SAE Aerospace
An SAE International Group

AEROSPACE STANDARD

SAE AS1969

Issued 1990-03
Reaffirmed 2013-01

Coupling Assembly, Self-Sealing, Quick Disconnect Fuel and Oil System Components

RATIONALE

AS1969 has been reaffirmed to comply with the SAE five-year review policy.

1. SCOPE:

This specification covers the requirements for self-sealing, quick-disconnect couplings for fuel and oil system components.

1.1 Classification:

Couplings shall be of the following types and classes:

TABLE 1 - Type I Fuel Line Coupling

	HIGH TEMPERATURE			LOW TEMPERATURE
CLASS	T (Operating)	T_t (Test)	T_a (Ambient)	FUEL AND AIR (Operating, Test, and Ambient)
A	140°F ± 5	167°F ± 9	167°F ± 9	-65.0°F ± 7
B	203°F ± 9	239°F ± 9	347°F ± 9	-65.0°F ± 7
C	302°F ± 9	356°F ± 13	599°F ± 18	-65.0°F ± 7

Test Fluid per MIL-T-5624, unless otherwise specified.
T = High operational fuel temperature
T_t = High fuel test temperature
T_a = High ambient temperature

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

TABLE 2 - Type II Oil Line Coupling

	HIGH TEMPERATURE			LOW TEMPERATURE
CLASS	T (Operating)	T_t (Test)	T_a (Ambient)	OIL AND AIR (Operating, Test, and Ambient)
A Petroleum Oil (MIL-L-6082)	250°F ± 5	250°F ± 5	160°F ± 5	-65°F ± 2
B Synthetic Oil (MIL-L-7808)	350°F ± 5	350°F ± 5	350°F ± 5	-65°F ± 2
C Synthetic Oil (MIL-L-23699)	400°F ± 5	400°F ± 5	400°F ± 5	-40°F ± 2

T = High operational oil temperature
T_t = High oil test temperature
T_a = High ambient temperature

1.2 Nonstandard Environment:

Wherever the temperature environment exceeds the classes of Table 1 or Table 2, or where unusual circumstances exist, the lowest and highest fluid, vapor, and ambient temperatures shall be identified. A component may still belong to one of the above classes if the exposure to a higher ambient temperature (T_a) is transitory and does not result in heating the component more than 86 °F above the test temperature (T_t) for more than 15 min total during 10 h of operation.

1.3 Sizes:

Types I and II couplings shall mate with hose and tubing of the following nominal sizes: 1/8, 1/4, 3/8, 1/2, 5/8, 3/4, 1, 1-1/4, 1-1/2, and 2 inch.

2. APPLICABLE DOCUMENTS:

2.1 Issues of Documents:

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

2.1.1 Federal:

QQ-P-35	Passivation Treatments for Corrosion-Resisting Steel
QQ-C-320	Chromium Plating (Electrodeposited)
P-D-680	Dry Cleaning Solvent
TT-S-735	Standard Test Fluid Hydrocarbon

2.1.2 Military Specifications:

MIL-P-5315	Packing, Preformed, Hydrocarbon Fuel Resistant
MIL-T-5624	Turbine Fuel, Aviation, Grade JP-4 and JP-5
MIL-L-6082	Lubricating Oil, Aircraft Reciprocating Engine (Piston)
MIL-C-7024	Calibrating Fluid, Aircraft Fuel System Components
MIL-R-7362	Rubber, Synthetic, Solid, Sheet, Strip, and Fabricated Parts, Synthetic Oil Resistant
MIL-L-7808	Lubricating Oil, Gas Turbine, Aircraft Engine, Synthetic Base
MIL-F-8615	General Specification for Fuel System Components
MIL-A-8625	Anodic Coatings, for Aluminum and Aluminum Alloys
MIL-H-8795	Hose Assemblies, Rubber, Hydraulic, Fuel and Oil Resistant
MIL-L-23699	Lubricating Oil, Aircraft Turbine Engines, Synthetic Base
MIL-H-25579	Hose Assembly, Tetrafluoroethylene, High Temperature, Medium Pressure
MIL-R-25988	Rubber, Fluorosilicone Elastomer, Oil and Fuel Resistant
MIL-R-83248	Rubber, Fluorocarbon Elastomer, High Temperature, Fluid, and Compression Set Resistant

2.1.3 Military Standards:

MIL-STD-129	Marking For Shipment and Storage
MIL-STD-130	Identification Marking of U.S. Military Property
MIL-STD-810	Environmental Test Methods
MS8000	Hose Assembly, Detachable Fittings, Tetrafluoroethylene, High Temperature, Medium Pressure, Flare to Flare
MS8001	Hose Assembly, Detachable Fittings, Tetrafluoroethylene, High Temperature, Medium Pressure, Flareless to Flareless
MS8005	Hose Assembly, Permanently Attached Fittings, Tetrafluoroethylene, High Temperature, Medium Pressure, Flare to Flare
MS8006	Hose Assembly, Permanently Attached Fittings, Tetrafluoroethylene, High Temperature, Medium Pressure, Flareless to Flareless
MS28741	Hose Assembly, Detachable End Fitting, Medium Pressure

2.1.4 Society of Automotive Engineers (SAE):

AIR1047	A Guide for the Selection of Quick-Disconnect Couplings for Aerospace Fluid Systems
ARP24B	Determination of Hydraulic Pressure Drop
ARP868A	Method-Pressure Drop Tests for Fuel System Components

3. REQUIREMENTS:

3.1 Qualification:

The couplings furnished under this specification shall be a product which has been tested, has passed the qualification tests specified herein, and has been approved by the procuring agency or prime contractor.

3.2 General Specification:

The requirements of MIL-F-8615 apply as requirements of this specification for fuel couplings with the exceptions and additions as specified herein. When the two specifications conflict, this specification shall govern. Additional requirements may be added in the detail specification.

3.3 Materials:

Materials used shall be of high quality and suitable for the environment expected for aircraft. The couplings shall be constructed of materials that will not change the composition of or be adversely affected by the applicable fluids specified in MIL-F-8615 and this specification. Other materials and fluids can be utilized for similar applications based on procuring agency requirements.

3.3.1 Magnesium, Copper, and Cadmium: Magnesium, copper, and cadmium plating shall not be used for parts that are normally in contact with fuel and synthetic oil.

3.3.2 Protective Treatment: When materials are used in the construction of the couplings that are subject to deterioration when exposed to climatic or environmental conditions likely to occur during storage or service usage, they shall be protected against such deterioration in a manner that will in no way prevent compliance with the performance requirements of this specification. The use of any protective coating that will chip, crack, abrade, peel, or scale during service life or extreme environmental conditions shall be unacceptable.

3.4 Design and Construction:

The configuration, dimensions, and other details of design of the couplings shall conform to applicable specification control drawings. The design objective shall be to obtain the smallest size and lightest weight commensurate with meeting performance requirements herein. When coupled, the coupling shall be such that it will permit fluid flow in either direction in accordance with the rated flow and pressure drop as specified in Table 3 and at the rated pressures specified in Table 4. Flow shall not be blocked under surge conditions.

3.4.1 Temperature Range: The couplings shall be designed to operate throughout the applicable temperature range for type and class of coupling.

3.4.2 Sealing and Fluid Loss: The couplings shall, when uncoupled, seal the ends of the disconnected lines at the point of disconnection and shall not permit external leakage during any phase of coupling or uncoupling. Fluid loss (spillage) as specified in Table 3 is not considered to be external leakage. Both halves of the coupling shall seal fluid under both low and high pressures.

3.4.3 Seals: Seals shall be in accordance with MIL-P-5315, MIL-R-7362, MIL-R-25988, MIL-R-83248 or other material compatible with the fluid used.

TABLE 3 - Rated Flow, Pressure Drop, and Fluid Loss

DASH NO.	EQUIVALENT TUBE SIZE IN INCHES	RATED FLOW GPM	SURGE FLOW GPM	PRESSURE DROP WITH WATER PSI (MAX)	AVERAGE FLUID LOSS (SPILLAGE) PER OPERATING CYCLE (in^3) (MAX)
-02	1/8	0.4	2.0	4.0	0.122
-04	1/4	1.2	6.0	4.5	0.153
-06	3/8	3.5	17.5	5.0	0.183
-08	1/2	6.0	30.0	5.5	0.244
-10	5/8	10.5	52.5	6.0	0.549
-12	3/4	16.0	80.0	7.0	0.915
-16	1	29.0	87.0	8.0	2.136
-20	1 1/4	45.0	90.0	10.0	2.746
-24	1 1/2	70.0	140.0	15.0	3.661
-32	2	125.0	250.0	15.0	5.492

TABLE 4 - Pressure Rating

			PRESSURE - PSI		
TYPE	CLASS	FLUID	OPERATING	PROOF	BURST
I	A, B, C	Fuel	60	120	240
II	A, B, C	Oil	120	240	360

3.4.4 Operation: The couplings shall be so designed that they can be coupled and uncoupled with a one-handed simple motion and without special tools, while one-half is held in a fixed mounting. It shall be possible to couple and uncouple throughout the applicable temperature range with a static pressure, as shown below, applied to both halves.

a. 60 psi for couplings applicable to 1/8 through 1-in (-02 through -16 size) outside diameter tubing

b. 10 psi for couplings applicable to 1-1/4- through 2-in (-20 through -32 size) outside diameter tubing except these shall be capable of disconnection at 60 psi

The couplings shall have a visual and touch feature to indicate the completely coupled condition; the touch feature shall be clear and unmistakable.

3.5 Interchangeability:

All coupling halves having the same manufacturer's part number shall be functionally interchangeable.

3.6 Performance:

The self-sealing couplings furnished under this specification shall perform satisfactorily when tested to the following performance requirements.

3.6.1 Envelope, Weight, Materials: Each coupling half shall conform to the applicable purchaser and supplier envelope dimensions, weight control, materials, and finishes.

3.6.2 Functional Test: Each coupling half shall meet operational and leakage requirements after being manually connected and disconnected with a mating half or functional adapter.

3.6.3 Proof Pressure: Each coupling half shall meet operational and leakage requirements after being subjected to the rated proof pressure specified in Table 4, or 150% of operating pressure specified on the control drawing as applicable, for a period of 2 min.

3.6.4 Low Pressure: Each coupling half shall meet specified leakage requirements at 1 to 5 psig static fluid pressure for a period of 2 min.

3.6.5 Vacuum: Each coupling half shall meet inward leakage requirements with no evidence of malfunction or degradation, with equivalent of 12.2 in of Hg applied in the connected position, and equivalent of 6.1 in Hg applied in the disconnected position for 5 min.

3.6.6 Operation: Each coupling half shall be capable of withstanding 200 connect and disconnect cycles without any indication of malfunction or serious degradation, with 15 psig pressure applied to both halves for the -02 thru -16 sizes and 10 psig pressure applied to both halves of the -20 thru -32 sizes.

3.6.7 Spillage: Coupling halves shall be capable of being disconnected with 60 psig pressure applied to both halves with spillage not exceeding the amount specified in Table 3.

NOTE: Both coupling halves shall be installed in systems capable of accommodating some fluid displacement without pressure rise.

3.6.8 Temperature Shock: Each connected coupling shall meet operational and leakage requirements after being subjected to the temperature shock test specified in method 503 of MIL-STD-810.

3.6.9 Pressure Drop: Each coupling shall indicate a pressure drop within the limits specified in Table 3 when using water at room temperature as the test fluid. The tests shall be conducted as recommended in ARP868. (ARP24 shall be optional.)

3.6.10 Surge Flow: Each coupling half shall meet the operational and leakage requirements after being subjected to the surge flow specified in Table 3 in both directions.

3.6.11 Accelerated Corrosion: Each coupling half shall meet the operational requirements and shall show no corrosion that would affect operation after being immersed in a saturated salt solution, exposed to 100% humidity for 20 min, and heated for 20 min.

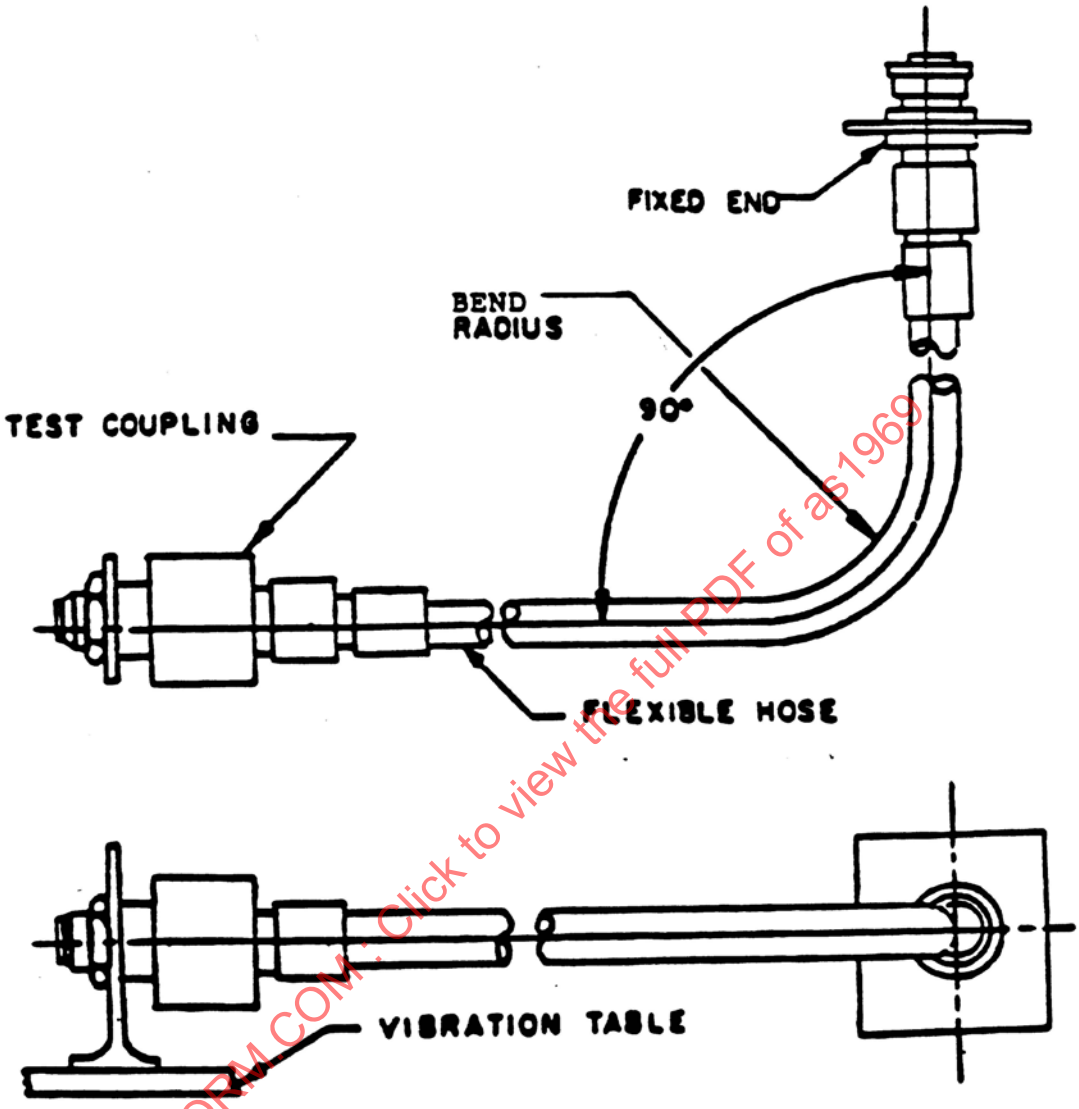
3.6.12 Salt Fog: Each coupling half shall meet the operational requirements and shall show no corrosion after being subjected to a salt fog test in accordance with method 509 of MIL-STD-810.

3.6.13 Dust: Each coupling shall be capable of manual disconnection after being subjected to a sand and dust test in accordance with method 510 of MIL-STD-810.

3.6.14 Vibration: Unless otherwise specified, the connected coupling shall meet the vibration test requirements specified in 4.6.14 without malfunction or degradation. The coupling shall be vibrated in each of two mutually perpendicular axes while pressurized to 10 psig. The test setup shall be as shown in Fig. 1 and the vibration test curve shall be as shown in Fig. 2.

The burst pressure specified in Table 4, or 250% of operating pressure specified on the control drawing as applicable, shall be applied to the connected couplings after completion of the vibration test. There shall be no leakage.

3.6.15 Compatibility: Each coupling half shall meet the operational and leakage requirements after being subjected to fluid resistance and low temperature tests and contaminated fluid endurance tests for fuel couplings.



The hose assemblies shall be MS8000 Style A or MS8801 Style A (optional MS8005 Style A or MS8006 Style A). The free hose length of hose between each end fitting shall be 9 in for all sizes through 1-1/2 in size. The 2-in size hose shall conform to MS28741, and the free length of hose between the end fittings shall be 12 in. The hose assemblies shall be installed in the minimum bend radius required in MIL-H-25579 for the MS8000 series assemblies and MIL-H-8795 for the MS28741 assemblies.

FIGURE 1 - Typical Setup for Vibration Test

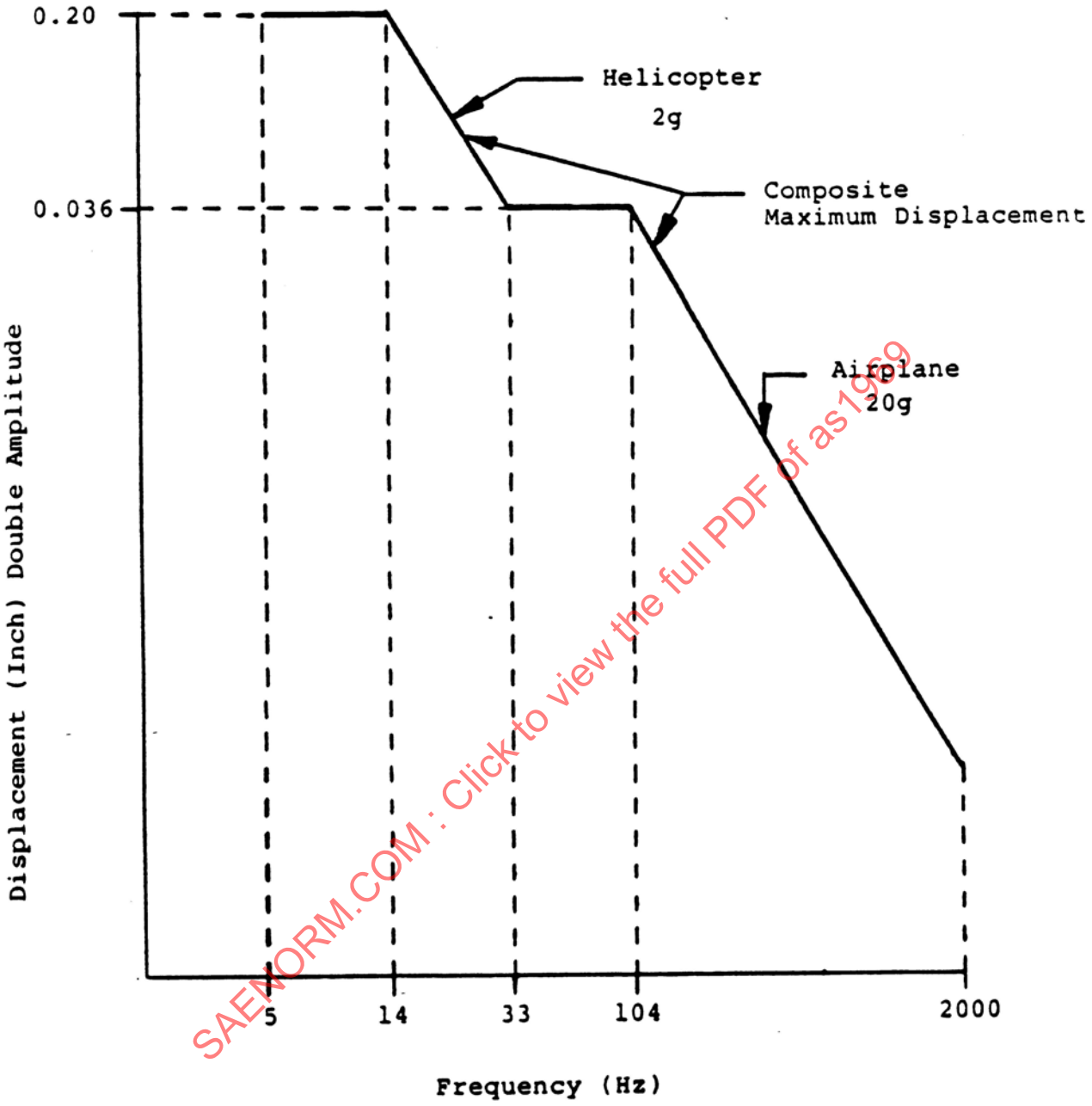


FIGURE 2 - Composite Vibration Test Curve for Equipment Mounted on Helicopters or Airplane Engines

3.6.16 Burst Pressure: The connected couplings shall not leak when subjected to the burst pressure specified in Table 4, or 250% of operating pressure specified on the control drawing as applicable, at the maximum temperature for type and class of coupling.

3.6.17 Electrical Resistance: The electrical resistance across the interface of the two coupling halves shall be less than 1 Ω when dry.

3.7 Identification of Product:

Each coupling half shall be marked for identification in accordance with MIL-STD-130.

3.7.1 The following information shall be included on a securely attached nameplate or etched, engraved, embossed or stamped in a suitable location:

Manufacturer's name or trademark
Manufacturer's part number
Assembly date

3.8 Color Identification:

Type I couplings shall meet the color code requirements of MIL-F-8615.

3.9 Workmanship:

Workmanship shall be of the quality necessary to produce couplings free from all defects which would affect proper functioning in service.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Inspection Responsibility:

The supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own or any other inspection facilities and services acceptable to the procuring agency. Inspection records of the examination and tests shall be kept complete and available to the procuring agency as specified in the contract or order. The government and/or procuring agency reserve the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Classification of Tests:

The tests shall consist of qualification tests and acceptance tests (4.3 and 4.4, respectively).

4.3 Qualification Tests:

4.3.1 The qualification tests shall consist of the following tests and shall be conducted in the following order. All tests are described under 4.6. Unless otherwise specified, two test samples of each size shall be subjected to all indicated tests. Test samples shall be typical production units.

a. Examination of Product	(4.6.1)
b. Functional Test	(4.6.2)
c. Proof Pressure	(4.6.3)
d. Low Pressure	(4.6.4)
e. Vacuum	(4.6.5)
f. Operation	(4.6.6)
g. Spillage	(4.6.7)
h. Extreme Temperature Shock	(4.6.8)
i. Pressure Drop	(4.6.9)
j. Surge Flow	(4.6.10)
k. Accelerated Corrosion	(4.6.11)
l. Salt Fog	(4.6.12)
m. Dust	(4.6.13)
n. Vibration	(4.6.14)
o. Compatibility	(4.6.15)
p. Burst Pressure	(4.6.16)
q. Electrical Resistance	(4.6.17)

4.4 Acceptance Tests:

4.4.1 The acceptance tests shall consist of the following tests. All tests are described under 4.6. Each coupling half manufactured shall pass the acceptance tests prior to delivery.

a. Examination of Product	(4.6.1)
b. Functional Test	(4.6.2)
c. Electrical Resistance	(4.6.17)
d. Proof Pressure	(4.6.3)
e. Low Pressure	(4.6.4)

4.5 Test Conditions:

4.5.1 Test Fluid: Unless otherwise specified, the fluid used for qualification testing shall be per Table 1 for fuel couplings and Table 2 for oil couplings. For acceptance testing, solvent in accordance with P-D-680 or calibration fluid per MIL-C-7024 may be used.

4.5.2 Atmospheric Conditions: Unless otherwise specified herein, all tests shall be performed under prevailing indoor atmospheric conditions.

4.6 Test Methods:

4.6.1 Examination of Product: Visually inspect the unit to verify good workmanship and correct markings. Physically measure and record all dimensions noted on applicable assembly drawings to verify correct configuration, envelope, mounting requirements, interface dimensions, and applicable dimensional tolerances. Record dry weight. Visually check finish and material usage.

For acceptance tests only, dimensions and weight are not required to be recorded, and weight is only required on a sampling basis.

4.6.2 Functional Test: Each coupling half shall be connected and disconnected five times with a mating half or a functional adapter. There shall be no sticking, binding, or any other evidence of faulty operation.

For acceptance tests only, one connect and disconnect shall be required.

4.6.3 Proof Pressure: The connected coupling and the disconnected halves shall be subjected to the proof pressure specified in Table 4, or 150% of operating pressure specified on the control drawing as applicable, for a period of 2 min minimum. There shall be no leakage, nor any permanent distortion or other malfunctioning of the coupling. The coupling shall couple and uncouple normally and seal fluid as required after having been subjected to this test.

For acceptance tests only, the specified pressure shall be applied for 30 s minimum and in the disconnected position. Coupling halves with seals that seal only when connected shall be further tested for 30 s minimum in the connected position.

4.6.4 Low Pressure: The connected coupling and the disconnected halves shall be subjected to a pressure of 1 to 5 psig for a period of 2 min minimum. There shall be no leakage.

For acceptance tests only, the pressure shall be applied for 30 s minimum and in the disconnected position. Coupling halves with seals that seal only when connected shall be further tested for 30 s minimum in the connected position.

4.6.5 Vacuum: A vacuum shall be applied to the connected coupling equivalent to 12.2 in Hg (-6 psig), and a vacuum shall be applied to the disconnected halves equivalent to 6.1 in Hg (-3 psig). When the correct pressure has been attained, the lines shall be closed for a period of 5 min, during which time there shall be no change in pressure. Temperature shall be maintained constant within ±2 °F, both fluid and ambient, during this test.

4.6.6 Operation: The coupling halves shall be connected and disconnected 200 times consecutively by hand and without any special means to keep the halves in perfect alignment. During each operation, 15 psig pressure shall be applied to both halves for -02 through -16 sizes and, 10 psig shall be applied to both halves of the -20 thru -32 sizes. The coupling halves shall withstand this test without malfunction or excessive wear. The coupling halves shall then be subjected to pass the tests specified in 4.6.3 and 4.6.4.

4.6.7 Spillage: Each coupling half shall be connected and disconnected 5 times with one hand without the use of tools. During connection, 60 psig pressure shall be applied to both halves for coupling sizes -02 through -16, and 10 psig pressure shall be applied to both halves for coupling sizes -20 through -32. During disconnection, 60 psig pressure shall be applied to both halves for all coupling sizes. One coupling half shall be securely mounted in a fixed position for this test. The fluid loss (spillage) shall be measured and shall not exceed the values specified in Table 3.

NOTE: Both coupling halves shall be installed in systems capable of accommodating some fluid displacement without pressure rise.

During this test, couplings shall be checked to ensure that the design allows no partially coupled positions in which the coupling can subsequently become uncoupled and block flow; and at the same time, indicate by sight and touch that the coupling is securely locked.

4.6.8 Extreme Temperature Shock: The coupling assembly, in a connected condition and filled with the test fluid, shall be subjected to the following tests without malfunction or leakage. A high temperature and low temperature chamber shall be used for this test:

4.6.8.1 High Temperature: The connected coupling shall be placed in a temperature chamber and pressurized at 5 psig. The chamber temperature shall be raised to 160 °F. The coupling and its fluid temperature shall also be raised to 160 °F and maintained for 4 h minimum. There shall be no measurable leakage from the connected couplings during this period. At the end of the 4 h period, the coupling shall be subjected to at least five disconnect/reconnect cycles. There shall be no binding or leakage during this operation.

4.6.8.2 Low Temperature: Upon completion of the high temperature testing above, the coupling shall be transferred, within 5 min, to a temperature chamber condition to -65 °F. The coupling and fluid temperature shall be allowed to stabilize at this temperature for 4 h minimum. There shall be no measurable leakage from the connected coupling during this period. At the end of the stabilization period, the coupling shall be subjected to at least five disconnect/reconnect cycles. There shall be no binding or leakage during this process; the coupling and fluid temperature may rise to -40 °F during this operation.

4.6.8.3 Rapid Warm-Up: Upon completion of the low temperature testing, the coupling assembly shall be transferred rapidly to the high temperature chamber, with an internal temperature of 160 °F. The coupling shall be subjected to 30-in static head pressure of the test fluid. The couplings and fluid shall be allowed to warm up rapidly to 160 °F, and shall be subjected to at least five operational cycles during this period without waiting for the fluid and coupling temperature to stabilize. There shall be no binding or leakage during this process. The coupling and fluid shall then be allowed to stabilize at room ambient.

The testing per 4.6.8.1 through 4.6.8.3 shall be repeated two more times, completing a total number of extreme temperature shock cycles to three. Upon successful completion of three cycles, the coupling halves shall demonstrate a normal connect/disconnect operation and shall pass the testing per 4.6.3 and 4.6.4.

4.6.9 Pressure Drop: Pressure drop through the connected coupling shall be measured at a flow equal to the rated flow specified in Table 3. Pressure drop shall not exceed the values specified in Table 3, when using water as the test fluid. The tests shall be conducted as recommended in ARP868 or ARP24. Also, tests shall be conducted over a range of flows and temperatures completely covering the design capacity of the coupling, and the values converted to the fluid for which the coupling is intended. The data shall be presented in the form of curves. Pressure drop shall be conducted in both directions.

4.6.10 Surge Flow: The connected couplings shall be subjected to the surge flow as specified in Table 3 for 3 s minimum duration in each direction. This surge flow pattern shall be repeated 100 times. There shall be no evidence of flow blocking or internal damage, and the disconnected halves shall then be subjected to and pass the tests specified in 4.6.3 and 4.6.4.

4.6.11 Accelerated Corrosion: With the ports open, the connected couplings shall be immersed in a saturated salt solution. The couplings shall then be drained for 30 s and operated to remove entrapped salt solution. The connected couplings shall be placed immediately in a test chamber maintained at a temperature of 86 °F ± 5 with a relative humidity of 100% for a period of 20 min. Upon completion o the humidity exposure period, the couplings shall be placed in an air oven maintained at a temperature of 130 °F for a period of 20 min. The couplings shall be washed with warm water to remove all exposed salt accumulations, after which the couplings shall be dried, wetted with fluid, and actuated as in normal service. Any corrosion that affects the operation of the couplings or is detectable without special visual aids shall be cause of rejection. Photographs of any corrosion shall be included in the test report.

4.6.12 Salt Fog: The connected couplings shall be subjected to a salt fog test in accordance with method 509 of MIL-STD-810. Any corrosion that affects the operation of the couplings or is detectable without special visual aids shall be cause for rejection. Photographs of any corrosion shall be included in the test report.

4.6.13 Dust: The connected couplings shall be subjected to a sand and dust test in accordance with method 510 of MIL-STD-810. It shall be possible to manually disconnect the couplings after this test.

4.6.14 Vibration - Sinusoidal:

4.6.14.1 Vibration Test Installation: A complete hose assembly as shown in Fig. 1 and coupling assembly shall be installed as shown in Fig. 1. The coupler half shall be connected to the hose assembly and pressure source. The other coupling half shall be connected to a rigid bulkhead mounted on the vibration table.

4.6.14.2 Vibration Test Fluid: The test fluid shall be the fluid for which the couplings were designed except that fuel couplings shall use solvent in accordance with P-D-680, calibration fluid per MIL-C-7024 or water. The couplings shall be pressurized to 10 psi for the vibration test (see 4.6.14.3).

4.6.14.3 Vibration Test Procedure: Unless otherwise specified by the Procuring Agency, the couplings shall withstand the following vibration tests without evidence of failure or leakage. During the vibration test, 10 psig pressure shall be applied. If the vibration testing is required per MIL-STD-810D, the parameters shall be established in conjunction with the Procuring Agency.

4.6.14.3.1 Resonant Search: The connected coupling shall be pressurized to a pressure of 10 psig and a resonance search shall be conducted in direction parallel and perpendicular to the longitudinal axis of the coupling (2 axes total). Resonant frequencies of the equipment shall be determined by varying the frequency of applied vibration slowly through the range of 5 - 2000 Hz at reduced test levels but with sufficient amplitude to excite the item.

4.6.14.3.2 Resonant Dwell: The test item shall be vibrated along each of the two axes, at the most severe resonant frequencies determined in the resonant search (4.6.14.3.1). The test levels and frequency range shall be in accordance with Fig. 2. The dwell time for each resonance shall be 30 min. If more than four significant resonant frequencies are found for any one axis, the four most severe resonant frequencies shall be chosen for the dwell test. If a change in resonant frequency occurs during the test, its time of occurrence shall be recorded and immediately the frequency shall be adjusted to maintain the peak resonance condition. The final resonant frequency shall be recorded.

4.6.14.3.3 Cycling: The test article shall be vibrated for a total duration of 3 h in each of the two axes. The resonance dwell time per axis shall be subtracted from the 3 h of required cycling time. These levels shall be per Fig. 2 and the sweep time shall be 20 min for 5 to 2000 to 5 Hz.

4.6.14.4 Pressure Tests After Vibration:

4.6.14.4.1 The couplings shall be subjected to and pass the tests specified in 4.6.3 and 4.6.4 after completion of the vibration tests.

4.6.14.4.2 The couplings shall be subjected to the burst pressure specified in Table 4, or 250% of operating pressure specified on the control drawing as applicable, for 1 min minimum. There shall be no leakage.

4.6.15 Compatibility:

4.6.15.1 Fuel Couplings: The connected couplings shall satisfactorily complete the fuel resistance and low temperature test. The test shall be conducted in a continuous manner in accordance with the schedule of Table 5. Each period shall follow the preceding one in the order noted with a minimum of delay. The soak periods shall be conducted with a body of fluid in continuous contact with all affected parts. For the dry periods, the component shall be drained, without disassembly, and blown dry with the ports open and placed in a test chamber having air continuously circulating around the component at the test temperature.