

**WAC 296-24-31503 Gaseous hydrogen systems. (1) Design.**

**(a) Containers.**

(i) You must ensure that hydrogen containers comply with one of the following:

(A) Designed, constructed, and tested in accordance with appropriate requirements of ASME Boiler and Pressure Vessel Code, Section VIII—Unfired Pressure Vessels—1968.

(B) Designed, constructed, tested and maintained in accordance with U.S. Department of Transportation specifications and regulations.

(ii) You must provide permanently installed containers with substantial noncombustible supports on firm noncombustible foundations.

(iii) You must legibly mark each portable container with the name "hydrogen" in accordance with "marking compressed gas containers to identify the material contained" ANSI Z48.1-1954. You must legibly mark each manifolded hydrogen supply unit with the name hydrogen or a legend such as "this unit contains hydrogen."

**(b) Safety relief devices.**

(i) You must ensure that hydrogen containers are equipped with safety relief devices as required by the ASME Boiler and Pressure Vessel Code, Section VIII Unfired Pressure Vessels, 1968 or the DOT specifications and regulations under which the container is fabricated.

(ii) You must arrange safety relief devices to discharge upward and unobstructed to the open air in such a manner as to prevent any impingement of escaping gas upon the container, adjacent structure of personnel. This requirement does not apply to DOT specification containers having an internal volume of 2 cubic feet or less.

(iii) You must design or locate safety relief devices or vent piping so that moisture cannot collect and freeze in a manner which would interfere with proper operation of the device.

**(c) Piping, tubing, and fittings.**

(i) You must ensure that piping, tubing, and fittings are suitable for hydrogen service and for the pressures and temperatures involved. You must not use case iron pipe and fittings.

(ii) You must ensure that piping and tubing conforms to Section 2—"Industrial Gas and Air Piping"—Code for Pressure Piping, ANSI B31.1-1967 with addenda B31.1-1969.

(iii) Joints in piping and tubing may be made by welding or brazing or by use of flanged, threaded, socket, or compression fittings. You must ensure that gaskets and thread sealants are suitable for hydrogen service.

**(d) Equipment assembly.**

(i) You must ensure that valves, gauges, regulators, and other accessories are suitable for hydrogen service.

(ii) Installation of hydrogen systems must be supervised by personnel familiar with proper practices with reference to their construction and use.

(iii) You must make storage containers, piping, valves, regulating equipment, and other accessories readily accessible, and ensure they are protected against physical damage and against tampering.

(iv) You must adequately ventilate cabinets or housings containing hydrogen control or operating equipment.

(v) You must adequately secure each mobile hydrogen supply unit used as part of a hydrogen system to prevent movement.

(vi) You must electrically bond mobile hydrogen supply units to the system before discharging hydrogen.

(e) **Marking.** You must permanently placard hydrogen storage location as follows: "HYDROGEN—FLAMMABLE GAS—NO SMOKING—NO OPEN FLAMES," or equivalent.

(f) **Testing.** After installations, you must test all piping, tubing, and fittings and prove it to be hydrogen gas tight at maximum operating pressure.

(2) **Location.**

(a) **General.**

(i) You must locate the system so that it is readily accessible to delivery equipment and to authorized personnel.

(ii) You must locate the systems above ground.

(iii) You must not locate the systems beneath electric power lines.

(iv) You must not locate the systems close to flammable liquid piping or piping of other flammable gases.

(v) You must locate the systems near aboveground flammable liquid storage on ground higher than the flammable liquid storage except when dikes, diversion curbs, grading, or separating solid walls are used to prevent accumulation of flammable liquids under the system.

(b) **Specific requirements.**

(i) You must ensure that the location of a system, as determined by the maximum total contained volume of hydrogen, is in the order of preference as indicated by Roman numerals in Table H-1.

TABLE H-1

Nature of location	Size of hydrogen system		
	Less than 3,000 CF	3,000 CF to 15,000 CF	In excess of 15,000 CF
Outdoors	I	I	I.
In a separate building	II	II	II.
In a special room	III	III	Not permitted.
Inside buildings not in a special room and exposed to other occupancies	IV	Not permitted.	Not permitted.

(ii) The minimum distance in feet from a hydrogen system of indicated capacity located outdoors, in separate buildings or in special rooms to any specified outdoor exposure must be in accordance with Table H-2.

(iii) The distances in Table H-2 Items 1, 14, and 3 to 10 inclusive do not apply where protective structures such as adequate fire walls are located between the system and the exposure.

(iv) Hydrogen systems of less than 3,000 CF when located inside buildings and exposed to other occupancies must be situated in the building so that the system will be as follows:

(A) In an adequately ventilated area as in (3)(b)(ii) of this section.

(B) Twenty feet from stored flammable materials or oxidizing gases.

(C) Twenty-five feet from open flames, ordinary electrical equipment or other sources of ignition.

(D) Twenty-five feet from concentrations of people.

(E) Fifty feet from intakes of ventilation or air-conditioning equipment and air compressors.

(F) Fifty feet from other flammable gas storage.

(G) Protected against damage or injury due to falling objects or working activity in the area.

(H) More than one system of 3,000 CF or less may be installed in the same room, provided the systems are separated by at least 50 feet. Each such system shall meet all of the requirements of this section.

(3) **Design consideration at specific locations.**

(a) **Outdoor locations.**

(i) Where protective walls or roofs are provided, you must ensure that they are constructed of noncombustible materials.

(ii) Where the enclosing sides adjoin each other, you must ensure that the area is properly ventilated.

(iii) You must ensure that electrical equipment meets the requirements for Class I, Division 2 hazardous locations of WAC 296-24-95613.

(b) **Separate buildings.**

(i) Separate buildings must be built of at least noncombustible construction. Windows and doors must be located so as to be readily accessible in case of emergency. Windows must be of glass or plastic in metal frames.

(ii) Adequate ventilation to the outdoors must be provided. Inlet openings must be located near the floor in exterior walls only. Outlet openings must be located at the high point of the room in exterior walls or roof. Inlet and outlet openings must each have minimum total area of one square foot per 1,000 cubic feet of room volume. Discharge from outlet openings must be directed or conducted to a safe location.

(iii) Explosion venting must be provided in exterior walls or roof only. The venting area must be equal to not less than 1 square foot per 30 cubic feet of room volume and may consist of any one or any combination of the following: Walls of light noncombustible material, preferably single thickness, single strength glass; lightly fastened hatch covers; lightly fastened swinging doors in exterior walls opening outward; lightly fastened walls or roof designed to relieve at a maximum pressure of 25 pounds per square foot.

(iv) There must be no sources of ignition from open flames, electrical equipment, or heating equipment.

(v) Electrical equipment must meet the requirements of chapter 296-24 WAC Part L.

(vi) Heating, if provided, must be by steam, hot water, or other indirect means.

(c) **Special rooms.**

(i) Floor, walls, and ceiling must have a fire-resistance rating of at least 2 hours. Walls or partitions must be continuous from floor to ceiling and must be securely anchored. At least one wall must be an exterior wall. Openings to other parts of the building must not be permitted. Windows and doors must be in exterior walls and must be located so as to be readily accessible in case of emergency. Windows must be of glass or plastic in metal frames.

(ii) Ventilation must be as provided in (3)(b)(ii) of this section.

(iii) Explosion venting must be as provided in (3)(b)(iii) of this section.

(iv) There must be no sources of ignition from open flames, electrical equipment or heating equipment.

(v) Electrical equipment must meet the requirements of chapter 296-24 WAC Part L.

(vi) Heating, if provided, must be by steam, hot water, or indirect means.

(4) **Operating instructions.** For installations which require any operation of equipment by the user, you must maintain legible instructions at operating locations.

(5) **Maintenance.** The equipment and functioning of each charged gaseous hydrogen system must be maintained in a safe operating condition in accordance with the requirements of this section. You must keep the area within 15 feet of any hydrogen container free of dry vegetation and combustible material.

TABLE H-2

Type of outdoor exposure	Size of hydrogen system		
	Less than 3,000 CF	3,000 to 15,000 CF	In excess of 15,000 CF
1. Building or structure	Wood frame construction* - 10	25	50
	Heavy timber, noncombustible or ordinary construction* - 0	10	**25
	Fire-resistive construction* - 0	0	0
2. Wall openings	Not above any part of a system - 10	10	10
	Above any part of a system - 25	25	25
3. Flammable liquids above ground	0 to 1,000 gallons - 10	25	25
	In excess of 1,000 gallons - 25	50	50
4. Flammable liquids below ground - 0 to 1,000 gallons	Tank - 10	10	10
	Vent or fill opening of tank - 25	25	25
5. Flammable liquids below ground - in excess of 1,000 gallons	Tank - 20	20	20
	Vent or fill opening of tank - 25	25	25
6. Flammable gas storage, either high pressure or low pressure	0 to 15,000 CF capacity - 10	25	25
	In excess of 15,000 CF capacity - 25	50	50
7. Oxygen storage	12,000 CF or less -	Refer to NFPA No. 51, gas systems for welding and cutting (1969).	
	More than 12,000 CF -	Refer to NFPA No. 566, bulk oxygen systems at consumer sites (1969).	
8. Fast burning solids such as ordinary lumber, excelsior or paper	- 50	50	25

Type of outdoor exposure	Size of hydrogen system		
	Less than 3,000 CF	3,000 CF to 15,000 CF	In excess of 15,000 CF
9. Slow burning solids such as heavy timber or coal _____	25	25	25
10. Open flames and other sources of ignition _____	25	25	50
11. Air compressor intakes or inlets to ventilating or air-condition equipment _____	50	50	50
12. Concentration of people*** _____	25	50	50
13. Public sidewalks _____	15	15	15
14. Line of adjoining property which may be built upon _____	5	5	5

\* Refer to NFPA No. 220 standard types of building construction for definitions of various types of construction. (1969 Ed.)

\*\* But not less than one-half the height of adjacent side wall of the structure.

\*\*\* In congested areas such as offices, lunchrooms, locker rooms, time-clock areas, and places of public assembly.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, and 49.17.060. WSR 15-24-100, § 296-24-31503, filed 12/1/15, effective 1/5/16. Statutory Authority: Chapter 49.17 RCW. WSR 91-24-017 (Order 91-07), § 296-24-31503, filed 11/22/91, effective 12/24/91; WSR 88-23-054 (Order 88-25), § 296-24-31503, filed 11/14/88. Statutory Authority: RCW 49.17.040 and 49.17.050. WSR 85-10-004 (Order 85-09), § 296-24-31503, filed 4/19/85; Order 76-6, § 296-24-31503, filed 3/1/76; Order 73-5, § 296-24-31503, filed 5/9/73 and Order 73-4, § 296-24-31503, filed 5/7/73.]