ABYC H-27 July 2021

Machinery Division Standard

Hull Piping Project
Technical Committee

The ABYC Standards and Technical Information Reports for Small Craft are the product of a consensus of representatives of government, industry, and public sectors. It is intended solely as a guide to aid manufacturers and the marine community in the design, construction, equipage, and maintenance of small craft.

ABYC reviews each standard at least every five years at which time it may be reaffirmed, revised, or withdrawn. ABYC welcomes any written comments on the standards and technical information reports.

ABYC H-27

SEACOCKS, THRU-HULL FITTINGS, AND DRAIN PLUGS

© 2021 American Boat & Yacht Council, Inc

Origin and Development

ABYC H-27 first appeared in 1972 as H-27, *Seacocks, Through-Hull Connections, Outboard Water Strainers, Water Scoops and Drain Plugs*. Revised editions were published in 1988, 1997, and 2008. In July 2014 H-27 was revised and renamed *Seacocks, Thru-Hull Fittings, and Drain Plugs*. The 2021 revision is the work of the Hull Piping Project Technical Committee.

Hull Piping Project Technical Committee

This list represents the membership at the time the committee was balloted.

Jon Sheller*, Chair*
Simon McFarland*, Vice Chair*

Pat Armano	Ulrich Heinemann	Derek Rhymes
Scott Berry	Bob Holt	Ed Wiser
Paul Campagna	Eric Johnson	
Steve D'Antonio	David Marlow	

Membership on a committee shall not in and of itself constitute an endorsement of ABYC or any document developed by the committee on which the member serves.

This standard, which is the result of extended and careful consideration of available knowledge and experience on the subject, was developed under procedures accredited as meeting the criteria for American National Standards and is intended to provide minimum performance requirements. The Project Technical Committee that approved the standard was balanced to ensure that individuals from competent and concerned interests have had an opportunity to participate.

ABYC's Project Technical Committee (PTC) meetings are open to the public. All inquiries regarding standards activity, interpretations, or meeting attendance should be directed to the ABYC Technical Department at comments@abycinc.org.

ABYC and its committees do not "approve" or "endorse" any item, construction, or proprietary device.

Request for Interpretations

Upon written request the Hull Piping PTC will render an interpretation of any requirement of the standard. The request for interpretation should be clear and unambiguous. Requests should be presented to the PTC in a manner in which they may be answered in a "Yes" or "No" fashion.

The committee reserves the right to reconsider any interpretation when or if additional information that might affect it becomes available to the PTC. Persons aggrieved by an interpretation may appeal to the committee for reinterpretation.

© 2021 American Boat & Yacht Council, Inc

Summary of Revisions

This list indicates revisions to the standard when compared with the previously published version. It is not intended to be used independently of the standard. It should be used for informational purposes and as a guide to the official requirements contained in this standard. It is the responsibility of the user to read and understand the complete standard.

The main changes in this revision of H-27, *Seacocks, Thru-Hull Fittings, and Drain Plugs* as compared with the previous edition dated 7/14, are:

- Scope and Purpose were combined and revised
- Units of Measure section was added
- Definitions were added
- Requirements from UL 1121 were incorporated

DISCLAIMER

ABYC technical board rules provide that all reports, including standards and technical information reports, are advisory only. Their use is entirely voluntary. They represent, as of the date of publication, the consensus of knowledgeable persons currently active in the field of small craft on performance objectives that contribute to small boat safety.

The American Boat & Yacht Council assumes no responsibility whatsoever for the use of, or failure to use, standards or technical information reports promulgated by it, their adaptation to any processes of a user, or any consequences flowing therefrom.

Prospective users of the standards and technical information reports are responsible for protecting themselves against liability for infringement of patents. The American Boat & Yacht Council Standards and Technical Information Reports are used to achieve a specific level of design or performance, and are not intended to preclude attainment of desired results by other means.

© 2021 American Boat & Yacht Council, Inc

TABLE OF CONTENTS

27.1 SCOPE 1
27.2 UNITS OF MEASURE 1
27.3 REFERENCES 1
27.4 DEFINITIONS 1
27.5 GENERAL REQUIREMENTS 2
27.6 INSTALLATION OF SEACOCK ASSEMBLIES 2
27.7 INSTALLATION OF DRAIN PLUGS 3
27.8 CONSTRUCTION - ALL DEVICES 3
27.9 CONSTRUCTION - THRU-HULL FITTINGS 3
27.10 CONSTRUCTION - SEACOCKS 4
27.11 MATERIALS 4
27.12 PERFORMANCE TESTING - ALL DEVICES 5
27.13 THERMAL CONDITIONING TEST 5
27.14 MECHANICAL AND THERMAL SHOCK TEST (SEACOCKS) 5
27.15 MOISTURE ABSORPTION TEST 6
27.16 RESISTANCE TO LIQUIDS TEST 6
27.17 VIBRATION TEST 6
27.18 SHOCK TEST 6
27.19 OPERATIONAL TEST (SEACOCKS) 6
27.20 LEAKAGE TEST (SEACOCKS) 7
27.21 10-DAY MOIST AMMONIA AIR STRESS CRACKING TEST 7
27.22 STATIC LOAD TEST 7
27.23 RESISTANCE TO ULTRAVIOLET WEATHERING TEST 7
27.24 MARKING 8
27.25 OWNER'S MANUAL AND COLLATERAL LITERATURE 8
FIGURE 1 - Seacock Assembly Static Load Test 9
TABLE 1 - Test Liquids 10
TABLE 2 - Torque Requirements for Threaded Connections 10

© 2021 American Boat & Yacht Council, Inc

H-27 SEACOCKS, THRU-HULL FITTINGS, AND DRAIN PLUGS

Based on ABYC's assessment of the existing technology, and the problems associated with achieving the goals of this standard, ABYC recommends compliance with this standard for all boats, associated equipment, and systems manufactured after July 31, 2022.

27.1 *SCOPE*

This standard applies to the selection of materials, design, construction, and installation of seacocks, thru-hull fittings, drain plugs, and other fittings intended for the passage of water in or out of a boat that penetrate the hull at or below the maximum heeled waterline. This standard applies to all boats.

27.2 *UNITS OF MEASURE*

Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate.

27.3 *REFERENCES*

The following references form a part of this standard. Unless otherwise noted the latest version of the referenced standards shall apply.

27.3.1 ABYC - American Boat & Yacht Council, Inc, 613 Third Street, Suite 10, Annapolis, MD 21403. Phone: (410) 990-4460. Fax: (410) 990-4466. Website: www.abycinc.org

ABYC E-2, *Cathodic Protection*
ABYC E-11, *AC and DC Electrical Systems on Boats*
ABYC H-8, *Buoyancy in the Event of Flooding/Swamping*
ABYC H-28, *Inflatable Boats*
ABYC P-1, *Installation of Exhaust Systems for Propulsion and Auxiliary Engines*

27.3.2 ASTM - ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959. Phone (610) 832-9500. Fax: (610) 832-9555. Website: www.astm.org

ANSI/ASTM D638-14, Standard Test Method for Tensile Properties of Plastics
ASTM G154 *Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials*
ASTM G155 *Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials*
ASTM 4329, *Standard Practice for Fluorescent Ultraviolet (UV) Lamp Apparatus Exposure of Plastics*

27.3.3 SAE - Society of Automotive Engineers, International, 400 Commonwealth Drive, Warrendale, PA 15096. Phone: (724)-776-4841. Fax: (724)-776-0790. Website: www.sae.org

SAE J30, *Fuel and Oil Hoses*

27.4 *DEFINITIONS*

For the purposes of this standard, the following definitions apply.

27.4.1 Drain Plug - removable plug that allows the draining of the bilge.

27.4.2 Maximum Heeled Waterline - the level of the water on the hull when the hull is inclined to:

27.4.2.1 for powerboats, an angle of seven degrees, or

27.4.2.2 for sailboats, the level of sheer amidships.

27.4.3 Readily Accessible - capable of being reached quickly and safely for effective use under emergency conditions without the use of tools.

27.4.4 Reinforced Hose - a hose manufactured with a secondary matrix or material to increase the strength and resists crushing and kinking (e.g., hose constructed with a fiber mesh or wire helix).

© 2021 American Boat & Yacht Council, Inc

Exhibit 1136
Bazooka v. Nuhn - IPR2024-00098
Page 5 of 15

27.4.5 Seacock - a type of valve used to control intake or discharge of water through the hull. It is operated by a lever type handle, usually operating through a 90° arc, clearly marked whether it is open or shut, and is typically of the two following types:

27.4.5.1 Flanged Sea Valve - a seacock with an integral flange used to individually and securely mount the device directly to the boat hull structure.

27.4.5.2 In-Line Ball Valve - a seacock designed to be supported entirely by the thru-hull fitting.

27.4.6 Static Floating Position - the attitude in which a boat floats in calm, fresh water with fuel tanks filled to rated capacity, but with no person or item of portable equipment aboard. The boat shall include all permanently installed factory supplied equipment and options such as, but not limited to, engine(s), battery(s), seats, engine oil, railings, fishing towers, etc, but not portable gear such as flags, searchlights, movable cushions, mattresses, portable fire extinguishers, lines, fenders, chairs, tables, anchors, chain, or personal floatation devices (PFDs). Other tanks such as water, holding, and live bait well tanks are to be empty.

27.4.7 Thru-Hull Fitting - a fitting designed to accept pipes, hoses, or valves to allow the passage of water in or out of a vessel.

27.5 *GENERAL REQUIREMENTS*

27.5.1 All thru-hull fittings or hull penetrations designed to accept pipes, hoses or valves, with any part of the opening below the maximum heeled waterline when inclined from the static floating position, shall be equipped with a seacock to stop the admission of water in the event of failure.

EXCEPTIONS:

1. *Boats that conform to the level flotation performance criteria of ABYC H-8, Buoyancy in the Event of Flooding/Swamping and use reinforced hose.*
2. *Hull penetrations that discharge above the waterline in its static floating position and below the maximum heeled waterline and use reinforced hose.*
3. *Shafting systems that use reinforced hose.*
4. *Jet and stern drive propulsion with integral components from intake through the discharge.*
5. *Inflatable boats that comply with ABYC H-28, Inflatable Boats and use reinforced hose.*
6. *Pontoon Boats that comply with ABYC H-35, Powering and Load Capacity of Pontoon Boats and use reinforced hose.*
7. *Exhaust system installation that comply with ABYC P-1, Installation of Exhaust Systems for Propulsion and Auxiliary Engines.*

27.5.2 Seacocks shall be designed and constructed to meet H-27.8 through H-27.24 where applicable.

27.5.3 Thru-hull fittings shall be designed and constructed to meet H-27.8 through H-27.24 where applicable.

EXCEPTION: Spuds or flanged fittings bolted to the hull, integral with, or mechanically fastened to the hull, and formed with a material compatible with the hull.

27.5.4 If a boat is fitted with a drain plug, the following requirements shall apply.

27.5.4.1 Attachment of the drain plug body to the hull shall be watertight, under normal operating conditions (i.e., removal and installation of the plug).

27.5.4.2 The use of expandable type drain plugs shall be limited to boats equipped with flotation in compliance with ABYC H-8, *Buoyancy in the Event of Flooding/Swamping*.

27.5.4.3 Expandable type plugs shall be adjusted and designed to prevent inadvertent disassembly.

NOTE: One method of effecting this is by crimping or distorting the threaded ends of the adjusting stem.

27.6 *INSTALLATION OF SEACOCK ASSEMBLIES*

27.6.1 A seacock assembly, including the thru-hull and tail piece, shall be securely mounted so that the assembly will withstand a 500 lb (227 kg) static force applied for 30 sec to the inboard end of the assembly, without the assembly failing to stop the ingress of water (see FIGURE 1).

© 2021 American Boat & Yacht Council, Inc

27.6.1.1 The installation shall prevent any movement of the assembly.

27.6.1.2 Thru-hull fittings and seacocks shall be connected directly.

EXCEPTION: If space constraints prevent meeting H-27.6.1.2 then one nonflexible component may be installed.

27.6.2 Threads used in seacock installations shall be compatible (e.g., NPT to NPT, NPS to NPS).

27.6.2.1 Thru-hull fitting and seacock manufacturers' recommendations shall be followed regarding thread engagement requirements.

27.6.3 Seacocks shall be readily accessible as installed, and oriented so that their handles are easy to operate.

27.6.4 If the seacock is fitted with a drain, the drain shall be oriented to permit drainage.

27.6.5 If the seacock is fitted with a grease fitting, the fitting shall be accessible as installed.

27.6.6 If a flanged seacock is used, its flange shall be securely mounted to the hull structure.

27.6.6.1 If present, holes in seacock flanges shall be used with proper fasteners.

27.6.7 On metal hulled boats, metal thru-hull fittings shall be galvanically compatible with the hull plating or shall be electrically insulated from the hull plating.

27.7 *INSTALLATION OF DRAIN PLUGS*

27.7.1 If installed, drain plugs shall be located in what is expected to be the lowest portion of the bilge when the boat is in storage and

27.7.1.1 drain plugs shall be readily accessible.

27.7.2 Provision shall be made to minimize galvanic corrosion of those devices incompatible with the hull material (see ABYC E-11, *AC and DC Electrical Systems on Boats*, and ABYC E-2, *Cathodic Protection*).

NOTE: Where metallic thru-hull fittings and drain plugs are installed below the normal accumulation of bilge water, consideration should be given to the installation of a bonding system (see ABYC E-11, AC and DC Electrical Systems on Boats and ABYC E-2, Cathodic Protection.

27.8 *CONSTRUCTION - ALL DEVICES*

27.8.1 A thru-hull fitting or seacock shall have a nonclogging passageway.

27.8.2 A thru-hull fitting or seacock shall be constructed to prevent loosening from the hull or shifting in position in service when mounted as intended.

27.9 *CONSTRUCTION - THRU-HULL FITTINGS*

27.9.1 A thru-hull fitting shall be constructed to provide the necessary rigidity and strength to withstand:

27.9.1.1 the pressures developed by the expansion and contraction of typical hull constructions resulting from moisture absorption and thermal effects, and

27.9.1.2 the vibration and shock stress that can be anticipated in the intended service, and

27.9.1.3 a 500 lb (227 kg) static load for 30 sec when installed with a seacock and tested in accordance with the Static Load Test (see H-27.22).

27.9.2 If a thru-hull fitting or the fitting attached to the seacock is intended for use with a hose, the hose connection shall:

27.9.2.1 have a bead or a series of annular grooves or serrations not less than 0.015 in (0.38 mm) deep, and

© 2021 American Boat & Yacht Council, Inc

Exhibit 1136
Bazooka v. Nuhn - IPR2024-00098
Page 7 of 15

27.9.2.2 be of such length that a 0.5 in (12.7 mm) wide clamp can be positioned beyond the bead or over the serrations of the spud with a minimum of one clamp width from the clamp to the hose end.

27.9.3 The threaded portion intended to extend through the hull planking or shell, and the doubler block, shall be sufficient length to provide at least five full threads engagement with a retaining nut or with the matching threaded body of a seacock when installed as intended.

27.9.4 If the flange of a flanged seacock is to be drilled in the field to match a particular installation, instructions shall be provided that describe in detail the intended mounting method, including number, size, and edge distance of holes and type and size of fastenings.

27.9.5 The external flanges of a thru-hull fitting shall:

27.9.5.1 have provision for holding or turning the thru-hull hull fitting,

27.9.5.2 permit the optional installation and use of strainers, scoops, or deflectors,

27.9.5.3 be formed to reduce the likelihood of the thru-hull fitting snagging on lines, and sea growth, and

27.9.5.4 be resistant to ultraviolet weathering, as determined in H-27.23, if of polymeric material.

27.10 *CONSTRUCTION - SEACOCKS*

27.10.1 A seacock, with or without an integral flange, when installed with a thru-hull fitting shall be capable of withstanding the Static Load Test in 27.22.

27.10.2 A seacock shall be provided with a lever type handle and if the handle is removed, it shall be possible to operate the seacock with ordinary tools such as crescent or ordinary wrenches, pliers, or pipe wrenches.

27.10.3 The position (open or closed) of a seacock shall be clearly marked.

27.10.4 A seacock shall be constructed so that its position (open or closed) will not be altered by vibration or shock.

27.10.5 A seacock shall be provided with a means to permit draining of any entrapped fluid, such as in the bore of a plug cock valve when the valve is closed.

EXCEPTION: A seacock capable of passing the freeze test without permanent damage when tested in accordance with the Thermal Conditioning Test (see H-27.13) need not comply with this requirement.

27.11 *MATERIALS*

27.11.1 The components of a thru-hull fitting or seacock shall be formed of galvanically compatible materials having the strength and resistance to corrosion necessary to withstand intended and abnormal use to which they are likely to be subjected.

27.11.1.1 Intended use includes:

27.11.1.1.1 exposure to the various fuels, fluids, and compounds used on boats,

27.11.1.1.2 exposure to varying temperatures,

27.11.1.1.3 exposure to moving water, and

NOTE: Moving water may result in erosion.

27.11.1.1.4 exposure to sustained stagnant water.

27.11.1.2 Abnormal use includes:

27.11.1.2.1 improper dry docking, and the like, and

© 2021 American Boat & Yacht Council, Inc

27.11.1.2.2 running aground.

27.11.2 A part made of drawn brass or machined from brass rod containing more than 15% zinc shall be subjected to the 10-Day Moist Ammonia Air Stress Cracking Test, H-27.21.

27.12 ***PERFORMANCE TESTING - ALL DEVICES***

27.12.1 Representative samples of a thru-hull fitting or seacock are to be subjected to the tests described in H-27.13. through H-27.23.

27.12.2 A thru-hull fitting is to be tested using either a retaining nut to simulate above water line installation or a closure device to simulate below water line installation, depending on the intended use.

27.12.3 The mechanical stresses normally imposed on or within a part as a result of the assembly and installation of the thru-hull fitting or seacock are to be applied in tests involving the complete device.

27.12.4 For the purpose of these requirements, mechanical malfunction is defined as a malfunction of the device that would necessitate repair or replacement, including any malfunction that would impair intended operation.

27.12.5 Two samples of the device are to be installed in a test rig in accordance with the manufacturer's installation instructions. The mounting portion of the rig is to consist of simulated hull sections of the same material and in the same thickness, or constructed of the material for which the device is intended for use (e.g., glass reinforced plastic, steel, aluminum, and the like). The simulated hull section is to be inclined 45° above the horizontal plane.

27.12.6 A threaded thru-hull fitting or seacock is to be tested while connected to a one foot (0.3 m) length of iron pipe size (IPS) pipe. A thru-hull fitting or seacock intended for use with a hose only is to be tested with a three foot (0.9 m) length of 30R2, Type 2 hose, complying with SAE J30, *Fuel and Oil Hoses,* and supported at the free end by a bracket connected directly to the specific test table.

27.12.7 A complete assembly, consisting of the samples of the device being tested in the arrangement described in H-27.12.5 and H-27.12.6, is to be subjected to each of the following tests. For a seacock, one of the samples is to be in the open position and the other in the closed position during the tests described in the Vibration Test (see H-27.17) and the Shock Test (see H-27.18).

27.13 ***THERMAL CONDITIONING TEST***

27.13.1 There shall be no mechanical malfunction or distortion of a thru-hull fitting or seacock, or of any component of the device, following thermal conditioning for 50 hr at a temperature of 60°C (140°F) and 50 hr at a temperature of -30°C (-22°F).

27.13.2 The assembled sample is to be placed in an air oven maintained at 60 ± 5°C (140 ± 9°F) and a second assembly placed in a cold chamber maintained at -30 ± 3°C (-22°F) for 50 hr.

27.13.3 For a seacock, immediately following the initial exposure period the samples in the air oven and the cold chamber are to be subjected to a minimum of six complete cycles of operation, their conditioning environments interchanged, and then the samples are to be conditioned for an additional 50 hr.

27.13.4 Following this second exposure period, the test samples are to be operated at least once and then examined for evidence of mechanical malfunction.

27.13.5 A seacock which has no drain plug (see H-27.10.6 EXCEPTION) shall additionally be tested in the cold chamber in accordance with H-27.13.3 with the bore filled completely with fresh water. The valve is to be closed during the test.

27.14 ***MECHANICAL AND THERMAL SHOCK TEST (SEACOCKS)***

27.14.1 A seacock shall withstand mechanical and thermal shock without mechanical malfunction.

27.14.2 Upon completion of the final 50 hr thermal conditioning period specified in H-27.13, each of the test assemblies is to be mounted on a shock table within 30 sec of its removal from the chamber and the assembly subjected to 25 shock impacts of 20 *g* (196 m/sec^2), acceleration and 20-25 msec duration as measured at the base of the half sine shock envelope.

© 2021 American Boat & Yacht Council, Inc

Exhibit 1136
Bazooka v. Nuhn - IPR2024-00098
Page 9 of 15

27.14.3 The machine used for this test is to be of the automatic cycling type producing a half sine shock pulse at the acceleration level and duration specified. The acceleration and shock pulse duration is to be measured by a piezoelectric accelerometer mounted on the test machine platform on an axis parallel to the axis of motion.

27.14.4 The test rig is to be mounted so that the center of gravity of the sample is as close as possible to the geometric center of the machine platform.

27.14.5 Following the test described in H-27.14.2 to H-27.14.4, each sample is to be preconditioned to a temperature of -30°C (-22°F). Water at 82°C (180°F) shall then flow through the sample.

27.15 *MOISTURE ABSORPTION TEST*

27.15.1 A thru-hull fitting or seacock and its mounting or supporting materials is to be dried for eight hours in an air oven maintained at 60°C (140°F). Following this drying period, the samples are to be tightened as intended in service, and the samples are to be submerged for eight hours in fresh water maintained at room ambient, approximately 23°C (73°F).

27.15.2 While submerged in water, the test assembly shall withstand, without mechanical malfunction, the contraction and expansion forces resulting from intended mounting and tightening of the device.

27.16 *RESISTANCE TO LIQUIDS TEST*

27.16.1 An assembly or component formed of a nonmetallic material shall be subjected to 30 days of continuous immersion in each of the specified liquids in TABLE 1 maintained at a temperature of 23°C (73°F). Following exposure to the designated liquids, the nonmetallic materials are to be examined for evidence of swelling, decomposition, or deformation and the sample tested for intended operation.

NOTE: If one sample is used for multiple liquids, it may be rinsed with water between each exposure.

27.17 *VIBRATION TEST*

27.17.1 A thru-hull fitting or seacock shall withstand, without mechanical malfunction, the vibration specified in H-27.17.2 and H-27.17.3.

27.17.2 The test assembly is to be subjected to variable frequency vibration in each of three rectilinear axes (horizontal, vertical, and lateral) for four hours in each plane (total 12 hr), at a peak to peak amplitude of 0.030 ± 0.001 in (0.76 ± 0.03 mm). The frequency of vibration is to be continuously varied, at a uniform rate, from 10 to 60 to 10 Hz every four minutes.

27.17.3 For this test, peak to peak amplitude is defined as the maximum displacement of sinusoidal motion of the vibration table in one complete cycle.

27.18 *SHOCK TEST*

27.18.1 A thru-hull fitting or seacock shall withstand 5000 shock impacts without development of mechanical malfunction or leakage.

27.18.2 The test assembly is to be mounted on a shock machine and subjected to 5000 shock impacts having a 10 *g* (98 m/sec^2) acceleration and a 20-25 ms duration, as measured at the base of the one half wave shock envelope.

27.19 *OPERATIONAL TEST (SEACOCKS)*

27.19.1 A seacock shall withstand the test conditions specified in H-27.19.2 through H-27.19.3 without mechanical malfunction, or the development of leakage in excess of two gallons (7.57 L) of water per 24 hr.

27.19.2 A sample of the valve is to be mounted with a thru-hull fitting on a simulated hull section in accordance with the manufacturer's installation instructions, and the assembly secured to a test chamber capable of maintaining a controlled hydrostatic head on the external opening of the thru-hull fitting.

27.19.3 The chamber is to be filled with water and purged of all air. The pressure in the chamber then is to be raised to 10 psig (69 kPa) and the sample subjected to 25 complete cycles of operation from the fully open to fully closed positions.

© 2021 American Boat & Yacht Council, Inc

27.20 ***LEAKAGE TEST (SEACOCKS)***

27.20.1 There shall be no evidence of leakage at the points of connection of a seacock when the device is installed and connected in accordance with the manufacturer's installation instructions and subjected to an aerostatic pressure of 50 psig (345 kPa) for one minute.

27.20.2 The pressure source is to be connected to the inlet of the sample and the outlet of the sample is to be provided with a five foot (1.5 m) length of pipe or hose that is capped or otherwise blocked at its free end.

27.21 ***10-DAY MOIST AMMONIA AIR STRESS CRACKING TEST***

27.21.1 After being tested as described in H-27.21.2 through H-27.21.5, a brass part containing more than 15% zinc shall show no evidence of cracking or delamination when examined using 25X magnification.

27.21.2 The sample is to be subjected to the mechanical stresses normally imposed on or within the part as the result of intended assembly with other components of the thru-hull fitting or seacock, or with tubing or piping. Such stresses are to be applied to the sample prior to and remain effective during the test. Samples with threads, intended to be used for installing the product in the field, are to have the threads engaged and tightened to the torque specified in TABLE 2. Teflon tape or pipe compound are not to be used on the threads.

27.21.3 Female pipe threaded ends are to be engaged with extra strong brass plugs, fittings, or pipe. Threaded parts are to be tightened to the degree normally found acceptable to produce a leak tight assembly.

27.21.4 Three samples are to be degreased and then continuously exposed in a set position for 10 d to a moist ammonia air mixture maintained in a glass chamber having length, width, and height approximately 12 x 12 x 12 in (305 x 305 x 305 mm) and having a glass cover.

27.21.5 Approximately 600 ml of aqueous ammonia having a specific gravity of 0.94 is to be maintained at the bottom of the glass chamber below the samples. The samples are to be positioned 1.5 in (38.1 mm) above the aqueous ammonia solution and supported by an inert tray. The moist ammonia air mixture in the chamber is to be maintained at atmospheric pressure with the temperature constant at approximately 34°C (93°F).

27.22 ***STATIC LOAD TEST***

27.22.1 There shall be no evidence of physical failure of a simulated installation of an assembly of a thru-hull fitting and seacock when a 500 lb (227 kg) load is applied to the end of the hose or pipe fitting used to connect the seacock to the boat system. The assembly is to be made in accordance with the manufacturer's instructions and the test load is to be held for a period of 30 sec (see FIGURE 1).

27.22.2 A combination seacock/thru-hull fitting is to be tested in the as-received condition. A seacock marked for use with a specific thru-hull fitting is to be tested with that fitting. A thru-hull fitting marked for use with a specific seacock is to be tested with that seacock. If the seacock (or fitting) is marked for use with both nonmetallic and metallic thru-hull fittings (or seacocks), the test is to be conducted using the weakest material. A seacock not marked for use with a specific thru-hull fitting(s) is to be tested with a bronze fitting and a thru-hull fitting not marked for use with a specific seacock(s) is to be tested with a bronze seacock. A test conducted on a sample of the smallest seacock of a series of seacocks, or the longest thru-hull fitting of a series of thru-hull fittings, of the same design is to be accepted as representing the series, providing the constructions are basically identical and the wall thicknesses are directly proportionate to the sizes. If, because of changes in wall thickness or differences in construction, the smallest seacock or longest fitting may not be the weakest assembly, tests on individual sizes may be necessary.

27.22.3 For the test, the thru-hull fitting/seacock assembly is to be installed in accordance with the manufacturer's instructions.

27.22.4 The hull test section in which the seacock assembly is mounted is to be secured to a rigid test fixture so that a 500 lb (227 kg) load can be applied to the seacock assembly. The load is to be applied at a controlled rate of 12 in/min through a straight hose fitting so that the load is applied 90° to the axis through the bore of the thru-hull fitting and valve.

27.23 ***RESISTANCE TO ULTRAVIOLET WEATHERING TEST***

27.23.1 A polymeric material used in the external flange of a thru-hull fitting shall retain at least 70% of its original tensile strength after being subjected to the light and water exposure conditioning specified in H-27.23.3.

© 2021 American Boat & Yacht Council, Inc

Exhibit 1136
Bazooka v. Nuhn - IPR2024-00098
Page 11 of 15

27.23.2 Five specimens of the polymeric material in the as-received condition and five specimens that have been conditioned as described in H-27.23.3 are to be tested as specified in the ANSI/ASTM D638-14, *Standard Test Method for Tensile Properties of Plastics* and the tensile strength recorded. The tensile strengths of the conditioned specimens are then to be compared to those of the as received specimens.

27.23.3 The five specimens that are to be conditioned are to be subjected to either:

27.23.3.1 720 hr of light and water exposure in accordance with ASTM G155, *Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials* cycle 7, or

27.23.3.2 720 hr of light and water exposure in accordance with ASTM G154, *Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials* with cycle ASTM 4329, *Standard Practice for Fluorescent Ultraviolet (UV) Lamp Apparatus Exposure of Plastics.*

27.24 *MARKING*

27.24.1 Each thru-hull fitting and seacock shall be legibly marked with the name, trademark, or other symbol identifying the manufacturer or private labeler and a distinctive model number, catalog designation, or the equivalent.

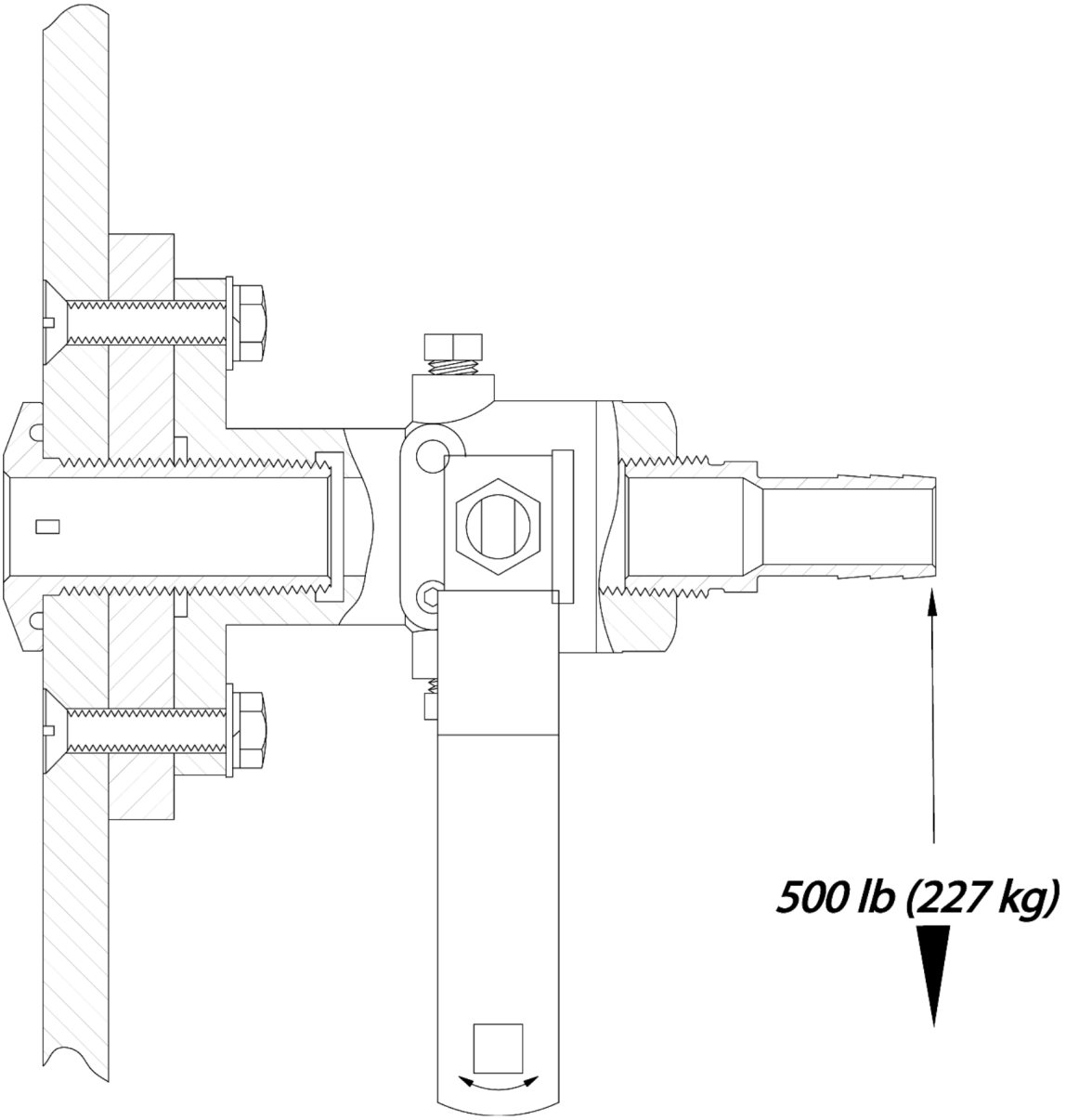
27.24.2 If a manufacturer produces a thru-hull fitting or seacock at more than one factory, each thru-hull fitting or seacock shall have a distinctive marking to identify it as the product of a particular factory.

27.25 *OWNER'S MANUAL AND COLLATERAL LITERATURE*

This standard does not contain any requirements for information to be included in the owner's manual or collateral literature.

© 2021 American Boat & Yacht Council, Inc

FIGURE 1 - Seacock Assembly Static Load Test



© 2021 American Boat & Yacht Council, Inc

Exhibit 1136
Bazooka v. Nuhn - IPR2024-00098
Page 13 of 15

TABLE 1 - Test Liquids

FLUID WITH WHICH THE DEVICE IS INTENDED TO BE IN CONTACT	TEST LIQUID TO BE USED
Fuel Oils, Nos 1 and 2, and Kerosene	IRM immersion oil 903
Gasoline	Reference Fuels A and C D471-96 (ASTM D 471-96)
Sodium hypochlorite	Sodium hypochlorite (5.25% by weight)
Ammonia	Commercial-type household ammonia
Fresh water	Fresh water
Salt water	Salt water (5% sodium chloride)

TABLE 2 - Torque Requirements for Threaded Connections

NOMINAL THREAD SIZE (in)	TORQUE	
	(lb-in)	(Nm)
1	1200	135.6
$1^1/_4$	1450	163.8
$1^1/_2$	1550	175.1
2	1650	186.4
$2^1/_2$	1750	197.7
3	1800	203.4

* * * * *

© 2021 American Boat & Yacht Council, Inc