



PHOENIX FIRE CODE SUMMARY

Fuel Storage for Diesel Fire Pump Drivers

REFERENCE FIRE CODE SECTION Phoenix Fire Code 27, 34, and NFPA 20 *Standard for the Installation of Stationary Pumps for Fire Protection*, 2003 edition as adopted and amended by the City of Phoenix.

SCOPE An explanation of the requirements for the design, installation and maintenance of fuel storage systems for diesel fire pump drivers.

SUMMARY OF HAZARDS

A concern of the Fire Department is that any flammable or combustible liquid fuel storage tank and its piping is liquid tight. In the case of fire pumps, a liquid tight system helps ensure that the pump driver will operate when required. A liquid tight storage and piping system also prevents the release of a fuel that may be ignited by the diesel engine. If a leak and fire occurs, a properly designed fuel system ensures that the storage tank is protected from over pressurization.

COMMONLY USED HAZARDOUS MATERIALS AND THEIR CLASSIFICATION

Diesel fuel is the fuel used to power the pump driver. Diesel fuel is assigned Chemical Abstract Service (CAS) Number 62435-54-2 and is classified as a Class II Combustible Liquid. Diesel fuel has the following NFPA 704 hazard ratings: Health: 1, Flammability: 2, Reactivity: 0, Special Hazards: Blank.

SUMMARY OF FIRE CODE REQUIREMENTS

1. **Phoenix Fire Code Section 913.2.** The regulation requires that a source of emergency power be provided for electric fire pumps. It offers three options:
 - 1.1. Use a listed electric fire pump that is connected to a standby power system such as a diesel driven generator,
 - 1.2. Use a listed electric fire pump that is connected to two independent utility power grids serving the property from two or more isolated locations, or
 - 1.3. Use an approved diesel driven fire pump.
2. **Phoenix Fire Code Requirements.** Chapter 34 of the Phoenix Fire Code and NFPA 30 – 2003 has requirements for the storage and handling of Class II Combustible Liquids. The following summarizes the requirements for the construction and installation of the fuel tank and piping system.
 - 2.1. **Fuel Storage Tank - Construction**
 - 2.1.1. The tank shall bear a permanent nameplate or marking indicating the standard used as a basis for design. At a minimum, atmospheric storage tanks including those incorporating secondary containment, shall be labeled as being constructed using Underwriters Laboratories 142, Standard for the Construction for Steel Flammable & Combustible Liquid Storage Tanks (PFC 3404.2.7 and NFPA 30 Section 4.2.3.1).
 - 2.1.2. Tanks constructed with integral secondary containment shall be listed as meeting UL 142.

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- 2.1.3. The tank nameplate shall state the required flow rate for the emergency vent. If a tank is constructed with integral secondary containment, the nameplate shall indicate the required flow rate for the primary and secondary containment tank (UL 142, Section 43.6 and PFC 3404.2.7.4).

2.2. Fuel Storage Tank – Secondary Containment

- 2.2.1. Secondary containment is required when the tank volume is more than 240 gallons inside a sprinklered building or 120 gallons in a non-sprinklered building (PFC 3403.4).
- 2.2.2. Secondary containment is required when a stationary aboveground storage tank is installed outside of a building (PFC 3404.2.9.6.4).

2.3. Fuel Storage Tank – Normal Vent

- 2.3.1. The tank normal vent shall be terminated outside of the building. The vent shall be terminated at least 12 feet above grade, 5 feet from property lines and 5 feet from building openings (PFC 3404.2.7.3.3).
- 2.3.2. Normal vents shall be installed so they will drain toward the tank without traps in which liquids can collect. The normal vent shall not be subject to physical damage or vibration (PFC 3404.2.7.3.4).
- 2.3.3. The minimum required diameter of a normal vent is 1 ¼ -inch. (NFPA 30 Section 4.2.5.1.2).

2.4. Fuel Storage Tank – Emergency Vent

- 2.4.1. An emergency vent shall be provided for the primary tank and secondary containment tank (PFC 3404.2.7.4).
- 2.4.2. Emergency vents shall be the commercially produced type that is stamped at the factory to indicate its flow rate and opening pressure (PFC 3404.2.7.4.3).

(NOTE: The tank manufacturer can fabricate emergency vents specifically designed for the each model of tank fabricated. The PFC requirements for these emergency vents are fairly detailed and have extensive testing requirements. See PFC 3404.2.7.4.3 and NFPA 30 Section 4.2.5.2).

- 2.4.3. The flow rate of the emergency vent shall equal or exceed the flow rate specified on the tank nameplate (NFPA 30 4.2.5.2.4).
- 2.4.4. In instances where the tank manufacturer desires to use the flow rate of the normal and the emergency vent to satisfy the minimum emergency vent flow rate, the normal vent shall be stamped to indicate its flow rate (PFC 3404.2.7.4.2).

2.5. Fuel Storage Tank – Tank Openings Other Than Vents

- 2.5.1. Tank fill connections shall be located outside of buildings (NFPA 30 4.3.2.5.5).
- 2.5.2. Tank fill openings shall be located not less than 5 feet from building openings or lines of property that can be built upon (NFPA 30 4.3.2.5.5).



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- 2.5.3. For top-loaded tanks, a metallic fill pipe shall be installed to minimize the generation of static electricity by terminating the pipe within 6-inches of the bottom of the tank, and shall be installed in such a manner that avoids excessive vibration (PFC 3404.2.7.5.5).
- 2.5.4. Tanks installed inside of buildings shall be equipped with a device or other means to prevent the overflow of liquid into the building. Suitable means include a float valve, a preset meter on the fill line, a valve actuated by the weight of the tank contents, etc. (PFC 3404.2.7.5.8).
- 2.5.5. Tanks installed outside of buildings that have a volume of 500 gallons or more shall be equipped with a positive means of overfill protection (PFC 3404.2.7.5.8 and 3404.2.9.6.6).
- 2.5.6. The gauging openings for tanks inside of buildings shall be protected against liquid overflow and possible vapor release by means of a spring-loaded check valve or other approved device (NFPA 30 Section 4.3.3.4.2).

2.6. Fuel Storage Tank – Support Columns

- 2.6.1. Tank supports, foundations, and anchors shall be designed and installed in accordance with Phoenix Building Code and PFC 3404.2.9.2.
- 2.6.2. Tanks having steel support structures or exposed pilings require a 2-hour fire resistance rating for the supports. If the pump room is sprinklered, no additional fire protection is required, unless the tank diameter is over 48-inches (NFPA 30 4.3.1.3 Exception 2).
- 2.6.3. If the fuel tank is located outside the building and is elevated more than 12 inches above grade, fire protection for the columns is required. When fire resistive assemblies are used, they shall meet ASTM E-1529, Standard Test Method for Determining Effects of Large Hydrocarbon Pool Fire on Structural Members and Assemblies (NFPA 30 4.2.4.1).

2.7. Fuel Piping

- 2.7.1. Thermoplastic piping is permitted to be used in accordance with PFC Section 3403.6.2 and ASME B31.3, Process Piping, Section A323.4.2.
- 2.7.2. Pipe joints that are dependant on the friction characteristics for liquid tightness of piping shall not be used in buildings (PFC 3403.6.10).
- 2.7.3. Low-melt point materials and fittings may be used when the operating pressure of the system is within the temperature and pressure limitations of the selected material (PFC 3403.6.2.1).
- 2.7.4. When low-melt point metallic piping is used, the piping shall be protected by automatic sprinkler protection (PFC 3403.6.2.1).
- 2.7.5. When threaded carbon steel pipe and fittings are used, the pipe thread sealant shall be approved for flammable liquid service (PFC 3403.6.10).
- 2.7.6. A guard or protective pipe shall be provided for all exposed fuel lines (NFPA 20 Section 11.4.2).



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- 2.7.7. Flame-resistant flexible hoses listed for diesel fuel service shall be provided at the engine for connection to the fuel system (NFPA 20 Section 11.4.6.1).
- 2.7.8. There shall be no shutoff valve in the fuel return line to the tank (NFPA 20 Section 11.4.6.3).
- 2.7.9. Prior to introducing fuel into the piping system, the pipe and fittings shall be pneumatically or hydrostatically tested. If pneumatically tested, the test pressure shall be 1.1X the design pressure of the system. If hydrostatically tested, the test pressure shall be 1.5X the design pressure of the system. The minimum test duration is 10 minutes (PFC 3403.6.3).

2.8. Other PFC Requirements

- 2.8.1. The tank cannot be filled or placed in service until it is inspected and approved by the Phoenix Fire Department **AND** the owner has obtained a Flammable/Combustible Liquids Storage, Handling and Use permit.
- 2.8.2. When a fire pump is equipped with a hose valve test header, a "DO NOT PUMP INTO THESE CONNECTIONS" sign shall be located above or adjacent to the test connection. This sign shall meet the PFD sign specification (PFC 913.5.5).
- 2.8.3. The tank shall be labeled to indicate its contents (PFC 3403.5.2 and 2703.5).

3. NFPA 20 Requirements

3.1. Fuel Tank – Design

- 3.1.1. The fuel tank shall be designed to contain a given volume. The volume shall equal 1 gallon of fuel for each 1 horsepower of the driver rating, plus a 5% volume for the sump and 5% volume for expansion (NFPA 20 Section 11.4.3.1, 11.4.5.2, and 11.4.5.3).
- 3.1.2. Means other than sight tubes shall be provided for determining the amount of fuel in the storage tank (NFPA 20 Section 11.4.5.7).
- 3.1.3. A separate fuel tank and fuel supply and return piping shall be provided for each engine (NFPA 20 Section 11.4.4).

3.2. Fuel Tank – Installation Requirements

- 3.2.1. The inlet to the fuel supply line shall be located so that its opening is no lower than the level of the engine fuel transfer pump (NFPA 20 Section 11.4.5.4).
- 3.2.2. If an electric solenoid valve is used to control the fuel supply to the engine, the valve shall be designed so that is capable of manual mechanical operation or it can be manually bypassed in the event of a control circuit failure (NFPA 20 Section 11.4.8).



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REQUIRED FIRE CODE PERMITS

The following permits are required for fuel storage tanks that supply diesel fire pump drivers:

- ❑ A PFD construction permit is required when installing an aboveground storage tank inside the building. Before this permit can be issued, a minimum of two sets of tank shop drawings shall be submitted to the Fire Department for review and approval. The plan review fee is \$200 and the permit fee for one tank is \$450.00. This permit is separate from the construction permit for the automatic sprinkler system (PFC Chapter 46 and NFPA 20 Section 11.4.1).
- ❑ The building owner or tenant is required to obtain a Flammable/Combustible Liquids Storage, Handling and Use permit. The permit application and Hazardous Materials Inventory Statement is available at Fire Department Headquarters, Fire Prevention Division located at 150 S. 12th Street. The permit application and fee schedule is available on-line at www.phoenix.gov/fire/ and click on "Permits and Inspections."

OTHER REQUIRED CITY OF PHOENIX PERMITS

Buildings housing fire pumps are required to meet the requirements of the Phoenix Building Code. This includes dedicated "pump houses" or rooms that house fire pumps.

The construction of the room or building will be required to meet the applicable Building, Mechanical, Electrical and Plumbing Code requirements.

An important element is the amount of diesel fuel stored inside the room or building. The maximum allowable quantity of **diesel fuel AND OTHER CLASS II COMBUSTIBLE LIQUIDS** inside a building is 240 gallons. If this quantity limit is exceeded in one control area, the Building Official will classify the pump room as a Group H-3 occupancy. The following additional fire and building code requirements will be applied:

- ❑ A copy of the permit application and the Hazardous Materials Inventory Statement submitted to Phoenix Fire Department for the Flammable/Combustible Liquids Storage, Handling and Use permit.
- ❑ Secondary containment designed to contain the largest container or tank + 20 minutes of sprinkler water flow.
- ❑ Depending on the area of the pump room, either a one- or two-hour fire-resistive wall assembly if the fire pump and fuel storage tank is located inside a mixed-use occupancy building.
- ❑ If the area of the pump room if its area is more than 200 Ft.², panic hardware is required on the exit door(s).
- ❑ If the room travel distance is more than 75 feet, two exits are required.
- ❑ The fuel storage tank may be located in a basement or on a floor above grade. The height that the tank may be installed above grade depends on the construction type and occupancy classification.
- ❑ Mechanical ventilation designed to exhaust the room at minimum airflow rate of 1 CFM/Ft.² is provided for the pump room.

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The fee for the building permit is calculated using the value of the building or area. To obtain an accurate fee calculation, contact the Development Services Department Business Customer Service Center at 602-534-2000.

HOW CAN I OBTAIN MORE INFORMATION?

If this fire code summary does not answer your questions, please feel free to contact one of the Phoenix Fire Department's fire protection engineers or fire plan examiners at 602-262-6771. E-mail inquiries can be sent to phoenix.fire.prevention@phoenix.gov

Requests for information about Building, Plumbing, Mechanical and Electrical Code requirements should be directed to the Development Services Department at 602-534-2000.

Telephony or e-mail messages regarding particular code requirements to the Phoenix Fire Department are not official interpretations. An official interpretation requires a plan review or written correspondence that requests an official interpretation, the referenced code section(s) **AND** includes sufficient information to interpret if the applicable code section(s) applies.

PREPARED BY

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