MEETING LOG
DIRECTORATE FOR ENGINEERING SCIENCES

SUBJECT: Meeting of the Z21/83 Water Heater Subcommittee

PLACE: Hilton Hotel South, Cleveland, OH

MEETING DATE: January 19, 1999

LOG ENTRY SOURCE: Donald W. Switzer

ENTRY DATE: January 25, 1999
COMMISSION ATTENDEES:

Donald W. Switzer ES

NON-COMMISSION ATTENDEES:

See Attached Attendance Sheet

MEETING SUMMARY

The primary agenda item for this meeting was to review comments received on two water heater Flammable Vapor Ignition Resistance (FVIR) test methods that were sent out for review and comment and choose one method to forward to the ANSI Z21/83 Committee. The subcommittee chose to forward the GAMA-proposed gasoline spill test methodology with minor revisions. A copy of the unrevised test method is attached.

The ANSI Z21/83 Committee will consider this item at its April 1999, meeting, and will vote whether or not to accept the water heater subcommittee's recommendation to include this test method in the American National Standard for Gas Water Heaters, ANSI Z21.10.1. If the Z21/83 Committee adopts the test method, the manufacturers and certifying agency will set the effective date for some time in the future.

Post-it® Fax Note 7671	Date 1/20/99	# of pages ▶ 3
To Don Switzer	From Julie CAIRNS	
Co./Dept. CPSC	Co.	
Phone #	Phone #	
Fax # 301-504-0025	Fax #	

ATTENDANCE RECORD

Z21/(Interim CSA) JOINT WATER HEATER SUBC
DAY 1 - TUESDAY, JANUARY 19, 1999

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16.	JOHN CORLISS	X	Energy INT.	216 328 8110	216 328 8101	JOHNC@agaresearch.com

Z21/(Interim CSA) JOINT WATER HEATER SUBCOMMITTEE

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January 19, 1999

Z21/(Interim CSA) JOINT WATER HEATER SUBCOMMITTEE

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45.	Al Callahan	IAS X				
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DRAFT PROPOSAL
to
American National Standard/CSA Standard for
Gas Water Heaters, Volume I, Storage Water Heaters with Input Ratings of 75,000 Btu per Hour or Less
(Z21.10.1 CSA 4.1)

2.38 FLAMMABLE VAPORS IGNITION RESISTANCE

The design of a water heater shall be such that it shall not ignite flammable vapors outside the water heater created by the spilling of both winter and summer blends or gasoline onto the floor of the test room described in the following method of test. This provision does not apply for water heaters for installation in recreational vehicles only.

METHOD OF TEST

These tests shall be conducted at normal inlet test pressure and input rating. The tests shall be conducted under the following three conditions with summer blend gasoline with a Reid Vapor Pressure of no more than 8 psi and winter blend gasoline with a Reid Vapor Pressure not less than 13 psi.

TEST CONDITION 1
The water heater shall be installed according to the manufacturer's instructions in a 6 ft. x 10 ft. x 8 ft. (1.8 m x 3 m x 2.4 m) high room equipped with a suitable access door. The walls, ceiling and door of the room shall be constructed of fire resistant materials and the floor shall be made of metal and leveled to prevent gasoline from forming puddles. A diagram of the test room is shown in **FIGURE 1**. The test room shall have:

a. Means to control temperature to the floor to 70 ± 10°F (21°C ± 6°C).
b. For water heaters that require air for combustion, ventilation, and dilution of flue gases from within the building:
   A combustion and ventilation air opening of one (1) square inch (645 square mm) per 1,000 BTUH of input located 12 inches (305 mm) from the ceiling in the area of the wall shown in **FIGURE 1.**
c. Means to spill a measured amount of gasoline onto a specified area of the floor, using the one (1) gallon (3.785 liter) gasoline container shown in **FIGURE 2.**
d. Provisions to provide pressure relief of the test room as shown in **FIGURE 1.**
e. A three-dimensional mannequin, measuring approximately 48 inches (1219 mm) in height. The mannequin shall be standing with its' legs spread apart a distance of approximately 14 inches (356 mm) with hands on hips. The depth of the mannequin shall be approximately 9 inches (2299 mm). The mannequin shall be
f. equipped with means to move it back and forth over a straight 3 foot (.91 meter) path at a velocity of 3 feet (.91 meter) per second.
g. Instruments to continuously measure the following:
   Average floor temperature
Ambient air temperature
The water heater's flue gas temperature

The bottom of flue gas baffle temperature *(if applicable)*
The inlet supply water temperature
The millivoltage output of the pilot *(if applicable)*
The hydrocarbon concentrations at the four (4) tube sample locations in the room, shown in **FIGURE 3**.

h. Means to observe the water heater under test from outside the room.
i. A suitable fire extinguishing system.
j. Means to verify the Reid vapor pressure of the gasoline prior to testing.

The water heater shall be located in the test room in the location shown in **FIGURE 1**. The water heater shall be tested with the venting arrangements described in 2.25.5, as shown in **FIGURE 3**, except as follows. When a manufacturer's supplied terminal(s) for either the air intake, vent exhaust, or both are designed for installation so that all air is derived from the outside atmosphere, or all flue gases discharge to the outside atmosphere, or both, then the terminal(s) shall be installed in accordance with the manufacturer's installation instructions and terminate outside the test room. The water heater shall be tested with all access doors in their normal position. If the lighting instructions call for the opening or removal of any door(s) to light the pilot and if the main burner(s) will operate with those door(s) removed or opened, the tests shall be repeated with removable door(s) removed, and sliding or hinged door(s) left in a fully open position unless self-closing. The water heater shall be supplied with water at a temperature of 70 ± 2°F (21 ± 1°C).

Hydrocarbon sample tubes shall be located in the test room on the water heater at the following locations: (See **FIGURE 3**):

1. At the lowest point in front of the water heater, on the side of the jacket not less than two (2) inches (51 mm) from the floor.
2. On the front of the water heater at a midpoint of the floor to jacket top height.
3. On the rear of the water heater at a midpoint of the floor to jacket top height.
4. On the top of the water heater's jacket.

If a manufacturer's supplied terminal for either the combustion air inlet and/or exhaust is designed for installation so that all combustion air is derived directly from the outside atmosphere and/or all flue gases discharge to the outside atmosphere, then the terminal shall be isolated from vapor concentrations.
A quick acting water valve shall be installed on the outlet water line located outside the test room. A flow restricting device shall be connected to the outlet of this valve. The flow restricting device shall be adjusted or constructed to maintain a flow rate of 3 ± .25 gallons (11.36 ± .95 liters) per minute during water draw periods.

With the water heater full of water, set the thermostat to the 120°F (49°C) mark and allow the water heater to operate until the gas supply to the main burner(s) is reduced to a minimum. Water shall then be drawn off at the specified flow rate until the thermostat functions and the main burner(s) ignite. Set a one (1) gallon (3.785 liter) gasoline container, full of winter blend gasoline, 20 inches (51 mm) from the water heater. The spout of the container should be toward the water heater in the direction of the tip. (See **FIGURE 1**). Begin recording the flue gas temperatures, bottom of flue baffle temperatures *(if applicable)*, the millivoltage output of the pilot *(if applicable)* and hydrocarbon concentrations at the four (4) sample tube locations. After the burners(s) have been in operation for at least one (1) minute, tip the gasoline container

toward the water heater. (See **FIGURE 2**). One (1) minute after the spill, move the mannequin three (3) times back and forth over a straight three (3) foot (.91 meter) path at a velocity of three (3) feet (.91 meter) per second. Repeat the mannequin movement after one (1) minute elapses and at one (1) minute intervals until the end of test. If the water heater cycles off on the thermostat, repeat the water draw cycle procedure. Allow the test to continue until, either a) the water heater's burner(s) are extinguished and there is no evidence of flame presence, b) the hydrocarbon concentrations at all four (4) sample tube locations shown in Figure 3 are below 50 percent of the 1.8 percent lower flammability limit (LFL) of Butane, c) the water heater has operated in a flammable vapor rich environment for a substantial period of time and in the judgment of the testing agency the water heater will not ignite flammable vapors if allowed to continue to operate, or d) ignition of flammable vapors has occurred outside the water heater.

Following this test, it shall be determined that either the water heater is not capable of being returned to normal operation or, if the water heater is capable of normal operation, there is no damage other than that of a superficial nature to the water heater wiring and controls, and no safety control (function) has been rendered inoperative. If the water heater is capable of normal operation, it may be used for the remaining tests described in this section. Components intended by the manufacturer to be field serviceable may be replaced between tests. If the water heater is not capable of being returned to normal operation, a new water heater may be used for the remaining tests.

The previous test shall then be repeated using the summer blend gasoline. The test procedure is the same as that described above for the winter blend gasoline except for the following:

a. Summer blend gasoline replaces winter blend
b. There is no movement of the mannequin, and
c. The gasoline container shall be tipped away from the water heater with the spout pointed in the direction of the tip.

TEST CONDITION 2

(This test condition does not apply to water heaters equipped with a continuous ignition source.) The water heater shall be installed as described under **TEST CONDITION 1**. The thermostat shall be set at the 120°F (49°C) mark and the water heater permitted to operate until the thermostat acts to reduce the gas supply to the main burner(s) to a minimum. Set a one (1) gallon (3.785 liter) gasoline container, full of winter blend gasoline, 20 inches (51 mm) from the water heater. The spout of the container should be toward the water heater in the direction of the tip. (See **FIGURE 1**). Begin recording the flue gas temperatures, bottom of flue baffle temperatures *(if applicable)*, the millivoltage output of the pilot *(if applicable)* and hydrocarbon concentrations at the four (4) sample tube locations. Tip the gasoline container toward the water heater. (See **FIGURE 2**). Water shall then be drawn off at the specified flow rate. One (1) minute after the spill, move the mannequin three (3) times back and forth over a straight three (3) foot (.91 meter) path at a velocity of three (3) feet (.91 meter) per second. Repeat the mannequin movement after one (1) minute elapses and at one (1) minute intervals until the end of test. If the water heater cycles off on the thermostat, repeat the water draw cycle procedure. Allow the test to continue until, either a) the water heater's burner(s) are extinguished and there is no evidence of flame presence, b) the hydrocarbon concentrations at all four (4) sample tube locations shown in Figure 3 are below 50 percent of the 1.8 percent lower flammability limit (LFL) of Butane, c) the water heater has operated in a flammable vapor rich environment for a substantial period of time and in the judgment of the testing agency the water heater will not ignite flammable vapors

if allowed to continue to operate, or d) ignition of flammable vapors has occurred outside the water heater. If the water heater is capable of normal operation it may be used for the remaining tests described in this section. Components intended by the manufacturer to be field serviceable may be replaced between tests. If the water heater is not capable of being returned to normal operation, a new water heater may be used for the remaining tests.

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a. Summer blend gasoline replaces winter blend
b. There is no movement of the mannequin, and
c. The gasoline container shall be tipped away from the water heater with the spout pointed in the direction of the tip."

TEST CONDITION 3

(This test condition only applies to water heaters equipped with a continuous ignition source.) The water heater is installed as described under **TEST CONDITION 1** and operated until the thermostat acts to reduce the gas supply to the main burner(s) to a minimum. The main burner(s) shall not operate during this test. Set a one (1) gallon (3.785 liter) gasoline container, full of winter blend gasoline, 20 inches (51 mm) from the water heater. The spout of the container should be toward the water heater in the direction of the tip. (See **FIGURE 1**). Begin recording the flue gas temperatures, bottom of flue baffle temperatures *(if applicable)*, the millivoltage output of the pilot *(if applicable)* and hydrocarbon concentrations at the four (4) sample tube locations. Tip the gasoline container toward the water heater. (See **FIGURE 2**). One (1) minute after gasoline is spilled, move the mannequin three (3) times back and forth over a straight three (3) foot (.91 meter) path at a velocity of three (3) feet (.91 meter) per second. Repeat the mannequin movement after one (1) minute elapses and at one (1) minute intervals until the end of test. Allow the test to continue until, either a) the water heater's burner(s) are extinguished and there is no evidence of flame presence, b) the hydrocarbon concentrations at all four (4) sample tube locations shown in Figure 3 are below 50 percent of the 1.8 percent lower flammability limit (LFL) of Butane, c) the water heater has been in the flammable vapor rich environment for a substantial period of time and in the judgment of the testing agency the water heater will not ignite flammable vapors if the test were to continue or d) ignition of flammable vapors has occurred outside the water heater. If the water heater is capable of normal operation, it may be used for the remaining tests described in this section. Components intended by the manufacturer to be field serviceable may be replaced between tests. If the water heater is not capable of being returned to normal operation, a new water heater may be used for the remaining tests.

The previous test shall then be repeated using the summer blend gasoline. The test procedure is the same as that described above for the winter blend gasoline except for the following:

a. Summer blend gasoline replaces winter blend
b. There is no movement of the mannequin, and
c. The gasoline container shall be tipped away from the water heater with the spout pointed in the direction of the tip.

Following each of the above tests, if the water heater is capable of normal operation then the water heater shall be filled with water at 70 ± 2°F (21 ± 1°C). The water heater shall then be operated for 15 minutes at which time a sample of the flue gases shall be secured at a point

immediately preceding their discharge from the flue outlet of the water heater. The sample shall then be analyzed and the carbon monoxide shall not be in excess of 0.04 percent, on an air free basis.

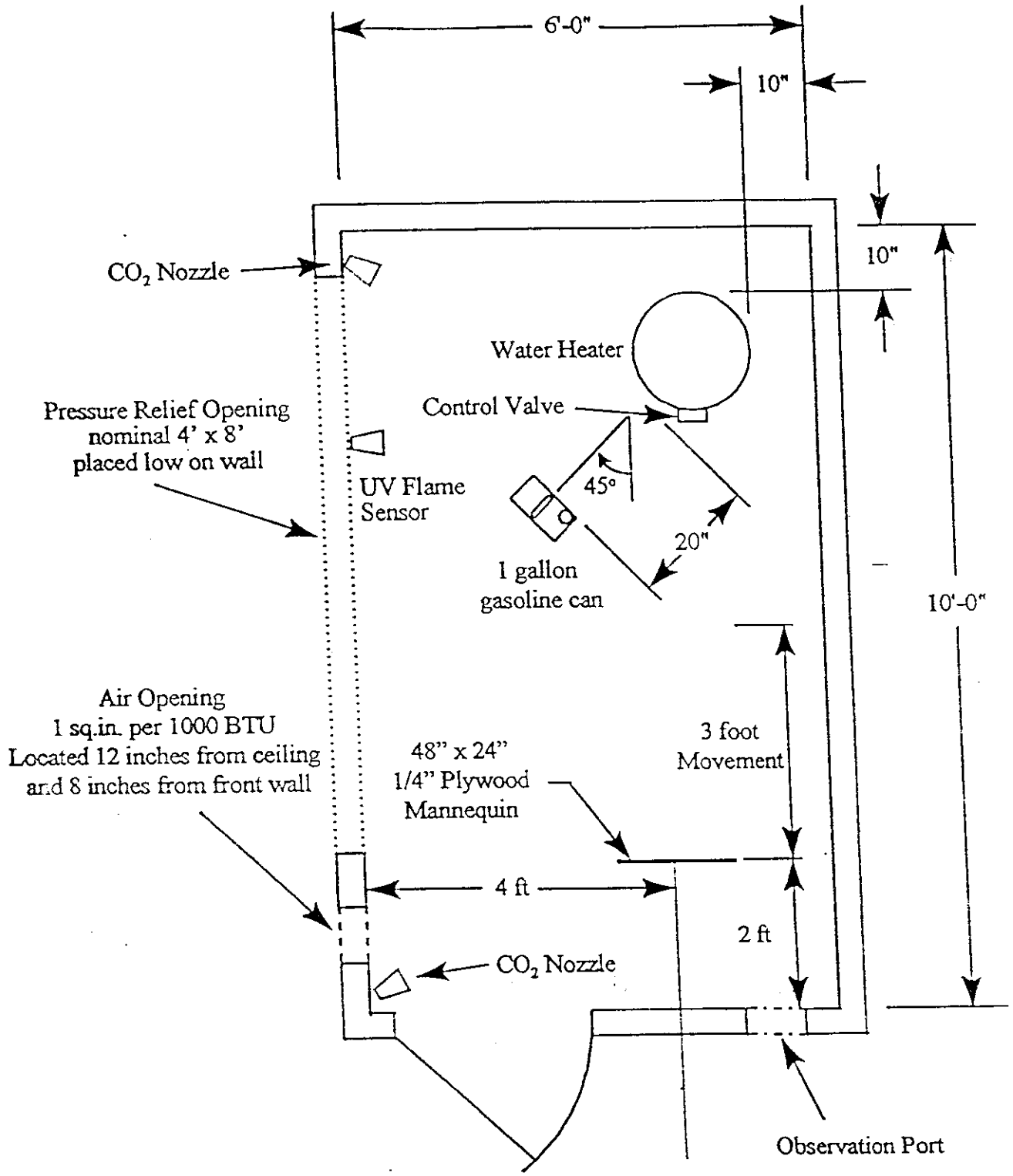
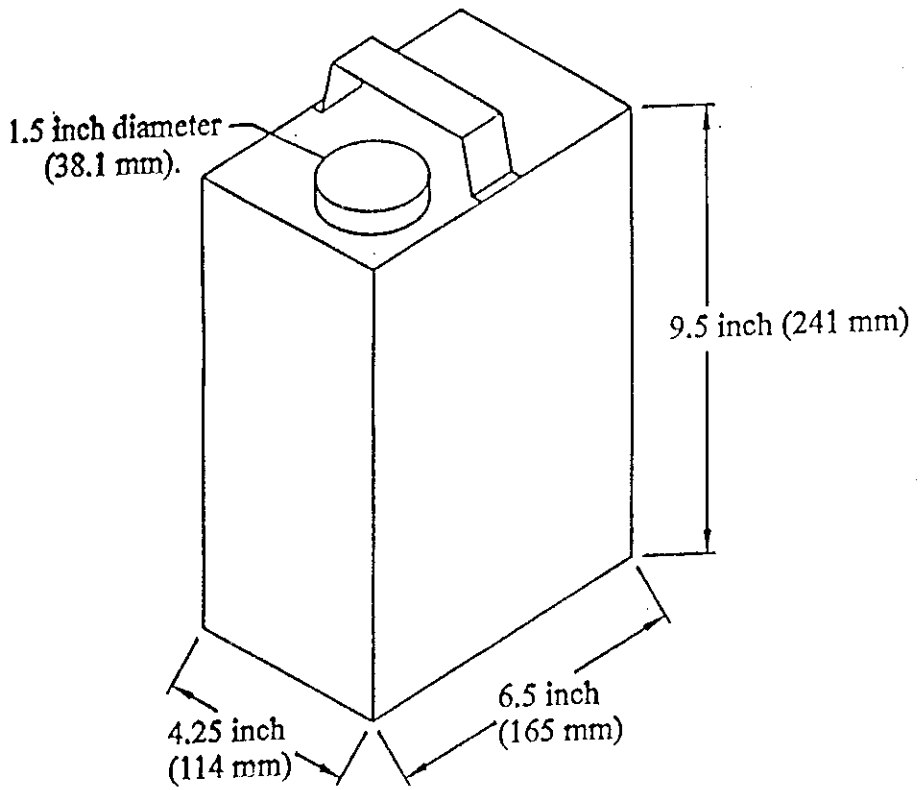


Figure 1 -Flammable Vapors Test Room



Tipped Position with Opening at Floor

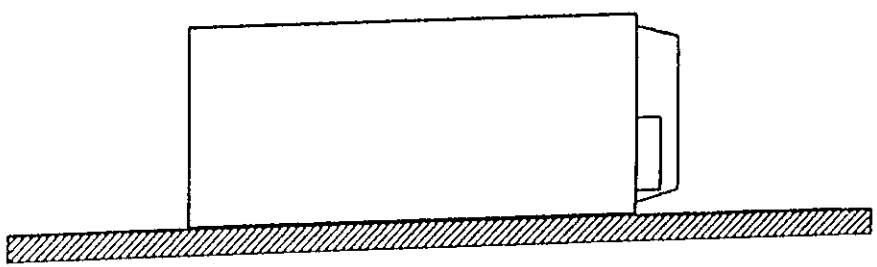


Figure 2 - Standard One Gallon Gas Can

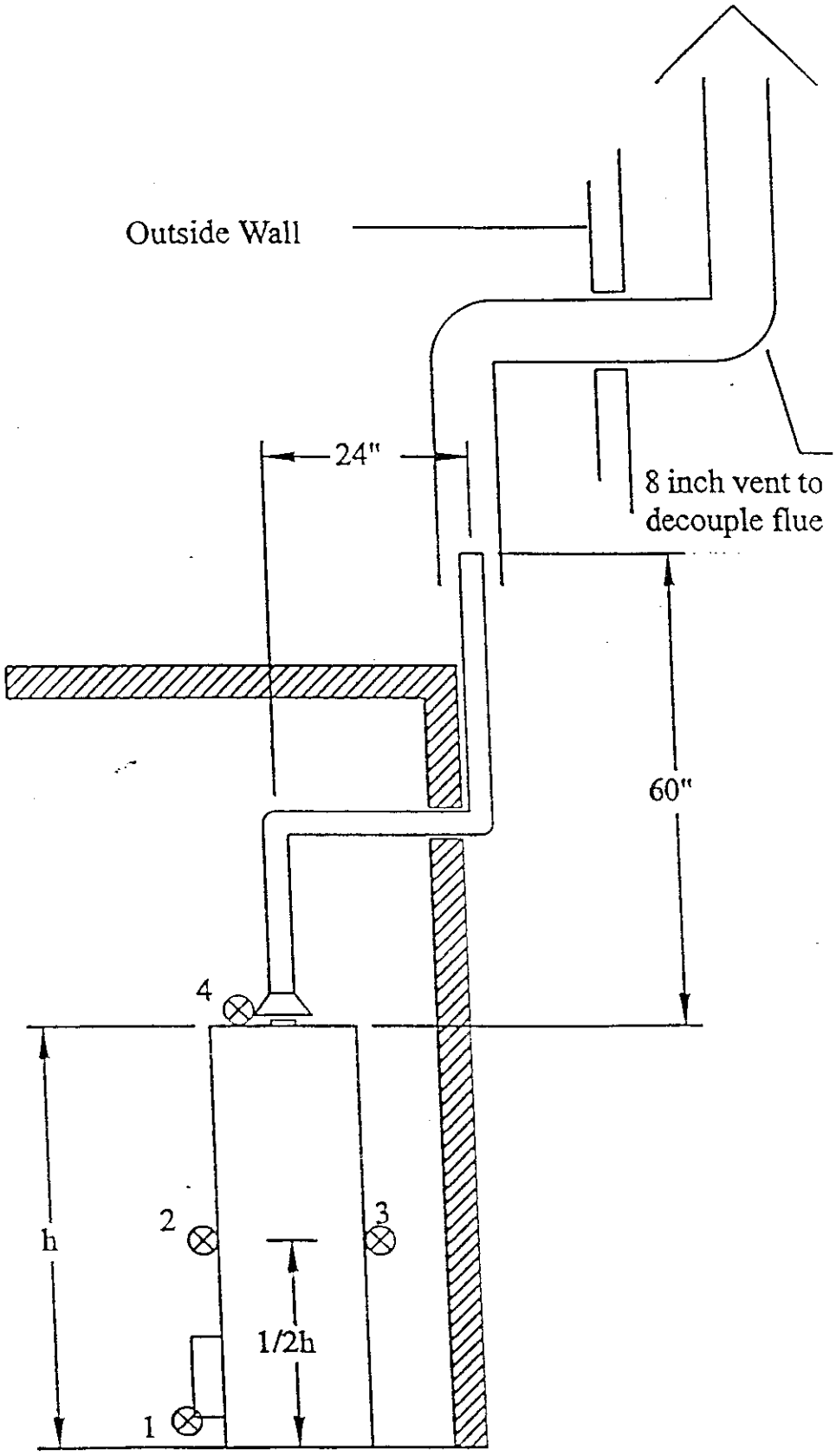


Figure 3 - Setup for Vent and Location of Hydrocarbon Sampling Points