE 18	AA87032 NUT  PAGE 20	AA87033 SLEEVE  PAGE 20	AA87034 TUBE END REDUCER  PAGE 21
AA87035 PLUG  PAGE 20	AA87036 CAP  PAGE 21	AA87037 MOUNTIE  PAGE 21	AA87038 HEX HEAD PLUG  PAGE 22	AA87039 FEMALE BULKHEAD CONNECTOR  PAGE 23	AA87040 PIPE CONNECTOR  PAGE 26	AA87041 PIPE NIPPLE  PAGE 26
AA87042 PIPE THREAD REDUCER  PAGE 27	AA87043 SQUARE HEAD PLUG  PAGE 27	AA87044 STREET ELBOW  PAGE 28	AA87045 STREET ELBOW 45°  PAGE 28	AA87046 FEMALE PIPE ELBOW  PAGE 28	AA87047 FEMALE PIPE TEE  PAGE 29	AA87048 FEMALE PIPE CROSS  PAGE 30
AA87049 HOLLOW HEX PIPE PLUG  PAGE 30	AA87050 HEX HEAD PIPE PLUG  PAGE 30	AA87051 BULKHEAD LOCKNUT  PAGE 31	AA87052 REDUCING CONNECTOR  PAGE 30	AA87053 HOLLOW HEX PLUG  PAGE 22	AA87054 FEMALE PIPE ADAPTER  PAGE 24	AA87055 FEMALE 90° ELBOW  PAGE 24
AA87056 LONG FEMALE 90° ELBOW  PAGE 24	AA87057 UNION  PAGE 25	AA87058 REDUCER EXPANDER  PAGE 25	AA87059 TUBE COUPLING  PAGE 23	AA87060 LONG PIPE NIPPLE  PAGE 27	AA87076 MALE PIPE ELBOW  PAGE 28	AA87075 FEMALE PIPE ELBOW 45°  PAGE 29
AA87077 MALE BRANCH TEE  PAGE 28	AA87078 STREET TEE  PAGE 29	AA87079 MALE PIPE TEE  PAGE 30	AA87080 LARGE HEX HEAD PLUG  PAGE 22	AA87081 SWIVEL NUT UNION  PAGE 18	AA87082 DOUBLE SWIVEL NUT UNION  PAGE 19	AA87083 DOUBLE SWIVEL NUT ELBOW  PAGE 18
AA87084 DOUBLE SWIVEL NUT TEE  PAGE 18	AA81000 WELD BOSS  PAGE 31			O-RING DETAIL  PAGE 19	WEIGHT CHART  PAGE 31	AND 8 SAE BOSS DETAIL  PAGE 32

ORDER ALLAN AIRCRAFT FITTINGS BY PART NUMBER AS LISTED IN THIS CATALOG

EXAMPLE: Fitting needed - 316 stainless steel tube union for 1" O.D. tube with mating "B" nuts and sleeves.

PART NUMBER:**AA67001-16KAL****Allan Aircraft Industrial Fitting**

Featuring 3 piece design incorporating body, nut and free floating sleeve.

Body Pattern Designator

001 = 37° flared union. Body designs available from stock include adapters, unions, elbows, tees, crosses.

Connection Size

-16 = 1" O.D. tube. Connection tube and pipe sizes stocked from -2 through -32 (tube sizes are determined by the number of sixteenths of an inch in the tube O.D. Pipe sizes by the number of eighths of an inch.)

Material

Type 316 stainless steel. Most fittings can be supplied from stock in the following alloys:

J - 304ss	M - Monel
K - 316ss	T - Titanium
S - 347ss	D - Aluminum

Assembly

With Mating "B" Nuts And Sleeves
Omit "A" to order fitting body only

Lockwire Holes

"B" Nut And Swivel Nut Drilled For Lockwire

SPECIFICATIONS:

Allan Aircraft fittings conform to standards set by:
S.A.E. - Society of Automotive Engineers
J.I.C. - Joint Industry Conference on Hydraulic Standards
MIL-F-5506 - Performance Standards
MIL-F-18866 - "Fittings, Flared Tube, 37° Degree,"
approved by the Department of Defense
for use by the Departments of the
Army, the Navy, and the Air Force.

THREADS:

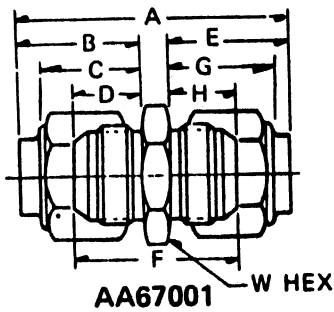
Straight threads - unified class 2A and 2B
Pipe threads - Dryseal American (National)
standard taper (N.P.T.F.)

SPECIAL FITTINGS:

Fittings in various materials or size combinations can be manufactured for your needs.

4 37° FLARED TUBE FITTINGS

CATALOG 4730



LARGE HEX UNION - REDUCING UNION
flared tube ends

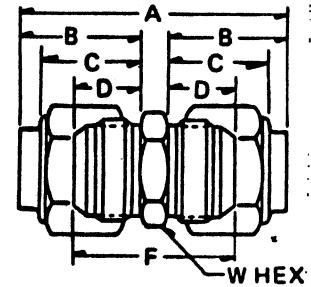
AA67001 - W HEX

PART NUMBER	TUBE O.D.	TUBE O.D.	A*	B*	C*	D	E*	F	G*	H	W
AA67001-2KA	1/8	1/8	1.79	.76	.64	.45	.76	1.20	.64	.45	9/16
AA67001-3KA	3/16	3/16	1.97	.85	.73	.48	.85	1.23	.72	.48	5/8
AA67001-4KA	1/4	1/4	2.09	.91	.74	.55	.91	1.27	.74	.55	11/16
AA67001-4-2KA	1/4	1/8	1.95	.91	.74	.55	.76	1.25	.64	.45	11/16
AA67001-4-3KA	1/4	3/16	2.04	.91	.74	.55	.85	1.28	.73	.48	11/16
AA67001-5KA	5/16	5/16	2.19	.96	.85	.55	.96	1.27	.85	.55	3/4
AA67001-5-4KA	5/16	1/4	2.19	.96	.85	.55	.91	1.36	.74	.55	3/4
AA67001-6KA	3/8	3/8	2.35	1.03	.84	.56	1.03	1.39	.84	.56	13/16
AA67001-6-4KA	3/8	1/4	2.30	1.03	.84	.56	.91	1.41	.74	.55	13/16
AA67001-8KA	1/2	1/2	2.62	1.16	.97	.66	1.16	1.58	.97	.66	1
AA67001-8-4KA	1/2	1/4	2.48	1.16	.97	.66	.91	1.53	.74	.55	1
AA67001-8-6KA	1/2	3/8	2.57	1.16	.97	.66	1.03	1.53	.84	.56	1
AA67001-10KA	5/8	5/8	3.18	1.41	1.14	.76	1.41	1.84	1.14	.76	1 1/8
AA67001-10-4KA	5/8	1/4	2.72	1.41	1.14	.76	.91	1.66	.74	.55	1 1/8
AA67001-10-6KA	5/8	3/8	2.81	1.41	1.14	.76	1.03	1.66	.84	.56	1 1/8
AA67001-10-8KA	5/8	1/2	2.96	1.41	1.14	.76	1.16	1.75	.97	.66	1 1/8
AA67001-12KA	3/4	3/4	3.38	1.47	1.22	.86	1.47	2.12	1.22	.86	1 3/8
AA67001-12-4KA	3/4	1/4	2.88	1.47	1.22	.86	.91	1.80	.74	.55	1 3/8
AA67001-12-6KA	3/4	3/8	2.97	1.47	1.22	.86	1.03	1.80	.84	.56	1 3/8
AA67001-12-8KA	3/4	1/2	3.12	1.47	1.22	.86	1.16	1.89	.97	.66	1 3/8
AA67001-16KA	1	1	3.75	1.66	1.29	.91	1.66	2.20	1.29	.91	1 5/8
AA67001-16-4KA	1	1/4	3.02	1.66	1.29	.91	.91	1.84	.74	.55	1 5/8
AA67001-16-6KA	1	3/8	3.33	1.66	1.29	.91	1.03	2.06	.84	.56	1 5/8
AA67001-16-8KA	1	1/2	3.49	1.66	1.29	.91	1.16	2.16	.97	.66	1 5/8
AA67001-16-12KA	1	3/4	3.62	1.66	1.29	.91	1.47	2.16	1.22	.86	1 5/8
AA67001-20KA	1 1/4	1 1/4	3.89	1.75	1.36	.96	1.75	2.30	1.36	.96	1 7/8
AA67001-20-4KA	1 1/4	1/4	3.17	1.75	1.36	.96	.91	1.89	.74	.55	1 7/8
AA67001-20-8KA	1 1/4	1/2	3.41	1.75	1.36	.96	1.16	1.98	.97	.66	1 7/8
AA67001-20-12KA	1 1/4	3/4	3.81	1.75	1.36	.96	1.47	2.25	1.22	.86	1 7/8
AA67001-20-16KA	1 1/4	1	3.91	1.75	1.36	.96	1.66	2.25	1.29	.91	1 7/8
AA67001-24KA	1 1/2	1 1/2	4.85	2.13	1.58	1.08	2.13	2.55	1.58	1.08	2 1/8
AA67001-24-16KA	1 1/2	1	4.24	2.13	1.58	1.08	1.66	2.36	1.29	.91	2 1/8
AA67001-24-20KA	1 1/2	1 1/4	4.39	2.13	1.58	1.08	1.75	2.41	1.36	.96	2 1/8
AA67001-28KA	1 3/4	1 3/4	4.97	2.28	1.78	1.21	2.28	2.83	1.78	1.21	2 1/2
AA67001-32KA	2	2	5.48	2.41	1.90	1.33	2.41	3.08	1.90	1.33	2 3/4
AA67001-32-16KA	2	1	4.53	2.41	1.90	1.33	1.66	2.61	1.29	.91	2 3/4
AA67001-32-24KA	2	1 1/2	5.02	2.41	1.90	1.33	2.13	2.78	1.58	1.08	2 3/4

*Average values
+Material K 316SS. See page 4 for additional materials and ordering information
Omit "A" from part number to order body only
Additional size combinations available

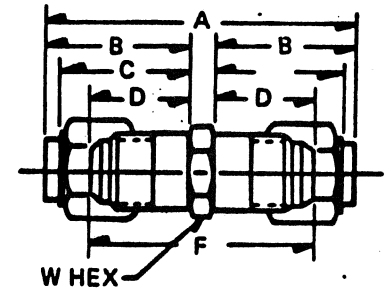
37° FLARED TUBE FITTINGS

PART NUMBER	FLARE SIZE	A	B	C	D	E	F	W
AA67000-2KA	1/8	1.79	.76	.64	.45	1.17	3/16	
AA67000-3KA	3/16	1.97	.85	.73	.48	1.23	1/8	
AA67000-4KA	1/4	2.09	.91	.74	.55	1.37	1/2	
AA67000-5KA	5/16	2.19	.96	.85	.55	1.37	9/16	
AA67000-6KA	3/8	2.35	1.03	.84	.56	1.41	5/8	
AA67000-8KA	1/2	2.62	1.16	.97	.66	1.62	13/16	
AA67000-10KA	5/8	3.18	1.41	1.14	.76	1.88	15/16	
AA67000-12KA	3/4	3.38	1.47	1.22	.86	2.16	1 1/8	
AA67000-16KA	1	3.75	1.66	1.29	.91	2.25	1 3/8	
AA67000-20KA	1 1/4	3.89	1.75	1.36	.96	2.43	1 7/8	
AA67000-24KA	1 1/2	4.85	2.13	1.58	1.08	2.75	2	
AA67000-28KA	1 3/4	4.97	2.28	1.78	1.21	2.83	2 3/8	
AA67000-32KA	2	5.48	2.41	1.90	1.33	3.40	2 5/8	



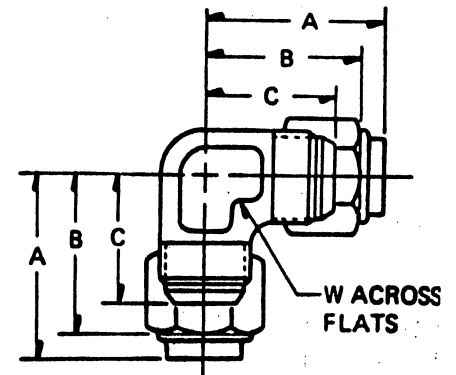
AA67000
UNION
flared tube ends

PART NUMBER	FLARE SIZE	A	B	C	D	E	F	W
AA67002-2KA	1/8	2.15	.95	.83	.64	1.53	3/16	
AA67002-3KA	3/16	2.40	1.07	.95	.70	1.66	1/8	
AA67002-4KA	1/4	2.50	1.13	.96	.77	1.78	1/2	
AA67002-5KA	5/16	2.73	1.24	1.13	.83	1.91	9/16	
AA67002-6KA	3/8	3.06	1.39	1.20	.92	2.12	5/8	
AA67002-8KA	1/2	3.50	1.61	1.42	1.11	2.50	13/16	
AA67002-10KA	5/8	4.21	1.93	1.66	1.28	2.91	15/16	
AA67002-12KA	3/4	4.53	2.06	1.81	1.45	3.31	1 1/8	
AA67002-16KA	1	5.13	2.36	2.00	1.61	3.63	1 3/8	
AA67002-20KA	1 1/4	5.70	2.60	2.23	1.81	4.13	1 7/8	
AA67002-24KA	1 1/2	6.76	3.08	2.53	2.03	4.66	2	
AA67002-28KA	1 3/4	7.74	3.68	3.18	2.62	5.62	2 3/8	
AA67002-32KA	2	8.31	3.78	3.28	2.70	6.13	2 5/8	



AA67002
LONG UNION
flared tube ends

PART NUMBER	FLARE SIZE	A	B	C	D	E	F	W
AA67003-2KA	1/8	1.08	.96	.77	5/16			
AA67003-3KA	3/16	1.20	1.08	.83	3/8			
AA67003-4KA	1/4	1.25	1.08	.89	1/2			
AA67003-5KA	5/16	1.36	1.25	.95	9/16			
AA67003-6KA	3/8	1.53	1.34	1.06	5/8			
AA67003-8KA	1/2	1.75	1.56	1.25	3/4			
AA67003-10KA	5/8	2.10	1.83	1.45	7/8			
AA67003-12KA	3/4	2.27	2.02	1.66	1 1/8			
AA67003-16KA	1	2.56	2.21	1.81	1 3/8			
AA67003-20KA	1 1/4	2.85	2.48	2.06	1 7/8			
AA67003-24KA	1 1/2	3.38	2.85	2.33	2			
AA67003-28KA	1 3/4	3.88	3.38	2.81	2 1/4			
AA67003-32KA	2	4.14	3.65	3.06	2 5/8			



AA67003
UNION ELBOW
flared tube ends

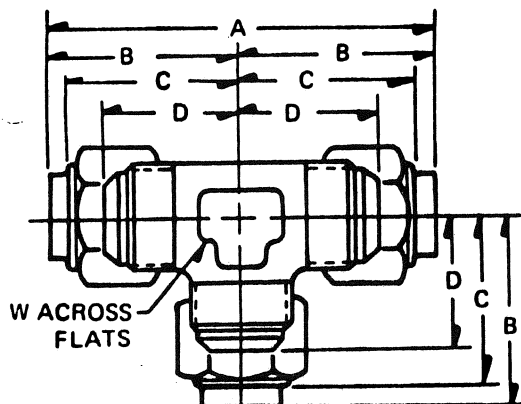
*Average values

+Material K 316SS. See page 3 for additional materials and ordering information

Omit "A" from part number to order body only

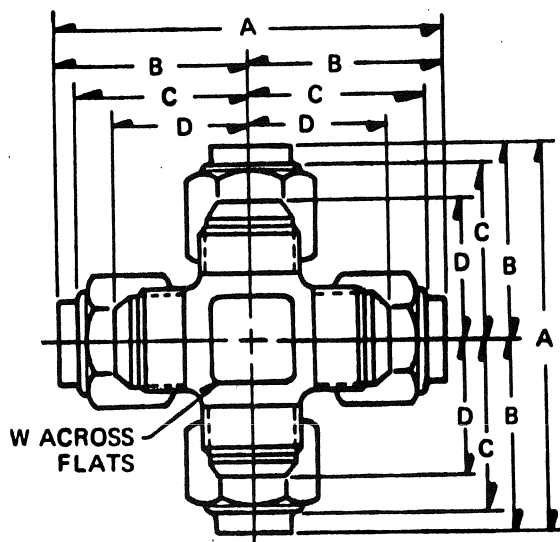
Additional size combinations available

37° FLARED TUBE FITTINGS



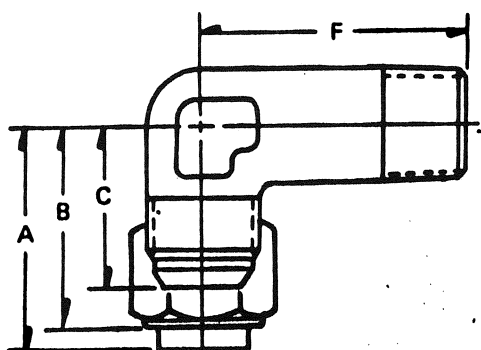
AA67004
UNION TEE
flared tube ends

PART NUMBER	TUBE O.D.	A*	B*	C*	D*	W
AA67004-2KA	1/8	2.16	1.08	.96	.77	5/16
AA67004-3KA	3/16	2.40	1.20	1.08	.83	3/8
AA67004-4KA	1/4	2.50	1.25	1.08	.89	7/16
AA67004-5KA	5/16	2.72	1.36	1.25	.95	1/2
AA67004-6KA	3/8	3.06	1.53	1.34	1.06	9/16
AA67004-8KA	1/2	3.50	1.75	1.56	1.25	3/4
AA67004-10KA	5/8	4.20	2.10	1.83	1.45	7/8
AA67004-12KA	3/4	4.54	2.27	2.02	1.66	1 1/16
AA67004-16KA	1	5.12	2.56	2.21	1.81	1 5/16
AA67004-20KA	1 1/4	5.72	2.86	2.48	2.06	1 9/16
AA67004-24KA	1 1/2	6.76	3.38	2.85	2.33	1 7/8
AA67004-28KA	1 3/4	7.76	3.88	3.38	2.81	2 1/4
AA67004-32KA	2	8.28	4.14	3.65	3.06	2 9/16



AA67005
UNION CROSS
flared tube ends

PART NUMBER	TUBE O.D.	A*	B*	C*	D*	W
AA67005-2KA	1/8	2.16	1.08	.96	.77	5/16
AA67005-3KA	3/16	2.40	1.20	1.08	.83	3/8
AA67005-4KA	1/4	2.50	1.25	1.08	.89	7/16
AA67005-5KA	5/16	2.72	1.36	1.25	.95	1/2
AA67005-6KA	3/8	3.06	1.53	1.34	1.06	9/16
AA67005-8KA	1/2	3.50	1.75	1.56	1.25	3/4
AA67005-10KA	5/8	4.20	2.10	1.83	1.45	7/8
AA67005-12KA	3/4	4.54	2.27	2.02	1.66	1 1/16
AA67005-16KA	1	5.12	2.56	2.21	1.81	1 5/16
AA67005-20KA	1 1/4	5.72	2.86	2.48	2.06	1 9/16
AA67005-24KA	1 1/2	6.76	3.38	2.85	2.33	1 7/8
AA67005-28KA	1 3/4	7.76	3.88	3.38	2.81	2 1/4
AA67005-32KA	2	8.28	4.14	3.65	3.06	2 9/16



AA67008
LONG MALE ELBOW
flared tube end- long male pipe end

PART NUMBER +	TUBE O.D.	MALE PIPE THREAD	A*	B*	C*	F
AA67008-2KA	1/8	1/8	1.08	.96	.77	1.00
AA67008-3KA	3/16	1/8	1.20	1.08	.83	1.03
AA67008-4KA	1/4	1/8	1.25	1.08	.89	1.19
AA67008-5KA	5/16	1/8	1.36	1.25	.95	1.22
AA67008-6KA	3/8	1/4	1.53	1.34	1.06	1.56
AA67008-8KA	1/2	3/8	1.75	1.56	1.25	1.78
AA67008-10KA	5/8	1/2	2.10	1.83	1.45	2.16
AA67008-12KA	3/4	3/4	2.27	2.02	1.66	2.41
AA67008-16KA	1	1	2.56	2.21	1.81	2.97
AA67008-20KA	1 1/4	1 1/4	2.86	2.48	2.06	3.66
AA67008-24KA	1 1/2	1 1/2	3.38	2.85	2.33	4.06
AA67008-28KA	1 3/4	1 1/2	3.88	3.38	2.81	4.47
AA67008-32KA	2	2	4.14	3.65	3.06	4.81

*Average values

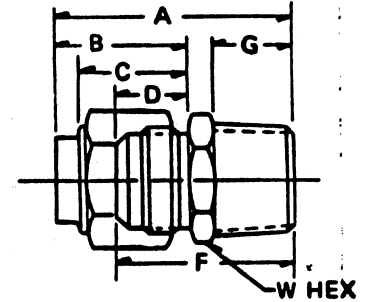
+Material K 316SS. See page 3 for additional materials and ordering information

Omit "A" from part number to order body only

Additional size combinations available

37° FLARED TUBE FITTINGS 7

AA67006
MALE CONNECTOR
 flared tube end-
 male pipe end



PART NUMBER	TUBE O.D.	MALE PIPE THREAD	A	B	C	D	F	G	W
AA67006-2KA	1/8	1/8	1.42	.76	.64	.45	1.04	.38	1/16
AA67006-3KA	3/16	1/8	1.50	.85	.73	.48	1.06	.38	1/16
AA67006-4KA	1/4	1/8	1.58	.91	.74	.55	1.12	.38	1/2
AA67006-4-4KA	1/4	1/4	1.76	.91	.74	.55	1.36	.57	1/16
AA67006-4-6KA	1/4	3/8	1.82	.91	.74	.55	1.41	.59	3/4
AA67006-4-8KA	1/4	1/2	2.04	.91	.74	.55	1.63	.75	3/8
AA67006-5KA	5/16	1/8	1.63	.96	.85	.55	1.15	.38	1/16
AA67006-5-4KA	5/16	1/4	1.83	.96	.85	.55	1.36	.57	1/16
AA67006-6KA	3/8	1/4	1.90	1.03	.84	.56	1.37	.57	5/8
AA67006-6-2KA	3/8	1/8	1.72	1.03	.84	.56	1.19	.38	5/8
AA67006-6-6KA	3/8	3/8	1.90	1.03	.84	.56	1.40	.59	3/4
AA67006-6-8KA	3/8	1/2	2.15	1.03	.84	.56	1.62	.75	1/8
AA67006-8KA	1/2	3/8	2.03	1.16	.97	.66	1.48	.59	1 1/16
AA67006-8-4KA	1/2	1/4	2.03	1.16	.97	.66	1.48	.57	1 1/16
AA67006-8-8KA	1/2	1/2	2.28	1.16	.97	.66	1.72	.75	1/8
AA67006-8-12KA	1/2	3/4	2.35	1.16	.97	.66	1.77	.78	1 1/8
AA67006-8-16KA	1/2	1	2.53	1.16	.97	.66	1.98	.96	1 3/8
AA67006-10KA	5/8	1/2	2.53	1.41	1.14	.76	1.82	.75	1 1/16
AA67006-10-6KA	5/8	3/8	2.34	1.41	1.14	.76	1.63	.59	1 1/16
AA67006-10-12KA	5/8	3/4	2.59	1.41	1.14	.76	1.86	.78	1 1/8
AA67006-12KA	3/4	3/4	2.67	1.47	1.22	.86	1.97	.78	1 1/8
AA67006-12-4KA	3/4	1/4	2.52	1.47	1.22	.86	1.84	.57	1 1/8
AA67006-12-6KA	3/4	3/8	2.54	1.47	1.22	.86	1.86	.59	1 1/8
AA67006-12-8KA	3/4	1/2	2.67	1.47	1.22	.86	1.97	.75	1 1/8
AA67006-12-16KA	3/4	1	2.86	1.47	1.22	.86	2.18	.96	1 3/8
AA67006-16KA	1	1	3.05	1.66	1.29	.91	2.23	.96	1 3/8
AA67006-16-8KA	1	1/2	2.80	1.66	1.29	.91	2.01	.75	1 3/8
AA67006-16-12KA	1	3/4	2.86	1.66	1.29	.91	2.04	.78	1 3/8
AA67006-20KA	1 1/4	1 1/4	3.18	1.75	1.36	.96	2.37	1.00	1 1/16
AA67006-20-16KA	1 1/4	1	3.15	1.75	1.36	.96	2.34	.96	1 1/16
AA67006-24KA	1 1/2	1 1/2	3.73	2.13	1.58	1.08	2.59	1.01	2
AA67006-24-20KA	1 1/2	1 1/4	3.70	2.13	1.58	1.08	2.56	1.00	2
AA67006-28KA	1 3/4	1 1/2	3.90	2.28	1.78	1.21	2.83	1.01	2 3/8
AA67006-32KA	2	2	4.19	2.41	1.90	1.33	3.09	1.04	2 5/8

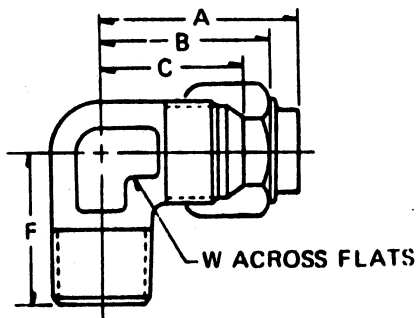
*Average values

+Material K 316SS. See page 3 for additional materials and ordering information
 Omit "A" from part number to order body only
 Additional size combinations available



37° FLARED TUBE FITTINGS

CATALOG 4730



AA67007
MALE ELBOW

flared tube end - male pipe end

ITEM NO.	TUBE DIA.	MALE PIPE DIA.	A	B	C	F	W
AA67007-2KA	1/8	1/8	1.08	.96	.77	.72	5/16
AA67007-3KA	3/16	1/8	1.20	1.08	.83	.72	3/8
AA67007-4KA	1/4	1/8	1.25	1.08	.89	.78	7/16
AA67007-4-4KA	1/4	1/4	1.41	1.24	1.05	1.09	9/16
AA67007-5KA	5/16	1/8	1.36	1.25	.95	.78	1/2
AA67007-5-4KA	5/16	1/4	1.46	1.35	1.05	1.09	9/16
AA67007-6KA	3/8	1/4	1.53	1.34	1.06	1.09	5/8
AA67007-6-2KA	3/8	1/8	1.53	1.34	1.06	.88	9/16
AA67007-6-6KA	3/8	3/8	1.61	1.43	1.18	1.22	3/4
AA67007-6-8KA	3/8	1/2	1.74	1.56	1.31	1.44	7/8
AA67007-8KA	1/2	3/8	1.75	1.56	1.25	1.22	3/4
AA67007-8-4KA	1/2	1/4	1.75	1.56	1.25	1.21	3/4
AA67007-8-8KA	1/2	1/2	1.84	1.65	1.35	1.47	1/8
AA67007-8-12KA	1/2	3/4	1.92	1.73	1.40	1.59	1 1/16
AA67007-10KA	5/8	1/2	2.10	1.83	1.45	1.47	1/8
AA67007-10-6KA	5/8	3/8	2.10	1.83	1.45	1.30	3/8
AA67007-10-12KA	5/8	3/4	2.18	1.91	1.53	1.59	1 1/16
AA67007-12KA	3/4	3/4	2.27	2.02	1.66	1.59	1 1/16
AA67007-12-8KA	3/4	1/2	2.27	2.02	1.66	1.56	1 1/16
AA67007-12-16KA	3/4	1	2.46	2.19	1.78	1.93	1 3/16
AA67007-16KA	1	1	2.56	2.21	1.81	1.97	1 3/16
AA67007-16-12KA	1	3/4	2.56	2.21	1.81	1.72	1 3/16
AA67007-20KA	1 1/4	1 1/4	2.86	2.48	2.06	2.38	1 3/8
AA67007-20-16KA	1 1/4	1	2.86	2.48	2.06	2.38	1 3/8
AA67007-24KA	1 1/2	1 1/2	3.38	2.85	2.26	2.57	1 7/8
AA67007-24-20KA	1 1/2	1 1/4	3.38	2.85	2.26	2.50	1 7/8
AA67007-28KA	1 3/4	1 1/2	3.88	3.38	2.81	2.78	2 1/4
AA67007-32KA	2	2	4.14	3.65	3.06	3.00	2 5/8

*Average values

+Material K 316SS. See page 3 for additional materials and ordering information

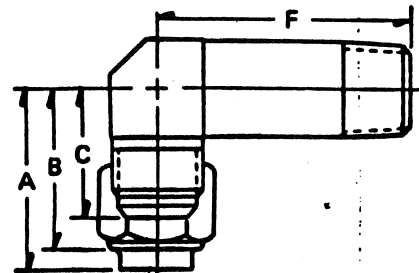
Omit "A" from part number to order body only

Additional size combinations available

37° FLARED TUBE FITTINGS

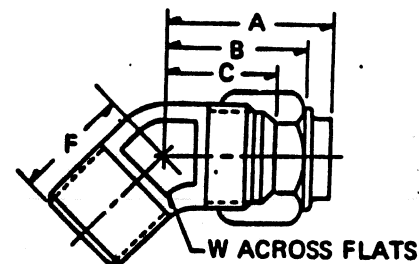


AA67009-2KA	1/8	1/8	1.08	.96	.77	1.28
AA67009-3KA	3/16	1/8	1.20	1.08	.83	1.34
AA67009-4KA	1/4	1/8	1.25	1.08	.89	1.59
AA67009-5KA	5/16	1/8	1.36	1.25	.95	1.66
AA67009-6KA	3/8	1/4	1.53	1.34	1.06	2.03
AA67009-8KA	1/2	3/8	1.75	1.56	1.25	2.34
AA67009-10KA	5/8	1/2	2.10	1.83	1.45	2.84
AA67009-12KA	3/4	3/4	2.27	2.02	1.66	3.22
AA67009-16KA	1	1	2.56	2.21	1.81	3.97
AA67009-20KA	1 1/4	1 1/4	2.86	2.48	2.06	4.94
AA67009-24KA	1 1/2	1 1/2	3.38	2.85	2.33	5.50
AA67009-28KA	1 3/4	1 1/2	3.88	3.38	2.81	6.16
AA67009-32KA	2	2	4.14	3.65	3.06	6.63



AA67009
EXTRA LONG MALE ELBOW
flared tube end-extra long male pipe end

Part Number	Flare	Flare	W	W	W	W	W
AA67010-2KA	1/8	1/8	.97	.85	.66	.52	1/8
AA67010-3KA	3/16	1/8	1.03	.91	.66	.52	3/8
AA67010-4KA	1/4	1/8	1.08	.91	.72	.64	7/8
AA67010-4-4KA	1/4	1/4	1.19	1.02	.83	.86	1 1/8
AA67010-5KA	5/16	1/8	1.18	1.07	.77	.64	1/2
AA67010-5-4KA	5/16	1/4	1.24	1.09	.80	.86	1 1/8
AA67010-6KA	3/8	1/4	1.30	1.11	.83	.86	1 1/8
AA67010-6-2KA	3/8	1/8	1.30	1.11	.83	.69	1 1/8
AA67010-6-6KA	3/8	3/8	1.41	1.22	.94	.95	3/4
AA67010-6-8KA	3/8	1/2	1.53	1.34	1.02	1.17	1/2
AA67010-8KA	1/2	3/8	1.48	1.29	.98	.95	3/4
AA67010-8-4KA	1/2	1/4	1.48	1.29	.98	.94	3/4
AA67010-8-8KA	1/2	1/2	1.63	1.44	1.08	1.17	1/2
AA67010-8-12KA	1/2	3/4	1.71	1.51	1.21	1.20	1 1/8
AA67010-10KA	5/8	1/2	1.76	1.49	1.11	1.17	3/8
AA67010-10-6KA	5/8	3/8	1.76	1.49	1.11	1.16	1/2
AA67010-10-12KA	5/8	3/4	1.76	1.49	1.11	1.18	1 1/8
AA67010-12KA	3/4	3/4	1.89	1.64	1.28	1.20	1 1/8
AA67010-12-8KA	3/4	1/2	1.89	1.64	1.28	1.19	1 1/8
AA67010-16KA	1	1	2.22	1.87	1.47	1.48	1 1/8
AA67010-16-12KA	1	3/4	2.22	1.87	1.47	1.25	1 1/8
AA67010-20KA	1 1/4	1 1/4	2.39	2.01	1.59	1.67	1 1/8
AA67010-20-16KA	1 1/4	1	2.39	2.01	1.59	1.53	1 1/8
AA67010-24KA	1 1/2	1 1/2	2.83	2.30	1.78	1.72	1 1/8
AA67010-24-20KA	1 1/2	1 1/4	2.83	2.30	1.78	1.65	1 1/8
AA67010-28KA	1 3/4	1 1/2	3.02	2.52	1.95	2.00	2 1/4
AA67010-32KA	2	2	3.30	2.81	2.22	2.11	2 1/8

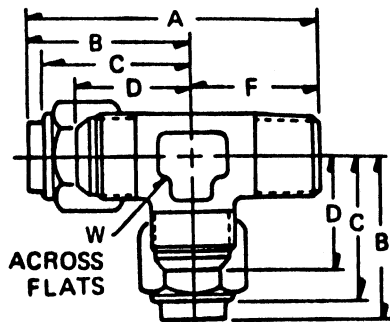


AA67010
MALE 45° ELBOW
flared tube end-male pipe end

*Average values
+Material K 316SS. See page 3 for additional materials and ordering information
Omit "A" from part number to order body only
Additional size combinations available

10 37° FLARED TUBE FITTINGS

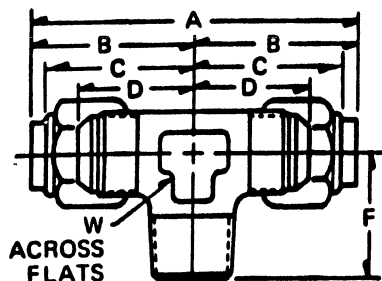
CATALOG 473K



AA67011
MALE RUN TEE

flared tube end- male pipe end-
flare tube outlet

Part No.	TUBE O.D.	MALE PIPE THREAD	A*	B*	C*	D	F	W
AA67011-2KA	1/8	1/8	1.80	1.08	.96	.77	.72	3/16
AA67011-3KA	3/16	1/8	1.92	1.20	1.08	.83	.72	3/16
AA67011-4KA	1/4	1/8	2.03	1.25	1.08	.89	.78	1/16
AA67011-4-4KA	1/4	1/4	2.33	1.33	1.15	.96	1.10	1/16
AA67011-5KA	5/16	1/8	2.14	1.36	1.25	.95	.78	1/2
AA67011-6KA	3/8	1/4	2.62	1.53	1.33	1.06	1.09	1/16
AA67011-8KA	1/2	3/8	2.97	1.75	1.56	1.25	1.22	3/4
AA67011-10KA	5/8	1/2	3.57	2.10	1.83	1.45	1.47	1/8
AA67011-12KA	3/4	3/4	3.86	2.27	2.02	1.66	1.59	1 1/16
AA67011-16KA	1	1	4.53	2.56	2.21	1.81	1.97	1 1/16
AA67011-16-12KA	1	3/4	4.24	2.56	2.21	1.81	1.68	1 1/16
AA67011-20KA	1 1/4	1 1/4	5.24	2.86	2.48	2.06	2.38	1 1/8
AA67011-20-16KA	1 1/4	1	5.04	2.86	2.48	2.06	2.18	1 1/8
AA67011-24KA	1 1/2	1 1/2	5.91	3.38	2.85	2.33	2.53	1 1/8
AA67011-24-20KA	1 1/2	1 1/4	5.84	3.38	2.85	2.33	2.46	1 1/8
AA67011-28KA	1 3/4	1 1/2	6.63	3.88	3.38	2.78	2.75	2 1/4
AA67011-32KA	2	2	7.14	4.14	3.65	3.06	3.00	2 1/8



AA67012
MALE BRANCH TEE

flared tube end- flared tube end-
male pipe branch

Part No.	TUBE O.D.	MALE PIPE THREAD	A*	B*	C*	D	F	W
AA67012-2KA	1/8	1/8	2.16	1.08	.96	.77	.72	3/16
AA67012-3KA	3/16	1/8	2.40	1.20	1.08	.83	.72	3/16
AA67012-4KA	1/4	1/8	2.50	1.25	1.08	.89	.78	1/16
AA67012-4-4KA	1/4	1/4	2.86	1.33	1.15	.96	1.10	1/16
AA67012-5KA	5/16	1/8	2.72	1.36	1.25	.95	.78	1/2
AA67012-6KA	3/8	1/4	3.06	1.53	1.33	1.06	1.09	1/16
AA67012-8KA	1/2	3/8	3.50	1.75	1.56	1.25	1.22	3/4
AA67012-10KA	5/8	1/2	4.20	2.10	1.83	1.45	1.47	1/8
AA67012-12KA	3/4	3/4	4.54	2.27	2.02	1.66	1.59	1 1/16
AA67012-16KA	1	1	5.12	2.56	2.21	1.81	1.97	1 1/16
AA67012-16-12KA	1	3/4	5.12	2.56	2.21	1.81	1.68	1 1/16
AA67012-20KA	1 1/4	1 1/4	5.72	2.86	2.48	2.06	2.38	1 1/8
AA67012-20-16KA	1 1/4	1	5.72	2.86	2.48	2.06	2.18	1 1/8
AA67012-24KA	1 1/2	1 1/2	6.76	3.38	2.85	2.33	2.53	1 1/8
AA67012-24-20KA	1 1/2	1 1/4	6.76	3.38	2.85	2.33	2.46	1 1/8
AA67012-28KA	1 3/4	1 1/2	7.76	3.88	3.38	2.78	2.75	2 1/4
AA67012-32KA	2	2	8.28	4.14	3.65	3.06	3.00	2 1/8

* Average values

+Material K 316SS. See page 3 for additional materials and ordering information

Omit "A" from part number to order body only

Additional size combinations available.

Federal
Manufacturers Code
065R1 60

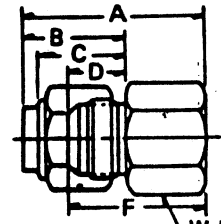
ALLAN AIRCRAFT
supply company

11643 Vanowen St.
North Hollywood, Calif. 91609

TEL: 213-877-0941/213-765-496
TWX: 910-499-2672

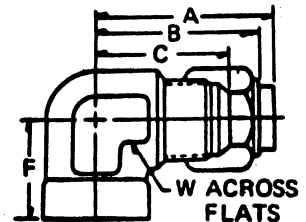
37° FLARED TUBE FITTINGS

PART NUMBER	TUBE O.D.	FEMALE PIPE THREAD						W
AA67013-2KA	1/8	1/8	1.43	.76	.64	.45	1.12	9/16
AA67013-3KA	3/16	1/8	1.50	.85	.73	.48	1.13	9/16
AA67013-4KA	1/4	1/8	1.55	.91	.74	.55	1.19	9/16
AA67013-4-4KA	1/4	1/4	1.74	.91	.74	.55	1.39	3/4
AA67013-5KA	5/16	1/8	1.58	.96	.85	.55	1.17	9/16
AA67013-5-4KA	5/16	1/4	1.75	.96	.85	.55	1.39	3/4
AA67013-6KA	3/8	1/4	1.87	1.03	.84	.56	1.40	3/4
AA67013-6-6KA	3/8	3/8	1.88	1.03	.84	.56	1.46	7/8
AA67013-8KA	1/2	3/8	2.06	1.16	.97	.66	1.56	7/8
AA67013-8-4KA	1/2	1/4	2.05	1.16	.97	.66	1.55	7/8
AA67013-8-8KA	1/2	1/2	2.25	1.16	.97	.66	1.79	1 1/8
AA67013-10KA	5/8	1/2	2.54	1.41	1.14	.76	1.89	1 1/8
AA67013-12KA	3/4	3/4	2.67	1.47	1.22	.86	2.06	1 3/8
AA67013-12-8KA	3/4	1/2	2.52	1.47	1.22	.86	2.05	1 1/8
AA67013-16KA	1	1	3.10	1.66	1.29	.91	2.35	1 5/8
AA67013-20KA	1 1/4	1 1/4	3.32	1.75	1.36	.96	2.49	2
AA67013-24KA	1 1/2	1 1/2	3.67	2.13	1.58	1.08	2.62	2 1/4
AA67013-28KA	1 3/4	1 1/2	3.58	2.28	1.78	1.21	2.50	2 3/8
AA67013-32KA	2	2	4.05	2.41	1.90	1.33	2.97	2 7/8



AA67013
FEMALE CONNECTOR
flared tube end- female pipe end

PART NUMBER +	TUBE O.D.	FEMALE PIPE THREAD						W
AA67014-2KA	1/8	1/8	1.31	1.19	1.00	.66		9/16
AA67014-3KA	3/16	1/8	1.40	1.28	1.03	.66		9/16
AA67014-4KA	1/4	1/8	1.44	1.27	1.08	.66		9/16
AA67014-4-4KA	1/4	1/4	1.49	1.32	1.13	.88		3/4
AA67014-5KA	5/16	1/8	1.49	1.38	1.08	.66		9/16
AA67014-5-4KA	5/16	1/4	1.54	1.43	1.13	.88		3/4
AA67014-6KA	3/8	1/4	1.70	1.51	1.23	.88		3/4
AA67014-6-2KA	3/8	1/8	1.53	1.34	1.06	.66		9/16
AA67014-6-6KA	3/8	3/8	1.70	1.51	1.23	1.02		7/8
AA67014-8KA	1/2	3/8	1.92	1.73	1.42	1.02		7/8
AA67014-8-4KA	1/2	1/4	1.76	1.56	1.25	.88		3/4
AA67014-8-8KA	1/2	1/2	1.92	1.73	1.42	1.23		1 1/8
AA67014-10KA	5/8	1/2	2.29	2.02	1.64	1.23		1 1/8
AA67014-12KA	3/4	3/4	2.50	2.25	1.89	1.36		1 5/8
AA67014-12-8KA	3/4	1/2	2.27	2.02	1.66	1.23		1 1/8
AA67014-16KA	1	1	2.92	2.57	2.17	1.62		1 5/8
AA67014-20KA	1 1/4	1 1/4	3.13	2.75	2.33	1.70		1 7/8
AA67014-24KA	1 1/2	1 1/2	3.94	3.41	2.89	2.08		2 1/8
AA67014-28KA	1 3/4	1 1/2	4.07	3.57	3.00	2.08		2 3/8
AA67014-32KA	2	2	4.38	3.89	3.30	2.39		2 7/8

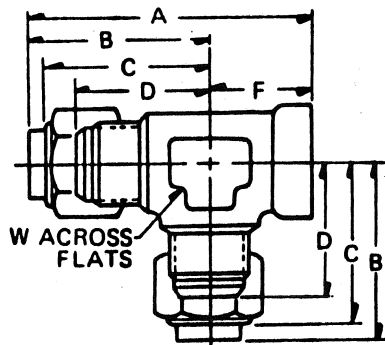


AA67014
FEMALE ELBOW
flared tube end- female pipe end

*Average values
+Material K 316SS. See page 3 for additional materials and ordering information
Omit "A" from part number to order body only
Additional size combinations available

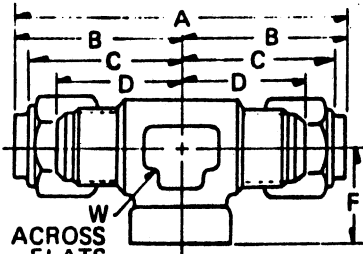
12 37° FLARED TUBE FITTINGS

CATALOG 473



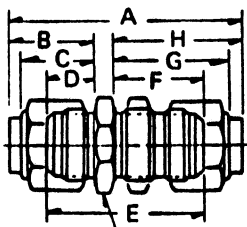
AA67015
FEMALE RUN TEE
flared tube end - female pipe end
flared tube outlet

PART NUMBER	TUBE (OD)	FEMALE PIPE (THREADS)	A	B	C	D	F	W
AA67015-2KA	1/8	1/8	1.97	1.31	1.19	1.00	.66	9/16
AA67015-3KA	3/16	1/8	2.06	1.40	1.28	1.03	.66	9/16
AA67015-4KA	1/4	1/8	2.10	1.44	1.27	1.08	.66	9/16
AA67015-5KA	5/16	1/8	2.15	1.49	1.38	1.08	.66	9/16
AA67015-6KA	3/8	1/4	2.58	1.70	1.51	1.23	.88	3/4
AA67015-8KA	1/2	3/8	2.94	1.92	1.73	1.42	1.02	7/8
AA67015-10KA	5/8	1/2	3.52	2.29	2.02	1.64	1.23	1 1/16
AA67015-12KA	3/4	3/4	3.86	2.50	2.25	1.89	1.36	1 1/8
AA67015-16KA	1	1	4.54	2.92	2.57	2.17	1.62	1 5/8
AA67015-20KA	1 1/4	1 1/4	4.83	3.13	2.75	2.33	1.70	1 7/8
AA67015-24KA	1 1/2	1 1/2	6.02	3.94	3.41	2.89	2.08	2 1/16
AA67015-28KA	1 3/4	1 1/2	6.15	4.07	3.57	3.00	2.08	2 1/8
AA67015-32KA	2	2	6.77	4.38	3.89	3.30	2.39	2 1/4



AA67016
FEMALE BRANCH TEE
flared tube end - flared tube end -
female pipe branch

PART NUMBER	TUBE (OD)	FEMALE PIPE (THREADS)	A	B	C	D	F	W
AA67016-2KA	1/8	1/8	2.62	1.31	1.19	1.00	.66	9/16
AA67016-3KA	3/16	1/8	2.80	1.40	1.28	1.03	.66	9/16
AA67016-4KA	1/4	1/8	2.88	1.44	1.27	1.08	.66	9/16
AA67016-5KA	5/16	1/8	2.98	1.49	1.38	1.08	.66	9/16
AA67016-6KA	3/8	1/4	3.40	1.70	1.51	1.23	.88	3/4
AA67016-8KA	1/2	3/8	3.84	1.92	1.73	1.42	1.02	7/8
AA67016-10KA	5/8	1/2	4.58	2.29	2.02	1.64	1.23	1 1/16
AA67016-12KA	3/4	3/4	5.00	2.50	2.25	1.89	1.36	1 1/8
AA67016-16KA	1	1	5.84	2.92	2.57	2.17	1.62	1 5/8
AA67016-20KA	1 1/4	1 1/4	6.26	3.13	2.75	2.33	1.70	1 7/8
AA67016-24KA	1 1/2	1 1/2	7.88	3.94	3.41	2.89	2.08	2 1/16
AA67016-28KA	1 3/4	1 1/2	8.14	4.07	3.57	3.00	2.08	2 1/8
AA67016-32KA	2	2	8.77	4.38	3.89	3.30	2.39	2 1/4



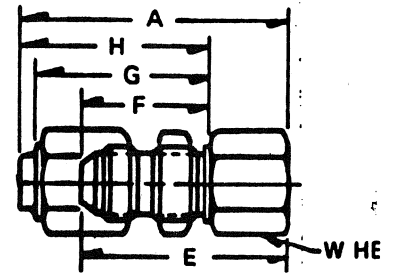
AA67017
BULKHEAD UNION
flared tube ends -
locknut included

PART NUMBER	TUBE (OD)	A	B	C	D	E	F	G	H	W
AA67017-2KA	1/8	2.43	.76	.64	.45	1.81	1.14	1.33	1.45	9/16
AA67017-3KA	3/16	2.58	.85	.73	.48	1.84	1.14	1.39	1.51	5/8
AA67017-4KA	1/4	2.72	.91	.74	.55	2.02	1.23	1.42	1.59	1 1/16
AA67017-5KA	5/16	2.82	.96	.85	.55	2.02	1.23	1.53	1.64	3/4
AA67017-6KA	3/8	3.06	1.03	.84	.56	2.19	1.31	1.59	1.78	1 3/16
AA67017-8KA	1/2	3.40	1.16	.97	.66	2.43	1.47	1.78	1.97	1
AA67017-10KA	5/8	3.98	1.41	1.14	.76	2.69	1.61	1.99	2.26	1 1/8
AA67017-12KA	3/4	4.26	1.47	1.22	.86	3.03	1.78	2.14	2.39	1 3/8
AA67017-16KA	1	4.57	1.66	1.29	.91	3.07	1.78	2.16	2.53	1 5/8
AA67017-20KA	1 1/4	4.81	1.75	1.36	.96	3.18	1.83	2.23	2.60	1 7/8
AA67017-24KA	1 1/2	5.55	2.13	1.58	1.08	3.33	1.84	2.34	2.89	2 1/8
AA67017-28KA	1 3/4	5.71	2.28	1.78	1.21	3.57	2.00	2.57	3.07	2 1/2
AA67017-32KA	2	6.28	2.41	1.90	1.33	3.85	2.12	2.69	3.20	2 3/4

* Average values
+ Material K 316SS. See page 3 for additional materials and ordering information
Omit "A" from part number to order body only
Additional size combinations available

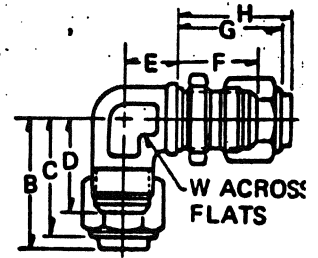
37° FLARED TUBE FITTINGS 13

PART NUMBER	TUBE O.D.	W	H	G	F	E	A	
AA67039-4KA	1/4	1/8	2.20	1.84	1.23	1.42	1.59	1 1/16
AA67039-5KA	5/16	1/8	2.25	1.84	1.23	1.53	1.64	3/4
AA67039-6KA	3/8	1/4	2.53	2.06	1.31	1.59	1.78	1 3/16
AA67039-8KA	1/2	3/8	2.85	2.34	1.47	1.78	1.97	1
AA67039-10KA	5/8	1/2	3.30	2.66	1.61	1.99	2.26	1 1/4
AA67039-12KA	3/4	3/4	3.52	2.91	1.78	2.14	2.39	1 5/8
AA67039-16KA	1	1	3.84	3.09	1.78	2.17	2.53	1 5/8
AA67039-20KA	1 1/4	1 1/4	4.01	3.20	1.83	2.23	2.62	2



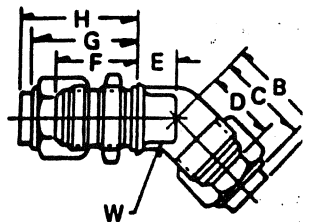
AA67039
FEMALE BULKHEAD CONNECTOR
 flared tube end- female pipe end

PART NUMBER	TUBE O.D.	W	H	G	F	E	A		
AA67018-2KA	1/8	1.15	1.03	.84	.40	1.02	1.21	1.33	5/16
AA67018-3KA	3/16	1.28	1.16	.91	.43	1.02	1.27	1.39	3/8
AA67018-4KA	1/4	1.33	1.16	.97	.48	1.11	1.30	1.47	7/16
AA67018-5KA	5/16	1.44	1.33	1.03	.51	1.11	1.41	1.52	1/2
AA67018-6KA	3/8	1.56	1.37	1.09	.62	1.19	1.47	1.66	5/8
AA67018-8KA	1/2	1.86	1.67	1.36	.73	1.38	1.69	1.88	3/4
AA67018-10KA	5/8	2.21	1.94	1.56	.87	1.52	1.90	2.17	7/8
AA67018-12KA	3/4	2.39	2.14	1.78	.98	1.69	2.05	2.30	1 1/16
AA67018-16KA	1	2.69	2.32	1.94	1.11	1.69	2.09	2.44	1 1/8
AA67018-20KA	1 1/4	2.94	2.57	2.17	1.39	1.73	2.13	2.51	1 5/8
AA67018-24KA	1 1/2	3.39	2.84	2.34	1.67	1.75	2.25	2.80	1 5/8
AA67018-28KA	1 3/4	3.66	3.16	2.59	1.87	1.91	2.48	2.98	2 1/4
AA67018-32KA	2	3.97	3.46	2.89	2.08	2.03	2.60	3.11	2 5/8



AA67018
BULKHEAD ELBOW
 flared tube ends-
 locknut included.

PART NUMBER	TUBE O.D.	W	H	G	F	E	A		
AA67019-2KA	1/8	.95	.83	.64	.36	1.02	1.21	1.33	5/16
AA67019-3KA	3/16	1.01	.89	.64	.36	1.02	1.27	1.39	3/8
AA67019-4KA	1/4	1.06	.89	.70	.42	1.11	1.30	1.47	7/16
AA67019-5KA	5/16	1.16	1.05	.75	.42	1.11	1.41	1.52	1/2
AA67019-6KA	3/8	1.28	1.09	.81	.48	1.19	1.47	1.66	5/8
AA67019-8KA	1/2	1.47	1.28	.97	.56	1.38	1.69	1.88	3/4
AA67019-10KA	5/8	1.74	1.47	1.09	.66	1.52	1.90	2.17	7/8
AA67019-12KA	3/4	1.88	1.63	1.27	.75	1.69	2.05	2.30	1 1/16
AA67019-16KA	1	2.20	1.83	1.45	.88	1.69	2.09	2.44	1 1/8
AA67019-20KA	1 1/4	2.36	1.99	1.58	.92	1.73	2.13	2.50	1 5/8
AA67019-24KA	1 1/2	2.82	2.27	1.77	.92	1.75	2.25	2.80	1 5/8
AA67019-28KA	1 3/4	3.02	2.52	1.95	.86	1.91	2.48	2.98	2 1/4
AA67019-32KA	2	3.28	2.77	2.20	.88	2.03	2.60	3.11	2 5/8

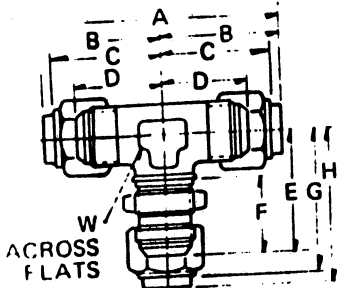


AA67019
BULKHEAD 45° ELBOW
 flared tube ends-
 locknut included

*Average values
 +Material K 316SS. See page 3 for additional materials and ordering information
 Omit "A" from part number to order body only
 Additional size combinations available

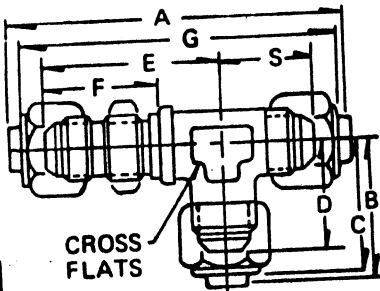
14 37° FLARED TUBE FITTINGS

CATALOG 4730



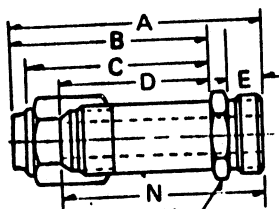
AA67020
BULKHEAD BRANCH TEE
flared tube ends-
locknut included

PART NUMBER	SIZE	A	B	C	D	E	F	G	H	I	J
AA67020-2KA	1/8	2.28	1.14	1.02	.83	1.41	1.02	1.58	1.72	1.72	5/16
AA67020-3KA	3/16	2.56	1.28	1.14	.89	1.44	1.02	1.64	1.81	1.81	3/8
AA67020-4KA	1/4	2.62	1.31	1.14	.95	1.58	1.11	1.80	1.98	1.98	1/2
AA67020-5KA	5/16	2.86	1.43	1.32	1.02	1.61	1.11	1.86	2.04	2.04	5/8
AA67020-6KA	3/8	3.10	1.55	1.36	1.08	1.80	1.19	2.09	2.29	2.29	7/8
AA67020-8KA	1/2	3.68	1.84	1.65	1.34	2.09	1.38	2.43	2.64	2.64	1 1/8
AA67020-10KA	5/8	4.40	2.20	1.93	1.55	2.38	1.52	2.78	3.04	3.04	1 1/4
AA67020-12KA	3/4	4.76	2.38	2.13	1.77	2.66	1.69	3.07	3.34	3.34	1 1/2
AA67020-16KA	1	5.34	2.67	2.32	1.92	2.78	1.69	3.23	3.56	3.56	1 3/4
AA67020-20KA	1 1/4	5.90	2.95	2.58	2.16	3.11	1.73	3.60	3.99	3.99	2
AA67020-24KA	1 1/2	6.76	3.38	2.85	2.33	3.41	1.75	3.98	4.51	4.51	2 1/4
AA67020-28KA	1 3/4	7.32	3.66	3.16	2.59	3.78	1.91	4.36	4.85	4.85	2 1/2
AA67020-32KA	2	7.92	3.96	3.47	2.88	4.09	2.03	4.73	5.23	5.23	2 3/4



AA67021
BULKHEAD RUN TEE
flared tube ends- locknut included

PART NUMBER	SIZE	A	B	C	D	E	F	G	H	I	J	K
AA67021-2KA	1/8	2.80	1.14	1.02	.83	1.41	1.02	2.56	.77	1.72	1.72	5/16
AA67021-3KA	3/16	3.01	1.26	1.14	.89	1.44	1.02	2.77	.83	1.81	1.81	3/8
AA67021-4KA	1/4	3.19	1.31	1.14	.95	1.58	1.11	2.85	.89	1.98	1.98	1/2
AA67021-5KA	5/16	3.38	1.43	1.32	1.02	1.61	1.11	3.16	.95	2.04	2.04	5/8
AA67021-6KA	3/8	3.80	1.55	1.36	1.08	1.80	1.19	3.42	1.06	2.29	2.29	7/8
AA67021-8KA	1/2	4.34	1.84	1.65	1.34	2.09	1.38	3.96	1.25	2.64	2.64	1 1/8
AA67021-10KA	5/8	5.13	2.20	1.93	1.55	2.38	1.52	4.59	1.45	2.99	2.99	1 1/4
AA67021-12KA	3/4	5.54	2.39	2.13	1.77	2.66	1.69	5.04	1.66	3.34	3.34	1 1/2
AA67021-16KA	1	6.09	2.67	2.32	1.92	2.78	1.69	5.39	1.81	3.56	3.56	1 3/4
AA67021-20KA	1 1/4	6.75	2.95	2.58	2.16	3.11	1.73	6.01	2.06	3.99	3.99	2
AA67021-24KA	1 1/2	7.84	3.38	2.85	2.33	3.41	1.75	6.74	2.33	4.51	4.51	2 1/4
AA67021-28KA	1 3/4	8.73	3.66	3.16	2.59	3.78	1.91	7.73	2.81	4.85	4.85	2 1/2
AA67021-32KA	2	9.31	3.96	3.47	2.88	4.09	2.03	8.33	3.06	5.23	5.23	2 3/4



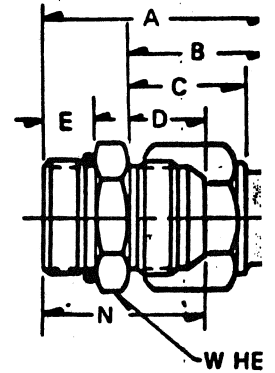
AA67023
STRAIGHT THREAD LONG
CONNECTOR
flared tube end- straight thread

PART NUMBER	SIZE	STRAIGHT THREAD	A*	B*	C*	D	E	F	G	H	I	J	K
AA67023-2KA	1/8	5/16-24	2.10	1.48	1.36	1.17	.30	1.79	1.79	1.79	1.79	1.79	5/16
AA67023-3KA	3/16	3/8-24	2.24	1.62	1.50	1.25	.30	1.87	1.87	1.87	1.87	1.87	3/8
AA67023-4KA	1/4	7/16-20	2.44	1.75	1.58	1.39	.36	2.08	2.08	2.08	2.08	2.08	1/2
AA67023-5KA	5/16	1/2-20	2.55	1.86	1.75	1.45	.36	2.14	2.14	2.14	2.14	2.14	5/8
AA67023-6KA	3/8	9/16-18	2.78	2.03	1.84	1.56	.39	2.31	2.31	2.31	2.31	2.31	7/8
AA67023-8KA	1/2	1 1/8-16	3.20	2.38	2.19	1.88	.44	2.70	2.70	2.70	2.70	2.70	1 1/8
AA67023-10KA	5/8	1 1/4-14	3.69	2.47	2.74	2.09	.50	3.04	3.04	3.04	3.04	3.04	1 1/4
AA67023-12KA	3/4	1 1/2-12	4.22	3.11	2.86	2.50	.59	3.61	3.61	3.61	3.61	3.61	1 1/2
AA67023-16KA	1	1 3/4-12	4.73	3.59	3.22	2.84	.59	3.98	3.98	3.98	3.98	3.98	1 3/4
AA67023-20KA	1 1/4	2-12	5.44	4.24	3.87	3.47	.59	4.69	4.69	4.69	4.69	4.69	2
AA67023-24KA	1 1/2	2 1/8-12	6.22	4.93	4.39	3.88	.59	5.17	5.17	5.17	5.17	5.17	2 1/4
AA67023-32KA	2	2 1/2-12	7.37	5.92	5.41	4.84	.59	6.29	6.29	6.29	6.29	6.29	2 1/2

*Average values
+Material K 316SS. See page 3 for additional materials and ordering information
Omit "A" from part number to order body only
Additional size combinations available

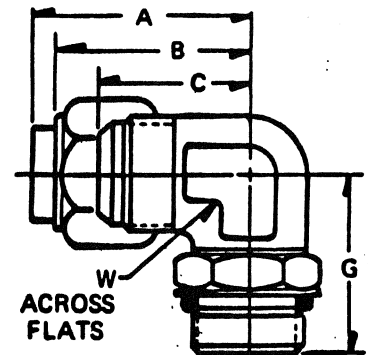
37° FLARED TUBE FITTINGS 15

PART NUMBER	TUBE O.D.	STRAIGHT THREAD	A	B	C	D	E	N	W
AA67022-2KA	1/8	5/16-24	1.37	.76	.64	.45	.30	1.06	7/16
AA67022-3KA	3/16	3/8-24	1.47	.85	.73	.48	.30	1.10	1/2
AA67022-4KA	1/4	1/2-20	1.59	.91	.74	.55	.36	1.23	5/8
AA67022-4-5KA	1/4	1/2-20	1.59	.91	.74	.55	.36	1.23	5/8
AA67022-4-6KA	1/4	9/16-18	1.66	.91	.74	.55	.39	1.30	11/16
AA67022-5KA	5/16	1/2-20	1.64	.96	.85	.55	.36	1.23	5/8
AA67022-6KA	3/8	9/16-18	1.77	1.03	.84	.56	.39	1.30	11/16
AA67022-6-4KA	3/8	7/8-20	1.68	1.03	.84	.56	.36	1.18	11/16
AA67022-6-8KA	3/8	3/4-16	1.85	1.03	.84	.56	.44	1.38	7/8
AA67022-8KA	1/2	3/4-16	1.98	1.16	.97	.66	.44	1.48	7/8
AA67022-8-6KA	1/2	9/16-18	1.86	1.16	.97	.66	.39	1.30	7/8
AA67022-8-10KA	1/2	7/8-14	2.10	1.16	.97	.66	.50	1.60	1
AA67022-8-12KA	1/2	1 1/16-12	2.26	1.16	.97	.66	.59	1.76	1 1/4
AA67022-10KA	5/8	7/8-14	2.35	1.41	1.14	.76	.50	1.70	1
AA67022-10-8KA	5/8	3/4-16	2.23	1.41	1.14	.76	.44	1.58	1
AA67022-10-12KA	5/8	1 1/16-12	2.51	1.41	1.14	.76	.59	1.86	1 1/4
AA67022-12KA	3/4	1 1/16-12	2.58	1.47	1.22	.86	.59	1.97	1 1/4
AA67022-12-8KA	3/4	3/4-16	2.39	1.47	1.22	.86	.44	1.78	1 1/8
AA67022-12-10KA	3/4	7/8-14	2.42	1.47	1.22	.86	.50	1.81	1 1/8
AA67022-12-16KA	3/4	1 5/16-12	2.61	1.47	1.22	.86	.59	2.00	1 1/2
AA67022-16KA	1	1 5/16-12	2.79	1.66	1.29	.91	.59	2.04	1 1/2
AA67022-16-12KA	1	1 1/16-12	2.76	1.66	1.29	.91	.59	2.01	1 5/8
AA67022-16-20KA	1	1 5/8-12	2.87	1.66	1.29	.91	.59	2.12	1 5/8
AA67022-20KA	1 1/4	1 5/8-12	2.96	1.75	1.36	.96	.59	2.17	1 5/8
AA67022-20-24KA	1 1/4	1 7/8-12	3.03	1.75	1.36	.96	.59	2.24	2 1/8
AA67022-24KA	1 1/2	1 7/8-12	3.42	2.13	1.58	1.08	.59	2.37	2 1/8
AA67022-24-32KA	1 1/2	2 1/2-12	3.58	2.13	1.58	1.08	.59	2.53	2 3/4
AA67022-32KA	2	2 1/2-12	3.86	2.41	1.90	1.33	.59	2.78	2 3/4



AA67022
STRAIGHT THREAD
CONNECTOR
flared tube end-
straight thread

PART NUMBER	TUBE O.D.	STRAIGHT THREAD	A	B	C	D	E	W
AA67024-2KA	1/8	5/16-24	1.08	.96	.77	.91	5/16	
AA67024-3KA	3/16	3/8-24	1.20	1.08	.83	.94	3/8	
AA67024-4KA	1/4	1/2-20	1.25	1.08	.89	1.03	7/16	
AA67024-5KA	5/16	1/2-20	1.36	1.25	.95	1.09	1/2	
AA67024-6KA	3/8	9/16-18	1.53	1.34	1.06	1.25	5/8	
AA67024-8KA	1/2	3/4-16	1.75	1.56	1.25	1.45	3/4	
AA67024-10KA	5/8	7/8-14	2.10	1.83	1.45	1.70	7/8	
AA67024-12KA	3/4	1 1/16-12	2.27	2.02	1.66	1.94	1 1/16	
AA67024-16KA	1	1 5/16-12	2.56	2.21	1.81	2.05	1 5/16	
AA67024-20KA	1 1/4	1 5/8-12	2.86	2.48	2.06	2.25	1 5/8	
AA67024-24KA	1 1/2	1 7/8-12	3.38	2.85	2.33	2.39	1 7/8	
AA67024-32KA	2	2 1/2-12	4.14	3.65	3.06	2.89	2 3/8	



AA67024
STRAIGHT THREAD ELBOW
flared tube end- straight thread
for adjustable positioning

*Average values

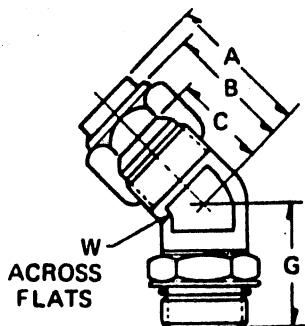
+Material K 316SS. See page 3 for additional materials and ordering information

Omit "A" from part number to order body only

Additional size combinations available

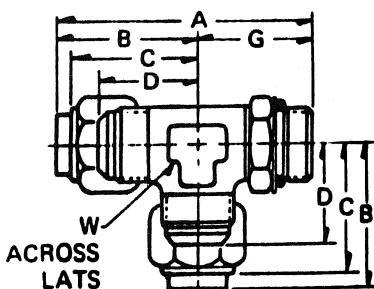
16 37° FLARED TUBE FITTINGS

CATALOG 4730



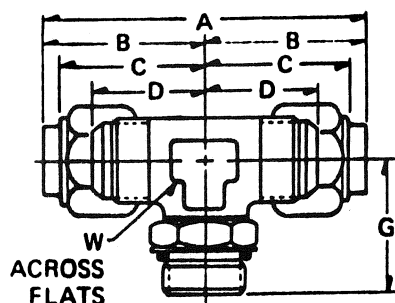
AA67025
STRAIGHT THREAD 45° ELBOW
flared tube end- straight thread
for adjustable positioning

Part Number	TUBE OD	STRAIGHT THREAD	A*	B*	C*	D	G	W
AA67025-2KA	1/8	5/16-24	.97	.85	.66	.88	5/16	
AA67025-3KA	3/16	3/8-24	1.03	.91	.66	.88	3/8	
AA67025-4KA	1/4	7/16-20	1.08	.91	.72	1.05	7/16	
AA67025-5KA	5/16	1/2-20	1.18	1.07	.77	1.05	1/2	
AA67025-6KA	3/8	9/16-18	1.30	1.11	.83	1.14	9/16	
AA67025-8KA	1/2	3/4-16	1.48	1.29	.98	1.30	3/4	
AA67025-10KA	5/8	7/8-14	1.76	1.49	1.11	1.52	7/8	
AA67025-12KA	3/4	1 1/16-12	1.89	1.64	1.28	1.73	1 1/16	
AA67025-16KA	1	1 5/16-12	2.22	1.87	1.47	1.86	1 5/16	
AA67025-20KA	1 1/4	1 5/8-12	2.39	2.01	1.59	1.91	1 5/8	
AA67025-24KA	1 1/2	1 7/8-12	2.83	2.30	1.78	1.91	1 7/8	
AA67025-32KA	2	2 1/2-12	3.30	2.81	2.22	1.86	2 1/2	



AA67026
STRAIGHT THREAD RUN TEE
flared tube end- straight thread for
adjustable positioning- flared tube end

Part Number	TUBE OD	STRAIGHT THREAD	A*	B*	C*	D	G	W
AA67026-2KA	1/8	5/16-24	1.99	1.08	.96	.77	.91	5/16
AA67026-3KA	3/16	3/8-24	2.14	1.20	1.08	.83	.94	3/8
AA67026-4KA	1/4	7/16-20	2.28	1.25	1.08	.89	1.03	7/16
AA67026-5KA	5/16	1/2-20	2.45	1.36	1.25	.95	1.09	1/2
AA67026-6KA	3/8	9/16-18	2.78	1.53	1.34	1.06	1.25	9/16
AA67026-8KA	1/2	3/4-16	3.20	1.75	1.56	1.25	1.45	3/4
AA67026-10KA	5/8	7/8-14	3.80	2.10	1.83	1.45	1.70	7/8
AA67026-12KA	3/4	1 1/16-12	4.21	2.27	2.02	1.66	1.94	1 1/16
AA67026-16KA	1	1 5/16-12	4.61	2.56	2.21	1.81	2.05	1 5/16
AA67026-20KA	1 1/4	1 5/8-12	5.10	2.85	2.48	2.06	2.25	1 5/8
AA67026-24KA	1 1/2	1 7/8-12	5.77	3.38	2.85	2.33	2.39	1 7/8
AA67026-32KA	2	2 1/2-12	7.03	4.14	3.65	3.06	2.89	2 1/2



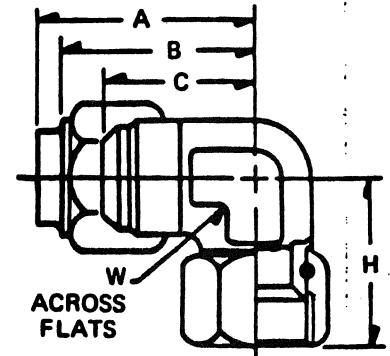
AA67027
STRAIGHT THREAD BRANCH TEE
flared tube end- flared tube end-
straight thread for adjustable
positioning

Part Number	TUBE OD	STRAIGHT THREAD	A*	B*	C*	D	G	W
AA67027-2KA	1/8	5/16-24	2.16	1.08	.96	.77	.91	5/16
AA67027-3KA	3/16	3/8-24	2.40	1.20	1.08	.83	.94	3/8
AA67027-4KA	1/4	7/16-20	2.50	1.25	1.08	.89	1.03	7/16
AA67027-5KA	5/16	1/2-20	2.72	1.36	1.25	.95	1.09	1/2
AA67027-6KA	3/8	9/16-18	3.06	1.53	1.34	1.06	1.25	9/16
AA67027-8KA	1/2	3/4-16	3.50	1.75	1.56	1.25	1.45	3/4
AA67027-10KA	5/8	7/8-14	4.20	2.10	1.83	1.45	1.70	7/8
AA67027-12KA	3/4	1 1/16-12	4.54	2.27	2.02	1.66	1.94	1 1/16
AA67027-16KA	1	1 5/16-12	5.12	2.56	2.21	1.81	2.05	1 5/16
AA67027-20KA	1 1/4	1 5/8-12	5.70	2.85	2.48	2.06	2.25	1 5/8
AA67027-24KA	1 1/2	1 7/8-12	6.76	3.38	2.85	2.33	2.39	1 7/8
AA67027-32KA	2	2 1/2-12	8.28	4.14	3.65	3.06	2.89	2 1/2

*Average values
+Material K 316SS. See page 3 for additional materials and ordering information
Omit "A" from part number to order body only
Additional size combinations available

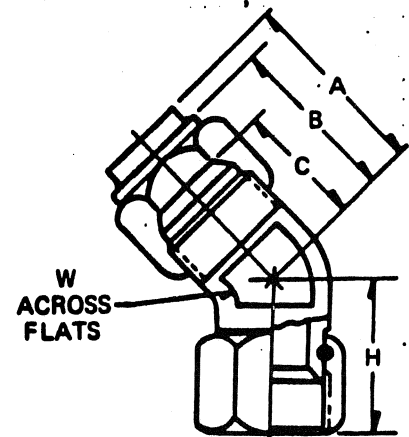
37° FLARED TUBE FITTINGS 17

PART NUMBER	TUBE OD	A	B	C	D	H	W
AA67028-2KA	1/8	1.08	.96	.77	.97	5/16	
AA67028-3KA	3/16	1.20	1.08	.83	1.00	3/8	
AA67028-4KA	1/4	1.25	1.08	.89	1.00	7/16	
AA67028-5KA	5/16	1.38	1.25	.95	1.06	1/2	
AA67028-6KA	3/8	1.53	1.34	1.06	1.25	9/16	
AA67028-8KA	1/2	1.75	1.56	1.25	1.38	3/4	
AA67028-10KA	5/8	2.10	1.83	1.45	1.62	7/8	
AA67028-12KA	3/4	2.27	2.02	1.66	1.75	1 1/16	
AA67028-16KA	1	2.56	2.21	1.81	2.00	1 3/16	
AA67028-20KA	1 1/4	2.85	2.48	2.06	2.31	1 5/8	
AA67028-24KA	1 1/2	3.38	2.85	2.33	2.59	1 7/8	
AA67028-32KA	2	4.14	3.65	3.06	3.38	2 1/8	



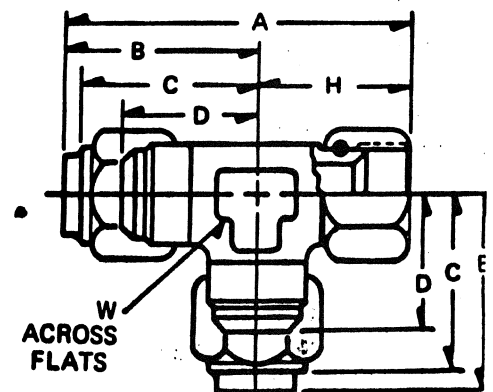
AA67028
SWIVEL NUT ELBOW
 flared tube end- swivel nut to mate
 with 37° cone

PART NUMBER	TUBE OD	A	B	C	D	H	W
AA67029-2KA	1/8	.97	.85	.66	.94	5/16	
AA67029-3KA	3/16	1.03	.91	.66	.94	3/8	
AA67029-4KA	1/4	1.08	.91	.72	.94	7/16	
AA67029-5KA	5/16	1.18	1.07	.77	1.00	1/2	
AA67029-6KA	3/8	1.30	1.11	.83	1.12	9/16	
AA67029-8KA	1/2	1.48	1.29	.98	1.28	3/4	
AA67029-10KA	5/8	1.76	1.49	1.11	1.44	7/8	
AA67029-12KA	3/4	1.89	1.64	1.28	1.50	1 1/16	
AA67029-16KA	1	2.22	1.87	1.47	1.75	1 3/16	
AA67029-20KA	1 1/4	2.39	2.01	1.59	2.03	1 5/8	
AA67029-24KA	1 1/2	2.83	2.30	1.78	2.25	1 7/8	
AA67029-32KA	2	3.30	2.81	2.22	2.91	2 1/8	



AA67029
SWIVEL NUT 45° ELBOW
 flared tube end- swivel nut to mate
 with 37° cone

PART NUMBER	TUBE OD	A	B	C	D	H	W
AA67030-2KA	1/8	2.05	1.08	.96	.77	.97	5/16
AA67030-3KA	3/16	2.20	1.20	1.08	.83	1.00	3/8
AA67030-4KA	1/4	2.25	1.25	1.08	.89	1.00	7/16
AA67030-5KA	5/16	2.42	1.36	1.25	.95	1.06	1/2
AA67030-6KA	3/8	2.78	1.53	1.34	1.06	1.25	9/16
AA67030-8KA	1/2	3.13	1.75	1.56	1.25	1.38	3/4
AA67030-10KA	5/8	3.72	2.10	1.83	1.45	1.62	7/8
AA67030-12KA	3/4	4.02	2.27	2.02	1.66	1.75	1 1/16
AA67030-16KA	1	4.56	2.56	2.21	1.81	2.00	1 3/16
AA67030-20KA	1 1/4	5.16	2.85	2.48	2.06	2.31	1 5/8
AA67030-24KA	1 1/2	5.97	3.38	2.85	2.33	2.59	1 7/8
AA67030-32KA	2	7.52	4.14	3.65	3.06	3.38	2 1/8

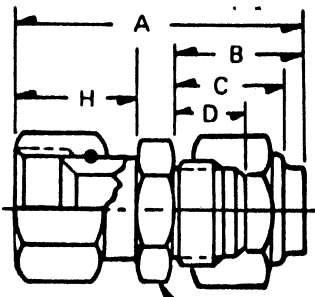


AA67030
SWIVEL NUT RUN TEE
 flared tube end- swivel nut on run to mate
 with 37° cone- flared tube end

*Average values
 +Material K 316SS. See page 3 for additional materials and ordering information
 Omit "A" from part number to order body only
 Additional size combinations available

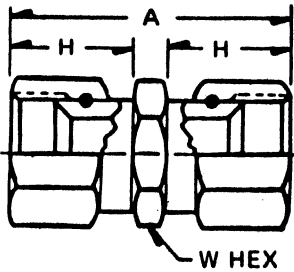
18 37° FLARED TUBE FITTINGS

CATALOG 4730



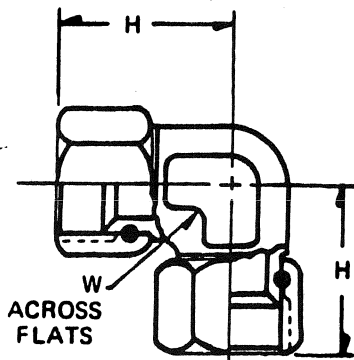
AA67081
SWIVEL NUT UNION
flared tube end-
swivel nut to mate with 37° cone

PART NUMBER	TUBE O.D.	A*	B*	C*	D	H	W
AA67081-4KA	1/4	1.79	.91	.74	.55	.69	11/16
AA67081-6KA	3/8	2.11	1.03	.84	.56	.81	13/16
AA67081-8KA	1/2	2.32	1.16	.97	.66	.86	1
AA67081-10KA	5/8	2.69	1.41	1.14	.76	.94	1 1/8
AA67081-12KA	3/4	2.97	1.47	1.22	.86	1.05	1 1/4
AA67081-16KA	1	3.21	1.66	1.29	.91	1.16	1 1/2



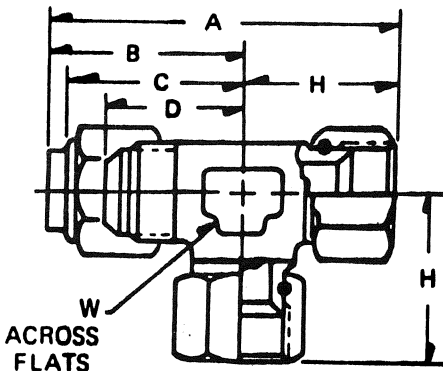
AA67082
DOUBLE SWIVEL NUT UNION
swivel nut-
swivel nut to mate with 37° cone

PART NUMBER	TUBE O.D.	A*	H	W
AA67082-4K	1/4	1.53	.69	11/16
AA67082-6K	3/8	1.88	.81	13/16
AA67082-8K	1/2	1.97	.86	1
AA67082-10K	5/8	2.19	.94	1 1/8
AA67082-12K	3/4	2.47	1.05	1 1/4
AA67082-16K	1	2.69	1.16	1 1/2



AA67083
DOUBLE SWIVEL NUT ELBOW
swivel nut-
swivel nut to mate with 37° cone

PART NUMBER	TUBE O.D.	H	W
AA67083-4K	1/4	1.00	7/16
AA67083-6K	3/8	1.25	9/16
AA67083-8K	1/2	1.38	3/4
AA67083-10K	5/8	1.62	7/8
AA67083-12K	3/4	1.75	1 1/16
AA67083-16K	1	2.00	1 1/8



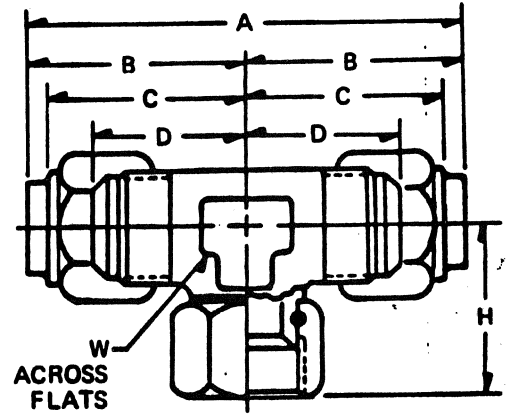
AA67084
DOUBLE SWIVEL NUT TEE
flared tube end- swivel nut-
swivel nut- to mate with 37° cone

PART NUMBER	TUBE O.D.	A*	B*	C*	D	H	W
AA67084-4KA	1/4	2.25	1.25	1.08	.89	1.00	7/16
AA67084-6KA	3/8	2.78	1.53	1.34	1.06	1.25	9/16
AA67084-8KA	1/2	3.13	1.75	1.56	1.25	1.38	3/4
AA67084-10KA	5/8	3.72	2.10	1.83	1.45	1.62	7/8
AA67084-12KA	3/4	4.04	2.29	2.02	1.66	1.75	1 1/16
AA67084-16KA	1	4.56	2.56	2.22	1.81	2.00	1 1/8

*Average values
+Material K 316SS. See page 3 for additional materials and ordering information
Omit "A" from part number to order body only
Additional size combinations available

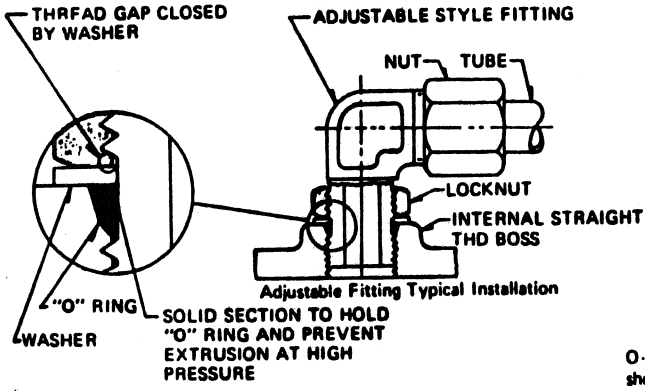
37° FLARED TUBE FITTINGS

AA67031-2KA	1/8	2.16	1.08	.96	.77	.97	3/16
AA67031-3KA	3/16	2.40	1.20	1.08	.83	1.00	3/8
AA67031-4KA	1/4	2.50	1.25	1.08	.89	1.00	7/16
AA67031-5KA	5/16	2.72	1.36	1.25	.95	1.06	1/2
AA67031-6KA	3/8	3.06	1.53	1.34	1.06	1.25	5/8
AA67031-8KA	1/2	3.50	1.75	1.56	1.25	1.38	3/4
AA67031-10KA	5/8	4.20	2.10	1.83	1.45	1.62	7/8
AA67031-12KA	3/4	4.54	2.27	2.02	1.66	1.75	1 1/8
AA67031-16KA	1	5.12	2.56	2.21	1.81	2.00	1 1/4
AA67031-20KA	1 1/4	5.70	2.85	2.48	2.06	2.31	1 3/8
AA67031-24KA	1 1/2	6.76	3.38	2.85	2.33	2.59	1 7/8
AA67031-32KA	2	8.28	4.14	3.65	3.06	3.38	2 1/4

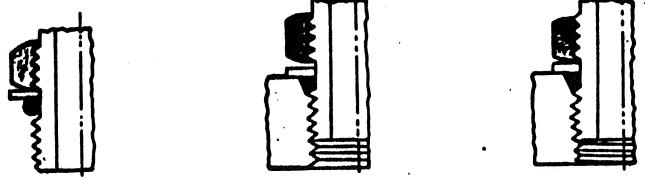


AA67031
SWIVEL NUT BRANCH TEE
 flared tube- flared tube-
 swivel nut on branch to mate with 37° cone

ASSEMBLY INSTRUCTIONS FOR ADJUSTABLE STYLE FITTINGS IN STRAIGHT THREAD "O" RING BOSSES



Adjustable end fittings provide LEAK-PROOF CONNECTIONS, EXACT POSITIONING in desired direction, ELIMINATES CRACKING or DISTORTING due to overtightening, and may be used with SAE or AND style boss.

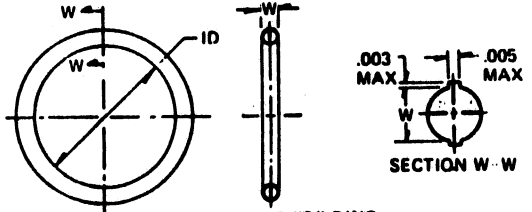


O-ring and back-up washer should be on undercut un-threaded section nearest to locknut (lubrication of O-ring is recommended.)

STEP 1 - Screw fitting by hand into straight thread boss until back-up washer contacts face of boss.

STEP 2 - To position fitting, unscrew as far as necessary (up to one full turn), hold fitting in desired position and tighten locknut with wrench.

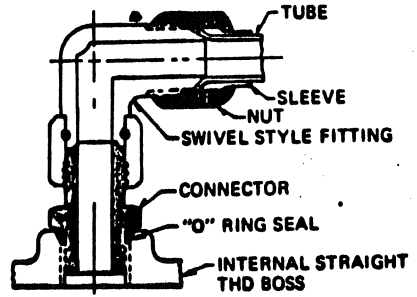
Lubrication - When assembling "O" rings with "O" ring style fittings lubricate the "O" ring with the fluid used in the system.



HYDRAULIC "O" RING

TUBE O.D.	W, WIDTH, DIA	INSIDE DIA
1/8	0.064 ± 0.003	0.239 ± 0.005
3/16	0.064 ± 0.003	0.301 ± 0.005
1/4	0.072 ± 0.003	0.351 ± 0.005
5/16	0.072 ± 0.003	0.414 ± 0.005
3/8	0.078 ± 0.003	0.468 ± 0.005
1/2	0.087 ± 0.003	0.644 ± 0.005
5/8	0.097 ± 0.003	0.755 ± 0.005
3/4	0.116 ± 0.004	0.924 ± 0.006
1	0.116 ± 0.004	1.171 ± 0.008
1 1/4	0.118 ± 0.004	1.475 ± 0.010
1 1/2	0.118 ± 0.004	1.720 ± 0.010
2	0.118 ± 0.004	2.337 ± 0.010

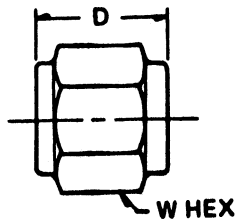
Swivel nut fittings are for use with straight connectors when space limitations in installation will not permit full rotation of the normally used straight thread fitting



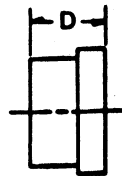
Swivel End Fitting Typical Installation

20 37° FLARED TUBE FITTINGS

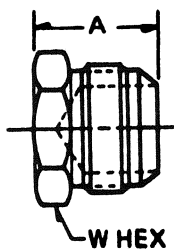
CATALOG 473



**AA67032
NUT**



**AA67033
SLEEVE**



**AA67035
PLUG**

PART NUMBER	TUBE O.D.	O.D.	W
AA67032-2K	1/8	.54	3/8
AA67032-3K	3/16	.60	7/16
AA67032-4K	1/4	.61	9/16
AA67032-5K	5/16	.67	5/8
AA67032-6K	3/8	.72	11/16
AA67032-8K	1/2	.84	7/8
AA67032-10K	5/8	.97	1
AA67032-12K	3/4	1.02	1 1/8
AA67032-16K	1	1.12	1 1/2
AA67032-20K	1 1/4	1.22	2
AA67032-24K	1 1/2	1.41	2 1/4
AA67032-28K	1 3/4	1.56	2 5/8
AA67032-32K	2	1.74	2 7/8

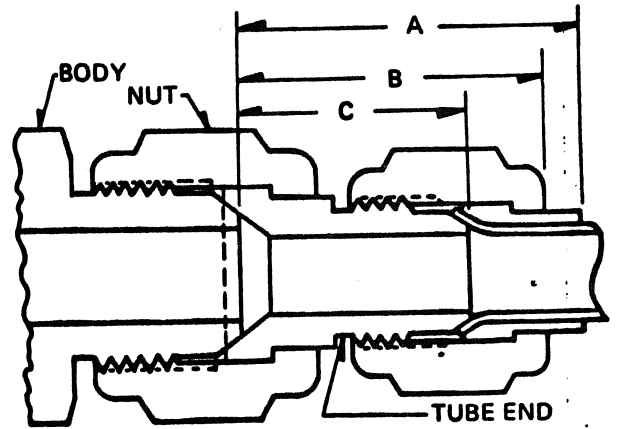
PART NUMBER +	TUBE O.D.	O.D.
AA67033-2K	1/8	.34
AA67033-3K	3/16	.39
AA67033-4K	1/4	.41
AA67033-5K	5/16	.44
AA67033-6K	3/8	.50
AA67033-8K	1/2	.56
AA67033-10K	5/8	.66
AA67033-12K	3/4	.68
AA67033-16K	1	.78
AA67033-20K	1 1/4	.91
AA67033-24K	1 1/2	1.12
AA67033-28K	1 3/4	1.12
AA67033-32K	2	1.19

PART NUMBER +	TUBE O.D.	A	W
AA67035-2K	1/8	.66	7/16
AA67035-3K	3/16	.69	7/16
AA67035-4K	1/4	.75	7/16
AA67035-5K	5/16	.78	1/2
AA67035-6K	3/8	.83	9/16
AA67035-8K	1/2	.94	3/4
AA67035-10K	5/8	1.10	7/8
AA67035-12K	3/4	1.22	1 1/8
AA67035-16K	1	1.30	1 3/8
AA67035-20K	1 1/4	1.37	1 7/8
AA67035-24K	1 1/2	1.50	2
AA67035-28K	1 3/4	1.62	2 3/8
AA67035-32K	2	1.75	2 5/8

+Material K 316SS. See page 3 for additional materials and ordering information
Additional size combinations available

37° FLARED TUBE FITTINGS 21

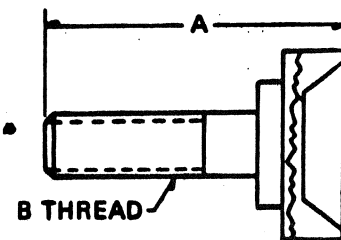
Part Number	Tube OD	Tube ID	Weight	Length	End Weight
AA67034-4-2KA	1/4	1/8	1.02	.89	.72
AA67034-6-4KA	3/8	1/4	1.25	1.08	.89
AA67034-8-4KA	1/2	1/4	1.25	1.08	.89
AA67034-8-6KA	1/2	3/8	1.36	1.17	.89
AA67034-10-4KA	5/8	1/4	1.28	1.11	.92
AA67034-10-6KA	5/8	3/8	1.39	1.20	.92
AA67034-10-8KA	5/8	1/2	x	x	x
AA67034-12-4KA	3/4	1/4	1.31	1.14	.95
AA67034-12-6KA	3/4	3/8	1.42	1.23	.95
AA67034-12-8KA	3/4	1/2	1.55	1.36	1.05
AA67034-12-10KA	3/4	5/8	x	x	x
AA67034-16-4KA	1	1/4	1.61	1.43	1.21
AA67034-16-6KA	1	3/8	1.49	1.29	1.00
AA67034-16-8KA	1	1/2	1.68	1.47	1.13
AA67034-16-12KA	1	3/4	1.94	1.69	1.33
AA67034-20-4KA	1 1/4	1/4	1.73	1.55	1.33
AA67034-20-6KA	1 1/4	3/8	1.75	1.55	1.26
AA67034-20-8KA	1 1/4	1/2	1.77	1.56	1.22
AA67034-20-10KA	1 1/4	5/8	1.78	1.57	1.23
AA67034-20-12KA	1 1/4	3/4	1.95	1.70	1.34
AA67034-20-16KA	1 1/4	1	2.17	1.84	1.40
AA67034-24-4KA	1 1/2	1/4	1.89	1.71	1.49
AA67034-24-6KA	1 1/2	3/8	1.89	1.69	1.40
AA67034-24-8KA	1 1/2	1/2	1.98	1.77	1.43
AA67034-24-10KA	1 1/2	5/8	2.12	1.86	1.46
AA67034-24-12KA	1 1/2	3/4	2.09	1.82	1.42
AA67034-24-16KA	1 1/2	1	2.19	1.86	1.42
AA67034-24-20KA	1 1/2	1 1/4	2.33	1.94	1.48
AA67034-32-12KA	2	3/4	2.47	2.20	1.80
AA67034-32-16KA	2	1	2.46	2.13	1.69
AA67034-32-20KA	2	1 1/4	2.47	2.08	1.62
AA67034-32-24KA	2	1 1/2	2.79	2.25	1.69



AA67034 TUBE END REDUCER
X SPECIAL ONE PIECE DESIGN

PART NUMBER	TUBE OD	Weight	Length
AA67037-4K	1/4	.72	1/4 - 20
AA67037-6K	3/8	.80	1/4 - 20
AA67037-8K	1/2	.98	5/16 - 18

mountie stud, used in place of sleeve,
to plug port when B nut is drawn up and
to provided threaded end (of stud)
to make tee or cross fitting self mounting

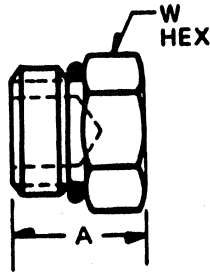


AA67037 MOUNTIE

*Average values
+Material K 316SS. See page 3 for additional materials and ordering information
Omit "A" from part number to order body only
Additional size combinations available

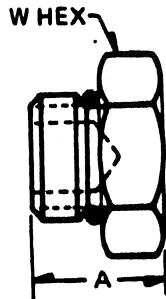
22 37 FLARED TUBE FITTINGS

CATALOG 473X



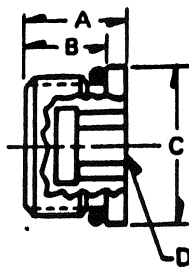
AA67038
HEX HEAD PLUG

PART NUMBER	TUBE O.D.	STRAIGHT THREAD	A	W
AA67038-2K	1/8	5/16-24	.60	7/16
AA67038-3K	3/16	3/8-24	.60	1/2
AA67038-4K	1/4	7/16-20	.67	9/16
AA67038-5K	5/16	1/2-20	.67	5/8
AA67038-6K	3/8	9/16-18	.73	11/16
AA67038-8K	1/2	3/4-16	.80	7/8
AA67038-10K	5/8	7/8-14	.93	1
AA67038-12K	3/4	1 1/16-12	1.09	1 1/4
AA67038-16K	1	1 5/16-12	1.12	1 1/2
AA67038-20K	1 1/4	1 5/8-12	1.20	1 5/8
AA67038-24K	1 1/2	1 7/8-12	1.27	2 1/8
AA67038-28K	1 3/4	2 1/4-12	1.35	2 1/2
AA67038-32K	2	2 1/2-12	1.43	2 3/4



AA67080
LARGE HEX HEAD PLUG

PART NUMBER	TUBE O.D.	STRAIGHT THREAD	A	W
AA67080-2K	1/8	5/16-24	.53	9/16
AA67080-3K	3/16	3/8-24	.53	5/8
AA67080-4K	1/4	7/16-20	.60	11/16
AA67080-5K	5/16	1/2-20	.60	3/4
AA67080-6K	3/8	9/16-18	.68	13/16
AA67080-8K	1/2	3/4-16	.75	1
AA67080-10K	5/8	7/8-14	.81	1 1/8
AA67080-12K	3/4	1 1/16-12	1.00	1 3/8
AA67080-16K	1	1 5/16-12	1.00	1 5/8
AA67080-20K	1 1/4	1 5/8-12	1.00	1 7/8
AA67080-24K	1 1/2	1 7/8-12	1.00	2 1/8
AA67080-28K	1 3/4	2 1/4-12	1.00	2 1/2
AA67080-32K	2	2 1/2-12	1.00	2 3/4



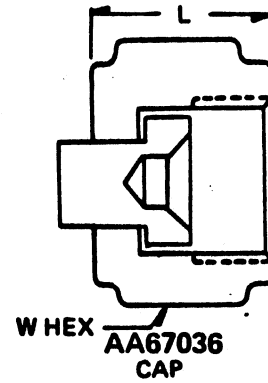
AA67053
INTERNAL HEX
HOLLOW HEX PLUG

PART NUMBER +	TUBE O.D.	STRAIGHT THREAD	A	B	C	D
AA67053-2K	1/8	5/16-24	.38	.30	.44	1/8
AA67053-3K	3/16	3/8-24	.38	.30	.50	1/8
AA67053-4K	1/4	7/16-20	.45	.36	.56	3/16
AA67053-5K	5/16	1/2-20	.45	.36	.63	3/16
AA67053-6K	3/8	9/16-18	.48	.39	.69	1/4
AA67053-8K	1/2	3/4-16	.56	.44	.88	5/16
AA67053-10K	5/8	7/8-14	.63	.50	1.00	3/8
AA67053-12K	3/4	1 1/16-12	.75	.59	1.25	5/8
AA67053-16K	1	1 5/16-12	.75	.59	1.50	5/8
AA67053-20K	1 1/4	1 5/8-12	.75	.59	1.88	3/4

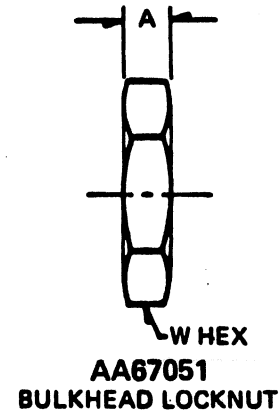
+Material K 316SS. See page 3 for additional materials and ordering information
Additional size combinations available

37° FLARED TUBE FITTINGS 23

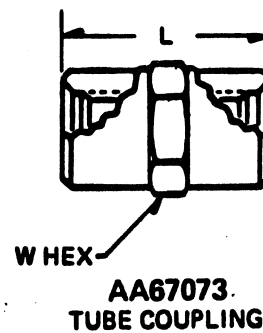
PART NUMBER	TUBE O.D.	FLARE O.D.	W	L
AA67036-2K	1/8	.54	3/8	
AA67036-3K	3/16	.60	7/16	
AA67036-4K	1/4	.61	9/16	
AA67036-5K	5/16	.67	5/8	
AA67036-6K	3/8	.72	11/16	
AA67036-8K	1/2	.84	7/8	
AA67036-10K	5/8	.97	1	
AA67036-12K	3/4	1.02	1 1/4	
AA67036-16K	1	1.12	1 1/2	
AA67036-20K	1 1/4	1.22	2	
AA67036-24K	1 1/2	1.41	2 1/4	
AA67036-28K	1 3/4	1.56	2 5/8	
AA67036-32K	2	1.74	2 7/8	



PART NUMBER	TUBE O.D.	FLARE O.D.	W	L
AA67051-2K	1/8	.22	9/16	
AA67051-3K	3/16	.22	5/8	
AA67051-4K	1/4	.25	11/16	
AA67051-5K	5/16	.25	3/4	
AA67051-6K	3/8	.27	13/16	
AA67051-8K	1/2	.31	1	
AA67051-10K	5/8	.36	1 1/8	
AA67051-12K	3/4	.41	1 3/8	
AA67051-16K	1	.41	1 5/8	
AA67051-20K	1 1/4	.41	1 5/8	
AA67051-24K	1 1/2	.41	2 3/16	
AA67051-28K	1 3/4	.41	2 3/16	
AA67051-32K	2	.41	2 3/16	



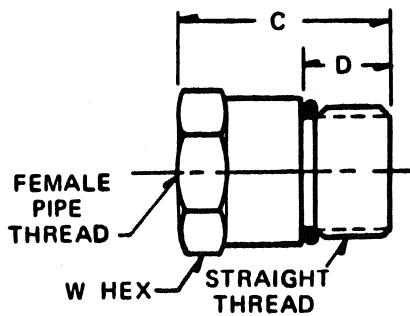
PART NUMBER	TUBE O.D.	FLARE O.D.	W	L
AA67073-2K	1/8	5/16-24	1.00	9/16
AA67073-3K	3/16	3/8-24	1.00	5/8
AA67073-4K	1/4	7/16-20	1.18	11/16
AA67073-5K	5/16	1/2-20	1.18	3/4
AA67073-6K	3/8	9/16-18	1.18	13/16
AA67073-8K	1/2	3/4-16	1.43	1
AA67073-10K	5/8	7/8-14	1.56	1 1/8
AA67073-12K	3/4	1 1/16-12	1.81	1 3/8
AA67073-16K	1	1 1/16-12	1.87	1 5/8
AA67073-20K	1 1/4	1 1/8-12	2.00	2
AA67073-24K	1 1/2	1 1/8-12	2.25	2 1/4
AA67073-28K	1 3/4	2 1/4-12	2.50	2 5/8
AA67073-32K	2	2 1/2-12	2.75	3



+Material K 316SS. See page 3 for additional materials and ordering information
Additional size combinations available

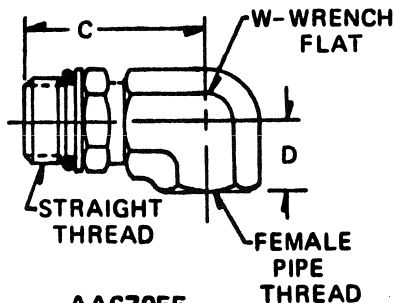
24 STRAIGHT THREAD ADAPTERS

CATALOG 4737



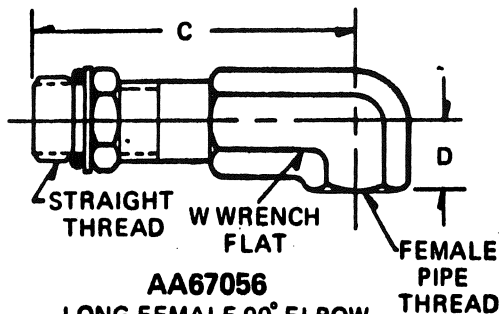
AA67054
FEMALE PIPE ADAPTER
straight thread - female pipe thread

Part Number	TUBE O.D.	STRAIGHT THREAD	FEMALE PIPE THREAD	C	D	W
AA67054-6K	3/8	1/8-18	1/4	1.09	.391	3/8
AA67054-8K	1/2	3/8-16	3/8	1.22	.438	7/8
AA67054-10K	5/8	7/8-14	1/2	1.50	.500	1 1/8
AA67054-10-4K	5/8	7/8-14	1/4	.81	.500	1
AA67054-10-6K	5/8	7/8-14	3/8	1.25	.500	1
AA67054-12K	3/4	1 1/8-12	3/4	1.66	.594	1 1/8
AA67054-12-8K	3/4	1 1/8-12	1/2	1.34	.594	1 1/4
AA67054-16K	1	1 1/2-12	1	1.88	.594	1 1/2
AA67054-16-8K	1	1 1/2-12	1/2	1.00	.594	1 1/2
AA67054-16-12K	1	1 1/2-12	3/4	1.50	.594	1 1/2
AA67054-20K	1 1/4	1 3/4-12	1 1/4	1.94	.594	2
AA67054-20-16K	1 1/4	1 3/4-12	1	1.00	.594	1 1/2
AA67054-24K	1 1/2	1 3/4-12	1 1/2	2.00	.594	2 1/4
AA67054-24-16K	1 1/2	1 3/4-12	1	1.00	.594	2 1/2
AA67054-24-20K	1 1/2	1 3/4-12	1 1/4	1.00	.594	2
AA67054-32K	2	2 1/2-12	2	2.06	.594	2 1/2
AA67054-32-16K	2	2 1/2-12	1	1.00	.594	2 3/4
AA67054-32-20K	2	2 1/2-12	1 1/4	1.00	.594	2 3/4
AA67054-32-24K	2	2 1/2-12	1 1/2	1.00	.594	2 3/4



AA67055
FEMALE 90° ELBOW
straight thread for adjustable positioning - female pipe thread

Part Number	TUBE O.D.	STRAIGHT THREAD	FEMALE PIPE THREAD	C	D	W
AA67055-4K	1/4	1/8-20	1/8	1.36	.64	3/8
AA67055-6K	3/8	1/8-18	1/4	1.36	.59	3/8
AA67055-8K	1/2	3/8-16	3/8	1.47	.63	7/8
AA67055-10K	5/8	7/8-14	1/2	1.81	.75	1 1/8
AA67055-12K	3/4	1 1/8-12	3/4	2.00	.81	1 3/8
AA67055-16K	1	1 1/2-12	1	2.25	1.00	1 1/2



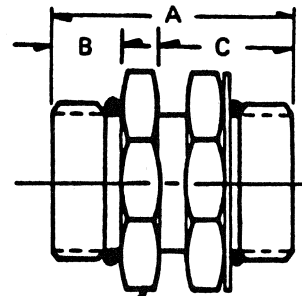
AA67056
LONG FEMALE 90° ELBOW
straight thread for adjustable positioning - female pipe thread

Part Number	TUBE O.D.	STRAIGHT THREAD	FEMALE PIPE THREAD	C	D	W
AA67056-4K	1/4	1/8-20	1/8	2.00	.64	3/8
AA67056-6K	3/8	1/8-18	1/4	2.44	.59	3/8
AA67056-8K	1/2	3/8-16	3/8	2.94	.63	7/8
AA67056-10K	5/8	7/8-14	1/2	3.56	.75	1 1/8
AA67056-12K	3/4	1 1/8-12	3/4	4.13	.81	1 3/8
AA67056-16K	1	1 1/2-12	1	4.63	1.00	1 1/2

*Material K 316SS. See page 3 for additional materials and ordering information
Additional size combinations available

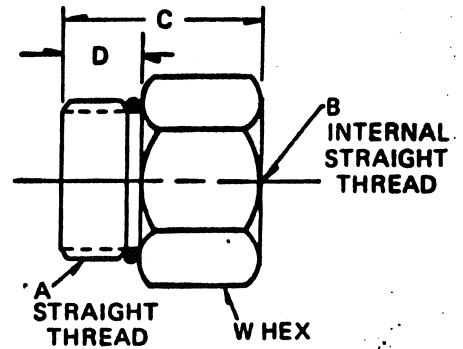
STRAIGHT THREAD ADAPTERS 25

MODEL NUMBER	UNION	THREAD	LENGTH	OD	ID	W
AA67057-2K	1/8	5/16-24	1.22	.30	.61	1/16
AA67057-3K	3/16	3/8-24	1.16	.30	.61	1/2
AA67057-4K	1/4	7/16-20	1.22	.36	.70	9/16
AA67057-5K	5/16	1/2-20	1.22	.36	.70	5/8
AA67057-6K	3/8	9/16-18	1.41	.39	.77	11/16
AA67057-8K	1/2	3/4-16	1.56	.44	.88	7/8
AA67057-10K	5/8	7/8-14	1.81	.50	1.02	1
AA67057-12K	3/4	1 1/8-12	2.13	.59	1.16	1 1/4
AA67057-16K	1	1 1/2-12	2.13	.59	1.16	1 1/2
AA67057-20K	1 1/4	1 5/8-12	2.13	.59	1.16	1 5/8
AA67057-24K	1 1/2	1 7/8-12	2.13	.59	1.16	2 1/8
AA67057-32K	2	2 1/2-12	2.13	.59	1.16	2 3/4



AA67057 UNION
straight thread-
straight thread for adjustable positioning

MODEL NUMBER	UNION	THREAD	LENGTH	OD	ID	W	
AA67058-4-5K	1/4	5/16	7/16-20	1/2-20	1.27	.360	3/4
AA67058-4-6K	1/4	3/8	7/16-20	9/16-18	1.16	.360	13/16
AA67058-6-4K	3/8	1/4	9/16-18	1/16-20	1.09	.406	13/16
AA67058-6-8K	3/8	1/2	9/16-18	3/4-16	1.38	.390	1
AA67058-8-6K	1/2	3/8	3/4-16	9/16-18	1.15	.453	1
AA67058-8-10K	1/2	5/8	3/4-16	7/8-14	1.56	.430	1 1/8
AA67058-10-6K	5/8	3/8	7/8-14	9/16-18	1.20	.515	1 1/8
AA67058-10-8K	5/8	1/2	7/8-14	3/4-16	1.36	.515	1 1/8
AA67058-10-12K	5/8	3/4	7/8-14	1 1/8-12	1.81	.500	1 3/8
AA67058-12-8K	3/4	1/2	1 1/8-12	3/4-16	1.32	.594	1 3/8
AA67058-12-10K	3/4	5/8	1 1/8-12	7/8-14	1.39	.594	1 3/8
AA67058-12-16K	3/4	1	1 1/8-12	1 1/8-12	1.88	.575	1 5/8
AA67058-16-8K	1	1/2	1 5/8-12	3/4-16	.98	.594	1 5/8
AA67058-16-12K	1	3/4	1 5/8-12	1 1/8-12	1.59	.594	1 5/8
AA67058-16-20K	1	1 1/4	1 5/8-12	1 1/8-12	1.97	.594	1 5/8
AA67058-20-10K	1 1/4	5/8	1 5/8-12	7/8-14	1.00	.594	1 5/8
AA67058-20-12K	1 1/4	3/4	1 5/8-12	1 1/8-12	.98	.594	1 5/8
AA67058-20-16K	1 1/4	1	1 5/8-12	1 1/8-12	1.36	.594	1 5/8
AA67058-20-24K	1 1/4	1 1/2	1 5/8-12	1 1/8-12	1.97	.594	2 1/4
AA67058-24-12K	1 1/2	3/4	1 7/8-12	1 1/8-12	1.00	.594	2 1/8
AA67058-24-16K	1 1/2	1	1 7/8-12	1 1/8-12	1.00	.594	2 1/8
AA67058-24-20K	1 1/2	1 1/4	1 7/8-12	1 5/8-12	1.59	.594	2 1/8
AA67058-32-16K	2	1	2 1/2-12	1 1/8-12	1.00	.594	2 3/4
AA67058-32-20K	2	1 1/4	2 1/2-12	1 5/8-12	1.00	.594	2 3/4
AA67058-32-24K	2	1 1/2	2 1/2-12	1 7/8-12	1.00	.594	2 3/4

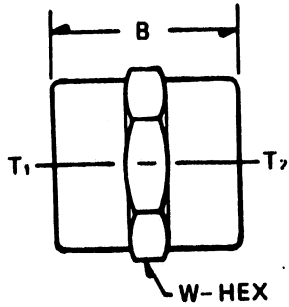


AA67058 REDUCER EXPANDER
straight thread-internal straight thread

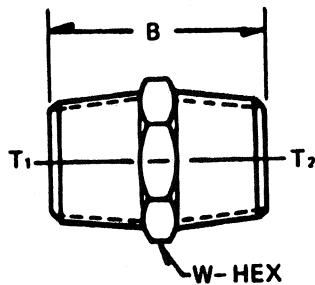
+Material K 316SS. See page 3 for additional materials and ordering information
Additional size combinations available

26 PIPE THREAD ADAPTERS

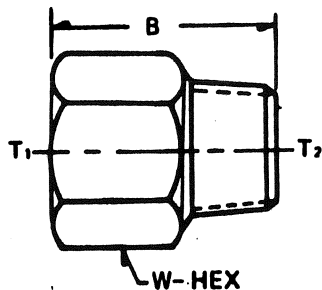
CATALOG 47:



AA67040
PIPE CONNECTOR
female pipe thread



AA67041
PIPE NIPPLE
male pipe thread



AA67052
REDUCING CONNECTOR
female pipe thread-
male pipe thread

PART NUMBER	PIPE THREAD T1	PIPE THREAD T2	B	W
AA67040-1K	1/8	1/8	.81	3/8
AA67040-2K	1/4	1/4	1.13	13/16
AA67040-2-1K	1/4	1/8	.94	13/16
AA67040-3K	3/8	3/8	1.18	15/16
AA67040-3-1K	3/8	1/8	1.03	15/16
AA67040-3-2K	3/8	1/4	1.13	15/16
AA67040-4K	1/2	1/2	1.56	1 1/16
AA67040-4-2K	1/2	1/4	1.38	1 1/16
AA67040-4-3K	1/2	3/8	1.50	1 1/16
AA67040-6K	3/4	3/4	1.59	1 1/8
AA67040-6-4K	3/4	1/2	1.88	1 1/8
AA67040-8K	1	1	1.90	1 1/4
AA67040-10K	1 1/4	1 1/4	1.94	2 1/8
AA67040-10-8K	1 1/4	1	1.94	2 1/8
AA67040-12K	1 1/2	1 1/2	2.65	2 1/2
AA67040-16K	2	2	2.65	2 1/2

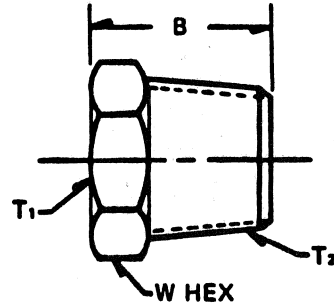
PART NUMBER	PIPE THREAD T1	PIPE THREAD T2	B	W
AA67041-1K	1/8	1/8	1.00	7/8
AA67041-2K	1/4	1/4	1.45	1 1/8
AA67041-2-1K	1/4	1/8	1.25	7/8
AA67041-3K	3/8	3/8	1.45	7/8
AA67041-3-1K	3/8	1/8	1.27	7/8
AA67041-3-2K	3/8	1/4	1.45	7/8
AA67041-4K	1/2	1/2	1.87	1 5/8
AA67041-4-2K	1/2	1/4	1.70	1 5/8
AA67041-4-3K	1/2	3/8	1.87	1 5/8
AA67041-6K	3/4	3/4	1.94	1 1/2
AA67041-6-4K	3/4	1/2	1.97	1 1/2
AA67041-8K	1	1	2.34	1 3/4
AA67041-10K	1 1/4	1 1/4	2.37	1 3/4
AA67041-10-8K	1 1/4	1	2.45	1 3/4
AA67041-12K	1 1/2	1 1/2	2.63	2
AA67041-16K	2	2	2.78	2 1/2

PART NUMBER+	FEMALE PIPE THREAD T1	MALE PIPE THREAD T2	B	W
AA67052-2-1K	1/4	1/8	1.22	3/4
AA67052-3-2K	3/8	1/4	1.44	7/8
AA67052-4-1K	1/2	1/8	1.50	1 1/8
AA67052-4-2K	1/2	1/4	1.69	1 1/8
AA67052-4-3K	1/2	3/8	1.69	1 1/8
AA67052-6-2K	3/4	1/4	1.78	1 1/8
AA67052-6-4K	3/4	1/2	1.94	1 1/8
AA67052-8-4K	1	1/2	2.16	1 1/8
AA67052-8-6K	1	3/4	2.19	1 1/8
AA67052-10-8K	1 1/4	1	2.47	2
AA67052-12-10K	1 1/2	1 1/4	2.50	2 1/8
AA67052-16-12K	2	1 1/2	2.63	2 1/2

+Material K 316SS. See page 3 for additional materials and ordering information
Additional size combinations available

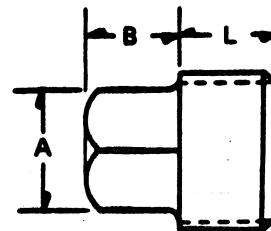
PIPE THREAD ADAPTERS

PART NUMBER	MALE PIPE THREAD	FEMALE PIPE THREAD	LENGTH	WEIGHT
AA67042-1K	1/4	1/8	.81	5/8
AA67042-2K	3/8	1/4	.81	3/4
AA67042-3K	3/8	1/8	.81	3/4
AA67042-4K	1/2	3/8	1.05	15/16
AA67042-5K	1/2	1/4	1.05	15/16
AA67042-6K	1/2	1/8	1.05	15/16
AA67042-7K	3/4	1/2	1.09	1 1/8
AA67042-8K	3/4	3/8	1.09	1 1/8
AA67042-9K	3/4	1/4	1.09	1 1/8
AA67042-10K	1	3/4	1.28	1 3/8
AA67042-10-6K	1 1/4	3/4	1.31	1 3/4
AA67042-10-8K	1 1/4	1	1.37	1 3/4
AA67042-11K	1	1/2	1.28	1 3/8
AA67042-12K	1	3/8	1.28	1 3/8
AA67042-12-4K	1 1/2	1/2	1.31	2
AA67042-12-6K	1 1/2	3/4	1.31	2
AA67042-12-8K	1 1/2	1	1.31	2
AA67042-12-10K	1 1/2	1 1/4	1.37	2
AA67042-16-8K	2	1	1.50	2 1/2
AA67042-16-10K	2	1 1/4	1.50	2 1/2
AA67042-16-12K	2	1 1/2	1.50	2 1/2



AA67042
PIPE THREAD REDUCER
male pipe thread-
female pipe thread

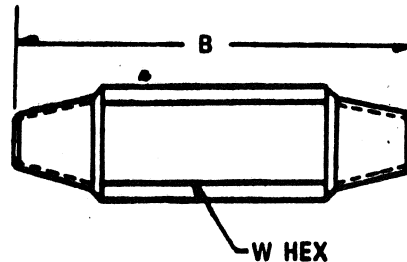
PART NUMBER	MALE PIPE THREAD	FEMALE PIPE THREAD	LENGTH	WEIGHT
AA67043-1K	1/8	9/32	.25	.34
AA67043-2K	1/4	3/8	.28	.50
AA67043-3K	3/8	7/16	.31	.50
AA67043-4K	1/2	9/16	.38	.64
AA67043-6K	3/4	5/8	.45	.66
AA67043-8K	1	13/16	.51	.81
AA67043-10K	1 1/4	15/16	.56	.84
AA67043-12K	1 1/2	1 1/8	.63	.84
AA67043-16K	2	1 5/8	.69	.86



AA67043
SQUARE HEAD PLUG
male pipe thread

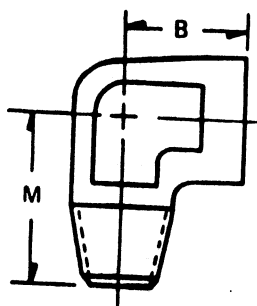
PART NUMBER	MALE PIPE THREAD	FEMALE PIPE THREAD	LENGTH	WEIGHT
AA67074-1K	1/8	*	2 1/16	
AA67074-2K	1/4	*	5/8	
AA67074-3K	3/8	*	3/4	
AA67074-4K	1/2	*	15/16	

*SPECIFY LENGTH

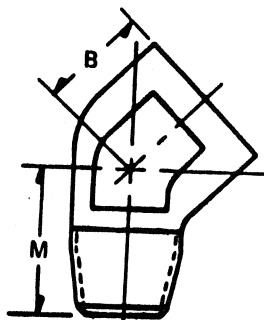


AA67074
LONG PIPE NIPPLE
male pipe thread

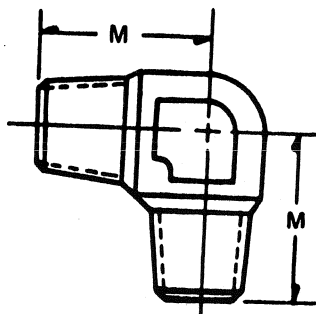
+Material K 316SS. See page 3 for additional materials and ordering information
Additional size combinations available



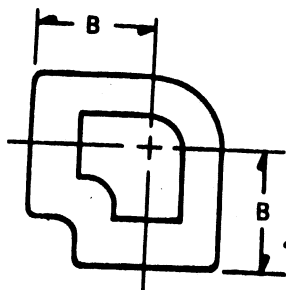
AA67044
STREET ELBOW
male pipe thread-
female pipe thread



AA67045
STREET ELBOW 45°
male pipe thread-
female pipe thread



AA67075
MALE PIPE ELBOW
male pipe thread



AA67046
FEMALE PIPE ELBOW
female pipe thread

PART NUMBER	PIPE SIZE	B	M
AA67044-1K	1/8	.65	.81
AA67044-2K	1/4	.88	1.2
AA67044-3K	3/8	.98	1.25
AA67044-4K	1/2	1.22	1.61
AA67044-6K	3/4	1.36	1.75
AA67044-8K	1	1.63	2.11
AA67044-10K	1 1/4	1.75	2.31
AA67044-12K	1 1/2	2.03	2.64
AA67044-16K	2	2.39	3.01

PART NUMBER	PIPE SIZE	B	M
AA67045-1K	1/8	.47	.72
AA67045-2K	1/4	.63	1.05
AA67045-3K	3/8	.72	1.06
AA67045-4K	1/2	.91	1.34
AA67045-6K	3/4	.97	1.38
AA67045-8K	1	1.13	1.72
AA67045-10K	1 1/4	1.20	1.87
AA67045-12K	1 1/2	1.69	2.06
AA67045-16K	2	2.22	2.16

PART NUMBER	PIPE SIZE	M
AA67075-1K	1/8	.78
AA67075-2K	1/4	1.09
AA67075-3K	3/8	1.22
AA67075-4K	1/2	1.47
AA67075-6K	3/4	1.59
AA67075-8K	1	1.97
AA67075-10K	1 1/4	2.38
AA67075-12K	1 1/2	2.64
AA67075-16K	2	3.00

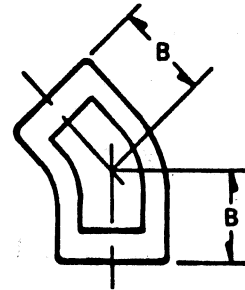
PART NUMBER	FEMALE PIPE THREAD	B
AA67046-1K	1/8	.66
AA67046-2K	1/4	.89
AA67046-3K	3/8	1.01
AA67046-4K	1/2	1.23
AA67046-6K	3/4	1.36
AA67046-8K	1	1.63
AA67046-10K	1 1/4	1.70
AA67046-12K	1 1/2	2.03
AA67046-16K	2	2.39

+Material K 316SS. See page 3 for additional materials and ordering information
Additional size combinations available

PIPE THREAD ADAPTERS 29

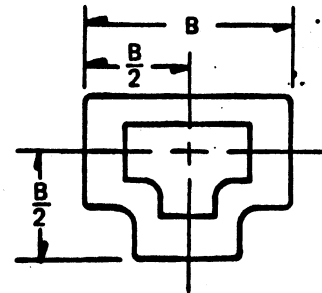
PART NUMBER	PIPE THREAD	B	W
AA67076-1K	1/8	.50	
AA67076-2K	1/4	.69	
AA67076-3K	3/8	.75	
AA67076-4K	1/2	.94	
AA67076-6K	3/4	1.00	
AA67076-8K	1	1.19	
AA67076-10K	1 1/4	1.44	
AA67076-12K	1 1/2	1.46	
AA67076-16K	2	1.59	

AA67076
FEMALE PIPE ELBOW 45°
female pipe thread



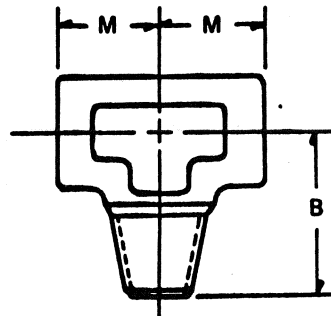
PART NUMBER	FEMALE PIPE THREAD	B	W
AA67047-1K	1/8	1.31	
AA67047-2K	1/4	1.78	
AA67047-3K	3/8	1.98	
AA67047-4K	1/2	2.47	
AA67047-6K	3/4	2.72	
AA67047-8K	1	3.25	
AA67047-10K	1 1/4	3.41	
AA67047-12K	1 1/2	4.06	
AA67047-16K	2	4.78	

AA67047
FEMALE PIPE TEE
female pipe threads



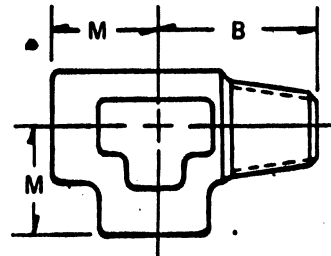
PART NUMBER	PIPE THREAD	B	W
AA67077-1K	1/8	.78	.66
AA67077-2K	1/4	1.09	.88
AA67077-3K	3/8	1.22	1.02
AA67077-4K	1/2	1.47	1.23
AA67077-6K	3/4	1.59	1.36
AA67077-8K	1	1.97	1.62
AA67077-10K	1 1/4	2.38	1.70
AA67077-12K	1 1/2	2.64	2.08
AA67077-16K	2	3.00	2.39

AA67077
MALE BRANCH TEE
female pipe thread-
male pipe thread



PART NUMBER	PIPE THREAD	B	W
AA67078-1K	1/8	.78	.66
AA67078-2K	1/4	1.09	.88
AA67078-3K	3/8	1.22	1.02
AA67078-4K	1/2	1.47	1.23
AA67078-6K	3/4	1.59	1.36
AA67078-8K	1	1.97	1.62
AA67078-10K	1 1/4	2.38	1.70
AA67078-12K	1 1/2	2.64	2.08
AA67078-16K	2	3.00	2.39

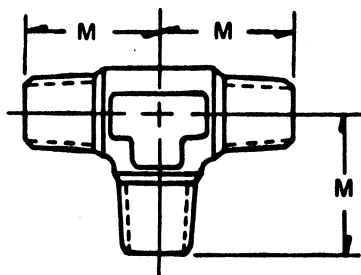
AA67078
STREET TEE
female pipe thread-
male pipe thread



+Material K 316SS. See page 3 for additional materials and ordering information
Additional size combinations available

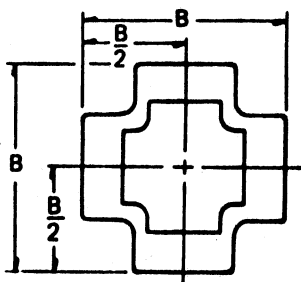
50 PIPE THREAD ADAPTERS

CATALOG 473K



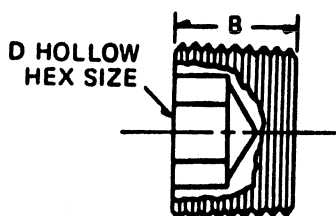
AA67079
MALE PIPE TEE
male pipe thread

PART NUMBER	MALE PIPE THREAD	B
AA67079-1K	1/8	.78
AA67079-2K	1/4	1.09
AA67079-3K	3/8	1.22
AA67079-4K	1/2	1.47
AA67079-6K	3/4	1.59
AA67079-8K	1	1.97
AA67079-10K	1 1/4	2.38
AA67079-12K	1 1/2	2.64
AA67079-16K	2	3.00



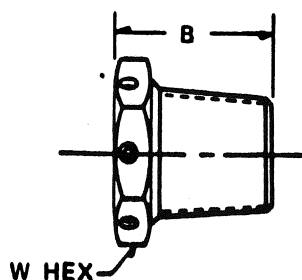
AA67048
FEMALE PIPE CROSS
female pipe thread

PART NUMBER	FEMALE PIPE THREAD	B
AA67048-1K	1/8	1.31
AA67048-2K	1/4	1.78
AA67048-3K	3/8	1.98
AA67048-4K	1/2	2.47
AA67048-6K	3/4	2.72
AA67048-8K	1	3.25
AA67048-10K	1 1/4	3.41
AA67048-12K	1 1/2	4.03
AA67048-16K	2	4.60



AA67049
HOLLOW HEX PIPE PLUG
male pipe thread

PART NUMBER	MALE PIPE THREAD	B	D
AA67049-1K	1/8	.28	3/32
AA67049-2K	1/4	.28	3/16
AA67049-3K	3/8	.42	1/4
AA67049-4K	1/2	.42	5/16
AA67049-5K	3/4	.54	3/8
AA67049-6K	1	.55	7/16
AA67049-7K	1 1/4	.69	1/2
AA67049-8K	1 1/2	.71	5/8

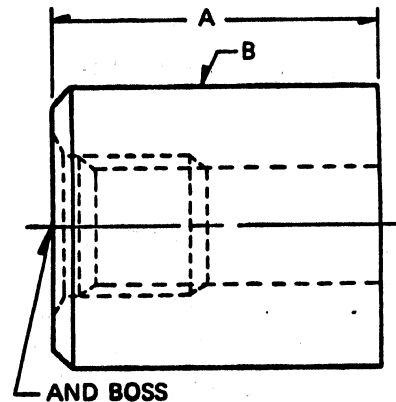


AA67050
HEX HEAD PIPE PLUG
male pipe thread

PART NUMBER	MALE PIPE THREAD	B	W
AA67050-1K	1/8	.61	1/16
AA67050-2K	1/4	.83	3/16
AA67050-3K	3/8	.91	1/8
AA67050-4K	1/2	1.09	1/4
AA67050-6K	3/4	1.17	1/2
AA67050-8K	1	1.39	3/4
AA67050-10K	1 1/4	1.42	1 1/8
AA67050-12K	1 1/2	1.44	1 1/4
AA67050-16K	2	1.47	1 1/2

+Material K 316SS. See page 3 for additional materials and ordering information
Additional size combinations available

AAB-1000-2	1/8	1.00	.75
AAB-1000-3	3/16	1.12	.87
AAB-1000-4	1/4	1.12	1.00
AAB-1000-5	5/16	1.25	1.12
AAB-1000-6	3/8	1.25	1.25
AAB-1000-8	1/2	1.37	1.37
AAB-1000-10	5/8	1.50	1.75
AAB-1000-12	3/4	1.75	1.87
AAB-1000-16	1	2.00	2.25
AAB-1000-20	1 1/4	2.25	2.37
AAB-1000-24	1 1/2	2.50	2.75
AAB-1000-28	1 3/4	2.50	2.93
AAB-1000-32	2	2.75	3.37
AAB-1000-40	2 1/2	2.75	3.50
AAB-1000-48	3	2.75	4.00



AND BOSS

AAB1000
WELDING BOSS

ASK ABOUT ALLAN AIRCRAFT WELDING BOSES AND ADAPTERS.

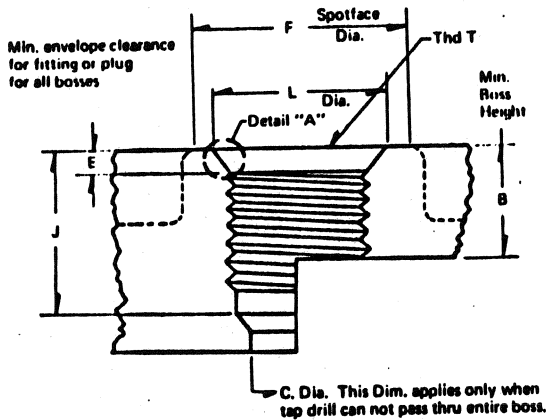
STAINLESS STEEL WEIGHT CHART

Weights shown in table are for individual fitting parts. To get total weight of assembled fitting, add nut and sleeve weights to body weight.

APPROXIMATE WEIGHTS (in pounds)

SIZE NO.	AA67805	AA67812	AA67820	AA67801	AA67807	AA67810	AA67814	AA67823	AA67811	AA67813	AA67815	AA67816	AA67808	AA67809	AA67817	AA67818	AA67819	AA67824	AA67826	AA67825	AA67822	AA67823
2	.022	.042	.027	.036	.030	.022	.067	.029	.039	.030	.094	.108	.030	.050	.037	.056	.064		.011	.014	.008	.0018
3	.028	.046	.030	.042	.033	.025	.070	.037	.047	.042	.096	.110	.045	.070	.045	.067	.066		.014	.017	.014	.0023
4	.030	.049	.034	.042	.047	.033	.075	.050	.064	.070	.098	.112	.067	.112	.070	.078	.078		.026	.024	.025	.0035
4-4	.042	.090			.059	.063	.156															
6	.036	.047	.041	.050	.056	.047	.075	.067	.072	.081	.103	.118	.095	.120	.081	.100	.099		.032	.031	.030	.0041
6-4	.048	.093			.067	.069																
6	.047	.093	.056	.072	.087	.061	.150	.078	.081	.120	.189	.218	.098	.115	.114	.123	.111		.040	.044	.037	.006
6-2	.047				.078	.062	.068															
6-4																		.025				
6-6	.070	.138			.101	.107	.218															
6-8	.095				.126	.156																
8	.100	.156	.113	.134	.183	.117	.234	.192	.117	.238	.276	.318	.120	.323	.207	.277	.244		.069	.073	.061	.013
8-4	.092				.180	.127	.162															
8-6																			.037			
8-8	.157				.260	.200	.397															
8-12	.194				.365	.303																
10	.168	.266	.176	.204	.263	.179	.398	.289	.361	.350	.488	.539	.378	.495	.319	.394	.341		.104	.132	.087	.017
10-6	.154				.274	.208												.050				
12	.266	.406	.296	.355	.400	.316	.550	.436	.540	.554	.755	.868	.604	.786	.481	.458	.549		.187	.210	.156	.028
12-4																			.075			
12-6																			.077			
12-8	.241				.375	.300	.390												.094			
16	.327	.533	.398	.467	.658	.470	1.125	.659	.868	.868	1.375	1.432	.828	1.080	.855	.948	.775		.291	.311	.217	.050
16-12	.333				.613	.450												.141				
20	.610	.907	.808	.669	1.008	.644	1.375	1.182	1.470	1.260	1.790	2.083	1.420	1.830	.928	1.265	1.164		.065	.470	.506	.086
24	.880	1.000	.827	.874	1.415		3.480	1.528	1.629	1.960	4.350	6.000	1.596	2.520	1.282	1.890	1.738		.780	.714	.655	.134
28	.896		1.424	1.484	1.960	1.316		2.150	2.609	2.296			2.587	4.750	1.990	3.710	3.413		1.117	1.100	.935	.183
32	1.176		1.939	2.100	2.324	1.624		2.794	3.080	2.718			2.998	5.900	2.360	4.303	3.598		1.721	1.430	1.383	.246

SAE internal straight thread BOSS

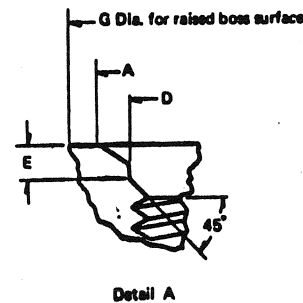
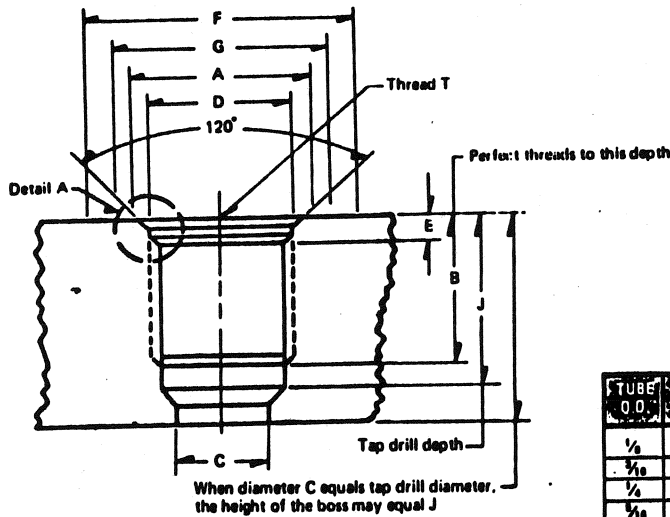


TUBE O.D.	THREAD	B	C	D	E	F	G	J
1/8	1/8-24	.390	.062	.358	.074	.672	.468	12
1/8	1/8-24	.390	.125	.421	.074	.750	.468	12
1/8	1/8-20	.464	.172	.487	.093	.828	.547	12
1/8	1/8-20	.464	.234	.550	.093	.906	.547	12
1/8	1/8-18	.500	.297	.618	.097	.969	.609	12
1/8	1/8-18	.500	.391	.811	.100	1.188	.688	15
1/8	1/8-14	.658	.484	.942	.100	1.344	.781	15
1/8	1/8-14	.658	.609	1.148	.130	1.625	.908	15
1	1 1/8-12	.750	.844	1.388	.130	1.910	.908	15
1	1 1/8-12	.750	1.078	1.713	.132	2.270	.908	15
1 1/2	1 1/2-12	.750	1.312	1.982	.132	2.560	.908	15
2	2 1/2-12	.750	1.781	2.587	.132	3.480	.908	15



ALLAN AIRCRAFT fittings and straight thread fittings are designed for use in SAE or AND style boss.

AND 10050 internal straight thread BOSS



Illustrations and tables for descriptive purposes only. Detailed specifications supplied upon request.

TUBE O.D.	THREAD	A	B	C	D	E	F	G	J
1/8	1/8-24	.438	.375	.062	.328	.083	.672	.562	.500
1/8	1/8-24	.500	.408	.125	.390	.083	.750	.625	.500
1/8	1/8-20	.562	.438	.172	.454	.075	.828	.688	.594
1/8	1/8-20	.625	.438	.234	.517	.075	.906	.750	.594
1/8	1/8-18	.688	.469	.297	.580	.083	.969	.812	.594
1/8	1/8-18	.775	.562	.391	.789	.084	1.188	1.032	.718
1/8	1/8-14	1.000	.625	.484	.896	.107	1.344	1.157	.781
1/8	1 1/8-12	1.234	.688	.609	1.088	.125	1.625	1.408	.908
1	1 1/8-12	1.487	.688	.844	1.338	.125	1.910	1.658	.938
1 1/2	1 1/8-12	1.800	.688	1.078	1.648	.125	2.270	1.989	.984
1 1/2	1 1/2-12	2.060	.750	1.312	1.888	.125	2.560	2.219	1.125
1 1/2	2 1/2-12	2.428	.812	1.547	2.273	.125	3.010	2.594	1.250
2	2 1/2-12	2.676	.938	1.781	2.524	.125	3.480	2.844	1.375

**MILITARY SPECIFICATION
MIL-F-18866
CONVERSION TABLE**

DESCRIPTION	MIL-F-18866	ALLAN AIRCRAFT
MALE CONNECTOR	TYPE I STYLE 1	AA67006
FEMALE CONNECTOR	TYPE I STYLE 2	AA67013
STRAIGHT THREAD CONNECTOR	TYPE I STYLE 3	AA67022
STRAIGHT THREAD LONG CONNECTOR	TYPE I STYLE 4	AA67023
UNION	TYPE II STYLE 1	AA67000
LARGE HEX UNION	TYPE II STYLE 2	AA67001
LONG UNION	TYPE II STYLE 3	AA67002
BULKHEAD UNION	TYPE II STYLE 4	AA67017
MALE 45° ELBOW	TYPE III STYLE 1	AA67010
MALE 90° ELBOW	TYPE III STYLE 2	AA67007
UNION ELBOW	TYPE III STYLE 3	AA67003
FEMALE 90° ELBOW	TYPE III STYLE 4	AA67014
BULKHEAD UNION ELBOW	TYPE III STYLE 5	AA67018
BULKHEAD 45° UNION ELBOW	TYPE III STYLE 6	AA67019
STRAIGHT THREAD 90° ELBOW	TYPE III STYLE 7	AA67024
STRAIGHT THREAD 45° ELBOW	TYPE III STYLE 8	AA67025
SWIVEL NUT 90° ELBOW	TYPE III STYLE 9	AA67028
SWIVEL NUT 45° ELBOW	TYPE III STYLE 10	AA67029
MALE RUN TEE	TYPE IV STYLE 1	AA67011
MALE BRANCH TEE	TYPE IV STYLE 2	AA67012
UNION TEE	TYPE IV STYLE 3	AA67004
FEMALE BRANCH TEE	TYPE IV STYLE 4	AA67016
FEMALE RUN TEE	TYPE IV STYLE 5	AA67015
BULKHEAD BRANCH TEE	TYPE IV STYLE 6	AA67020
BULKHEAD RUN TEE	TYPE IV STYLE 7	AA67021
STRAIGHT THREAD RUN TEE	TYPE IV STYLE 8	AA67026
SWIVEL NUT RUN TEE	TYPE IV STYLE 9	AA67030
STRAIGHT THREAD BRANCH TEE	TYPE IV STYLE 10	AA67027
SWIVEL NUT BRANCH TEE	TYPE IV STYLE 11	AA67031
UNION CROSS	TYPE V	AA67005
PLUG	TYPE VI	AA67035
TUBE NUT	TYPE VII	AA67032
SLEEVE	TYPE VIII	AA67033
CAP	TYPE IX	AA67036
LOCKNUT	TYPE X STYLE 1	AA1468
LOCKNUT	TYPE X STYLE 2	AA67051
TUBE END REDUCER	TYPE XIII	AA67034
STRAIGHT THREAD BOSS PLUG	TYPE XIV	AA67038

**FLAKE FITTING
CROSS REFERENCE CHART**

<u>MC</u>	<u>KC</u>	<u>MS</u>	<u>AN</u>	<u>PARKER AQR</u>
MC124	KC142		AN818	PTX
MC125	KC143	MS20819	AN819	TX
MC156	KC120	MS24388	AN753	
MC157	KC119	MS24389	AN784	
MC158	KC114	MS24390	AN804	WJTX
MC159	KC130	MS24401	AN806	PNTX
MC160	KC126	MS24392	AN813	HTX
MC161	KC116	MS24401	AN821	FTX
MC162	KC123	MS24402	AN824	JTX
MC163	KC117	MS24403	AN827	KTX
MC164	KC124	MS24393	AN832	WTX
MC165	KC113	MS24394	AN833	WTX
MC166	KC127	MS24395	AN834	WJTX
MC167	KC128	MS24396	AN837	WNTX
MC169	KC125	MS24399	AN919	
MC177				FNTX
MC178	KC136			
MC200	KC131			CGX
MC201	KC108			CSX
MC202	KC132			V6X
MC203	KC129			V5X
MC204	KC109			S6
MC205	KC107			R6X
MC206	KC111			S5X
MC207	KC110			R5X
MC210	KC137			
MC211	KC138			
MC212	KC139			
MC213	KC140			
MC221				
MC223	KC141			
MC224			AN929	
MC233				F565
MC234		MS24397	AN893	F565
MC235	KC133			
MC236	KC134			X112A
MC237	KC112	MS24487		F5X
MC238		MS24391	AN814	
MC239	KC115	MS24398	AN894	
MC241				F50F50
MC242	KC135			F5X
MC243				A11A
MC244				
MC247	KC106			T11TX
MC250				R5X
MC251				S5X
	KC116		AN816	FTX
	KC121	MS20826	AN826	RTX
	KC122	MS20825	AN825	STX
	KC144			

**FLARE FITTING
CROSS REFERENCE CHART**

<u>KC</u>	<u>MC</u>	<u>MS</u>	<u>AN</u>	<u>PARKER AQR</u>
KC106	MC217			TRTX
KC107	MC205			R6X
KC108	MC201			C6X
KC109	MC204			S6
KC110	MC207			R5X
KC111	MC206			S5X
KC112	MC217	MS24447		F5X
KC113	MC165	MS24394	AN833	WLTX
KC114	MC158	MS24390	AN804	WJTX
KC115	MC239	MS24398	AN894	
KC116			AN816	FTX
KC117	MC163	MS24403	AN827	KTX
KC118	MC161	MS24401	AN821	ETX
KC119	MC157	MS24389	AN744	
KC120	MC150	MS24388	AN783	
KC121		MS20826	AN826	RTX
KC122		MS20825	AN825	STX
KC123	MC162	MS24402	AN824	JTX
KC124	MC164	MS24393	AN832	WTX
KC125	MC169	MS24399	AN919	
KC126	MC160	MS24392	AN815	HTX
KC127	MC166	MS24395	AN834	WJTX
KC128	MC167	MS24396	AN837	WNTX
KC129	MC207			V5X
KC130	MC159	MS24404	AN806	PNTX
KC131	MC200			C6X
KC132	MC202			V6X
KC133	MC235			
KC134	MC236			X112A
KC135	MC242			F5X
KC136	MC178			
KC137	MC210			
KC138	MC211			
KC139	MC212			
KC140	MC213			
KC141	MC223			
KC142	MC124		AN818	DTX
KC143	MC125	MS20819	AN819	TX
KC144				
	MC221			
	MC224		AN929	
	MC233			F565
	MC234	MS24397	AN893	F565
	MC238	MS24391	AN814	
	MC241			F50F60
	MC243			A11A
	MC244			
	MC250			R6X
	MC251			S5X
	MC177			ENTX

**FLAKE FITTING
CROSS REFERENCE CHART**

<u>MC</u>	<u>KC</u>	<u>MS</u>	<u>AN</u>	<u>PARKER AGR</u>
MC121	KC142		AN818	PTX
MC125	KC143	MS20819	AN819	TX
MC156	KC120	MS24388	AN753	
MC157	KC119	MS24389	AN784	
MC158	KC114	MS24390	AN803	WJTX
MC159	KC130	MS24401	AN806	PNTX
MC160	KC126	MS24392	AN815	HTX
MC161	KC118	MS24401	AN821	ETX
MC162	KC123	MS24402	AN824	JTX
MC163	KC117	MS24403	AN827	KTX
MC164	KC124	MS24393	AN832	WTX
MC165	KC113	MS24394	AN833	WE TX
MC166	KC127	MS24395	AN834	WJTX
MC167	KC128	MS24396	AN837	WNTX
MC169	KC125	MS24399	AN919	
MC177				FNTX
MC178	KC136			
MC200	KC131			C6X
MC201	KC108			C5X
MC202	KC132			V6X
MC203	KC129			V5X
MC204	KC109			S6
MC205	KC107			R6X
MC206	KC111			S5X
MC207	KC110			R5X
MC210	KC137			
MC211	KC138			
MC212	KC139			
MC213	KC140			
MC221				
MC223	KC141			
MC224			AN929	
MC233				F565
MC234		MS24397	AN893	F565
MC235	KC133			
MC236	KC134			X112A
MC237	KC112	MS24487		F5X
MC238		MS24391	AN814	
MC239	KC115	MS24398	AN894	
MC241				F50F60
MC242	KC135			F5X
MC243				A11A
MC244				
MC247	KC106			TRTX
MC250				R5X
MC251				S5X
	KC116		AN816	FTX
	KC121	MS20826	AN826	RTX
	KC122	MS20825	AN825	STX
	KC144			

**FLARE FITTING
CROSS REFERENCE CHART**

<u>KC</u>	<u>MC</u>	<u>MS</u>	<u>AN</u>	<u>PARKER AQR</u>
KC106	MC247			TRTX
KC107	MC205			R6X
KC108	MC201			C5X
KC109	MC204			S6
KC110	MC207			R5X
KC111	MC206			S5X
KC112	MC237	MS24447		F5X
KC113	MC165	MS24394	AN833	WE TX
KC114	MC158	MS24390	AN804	WJTX
KC115	MC239	MS24398	AN894	
KC116			AN816	FTX
KC117	MC163	MS24403	AN827	KTX
KC118	MC161	MS24401	AN821	ETX
KC119	MC157	MS24369	AN744	
KC120	MC150	MS24348	AN763	
KC121		MS20826	AN826	HTX
KC122		MS20825	AN825	STX
KC123	MC162	MS24402	AN824	JTX
KC124	MC164	MS24393	AN832	WTX
KC125	MC169	MS24399	AN919	
KC126	MC160	MS24392	AN815	HTX
KC127	MC166	MS24395	AN834	WJTX
KC128	MC167	MS24396	AN837	WNTX
KC129	MC207			V5X
KC130	MC159	MS24404	AN806	PNTX
KC131	MC200			C6X
KC132	MC202			V6X
KC133	MC235			
KC134	MC236			X112A
KC135	MC242			F5X
KC136	MC178			
KC137	MC210			
KC138	MC211			
KC139	MC212			
KC140	MC213			
KC141	MC223			
KC142	MC124		AN818	PTX
KC143	MC125	MS20819	AN819	TX
KC144				
	MC221			
	MC224		AN929	
	MC233			F565
	MC234	MS24397	AN893	F565
	MC238	MS24391	AN814	
	MC241			F50F80
	MC243			AHA
	MC244			
	MC250			R5X
	MC251			S5X
	MC177			ENTX



ALPHABETICAL INDEX

PUBLICATIONS 543-G-23, 543-G-25, AND 543-G-26

15 SEPTEMBER 1977

PAGE

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CLAMP, LOOP, CUSHIONED, DOUBLE SELF-LKG	ME127-0068	543-G-25	VOL 2	1272-6	COUPLING, 40 DEG V-BAND, CRES	ME277-0019	543-G-23	VOL 1	2770-25
CLAMP, LOOP, CUSHIONED, TRIPLE SELF-LKG	ME127-0069	543-G-25	VOL 2	1272-7	COVER, VENT				
CLAMP, LOOP, CUSHIONED, QUAD, SELF-LK 3	ME127-0070	543-G-25	VOL 2	1272-8	COVER ASSY-VENT, .004 THICK,				
CLAMP, LOOP, CUSHIONED, WEDGE, SELF-LKG	ME127-0071	543-G-25	VOL 2	1272-9	INSULATION BLANKET				
SELF-LOCKING, TAB					COVER-VENT, .004 THICK,				
CLAMP, PLAIN, SUPPORT, LOOP TYPE AIRCRAFT	ME127-0072	543-G-25	VOL 2	1272-12	INSULATION BLANKET	MD193-0020	543-G-25	VOL 3	1932-1
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CLAMP, SADDLE, 2-HOLE MTG, BARE METAL	ME127-0077	543-G-25	VOL 2	1272-15	ELECTRICAL SYSTEM IDENTIFICATION TYPES				
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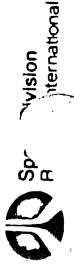


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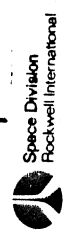
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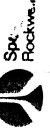


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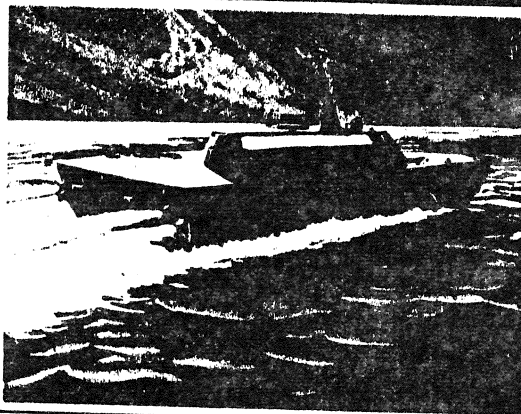
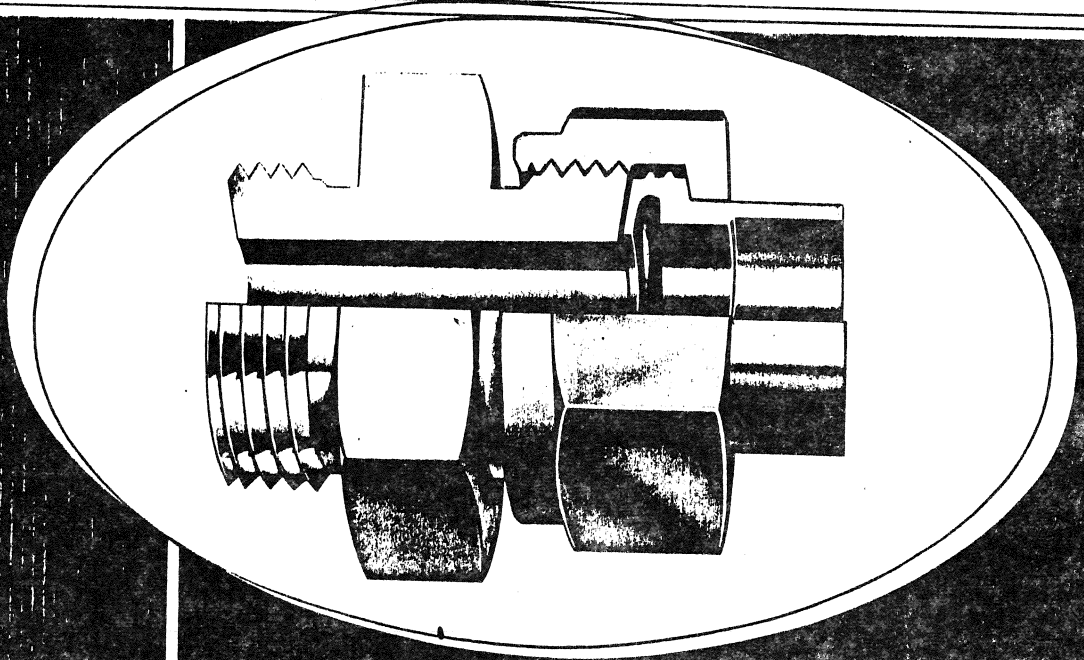


RESISTOFLEX
CORPORATION

DY-8

DYNATUBE® FITTING

dynamically sealed
connection for high performance systems





DYNATUBE® FITTING

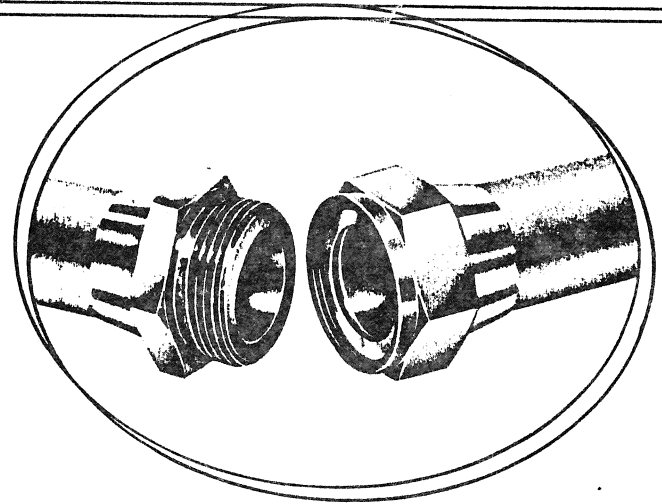
dynamically sealed connection

Superior Seal The Dynatube fitting, a Resistoflex® development, is rapidly becoming the standard connector for performance systems. It offers the ultimate in quality assurance for fuel, pneumatic, hydraulic and other critical connectors. With its superior sealing principle, it is a lighter and shorter connector that saves weight and space, and yet is so strong it will withstand the most severe service abuse.

Small Envelope Because the nut and connector hexes are the same or smaller than equivalent AN sizes and substantially shorter in axial length, the Dynatube fitting has a smaller envelope. Less clearance is required for installation and maintenance in critical applications — far less than comparable AN fittings. Wrench access is easier, and if it is necessary to install the Dynatube fitting vertically, the threaded shoulder maintains the nut at the end of the tube or hose in a ready position during installation.

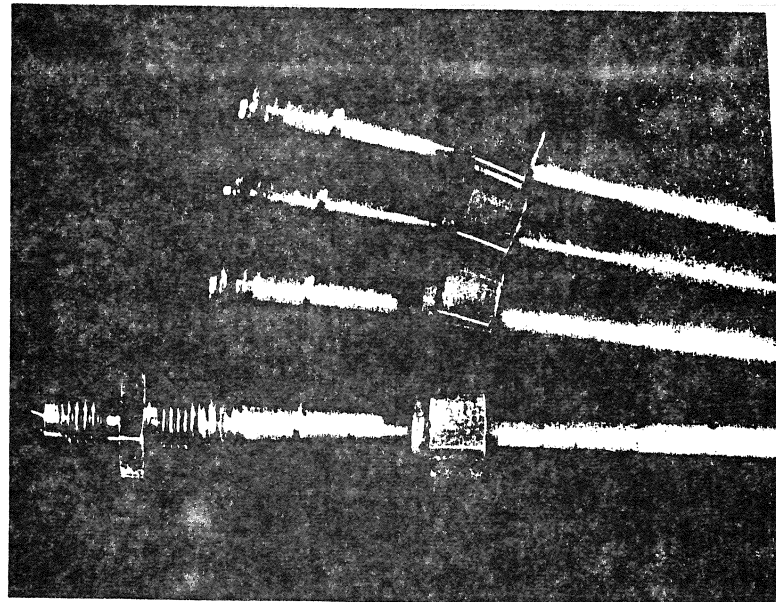


Strong Construction The Dynatube fitting is considerably stronger structurally than AN or MS fittings. Its high strength construction and design afford greater protection from human errors in service. The possibility of damage to the seal either before installation or during overhaul is minimized as the threaded shoulder allows the nut to act as a protective cover for the tube end.



Zero Leakage There are no leakage problems with the Dynatube fitting. Its ability to hold pressure without leakage cannot be matched by any standard fitting. Its unique design is based on the principle of predetermined stress level at the sealing point. Efficiency actually increases with higher pressures. The standard materials, 17-4PH and Titanium 6-4 are rated for hot service, to 600° F, depending upon the application and is qualified at minus 65° F as well. The Dynatube fitting is not affected by temperature cycling as are standard connections because the design and principle compensate for "creep" of the metals.

Protrusion Advantage



Because the nut can be pulled back, the sealing surface of the tube fitting can be easily aligned with sealing surface of the connector as illustrated. This facilitates installation by eliminating the need to spring the tubing.

Resistoflex licensees:
Aeroquip Corporation, subsidiary of Libbey-Owens-Ford Co., Jackson, Michigan, U.S.A.
Palmer Aero Division of BTR Industries, Ltd., London, England
Resistoflex GmbH, Plorzheim, Germany
Sakura Rubber Co., Ltd., Tokyo, Japan

Dynatube, a Resistoflex development, is patented in the United States and foreign countries.

©RESISTOFLEX CORPORATION, 1969, 1974

Torque Independence The high torque resistant structural design of the Dynatube fitting provides protection against over-tightening because the stress on sealing surfaces is controlled by the dimensions built in at the factory. The torque range of the Dynatube fitting is so wide that from a practical standpoint, torque wrenches may be dispensed with, if not required for procedural uniformity. The Dynatube fitting seal is independent of torque effects.

Materials The standard Dynatube fitting, unless otherwise specified, is made of 17-4PH and Titanium 6-4.

Method of Attachment Fitting tube receptacle design for brazing, welding or mechanical attachment (internal swaging) can be furnished per customer specifications.

DYNATUBE FITTINGS
are now used in applications
such as:

- Hydraulic and Pneumatic Systems
- In Latest Air Force and Navy Superiority Fighters
- Helicopters
- Hydrofoils
- Jet Engine Fuel and Lube Systems
- Commercial Aircraft Utility System
- Nuclear Reactors

Resumé of Evaluation Tests

ZERO LEAKAGE*

Zero Leakage at 3000 psi gaseous helium service.

Zero Leakage at 10^{-10} Torr hard vacuum service.

REDUNDANCY

Redundancy requirements met by special secondary seal designs capable of less than 10^{-4} cc/sec helium at 1000 psi.

*Mass spectrometer sensitivity of less than 10^{-9} cc/sec.

Weight Comparison (pounds)

Dynatube® vs. MS Flareless

Weight of steel Dynatube® mechanically swaged fittings compared to steel MS Flareless. Comparison made on the total weight of a straight tube to tube union.

SIZE	STEEL MECHANICALLY ATTACHED DYNATUBE® TUBE-TO-TUBE UNION	FLARELESS TUBE-TO-TUBE UNION	% SAVINGS WITH DYNATUBE® UNION
03	.023	.056	59
04	.040	.102	61
05	.048	.115	58
06	.062	.165	62
08	.100	.275	64
10	.162	.387	58
12	.210	.643	67
16	.375	.864	57
20	.462	1.500	69
24	.695	1.750	60

Nominal Installation Torque Values

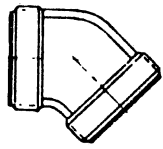
SIZE	-03	-04	-05	-06	-08	-10	-12	-16	-20	-24
FOOT POUNDS	7	12	13	20	35	48	60	82	105	130
INCH POUNDS	84	144	156	240	420	576	720	984	1260	1560

Lighter Dynatube fittings are significantly lighter than flared, modified flared, and flareless fitting designs. As the weight comparison chart illustrates, its unique design offers up to 67 percent savings over flareless fittings in steel.

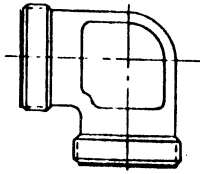
Additional Literature:

Presenting the Dynatube Fitting ... DYP-4 Bulletin
 Dynatube Fitting Repair Procedure . DY-5 Bulletin
 Dynatube Tool Service Procedure .. DY-6 Bulletin
 Dynatube to Rosan & Crissair DY-7 Bulletin

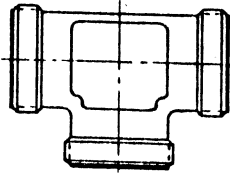
TYPICAL DYNATUBE FITTING CONFIGURATIONS



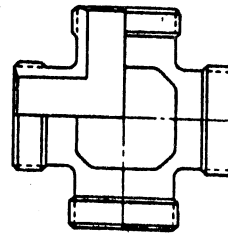
R44104 45° Elbow



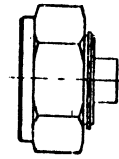
R44106 90° Elbow



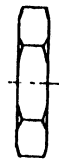
R44111 Tee



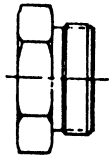
R44114 Cross



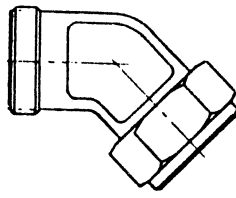
R44117 Cap



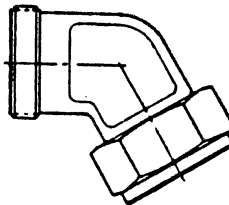
R44118 Jam Nut



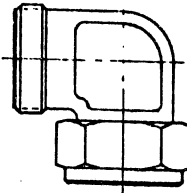
R44119 Plug



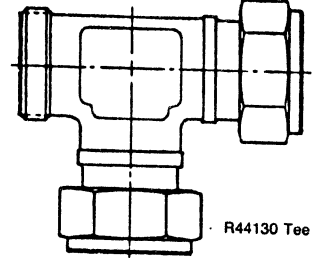
R44129-45 45° Elbow



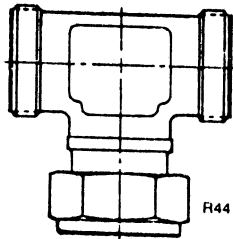
R44129-60 60° Elbow



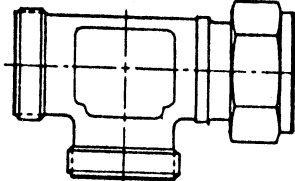
R44129-90 90° Elbow



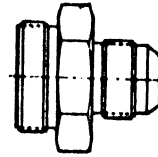
R44130 Tee



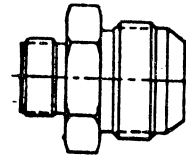
R44132 Tee



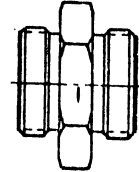
R44133 Tee



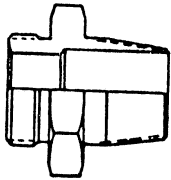
R44180 Reducer to AN



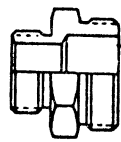
R44181 Expander to AN



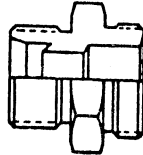
R44182 To Port



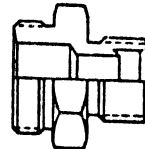
R44184 To Male Pipe



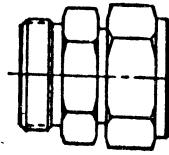
R44191 Expander to Port



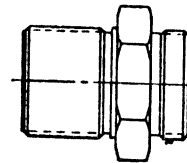
R44195 To MS



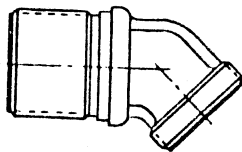
R44197 Reducer to MS



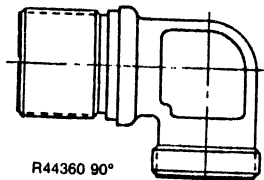
R44239 Connector



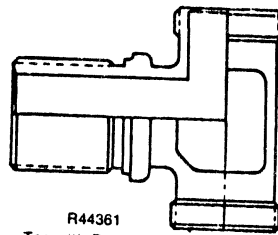
R44358 Connector with Bulkhead



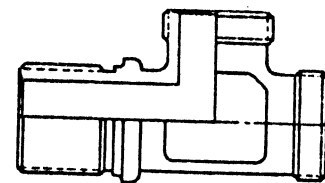
R44359 45° Elbow with Bulkhead



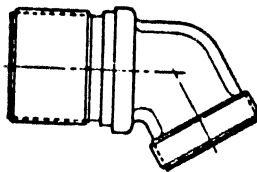
R44360 90° Elbow with Bulkhead



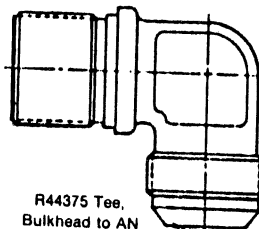
R44361 Tee with Bulkhead



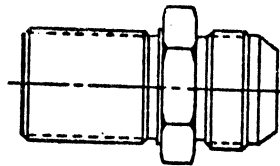
R44362 Tee with Bulkhead



R44365 60° Elbow with Bulkhead



R44375 Tee, Bulkhead to AN



R44382 Bulkhead to AN

50599 C . R44120
 SCALE: NONE
 STANDARD SHEET
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 SIZE

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R44120M

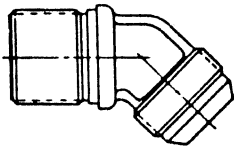
3

TYPICAL DYNATUBE FITTING CONFIGURATIONS

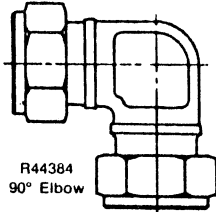
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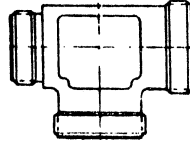
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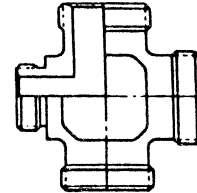
R44383 45° Elbow to AN



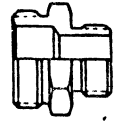
R44384
90° Elbow



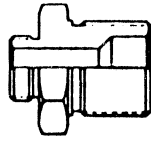
R45111 Tee Reducer



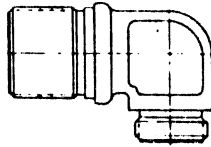
R45114 Cross Reducer



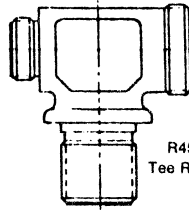
R45116
Reducer to Port



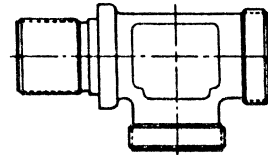
R45118 Bulkhead Reducer



R45120 90° Elbow Reducer



R45121
Tee Reducer



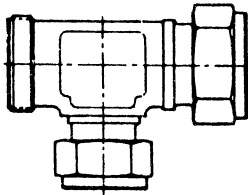
R45122 Tee Reducer

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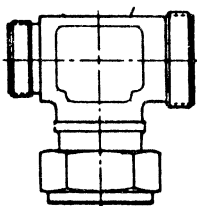
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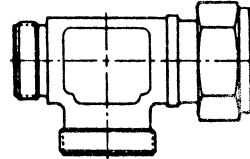
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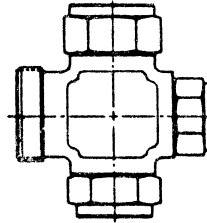
R45130 Tee Reducer



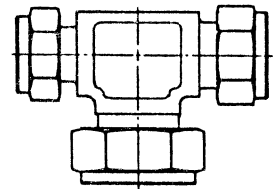
R45132 Tee Reducer



R45133 Tee Reducer

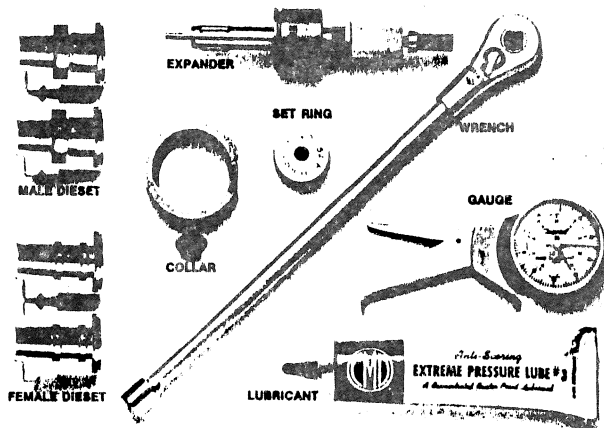


R45138 Cross Reducer

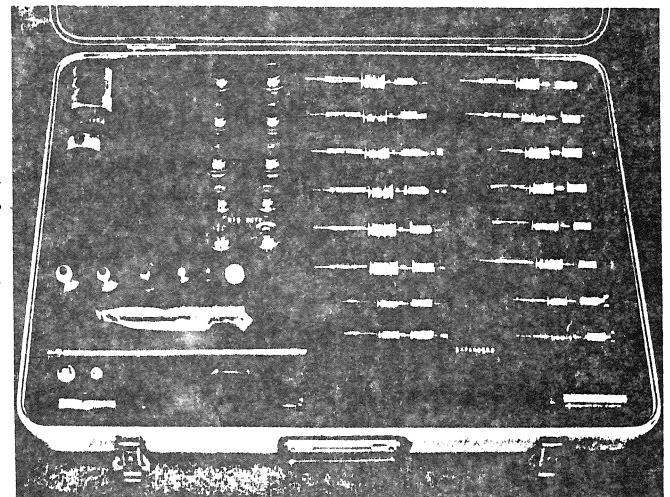


R45140 Tee Reducer

TOOLING FOR SWAGING AND REPAIR



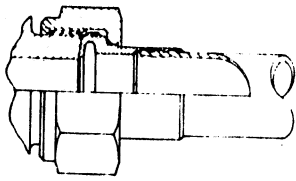
Typical tools for mechanical swaging



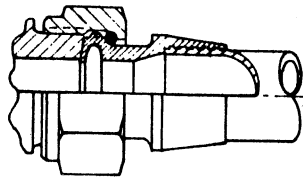
Tooling kit for field installation and repair

METHODS OF ATTACHMENT TO ALUMINUM, STEEL & TITANIUM TUBING

Mechanical—Internal Swaging

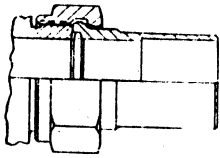


MR44000
SERIES
(17-4PH)

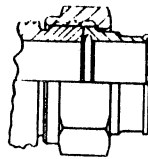


MR54040
SERIES
(Titanium)

Welding

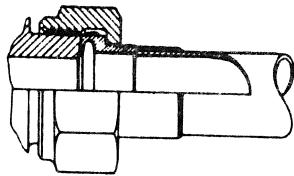


STANDARD
BUTT WELD

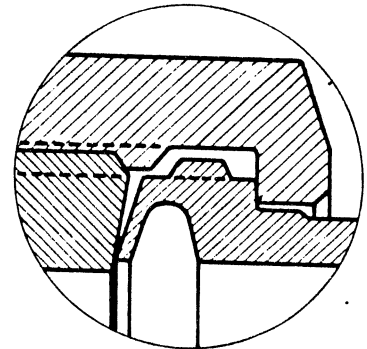


INTEGRAL T
BUTT WELD

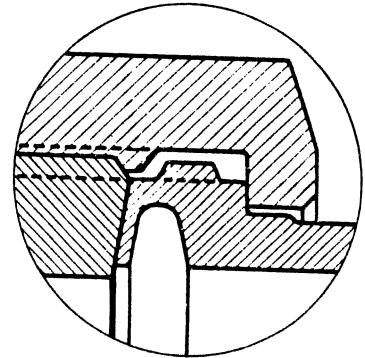
Brazing



DYNATUBE® SUPERIOR SEALING PRINCIPLE



View of Seal in
Unloaded Condition



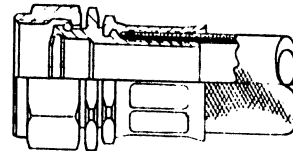
View of Seal in
Loaded Condition Showing:

1. Self-energizing metal to metal seal:
2. Hydraulic boost in seal. (Seal efficiency increases with higher pressure.)
3. Tightening produces structural forces only.
4. Loaded seal provides self locking action.

ATTACHMENT TO HOSE

For attachment to Teflon hose the externally swaged method is preferred and recommended. Approved to MIL-H-25579 for Medium Pressure and MIL-H-38360 for High Pressure.

Model A26699 Swaging Tool permits field fabrication of hose assemblies.



REFER OUR "AEROSPACE PRODUCT HANDBOOK" FOR COMPLETE INFORMATION

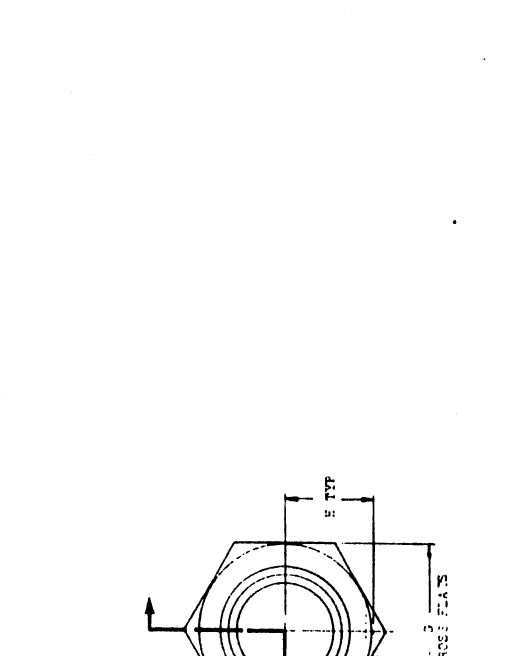
RESISTOFLEX CORPORATION

ROSELAND, NEW JERSEY 07068 (201) 226-7700
ANAHEIM, CALIFORNIA 92803 (714) 772-4700
Sales Offices and Distributors in Major Cities

Litho in U.S.A.

REVISIONS			
SYM	DATE	BY	ECN
A	10-26-74	MM	22849
B	10-26-74	MM	22859

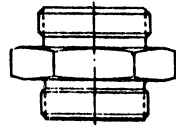
NOTES:
 1. CLEAN PER RES 104 - NO EXCLUSIONS PERMITTED.
 2. VARY RESISTOFLEX PART NO. AND DIMENSION PART NO. ON PACKAGE.



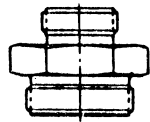
SIZE	+0.00 -0.005 A		+0.010 -0.005 B		+0.007 -0.005 C		+0.010 -0.005 D		+0.007 -0.005 E		+0.005 -0.005 F		+0.005 -0.005 G		+0.005 -0.005 H		+0.005 -0.005 J		+0.003 -0.003 K		+0.020 -0.020 L		T THREAD
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04	.035	.180	.725	.475	.275	.375	.152	.435	.171	.075	.062	.062	.062	.062	.062	.062	.062	.062	.062	.062	.062	.062	.4375-24 UNJS-3A
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06	.049	.277	.756	.536	.266	.375	.152	.435	.171	.075	.062	.062	.062	.062	.062	.062	.062	.062	.062	.062	.062	.062	.5625-20 UNJS-3A
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10	.083	.459	.877	.627	.372	.525	.227	.527	.275	.123	.062	.062	.062	.062	.062	.062	.062	.062	.062	.062	.062	.062	.8125-18 UNJS-3A
12	.095	.560	1.011	.711	.412	.563	.252	1.000	.453	.172	.062	.062	.062	.062	.062	.062	.062	.062	.062	.062	.062	.062	1.0000-16 UNJS-3A
15	.120	.760	1.065	.765	.460	.612	1.002	1.250	.629	.272	.062	.062	.062	.062	.062	.062	.062	.062	.062	.062	.062	.062	1.2500-14 UNJS-3A
20	.065	1.120	1.125	.825	.485	.681	1.352	1.625	.816	.370	.062	.062	.062	.062	.062	.062	.062	.062	.062	.062	.062	.062	1.5156-14 UNJS-3A
24	.065	1.370	1.310	.810	.510	.770	1.502	1.875	.910	.470	.062	.062	.062	.062	.062	.062	.062	.062	.062	.062	.062	.062	1.7812-14 UNJS-3A

RESISTOFLEX - ROSELAND, N.J.
 CONNECTOR, DYNATUBE BUTT-WELD MALE THREADED
 SIZE C R44120
 PART NO. 50599
 DATE 5-21-72
 DRAWN BY J. J. COAKLEY
 CHECKED BY J. J. COAKLEY
 APPROVED BY J. J. COAKLEY
 REVISIONS: 1
 SCALE: 1:1
 SHEET: 1 OF 1

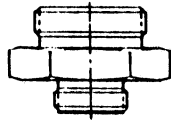
CONNECTORS



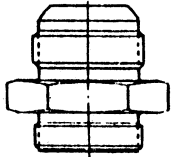
R4185
CONNECTOR, SIZE TO SIZE
Dynatube Male to AS930 Boss



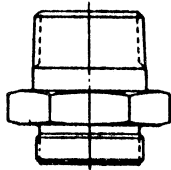
R4516
CONNECTOR, REDUCER
Dynatube Male to AS930 Boss



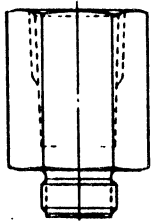
R4191
CONNECTOR, EXPANDER
Dynatube Male to AS930 Boss



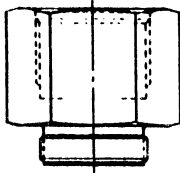
R4197
CONNECTOR, SIZE TO SIZE
Dynatube Male to GS Ball Boss



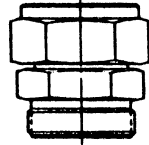
R4119
CONNECTOR
Dynatube Male to Male Pipe



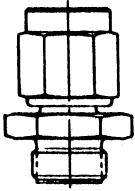
R4119
CONNECTOR
Dynatube Male to Female Pipe



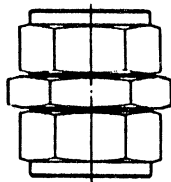
R4193
CONNECTOR, SIZE & EXPANDER
Dynatube Male to MS3649 Post



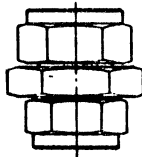
R4199
CONNECTOR, SIZE & EXPANDER
Dynatube Male to Dynatube Female



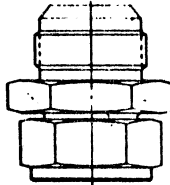
R4168
CONNECTOR, Q403 SIZE ONLY
Dynatube Male to MS Female



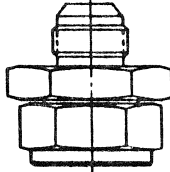
R4280
CONNECTOR, SIZE TO SIZE
Dynatube Female to Dynatube Female



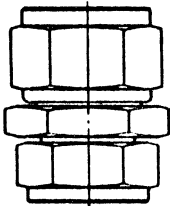
R4280
CONNECTOR, EXPANDER
Dynatube Female to Dynatube Female



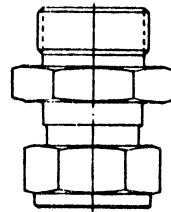
R4150
CONNECTOR, SIZE TO SIZE
Dynatube Female to AN Male



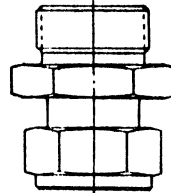
R4150
CONNECTOR, REDUCER
Dynatube Female to AN Male



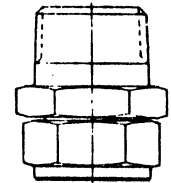
R4219
CONNECTOR, SIZE & SIZE
Dynatube Female to AN Female



R4120
CONNECTOR, SIZE TO SIZE
Dynatube Female to MS Male



R4256
CONNECTOR, SIZE TO SIZE
Dynatube Female to MS Male



R4256
CONNECTOR
Dynatube Female to Male Pipe

REVISIONS		DATE	BY	TCR
1				

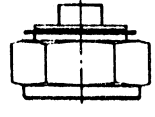
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE AFTER PLATING 1 - 1/2 - 1/2 1 - 1/2 - 1/2 1 - 1/2 - 1/2		DRAWN W. WILLIAMS DATE 1-24-73	CHECKED J. BOOKER DATE 7-29-73
FOR INTERPRETATION SEE PAGE 11 REMOVE ALL BURRS AND SHARP EDGES ALL DIAMETERS MUST BE CONCENTRIC WITHIN .005 T.I.R. DO NOT SCALE WORK TO DIMENSIONS GIVEN		RELEASE NO. 11796 DATE 7-29-73	RESISTOFLEX CORP. ROSELAND, N.J.
MATERIAL:		QUANTITY 1	CODE PART NO. 50599
PART NUMBER		QUANTITY 1	CODE PART NO. C
PART NAME		QUANTITY 1	CODE PART NO. RSK734

ADAPTOR AND TEST FITTINGS

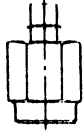
STANDARD SHEET

REVISIONS			
REV	DATE	BY	REASON

PRESSURE CAPS



RML117
PRESSURE CAP



RML107
PRESSURE CAP
Resilient Seal, 02 Size Only



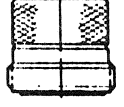
RML371
PRESSURE CAP
Low Pressure Shipping Closure



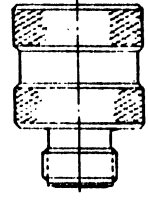
RML119
PLUG



RML380
PLUG
For RML093 Port Design

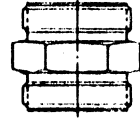


RML385
PLUG
Low Pressure Shipping Closure

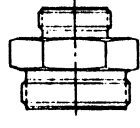


RML379
PLUG
Bench Testing, 04 Size Only

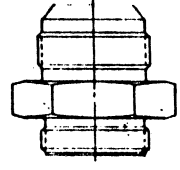
CONNECTORS



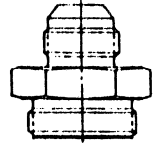
RML101
CONNECTOR, SIZE TO SIZE
Dynatube Male to Dynatube Male



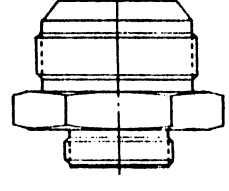
RML116
CONNECTOR, REDUCER
Dynatube Male to Dynatube Male



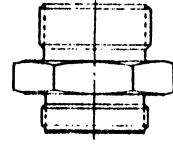
RML121
CONNECTOR, SIZE TO SIZE
Dynatube Male to AN Male



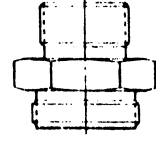
RML180
CONNECTOR, REDUCER
Dynatube Male to AN Male



RML181
CONNECTOR, EXPANDER
Dynatube Male to AN Male



RML195
CONNECTOR, SIZE TO SIZE
Dynatube Male to NS Male



RML197
CONNECTOR, REDUCER
Dynatube Male to NS Male

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE AFTER PLATING		DATE 1-28-73	DATE 1-29-73
DESIGNED BY W. WILCOX	DATE 1-28-73	DATE 1-29-73	DATE 1-29-73
CHECKED BY W. BOKER	DATE 1-29-73	DATE 1-29-73	DATE 1-29-73
RELEASED BY 11796	DATE 1-29-73	DATE 1-29-73	DATE 1-29-73
FOR INFORMATION OF THE BUYER: THIS DRAWING IS THE PROPERTY OF RESISTOFLEX CORP. IT IS TO BE USED ONLY FOR THE MANUFACTURE OF THE PARTS SPECIFIED THEREON. IT IS NOT TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT THE WRITTEN PERMISSION OF RESISTOFLEX CORP.			
REMOVE ALL BURRS AND SHARP EDGES ALL DIAMETERS MUST BE CONCENTRIC WITHIN 0.05 T.I.E. DO NOT SCALE WORK TO DIMENSIONS GIVEN MATERIAL.			
APPROVED BY	DATE	APPROVED BY	DATE
RESISTOFLEX CORP. ROSELAND, N.J.		ADAPTOR AND TEST FITTINGS	
CODE	REV	DATE	BY
50599	C		
STANDARD SHEET		1 OF 3	

RSK734

A

B

A

B

FITTINGS, DYNATUBE®

1. GENERAL

1.1 The Dynatube®, as shown in Figure 1.1, is an all metal separable fluid fitting system developed by Resistoflex Corp. It has been selected at Space Division as the preferred separable fluid fitting for use in flight equipments. The reason for its selection is its all metal construction, sealing capabilities with various fluid media and ability to perform in cryogenic as well as elevated temperatures. In addition, Dynatube® fittings have smaller envelopes, higher strengths and are lighter weight than comparable MS and KC fittings. The low protrusion factors make component removal possible without line removal. The make-up or installation torque, though controlled, is less critical than MS or KC fittings.

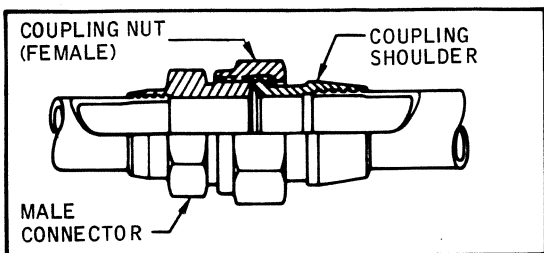


FIGURE 1.1 IN-LINE SWAGED DYNATUBE® CONNECTION

1.2 Space Division has qualification tested Resistoflex Dynatube® fittings to operating pressures to 3000 psi in 17-4PH and Inconel 718 CRES, as well as, 6AL-4V Titanium materials. Additional testing would be required prior to usage of these materials in Space Division designs where the operating pressures exceed 3000 psi.

2. DYNATUBE® FITTING CHARACTERISTICS

2.1 The fitting sealing mechanism is shown in Figure 2.1. The cross sectional views detail the sealing surfaces in both the unloaded and loaded conditions.

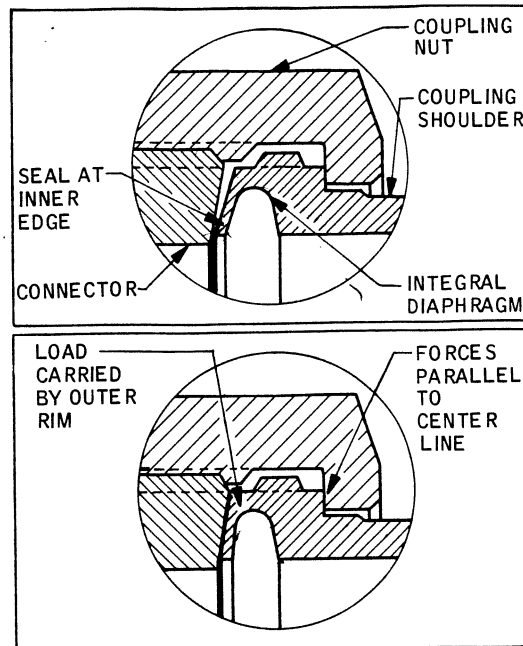


FIGURE 2.1 DYNATUBE® SEALING SURFACES UNLOADED AND LOADED

2.1.1 The assembly is usually installed initially finger tight. Before full deflection of the cantilever beam of the coupling shoulder (upper illustration), the pressure seal is formed at the inner edge of the beam. Tightening the coupling nut brings the angled face of the male connector into contact with the outer rim (stop area) of the shoulder. The beam portion of the shoulder continues to seal at its inner edge, and the Belleville spring action serves as a lock for the entire fitting assembly, preventing loosening.

2.2 DYNATUBE® ATTACHMENT METHODS

2.2.1 With titanium tubing, the fittings shall be joined by mechanically swaging only.

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FITTINGS, DYNATUBE®

2.2.2 For systems using corrosion resistant steel tubing, weld/braze Dynatube® fittings as shown in Figure 2.2.2 may be used.

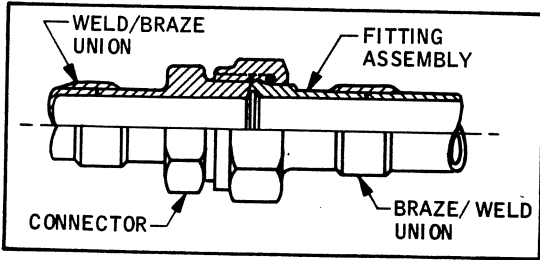


FIGURE 2.2.2 IN-LINE WELD/BRAZE DYNATUBE® CONNECTION

2.2.3 Methods of attachment and usage is summarized in Table 2.2.3.

TABLE 2.2.3			
MATERIAL	METHOD OF ATTACHMENT	SURFACE FINISH	USES
Titanium	Swage	Everlube 620A	Hydraulics, lube oil
Inconel 718	Braze/weld	8 RMS for size 5/8 and smaller. TFE Teflon for sizes 3/4 and larger.	All systems experiencing temperatures below -65°F
17-4PH CRES	Braze/weld	8 RMS for size 5/8 and smaller. TFE Teflon for sizes 3/4 and larger	All systems, other than hydraulics, experiencing no temperature below -65°F

2.3 FITTING END CONNECTIONS

2.3.1 The shallow cone angle of the fittings lip seal, plus the retractability of the nut, permits installation of the line with negligible deflection of mating parts. Connection to components may be made by utilizing female ports or integral machined connections.

2.3.1.1 To utilize the Dynatube® connection from line to a component port, the Rosan® fluid port adapter fitting, may be specified. The fitting is shown in Figure 2.3.1.1. This combination also allows component replacement without line removal.

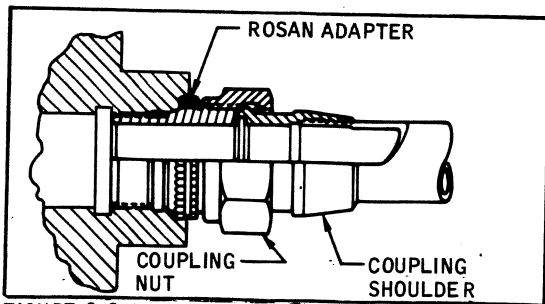


FIGURE 2.3.1.1 LINE CONNECTION TO COMPONENT

2.3.1.1.1 If the component is supplied with the Rosan® adapter fitting already installed, the final connection and installation of the Dynatube® coupling is accomplished by specifying install per MA0102-306.

2.3.2 Design requirements occasionally dictate that the connector (male) end configurations of these fittings be integrally machined in the housing or body of pumps, valves, filters, etc. For this purpose, the following Design Standard Drawings have been prepared:

MP273-0002 "Fitting End, Dynatube® Connector, Standard Dimensions for"

MP273-0003 "Fitting End, Bulkhead Dynatube® , Standard Dimensions for"

2.3.2.1 These Design Standard Drawings contain sufficient data for use by Space Division designers for envelope definition purposes and satisfies subcontractor's requirements for estimating and quotation purposes. They reference Resistoflex Corp. proprietary drawings R44090MP and/or R44094MP, as applicable, which contain complete details to fabricate the male fitting end. MP273-0002 and MP273-0003 shall not be used to define fitting ends on detail drawings (V070 or G070 Series) for fittings. Such applications shall be documented by Specification Control Drawings (SCD). A typical Dynatube® integrally machined fitting end is shown in Figure 2.3.2.1.

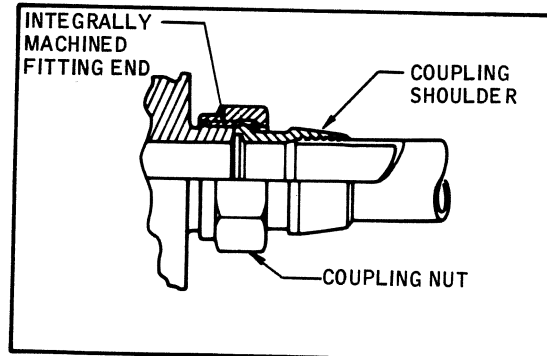


FIGURE 2.3.2.1 INTEGRALLY MACHINED CONNECTOR

2.3.2.1.1 Specification Control Drawings (SCD's) - SCD's covering Dynatube® fluid fittings are sole sourced to Resistoflex Corp. SCD's shall make reference to the proper Resistoflex Corp. part number.

2.3.2.1.2 Procurement Specifications - Where the integral machined fitting ends are required on components defined in Procurement Specifications, the following callouts shall be used:

FITTING END PER MP273-0002-XXXX, OR
FITTING END PER MP273-0003-XXXX

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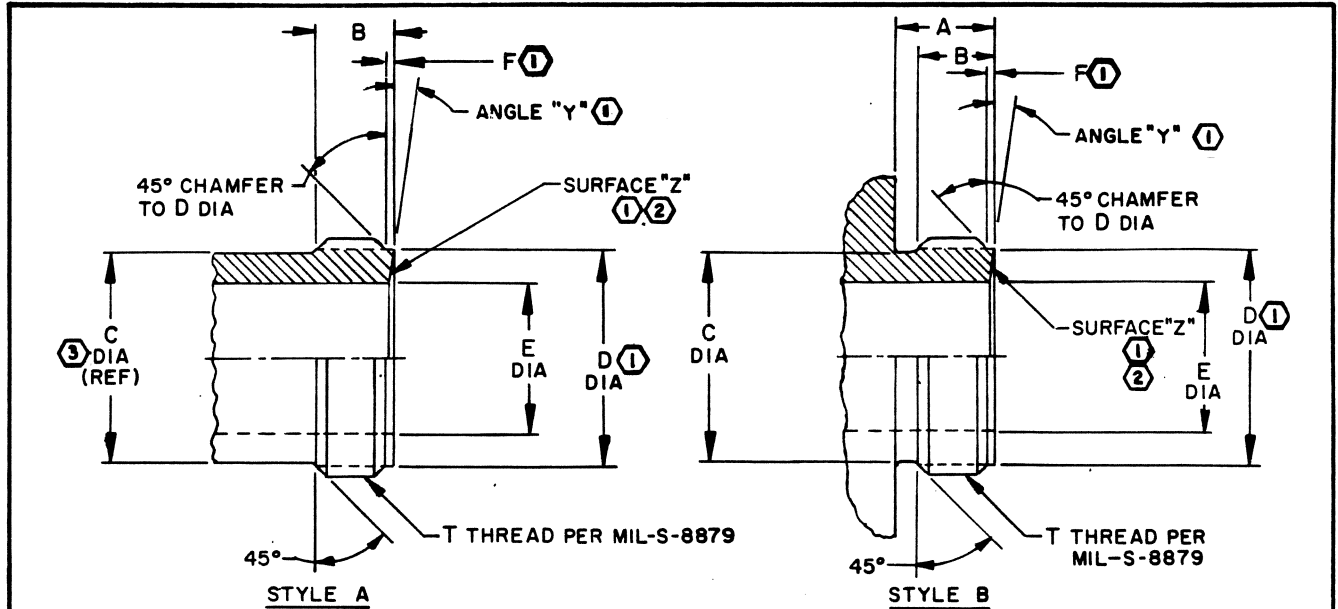
ROSAN® is a registered trade name of Rosan Inc., Newport Beach, Calif.

STANDAKU DESIGN PRACTICE

273-0003MP



FITTINGS, DYNATUBE®



DESIGN STANDARD DASH NUMBER		TUBE OD (REF)	T THREAD	A	B	C DIA	E DIA
STYLE A	STYLE B						
-0004	-1004	.250	.4375-24 UNJS-3A	.260 .290	.227 .197	.378 .368	.184 .194
-0005	-1005	.312	.5000-24 UNJS-3A	.260 .290	.227 .197	.441 .431	.232 .242
-0006	-1006	.375	.5625-20 UNJS-3A	.280 .310	.235 .205	.493 .483	.297 .307
-0008	-1008	.500	.7188-20 UNJS-3A	.293 .323	.248 .218	.649 .639	.398 .408
-0010	-1010	.625	.8438-18 UNJS-3A	.357 .387	.304 .274	.767 .757	.512 .523
-0012	-1012	.750	1.0000-16 UNJ-3A	.397 .427	.333 .303	.915 .905	.649 .660
-0014	-1014	.875	1.1250-16 UNJ-3A	.415 .445	.348 .318	1.040 1.030	.769 .780
-0016	-1016	1.000	1.2500-14 UNJS-3A	.445 .475	.368 .338	1.154 1.144	.862 .874
-0020	-1020	1.250	1.5156-14 UNJS-3A	.442 .472	.365 .335	1.419 1.409	1.115 1.128
-0021	-1021	1.250	1.5781-14 UNJS-3A	.442 .472	.365 .335	1.482 1.472	1.115 1.128
-0024	-1024	1.500	1.7812-14 UNJS-3A	.527 .557	.450 .420	1.685 1.675	1.324 1.337
-0025	-1025	1.500	1.8438-14 UNJS-3A	.527 .557	.450 .420	1.747 1.737	1.324 1.337

-0021,-1021,-0025,-1025 FOR TITANIUM SYSTEMS, I.E., HYDRAULICS SYSTEMS

THIS DRAWING DOES NOT CONTAIN ALL DATA NECESSARY TO FABRICATE DYNATUBE® FITTING ENDS. SEE NOTE ①

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THIS IS A DESIGN STANDARD, NOT TO BE USED AS A PART NUMBER.

DESIGN STANDARD DATA SHEET	FITTING END- DYNATUBE® CONNECTOR, STANDARD DIMENSIONS FOR	MP273-0002
FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.		SHEET 1 OF 2

STANDARD DESIGN PRACTICE

273-0003MP

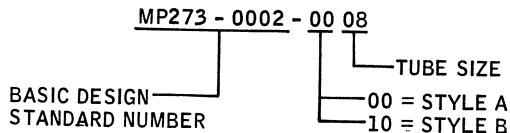


FITTINGS, DYNATUBE[®]

NOTES:

- 1
1. FOR ANGLE "Y" SURFACE "Z" DIMENSIONS "D" AND "F" AND OTHER DETAIL MANUFACTURING DIMENSIONS, AND PROCESSING REQUIREMENTS (MACHINING METHODS, SURFACE TREATMENTS, ETC.) SEE RESISTOFLEX CORPORATION DRAWING R44090MP, WHICH CONTAINS DATA PROPRIETARY TO RESISTOFLEX CORPORATION. ROCKWELL INTERNATIONAL SUBCONTRACTORS SHALL CONTACT RESISTOFLEX CORPORATION, ROSELAND, NEW JERSEY, FOR MANUFACTURING RIGHTS AND COPIES OF THE DRAWING, AS NECESSARY.
2. REMOVE ALL BURRS AND SHARP EDGES.
3. ALL DIAMETERS TO BE CONCENTRIC WITHIN .005 TIR.
4. ALL DIMENSIONS SHOWN ARE FINAL (AFTER HEAT TREATMENT).
5. SURFACE ROUGHNESS 125 RHR PER ASA B46.1 EXCEPT FOR THREADS AND SURFACE "Z".
- 3
6. NOT RECOMMENDED FOR CASTINGS.
7. COMPONENT MATERIAL FOR INTEGRAL MACHINING SHALL HAVE A MINIMUM YIELD STRENGTH OF 120,000 PSI.
8. THREADS SHALL HAVE A 63 RHR MAXIMUM SURFACE ON FLANKS WITH NO EVIDENCE OF TEARING. NO DISCONTINUITIES WILL BE PERMITTED IN THE THREAD FORM. THE APPROVED METHODS OF FABRICATION ARE SINGLE POINT ROLLING, MILLING AND GRINDING; EXCEPT THREAD GRINDING OF TITANIUM COMPONENTS IS PROHIBITED.
- 2
9. SURFACE "Z"
 - A. THE SEAT SURFACE SHALL BE FREE FROM BURRS, LONGITUDINAL AND ANNULAR TOOL MARKS AND SHALL BE SMOOTH EXCEPT THAT SPIRAL TOOL MARKS UP TO 50 MICROINCHES RHR WILL BE ALLOWED IN TITANIUM. FOR 17-4PH AND INCONEL 718 FITTING SIZES 5/8 INCH AND SMALLER, SURFACE "Z" SHALL HAVE A SURFACE ROUGHNESS OF 8 RHR OR FINER. FOR 17-4PH AND INCONEL 718 FITTING SIZES 3/4 INCH AND LARGER, SURFACE "Z" SHALL HAVE A TEFLON TFE COATING PER RESISTOFLEX SPECIFICATION RES 376.
 - B. THE SEAT SURFACE IS TO BE GENERATED BY SINGLE POINT TURNING ONLY AND SHALL BE SQUARE WITH THE THREAD PITCH DIAMETER. TO ACCOMPLISH THIS EITHER:
 - (a) TURN SEAT AT SAME CHUCKING AS THREAD; OR
 - (b) LOCATE ON THREAD WHILE TURNING SEAT.
 - C. NO BURNISHING OF SEAT WITH GRIT CLOTH (OR EQUIVALENT) IS PERMITTED.
10. FINISH REQUIREMENTS - TO PREVENT THE GALLING OR SEIZING OF DYNATUBE[®] INTERFACES, A PERMANENT EVERLUBE DRY FILM LUBRICANT SHALL BE APPLIED TO ALL TITANIUM THREADED DYNATUBE[®] ENDS.

EXAMPLE OF COMPLETE DESIGN STANDARD NUMBER:



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THIS IS A DESIGN STANDARD, NOT TO BE USED AS A PART NUMBER.

DESIGN STANDARD DATA SHEET	FITTING END- DYNATUBE [®] CONNECTOR, STANDARD DIMENSIONS FOR	MP273-0002
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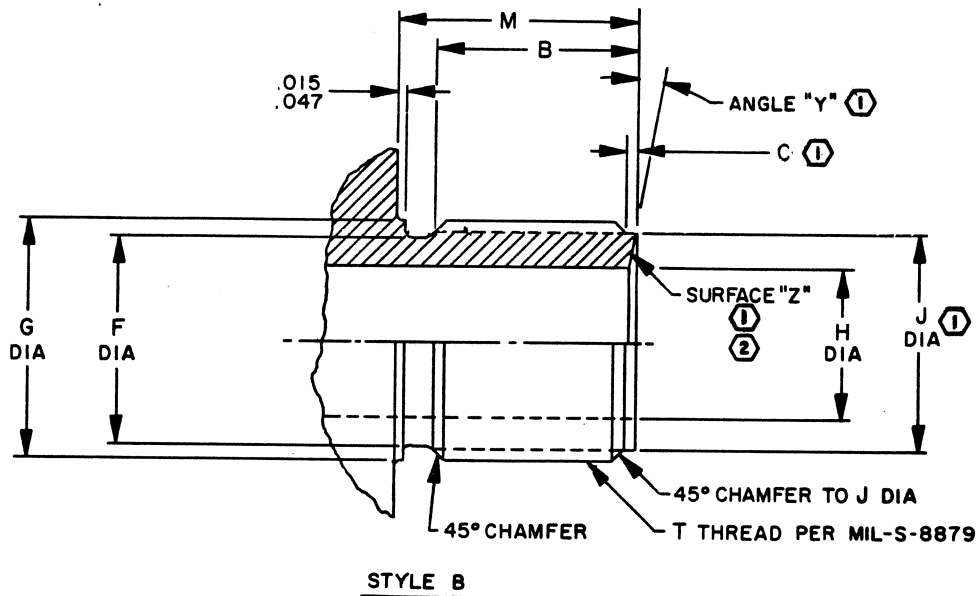
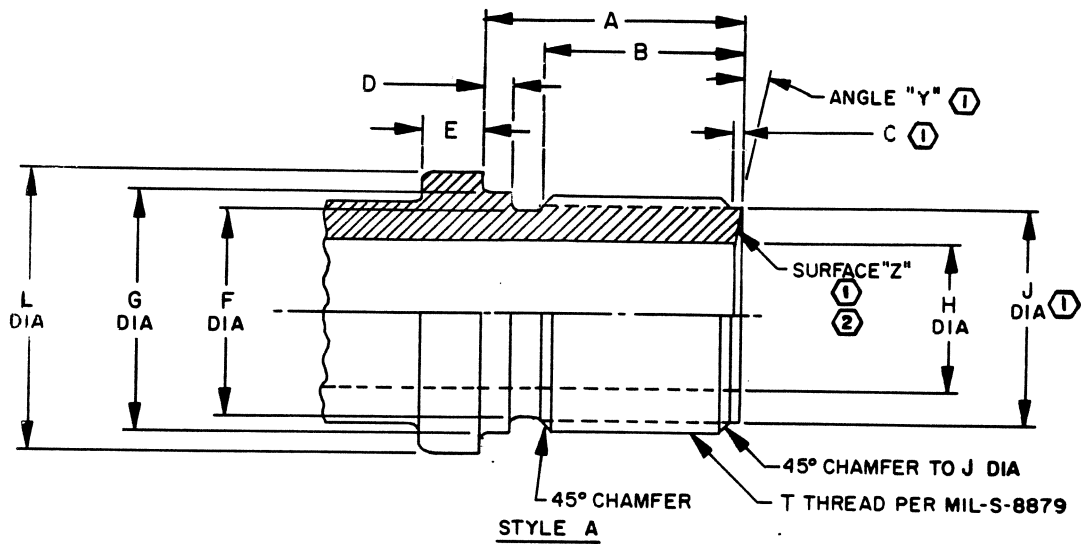
STANDARD DESIGN PRACTICE

273-0003MP





FITTINGS, DYNATUBE®



THIS DRAWING DOES NOT CONTAIN ALL DATA NECESSARY TO FABRICATE DYNATUBE® FITTING ENDS. SEE NOTE ①

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DESIGN STANDARD DATA SHEET FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.	FITTING END- BULKHEAD DYNATUBE®, STANDARD DIMENSIONS FOR	MP273-0003 SHEET 1 OF 3
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STANDARD DESIGN PRACTICE

273-0003MP



FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-10

15 SEPTEMBER 1977

FITTINGS, DYNATUBE[®]

DESIGN STANDARD DASH NUMBER		TUBE OD (REF)	T THREAD	A	B
STYLE A	STYLE B				
-0004	-1004	.250	.4375-24 UNJS-3A	.728 .758	.598 .568
-0005	-1005	.312	.5000-24 UNJS-3A	.728 .758	.598 .568
-0006	-1006	.375	.5625-20 UNJS-3A	.767 .797	.618 .588
-0008	-1008	.500	.7188-20 UNJS-3A	.834 .864	.644 .614
-0010	-1010	.625	.8438-18 UNJS-3A	.973 1.003	.770 .740
-0012	-1012	.750	1.0000-16 UNJ-3A	1.069 1.099	.848 .818
-0014	-1014	.875	1.1250-16 UNJ-3A	1.121 1.151	.900 .870
-0016	-1016	1.000	1.2500-14 UNJS-3A	1.161 1.191	.940 .910
-0020	-1020	1.250	1.5156-14 UNJS-3A	1.155 1.185	.934 .904
-0021	-1021	1.250	1.5781-14 UNJS-3A	1.155 1.185	.934 .904
-0024	-1024	1.500	1.7812-14 UNJS-3A	1.325 1.355	1.104 1.074
-0025	-1025	1.500	1.8438-14 UNJS-3A	1.325 1.355	1.104 1.074

DESIGN STANDARD DASH NUMBER		TUBE OD (REF)	D	E	F DIA	G DIA	H DIA	L DIA	M
STYLE A	STYLE B								
-0004	-1004	.250	.078 .110	.192 .102	.378 .368	.438 .431	.184 .194	.593 .563	.665 .695
-0005	-1005	.312	.078 .110	.195 .105	.441 .431	.500 .493	.232 .242	.655 .625	.665 .695
-0006	-1006	.375	.078 .110	.218 .128	.493 .483	.563 .555	.297 .307	.718 .688	.704 .734
-0008	-1008	.500	.109 .141	.231 .141	.649 .639	.719 .711	.398 .408	.874 .844	.740 .770
-0010	-1010	.625	.109 .141	.241 .151	.767 .757	.844 .835	.512 .523	.999 .969	.879 .909
-0012	-1012	.750	.109 .141	.266 .176	.915 .905	1.000 .991	.649 .660	1.155 1.125	.975 1.005
-0014	-1014	.875	.109 .141	.309 .219	1.040 1.030	1.125 1.116	.769 .780	1.405 1.375	1.027 1.057
-0016	-1016	1.000	.109 .141	.268 .178	1.154 1.144	1.250 1.240	.862 .874	1.405 1.375	1.067 1.097
-0020	-1020	1.250	.109 .141	.268 .178	1.419 1.409	1.516 1.506	1.115 1.128	1.670 1.640	1.061 1.091
-0021	-1021	1.250	.109 .141	.268 .178	1.482 1.472	1.578 1.568	1.115 1.128	1.733 1.703	1.061 1.091
-0024	-1024	1.500	.109 .141	.268 .178	1.685 1.675	1.781 1.771	1.324 1.337	1.936 1.906	1.231 1.261
-0025	-1025	1.500	.109 .141	.268 .178	1.747 1.737	1.844 1.834	1.324 1.337	1.999 1.969	1.231 1.261

-0021, -1021, -0025, -1025 FOR TITANIUM SYSTEMS, I.E., HYDRAULIC SYSTEMS

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STANDARD DESIGN PRACTICE

273-0003MP

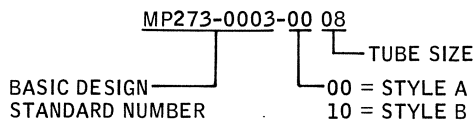




NOTES:

- ① 1. FOR ANGLE "Y", SURFACE "Z" DIMENSIONS "C" AND "J" AND OTHER MANUFACTURING DIMENSIONS, AND PROCESSING REQUIREMENTS (MACHINING METHODS, SURFACE TREATMENTS, ETC.) SEE RESISTOFLEX CORPORATION DRAWING R44094MP, WHICH CONTAINS DATA PROPRIETARY TO RESISTOFLEX CORPORATION. ROCKWELL INTERNATIONAL SUBCONTRACTORS SHALL CONTACT RESISTOFLEX CORPORATION, ROSELAND, NEW JERSEY, FOR MANUFACTURING RIGHTS AND COPIES OF THE DRAWING, AS NECESSARY.
2. REMOVE ALL BURRS AND SHARP EDGES.
3. ALL DIAMETERS TO BE CONCENTRIC WITHIN .005 TIR.
4. ALL DIMENSIONS SHOWN ARE FINAL (AFTER HEAT TREATMENT).
5. SURFACE ROUGHNESS 125 RHR PER ASA B46.1 EXCEPT FOR THREADS AND SURFACE "Z".
6. NOT RECOMMENDED FOR CASTINGS.
7. COMPONENT MATERIAL FOR INTEGRAL MACHINING SHALL HAVE A MINIMUM YIELD STRENGTH OF 120,000 PSI.
8. THREADS SHALL HAVE A 63 RHR MAXIMUM SURFACE ON FLANKS WITH NO EVIDENCE OF TEARING. NO DISCONTINUITIES WILL BE PERMITTED IN THE THREAD FORM. THE APPROVED METHODS OF FABRICATION ARE SINGLE POINT ROLLING, MILLING AND GRINDING; EXCEPT THREAD GRINDING OF TITANIUM COMPONENTS IS PROHIBITED.
- ② 9. SURFACE "Z"
 - A. THE SEAT SURFACE SHALL BE FREE FROM BURRS, LONGITUDINAL AND ANNULAR TOOL MARKS AND SHALL BE SMOOTH EXCEPT THAT SPIRAL TOOL MARKS UP TO 50 MICROINCHES RHR WILL BE ALLOWED IN TITANIUM. FOR 17-4PH AND INCONEL 718 FITTING SIZES 5/8 INCH AND SMALLER, SURFACE "Z" SHALL HAVE A SURFACE ROUGHNESS OF 8 RHR OR FINER. FOR 17-4PH AND INCONEL 718 FITTING SIZES 3/4 INCH AND LARGER, SURFACE "Z" SHALL HAVE A TEFLON TFE COATING PER RESISTOFLEX SPECIFICATION RES 376.
 - B. THE SEAT SURFACE IS TO BE GENERATED BY SINGLE POINT TURNING ONLY AND SHALL BE SQUARE WITH THE THREAD-PITCH DIAMETER. TO ACCOMPLISH THIS EITHER:
 - (a) TURN SEAT AT SAME CHUCKING AS THREAD; OR
 - (b) LOCATE ON THREAD WHILE TURNING SEAT.
 - C. NO BURNISHING OF SEAT WITH GRIT CLOTH (OR EQUIVALENT) IS PERMITTED.
10. FINISH REQUIREMENTS - TO PREVENT THE GALLING OR SEIZING OF DYNATUBE® INTERFACES, A PERMANENT EVERLUBE DRY FILM LUBRICANT SHALL BE APPLIED TO ALL TITANIUM THREADED DYNATUBE® ENDS.

EXAMPLE OF COMPLETE DESIGN STANDARD NUMBER:



DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION

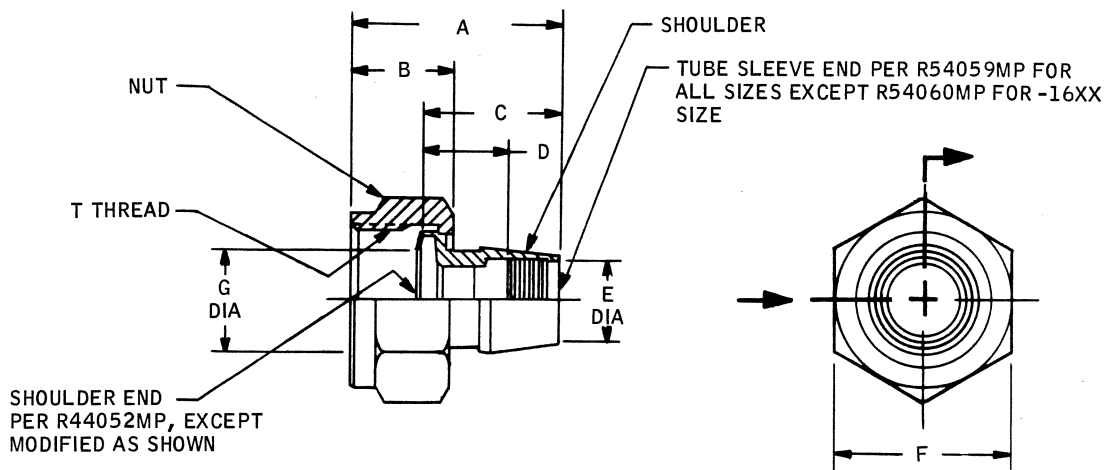
THIS IS A DESIGN STANDARD, NOT TO BE USED AS A PART NUMBER.

DESIGN STANDARD DATA SHEET	FITTING END-BULKHEAD DYNATUBE®, STANDARD DIMENSIONS FOR	MP273-0003
FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.		SHEET 3

STANDARD DESIGN PRACTICE 273-0003MP



FITTINGS, DYNATUBE® AND DUAL SEAL*



ME273-0085 DASH NUMBER	TUBE SIZE (REF) NUT END	TUBE SIZE (REF) TUBE END	T THREAD PER MIL-S-8879	A REF	B ±.010	C ±.015	D ±.015	E DIA ±.002	F REF	G DIA ±.005
-0504	5/16	1/4	.5000-24 UNJS-3B	1.009	.459	.775	.420	.255	.625	.262
-0604	3/8	1/4	.5625-20 UNJS-3B	1.008	.518	.755	.400	.255	.688	.318
-0804	1/2	1/4	.7188-20 UNJS-3B	1.043	.510	.773	.418	.255	.875	.419
-0806		3/8						.380		
-1006	5/8	3/8	.8438-18 UNJS-3B	1.097	.571	.766	.411	.380	1.000	.539
-1008		1/2		1.172				.841			.506
-1208	3/4	1/2	1.0000-16 UNJ-3B	1.305	.637	.938	.508	.506	1.125	.691
-1210		5/8		1.380				1.013			.631
-1410	7/8	5/8	1.1250-16 UNJ-3B	1.519	.690	1.149	.644	.631	1.375	.805
-1412		3/4						.756		
-1612	1	3/4	1.2500-14 UNJS-3B	1.433	.745	1.043	.538	.756	1.500	.876
-1614		7/8		1.533		1.123		.881		
-2114	1-1/4	7/8	1.5781-14 UNJS-3B	1.719	.812	1.308	.723	.881	1.875	1.120
-2116		1						1.006		
-2516	1-1/2	1	1.8438-14 UNJS-3B	1.840	.914	1.346	.761	1.006	2.125	1.381
-2520		1-1/4		1.915		1.421		1.256		

MATERIAL: TITANIUM 6AL-4V PER RESISTOFLEX CORPORATION SPECIFICATION RES 143

COATING: EVERLUBE 620A (EVERLUBE CORP., NO. HOLLYWOOD, CA)
DRY LUBRICANT ON INTERNAL THREAD AND BEARING SURFACE OF NUT

I & T REQUIREMENTS:

TRACEABILITY NOT REQUIRED

REFERENCED DRAWINGS:

R44052MP, R54059MP AND R54060MP ARE CONTROLLED ACCESS DRAWINGS CONTAINING DATA PROPRIETARY TO RESISTOFLEX CORPORATION, AND ARE ACCESSIBLE ONLY THRU DATA MANAGEMENT.

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORP., ROSELAND, N.J.
DUAL SEAL* IS A TRADEMARK OF TITFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.	FITTING ASSEMBLY, DYNATUBE® MECHANICALLY ATTACHED REDUCER	ME273-0085
		SHEET 1 OF 1

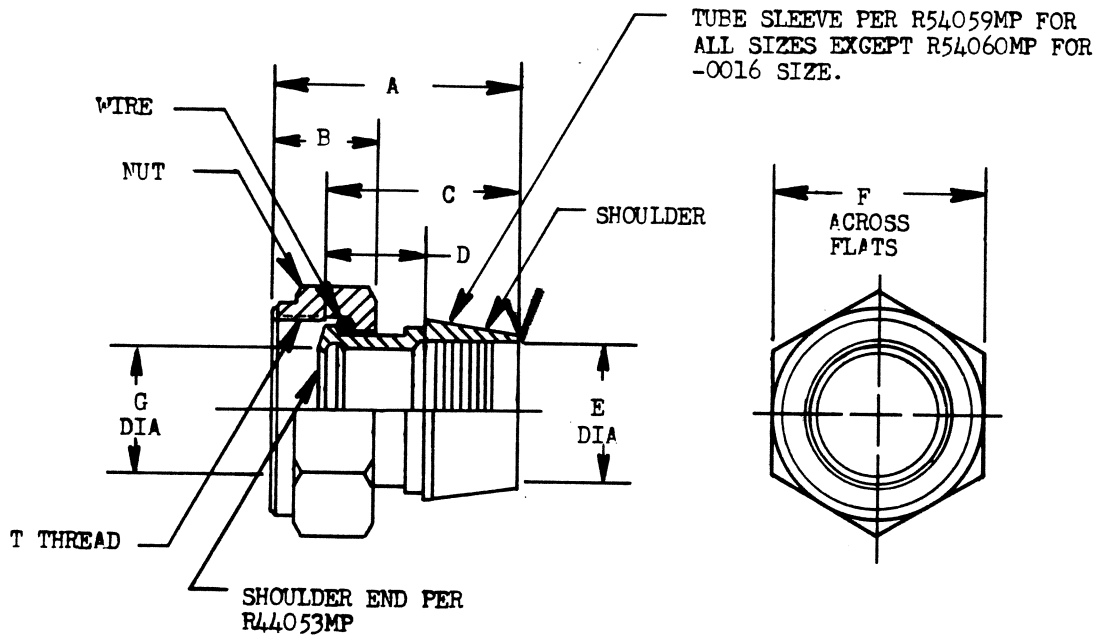


FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-22

15 SEPTEMBER 1977

FITTINGS, DYNATUBE[®] AND DUAL SEAL*

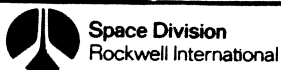


ME273-0086 DASH NUMBER	TUBE SIZE (REF)	T THREAD PER MIL-S-8879	A (REF)	B ±.010	C ±.015	D ±.015	E DIA ±.002	F (REF)	G DIA ±.005
-0004	1/4	.4375-24 UNJS-3B	1.013	.454	.807	.452	.255	.562	.197
-0005	5/16	.5000-24 UNJS-3B	1.023	.459	.813	.458	.317	.625	.262
-0006	3/8	.5625-20 UNJS-3B	1.066	.518	.833	.478	.380	.688	.318
-0008	1/2	.7188-20 UNJS-3B	1.167	.510	.918	.488	.506	.875	.419
-0010	5/8	.8438-18 UNJS-3B	1.361	.571	1.054	.549	.631	1.000	.539
-0012	3/4	1.0000-16 UNJ-3B	1.444	.637	1.101	.596	.756	1.125	.691
-0014	7/8	1.1250-16 UNJ-3B	1.563	.690	1.215	.630	.881	1.375	.805
-0016	1	1.2500-14 UNJS-3B	1.747	.745	1.381	.796	1.006	1.500	.876
-0021	1-1/4	1.5781-14 UNJS-3B	1.887	.812	1.518	.858	1.256	1.875	1.120
-0025	1-1/2	1.8438-14 UNJS-3B	2.142	.914	1.693	.958	1.506	2.125	1.381

DYNATUBE[®] IS A REGISTERED TRADEMARK OF RESISTOFLEX CORP., ROSELAND, N.J.
DUAL SEAL* IS A TRADEMARK OF TITFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET	FITTING ASSEMBLY, DYNATUBE [®] , MECHANICALLY ATTACHED	ME273-0086
FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.		SHEET 1 OF 2

Data Sheet Revised





FITTINGS, DYNATUBE[®] AND DUAL SEAL*

MATERIAL: SHOULDER AND NUT - 6AL-4V TITANIUM PER RESISTOFLEX CORPORATION SPECIFICATION RES 143
WIRE - CRES (302) PER AMS 5637

COATING: EVERLUBE 620A (EVERLUBE CORP., NO. HOLLYWOOD, CA) DRY LUBRICANT ON INTERNAL THREAD
AND BEARING SURFACE OF NUT

I & T REQUIREMENTS:

TRACEABILITY NOT REQUIRED

REFERENCED DRAWINGS:

R44053MP, R54059MP AND R54060MP ARE CONTROLLED ACCESS DRAWINGS CONTAINING DATA
PROPRIETARY TO RESISTOFLEX CORPORATION, AND ARE ACCESSIBLE ONLY THRU DATA MANAGEMENT.

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

FITTING ASSEMBLY, DYNATUBE[®],
MECHANICALLY ATTACHED

ME273-0086

SHEET 2 OF 2

Data Sheet Revised



Space Division
Rockwell International



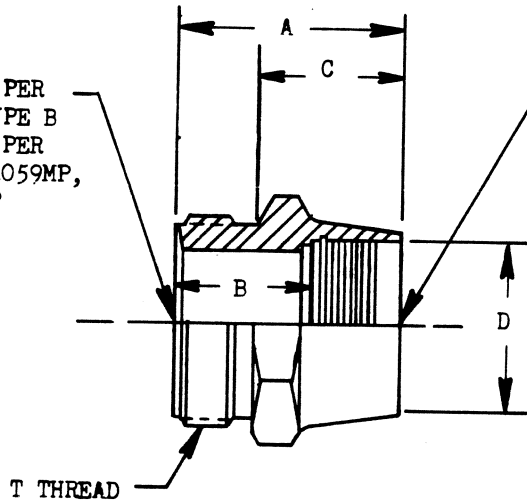
FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-24

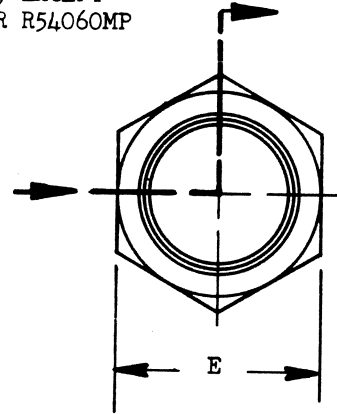
15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*

FITTING END PER R44090MP, TYPE B EXCEPT BORE PER J DIA OF R54059MP, AND R54060MP (FOR -0016)



FITTING END PER R54059MP; EXCEPT -0016 PER R54060MP



ME273-0087 DASH NUMBER	TUBE SIZE (REF)	T THREAD	A ±.007	B ±.007	C ±.007	D DIA (REF)	E REF
-0004	1/4	.4375-24UNJS-3A	.830	.475	.555	.255	.438
-0005	5/16	.5000-24UNJS-3A	.861	.506	.586	.317	.500
-0006	3/8	.5625-20UNJS-3A	.891	.536	.596	.380	.562
-0008	1/2	.7188-20UNJS-3A	1.025	.595	.717	.506	.750
-0010	5/8	.8438-18UNJS-3A	1.182	.677	.810	.631	.875
-0012	3/4	1.0000-16UNJ-3A	1.219	.714	.807	.756	1.000
-0014	7/8	1.1250-16UNJ-3A	1.315	.730	.885	.881	1.125
-0016	1	1.2500-14UNJS-3A	1.345	.760	.885	1.006	1.250
-0021	1 1/4	1.5781-14UNJS-3A	1.480	.820	1.023	1.256	1.625
-0025	1 1/2	1.8438-14UNJS-3A	1.640	.905	1.098	1.506	2.000

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORP., ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.

CONNECTOR, DYNATUBE®, MECHANICALLY ATTACHED, MALE THREADED

ME273-0087

SHEET 1 OF 2

Data Sheet Revised





FITTINGS, DYNATUBE® AND DUAL SEAL*

MATERIAL: TITANIUM 6AL-4V PER RESISTOFLEX CORPORATION SPECIFICATION RES 143

COATING: EVERLUBE 620A (EVERLUBE CORP., NO. HOLLYWOOD, CA) DRY LUBRICANT EXCEPT IN CONNECTOR I.D.

I & T REQUIREMENTS:

TRACEABILITY NOT REQUIRED

REFERENCED DRAWINGS:

R44090MP, R54059MP AND R54060MP ARE CONTROLLED ACCESS DRAWINGS CONTAINING DATA PROPRIETARY TO RESISTOFLEX CORPORATION, AND ARE ACCESSIBLE ONLY THRU DATA MANAGEMENT.

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.

CONNECTOR, DYNATUBE®, MECHANICALLY ATTACHED, MALE THREADED

ME273-0087

SHEET 2 OF 2

Data Sheet Revised



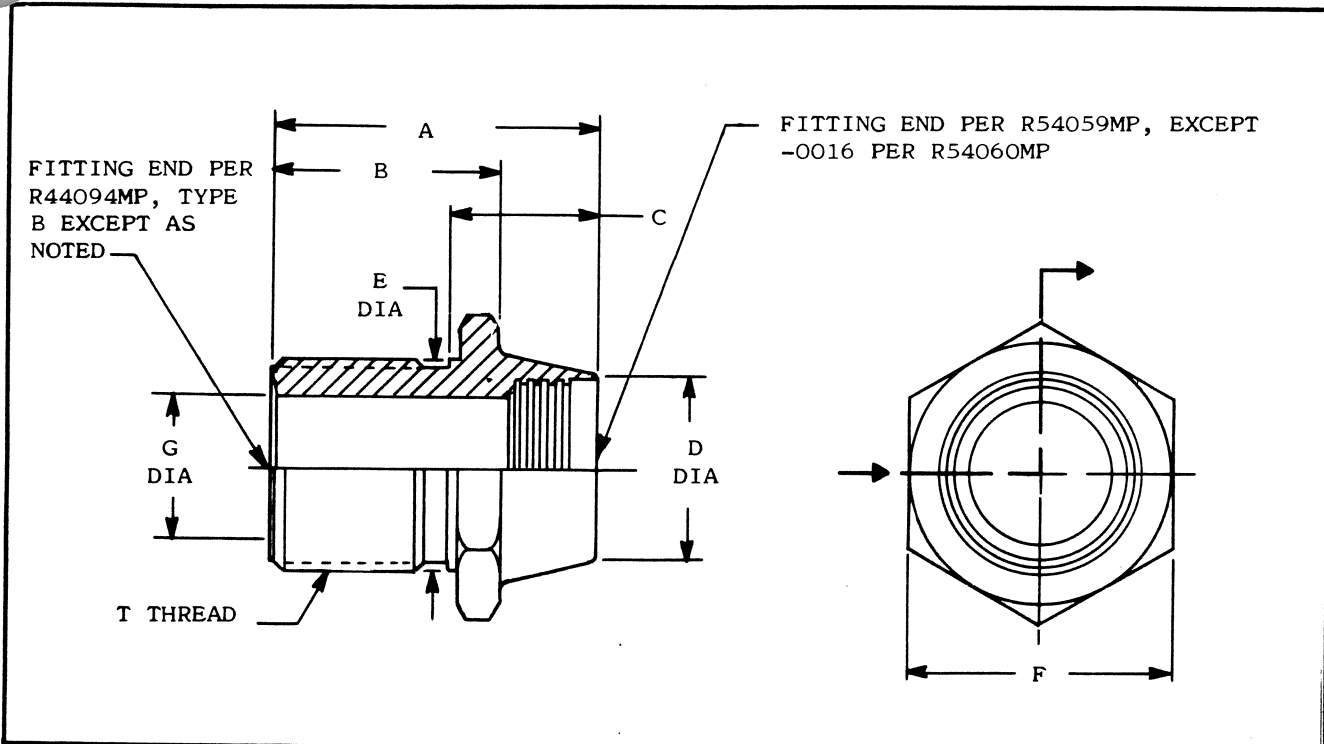
Space Division
Rockwell International



2733-26

15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



ME273-0088 DASH NUMBER	TUBE SIZE (REF)	T THREAD	A ±.007	B ±.007	C ±.007	D DIA (REF)	E DIA	F (REF)	G DIA
-0004	1/4	.4375-24 UNJS-3A	1.204	.849	.555	.255	.438 .431	.688	.198 .195
-0005	5/16	.5000-24 UNJS-3A	1.235	.880	.586	.317	.500 .493	.750	.251 .248
-0006	3/8	.5625-20 UNJS-3A	1.284	.929	.596	.380	.563 .555	.813	.313 .310
-0008	1/2	.7188-20 UNJS-3A	1.441	1.011	.717	.506	.719 .711	1.000	.414 .411
-0010	5/8	.8438-18 UNJS-3A	1.673	1.168	.810	.631	.844 .835	1.125	.529 .526
-0012	3/4	1.0000-16 UNJ-3A	1.766	1.261	.807	.756	1.000 .991	1.250	.660 .649
-0014	7/8	1.1250-16 UNJ-3A	1.896	1.311	.885	.881	1.125 1.116	1.375	.780 .769
-0016	1	1.2500-14 UNJS-3A	1.936	1.351	.885	1.006	1.250 1.240	1.500	.874 .862
-0021	1-1/4	1.5781-14 UNJS-3A	2.068	1.408	1.023	1.256	1.578 1.568	1.875	1.128 1.115
-0025	1-1/2	1.8438-14 UNJS-3A	2.313	1.578	1.098	1.506	1.844 1.834	2.125	1.337 1.324

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORP., ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.	CONNECTOR, DYNATUBE®, BULKHEAD, MECH. ATTACHED, MALE THREADED	ME273-0088
		SHEET 1 OF 2

Data Sheet Revised



FITTINGS, DYNATUBE[®] AND DUAL SEAL* 2733-27
15 SEPTEMBER 1977

MATERIAL: TITANIUM 6AL-4V PER RESISTOFLEX CORPORATION SPECIFICATION RES 143

COATING: EVERLUBE 620A (EVERLUBE CORP., NO. HOLLYWOOD, CA) DRY LUBRICANT
EXCEPT IN CONNECTOR I.D.

I & T REQUIREMENTS:

TRACEABILITY NOT REQUIRED

REFERENCED DRAWINGS:

R44094MP, R54059MP AND R5460MP ARE CONTROLLED ACCESS DRAWINGS
CONTAINING DATA PROPRIETARY TO RESISTOFLEX CORPORATION, AND ARE
ACCESSIBLE ONLY THRU DATA MANAGEMENT.

PARTS DATA SHEET	CONNECTOR, DYNATUBE [®] , BULKHEAD, MECH. ATTACHED, MALE THREADED	ME273-0088
FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.		SHEET 2 OF 2

Data Sheet Revised

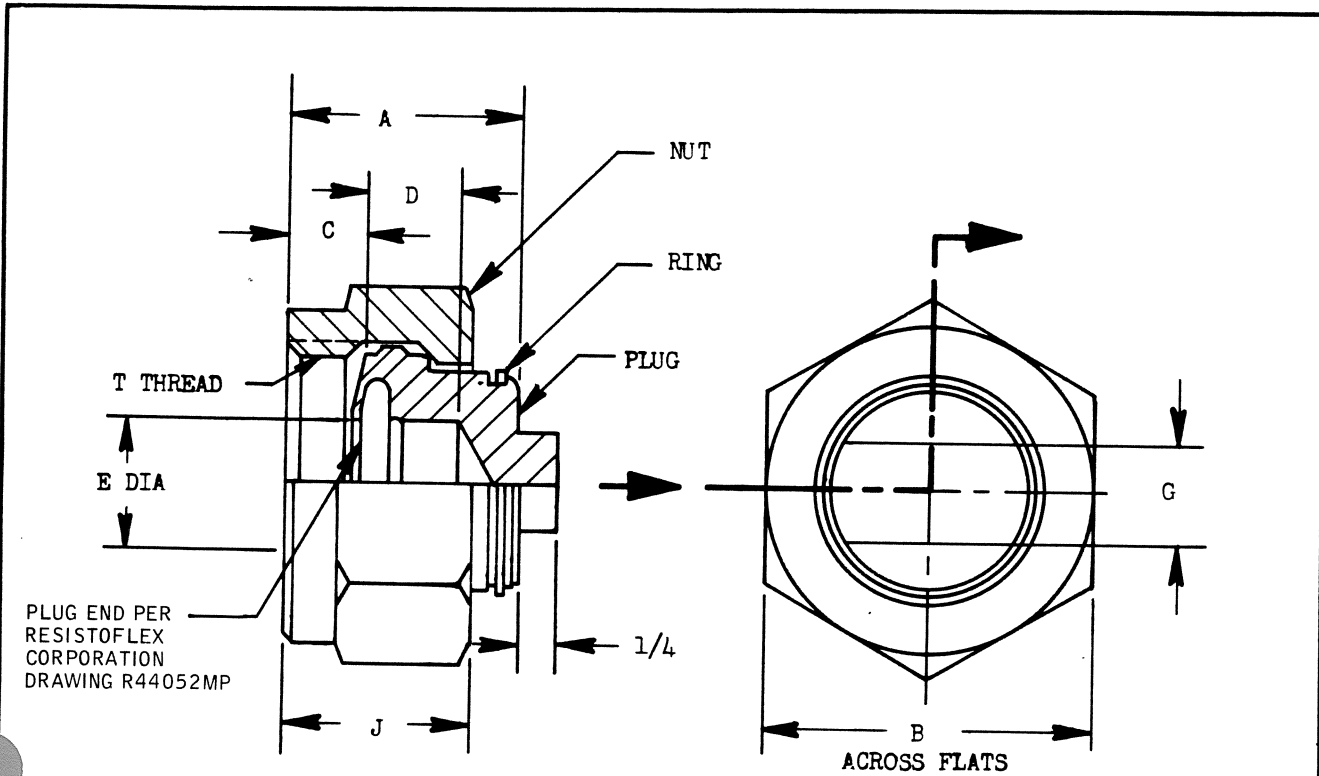


FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-28

15 SEPTEMBER 1977

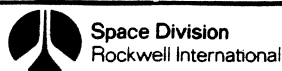
FITTINGS, DYNATUBE[®] AND DUAL SEAL*



ME273-0089 DASH NUMBER	TUBE SIZE REF	T THREAD	A	B	C	D	E MIN	G	J
-0004	1/4	.4375-24 UNJS-3B	.579	.562	.229	.180	.185	.188	.454
-0005	5/16	.5000-24 UNJS-3B	.584	.625	.234	.180	.247	.250	.459
-0006	3/8	.5625-20 UNJS-3B	.643	.688	.253	.180	.309	.250	.518
-0008	1/2	.7188-20 UNJS-3B	.635	.875	.270	.175	.403	.375	.510
-0010	5/8	.8438-18 UNJS-3B	.696	1.000	.331	.175	.526	.375	.571
-0012	3/4	1.0000-16 UNJ-3B	.763	1.125	.367	.176	.678	.375	.637
-0014	7/8	1.1250-16 UNJ-3B	.825	1.375	.370	.175	.792	.500	.690
-0016	1	1.2500-14 UNJS-3B	.881	1.500	.410	.171	.860	.500	.745
-0021	1-1/4	1.5781-14 UNJS-3B	.952	1.875	.411	.095	1.103	.500	.812
-0025	1-1/2	1.8438-14 UNJS-3B	1.052	2.125	.494	.057	1.367	.500	.914

PARTS DATA SHEET	FITTING, PRESSURE CAP, TITANIUM	ME273-0089
FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.		SHEET 1 OF 2

Data Sheet Revised





FITTINGS, DYNATUBE[®] AND DUAL SEAL*

MATERIAL: PLUG AND NUT - 6AL-4V TITANIUM PER AMS 4965
RING - PH15-7Mo PER AMS 5520

FINISH: CRES - PASSIVATE PER MIL-S-5002
TITANIUM - NONE

COATING: EVERLUBE 620A (EVERLUBE CORP., NO. HOLLYWOOD, CA)
DRY LUBRICANT ON INTERNAL THREAD AND BEARING SURFACE OF NUT ONLY

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM HYDRAULIC FLUID SYSTEMS

DYNATUBE[®] IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORPORATION, SPRINGFIELD, MASS.

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

FITTING, PRESSURE CAP,
TITANIUM

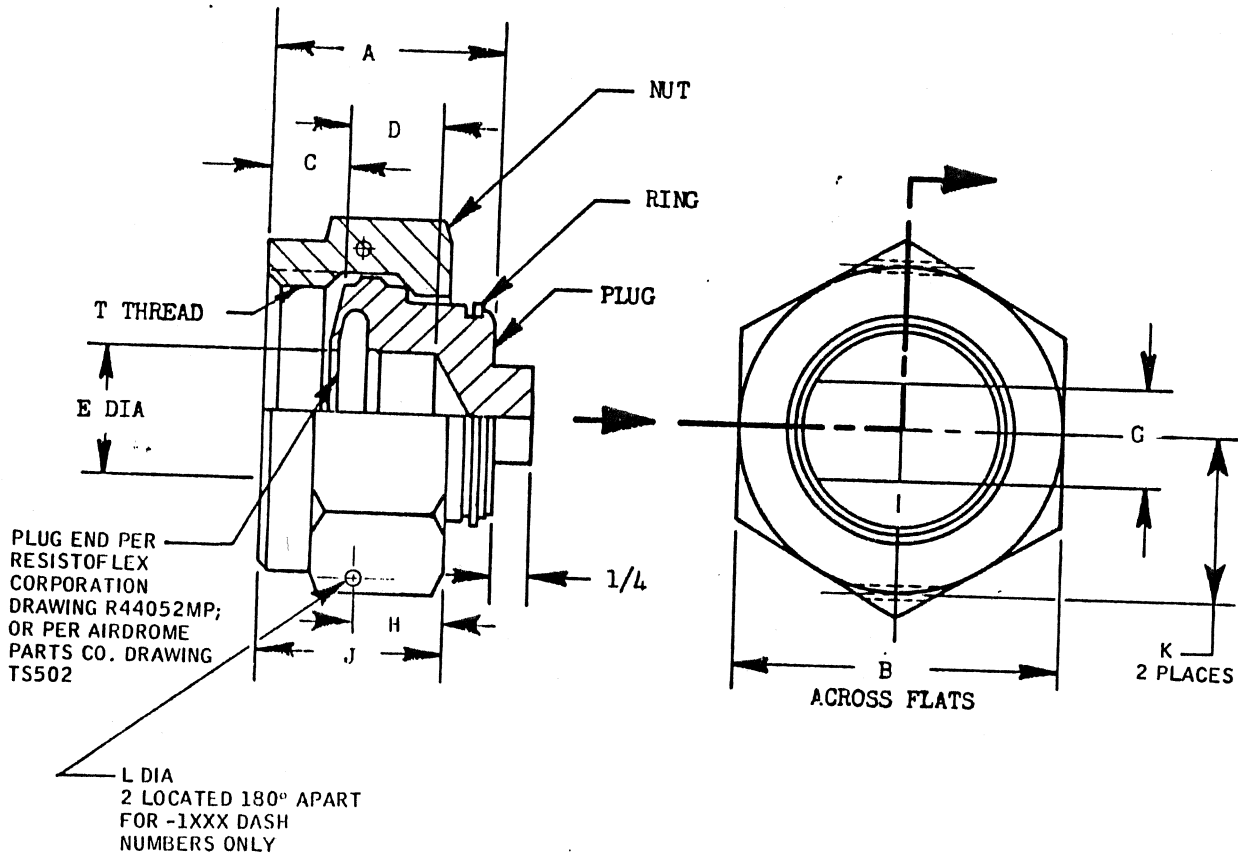
ME273-0089

SHEET 2 OF 2





HITTINGS, DYNATUBE[®] AND DUAL SEAL*



MATERIAL: PLUG AND NUT - 6AL-4V TITANIUM PER AMS 4965
RING - PH14-7Mo PER AMS 5520

FINISH: TITANIUM - NONE
CRES - PASSIVATE PER MIL-S-5002

COATING: EVERLUBE 620A (EVERLUBE CORP., NO. HOLLYWOOD, CA) DRY FILM
LUBRICANT ON INTERNAL THREAD AND BEARING SURFACES OF NUT

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM HYDRAULIC FLUID SYSTEMS

DYNATUBE[®] IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL[®] IS A TRADEMARK OF TITFLEX CORPORATION, A BUNDY COMPANY

17 PARTS DATA SHEET	FITTING, PRESSURE CAP, TITANIUM	ME273-0089
FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES		SHEET 1 OF 2



FITTINGS, DYNATUBE® AND DUAL SEAL*

SOURCE CONTROL DRAWING DASH NUMBER		TUBE SIZE REF	T THREAD	A REF	B	C	D
①	②						
-0004	-1004	1/4	.4375-24 UNJS-3B	.579	.562	.229	.180
-0005	-1005	5/16	.5000-24 UNJS-3B	.584	.625	.234	.180
-0006	-1006	3/8	.5625-20 UNJS-3B	.643	.688	.253	.180
-0008	-1008	1/2	.7188-20 UNJS-3B	.635	.875	.270	.175
-0010	-1010	5/8	.8438-18 UNJS-3B	.696	1.000	.331	.175
-0012	-1012	3/4	1.0000-16 UNJ-3B	.763	1.125	.367	.176
-0014	-1014	7/8	1.1250-16 UNJ-3B	.825	1.375	.370	.175
-0016	-1016	1	1.2500-14 UNJS-3B	.881	1.500	.410	.171
-0021	-1021	1-1/4	1.5781-14 UNJS-3B	.952	1.875	.411	.095
-0025	-1025	1-1/2	1.8438-14 UNJS-3B	1.052	2.125	.494	.057

SOURCE CONTROL DRAWING DASH NUMBER		TUBE SIZE REF	E DIA MIN	G REF	J	H	K	L
①	②							
-0004	-1004	1/4	.185	.188	.454	.188	.261	.047
-0005	-1005	5/16	.247	.250	.459	.188	.298	.047
-0006	-1006	3/8	.309	.250	.518	.188	.334	.047
-0008	-1008	1/2	.403	.375	.510	.188	.423	.070
-0010	-1010	5/8	.526	.375	.571	.250	.495	.070
0012	-1012	3/4	.670	.375	.637	.250	.567	.070
0014	1014	7/8	.792	.500	.690	.250	.702	.070
0016	1016	1	.860	.500	.745	.250	.774	.070
0021	1021	1-1/4	1.103	.500	.812	.250	.990	.070
-0025	-1025	1-1/2	1.367	.500	.914	.281	1.138	.070

① CAP WITHOUT SAFETY WIRE HOLES

② CAP WITH SAFETY WIRE HOLES

PARTS DATA SHEET

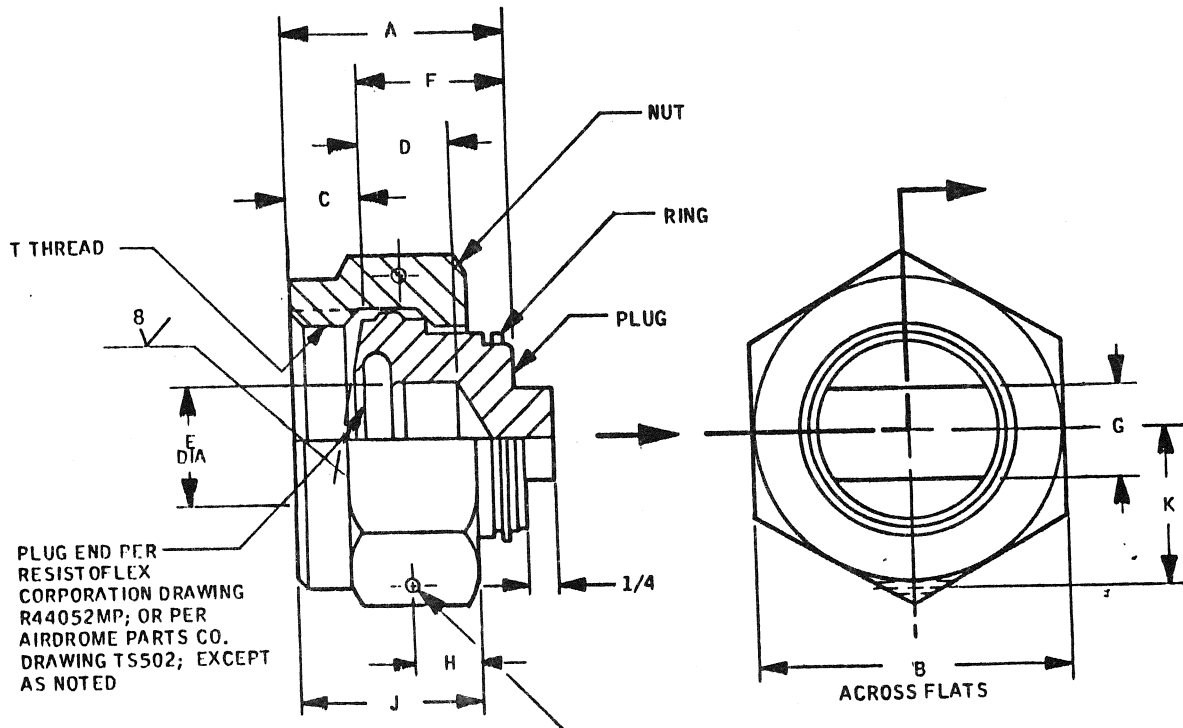
FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.

FITTING, PRESSURE CAP, TITANIUM

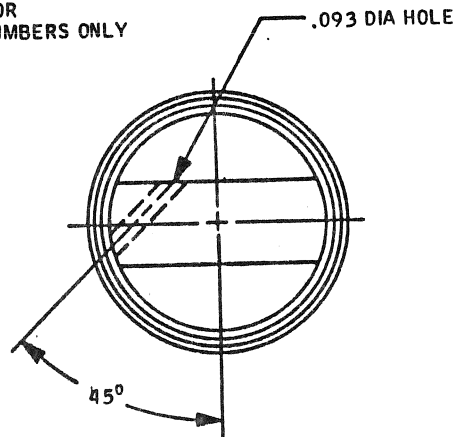
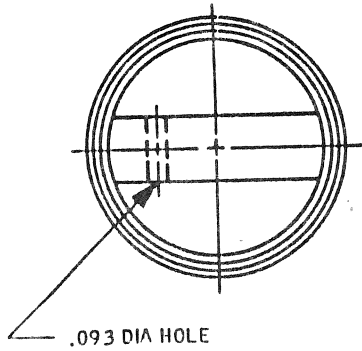
ME273-0089

SHEET 2 OF 2

FITTINGS, DYNATUBE[®] AND DUAL SEAL*



L DIA
 OPTIONAL SAFETY WIRE HOLES
 2 HOLES 180° APART FOR
 CODE (3) OR (4) DASH NUMBERS ONLY



SAFETY CHAIN HOLE
 OPTION

-1004 THRU -1006
 OR
 -3004 THRU -3006

-1008 THRU -1024
 OR
 -3008 THRU -3024

PARTS DATA SHEET

FITTING, PRESSURE CAP,
 17-4PH

ME273-0099

SHEET 1 OF 2

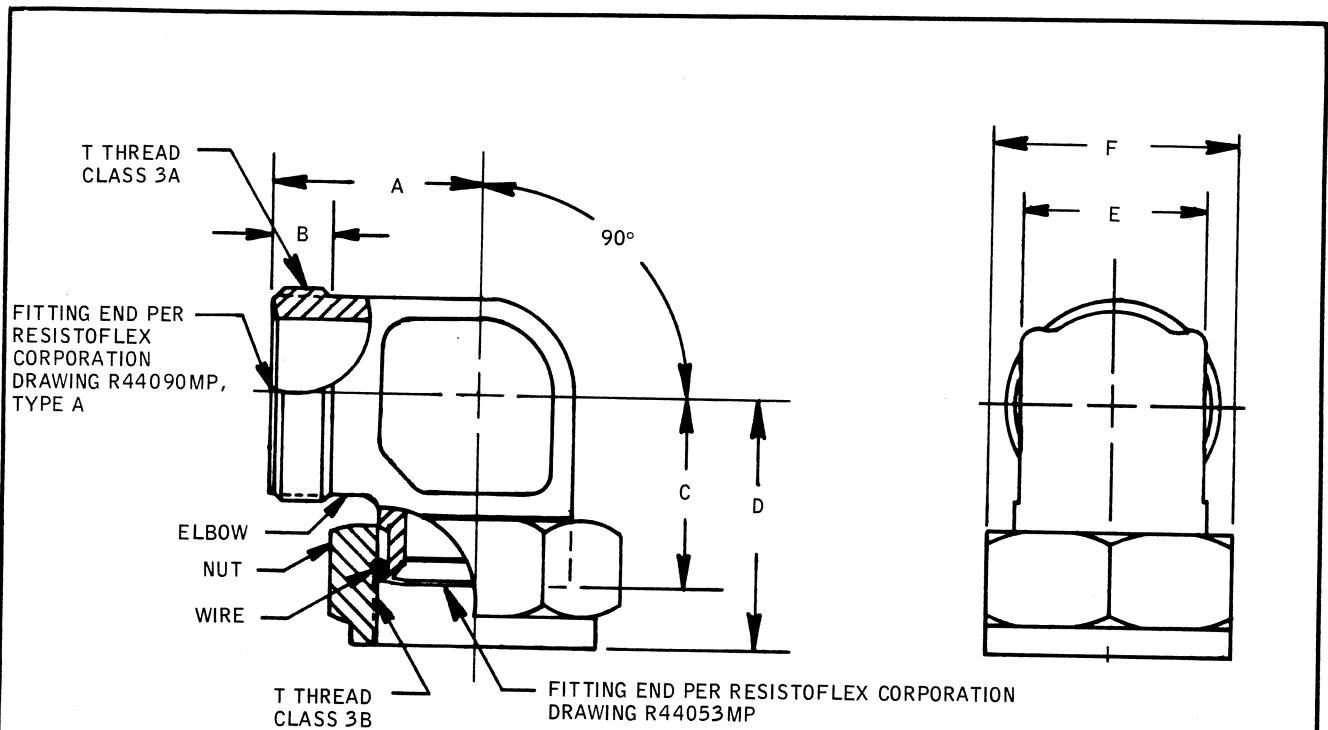
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FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-30

15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



ME273-0090 DASH NUMBER	TUBE SIZE (REF)	T THREAD	A ±.015	B ±.020	C ±.015	D REF	E REF	F REF
-0004	1/4	.4375-24 UNJS	.617	.212	.517	.723	.375	.562
-0005	5/16	.5000-24 UNJS	.653	.212	.551	.761	.438	.625
-0006	3/8	.5625-20 UNJS	.704	.220	.618	.851	.500	.688
-0008	1/2	.7188-20 UNJS	.824	.233	.672	.921	.562	.875
-0010	5/8	.8438-18 UNJS	.955	.289	.738	1.045	.688	1.000
-0012	3/4	1.0000-16 UNJ	1.062	.318	.846	1.189	.875	1.125
-0014	7/8	1.1250-16 UNJ	1.216	.333	1.052	1.400	1.125	1.375
-0016	1	1.2500-14 UNJS	1.246	.353	1.149	1.515	1.125	1.500
-0021	1-1/4	1.5781-14 UNJS	1.387	.350	1.397	1.766	1.375	1.875
-0025	1-1/2	1.8438-14 UNJS	1.688	.435	1.542	1.991	1.625	2.125

PARTS DATA SHEET	ELBOW, 90°, MALE TO FEMALE, TITANIUM	ME273-0090
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Data Sheet Revised



FITTINGS, DYNATUBE[®] AND DUAL SEAL*

2733-31

15 SEPTEMBER 1977

MATERIAL:

ELBOW AND NUT - 6AL-4V TITANIUM PER AMS 4965
 NUT RETAINING WIRE - 302 CRES PER AMS 5637, OR
 305 CRES PER AMS 5685

FINISH: CRES - PASSIVATE PER MIL-S-5002
 TITANIUM - NONE

COATING: EVERLUBE 620A (EVERLUBE CORP., NO. HOLLYWOOD, CA) DRY LUBRICANT ON
 INTERNAL THREAD, BEARING SURFACE OF NUT AND SEALING FACE OF MALE CONNECTOR

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM HYDRAULIC FLUID SYSTEMS

DYNATUBE[®] IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.
 DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR
 PROCUREMENT OR INSPECTION PURPOSES.

ELBOW, 90°, MALE TO FEMALE,
 TITANIUM

ME273-0090

SHEET 2 OF 2

Data Sheet Revised



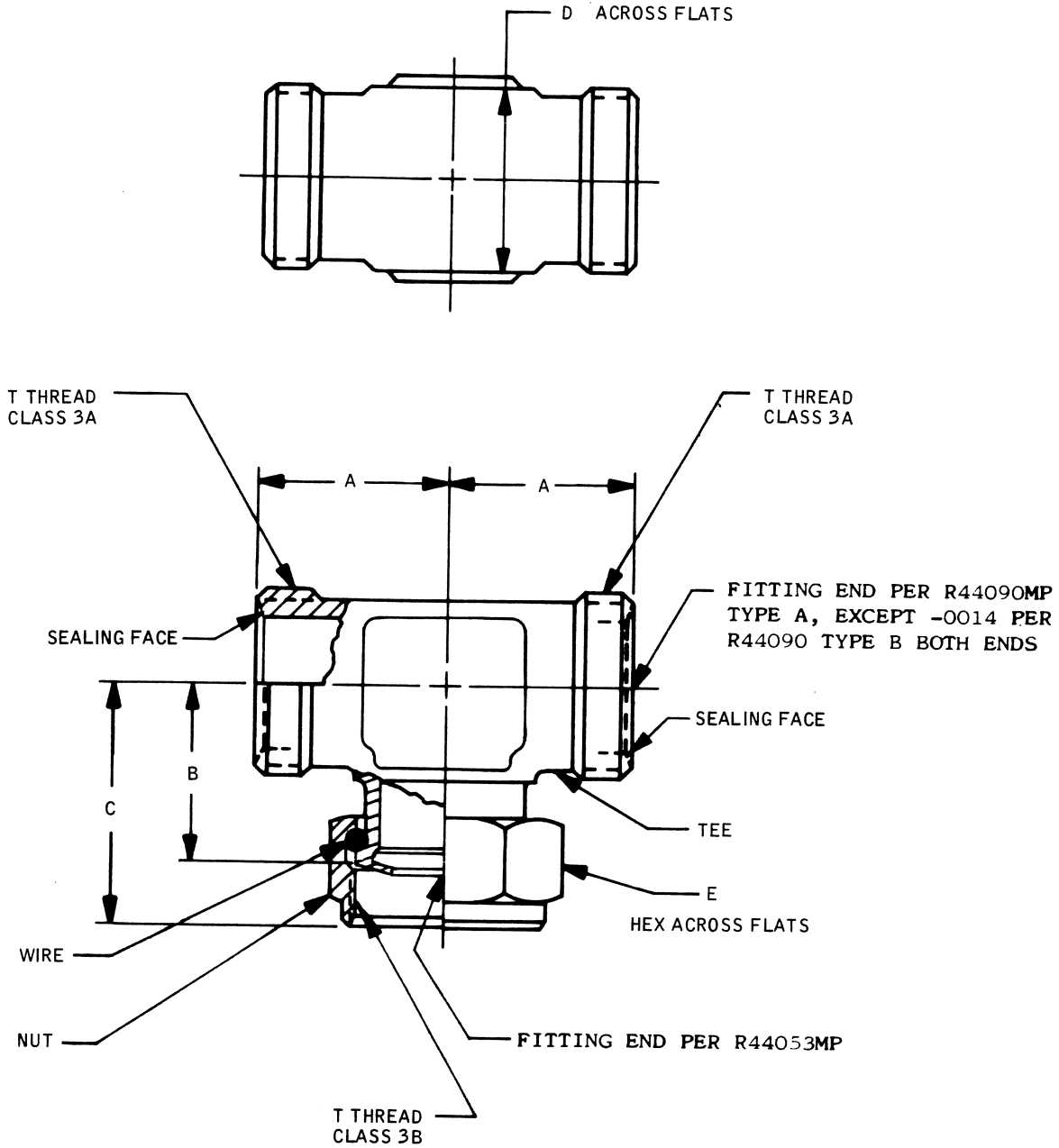
Space Division
 Rockwell International



2733-32

15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



PARTS DATA SHEET

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Data Sheet Revised

TEE, MALE ON RUNS, FEMALE ON SIDE, TITANIUM

ME273-0091

SHEET 1 OF 2



FITTINGS, DYNATUBE® AND DUAL SEAL*

ME273-0091 DASH NUMBER	TUBE SIZE (REF)	T THREAD	A ±.015	B ±.015	C (REF)	D (REF)	E (REF)
-0004	1/4	.4375-24 UNJS	.617	.808	1.014	.375	.562
-0005	5/16	.5000-24 UNJS	.653	.850	1.060	.438	.625
-0006	3/8	.5625-20 UNJS	.704	.945	1.178	.500	.688
-0008	1/2	.7188-20 UNJS	.824	1.045	1.294	.562	.875
-0010	5/8	.8438-18 UNJS	.955	1.178	1.485	.688	1.000
-0012	3/4	1.0000-16 UNJ	1.062	1.316	1.659	.875	1.125
-0014	7/8	1.1250-16 UNJ	1.216	1.514	1.862	1.125	1.375
-0016	1	1.2500-14 UNJS	1.246	1.529	1.895	1.125	1.500
-0021	1-1/4	1.5781-14 UNJS	1.387	1.847	2.216	1.375	1.875
-0025	1-1/2	1.8438-14 UNJS	1.688	2.171	2.620	1.625	2.125

MATERIAL:

TEE AND NUT - 6AL-4V TITANIUM PER AMS 4965

NUT RETAINING WIRE - 302 CRES PER AMS 5637, OR
305 CRES PER AMS 5685

FINISH: CRES - PASSIVATE PER MIL-S-5002

TITANIUM - NONE

COATING: EVERLUBE 620A (EVERLUBE CORP., NO. HOLLYWOOD, CA) DRY LUBRICANT ON
INTERNAL THREAD, BEARING SURFACE OF NUT, AND SEALING FACE OF MALE
CONNECTOR

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM HYDRAULIC FLUID SYSTEMS

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

TEE, MALE ON RUNS, FEMALE
ON SIDE, TITANIUM

ME273-0091

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SHEET 2 OF 2

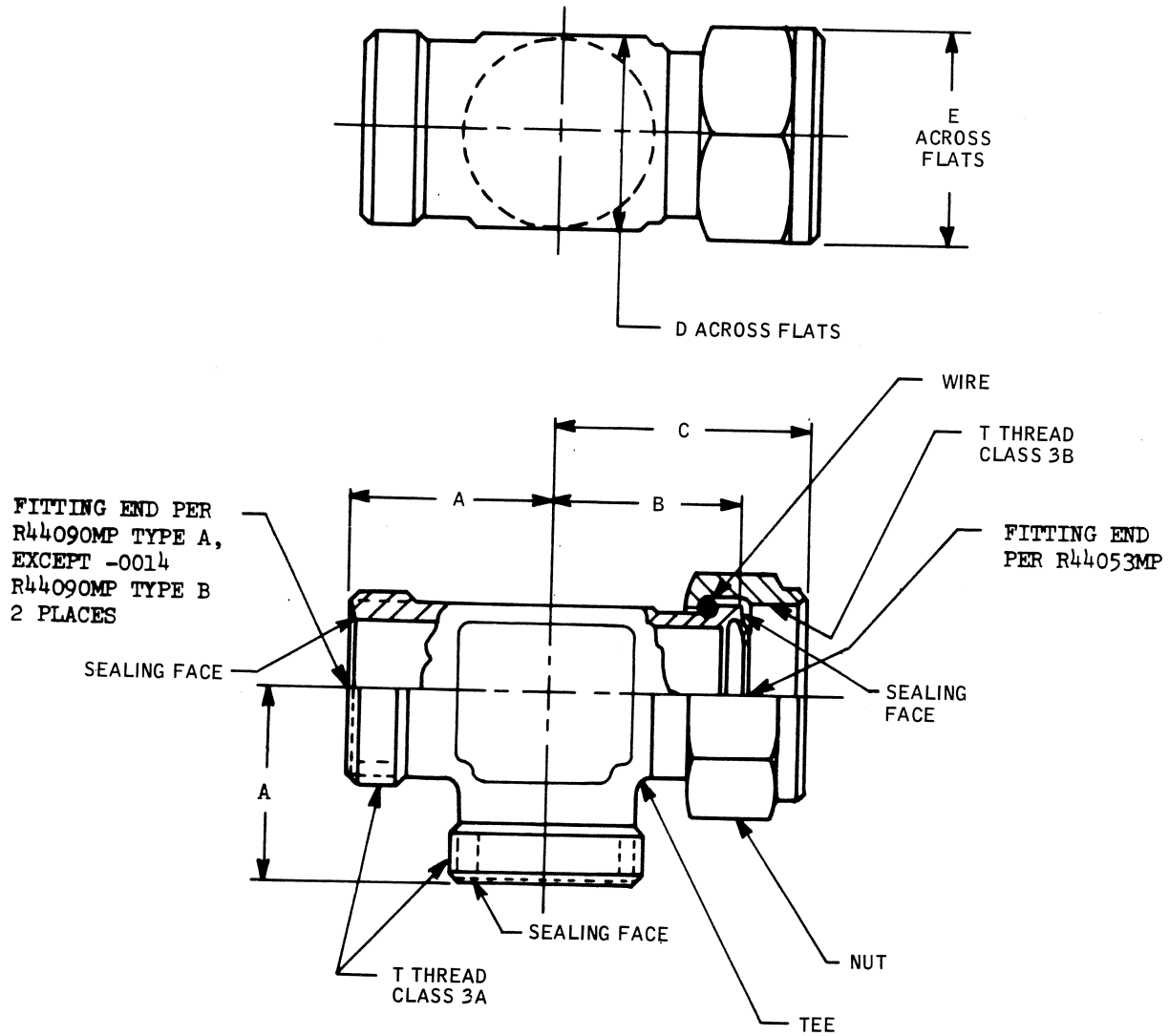




2733-34

15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



PARTS DATA SHEET

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TEE, MALE TO FEMALE ON RUN, MALE ON SIDE, TITANIUM

ME273-0092

SHEET 1 OF 2

Data Sheet Revised



FITTINGS, DYNATUBE® AND DUAL SEAL*

ME273-0092 DASH NUMBER	TUBE SIZE (REF)	T THREAD	A ±.015	B ±.015	C (REF)	D (REF)	E (REF)
-0004	1/4	.4375-24 UNJS	.617	.808	1.014	.375	.562
-0005	5/16	.5000-24 UNJS	.653	.850	1.060	.438	.625
-0006	3/8	.5625-20 UNJS	.704	.945	1.178	.500	.688
-0008	1/2	.7188-20 UNJS	.824	1.045	1.294	.562	.875
-0010	5/8	.8438-18 UNJS	.955	1.178	1.485	.688	1.000
-0012	3/4	1.0000-16 UNJ	1.062	1.316	1.659	.875	1.125
-0014	7/8	1.1250-16 UNJ	1.216	1.514	1.862	1.125	1.375
-0016	1	1.2500-14 UNJS	1.246	1.529	1.895	1.125	1.500
-0021	1-1/4	1.5781-14 UNJS	1.387	1.847	2.216	1.375	1.875
-0025	1-1/2	1.8438-14 UNJS	1.688	2.171	2.620	1.625	2.125

MATERIAL:

TEE AND NUT - 6AL-4V TITANIUM PER AMS 4965
 NUT RETAINING WIRE - 302 CRES PER AMS 5637, OR
 305 CRES PER AMS 5685

FINISH: CRES - PASSIVATE PER MIL-S-5002
 TITANIUM - NONE

COATING: EVERLUBE 620A (EVERLUBE CORP., NO. HOLLYWOOD, CA) DRY LUBRICANT ON INTERNAL
 THREAD, BEARING SURFACE OF NUT, AND SEALING FACE OF MALE CONNECTOR

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM HYDRAULIC FLUID SYSTEMS

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

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 PROCUREMENT OR INSPECTION PURPOSES.

TEE, MALE TO FEMALE ON RUN,
 MALE ON SIDE, TITANIUM

ME273-0092

SHEET 2 OF 2



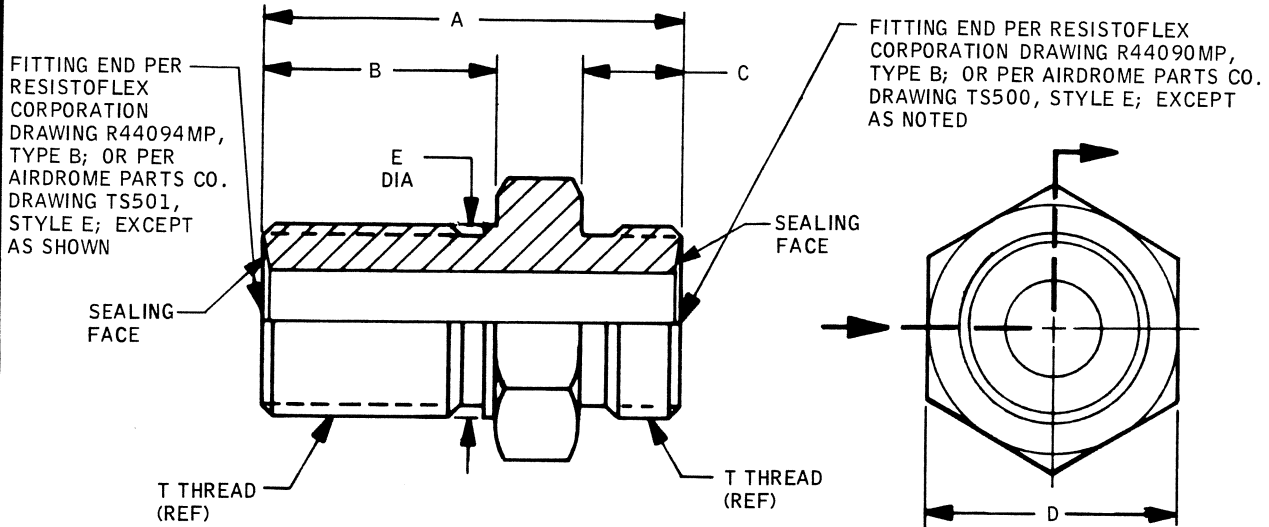


FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-36

15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



ME273-0093 DASH NUMBER	TUBE SIZE (REF)	T THREAD	A ±.015	B ±.015	C ±.015	D (REF)	E DIA
-0004	1/4	.4375-24 UNJS-3A	1.187	.680	.275	.688	.438 .431
-0005	5/16	.5000-24 UNJS-3A	1.197	.680	.275	.750	.500 .493
-0006	3/8	.5625-20 UNJS-3A	1.302	.719	.295	.812	.563 .555
-0008	1/2	.7188-20 UNJS-3A	1.363	.755	.308	1.000	.719 .711
-0010	5/8	.8438-18 UNJS-3A	1.572	.894	.372	1.125	.844 .835
-0012	3/4	1.0000-16 UNJ-3A	1.774	.990	.412	1.250	1.000 .991
-0014	7/8	1.1250-16 UNJ-3A	1.852	1.042	.430	1.375	1.125 1.116
-0016	1	1.2500-14 UNJS-3A	1.928	1.082	.460	1.500	1.250 1.240
-0021	1 1/4	1.5781-14 UNJS-3A	1.971	1.076	.457	1.875	1.578 1.568
-0025	1 1/2	1.8438-14 UNJS-3A	2.226	1.246	.542	2.125	1.844 1.834

PARTS DATA SHEET

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PROCUREMENT OR INSPECTION PURPOSES.

CONNECTOR, BULKHEAD TO MALE,
TITANIUM

ME273-0093

SHEET 1 OF 2

Data Sheet Revised



FITTINGS, DYNATUBE[®] AND DUAL SEAL*

MATERIAL: 6AL-4V TITANIUM PER AMS 4965

FINISH: NONE

COATING: EVERLUBE 620A (EVERLUBE CORP., NO. HOLLYWOOD, CA) DRY LUBRICANT
ON SEALING FACE OF FITTING ENDS

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM HYDRAULIC FLUID SYSTEMS

DYNATUBE[®] IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

CONNECTOR, BULKHEAD TO MALE,
TITANIUM

ME273-0093

SHEET 2 OF 2



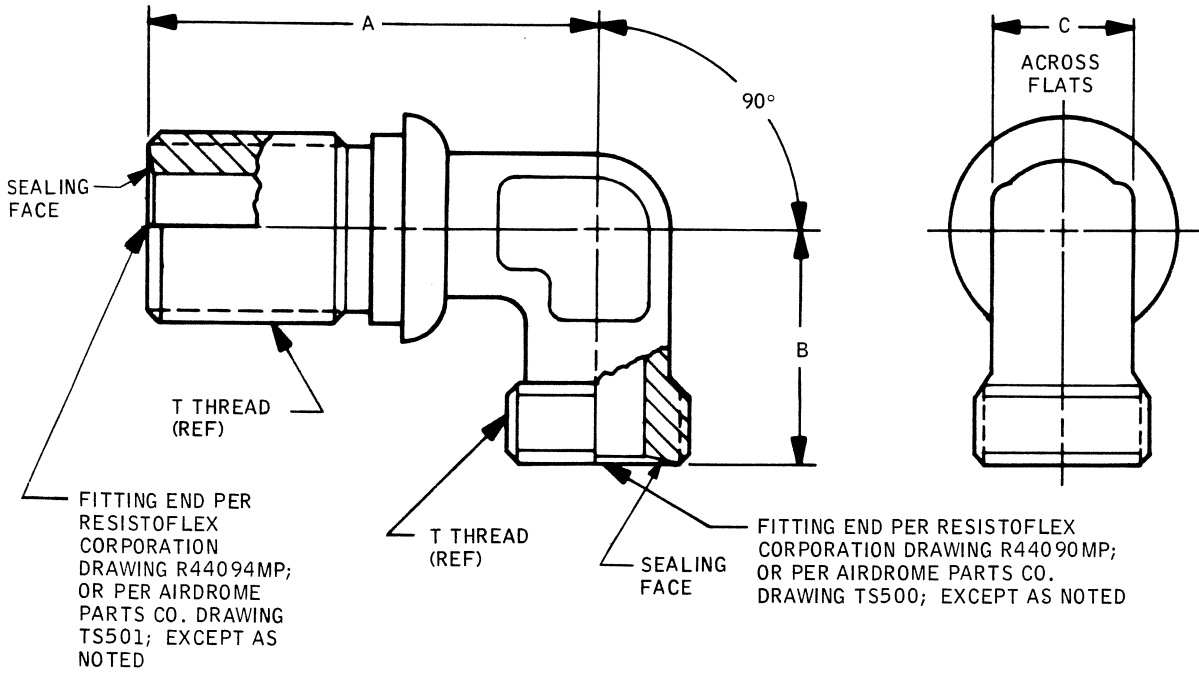


FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-38

15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



ME273-0094 DASH NUMBER	TUBE SIZE (REF)	T THREAD	A ± .015	B ± .015	C (REF)
-0004	1/4	.4375-24 UNJS-3A	1.225	.617	.375
-0005	5/16	.5000-24 UNJS-3A	1.261	.653	.438
-0006	3/8	.5625-20 UNJS-3A	1.353	.704	.500
-0008	1/2	.7188-20 UNJS-3A	1.542	.824	.562
-0010	5/8	.8438-18 UNJS-3A	1.769	.955	.688
-0012	3/4	1.0000-16 UNJ-3A	1.953	1.062	.875
-0014	7/8	1.1250-16 UNJ-3A	2.188	1.216	1.125
-0016	1	1.2500-14 UNJS-3A	2.188	1.246	1.125
-0021	1 1/4	1.5781-14 UNJS-3A	2.326	1.387	1.375
-0025	1 1/2	1.8438-14 UNJS-3A	2.712	1.688	1.625

TS DATA SHEET

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OR INSPECTION PURPOSES.

ELBOW, 90°, BULKHEAD TO MALE,
TITANIUM

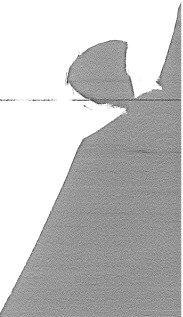
ME273-0094

SHEET 1 OF 2

sed



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Rockwell International



FITTINGS, DYNATUBE[®] AND DUAL SEAL* 2733-39
15 SEPTEMBER 1977

MATERIAL: 6AL-4V TITANIUM PER AMS 4965

FINISH: NONE

COATING: EVERLUBE 620A (EVERLUBE CORP., NO. HOLLYWOOD, CA) DRY FILM LUBRICANT ON SEALING FACE OF FITTING ENDS

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM HYDRAULIC FLUID SYSTEMS

DYNATUBE[®] IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

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ELBOW, 90°, BULKHEAD TO MALE, TITANIUM

ME273-0094

SHEET 2 OF 2

Data Sheet Revised



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Rockwell International

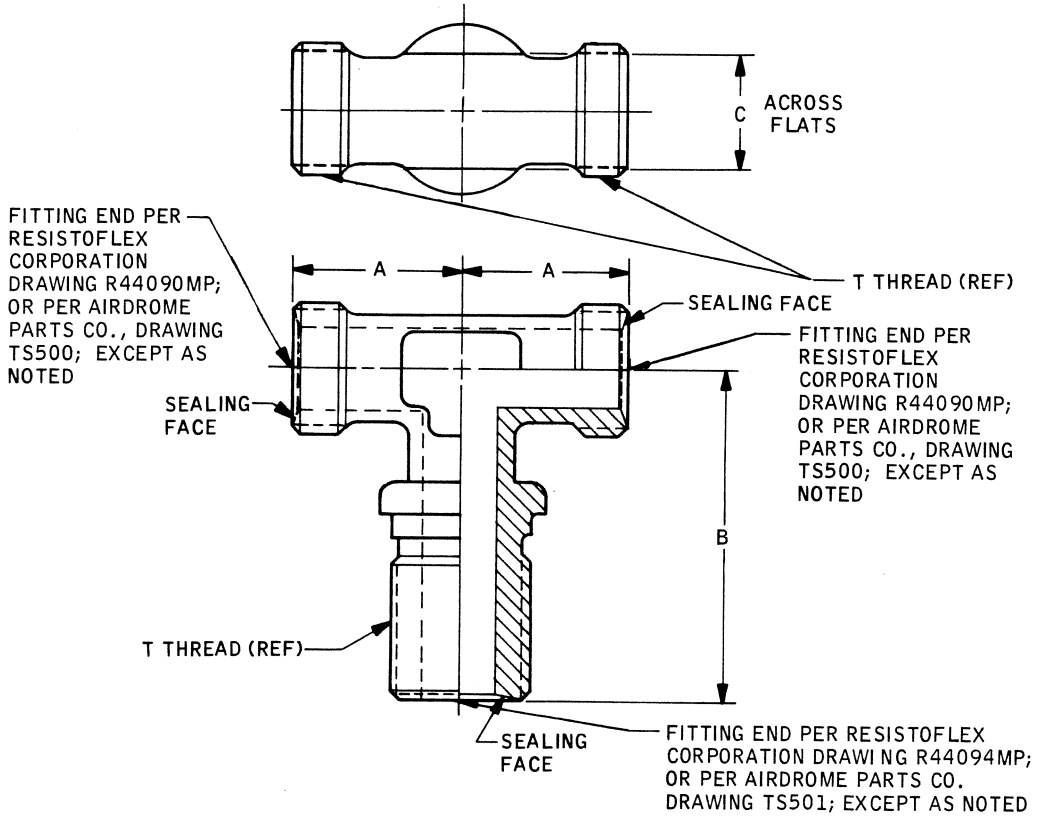


FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-40

15 SEPTEMBER 1977

FITTINGS, DYNATUBE[®] AND DUAL SEAL*



ME273-0095 DASH NO.	TUBE SIZE (REF)	T THREAD	A ±.015	B ±.015	C (REF)
-0004	1/4	.4375-24 UNJS-3A	.617	1.225	.375
-0005	5/16	.5000-24 UNJS-3A	.653	1.261	.438
-0006	3/8	.5625-20 UNJS-3A	.704	1.353	.500
-0008	1/2	.7188-20 UNJS-3A	.824	1.542	.562
-0010	5/8	.8438-18 UNJS-3A	.955	1.769	.688
-0012	3/4	1.0000-16 UNJ-3A	1.062	1.953	.875
-0014	7/8	1.1250-16 UNJ-3A	1.216	2.188	1.125
-0016	1	1.2500-14 UNJS-3A	1.246	2.188	1.125
-0021	1-1/4	1.5781-14 UNJS-3A	1.387	2.326	1.375
-0025	1-1/2	1.8438-14 UNJS-3A	1.688	2.712	1.625

MATERIAL: 6AL-4V TITANIUM PER AMS 4965

FINISH: NONE

COATING: EVERLUBE 620A (EVERLUBE CORP., NO. HOLLYWOOD, CA) DRY LUBRICANT ON SEALING SURFACES

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM HYDRAULIC FLUID SYSTEMS

DYNATUBE[®] IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

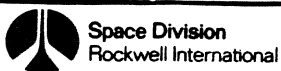
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TEE, MALE TO MALE, BULKHEAD
ON SIDE, TITANIUM

ME273-0095

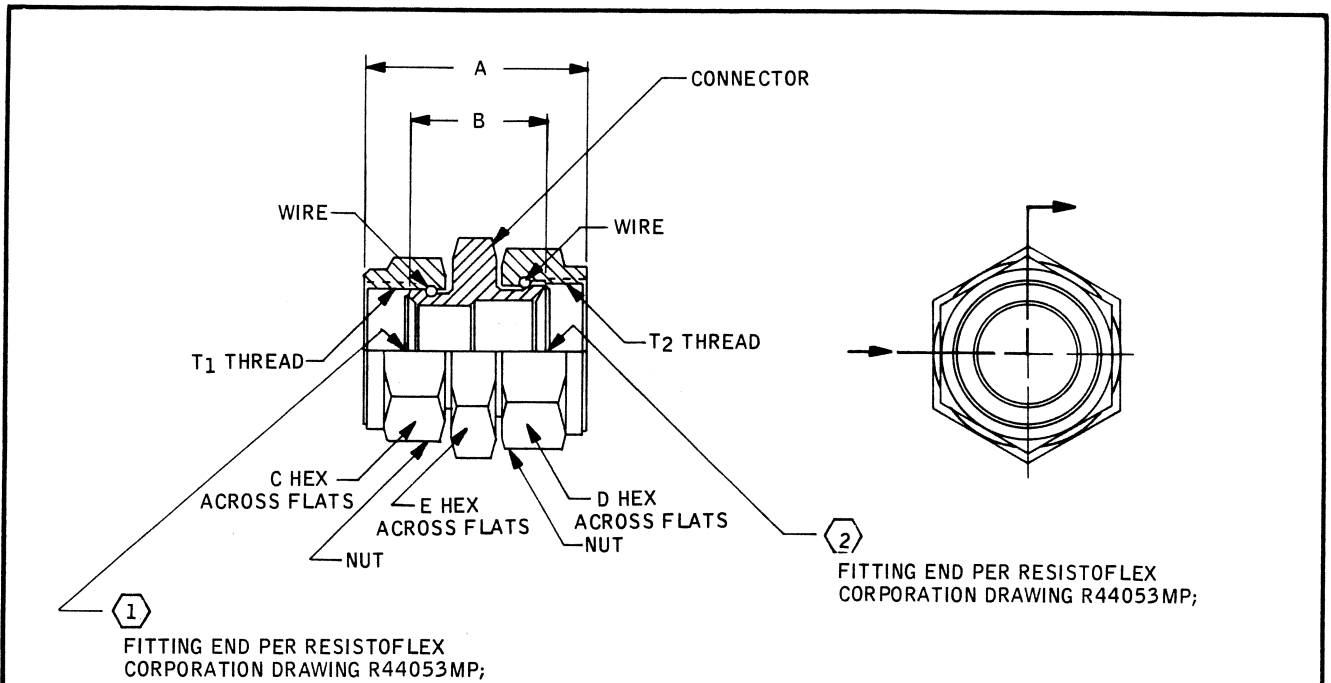
SHEET 1 OF 1

Data Sheet Revised





FITTINGS, DYNATUBE® AND DUAL SEAL*



ME273-0096 DASH NO.	TUBE SIZE REF (1)	TUBE SIZE REF (2)	T ₁ THREAD	T ₂ THREAD	A REF	B ±.015	C REF	D REF	E REF
-0406	1/4	3/8	.4375-24 UNJS-3B	.5625-20 UNJS-3B	1.257	.818	.562	.688	.750
-0608	3/8	1/2	.5625-20 UNJS-3B	.7188-20 UNJS-3B	1.372	.890	.688	.875	1.000
-0810	1/2	5/8	.7188-20 UNJS-3B	.8438-18 UNJS-3B	1.431	.875	.875	1.000	1.125
-1012	5/8	3/4	.8438-18 UNJS-3B	1.0000-16 UNJ-3B	1.632	.982	1.000	1.125	1.375
-1214	3/4	7/8	1.0000-16 UNJ-3B	1.1250-16 UNJ-3B	1.757	1.066	1.125	1.375	1.500
-1416	7/8	1	1.1250-16 UNJ-3B	1.2500-14 UNJS-3B	1.889	1.175	1.375	1.500	1.625
-1621	1	1-1/4	1.2500-14 UNJS-3B	1.5781-14 UNJS-3B	2.033	1.298	1.500	1.875	2.125
-2125	1-1/4	1-1/2	1.5781-14 UNJS-3B	1.8438-14 UNJS-3B	2.199	1.381	1.875	2.125	2.375

PARTS DATA SHEET FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.	UNION, EXPANDER, FEMALE TO FEMALE, TITANIUM	ME273-0096
		SHEET 1 OF 2

Data Sheet Revised



FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-42

15 SEPTEMBER 1977

FITTINGS, DYNATUBE[®] AND DUAL SEAL*

MATERIAL:

CONNECTOR AND NUTS - 6AL-4V TITANIUM PER AMS 4965
NUT RETAINING WIRES - 302 CRES PER AMS 5637, OR
305 CRES PER AMS 5685

FINISH: CRES - PASSIVATE PER MIL-S-5002
TITANIUM - NONE

COATING: EVERLUBE 620A (EVERLUBE CORP., NO. HOLLYWOOD, CA) DRY LUBRICANT ON NUT THREADS

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM HYDRAULIC FLUID SYSTEMS

DYNATUBE[®] IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

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PROCUREMENT OR INSPECTION PURPOSES.

UNION, EXPANDER, FEMALE TO
FEMALE, TITANIUM

ME273-0096

SHEET 2 OF 2

Data Sheet Revised

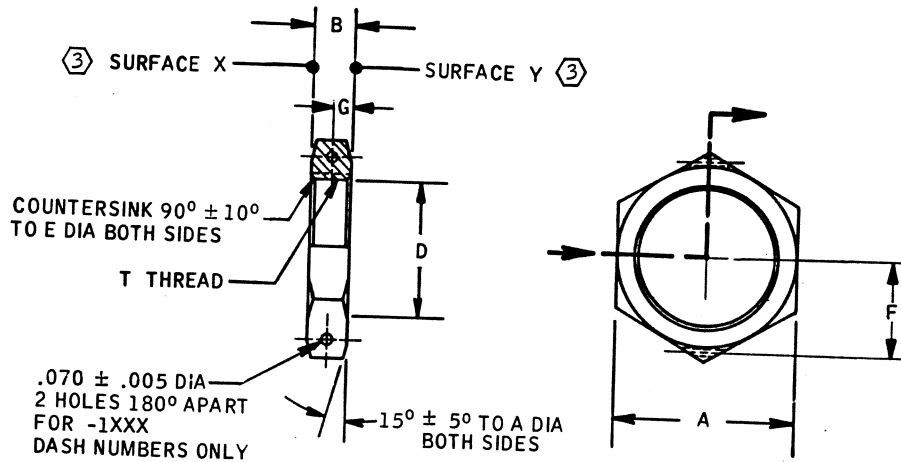


Space Division
Rockwell International



FITTINGS, DYNATUBE® AND DUAL SEAL*

2733-43
15 SEPTEMBER 1977



ME273-0097 DASH NUMBER		TUBE SIZE (REF)	T THREAD	A (REF)	B $\pm .010$	③ C MAX	D $\pm .005$	E $+ .020$ $- .015$	F $\pm .005$	G $\pm .005$
①	②									
-0004	-1004	1/4	.4375-24 UNJS-3B	.688	.210	.005	.400	.453	.313	.105
-0005	-1005	5/16	.5000-24 UNJS-3B	.750	.210	.005	.463	.515	.349	.105
-0006	-1006	3/8	.5625-20 UNJS-3B	.812	.242	.005	.519	.578	.385	.121
-0008	-1008	1/2	.7188-20 UNJS-3B	1.000	.242	.005	.673	.733	.493	.121
-0010	-1010	5/8	.8438-18 UNJS-3B	1.125	.278	.005	.792	.859	.557	.139
-0012	-1012	3/4	1.0000-16 UNJ-3B	1.250	.306	.008	.942	1.015	.629	.153
-0014	-1014	7/8	1.1250-16 UNJ-3B	1.375	.338	.008	1.068	1.140	.702	.169
-0016	-1016	1	1.2500-14 UNJS-3B	1.500	.338	.008	1.183	1.265	.774	.169
-0021	-1021	1-1/4	1.5781-14 UNJS-3B	1.875	.338	.008	1.511	1.593	.990	.169
-0025	-1025	1-1/2	1.8438-14 UNJS-3B	2.125	.338	.008	1.777	1.859	1.129	.169

① NUT WITHOUT SAFETY WIRE HOLES ② NUT WITH SAFETY WIRE HOLES

MATERIAL: 6AL-4V TITANIUM PER AMS 4965

FINISH: NONE

COATING: EVERLUBE 620A (EVERLUBE CORP., NO. HOLLYWOOD, CA) DRY LUBRICANT ON INTERNAL THREAD

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM HYDRAULIC FLUID SYSTEMS

NOTES:

③ 1. PITCH DIAMETER OF THREAD SHALL BE SQUARE TO SURFACES X AND Y WITHIN C TIR

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DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

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Data Sheet Revised

JAM-NUT, BULKHEAD AND UNIVERSAL
FITTINGS, TITANIUM

ME273-0097

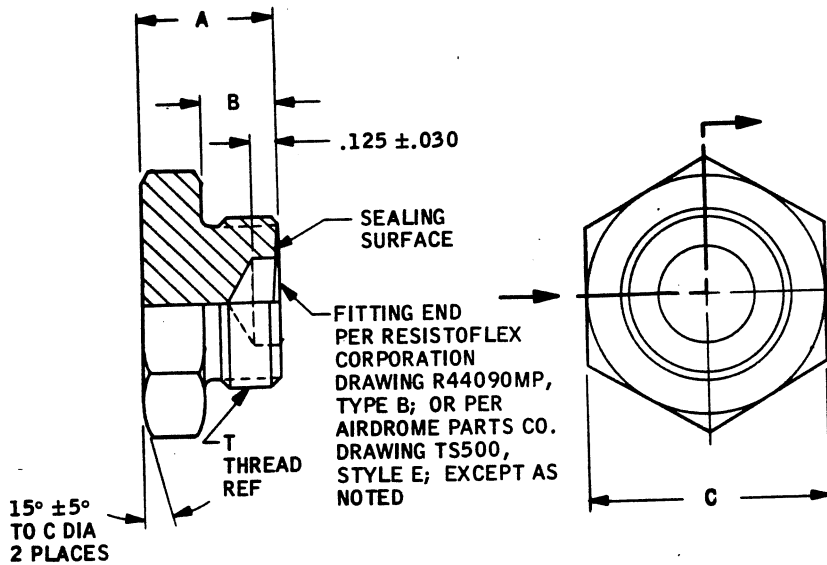
SHEET 1 OF 1



FLUID SYSTEMS DESIGN AND PARTS MANUAL

33-44
SEPTEMBER 1977

FITTINGS, DYNATUBE[®] AND DUAL SEAL*



SOURCE CONTROL DRAWING DASH NUMBER	TUBE SIZE REF	T THREAD	A ±.015	B ±.015	C REF
-0004 ①	1/4	.4375-24 UNJS-3A	.437	.275	.438
-0005 ①	5/16	.5000-24 UNJS-3A	.449	.275	.500
-0006 ①	3/8	.5625-20 UNJS-3A	.483	.295	.562
-0008 ①	1/2	.7188-20 UNJS-3A	.550	.308	.750
-0010 ①	5/8	.8438-18 UNJS-3A	.664	.372	.875
-9012 ①	3/4	1.0000-16 UNJ-3A	.712	.412	1.000
-9014 ①	7/8	1.1250-16 UNJ-3A	.736	.430	1.125
③ -0012 ②	3/4	1.0000-16 UNJ-3A	.712	.412	1.000
③ -0014 ②	7/8	1.1250-16 UNJ-3A	.736	.430	1.125
-0016 ②	1	1.2500-14 UNJS-3A	.832	.460	1.250
-0020 ②	1-1/4	1.5156-14 UNJS-3A	.869	.457	1.625
-0024 ②	1-1/2	1.7812-14 UNJS-3A	.980	.542	1.875

③ INACTIVE FOR DESIGN AND PROCUREMENT AFTER APRIL 15, 1977. USE -9012 OR -9014

MATERIAL: 17-4PH CRES PER AMS 5643, HEAT TREAT TO CONDITION H-1075 (145 KSI TENSILE MIN) PER MIL-H-6875
FINISH: PASSIVATE PER MIL-S-5002

COATING: ① PLUGS, -0004 THRU -0010, -9012 AND -9014, UNCOATED WITH 8 RMS FINE FINISH ON SEALING SURFACE
 ② PLUGS, -0012 THRU -0024, THE SEALING SURFACE SHALL BE COATED PER AMS 2515C WITH DUPONT 850-204 TETRAFLUOROETHYLENE (TFE) TO A THICKNESS OF .1-.6 MILS.

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY.

PROCUREMENT SPECIFICATION: MC273-0129

APPLICATION: SPACE SHUTTLE PROGRAM NON-CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

DYNATUBE[®] IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.
 DUAL SEAL* IS A TRADEMARK OF TITFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

PLUG, MALE THREADED, 17-4PH

ME273-0098

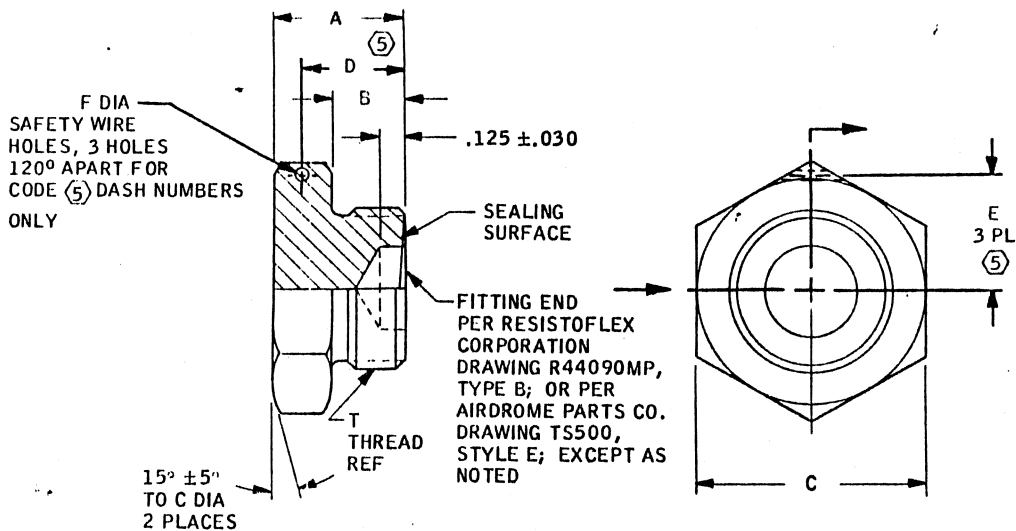
FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.

SHEET 1 OF 1

Sheet Revised



FITTINGS, DYNATUBE® AND DUAL SEAL*



SOURCE CONTROL DRAWING DASH NUMBER		TUBE SIZE REF	T THREAD	A ±.015	B ±.015	C REF	D ±.010	E ±.005	F DIA ±.005
(4)	(5)								
-0004 (1)	-1004 (1)	1/4	.4375-24UNJS-3A	.437	.275	.438	.356	.171	.070
-0005 (1)	-1005 (1)	5/16	.5000-24UNJS-3A	.449	.275	.500	.362	.207	.070
-0006 (1)	-1006 (1)	3/8	.5625-20UNJS-3A	.483	.295	.562	.389	.243	.070
-0008 (1)	-1008 (1)	1/2	.7188-20UNJS-3A	.550	.308	.750	.429	.349	.070
-0010 (1)	-1010 (1)	5/8	.8438-18UNJS-3A	.664	.372	.875	.518	.421	.070
-9012 (1)	-1012 (1)	3/4	1.0000-16UNJ-3A	.712	.412	1.000	.562	.493	.070
-9014 (1)	-1014 (1)	7/8	1.1250-16UNJ-3A	.736	.430	1.125	.583	.557	.070
(3)-0012 (2)	-	3/4	1.0000-16UNJ-3A	.712	.412	1.000	-	-	-
(3)-0014 (2)	-	7/8	1.1250-16UNJ-3A	.736	.430	1.125	-	-	-
-0016 (2)	-1016 (2)	1	1.2500-14UNJS-3A	.832	.460	1.250	.646	.629	.070
-0020 (2)	-1020 (2)	1-1/4	1.5156-14UNJS-3A	.869	.457	1.625	.663	.846	.070
-0024 (2)	-1024 (2)	1-1/2	1.7812-14UNJS-3A	.980	.542	1.875	.761	.990	.070

(3) INACTIVE FOR DESIGN AND PROCUREMENT AFTER 15 APRIL 1977. USE -9012 OR -9014.

(4) PLUG WITHOUT SAFETY WIRE HOLES

(5) PLUG WITH SAFETY WIRE HOLES

PARTS DATA SHEET	PLUG, MALE THREADED, 17-4PH	ME273-0098
FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.		SHEET 1 OF 2



FLUID SYSTEMS DESIGN AND PARTS MANUAL

FITTINGS, DYNATUBE[®] AND DUAL SEAL*

MATERIAL: 17-4PH CRES PER AMS 5643, HEAT TREAT TO CONDITION H-1075
(145 KSI TENSILE MIN) PER MIL-H-6875

FINISH: PASSIVATE PER MIL-S-5002

COATING:

① PLUGS, -0004 THRU -0010, -9012 AND -9014, AND -1004 THRU
-1014 UNCOATED WITH 8 RMS FINE FINISH ON SEALING SURFACE

② PLUGS, -0012 THRU -0024, AND -1016 THRU -1024, THE
SEALING SURFACE SHALL BE COATED PER AMS 2515C WITH
DUPONT 850-204 TETRAFLUOROETHYLENE (TFE) TO A
THICKNESS OF .1-.6 MILS

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM NON-CRYOGENIC AND NON-HYDRAULIC
FLUID SYSTEMS

EXAMPLE OF CONTROL NUMBER:

ME273-0098-0008 = 1/2 INCH TUBE SIZE PLUG WITHOUT SAFETY WIRE HOLES

ME273-0098-1008 = 1/2 INCH TUBE SIZE PLUG WITH SAFETY WIRE HOLES

DYNATUBE[®] IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.
DUAL SEAL* IS A TRADEMARK OF TITEFLEX CORPORATION, A BUNDY COMPANY

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

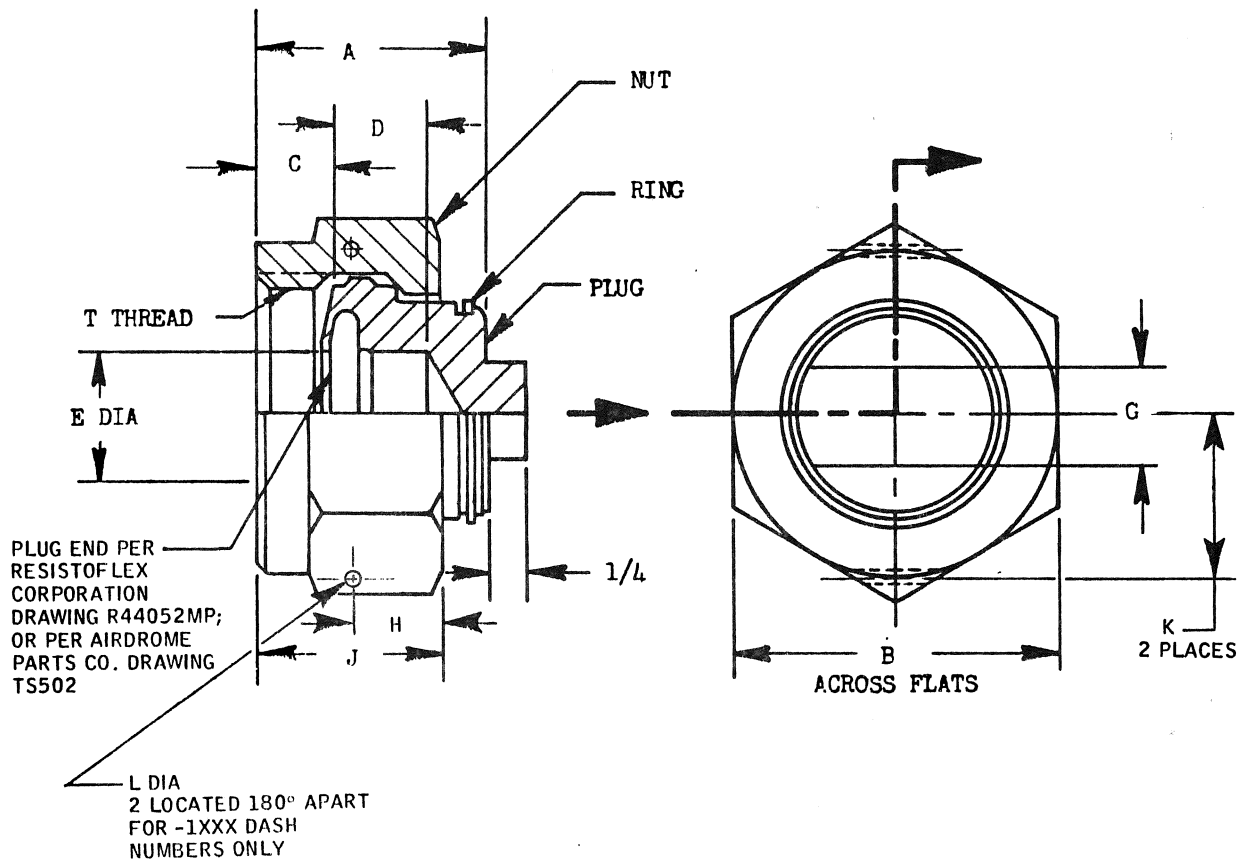
PLUG, MALE THREADED,
17-4PH

ME273-0098

SHEET 2 OF 2

FLUID SYSTEMS DESIGN AND PARTS MANUAL

HITTINGS, DYNATUBE[®] AND DUAL SEAL^{*}



MATERIAL: PLUG AND NUT - 6AL-4V TITANIUM PER AMS 4965
RING - PH14-7Mo PER AMS 5520

FINISH: TITANIUM - NONE
CRES - PASSIVATE PER MIL-S-5002

COATING: EVERLUBE 620A (EVERLUBE CORP., NO. HOLLYWOOD, CA) DRY FILM
LUBRICANT ON INTERNAL THREAD AND BEARING SURFACES OF NUT

PROCUREMENT SPECIFICATION: MC273-0129

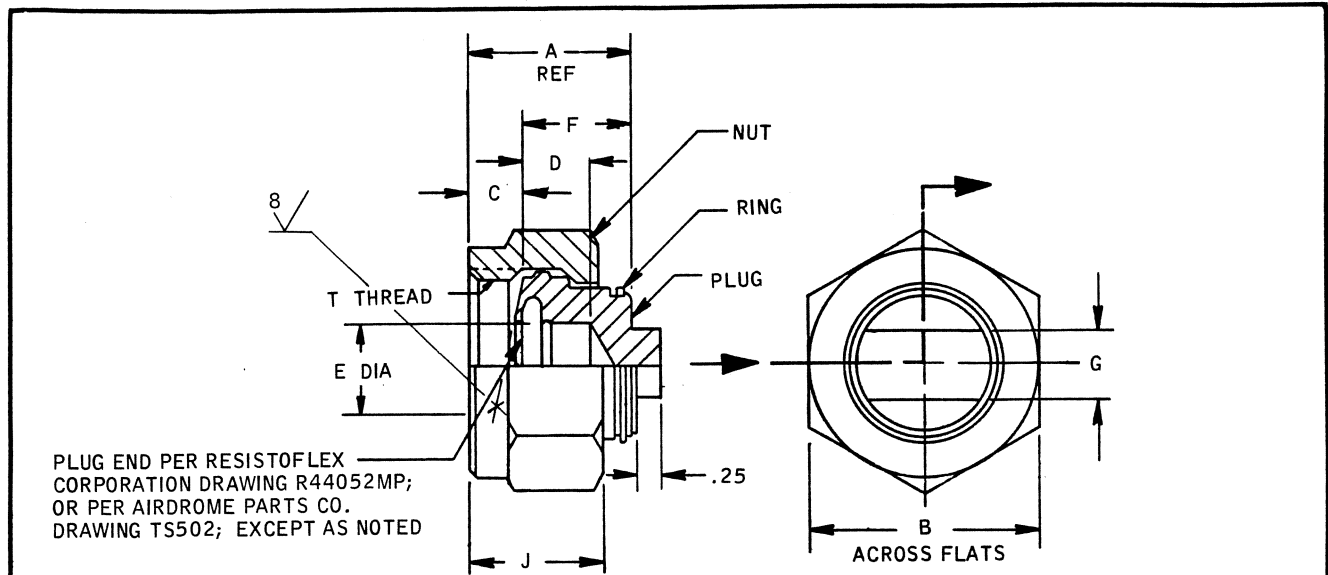
TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM HYDRAULIC FLUID SYSTEMS

DYNATUBE[®] IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL^{*} IS A TRADEMARK OF TITFLEX CORPORATION, A BUNDY COMPANY

FITTINGS, DYNATUBE® AND DUAL SEAL*



ME273-0099 DASH NUMBER	TUBE SIZE REF	T THREAD	A REF	B	C	D	E MIN	F	G REF	J
-0004	1/4	.4375-24 UNJS-3B	.579	.562	.229	.180	.185	.350	.188	.454
-0005	5/16	.5000-24 UNJS-3B	.584	.625	.234		.247				.250	.459
-0006	3/8	.5625-20 UNJS-3B	.643	.688	.253		.309	.390	.518	
-0008	1/2	.7188-20 UNJS-3B	.635	.875	.270	.175	.403	.365	.375	.510
-0010	5/8	.8438-18 UNJS-3B	.696	1.000	.331		.526				.571
-0012	3/4	1.0000-16 UNJ-3B	.763	1.125	.367	.176	.678	.396	.500	.637
-0014	7/8	1.1250-16 UNJ-3B	.825	1.250	.370	.175	.792	.455		.660
-0016	1	1.2500-14 UNJS-3B	.881	1.375	.410	.171	.860	.471		.705
-0020	1-1/4	1.5156-14 UNJS-3B	.828	1.625	.407	.101	1.132	.421	.800	.687
-0024	1-1/2	1.7812-14 UNJS-3B	.941	2.000	.492	.064	1.367	.449		.800

MATERIAL: PLUG AND NUT - 17-4PH CRES PER AMS 5643, HEAT TREAT TO CONDITION H-1075 (145 KSI TENSILE MIN) PER MIL-H-6875

RING - PH15-7Mo PER AMS 5520

FINISH: PASSIVATE PER MIL-S-5002

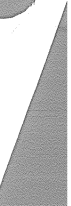
PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY.

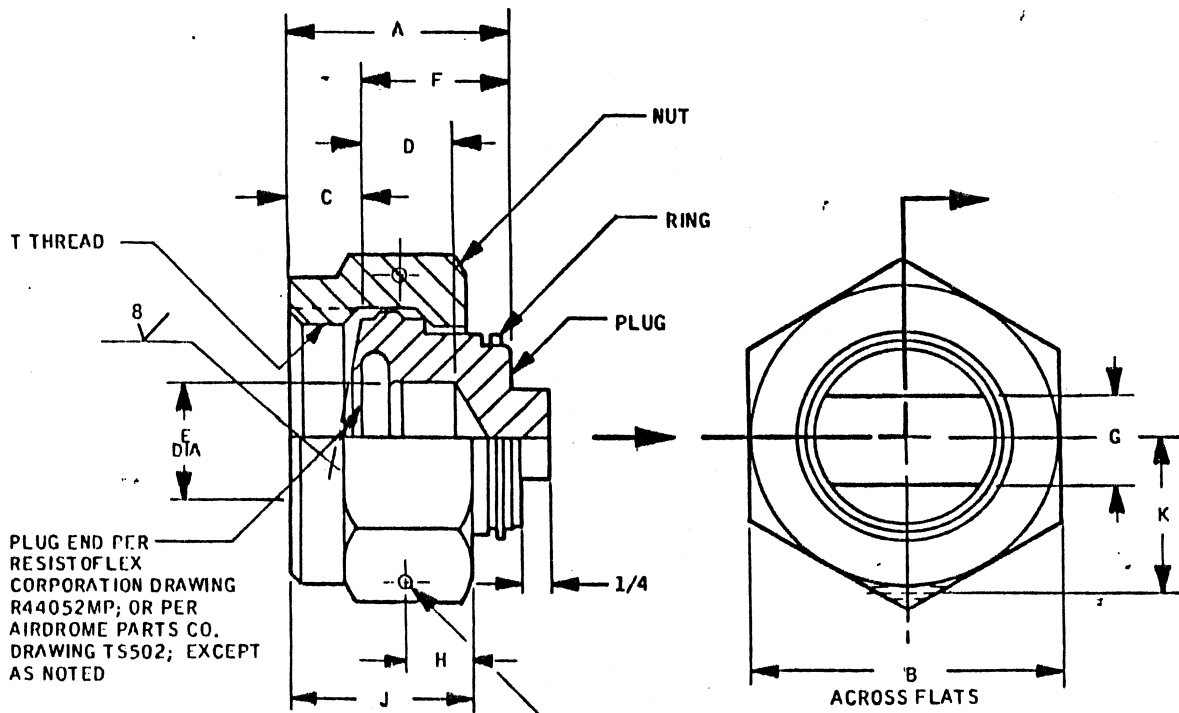
APPLICATION: SPACE SHUTTLE PROGRAM NON-CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.
DUAL SEAL* IS A TRADEMARK OF TITFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET	FITTING, PRESSURE CAP, 17-4PH	ME273-0099
FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.		SHEET 1 OF 1

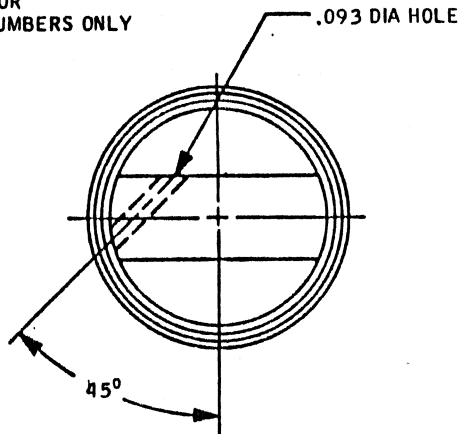
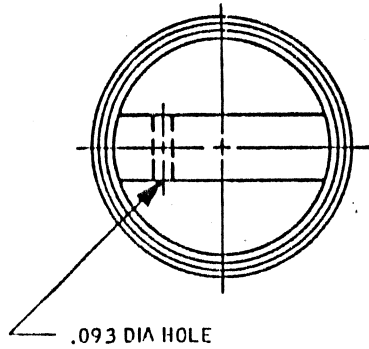


FITTINGS, DYNATUBE® AND DUAL SEAL*



PLUG END PER
RESISTOFLEX
CORPORATION DRAWING
R44052MP; OR PER
AIRDROME PARTS CO.
DRAWING T5502; EXCEPT
AS NOTED

L DIA
OPTIONAL SAFETY WIRE HOLES
2 HOLES 180° APART FOR
CODE (3) OR (4) DASH NUMBERS ONLY



SAFETY CHAIN HOLE
OPTION

-1004 THRU -1006
OR
-3004 THRU -3006

-1008 THRU -1024
OR
-3008 THRU -3024

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES

FITTING, PRESSURE CAP,
17-4PH

ME273-0099

SHEET 1 OF 2



FLUID SYSTEMS DESIGN AND PARTS MANUAL

FITTINGS, DYNATUBE® AND DUAL SEAL*

SOURCE CONTROL DRAWING DASH NUMBER				TUBE SIZE REF	T THREAD	A REF	B	C	D
①	②	③	④						
-0004	-1004	-2004	-3004	1/4	.4375-24 UNJS-3B	.579	.562	.229	.180
-0005	-1005	-2005	-3005	5/16	.5000-24 UNJS-3B	.584	.625	.234	.180
-0006	-1006	-2006	-3006	3/8	.5625-20 UNJS-3B	.643	.688	.253	.180
-0008	-1008	-2008	-3008	1/2	.7188-20 UNJS-3B	.635	.875	.270	.175
-0010	-1010	-2010	-3010	5/8	.8438-18 UNJS-3B	.696	1.000	.331	.175
-0012	-1012	-2012	-3012	3/4	1.0000-16 UNJ-3B	.763	1.125	.367	.176
-0014	-1014	-2014	-3014	7/8	1.1250-16 UNJ-3B	.825	1.250	.370	.175
-0016	-1016	-2016	-3016	1	1.2500-14 UNJS-3B	.881	1.375	.410	.171
-0020	-1020	-2020	-3020	1-1/4	1.5156-14 UNJS-3B	.828	1.625	.407	.101
-0024	-1024	-2024	-3024	1-1/2	1.7812-14 UNJS-3B	.941	2.000	.492	.064

SOURCE CONTROL DRAWING DASH NUMBER				TUBE SIZE REF	E MIN	F	G REF	J	H	K	L DIA
①	②	③	④								
-0004	-1004	-2004	-3004	1/4	.185	.350	.188	.454	.188	.261	.047
-0005	-1005	-2005	-3005	5/16	.247	.350	.250	.459	.188	.298	.047
-0006	-1006	-2006	-3006	3/8	.309	.390	.250	.518	.188	.334	.047
-0008	-1008	-2008	-3008	1/2	.403	.365	.375	.510	.188	.423	.070
-0010	-1010	-2010	-3010	5/8	.526	.365	.375	.571	.250	.495	.070
-0012	-1012	-2012	-3012	3/4	.678	.396	.375	.637	.250	.567	.070
-0014	-1014	-2014	-3014	7/8	.792	.455	.500	.660	.250	.640	.070
-0016	-1016	-2016	-3016	1	.860	.471	.500	.705	.250	.712	.070
-0020	-1020	-2020	-3020	1-1/4	1.132	.421	.500	.687	.250	.849	.070
-0024	-1024	-2024	-3024	1-1/2	1.367	.449	.500	.800	.281	1.065	.070

- ① CAP WITHOUT SAFETY CHAIN HOLE AND SAFETY WIRE HOLES.
- ② CAP WITH SAFETY CHAIN HOLE.
- ③ CAP WITH SAFETY WIRE HOLES.
- ④ CAP WITH SAFETY CHAIN HOLE AND SAFETY WIRE HOLES.

MATERIAL: PLUG AND NUT - 17-4PH CRES PER AMS 5643, HEAT TREAT TO CONDITION H-1075 (145 KSI TENSILE MIN) PER MIL-H-6875

RING - PH15-7Mo PER AMS 5520

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM NON-CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.
 DUAL SEAL* IS A TRADEMARK OF TITFLEX CORPORATION, A BUNDY COMPANY

PARTS DATA SHEET	FITTING, PRESSURE CAP, 17-4PH	ME273-0099
FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.		SHEET 2 OF 2

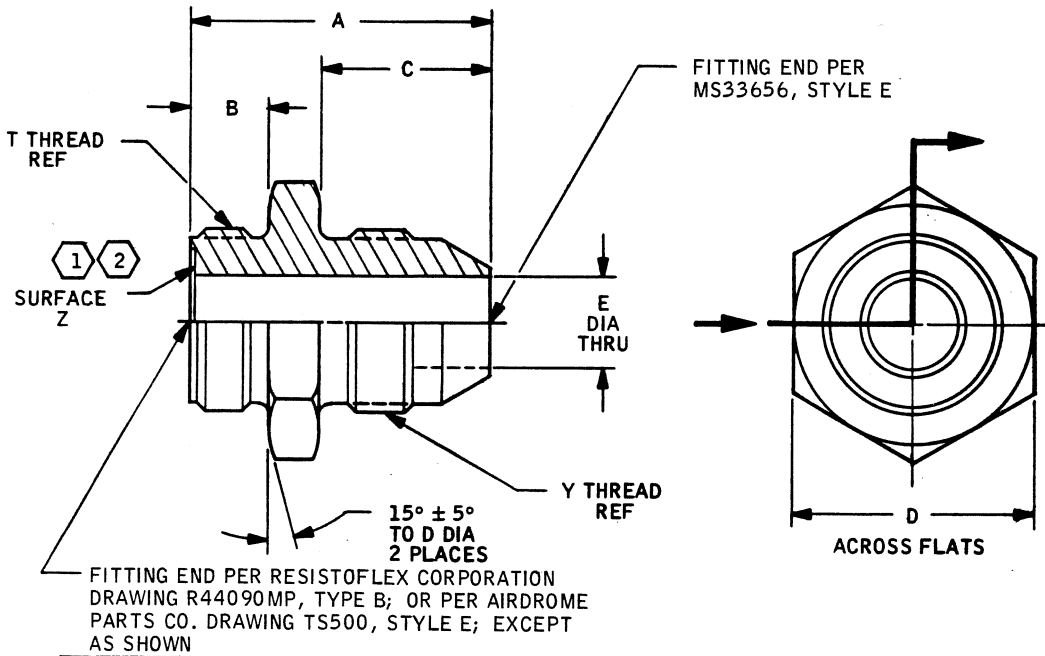


FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-46

15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



ME273-0100 DASH NUMBER	TUBE SIZE REF	T THREAD	Y THREAD	A ±.015	B ±.015	C ±.015	D REF	E DIA ±.005
-0004	① 1/4	.4375-24 UNJS-3A	.4375-20 UNF-3A	1.057	.275	.550	.688	.172
-0005	① 5/16	.5000-24 UNJS-3A	.5000-20 UNF-3A	1.067	.275	.550	.750	.234
-0006	① 3/8	.5625-20 UNJS-3A	.5625-18 UNF-3A	1.139	.295	.556	.813	.297
-0008	① 1/2	.7188-20 UNJS-3A	.7500-16 UNF-3A	1.265	.308	.657	1.000	.391
-0010	① 5/8	.8438-18 UNJS-3A	.8750-14 UNF-3A	1.436	.372	.758	1.125	.484
-9012	① 3/4	1.0000-16 UNJ-3A	1.0625-12 UN-3A	1.656	.412	.864	1.375	.609
③-0012	② 3/4	1.0000-16 UNJ-3A	1.0625-12 UN-3A	1.656	.412	.864	1.375	.609
-0016	② 1	1.2500-14 UNJS-3A	1.3125-12 UN-3A	1.783	.460	.911	1.625	.844
-0020	② 1 1/4	1.5156-14 UNJS-3A	1.6250-12 UN-3A	1.853	.457	.958	1.875	1.078
-0024	② 1 1/2	1.7812-14 UNJS-3A	1.8750-12 UN-3A	2.063	.542	1.083	2.125	1.312
④-0032	② 2	2.3750-12 UNJ-3A	2.5000-12 UN-3A	2.457	.686	1.333	2.750	1.781

③ INACTIVE FOR DESIGN AND PROCUREMENT AFTER 1 JUNE 1977. USE -9012.

④ INACTIVE FOR DESIGN AND PROCUREMENT AFTER 1 JUNE 1977. NO SUPERSEDING DASH NO.

PARTS DATA SHEET	UNION, MALE TO MS33656, INCONEL 718	ME273-0100
FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.		SHEET 1 OF 2

Data Sheet Revised



FITTINGS, DYNATUBE[®] AND DUAL SEAL*

MATERIAL: INCONEL 718 PER AMS 5663

FINISH: PASSIVATE PER MIL-S-5002

COATING:

- ① UNIONS -0004 THRU -0010, AND -9012, UNCOATED WITH 8 RMS SURFACE TEXTURE ON SEALING SURFACE Z
- ② UNIONS -0012 THRU -0032, THE SEALING SURFACE Z SHALL BE COATED PER AMS 2515C WITH DUPONT 850-204 TETRAFLUOROETHYLENE (TFE) TO A THICKNESS OF .1-.6 MILS

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS.

DYNATUBE[®] IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.
 DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

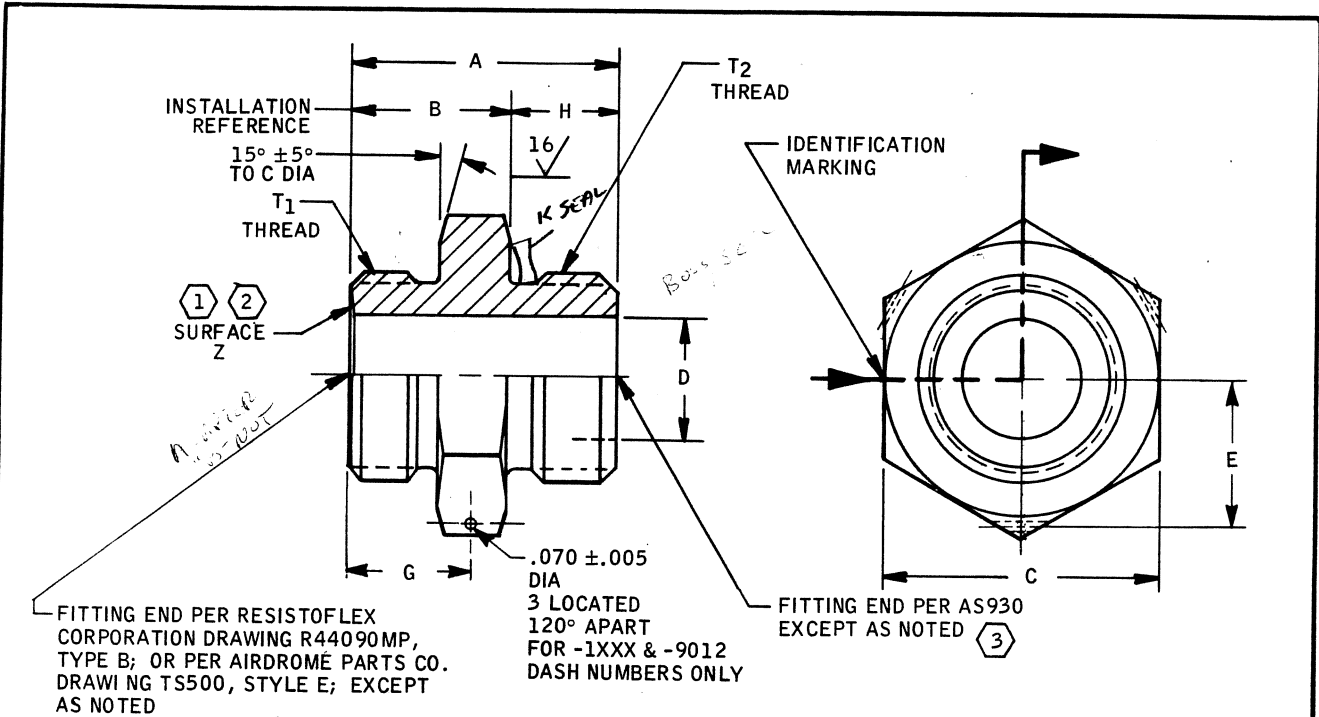
PARTS DATA SHEET	UNION, MALE TO MS33656, INCONEL 718	ME273-0100
FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.		SHEET 2 OF 2



FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-48
15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



SOURCE CONTROL DWG DASH NUMBER		TUBE SIZE (REF)	T1 THREAD	T2 THREAD	A ±.015	B REF	C REF	D DIA	E ±.005	G ±.010	H ±.010
WITH LOCKWIRE HOLES	WITHOUT LOCKWIRE HOLES										
-1004 (1)	-0004 (1)	1/4	.4375-24 UNJS-3A	.4375-20 UNJF-3A	.875	.460	.688	.194 .184	.313	.375	.415
-1005 (1)	-0005 (1)	5/16	.5000-24 UNJS-3A	.5000-20 UNJF-3A	.906	.491	.750	.242 .232	.349	.390	.415
-1006 (1)	-0006 (1)	3/8	.5625-20 UNJS-3A	.5625-18 UNJF-3A	.936	.521	.812	.307 .297	.385	.415	.415
-1008 (1)	-0008 (1)	1/2	.7188-20 UNJS-3A	.7500-16 UNJF-3A	1.035	.580	1.000	.408 .398	.493	.451	.455
-1010 (1)	-0010 (1)	5/8	.8438-18 UNJS-3A	.8750-14 UNJF-3A	1.117	.662	1.125	.523 .512	.557	.524	.455
-9012 (1)	-8012 (1)	3/4	1.0000-16 UNJ-3A	1.0625-12 UNJ-3A	1.264	.769	1.375	.660 .649	.702	.598	.495
(4) -1012 (2)	(4) -0012 (2)	3/4	1.0000-16 UNJ-3A	1.0625-12 UNJ-3A	1.264	.769	1.375	.660 .649	.702	.598	.495
-1016 (2)	-0016 (2)	1	1.2500-14 UNJS-3A	1.3125-12 UNJ-3A	1.325	.830	1.625	.874 .862	.846	.652	.495
-1020 (2)	-0020 (2)	1-1/4	1.5156-14 UNJS-3A	1.6250-12 UNJ-3A	1.375	.880	1.875	1.128 1.115	.990	.676	.495
-1024 (2)	-0024 (2)	1-1/2	1.7812-14 UNJS-3A	1.8750-12 UNJ-3A	1.460	.965	2.125	1.337 1.324	1.129	.761	.495

(3) AS930 IS A SOCIETY OF AUTOMOTIVE ENGINEERS (SAE) AEROSPACE STANDARD
(4) INACTIVE FOR DESIGN AND PROCUREMENT AFTER 1 APRIL 1977. USE -8012 OR -9012.

Data Sheet Revised





FITTINGS, DYNATUBE® AND DUAL SEAL*

MATERIAL: INCONEL 718 PER AMS 5663

FINISH: PASSIVATE PER MIL-S-5002

COATING: ① UNIONS -0004 THRU -0010, -1004 THRU -1010, -8012 AND -9012, UNCOATED WITH 8 RMS SURFACE FINISH ON SEALING SURFACE Z

② UNIONS -0012 THRU -0024, AND -1012 THRU -1024, SEALING SURFACE Z SHALL BE COATED PER AMS 2515C WITH DUPONT 850-204 TETRAFLUOROETHYLENE (TFE) TO A THICKNESS OF .1-.6 MILS

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS



DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.
 DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET	UNION, MALE TO AS930, INCONEL 718	ME273-0115
FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.		SHEET 2 OF 2

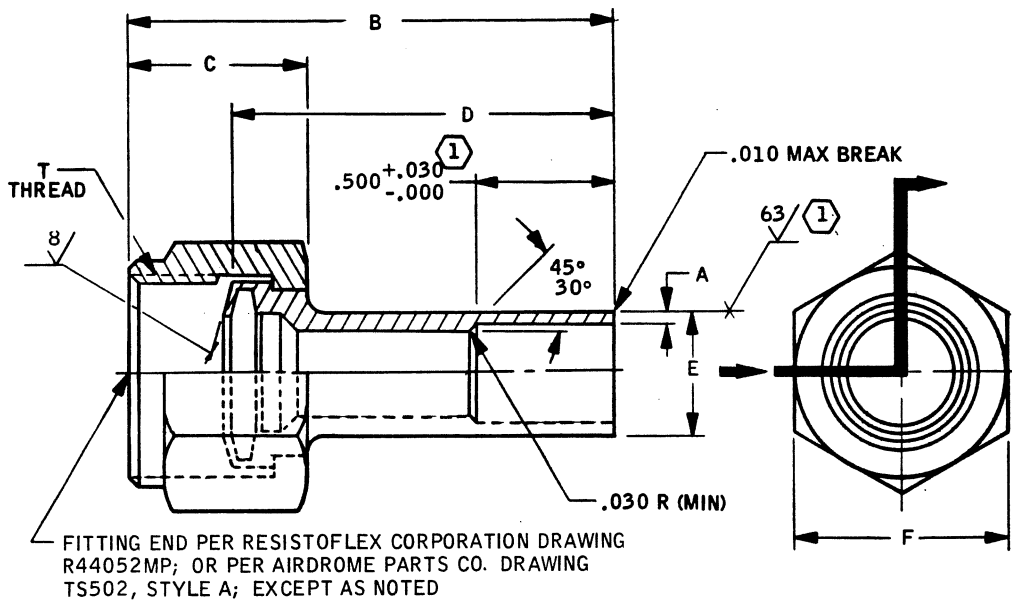


FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-50

SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



ME273-0116 DASH NO.	NUT TUBE SIZE	SHOULDER TUBE SIZE	T THREAD	A ±.002	B REF	C ±.015	D ±.015	E	F REF
-0001	5/16	1/4	.5000-24 UNJS-3B	.020	1.499	.459	1.265		.625
-0002				.035					
-0003	3/8	1/4	.5625-20 UNJS-3B	.020	1.558	.518	1.305	.253 .250	.688
-0004				.035					
-0005	1/2	1/4	.7188-20 UNJS-3B	.020	1.550	.510	1.280		.875
-0006				.035					
-0007	1/2	3/8	.7188-20 UNJS-3B	.020	1.660	.510	1.390	.378 .375	.875
-0009	5/8	3/8	.8438-18 UNJS-3B		1.721		1.390	.378 .375	1.000
-0011	3/4	5/8	1.0000-16 UNJ-3B	.025	1.799	.637	1.432	.629 .625	1.125
-0012				.072					
-0013	5/8	1/2	.8438-18 UNJS-3B	.020	1.721	.571	1.390	.503 .500	1.000
-0015	5/8	1/4								.253 .250
-0017	5/16	3/8	.5000-24 UNJS-3B	.020	1.605	.459	1.395	.378 .375	.625
-0019	1/2	5/8	.7188-20 UNJS-3B	.020	1.639	.510	1.390	.629 .625	.875

① NO MARKING OR IDENTIFICATION IN THIS AREA. 63/ SURFACE TEXTURE THIS AREA.

MATERIAL: 17-4PH CRES PER AMS 5643, HEAT TREAT TO CONDITION H-1075 (145 KSI TENSILE MIN) PER MIL-H-6875

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM NON-CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

FITTING ASSEMBLY, REDUCER,
FEMALE TO BRAZE/WELD, 17-4PH

ME273-0116

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

SHEET 1 OF 1

Data Sheet Revised



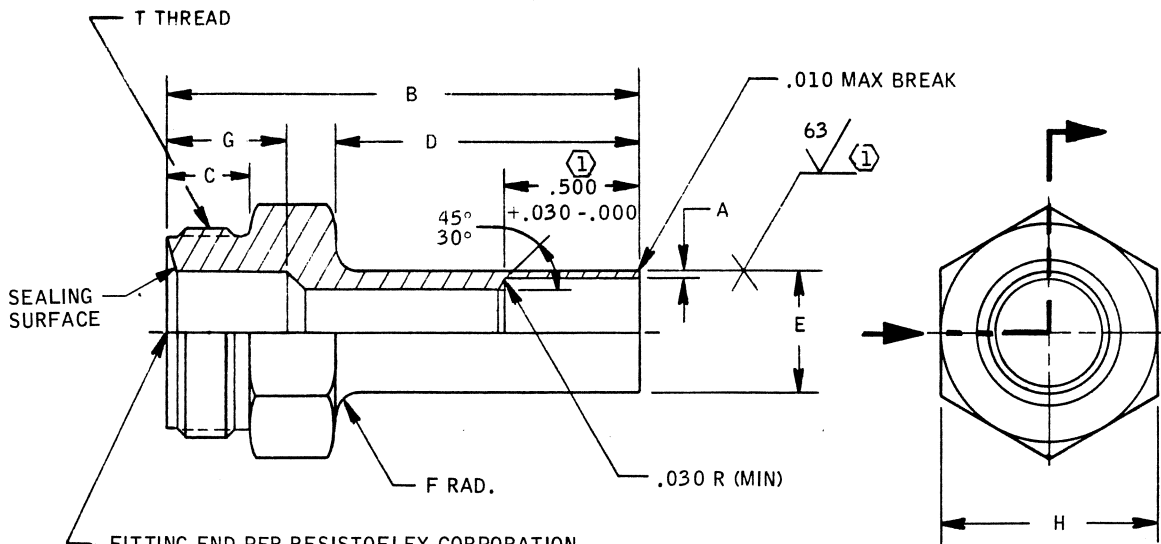
Space Division
Rockwell International



FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-52
15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



FITTING END PER RESISTOFLEX CORPORATION
DRAWING R44090MP, TYPE B; OR PER AIRDROME
PARTS CO. DRAWING TS500, STYLE E; WITH
8 RMS FINISH ON SEALING SURFACE

ME273-0117 DASH NUMBER	THREADED TUBE SIZE	BRAZE/ WELD TUBE SIZE	T THREAD	A ±.002	B ±.015	C REF	D ±.010	E	F RAD ±.010	G ±.010	H REF
-0001	5/16	1/4	.5000-24 UNJS-3A	.020	1.515	.275	1.040	.253	.080	.375	.500
-0002				.035				.250			
-0003	3/8	1/4	.5625-20 UNJS-3A	.020	1.577	.295	1.040	.253	.080	.416	.562
-0004				.035				.250			
-0005	1/2	1/4	.7188-20 UNJS-3A	.020	1.636	.308	1.150	.253	.100	.452	.750
-0006				.035				.250			
-0007	1/2	3/8	.8438-18 UNJS-3A	.020	1.746	.308	1.150	.378	.100	.452	.750
-0009	5/8	3/8		.375							
(2) -0011	3/4	5/8	1.0000-16 UNJ-3A	.025	1.880	.412	1.162	.629	.100	.565	1.000
(2) -0012				.072				.625			
-0013	5/8	1/2	.8438-18 UNJS-3A	.020	1.828	.372	1.150	.503	.080	.525	.875
-0015	5/8	1/4		.500							
-0017	5/16	3/8	.5000-24 UNJS-3A	.020	1.625	.275	1.150	.378	.100	--	.500
-0019	1/2	5/8	.7188-20 UNJS-3A	.020	1.758	.308	1.162	.375		--	.750
-0021	3/4	5/8	1.0000-16 UNJ-3A	.025	1.880	.412	1.162	.629	.100	.565	1.000
-0022				.072				.625			

① NO MARKING OR IDENTIFICATION IN THIS AREA. 63/ SURFACE TEXTURE THIS AREA.

② INACTIVE FOR DESIGN AND PROCUREMENT AFTER 15 APRIL 1977. USE -0021 OR -0022.

PARTS DATA SHEET

UNION, REDUCER, MALE TO
BRAZE/WELD, 17-4PH

ME273-0117

SHEET 1 OF 2

FOR DESIGN USE ONLY. NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

Data Sheet Revised



FITTINGS, DYNATUBE[®] AND DUAL SEAL* 2733-53
15 SEPTEMBER 1977

MATERIAL: 17-4PH CRES PER AMS 5643, HEAT TREAT TO CONDITION H-1075 (145 KSI TENSILE MIN)
PER MIL-H-6875

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY.

APPLICATION: SPACE SHUTTLE PROGRAM NON-CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

DYNATUBE[®] IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.
DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET	UNION, REDUCER, MALE TO BRAZE/WELD, 17-4PH	ME273-0117
FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.		SHEET 2 OF 2

Data Sheet Revised



Space Division
Rockwell International

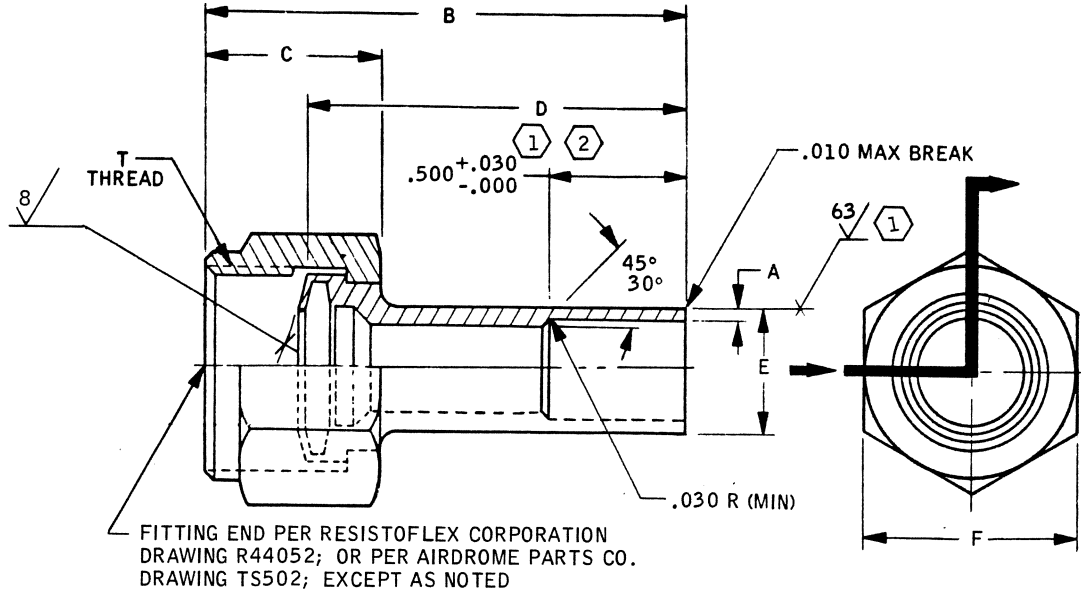


FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-54

15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*

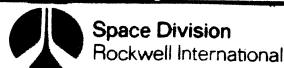


ME273-0118 DASH NO.	NUT TUBE SIZE	SHOULDER TUBE SIZE	T THREAD	A ±.002	B REF	C ±.015	D ±.015	E	F REF
-0001 -0002	5/16	1/4	.5000-24UNJS-3B	.020 .035	1.499	.459	1.265	.253 .250	.625
-0003 -0004	3/8	1/4	.5625-20UNJS-3B	.020 .035	1.558	.518	1.305		.688
-0005 -0006	1/2	1/4	.7188-20UNJS-3B	.020 .035	1.550	.510	1.280	.378 .375	.875
-0007 -0008	1/2	3/8		.049	1.660		1.390		1.000
-0009	5/8	3/8	.8438-18UNJS-3B	.020	1.721	.571			
-0011 -0012	3/4	5/8	1.0000-16UNJ-3B	.025 .072	1.799	.637	1.432	.629 .625	1.125
-0013	5/8	1/2	.8438-18UNJS-3B	.020	1.721	.571	1.390	.503 .500	1.000
-0015	5/8	1/4		.020				.253 .250	
-0017	5/16	3/8	.5000-24UNJS-3B	.020	1.605	.459	1.395	.378 .375	.625
-0019	1/2	5/8	.7188-20UNJS-3B	.020	1.639	.510	1.390	.629 .625	.875
-0020	3/4	1/2	1.0000-16UNJ-3B	.025	1.799	.637	1.432	.503 .500	1.125

(1) NO MARKING OR IDENTIFICATION IN THIS AREA. 63/ SURFACE TEXTURE THIS AREA.

PARTS DATA SHEET	FITTING ASSEMBLY, REDUCER, FEMALE TO BRAZE/WELD, INCONEL 718	ME273-0118
FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.		SHEET 1 OF 2

Data Sheet Revised





FITTINGS, DYNATUBE[®] AND DUAL SEAL*

MATERIAL: INCONEL 718 PER AMS 5663

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

NOTES:

- ② 1. NICKEL PLATE THE SHANK OD (FOR .500 LENGTH AS A MINIMUM) .0002 TO .0005 INCH THICK PER QQ-N-290, CLASS 1, GRADE G TO FACILITATE BRAZING. TOLERANCE ON DIAMETER SHALL APPLY AFTER PLATING.

DYNATUBE[®] IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

FITTING ASSEMBLY, REDUCER, FEMALE TO
BRAZE/WELD, INCONEL 718

ME273-0118

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

SHEET 2 OF 2

Data Sheet Revised



Space Division
Rockwell International

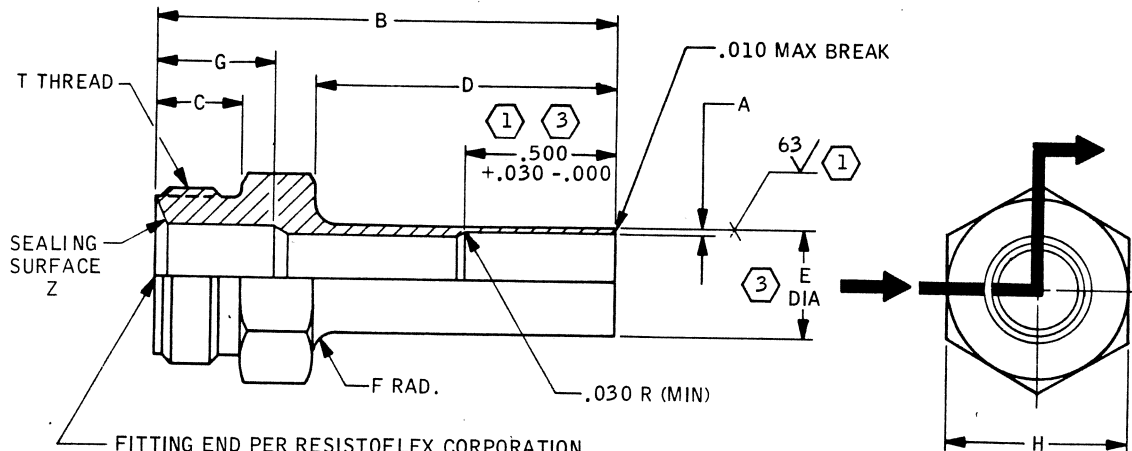


FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-56

15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



FITTING END PER RESISTOFLEX CORPORATION
DRAWING R44090MP, TYPE B; OR PER
AIRDROME PARTS CO. DRAWING TS500,
STYLE E; WITH 8 RMS FINISH ON SEALING
SURFACE Z

ME273-0119 DASH NO.	THREADED TUBE SIZE	BRAZE/ WELD TUBE SIZE	T THREAD	A	B	C	D	E	F	G	H
				±.002	±.015	REF	±.010	DIA	±.010	±.010	REF
-0001	5/16	1/4	.5000-24	.020	1.515	.275	1.040	.253	.080	.375	.500
-0002			UNJS-3A	.035				.250			
-0003	3/8	1/4	.5625-20	.020	1.577	.295	1.040	.253	.080	.416	.562
-0004			UNJS-3A	.035				.250			
-0005	1/2	1/4	.7188-20	.020	1.636	.308	1.150	.253	.100	.452	.750
-0006				UNJS-3A				.035				.250
-0007	1/2	3/8	UNJS-3A	.020	1.746			.378			
-0009	5/8	3/8	.8438-18	.020	1.828	.372	1.150	.378		.525	.875
-0011 (2)	3/4	5/8	1.000-16	.025	1.880	.412	1.162	.629	.100	.565	1.000
-0012 (2)				UNJ-3A				.072				.625
-0013	5/8	1/2	.8438-18	.020	1.828		1.150	.503			
-0015	5/8	1/4	UNJS-3A	.020	1.718	.372	1.040	.500		.525	.875
-0017	5/16	3/8	.5000-24	.020	1.625	.275	1.150	.253	.080	---	.500
-0019	1/2	5/8	.7188-20	.020	1.758	.308		.375		---	.750
-0021	3/4	5/8	1.0000-16	.025	1.880	.412	1.162	.629	.100	.565	1.000
-0022				UNJ-3A				.072				.625

① NO MARKING OR IDENTIFICATION IN THIS AREA. 63/ SURFACE TEXTURE THIS AREA.

② INACTIVE FOR DESIGN AND PROCUREMENT AFTER 24 JUNE 1977. USE -0021 OR -0022.

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

UNION, REDUCER, MALE TO
BRAZE/WELD, INCONEL 718

ME273-0119

SHEET 1 OF 2

Data Sheet Revised



Space Division
Rockwell International



FITTINGS, DYNATUBE[®] AND DUAL SEAL*

MATERIAL: INCONEL 718 PER AMS 5663

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

NOTES:

- ③ 1. NICKEL PLATE THE SHANK OD (FOR .500 LENGTH AS A MINIMUM) .0002 TO .0005 INCH THICK PER QQ-N-290, CLASS 1, GRADE G TO FACILITATE BRAZING. TOLERANCE ON DIAMETER SHALL APPLY AFTER PLATING.

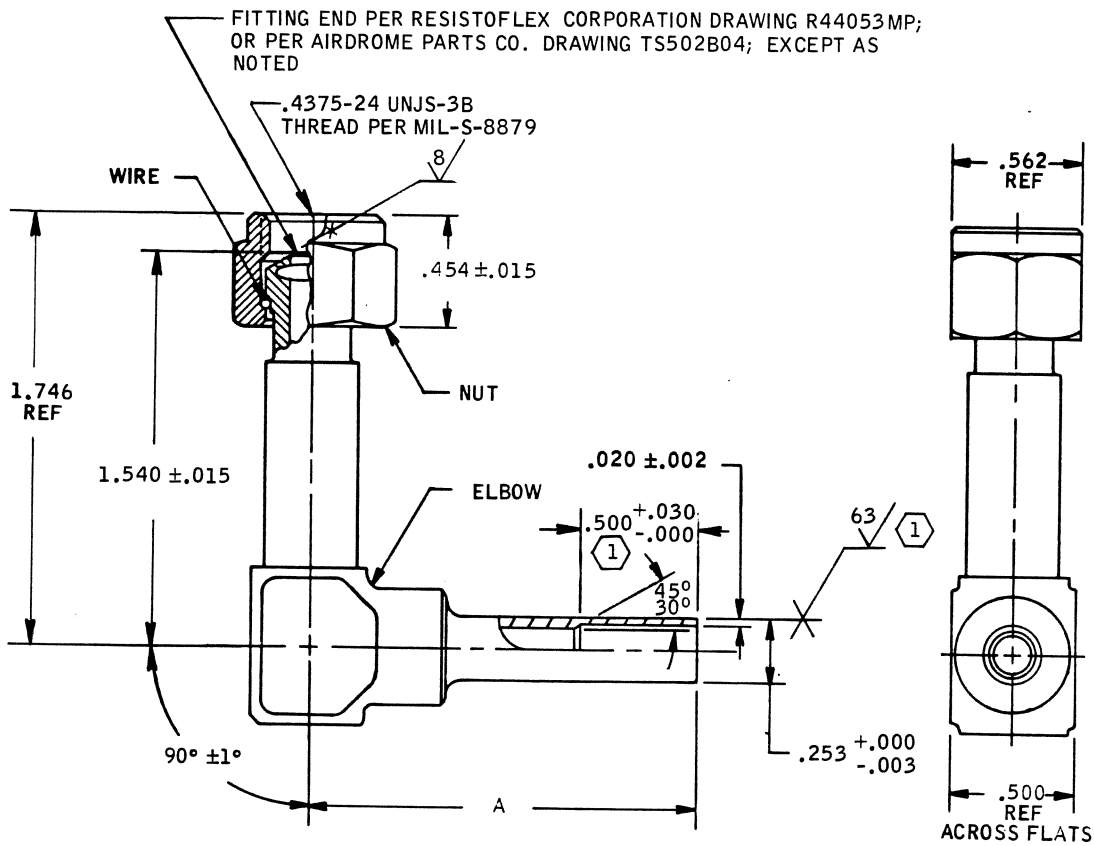
DYNATUBE[®] IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET	UNION, REDUCER, MALE TO BRAZE/WELD, INCONEL 718	ME273-0119
FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.		SHEET 2 OF 2



FITTINGS, DYNATUBE® AND DUAL SEAL*



ME273-0120 DASH NUMBER	A ±.010
-0001	1.360
-0002	1.180
-0003	1.610

① NO MARKING OR IDENTIFICATION IN THIS AREA.

MATERIAL: BODY AND NUT - 17-4PH CRES PER AMS 5643, HEAT TREAT TO CONDITION H-1075
(145 KSI TENSILE MIN) PER MIL-H-6875

NUT RETAINING WIRE - 302 CRES PER AMS 5637, OR 305 CRES PER AMS 5685

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM NON-CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

FITTING ASSEMBLY, ELBOW, 90°, FEMALE
TO BRAZE/WELD, 17-4PH

ME273-0120

SHEET 1 OF 1

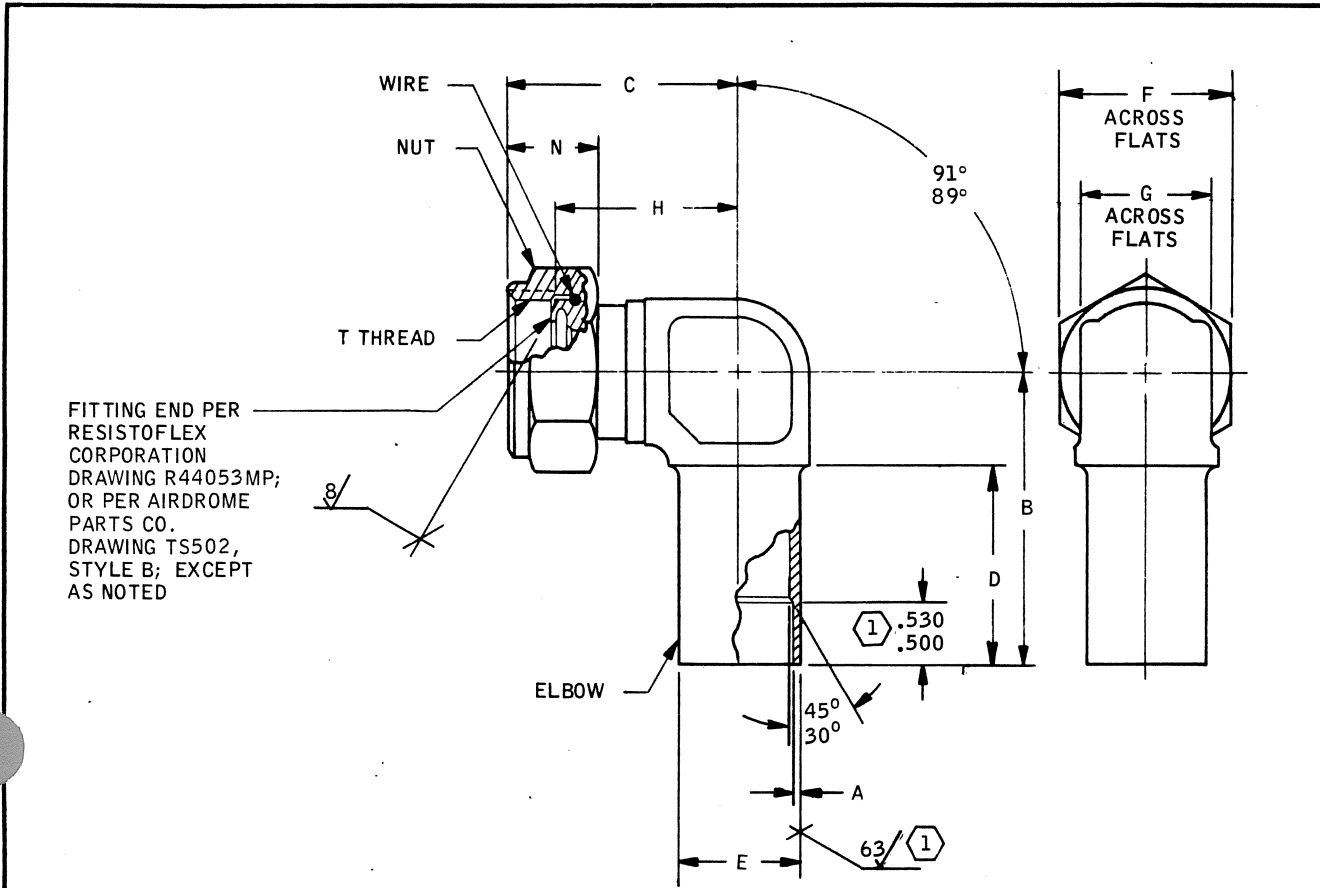


FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-60

SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



FITTING END PER
RESISTOFLEX
CORPORATION
DRAWING R44053MP;
OR PER AIRDROME
PARTS CO.
DRAWING TS502,
STYLE B; EXCEPT
AS NOTED

① NO MARKING OR IDENTIFICATION IN THIS AREA. 63/ SURFACE TEXTURE IN THIS AREA.

ME273-0121 DASH NUMBER	T THREAD	A ±.002	B	C REF	D	E DIA	F REF	G REF	H ±.015	N ±.015
-0420	.4375-24 UNJS-3B	.020	1.381	1.014	1.040	.253	.562	.500	.808	.454
-0435		.035								
-0520	.5000-24 UNJS-3B	.020	1.491	1.060	1.150	.315	.625	.500	.850	.459
-0620	.5625-20 UNJS-3B	.020		1.178							.378	.688	.945	.518
-0820	.7188-20 UNJS-3B	.020	1.569	1.294	.503	.875	.562	1.045	.510	
-0825		.025								
-0865		.065								
-1020	.8438-18 UNJS-3B	.020	1.644	1.485	1.162	.629	1.000	.688	1.178	.571
-1025		.025								
-1072		.072								
-1220		.020								
-1228	1.0000-16 UNJ-3B	.028	1.780	1.659	1.220	.754	1.125	.875	1.316	.637
-1628	1.2500-14 UNJS-3B	.028	2.258	1.895	1.620	1.004	1.375	1.125	1.529	.705
-1649		.049								
-1683		.083								
-2035	1.5156-14 UNJS-3B	.035	2.399	2.026	1.254	1.625	1.375	1.655	1.687	
-2049		.049								
-2435	1.7812-14 UNJS-3B	.035	2.682	2.438	1.700	1.504	2.000	1.625	1.984	.800
-2449		.049								



FITTINGS, DYNATUBE® AND DUSL SEAL*

MATERIAL: BODY AND NUT - 17-4PH CRES PER AMS 5643, HEAT TREAT TO CONDITION H-1075
(145 KSI TENSILE MIN) PER MIL-H-6875

NUT RETAINING WIRE - 302 CRES PER AMS 5637, OR 305 CRES PER AMS 5685

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY.

APPLICATION: SPACE SHUTTLE PROGRAM NON-CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

ELBOW, 90°, FEMALE TO
BRAZE/WELD, 17-4PH

ME273-0121

FOR DESIGN USE ONLY. NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

SHEET 2 OF 2



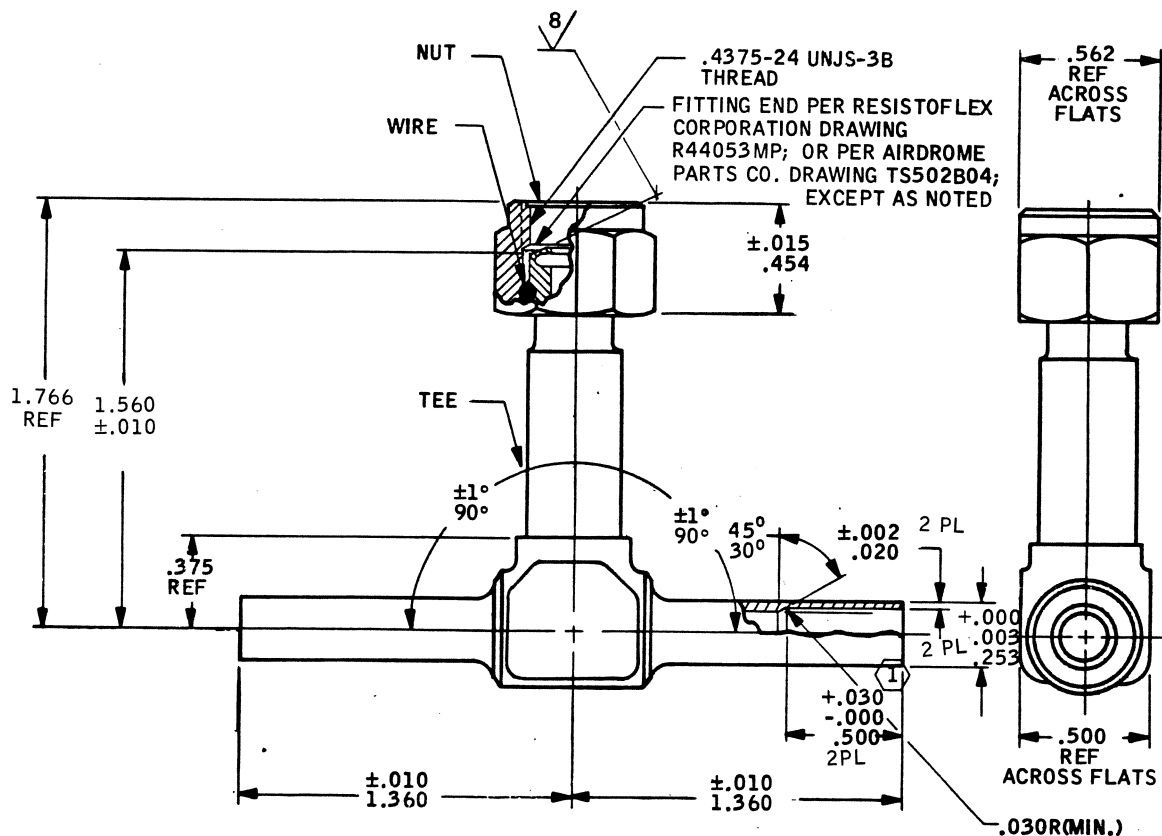


FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-62

15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



SOURCE CONTROL DRAWING DASH NUMBER	-0420
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① NO MARKING OR IDENTIFICATION IN THIS AREA. $\sqrt{63}$ SURFACE TEXTURE THIS AREA.

MATERIAL: BODY AND NUT - 17-4PH CRES PER AMS 5643, HEAT TREAT TO CONDITION H-1075 (145 KSI TENSILE MIN) PER MIL-H-6875

NUT RETAINING WIRE - 302 CRES PER AMS 5637, OR 305 CRES PER AMS 5685

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM NON-CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

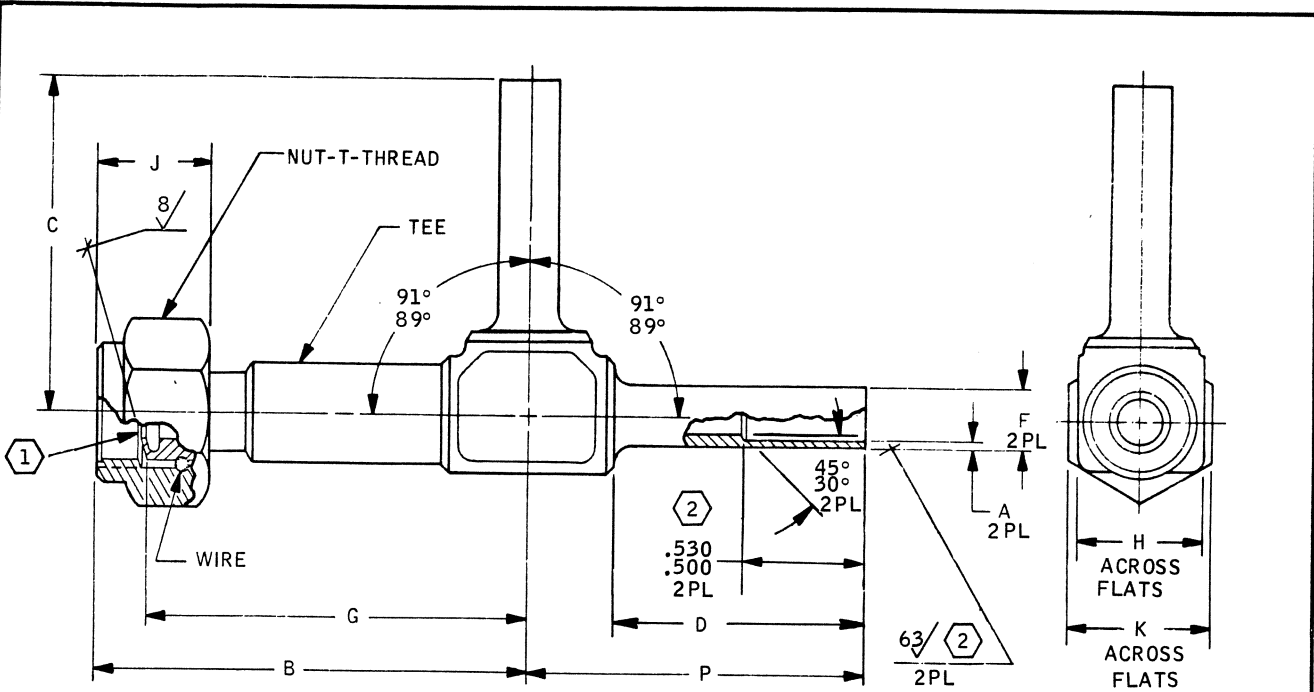
PARTS DATA SHEET FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.	TEE, BRAZE/WELD ON RUNS, FEMALE ON SIDE, 17-4PH	ME273-0122
		SHEET 1 OF 1

Data Sheet Revised





FITTINGS, DYNATUBE® AND DUAL SEAL* 2733-63
 15 SEPTEMBER 1977



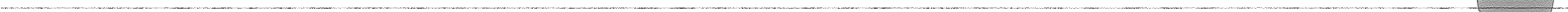
- ① FITTING END PER RESISTOFLEX CORPORATION DRAWING R44053MP; OR PER AIRDROME PARTS CO. DRAWING TS502, STYLE B; WITH 8 RMS FINISH ON SEALING SURFACE
- ② NO MARKING OR IDENTIFICATION IN THIS AREA. 63/2PL SURFACE TEXTURE THIS AREA.

SOURCE CONTROL DRAWING DASH NUMBER	T THREAD CLASS 3B	A ±.002	B REF	C	D	F DIA	G ±.015	H REF	J ±.015	K REF	P
-0420	.4375-24 UNJS	.020	1.766	1.381	.839	.253	1.560	.500	.454	.562	1.180
-0435		.035									
-0520	.5000-24 UNJS	.020	1.750	1.491	1.150	.315	1.540		.459	.625	1.491
-0620	.5625-20 UNJS	.020	1.773			.378			.518		
-0825	.7188-20 UNJS	.025	1.784	1.569		.503	1.535	.562	.510	.875	1.569
-0865		.065									
-1025	.8438-18 UNJS	.025	1.842	1.644	1.162	.629	1.536	.688	.571	1.000	1.644
-1072		.072									
-1228	1.0000-16 UNJ	.028	1.879	1.780	1.220	.754	1.536	.875	.637	1.125	1.780
-1628	1.2500-14 UNJS	.028	1.897	2.258	1.620	1.004	1.531	1.125	.705	1.375	2.258
-1649		.049									
-1683		.083									
-2035	1.5156-14 UNJS	.035	1.902	2.399	1.520	1.254	1.531	1.375	.687	1.625	2.399
-2049		.049									
-2435	1.7812-14 UNJS	.035	2.233	2.682	1.700	1.504	1.779	1.625	.800	2.000	2.682
-2449		.049									

PARTS DATA SHEET	TEE, FEMALE TO BRAZE/WELD ON RUN, BRAZE/WELD ON SIDE, 17-4PH	ME273-0123
FOR DESIGN USE ONLY - NOT TO BE USED FOR PRODUCTION OR INSPECTION PURPOSES.		SHEET 1 OF 2

Data Sheet Revised





FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-64

SEPTEMBER 1977

FITTINGS, DYNATUBE[®] AND DUAL SEAL*

MATERIAL: BODY AND NUT - 17-4PH CRES PER AMS 5643, HEAT TREAT TO CONDITION H-1075
(145 KSI TENSILE MIN) PER MIL-H-6875

NUT RETAINING WIRE - 302 CRES PER AMS 5637, OR 305 CRES PER AMS 5685

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM NON-CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS.

DYNATUBE[®] IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

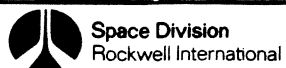
FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

TEE, FEMALE TO BRAZE/WELD ON RUN,
BRAZE/WELD ON SIDE, 17-4PH

ME273-0123

SHEET 2 OF 2

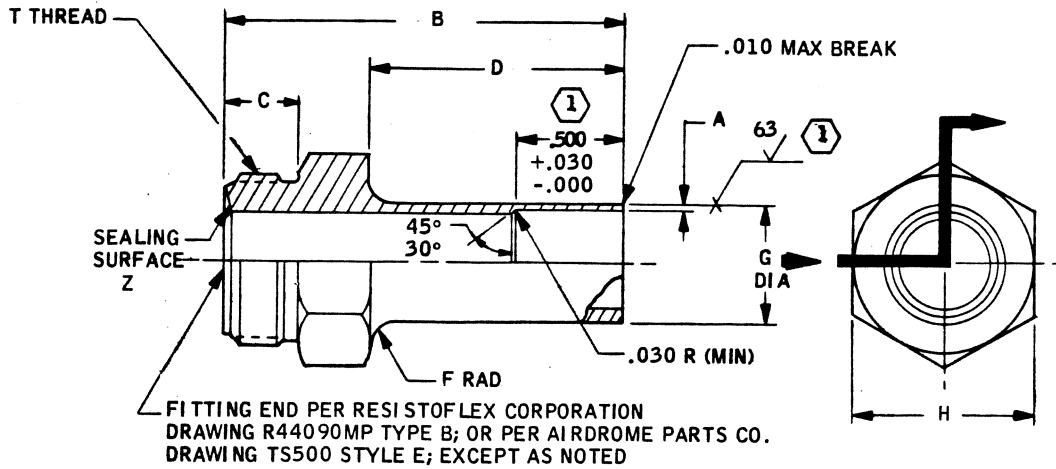
Data Sheet Revised



Space Division
Rockwell International



FITTINGS, DYNATUBE® AND DUAL SEAL*



① NO MARKING OR IDENTIFICATION IN THIS AREA. 63 SURFACE TEXTURE THIS AREA.

SOURCE CONTROL DRAWING DASH NUMBER	T THREAD CLASS 3A	A ±.002	B ±.015	C REF	D	F	G DIA	H REF
-0420 (2)	.4375-24 UNJS	.020	1.515	.275	1.040	.080	.253	.438
-0428 (2)		.028						
-0435 (2)		.035						
-0520 (2)	.5000-24 UNJS	.020	1.625	.275	1.150	.100	.315	.500
-0620 (2)	.5625-20 UNJS	.020	1.687	.295	1.150	.100	.378	+.000 -.003
-0635 (2)		.035						
-0820 (2)		.020						
-0825 (2)	.7188-20 UNJS	.025	1.746	.308	1.150	.100	.503	.750
-0842 (2)		.042						
-0865 (2)		.065						
-1020 (2)	.8438-18 UNJS	.020	1.840	.372	1.162	.100	.629	.875
-1025 (2)		.025						
-1058 (2)		.058						
-1072 (2)	1.0000-16 UNJ	.072	1.938	.412	1.220	.100	.754	1.000
-1220 (2)		.020						
-9228 (2)		.028						
-9249 (2)	1.2500-14 UNJS	.049	2.386	.460	1.620	.100	1.004	+.000 -.004
-1228 (3)		.028						
-1249 (3)		.049						
-1620 (3)	1.5156-14 UNJS	.020	2.383	.457	1.620	.100	1.254	1.625
-1628 (3)		.028						
-1649 (3)		.049						
-1683 (3)	1.7812-14 UNJS	.083	2.548	.542	1.700	.100	1.504	1.875
-2035 (3)		.035						
-2049 (3)		.049						
-2435 (3)	1.7812-14 UNJS	.035	2.548	.542	1.700	.100	1.504	1.875
-2449 (3)		.049						

④ INACTIVE FOR DESIGN AND PROCUREMENT AFTER 15 JULY 1977. USE -9228 OR -9249.

PARTS DATA SHEET FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.	UNION, MALE TO BRAZE/WELD, 17-4PH	ME273-0124
		SHEET 1 OF 2

Data Sheet Revised



2733-66
15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*

MATERIAL: 17-4PH CRES PER AMS 5643, HEAT TREAT TO CONDITION H-1075
(145 KSI TENSILE MIN) PER MIL-H-6875

FINISH: PASSIVATE PER MIL-S-5002

COATING: (2) UNIONS -0420 THRU -1220, -9228 AND -9249, SHALL BE UNCOATED
WITH 8 RMS SURFACE TEXTURE ON SEALING SURFACE Z

(3) UNIONS -1228 THRU -2449, SEALING SURFACE Z SHALL BE COATED
PER AMS 2515C WITH DUPONT 850-204 TETRAFLUOROETHYLENE (TFE)
TO A THICKNESS OF .1-.6 MILS

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY.

APPLICATION: SPACE SHUTTLE PROGRAM NON-CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS.

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

UNION, MALE TO BRAZE/WELD,
17-4PH

ME273-0124

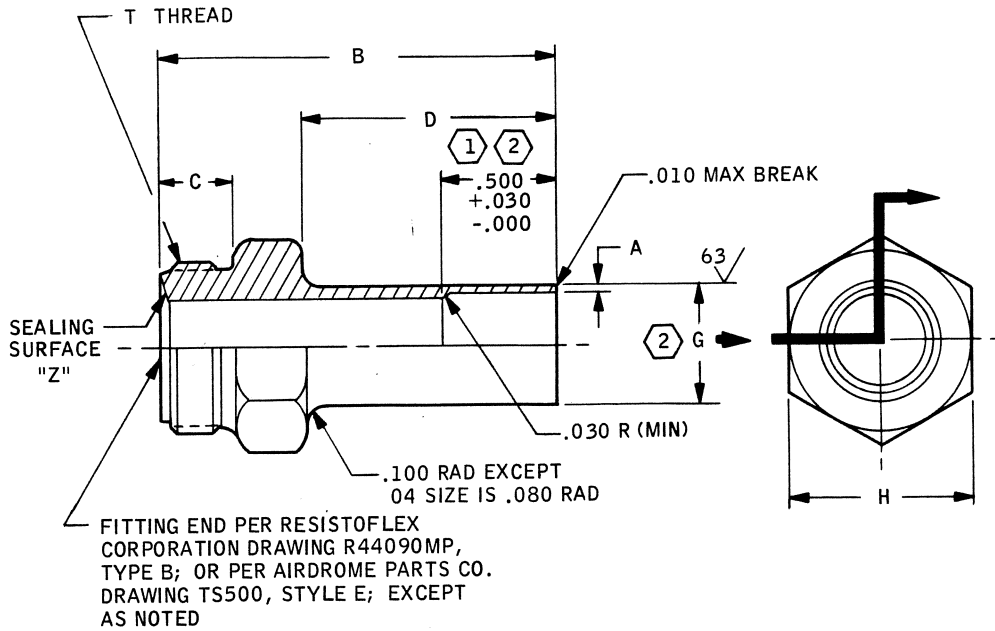
FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

SHEET 2 OF 2

Data Sheet Revised



FITTINGS, DYNATUBE® AND DUAL SEAL*



ME273-0125 DASH NUMBER	T THREAD CLASS 3A	A ±.002	B ±.015	C REF	D	G DIA	H REF
-0420 (3)	.4375-24 UNJS	.020	1.515	.275	1.040	.253	.438
-0435 (3)		.035					
-0520 (3)	.5000-24 UNJS	.020	1.625	.295	1.150	.315	.500
-0620 (3)	.5625-20 UNJS	.020	1.687				
-0635 (3)	.7188-20 UNJS	.035	1.746	.308	.503	+.000 -.003	.562
-0825 (3)		.025					
-0865 (3)	.8438-18 UNJS	.065	1.840	.372	1.162	.629	.875
-1025 (3)		.025					
-1072 (3)	1.0000-16 UNJ	.072	1.938	.412	1.220	.754	1.000
-9228 (3)		.028					
-9249 (3)	1.0000-16 UNJ	.049	1.938	.412	1.220	.754	+.000 -.004
(5) -1228 (4)		.028					
(5) -1249 (4)	1.2500-14 UNJS	.049	2.386	.460	1.620	1.004	1.250
-1628 (4)		.028					
-1649 (4)	1.2500-14 UNJS	.049	2.386	.460	1.620	1.004	1.250
-1683 (4)		.083					

(1) NO MARKING OR IDENTIFICATION IN THIS AREA. 63 SURFACE TEXTURE THIS AREA.

(5) INACTIVE FOR DESIGN AND PROCUREMENT AFTER 24 JUNE 1977. USE -9228 OR -9249.

PARTS DATA SHEET	UNION, MALE TO BRAZE.WELD, INCONEL 718	ME273-0125
FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.		SHEET 1 OF 2



FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-68

15 SEPTEMBER 1977

FITTINGS, DYNATUBE[®] AND DUAL SEAL*

MATERIAL: INCONEL 718 PER AMS 5663

FINISH: PASSIVATE PER MIL-S-5002

COATING: (3) UNIONS -0420 THRU -1072, -9228 AND -9249, UNCOATED WITH 8 RMS SURFACE TEXTURE ON SEALING SURFACE Z

(4) UNIONS -1228 THRU -1683, THE SEALING SURFACE Z SHALL BE COATED PER AMS 2515C WITH DUPONT 850-204 TETRAFLUOROETHYLENE (TFE) TO A THICKNESS OF .1-.6 MILS

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY.

APPLICATION: SPACE SHUTTLE PROGRAM CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

NOTES:

- (2) 1. NICKEL PLATE THE SHANK OD (FOR .500 LENGTH AS A MINIMUM) .0002 TO .0005 INCH THICK PER QQ-N-290, CLASS 1, GRADE G TO FACILITATE BRAZING. TOLERANCE ON DIAMETER SHALL APPLY AFTER PLATING

DYNATUBE[®] IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.
DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

UNION, MALE TO BRAZE/WELD,
INCONEL 718

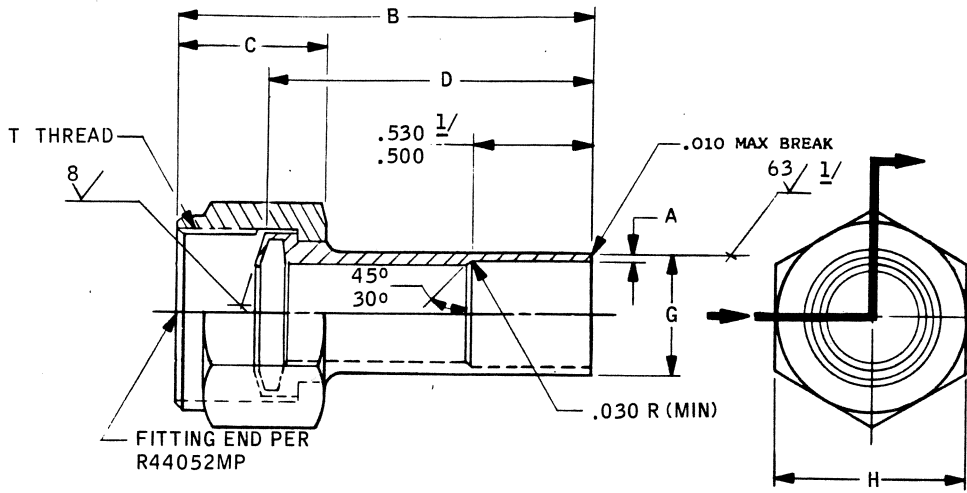
ME273-0125

SHEET 2 OF 2

Data Sheet Revised



FITTINGS, DYNATUBE® AND DUAL SEAL*



R

ME273-0126 DASH NUMBER	T THREAD CLASS 3B	A ±.002	B ±.015	C REF	D ±.015	G DIA	H REF
-0420	.4375-24 UNJS	.020	1.529	.454	1.300	.253	.562
-0428		.028					
-0435		.035					
-0520	.5000-24 UNJS	.020	1.589	.459	1.355	.315	.625
-0620	.5625-20 UNJS	.020	1.693	.518	1.440	.378	+.000 -.003
-0635		.035					
-0820	.7188-20 UNJS	.020	1.691	.510	1.421	.503	.875
-0825		.025					
-0842		.042					
-0865		.065					
-1020	.8438-18 UNJS	.020	1.768	.571	1.437	.629	1.000
-1025		.025					
-1058		.058					
-1072		.072					
-1220	1.0000-16 UNJ	.020	1.899	.637	1.532	.754	1.125
-1228		.028					
-1249		.049					
-1620	1.2500-14 UNJS	.020	2.400	.705	1.990	1.004	1.375
-1628		.028					
-1649		.049					
-1683	1.5156-14 UNJS	.083	2.437	.687	2.030	1.254	1.625
-2035		.035					
-2049		.049					
-2435	1.7812-14 UNJS	.035	2.560	.800	2.068	1.504	2.000
-2449		.049					

1/ NO MARKING OR IDENTIFICATION IN THIS AREA 63/ SURFACE TEXTURE THIS AREA.

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

FITTING ASSEMBLY, DYNATUBE®
SLEEVE, BRAZING/WELDING
17-4PH

ME273-0126

SHEET 1 OF 2

R Data Sheet Revised



2733-70

15 SEPTEMBER 1977

FITTINGS, DYNATUBE[®] AND DUAL SEAL*

MATERIAL: 17-4PH CORROSION RESISTANT STEEL PER RESISTOFLEX CORPORATION SPECIFICATION RES 266

FINISH: UNCOATED, WITH 8 RMS SURFACE TEXTURE ON SEALING SURFACE

R TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

REFERENCE DRAWING: R44090MP IS A CONTROLLED ACCESS DRAWING CONTAINING DATA PROPRIETARY TO RESISTOFLEX CORPORATION, AND IS ACCESSIBLE ONLY THRU DATA MANAGEMENT

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

FITTING ASSEMBLY, DYNATUBE[®]
SLEEVE, BRAZING/WELDING,
17-4PH

ME273-0126

SHEET 2 OF 2

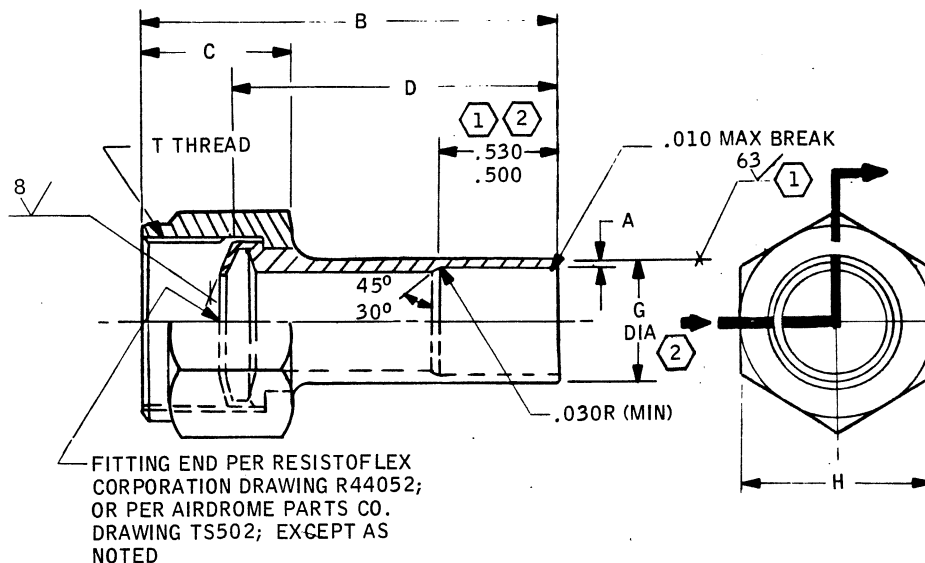
R Data Sheet Revised



Space Division
Rockwell International



FITTINGS, DYNATUBE® AND DUAL SEAL*

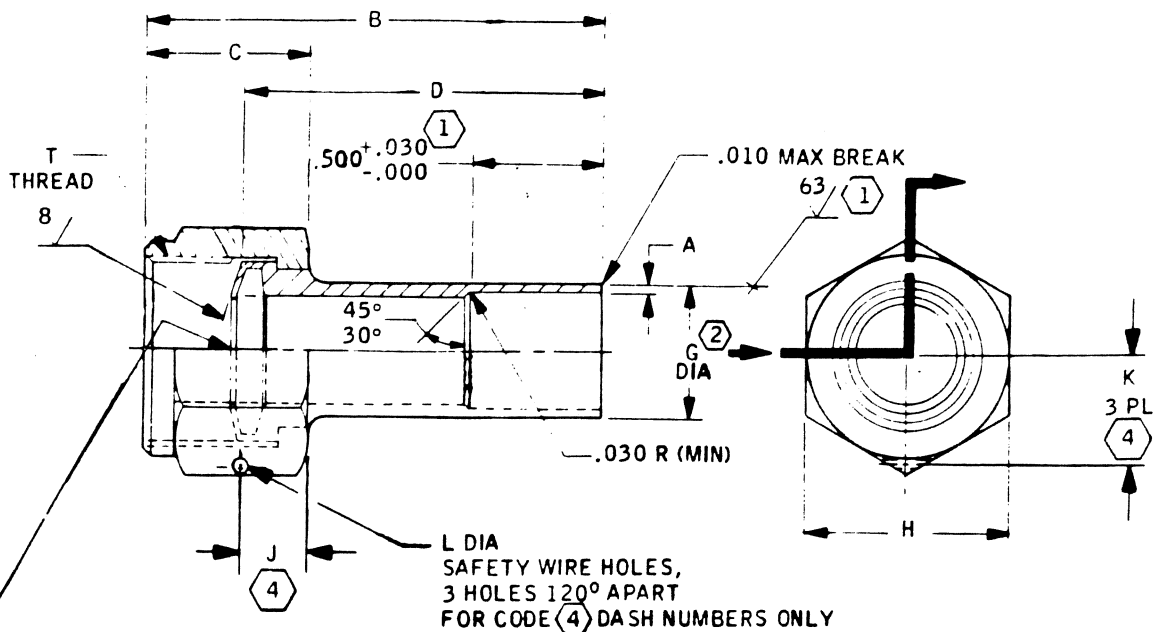


ME273 -0127 DASH NO.	T THREAD CLASS 3B	A ±.002	B REF	C ±.015	D ±.015	G DIA	H REF
-0420 -0435	.4375-24UNJS	.020 .035	1.529	.454	1.300	.250	.562
-0520	.5000-24UNJS	.020	1.589	.459	1.335	.315	.625
-0620 -0635	.5625-20UNJS	.020 .035	1.693	.518	1.440	.375	.688
-0825 -0865	.7188-20UNJS	.025 .065	1.691	.510	1.421	.500	.875
-1025 -1072	.8438-18UNJS	.025 .072	1.768	.571	1.437	.625	1.000
-1228 -1249	1.0000-16UNJ	.028 .049	1.899	.637	1.532	.750	1.125
-1628 -1649 -1683	1.2500-14UNJS	.028 .049 .083	2.400	.705	1.990	1.000	1.375

1 NO MARKING OR IDENTIFICATION IN THIS AREA. 63 SURFACE TEXTURE THIS AREA.

PARTS DATA SHEET	UNION, FEMALE THREADED TO BRAZE/WELD, INCONEL 718	ME273-0127
FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.		SHEET 1 OF 2





FITTING END PER RESISTOFLEX CORPORATION DRAWING R44052; OR PER AIRDROME PARTS CO. DRAWING TS502; EXCEPT AS NOTED

L DIA SAFETY WIRE HOLES, 3 HOLES 120° APART FOR CODE (4) DASH NUMBERS ONLY

SOURCE CONTROL DRAWING DASH NUMBER		T THREAD CLASS 3B	A	B	C	D	G DIA	H	J	K	L DIA
(3)	(4)		±.002	REF	±.015	±.015		REF	±.020	±.010	±.006
-0420	-0001	.4375-24UNJS	.020	1.529	.454	1.300	.250	.562	.188	.261	.047
-0428	-0015		.028								
-0435	-0002		.035								
-0520	-0003	.5000-24UNJS	.020	1.589	.459	1.335	.315	.625	.188	.298	.047
-0620	-0004 ✓	.5625-20UNJS	.020	1.693	.518	1.440	.375	.688	.188	.334	.047
-0635	-0005		.035								
-0825	-0006	.7188-20UNJS	.025	1.691	.510	1.421	.500	.875	.188	.423	.070
-0865	-0007		.065								
-1025	-0008	.8438-18UNJS	.025	1.768	.571	1.437	.625	1.000	.250	.495	.070
-1072	-0009		.072								
-1228	-0010	1.0000-16UNJ	.028	1.899	.637	1.532	.750	1.125	.250	.567	.070
-1249	-0011		.049								
-1628	-0012	1.2500-14UNJS	.028	2.400	.705	1.990	1.000	1.375	.250	.712	.070
-1649	-0013		.049								
-1683	-0014		.083								

- (1) NO MARKING OR IDENTIFICATION IN THIS AREA. 63 SURFACE TEXTURE THIS AREA.
- (3) UNION WITHOUT SAFETY WIRE HOLES
- (4) UNION WITH SAFETY WIRE HOLES

SIZE A	CODE IDENT NO. 03953	DRAWING NO. ME273-0127
SCALE NONE	REV E	SHEET 4 OF



FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-72

15 SEPTEMBER 1977

FITTINGS, DYNATUBE[®] AND DUAL SEAL*

MATERIAL: INCONEL 718 PER AMS 5663

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

NOTES:

- ② 1. NICKEL PLATE THE SHANK OD (FOR .500 LENGTH AS A MINIMUM) .0002 TO .0005 INCH THICK PER QQ-N-290, CLASS 1, GRADE G TO FACILITATE BRAZING. TOLERANCE ON DIAMETER SHALL APPLY AFTER PLATING.

DYNATUBE[®] IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

UNION, FEMALE THREADED TO
BRAZE/WELD, INCONEL 718

ME273-0127

SHEET 2 OF 2

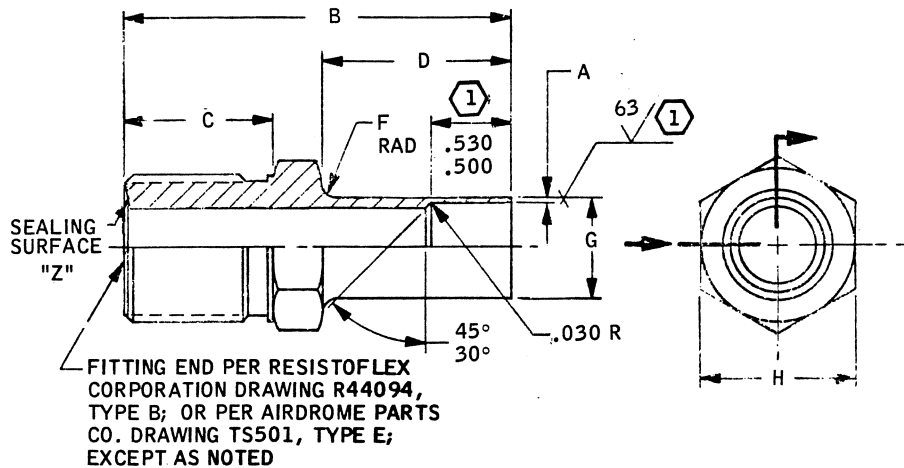
Data Sheet Revised



Rockwell
International



FITTINGS, DYNATUBE® AND DUAL SEAL*



① NO MARKING OR IDENTIFICATION THIS AREA. 63/① SURFACE TEXTURE THIS AREA.

SPEC CONTROL DRAWING DASH NUMBER	T THREAD CLASS 3A	A ±.002	B ±.015	C REF	D ±.010	F ±.010	G DIA	H REF
-0420 ②	.4375-24 UNJS	.020	1.920	.680	1.040	.080	.253	.688
-0435 ②		.035						
-0520 ②	.5000-24 UNJS	.020	2.030	.680	1.150	.100	.315	.750
-0620 ②	.5625-20 UNJS	.020	2.111	.719	1.150	.100	.378	.812
-0825 ②	.7188-20 UNJS	.025	2.193	.755	1.150	.100	.503	1.000
-0865 ②		.065						
-1025 ②	.8438-18 UNJS	.025	2.362	.894	1.162	.100	.629	1.125
-1072 ②		.072						
-9228 ②	1.0000-16 UNJ	.028	2.516	.990	1.220	.100	.754	1.250
④ -1228 ③	1.0000-16 UNJ	.028	2.516	.990	1.220	.100	.754	1.250
-1628 ③		.028						
-1649 ③	1.2500-14 UNJS	.049	3.008	1.082	1.620	.100	1.004	1.500
-1683 ③		.083						
-2035 ③	1.5156-14 UNJS	.035	3.002	1.076	1.620	.100	1.254	1.750
-2049 ③		.049						
-2435 ③	1.7812-14 UNJS	.035	3.252	1.246	1.700	.100	1.504	2.000
-2449 ③		.049						

④ INACTIVE FOR DESIGN AND PROCUREMENT AFTER 22 APRIL 1977. USE -9228.

PARTS DATA SHEET
FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.

CONNECTOR, BULKHEAD TO BRAZE/ WELD, 17-4 PH

ME273-0130

SHEET 1 OF 2



FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-74

15 SEPTEMBER 1977

FITTINGS, DYNATUBE[®] AND DUAL SEAL*

MATERIAL: 17-4PH CRES PER AMS 5643, HEAT TREAT TO CONDITION H-1075 (145 KSI TENSILE MIN) PER MIL-H-6875

FINISH: PASSIVATE PER MIL-S-5002

COATING: (2) CONNECTORS -0420 THRU -1072, AND -9228, UNCOATED WITH 8 RMS SURFACE TEXTURE ON SEALING SURFACE "Z"

(3) CONNECTORS -1228 THRU -2449, THE SEALING SURFACE "Z" SHALL BE COATED PER AMS 2515C WITH DUPONT 850-204 TETRAFLUOROETHYLENE (TFE) TO A THICKNESS OF .1-.6 MILS

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM NON-CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

DYNATUBE[®] IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

CONNECTOR, BULKHEAD TO
BRAZE / WELD, 17-4 PH

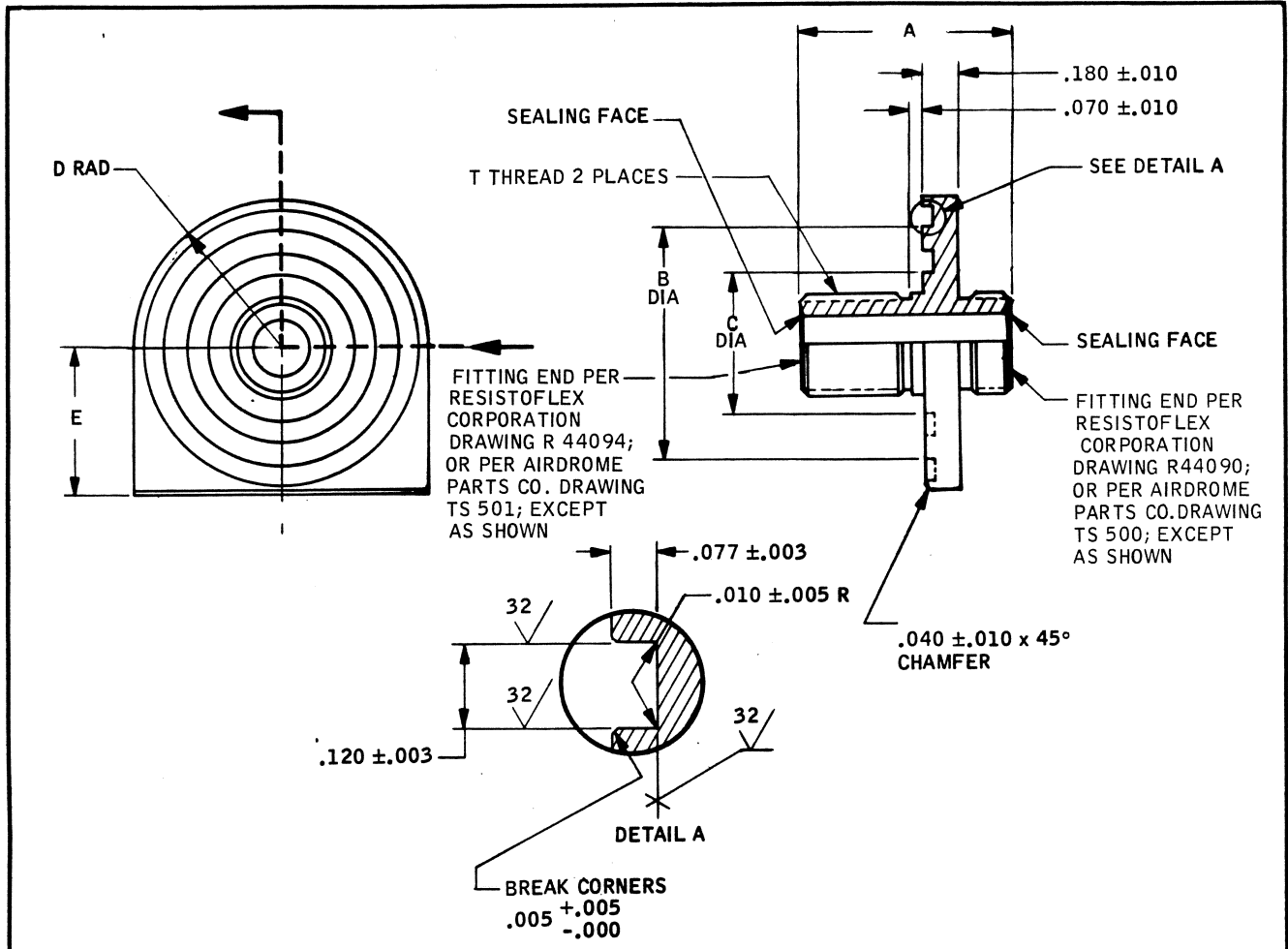
ME273-0130

SHEET 2 OF 2

Data Sheet Revised



FITTINGS, DYNATUBE® AND DUAL SEAL*



ME273-0131 DASH NO.	T THREAD CLASS 3A	A REF	B	C	D ±.010	E ±.005		
-0004	.4375-24 UNJS	1.135	1.112	+0.011 -0.000	.674	+0.006 -0.000	.790	.790
-0006	.5625-20 UNJS	1.194	1.299	+0.013 -0.000	.862	+0.008 -0.000	.850	.850

MATERIAL: 6AL-4V TITANIUM PER AMS 4965

FINISH: NONE

COATING: EVERLUBE 620A (EVERLUBE CORP., NO. HOLLYWOOD, CA) DRY FILM LUBRICANT ON SEALING FACES OF FITTING ENDS

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORP., ROSELAND, N.J.
 DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.	CONNECTOR, MALE THREADED, TITANIUM	ME273-0131
		SHEET 1 OF 1

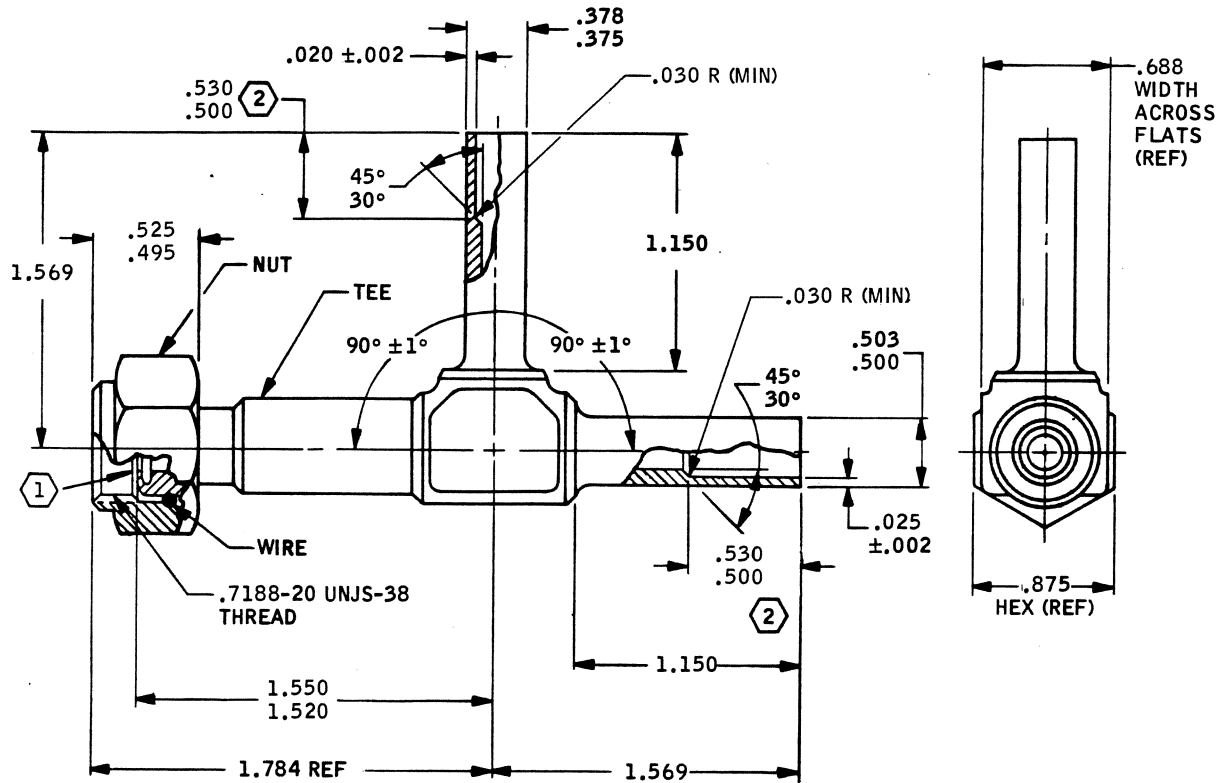


FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-76

15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



① FITTING END PER RESISTOFLEX CORPORATION DRAWING R44053MP-08; OR PER AIRDROME PARTS CO. DRAWING TS502B08; WITH 8 RMS FINISH ON SEALING SURFACE

② NO MARKING OR IDENTIFICATION IN THIS AREA. $R_{a} = .63$ SURFACE TEXTURE THIS AREA.

ME273-0132
DASH NUMBER

-0001

MATERIAL: BODY AND NUT - 17-4PH CRES PER AMS 5643, HEAT TREAT TO CONDITION H-1075 (145 KSI TENSILE MIN) PER MIL-H-6875

NUT RETAINING WIRE - 302 CRES PER AMS 5637, OR 305 CRES PER AMS 5685

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM NON-CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET


FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

TEE, REDUCER, FEMALE TO BRAZE/
WELD ON RUN, BRAZE/WELD ON
SIDE, 17-4PH

ME273-0132

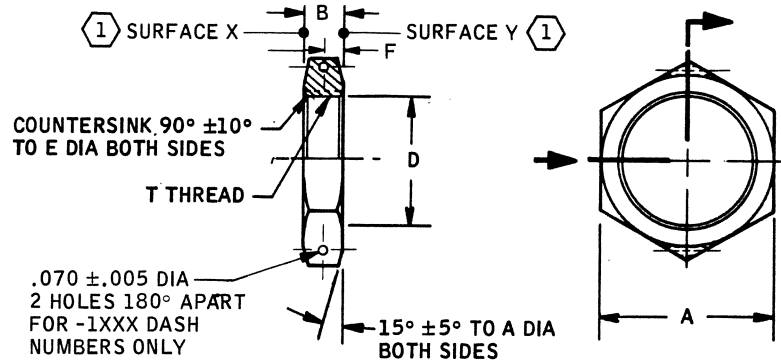
SHEET 1 OF 1

Data Sheet Revised

 Space Division
Rockwell International



FITTINGS, DYNATUBE® AND DUAL SEAL*



ME273-0134 DASH NUMBER		TUBE SIZE (REF)	T THREAD PER MIL-S-8879	A (REF)	B ±.010	C MAX (1)	D ±.005	E +.020 -.015	F ±.005	G ±.005
WITHOUT SAFETY WIRE HOLES	WITH SAFETY WIRE HOLES									
-0004	-1004	1/4	.4375-24 UNJS-3B	.688	.210	.005	.400	.453	.105	.313
-0005	-1005	5/16	.5000-24 UNJS-3B	.750	.210	.005	.463	.515	.105	.349
-0006	-1006	3/8	.5625-20 UNJS-3B	.812	.242	.005	.519	.578	.121	.385
-0008	-1008	1/2	.7188-20 UNJS-3B	1.000	.242	.005	.673	.733	.121	.493
-0010	-1010	5/8	.8438-18 UNJS-3B	1.125	.278	.005	.792	.859	.139	.557
-0012	-1012	3/4	1.0000-16 UNJ-3B	1.250	.306	.008	.942	1.015	.153	.629
-0014	-1014	7/8	1.1250-16 UNJ-3B	1.375	.338	.008	1.068	1.140	.169	.702
-0016	-1016	1	1.2500-14 UNJS-3B	1.500	.338	.008	1.183	1.265	.169	.774
-0020	-1020	1-1/4	1.5156-14 UNJS-3B	1.750	.338	.008	1.441	1.531	.169	.918
-0021 (2)	-	1-1/4	1.5781-14 UNJS-3B	1.875	.338	.008	1.511	1.593	-	-
-0024	-1024	1-1/2	1.7812-14 UNJS-3B	2.000	.338	.008	1.714	1.796	.169	1.062
-0025 (2)	-	1-1/2	1.8438-14 UNJS-3B	2.125	.338	.008	1.777	1.859	-	-

(1) PITCH DIAMETER OF THREAD SHALL BE SQUARE TO SURFACES X AND Y WITHIN C TIR

(2) INACTIVE FOR DESIGN AND PROCUREMENT

MATERIAL: 17-4PH CRES PER AMS 5643, HEAT TREAT TO CONDITION H-1075 (145 KSI TENSILE MIN) PER MIL-H-6875

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM NON-CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

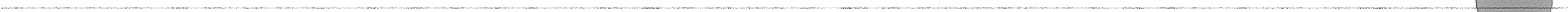
PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.

JAM - NUT, BULKHEAD AND UNIVERSAL FITTINGS, 17-4PH

ME273-0134

SHEET 1 OF 1

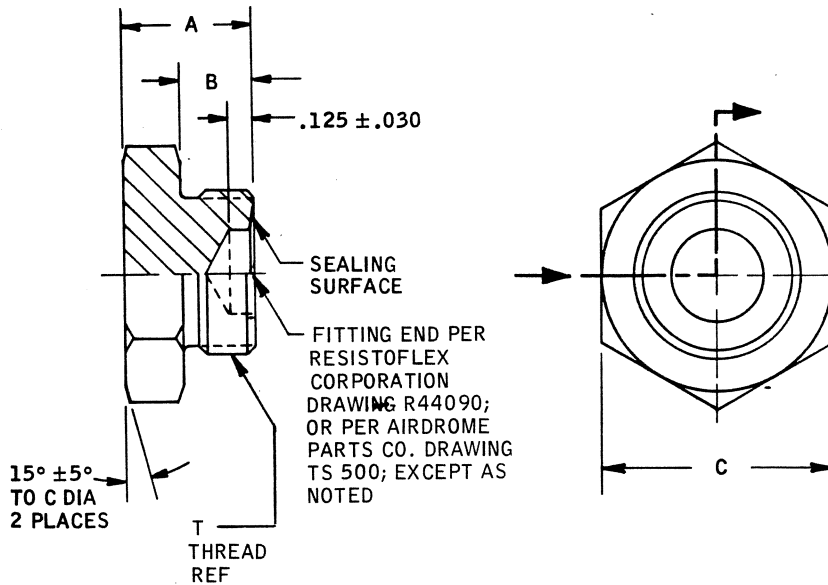


FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-80

5 SEPTEMBER 1977

FITTINGS, DYNATUBE[®] AND DUAL SEAL*



ME273-0135 DASH NUMBER	TUBE SIZE REF	T THREAD	A ±.015	B ±.015	C REF
-0004	1/4	.4375-24 UNJS-3A	.437	.275	.438
-0005	5/16	.5000-24 UNJS-3A	.449		.500
-0006	3/8	.5625-20 UNJS-3A	.483	.295	.562
-0008	1/2	.7188-20 UNJS-3A	.550	.308	.750
-0010	5/8	.8438-18 UNJS-3A	.664	.372	.875
-0012	3/4	1.0000-16 UNJ-3A	.712	.412	1.000
-0014	7/8	1.1250-16 UNJ-3A	.736	.430	1.125
-0016	1	1.2500-14 UNJS-3A	.832	.460	1.250
-0021	1-1/4	1.5781-14 UNJS-3A	.869	.457	1.625
-0025	1-1/2	1.8438-14 UNJS-3A	.980	.542	1.875

MATERIAL: 6AL-4V TITANIUM PER AMS 4965

FINISH: NONE

COATING: EVERLUBE 620A (EVERLUBE CORP., NO. HOLLYWOOD, CA) DRY FILM LUBRICANT ON SEALING SURFACE

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

DYNATUBE[®] IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

PLUG, MALE THREADED,
TITANIUM

ME273-0135

SHEET 1 OF 1

Data Sheet Revised

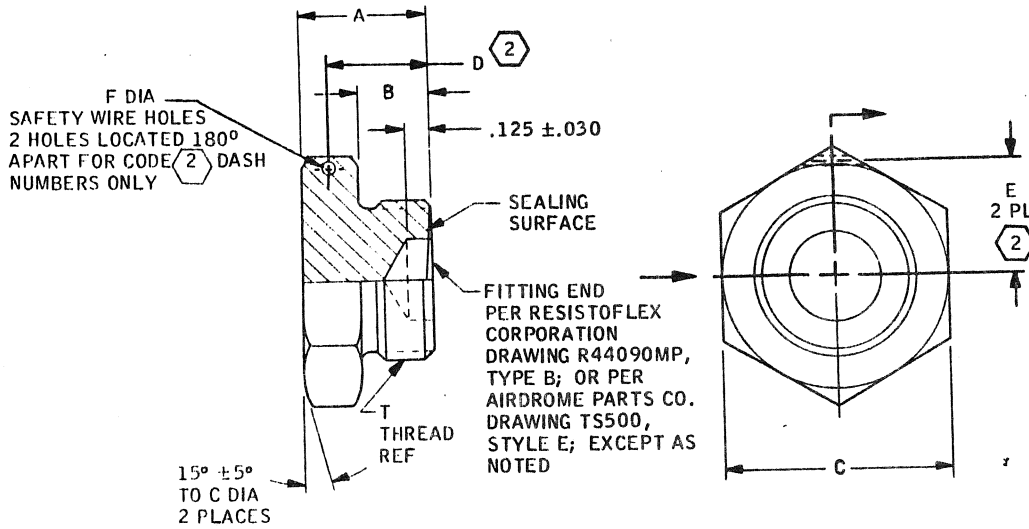


Space Division
Rockwell International



FLUID SYSTEMS DESIGN AND PARTS MANUAL

FITTINGS, DYNATUBE[®] AND DUAL SEAL *



SOURCE CONTROL DRAWING DASH NUMBER		TUBE SIZE REF	T THREAD	A ±.015	B ±.015	C REF	D ±.010	E ±.005	F DIA ±.005
1	2								
-0004	-1004	1/4	.4375-24UNJS-3A	.437	.275	.438	.356	.171	.070
-0005	-1005	5/16	.5000-24UNJS-3A	.449	.275	.500	.362	.207	.070
-0006	-1006	3/8	.5625-20UNJS-3A	.483	.295	.562	.389	.243	.070
-0008	-1008	1/2	.7188-20UNJS-3A	.550	.308	.750	.429	.349	.070
-0010	-1010	5/8	.8438-18UNJS-3A	.664	.372	.875	.518	.421	.070
-0012	-1012	3/4	1.0000-16UNJ-3A	.712	.412	1.000	.562	.493	.070
-0014	-1014	7/8	1.1250-16UNJ-3A	.736	.430	1.125	.583	.557	.070
-0016	-1016	1	1.2500-14UNJS-3A	.832	.460	1.250	.646	.629	.070
-0021	-1021	1-1/4	1.5781-14UNJS-3A	.869	.457	1.625	.663	.846	.070
-0025	-1025	1-1/2	1.8438-14UNJS-3A	.980	.542	1.875	.761	.990	.070

1 PLUG WITHOUT SAFETY WIRE HOLES

2 PLUG WITH SAFETY WIRE HOLES

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

PLUG, MALE THREADED,
TITANIUM

ME273-0135

SHEET 1 OF 2

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FLUID SYSTEMS DESIGN AND PARTS MANUAL



FITTINGS, DYNATUBE[®] AND DUAL SEAL

MATERIAL: 6AL-4V TITANIUM PER AMS 4965

FINISH: NONE

COATING: EVERLUBE 620A (EVERLUBE CORP., NO. HOLLYWOOD, CA) DRY FILM LUBRICANT ON SEALING SURFACE OF FITTING END

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM HYDRAULIC FLUID SYSTEMS

EXAMPLE OF CONTROL NUMBER:

ME273-0135-0008 = 1/2 INCH TUBE SIZE PLUG WITHOUT SAFETY WIRE HOLES

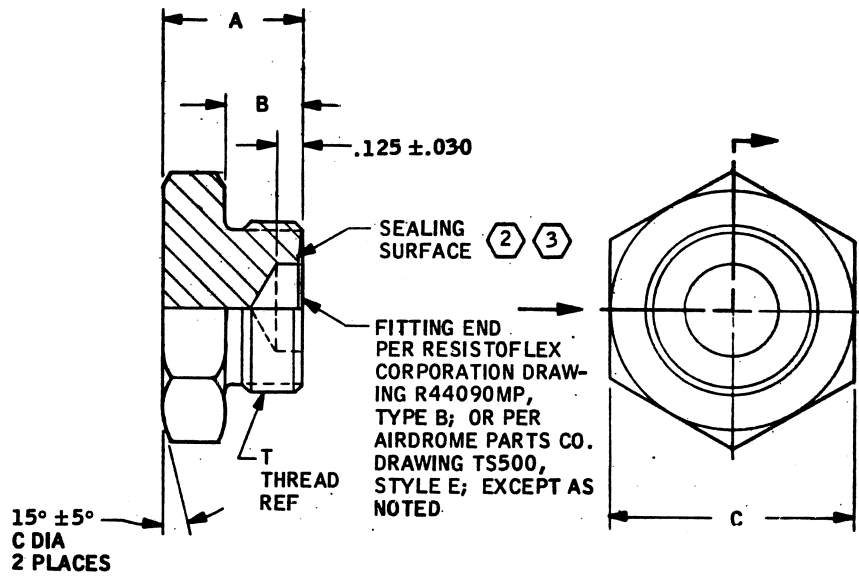
ME273-0135-1008 = 1/2 INCH TUBE SIZE PLUG WITH SAFETY WIRE HOLES

DYNATUBE[®] IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.
DUAL SEAL* IS A TRADEMARK OF TITFLEX CORPORATION, A BUNDY COMPANY

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PARTS DATA SHEET	PLUG, MALE THREADED, TITANIUM	ME273-0135
FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.		SHEET 2 OF 2

FITTINGS, DYNATUBE® AND DUAL SEAL*



SOURCE CONTROL DRAWING DASH NUMBER	TUBE SIZE REF	T THREAD	A ±.015	B ±.015	C REF
-0004 (2)	1/4	.4375-24 UNJS-3A	.437	.275	.438
-0005 (2)	5/16	.5000-24 UNJS-3A	.449	.275	.500
-0006 (2)	3/8	.5625-20 UNJS-3A	.483	.295	.562
-0008 (2)	1/2	.7188-20 UNJS-3A	.550	.308	.750
-0010 (2)	5/8	.8438-18 UNJS-3A	.664	.372	.875
-9012 (2)	3/4	1.0000-16 UNJ-3A	.712	.412	1.000
-9014 (2)	7/8	1.1250-16 UNJ-3A	.736	.430	1.125
(1) -0012 (3)	3/4	1.0000-16 UNJ-3A	.712	.412	1.000
(1) -0014 (3)	7/8	1.1250-16 UNJ-3A	.736	.430	1.125
-0016 (3)	1	1.2500-14 UNJS-3A	.832	.460	1.250
-0020 (3)	1-1/4	1.5156-14 UNJS-3A	.869	.457	1.625
-0024 (3)	1-1/2	1.7812-14 UNJS-3A	.980	.542	1.875

(1) INACTIVE FOR DESIGN AND PROCUREMENT AFTER 15 APRIL 1977. USE -9012 OR -9014

PARTS DATA SHEET	PLUG, MALE THREADED, INCONEL 718	ME273-0136
FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.		SHEET 1 OF 2

Data Sheet Revised



FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-82

SEPTEMBER 1977

FITTINGS, DYNATUBE[®] AND DUAL SEAL*

MATERIAL: INCONEL 718 PER AMS 5663

FINISH: PASSIVATE PER MIL-S-5002

COATING: (2) PLUGS, -0004 THRU -0010, -9012 AND -9014, UNCOATED WITH 8 RMS FINE FINISH ON SEALING SURFACE

(3) PLUGS, -0012 THRU -0024, THE SEALING SURFACE SHALL BE COATED PER AMS 2515C WITH DUPONT 850-204 TETRAFLUOROETHYLENE (TFE) TO A THICKNESS OF .1-.6 MILS

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

DYNATUBE[®] IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

PLUG, MALE THREADED,
INCONEL 718

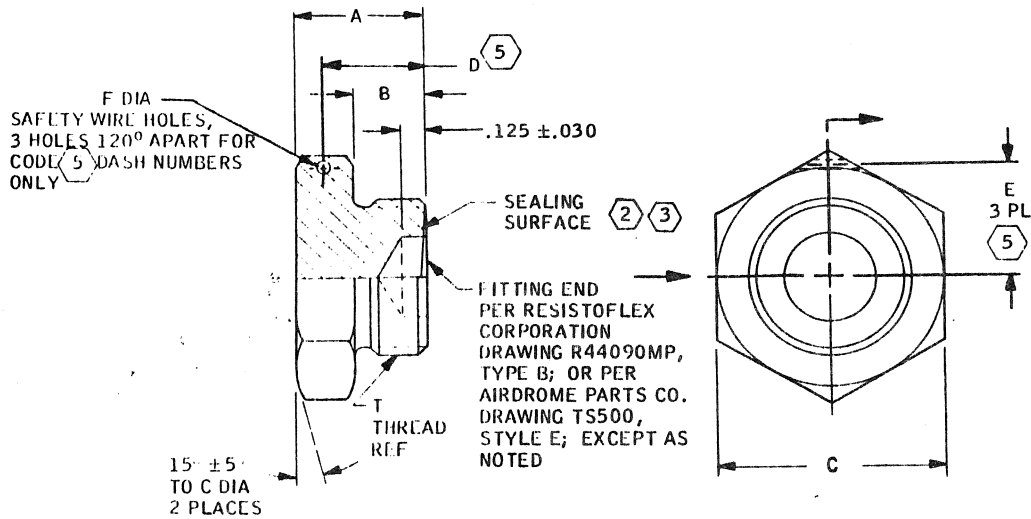
ME273-0136

SHEET 2 OF 2

Data Sheet Revised



FITTINGS, DYNATUBE® AND DUAL SEAL*



SOURCE CONTROL DRAWING DASH NUMBER		TUBE SIZE REF	T THREAD	A	B	C	D	E	F DIA
4	5			±.015	±.015	REF	±.010	±.005	±.005
-0004 2	-1004 2	1/4	.4375-24UNJS-3A	.437	.275	.438	.356	.171	.070
-0005 2	-1005 2	5/16	.5000-24UNJS-3A	.449	.275	.500	.362	.207	.070
-0006 2	-1006 2	3/8	.5625-20UNJS-3A	.483	.295	.562	.389	.243	.070
-0008 2	-1008 2	1/2	.7188-20UNJS-3A	.550	.308	.750	.429	.349	.070
-0010 2	-1010 2	5/8	.8438-18UNJS-3A	.664	.372	.875	.518	.421	.070
-9012 2	-1012 2	3/4	1.0000-16UNJ-3A	.712	.412	1.000	.562	.493	.070
-9014 2	-1014 2	7/8	1.1250-16UNJ-3A	.736	.430	1.125	.583	.557	.070
1-0012 3	-	3/4	1.0000-16UNJ-3A	.712	.412	1.000	-	-	-
1-0014 3	-	7/8	1.1250-16UNJ-3A	.736	.430	1.125	-	-	-
-0016 3	-1016 3	1	1.2500-14UNJS-3A	.832	.460	1.250	.646	.629	.070
-0020 3	-1020 3	1-1/4	1.5156-14UNJS-3A	.869	.457	1.625	.663	.846	.070
-0024 3	-1024 3	1-1/2	1.7812-14UNJS-3A	.980	.542	1.875	.761	.990	.070

- ① INACTIVE FOR DESIGN AND PROCUREMENT AFTER 15 APRIL 1977. USE -9012 OR -9014.
- ④ PLUG WITHOUT SAFETY WIRE HOLES
- ⑤ PLUG WITH SAFETY WIRE HOLES

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FLUID SYSTEMS DESIGN AND PARTS MANUAL

FITTINGS, DYNATUBE[®] AND DUAL SEAL*

MATERIAL: INCONEL 718 PER AMS 5663

FINISH: PASSIVATE PER MIL-S-5002

COATING:

② PLUGS, -0004 THRU -0010, -9012 AND -9014, AND -1004 THRU -1014 UNCOATED WITH 8 RMS FINE FINISH ON SEALING SURFACE

③ PLUGS, -0012 THRU -0024, AND -1016 THRU -1024, THE SEALING SURFACE SHALL BE COATED PER AMS 2515C WITH DUPONT 850-204 TETRAFLUOROETHYLENE (TFE) TO A THICKNESS OF .1-.6 MILS

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

EXAMPLE OF CONTROL NUMBER:

ME273-0136-0008 = 1/2 INCH TUBE SIZE PLUG, WITHOUT SAFETY WIRE HOLES

ME273-0136-1008 = 1/2 INCH TUBE SIZE PLUG, WITH SAFETY WIRE HOLES

DYNATUBE[®] IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.
DUAL SEAL* IS A TRADEMARK OF TITFLEX CORPORATION, A BUNDY COMPANY

PARTS DATA SHEET

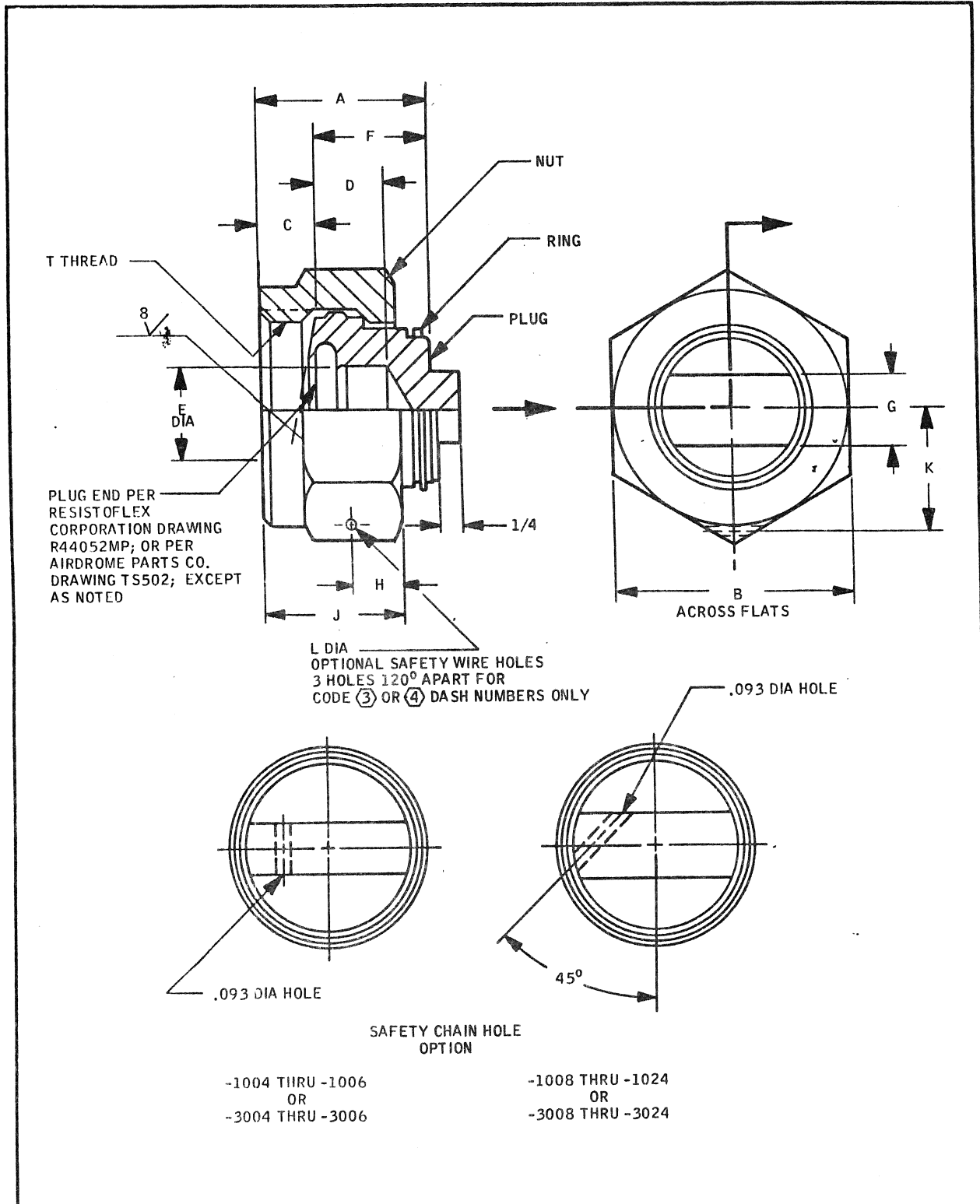
PLUG, MALE THREADED,
INCONEL 718

ME273-0136

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

SHEET 2 OF 2

FITTINGS, DYNATUBE® AND DUAL SEAL*



<p>PARTS DATA SHEET</p> <p>FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.</p>	<p>FITTING, PRESSURE CAP, INCONEL 718</p>	<p>ME273-0137</p> <p>SHEET 1 OF 3</p>
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FLUID SYSTEMS DESIGN AND PARTS MANUAL

FITTINGS, DYNATUBE® AND DUAL SEAL*

SOURCE CONTROL DRAWING DASH NUMBER				TUBE SIZE REF	T THREAD	A REF	B	C	D
1	2	3	4						
-0004	-1004	-2004	-3004	1/4	.4375-24UNJS-3B	.579	.562	.229	.180
-0005	-1005	-2005	-3005	5/16	.5000-24UNJS-3B	.584	.625	.234	.180
-0006	-1006	-2006	-3006	3/8	.5625-20UNJS-3B	.643	.688	.253	.180
-0008	-1008	-2008	-3008	1/2	.7188-20UNJS-3B	.635	.875	.270	.175
-0010	-1010	-2010	-3010	5/8	.8438-18UNJS-3B	.696	1.000	.331	.175
-0012	-1012	-2012	-3012	3/4	1.0000-16UNJ-3B	.763	1.125	.367	.176
-0014	-1014	-2014	-3014	7/8	1.1250-16UNJ-3B	.825	1.250	.370	.175
-0016	-1016	-2016	-3016	1	1.2500-14UNJS-3B	.881	1.375	.410	.171
-0020	-1020	-2020	-3020	1-1/4	1.5156-14UNJS-3B	.828	1.625	.407	.101
-0024	-1024	-2024	-3024	1-1/2	1.7812-14UNJS-3B	.941	2.000	.492	.064

SOURCE CONTROL DRAWING DASH NUMBER				TUBE SIZE REF	E MIN	F	G REF	J	H	K	L DIA
1	2	3	4								
-0004	-1004	-2004	-3004	1/4	.185	.350	.188	.454	.188	.261	.047
-0005	-1005	-2005	-3005	5/16	.247	.350	.250	.459	.188	.298	.047
-0006	-1006	-2006	-3006	3/8	.309	.390	.250	.518	.188	.334	.047
-0008	-1008	-2008	-3008	1/2	.403	.365	.375	.510	.188	.423	.070
-0010	-1010	-2010	-3010	5/8	.526	.365	.375	.571	.250	.495	.070
-0012	-1012	-2012	-3012	3/4	.678	.396	.375	.637	.250	.567	.070
-0014	-1014	-2014	-3014	7/8	.792	.455	.500	.660	.250	.640	.070
-0016	-1016	-2016	-3016	1	.860	.471	.500	.705	.250	.712	.070
-0020	-1020	-2020	-3020	1-1/4	1.132	.421	.500	.687	.250	.849	.070
-0024	-1024	-2024	-3024	1-1/2	1.367	.449	.500	.800	.281	1.065	.070

- 1 CAP WITHOUT SAFETY CHAIN HOLE AND SAFETY WIRE HOLES
- 2 CAP WITH SAFETY CHAIN HOLE
- 3 CAP WITH SAFETY WIRE HOLES
- 4 CAP WITH SAFETY CHAIN HOLES AND SAFETY WIRE HOLES

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR

FITTING, PRESSURE CAP,
INCONEL 718

ME273-0137

SHEET 2 OF 3

FITTINGS, DYNATUBE® AND DUAL SEAL*

MATERIAL: PLUG AND NUT - INCONEL 718 PER AMS 5663
RING - PH15-7Mo PER AMS 5520

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

EXAMPLE OF CONTROL NUMBER:

ME273-0137-0004 = 1/4 INCH TUBE SIZE PRESSURE CAP WITHOUT SAFETY CHAIN HOLE AND SAFETY WIRE HOLES

ME273-0137-1006 = 3/8 INCH TUBE SIZE PRESSURE CAP WITH SAFETY CHAIN HOLE

ME273-0137-2008 = 1/2 INCH TUBE SIZE PRESSURE CAP WITH SAFETY WIRE HOLES

ME273-0137-3010 = 5/8 INCH TUBE SIZE PRESSURE CAP WITH SAFETY CHAIN HOLES AND SAFETY WIRE HOLES

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.
DUAL SEAL* IS A TRADEMARK OF TITFLEX CORPORATION, A BUNDY COMPANY

PARTS DATA SHEET

FITTING, PRESSURE CAP,
INCONEL 718

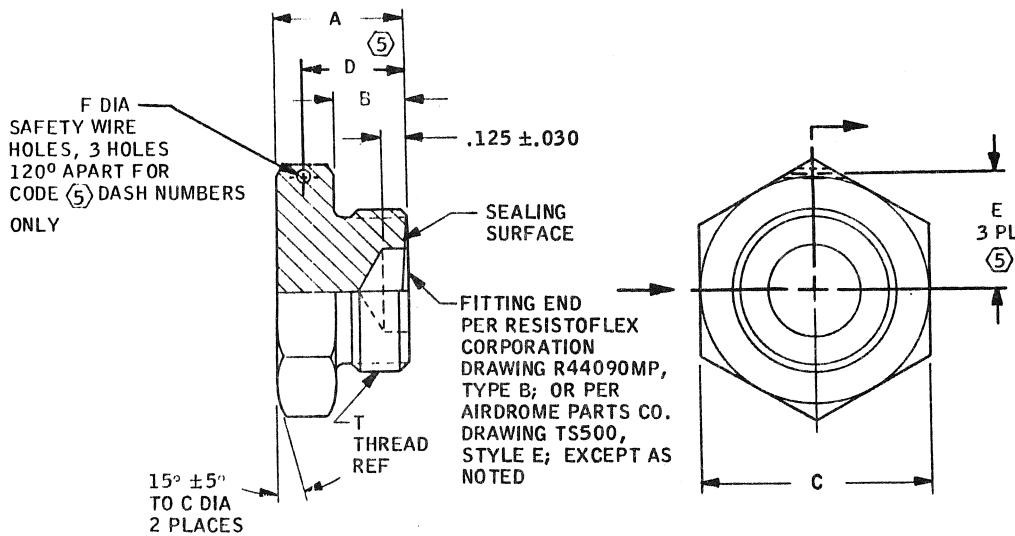
ME273-0137

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

SHEET 3 OF 3

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FITTINGS, DYNATUBE[®] AND DUAL SEAL*



SOURCE CONTROL DRAWING DASH NUMBER		TUBE SIZE REF	T THREAD	A	B	C	D	E	F DIA
(4)	(5)			±.015	±.015	REF	±.010	±.005	±.005
-0004 (1)	-1004 (1)	1/4	.4375-24UNJS-3A	.437	.275	.438	.356	.171	.070
-0005 (1)	-1005 (1)	5/16	.5000-24UNJS-3A	.449	.275	.500	.362	.207	.070
-0006 (1)	-1006 (1)	3/8	.5625-20UNJS-3A	.483	.295	.562	.389	.243	.070
-0008 (1)	-1008 (1)	1/2	.7188-20UNJS-3A	.550	.308	.750	.429	.349	.070
-0010 (1)	-1010 (1)	5/8	.8438-18UNJS-3A	.664	.372	.875	.518	.421	.070
-9012 (1)	-1012 (1)	3/4	1.0000-16UNJ-3A	.712	.412	1.000	.562	.493	.070
-9014 (1)	-1014 (1)	7/8	1.1250-16UNJ-3A	.736	.430	1.125	.583	.557	.070
(3)-0012 (2)	-	3/4	1.0000-16UNJ-3A	.712	.412	1.000	-	-	-
(3)-0014 (2)	-	7/8	1.1250-16UNJ-3A	.736	.430	1.125	-	-	-
-0016 (2)	-1016 (2)	1	1.2500-14UNJS-3A	.832	.460	1.250	.646	.629	.070
-0020 (2)	-1020 (2)	1-1/4	1.5156-14UNJS-3A	.869	.457	1.625	.663	.846	.070
-0024 (2)	-1024 (2)	1-1/2	1.7812-14UNJS-3A	.980	.542	1.875	.761	.990	.070

(3) INACTIVE FOR DESIGN AND PROCUREMENT AFTER 15 APRIL 1977. USE -9012 OR -9014.

(4) PLUG WITHOUT SAFETY WIRE HOLES

(5) PLUG WITH SAFETY WIRE HOLES

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.

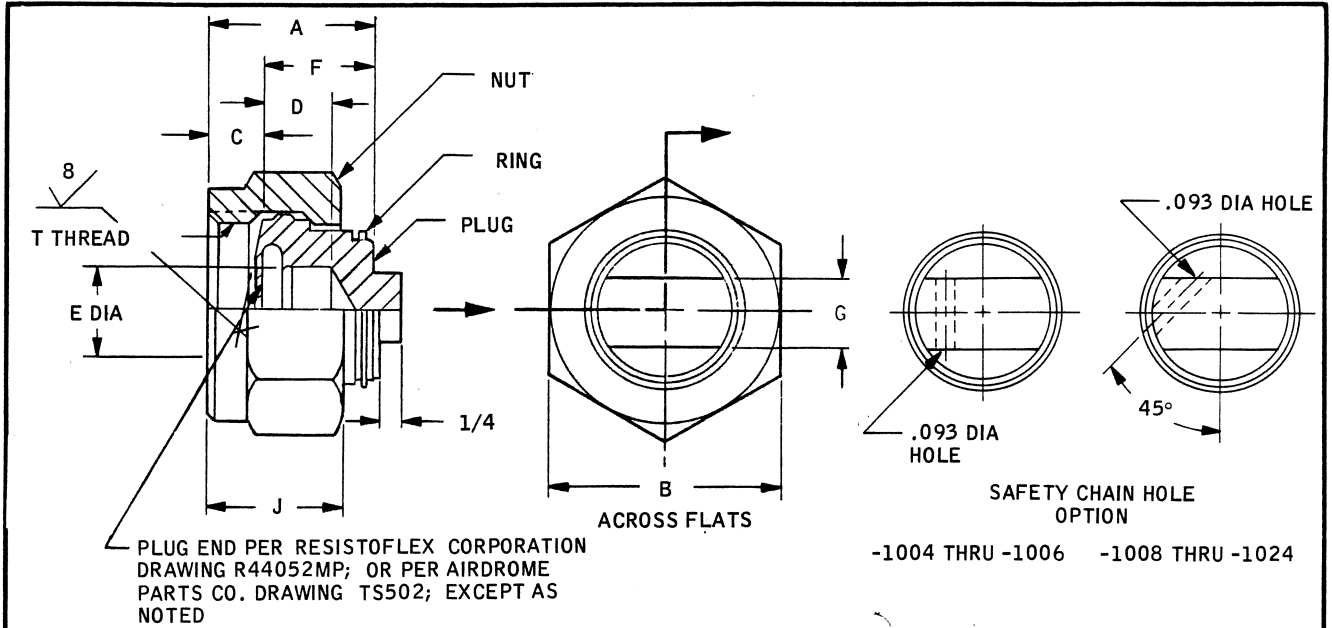
PLUG, MALE THREADED, 17-4PH

ME273-0098

SHEET 1 OF 2

18

FITTINGS, DYNATUBE® AND DUAL SEAL*



ME273-0137 DASH NUMBER		TUBE SIZE REF	T THREAD	A REF	B	C	D	E MIN	F	G REF	J
1	2										
-0004	-1004	1/4	.4375-24 UNJS-3B	.579	.562	.229	.180	.185	.350	.188	.454
-0005	-1005	5/16	.5000-24 UNJS-3B	.584	.625	.234		.247	.250	.459	.518
-0006	-1006	3/8	.5625-20 UNJS-3B	.643	.688	.253		.309				.390
-0008	-1008	1/2	.7188-20 UNJS-3B	.635	.875	.270	.175	.403	.365	.375	.510
-0010	-1010	5/8	.8438-18 UNJS-3B	.696	1.000	.331		.526			.571
-0012	-1012	3/4	1.0000-16 UNJ-3B	.763	1.125	.367	.176	.678	.396	.500	.637
-0014	-1014	7/8	1.1250-16 UNJ-3B	.825	1.250	.370	.175	.792	.455		.660
-0016	-1016	1	1.2500-14 UNJS-3B	.881	1.375	.410	.171	.860	.471		.705
-0020	-1020	1-1/4	1.5156-14 UNJS-3B	.828	1.625	.407	.101	1.132	.421	.687	.800
-0024	-1024	1-1/2	1.7812-14 UNJS-3B	.941	2.000	.492	.064	1.367	.449		

1 CAP WITHOUT SAFETY CHAIN HOLE

2 CAP WITH SAFETY CHAIN HOLE

MATERIAL: PLUG AND NUT - INCONEL 718 PER AMS 5663

RING - PH15-7Mo PER AMS 5520

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

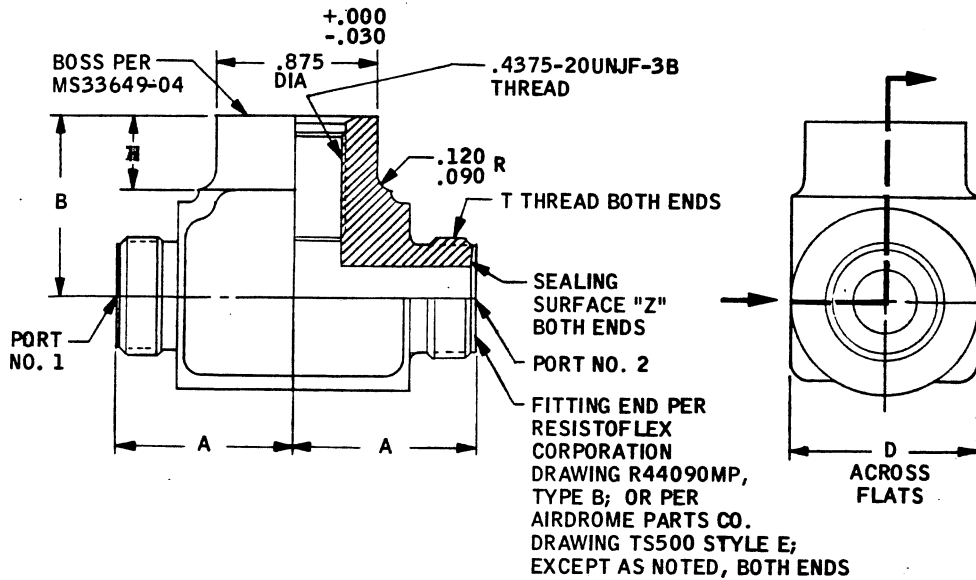
PARTS DATA SHEET FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.	FITTING, PRESSURE CAP, INCONEL 718	ME273-0137
		SHEET 1 OF 1

FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-84

15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



SOURCE CONTROL DRAWING DASH NUMBER	TUBE SIZE		T THREAD	A ±.015	B ±.015	D REF	H ±.020
	PORT NO. 1	PORT NO. 2					
-0004 ①	1/4	1/4	.4375-24UNJS-3A	.925	.783	.875	.156
-0005 ①	5/16	5/16	.5000-24UNJS-3A		.807		.180
-0006 ①	3/8	3/8	.5625-20UNJS-3A	.945	.839		.212
-0008 ①	1/2	1/2	.7188-20UNJS-3A	.958	.890		.263
-0010 ①	5/8	5/8	.8438-18UNJS-3A	1.022	.948		.321
-9012 ①	3/4	3/4	1.0000-16UNJ-3A	1.062	1.016		.389
-9014 ①	7/8	7/8	1.1250-16UNJ-3A	1.216	1.076	1.125	.321
③ -0012 ②	3/4	3/4	1.0000-16UNJ-3A	1.062	1.016	.875	.389
③ -0014 ②	7/8	7/8	1.1250-16UNJ-3A	1.216	1.076	1.125	.321
-0016 ②	1	1	1.2500-14UNJS-3A	1.246	1.123	1.125	.368
-0020 ②	1-1/4	1-1/4	1.5156-14UNJS-3A	1.387	1.250	1.375	.360
-0024 ②	1-1/2	1-1/2	1.7812-14UNJS-3A	1.688	1.355	1.625	.335

③ INACTIVE FOR DESIGN AND PROCUREMENT AFTER 29 APRIL 1977. USE -9012 OR -9014.

FITTINGS, DYNATUBE[®] AND DUAL SEAL*

2733-85
15 SEPTEMBER 1977

MATERIAL: 17-4PH CRES PER AMS 5643, HEAT TREAT TO CONDITION H-1075 (145 KSI TENSILE MIN)
PER MIL-H-6875

FINISH: PASSIVATE PER MIL-S-5002

COATING:

① TEES -0004 THRU -0010, -9012 AND -9014, UNCOATED WITH 8 RMS SURFACE FINISH ON SEALING SURFACE "Z"

② TEES -0012 THRU -0024, SEALING SURFACE "Z" SHALL BE COATED PER AMS 2515C WITH DUPONT 850-204 TETRAFLUOROETHYLENE (TFE) TO A THICKNESS OF .1-.6 MILS

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM NON-CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

DYNATUBE[®] IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.
DUAL SEAL* IS A TRADEMARK OF TITFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

TEE, MALE ON RUNS, BOSS ON SIDE
17-4 PH

ME273-0139

SHEET 2 OF 2

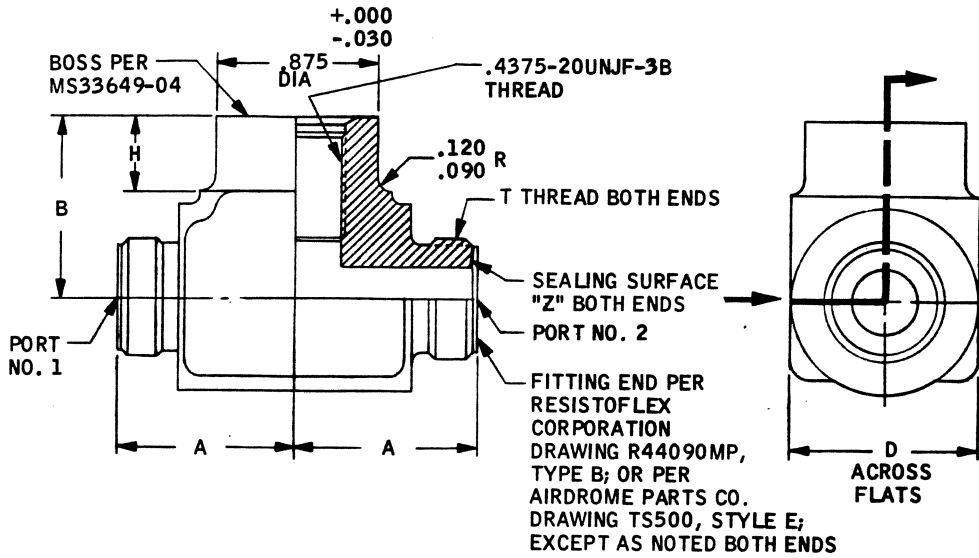
Data Sheet Revised

FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-86

15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



SOURCE CONTROL DRAWING DASH NUMBER	TUBE SIZE		T THREAD	A ±.015	B ±.015	D REF	H ±.020
	PORT NO. 1	PORT NO. 2					
-0004 (1)	1/4	1/4	.4375-24UNJS-3A	.925	.783	.875	.156
-0005 (1)	5/16	5/16	.5000-24UNJS-3A	.925	.807	.875	.180
-0006 (1)	3/8	3/8	.5625-20UNJS-3A	.945	.839	.875	.212
-0008 (1)	1/2	1/2	.7188-20UNJS-3A	.958	.890	.875	.263
-0010 (1)	5/8	5/8	.8438-18UNJS-3A	1.022	.948	.875	.321
-9012 (1)	3/4	3/4	1.0000-16UNJ-3A	1.062	1.016	.875	.389
-9014 (1)	7/8	7/8	1.1250-16 UNJ-3A	1.216	1.076	1.125	.321
(3) -0012 (2)	3/4	3/4	1.0000-16UNJ-3A	1.062	1.016	.875	.389
(3) -0014 (2)	7/8	7/8	1.1250-16UNJ-3A	1.216	1.076	1.125	.321
-0016 (2)	1	1	1.2500-14UNJS-3A	1.246	1.123	1.125	.368
-0020 (2)	1-1/4	1-1/4	1.5156-14UNJS-3A	1.387	1.250	1.375	.360
-0024 (2)	1-1/2	1-1/2	1.7812-14UNJS-3A	1.688	1.355	1.625	.335

(3) INACTIVE FOR DESIGN AND PROCUREMENT AFTER 29 APRIL 1977. USE -9012 OR -9014.

PARTS DATA SHEET	TEE, MALE ON RUNS, BOSS ON SIDE, INCONEL 718	ME273-0140
FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.		SHEET 1 OF 2

Data Sheet Revised

FITTINGS, DYNATUBE® AND DUAL SEAL*

MATERIAL: INCONEL 718 PER AMS 5663

FINISH: PASSIVATE PER MIL-S-5002

COATING: ① TEES -0004 THRU -0010, -9012 AND -9014, UNCOATED WITH 8 RMS SURFACE FINISH ON SEALING SURFACE "Z"

② TEES -0012 THRU -0024, SEALING SURFACE "Z" SHALL BE COATED PER AMS 2515C WITH DUPONT 850-204 TETRAFLUOROETHYLENE (TFE) TO A THICKNESS OF .1-.6 MILS

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.

TEE, MALE ON RUNS, BOSS ON SIDE,
INCONEL 718

ME273-0140

SHEET 2 OF 2

Data Sheet Revised

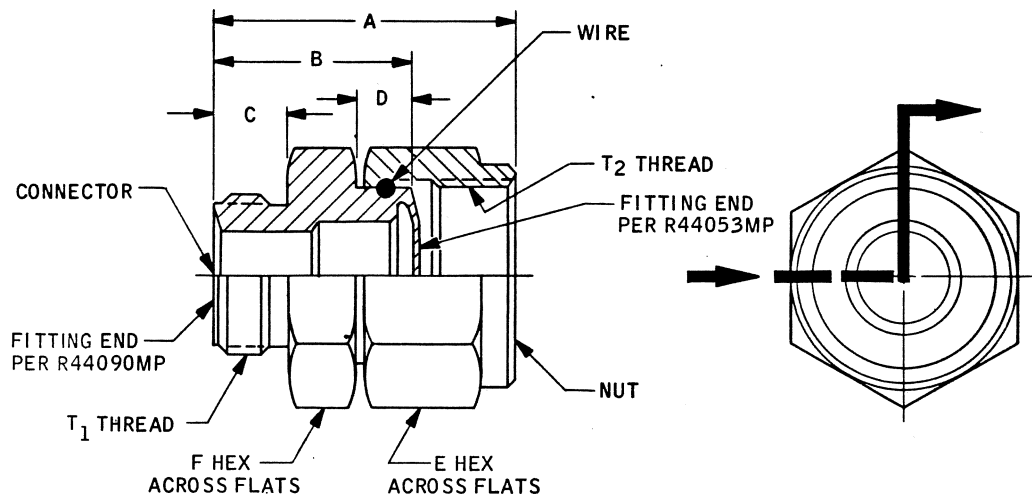


FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-88

15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



SOURCE CONTROL DRAWING DASH NO.	MALE THREAD TUBE SIZE	FEMALE THREAD TUBE SIZE	T ₁ THREAD	T ₂ THREAD	A	B	C	D	E	F
-0405	1/4	5/16	.4375-24UNJS-3A	.5000-24UNJS-3B	.930	.720	.275	.271	.625	.500
-0406		3/8		.5625-20UNJS-3B	1.003	.770		.307	.688	.562
-0408		1/2		.7188-20UNJS-3B	1.049	.800		.283	.875	.750
-0410		5/8		.8438-18UNJS-3B	1.160	.853		.286	1.000	.875
-0412		3/4		1.0000-16UNJ-3B	1.234	.891		.316	1.125	1.000
-0416		1		1.2500-14UNJS-3B	1.412	1.046		.399	1.500	1.250
-0421		1-1/4		1.5781-14UNJS-3B	1.517	1.148		.461	1.875	1.625
-0506	5/16	3/8	.5000-24UNJS-3A	.5625-20UNJS-3B	1.003	.770	.275	.307	.688	.562
-0508		1/2		.7188-20UNJS-3B	1.049	.800		.283	.875	.750
-0512		3/4		1.0000-16UNJ-3B	1.234	.891		.316	1.125	1.000
-0608	3/8	1/2	.5625-20UNJS-3A	.7188-20UNJS-3B	1.069	.820	.295	.283	.875	.750
-0610		5/8		.8438-18UNJS-3B	1.180	.873		.286	1.000	.875
-0612		3/4		1.0000-16UNJ-3B	1.254	.911		.316	1.125	1.000
-0616		1		1.2500-14UNJS-3B	1.432	1.066		.399	1.500	1.250
-0621		1-1/4		1.5781-14UNJS-3B	1.537	1.168		.461	1.875	1.625
-0810	1/2	5/8	.7188-20UNJS-3A	.8438-18UNJS-3B	1.193	.886	.308	.286	1.000	.875
-0812		3/4		1.0000-16UNJ-3B	1.267	.924		.316	1.125	1.000
-0816		1		1.2500-14UNJS-3B	1.445	1.079		.399	1.500	1.250
-1012	5/8	3/4	.8438-18UNJS-3A	1.0000-16UNJ-3B	1.331	.988	.372	.316	1.125	1.000
-1016		1		1.2500-14UNJS-3B	1.471	1.102		.399	1.500	1.250
-1208	3/4	1/2	1.0000-16UNJ-3A	.7188-20UNJS-3B	1.244	.995	.412	.283	1.000	.875
-1216		1		1.2500-14UNJS-3B	1.549	1.183		.399	1.500	1.250
-1624	1	1-1/2	1.2500-14UNJS-3A	1.7812-14UNJS-3B	1.720	1.266	.460	.368	2.000	1.875
-2024	1-1/4	1-1/2	1.5156-14UNJS-3A		1.717	1.263					.457

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.

CONNECTOR, EXPANDER, MALE TO FEMALE, TITANIUM

ME273-0141

SHEET 1 OF 2

Data Sheet Revised

FITTINGS, DYNATUBE[®] AND DUAL SEAL*

MATERIAL: CONNECTOR AND NUT - 6AL-4V TITANIUM PER RESISTOFLEX CORPORATION SPECIFICATION RES 143
WIRE - CRES 302 PER AMS 5637

COATING: EVERLUBE 620A (EVERLUBE CORP., NO. HOLLYWOOD, CA) DRY LUBRICANT ON INTERNAL THREAD,
BEARING SURFACE OF NUT AND SEALING FACE OF MALE CONNECTOR.

I & T REQUIREMENTS: TRACEABILITY NOT REQUIRED.

REFERENCED DRAWINGS: R44090MP AND R44053MP ARE CONTROLLED ACCESS DRAWINGS CONTAINING DATA
PROPRIETARY TO RESISTOFLEX CORPORATION, AND ARE ACCESSIBLE ONLY THRU
DATA MANAGEMENT.

APPLICATION NOTE:

1. REFER TO STANDARD DESIGN PRACTICE 273-0003MP FOR DESIGN INFORMATION AND INSTALLATION DATA.

DYNATUBE[®] IS A REGISTERED TRADEMARK OF RESISTOFLEX CORP., ROSELAND, N.J.

PARTS DATA SHEET

CONNECTOR, EXPANDER, MALE
TO FEMALE, TITANIUM

ME273-0141

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

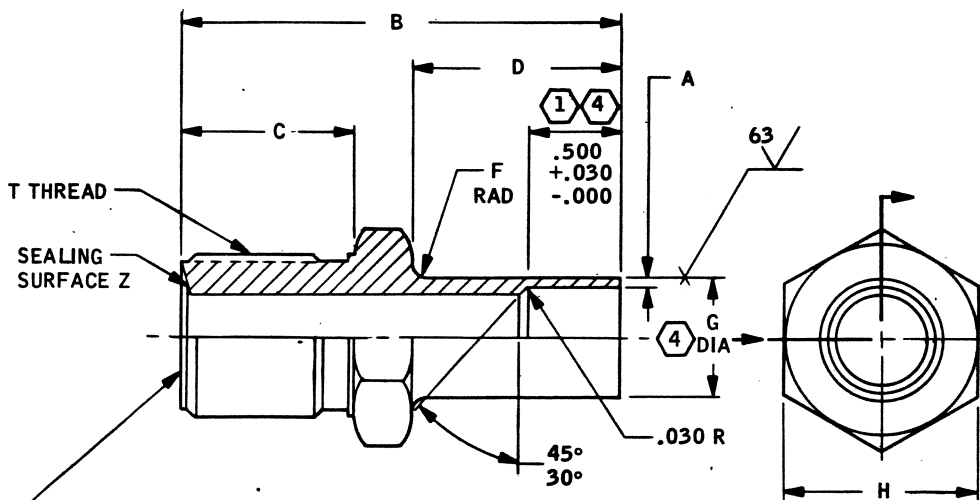
SHEET 2 OF 2



2733-90

15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



FITTING END PER RESISTOFLEX CORPORATION DRAWING R44094MP, TYPE B; OR PER AIRDROME PARTS CO. DRAWING TS501 TYPE E; EXCEPT AS NOTED.

① NO MARKING AND/OR IDENTIFICATION IN THIS AREA. 63 SURFACE TEXTURE THIS AREA.

SOURCE CONTROL DRAWING DASH NUMBER	T THREAD CLASS 3A	A ±.002	B ±.015	C REF	D ±.010	F ±.010	G DIA	H REF
-0420 ②	.4375-24 UNJS	.020	1.920	.680	1.040	.080	+.000 -.003	.688
-0435 ②		.035						
-0520 ②	.5000-24 UNJS	.020	2.030	.680	1.150	.100		.750
-0620 ②		.020						
-0649 ②	.5625-20 UNJS	.049	2.111	.719	1.150	.100		.812
-0825 ②		.025						
-0858 ②	.7188-20 UNJS	.058	2.193	.755	1.150	.100	1.000	
-0865 ②		.065						
-1025 ②	.8438-18 UNJS	.025	2.362	.894	1.162	.100	1.125	
-1072 ②		.072						
-9228 ②	1.0000-16 UNJ	.028	2.516	.990	1.220	.100	1.250	
⑤ -1228 ③	1.0000-16 UNJ	.028					1.250	
-1628 ③	1.2500-14 UNJS	.028	3.008	1.082	1.620	.100	1.004	1.500
-1649 ③		.049						
-1683 ③		.083	3.002	1.076	1.620	.100	1.254	1.750
-2035 ③	1.5156-14 UNJS	.035						
-2049 ③		.049	3.252	1.246	1.700	.100	1.504	2.000
-2435 ③	1.7812-14 UNJS	.035						
-2449 ③		.049						

⑤ INACTIVE FOR DESIGN AND PROCUREMENT AFTER 23 JUNE 1977. USE -9228.

PARTS DATA SHEET FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.	CONNECTOR, BULKHEAD TO BRAZE/WELD, INCONEL 718	ME273-0142
		SHEET 1 OF 2

Data Sheet Revised

FITTINGS, DYNATUBE[®] AND DUAL SEAL*

2733-91
15 SEPTEMBER 1977

MATERIAL: INCONEL 718 PER AMS 5663

FINISH: PASSIVATE PER MIL-S-5002

COATING:

② CONNECTORS -0420 THRU -1072, AND -9228, UNCOATED WITH 8 RMS SURFACE TEXTURE ON SEALING SURFACE Z

③ CONNECTORS -1228 THRU -2449, THE SEALING SURFACE Z SHALL BE COATED PER AMS 2515C WITH DUPONT 850-204 TETRAFLUOROETHYLENE (TFE) TO A THICKNESS OF .1-.6 MILS.

PROCUREMENT SPECIFICATION: MC273-0129.

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY.

APPLICATION: SPACE SHUTTLE PROGRAM CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

NOTES:

- ④ 1. NICKEL PLATE THE SHANK OD (FOR .500 LENGTH AS A MINIMUM) .0002 TO .0005 INCH THICK PER QQ-N-290, CLASS 1, GRADE G TO FACILITATE BRAZING. TOLERANCE ON DIAMETER SHALL APPLY AFTER PLATING.

DYNATUBE[®] IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

CONNECTOR, BULKHEAD TO
BRAZE/WELD, INCONEL 718

ME273-0142

SHEET 2 OF 2

Data Sheet Revised

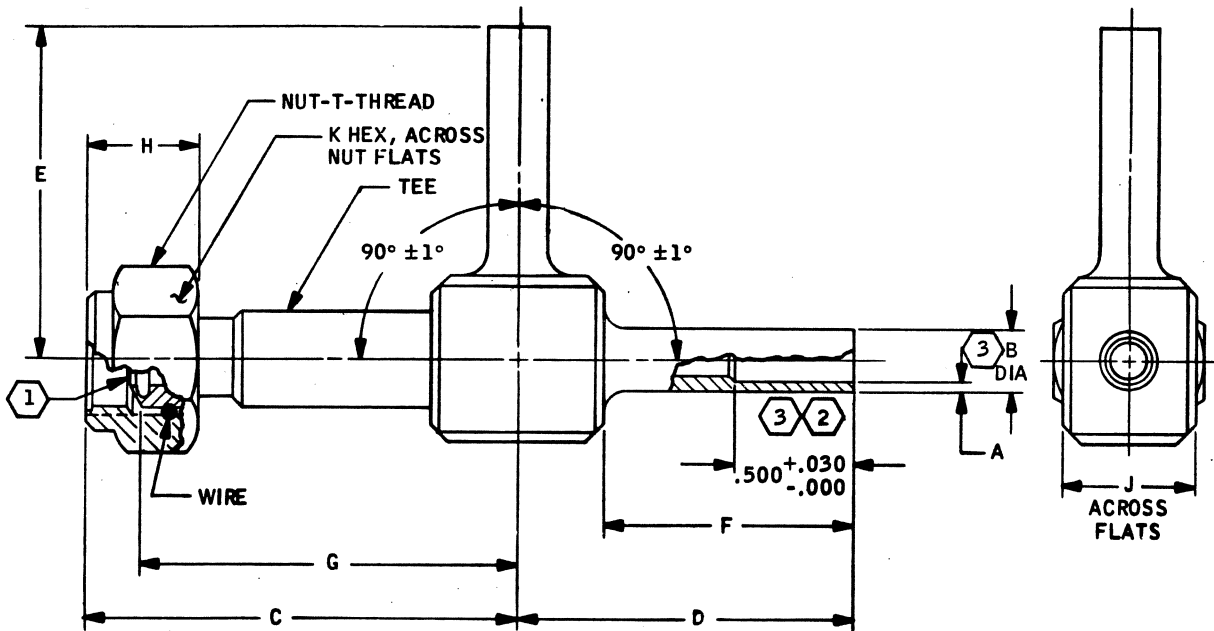


Rockwell
International
Space Division

2733-92

15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



1 FITTING END PER RESISTOFLEX CORPORATION DRAWING R44053; OR PER AIRDROME PARTS CO. DRAWING TS502; WITH 8 RMS FINISH ON SEALING SURFACE

2 NO MARKING OR IDENTIFICATION IN THIS AREA

SOURCE CONTROL DRAWING DASH NO.	T THREAD CLASS 3B	A ±.002	B DIA	C REF	D ±.010	E ±.010	F ±.010	G ±.015	H ±.015	J REF	K REF
-0420	.4375-24 UNJS	.020	.253	1.766	1.180	1.381	.839	1.560	.454	.500	.562
-0435		.035									
-0520	.5000-24 UNJS	.020	.315	1.750	1.491	1.491	1.150	1.540	.459	.562	.625
-0620	.5625-20 UNJS	.020		1.773							
-0649		.049	.378		1.784	1.569	1.569	1.535	.510	.750	.875
-0825	.7188-20 UNJS	.025		.503							
-0858		.058	.754		1.879	1.780	1.780	1.220	1.536	.637	1.000
-0865	.065	.754		1.879							
-1025	.8438-18 UNJS		.025		.629	1.842	1.644	1.644	1.162	1.536	.637
-1072		.072	.754	1.879							
-1228	1.0000-16 UNJ	.028			.754	1.879	1.780	1.780	1.220	1.536	.637
-1628	1.2500-14 UNJS	.049	1.004	1.897							
-1649		.028			.754	1.897	2.258	2.258	1.620	1.531	.705
-1683	1.5156-14 UNJS	.083	1.254	1.902							
-2035		.049			1.504	1.902	2.399	2.399	1.520	1.531	.687
-2049	1.7812-14 UNJS	.035	1.504	2.233							
-2435		.049			1.504	2.233	2.682	2.682	1.700	1.779	.800
-2449											

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.

TEE, FEMALE TO BRAZE/WELD, BRAZE/WELD ON SIDE, INCONEL 718

ME273-0143

SHEET 1 OF 2

Data Sheet Revised

FITTINGS, DYNATUBE® AND DUAL SEAL*

MATERIAL:

BODY AND NUT - INCONEL 718 PER AMS 5663
 NUT RETAINING WIRE - 302 CRES PER AMS 5637, OR
 305 CRES PER AMS 5685

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129.

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY.

APPLICATION: SPACE SHUTTLE PROGRAM CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

NOTES:

- ③ 1. NICKEL PLATE THE SHANK OD (FOR .500 LENGTH AS A MINIMUM) .0002 TO .0005 INCH THICK PER QQ-N-290, CLASS 1, GRADE G TO FACILITATE BRAZING. TOLERANCE ON DIAMETER SHALL APPLY AFTER PLATING.

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR
 PROCUREMENT OR INSPECTION PURPOSES.

TEE, FEMALE TO BRAZE/WELD,
 BRAZE/WELD ON SIDE, INCONEL 718

ME273-0143

SHEET 2 OF 2

Data Sheet Revised



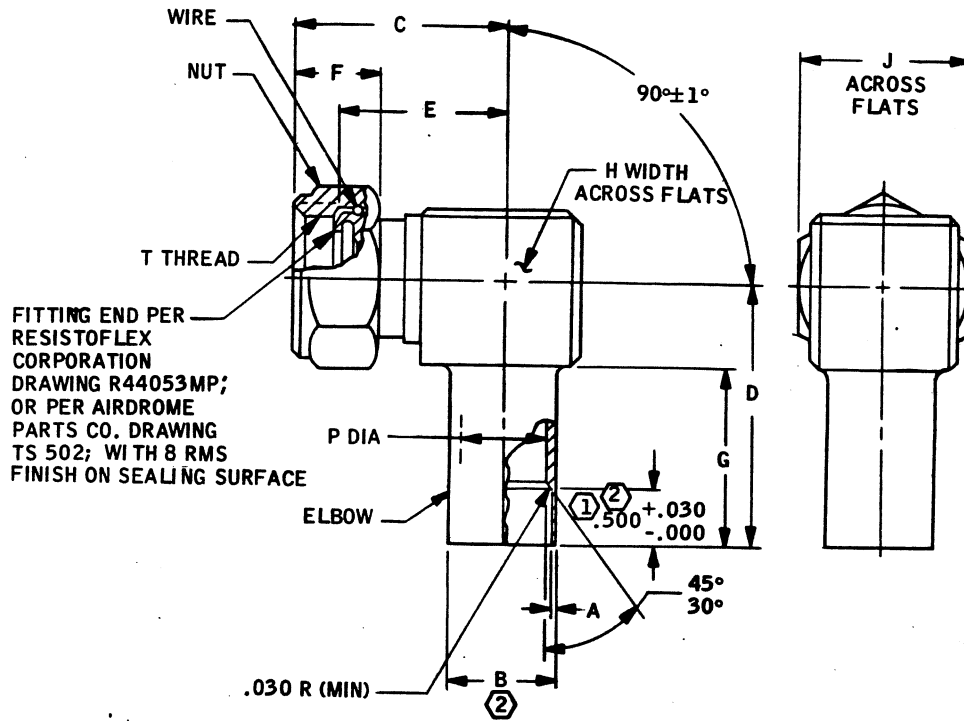
Rockwell
 International
 Space Division

FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-94

15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



(1) NO MARKING OR IDENTIFICATION IN THIS AREA

SOURCE CONTROL DRAWING DASH NO.	T THREAD CLASS 3B	A ±.002	B DIA	C REF	D ±.010	E ±.015	F ±.015	G ±.010	H REF	J REF	P DIA +.015 - .000
-0420	.4375-24 UNJS	.020	.253	1.014	1.381	.808	.454	1.040	.500	.562	.180
-0435		.035									.150
-0520	.5000-24 UNJS	.020	+.000 -.003	1.060	1.491	.850	.459	1.150	.562	.625	.227
-0620	.5625-20 UNJS	.020		1.178		.945	.518		.625	.688	.292
-0649		.049	.378	.250							
-0825	.7188-20 UNJS	.025	.503	1.294	1.569	1.045	.510	.750	.875	.393	
-0858		.058								.354	
-0865		.065								.340	
-1025	.8438-18 UNJS	.025	.629	1.485	1.644	1.178	.571	1.162	.875	1.000	.508
-1072		.072									.451
-1228	1.0000-16 UNJ	.028	.754	1.659	1.780	1.316	.637	1.220	1.000	1.125	.645
-1628	1.2500-14 UNJS	.028		1.004	+.000 -.004	1.895	2.258	1.529	.705	1.250	1.375	.859
-1649		.049	.859								
-1683		.083	.804								
-2035	1.5156-14 UNJS	.035	1.254	2.026	2.399	1.655	.687	1.500	1.625	1.113	
-2049		.049								1.113	
-2435	1.7812-14 UNJS	.035	1.504	2.438	2.682	1.984	.800	1.700	1.750	2.000	1.322
-2449		.049									1.322

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.

ELBOW, 90°, FEMALE TO BRAZE/WELD, INCONEL 718

ME273-0144

SHEET 1 OF 2

Data Sheet Revised



FITTINGS, DYNATUBE[®] AND DUAL SEAL*

2733-95
15 SEPTEMBER 1977

MATERIAL:

BODY AND NUT - INCONEL 718 PER AMS 5663

NUT RETAINING WIRE - 302 CRES PER AMS 5637, OR 305 CRES PER AMS 5685

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129.

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY.

APPLICATION: SPACE SHUTTLE PROGRAM CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

NOTES:

- ② 1. NICKEL PLATE THE SHANK OD (FOR .500 LENGTH AS A MINIMUM) .0002 TO .0005 INCH THICK PER QQ-N-290, CLASS 1, GRADE G TO FACILITATE BRAZING. TOLERANCE ON DIAMETER SHALL APPLY AFTER PLATING.

DYNATUBE[®] IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.
DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

ELBOW, 90°, FEMALE TO BRAZE/WELD,
INCONEL 718

ME273-0144

SHEET 2 OF 2

Data Sheet Revised



Rockwell
International
Space Division

AND DUAL SEAL*

SAFETY CONTROL MARKING	Y THREAD CLASS 30	A	B	C	D	E	F	G	H	J	P	K	L	M
①	.6378-34 UNUS	1.042	.253	1.014	1.301	.800	.454	1.040	.500	.562	.180	.188	.261	.047
②	.6423-34 UNUS	1.042	.311	1.014	1.301	.800	.454	1.040	.500	.562	.180	.188	.261	.047
④	.6423-30 UNUS	1.042	.378	1.178	1.491	.945	.518	1.150	.625	.688	.292	.188	.334	.047
④	.7100-30 UNUS	1.042	.503	1.294	1.800	1.045	.510	1.150	.750	.875	.292	.188	.334	.047
④	.8430-18 UNUS	1.042	.629	1.485	1.644	1.178	.571	1.162	.875	1.000	.314	.188	.423	.070
④	1.1885-16 UNUS	1.042	.754	1.627	1.788	1.318	.537	1.220	1.000	1.125	.314	.250	.495	.070
④	1.2300-14 UNUS	1.042	1.004	1.895	2.258	1.529	.705	1.620	1.250	1.375	.314	.250	.712	.070
④	1.5156-14 UNUS	1.042	1.254	2.026	2.399	1.685	.687	1.620	1.500	1.625	.314	.250	.849	.070
④	1.7812-14 UNUS	1.042	1.504	2.438	2.682	1.984	.800	1.700	1.750	2.000	.314	.281	1.065	.070

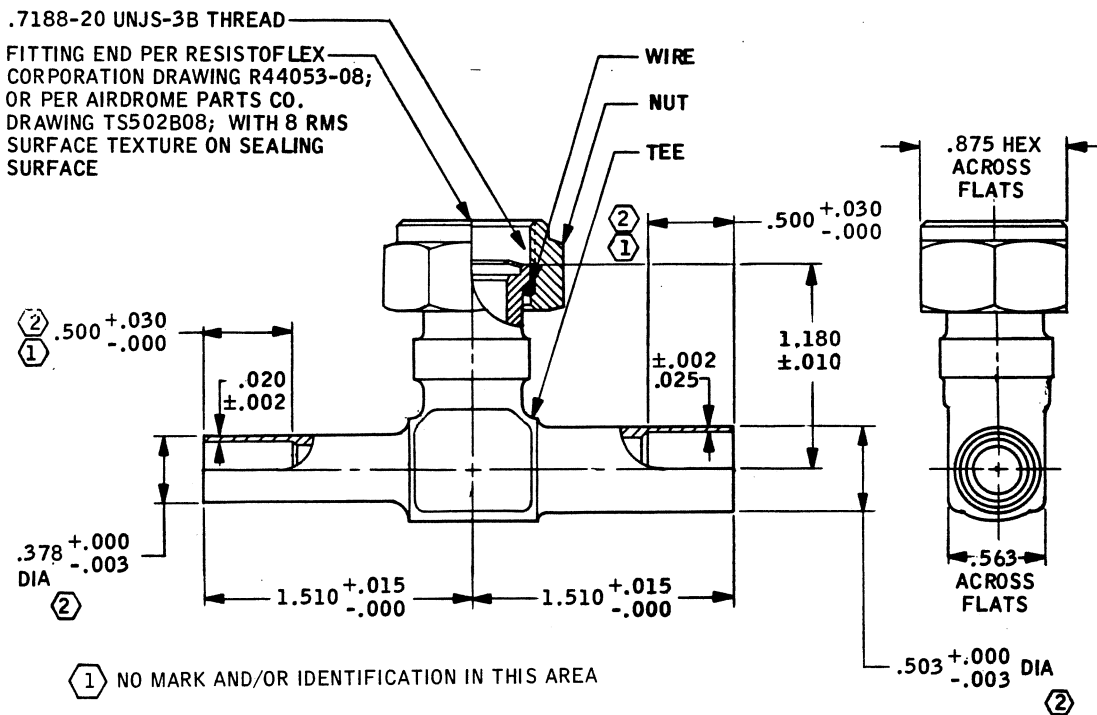
- ① NO MARKING OR IDENTIFICATION IN THIS AREA
- ② ELBOW WITHOUT SAFETY WIRE HOLES
- ④ ELBOW WITH SAFETY WIRE HOLES

SIZE A	CODE IDENT NO. 03953	DRAWING NO. ME273-0144
DATE	REV 6	SHEET 5 OF 5

2733-96

15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



1 NO MARK AND/OR IDENTIFICATION IN THIS AREA

SOURCE CONTROL DRAWING DASH NUMBER -0001

MATERIAL:

BODY AND NUT - INCONEL 718 PER AMS 5663
 NUT RETAINING WIRE - 302 CRES PER AMS 5637, OR
 305 CRES PER AMS 5685

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129.

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY.

APPLICATION: SPACE SHUTTLE PROGRAM CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

NOTES:

- 2 1. NICKEL PLATE THE SHANK OD (FOR .500 LENGTH AS A MINIMUM) .0002 TO .0005 INCH THICK PER QQ-N-290, CLASS 1, GRADE G TO FACILITATE BRAZING. TOLERANCE ON DIAMETER SHALL APPLY AFTER PLATING.

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR
 PROCUREMENT OR INSPECTION PURPOSES.

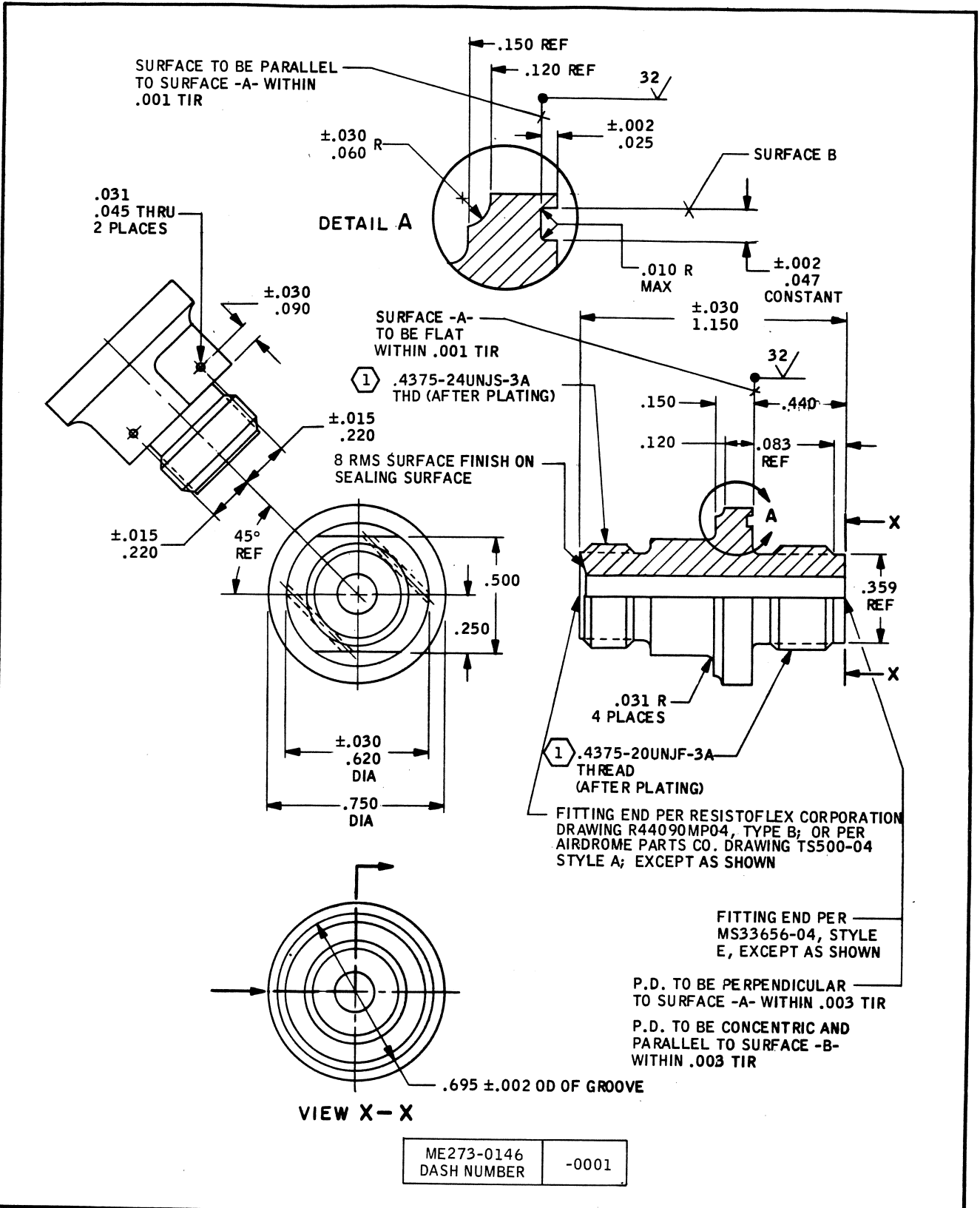
TEE, EXPANDER, BRAZE/WELD ON RUN,
 FEMALE ON SIDE, INCONEL 718

ME273-0145

SHEET 1 OF 1

*Data Sheet Revised

FITTINGS, DYNATUBE® AND DUAL SEAL*



ME273-0146
DASH NUMBER -0001

<p>PARTS DATA SHEET</p> <p>FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.</p>	<p>ADAPTER, MALE FLANGED, INCONEL 718</p>	<p>ME273-0146</p> <p>SHEET 1 OF 2</p>
---	---	---------------------------------------

Data Sheet Revised



2733-98

15 SEPTEMBER 1977

FITTINGS, DYNATUBE[®] AND DUAL SEAL*

MATERIAL: INCONEL 718 PER AMS 5663

FINISH: CLEAN AND PASSIVATE PER MIL-S-5002

① SILVER PLATE THREADED SURFACE .0002 TO .0004 THICKNESS
PER AMS 2410

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS.

DYNATUBE[®] IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.
DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

ADAPTER, MALE FLANGED,
INCONEL 718

ME273-0146

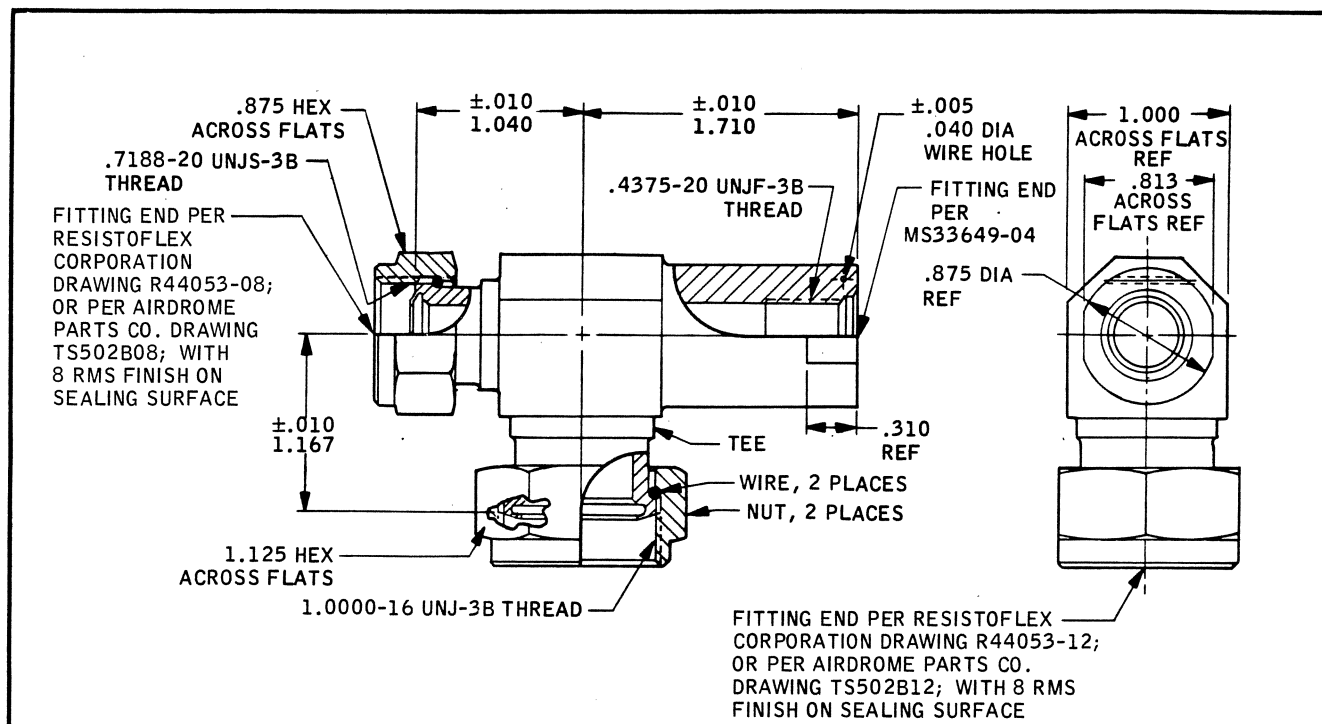
SHEET 2 OF 2

Data Sheet Revised



Space Division
Rockwell International

FITTINGS, DYNATUBE® AND DUAL SEAL*



ME273-Q149 DASH NUMBER
-0001

MATERIAL: TEE AND NUT - INCONEL 718 PER AMS 5663
NUT RETAINING WIRE - 302 CRES PER AMS 5637, OR 305 CRES PER AMS 5685

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

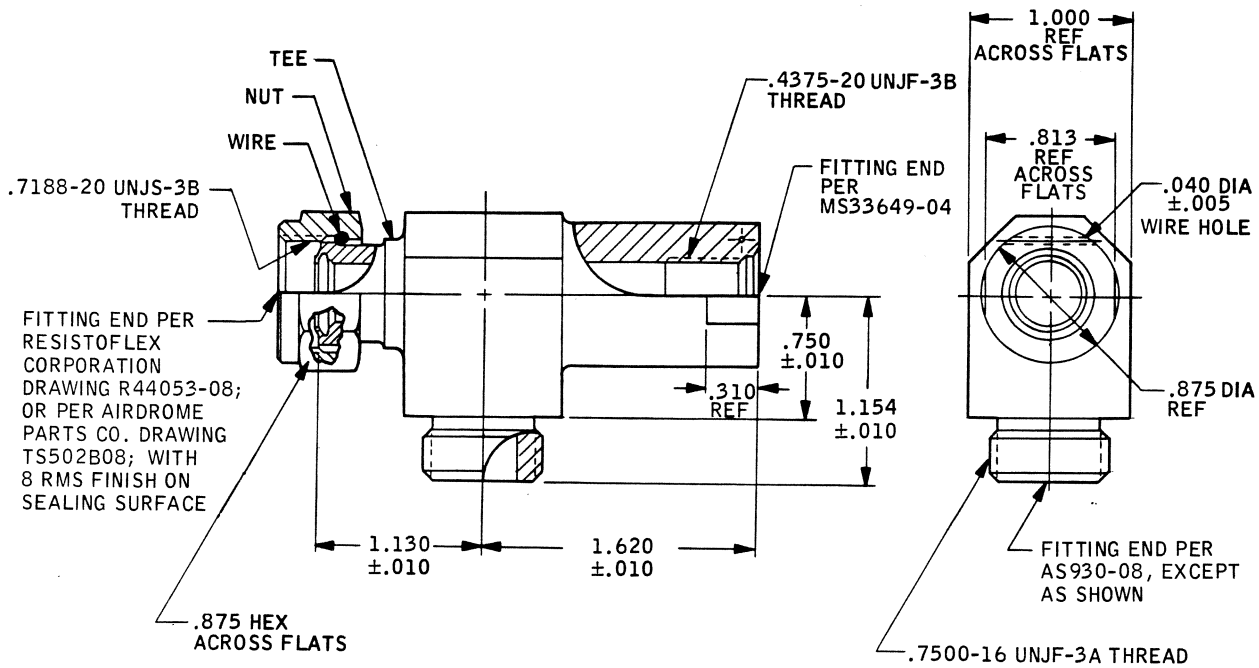
PARTS DATA SHEET FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.	FTG ASSY, TEE, FEMALE TO BOSS ON RUN, FEMALE ON SIDE, INCONEL 718	ME273-0149
		SHEET 1 OF 1

FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-102

15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



ME273-0150
DASH NUMBER

-0001

MATERIAL: TEE AND NUT - INCONEL 718 PER AMS 5663

NUT RETAINING WIRE - 302 CRES PER AMS 5637, OR
305 CRES PER AMS 5685

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

FTG ASSY, TEE, FEMALE TO BOSS ON RUN,
MALE ON SIDE, INCONEL 718

ME273-0150

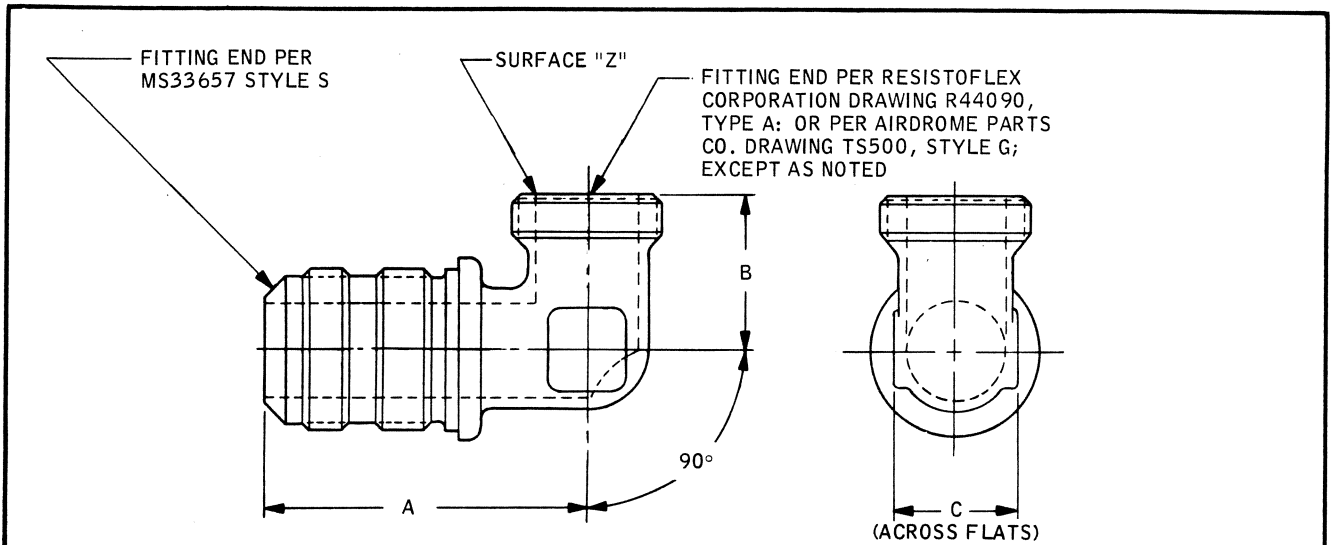
SHEET 1 OF 1

Data Sheet Revised



Space Division
Rockwell International

FITTINGS, DYNATUBE® AND DUAL SEAL*



ME273-0151 DASH NUMBER	TUBE SIZE REF	A ±.015	B ±.015	C REF
-0004 ①	1/4	1.601	.617	.375
-0005 ①	5/16	1.637	.653	.438
-0006 ①	3/8	1.768	.704	.500
-0008 ①	1/2	2.077	.824	.562
-0010 ①	5/8	2.306	.955	.688
-9012 ①	3/4	2.565	1.062	.875
③ -0012 ②	3/4	2.565	1.062	.875
-0016 ②	1	2.708	1.246	1.125
-0020 ②	1-1/4	2.899	1.387	1.375
-0024 ②	1-1/2	3.131	1.688	1.625
④ -0032 ②	2	3.770	2.176	2.250

③ INACTIVE FOR DESIGN AND PROCUREMENT AFTER 2 MAY 1977. USE -9012.

④ INACTIVE FOR DESIGN AND PROCUREMENT AFTER 2 MAY 1977. NO SUPERSEDING DASH NUMBER.

PARTS DATA SHEET	ELBOW, 90°, BULKHEAD TO MALE, 17-4PH	ME273-0151
FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.		SHEET 1 OF 2

2733-104
15 SEPTEMBER 1977

FITTINGS, DYNATUBE[®] AND DUAL SEAL*

MATERIAL: 17-4PH CRES PER AMS 5643, HEAT TREAT TO CONDITION H-1075
(145 KSI TENSILE MIN) PER MIL-H-6875

FINISH: PASSIVATE PER MIL-S-5002

COATING: ① ELBOWS -0004 THRU -0010, AND -9012, UNCOATED WITH 8 RMS SURFACE
TEXTURE ON SEALING SURFACE "Z"

② ELBOWS -0012 THRU -0032, THE SEALING SURFACE "Z" SHALL BE COATED
PER AMS 2515C WITH DUPONT 850-204 TETRAFLUOROETHYLENE (TFE) TO A
THICKNESS OF .1-.6 MILS

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM NON-CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

DYNATUBE[®] IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

ELBOW, 90°, BULKHEAD TO MALE,
17-4PH

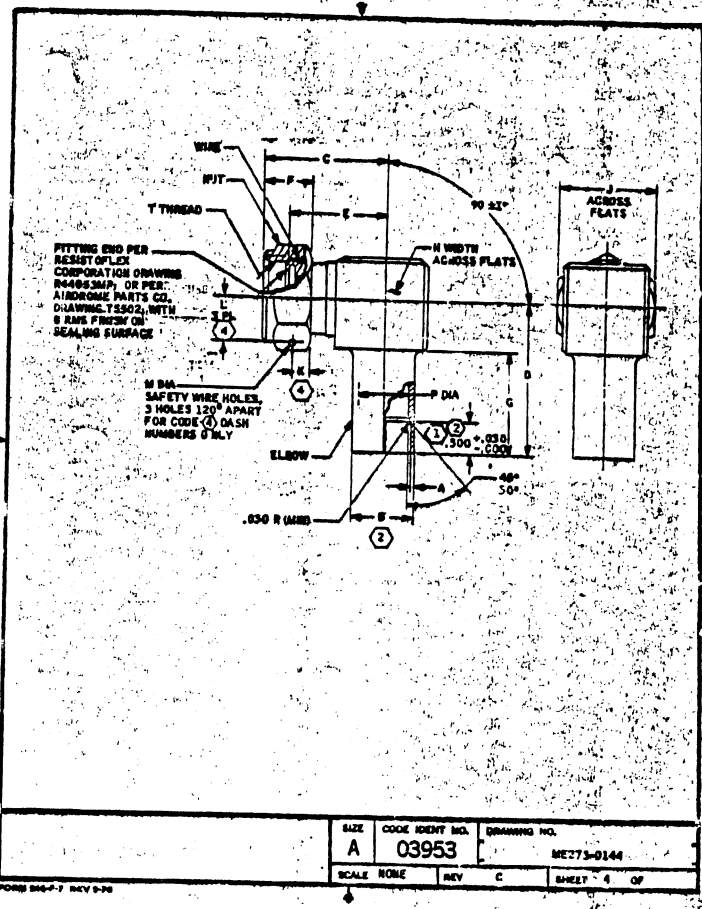
ME273-0151

SHEET 2 OF 2

Data Sheet Revised

SHUTTLE

APPLICATION		REVISIONS				
NEXT ACRY	USED ON	LTR	DESCRIPTION	DATE	APPROVED	
NOT APPLICABLE			SEE REVISION SHEET			
SOURCE CONTROL DRAWING						
<small>UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.</small> <small>TOLERANCES UNLESS OTHERWISE SPECIFIED</small> <small>DECIMALS .0015 .001 .0005 .0002 .0001</small> <small>FRACTIONS 1/32 1/64 3/32 1/16 1/8 3/16 1/4 5/16 3/8 7/16 1/2 5/8 3/4 7/8 1 1 1/8 1 1/4 1 1/2 1 3/4 2 2 1/4 2 1/2 3 3 1/4 3 1/2 4 4 1/4 4 1/2 5 5 1/4 5 1/2 6 6 1/4 6 1/2 7 7 1/4 7 1/2 8 8 1/4 8 1/2 9 9 1/4 9 1/2 10</small> <small>ANGLES 15° 30° 45° 60° 75° 90° 105° 120° 135° 150° 165° 180°</small> <small>THREADS PER INCH 11.5 11.75 12 12.25 12.5 12.75 13 13.25 13.5 13.75 14 14.25 14.5 14.75 15</small> <small>ROUNDED CORNERS UNLESS OTHERWISE SPECIFIED</small> <small>UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.</small> <small>TOLERANCES UNLESS OTHERWISE SPECIFIED</small> <small>DECIMALS .0015 .001 .0005 .0002 .0001</small> <small>FRACTIONS 1/32 1/64 3/32 1/16 1/8 3/16 1/4 5/16 3/8 7/16 1/2 5/8 3/4 7/8 1 1 1/8 1 1/4 1 1/2 1 3/4 2 2 1/4 2 1/2 3 3 1/4 3 1/2 4 4 1/4 4 1/2 5 5 1/4 5 1/2 6 6 1/4 6 1/2 7 7 1/4 7 1/2 8 8 1/4 8 1/2 9 9 1/4 9 1/2 10</small> <small>ANGLES 15° 30° 45° 60° 75° 90° 105° 120° 135° 150° 165° 180°</small> <small>THREADS PER INCH 11.5 11.75 12 12.25 12.5 12.75 13 13.25 13.5 13.75 14 14.25 14.5 14.75 15</small> <small>ROUNDED CORNERS UNLESS OTHERWISE SPECIFIED</small>						
DR BY <u>M. JIMENEZ</u> 0/75 CHK BY <u>[Signature]</u>		SPACE DIVISION ROCKWELL INTERNATIONAL 1224 LAKEWOOD BOULEVARD • DONNEY, CALIFORNIA 94501				
APPROVALS [Signatures]		ELBOW, 90°, FEMALE TO BRAZE/WELD, INCONEL 718				
SIZE	CODE IDENT NO.	DRAWING NO.				
A	03953	ME273-0144				
SCALE	NONE	REV	C	SHEET 1 OF 2		



INDEX	
SHEET NO.	SUBJECT
1	TITLE
2	INDEX
3	GENERAL NOTES
4 & 5	CONFIGURATION REQUIREMENTS
6	REVISION SHEET
7 & 8	APPROVED SOURCES OF SUPPLY

SIZE	CODE IDENT NO.	DRAWING NO.
A	03953	ME273-0144
SCALE	NONE	REV C
SHEET 2 OF		

NOTES: UNLESS OTHERWISE SPECIFIED

- PROCUREMENT SPECIFICATION ME273-0129.
- MATERIAL:
BODY AND NUT - INCONEL 718 PER AMS 5665
NUT RETAINING WIRE - 302 CRSS PER AMS 5637, OR 305 CRSS PER AMS 5685
- FINISH: PASSIVATE PER MIL-S-3002
- NICKEL PLATE THE HANK OD (FOR .500 LENGTH AS A MINIMUM) .0002 TO .0005 INCH THICK PER QQ-N-500, CLASS 1, GRADE G TO FACILITATE BRAZING. TOLERANCE ON DIAMETER SHALL APPLY AFTER PLATING.
- TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY.
- ONLY THE ITEMS DESCRIBED ON THIS DRAWING WHEN PROCURED FROM THE VENDORS LISTED HEREON ARE APPROVED BY SPACE DIVISION OF ROCKWELL INTERNATIONAL CORPORATION, DONNEY, CALIFORNIA FOR USE IN THE APPLICATION(S) SPECIFIED HEREON. A SUBSTITUTE ITEM SHALL NOT BE USED WITHOUT PRIOR TESTING AND APPROVAL BY SPACE DIVISION OF ROCKWELL INTERNATIONAL CORPORATION OR BY THE GOVERNMENT PROCURING ACTIVITY.

SIZE	CODE IDENT NO.	DRAWING NO.
A	03953	ME273-0144
SCALE	NONE	REV C
SHEET 3 OF		

2733-109

3409

SHUTTLE

PREPARED BY J. WELSH 082-500 2-1698 APPROVAL U. J. EDRE T. A. ELD S. LUCKER	CODE IDENT. NO. 03953 Rockwell International Space Systems Group AMENDMENT ELBOW, 90°, FEMALE TO BRAZE/ WELD, INCONEL 718	DOCUMENT NUMBER ME273-0144 REV C 01 DOCUMENT TYPE SOURCE CONTROL DW. AUTHORITY MCR 6027, 0040111 DATE 2-29-80 PAGE 1 OF 1 SUBJECT CHANGE-RELEASE
--	--	--

DIRECT DRAWING CHANGES INCORPORATED AND RELEASED AT "C" REVISION

SHEET 4

- ADDED TO FIELD OF DRAWING:
 DIMENSION K (4), DIMENSION L 3 PL (4), M DIA SAFETY WIRE HOLES,
 3 HOLES 120° APART FOR CODE (A) DASH NUMBERS ONLY

SHEET 5

- ADDED CODE (3) TO DASH NUMBERS -0420 THRU -2449
- ADDED CODE (4) COLUMNS WITH DASH NUMBERS -0001 THRU -0018
- ADDED:
 (3) ELBOW WITHOUT SAFETY WIRE HOLES
 (4) ELBOW WITH SAFETY WIRE HOLES
- ADDED TABULATED COLUMNS K, L AND M

SHEET 7

- ADDED DASH NUMBERS -0001 THRU -0010, AND SUPPLIERS PART NUMBERS
 R44875-90MFM04U20 THRU R44875-90MFM24U49 TO RESISTOFLEX CORPORATION

SHEET 8 (ADDED)

- ADDED DASH NUMBERS -0001 THRU -0018, AND SUPPLIERS PART NUMBERS
 AP556R04-020W THRU AP556R24-049W TO AIRDRONE PARTS CO.

RECEIVED
MAY 13 1980

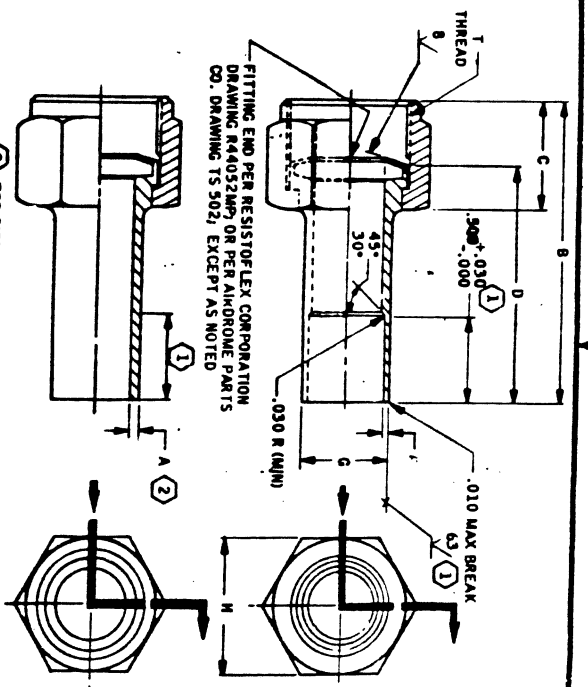
APPLICATION		REVISIONS			
EXT ASSY	USED ON	LTR	DESCRIPTION	DATE	APPROVED
✓	✓		SEE REVISION SHEET		

THE ABOVE SPECIFIED PARTS ARE TO BE USED IN THE FOLLOWING MANNER:
 DR BY: M. J. JINENEZ
 CHK BY: [Signature]
 APPROVALS: [Signature]
 T. R. KELLY
 H. GALLANES

12214 Lakewood Boulevard, Downey, California 90241
 Rockwell International Corporation
 Space Division
 UNION, FEMALE THREADED TO BRAZE/WELD,
 INCONEL 718

SIZE: A
 CODE IDENT NO.: 03953
 DRAWING NO.: ME273-0155
 SCALE: NONE
 REV. A
 SHEET 1 OF 6

SOURCE CONTROL DRAWING



SOURCE CONTROL DRAWING DASH NUMBER	T THREAD CLASS 38	A	B REF	C ±.015	D ±.015	G DIA	H REF
-0420	.4375-24 UNJS	.020	1.529	.454	1.300	.253	.562
-0435 (2)	.5000-24 UNJS	.035	1.589	.459	1.355	.315	.625
-0520	.5625-20 UNJS	.020	1.693	.518	1.440	.378	+0.000 -.003
-0635 (2)	.7188-20 UNJS	.035	1.691	.510	1.421	.503	.875
-0825 (2)	.8438-18 UNJS	.025	1.768	.571	1.437	.629	1.000
-1025	1.0000-16 UNJ	.028	1.899	.637	1.532	.754	+0.000 -.004
-1072 (2)	1.2500-14 UNJS	.049	2.400	.705	1.990	1.004	1.125
-1228		.028					
-1249 (2)		.049					
-1628		.028					
-1649		.049					
-1683 (2)		.083					

1 NO MARKING OR IDENTIFICATION IN THIS AREA. 2 SURFACE TEXTURE THIS AREA.

FORM 344-P7 REV 9-70
 SIZE: A
 CODE IDENT NO.: 03953
 DRAWING NO.: ME273-0155
 SCALE: NONE
 REV. A
 SHEET 4 OF 6

INDEX

SHEET NO.

SHEET NO.	TITLE	SUBJECT
1	INDEX	
2	INDEX	
3	GENERAL NOTES	
4	CONFIGURATION REQUIREMENTS	
5	REVISION SHEET	
6	APPROVED SOURCES OF SUPPLY	

SIZE	CODE IDENT NO.	DRAWING NO.
A	03953	ME273-0155
SCALE	NOTE	REV A
		SHEET 2 OF

FORM 94-7, REV 9-70

NOTES: UNLESS OTHERWISE SPECIFIED

1. PROCUREMENT SPECIFICATION MC273-0129.
2. MATERIAL: INCONEL 718 PER AMS 5662.
3. FINISH: PASSIVATE PER MIL-S-5002.
4. TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEAB.
5. ONLY THE ITEMS DESCRIBED ON THIS DRAWING WHEN PROCURED FROM THE VENDORS LISTED HEREBY ARE APPROVED BY SPACE DIVISION OF ROCKWELL INTERNATIONAL CORPORATION, DOWNY, CALIFORNIA FOR USE IN THE APPLICATION(S) SPECIFIED HEREBY. A SUBSTITUTE ITEM SHALL NOT BE WITHOUT PRIOR TESTING AND APPROVAL BY SPACE DIVISION OF ROCKWELL INTERNATIONAL CORPORATION OR BY THE GOVERNMENT PROCURING ACTIVITY.
6. THE TUBULAR SHANK OF THE FITTING SHALL BE BRIGHT AND FREE FROM DISCOLORATION DUE TO TIGHTLY ADHERING OXIDE FILMS.

SIZE	CODE IDENT NO.	DRAWING NO.
A	03953	ME273-0155
SCALE	NOTE	REV A
		SHEET 3

FORM 94-7, REV 9-70

SIZE	CODE IDENT NO.	DRAWING NO.
A	03953	ME273-0155
SCALE NONE	REV A	SHEET 5 OF

FORM 846-F-13 NEW 11-72

APPROVED SOURCES OF SUPPLY

SOURCE CONTROL DRAWING DASH NUMBER	SUPPLIER	SUPPLIER PART NUMBER	APPLICATION
-0420 -0435 -0520 -0620 -0635 -0825 -0865 -1025 -1072 -1228 -1249 -1628 -1649 -1683	RESISTOFLEX CORPORATION WESTERN DIVISION 301 N. CRESCENT WAY ANAHEIM, CA 92803 CODE IDENT NO. 06851	R44882NFN04-20 R44882NFN04-35 R44882NFN05-20 R44882NFN06-20 R44882NFN06-35 R44882NFN08-25 R44882NFN08-65 R44882NFN10-25 R44882NFN10-72 R44882NFN12-28 R44882NFN12-49 R44882NFN16-28 R44882NFN16-49 R44882NFN16-83	SPACE SHUTTLE PROGRAM CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS
-0420 -0435 -0520 -0620 -0635 -0825 -0865 -1025 -1072 -1228 -1249 -1628 -1649 -1683	AIRDROME PARTS CO. 3251 AIRPORT WAY LONG BEACH, CA 90808 CODE IDENT NO. 01673 AIRDROME PARTS CO. IS A LICENSEE OF TITEFLEX DIVISION OF ATLAS CORP. 603 HENDEE ST. SPRINGFIELD, MASS 01109	AP451-04-020 AP451-04-035 AP451-05-020 AP451-06-020 AP451-06-035 AP451-08-025 AP451-08-065 AP451-10-025 AP451-10-072 AP451-12-028 AP451-12-049 AP451-16-028 AP451-16-049 AP451-16-083	

SIZE	CODE IDENT NO.	DRAWING NO.
A	03953	ME273-0155
SCALE NONE	REV A	SHEET 6 OF

FORM 846-F-7 REV 9-70


3020

PREPARED BY J. NELSON 092-500 AE99 2-370B	APPROVAL <i>[Signature]</i> L.M.V. GREGOR L.J. KORB <i>[Signature]</i> T.R. KELLY 77 V. JOHNSON 1/1/77

CODE IDENT. NO. 03953

Space Division
Rockwell International

AMENDMENT



DOCUMENT NUMBER ME273-0155	REV A	SEQ 01
DOCUMENT TYPE SOURCE CONTROL DRAWING		
AUTHORITY GO-JOU39		
DATE 3-8-77	PAGE OF	1 1
SUBJECT CHANGE-RELEASE		

DIRECT DRAWING CHANGES INCORPORATED AND RELEASED AT "A" REVISION

SHEET 1 TITLE CHANGE

- UNION, FEMALE THREADED TO BRAZE/WELD, INCONEL 718

WAS:

FITTING ASSEMBLY, FEMALE THREADED TO SLEEVE BRAZING/WELDING, INCONEL 718

SHEET 3

- ADDED:

FINISH: PASSIVATE PER MIL-S-5002

SHEET 4

- FITTING END PER RESISTOFLEX CORPORATION DRAWING R44052MP; OR PER AIRDROME PARTS CO. DRAWING TS 502; EXCEPT AS NOTED

WAS:

FITTING END PER RESISTOFLEX CORPORATION DRAWING R44052 8 RMS FINISH ON SEALING SURFACE

- DELETE FROM F/D; 2 PLACES:

IDENTIFICATION MARKING PER RES 135

- ADDED ALTERNATE FIGURE AND $\text{\textcircled{2}}$ FOR SIZES WHERE INSIDE DIAMETER AT TUBE END IS SMALLER THAN INSIDE DIAMETER AT R44052MP OR TS 502 END

- ADDED CODE $\text{\textcircled{2}}$ TO DASH NUMBERS -0435, -0635, -0865, -1072, -1249 AND -1683.

SHEET 6

- ADDED DUPLICATE LIST OF SOURCE CONTROL DRAWING DASH NUMBERS AND CORRESPONDING AIRDROME PARTS CO. PART NUMBERS

OFFICIALLY
RELEASED
MAR 14 1977
2:10 PM
ENGINEERING

FORM 1048-E REV 2-74

CODE IDENT. NO. 03953

ME273-0155	A	01	PAGE 2
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SHEET 6 (CONTINUED)

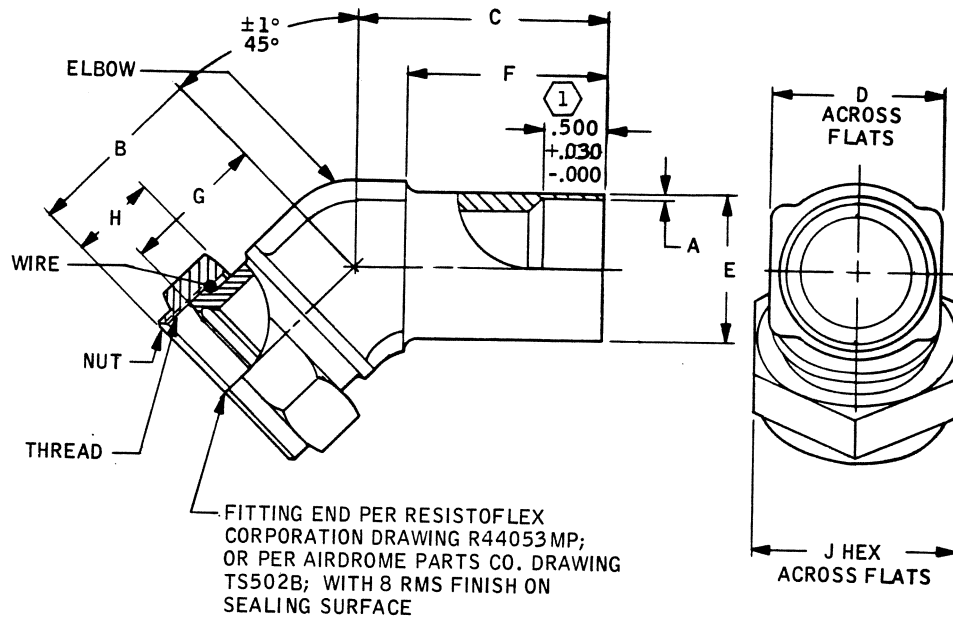
- ADDED AS SECOND APPROVED SOURCE OF SUPPLY:

AIRDROME PARTS CO.
3251 AIRPORT WAY
LONG BEACH, CA 90808

- ADDED:

AIRDROME PARTS CO. IS A LICENSEE
OF TITFLEX, DIVISION OF ATLAS CORP.,
603 HENDEE ST.
SPRINGFIELD, MASS. 01109

FITTINGS, DYNATUBE® AND DUAL SEAL*



1 NO MARKING AND/OR IDENTIFICATION IN THIS AREA.

ME273-0162 DASH NUMBER	TUBE SIZE REF	T THREAD	A ±.002	B REF	C ±.010	D REF	E	F ±.010	G ±.015	H ±.015	J
-0420	1/4	.4375-24 UNJS-3B	.020	.868	1.212	.375	.253	1.040	.662	.454	.562
-0428			.028								
-0435			.035								
-0520	5/16	.5000-24 UNJS-3B	.020	.895	1.338	.438	.315	1.150	.685	.459	.625
-0620	3/8	.5625-20 UNJS-3B	.020	1.002	1.353	.500	.378	1.150	.769	.518	.688
-0635			.035								
-0820	1/2	.7188-20 UNJS-3B	.020	1.054	1.400	.562	.503	1.150	.805	.510	.875
-0825			.025								
-0865			.065								
-1020	5/8	.8438-18 UNJS-3B	.020	1.208	1.443	.688	.629	1.162	.901	.571	1.000
-1025			.025								
-1072			.072								
-1220	3/4	1.0000-16 UNJ-3B	.020	1.347	1.532	.875	.754	1.220	1.004	.637	1.125
-1228			.028								
-1249			.049								
-1628	1	1.2500-14 UNJS-3B	.028	1.501	1.995	1.125	1.004	1.620	1.135	.705	1.375
-1649			.049								
-1683			.083								
-2035	1-1/4	1.5156-14 UNJS-3B	.035	1.544	2.042	1.375	1.254	1.620	1.173	.687	1.625
-2049			.049								
-2435	1-1/2	1.7812-14 UNJS-3B	.035	1.822	2.200	1.625	1.504	1.700	1.368	.800	2.000
-2449			.049								

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.

ELBOW, 45°, FEMALE TO BRAZE/WELD, 17-4PH

ME273-0162

SHEET 1 OF 2

Data Sheet Revised



Space Division
Rockwell International

FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-122

15 SEPTEMBER 1977

FITTINGS, DYNATUBE[®] AND DUAL SEAL*

MATERIAL: ELBOW AND NUT - 17-4PH CRES PER AMS 5643, HEAT TREAT TO CONDITION H-1075
(145 KSI TENSILE MIN) PER MIL-H-6875

NUT RETAINING WIRE - 302 CRES PER AMS 5637, OR
305 CRES PER AMS 5685

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: ME273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM NON-CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

DYNATUBE[®] IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

ELBOW, 45°, FEMALE TO
BRAZE/WELD, 17-4PH

ME273-0162

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

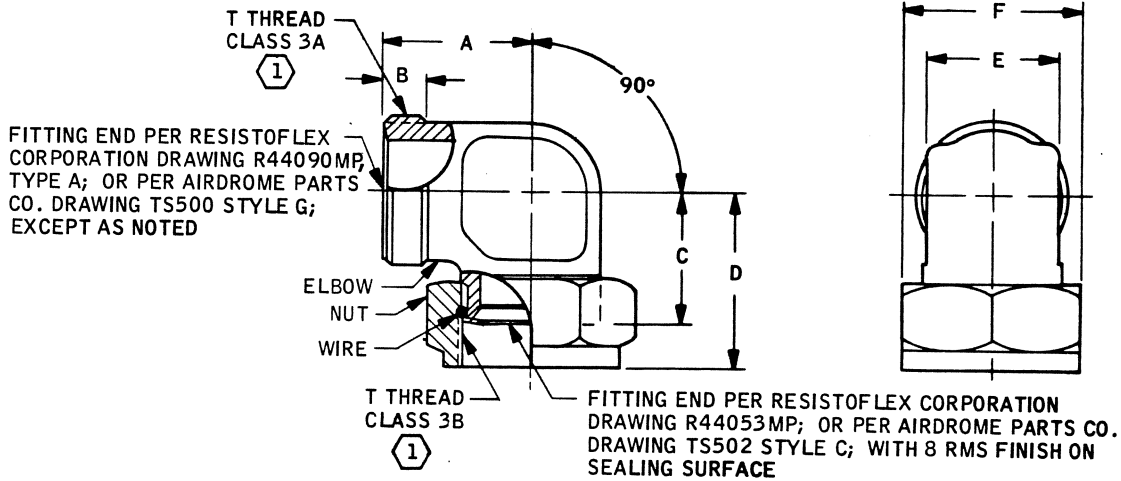
SHEET 2 OF 2

Data Sheet Revised



Space Division
Rockwell International

FITTINGS, DYNATUBE® AND DUAL SEAL*



SOURCE CONTROL DRAWING DASH NUMBER	TUBE SIZE (REF)	T THREAD ^①	A ±.015	B ±.020	C ±.015	D REF	E REF	F REF
-0004 ^②	1/4	.4375-24 UNJS	.617	.212	.517	.723	.375	.562
-0005 ^②	5/16	.5000-24 UNJS	.653	.212	.551	.761	.438	.625
-0006 ^②	3/8	.5625-20 UNJS	.704	.220	.618	.851	.500	.688
-0008 ^②	1/2	.7188-20 UNJS	.824	.233	.672	.921	.562	.875
-0010 ^②	5/8	.8438-18 UNJS	.955	.289	.738	1.045	.688	1.000
-9012 ^②	3/4	1.0000-16 UNJ	1.062	.318	.846	1.189	.875	1.125
-9014 ^②	7/8	1.1250-16 UNJ	1.216	.333	1.052	1.400	1.125	1.250
^④ -0012 ^③	3/4	1.0000-16 UNJ	1.062	.318	.846	1.189	.875	1.125
^④ -0014 ^③	7/8	1.1250-16 UNJ	1.216	.333	1.052	1.400	1.125	1.250
-0016 ^③	1	1.2500-14 UNJS	1.246	.353	1.149	1.515	1.125	1.375
-0020 ^③	1-1/4	1.5156-14 UNJS	1.387	.350	1.150	1.521	1.375	1.625
-0024 ^③	1-1/2	1.7812-14 UNJS	1.688	.435	1.368	1.822	1.625	2.000

^④ INACTIVE FOR DESIGN AND PROCUREMENT AFTER 24 JUNE 1977. USE -9012 OR -9014.

PARTS DATA SHEET FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.	ELBOW, 90°, MALE TO FEMALE, 17-4PH	ME273-0163
		SHEET 1 OF 2

2733-124
15 SEPTEMBER 1977

FITTINGS, DYNATUBE[®] AND DUAL SEAL*

MATERIAL: ELBOW AND NUT - 17-4PH CRES PER AMS 5643, HEAT TREAT TO CONDITION H-1075
(145 KSI TENSILE MIN) PER MIL-H-6875

NUT RETAINING WIRE - 302 CRES PER AMS 5637, OR
305 CRES PER AMS 5685

FINISH: PASSIVATE PER MIL-S-5002

COATING: ② ELBOWS -0004 THRU -0010, -9012 AND -9014, UNCOATED WITH 8 RMS SURFACE
TEXTURE ON MALE FITTING END SEALING SURFACE

③ ELBOWS -0012 THRU -0024, THE SEALING SURFACE OF THE MALE FITTING END
SHALL BE COATED PER AMS 2515C WITH DUPONT 850-204 TETRAFLUOROETHYLENE
(TFE) TO A THICKNESS OF .1-.6 MILS

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY.

APPLICATION: SPACE SHUTTLE PROGRAM NON-CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

DYNATUBE[®] IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

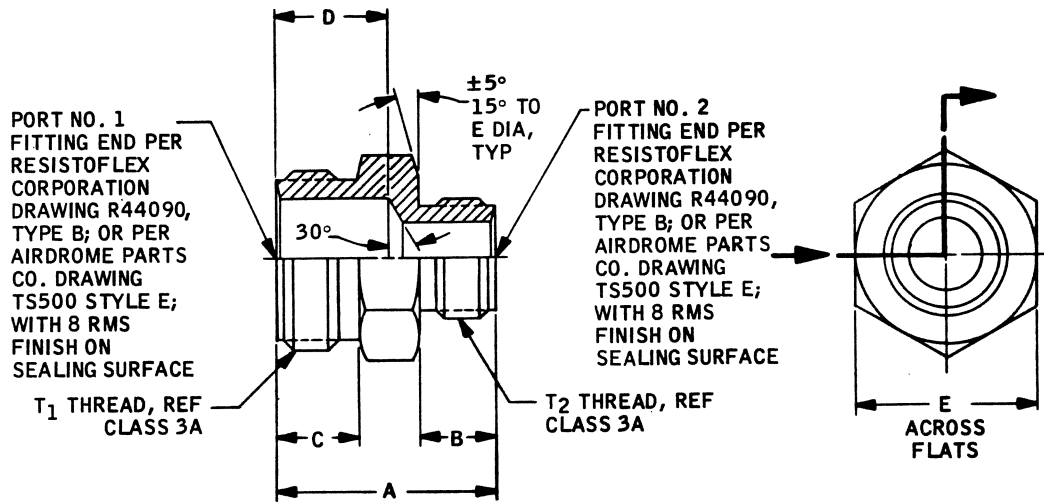
ELBOW, 90°, MALE TO FEMALE,
17-4PH

ME273-0163

SHEET 2 OF 2

Data Sheet Revised

FITTINGS, DYNATUBE® AND DUAL SEAL*



SOURCE CONTROL DRAWING DASH NO.	TUBE SIZE (REF)		T ₁ THREAD CLASS 3A	T ₂ THREAD CLASS 3A	A ±.015	B ±.015	C ±.015	D ±.015	E REF
	PORT NO. 1	PORT NO. 2							
-0604	3/8	1/4	.5625-20 UNJS	.4375-24 UNJS	.758	.275	.295	.348	.562
-0804	1/2	1/4	.7188-20 UNJS	.5625-20 UNJS	.825	.295	.308	.385	.750
-0806		3/8			.418				
-1004	5/8	1/4	.8438-18 UNJS	.5625-20 UNJS	.939	.275	.372	.466	.875
-1006		3/8						.499	
-1008		1/2						.528	

MATERIAL: 17-4PH PER AMS 5643, HEAT TREAT TO CONDITION H-1075 (145 KSI TENSILE MIN) PER MIL-H-6875

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129

CONTROL NUMBER EXAMPLE:

ME273-0164-0806 = REDUCER FOR 1/2 TUBE SIZE TO 3/8 TUBE SIZE

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM NON-CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

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PARTS DATA SHEET

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CONNECTOR, REDUCER, MALE THREADED, 17-4PH

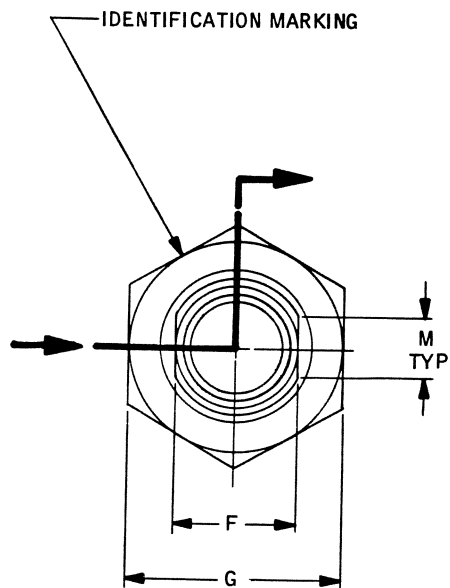
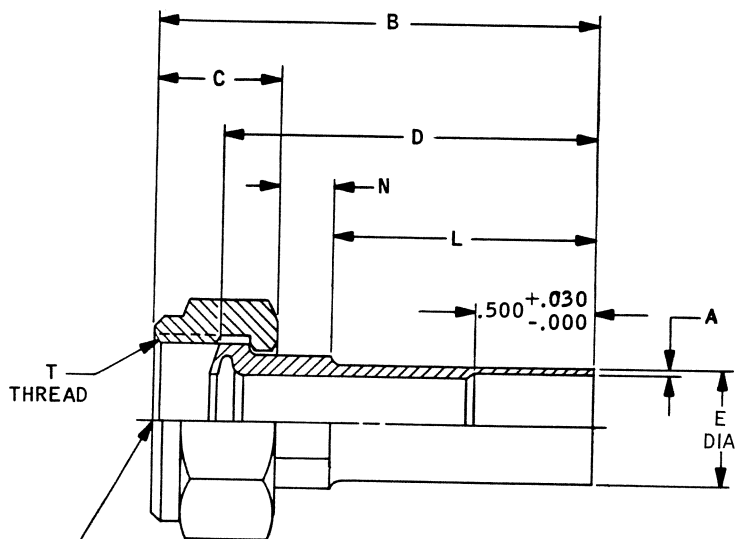
ME273-0164

SHEET 1 OF 1

FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-126
15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



FITTING END PER RESISTOFLEX CORPORATION DRAWING R44052MP; OR PER AIRDROME PARTS CO. DRAWING TS 502A; WITH 8 RMS FINISH ON SEALING SURFACE

SOURCE CONTROL DRAWING DASH NO.	TUBE SIZE (NOM)	T THREAD	A ±.002	B REF	C ±.015	D ±.015	E DIA FOR .500 LENGTH		F REF	G REF	L REF	M REF	N REF
-0420	1/4	.4375-24 UNJS-3B	.020	1.829	.454	1.600	.253	+0.000 -0.003	.250	.562	1.040	.180	.335
-0428	1/4	.4375-24 UNJS-3B	.028	1.829	.454	1.600	.253	+0.000 -0.003	.250	.562	1.040	.180	.335
-0620	3/8	.5625-20 UNJS-3B	.020	1.993	.518	1.740	.378	+0.000 -0.003	.375	.688	1.150	.208	.325
-0635	3/8	.5625-20 UNJS-3B	.035	1.993	.518	1.740	.378	+0.000 -0.003	.375	.688	1.150	.208	.325
-0820	1/2	.7188-20 UNJS-3B	.020	1.991	.510	1.721	.503	+0.000 -0.003	.500	.875	1.150	.258	.331
-0842	1/2	.7188-20 UNJS-3B	.042	1.991	.510	1.721	.503	+0.000 -0.003	.500	.875	1.150	.258	.331
-1020	5/8	.8438-18 UNJS-3B	.020	2.068	.571	1.737	.629	+0.000 -0.004	.625	1.000	1.162	.321	.335
-1220	3/4	1.0000-16 UNJ-3B	.020	2.199	.637	1.832	.754	+0.000 -0.004	.750	1.125	1.220	.388	.342
-1620	1	1.2500-14 UNJS-3B	.020	2.700	.705	2.290	1.004	+0.000 -0.004	1.000	1.375	1.620	.366	.375

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.

UNION, FEMALE TO BRAZE/WELD, 17-4PH

ME273-0165

SHEET 1 OF 2

Data Sheet Revised

FITTINGS, DYNATUBE[®] AND DUAL SEAL*

MATERIAL: 17-4PH CRES PER AMS 5643, HEAT TREAT TO CONDITION H-1075 (145 KSI TENSILE MIN)
PER MIL-H-6875

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129

CONTROL NUMBER EXAMPLE:

ME273-0165-0820 = UNION, 1/2 INCH TUBE SIZE WITH .020 WALL THICKNESS

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM NON-CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

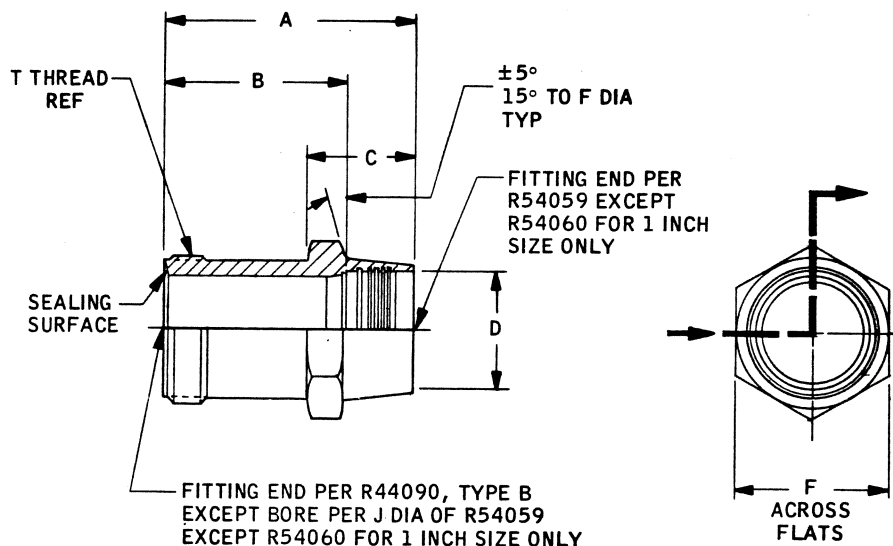
DYNATUBE[®] IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET	UNION, FEMALE TO BRAZE/WELD, 17-4PH	ME273-0165
FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.	SHEET 2 OF 2	



FITTINGS, DYNATUBE® AND DUAL SEAL*



SPEC CONTROL DRAWING DASH NUMBER	TUBE SIZE REF	T THREAD	A ±.007	B ±.007	C ±.007	D REF	F REF
-0004	1/4	.4375-24 UNJS-3A	1.205	.850	.555	.255	.438
-0005	5/16	.5000-24 UNJS-3A	1.236	.881	.586	.317	.500
-0006	3/8	.5625-20 UNJS-3A	1.266	.911	.596	.380	.562
-0008	1/2	.7188-20 UNJS-3A	1.475	1.045	.717	.506	.750
-0010	5/8	.8438-18 UNJS-3A	1.702	1.197	.810	.631	.875
-0012	3/4	1.0000-16 UNJ-3A	1.734	1.229	.807	.756	1.000
-0014	7/8	1.1250-16 UNJ-3A	1.900	1.315	.885	.881	1.125
-0016	1	1.2500-14 UNJS-3A	1.930	1.345	.885	1.006	1.250
-0021	1-1/4	1.5781-14 UNJS-3A	2.130	1.470	1.023	1.256	1.625
-0025	1-1/2	1.8438-14 UNJS-3A	2.355	1.620	1.098	1.506	2.000

MATERIAL: TITANIUM 6AL-4V PER RESISTOFLEX CORPORATION SPECIFICATION RES 143

COATING: EVERLUBE 620A (EVERLUBE CORP, N. HOLLYWOOD, CA) DRY FILM LUBRICANT ON SEALING SURFACE

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

CONTROL NUMBER EXAMPLE: ME273-0166-0008 = 1/2 INCH TUBE CONNECTOR, FOR REPAIR

REFERENCE DRAWINGS: R44090, R54059 AND R54060 ARE CONTROLLED ACCESS DRAWINGS CONTAINING DATA PROPRIETARY TO RESISTOFLEX CORPORATION AND ARE ACCESSIBLE ONLY THRU DATA MANAGEMENT.

APPLICATION NOTE:

1. REFER TO STANDARD DESIGN PRACTICE 273-0003MP FOR DESIGN INFORMATION AND INSTALLATION DATA.

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PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.

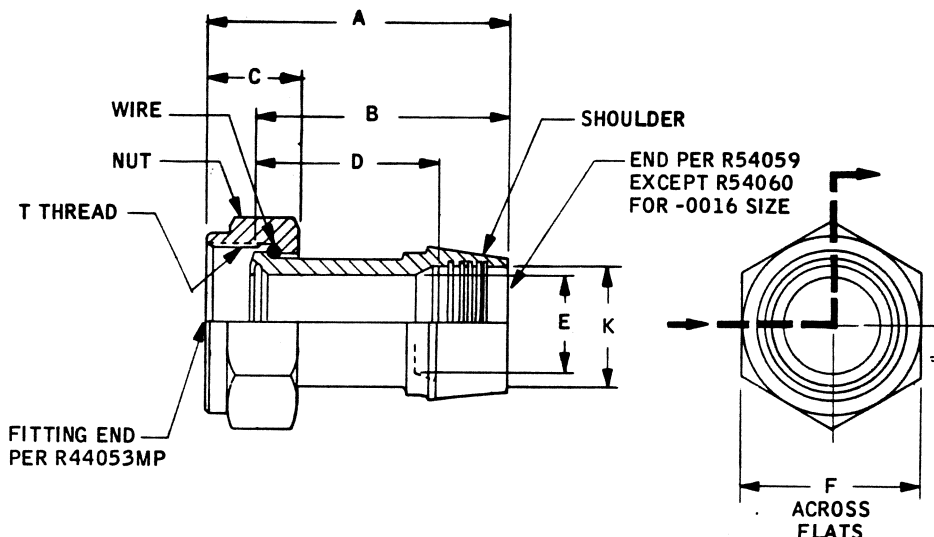
CONNECTOR, DYNATUBE®, REPAIR, MECHANICALLY ATTACHED, MALE THREADED

ME273-0166

SHEET 1 OF 1

2733-129
15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



SPEC CONTROL DRAWING DASH NUMBER	TUBE SIZE REF	T THREAD	A REF	B ±.015	C ±.010	D ±.015	E ±.006	F REF	K ±.002
-0004	1/4	.4375-24 UNJS-3B	1.388	1.182	.454	.827	.201	.562	.255
-0005	5/16	.5000-24 UNJS-3B	1.398	1.188	.459	.833	.253	.625	.317
-0006	3/8	.5625-20 UNJS-3B	1.441	1.208	.518	.853	.318	.688	.380
-0008	1/2	.7188-20 UNJS-3B	1.617	1.368	.510	.938	.419	.875	.506
-0010	5/8	.8438-18 UNJS-3B	1.881	1.574	.571	1.069	.534	1.000	.631
-0012	3/4	1.0000-16 UNJ-3B	1.959	1.616	.637	1.111	.628	1.125	.756
-0014	7/8	1.1250-16 UNJ-3B	2.148	1.800	.690	1.215	.745	1.375	.881
-0016	1	1.2500-14 UNJS-3B	2.332	1.966	.745	1.381	.868	1.500	1.006
-0021	1-1/4	1.5781-14 UNJS-3B	2.537	2.168	.812	1.508	1.108	1.875	1.256
-0025	1-1/2	1.8438-14 UNJS-3B	2.857	2.408	.914	1.673	1.332	2.125	1.506

MATERIAL: SHOULDER AND NUT - 6AL-4V TITANIUM PER RESISTOFLEX CORPORATION SPECIFICATION RES 143

NUT RETAINING WIRE - CRES 302 PER AMS 5637

COATING: EVERLUBE 620A (EVERLUBE CORP, N. HOLLYWOOD, CA) DRY FILM LUBRICANT, ON INTERNAL THREAD AND BEARING SURFACE OF NUT ONLY.

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY.

CONTROL NUMBER EXAMPLE: ME273-0167-0008 = 1/2 INCH TUBE FITTING ASSEMBLY, FOR REPAIR.

REFERENCE DRAWING: R44053MP, R54059 AND R54060 ARE CONTROLLED ACCESS DRAWINGS CONTAINING DATA PROPRIETARY TO RESISTOFLEX CORPORATION AND ARE ACCESSIBLE ONLY THRU DATA MANAGEMENT

APPLICATION NOTE:

1. REFER TO STANDARD DESIGN PRACTICE 273-0003MP FOR DESIGN INFORMATION AND INSTALLATION DATA.

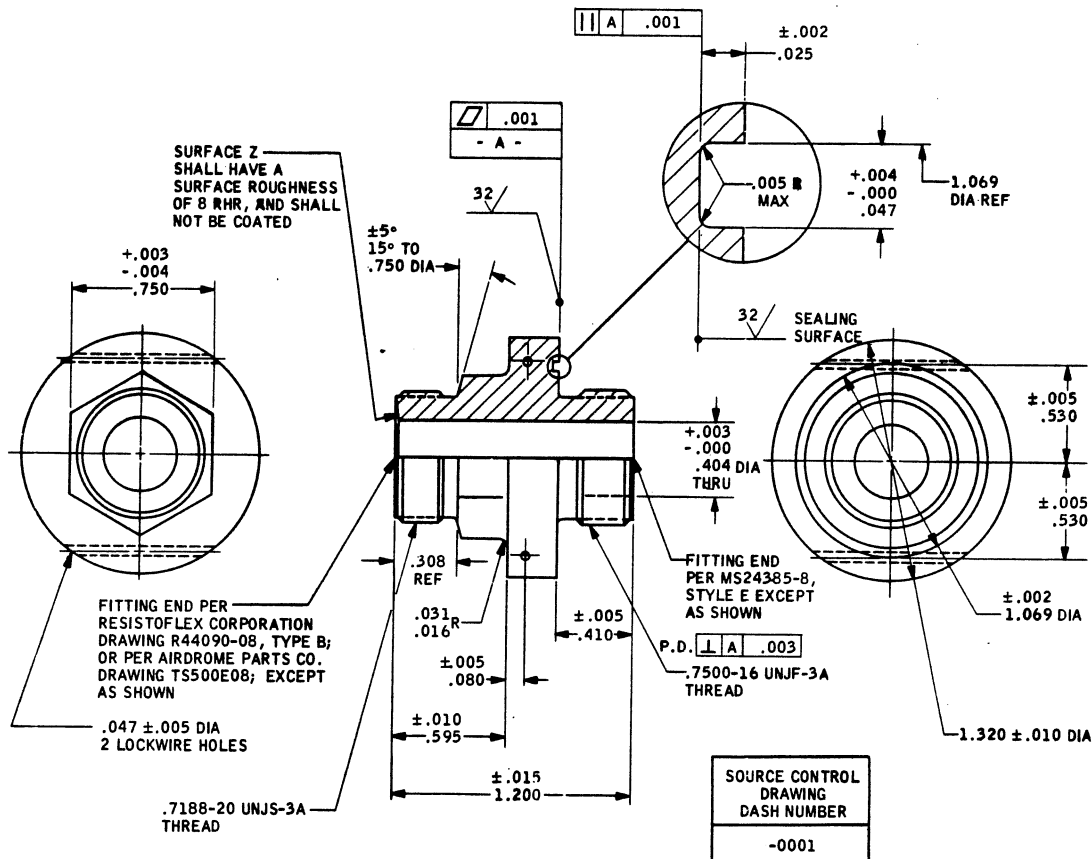
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PARTS DATA SHEET	FITTING ASSEMBLY, DYNATUBE®, MECHANICALLY ATTACHED, FOR REPAIR	ME273-0167
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2733-130
15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



MATERIAL: 17-4PH CRES PER AMS 5643, HEAT TREAT TO CONDITION H-1075 (145 KSI TENSILE MIN) PER MIL-H-6875

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM NON-CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

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PARTS DATA SHEET

ADAPTER, MALE TO MALE
STRAIGHT THREAD, 17-4PH

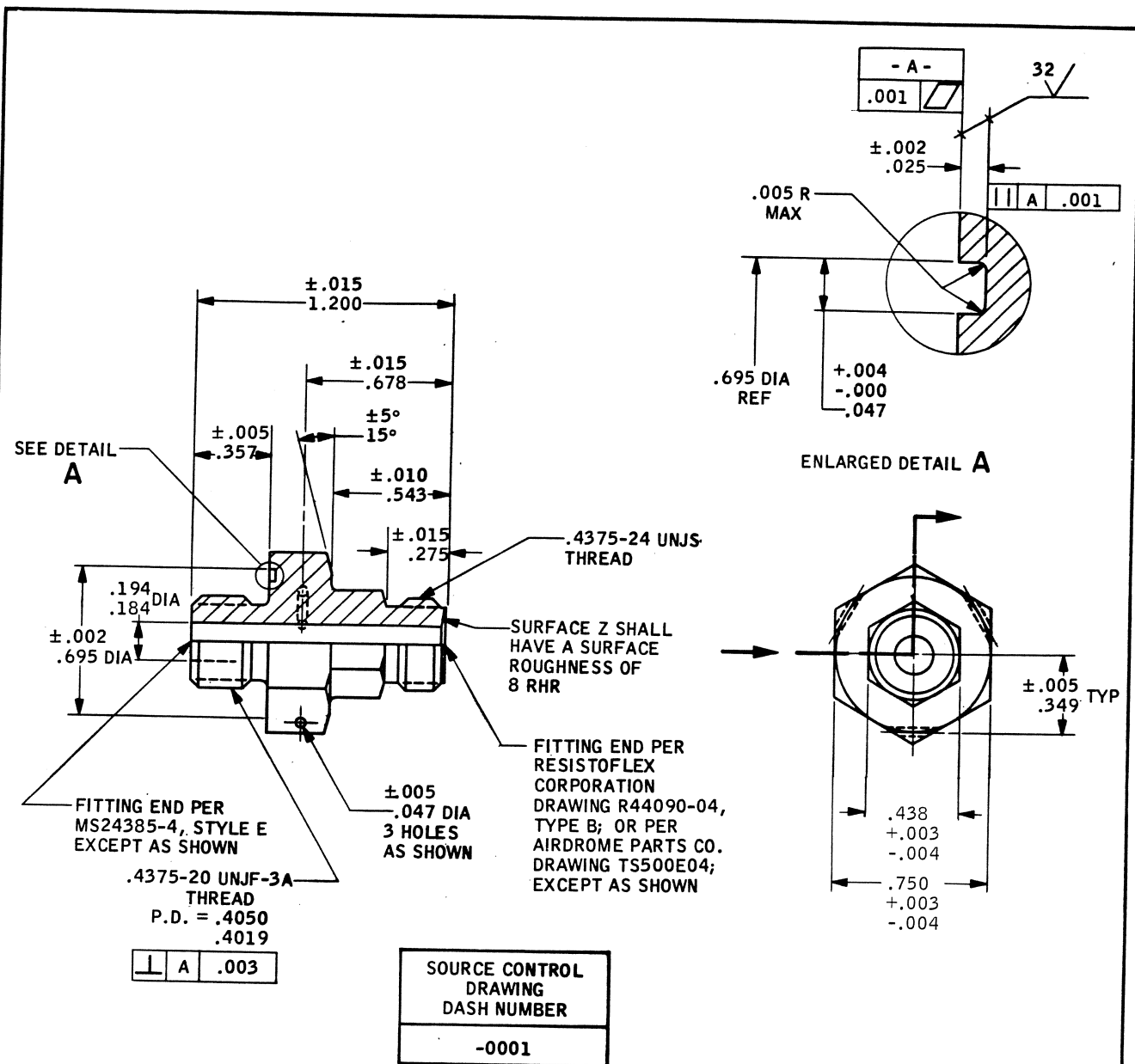
ME273-0169

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PROCUREMENT OR INSPECTION PURPOSES.

SHEET 1 OF 1

Data Sheet Revis...

FITTINGS, DYNATUBE® AND DUAL SEAL*



MATERIAL: 17-4PH CRES PER AMS 5643, HEAT TREAT TO CONDITION H-1075 (145 KSI TENSILE MIN) PER MIL-H-6875

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM NON-CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

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PARTS DATA SHEET

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CONNECTOR, MALE TO MODIFIED
MS24385, 17-4PH

ME273-0170

SHEET 1 OF 1

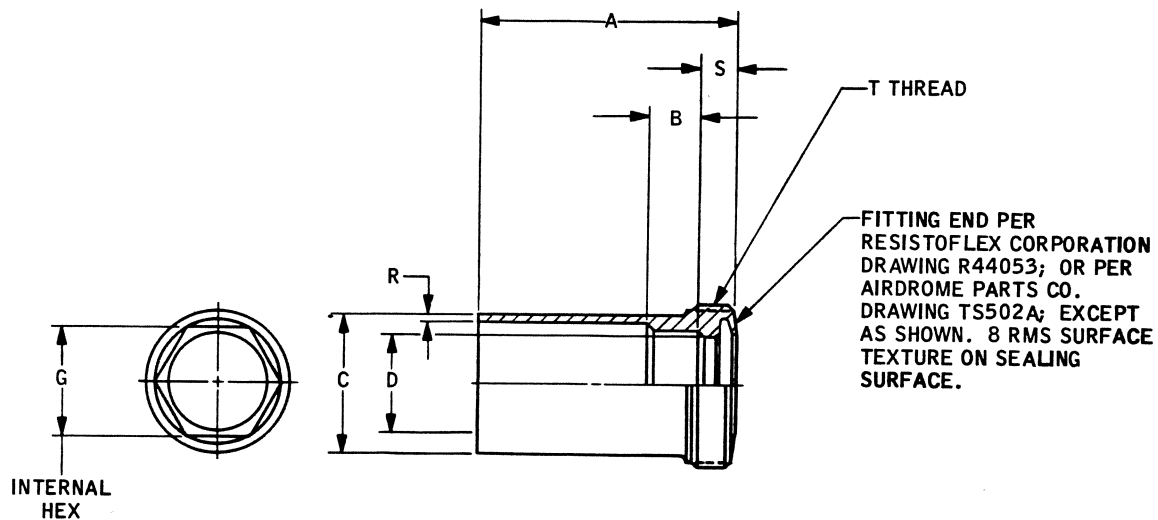
Data Sheet Revised

FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-132

SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



SOURCE CONTROL DRAWING DASH NUMBER	TUBE SIZE	T THREAD	A ±.010	B ±.010	C DIA ±.005	D DIA	G	R ±.004	S ±.005
-0001	1/4	.4375-24UNJS-3A	2.000	.350	.281	.155 .145	.188	.031	.160
-0002	5/8	.8438-18UNJS-3A	2.000	.350	.750	.540 .530	.562	.031	.160
-0003	1	1.2500-14UNJS-3A	2.000	.350	1.125	.855 .845	.875	.031	.160

MATERIAL: INCONEL 718 PER AMS 5663

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

ENGINEERING NOTE: THIS CONNECTOR IS USED WITH ME273-0172 FITTING

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PARTS DATA SHEET

CONNECTOR, MALE THREAD,
INCONEL 718

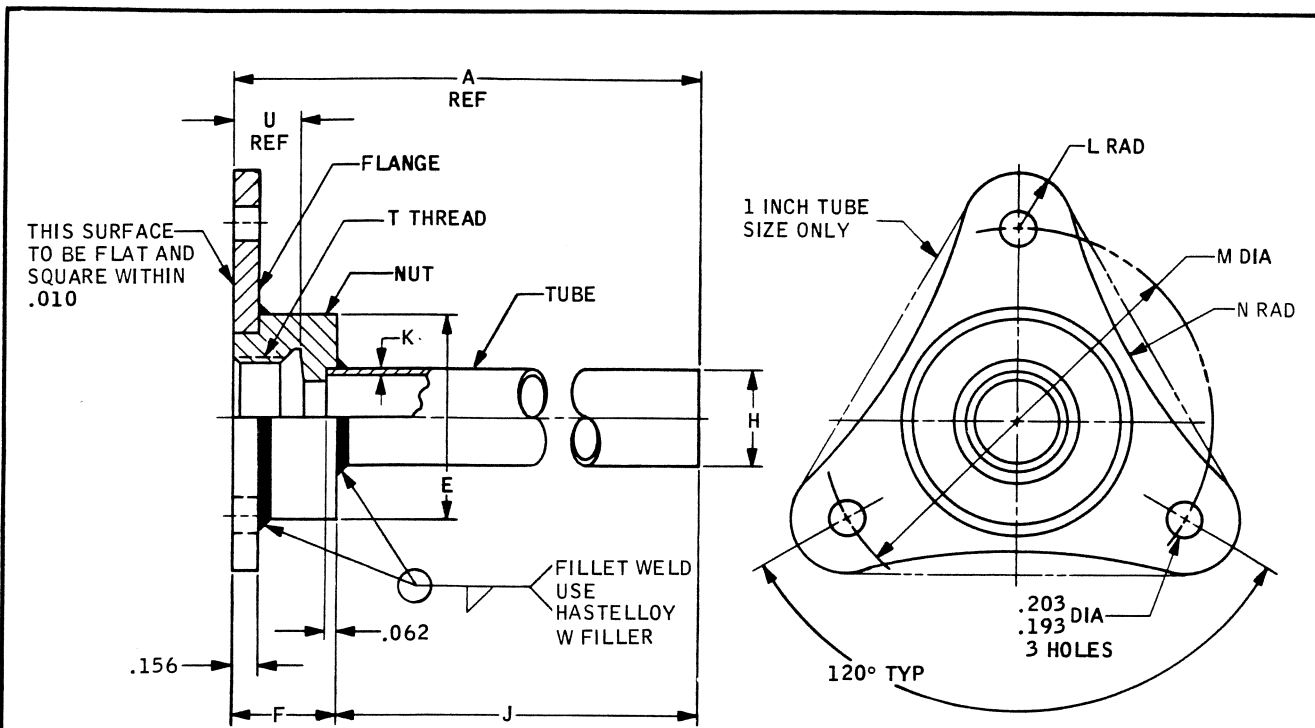
ME273-0171

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PROCUREMENT OR INSPECTION PURPOSES.

SHEET 1 OF 1

Data Sheet Revised

FITTINGS, DYNATUBE® AND DUAL SEAL*



SOURCE CONTROL DRAWING DASH NUMBER	TUBE SIZE	T THREAD	A REF	E ±.015	F ±.010	H	J ±.020	K	L	M	N	U
-0001	1/4	.4375-24 UNJS-3B	3.170	.635	.670	.250	2.500	.035	.280	1.500	1.00	.357
-0002	5/8	.8438-18 UNJS-3B	3.071	1.125	.571	.500	2.500	.025	.280	2.125	6.00	.455
-0003	1	1.2500-14 UNJS-3B	3.705	1.568	.705	1.000	3.000	.028	.280	2.375	--	.487

MATERIAL: TUBE - STAINLESS STEEL TUBING PER AMS 5561 (21-6-9)
FLANGE - STAINLESS STEEL PER AMS 5510 (321)
NUT - INCONEL 718 PER AMS 5663

FINISH: PASSIVATE PER MIL-S-5002

INTERNAL THREADS AND SEALING FACE TO HAVE 811R EVERLUBE SOLID FILM APPLIED AFTER ASSEMBLY IS WELDED

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

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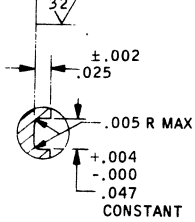
PARTS DATA SHEET	FITTING ASSEMBLY, FLANGED, FEMALE THREAD	ME273-0172
FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.		SHEET 1 OF 1

2733-134
15 SEPTEMBER 1977

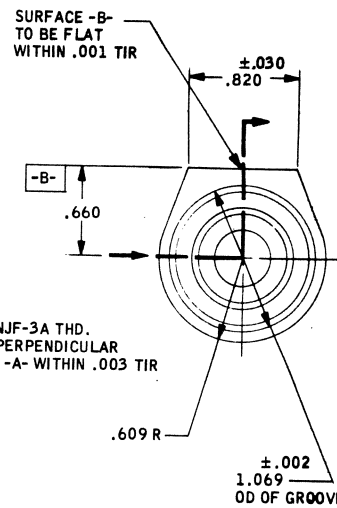
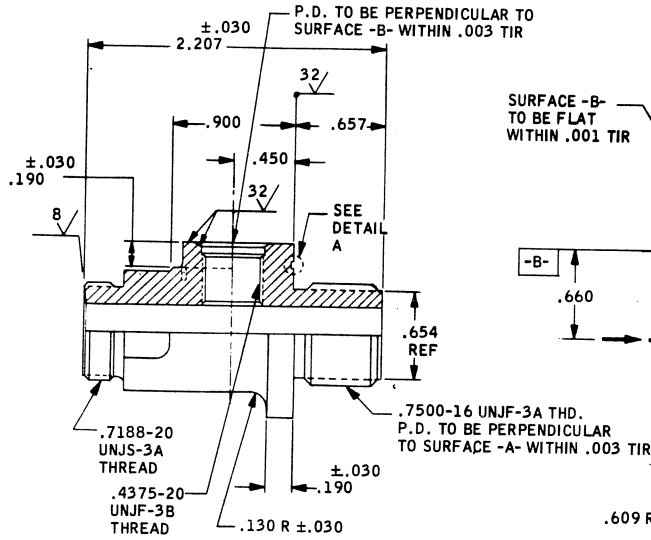
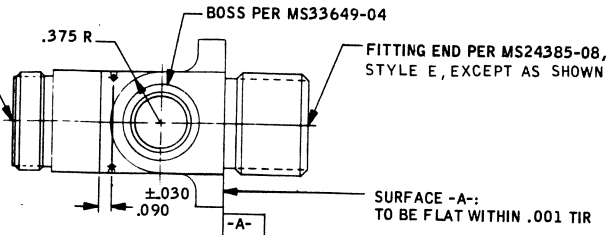
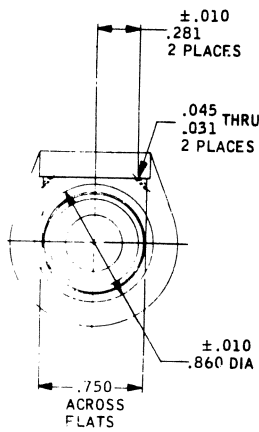
FITTINGS, DYNATUBE® AND DUAL SEAL*

FITTING END PER RESISTOFLEX CORPORATION DRAWING R44090-08, TYPE B; OR PER AIRDROME PARTS CO. DRAWING TS500E08; WITH 8 RMS FINISH ON SEALING SURFACE

SURFACE TO BE PARALLEL TO SURFACE -A- WITHIN .001 TIR



DETAIL A



SOURCE CONTROL DRAWING DASH NUMBER	-0001
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MATERIAL: 17-4PH CRES PER AMS 5643, HEAT TREAT TO CONDITION H-1075 (145 KSI TENSILE MIN) PER MIL-H-6875

FINISH: CLEAN AND PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM NON-CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

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PARTS DATA SHEET

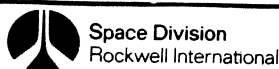
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TEE, MALE TO MALE STRAIGHT THREAD, BOSS ON SIDE, 17-4PH

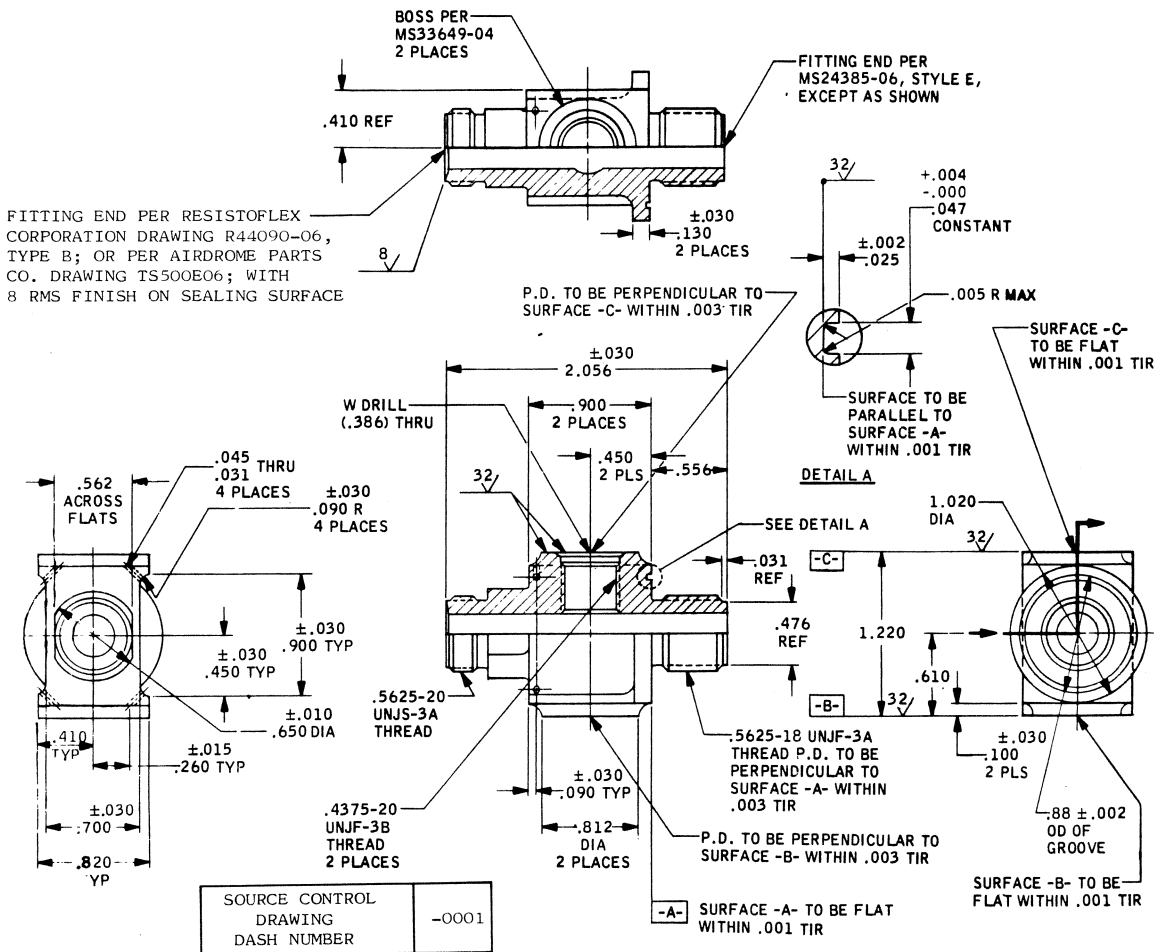
ME273-0173

SHEET 1 OF 1

Data Sheet Revised



FITTINGS, DYNATUBE® AND DUAL SEAL*



MATERIAL: 17-4PH CRES PER AMS 5643, HEAT TREAT TO CONDITION H-1075 (145 KSI TENSILE MIN) PER MIL-H-6875

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM NON-CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

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DUAL SEAL* IS A TRADEMARK OF TITFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.

CROSS, MALE TO MALE STRAIGHT THREAD, FEMALE PORTS ON SIDES, 17-4PH

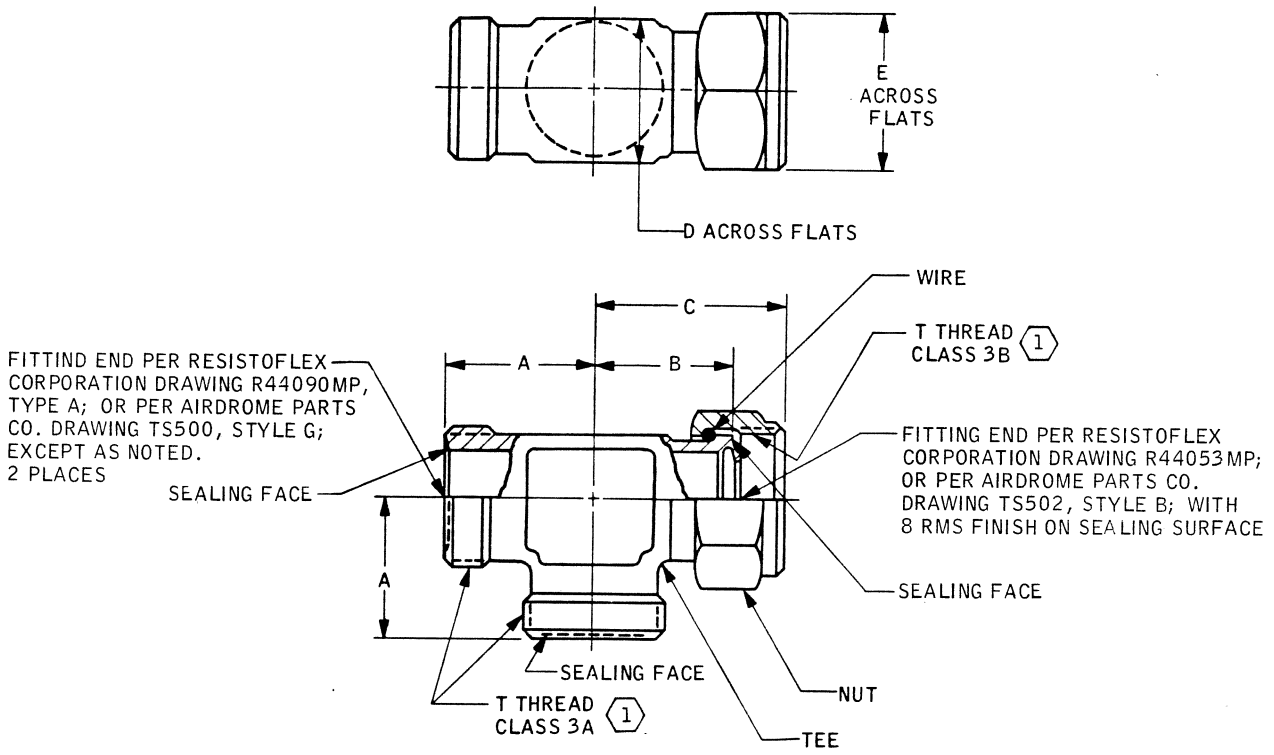
ME273-0174

SHEET 1 OF 1

FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-136
15 SEPTEMBER 1977

FITTINGS, DYNATUBE[®] AND DUAL SEAL*



ME273-0175 DASH NUMBER	TUBE SIZE REF	T (1) THREAD	A ±.015	B ±.015	C REF	D REF	E REF
-0004 (2)	1/4	.4375-24 UNJS	.617	.808	1.014	.375	.562
-0005 (2)	5/16	.5000-24 UNJS	.653	.850	1.060	.438	.625
-0006 (2)	3/8	.5625-20 UNJS	.704	.945	1.178	.500	.688
-0008 (2)	1/2	.7188-20 UNJS	.824	1.045	1.294	.562	.875
-0010 (2)	5/8	.8438-18 UNJS	.955	1.178	1.485	.688	1.000
-9012 (2)	3/4	1.0000-16 UNJ	1.062	1.316	1.659	.875	1.125
(4) -0012 (3)	3/4	1.0000-16 UNJ	1.062	1.316	1.659	.875	1.125
-0016 (3)	1	1.2500-14 UNJS	1.246	1.529	1.895	1.125	1.500
-0020 (3)	1-1/4	1.5156-14 UNJS	1.387	1.655	2.026	1.375	1.625
-0024 (3)	1-1/2	1.7812-14 UNJS	1.688	1.984	2.438	1.625	2.000

(4) INACTIVE FOR DESIGN AND PROCUREMENT AFTER 17 JUNE 1977. USE -9012.

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

TEE, MALE TO FEMALE ON RUN,
MALE ON SIDE, 17-4PH

ME273-0175

SHEET 1 OF 2

Data Sheet Revised

FITTINGS, DYNATUBE® AND DUAL SEAL*

MATERIAL: TEE AND NUT - 17-4PH CRES PER AMS 5643, HEAT TREAT TO CONDITION H-1075
(145 KSI TENSILE MIN) PER MIL-H-6875

NUT RETAINING WIRE - 302 CRES PER AMS 5637, OR
305 CRES PER AMS 5685

FINISH: PASSIVATE PER MIL-S-5002

COATING: ② TEES -0004 THRU - 0010, AND -9012, SHALL BE UNCOATED AND SHALL HAVE
8 RMS SURFACE TEXTURE ON MALE FITTING ENDS SEALING SURFACE

③ TEES -0012 THRU -0024, THE SEALING SURFACE OF THE MALE FITTING ENDS
SHALL BE COATED PER AMS 2515C WITH DUPONT 850-204 TETRAFLUOROETHYLENE
(TFE) TO A THICKNESS OF .1-.6 MILS

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM NON-CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET	TEE, MALE TO FEMALE ON RUN, MALE ON SIDE, 17-4PH	ME273-0175
FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.		SHEET 2 OF 2

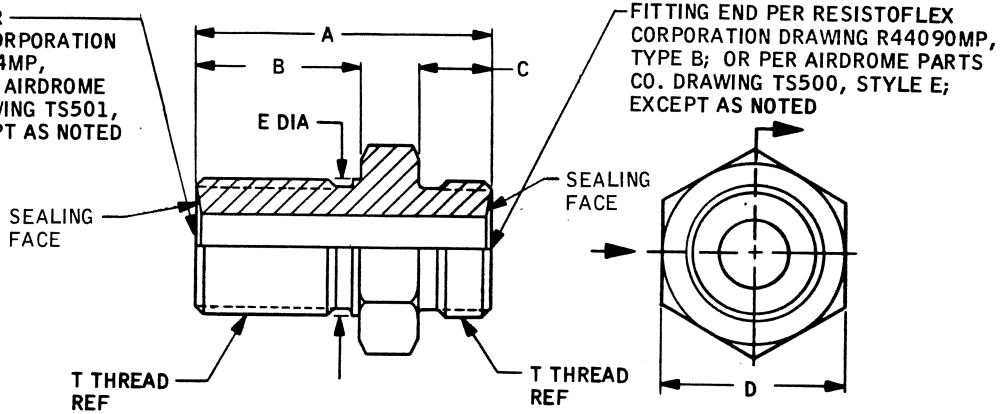
FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-138

15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*

FITTING END PER
RESISTOFLEX CORPORATION
DRAWING R44094MP,
TYPE B; OR PER AIRDROME
PARTS CO. DRAWING TS501,
STYLE E; EXCEPT AS NOTED



ME273-0176 DASH NUMBER	TUBE SIZE REF	T THREAD	A ±.015	B ±.015	C ±.015	D REF	E DIA
-0004 (2)	1/4	.4375-24 UNJS-3A	1.187	.680	.275	.688	.438 .431
-0005 (2)	5/16	.5000-24 UNJS-3A	1.197	.680	.275	.750	.500 .493
-0006 (2)	3/8	.5625-20 UNJS-3A	1.302	.719	.295	.812	.563 .555
-0008 (2)	1/2	.7188-20 UNJS-3A	1.363	.755	.308	1.000	.719 .711
-0010 (2)	5/8	.8438-18 UNJS-3A	1.572	.894	.372	1.125	.844 .835
-9012 (2)	3/4	1.0000-16 UNJ-3A	1.774	.990	.412	1.250	1.000 .991
(1) -0012 (3)	3/4	1.0000-16 UNJ-3A	1.774	.990	.412	1.250	1.000 .991
-0016 (3)	1	1.2500-14 UNJS-3A	1.928	1.082	.460	1.500	1.250 1.240
-0020 (3)	1-1/4	1.5156-14 UNJS-3A	1.971	1.076	.457	1.750	1.516 1.506
-0024 (3)	1-1/2	1.7812-14 UNJS-3A	2.226	1.246	.542	2.000	1.781 1.771

(1) INACTIVE FOR DESIGN AND PROCUREMENT AFTER 1 APRIL 1977. USE -9012.

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

CONNECTOR, BULKHEAD TO MALE,
17-4PH

ME273-0176

SHEET 1 OF 2

Data Sheet Revised



Space Division
Rockwell International

FITTINGS, DYNATUBE® AND DUAL SEAL*

MATERIAL: 17-4PH CRES PER AMS 5643, HEAT TREAT TO CONDITION H-1075
(145 KSI TENSILE MIN) PER MIL-H-6875

FINISH: PASSIVATE PER MIL-S-5002

COATING: ② CONNECTORS -0004 THRU -0010, AND -9012 UNCOATED WITH 8 RMS
SURFACE TEXTURE ON FITTING ENDS SEALING SURFACE

③ CONNECTORS -0012 THRU -0024, THE SEALING SURFACE OF THE
FITTING ENDS SHALL BE COATED PER AMS 2515C WITH DUPONT
850-204 TETRAFLUOROETHYLENE (TFE) TO A THICKNESS OF
.1-.6 MILS

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM NON-CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

CONNECTOR, BULKHEAD TO MALE,
17-4PH

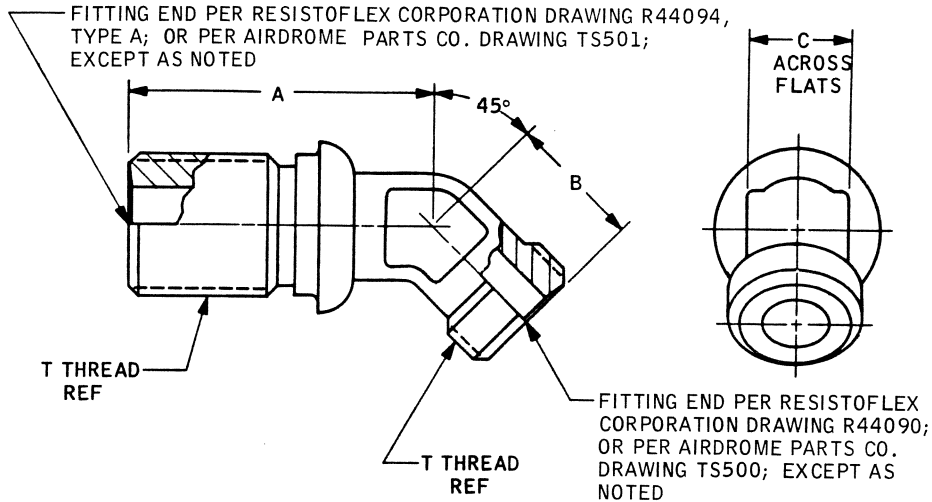
ME273-0176

SHEET 2 OF 2



2733-140
15 SEPTEMBER 1977

FITTINGS, DYNATUBE[®] AND DUAL SEAL*



ME273-0177 DASH NUMBER	TUBE SIZE REF	T THREAD	A ±.015	B ±.015	C REF
-0004	1/4	.4375-24 UNJS-3A	1.028	.420	.375
-0005	5/16	.5000-24 UNJS-3A	1.046	.438	.438
-0006	3/8	.5625-20 UNJS-3A	1.120	.471	.500
-0008	1/2	.7188-20 UNJS-3A	1.246	.528	.562
-0010	5/8	.8438-18 UNJS-3A	1.433	.619	.688
-0012	3/4	1.0000-16 UNJ-3A	1.576	.685	.875
-0014	7/8	1.1250-16 UNJ-3A	1.723	.753	1.125
-0016	1	1.2500-14 UNJS-3A	1.725	.783	1.125
-0021	1-1/4	1.5781-14 UNJS-3A	1.775	.836	1.375
-0025	1-1/2	1.8438-14 UNJS-3A	2.027	1.003	1.625

MATERIAL: 6AL-4V TITANIUM PER AMS 4965

FINISH: NONE

COATING: EVERLUBE 620A (EVERLUBE CORP., NO. HOLLYWOOD, CA) DRY FILM LUBRICANT ON SEALING FACE OF FITTING ENDS

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM HYDRAULIC FLUID SYSTEMS

DYNATUBE[®] IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.

ELBOW, 45°, BULKHEAD TO MALE, TITANIUM

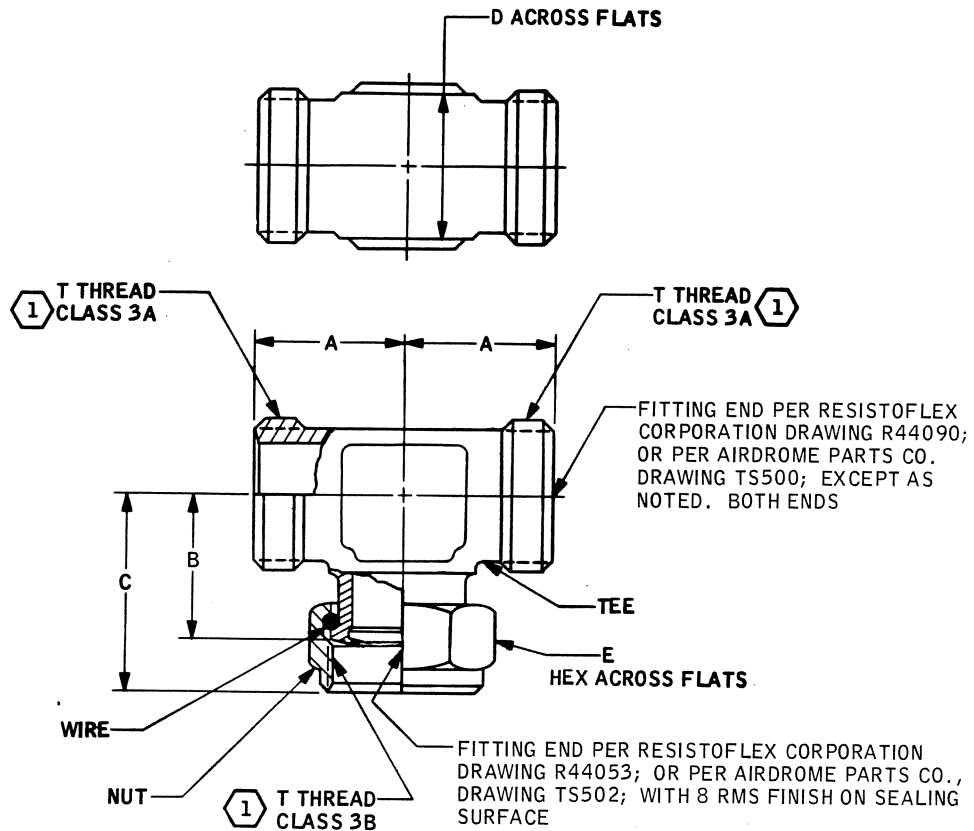
ME273-0177

SHEET 1 OF 1

Data Sheet Revised

FITTINGS, DYNATUBE® AND DUAL SEAL*

2733-141
15 SEPTEMBER 1977



ME273-0179 DASH NUMBER	TUBE SIZE (REF)	T ^① THREAD	A ±.015	B ±.015	C (REF)	D (REF)	E (REF)
-0004 ②	1/4	.4375-24 UNJS	.617	.808	1.014	.375	.562
-0005 ②	5/16	.5000-24 UNJS	.653	.850	1.060	.438	.625
-0006 ②	3/8	.5625-20 UNJS	.704	.945	1.178	.500	.688
-0008 ②	1/2	.7188-20 UNJS	.824	1.045	1.294	.562	.875
-0010 ②	5/8	.8438-18 UNJS	.955	1.178	1.485	.688	1.000
-9012 ②	3/4	1.0000-16 UNJ	1.062	1.316	1.659	.875	1.125
-9014 ②	7/8	1.1250-16 UNJ	1.216	1.514	1.862	1.125	1.375
④ -0012 ③	3/4	1.0000-16 UNJ	1.062	1.316	1.659	.875	1.125
④ -0014 ③	7/8	1.1250-16 UNJ	1.216	1.514	1.862	1.125	1.375
-0016 ③	1	1.2500-14 UNJS	1.246	1.529	1.895	1.125	1.375
-0020 ③	1-1/4	1.5156-14 UNJS	1.387	1.655	2.026	1.375	1.625
-0024 ③	1-1/2	1.7812-14 UNJS	1.688	1.984	2.438	1.625	2.000

④ INACTIVE FOR DESIGN AND PROCUREMENT AFTER 15 JUNE 1977. USE -9012 OR -9014.

PARTS DATA SHEET	TEE, MALE ON RUNS, FEMALE ON SIDE, 17-4PH	ME273-0179
FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.		SHEET 1 OF 2

Data Sheet Revised



2733-142
15 SEPTEMBER 1977

FITTINGS, DYNATUBE[®] AND DUAL SEAL*

MATERIAL: TEE AND NUT - 17-4PH CRES PER AMS 5643, HEAT TREAT TO CONDITION H-1075
(145 KSI TENSILE MIN) PER MIL-H-6875

NUT RETAINING WIRE - 302 CRES PER AMS 5637, OR 305 CRES PER AMS 5685

FINISH: PASSIVATE PER MIL-S-5002

COATING: ② TEES -0004 THRU -0010, -9012 AND -9014, UNCOATED AND SHALL HAVE 8 RMS SURFACE
TEXTURE ON MALE END SEALING SURFACES

③ TEES -0012 THRU -0024, THE SEALING SURFACE OF THE MALE ENDS SHALL BE COATED
PER AMS 2515C WITH DUPONT 850-204 TETRAFLUOROETHYLENE (TFE) TO A THICKNESS
OF .1-.6 MILS

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM NON-CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

DYNATUBE[®] IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.
DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

TEE, MALE ON RUNS, FEMALE
ON SIDE, 17-4PH

ME273-0179

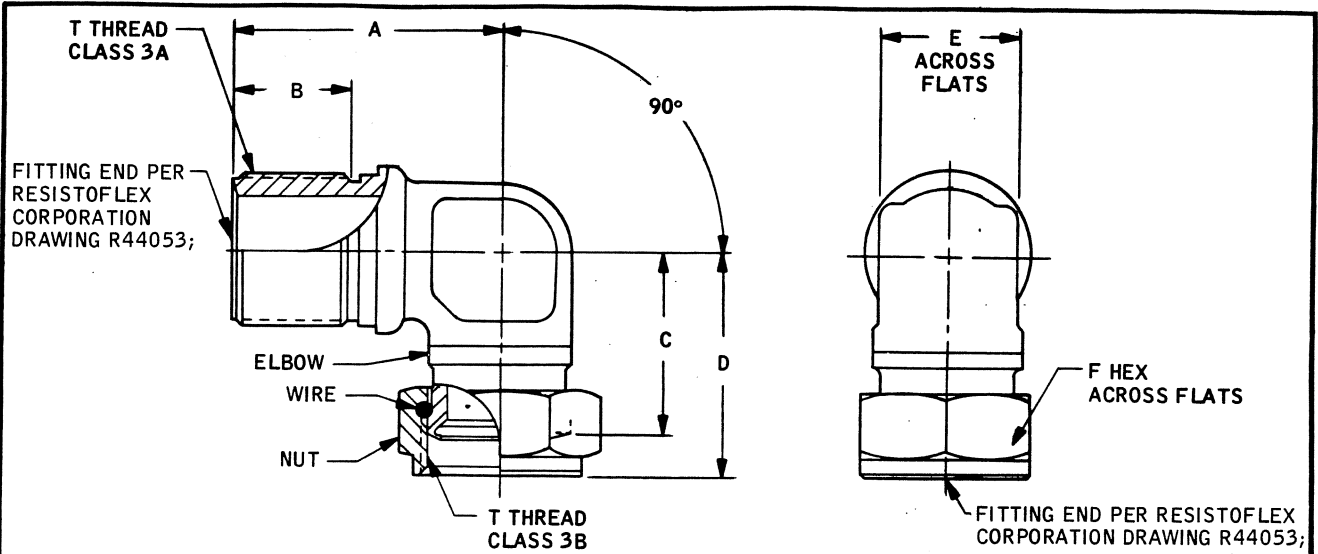
SHEET 2 OF 2

Data Sheet Revised



Rockwell
International
Space Division

FITTINGS, DYNATUBE® AND DUAL SEAL*



ME273-0181 DASH NUMBER	TUBE SIZE REF	T THREAD	A ±.015	B ±.020	C ±.015	D REF	E REF	F REF
-0004	1/4	.4375-24 UNJS	1.225	.583	.808	1.014	.375	.562
-0005	5/16	.5000-24 UNJS	1.261	.583	.850	1.060	.438	.625
-0006	3/8	.5625-20 UNJS	1.353	.603	.945	1.178	.500	.688
-0008	1/2	.7188-20 UNJS	1.542	.629	1.045	1.294	.562	.875
-0010	5/8	.8438-18 UNJS	1.769	.755	1.178	1.485	.688	1.000
-0012	3/4	1.0000-16 UNJ	1.953	.833	1.316	1.659	.875	1.125
-0014	7/8	1.1250-16 UNJ	2.188	.885	1.514	1.862	1.125	1.375
-0016	1	1.2500-14 UNJS	2.188	.925	1.529	1.895	1.125	1.500
-0021	1-1/4	1.5781-14 UNJS	2.326	.919	1.847	2.216	1.375	1.875
-0025	1-1/2	1.8438-14 UNJS	2.712	1.089	2.171	2.620	1.625	2.125

MATERIAL: ELBOW AND NUT - 6AL-4V TITANIUM PER AMS 4965
 NUT RETAINING WIRE - 302 CRES PER AMS 5637, OR 305 CRES PER AMS 5685

FINISH: CRES - PASSIVATE PER MIL-S-5002
 TITANIUM - NONE

COATING: EVERLUBE 620A (EVERLUBE CORP., NO. HOLLYWOOD, CA) DRY FILM LUBRICANT,
 INTERNAL THREAD AND BEARING SURFACES OF NUT, AND SEALING FACE OF MALE
 FITTING END ONLY

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM HYDRAULIC FLUID SYSTEMS

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

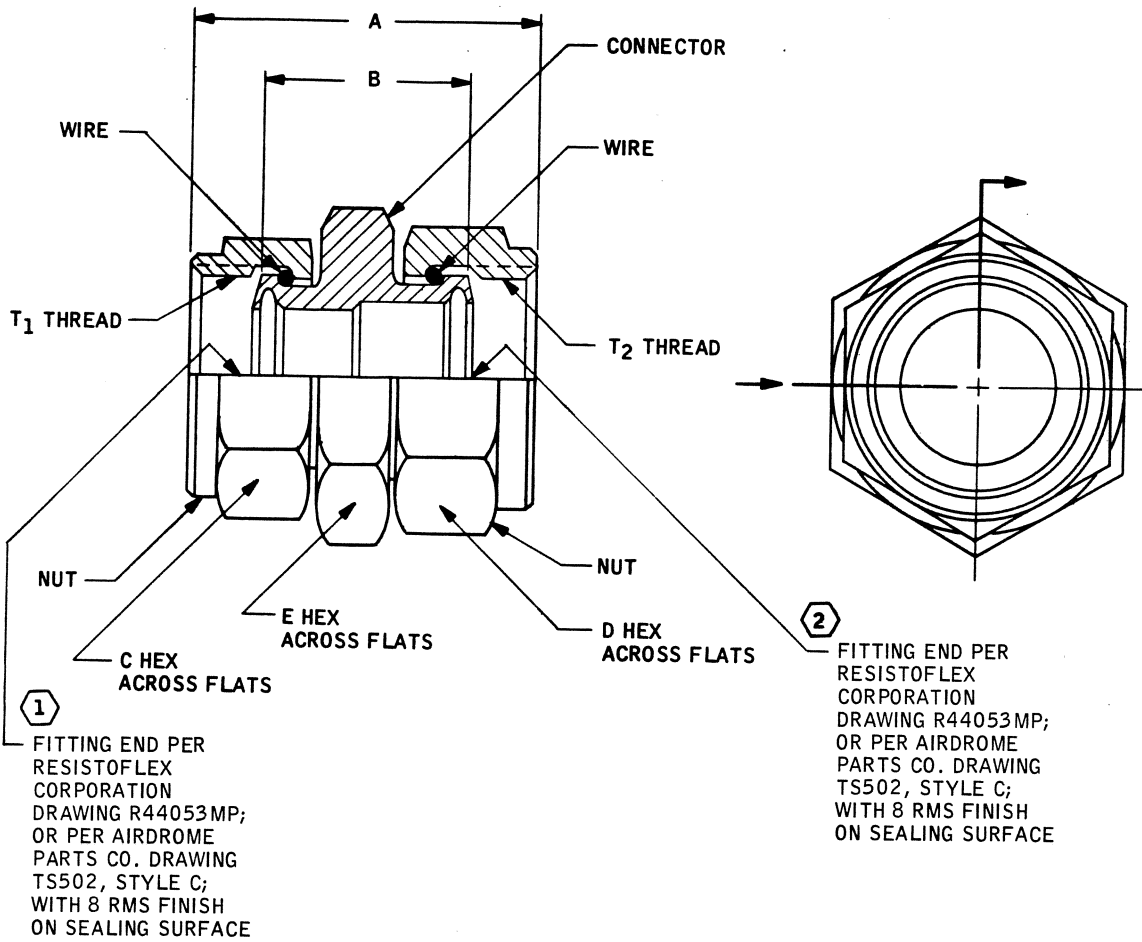
PARTS DATA SHEET FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.	ELBOW, 90°, BULKHEAD TO FEMALE, TITANIUM	ME273-0181
		SHEET 1 OF 1

Data Sheet Revised

FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-144
15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



ME273-0182 DASH NO.	TUBE SIZE REF ①	TUBE SIZE REF ②	T ₁ THREAD	T ₂ THREAD	A REF	B ±.015	C REF	D REF	E REF
-0304	3/16	1/4	.3750-28 UNJS-3B	.4375-24 UNJS-3B	1.118	.741	.500	.562	.625
-0406	1/4	3/8	.4375-24 UNJS-3B	.5625-20 UNJS-3B	1.257	.818	.562	.688	.750
-0608	3/8	1/2	.5625-20 UNJS-3B	.7188-20 UNJS-3B	1.372	.890	.688	.875	1.000
-0810	1/2	5/8	.7188-20 UNJS-3B	.8438-18 UNJS-3B	1.431	.875	.875	1.000	1.125
-1012	5/8	3/4	.8438-18 UNJS-3B	1.0000-16 UNJ-3B	1.632	.982	1.000	1.125	1.375
-1214	3/4	7/8	1.0000-16 UNJ-3B	1.1250-16 UNJ-3B	1.757	1.066	1.125	1.250	1.500
-1416	7/8	1	1.1250-16 UNJ-3B	1.2500-14 UNJS-3B	1.889	1.175	1.250	1.375	1.625
-1620	1	1-1/4	1.2500-14 UNJS-3B	1.5156-14 UNJS-3B	1.912	1.175	1.375	1.625	2.125
-2024	1-1/4	1-1/2	1.5156-14 UNJS-3B	1.7812-14 UNJS-3B	1.969	1.144	1.625	2.000	2.375

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCLRE"EMENT OR INSPECTION PURPOSES.

UNION, EXPANDER, FEMALE TO FEMALE, 17-4PH

ME273-0182

SHEET 1 OF 2

Data Sheet Revised

FITTINGS, DYNATUBE® AND DUAL SEAL*

MATERIAL: CONNECTOR AND NUTS - 17-4PH CRES PER AMS 5643, HEAT TREAT TO CONDITION H-1075
(145 KSI TENSILE MIN) PER MIL-H-6875

NUT RETAINING WIRES - 302 CRES PER AMS 5637, OR 305 CRES PER AMS 5685

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY.

APPLICATION: SPACE SHUTTLE PROGRAM NON-CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

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PROCUREMENT OR INSPECTION PURPOSES.

UNION, EXPANDER, FEMALE TO
FEMALE, 17-4 PH

ME273-0182

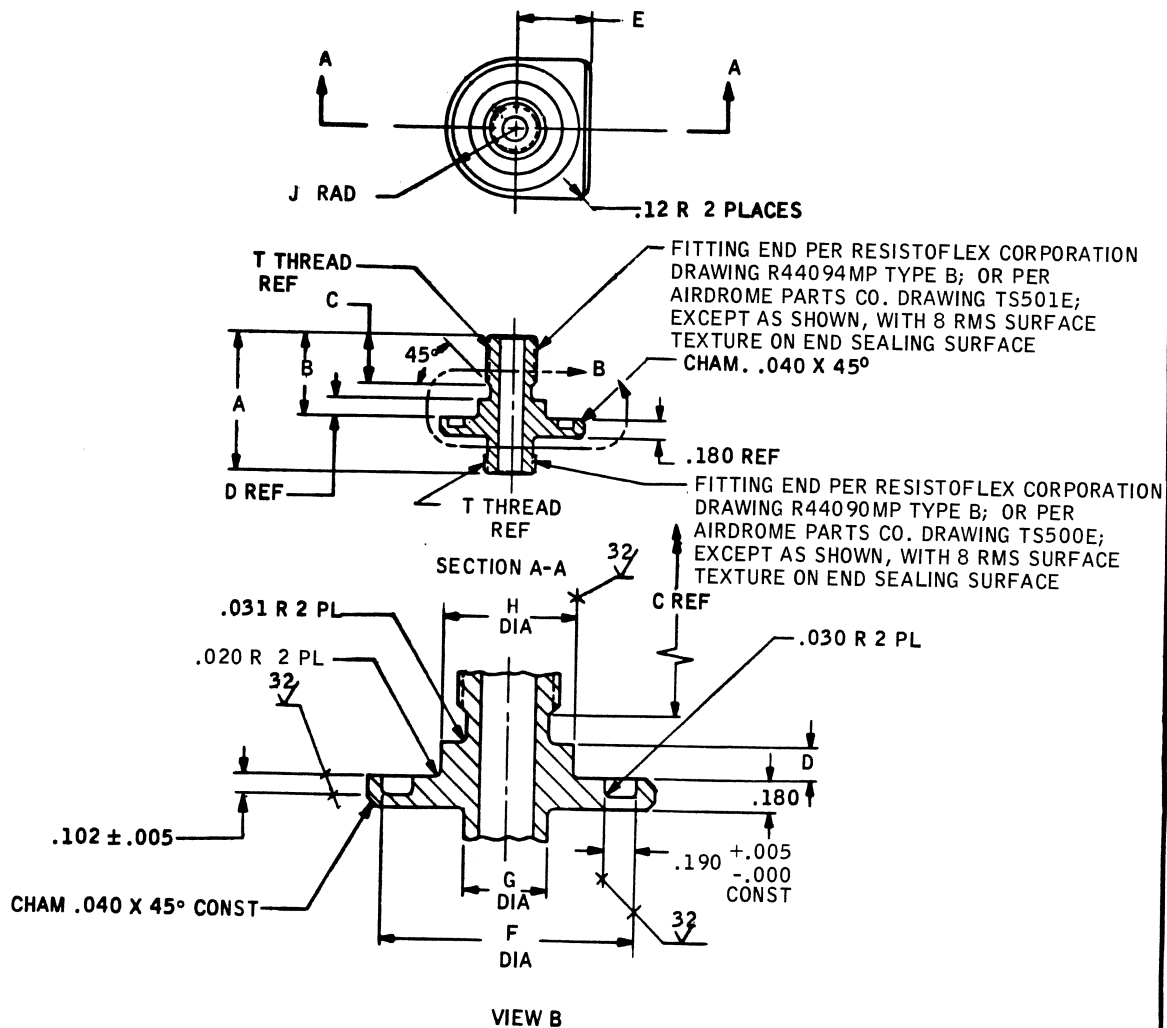
SHEET 2 OF 2

Data Sheet Revised



2733-146
15 SEPTEMBER 1977

FITTINGS, DYNATUBE[®] AND DUAL SEAL*



ME273-0184 DASH NO.	TUBE SIZE REF	T THREAD REF	A	B	C	D	E	F DIA	G DIA	H DIA	J RAD
-0004	1/4	.4375-24 UNJS-3A	±.010	±.010	±.010	±.010	±.010	+ .000 - .008	+ .000 - .010	±.003	±.010
-0006	3/8	.5625-20 UNJS-3A	1.650	1.050	.625	.345	.830	1.440	.493	.745	.790
-0010	5/8	.8438-18 UNJS-3A	2.087	1.306	.881	.345	.940	1.640	.767	.995	.900

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

CONNECTOR, MALE TO BULKHEAD,
FLANGED, 17-4PH

ME273-0184

SHEET 1 OF 2

Data Sheet Revised

FITTINGS, DYNATUBE[®] AND DUAL SEAL*

2733-147
15 SEPTEMBER 1977

MATERIAL: 17-4PH CRES PER AMS 5643, HEAT TREAT TO CONDITION H-1075 (145 KSI TENSILE MIN)
PER MIL-H-6875

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM NON-CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS.

DYNATUBE[®] IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.
DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

CONNECTOR, MALE TO BULKHEAD,
FLANGED, 17-4 PH

ME273-0184

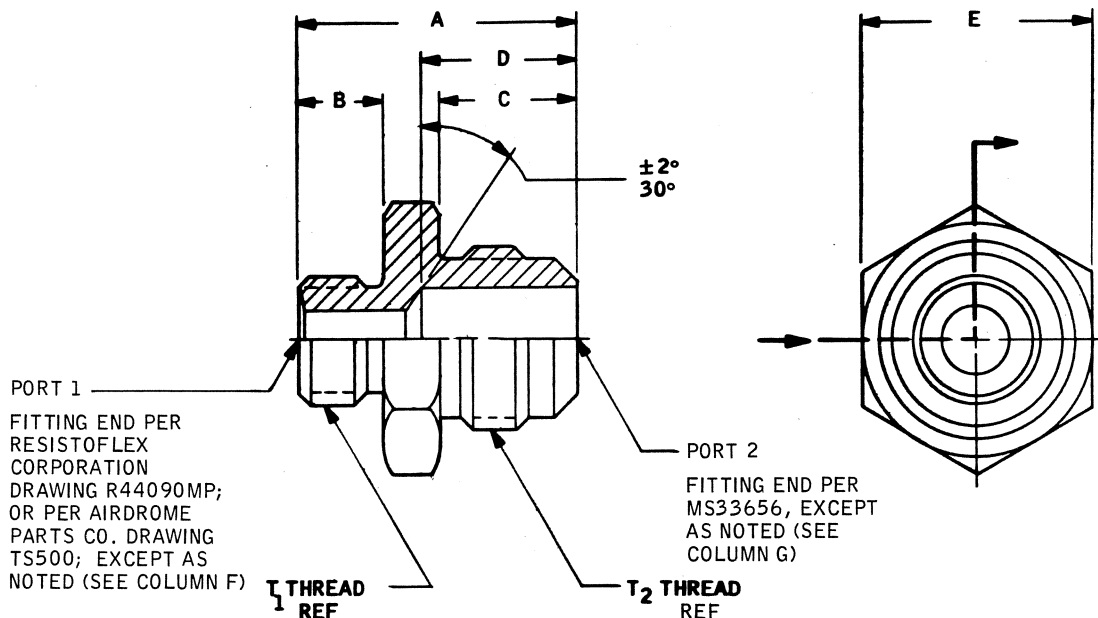
SHEET 2 OF 2

Data Sheet Revised

FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-148
15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



ME273-0185 DASH NO.	T ₁ THREAD REF	T ₂ THREAD REF	A ±.015	B ±.015	C ±.015	D ±.015	E REF	F PORT 1 SIZE	G PORT 2 SIZE
-0304	.3750-28 UNJS-3A	.4375-20 UNJF-3A	1.015	.233	.550	.610	.688	03	04
-0405	.4375-24 UNJS-3A	.5000-20 UNJF-3A	1.067	.275	.550	.610	.750	04	05
-0406	.4375-24 UNJS-3A	.5625-18 UNJF-3A	1.119	.275	.556	.616	.812	04	06
-0408	.4375-24 UNJS-3A	.7500-16 UNJF-3A	1.232	.275	.657	.717	1.000	04	08
-0608	.5625-20 UNJS-3A	.7500-16 UNJF-3A	1.252	.295	.657	.717	1.000	06	08
-0610	.5625-20 UNJS-3A	.8750-14 UNJF-3A	1.359	.295	.758	.818	1.125	06	10
-0810	.7188-20 UNJS-3A	.8750-14 UNJF-3A	1.372	.308	.758	.818	1.125	08	10
-0812	.7188-20 UNJS-3A	1.0625-12 UNJ-3A	1.552	.308	.864	.924	1.375	08	12
-1012	.8438-18 UNJS-3A	1.0625-12 UNJ-3A	1.616	.372	.864	.924	1.375	10	12
-1216	1.0000-16 UNJ-3A	1.3125-12 UNJ-3A	1.735	.412	.911	.971	1.625	12	16
-1416	1.1250-16 UNJ-3A	1.3125-12 UNJ-3A	1.753	.430	.911	.971	1.625	14	16
-1220	1.0000-16 UNJ-3A	1.6250-12 UNJ-3A	1.808	.412	.958	1.018	1.875	12	20
-1620	1.2500-14 UNJS-3A	1.6250-12 UNJ-3A	1.856	.460	.958	1.018	1.875	16	20

MATERIAL: 6AL-4V TITANIUM PER AMS 4965

FINISH: NONE

COATING: EVERLUBE 620A (EVERLUBE CORP., NO. HOLLYWOOD, CA) DRY FILM LUBRICANT ON SEALING FACE OF PORT 1 FITTING END

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM HYDRAULIC FLUID SYSTEMS

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.

UNION, EXPANDER, MALE TO
MS33656, TITANIUM

ME273-0185

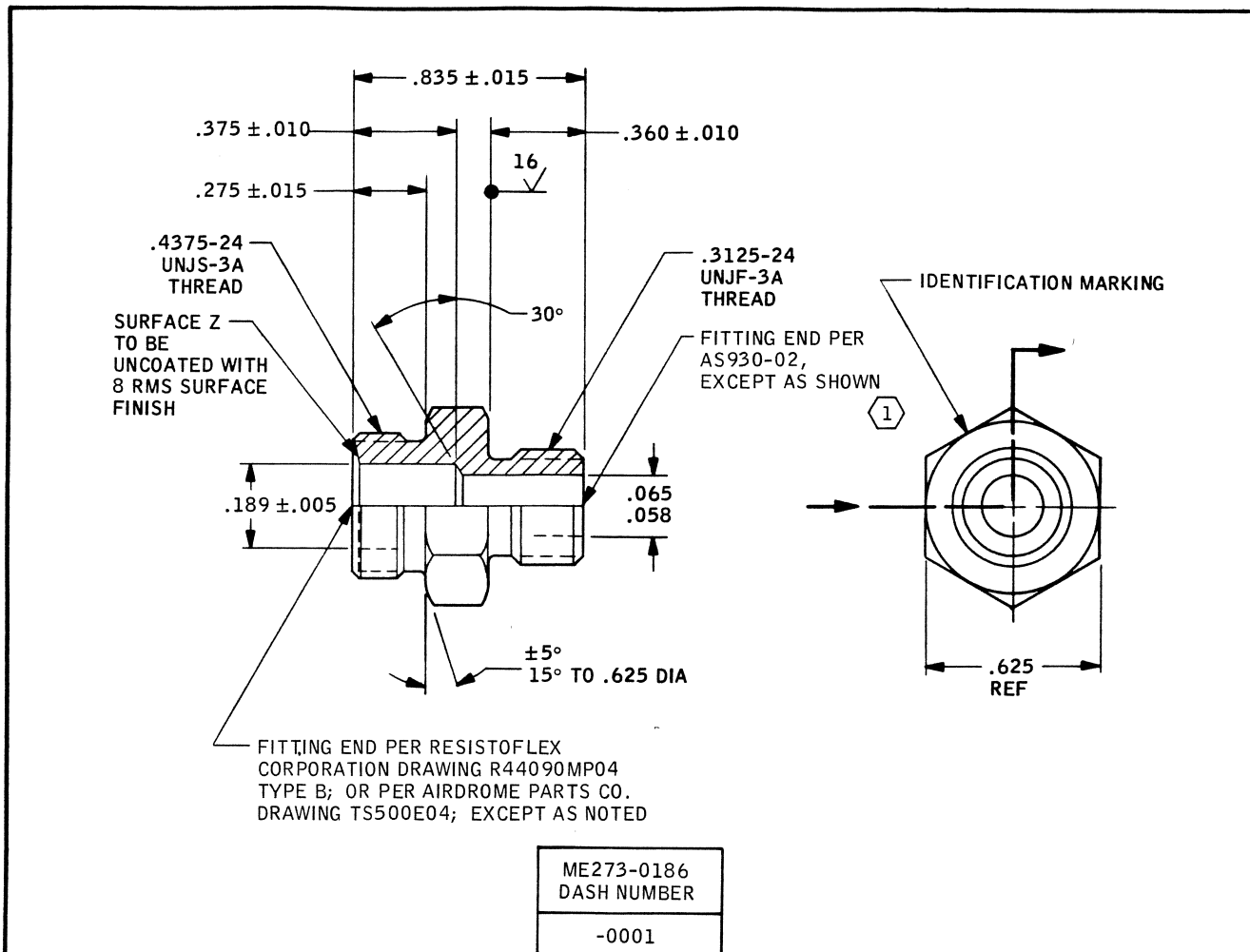
SHEET 1 OF 1

Data Sheet Revised



FITTINGS, DYNATUBE® AND DUAL SEAL*

2733-149
15 SEPTEMBER 1977



MATERIAL: 17-4PH CRES PER AMS 5643, HEAT TREAT TO CONDITION H-1075 (145 KSI TENSILE MIN) PER MIL-H-6875

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY.

APPLICATION: SPACE SHUTTLE PROGRAM NON-CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

1 AS930 IS A SOCIETY OF AUTOMOTIVE ENGINEERS (SAE) AEROSPACE STANDARD

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

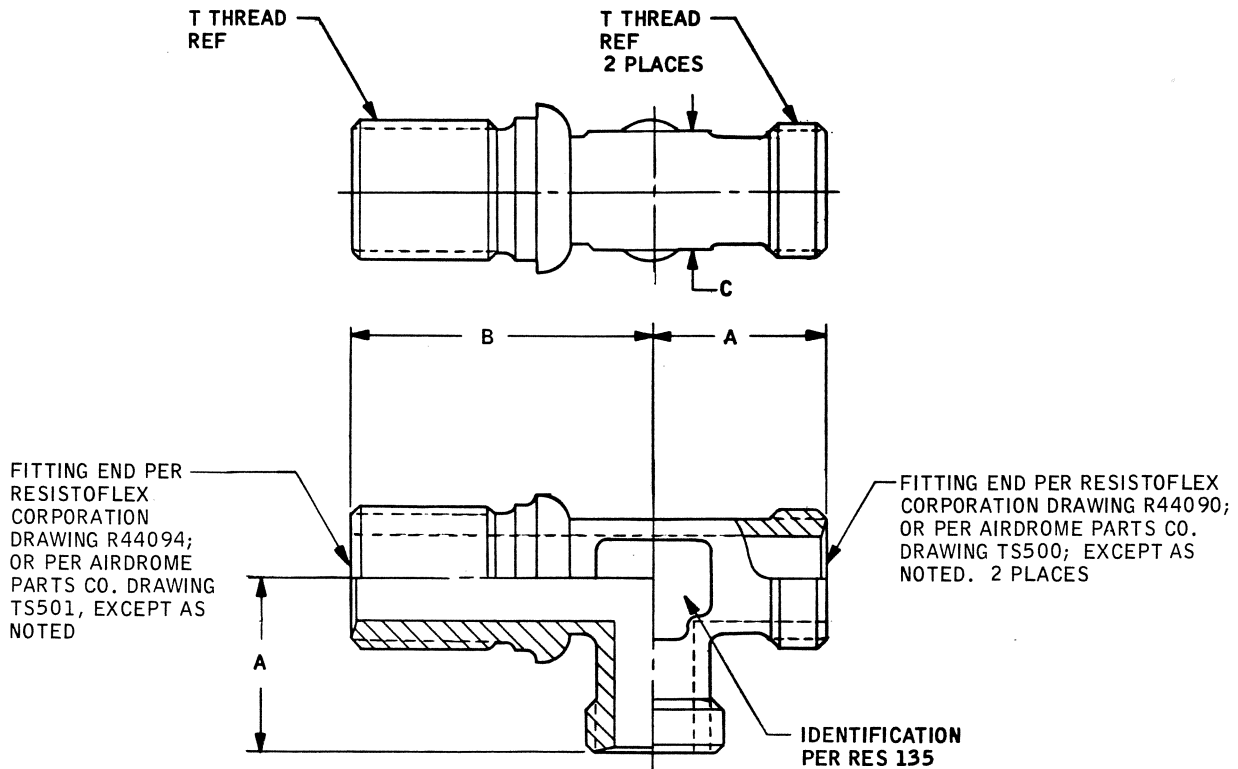
DUAL SEAL* IS A TRADEMARK OF TITFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.	UNION, REDUCER, MALE TO AS930, 17-4PH	ME273-0186
		SHEET 1 OF 1

Data Sheet Revised

2733-150
15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



ME273-0188 DASH NUMBER	TUBE SIZE REF	T THREAD	A ±.015	B ±.015	C REF
-0004	1/4	.4375-24 UNJS-3A	.617	1.225	.375
-0005	5/16	.5000-24 UNJS-3A	.653	1.261	.438
-0006	3/8	.5625-20 UNJS-3A	.704	1.353	.500
-0008	1/2	.7188-20 UNJS-3A	.824	1.542	.562
-0010	5/8	.8438-18 UNJS-3A	.955	1.769	.688
-0012	3/4	1.0000-16 UNJ-3A	1.062	1.953	.875
-0014	7/8	1.1250-16 UNJ-3A	1.216	2.188	1.125
-0016	1	1.2500-14 UNJS-3A	1.246	2.188	1.125
-0021	1-1/4	1.5781-14 UNJS-3A	1.387	2.326	1.375
-0025	1-1/2	1.8438-14 UNJS-3A	1.688	2.712	1.625

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

TEE, BULKHEAD TO MALE, MALE
ON SIDE, TITANIUM

ME273-0188

SHEET 1 OF 2

Data Sheet Revised

FITTINGS, DYNATUBE[®] AND DUAL SEAL*

MATERIAL: 6AL-4V TITANIUM PER AMS 4965

FINISH: NONE

COATING: EVERLUBE 620A (EVERLUBE CORP., NO. HOLLYWOOD, CA) DRY FILM LUBRICANT
ON SEALING FACE OF FITTING ENDS.

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM HYDRAULIC FLUID SYSTEMS

DYNATUBE[®] IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

TEE, BULKHEAD TO MALE, MALE
ON SIDE, TITANIUM

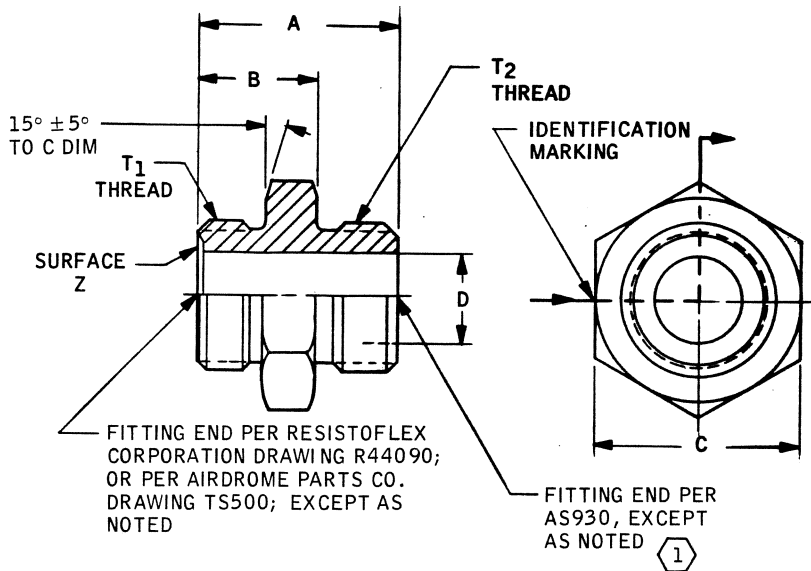
ME273-0188

SHEET 2 OF 2

Data Sheet Revised

2733-152
15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



ME273-0189 DASH NUMBER	TUBE SIZE REF	T ₁ THREAD	T ₂ THREAD	A ±.015	B ±.015	C REF	D DIA
-0004	1/4	.4375-24 UNJS-3A	.4375-20 UNJF-3A	.875	.475	.688	.194 .184
-0005	5/16	.5000-24 UNJS-3A	.5000-20 UNJF-3A	.906	.506	.750	.242 .232
-0006	3/8	.5625-20 UNJS-3A	.5625-18 UNJF-3A	.936	.536	.812	.307 .297
-0008	1/2	.7188-20 UNJS-3A	.7500-16 UNJF-3A	1.035	.595	1.000	.408 .398
-0010	5/8	.8438-18 UNJS-3A	.8750-14 UNJF-3A	1.117	.677	1.125	.523 .512
-0012	3/4	1.0000-16 UNJ-3A	1.0625-12 UNJ-3A	1.264	.784	1.375	.660 .649
-0014	7/8	1.1250-16 UNJ-3A	1.1875-12 UNJ-3A	1.290	.810	1.500	.780 .769
-0016	1	1.2500-14 UNJS-3A	1.3125-12 UNJ-3A	1.325	.845	1.625	.874 .862
-0021	1-1/4	1.5781-14 UNJS-3A	1.6250-12 UNJ-3A	1.375	.895	1.875	1.128 1.115
-0025	1-1/2	1.8438-14 UNJS-3A	1.8750-12 UNJ-3A	1.460	.980	2.125	1.337 1.324

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

UNION, MALE TO AS930,
TITANIUM

ME273-0189

SHEET 1 OF 2

Data Sheet Revised

FITTINGS, DYNATUBE® AND DUAL SEAL*

MATERIAL: 6AL-4V TITANIUM PER AMS 4965

FINISH: NONE

COATING: EVERLUBE 620A (EVERLUBE CORP., NO. HOLLYWOOD, CA) DRY FILM LUBRICANT ON SEALING SURFACE Z

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM HYDRAULIC FLUID SYSTEMS

① AS930 IS A SOCIETY OF AUTOMOTIVE ENGINEERS (SAE) AEROSPACE STANDARD

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.
DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

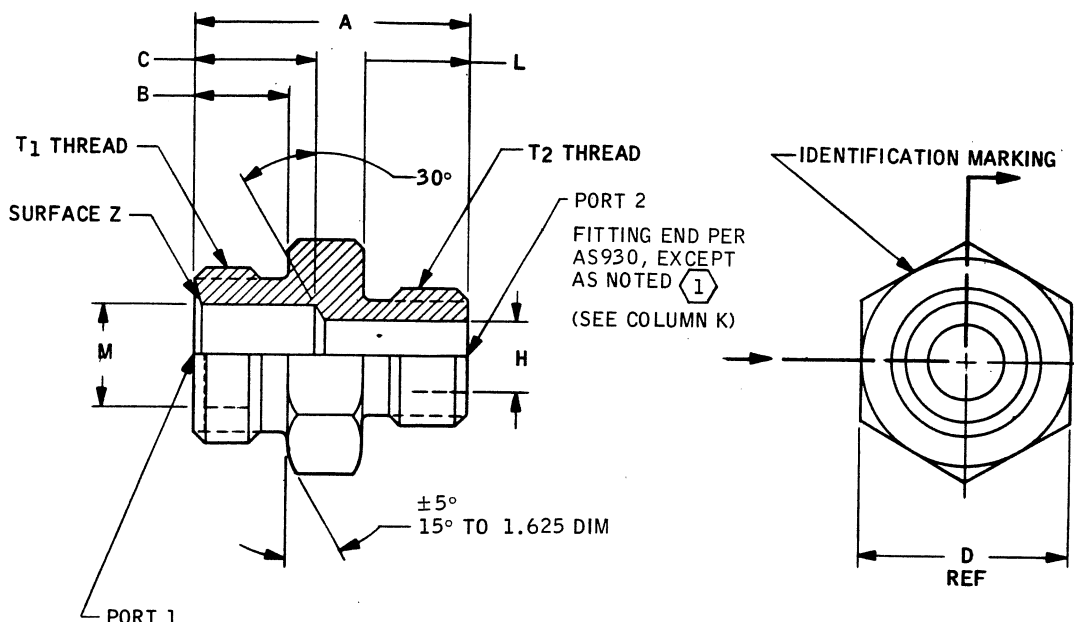
PARTS DATA SHEET	UNION, MALE TO AS930, TITANIUM	ME273-0189
FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.		SHEET 2 OF 2

Data Sheet Revised

FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-154
15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



FITTING END PER RESISTOFLEX CORPORATION DRAWING R44090; OR PER AIRDROME PARTS CO. DRAWING TS500; EXCEPT AS NOTED. (SEE COLUMN J)

ME273-0190 DASH NUMBER	T ₁ THREAD	T ₂ THREAD	A ±.015	B ±.015	C ±.010	D REF	H DIA	J PORT 1 SIZE	K PORT 2 SIZE	L ±.010	M DIA ±.003
-2108	1.5781-14 UNJS-3A	.7500-16 UNJF-3A	1.309	.457	.663	1.625	.506 .499	21	08	.440	1.125
-2116	1.5781-14 UNJS-3A	1.3125-12 UNJ-3A	1.349	.457	.663	1.625	.979 .968	21	16	.480	1.125

MATERIAL: 6AL-4V TITANIUM PER AMS 4965

FINISH: NONE

COATING: EVERLUBE 620A (EVERLUBE CORP., NO. HOLLYWOOD, CA) DRY FILM LUBRICANT ON SEALING SURFACE Z

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM HYDRAULIC FLUID SYSTEMS

(1) AS930 IS A SOCIETY OF AUTOMOTIVE ENGINEERS (SAE) AEROSPACE STANDARD

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.

UNION, REDUCER, MALE TO AS930, TITANIUM

ME273-0190

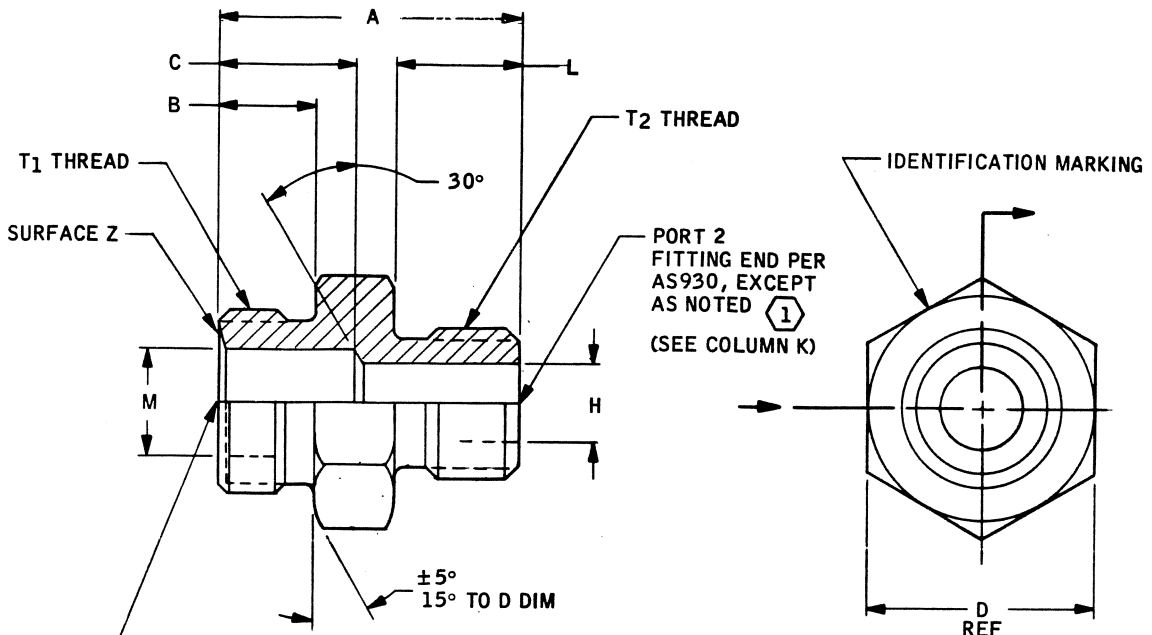
SHEET 1 OF 1

Data Sheet Revised

2733-155

15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



SOURCE CONTROL DRAWING DASH NUMBER	T ₁ THREAD	T ₂ THREAD	A ±.015	B ±.015	C ±.010	D REF	H	J PORT 1 SIZE	K PORT 2 SIZE	L ±.010	M ±.003
-0604 (2)	.5625-20 UNJS-3A	.4375-20 UNJF-3A	.927	.295	.411	.688	.251 .245	06	.04	.400	.304
-0804 (2)	.7188-20 UNJS-3A	.4375-20 UNJF-3A	.950	.308	.429	.750	.251 .245	08	04	.400	.405
-0806 (2)	.7188-20 UNJS-3A	.5625-18 UNJF-3A	.996	.308	.452	.812	.354 .347	08	06	.400	.405
-1008 (2)	.8438-18 UNJS-3A	.7500-16 UNJF-3A	1.112	.372	.522	1.000	.506 .499	10	08	.440	.520
(4) -1208 (3)	1.0000-16 UNJ-3A	.7500-16 UNJF-3A	1.152	.412	.562	1.000	.506 .499	12	08	.440	.657
(4) -1210 (3)	1.0000-16 UNJ-3A	.8750-14 UNJF-3A	1.158	.412	.565	1.125	.617 .608	12	10	.440	.657
-1610 (3)	1.2500-14 UNJS-3A	.8750-14 UNJF-3A	1.280	.460	.650	1.375	.617 .608	16	10	.440	.871
-1612 (3)	1.2500-14 UNJS-3A	1.0625-12 UNJ-3A	1.320	.460	.650	1.375	.791 .780	16	12	.480	.871
-9208 (2)	1.0000-16 UNJ-3A	.7500-16 UNJF-3A	1.152	.412	.562	1.000	.506 .499	12	08	.440	.657
-9210 (2)	1.0000-16 UNJ-3A	.8750-14 UNJF-3A	1.158	.412	.565	1.125	.617 .608	12	10	.440	.657

(1) AS930 IS A SOCIETY OF AUTOMOTIVE ENGINEERS (SAE) AEROSPACE STANDARD
 (4) INACTIVE FOR DESIGN AND PROCUREMENT AFTER MARCH 15, 1977. USE -9208 OR -9210.

PARTS DATA SHEET FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.	UNION, REDUCER, MALE THREADED TO AS930, INCONEL 718	ME273-0191
		SHEET 1 OF 2

Data Sheet Revised



FITTINGS, DYNATUBE[®] AND DUAL SEAL*

MATERIAL: INCONEL 718 PER AMS 5663

FINISH: PASSIVATE PER MIL-S-5002

COATING:

② REDUCERS -0604 THRU -1008, -9208 AND -9210, UNCOATED WITH 8 RMS SURFACE TEXTURE ON SEALING SURFACE Z

③ REDUCERS -1208 THRU -1612, THE SEALING SURFACE Z SHALL BE COATED PER AMS 2515C WITH DUPONT 850-204 TETRAFLUOROETHYLENE (TFE) TO A THICKNESS OF .1-.6 MILS

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

DYNATUBE[®] IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.

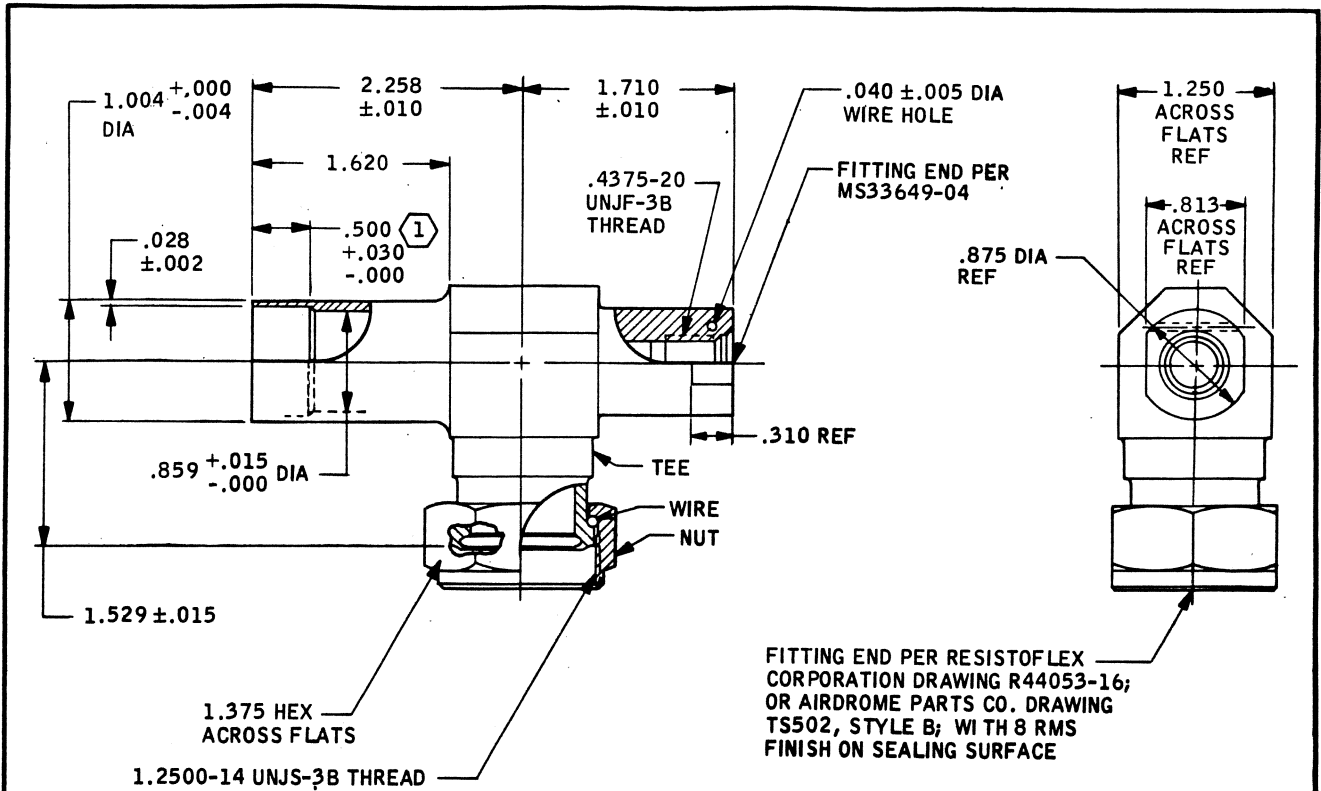
UNION, REDUCER, MALE THREADED TO AS930, INCONEL 718

ME273-0191

SHEET 2 OF 2

Data Sheet Revised

FITTINGS, DYNATUBE® AND DUAL SEAL*



① NO MARKING OR IDENTIFICATION IN THIS AREA

SOURCE CONTROL DRAWING DASH NUMBER
-0001

MATERIAL: TEE AND NUT - 17-4PH CRES PER AMS 5643, HEAT TREAT TO CONDITION H-1075 (145 KSI TENSILE MIN) PER MIL-H-6875

NUT RETAINING WIRE - 302 CRES PER AMS 5637, OR 305 CRES PER AMS 5685

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM NON-CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

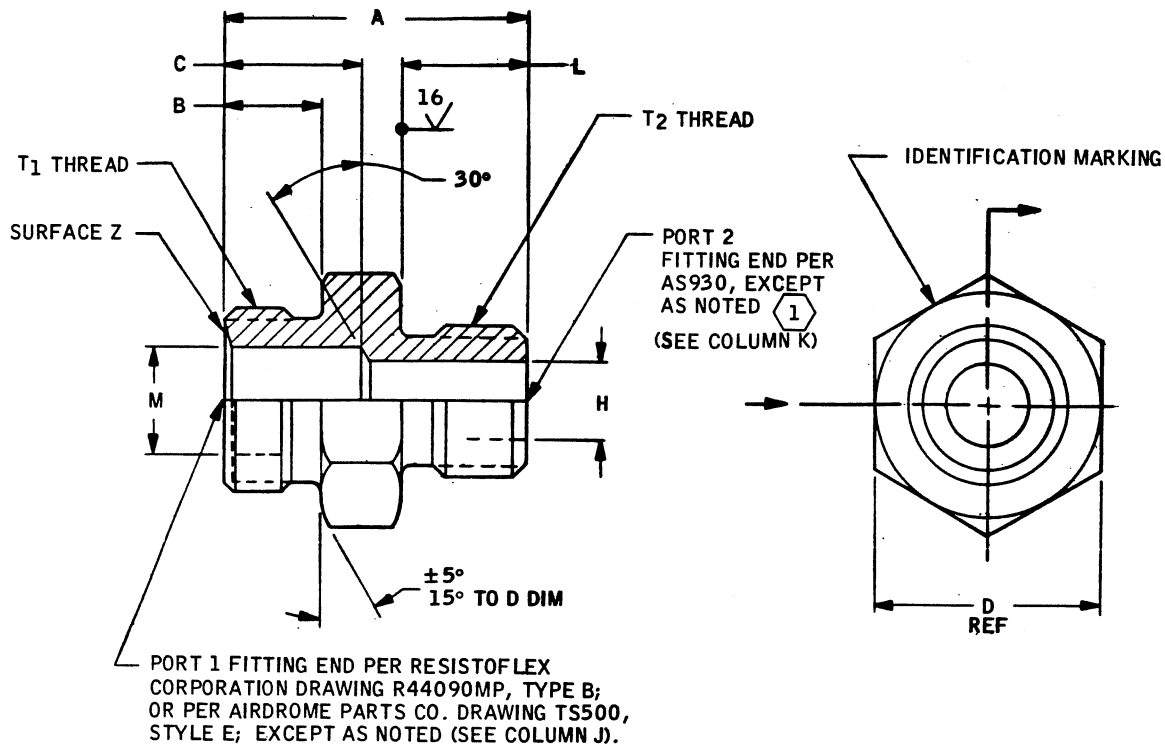
DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.	TEE, BRAZE/WELD TO BOSS, FEMALE ON SIDE, 17-4PH	ME273-0192
		SHEET 1 OF 1

Data Sheet Revised

2733-158
15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



SOURCE CONTROL DRAWING DASH NUMBER	T1 THREAD	T2 THREAD	A ±.015	B ±.015	C ±.010	D REF	H	J PORT 1 SIZE	K PORT 2 SIZE	L ±.010	M ±.003
-0604 (2)	.5625-20 UNJS-3A	.4375-20 UNJF-3A	.927	.295	.411	.688	.251 .245	06	04	.400	.304
-0804 (2)	.7188-20 UNJS-3A	.4375-20 UNJF-3A	.950	.308	.429	.750	.251 .245	08	04	.400	.405
-0806 (2)	.7188-20 UNJS-3A	.5625-18 UNJF-3A	.996	.308	.452	.812	.354 .347	08	06	.400	.405
-1008 (2)	.8438-18 UNJS-3A	.7500-16 UNJF-3A	1.112	.372	.522	1.000	.506 .499	10	08	.440	.520
-1208 (2)	1.0000-16 UNJ-3A	.7500-16 UNJF-3A	1.152	.412	.562	1.000	.506 .499	12	08	.440	.657
-1210 (2)	1.0000-16 UNJ-3A	.8750-14 UNJF-3A	1.158	.412	.565	1.125	.617 .608	12	10	.440	.657
-1610 (3)	1.2500-14 UNJS-3A	.8750-14 UNJF-3A	1.280	.460	.650	1.375	.617 .608	16	10	.440	.871
-1612 (3)	1.2500-14 UNJS-3A	1.0625-12 UNJ-3A	1.320	.460	.650	1.375	.791 .780	16	12	.480	.871

(1) AS930 IS A SOCIETY OF AUTOMOTIVE ENGINEERS (SAE) AEROSPACE STANDARD

PARTS DATA SHEET FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.	UNION, REDUCER, MALE TO AS930, INCONEL 718	ME273-0193
		SHEET 1 OF 2

Data Sheet Revised



FITTINGS, DYNATUBE® AND DUAL SEAL*

MATERIAL: INCONEL 718 PER AMS 5663

FINISH: PASSIVATE PER MIL-S-5002

COATING:

② REDUCERS -0604 THRU -1210, UNCOATED WITH 8 RMS SURFACE TEXTURE ON SEALING SURFACE Z

③ REDUCERS -1610 AND -1612, THE SEALING SURFACE Z SHALL BE COATED PER AMS 2515C WITH DUPONT 850-204 TETRAFLUOROETHYLENE (TFE) TO A THICKNESS OF .1-.6 MILS

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.
DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.

UNION, REDUCER, MALE TO AS930, INCONEL 718

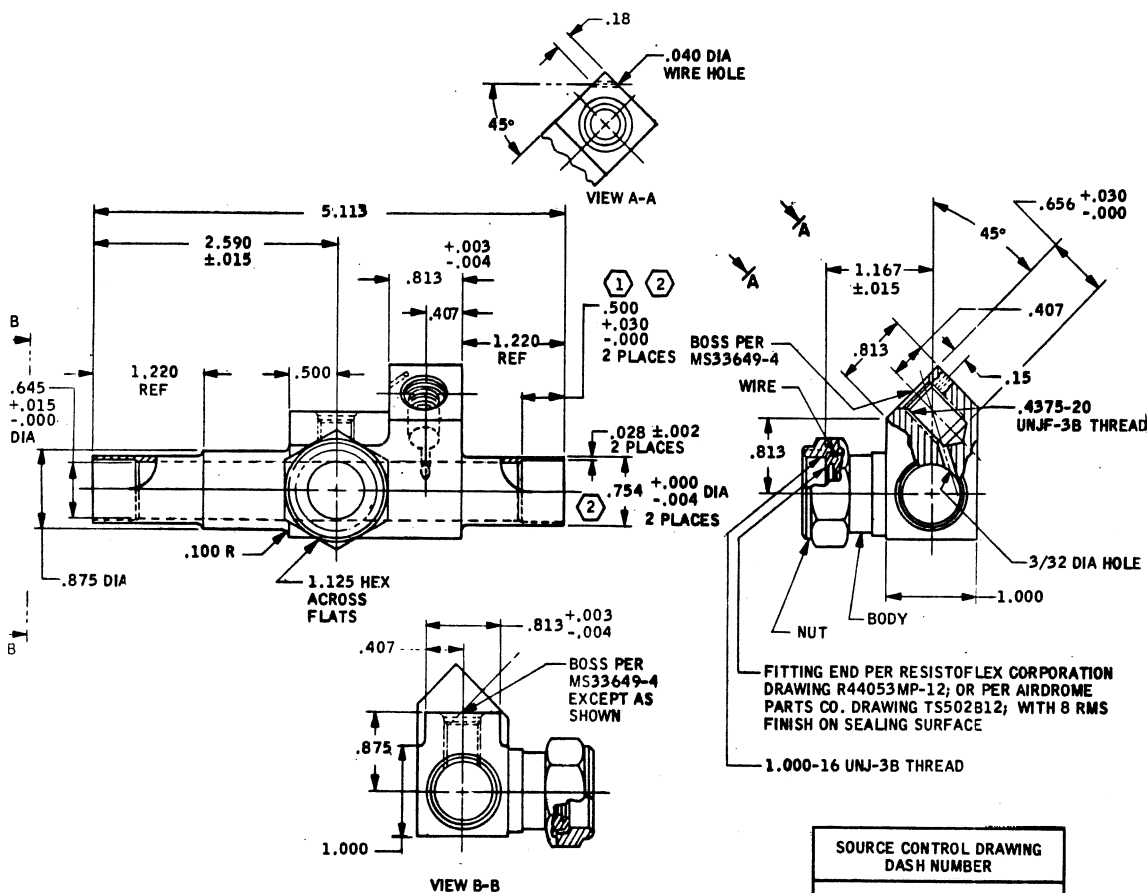
ME273-0193

SHEET 2 OF 2

Data Sheet Revised

2733-160
15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



SOURCE CONTROL DRAWING DASH NUMBER
-0001

① NO MARKING OR IDENTIFICATION IN THIS AREA. $\sqrt{63}$ SURFACE TEXTURE THIS AREA.

MATERIAL:

BODY AND NUT - INCONEL 718 PER AMS 5663
NUT RETAINING WIRE - 302 CRES PER AMS 5637, OR
305 CRES PER AMS 5685

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

NOTES:

- ② 1. NICKEL PLATE THE SHANK OD (FOR .500 LENGTH AS A MINIMUM) .0002 TO .0005 INCH THICK PER QQ-N-290, CLASS 1, GRADE G TO FACILITATE BRAZING. TOLERANCE ON DIAMETER SHALL APPLY AFTER PLATING.

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET
FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

FITTING, MANIFOLD, SPECIAL

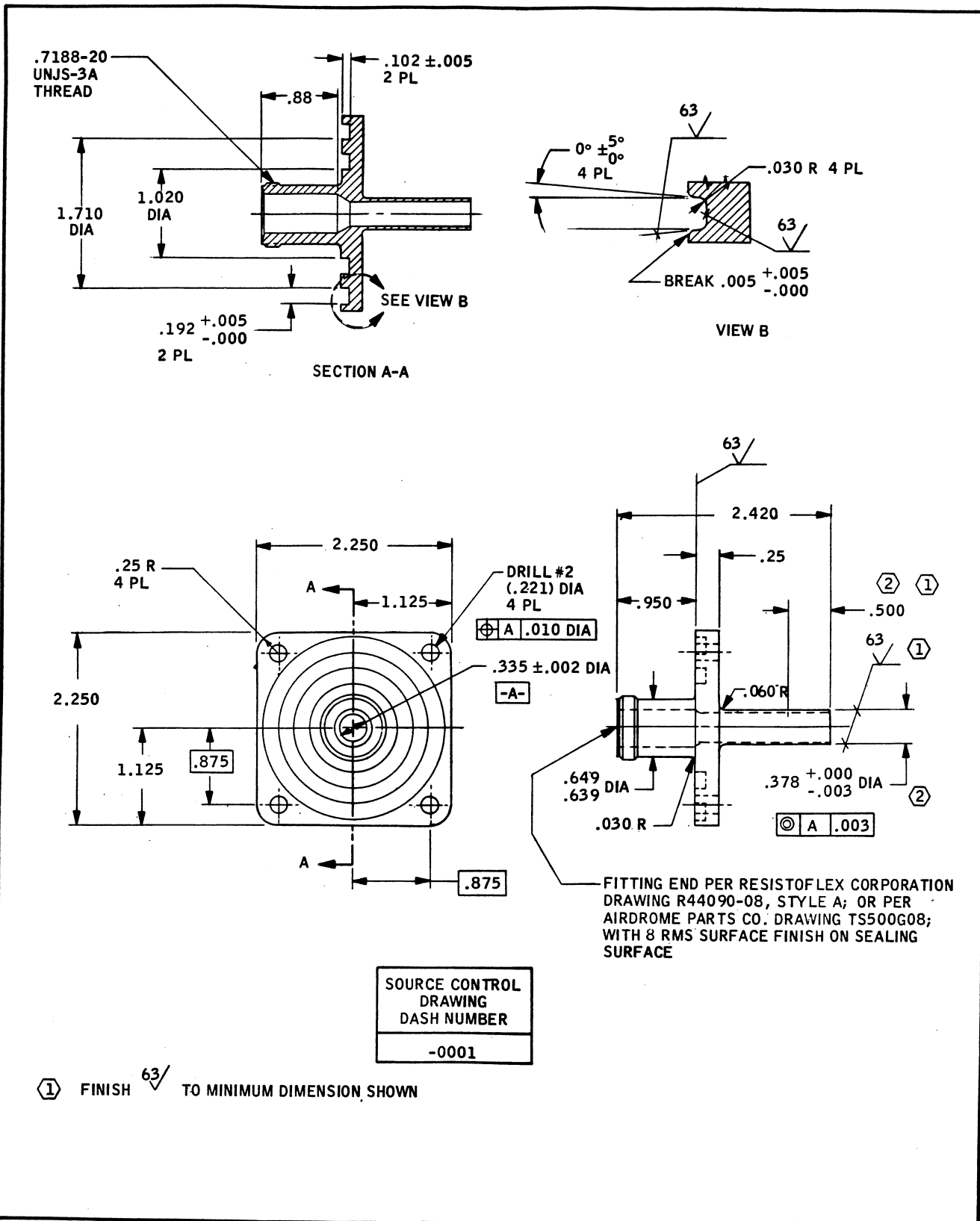
ME273-0194

SHEET 1 OF 1

Data Sheet Revised



FITTINGS, DYNATUBE® AND DUAL SEAL*



<p>PARTS DATA SHEET</p> <p>FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.</p> <p>Data Sheet Revised</p>	<p>CONNECTOR, BULKHEAD TO BRAZE/WELD, INCONEL 718</p>	<p>ME273-0195</p> <p>SHEET 1 OF 2</p>
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2733-162
15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*

MATERIAL: INCONEL 718 PER AMS 5663

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY.

APPLICATION: SPACE SHUTTLE PROGRAM CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

NOTES:

- ② 1. NICKEL PLATE THE SHANK OD (FOR .500 LENGTH AS A MINIMUM) .0002 TO .0005 INCH THICK PER QQ-N-290, CLASS 1, GRADE G TO FACILITATE BRAZING. TOLERANCE ON DIAMETER SHALL APPLY AFTER PLATING.

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.
DUAL SEAL* IS A TRADEMARK OF TITFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

CONNECTOR, BULKHEAD TO BRAZE/WELD,
INCONEL 718

ME273-0195

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

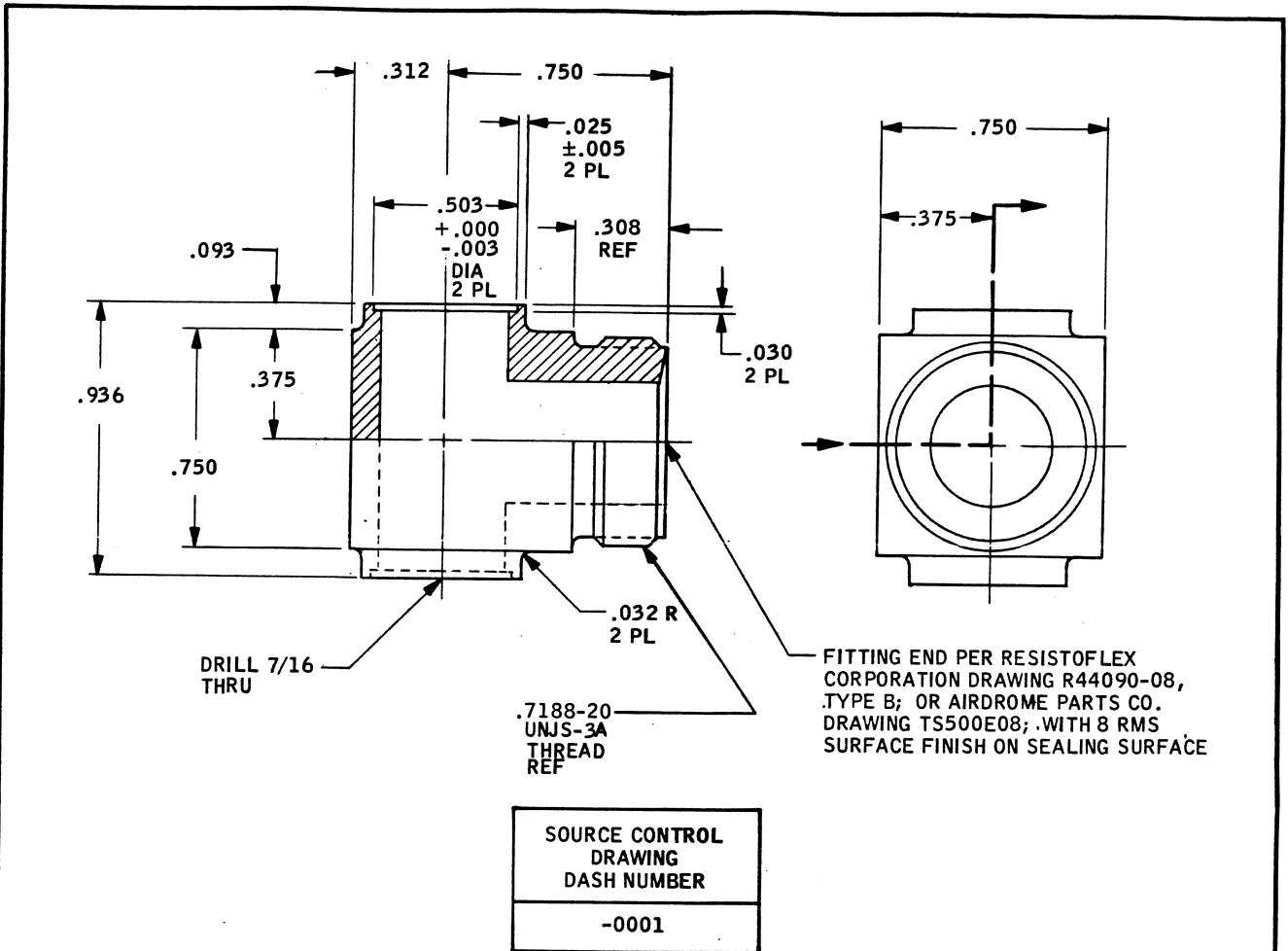
SHEET 2 OF 2

Data Sheet Revised



Space Division
Rockwell International

FITTINGS, DYNATUBE® AND DUAL SEAL*



MATERIAL: 17-4PH CRES PER AMS 5643, HEAT TREAT TO CONDITION H-1075 (145 KSI TENSILE MIN) PER MIL-H-6875

FINISH: CLEAN AND PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM NON-CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.
 DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

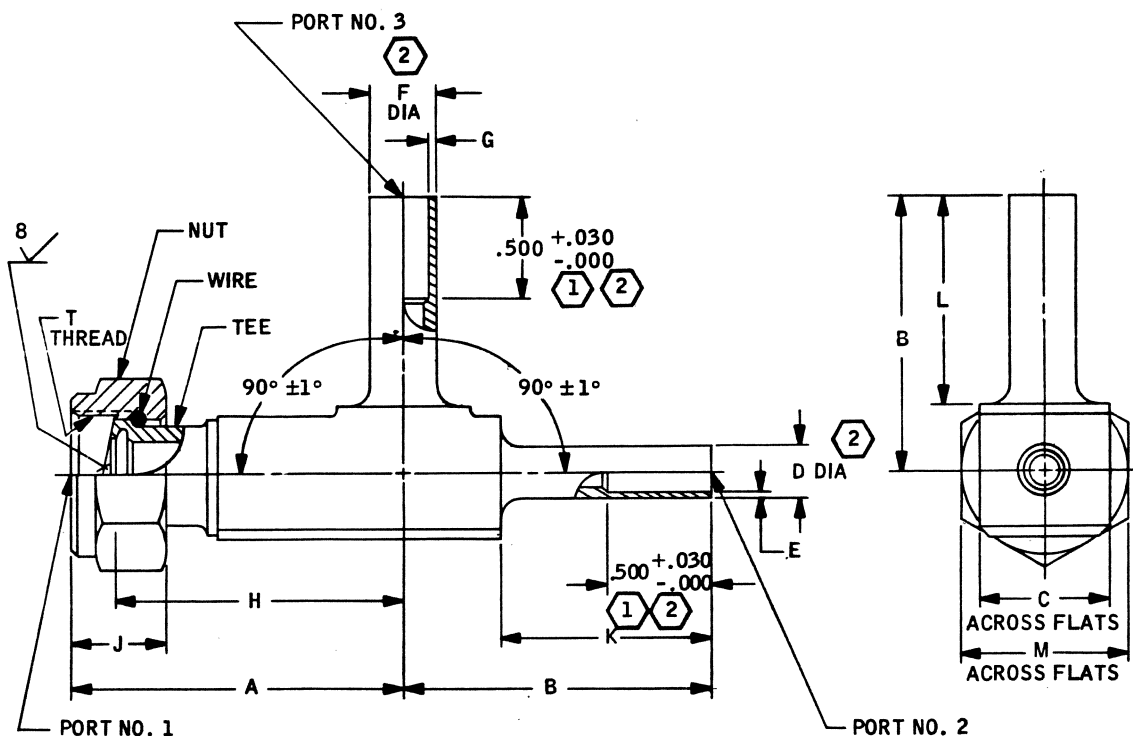
PARTS DATA SHEET FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.	TEE, ADAPTER, WELDS ON RUN, MALE ON SIDE, 17-4PH	ME273-0196
		SHEET 1 OF 1

Data Sheet Revised

2733-164

15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



PORT NO. 1
FITTING END PER RESISTOFLEX CORPORATION
DRAWING R44053; OR PER AIRDROME PARTS CO.
DRAWING TS502, STYLE B; EXCEPT AS NOTED

PORT NO. 2

MATERIAL: TEE AND NUT - INCONEL 718 PER AMS 5663
NUT RETAINING WIRE - 302 CRES PER AMS 5637, OR
305 CRES PER AMS 5685

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

NOTES:

- ② 1. NICKEL PLATE THE SHANK OD (FOR .500 LENGTH AS A MINIMUM) .0002 TO .0005 INCH THICK PER QQ-N-290, CLASS 1, GRADE G TO FACILITATE BRAZING. TOLERANCE ON OUTSIDE DIAMETER SHALL APPLY AFTER PLATING.
- ① NO MARKING OR IDENTIFICATION IN THIS AREA.

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORPORATION, ROSELAND, N.J.
DUAL SEAL* IS A TRADEMARK OF TITFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.

TEE, REDUCER, FEMALE TO BRAZE/WELD,
BRAZE/WELD ON SIDE, INCONEL 718

ME273-0197

SHEET 1 OF 2

Data Sheet Revised

FITTINGS, DYNATUBE® AND DUAL SEAL*

SOURCE CONTROL DRAWING DASH NUMBER	TUBE SIZE (REF)			T THREAD	A REF	B ±.010	C REF	D DIA +.000 -.003
	PORT NO. 1	PORT NO. 2	PORT NO. 3					
-0001	3/8	3/8	1/4	.5625-20 UNJS-3B	1.773	1.491	.562	.378
-0002	3/8	1/4	1/4	.5625-20 UNJS-3B	1.773	1.491	.562	.253
-0003	3/8	1/4	3/8	.5625-20 UNJS-3B	1.773	1.491	.562	.253
-0004	1/2	3/8	1/4	.7188-20 UNJS-3B	1.784	1.569	.688	.378
-0005	1/2	1/4	1/4	.7188-20 UNJS-3B	1.784	1.569	.688	.253
-0006	1/2	1/4	3/8	.7188-20 UNJS-3B	1.784	1.569	.688	.253
-0007	1/2	1/2	1/4	.7188-20 UNJS-3B	1.784	1.569	.688	.503
-0008	1/2	1/4	1/2	.7188-20 UNJS-3B	1.784	1.569	.688	.253
-0009	1/2	1/2	3/8	.7188-20 UNJS-3B	1.784	1.569	.688	.503
-0010	1/2	3/8	3/8	.7188-20 UNJS-3B	1.784	1.569	.688	.378
-0011	1/2	3/8	1/2	.7188-20 UNJS-3B	1.784	1.569	.688	.378
-0012	5/8	5/8	1/2	.8438-18 UNJS-3B	1.867	1.644	.812	.629

SOURCE CONTROL DRAWING DASH NUMBER	E ±.002	F DIA +.000 -.003	G ±.002	H ±.015	J ±.015	K	L	M REF
-0001	.020	.253	.020	1.540	.518	1.150	1.040	.688
-0002	.020	.253	.020	1.540	.518	1.040	1.040	.688
-0003	.020	.378	.020	1.540	.518	1.040	1.150	.688
-0004	.020	.253	.020	1.535	.510	1.150	1.040	.875
-0005	.020	.253	.020	1.535	.510	1.040	1.040	.875
-0006	.020	.378	.020	1.535	.510	1.040	1.150	.875
-0007	.025	.253	.020	1.535	.510	1.150	1.040	.875
-0008	.020	.503	.025	1.535	.510	1.040	1.150	.875
-0009	.025	.378	.020	1.535	.510	1.150	1.150	.875
-0010	.020	.378	.020	1.535	.510	1.150	1.150	.875
-0011	.020	.503	.025	1.535	.510	1.150	1.150	.875
-0012	.025	.503	.025	1.535	.571	1.162	1.150	1.000

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

TEE, REDUCER, FEMALE TO BRAZE/WELD,
BRAZE/WELD ON SIDE, INCONEL 718

ME273-0197

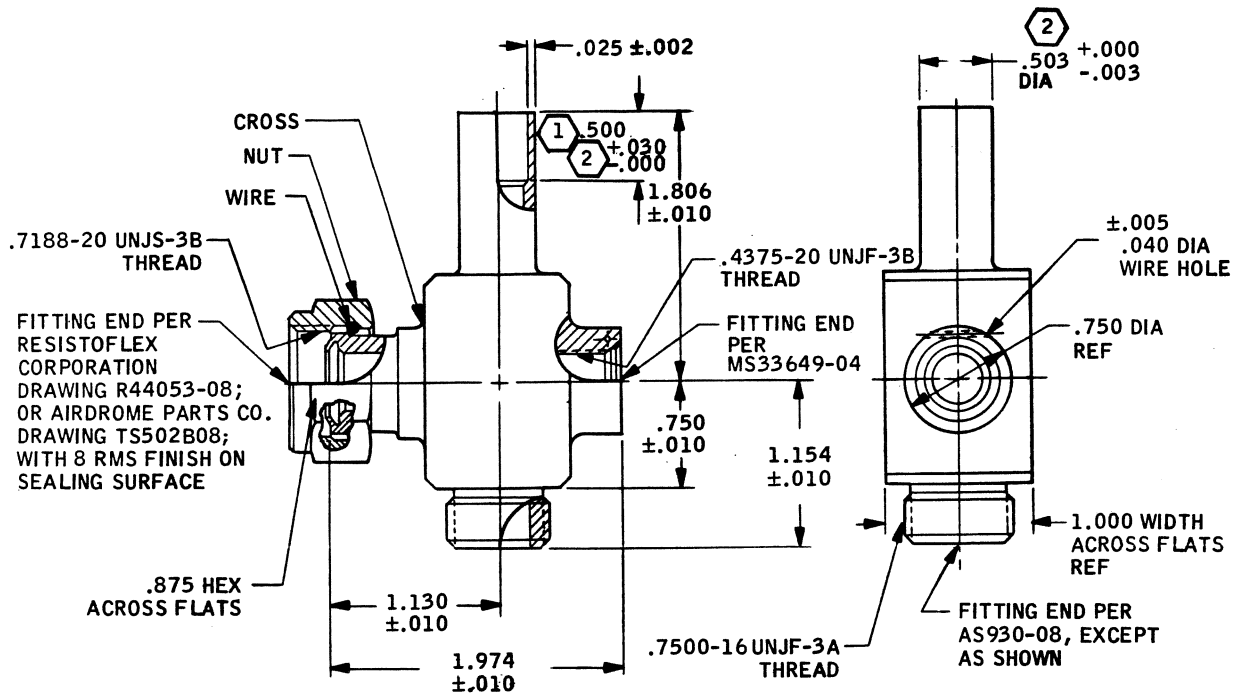
SHEET 2 OF 2

Data Sheet Revised



2733-166
15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



1 NO MARKING AND/OR IDENTIFICATION IN THIS AREA

SOURCE CONTROL DRAWING DASH NUMBER
-0001

MATERIAL: CROSS AND NUT - INCONEL 718 PER AMS 5663
NUT RETAINING WIRE - 302 CRES PER AMS 5637, OR
305 CRES PER AMS 5685

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

NOTES:

- 2 1. NICKEL PLATE THE SHANK OD (FOR .500 LENGTH AS A MINIMUM) .0002 TO .0005 INCH THICK PER QQ-N-290, CLASS 1, GRADE G TO FACILITATE BRAZING. TOLERANCE ON DIAMETER SHALL APPLY AFTER PLATING

DYNATUBE® IS A REGISTERED TRADEMARK OF RESISTOFLEX CORP., ROSELAND, N.J.

DUAL SEAL* IS A TRADEMARK OF TITFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

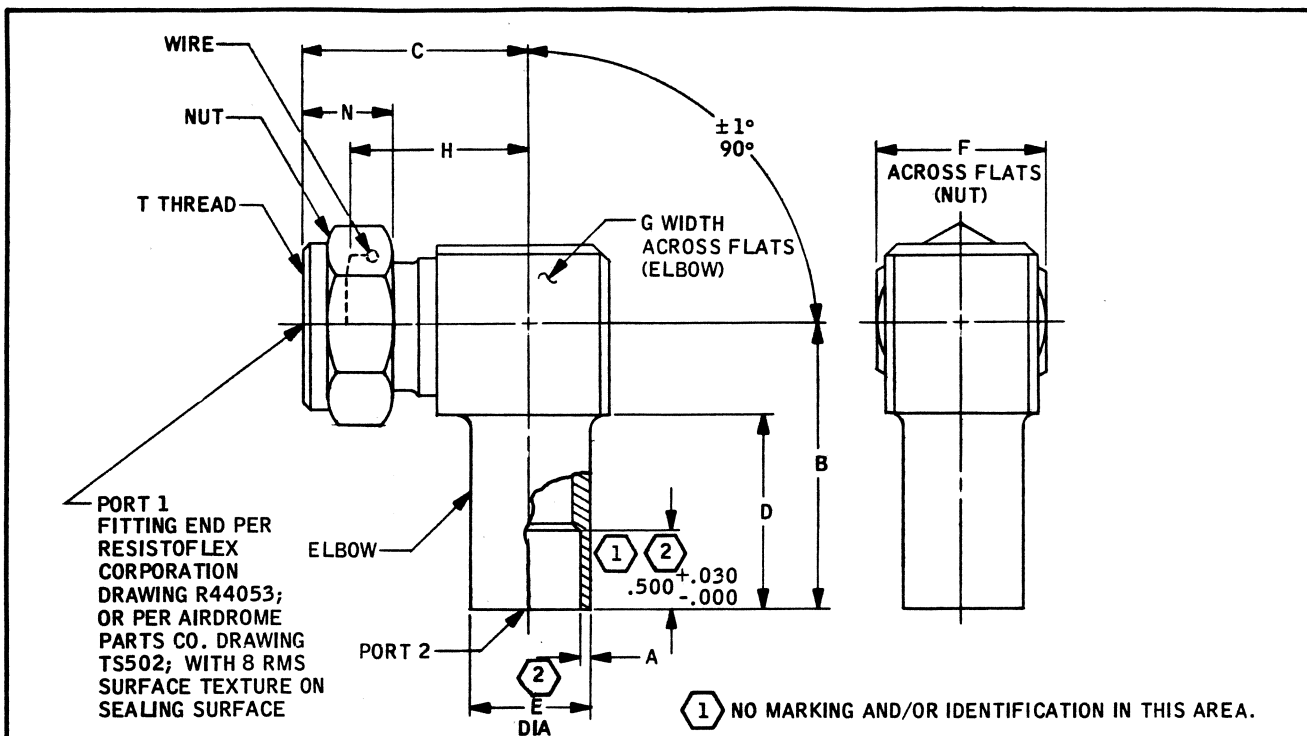
FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.

CROSS, FEMALE TO BOSS, BRAZE/
WELD TO MALE, INCONEL 718

ME273-0198

SHEET 1 OF 1

FITTINGS, DYNATUBE® AND DUAL SEAL*



PORT 1 FITTING END PER RESISTOFLEX CORPORATION DRAWING R44053; OR PER AIRDROME PARTS CO. DRAWING TS502; WITH 8 RMS SURFACE TEXTURE ON SEALING SURFACE

(1) NO MARKING AND/OR IDENTIFICATION IN THIS AREA.

DASH NO.	T THREAD	PORT 1 TUBE SIZE	PORT 2 TUBE SIZE	A ±.002	B	C REF	D	E DIA +.000 - .003	F REF	G REF	H ±.015	N ±.015
-0001	.5625-20 UNJS-3B	3/8	1/4	.020	1.381	1.116	1.040	.253	.688	.625	.883	.518
-0002	.5625-20 UNJS-3B	3/8	1/4	.035	1.381	1.116	1.040	.253	.688	.625	.883	.518
-0003	.7188-20 UNJS-3B	1/2	3/8	.020	1.569	1.232	1.150	.378	.875	.750	.983	.510
-0004	.7188-20 UNJS-3B	1/2	3/8	.049	1.569	1.232	1.150	.378	.875	.750	.983	.510
-0005	1.0000-16 UNJ-3B	3/4	1/2	.025	1.710	1.534	1.150	.503	1.125	1.000	1.191	.637
-0006	1.0000-16 UNJ-3B	3/4	1/2	.058	1.710	1.534	1.150	.503	1.125	1.000	1.191	.637

MATERIAL: BODY AND NUT - INCONEL 718 PER AMS 5663
NUT RETAINING WIRE - 302 CRES PER AMS 5637, OR 305 CRES PER AMS 5685

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

NOTES:

- (2) 1. NICKEL PLATE THE SHANK OD (FOR .500 LENGTH AS A MINIMUM) .0002 TO .0005 INCH THICK PER QQ-N-290, CLASS 1, GRADE G TO FACILITATE BRAZING. TOLERANCE ON DIAMETER SHALL APPLY AFTER PLATING.

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DUAL SEAL* IS A TRADEMARK OF TITFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

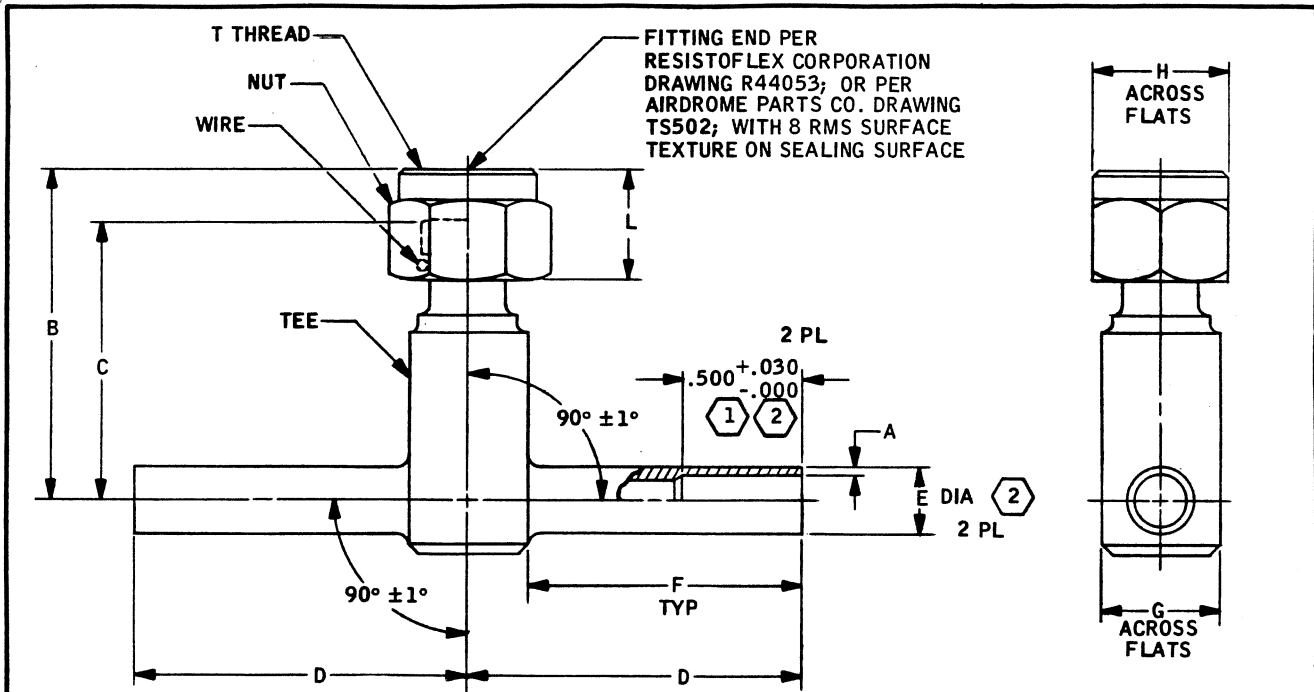
PARTS DATA SHEET FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.	ELBOW, 90°, REDUCER, FEMALE TO BRAZE/WELD, INCONEL 718	ME273-0199
		SHEET 1 OF 1

FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-168

15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



(1) NO MARKING AND/OR IDENTIFICATION
IN THIS AREA

SOURCE CONTROL DRAWING DASH NUMBER	TUBE SIZE REF	T THREAD	A ±.002	B REF	C ±.015	D ±.010	E DIA	F ±.010	G REF	H REF	L ±.015
-0420	1/4	.4375-24 UNJS-3B	.020	1.014	.808	1.381	.253	1.040	.500	.562	.454
-0435			.035								
-0620	3/8	.5625-20 UNJS-3B	.020	1.178	.945	1.491	.378	1.150	.625	.688	.518
-0649			.049								
-0825	1/2	.7188-20 UNJS-3B	.025	1.294	1.045	1.569	.503	1.150	.750	.875	.510
-0858			.058								

PARTS DATA SHEET	TEE, BRAZE/WELD ON RUN, FEMALE ON SIDE, INCONEL 718	ME273-0200
FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.		SHEET 1 OF 2

Data Sheet Revised



FITTINGS, DYNATUBE[®] AND DUAL SEAL*

MATERIAL: BODY AND NUT - INCONEL 718 PER AMS 5663
NUT RETAINING WIRE - 302 CRES PER AMS 5637, OR 305 CRES PER AMS 5685

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY.

APPLICATION: SPACE SHUTTLE PROGRAM CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS.

NOTES:

- ② 1. NICKEL PLATE THE SHANK OD (FOR .500 LENGTH AS A MINIMUM) .0002 TO .0005 INCH THICK PER QQ-N-290, CLASS 1, GRADE G TO FACILITATE BRAZING. TOLERANCE ON DIAMETER SHALL APPLY AFTER PLATING.

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DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

TEE, BRAZE/WELD ON RUN,
FEMALE ON SIDE, INCONEL 718

ME273-0200

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

SHEET 2 OF 2

Data Sheet Revised

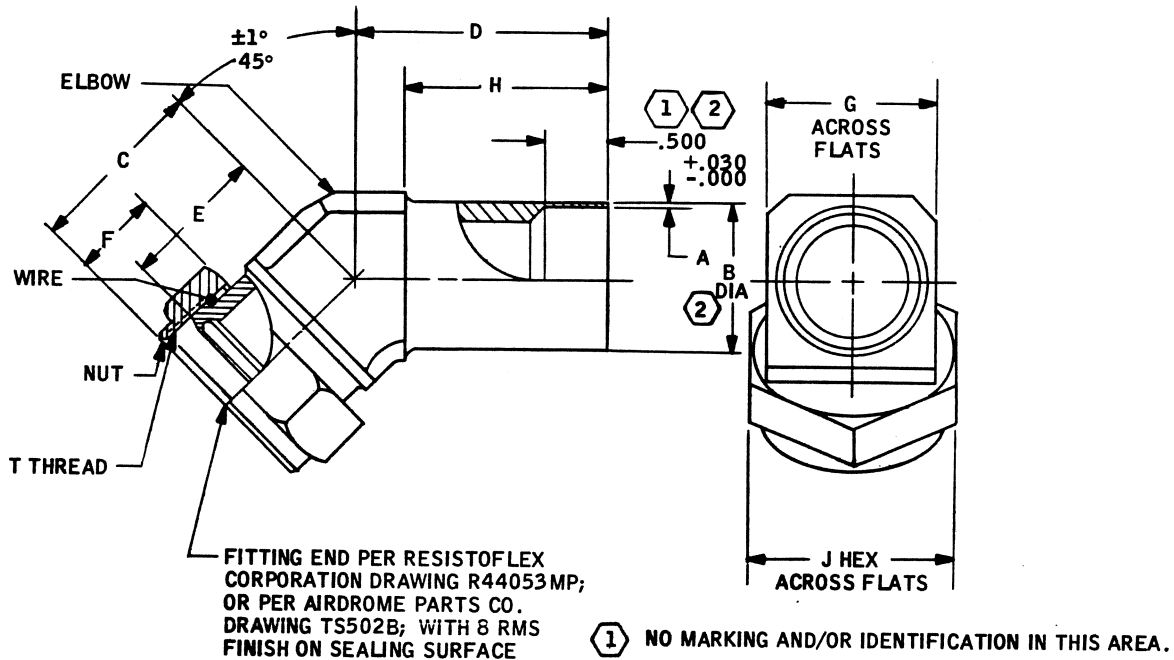


Space Division
Rockwell International

FLUID SYSTEMS DESIGN AND PARTS MANUAL

2733-170
15 SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



MATERIAL: ELBOW AND NUT - INCONEL 718 PER AMS 5663
NUT RETAINING WIRE - 302 CRES PER AMS 5637, OR
305 CRES PER AMS 5685

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY.

APPLICATION: SPACE SHUTTLE PROGRAM CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

NOTES:

- ② 1. NICKEL PLATE THE SHANK OD (FOR .500 LENGTH AS A MINIMUM) .0002 TO .0005 INCH THICK PER QQ-N-290, CLASS 1, GRADE G TO FACILITATE BRAZING. TOLERANCE ON DIAMETER SHALL APPLY AFTER PLATING.

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DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

FOR DESIGN USE ONLY - NOT TO BE USED FOR
PROCUREMENT OR INSPECTION PURPOSES.

ELBOW, 45°, FEMALE TO
BRAZE/WELD, INCONEL 718

ME273-0201

SHEET 1 OF 2

Data Sheet Revised

FITTINGS, DYNATUBE® AND DUAL SEAL*

SOURCE CONTROL DRAWING DASH NUMBER	TUBE SIZE REF	T THREAD	A ±.002	B DIA	C REF	D ±.010	E ±.015	F ±.015	G REF	H ±.010	J REF
-0420	1/4	.4375-24 UNJS-3B	.020	.253	.868	1.212	.662	.454	.500	1.040	.562
-0428			.028								
-0435			.035								
-0520	5/16	.5000-24 UNJS-3B	.020	.315	.895	1.338	.685	.459	.562	1.150	.625
-0620	3/8	.5625-20 UNJS-3B	.020	.378	1.002	1.353	.769	.518	.625	1.150	.688
-0635			.035								
-0820	1/2	.7188-20 UNJS-3B	.020	.503	1.054	1.400	.805	.510	.750	1.150	.875
-0825			.025								
-0865			.065								
-1020	5/8	.8438-18 UNJS-3B	.020	.629	1.208	1.443	.901	.571	.875	1.162	1.000
-1025			.025								
-1072			.072								
-1220	3/4	1.0000-16 UNJ-3B	.020	.754	1.347	1.532	1.004	.637	1.000	1.220	1.125
-1228			.028								
-1249			.049								
-1628	1	1.2500-14 UNJS-3B	.028	1.004	1.501	1.995	1.135	.705	1.250	1.620	1.375
-1649			.049								
-1683			.083								
-2035	1-1/4	1.5156-14 UNJS-3B	.035	1.254	1.544	2.042	1.173	.687	1.500	1.620	1.625
-2049			.049								
-2435	1-1/2	1.7812-14 UNJS-3B	.035	1.504	1.822	2.200	1.368	.800	1.750	1.700	2.000
-2449			.049								

EXAMPLE OF CONTROL NUMBER:

ME273-0201-0820 = 45° ELBOW, INCONEL 718, FOR 1/2 OD TUBING WITH .020 WALL THICKNESS

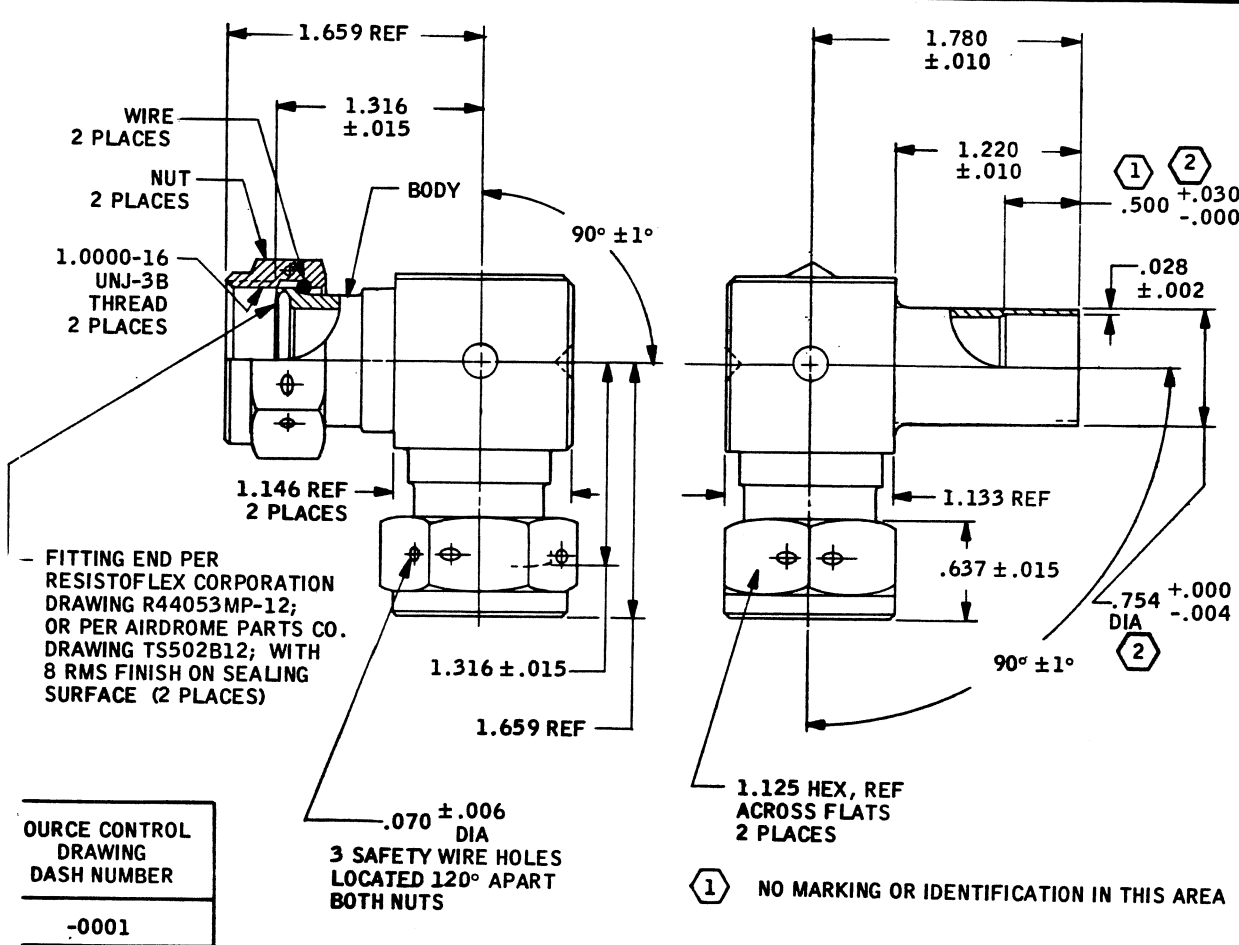
PARTS DATA SHEET FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.	ELBOW, 45°, FEMALE TO BRAZE/WELD, INCONEL 718	ME273-0201
		SHEET 2 OF 2



FLUID SYSTEMS DESIGN AND PARTS MANUAL

33-172
SEPTEMBER 1977

FITTINGS, DYNATUBE® AND DUAL SEAL*



MATERIAL: BODY AND NUTS - INCONEL 718 PER AMS 5663
NUT RETAINING WIRE - 302 CRES PER AMS 5637, OR 305 CRES PER AMS 5685

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY.

APPLICATION: SPACE SHUTTLE PROGRAM CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

NOTES:

- ② 1. NICKEL PLATE THE SHANK OD (FOR .500 LENGTH AS A MINIMUM) .0002 TO .0005 INCH THICK PER QQ-N-290, CLASS 1, GRADE G TO FACILITATE BRAZING. TOLERANCE ON DIAMETER SHALL APPLY AFTER PLATING.

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DUAL SEAL* IS A TRADEMARK OF TITEFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET

DESIGN USE ONLY - NOT TO BE USED FOR PURCHASE OR INSPECTION PURPOSES.

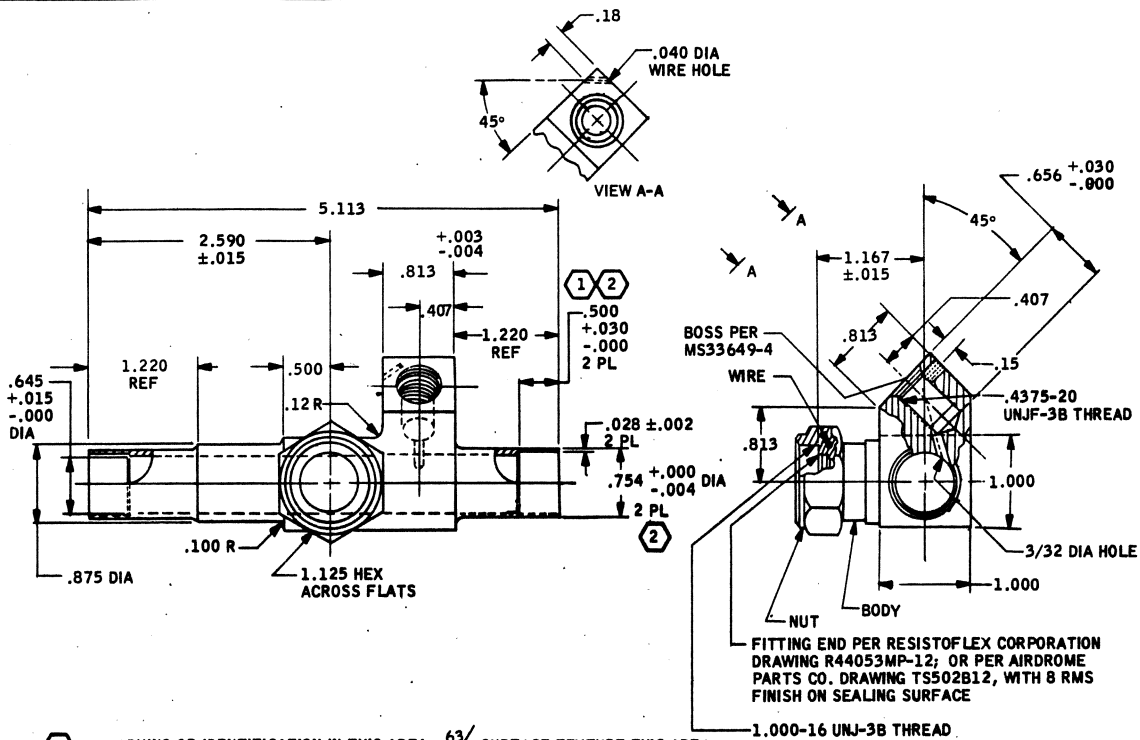
ELBOW, 90°, FEMALE TO BRAZE/WELD,
PORT ON SIDE, INCONEL 718

ME273-0202

SHEET 1 OF 1

Sheet Revised

FITTINGS, DYNATUBE® AND DUAL SEAL*



(1) NO MARKING OR IDENTIFICATION IN THIS AREA. (2) SURFACE TEXTURE THIS AREA.

SOURCE CONTROL DRAWING DASH NUMBER
-0001

MATERIAL: BODY AND NUT - INCONEL 718 PER AMS 5663
NUT RETAINING WIRE - 302 CRES PER AMS 5637, OR
305 CRES PER AMS 5685

FINISH: PASSIVATE PER MIL-S-5002

PROCUREMENT SPECIFICATION: MC273-0129

TRACEABILITY: ALL ITEMS ON THIS DRAWING ARE EXEMPT FROM TRACEABILITY

APPLICATION: SPACE SHUTTLE PROGRAM CRYOGENIC AND NON-HYDRAULIC FLUID SYSTEMS

NOTES:

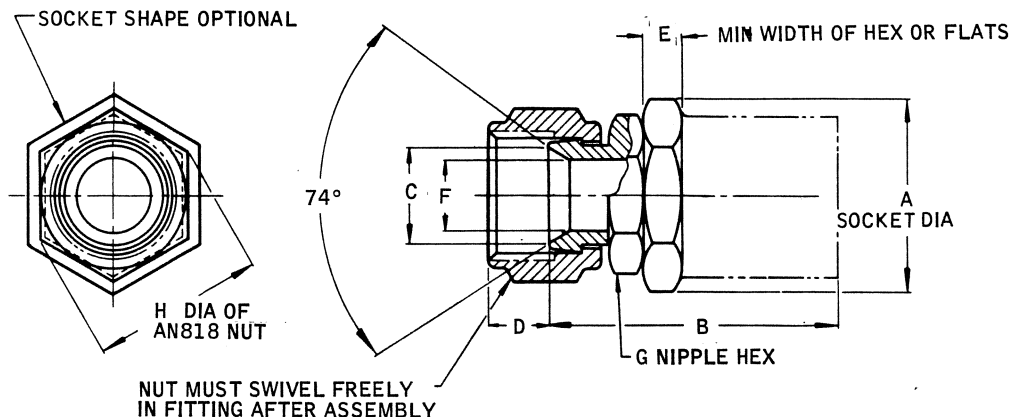
- (2) 1. NICKEL PLATE THE SHANK OD (FOR .500 LENGTH AS A MINIMUM) .0002 TO .0005 INCH THICK PER QQ-N-290, CLASS 1, GRADE G TO FACILITATE BRAZING. TOLERANCE ON DIAMETER SHALL APPLY AFTER PLATING.

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DUAL SEAL* IS A TRADEMARK OF TITFLEX, DIVISION OF ATLAS CORP., SPRINGFIELD, MASS.

PARTS DATA SHEET	TEE, BRAZE/WELD ON RUNS, FEMALE ON SIDE, INCONEL 718	ME273-0203
FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.		SHEET 1 OF 1

Data Sheet Revised

FITTINGS, HOSE



MS28760 DASH NO.	HOSE ID REF	TUBING OD	NUT	A MAX DIA	B MAX	C DIA	D		E MIN	F MIN DIA	G MIN NIPPLE HEX	H REF		
-4	.219	.2500	AN818-4	.875	2.100	.295	±.010	.375	±.016	.188	.146	.563	.649	
-5	.281	.3125	AN818-5	.937	2.240	.355				.177	.625	.721		
-6	.344	.3750	AN818-6	1.160	2.470	.435				.271	.688	.794		
-8	.438	.5000	AN818-8	1.375	2.700	.570	±.031	.438	.250	.365	.875	1.010		
-10	.562	.6250	AN818-10	1.550	3.000	.680				.515	.312	.455	1.000	1.155
-12	.688	.7500	AN818-12	1.740	3.230	.850				.562	.375	.568	1.250	1.443
-16	.875	1.0000	AN818-16	2.000	3.800	1.103	±.015	.620		.778	1.500	1.732		

MATERIALS: NIPPLES AND NUTS, STEEL PER MIL-S-6758 (4130), MIL-S-8695 (4037), MIL-S-6050 (8630), AND QQ-S-633 (C1137, C1141), QQ-S-624, MIL-S-6049 (8740).
 SOCKET, ALUMINUM ALLOY PER QQ-A-225/4 (2014-T6), QQ-A-225/6 (2024-T6 OR T851)

FINISH: ALUMINUM ANODIZED PER MIL-A-8625, TYPE II
 STEEL CADMIUM PLATED PER QQ-P-416, TYPE II, CLASS 3, BLACK

PROCUREMENT SPECIFICATION: MIL-F-8789

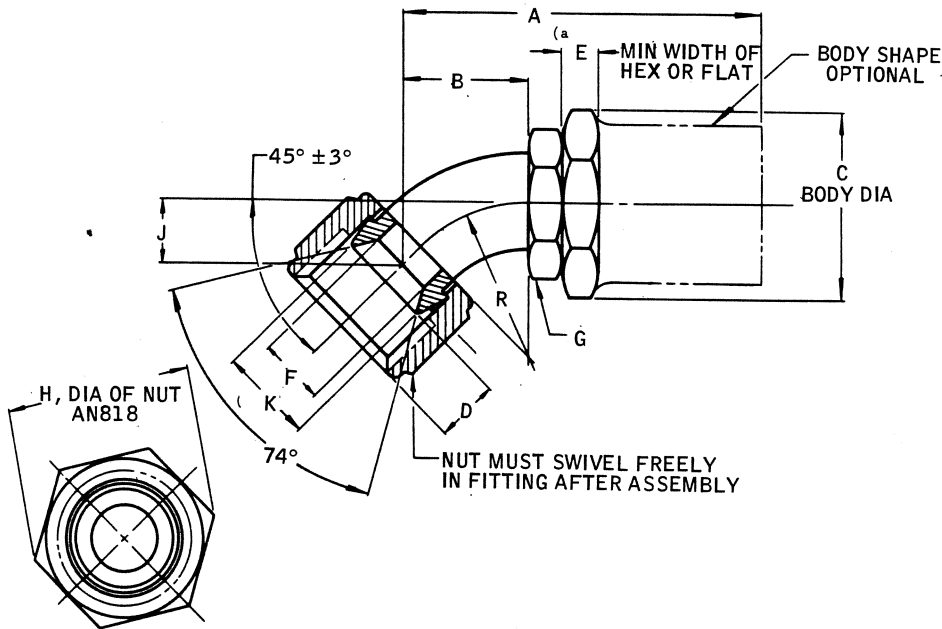
EXAMPLE OF PART NUMBER: MS28760-4 = FITTING FOR 7/32 ID HOSE

APPLICATION: THESE FITTINGS FOR USE WITH MIL-H-8788 HOSE IN HYDRAULIC SYSTEMS WITH OPERATING PRESSURES TO 3000 PSI MAX.

SYSTEM SAFETY: CADMIUM PLATED STEEL FITTINGS SHALL NOT BE USED IN SPACE ORIENTED FLUID SYSTEMS.

PARTS DATA SHEET FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.	ADAPTER, STRAIGHT, TUBE TO HOSE	MS28760
		SHEET 1 OF 1

FITTINGS, HOSE



MS28780 DASH NO.	HOSE ID REF	TUBING OD	NUT	A MAX	B MAX	C MAX	D	E MIN	F MIN	G MIN NIPPLE HEX ACROSS FLATS	H REF	J MAX	K DIA	R ±.031	WT MAX LB
-4	.219	.2500	AN818-4	2.875	.578	.875	.375	.188	.146	.563	.649	.388	.295	.375	.13
-5	.281	.3125	AN818-5		.656	.937			±.016	.177	.625	.721	.450		.355	±.010	.437	.14
-6	.344	.3750	AN818-6	3.000	.719	1.160	.250	.271		.688	.794	.480	.435	.500	.16
-8	.438	.5000	AN818-8	3.125	.734	1.375		±.031	.365	.875	1.010	.490	.570		1.250	.25
-10	.562	.6250	AN818-10	3.312	.859	1.550	.312		.455	1.000	1.155	.562	.680	.625		.38
-12	.688	.7500	AN818-12	4.000	1.328	1.740		.562	.375	.568	1.250	1.443	.781		.850
-16	.875	1.0000	AN818-16	4.750	1.500	2.000	.620		.778	1.500	1.732	.844	1.103	±.015	1.500

MATERIALS: NIPPLES, NUTS AND ELBOW, STEEL PER MIL-S-6758 (4130), MIL-S-8695 (4037), MIL-S-6050 (8630), AND QQ-S-633 (C1137, C1141), QQ-S-624, MIL-S-6049 (8740)
 ALTERNATE: ELBOW MAY BE AMS 5050 OR AMS 5053 TUBING AND JOINTS WELDED PER MIL-T-5021, CLASS A, GROUP I OR II, OR COPPER HYDROGEN BRAZED PER MIL-B-7883.
 BODY, ALUMINUM ALLOY PER QQ-A-225/4 (2014-T6), QQ-A-225/6 (2024-T6 OR T851)

FINISH: ALUMINUM ANODIZED PER MIL-A-8625, TYPE II
 STEEL CADMIUM PLATED PER QQ-P-416, TYPE II, CLASS 3, BLACK

PROCUREMENT SPECIFICATION: MIL-F-8789

EXAMPLE OF PART NUMBER: MS28780-4 = 45° ELBOW FOR 7/32 ID HOSE.

APPLICATION NOTE: FOR USE WITH MIL-H-8788 HOSE IN HYDRAULIC SYSTEMS WITH OPERATING PRESSURES TO 3000 PSI MAX.

SYSTEM SAFETY: CADMIUM PLATED STEEL FITTINGS SHALL NOT BE USED IN SPACE ORIENTED FLUID SYSTEMS.

PARTS DATA SHEET

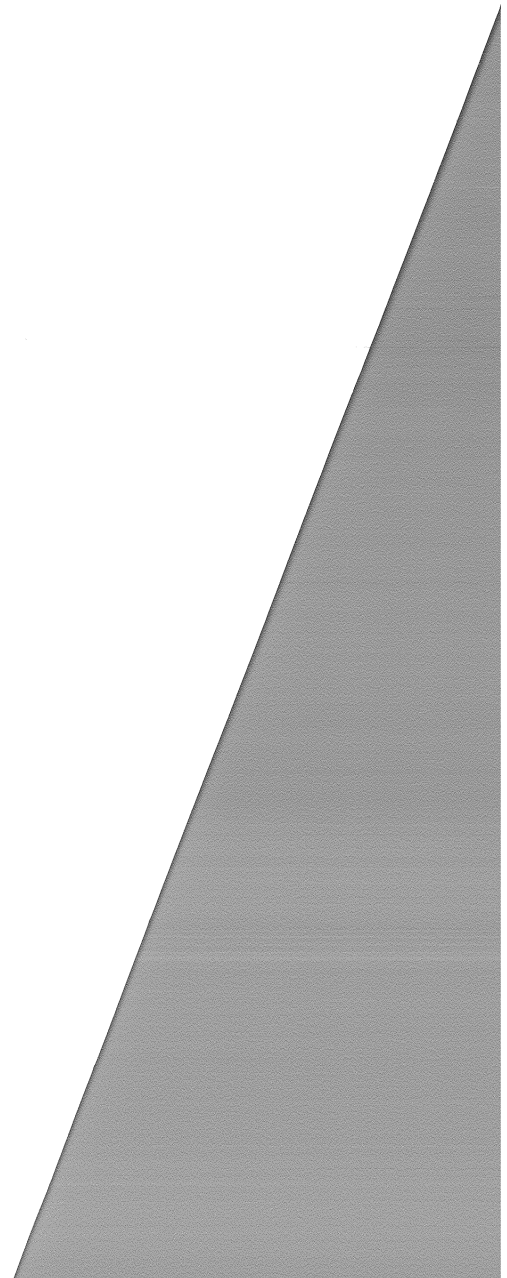
FOR DESIGN USE ONLY - NOT TO BE USED FOR PROCUREMENT OR INSPECTION PURPOSES.

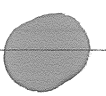
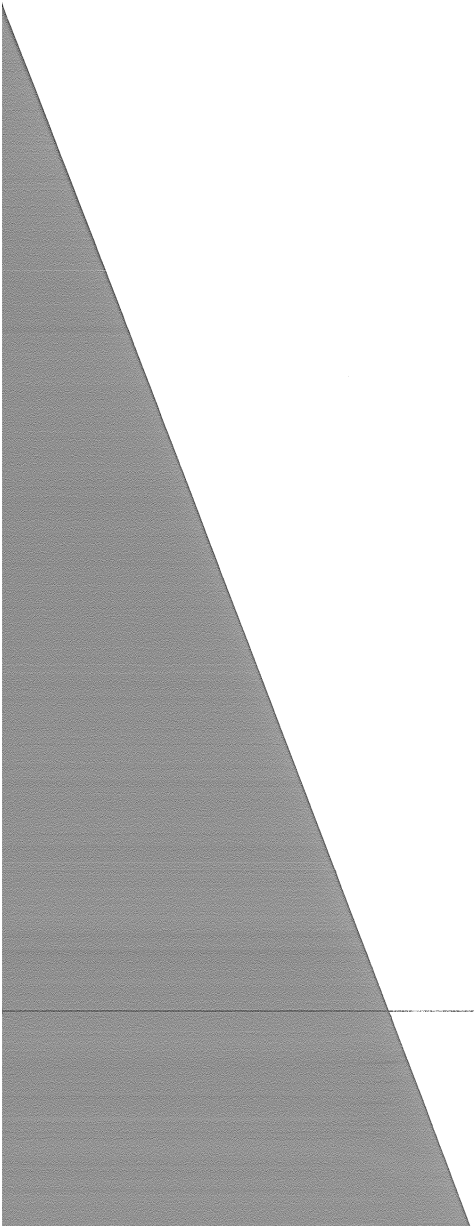
ELBOW, 45°, FLARED TUBE TO HOSE, ATTACHABLE, HYDRAULIC (3,000 PSI)

MS28780

SHEET 1 OF 1

SECTION 6 - CONVERSION CHART (ROCKWELL-TO-DYNATUBE-AIRDROME PART NO.)







DUAL SEAL - DYNATUBE - ROCKWELL SPECIFICATION

REV. T
PAGE 1 OF 3

CONVERSION CHART

MTL.			
ME273-0085T	MR54027	AP442	UNION, F. SW. RED.
ME273-0086T	MR54040	AP442	UNION, F. SW.
ME273-0087T	MR54100	AP440	UNION, M. SW.
ME273-0088T	MR54124	AP441	UNION, M. SW. BHD
ME273-0089T	R44117	AP392	CAP, PRESSURE, TI.
ME273-0090T	R44126-90	AP399	EL, 90°, M. TO F.
ME273-0091T	R44132	AP379	TEE, M-M-F
ME273-0092T	R44133	AP378	TEE, M-F-M
ME273-0093T	R44358	AP301	UNION, BHD-M
ME273-0094T	R44360	AP341	EL, 90°, BHD-M
ME273-0095T	R44361	AP361	TEE, BHD ON SIDE
ME273-0096T	R45280	AP319	UNION, F-F
ME273-0097T	R44118	AP391	NUT, JAM
ME273-0098P	R44119	AP390	PF PLUG, M. 17-4
ME273-0099P	R44117	AP392	PF CAP, PRESSURE, 17-4
ME273-0100N	R44151	AP305	NF UNION, M-MS33656
ME273-0115N	R44146	AP302	NF UNION, AS930 END, INC.
ME273-0116P	R44856PFN	AP452	UNION, WELD-F, RED.
ME273-0117P	R44857PF	AP462	UNION, WELD-M, RED.
ME273-0118N	R44858NFN	AP563	UNION, WELD-F, RED.
ME273-0119N	R44859NF	AP562	UNION, WELD-M, RED.
ME273-0120P	R44851-90	AP455	EL, 90°, WELD-F
ME273-0121P	R44852-90	AP456	EL, 90°, WELD-F
ME273-0122P	R44853	AP457	TEE, W-W-F (SIZE 04)
ME273-0123P	R44854	AP458	TEE, W-F-W
ME273-0124P	R44286	AP459	UNION, W-M
ME273-0125N	R44282	AP550	UNION, W-M, INC.
ME273-0126P	R44285	AP461	UNION, F-M, 17-4
ME273-0127N	R44281	AP551	UNION, F-W, INC.
ME273-0130P	R44287	AP454	UNION, W-BHD
ME273-0131T	R44850	AP397	UNION, BHD, FLANGED
ME273-0132P	R44855	AP467	TEE, WELD, FEMALE RUN
ME273-0133AL	R44371	AP396	CAP, DUST
ME273-0134P	R44118	AP391	NUT, JAM, 17-4PH
ME273-0135T	R44119	AP390	PLUG, TI.
ME273-0136N	R44119	AP390	NF PLUG, M., INC.
ME273-0137N	R44117N	AP392	NF CAP, PRESSURE, INC.
ME273-0139P	R44676	AP363	TEE, 33649 ON SIDE, 17-4
ME273-0140N	R44676	AP363	TEE, 33649 ON SIDE, INC.
ME273-0141T	R44239	AP318	UNION, M-F, RED.
ME273-0142N	R44283	AP554	UNION, M-BHD TO WELD

LEGEND

- F = FEMALE
- SW = SWAGED
- M = MALE
- TI = TITANIUM
- INC = INCONEL
- RED = REDUCER
- W = WELD
- EL = ELBOW
- P = 17-4PH
- BHD = BULKHEAD



DUAL SEAL
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ROCKWELL SPECIFICATION CONVERSION CHART

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MTL.			
ME273-0143	N	R44876	AP558 TEE, W-F-W
ME273-0144	N	R44875	AP556 EL. 90° F-W
ME273-0145	N	R44870	AP577 TEE, W-W-F
ME273-0146	N	R44877	AP465 UNION, FLANGED
ME273-0147	N	R44891	AP470 TEE, RED., W-F-W
ME273-0148	N	R44871	AP471 CROSS, F-33649-W-M
ME273-0149	N	R44872	AP472 TEE, F-33649-F
ME273-0150	N	R44873	AP473 TEE, F-33649-M
ME273-0151	P	R44183	AP474 EL, 90°, M-33657
ME273-0152	N	R44885	AP463 UNION, F-W, RED.
ME273-0153	N	R44886	AP462 UNION, M-W, RED.
ME273-0154	N	R44883	AP450 UNION, M-W
ME273-0155	N	R44882	AP451 UNION, F-W
ME273-0156	N	R44884	AP454 UNION, W-BHD
ME273-0157	N	R44889	AP458 TEE, F-W-W
ME273-0158	N	R44888	AP456 EL, 90°, F-W
ME273-0159	N	R44887	AP477 TEE, W-W-F
ME273-0160	N	R44893	AP475 EL, 90°, RED., F-W
ME273-0161	N	R44894	AP476 TEE, W-W-F
ME273-0162	P	R44881	AP478 EL, 45°, F-W
ME273-0163	P	R44126	AP359 PF EL, 90°, M-F
ME273-0164	P	R44116	AP300 PF UNION, REDUCER, MALE
ME273-0165	P	R44896	AP479 UNION, F-W
ME273-0166	T	MR54225	AP443 UNION, M., SWAGED, REPAIR
ME273-0167	T	MR54035	AP444 UNION, F, SWAGED, REPAIR
ME273-0168	N	R44892	AP478 ELBOW, 45°, F-W
ME273-0169	P	R44879	AP480 UNION, DUAL SEAL, FLANGED
ME273-0170	P	R44895	AP481 UNION, DUAL SEAL, SPECIAL
ME273-0171	N	R44900F1	AP482 SLEEVE, DUAL SEAL, FEMALE
ME273-0172	Misc.	R44900K2	AP483 FITTING, ASSY, DUAL SEAL, FLANGED
ME273-0173	P	R44874	AP484 TEE, MS PORT ON SIDE
ME273-0174	P	R44878	AP485 CROSS, SPECIAL
ME273-0175	P	R44133PFN	AP378 PF TEE, FEMALE ON RUN
ME273-0176	P	R44358PF	AP301 PF UNION, MALE TO BULKHEAD
ME273-0177	T	R44359	AP321 ELBOW, 45°, MALE TO BULKHEAD
ME273-0179	P	R44132	AP377 PF TEE, FEMALE ON SIDE
ME273-0180	N	R44907	AP486 ELBOW, 90°, F-F-W, SPECIAL
ME273-0181	T	R44144	AP357 ELBOW, 90°, BULKHEAD TO FEMALE
ME273-0182	P	R45280	AP319 PF UNION, F-F, REDUCER
ME273-0184	P	R44914	AP487 UNION, M-BHD, FLANGED
ME273-0185	T	R44161	AP305 UNION, F-MS33656
ME273-0186	P	R44146	AP488 UNION, MALE DUAL SEAL TO AS930
ME273-0187	N	R44920NFN	AP489 TEE, SPECIAL
ME273-0188	T	R44362	AP362 TEE, MALE, BHD ON RUN
ME273-0189	T	R44182	AP302 UNION, MALE TO AS930
ME273-0190	T	R45116	AP313 UNION, MALE TO AS930



DUAL SEAL
DYNATUBE
ROCKWELL SPECIFICATION CONVERSION CHART

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ME273-0192 P	R44923	AP493	TEE, W-W-F
ME273-0193 N	R44146	AP492 NF	M-AS930, RED.
ME273-0194 N	R44924	AP491	MANIFOLD, DUAL SEAL
ME273-0195 N	R44866	AP494	UNION, FLANGED
ME273-0196 P	R44865	AP495	ELBOW, 90°, M-W
ME273-0197 N	R44927	AP570	TEE, RED. W-F-W
ME273-0198 N	R44926	AP571	CROSS, F-33649-W-M
ME273-0199 N	R44929	AP575	EL., 90°, RED. F-W
ME273-0200 N	R44930	AP576	TEE, W-W-F
ME273-0201 N	R44928	AP578	EL., 45°, F-W
ME273-0202 N	R44931	AP586	EL., 90°, F-F-W
ME273-0203 N	R44932	AP589	MANIFOLD
ME273-0204 P	R44936	AP521	UNION, M-FLANGED
ME273-0205 P	R44933	AP520	UNION, F-W
ME273-0206 P	R44934	AP522	EL., 5° AND 7°, F-W
ME273-0207			
ME273-0208 N	TBD	AP496	SLEEVE, THREADED
ME273-0209 P	R44146	AP302PF	UNION, M-AS930
ME273-0210 N	R44938	AP527	UNION, BHD-BRAZED
ME273-0211 P	R44939	AP531	ELBOW, 90°, F-W
ME273-0212 P	TBD	AP533	EL, 90°, M-W
ME273-0213 P	TBD	AP432	UNION, M-ORIFICE



DUAL SEAL - DYNATUBE
PART NUMBER CONVERSION CHART

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AP300	R44101	UNION
AP300	R44116	UNION, REDUCER
AP301	R44358	UNION, BULKHEAD
AP301	R45118	UNION, BULKHEAD, REDUCER
AP302	R44182	UNION, AS930 ONE END
AP302	R44191	UNION, AS930 ONE END, EXPANDER
AP302	R45116	UNION, AS930 ONE END, REDUCER
AP303	R44195	UNION, MS33514 ONE END
AP303	R44197	UNION, MS33514 ONE END, REDUCER
AP304		UNION, MS33515 ONE END
AP305	R44151	UNION, MS33656 ONE END
AP305	R44180	UNION, MS33656 ONE END, REDUCER
AP305	R44181	UNION, MS33656 ONE END, EXPANDER
AP306	R44153	UNION, MS33657 ONE END
AP307		UNION, BHD. TO AS930
AP308		UNION, BHD. TO MS33514
AP309	R44382	UNION, BHD TO MS33656
AP310	{R44150 R44150	UNION, FEMALE TO MS33656
AP311		UNION, MALE TO BRAZE
AP312		UNION, MALE TO AS930, SPECIAL
AP313		UNION, MALE TO AS930, SPECIAL
AP314		UNION, MALE TO KC104
AP315		UNION, MALE TO PERMASWAGE
AP316	R44238	UNION, FEMALE TO AN SWIVEL
AP317		UNION, MALE TO BHD, SPECIAL
AP318	R44239	UNION, MALE TO FEMALE
AP319	R44280	UNION, FEMALE TO FEMALE
AP319	R45280	UNION, FEMALE TO FEMALE, REDUCER



AP320	R44104	ELBOW 45°, MALE TO MALE
AP321	R44359	ELBOW 45°, BULKHEAD
AP322		ELBOW 45°, MS33514 ONE END
AP323	R44654	ELBOW 45°, MS33515 ONE END
AP324		ELBOW 45°, MS33656 ONE END
AP325		ELBOW 45°, MS33657 ONE END
AP326		ELBOW 45°, BHD TO MS33514
AP327	R44159	ELBOW 45°, BHD TO MS33656
AP328		
AP329		ELBOW, 45°, MALE TO FEMALE .
AP330		
AP331		
AP332		
AP333		
AP334		
AP335		
AP336		
AP337		ELBOW, 45°, MALE, FLANGED
AP338		ELBOW, 45°, MALE TO SPECIAL .
AP339		ELBOW, 45°, MALE TO FEMALE PULL BACK NUT
AP340	R44106	ELBOW 90°, MALE TO MALE
AP341	R44360	ELBOW 90°, MALE TO BHD
AP341	R45120	ELBOW 90°, MALE TO BHD, REDUCER
AP342		ELBOW 90°, MALE TO MS33514
AP343		ELBOW 90°, MALE TO MS33515
AP344	R44157	ELBOW 90°, MALE TO MD33656
AP345		ELBOW 90°, MALE TO MS33657
AP346		ELBOW 90°, BHD TO MS33514
AP347	R44161	ELBOW 90°, BHD TO MS33656
AP348		
AP349		

AIRDROME



PARTS CO.

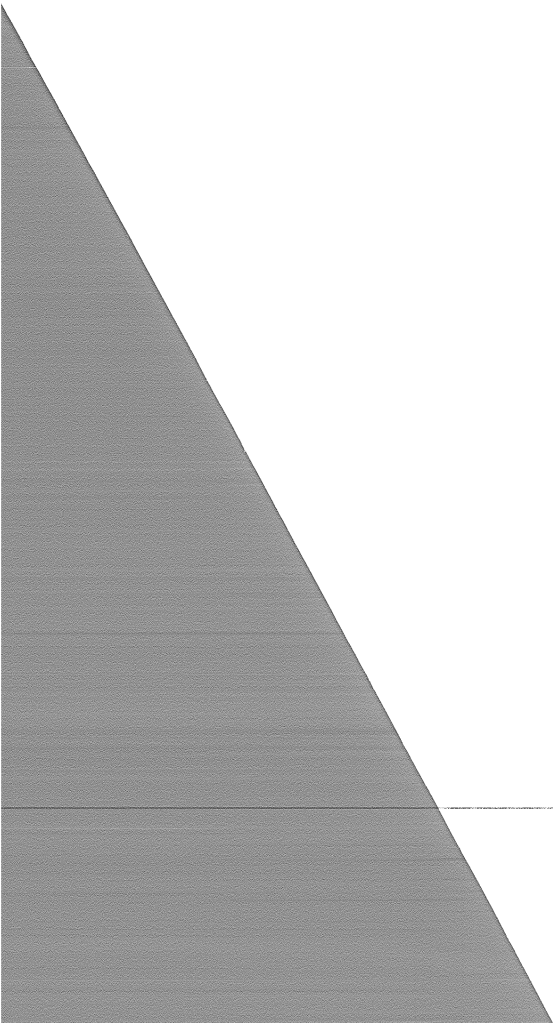
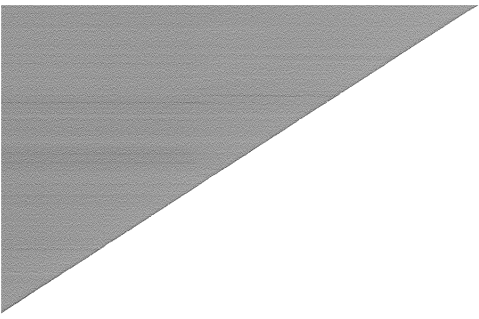
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AP350		
AP351		
AP352		
AP353		
AP354		
AP355		
AP356		
AP357		ELBOW, 90°, BHD TO FEMALE, PULL BACK NUT
AP358	R44129-90	ELBOW 90°, MALE TO FEMALE, PULL BACK NUT
AP359	R44126-90	ELBOW 90°, MALE TO FEMALE
AP359	R44126-90	ELBOW 90°, MALE TO FEMALE
AP360	R44111	TEE, MALE
AP360	R45111	TEE, MALE, REDUCER
AP361	R44361	TEE, MALE, BHD ON SIDE
AP361	R45121	TEE, MALE, BHD ON SIDE, REDUCER
AP362	R44362	TEE, MALE, BHD ON RUN
AP362	R45122	TEE, MALE, BHD ON RUN, REDUCER
AP363		TEE, MALE, MS33649 ON SIDE
AP364		TEE, MALE, MS33656 ON SIDE
AP365	R44326	TEE, MS33649 TO MALE TO BULKHEAD
AP366		TEE, MS33649 TO FEMALE TO MALE
AP367		
AP368		
AP369		
AP370		
AP371		
AP372		TEE, MALE, BOSS ON SIDE
AP373		TEE, MALE, SWIVEL ON RUN
AP374		TEE, MALE TO FEMALE TO MS33649
AP375	R45140	TEE, REDUCER, FEMALE, DUAL SEAL
AP376		TEE, MALE, FEMALE PULL BACK NUT ON RUN & SIDE, RI
AP377		TEE, MALE, FEMALE PULL BACKNUT ON SIDE

SECTION 7 - CONVERSION OF MBO SPEC'S TO VENDOR PART NUMBER



CONVERSION OF MBO SPECIFICATION TO VENDOR PART NUMBER
DATA FROM ROCKWELL QSL

NOTE

WHENEVER POSSIBLE, THE NSN SHALL BE
USED TO IDENTIFY DESIRED MATERIAL.

NSL = NOT STOCK LISTED

NPN = VENDOR IDENTIFIED, NO PART NUMBER ON QSL

TBD = NO VENDOR OR PART NUMBER

<u>SPEC #</u>	<u>NSN</u>	<u>VENDOR P/N</u>	<u>CUSTOMER P/N</u>	<u>NOMENCLATURE</u>
MB0110-005	6850-00-K32-3587	340	39-5110-90041	GREASE, HEAT DISSIPATING, MB0110-005 TYPE I, DOW-CORNING
MB0110-005	6850-00-K32-3587	INSULGREASE G-641	39-5110-90041	GREASE, HEAT DISSIPATING, MB0110-005 TYPE I, GENERAL ELECTRIC
MB0110-005	9150-00-K36-3332	BRAYCOTE 3L-38-ZN	39-5110-10050	GREASE, HEAT DISSIPATING, MB0110-005 TYPE II BRAY OIL CO. BRAYCOTE
MB0110-010	NSL	NPN	NO NUMBER 113	MOLECULAR SIEVE, HIGH ABSORP- TIVE DESICCANT, MB0110-010 TYPE WM, ZORBITE CORP.
MB0110-010	6850-00-K33-7970	EVER-DRY	39-3846-11000	MOLECULAR SIEVE, HIGH ABSORP- TIVE DESICCANT, MB0110-010 TYPE 4A
MB0110-010	6850-00-K33-7970	TBD	39-3846-11000	MOLECULAR SIEVE, HIGH ABSORP- TIVE DESICCANT, MB0110-010 TYPE 5A
MB0110-014	8030-00-K31-5134	TBD	39-0818-16040	SEALING COMPOUND
MB0115-021	8030-00-K32-0218	TBD	39-0818-06079	COMPOUND

MB0115-036	1850-00-K30-5355-D	TBD	39-2895-83010	SILICA POWDER
MB0115-041	8030-00-K36-4429	TBD	39-0818-06085	COMPOUND
MB0120-008	8040-00-K32-5432	EA934	39-0671-83002	ADHESIVE ROOM TEMP CURE -250 TO 500F, MB0120-008 TYPE I CLASS I, HYSOL DIVISION
MB0120-008		EA934		ADHESIVE ROOM TEMP CURE -250 TO 500F, MB0120-008 TYPE I CLASS II, ABELSTIK ADHESIVE CO.
MB0120-020		TBD		ADHESIVE, STRUCTURAL CRYO FOR BONDING METALS AND NON-METALS, MB0120-020
MB0120-025	1850-00-K30-5356	6-1015	39-0707-31016	ADHESIVE, HEAT CURING BONDING DACRON WEBBING TO NEOPRENE, MB0120-025, ORGANOCERAMS INC.
MB0120-028 TY I	8010-00-K31-3565	CHEMLOCK 205 (PART I)	39-8057-30002	ADHESIVE & PRIMER UNCURED RUBBER TO METAL OR RIGID PLASTIC BONDING, MB0120-028, HUGHSON CHEM CO. PART I PRIMER
MB0120-028 TY II	8040-00-K32-9443	CHEMLOCK 220 (PART II)	39-0665-30000	ADHESIVE & PRIMER UNCURED RUBBER TO METAL OR RIGID PLASTIC BONDING, MB0120-028, HUGHSON CHEM CO. PART II ADHESIVE
MB0120-028 TY I	8010-00-K31-3565	CHEMLOCK 205 (PART I)	39-8057-30002	ADHESIVE & PRIMER UNCURED RUBBER TO METAL OR RIGID PLASTIC BONDING, MB0120-028, R. D. ABBOTT CO.
MB0120-028 TY II	8040-00-K32-9443	CHEMLOCK 220 (PART II)	39-0665-30000	ADHESIVE & PRIMER UNCURED RUBBER TO METAL OR RIGID PLASTIC BONDING, MB0120-028, R. D. ABBOTT CO.

MB0120-037	954 PARTS A&B			ADHESIVE ROOM TEMP CURING STRUCTURAL, MB0120-037 TYPE I CLASS I, HYSOL DIVISION
MB0120-037	377			ADHESIVE ROOM TEMP CURING STRUCTURAL, MB0120-037 TYPE I CLASS I, RELIABOND MFG CORP
MB0120-037	954			ADHESIVE ROOM TEMP CURING STRUCTURAL, MB0120-037 TYPE I CLASS II, ABELSTIK ADHESIVE CO
MB0120-037	8040-00-K33-0886	9321 PARTS A&B	39-0667-9542	ADHESIVE ROOM TEMP CURING STRUCTURAL, MB0120-037 TYPE II CLASS I, HYSOL DIVISION
MB0120-037	8040-00-K32-9691	956 PARTS A&B	39-0668-30000	ADHESIVE ROOM TEMP CURING STRUCTURAL, MB0120-037 TYPE III CLASS I, HYSOL DIVISION
MB0120-039A	6850-00-K33-8648		39-3068-30000	COMPOUND
MB0120-041 TY II	8040-00-K33-7959	RTV102	39-0748-90000	ADHESIVE
MB0120-041 TY III	8040-00-K36-2051	RTV108	39-0749-90010	ADHESIVE
MB0120-048		3004		ADHESIVE TAPE CRYO & HEAT RESISTANT, MB0120-048 TYPE I, AEROBOND ADHESIVE ENG
MB0120-048		3004		ADHESIVE TAPE CRYO & HEAT RESISTANT, MB0120-048 TYPE II, AEROBOND ADHESIVE ENG
MB0120-048 TY III	8040-00-K33- 330221-D	3004	HT424	ADHESIVE TAPE CRYO & HEAT RESISTANT, MB0120-048 TYPE III, AEROBOND ADHESIVE ENG
MB0120-048		3004		ADHESIVE TAPE CRYO & HEAT RESISTANT, MB0120-048 TYPE IV, AEROBOND ADHESIVE ENG

MB0120-048	HT424	ADHESIVE TAPE CRYO & HEAT RESISTANT, MB0120-048 TYPE I, AMERICAN CYANAMIDE CO
MB0120-048	HT424	ADHESIVE TAPE CRYO & HEAT RESISTANT, MB0120-048 TYPE II, AMERICAN CYANAMIDE CO
MB0120-048	HT424	ADHESIVE TAPE CRYO & HEAT RESISTANT, MB0120-048 TYPE III, AMERICAN CYANAMIDE CO
MB0120-048	HT424	ADHESIVE TAPE CRYO & HEAT RESISTANT, MB0120-048 TYPE IV, AMERICAN CYANAMIDE CO
MB0120-050	6850-00-K32-3589	PRIMER, SILICONE, COMPOUND
MB0120-053	FM123-2 FILM .06 PSF	ADHESIVE, STRUCTURAL HIGH PEEL, MB0120-053 TYPE I, AMERICAN CYANAMIDE CO
MB0120-053	FM123-2 FILM .085 PSF	ADHESIVE, STRUCTURAL HIGH PEEL, MB0120-053 TYPE II, AMERICAN CYANAMIDE CO
MB0120-053	FM123-2 FILM .135 PSF	ADHESIVE, STRUCTURAL HIGH PEEL, MB0120-053 TYPE III, AMERICAN CYANAMIDE CO
MB0120-065	RL-4389 REFSET (EF-CATALYST)	SEALANT, FLUORCARBON, CRYOGENIC APPLICATION, MB0120- 065 TYPE I, RAYBESTOS MANHAT- TAN
MB0120-065	RL-4495 (EF-CATALYST)	SEALANT, FLUORCARBON, CRYOGENIC APPLICATION, MB0120- 065 TYPE I, RAYBESTOS MANHAT- TAN

MB0120-065	8030-00-K33-0547	2030 DAPCOSEAL COMPONENT A&B	39-8453-12130	SEALANT, FLUORCARBON, CRYOGENIC APPLICATION, MB0120- 065 TYPE II, D'AIRCRAFT PROD CO
MB0120-070	8040-00-K33-7204		39-8064-03927	ADHESIVE
MB0120-070 TY I CLASS I	1850-00-K32-5773		39-8064-03918	PRIMER, ADHESIVE
MB0120-070	8010-00-K32-5896		39-8062-00400	TY III PRIMER, ADHESIVE
MB0120-078		FM24 .030 PSF FILM		ADHESIVE, RETICULATING FOR USE FROM -200 TO 200F FILM, MB0120-078 TYPE I, AMERICAN CYANAMIDE CO
MB0120-078		FM24 .045 PSF FILM		ADHESIVE, RETICULATING FOR USE FROM -200 TO 200F FILM, MB0120-078 TYPE II, AMERICAN CYANAMIDE CO
MB0120-078		FM24 .060 PSF FILM		ADHESIVE, RETICULATING FOR USE FROM -200 TO 200F FILM, MB0120-078 TYPE III, AMERICAN CYANAMIDE CO
MB0120-078	8010-00-K32-3664	BR127	39-8062-00127	ADHESIVE, RETICULATING FOR USE FROM -200 TO 200F FILM, MB0120-078 TYPE IV, AMERICAN CYANAMIDE CO
MB0120-079	8040-00-K32-3404	EA 9309	39-0760-12079	EPOXY POLYAMIDE ADHESIVE, MB0120-079, HYSOL DIVISION
MB0120-080		FILM .10		ADHESIVE, MODIFIED EPOXY FOAM- ING TYPE TAPE, MB0120-080 TYPE I, AMERICAN CYANAMIDE CO
MB0120-080		FILM .05		ADHESIVE, MODIFIED EPOXY FOAM- ING TYPE TAPE, MB0120-080 TYPE II, AMERICAN CYANAMIDE CO

MB0120-080	FILM .025			ADHESIVE, MODIFIED EPOXY FOAM- ING TYPE TAPE, MB0120-080 TYPE III, AMERICAN CYANAMIDE CO
MB0120-081	M-BOND 610, 8-338			ADHESIVE FOR BONDING IN- STRUMENTATION, MB0120-081 TYPE I, PREMTRONICS INC
MB0120-081	8040-00-K33-8695 87336 EPI BOND	39-0759-12079		ADHESIVE FOR BONDING IN- STRUMENTATION, MB0120-081 TYPE II, FURANCO PLASTIC
MB0120-081	8040-00-K33-8695 463-1 ABLE BOND	39-0759-12079		ADHESIVE FOR BONDING IN- STRUMENTATION, MB0120-081 TYPE II, ABELSTIK ADHESIVE CO
MB0120-082	8040-00-K36-1451 3008	39-4712-03002		EPOXY
MB0120-083	8030-00-K32-5178 71-Y-1	39-8490-020083		SEALANT, CORROSION INHIBITING FOR FASTENER INSTALLATION, MB0120-083, DEFT CHEMICAL COATINGS
MB0120-084	M-BOND AE-15, B-337			STRAIN SENSOR ADHESIVE FOR AMBIENT/ELEVATED TEMPERATURE SERVICE, MB0120-084 TYPE I, PREMTRONICS INC
MB0120-084	8040-00-K33-0003 M-BOND AE-10, B-337	39-0759-12082		STRAIN SENSOR ADHESIVE FOR AMBIENT/ELEVATED, MB0120-084 TYPE II, PREMTRONICS INC
MB0120-085	OBSOLETED			CEMENT FUSED SILICA, MB0120- 085
MB0120-086	8040-00-K36-1762 EC2216	39-0776-02216		LOW VOLATILE CONDENSIBLE MATERIAL 2 PARTS FLEXIBLE EPOXY ADHESIVE, MB0120-086, 3M CO.

MB0120-090

EC2290

SINGLE COMPONENT EPOXY SETTING EPOXY ADHESIVE, MB0120-090, 3M CO.

MB0120-091

C8-H717/H2-3561 OR HD3561

LOW VOLATILE CONDENSIBLE MATERIAL, HIGH THERMALLY CONDUCTIVE ADHESIVE MB0120-091, HYSOL DIVISION

MB0120-108

8040-00-K30-0350

39-0672-0000

ADHESIVE

MB0125-038

8010-00-K33-7944

39-8067-10000

PRIMER

MB0125-040

8010-00-K33-2634

39-2895-83000

COATING

MB0125-044

8010-00-K33-4181

39-2897-02241

COATING

MB0125-050

6850-00-K32-3589 SS4155

39-8057-20000

PRIMER SILICONE LOW VOLATILE CONTENT APPLICATION, MB0125-050, GENERAL ELECTRIC

MB0125-052

TBD

THERMAL CONTROL COATING, WHITE, MB0125-052 TYPE I

MB0125-052

NPN

THERMAL CONTROL COATING, WHITE, MB0125-052 TYPE II, MT RESEARCH INST S13GLO WITH TMG CATALYST AND X-99 THINNER

MB0125-055

1850-00-K30-5354 TBD

39-8068-20000

PRIMER EPOXYAMINE CORROSION PREVENTIVE ROOM TEMP CURE, MB0125-055

MB0125-057

8030-00-K32-9436 HUMISEAL 1B12

39-2811-25057

PROTECTIVE COATING CLEAR FOR PRINTED MARKING, MB0125-057, COLUMBIA TECH CORP

MB0125-063

8010-00-K33-8320

39-2816-20001

COATING, WHITE

MB0125-063

8010-00-K33-2504

39-2816-20005

COATING, YELLOW

MB0125-063

8010-00-K32-3482

39-2847-12563

COATING, BLACK

MB0-125-069

1850-00-K30-5361

39-2895-85069

COATING

MB0125-069A	8030-00-K31-5150	MB0125-069A	SEALING COMPOUND
MB0125-070	1850-00-K30-5360 02-GY-3	39-2870-02003	COATING ELECTRICALLY CONDUCTIVE EPOXY PAINT, MB0125-070, DEFT CHEMICAL COATINGS
MB0125-074	8010-00-K30-5310	39-2845-12574	COATING, WHITE
MB0125-080	8010-00-K30-5299 CHEMGLAZE II A276	39-4500-90000	THERMAL CONTROL COATING, ENVIRONMENTALLY RESISTANT, MB0125-080, HUGHSON CHEMICAL CO
MB0125-084	8010-00-K32-4634 CHEMGLAZE WASH PRIMER 9924	39-8069-50000	PRIMER, POLYVINYL BUTYRAL RESIN, CORROSION INHIBITING, MB0125-084, HUGHSON CHEMICAL CO
MB0130-024	TEDLAR 200 BS30		FILM PLASTIC, GAS PERMEABILITY BARRIER, MB0130-024, MOLAND PAPER, SPECIALTY CONVERTING INC
MB0130-032D	8030-00-K33-7418	39-8240-82651	RESIN, EPOXY
MB0130-065	13-T-23685-1		BARRIER, THERMAL INSULATION GLASS FABRIC & ALUM FOIL, MB0130-065, H. I. THOMPSON
MB0130-071	3470 WHITE		FILM, PROTECTIVE, VINYL PLASTIC, MB0130-071, 3M CO.
MB0130-085	1850-00-K30-5363 RTV566A & 566B	39-3094-50000	SILICONE RUBBER, LOW VOLATILE CONTENTS, MB0130-085, GENERAL ELECTRIC
MB0130-087	HYE 1034C		ADVANCED COMPOSITE MATERIAL - GRAPHITE/RESIN PREPREY, TYPE III CLASS 2 CATEGORY U-4, FIBERITE CORP

MB0130-087	HMF330B/34	ADVANCED COMPOSITE MATERIAL - GRAPHITE/RESIN PREPREY, TYPE III CLASS 2 CATEGORY B-7, FIBERITE CORP
MB0130-087	HMF330C/34	ADVANCED COMPOSITE MATERIAL - GRAPHITE/RESIN PREPREY, TYPE III CLASS 2 CATEGORY B-13, FIBERITE CORP
MB0130-105	CE9010A/120/MPC4	GLASS FABRIC, EPOXY RESIN IM- PREGNATED, TYPE III CLASS I GRADES FR & GP, FERRO CORP
MB0130-105	120- -F164-1	GLASS FABRIC, EPOXY RESIN IM- PREGNATED, TYPE III CLASS I GRADES GP, HEXCEL AEROSPACE
MB0130-105	CE9010A/7781/MPC4	GLASS FABRIC, EPOXY RESIN IM- PREGNATED, TYPE VIIIB CLASS I GRADES FR & GP, FERRO CORP
MB0130-105	7781- F164-1	GLASS FABRIC, EPOXY RESIN IM- PREGNATED, TYPE VIII B CLASS I GRADES GP, HEXCEL AEROSPACE
MB0130-106	8040-00-K36-3673 PR1710	ADHESIVE FLUOROELASTOMERIC, NON STRUCTURAL, MB0130-106
MB0130-106	8040-00-K36-3673 PR1711	PRIMER, FLUOROELASTOMERIC, NON STRUCTURAL, MB0130-106
MB0130-119	8040-00-K32-2296 RTV511	SILICONE RUBBER, LOW TEMP RESISTANT ROOM TEMP CURE, MB0130-119 TYPE I, GENERAL ELECTRIC
MB0130-119	8040-00-K32-2297 RTV560	SILICONE RUBBER, LOW TEMP RESISTANT ROOM TEMP CURE, MB0130-119 TYPE II, GENERAL ELECTRIC

MB0130-119	1850-00-K30-5364	RTV577	39-3066-57700	SILICONE RUBBER, LOW TEMP RESISTANT ROOM CURE, MB0130-119 TYPE III, GENERAL ELECTRIC
MB0130-136	8030-00-K33-7423	PR1660	39-8247-13610	POLYURETHANE RESIN SYSTEM, TWO-COMPONENT, MB0130-136, RESEARCH PRODUCTS AND CHEMICAL CORP
MB0130-144	8030-00-K31-5158	RTV142	39-0765-13014	SILICONE RUBBER, SINGLE COMPONENT LOW OUTGASSING, MB0130-144, GENERAL ELECTRIC
MB0130-145		TBD		MOLDED RTV SILICONE RUBBER, MB0130-145, SFS INDUSTRIES INC
MB0130-146		NPN		POLYURETHANE FOAM HALF SHELL INSULATION FOR CAYO LINES, MB0130-146 GRADE A, ROCKWELL
MB0130-146		NPN		POLYURETHANE FOAM HALF SHELL INSULATION FOR CAYO LINES, MB0130-146 GRADE B, ROCKWELL
MB0130-149	PDL4034-2.55			POLYURETHANE POUR FOAM 275 DEGREES F RESISTANT, MB0130-149, POLYMER DEVELOP LAB
MB0130-175	8040-00-K33-6774		39-3014-84000	ADHESIVE
MB0135-002	1820-00-K33-6673	NPN		GLASS YARN WHITE, YARN & TAPE, POLYTETRAFLUOROETHYLENE, IMPREGNATED GLASS, MB0135-002 TYPE I, ENGINEERED YARNS
MB0135-002		NPN		YARN & TAPE, POLYTETRAFLUOROETHYLENE, IMPREGNATED GLASS, MB0135-002 TYPE II, SANTA FE TEXTILES

MB0135-009	112	FABRIC, GLASS, FINISHED, FOR PLASTIC LAMINATES, MB0135-009 TYPE 1, *
MB0135-009	128 OR 1528	FABRIC, GLASS, FINISHED, FOR PLASTIC LAMINATES, MB0135-009 TYPE 3, *
MB0135-009	162 OR 1562	FABRIC, GLASS, FINISHED, FOR PLASTIC LAMINATES, MB0135-009 TYPE 4, *
MB0135-009	164 OR 1564	FABRIC, GLASS, FINISHED, FOR PLASTIC LAMINATES, MB0135-009 TYPE 4, *
MB0135-009	143	FABRIC, GLASS, FINISHED, FOR PLASTIC LAMINATES, MB0135-009 TYPE 5, *
MB0135-009	181 OR 1581	FABRIC, GLASS, FINISHED, FOR PLASTIC LAMINATES, MB0135-009 TYPE 6, *
MB0135-009	182 OR 1582	FABRIC, GLASS, FINISHED, FOR PLASTIC LAMINATES, MB0135-009 TYPE 7, *
MB0135-009	120	FABRIC, GLASS, FINISHED, FOR PLASTIC LAMINATES, MB0135-009 TYPE 8, *
MB0135-009	116	FABRIC, GLASS, FINISHED, FOR PLASTIC LAMINATES, MB0135-009 TYPE 9, *
MB0135-009	183 OR 1583	FABRIC, GLASS, FINISHED, FOR PLASTIC LAMINATES, MB0135-009 TYPE 10, *

MB0135-009	184 OR 1584	FABRIC, GLASS, FINISHED, FOR PLASTIC LAMINATES, MB0135-009 TYPE 11,*
MB0135-009	136, GARAN A	FABRIC, GLASS, FINISHED, FOR PLASTIC LAMINATES, MB0135-009 FINISH A,*
MB0135-009	A172, VOLAN	FABRIC, GLASS, FINISHED, FOR PLASTIC LAMINATES, MB0135-009 FINISH A,*
MB0135-009	VOLAN A UM619	FABRIC, GLASS, FINISHED, FOR PLASTIC LAMINATES, MB0135-009 FINISH A, UNITED MERCHANTS
MB0135-009	VOLAN	VOLAN UM619 FABRIC, GLASS, FINISHED, FOR PLASTIC LAMINATES, MB0135-009 FINISH B, UNITED MERCHANTS
MB0135-009	VOLAN, VOLAN A UM619	FABRIC, GLASS, FINISHED, FOR PLASTIC LAMINATES, MB0135-009 FINISH C, UNITED MERCHANTS
MB0135-009	AA-1100	FABRIC, GLASS, FINISHED, FOR PLASTIC LAMINATES, MB0135-009 FINISH D,*
MB0135-009	112-NEUTRAL	FABRIC, GLASS, FINISHED, FOR PLASTIC LAMINATES, MB0135-009 FINISH E,*
MB0135-009	F41	FABRIC, GLASS, FINISHED, FOR PLASTIC LAMINATES, MB0135-009 FINISH F, HEXCEL

MB0135-009	CS290	FABRIC, GLASS, FINISHED, FOR PLASTIC LAMINATES, MB0135-009 FINISH F, CLARK-SCHWEBEL FIBER
MB0135-009	UM696	FABRIC, GLASS, FINISHED, FOR PLASTIC LAMINATES, MB0135-009 FINISH F, UNITED MERCHANTS
MB0135-009	GREIGE OR GREY	FABRIC, GLASS, FINISHED, FOR PLASTIC LAMINATES, MB0135-009 FINISH G,*
		NOTE
		* UNITED MERCHANTS, HESS GOLDSMITH & CO, HEXCEL, J.P. STEVENS & CO. OR CLARK-SCHWEBEL FIBER
MB0135-021	STYLE 1245	FABRIC, WOVEN NYLON, MB0135- 021 TYPE I, BURLINGTON IND
MB0135-021	STYLE 1239	FABRIC, WOVEN NYLON, MB0135- 021 TYPE II, BURLINGTON IND
MB0135-021	STYLE 9008	FABRIC, WOVEN NYLON, MB0135- 021 TYPE III, BURLINGTON IND
MB0135-021	34101	FABRIC, WOVEN NYLON, MB0135- 021 TYPE IV

MB0135-021	34103	FABRIC, WOVEN NYLON, MB0135-021 TYPE IV, J. P. STEVENS
MB0135-021	34104	FABRIC, WOVEN NYLON, MB0135-021 TYPE IV, J. P. STEVENS
MB0135-021	34106	FABRIC, WOVEN NYLON, MB0135-021 TYPE IV, J. P. STEVENS
MB0135-024	TG15,000	INSULATION THERMAL FIBROUS - 300 DEGREE F TO 700 DEGREE F, MB0135-024 TYPE I, 3LBS DENSITY, HITCO
MB0135-024	TG15,000	INSULATION THERMAL FIBROUS - 300 DEGREE F TO 700 DEGREE F, MB0135-024 TYPE II, 6LBS DENSITY, HITCO
MB0135-024	M-S-AA	INSULATION THERMAL FIBROUS - 300 DEGREE F TO 700 DEGREE F, MB0135-024 TYPE 1, HI TEMP INSUL INC
MB0135-029	Q-24/9751	THREAD, QUARTZ TEMP RESISTANT, POLYTETRAFLUOROETHYLENE COATED, MB0135-029, J. P. STEVENS
MB0135-031	DYNAFLEX DF600	INSULATION, THERMAL, FIBROUS - 300 DEGREE TO 2600 DEGREE F, MB0135-031 TYPE VI CLASS 1, JOHN MANSVILLE
MB0135-031	THERMOFLEX RF600	INSULATION, THERMAL, FIBROUS - 300 DEGREE TO 2600 DEGREE F, MB0135-031 TYPE VI CLASS 2, JOHN MANSVILLE
MB0135-031	DYNAFLEX DF800	INSULATION, THERMAL, FIBROUS - 300 DEGREE TO 2600 DEGREE F, MB0135-031 TYPE VII CLASS 1, JOHN MANSVILLE

MB0135-031	THERMAFLEX RF800	INSULATION, THERMAL, FIBROUS - 300 DEGREE TO 2600 DEGREE F, MB0135-031 TYPE VIII CLASS 2, JOHN MANSVILLE
MB0135-031	DYNAFLEX DF1200	INSULATION, THERMAL, FIBROUS - 300 DEGREE TO 2600 DEGREE F, MB0135-031 TYPE XII CLASS 1, JOHN MANSVILLE
MB0135-031	THERMAFLEX RF1200	INSULATION, THERMAL, FIBROUS - 300 DEGREE TO 2600 DEGREE F, MB0135-031 TYPE XII CLASS 2
MB0135-031	DYNAFLEX DF2400	INSULATION, THERMAL, FIBROUS - 300 DEGREE TO 2600 DEGREE F, MB0135-031 TYPE XXIV CLASS 1
MB0135-031	THERMAFLEX RF2400	INSULATION, THERMAL, FIBROUS - 300 DEGREE TO 2600 DEGREE F, MB0135-031 TYPE XXIV CLASS 2
MB0135-035	HT-30TVS NATURAL	TAPE, LACING & TYPING FOR S/C WIRE ASSY, MB0135-035 TYPE I, BENTLEY HARRIS MFG
MB0135-035	HT-30LOC-B NATURAL	TAPE, LACING & TYPING FOR S/C WIRE ASSY, MB0135-035 TYPE II, BENTLEY HARRIS MFG
MB0135-038	1003-A-30K G1P	FILM, POLYIMIDE, GOLDIZED, MB0135-038 TYPE I CLASS 1 GRADE A, STANDARD PACKAGING CO
MB0135-038	1003-A-30K G1	FILM, POLYIMIDE, GOLDIZED, MB0135-038 TYPE I CLASS 1 GRADE B, STANDARD PACKAGING CO
MB0135-038	1003-A-50K G1P	FILM, POLYIMIDE, GOLDIZED, MB0135-038 TYPE I CLASS 2 GRADE A, STANDARD PACKAGING CO

MB0135-038	1003-A-50K G1	FILM, POLYIMIDE, GOLDIZED, MB0135-038 TYPE I CLASS 2 GRADE B, STANDARD PACKAGING CO
MB0135-038	1003-A-30F G2P	FILM, POLYIMIDE, GOLDIZED, MB0135-038 TYPE II CLASS 1 GRADE A, STANDARD PACKAGING CO
MB0135-038	1003-A-30K G2	FILM, POLYIMIDE, GOLDIZED, MB0135-038 TYPE II CLASS 1 GRADE B, STANDARD PACKAGING CO
MB0135-038	1003-A-50K G2P	FILM, POLYIMIDE, GOLDIZED, MB0135-038 TYPE II CLASS 2 GRADE A, STANDARD PACKAGING CO
MB0135-038	1003-A-50K G2	FILM, POLYIMIDE, GOLDIZED, MB0135-038 TYPE II CLASS 2 GRADE B, STANDARD PACKAGING CO
MB0135-038	NM50-49	FILM, POLYIMIDE, GOLDIZED, MB0135-038 TYPE I CLASS 4 GRADE B, STANDARD PACKAGING CO
MB0135-038	G404920	FILM, POLYIMIDE, GOLDIZED, MB0135-038 TYPE I CLASS 4 GRADE B, SHELDAHL CO
MB0135-038	G404974	FILM, POLYIMIDE, GOLDIZED, MB0135-038 TYPE I CLASS 1 GRADE A, SHELDAHL CO
MB0135-038	G404970	FILM, POLYIMIDE, GOLDIZED, MB0135-038 TYPE I CLASS 1 GRADE B, SHELDAHL CO
MB0135-038	G404964	FILM, POLYIMIDE, GOLDIZED, MB0135-038 TYPE I CLASS 2 GRADE A, SHELDAHL CO

MB0135-038	G404960	FILM, POLYIMIDE, GOLDIZED, MB0135-038 TYPE I CLASS 2 GRADE B, SHELDAHL CO
MB0135-038	G401874	FILM, POLYIMIDE, GOLDIZED, MB0135-038 TYPE II CLASS 1 GRADE A, SHELDAHL CO
MB0135-038	G401870	FILM, POLYIMIDE, GOLDIZED, MB0135-038 TYPE II CLASS 1 GRADE B, SHELDAHL CO
MB0135-038	G401844	FILM, POLYIMIDE, GOLDIZED, MB0135-038 TYPE II CLASS 2 GRADE A, SHELDAHL CO
MB0135-038	G401860	FILM, POLYIMIDE, GOLDIZED, MB0135-038 TYPE II CLASS 2 GRADE B, SHELDAHL CO
MB0135-038	G401850	FILM, POLYIMIDE, GOLDIZED, MB0135-038 TYPE II CLASS 3 GRADE B, SHELDAHL CO
MB0135-042	TBD	FABRIC, MESH, KNITTED POLYESTER, MB0135-042
MB0135-047	TG15000	FIBROUS THERMAL INSULATION, MB0135-047 TYPE I 3LB DENSITY, HITCO DEFENSE PROD DIV.
MB0135-047	TG15000	FIBROUS THERMAL INSULATION, MB0135-047 TYPE II 6LB DEN- SITY, HITCO DEFENSE PROD DIV.
MB0135-047	TG15000	FIBROUS THERMAL INSULATION, MB0135-047 TYPE III 2.25LB DENSITY, HITCO DEFENSE PROD DIV.
MB0135-047	TG15000	FIBROUS THERMAL INSULATION, MB0135-047 TYPE IV 2.0 LB DEN- SITY, HITCO DEFENSE PROD DIV.

MB0135-047	M-S-AA	FIBROUS THERMAL INSULATION, MB0135-047 TYPE IV 2.0 LB DEN- SITY, HI TEMP INSULATION INC.
MB0135-048	G134600	FILM, REINFORCED POLYIMIDE, MB0135-048 TYPE I, GOLD COATED NON-POROLATED, SHELDAHL CO
MB0135-048	G134600	FILM, REINFORCED POLYIMIDE, MB0135-048 TYPE II, GOLD COATED POROLATED, SHELDAHL CO
MB0135-048	G145100	FILM, REINFORCED POLYIMIDE, MB0135-048 TYPE III GOLD COATED NON-POROLATED, SHELDAHL CO
MB0135-050	8315-00-K33-0702 7361	MB0135-050TY1 TAPE, POLYIMIDE, TEMPERATURE RESISTANT, PRESSURE SENSITIVE, MB0135-050 TYPE I, MYSTIC (1/2")
MB0135-050	G402600	TAPE, POLYIMIDE, TEMPERATURE RESISTANT, PRESSURE SENSITIVE, MB0135-050 TYPE II, SHELDAHL CO
MB0135-050	G402602	TAPE, POLYIMIDE, TEMPERATURE RESISTANT, PRESSURE SENSITIVE, MB0135-050 TYPE II BLUE OVER- LAY ADDED, SHELDAHL CO
MB0135-050	8315-00-K33-0701 T966	MB0135-050TY3 1.000 WIDE (D8) TAPE, POLYIMIDE, TEMPERATURE RESISTANT, PRESSURE SENSITIVE, MB0135-050 TYPE III, FRALOCK DIVISION
MB0135-050	8315-00-K33-0701 43/81/1	MB0135-050TY3 1.000 WIDE (D8) TAPE, POLYIMIDE, TEMPERATURE RESISTANT, PRESSURE SENSITIVE, MB0135-050 TYPE III, NAT METALLIZING DIV

MB0135-050	1820-00-K33-6211 G406400	0.500 WIDE (IA)	TAPE, POLYIMIDE, TEMPERATURE RESISTANT, PRESSURE SENSITIVE, MB0135-050 TYPE IV, SHELDAHL CO (GLASS YARN, WHITE)
MB0135-050	1820-00-K33-6211 G406402	0.500 WIDE (IA)	TAPE, POLYIMIDE, TEMPERATURE RESISTANT, PRESSURE SENSITIVE, MB0135-050 TYPE IV BLUE OVER-LAY ADDED, SHELDAHL CO (GLASS YARN, WHITE)
MB0135-050	45/9/1		TAPE, POLYIMIDE, TEMPERATURE RESISTANT, PRESSURE SENSITIVE, MB0135-050 TYPE IV, NAT METAL-LIZING DIV
MB0135-053	1650		SLEEVING AND FABRIC, KNIT, ARAMID, MB0135-053 SLEEVING, F. B. WRIGHT CO
MB0135-053	FBW3601		SLEEVING AND FABRIC, KNIT, ARAMID, MB0135-053 FABRIC, F. B. WRIGHT CO
MB0135-058	9530-00-K32-4243 047		MB0135-058TY1 CL 1 FELT, THERMAL BARRIER (FILLER 0.090 X 0.900 WIDE BAR), MB0135-058 TYPE I CLASS (YY)
MB0135-058	048		FELT, THERMAL BARRIER (FILLER BAR), MB0135-058 TYPE I CLASS 2
MB0135-058	347		FELT, THERMAL BARRIER (FILLER BAR), MB0135-058 TYPE I CLASS 3
MB0135-058	TBD		FELT, THERMAL BARRIER (FILLER BAR), MB0135-058 TYPE II CLASS I

MB0135-058	1850-00-K30-5390	TBD	MB0135-058TY2 CL2 0.115 X 0.750 WIDE (K5)	FELT, THERMAL BARRIER (FILLER BAR), MB0135-058 TYPE II CLASS 2
MB0135-058		TBD		FELT, THERMAL BARRIER (FILLER BAR), MB0135-058 TYPE II CLASS 3
MB0135-059	1850-00-K33-5195	G134902	1.000 WIDE (NX)	TAPE, GLASS CLOTH, PLASTIC IM- PREGNATED PRESSURE SENSITIVE, MB0135-059 TYPE I BLUE OVERLAY ADDED, SHELDAHL CO
MB0135-059	1850-00-K33-5195	G134900	1.000 WIDE (NX)	TAPE, GLASS CLOTH, PLASTIC IM- PREGNATED PRESSURE SENSITIVE, MB0135-059 TYPE I, SHELDAHL CO
MB0135-059		5451		TAPE, GLASS CLOTH, PLASTIC IM- PREGNATED PRESSURE SENSITIVE, MB0135-059 TYPE II, 3M CO.
MB0135-062		7455-B5L3A1		HEAT REFLECTIVE, PRESS SENSI- TIVE, ALUM COATED, FIBERGLASS CLOTH TAPE, MB0135-062, MYSTIC
MB0135-063	1820-00-K33-5469	G401900	4.000 WIDE (OD)	TAPE, PRESS SENSITIVE, THERMAL CONTROL, FILM 2ND SURFACE MIR- ROR, MB0135-063 TYPE I, SHEL- DAHL CO
MB0135-063	1820-00-K33-5469	45/9/2	4.000 WIDE (OD)	TAPE, PRESS SENSITIVE, THERMAL CONTROL, FILM 2ND SURFACE MIR- ROR, MB0135-063 TYPE I, NAT METALLIZING DIV
MB0135-063		G404200		TAPE, PRESS SENSITIVE, THERMAL CONTROL, FILM 2ND SURFACE MIR- ROR, MB0135-063 TYPE II, SHEL- DAHL CO

MB0135-063	G404202	TAPE, PRESS SENSITIVE, THERMAL CONTROL, FILM 2ND SURFACE MIRROR, MB0135-063 TYPE II BLUE OVERLAY ADDED, SHELDAHL CO
MB0135-065	ES1305	FABRIC, CERAMIC FIBER, MB0135-065 TYPE I CLASS I, WOVEN STRUCTURES DIV, HITCO
MB0135-065	STYLE 22T	FABRIC, CERAMIC FIBER, MB0135-065 TYPE II CLASS I, 3M CO.
MB0135-065	ES1298	FABRIC, CERAMIC FIBER, MB0135-065 TYPE II CLASS I, WOVEN STRUCTURES DIV, HITCO
MB0135-065	STYLE 608	FABRIC, CERAMIC FIBER, MB0135-065 TYPE I CLASS I, FABRIC DEVELOPMENT
MB0135-065	STYLE 587	FABRIC, CERAMIC FIBER, MB0135-065 TYPE II CLASS I, FABRIC DEVELOPMENT
MB0135-065	WWS-1302	FABRIC, CERAMIC FIBER, MB0135-065 TYPE III CLASS I, 3M CO.
MB0135-065	STYLE B	FABRIC, CERAMIC FIBER, MB0135-065 TYPE III CLASS I, 3M CO.
MB0135-065	ES1503	FABRIC, CERAMIC FIBER, MB0135-065 TYPE III CLASS I, WOVEN STRUCTURES DIV, HITCO
MB0135-065	STYLE 556	FABRIC, CERAMIC FIBER, MB0135-065 TYPE III CLASS I, FABRIC DEVELOPMENT
MB0135-065	ES1305 (BLACK)	FABRIC, CERAMIC FIBER, MB0135-065 TYPE I CLASS 2, WOVEN STRUCTURES DIV, HITCO

MB0135-065	STYLE 608 (BLACK)	FABRIC, CERAMIC FIBER, MB0135-065 TYPE I CLASS 2, FABRIC DEVELOPMENT
MB0135-065	STYLE 22T (BLACK)	FABRIC, CERAMIC FIBER, MB0135-065 TYPE II CLASS 2, 3M CO.
MB0135-065	ES1298 (BLACK)	FABRIC, CERAMIC FIBER, MB0135-065 TYPE II CLASS 2, WOVEN STRUCTURES
MB0135-065	STYLE 587 (BLACK)	FABRIC, CERAMIC FIBER, MB0135-065 TYPE II CLASS 2, FABRIC DEVELOPMENT
MB0135-065	ES1503 (BLACK)	FABRIC, CERAMIC FIBER, MB0135-065 TYPE III CLASS 2, WOVEN STRUCTURES
MB0135-065	STYLE 556 (BLACK)	FABRIC, CERAMIC FIBER, MB0135-065 TYPE III CLASS 2, FABRIC DEVELOPMENT
MB0135-065	STYLE 228 (BLACK)	FABRIC, CERAMIC FIBER, MB0135-065 TYPE III CLASS 2, 3M CO.
MB0135-066	SF744 OR SF2600	SLEEVING AND TAPE, CERAMIC FIBER, MB0135-066 TYPE I SLEEVING,
MB0135-066	SF2600T	SLEEVING AND TAPE, CERAMIC FIBER, MB0135-066 TYPE II TAPE,
MB0135-067	NPN	INSULATION, HI TEMP GRADE, RESILENT, MB0135-067 TYPE III, SAFFIL ALUMINA FIBER LO MAT, ICI UNITED STATES INC
MB0135-067	NPN	INSULATION, HI TEMP GRADE, RESILENT, MB0135-067 TYPE VI, SAFFIL ALUMINA FIBER BLANKET, ICI UNITED STATES INC

MB0135-071 FIN "B"	1850-00-K30-5145-D	4.000 WIDE (HK)	BASE STOCK, FABRIC GAP FILLER, MB0135-077
MB0135-077	TBD		TAPE, POLYIMIDE, FLAME RESIS- TANT PRESSURE SENSITIVE. MB0135-087
MB0135-087	TBD		SEALING AND ANTI-SEIZE COM- POUND, GASKET AND THREAD FOR LIQUID OXYGEN SERVICE, MB0140- 001
MB0140-001	OBSOLETE		LUBRICANT, GENERAL PURPOSE GREASE FOR AEROSPACE VEHICLES, MANNED SPACECRAFT AND AS- SOCIATED GSE, MB0140-005, E. I. DUPONT
MB0140-005	9150-00-K04-3535 KRYTOX 240AC		LUBRICANT, GENERAL PURPOSE GREASE FOR AEROSPACE VEHICLES, MANNED SPACECRAFT AND AS- SOCIATED GSE, MB0140-005, B
MB0140-005	9150-00-K36-1184 BRAYCOTE 640AC	39-6099-90400 NO NUMBER 196	LUBRICANT, GENERAL PURPOSE GREASE FOR AEROSPACE VEHICLES, MANNED SPACECRAFT AND AS- SOCIATED GSE, MB0140-005, B
MB0140-010	9150-00-K36-1159 BRAYCO 815Z	60-6740-81500 NO NUMBER 175	FLUORINATED LUBRICANTS FOR SPACE VEHICLES AND GROUND SUP- PORT EQUIPMENT, MB0140-010 TYPE I, BRAY OIL CO
MB0140-010	1850-00-K30-5420 BRAYCO 3L-38RP 601	39-5110-90045 60-4038-30002	FLUORINATED LUBRICANTS FOR SPACE VEHICLES AND GROUND SUP- PORT EQUIPMENT, MB0140-010 TYPE II, BRAY OIL CO
MB0150-004	NPN		INSULATION SLEEVING, ELECTRI- CAL, SILICONE RUBBER COATED FIBER GLASS, FLEXIBLE, 200C, ALL GAUGES, MB0150-004, BENTLEY HARRIS MFG

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MB0150-004	NPN	INSULATION SLEEVING, ELECTRI- CAL, SILICONE RUBBER COATED FIBER GLASS, FLEXIBLE, 200C, FROM 26 GAUGE CABLE TO 1/2" ID, MB0150-004, FRANK MARKEL & SON
MB0150-049	11071	THERMOCOUPLE, CHROMEL/ALUMEL, PLATINUM/RHODIUM - PLATINUM, COPPER/COPPER ALLOY, POLYIMIDE INSULATED, MB0150-049 MP572- 0277-0001
MB0150-049	11072	THERMOCOUPLE, CHROMEL/ALUMEL, PLATINUM/RHODIUM - PLATINUM, COPPER/COPPER ALLOY, POLYIMIDE INSULATED, MB0150-049 MP572- 0278-0001
MB0150-049	11074	THERMOCOUPLE, CHROMEL/ALUMEL, PLATINUM/RHODIUM - PLATINUM, COPPER/COPPER ALLOY, POLYIMIDE INSULATED, MB0150-049 MP572- 0278-0001
MB0150-049	D2924	THERMOCOUPLE, CHROMEL/ALUMEL, PLATINUM/RHODIUM - PLATINUM, COPPER/COPPER ALLOY, POLYIMIDE INSULATED, MB0150-049 MP572- 0329-0001
MB0150-049	D2920	THERMOCOUPLE, CHROMEL/ALUMEL, PLATINUM/RHODIUM - PLATINUM, COPPER/COPPER ALLOY, POLYIMIDE INSULATED, MB0150-049 MP572- 0329-0002
MB0150-049	D2916	THERMOCOUPLE, CHROMEL/ALUMEL, PLATINUM/RHODIUM - PLATINUM, COPPER/COPPER ALLOY, POLYIMIDE INSULATED, MB0150-049 MP572- 0329-0003

MB0150-059	5970-00-K33-4261	RT218-3/64-MS218	MB0150-059TY1 3/64	HEAT SHRINKABLE MARKING AND INSULATION SLEEVING, MB0150- 059 TYPE I 3/64, RAYCHEM CORP
MB0150-059		RT218-3/32-MS218		HEAT SHRINKABLE MARKING AND INSULATION SLEEVING, MB0150- 059 TYPE I 3/32, RAYCHEM CORP
MB0150-059		RT218-1/8-MS218		HEAT SHRINKABLE MARKING AND INSULATION SLEEVING, MB0150- 059 TYPE I 1/8, RAYCHEM CORP
MB0150-059		RT218-3/16-MS218		HEAT SHRINKABLE MARKING AND INSULATION SLEEVING, MB0150- 059 TYPE I 3/16, RAYCHEM CORP
MB0150-059		RT218-1/4-MS218		HEAT SHRINKABLE MARKING AND INSULATION SLEEVING, MB0150- 059 TYPE I 1/4, RAYCHEM CORP
MB0150-059		RT218-3/8-MS218		HEAT SHRINKABLE MARKING AND INSULATION SLEEVING, MB0150- 059 TYPE I 3/8, RAYCHEM CORP
MB0150-059		RT218-1/2-MS218		HEAT SHRINKABLE MARKING AND INSULATION SLEEVING, MB0150- 059 TYPE I 1/2, RAYCHEM CORP
MB0150-059		RT218-3/4-MS218		HEAT SHRINKABLE MARKING AND INSULATION SLEEVING, MB0150- 059 TYPE I 3/4, RAYCHEM CORP
MB0150-059		RT218-1 1/2-MS218		HEAT SHRINKABLE MARKING AND INSULATION SLEEVING, MB0150- 059 TYPE I 1 1/2, RAYCHEM CORP
MB0150-059		HT-TMS-3/32-1.50 WHITE MS216		HEAT SHRINKABLE MARKING AND INSULATION SLEEVING, MB0150- 059 TYPE II 3/32, RAYCHEM CORP
MB0150-059		HT-TMS-1/8-1.50 WHITE MS216		HEAT SHRINKABLE MARKING AND INSULATION SLEEVING, MB0150- 059 TYPE II 1/8, RAYCHEM CORP

MB0150-059	HT-TMS-3/16-1.50 WHITE MS216	HEAT SHRINKABLE MARKING AND INSULATION SLEEVING, MB0150- 059 TYPE II 3/16, RAYCHEM CORP
MB0150-059	HT-TMS-1/4-1.50 WHITE MS216	HEAT SHRINKABLE MARKING AND INSULATION SLEEVING, MB0150- 059 TYPE II 1/4, RAYCHEM CORP
MB0150-059	HT-TMS-1/2-1.50 WHITE MS216	HEAT SHRINKABLE MARKING AND INSULATION SLEEVING, MB0150- 059 TYPE II 1/2, RAYCHEM CORP
MB0150-064	RT1150	CONDUIT TUBING, KYNAR, FLEXIBLE, CONVOLUTED, ARMORED, AND UNARMORED, MB0150-064 TYPE I, RAYCHEM CORP
MB0150-064	RSC-11A	CONDUIT TUBING, KYNAR, FLEXIBLE, CONVOLUTED, ARMORED, AND UNARMORED, MB0150-064 TYPE II, RAYCHEM CORP
MB0150-064	RSC-11B	CONDUIT TUBING, KYNAR, FLEXIBLE, CONVOLUTED, ARMORED, AND UNARMORED, MB0150-064 TYPE IIB, RAYCHEM CORP
MB0160-035	9MN (21-6-9)	STEEL TUBING, CORROSION RESIS- TANT, 21CRE, 6NI, MB0160-035, TRENT TUBE CO
MB0160-035	9MN (21-6-9)	STEEL TUBING, CORROSION RESIS- TANT, 21CRE, 6NI, MB0160-035, WALL TUBE & METAL CO
MB0160-035	9MN (21-6-9)	STEEL TUBING, CORROSION RESIS- TANT, 21CRE, 6NI, MB0160-035, SUPERIOR TUBE CO

MB0160-035	9MN (21-6-9)		STEEL TUBING, CORROSION RESISTANT, 21CRE, 6NI, MB0160-035, BISHOP TUBE CO
MB0160-035	9MN (21-6-9)		STEEL TUBING, CORROSION RESISTANT, 21CRE, 6NI, MB0160-035, HANDY & HARMAN
MB0160-035	9MN (21-6-9)		STEEL TUBING, CORROSION RESISTANT, 21CRE, 6NI, MB0160-035, WESTERN PNEUMATIC
MB0160-045	9515-00-K36-0297 NPN	MB0160-045 0.001 X 12 X 1152 (NL)	CORROSION RESISTANT STEEL FOIL, MB0160-045, BROWN METALS CO
MB0160-045	1820-00-K35-1063 NPN	MB0160-045 0.001 X 12 X 1152 (NL)	
MB0160-048	NPN		FASTENER TAPES, HOOK AND PILE. METAL, MB0160-048 TYPE I CLASS 1, HOOK TAPE, CONTINUOUS, NARROW SELVAGE
MB0160-048	NPN		FASTENER TAPES, HOOK AND PILE. METAL, MB0160-048 TYPE I CLASS 2, HOOK TAPE TWO INCH REPEATING, WIDE SELVAGE
MB0160-048	8315-00-K31-9677 NPN	MB0160-048TY1 CL3	FASTENER TAPES, HOOK AND PILE. METAL, MB0160-048 TYPE I CLASS 3, HOOK TAPE THREE INCH REPEATING, WIDE SELVAGE
MB0160-048	NPN		FASTENER TAPES, HOOK AND PILE. METAL, MB0160-048 TYPE I CLASS 4, HOOK TAPE, CONTINUOUS, WIDE SELVAGE
MB0160-048	NPN		FASTENER TAPES, HOOK AND PILE. METAL, MB0160-048 TYPE II CLASS 1, PILE TAPE, CONTINUOUS, NARROW SELVAGE

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MB0160-048	NPN		FASTENER TAPES, HOOK AND PILE, METAL, MB0160-048 TYPE II CLASS 2 PILE TAPE, TWO INCH REPEATING, WIDE SELVAGE
MB0160-048	NPN		FASTENER TAPES, HOOK AND PILE, METAL, MB0160-048 TYPE II CLASS 3, PILE TAPE, THREE INCH REPEATING, WIDE SELVAGE
MB0160-048	NPN		FASTENER TAPES, HOOK AND PILE, METAL, MB0160-048 TYPE II CLASS 4 PILE TAPE CONTINUOUS, WIDE SELVAGE
MB0160-048		8315-00-K31-9690	FASTENER
MB0170-014	NICCRO 80		GOLD-COPPER-NICKEL BRAZE ALLOY, MB0170-014, WESTERN GOLD & PLATINUM
MB0170-014	WILBRAS 81162		GOLD-COPPER-NICKEL BRAZE ALLOY, MB0170-014, WILKINSON CO
MB0190-003	44		INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE I CLASS 1, WHITE, INDEPENDENT INK CO
MB0190-003	44		INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE I CLASS 1, YELLOW, INDEPENDENT INK CO
MB0190-003	64		INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE I CLASS 1, BLACK, INDEPENDENT INK CO
MB0190-003	73X		INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE I CLASS 2, BLACK, INDEPENDENT INK CO

MB0190-003	73X	INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE I CLASS 2, WHITE, INDEPENDENT INK CO
MB0190-003	73X	INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE I CLASS 2, RED, INDEPENDENT INK CO
MB0190-003	73X	INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE I CLASS 2, YELLOW, INDEPENDENT INK CO
MB0190-003	19	INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE I CLASS 3, BLACK, INDEPENDENT INK CO
MB0190-003	NO. 1	INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE I CLASS 3, BLACK, MENKE MARKING DEVICES
MB0190-003	NO. 1	INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE I CLASS 3, WHITE, MENKE MARKING DEVICES
MB0190-003	NO. 1	INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE I CLASS 3, RED, MENKE MARKING DEVICES
MB0190-003	41	INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE II CLASS 1, BLACK, INDEPENDENT INK CO

INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE II CLASS 1, WHITE, INDEPENDENT INK CO

INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE II CLASS 1, YELLOW, INDEPENDENT INK CO

INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE II CLASS 1, MARKIM. MACHINE CO

INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE II CLASS 1, BLACK, MENKE MARKING DEVICES

INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE II CLASS 1, WHITE, MENKE MARKING DEVICES

INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE II CLASS 1, RED, MENKE MARKING DEVICES

INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE II CLASS 1, YELLOW, MENKE MARKING DEVICES

INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE II CLASS 2, BLACK, INDEPENDENT INK CO

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GK-6646-P

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1258

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MB0190-003

MB0190-003

MB0190-003

MB0190-003

MB0190-003

MB0190-003

MB0190-003

MB0190-003

MB0190-003

41

INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE II CLASS 2, WHITE, INDEPENDENT INK CO

MB0190-003

41

INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE II CLASS 2, YELLOW, INDEPENDENT INK CO

MB0190-003

104N3-4

INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE II CLASS 2, BLACK, CAL/INK DIV

MB0190-003

104W3-2

INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE II CLASS 2, WHITE, CAL/INK DIV

MB0190-003

104-26-5

INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE II CLASS 2, YELLOW, CAL/INK DIV

MB0190-003

104-07-1

INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE II CLASS 2, RED, CAL/INK DIV

MB0190-003

50-100

INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE II CLASS 3, WHITE, ERNST W. DORN CO

MB0190-003

50-201

INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE II CLASS 3, YELLOW, ERNST W. DORN CO

MB0190-003	50-206	INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE II CLASS 3, ORANGE, ERNST W. DORN CO
MB0190-003	50-301	INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE II CLASS 3, GREEN, ERNST W. DORN CO
MB0190-003	50-407	INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE II CLASS 3, BLUE, ERNST W. DORN CO
MB0190-003	50-422	INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE I CLASS 3, VIOLET, ERNST W. DORN CO
MB0190-003	50-700	INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE II CLASS 3, BLACK, ERNST W. DORN CO
MB0190-003	CATALYST NO. 20	INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE I CLASS 3, ERNST W. DORN CO
MB0190-003	THINNER NO. 50-900	INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE I CLASS 3, ERNST W. DORN CO
MB0190-003	50-100	INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE II CLASS 4, WHITE, ERNST W. DORN CO
MB0190-003	50-201	INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE II CLASS 4, YELLOW, ERNST W. DORN CO

MB0190-003	50-206	INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE II CLASS 4, ORANGE, ERNST W. DORN CO
MB0190-003	50-507	INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE II CLASS 4, RED, ERNST W. DORN CO
MB0190-003	50-301	INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE II CLASS 4, GREEN, ERNST W. DORN CO
MB0190-003	50-407	INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE II CLASS 4, BLUE, ERNST W. DORN CO
MB0190-003	50-422	INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE II CLASS 4, VIOLET, ERNST W. DORN CO
MB0190-003	50-700	INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE II CLASS 4, BLACK, ERNST W. DORN CO
MB0190-003	CATALYST NO. 9	INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE II CLASS 4, ERNST W. DORN CO
MB0190-003	THINNER NO. 50-900	INK, RUBBER STAMPING (NON-ETCHING), MB0190-003 TYPE II CLASS 4, ERNST W. DORN CO
MB0190-006	M-O-N	INK, SILK SCREENING SERIES M WOKNOWINK PLUS CATALYST A, MB0190-006 BLACK,

MB0190-006	M-9-N	INK, SILK SCREENING SERIES M WOKNOWINK PLUS CATALYST A, MB0190-006 WHITE,
MB0190-006	M-2-N	INK, SILK SCREENING SERIES M WOKNOWINK PLUS CATALYST A, MB0190-006 RED,
MB0190-006	M-4-N	INK, SILK SCREENING SERIES M WOKNOWINK PLUS CATALYST A, MB0190-006 YELLOW
MB0210-007	NPN	WATER, HIGH PURITY DISTILLED OR DEIONIZED WATER, MB0210-007 TYPE I, ARROWHEAD-PURITAN WATER CO
MB0210-007	NPN	WATER, HIGH PURITY DISTILLED OR DEIONIZED POLISHED WATER, MB0210-007 TYPE II, ROCKWELL INT
MB0210-007	NPN	WATER, HIGH PURITY DISTILLED OR DEIONIZED WATER, MB0210-007 TYPE IV, ROCKWELL INT
MB0295-006	UCF-165	FILM, TRANSPARENT, PRECISION CLEAN PACKAGING, MB0295-006 TYPE I, CLEAN ROOM PRODUCTS INC
MB0295-006	MICRO-CLEAN NYLON	FILM, TRANSPARENT, PRECISION CLEAN PACKAGING, MB0295-006 TYPE I, SCIENTIFIC ENTERPRISES
MB0295-006	RC CLEAN NYLON A-126	FILM, TRANSPARENT, PRECISION CLEAN PACKAGING, MB0295-006 TYPE I, RICHMOND CORP

MB0295-006

RCAS-2400 NYLON

FILM, TRANSPARENT, PRECISION
CLEAN PACKAGING, MB0295-006
TYPE I, FIBERGLASS REINFORCE-
MENT INC

MB0295-006

ACLAR OR ACLAR 33C

FILM, TRANSPARENT, PRECISION
CLEAN PACKAGING, MB0295-006
TYPE II, SCIENTIFIC EN-
TERPRISES INC

MB0295-006

ACLAR OR ACLAR 33C

FILM, TRANSPARENT, PRECISION
CLEAN PACKAGING, MB0295-006
TYPE I, RICHMOND CORP

MB0295-006

ACLAR OR ACLAR 33C

FILM, TRANSPARENT, PRECISION
CLEAN PACKAGING, MB0295-006
TYPE I, BUERMAN PAPER CO.

MB0295-006

ACLAR OR ACLAR 33C

FILM, TRANSPARENT, PRECISION
CLEAN PACKAGING, MB0295-006
TYPE I, CLEAN ROOM PRODUCTS
INC.



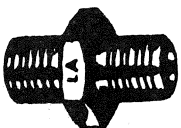

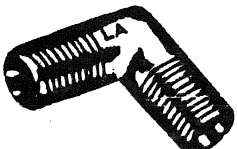
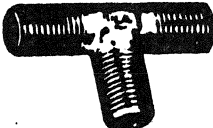
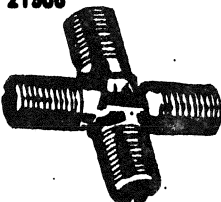

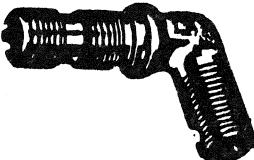
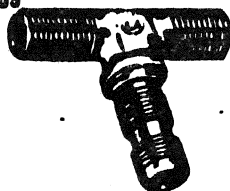



FLARED FITTINGS PRECISION TYPE

<p>24387</p>  <p>BOLT-FLARED TUBE FITTING END UNIVERSAL PRECISION TYPE</p>	<p>MS 24388</p>  <p>TEE-FLARED TUBE INTERNAL THREAD ON SIDE PRECISION TYPE</p>	<p>MS 24389</p>  <p>TEE-FLARED TUBE INTERNAL THREAD ON RUN PRECISION TYPE</p>	<p>MS 24390</p>  <p>TEE-FLARED TUBE WITH BULKHEAD ON RUN PRECISION TYPE</p>
<p>24391</p> <p>L (SHOWN)</p>  <p>PLUG AND BLEEDER SCREW THREAD PRECISION TYPE</p>	<p>MS 24392</p>  <p>UNION-FLARED TUBE PRECISION TYPE</p>	<p>MS 24393</p>  <p>UNION-FLARED TUBE BULKHEAD PRECISION TYPE</p>	<p>MS 24394</p>  <p>ELBOW-FLARED TUBE AND BULKHEAD 90° PRECISION TYPE</p>
<p>24395</p>  <p>TEE-FLARED BULKHEAD TUBE PRECISION TYPE</p>	<p><i>Airway Hydraulic Supply</i></p> <p>2300 Seminole Blvd. City Point LARGO FLORIDA COCOA FLORIDA 584-7512 636-3018</p> <p>ALUMINUM - STEEL - STAINLESS STEEL - TITANIUM</p>		<p>MS 24396</p>  <p>ELBOW-FLARED TUBE BULKHEAD 45° PRECISION TYPE</p>
<p>FLARED FITTINGS PRECISION TYPE MS 24385 MS 24386</p>			<p>FLARED FITTINGS PRECISION TYPE MS 24385 MS 24386</p>
<p>24397</p>  <p>BUSHING-SCREW THREAD REDUCING PRECISION TYPE</p>	<p>MS 24398</p>  <p>BUSHING-SCREW THREAD EXPANDER PRECISION TYPE</p>	<p>MS 24399</p>  <p>REDUCER-EXTERNAL THREAD FLARED TUBE PRECISION TYPE</p>	<p>MS 24400</p>  <p>NUT- FLARED TUBE BULKHEAD PRECISION TYPE</p>
<p>24401</p>  <p>ELBOW-FLARED TUBE 90° PRECISION TYPE</p>	<p>MS 24402</p>  <p>TEE-FLARED TUBE PRECISION TYPE</p>	<p>MS 24403</p>  <p>CROSS-FLARED TUBE PRECISION TYPE</p>	<p>MS 24404</p>  <p>PLUG-FLARED TUBE PRECISION TYPE</p>

FLARED FITTINGS PRECISION TYPE

FLARELESS FITTINGS PER MIL-F-1020U

<p>MS 21900</p>  <p>ADAPTER, FLARELESS TUBE TO AN FLARED TUBE</p>	<p>MS 21901</p>  <p>ADAPTER, FLARELESS TUBE FOR BULKHEAD AND UNIVERSAL TO AN FLARED TUBE</p>	<p>MS 21902</p>  <p>UNION, FLARELESS TUBE</p>	<p>MS 21903</p>  <p>UNION, FLARELESS TUBE BULKHEAD AND UNIVERSAL</p>
<p>MS 21904</p>  <p>ELBOW, FLARELESS TUBE 90</p>	<p>MS 21905</p>  <p>TEE, FLARELESS TUBE</p>	<p>MS 21906</p>  <p>CROSS, FLARELESS TUBE</p>	<p>MS 21907</p>  <p>ELBOW, FLARELESS TUBE AND UNIVERSAL 45°</p>
<p>MS 21908</p>  <p>ELBOW, FLARELESS TUBE BULKHEAD & UNIVERSAL 90°</p>	<p>MS 21909</p>  <p>TEE, BULKHEAD & UNIVERSAL FLARELESS TUBE</p>	<p>MS 21910</p>  <p>TEE, FLARELESS TUBE BULKHEAD AND UNIVERSAL & INTERNAL THREAD ON BRANCH</p>	

ALUMINUM - STEEL - STAINLESS STEEL - TITANIUM

FLARELESS FITTINGS PER MIL-F-18280

FLARELESS FITTINGS PER MIL-F-18280

Airway Hydraulic Supply

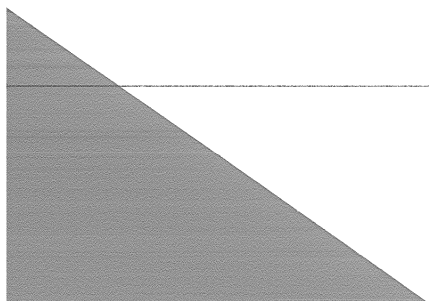
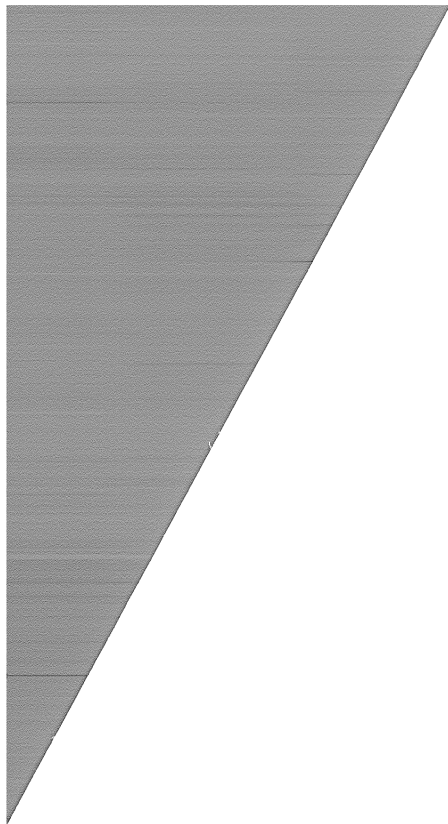
2300 Seminole Blvd.
LARGO FLORIDA
584-7512

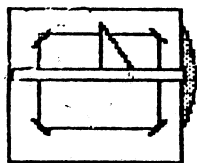
City Point
COCOA FLORIDA
636-3018

<p>MS 21911</p>  <p>TEE, FLARELESS TUBE BULKHEAD & UNIVERSAL & INTERNAL THREAD ON RUN</p>	<p>MS 21912</p>  <p>TEE, FLARELESS TUBE WITH UNIVERSAL ON RUN</p>		
<p>MS 21913</p>  <p>PLUG, FLARELESS TUBE</p>	<p>MS 21914 ASSY</p>  <p>CAP, PRESSURE SEAL FLARELESS TUBE FITTING</p>	<p>MS 21915</p>  <p>BUSHING, SCREW EXPANDER FLARELESS TUBE CONNECTOR</p>	<p>MS 21916</p>  <p>REDUCER, EXTERNAL THREAD FLARELESS TUBE</p>
<p>MS 21921</p>  <p>NUT, SLEEVE COUPLING FLARELESS</p>	<p>MS 21922</p>  <p>SLEEVE COUPLING FLARELESS</p>	<p>MS 21923</p>  <p>ADAPTER, FLARELESS TUBE FOR BULKHEAD & UNIVERSAL TO AN FLARED TUBE</p>	<p>MS 21924</p>  <p>UNION, FLARELESS TUBE, BULKHEAD & UNIVERSAL</p>

FLARELESS FITTINGS PER MIL-F-18280

SECTION 9 - ACTIVE LO DRAWING LIST FOR ROCKWELL EQUIPMENT FOR WHICH
LSOC HAS DESIGN AND O&M RESPONSIBILITY





DESIGN/ DRAFTING

Dept 828/112
ZL84, 7-2822/3113

L070 DRAWING RECORD FOR: OCT 13 1983
(SORTED BY MODEL NO.)

PAGE 1

MODEL NO	DWG NO	REV	EO	SEQ	NXT	US	DWG	TITLE	STATUS
	L070-000017				END	ITEM		PANELS-PORTABLE GAS SAMPLING	REQMTS DELETED
	L070-000018	NC	A	02	END	ITEM		BRACKET-CRADLE LIFTING POD	RELEASED JAN 78
	L070-000042							HOSE ASSY-LETF/ATP	OBSOLETE PER EDM873123
	L070-000048							PLATE/DOUBLER	REQMTS DELETED
	L070-000049							BRACKET INSTL (H70-0713)-VERTICAL ROTATION	REQMTS DELETED
	L070-000052	NC			END	ITEM		TEMPLATE/DRILL-VERT ROTATION BKT	REQMTS DELETED
	L070-000058							AMONNIA SAMPLER	REQMTS DELETED
	L070-000071	NC	A	02	END	ITEM		SPACER-VAB LIFTING HOOK ADAPTER	EO A02 REL OCT 79
	L070-000076								REQMTS DELETED
	L070-000077								REQMTS DELETED
	L070-000121	NC			END	ITEM		NOZZLE-PORTABLE FIRE EXTINGUISHER	RELEASED AUG 79
	L070-000131	NC			END	ITEM		BEARING/TVC ROD END	RELEASED AUG 79
	L070-000147	A			END	ITEM		TEST EQUIP (MISC)-APU HOT FIRE TEST	RELEASED OCT 79
	L070-000194							OPF SPACE ALLOCATION FLOOR PLAN	NOT RELEASED
	L070-000234								REQMTS DELETED
	L070-000237								REQMTS DELETED
	L070-000248								REQMTS DELETED
	L070-000262	NC						TOOL-TORQUE 'B'NUT/BD	REQMTS DELETED
A70-1278	L070-000148	A			END	ITEM		STORAGE MEZZANINE-OPF HIGH BAY 1 INSTL	RELEASED JUL 82
A79-0032	L070-000081	NC			END	ITEM		SCAFFOLD-AFT ACCESS FOR MATE/DENATE	RELEASED DEC 78
E70-0001	L070-000003				END	ITEM		B/O BOX SET	REQMTS DELETED
E70-0002	L070-000009	B			END	ITEM		APU CONTROLLER TEST UNIT	RELEASED JUN 80
70-0003	L070-000007	NC	A	01	END	ITEM		DETECTOR-PWR PHASE SEQ	RELEASED DEC 77
E70-0003	L070-000008	NC			L070-000007			WIRE BUNDLE-PWR PHASE SEQ DET	RELEASED DEC 77
E70-0004	L070-000011	NC	A	02	END	ITEM		BATTERY SWITCHOVER TEST BOX	RELEASED NOV 78
E70-0005	L070-000014	D	E	01	END	ITEM		INTERFACE VERIF UNIT-T/O L02 & LH2 ELEC	EO E01 REL SEP 83
E70-0005	L070-000015	C			L070-000014			WIRE BUNDLE-T/O L02 INTERFACE UNIT	REV C REL MAR 83
E70-0005	L070-000016	C	D	01	L070-000014			WIRE BUNDLE-T/O LH2 INTERFACE UNIT	EO D01 REL SEP 83
E70-0005	L070-000019	B	C	01	L070-000014			CABLE SET-T/O L02 & LH2 INTERFACE UNIT	EO C01 REL SEP 83
E70-0006	L070-000050	NC	A	05	END	ITEM		ADAPTER/TEST LEAD SET	EO A05 REL AUG 80
E70-0007	L070-000001	A			END	ITEM		CABLE SET-HMF VALVE BOX	RELEASED AUG 79
E70-0008	L070-000020	B			END	ITEM		VERIFICATION UNIT-VEH/GSE INTERFACE	RELEASED APR 79
E70-0008	L070-000021	B			L070-000020			VERIF UNIT-VEH/GSE INTER (MECH.DETAILS)	REV B REL OCT 83
E70-0008	L070-000022	NC			L070-000020			VERIF UNIT-VEH/GSE INTER (SCHEMATIC)	RELEASED NOV 78
E70-0008	L070-000023	B			L070-000020			WIRING DIAGRAM-VEH/GSE VERIF UNIT	REV B REL OCT 83
E70-0008	L070-000024	A			L070-000021			PANEL-VEH/GSE VERIF UNIT	RELEASED FEB 79
E70-0008	L070-000025	NC			L070-000021			COMPONENT BOARD A1	RELEASED NOV 78
E70-0008	L070-000026	NC			L070-000025			WIRE BUNDLE-COMPONENT BOARD A1	RELEASED AUG 78
E70-0008	L070-000027	NC			L070-000021			COMPONENT BOARD A2	RELEASED JAN 79
E70-0008	L070-000028	A			L070-000027			WIRE BUNDLE-COMPONENT BOARD A2	REV A REL OCT 83
E70-0008	L070-000029	NC			L070-000021			COMPONENT BOARD A3	RELEASED JAN 79
E70-0008	L070-000030	A			L070-000029			WIRE BUNDLE-COMPONENT BOARD A3	REV A REL OCT 83
E70-0008	L070-000031	B			L070-000021			COMPONENT BOARD A4	REV B REL OCT 83
E70-0008	L070-000032	A			L070-000031			WIRE BUNDLE-COMPONENT BOARD A4	RELEASED FEB 79
E70-0008	L070-000033	A			L070-000021			COMPONENT BOARD A5	RELEASED FEB 79
E70-0008	L070-000034	A			L070-000033			WIRE BUNDLE-COMPONENT BOARD A5	RELEASED FEB 79
E70-0008	L070-000035	A			L070-000021			COMPONENT BOARD A6	RELEASED FEB 79
70-0008	L070-000036	A			L070-000035			WIRE BUNDLE-COMPONENT BOARD A6	RELEASED FEB 79
70-0008	L070-000037	A			L070-000021			COMPONENT BOARD A7	RELEASED FEB 79
E70-0008	L070-000038	A			L070-000037			WIRE BUNDLE-COMPONENT BOARD A7	RELEASED FEB 79
E70-0008	L070-000039	A			L070-000021			COMPONENT BOARD A8	RELEASED JAN 79
E70-0008	L070-000040	A			L070-000039			WIRE BUNDLE-COMPONENT BOARD A8	RELEASED SEP 78
E70-0008	L070-000041	NC			L070-000021			MIA EDGE CARD	RELEASED JUL 78
E70-0008	L070-000044	A			L070-000020			CABLE ASSY-VEH/GSE INTER VERIF UNIT	REV A REL OCT 83
E70-0010	L070-000074	A			END	ITEM		GPC MONITOR UNIT	REV 'A' REL JUL 81

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MODEL NO	DWG NO	REV	EO SEQ	NXT US DWG	TITLE	STATUS
E70-0011	L070-000082	B	C 03	L070-000240	ADAPTER UNITS-FLCA PYRO TEST	EO C03 REL MAR 83
E70-0011	L070-000083	NC		L070-000082	ADAPTER CONNECTOR FLCA PYRO TEST	OBSOLETE PER EOM873128
E70-0011	L070-000084	B	C 01	L070-000240	CABLES-PYRO CKT TEST	EO C01 REL AUG 82
E70-0011	L070-000085	B	C 02	L070-000240	CABLES-PORT & STBD MANIP. JET SYS 1 & 2	EO C02 REL AUG 82
E70-0011	L070-000086	A	B 01	L070-000240	SAFING PLUG-PYRO CIRCUIT	EO B01 REL AUG 82
E70-0011	L070-000240	NC	A 02	END ITEM	TEST EQUIP SET - PYRO ELEC SYSTEMS	EO A02 REL MAR 83
E70-0012	L070-000045	NC	A 03	END ITEM	CABLE SET-DCU MEMORY LOADER GND	RELEASED MAR 79
E70-0013	L070-000094	B		END ITEM	CHECKOUT UNIT-OMS/RCS HEATER CONTINUITY	REV B REL AUG 81
E70-0013	L070-000095	B		L070-000094	WIRE BUNDLE-OMS/RCS HTR CONT C/O UNIT	REV B REL AUG 81
E70-0014	L070-000090	NC	A 17	END ITEM	ELEC. TEST EQUIP SET (MISC)	EO A17 REL OCT 83?
E70-0014	L070-000097	NC	A 02	L070-000090	BRACKET-COUPLER SUPPORT ARM	EO A02 REL OCT 82
E70-0014	L070-000098	NC		L070-000090	TOOL/TORQUE-COUPLER SUPPORT ARM	RELEASED MAY 82
E70-0014	L070-000109	A	B 03	L070-000090	ADAPTER SET-ELEC.	EO B03 REL MAY 82
E70-0014	L070-000154	NC		L070-000090	CABLE ADAPTER SET/C70-0547 LOAD BANK	RELEASED MAY 82
E70-0014	L070-000182	NC	A 01	L070-000090	ADAPTER UNIT-SSME AC INTERFACE	EO A01 REL APR 80
E70-0014	L070-000183	NC		L070-000090	PLUG ADAPTER CABLE-TWIST LOCK	RELEASED JUN 80
E70-0014	L070-000195	NC		L070-000090	SHELF/WORK-AVIONICS BAY	RELEASED MAY 82
E70-0014	L070-000205	NC	A 01	L070-000090	DETECTOR/RF RADIATION (HIGH PWR) SET	EO A01 REL JAN 83
E70-0014	L070-000250	NC		L070-000090	ADAPTER CABLE-MCIU	REQMTS DELETED
E70-0014	L070-000265	NC	A 01	L070-000090	HMF SIGNAL CONDITIONER BALANCE UNIT	EO A01 REL JUN 82
E70-0014	L070-000270	NC		L070-000090	ACCELEROMETER SIMULATORS	RELEASED JUN 82
E70-0014	L070-000277	NC		L070-000090	STRAIN GAGE SIMULATOR ASSY	RELEASED JUN 82
E70-0014	L070-000285	NC		L070-000090	TEST PLUG-RATE 6YRD POLARITY VERIF.	RELEASED JUN 82
E70-0014	L070-000289	A		L070-000090	SPAS-01 ADAPTER CABLE ASSY SET	REV A REL AUG 83
E70-0014	L070-000294	NC		L070-000090	CABLE ADAPTER, A13-034 PDU CARRY-ON FLOWMETER	RELEASED SEP 82
E70-0014	L070-000306	NC		L070-000090	TOOL-SCR DIODE REMOVAL SOCKET	RELEASED JUL 83
E70-0014	L070-000313	NC		L070-000289	WIRE/BUNDLE-SPAS-01 ADAPTER CABLE	RELEASED AUG 83
E70-0014	L070-000323	NC	A 02	L070-000090	VMS SIGNAL CONDITIONER ADJ & C/O COUPLER ASSY	EO A02 REL OCT 83
E70-0014	L070-000329	NC		L070-000090	FEC SENSOR UNIT-C70-1153	RELEASED OCT 83?
E70-0015	L070-000096	NC		END ITEM	CONNECTOR SAVER SET-SSME CONTROLLER	RELEASED APR 79
E70-0017	L070-000107	NC	A 01	END ITEM	PANEL-OVERLAY SET (MISC)	EO A01 NOT REL
E70-0018	L070-000342	NC		L070-000111	CABLE ADAPTER-SSME/SRB	IN WORK 9-83
E70-0018	L070-000111	NC		END ITEM	CABLE ADAPTER UNIT-MPS ACT POSIT CALIB	RELEASED JUN 79
E70-0019	L070-000137	NC	A 01	END ITEM	TEST SET/COMPUTER GEN PURP	EO A01 REL OCT 82
E70-0020	L070-000138	NC		END ITEM	MCDS/MMU SYS TEST SET	RELEASED MAY 81
E70-0021	L070-000123	NC		END ITEM	CABLE/GROUND	RELEASED AUG 79
E70-0022	L070-000139	NC		END ITEM	COUPLING SET-CABLE CONNECTOR	RELEASED AUG 79
E70-0023	L070-000146	NC		END ITEM	CABLE/ELEC PWR-PORTABLE PURGE UNIT (S70-0534)	RELEASED NOV 79
E70-0024	L070-000144	A		END ITEM	CABLE ADAPTER UNIT-APS ONE COVER	REV A REL AUG 81
E70-0025	L070-000145	A		END ITEM	FIXTURE ASSY-RF ABSORBER	REV A REL JUN 82
E70-0026	L070-000160	NC		END ITEM	CONTROL BOX ASSY-FIRE	RELEASED JAN 80
E70-0027	L070-000171	NC		END ITEM	STRAIN GAGE SIG COND ADJ EQUIP SET	RELEASED JAN 81
E70-0027	L070-000177	A		L070-000171	CABLE ASSY/ADAPTER 90 DEG TEST AID-STRAIN GAGE	REV A REL NOV 81
E70-0027	L070-000178	A		L070-000171	TEST AID-STRAIN GAGE SIG CONDITIONER	REV A REL NOV 81
E70-0027	L070-000179	A		L070-000171	TOOL SET-SPT SIG CONDITIONER ALIGN	REV A REL NOV 81
E70-0028	L070-000152	NC		END ITEM	CABLE/ADAPTER-OMS ENGINES	RELEASED NOV 79
E70-0030	L070-000165	A		END ITEM	BREAK-THRU BOX ASSY-DEU/DU	REV A REL SEP 81
E70-0031	L070-000236	NC		L070-000238	PANEL/PATCH - OMS ACTUATOR TEST RECORDER	RELEASED JUN 82
E70-0031	L070-000238	A		END ITEM	OMS ACTUATOR TEST RECORDER RACK	REV A REL OCT 83
E70-0032	L070-000192	NC		END ITEM	B/O BOX-SSME HEATER	RELEASED MAY 80
E70-0033	L070-000197	NC	A 03	END ITEM	TEST DEVICE/HIGH POTENTIAL-VAC ION PMP	EO A03 REL APR 83
E70-0034	L070-000330	NC		L070-000211	INTERFACE TEST EQUIP-HGDS MICRO/PANEL ASSY	IN WORK JUL 83
E70-0034	L070-000211	NC		END ITEM	TEST UNIT-HGDS SMPL & DEL SUBSYS	RELEASED DEC 80
E70-0035	L070-000245	A		END ITEM	LOAD BANK/400 HZ STATIC INVERTER	REV A REL OCT 82
E70-0036	L070-000244	NC		END ITEM	CHECKOUT UNIT-ET POINT SENSOR	RELEASED JUL 81

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MODEL NO	DWG NO	REV	ED SEQ	NXT US DWG	TITLE	STATUS
E70-0037	LD70-000253	NC	A 04	END ITEM	OMS/RCS MOTORIZED VALVE CONTROL UNIT	EO A04 REL JUN 83
E70-0037	LD70-000269	NC	A 02	LD70-000253	WIRE BUNDLE-OMS/RCS MOTORIZED VALVE CONTROL UNIT	EO A02 REL JAN 83
E70-0038	LD70-000257	NC	A 01	END ITEM	TEST EQUIPMENT SET/FACT MACHINE	EO A01 REL APR 82
E70-0038	LD70-000258	NC	A 01	LD70-000257	TEST UNIT/RELAY	EO A01 REL APR 82
E70-0038	LD70-000259	NC		LD70-000257	B/O BOX & CABLE ASSY	RELEASED MAR 82
E70-0038	LD70-000260	NC		LD70-000257	TEST SET/ROTARY SWITCH	RELEASED MAR 82
E70-0038	LD70-000266	NC	A 01	LD70-000257	PLUG-DIODE SHORTING SET	EO A01 REL APR 82
E70-0039	LD70-000263	NC	A 01	END ITEM	ORBITER AUDIO CK/OUT EQUIP SET	EO A01 REL MAY 83
E70-0040	LD70-000267	NC	A 02	END ITEM	SOLENOID VALVE CHECKOUT UNIT	EO A02 REL JAN 83
E70-0041	LD70-000324	NC		END ITEM	DIFFERENTIAL RECEIVER	RELEASED SEP 83
E70-0042	LD70-000334	NC		END ITEM	B/O ELECT. TEST UNITS	RELEASED SEP 83?
E70-0043	LD70-000337	NC		LD70-000336	W/B PAYLOAD RETENTION LATCH CONTROL UNIT	TO BE WORKED
E70-0043	LD70-000336	NC		END ITEM	PAYLOAD RETENTION LATCH GND CONTROL UNIT	TO BE WORKED
E72-0009	LD70-000069	A		END ITEM	TRANSDUCER C/O UNIT-ANALOG -001 & DISCRETE -002	RELEASED JAN 79
F70-0001	LD70-000010	NC	A 01	END ITEM	PPU FLOW TUBES	RELEASED DEC 77
F70-0003	LD70-000053	A	B 01	END ITEM	DELTA 'P' TEST TOOL KIT-FUEL/OXID/GAS	EO B01 REL NOV 82
F70-0004	LD70-000068	B		END ITEM	IODINE INJECTION DEVICE	REV B REL OCT 81
F70-0005	LD70-000056	NC		END ITEM	FITTING ADAPTER-KC/CRYO FLANGE	RELEASED FEB 78
F70-0006	LD70-000004	NC	A 03	END ITEM	PANELS/GAS CALIBRATION	EO A03 REL NOV 80
F70-0007	LD70-000059	A		LD70-000060	PANEL-FLIGHT SIMULATOR QD	RELEASED SEP 78
F70-0007	LD70-000060	NC	A 01	END ITEM	TSM T/O UMB & ATP TEST HDW	RELEASED NOV 78
F70-0007	LD70-000061	NC		LD70-000060	SEAL-R/H T/O L02 UMB LOC 7;8 & 2 APT & LETF	RELEASED MAY 78
F70-0007	LD70-000062	NC		LD70-000060	SEAL-LH T/O LH2 UMB ATP & LETF	RELEASED JUN 78
F70-0007	LD70-000063	NC	A 01	LD70-000060	COVER-RH T/O L02 UMB ATP & LETF	RELEASED SEP 78
F70-0007	LD70-000064	NC		LD70-000060	COVER LH T/O LH2 UMB ATP & LETF	RELEASED SEP 78
F70-0007	LD70-000065	NC	A 01	LD70-000060	PLATE-CLOSEOUT ATP & LETF	RELEASED SEP 78
F70-0007	LD70-000066	NC		LD70-000060	SEAL-CLOSEOUT ATP & LEFT	RELEASED SEP 78
F70-0007	LD70-000067	NC	A 02	LD70-000060	CAP-CLOSEOUT ATP & LEFT	RELEASED DEC 78
F70-0007	LD70-000072	NC	A 02	LD70-000060	CARRIER PLATE QD SIMULATION	RELEASED AUG 78
F70-0007	LD70-000075	NC	A 01	LD70-000060	BRACKET-DIAL INDICATOR SUPPORT	EO A01 REL FEB 79
F70-0009	LD70-000070	NC	A 05	END ITEM	TUBE ASSY-BEN PURP	EO A05 REL APR 83
F70-0010	LD70-000080	NC		END ITEM	FLEX HOSE TAB INDEX	RELEASED AUG 79
F70-0010	LD70-000286	NC		LD70-000080	HOSE ASSY-VACUUM MEASURING	RELEASED JUL 82?
F70-0011	LD70-000110	NC		END ITEM	ADJUSTERS-PAD ECS BACK PRESSURE	RELEASED MAY 79
F70-0012	LD70-000331	NC		LD70-000092	ADAPTERS-TURING PRESSURIZATION	RELEASED AUG 83?
F70-0012	LD70-000043	NC	A 03	LD70-000092	VALVE/FINE METERING-HMF GSE VALIDATION	EO A03 REL FEB 80
F70-0012	LD70-000088	A	B 02	LD70-000092	TUBE ASSY-SPECIAL PURP	EO B02 REL JUL 82
F70-0012	LD70-000092	NC	A 12	END ITEM	FLUID TEST EQUIP SET (MISC)	EO A12 REL OCT 83
F70-0012	LD70-000102	NC		LD70-000092	ADAPTERS-OMS/RCS TEST POINT	RELEASED MAR 79
F70-0012	LD70-000134	NC		LD70-000092	ADAPTER-APU LEAK TEST	RELEASED DEC 79
F70-0012	LD70-000136	NC	A 01	LD70-000092	FITTING ADAPTER-PRESSURE TRANSDUCER	EO A01 REL OCT 79
F70-0012	LD70-000143	NC		LD70-000092	ADAPTER-SECONDARY SEAL TEST PORT	RELEASED NOV 79
F70-0012	LD70-000187				VALVE/CHECK-MICROBIAL	REQMTS DELETED
F70-0012	LD70-000191	NC		LD70-000092	ADAPTER-HAZ GAS DETECTION SYS	RELEASED MAY 80
F70-0012	LD70-000225	NC		LD70-000092	FILTER TEST UNIT-WCS BACTERIA ODOR	RELEASED JUL 81
F70-0012	LD70-000256	NC	A 03	LD70-000092	HYPER SPILL CONTAINMENT ASSY/SET	EO A03 REL FEB 83
F70-0012	LD70-000315	NC	A 01	LD70-000092	FUEL BARREL ADAPTER	EO A01 REL AUG 83
F70-0012	LD70-000326	NC		LD70-000092	CONTAINER, SPILL-APU LUBE OIL	RELEASED JUN 83
F70-0013	LD70-000089	B		END ITEM	VACUUM SYS INSTL & ASSY OPF	RELEASED JUN 79
F70-0014	LD70-000104	NC		END ITEM	APU HYDRAZINE QTY VERIF UNIT	RELEASED JUL 79
F70-0015	LD70-000105			END ITEM	APU HIGH POINT BLEED UNIT	OBSOLETE PER EQM898953
F70-0016	LD70-000103	NC		END ITEM	AIR MEASURING DEVICE	RELEASED MAR 79
F70-0017	LD70-000101	C		END ITEM	VALVE/FLEX HOSE ASSY-SUP H2O DMP SAMPLE	REV C REL MAY 83
F70-0019	LD70-000135	C		END ITEM	POLISHING UNIT-LCS COOLANT LOOP	REV C REL JUL 83
F70-0020	LD70-000209	A		END ITEM	DEVICE/AIR FLOW MEASUREMENT-CPU/10P	REV A REL SEP 81

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MODEL NO	DWG NO	REV	EO SEQ	NXT US DWG	TITLE	STATUS
F70-0021	L070-000166	B			END ITEM TOOL/TORQUE ADAPTERS	REV B REL OCT 82
F70-0022	L070-000153	NC	A 01		END ITEM ADAPTER/SAMPLING SET-EJECTION SEAT Q2 SYS	EO A01 REL MAR 80
F70-0022	L070-000155	NC		L070-000153	HOSE ADAPTER ASSY	RELEASED NOV 79
F70-0023	L070-000280	NC			END ITEM DYNATUBE POLISHING TOOL SET	TO BE WORKED
F70-0023	L070-000281	NC		L070-000280	DYNATUBE POLISHING SET FOR RCS THRUSTER FITTINGS	RELEASED JUN 82
F70-0023	L070-000282	NC		L070-000280	DYNATUBE 'B'NUT REPLACEMENT TOOL SET	RELEASED MAR 83
F70-0023	L070-000283	NC		L070-000280	DYNATUBE POLISHING SET/GEN PURPOSE	TO BE WORKED
F70-0024	L070-000162	NC	A 01		L070-000198 FIXTURE/TEST INSTL & ASSY-PRSD POD	RELEASED JUL 80
F70-0024	L070-000198	NC	A 02		END ITEM TOOL SET - PRSD QD	EO A02 REL FEB 82?
F70-0024	L070-000271	NC		L070-000198	TOOL - PRSD QD	RELEASED FEB 82?
F70-0025	L070-000188	NC			END ITEM JUMPER/RELIEF-GMD COOLANT LC-39	RELEASED APR 82
F70-0026	L070-000186	NC			END ITEM PANEL/FLOW SIMULATOR-EJECTION SUIT	RELEASED SEP 80
F70-0027	L070-000184	NC			END ITEM TEST EQUIP-HAZ GAS DETECTION SET	RELEASED JUN 80
F70-0028	L070-000196	NC			END ITEM FIXTURE TEST SET-RCS THRUSTER THROAT PLUG	RELEASED SEP 80
F70-0029	L070-000199	NC	A 02		END ITEM TRAINING AID SET-QMS/RCS QD SCUPPER	EO A02 REL JAN 81
F70-0030	L070-000208	NC	A 01		END ITEM ASPIRATOR/HYD FLUID SPILL	EO A01 REL MAR 82
F70-0031	L070-000217	NC	A 01		END ITEM TOOL & QD CAP STORAGE & INSTL SET	EO A01 REL OCT 82
F70-0031	L070-000218	A		L070-000217	TOOLS-QMS/RCS/APU QD CAP REMOVAL	REV A REL JUL 81
F70-0031	L070-000219	NC	A 01		L070-000217 TOOLS/QD-QMS/RCS MISC	EO A01 REL JUL 81
F70-0032	L070-000220	B	C 03		END ITEM TOOL/INST/REMOVAL-RCS PLUG	EO C03 REL OCT 82
F70-0032	L070-000299	NC		L070-000220	THROAT PLUG-FWD RCS	RELEASED OCT 82
F70-0033	L070-000247	A	B 01		END ITEM ECS FLEXDUCT ADAPTER SET	EO B01 REL FEB 83
F70-0034	L070-000249	NC			END ITEM LIQH CARTRIDGE CONTAINER PURGE & PRESS. ASSY	REQMTS DELETED
F70-0035	L070-000321	NC			END ITEM PURGE & PRESSURE PANELS	RELEASED JUL 83
F70-0036	L070-000252	A			END ITEM TOOL/SEAL INSTALLATION-L02 & LH2 QD	REV A REL OCT 83
F70-0037	L070-000268	NC			END ITEM HYDRAULIC FREEZE BLOCK SET	TO BE WORKED
F70-0038	L070-000200	A		L070-000272	FIXTURE/TEST-ECLSS POD	REV A REL APR 83
F70-0038	L070-000272	NC			END ITEM TOOL SET - ECLSS QD	RELEASED FEB 82?
F70-0039	L070-000288	NC	A 03		END ITEM VENT ASSY-APU CATCH BOTTLE DRAIN CONTINUOUS	EO A03 REL JAN 83
F70-0040	L070-000293	NC			END ITEM APU ALCOHOL FLUSH ASSY	RELEASED JUL 83?
F70-0041	L070-000300	NC	A 01		END ITEM SAMPLE CYLINDER SET (METAL)	EO A01 REL SEP 83
F70-0042	L070-000310	NC			END ITEM PANEL SET-DESERVICING, THRUSTER MANIFOLD	IN ENG FOR CHK 4-29-83
F70-0043	L070-000308	NC	A 01		END ITEM PANEL-PRESSURE PORTABLE	EO A01 REL SEP 83?
F72-0002	L070-000057	NC	A 05		END ITEM PANEL-PORTABLE GAS SAMPLING N2 & O2	EO A05 REL AUG 83
F72-0002	L070-000311	NC	A 02		END ITEM PANEL-PORTABLE GAS SAMPLING	EO A02 REL SEP 83
H70-0570	L070-000149				VALVE BOX-ORBITER AFT JACK FINE CONTROL	CONV TO 6W70-540570
H70-0570	L070-000150	NC			END ITEM VALVE BOX INSTL-ORB AFT JACK FINE CTRL	REQMTS DELETED
M70-0001	L070-000002	NC	A 08		END ITEM SLING SET-GEN PURP	EO A08 REL SEP 82
M70-0001	L070-000290	NC		L070-000002	SLING ASSY-THRUSTER REMOVAL TOOL	RELEASED SEP 82
M70-0005	L070-000006	NC	A 01		END ITEM PEDESTAL ADAPTER FIXTURE	RELEASED JAN 78
M70-0007	L070-000051	A	B 01		END ITEM SLING SET-APS POD HORIZONTAL HANDLING	EO B01 REL JAN 82
M70-0007	L070-000078	A		L070-000051	WEIGHT/BALANCE ASSY-FDR HMF-961 APS CRADLE	REV A REL AUG 81
M70-0007	L070-000079	NC		L070-000078	WEIGHTS-HMF-961 APS CRADLE	RELEASED NOV 78
M70-0008	L070-000046	A			END ITEM SLING SET-APS POD VERTICAL ROTATION	REV A REL AUG 81
M70-0008	L070-000163	A		L070-000046	ROTALOCK PIN REMOVER ASSY-QMS POD CRADLE	REV A REL APR 81
M70-0009	L070-000125	A	B 01		END ITEM STAR/TRACKER ACCESS CLEAN ROM INSTL/ASSY	EO B01 REL OCT 81
M70-0011	L070-000091	NC	A 06		END ITEM MECH. TEST EQUIP SET (MISC)	EO A06 REL JUL 83
M70-0011	L070-000223	NC		L070-000091	TOOL/REMOVAL-STUD & BARREL	RELEASED MAY 82
M70-0011	L070-000226	NC		L070-000091	BAG/TRASH-ORBITER	RELEASED JUL 81
M70-0011	L070-000264	NC		L070-000091	TOOL-MID DECK LOCKER	RELEASED MAY 82
M70-0011	L070-000298	NC	A 01		L070-000091 PINS, GUIDE/FWD ET ASSY	EO A01 REL MAR 83
M70-0011	L070-000301	NC		L070-000091	60/NOGO GAGE, ORB/ET UMB. MATE	RELEASED NOV 82
M70-0011	L070-000304	NC		L070-000091	ORBITER VENT DOOR BAFFLE	RELEASED JAN 83
M70-0011	L070-000319	NC		L070-000091	STAND-INFRARED CAMERA	RELEASED JUL 83
M70-0012	L070-000124	NC			END ITEM DOLLY/STORAGE-QMS POD LIFTING SLING & FIXTURE	RELEASED NOV 79

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MODEL NO	DWG NO	REV	EO SEQ	NXT US DWG	TITLE	STATUS
M70-0013	L070-000339	NC		L070-000090	TOOL,TILE BOND TOLERANCE MEASUREMENT	TO BE WORKED
M70-0013	L070-000338	NC		L070-000099	TILE REMOVAL TOOL - HOT WIRE	TO BE WORKED
M70-0013	L070-000099	NC	A 04	END ITEM	TOOL SET-TPS INSTL	EO A04 REL SEP 81
M70-0013	L070-000213	NC	A 03	L070-000099	VACUUM DROP ALARM UNIT	EO A03 REL FEB 82
M70-0013	L070-000214	NC		L070-000099	TOOL/T-HANDLE-TPS INSTL	REQMTS DELETED
M70-0013	L070-000215	NC		L070-000099	VACUUM CUP-STD 5'	REQMTS DELETED
M70-0013	L070-000216	NC		L070-000099	FRAMES/BONDING	RELEASED MAR 81
M70-0013	L070-000222	NC		L070-000099	TPS VERIF & PROOF TEST TABLE	RELEASED JUN 81
M70-0013	L070-000224	NC	A 01	L070-000099	TRI-POD/TPS BONDING SUPPORT	EO A01 REL NOV 81
M70-0013	L070-000227	NC		L070-000222	TOOL/PULL TEST-TPS VERIF & PROOF TEST TABLE	RELEASED JUN 81
M70-0013	L070-000239	NC		L070-000099	TOOL-WIRE TRACK BONDING	RELEASED JUN 81
M70-0014	L070-000130	NC		L070-000230	LONGERON BRIDGE HANDLING & STORAGE ASSY	NOT RELEASED
M70-0014	L070-000230	NC		END ITEM	STORAGE EQUIP SET-PAYLOAD ATTACH HDW & HNDLG	NOT RELEASED
M70-0014	L070-000231	NC		L070-000230	HANDLING & STORAGE-KEEL BRIDGE	NOT RELEASED
M70-0014	L070-000232	NC		L070-000230	LONGERON BRIDGE LATCH C/O & STORAGE ASSY	NOT RELEASED
M70-0014	L070-000233	NC		L070-000230	KEEL BRIDGE LATCH C/O & STORAGE ASSY	NOT RELEASED
M70-0015	L070-000129	NC		END ITEM	BALLAST HANDLING & STORAGE SET-NOSE WHEEL	RELEASED JAN 81
M70-0015	L070-000133	NC	A 01	L070-000129	BALLAST STORAGE CONTAINER-NOSE WHEEL	EO A01 REL MAR 81
M70-0016	L070-000108	NC	A 01	L070-000193	BALLAST BLOCK TETHER	EO A01 REL MAY 80
M70-0016	L070-000126	NC		END ITEM	BALLAST HANDLING CONTAINER LIFTING SLING	NOT RELEASED
M70-0016	L070-000127	NC		L070-000193	BALLAST HANDLING & STORAGE PALLET-PAYLOAD BAY	NOT RELEASED
M70-0016	L070-000128	NC		L070-000193	BALLAST RACK HANDLING & STORAGE ASSY-PAYLOAD BAY	NOT RELEASED
M70-0016	L070-000132	NC		L070-000193	BALLAST STORAGE CONTAINER-PAYLOAD BAY	NOT RELEASED
M70-0016	L070-000193	NC		END ITEM	BALLAST HANDLING SET-PAYLOAD BAY	NOT RELEASED
M70-0017	L070-000100	C		END ITEM	BRACKET-OTV CAMERA MOUNTING	REV C REL SEP 82
M70-0018	L070-000106	NC	A 01	END ITEM	AIRLOCK/CHANGE RM-ORBITER I/E HATCH DR 50-2	EO A01 REL OCT 82
M70-0019	L070-000116	NC		END ITEM	COVERS-PROTECTIVE/PLATFORM 13 OPF	RELEASED JUN 79
M70-0020	L070-000112	A		L070-000113	SUPPORT & POSITIONING LINK-SSME HYD JACK	RELEASED APR 80
M70-0020	L070-000113	A		END ITEM	SUPPORT & POSITIONING LINK-SSME HYD JACK SET	RELEASED APR 80
M70-0021	L070-000114	A		END ITEM	CALIBRATION SET-MPS ENG ACTUATOR	REV A REL AUG 81
M70-0022	L070-000117	NC	A 13	END ITEM	PROTECTIVE COVER SET-FWD FUSELAGE	EO A13 REL JUN 83?
M70-0022	L070-000156	NC		L070-000117	FIXTURE-CREW COMPT WATER PMP PKG COVER & HOSE SUP	RELEASED JAN 80
M70-0022	L070-000201	NC	A 02	L070-000117	DEBRIS NET SET-CREW MODULE	EO A02 REL AUG 82
M70-0022	L070-000212	B		L070-000117	COVER/PROTECTIVE-ORBITER NOSE CONE	REV B REL SEP 83
M70-0022	L070-000229	A		L070-000117	COVERS/PROTECTIVE (SOFT)-ORBITER WINDOWS	REV A REL AUG 83
M70-0022	L070-000251	NC	A 01	L070-000117	STOOL/STEP-ASTRONAUT INGRESS AID	EO A01 REL OCT 81
M70-0022	L070-000255	NC		L070-000117	COVERS/PROTECTIVE EDGE-ORB NOSE GEAR DOOR	NOT RELEASED
M70-0022	L070-000278	NC		L070-000117	COVERS,SECURITY-PAYLOAD BAY WINDOW	RELEASED MAY 82
M70-0022	L070-000291	NC		L070-000117	FRC CAVITY COVER	RELEASED OCT 82
M70-0022	L070-000292	NC		L070-000117	PROTECTOR-CREW HATCH SILL	RELEASED OCT 82
M70-0022	L070-000295	NC		L070-000117	SUPPORT,HYD HOSE/50-44 DOOR	IN HOLD
M70-0022	L070-000296	NC		L070-000117	PANELS,PROTECTIVE/MID-DECK FLOOR	REQMTS DELETED
M70-0022	L070-000297	NC		L070-000117	COVER,PROTECTIVE/HYGIENE COMPARTMENT AFT WALL	RELEASED OCT 82
M70-0022	L070-000318	NC	A 04	END ITEM	SECURITY COVER-AVIONICS BAY	EO A04 REL SEP 83
M70-0022	L070-000325	NC		L070-000117	COVERS,PROTECTIVE-AFT FLIGHT DECK	RELEASED JUN 83?
M70-0023	L070-000335	NC		L070-000118	LADDER,EVA HATCH ACCESS-A70-0519	RELEASED SEP 83
M70-0023	L070-000118	NC	A 10	END ITEM	PROTECTIVE COVER SET-MID FUSELAGE	EO A10 REL SEP 83
M70-0023	L070-000141	B		L070-000118	PLATFORMS/WORK-PAYLOAD BAYS 11 & 12	REV B REL MAY 83
M70-0023	L070-000158	NC		L070-000118	DOOR/TEST-ORBITER ACCESS OPENING NO.46	RELEASED JUN 80
M70-0023	L070-000221	NC		L070-000118	PLATFORM-ORBITER MIDBODY VERT ACCESS	RELEASED AUG 82
M70-0023	L070-000242	NC	A 01	L070-000118	FENDER-44 DOOR	EO A01 REL AUG 82
M70-0023	L070-000254	NC	A 01	L070-000118	COVERS/PROTECTIVE EDGE-ORBITER LANDING GEAR DOORS	EO A01 REL MAR 82
M70-0023	L070-000275	NC		L070-000118	COVERS,PROTECTIVE-ELEVON & FLIPPER DOOR	RELEASED JUL 82
M70-0023	L070-000309	NC		L070-000118	COVER,BULKHEAD DEBRIS, AT X0-1307	RELEASED JUN 83
M70-0024	L070-000333	NC		L070-000119	ACCESS STANDS-SSME VERTICAL	TO BE WORKED

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MODEL NO	DWG NO	REV	EO SEQ	NXT US DWG	TITLE	STATUS
M70-0024	L070-000119	NC	A 08	END ITEM	PROTECTIVE COVER SET-AFT FUSELAGE	EO A08 REL JUN 83
M70-0024	L070-000159	NC		L070-000119	DOOR/TEST-ORBITER ACCESS OPENING AT ID 1307	RELEASED SEP 80
M70-0024	L070-000169	A	B 02	L070-000119	COVER PLT SET-AFT ORBITER RIGID COAX	EO B02 REL AUG 82
M70-0024	L070-000207	A	B 01	L070-000119	COVER/CLOSEOUT-SSME AFT FUSELAGE	EO B01 REL APR 83
M70-0024	L070-000243	A	B 01	L070-000119	PROTECTIVE COVER - SOLENDID VALVE	EO B01 REL AUG 82
M70-0024	L070-000246	NC	A 01	L070-000119	PROTECTIVE COVER/AMBIENT TEMP PROBES	EO A01 REL AUG 82
M70-0024	L070-000261	A		L070-000119	PROTECTIVE EDGE COVERS/EXTERNAL TANK DOORS	REV A REL OCT 82
M70-0024	L070-000273	NC		L070-000119	CABLE TRAY - ELECTRICAL TEST	RELEASED MAY 82
M70-0024	L070-000284	NC		L070-000119	PROTECTIVE COVER-BASE HEAT SHIELD	RELEASED JUN 83
M70-0024	L070-000303	NC		L070-000119	OMS POD COVER SET	RELEASED FEB 83
M70-0024	L070-000307	NC		L070-000119	COVER-ACCESS PERIPHERY RUDDER SPEEDBRAKE	TO BE WORKED
M70-0025	L070-000122	A	B 01	END ITEM	SUPPORT SIMULATOR-KU BAND ANTENNA	EO B01 REL DEC 80
M70-0026	L070-000120	NC		END ITEM	PLATFORMS/WORK-OMS POD ACCESS	RELEASED AUG 79
M70-0027	L070-000142	A	B 01	END ITEM	STAND/JACK-CREW COMPARTMENT LOCKER INST	EO B01 REL MAR 82
M70-0028	L070-000151	B		END ITEM	HANDLING FIXTURE-HEAT SHIELD	RELEASED MAR 81
M70-0029	L070-000157	NC		END ITEM	CALCULATOR-SSME ALIGNMENT PROGRAMABLE	RELEASED NOV 79
M70-0030	L070-000172	NC	A 01	END ITEM	FIXTURE/HANDLING & INSTL SET-OME COVER	EO A01 REL MAY 82
M70-0031	L070-000161				RADIATOR SUPPORT STRUT SET	REQMTS DELETED
M70-0032	L070-000164	NC		END ITEM	STANDS/FLEX HOSE-OMS POD THROAT PLUG	RELEASED SEP 80
M70-0033	L070-000173			L070-000176	STRUTS/STAND SUPPORT-OMES ACCESS	REQMTS DELETED
M70-0033	L070-000174			L070-000176	STAND-OMS ACCESS AT ID 517.25	REQMTS DELETED
M70-0033	L070-000175			L070-000176	STAND/OMS ACCESS AT ID 374	REQMTS DELETED
M70-0033	L070-000176			END ITEM	STANDS-OMS POD ACCESS SET	REQMTS DELETED
M70-0033	L070-000180			L070-000176	STAND-OMS ACCESS AT ID 1315-1390	REQMTS DELETED
M70-0033	L070-000181			L070-000176	STAND-OMS ACCESS AT ID 426	REQMTS DELETED
M70-0034	L070-000189	A		END ITEM	SLIDEBOARD-EGRESS	REV A REL APR 83
M70-0035	L070-000190	NC	A 01	END ITEM	SIMULATOR/TRAINING-ORBITER POST LANDING	RELEASED DEC 80
M70-0036	L070-000203	A		END ITEM	STRONGBACK-FLUID LINE CARRIER	RELEASED MAY 81
M70-0036	L070-000228	A		L070-000203	SUPPORT/BD FLUID LINE-PAYLOAD BAY	REV A REL SEP 81
M70-0037	L070-000204	NC		END ITEM	TOOL SET-APS POD ALIGNMENT	OBSOLETE PER EDM878065
M70-0037	L070-000317	NC	A 01	END ITEM	TOOL SET - OMS POD ALIGNMENT	EO A01 REL JUL 83
M70-0038	L070-000206	NC		END ITEM	COVER/PROTECTIVE-ORBITER TPS	RELEASED MAY 81
M70-0039	L070-000210	NC		END ITEM	TOOL/MANIPULATOR-CREW SCO SW & C/B	OBSOLETE PER EDM878063
M70-0040	L070-000340	NC		END ITEM	DOLLY-TURBO PUMP MAINT.	RELEASED OCT 83
M70-0041	L070-000241	NC		END ITEM	HANDLING DEVICE-MLR VERTICAL	NOT RELEASED
M70-0042	L070-000274	NC	A 01	END ITEM	PLATFORMS-WORK, ASE CONTINGENCY REMOVAL ACCESS	EO A01 REL AUG 83
	L070-000322					REQMTS DELETED
M70-0043	L070-000279	A		END ITEM	TOOL, SSME ALIGNMENT-PERFECT ENGINE TOOL (PET)	REV A REL OCT 83
M70-0044	L070-000305	NC		END ITEM	T/O UMBILICAL ADJUSTMENT/MATING DEVICE	RELEASED JUN 83
M70-0044	L070-000320	NC		L070-000305	CASE, STORAGE-T/O ALIGNMENT TOOL	RELEASED JUN 83
M70-0045	L070-000314	NC		END ITEM	SSME LIFTING FIXTURE	CANCELLED
M70-0046	L070-000312	NC		END ITEM	ELEVON/TSM LOCK SET	REQMTS DELETED
M70-0047	L070-000327	NC		END ITEM	CART-GAS BEAM TRANSPORT	RELEASED SEP 83
M70-0048	L070-000341	NC		END ITEM	CLEANING SET	TO BE WORKED
M72-0003	L070-000013	B		L070-000167	TARGET HOLDER ADAPTER	RELEASED JAN 81
M72-0003	L070-000073	A		L070-000167	OPTICAL TARGET FIXTURE	REV A REL OCT 83
M72-0003	L070-000140	A		L070-000167	INSTRUMENT CARRIAGE VERNIER MODIFICATION	REV A REL OCT 83
M72-0003	L070-000167	A		END ITEM	OPTICAL ALIGNMENT EQUIP SET	REV A REL OCT 83
M72-0003	L070-000168	A		L070-000167	TARGET/OPTICAL ALIGN-BOOSTER SEPARATION MTR NOZZLE	REV A REL OCT 83
M72-0003	L070-000170	NC		L070-000167	STAND/OPTICAL EQUIP SET-UP - PAYLOAD BAY	RELEASED APR 80
M72-0003	L070-000185	NC		L070-000167	TARGET-OPTICAL ALIGN-SRB SKIRT SHOES	RELEASED APR 80
M72-0003	L070-000235	A		L070-000167	HOUSING/LASER-PREBURN IGNITER ADAPTER	REV A REL OCT 83
M72-0003	L070-000276	A		L070-000167	HOLDER, ALIGNMENT SCOPE-M2 IGNITER ALIGNMENT	REV A REL OCT 83
M72-0003	L070-000287	NC		L070-000167	SRB/ET THRUST POST TARGET SET	RELEASED OCT 82
M72-0003	L070-000302	A		L070-000167	CABLE, EXTENSION-3D SYSTEM	REV A REL OCT 83

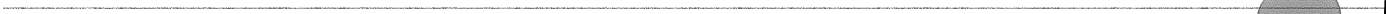
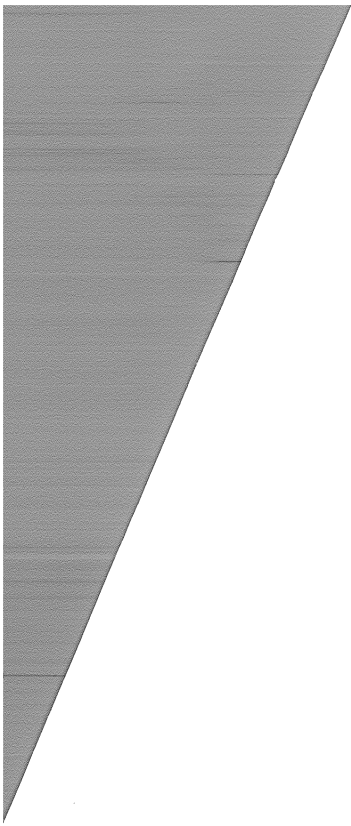
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MODEL NO	DWG NO	REV	EO SEQ	NXT US DWG	TITLE	STATUS
M72-0003	L070-000316	NC		L070-000167	TARGET - OPTICAL LIFT ATTACH POINT	RELEASED MAR 83
M72-0004	L070-000012	A	B 01	END ITEM	SCALE-OPTICAL MV6VT	EO B01 REL NOV 82
M72-0006	L070-000047	NC	A 04	END ITEM	CONTAINER/REUSABLE (FOR NASA INITIATORS)	EO A04 REL JUL 81
MV0070A	L070-000115	NC		END ITEM	PGHM SUPPORT-TEMP INSTL	RELEASED JUN 79
P70-0805	L070-000328	NC		END ITEM	CARTS-ISOPD	RELEASED JUL 83
TEST	L070-000054	NC	A 02	END ITEM	TAGS-REF DESIG	RELEASED JUN 78
U72-0245	L070-000055	D		END ITEM	SIMULATOR-ORB FORM INSTL	RELEASED JUL 79
Z70-0001	L070-000093	A	B 04	END ITEM	SLING (STRAP) SET-GENERAL PURP	EO B04 REL APR 83
Z70-0018	L070-000332	NC		L070-000087	REGULATOR PANELS-PNEUMATIC	TO BE WORKED
Z70-0018	L070-000087	A		END ITEM	REG PANELS/REG-PORTABLE PNEU	REV A REL JUL 83
Z70-0019	L070-000005	A		END ITEM	B/O BOXES;CABLES & ADAPTERS-TAB INDEX	RELEASED FEB 81
Z70-0022	L070-000202	NC		END ITEM	CAMERA CASE-CRT CLOSE UP (LAND CAMERA)	RELEASED AUG 82



SECTION 10 - LO HOSE IDENTIFICATION LIST OF HOSES LOCATED IN OPF (RM.



FLEX HOSE DESIGNATION

L070-000080-XXX

INSIDE HOSE DIAMETER

1 = 1/4 INCH
 2 = 3/8
 3 = 1/2
 4 = 3/4
 5 = 1
 6 = 1-1/4
 7 = 1-1/2 INCH

PRESSURE

0 = 4000 PSIG
 1 = 1000
 2 = 1500
 3 = 3000
 4 = 4500
 5 = 1250
 6 = 4000
 7 = 7000 PSIG

LENGTH

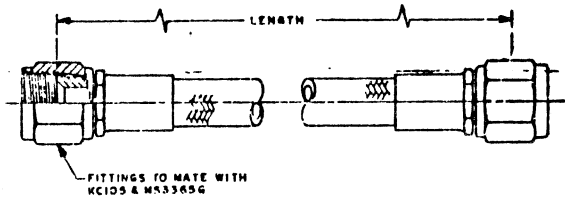
0 = 36 INCHES
 1 = 72
 2 = 108
 3 = 144
 4 = 180
 5 = 216 INCHES
 6 = 0 TO 72 INCHES BUT NOT 36 OR 72 INCHES
 7 = 73 TO 180 INCHES BUT NOT 108, 144 OR 180 INCHES
 8 = 181 TO 360 INCHES BUT NOT 216 INCHES
 9 = GREATER THAN 360 INCHES

HOSE MFG CODE (SEE CORRESPONDING TAB BLOCK)

R = RESISTOFLEX
 B = RESISTOFLEX, 991
 T = TITEXLE
 S = STRATOFLEX
 A = AEROGUIP
 P = PRECE
 V = VARIOUS (RESISTOFLEX, AEROGUIP OR TITEXLE)

NOTES: UNLESS OTHERWISE SPECIFIED

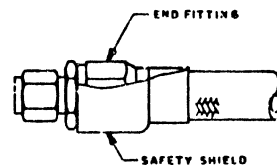
1. ALL HOSES ARE CLEANED TO KSC-C-1125E, LEVEL 3004 HYDRAULIC FLUID USE ONLY.
2. WATER USE ONLY.
3. R2799 FITTING-B NUT END FITTING TUBE IS 3/8" LONGER THAN REGULAR AN FITTING.
4. AMINCO SUPER PRESSURE AN FITTING.
5. HYPER USE ONLY.
7. HOSE TAGGING & INSTALLATION COVERED IN LATEST REVISION OF MPP-LO-0006, REQUIREMENTS & PROCEDURES FOR IDENTIFICATION, CONTAMINATION CONTROL, INSPECTION & SAFETY OF METAL BRAIDED FLEXIBLE HOSES.
8. SOME HOSE MANUFACTURERS USE TWO PIECE END FITTINGS WHERE IT IS POSSIBLE TO BACK OUT THE FITTING. KSC SAFETY HAS DICTATED THAT THESE HOSE END FITTINGS WILL BE FITTED WITH SWAG-D PIECES OF PIPE (SAFETY SHIELDS) SO THE FITTING CANNOT BE BACKED OUT FROM THE HOSE.



TYP HOSE ASSY
 SCALE: NONE

HOSE LOCATION

S/N	STAGING AREA
3000-3199	OAC (M7-905)
3200-3299	PAD A
3300-3374	OAC (M7-905)
3375-3423	HAF
3424-3499	OAC (M7-905)
3500-3599	CALIBRATION LAB (VAB)
3600-3799	OPF
3800-3899	MLP
3900-3999	MSMR



END FITTING WITH SAFETY SHIELD

		UNLESS OTHERWISE SPECIFIED ALL UNITS ARE IN INCHES UNLESS OTHERWISE SPECIFIED		ORIGINAL DATE OF OBSERVATION: JULY 25, 1979 PREPARED BY: CAX CHECKED BY: [Signature] DRAWN BY: [Signature]		FLEX HOSE ASSY - TABULATION PART NO: L070-000080	
ITEM	QTY	END ITEM	F70-0000	SEE ENGINEERING RECORDS	APPROVAL	DATE	SCALE: NONE
REQD PER END ITEM		NETT ASSY	USED OR	APPLICATOR			

OPF FLEX HOSES (ROOM 122)

F70-0010

L070-000080

<u>DASH NUMBER</u>	<u>DIAMETER</u>	<u>LENGTH</u>	<u>WORK PRESSURE</u>
-120	1/4 INCH	36 INCHES	1500 PSI
-121	1/4 INCH	72 INCHES	1500 PSI
-123	1/4 INCH	144 INCHES	1500 PSI
-126	1/4 INCH	18 INCHES	1500 PSI
-126	1/4 INCH	24 INCHES	1500 PSI
-126	1/4 INCH	48 INCHES	1500 PSI
-126	1/4 INCH	60 INCHES	1500 PSI
-126	1/4 INCH	67 INCHES	1500 PSI
-126	1/4 INCH	73 INCHES	1500 PSI
-127	1/4 INCH	78 INCHES	1500 PSI
-127	1/4 INCH	84 INCHES	1500 PSI
-127	1/4 INCH	96 INCHES	1500 PSI
-127	1/4 INCH	120 INCHES	1500 PSI
-127	1/4 INCH	168 INCHES	1500 PSI
-127	1/4 INCH	240 INCHES	1500 PSI
-128	1/4 INCH	192 INCHES	1500 PSI
-128	1/4 INCH	240 INCHES	1500 PSI
-128	1/4 INCH	360 INCHES	1500 PSI
-129	1/4 INCH	460 INCHES	1500 PSI
-129	1/4 INCH	480 INCHES	1500 PSI
-129	1/4 INCH	600 INCHES	1500 PSI
-130	1/4 INCH	36 INCHES	3000 PSI
-131	1/4 INCH	72 INCHES	3000 PSI
-133	1/4 INCH	144 INCHES	3000 PSI
-136	1/4 INCH		3000 PSI
-137	1/4 INCH	96 INCHES	3000 PSI
-137	1/4 INCH	156 INCHES	3000 PSI
-137	1/4 INCH	162 INCHES	3000 PSI
-138	1/4 INCH	240 INCHES	3000 PSI
-138	1/4 INCH	360 INCHES	3000 PSI
-160	1/4 INCH	36 INCHES	6000 PSI
-161	1/4 INCH	72 INCHES	6000 PSI
-163	1/4 INCH	144 INCHES	6000 PSI
-166	1/4 INCH	24 INCHES	6000 PSI
-166	1/4 INCH	48 INCHES	6000 PSI
-166	1/4 INCH	60 INCHES	6000 PSI
-167	1/4 INCH	98 INCHES	6000 PSI
-167	1/4 INCH	120 INCHES	6000 PSI

<u>DASH NUMBER</u>	<u>DIAMETER</u>	<u>LENGTH</u>	<u>WORK PRESSURE</u>
-168	1/4 INCH	120 INCHES	6000 PSI
-168	1/4 INCH	240 INCHES	6000 PSI
-168	1/4 INCH	250 INCHES	6000 PSI
-168	1/4 INCH	360 INCHES	6000 PSI
-168	1/4 INCH	598 INCHES	6000 PSI
-169	1/4 INCH	600 INCHES	6000 PSI
-171	1/4 INCH	72 INCHES	6000 PSI
-193	1/4 INCH	144 INCHES	7500 PSI
-221	3/8 INCH	72 INCHES	1500 PSI
-223	3/8 INCH	144 INCHES	1500 PSI
-224	3/8 INCH	180 INCHES	1500 PSI
-226	3/8 INCH	18 INCHES	1500 PSI
-226	3/8 INCH	62 INCHES	1500 PSI
-226	3/8 INCH	64 INCHES	1500 PSI
-226	3/8 INCH	65 INCHES	1500 PSI
-228	3/8 INCH	192 INCHES	1500 PSI
-228	3/8 INCH	240 INCHES	1500 PSI
-228	3/8 INCH	300 INCHES	1500 PSI
-229	3/8 INCH	720 INCHES	1500 PSI
-233	3/8 INCH	144 INCHES	3000 PSI
-237	3/8 INCH	87 INCHES	3000 PSI
-261	3/8 INCH	72 INCHES	6000 PSI
-263	3/8 INCH	144 INCHES	6000 PSI
-266	3/8 INCH	65 INCHES	6000 PSI
-268	3/8 INCH	192 INCHES	6000 PSI
-268	3/8 INCH	240 INCHES	6000 PSI
-268	3/8 INCH	252 INCHES	6000 PSI
-268	3/8 INCH	300 INCHES	6000 PSI
-277	3/8 INCH	96 INCHES	2000 PSI
-313	1/2 INCH	144 INCHES	1500 PSI
-316	1/2 INCH		1000 PSI
-318	1/2 INCH	300 INCHES	1500 PSI
-320	1/2 INCH	18 INCHES	1500 PSI
-321	1/2 INCH	72 INCHES	1500 PSI
-322	1/2 INCH	108 INCHES	1500 PSI
-323	1/2 INCH	108 INCHES	1500 PSI
-323	1/2 INCH	144 INCHES	1500 PSI
-324	1/2 INCH	180 INCHES	1500 PSI
-325	1/2 INCH	180 INCHES	1500 PSI

OPF FLEX HOSES (ROOM 122)
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PAGE 3.

<u>DASH NUMBER</u>	<u>DIAMETER</u>	<u>LENGTH</u>	<u>WORK PRESSURE</u>
-325	1/2 INCH	216 INCHES	1500 PSI
-326	1/2 INCH	20 INCHES	1500 PSI
-326	1/2 INCH	21 INCHES	1500 PSI
-326	1/2 INCH	48 INCHES	1500 PSI
-326	1/2 INCH	66 INCHES	1500 PSI
-327	1/2 INCH	30 INCHES	1500 PSI
-327	1/2 INCH	78 INCHES	1500 PSI
-327	1/2 INCH	96 INCHES	1500 PSI
-327	1/2 INCH	108 INCHES	1500 PSI
-327	1/2 INCH	120 INCHES	1500 PSI
-327	1/2 INCH	126 INCHES	1500 PSI
-327	1/2 INCH	160 INCHES	1500 PSI
-327	1/2 INCH	180 INCHES	1500 PSI
-328	1/2 INCH	228 INCHES	1500 PSI
-328	1/2 INCH	240 INCHES	1500 PSI
-328	1/2 INCH	252 INCHES	1500 PSI
-328	1/2 INCH	312 INCHES	1500 PSI
-328	1/2 INCH	360 INCHES	1500 PSI
-328	1/2 INCH	600 INCHES	1500 PSI
-329	1/2 INCH	360 INCHES	1500 PSI
-331	1/2 INCH	72 INCHES	3000 PSI
-336	1/2 INCH	90 INCHES	3000 PSI
-337	1/2 INCH	78 INCHES	3000 PSI
-338	1/2 INCH	218 INCHES	3000 PSI
-360	1/2 INCH	36 INCHES	6000 PSI
-361	1/2 INCH	72 INCHES	6000 PSI
-362	1/2 INCH	108 INCHES	6000 PSI
-363	1/2 INCH	144 INCHES	6000 PSI
-364	1/2 INCH	180 INCHES	6000 PSI
-366	1/2 INCH	48 INCHES	6000 PSI
-367	1/2 INCH	78 INCHES	6000 PSI
-367	1/2 INCH	109 INCHES	6000 PSI
-367	1/2 INCH	132 INCHES	6000 PSI
-367	1/2 INCH	168 INCHES	6000 PSI
-368	1/2 INCH	240 INCHES	6000 PSI
-368	1/2 INCH	300 INCHES	6000 PSI
-377	1/2 INCH	120 INCHES	2000 PSI
-378	1/2 INCH	226 INCHES	2000 PSI
-411	3/4 INCH	72 INCHES	1000 PSI
-413	3/4 INCH	144 INCHES	1000 PSI
-416	3/4 INCH	48 INCHES	1000 PSI

OPF FLEX HOSES (ROOM 122)
F70-0010 - L070-000080

PAGE 4.

<u>DASH NUMBER</u>	<u>DIAMETER</u>	<u>LENGTH</u>	<u>WORK PRESSURES</u>
-416	3/4 INCH	54 INCHES	1000 PSI
-416	3/4 INCH	135 INCHES	1000 PSI
-417	3/4 INCH	87 INCHES	1500 PSI
-417	3/4 INCH	120 INCHES	1500 PSI
-417	3/4 INCH	132 INCHES	1500 PSI
-417	3/4 INCH	220 INCHES	1500 PSI
-418	3/4 INCH	190 INCHES	1000 PSI
-418	3/4 INCH	294 INCHES	1000 PSI
-427	3/4 INCH	120 INCHES	1000 PSI
-433	3/4 INCH	144 INCHES	3000 PSI
-437	3/4 INCH	78 INCHES	3000 PSI
-437	3/4 INCH	120 INCHES	3000 PSI
-438	3/4 INCH	250 INCHES	3000 PSI
-453	3/4 INCH	144 INCHES	1250 PSI
-453	3/4 INCH	144 INCHES	1500 PSI
-533	1 INCH	144 INCHES	3000 PSI
-554	1 INCH	180 INCHES	1250 PSI
-557	1 INCH	78 INCHES	1250 PSI
-558	1 INCH	180 INCHES	1250 PSI
-558	1 INCH	260 INCHES	1250 PSI
-617	1.25 INCH	74 INCHES	1000 PSI
-711	1.50 INCH	72 INCHES	1000 PSI

FLEX HOSE DESIGNATION



NOTE:

If specific hose length is required, identify by S/N as indicated on F70-0010 drawing. If you do not include S/N, any hose of a given dash number may be provided.

BP05003

LO70-000080-XXX

FLEX HOSE CODE

1 = 1/4

2 = 3/8

3 = 1/2

4 = 3/4

5 = 1"

6 = 1 1/4"

7 = 1 1/2"

1 = 1000 PSIG

2 = 1500 PSIG

3 = 3000 PSIG

4 = 4500 PSIG

5 = 1250 PSIG

6 = 6000 PSIG

7 = 2000 PSIG

8 = —

9 = 7500 PSIG

0 = 3'

1 = 6'

2 = 9'

3 = 12'

4 = 15'

5 = 18'

6 = 0' to 6' BUT NOT 3' to 6'

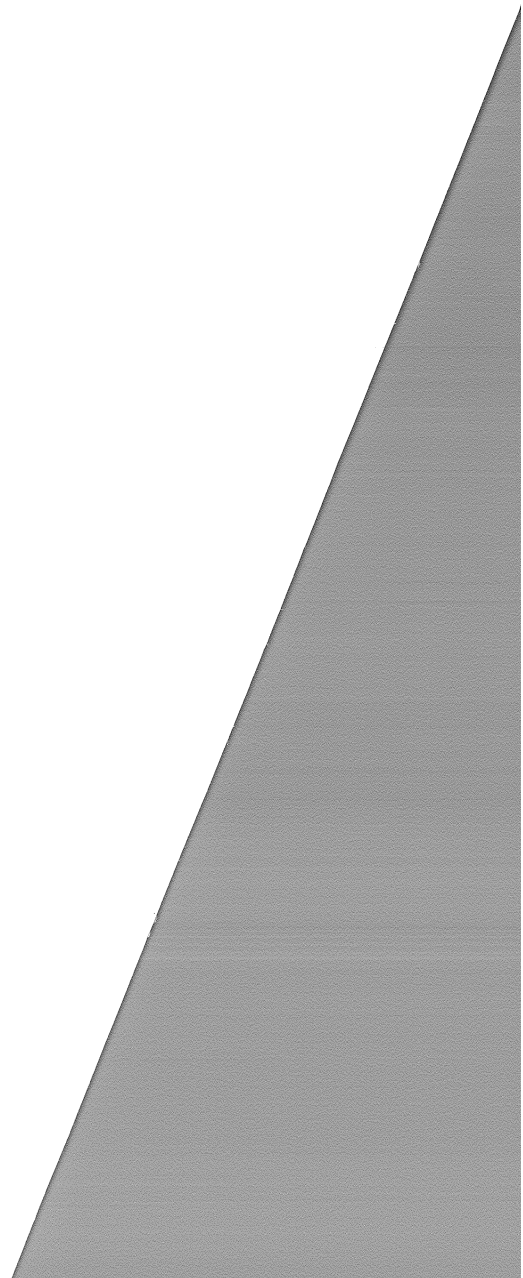
7 = 6' to 15' BUT NOT 9', 12', 15'

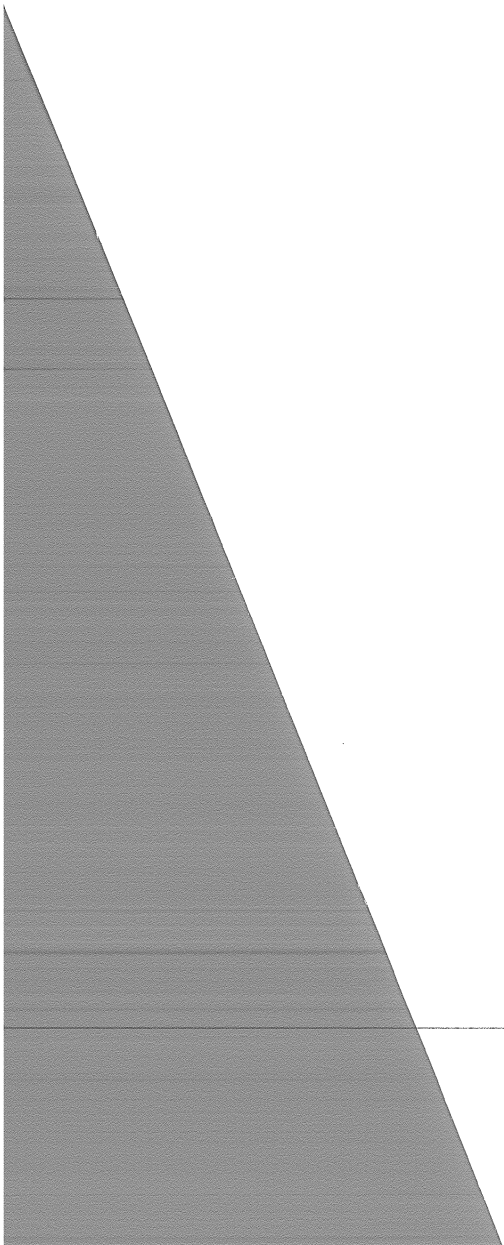
8 = 15' to 30' BUT NOT 18'

9 = GREATER THAN 30'



SECTION 11 - KELLUM GRIP SELECTION CHART





TYPES OF ATTACHMENT

TYPE C

DOUBLE EYE GRIP USED WHERE FASTENING IS MADE WITH EYEBOLTS OR SIMILAR ANCHOR TERMINATION.

TYPE A

SINGLE EYE GRIP USED WHERE FASTENING MUST BE MADE FROM ONE POINT.

TYPE U

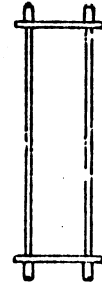
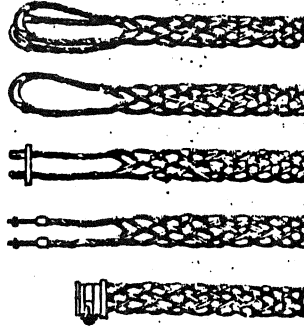
UNIVERSAL BAILE GRIP: USED TO FASTEN AROUND A STRUCTURE OR CLOSED EYE.

TYPE Y

THREADED BOLT (5/16-18X1-1/2" LONG) USED TO FASTEN THROUGH DRILLED HOLE IN PLATE.

TYPE F

SPLIT FITTING TO FIT AN-816 NUTS. FITTING IS POSITIONED OVER NUT AND LOCATED WITH INTERNAL FLANGE. A HOSE CLAMP IS FURNISHED AND REQUIRED TO HOLD THE FITTING IN CORRECT POSITION.



UNIVERSAL BAILE

KELLUM GRIP SELECTION CHART

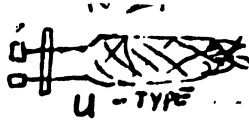
LO70-000000-(DASH NO.)	KELLUM GRIP TYPE & DASH NUMBER (014-02-XXXX)					KELLUM BALES 204-12-XXX(537)
	E	A	U	Y	F	
1 -11X,-12X	1500 (1) 1329 (1)	1920 (1) 1448 (1)	1920 (2), 1926 (3) 1704 (1), 1286 (3)	1930 (1) 1302 (1)	1132 (1)	NOT ALLOWED
-10X,-13X,-14X,-16X,-19X	1329 (1) 1491 (1)	1442 (1) 1286 (1)	1304 (2), 1286 (3) 1308 (2), 1307 (3)	1302 (1) 1302 (1)	1182 (1) 1208 (1)	
-16X WITH SAFETY SHIELDS	1224 (1)	1230 (1)	1138 (2), 1139 (3)	1149 (1)	1206 (1) 1412 (1)	
-21X,-22X	1329 (1) 1491 (1)	1442 (1) 1286 (1)	1304 (2), 1286 (3) 1308 (2), 1307 (3)	1302 (1) 1302 (1)	1181 (1)	
-20X,-23X,-24X,-26X	1491 (1) 1224 (1)	1285 (1) 1230 (1)	1308 (2), 1307 (3) 1138 (2), 1139 (3)	1302 (1) 1149 (1)	1181 (1) 1158 (1)	
-26X WITH SAFETY SHIELDS	1224 (1)	1230 (1)	1138 (2), 1139 (3)	1149 (1)	1156 (1)	NOT ALLOWED
30X,-33X	1224 (1) 1223 (1)	1230 (1) 1284 (1)	1138 (2), 1139 (3) 1140 (2), 1141 (3)	1149 (1) 1086 (1)	1216 (1)	
-10X,-33X	1224 (1) 1223 (1)	1230 (1) 1284 (1)	1138 (2), 1139 (3) 1140 (2), 1141 (3)	1149 (1) 1086 (1)	1216 (1) 1113 (1)	
-30X (1), -11X	224 (1) 1223 (1)	1230 (1) 1284 (1)	1138 (2), 1139 (3) 1140 (2), 1141 (3)	1149 (1) 1086 (1)	1301 (1)	
-36X (2) WITH SAFETY SHIELDS	1279 (1)	1305 (1)	1142, 1143	1190 (1)	1113 (1) 1114 (1) 1157 (1)	-001 (1 FOOT) -002 (2 FEET) -003 (5 FEET) -004 (4 FEET)
-43X	1223 (1) 1279 (1)	1284 (1) 1309 (1)	1140 (2), 1141 (3) 1142 (2), 1143 (3)	1086 (1) 1190 (1)	1301 (1) 1157 (1)	
-55X	1223 (1) 1279 (1)	1284 (1) 1309 (1)	1140 (2), 1141 (3) 1142 (2), 1143 (3)	1086 (1) 1190 (1)	1346 (1)	
-53X,-61X	1279 (1) 1221 (1)	1305 (1) 1321 (1)	1142 (2), 1143 (3)	1190 (1) 1272 (1)	1366 (1) 1314 (1)	
-71X	1221 (1) 1430 (1)	1521 (1) 1522 (1)	1927 (1), 1166 (2) 1173 (1), 1928 (2)	1233 (1) 1272 (1)	1172 (1)	

NOTES FOR KELLUM GRIP CHART ONLY

- (1) GRIP LENGTH, 2 FEET
- (2) GRIP LENGTH, 2 FEET; EYE LENGTH, 1 FOOT
- (3) GRIP LENGTH, 2 FEET; EYE LENGTH, 2 FEET
- (4) GRIP LENGTH, 3 FEET
- (5) GRIP LENGTH, 3 FEET; EYE LENGTH, 1 FOOT
- (6) GRIP LENGTH, 3 FEET; EYE LENGTH, 2 FEET
- (7) BALES NOT ALLOWED

EXAMPLE SELECT KELLUM GRIP FOR LO70-000080-332 HOSE -TYPE F GRIP.

1. IN DRAWING DASH NUMBER COLUMN FIND -33X.
2. MOVE FROM LEFT TO TYPE F COLUMN WHERE TWO CHOICES ARE AVAILABLE-1216 & 1113. PROPER PART NUMBER IS EITHER 014-02-1216 OR 1113. THE BOTTOM NUMBER REFERS TO A LARGER DIAMETER GRIP. EITHER ONE WILL FIT THAT PARTICULAR HOSE.



KELLEM GRIPS

B-NUT, F-TYPE & T-TYPE FOR UNIONS

[DIAL 8-244-2000 PZ OPER-ALL FOR 535-1850 "LUM"]



QTY.	FITS FLEX HOSE	P/N	ACTUAL LENGTH OF KELLEM GRIP ± .003"	STRANDS	GRADE SIZE	DECIMAL SIZE	NOMENCLATURE	CLAMP NO. & SIZE	
								FRONT CLAMP	REAR CLAMP
	1/4"	014-02-1112	36"	12 STRAND		.56		10	30
		1182	36"	8 STRAND		.56			
		(50-24X1.13) 1185	18"	12 STRAND		.56	SHORT	10	30
		1208	24"?						
	1/2"	014-02-1113	36"	12 STRAND	LARGE	.87		56	10
		1216	36"	12 STRAND	SMALL	.87			
		(50-24X1.13) 1300	18"	12 STRAND		.87	SHORT	56	10
	3/4"	014-02-1157	36"	12 STRAND	LARGE	1.25		24/25	24/25
		1188	18"	12 STRAND	LARGE	1.25	SHORT	24/25	28/30
		1301	36"	12 STRAND	MEDIUM	1.25		24/25	20
	1"	014-02-1189	24"	12 STRAND		1.50	SHORT		
		1314	60"±5 FOOT	12 STRAND		1.50	EXTRALONG		
		1366	36"	12 STRAND		1.50		28/30	28/30
		1415	18"	12 STRAND		1.56	SHORT	28/30	28/30
	1 1/4"	014-02-1190	18"	12 STRAND		2.00	SHORT	28/30	28/30
		1442	60"±5 FOOT	12 STRAND		2.00	EXTRALONG		
		1531	36"?						
	2"	014-02-1116	24"?						
		1172	36"?						
		1191	36"?						
		1515	36"?						
	3/4" & 1/2"	1152		1 FT LONG		50-24 1.15 DIA MAX	T-TYPE 12" MAX.		
	1/2" & 1/4"	1318		2 FT LONG		50-24 1.15 DIA MAX	T-TYPE 24" MAX.		
	1/2" & 1/8"	1153	72"			50-24 1.15 DIA MAX	T-TYPE		
		1075					T-TYPE		
		1133					T-TYPE		
		1140					U-TYPE		
		1142					U-TYPE		
		1153					T-TYPE		

KELLUM GRIP HOSE CLAMPS

CLAMP P/N	CLAMP SIZE RANGE	NOMENCLATURE	QTY. F/H TR.	QTY. STAG. AD.
NO. 8/10	3/8" TO 1 1/16"	⊙	89	
NO. 10	3/2" TO 1 3/8"	⊙	155	
NO. 20	1" TO 1 5/16"	⊙	156	
AN 22	3/2" TO 3/4"	AN 737 TW-XX	69	
AN 24/25	1 1/16" TO 2"	"	113	
NO. 25	1 3/8" TO 2"	⊙	1	
AN 26/34	3/4" TO 1 1/8"	"	126	
AN 28/30	1 5/16" TO 2 1/4"	"	127	
AN 30	5/8" TO 7/8"	"	45	20
AN 32/35	1 1/16" TO 2 1/2"	"	3	
AN 34/38	3/4" TO 1 3/16"	"	40	
NO. 36	1 1/8" TO 2 5/8"	= EQUAL TO MN AN 74/91	1	
AN 44/48	1" TO 1 1/2"	AN 737 TW-XX	22	
AN 46	1" TO 1 5/16"	"	6	
AN 48	1 1/8" TO 1 1/2"	"	6	
AN 56	1 1/4" TO 1 5/8"	"	27	
AN 58	1 3/8" TO 1 3/4"	"	4	400
AN 66	1 7/16" TO 1 7/8"	"	1	45
AN 74/92	1 7/8" TO 2 3/4"	= EQUAL TO SIZE NO. 36	1	105
AN 82	2 1/16" TO 2 9/16"	"	1	90
AN 98/114	2 9/16" TO 3 1/2"	"	2	31

⊙ EMMENS COMPANY
GOLD SEAL
MURRAY CORP.
STAINLESS

All AN XX. NO. Clamps
CARRY SAME P/N
AN 737 TW-XX, ETC.

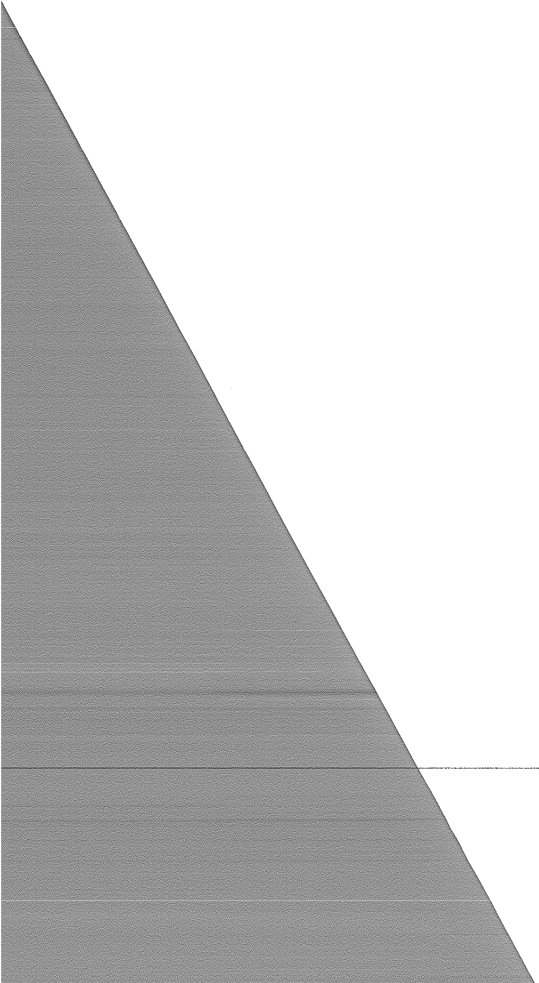
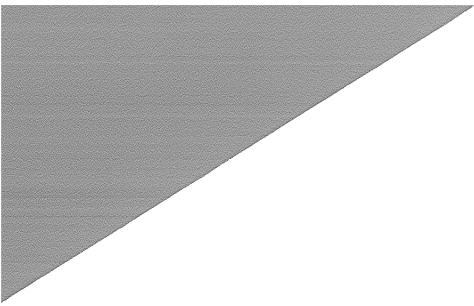
Table 7. Pressures for Tube and Fittings at 300 to Minus 320 Degrees F,
 Types 304 and 316 SST

TUBE O.D. INCHES	TUBE WALL THK. INCHES	TUBE MAX. WORKING PRESSURE LB/IN ²	TUBE HYDROSTATIC TEST PRESSURE LB/IN ²	FLARED TUBE FITTINGS MAX WORKING PRESSURE LB/IN ²
1/4	0.035**	6000	9000	9600
	0.049	8600	12900	
3/8	0.035**	3800	5700	6900
	0.049	5500	8300	
	0.058**	6700	10100	
	0.065	7500	11300	
1/2	0.035	2800	4200	7400
	0.042	3400	5100	
	0.049**	4000	6000	
	0.058	4900	7400	
	0.065	5500	8300	
	0.072**	6100	9200	
3/4	0.083	7200	10800	6500
	0.049	2600	3900	
	0.058	3000	4500	
	0.065**	3500	5300	
	0.072	4000	6000	
	0.083	4600	6900	
	0.095	5300	8000	
0.109**	6200	9300		
1	0.120	6900	10400	5300
	0.065	2600	3900	
	0.072	2900	4400	
	0.083	3400	5100	
	0.095**	3900	5900	
1-1/4	0.109	4500	6800	5200
	* 0.120**	5000	7500	
	0.049**	1500	2300	
	0.065	2000	3000	
	0.083	2700	4100	
1-1/2	0.120	3900	5900	4600
	* 0.134**	4400	6600	
	0.049**	1200	1800	
	0.065	1700	2600	
	0.095	2500	3800	
	0.109	2900	4400	
	0.120	3200	4800	
	0.134	3500	5300	
0.156	4000	6000		
2	* 0.188**	5200	7900	3600
	0.065**	1300	2000	
	* 0.188**	3800	5700	

* This size is not recommended for formed flaring

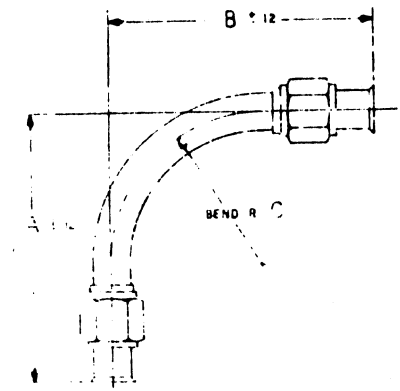
** Standard size which shall be used for all new designs unless deviation is approved by Design Engineering.

SECTION 12 - BACK-TO-BACK/TUBE TO HOSE SELECTION CHART



TUBE ASST (FIG. NO.) NOMENCLATURE	ASST DATA NO.	TUBE DATA NO.	TUBE MATERIAL	MATERIAL SPEC	OD OF TUBE	WALL THK	TUBE LENGTH	TUBE ENDS PER	TYPE OF FITTINGS	QTY	TUBE ENDING OR NUMBER PART NO.	A	B	C
FIG. 1 (5000 PSI SERVICE)	004	101	304 / 316 CRS	ML-T-6000 /AMS 2649	1/8	.028	1.50	MS33664	KC142C KC143C	1				4
	006	102			1/4	.088	3.00		KC148C4 KC143C4	1				4
	008	108			3/8	.088	3.00		KC148C5 KC143C4	1				4
	004	104			1/2	.078	3.00		KC148C6 KC143C6	1				4
(6000 PSI SERVICE)	008	108			5/8	.088	3.00		KC148C10 KC143C10	1				4
	008	108			3/4	.108	3.00		KC148C12 KC143C12	1				4
FIG. 1 (5000 PSI SERVICE)	007	107			1	.088	3.00		KC148C16 KC143C16	1				3
FIG. 2 (6000 PSI SERVICE)	008	108			1/8	.088	1.50		KC148C2 KC143C2	2				4
	008	108			1/4	.088	3.00		KC148C4 KC143C4	2				4
(6000 PSI SERVICE)	010	110			3/8	.088	3.00		KC148C8 KC143C8	2				4
	011	111			1/2	.078	3.00		KC148C10 KC143C10	2				4
	012	112			3/8	.088	3.00		KC148C12 KC143C12	2				4
	013	113			3/4	.108	3.00		KC148C16 KC143C16	2				4
FIG. 2 (5000 PSI SERVICE)	014	114			1	.088	4.00		KC148C18 KC143C18	2				3
FIG. 3 (6000 PSI SERVICE)	015	115			1/8	.088	---		KC148C2 KC143C2	2		1.75	1.75	36
	016	116			1/4	.088	---		KC148C4 KC143C4	2		2.00	2.00	78
(6000 PSI SERVICE)	017	117			3/8	.088	---		KC148C8 KC143C8	2		2.75	2.75	126
	018	118			1/2	.078	---		KC148C10 KC143C10	2		4.31	4.31	400
	019	119			5/8	.088	---		KC148C12 KC143C12	2		4.00	4.00	250
	020	120			3/4	.108	---		KC148C16 KC143C16	2		5.66	5.66	350
FIG. 3 (6000 PSI SERVICE)	021	121	304 / 316 CRS	ML-T-6000 /AMS 2649	1	.088	---	MS33664	KC148C18 KC143C18	2		8.03	8.03	400
	022	122												
	023	123												
	024	124												
	025	125												
	026	126												
	027	127												
	028	128												
	029	129												
	030	130												
	031	131												
	032	132												
	033	133												
	034	134												
	035	135												
	036	136												
	037	137												
	038	138												
	039	139												
	040	140												
	041	141												

L070-000070



BACK-TO-BACKS / TUBE TO HOSE TUBES

FIG. 3

ENGINEERING ORDER

MODEL F70-0009	EFFECT ON END ITEM 1 & SUBS	AUTHORITY GO 40178	PARTS MADE OK TO USE <input type="checkbox"/> MAY BE RPKD <input checked="" type="checkbox"/> NOTED <input type="checkbox"/>	SHEET 1 OF 1 DOCUMENT NO. L070-000070 REV A SEQ 02
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ADD THE FOLLOWING TO P/L & F/D:

TUBE ASSY NOMENCLATURE (FIG NO.)	ASSY DASH NO.	TUBE DASH NO.	TUBE MATERIAL	MATERIAL SPEC	DIA OF TUBE	WALL THK	TUBE LG	TYPE OF		
								TUBE ENDS PER	FITTINGS	QTY
FIG. 4 (150 PSI SERVICE)	-022	-122	304/316 CRES	MIL-T-6845/AMS5648	1/4	.035	---	MS33584	KC142C4 KC143C4	1 1

SUBJECT CHANGE

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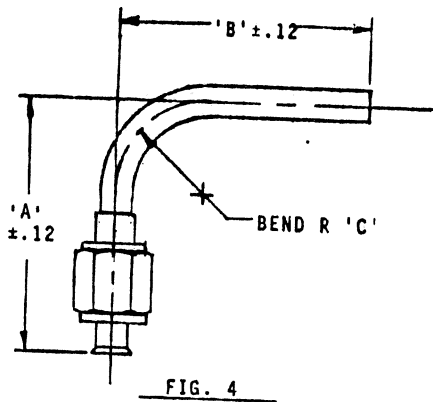


FIG. 4

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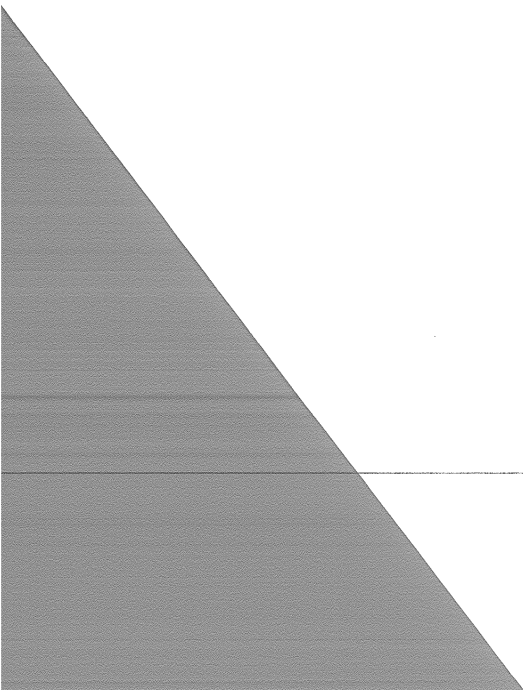
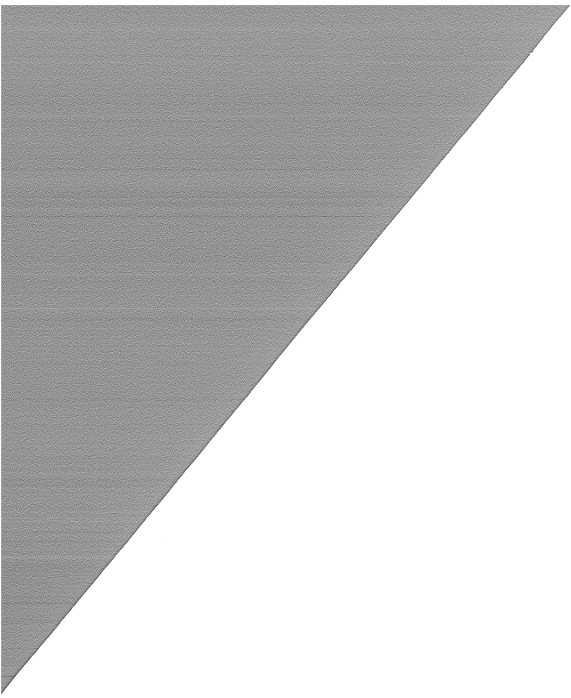
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SECTION 13 - MISCELLANEOUS DATA AND CONVERSIONS



Measurement Techniques

Standards, Calibration, and Traceability

The calibration of an instrument involves using it to make measurements of a "standard" device, which is a device having known characteristics, then adjusting the instrument so its measurements agree with those characteristics. This requires standards of the highest possible quality, since all subsequent measurements made by that instrument descend from that calibration comparison. Typically, instruments are calibrated in a series of transfer operations, such as the following: Standard "A" is used to calibrate instrument "B" in the standards lab; "B" is used to calibrate instrument "C" in the manufacturing plant; and "C" is used to calibrate the finished products, "D." The standard used to calibrate "D" is "A," and the path of calibration is A-B-C-D. This path is the standards traceability path, usually shortened to just "traceability."

Recognized standards are always required for measurement integrity, since high quality standards lead directly to high measurement accuracy. But recognized standards are also sometimes required by regulation, where proof is required that the measurements being made by an instrument have an unbroken, traceable path back to a standard. Such regulations are seen in MIL-STD-45662A, common in the United States, and ISO-9000, common in Europe.

Recognized standards can take many forms. One form is the "fundamental physical constant," derived from an inviolable law of nature, such as the speed of light in vacuum. HP uses such standards in wavelength calibration, in the form of gas spectral line emission lamps. The discrete lines from these lamps are determined by the laws of quantum physics.

Another recognized standard is that of "general consensus." Many HP instruments are truly state-of-the-art, and cannot be calibrated by the existing methods available at any of the national standards laboratories. In these situations, a set of devices is circulated in a measurement round-robin among expert researchers, and a consensual evaluation of the measurement results is then defined to be the standard. HP uses this method for photoreceiver frequency responsivity.

The most common recognized standard takes the form of an artifact maintained by a national standards lab, such as NIST (National Institute of Standards and Technology) in the United States, or PTB in Germany. An example of the use of this type of standard, for the case of optical power, and a typical traceability path follows.

Power Measurements

Improving the traceability and accuracy of optical power measurements is a major challenge facing the lightwave industry. Meeting this challenge was a primary objective in the design and manufacture of the optical power sensor

modules and optical heads for the HP 8153A lightwave multimeter.

These sensors have an accuracy between ± 2.2 and $\pm 2.5\%$, traceable to both the Physikalisch-Technische Bundesanstalt (PTB) of Germany and the NIST. The PTB provides HP with calibration data over the wavelength range of 450 to 1700 nm, which HP then uses to calibrate power meters in 10 nm increments. To ensure parallel NIST traceability, selected meters are regularly sent to NIST for calibration. HP's traceability chains are shown in Figure 1.

Parallel-beam calibration within almost the entire calibration chain keeps the uncertainties to a minimum. Also important are the small number of steps in the chain. Besides regular-production power meters, meters with special calibrations are available to best meet customers' needs.

For the user of HP's optical-power measuring instruments, this means less calibration uncertainty and more accurate power measurements.

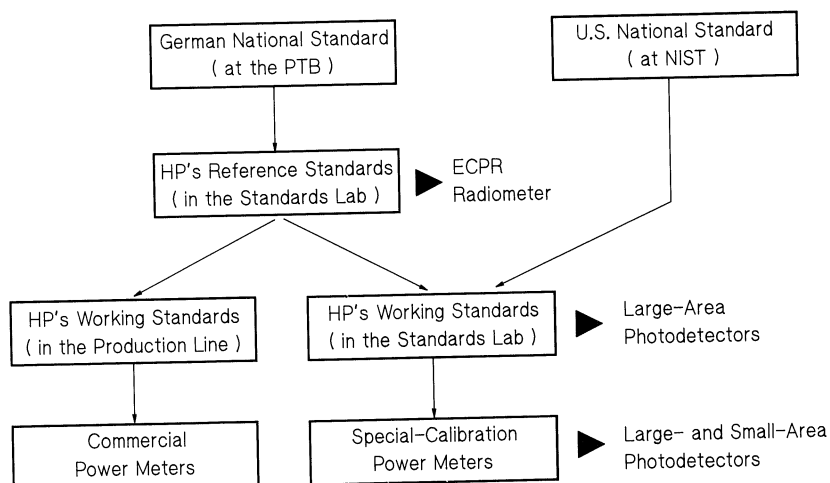


Figure 1. HP's traceability path

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Measurement Techniques

Power Measurements

Choosing the Right Test Equipment

Fiber optic transmission systems include many different active and passive components, such as lasers, LEDs, fiber, connectors, couplers, switches, isolators, and photodiodes.

If a system is to operate at its required performance, each component or module must be designed and manufactured to precise specifications. To test these, designers and manufacturers have to make a number of power and loss measurements.

The HP 8153A lightwave multimeter is a modular system that can be tailored for a designated application. Built-in software makes possible automated standard measurements, without the need of an external controller. High measurement speed and fast data transfer via HP-IB increase throughput in production.

Available accessories include power splitters for monitoring power in a running system or for measuring loss independent of the stability of the stimulating source; lens interfaces for measuring absolute power of divergent beams; and user-exchangeable interfaces for various connector types and bare fibers. All important parameters are thoroughly specified and guaranteed for excellent performance and unsurpassed measurement accuracy.

Absolute Power Measurements

The absolute power of active components, such as lasers or LEDs, is measured from the early stages of the production process through final inspection. The HP 8153A lightwave multimeter offers a solution at every stage of this process. The power of free beams, whether parallel or divergent, can be measured, as well as the power emitted by a bare fiber or various connector types.

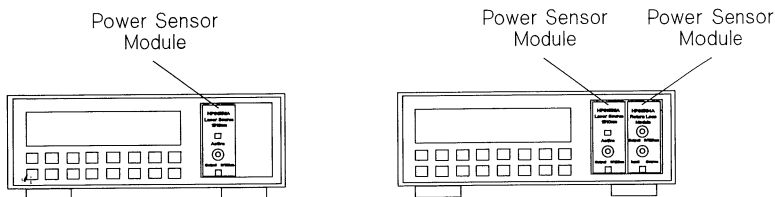


Figure 2. The HP 8153A Lightwave Multimeter configured as a one/two channel power meter

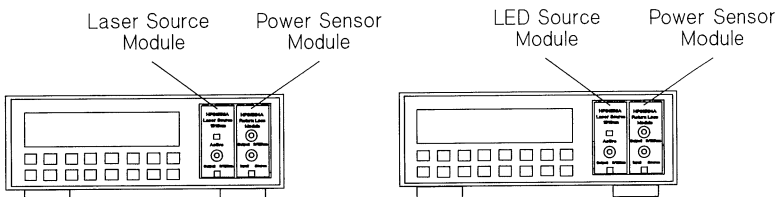


Figure 3. The HP 8153A Lightwave Multimeter configured as a single-mode/multimode loss test set

The most important specifications for absolute optical power measurements are the uncertainty at reference conditions and the total uncertainty. See Figure 2.

The uncertainty at reference conditions for an absolute power measurement describes the greatest accuracy that you can achieve with the HP 8153A, when the measurement conditions approach the conditions under which the power sensor was calibrated. The total uncertainty describes the worst-case accuracy over a wide range of power, wavelength, and ambient temperature conditions. The lightwave multimeter is also specified for various connector types, including degradations due to aging of the photo detector. Of course, the uncertainty specifications are traceable to national standard laboratories such as NIST or PTB.

Insertion Loss Measurements

A stabilized laser or LED source and a power meter (see Figure 3) are required to measure the insertion loss of an optical component. The most important specifications in this case are the stability of the source and the linearity of the power meter. The dynamic range of the system is the difference between the source output power and the power meter sensitivity in dB.

The HP 8153A lightwave multimeter can be configured as a compact loss test set by combining a laser or LED source module and a power sensor module in the mainframe. Laser and LED source modules offer outstanding stability, even under changing ambient temperature, and the sensor modules and the optical heads are specially calibrated for good linearity.

Measurement Techniques

Wavelength Measurements

The growing demands placed on telecommunications operators to increase transmission system capacity and quality call for greater performance requirements for the components and systems employed. The ability to accurately measure the carrier wavelength is necessary in order to optimize components (EDFAs), to minimize disruptive effects (chromatic dispersion), and to expand capacity with additional optical carriers (Wavelength Division Multiplexing).

Light as a Carrier

In transmission systems, we use lasers as the source for a lightwave carrier. We often think of this light in its spectral representation; however, the light carrier is, in fact, an extremely high frequency wave. Because it is easier to think of lightwave carriers in terms of wavelength, we often refer to the carrier in wavelength units of nm or μm rather than in the frequency units of THz.

Equation 1: Wavelength as a function of frequency and transmission medium's refractive index.

$$\lambda = c/(nf) \text{ where:}$$

- λ = wavelength
- f = optical frequency
- n = refractive index of the dielectric material
- $n(\text{vacuum}) = 1.000000$
- $n(\text{air}) = 1.000273$
- c = speed of light in a vacuum
- $c = 2.997925 \times 10^8 \text{ m/s}$

Notice in Equation 1 that carrier wavelength is dependent upon the medium in which the optical wave is traveling. Therefore, when we refer to a signal with units of wavelength, we must consider the refractive index of the host medium. The refractive index of a vacuum is 1.000000; whereas, the refractive index of air is 1.000273. Though the refractive indices are similar, when measuring wavelength, accounting for the different media can become critical (as indicated below)—

particularly if considerable accuracy is required.

$$\begin{aligned} &\text{For a 195 THz carrier signal} \\ &\lambda = 1537.397 \text{ nm as measured} \\ &\quad \text{in a vacuum} \\ &n(\text{vacuum}) = 1.000000 \\ &\lambda = 1536.978 \text{ nm as measured in air} \\ &n(\text{air}) = 1.000273 \\ &\text{the difference is } 0.419 \text{ nm} \end{aligned}$$

Though the difference in measurement results is small, the effects on a transmission system from even as little as tenths of a nanometer could be detrimental to a long-haul system where chromatic dispersion is a concern or in a dense WDM system where channel spacing is of paramount importance.

When measuring small differences in wavelength, such as resolving closely spaced signals or accurately determining the offset to be used in making a signal-to-noise ratio measurement, we often retain the units of frequency for convenience.

Equation 2: Difference in wavelength $d\lambda$ as a function of frequency variation df .

$$d\lambda = -c/\lambda^2 d\lambda$$

- 20 GHz at 1300 nm = 0.113 nm
- 20 GHz at 1550 nm = 0.160 nm

Absolute wavelength accuracy can be given in parts-per-million (ppm), in wavelength, or in frequency. The following compares the relationship among these three measures of accuracy:

Frequency, wavelength, and ppm comparison
at 195 THz
1 ppm is 195 MHz or 0.0015 nm

Measuring Optical Carriers

In addition to the absolute wavelength and frequency of an optical carrier, we might also wish to verify amplitude, separation between signals (channel spacing), the drift of a carrier over time, or the signal-to-noise ratios within a system. If, in addition to the carrier wavelengths, we know the individual

power levels, we can determine channel spacing and drift by comparing those wavelengths and powers to a known reference or to themselves.

If we measure the system noise level as well as the signal power, then we can determine the signal-to-noise ratio. For an accurate noise measurement, we not only need to know the amplitude of the noise at the wavelength of interest, but we must also consider in which bandwidth we are measuring the noise. When calculating the signal-to-noise ratio, we normalize the noise measured to a 1 nm bandwidth.

Equation 3: Signal-to-noise ratio
 $S/N \text{ (dB/nm)} =$
 $P_{\text{sig}} \text{ (dBm)} - P_{\text{noise}} \text{ (dBm/nm)}$

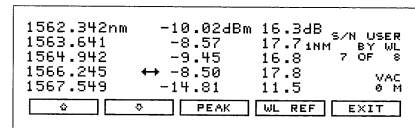


Figure 4. Signal-to-noise ratios verify transmission, system performance

Wavelength Measurements Solutions

To address the need for accurate wavelength measurements, Hewlett-Packard provides the HP 86120A Multi-Wavelength Meter and the HP 71450B OSA Family. These instruments, with their measurement and performance contributions, are discussed in detail on Pages 51 and 59 of this catalog.

Measurement Techniques

Spectral Measurements

Spectral analysis is the measurement of optical power as a function of wavelength. Applications include testing laser and LED sources for spectral purity and power distribution as well as testing transmission characteristics of optical devices.

For example, the spectral width of a light source is an important parameter in fiber-optic communications systems due to chromatic dispersion, which occurs in the fiber and can limit the modulation bandwidth of a system. The effect of chromatic dispersion can be seen in the time domain as pulse broadening of a digital waveform. Because chromatic dispersion is a function of the spectral width of the light source, narrow spectral widths are desirable for high-speed communications systems.

Light-Emitting Diodes (LEDs)

In light-emitting diodes, light is generated by spontaneous emission which occurs when an electron in a high energy conduction band changes to a low energy valence band. The energy lost by the electron is released as a photon. The energy of the released photon is equal to the energy lost by the electron, and the wavelength of the emitted photon is a function of its energy. As a result, the wavelength of the photon is determined by the material used to make the LED.

The difference in energy between the conduction band and the valence band is called the bandgap energy (E_g) and is expressed in units of either joules or electron volts (eV). The wavelength of the emitted photons is determined by the bandgap energy as shown:

$$\lambda = \frac{hc}{E_g} = \frac{1.24 \mu\text{m}}{E_g \text{ eV}}$$

where:

h = Planck's constant, $6.62 \times 10^{-34} \text{ W}\cdot\text{s}$

c = the speed of light, $2.998 \times 10^8 \text{ m/s}$

E_g = the bandgap energy of the material

LEDs emit a broad distribution of wavelength. The spectral width is often specified by the full-width at half-maximum or half-power point of the spectrum. Typical values for spectral width range from 20 nm to 80 nm. Other light-emitting parameters that are commonly measured are: total power; mean wavelength (center of mass); sigma (spectral width based on a Gaussian distribution); FWHM (spectral width at the half power points); spectral width at X dBc from the peak wavelength; peak wavelength; and power spectral density (see Figure 5.)

Fabry-Perot Lasers

A Fabry-Perot laser differs from an LED because it generates light mainly by stimulated emission. Some of the photons are generated by spontaneous emission, as described for the LED, however, the majority of photons trigger additional electron-hole recombinations, resulting in additional photons. A simulated photon travels in the same direction and has the same wavelength and phase as the photon that triggered its generation.

As a photon passes through the region of holes and conduction band electron, additional photons are generated.

If the material is long enough, photons might be generated to produce a significant amount of power at a single wavelength. Fabry-Perot lasers use reflective mirrors, which build up the number of photons with each trip. These mirrors form resonators, which is a requirement for laser operation. The resonator acts as a Fabry-Perot interferometer, because only the light for which the resonator spacing is an integral number of half wavelengths will add constructively. As a result, the spectrum of a Fabry-Perot laser contains multiple discrete-wavelength components.

The possible wavelengths produced by the resonator are given by:

$$f_{res} = \frac{mc}{2ln}$$

Where:

m = integer

c = speed of light (3×10^8)

l = length of the cavity

n = refractive index of the cavity

LED Test			
mean (FWHM)	= 1299.09 nm	FWHM	= 76.56 nm
mean (3dB)	= 1300.00 nm	3 dB width	= 51.75 nm
peak waveln	= 1290.50 nm	total power	= -36.49 dBm
sigma	= 32.51 nm	pk dens (1nm)	= -54.92 dBm

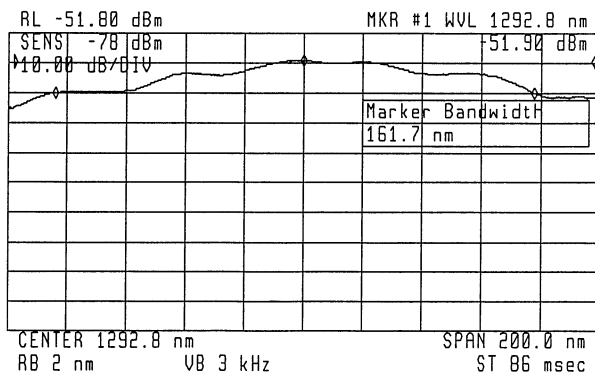


Figure 5. LED measurement routine

Measurement Techniques

Spectral Measurements

The actual output power at each of these wavelengths is determined by the laser gain and mirror reflectivity at that wavelength. The separation between the different wavelengths, mode spacing, can be determined from the separation of the mirrors as follows:

Mode spacing =

$$\frac{c}{2ln}(\text{Hz}) = \frac{\lambda^2}{2ln}(\text{m})$$

Many of the commonly measured parameters of Fabry-Perot lasers are discussed above. Others include: total power, mean wavelength, sigma, spectral width (at half-power points or X dBc from the peak), peak amplitude, and peak wavelength.

Distributed Feedback (DFB) Lasers

Distributed feedback lasers are similar to Fabry-Perot lasers, except that all but one of the spectral components are significantly reduced. DFB lasers utilize a grating along the active layer of the semiconductor. Rather than using just two reflecting surfaces at the ends of the diode, as a Fabry-Perot laser does, the DFB laser uses each ridge of the grating as a reflective surface. At the resonant wavelength all reflections from different ridges add in phase, therefore only one resonant wavelength is in the region of laser gain. This results in the single laser wavelength with the largest side modes between 30 to 50 dB lower than the main spectral output.

The key spectral measurements made on DFB lasers are: side-mode suppression ratio, mode offset, peak wavelength, peak amplitude, stop band, center offset, bandwidth, and linewidth.

See the HP 7145XB family of optical spectrum analyzers for more information on spectral measurement.

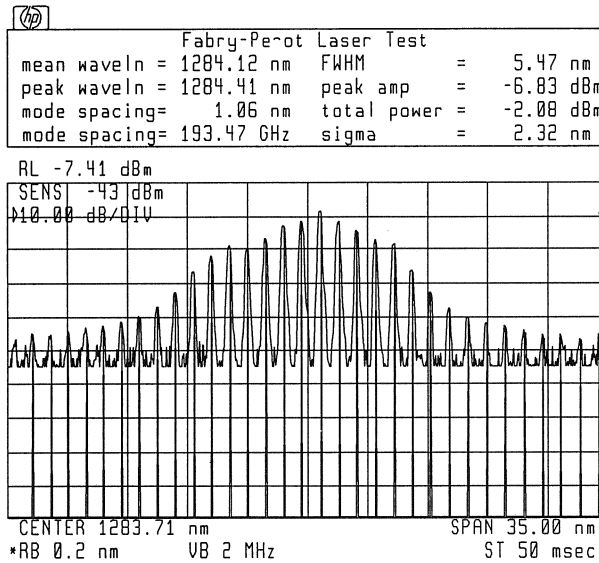


Figure 6. Fabry-Perot laser measurement routine

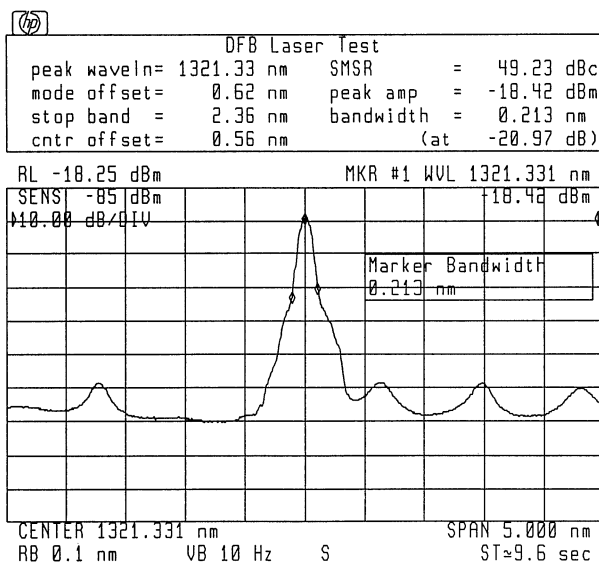


Figure 7. DFB laser measurement routine

Measurement Techniques

Optical Amplifier Testing

Erbium-doped optical amplifiers (EDFAs) are today's key component to extend the length of fiberoptic links. They boost the output power of a transmitter, compensate for the losses along the fiber, and pre-amplify the signal in front of a receiver. The basic EDFA design (Figure 8) has a pump laser providing energy through a coupler to the Erbium ions in the active fiber, and an isolator to protect the amplifier from backreflections beyond the output.

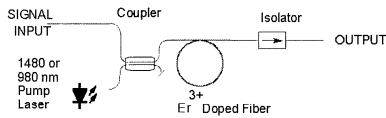


Figure 8. Basic EDFA design

Without an input signal, the energy in the Erbium is converted to amplified spontaneous emission (ASE) which is the noise source within the amplifier. If a signal stimulates the Erbium to emit photons, then most of the energy is used for amplification, and only a small fraction remains for the ASE (Figure 9). Furthermore, the input signal supersedes the noise at the wavelength of interest. These facts make it difficult to accurately characterize an optical amplifier.

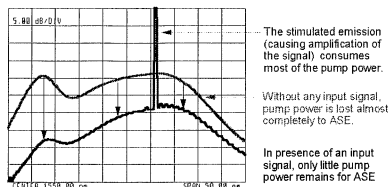


Figure 9. EDFA output spectrum with and without input signal

A typical test setup (Figure 10) stimulates the EDFA with a tunable laser source (TLS) and analyzes the output light with an optical spectrum analyzer (OSA). The gain can be calculated by measuring the laser signal at the input and the output of the amplifier with an OSA. However, the signal hides the ASE at its center wavelength where the noise level of interest has to be measured. Therefore, the test equipment must use elaborate techniques in order to measure the noise accurately. Today, the most common EDFA test techniques are ASE interpolation, polarization extinction, and time-domain extinction.

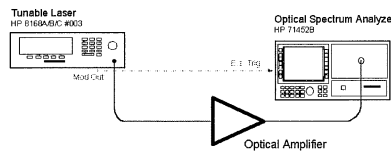


Figure 10. Basic EDFA test setup

ASE Interpolation

As shown in Figure 11, this technique interpolates the ASE at the wavelength of the signal. It takes advantage of the fact that in many cases the ASE power changes approximately in a linear fashion over a small wavelength range.

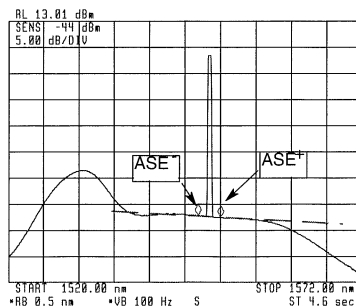


Figure 11. ASE interpolation

Polarization Extinction

The light from the stimulating tunable laser is highly polarized before and after the amplification but the ASE is not. It is possible to suppress the signal with a polarization controller and a polarizer (Figure 12). If the nulling is deep enough, then the ASE can be measured directly at the signal wavelength. Otherwise, interpolation must be used again. The reduced signal amplitude gives the advantage that the interpolation markers can be placed much closer together. Therefore, it can minimize interpolation errors.

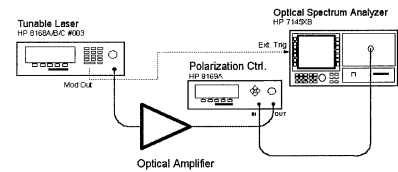


Figure 12. Polarization extinction setup

Time-Domain Extinction (TDE)

Because the Erbium has a relatively long relaxation constant (~1ms), the ASE power level does not change immediately when the input signal is turned off. The TDE technique uses this effect to measure the ASE power at any wavelength, including the signal wavelength. During TDE measurements, the TLS in Figure 10 is internally on-off modulated at 25 kHz. The OSA samples the waveform synchronized with the modulation (Figure 13). At that point, the EDFA output spectrum consists of ASE power only.

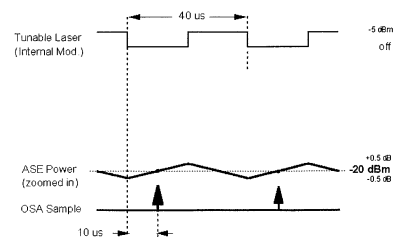


Figure 13. TDE timing diagram

Measurement Techniques

Optical Amplifier Testing

Using TDE, the OSA can tune to any wavelength, including the signal wavelength, and measure the noise power accurately. Figure 14 shows the effect of TDE on an OSA display: The top trace shows the undriven ASE, the next one measures the ASE plus the amplified signal, and the bottom one consists of ASE power only.

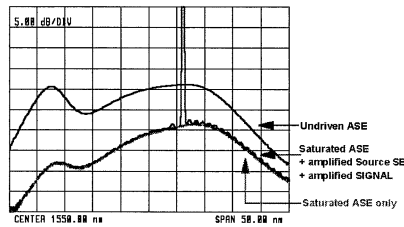


Figure 14. Signal extinction due to TDE

TDE can also be used to analyze the spectrum at the end of an installed link incorporating EDFAs. In Figure 15, an HP 7145XB Optical Spectrum Analyzer splits the output spectrum of an EDFA into the ASE components using TDE and into the signal part using a method similar to those used by lock-in amplifiers.

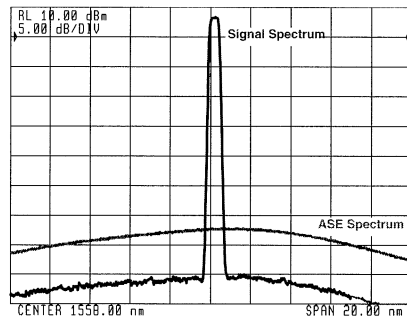


Figure 15. Link output spectra

Advanced EDFA Measurements

For telecommunication links deploying wavelength division multiplexing (WDM) there are new measurements. A new requirement coming along with

WDM is gain flatness. If different channels are not amplified equally (Figure 16), then the signal-to-noise ratio of some channels can degrade.

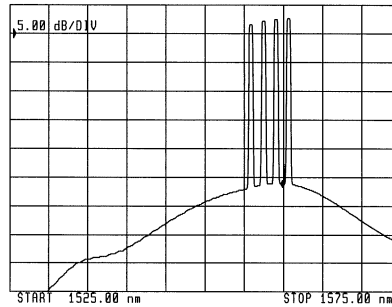


Figure 16. EDFA with unequal gain for four WDM channels

One alternative to overcome that problem is to pre-emphasize these channels accordingly. Other ways use special doping or filters within the amplifier to flatten the gain over a given wavelength range. Because the gain dependence on wavelength measured with the setup in Figure 11 can be significantly different to the one observed in a WDM system, it is essential to characterize the amplifier with one of the following setups.

Testing With Multiple Laser Sources

The setup in Figure 17 simulates the WDM transmitters with an appropriate number of either tunable laser sources (with built-in attenuator) or DFB lasers (followed by an optical attenuator).

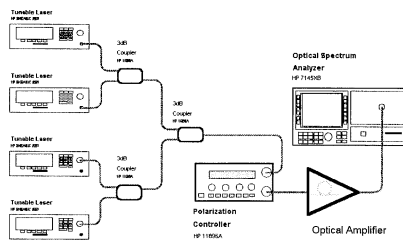


Figure 17. Most flexible amplifier test setup for WDM applications

The polarization controller helps to randomize the highly polarized laser light so that the OSA can minimize measurement errors by averaging.

Measuring the Noise-Gain Profile

Another and even faster alternative to characterize the gain shape uses a noise source in combination with the time-domain extinction technique (Figure 18): In the presence of a saturating signal from a tunable laser source, the edge emitting LED (EELED) probes the amplifier with a broadband but small signal in the break of the TLS modulation.

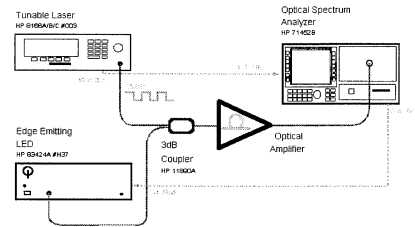


Figure 18. Setup for noise-gain profile measurements

The EELED stimulation leads to the EDFA output spectrum displayed as Trace B in Figure 19. When the EELED remains off, then the OSA measures the ASE only (Trace C). From that, the noise-gain profile can be calculated as the difference between traces B and C divided by the EELED spectrum (which has been stored in advance as Trace A).

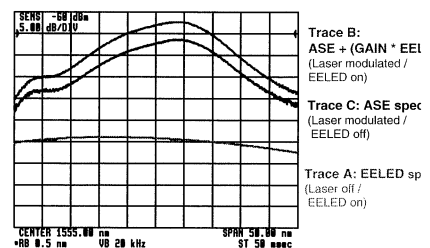


Figure 19. Noise-gain measurement (raw data)

Measurement Techniques

Optical Amplifier Testing

Noise-gain profiles not only can help to determine the gain peak (an important characteristic for very long links incorporating dozens of amplifiers) but also qualify Erbium-doped fibers and amplifiers for WDM applications. Figure 20 compares the gain shape of four noise-gain profiles with the channel gains obtained by the setup in Figure 14. The saturating signal for each noise-gain profile has been set to a channel wavelength, and its power has been adjusted to properly saturate the amplifier.

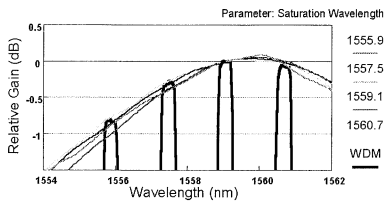


Figure 20. Correlation between noise-gain profiles and actual channel gains

Measurement Uncertainties

Figure 21 provides an overview of achievable measurement uncertainties. Note that the input and output connections of the device under test have a greater impact on the accuracy than the measurement technique.

	ASE Interpolation	Time Domain Extinction	Noise Gain Profile
Gain Uncertainty (Splices)	0.17 dB	0.22 dB	0.11 dB
Gain Uncertainty (Conn.)	0.52 dB	0.54 dB	0.30 dB
NF Uncertainty (Splices)	0.35 dB	0.37 dB	0.34 dB
NF Uncertainty (Conn.)	0.53 dB	0.55 dB	0.53 dB
Gain Shape Uncertainty	N/A	N/A	0.1 dB

Note: all values are +/- (with 95% confidence level)

Figure 21. Uncertainties overview

For more information on optical amplifier characterization, see the HP 71452B Optical Spectrum Analyzer, HP 8168B/C Tunable Laser, and HP 81600 EDFA Test System catalog pages. Additional reference literature can be ordered by contacting your local Hewlett-Packard sales office.

Measurement Techniques

Polarization Measurements

Polarization effects change an optical signal by altering the relative magnitudes and phase of its E-field components. These changes are due to the interaction between the polarization of the optical signal and the polarization transmission properties of the optical components and systems.

In some cases, polarization effects are advantageous in improving device and system performance. Such is the case with directional, optical isolators which use polarization effects to prevent reflected optical signals from interfering with forward transmissions. In other situations, polarization effects are a liability and must be minimized to prevent performance reductions. In long-haul telecommunication systems, for example, polarization dependent loss (PDL) or polarization mode dispersion (PMD) can degrade system performance by introducing power loss and distortion.

State of Polarization and Degree of Polarization

The state of polarization (SOP) is created by the relative magnitude and phase of the E-field vector components present at any point in time. All vector components can be resolved into two arbitrary, orthogonal vector components, $E_x(t)$ and $E_y(t)$. If the relative phase, ϕ , between the $E_x(t)$ and $E_y(t)$ vectors is constant, then that part of the lightwave signal is said to be polarized and the resultant vector $E_r(t)$ is created. If the relative phase, ϕ , is changing, then that part of the lightwave signal is randomly polarized or unpolarized and the resultant vector, $E_r(t)$, equals zero.

$$E_x(t) = A_x \sin(\omega t + \theta_x)i$$

$$E_y(t) = A_y \sin(\omega t + \theta_y)j$$

$$E_r(t) = E_x(t) + E_y(t)$$

$$= A_x e^{j(\omega t)i} + A_y e^{j(\omega t + \Delta\theta)j}$$

where:

A = magnitude of the E_n vector

ω = radians per second

θ = absolute phase of vector rotation

In most lightwave signals, only part of the total energy is polarized.

The degree of polarization (DOP) is a measure of the percentage of the total average lightwave signal power that is polarized

$$\left[\frac{\text{polarized power}}{\text{total power}} \times 100 \right] .$$

Representation of Polarization

There are many ways to visually display or mathematically describe the polarization of a lightwave signal: elliptical displays; Poincare sphere; Jones matrix; and Stokes parameters.

The E-field elliptical display (Figure 22) shows the magnitude and phase relationships for linear, circular, and elliptical states of polarization. Notice the E-field magnitude and phase relationships for each case.

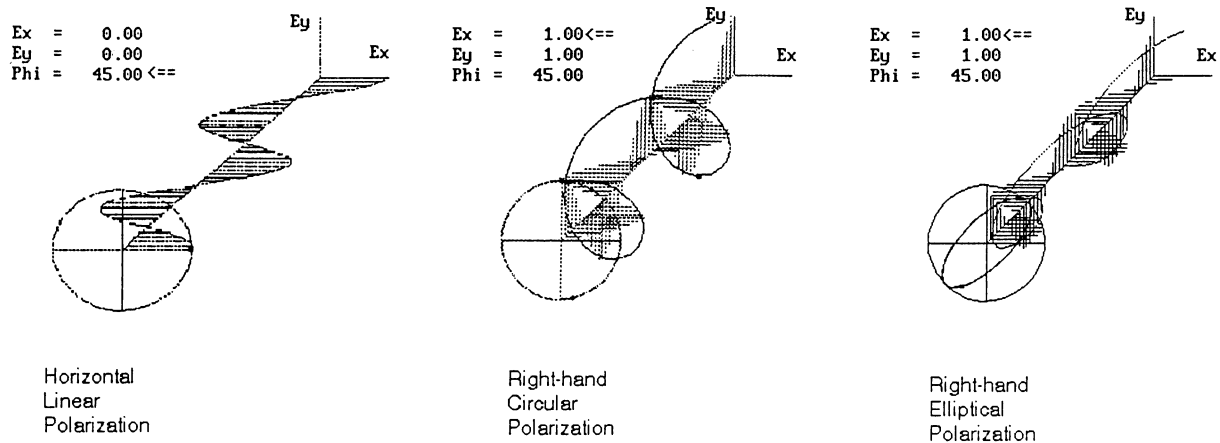


Figure 22. Linear, circular and elliptical states of polarization

Measurement Techniques

Polarization Measurements

Each elliptical display can also be quantified two dimensionally by its azimuth (alpha) and ellipticity (w) as shown in Figure 23.

where:

a = length of semi-major axis

b = length of the semi-minor axis

α = azimuth of tilt of the X', Y' axes

A_n = magnitude of E_x and E_y fields

$\beta = \tan^{-1}(A_x/A_y)$

The Poincare sphere can be used to monitor signal-polarization changes because all SOPs are seen at the same time. On this three-dimensional display, each state of polarization is represented by a point on the sphere. Points on the equator represent states of linear polarization, the poles represent right-hand and left-hand circular polarization, and other points represent elliptical polarization.

The Stokes parameters, S_0, S_1, S_2, S_3 , completely describe the polarization state of a signal. Each element of the matrix is based upon measured power levels. S_0 is the average power of the entire light beam. S_1 is the difference in power between the horizontal and vertical linear polarization components of the beam. S_2 indicates the power difference between the +45 and -45 degree linear polarization. S_3 is the power difference between the right-hand and left-hand circular polarization. The Stokes parameters are shown in Figure 24 on the Poincare sphere.

Polarization-Dependent Loss

Polarization-dependent loss (PDL) describes the relative difference between an optical component's maximum and minimum transmission loss or gain assuming all states of polarization have been covered. PDL values range from less than 0.05 dB for optical connectors and cables to greater than 30 dB for optical polarizers.

Measurements of PDL can be made with a variety of instruments: power meters, lightwave polarization analyzer, and optical spectrum analyzer.

See pages on the HP 8509 polarization analyzer, HP 8153A lightwave multi-meter, and HP 71451B optical spectrum analyzer for more information.

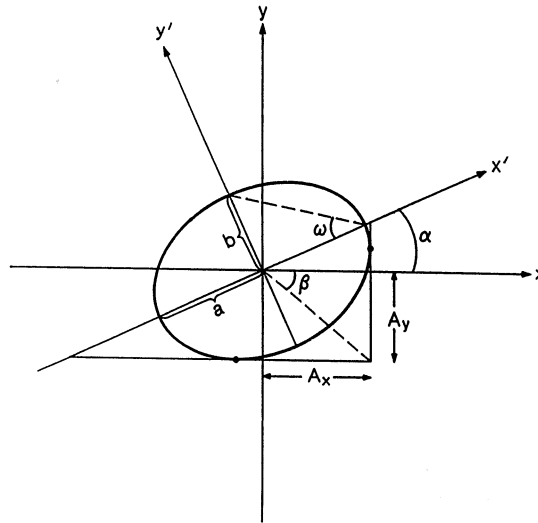


Figure 23. Elliptical display

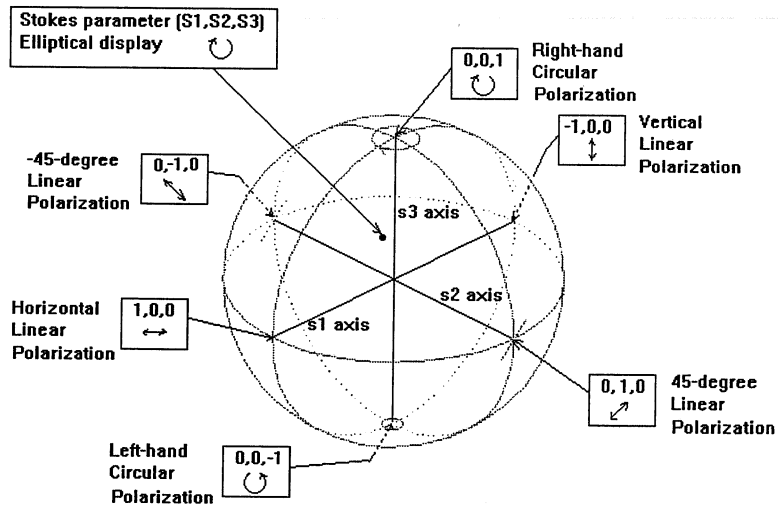


Figure 24. Stokes parameters on the Poincare sphere

Measurement Techniques

Frequency-Domain Measurements

Laser RIN can then be determined by the following equation:

$$RIN_{\text{laser}} = \frac{N_{\text{th}}}{R_L(rP_{\text{avg}})^2} - \frac{2q}{rP_{\text{avg}}}$$

where:

RIN_{system} is the total system RIN;

N_{th} is the thermal noise;

R_L is the load resistance (typically 50 ohms);

r is the responsivity (typically 0.8 A/W);

P_{avg} is the average optical power in watts;

q is the electron charge (1.60×10^{-19} coulomb)

See Product Note 71400-1, "Lightwave Signal Analyzers Measure Relative Intensity Noise," HP literature number 5091-2196E, for a more detailed discussion of RIN measurement, and product pages on the HP 71400C Lightwave Signal Analyzer in this catalog.

Modulation Distortion

A laser transmitter can cause large distortions on a modulation signal. The amount of distortion, harmonic and noise, can dramatically vary with small frequency and power level changes in the baseband signal or back reflections into the laser. Figure 32 shows a baseband modulation signal with harmonic distortion and noise effects on the output of a laser transmitter.

Refer to catalog pages on the HP 71400C Lightwave Signal Analyzer and HP 83810B Portable Lightwave Signal Analyzer for more information.

Laser Linewidth

Linewidth is a term used to describe the spectral width of single-line lasers, similar to distributed feedback (DFB) lasers. Linewidth is specified in terms of "full-width, half-maximum" (FWHM) and can range from a few kilohertz to hundreds of megahertz.

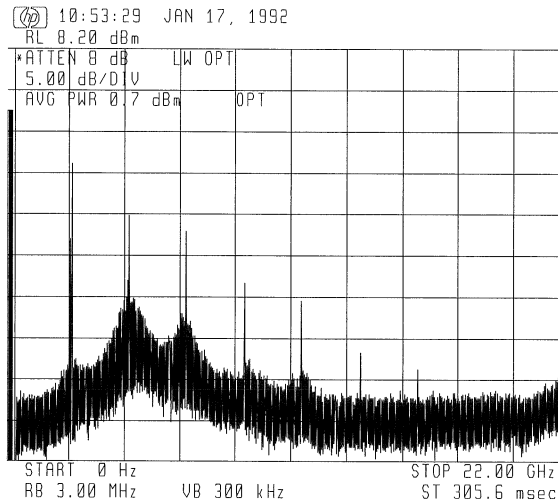


Figure 32. Harmonic distortion and noise effects of a modulated laser

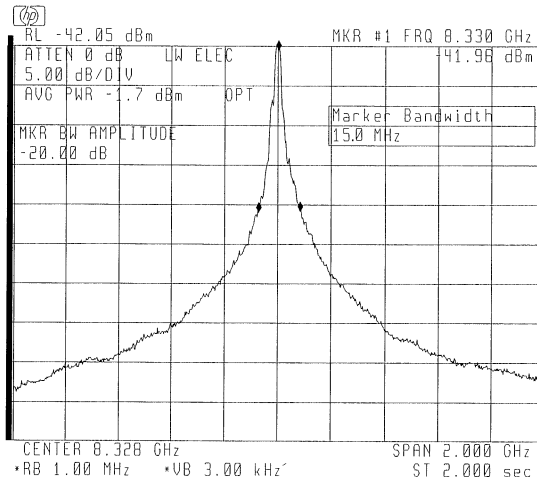


Figure 33. DFB laser lineshape; heterodyne measurement utilizing the HP 8168 tunable laser source and HP 71400C receiver and analyzer

The spectrum typically takes on a Lorentzian shape for semiconductor lasers and often exhibits satellite bands at harmonics of the relaxation-oscillation frequency of the laser. These satellite bands have a peak substantially smaller than the Lorentzian peak and can exhibit asymmetrical heights about the carrier frequency. The center wavelength, laser linewidth, and relaxation-frequency harmonics can all be modified by changing the material structure of the laser (see Figure 33).

See the HP 71400C Lightwave Signal Analyzer and HP 11980A Fiber-Optic Interferometer catalog pages for more information on linewidth measurements.

Measurement Techniques

Frequency-Domain Measurements

Laser Chirp

Laser chirp is a term to describe the incidental frequency (or wavelength) shift of the laser's output as a function of intensity modulation (see Figures 34 and 35). While some systems use external modulation schemes which retain the linewidth of the laser, many systems must use a direct modulation technique. Direct modulation causes a laser to chirp from a few megahertz to gigahertz.

Chirp is seen as a broadening of the linewidth and can be thought of as either a positive or negative effect. Chirp is a positive phenomena because it increases the intensity modulation (IM) to frequency modulation (FM) conversion. In addition, frequency shift keying (FSK) systems rely on wide chirp for the design of FM discriminators. On the other hand, chirp acts to decrease the bandwidth of systems working at 1550 nm due to the increase of chromatic dispersion, and can be a limiting factor in the channel spacing of wavelength division multiplexed (WDM) system.

Responsivity

Responsivity is the term used to describe how efficiently an electrical signal is converted to modulated light by a lightwave transmitter, or how efficiently modulated light is converted to an electrical signal by a lightwave receiver. Responsivity is a static and dynamic parameter. In the static sense, it is simply the ratio of the average optical power to average electrical current. In the dynamic case, responsivity refers to the change in the output parameter due to the change of the input parameter. This is sometimes called "slope" responsivity.

For a lightwave source, slope responsivity is calculated as:

$$R_s = \frac{\Delta P_{out}}{\Delta I_{in}}$$

The units of source responsivity are Watts per Amp.

Similarly, receiver responsivity is computed as:

$$R_r = \frac{\Delta I_{out}}{\Delta P_{in}}$$

The units of receiver responsivity are Amps per Watt.

It is often convenient to express responsivity in decibels, particularly when transducers are used in a complete communication link. Source and receiver responsivities, when expressed in decibels, are related to levels of 1 W/A and 1 A/W respectively.

$$R_s(dB) = 20 \log_{10} \frac{(R_s(W/A))}{(1(W/A))}$$

$$R_r(dB) = 20 \log_{10} \frac{(R_r(A/W))}{(1(A/W))}$$

The fact that a "20 log" factor is used when relating optical and electrical signals, as opposed to "10 log", can be understood intuitively by considering a simple photodiode. If the optical input power is doubled, the output electrical current will also double. However, the output electrical power, proportional to the square of the current, will increase by a factor of four. Thus a three dB change in optical power produces a six dB change in electrical power.

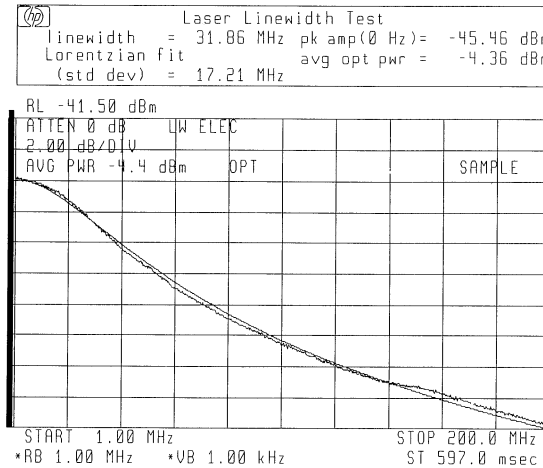


Figure 34. Laser linewidth, measured with the HP 70880A program on the HP 71400C

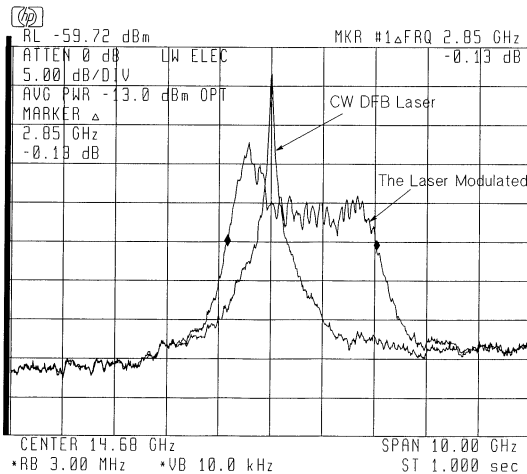


Figure 35. Laser chirp induced by intensity modulation

Measurement Techniques

Frequency-Domain Measurements

Similarly, a six dB change in electrical power into a source produces a three dB change in optical output power.

In some cases, it is desirable to specify receiver responsivity in terms of Volts per Watt (V/W). If the system electrical impedance “ Z_o ” is known, then responsivity in V/W is determined by:

$$R_r(V/W) = R_r(A/W) \times Z_o$$

The measurement of source responsivity requires an accurate electrical source and a calibrated photodiode receiver. This is achieved using either the HP 8702B and 8703A Lightwave Component Analyzers (pages 85-94) or the HP 71400C and 71401C Lightwave Signal Analyzers (pages 75-84). Receiver responsivity measurements require a calibrated lightwave source and electrical receiver and are also performed by the HP 8702B and 8703A Lightwave Component Analyzers.

Frequency Response and Modulation Bandwidth

As modulation rates increase, eventually laser and photodiode responsivity will degrade, limiting overall system data rates. Thus a fundamental measurement of lightwave components is modulation bandwidth or frequency response. In addition, basic time-domain responses such as risetime, ringing and overshoot are directly related to device frequency response.

A wide bandwidth and well-behaved frequency response will result in a very fast device with short risetimes and little or no overshoot and ringing. Such devices are then capable of performing at high data rates. The following measurements show device frequency responses and their subsequent step responses (see Figures 36 and 37).

The measurement of a high-speed photodiode shows a very smooth, well-behaved frequency response. Its step response is consequently very fast and without distortion (see Figure 36).

The measurement of a laser module shows an erratic frequency response. Significant overshoot and ringing in the device step response can be attributed to the peaking in the frequency response (see Figure 37).

Frequency response measurements provide useful insight into fundamental device performance, independent of the type of data to be transmitted. As modulation rates increase, accurate measurements of frequency response become a valuable tool in optimizing performance.

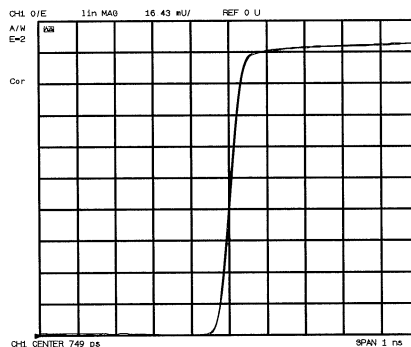
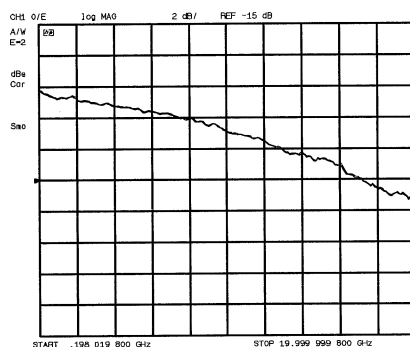


Figure 36. Photodiode frequency and step response measurements

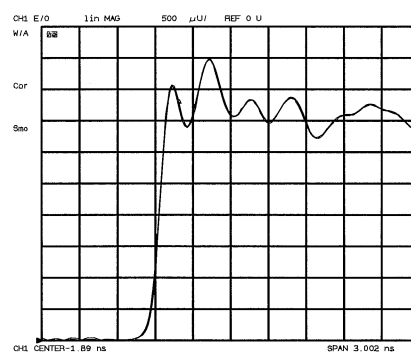
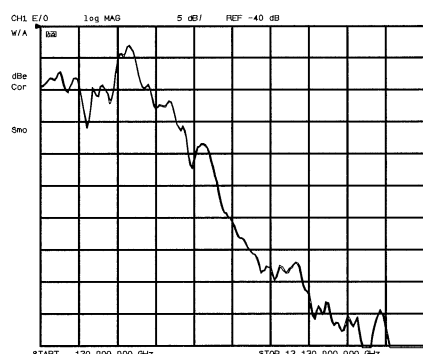


Figure 37. Laser frequency and step response measurements

Measurement Techniques

Time-Domain Measurements

Optical communication systems, using digital transmission formats, often require time-domain measurements to insure overall data transmission quality. Time-domain measurements are made on both single-valued waveforms and multi-valued waveforms. Single-valued waveform measurements include pulse parameters, templates and statistical measurements such as rms noise and rms jitter. Multi-valued waveform measurements, commonly called eye-diagrams, include pulse parameters, masks, extinction ratio, and jitter.

Pulse parameter measurements include rise time, fall time, overshoot, undershoot, preshoot, pulse width, duty cycle, period, and settling time. An optical time-domain measurement system's impulse response is critical to making accurate pulse parameter measurements. Impulse response is usually defined as the full-width-half-maximum (FWHM) or the width of the system's impulse response measured halfway between its peak and the baseline. To accurately measure fast optical input signals, the system impulse response should be at least four times narrower than the narrowest bit in the signal it is trying to measure.

Bandwidth, like impulse response, is a characteristic of the measurement system that is used to estimate the system's ability to accurately respond to "high-speed" input signals. Bandwidth is specified in two different ways. Optical bandwidth refers to the modulation frequency at which the optical power is down by one-half or 3 dB. Because of the photo-detection process, a 3 dB change in optical power results in a 6 dB decrease in detected electrical voltage. Electrical bandwidth refers to the modulation frequency that the system's electrical detected frequency response decreases by one-half or 3 dB. The frequency response of a measurement system

can be obtained from the impulse response by taking its Fourier transform. Conversely, the impulse response of a system may be calculated by taking the inverse Fourier transform of its frequency response. Assuming a Gaussian impulse response, the -3 dB electrical bandwidth of a system = $0.31/\text{FWHM}$; the -3 dB optical bandwidth = $0.44/\text{FWHM}$.

Eye-Diagram Measurements

An essential capability of high-speed digital fiber-optic data-communication and telecommunication links is to transmit signals with very low error rates. This performance is confirmed using Bit Error Ratio testing. Generally, a pseudo-random binary sequence is used to modulate the transmission system's source, the received signal is compared to the transmitted pattern and the error ratio calculated. Eye-diagrams are formed by overlaying multiple segments of the PRBS waveforms on the display of an oscilloscope or eye-diagram analyzer (Figure 38).

Eye-diagram measurements are extremely useful in gathering system or component performance information. In general, the more open the eye is, the lower the likelihood that the system may mistake a "1" bit for a "0" bit or vice versa. The eye-diagram opening width (the time between the zero-to-one/one-to-zero crossings) shows the time interval over which the signal may be sampled without error due to intersymbol interference or jitter.

For best noise immunity, the best time to sample is when the eye-diagram opening height, which is the voltage difference between the top of the zero-level and bottom of the one-level, is at its maximum value.

The rise and fall times, generally measured at 10 percent to 90 percent, and the slope of the rise and fall times are

important variables that influence system timing errors. The more horizontal the slopes at the system trigger threshold, the greater the system's sensitivity to timing errors. Timing error or jitter arises from variation in laser turn-on time, pulse distortion from the optical fiber, and optical and electrical phase noise. Jitter is characterized by measuring the width of the crossing points and is expressed in picoseconds, degrees, and fraction or percent of the bit-interval.

In an effort to standardize the high-speed telecommunications and data communications systems that are being developed and deployed, internationally recognized committees have adopted standards for equipment manufacturers and service providers to use. Two standards for telecommunications are SDH, which stands for Synchronous Digital Hierarchy, defined by the ITU (formerly CCITT), and SONET, which stands for Synchronous Optical Network, defined by ANSI. Fortunately, the physical layer definitions of the two standards have converged for compatibility. One of the goals of these standards is to provide for "mid-span meet" so that equipment from multiple vendors may be used in the same telecommunications link. The standards include using eye-diagram measurements with a tightly-defined reference receiver (pages 104 and 110) for mask and extinction ratio measurements to help insure that transmitters from multiple vendors may be used.

Optical Accessories

General Accessories

Lenses

Used with the HP 81520A, 81521B, 81524A, and 81525A optical heads in combination with an HP 81000xA connector adaptor. For more details, please ask for reference literature "HP 8153A Lightwave Multimeter Configuration Guide."

HP 81050AL Lens, multimode, 450 to 1020 nm wavelength range

HP 81050BL Lens, multimode, 900 to 1700 nm wavelength range

HP 81010BL Lens, single-mode, 900 to 1700 nm wavelength range

Attenuating Lens Adapter

The HP 81230FL mounts onto an HP 81521B or HP 81524A optical head to measure the output power of LED or laser chips, up to 200 mW, before the fiber pigtail is attached. Anti-reflection coating on all optical surfaces guarantees minimal back reflections. The maximum acceptable numerical aperture is $NA=0.5$ in the wavelength range 1200 to 1650 nm (calibrated at 1300 nm and 1550 nm).

HP 81230FL Attenuating Lens Adapter

Filter and Filter Holder

To measure higher power levels, these accessories can be inserted between the optical head and the lens.

HP 81000AF Filter holder for filters with 1 inch diameter

HP 81001FF 10dB diffraction filter for a wavelength range from 450 to 1700 nm (consists of HP 81000AF and 10 dB filter). You can cascade two filters for power measurements up to 200 mW.

HP 81000DF Depolarizing filter to reduce PDL of optical heads to typical ≤ 0.003 dBpp in the wavelength ranges $1300 \text{ nm} \pm 50 \text{ nm}$ and $1550 \text{ nm} \pm 50 \text{ nm}$. Typical insertion loss is 10 dB.

Optical Power Splitters

Not sensitive to mode and polarization. Split ratio is approximately 10:1. The HP 81010BS offers high return loss and accepts single-mode fibers only with user-exchangeable connector interfaces.

HP 81010BS Optical Power Splitter, 1200 to 1650 nm wavelength range, single-mode. Requires two connector interfaces.

Reference Reflector

A gold-plated HMS-10 connector for use in measuring return loss of optical connectors. It allows you to establish a precise reference for reflection measurements. Return loss is $0.18 \text{ dB} \pm 0.1 \text{ dB}$ ($96\% \pm 2\%$).

HP 81000BR Reference Reflector

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International System of Units (SI) Prefixes and Symbols

QUANTITY	MULTIPLIER	SYMBOL	PREFIX
million millions (British billion) or trillion	10^{12}	T	tera
thousand millions (American billion)	10^9	G	giga
millions	10^6	M	mega
thousands	10^3	k	kilo
hundreds	10^2	h	hecto
tens	10	da	deca (or deka)
UNITY			
tenths	10^{-1}	d	deci
hundredths	10^{-2}	c	centi
thousandths	10^{-3}	m	milli
millionths	10^{-6}	μ	micro
thousandths of a millionth (millimicro) or billionths	10^{-9}	n	nano
millionths of a millionth (micromicro) or trillionths	10^{-12}	p	pico
thousandths of a millionth (millimicromicro) or quadrillionths	10^{-15}	f	femto
millionths of a millionth of a millionth or quintillionths	10^{-18}	a	atto

Common Abbreviations

BTU	British Thermal unit – 1 BTU= Heat required to raise temperature of 1 pound of water 1°F.
°C	Degrees Centigrade
CAL.	Calorie – 1 CAL. = Heat required to raise temperature of one gram of water 1°C
C. C.	Cubic Centimeter
CU. FT.	Cubic Feet
CU. IN.	Cubic Inches
°F	Degrees Fahrenheit
FPS.	Feet per second
FT.	Feet (foot)
GAL.	U.S. Gallon
GPM.	Gallons per minute
HP.	Horsepower = work at rate of 33,000 FT. LB/MIN.
IN.	Inch(es)
°K	Degrees Kelvin
LB.	U.S. Pound
MIN.	Minute(s) of time
PSI.	Pounds per square inch
REV.	Revolutions (of a shaft or pump)
SEC.	Second(s) of time
SP. GR.	Specific Gravity – Ratio of the weight of a body top the weight of an equal volume of water at 4°C or other specified temperature.
SP. HT.	Specific Heat – Ratio of heat required to raise a unit of weight of a substance 1°F to the amount of heat required to raise an equal weight of water 1°F at a certain temperature. (hydraulic oil is approx. 0.45)
SP. WT.	Specific Weight or weight density = LB./CU. FT.; LB./CU. IN. or grams/C.C.
SQ. IN.	Square inch(es)

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Area & Volume Conversions

AREA

from \ to	cm ²	m ²	km ²	in. ²	ft ²	mile ²
cm ²	1	0.0001	1x10 ⁻¹⁰	0.1550	0.00108	3.86x10 ⁻¹¹
m ²	1x10 ⁴	1	1x10 ⁻⁶	1550	10.76	3.86x10 ⁻⁷
km ²	1x10 ¹⁰	1x10 ⁶	1	1.55x10 ⁸	1.08x10 ⁷	0.3861
in. ²	6.452	6.45x10 ⁻⁴	6.45x10 ⁻¹⁰	1	0.00694	2.49x10 ⁻¹⁰
ft ²	929.0	0.09290	9.29x10 ⁻⁸	144	1	3.59x10 ⁻⁸
mile ²	2.59x10 ¹⁰	2.59x10 ⁶	2.590	4.01x10 ⁸	2.79x10 ⁷	1

VOLUME

from \ to	cm ³	liter	m ³	in. ³	ft ³	yd ³
cm ³	1	0.001	1x10 ⁻⁶	0.06102	3.53x10 ⁻⁵	1.31x10 ⁻⁶
liter	1000	1	0.001	61.02	0.03532	0.00131
m ³	1x10 ⁶	1000	1	6.10x10 ⁴	35.31	1.308
in. ³	16.39	0.01639	1.64x10 ⁻⁵	1	5.79x10 ⁻⁴	2.14x10 ⁻⁵
ft ³	2.83x10 ⁴	28.32	0.02832	1728	1	0.03704
yd ³	7.65x10 ⁵	764.5	0.7646	4.67x10 ⁴	27	1
fl oz	29.57	0.02957	2.96x10 ⁻⁵	1.805	0.00104	3.87x10 ⁻⁵
fl pt	473.2	0.4732	4.73x10 ⁻⁴	28.88	0.01671	6.19x10 ⁻⁴
fl qt	946.4	0.9463	9.46x10 ⁻⁴	57.75	0.03342	0.00124
gal	3785	3.785	0.00379	231.0	0.1337	0.00495
gal (Br.)	4546	4.546	0.00455	277.4	0.1605	0.00595
bbl (oil)	1.59x10 ⁵	159.0	0.1590	9702	5.615	0.2079
bbl (liq)	1.19x10 ⁵	119.2	0.1192	7299	4.211	0.1560

1 cord = 128 ft³ = 3.625 m³

fl oz	fl pt	fl qt	gal	gal (Br.)	bbl (oil)	bbl (liq)
0.03381	0.00211	0.00106	2.64x10 ⁻⁴	2.20x10 ⁻⁴	6.29x10 ⁻⁶	8.39x10 ⁻⁶
33.81	2.113	1.057	0.2642	0.2200	0.00629	0.00839
3.38x10 ⁴	2113	1057	264.2	220.0	6.290	8.386
0.5541	0.03463	0.01732	0.00433	0.00360	1.03x10 ⁻⁴	1.37x10 ⁻⁴
957.5	59.84	29.92	7.481	6.229	0.1781	0.2375
2.59x10 ⁴	1616	807.9	202.0	168.2	4.809	6.412
1	0.06250	0.03125	0.00781	0.00651	1.86x10 ⁻⁴	2.48x10 ⁻⁴
16	1	0.5000	0.1250	0.1041	0.00298	0.00397
32	2	1	0.2500	0.2082	0.00595	0.00794
128	8	4	1	0.8327	0.02381	0.03175
153.7	9.608	4.804	1.201	1	0.02859	0.03813
5376	336	168	42	34.97	1	1.333
4032	252	126	31.5	26.23	0.7500	1

Millimeters to Inches Equivalents

1mm = 0.039 in.	8mm = 0.315 in.	15mm = 0.590 in.	22mm = 0.866 in.
2mm = 0.079 in.	9mm = 0.354 in.	16mm = 0.630 in.	23mm = 0.905 in.
3mm = 0.118 in.	10mm = 0.394 in.	17mm = 0.669 in.	24mm = 0.944 in.
4mm = 0.157 in.	11mm = 0.433 in.	18mm = 0.709 in.	25mm = 0.984 in.
5mm = 0.197 in.	12mm = 0.472 in.	19mm = 0.748 in.	25.4mm = 1 in.
6mm = 0.236 in.	13mm = 0.512 in.	20mm = 0.787 in.	
7mm = 0.276 in.	14mm = 0.551 in.	21mm = 0.827 in.	

Flow Rate & Pressure Conversions

FLOW RATE

from \ to	lit/sec	gal/min	ft ³ /sec	ft ³ /min	bbl/hr	bbl/day
lit/sec	1	15.85	0.03532	2.119	22.66	543.8
gal/min	0.06309	1	0.00223	0.1337	1.429	34.30
ft ³ /sec	28.32	448.8	1	60	641.1	1.54x10 ⁴
ft ³ /min	0.4719	7.481	0.01667	1	10.69	256.5
bbl/hr	0.04415	0.6997	0.00156	0.09359	1	24
bbl/day	0.00184	0.02917	6.50x10 ⁻⁵	0.00390	0.04167	1

bbl refers to bbl oil = 42 gallons

PRESSURE

PSI = .14504 x K Pa

from \ to	mm Hg	in. Hg	in. H ₂ O	ft H ₂ O	atm	lb/in. ²	kg/cm ²
mm Hg	1	0.03937	0.5353	0.04460	0.00132	0.01934	0.00136
in. Hg	25.40	1	13.60	1.133	0.03342	0.4912	0.03453
in. H ₂ O	1.868	0.07355	1	0.08333	0.00246	0.03613	0.00254
ft H ₂ O	22.42	0.8826	12	1	0.02950	0.4335	0.03048
atm	760	29.92	406.8	33.90	1	14.70	1.033
lb/in. ²	51.71	2.036	27.67	2.307	0.06805	1	0.07031
kg/cm ²	735.6	28.96	393.7	32.81	0.9678	14.22	1

1 Bar = 1 x 10⁵ dynes/cm² = 0.98692 atm = 14.5 psi

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Temperature Conversions

°C	°F	°C	°F	°C	°F	°C	°F
-200	-328	25	77	240	464	540	1004
-180	-292	30	86	250	482	550	1022
-160	-256	35	95	260	500	560	1040
-140	-220	40	104	270	518	570	1058
-120	-184	45	113	280	536	580	1076
-100	-148	50	122	290	554	590	1094
-95	-139	55	131	300	572	600	1112
-90	-130	60	140	310	590	610	1130
-85	-121	65	149	320	608	620	1148
-80	-112	70	158	330	626	630	1166
-75	-103	75	167	340	644	640	1184
-70	-94	80	176	350	662	650	1202
-65	-85	85	185	360	680	660	1220
-60	-76	90	194	370	698	670	1238
-55	-67	95	203	380	716	680	1256
-50	-58	100	212	390	734	690	1274
-45	-49	110	230	400	752	700	1292
-40	-40	120	248	410	770	710	1310
-35	-31	130	266	420	788	720	1328
-30	-22	140	284	430	806	730	1346
-25	-13	150	302	440	824	740	1364
-20	-4	160	320	450	842	750	1382
-15	5	170	338	460	860	760	1400
-10	14	180	356	470	878	770	1418
-5	23	190	374	480	896	780	1436
0	32	200	392	490	914	790	1454
5	41	210	410	500	932	800	1472
10	50	212	414	510	950	810	1490
15	59	220	428	520	968	820	1508
20	68	230	446	530	986	830	1526

TEMPERATURE CONVERSION FORMULAS

$$^{\circ}\text{C} = 5/9(^{\circ}\text{F}-32) \quad ^{\circ}\text{F} = 9/5^{\circ}\text{C}+32$$

Decimal Equivalents

8ths.	16ths.	32nds.	
$1/8=.125$	$1/16=.0625$	$1/32=.03125$	$17/32=.53125$
$1/4=.250$	$3/16=.1875$	$3/32=.09375$	$19/32=.59375$
$3/8=.375$	$5/16=.3125$	$5/32=.15625$	$21/32=.65625$
$1/2=.500$	$7/16=.4375$	$7/32=.21875$	$23/32=.71875$
$5/8=.625$	$9/16=.5625$	$9/32=.28125$	$25/32=.78125$
$3/4=.750$	$11/16=.6875$	$11/32=.34375$	$27/32=.84375$
$7/8=.875$	$13/16=.8125$	$13/32=.40625$	$29/32=.90625$
	$15/16=.9375$	$15/32=.46875$	$31/32=.96875$

64ths.		
$1/64=.015625$	$23/64=.359375$	$45/64=.703125$
$3/64=.046875$	$25/64=.390625$	$47/64=.734375$
$5/64=.078125$	$27/64=.421875$	$49/64=.765625$
$7/64=.109375$	$29/64=.453125$	$51/64=.796875$
$9/64=.140625$	$31/64=.484375$	$53/64=.828125$
$11/64=.171875$	$33/64=.515625$	$55/64=.859375$
$13/64=.203125$	$35/64=.546875$	$57/64=.890625$
$15/64=.234375$	$37/64=.578125$	$59/64=.921875$
$17/64=.265625$	$39/64=.609375$	$61/64=.953125$
$19/64=.296875$	$41/64=.640625$	$63/64=.984375$
$21/64=.328125$	$43/64=.671875$	

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Chemical Symbols for The Elements

Ac Actinium	Er Erbium	Mn Manganese	Ru Ruthenium
Ag Silver	Es Einsteinium	Mo Molybdenum	S Sulfur
Al Aluminum	Eu Europium	N Nitrogen	Sb Antimony
Am Americium	F Fluorine	Na Sodium	Sc Scandium
Ar Argon	Fe Iron	Nb Niobium	Se Selenium
As Arsenic	Fm Fermium	Nd Neodymium	Si Silicon
At Astatine	Fr Francium	Ne Neon	Sm Samarium
Au Gold	GA Gallium	Ni Nickel	Sn Tin
B Boron	Gd Gadolinium	No Nobelium	Sr Strontium
Ba Barium	Ge Germanium	Np Neptunium	Ta Tantalum
Be Beryllium	H Hydrogen	O Oxygen	Tb Terbium
Bi Bismuth	He Helium	Os Osmium	Tc Technetium
Bk Berkelium	Hf Hafnium	P Phosphorus	Te Tellurium
Br Bromine	Hg Mercury	Pa Protactinium	Th Thorium
C Carbon	Ho Holmium	Pb Lead	Ti Titanium
Ca Calcium	I Iodine	Pd Palladium	Tl Thallium
Cd Cadmium	In Indium	Pm Promethium	Tm Thulium
Ce Cerium	Ir Iridium	Po Polonium	U Uranium
Cf Californium	K Potassium	Pr Praseodymium	V Vanadium
Cl Chlorine	Kr Krypton	Pt Platinum	W Tungsten
Cm Curium	La Lanthanum	Pu Plutonium	Xe Xenon
Co Cobalt	Li Lithium	Ra Radium	Y Yttrium
Cr Chromium	Lr Lawrencium	Rb Rubidium	Yb Ytterbium
Cs Cesium	Lu Lutetium	Re Rhenium	Zn Zinc
Cu Copper	Md Mendelevium	Rh Rhodium	Zr Zirconium
Dy Dysprosium	Mg Magnesium	Rn Radon	

Factors & Constants

1 horsepower = 33,000 foot pounds/min. = 550 foot pounds/sec. = 0.746 kilowatt.

1 boiler horsepower = the work of converting 30 lbs. of water/hour from an initial temp. of 100°F. to steam at 70 lbs. gage pressure; or the evaporation of 34.5 lb of water/hour at 212°F. into steam at 212°F.

1 watt = .00134 horsepower = 44.3 foot pounds/min.

1 kilowatt = 1000 watts = 1.34102 horsepower = 44253.6 foot pounds/min.

1 gram weight = 981 dynes (force) approximately.

Absolute Zero = -273.13° C. = -459.6° F. = 0° K

1 British thermal unit (BTU) = 252 calories (gram) = 778.57 foot pound.

1 gram calorie = 4.185 joules 3.968×10^{-3} BTU = 3.087 foot pounds.

Heat of fusion of ice = 144 BTU/pound.

Heat of vaporization of water = 996.6 BTU/pound.

1 gram-molecular volume of a gas at 760 mm. press. and 0° C. = 22.4 liters.

1 atmosphere = 14.7 lbs./sq. in. = 1.0333 kilograms/sq. cm. = 760mm Hg.

1 kilogram/sq. cm. = 0.9677 atmosphere = 14.22 lbs./sq. in.

1 inch (pressure) of mercury = 13.6 inches of water.

Coefficient of expansion of gases = .003665/degree C.

Density of dry air at 0° C. and 760 mm. = .001293 grams/cc.

Mean radius of the earth = 6371 kilometers = 3959 miles.

Mean density of the earth = 5.52 grams/cc.

Density of sea water = 1.025 grams/cc.

1 degree of latitude at 40° lat. = 69 miles.

Acceleration of gravity (sea level lat. 45°) = 980.60 centimeters/sec² = 32.172 feet/sec²

1 gram/100 cc. = 0.0833 lbs./gallon.

1 Angstrom (\AA) = 10^{-8} centimeter = 0.1 millimicron.

1 micron (μ) = one millionth meter = 0.001 millimeter.

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Definitions by Formulas

ACCELERATION $a = \frac{F}{M} = \frac{Fg}{W}$; from $F = MA$ and $M = \frac{W}{g}$

$a = \text{Radians/SEC.}^2 = \frac{\text{Degrees/SEC.}^2}{57.3}$

COMPRESSIBILITY OF OIL $C = \frac{PV}{250,000}$

DENSITY $D = \frac{1728M}{V} = \frac{\text{SP. WT.}}{g} = \frac{\text{LB./CU. FT.}}{32.16}$ (at sea level)

or $\frac{\text{GRAMS}}{\text{cc}}$ (at sea level)

ENERGY $E = H_E + H_v + H_P = \text{Total energy contained in fluid}$

FLOW Through an orifice — see **PRESSURE DROP**

FORCE $F = AP$

FRICTION-MECHANICAL $M_r = W \times f$ NOTE: Static (or breakaway) friction coefficient is greater than kinetic (or moving) friction coefficient.

GRAVITY $g = 32.16 \text{ FT./SEC.}^2 = \text{(at sea level)}$

GRAVITY-SPECIFIC SP. GR. = Ratio of weight of a substance to weight of equal volume of water. For hydraulic oil: 0.9 (approx.)

HEAD-ELEVATION Height of liquid or fluid in feet above reference plane.
To express FT. of water:
 $H_E = \text{Vertical height of liquid above reference plane} \times \text{SP. GR.}$

HEAD-VELOCITY $H_v = \frac{U^2}{2}$

HEAD-PRESSURE $H_P = \frac{U^2}{2g} = P \times 2.309$

HEAT $\text{BTU/MIN.} = L \times \text{SP. HT.} \times \text{LB./GAL} \times \text{Temperature Change } F^\circ$

HORSEPOWER $HP = \frac{FU}{550} = \frac{LP}{1714} = \frac{TN}{63,025}$

Definitions by Formulas, continued.

MASS $M = \frac{W}{g}$ or, at sea level, $= \frac{W}{32.16}$, or $= \frac{W}{980}$

NOTE: Mass is constant regardless of altitude

ORIFICE AREA see **PRESSURE DROP**

PRESSURE $P = \frac{F}{A}$ (consistent units)

PRESSURE-ATMOSPHERIC Normal = 14.7 PSI - 29.92 IN. Hg = 33.9 FT. water

PRESSURE DROP For oil hydraulic systems, the following will approximate pressure drop through "short orifice" (1/4 to 1/2-inch long-length not over 3 times diameter):

$$\Delta P = \frac{0.001056L^2}{A^2}$$

For specified pressure drop:

$$A \text{ (required)} = \frac{0.0325L}{\sqrt{\Delta P}}$$

RADIAN Arc (of circle) = Length of radius (see velocity, angular).

$$\text{In degrees} = \frac{360}{2\pi} = \frac{180}{\pi} = 57.3^\circ$$

SPRING RATE $\frac{F}{\text{Distance compressed (or stretched) where the distance is from the free length.}}$

TORQUE $T = F \times r = \frac{\text{HP} \times 63.025}{N} = \frac{\text{CU. IN./REV} \times P}{2\pi}$

VELOCITY Angular: $\text{Radians/SEC.} = \frac{\text{Degrees/SEC.}}{57.3}$

Flow: $U = 0.321 \frac{L}{A}$

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Common Formulas for Laser Applications

$$\begin{aligned} \text{AVERAGE POWER} &= \text{Pulse Energy (joules)} \times \text{Pulse Repetition Rate (Hz)} \\ \text{(Watts)} & \qquad \qquad \qquad \mathbf{P_A = ER} \end{aligned}$$

$$\begin{aligned} \text{AVERAGE POWER} &= \text{Peak Power Pulse (Watts)} \times \text{Pulsewidth (Sec.)} \times \text{Pulse} \\ \text{(Watts)} & \qquad \qquad \qquad \text{Repetition Rate (Hz)} \\ \mathbf{P_A} &= \mathbf{PPTR} \end{aligned}$$

$$\begin{aligned} \text{BRIGHTNESS} &= \frac{\text{Power (Watts)}}{[\text{Beam Diameter (MM)} \times \text{Beam Divergence (mr)}]^2} \\ \mathbf{B} &= \frac{\mathbf{P}}{(\Theta D)^2} \end{aligned}$$

$$\begin{aligned} \text{PULSE ENERGY} &= \text{Peak Power Pulse (Watts)} \times \text{Pulsewidth (Sec.)} \\ \text{(Joules)} & \\ \mathbf{E} &= \mathbf{PpT} \end{aligned}$$

$$\begin{aligned} \text{LIGHT TRANSMISSION} &= \frac{\text{Intensity of light after passing through filter}}{\text{Intensity of light}} = T_\lambda \end{aligned}$$

$$\begin{aligned} \text{OPTICAL DENSITY} &= -1 \times \text{Log} \times \text{Light transmission} \\ \mathbf{OD} &= \mathbf{-1 \text{ Log } T_\lambda} \end{aligned}$$

CALL KENTEK FOR INFO ON OPTICAL DENSITY REQUIREMENTS

notes

- 1. Call Kentek for lower prices, better service, and prompt delivery!*

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Procedure for Cleaning Optics

Materials Required:

1. Reagent grade methanol or 2-propanol in a drop dispensing bottle (part # KM-6)
2. Lens tissue, a long fiber, low ash content type; having no chemical additives (part # KLT-5, 500 sheets or KLT-1, 1000 sheets)
3. Clean air duster (part # KAB-1)
4. High intensity light source, part #I-150
5. Rubber gloves (part # KFG-12)

...or KLC-1, entire kit, \$62.50 ea.

This optics cleaning procedure will minimize scratches and provide an effective means for removal of dust and dirt films which may have contaminated an optical component.

Following these steps will develop good cleaning habits, which will contribute to a longer and more productive life for your optical components:

- A. Before dismounting the optic to be cleaned; set aside a clean work area.
- B. Dismount the optic. Holding it by its edges, inspect the surface to be cleaned by illuminating it with the high intensity light. The bright light will highlight dust particles and films to a more visual degree than average room light.
- C. With the clean air duster, blow the surface. This will dislodge loose particles.
- D. Place the optic down on a piece of clean lens tissue. Slip finger cots on your thumb and first two fingers of each hand. Rinse the finger cots with the methanol. This will wash away any powder residue on the finger cots.
- E. Take a single piece of lens tissue, holding it by the edges, and fold the length in halves until it is one inch wide. Next, fold the width in half. Dispense 3 to 4 drops of methanol on folded end. Place this wet portion of the lens tissue on the optic. With gentle pressure from your index finger from above the lens tissue, wipe it across the surface. Discard this piece of lens tissue, as reuse can cause recontamination of wiped surfaces.
- F. Inspect the cleaned surface under a high intensity light.
- G. Repeat items E and F until surface is clean or it is determined the optic has permanent damage.

Some good practice tips:

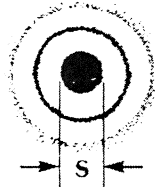
- Reagent grade methanol is a high purity chemical. The dispensing container should be rinsed out with the methanol before filling. **Never** stick lens tissue, cotton swabs, fingers, etc. into the methanol. Always **drip** the methanol onto the material. This eliminates contamination of the methanol or its container.
- Lens tissue, when dry, is very abrasive to optical surfaces and will scratch them.
- Finger cots are a very effective way to keep your skin oils off surfaces touched. Once they are on your fingers and have been washed, they are clean. As you handle materials they will become contaminated. Be alert for this condition and wash or change them as required.
- **Always hold optics by their edges.**
- Once an optic is cleaned, install it or keep it covered. This will ensure that airborne particles will not have a chance to settle on the optic.
- Store your cleaning materials in a clean, covered area.

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Uniform Intensity Distribution

When a lens system is irradiated at its aperture with a uniform intensity distribution, a diffraction pattern is formed at the focus. The pattern consists of a bright central spot surrounded by rings of rapidly diminishing intensity. The diameter of the central spot known as the Airy disc is approximated by this equation:

$$s = 2.44\lambda F/\#$$

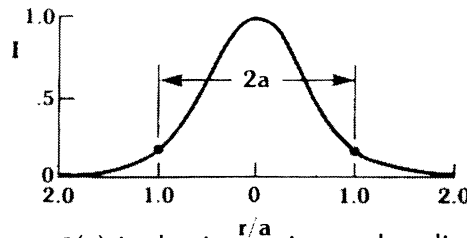


where s is the diameter of the central spot, λ is the wave-length of the source, and $F/\#$ is the ratio of the focal length to the lens aperture. In the absence of any lens imperfection, **84%** of the energy is contained within the diameter s and the remainder is distributed in the outer rings. If a difference exists between the longest and shortest optical paths leading to a focus, a change in the size of the central spot as well as a redistribution of energy occurs. For an optical path difference of one quarter of the wave-length ($\lambda/4$), the size of the central spot is essentially unchanged, but there is a decrease of energy from the central spot to **68%**. Traditionally, when this $\lambda/4$ limit on optical paths (known as the Rayleigh criterion) is not exceeded, the lens system is considered diffraction limited.

Gaussian Intensity Distribution

In the case of a lens system irradiated by a laser operating in the fundamental transverse mode (TEM_{00}), some flexibility is required in assigning a diffraction limited label to the lens system. The Gaussian distribution which describes the fundamental mode of a laser is given by the formula:

$$I(r) = \frac{2 P_0}{\pi a^2} e^{-2r^2/a^2}$$



where P_0 is the total output power, $I(r)$ is the intensity at the distance r from beam center and a is the radius where the intensity falls to I/e^2 or **13.5%** of the central intensity. The accepted **beam diameter** of the laser is defined as $2a$ and contains **86.5%** of the total beam power.

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Laser Glossary

ABSORB: To transform radiant energy into a different form, usually with a resultant rise in temperature.

ABSORBANCE: The ability of a medium to absorb radiation depending on temperature and wavelength. Expressed as the negative common logarithm of the transmittance.

ABSORPTION COEFFICIENT: The amount of radiant energy absorbed per unit or path-length.

ACTIVE MEDIUM: A medium in which lasing will take place, rather than absorption, at a given wavelength.

AFOCAL: Literally, "without a focal length;" an optical system with its object and image point at infinity.

AMPLIFICATION: The growth of the radiation field in the laser resonator cavity. As the light wave bounces back and forth between the cavity mirrors, it is amp stimulated emission on each pass through the active medium.

AMPLITUDE: The maximum value of the electromagnetic wave, measured from the mean to the extreme; put simply, the height of the wave. (See drawing under "polarization.")

ANGLE OF INCIDENCE: see "INCIDENT RAY."

ANGSTROM UNIT: A unit of measurement for a wavelength of light (written Å), equal to one ten billionth of a meter (10^{10} meter). Occasionally still used.

ANODE: An electrical element in laser excitation which attracts electrons from a cathode. An anode can be cooled directly by water or by radiation.

AR COATINGS: Anti-reflection coatings, used on the backs of laser output mirrors to suppress unwanted multiple reflections which reduce power.

AUTOCOLLIMATOR: A single instrument combining the functions of a telescope and a collimator to detect small angular displacements of a mirror by means of its own collimated light.

AXIAL-FLOW LASER: The simplest and most efficient of the gas lasers. An axial flow of gas is maintained through the tube to replace those gas molecules depleted by the electrical discharge used to excite the gas molecules to the lasing state. (see "GAS DISCHARGE LASER.")

AXIS, OPTICAL AXIS: The optical center-line for a lens system; the line passing through the centers of curvature of the optical surfaces of a lens.

BEAM BENDER: Hardware assembly or optical device, such as a mirror, capable of changing laser beam direction; used to re-point the beam and in "folded," compact delivery systems.

BEAM DIAMETER: The diameter of that Portion of the beam which contains 86% of the output power.

BEAM EXPANDER: Optical device increasing beam diameter and reducing divergence. Result: A smaller focussed spot for more distance between lens and part.

BEAM SPLITTING: Optically splitting a laser beam into two or more beams, allowing work on more than one side of a part at the same time—but at somewhat less power than with a multiple-output beam system.

BREWSTER WINDOWS: The transmissive end (or both ends) of the laser tube, made of transparent optical material and set at Brewster's angle in gas lasers to achieve zero reflective loss of vertically polarized light. Non-standard on industrial lasers, but a must if polarization is desired.

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Laser Glossary

BRIGHTNESS: The visual sensation of the luminous power of a light beam, as opposed to scientifically measured power of the beam.

CALORIMETER: An instrument which measures the heat generated by absorption of the laser beam—another way to measure laser power.

CATHODE: The element providing the electrons for the electrical discharge used to excite the lasing medium.

CO₂ LASER: A laser largely used in industry in which the primary lasing medium is carbon dioxide. Coherent, Inc., CO₂ lasers are tradenamed EVERLASE™.

COAXIAL GAS: Most laser welding is done with a shield of inert gas flowing over the work surface to prevent plasma oxidation and absorption, to blow away debris, and to control heat reaction. The gas jet has the same axis as the beam so the two can be aimed together.

COHERENT LIGHT, COHERENT RADIATION: Radiation composed of wave trains vibrating in phase with each other. Simply expressed: parallel rays of light.

COLLIMATED LIGHT: Divergent light rays rendered parallel by means of a lens or other device, allowing a sharp image of the object to be focussed at the focal plane of the lens.

COLLIMATION: The process by which divergent rays (white, or natural, light) are converted into parallel rays (coherent light).

CONVERGENCE: The bending of light rays toward each other, as by a positive (convex) lens.

CURRENT SATURATION: Maximum flow of electric force in a conductor; in a laser, the point at which further electrical charge will not increase lasing action.

CW: Continuous Wavefront; the continuous-emission mode of a laser, as opposed to pulsed operation.

DEPTH OF FIELD: The working range of the beam, a function of wavelength, diameter of the unfocused beam, and focal length of the lens. To achieve a small diameter spot size, and thus a high power density, a short depth of field must be accepted.

DIVERGENCE: The angle at which the laser beam spreads in the far field; the bending of rays away from each other, as by a concave lens or convex mirror.

DRIFT, ANGULAR: All undesirable variations in output (either amplitude or frequency); angular drift of the beam, measured in milliradians before, during, and after warm-up.

DUTY CYCLE: The length of time the laser beam is actually cutting, drilling, welding, or heat-treating, as compared to the entire work cycle time.

ELECTRIC VECTOR: The electric field associated with a light wave and having both direction and amplitude. Commonly represented by a line with an arrowhead.

ELECTROMAGNETIC WAVE: A disturbance which propagates outward from an electric charge which oscillates or is accelerated. Includes radio waves; X-rays; gamma rays; and infrared, ultraviolet, and visible light.

EMISSIVITY, EMITTANCE: Rate at which emission takes place; the ratio of the radiant energy emitted by a source or surface to that emitted by a blackbody at the same temperature.

ENHANCED PULSING: Electronic modulation of a laser beam to produce high peak power at the initial stage of the pulse. This allows rapid vaporization of the material without heating the surrounding area. Such pulses are many times the peak power of the CW mode.

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Laser Glossary

EXPOSURE: A measure of the total radiant energy incident on a surface per unit area; radiant exposure.

FAR-FIELD IMAGING: An imaging technique with solid-state lasers that has several limitations: non-uniform energy distribution, very short working distances, and poor control of hole geometry.

FLASHLAMP: Source of powerful light; often in the form of a helical coil and used to excite photon emission in a solid-state laser. See pages 24 - 26.

FLEXOGRAPHY: A printing process involving laser-engraved, seamless rubber plates.

FLUORESCENCE: The glow induced in a material when bombarded by light. Brewster windows of fused silica fluoresce in UV light, increasing absorption of laser radiation and degrading laser mode and output.

FLUX: The radiant, or luminous, power of a light beam; the time rate of the flow of radiant energy across a given surface.

FOCUS: *Noun:* the point where rays of light meet which have by a lens, giving rise to an image of the source. *Verb:* to adjust focal length for the clearest image.

FOCAL POINT: Same as first definition under "FOCUS;" in laser work, the focal point of the beam relative to the work surface has a critical effect, such as the depth and shape of drilled holes. When the focal point is at the surface, holes are of uniform diameter. When the focus is below the surface, conical holes are drilled.

FOLDED RESONATOR: Construction in which the interior optical path is bent by mirrors mounted on corner blocks bolted into pre-aligned position, permitting compact packaging of a long laser cavity.

FREQUENCY: The number of light waves passing a fixed point unit of time, or the number of complete vibrations in that period of time.

GAIN: Another term for amplification, usually referring to the efficiency of a lasing medium in attaining a population inversion. High gain is typically more than 50% per pass of the light wave between cavity mirrors.

GAS DISCHARGE LASER: A laser containing a gaseous lasing medium in a glass tube in which a constant flow of gas replenishes the molecules depleted by the electricity or chemicals used for excitation. The discharged gas can be filtered and 90% recycled for economy.

GAS JET ASSIST: An assisting coaxial gas, such as oxygen, argon, or nitrogen, which may be used to achieve very high power levels for cutting certain metals.

GASTRANSPORT: A laser design which generates very high beam power within a fairly small resonator structure. Long electrodes parallel the axis and gas is circulated across the resonator cavity.

GAUSSIAN: The "normal curve," or normal distribution, an example of which is the symmetrical bell shape of the holes created by the uncorrected, unfocused laser beam in its optimum mode. A Gaussian laser beam has most of its energy in the center.

HAZ: Heat-Affected Zone, or the area where laser beam and metal (or other) surface are in contact.

HELIUM-NEON LASER: ("HeNe"), Laser in which the active medium is a mixture of helium and neon, which is in the visible range. Used widely in industry for alignment, recording, printing, and measuring, it is also valuable as a pointer or aligner of invisible CO₂ laser light.

KENTEK: ONE STOP SHOPPING CONVENIENCE!

Laser Glossary

HEAT SINK: A substance or device used to dissipate or absorb unwanted heat, as from a manufacturing process (or, with lasers, from reflected rays).

HERTZ: The approved international term, abbreviated Hz, which replaces CPS for cycles per second.

IMAGE: The optical reproduction of an object, produced by a lens or mirror. A typical positive lens converges rays to form a "real" image which can be photographed. A negative lens spreads rays to form a "virtual" image which can't be projected.

INCIDENT LIGHT: A ray of light that falls on the surface of a lens — or any other object. The "angle of incidence" is the angle made by the ray with a perpendicular to the surface.

ION LASER: A type of laser employing a very high discharge current, passing down a small bore to ionize a noble gas such as argon or krypton. The ionization process creates a population inversion for lasing to occur. A research laser useful for some industrial applications.

INTENSITY: The magnitude of radiant energy (light) per unit, such as time or reflecting surface.

IRRADIATION: Exposure to radiant energy, such as heat, X-rays, or light; the product of irradiance and time.

JOULE: One watt per second; a measurement frequently given for laser output in pulsed operation.

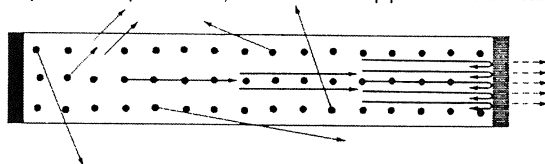
KEYHOLING: In welding, the deep-penetration holes, which fill quickly with molten metal, that can be made in a few milliseconds by laser.

LASER: An acronym of **L**ight **A**mplification by **S**timulated **E**mission of **R**adiation. A laser is a cavity that has mirrors at the ends and is filled with lasable material such as crystal, glass, liquid, gas, or dye. These materials must have atoms, ions, or molecules capable of being excited to a metastable state by light, electric discharge, or other stimulus. The transition from this metastable state back to the normal ground state is accompanied by the emission of photons which form a coherent beam.

LASER ACCESSORIES: The hardware and options available for lasers, such as secondary gases, Brewster windows, Q-switches, and electronic shutters.

LASER HARDENING: Laser-beam traversal of metal to harden quenching process producing the maximum hardness for most metals.

LASER OSCILLATION: The buildup of the coherent wave between laser cavity end mirrors. In CW mode, the wave bounding back and forth between mirrors transmits a fraction of its energy on each trip; in pulsed operation, emission happens instantaneously.



LASER ROD: A solid-state, rod-shaped lasing medium in which ion excitation is caused by a source of intense light, such as a flashlamp. Various materials are used for the rod, the earliest of which was synthetic ruby crystal. See page 29.

LEADING EDGE SPIKE: The initial pulse in a series of pulsed laser emissions, often useful in starting a reaction at the target surface. The trailing edge of the laser power is used to maintain the reaction after the initial burst of energy.

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Laser Glossary

LIGHT: The range of electromagnetic radiation frequencies detected by the eye, or the wavelength range from about 400 to 750 nanometers. It is sometimes extended to include photovoltaic effects and radiation beyond visible limits.

LIGHT REGULATION: A form of power regulation in which output power is maintained at a constant level by controlling discharge current.

LUMINANCE: Commonly called illumination; the luminous or visible flux per unit area on a receiving surface at any given point.

MENISCUS LENS: The lens used primarily in CO₂ lasers by Coherent, Inc. It has one side convex, the other concave. See page 32.

METASTABLE, METASTABLE STATE: Unstable condition in which the energy of a molecule is at some discrete level above the lowest, or ground state. It is this condition which is necessary for emission of photons in a laser. (From quantum theory.)

MICROMETER: A "MY-kro' mee-ter" is a unit of length equal to one millionth of a meter, or one micron. (Not to be confused with my-KROM'-a-ter, a measuring instrument used with a telescope, microscope, or laser for fine focussing).

MODE: A particular functioning arrangement, setup, or condition for laser operation, such as continuous emission, pulses, or grouped pulses. "Mode" also describes the cross-sectional shape of the beam. (see "TEM.")

MODULATION: The ability to superimpose an external signal on the output beam of the laser as a control.

MONOCHROMATIC LIGHT: Theoretically, light consisting of just one wavelength. Since no light is completely monochromatic, it usually consists of a very narrow band of wavelengths. Lasers provide the narrowest bands.

NANOMETER: A unit of length in the International System of Units (SI) equal to one billionth of a meter (10^9 meter). Once called a millimicron, it is used to represent wavelength.

NEAR FIELD IMAGING: A solid-state laser imaging technique offering control of spot size and hole geometry, adjustable working distance, uniform energy distribution, and easily produced range of spot sizes.

Nd:GLASS LASER: A solid-state laser of Neodymium:glass offering high power or short pulses, or both, for specific industrial applications.

Nd:YAG LASER: A solid-state laser of Neodymium:Yttrium-Aluminum Garnet, similar to the Nd:glass laser. Both are pumped by flashlamp.

NEMA: National Electrical Manufacturers' Association, a group which defines and recommends safety standards for electrical equipment.

NOISE: Unwanted, minor currents or voltages in an electrical system.

OBJECT: The subject matter or figure imaged by, or seen through, an optical system.

OPTICAL DENSITY: Protection factor provided by a filter (such as used in eyewear, viewing windows, etc.) at a specific wavelength. Each unit of OD represents a 10x increase in protection.

OPTICAL FIBER: Filament of quartz or other optical material capable of transmitting light along its conformation and emitting it at the end.

OPTICAL PUMPING: Exciting the lasing medium by the application of light rather than electrical discharge from anode and cathode.

Laser Glossary

OUTPUT COUPLER: The resonator mirror which transmits light; the one at the opposite end is totally reflective.

OUTPUT POWER: The energy per second emitted from the laser in the form of coherent light, usually measured in watts for continuous-wave operation and joules for pulsed operation.

OXYGEN ASSIST: In certain cutting operations, coaxial oxygen initiates an exothermic reaction to enhance the cutting rate for thick metals; in other words, oxygen actually does the cutting, with the reaction being maintained by the laser beam.

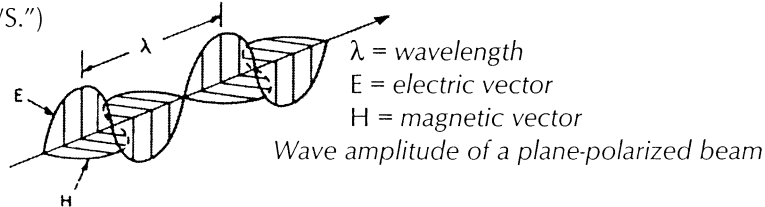
PHOTOMETER: An instrument which measures luminous intensity.

PHOTON: In quantum theory, the elemental unit of light, having both wave and particle behavior. It has motion, but no mass or charge.

PLASMA: In laser welding, a metal vapor that forms above the spot where the beam reacts with the metal surface. Also used to describe the laser tube (plasma tube, discharge tube) which contains the completely ionized gas in certain lasers.

POINTING ERRORS: Beam movement and divergence, often preventable by using short path-lengths.

POLARIZATION: Restriction of the vibrations of the electromagnetic field to a single plane, rather than the innumerable planes rotating about the vector axis. This prevents optical losses at interfaces between the lasing medium and optical elements. Various forms of polarization include random, linear (plane), vertical, horizontal, elliptical, and circular. Of two polarization components (so-called), S and P, the P component has zero losses at Brewster's angle. (see "BREWSTER WINDOWS.")



POPULATION INVERSION: When more molecules (atoms, ions) in a laser are in a metastable state than in the ground state (a situation needed for sustaining a high rate of stimulated emissions), a "population inversion" is said to exist. Without a population inversion, there can be no lasing action.

POWER DENSITY: The amount of radiant energy concentrated on a surface.

POWER METER: An accessory used to monitor laser beam power at the rear reflector, tune the beam for optimum power, or monitor power delivered to the work station.

POWER RAMPING: A controlled change in the power level of a laser beam, either linearly, as up a ramp, across, and down again—or in several discrete steps. Useful for smooth completion of circular welds and for preventing fractures from rapid cooling.

PULSE ENERGY: The power of a single, brief emission from a laser programmed for pulsed behavior rather than continuous operation. Pulse energy can be several times greater than CW emission.

PULSE TAIL: Pulse decay time, which can be shortened (by using a special mixture of gases) to allow for fast repetition of laser pulses within a given length of time.

PUMP: To excite the lasing medium (see "OPTICAL PUMPING").

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Laser Glossary

Q: The energy-storing efficiency of a laser resonator. The higher the "Q," the less energy loss.

Q-SWITCH: A device that has the effect of a shutter moving rapidly in and out of the beam to "spoil" the resonator's normal Q, keeping it low to prevent lasing action until a high level of energy is stored. Result: a giant pulse of power when normal Q is restored.

RADIAN: An arc in a circle, equal in length to the radius; an angle (57.3°) at the center of a circle, formed by 2 radii cutting off such an arc. Thus one rad = 57.3° .

RADIANCE: Brightness; the radiant energy per unit solid angle and per unit projected area of a radiating surface.

RADIANT ENERGY: Energy traveling as wave motion; specifically, the energy of electromagnetic waves (light, X-rays, radio, gamma rays).

RADIANT FLUX: The rate of emission or transmission of radiant energy.

RADIANT INTENSITY: Radiant power, or flux, expressed as emission per unit solid angle about the direction of the light in a given length of time.

RADIANT POWER: The amount of radiant energy available per unit; the radiant flux.

RAMPER: Power controls for accomplishing the ramping steps; may be computer-controlled.

REFLECTANCE: The ratio of the reflected flux to the incident flux, or the ratio of reflected light to light falling on the object.

REFLECTION: The return of radiant energy (incident light) by a surface, with no change in wavelength.

REFRACTION: The change of direction of propagation of any wave, such as an electromagnetic wave, when it passes from one medium to another in which the wave velocity is different. Simply put, the bending of incident rays as they pass from one medium to another, such as air to water.

RESOLUTION: Resolving power, or the quantitative measure of the ability of an optical instrument to produce separable images of different points on an object; the capability of making distinguishable the individual parts of an object, closely adjacent images, or sources of light.

RESONATOR: The mirrors (or reflectors) making up the laser cavity containing the laser rod or tube. The mirrors reflect light back and forth to build up amplification under an external stimulus. Emission is through one of them, called a coupler, which is partially transmissive.

RMS: Units of electronic noise; the letters stand for Root-Mean-Square.

ROCKWELL C: A scale or test used to define hardness in metals; particularly steel and titanium.

ROTATING LENS: Beam delivery in a circular movement for cutting large-diameter holes. (De-focusing the beam for this lowers power density and increases drilling time.)

SPECTRAL RESPONSE: The response of a device or material to monochromatic light as a function of wavelength.

STABILITY: Temperature, electrical, dimensional, and power stability are important attributes in a working laser. The Everlase™ series of industrial lasers achieve such stability through circulating coolant, cast iron end pieces, permanent alignment, electrical control, and kinematic mounting. Result: long-term variation of only +/- 2% of rated power.

HOURS: 8AM TO 5PM EASTERN STANDARD TIME.

Laser Glossary

STIMULATED EMISSION: When an atom, ion, or molecule capable of lasing is excited to a higher energy level by an electric charge or other means, it will spontaneously emit a photon as it decays to the normal ground state. If that photon passes near another atom of the same frequency which is also at some metastable energy level, the second atom will be stimulated to emit a photon. Both photons will be of the same wavelength, phase, and spatial coherence. Light amplified in this manner is intense, coherent (collimated or parallel), and monochromatic. In short, laser light.

TEM: Abbreviation for **Transverse Electromagnetic Mode**, the cross-sectional shape of the working laser beam. An infinite number of shapes can be produced, but only a relatively small number are needed for industrial applications. In general, "the higher the TEM, the coarser the focussing." The best modes for industrial use are shown on the following page...

- TEM00 *A Gaussian-curve mode that is the best collimated and produces the smallest spot of high power density for drilling, welding and cutting.*
 - TEM01 *Divided into two equal beams for special applications.*
- TEM01* *A donut-shaped mode for heat-treating, drilling larger holes, and other special uses.*

THRESHOLD: During excitation of the laser medium, this is the point where lasing begins.

TRANSFORMATION HARDENING: A Process well suited to lasers which involves hardening metal by heating it to the critical temperature for transformation, quenching it, and solidifying it with uniform distribution of its carbon content.

TRANSMISSION: In optics, the passage of radiant energy (light) through a medium.

TRANSMITTANCE: The ratio of transmitted radiant energy to incident radiant energy, or the fraction of light that passes through a medium.

TREPANNING THE BEAM: Relative motion of the beam with respect to the part, usually in a circular fashion (see "ROTATING LENS").

VIGNETTING: The loss of light through an optical element when the entire bundle does not pass through; an image or picture that shades off gradually into the background.

VISIBLE LIGHT TRANSMISSION/TRANSMITTANCE: The amount of visible light usable to the eye that passes through a filter. As a rule of thumb, as optical density increases, visible light transmission decreases – but not always.

WAVE: An undulation or vibration, a form of movement by which all radiant energy of the electromagnetic spectrum is thought to travel.

WAVELENGTH: The fundamental property of light—the length of the light wave, which determines its color. Common units of measurement (which is usually from crest to crest) are the micron, the nanometer, and (earlier) the angstrom.

WINDOW: A piece of glass with plane parallel sides which admits light into or through an optical system and excludes dirt and moisture.

ANY QUESTIONS?
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Krytox® *High Performance Fluorinated Lubricants*

Explore the wide world of Krytox products and discover the myriad applications for these remarkable fluorinated greases and oils.

Krytox Fluorinated Greases and Oils are a family of multipurpose lubricants that are particularly useful where the performance of conventional lubricants is unsatisfactory. These products are versatile lubricants that can work in extreme pressure, high temperature and chemically aggressive atmospheres.

Krytox general purpose lubricants possess an extraordinary combination of properties:

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- Non-flammable, non-reactive.
- Chemically inert - insoluble in hydrocarbons, petroleum distillates, water, steam, chemical solvents, and acids/bases. Provides extra protection against aggressive chemicals that degrade conventional lubricants.
- Non-toxic.
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- No chlorine or chlorine induced corrosion.
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203 743-4447
Facsimile No: 203 791-8702

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Rexdale, Ontario M9W 5R9
416 675-3204
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The recommendations made herewith and the information set forth with respect to the performance or use of our products are believed, but not warranted to be accurate. The products discussed are sold without warranty, as to the fitness of performance, express or implied, and upon condition that purchasers shall make their own tests to determine the suitability of such products for their particular purposes. Likewise, statements concerning the possible uses of our products are not intended as recommendations to use our products in the infringement of any patent.



Krytox Applications (Partial list)

Bearings	Knife Gate Valves in Sulfuric Acid Plants
Chemical Service Control Valves	Liquid Oxygen Pump Bearing Housings
Chemical Reactor Agitator Shaft Seals	Office Equipment
Chemical Laboratory Stopcocks	Oven Conveyor Chains & Bearings
Computer Gear Drives	Paper Corrugating Bearings
Electric Motor Bearings	Pillow-Block Bearings in Fabric Slitting
Electric Submersible Equipment	Plasma Etching Equipment
Electronic Instruments	Plug Valves in Corrosive Chemical Service
Fuel Pumps	Pressure Relief Valves
Gyroscope Fluid	Pumps in Chlorine Service
Ground Glass Joints	Rack and Pinion Disk Drives
High-performance Automobile Bearings, CV Joints, Gears and Weather Stripping	Seals in Reactive Chemical Environments
Instrument Bearings	Scuba Gear
Kiln Car Bearings	Valves & O-rings in Oxygen Service
	Water-immersed Valves and Bearings

Typical Product/Applications (partial list)

Krytox® Product	Used For:
GPL 206 or 226	Valves: Plug, Ball and Release
GPL 206 or 240AC (Mil. Spec.)	Oxygen Equipment Valves
GPL 215	Race Cars: Constant Velocity Joints and Wheel Bearings
GPL 105	Rubber Weather Stripping
GPL 226 or 283AC	Alternator Needle Bearings
GPL 223	Anti-lock Breaking Systems
GPL 226 or 283AC	Emission Systems
GPL 226	Fan Clutch Ball Bearings

NOTE: Please consult Material Safety Data Sheet (MSDS) for further product and handling information.



Surface Preparation

Clean components with a solvent cleaner prior to applying Krytox lubricant. Miller-Stephenson offers 941/CO2 Safezone® Precision Cleaning Solvent in aerosol form and 943 Safezone Precision Cleaning Solvent in bulk liquid form (quarts, gallons, and 55gallon drums).

Packaging

Krytox is available in varying grades of greases and oils. Containers consists of 1/2 oz. syringes, 2 oz. dab bottles, 2 oz. tubes, 8 oz. tubes, 1 lb. jars, 1.75 lb. cartridges, and pails up to 75 lbs.

Military Specification

Krytox 240 Series Grease, grades AZ, AB & AC, meet Military Specification Mil-G-27617. Type I = 240AZ; Type II = 240AB; Type III = 240AC.

Additives

Krytox is available with special additives:

- Extreme pressure additive
- Rust inhibitor additive
- Anti-corrosion additive

Product Information

Contents: Perfluoroalkylpolyether (PFPE) - base oil
Telomer of Tetrafluoroethylene - thickener

Melting Point: 320°C/608°F
Flash Point: Does not ignite
Toxicity: Not Classified
Safety: Stable and non-flammable
pH: Neutral

Product Number Designation of Krytox Lubricants

1st digit	xxx	1 = oil; 2 = grease
2nd digit	xxx	0 = none; additive
3rd digit	xxx	viscosity of base oil





Inco Alloys **NEWS**

News of the Company and its products 1995 No.1

M **9** O N E L

four score years and ten

The first of the MONEL nickel-copper alloys was created in 1905.

US Patent No. 811,239, Manufacture of Nickel-Copper Alloys, was granted on January 30th of the following year. Ten months later, the first trademark registration (US No. 58191) for "MONEL", a metal alloy containing nickel and copper, was granted to Inco (The International Nickel Company). The nickel alloy age had dawned.

MONEL® is a registered trademark of the Inco family of companies.

R. H. MALLETT
SUPERINTENDENT

THE ORFORD COPPER COMPANY.
NEW BRIGHTON, N. J.

RECEIVED
DEC 31 1904
P. M. J.

Dec. 30, 1904.

No. 13

The Orford Copper Co.,
43 Exchange Place, New York.
Mr. F. S. Jordan.

Dear Sir:- Will you kindly make requisition to the Canadian Copper Co., for one car Bessemer matte free from iron or blown down to as low iron contents as possible. We wish this for experimental purposes and would like same as soon as possible.

Very truly yours,

This request for the first car of matte to be used experimentally for direct production of nickel-copper alloy was written, in December 1904, by R C Stanley, later president and chairman of the board of The International Nickel Company, of Canada, Ltd.

CELEBRATING NINETY YEARS OF THE "MONEL" ALLOYS

Looking back on a past anniversary of the MONEL alloys, one writer commented that "some industrious metallurgist probably would have eventually put a two-to-one ratio of nickel and copper together, but luckily nature did it first". That was a reference to the fact that the ores of the Sudbury basin in Ontario, Canada, contain nickel and copper in just about those proportions. If, at the turn of the last century, you were in the business of supplying to nickel silver manufacturers, that was a natural phenomenon well worth a closer look.

In 1902, The International Nickel Co. had been created by the consolidation of the Canadian Copper Company, at Copper Cliff, Ontario, and the Orford Copper Company, in New Jersey. In 1905, the new Inco company's production of nickel from the Canadian ores had nudged ahead of the product from the silicate ores of New Caledonia in the South Pacific. For the new market leader it was time to look further into improving the business and the production costs of one of the most important applications. Rather than melting nickel, copper and zinc to produce nickel silver, they would use the natural two-to-one combination of nickel and copper in the

Canadian ore, and simply add the zinc. That turned out to be a blind alley. They tried to oxidize a nickel-copper matte produced by roasting the ore, reduce its oxide with charcoal, and add the zinc to the molten metal. Those experiments failed because sulfur could not be adequately removed from the matte.

Robert C. Stanley, the young company's assistant superintendent, decided on another approach to the problem. He began with a matte with a metallic content of about 70 per cent nickel and 30 per cent copper, produced from the

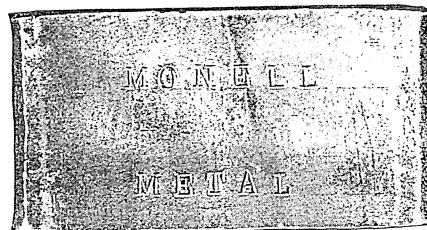


*Robert C Stanley,
the creator of the first
MONEL alloy.*

sulfide ores at Inco's Creighton mine, and requested the matte be free from iron, or blown down to as low an iron content as possible. He had the ore processed through Orford's calcining furnace with orders to remove as much sulfur as possible. The oxide was then reduced and melted with charcoal at the nickel refinery. When the metal was molten, Stanley de-oxidized it with magnesium rather than with zinc, cast it into a small ingot, and had it forged into a bar. After cooling, he heated it again, to 180°F (80°C), and bent the bar. The metal was sound, and ductile!

It still wasn't nickel silver, but Stanley's new alloy had a unique combination of interesting properties. It was silvery white in color, brighter than nickel, stronger than low-carbon steel, and more resistant than bronze to corrosion by sulfuric acid and salt water. At that time no other metal could make such claims.

They first called the material "Monell Metal", in honor of Ambrose Monell, the Inco president. Soon, to register a trademark, the designation was adapted to MONEL. Today, ninety years on, the alloy is known as MONEL alloy 400.



A sample from one of the first melts of the new alloy, first designated "Monell Metal" in honor of Ambrose Monell, the company president.



Inco engaged Columbia University to help evaluate the new alloy's properties. By "observation and imagination" they began to fill out the picture, and it was very promising. The alloy resisted sulfuric acid so well it could not be pickled without the addition of ferric chloride or nitric acid to the pickling liquor. A MONEL alloy shaft in a pump in the company's plant handling water from New York harbor did not corrode. The alloy did not tarnish as readily as copper in a metropolitan atmosphere. Hot steam neither corroded it nor diminished its strength. All the developing evidence suggested a range of potential applications - for pickling equipment in the steel industry, rods and shafts for turbine pumps, turbine blading, uses in oil stills, and architectural applications like the roofs of city buildings. Clearly, it was well worth further investment of time and talent to develop the business.

The next step, of course, was to bring the alloy to the market in the appropriate wrought forms - a management challenge, because International Nickel had neither hot nor cold working facilities in-house. They built a network of co-operation with other companies; American Sheet & Tin Plate Co., and later West Penn Steel, to make sheet; Crucible Steel to make rods; and Central Iron & Steel to roll plate.

In 1907, they sold a total of 500,000 lb (225 tonnes) of the new alloy, and in 1908 came the first of the "big ones", a single order for 264,000 lb (119 tonnes) of MONEL alloy sheet to roof the new Pennsylvania Railroad station in New York City. Within two years, there were 23 recorded applications, from golf clubs to battleship propellers.

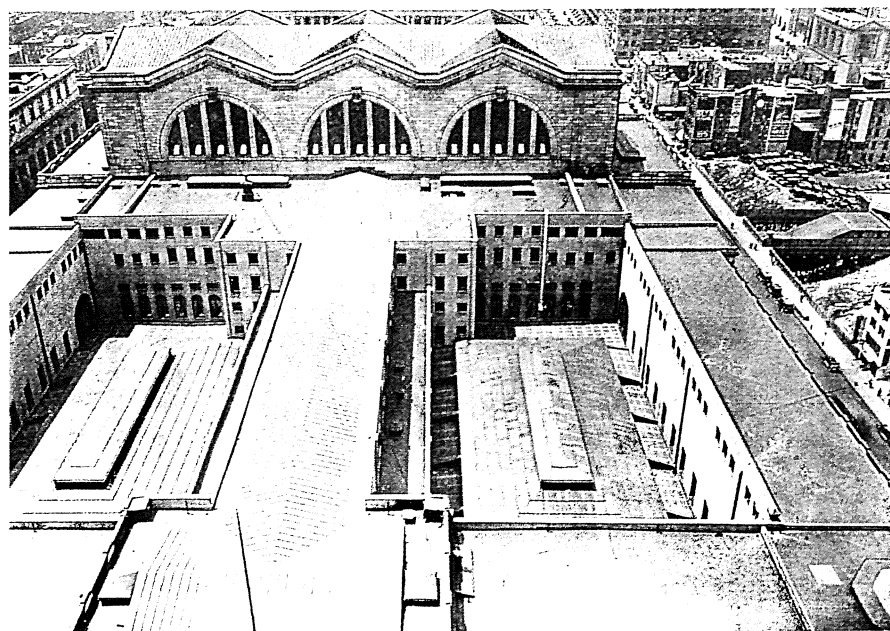
The new alloy was not easy to cast. To research and resolve this problem, Inco formed the Bayonne Casting Co., in New Jersey. Production began in an old stable foundry, and in its first year in business Bayonne Casting produced 12,000 lb (5.4 tonnes) of material.

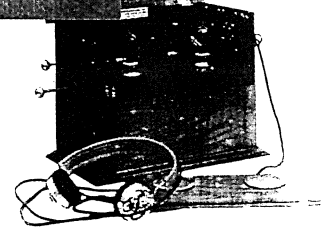
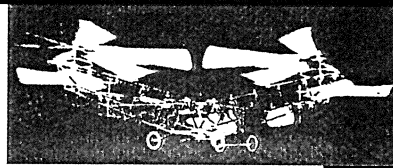
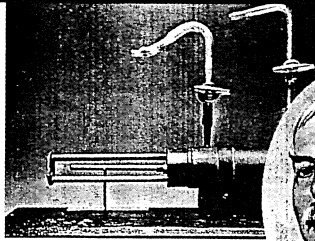
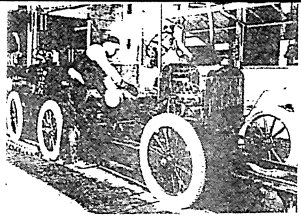
The US and other navies became interested in the new alloy. The battleship USS *North Dakota* was fitted with MONEL alloy propellers - three-bladed wheels, 13ft (4m) diameter, weighing 15,000 lb (6.75 tonnes) and each cast in one piece. More than 40 propellers were cast for the US Navy and the alloy was ordered for turbine nozzles and porthole frames for ships in the Argentine, Italian and Japanese navies. Within four years, production at Bayonne Casting exceeded 280,000 lb (126 tonnes). The use of the MONEL alloys by the US and British navies in World War I established them as recognized sea-going engineering materials.

INVESTMENT IN PRODUCTION, AND THE GROWTH OF AN INTERNATIONAL BUSINESS

The market leader has the experience and confidence to see beyond cyclical business like the defense industries, and the imagination to invest in the development of new applications. Soon after the war, Robert C Stanley, by then vice-president of Inco, decided to launch a major advertising campaign to develop commercial markets for the alloy. Studies showed a market that was beyond the capacity of the toll workers and it was also clear that unless Inco got into the business of melting and rolling the alloy itself, it would never be able to establish a full, in-house quality control. The time was right for another major initiative, and Stanley was ready to act again. He was described as "one of those men (there are always a few in each generation)

The first major order for the new alloy was for 264,000 lb (119 tonnes) of sheet for the roof of the new Pennsylvania Railroad station in New York City. Not many years before the station was closed, the roof was given a projected service life of 300 years.





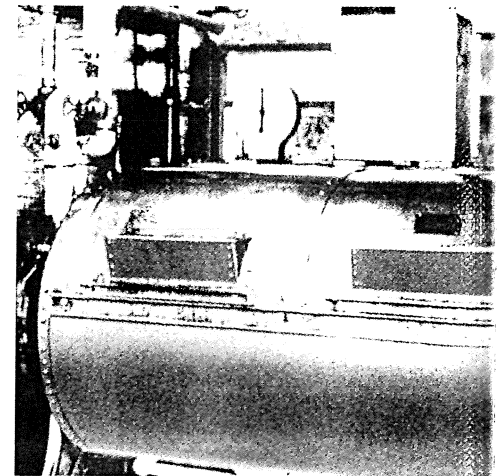
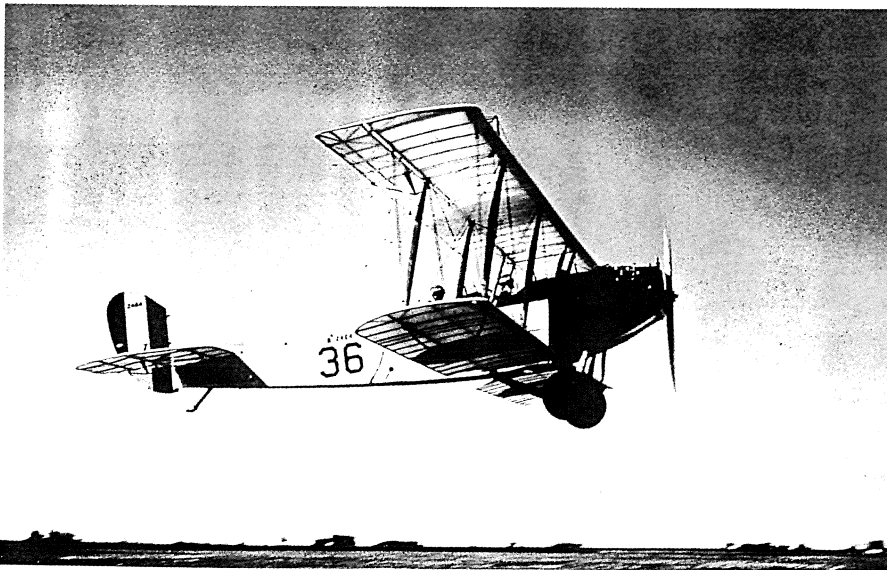
who are willing to take the risk, win or lose, in backing up an idea; and, win or lose, to keep on risking". The Inco board agreed his proposal to spend the, then, formidable sum of \$3 million to build a melting facility and rolling mill, in West Virginia, for the production of the MONEL alloys and the development and production of other nickel-base alloys.

On May 25, 1922, the Huntington, West Virginia, facility went into operation, manned by skilled and experienced operators from Bayonne and from the earlier toll-working partners. Today, the plant in Huntington is the US headquarters of Inco Alloys International, Inc., the North American component of "Inco Alloys International".

The first shipment of MONEL alloy sheet from the Huntington factory went to The American Laundry Company, in Cincinnati, in July, 1922. The laundry and dry cleaning industry remained a major market for the MONEL alloys until the 1950s when the US government prohibited the non-essential use of MONEL alloys because they were needed for the Korean war effort.

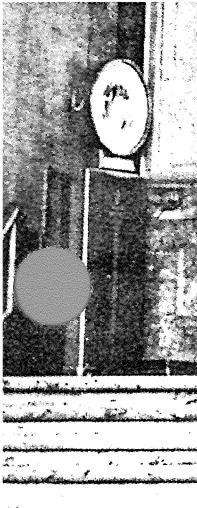
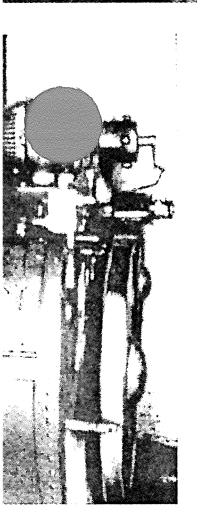
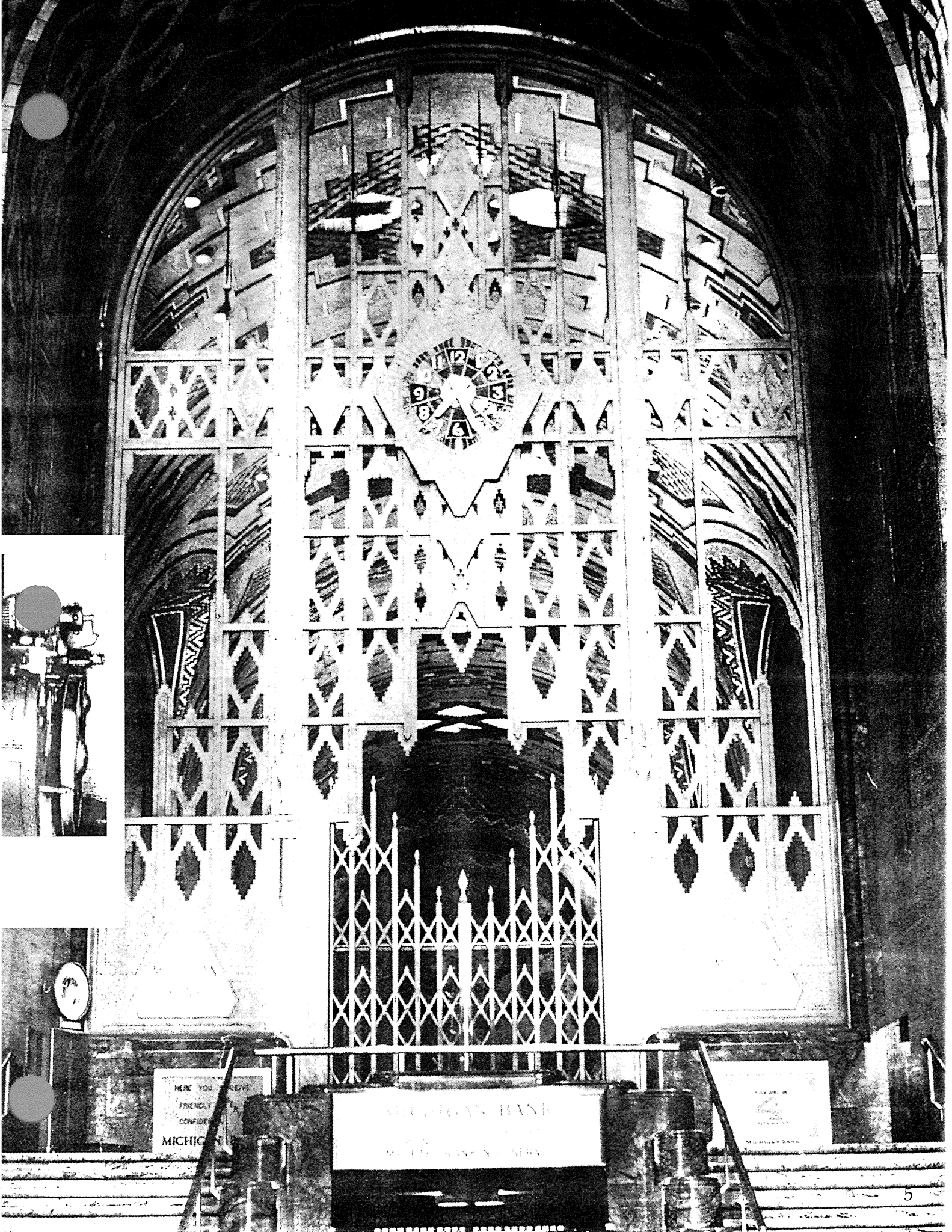
In 1928, Monel-Weir Ltd., a subsidiary of G & J Weir Ltd., one-quarter owned by Inco, was established, in Scotland, to carry on the business of merchandizing and manufacturing MONEL alloys in Britain and continental Europe, taking over from G & J Weir, who had been

The first mass-produced American training aircraft, the Curtis JN4-D, the "Jenny", used a MONEL alloy water jacket to cool its 90 hp engine.



The great laundry news of 1915 was the arrival on the market of this electrically heated washer, the first to be made of MONEL alloy.

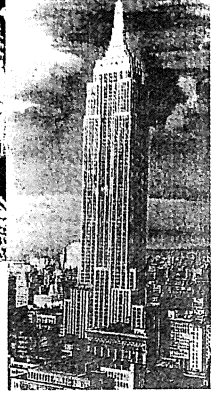
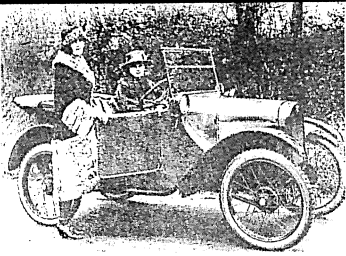
Right:
The use of MONEL alloy to beautify building interiors in the twenties and thirties, such as Detroit's Guardian Building, paved the way for the use of "white metals" in modern architecture.



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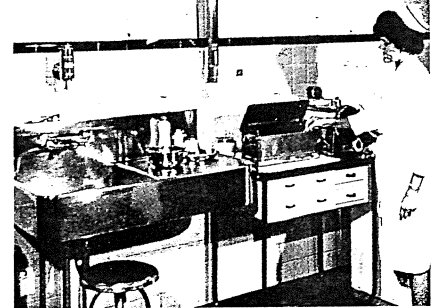
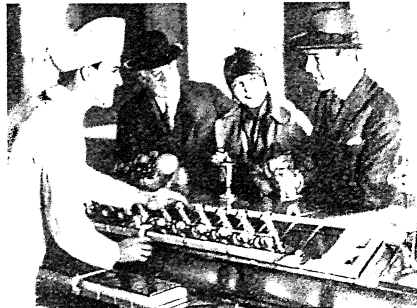
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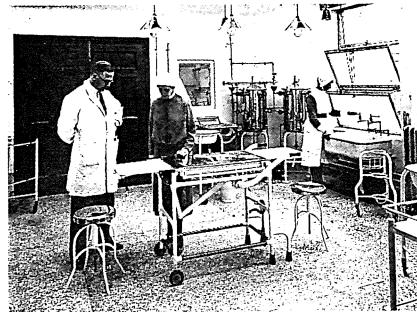


The rectangular sterilizer the nurse is holding was the first ever made in MONEL alloy, in 1916. By the thirties, when this picture was taken, the alloy was being used for the sink, the stool and the bowls.

The 1920s saw the rise of the soda fountain as a social center for a (legal) drink in the U.S.A. As the Inco adverts said, the silvery beauty of the MONEL alloy fittings attracted the customers, and their ease of maintenance pleased the owners.



the Inco distributors. In 1929, International Nickel merged with the British Mond Nickel Co. Ltd., to create The International Nickel Co., of Canada, Ltd. Three years later, in 1932, the Mond subsidiary, Henry Wiggin & Co. Ltd., which had been in operation since 1835, took over the MONEL alloy business from Monel-Weir and that company was liquidated. The MONEL alloys were then made at the Wiggin Zenith Works, in Glasgow, and at the main Wiggin factory in Birmingham. Both plants were closed at the turn of the fifties and sixties when all the U.K. production was concentrated at a greenfield site in Hereford. Today, the Hereford facility is the operating base for Inco Alloys Ltd., the European arm of Inco Alloys International.



1929, and new MONEL alloy equipment was in use in Nottingham General Hospital, in England.

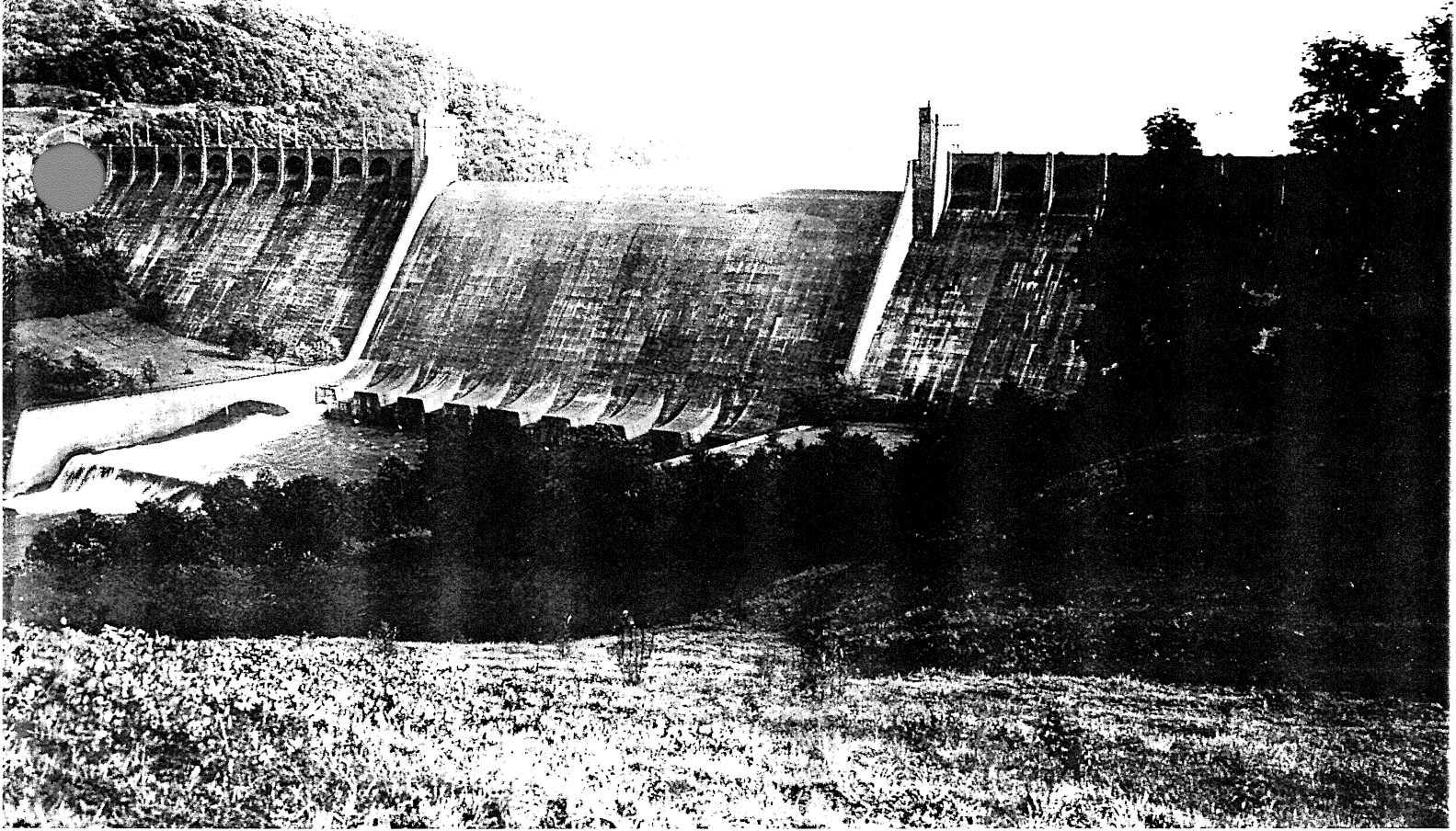


In the thirties, the advertisers were working on the promotion of the alloy for kitchen sinks, tabletops and working surfaces for high society, "turning the kitchen into another guest room".

Back to the alloy history. Early market development effort – in the 1920s there were forty metallurgists and engineers engaged in research into the alloy and its potential applications – concentrated on its pleasing, silvery appearance and its easily maintained satin finish. It was sold for commercial kitchen and cafeteria equipment, hospital tables, clinical utensils, soda fountains and ice cream cabinets. It became popular for intricate, ornamental architecture such as grill-work,

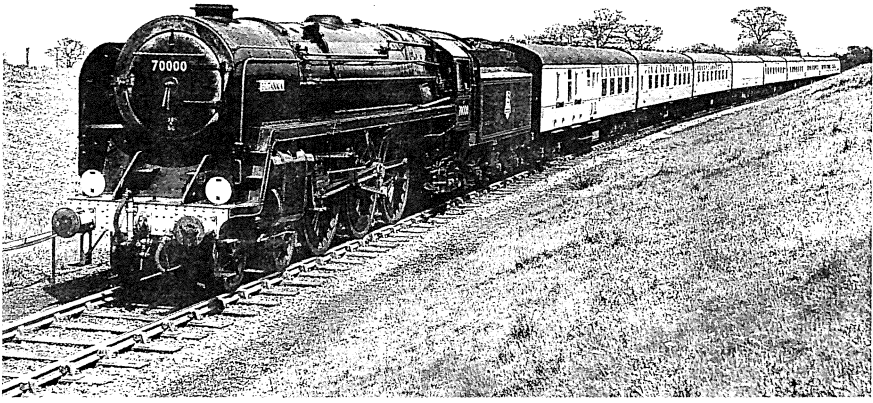
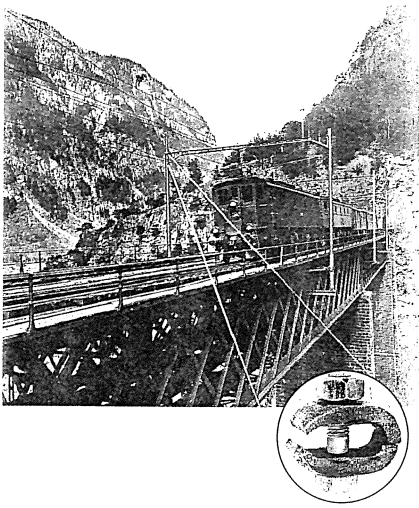
elevator and entrance doors and railings. Later in the twenties, it became the material of choice for hundreds of custom-made kitchen and pantry sinks in fine homes and apartments. This led to the introduction, in 1931, of a standard range of MONEL alloy kitchen sinks, the forerunners of the modern concept of fitted kitchens with cabinet type sinks, double bowls and drain-boards. Hot water storage tanks and heaters accounted for another important market. In the first twenty years after they were introduced, in 1932, over 30 million pounds (13,500 tonnes) of the alloy were sold for that application alone.

As the stainless steels moved in to dominate the interior and exterior architectural markets, so the developers of the MONEL alloys switched attention to a new range of "industrial" applications calling on the alloys' strength and corrosion-resistance – in marine engineering, the chemical and process industries, power generation, petrochemical processing, and offshore oil and gas production. In the nineties, MONEL alloy 400 is still a standard engineering material for valves, pumps, fasteners, springs, tanks, process vessels, heat exchangers and process piping systems.

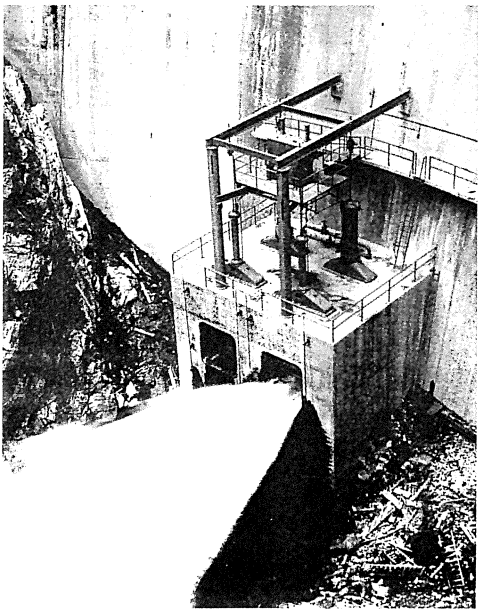


One of the earliest civil engineering applications for the age-hardenable MONEL alloy K-500 was for sluice gate stems on the Tygart River Dam at Grafton, West Virginia, installed in 1938.

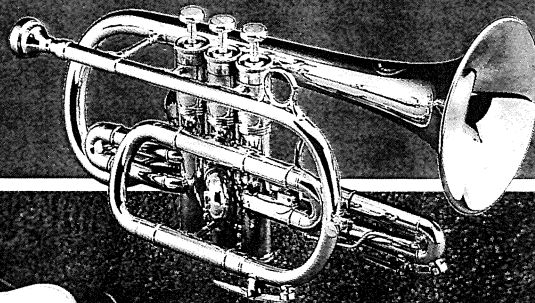
The late thirties, and MONEL alloy 400 bolts are introduced to secure power transmission lines for the Swiss Federal Railways.



The fireboxes of the post World War II generation of British steam locomotives were fitted with MONEL alloy 400 staybolts. A small tank engine, much smaller than this impressive express, used over 1300 of these alloy bolts.

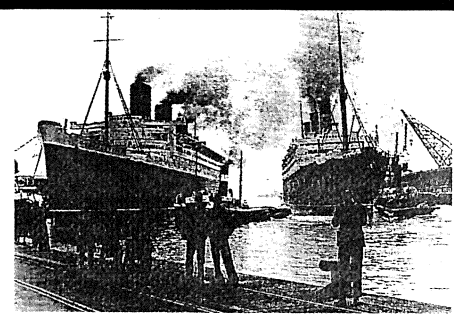
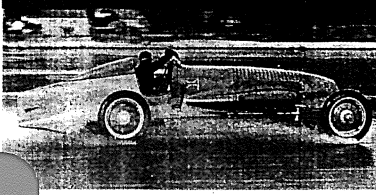


The Tumut Pond Dam was completed in 1958, part of the Snowy Mountains Scheme in Australia. The connecting links between the dam gates and driving mechanism are shafts in MONEL alloy 400.



A 1970s Gibson guitar, made in the U.S.A. The strings were made in MONEL alloy 400. From the same era, the same alloy was used for the valves of the Boosey & Hawkes cornet, made in the U.K.

The Statue of Liberty was refitted to repair damage caused over the years by rain, winds, and the New York harbor atmosphere laden with salt spray and industrial pollution. More than 65,000 MONEL alloy 400 self-tapping screws were threaded into the original rivet holes tightening the structural plates back into their original positions.



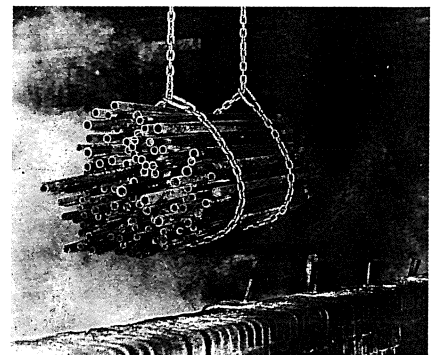
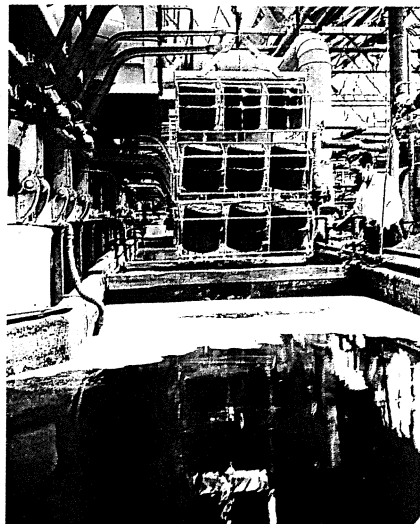
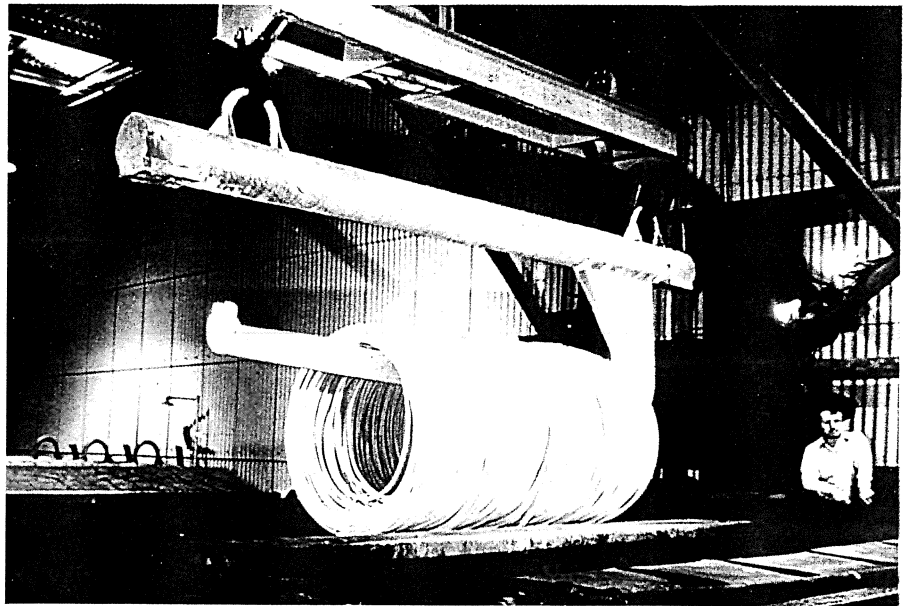
AGE-HARDENABLE ALLOYS

The discovery of age-hardening gave the MONEL alloys an additional boost in industrial applications. As early as 1908, Inco had added varying quantities of chromium, manganese, aluminum, iron, molybdenum, tungsten, titanium and other elements to MONEL alloy to try to increase its strength. In 1919, Inco patented a nickel-copper alloy containing up to 17 per cent aluminum.

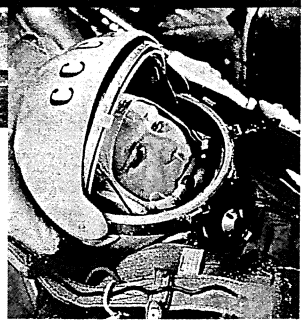
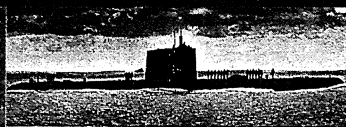
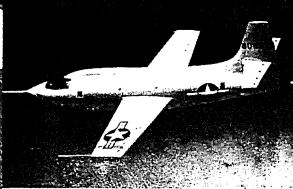
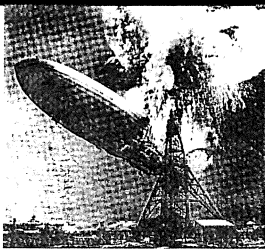
In 1924, researchers at Huntington, working on this alloy, noted that microscopic examination of an unusually hard specimen showed what seemed to be a eutectic structure similar to oxidized copper. This observation led to speculation that the alloy might not be the solid solution it had been considered to be. A duplicate specimen was quenched from 1600°F (870°C) and found to have a hardness of HB 150. After aging overnight at 1000°F (540°C), its hardness had gone up to HB 275. The experiment had proved the alloy to be age-hardenable, although microscopic examination failed to find the eutectic structure of the first specimen. Within the hour the original "eutectic" was proved to have been an accidental arrangement of dust from the etching solution - a useful accident, indeed, which had contributed to the development of the first age-hardenable nickel alloy.

Inco called the new alloy "K" Monel. Later, titanium was substituted for part of the aluminum, and today the Inco Alloys International product is known as MONEL alloy K-500. It is widely used for applications that call for the corrosion-resistance of MONEL alloy 400, with added strength - pump shafts and impellers, doctor blades and scrapers, springs, oil-well drill collars and valve trim.

Millions of pounds of alloy K-500 were made for propeller shafts for the World War II US Navy PT boats. During that war, the US Navy requirements for MONEL alloys more than doubled the demand on the Huntington factory. And the battlefield applications extended beyond the engineering equipment. GIs wore MONEL alloy identification tags, and navigators carried MONEL alloy ball-point pens!



Pickling equipment, one of the first applications for MONEL alloys, and still an established use - hooks and chain slings to support work through aggressively corrosive pickling liquors.

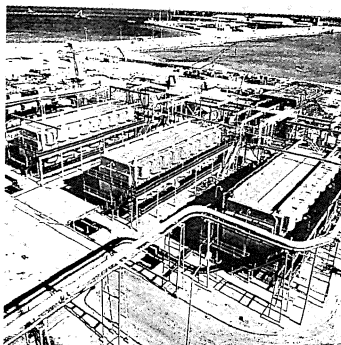
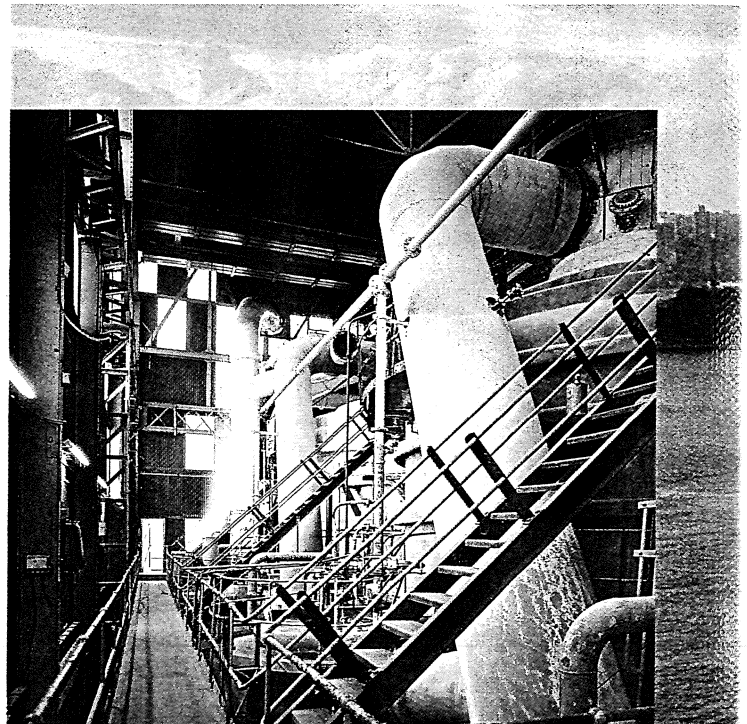


MONEL alloy 400 sheathing protecting the steel structure of an offshore platform in the Gulf of Mexico against corrosion and marine fouling in the critical "splash zone".

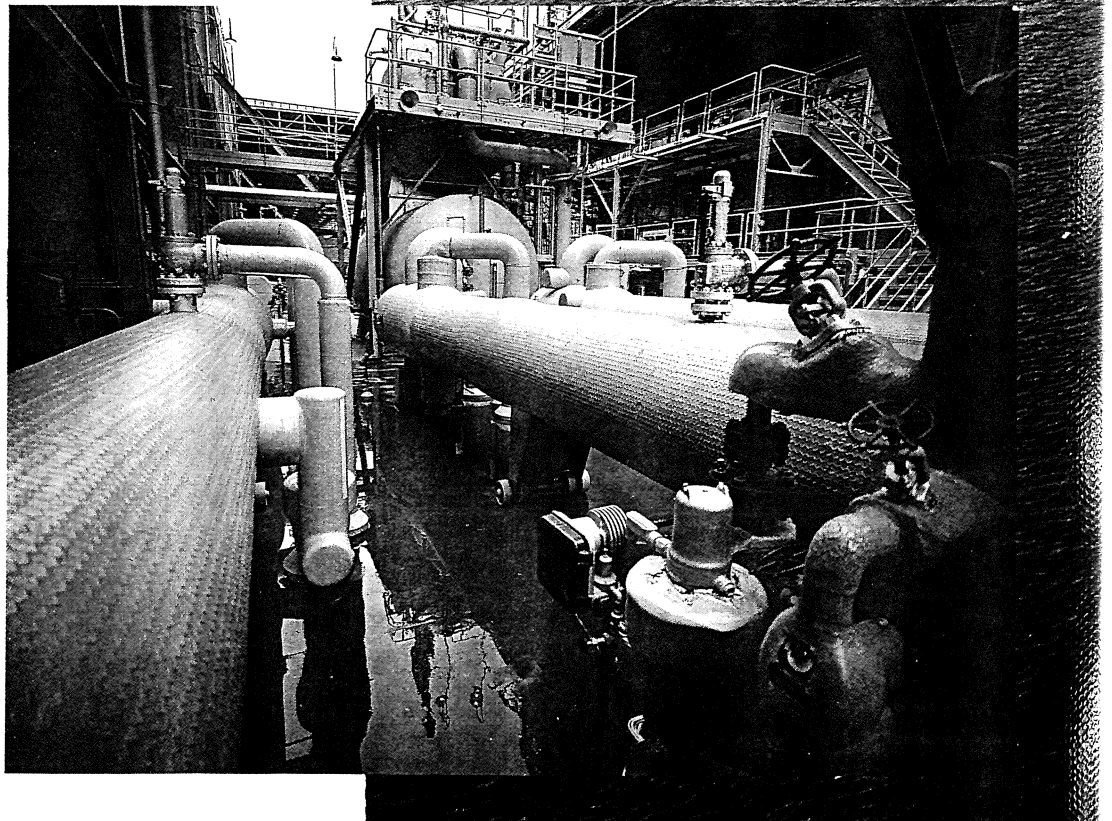


Part of a four-effect salt evaporation process. The first, hottest, vessel is made entirely in MONEL alloy 400, as are the calandria of the second effect and all parts of the filters in contact with the salt slurry.

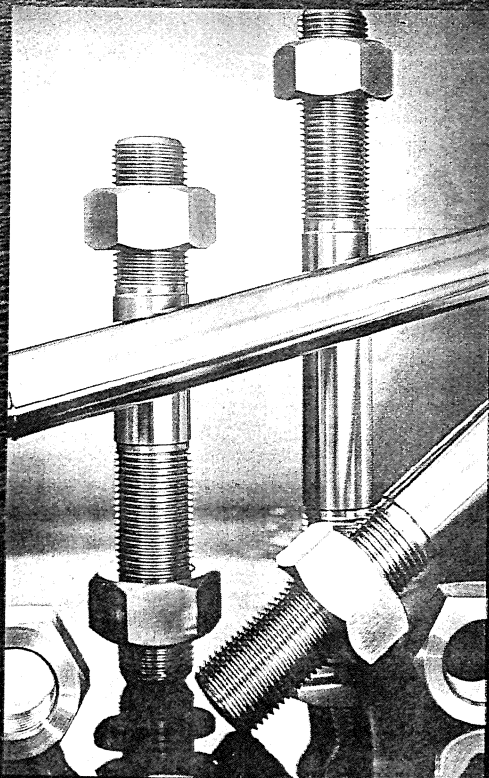
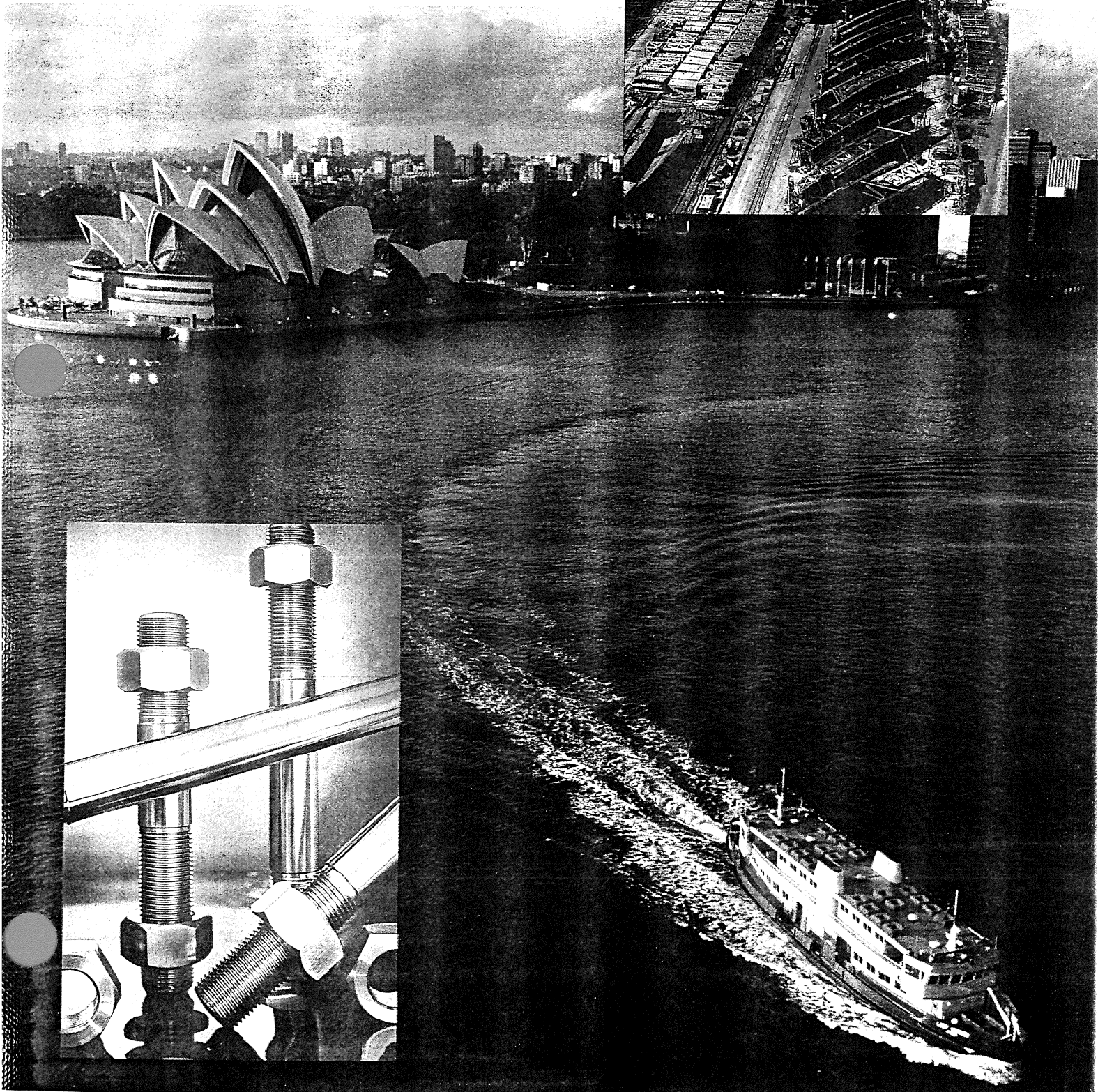
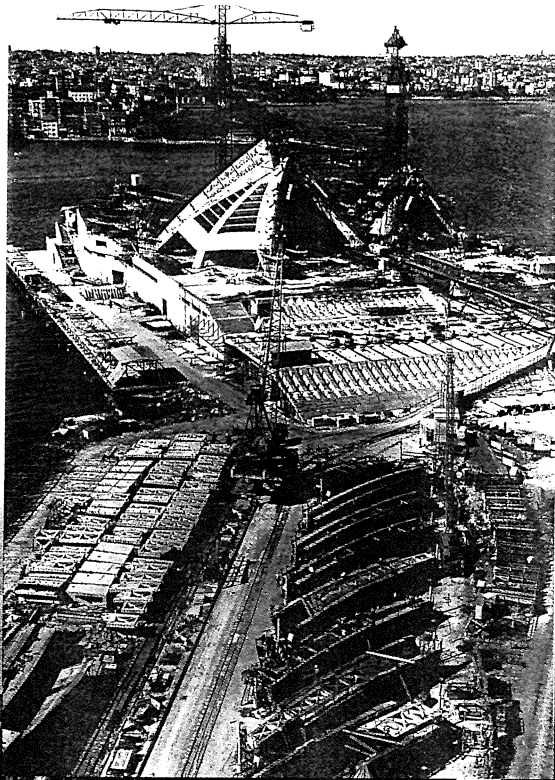
Miles of MONEL alloy 400 feedwater heater tubing have been supplied to power utilities since this application was first introduced in 1941. Thirty and forty year service lives handling corrosion and stress in this application are by no means uncommon.

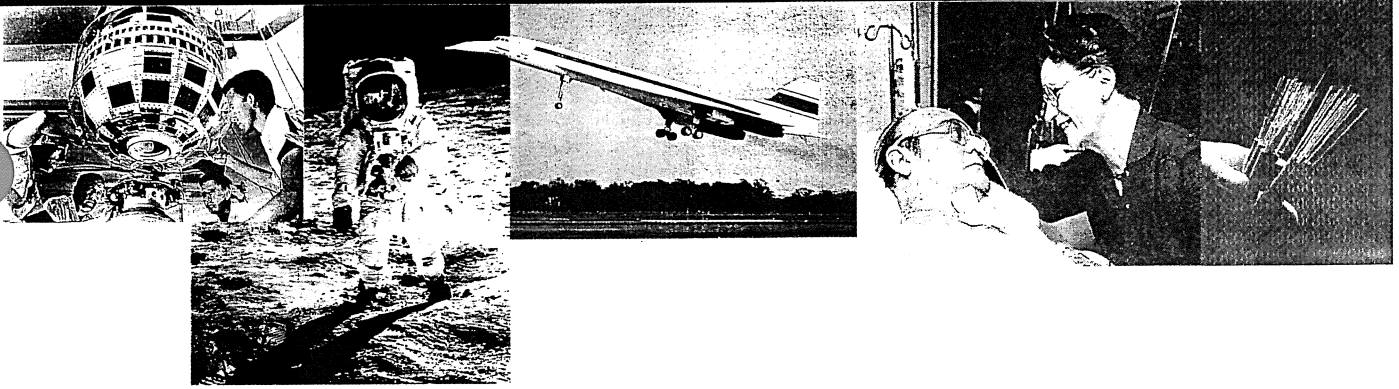


A desalination plant in the Middle East, producing one million gallons of drinking water each day from seawater. At the heart of the system, the demisters are made from pads of MONEL alloy 400 wire to resist corrosion by hot brine solutions containing sodium, calcium and magnesium chlorides at up to 120°C (250°F).



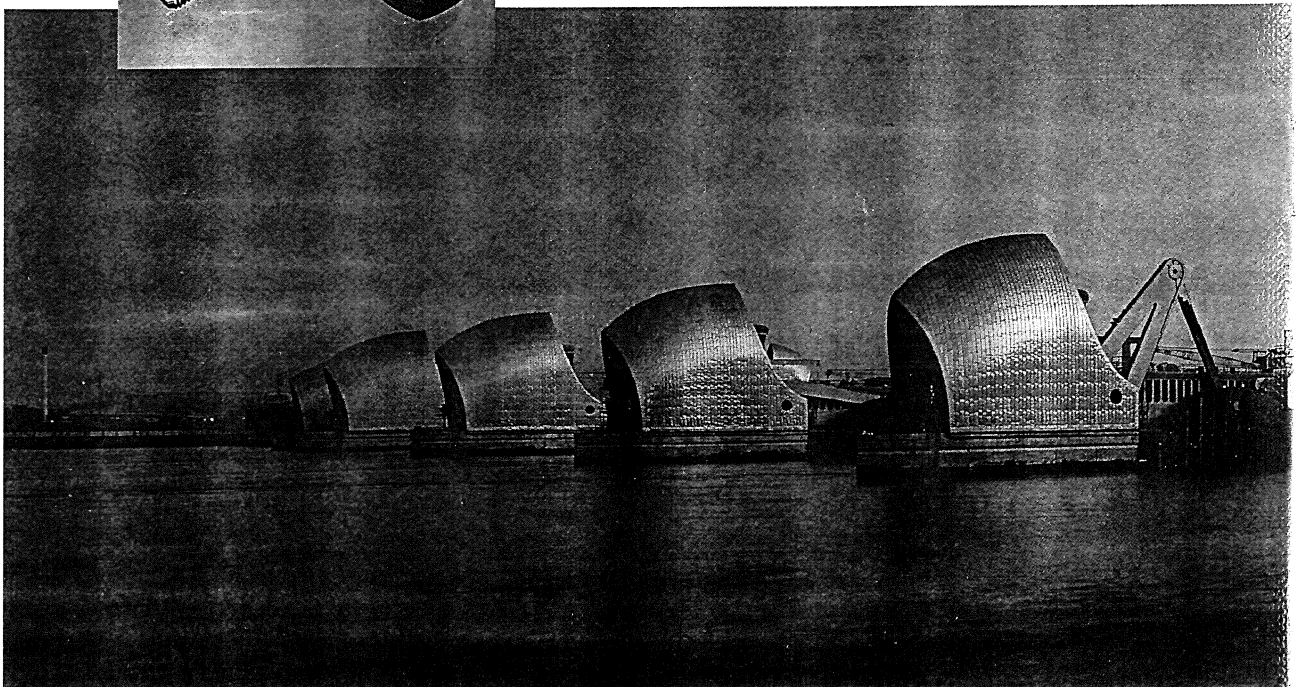
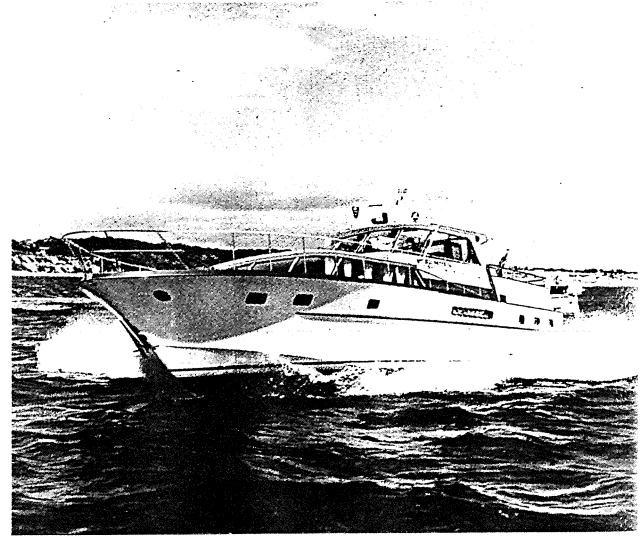
*Construction of the Sydney Opera House.
The roof sections are held in place with
MONEL alloy K-500 bolts. Twenty tons of the
alloy were used to secure the pre-cast concrete rib
segments of the familiar shells. The casting
yards are in the foreground of the picture
on the right.*



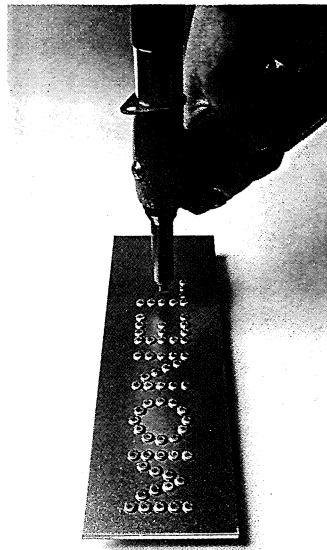
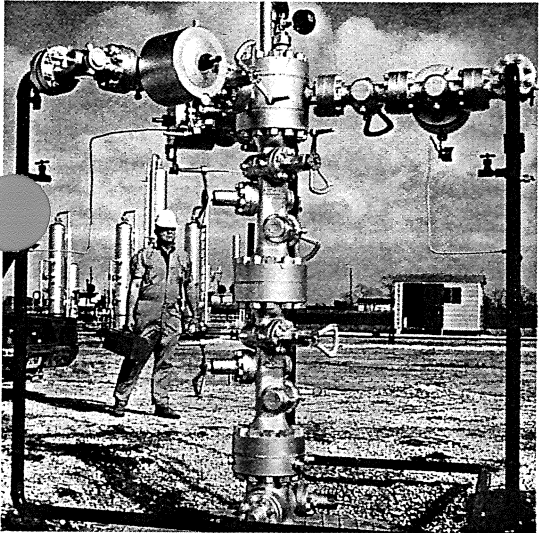
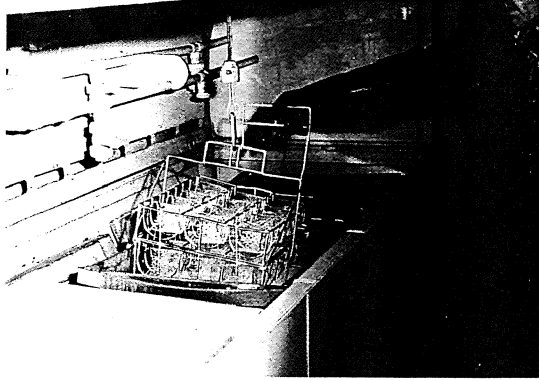


A 15.3 metre powerboat with twin MONEL alloy K-500 prop shafts. On one occasion, accidentally driven aground at over 30 knots, the props of this vessel were destroyed. The alloy shafts survived unscathed and were re-used in the re-fit.

The rising sector gates of the Thames Barrier, downstream from the Port of London, are secured through hinge assemblies incorporating over 8,000 36mm diameter stud bolts in MONEL alloy K-500 and over 16,000 72mm diameter MONEL alloy 400 nuts and washers.

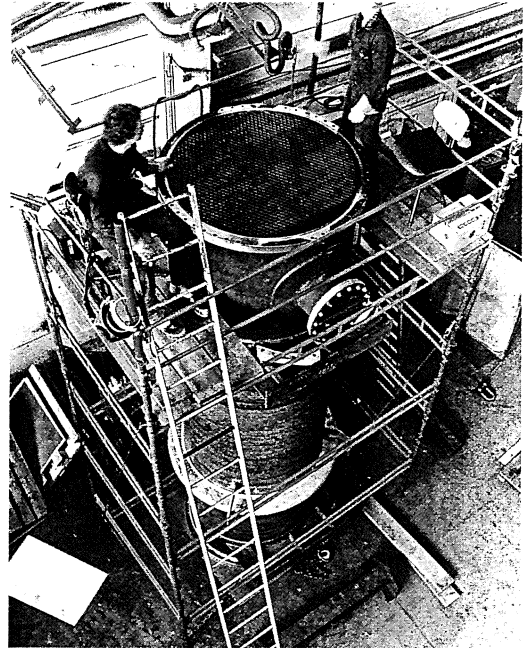


A two-tier MONEL alloy 400 basket for carrying fine cut crystalware through hydrofluoric or sulfuric acid polishes, followed by a sulfuric acid rinse.

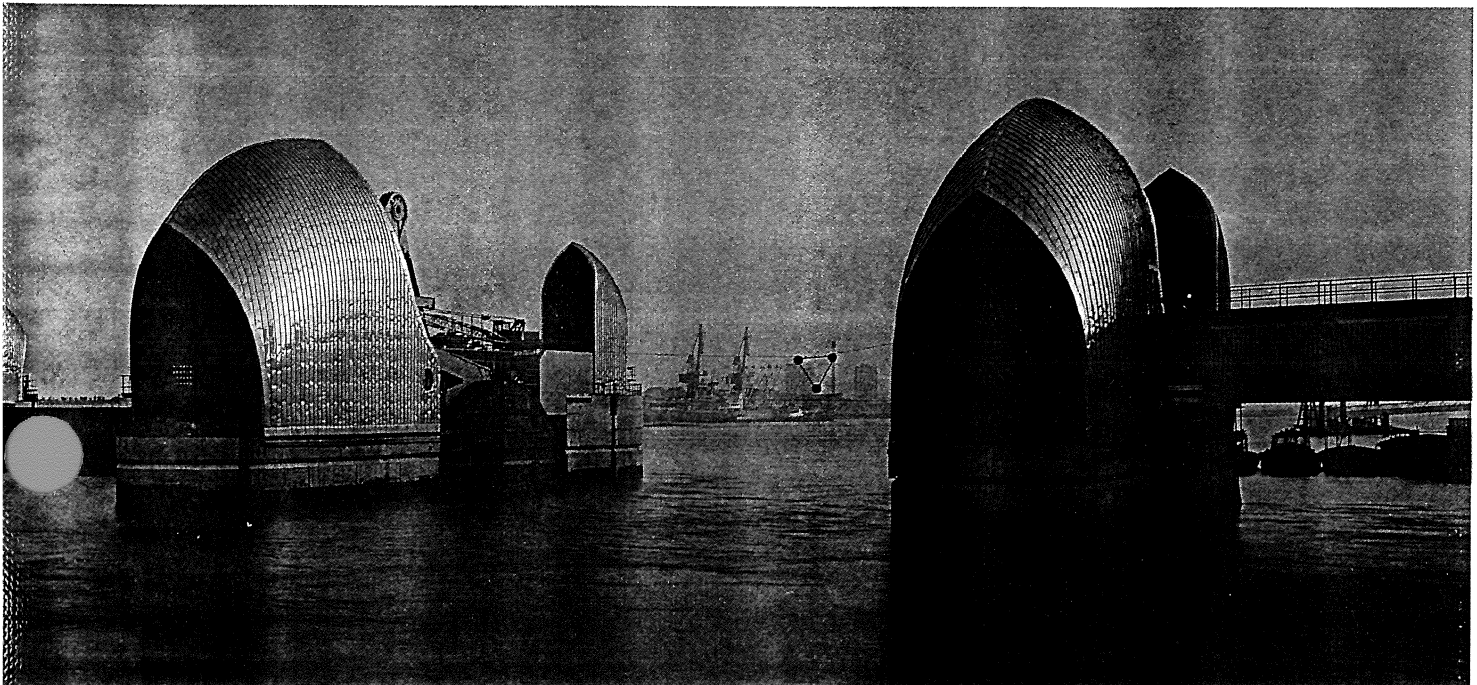


One of the major volume applications for MONEL alloy 400 strip, "Pop"[®] rivets for uses ranging from airframes to transport/storage containers, was illustrated in this picture prepared for a press advertisement in the seventies.

Made in Sweden, this heat exchanger has MONEL alloy 400 tubes and explosively bonded alloy 400-clad steel tubeplates. The alloy was selected to resist corrosion by chlorinated hydrocarbons inside the tubing and cooling water outside.



MONEL alloys 400 and K-500 are used in oil wellhead hardware, pumps and valves.



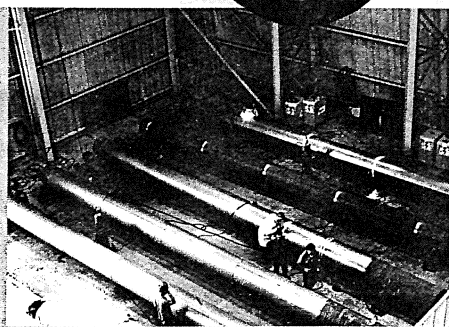
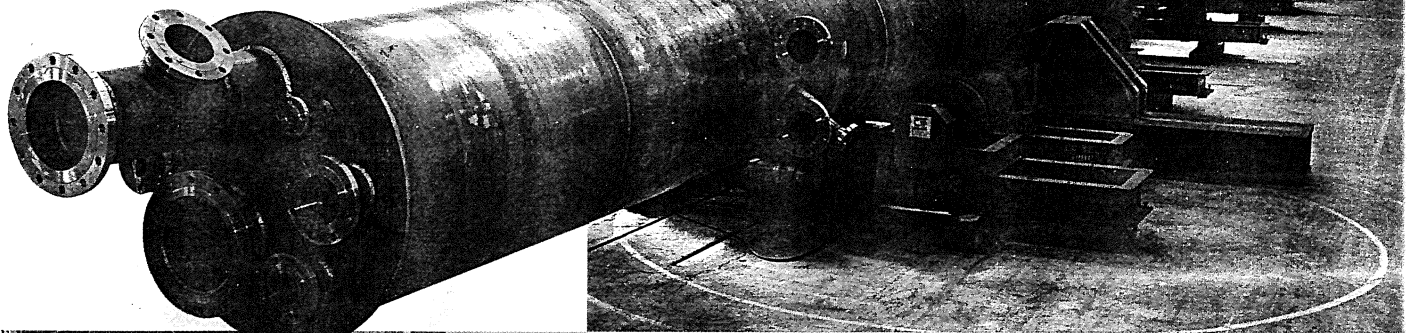


Today

and for the years to come

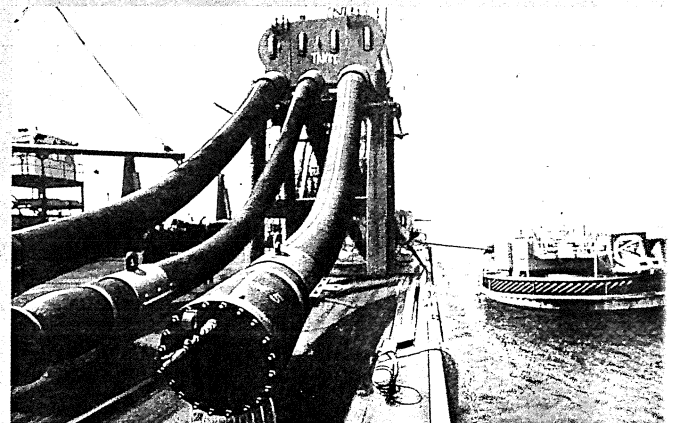
Ninety years later, the MONEL alloys have outgrown their original applications in architecture and domestic interiors, and grown through their wartime duties to a wide range of general engineering uses where their combination of strength and corrosion-resistance has made them the cost-effective materials of choice in service around the world. At the latest count, it is estimated that the North American facilities alone of Inco Alloys International have produced and delivered more than one and a half billion pounds (675,000 tonnes) of the MONEL alloys since their introduction ninety years ago.

► A drain caisson for an offshore gas platform. 47 metres long, weighing 41 tonnes, it was made of 26 mm double-clad steel plate, with a 2 mm cladding of MONEL alloy 400 on either side of the steel.

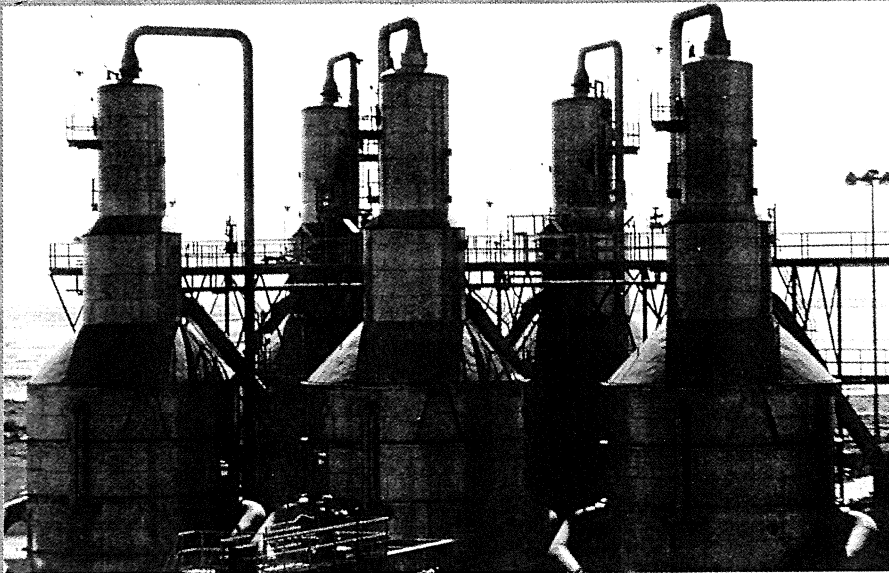


▲ Welding MONEL alloy 400 sheet onto steel riser pipes for an offshore production platform. Used in the splash zone, the alloy is resistant to mussel build-up. Operators report no difficulty in clearing other types of marine fouling.

◀ MONEL alloy 400 tubes resist general corrosion and pitting caused by CO₂ in MEA reboilers and boiler water feed pre-heaters used in the production of hydrogen.



▲ Submarine oil hose for connection from supertankers to on-shore tank farms in Saudi Arabia. Connections are secured with MONEL alloy 400 nuts and bolts.

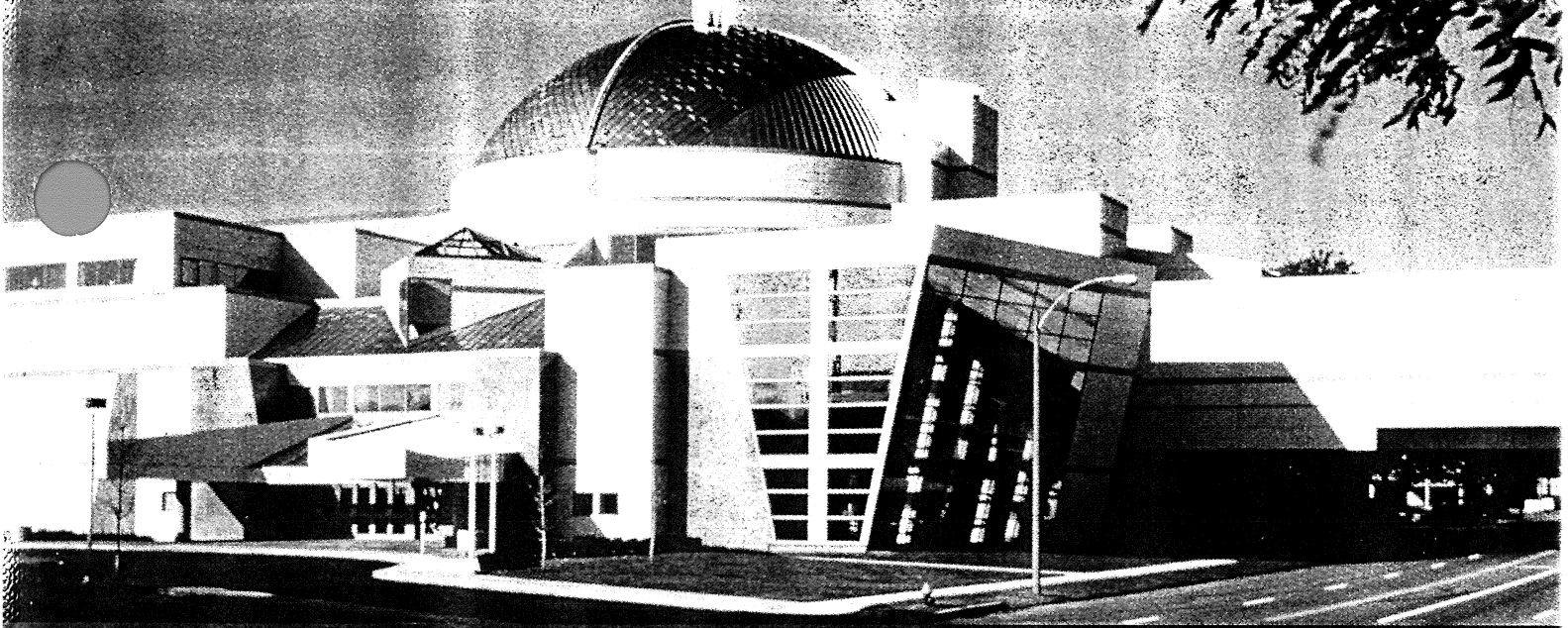


◀ Part of the crystallization process facilities, converting Dead Sea brine to potash for fertilizers at the Safi works of The Arab Potash Co., in Jordan. MONEL alloy 400 is used for pipe systems fabricated from seam-welded plate.

▼ MONEL alloy 400 evaporator vessels are included in this quadruple-effect salt plant producing 1200 tons of salt a day, in Mexico.



▲ Non-magnetic MONEL alloy K-500 is specified for the anchor chains of the U.S. Navy's Osprey-class minehunters.



▲ Over 80 years since the first use on the Pennsylvania Railroad station in New York City, MONEL alloy 400 is still a prime choice as a roofing material – here for the dome of the St. Louis Science Center. 19,000 lb (8.5 tonnes) of alloy sheet was used in this impressive construction.

1905 – 1995
MONEL

four score years and ten

MONEL alloy 400

A nickel-copper alloy with high strength and excellent corrosion resistance in a range of media including sea water, hydrofluoric acid, sulfuric acid and alkalis. Used for marine engineering, chemical and hydrocarbon processing equipment, valves, pumps, shafts, fittings, fasteners and heat exchangers. Standard product forms are round, hexagon, flats, forging stock, pipe, tube, plate, sheet, strip and wire.

Limiting chemical composition, %

Ni*	63.0 min	Mn	2.0 max	Si	0.5 max
Cu	28.0 - 34.0	C	0.3 max		
Fe	2.5 max	S	0.024 max		

* Plus Co

Typical mechanical properties (annealed)

Tensile strength, psi	80,000
MPa	550
Yield strength (0.2% offset), psi	35,000
MPa	240
Elongation, %	40

MONEL alloy K-500

An age-hardenable nickel-copper alloy that combines the corrosion resistance of MONEL alloy 400 with greater strength and hardness. It also has low permeability and is non-magnetic to under -150°F (-101°C). Used for pump shafts, oil-well tools and instruments, doctor blades and scrapers, springs, valve trim, fasteners and marine propeller shafts. Standard product forms are round, hexagon, flats, forging stock, pipe, tube, plate, sheet, strip and wire.

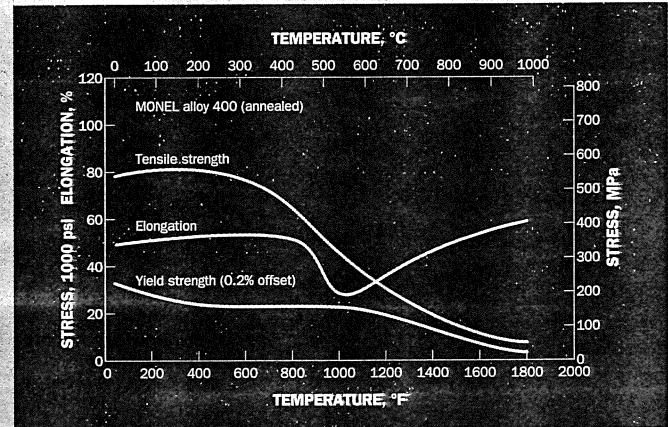
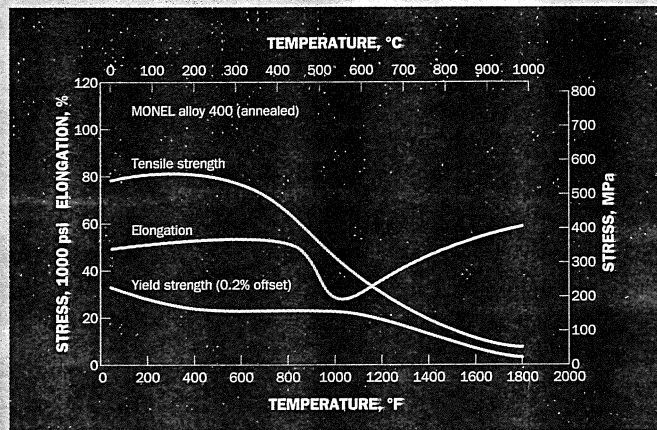
Limiting chemical composition, %

Ni*	63.0 min	Ti	0.35 - 0.85	Mn	1.5 max
Cu	27.0 - 33.0	Fe	2.0 max	S	0.01 max
Al	2.30 - 3.15	C	0.25 max	Si	0.5 max

* Plus Co

Typical mechanical properties (age-hardened)

Tensile strength, psi	160,000
MPa	1100
Yield strength (0.2% offset), psi	115,000
MPa	790
Elongation, %	20



Physical constants and thermal properties

Density, lb/in ³	0.318
g/cm ³	8.80
Melting range, °F	2370 - 2460
°C	1300 - 1350
Specific heat, Btu/lb•°F	0.102
J/kg•°C	427
Curie temperature, °F	70 - 120
°C	20 - 50
Coefficient of expansion, 70 - 200°F, 10 ⁻⁶ in/in•°F	7.7
21 - 93°C, μm/m•°C	13.9
Thermal conductivity, Btu•in/ft ² •h•°F	151
W/m•°C	21.8
Electrical resistivity, ohm•circ mil/ft	329
μΩ•m	0.547

Specifications and designations

UNS N04400	BS 3072 - 3076 (NA 13)
ASTM B 127, B 163 - B 165, B 564	AECMA PrEN 2305
ASME SB-127, SB-163 - SB-165, SB-564,	AFNOR NU30
Boiler Code Sections III, IV, VIII, IX	VdTUV 263
SAE AMS 4544, 4574, 4575, 4675,	QQ-N-281
4730, 4731, 7233	NACE MR-01-75
DIN 17743, 17750 - 17754	
Werkstoff Nr. 2.4360, 2.4361	
MIL-T-1368, MIL-T-23520, MIL-N-24106	

Physical constants and thermal properties

Density, lb/in ³	0.305
g/cm ³	8.44
Melting range, °F	2400 - 2460
°C	1315 - 1350
Specific heat, Btu/lb•°F	0.100
J/kg•°C	419
Curie temperature, °F	-150
°C	-65
Permeability at 200 oersted (15.9 kA/m)	1.002
Coefficient of expansion, 70 - 200°F, 10 ⁻⁶ in/in•°F	7.6
21 - 93°C, μm/m•°C	13.7
Thermal conductivity, Btu•in/ft ² •h•°F	121
W/m•°C	17.5
Electrical resistivity, ohm•circ mil/ft	370
μΩ•m	0.615

Specifications and designations

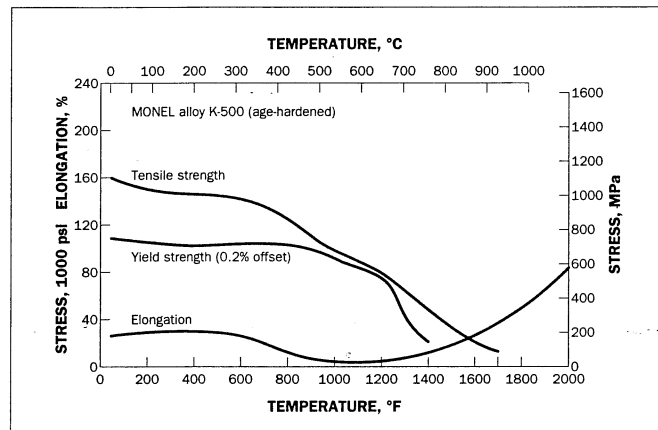
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BS 3072 - 3076 (NA 18)
ASME Boiler Code Section VIII
SAE AMS 4676
DIN 17743, 17752, 17754
Werkstoff Nr. 2.4375
MIL-N-24549
QQ-N-286
NACE MR-01-75



INCO ALLOYS
INTERNATIONAL

CORRECTION

The graphs on page 18 of this edition of "Inco Alloys News" are, incorrectly, printed as the same for both of the MONEL[®] alloys. The graph on the left, for MONEL[®] alloy 400, is correct. The graph for the age-hardenable MONEL[®] alloy K-500 should read as follows:



We apologise to our readers for this confusion.

MONEL is a trademark of the Inco family of companies.



**INCO ALLOYS
INTERNATIONAL**

ALLOY PRODUCTS

Nickel 200, 201, 205,
212, 213, 270 & 290.

PERMANICKEL® alloy 300.

DURANICKEL® alloy 301.

MONEL® alloys 400, 401,
404, R-405, 450
& K-500.

INCONEL® alloys 600, 601,
601GC®, 617,
622†, 625, 625LCF®,
686, 690, 706, 718,
718SPF™, 725, X-750,
751, 783, MA 754
& MA 758.

INCOLOY® alloys 800, 800H,
800HT®, 801, 802,
803, 825, 840,
903, 907, 908,
909, 925,
MA 956 & DS.

INCO® alloys 330, A-286,
G-3, C-276,
25-6MO, 020,
HX, MS 250
& Waspaloy.

NIMONIC® alloys 70, 75,
80A, 81, 86, 90,
91, 101, 105, 108,
115, 263, 901,
PE11, PE16
& PK33.

NIMOLOY® alloy PK37.

NI-SPAN-C® alloy 902.

BRIGHTRAY® alloys B, C, F, S,
35 & ICA.

NILO® alloys 36, 42,
48, 475, 55
& K.

NILOMAG® alloy 77.

FERRY® alloy.

**Electroformed nickel foil &
MAXORB® surface treated nickel foil.**

**Welding electrodes, filler metals & fluxes,
including the NI-ROD®, INCO-WELD® and
INCOFLUX® welding products.**

**Incotherm mineral-insulated, metal-sheathed
(MIMS) thermocouple cables, cable tubing
and thermocouple wires.**

**BRIGHTRAY, DURANICKEL, INCO, INCOFLUX,
INCOLOY, INCONEL, INCO-WELD, MAXORB,
MONEL, NILO, NILOMAG, NIMOLOY, NIMONIC,
NI-ROD, NI-SPAN-C, PERMANICKEL, 601GC,
625LCF, 718SPF & 800HT are trademarks of
the Inco family of companies.**

† Not for sale in all countries.
Please inquire for details.

PRODUCT FORMS

Rod, bar, hexagons, flats, squares,
pipe, tube, plate, sheet, strip, foil,
wire, forgings and extruded sections.

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INCO ALLOYS LTD.



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Birmingham, England.

DEFINITION OF DEFECTS

BRINELLING - Occurrence of shallow, spherical depressions in a surface, usually produced by a part having a small radius in contact with the surface under high load. **RADIUS**

BURNING - Polishing of one surface by sliding contact with a smooth, harder surface. Usually no displacement nor removal of metal.

BURR - A small, thin section of metal extending beyond a regular surface, usually located at a corner or on the edge of a bore or hole.

CORROSION - Loss of metal from the surface by chemical or electrochemical action. The corrosion products generally are easily removed by mechanical means. Iron rust is an example of corrosion.

CRACK - A physical separation of two adjacent portions of metal, evidence by a fine or thin line across the surface, caused by excessive stress at that point. It may extend inward from the surface from a few thousandths inch to completely through the section.

CUT - Loss of metal, usually to an appreciable depth over a relatively long and narrow area, by mechanical means, as would occur with the use of a saw blade, chisel or sharp-edged stone striking a glancing blow.

DENT - Indentation in a metal surface produced by an object striking with force. The surface surrounding the indentation will usually be slightly upset.

EROSION - Loss of metal from the surface by mechanical action of foreign objects, such as grit or fine sand. The eroded area will be rough and may be lined in the direction in which the foreign material moved relative to the surface.

CHATTERING - Breakdown or deterioration of metal surface by vibratory or "chattering" action. Usually no loss of metal or cracking of surface but generally showing similar appearance.

GALLING - Breakdown (or build-up) of metal surfaces due to excessive friction between two parts having relative motion. Particles of the softer metal are torn loose and "welded" to the harder.

GOUGE - Grooves in, or breakdown of, a metal surface from contact with foreign material under heavy pressure. Usually indicates metal loss but may be largely displacement of material.



INCLUSION - Presence of foreign or extraneous material wholly within a portion of metal. Such material is introduced during the manufacture of rod, bar or tubing by rolling or forging.

NICK - Local break or notch on edge. Usually displacement of metal rather than loss.

PITTING - Sharp, localized breakdown (small, deep cavity) of metal surface, usually with defined edges.

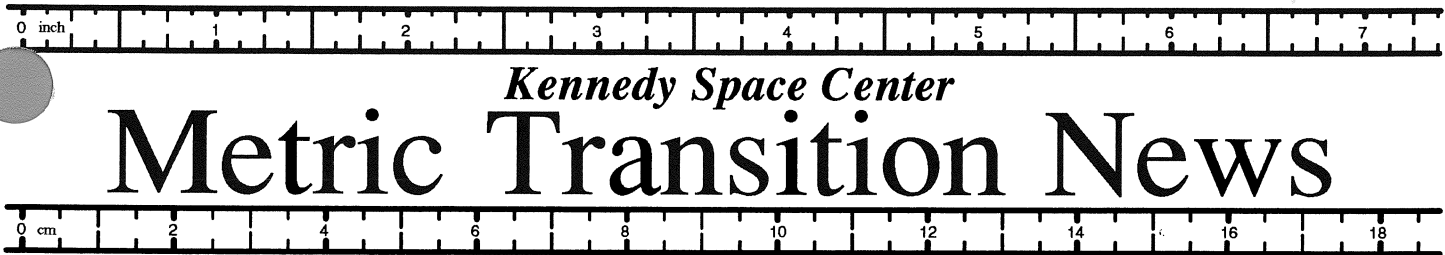
SCRATCH - Slight tear or break in metal surface from light, momentary contact by foreign material.

SCORE - Deeper (than scratch) tear or break in metal surface from contact under pressure. May show discoloration from temperature produced by friction.

STAIN - A change in color, locally causing a noticeably different appearance from the surrounding area.

UPSETTING - A displacement of material beyond the normal contour or surface (a local bulge or bump). Usually indicates no metal loss.





Kennedy Space Center

Metric Transition News

August 1992

This special edition of the *Metric Transition News* is being sent to every KSC employee. It provides basic information about the metric system, reasons for metrication, and other metric trivia. On pages 1 and 2 is an updated metric conversion card, KSC Form 21-603, to cut out and keep. Test your knowledge of the metric system with the crossword puzzle on page 4. Many of the answers can be found in this newsletter. Answers will be published in the September issue.

The *Metric Transition News* is normally a quarterly newsletter that gives updates to metric activities throughout NASA and KSC. The regular issues of the *Metric Transition News* are sent to every civil service employee and each contractor office. If you have not seen the June 1992 issue, please ask your office manager to circulate a copy of it for your information.

NASA Transition to Metric. Executive Order 12770 mandates the Federal Government to transition to the metric system "to the extent economically feasible." For NASA, this means that many existing programs shall remain in English units. Exempted programs include Shuttle, ASRM, Flight Attendant, Robotic Servicer, Extended Duration Orbiter, Space Station Freedom, and existing expendable launch vehicles. All programs approved after October 1990 will be metric.

NASA currently has nine pilot construction projects planned for an estimated \$15 million. The projects range from a parking lot paving project to office and laboratory buildings to a payload fabrication and integration facility.

KSC Transition to Metric. Not everyone at KSC will have to convert to metric immediately. Those people working on exempted programs shall continue business as usual. Everyone else will be transitioning to metric.


KSC Metric Planning Group (KMPG). The KSC Metric Planning Group is KSC's metric transition coordination team. Please call on the team members, listed below, if you have suggestions, questions, or comments about metrication or the metric system itself.

- DM-MED-33/Larry Schultz (Chairperson) 7-7584
- DM-MED-33/Elisa Artusa (Vice Chairperson) 7-7584
- DF-ESD-2/Bobby Nelson 7-7537
- CP-FGO/Enoch Moser 7-7651
- OP-AMS/Kim Lepore 7-7353
- PA-PIB/Bruce Buckingham 7-2468
- PM-TNG/Jim Norman, Don Colby 7-2737
- SI-PEI-1B/John Riley, Kristen Berland 7-4737
- SI-SAT-1/Michael Murray, Kyle Longstreth 7-3493
- SI-M-LLP-5/Tom Cain 7-2720

In addition, KSC metrication activities include issuance of KMI 8010.2 (*Use of the Metric System Of Measurement in KSC Facilities, Systems, and Equipment*), KHB 8010.2 (*KSC Metric Transition Plan*), and DE-MI 8010.2 (*Metric System*).

These documents are available from the Forms Warehouse. Standards and specifications are being revised to include metric equivalence and a KSC SI Guide is being written. The Reference Library has a shelf devoted to metric information. Studies are being conducted for metrication of the proposed NLS facilities and of threaded fastener inventories. Awareness programs are being devised in the OP and CM directorates. Some laboratories have had dual system and metric equipment for many years, like the Metrology and Calibration Laboratories. Others, such as the Prototype Laboratory, are purchasing new equipment and setting up for metric business. Plans are beginning for the pilot construction project—the Transporter Canister Rotation Facility Operations Building to be located on the south side of the Industrial Area.

Let us know what your office is doing to transition to the metric system and we will publish it in the next newsletter.

 SI Metric Units for Engineering Use	
National Aeronautics and Space Administration John F. Kennedy Space Center Kennedy Space Center, Florida 32899	
Length	1 in = 25.4 mm* 1 mm = 0.039 in 1 ft = 0.3048 m* 1 cm = 0.39 in 1 yd = 0.9144 m* 1 m = 3.281 ft 1 stmi = 1.6093 km 1 km = 0.621 stmi 1 nmi = 1.852 km 1 km = 0.540 nmi
Area	1 in ² = 645.16 mm ² mm ² = 0.0016 in ² 1 ft ² = 0.0929 m ² m ² = 0.155 in ² 1 yd ² = 0.836 m ² m ² = 10.764 ft ² 1 mi ² = 2.589 km ² km ² = 0.386 mi ² 1 acre = 0.4047 ha km ² = 247 acres 1 ha = 2.471 acres
Volume	1 barrel (42 US gal) = 0.159 m ³ 1 fluid oz = 29.57 cm ³ = 29.57 mL 1 gal = 3.785 L 1 qt = 0.946 L
Electrical Units	1 Ah = 3600 C
Pressure	1 psi = 6.895 kPa 1 torr = 0.133 kPa 1 mbar = 0.100 kPa* 1 kip/in ² = 6895 kPa 1 lb/ft ² = 0.0479 kPa 1 in of Hg = 3.3864 kPa
Temperature	100 °C = 212 °F °F = 9/5 x °C + 32 37 °C = 98.6 °F °C = 5/9 x (°F - 32) 21 °C = 70 °F K = °F + 1.8 0 °C = 32 °F K = °C + 273.16 -40 °C = -40 °F °C = 1.8 °F °F = 0.56 °C
Mass	1 lb = 0.454 kg 1 lb/ft ³ = 16.033 kg/m ³ 1 lb/in ³ = 27.68 g/cm ³
Force	1 pdl = 0.138 N 1 lbf = 4.448 N 1 lbf/ft = 14.594 N/m 1 lbf/in = 175.126 N/m
Thermal Energy	1 Btu/h-ft °F = 1.713 W/m K 1 Btu/h = 0.293 W 1 Btu/ft ² = 11.357 J/m ² 1 Btu/lb = 2326 J/kg 1 cal = 4.187 J 1 cal/s = 4.187 W 1 cal/g = 4187 J/kg
Mechanical Energy	1 in-lb = 0.113 J 1 ft-lb = 1.356 J 1 Hp-hr = 2.685 MJ 1 Hp = 745.7 W
Speed/Velocity	1 ft/s = 0.3048 m/s 1 knot = 0.5148 m/s 1 mi/h = 1.6093 km/h 1 km/h = 0.28 m/s
Acceleration	1 ft/s ² = 0.3048 m/s ² 32.174 ft/s ² = 9.807 m/s ²

NAS 10000: *NAS Documents Preparation and Maintenance in SI (Metric) Units*

NAS 10001: *Preferred Metric Units for Aerospace*

Bibliography:

American Metric Journal, *SI for Use in Design and Construction*. AMJ Publishing Co., Murrieta, California, Volume XVIII, Unit 4 July/August 1990, p. 32.

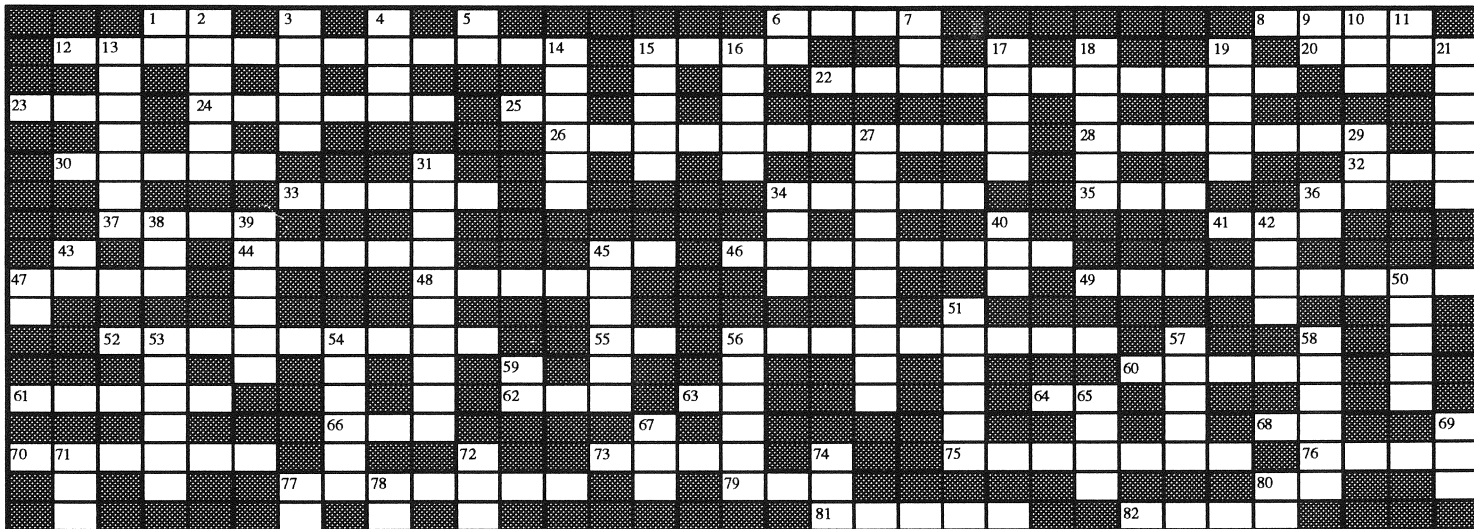
American Society of Testing and Materials. ASTM E380, *Standard Prac-*

tice for Use of the International System of Units (SI) (The Modernized Metric System), 1991.

The Construction Subcommittee of the Metrication Operating Committee of the Interagency Council on Metric Policy. *Metric Guide for Federal Construction*. National Institute of Building Sciences, Washington, 1991

NASA Lewis Research Center, *Metric (SI) Guide*, 1992.

Webster's Ninth New Collegiate Dictionary. Merriam-Webster Inc., Springfield, Massachusetts, 1986, p. 748.



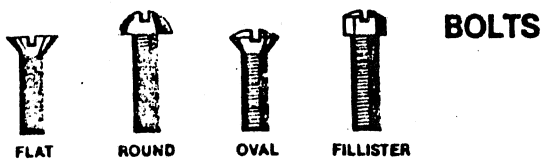
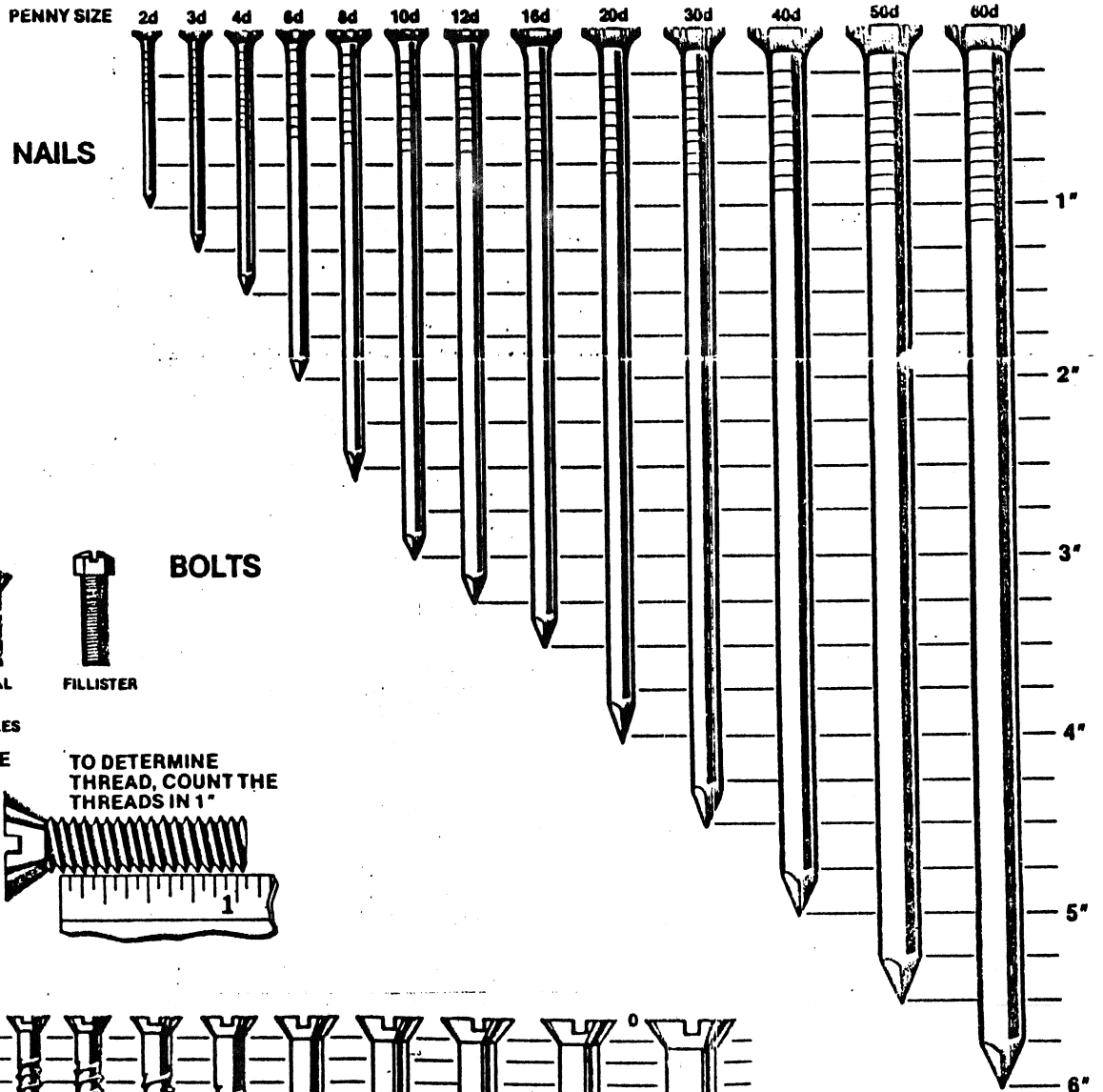
ACROSS

1. One thousand units of power, abbr.
6. Prefix: 10^6
8. English unit of dry-measure volume; 1/4 bushel
12. m/s^2 or ft/s^2
15. He signed the legislation in 1988 making the metric system the preferred system of measurement in the U.S.
20. An amount of a substance, or a church service
22. Conversion of one system of units to the metric system
23. Deg, _____, sec; 1/360 of a circle
24. English liquid measure equal to 128 ounces
25. Short for attowatt (watt times 10^{-18})
26. Measured in °C, °F, °R, or K
28. Unit of electric charge, named for Charles A. de _____
30. Prefix: 10^2
32. Decimal system base
33. English unit of radioactivity, named for Marie & Pierre _____
34. Omnibus _____ and Competitiveness Act of 1988
35. English system counterpart of N
36. Greek symbol for permeability
37. m^2 or ft^2 , for example
41. Metric counterpart of lbm (pounds-mass)
44. MKS system unit length
45. Short for petameter (meter times 10^{15})
46. Psi or Pa
47. Three of 55 Across
48. Executive _____ 12770
49. SI units of mass
52. Solid angle measurement of a sphere
55. Short for English unit of length, or what has toes and a heel
56. One tenth of SI unit length
60. Its SI unit is a newton
61. Unit of inductance, named after Joseph _____
62. Unit of illumination
63. Measure of atmospheric pressure: mm of _____
64. SI unit of power times 10^6 , abbr.
66. English unit of length equal to 5.029 meters
68. One billionth of unit of electric potential, abbr. m^3 or in^3
70. 6.022×10^{23} molecules, or a yard pest
73. SI unit for large area ($10\,000\,m^2$)
75. English unit of length, or division of a ruler
76. English unit of length, or division of a ruler
77. Temperature scale where water boils at 100 degrees
79. Prefix: 10^{18}
80. 1000 SI units of force, abbr.
81. Millimeters to meters (1000:1), for example
82. Prefix: 10^{15}

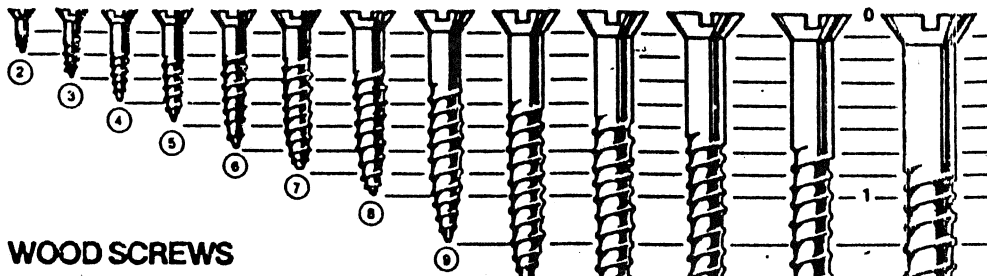
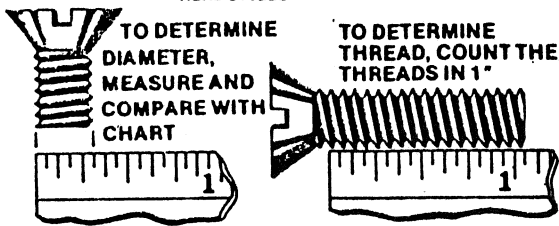
DOWN

1. 1000 units of electric charge, abbr.
2. Kilograms times $9.807\,m/s^2$
3. Unit of magnetic flux density, named after Nikola _____; or name of popular rock music group
Prefix: 10^{-9}
4. International System of Units, abbr.
6. One thousandth of a unit of inductance, abbr.
7. Metric Conversion _____ of 1975
9. Short for exameter (meter times 10^{18})
10. English unit of thermal energy, abbrev.; food energy unit
11. Short for kilosecond (second times 10^3)
13. Unit of luminous intensity
14. Kilogram times a meter per square second ($kg \cdot m/s^{-2}$)
15. Country not yet converted to the metric system
16. Miles per hour, for example
17. SI liquid measure equal to 1.06 quarts
18. SI unit of pressure, named after Blaise _____
19. SI unit of work or energy, named after James P. _____, sounds like "jewel"
21. Unit of time, or not first
27. Period of change, or KSC Metric _____ Plan, KHB 8010.2
29. British thermal unit, abbr.
31. μF , one millionth of unit of capacitance
34. Unit of pressure, rhymes with "more"
36. One thousandth of SI unit length
38. Plane ang. measurement: 2π of these per 360 deg
39. Unit of electric current, named for Andre-Marie _____
40. 100 square meters, or form of verb "to be"
42. Prefix: 10^9
43. Short for hectare
45. Pico, or femto, for example
47. Short for 47 Across
50. Prefix: 10^{-3}
51. Volume divided by area, or linear measurement
53. Measured in newton-meters (SI) or foot-pounds (English)
54. Unit of temperature
56. Celsius scale division
57. Measured in watts (SI) or horsepower (English)
58. Absolute temperature scale
59. One thousandth of a liter, abbr.
65. Unit of power, named after James _____
67. 1000 kilograms or 2000 pounds
69. Unit of conductance
71. Inverse of 66 Down, named after Georg S. _____
72. Short for kilopound (1000 pounds)
74. English unit of pressure, or a serving of chocolate candy
77. 10 mm
78. English unit of wt.
80. One thousand units of current, abbr.

This newsletter was published by DM-MED-33. Please direct any questions, comments or suggestions to Elisa Artusa or Larry Schultz at 867-7584.



HEAD STYLES

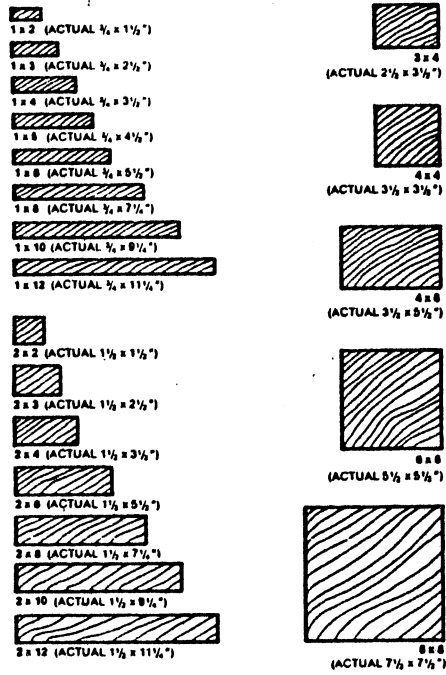


WOOD SCREWS

LENGTH	GAUGE NUMBERS																									
	0	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	24								
1/4 INCH																										
3/8 INCH			2	3	4	5	6	7																		
1/2 INCH			2	3	4	5	6	7	8																	
5/8 INCH				3	4	5	6	7	8	9	10															
3/4 INCH					4	5	6	7	8	9	10	11														
7/8 INCH						6	7	8	9	10	11	12														
1 INCH							6	7	8	9	10	11	12	14												
1 1/4 INCH								7	8	9	10	11	12	14	16											
1 1/2 INCH									6	7	8	9	10	11	12	14	16	18								
1 3/4 INCH										8	9	10	11	12	14	16	18	20								
2 INCH											8	9	10	11	12	14	16	18	20							
2 1/4 INCH												9	10	11	12	14	16	18	20							
2 1/2 INCH													12	14	16	18	20									
2 3/4 INCH															14	16	18	20								
3 INCH																16	18	20								
3 1/2 INCH																	18	20	24							
4 INCH																		18	20	24						

WHEN YOU BUY SCREWS, SPECIFY (1) LENGTH, (2) GAUGE NUMBER, (3) TYPE OF HEAD—FLAT, ROUND, OR OVAL, (4) MATERIAL—STEEL, BRASS, BRONZE, ETC., (5) FINISH—BRIGHT, STEEL BLUED, CADMIUM, NICKEL, OR CHROMIUM PLATED

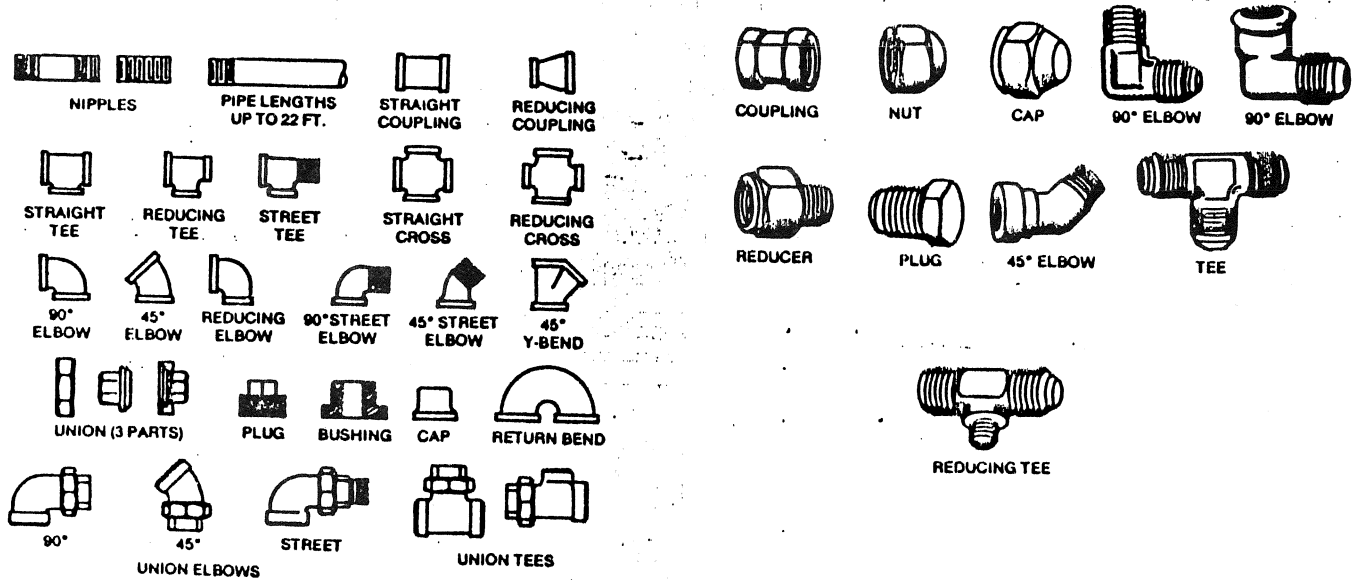
STANDARD LUMBER SIZES



ABRASIVE PAPER GRADES			
GRIT	EQUIV. "O" SERIES	GENERAL DESCRIPTION	REMARKS
800	—	SUPER-FINE	USED FOR WET SANDING PRODUCES HIGH SATIN FINISH
500	—		
400	10/0		
360	—		
320	9/0	VERY FINE	GENERAL RANGE OF ABRASIVE PAPERS USED FOR WET SANDING LACQUER AND VARNISH TOP COATS
280	8/0		
240	7/0		
220	6/0*	FINE	USED FOR DRY SANDING ALL FINISHING UNDERCOATS. THESE GRADES WILL NOT SHOW SANDING MARKS
180	5/0		
150	4/0*	MEDIUM	FOR FINAL SANDING OF BARE WOOD. GOOD FOR SMOOTHING OLD PAINT
120	3/0		
100	2/0*		
80	1/0	COARSE	USE FOR GENERAL WOOD SANDING. GOOD FOR FIRST SMOOTHING OF OLD PAINT, PLASTER PATCHES
60	1/2*		
50	1		
40	1 1/2		
38	2	VERY COARSE	ALL TOO COARSE FOR PAD SANDERS. THESE GRADES REQUIRE HEAVY MACHINES AND HIGH SPEED TO CUT WELL
30	2 1/2		
24	3		

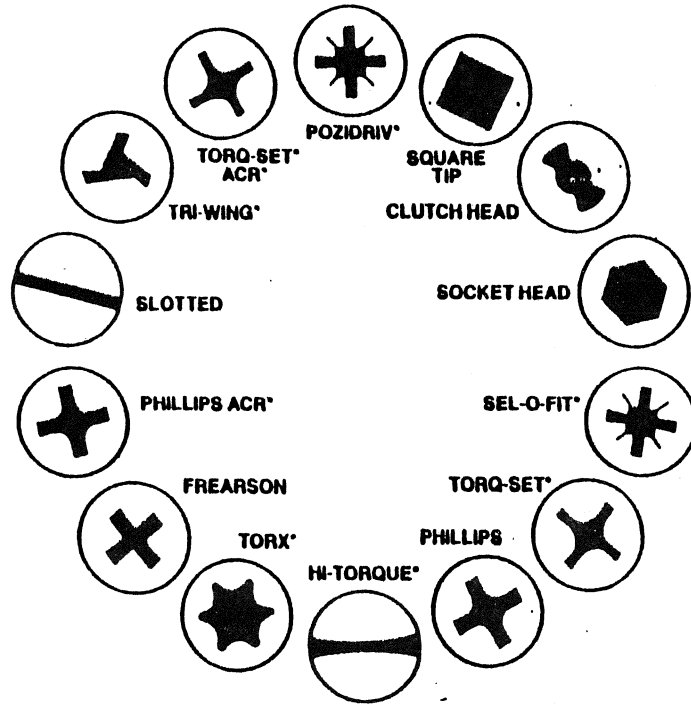
Grades generally supplied as Very Fine, Fine, Medium and Coarse

PIPE FITTINGS



STANDARD STEEL PIPE (All Dimensions in Inches)					
Nominal Size	Outside Diameter	Inside Diameter	Nominal Size	Outside Diameter	Inside Diameter
1/8	0.405	0.269	1	1.315	1.049
1/4	0.540	0.364	1 1/2	1.660	1.380
3/8	0.675	0.483	2	1.900	1.610
1/2	0.840	0.622	2 1/2	2.375	2.067
3/4	1.050	0.824		2.875	2.469

APEX[®]



SCREW FASTENER HEAD
CONFIGURATION/MFG

General Information

SAFETYING OF BOLTS, NUTS, AND PINS

Lockwire

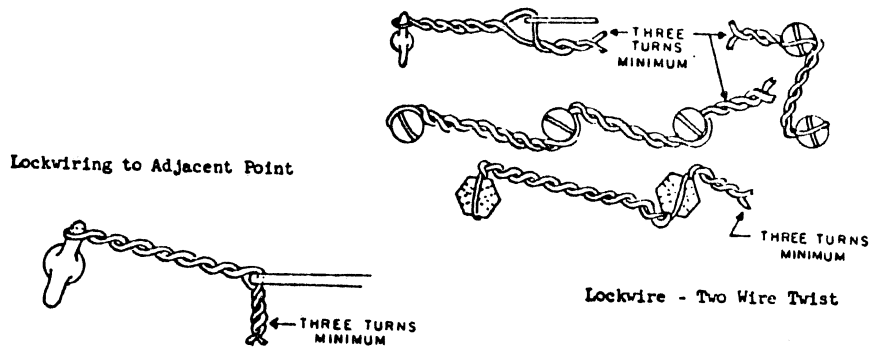
There are two types of lockwire:

Carbon Steel - AN995-F zinc coated, Spec. AN-W-22.
Inconel - AN995-N, Spec. AN-N-4 Cond. A (annealed).

Inconel wire is used adjacent to compass installations and for high temperature applications.

Where carbon steel or inconel wire of a diameter smaller than 0.040-inch is specified on the drawing, carbon steel or inconel wire of 0.040-inch diameter may be used provided no interference occurs.

Lockwire should be installed only one time. If the wire is removed for any reason, it should be destroyed. Kinks and sharp bends should not be made in lockwire. Lockwire should also be as short as possible, attached in the most direct way using the two wire twist only, and installed so that the lockwire tends to tighten the bolt or nut. The ends of the wire should have a minimum of three turns.



When safetying to an adjacent point, the lockwire should be as short as possible and attached in the most direct way.

NOTE

All illustrations are for right-hand thread.
Reverse procedure for left-hand thread.

NOTE

Lockwire must pass over the head of the head of the bolt, but can pass over or around the head of screws.

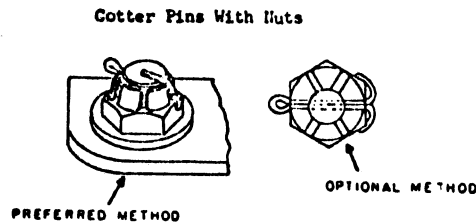
(Cont'd)

Cotter Pins

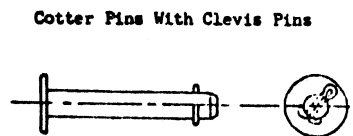
Cotter pins are used to secure nuts and pins. They are installed only once. If the pin is removed for any reason, it is destroyed. Sharp bends should be avoided when installing cotter pins.

For correct safetying, the center of the hole must not be past the top of the castellated nut.

Castellated nuts can be secured with either lockwire or cotter pins.



The preferred method should be used **wherever** possible. The optional method should be used only when the preferred method presents installation difficulties or interferes with clothing or equipment.



All cable turnbuckle assemblies should be installed, adjusted, and safetyed in accordance with Process Specification FA6-2.

NOTE: When dimensions are given in inches, they are to be used for the purpose of determining the tolerance of the dimensions. The tolerance of the dimensions may be determined by referring to the United States Government Specification for the tolerance of the dimensions. The tolerance of the dimensions may be determined by referring to the United States Government Specification for the tolerance of the dimensions. The tolerance of the dimensions may be determined by referring to the United States Government Specification for the tolerance of the dimensions.

MATERIAL	NOMINAL WIRE DIAMETER						NOTES
	.015	.020	.032	.040	.047	.091	
NI-CU ALLOY (MONEL)		NC20	NC32	NC40		NC51	NC91 (3)
NI-CR-FE ALLOY (INCONEL)		N20	N32	N40		N51	N91 (3)
CARBON STEEL ZINC-COATED		F20	F32	F41	F47		F91
CORROSION-RESIST. STEEL		C15	C20	C32	C41	C47	C91
ALUMINUM ALLOY (BLUE)		AB20	AB32	AB41	AB47		AB91 (3)
COPPER (YELLOW)		CY15	CY20				(2 & 4)

WIRE TOLERANCE SHALL BE IN ACCORDANCE WITH VALUES SPECIFIED IN THE APPLICABLE WIRE MATERIAL SPECIFICATION.

- MATERIAL: (DESIGNATED BY PREFIX LETTER REPLACING DASH BEFORE FIRST DASH NUMBER)
- F - CARBON STEEL, ZINC-COATED, SPECIFICATION QQ-W-461, ANSI NUMBERS 1006, 1010, OR 1015, ANNEALED.
 - C - CORROSION-RESISTANT STEEL, SPECIFICATION QQ-W-423, FORM 1, COMPOSITION 302 OR 304, CONDITION A.
 - N - NICKEL-CHROMIUM-IRON ALLOY, SPECIFICATION QQ-W-390, TEMPER A, ANNEALED.
 - NC - NICKEL-COPPER ALLOY, SPECIFICATION QQ-W-281, CLASS A, FORM 7, ANNEALED.
 - CY - COPPER, SPECIFICATION QQ-W-343, TYPE "S", ANNEALED, CADMIUM PLATED IN ACCORDANCE WITH QQ-P-418, TYPE II, CLASS 2 (GOLDEN YELLOW).
 - AB - ALUMINUM ALLOY WIRE 8086 ANODIZED, DYED BLUE IN ACCORDANCE WITH MIL-A-8625, TYPE I OR II, CLASS 2, COLOR EQUIVALENT TO NUMBERS 15102 OR 25102 IN ACCORDANCE WITH FED STD 595.

DASH NUMBERS INDICATE WIRE MATERIAL AND DIAMETER IN THOUSANDTHS OF AN INCH. ADDITIONAL DASH NUMBERS INDICATING LENGTH IN INCHES ARE FOR REFERENCE ONLY AND SHALL NOT BE USED FOR PROCUREMENT OR STOCKING.

WIRE SIZES .015 TO .041 INCH IN DIAMETER SHALL BE FURNISHED ON SPOOLS CONTAINING 1 TO 5 POUNDS EACH.
WIRE SIZE .047 TO .091 SHALL BE FURNISHED ON SPOOLS OR REELS CONTAINING 5 TO 10 POUNDS EACH.

- EXAMPLES OF PART NUMBERS
- MS 20995 CY20 - COPPER, CADMIUM PLATED, YELLOW, SHEAR OR SEAL WIRE, .020 DIA.
 - MS 20995 AB32 - ALUMINUM ALLOY, ANODIZED, BLUE, .032 DIA.

- DIMENSIONS IN INCHES:
- DESIGN AND USAGE LIMITATIONS (NOTES):
- (1) FOR GENERAL PRACTICES FOR SAFETY WIRING, USE MS 33540.
 - (2) FOR LOCK WIRING OF TURNBUCKLES, USE MS 33591 AND MS 33736.
 - (3) INCONEL WIRE (UNCOATED) USE FOR GENERAL LOCK WIRE AT TEMPERATURES 700°F AND ABOVE. MONEL WIRE (UNCOATED) USE FOR GENERAL LOCK WIRE AT TEMPERATURES UP TO 700°F. COPPER (CY) WIRE USE FOR SHEAR OR SEALING WIRE, ALUMINUM ALLOY (AB) USE FOR LOCK WIRE WITH MAGNESIUM.
 - (4) CADMIUM PLATED COPPER IS NOT TO BE USED IN SPACE APPLICATIONS.

ENTIRE STANDARD REVISED.

APPROVED 3 JAN 57 REVISED 87 SEP 74

TITLE WIRE, SAFETY OR LOCK	MILITARY STANDARD	
	MS 20995	
SUPPLEMENTS None	SUPERSEDES AN995	SHEET 1 OF 2

SUPERSESION TABLE:

MS 20995D PART NUMBER	MS 20995E SUPERSEDIING PART NUMBER
CU20	CY20
AA20	AB20
A31	AR32 (OR AR31)
AA41	AB41
AA47	AR47
AA91	AR91
AA32	AB32

INTERCHANGEABILITY RELATIONSHIP:

FOR SAME DIAMETER AND LENGTH NI-CU ALLOY (MONEL) WIRE CAN BE SUBSTITUTED FOR CARBON STEEL AND CORROSION RESISTANT STEEL WIRE.

FOR DESIGN FEATURE PURPOSES, THIS STANDARD TAKES PRECEDENCE OVER PROCUREMENT DOCUMENTS REFERENCED HEREIN.

REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT OF DATE OF INVITATIONS FOR BID.

LOCK WIRE TO COMPLY WITH THIS STANDARD SHALL BE OBTAINED FROM STOCK IN ACCORDANCE WITH THE SPECIFICATIONS AS APPLICABLE.

THIS DOCUMENT HAS BEEN PROMULGATED BY THE DEPARTMENT OF DEFENSE AS A MILITARY STANDARD TO LIMIT THE SELECTION OF THE ITEM, PRODUCT, OR DESIGN COVERED HERE IN ENGINEERING, DESIGN, AND PROCUREMENT. THIS STANDARD SHALL BECOME EFFECTIVE NOT LATER THAN 90 DAYS AFTER THE LATEST DATE OF APPROVAL SHOWN.

- * THESE ALLOYS ARE TO BE USED AS SAFETY WIRE.
- ** TO BE USED AS SAFETY WIRE OR LOCK WIRE ACCORDING TO NOTE (3).

(E) ENTIRE STANDARD REVISED.

APPROVED 3 JAN 57 REVISED E 17 Sep 74

P.A. 84 Other Code AS MI	TITLE WIRE, SAFETY OR LOCK	MILITARY STANDARD	
		MS20995	
PROCUREMENT SPECIFICATION NONE	SUPERSEDES: AN 995	SHEET 2	OF 2

DD FORM 672-1 (Coordinated)

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE.

U.S. GOVERNMENT PRINTING OFFICE: 1974-603-111/2627

THREADS AND DRILLS

Thread Sizes and Tap Drill Data

Thread Size	Threads Per Inch	Series	Unified & American Screw Threads			Tap Drill Diameter Inches
			Major Dia. Class 1A	UNC, UNF & UNEF Class 2A	Standard Series Class 3A	
0 (.060)	80	NF	Max	0.0595	0.0600	3/64" 0.0469
			Min	.0563	.0566	
			Tol	.0032	.0034	
1 (.073)	64	NC	Max	0.0724	0.0730	53 0.0595
			Min	.0686	.0692	
			Tol	.0038	.0038	
1 (.073)	72	NF	Max	0.0724	0.0730	53 0.0595
			Min	.0689	.0694	
			Tol	.0035	.0036	
2 (.086)	56	NC	Max	0.0854	0.0860	50 0.0700
			Min	.0813	.0820	
			Tol	.0041	.0040	
2 (.086)	64	NF	Max	0.0854	0.0860	50 0.0700
			Min	.0816	.0822	
			Tol	.0038	.0038	
3 (.099)	48	NC	Max	0.0983	0.0990	47 0.0785
			Min	.0938	.0946	
			Tol	.0045	.0044	
3 (.099)	56	NF	Max	0.0983	0.0990	45 0.0820
			Min	.0942	.0950	
			Tol	.0041	.0040	
4 (.112)	40	NC	Max	0.1112	0.1120	43 0.0890
			Min	.1061	.1072	
			Tol	.0051	.0048	

Threads and Drills

(Cont'd)

Thread Size	Threads Per Inch	Series	Unified & American Screw Threads			Tap Drill Diameter Inches	
			Major Dia. Class 1A	Standard Series UNC, UNF & UNEF Class 2A	(Inches) NC, NF&N Class 2&3		
4 (.112)	48	NF	Max	0.1113	0.1120	42	0.0935
			Min	.1068	.1076		
			Tol	.0045	.0044		
5 (.125)	40	NC	Max	0.1242	0.1250	38	0.1015
			Min	.1191	.1202		
			Tol	.0051	.0048		
5 (.125)	44	NF	Max	0.1243	0.1250	37	0.1040
			Min	.1195	.1204		
			Tol	.0048	.0046		
6 (.138)	32	NC	Max	0.1372	0.1380	36	0.1065
			Min	.1312	.1326		
			Tol	.0060	.0054		
6 (.138)	40	NF	Max	0.1372	0.1380	33	0.1130
			Min	.1321	.1332		
			Tol	.0051	.0048		
8 (.164)	32	NC	Max	0.1631	0.1640	29	0.1360
			Min	.1571	.1586		
			Tol	.0060	.0054		
8 (.164)	56	NF	Max	0.1632	0.1640	29	0.1360
			Min	.1577	.1590		
			Tol	.0055	.0050		
10 (.190)	24	NC	Max	0.1890	0.1900	25	0.1495
			Min	.1818	.1834		
			Tol	.0072	.0066		

(Cont'd)

Threads and Drills

Thread Size	Threads Per Inch	Series	Unified & American Screw Threads			Tap Drill Diameter Size Inches
			Major Dia.	Standard Series UNC, UNF & UNEF Class 1A Class 2A Class 3A	(Inches) NC, NF&N Class 2&3	
10 (.190)	32	NF	Max	0.1891	0.1900	21 0.1590
			Min	.1831	.1846	
			Tol	.0060	.0054	
12 (.216)	24	NC	Max	0.2150	0.2160	16 0.1770
			Min	.2078	.2094	
			Tol	.0072	.0066	
12 (.216)	28	NF	Max	0.2150	0.2160	14 0.1820
			Min	.2085	.2098	
			Tol	.0065	.0062	
12 (.216)	32	NEF	Max	0.2151	0.2160	13 0.1850
			Min	.2091	.2106	
			Tol	.0060	.0054	
1/4"	20	UNC & NC	Max	0.2489	0.2500	7 0.2010
			Min	.2367	.2419	
			Tol	.0122	.0081	
1/4"	28	UNF & NF	Max	0.2490	0.2500	3 0.2130
			Min	.2392	.2435	
			Tol	.0098	.0065	
1/4"	32	NEF	Max	0.2490	0.2500	7/32" 0.2187
			Min	.2430	.2446	
			Tol	.0060	.0054	
5/16"	18	UNC & NC	Max	0.3113	0.3125	F 0.2570
			Min	.2982	.3038	
			Tol	.0131	.0087	
5/16"	24	UNF & NF	Max	0.3114	0.3125	I 0.2720
			Min	.3006	.3053	
			Tol	.0108	.0072	

Threads and Drills

(Cont'd)

Thread Size	Threads Per Inch	Series	Unified & American Screw Threads			(Inches) NC, NF&N Class 2&3	Tap Drill Diameter Size Inches
			Major Dia.	Standard Series UNC, UNF & UNEF Class 1A Class 2A Class 3A	Standard Series UNC, UNF & UNEF Class 2&3		
5/16"	32	NEF	Max	0.3115	0.3125	9/32"	0.2812
			Min	.3055	.3071		
			Tol	.0060	.0054		
3/8"	16	UNF & NC	Max	0.3737	0.3750	5/16"	0.3125
			Min	.3595	.3660		
			Tol	.0142	.0094		
3/8"	24	UNF & NF	Max	0.3739	0.3750	Q	0.3320
			Min	.3631	.3678		
			Tol	.0108	.0072		
7/16"	14	UNC & NC	Max	0.4361	0.4375	U	0.3680
			Min	.4206	.4272		
			Tol	.0155	.0103		
7/16"	20	UNF & NF	Max	0.4362	0.4375	25/64"	0.3906
			Min	.4240	.4294		
			Tol	.0122	.0081		
1/2"	13	UNC & NC	Max	0.4985	0.5000	27/64"	0.4219
			Min	.4822	.4891		
			Tol	.0163	.0109		
1/2"	20	UNF & NF	Max	0.4987	0.5000	29/64"	0.4531
			Min	.4865	.4919		
			Tol	.0122	.0081		
9/16"	12	UNC & NC	Max	0.5609	0.5625	31/64"	0.4844
			Min	.5437	.5511		
			Tol	.0172	.0114		

(Cont'd)

Thread Size	Threads Per Inch	Unified & American Screw Threads			(Inches) NC, NF&N Class 2&3	Tap Drill Diameter Size Inches
		Series	Major Dia.	Standard Series UNC, UNF & UNEF Class 1A Class 2A Class 3A		
9/16"	18	UNF & NF	Max	0.5611	0.5625	33/64" 0.5156
			Min	.5480	.5538	
			Tol	.0131	.0087	
5/8"	11	UNC & NC	Max	0.6234	0.6250	17/32" 0.5312
			Min	.6052	.6129	
			Tol	.0182	.0121	
5/8"	18	UNF & NF	Max	0.6236	0.6250	37/64" 0.5781
			Min	.6105	.6163	
			Tol	.0131	.0087	
3/4"	10	UNC & NC	Max	0.7482	0.7500	21/32" 0.6562
			Min	.7288	.7371	
			Tol	.0194	.0129	
3/4"	16	UNF & NF	Max	0.7485	0.7500	11/16" 0.6875
			Min	.7343	.7406	
			Tol	.0142	.0094	
7/8"	9	UNC & NC	Max	0.8731	0.8750	49/64" 0.7656
			Min	.8523	.8611	
			Tol	.0208	.0139	
7/8"	14	UNF & NF	Max	0.8734	0.8750	13/16" 0.8125
			Min	.8579	.8647	
			Tol	.0155	.0103	
1"	8	UNC & NC	Max	0.9980	1.0000	7/8" 0.8750
			Min	.9755	.9850	
			Tol	.0225	.0150	
1"	12	UNF N	Max	0.9982	1.0000	59/64" 0.9219
			Min	.9810	.9886	
			Tol	.0172	.0114	

Threads and Drills

Sheet Gages and Weights (Steel and Non-Ferrous Metals)

CARBON STEEL			BRASS		
USS Ga. No.	Revised Mfr's. Thickness for Steel	Approx WT Per SQ FT LBS	B&S Ga. No.	Dec. Thick- ness	Approx WT Per SQ FT LBS
1	.28125	11.250	1	.2893	12.75
2	.26562	10.620	2	.2576	11.35
3	.2391	10.000	3	.2294	10.11
4	.2242	9.375	4	.2043	9.002
5	.2092	8.750	5	.1819	8.015
6	.1943	8.125	6	.1620	7.138
7	.1793	7.500	7	.1443	6.358
8	.1644	6.875	8	.1285	5.662
9	.1494	6.250	9	.1144	5.041
10	.1345	5.625	10	.1019	4.490
11	.1196	5.000	11	.0907	3.997
12	.1046	4.375	12	.0808	3.560
13	.0897	3.750	13	.0720	3.173
14	.0747	3.125	14	.0641	2.825
15	.0673	2.812	15	.0571	2.516
16	.0598	2.500	16	.0508	2.238
17	.0538	2.250	17	.0453	1.996
18	.0478	2.000	18	.0403	1.776
19	.0418	1.750	19	.0359	1.582
20	.0359	1.500	20	.0320	1.410
21	.0329	1.375	21	.0285	1.256
22	.0299	1.250	22	.0254	1.119
23	.0269	1.125	23	.0226	.9958
24	.0239	1.000	24	.0201	.8857
25	.0209	.875	25	.0179	.7887
26	.0179	.750	26	.0159	.7006
27	.0164	.687	27	.0142	.6257
28	.0149	.625	28	.0126	.5552
29	.0135	.562	29	.0113	.4979
30	.0120	.500	30	.0100	.4406

(Cont'd)

COPPER			ZINC		
Stubs Ga. No.	Dec. Thick- ness	Approx. WT Per SQ FT LBS	Zinc Ga. No.	Dec. Thick- ness	Approx WT Per SQ FT LBS
1	.300	13.94	24	.125	4.70
2	.284	13.20	23	.100	3.75
3	.259	12.04	22	.090	3.37
4	.238	11.07	21	.080	3.00
5	.220	10.22	20	.070	2.62
6	.203	9.420	19	.060	2.25
7	.180	8.360	18	.055	2.06
8	.165	7.660	17	.050	1.87
9	.148	6.875	16	.045	1.68
10	.134	6.225	15	.040	1.50
11	.120	5.575	14	.036	1.35
12	.109	5.065	13	.032	1.20
13	.095	4.410	12	.028	1.05
14	.083	3.860	11	.024	.90
15	.072	3.338	10	.020	.75
16	.065	3.020	9	.018	.67
17	.058	2.695	8	.016	.60
18	.049	2.280	7	.014	.52
19	.042	1.952	6	.012	.45
20	.035	1.627	5	.010	.37
21	.032	1.484	4	.008	.30
22	.028	1.302	3	.006	.22
23	.025	1.162			
24	.022	1.022			
25	.020	.928			

Weight of Galvanized Sheets (Weights Without Bands)

NOTE

The weight of black sheets is 2½ ounces per square foot less than weights for galvanized.

Galv. Sheet Gage No.	10	12	14	16	18	20	22	Galv. Sheet Gage No.
OZ-SQ FT	92.5	72.5	52.5	42.5	34.5	26.5	22.5	OZ-SQ FT
LBS-SQ FT	5.781	4.531	3.281	2.656	2.156	1.656	1.406	LB-SQ FT
Size in Inches	LBS PER SHEET							Size in Inches
24 x 96	92.5	72.5	52.5	42.5	34.5	26.5	22.5	24 x 96
24 x 120	115.6	90.6	65.6	53.1	43.1	33.1	28.1	24 x 120
26 x 96	100.2	78.5	56.9	46.0	37.4	28.7	24.4	26 x 96
26 x 120	125.3	98.2	71.1	57.5	46.7	35.9	30.5	26 x 120
28 x 72	80.9	63.4	45.9	37.2	30.2	23.2	19.7	28 x 72
28 x 84	94.4	74.0	53.6	43.4	35.2	27.1	23.0	28 x 84
28 x 96	107.9	84.6	61.3	49.6	40.3	30.9	26.3	28 x 96
28 x 108	121.4	95.2	68.9	55.8	45.3	34.8	29.5	28 x 108
28 x 120	134.9	105.7	76.6	62.0	50.3	38.6	32.8	28 x 120
28 x 144	161.9	126.9	91.9	74.4	60.4	46.4	39.4	28 x 144
30 x 96	115.6	90.6	65.6	53.1	43.1	33.1	28.1	30 x 96
30 x 120	144.5	113.3	82.0	66.4	53.9	41.4	35.2	30 x 120
30 x 144	173.4	135.9	98.4	79.7	64.7	49.7	42.2	30 x 144
36 x 96	138.8	108.8	78.8	63.8	51.8	39.8	33.8	36 x 96
36 x 120	173.4	135.9	98.4	79.7	64.7	49.7	42.2	36 x 120
42 x 96	161.8	126.8	91.9	74.4	60.4	46.4	39.4	42 x 96
42 x 120	202.3	158.7	114.8	93.0	75.5	58.0	49.2	42 x 120
48 x 96	185.0	145.0	105.0	85.0	69.0	53.0	45.0	48 x 96
48 x 120	231.2	181.2	131.2	106.2	86.2	66.2	56.2	48 x 120

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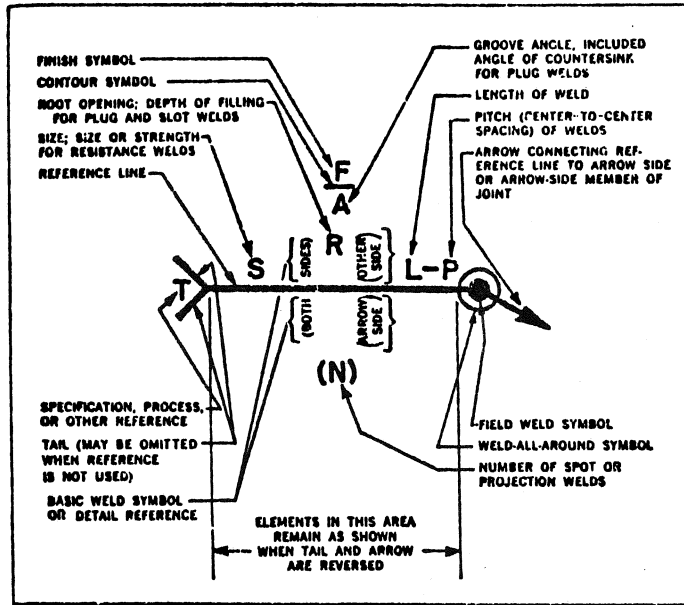
Galv. Sheet Gage No.	24	26	27	28	29	30	Galv. Sheet Gage No.
OZ-SQ FT	18.5	14.5	13.5	12.5	11.5	10.5	OZ-SQ FT
LBS-SQ FT	1.156	.906	.844	.781	.719	.656	LB-SQ FT
Size in Inches	LBS PER SHEET						Size in Inches
24 x 96	18.5	14.5	13.5	12.5	11.5	10.5	24 x 96
24 x 120	23.1	18.1	16.9	15.6	14.4	13.1	24 x 120
26 x 96	20.0	15.7	14.6	13.5	12.5	11.4	26 x 96
26 x 120	25.1	19.6	18.3	16.9	15.6	14.2	26 x 120
28 x 72	16.2	12.7	11.8	10.9	10.1	9.2	28 x 72
28 x 84	18.9	14.8	13.8	12.8	11.7	10.7	28 x 84
28 x 96	21.6	16.9	15.8	14.6	13.4	12.3	28 x 96
28 x 108	24.3	19.0	17.7	16.4	15.1	13.8	28 x 108
28 x 120	27.0	21.1	19.7	18.2	16.8	15.3	28 x 120
28 x 144	32.4	25.4	23.6	21.8	20.1	18.4	28 x 144
30 x 96	23.1	18.1	16.9	15.6	14.4	13.1	30 x 96
30 x 120	28.9	22.7	21.1	19.5	18.0	16.4	30 x 120
30 x 144	34.7	27.2	25.3	23.4	21.6	19.7	30 x 144
36 x 96	27.8	21.8	20.3	18.8	17.3	15.8	36 x 96
36 x 120	34.7	27.2	25.3	23.4	21.6	19.7	36 x 120
42 x 96	32.4	25.4	23.6	21.9	20.1	18.4	42 x 96
42 x 120	40.5	31.7	29.5	27.3	25.2	23.0	42 x 120
48 x 96	37.0	29.0	27.0	25.0	23.0	21.0	48 x 96
48 x 120	46.2	36.2	33.8	31.2	28.8	26.2	48 x 120

Standard Gages (Wire-Sheets-Plates), Equivalent In Decimals of An Inch

THICKNESS IN DECIMALS OF AN INCH							
No. of Gages	Nearest Fraction of an Inch	Birmingham Wire (B.W.G.) also Stubs Iron Wire	Brown & Sharpe or American Wire	U.S. Standard Revised Mfr's. Thickness for Steel	British Imp. Stand. Wire (S.W.G.)	Stand. Steel Wire Gages or Washburn & Moen	Stubs Steel Wire
7-0's	1/2	.....	.....	.....	.500	.4900	.....
6-0's	15/32	.....	.5800	.....	.464	.4615	.....
5-0's	7/16	.500	.5165	.....	.432	.4305	.....
4-0's	13/32	.454	.4600	.....	.400	.3938	.....
3-0's	3/8	.425	.4096	.....	.372	.3625	.....
2-0's	11/32	.380	.3648	.....	.348	.3310	.....
0	21/64	.340	.3249	.....	.324	.3065	.....
1	19/64	.300	.2893	.....	.300	.2830	.227
2	9/32	.284	.2576	.....	.276	.2625	.219
3	1/4	.259	.2294	.2391	.252	.2437	.212
4	15/64	.238	.2043	.2242	.232	.2253	.207
5	7/32	.220	.1819	.2092	.212	.2070	.204
6	3/16	.203	.1620	.1943	.192	.1920	.201
7	11/64	.180	.1443	.1793	.176	.1770	.199
8	6/32	.165	.1285	.1644	.160	.1620	.197
9	9/64	.148	.1144	.1495	.144	.1483	.194
10	1/8	.134	.1019	.1345	.128	.1350	.191
11	7/64	.120	.0907	.1196	.116	.1205	.188
12	1/10	.109	.0808	.1046	.104	.1055	.185
13	3/32	.095	.0720	.0897	.092	.0915	.182
14	5/64	.083	.0641	.0747	.080	.0880	.180
15	.....	.072	.0571	.0673	.072	.0720	.178
16	1/16	.065	.0508	.0598	.064	.0625	.175
17	.....	.058	.0453	.0538	.056	.0540	.172
18	3/64	.049	.0403	.0478	.048	.0475	.168
19	.....	.042	.0359	.0418	.040	.0410	.164
20	.....	.035	.0320	.0359	.036	.0348	.161
21	1/32	.032	.0285	.0329	.032	.0317	.157
22	.....	.028	.0253	.0299	.028	.0286	.155
23	.....	.025	.0226	.0269	.024	.0258	.153
24	.....	.022	.0201	.0239	.022	.0230	.151
25	.....	.020	.0179	.0209	.020	.0204	.148

AMERICAN STANDARD WELDING SYMBOLS

Standard Location of Elements of a Welding Symbol



Basic Arc And Gas Weld Symbols

BASIC ARC AND GAS WELD SYMBOLS							
FILLET	PLUG OR SLOT	ARC-SPOT OR ARC-SEAM	BACK OR BACKING	SUR-FACING	FLANGE		MELT-THRU
					EDGE	CORNER	
GROOVE							MELT-THRU
SQUARE	V	BEVEL	U	J	FLARE-V	FLARE-BEVEL	
BASIC RESISTANCE WELD SYMBOLS							
RESISTANCE-SPOT	PROJECTION	RESISTANCE-SEAM	FLASH GR UPSET				

Supplementary Symbols

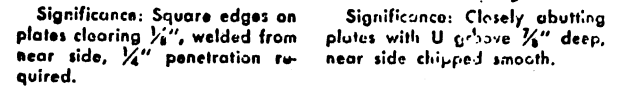
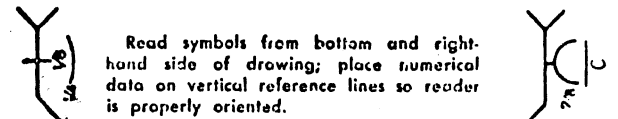
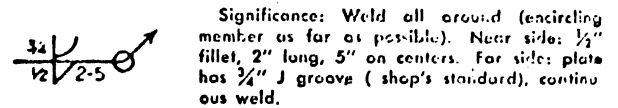
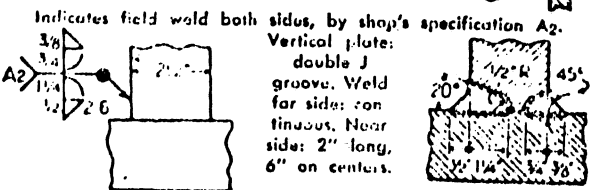
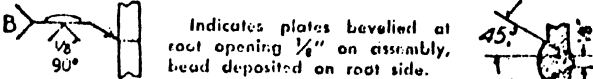
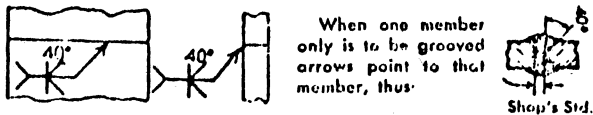
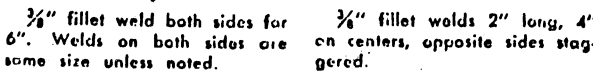
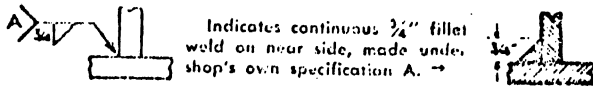
WELD ALL AROUND	FIELD WELD	CONTOUR	
		FLUSH	CONVEX

Weldability of Steels

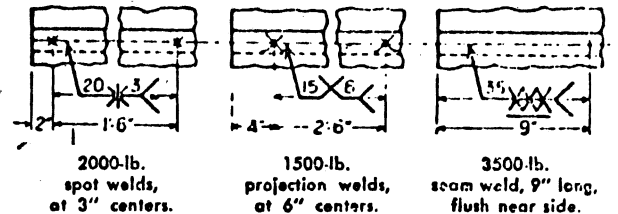
Approximate Range of Current Values for Metallic Electrodes

Thickness of Metal to be Welded	Diameter of Electrode	Voltage Across Arc	Welding Cur. (AMPS)	Voltage Across Arc	Welding Cur. (AMP)
22-18 gage	1/16"	15-17	25-30	16-18	30-35
18-16 gage	3/32"	15-17	35-80	16-18	40-90
1/16"-1/8"	1/8"	17-20	90-135	20-22	90-140
1/8"-5/16"	5/32"	18-20	115-175	20-25	115-220
1/4" and up	3/16"	18-25	150-260	28-30	150-275
3/8" and up	1/4"	18-25	200-300	30-32	200-325
3/8" and up	5/16"	....	.....	30-32	250-400
1/2" and up	3/8"	....	.....	32-36	300-500

Significance of Typical Combinations



Symbols govern to break in continuity of structure or to extent of hatching or dimension lines. Strength of resistance welds in hundreds of pounds noted instead of size:



Cylinder Color Code

NOTE

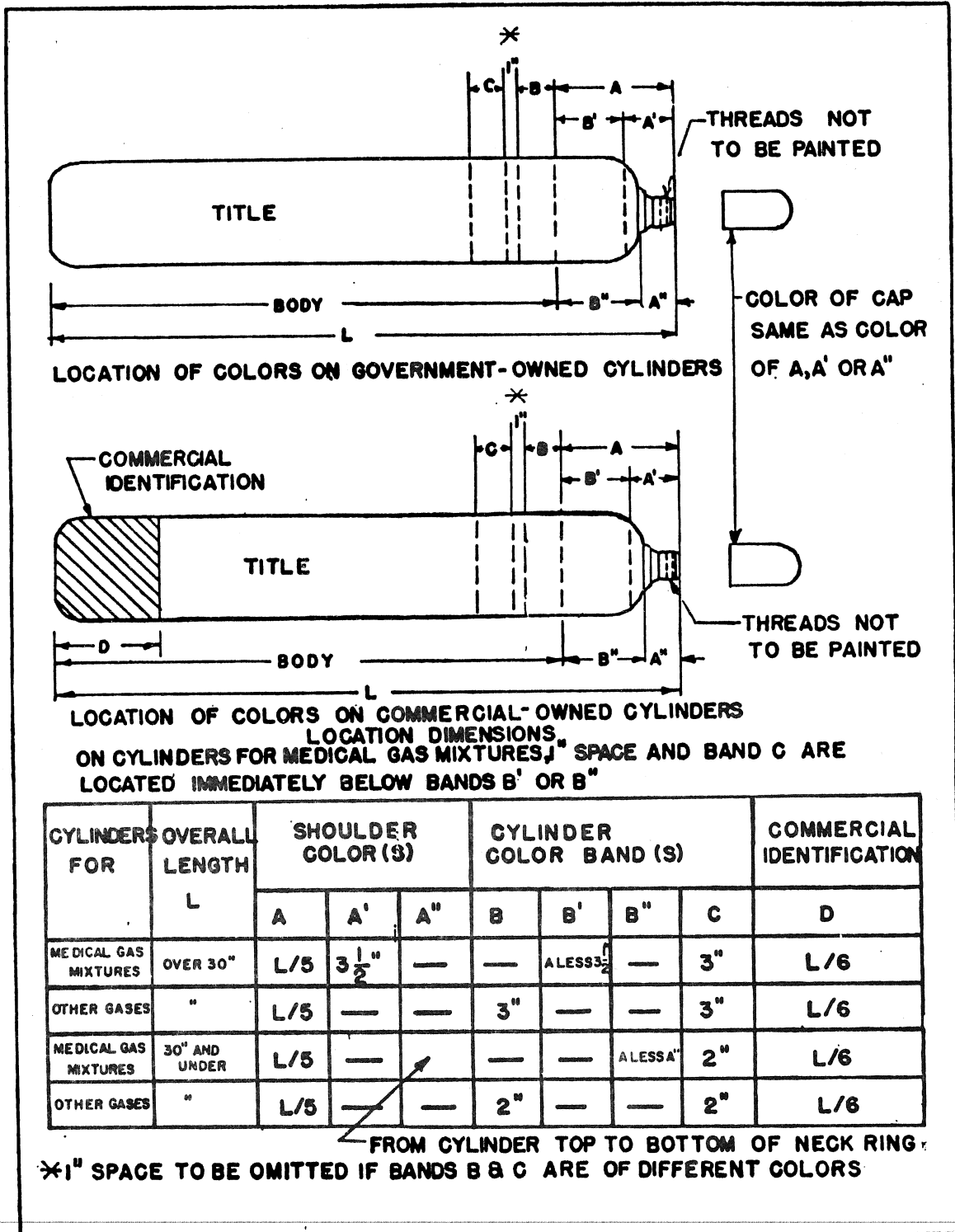
See footnotes at end of table.

Title	Top A	Location on cylinder		Body
		Band B	Band C	
Acetylene	Yellow	Yellow	Yellow	Yellow
Acrolein	Yellow	Brown	Black	Brown
Aerosol insecticide	Buff	Buff	Buff	Buff
Air, oil pumped	Black	Green	Green	Black
Air, water pumped	Black	Green	Black	Black
Alkyl D.aborane	Yellow	Brown	Brown	Yellow
Alkyl Pentaborane	Yellow	Brown	Brown	Yellow
Ammonia	Brown	Yellow	Orange	Orange
Argon, oil pumped	Gray	White	White	Gray
Argon-Oxygen (% Mixture)	Gray	Green	White	Gray
Argon, water pumped	Gray	White	Gray	Gray
Boron trichloride	Gray	Brown	Gray	Brown
Boron trifluoride	Gray	Brown	Brown	Brown
Bromoacetone	Brown	Black	Black	Brown
Bromochloromethane	Buff	Gray	Buff	Buff
Bromochloromethane (Fire only)	Red	Gray	Red	Red
Bromotrifluoromethane	Orange	White	Gray	Orange
Bromotrifluoromethane (Fire only)	Red	White	Gray	Red
Butadiene	Yellow	White	Buff	Buff
Carbon dioxide	Gray	Gray	Gray	Gray
Carbon dioxide (Fire only)	Red	Red	Red	Red
Carbon monoxide	Yellow	Brown	Brown	Brown
Chloroacetone	Black	Brown	Black	Brown
Chlorine	Brown	Brown	Brown	Brown
Chlorine trifluoride	Brown	Green	Brown	Brown
Chloropicrin	Brown	Orange	Orange	Brown
Cyanogen	Yellow	Brown	Yellow	Brown
Cyclopropane, medical	Orange	Yellow	Blue	Blue
Cyclopropane, medical	Orange	Chromium plated		
Diborane	Yellow	Brown	Brown	Yellow
Dibromodifluoromethane	Buff	White	Buff	Buff
Dibromodifluoromethane (Fire only)	Red	White	Red	Red
Difluorochloroethane	Gray	Yellow	Yellow	Orange
Difluoroethane	Gray	Yellow	Orange	Orange
Dihydro-tetraborane	Yellow	Brown	Brown	Yellow
Dimethylamine, anhydrous	Yellow	Blue	White	Buff
Dimethylether	Yellow	Brown	Buff	Buff
Dispersant, Dichlorodifluoromethane-Difluoroethane Mix	Buff	Gray	Gray	Buff
Ethane	Yellow	Blue	Yellow	Yellow
Ethyl chloride	Buff	Blue	Yellow	Buff
Ethyl nitrite	Yellow	Buff	Buff	Buff
Ethylamine, anhydrous	Yellow	Blue	Blue	Buff
Ethylene, industrial	Blue	Yellow	Buff	Buff
Ethylene, medical	Yellow	Blue	Blue	Blue
Ethylene oxide	Yellow	Blue	Buff	Buff
F-11, Trichlorofluoromethane	Orange	Orange	Orange	Orange
F-12, Dichlorodifluoromethane	Orange	Orange	Orange	Orange
F-13, Chlorotrifluoromethane	Orange	Orange	Orange	Orange
F-21, Dichlorofluoromethane	Orange	Orange	Orange	Orange
F-22, Chlorodifluoromethane	Orange	Orange	Orange	Orange
F-113, Trichlorotrifluoroethane	Orange	Orange	Orange	Orange
F-114, Dichlorotetrafluoroethane	Orange	Orange	Orange	Orange
F-124A, Chlorotetrafluoroethane	Orange	Orange	Orange	Orange
Fluorine	Brown	Green	Green	Brown
Fumigant, Carbon dioxide-Ethylene oxide	Buff	Blue	Buff	Buff
Helium, oil free or medical	Buff	Gray	Gray	Gray

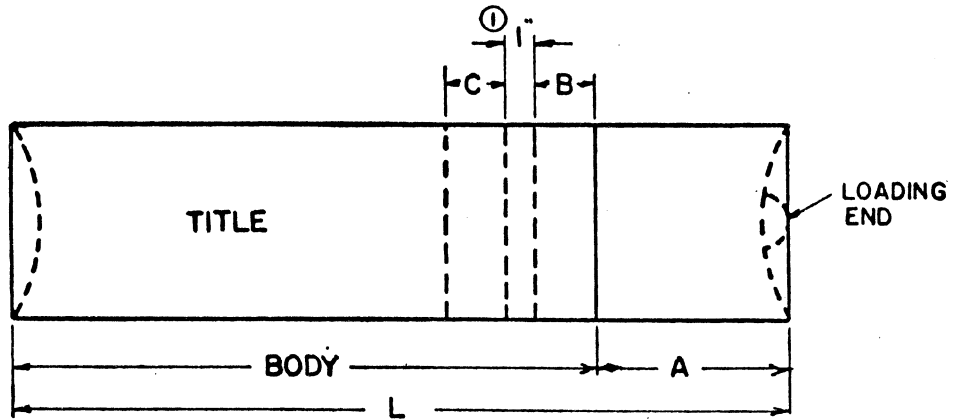
Title	Location on cylinder			
	Top A	Band B	Band C	Body
Helium, oil pumped	Gray	Orange	Gray	Gray
Helium-Oxygen	Buff *	White **	Green	Green
Hydrogen	Yellow	Black	Yellow	Yellow
Hydrogen bromide	Black	Brown	Brown	Brown
Hydrogen chloride, anhydrous	Brown	White	Brown	Brown
Hydrogen cyanide, anhydrous	Yellow	Brown	White	Brown
Hydrogen fluoride, anhydrous	Green	Brown	Brown	Brown
Hydrogen sulfide	Brown	Yellow	Brown	Brown
Krypton, oil pumped	Gray	Buff	Buff	Gray
Krypton, water pumped	Gray	Buff	Gray	Gray
Manufactured Gas — (Specify) Coal, oil, water, producer, etc.	Brown	Yellow	Yellow	Yellow
Methane	Yellow	White	Yellow	Yellow
Methylamine	Yellow	Brown	Yellow	Buff
Methyl bromide	Brown	Black	Brown	Brown
Methyl bromide (Fire only)	Red	Brown	Red	Red
Methyl chloride	Yellow	Brown	Orange	Orange
Methyl mercaptan	Brown	Yellow	Yellow	Brown
Methyl sulfide	Yellow	Brown	Buff	Brown
Methylene chloride	Gray	Blue	Orange	Orange
Natural gas	Yellow	Brown	Yellow	Yellow
Neon, oil pumped	White	Buff	Gray	Gray
Neon, water pumped	White	Buff	Buff	Gray
Nickel carbonyl	Yellow	White	Yellow	Brown
Nitric oxide	Brown	Buff	Brown	Brown
Nitrogen dioxide	Brown	Buff	Buff	Brown
Nitrogen-Helium (% Mixture)	Gray	Black	Orange	Gray
Nitrogen, oil pumped	Gray	Black	Gray	Gray
Nitrogen-Oxygen (% Mixture)	Black	White	Green	Green
Nitrogen, water pumped	Gray	Black	Black	Gray
Nitrosyl chloride	Brown	White	White	Brown
Nitrous oxide	Blue	Blue	Blue	Blue
Oxygen, medical	White	Green	Green	Green
Oxygen, aviator's	Green	White	Green	Green
Oxygen	Green	Green	Green	Green
Oxygen-Carbon dioxide	Gray *	White **	Green	Green
Oxygen, Electrolytic	Green	White	White	Green
Oxygen Fluoride	Green	Brown	Green	Brown
Ozone	Brown	Green	Green	Green
Pentaborane, Stable	Yellow	Brown	Brown	Yellow
Petroleum Gas — (Specify) Acetogen, Butane, Butane-Propane, Butene-1, Cyclopropane, Isobutane, Isobutylene, Neopentane, Propane, etc.	Yellow	Orange	Yellow	Yellow
Phenylcarbylamine chloride	Brown	Gray	Gray	Brown
Phosgene	Brown	Orange	Brown	Brown
Propylene	Yellow	Gray	Buff	Buff
Propyne	Gray	Yellow	Yellow	Yellow
Sulfur dioxide	Brown	Gray	Brown	Brown
Sulfur hexafluoride	Gray	White	Black	Gray
Tetrafluoroethylene, inhibited	Buff	White	White	Buff
Trimethylamine, anhydrous	Yellow	Blue	Orange	Buff
Vinyl bromide	Buff	Blue	Blue	Buff
Vinyl chloride	Yellow	Orange	Buff	Buff
Vinyl methyl ether, inhibited	Yellow	Black	Buff	Buff
Xenon, oil pumped	White	Black	Black	Gray
Xenon, water pumped	White	Black	Gray	Gray

*A' or A'' (See following figure) for medical gas mixtures.
**B'' or B''' (see following figure) for medical gas mixtures.

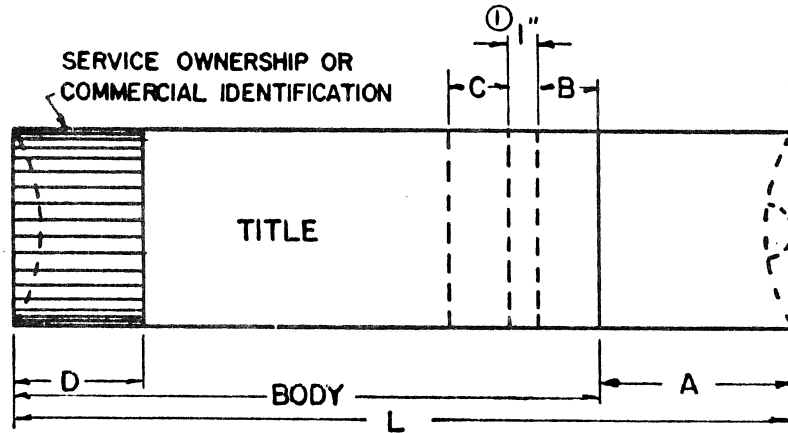
Bottle-Type Cylinders



Tube-Type Cylinders



LOCATION OF COLORS ON GOVERNMENT-OWNED CYLINDERS



LOCATION OF COLORS ON COMMERCIAL-OWNED CYLINDERS

LOCATION DIMENSIONS

OVERALL LENGTH	CAP AND SHOULDER COLOR	CYLINDER COLOR BAND(S)	COMMERCIAL IDENTIFICATION
L	A	B & C	D
OVER 30"	$\frac{1}{4}$ OF L.	3"	$\frac{1}{6}$ OF L.
30" AND UNDER	$\frac{1}{4}$ OF L.	2"	$\frac{1}{6}$ OF L.

① 1" SPACE TO BE OMITTED IF BANDS B & C ARE OF DIFFERENT COLORS.

General Information

ASRE REFRIGERANT NUMBERING SYSTEM

ASRE STANDARD REFRIGERANT DESIGNATION	CHEMICAL NAME	CHEMICAL FORMULA	MOLEC- ULAR WEIGHT	BOILING POINT, F	STATUS ¹
<u>Halocarbon Compounds</u>					
10	Carbontetrachloride	CCl ₄	153.8	-170.2	
11	Trichloromonofluoromethane	CCl ₃ F	137.4	74.8	C
12	Dichlorodifluoromethane	CCl ₂ F ₂	120.9	-21.6	C
13	Monochlorotrifluoromethane	CClF ₃	104.5	-114.6	C
13B1	Monobromotrifluoromethane	CBrF ₃	148.9	-72.0	S
14	Carbontetrafluoride	CF ₄	88.0	-198.4	S
20	Chloroform	CHCl ₃	119.4	142	
21	Dichloromonofluoromethane	CHCl ₂ F	102.9	48.1	D
22	Monochlorodifluoromethane	CHClF ₂	86.5	-41.4	C
23	Trifluoromethane	CHF ₃	70.0	-119.9	D
30	Methylene Chloride	CH ₂ Cl ₂	84.9	105.2	C
31	Monochloromonofluoromethane	CH ₂ ClF	68.5	48.0	
32	Methylene Fluoride	CH ₂ F ₂	52.0	-61.4	
40	Methyl chloride	CH ₃ Cl	50.5	-10.8	C
41	Methyl Fluoride	CH ₃ F	34.0	-109	
(50)	Methane	CH ₄	16.0	-259	C) ²
110	Hexachloroethane	CCl ₃ CCl ₃	236.8	365	
111	Pentachloromonofluoroethane	CCl ₃ CCl ₂ F	220.3	279	
112	Tetrachlorodifluoroethane	CCl ₂ FCCl ₂ F	203.8	199.0	
112a	Tetrachlorodifluoroethane	CCl ₃ CClF ₂	203.8	195.8	
113	Trichlorotrifluoroethane	CCl ₂ FCClF ₂	187.4	117.6	C
113a	Trichlorotrifluoroethane	CCl ₃ CF ₃	187.4	144.2	
114	Dichlorotetrafluoroethane	CClF ₂ CClF ₂	170.9	38.4	C
114a	Dichlorotetrafluoroethane	CCl ₂ FCF ₃	170.9	38.5	C
114B2	Dibromotetrafluoroethane	CBrF ₂ CBrF ₂	259.9	117.5	D
115	Monochloropentafluoroethane	CClF ₂ CF ₃	154.5	-37.7	D
116	Hexafluoroethane	CF ₃ CF ₃	138.0	-108.8	
120	Pentachloroethane	CHCl ₂ CCl ₃	202.3	324	
123	Dichlorotrifluoroethane	CHCl ₂ CF ₃	153	83.7	
124	Monochlorotetrafluoroethane	CHClF ₂ CF ₃	136.5	10.4	
124a	Monochlorotetrafluoroethane	CHF ₂ CClF ₂	136.5	14	D
125	Pentafluoroethane	CHF ₂ CF ₃	120	-55	
133a	Monochlorotrifluoroethane	CH ₂ ClCF ₃	118.5	43.0	D
140a	Trichloroethane	CH ₃ CCl ₃	133.4	165	
142b	Monochlorodifluoroethane	CH ₃ CClF ₂	100.5	12.2	S
143a	Trifluoroethane	CH ₃ CF ₃	84	-53.5	
150a	Dichloroethane	CH ₃ CHCl ₂	98.9	140	
152a	Difluoroethane	CH ₃ CHF ₂	66	-12.4	C
160	Ethyl chloride	CH ₃ CH ₂ Cl	64.5	54.0	
(170)	Ethane	CH ₃ CH ₃	30	-127.5	C) ²
218	Octafluoropropane	CF ₃ CF ₂ CF ₃	183	-36.4	
(290)	Propane	CH ₃ CH ₂ CH ₃	44	-44.2	C) ²

ASRE STANDARD REFRIGERNAT DESIGNATION	CHEMICAL NAME	CHEMICAL FORMULA	MOLEC-BOILING ULAR WEIGHT	POINT, F	STATUS ¹
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Cyclic Organic Compounds

C316	Dichlorohexafluorocyclo- butane	C ₄ Cl ₂ F ₆	233	140	
C317	Monochloroheptafluorocyclo- butane	C ₄ ClF ₇	216.6	77	
C318	Octafluorocyclobutane	C ₄ F ₈	200	21.1	D

Azeotropes

500	Refrigerants 12/152a 73.8/ 26.2 WT% †	CCl ₂ F ₂ / CH ₃ CHF ₂	99.29	- 28.0	C
501	Refrigerants 22/12 75/25 WT %	CHClF ₂ / CCl ₂ F ₂	93.1	- 42	
502	Refrigerants 11/115 48.8/ 51.2 WT%	CHClF ₂ / CClF ₂ CF ₃	112	- 50.1	

Miscellaneous Organic Compounds

Hydrocarbons

50	Methane	CH ₄	16.0	-259	C
170	Ethane	CH ₃ CH ₃	30	-127.5	C
290	Propane	CH ₃ CH ₂ CH ₃	44	- 44.2	C
600	Butane	CH ₃ CH ₂ CH ₂ CH ₃	58.1	31.3	
601	Isobutane	CH(CH ₃) ₃	58.1	14	
(1150)	Ethylene	CH ₂ =CH ₂	28.0	-155.0	C) ³
(1270)	Propylene	CH ₃ CH=CH ₂	42.1	- 53.7	C) ³

Oxygen Compounds

610	Ethyl ether	C ₂ H ₅ OC ₂ H ₅	74.1	94.3	
611	Methyl formate	HCOOCH ₃	60.0	89.2	

Sulfur Compounds

620

Nitrogen Compounds

630	Methyl amine	CH ₃ NH ₂	31.1	20.3	
631	Ethyle amine	C ₂ H ₅ NH ₂	45.1	61.8	

CRYOGENICS GAS AND VAPORS DATA

PROPERTIES OF VARIOUS GASES

	MP (°F)	BP (°F)	<u>Specific Heat</u>			Heat of Fusion BTU/LB	Heat of Vaporization BTU/LB
			Sol.	Liq.	Gas		
Argon	-309	-302	.115	.134	.125	12.1	67.6
Helium	-458	-454	----	---	1.25	----	10.8
Hydrogen	-455	-423	.57	.231	3.389	25.2	195
Nitrogen	-346	-320	.39	.474	.245	11.0	86
Oxygen	-361	-297	.336	.394	.218	5.95	81.5

LIQUIDS

Substance	Specific Heat	Heat of Vaporization BTU Per LB	Boiling Point °F	Weight in LBS per CU FT	Weight in LBS Per Gallon
Acetic acid	.472	153	245	66	8.81
Alcohol	.65	365	172	55	7.35
Benzine	.45	166	175	56	7.49
Ether	.503	160	95	46	6.15
Glycerine	.58	---	554	79	10.58
Mercury	.0333	117	675	845	112.97
Oil, cotton-seed	.47	---	---	60	7.76
Oil, olive	.471	---	570	58	7.75
Paraffin, melted	.71	---	750	56	7.49
Petroleum	.51	---	---	56	
Sulphur, melted	.234	652	601	---	----
Turpentine	.41	133	319	54	7.22
Water	1.0	965	212	62.5	8.34

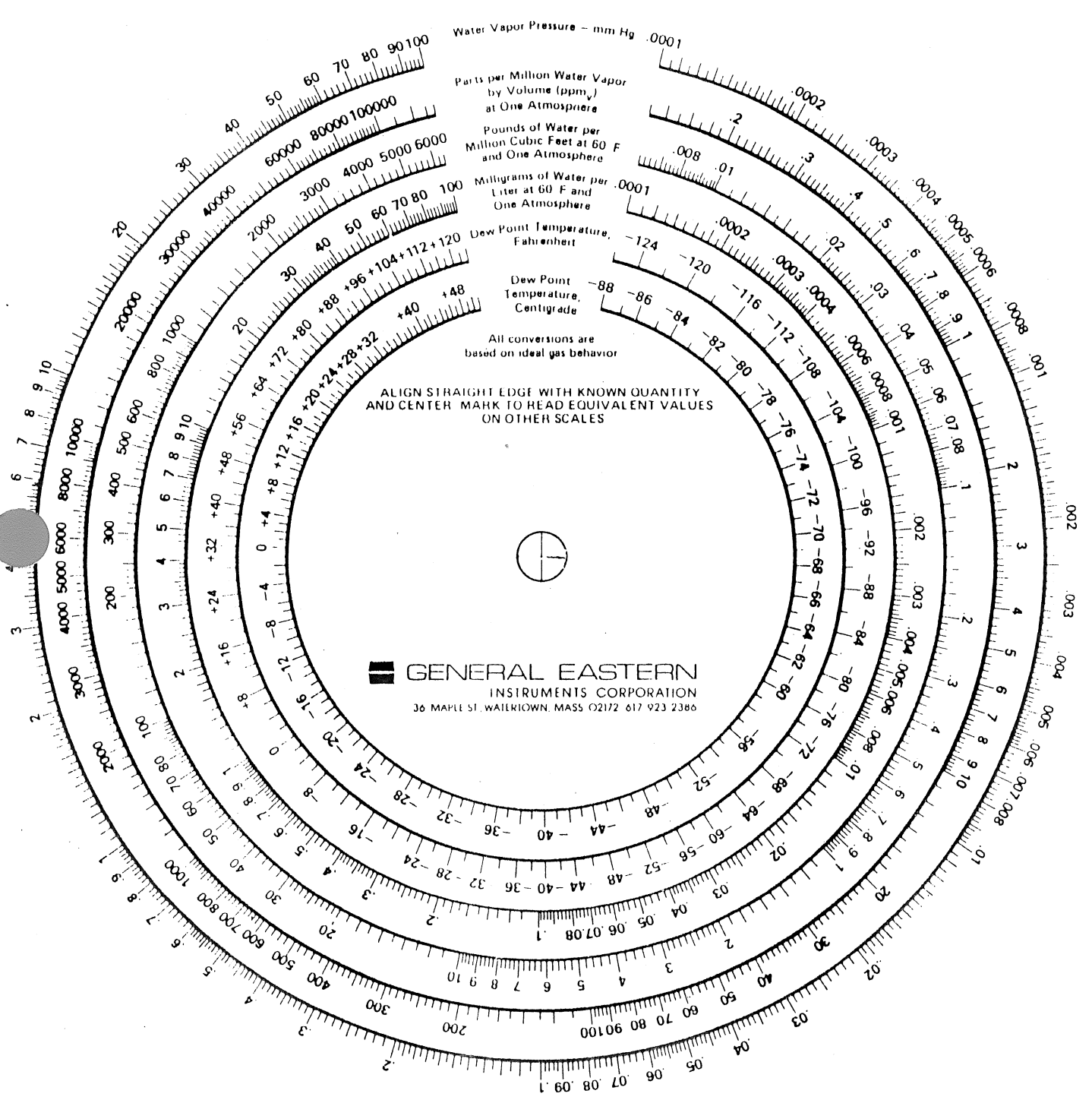
General Information

(Cont'd)

GASES AND VAPORS

Substance	Specific Heat Constant Pressure	Weight in LBS Per CU FT at Approx. 70°F and Atmospheric Pressure
Acetylene	.35	.073
Air	.237	.080
Alcohol	.453	---
Ammonia	.520	.048
Argon	.124	.1037
Carbon dioxide	.203	.123
Carbon monoxide	.243	.078
Chlorine	.125	.20
Ethylene	.40	.728
Helium	1.25	.0104
Hydrochloric Acid	1.95	.102
Hydrogen	3.41	.0056
Methane	.60	.0447
Methyl chloride	.24	.1309
Nitric oxide	.231	.0779
Nitrogen	.245	.078
Oxygen	.218	.09
Sulphur dioxide	.155	.179

<i>Multiply</i>	<i>by</i>	<i>to obtain</i>	<i>Multiply</i>	<i>by</i>	<i>to obtain</i>
acres	43,560	square feet	grams	980.7	dynes
acres	4047	square meters	grams	0.03527	ounces
acres	1.562x10 ³	square miles	horse-power	42.44	B.t.units per minute
acres	4840	square yards	horse-power	33,000	foot-pounds per min.
amperes	1/10	abamperes	horse-power	550	foot-pounds per sec.
atmospheres	76.0	cms. of mercury	horse-power	1.014	horse-power (metric)
atmospheres	29.92	inches of mercury	horse-power	10.70	kg.-calories per min.
atmospheres	33.90	feet of water	horse-power	0.7457	kilowatts
atmospheres	14.70	lbs. per sq. inch	horse-power	745.7	watts
British thermal units	0.2520	kilogram-calories	horse-power (boiler)	33,520	B.t.u. per hour
British thermal units	777.5	foot-pounds	horse-power (boiler)	9,804	kilowatts
British thermal units	3.927x10 ³	horse-power-hours	horse-power-hours	2547	British thermal units
British thermal units	1054	joules	horse-power-hours	1.98x10 ³	foot-pounds
British thermal units	107.5	kilogram-meters	horse-power-hours	2.540	centimeters
British thermal units	2.928x10 ³	kilowatt-hours	inches	0.03342	atmospheres
B.t.u. per min.	12.96	foot-pounds per sec.	inches of mercury	1.133	feet of water
B.t.u. per min.	0.02356	horse-power	inches of mercury	0.002458	atmospheres
B.t.u. per min.	0.01757	kilowatts	inches of water	0.03613	pounds per sq. inch
B.t.u. per min.	17.57	watts	kilograms	980,665	dynes
B.t.u. per sq. ft. per min.	0.1220	watts per sq. inch	kilograms	2,2046	pounds
bushels	1,244	cubic feet	kilogram-calories	3,968	British thermal units
bushels	2150	cubic inches	kilogram-calories	3086	foot-pounds
centimeters	0.3937	inches	k.g.-calories per min.	51.43	foot-pounds per sec.
centimeters	0.01	meters	k.g.-calories per min.	0.06972	kilowatts
centimeter-grams	980.7	centimeter-dynes	kilometers	10 ³	centimeters
centimeters of mercury	0.01316	atmospheres	kilometers	3281	feet
centimeters of mercury	0.4461	feet of water	kilometers	10 ³	meters
centimeters per second	1.969	feet per minute	kilometers	0.6214	miles
centimeters per second	0.03281	feet per second	kilometers	1093.6	yards
cubic centimeters	3.531x10 ³	cubic feet	kilowatts	56.92	B.t.units per min.
cubic centimeters	6.102x10 ³	cubic inches	kilowatts	4.425x10 ³	foot-pounds per min.
cubic feet	2.832x10 ³	cubic cms.	kilowatts	737.6	foot-pounds per sec.
cubic feet	1728	cubic inches	kilowatts	1.341	horse-power
cubic feet	0.02832	cubic meters	kilowatts	14.34	kg.-calories per min.
cubic feet	0.03704	cubic yards	kilowatts	10 ³	watts
cubic feet	7.481	gallons	kilowatt-hours	3415	British thermal units
cubic feet	62.43	pounds of water	kilowatt-hours	2.655x10 ³	foot-pounds
cubic feet per minute	472.0	cubic cms. per sec.	kilowatt-hours	1.341	horse-power-hours
cubic feet per minute	0.1247	gallons per sec.	kilowatt-hours	3.6x10 ³	joules
cubic feet per minute	0.4720	liters per second	kilowatt-hours	860.5	kilogram-calories
cubic feet per minute	62.4	lbs. of water per min.	kilowatt-hours	3.671x10 ³	kilogram-meters
cubic inches	16.39	cubic centimeters	log ¹⁰ N	2.303	log _e N or ln N
cubic inches	5.787x10 ³	cubic feet	log ₁₀ N	0.4343	log ₁₀ N
cubic yards	27	cubic meters	meters	100	centimeters
cubic yards	0.7646	cubic feet	meters	3.2808	feet
cubic yards per minute	0.45	cubic meters	meters	39.37	inches
degrees (angle)	60	cubic feet per sec.	meters	5280	feet
degrees (angle)	0.01745	minutes	miles	1.6093	kilometers
degrees (angle)	3600	seconds	miles per hour	88	feet per minute
dynes	7.233x10 ³	poundals	ounces	28.35	grams
ergs	2.390x10 ⁻¹¹	kilogram-calories	ounces per sq. inch	0.0625	pounds per sq. inch
feet	30.48	centimeters	pints (dry)	33.60	cubic inches
feet	12	inches	pints (liq.)	28.37	cubic inches
feet	0.3048	meters	pounds	453.6	grams
feet	.36	varas	pounds	16	ounces
feet	1/3	yards	pounds of water	0.01602	cubic feet
feet of water	0.02950	atmospheres	pounds of water	27.68	cubic inches
feet of water	0.8826	inches of mercury	pounds of water	0.1198	gallons
feet of water	304.8	kgs. per sq. meter	pounds of water per min.	2.669x10 ³	cubic feet per sec.
feet of water	62.43	pounds per sq. ft.	pounds per cubic foot	5.737x10 ³	pounds per cubic in.
feet of water	0.4335	pounds per sq. inch	pounds per sq. foot	0.01602	feet of water
foot-pounds	1.286x10 ³	British thermal units	pounds per sq. inch	0.06804	atmospheres
foot-pounds	1.356x10 ⁷	ergs	pounds per sq. inch	2.307	feet of water
foot-pounds	5.050x10 ⁷	horse-power-hours	quarts	32	fluid ounces
foot-pounds	1.356	joules	quarts (dry)	67.20	cubic inches
foot-pounds per min.	1.286x10 ³	B.t. units per minute	quarts (liq.)	57.75	cubic inches
foot-pounds per min.	0.01667	foot-pounds per sec.	rods	16.5	feet
foot-pounds per min.	3.030x10 ³	horse-power	square centimeters	0.1550	square inches
foot-pounds per min.	2.260x10 ³	kilowatts	square inches	6.452	square centimeters
foot-pounds per sec.	7.717x10 ³	B.t. units per minute	square miles	640	acres
gallons	8.345	pounds of water	square miles	27.88x10 ³	square feet
gallons	231	cubic inches	square yards	0.8361	square meters
gallons	3.785	liters	temp. (degs. C.)+17.8	1.8	temp. (degs. Fahr.)
gallons per minute	2.228x10 ³	cubic feet per sec.	temp. (degs. F.)-32	5/9	temp. (degs. Cent.)
grams (troy)	0.06480	grams	yards	.9144	meters
LBS (POUNDS)	453.6	GRAMS			



WATER VAPOR CONVERSIONS



LEAK RATE (FLOW) CONVERSION FACTORS

TO CONVERT FROM	TO	MULTIPLY BY
bar cubic centimeters per second (bar cm ³ /s)	atm cm ³ /s	0.99
	micron L/s	7.50 x 10 ²
	micron ft ³ /h	9.53 x 10 ⁴
	torr L/s	7.50 x 10 ⁻¹
atmosphere cubic centi- meters per second (atm cm ³ /s)	micron L/s	7.60 x 10 ²
	micron ft ³ /h	9.66 x 10 ⁴
	torr L/s	7.60 x 10 ⁻¹
	bar cm ³ /s	1.01
micron liters per sec (micron L/s)	atm cm ³ /s	1.32 x 10 ⁻³
	micron ft ³ /h	1.27 x 10 ²
	torr L/s	1.00 x 10 ⁻³
	bar cm ³ /s	1.3 x 10 ⁻³
micron cubic ft per hr (micron ft ³ /h)	atm cm ³ /s	1.04 x 10 ⁻⁵
	micron L/s	7.87 x 10 ⁻³
	torr L/s	7.87 x 10 ⁻⁶
	bar cm ³ /s	1.04 x 10 ⁻⁵
torr liters per sec (torr L/s)	atm cm ³ /s	1.32
	micron L/s	1.00 x 10 ³
	micron ft ³ /h	1.27 x 10 ⁵
	bar cm ³ /s	1.33

HELIUM FACTORS

Percentage of helium in air = 0.0004%

Ratio of helium in air = 1He/250,000 air

Partial pressure of helium in air at STP

= 3.04 x 10⁻³ mm Hg

= 3.04 microns Hg

= 3.95 microbars



PRESSURE CONVERSION FACTORS

TO CONVERT FROM	TO	MULTIPLY BY
atmosphere	mm Hg	7.60×10^2
	micron Hg	7.60×10^5
	torr	7.60×10^2
	millitorr	7.60×10^5
	bar	1.01
	millibar(mbar)	1010.0
mm Hg	atmosphere	1.32×10^{-3}
	micron Hg	1.00×10^3
	torr	1.00
	millitorr	1.00×10^3
	bar	1.33×10^{-3}
	mbar	1.33
micron Hg	atmosphere	1.32×10^{-6}
	mm Hg	1.00×10^{-3}
	torr	1.00×10^{-3}
	millitorr	1.00
	bar	1.33×10^{-6}
	mbar	1.33×10^{-3}
torr	atmosphere	1.32×10^{-3}
	mm Hg	1.00
	micron Hg	1.00×10^3
	millitorr	1.00×10^3
	bar	1.33×10^{-3}
	mbar	1.33
millitorr	atmosphere	1.32×10^{-6}
	mm Hg	1.00×10^{-3}
	micron Hg	1.00
	torr	1.00×10^{-3}
	bar	1.33×10^{-6}
	mbar	1.33×10^{-3}



Section 3

CONVERSION FACTORS

Length

Area

Volume

Plane angle

Solid angle

Mass

Density

Time

Speed

Force

Pressure

Energy, work, heat

Power

Thermal conductivity

Absolute or dynamic viscosity

Inductance

Kinematic viscosity

Capacitance

Electric resistance

Electric resistivity, reciprocal
conductivity

Magnetic vector

Magnetomotive force

Magnetic flux

Magnetic field strength

Machine screws-tap drill and clearance
drill sizes

Decimal equivalents of drill size

Standard gauges



Length

Item	cm	meter	km	in.	ft	m
1 centimeter	1	10 ⁻²	10 ⁻⁵	0.3937	3.281 × 10 ⁻²	6.214 × 10 ⁻⁶
1 meter	100	1	10 ⁻³	39.37	3.281	6.214 × 10 ⁻⁴
1 kilometer	10 ⁵	1000	1	3.937 × 10 ⁴	3281	0.6214
1 inch	2.540	2.540 × 10 ⁻²	2.540 × 10 ⁻⁵	1	8.333 × 10 ⁻²	1.578 × 10 ⁻⁵
1 foot	30.48	0.3048	3.048 × 10 ⁻⁴	12	1	1.894 × 10 ⁻⁴
1 statute mile	1.609 × 10 ⁵	1609	1.609	6.336 × 10 ⁴	5280	1

1 foot = 1200/3937 meter (m)
 1 meter = 3937/1200 ft
 1 angstrom (Å) = 10⁻¹⁰ meter
 1 X-unit = 10⁻¹³ meter
 1 micron = 10⁻⁶ meter
 1 millimicron (mμ) = 10⁻⁹ meter
 1 nautical mile (n.mi.) = 1852 m = 1.1508 statute miles = 6076.10 ft

Area

1 square mile = 27,878,400 ft² = 640 acres; 1 acre = 43,560 ft²; 1 barn = 10⁻²⁸ meter².

Item	meter ²	cm ²	ft ²	in. ²	circ mil
1 square meter	1	10 ⁴	10.76	1550	1.974 × 10 ⁹
1 square cm	10 ⁻⁴	1	1.076 × 10 ⁻³	0.1550	1.974 × 10 ⁵
1 square foot	9.290 × 10 ⁻²	929.0	1	144	1.833 × 10 ⁸
1 square inch	6.452 × 10 ⁻⁴	6.452	6.944 × 10 ⁻³	1	1.273 × 10 ⁶
1 circular mil	5.067 × 10 ⁻¹⁰	5.067 × 10 ⁻⁶	5.454 × 10 ⁻⁹	7.854 × 10 ⁻⁷	1



Volume

1 U.S. fluid gallon = 4 U.S. fluid quarts = 8 U.S. fluid pints = 128 U.S. fluid ounces = 231 in.³; 1 British imperial gallon = 277.42 in.³ (volume of 10 lb H₂O at 62°F); 1 liter = 1000.028 cm³ (volume of 1 kgm H₂O at its maximum density).

Item	meter ³	cm ³	liter	ft ³	in. ³
1 cubic meter	1	10 ⁶	1000	35.31	6.102 × 10 ⁴
1 cubic cm	10 ⁻⁶	1	1.000 × 10 ⁻³	3.531 × 10 ⁻³	6.102 × 10 ⁻²
1 liter	1.000 × 10 ⁻³	1000	1	3.531 × 10 ⁻²	61.02
1 cubic foot	2.832 × 10 ⁻²	2.832 × 10 ⁴	28.32	1	1728
1 cubic inch	1.639 × 10 ⁻⁵	16.39	1.639 × 10 ⁻²	5.787 × 10 ⁻⁴	1

Plane Angle

1 rev = 2 π radians = 360°; 1° = 60' = 3600"

Item	degree	minute	second	radian	rev
1 degree	1	60	3600	1.745 × 10 ⁻²	2.778 × 10 ⁻³
1 minute	1.667 × 10 ⁻²	1	60	2.909 × 10 ⁻⁴	4.630 × 10 ⁻⁵
1 second	2.778 × 10 ⁻⁴	1.667 × 10 ⁻²	1	4.848 × 10 ⁻⁶	7.716 × 10 ⁻⁷
1 radian	57.30	3438	2.063 × 10 ⁵	1	0.1592
1 revolution	360	2.16 × 10 ⁴	1.296 × 10 ⁵	6.283	1

Solid Angle

1 sphere = 4π steradians = 12.57 steradians



Mass

Item	gm	kgm	slug	amu	oz	lb	ton
1 gram	1	0.001	6.852×10^{-5}	6.024×10^{23}	3.527×10^{-2}	2.205×10^{-3}	1.102×10^{-6}
1 kilogram	1000	1	6.852×10^{-2}	6.024×10^{26}	35.27	2.205	1.102×10^{-3}
1 slug = 11.5 _m	1.459×10^4	14.59	1	8.789×10^{27}	514.8	32.17	1.609×10^{-2}
1 amu	1.600×10^{-24}	1.660×10^{-27}	1.137×10^{-28}	1	5.855×10^{-26}	3.660×10^{-27}	1.829×10^{-30}
1 ounce (avoirdupois)	28.35	2.835×10^{-2}	1.943×10^{-3}	1.708×10^{25}	1	6.250×10^{-2}	3.125×10^{-5}
1 pound (avoirdupois)	453.6	0.4536	3.108×10^{-2}	2.732×10^{26}	16	1	0.0005
1 ton	9.072×10^{-5}	907.2	62.16	5.465×10^{29}	3.200×10^4	2000	1

Note: Portion of table enclosed in heavy lines must be used with caution because those units are not properly mass units but weight equivalents, which depend on standard terrestrial acceleration due to gravity (g).

Density

Item	slug/ft ³	kgm/m ³	gm/cm ³	lb/ft ³	lb/in. ³
1 slug per ft ³	1	515.4	0.5154	32.17	1.862×10^{-2}
1 kilogram per meter ³	1.940×10^{-3}	1	0.001	6.243×10^{-2}	3.613×10^{-5}
1 gm per cm ³	1.940	1000	1	62.43	3613×10^{-2}
1 lb per ft ³	3.108×10^{-2}	16.02	1.602×10^{-2}	1	5.787×10^{-4}
1 lb per in. ³	53.71	2.768×10^4	27.68	1728	1

Note: Portion of table enclosed in heavy lines must be used with caution because those units are not mass-density units but weight-density units which depend on g

Time

1 year = 365.24219879 days.

Item	yr	day	hr	min	sec
1 year	1	365.2	8.766×10^3	5.259×10^5	3.156×10^7
1 day	2.738×10^{-3}	1	24	1440	8.640×10^4
1 hour	1.41×10^{-4}	4.167×10^{-2}	1	60	3600
1 minute	1.901×10^{-6}	6.944×10^{-4}	1.667×10^{-2}	1	60
1 second	3.169×10^{-8}	1.157×10^{-5}	2.778×10^{-4}	1.667×10^{-2}	1



Speed

1 knot = 1 nautical mile/hr; 1 mile/min = 88 ft/sec = 60 miles/hr.

Item	ft/sec	km/hr	m/sec	mi./hr	cm/sec	knot
1 foot per second	1	1.097	0.3408	0.6818	30.48	0.5925
1 kilometer per hour	0.9113	1	0.2778	0.6214	27.78	0.5400
1 meter per second	3.281	3.600	1	2.237	100	1.944
1 mile per hour	1.467	1.609	0.4770	1	44.70	0.8689
1 centimeter per sec	3.281×10^{-2}	3.600×10^{-2}	0.0100	2.237×10^{-2}	1	1.944×10^{-2}
1 knot	1.688	1.852	0.5144	1.151	51.44	1

Force

1 kgf = 9.80665 newton. 1 lb = 32.17398 poundal.

Item	dyne	NT	lb	pdl	gf	kgf
1 dyne	10^{-5}	10^{-5}	2.248×10^{-6}	7.233×10^{-5}	1.020×10^{-3}	1.020×10^{-6}
1 Newton (NT)	10^5	1	0.2248	7.233	102.0	0.1020
1 pound	4.480×10^5	4.448	1	32.17	453.6	0.4536
1 poundal	1.383×10^4	0.1383	3.108×10^{-2}	1	14.10	1.410×10^{-2}
1 gram-force	980.7	9.807×10^{-3}	2.205×10^{-3}	7.093×10^{-2}	1	0.001
1 kilogram-force	9.807×10^5	9.807	2.205	70.93	1000	1

Note: Portion of table enclosed in heavy lines must be used with caution because those units are not force units but weight equivalents of mass, which depend on g.

Pressure

1 bar = 10^6 dyne/cm².

Item	atm	dyne/cm ²	in. of water	cm Hg	NT/meter ²	lb./in. ²	lb./ft ²
1 atmosphere	1	1.013×10^6	406.8	76	1.013×10^5	14.70	2116
1 dyne per cm ²	9.869×10^{-7}	1	4.015×10^{-4}	7.501×10^{-5}	0.100	1.450×10^{-5}	2.089×10^{-3}
1 inch of water at 4°C ^a	2.458×10^{-3}	2491	1	0.1868	249.1	3.613×10^{-2}	5.202
1 centimeter of mercury at 0°C ^a	1.316×10^{-2}	1.333×10^4	5.353	1	1333	0.1934	27.85
1 Newton per meter ²	9.869×10^{-6}	10	4.015×10^{-3}	7.501×10^{-4}	1	1.450×10^{-4}	2.089×10^{-2}
1 lb per in. ²	6.805×10^{-2}	6.895×10^4	27.68	5.171	6.895×10^3	1	144
1 lb per ft ²	4.725×10^{-4}	478.8	0.1922	3.591×10^{-2}	47.88	6.944×10^{-3}	1

^aWhere the acceleration of gravity has the standard value 9.80665 meter/sec².



Energy, Work, Heat

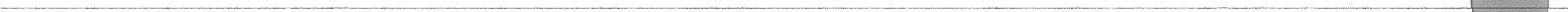
1 meter-kgf = 9.807 joule, 1 watt-sec = 1 joule = 10⁷ erg, 1 dyne-cm = 1 erg

Item	Btu	erg	ft-lb	hp-hr	joule
1 British thermal unit	1	1.055 × 10 ¹⁰	777.9	3.929 × 10 ⁻⁴	1055
1 erg	9.481 × 10 ⁻¹¹	1	7.376 × 10 ⁻⁸	3.725 × 10 ⁻¹⁴	10 ⁻⁷
1 foot-pound	1.285 × 10 ⁻³	1.356 × 10 ⁷	1	5.051 × 10 ⁻⁷	1.356
1 horsepower-hour	2545	2.685 × 10 ¹³	1.980 × 10 ⁶	1	2.685 × 10 ⁶
1 joule	9.481 × 10 ⁻⁴	10 ⁷	0.7376	3.725 × 10 ⁻⁷	1
1 calorie	3.968 × 10 ⁻³	4.186 × 10 ⁷	3.087	1.559 × 10 ⁻⁶	4.186
1 kilowatt-hour	3413	3.6 × 10 ¹³	2.655 × 10 ⁶	1.341	3.6 × 10 ⁶
1 electron volt	1.519 × 10 ⁻²²	1.602 × 10 ⁻¹²	1.182 × 10 ⁻¹⁹	5.967 × 10 ⁻²⁶	1.602 × 10 ⁻¹⁹
1 million electron volts	1.519 × 10 ⁻¹⁶	1.602 × 10 ⁻⁶	1.182 × 10 ⁻¹³	5.967 × 10 ⁻²⁰	1.602 × 10 ⁻¹³
1 kilogram	8.521 × 10 ¹³	8.987 × 10 ²³	6.629 × 10 ¹⁶	3.348 × 10 ¹⁰	8.987 × 10 ¹⁶
1 atomic mass unit (amu)	1.415 × 10 ⁻¹³	1.492 × 10 ⁻³	1.100 × 10 ⁻¹⁰	5.558 × 10 ⁻¹⁷	1.492 × 10 ⁻¹⁰

Energy, Work, Heat—cont.

Item	cal	kw-hr	ev	Mev	kgm	amu
1 British thermal unit	252.0	2.930 × 10 ⁻⁴	6.585 × 10 ¹⁵	6.585 × 10 ¹⁵	1.174 × 10 ⁻¹⁴	7.074 × 10 ¹²
1 erg	2.389 × 10 ⁻⁸	2.778 × 10 ⁻¹⁴	6.242 × 10 ¹¹	6.242 × 10 ¹¹	1.113 × 10 ⁻²⁴	670.5
1 foot-pound	0.3239	3.766 × 10 ⁻⁷	8.464 × 10 ¹⁸	8.464 × 10 ¹⁸	1.509 × 10 ⁻¹⁷	9.092 × 10 ⁹
1 horsepower-hour	6.414 × 10 ⁵	0.7457	1.676 × 10 ²⁵	1.676 × 10 ²⁵	2.988 × 10 ⁻¹¹	1.800 × 10 ¹⁶
1 joule	0.2389	2.778 × 10 ⁻⁷	6.242 × 10 ¹⁸	6.242 × 10 ¹⁸	1.113 × 10 ⁻¹⁷	6.705 × 10 ⁷
1 calorie	1	1.163 × 10 ⁻⁶	2.613 × 10 ¹⁹	2.613 × 10 ¹⁹	4.659 × 10 ⁻¹¹	2.807 × 10 ¹⁰
1 kilowatt-hour	8.601 × 10 ⁵	1	2.247 × 10 ²⁵	2.247 × 10 ²⁵	4.007 × 10 ⁻¹¹	2.414 × 10 ¹⁶
1 electron volt	3.827 × 10 ⁻²⁰	4.450 × 10 ⁻²⁶	10 ⁶	10 ⁶	1.783 × 10 ⁻³⁶	1.074 × 10 ⁻⁹
1 million electron volts	3.827 × 10 ⁻¹⁴	4.450 × 10 ⁻²⁰	10 ³⁵	1	1.783 × 10 ⁻³⁰	1.074 × 10 ⁻³
1 kilogram	2.147 × 10 ¹⁶	2.497 × 10 ¹⁰	9.310 × 10 ⁸	5.610 × 10 ²⁹	1	1.074 × 10 ⁻³
1 atomic mass unit	3.564 × 10 ⁻¹¹	4.145 × 10 ⁻¹⁷	9.310 × 10 ⁸	931.0	1.660 × 10 ⁻²⁷	6.025 × 10 ²⁶

Notes: The electron volt is the kinetic energy an electron gains from being accelerated through the potential difference of one volt in an electric field. The units enclosed by heavy lines are not properly energy units; they arise from the relativistic mass-energy equivalent formula, $E = mc^2$.



Power

Item	Btu hr	Btu sec	ft-lb min	ft-lb sec	hp	cal sec	kw	watt
1 British thermal unit per hour	1	2.778×10^{-4}	12.97×10^{-4}	0.2161	3.929×10^{-4}	7.000×10^{-2}	2.930×10^{-4}	0.2930
1 British thermal unit per second	3600	1	4.669×10^4	777.9	1.414	252.0	1.055	1.055×10^{-3}
1 foot-pound per minute	7.713×10^{-2}	2.142×10^{-5}	1	1.667×10^{-2}	3.030×10^{-5}	5.399×10^{-3}	2.260×10^{-5}	2.260×10^{-2}
1 foot-pound per second	4.628	1.286×10^{-3}	60	1	1.818×10^{-3}	0.3239	1.356×10^{-3}	1.356
1 horsepower	2545	0.7069	3.3×10^4	550	1	178.2	0.7457	745.7
1 calorie per second	14.29	0.3950	1.852×10^2	3.087	5.613×10^{-3}	1	4.186×10^{-3}	4.186
1 kilowatt	3413	0.9481	4.425×10^4	737.6	1.341	238.9	1	1000
1 watt	3.413	9.481×10^{-4}	44.25	0.7376	1.341×10^{-3}	0.2389	0.001	1

Thermal Conductivity (k)

Item	cal sec-cm ² °C	watt meter ² K	watt in. ² °C	Btu hr-ft ² °F	Btu sec-in. ² °F	hp ft ² °F
1 calorie per sec per centimeter per °C	1	418.5	10.63	241.9	5.600×10^{-3}	9.503×10^{-2}
1 watt per meter per °K	2.390×10^{-3}	1	2.540×10^{-2}	0.5781	1.338×10^{-5}	2.271×10^{-4}
1 watt per in. per °C	9.407×10^{-2}	39.37	1	22.76	5.269×10^{-4}	8.939×10^{-3}
1 Btu per hour per foot per °F	4.134×10^{-3}	1.730	4.394×10^{-2}	1	2.315×10^{-5}	3.929×10^{-4}
1 Btu per sec per in. per °F	1.786×10^2	7.474×10^4	1.898×10^3	4.320×10^4	1	16.97
1 horsepower per foot per °F	10.52	4403	111.8	2546	5.894×10^{-2}	1



Absolute or Dynamic Viscosity

Item	centipoise	poise	kgm _f -sec m ²	lb-sec ft ²	kgm m-sec	ft-sec
1 centipoise	1	10 ⁻²	1.020 × 10 ⁻⁴	2.089 × 10 ⁻⁵	10 ⁻³	6.720 × 10 ⁻⁴
1 poise	100	1	1.020 × 10 ⁻²	2.089 × 10 ⁻³	0.100	6.720 × 10 ⁻²
1 kilogram (force)-sec per meter ²	9.807 × 10 ³	98.07	1	0.2048	9.807	6.590
1 pound (force)-sec per ft ²	4.788 × 10 ⁴	4.788 × 10 ²	4.882	1	47.88	32.174
1 kilogram per meter-sec	10 ³	10	0.1020	2.089 × 10 ⁻²	1	0.6720
1 pound (mass) per ft-sec	1.488 × 10 ³	14.88	0.1518	3.108 × 10 ⁻²	1.488	1

Note: The absolute viscosity μ is properly expressed in force units according to its definition. In heat transfer and fluid mechanics it is usually expressed in mass-equivalent units to avoid the use of a conversion factor in Reynolds Number. Mass units have been used in the portion of the table enclosed in heavy line. The 2 proper force units for μ in the mksq system are Newton-sec per meter²; they are seldom used. The poise, the cgs force unit, is defined as dyne-sec/cm².

Inductance

Item	abhenry	henry	μ h	stathenry
1 abhenry (1 emu)	10 ⁹	10 ⁻⁹	0.001	1.113 × 10 ⁻²¹
1 henry	10 ³	1	10 ⁶	1.113 × 10 ⁻¹²
1 microhenry	10 ³	10 ⁻⁶	1	1.113 × 10 ⁻¹⁸
1 stathenry (1 esu)	8.987 × 10 ²⁰	8.987 × 10 ¹¹	8.987 × 10 ¹⁷	1

Capacitance

Item	abf	farad	μ f	statf
1 abfarad (1 emu)	10 ⁻⁹	10 ⁹	10 ¹⁵	8.987 × 10 ²⁰
1 farad	10 ⁻¹⁵	1	10 ⁶	8.987 × 10 ¹¹
1 microfarad	10 ⁻¹⁵	10 ⁻⁶	1	8.987 × 10 ⁵
1 statfarad (1 esu)	1.113 × 10 ⁻²¹	1.113 × 10 ⁻¹²	1.113 × 10 ⁻⁶	1

Kinematic Viscosity ($\nu = \mu/\rho$)

1 stoke = 1 centimeter²/sec

Item	centistoke	stoke	m ² /sec	ft ² /sec
1 centistoke	1	10 ⁻²	10 ⁻⁶	1.076 × 10 ⁻⁵
1 stoke	100	1	10 ⁻⁴	1.076 × 10 ⁻³
1 m ² /sec	10 ⁸	10 ⁴	1	10.76
1 ft ² /sec	9.290 × 10 ⁴	929.0	9.290 × 10 ⁻²	1

Electric Resistance

Item	abohm	ohm	stathm
1 abohm (1 emu)	10 ⁹	10 ⁻⁹	1.113 × 10 ⁻²¹
1 ohm	10 ⁹	1	1.113 × 10 ⁻¹²
1 stathm (1 esu)	8.987 × 10 ²⁰	8.987 × 10 ¹¹	1



Electric Resistivity, Reciprocal Conductivity

Item	abohm-cm	ohm-cm	ohm-m	statohm-cm	ohm-circ mil/ft
1 abohm-centimeter (1 emu)	10^9	10^{-9}	10^{-11}	1.113×10^{-21}	6.015×10^{-3}
1 ohm-centimeter	10^{11}	1	0.0100	1.113×10^{-12}	6.015×10^6
1 ohm-meter	10^{20}	100	1	1.113×10^{-10}	6.015×10^8
1 statohm-centimeter (1 esu)	8.987×10^{20}	8.987×10^{11}	8.987×10^9	1	5.406×10^{18}
1 ohm-circular mil per ft	166.2	1.662×10^{-7}	1.662×10^{-9}	1.850×10^{-19}	1

Magnetic Vector (H)

1 oersted = 1 gilbert/cm; 1 esu = 2.655×10^{-9} amp-turn/m; 1 proersted = 4π amp-turn/m.

Item	abamp-turn cm	amp-turn cm	amp-turn m	amp-turn in.	oersted
1 abampere-turn per cm	1	10	1000	25.40	12.57
1 ampere-turn per cm	0.109	1	100	2.54	1.257
1 ampere-turn per meter	10^{-3}	10^{-2}	1	2.540×10^{-2}	1.257×10^{-2}
1 ampere-turn per inch	3.937×10^{-2}	0.3937	39.37	1	0.4947
1 oersted	7.958×10^{-2}	0.7958	79.58	2.021	1

Magnetic Flux

1 esu = 2.998 webers.

Item	maxwell	kiloline	weber
1 maxwell (1 line or 1 emu)	1	0.001	10^{-8}
1 kiloline	1000	10^5	10^{-5}
1 weber	10^8	10^5	1

Magnetomotive Force

1 pragilbert = 4π amp-turn; 1 esu = 2.655×10^{-11} amp-turn.

Item	abamp-turn	amp-turn	gilbert
1 abamp-turn	1	10	12.57
1 amp-turn	0.100	1	1.257
1 gilbert	7.958×10^{-2}	0.7958	1

Magnetic Field Strength (B)

1 esu = 2.998×10^6 weber/meter²

Item	gauss	kiloline in ²	weber m ²	milligauss	gamma
1 gauss (line per cm ²)	1	6.452×10^{-3}	10^{-4}	1000	10^5
1 kiloline per in ²	155.0	1	1.550×10^{-2}	1.550×10^5	1.550×10^7
1 weber per meter ²	10^4	64.52	1	10^7	10^{10}
1 milligauss	10^{-3}	6.452×10^{-6}	10^{-7}	1	100
1 gamma	10^{-5}	6.452×10^{-8}	10^{-9}	10^{-2}	1

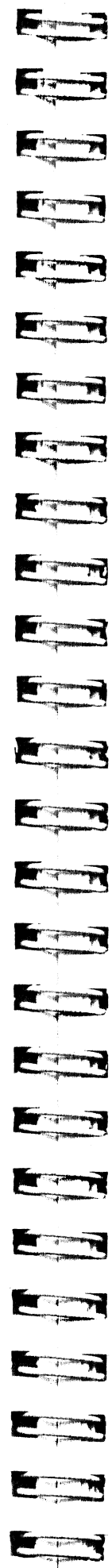


Decimal Equivalents of Drill Sizes

Letter	Letter sizes		Number sizes	
	Sizes in inches	No.	Sizes in inches	No.
A	.234	1	.2280	41
B	.238	2	.2210	42
C	.242	3	.2130	43
D	.246	4	.2090	44
E	.250	5	.2055	45
F	.257	6	.2040	46
G	.261	7	.2010	47
H	.266	8	.1990	48
I	.272	9	.1960	49
J	.277	10	.1935	50
K	.281	11	.1910	51
L	.290	12	.1890	52
M	.295	13	.1850	53
N	.302	14	.1820	54
O	.316	15	.1800	55
P	.323	16	.1770	56
Q	.332	17	.1730	57
R	.339	18	.1695	58
S	.348	19	.1660	59
T	.358	20	.1610	60

Standard Series Tap Drill and Clearance Drill Sizes

No.	Threads per inch		Drill sizes	
	N. C.	N. F.	Tap	Clear
0	.060	80	3/64	#51
1	.073	64	#53	#47
1	.073	72	#53	#47
2	.086	56	#50	#42
2	.086	64	#50	#42
3	.099	48	#47	#37
3	.099	56	#46	#37
4	.112	40	#43	#31
4	.112	48	3/32	#31
5	.125	40	#38	#29
5	.125	44	#37	#29
6	.138	32	#33	#27
6	.138	40	#29	#18
8	.164	32	#29	#18
8	.164	36	#29	#18
10	.190	24	#26	#9
10	.190	32	#21	#9
12	.216	24	#16	#2
12	.216	28	#15	#2



(Fractional sizes start here)

U	.368	21	.1590	61	.0390
V	.377	22	.1570	62	.0380
W	.386	23	.1540	63	.0370
X	.397	24	.1520	64	.0360
Y	.404	25	.1495	65	.0350
Z	.413	26	.1470	66	.0330
		27	.1440	67	.0320
		28	.1405	68	.0310
		29	.1360	69	.0292
		30	.1285	70	.0280
		31	.1200	71	.0260
		32	.1160	72	.0250
		33	.1130	73	.0240
		34	.1110	74	.0225
		35	.1100	75	.0210
		36	.1065	76	.0200
		37	.1040	77	.0180
		38	.1015	78	.0160
		39	.0995	79	.0145
		40	.0980	80	.0135

Tap drill sizes shown give approximately 75% depth of thread.



Standard Gauges

This table shows the standard gauges and the names of major commodities for which it is used. To determine the gauge used for any commodity, note the number in parentheses in the commodity named and find the gauge column below bearing the same number in parentheses.

Commodity	Ga. No.	(1) Birmingham or Stubs	(2) American or Browne & Sharpe	(3) U.S. Standard	(4) Washburn & Moen	(5) Music wire (Std)	(6) Mfgs. std. ga. for sheet metal
Aluminum (2) except tubing (1)	1/0	.340	.3249	.3125	.3065	.009	
Bands (1)	1	.300	.2893	.2812	.2830	.010	
Brass tubing (1/8" O.D. and larger) (1)	2	.284	.2576	.2656	.2625	.011	.2391
Brass tubing (smaller than 1/8" O.D.) (2)	3	.259	.2294	.2500	.2437	.012	.2242
Brass sheets (2)	4	.238	.2043	.2243	.2253	.013	.2092
Brass strips (2)	5	.220	.1819	.2187	.2070	.014	.1943
Brass wire (2)	6	.203	.1620	.2031	.1920	.016	.1793
Copper sheets (2)	7	.180	.1443	.1875	.1770	.018	.1644
Copper wire (2)	8	.165	.1285	.1718	.1620	.020	.1495
Flat wire (1)	9	.148	.1144	.1562	.1483	.022	.1345
Hoops (1)	10	.134	.1019	.1406	.1350	.024	.1196
Iron wire (4)	11	.120	.0907	.1250	.1205	.026	.1046
Monel metal sheets (3)	12	.109	.0808	.1093	.1055	.029	.0897
Music wire (5)	13	.095	.0719	.0937	.0915	.031	.0747
Nickel sheets (3)	14	.083	.0640	.0781	.0800	.033	.0673
	15	.072	.0570	.0703	.0720	.035	
Nickel silver sheets (2)	16	.065	.0508	.0625	.0625	.037	.0598
Nickel silver wire (2)	17	.058	.0452	.0562	.0540	.039	.0538
Phosphor bronze strip (2)	18	.049	.0403	.0500	.0475	.041	.0478
Spring steel (1)	19	.042	.0359	.0437	.0410	.043	.0418
Stainless steel (3)	20	.035	.0319	.0375	.0348	.045	.0359
Steel plates (6)	21	.032	.0284	.0343	.0317	.047	.0329
Steel sheets (6)	22	.028	.0253	.0312	.0286	.049	.0299
Steel tubing, seamless and welded (1)	23	.025	.0225	.0281	.0258	.051	.0269
Steel wire (4) exceptions:	24	.022	.0201	.0250	.0230	.055	.0239
Music wire (5)	25	.020	.0179	.0218	.0204	.059	.0209
Armature binding wire (2)	26	.018	.0159	.0187	.0181	.063	.0179
Flat wire (1)	27	.016	.0142	.0171	.0173	.067	.0164
Strip steel (1)	28	.014	.0126	.0156	.0162	.071	.0149
	29	.013	.0112	.0140	.0150	.075	.0135
	30	.012	.0100	.0125	.0140	.080	.0120
	31	.010	.0089	.0109	.0132	.085	.0105
	32	.009	.0079	.0101	.0128	.090	.0097
	33	.008	.0071	.0093	.0118	.095	.0090
	34	.007	.0063	.0085	.0104	.100	.0082
	35	.005	.0056	.0078	.0095	.106	.0075
	36	.004	.0050	.0070	.0090	.112	.0067
	37		.0044	.0066	.0085	.118	.0064
	38		.0039	.0062	.0080	.124	.0060



CONVERSION TABLES

MULTIPLY	BY	TO OBTAIN
DENSITY		
Grams per cc.	62.428 0.03613 8.345	Pounds per cubic feet Pounds per cubic inch Pounds per U.S. gallon
Pound per cubic foot . .	16.02	Kg. per cubic meter
Gram-moles of Ideal Gas @ 0°C & 760 mm Hg	22.4140	Liters
Pounds per cubic inch . .	1728 27.68	Pounds per cubic feet Grams per cc.
Pound-moles of Ideal Gas @ 0°C & 760 mm Hg	359.05	Cubic feet
PRESSURE		
Atmospheres.	101.4 760 29.921 33.93 10332 14.696 2116.2 1.0133 1.0332	Kilopascals Millimeters of mercury Inches of mercury Feet of water Kg. per square meter Lbs. per square inch Lbs. per square foot Bars Kg. per square centimeter
Bars.	100	Kilopascals
Centimeters of Hg.	5.3524 0.4460 1.33 0.1934 27.845 135.95	Inches of water Feet of water Kilopascals Lbs. per square inch Lbs. per square foot Kg. per square meter
Feet of water	0.02947 0.4335 62.378 2.99	Atmospheres Lbs. per square inch Lbs. per square foot Kilopascals
Inches of Hg.	0.03342 13.60 1.133 3.389 0.4912 70.727 345.32	Atmospheres Inches of water Feet of water Kilopascals Lbs. per square inch Lbs. per square foot Kg. per square meter
Inches of water	0.249 0.03609 5.1981 25.38	Kilopascals Lbs. per square inch Lbs. per square foot Kg. per square meter
Kg. per square centimeter	0.9678 98.1 14.22	Atmospheres Kilopascals Lbs. per square inch
Pounds per square inch.	70.31 6.9 2.036 2.311	Grams per cm ² Kilopascals Inches of mercury Feet of water
FLOW		
Ft. ³ /min	472 0.4719 7.87	Cm ³ /sec. Liters/sec. Cm ³ /sec.
Ft. ³ /hour	28.31605 28.31605	Liters/hour Liters/sec.
Ft. ³ /sec.	1698.963 28316.847	Liters/min. Cm ³ /sec.
Gallons/hour.	6.3090 x 10 ⁻⁵ 3.7854	M ³ /min. Liters/hour

MULTIPLY	BY	TO OBTAIN
HEATING VALUE		
BTU/ft. ³	0.037	Joules/cm ³
BTU/pound	2.32444	Joules/gram
VOLUME		
Cubic centimeters.	0.001 0.0610	Liters Cubic inches
Liters.	0.2642 0.0353 1.0567 61.025	Gallons Cubic feet Quarts Cubic inches
Cubic feet	28317 1728 0.03704 7.481 28.32 0.028 16.387 0.01639 4.329 x 10 ⁻³ 0.01732 1.6387 x 10 ⁻⁵	Cubic centimeters Cubic inches Cubic yards Gallons Liters Cubic meters Cubic centimeters Cubic inches Cubic yards Gallons Liters Cubic meters Liters Gallons Quarts (liquid) Cubic meters
MASS		
Pounds	0.4536 435.59237 0.04448 4.448	Kilograms Grams Joules/cm Joules/meter
Pounds of water.	0.01602 27.68 0.1198	Cubic feet Cubic inches Gallons
Ounces	28.349527	Grams
TEMPERATURE		
Degrees Fahrenheit = 1.8 (degrees Celcius) + 32		
Degrees Kelvin = degrees Celcius + 273.16		
Degrees Rankine - degrees Fahrenheit + 459.69		
VISCOSITY (Absolute)		
Poise	1.0 1.0 100	Gm/cm sec. Dyne sec./cm ² Centipoise
Centipoise	0.000672 0.0000209 2.42	Lb./ft. sec. Lb. sec./ft. ² Lb./ft. hr.
VISCOSITY (Kinematic)		
Stoke	1.0 0.155 0.001076 density (gm/cm ³)	Cm ² /sec. In. ² /sec. Ft. ² /sec. Poise
MISC. PHYSICAL CONSTANTS		
CONSTANT	NUMERICAL VALUE	UNITS
Avogadro's Number . .	6.0228 x 10 ²³	Molecules/gm-mole
Gas-Law Constant R . .	1.987 1.987 82.06	Cal./(gm-mole)(°K.) BTU/(lb.-mole)(°R.) (cm ³)(atm.)/(gm-mole)(°K.)
	0.08205	(liter)(atm.)/(gm-mole)(°K.)
	10.731	(ft. ³)(lb.)/(in. ²)(lb.-mole)(°R.)
	0.7302	(ft. ³)(atm.)/(lb.-mole)(°R.)
	8.31432 x 10 ³	J/(k mole)(°K)





CONVERSION FACTORS

Presented below are some of the more commonly used conversion factors which we at PLASTIC CAPACITORS, INC. have found useful — we hope you do, too.

MULTIPLY	BY	TO GET
Acres	.0015625	Sq. Miles
Acres	43,560	Sq. Feet
Acres	.40469	Hectares
Amperes/Sq. Cm.	6.452	Amperes/Sq. Inch
Amperes/Sq. Inch	.1550	Amperes/Sq. Cm.
Angstrom	1×10^{-8}	Centimeters
Atmospheres	76	Cm. of Mercury
Atmospheres	29.92	Inches of Mercury
Atmospheres	33.90	Feet of Water
Atmospheres	14.70	Lbs./Sq. Inches
BTU	778.3	Foot-Pounds
BTU	1055	Joules
BTU	0.2520	Kilogram-Calories
BTU	.2930	Watts
BTU/Min	17.58	Watts
Cable Lengths	720	Feet
Centimeters	0.2381	Feet
Centimeters	0.3937	Inches
Circular Mills	7.85×10^{-7}	Sq. Inches
Cubic CMS	.061	Cubic Inches
Cubic CMS	16.2306	Minims (U.S. FL.)
Cubic CMS	3.697	Drams (U.S. FL.)
Cubic CMS/SEC	.002119	Cubic FT/Minute
Cubic Feet	2.83×10^{-4}	Cubic CMS.
Cubic Feet	1728	Cubic Inches
Cubic Feet	7.481	Gallons (U.S.)
Cubic Feet	6.229	Gallons (Br.)
Cubic Feet	28.316	Liters
Cubic Feet Air	.08	Pounds
Cubic Feet Water	62.43	Pounds
Cubic Inches	16.38716	Cubic CMS
Cubic Inches	1.8047	Ounce (U.S., FL.)
Cubic Inches	1.6387×10^{-5}	Cubic Meters
Dalton	1.650×10^{-24}	Grams
Days	1440	Minutes
Days	86,400	Seconds
Drams (avdp.)	1.7718	Grams
Dynes	1.020×10^{-3}	Grams
Dynes	2.248×10^{-6}	Pounds
Ergs	9.4805×10^{-11}	BTU
Feet	30.48	Centimeters
Feet	.3048	Meters
Feet of Water	.02950	Atmospheres
Feet of Water	.8826	Inches of Mercury
Feet of Water	62.43	Pounds/Sq. Foot
Foot-Pounds	1.285×10^{-3}	BTU
Foot-Pounds	1.356	Joules
Foot-Pounds	3.238×10^{-4}	Kilogram-Calories

A WORD ABOUT PCI



Plastic Capacitors, Inc. was incorporated in Illinois in 1952 and is a closely held corporation.

We specialize in custom designed High Voltage components. We catalog capacitors of 200,000 volts, have designed banks of capacitors up to 3,000,000 volts.

Our Quality Control System meets the requirements of MIL-I-45208A and MIL-STD-45662.

Our factory is located in Chicago, the transportation center of the United States, and is over 56,000 square feet in area. All of our products are manufactured with pride in Illinois.

Call or write us with your problem applications and if it is an item that we cannot manufacture, we can probably tell you where to obtain it.

LIMITED WARRANTY

Plastic Capacitors, Inc. warrants its products under normal usage and service, against defects in workmanship or materials, for a period of ONE (1) YEAR from the date of delivery.

The sole obligation of PLASTIC CAPACITORS under this warranty shall be to repair or replace any part which, in the opinion of P.C.I., shall prove to be defective in normal use and service within said ONE (1) YEAR period from the date of delivery. This warranty does not cover normal wear and tear. In addition, the warranty shall be null and void if the equipment is modified, improperly installed or used, or damaged by accident or neglect, or otherwise repaired by another party during the aforesaid period. PLASTIC CAPACITORS reserves the right, in its sole discretion, to replace any product or part thereof, found to be defective.

Defective products shall be returned, freight prepaid, directly to PLASTIC CAPACITORS, 2623 N. Pulaski Rd., Chicago, IL 60639.

THE ABOVE WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, STATUTORY OR OTHERWISE, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. PLASTIC CAPACITORS shall not be liable for any damages sustained by its customer or any other party arising from or relating to any product failure, including, but not limited to, consequential damages, nor shall PLASTIC CAPACITORS have any liability for delays in replacement or repair of its products.

No agent, representative, dealer or employee of PLASTIC CAPACITORS shall have the authority to increase, alter or otherwise modify the provisions of this LIMITED WARRANTY.

Plastic Capacitors, Inc.

2623 N. PULASKI ROAD
CHICAGO, ILLINOIS 60639
Area 312, Phone 489-2229
FAX: 312-489-0496

Plastic Capacitors, Inc.

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CONVERSION FACTORS

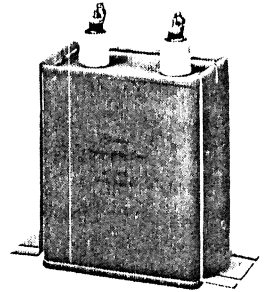
TYPE LK

Medium And High Voltage
Hermetically-Sealed Capacitors



MULTIPLY	BY	TO GET
Foot-Pounds	3.766x10 ⁻⁷	Kilowatt Hours
Foot-Pounds/Min.	2.260x10 ⁻⁵	Kilowatts
Furlong	660	Feet
Gallons	3785	Cubic Centimeters
Gallons	.1337	Cubic Feet
Gallons	231	Cubic Inches
Gallons	3.7853	Liters
Gallons/Second	8.0192	Ft. 3/Minute
Gausses	6.452	Lines/Sq. Inch
Gill (Br.)	5	Ounces (Br. Fl.)
Gill (Br.)	.1421	Liters
Gilberts	.7958	Ampere Turns
Gilberts/Cm.	2.021	Ampere Turns/Inch
Grams	980.7	Dynes
Grams	.03527	Ounces
Grams	.07093	Poundals
Grams	2.205x10 ⁻³	Pounds
Gram Calories (ft.)	3.968x10 ⁻³	BTU
Grams/Centimeters	5.60x10 ⁻³	Pounds/Inch
Grams/Cu. Cm.	62.43	Lbs./Cu. Foot
Grams/Cu. Cm.	.03613	Lbs./Cu. Inch
Hectares	2.471	Acres
Hectares	1.0764x10 ⁵	Sq. Feet
Horse-Power (Metra)	.98632	Horsepower (U.S.)
Horse-Power (U.S.)	42.40	BTU/Min.
Horse-Power (U.S.)	33,000	Foot-Pounds/Min.
Horse-Power (U.S.)	550	Foot-Pounds/Sec.
Horse-Power (U.S.)	10.68	KG-Calories/Min.
Horse-Power (U.S.)	.7457	Kilowatts
Horse-Power (U.S.)	.745	Watts
Horse-Power Hours	2545	BTU
Horse-Power Hours	1.98x10 ⁶	Foot-Pounds
Horse-Power Hours	2.684x10 ⁶	Joules
Inches	2.54	Centimeters
Inches	2.54x10 ⁸	Angstroms
Inches of Mercury	.03342	Atmosphere
Inches of Mercury	1.133	Feet of Water
Inches of Mercury	.4912	Pounds/Sq. Inch
Inches of Water	.002458	Atmospheres
Inches of Water	.07355	Inches of Mercury
Inches of Water	25.4	MM. of Mercury
Inches of Water	5.204	Pounds/Sq. Foot
Inches of Water	.03613	Pounds/Sq/ Inch
Joules (Int)	9.480x10 ⁻⁴	BTU
Joules (Int)	.7378	Foot-Pounds
Joules (Int)	2.778x10 ⁻⁴	Watt-Hours
Kg/CM ²	14.2234	Pounds/Inch ²
Kg/M ²	.204817	Pounds/Ft ²
Kg/M ³	.062434	Pounds/Ft ³
Kilograms	2.205	Pounds

TYPE LK CAPACITORS offer unusually good electrical characteristics, coupled with very small size. They are designed to meet the requirements of MIL-C-25 AND MIL-C-19978, but are not a QPL item.



TYPE LK CAPACITORS are specifically designed for filter, bypass and coupling applications in the low audio frequency range. The CP70 style container and internal construction permit operation in any position. Glazed steatite or alumina bushings are used as terminals. The terminal stud is supplied with a nut washer and/or solder lug. The whole assembly is hermetical sealed. Footed mounting brackets are supplied with all LK units.

TYPE LK capacitors are cataloged in our 200 voltage and capacitance combinations, many with alternative packaging size. Catalog Voltage ratings available range from 600 VDC to 50 KVDC, with capacitance values of .1mfd-50mfd at the lower end to .005mfd-.5mfd at the higher voltages. Other voltage/capacitance values available upon request.

Mylar* film and Kraft capacitor tissue are used as the dielectric. Environmentally safe mineral oil is used as the impregnant. For details, ask for catalog sheet A9.

The following chart is representative of catalog designs; the sizes given are Length x Width x Height of the capacitor, not including the height of the terminal.

PART NUMBER	DC VOLTS	CAP. MFD.	SIZE (Inches)
LK6-106	600 V	10	3 3/4 x 1 1/4 x 4 1/2
LK50-104	5 KV	.1	1 3/4 x 1 x 2 1/8
LK50-406Y	5 KV	40	7 3/8 x 5 5/8 x 1 1/4
LK200-205	20 KV	2	13 1/2 x 4 1/8 x 9 1/4
LK500-104Z	50 KV	.1	6 x 4 11/16 x 6 1/2

*DuPont Polyester Film

Plastic Capacitors, Inc.

2

2623 N. PULASKI ROAD
CHICAGO, ILLINOIS 60639
Area 312, Phone 489-2229
FAX: 312-489-0496

- PULSE FORMING NETWORKS
- PLASTIC FILM CAPACITORS
- PAPER DIELECTRIC CAPACITORS
- HIGH VOLTAGE POWER SUPPLIES

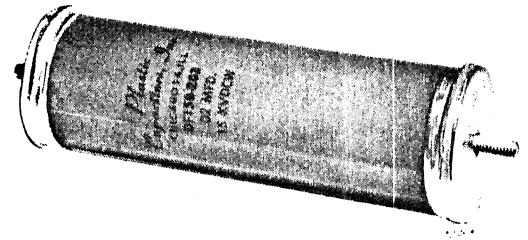




CONVERSION FACTORS

MULTIPLY	BY	TO GET
Kilogram-Calories	3.968	BTU
Kilogram-Calories	3088	Foot-Pounds
Kilogram-Calories	4186	Joules
Kilogram-Calories	1.163×10^{-3}	Kilowatt-Hours
Kilometers	3281	Feet
Kilometers	.6214	Miles
Kilometers/Hr.	27.78	Cms./Sec
Kilometers/Hr.	54.68	Feet/Min.
Kilometers/Hr.	.9113	Feet/Sec.
Kilometers/Hr.	.6214	Miles/Hour
Kilowatts	56.88	BTU/Min.
Kilowatts	4.427×10^{-4}	Foot-Pounds/Min.
Kilowatts	1.341	Horse-Power
Kilowatts	14.33	KG-Calories/Min.
Kilowatt Hours	3413	BTU
Kilowatt Hours	2.656×10^6	Foot-Pounds
Kilowatt Hours	1.341	Horse-Power-Hours
Kilowatt Hours	3.6×10^6	Joules
Kilowatt Hours	860	Kilogram-Calories
Knots	6080	Feet/Hr.
Knots	1.152	Miles/Hr.
League (Naut.)	.333	Miles (Naut.)
Lines/Sq. Cm.	1	Gausses
Lines/Sq. In.	.1550	Gausses
Liters	.03531	Cubic Feet
Liters	61.02	Cubic Inches
Liters	.2642	Gallons
Liters	33.8147	Ounces (U.S. Fl.)
Liters/second	15.85	Gallons (U.S.)/Minute
Lux	.0929	Foot Candles
Meters	3.281	Feet
Meters	39.37	Inches
Meters	6.214×10^{-4}	Miles
Microns	0.001	Millimeters
Miles	1.609×10^5	Centimeters
Miles	5280	Feet
Miles	1.609	Kilometers
Miles/Hour	1.4667	Feet/Sec.
Miles/Hour	44.70	Cm./Sec.
Miles/Hour	88	Feet/Min.
Miles/Hour	.8684	Knots
Millimeters of Mercury	1.3595	Grams/Cm ²
Minutes	6.944×10^{-4}	Days
Minutes	.01667	Hours
Minutes (Angle)	2.909×10^{-4}	Radians
Ounces	437.5	Grains
Ounces	28.35	Grams
Ounces	.0625	Pounds
Ounces (Fluid)	1.805	Cubic Inches
Ounces (Fluid)	29.57	Cu. Centimeters

TYPE OF Medium And High Voltage Hermetically-Sealed Capacitors



TYPE OF capacitors offer small values of capacitance (from .0001 to 0.5 mfd) in the medium and high voltage range—2000 volts to 60,000 volts. The capacitor element utilizes a paper plastic dielectric and is impregnated with highly purified and inhibited mineral oil.

The capacitor element is encased in a heavy-wall hard glass tube. Sealing is accomplished by soldering tinned monel ferrules to each end of the glass tube. Tinned wire leads or axial studs enable easy electrical connection and mounting.

Capacitance change is less than 6% from minus 60°C to 105°C and power factor is well under 1% at 60 and 1000 cycles except at very low temperatures. The capacitors may be mounted in any position. Peak to peak ripple voltage may be 25% at 60 cycles, 20% at 120 cycles, 5% at 400 cycles of the nameplate voltage rating, provided the peak voltage does not exceed the nameplate voltage rating. Dielectric resistance, measured with nameplate voltage rating and with two minutes electrification time is 10,000 megohms x mfd at 20°C and 1200 megohms x mfd at 85°C.

Operating temperature range is minus 55°C to 85° with nameplate rated voltage, and may be used at 105°C with 60% nameplate rated voltage. Non-operating temperature range is minus 65°C to 110°C.

APPLICATIONS. The excellent electrical characteristics make type OF capacitors extremely useful in the low current power supplies and coupling and bypass applications in the low and medium and high frequency audio range.

TYPE OF capacitors are designed to pass the tests and exceed the requirements of MIL-C-25D for terminal "D".

NOT QPL LISTED

Plastic Capacitors, Inc.

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- PULSE FORMING NETWORKS
- PLASTIC FILM CAPACITORS
- PAPER DIELECTRIC CAPACITORS
- HIGH VOLTAGE POWER SUPPLIES





CONVERSION FACTORS

MULTIPLY	BY	TO GET
Pounds/Cu. Inch	27.68	Grams/Cu. Centimeters
Pounds	444,823	Dynes
Pounds (Avdp.)	453.6	Grams
Pounds of Air	12.5	Cubic Feet
Pounds of Water	.01602	Cubic Feet
Pounds of Water	27.62	Cubic Inches
Pounds of Water	.1198	Gallons
Pounds/Cubic Foot	.01602	Grams/Cubic Cm.
Pounds/Cubic Foot	5.787×10^{-4}	Pounds/Cubic Inch
Pounds/Sq. Foot	4.725×10^{-4}	Atmospheres
Pounds/Sq. Foot	4.882	Kgs./Square Meter
Pounds/Sq. Foot	$.6944 \times 10^{-3}$	Pounds/Square Inch
Pounds/Sq. Inch	2.307	Feet of Water
Pounds/Sq. Inch	.06804	Atmospheres
Pounds/Sq. Inch	5.1715	Cms. of Mercury
Pounds/Sq. Inch	2.036	Inches of Mercury
Quart (U.S. dry)	1.10119	Liters
Quart (U.S. Fl.)	.946326	Liters
Radians	57.30	Degrees
Rods	5.0292	Meters
Square Centimeters	1.973×10^5	Circular Mills
Square Centimeters	1.076×10^{-3}	Square Feet
Square Centimeters	0.1550	Square Inches
Square Feet	2.296×10^{-5}	Acres
Square Feet	929	Sq. Centimeters
Square Inches	1.273×10^6	Circular Mills
Square Inches	6.452	Sq. Centimeters
Square Meter	10.76391	Sq. Feet
Square Miles	6.40	Acres
Square Miles	2.788×10^7	Sq. Feet
Square Yard	1296	Sq. Inches
Square Yard	.836127	Sq. Meter
Ton (Short)	907.185	Kilograms
Ton (Short)	2000	Pounds
Ton (Long)	2240	Pounds
Watts	.05688	BTU/Min.
Watts	44.254	Foot-Pounds/Min.
Watts	1.341×10^{-3}	Horsepower
Watts	.01433	KG-Calories/Min.
Watt Hours	3.413	BTU
Watt Hours	2656	Foot-Pounds
Watt Hours	.860	Kilogram-Calories
Webers	10	Maxwells
Yards	.914402	Meters
Years (365 days)	8760	Hours

We hope that you have found our booklet useful and, of course, that you will keep us in mind when you need the high voltage products that we manufacture. If you have any comments on this booklet or have some special equations that might be of use to other engineers, please let us know!

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HIGH FREQUENCY CAPACITORS



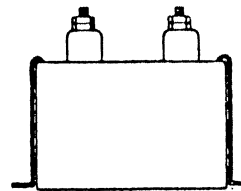
Capacitors which operate at 400Hz to the megahertz frequencies normally handle kilovolt-amperes. This type of operation requires the capability of not overheating with the KVA and must be constructed to handle large current values. Therefore, the dissipation factor is necessarily low.

Typical applications would include:

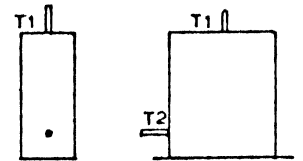
- RF and audio frequency tuning circuits
- Low series inductance discharge circuits
- RF coupling and bypass
- Pulse forming networks
- Power factor correction
- De-spiking networks
- SCR commutation
- Induction heaters

This type of capacitor, generally using polypropylene film as the solid dielectric, is available in many different case styles, to provide alternative packaging configurations for almost any application.

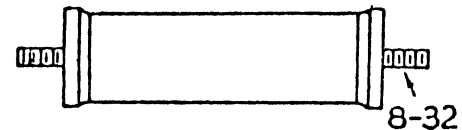
Among the most popular container styles available are:



CP70 type steel or brass can, with steatite HV bushings.



Phenolic case rectangular, footed mounting plate, brass screw terminations.



Glass case tubular, with Monel metal end caps, brass screw terminations.

CALL US WITH YOUR SPECIFIC DESIGN PROBLEMS AND APPLICATIONS.

- PULSE FORMING NETWORKS
- PLASTIC FILM CAPACITORS
- PAPER DIELECTRIC CAPACITORS
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CAPACITOR LIFE

Generally, capacitors follow certain laws of life making possible a fairly good determination of life expectancy under operating conditions. Operating conditions for hermetically-sealed DC filter types primarily involve temperature and voltage. Short term life testing at the extremes of voltage and temperature will permit interpolation by means of formulae. Extrapolation may lead to erroneous conclusions.

For this reason, 250 to 1000 hours life tests at high temperature and at a voltage above the desired operating voltage can lead to conclusions regarding operating life.

For determining life at the operating voltage

$$\frac{V_T^5}{V_0^5} = \frac{L_0}{L_T} \quad \text{OR} \quad L_0 = \frac{V_T^5 L_T}{V_0^5}$$

Where V_T is the short time test voltage.

V_0 is the operating voltage.

L_T are the hours of mean life at the test voltage.

L_0 are the hours of life expectancy at the operating voltage and the test temperature.

For determination of life at other temperatures, the general law of chemical activity is used. Preferably the operating temperature should be the same or lower than the test temperature.

$$\frac{T_T^7}{T_0^7} = \frac{L_0}{L_T} \quad \text{OR} \quad L_0 = \frac{T_T^7 L_T}{T_0^7}$$

Where T_T is the test temperature in degrees Kelvin.

T_0 is the operating temperature in degrees Kelvin.

Relationship among temperature scales

Degrees Kelvin = Degrees Centigrade + 273

Degrees Fahrenheit = $9/5$ °C. + 32

Degrees C. = $(°F - 32) \times 5/9$

TEMPERATURE SCALES

K°	C°	F°
0	-273	-459
73	-200	-328
173	-100	-148
213	-60	-76
233	-40	-40
255.2	-17.8	0
273	0	32
293	20	68
338	65	149
358	85	185
373	100	212
398	125	257
423	150	302
473	200	392

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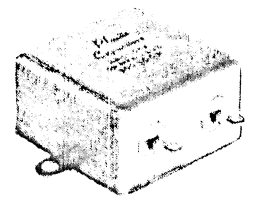
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TYPE AB

Metallized Mylar * Capacitors
Hermetically-Sealed



MYLAR* FILM, one of the many dielectrics employed by Plastic Capacitors, Inc. in the fabrication of the highest quality capacitors, offers particular advantages not obtainable with other materials. Mylar* satisfies the requirements of high resistance, low absorption, excellent retrace and capacitance stability over a wide temperature range and high ambient operating conditions.



METALLIZED MYLAR* has several advantages that are outstanding. The self-healing characteristics are well-known and extend the useful life of the capacitor. The second, and most over-looked feature, is the possibility of making full use of the highest volts-per-mil rating of the film by eliminating all the weak dielectric areas. This results in extreme small size without sacrificing life, reliability and economy.

Unlike other metallized dielectrics, metallized Mylar* does not spark, and may be used in very low voltages since there is no problem of particle migration. Plastic Capacitors TYPE AB in bathtub containers achieve the maximum possible characteristics of Mylar* film.

Other container shapes and materials are also available: phenolic round and rectangular; rectangular CP70 type cases in steel or brass.

TYPE AB capacitors are available rated at 200, 300, 400 and 600 VDC in 37 voltage/capacitance combinations ranging from .05 mfd to 30 mfd. Standard capacitance tolerance is $\pm 20\%$.

TERMINALS are glass to metal solder seals and may be mounted on the front of the unit (as shown) or on the top or bottom.

EXTENDED FOIL construction provides low inductance and internal wiring is designed with discharge applications in mind. Call for discharge ratings on specific values.

For more information, ask for catalog data sheet B11.

* DUPONT POLYESTER FILM

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PARALLEL

C_T = C_1 + C_2 + C_3 + ...

SERIES

C_T = 1 / (1/C_1 + 1/C_2 + 1/C_3 + ...)

q = CE

X_C = 1 / (2 * pi * f * C)

D_f = R_s / X_c

Z_c = sqrt(X_c^2 + R_s^2)

P_f = R_s / Z_c

JOULES = 1/2 * CE^2

One Joule = One Watt Second

Current Flowing in a Circuit of R Ohms and C Farads Series Capacitance t Seconds After the Source of EMF is Short Circuited, the Potential Across the Capacitor at the Instant of Short Circuiting Being E Volts

i = (E/R) * e^(-t/RC)

q = CE * e^(-t/RC)

E_T = E * e^(-t/RC)

VAR = I^2 * X_c

VA = I^2 * Z

POWER LOSS OF CAPACITOR

P = VA * Cos theta

P = VA * (R_s / Z)

P = VA * Power Factor

VA = sqrt(P^2 + (VAR)^2)

OHMS LAW R = E / I

f_r = 1 / (2 * pi * sqrt(LC))

X_L = 2 * pi * f * L

Z_L = sqrt(X_L^2 + R_L^2)

Q = X_L / R_s or X_C / R_s

C_T - Total Capacitance

C - Capacitance in Farads

q - Coulombs Charge Equal to One Ampere For One Sec.

X_C - Capacitance Reactance

D_f - Dissipation Factor

R_s - Equivalent Series Resistance

Z_c - Impedance of C

P_f - Power Factor

i - Instantaneous Current

E_T - Unidirectional Voltage

R - DC Resistance in Ohms

t - Time in Seconds

e - Epsilon 2.718

VAR - Volt-Amperes Reactive

I - RMS or DC Current

VA - Volt-Amperes

P - Power in Watts

f_r - Resonant Frequency

pi = 3.1416

2 * pi = 6.2832

L - Inductance in Henrys

X_L - Inductance Reactance

f - Frequency

Q - Figure of Merit for Capacitors or Inductors



PLASTIC CAPACITORS INC. manufacture a wide range of low-current, high voltage power supplies as cataloged items available from stock.

TYPE HV-M silicon diode power packs use the latest technique and advanced materials to achieve small package size.

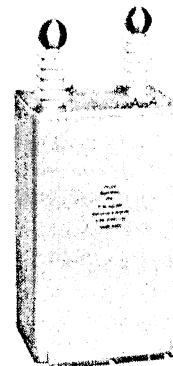
Available with output ratings of 1,000 volts to 100 KVDC at 1.5, 5.0 or 10 ma, these hermetically sealed, oil filled power packs may have the output voltage adjusted by means of varying the input voltage from 0 to 118 VAC at 50 to 500 Hz. Also available is 0 to 230 VAC input.

Long life and low ripple are among the many features in this latest development in the state of the art for production of power supplies consistent with economy.

Write for complete specifications.



HV50-502M



HV500-502M

Table with 4 columns: PART NUMBER, OUTPUT KVDC, OUTPUT MA, CONTAINER SIZE. Lists models HV50-502M, HV100-103M, HV200-152M, HV250-103M, HV300-152M, HV500-502M, HV750-152M.

This is a partial listing.

DESIGN LIFE is 40,000 hours at 35° C and 25,000 hours at 65° C. Most units may be mounted in any position and will withstand a substantial vibration test.

POLARITY. All but the 75KV & 100KV output units are made with both positive and negative output terminations, with the output independent from the case.

CORONA SPHERES are sent with power packs having an output of 25KV and above; the corona sphere forms the termination, with a user-supplied miniature banana plug.

Plastic Capacitors, Inc.

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FULL WAVE RECTIFICATION

Critical Value of Inductor For Inductor Input to Filter

$$R + R_L = 1131L \text{ 60 CPS Input}$$

$$R + R_L = 7536L \text{ 400 CPS Input}$$

$$I_{DC} = \frac{2\sqrt{2}}{\pi} \cdot \frac{E_s}{R + R_L}$$

$$E_{DC} = \frac{2\sqrt{2}}{\pi} \cdot \frac{R}{R + R_L} \cdot E_s$$

$$E_2 = \frac{4}{3\pi} \cdot \frac{E_s}{(4\omega^2 L_1 C_1)(4\omega^2 L_2 C_2)}$$

Ripple Factor for LC Networks For Each Section Ripple Is Reduced By This Factor

$$R.F. = \frac{0.827 \times 10^{-6}}{LC} \text{ (60 CPS)}$$

$$R.F. = \frac{187 \times 10^{-10}}{LC} \text{ (400 CPS)}$$

$$R.F. = \frac{1}{4\omega^2 LC} \text{ (ANY FREQ.)}$$

- R - Load
- R_L - Resistance of Inductor
- L - Inductance in Henrys
- I_{DC} - Direct Current Output
- E_s - Peak Varying Potential on the Cathode of the Rectifier Somewhat Less than the Peak AC
- E_{DC} - Voltage Output
- E₂ - Ripple Voltage For Two Section Filter
- L₁L₂ - Inductance In Each Section
- C₁C₂ - Capacitance In Each Mesh
- ω - 2πf
- R.F. - Ripple Factor
- C - Capacitance In Farads

TRANSFORMER RELATIONSHIPS

$$\frac{N_p}{N_s} = \frac{E_p}{E_s} = \frac{I_s}{I_p} = \sqrt{\frac{Z_p}{Z_s}}$$

$$N = \frac{3.49E \times 10^6}{f A_c B}$$

$$L = \frac{3.19 N^2 A_c \cdot 10^{-8}}{lq + \frac{lc}{\Delta\mu}}$$

$$D.C. \text{ FLUX} = \frac{0.6 N I_{DC}}{lq}$$

- Z - Impedance
- N - Number of Turns
- P - Primary
- S - Secondary
- I - AC Current RMS
- E - AC Volts
- f - Frequency
- A_c - Area of Iron Core Sq. In.
- B - In Gauss
- lq - Core Gap Inches
- lc - Core Length in Inches
- RMS - Root Mean Square
- Δμ - Incremental Permeability

SINUSOIDAL RELATIONSHIPS

RMS = 0.707 x Peak Value

Average Value = 0.637 Peak

Peak to Peak Value = 2.828 RMS

Peak Value = 1.41 RMS

As a specialty line, PCI can supply transformers for operation with inputs of 50, 60 and 400Hz. We have been manufacturing transformers for use in our HV-M power packs for many years, and now offer transformers to your design specification, with output voltages ranging from 5KV to 100KV.

METERED POWER SUPPLIES

CASED or rack-panel mounted power supplies are available with voltage output to 50KVDC and have the following features:

- INPUT 50 or 60HZ with variable transformer to control output voltage
- OUTPUT single or double polarity, with plug-in, shielded high voltage cable
- METERS - Kilovolt output and Current
- GROUNDING 3 pin plug and line cord, to pass OSHA requirements
- ON-OFF SWITCH and pilot light
- OVERLOAD protection against accidental shorting
- FUSED

CONSIDERATIONS OF CAPACITOR APPLICATIONS

Filter capacitors are not designed for repetitive discharges. The volt-amperes to which the capacitor is subjected will cause heating. In filter applications, the ripple percentage is critical. The filter capacitor will change energy levels from the peak of the ripple to the low point of the ripple and at a rate of 2 times the ripple frequency.

Ionization in a capacitor is destructive. Since there is always some current flow thru the capacitor, under pure DC conditions, the life of the capacitor may be affected if hot spots develop due to excessive current. However, alternating currents can cause hot spots to develop to such an extent that the impregnant vaporizes, resulting in vapor ionization and excessive heating.

There is no hard and fast rule or ratio for DC voltage to AC voltage rating for capacitors rated more than 1000VDC. Increasing the operating ambient of the capacitor decreases the life expectancy.

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RESISTIVITY

Resistivity in Microhms per Centimeter Cube at 20°C	
MATERIAL	MICROHMS
ALUMINUM	2.828
ANTIMONY	41.7
BERYLLIUM	10.1
BISMUTH	120
CARBON	3450
CALCIUM	4.6
CHROMIUM	2.8
CONSTANTAN	44.2
COBALT	9.7
COPPER	1.7
GOLD	2.44
IRON	10.0
LEAD	22.0
MAGNESIUM	4.6
MANGANESE	5
MANGANIN	44
MERCURY	95.8
MOLYBDENUM	5.7
NICHROME*	100
NICKEL	6.84
PALADIUM	11
PLATINUM	10
RHODIUM	4.6
SILVER	1.59
TANTALUM	15.5
TIN	11.5
TITANIUM	48-60
TUNGSTEN	5.6
ZINC	5.8

SPECIFIC HEAT

Specific Heat of some common materials BTU per pound per degree F. or Gram-Calories per pound per degree C. Average from 0° to 100°C. (at one atmosphere)	
MATERIAL	HEAT
AIR	.238
ALUMINUM	.226
ASBESTOS	.195
BERYLLIUM	.425
BRASS	.092
CARBON DIOXIDE	.202
COPPER	.0928
CORK	.485
GLASS	.180
ICE (AT -2°C)	.502
IRON	.117
LEAD	.0309
MERCURY	.033
MICA	.206
MINERAL OIL	.505
PLANTINUM	.032
PORCELAIN	.260
QUARTZ	.188
SILICON	.181
SILVER	.056
TIN	.0556
TUNGSTEN	.034
WATER	1.000
WOOD	.420
ZINC	.095

* T.M. COLOR SCALE OF TEMPERATURE

Commonly used terms to describe color of heat related to an approximation of temperature in degrees centigrade.

COLOR	TEMPERATURE DEGREES CENTIGRADE
INCIPIENT RED HEAT	500- 550
DARK RED HEAT	650- 750
BRIGHT RED HEAT	800- 900
ORANGE-RED HEAT	900-1000
YELLOW HEAT	1050-1150
INCIPIENT WHITE HEAT	1250-1350
WHITE HEAT	Above 1450

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TYPE BVX Snubber Capacitors



TYPE BVX Capacitors are designed for smoothing the spikes generated by SCR's. All are designed for low inductance and use low-loss film dielectrics. Of particular note for reliability is that all oil-seal locations are soldered, not gasketed, assuring trouble-free operation.

Catalog voltage ratings are 350, 600 and 1000 volts peak. Capacitors are designed to be operated while mounted in any position. Bushings are glazed steatite with threaded brass contacts for maximum current carrying capability. Containers are deep drawn steel.

The following chart is representative of catalog designs; the sizes given are Length x Width x Height of the capacitor, not including the height of the terminal. For full information, ask for catalog sheet E3.

PART NUMBER	PEAK VOLTS	CAP. MFD.	MAX. VA	SIZE (inches)
BVX35-105	350	1	3610	2.16 x 1.31 x 2.88
BVX35-106	350	10	7690	2.91 x 1.91 x 4.75
BVX60-205	600	2	5470	2.91 x 1.91 x 3.88
BVX60-106	600	10	13600	3.66 x 1.97 x 6.25
BVX100-305	1000	3	7360	2.91 x 1.91 x 4.50
BVX100-505	1000	5	9660	2.91 x 1.91 x 6.25

EQUATIONS FOR AC CAPACITORS

$$VA = (E^2) (2\pi fC)$$

$$VA \times Df = \text{watts Lost (HEAT!)}$$

$$I = (E) (2\pi fC)$$

$$VAR = \frac{E^2}{X_c}$$

$$\text{Phase to neutral } E = \sqrt{\frac{E_{PP}}{3}}$$

$$E_{PP} = \text{Phase-phase voltage (Line Voltage, 3 Phase)}$$

VA-Volt-Amperes

VAR-Volt-Amperes Reactive

E-Voltage in volts

C-Capacitance in Farads

f-Frequency in Hertz

I-Current in amperes

Df-Dissipation (power) Factor

X_c-Capacitance Reactance

2π-6.2832

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**DEFINITIONS OF COMMON
ELECTRONIC TERMS**

AVALANCHE DIODE

A silicon diode that has a high ratio of reverse to forward resistance until avalanche breakdown occurs. After breakdown, the voltage drop across the diode is essentially constant and independent of current. Also called breakdown diode; originally called zener diode, before it was found that the zener effect had no significant role in the operation of diodes of this type.

BREAKDOWN VOLTAGE

The voltage required to jump an air gap or to "break down", i.e., penetrate, a solid or liquid dielectric.

CAPACITOR (Symbol C)

A device consisting essentially of two conducting surfaces, separated by an insulating material such as air, paper, mica, ceramic, glass or plastic film. A capacitor can: store and discharge electrical energy; block the flow of direct current; permit the flow of alternating current to a degree dependent on its capacitance and the frequency. Call us with your specific application. Sometimes still (and incorrectly) called an electrical condenser.

CMOS (Complementary MOS)

With extra diffusions, a circuit with both P- and N-channel FETs on the same MOS wafer. CMOS, complementary metal-oxide-semiconductor logic, is designed to have extremely low power dissipation (essentially zero during standby) making it especially useful for remote applications where power is expensive. Other attributes: high noise immunity, high fan-out, full power supply swings and ready acceptance of a wide range of power supplies.

DC BREAKDOWN

Voltage at which ionization occurs when subjected to a slowly rising DC voltage.

DIELECTRIC

A material in a capacitor that can serve as an insulator because it has poor electrical conductivity. At PCI, we use a wide range of liquid and film dielectrics to assure good capacitor life in virtually any high voltage application. The dielectric separates the two (or more) conducting plates of the capacitor.

DIODE

Basic in semiconductor art; it passes current in one direction and blocks it in the other.

ELECTRONIC

Pertaining to the application of that branch of science which deals with the motion, emission and behavior of currents of free electrons, especially in vacuum, gas or phototubes and special conductors or semiconductors; contrasted with ELECTRIC, which pertains to the flow of large currents in wires or conventional conductors.

**DEFINITIONS OF COMMON
ELECTRONIC TERMS
Continued**



ELECTROSTATIC

Pertaining to electricity at rest, such as an electrical charge on an object.

FILM RESISTOR

A component in which the resistance element is a thin layer of conductive material on an insulated form. The conductive material does not contain either binders or insulating material.

IMPULSE BREAKDOWN

Voltage at which ionization occurs when subjected to fast-rising voltage. One of our customers tried to destroy a special capacitor, to determine its safety factor... a 900KV impulse test could not destroy it.

IMPULSE RATIO

Ratio of impulse breakdown to DC breakdown.

IONIZATION

The result of adding or subtracting one or more electrons from a neutral atom or group of neutral atoms.

KISS

Abbreviation for a method of reducing the complexity of information fed into a computer. (Keep It Simple, Stupid.)

MOS

Abbreviation for metal-oxide-semiconductor. It is one of the solid state technologies used for the fabrication of large, low cost memories with high input impedance. The insulator used is an oxide of the semiconductor substrate material.

NANOSECOND (NS)

One billionth of a second or one millimicro second. An electric current travels a distance of about one foot in one nanosecond on a wire.

PEAK DISCHARGE ENERGY

Maximum amount of energy that a device can withstand during operation without permanent or significant change in breakdown ratings or specified life expectancy.

PEAK CURRENT

Maximum amplitude of current ionized device can pass without permanent change in breakdown ratings or specified life expectancy.

RINGING

Transient decaying oscillation about high or low limit induced by unmatched impedance reflections.

TRIP VOLTAGE

Voltage at which ionization occurs under any circumstances (also referred to as firing voltage).

ZAPPING

Slang for burning out.

- PULSE FORMING NETWORKS
- PLASTIC FILM CAPACITORS
- PAPER DIELECTRIC CAPACITORS
- HIGH VOLTAGE POWER SUPPLIES

Plastic Capacitors, Inc.

2623 N. PULASKI ROAD
CHICAGO, ILLINOIS 60639
Area 312, Phone 489-2229
FAX: 312-489-0496





CARATS vs. KARATS
(Not the garden variety)

With widespread interest in the purchase of precious metals and precious stones as an investment opportunity, we include a few conversion factors and definitions relating to trading commodities.

A CARAT is a measure of weight of precious stones equivalent to 200 milligrams. To make small stones sound larger, sizes of fractional carat items are frequently quoted in POINTS. A point represents 2 milligrams, 100 points to the carat.

A KARAT has nothing to do with weight, but is a measurement of the purity of gold. In this context, 24K gold is pure; 18K is 75% gold; 12K is 50% gold. Many other metals are alloyed with pure gold to give it strength and different colors. The most common are Copper and Silver in various proportions, but also used in some formulations are Iron, Zinc, Platinum, Nickel, Palladium, Brass or Aluminum.

Precious metals prices are usually quoted by the Troy ounce or gram, but they are frequently sold in other measures.

One TROY OUNCE EQUALS:

31.1035 grams	1.0971 ounces Avdp.
20 pennyweights	.08333 pounds TROY
480 grains	.06857 pounds Avdp.

There are 12 Troy ounces in a Troy pound.

PREFIXES OF UNITS		
Multiples and sub-multiples	Prefixes	Symbols
1 000 000 000 000 = 10 ¹²	tera	T
1 000 000 000 = 10 ⁹	giga	G
1 000 000 = 10 ⁶	mega	M
1 000 = 10 ³	kilo	k
100 = 10 ²	hecto	h
10 = 10	deka	da
0.1 = 10 ⁻¹	deci	d
0.01 = 10 ⁻²	centi	c
0.001 = 10 ⁻³	milli	m
0.000 001 = 10 ⁻⁶	micro	μ
0.000 000 001 = 10 ⁻⁹	nano	n
0.000 000 000 001 = 10 ⁻¹²	pico	p
0.000 000 000 000 001 = 10 ⁻¹⁵	femto	f
0.000 000 000 000 000 001 = 10 ⁻¹⁸	atto	a

Plastic Capacitors, Inc.

18

2623 N. PULASKI ROAD
CHICAGO, ILLINOIS 60639
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TYPE LJ
30KVDC to 200KVDC
Phenolic Case Capacitors



TYPE LJ CAPACITORS are designed for high voltage application with plastic-paper dielectric capacitor elements. Connections are made to the extended foil sections with medium-heavy wiring allowing large discharge current. Consult factory for current and repetition rate limits. Applications include; power supply filters, discharge, pulse forming networks, bypass, and arc and spark suppression.

Operating Temperature range is -55°C to +65°C, without derating. Test voltage is 150% of nameplate voltage for 2 minutes in air, at room temperature.

Terminations are brass screws or threaded inserts, thus eliminating the need for large and expensive ceramic bushings.

Over 100 different voltage/capacitance combinations are offered as standard designs. The following table is representative of the sizes and voltages available. Sizes shown are length (A) X width (B) X height (C). For Full Information, Ask For Catalog Sheet A5.

PART NUMBER	CAP. MFD.	KV DCW	A	B	C
LJ300-103BF	.01	30	2 3/4	1 3/4	6
LJ300-503BF	.05	30	3 3/4	2 3/4	6 1/2
LJ300-104BF	.10	30	4 3/4	3 3/4	6
LJ300-254BF	.25	30	6 3/4	4 3/4	6 1/4
LJ300-504BF	.50	30	10 3/4	5 3/4	6
LJ1000-202BF	.002	100	2 3/4	1 3/4	14
LJ1000-103BF	.01	100	4 3/4	1 3/4	14
LJ1000-503BF	.05	100	6 3/4	3 3/4	15
LJ1000-104BF	.10	100	8 3/4	5 3/4	14
LJ1000-254BF	.25	100	10 3/4	7 3/4	18
LJ2000-102BF	.001	200	2 3/4	1 3/4	26
LJ2000-502BF	.005	200	4 3/4	1 3/4	26
LJ2000-103BF	.01	200	4 3/4	2 3/4	27
LJ2000-503BF	.05	200	8 3/4	5 3/4	26
LJ2000-104BF	.10	200	10 3/4	7 3/4	27

- PULSE FORMING NETWORKS
- PLASTIC FILM CAPACITORS
- PAPER DIELECTRIC CAPACITORS
- HIGH VOLTAGE POWER SUPPLIES



WEIGHTS AND MEASURES (ENGLISH SYSTEM)

Length

1 mile = 1760 yards = 5280 feet.

1 yard = 3 feet = 36 inches.

1 mil = 0.001 inch.

1 micro-inch = one millionth inch or 0.000001 inch. (1 micron = one millionth meter = 0.00003937 inch.)

Nautical Measure

1 nautical mile = 6076.10 feet = 1.1508 statute miles.

Square Measure

1 square mile = 640 acres = 6400 square chains.

1 square yard = 9 square feet.

1 square foot = 144 square inches.

An acre is equal to a square, the side of which is 208.7 feet.

Cubic Measure

1 cubic yard = 27 cubic feet.

1 cubic foot = 1728 cubic inches.

Liquid Measure

1 U.S. gallon = 0.1337 cubic foot - 231 cubic inches = 4 quarts = 8 pints.

1 British Imperial gallon = 1.2009 U.S. gallon = 277.42 cubic inches.

1 cubic foot = 7.48 U. S. gallons.

Avoirdupois or Commercial Weight

1 gross or long ton = 2240 pounds.

1 net or short ton = 2000 pounds.

Pressure

- 1 pound per square inch = 144 pounds per square foot =
0.068 atmosphere = 2.042 inches of mercury at 62 degrees F =
27.7 inches of water at 62 degrees F = 2.31 feet of water
at 62 degrees F.
- 1 atmosphere = 30 inches of mercury at 62 degrees F = 14.7 pounds
per square inch = 2116.3 pounds per square foot = 33.95 feet
of water at 62 degrees F.
- 1 foot of water at 62 degrees F = 62.355 pounds per square foot =
0.433 pound per square inch.
- 1 inch of mercury at 62 degrees F = 1.132 foot of water = 13.58
inches of water = 0.491 pound per square inch.

Inches In Decimals Of a Foot

Inch	Decimals of a Foot					
	0	1	2	3	4	5
.....	.....	0.0833	0.1667	0.2500	0.3333	0.4167
1/32	0.0026	0.0859	0.1693	0.2526	0.3359	0.4193
1/16	0.0052	0.0885	0.1719	0.2552	0.3385	0.4219
3/32	0.0078	0.0911	0.1745	0.2578	0.3411	0.4245
1/8	0.0104	0.0938	0.1771	0.2604	0.3438	0.4271
5/32	0.0130	0.0964	0.1797	0.2630	0.3464	0.4297
3/16	0.0156	0.0990	0.1823	0.2656	0.3490	0.4323
7/32	0.0182	0.1016	0.1849	0.2682	0.3516	0.4349
1/4	0.0208	0.1042	0.1875	0.2708	0.3542	0.4375
9/32	0.0234	0.1068	0.1901	0.2734	0.3568	0.4401
5/16	0.0260	0.1094	0.1927	0.2760	0.3594	0.4427
11/32	0.0286	0.1120	0.1953	0.2786	0.3620	0.4453
3/8	0.0313	0.1146	0.1979	0.2813	0.3646	0.4479
13/32	0.0339	0.1172	0.2005	0.2839	0.3672	0.4505
7/16	0.0365	0.1198	0.2031	0.2865	0.3698	0.4531
15/32	0.0391	0.1224	0.2057	0.2891	0.3724	0.4557
1/2	0.0417	0.1250	0.2083	0.2917	0.3750	0.4583
17/32	0.0443	0.1276	0.2109	0.2943	0.3776	0.4609
9/16	0.0469	0.1302	0.2135	0.2969	0.3802	0.4635
19/32	0.0495	0.1328	0.2161	0.2995	0.3828	0.4661
5/8	0.0521	0.1354	0.2188	0.3021	0.3854	0.4688
21/32	0.0547	0.1380	0.2214	0.3047	0.3880	0.4714
11/16	0.0573	0.1406	0.2240	0.3073	0.3906	0.4740
23/32	0.0599	0.1432	0.2266	0.3099	0.3932	0.4766
3/4	0.0625	0.1458	0.2292	0.3125	0.3958	0.4792
25/32	0.0651	0.1484	0.2318	0.3151	0.3984	0.4818
18/16	0.0677	0.1510	0.2344	0.3177	0.4010	0.4844
27/32	0.0703	0.1536	0.2370	0.3203	0.4036	0.4870
7/8	0.0729	0.1563	0.2396	0.3229	0.4063	0.4896
29/32	0.0755	0.1589	0.2422	0.3255	0.4089	0.4922
15/16	0.0781	0.1615	0.2448	0.3281	0.4115	0.4948
31/32	0.0807	0.1641	0.2474	0.3307	0.4141	0.4974

Weights, Measures
English

(Cont'd)

Inch	Inches Into Decimals of a Foot					
	6	7	8	9	10	11
	Decimals of a Foot					
.....	0.5000	0.5833	0.6667	0.7500	0.8333	0.9167
1/32	0.5026	0.5859	0.6693	0.7526	0.8359	0.9193
1/16	0.5052	0.5885	0.6719	0.7552	0.8358	0.9219
3/32	0.5078	0.5911	0.6745	0.7578	0.8411	0.9245
1/8	0.5104	0.5938	0.6771	0.7604	0.8438	0.9271
5/32	0.5130	0.5964	0.6797	0.7630	0.8464	0.9297
3/16	0.5156	0.5990	0.6823	0.7656	0.8490	0.9323
7/32	0.5182	0.6016	0.6849	0.7682	0.8516	0.9349
1/4	0.5208	0.6042	0.6875	0.7708	0.8542	0.9375
9/32	0.5234	0.6068	0.6901	0.7734	0.8568	0.9401
5/16	0.5260	0.6094	0.6927	0.7760	0.8594	0.9427
11/32	0.5286	0.6120	0.6953	0.7786	0.8620	0.9453
3/8	0.5313	0.6146	0.6979	0.7813	0.8646	0.9479
13/32	0.5339	0.6172	0.7005	0.7839	0.8672	0.9505
7/16	0.5265	0.6198	0.7031	0.7865	0.8698	0.9531
15/32	0.5391	0.6224	0.7057	0.7891	0.8742	0.9557
1/2	0.5417	0.6250	0.7083	0.7917	0.8750	0.9583
17/32	0.5443	0.6276	0.7109	0.7943	0.8776	0.9609
9/16	0.5469	0.6302	0.7135	0.7960	0.8802	0.9635
19/32	0.5495	0.6328	0.7161	0.7995	0.8828	0.9661
5/8	0.5521	0.6354	0.7188	0.8021	0.8854	0.9688
21/32	0.5547	0.6380	0.7214	0.8047	0.8880	0.9714
11/16	0.5573	0.6406	0.7240	0.8073	0.8906	0.9740
23/32	0.5599	0.6432	0.7266	0.8099	0.8932	0.9766
3/4	0.5625	0.6458	0.7292	0.8125	0.8958	0.9792
25/32	0.5651	0.6484	0.7318	0.8151	0.8984	0.9818
18/16	0.5677	0.6510	0.7344	0.8177	0.9010	0.9844
27/32	0.5703	0.6536	0.7370	0.8203	0.9036	0.9870
7/8	0.5729	0.6563	0.7396	0.8229	0.9063	0.9896
29/32	0.5755	0.6589	0.7422	0.8255	0.9089	0.9922
15/16	0.5781	0.6615	0.7448	0.8281	0.9115	0.9948
31/32	0.5807	0.6641	0.7474	0.8307	0.9141	0.9974

Converting U.S. Gallons into Cubic Feet, and Cubic Feet into Gallons

U.S. Gallons into Cubic Feet

Gallons	Cubic Feet	Gallons	Cubic Feet	Gallons	Cubic Feet	Gallons	Cubic Feet
1	0.134	20	2.674	300	40.10	4,000	534.72
2	0.267	30	4.010	400	53.47	5,000	668.40
3	0.401	40	5.347	500	66.84	6,000	802.08
4	0.535	50	6.684	600	80.21	7,000	935.76
5	0.668	60	8.021	700	93.58	8,000	1,069.44
6	0.802	70	9.358	800	106.94	9,000	1,203.12
7	0.936	80	10.694	900	120.31	10,000	1,336.81
8	1.069	90	12.031	1000	133.68	50,000	6,684.03
9	1.203	100	13.368	2000	267.36	100,000	13,368.06
10	1.337	200	26.736	3000	401.04	500,000	66,840.28

Cubic Feet into Gallons

(1 cubic foot = 7.4805 U.S. gallons; 1 gallon = 231 cubic inches = 0.13368 cubic foot.)

Cubic Feet	Gallons	Cubic Feet	Gallons	Cubic Feet	Gallons	Cubic Feet	Gallons
0.1	0.75	2	14.96	30	224.4	400	2,992.2
0.2	1.50	3	22.44	40	299.2	500	3,740.3
0.3	2.24	4	29.92	50	374.0	600	4,488.3
0.4	2.99	5	37.40	60	448.8	700	5,236.4
0.5	3.74	6	44.88	70	523.6	800	5,984.4
0.6	4.49	7	52.36	80	598.4	900	6,732.5
0.7	5.24	8	59.84	90	673.2	1,000	7,480.5
0.8	5.98	9	67.32	100	748.1	5,000	37,402.6
0.9	6.73	10	74.81	200	1496.1	10,000	74,805.2
1.0	7.48	20	149.61	300	2244.2	50,000	374,025.9

Weights, Measures
English

Contents in Cubic Feet and U.S. Gallons of Pipes and Cylinders One Foot in Length

DIAM in Inches	For 1 Foot in Length		DIAM in Inches	For 1 Foot in Length		DIAM in Inches	For 1 Foot in Length	
	Cubic Feet	U.S. Gallons		Cubic Feet	U.S. Gallons		Cubic Feet	U.S. Gallons
1/4	0.0003	0.0025	6 3/4	0.2485	1.859	19	1.969	14.73
5/16	0.0005	0.0040	7	0.2673	1.999	19 1/2	2.074	15.51
3/8	0.0008	0.0057	7 1/4	0.2867	2.145	20	2.182	16.32
7/16	0.0010	0.0078	7 1/2	0.3068	2.295	20 1/2	2.292	17.15
1/2	0.0014	0.0102	7 3/4	0.3276	2.450	21	2.405	17.99
9/16	0.0017	0.0129	8	0.3491	2.611	21 1/2	2.521	18.86
5/8	0.0021	0.0159	8 1/4	0.3712	2.777	22	2.640	19.75
11/16	0.0026	0.0193	8 1/2	0.3941	2.948	22 1/2	2.761	20.66
3/4	0.0031	0.0230	8 3/4	0.4176	3.125	23	2.885	21.58
13/16	0.0036	0.0269	9	0.4418	3.305	23 1/2	3.012	22.53
7/8	0.0042	0.0312	9 1/4	0.4667	3.491	24	3.142	23.50
15/16	0.0048	0.0359	9 1/2	0.4922	3.682	25	3.409	25.50
1	0.0055	0.0408	9 3/4	0.5185	3.879	26	3.687	27.58
1 1/4	0.0085	0.0638	10	0.5454	4.080	27	3.976	29.74
1 1/2	0.0123	0.0918	10 1/4	0.5730	4.286	28	4.276	31.99
1 3/4	0.0167	0.1249	10 1/2	0.6013	4.498	29	4.587	34.31
2	0.0218	0.1632	10 3/4	0.6303	4.715	30	4.909	36.72
2 1/4	0.0276	0.2066	11	0.6600	4.937	31	5.241	39.21
2 1/2	0.0341	0.2550	11 1/4	0.6903	5.164	32	5.585	41.78
2 3/4	0.0412	0.3085	11 1/2	0.7213	5.396	33	5.940	44.43
3	0.0491	0.3672	11 3/4	0.7530	5.633	34	6.305	49.16
3 1/4	0.0576	0.4309	12	0.7854	5.875	35	6.681	49.98
3 1/2	0.0668	0.4998	12 1/2	0.8522	6.375	36	7.069	52.88
3 3/4	0.0767	0.5738	13	0.9218	6.895	37	7.467	55.86
4	0.0873	0.6528	13 1/2	0.9940	7.436	38	7.876	58.92
4 1/4	0.0985	0.7369	14	1.069	7.997	39	8.296	62.06
4 1/2	0.1104	0.8263	14 1/2	1.147	8.578	40	8.727	65.28
4 3/4	0.1231	0.9206	15	1.227	9.180	41	9.168	68.58
5	0.1364	1.020	15 1/2	1.310	9.801	42	9.621	71.97
5 1/4	0.1503	1.125	16	1.396	10.44	43	10.085	75.44
5 1/2	0.1650	1.234	16 1/2	1.485	11.11	44	10.559	78.99
5 3/4	0.1803	1.349	17	1.576	11.79	45	11.045	82.62
6	0.1963	1.469	17 1/2	1.670	12.49	46	11.541	86.33
6 1/4	0.2131	1.594	18	1.767	13.22	47	12.048	90.13
6 1/2	0.2304	1.724	18 1/2	1.867	13.96	48	12.566	94.00

One cubic foot of water at 39.1 degrees F weighs 62.4245 pounds.

One cubic foot of air at 32 degrees F atmospheric pressure, weighs 0.08073 pound.

One pound of water at 39.1 degrees F has a volume of 0.01602 cubic foot.

One pound of air at 32 degrees F atmospheric pressure, has a volume of 12.387 cubic feet.

One gallon of water at 62 degrees F weighs 8.336 pounds.

One pound of water at 62 degrees F has a volume of 0.1199 U.S. gallon.

Weights, Measures
English

Contents of Cylindrical Tanks in U.S. Gallons

Depth of Tank, Feet	Diameter of Tank, Feet								
	5	6	7	8	9	10	11	12	13
Contents of Tank, U.S. Gallons									
5	734	1058	1439	1880	2379	2,938	3,555	4,230	4,965
6	881	1269	1727	2256	2855	3,525	4,265	5,076	5,957
7	1028	1481	2015	2632	3331	4,113	4,976	5,922	6,950
8	1175	1692	2303	3008	3807	4,700	5,687	6,788	7,943
9	1322	1904	2591	3384	4283	5,288	6,398	7,614	8,936
10	1469	2115	2879	3760	4759	5,875	7,109	8,460	9,929
11	1616	2327	3167	4136	5235	6,463	7,820	9,306	10,922
12	1763	2538	3455	4512	5711	7,050	8,531	10,152	11,915
13	1909	2750	3742	4888	6187	7,638	9,242	10,998	12,808
14	2056	2961	4030	5264	6662	8,225	9,953	11,844	13,801
15	2203	3173	4318	5640	7138	8,813	10,664	12,690	14,894
16	2350	3384	4606	6016	7614	9,400	11,374	13,536	15,887
17	2497	3596	4894	6392	8090	9,888	12,085	14,383	16,879
18	2644	3807	5182	6768	8566	10,575	12,796	15,229	17,872
19	2791	4019	5480	7144	9042	11,163	13,507	16,075	18,865
20	2938	4230	5758	7520	9518	11,750	14,218	16,921	19,858

Depth of Tank, Feet	Diameter of Tank, Feet							
	14	15	16	18	20	22	24	25
Contents of Tank, U.S. Gallons								
5	5,758	6,610	7,521	9,518	11,751	14,218	16,921	18,560
6	6,909	7,931	9,025	11,422	14,101	17,062	20,305	22,032
7	8,061	9,253	10,529	13,325	16,451	19,905	23,689	25,704
8	9,212	10,575	12,033	15,229	18,801	22,749	27,073	29,376
9	10,364	11,897	13,537	17,132	21,151	25,592	30,457	33,048
10	11,515	13,219	15,041	19,036	23,501	28,436	33,841	36,720
11	12,667	14,541	16,545	20,940	25,851	31,280	37,225	40,392
12	13,818	15,863	18,049	22,843	28,201	34,123	40,609	44,064
13	14,970	17,185	19,553	24,747	30,551	36,967	43,993	47,736
14	16,121	18,507	21,057	26,650	32,901	39,810	47,377	51,408
15	17,273	19,829	22,562	28,554	35,252	42,654	50,762	55,080
16	18,424	21,150	24,066	30,458	37,602	45,498	54,146	58,752
17	19,576	22,472	25,570	32,361	39,952	48,341	57,530	62,424
18	20,727	23,794	27,074	34,265	42,302	51,185	60,914	66,096
19	21,879	25,116	28,578	36,168	44,652	54,028	64,298	69,768
20	23,030	26,438	30,082	38,072	47,002	56,872	67,682	73,440

A cylinder 7 inches in diameter and 6 inches high contains one gallon within 0.1 of a cubic inch.
 The volume, in U.S. gallons, of a cylinder, equals the square of the diameter in inches X height of cylinder in inches X 0.0034.

WEIGHTS AND MEASURES (METRIC SYSTEM)

Length

10 millimeters (mm)	=	1 centimeter (cm).
10 centimeters	=	1 decimeter (dm).
10 decimeters	=	1 meter (m).
1000 meters	=	1 kilometer (Km).

Cubic

1000 cubic millimeters (mm^3)	=	1 cubic centimeter (cm^3).
1000 cubic centimeters	=	1 cubic decimeter (dm^3).
1000 cubic decimeters	=	1 cubic meter (m^3).

Dry and Liquid Measure

10 milliliters (ml)	=	1 centiliter (cl).
10 centiliters	=	1 deciliter (dl).
10 deciliters	=	1 liter (l).
100 liters	=	1 hectoliter (Hl).

1 liter = 1 cubic decimeter = the volume of 1 kilogram of pure water at a temperature of 39.2 degrees F.

Weight

10 milligrams (mg)	=	1 centigram (cg).
10 centigrams	=	1 decigram (dg).
10 decigrams	=	1 gram (g).
10 grams	=	1 decagram (Dg).
10 decagrams	=	1 hectogram (Hg).
10 hectograms	=	1 kilogram (Kg).
1000 kilograms	=	1 (metric) ton (T).

Metric and English Conversions

Linear Measure

1 kilometer = 0.6214 mile.	1 mile = 1609 kilometers.
1 meter = 39.37 inches.	1 yard = 0.9144 meter.
= 3.2808 feet.	1 foot = 0.3048 meter.
= 1.0936 yard.	1 foot = 304.8 millimeters.
1 centimeter = 0.3937 inch.	1 inch = 2.54 centimeters.
1 millimeter = 0.03937 inch.	1 inch = 25.4 millimeters.

Metric and English Conversions

Square Measure

- 1 square kilometer = 0.3861 square mile = 247.1 acres.
- 1 hectare = 2.471 acre = 107,640 square feet.
- 1 are = 0.0247 acre = 10.764 square feet.
- 1 square meter = 10.764 square feet = 1.196 square yard.
- 1 square centimeter = 0.155 square inch.
- 1 square millimeter = 0.00155 square inch.

- 1 square mile = 2.5899 square kilometers.
- 1 acre = 0.407 hectare = 40.47 ares.
- 1 square yard = 0.836 square meter.
- 1 square foot = 0.0929 square meter = 929 square centimeters.
- 1 square inch = 6.452 square centimeters = 645.2 square millimeters.

Cubic Measure

- 1 cubic meter = 35.314 cubic feet = 1.308 cubic yard.
- 1 cubic meter = 264.2 U. S. gallons.
- 1 cubic centimeter = 0.061 cubic inch.
- 1 liter (cubic decimeter) = 0.0353 cubic foot = 61.023 cubic inches.
- 1 liter = 0.2642 U. S. gallon = 1.0567 U. S. quart.

- 1 cubic yard = 0.7645 cubic meter.
- 1 cubic foot = 0.02832 cubic meter = 28.317 liters.
- 1 cubic inch = 16.38716 cubic centimeters.
- 1 U. S. gallon = 3.785 liters.
- 1 U. S. quart = 0.946 liter.

Weight

- 1 metric ton = 0.9842 ton (of 2440 pounds) = 2204.6 pounds.
- 1 kilogram = 2.2046 pounds = 35.274 ounces avoirdupois.
- 1 gram = 0.03215 ounce troy = 0.03327 ounce avoirdupois.
- 1 gram = 15.423 grains

- 1 ton (of 2240 pounds) = 1.016 metric ton = 1016 kilograms.
- 1 pound = 0.4536 kilogram = 453.6 grams.
- 1 ounce avoirdupois = 28.35 grams.

- 1 kilogram per square millimeter = 1422.32 pounds per square inch.
- 1 kilogram per square centimeter = 14.223 pounds per square inch.
- 1 kilogram-meter = 7.233 foot-pounds.
- 1 pound per square inch = 0.0703 kilogram per square centimeter.
- 1 calorie (kilogram calorie) = 3.968 BTU (British thermal unit).

Weights, Measures
Metric

*

Centimeter Conversions: Inch - Millimeter and Inch

NOTE

Based on 1 inch 25.4 millimeters,
exactly†

INCHES TO MILLIMETERS									
IN.	Mm.	IN.	Mm	IN.	Mm	IN.	Mm	IN.	Mm
10	254.000	1	25.400	0.1	2.540	0.01	0.254	0.001	0.025
20	508.000	2	50.800	0.2	5.080	0.02	0.508	0.002	0.051
30	762.000	3	76.200	0.3	7.620	0.03	0.762	0.003	0.076
40	1,016.000	4	101.600	0.4	10.160	0.04	1.016	0.004	0.102
50	1,270.000	5	127.000	0.5	12.700	0.05	1.270	0.005	0.127
60	1,524.000	6	152.400	0.6	15.240	0.06	1.524	0.006	0.152
70	1,778.000	7	177.800	0.7	17.780	0.07	1.778	0.007	0.178
80	2,032.000	8	203.200	0.8	20.320	0.08	2.032	0.008	0.303
90	2,286.000	9	228.600	0.9	22.860	0.09	2.286	0.009	0.229
100	2,540.000	10	254.000	1.0	25.400	0.10	2.540	0.010	0.254

MILLIMETERS TO INCHES									
Mm	IN.	Mm	IN.	Mm	IN.	Mm	IN.	Mm	IN.
100	3.9370	10	0.3937	1	0.0394	0.1	0.0039	0.01	0.0004
200	7.8740	20	0.7874	2	0.0787	0.2	0.0079	0.02	0.0008
300	11.8110	30	1.1811	3	0.1181	0.3	0.0118	0.03	0.0012
400	15.7480	40	1.5748	4	0.1575	0.4	0.0157	0.04	0.0016
500	19.6850	50	1.9685	5	0.1968	0.5	0.0197	0.05	0.0020
600	23.6220	60	2.3622	6	0.2362	0.6	0.0236	0.06	0.0024
700	27.5591	70	2.7559	7	0.2756	0.7	0.0276	0.07	0.0028
800	31.4961	80	3.1496	8	0.3150	0.8	0.315	0.08	0.0031
900	35.4331	90	3.5433	9	0.3543	0.9	0.0354	0.09	0.0035
1,000	39.3701	100	3.9370	10	0.3937	1.0	0.0394	0.10	0.0039

*For inches to centimeters, shift decimal point in mm column one place to left and read centimeters, thus:

$$40 \text{ IN.} = 1,016 \text{ mm} = 101.6 \text{ cm}$$

For centimeters to inches, shift decimal point of centimeter value one place to right and enter mm column, thus:

$$70 \text{ cm} = 700 \text{ mm} = 27.5591 \text{ inches}$$

† American Standard Practice for Industrial Use (ASA B48.1)

Millimeter Conversions: Fractional Inch, Inch, and Foot

NOTE

Based on 1 inch = 25.4
millimeters, exactly*

FRACTIONAL INCH TO MILLIMETERS			
IN.	Mm	IN.	Mm
	1/64		0.397
1/32		17/64	6.747
	3/64	9/32	7.144
1/16		19/64	7.541
	5/64	5/16	7.938
3/32		21/64	8.334
	7/64	11/32	8.731
1/8		23/64	9.128
	9/64	3/8	9.525
5/32		25/64	9.922
	11/64	13/32	10.319
3/16		27/64	10.716
	13/64	7/16	11.112
7/32		29/64	11.509
	15/64	15/32	11.906
1/4		31/64	12.303
		1/2	12.700
IN.	Mm	IN.	Mm
	33/64		13.097
17/32		49/64	19.447
	35/64	25/32	19.844
9/16		51/64	20.241
	37/64	13/16	20.638
19/32		53/64	21.034
	39/64	27/32	21.431
5/8		55/64	21.828
	41/64	7/8	22.225
21/32		57/64	22.622
	43/64	29/32	23.019
11/16		59/64	23.416
	45/64	15/16	23.812
23/32		61/64	24.209
	47/64	31/32	24.606
3/4		63/64	25.003
		1	25.400

*American Standard Practice For Industrial Use (ASAB48.1)

Weights, Measures
Metric

INCHES TO MILLIMETERS									
IN.	Mm	IN.	Mm	IN.	Mm	IN.	Mm	IN.	Mm
1	25.4	3	76.2	5	127.0	7	177.8	9	228.6
2	50.8	4	101.6	6	152.4	8	203.2	10	254.0
IN	Mm								
11	279.4								
12	304.8								
FEET TO MILLIMETERS									
FT	Mm	FT	Mm	FT	Mm	FT	Mm		
100	30,480	10	3,048	1	304.8	0.1	30.48		
200	60,960	20	6,096	2	609.6	0.2	60.96		
300	91,440	30	9,144	3	914.4	0.3	91.44		
400	121,920	40	12,192	4	1,219.2	0.4	121.92		
500	152,400	50	15,240	5	1,524.0	0.5	152.40		
600	182,880	60	18,288	6	1,828.0	0.6	182.88		
700	213,360	70	21,336	7	2,133.6	0.7	213.36		
800	243,840	80	24,384	8	2,438.4	0.8	243.84		
900	274,320	90	27,432	9	2,743.2	0.9	274.32		
1,000	304,800	100	30,480	10	3,048.0	1.0	304.80		
FT	Mm								
0.01	3.048								
0.02	6.096								
0.03	9.144								
0.04	12.192								
0.05	15.240								
0.06	18.288								
0.07	21.336								
0.08	24.384								
0.09	27.432								
0.10	30.480								

*American Standard Practice for Industrial Use (ASA B48.1)

Kilometer Conversion: Foot-Meter and Mile

NOTE

Based on 1 meter = 39.37 inches*

FEET TO METERS (1 FT = 0.304801 m)									
Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters
100	30.480	10	3.048	1	0.305	0.1	0.030	0.01	0.003
200	60.960	20	6.096	2	0.610	0.2	0.061	0.02	0.006
300	91.440	30	9.144	3	0.914	0.3	0.091	0.03	0.009
400	121.920	40	12.192	4	1.219	0.4	0.122	0.04	0.012
500	152.400	50	15.240	5	1.524	0.5	0.152	0.05	0.015
600	182.881	60	18.288	6	1.829	0.6	0.183	0.06	0.018
700	213.361	70	21.336	7	2.134	0.7	0.213	0.07	0.021
800	243.841	80	24.384	8	2.438	0.8	0.244	0.08	0.024
900	274.321	90	27.432	9	2.743	0.9	0.274	0.09	0.027
1,000	304.801	100	30.480	10	3.048	1.0	0.305	0.10	0.030

METERS TO FEET (1m = 3.280833 FT)									
Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet
100	328.083	10	32.808	1	3.281	0.1	0.328	0.01	0.033
200	656.167	20	65.617	2	6.562	0.2	0.656	0.02	0.066
300	984.250	30	98.425	3	9.842	0.3	0.984	0.03	0.098
400	1,312.333	40	131.233	4	13.123	0.4	1.312	0.04	0.131
500	1,640.416	50	164.042	5	16.404	0.5	1.640	0.05	0.164
600	1,968.500	60	196.850	6	19.685	0.6	1.968	0.06	0.197
700	2,296.583	70	229.658	7	22.966	0.7	2.297	0.07	0.230
800	2,624.667	80	262.467	8	26.247	0.8	2.625	0.08	0.262
900	2,952.750	90	295.275	9	29.528	0.9	2.953	0.09	0.295
1,000	3,280.833	100	328.083	10	32.808	1.0	3.281	0.10	0.328

*Act of U.S. Congress, 1866. On this basis 1 inch = 25.40005 mm, approximately.

NOTE

Based on 1 meter = 39.37 inches*

MILES TO KILOMETERS (1 mile = 1.609347 Km)									
Miles	Km	Miles	Km	Miles	Km	Miles	Km	Miles	Km
1,000	1,609.35	100	160.93	10	16.09	1	1.61	0.1	0.16
2,000	3,218.69	200	321.87	20	32.19	2	3.22	0.2	0.32
3,000	4,828.04	300	482.80	30	48.28	3	4.83	0.3	0.48
4,000	6,437.39	400	643.74	40	64.37	4	6.44	0.4	0.64
5,000	8,046.74	500	804.67	50	80.47	5	8.05	0.5	0.80
6,000	9,656.08	600	965.61	60	96.56	6	9.66	0.6	0.97
7,000	11,265.43	700	1,126.54	70	112.65	7	11.27	0.7	1.13
8,000	12,874.78	800	1,287.48	80	128.75	8	12.87	0.8	1.29
9,000	14,484.78	900	1,448.41	90	144.84	9	14.48	0.9	1.45
10,000	16,093.47	1,000	1,609.35	100	160.93	10	16.09	1.0	1.61

KILOMETERS TO MILES (1 km = 0.621370 mile)									
Km	Miles	Km	Miles	Km	Miles	Km	Miles	Km	Miles
1,000	621.37	100	62.14	10	6.21	1	0.62	0.1	0.06
2,000	1,242.74	200	124.27	20	12.43	2	1.24	0.2	0.12
3,000	1,864.11	300	186.41	30	18.64	3	1.86	0.3	0.19
4,000	2,485.48	400	248.55	40	24.86	4	2.49	0.4	0.25
5,000	3,106.85	500	310.68	50	31.07	5	3.11	0.5	0.31
6,000	3,728.22	600	372.82	60	37.28	6	3.73	0.6	0.37
7,000	4,349.59	700	434.96	70	43.50	7	4.35	0.7	0.43
8,000	4,970.96	800	497.10	80	49.71	8	4.97	0.8	0.50
9,000	5,592.33	900	559.23	90	55.92	9	5.59	0.9	0.56
10,000	6,213.70	1,000	621.37	100	62.14	10	6.21	1.0	0.62

*Act of U.S. Congress, 1866. On this basis 1 inch = 25.4005 mm, approximately.

Square Meter Conversions: Square Inch - Square Centimeter and Square Feet

NOTE

Based on 1 meter = 39.37 inches*

SQUARE INCHES TO SQUARE CENTIMETERS (1 SQ IN. = 6.45163 SQ CM)									
SQ IN	SQ Cm	SQ IN	SQ Cm	SQ IN	SQ Cm	SQ IN	SQ Cm	SQ IN	SQ Cm
100	645.16	10	64.52	1	6.45	0.1	0.65	0.01	0.06
200	1,290.33	20	129.03	2	12.90	0.2	1.29	0.02	0.13
300	1,935.49	30	193.55	3	19.35	0.3	1.94	0.03	0.19
400	2,580.65	40	258.07	4	25.81	0.4	2.58	0.04	0.26
500	3,225.82	50	322.58	5	32.26	0.5	3.23	0.05	0.32
600	3,870.98	60	387.10	6	38.71	0.6	3.87	0.06	0.39
700	4,516.14	70	451.61	7	45.16	0.7	4.52	0.07	0.45
800	5,161.30	80	516.13	8	51.61	0.8	5.16	0.08	0.52
900	5,806.47	90	580.65	9	58.06	0.9	5.81	0.09	0.58
1,000	6,451.63	100	645.16	10	64.52	1.0	6.45	0.10	0.65

SQUARE CENTIMETERS TO SQUARE INCHES (1 SQ CM = 0.155000 SQ IN)									
SQ Cm	SQ IN	SQ Cm	SQ IN	SQ Cm	SQ IN	SQ Cm	SQ IN	SQ Cm	SQ IN
100	15.500	10	1.550	1	0.155	0.1	0.015	0.01	0.002
200	31.000	20	3.100	2	0.310	0.2	0.031	0.02	0.003
300	46.500	30	4.650	3	0.465	0.3	0.046	0.03	0.005
400	62.000	40	6.200	4	0.620	0.4	0.062	0.04	0.006
500	77.500	50	7.750	5	0.775	0.5	0.078	0.05	0.008
600	93.000	60	9.300	6	0.930	0.6	0.093	0.06	0.009
700	108.500	70	10.850	7	1.085	0.7	0.108	0.07	0.011
800	124.000	80	12.400	8	1.240	0.8	0.124	0.08	0.012
900	139.500	90	13.950	9	1.395	0.9	0.140	0.09	0.014
1,000	155.000	100	15.500	10	1.550	1.0	0.155	0.10	0.016

*Act of U.S. Congress, 1866. On this basis 1 inch = 25.40005 mm, approximately.

Weights, Measures
Metric

(Cont'd)

NOTE

Based on 1 meter = 39.37 inches*

SQUARE FEET TO SQUARE METERS (1 SQ FT = 0.0929034 SQ M)									
SQ FT	SQ M	SQ FT	SQ M	SQ FT	SQ M	SQ FT	SQ M	SQ FT	SQ M
1,000	92.903	100	9.290	10	0.929	1	0.093	0.1	0.009
2,000	185.807	200	18.581	20	1.858	2	0.186	0.2	0.019
3,000	278.710	300	27.871	30	2.787	3	0.279	0.3	0.028
4,000	371.614	400	37.161	40	3.716	4	0.372	0.4	0.037
5,000	464.517	500	46.452	50	4.645	5	0.465	0.5	0.046
6,000	557.420	600	55.742	60	5.574	6	0.557	0.6	0.056
7,000	650.324	700	65.032	70	6.503	7	0.650	0.7	0.065
8,000	743.227	800	74.323	80	7.432	8	0.743	0.8	0.074
9,000	836.131	900	83.613	90	8.361	9	0.836	0.9	0.084
10,000	929.034	1,000	92.903	100	9.290	10	0.929	1.0	0.093

SQUARE METERS TO SQUARE FEET (1 SQ M = 10.76387 SQ FT)									
SQ M	SQ FT	SQ M	SQ FT	SQ M	SQ FT	SQ M	SQ FT	SQ M	SQ FT
100	1,076.39	10	107.64	1	10.76	0.1	1.08	0.01	0.11
200	2,152.77	20	215.28	2	21.53	0.2	2.15	0.02	0.22
300	3,229.16	30	322.92	3	32.29	0.3	3.23	0.03	0.32
400	4,305.55	40	430.56	4	43.06	0.4	4.31	0.04	0.43
500	5,381.94	50	538.19	5	53.82	0.5	5.38	0.05	0.54
600	6,458.32	60	645.83	6	64.58	0.6	6.46	0.06	0.65
700	7,534.71	70	753.47	7	75.35	0.7	7.53	0.07	0.75
800	8,611.10	80	861.11	8	86.11	0.8	8.61	0.08	0.86
900	9,687.48	90	968.75	9	96.87	0.9	9.69	0.09	0.97
1,000	10,763.87	100	1,076.39	10	107.64	1.0	10.76	0.10	1.08

*Act of U.S. Congress, 1866. On this basis 1 inch = 25.40005 mm, approximately.

Cubic Meter Conversions: Cubic Inch - Cubic Centimeter and Cubic Foot

NOTE

Based on 1 meter = 39.37 inches)*

CUBIC INCHES TO CUBIC CENTIMETERS (1 CU IN. = 16.38716 cu cm)									
CU IN.	Cu Cm	CU IN.	Cu Cm	CU IN.	Cu Cm	CU IN.	Cu Cm	CU IN.	Cu Cm
100	1,638.72	10	163.87	1	16.39	0.1	1.64	0.01	0.16
200	3,277.43	20	327.74	2	32.77	0.2	3.28	0.02	0.33
300	4,916.15	30	491.62	3	49.16	0.3	4.92	0.03	0.49
400	6,554.86	40	655.49	4	65.55	0.4	6.56	0.04	0.66
500	8,193.58	50	819.36	5	81.94	0.5	8.19	0.05	0.82
600	9,832.30	60	983.23	6	98.32	0.6	9.83	0.06	0.98
700	11,471.01	70	1,147.10	7	114.71	0.7	11.47	0.07	1.15
800	13,109.73	80	1,310.97	8	131.10	0.8	13.11	0.08	1.31
900	14,748.44	90	1,474.84	9	147.48	0.9	14.75	0.09	1.47
1,000	16,387.16	100	1,638.72	10	163.87	1.0	16.39	0.10	1.64

CUBIC CENTIMETERS TO CUBIC INCHES (1 cu cm = 0.0610234 CU IN.)									
Cu Cm	CU IN.	Cu Cm	CU IN.	Cu Cm	CU IN.	Cu Cm	CU IN.	Cu Cm	CU IN.
1,000	61.023	100	6.102	10	0.610	1	0.061	0.1	0.006
2,000	122.047	200	16.205	20	1.220	2	0.122	0.2	0.012
3,000	183.070	300	18.307	30	1.831	3	0.183	0.3	0.018
4,000	244.094	400	24.409	40	2.441	4	0.244	0.4	0.024
5,000	305.117	500	30.512	50	3.051	5	0.305	0.5	0.031
6,000	366.140	600	36.614	60	3.661	6	0.366	0.6	0.037
7,000	427.164	700	42.716	70	4.272	7	0.427	0.7	0.043
8,000	488.187	800	48.819	80	4.882	8	0.488	0.8	0.049
9,000	549.211	900	54.921	90	5.492	9	0.549	0.9	0.055
10,000	610.234	1,000	61.023	100	6.102	10	0.610	1.0	0.061

(Cont'd)

NOTE

Based on 1 meter = 39.37 inches)*

CUBIC FEET TO CUBIC METERS (1 CU FT = 0.0283170 cu m)									
CU FT	Cu M	CU FT	Cu M	CU FT	Cu M	CU FT	Cu M	CU FT	Cu M
1,000	28.317	100	2.832	10	0.283	1	0.028	0.1	0.003
2,000	56.634	200	5.663	20	0.566	2	0.057	0.2	0.006
3,000	84.951	300	8.495	30	0.850	3	0.085	0.3	0.008
4,000	113.268	400	11.327	40	1.133	4	0.113	0.4	0.011
5,000	141.585	500	14.158	50	1.416	5	0.142	0.5	0.014
6,000	169.902	600	16.990	60	1.699	6	0.170	0.6	0.017
7,000	198.219	700	19.822	70	1.982	7	0.198	0.7	0.020
8,000	226.536	800	22.654	80	2.265	8	0.227	0.8	0.023
9,000	254.853	900	25.485	90	2.549	9	0.255	0.9	0.025
10,000	283.170	1,000	28.317	100	2.832	10	0.283	1.0	0.028

CUBIC METERS TO CUBIC FEET (1 cu m = 35.31445 CU FT)									
Cu M	CU FT	Cu M	CU FT	Cu M	CU FT	Cu M	CU FT	Cu M	CU FT
100	3,531.44	10	353.14	1	35.31	0.1	3.53	0.01	0.35
200	7,062.89	20	706.29	2	70.63	0.2	7.06	0.02	0.71
300	10,594.34	30	1,059.43	3	105.94	0.3	10.59	0.03	1.06
400	14,125.78	40	1,412.58	4	141.26	0.4	14.13	0.04	1.41
500	17,657.22	50	1,765.72	5	176.57	0.5	17.66	0.05	1.77
600	21,188.67	60	2,118.87	6	211.89	0.6	21.19	0.06	2.12
700	24,720.12	70	2,472.01	7	247.20	0.7	24.72	0.07	2.47
800	28,251.56	80	2,825.16	8	282.52	0.8	28.25	0.08	2.83
900	31,783.00	90	3,178.30	9	317.83	0.9	31.78	0.09	3.18
1,000	35,314.45	100	3,531.44	10	353.14	1.0	35.31	0.10	3.53

* Act of US. S. Congress, 1866. On this basis 1 inch = 24.4005 mm. approximately.

Liter Conversions: Cubic Foot - Liter and Gallon

NOTE

Based on 1 liter = 1000.028
cubic centimeters*

CUBIC FEET TO LITERS (1 CU FT = 28.31622 liters)									
CU FT	Liters	CU FT	Liters	CU FT	Liters	CU FT	Liters	CU FT	Liters
100	2,831.62	10	283.16	1	28.32	0.1	2.83	0.01	0.28
200	5,663.24	20	566.32	2	56.63	0.2	5.66	0.02	0.57
300	8,494.87	30	849.49	3	84.95	0.3	8.49	0.03	0.85
400	11,326.49	40	1,132.65	4	113.26	0.4	11.33	0.04	1.13
500	14,158.11	50	1,415.81	5	141.58	0.5	14.16	0.05	1.42
600	16,989.73	60	1,698.97	6	169.90	0.6	16.99	0.06	1.70
700	19,821.35	70	1,982.14	7	198.21	0.7	19.82	0.07	1.98
800	22,652.98	80	2,265.30	8	226.53	0.8	22.65	0.08	2.27
900	25,484.60	90	2,548.46	9	254.85	0.9	25.48	0.09	2.55
1,000	28,316.22	100	2,831.62	10	283.16	1.0	28.32	0.10	2.83

LITERS TO CUBIC FEET (1 liter = 0.0353154 CU FT)									
Liters	CU FT	Liters	CU FT	Liters	CU FT	Liters	CU FT	Liters	CU FT
1,000	35.315	100	3.532	10	0.353	1	0.035	0.1	0.004
2,000	70.631	200	7.063	20	0.706	2	0.071	0.2	0.007
3,000	105.946	300	10.595	30	1.059	3	0.106	0.3	0.011
4,000	141.262	400	14.126	40	1.413	4	0.141	0.4	0.014
5,000	176.577	500	17.658	50	1.766	5	0.177	0.5	0.018
6,000	211.892	600	21.189	60	2.119	6	0.212	0.6	0.021
7,000	247.208	700	24.721	70	2.472	7	0.247	0.7	0.025
8,000	282.523	800	28.252	80	2.825	8	0.283	0.8	0.028
9,000	317.839	900	31.784	90	3.178	9	0.318	0.9	0.032
10,000	353.154	1,000	35.315	100	3.532	10	0.353	1.0	0.035

*For practical purposes in some applications 1 liter is taken as being equal to 1,000 cubic centimeters, exactly.

Weights, Measures
Metric

(Cont'd)

NOTE

Based on 1 liter = 1000.028
cubic centimeters*

U.S. GALLONS TO LITERS (1 U.S. gallon = 3.785329 liters)									
GALS	Liters	GALS	Liters	GALS	Liters	GALS	Liters	GALS	Liters
1,000	3,785.33	100	378.53	10	37.85	1	3.79	0.1	0.38
2,000	7,570.66	200	757.07	20	75.71	2	7.57	0.2	0.76
3,000	11,355.99	300	1,135.60	30	113.56	3	11.36	0.3	1.14
4,000	15,141.32	400	1,514.13	40	151.41	4	15.14	0.4	1.51
5,000	18,926.64	500	1,892.66	50	189.27	5	18.93	0.5	1.89
6,000	22,711.97	600	2,271.20	60	227.12	6	22.71	0.6	2.27
7,000	26,497.30	700	2,649.73	70	264.97	7	26.50	0.7	2.65
8,000	30,282.63	800	3,028.26	80	302.83	8	30.28	0.8	3.03
9,000	34,067.96	900	3,406.80	90	340.68	9	34.07	0.9	3.41
10,000	37,853.29	1,000	3,785.33	100	378.53	10	37.85	1.0	3.79

LITERS TO U.S. GALLONS (1 liter = 0.264178 U.S. gallon)									
Liters	GALS	Liters	GALS	Liters	GALS	Liters	GALS	Liters	GALS
1,000	264.18	100	26.42	10	2.64	1	0.26	0.1	0.03
2,000	528.36	200	52.84	20	5.28	2	0.53	0.2	0.05
3,000	792.53	300	79.25	30	7.93	3	0.79	0.3	0.08
4,000	1,056.71	400	105.67	40	10.57	4	1.06	0.4	0.11
5,000	1,320.89	500	132.09	50	13.21	5	1.32	0.5	0.13
6,000	1,585.07	600	158.51	60	15.85	6	1.59	0.6	0.16
7,000	1,849.25	700	184.92	70	18.49	7	1.85	0.7	0.18
8,000	2,113.42	800	211.34	80	21.13	8	2.11	0.8	0.21
9,000	2,377.60	900	237.76	90	23.78	9	2.38	0.9	0.24
10,000	2,641.78	1,000	264.18	100	26.42	10	2.64	1.0	0.26

*For practical purposes in some applications 1 liter is taken as being equal to 1,000 cubic centimeters, exactly.

Gram Conversions: Pound - Kilogram and Ounce

POUNDS TO KILOGRAMS (1 pound = 0.453592 kilogram)

LB	Kg	LB	Kg	LB	Kg	LB	Kg	LB	Kg
1,000	453.59	100	45.36	10	4.54	1	0.45	0.1	0.05
2,000	907.18	200	90.72	20	9.07	2	0.91	0.2	0.09
3,000	1,360.78	300	136.08	30	13.61	3	1.36	0.3	0.14
4,000	1,814.37	400	181.44	40	18.14	4	1.81	0.4	0.18
5,000	2,267.96	500	226.80	50	22.68	5	2.27	0.5	0.23
6,000	2,721.55	600	272.16	60	27.22	6	2.72	0.6	0.27
7,000	3,175.14	700	317.51	70	31.75	7	3.18	0.7	0.32
8,000	3,628.74	800	362.87	80	36.29	8	3.63	0.8	0.36
9,000	4,082.33	900	408.23	90	40.82	9	4.08	0.9	0.41
10,000	4,535.92	1,000	453.59	100	45.36	10	4.54	1.0	0.45

KILOGRAMS TO POUNDS (1 kilogram = 2.204622 pounds)

Kg	LB	Kg	LB	Kg	LB	Kg	LB	Kg	LB
1,000	2,204.62	100	220.46	10	22.05	1	2.20	0.1	0.22
2,000	4,409.24	200	440.92	20	44.09	2	4.41	0.2	0.44
3,000	6,613.87	300	661.39	30	66.14	3	6.61	0.3	0.66
4,000	8,818.49	400	881.85	40	88.18	4	8.82	0.4	0.88
5,000	11,023.11	500	1,102.31	50	110.23	5	11.02	0.5	1.10
6,000	13,227.73	600	1,322.77	60	132.28	6	13.23	0.6	1.32
7,000	15,432.35	700	1,543.24	70	154.32	7	15.43	0.7	1.54
8,000	17,636.98	800	1,763.70	80	176.37	8	17.64	0.8	1.76
9,000	19,841.60	900	1,984.16	90	198.42	9	19.84	0.9	1.98
10,000	22,046.22	1,000	2,204.62	100	220.46	10	22.05	1.0	2.20

OUNCES TO GRAMS (1 ounce = 28.3495 grams)

OZ	G	OZ	G	OZ	G	OZ	G	OZ	G
10	283.50	1	28.35	0.1	2.84	0.01	0.28	0.001	0.03
20	566.99	2	56.70	0.2	5.67	0.02	0.57	0.002	0.06
30	850.48	3	85.05	0.3	8.50	0.03	0.85	0.003	0.09
40	1,133.98	4	113.40	0.4	11.34	0.04	1.13	0.004	0.11
50	1,417.48	5	141.75	0.5	14.17	0.05	1.42	0.005	0.14
60	1,700.97	6	170.10	0.6	17.01	0.06	1.70	0.006	0.17
70	1,984.46	7	198.45	0.7	19.84	0.07	1.98	0.007	0.20
80	2,267.96	8	226.80	0.8	22.68	0.08	2.27	0.008	0.23
90	2,551.46	9	255.15	0.9	25.51	0.09	2.55	0.009	0.26
100	2,834.95	10	283.50	1.0	28.35	0.10	2.83	0.010	0.28

Weights, Measures
Metric

GRAMS TO OUNCES (1 gram = 0.035274 ounce)									
G	OZ	G	OZ	G	OZ	G	OZ	G	OZ
100	3.527	10	0.353	1	0.035	0.1	0.004	0.01	0.000
200	7.055	20	0.706	2	0.071	0.2	0.007	0.02	0.001
300	10.582	30	1.058	3	0.106	0.3	0.011	0.03	0.001
400	14.110	40	1.411	4	0.141	0.4	0.014	0.04	0.001
500	17.637	50	1.764	5	0.176	0.5	0.018	0.05	0.002
600	21.164	60	2.116	6	0.212	0.6	0.021	0.06	0.002
700	24.692	70	2.469	7	0.247	0.7	0.025	0.07	0.002
800	28.219	80	2.822	8	0.282	0.8	0.028	0.08	0.003
900	31.747	90	3.175	9	0.317	0.9	0.032	0.09	0.003
1,000	35.274	100	3.527	10	0.353	1.0	0.035	0.10	0.004

Kilograms per Square Meter Conversions: Pounds per Square Inch -
Kilograms per Square Centimeter and Pounds per Square Foot

POUNDS PER SQUARE INCH TO KILOGRAMS PER SQUARE CENTIMETER (1 LB PER SQ IN. = 0.0703066 kg per sq cm)									
LB/ IN ²	Kg/ cm ²	LB/ IN ²	Kg/ cm ²	LB/ IN ²	Kg/ cm ²	LB/ IN ²	Kg/ cm ²	LB/ IN ²	Kg/ cm ²
1,000	70.307	100	7.031	10	0.703	1	0.070	0.1	0.007
2,000	140.613	200	14.061	20	1.406	2	0.141	0.2	0.014
3,000	210.920	300	21.092	30	2.109	3	0.211	0.3	0.021
4,000	281.226	400	28.123	40	2.812	4	0.281	0.4	0.028
5,000	351.533	500	35.153	50	3.515	5	0.352	0.5	0.035
6,000	421.840	600	42.184	60	4.218	6	0.422	0.6	0.042
7,000	492.146	700	49.215	70	4.921	7	0.492	0.7	0.049
8,000	562.453	800	56.245	80	5.625	8	0.562	0.8	0.056
9,000	632.759	900	63.276	90	6.328	9	0.633	0.9	0.063
10,000	703.066	1000	70.307	100	7.031	10	0.703	1.0	0.070

KILOGRAMS PER SQUARE CENTIMETER TO POUNDS PER SQUARE INCH (1 kg per sq cm = 14.22340 LB per SQ IN.)									
Kg/ cm ²	LB/ IN ²	Kg/ cm ²	LB/ IN ²	Kg/ cm ²	LB/ IN ²	Kg/ cm ²	LB/ IN ²	Kg/ cm ²	LB/ IN ²
100	1,422.34	10	142.23	1	14.22	0.1	1.42	0.01	0.14
200	2,844.68	20	284.47	2	28.45	0.2	2.84	0.02	0.28
300	4,267.02	30	426.70	3	42.67	0.3	4.27	0.03	0.43
400	5,689.36	40	568.94	4	56.89	0.4	5.69	0.04	0.57
500	7,111.70	50	711.17	5	71.12	0.5	7.11	0.05	0.71
600	8,534.04	60	853.40	6	85.34	0.6	8.53	0.06	0.85
700	9,956.38	70	995.64	7	99.56	0.7	9.96	0.07	1.00
800	11,378.72	80	1,137.87	8	113.79	0.8	11.38	0.08	1.14
900	12,801.06	90	1,280.11	9	128.01	0.9	12.80	0.09	1.28
1,000	14,223.40	100	1,422.34	10	142.23	1.0	14.22	0.10	1.42

(Cont'd)

POUNDS PER SQUARE FOOT TO KILOGRAMS PER SQUARE METER (1 LB per SQ FT = 4.882409 kg per sq m)									
LB/ FT ²	Kg/ m ²	LB/ FT ²	Kg/ m ²	LB/ FT ²	Kg/ m ²	LB/ FT ²	Kg/ m ²	LB/ FT ²	Kg/ m ²
1,000	4,882.41	100	488.24	10	48.82	1	4.88	0.1	0.49
2,000	9,764.82	200	976.48	20	97.65	2	9.76	0.2	0.98
3,000	14,647.23	300	1,464.72	30	146.47	3	14.65	0.3	1.46
4,000	19,529.64	400	1,952.96	40	195.30	4	19.53	0.4	1.95
5,000	24,412.04	500	2,441.20	50	244.12	5	24.41	0.5	2.44
6,000	29,294.45	600	2,929.44	60	292.94	6	29.29	0.6	2.93
7,000	34,176.86	700	3,417.69	70	341.77	7	34.18	0.7	3.42
8,000	39,059.27	800	3,905.93	80	390.59	8	39.06	0.8	3.91
9,000	43,941.68	900	4,394.17	90	439.42	9	43.94	0.9	4.39
10,000	48,824.09	1,000	4,882.41	100	488.24	10	48.82	1.0	4.88

KILOGRAMS PER SQUARE METER TO POUNDS PER SQUARE FOOT (1 kg per sq m = 0.204817 per SQ FT)									
Kg/ m ²	LB/ FT ²	Kg/ m ²	LB/ FT ²	Kg/ m ²	LB/ FT ²	Kg/ m ²	LB/ FT ²	Kg/ m ²	LB/ FT ²
1,000	204.82	100	20.48	10	2.05	1	0.20	0.1	0.02
2,000	409.63	200	40.96	20	4.10	2	0.41	0.2	0.04
3,000	614.45	300	61.44	30	6.14	3	0.61	0.3	0.06
4,000	819.27	400	81.93	40	8.19	4	0.82	0.4	0.08
5,000	1,024.08	500	102.41	50	10.24	5	1.02	0.5	0.10
6,000	1,228.90	600	122.89	60	12.29	6	1.23	0.6	0.12
7,000	1,433.72	700	143.37	70	14.34	7	1.43	0.7	0.14
8,000	1,638.54	800	163.85	80	16.39	8	1.64	0.8	0.16
9,000	1,843.35	900	184.34	90	18.43	9	1.84	0.9	0.18
10,000	2,048.17	1,000	204.82	100	20.48	10	2.05	1.0	0.20

Kilograms Per Cubic Meter Conversions: Pounds per Cubic Inch -
Grams per Cubic Centimeter and Pounds per Cubic Foot

POUNDS PER CUBIC INCH TO GRAMS PER CUBIC CENTIMETER (1 lb per cu in. = 27.67974 per cu m)									
LB/ IN. ³	G/ cm ³	LB/ IN. ³	G/ cm ³	LB/ IN. ³	G/ cm ³	LB/ IN. ³	G/ cm ³	LB/ IN. ³	G/ cm ³
100	2,767.97	10	276.80	1	27.68	0.1	2.77	0.01	0.28
200	5,535.95	20	553.60	2	55.36	0.2	5.54	0.02	0.55
300	8,303.92	30	830.39	3	83.04	0.3	8.30	0.03	0.83
400	11,071.90	40	1,107.19	4	110.72	0.4	11.07	0.04	1.11
500	13,839.87	50	1,383.09	5	138.40	0.5	13.84	0.05	1.38
600	16,607.84	60	1,660.78	6	166.08	0.6	16.61	0.06	1.66
700	19,375.82	70	1,937.58	7	193.76	0.7	19.38	0.07	1.94
800	22,143.79	80	2,214.38	8	221.44	0.8	22.14	0.08	2.21
900	24,911.77	90	2,491.18	9	249.12	0.9	24.91	0.09	2.49
1,000	27,679.74	100	2,767.97	10	276.80	1.0	27.68	0.10	2.77

GRAMS PER CUBIC CENTIMETER TO POUNDS PER CUBIC INCH (1 g per cu cm = 0.0361275 LB per CU IN)									
G/ cm ³	LB/ IN. ³	G/ cm ³	LB/ IN. ³	G/ cm ³	LB/ IN. ³	G/ cm ³	LB/ IN. ³	G/ cm ³	LB/ IN. ³
1,000	36.128	100	3.613	10	0.361	1	0.036	0.1	0.004
2,000	72.255	200	7.226	20	0.723	2	0.072	0.2	0.007
3,000	108.382	300	10.838	30	1.084	3	0.108	0.3	0.011
4,000	144.510	400	14.451	40	1.445	4	0.145	0.4	0.014
5,000	180.638	500	18.064	50	1.806	5	0.181	0.5	0.018
6,000	216.765	600	21.676	60	2.168	6	0.217	0.6	0.022
7,000	252.892	700	25.289	70	2.529	7	0.253	0.7	0.025
8,000	289.020	800	28.902	80	2.890	8	0.289	0.8	0.029
9,000	325.148	900	32.515	90	3.251	9	0.325	0.9	0.033
10,000	361.275	1,000	36.128	100	3.613	10	0.361	1.0	0.036

Weights, Measures
Metric

(Cont'd)

POUNDS PER CUBIC FOOT TO KILOGRAMS PER CUBIC METER (1 LB per CU FT = 16.01837 kg per cu m)									
LB/ FT ³	Kg/ m ³	LB/ FT ³	Kg/ m ³	LB/ FT ³	Kg/ m ³	LB/ FT ³	Kg/ m ³	LB/ FT ³	Kg/ m ³
100	1,601.84	10	160.18	1	16.02	0.1	1.60	0.01	0.16
200	3,203.67	20	320.37	2	32.04	0.2	3.20	0.02	0.32
300	4,805.51	30	480.55	3	48.06	0.3	4.81	0.03	0.48
400	6,407.35	40	640.73	4	64.07	0.4	6.41	0.04	0.64
500	8,009.18	50	800.92	5	80.09	0.5	8.01	0.05	0.80
600	9,611.02	60	961.10	6	96.11	0.6	9.61	0.06	0.94
700	11,212.86	70	1,121.29	7	112.13	0.7	11.21	0.07	1.12
800	12,814.70	80	1,281.47	8	128.15	0.8	12.81	0.08	1.28
900	14,416.53	90	1,441.65	9	144.17	0.9	14.42	0.09	1.44
1,000	16,018.37	100	1,601.84	10	160.18	1.0	16.02	0.10	1.60

KILOGRAMS PER CUBIC METER TO POUNDS PER CUBIC FOOT (1 kg per cu m = 0.062483 LB per CU FT)									
Kg/ m ³	LB/ FT ³	Kg/ m ³	LB/ FT ³	Kg/ m ³	LB/ FT ³	Kg/ m ³	LB/ FT ³	Kg/ m ³	LB/ FT ³
1,000	62.428	100	6.243	10	0.624	1	0.062	0.1	0.006
2,000	124.857	200	12.486	20	1.249	2	0.125	0.2	0.012
3,000	187.285	300	18.728	30	1.873	3	0.187	0.3	0.019
4,000	249.713	400	24.971	40	2.497	4	0.250	0.4	0.025
5,000	312.142	500	31.214	50	3.121	5	0.312	0.5	0.031
6,000	374.570	600	37.457	60	3.746	6	0.375	0.6	0.037
7,000	436.998	700	43.700	70	4.370	7	0.437	0.7	0.044
8,000	499.426	800	49.943	80	4.994	8	0.499	0.8	0.050
9,000	561.855	900	56.186	90	5.619	9	0.562	0.9	0.056
10,000	624.283	1,000	62.428	100	6.243	10	0.624	1.0	0.062

RELATIVE SIZE OF PARTICLES

MAGNIFICATION: 500 TIMES

2 Microns



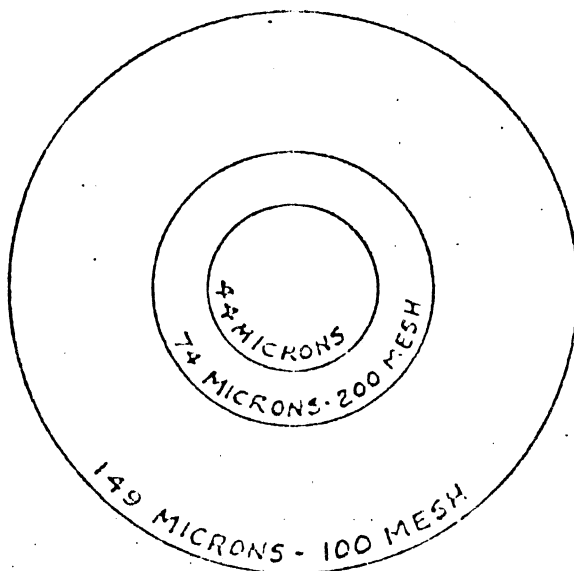
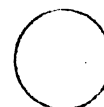
8 Microns



5 Microns



25 Microns



LINEAR EQUIVALENTS

1 Inch	25.4 Millimeters	25,400 Microns
1 Millimeter	.0394 Inches	1000 Microns
1 Micron	$\frac{1}{25,400}$	.001 Millimeters
1 Micron	3.94×10^{-5}	.000039 Inches

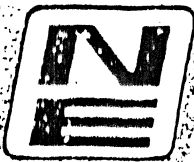
RELATIVE SIZES

Lower Limit of Visibility (Naked Eye)	40 Microns
White Blood Cells	25 Microns
Red Blood Cells	8 Microns
Bacteria (Cocci)	2 Microns

SCREEN SIZES

<u>Meshs Per</u> <u>Linear Inch</u>	<u>U. S. Sieve No.</u>	<u>Opening in</u> <u>Inches</u>	<u>Opening in</u> <u>Microns</u>
52.36	50	.0117	297
72.45	70	.0083	210
101.01	100	.0059	149
142.86	140	.0041	105
200.00	200	.0029	74
270.26	270	.0021	53
323.00	325	.0017	44



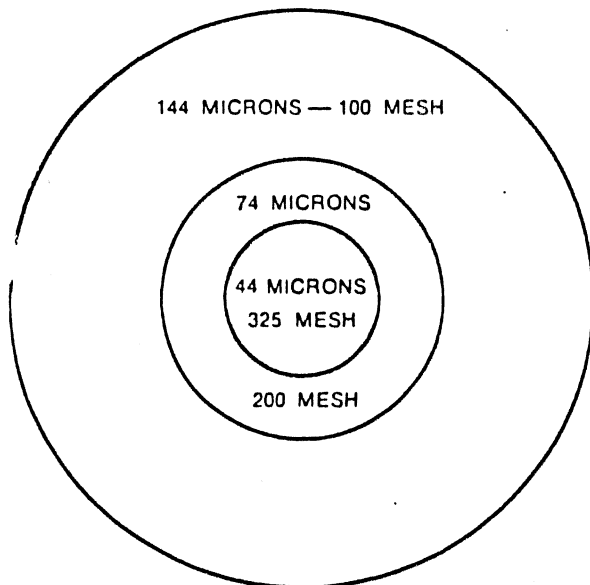
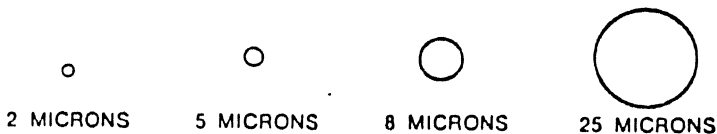


Particles

How Large Is A Micron

Since a particle the size of 1 micron is too small to see without the aid of a Microscope, we can illustrate size either by comparison with known visible particles or by magnification.

RELATIVE SIZE OF PARTICLES MAGNIFICATION 500 TIMES



Ultraporous filters with Stainless Steel wire cloth elements can stop contaminant particles as small as 2 microns and — are completely recleanable.

LINEAR EQUIVALENTS

1	=	39.37×10^{-6}	=	.00003937
2	=	78.74×10^{-6}	=	.00007874
5	=	19.69×10^{-5}	=	.0001969
10	=	39.37×10^{-5}	=	.0003937
20	=	78.75×10^{-5}	=	.0007874
40	=	15.75×10^{-4}	=	.001575
75	=	29.53×10^{-4}	=	.009253
100	=	39.37×10^{-4}	=	.003937
200	=	78.74×10^{-4}	=	.007874
1,000	=	39.37×10^{-3}	=	.03937
25,400	=	10.00×10^{-1}	=	1.000

RELATIVE SIZES

	MICRONS
LOWER LIMIT OF VISIBILITY (NAKED EYE)	40
WHITE BLOOD CELLS	25
RED BLOOD CELLS	8
BACTERIA (COCCI)	2
FINE SAND	125
HUMAN HAIR DIAMETER	80
FLOUR	60
TABLE SALT	100
TALCUM POWDER	10
MIST, SILT, FUMES	2/15
PAINT PIGMENT	0.1/15
FINE AIRBORNE DUST	0.5/5
SEWING MACHINE NEEDLE DIA.	750
CLEAN UNUSED HYDRAULIC FLUID	3/10
PROCESS CHEMICALS	1/30
SPRAY DRIED MILK	0.1/10
TOBACCO SMOKE	0.01/1
LUNG DAMAGING DUST	0.05/5

SCREEN SIZES

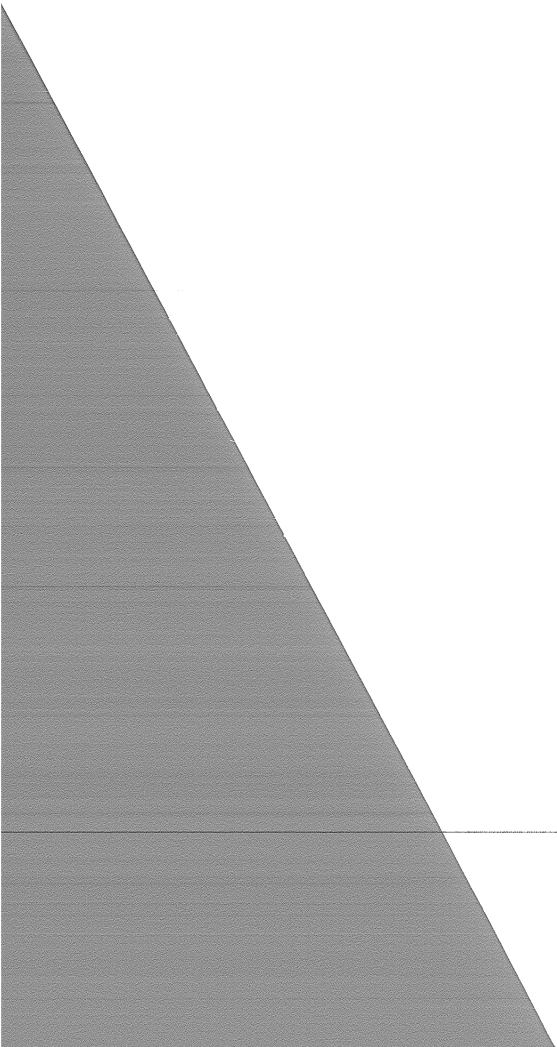
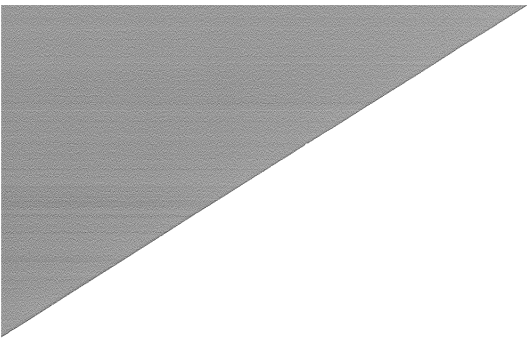
MESHES PER LINEAR INCH	U.S. SIEVE NO.	OPENING IN INCHES	OPENING IN MICRONS
52.36	50	.0117	297
72.45	70	.0083	210
101.01	100	.0059	144
142.86	140	.0041	105
200.00	200	.0029	74
270.26	270	.0021	53
325.00	325	.0017	44
		.00039	10
		.000019	.5



<u>ITEM DESCRIPTION</u>	<u>P/N NSN STOCK NO.</u>	<u>REMARKS</u>
Box, Tote (Plastic 20 X 15)	3990-01-264-1267	
Gloves	8415-00-K04-5217	Cotton/Nylon Orbiter.
Freon (Type 114)	6830-00-785-3306	Used for S70-0508/ Orbiter GSE heat exchanger loop service.
1 Ton Carboy		
Freon (Type 22)	6830-00-106-1659	Used for S70-0508
50 lb. Cylinder		Refer cooling loop (22/114 heat exchanger) service.
Tie Cord (Black)	4020-00-656-1125	Used for lacing electrical wire bundles and tethering tools, etc.
Tag, Label SS (Dog Tag)	8465-00-242-4804	Used to identify hoses and other identifiable items.
Gage, Thickness, .004-.074, 29 Blades	5210-00-189-9518	
Headset Interface Unit	5965-00-K33-1664	
Labels, Press-A-Ply, White	7530-00-781-6212	
Cushioning Material, Bubble Wrap	8135-00-142-9106	
Magnifier, 2X2in. Dia., Handle	6650-00-252-6250	
Mirror, Inspection	5120-00-618-6901	
Multimeter, Analog, Simpson	6625-00-897-4051	
Rope, Fibrous, Nylon, 3/8"X600'	4020-00-968-1356	
Rope, Kelvar	4020-00-K31-1454	
Rope, Nylon, 1/4"X600'	4020-00-928-3438	
Scale, Machinists, Gin	7920-00-291-5812	
Rule, Steel, Machinists, 12 in.	5210-00-234-5224	
Strap, Tiedown, Elect, 1/16 to 4" Dia.	5975-00-899-4606	
Strap, Tiedown, Elect, 1/16 to 4" Dia.	5975-00-156-3253	
Strap, Tiedown, Elect, 1/16 to 3 1/2" Dia.	5975-00-842-5258	
Strap, Tiedown, Elect, 3/16 to 4" Dia.	5975-00-985-6630	
Strap, Tiedown, Elect, 3/16 to 8" Dia.	5975-00-133-8696	
Wire, Lock, 0.020 Dia. In. (MS20995C20)	9505-00-596-5101	
Wire, Lock, 0.020 Dia. In. (MS20995N20)	9505-00-K32-4232	
Wire, Lock, 0.032 Dia. In. (MS20995C32)	9525-00-K32-2536	
Wire, Lock, 0.032 Dia. In. (MS20995N32)	9525-00-K33-8945	
Wire, Lock, 0.040 Dia. In. (MS20995N40)	6145-00-K32-4590	
Wire, Lock, 0.041 Dia. In. (MS20995C41)	9505-00-331-3275	
Wrist, Stat, Velcor Wristband, 6' Cord	8415-00-K03-5618	
Tool Tethers	5340-00-K84-3741	



ADDENDUM B - FLEX HOSES: RESISTOFLEX 79K80260, AEROQUIP CORP 79K80264





REVISION		DATE	APPROVAL
SYM	DESCRIPTION		
E	SH 1, 5 REV & REDR SH 6 ADDED, SH 4 REV	5/1/86	JT

1. SERVICE: AIR, NITROGEN, HELIUM, HYD FLUIDS PER MIL-H-83282, MIL-H-5696, OR MIL-H-6883. HYDROGEN, OXYGEN, WATER & ALL FLUIDS COMPATIBLE WITH 300 SERIES SST, 17-4PH SST & TEFLON. SEE SERVICE LIMITATION ON SH 3 & 4.

2. OPERATING PRESSURE: SEE SH 3 & 4

3. PROOF PRESSURE: 1 1/2 TIMES OPERATING PRESSURE

4. BURST PRESSURE: 4 TIMES OPERATING PRESSURE (MIN)

5. END CONNECTIONS: SEE SH 5

6. LEAKAGE: BUBBLE TIGHT WHEN CHECKED WITH NITROGEN AT ROOM TEMP & AT RATED PRESSURE FOR ONE MINUTE. SEE NOTE C.

7. OPERATING TEMPERATURE: VENDOR'S PRESSURE RATINGS OF 1500 PSI & BELOW APPLY TO HOSES IN A TEMPERATURE RANGE FROM -67° F TO 450° F. VENDOR'S PRESSURE RATINGS OF 3000 PSI & ABOVE APPLY TO HOSES IN A TEMPERATURE RANGE FROM -67° F TO 400° F. HOSES FOR OXYGEN SERVICE ARE LIMITED TO A TEMPERATURE RANGE OF -67° F TO 160° F.

8. MATERIALS: INNER HOSE SHALL BE SEAMLESS POLYTETRAFLUOROETHYLENE WITH CARBON ADDITIVE FOR HOSE ASSEMBLIES 79K80260-1 THRU -16. OXYGEN HOSE ASSEMBLIES 79K80260-17 THRU -32 SHALL HAVE INNER HOSE MADE FROM SEAMLESS WHITE VIRGIN POLYTETRAFLUOROETHYLENE WITH NO CARBON ADDITIVES. OXYGEN HOSES SHALL BE BATCH TESTED PER NHB 8066.1

BATCH TEST WILL BE PROVIDED BY THE PROCURING AGENCY. TRACEABILITY RECORDS FROM TESTED BATCH TO PROCURED HOSES SHALL BE SUPPLIED BY THE HOSE VENDOR. METALLIC PARTS SHALL BE 304, 316 & 17-4PH SST. PARTS MADE FROM 17-4PH SST SHALL BE HEAT TREATED TO CONDITION H1000 OR ABOVE.

9. CLEANING: CLEAN, PROTECT & INSPECT PER KSC-C-123.

- A. PROCEDURE: AS APPLICABLE
- B. CLEANLINESS: LEVEL 300 A
- C. TEST METHOD: A
- D. CERTIFICATION REQUIRED

10. TESTING: THE MANUFACTURER SHALL PROOF TEST HOSE ASSEMBLIES PER ITEM 3 & LEAK CHECK PER ITEM 6. CERTIFICATION REQUIRED.

11. MARKING: THE VENDOR'S NAME OR TRADEMARK, VENDOR'S PART NO., KSC "9" M/L, PROOF TEST DATE & OPERATING PRESSURE SHALL BE MARKED BY THE MANUFACTURER PERMANENTLY & LEGIBLY UPON THE ASSEMBLY.

NOTES:

- A. SEE DWG 79K90260 FOR MAINTENANCE REQUIREMENTS.
- B. FOR DESIGN THIS DWG SUPERSEDES 75M12292, 75M13772, 75M18809, 75M51683.
- C. FOR HOSE ASSYS 79K80260-3 & -15, LEAKAGE TEST PRESSURE SHALL BE 3000 PSIG FOR ONE MINUTE.

COMPONENT SPECIFICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	ORIGINAL DATE	20 OCT 76
SEE ENGINEERING RECORDS	DESIGNED BY	W.C. JONES
	CHECKED BY	BEDELL
	DRAWN BY	ROSSA
	APPROVED BY	F. E. LUNDY
	MATERIAL	KSC GSE
	HEAT TREATMENT	
	FINISH PROTECTIVE FINISH	
	WT CHECKER	DATE
	UNIT	SEE SH 3 & 4
	SCALE	
	CODE	22264
	THE SIZE	
		B
		79K80260
		SHEET 1 OF 6

DOCUMENT RELEASE AUTHORIZATION		KENNEDY SPACE CENTER, NASA		PAGE 1 OF 1	
REV LETTER	DATE	APPROVAL	SYSTEM	E-00K801-1025	
			W/C	N/A	
			PCH	78956	
			EFFECTIVITY SIS		
			MODEL NOB	N/A	

REVISION SHEET

SYN	DESCRIPTION	DATE	APPROVAL
A	REV ITEM 18	7-4-77	<i>[Signature]</i>
B	REV ITEM 18	6-24-77	<i>[Signature]</i>
C	NO CHG	12-4-74	<i>[Signature]</i>
D	NO CHG	11-13-73	<i>[Signature]</i>
E	NO CHG	5/1/86	<i>[Signature]</i>

12. PACKAGING: PER MANUFACTURER'S STANDARD COMMERCIAL PRACTICE PROVIDED THAT PACKING SHALL BE SUFFICIENT TO PROTECT HOSE ASSEMBLY AGAINST DAMAGE DURING SHIPMENT. EXTERNAL SHIPPING CONTAINER SHALL CONFORM TO FREIGHT CLASSIFICATION RULES & APPLICABLE CONTAINER SPECIFICATIONS.
13. APPROVAL: ANY CHANGE TO THE COMPONENTS DESCRIBED BY THIS DWG REQUIRES PRIOR KSC DESIGN ENGINEERING APPROVAL.
14. VENDOR DATA: WHEN SPECIFIED ON THE PURCHASE ORDER, THE VENDOR SHALL PROVIDE THREE (3) SETS OF NON-RESTRICTIVE ASSEMBLY DWGS, PARTS LISTS, TECHNICAL DATA, INSTRUCTIONS, ETC., SUITABLE FOR INSPECTION, TEST & MAINTENANCE.
15. INSTALLATION RESTRICTIONS: HOSE INSTALLATION DESIGNS SHALL INCLUDE HOSE RESTRICTIONS PER KSC-STD-2-0006.
16. DIMENSIONS: SEE SH 3, 4 & 5
17. MOUNTING ATTITUDE: ANY POSITION
18. SUGGESTED SOURCE: RESISTORFLEX CORP.
ROSELAND, NEW JERSEY 07068
FSOM 50599
OR KSC DESIGN ENGINEERING APPROVED EQUAL. SEE DWG 79K80264 FOR ALTERNATE SOURCE.

COMPONENT SPECIFICATION

CODE IDENT NO.	DWG SIZE	79K80260
22264	B	
		SHEET 2

DOCUMENT RELEASE AUTHORIZATION		KENNEDY SPACE CENTER, NASA		PAGE 1 OF 2	
REV LETTER	DATE	APPROVAL	DRAWING NO.	SYSTEM	W/C
			E-00K531-	KSC GSE	N/A
				PCN	78956
				EFFECTIVITY SIS	
				MODEL NO.	N/A

COMBINATORIAL SHEET

SYM	DESCRIPTION	DATE	APPROVAL
A	ADDED	1-4-77	<i>[Signature]</i>
B	REV PLUMB NOTES & LENGTHS	6-24-77	<i>[Signature]</i>
C	REV DIMS	12-14-78	<i>[Signature]</i>
D	NO DIMS	10-13-80	<i>[Signature]</i>
E	NO DIMS	5/1/86	<i>[Signature]</i>

NOTE: THE LAST FOUR DIGITS OF BOTH ESC & VEHDOR PART NO. ARE TO BE ADDED WHEN HOSE ASSEMBLY LENGTH IS DETERMINED. SEE SH 3.

B VEHDOR SHALL HAVE HOSE ASST'S UP TO THE LENGTH LISTED WITHOUT SPLICES.

C HOSE ASST'S 79K80260-1 THRU -16 NOT FOR USE IN OUTGAS SERVICE. HOSE ASST'S -17 THRU -32 ARE FOR OUTGAS SERVICE ONLY.

D THESE HOSE ASST'S ARE NOT FOR HYDROGEN SERVICE.

PARTIC ESC PART NO.	BASIC VEHDOR PART NO.	HOSE I.D. (REF)	MIN BEND RADIUS (INCHES)	OPERATING PRESSURE (PSI MAX)	HOSE WT (LBS/FT) (REF)	FITTING WT. (LBS EA) (REF)	HOSE O.D. (REF)	MAX UNSPLICED LENGTH (FT)
79K80260-1	RS0200CC-4	1/8	2	1500	.077	.042	5/16	50
79K80260-2	000NE50-4	15/64	3	3000	.173	.075	29/64	50
79K80260-3	RS2200CC-4	7/32	3	6000	.235	.122	15/32	20
79K80260-4	RS0200CC-6	5/16	4	1500	.118	.072	29/64	50
79K80260-5	000NE50-6	5/16	5	3000	.220	.100	35/64	50
79K80260-6	RS2200CC-6	5/16	5	6000	.310	.168	37/64	20
79K80260-7	RS0200CC-8	13/32	4-5/8	1500	.195	.129	9/16	50
79K80260-8	000NE50-8	7/16	5-3/4	3000	.370	.167	47/64	50
79K80260-9	RS2200CC-8	7/16	5-3/4	6000	.630	.338	51/64	20
79K80260-10	RS0200CC-12	5/8	6-1/2	1000	.242	.206	51/64	50
79K80260-11	000NE50-12	11/16	7-3/4	3000	.825	.421	1-1/16	50
79K80260-12	RS0200CC-16Z	7/8	7-3/8	1250	.533	.414	1-7/64	15
79K80260-13	000NE50-16	7/8	9-5/8	3000	1.020	.555	1-17/64	15
79K80260-14	RS0200CC-20Z	1-1/8	11	1000	.634	.872	1-23/64	15
79K80260-15	RS0200CC-24Z	1-3/8	14	1000	.980	1.129	1-43/64	15
79K80260-16	RS0200CC-32Z	1-25/32	22	750	1.196	1.978	2-3/32	15

COMPONENT SPECIFICATION
 CODE IDENT NO 22264 B
 DWG SIZE 79K80260
 SHEET 3

DOCUMENT RELEASE AUTHORIZATION KENNEDY SPACE CENTER, NASA			
REV LETTER	DATE	APPROVAL	ESC USE
			N/A
			78956
			ESC USE N/A

ESC NO. E-00K501-1625
 SYSTEM N/A
 PER 78956
 REVISE STS
 ESC USE N/A

CONTINUATION SHEET

SYM	DESCRIPTION	DATE	APPROVAL
A	THIS SHEET	1-4-77	[Signature]
B	REV LENS	6-24-77	[Signature]
C	REV VENDOR PART NOS & DESCRIPTIVE DATA	10-11-78	[Signature]
D	NO CHG	10-11-78	[Signature]
E	FLUID TEMP REV.	5/1/86	[Signature]

NOTE:
 A. THE LAST FOUR DIGITS OF BOTH JSC & VENDOR PART NO. ARE TO BE USED WHEN MAKE ASSY LENGTH IS DETERMINED. SEE SN 9.
 B. VENDOR SHALL MAKE THESE ASSY'S UP TO THE LENGTH LISTED WITHOUT SPICES.
 C. THESE ASSY'S 79K0260-17 THRU -32 ARE OUYEN COMPATIBLE UP TO THE OPERATING PRESSURES SHOWN. MATCH TEST REQUIRED.

BASIC JSC PART NO.	BASIC VENDOR PART NO.	HORIZONTAL (TUBE) SIZE	HOSE I.D. (REF)	MIN BEND RADIUS (INCHES)	MAX FLUID & AIR TEMP	VENDOR'S PRESSURE RATING % MAX	HOSE WT (REF)	FITTING WT. (REF)	HOSE O.D. (REF)	MAX UNSPLICED LENGTH FT
79K0260-17	R38005CC-4	1/4	3/16	2	160	1500	.077	.043	5/16	50
79K0260-18	000AF50-4	1/4	15/64	3	50	3000	.173	.075	29/64	50
79K0260-19	R65800CC-4	1/4	7/32	3	160	6000	.235	.124	31/64	20
79K0260-20	R38005CC-6	3/8	5/16	4	160	1500	.118	.074	29/64	50
79K0260-21	000AF50-6	3/8	5/16	5	160	3000	.220	.100	35/64	50
79K0260-22	R65800CC-6	3/8	5/16	5	160	6000	.310	.172	19/32	20
79K0260-23	R38005CC-8	1/2	13/32	4-5/8	160	1500	.144	.126	9/16	50
79K0260-24	000AF50-8	1/2	7/16	5-3/4	160	3000	.370	.167	47/64	50
79K0260-25	R65800CC-8	1/2	7/16	5-3/4	160	6000	.630	.338	13/16	20
79K0260-26	R38005CC-12	3/4	5/8	6-1/2	160	1000	.242	.280	51/64	50
79K0260-27	000AF50-12	3/4	11/16	7-3/4	160	3000	.825	.421	1-1/16	50
79K0260-28	R38005CC-16Z	1	7/8	7-3/8	160	1250	.487	.413	1-1/8	15
79K0260-29	000AF50-16	1	7/8	9-5/8	160	3000	1.020	.555	1-17/64	15
79K0260-30	R38005CC-20Z	1-1/4	1-1/8		160	1000	.583	.858	1-3/8	15
79K0260-31	R38005CC-24Z	1-1/2	1-3/8	14	160	1000	.675	1.125	1-45/64	15
79K0260-32	R38005CC-32Z	2	1-25/32	22	160	750	1.196	1.978	2-3/32	15

79K80260
 SPECIFICATION
 CODE IDENT NO. 22264
 DWG SIZE B
 SHEET 4

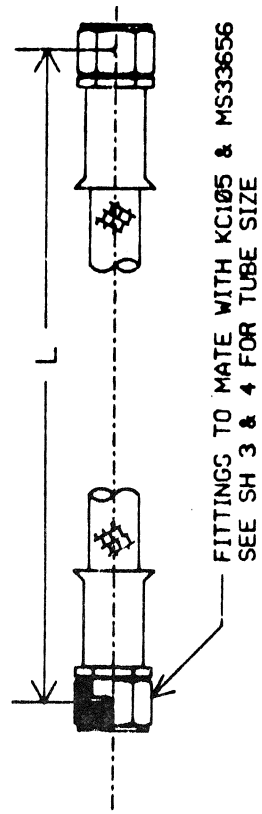
DOCUMENT RELEASE AUTHORIZATION
 KENNEDY SPACE CENTER, NASA

DATE: 1-4-77
 APPROVAL: [Signature]

REV LETTER: E-00K501-1025
 SYSTEM: KSC ESE
 W/C: N/A
 P/CN: 78956
 EFFICIENCY: STS
 MODEL NO: N/A

PAGE 1 OF 1

SYMBOL	DESCRIPTION	REVISION	DATE	APPROVAL
E	SH REVISED & REDW		5/1/86	



HOSE ASSEMBLY
SCALE: NONE

NOTES:

A. LENGTH L SHALL BE SPECIFIED BY FOUR DIGITS WHICH BECOME A PART OF THE ASSY PART NO. THE FIRST THREE DIGITS ARE TO INDICATE INCHES, THE LAST DIGIT TO INDICATE FRACTIONS IN EIGHTHS. FOR EXAMPLE: 79K80260-9-0846 IS A HOSE ASSY 84-3/4 INCHES LONG.

B. LENGTH L TOLERANCES:
 UNDER 18 INCHES LONG $\pm 1/8$ INCH
 FROM 18 TO 36 INCHES $\pm 1/4$ INCH
 FROM 36 TO 50 INCHES $\pm 1/2$ INCH
 OVER 50 INCHES $\pm 1/2$ INCH

C. THIS VIEW FOR ALL DASH NUMBERS EXCEPT -3, -6, -9, -19, -22, -25 (SEE SHEET 6)

COMPONENT IDENTIFICATION	79K80260
IDENT. NO.	22284
	B
	SHEET 5 OF 6

DOCUMENT RELEASE AUTHORIZATION		PAGE 1 OF 1
KENNEDY SPACE CENTER, NASA		
ORA REVISION	APPROVAL	ORA NO. E-00K501-1025
REV LETTER	DATE	SYSTEM KSC GSE
		W/C N/A
		PCN 78956
		EFFECTIVITY SIS
		ORIG. WORK N/A

SAFETY SHIELD INSTALLATION

NTS

SYMBOL	DESCRIPTION	DATE	APPROVAL
E	ADDED SHEET	5/1/86	[Signature]

SAFETY SHIELD — FINGER DEPRESSION FITTING SKIRT



TYPICAL HOSE CONNECTION
END ASSEMBLY



TYPICAL HOSE SPLICE
ASSEMBLY

HOSE PART NUMBER	SAFETY SHIELD TUBING SIZE	SAFETY SHIELD DIMENSIONS		USE CRIMPING FINGERS	CRIMP DIMENSIONS (APPROXIMATE)
		END FITTING	LENGTH SPLICE		
79K88258-3-XXXX AND 79K88258-19-XXXX 79K88258-6-XXXX AND 79K88258-22-XXXX 79K88258-4-XXXX AND 79K88258-25-XXXX	7/8" OD X 0.049"	1-1/8"	2-5/8"	HP-6	0.793"
		1-1/4"	2-3/4"	HP-6	0.898"
		1-1/2"	3-1/4"	MP-12	1.098"

• TUBING IS 3000 SERIES STAINLESS STEEL SEAMLESS
 • CRIMP DIMENSIONS ARE TAKEN ACROSS FINGER DEPRESSIONS (LOW POINT).
 • CRIMP DIMENSIONS ARE NO CRITICAL BUT MUST BE SUFFICIENT FOR
 FINGER DEPRESSIONS TO RETAIN SKIRT TO FITTING WITHOUT BINDING
 (SHIELD MUST ROTATE FREELY).

COMPONENT SPECIFICATION
 CODE 79K80260
 IDENTITY NO. B SHEET 6 OF 6

DOCUMENT RELEASE AUTHORIZATION KENNEDY SPACE CENTER, MAZ		PAGE 1 OF 1
REV LETTER	DATE	APPROVAL
DRA REVISION		STAR NO.
		E-00K801-1025
SYSTEM	USE	
N/A	KSC USE	
REQ	78358	
ACTIVITY	SIS	
WORK-REQ	N/A	

REVISION		
SYM.	DESCRIPTION	DATE
E	SH 1, 5 REV & REDR SH 6 ADDED. SH 4 REV	5/1/86
		277

1. SERVICE: AIR, NITROGEN, HELIUM, HYD FLUIDS PER MIL-H-83282, MIL-H-5696, OR MIL-H-6083. HYDROGEN, OXYGEN, WATER & ALL FLUIDS COMPATIBLE WITH 3000 SERIES SST, 17-4PH SST & TEFLON. SEE SERVICE LIMITATION ON SH 3 & 4.
2. OPERATING PRESSURE: SEE SH 3 & 4
3. PROOF PRESSURE: 1 1/2 TIMES OPERATING PRESSURE
4. BURST PRESSURE: 4 TIMES OPERATING PRESSURE (MIN)
5. END CONNECTIONS: SEE SH 5
6. LEAKAGE: BUBBLE TIGHT WHEN CHECKED WITH NITROGEN AT ROOM TEMP & AT RATED PRESSURE FOR ONE MINUTE. SEE NOTE C.
7. OPERATING TEMPERATURE: VENDOR'S PRESSURE RATINGS OF 1500 PSI & BELOW APPLY TO HOSES IN A TEMPERATURE RANGE FROM -67° F TO 450° F. VENDOR'S PRESSURE RATINGS OF 3000 PSI & ABOVE APPLY TO HOSES IN A TEMPERATURE RANGE FROM -67° F TO 400° F. HOSES FOR OXYGEN SERVICE ARE LIMITED TO A TEMPERATURE RANGE OF -67° F TO 160° F.
8. MATERIALS: INNER HOSE SHALL BE SEAMLESS POLYTETRAFLUOROETHYLENE WITH CARBON ADDITIVE FOR HOSE ASSEMBLIES 79K80260-1 THRU -16. OXYGEN HOSE ASSEMBLIES 79K80260-17 THRU -32 SHALL HAVE INNER HOSE MADE FROM SEAMLESS WHITE VIRGIN POLYTETRAFLUOROETHYLENE WITH NO CARBON ADDITIVES. OXYGEN HOSES SHALL BE BATCH TESTED PER MMB 88601.

- BATCH TEST WILL BE PROVIDED BY THE PROCURING AGENCY. TRACEABILITY RECORDS FROM TESTED BATCH TO PROCURED HOSES SHALL BE SUPPLIED BY THE HOSE VENDOR. METALLIC PARTS SHALL BE 304, 316 & 17-4PH SST. PARTS MADE FROM 17-4PH SST SHALL BE HEAT TREATED TO CONDITION H10000 OR ABOVE.
9. CLEANING: CLEAN, PROTECT & INSPECT PER KSC-C-123.
 A. PROCEDURE AS APPLICABLE
 B. CLEANLINESS LEVEL 300 A
 C. TEST METHOD A
 D. CERTIFICATION REQUIRED
10. TESTING: THE MANUFACTURER SHALL PROOF TEST HOSE ASSEMBLIES PER ITEM 3 & LEAK CHECK PER ITEM 6. CERTIFICATION REQUIRED.
11. MARKING: THE VENDOR'S NAME OR TRADEMARK, VENDOR'S PART NO., KSC PART NO., PROOF TEST DATE & OPERATING PRESSURE SHALL BE MARKED BY THE MANUFACTURER PERMANENTLY & LEGIBLY UPON THE ASSEMBLY.
- NOTES:
 A. SEE DWG 79K90260 FOR MAINTENANCE REQUIREMENTS.
 B. FOR DESIGN THIS DWG SUPERSEDES 75M12292, 75M13772, 75M18809, 75M51683.
 C. FOR HOSE ASSY'S 79K80260-3 & -15, LEAKAGE TEST PRESSURE SHALL BE 3000 PSIG FOR ONE MINUTE.

UNLESS OTHERWISE SPECIFIED ORIGINAL DATE			20 OCT 76		
DIMENSIONS ARE IN INCHES			OF DWG		
SEE ENGINEERING RECORDS	DESIGNER	REVELL	CHECKER	ROSA	DATE
	DRAWN	ROSA	APPROVED	F. E. LUNDY	
	MATERIAL	KSC GSE			
	HEAT TREATMENT	W. J. MIMS			
	FINAL PROTECTIVE FINISH	10-20-76			
	APPLICATION	NEXT ASSY USED ON			
		KSC GSE			
		MT CHECKER DATE CODE			
		SCALE UNIT SEE SH			
		79K80260			
		B SHEET 1 OF 6			

DOCUMENT RELEASE AUTHORIZATION			KENNEDY SPACE CENTER, FLORIDA
REV LETTER	DATE	APPROVAL	ORIG. NO.
			E-00K501-1025
			SYSTEM *KSC GSE
			W/C N/A
			PCR 78956
			EFFECTIVITY SIS
			MODE. SOB N/A

PAGE 1 OF 1

CONSTRUCTION SHEET

REV	DESCRIPTION	DATE	APPROVAL
A	NEW ITEM 15, 16	4-77	[Signature]
B	NEW ITEM 14	6-24-77	[Signature]
C	NO CHG	12-4-77	[Signature]
D	NO CHG	10-2-78	[Signature]
E	NO CHG	5/1/81	[Signature]

12. PACKAGING: PER MANUFACTURER'S STANDARD COMMERCIAL PRACTICE PROVIDED THAT PACKING SHALL BE SUFFICIENT TO PROTECT FREE ASSEMBLY AGAINST DAMAGE DURING SHIPMENT. EXCEPTOR SHIPPING CONTAINER SHALL CONFORM TO FREIGHT CLASSIFICATION RULES & APPLICABLE CONTAINER SPECIFICATIONS.

13. APPROVAL: ANY CHANGE TO THE COMPONENTS DESCRIBED BY THIS DWG REQUIRES PRIOR KSC DESIGN ENGINEERING APPROVAL.

14. VENDOR DATA: WHEN SPECIFIED ON THE PURCHASE ORDER, THE VENDOR SHALL PROVIDE THREE (3) SETS OF NON-RESTRICTIVE ASSEMBLY DWGS, PARTS LISTS, TECHNICAL DATA, INSTRUCTIONS, ETC., SUITABLE FOR INSPECTION, TEST & MAINTENANCE.

15. INSTALLATION RESTRAINTS: HOSE INSTALLATION DESIGNS SHALL INCLUDE HOSE RESTRAINTS PER RSC-STD-2-0086.

16. DIMENSIONS: SEE SW 3, 4 & 5

17. MOUNTING ATTITUDE: ANY POSITION

18. SUGGESTED SOURCE: RESISTORLEX CORP
ROSELAND, NEW JERSEY 07068
ESON 50569

OR KSC DESIGN ENGINEERING APPROVED EQUAL. SEE DWG 79K80264 FOR ALTERNATE SOURCE.

COMPONENT SPECIFICATION

CODE IDENT NO.	22264
DWG SIZE	B
79K80260	
SHEET 2	

DOCUMENT RELEASE AUTHORIZATION		KENNEDY SPACE CENTER, NASA		PAGE 1 OF 2	
REV LETTER	DATE	APPROVAL	ORA NO.	E-00K501-1025	
			SYSTEM	*KSC GSE	
			P/C	N/A	
			PCN	78956	
			EFFECTIVITY	STS	
			ORIG. NO.	N/A	

COMBINATION SHEET

REV	DESCRIPTION	DATE	APPROVAL
A	ADD	1-4-77	[Signature]
B	REV PLAN NOTES & LENGTHS	5-27-77	2814
C	REV CHS	12-14-78	281
D	REV CHS	10-13-77	281
E	REV CHS	5/1/80	281

NOTE: THE LAST FOUR DIGITS OF BOTH KSC & VENDOR PART NO. ARE TO BE ADDED WHEN HOSE ASSY LENGTH IS DETERMINED. SEE SH 3.

B. VENDOR SMALL HOSE ASSY'S UP TO THE LENGTH LISTED WITHOUT SPLICES.

C. HOSE ASSY'S 79K80260-1 THRU -16 NOT FOR USE IN OXYGEN SERVICE. HOSE ASSY'S -17 THRU -32 ARE FOR OXYGEN SERVICE ONLY.

D. THESE HOSE ASSY'S ARE NOT FOR HYDROGEN SERVICE.

BASIC KSC PART NO.	BASIC VENDOR PART NO.	NOMINAL (TUBE) SIZE	HOSE I.D. (REF)	MIN BEND RADIUS (INCHES)	OPERATING PRESSURE PSI MAX	HOSE WT LBS/FT (REF)	FITTING WT. LBS/EA (REF)	HOSE O.D. (REF)	MAX UNSPALCED LENGTH FT
79K80260-1	RS0200CC-4	1/4	1/8	2	1500	.077	.042	5/16	50
79K80260-2	0004E50-4	1/4	15/64	3	3000	.173	.075	29/64	50
79K80260-3	RS2000CC-4	1/4	7/32	3	6000	.235	.122	15/32	20
79K80260-4	RS0200CC-6	3/8	5/16	4	1500	.118	.072	29/64	50
79K80260-5	0004E50-6	3/8	5/16	5	3000	.220	.101	35/64	50
79K80260-6	RS2000CC-6	3/8	5/16	5	6000	.310	.168	37/64	20
79K80260-7	RS0800CC-8	1/2	13/32	4-5/8	1500	.185	.129	9/16	50
79K80260-8	0004E50-8	1/2	7/16	5-3/4	3000	.370	.167	47/64	50
79K80260-9	RS2000CC-8	1/2	7/16	5-3/4	6000	.630	.338	51/64	20
79K80260-10	RS0200CC-12	3/4	5/8	6-1/2	1000	.242	.282	51/64	50
79K80260-11	0004E50-12	3/4	11/16	7-3/4	3000	.825	.421	1-1/16	90
79K80260-12	RS0200CC-16Z	1	7/8	7-3/8	1250	.533	.414	1-7/64	15
79K80260-13	0004E50-16	1	7/8	9-5/8	3000	1.020	.585	1-17/64	15
79K80260-14	RS0200CC-20Z	1-1/4	1-1/8	11	1000	.634	.872	1-23/64	15
79K80260-15	RS0200CC-24Z	1-1/2	1-3/8	14	1000	.980	1.129	1-43/64	15
79K80260-16	RS0200CC-32Z	2	1-25/32	22	750	1.196	1.978	2-3/32	15

COMPONENT SPECIFICATION

CODE IDENT NO: 22264 B
 DWG SIZE: 79K80260
 SHEET 3

DOCUMENT RELEASE AUTHORIZATION
 KENNEDY SPACE CENTER, NASA

REV LETTER: [] DATE: [] APPROVAL: []

ORA NO: E-00K501-1625

SYSTEM: KSC GSE
 W/C: N/A
 P/CN: 78956
 EFFECTIVITY: S/S
 MOD: N/A

Page 1 of 1

REVISION		
SYM	DESCRIPTION	DATE
A	THIS IS A REVISION	1-4-71
B	REV LENGTHS	6-29-71
C	REV MEMBER PART NOS & DESCRIPTIVE DATA	12-14-71
D	NO CHG	10-11-71
E	FLUID TEMP REV.	5/1/86

NOTE:
 A. THE LAST FOUR DIGITS OF BOTH SSC & MEMBER PART NO. ARE TO BE ADDED WHEN HOSE ASSY LENGTH IS DETERMINED. SEE SN 5.
 B. MEMBER SHALL HAVE HOSE ASSY'S UP TO THE LENGTH LISTED WITHOUT SPLICES.
 C. HOSE ASSY'S 79K80260-17 THRU -32 ARE OTHER COMPATIBLE UP TO THE OPERATING PRESSURES SHOWN. BATCH TEST REQUIRED.

BASIC SSC PART NO.	BASIC MEMBER PART NO.	NOMINAL (TUBE) SIZE	HOSE I.D. (REF)	REIN BEND RADIUS (INCHES)	MAX FLUID & AMBIENT TEMP OF	MEMBER'S PRESSURE (PSI MAX)	HOSE WT (LBS/FT) (REF)	FITTING WT. (LBS EA) (REF)	HOSE O.D. (REF)	MAX UNSPLICED LENGTH (FT)
79K80260-17	R380005CC-4	1/4	3/16	2	160	1500	.077	.043	5/16	50
79K80260-18	000AP50-4	1/4	15/64	3	160	3000	.173	.075	29/64	50
79K80260-19	R658000C-4	1/4	7/32	3	150	6000	.236	.124	31/64	20
79K80260-20	R380005CC-6	3/8	5/16	4	160	1500	.118	.074	29/64	50
79K80260-21	000AP50-6	3/8	5/16	5	160	3000	.220	.100	35/64	50
79K80260-22	R658000C-6	3/8	5/16	5	160	6000	.319	.172	19/32	20
79K80260-23	R380005CC-8	1/2	13/32	4-5/8	160	1500	.144	.126	9/16	50
79K80260-24	000AP50-8	1/2	7/16	5-3/4	160	3000	.379	.167	47/64	50
79K80260-25	R658000C-8	1/2	7/16	5-3/4	160	6000	.638	.338	13/16	20
79K80260-26	R380005CC-12	3/4	5/8	6-1/2	160	1000	.242	.280	51/64	50
79K80260-27	000AP50-12	3/4	11/16	7-3/4	160	3000	.825	.421	1-1/16	50
79K80260-28	R380005CC-16Z	1	7/8	7-3/8	160	1250	.487	.413	1-1/8	15
79K80260-29	000AP50-16	1	7/8	9-5/8	160	3000	1.020	.555	1-17/64	15
79K80260-30	R380005CC-20Z	1-1/4	1-1/8		160	1000	.583	.858	1-3/8	15
79K80260-31	R380005CC-24Z	1-1/2	1-3/8	14	160	1000	.875	1.125	1-45/64	15
79K80260-32	R380005CC-32Z	2	1-25/32	22	160	750	1.196	1.978	2-3/32	15

79K80260
 SPECIFICATION
 22264 B
 SHEET 4

DOCUMENT RELEASE AUTHORIZATION
 KENNEDY SPACE CENTER, NASA

REV LETTER: _____ DATE: _____ APPROVAL: _____

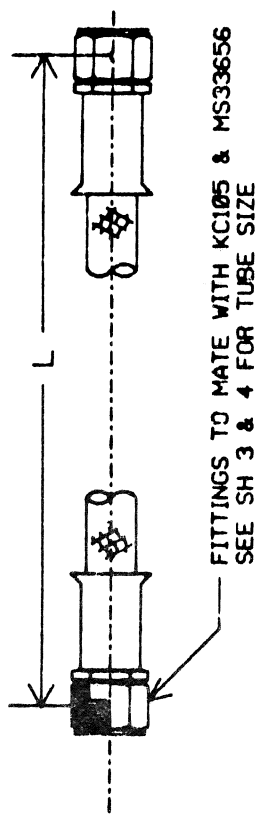
DRAWING NO: _____

SYSTEM: E-00K501-1025
 KSC GSE

PCN: 78956
 EFFECTIVITY: S1S
 MODEL NO: R/A

PAGE 1 OF 1

SYMBOL	REVISION	DATE	APPROVAL
E	SH REVISED & REDW	5/1/86	[Signature]



HOSE ASSEMBLY
SCALE: NONE

NOTES:

- A. LENGTH L SHALL BE SPECIFIED BY FOUR DIGITS WHICH BECOME A PART OF THE ASSY PART NO. THE FIRST THREE DIGITS ARE TO INDICATE INCHES, THE LAST DIGIT TO INDICATE FRACTIONS IN EIGHTHS. FOR EXAMPLE: 79K80260-9-0846 IS A HOSE ASSY 84-3/4 INCHES LONG. FRACTION OF AN INCH IN EIGHTHS LENGTH IN INCHES
- B. LENGTH L TOLERANCES:
 UNDER 18 INCHES LONG $\pm 1/8$ INCH
 FROM 18 TO 36 INCHES $\pm 1/4$ INCH
 FROM 36 TO 50 INCHES $\pm 1/2$ INCH
 OVER 50 INCHES $\pm 1/2$
- C. THIS VIEW FOR ALL DASH NUMBERS EXCEPT -3, -6, -9, -19, -22, -25 (SEE SHEET 6)

COMPONENT SPECIFICATION	79K80260
LODGE IDENT. NO.	22284
	B
	SHEET 5 OF 6

DOCUMENT RELEASE AUTHORIZATION KENNEDY SPACE CENTER, NASA		PAGE 1 OF 2
REV LETTER	DATE	APPROVAL
DRG NO.	E-00K501-1025	
SYSTEM	KSC GSE	
DOC	N/A	
PCN	78956	
EFFECTIVITY	SIS	
ISSUE NO.	N/A	

SAFETY SHIELD INSTALLATION

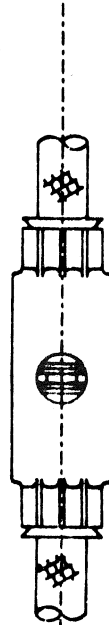
NTS

SYMBOL	DESCRIPTION	DATE	APPROVAL
E	ADDED SHEET	5/1/86	[Signature]

SAFETY SHIELD — FINGER DEPRESSION FITTING SKIRT



TYPICAL HOSE CONNECTION
END ASSEMBLY



TYPICAL HOSE SPLICE
ASSEMBLY

HOSE PART NUMBER	SAFETY SHIELD DIMENSIONS TUBING SIZE	SAFETY SHIELD DIMENSIONS LENGTH		USE CRIMPING FINGERS	CRIMP DIMENSIONS (APPROXIMATE)
		END FITTING	SPLICE		
79K88268-3-XXXX AND 79K88268-19-XXXX	7/8" O.D. X 0.049"	1-1/8"	2-5/8"	HP-6	0.703"
79K88268-6-XXXX AND 79K88268-22-XXXX	X 0.049"	1 1/4"	2-3/4"	HP-6	0.800"
79K88268-9-XXXX AND 79K88268-25-XXXX	X 0.049"	1-1/2"	3-1/4"	HP-12	1.000"

• TUBING IS 3000 SERIES STAINLESS STEEL SEAMLESS
 • CRIMP DIMENSIONS ARE TAKEN ACROSS FINGER DEPRESSIONS (LOW POINT).
 • CRIMP DIMENSIONS ARE NO CRITICAL BUT MUST BE SUFFICIENT FOR
 FITTING SKIRT TO RETAIN SHIELD WITHOUT BINDING.
 (SHIELD MUST ROTATE FREELY.)

COMPONENT SPECIFICATION
 CODE NO. 79K80260
 IDENT. NO. B SHEET 6 OF 6

DOCUMENT RELEASE AUTHORIZATION		KENNEDY SPACE CENTER, NASA	
REV. LETTER	DATE	APPROVAL	DRAWING NO.
			E-00K801-1025
			ISSUE USE
			N/A
			PCB 78956
			EFFECTIVITY STS
			MODE. CODE N/A

PAGE 1 OF 1

REV. NO.		REV. DATE		REV. BY		REV. REASON	
A	REV SH 3 & 4	74-05	5	LMADY			
B	REV & REOR ALL SHITS	5-11-74	1				

- SERVICE: AIR, NITROGEN, HELIUM, HYD FLUIDS PER MIL-H-83282 OR MIL-H-5526; HYDROGEN, OXYGEN, WATER & ALL FLUIDS COMPATIBLE WITH 308 SERIES SST & TEFLON. SEE SH 3 & 4 FOR SERVICE LIMITATIONS.
- OPERATING PRESSURE: SEE SH 3 & 4
- HYDROSTATIC TEST PRESSURE: 1-1/2 TIMES RATED OPERATING PRESSURE.
- BURST PRESSURE: 4 TIMES RATED OPERATING PRESSURE (MIN).
- END CONNECTIONS: SEE SH 3
- LEAKAGE: BUBBLE TIGHT WHEN CHECKED WITH NITROGEN AT ROOM TEMP & AT RATED OPERATING PRESSURE FOR ONE MINUTE.
- OPERATING TEMPERATURE: SEE SH 3 & 4
- MATERIALS: INNER HOSE - CARBON LINED SEAMLESS POLYTETRAFLUOROETHYLENE FOR HOSE ASSY'S 79K80264-1 THRU -4, -6, -7, -9, THRU -1A, SEAMLESS WHITE VIRGIN POLYTETRAFLUOROETHYLENE WITH NO CARBON ADDITIVES FOR HOSE ASSY'S 79K80264-5, -8, -15 THRU -20. OXYGEN HOSES SHALL BE BATCH TESTED PER NAB 8060.1 AND 79K1996. METALLIC PARTS SHALL BE 308 SERIES SST.
- CLEANING: CLEAN, PROTECT, & INSPECT PER KSC-C-123.
 - PROCEDURE, AS APPLICABLE
 - CLEANLINESS: LEVEL 300A
 - TEST METHOD A
 - CERTIFICATION REQUIRED
- TESTING: THE MANUFACTURER SHALL HYDROSTATICALLY TEST HOSE ASSEMBLIES PER ITEM 3 & LEAK CHECK PER ITEM 6. CERTIFICATION REQUIRED.

MARKING: THE VENDOR'S NAME OR TRADEMARK, VENDOR'S PART NO., KSC PART NO., HYDROSTATIC TEST DATE & RATED OPERATING PRESSURE SHALL BE MARKED BY THE MANUFACTURER PERMANENTLY & LEGIBLY UPON THE ASSEMBLY.

NOTE 1
A. SEE DWG 79K80264 FOR MAINTENANCE REQUIREMENTS.

UNLESS OTHERWISE SPECIFIED		ORIGINAL DATE OF DRAWING		77-7-22	
SEE ENGINEERING RECORDS	DESIGNED BY	DATE	BY	DATE	BY
	W. I. MOORE				
NEXT ASSY USED ON APPLICATION	DESIGNED BY	DATE	BY	DATE	BY
	W. I. MOORE				
COMPONENT SPECIFICATION					
HOSE ASSEMBLY					
JOHN F. KENNEDY SPACE CENTER, NASA					
79K80264					

REV. NO.	DATE	DESCRIPTION
B	REVISED & REDRAWN	

79K80264
Part 2

12. PACKAGING: PER MANUFACTURER'S STANDARD COMMERCIAL PRACTICE PROVIDED THAT PACKING SHALL BE SUFFICIENT TO PROTECT HOSE ASSEMBLY AGAINST DAMAGE DURING SHIPMENT. EXTERIOR SHIPPING CONTAINER SHALL CONFORM TO FREIGHT CLASSIFICATION RULES & APPLICABLE CONTAINER SPECIFICATIONS.
13. APPROVAL: ANY CHANGE TO THE COMPONENTS DESCRIBED BY THIS DWG. REQUIRES PRIOR KSC DESIGN ENGINEERING APPROVAL.
14. VENDOR DATA: WHEN SPECIFIED ON THE PURCHASE ORDER, THE VENDOR SHALL PROVIDE THREE (3) SETS OF NON-RESTRICTIVE ASSEMBLY DWGS, PARTS LISTS, TECHNICAL DATA, INSTRUCTIONS, ETC. SUITABLE FOR INSPECTION, TEST & MAINTENANCE.
15. INSTALLATION REQUIREMENTS: HOSE INSTALLATION DESIGNS SHALL REQUIRE HOSE RESTRAINTS PER KSC-STD-2-0005.
16. DIMENSIONS: SEE SH 3 & 4
17. MOUNTING ATTITUDE: ANY POSITION
18. SUGGESTED SOURCE: AERODUJIP CORPORATION/AERODUJIP AEROSPACE DIVISION
300 SOUTH EAST AVENUE
JACKSON, MICHIGAN 49203
FSCM 00624
OR KSC DESIGN ENGINEERING APPROVED EQUAL. SEE DWG 79K80260 AND 79K80463 FOR ALTERNATE SOURCE.

NOTE:

A THE LAST FOUR DIGITS OF BOTH KSC & VENDOR PART NO. ARE TO BE ADDED WHEN HOSE ASSY LENGTH IS DETERMINED. SEE SH 5.

B THESE PART NOS. ARE NOT FOR OXYGEN SERVICE.

C THESE PART NOS. ARE NOT FOR HYDRAULIC SERVICE.

D VENDOR SHALL MAKE HOSE ASSY'S UP TO 50 FEET LONG WITHOUT SPLICES.

E LISTED TEMP RANGES ARE FOR PNEUMATIC SERVICE. UPPER LIMIT MAY BE INCREASED TO 450 DEG F FOR HOSE ASSY'S 79K80264-1, -3, -6, -9, & -11 WHEN THESE HOSES ARE USED IN HYDRAULIC SERVICE.

REVISED AND REDRAWN	
DATE	BY
	B

REVISIONS	
NO.	DESCRIPTION
1	

BASIC KSC NUMBER	BASIC VENDOR PART NO.	NOMINAL (TUBE) SIZE	HOSE I.D.(REF)	MIN BEND RADIUS (INCHES)	OPERATING PRESSURE (PSI MAX)	HOSE WT (LBS/FT) (REF)	FITTING WT (LBS) EA (REF)	HOSE O.D.(REF)	OPERATING TEMPERATURE RANGE (DEG F)
79K80264-1	AE3660000E	1/4	.188	2	1500	.882	.658	.312	-65 TO 160
79K80264-2	AE2460000E	1/4	.212	1-1/2	3000	.113	.857	.410	-67 TO 400
79K80264-3	AE3662000G	3/8	.313	4	1500	.117	.808	.456	-65 TO 160
79K80264-4	AE2460000G	3/8	.298	2-1/2	3000	.160	.877	.510	-67 TO 400
79K80264-5	735000-6	3/8	.298	5	6000	.311	.175	.582	-65 TO 160
79K80264-6	AE3660000H	1/2	.406	4-5/8	1500	.145	.136	.562	-65 TO 160
79K80264-7	AE2460000H	1/2	.391	2-7/8	3000	.235	.143	.648	-67 TO 400
79K80264-8	735000-3	1/2	.422	8	6000	.598	.369	.815	-65 TO 160
79K80264-9	AE100-920K	3/4	.625	6-1/2	1000	.246	.200	.789	-65 TO 160
79K80264-10	AE2460000K	3/4	.602	7-3/4	3000	.463	.342	.920	-67 TO 400
79K80264-11	AE1004167M	1	.875	7-3/8	1250	.517	.423	1.179	-65 TO 160
79K80264-12	AE1006069M	1	.852	9-5/8	3000	1.030	1.848	1.398	-67 TO 400
79K80264-13	AE1004167N	1-1/4	1.125	11	1000	.501	.626	1.359	-65 TO 160
79K80264-14	AE1004167P	1-1/2	1.375	14	1000	.848	1.105	1.672	-65 TO 160

79K80264
Sheet 3

REV. NO.	REV. DATE	REVISIONS
8	12/11/74	REVISED AND REDRAWN

NOTE:

A. THE LAST FOUR DIGITS OF BOTH KSC & VENDOR PART NO. ARE TO BE ADDED WHEN HOSE ASSY LENGTH IS DETERMINED. SEE SH 5.

B.

HOSE ASSY'S 79K80264-15 THRU -20 ARE OXYGEN COMPATIBLE. BATCH TEST REQUIRED.

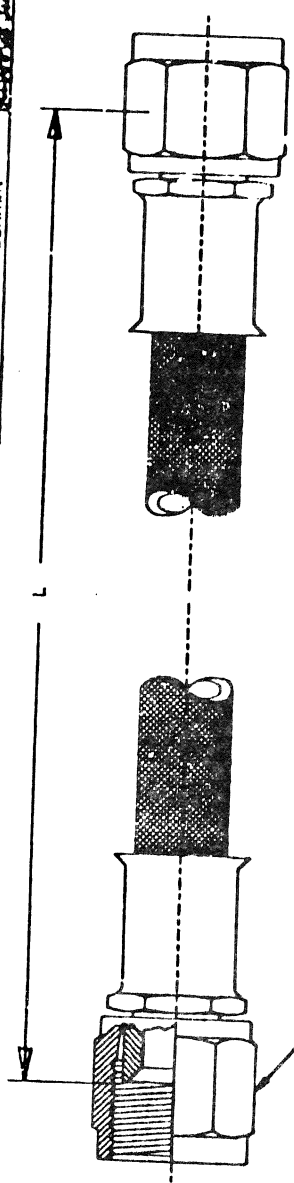
C.

VENDOR SHALL MAKE HOSE ASSY'S UP TO 50 FEET LONG WITHOUT SPLICES.

BASIC KSC PART NO.	BASIC VENDOR PART NO.	NOMINAL (TUBE) SIZE	HOSE I.D.(REF)	MIN BEND RADIUS (INCHES)	OPERATING PRESSURE PST MAX	HOSE WT LBS/FT (REF)	FITTING WT LBS EA (REF)	HOSE O.D.(REF)	OPERATING TEMPERATURE RANGE DEG F
79K80264-15	AE1010010E	1/4	.173	2	1500	.302	.358	.328	-65 TO 168
79K80264-16									
79K80264-17	AE1010010C	3/8	.298	4	1500	.117	.300	.468	-65 TO 168
79K80264-18	AE10099060	3/8	.309	5	6000	.31	.175	.580	-65 TO 168
79K80264-19	AE1010010H	1/2	.378	4-5/8	1500	.145	.135	.562	-65 TO 168
79K80264-20	AE1009910H	1/2	.422	8	6000	.598	.368	.415	-65 TO 168

REV. NO.	REV. DATE	79K80264
8	12/11/74	

REVISIONS			
REV	DATE	BY	APP
8		REVISED AND REDRAWN	



FITTINGS TO MATE WITH KC105 & MS33056
SEE SH 3 FOR TUBE SIZE

HOSE ASSEMBLY
SCALE: NONE

NOTES:

A. LENGTH L SHALL BE SPECIFIED BY FOUR DIGITS WHICH BECOME A PART OF THE ASSY PART NO. THE FIRST THREE DIGITS ARE TO INDICATE INCHES, THE LAST DIGIT TO INDICATE FRACTIONS IN EIGHTHS. FOR EXAMPLE:

79K80264-9-0846 IS A HOSE ASSY 8 1/4 INCHES LONG.
FRACTION OF AN INCH IN EIGHTHS
LENGTH IN INCHES

B. LENGTH L TOLERANCES:
UNDER 18 INCHES LONG $\pm 1/16$ INCH
FROM 18 TO 36 INCHES $\pm 1/8$ INCH
FROM 36 TO 50 INCHES $\pm 1/4$ INCH
OVER 50 INCHES $\pm 1/2$ INCH

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Part 5 of 5

