CAMPUS FIRE SAFETY CODE TALK

Campus Fire Safety e-NewZone

Fuel Storage for Stationary Engines for Emergency Generators

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[Sixth in a series of articles dealing with National Fire Protection Association codes and standards for flammable and combustible liquids. Prior articles are: *Safety Cans* (August 2011); *Flammable Liquids Storage Cabinets* (November 2011); *Safe Handling of Flammable and Combustible Liquids* (February 2014); *NFPA 30 and MAQs* (January 2015); Differences in Flammable / Combustible Liquids Classification (October 2016).]

Introduction. In this sixth installment, I want to discuss some of the basic provisions for fuel storage for stationary internal combustion engines. I use the phrase "for emergency generators" in the title, but stationary engines are also used to provide motive power for fire pumps, water pumps, and electrical generators for clean power and isolated power systems. There are several NFPA documents involved here:

- NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection*

- NFPA 37, *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines*

- NFPA 110, *Standard for Emergency and Standby Power Systems*

This discussion focuses on NFPA 37, specifically Chapter 6 "Fuel Supply — Liquid". In almost all cases, the liquid fuel will be diesel fuel, so I will not address storage for gasoline-fueled engines.

Fuel Tanks. Any storage tank that meets the provisions of Subsection 21.4.2 of NFPA 30, *Flammable and Combustible Liquids Code*, is acceptable for storing diesel fuel. For aboveground tanks, this includes tanks constructed in accordance with API Standard 650 and those built in accordance with UL Standards 80, 142, 2080, and 2085; for underground tanks, this includes those constructed in accordance with UL 58 and UL 1316. Equivalent standards, such as those developed by the CSA Group (formerly Canadian Standards Association), can also be considered. Fuel tanks mounted directly on the engine by the manufacturer and that gravity feed to the engine do not need to meet the above standards, but must be securely mounted to the engine and protected against vibration and physical and thermal damage.

Fuel Tanks Outside Buildings. Consider a situation where the engine is inside a building, but the fuel storage tank is located outside the building, either aboveground or underground (buried). In both cases, Chapter 21 of NFPA 30, *Flammable and*

Combustible Liquids Code, will cover general design and construction of the tank, normal (breather) vents, corrosion protection, testing requirements, basic operating provisions, and inspection and maintenance. For aboveground tanks, Chapter 22 of NFPA 30 will also apply; it includes requirements specific to aboveground tanks, such as: siting (separation distances); shell-to-shell spacing for multiple tank installations; supports and foundations; emergency relief venting; spill control. Chapter 22 also contains special provisions for fire-resistant tanks, "protected" tanks, and secondary containment-type tanks. If the tank is installed underground, and by this I mean buried and back-filled, then Chapter 23 of NFPA 30 also applies. Chapter 23 covers those topics peculiar to buried tanks: external corrosion protection; separation from building foundations and subterranean spaces; bedding and backfill; depth of cover.

Fuel Tanks Inside Buildings. In many cases, the fuel storage tank is located in the building, either in the same room as the engine(s) served or in a dedicated enclosure. Almost always, these will be factory-built aboveground tanks. In these cases, NFPA 30 takes a subordinate position to NFPA 37. Certain elements of Chapter 21 of NFPA 30 will be applicable, such as general design and construction, sizing of normal vents,

and testing prior to being placed in service. But Subsection 6.3.2 of NFPA 37 will set limits on the number of tanks allowed and their capacity.

In situations where the fuel tanks are in the same room as the engine(s) served, the tanks cannot be larger than 660 gallons (2500 L) capacity. Any tank larger than this must be in a dedicated room. In addition, Subsection 6.3.2 mandates the following: not more than one 660-gallon tank, or two or more tanks with the same aggregate capacity, is allowed to be connected to a single engine. Furthermore, the combined capacity of all fuel tanks in a building is limited to 1,320 gallons (5000 L), unless the storage capacity that exceeds this maximum is placed in a dedicated room, as mentioned above. So, a particular installation could have two engines, each supplied by a single 660-gallon tank. Or, two engines, each with twin 330-gallon tanks. But, you would not be allowed to have a single engine coupled with a 1,320-gallon tank.

Except. There is an exception to Subsection 6.3.2 that reads as follows:

> "Exception: Fuel tanks of any size shall be permitted within engine rooms or mechanical spaces, provided the engine or mechanical room is designed using recognized engineering practices with suitable fire

detection, fire suppression, and containment means to prevent the spread of fire beyond the room of origin."

This exception allows the authority having jurisdiction some flexibility to consider unusual circumstances where greater capacity is needed, but conditions make a dedicated room impractical.

Dedicated Rooms for Storage Tanks. Subsection 6.3.5 of NFPA 37 allows a dedicated storage tank room for an additional 1,320 gallons of fuel, either in a single tank or multiple tanks. The room must provide a one-hour fire-rated envelope around the tank(s), floor, walls, and ceiling. The room must be sized so that a 15-inch clearance is maintained around each tank. This is to facilitate inspection and repair. The entrance to the room must be protected by a self-closing fire door having a 1-hour protection rating, if the doorway opens to the interior of the building. If an exterior door is provided, it must be listed for fire exposures. To provide spill control, each room must be capable of containing the capacity of the largest tank in the room. This can be accomplished by a curb at the entrance to the room or the room can be provided with an overflow or drainage system that can convey any spillage of fuel to either another tank to a retention basin outside the building. Subsection 6.3.5 also

requires mechanical or gravity ventilation sufficient to maintain the concentration of vapors within the room at or below 25 percent of the lower flammable limit (LFL) of the fuel used. (The general rule of thumb here is 1 cfm per sq. ft. of floor area, with a 150 cfm minimum.)

What if the quantity of fuel needed is greater than 2,640 gallons? In other words, more than what can be accommodated by tanks in the engine room plus one dedicated room. You could build a second (or third) dedicated room. Or, you could build a more robust dedicated room. Subsection 6.3.6 allows for such a room, one that is allowed to house one or more fuel tanks with aggregate capacity of more than 1,320 gallons. The provisions for such a room include those of Subsection 6.3.5, with a few exceptions. First, the required fire resistance rating for the floor, walls, and ceiling is increased to 3 hours and the entrance door must have a 3-hour fire protection rating. Second, spill control provisions are somewhat more detailed.

Fuel Tanks on Roofs. Fuel tanks are allowed to be located on the roof of the building. Such tanks must be securely installed on noncombustible supports. And, there must be spill control in the form of curbing or a dike that can hold at least the capacity of the largest tank. Alternatives include: (1) containment of lesser capacity

that drains to another tank or to a safe area outside the structure; (2) use of a secondary containment-type tank.

Summary. These days, most stationary emergency generator sets are of the "belly tank" type. The prime mover and generator are mounted together with and above the fuel tank into a frame to form a complete package unit. The capacity limits for engines and fuel supplies in a common room apply to these as well.

NFPA 37 also contains a number of requirements that address fuel piping, tank vents, and control of fuel flow. These can be found in Section 6.5 through Section 6.8 of the standard.