SAE The Engineering Society For Advancing Mobility Land Sea Air and Space®
INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE STANDARD

SAE AS5072

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Submitted for recognition as an American National Standard

COUPLING ASSEMBLIES, NON-LOCKING PROBE STYLE, MINIATURE SELF-ALIGNING, SELF-SEALING DISCONNECTS

1. SCOPE:

This SAE Aerospace Standard (AS) establishes the general requirements for a miniature probe type self-sealing, self-aligning, non-locking coupling intended for aerospace liquid cooling systems. The AS5072/slash sheets define the specific performance and dimensional requirements.

2. 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.

2.1 SAE Publications:

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

ARP868	Method - Pressure Drop Test for Fuel System Components
AS4251	Coupling Assemblies, Non-Locking Probe Style, Self-Aligning, Self-Sealing Disconnects
AS5072/1	Coupling Assemblies, .375 in Diameter, Non-Locking Probe Style, Miniature Self-Aligning, Self-Sealing Disconnect for Ethylene/Glycol/Water
AS5072/2	Coupling Assemblies, .375 in Diameter, Non-Locking Probe Style, Miniature Self-Aligning, Self-Sealing Disconnect for Polyalphaolefin
AS5072/3	Coupling Assemblies, .420 in Diameter, Non-Locking Probe Style, Miniature Self-Aligning, Self-Sealing Disconnect for Polyalphaolefin

2.2 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-HDBK-5400 Electrical Equipment, Aircraft, General Specifications for

MIL-STD-810 Environmental Test Methods

3. GENERAL REQUIREMENTS:

3.1 Qualification:

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

3.2 General Specification:

3.3 Materials:

The coupling shall be constructed of materials that will not change the composition of or be adversely affected by specific fluids. Materials, processes, and parts shall meet the requirements of MIL-E-5400 and this document. Fluids and material compatibility tests shall be conducted by the supplier to demonstrate the satisfactory performance of the couplings.

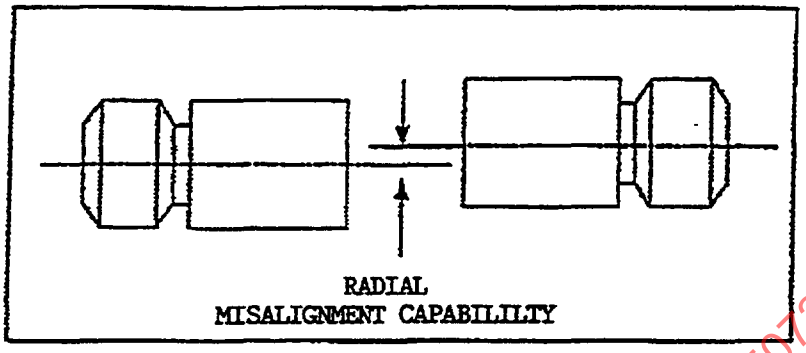
3.4 Design and Construction:

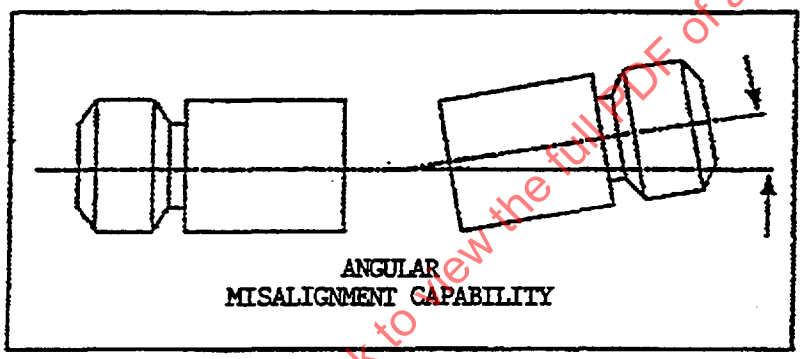
The configuration, dimensions, and other design details of the couplings shall conform to the appropriate slash sheets unless stated in a procurement control drawing.

The coupling shall contain radial, axial, and angular misalignment provisions in either or both halves as required (see Figure 1). When coupled, the coupling shall be designed so that it will permit fluid flow in either direction in accordance with the rated flow and pressure drop specified. Flow shall not be blocked under surge conditions. A thermal relief valve shall be incorporated in the module half.

3.4.1 Temperature Range: Couplings shall be designed to operate throughout the temperature range in accordance with the appropriate slash sheets.

3.4.2 Sealing and Fluid Loss: When disconnected, the couplings shall seal the end of the disconnected lines at the point of disconnection and shall not permit external leakage during any phase of connection or disconnection. Fluid loss (spillage) as specified on the slash sheet is not considered to be external leakage.





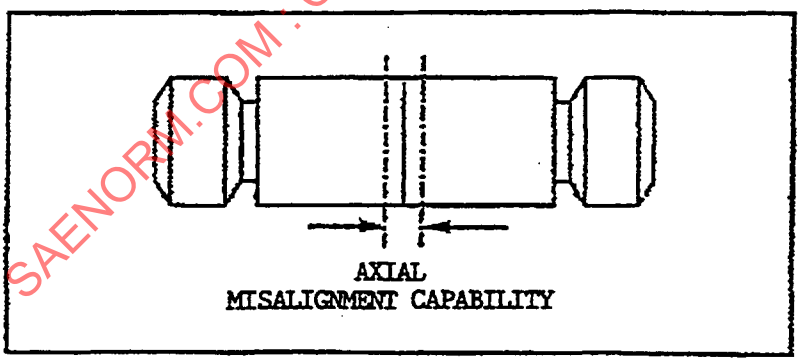


FIGURE 1 - Misalignment Capabilities

3.4.3 Seals: Packing and retainer materials shall be compatible with the fluid listed on the appropriate slash sheets. The supplier shall perform material compatibility tests to demonstrate satisfactory performance of the coupling.

3.4.4 Operation: The couplings shall be designed so that they can be connected and disconnected while mounted in their respective manifolds or fixtures. It shall be possible to connect and disconnect with an internal pressure, as shown in the applicable slash sheet, applied to both halves and to each half respectively.

3.5 Interchangeability:

It shall be impossible to interconnect different line sizes. Coupling halves of the same part number shall be interchangeable and cross-couple all reference mating halves of the same manufacturer.

3.6 Performance:

The miniature self-sealing couplings furnished under the slash sheet shall perform satisfactorily to the following performance requirements.

3.6.1 Envelope, Weight Materials: Each coupling half must conform to applicable slash sheet and/or 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 test of 4.6.2.

3.6.3 Extreme Temperature Functioning: Each coupling half shall show no malfunctioning or leakage during or after being cycled through extreme temperature.

3.6.4 Leakage:

3.6.4.1 Low Pressure: The connected coupling and the disconnected halves shall be capable of withstanding an internal pressure equal to a 30 in head of fluid for 12 min. There shall be no leakage from the connected coupling. Leakage from the disconnected halves shall not exceed one drop in 10 min, after a 2 min waiting period.

3.6.4.2 High Pressure: The connected coupling and the disconnected halves shall be capable of withstanding an internal pressure equal to the applicable rated pressure (as specified on the applicable slash sheet) for 15 min. There shall be no leakage from the connected coupling. Leakage from the disconnected halves shall not exceed a trace (insufficient to form a drop). Fluid loss (spillage), as specified in the applicable slash sheet, is not considered to be external leakage.

3.6.5 Vacuum: The connected coupling and the disconnected halves shall meet inward leakage requirements with no evidence of malfunction, degradation, or pressure change, with the equivalent of 10 in Hg applied and lines closed for 5 min.

3.6.6 Surge Flow: The disconnected halves shall meet the leakage requirements after the connected coupling is subjected to a surge flow of five times the rated flow in each direction as specified in the applicable slash sheet. There shall be no evidence of flow blocking or internal damage.

3.6.7 Vibration: The connected and disconnected couplings must be capable of withstanding the vibration environment specified without experiencing any malfunction or degradation.

3.6.8 Relief Valve Operation: The relief valve of the disconnected module half shall open within the crack pressure range, and close at the minimum reseat pressure, specified in the applicable slash sheet. Leakage after reseat shall not exceed one drop in 15 min.

3.6.9 Endurance: Each coupling half shall be capable of withstanding 1000 endurance cycles without any evidence of malfunction, or degradation, with 100 psig internal pressure applied to the module half.

3.6.10 Operation and Separating Force: Coupling halves shall be capable of being connected and disconnected with no evidence of malfunction, and no leakage, spillage, or connecting force beyond the specified limits of the slash sheet.

3.6.11 Spillage: The spillage for all coupling halves shall be within limits per the appropriate slash sheets with internal fluid pressure applied.

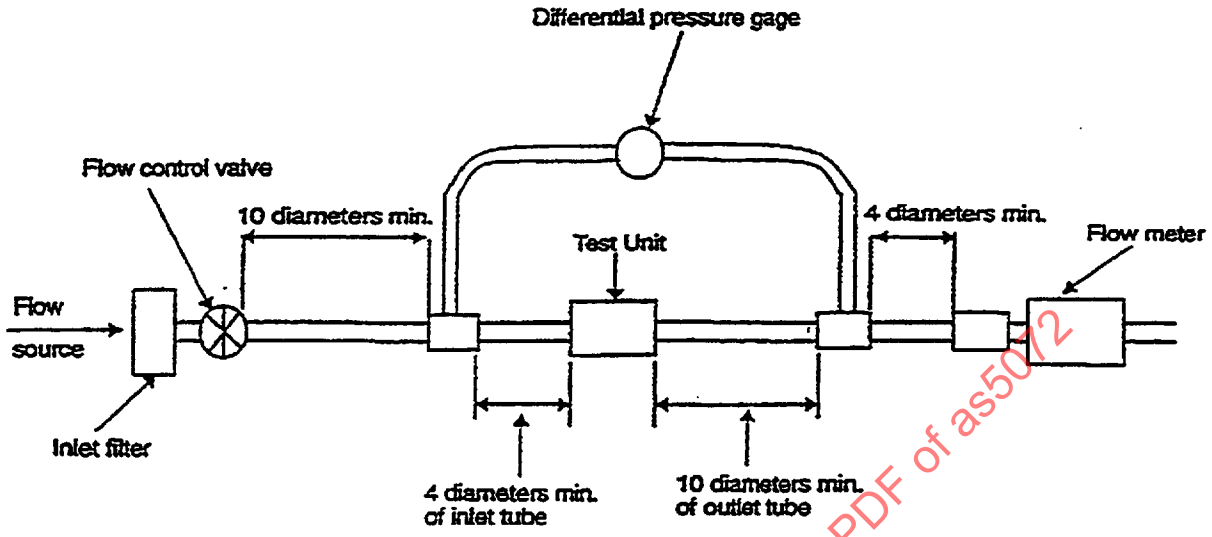
3.6.12 Air Inclusion: The air inclusion for all coupling halves shall be within specified limits per appropriate slash sheet at 30 in of internal fluid pressure applied.

3.6.13 Impact: Unless otherwise specified by the procuring agency, connected and disconnected assemblies shall withstand a 20 g impact test without evidence of damage. Evidence of leakage or malfunction after the test is not permitted.

3.6.14 Pressure Drop: Each coupling shall indicate a pressure drop within the limits specified on the appropriate slash sheet. The test setup shall be per Figure 2.

3.6.15 Sand and Dust/Salt Fog: The assembly shall be able to resist sand and dust/salt fog deterioration when tested in accordance with MIL-STD-810 method 510.1 and method 509.1.

3.6.16 Burst Pressure: The connected coupling shall be capable of withstanding the burst pressure at maximum temperature per the appropriate slash sheet without fluid loss or rupture.



*Pressure drop test setup per ARP868 may be used as an option.

FIGURE 2 - Pressure Drop Test Setup*

3.7 Identification of Product:

The coupling shall be permanently marked with the customer part number, manufacturer's part number, and the manufacturer's name or code identification number. When available surface area precludes complete identification, a tag may be attached or applied to the package.

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. Except as otherwise specified, the supplier may utilize his/her 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 or procuring agency, or both, reserve the right to perform any of the inspections set forth herein where such inspections are deemed necessary to assure suppliers and services conform to prescribed requirements.

4.2 Classification of Tests:

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

4.3 Qualification Tests:

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

a. Examination of product: 4.6.1
b. Immersion test: 4.5.3
c. Proof pressure: 4.6.2
d. Extreme temperature: 4.6.3
e. Leakage: 4.6.4
f. Vacuum: 4.6.5
g. Surge flow: 4.6.6
h. Vibration: 4.6.7
i. Relief valve operation: 4.6.8
j. Endurance: 4.6.9
k. Operating and separating force: 4.6.10
l. Spillage: 4.6.11
m. Air inclusion: 4.6.12
n. Impact: 4.6.13
o. Pressure drop: 4.6.14
p. Sand and dust/salt fog: 4.6.15
q. Burst pressure: 4.6.16

4.4 Acceptance Tests:

The acceptance tests shall consist of the following tests. Tests are described in 4.7.

a. Examination of product: 4.7.1
b. Leakage: 4.7.2
c. Operation: 4.7.3
d. Relief valve: 4.7.4

4.5 Test Conditions:

4.5.1 Test Fluid: Unless otherwise specified, the fluid for qualification testing shall be fluids as specified by the slash sheet.

4.5.2 Temperature: Unless otherwise specified, the tests shall be conducted at a room temperature of 70 to 90 °F, with a fluid temperature of 70 to 110 °F, as measured within 12 in of the test sample. The actual fluid temperature during the tests shall be recorded in the test reports.

4.5.3 Immersion: The couplings shall be immersed continuously in the specified fluid for a period of 72 h at a maximum specified temperature prior to conducting the qualification tests. All internal parts of the coupling shall be in contact with the fluid during this immersion. After the 72-h 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 configuration, envelope, mounting requirements, interface dimensions, and applicable dimensional tolerances. Record dry weight. Visually check finish and material usage.

4.6.2 Proof Pressure: The coupled coupling and the uncoupled halves shall be subjected to a proof pressure per the appropriate slash sheet for a period of 5 min. There shall be no leakage greater than specified, nor any permanent distortion or other malfunctioning of the coupling. The coupling shall couple and uncouple normally and seal fluid as required after being subjected to this test.

4.6.3 Extreme Temperature Functioning:

4.6.3.1 Procedure: Utilizing the configuration of Figure 3 with one connected coupling, place the coupling inside the thermal chamber. Perform each of the following tests.

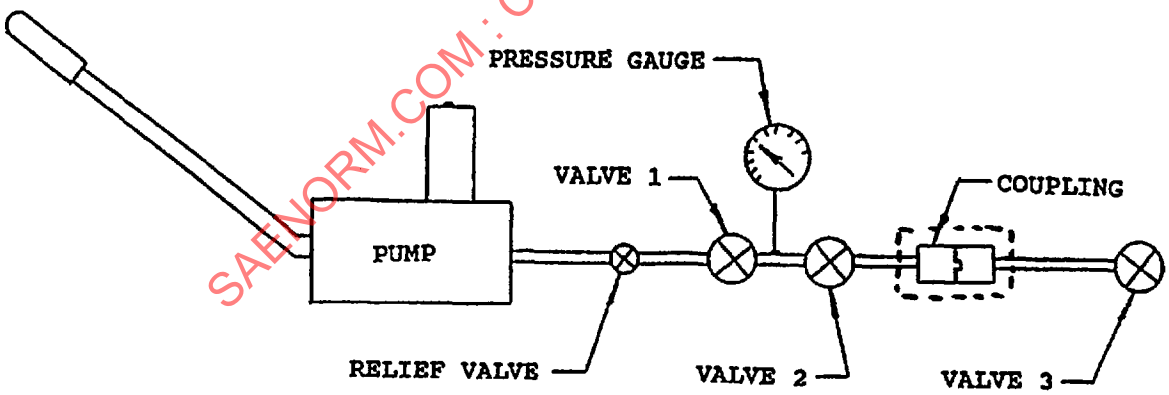


FIGURE 3 - Extreme Temperature Setup

4.6.3.2 High Temperature: Close valve 3 (valves 1 and 2 open). Using the hand pump, increase the pressure to maximum operating pressure. Increase the chamber temperature to 220 °F and maintain this temperature (and pressure) for 6 h. Reduce pressure to a pressure 10 psig less than the minimum relief valve cracking pressure on the appropriate slash sheet and disconnect the coupling. Increase pressure to maximum operating pressure. Maintain pressure and temperature for 5 min. Reconnect the coupling, maintain pressure and temperature for 5 min. Repeat for 9 more cycles while noting any leakage. Turn off the chamber oven and allow the setup to cool to room temperature. While maintaining maximum operating pressure, examine the coupling for any leaks and document the location and amount of liquid dispensed. Proof pressure test per 4.6.2.

Disconnect the coupling while pressurized to 20 psig less than operating pressure and place the coupling halves in the oven. Dwell at 220 °F for 4 h. Reconnect couplings and pressurize to maximum operating pressure. Record any leakage. Allow coupling to cool to room temperature. Proof pressure test per 4.6.2.

4.6.3.3 Low Temperature: After the completion of the high temperature tests, the coupling while connected and pressurized to maximum operating pressure shall be subjected to a temperature of -40 °F for a period of 4 h after stabilization. There shall be no measurable leakage from the coupled test unit during this period. At the end of the 4-h period, at least 10 cycles of connect/disconnect shall be completed. The pressure may be reduced to 10 psi less than the actual relief valve cracking pressure during the connect and disconnecting. There shall be no binding during any cycle of disconnect/connect. The uncoupled halves shall be subjected to the leakage at low pressure test and then at high pressure test per 4.6.4. It will be satisfactory for the temperature to rise to 0 °F during the process.

4.6.4 Leakage:

4.6.4.1 Leakage at Low Pressure: All external surfaces shall be dry at the beginning of this test. The coupled assembly and the uncoupled halves shall be subjected to an internal pressure equal to a head of 30 in of test fluid for 12 min. A waiting period of 2 min shall be allowed for the leakage rate to become constant from the uncoupled halves. Following this waiting period, leakage shall be measured for the next 10 min.

4.6.4.2 Leakage at High Pressure: All external surfaces shall be dry at the beginning of this test. The coupled and uncoupled halves shall be subjected to a test fluid pressure equal to the applicable rated pressure for 15 min.

This test will be conducted at 100 psig for relief valve units.

4.6.5 Vacuum: A vacuum shall be applied to the coupled and uncoupled halves equivalent to 10 in Hg absolute. When the correct pressure has been attained, the lines shall be closed for a period of 5 min.

4.6.6 Surge Flow: The couplings shall be subjected to flow for 3 s minimum duration in each direction and flow rate as specified in the applicable slash sheet. This surge flow pattern shall be repeated 100 times. The disconnected halves shall be subjected to the leakage tests 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 tests, 15 psig pressure shall be applied. The vibration testing shall be per Figures 4 and 5.

4.6.7.1 Resonance:

4.6.7.1.1 Resonance Search: The coupled assembly and the uncoupled halves shall be pressurized to 100 psig pressure and a resonance search conducted, in direction 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 coupling 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 Figure 4. 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 the resonant frequency occurs during the test, its time of occurrence shall be recorded and the frequency shall be adjusted immediately to maintain the peak resonance condition. The final resonant frequency shall be recorded.

4.6.7.2 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 Figure 4. Sweep time shall be 20 min for 5 to 2000 to 5 Hz.

4.6.8 Relief Valve Operation: Gradually pressurize the uncoupled module half until relief valve cracks open and record the pressure. Reduce pressure to 50 psig and record any leakage over a 15 min period.

4.6.9 Endurance: The couplings shall be subjected to 1000 connect/disconnect operational cycles. During each operation, 100 psig shall be applied to each half of the coupling. The first 500 connections shall be at the maximum radial misalignment and same radial alignment for the applicable slash sheet, and the remainder at nominal. 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 as specified in the applicable slash sheet. There shall be no external leakage.

4.6.10 Operation and Separating Force:

NOTE: The assembly shall be installed in a system capable of accommodating some fluid displacement without pressure rise, unless relief valves are required.

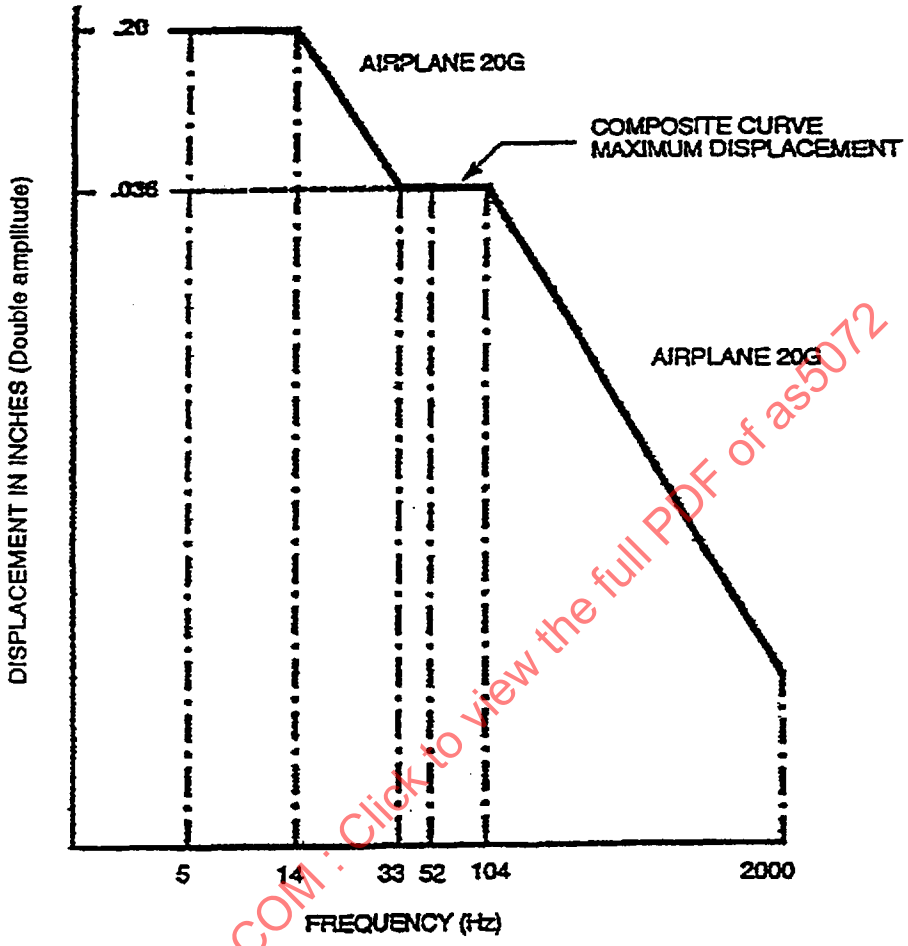


FIGURE 4 - Composite Vibration Test Curve

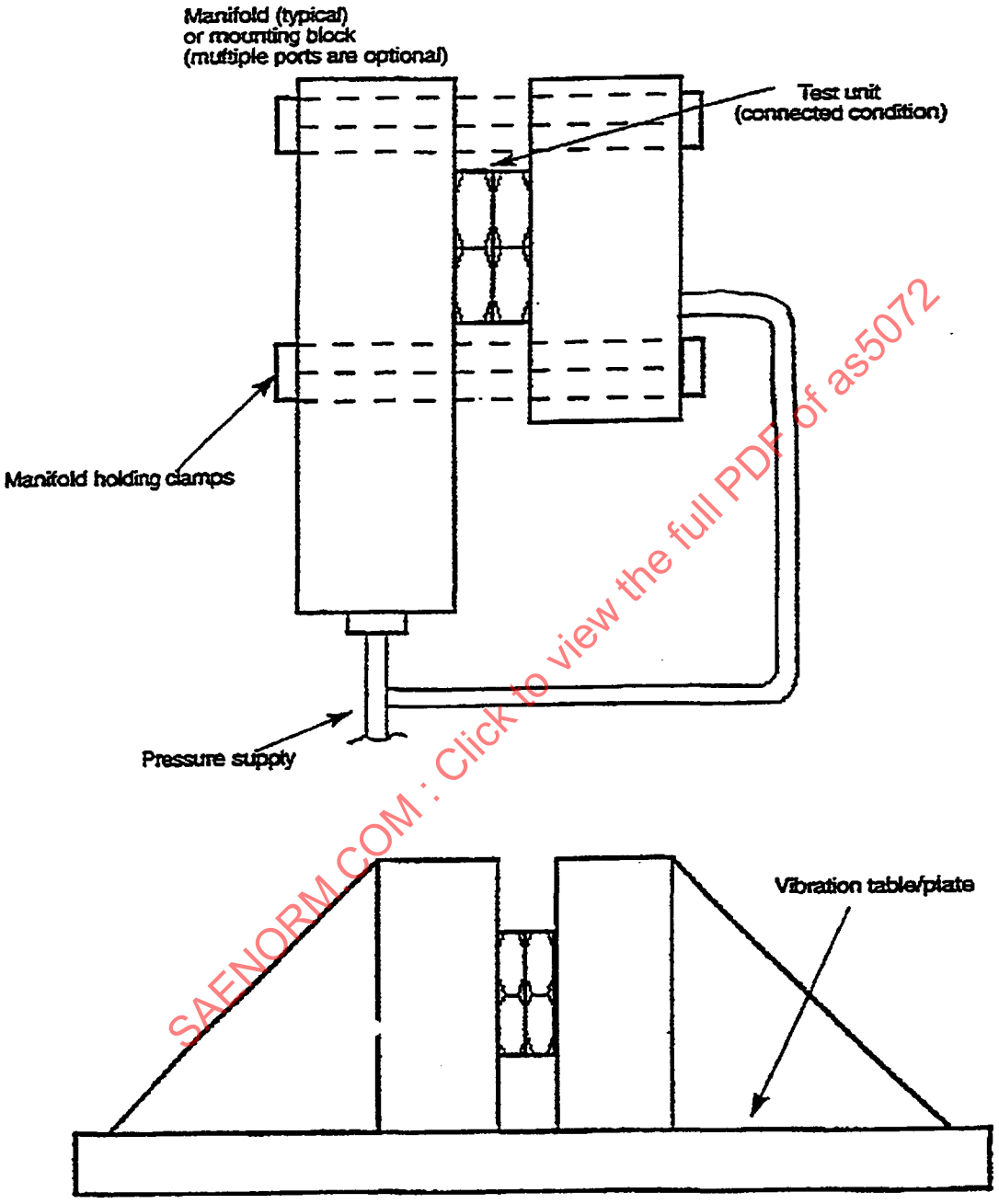


FIGURE 5 - Vibration Test Setup