Table 19-1.
Fire Extinguisher Requirements for Launches/Motorboats

Length	Extinguisher
Less than 26 feet (7.9 m)	One 1-A:10-B:C
26 feet (7.9 m) or more	Two 1-A:10-B:C

19-10. Checklists and Forms.
ENG Form 6175, Small Boat (Less Than 26 Feet) and Equipment Checklist (https://www.publications.usace.army.mil/USACE-Publications/Engineer-Forms)

Chapter 20
Pressurized Equipment and Systems

20-1. References.

a. ASME B31, Code for Pressure Piping (https://www.asme.org) (20-1.a)

b. ASME B31Q, Pipeline Personnel Qualification (https://www.asme.org/) (20-1.b)

c. ASME, Boiler and Pressure Vessel Code (BPVC) (https://www.asme.org/) (20-1.c)

d. ASME, Code for Unfired Pressure Vessels (https://www.asme.org/) (20-1.d)

e. CGA C-6, Standard Visual Inspection of Steel Compressed Gas Cylinders (https://portal.cganet.com/Publication/index.aspx) (20-1.e)

f. CGA C-8, Standard for Requalification of DOT-3HT, CTC-3HT, and TC-3HTM Seamless Steel Cylinders (https://portal.cganet.com/Publication/index.aspx) (20-1.f)

g. CGA P-1, Standard for Safe Handling of Compressed Gases in Containers (https://portal.cganet.com/Publication/index.aspx) (20-1.g)

h. MIL-STD 101B, Color Code for Pipelines and for Compressed Gas Cylinders (https://webstore.ansi.org/) (20-1.h)

i. National Board of Boiler and Pressure Vessel Inspectors (NBBI), National Board Inspection Code (NBIC) (https://www.nationalboard.org/index.aspx?pageID=4) (20-1.i)

j. 49 CFR 171, General Information, Regulations, and Definitions (Hazardous Materials Regulations) (https://www.govinfo.gov/content/pkg/CFR-2020-title49-vol2/pdf/CFR-2020-title49-vol2-part171.pdf) (20-1.j)

k. 49 CFR 172, Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, Training Requirements, and Security Plans (https://www.govinfo.gov/content/pkg/CFR-2020-title49-vol2/pdf/CFR-2020-title49-vol2-part172.pdf) (20-1.k)

l. 49 CFR 173, Shippers- General Requirements for Shipments and Packagings (https://www.govinfo.gov/content/pkg/CFR-2020-title49-vol2/pdf/CFR-2020-title49-vol2-part173.pdf) (20-1.l)

m. 49 CFR 175, Carriage by Aircraft (https://www.govinfo.gov/content/pkg/CFR-2020-title49-vol2/pdf/CFR-2020-title49-vol2-part175.pdf) (20-1.m)

n. 49 CFR 176, Carriage by Vessel (https://www.govinfo.gov/content/pkg/CFR-2020-title49-vol2/pdf/CFR-2020-title49-vol2-part176.pdf) (20-1.n)

o. 49 CFR 177, Carriage by Public Highway (https://www.govinfo.gov/content/pkg/CFR-2020-title49-vol2/pdf/CFR-2020-title49-vol2-part177.pdf) (20-1.o)

20-2. Definitions.

a. Air Receiver. A tank used for the storage of air discharged from the compressor; used to help eliminate pressure pulsations in the discharge line. (20-2.a)

b. Competent Person (CP). See paragraphs 1-2 or 2-2, as applicable. (20-2.b)

c. Fuel Gas. A gas (for example, acetylene, hydrogen, natural gas, propane) used with oxygen in the oxy-fuel process and for heating. (20-2.c)

d. Fusible Plug. A device designed to relieve pressure and to indicate certain conditions that contribute to low water. (20-2.d)

e. Pressure Systems. All pipe, tubing, valves, controls, and other devices that operate or are maintained above atmospheric pressure. (20-2.e)

f. Qualified Inspector (QI). Individuals performing authorized inspections as required in the ASME BPVC. The QI may not be employed by the manufacturer. (20-2.f)

g. Qualified Person (QP). See paragraphs 1-2 or 2-2, as applicable. (20-2.g)

h. Safety Lashing. A rope, cord, chain, or other suitable material flexible lacing that is used to fasten two objects together securely and thus rendering the objects safe. (20-2.h)

i. Safety Relief Valves. Valves that relieve excess pressure or vacuum (depending on their design) that would otherwise damage equipment or cause injury to personnel. (20-2.i)

j. Unfired Pressure Vessels. Vessels that can withstand internal pressure or vacuum, but are not heated by burning fuel or electricity (heat may be generated in the vessel due to chemical reactions or the application of heat directly to vessel contents). (20-2.j)

20-3. Personnel Required Qualification/Training.

a. Qualified Inspectors (QI). QIs must be certified by an ASME accredited Authorization Inspection Agency or Qualified Inspection Organization. The QI may not be employed by the manufacturer. (20-3.a)

b. Qualified Mechanics. Mechanics who adjust or change the settings of safety relief valves must be qualified according to the ASME BPVC. (20-3.b)

20-4. Roles and Responsibilities.

a. Qualified Inspectors (QI). Perform and oversee inspections according to paragraph 20-5. (20-4.a)

b. Competent Person (CP). (20-4.b)

(1) Perform and oversee inspections according to paragraph 20-5.

(2) Develop and supervise test procedures that involve pressurized air or gases. Submit procedures to the USACE supervisor or approval or to the KO or COR for acceptance.

c. Qualified Person (QP). (20-4.c)

(1) Supervise the bleeding of compressed gas cylinders containing toxic gases.

(2) Only QPs may refill compressed gas cylinders.

20-5. Inspection Requirements.
Records of the inspections and tests must be available for review on request. Post certificates of compliance near the vessel controls prior to operation of the equipment.

a. Inspections and Tests - General. (20-5.a)

(1) Inspect and conduct performance tests on pressurized equipment and systems before placing them in service and after any repair or modification.

(a) New pressure vessels. Conduct inspections of pressure vessels prior to placing in service according to the ASME BPVC.

(b) In-service pressure vessels. Conduct inspections of in-service pressure vessels according to the NBBI/NBIC.

(2) If not otherwise specified by state or local codes or the manufacturer, the QI will determine inspection frequency and document the inspections. State and local codes take precedent for inspection frequency.

(3) A CP must perform and document visual inspections of pressurized equipment. Inspect temporary or portable pressurized equipment and systems at least once every six months and permanent installations at least annually.

b. Hydrostatic Testing of In-Service Pressure Vessels. (20-5.b)

(1) Unless otherwise specified by state or local codes, perform hydrostatic testing of in-service unfired pressured vessels as follows:

(a) After any repairs or modifications that may affect the integrity of the system or its ability to maintain stored pressure, as determined by the QI.

(b) According to the manufacturer's instructions or a QI's recommendations after consultation with the manufacturer.

(2) Perform hydrostatic testing on vessels with inspection doors, such as oil filled (governor) pressure tanks, whenever they are repaired or modified or appear to be deteriorating. The frequency of inspections to determine internal or external conditions will be according to the manufacturer's recommendations or as determined by a QI.

(3) The following unfired vessels are exempt from this requirement:

(a) Vessels designed for a maximum allowable pressure not exceeding 15 psi (103.4 kPa).

(b) Vessels having an internal volume of 5 ft^3 (0.14 m^3) or less and a maximum rated pressure of 100 psi (689.5 kPa).

(c) Compression tanks containing water under pressure not exceeding 100 psi (689.5 kPa) and temperatures not exceeding 200°F (93.3°C).

(d) Compression tanks containing water and fitted with a permanent air charging line subject to pressures not exceeding 15 psi (103.4 kPa) and temperatures not exceeding 200°F (93.3°C).

(4) Fire extinguishers (see chapter 9).

c. Boiler and Systems Inspection. (20-5.c)

(1) Inspect safety devices affecting operation of the firing equipment to determine if they are installed and located so that they cannot be isolated from the heat source by the closing of a valve.

(2) Re-inspect and post a new certificate prior to placing into operation any boilers that have undergone major structural repairs or those that have been relocated during their current 12-month certification period.

(3) Inspect steam boilers and pressure vessels according to the ASME BPVC.

d. Compressed Gas Cylinders. Visually inspect compressed gas cylinders according to 49 CFR 171–173 and 175–177 and CGA C-6, C-8, and P-1. (20-5.d)

20-6. Activity Hazard Analysis (AHA) Requirements.
Develop AHAs according to paragraphs 1-6 or 2-6, as applicable.

20-7. Minimum Plan Requirements.
Not Applicable.

20-8. General Requirements.

a. General. (20-8.a)

(1) Tag any pressurized equipment or system found to be in an unsafe operating condition as "UNSAFE PRESSURIZED SYSTEM - DO NOT USE". Locate the tag at the controls. Do not use the equipment until the unsafe conditions are corrected.

(2) Only designated personnel may operate or maintain pressurized equipment and systems.

(3) Do not operate any pressurized equipment or systems above their design pressure.

(4) Do not remove or make ineffective any safety appliance or device, except for when making immediate repairs or adjustments. Ensure that the pressure is relieved and the power shut off using proper LOTO procedures prior to working on the equipment or systems. (See chapter 12).

(5) Prepare a written safe clearance (that is, control of hazardous energy) procedure prior to repairing or adjusting equipment or systems under pressure (see chapter 12).

(6) Locate discharge from safety valves, relief valves, and blowoffs so that it is not a hazard to personnel.

(7) Master valves and controls must be either located or equipped to permit operation from the floor level, or they must be provided with safe access to them.

(8) Provide a pressure gauge on all pressurized equipment and systems; and maintain it in good operational condition.

(9) Provide safety and relief valves on all pressurized equipment and systems.

(a) Do not set the safety relief valve higher than the maximum allowable pressure of the receiver or the system. A safety relief valve setting not more than 10% over working pressure is recommended.

(b) Do not place valves between the pressure vessel or generating equipment and a safety or relief valve, or between the safety or relief valve and the atmosphere, unless the configuration meets the requirements of the ASME BPVC.

(c) Only qualified mechanics using appropriate equipment may adjust or change the settings of safety relief valves (see para 20-3.b). All valves must be sealed after adjusting.

(d) Check the functioning of the pressure gauge immediately if the pressure gauge registers above the maximum allowable working pressure and the safety or relief valve does not open. If the safety or relief valve is inoperative or malfunctioning, then remove the associated equipment from service until the safety or relief valve is adjusted or replaced.

(10) Piping must meet requirements of the ASME B31.

(11) Provide an automatic shut-off or other enabling device control on pressurized manual equipment that might whip or rotate if released.

(12) Except where automatic shutoff valves are used, install safety lashings or suitable double action locking devices where high-pressure hose lines connect to machines or another high-pressure line.

(13) Secure the connections to high pressure hoses with a safety lashing or whip check.

(a) Safety lashings must be made of two metal hose clamps connected by a flexible lacing. The metal hose clamps must attach to the hose ends separate from the quick makeup connection.

(b) The flexible lacing material must be suitably strong material. Wires or pins through the quick makeup connection are not acceptable for use as safety lashings.

(14) Equip all pressurized cylinders, actuating booms, outriggers, or other load supporting appliances with pilot check valves, holding valves, or positive mechanical locks to prevent movement in case of failure in the pressure system. Pressure system fitting replacement parts must be equivalent to the manufacturer's standards.

b. Compressed Air and Gas Systems. (20-8.b)

(1) Construct air receivers according to the ASME BPVC.

(2) Construct, install, test, and maintain all safety valves according to the ASME BVPC.

(3) Access and Guarding.

(a) Locate compressors and related equipment to allow safe access to all parts of the equipment for operation, maintenance, and repairs.

(b) Construct, locate, and install safety appliances, such as valves, indicating devices, and controlling devices, so that they cannot be readily rendered inoperative by any means, including the elements.

(4) Do not exceed the manufacturer’s safe operating pressure for air hoses, pipes, filters, or valves and other fittings. Remove defective hoses from service.

(5) To avoid tripping hazards, do not lay hoses over ladders, steps, scaffolds, or walkways.

(6) Do not use compressed air to blow dirt from the hands face or clothing.

(7) Do not use compressed air for cleaning purposes unless the outlet pressure is regulated to less than 30 psi (206.8 kPa) and then only when effective chip guarding and PPE (for example, face shield and safety glasses) are in place. This 30 psi (206.8 kPa) requirement does not apply to concrete form, mill scale, and similar cleaning purposes.

(8) When used with tools and equipment such as track drills, all airlines exceeding one-half (½) inch (1.3 cm) inside diameter must have a safety device at the source of supply or branch line to reduce pressure in case of hose failure.

(9) Governors.

(a) Install a speed governor, independent of the unloaders, on all air compressors, except those driven by electrical induction or electrical synchronized motors.

(b) If the air compressor is engine or turbine driven, install an auxiliary control to the governor to prevent racing when the unloader operates.

(10) Every air compressor must automatically stop its air compression operation before the discharge pressure exceeds the maximum working pressure allowable on the weakest portion of the system.

(a) If this automatic mechanism is electrically operated, the actuating device must be designed and constructed so that the electrical contact or contacts cannot lock or fuse in a position that will cause the compressor to continue its operation.

(b) An air bypass and alarm may be used as an alternative.

(11) Make provisions to exclude flammable materials and toxic gases, vapors, or dusts from the compressor and compressor intake and to prevent steam, water, or waste being blown or drawn into a compressor intake.

(12) Do not install valves in the air intake pipe to an air compressor with an atmospheric intake.

(13) The air discharge piping from the compressor to the air receiver must be at least as large as the discharge opening on the air compressor.

(14) Install a stop valve between the air receiver and each piece of stationary utilization equipment at a point convenient to the operator. Additionally, install a stop valve at each outlet to which an air hose may be attached.

(15) If a stop valve is located between the compressor and the receiver, install spring-loaded safety valves between the air compressor and the stop valve.

(a) Safety valves must be capable of limiting pressure in the air discharge piping to 10% above the working pressure of the piping.

(b) Stop valves should be the gate type. If a globe valve is used, it must be installed so that the pressure is under the seat and that the valve will not trap condensation.

(16) Make provisions in compressed air and gas systems for expansion and contraction and to counteract pulsation and vibration.

(17) Equip piping with traps or other means for removing liquid from the lines.

(18) Install air discharge piping to eliminate possible oil pockets.

(19) Installation and location of air receivers.

(a) Install air receivers so that all drains, hand holes, and manholes are accessible.

(b) Support air receivers with sufficient clearance to permit a complete external inspection and to avoid corrosion of external surfaces.

(c) Do not bury air receivers underground or locate them in inaccessible places.

(d) Locate the receiver to keep the discharge pipe as short as possible.

(e) Locate the receiver in a cool place to facilitate condensation of moisture and oil vapors.

(20) Install a drain valve at the lowest point of every air receiver for the removal of accumulated oil and water.

(21) Automatic traps may be installed in addition to drain valves.

(22) Open the drain valve on the air receiver and drain the receiver often enough to prevent the accumulation of excessive liquid in the receiver.

(23) Do not change tools or repair work until the stop valve in the air line supplying the equipment is closed.

(24) Use soapy water or any suitable non-toxic, non-flammable solution to clean the system.

(25) Use hose and hose connections used for connecting compressed air to utilization equipment that are designed for the pressure and service to which they are subjected according to the manufacturer's instructions.

c. Boilers and Systems. (20-8.c)

(1) Construct, operate, maintain, and inspect steam boilers and pressure vessels according to the ASME BPVC.

(2) When any boiler is being placed in service or restored to service after repairs to control circuits or safety devices are made, an operator must be in constant attendance until controls have successfully functioned through several cycles or for a 24-hour period, whichever is greater. The operator must read and record all indicating instruments at half-hour intervals to include time, date, and duration of test; water pressure at boiler; boiler make, type, and serial number; design pressure and rated capacity; gas pressure at burner; flue gas temperature at boiler outlet; and the surface temperature of the boiler jacket. Provide the completed record to the USACE supervisor/KO or COR.

(3) Provide fusible plugs on all boilers except water tube type.

(a) Replacement of fusible plugs must coincide with the inspections recommended by the ASME BPVC.

(b) When it is necessary to replace fusible plugs between inspections, prepare and forward to the responsible boiler inspector a written report that includes the circumstances, the make, part number, and the temperature rating for each of the plugs removed and replaced.

(4) Equip all boilers with water columns, gauge glass, and try cocks approved by a NRTL.

(a) Guard gauge glasses and water columns.

(b) When shutoffs are used on the connections to a water column, they must be of an approved locking or sealing type. See NBBI NBIC code for definition of an approved type.

(5) Equip all boilers with blowoff cocks or valves approved by a NRTL. Arrange the blowoff line so that leakage can be observed by the operator.

d. Compressed Gas Cylinders. (20-8.d)

(1) All Government-owned cylinders must be color-coded, and the gas contained identified by name according to MIL-STD 101B.

(2) Storage. Any cylinder in which gas will not be drawn from the cylinder within 24 hours must be stored according to the following:

(a) Store cylinders in well-ventilated locations.

(b) Store cylinders containing the same gas in a segregated group. Label empty cylinders as “EMPTY” and store in the same manner.

(c) Separate stored cylinders from flammable or combustible liquids and from easily ignitable materials (for example, wood, paper, packaging materials, oil, grease) by at least 40 feet (12.2 m) or by a fire-resistive partition having at least a 1-hour rating.

(d) Separate cylinders containing oxygen or oxidizing gases from cylinders in storage containing fuel gases by at least 20 feet (6.1 m) or by a fire-resistive partition having at least a 1-hour rating.

(e) Areas containing hazardous gas in storage must be appropriately placarded according to CGA P-1.

Note. Exception. If it is reasonably anticipated that gas will be drawn from a cylinder within 24 hours of initial storage, then it is considered “in-service” and these storage requirements do not apply.

(3) Smoking is prohibited wherever cylinders are stored, handled, or used. Separate all sources of ignition, including smoking, at least 50 feet (15.2 m) from areas where cylinders are stored, handled, or used. Conspicuously post with legible signs stating, “NO SMOKING, MATCHES, or OPEN FLAME.” (See chapter 9)

(4) Protect cylinders from physical damage, electric current, and extremes of temperature. Cylinder temperature must not exceed 125°F (51.7°C).

(5) Do not take cylinders containing oxygen and acetylene (or other fuel gas) into confined spaces.

(6) Cylinder Valves and Valve Caps.

(a) Close cylinder valves when cylinders are in storage, in transit, not in use, or empty.

(b) Cylinder valve caps must be in place when cylinders are in storage or transit, or whenever the regulator is not in place.

(c) Cylinder valves must be accessible while cylinders are in use to allow for shut off in an emergency situation.

(7) Secure all in-service compressed gas cylinders within substantial fixed or portable racks or hand trucks.

(8) Secure compressed gas cylinders in an upright position at all times, except when being hoisted. Do not store or transport acetylene cylinders horizontally.

(9) Compressed gas cylinders transported by crane, hoist, or derrick must be securely transported in cradles, nets, or skip pans and never directly by slings, chains, or magnets, unless the cylinder manufacturer’s handling instructions specifically allows other handling methods.

(10) Valve wrench or wheel must be in operating position when cylinder is in use.

(a) Open valves slowly.

(b) Do not open quick closing valves on fuel gas cylinders more than 1-1/2 turns.

(11) Use cylinders only for their designed purpose of containing a specific compressed gas.

(12) Only QPs may refill cylinders.

(13) Handle cylinders in a manner that will not weaken or damage the cylinder or valve.

(14) If a cylinder is leaking and can be safely moved, transport it to an isolated location out of doors and crack the valve to allow the gas to slowly escape.

(a) Keep personnel and all sources of ignition at least 100 feet (30.5 m) away from leaking cylinders.

(b) Use monitors to assure protection of personnel from health and flammability hazards.

(c) After the gas has escaped, tag the cylinder “DEFECTIVE.”

(15) Do not simultaneously bleed cylinders containing different gases while in close proximity to each other.

(16) A QP must supervise the bleeding of cylinders containing toxic gases. Perform the work according to applicable environmental regulations and the accepted safety plans (for example, APP, AHA).

(17) Keep oxygen cylinders and fittings away from oil or grease.

(a) Keep cylinders, cylinder valves, couplings, regulators, hose, and other apparatus free from oil or greasy substance and do not handle with oily hands or gloves.

(b) Do not direct oxygen at oily surfaces, greasy cloths, or within a fuel oil or other storage tank or vessel.

(18) Oxygen and fuel gas pressure regulators, including their related gauges, must be in proper working order while in use.

e. Testing Using Pressurized Gases or Air. (20-8.e)

(1) Do not use pressurized gases or air during structural integrity or leak testing, except when permitted by the applicable manufacturer’s specifications or when specified by an applicable code.

(2) Comply with the applicable codes and manufacturer’s specifications when conducting tests that involve pressurized air or gases. A CP must develop the test procedures and submit them to the USACE supervisor for approval or to the KO or COR for acceptance. The CP is responsible for supervising the testing procedures. All workers performing the testing must be knowledgeable of the procedures, hazards, and