



## Fire Department Preconstruction Commercial

Fire Marshal's Office – Inspections

# Fire Pump Installation Common Issues

When designing or installing electrical power supplies for fire pumps and their accessories, special rules apply as listed in (NFPA 70), the National Electrical Code (NEC), and the Standard for Centrifugal Fire Pumps (CFP) NFPA 20. These special rules protect the pump and associated electrical equipment from hazards that might cause complete failure due to floods, fire, high wind, etc.

*Power sources.* Secs. 6-3.1 through 6-3.2.2 in NFPA 20 lists the requirements for the supply of electrical power to fire pumps and their accessories. Several sections in the 1999 NEC coordinate with NFPA 20 and reinforce those requirements.

*Service supply.* The electrical service, whether supplied by the utility or the owner, must be reliable as well as located and installed to minimize the probability of damage by fire from within the premises [per CFP 20, 6-2.1, and NEC Sec. 695-3(a)(1)].

Where a second service is provided for the fire pump, as permitted in NEC Secs. 230-2(a)(1), 695-3(a)(1), and 695-6(b), the service conductors must be routed outside of the building or encase them in at least 2 in. of concrete. If encased in concrete, the conductors are considered to be located outside the building. The service conductors can be installed either overhead or underground.

Designers sometimes specify that an underground lateral supplies the fire pump system and an overhead drop or vice-versa supplies the service equipment.

*Tap supply.* If a tap is used to provide power to a fire pump, it is required to make the connection ahead of the main disconnecting means in the service equipment [per NEC Sec. 230-82(4)]. NEC Sec. 695-

3(a)(1) does not allow a tap for emergency systems in the same cabinet that houses service equipment containing the normal service. Designers usually specify installation of a tap ahead of the normal service equipment and place it in a completely different area or location.

CFP 20, Sec. 6-3.1 and Secs. 695-3(a)(1) and 695-6(a) allows the routing the conductors serving a fire pump and its accessories in a fire pump room without enclosing them in 2 in. of concrete if protected from possible damage by fire, structural failure, or operational accident.

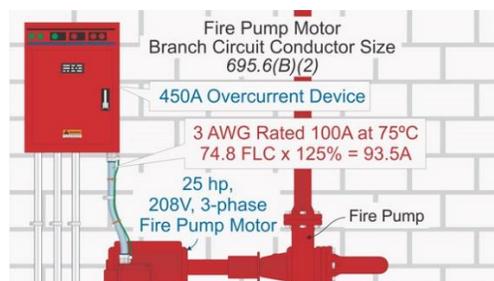
*Transformer supply.* Transformers shall be installed to step up or step down the voltage serving a fire pump to comply with NEC Art. 450. Protect conductors from overcurrent in accordance with NEC Secs. 240-3, 240-100, and 240-101. The NEC requires overcurrent protection for transformers to meet the provisions of Table 450-3(a) or Table 450-3(b). Sec. 6-1 in NFPA 20 appears to refer to the NEC for the rules of installing transformers to supply power to fire pumps.

A separate supply from a second transformer can be used to supply power to a fire pump system. Therefore, if the main transformer supplying power to the normal service should for any reason fail, the second transformer would still energize the fire pump supply.

The National Fire Protection Association Standards Council issued a major interim revision to Sec. 695-3(b) of the NEC. This mandate makes it clear that a fire pump can be connected to a utility service. If this service is deemed unreliable, it can be backed up with an on-site standby generator. Note: Such power sources must comply with the separation rules in NEC Sec. 695-3(b)(3).

*Power wiring.* Appendix A-6-2.3(3) in NFPA 20 and Sec. 695-6(b) of the NEC stipulate the fire pumps feeder circuit conductors must be routed outside of the building, enclose them in 2 in. of concrete, or have a 1-hr fire resistance rating. Note that wiring located in the pump room must be enclosed in rigid metal conduit, intermediate metal conduit, type MI cable, liquid tight flexible metal conduit, or liquid tight flexible nonmetallic conduit type LFNC-B per NEC Sec. 695-6(e).

The feeder circuit conductors between the lines of each power source must be computed to no less than 125% times the sum of fire pumps and pressure maintenance motor(s), plus 100% of the associated fire pump accessory equipment. See NEC Secs. 695-6(c)(1) and (c)(2).



*Overcurrent protection devices.* If overcurrent protection devices are installed ahead of the feeder pump circuits in the power supply for either utility or customer-owned supply systems, these protective devices shall be capable of carrying the locked-rotor current of the fire pump motor(s) and the pressure

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maintenance pump motor(s), and associated fire pump accessory equipment. See NEC Sec. 695-4(b)(1) and 695-5(b) for verification of this requirement.

When installed only in the feeder circuit to the fire pump and its accessories, NEC Secs. 230-90(a), Ex. 4 and 695-4(b)(1) require the size of the overcurrent protection device to carry the sum of the locked-rotor currents without opening.

The NEC permits a locked-rotor overcurrent protection device to be located between the isolation means and fire pumps motor. If installed, the overcurrent protection device in the fire pump controller as mentioned above, the following provisions must be met: 1. The device shall comply with the following for a squirrel-cage or wound-rotor induction motor: a) Have a tripping time between 8 sec and 20 sec at locked-rotor current. (Note that this setting is about six times the full load current of a squirrel-cage motor.) b) The device shall be set at three times the motor's full load current. 2. For a DC motor, the device shall be set at four times the full load current of the motor, and the device has to be the instantaneous type.

*Disconnecting means.* Disconnecting means must be provided to disconnect all plant circuits from the power supply source -- placing them in an accessible location in case of fire. The disconnecting means and overcurrent protection techniques must comply with NEC Art. 230, 240 and Sec. 695-4(b). In addition, the overcurrent protection device must meet the provisions of NEC Secs. 450-3 and 695-4(b)(1). Such protective devices are unique to fire pump loads.

The disconnecting means shall be capable of disconnecting the total locked-rotor current of the fire pump motor(s). Where the disconnecting means disconnects the fire pump motor(s), its accessories, and the plant loads, it shall be capable of disconnecting the sum of the locked-rotor current of such loads.

*Controllers.* All controllers used in a fire pump system have to be suitable for use as service equipment per Sec. 7-1.2.4 in NFPA 20. Controllers must be installed as close as practical within sight of all motors in which they control. See Sec. 7-2.1 in NFPA 20 and Sec. 695-12(b) in the NEC.

Controllers must be installed at least 12 in. above the floor to protect them from water escaping from pumps or pump connections per Sec.7-2.2 in NFPA 20 and NEC Sec. 695-12(d).

The fire pump controller cannot be used as a junction box for wiring to supply other electrical equipment. Conductors supplying power for pressure maintenance (jockey or make up) pump(s) must not be connected to the fire pump controller, per Sec. 7-3.4.4 in NFPA 20 and NEC Sec. 695-6(f).

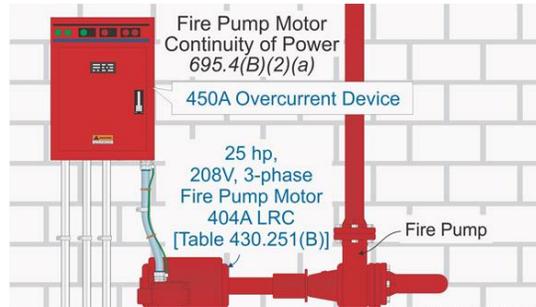
Overcurrent protection devices shall not protect auxiliary control circuits used for the operation of the controller. See Sec. 7-3.5 in NFPA 20 for this requirement. Controllers in Sec. 7-1.2.2 in NFPA 20 are required to be sized to handle the driven load and selected to stand the available fault current for the circuit in which it is utilized.

*Motors.* Sec. 6-5.1.3 in NFPA 20 requires all motors used in the fire pump system to be rated for continuous duty. Motors have to be designed and selected to drive the pump load under all conditions of use without their full load amps being exceeded.

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The current-carrying parts of motors must be installed at least 12 in. above the finished floor for protection from water that may escape from the pumps.

*Summary.* The designer must reference both the 1999 NEC (NFPA 70) and NFPA 20 to ensure a safe and reliable power source for supplying fire pumps.



If there any questions or concerns, do not hesitate to contact me.

Respectfully submitted,

*Kenneth E. Bell*

Kenneth E. Bell  
Deputy Fire Marshal  
kbell@rowlett.com

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