

COUPLING ASSEMBLY, SELF-SEALING, ONE SIDE ONLY, HYDRAULIC

1. SCOPE:

1.1 This specification covers the requirements for aircraft, hydraulic couplings, self sealing one side only, for use in Type II hydraulic systems (-65°F to +275° temperature range) as defined by MIL-H-5440. The purpose being to connect a hose or tube to a standard MS33656, MS33514 or MIL-F-85421 fitting and provide the self sealing feature on that side only.

1.2 Classification: Hydraulic self sealing couplings shall be of the following classes and types:

Class 1000:	1000 psi rated pressure.
Class 3000:	3000 psi rated pressure.
Class 4000:	4000 psi rated pressure.

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 Military Specifications:

- MIL-H-5440 - Hydraulic Systems: Design, Installation and Test of Aircraft (General Specification For)
- MIL-H-5606 - Hydraulic Fluid, Petroleum Base, Aircraft and Ordnance
- MIL-H-8775 - Hydraulic System Components, Aircraft and Missile, General Specifications For
- MIL-H-25579 - Hose Assembly, Tetrafluoroethylene, High Temperature, Medium Pressure, General Requirements For
- MIL-H-83282 - Hydraulic Fluid, Fire Resistant Synthetic Hydrocarbon Base, Aircraft
- MIL-P-83461 - Packing, Preformed, Petroleum Hydraulic Fluid Resistant, Improved Performance at 275°F
- MIL-R-8791 - Retainer, Packing, Hydraulic and Pneumatic, Tetrafluoroethylene Resin

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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)

- AIR 1047 - A Guide for the Selection of Quick Disconnect Couplings for Aerospace Fluid Systems
- ARP 24 - Hydraulic Pressure Determination Of
- ARP 603 - Impulse Testing of Hydraulic Hose Assemblies, Tubing, and Fittings
- ARP 614 - Hose Assemblies, Aircraft and Missiles, High Temperature (450°F), High Pressure (4000 psig)
- ARP 868 - Pressure Drop Test for Fuel System Components
- AS 1339 - Hose Assembly, Tetrafluoroethylene, Lightweight, High Temperature, High Pressure 3000 psi (20684 kPa) Hydraulic and Pneumatic

3. REQUIREMENTS:

- 3.1 Qualification: The couplings furnished under this specification shall be a product which has been tested, and 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-H-8775 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 or MIL-H-83282. 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 details of design of the couplings shall conform to applicable Specification Control Drawings. This shall include mating with MS33656, MS33514, or MIL-F-85421 end fittings as may be specified. The design objective shall be to obtain the smallest size and lightest weight commensurate with meeting performance requirements herein.
 - 3.4.1 Temperature Range: Couplings shall be designed to operate throughout the temperature range of -65°F to +275°F (see para. 4.6.3).
 - 3.4.2 Sealing, Fluid Loss, and Air Inclusion: The couplings shall, when uncoupled, seal the end of the disconnected line at the point of disconnection and shall not permit external leakage during any phase of coupling and uncoupling. Fluid loss (spillage) as specified in Table II and as determined by para. 4.6.11 is not considered to be external

3.4.2 (Continued):

leakage. The coupling containing the valving shall seal under both low and high pressures (see para. 4.6.4).

- 3.4.3 Seals: Only MIL-P-83461 packing material and MIL-R-8791 retainer material shall be used with MIL-H-5606 hydraulic fluid. Packing and retainer material for other fluids shall be specified by the Procuring Agency.

TABLE I

Rated Flow and Pressure Drop

Dash No.	Equivalent Tube Size In Inches	Rated Flow GPM	Surge Flow GPM	Pressure Drop PSI (Max.)
-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
-32	2	100.0	200	4

TABLE II

Air Inclusion and Fluid Loss
(see para. 4.6.11)

Dash No.	Equivalent Tube Size (In Inches)	Air Inclusion Std. Cm3 (cu. in.) (Max.)	Average Fluid Loss (Spillage) Per Operating Cycle Cm3 (Cu.in.) (Max.)
-04	1/4	1.64 (.10)	1.64 (.10)
-06	3/8	2.46 (.15)	2.46 (.15)
-08	1/2	4.10 (.25)	4.10 (.25)
-10	5/8	4.92 (.30)	4.92 (.30)
-12	3/4	11.47 (.70)	11.47 (.70)
-16	1	16.39 (1.00)	16.39 (1.00)
-20	1 1/4	36.88 (2.25)	36.88 (2.25)
-24	1 1/2	49.17 (3.00)	49.17 (3.00)
-32	2	98.34 (6.00)	98.34 (6.00)

- 3.4.4 Operation: The coupling shall be so designed that it can be coupled and uncoupled without special tools (but using standard wrenches), while the mating 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 the MS33514E mating end. The force, or torque, shall not exceed the values shown in Table III. When completely coupled, the appropriate fitting torque shall be applied in accordance with ARP 908. The coupling shall not inadvertently uncouple under a 20G maximum load.

TABLE III

Coupling Forces with the Indicated Static
Pressure Applied to MS33514E Fitting End
Tighten Per ARP 908 (Final Torque)

Dash No.	Static Pressure	Hand Tightening Torque in Lbs. (Approx.)	Torque in Lbs.	Tightening (ARP 908)
	PSIG		CRES	ALUM.
-04	100	15	145	65
-06	100	20	245	130
-08	100	25	470	260
-10	100	30	680	360
-12	100	40	945	500
-16	100	50	1280	700
-20	60	60	1680	900
-24	60	70	2100	900
-32	30	80	2940	2000

- 3.5 Interchangeability: Couplings of the same part number shall be interchangeable. It shall be impossible to interconnect different tube sizes.
- 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 dimensions, 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% operating pressure for a period of one minute (Ref. para. 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°F to +275°F (Ref. para. 4.6.3).

- 3.6.4 Leakage: Coupling halves shall meet specified leakage requirements at 30 inch static head of hydraulic fluid and at operating pressure (Ref. para. 4.6.4).
- 3.6.5 Vacuum: Each coupling half shall meet inward leakage requirements with no evidence of malfunction or degradation, with equivalent of 10 inches of Hg applied and lines closed for five minutes (Ref. para. 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, -24, and -32) the rated flow in each direction (Ref. para. 4.6.6).
- 3.6.7 Vibration: Each coupling half must be capable of withstanding the vibration environment specified without experiencing any malfunction or degradation. Couplings shall be pressurized with 15 psig pressure (Ref. para. 4.6.7).
- 3.6.8 Impulse: Coupling halves shall be capable of withstanding the impulse testing specified per ARP 603 without any indication of malfunction. Pressures, rate of rise and impulse form shall be per Table V and Figure 3 (Ref. para. 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 the self sealing half. Size -32 shall have 10 psig pressure (Ref. para. 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: Couplings shall be installed in systems capable of accomodating some fluid displacement without pressure rise. The coupling force/torque and applied pressures shall be per Table III (Ref. para. 4.6.10).
- 3.6.11 Air Inclusion: The air inclusion for all coupling halves shall be within specified limits per Table II (Ref. para. 4.6.11).
- 3.6.12 Impact: Coupling halves shall withstand a 20G impact test without evidence of disconnect, leakage or other malfunction. The test shall be performed per MIL-STD-810, Method 516.2, Procedure 1 (Ref. para. 4.6.12).
- 3.6.13 Pressure Drop: Each coupling shall indicate a pressure drop within the limits specified in Table I. The fluid temperature shall be $100^{\circ} + 10^{\circ}\text{F}$ and test set-up shall be as shown in Figure 4 (Ref. para. 4.6.13).
- 3.6.14 Burst Test: Coupling half shall be capable of withstanding 250% of operating pressure and 275°F temperature without fluid loss or rupture (Ref. para. 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 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 record of the examination and test 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, one test sample 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) 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 under 4.6.

- | | |
|---------------------------|----------|
| a) Examination of Product | (4.6.1) |
| b) Proof Pressure | (4.6.2) |
| c) Leakage | (4.6.3) |
| d) Manual Operation | (4.6.10) |

4.5 Test Conditions:

4.5.1 Test Fluid: Unless otherwise specified, MIL-H-5606 shall be used for all qualification testing. Other fluids 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°F 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: After Examination of Product (4.6.1) is complete, all couplings shall be immersed continuously in hydraulic fluid for a period of 72 hours at a fluid temperature of 275° $\pm$ 5°F, 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 hours soak period, the coupling shall be subjected to the next test immediately or remain in the fluid at normal room temperature 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 configurations, 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 Pressures: The coupling shall be subjected to a proof pressure of 150% of the rated pressure for a period of one (1) minute at room temperature in the coupled and in the uncoupled state. There shall be no leakage greater than specified herein, nor any permanent distortion or other malfunctioning of the coupling. The coupling shall couple and uncouple 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 have been accomplished, but just prior to the burst pressure test (Ref. para. 4.6.14). This repeat test shall be conducted at 275°F $\pm$ 5°F for a duration of five (5) minutes for qualification tests and at room temperature for a duration of one (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 uncoupled, the coupling shall be connected to a 30 inch static head of hydraulic fluid and subjected to a temperature of $275^{\circ}\text{F} + 5^{\circ}\text{F}$ 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 $140^{\circ} + 5^{\circ}\text{F}$ and shall be subjected to the Leakage at Low Pressure test and then 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 four (4) hours after stabilization. There shall be no measurable leakage from the coupled coupling during this period. At the end of this period, at least five cycles of coupling and uncoupling shall be completed. There shall be no binding during any cycle of coupling and uncoupling. The uncoupled half shall be subjected to the Leakage at Low Pressure test and then 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-Warming: The coupled coupling, while connected to a 30 inch static head of hydraulic fluid, shall be allowed to warm up rapidly from -65°F to $+40^{\circ}\text{F}$ within a 5 minute period and shall be coupled and uncoupled 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 coupling and uncoupling 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 coupled coupling and the uncoupled half 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 coupled coupling. A waiting period of 2 minutes shall be allowed for the leakage rate to become constant from the uncoupled half. Following this waiting period, leakage shall be measured for the next 10 minutes and shall not exceed one drop.

For acceptance tests, the coupled coupling and the uncoupled half shall be subjected to internal pressure equal to 30 inches of hydraulic fluid for 2 minutes. All external surfaces shall be dry at the beginning of this test. There shall be no evidence of leakage from either the coupled coupling or the uncoupled half.

- 4.6.4.2 Leakage at High Pressure: Both the coupled coupling and the uncoupled half 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 coupled coupling. Leakage from the uncoupled half shall not exceed a trace (insufficient to form a drop in ten 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 coupled coupling equivalent to 10 inches Hg. When the correct pressure has been attained, the lines shall be closed for a period of 5 minutes, during which there shall be no change in pressure. Temperature shall be maintained constant within $\pm 2^{\circ}\text{F}$, both fluid and ambient, during this test.
- 4.6.6 Surge Flow: The coupling shall be subjected to flow of five times (three times for -16, and two times for -20, -24, and -32 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 uncoupled half shall pass the leakage tests (4.6.4) at the completion of the surge flow sequence.
- 4.6.7 Vibration: The couplings shall withstand the following tests without evidence of failure or leakage. During the vibration test, 15 psig pressure shall be applied.
- 4.6.7.1 Resonance:
- 4.6.7.1.1 Resonance Search: The coupled coupling shall be pressurized to 15 psig pressure and a resonance search conducted, in directions parallel and perpendicular to the axis of the coupling (3 axes total), in accordance with Method 514.2 (para. 4.5.1.1) of MIL-STD-810. The test article temperature shall be $225^{\circ} \pm 5^{\circ}\text{F}$. Figure I shows test set-up.
- 4.6.7.1.2 Resonance Dwell: The test item shall be vibrated along each of the three axes, at the most severe resonant frequencies determined in para. 4.6.7.1.1, in accordance with Method 514.2 (para. 5.6.1.2) of MIL-STD-810. Conditions shall be as shown in Figure 2. The test time schedule (per axis) shall be in accordance with Table 514.2-II for Procedure I, Part I of MIL-STD-810. The displacement vs frequency to be followed shall be in accordance with the composite curve, Figure 2. The test article temperature shall be $225^{\circ}\text{F} \pm 5^{\circ}\text{F}$. Figure 2 represents the more severe of the airplane engine (L) and helicopter (M) curves in MIL-STD-810.
- 4.6.7.2 Cycling: The test article shall be vibrated for a total duration of 3 hours in each of the three axes in accordance with MIL-STD-810, para. 5.6.1.3 and the time schedule of Table 514.2-II for Procedure No. I, Part I, of Method 514.2. Test levels shall be as shown on the composite curve, Figure 2. The test article temperature shall be $225^{\circ}\text{F} \pm 5^{\circ}\text{F}$.

- 4.6.8 **Impulse:** The coupled coupling shall be subjected to impulse testing in accordance with the general requirements of ARP 603. Test conditions shall be per Table V in a setup per Figure 1. The impulse test machine shall produce dynamic pressure impulses, in the coupling, of the magnitude indicated by the graph shown in Figure 3. An oscilloscope photograph of the nature of the impulse shall be included in the test report.

TABLE IV

Hose Lengths and Bend Radii
For Vibration and Impulse Test

Class 1000 Based on MIL-H-25579*

Coupling Size	Equivalent Tube Size (In Inches)	Hose Length Flexible Section (In Inches)	Bend Radii (In Inches)
-04	1/4	6.00	2.00
-06	3/8	9.75	4.00
-08	1/2	11.25	4.63
-10	5/8	13.00	5.50
-12	3/4	14.75	6.50
-16	1	17.25	7.38
-20	1 1/4	15.00	11.00
-24	1 1/2	18.00	14.00

*Briefly describe hose construction in test report.

Class 3000 Based on AS 1339*

Coupling Size	Equivalent Tube Size (In Inches)	Hose Length Flexible Section (In Inches)	Bend Radii (In Inches)
-04	1/4	5.50	1.50
-06	3/8	7.75	2.50
-08	1/2	8.50	2.88
-10	5/8	9.75	3.25
-12	3/4	10.75	4.00
-16	1	13.75	5.00

*Briefly describe hose construction in test report.

TABLE IV (Cont'd.)

Class 4000 Based on ARP 614*

Coupling Size	Equivalent Tube Size (In Inches)	Hose Length Flexible Section (In Inches)	Bend Radii (In Inches)
-04	1/4	10.00	3.00
-06	3/8	13.75	5.00
-08	1/2	15.50	5.75
-10	5/8	17.50	6.50
-12	3/4	19.00	7.75
-16	1	24.25	9.63

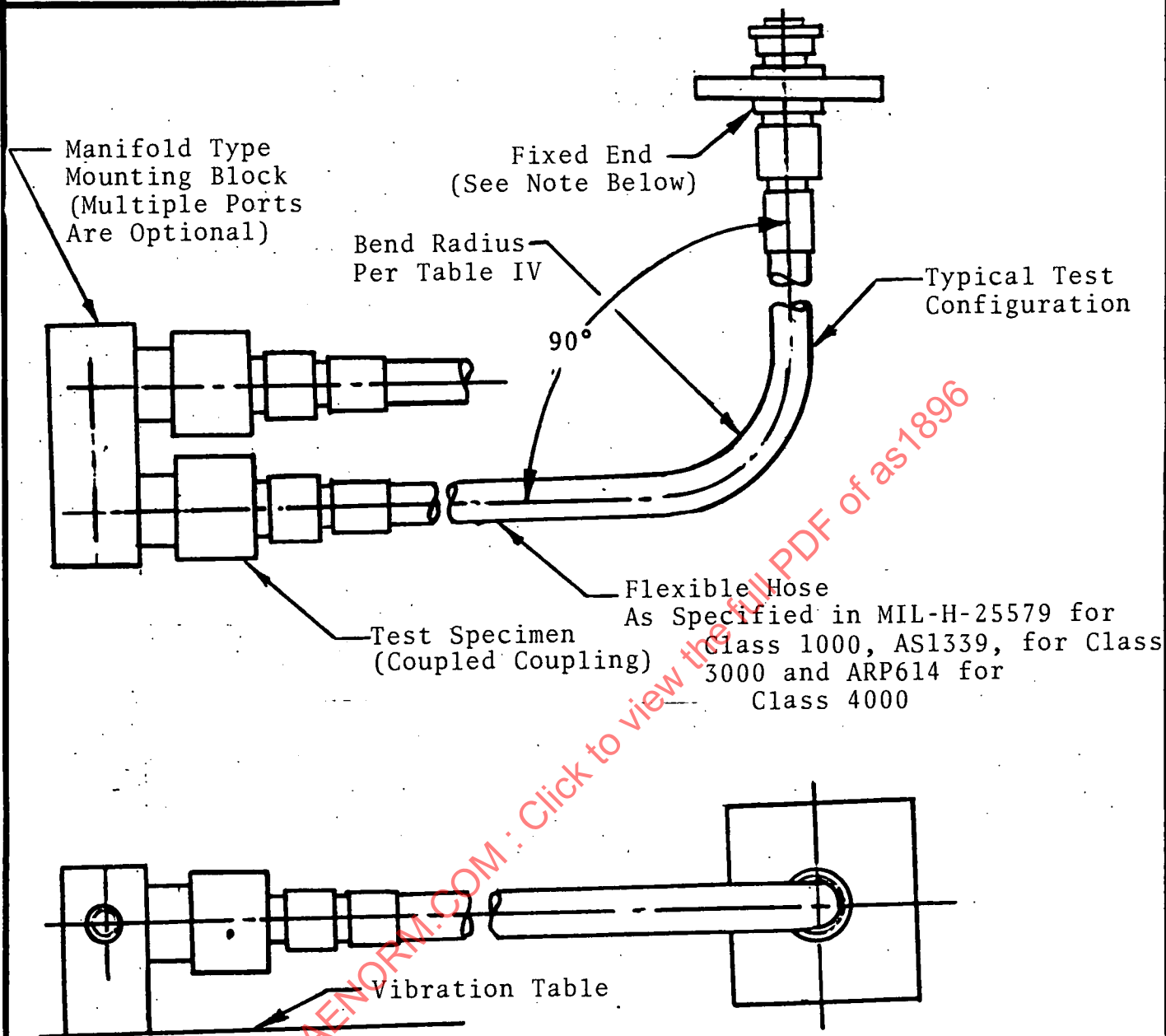
*Briefly describe hose construction in test report.

TABLE V

Impulse Test

	Class 1000	Class 3000	Class 4000
1. Operating Pressure	1000	3000	4000
2. Peak Pressure + 5%	1500	4500	6000
3. Temperature	25% at 275°F and 75% at 225°F		
4. Cycle Rate (cpm)	70 ± 10		
5. Rate of Rise PSI/SEC.	Min. 10,000 Max. 100,000	45,000 300,000	60,000 300,000
6. Number of Cycles	100,000	200,000	200,000

- 4.6.9 **Endurance:** The coupling shall be subjected to 200 coupling and uncoupling operations. During each operation 15 psi shall be applied to the self sealing coupling (except for the -32 size, where 10 psi shall be applied). The coupling shall be observed for any indication of malfunction, and the fluid loss plus leakage for this test shall be measured. The coupling shall withstand this test without malfunction or excessive wear. The fluid loss shall not exceed the values of Table II. There shall be no external leakage.



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. During vibration both ends are to be mounted to the shaker table

FIGURE 1

SET-UP FOR IMPULSE & VIBRATION TEST

DERIVED FROM MIL-STD-810

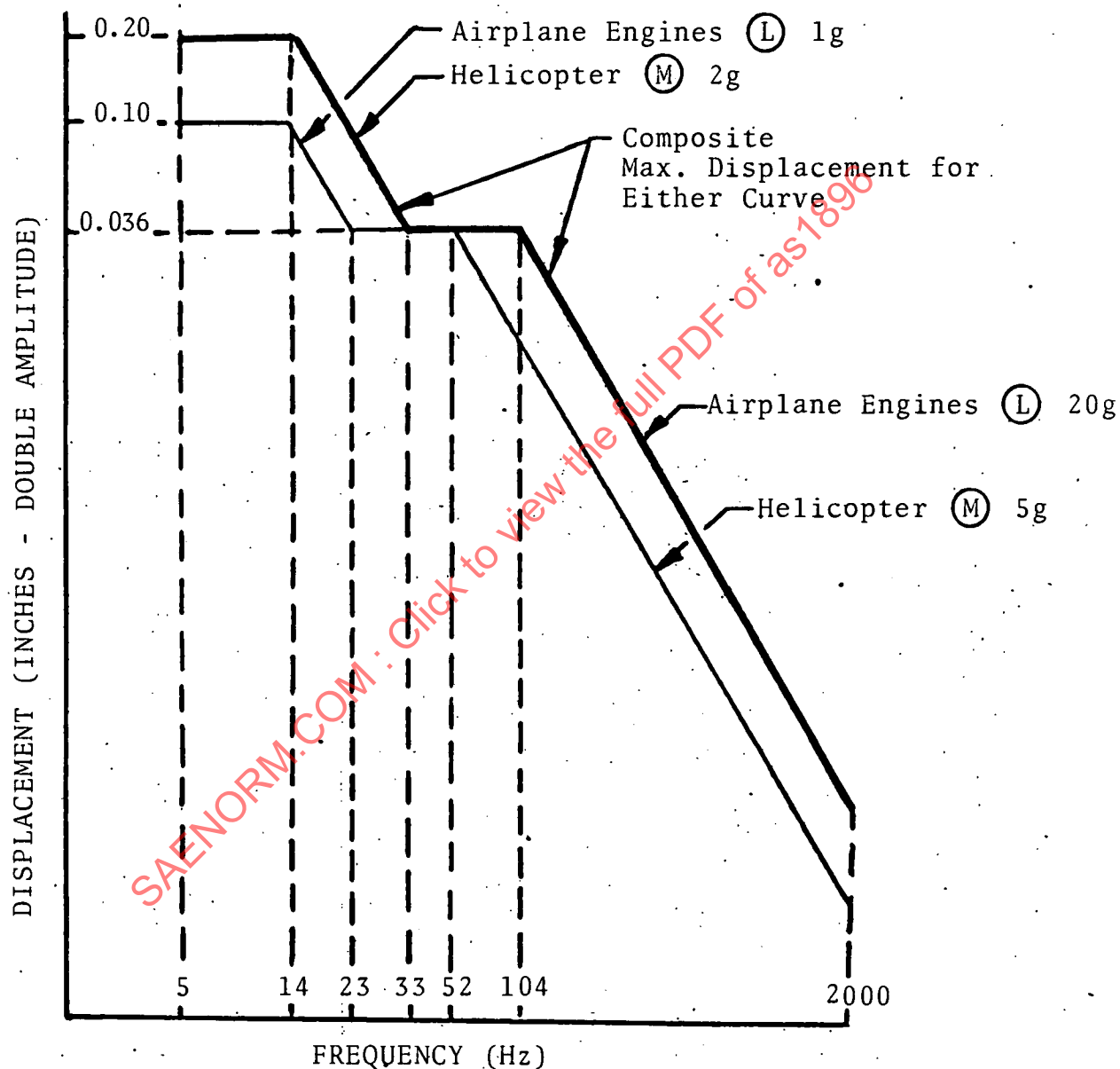


FIGURE 2
COMPOSITE
VIBRATION TEST CURVE FOR EQUIPMENT
MOUNTED ON HELICOPTERS OR AIRPLANE ENGINES