



**Date:** November 10, 2023  
**To:** City of Houston HPW-HPC  
**Attention:** CCM  
**From:** Jensen Hughes  
**Subject:** Break Tanks and Fire Pump Code Changes

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This technical memo is provided to describe the new changes to the Houston Building Code and Houston Fire Code with regards to the requirement for fire pumps and break tanks.

**Deleted the existing amendment 901.13 from the Fire Code. Moved the information to be retained to Section 913 for fire pumps.**

~~901.13 Fire pumps. Fire pumps shall be listed by Factory Mutual, Underwriters Laboratories or another approved agency and shall not deliver less than the required fire flow and pressure in accordance with the listing. Such pumps shall be automatic operation. (See the Electrical Code for additional requirements.) The source of supply for such pumps shall be a break tank served from the city main sized as required by NFPA 20, or a minimum 2500 gallons, whichever is more restrictive.~~

**Deleted the existing amendment 901.9 from the Building Code. Moved the information to be retained to Section 913 for fire pumps.**

~~901.9 Fire pumps. Fire pumps shall be listed by Factory Mutual, Underwriters Laboratories or another agency approved by the fire code official and shall not deliver less than the required fire flow and pressure in accordance with the listing. Such pumps shall be automatic operation. (See the Electrical Code for additional requirements.) The source of supply for such pumps shall be a minimum 2,500 gallon (9,463.530 L) break tank served by the city main, or a break tank sized as required by NFPA 20, whichever is more restrictive.~~

**Added a new Section 913.1.1 under General to the Fire Code to detail the requirements for listings of fire pumps.**

**913.1.1 Listing**

Fire pumps shall be listed by FM Global, UL Solutions or other approved agency and shall not deliver less than the required flow and pressure in accordance with the listing.

*Justification:*

The requirement in NFPA 20 for listing of fire pumps is left to the Authority Having Jurisdiction. This amendment will bring clarity to this requirement and will carry forward a previous amendment that was wrapped up in a multi-criteria amendment (Section 901.13) in previous editions of the Houston Fire Code.

**memo.**

**Added a new Section 913.1.1 to the Building Code to match Fire Code amendment.***[F] 913.1.1 Listing*

Fire pumps shall be listed by FM Approvals, UL Solutions or other approved agency and shall not deliver less than the required flow and pressure in accordance with the listing.

*Justification:*

See Fire Code amendment above.

**Added a new Section 913.1.2 to Fire Code to require automatic operation.***913.1.2 Automatic Operation.*

Fire pumps shall be automatic operation. (See the Electrical Code for additional requirements.)

*Justification:*

NFPA 20 describes and provides requirements automatic and manually operated fire pumps and leaves the type of operation to the Authority Having Jurisdiction. This amendment will bring clarity to this requirement and will carry forward a previous amendment that was wrapped up in a multi-criteria amendment (Section 901.13) in previous editions of the Houston Fire Code.

**Add new Section 913.1.2 to the Building Code to match Fire Code amendment.***[F] 913.1.2 Automatic Operation.*

Fire pumps shall be automatic operation. (See the Electrical Code for additional requirements.)

*Justification:*

See Fire Code amendment above.

**Added a new Section 913.6 to replace existing 901.13 2015 amendment requiring break tanks. New Section will not require break tanks but will require designing the system to not drop city water below the minimum pressure of 20 psi.***913.6 Minimum Suction pressure.*

Fire pumps taking direct suction from the city water supply shall be designed such that the city water pressure does not drop to less than 20 psi at 150 percent of rated capacity of the selected pump. Where the public water supply is not adequate to meet the minimum suction pressure requirements, an alternative water supply shall be provided in accordance with Section 507.2. The tank size cannot be less than the full fire protection demand without the refill rate included unless it meets the requirements of a break tank per NFPA 22.

*Justification:*

City of Houston has long required tanks to separate the public water supply from fire pumps to prevent direct suction connections. This was originally done under requirements to meet the State of Texas Superior Public Water System quality designation which did not previously allow any taps that had pumps connected to city water mains. These original water quality connections have been revised to allow fire pump connections in accordance with AWWA requirements and not affect the ability to achieve the rating. The city water department is still required to maintain a minimum pressure on the system in accordance with Texas Commission on Environmental Quality (TCEQ). TCEQ under 30 TAC 290.46(r) states the



following: (r) Minimum pressures. All public water systems shall be operated to provide a minimum pressure of 35 psi throughout the distribution system under normal operating conditions. The system shall also be operated to maintain a minimum pressure of 20 psi during emergencies such as firefighting. As soon as safe and practicable following the occurrence of a natural disaster, a public water system that is an affected utility shall maintain a minimum of 35 psi throughout the distribution system during an extended power outage.

**FAQ:** Is the purpose of a fire pump to create water or is its purpose only to boost pressure?

It is important to realize that fire pumps cannot create water or increase the capacity of a liquid supply; they can only boost or supply the pressure and flow from an available liquid source. Fire pump installations are a critical and essential component of the liquid supply for a fire protection system, because they provide the necessary system flow and pressure to meet the system demand requirements. The performance of any liquid-based fire protection system. As stated in the Administrative Code, the minimum normal operation of the system is 35 psi; however, this code recognizes that firefighting operations (including operation of automatic fire protection systems) which happen in an emergency condition can drop the pressure to 20 psi. This drop typically will have a limited area impact as opposed to system wide impacts that may occur in a loss of power to the city's water facilities. The application of a break tank for creating a separation between city supply and fire pumps has been inconsistent over the years. The original Houston code requirements did not allow any direct connection and specifically required a minimum 2,500 gal. tank in accordance with NFPA 22 requirements. In the early 2000s, the code was amended (2003 and 2006) to allow direct connections when approved in accordance with an administrative policy. Where pumps were not approved for direct connection, they required a minimum 2,500 gal. suction tank. With the adoption of the 2012 IBC/IFC, the reference codes and standards referred to an updated edition of NFPA 20. In the 2007 NFPA 20, specific requirements for a break tank were addressed and these new requirements were greater than the 2,500 gal. minimum size. The code was modified to allow something less than what was required in NFPA 20 if an engineering analysis could show that the refill could meet the outflow. With the adoption of the 2015 IBC/IFC, it was decided during the code review process to ensure that the most restrictive requirement between the previous 2,500 gal. size and the NFPA 20 sizing was met. This reference to the 2,500 gal tank size was unnecessary as the NFPA 20 sizing requirements would always be greater than 2,500 gal. The city has numerous 2,500 gal tanks and continues to accept a calculated refill rate even though the current adopted code requirements no longer allow this. This has resulted in tanks that cannot provide the required flow during the testing of the fire pump and potentially during a fire event. The industry has seen tanks run dry in as little as 5 min., which will not provide adequate fire protection supply. During the Task Force Group 1 meeting on March 2, 2023, with various stakeholders, these items were discussed. The response from the industry representatives is that a break tank adds cost and lowers the reliability of the fire protection system. As a fire pump does not create water and only increases pressure supplied by the public system (see Commentary from NFPA 20 below), there is no issue with reducing the pressure of the system to create a contamination situation. The codes require that fire protection systems be designed to limit the minimum incoming pressure to a fire pump to 20 psi. Any existing system that the maximum flow would be less than 20 psi is required to design the system with a tank designed per NFPA 22. With the change from the original intent of the water quality standards there is no reason to continue to require a break tank for fire protection systems.

### **Language and Commentary from NFPA 20 – 2019 edition**

#### 1.2 Purpose.

The purpose of this standard is to provide a reasonable degree of protection for life and property from fire through installation requirements for stationary pumps for fire protection based upon sound engineering principles, test data, and field experience.



**Added a new Section 913.6 to the Building Code to match Fire Code amendment.***[F] 913.6 Minimum Suction pressure.*

Fire pumps taking direct suction from the city water supply shall be designed such that the city water pressure does not drop to less than 20 psi at 150 percent of rated capacity of the selected pump. Where the public water supply is not adequate to meet the minimum suction pressure requirements, an alternative water supply shall be provided in accordance with Section 507.2 of the Fire Code. The tank size cannot be less than the full fire protection demand without the refill rate included unless it meets the requirements of a break tank per NFPA 22.

*Justification:*

See Fire Code amendment above.

## PREVIOUS 2015 IFC Amendment

This is provided for reference to what is in the current code.

901.13 Fire pumps. Fire pumps shall be listed by Factory Mutual, Underwriters Laboratories or another approved agency and shall not deliver less than the required fire flow and pressure in accordance with the listing. Such pumps shall be automatic operation. (See the Electrical Code for additional requirements.) The source of supply for such pumps shall be a break tank served from the city main sized as required by NFPA 20, or a minimum 2500 gallons, whichever is more restrictive.

**Added a new Section 507.1.1 to Fire Code to address concern with adequacy of public water supply's ability to meet Fire Flow requirements.***507.1.1 Adequacy of Water Supply.*

Where the public water supply is not adequate to meet the flow and pressure requirements for fire flow calculated in accordance with Section 507.3 and Appendix B, an alternative water supply shall be provided in accordance with Section 507.2.

*Justification:*

There are numerous areas of the city that cannot meet the minimum requirements for fire flow from the IFC. Since this is related to the system outside the building, industrial type buildings (e.g., high-piled storage warehouses) that are located or proposed in these reduced water supply areas cannot obtain fire department approval without an improvement in the public water supply or the installation of a private water supply system. This amendment will help ensure that the potential need for an adequate system is addressed by the code.

*Calculation Examples*

**EXAMPLE 1 BREAK TANK NOT REQUIRED**

A water flow test was provided by the designer to show the following city water supply.

Static Reading: 54 psi

Adjusted Static (3 ft depth) : 57 psi

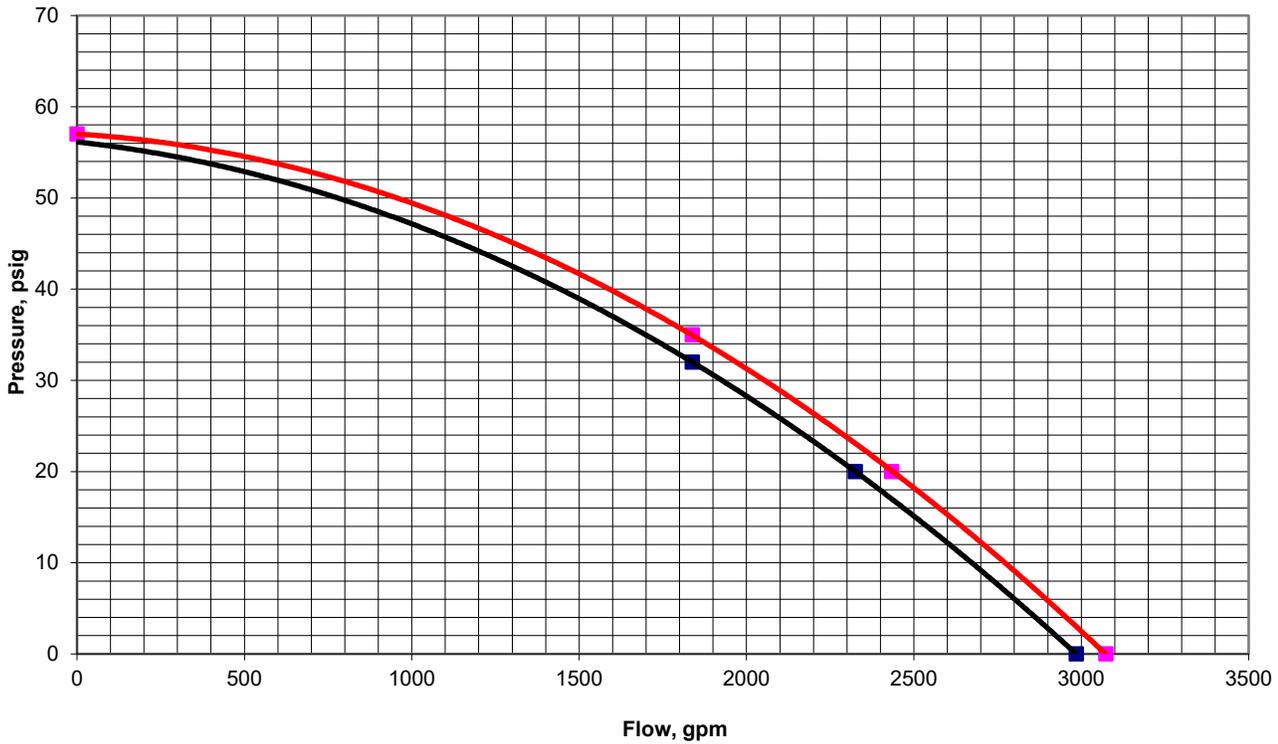
Residual Reading: 32 psi

Adjusted Residual (3 ft hydrant height): 35 psi

Residual Flow: 1838 gpm

Flow at 20 psi: 2434 GPM

Flow at 0 psi: 3073 GPM



**Figure 1: Hydrant Flow Test Example 1**

A sprinkler system for a one-story warehouse with high-piled storage throughout is provided as an example. The design requires the use of sprinklers with a K-factor of K-16.8 sprinkler. The system requires design pressures of 35 psi for a total



of 12 sprinklers within the remote area and a hose requirement of 250 gpm. The pressure and flow required for the system is 1450 gpm at 100 psi at the fire pump discharge including the required City of Houston safety factors.

The fire pump chosen for the project is rated at 1250 gpm at 120 psi. The 150% rating is 1,875 gpm at 85 psi.

The cumulative pressure losses through the aboveground, underground and its appurtenances to the point of connection of the fire pump suction flange is 10 psi at the pump's 150% rating of 1875 gpm.

Taken from the flow test, the residual pressure at the 150% of the fire pump selection gpm is 34 psi. The residual pressure of the flow test (34 psi) minus the pressure losses up to the fire pump suction (10 psi) will provide 24 psi at the point of connection of the fire pump suction flange.

A minimum residual pressure of 20 psi is to be maintained at the point of connection to the fire pump in order for a break tank system to not be provided. A break tank is not required for the system.

**memo.**