

**NEWPORT NEWS SHIPBUILDING
NEWPORT NEWS, VIRGINIA
APPENDIX L - DoD CONTRACTS
SHOCK REQUIREMENTS**

I. GENERAL

This appendix is applicable when invoked by the purchase order. This appendix sets forth shock definitions and grade designations, shock testing requirements and procedures, dynamic design and analysis requirements, procedures, installation bolting requirements and equipment data submittal requirements.

It is the intent of this appendix to set forth requirements that will provide shock resistance for non-contact underwater explosions. Where Military or other applicable purchase specifications require shockproofing for other than non-contact underwater explosions, the requirements of such specifications shall also apply.

The fact that equipment may be covered by NavSea standard plans or Military Specifications does not exempt the vendor from his responsibility to meet the shock requirements of this appendix, including redesign for shock, if required, and testing for such equipment.

The grade of shock resistance required for each item of equipment will be specified in the purchase order.

During the guarantee period of the ship, the Department of the Navy, at its own expense, may conduct a full scale shock test to determine the performance of ship systems and structures under moderate to severe attack conditions.

The test will consist of exploding several charges at progressively decreasing distance abeam of the ship. The test will cause levels of shock through the ship which are less severe than those invoked in the purchase order.

Only those failures which result from nonconformance with the requirements of the purchase specifications will be considered as the responsibility of the vendor.

Equipment may be furnished to meet the shock requirements of MIL-S-901C as modified by this Appendix via shock test extension approval if the equipment is identical to previously furnished equipment which was approved or extended to meet the requirements of MIL-S-901C as modified by this Appendix.

Equipment which requires a new shock test or dynamic shock analysis due to new design or changes from previously furnished equipment must meet the requirements of MIL-S-901D.

When performing a shock test to the requirements of MIL-S-901D, an alternative Half Energy High Impact Shock Test may be performed for certain cases as approved by Newport News Shipbuilding and the Government. The half energy tests shall be limited to items which are aircraft carrier unique and are installed at the following locations only: on or above the 4th deck forward of frame 200, or on or above 3rd deck aft of frame 200. Project Peculiar Document (PPD) No. 802-6337238 describes the half energy test method and applicable requirements.

II. SHOCK DEFINITIONS AND GRADE DESIGNATIONS

System. A system is an arrangement or combination of principal units and items necessary to perform a specific operational function or functions (Examples: Main propulsion system, refrigeration system, electronic systems, weapons control systems, hydraulic systems, etc.).

Principal Units. Principal units are items of equipment, or assemblies of equipment or machinery which are major parts of a system such as diesel-generator sets, air conditioning plants, switchboards, radio transmitters, steam generators, cranes or larger valves directly supported by ships structure. Principal units consist of subsidiary components and sub-assemblies.

Subsidiary Components. Subsidiary components are items or assemblies of equipment which form a part of, or are supported on, a principal unit. These would include such items as the diesel engine of a diesel-generator set, the electric motor of an air conditioning unit, the power supply section of a radio transmitter, a switchboard circuit breaker, items which are attached to the steam generator or a valve supported by the attached piping and similar items.

Subassemblies. Subassemblies are parts or groups of parts of a subsidiary component or a system. This would include such items as thermometers, individual gages or meters, relays, resistors, and similar items. The distinction between subassembly and assembly or part as used herein may be different than that used in various equipment specifications. As used herein it is the smallest breakdown of a complete system which will be accepted as a separate unit under this specification.

Item. A complete and definable unit or a component of machinery, equipment or system. An item can be a principal unit, subsidiary component or subassembly.

Shock Loadings. Shock loadings referred to are those associated with the tests specified in MIL-S-901C or MIL-S-901D as applicable and design criteria specified herein.

Shock resistance of machinery, equipment and systems is defined by grade as follows:

Grade A. Grade A items are machinery, equipment and systems essential for the safety and continued combat capability of the ship and personnel. Shock testing, or design, of Grade A items shall demonstrate that the item will continue to perform its principal function without

significant change in performance and that no portion of the equipment will come adrift or otherwise become a hazard to personnel at battle stations, or to Grade A machinery, equipment or systems during and following application of shock loadings.

Grade B. Grade B items are machinery, equipment and systems not required for the safety of the ship and personnel or the continued combat capability of the ship. Shock testing, or design requirements of Grade B items are the same as Grade A requirements except that shock testing, or design need only demonstrate that no portion of the unit will come adrift or otherwise create a hazard to personnel at battle stations, or Grade A systems or equipment. Failure of a Grade B unit to perform its principal function after the shock shall not be cause for rejection.

Grade C. Grade C items are machinery, equipment and systems which do not have shock requirements, except that they must be arranged or located so as not to become a hazard.

Hazard. An item constitutes a hazard if it is possible for it, or a portion of it (under shock loading), to strike and harm personnel at battle stations or any part of a Grade A system. In determining this possibility, the assumption shall be made that the item could be projected in any direction as much as five feet before striking or rebounding onto a target. Consideration shall be given to the capability of the item to impair the operability of any Grade A system or component or to injure personnel and to the relative weights of the item and any intervening structure. An item also constitutes a hazard if shock might cause an electrical short which could result in a failure or malfunction of a Grade A system, or release of any injurious fluid such as steam, hot water, toxic gas, diesel oil, radioactive fluids, JP-5, etc., which could affect the operability of any other Grade A system or personnel located at battle stations.

Additional definitions relating to shock requirements are found in MIL-S-901C or MIL-S-901D as applicable.

III. SHOCK TESTING REQUIREMENTS AND PROCEDURES

Grade A and B items weighing 60,000 pounds and less when installed on the shock testing apparatus shall be shock tested in accordance with MIL-S-901D. This 60,000 pound weight limit includes the weight of the item in operating condition as well as the weight of foundations and test fixtures required for the test. For additional information relating to shock testing, refer to NAVSHIPS 250-660-30, 900-185A, UERD Report 7-61, and NRL Letter Report 6260- 7A:ROB:Kep, by R. O. Belsheim, dated February 18, 1964.

The purchase order will indicate, in the case of systems and principal units weighing over 60,000 pounds, how the assemblies shall be broken into subsidiary components and subassemblies for testing. Where such breakdowns are not provided, proposals from the vendor will be considered. The proposal should indicate the method of testing the subassemblies, including simulation of shipboard installation restrictions, and the method of analysis of connective equipment such as shafts and sub-bases.

It is the intent of this appendix to use Shock testing to the maximum extent possible and use dynamic design procedure only where testing is impractical.

If an item weighing 60,000 pounds or less cannot be shock tested due to configuration, or center of gravity (see Fig. 2), the dynamic design analysis procedure described herein shall apply.

Where two or more items are installed on a common sub-base and the total installed operating weight is less than 60,000 pounds the assembly shall be shock tested in accordance with MIL-S-901D. Equivalent dummy weights may be used to simulate all but one of a group of identical units installed on a common sub-base.

Shock Grade A and B valves and valve operators shall be tested and inspected for qualification in accordance with MIL-STD-798, Section 11.

Valves and fittings shall be shock tested when pressurized with tap water to the primary service rating (the rating stamped on the valve body) or to the actual operating pressure, whichever is greater.

Delete Note 1 of Table V, Section 11.1 of MIL-STD-798 and substitute the following:

"Relief, sentinel and safety valves shall be tested in the full closed position only. The valves shall be tested at the upper setting of the heaviest spring and lowest setting of the lightest spring for which the valve is designed. Valves designed for only one spring shall be tested at the highest and lowest spring setting. The hydrostatic pressure during shock test shall be equal to the reseal pressure specified for the spring setting being tested. This test qualifies the valve for the entire series of springs and spring settings for that size and design."

"Relief, sentinel and safety valves which have previously been successfully tested at only one set pressure with any of a series of springs for which the valve is designed will be acceptable as shock qualified valves or as a base for extension except that valves furnished to Military Specification MIL-V-22549 and to Revision D of MIL-V-20065 shall be qualified in accordance with the above paragraph. Also relief, sentinel and safety valves furnished to any Military Specification which have not been previously successfully tested or cannot be covered by an extension shall be qualified in accordance with the above paragraph."

MIL-S-901C shall be modified as follows (paragraph numbers refer to MIL-S-901C):

3.1.2.1 Hull Mounted. Delete "main deck" and substitute "water line".

Deck Mounted. Delete "on main deck or above" and substitute "above the water line".

3.1.4.1 Light Weight. Add "The total weight of equipment and test fixture shall not exceed 550 pounds."

3.1.4.2 Medium Weight. Delete "approximately 250 lbs to 6000 lbs" and substitute "up to approximately 6000 lbs".

3.1.4.3 Heavy Weight. Delete "approximately 6000 . . . (see 4.2.3.3)" and substitute "up to approximately 60,000 lbs".

3.2.2 Extension of Shock Tests. In the second line, delete "another" and substitute "a similar item". In line 7, after "concerned" add "for propulsion plant equipment for which the equipment outline and assembly drawing are required to be submitted to NAVSEA for approval and to the Supervisor of Shipbuilding, Newport News, for all other items." In the last line, delete "requests". After the first line, add the following:

(a) Requests for extension must be accompanied by supporting evidence which should include:

1. Detailed drawings of tested and untested items, and delineation of the orientation of the tested and untested items in the ship.
2. A copy of the report of the shock test and post shock test reports upon which the requested extension is based.
3. A detailed comparison of the differences in materials and design showing that the untested items have equal or greater shock resistance than the tested item.

(b) Extensions will not be granted for equipment based upon tests in different weight classifications or on equipment by different manufacturers unless specific approval is obtained.

(c) Extensions will not be granted for items where the original test report was marginal or unacceptable by present standards.

(d) Extensions will not be granted whenever reasonable doubt exists in the area of the original shock test, the design or fabrication of the unit or the intended use of the equipment.

(e) In case of doubt, general guidance as to allowable size spreads between tested and untested items may be obtained from the Purchaser.

(f) Requests for extensions of equipment using resilient mounts shall be thoroughly documented to justify using such mounts; it is intended that equipment shall be designed to meet shock requirements without use of resilient mounts.

(g) Shock test of valves may be extended to other sizes of the same design in accordance with the criteria as specified in MIL-STD-798, Section 11.

(h) Conditional shock test extensions may be granted for heavy weight items prior to the test of the item upon which the extension is to be based. In such cases, paragraphs (a)1, (a)3, (b), (e), (f) and (g) above shall apply. A final shock test extension will be granted when a shock test report is submitted which certifies that the item tested has satisfactorily passed the shock test. The vendor shall, at his expense, make similar necessary corrections to the extended item as may be required to be made to the tested item due to the results of the shock test.

(i) Subject to satisfying the requirements of paragraphs (a)1., 2., 3., (c), (d), and (f), above, items whose degree of similarity are difficult to assess, such as those listed below, may be extended from tests of generally similar components by reference to calculations furnished by the vendor to show that the tested item and the untested item are designed by the same criteria and that the untested item is at least equal in shock resistance to the tested item. Typical items in this category are listed below:

1. Piping system castings
2. Tanks
3. Ladders, gratings, floor plates, handrails and tool mountings
4. Ventilation system components

4.2.2.1 Type A. In line 3, delete "can" and substitute "will". In line 4, insert "as" between "be" and "specified".

4.2.3.3 Heavy Weight Equipment. In lines 3 and 4 delete "the most severe condition . . . encountered" and substitute "the most severe arrangement likely to be encountered on board ship". In lines 6-10, delete "The upper weight limit . . . machine" and substitute "The upper weight limit of 60,000 pounds is established for equipment, including its foundation and test fixture, on the floating shock platform and may be reduced depending on the individual test installation as it affects the stability of the floating shock platform".

4.2.4 Test Procedure. In line 3, after "standstill" insert "valves such as gate valves shall be tested at design pressure in open and closed position (check valves need not be tested in check position)". At end of paragraph, add "The medium weight shock testing machine may be used to shock qualify light weight equipment and their foundations. The heavy weight floating platform may be used to shock qualify medium and light weight equipment and their foundations.

When an equipment operates at different speeds, loads, capacities, or modes or when the function of the equipment capacities, or modes or when the function of the equipment is such that it may also be in a non-running (secured or standby) mode, the equipment is said to have more than one significant operating mode.

This specification is very general so as to cover the entire field of shipboard equipment and systems. In order to apply this specification properly and to avoid post-test disagreements, test procedures shall specify, describe or define all the features enumerated in 6.1. For heavyweight tests only the test procedure shall be approved by the purchaser and the Government review and acceptance authority prior to the shock test. Approval of the test procedure does not constitute approval of deviations from the requirements of this specification unless such deviations are specifically identified when the procedure is submitted for approval.

4.2.4.1.1 In first line, after "nine blows shall be applied" insert "for each significant operating condition." In line 6, after "circuitbreakers" insert "valves, motor".

4.2.4.1.2 Delete paragraph entirely.

4.2.4.2 For medium weight equipment, In line 3, after "as specified in" insert "the". In line 6, after "hammer" insert "drop". In line 8, after "the fixture used" insert "for the inclined orientation." After line 9, insert "The equipment may be rotated 90° on Figure 9-1 in lieu of using Figure 10-1 or 10-2."

Where equipment has more than one significant operating mode, the series of blows shall be programmed to test the equipment in each of these modes. In this case, the mode of operation and the number and type of blows for each mode shall be as specified (see paragraph 6.1). A separate item of equipment may be submitted for each series or part of a series of six blows in excess of six blows, if desired by the manufacturer."

4.2.4.3 For heavy weight equipment, Delete "Requirements . . . these facilities." and substitute "Requirements for equipment operation, orientation, inspection, and installation shall be as approved."

4.2.6 Disposition of shock test equipment, In line 2, delete "and is to be retained by the Government".

4.2.7.2 Delete and substitute: "The number of shock test and post shock test examination reports to be submitted by the vendor to the purchaser shall be as specified in the purchase order. The Supervisor of Shipbuilding, Newport News will review the test reports submitted by the purchaser and take appropriate action as to shock qualification."

(1) For Light Weight and Medium Weight Equipment

(a) A report by the shock test facility including NAVEXOS form 3373 and clear photographs of each test set-up and each instance of damage.

(b) A report by the activity (manufacturer or other) performing the post shock test inspection and performance testing of the equipment.

(c) A description of the corrective measures taken and recommendations as to proposed design changes which will correct any deficiencies found during the post test inspection. (In certain cases, the Purchaser may accept the equipment as shock qualified on the basis of the corrective design changes rather than to require retesting).

(d) Certification of the report describing the shock test shall be by the facility performing the shock test.

(e) Certification of the post shock test inspection and performance testing report shall be by the Government representative. The Government representative need not witness all tests but it is desired that a sampling of the tests by each test facility be witnessed by the Government representative.

(2) For Heavy Weight Equipment

(a) As in (1)(a), above, except that NAVEXOS form 3373 is not applicable.

(b) As in (1)(b), above.

(c) As in (1)(c), above.

(d) Certification of the report describing the shock test shall be by a Government representative who shall actually witness the test. The test procedure shall specify the activity whose representative will witness the inspection and testing.

(e) As in (1)(e) above, except that the Government representative must witness the actual inspection and performance tests. The test procedure shall specify the activity whose representative will witness the inspection and testing.

4.2.7.3 Delete entirely.

Add the following note to Figure 10-2, "12. This fixture is primarily intended to be used for dual (deck and bulkhead) mounted equipment. In cases where bulkhead-mounted equipment will not fit hereon due to length or configuration, the 30° fixture shown on Figure 10-1 shall be used."

MIL-S-901D shall be modified as follows (paragraph numbers refer to MIL-S-901D):

1.2.5 Hull mounted is defined as: Equipment and foundations systems mounted directly to the basic hull structure (frames, structural bulkheads below the waterline, and shell plating above the waterline).

1.2.5 Deck mounted is defined as: Equipment and foundations systems mounted directly to decks, non-structural bulkheads, or to structural bulkheads which are above the waterline.

Post shock test inspection and post shock test functional testing of Grade A and B shock resistant equipment. For equipment which has not been previously successfully tested or is not covered by extension, the requirements for post shock test inspections and post shock test functional testing shall be as specified in the applicable military specifications, this appendix, and the purchase order.

If not otherwise specified, the following minimum requirements shall apply to the post shock test inspection and functional testing.

Inspections. In general, after shock testing, all equipment shall be disassembled and inspected for breakage, deformation, and misalignment. Areas highly stressed during shock response and areas suspected of yielding shall be liquid-penetrant or magnetic particle inspected for cracks. Critical tolerance areas shall be checked for proper operating clearances. Dimensions shall be as specified on the working plans.

Equipment shall be considered to have failed the shock test if inspection reveals any condition that could prevent the equipment from performing its intended function, or could create a personnel hazard as a result of the shock.

Functional Testing. After shock testing and inspection and prior to delivery to the Purchaser, the equipment shall be given suitable functional and other tests as required to determine whether or not it meets the specified operational requirements. Functional testing shall be conducted to the maximum extent practical for the equipment to insure that the equipment meets the operational requirements of the purchase order after having been shock tested.

In general, the functional tests shall include but not be limited to:

Checking the input/output of the component or equipment, its operating temperatures (bearings, coil windings, etc.), cyclic tests, etc., wherever appropriate, to determine compliance with design specifications.

Hydraulic, pneumatic, and fluid systems equipment, etc., shall be hydrostatically tested at their test pressure to test for leaks, if not previously checked during shock testing. Electrical equipment shall be ground tested to detect breakdown of insulation. Rotating and reciprocating equipment shall be vibration tested to determine if the level of vibration meets design requirements by checking the vibration of the equipment while it is running at design speed.

Equipment shall be considered to have failed the shock test if the equipment is unable to meet the specified functional requirements.

When an item has passed the shock qualification requirements and all damage which may have occurred during the test has been corrected, the vendor shall deliver to the Purchaser an item that is in all respects new equipment.

For lightweight and mediumweight equipment as defined in MIL-S-901C or MIL-S-901D as applicable, all costs incurred because of shock qualification requirements such as transportation, test set-ups, shock testing, repair or replacement, retesting, post shock test inspection, post shock functional testing, repairs and reconditioning shall be borne by the vendor. This shall include costs for thorough inspection and correction of all damage to test samples which have successfully passed shock qualification tests and which are to be delivered to the Purchaser.

Equipment weighing less than 6,000 pounds, which will not fit on the shock testing machines, shall be treated as heavyweight equipment and shall be tested on a floating shock platform as outlined for heavyweight equipment.

Locations of Navy approved lightweight and mediumweight testing facilities will be furnished to the vendor upon request.

For items categorized as heavyweight by MIL-S-901C as revised herein (6,000 to 60,000 pounds) or MIL-S-901D as applicable, all costs incurred because of shock qualification requirements shall be borne by the vendor and shall include but not be limited to the following:

1. All transportation costs to and from the test facility.
2. Test component installation and removal including temporary equipment associated therewith.
3. Shock testing and associated instrumentation.
4. Repair or replacement of equipment during or after heavyweight shock test.
5. Total cost involved in retesting including retest itself and any additional transportation or test facility cost incurred due to initial failure of the equipment to pass shock tests.
6. Post shock test inspection.
7. Post shock functional testing.
8. Repairs and reconditioning, post shock and otherwise.

9. All reports and procedures as required herein.
10. The furnishing of personnel at the shock test facility required to assist in operation of and minor repairs to equipment during the shock test.
11. Test foundation, except as noted below. Disposition of the test foundation shall be as directed by the Purchaser.

The Purchaser's responsibilities in heavyweight shock qualification shall be limited to providing the test foundation design.

Heavyweight equipment will be designated as "hull mounted" or "deck mounted" in the purchase order. For hull mounted equipment, the test foundation shall be mounted directly on the inner bottom of the floating shock platform. For deck mounted equipment, the test foundation shall be mounted on a test fixture installed on the floating shock platform. The test fixture, which is used to simulate the shipboard deck, shall be designed to have a natural frequency as specified in the purchase order when the equipment is installed for testing.

The vendor shall prepare a shock test procedure and a post shock test inspection and functional test procedure for all heavyweight equipment. These procedures shall be submitted to the Purchaser for approval no later than three months prior to the test date. The shock test procedure shall include, but not be limited to the system test conditions, definition of "Failure to Perform Specified Function," method of mounting equipment for test, and mode of equipment operation during test.

Manufacturing schedules shall allow ample time for shock testing at the test site and still meet the Purchaser's delivery requirements. Equipment that fails to pass the initial shock tests will have to be rescheduled as the shock test facility scheduling permits.

The vendor shall also allow sufficient time after the shock tests to allow for shipment back to the place of manufacture for post shock inspection, functional testing, and correction of all deficiencies so that the equipment may be delivered to the Purchaser on schedule.

In order to verify proper charge weight and test geometry, at least one velocity meter shall be placed on the floating shock platform at the base of the foundation or test fixture. The velocity meter instrumentation shall record the velocity-time history motion of the shock input to the base of the foundation or test fixture. This data shall be included in the shock test report.

The vendor shall furnish the following information to the test site with copy of forwarding letters to the Purchaser no later than three months prior to the scheduled test date:

1. Three copies of the Equipment Data Sheet (Fig. 1) complete with estimated delivery date and required completion date.
2. Drawings and/or Technical Manual showing:
 - (a) Outline of equipment.
 - (b) Sectional assembly of equipment.
 - (c) Bedplates and mounting when applicable.
 - (d) Plans showing all connections to the equipment such as piping, electrical conduit, air ducting, etc., which may affect the dynamic response of the equipment.

IV. DYNAMIC DESIGN AND ANALYSIS REQUIREMENTS AND PROCEDURES

Where approved by NNS and NAVSEA or specified in the purchase order; Grade A and B items which cannot be shock tested shall be designed for shock by the Dynamic Design Analysis Method (DDAM). Criteria for dynamic analysis and related stress analysis criteria, as specified by publication, NAVSEA 0908-LP-000-3010 shall be used. Guidance for dynamic analysis of specific items will be provided by the shipbuilder, as required. The static shock calculations shall also be included in the submittal of the concurrent dynamic analysis as required below. The dynamic analysis report shall be submitted to the Purchaser no less than four (4) months prior to scheduled delivery of the item to the Purchaser. Where calculated stresses exceed the allowed stresses, as defined below, or other unsatisfactory conditions are predicted as a result of the dynamic analysis, the Vendor shall provide a dynamic analysis of a satisfactory design including deficiencies. This information shall be submitted as a part of and at the same time as the dynamic analysis report. NAVSEA and the Purchaser will determine if it is desirable to correct the deficiencies and any such corrections will be made at the expense of the Purchaser.

The mathematical model report shall contain sufficient information to permit a meaningful dynamic analysis directly from the information contained therein. Supporting data for the dynamic shock analysis review, and the mathematical model report and dynamic analysis formats and contents shall be in accordance with the requirements of NAVSEA 0908-LP-000-3010.

Motion inputs for dynamic analysis will be as specified in the purchase order.

Strength and rigidity of foundations shall be suitable to withstand shock loads (where required) and to distribute them into the structure of the hull.

In general, possible shock damage shall be minimized. If misalignment would not interfere with operation of equipment, permanent deformation of the foundation is preferable to damage to the equipment or the hull. In any case, deformation should take the form of buckling or bending of local structure, rather than permitting the equipment to tear loose from its attachment. Foundation structure shall be proportioned to give a reasonable and uniform stress distribution, permitting maximum absorption of energy through elastic deformation. Corners and other causes of stress concentration shall be avoided. Brittle materials, such as cast iron, shall not be used. Under vertical shock forces, belts shall be stressed in tension rather than shear, insofar as practicable.

All foundations which support Grade A and B equipment shall be assigned the same shock grade as the supported equipment.

Buffers used to limit deflection under shock loading are subject to the same requirements as foundations.

The design of hold-down bolts shall be based upon the elastic design motion inputs specified in the purchase order. The item held down may, in general, be considered as a rigid body for those cases in which the bolts have not been, or cannot be, included in an item's shock test. Where the hold down bolts have been tested with the item and are acceptable for the intended installation in accordance with Mil. Spec. MIL-S-901, then these bolts will be considered satisfactory for shipboard installation.

Each principal direction of shock loading (vertical, athwartship, and fore-and-aft) shall be considered separately. Continuous operating stresses shall be added to calculated shock stresses. Comparison of calculated and allowable stresses will generally determine design acceptability. However, it shall also be assured that column buckling will not occur, and that deflection of foundations must not lead to overloading of flexible couplings or other displacement-critical components.

Hold-down bolts for equipment which has been qualified for shock on the basis of shock testing shall possess strength characteristics at least equal to those of hold-down bolts utilized during shock tests of the equipment. If the type of bolting used during the shock test is not known, the vendor shall establish and install hold-down bolts based upon the equipment elastic design motion inputs specified in Table 2 of Design Data Sheet DDS 072-1. The definitions of "hull-mounted" and "deck-mounted" as contained in Section B of DDS 072-1 do not apply. Instead, the definitions are modified as previously described in this appendix.

V. INSTALLATION

Bolts for holding down Grade A and B equipment to their foundations or subbases shall be installed in holes no greater than the following sizes:

| Nominal Bolt diameter (inches) | Maximum Diameter of hole (inches) |
|--------------------------------|-----------------------------------|
| 3/4 and smaller | Nominal bolt diameter + 1/32 |
| Larger than 3/4 | Nominal bolt diameter + 1/16 |

The above applies to clearance holes only. Where alignment must be maintained, fitted bolts or other positive methods should be used.

When equipment is supported on Distributed Isolation Material (DIM), the permissible diametral clearance between bolt and hole shall be increased by twice the wall thickness of the bushing required.

It is the intent of this appendix to provide equipment capable of meeting the shock requirements without the use of shock mounts. Shock mountings shall not be used without prior Shipbuilder approval.

When use of shock mounts has been approved, items shall be shock tested while installed on the same type of resilient mountings, including buffers (snubbers), that are to be used for shipboard installation. The resilient mountings used for the shock test shall not be installed aboard ship.

In the case of identical items which are to be hard-mounted as well as resilient-mounted, shock testing of the hard-mounted item will qualify the resilient-mounted item provided the resilient-mounted item is to be "hull-mounted". If a resilient mounted item is to be "deck-mounted", it shall also be tested.

VI. EQUIPMENT DATA SUBMITTAL REQUIREMENTS

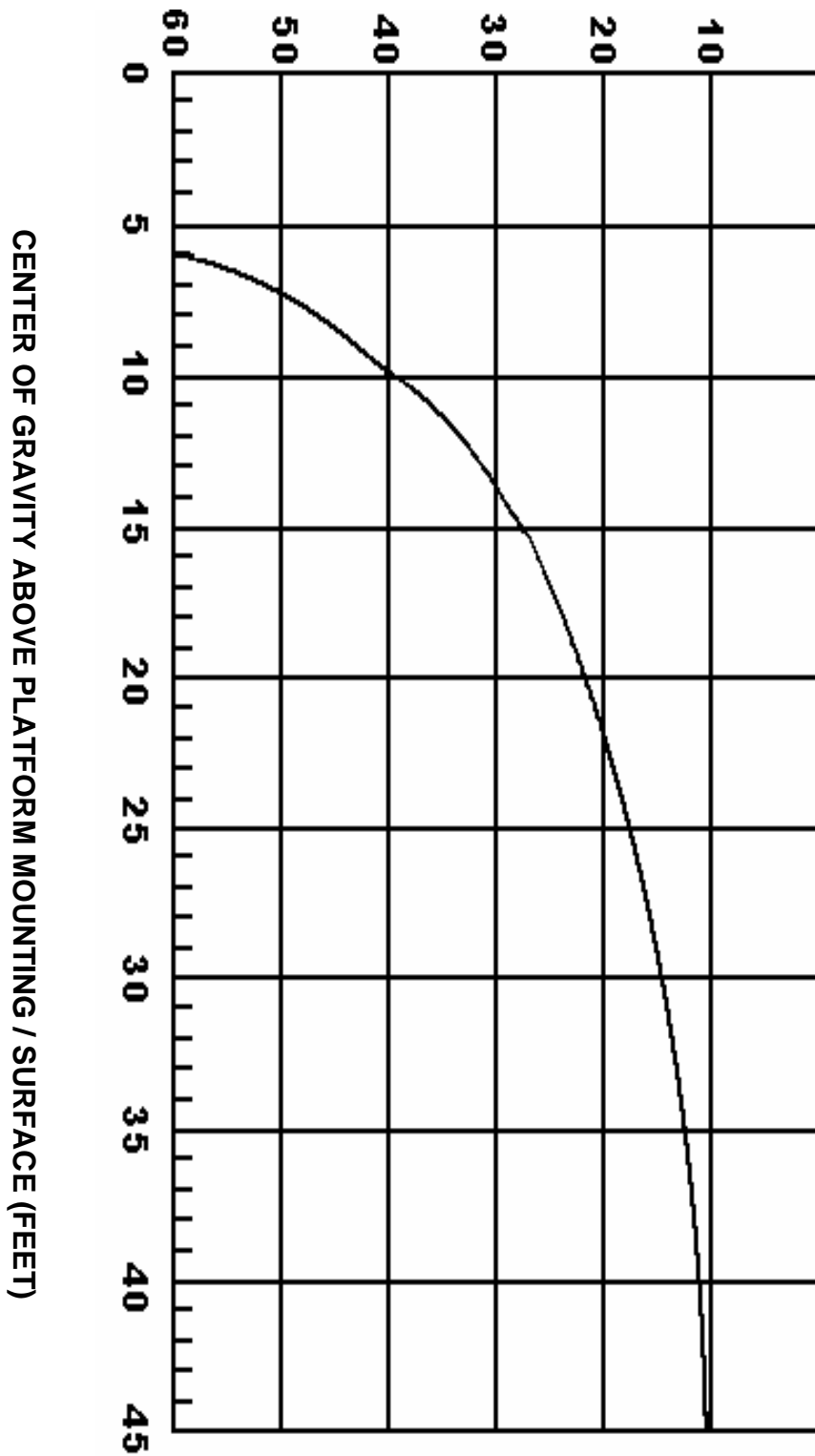
For each item of equipment 6,000 pounds and over, the information specified in the Equipment Data Sheet, Figure 1, attached hereto, shall be submitted to the Purchaser within 30 days after the placement of the purchase order. An Equipment Data Sheet shall also be submitted for items weighing less than 6,000 pounds that will not fit on the lightweight or mediumweight shock testing machines due to configuration.

The information contained in the Equipment Data Sheet shall be kept current. The vendor shall submit to the Purchaser a revised Equipment Data Sheet whenever new or up-dated information becomes available.

1. From: _____
2. To: _____
3. Equipment: _____
4. Size/Capacity: _____
5. Service: _____
6. Manufacturer: _____
7. Place of Manufacture: _____
8. Model No.: _____
9. Outline Dwg. No. : _____
10. Sectional Assy Dwg. No.: _____
11. Technical Manual No.: _____
12. Contract or Purchase Order No. : _____
13. Weight per Unit _____ Wet: _____ Dry: _____
14. Weight per Assy (For Multi-Unit Bedplate Assy) _____ Wet: _____ Dry: _____
NOTE: "Wet" Weight is considered to be the total operating weight of the equipment
15. Approx. Overall Envelop Size: _____ High: _____ Long: _____ Wide: _____
16. Height of Center-of-Gravity above Base of Equipment: _____ Ft.: _____
17. Has Equipment Ever Been Shock Tested? YES: _____ NO: _____ Med. Wt.: _____ Heavy Weight: _____
18. Grade: _____ (A or B)
19. Shock Test Report No.: _____ Passed: _____ Failed: _____
20. Applicable Ships: _____
21. Equipment Serial No.: _____
22. Expected Date Delivery: _____
To-Shipbuilder
23. Scheduled Date Installation: _____
In-Ship
24. Schedule Date Delivery: _____
To-FSP Test Facility
25. Remarks: _____

FIGURE 1

WEIGHT OF TEST ITEM (INCLUDING FOUNDATION & FIXTURES) KIPS



**FLOATING SHOCK PLATFORM
MAXIMUM PERMISSIBLE VERTICAL CENTER OF GRAVITY
FOR TESTED ITEMS
14" x 26" WORKING AREA MAXIMUM**

FIGURE 2