



# CITY OF HOUSTON

## Fire Marshal, Houston Fire Department

### Hazardous Materials / High-Piled Inspection Team



## **High-Piled Storage Plan Review**

UPDATED: 01/10/2024

### **2021 International Fire Code w/COH Amendments & Referenced Standards**

- Owner's Statement of Intended Use attached to front of plans. Available at <https://www.houstonpermittingcenter.org/search?keys=owners+statement+of+intended+use+>
- HMIS attached to front of plans, if applicable.

### **Site Plan**

- Show surrounding streets, property lines, buildings, and all applicable dimensions.
- Clearly show fire apparatus access roadway in compliance with **Section 503 and Appendix D of the 2021 Houston Fire Code and HFD LSB Standard 03**.
- Must show on plans inside turning radius throughout the fire/aerial apparatus access roadway as per **Section 503.2.4**. Our minimum acceptable **inside** turning radius is 28 ft.
- If building is over 30 feet in height: **Appendix D of the 2021 IFC, Section D105 Aerial:**
  - (1) Required if building is > 30ft in height with no overhead utility and power lines obstruction located between building and aerial fire apparatus access roadways.
  - (2) Min. unobstructed width of 26 feet.
  - (3) Located with min of 15 feet or max. 30 feet from the building. Positioned parallel to one entire side of the building.
- If Public Street is used as part of access roadway, statement on plans that area between road and building is free of obstructions from fences, large drainage ditches, brush, etc., if applicable.
- Print on plan roadway will support a load of 90,000 lbs. and is all-weather concrete or asphalt per **Appendix D, Section D102.1 (IFC 2021 Amendments)**.  
**Engineering stamp required.** (Not required for public roads.)
- **Two** separate access roadways (access points) for sprinklered buildings greater than **124,000 sq. ft. (62,000 sq. ft. if non-sprinklered)** per **D104.2**.
- **Two** separate access roadways (access points) required for buildings or facilities **exceeding 30 feet or three (3) stories in height** per **D104.1**.
- Concrete or asphalt walkway leading from the fire apparatus access roadway to all HFD access doors/exterior openings shall be provided, if applicable, per **Section 504.1**. Minimum width of 5 ft.
- Show fire hydrant(s) in compliance with distance requirements of **Section 507.5.1**.  
**\* 600' for sprinkled buildings**                      **\* 400' for non-sprinkled buildings**
- Hydrant(s) min. 40 ft. from building per **NFPA 24, 2019 edition, Section 7.2.3**.
- Adjacent to hydrant(s) provide gpm flow at 20 psi residual pressure. Include flow test date and results, as well as all calculations used to convert to available flow at 20 psi residual pressure. **NOTE:** Must be witnessed by the COH and documentation provided.
- Access roadway adjacent to hydrant minimum 26 ft. in width per **Section D103.1** (this width maintained for 20 ft. in each direction from hydrant per **Figure D103.1**).
- No parking spaces within 15 ft. of hydrant.
- Show on plans any fences, gates, or other possible outdoor obstructions to access roadway or HFD access doors. Must have 911 keybox at gate(s), or state on plans that gate(s) are never locked.

- If plans show a fence between apparatus access roadway and building, that fence must have gate(s) with 911 keyboxes, and walkways, that line-up with each HFD access door on that side between the fence and the road.

### **Floor Plan**

- Show rack / commodity storage array layout. Include aisle widths. Ensure no dead-end aisles as noted in **Section 3206.10.3 Dead End Aisles (2021 IFC)**.
- Provide square-footage of high-piled area per application of **Table 3206.2**.
- For separated high-piled areas provide square footage for each area and show separation wall(s). Print on plans rating of wall(s).
- Print on plans “No High-Piled Storage” for those areas where there will be no HP storage.
- All High-piled storage buildings shall meet with the requirements of **Section 3206.6 Building access** unless using the Exception. An Alternate Means request must be submitted to the **Fire Marshal Office Route #180 Hazmat/High-piled Plan Review Section** prior to approving plans. The Exception is in reference to additional fire protection authorized by the fire code official.

NOTE: There are no amendments that would require installation of a Dry or Wet Standpipes on HFD access doors not facing a required fire apparatus access roadway as previously required in older International Fire Codes w/COH Amendments.

- Note on plans that HFD access doors to be marked on site per **Section 3206.7.4**. Fire department access doors shall be labeled on the exterior side with the following sign or other *approved* sign:

**FIRE DEPARTMENT ACCESS DOOR  
DO NOT BLOCK**

The lettering shall be in a contrasting color to the background. Letters shall have a minimum height of 2 inches with a minimum stroke of 3/8 inch. AHJ will authorize the previous Fire Codes wording used. The “HFD” signage located on top left-hand corner of access doors.

- Clearly note or show hardware type for HFD access doors. Must allow entrance from exterior as well as exit from interior, per **Section 3206.7.7 Locking devices**. **All “HFD” access doors, noted on plans, need to be keyed the same.**
- Show HFD access doors in compliance with **Section 3206.7.5**. Clearly designate which doors are HFD access doors. Include dimensions between doors. Minimum distance such that the lineal distance shall not exceed **125 feet** between HFD access doors measured center to center.  
**See Exception:** The linear distance between adjacent access doors shall not exceed “**200 feet**” in existing buildings where change in occupancy is not proposed.
- Show location of FDC. Must be on street-facing side of building per **Section 912.2.1 Visible location**. Fire department connections shall be located on the street side of buildings or facing *approved* fire apparatus access roads, fully visible and recognizable from the street, fire apparatus access road or nearest point of fire department vehicle access or as otherwise *approved* by the *fire code official*.
- Print on plans sprinkler design criteria per **NFPA 13 2019**. Include all tables, figures, and references used to calculate density. Include all calculations.
- Per **Table 3206.2**: If installing a “fire detection system” in lieu of an “Automatic fire-extinguishing system”, plans must comply with **Section 3206.5**. The system shall also be monitored and installed in accordance with Section 907.
- If applicable, meet with **NFPA 13, 2019 ed. (Section 16.1.4) Fire Protection of Steel Columns**: Class I-IV. (**Section 17.1.4 / 17.1.4.1\*) Fire Protection of Steel Columns**: Plastics. (**Section 18.2.1) Columns within Rubber Tire Storage**.
- If applicable: meet with **NFPA 13, 2019 ed. (Section A.17.1.4.1) Protection for columns with sprinkler head locations outside the rack structure**.

- Show on plans near main entrance one key box per **Section 3206.7.8 Key Box and Section 506.1**. The key box shall be of an approved type listed in accordance with UL 1037. (Not required for shell buildings). The Houston Fire Marshal's Office has approved the **3200 Series Knox Box, Single-Key, ONLY** with the hinged lid. The key box shall contain keys or devices to allow for entry through the fire department access doors.
- Access gates installed on the fire apparatus access roadway must meet with the requirements of **LSB Standard 4 and Appendix D, Section D103.5 (2021 IFC w/COH Amendments): Access Control Gates**.
  - (4.3.2.3) **Access Control Gate/Barrier on Fire Apparatus Access Roads, at Hazardous Material sites, Group H occupancies and High-piled Combustible Storage sites.**
- If interior has fenced enclosure:
  - Cannot obstruct access doors, aisles, or exits in any manner.
  - Cannot exceed 10,000 sq. ft.
  - Maximum dimension of 100 ft. (Class I – IV) or 50 ft. (High Hazard).
  - Access gates every 100 lineal feet or fraction thereof.
  - Access gates not locked and provided with either approved passage hardware or no hardware of any kind.
  - Required segregated storage, such as aerosol storage, to be reviewed on a case-by-case basis.
- **NFPA 13 (Installation of Sprinkler Systems), 2019 Edition**, released a new set of HVLS installation and design rules based on this series of tests:
  - NFPA 13, 2019 ed. (Section 11.1.7\*) High Volume Low Speed (HVLS) fans.** The installation of HVLS fans in building equipped with sprinklers, including ESFR sprinklers, shall comply with the following:
    1. The maximum allowable HVLS fan diameter is 24 feet (8 meters).
    2. HVLS fans need to be centered between four adjacent sprinklers.
    3. The vertical clearance from the HVLS fan to sprinkler deflector shall be a minimum of 3 ft. (0.9m).
    4. All HVLS fans shall be interlocked to shut down immediately upon receiving a water flow signal from the fire alarm system in accordance with the requirements of NFPA 72.
- **Fire Command Center** if building is greater than 500,000sf for F1 and S1 occupancies. Per **Section 508.1 (2021 IFC)**.
- Please provide a written response addressing each comment separately indicating the folder and sheet in the plan set for each comment correction.

**Roof Plan** – If Smoke/Heat (S/H) vents are required:

- See **Section 910 (2021 IFC)** for smoke / heat vent requirements.
- **Comply with Table 3206.2 of 2021 IFC**, regarding installation of S/H vents:
  - **Class I-IV:** 2,500-12,000 sq. ft., **Nonpublic accessible (Option 2) and over** require installation of S/H vents. (Not needed with ESFR)
  - **Class I-IV:** 12,001-20,000 sq. ft. **Require S/H vents.**
  - **High Hazard:** 501-2,500 sq. ft., **Nonpublic accessible (Option 2) and over** require installation of S/H vents. (Not needed with ESFR)
- Show on plans location of S/H vents. Per **Section 910.3.2 Smoke and heat vent location**. Show on plans location of any interior walls in relation to S/H vents and provide dimension between the walls and S/H vents (see **Section 910.3.2**).
- Show on plans compliance with **Section 910.3.3 Smoke and Heat vent area**.
- Provide spec. sheet for S/H vents. Must comply with **Section 910.3.1 Listing and labeling**: Design must state on plans that "S/H vents shall be listed and labeled to indicate compliance with UL 793 or FM 4430".
- For automatic pop-up vents print on plans activation temperature of fusible link.

- If ESFR sprinkler, any automatic vent must be rated at least 360°F.
- With ESFR sprinkler, S/H vents can be deleted entirely per Building Code Section 910.2 exception 2.
- For melt-out / drop-out S/H vents, note on plans “No obstructions under smoke/heat vents.”
- **NFPA 13, the 2019 Ed. (Section 12.1.1.2)** states “Early suppression fast-response (ESFR) sprinklers shall not be used in buildings with automatic heat or smoke vents unless the vents use a high-temperature rated, standard response operating mechanism.”

**CODE OF RECORD ISSUES FOR HIGH-PILED STORAGE:**

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**COR request must be submitted to the Building Department for approval**  
[HPC-RA@houston.tx.gov](mailto:HPC-RA@houston.tx.gov).

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**Building Codes prior to 1973 Fire Code “Pre 73 FC”**

- Review plans for sprinkler protection only. Sprinkler design shall be based out of “current” adopted code reference standard NFPA 13. 20\*\*.

**1973 Fire Code**      *(Buildings permitted after 11-21-73)*

- HFD access doors in each 100 lineal feet or fraction thereof of exterior walls on at least two (2) sides of the building (sec. 35-16).
  - Allowances can be made for the doors on those 2 sides if additional HFD access doors are provided on the other sides of the building.
  - All modern maintenance items for HFD access doors apply to these doors (size and type, approved locking devices, marking of doors).
  - 911 keybox near main entrance.
- Smoke/heat vents if area is greater than 50,000 sq. ft. (sec. 35-13).
- Complete sprinkler design on plans per NFPA 13 2010.
- No fire hydrant distance required.

**1991 Uniform Fire Code**      *(Buildings permitted after 05-14-95)*

- Fire hydrant distance allowed being 950 feet.
- Access roads must be within 150 ft. of building (no exceptions) for HP in excess of 12,000 sq. ft. (Sec. 81.109 & Article 10 Division II).
- HFD access door distance is **100 feet**, and location is any exterior walls which face the access roadways.
- No provisions for aerial access roadways.
- Everything else is basically the same as current code.

**1994 Uniform Fire Code**      *(Buildings permitted after 01-25-97)*

- Fire hydrant distance allowed being 950 feet.
- Access roads can exceed 150 ft. from building if the roadway(s) cover 60 % of building, building is fully sprinklered, and no high-hazard high-piled commodities (Sec. 902.2.1.1)
- HFD access door distance is **105 feet**, and location is any exterior walls which face the access roadways.

- No provisions for aerial access roadways.
- Everything else is basically the same as current code.

**1997 Uniform Fire Code** (*Buildings permitted after 03-12-2000*)

- Fire hydrant distance allowed being 950 feet.
- No provisions for aerial access roadways.
- Everything else is basically the same as current code.
- HFD access door distance is **105 feet**, or fraction thereof, of exterior walls.

**2000 International Fire Code** (*Buildings permitted after 10/2003*)

- Fire hydrant distance allowed to 600 feet (sprinklered building) 400 (sprinklered building)
- Aerial provisions into effect (Appendix Section D 105)
- Minimum of one (1) HFD access door shall be provided in each **105 lineal feet**, or fraction thereof, of the exterior walls.
- Smoke and heat vent required for S-1 and F-1 having more than 50,000 sf. in undivided area.
- Everything else is basically the same a current code.

**2006 International Fire Code** (*Building permitted after 12-31-2010*)

- Smoke and Heat vent: Must be listed and labeled to indicate compliance with **UL 793**,
- HFD access doors, a minimum of one (1) HFD access door shall be provided **in each 100 lineal feet, or fraction thereof, of the exterior walls which face the access roadway.**
- Everything else is basically the same as current code.

**2012 International Fire Code:** (*Building permitted after* )

If standpipe is installed per the exception in 3206.6:

- Fire apparatus access roadway must be provided to no less than 60 % of the perimeter of the entire building for new buildings and 50% for existing buildings. Show calculations on plans.
- Clearly designate on plans if standpipe system is wet or dry.
- For wet standpipe system:
  - Show 2 1/2" discharge hose connections installed outside and adjacent to each HFD access door not fronting an access roadway. Discharge must be on strike side of door, not hinge side.
  - Show on plans drawing/spec sheet for exact type of 2 1/2" discharge hose connection to be installed onsite.
  - **Statement on plans that system is capable of delivering 500 GPM through the 2 1/2" discharge connections.**
- For dry standpipe system:
  - Show 2 1/2" discharge hose connections installed outside and adjacent to each HFD access door not fronting an access roadway. Discharge must be on strike side of door, not hinge side.
  - Show on plans drawing/spec sheet for exact type of 2 1/2" discharge hose connection to be installed onsite.
  - Show/state on plans minimum 4-inch IPS pipe for up to and including 1,000 ft. in length, or 6-inch IPS pipe for over 1,000 ft. in length.
  - Show on plans location of dry-pipe FDC and note on plans that signage ("DRY PIPE HOSE SYSTEM" with min. 2" lettering) provided at this FDC.

**NOTE:** If the facility occupies the entire building, dry standpipe FDC should be located street-side adjacent to the sprinkler FDC. However, tenants occupying only a portion of a building, especially when the remainder of the building is not high piled, may end up installing FDC along the apparatus access roadway in front of their tenant space, which may be far removed from the location of the sprinkler FDC which covers the entire building.

**2015 International Fire Code: (Building permitted after )**

- Same as 2012 IFC requirements.

**TABLE 3206.2  
GENERAL FIRE PROTECTION AND LIFE SAFETY REQUIREMENTS**

COMMODITY CLASS	SIZE OF HIGH-PILED STORAGE AREA <sup>a</sup> (square feet) (see Sections 3206.2 and 3206.4)	ALL STORAGE AREAS (See Sections 3206, 3207 and 3208) <sup>b</sup>				SOLID-PILED STORAGE, SHELF STORAGE AND PALLETIZED STORAGE (see Section 3207.3)		
		Automatic fire-extinguishing system (see Section 3206.4)	Fire detection system (see Section 3206.5)	Building access (see Section 3206.6)	Smoke and heat removal (see Section 3206.7)	Maximum pile dimension <sup>c</sup> (feet)	Maximum permissible storage height <sup>d</sup> (feet)	Maximum pile volume (cubic feet)
I-IV	0-500	Not Required <sup>e</sup>	Not Required	Not Required <sup>e</sup>	Not Required	Not Required	Not Required	Not Required
	501-2,500	Not Required <sup>e</sup>	Yes <sup>f</sup>	Not Required <sup>e</sup>	Not Required	100	40	100,000
	2,501-12,000 Public accessible	Yes	Not Required	Not Required <sup>e</sup>	Not Required	100	40	400,000
	2,501-12,000 Nonpublic accessible (Option 1)	Yes	Not Required	Not Required <sup>e</sup>	Not Required	100	40	400,000
	2,501-12,000 Nonpublic accessible (Option 2)	Not Required <sup>e</sup>	Yes	Yes	Yes <sup>f</sup>	100	30 <sup>f</sup>	200,000
	12,001-20,000	Yes	Not Required	Yes	Yes <sup>f</sup>	100	40	400,000
	20,001-500,000	Yes	Not Required	Yes	Yes <sup>f</sup>	100	40	400,000
	Greater than 500,000 <sup>g</sup>	Yes	Not Required	Yes	Yes <sup>f</sup>	100	40	400,000
High hazard	0-500	Not Required <sup>e</sup>	Not Required	Not Required <sup>e</sup>	Not Required	50	Not Required	Not Required
	501-2,500 Public accessible	Yes	Not Required	Not Required <sup>e</sup>	Not Required	50	30	75,000
	501-2,500 Nonpublic accessible (Option 1)	Yes	Not Required	Not Required <sup>e</sup>	Not Required	50	30	75,000
	501-2,500 Nonpublic accessible (Option 2)	Not Required <sup>e</sup>	Yes	Yes	Yes <sup>f</sup>	50	20	50,000
	2,501-300,000	Yes	Not Required	Yes	Yes <sup>f</sup>	50	30	75,000
	300,001-500,000 <sup>h,i</sup>	Yes	Not Required	Yes	Yes <sup>f</sup>	50	30	75,000

For SI: 1 foot = 304.8 mm, 1 cubic foot = 0.02832 m<sup>3</sup>, 1 square foot = 0.0929 m<sup>2</sup>.

- a. Where automatic sprinklers are required for reasons other than those in Chapter 32, the portion of the sprinkler system protecting the high-piled storage area shall be designed and installed in accordance with Sections 3207 and 3208.
- b. For aisles, see Section 3206.9.
- c. Piles shall be separated by aisles complying with Section 3206.9.
- d. For storage in excess of the height indicated, special fire protection shall be provided in accordance with Note g where required by the fire code official. See Chapters 51 and 57 for special limitations for aerosols and flammable and combustible liquids, respectively.
- e. Section 503 shall apply for fire apparatus access.
- f. For storage exceeding 30 feet in height, Option 1 shall be used.
- g. Special fire protection provisions including, but not limited to, fire protection of exposed steel columns; increased sprinkler density; additional in-rack sprinklers, without associated reductions in ceiling sprinkler density; or additional fire department hose connections shall be provided required by the fire code official.
- h. High-piled storage areas shall not exceed 500,000 square feet. A 2-hour fire wall constructed in accordance with Section 706 *the International Building Code* shall be used to divide high-piled storage exceeding 500,000 square feet in area.
- i. Not required where an automatic fire-extinguishing system is designed and installed to protect the high-piled storage area in accordance with Sections 3207 and 3208.
- j. Not required where storage areas are protected by either early suppression fast response (ESFR) sprinkler systems or control mode special application sprinklers with a response time index of 50 (m • s)<sup>1/2</sup> or less that are listed to control a fire in the stored commodities with 12 or fewer sprinklers, installed in accordance with NFPA 13.

**16.1.4 Fire Protection of Steel Columns — Columns Within Storage Racks.** See Section C.10.

16.1.4.1\* Where fireproofing of building columns is not provided and storage heights are in excess of 15 ft (4.6 m), protection of building columns located wholly or partially within the rack footprint inclusive of flue spaces or within 12 in. (300 mm) of the footprint shall be protected in accordance with one of the following:

- (1) In-rack sprinklers
- (2) Sidewall sprinklers at the 15 ft (4.6 m) elevation, pointed toward one side of the steel column
- (3) Provision of ceiling sprinkler density for a minimum of 2000 ft<sup>2</sup> (186 m<sup>2</sup>) with ordinary 165°F (74°C) or high-temperature 286°F (140°C) rated sprinklers as shown in Table 16.1.4.1 for storage heights above 15 ft (4.6 m), up to and including 20 ft (6.1 m)
- (4) Provision of CMSA or ESFR ceiling sprinkler protection

**Table 16.1.4.1 Ceiling Sprinkler Densities for Protection of Steel Building Columns**

Commodity Classification	Aisle Width			
	4 ft (1.2 m)		8 ft (2.4 m)	
	gpm/ft <sup>2</sup>	(L/min)/m <sup>2</sup>	gpm/ft <sup>2</sup>	(L/min)/m <sup>2</sup>
Class I	0.37	15.1	0.33	13.4
Class II	0.44	17.9	0.37	15.1
Class III	0.49	20.0	0.42	17.1
Class IV	0.68	27.7	0.57	23.2

16.1.4.2 Where storage heights are in excess of 15 ft (4.6 m) and vertical rack members support the building structure, the vertical rack members shall be protected in accordance with one of the options in 16.1.4.1.

16.1.4.3 The flow from a column sprinkler(s) shall be permitted to be omitted from the sprinkler system hydraulic calculations.



**17.1.4 Fire Protection of Steel Columns — Columns Within Storage Racks.** See Section C.10.

17.1.4.1\* Where fireproofing of building columns is not provided and storage heights are in excess of 15 ft (4.6 m), protection of building columns located wholly or partially within the rack footprint inclusive of flue space or within 12 in. (305 mm) of the footprint shall be protected in accordance with one of the following:

- (1) In-rack sprinklers
- (2) Sidewall sprinklers at the 15 ft (4.6 m) elevation, pointed toward one side of the steel column
- (3) Provision of ceiling sprinkler density for a minimum of 2000 ft<sup>2</sup> (186 m<sup>2</sup>) with ordinary temperature- or high temperature-rated sprinklers as shown in Table 17.1.4.1 for storage heights above 15 ft (4.6 m) up to and including 20 ft (6.1 m)
- (4) Provision of CMSA or ESFR ceiling sprinkler protection

**18.2 Columns Within Rubber Tire Storage.**

18.2.1 Where fireproofing is not provided, steel columns shall be protected as follows:

- (1) Storage exceeding 15 ft through 20 ft (4.6 m through 6.1 m) in height — one sidewall sprinkler directed to one side of the column at a 15 ft (4.6 m) level
- (2) Storage exceeding 20 ft (6.1 m) in height — two sidewall sprinklers, one at the top of the column and the other at a 15 ft (4.6 m) level, both directed to the side of the column