



AEROSPACE STANDARD

AS1709**REV. A**

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Superseding ARP1709

Coupling Assembly, Hydraulic Self Sealing, Quick Disconnect

RATIONALE

AS1709A has been reaffirmed to comply with the SAE five-year review policy.

1. SCOPE:

- 1.1 This specification covers the requirements for aircraft, hydraulic, self-sealing, quick disconnect couplings, for use in Type II hydraulic systems (-65 to +275 °F temperature range) as defined by AS5440.

1.2 Classification:

Hydraulic self-sealing, quick disconnect couplings shall be of the following classes and types:

Class 1000: 1000 psig
Class 3000: 3000 psig
Class 4000: 4000 psig
Class 5000: 5000 psig

Type I Quick Disconnects shall have a visual indication that they are completely connected and open to flow.

Type II Quick Disconnects shall have both a visual and touch indication that they are completely connected and open to flow.

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:

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SAE WEB ADDRESS:

2.1.1 Military Specifications:

MIL-H-5606	Hydraulic Fluid, Petroleum Base, Aircraft and Ordnance
MIL-H-25579	Hose Assembly, Tetrafluoroethylene, High Temperature, Medium Pressure, General Requirements for
MIL-PRF-83282	Hydraulic Fluid, Fire Resistant Synthetic Hydrocarbon Base, Aircraft
MIL-PRF-87257	Hydraulic Fluid, Fire Resistant, Low Temperature, Synthetic Hydrocarbon Base, Aircraft and Missile

2.1.2 Military Standards:

MIL-STD-129	Marking for Shipment and Storage
MIL-STD-130	Identification Markings of U.S. Military Property
MIL-STD-810	Environmental Test Methods

2.2 Other Publications:

Society of Automotive Engineers (SAE), Inc.

AIR1047	A Guide for the Selection of Quick-Disconnect Couplings for Aerospace Fluid Systems
ARP24	Hydraulic, Pressure Drop, Determination of
ARP603	Hose, Hydraulic, Tubing and Fitting Assemblies, Impulse Testing of
AS614	Hose Assembly, Tetrafluoroethylene, Heavy Duty, High Temperature, High Pressure, 4000 psi (27 580 kPa) Hydraulic and Pneumatic
AS5440	Hydraulic Systems: Design, Installation and Test of Aircraft (General Specification for)
AS8775	Hydraulic System Components, Aircraft and Missile, General Specification for
AS8791	Retainer, Packing, Hydraulic and Pneumatic, Tetrafluoroethylene Resin
AS1339	Hose Assembly, Tetrafluoroethylene, 400 °F, 3000 psi Hydraulic, Lightweight

3. REQUIREMENTS:

3.1 Qualification:

The couplings furnished under this specification shall be a product that 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 AS8775 apply to this specification except as specified herein.

3.3 Materials:

The coupling shall be constructed of materials that will not change the composition of, or be adversely affected by hydraulic fluid conforming to MIL-H-5606, MIL-PRF-83282, MIL-PRF-87257 or AS1241 Type IV. Materials, processes, and parts shall meet the design requirements and intent of AS8775. Other materials and fluids can be utilized for similar applications based on procuring agency requirements.

3.4 Design and Construction:

The configuration, dimensions, and other design details 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 I. Flow shall not be blocked under surge conditions.

3.4.1 Temperature Range: Couplings shall be designed to operate throughout the temperature range of -65 to +275 °F (see 4.6.3).

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 II is not considered to be external leakage. Both halves of the coupling shall seal fluid under both low and high pressures (see 4.6.4).

3.4.3 Seals: The packing and retainer materials shall be compatible with the applicable fluid specified on the procurement specification; MIL-H-5606, MIL-PRF-83282, MIL-PRF-87257 or AS1241 Type IV. Packing and retainer material for other fluid shall be specified by the procuring agency. However, the supplier shall demonstrate that the performance of the coupling is satisfactory with the packing retainer material used.

TABLE I - Rated Flow and Pressure Drop

Dash No.	Equivalent Tube Size (in)	Rated Flow (gal/min)	Surge Flow (gal/min)	Differential Pressure Drop (psid)
-04	1/4	1.2	6	8
-06	3/8	3.5	17.5	8
-08	1/2	6.0	30	8
-10	5/8	10.5	52.5	8
-12	3/4	16.0	80	8
-16	1	29.0	87	8
-20	1 1/4	45.0	90	4
-24	1 1/2	60.0	120	4

TABLE II - Air Inclusion and Fluid Loss

Dash No.	Equivalent Tube Size (in)	Air Inclusion Standard Cubic Centimeters (max)	Average Fluid Loss (Spillage) per Operating Cycle Cubic Centimeter (max)
-04	1/4	0.10	0.05
-06	3/8	0.20	0.10
-08	1/2	0.40	0.20
-10	5/8	0.60	0.30
-12	3/4	1.00	0.50
-16	1	1.75	1.00
-20	1 1/4	2.00	1.20
-24	1 1/2	2.50	1.50

- 3.4.4 Operation: The coupling shall be so designed that it 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 with a static pressure (as shown in Table III) applied to both halves and each one-half of the coupling, respectively. The force, or torque, shall not exceed the values shown in Table III.

The Type I coupling shall have a clear and unmistakable visual indication that it is fully connected and open when viewed at a 90° angle to the axis from any side.

The Type II coupling shall have a visual and touch feature that indicates the completely connected condition. The touch feature shall be clear and unmistakable.

The coupling shall not inadvertently uncouple under a 20 g maximum load.

TABLE III - Coupling Forces With the Indicated Static Pressure Applied to Both Halves

Dash No.	Static Pressure (psig)	Push-Pull Axial (lb)	Torque Rotation (in-lb)
-04	60	30	15
-06	60	35	20
-08	60	40	25
-10	60	45	30
-12	50	50	40
-16	30	60	50
-20	20	60	60
-24	15	60	70

3.5 Interchangeability:

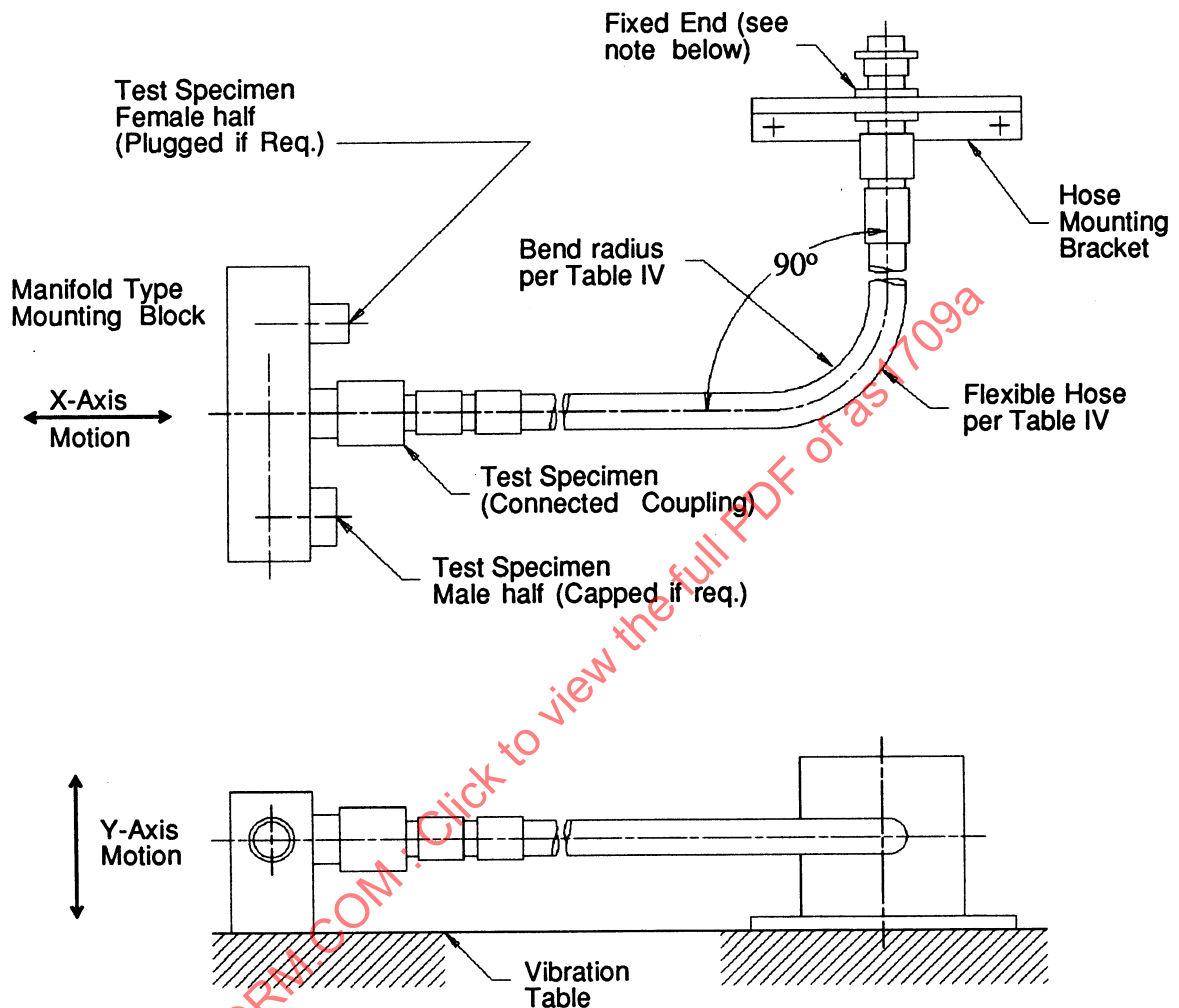
Couplings shall be interchangeable as a connected assembly (not individual coupling halves). It shall be impossible to interconnect different body sizes; however, it shall be permissible to jump tube sizes by changing the end fitting configuration. Couplings of different pressure classes shall not be capable of cross-coupling.

3.6 Performance:

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

- 3.6.1 Envelope, Weight, Materials: Each coupling half must conform to the applicable purchaser and supplier envelope dimension, weight control, materials, and finishes.
- 3.6.2 Proof Pressure: Each coupling half must meet operational and leakage requirements after being subjected to proof pressure of 150% of operating pressure for a period of 1 minute (4.6.2).
- 3.6.3 Extreme Temperature Functioning: Each coupling half shall show no malfunction during or after being subjected to extreme temperature testing from -65 to +275 °F (4.6.3).
- 3.6.4 Leakage: Coupling halves shall meet specified leakage requirements at 30-in static head of hydraulic fluid and at operating pressure (4.6.4).
- 3.6.5 Vacuum: The connected and disconnected coupling shall meet inward leakage requirements with no evidence of malfunction or degradation, with the equivalent of 10 in of Hg applied and lines closed for 5 minutes (4.6.5).
- 3.6.6 Surge Flow: Coupling halves shall meet leakage, operational, and pressure drop requirements after being subjected to five times (three times for -16, two times for -20, and -24) the rated flow in each direction (4.6.6).
- 3.6.7 Vibration: The connected and disconnected coupling halves with pressure cap and plug if required, shall be capable of withstanding the vibration environment specified herein without experiencing any malfunction or degradation. Couplings shall be pressurized with 15 psig pressure (4.6.7). The test set-up shall be as shown in Fig. 1.
- 3.6.8 Impulse: The connected coupling and disconnected coupling halves with pressure cap and plug if required, shall be capable of withstanding the impulse testing specified in ARP603 without any indication of malfunction. Pressure, rate of rise, and impulse form shall be per Table V and Fig. 2 (4.6.8).
- 3.6.9 Endurance: Each coupling half shall be capable of withstanding 200 endurance cycles without any evidence of malfunction or serious degradation, with 15 psig pressure applied to each half (4.6.9).
- 3.6.10 Manual Operation: Coupling halves shall be capable of being tested in accordance with specified requirements with no evidence of coupling forces, leakage, or spillage beyond the specified limits.

NOTE: Both coupling halves shall be installed in systems capable of accommodating some fluid displacement without pressure rise. The connecting force/torque and applied pressures shall be per Table III (4.6.10).



NOTE: The end shall be fixed to allow equivalent length and bend radius shown on Table IV by clamping either the end fitting or the hose as required.

FIGURE 1 - Set-Up for Impulse and Vibration Test

TABLE IV - Hose Lengths and Bend Radii for Impulse and Vibration Tests

Class 1000			
Hose Size	Equivalent Tube Size	Hose Length Flexible Section (in ± 0.25)	Bend Radius (in ± 0.25) Based on MIL-H-25579
-04	0.250	7.50	2.00
-06	0.375	10.75	4.00
-08	0.500	11.75	4.63
-10	0.625	13.25	5.50
-12	0.750	15.00	6.50
-16	1.000	16.50	7.38
-20	1.250	22.50	11.00
-24	1.500	27.50	14.00

Class 3000			
Hose Size	Equivalent Tube Size	Hose Length Flexible Section (in ± 0.25)	Bend Radii (in ± 0.25) Based on AS604
-04	0.250	9.25	3.00
-06	0.375	12.50	5.00
-08	0.500	13.75	5.75
-10	0.625	15.00	6.50
-12	0.750	17.25	7.75
-16	1.000	20.25	9.63
-20	1.250	24.25	12.00

Class 4000/5000			
Hose Size	Equivalent Tube Size	Hose Length Flexible Section (in ± 0.25)	Bend Radii (in ± 0.25) Based on AS614
-04	0.250	9.25	3.00
-06	0.375	12.50	5.00
-08	0.500	13.75	5.75
-10	0.625	15.00	6.50
-12	0.750	17.25	7.75
-16	1.000	20.25	9.63

TABLE V - Impulse Test (Per ARP603)

Parameters	Class 1000	Class 3000	Class 4000	Class 5000
1. Operating Pressure	1000	3000	4000	5000
2. Peak Pressure +5%	1500	4500	6000	7500
3. Temperature (all three classes)	25% at 275°F and 75% at 225°F			
4. Cycle Rate (CPM)	70 $\pm$ 5	70 $\pm$ 5	70 $\pm$ 5	70 $\pm$ 5
5. Rate of Rise (psi/sec)	Min. 10000 Max 100000	Min. 45000 Max 315000	Min. 60000 Max. 420000	Min. 75000 Max. 200000
6. Number of Cycles	100000	200000	200000	200000

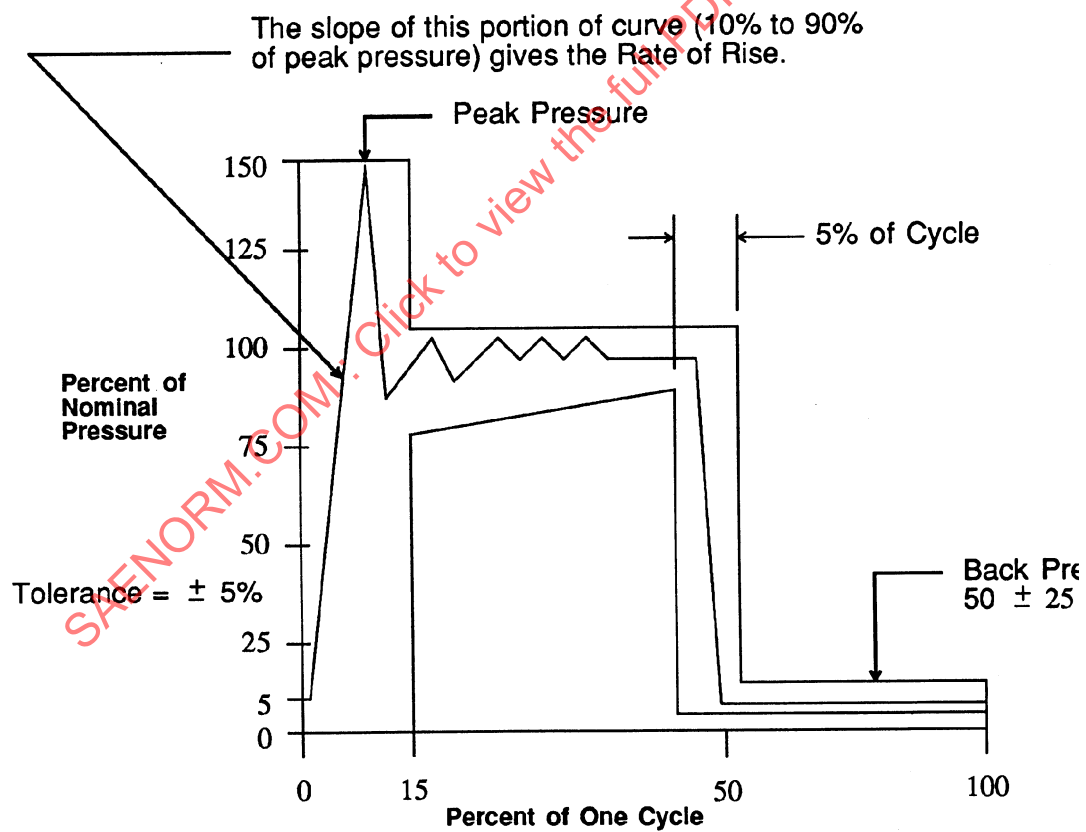
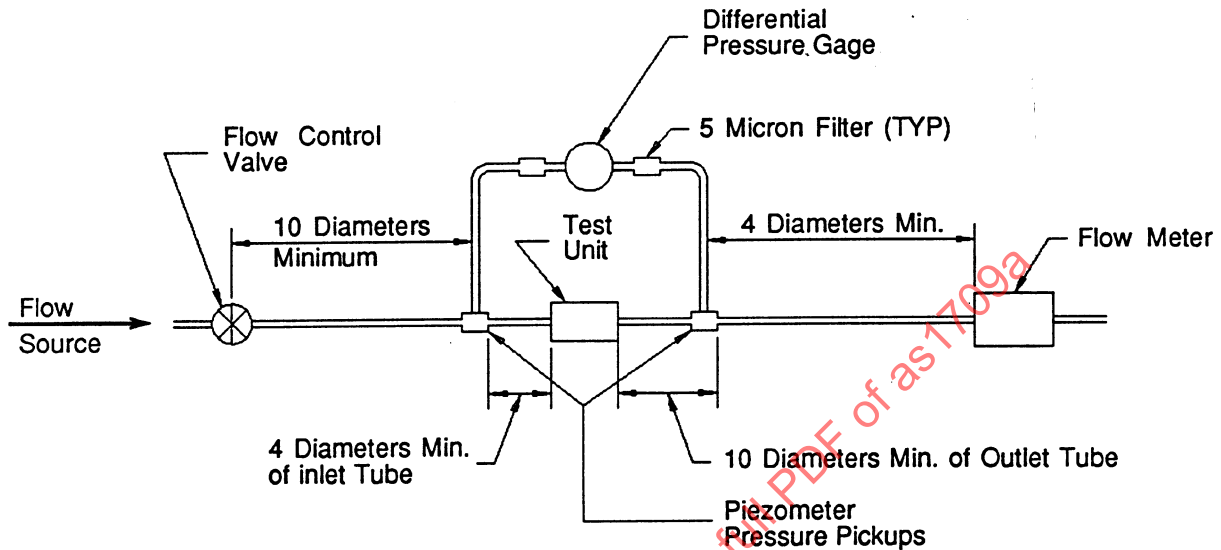


FIGURE 2 - Graph of Pressure Impulse Cycle (Per ARP603)



NOTE: In order to perform the pressure drop test in the opposite direction, detach the test unit from the piezometer tubes connection, rotate 180° and re-attach to piezometer tubes.

FIGURE 3 - Set-up for Pressure Drop Test (Ref. ARP24)

- 3.6.11 Air Inclusion: The air inclusion for all coupling halves shall be within specified limits per Table II and at 30 inches of oil pressure (4.6.11).
- 3.6.12 Impact: Connected couplings and coupling halves (disconnected coupling halves with caps and plugs, if required) shall withstand a 20 g impact test without evidence of disconnection. Evidence of leakage or malfunction after the test is not permitted (4.6.12). This can be accomplished by 20 g acceleration during the vibration testing per 4.6.7.
- 3.6.13 Pressure Drop: Each coupling shall indicate a pressure drop within the limits specified in Table I. The fluid temperature shall be $100^{\circ}\text{F} \pm 10$ and test set-up shall be as shown in Fig. 3 (4.6.13).
- 3.6.14 Burst Test: Coupling halves shall be capable of withstanding 250% of operating pressure and 275°F temperature without fluid loss or rupture (4.6.14).

3.7 Identification of Product:

The coupling shall be marked for identification in accordance with MIL-STD-130. In addition, each coupling shall be permanently marked with the customer (NSN, MS, Purchaser Assigned) part number, manufacturer's part number, and the manufacturer's name or code identification number. Class number (or operating pressure) shall be part of product identification. When available surface area precludes complete identification, a tag may be attached.

3.8 Workmanship:

Workmanship shall be of the quality necessary to produce couplings free from all defects that 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 records of the examination and tests. These records shall be kept complete and available to procuring agency as specified in the contract or order. The government and/or procuring agency reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure that 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 which shall be conducted in the order shown. All tests are described in 4.6. Unless otherwise specified, one test sample of each size shall be subjected to all indicated tests. Test samples shall be typical production units.

Test	Paragraph
a. Examination of product	4.6.1
b. Proof pressure	4.6.2
c. Extreme temperature functioning	4.6.3
d. Leakage	4.6.4
e. Vacuum	4.6.5
f. Surge flow	4.6.6
g. Vibration	4.6.7
h. Impulse	4.6.8
i. Endurance	4.6.9
j. Manual operation	4.6.10
k. Air inclusion	4.6.11
l. Impact	4.6.12
m. Pressure drop	4.6.13
n. Burst pressure	4.6.14

4.4 Acceptance Tests:

The acceptance tests shall consist of the following tests. All tests are described in 4.7. The detail test parameters and extent of the production testing shall be established by the procuring agency.

a. Examination	4.7.1
b. Proof pressure	4.7.2
c. Manual operation	4.7.3
d. Leakage	4.7.4
e. Cleanliness verification	4.7.5

4.5 Test Conditions:

- 4.5.1 Test Fluid: Unless otherwise specified, the fluid used shall be per MIL-PRF-83282 or MIL-H-5606 for all qualification testing. Other fluid may be specified by the procuring agency, if required, for system compatibility.
- 4.5.2 Temperatures: Except where otherwise specified, the tests of this specification shall be conducted at a room temperature of 70 to 90 °F and with a fluid temperature of 70 to 110 °F, as measured within 12 inches of the test sample. The actual temperature of the fluid during the tests shall be recorded in the test reports.

4.5.3 Immersion: All couplings shall be immersed continuously in hydraulic fluid for a period of 72 hours at a fluid temperature of $275^{\circ}\text{F} \pm 5$, prior to conducting the qualification tests (see 4.3) specified herein. All internal parts of the coupling shall be in contact with the fluid during this immersion. After the 72-hour soak period, the coupling shall be subjected to the next test immediately or remain in the fluid at normal room temperatures until such test.

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

4.6.2 Proof Pressure: The connected couplings and the disconnected halves shall be subjected to a proof pressure of 150% of the rated pressure for a period of 1 minute at room temperature. There shall be no leakage greater than as specified in 4.6.4, nor any permanent distortion or other malfunctioning of the coupling. The coupling shall connect and disconnect normally and seal hydraulic fluid as required after having been subjected to this test. This test shall be repeated after all other tests required herein, except the burst pressure test (4.6.14), have been accomplished. This repeat test shall be conducted at $275^{\circ}\text{F} \pm 5$ for a duration of 5 minutes for qualification tests and at room temperature for a duration of 1 minute for acceptance tests (4.3 and 4.4, respectively).

4.6.3 Extreme Temperature Functioning: The couplings shall withstand the following tests without malfunctioning or leakage in excess of the values specified herein (see 4.6.4).

4.6.3.1 High Temperature: After immersion (4.5.3), but before being disconnected, the coupling shall be connected to a 30-inch static head of hydraulic fluid and subjected to a temperature of $275^{\circ}\text{F} \pm 5$ for a period of 6 hours. There shall be no measurable leakage from the connected coupling during the 6-hour period. At the end of this time, the coupling shall be cooled to $140^{\circ}\text{F} \pm 5$ and at least five cycles of connection and disconnection shall be completed. There shall be no binding during any of these cycles. The temperature of the disconnected halves shall be raised to $225^{\circ}\text{F} \pm 5$ and shall be subjected to the leakage at low pressure test and then the leakage at high pressure test (4.6.4).

4.6.3.2 Low Temperature: After completion of the high temperature tests (4.6.3.1), the couplings shall be connected to a 30-inch static head of hydraulic fluid and subjected to a temperature not warmer than -65°F for a period of 4 hours after stabilization. There shall be no measurable leakage from the connected coupling during this period. At the end of this period, at least five cycles of connection and disconnection shall be completed. There shall be no binding during any of these cycles. The disconnected halves shall be subjected to the leakage at low pressure test and then the leakage at high pressure test (4.6.4). It will be satisfactory for the temperature to rise to -40°F during this process.

4.6.3.3 Rapid Warmup: The connected coupling, while attached to a 30-inch static head of hydraulic fluid, shall be allowed to warm up rapidly from -65 to +40 °F within a 5-minute period and shall be connected and disconnected at least five times during this period without waiting for the fluid, coupling, and ambient air temperature to stabilize. Temperature is to be measured at coupling outer surface. During the connection and disconnection process, the coupling shall be observed for any malfunction; there shall be none.

4.6.4 Leakage:

4.6.4.1 Leakage at Low Pressure: The connected coupling and the disconnected halves shall be subject to an internal pressure equal to a head of 30 inches of hydraulic fluid for 12 minutes. All external surfaces shall be dry at the beginning of this test. There shall be no evidence of any external leakage from the connected coupling. A waiting period of 2 minutes shall be allowed for the leakage rate to become constant from the disconnected halves. Following this waiting period, leakage shall be measured for the next 10 minutes and shall not exceed 1 drop.

4.6.4.2 Leakage at High Pressure: Both the connected coupling and the disconnected halves shall be subjected to a hydraulic static pressure equal to the applicable operating pressure for 15 minutes. All external surfaces shall be dry at the beginning of this test. There shall be no evidence of any external leakage from the connected coupling. Leakage from the disconnected halves shall not exceed a trace (insufficient to form a drop in 10 minutes). Fluid loss (spillage), as specified in Table II, is not considered to be external leakage.

4.6.5 Vacuum: A vacuum shall be applied to the connected and disconnected coupling equivalent to 10 inches Hg. When the correct vacuum pressure has been attained, the lines shall be closed for a period of 5 minutes, during which time there shall be no change in vacuum pressure.

4.6.6 Surge Flow: The couplings shall be subjected to flow of five times (three times for -16, and two times for -20 and -24 sizes) the rated flow for 3 seconds 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 pass the leakage tests in 4.6.4 at the completion of the surge flow sequence.

4.6.7 Vibration - Sinusoidal: The couplings shall withstand the following vibration tests without evidence of failure or leakage. During the vibration test, 15 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.

4.6.7.1 Resonance:

4.6.7.1.1 Resonance Search: The connected coupling and disconnected coupling halves, if required, shall be pressurized to 15 psig pressure and a resonance search conducted, in directions parallel and perpendicular to the axis of the coupling (two axes total). Resonant frequencies of the equipment shall be determined by varying the frequency of applied vibration slowly through the range of 5 to 2000 Hz at reduced test levels but with sufficient amplitude to excite the item.

4.6.7.1.2 Resonance Dwell: The test item shall be vibrated along each of the two axes, at the most severe resonant frequencies determined in 4.6.7.1.1. The test levels and frequency range shall be in accordance with Fig. 4. The dwell time for each resonance shall be 30 minutes. 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 the 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.

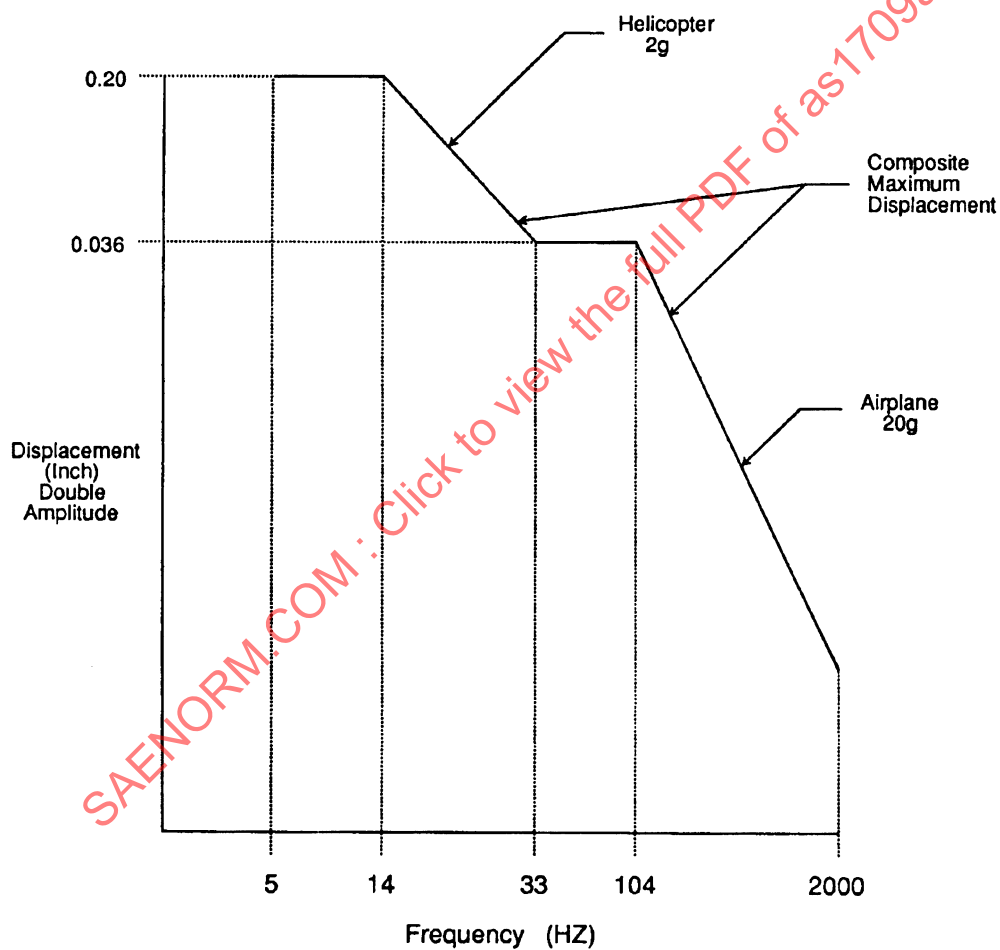


FIGURE 4 - Composite Vibration Test Curve for Equipment Mounted on Helicopters or Airplane Engines