

# Fixed Firefighting System Installation

Text and photographs by Steve D'Antonio

## TOOLS AND PARTS:

- common hand tools
- multimeter
- fixed fire extinguisher bottle
- relay kit
- manual-discharge cable
- common fasteners

## ABYC REFERENCE:

- ABYC A-4 Firefighting

## INTRODUCTION:

These guidelines will assist you in properly specifying and installing fixed fire suppression systems (FFSS) and related components.

ABYC standards are clear on the subject: "Fire extinguishing equipment (portable or fixed) shall be listed or approved by a US Coast Guard-recognized independent testing laboratory. The installation and use of such fire extinguishing equipment shall be in accordance with the manufacturer's instructions."

Among other things, these must *not* be dry chemical systems. They must utilize a clean gaseous agent that does not leave a residue or damage equipment in the protected space.

These systems, which automatically discharge in the event of a fire, are intended to protect enginerooms/compartments and other discrete machinery spaces. For ABYC compliance,



*This professionally installed fixed fire suppression system in a tidy engineroom is sized to smother a fire in the confines of the closed mechanical space. The system can be triggered automatically by a sensor on the bottle or discharged through a remote manual switch at the helm.*

systems must include manual and automatic discharge capabilities. For diesel-powered vessels, the engine(s), generator(s), and blower(s) in the protected space must shut down automatically, and after discharge is complete, the minimum concentration of the extinguishing agent required under ABYC A-4.8.11 must remain. In some cases, shutters that close upon discharge are

required to retain the extinguishing agent within the space for the time specified in the ABYC standard. These shutters also prevent fresh air from feeding the fire.

For gasoline-powered vessels, there must be a remote discharge indicator installed at the primary helm location. While automatic shutdown of the engine(s), generator(s), and blower(s) is not required for ABYC compliance on gasoline-powered vessels, it is desirable.

For both diesel- and gasoline-powered vessels, a placard must be installed at each helm location that reads:

*In case of engine compartment fire, shut down engine(s), generator(s), and blower(s) before manual discharge, or immediately after automatic discharge.*

For spaces protected by a FFSS, a label must be installed at the entrances or at each helm, providing warnings to avoid inhaling potentially toxic combustion by-products following FFSS discharge.



*To retain the active fire suppression agent in the engineroom, these louvered shutters will close automatically upon discharge of the fire extinguisher.*

This helm display indicates the status of the two fixed extinguishing systems and includes the required warning to shut down engines and other equipment upon discharge.



“CAUTION! Engine [or the name of the space if other than engine] compartment is protected by a fire extinguishing system. Avoid inhalation of potentially toxic combustion by-products. If the fire extinguishing system discharges, ventilate space before entering.”

Where openings between compartment(s) have a combined area of more than 2% of the shared bulkhead area, the volume of adjoining compartment(s) separated by such a bulkhead shall be added to that of the primary compartment(s) being protected. For example, if the area of a louver or other opening, installed in a bulkhead between an engine compartment and lazarette, exceeds 2% of the overall bulkhead area, then

the spaces must be considered as one when calculating the size/capacity of the FFSS.

Note that this Task Sheet applies only to pre-engineered FFSSs—systems consisting of one bottle, with an integral temperature trigger. Such single-bottle systems are typically available for protection of compartments up to about 1,800 cu ft (167m<sup>2</sup>).

For larger compartments, where multiple extinguishers are required to flood the space with the necessary concentration of agent, you’ll need an engineered system with multiple bottles plumbed together. These require design and engineering guidance from the FFSS manufacturer.

As a FFSS installer, the onus is on you to select the equipment carefully, to ensure that it is compliant, and to follow all manufacturer instructions and relevant ABYC standards. The installed system must be robust and reliable, especially one that is interlinked with propulsion engines, as any failure of this system could lead to injury and loss of life or the vessel. Reread the installation instructions before each installation to refresh your memory and alert you to changes the manufacturer may have made.

## SAFETY:

Most FFSSs rely on a gaseous “clean” agent, which may be harmful or even lethal to personnel in the space where the system discharges. Acceptable agents vary; however, *fixed CO<sub>2</sub> systems are prohibited for use on all recreational craft.*

Make certain you understand the difference between systems designed for “occupied spaces,” and those designed for “normally unoccupied spaces.” The former systems are “people safe,” meaning they’re not harmful provided the concentration remains within manufacturer’s specifications, while the latter may employ an agent likely to be harmful or lethal to personnel.

Oversizing the bottle or adding multiple bottles in an attempt to improve a safety margin can turn a system designed for an “occupied” space (and thus safe for personnel) into one that could be harmful or lethal. FFSSs include a built-in margin; do not oversize them.

While engine compartments, lazarettes, and other machinery spaces may be considered “normally unoccupied” because crew, owners, and service personnel don’t dwell in them, I



This bottle contains a potentially harmful extinguishing agent specified for “normally unoccupied” compartments.

recommended applying “people safe” agents in all applications.

The contents of these systems are discharged with violent force at an extremely cold temperature, which

means they can cause severe injury, including blindness and frostbite. Wear safety glasses whenever working with and around these systems, and if the bottle is equipped with a disarming pin or device, keep it in place throughout the installation, and remove it to enable manual discharge only when the system is commissioned.

If the extinguisher is mishandled or dropped, and the nozzle is damaged or broken off, the bottle can become a projectile. Always handle with care.

**This guideline is not a substitute for following all applicable manufacturer and ABYC guidelines, as well as recognized marine industry best practices.**

**PROCEDURE:**

**1.** Assess the installation. After reading the installation instructions, and reviewing ABYC A-4, begin with the compartment to be protected. Among other things, ABYC A-4 notes: “A permanently affixed label in the machinery compartment shall state the gross volume of the compartment less the volume of permanently installed tankage for the purpose of sizing fire protection equipment.” If you can’t find the volume label (they are rarely evident), contact the vessel’s builder to determine the volume. If that’s not possible, you must calculate the volume yourself by multiplying length by width by height of the compartment. Except for permanently installed tankage, no deductions are made for engines, generators, or related components and machinery. Keep in mind that it may be easier to break the compartment down into several smaller shapes, determine their volume, and then add up the results.

- 2.** Select a location to mount the FFSS bottle by applying the following criteria:
- as high and central as possible to ensure that the unit discharges soon after a fire starts
  - between engines in twin-engine applications
  - vertically or horizontally, depending on manufacturer’s instructions.

You should *not* mount it:

- close to heat sources such as turbochargers or exhaust manifolds
- close to fresh-air inlets or air-exhaust vents, which can delay activation
- where it will impede access or passage, pose a head-injury hazard, or snag clothing or tools on the nozzle and cause an accidental discharge
- where water will drip on it
- to a removable hatch or cover

**3.** Before mounting the bottle, ensure that the disarming pin is inserted into the manual discharge mechanism so the bottle won’t accidentally discharge during installation.

**4.** Mount the bottle securely. For all but the smallest units, I prefer a through-bolted installation using machine screws. If that’s not possible,



*Fastened to the engineroom bulkhead on a secondary plywood panel, this bottle is secured horizontally.*

through-bolt support brackets to a section of thick plywood panel, which is then fastened to a bulkhead with multiple large tapping screws. Consider carefully if the mounting bulkhead or structure is strong enough to withstand the conditions and use the vessel will be subjected to. High-speed planing vessels as well as bluewater offshore passagemakers (power and sail) may be exposed to significant shock and slamming loads. There must be no possibility of the bottle coming adrift in any conditions.

Ensure that critical data on the bottle’s label—model and serial number, type of extinguishing agent, and protected volume etc.—as well as the pressure gauge will be visible after the installation is complete.



*Left—Mount the bottle as high as possible in the compartment. Below—The safety or shipping pin prevents unintentional discharge during installation and maintenance but must be removed when the system is in service.*



**5.** Install the manual release cable. For smaller vessels, the discharge T-handle should be mounted near the helm station; on larger vessels it may be located outside the entrance to the protected compartment. Don't put it inside a cabinet, drawer, or other obscured location. It should be in plain view, and no tools should be required for access.

After the cable is installed but before it is connected to the FFSS's discharge nozzle, confirm that it moves freely. The permissible number of bends in the cable and the bend radius are often limited by the manufacturer.

Insert the safety pin, and *secure it using only the supplied breakaway plastic tie*. Never use a zip tie or other substitute device.

I recommend installing optional fire-proof sleeves to protect cables where they are exposed inside protected compartments.

**6.** Install the indicator/annunciator panel. On most systems this is a basic display panel that confirms the bottle has not been discharged, typically indicated by a light that will remain illuminated as long as the bottle is pressurized. Some include an audible alarm that will sound if the system is discharged manually or automatically.

For ABYC compliance, diesel-powered vessels must apply a version of this system that includes a relay device designed to interface with the stop circuits for engines and generators, as well as ventilation systems and/or intake shutters. Closely follow the instructions for these relay kits, as their malfunction can lead to sudden, unexpected, and potentially dangerous shutdowns of, or the inability to start, propulsion engines. All wiring associated with automatic shutdown systems must be completely secure, properly supported, and made with highest quality solderless terminals.

Keep in mind, the relay system needs power to operate, including on occasions where the engines are not running but a generator and/or ventilation systems are. The system must be energized under all these conditions. If a circuit breaker is used to supply power to the FFSS, it should be



*Left—The manual-discharge T-handle should be secured with a safety pin and breakaway plastic tie. Below left—This helm display has an audible alarm and red and green lights to indicate when the system is charged or discharged (both illuminated here during a test).*

covered or protected so it cannot be inadvertently turned off, and should be labeled “NORMALLY ON.”

In some cases, users may request that you install a bypass system for the FFSS manufacturer's automatic engine shutdown relay, one that is fully independent of this system. If you are installing such a system, make certain the switch or switches for its activation are protected, or covered, and that a placard is affixed adjacent to them with instructions for their use. While it can afford a user added peace of mind, if such a backup system is inadvertently actuated, there will be no outward indication. The vessel will function normally. However, the circuit that automatically shuts down the engine (and any other gear included in the external bypass system) will not function, so the engine will not shut down automatically upon the FFSS's discharge; and the system will potentially not extinguish the fire that triggered the discharge.

**7.** Most systems are tested by separating the electrical connection at the bottle's pressure switch, simulating a discharge. If the system is equipped with only an indicator light, it should turn off when this test is carried out, and it should relight when you restore the connection.



*A connected relay kit automatically shuts down circuits for engines, generators, and blowers and activates ventilation shutters when the system is deployed.*



Relay bypass switches should be clearly labeled, covered to prevent accidental tripping, and kept in the off position during normal operation.

alarm, after which all the interlinked gear should be able to be restarted. Assuming it does, manually shut down all protected gear, restore the connection at the bottle, clear the alarm at the control panel, and restart all protected gear one final time to ensure that it is functioning properly.

**8.** Lastly, train the operator. When the installation is complete, explain to the owner or vessel operator how it functions; show them the relay box and its power supply (if it's a fuse, make certain it is labeled), the manual discharge, and how to activate the integral (and external, if equipped) bypasses.

**PBB**

If the system is equipped with an automatic engine shutdown relay, then all interlinked gear—engines, gensets, ventilation systems, and LP gas and diesel heating systems—should be operating for the test. Make certain there is no load on the genset. When you break the electrical connection, all interlinked gear should shut down, and an audible alarm should sound. If it does, the next test involves proving the integral bypass system. To do this, engage the bypass according to the manufacturer's instructions. That should silence the audible

***About the Author:** For many years a full-service yard manager, Steve now works with boatbuilders and owners and others in the industry as Steve D'Antonio Marine Consulting. He is an ABYC-certified Master Technician and sits on that organization's Engine and Powertrain, Electrical, and Hull Piping Project Technical Committees. He is also technical editor of Professional BoatBuilder.*



## FIRE DETECTION & SUPPRESSION SYSTEMS

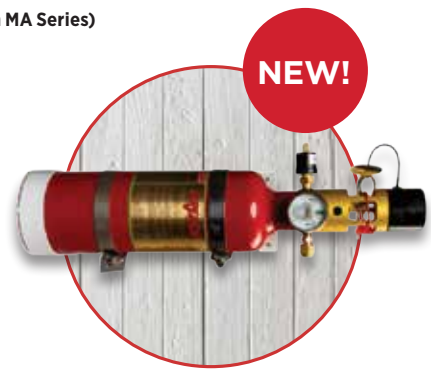
- Models available in worldwide approved Clean Agent HFC-227ea and FK-5-1-12 Clean Extinguishing Agent\*
- Protects engine rooms and machinery spaces up to 1,800 cubic feet
- Pre-engineered, total flooding system
- The safest way to combat an engine room fire
- Automatic discharge at 175°F (Optional manual release on MA Series)



**MA SERIES**  
Manual / Automatic Discharge  
Fixed Clean Agent Fire Extinguisher  
Protects engine rooms and machinery spaces up to 1,800 cubic feet.



**CG SERIES**  
Automatic Discharge Fixed Clean Agent Fire Extinguisher  
Protects engine rooms and machinery spaces up to 1000 cubic feet.



**CU & MU Horizontal SERIES**  
FK-5-1-12 Clean Extinguishing Agent with Very Low Global Warming Potential (GWP <1)  
Protects engine rooms and machinery spaces up to 485 cubic feet.

\* FK-5-1-12 Clean Extinguishing Agent is a highly effective clean fire suppressant, designed to extinguish a fire in its incipient stage before it has a chance to spread



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