INCH-POUND
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SUPERSEDING
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2 August 1971
(see 6.9)

MILITARY SPECIFICATION

MOUNTS, RESILIENT: TYPES 6E100, 6E150, 7E450, 6E900, 6E2000, 5E3500, 6E100BB, 6E150BB, 7E450BB, AND 6E900BB

This specification is approved for use by the Naval Sea Systems Command, Department of the Navy, and is available for use by all departments and agencies of the Department of Defense

1. SCOPE

1.1 Scope. This specification covers the Naval Ship Research and Development Center types of rubber resilient mounts together with tests for evaluating the rubber compounds and the completely assembled mounts.

1.2 Classification.

1.2.1 The resilient mounts shall be in a accordance with Drawing 803-1385778 and shall be furnished in the following types as specified (see 6.2):

6E100 (load capacity of 50 to 100 pounds)
6E150 (load capacity of 100 to 150 pounds)
7E450 (load capacity of 150 to 450 pounds)
6E900 (load capacity of 400 to 900 pounds)
6E2000 (load capacity of 700 to 2000 pounds)
5E3500 (load capacity of 2000 to 3500 pounds)
6E100BB (load capacity of 50 to 100 pounds)
6E150BB (load capacity of 100 to 150 pounds)
7E450BB (load capacity of 150 to 450 pounds)
6E900BB (load capacity of 400 to 900 pounds)

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Sea Systems Command, SEA 55Z3, Department of the Navy, Washington, DC 20362-5101 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 5340

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1.2.1.1 The numbers and letters in the type designation denote the following

First number	–	Denotes the resonance frequency (hertz) in the axial direction at upper rated load
Letter E	–	Denotes the mount design activity (Naval Ship Research and Development Center)
Last number	–	Denotes the upper load rating (pounds)
Letters BB	–	Denotes that the mount is designed in a back-to-back configuration

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. The following specifications and standards form a part of this document to the extent specified herein Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

FEDERAL

PPP-F-320	Fiberboard· Corrugated and Solid Sheet Stock (Contain Grade) and Cut Shapes
QQ-S-781	Strapping, Steel, and Seals

MILITARY

MIL-P-116	Preservation, Methods of
MIL-L-19140	Lumber and Plywood, Fire Retardant Treated

STANDARDS

MILITARY

MIL-STD-407	Visual Inspection Guide for Rubber Molded Items
MIL-STD-1186	Cushioning, Anchoring, Bracing, Blocking, and Waterproofing, with Appropriate Test Methods
MIL-STD-2073/1	DOD Material Procedures for Development and Application of Packaging Requirements

(Unless otherwise indicated, copies of federal and military specifications and standards are available from the Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.1.2 Other Government drawing. The following other Government drawing forms a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

DRAWING

NAVAL SEA SYSTEMS COMMAND (NAVSEA)

803-1385778	Mount, Resilient, EES Type

(Copies of drawing required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity)

2.2 Non-Government publications. The following documents form a part of this specification to the extent specified herein Unless otherwise specified, the issues of the documents which are DOD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

D 395	Standard Test Methods for Rubber Property – Compression Set; (DOD adopted)
D 412	Standard Test Methods for Rubber Properties in Tension, (DOD adopted)
D 429	Standard Test Methods for Rubber Property – Adhesion to Rigid Substrates; (DOD adopted)
D 471	Standard Test Method for Rubber Property – Effect of Liquids
D 573	Standard Test Method for Rubber – Deterioration in an Air Oven, (DOD adopted)
D 792	Standard Test Methods for Specific Gravity and Density of Plastics by Displacement

D 1005	Measurement of Dry-film Thickness of Organic Coatings Using Micrometers, Standard Test Methods for, (DOD adopted)
D 1149	Standard Test Method for Rubber Deterioration – Surface Ozone Cracking in a Chamber (Flat Specimen)
D 1186	Standard Methods for Nondestructive Measurement of Dry Film Thickness of Non-Magnetic Coatings Applied to a Ferrous Base, (DOD adopted)
D 1229	Standard Test Method for Rubber Property – Compression Set at Low Temperatures, (DOD adopted)
D 1400	Nondestructive Measurement of Dry Film Thickness of Nonconductive Coatings Applied to a Nonferrous Metal Base, Standard Test Method for
D 2231	Standard Test Method for Evaporation Residue of Naphthalene
D 2240	Standard Test Method for Rubber Property – Durometer Hardness
D 3951	Standard Practice for Commercial Packaging

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

ACOUSTICAL SOCIETY OF AMERICA

ASA 31	Experimental Determination of Mechanical Mobility Part I: Basic Definitions and Transducers, Methods for
ASA 32	Experimental Determination of Mechanical Mobility Part II: Measurement Using Single-Point Translational Excitation, Methods for

(Applications for copies should be addressed to the Acoustical Society of America, 335 East 45th Street, New York, NY 10017.)

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO 2856	Elastomers – General Requirements for Dynamic Testing Second Edition

(Applications for copies should be addressed to the International Organization for Standardization, 1 rue de Varemde, Geneve, Switzerland.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 **Order of precedence.** In the event of a conflict between the text of this document and the references cited herein (except for associated detail specifications, specification sheets or MS standards), the text of this specification takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 **Qualification.** The mounts furnished under this specification shall be products which are authorized by the qualified activity for applicable qualified products list at the time of award of contract (see 4.3 and 6.3).

3.2 **Definitions.** Definitions for axial direction and radial direction shall be as follows:

3.2.1 **Axial direction.** Tests specified in the axial direction shall be interpreted to mean a direction which is parallel to the center bolt axis of the mount. When the mount is in service, the axial direction is normally the vertical direction

3.2.2 **Radial direction.** Tests specified in the radial direction shall be interpreted to mean a direction which is perpendicular to the center bolt axis of the mount. When the mount is in service, the radial direction is normally the horizontal direction.

3.3 **Materials.** Materials shall be as follows

3.3.1 **Metal.** The metal components of the mounts shall be of material equivalent to that specified on the drawings for the mounts. The contracting activity shall specify (see 6.2) whether the mounts are to be manufactured from steel or manganese bronze as shown on Drawing 803-1385778 The metal components for the mounts shall be formed to shape and finished in accordance with the dimensions and allowable tolerances specified by the applicable mount drawing.

3.3.2 **Rubber.**

3.3.2.1 **Resilient element.** The resilient elements of the 7E450, 6E900, 6E2000, 7E450BB, and 6E900BB mounts shall be fabricated of oil resistant compounds utilizing polymerized chloroprene (see 6.4) as the basic material. The resilient elements of the 6E100, 6E150, 5E3500, 6E100BB, and 6E150BB mounts shall be molded from compounds using natural rubber (see 6.4) as the basic material The natural rubber components shall be coated with an oil-ozone resistant compound (see 6 5) Coating of the mounts may be accomplished by, but is not limited to, dipping, painting, or spraying The mounts shall be molded to the specified form as shown on Drawing 803-1385778.

3.3.2.1.1 Porosity and delamination. The rubber elements of the furnished mounts shall have no delamination, air pockets, or porosity in any portion when tested in accordance with 4.6.17.

3.3.2.1.2 Bond. The rubber elements shall be bonded to the metal components as specified on Drawing 803-1385778.

3.3.2.1.3 Surface condition. There shall be no backrinding nor blisters on the outer surfaces of the rubber elements of the finished mounts.

3.3.2.1.4 Physical requirements.

3.3.2.1.4.1 Rubber compounds. The vulcanized rubber compounds used in the resilient elements of the mounts shall be in accordance with the physical requirements specified in table I

3.3.2.1.4.2 Hardness. The hardness of the rubber compounds used in the resilient elements shall be determined in accordance with 4 6.10. The hardness found during qualification inspection of the mount compounds shall be recorded as a requirement with a tolerance of plus or minus 5 points for subsequent quality conformance testing of the mount compounds.

3.3.2.1.4.3 Specific gravity. The specific gravity of the rubber compounds used for the resilient elements shall be determined in accordance with 4.6.11. The specific gravity found during qualification inspection of the mount compounds shall be recorded as a requirement with a tolerance of plus or minus 0 02 for subsequent quality conformance testing of the mount compounds.

3.3.2.1.4.2 Hardness. The hardness of the rubber compounds used in the resilient elements shall be determined in accordance with 4 6.10. The hardness found during qualification inspection of the mount compounds shall be recorded as a requirement with a tolerance of plus or minus 5 points for subsequent quality conformance testing of the mount compounds.

3.3.2.1.4.3 Specific gravity. The specific gravity of the rubber compounds used for the resilient elements shall be determined in accordance with 4.6.11. The specific gravity found during qualification inspection of the mount compounds shall be recorded as a requirement with a tolerance of plus or minus 0.02 for subsequent quality conformance testing of the mount compounds.

TABLE I *Physical requirements for rubber compounds*

	Resilient elements				
	Type 6E100, 6E100BB mounts	Type 6E150, 5E3500, 6E150BB mounts	Type 7E450BB mounts	Type 6E900, 6E900BB, 6E2000 mounts	Test method
Tensile strength (min), lb/in^2					
Before aging	2200	3200	2200	2500	4.6.2
After aging 46 hours at 194 °F	2100	2600	2100	2400	4.6.4
Elongation at break (min), percent					
Before aging	550	500	600	600	4.6.2
After aging 46 hours at 194 °F	500	450	550	550	4.6.4
Compression set (max), percent after aging 46 hours at 194 °F	30	35	37	37	4.6.3.1
Cold compression set (max), percent	20	20	50	60	4.6.3.2
Volume change in oil (max), percent	-	-	15	15	4.6.5.1
Adhesion of rubber to metal (min), lb/in^2	400	500	450	500	4.6.6.1

3.3.2.1.4.4 Oil-ozone resistant coating. The oil-ozone resistant coating shall be in accordance with the physical requirements specified in table II (see 6.5)

TABLE II. *Physical requirements for oil-resistant coating*

Property	Requirement	Test
Properties of dried film		
Tensile strength (min), lb/in^2	2000	4.6.2
Elongation at break (min), percent	400	4.6.2
Properties of coated test specimens		
Volume change (max) after immersion in oil at 158 °F for 70 hours, percent	5	4.6.5.2
Adhesion of coating		
Before immersion in oil	No failures	4.6.6.2
After immersion in oil at 158 °F	No failures	4.6.6.2
Ozone resistance after 1 week at 104 °F in air containing 100 pphm ozone	No cracks	4.6.7
Flexibility of coating after flexing for 6 cycles to 100 percent elongation	No cracks	4.6.8
Properties of coated mount		
Appearance	Shall be dry and tack free and free from blisters or other imperfections	4.4.3.1.2
Film thickness (min) on rubber element as measured on coated metal, inch	0.003	4.6.9

3.3.3 **Protective treatment.** The metal components and elastomers used in the mounts shall be resistant to or protected against corrosion by seawater, oil, ozone, or other atmospheric conditions encountered in service. Unless otherwise specified (see 6.2), the coating on the metal shall be equivalent to that specified on Drawing 803-1385778 and shall have a minimum dry film thickness of 0.006 inch.

3.4 **Requirements for the finished mounts.**

3.4.1 **Dynamic stiffness.** The dynamic stiffness and resonant frequency of the mounts, when tested in the axial direction in accordance with 4.6.12, shall be within the specified limits of table III.

TABLE III. *Axial dynamic stiffness and resonant frequency requirements at various loads*

Mount	Requirement-limits		
	Test load (lb)	Resonant frequency (Hz)	Dynamic stiffness (lb/in)
6E100	50	7.6 – 8.8	294 – 395
	70	6.2 – 7.5	274 – 402
	85	5.6 – 6.8	271 – 401
	100	5.3 – 6.6	286 – 444
6E150	100	5.7 – 7.7	331 – 605
	120	5.2 – 7.1	330 – 617
	135	4.7 – 6.7	304 – 618
	150	4.4 – 6.3	296 – 607
7E450	150	7.2 – 9.1	793 – 1267
	250	6.2 – 8.2	980 – 1715
	350	6.1 – 7.7	1310 – 2123
	450	6.0 – 7.5	1625 – 2582
6E900	400	5.0 – 7.0	1020 – 1999
	540	5.0 – 7.0	1377 – 2699
	720	5.0 – 7.0	1836 – 3599
	900	5.0 – 7.0	2295 – 4498
6E2000	700	5.0 – 7.0	1785 – 3499
	1150	5.0 – 7.0	2932 – 5748
	1600	5.0 – 7.0	4080 – 7997
	2000	5.0 – 7.0	5100 – 9996
5E3500	2000	4.0 – 6.0	3264 – 7344
	2500	4.0 – 6.0	4080 – 9180
	3000	4.0 – 6.0	4896 – 11016
	3500	4.0 – 6.0	5712 – 12852
6E100BB	50	7.6 – 10.2	294 – 531
	70	6.6 – 9.0	311 – 578
	85	5.9 – 7.9	301 – 541
	100	5.6 – 7.6	319 – 589
6E150BB	100	6.9 – 9.3	485 – 882
	120	6.3 – 8.6	485 – 905
	135	6.0 – 8.2	495 – 925
	150	5.7 – 7.7	497 – 907
74E450BB	150	6.5 – 9.1	646 – 1267
	250	6.5 – 8.5	1077 – 1842
	350	6.5 – 8.5	1487 – 2610
	450	6.5 – 8.5	1939 – 3316
6E900BB	400	5.0 – 7.5	1020 – 2295
	450	5.0 – 7.5	1377 – 3098
	720	5.0 – 7.5	1836 – 4131
	900	5.0 – 7.5	2295 – 5164

3.4.2 **Deflection at rated load.** The deflections of the mounts, when tested in the axial direction at their respective rated loads in accordance with 4.6.13, shall be within the specified limits of table IV and shall not show any break or separation between component parts

TABLE IV. *Deflection at rated load*

Mount	Test load (lb)	Deflection (inch)	
		Minimum	Maximum
6E100	100	0.20	0.35
6E150	150	0.22	0.37
7E450	450	0.26	0.44
6E900	900	0.37	0.62
6E2000	2000	0.40	0.68
5E3500	3500	0.46	0.56
6E100BB	100	0.34	0.56
6E150BB	150	0.25	0.42
7E450BB	450	0.41	0.69
6E900BB	900	0.52	0.88

3.4.3 **Quality of the rubber to metal bond.** Mounts, when tested in accordance with 4.6.14, shall show no breaks, cracks, or tears in the rubber elements or evidence of delamination at rubber to metal bond interfaces.

3.4.4 **Strength.** Mounts, when tested in the axial direction in accordance with 4.6.15.1 or in the radial direction in accordance with 4.6.15.2 shall not show any separation or break between the parts nor any permanent deformation of the metal parts in excess of 1/32 inch.

3.4.5 **Drift.** Mounts, when tested in accordance with 4.6.16, shall not exceed the drift requirements of table V. There shall be no failure of the resilient element, rubber to metal bond, or metal parts during the tests. At the end of testing, the dynamic stiffness and resonant frequency of each mount shall not exceed the requirements specified in table III.

TABLE V. *Drift requirements.*

Mount	Drift (max) inches
6E100	0.025
6E150	0.025
7E450	0.050
6E900	0.060
6E2000	0.080
5E3500	0.035
6E100BB	0.025
6E150BB	0.025
7E450BB	0.050
6E900BB	0.060

3.4.6 **Fatigue.** Mounts, when tested in accordance with 4.6 17, shall withstand 500,000 cycles of fatigue loading without any signs of failure or deterioration in the resilient element, rubber to metal bond, oil-ozone resistant coating, or metal components.

3.4.7 **Porosity and delamination.** The resilient elements of the mounts, when tested and examined in accordance with 4 6.8, shall show no evidence of porosity in the rubber nor separation of the rubber into distinct layers or laminations

3.5 **Identification.** Each mount shall be identified with the applicable markings specified on Drawing 803-1385778

3.6 **Mount design.** Each mount shall be in accordance with the applicable details shown on Drawing 803-1385778.

4. QUALITY ASSURANCE PROVISIONS

4.1 **Responsibility for inspection.** Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements

4.1.1 **Responsibility for compliance.** All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program (see 6.2). The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of the manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.2 **Classification of inspections.** The inspection requirements specified herein are classified as follows:

a. Qualification inspection (see 4.3)
b. Quality conformance inspection (see 4.4).

4.3 **Qualification inspection.** Qualification inspection shall be conducted at a laboratory satisfactory to NAVSEA (see 6.3) on sample units as specified herein. Qualification inspection shall be monitored by a Defense Contract Administration Inspector.

4.3.1 Samples for qualification inspection.

4.3.1.1 Rubber samples. For the tests specified in 4.3.2, the samples listed in table VI shall be provided.

TABLE VI *Rubber samples for qualification*

Quantity	Type of rubber compound	Sample description	Size of sample (inches)	Property to be measured
3	Resilient element	Sheet	0 08 ± 0 01 × 6 × 6	Tensile strength and ultimate elongation (initial and aged) Specific gravity
3	Resilient element	Sheet[1]	0 08 ± 0 01 × 1 × 2	Resistance to oil, volume change
3	Resilient element	Specimen covered with oil-resistant coating[2]	0 08 ± 0 01 × 1 × 2	Resistance to oil, volume change
3	Resilient element	Specimen covered with oil-resistant	0 08 ± 0 01 × 1 × 1 × 6	Ozone resistance, adhesion, and flexibility of coating
3	Resilient element	ASTM D 429 Method A specimen	–	Rubber-metal adhesion
4	Resilient element	Cylinder	0 50 ± 0 02 height × 1 14 ± 0 02 diameter	Compression set and hardness
1	Oil-resistant coating	Sheet	0 006 ± 0.003 x 6 x 6	Tensile strength and ultimate elongation

[1]Uncoated resilient element sheet specimens for 7F450, 6E900, 6E2000, 7E450BB, and 6E900BB mounts only
[2]Resilient element specimens covered with oil-resistant coating for 6E100, 6E150, 5E3500, 6E100BB, and 6E150BB mounts only

4.3.1.2 Mount samples. If the rubber samples listed in table VI meet the requirements herein, the contractor shall then conduct the tests specified in 4.3.3 using four mounts of each type manufactured from the compounds represented by the rubber samples.

4.3.2 Qualification inspection on rubber samples.

4.3.2.1 **Uncoated rubber samples.** The uncoated rubber samples specified in 4.3.1.1 shall be subjected to the following tests

Test	Requirement	Inspection
Initial tensile strength	Table I	4.6.2
Initial ultimate elongation	Table I	4.6.2
Tensile strength after oven aging	Table I	4.6.2 and 4.6.4
Ultimate elongation after oven aging	Table I	4.6.2 and 4.6.4
Compression set after oven aging	Table I	4.6.3.1
Cold compression set	Table I	4.6.3.2
Resistance to oil[1]	Table I	4.6.5.1
Adhesion to metal	Table I	4.6.6.1
Ozone resistance[1]	–	4.6.7
Hardness	3.3.2.1.4.2	4.6.10
Specific gravity	3.3.2.1.4.3	4.6.11

4.3.2.2 **Oil-ozone resistant coating.** The oil-ozone resistant coating samples specified in 4.3.1.1 shall be subjected to the following tests:

Test	Requirement	Inspection
Tensile strength of dried film	Table II	4.6.2
Ultimate elongation of dried film	Table II	4.6.2
Swelling of coated rubber sample[2]	Table II	4.6.5.2
Adhesion of coating[2]	Table II	4.6.6.2
Ozone resistance[2]	Table II	4.6.7
Flexibility of coating[2]	Table II	4.6.8

4.3.3 **Qualification inspection of the finished mounts.**

4.3.3.1 Two mounts of each type specified in 4.3.1.2 shall be subjected to the following examination and tests:

Test	Requirement	Inspection
Examination	–	4.4.3.1
Film thickness of oil-ozone resistant coating	Table II	4.6.9
Dynamic stiffness and resonant frequency	3.4.1	4.6.12
Deflection at rated load	3.4.2	4.6.13
Quality of rubber-to-metal bond	3.4.3	4.6.14
Strength, axial	3.4.4	4.6.15.1
Strength, radial	3.4.4	4.6.15.2

[1] 7E450, 6E900, 6E2000, 7E450BB, and 6E900BB mounts only
[2] 6E100, 6E150, 5E3500, 6E100BB, and 6E150BB mounts only

4.3.3.2 The remaining two mounts of each type specified in 4.3.1.2 shall be subjected to the following examination and tests

Test	Requirement	Inspection
Examination	–	4.4.3.1
Dynamic stiffness and resonant frequency	3.4.1	4.6.12
Deflection at rated load	3.4.2	4.6.13
Quality of rubber-to-metal bond	3.4.3	4.6.14
Drift	3.4.5	4.6.16
Fatigue	3.4.6	4.6.17
Porosity and delamination	3.4.7	4.6.18

4.4 **Quality conformance inspection.** Quality conformance inspection shall consist of the examination and the tests of sample units as specified herein. Quality conformance inspection shall be monitored by a Defense Contract Administration Inspector (see 6.2).

4.4.1 **Lot.** For the purpose of quality conformance inspection and sampling, a production lot shall consist of all the mounts of one type, design, and load rating produced in the same facility under the same conditions with the same materials and being offered for delivery at one time. A lot serial number shall be assigned to each mount The lot serial number shall not be repeated in any one quarter. The serial number shall be traceable to the mount rubber batch numbers, the manufacturing and process records against which the mounts were manufactured, and all quality conformance requirements as required by this specification The lot serial number shall be specified on all shipping documents sent to the receiving facility, as well as on all package and shipping containers.

4.4.2 **Samples and tests for quality conformance inspection.**

4.4.2.1 **Rubber compound samples.** As specified in table VII, samples shall be provided from each batch of rubber stock which is mixed for manufacture of the mounts in the lot. The samples shall be certified to be of the same material and equivalent cure as the corresponding components in the lot of finished mounts offered for delivery.

TABLE VII. *Rubber samples for quality conformance*

Quantity	Type of rubber compound	Description of sample	Size of sample (inch)	Property to be measured
2	Resilient element	Sheet	0.08 ± 0.01 × 6 × 6	Tensile strength and ultimate elongation Specific gravity
1	Resilient element	Slab or disc	0.5 thick	Hardness

4.4.2.2 Quality conformance tests on rubber samples. Samples as specified in 4 4 2 1 shall be subjected to the tests of 4 6 2, 4 6.10, and 4.6.11.

4.4.2.3 Rejection. If any samples tested in accordance with 4 4 2.2 fail to meet the test requirements of table I, all mounts in the lot represented by the samples shall be rejected

4.4.3 Quality conformance inspection on mounts.

4.4.3.1 Visual and dimensional examination.

4.4.3.1.1 Sampling for visual and dimensional examination. As a minimum, the contractor shall select a sample quantity of mounts in accordance with Table VIII and inspect them in accordance with 4.4.3 1.2 Classification of defects is shown in Table IX If one or more defects is found in any sample, the entire lot shall be rejected The contractor has the option of screening 100 percent of the rejected lot for all specified attributes, or providing a new lot, which shall be inspected in accordance with the sampling plan.

TABLE VIII *Sampling for visual and dimensional examination*

Lot size	Sample size	
	Major defects	Minor defects
90 and under	8	5
91 to 280	12	7
281 to 500	16	9
501 to 1,200	19	11
1,201 to 3,200	23	13
3,201 to 10,000	29	15

4.4.3.1.2 Procedure for visual and dimensional examination. Each of the mounts selected in accordance with table VIII shall be visually and dimensionally examined for the defects listed in table IX and to verify compliance with this specification. MIL-STD-407 shall be used to determine and evaluate defects through visual examination.

4.4.3.2 Quality conformance tests on mounts.

4.4.3.2.1 Tests to be performed on sampling of mounts.

4.4.3.2.1.1. Sampling. As a minimum, the contractor shall select a sample quantity of mounts in accordance with table X and subject each mount in the sample to the test specified in table XI. If one or more defects are found in any sample, the entire lot shall be rejected. The contractor has the option of screening 100 percent of the rejected lot for the defect(s) found or providing a new lot which shall be inspected in accordance with the sampling plan.

TABLE IX *Classification of defects.*

Category	Defects
Critical:	
1	None defined in this table
Major:	
101	Evidence of use of unauthorized materials
102	Resilient elements not molded to specified form on drawing
103	Evidence of delamination or air pockets in rubber elements of finished product
104	Rubber elements not bonded to metal components in accordance with drawing
105	Evidence of backrinding and blisters on outer surface of rubber elements
106	Evidence of tackiness or non-drying of the oil resistant coating
107	Metal components not protected from corrosion by seawater or spray or other atmospheric conditions encountered in service
108	Dimension, length, width and height, and configuration not in accordance with drawing
109	Any other defect which would affect the serviceability of the mounts
Minor:	
201	Identification marking not in accordance with drawing
202	Burrs, rough edges, and sharp corners not removed
203	Any other defect which would not affect the serviceability of the mount

TABLE X. *Sampling for quality conformance tests.*

Lot size	Sample size
15 and under	5
16 to 25	7
26 to 90	8
91 to 150	13
151 to 280	20
281 to 500	29
501 to 1,200	34
1,201 to 3,200	42
3,201 to 10,000	68

4.4.3.2.1.2 Tests to be performed. Each of the samples selected in accordance with 4.4.3.2.1.1 shall be subjected to the tests specified in table XI.

TABLE XI. *Quality conformance tests.*

Test[1]	Requirement	Test
Thickness of oil-resistant film	Table II	4 6.9
Dynamic stiffness	3 4 1	4 6 12
Deflection at rated load	3 4 2	4.6 13
Quality of rubber to metal bond	3 4 3	4.6 14

[1]Listed in sequence of performance

4.5 **Confirmation of quality.** When deemed necessary by NAVSEA or the inspector, samples of the mounts shall be taken from the contractor and forwarded to a laboratory satisfactory to NAVSEA. These samples shall be subjected to any test considered necessary by NAVSEA to determine that the samples are equal to the samples upon which qualification was based. If an unsatisfactory test result is obtained, NAVSEA will notify the contractor and take appropriate action to ensure that only quality components are provided for Navy use

4.6 **Test methods.**

4.6.1 **Standard test conditions.** Unless otherwise specified, all tests shall be made within an ambient temperature range of 65 to 89 degrees Fahrenheit (F)

4.6.2 **Tensile and ultimate elongation tests.** Tensile strength and ultimate elongation tests shall be conducted on the resilient element rubber compounds and the 0.006 inch thick coating film in accordance with ASTM D 412. Die C test specimens shall be used. Tensile strength and elongations of the rubber compounds and the coatings shall meet the requirements of tables I and II.

4.6.3 **Compression set.**

4.6.3.1 **Compression set after aging.** Compression set shall be determined in accordance with ASTM D 395 method B, except oven aging conditions shall be 194 ± 2 °F for 46 ± 1/4-hours.

4.6.3.2 **Cold compression set.** Cold compression set shall be determined in accordance with ASTM D 1229, except the exposure shall be 30 ± 2 °F for 94 ± 1/2-hour. Compression set shall be determined 30 minutes after release from compression.

4.6.4 **Oven aging test.** Specimens for tensile, ultimate elongation, and compression set tests shall be oven aged in accordance with ASTM D 573 at a temperature of 194 ± 2 °F for 46 ± 1/4-hours. Final determination of aged tensile and ultimate elongation specimens shall be made not less than 16 hours nor more than 48 hours after removal from the oven. Tensile and ultimate elongation tests on unaged specimens shall be made immediately prior to, and on the same machine as, the tensile tests on the oven aged specimens (see 4.6.2).

4.6.5 **Swelling in oil.**

4.6.5.1 **Volume change in oil (uncoated rubber compounds).** Volume change shall be determined in accordance with ASTM D 471 on uncoated 0.08 by 1 by 2 inch specimens as described in table VI. The specimen shall be immersed in reference oil No. 3 of ASTM D 471. The immersion period shall be 46 ± 1/4-hours at 73 ± 2 °F.

4.6.5.2 **Volume change in oil (coated samples).** Volume change in oil shall be determined in accordance with ASTM D 471 on the three coated 0.08 by 1 by 2 inch specimens as described in table VI and the immersion period shall be 70 ± 1/4-hours at 158 ± 2 °F The specimen shall be immersed in reference oil No. 3 of ASTM D 471.

4.6.6 Adhesion tests.

4.6.6.1 Adhesion to metal tests. The adhesion tests shall be in accordance with method A of ASTM D 429. Three specimens of each rubber compound, as described in table VI, shall be tested and the results averaged.

4.6.6.2 Adhesion of coating (coated sample). The adhesion of the oil resistant coating to three 0.08 by 1 by 2 inch samples of the coated rubber specimens (see table VI) shall be determined before and after immersion in oil in accordance with 4.6.5.2 Each coated specimen shall be flexed, elongated by hand, and then visually examined for adhesion failures. The coated specimens shall not exhibit cracks, breaks, tears, or blisters conducive to peeling of the coating by hand either before or after immersion in oil.

4.6.7 Ozone resistance. The ozone resistance of the coated and uncoated resilient components of the mounts shall be determined on two coated 1 by 6 by 0.080 inch thick specimens (see table VI) The specimens shall be elongated to 20 percent extension. A thin layer of melted paraffin wax shall be applied to each of the four surfaces of the stretched specimens in an area not exceeding a 1/4-inch width from the clamps. The stretched specimens shall be conditioned for 16 ± 2 hours at 104 ± 2 °F before being exposed, in accordance with ASTM D 1149. The concentration of ozone shall be 100 ± 10 parts per hundred million (pphm) by volume, the temperature shall be 104 ± 2 °F, and the period of exposure shall be 168 hours. Observation magnification shall be 7X.

4.6.8 Flexibility of the coating. The flexibility of the coated 1 by 6 by 0.080 inch coated rubber specimens specified in table VI shall be determined. Each specimen shall be clamped in a universal test machine and a tensile force applied to elongate the specimen 100 percent at a loading rate of 20 inches per minute. The force shall then be released so that the specimen is no longer elongated. The cycle shall be repeated six times. The coated specimens shall be visually examined and shall exhibit no cracks, breaks, tears, or blisters.

4.6.9 Film thickness of the oil resistant coating. The film thickness of the oil resistant coating as specified in table II shall be measured on the coated steel plates of the mount using a micrometer. The thickness of the steel plate shall be determined before coating and after 0.003 inch of multiple coatings have been applied to the mount. The difference in the two thickness measurements divided by two shall be the file thickness of the oil resistant coating. In lieu of the above procedure, the film thickness may also be measured by using a magnetic type thickness gauge in accordance with ASTM D 1186.

4.6.10 Hardness. The hardness of the 0.50 inch thick specimens representing the rubber components of the mount shall be determined in accordance with ASTM D 2240. A 3-second reading shall be taken to determine conformance with 3.3.2.1.4.2.

4.6.11 Specific gravity. The specific gravity of the rubber compounds used for the mounts shall be determined on specimens cut from 0.08 by 6 by 6 inch sheets in accordance with ASTM D 792. The average of three determinations shall be reported to determine conformance with 3.3.2.1.4.3.

4.6.12 Dynamic stiffness test. Dynamic stiffness shall be measured for each mount in the axial direction at loads specified in table XII to determine conformance with 3.4.1 Type 6E100BB, 6E150BB, 7E450BB, and 6E900BB mounts shall be tested in the zero preload condition. The methods for determining dynamic stiffness of the mounts are classified into two groups, resonant and nonresonant methods. The double amplitude of vibration for each method shall be 0.020 inch from peak to peak. An example of each type is given, but is not limited to, the methods of 4.6.12.1 and 4 6.12.2.

TABLE XII *Loads for testing dynamic stiffness.*

Mount type	Loads, pounds
6E100, 6E100BB	50, 70, 85, and 100
6E150, 6E150BB	100, 120, 135, and 150
7E450, 7E450BB	150, 250, 350, and 450
6E900, 6E900BB	400, 540, 720, and 900
6E2000	700, 1,150, 1,600, and 2,000
5E3500	2,000, 2,500, 3,000, and 35,000

4.6.12.1 Dynamic stiffness and resonance frequency. Either the dynamic stiffness or resonance frequency, at the option of the manufacturer, shall be measured in the axial direction at the appropriate load on mounts without the cushion pads installed to determine conformances with 3 4.1.

4.6.12.1.1 General procedure. There are two basic types of tests for determining these properties: resonant and nonresonant methods. An example of each method is given in paragraph 4.6.12.1.2 and 4.6.12.2 Although the manufacturer is not required to use these exact procedures, his test procedures shall follow the guidelines given in ASTM D 2231 and ISO 2856 and in addition, where mechanical mobility is measured, ASA 31 and ASA 32. In accordance with ASTM D 2231, instrumentation should have the following general characteristics:

a. Adequate sensitivity and resolution for transducers, signal conditioners, and readout instrumentation

b. Adequate dynamic range and signal to noise ratio for the range of specimen stiffnesses to be measured

c. Flat frequency response and good amplitude linearity within the range of measurements

d. Essentially no zero drift or calibration change within the test period

e. Low sensitivity to changes in temperature.

The test machine should be decoupled from the floor with soft mounts where possible to minimize the effect of background vibration on the measurement results. The components of the test machine in series with the specimens should be very stiff to minimize systematic error in the measurement. Where systematic error in the measurement due to machine flexibility exceeds 1%, results should be corrected for this effect (see 4.6.12.2.7). For both resonant and nonresonant tests the measurements shall be conducted using sinusoidal vibration with a displacement amplitude of approximately 0 008 inches (0.2 mm) peak to peak For nonresonant tests the nominal frequency of excitation shall be 6 Hz for all mounts except the 7E450, 7E450BB, and 5E3500 mounts where the nominal shall be 7 Hz and 5 Hz respectively When qualifying the manufacturer shall include a detailed description of his test equipment and procedures used to measure dynamic stiffness or resonance frequency. The Government reserves the right to perform these tests on mounts offered for qualification.

4.6.12.1.2 Resonant methods. Figure 1 shows a typical apparatus for the direct measurement of resonance frequency of a mount. The test load is applied to the mount by weights suspended from a steel rod The system is excited with a electromagnetic shaker and impedance head attached to the bottom of the rod using swept sinusoidal vibration with a sweep rate low enough to achieve quasi-steady-state response. The instrumentation of figure 1 is used to measure the ratio of velocity to force, or mechanical mobility of the system (alternatively the ratio of acceleration to force (accelerance) or displacement to force (dynamic compliance) could be used in lieu of mobility). The fundamental resonance frequency of the system occurs at the lowest frequency corresponding to a maximum in the mobility, accelerance or dynamic compliance ratios as applicable. Because of flexibility in components of the test apparatus that are in series with the mount (test frame, hanger rod, etc.), the system resonance frequency that is measured will be lower than the (true) resonance frequency of the mount-mass system that would be measured with a rigid apparatus. Where such systematic error in measuring resonance frequency exceeds 1%, the measurement must be corrected to determine conformance with 3.4.1 A procedure for obtaining the corrected resonance frequency is given in 4 6.12.2 7. It is noted that for the measurement error to be less than 1% (and not require correction) the static stiffness of the test apparatus must be at least 50 times greater than the dynamic stiffness of the mount being tested In practice most measurements made using the system of Figure 1 to test mounts will require correction since the stiffness of the hanger rod itself, usually the most flexible element of the system, is generally less than 50 times stiffer than the mount. In no case, however, shall measurement systems be used which result in stiffness ratios less than 30

4.6.12.1.3 In lieu of using an impedance head as shown in figure 1, separate force and motion transducers may be used One such system operates in a closed loop mode using the signal from the force transducer to control a shaker and maintain constant input force to the system while conducting the frequency sweep. The frequency at which the signal from the motion transducer is a maximum is considered to be the system resonance frequency The same requirements as in 4.6.12 1.2 apply in determining if correction must be made to the measurements in determining conformance with 3.4.1.)

4.6.12.2 Nonresonant methods. These methods are based on the transmitted force principle and used a linear dynamic model consisting of a paralle combination of an ideal spring and dashpot to represent an elastomeric specimen Although a more exact model includes a mass term, it may be omitted with negligible error for relatively light specimens, stiff load cells and low excitation frequencies. The method requires the measurement of two independent quantities: the sinusoidal displacement or velocity across the specimen and the resulting force transmitted through the specimen as well as the phase relationship between them A commonly used type of equipment for conducting such measurements is the closed-loop servohydraulic test machine shown schematically in figure 2. The machine consists of a load frame, hydraulic actuator, load cell, and associated hydraulic and electronic components which permits a static load to be applied to a rubber specimen while an oscillatory vibration is superimposed upon it The machine operates in a closed-loop mode utilizing the feedback signal from either the force or motion transducer to control the hydraulic actuator. Tests are usually conducted in the force control mode so that constant load is maintained on the specimen while it creeps. Electronic circuitry controlling the servo valve permits the operator to independently vary the vibration frequency, amplitude and static load applied to the specimen. Dynamic stiffness is calculated from the measured force and displacement signals as follows:

where K = Uncorrected dynamic stiffness of specimen, lb/in (kN/m)
F = Amplitude of sinusoidal force transmitted thru specimen, lbf (kN)
X = Amplitude of sinusoidal displacement applied to specimen, in (m)
ϕ = Phase angle between force and displacement phasors
C = Scaling factor determined by the procedure given in 4.6.12.2.3.

As in the case of resonant testing, flexibility in components of the test apparatus that are in series with the specimen (primarily the load cell and test frame) can result in measured values of dynamic stiffness for the specimen that are lower than if the apparatus were rigid. Where an overall system calibration (which includes machine flexibility) using steel coil springs is not performed (see 4.6.12.2.3) and the basic sensitivities of the transducers are used instead to calculate dynamic stiffness, the measurements must be corrected to determine conformance with 3.4.1 if the systematic error exceeds 1%. Procedures for correcting for such error are given in 4.6.12.2.7). For such systems it is noted that the static stiffness of the test apparatus must be at least 100 times the dynamic stiffness of the specimen in order to limit the error to 1% (and require no correction). Regardless of the type of calibration used, however, measurement systems which result in stiffness ratios less than 30 shall not be used.

4.6.12.2.1 Calibration of test systems. All systems used to conduct resonance frequency or dynamic stiffness measurements shall be calibrated before use. Although the calibrations discussed in this section are combined system calibrations, basic calibrations should be performed on the individual components of the measurement system (transducers, amplifiers, etc.) if difficulties are encountered with the combined system calibration and should in any case be conducted at regular intervals.

4.6.12.2.2 Resonance frequency. For measurement of resonance frequency using mobility methods, the operational calibration procedures given in ASA 31 shall be followed. This method involves driving through the impedance head into a freely suspended mass while utilizing the same gains on the force and acceleration channel as will be used in later measurements. A scaling factor by which the measured mobility or accelerance must be multiplied to obtain the correct value ($1/2\pi fm$ or $1/m$ as appropriate) for the known mass, m, is calculated and applied to subsequent measurements.

4.6.12.2.3 Dynamic stiffness. For measurement of dynamic stiffness using servohydraulic test equipment, overall system calibration shall be performed using steel coil springs of known spring rate. Calibration springs shall be selected on the basis of linear force-deflection properties and shall be used alone or in parallel combinations to produce a spring rate comparable to the dynamic stiffness of the sample to be tested. The procedure is to load the spring(s) to a static load within its linear range and apply a sinusoidal vibration of approximately the same amplitude and frequency as will be used later in testing mount samples Using the same gains as for later measurement on samples, measure transducer signals proportional to the amplitudes of the transmitted force, displacement applied to the specimen and their relative phase. These quantities may then be substituted into the equation of 4.6.12.2 to obtain a scaling factor by which the measured stiffness, K, must be multiplied to equal the known spring rate of the calibration spring(s). The scaling factor is then applied to subsequent measurements on mount samples When testing mounts that are softer or stiffer than the springs used to obtain the scaling factor, a new calibration should be conducted using springs of the appropriate stiffness in order to avoid overcorrecting or undercorrecting the measurements. This is especially important for measurement systems that approach the 30 to 1 minimum allowable stiffness ratio of 4.6.12.2.

4.6.12.2.4 Measurement of machine stiffness. The stiffness of those components of the test machine in series with the specimen shall be determined experimentally in accordance with the procedures of 4.6.12.2.5 or 4.6.12.2.6 as appropriate.

4.6.12.2.5 Resonance frequency test equipment. For test systems used to measure resonance frequency (figure 1), the rubber test specimen shall be replaced by a stiff steel spacer, the shaker and impedance head removed and a downward force applied to the bottom of the hanger rod using a calibrated load cell or proving ring. Deflection at the bottom of the rod is measured with a dial indicator The force applied shall be sufficient to insure good resolution for both the force and deflection readings. Several points shall be taken to insure that the force-deflection relationship is linear. The resulting spring rate of the system shall be used to determine if the measurement system meets the stiffness requirements of 4.6.12.1.2 as well as the amount (if any) of correction to be applied to the resonance frequency measurements

4.6.12.2.6 Dynamic stiffness test equipment. For test systems used to measure dynamic stiffness of mounts (figure 2), test machine stiffness can be determined using the internal transducers of the machine itself. Operating in the load feedback mode with the displacement transducer on its most sensitive range and the force transducer on its full scale setting, bring the platens of the machine either directly in contact or against a stiff steel spacer separating the platens.

CAUTION:

This procedure is not recommended for test machines not equipped with a safety interlock system to prevent the force from exceeding a predetermined value.

The force applied shall be sufficient to insure good resolution from both the force and deflection readout instruments (typically 70-80% of maximum capacity of the load cell). Several points shall be taken to insure that the force-deflection relationship is linear and that effects such as non-parallelism between the platens do not produce nonlinear results. The resulting spring rate of the system shall be used to determine if the measurement system meets the stiffness requirements of 4.6.12.2 as well as the amount (if any) of correction to be applied to the dynamic stiffness measurements.

4.6.12.2.7 Correction for flexibility of test machine. When test machines fail to meet the minimum stiffness requirements for limiting measurement error to 1% (see 4 6 12 1.2 and 4 6.12.2) and, for dynamic stiffness measurement systems, where steel coil springs are not used as in 4 6.10.4.2 to conduct overall system calibrations, then measurements must be corrected to determine conformance with 3.4.1 For purposes of this calculation the components of the test machine in series with the sample can be considered a single spring of known spring rate (4.6.12.2.4) in series with the true stiffness of the sample as follows:

$$1/K = 1/K_s + 1/K_M$$

where K_s = True stiffness of sample (to be determined)
K_M = Spring rate of test machine (from 4.6.10.4.3)
K = Combined stiffness of K_s and K_M (measured in 4 6.10.2 and 4.6.10 3)

For nonresonant tests the true stiffness of the sample, K_s, can be determined directly from the above equation since K is measured directly (4.6.12.2) and compared with the requirements of 3 4 1. However, for resonance frequency measurements the system resonance frequency obtained in 4 6.12.1.2 must be converted to stiffness to obtain K for substitution into the previous equation. the following relation for a spring-mass system can be used for this conversion.

English System

$$K = 0.102f^2w$$

where
K = dynamic stiffness of sample, lb/in
w = supported weight, lbf
f = resonance frequency of system, Hz

Metric System

$$K = 0.0395f^2m$$

where
K = dynamic stiffness of sample, kN/m
m = supported mass, kg
f = resonance frequency of system, Hz

As was the case with nonresonant tests the value of K obtained can be substituted into the equation of 4.6.12.2.7 to obtain the true stiffness of the sample, K_s. K_s can then either be used directly to determine conformance with 3.4.1 or it can be converted back into frequency using the previous relationship to obtain the corrected resonance frequency of the mount for comparison with the resonance frequency requirements of 3.4.1.

4.6.13 Deflection at rated load. A universal type testing machine shall be used. Each mount shall be subjected to a single loading cycle in the axial direction. Types 6E100BB, 6E150BB, 7E450BB, and 6E900BB shall be tested in the zero preload condition. The loading shall be accomplished at a constant rate such that the maximum load is attained in not less than 1 minute. The deflection at rated load shall be measured to the closest 0.001 inch. The highest load given in table XII for each mount is the upper rated load. The deflection of the upper rated load shall be recorded to determine conformance with 3.4.2.

4.6.14 Quality of the rubber-to-metal bond. The load on the mounts, tested as specified in 4.6.13, shall be increased to two times the upper rated load after recording the deflection at the upper rated load. The rate of loading shall be such that the maximum load is attained in not less than 2 minutes. The mount shall be held at two times its upper rated load while the appearance of the resilient element and of the rubber-to-metal bond is examined to determine conformance to 3.4.3.

4.6.15 **Strength tests.** A universal type testing machine shall be employed to conduct strength tests on mounts. The testing machine shall load the mounts at a constant rate of deflection.

4.6.15.1 **Strength tests in the axial direction.** The mounts shall be secured in a suitable jig and subjected to four loading and unloading cycles in the axial direction. Type 6E100BB, 6E150BB, 7E450BB, and 6E900BB mounts shall be tested in the zero preload condition. The loadings shall be conducted at a rate not to exceed 0.3 inch per minute. For the first three loading cycles, the loads shall be applied up to the load specified on curve number 2 of figure 3 for the upper load rating of the mount For the fourth loading cycle, the mount shall be loaded up to the peak load specified on curve number 1 of figure 3 for the upper load rating of the mount. The deflection at the rated load for each mount shall be noted during the fourth cycle. The mounts shall be examined during and after testing for any break or separation in the rubber or between rubber and metal parts or deformation of metal parts.

4.6.15.2 **Strength tests in the radial direction.** Two mounts shall be secured in a jig similar to that on figure 4 and tested for compressive strength in the radial direction. Each mount shall be compressed axially to that amount at which its upper rated load rating deflected the mount during the test for deflection at rated load in the axial direction (see 4.6.13). This compression is obtained by adjusting the nuts on the four bolts which changes the distance between the brackets and the plane of the loading plate. After assembly, the two mounts shall be subjected radially to four loading and unloading cycles in accordance with the procedure of 4 6.15.1. Types 6E100BB, 6E150BB, 7E450BB, and 6E900BB shall not be tested in the radial direction.

4.6.16 **Drift test.** Each mount shall be loaded to its upper rated load (see table XII) in the axial direction after being previously tested for dynamic stiffness. Types 6E100BB, 6E150BB, 7E450BB, and 6E900BB mounts shall be tested in the zero preload condition. The height of the mount shall be measured to the nearest 0.001 inch 1 hour after loading and again after 96 hours. The difference in the two readings shall be taken as the drift of the mount. Within 15 minutes after the final reading has been obtained, the mount shall be tested again for dynamic stiffness at its upper rated load. Tests shall be conducted at an ambient temperature of 80 + 5 °F.

4.6.17 **Fatigue test.** Each mount shall be statically loaded to its upper rated load (see table XII) in the axial direction; the back-to-back mounts shall be tested in the zero preload condition. Each mount shall then be subjected to 500,000 cycles of vibration at its natural frequency; the exciting force shall produce a mount deflection of ±0.050 inch.

4.6.18 **Porosity and delamination.** One of the mounts used for the drift test shall be cut into two parts along a vertical plane through the center of the mount. The cut surfaces of these components shall be carefully examined for porosity. The parts shall be immersed in toluol (technical grade) for 24 hours. After removal from the toluol, the rubber elements shall be examined for evidence of separation into distinct layers or laminations.

4.7 **Inspection of packaging.** Sample packages and packs, and the inspection of the preservation, packing, and marking for shipment, stowage, and storage shall be in accordance with the requirements of section 5 and the documents specified therein.

5. PACKAGING

(The packaging requirements specified herein apply only for direct Government acquisition. For the extent of applicability of the packaging of referenced documents listed in section 2, see 6.2.)

5.1 General.

5.1.1 Navy fire-retardant requirements.

5.1.1.1 Lumber and plywood. Unless otherwise specified (see 6.2), all lumber and plywood including laminated veneer material used in shipping container and pallet construction members, blocking, bracing, and reinforcing shall be fire-retardant treated material conforming to MIL-L-19140 as follows:

Level A and B	Type II – weather resistant Category I – general use
Level C	Type I – non-weather resistant Category I – general use.

5.1.1.2 Fiberboard. Unless otherwise specified (see 6.2) fiberboard used in the construction of class domestic, non-weather resistant fiberboard, and cleated fiberboard boxes, including interior packaging forms shall meet the requirements of PPP-F-320 and amendments thereto.

5.2 Preservation. Preservation shall be level A, C, or commercial as specified (see 6.2).

5.2.1 Level A. Mounts shall be individually preserved in accordance with method III of MIL-P-116. Contact preservative is not required.

5.2.1.1 Unit and intermediate containers. Unit and intermediate containers shall conform to Appendix F, table I of MIL-STD-2073/1. Containers shall be of the water-resistant variety or class. Unit quantities in an intermediate container shall be as specified (see 6.2).

5.2.2 Level C. Mounts shall be preserved and unit protected as specified for level A except that unit and intermediate containers shall be of the non-water-resistant domestic variety or class.

5.2.3 Commercial. Preservation shall be in accordance with ASTM D 3951.

5.3 Packing. Packing when required (see 6.2), shall be level A, B, or commercial as specified (see 6.2).

5.3.1 General requirements for levels A and B. Containers selected (see 5.3.2) shall be of minimum weight and cube consistent with the protection required of uniform size and contain identical quantities

5.3.2 **Levels A and B containers** Mounts, preserved as specified (see 5.2), shall be packed in exterior shipping containers in accordance with Appendix C, table VII of MIL-STD-2073/1, for the level of packing specified (see 5.3). Unless otherwise specified (see 6.2), container selection including container options shall be the contractor's option.

5.3.2.1 **Waterproofing.** Unless otherwise specified (see 6.2), level A and when specified (see 6.2.1), level B shipping containers shall be provided with caseliners, linings, wraps, or shrouds in accordance with the waterproofing requirements of MIL-STD-1186.

5.3.2.2 **Closure and gross weight.**

5.3.2.2.1 **Closure.** Container closure, reinforcing, or banding shall be in accordance with the applicable container specification or appendix thereto except that weather-resistant fiberboard boxes shall be closed in accordance with method V and reinforced with non-metallic or tape banding and domestic non-weather-resistant fiberboard boxes shall be closed in accordance with method I using pressure sensitive tape.

5.3.2.2.2 **Weight.** Wood, plywood, and cleated type containers exceeding 200 pounds gross weight shall be modified by the addition of skids in accordance with MIL-STD-2073/1 and the applicable container specification or appendix thereto.

5.3.3 **Commercial.** Mounts, preserved as specified (see 5.2), shall be packed for shipment in accordance with ASTM D 3951 and herein.

5.3.3.1 **Container modification.** Shipping containers exceeding 200 pounds gross weight shall be provided with a minimum of two, 3- by 4-inch nominal wood skids laid flat, or a skid- or sill-type based which will support the material and facilitate handling by mechanical handling equipment during shipment, stowage, and storage.

5.4 **Palletized unit loads.** When specified (see 6.2), containers shall be palletized in accordance with Appendix F of MIL-STD-2073/1.

5.5 **Marking.**

5.5.1 **Levels A, B, and commercial.** In addition to any special marking required (see 6.2.1), interior (unit) packs, intermediate and shipping containers, and palletized unit loads shall be marked for shipment, stowage, and storage in accordance with Appendix F of MIL-STD-2073/1 and shall include bar coding.

5.5.2 **Special marking.** Each unit, intermediate, and shipping container shall be marked with waterproof ink on two adjacent sides with the following information completed:

MOUNT IDENTIFICATION ____________________
MILITARY SPEC. NO. ________________________
DATE OF MFG ______________________________
LOT NO (s). _________________________________

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.

6.1 Intended use. The mount assemblies covered in this specification are intended for noise and vibration attenuation. The mounts are primarily for use in submarines and surface ships

.

6.2 Acquisition requirements. Acquisition documents must specify the following:

a. Title, number, and date of this specification

b Type of mount (see 1.2.1)

c. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1)

d Type of material to be used in the manufacture of metal parts (see 3.3 1)

e Protective treatment, if different from that specified on Drawing 803-1385778 (see 3.3.3)

f. Specify Government Source Inspection (GSI) (see 4.4)

g. When fire-retardant materials are not required (see 5.1.1)

h. Level of preservation and packing required (see 5.2 and 5.3)

i. When palletization is not required (see 5.4).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Products List QPL-17508 whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or purchase orders for the products covered by this specification. The activity responsible for the QPL is the Naval Sea Systems Command, SEA 55Z3, Department of the Navy, Washington, DC 20362-5101 and information pertaining to qualification of products may be obtained from that activity.

6.3.1 Copies of "Provisions Governing Qualification SD-6" may be obtained upon application to Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

6.4 Techniques for manufacturing mounts (see 6.6). Information on the techniques for manufacturing the type 6E100, 6E150, 7E450, 6E900, 6E2000, 5E3500, 6E100BB, 6E150BB, 7E450BB, and 6E900BB mounts and recipes for rubber stock formulations is available (see 6.3) from the Department of the Navy and will be furnished upon request from prospective bidders.

6.5 Suggested formulations and application procedure for oil-resistant coating (see 6.6).

6.5.1 Suggested formulations. The formulations shown below should be blended together just prior to use. The viscosity of the blend should be adjusted to about 650 centipoises by using more or less methyl ethyl ketone in the formulations

	A	B
Prefluxed blend of 70 percent nitrile rubber with 30 percent polyvinyl chloride	100	100
N330 carbon black	30	30
Stearic acid	1	1
Zinc oxide	5	5
CPB (Dibutyl xanthogen disulfide)	8	
DBA (dibenzyl amine)		8
Sulfur		4
Methyl ethyl ketone	656	674

6.5.2 Suggested procedure for application of coating to mounts. The sequence of operations shown below should be followed in order to obtain satisfactory performance from the coating:

a. Remove rubber flash from component by trimming or buffing

b Sandblast the component, brush off dust

c. Apply one brush coat of Thixon P-5 metal primer, or equivalent, to all metal surfaces and allow to dry for at least 1 hour

d. Wash the rubber portion of the component with an aqueous solution of Vel detergent, or equivalent, and rinse with tap water

e. Chlorinate the rubber surfaces by immersing each component for 3 minutes in water saturated with chlorine

f. Rinse mount components with tap water and dry until all traces of water have evaporated

g. Blend the A solution with the B solution and let stand 1 hour to permit entrapped air to escape

h. Apply two coats (0 003 inch minimum dry film thickness) of the blended formulations to the entire component, including metal parts, by brushing, dipping, or spraying i Determine the thickness of coating on the rubber element by measuring the thickness of the coated metal plate of the mount (see 4 6.9)

j Apply additional coats on the metal parts of the mount only to bring the minimum dry film thickness of the coating up to 0.006 inch (on the metal parts only)

k Allow all coats except the final coat to dry for at least 1 hour before subsequent coats are applied Allow the final coat to dry for at least 4 days before handling the mount, alternatively, the final coat should be allowed to dry for at least 4 hours, and then the component placed in an oven at 130 ± 5 °F for 16 hours to cure the coating.

6.6 The furnishing of information and the formulations and procedures (see 6 4 and 6.5) are solely for assistance in fabrication of the mounts for naval use. The use of this information does not constitute any agreement or obligation by the Department of the Navy to acquire mounts made of these formulae. Also, the use of this information does not guarantee compliance with this specification, nor will it relieve the contractor from having the mounts tested against the applicable test requirements of this specification Furthermore, the Government does not guarantee that the mounts made using these formulations will conform to the requirements of this specification. Certain ingredients appear as proprietary names since these were the specific ones used in the development work. It is not intended to limit the choice of commercial sources for an ingredient or to infer that one proprietary product is better than another.

6.7 Sub-contracted material and parts. The packaging requirements of referenced documents listed in section 2 do not apply when material and parts are acquired by the contractor for incorporation into the equipment and lose their separate identity when the equipment is shipped.

6.8 Subject term (key word) listing.

Axial
Gravity
Ozone resistance
Stearic acid
Sulfur

6.9 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issues due to the extensiveness of the changes.

Preparing Activity:
Navy – SH
(Project 5340-N097)

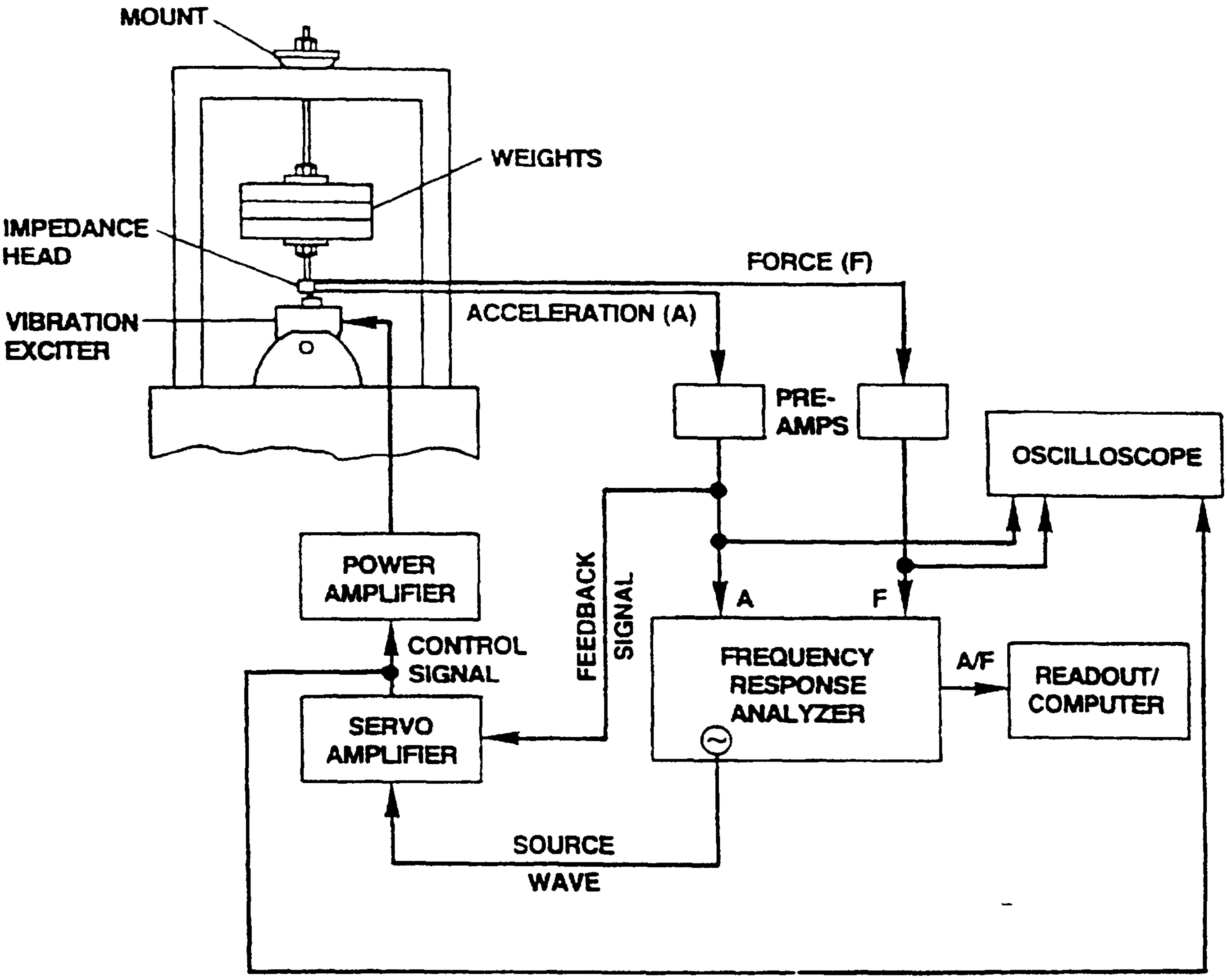

FIGURE 1 *Typical system for measurement of resonant frequency by the suspended mass method*

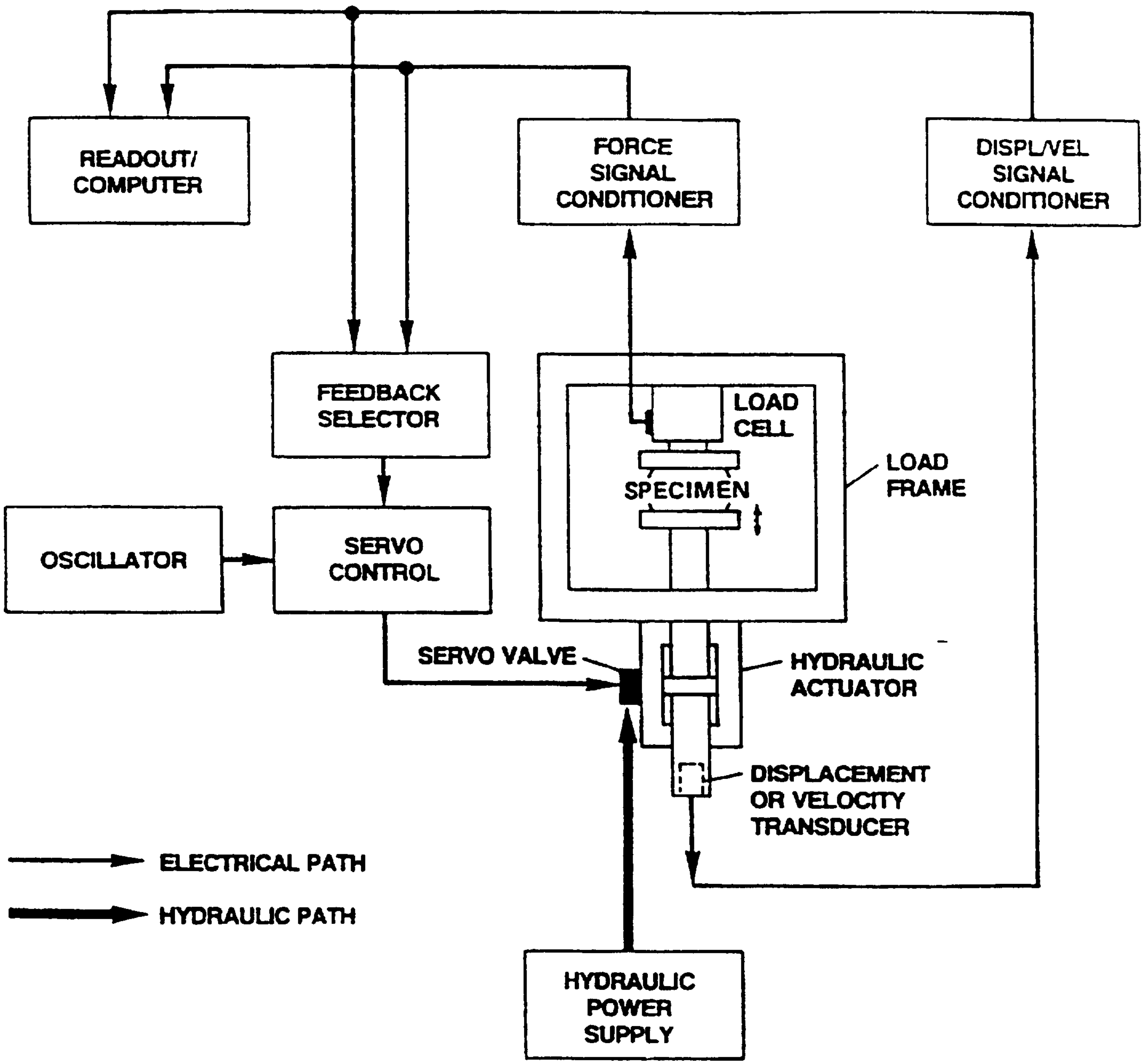

FIGURE 2. Schematic diagram of major components of electrohydraulic closed-loop test machine.

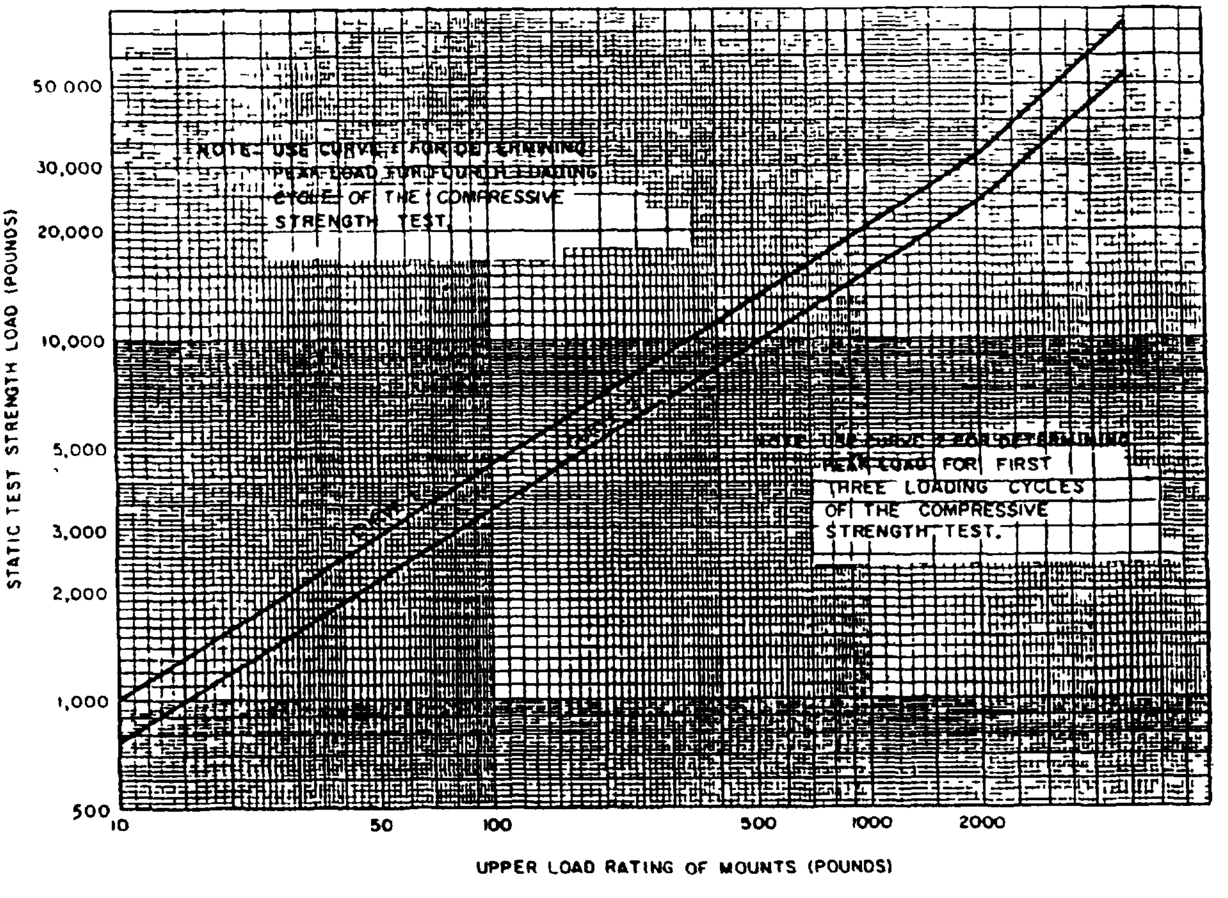

FIGURE 3. *Minimum static test strength loads for resilient mountings.*

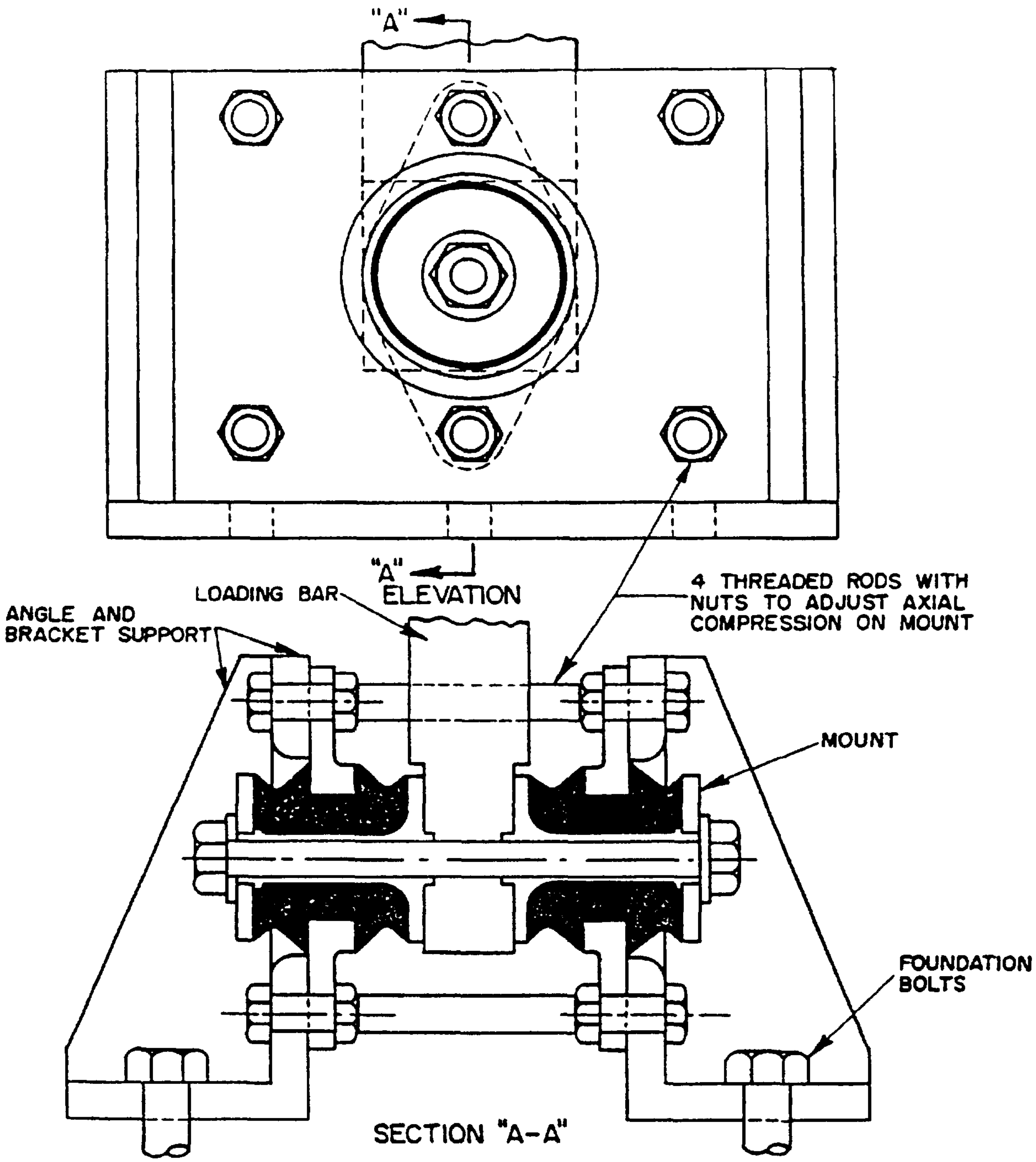

FIGURE 4. *Jig for holding mounts when conducting tests in the radial direction.*

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INSTRUCTIONS

1 The preparing activity must complete blocks 1, 2, 3, and 8 In block 1, both the document number and revision letter should be given

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I RECOMMEND A CHANGE:

1 DOCUMENT NUMBER: MIL-M-17508F(SH)

2 DOCUMENT DATE *(YYMMDD)*: 12 December 1990

3 DOCUMENT TITLE: MOUNTS RESILIENT: TYPES 6E100, 6E150, 7E450, 6E900, 6E2000, 5E35000, 6E100BB, 6E150BB

4 NATURE OF CHANGE *(Identify paragraph number and include proposed rewrite, if possible Attach extra sheets as needed)*

5 REASON FOR RECOMMENDATION

6 SUBMITTER

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(1) Commercial
(2) AUTOVON *(If applicable)*

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