

Coupling Assemblies, Quick Disconnect, Automatic Shutoff

1. SCOPE:

This specification establishes requirements for automatic shutoff, quick-disconnect coupling assemblies for fuel and oil lines.

1.1 Classification:

Quick-disconnect couplings shall be of the following types and classes:

Type I - Fuel Line Coupling

Class A: -65 to +135 °F fuel and +160 °F ambient
Class B: -65 to +200 °F fuel and +350 °F ambient
Class C: -65 to +300 °F fuel and +600 °F ambient

Type II - Oil Line Coupling

Class A - Petroleum Oil (J1966): -65 to +250 °F oil and +160 °F ambient
Class B - Synthetic Oil (MIL-PRF-7808): -65 to +350 °F oil and +350 °F ambient
Class C - Synthetic Oil (MIL-PRF-23699): -40 to +400 °F oil and +400 °F ambient

2. REFERENCES:

2.1 Applicable Documents:

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

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SAE WEB ADDRESS:

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2.1.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 3216	Fluorocarbon (FKM) Rubber, Fuel and Oil Resistant, 70-80
AMS 3331	Fluorosilicone (FVMQ) Rubber, Fuel and Oil Resistant, 65-75
AMS-QQ-P-35	Passivation Treatments For Corrosion Resistant Steels
AMS-QQ-C-320	Chromium Plating (Electrodeposited)
ARP868	Pressure Drop Test for Fuel System Components
AS8879	Screw Threads – UNJ Profile, Inch
AS1946	Hose Assembly, Polytetrafluorethylene (PTFE), up to 450 °F (232 °C) and 1500 psi (10500 kPa), Procurement Specification
J1966	Lubricating Oil, Aircraft Piston Engine (Nondispersant Mineral Oil), Standard

2.1.2 U.S. Government Publications: Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-PRF-680	Degreasing Solvent
MIL-P-5315	Packing, Preformed, Hydrocarbon Fuel Resistant
MIL-R-7362	Rubber, Synthetic, Solid, Sheet, Strip, and Fabricated Parts, Synthetic Oil Resistant
MIL-PRF-7808	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base
MIL-DTL-8795	Hose Assemblies, Elastomeric-Hydraulic Fluid, Fuel and Oil Resistant, General Specification for
MIL-PRF-23699	Lubricating Oil, Aircraft Turbine Engines, Synthetic Base
MIL-C-81706	Chemical Conversion Materials for Coating Aluminum and Aluminum Alloys
MIL-STD-130	Identification Marking of U.S. Military Property
MIL-STD-810	Environmental Engineering Considerations and Laboratory Tests
MIL-STD-889	Dissimilar Metals
MS8000	Hose Assembly, Detachable Fittings, Tetrafluorethylene, High Temperature, Medium Pressure, Flare to Flare
MS8001	Hose Assembly, Detachable Fittings, Tetrafluorethylene, High Temperature, Medium Pressure, Flareless to Flareless
MS28741	Hose Assembly, Detachable End Fitting, Medium Pressure

2.2 Definitions:

The following definitions are applicable to this specification.

COUPLER HALF: The half that contains the locking device which holds the coupling halves together in the coupled position; generally connected to a hose assembly and is known as the hose attaching half, or female half.

FIXED HALF: The half which, normally, is rigidly mounted to a bulkhead, firewall, or tube assembly; also known as the bulkhead mounting half, nipple, or male half.

3. TECHNICAL REQUIREMENTS:

3.1 First Article:

The supplier shall provide sample coupling assemblies of each size being purchased to the purchaser, prior to starting production. These samples shall demonstrate that the production methods and design choice will produce coupling assemblies that comply with the requirements specified herein. Approval of first article samples will not relieve the supplier of the obligation to furnish coupling assemblies conforming to the applicable provisions of this document. Any changes or deviations of the production coupling assemblies from the first article sample during production will be agreed upon by the supplier and the purchaser.

3.2 Design and Construction:

The complete quick-disconnect coupling assembly shall consist of two separate coupling halves. A self-sealing shutoff device shall be incorporated in each coupling half, and the locking device for the coupling shall be included in the coupler half. The purchaser shall have the option of procuring the complete quick-disconnect coupling assembly or either of the separate coupling halves.

3.2.1 Design: Coupling assemblies configurations shall not exceed the basic outline dimensions and weights shown on Figure 1 and Table 1. One coupling half shall be primarily designed for, but not limited to bulkhead or firewall mounting. A means for quick separation of the coupling halves shall be incorporated with provisions for automatically sealing the contained fluid against flow during the disconnect cycle. When connected, the coupling assembly shall permit fluid flow in either direction in accordance with the rated flows and pressure drops specified in Table 1 and at the rated pressures specified in Table 2. Flow shall not be blocked under surge conditions.

3.2.1.1 Method of Connecting and Disconnecting Coupling Assembly: The coupling assembly shall be designed such that they can be manually connected or disconnected throughout the applicable temperature range for the coupling type and class when subjected to the following line pressures:

- a. 60 pounds per square in (psi) for couplings applicable to 0.250 in through 1.000 in outside diameter (OD) tubing
- b. 20 psi for couplings applicable to 1.250 in through 2.000 in OD tubing except that these shall be capable of disconnection at 60 psi.

3.2.1.2 Locking: Devices shall be provided for positively locking connected couplings and means incorporated for visually and physically verifying the locked condition.

3.2.1.3 Overhaul: The couplings shall be designed to permit overhaul or repair without the use of special tools or fixtures.

3.2.1.4 Interchangeability: All coupling halves having the same manufacturer's part number shall be functionally and dimensionally interchangeable.

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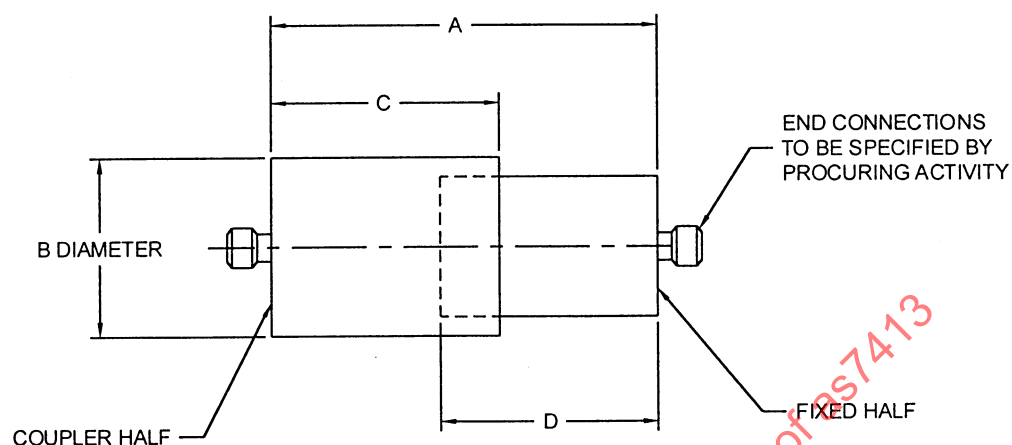


FIGURE 1 - Maximum Envelope Dimensions

TABLE 1 - Maximum Envelope Dimensions, Weights, Spillage, Rated Flow, and Pressure Drops

Tube Size (in)	Maximum Envelope Dimension A (in)	Maximum Envelope Dimension B (in)	Maximum Envelope Dimension C (in)	Maximum Envelope Dimension D (in)	lb/ Coupled Max	Fluid Loss During Disconnection Max (cm ³)	Rated Flow (GPM)	Pressure Drop (psi)
0.250	3.900	1.800	2.300	2.200	0.8	2.5	1.2	4.5
0.375	3.900	1.800	2.300	2.200	0.8	3.0	3.5	5.0
0.500	3.900	1.800	2.300	2.200	0.8	4.0	6.0	5.5
0.625	4.600	2.800	3.200	2.800	1.3	9.0	10.5	6.0
0.750	4.600	2.800	3.200	2.800	1.3	15.0	16.0	7.0
1.000	4.600	2.800	4.300	2.800	1.8	35.0	29.0	8.0
1.250	5.700	3.500	4.300	3.800	2.8	45.0	45.0	10.0
1.500	5.700	3.500	4.300	3.800	3.5	60.0	70.0	15.0
2.000	6.400	4.000	4.300	3.800	4.0	90.0	125.0	15.0

TABLE 2 - Pressure Rating Pressure - psi

Type	Class	Fluid	Operating	Proof	Burst
I	A, B, C	Fuel	60	120	240
II	A	Oil	120	240	360
II	B	Oil	120	240	360
II	C	Oil	120	240	360

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3.2.1.5 Screw Threads: All threads shall be in accordance with AS8879.

3.2.2 Construction: The coupling assembly shall be constructed to withstand the normal strains, jars, vibrations, and other such conditions incident to shipping, storage, installation, and service. Manual connection and disconnection of the coupling shall have no adverse effect on its leakage characteristics, irrespective of the alignment of mating assemblies.

3.2.2.1 Materials: Coupling assembly materials used shall be uniform in quality, free from defects, and shall conform to the applicable specifications and the requirements specified herein.

3.2.2.1.1 Metals: Metals shall be corrosion resistant or treated to resist corrosion due to fuels, oils, salt spray, atmospheric conditions, or wear encountered in transportation, storage, or during normal service life.

3.2.2.1.2 Dissimilar Metals: Dissimilar metals as defined in MIL-STD-889 shall not be used in intimate contact with each other unless suitably protected against electrolytic corrosion.

3.2.2.2 Finishes:

3.2.2.2.1 Aluminum Alloy: Aluminum alloy parts shall have a MIL-C-81706, Class 3 coating.

3.2.2.2.2 Corrosion-Resistant Steel: Corrosion-resistant steel parts shall be passivated in accordance with AMS-QQ-P-35.

3.2.2.2.3 Chromium Plating: Chromium plating shall conform to AMS-QQ-C-320, Class 2.

3.2.2.3 Non-metallic Components: Non-metallic components shall be compatible with the applicable fluids used in the fuel or oil system for types I and II couplings, respectively.

3.2.2.3.1 Packings, O-rings, or Special Seals: Packings, O-rings, or special seals shall conform to MIL-P-5315, MIL-R-7362, AMS 3331, AMS 3216, or other compatible material.

3.2.2.3.2 Lubrication: Lubricants that are compatible with system fluids and temperatures may be used on threads and O-ring packings at assembly. Bonded dry film lubricants compatible with system fluids are permissible. Lubricants compatible with system fluids and fluid temperature ranges may be applied to external parts subject to wear during coupling connection and disconnection cycles.

3.2.2.4 Protective Treatment: Materials that are used in the construction of the couplings which are subject to deterioration when exposed to climatic or environmental conditions likely to occur during storage or service usage 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 avoided.

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3.2.2.5 Material Restrictions: Surfaces of the coupling assembly that are normally in contact with fuel and synthetic oil shall not be of magnesium, copper, nor be cadmium plated.

3.3 Performance:

3.3.1 Examination of Product: Each coupling half shall conform to the requirements of this specification with respect to design, workmanship, and identification.

3.3.2 Functional Test: There shall be no binding, sticking or any other evidence of faulty operation after performing the test in 4.6.2.

3.3.3 Fluid Loss:

3.3.3.1 Sealing Under Pressure: The coupling halves 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 the coupling or uncoupling. Fluid loss as specified in Table 1 is not considered as external leakage. Both halves of the coupling shall seal fluid with not more than a leakage trace when tested in accordance with 4.6.3.1.

3.3.3.2 Fluid Loss: The average fluid lost during five consecutive connect and disconnect cycles at the specified operating pressure shall not exceed the amounts shown in Table 1 when subjected to the test in 4.6.3.2.

3.3.4 Pressure Tests:

3.3.4.1 Proof Pressure: There shall be no visible signs of leakage after 2 min minimum of pressurization when subjected to the test in 4.6.4.1.

3.3.4.2 Low Pressure: There shall be no visible signs of leakage after 2 min minimum of pressurization when subjected to the test in 4.6.4.2.

3.3.4.3 Pressure Drop: The pressure drop through the connected couplings shall not exceed the values shown in Table 1 when tested in accordance with 4.6.4.3 using water as the test fluid. An additional test shall be conducted using the applicable fluid for the type and class of the coupling as the test fluid.

3.3.4.4 Vacuum: There shall be no visible signs of leakage as indicated by a loss of vacuum in 5 min at the negative pressures, shown by the vacuum gage used, when subjected to the test in 4.6.4.4.

3.3.4.5 Burst Pressure: There shall be no leakage when subjected to the test in 4.6.13.5. Distortion of the coupling above the burst pressure is not reason for rejection.

3.3.5 Operation: After the couplings are manually connected and disconnected in the manner specified in 4.6.5, the coupling shall meet the requirements of 3.3.4.1 and 3.3.4.2.

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- 3.3.6 Temperature Shock: When subjected to the test in 4.6.6, the couplings shall withstand the thermal cycling effects of its environment and fluid temperature changes without deterioration in either performance or endurance. The coupling shall connect and disconnect manually as in normal service without any mechanical assistance and meet the requirements of 3.3.4.1 and 3.3.4.2.
- 3.3.7 Surge Flow: When subjected to the test in 4.6.7, there shall be no evidence of flow blocking or internal damage, and the disconnected halves shall meet the requirements of 3.3.4.1 and 3.3.4.2.
- 3.3.8 Accelerated Corrosion: Any corrosion that affects the operation of the couplings or is detectable without special visual aids shall be cause for rejection when subjected to the test in 4.6.8.
- 3.3.9 Salt Fog: Any corrosion that affects the operation of the couplings or is detectable without special visual aids shall be cause for rejection when subjected to the test in 4.6.9.
- 3.3.10 Dust: It shall be possible to manually disconnect the couplings when subjected to the test in 4.6.10.
- 3.3.11 Electrical Resistance: The resistance shall not exceed 1 ohm when subjected to the test in 4.6.11.
- 3.3.12 Endurance: After completion of cyclic testing of 4.6.12, the couplings shall meet the requirements of 3.3.4.1 and 3.3.4.2. The coupling shall not exhibit any undue looseness due to wear from the vibration.
- 3.3.13 Vibration: After performing the vibration test in 4.6.13, the couplings shall meet the requirements of 3.3.4.1 and 3.3.4.2. The couplings shall not exhibit any looseness due to wear from the vibration.
- 3.3.14 Contaminated Fluid Endurance: After being subjected to the test in 4.6.14, it shall be possible to manually disconnect and connect the couplings and shall meet the requirements of 3.3.4.1 and 3.3.4.2.

3.5 Identification of Product:

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

- 3.5.1 Identification Information: The following information shall be included on a securely attached nameplate or etched, engraved, embossed, or stamped in a suitable location on a primary housing of each coupling half.

Manufacturer's name or trademark, or both
Coupler half or fixed half (optional)
Manufacturer's part number and serial number, if used
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Type (I or II) Class (A, B or C)

- 3.5.2 Connection and Disconnection Instructions: Connection and disconnection instructions shall appear on the coupling half containing the locking device.

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3.5.3 Color Identification of Type I Coupling Halves: Type I coupling halves shall be color coded to indicate fuel use by means of a red color. The color shall be permanent and shall not deteriorate, loosen or fade due to contact with fuel or the operational environment. The marking shall consist of a red band 0.250 in or wider around the component body; or a stripe at least 1 in long on opposite sides of the component or by coloring the entire outer surface of the coupling half.

3.6 Cleaning:

All parts shall be clean and free from dirt, sand, metal chips, and other foreign matter during and after assembly.

3.7 Workmanship:

The couplings shall be free from all defects or irregularities that would affect its service performance.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements specified herein. The supplier may utilize his own facilities or any other facilities acceptable to the procuring activity for the performance of the inspection requirements. The procuring activity has the right to perform any of the inspections set forth in this document, as deemed necessary, to assure that supplies and services conform to prescribed requirements.

4.2 Classification of Inspections:

The examination and testing of the coupling assemblies shall be classified as follows:

- a. First article inspection
- b. Quality conformance inspection

4.3 Test Conditions:

4.3.1 Atmospheric Conditions: All tests shall be performed at an atmospheric pressure within the range of 28 to 31 in Hg, a temperature between 65 and 85 °F, and a relative humidity of not more than 90%. Actual atmospheric conditions shall be recorded during each test.

4.3.2 Test Fluid: The fluid used for first article testing shall be the fluid for which the couplings are intended. For quality conformance testing of fuel couplings, MIL-PRF-680 solvents may be used.

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4.4 First Article Inspection:

The first article inspection shall consist of the following examination and tests and shall be conducted on complete production coupling assemblies:

- a. Each coupling half shall successfully complete the examination and tests specified under the quality conformance inspection in 4.5.
- b. One complete coupling assembly of each line size for each type and class being procured shall be subjected to the following tests in the order listed:
 1. Vacuum (see 4.6.4)
 2. Operation (see 4.6.5)
 3. Fluid loss (see 4.6.3)
 4. Temperature shock (see 4.6.6)
 5. Pressure drop (see 4.6.4.3)
 6. Surge flow (see 4.6.7)
 7. Accelerated corrosion (see 4.6.8)
 8. Salt fog (see 4.6.9)
 9. Electrical resistance (see 4.6.11)
 10. Dust (see 4.6.10)
- c. One complete coupling assembly of each line size for each type and class being procured shall be subjected to the following tests in the order listed:
 1. Endurance (see 4.6.12)
 2. Vibration (see 4.6.13)
- d. One complete coupling assembly of each line size for each type and class being procured shall be subjected to the following tests in the order listed:
 1. Contaminated fluid endurance (see 4.6.14)
 2. Burst pressure (see 4.6.13.5)

Where designs are such that the basic difference between two or more coupling assemblies is the size of the end fitting, only the couplings with the largest end fittings shall be subjected to all of the applicable tests. Pressure drop and vibration tests shall be performed on all sizes.

4.5 Quality Conformance Inspection:

Each coupling shall be subjected to the following examination and tests before shipment to the purchaser:

- a. Examination of product (see 4.6.1)
- b. Functional test (see 4.6.2)
- c. Proof pressure (see 4.6.4.1)
- d. Low pressure (see 4.6.4.2).

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4.6 Tests:

- 4.6.1 Examination of Product: Each coupling half shall be carefully examined to determine conformance to the requirements of this specification with respect to design, workmanship, and identification. The couplings shall be within the weight allowance, clean and free of contaminants, oil, grease, preservatives or any other material not specified.
- 4.6.2 Functional Test: Each coupling half shall be manually connected and disconnected five times with a mating coupling half or adapter while at the operating pressure specified in Table 2.
- 4.6.3 Fluid Loss:
- 4.6.3.1 Sealing Under Pressure: The disconnected coupling halves shall be subjected to a static pressure equal to the operating pressure for 15 min. All external surfaces shall be dry at the start of this test. Measure the leakage from the disconnected halves.
- 4.6.3.2 Fluid Loss: This test shall be performed immediately following the test specified in 4.6.5. Subject the connected couplings to a static pressure equal to the operating pressure. Stabilize the pressure for 2 min. Disconnect the coupling halves. Measure the fluid loss. Reconnect and stabilize pressure. Repeat five times. Average the fluid loss measurements.
- 4.6.4 Pressure Tests:
- 4.6.4.1 Proof Pressure: Each coupling, connected and disconnected, shall be subjected to the proof pressure specified in Table 2. Observe for visible signs of leakage.
- 4.6.4.2 Low Pressure: Each coupling, connected or disconnected, shall be subjected to a static pressure between 1 to 5 psig. Observe for visible signs of leakage.
- 4.6.4.3 Pressure Drop: The tests shall be conducted in accordance with double piezometer test method of ARP868. The flow rate shall be as specified in Table 1 at the lowest, mean and highest temperature of the operating range and the ambient temperature specified in 1.1. The coupling shall have a horizontal attitude for all tests. Pressure drops shall be conducted in both directions.
- 4.6.4.4 Vacuum: A vacuum of -6 psig shall be applied to the connected couplings and -3 psig to the disconnected coupling halves. See Figure 2 for a typical test setup. Observe for loss of vacuum.
- 4.6.5 Operation: The couplings shall be connected and disconnected 200 times consecutively by hand and without any special means to keep the coupling halves in perfect alignment with an internal pressure equal to the operating pressure specified in Table 2. The coupling shall then be subjected to the tests specified in 4.6.4.1 and 4.6.4.2.
- 4.6.6 Temperature Shock: Mating couplings shall be connected and tested in accordance with the temperature shock test specified in MIL-STD-810, Method 503. The coupling assembly shall be tested in its normal operational condition. The temperature limits shall be the upper and lower limits of its operating range (see 1.1). After this test, the couplings shall be subjected to the tests specified in 4.6.4.1 and 4.6.4.2.

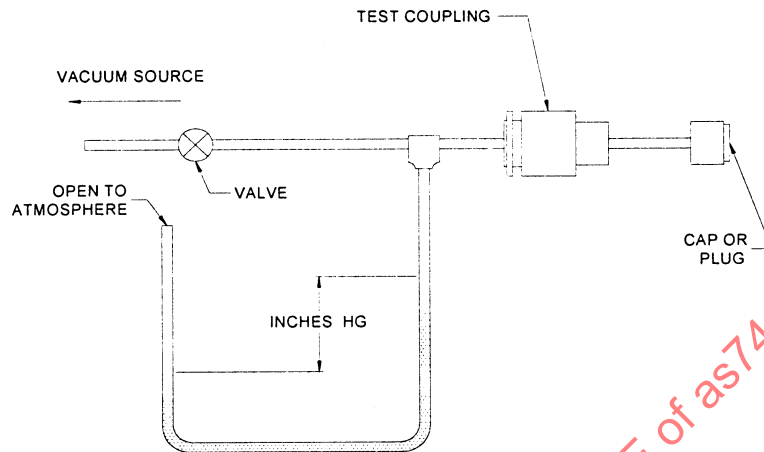


FIGURE 2 - Typical Setup for Vacuum Test

- 4.6.7 Surge Flow: The coupling shall be subjected to flow at five times the rated flow for 5 s minimum duration in each direction. This surge flow pattern shall be repeated 100 times. After this test the couplings shall be subjected to the tests specified in 4.6.4.1 and 4.6.4.2.
- 4.6.8 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 for a period of 20 min maintained at a temperature of $86\text{ }^{\circ}\text{F} \pm 3\text{ }^{\circ}\text{F}$ with a relative humidity of 100%. Upon completion of the humidity exposure period, the couplings shall be placed in an air oven maintained at a temperature of $130\text{ }^{\circ}\text{F}$ for a period of 20 min. The component shall complete a total of 50 immersion, high humidity, and drying cycles. 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.
- 4.6.9 Salt Fog: The connected couplings shall be subjected to a salt fog test in accordance with MIL-STD-810, Method 509. The test shall be conducted with the connected coupling assembly set up in its operational condition. The test shall be composed of a 24 h exposure period followed by a 24 h drying period. This 48 h cycle shall be conducted twice for a total duration of 96 h. At the end of the test period, the coupling assembly shall be washed with warm water to remove the deposits, dried, wetted with fluid, and actuated as in normal service.

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4.6.10 Dust: The connected couplings shall be subjected to a dust test in accordance with MIL-STD-810, Method 510. The test conditions are as follows:

- a. Temperature shall be the mid point of the operating range for the applicable type and class of coupling as specified in 1.1.
- b. The relative humidity shall be 25%.
- c. The air velocity shall be within the range of blowing dust.
- d. The composition and concentration of the blowing dust shall be the default values of MIL-STD-810, Method 510.

4.6.11 Electrical Resistance: The electrical resistance across the interface of the two coupling halves shall be measured with the couplings in the dry condition.

4.6.12 Endurance:

4.6.12.1 Endurance Test Installation: A complete MS8000 Style A or MS8001 Style A hose assembly and coupling assembly of the type and class applicable shall be installed in a cyclic test setup. The apparatus shall consist of two manifolds, one fixed and the other reciprocating axially. The coupling shall be attached to the fixed manifold and a vibration imposed on it by means of the hose assembly that shall connect the coupling and vibrating manifold. Fluid shall circulate from one manifold through the coupling to the second manifold. The free length of hose between hose fittings shall be 9 in for all sizes through the 1.500 in size. The 2.000 in size hose assembly shall conform to MS28741, and the free length of hose between hose end fittings shall be 12 in. The hose assemblies shall be installed in the minimum bend radius required in AS1946 for MS8000 and MS8001 assemblies and MIL-DTL-8795 for MS28741 assemblies.

4.6.12.2 Endurance Test Fluid: The endurance test shall be conducted using the fluid that is applicable to the type and class of coupling that is being tested.

4.6.12.3 Endurance Test Procedure: The hose and coupling assemblies shall be subjected to a minimum of 200 h of fluid circulation and vibration with a minimum of 10 cycles of temperature and pressure. Each cycle shall consist of at least 20 h duration. The total amplitude of the vibration shall be 0.060 in, and the frequency of vibration shall be 55 Hz $\pm$ 2 Hz. The temperature and pressure readings shall be recorded at least once every hour.