



# Think Safety!

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## Things To Know About Tankless Water Heaters II



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In the last Think Safety, we looked at some basic elements of a tankless water heater such as how they work, when to use them and sizing the water heater for the application.

In this issue, we will focus on some essentials of installation. The water heater will not work to its maximum efficiency and output if the water and gas lines are sized incorrectly. Undersized gas and water lines

are the most common culprits of early service calls.

Venting is another important component in the tankless water heater installation. An improper vent installation can lead to several problems that can shorten the life of the water heater, produce troublesome operation, or in extreme cases keep the water heater from functioning at all.

### Sizing Supply Lines:

In order for the tankless water heater to operate correctly and supply the most hot water possible, both the water and gas supply lines must be sized correctly.

Water and gas lines coming into the water heater should be around 3/4 inch. If the water line is too small, the water heater will be unable to produce its maximum flow rate downstream. If the gas line is too small, the water heater will act like any other appliance starved for fuel. It may even shut down.

The gas line leading to the water heater must be sized correctly. Let's assume we are going to install a tankless water heater with a maximum BTU rating of 199,000. The home also will have an 80,000 BTU furnace, a 65,000 BTU gas range and a 32,000 BTU set of gas logs. The tank will be 50 feet from the house. Use Table 1, 2 or 3 on page two to determine the size yard line needed to supply adequate gas pressure. Table 1 is for copper tubing and Table 2 or 3 for

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# Sizing Supply Lines:

**Continued from Page One** poly tubing. tubing or poly pipe is used, 1/2 inch tubing would be required.

The total BTU/hour load would be 376,000 BTU/hour. The tank will be set 50 feet from the house, so the first stage length will be just over 50 feet when taking into consideration the upturn of the lines to the first and second stage regulators. If either copper

For second stage piping, measure the distance from the second stage regulator to the appliance furthest away. For simplicity, we are going to use schedule 40 black iron (Table 4). There are other piping materials that can be used such as CSST. In this example, we will use a distance

60 feet. The total load will be 376,000 BTU/hour. Use Table 4. The first section of pipe or main trunk line, will carry the whole load. This section of pipe will be one inch schedule 40 piping. You can size each branch line from there using the same table to determine the appropriate size line based on the distance of that branch and the Btu/hr rating to be

carried by the branch. These pipe sizes are minimums. For simplicity, of course all lines could be piped with the larger pipe sizes. For instance, all of the second stage piping could be piped with one inch piping for the main trunk and 3/4 inch schedule 40 black iron for the branches as long as the minimum pipe sizes are met.

**Table 1**

First Stage Piping between first stage and second stage regulator: Outside diameter copper tubing. 10 psi with a 1 psi pressure drop. Capacities are in 1000 Btu/hr.

Tubing Length (ft)	3/8"	1/2"	5/8"	3/4"	7/8"
30	309	700	1303	2205	3394
40	265	599	1115	1887	2904
50	235	531	988	1672	2574
60	213	481	896	1515	2332
70	196	443	824	1394	2146
80	182	412	767	1297	1996
90	171	386	719	1217	1873
100	161	365	679	1149	1769

**Table 2**

Polyethylen plastic pipe between first stage and second stage regulator: Nominal Outside Diameter (IPS). Capacities are in 1000 Btu/hr.

Tubing Length (ft)	1/2"	3/4"	1"	1 1/4"	1 1/2"
30	2143	4292	7744	13416	20260
40	1835	3673	6628	11482	17340
50	1626	3256	5874	10176	15368
60	1473	2950	5322	9220	13924
70	1355	2714	4896	8483	12810
80	1261	2525	4555	7891	11918
90	1183	2369	4274	7404	11182
100	1117	2238	4037	6994	10562

**Table 3**

Polyethylen plastic pipe between first stage and second stage regulator: Nominal Outside Diameter (CTS). Capacities are in 1000 Btu/hr.

Tubing Length (ft)	1/2"	1"
30	762	5225
40	653	4472
50	578	3964
60	524	3591
70	482	3304
80	448	3074
90	421	2884

**Table 4**

Second State or integral twin stage pipe sizing between regulator and appliance. Maximum capacity of pipe or tubing in 1000 Btu/hr.

Tubing Length (ft)	3/8"	1/2"	5/8"	3/4"	7/8"	1"
10	49	110	206	348	536	1146
20	34	76	141	239	368	788
30	27	61	114	192	296	632
40	23	52	97	164	253	541
50	20	46	86	146	224	480
60	19	42	78	132	203	435
70	16	36	67	113	174	400
80	14	32	59	100	154	372

## Two Pound Systems:

Two pound systems are an option to the installation of larger pipe sizes and can be especially useful in a home where the existing gas lines are inadequate to supply a tankless water heater.



When installing a two-pound system, a two-pound delivery regulator is

installed in place of the second stage regulator. The two-pound regulator delivers two pounds of pressure inside the structure. Another line pressure regulator is mounted upstream of the appliances. This regulator is equipped with a vent limiting device and

performs similar to that of an appliance regulator. One line pressure regulator can either be mounted per appliance, or one regulator can serve a trunk line with multiple appliances. (Consult the regulator manufacturer to determine BTU load limits. Some of these regulators have a lower load limit for single appliance

use than for use in a trunk line due to the single load surge of that individual appliance.)

The higher delivery pressure allows for the use of smaller piping. Table 5 is an example of 2-psi system line sizing. A comparison to Table 4 illustrates the reduced piping size allowed versus a traditional two-stage system.

## Venting Specifications:

Venting for tankless water heaters is hardly a one size fits all.

Here are a few of the different vent types.

1. Horizontal Side Wall Concentric Vent – the vent exits the building through the outside wall. Concentric pipe is a “pipe within a pipe”. Flue gas exits through the inside pipe, air for combustion is drawn in around the space between the inner and outer pipe.

2. Horizontal Side Wall Double Pipe (Separate flue gas pipe out and another pipe for air in)

3. Vertical Double Pipe vent exits the building through the roof. (Separate flue gas pipe out and another pipe for air in)

4. There are some water heaters that vent the exhaust and use air from inside the installation space for combustion.

5. Vertical Concentric Vent – the vent exits the building through the roof. Some types of this venting require a condensate drain to be incorporated into the system.

In some cases they may be direct vent or they may be clas-

sified mechanical exhausting. There are different requirements for those as to termination outside the building.

There are usually requirements for maximum vent and air intake lengths as well as in some cases minimum lengths. Vent terminals vary with manufacturers and are not interchangeable from manufacturer to manufacturer.

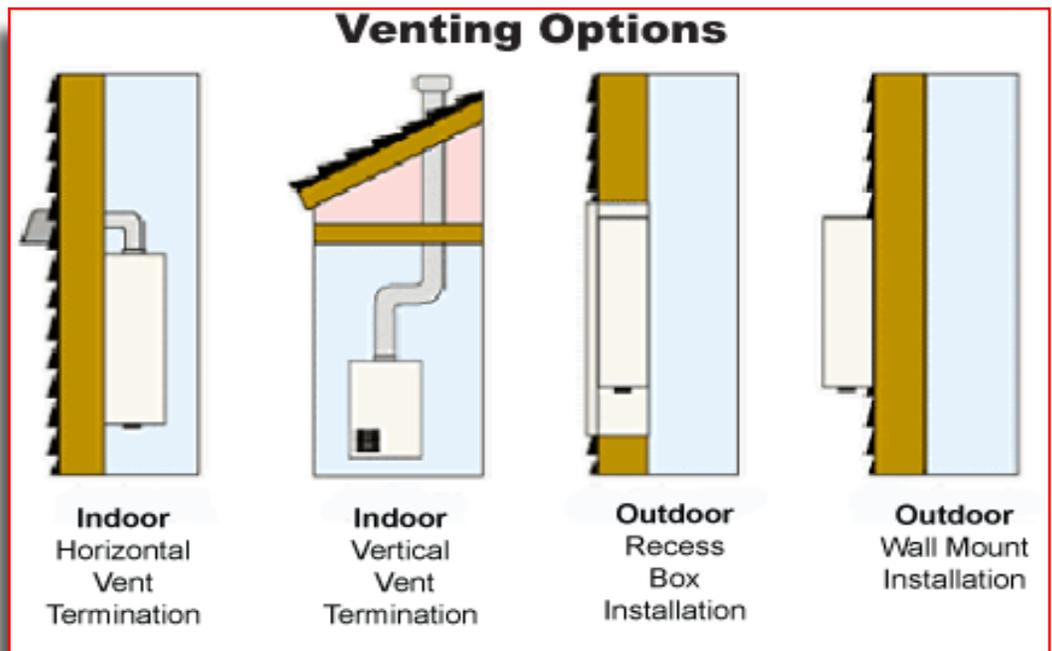
Side out venting is popular,

**Table 5**

Copper tubing or pipe sizing between 2 psi service regulator and line pressure regulator. Capacity listed in 1000 Btu/hr.

Tubing Length (ft)	3/8"	1/2"	5/8"	3/4"	7/8"
10	451	1020	1900	3215	4948
20	310	701	1306	2210	3401
30	249	563	1049	1774	2731
40	213	482	898	1519	2337
50	189	427	795	1346	2071
60	171	387	721	1219	1877
70	157	356	663	1122	1727
80	146	331	617	1044	1606

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## Venting Specifications:

*Continued from Page Three*

usually requiring less venting materials, here are some of the typical side out venting requirements:

- Vent terminal must be at least 1 foot from any door, window, or gravity inlet into the building.

- The double pipe (Example: The vent and air intake terminals must be at the same height and their center lines must be between 12 and 36 inches apart. Both terminals must be on the same wall)

- All terminal bottoms must be 12 inches above normal snow line or no less than 12 inches above grade. (Note: it is often difficult to determine normal snow line)

- 7 feet above public walkway

- Do not install directly above windows or doors

- The bottom of the vent terminal must be at least 3 feet above any forced air inlet located within 10 feet.

- A horizontal distance of at least 4 feet between the vent terminal and gas meters, electric meters, regulators and relief equipment. Do not install vent terminal over this

equipment due to condensate.

- Do not locate vent under decks.

- Top of vent terminal must be at least 5 feet below eaves, soffits, or overhangs. Maximum depth of overhang is 3 feet.

- Vent terminal must be 6 feet from an inside corner.

- Be aware that condensate may freeze and cause damage to structures nearby.

- Install vent termination away from prevailing winds in excess of 40 MPH.

- Air intake must not be near possible combustion air contaminants.

Failure to observe these equivalent calculations can result in an inadequate air supply for direct-vent units.

The venting for condensing water heaters has different requirements, due to their high efficiency. Venting must be accomplished with a fan, because the vent gases are not hot enough to operate the natural draft vent. Water will condense in the vent and will dissolve some of the gases produced during combustion, which are slightly acidic. The vent materials used with these appliances must be able to resist the acidic

condensate. Plastic vent material is acceptable and preferred for corrosion reasons.

Observe the following limitations on the location of all vertical vent terminals.

- The top of the vent pipe must be at least 2 feet above any object located within 10 feet.

- The vertical distance between top of the vent and air inlet terminal openings must be at least 12”.

- The bottom of the air inlet terminal must be at least 12” above the normal snow accumulation that can be expected on the roof.

- The air intake terminal must be located on the roof and must be no further than 24” horizontally from the exhaust pipe.

Wall thimbles - Wall thimbles are often required where single wall vent pipe passes through combustible walls.

Pitch of Horizontal Piping - Pitch all horizontal piping so that any condensate, which forms in the piping, will run away from the water heater

- Pitch horizontal concentric venting 5/8” per foot

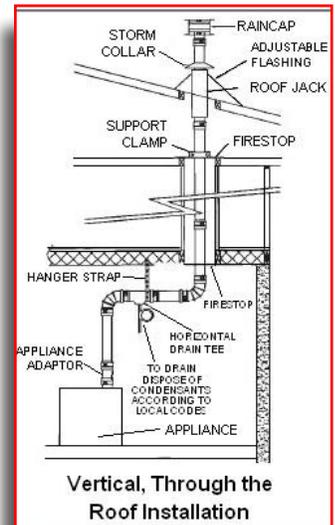
- Pitch Stainless steel venting 1/4” per foot.

Vertical and horizontal sections of pipe must be properly supported:

- Support concentric venting near the female end of each straight section of pipe.

- Support stainless steel venting as called for by the vent manufacturer’s instructions.

Pay attention to maximum distances for the vent run while remembering to calculate lost run footage for elbows. An example would be: 90-degree concentric elbow equals 4.5 feet, a 45-degree concentric elbow equals 4 feet, a 3” 90 degree elbow equals 5.5 feet, a 3” 45 degree elbow equals 4 feet.



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# Training Quiz

Name \_\_\_\_\_ Social Security Number \_\_\_\_\_

1. In order for the tankless water heater to operate correctly and supply the most hot water possible, both the water and gas supply lines must be sized correctly.  
A. True                      B. False
2. Water and gas lines coming into the water heater should be around \_\_\_ inch.  
A. 3/4                      B. 1/2                      C. 1                      D. 3/8
3. Using the sizing tables on page two, determine what size copper gas line would be needed from the first state regulator to the second stage regulator for the following example: Tankless water heater (199,000 Btu/hr), gas range (65,000 Btu/hr) and a gas furnace (80,000 Btu). The tank is 50 feet from the house.  
A. 3/4"                      B. 3/8"                      C. 1/2"                      D. 1"
4. Using the tables on page two and the example in number 4, what size poly line would be used for the same yardline.  
A. 3/4"                      B. 3/8"                      C. 1/2"                      D. 1"
5. Using Table 4, what size second stage line would be needed for schedule 40 black iron in the example from question 3 if the distance from the second stage regulator to the furthest appliance is 60 feet?  
A. 3/4"                      B. 3/8"                      C. 1/2"                      D. 1"
6. Two-pound systems allow the installation of a smaller pipe size inside a structure.  
A. True                      B. False
7. When installing a two-pound system, a two-pound delivery regulator is installed in place of the second stage regulator.  
A. True                      B. False
8. When using a two-pound system, a line pressure regulator is mounted downstream of the appliances.  
A. True                      B. False
9. The line pressure regulator is equipped with a vent limiting device and performs similar to that of an appliance regulator.  
A. True                      B. False
10. Depending on the model of tankless water heater, it can be vented either vertically or horizontally.  
A. True                      B. False
11. Vent terminals vary with manufacturers but are interchangeable from manufacturer to manufacturer.  
A. True                      B. False
12. Using the example in question 3, what size piping would be required for the main trunk line inside the structure if a two-pound system was used?  
A. 3/4"                      B. 3/8"                      C. 1/2"                      D. 1"
13. A side-out vent terminal must be at least \_\_\_\_\_ from any door, window, or gravity inlet into the building.  
A. 1 foot                      B. 2 feet                      C. 3 feet                      D. 4 feet
15. All terminal bottoms must be \_\_\_ inches above normal snow line or no less than \_\_\_ inches above grade.  
A. 24, 24                      B. 12, 12                      C. 36, 36                      D. 18, 18
16. Do not install vent terminations directly above windows or doors  
A. True                      B. False

# Training Quiz Answers

Name \_\_\_\_\_ Social Security Number \_\_\_\_\_

- In order for the tankless water heater to operate correctly and supply the most hot water possible, both the water and gas supply lines must be sized correctly.  
 A. True  B. False
- Water and gas lines coming into the water heater should be around \_\_\_ inch.  
 A. 3/4  B. 1/2  C. 1  D. 3/8
- Using the sizing tables on page two, determine what size copper gas line would be needed from the first state regulator to the second stage regulator for the following example: Tankless water heater (199,000 Btu/hr), gas range (65,000 Btu/hr) and a gas furnace (80,000 Btu). The tank is 50 feet from the house.  
 A. 3/4"  B. 3/8"  C. 1/2"  D. 1"
- Using the tables on page two and the example in number 4, what size poly line would be used for the same yardline.  
 A. 3/4"  B. 3/8"  C. 1/2"  D. 1"
- Using Table 4, what size second stage line would be needed for schedule 40 black iron in the example from question 3 if the distance from the second stage regulator to the furthest appliance is 60 feet?  
 A. 3/4"  B. 3/8"  C. 1/2"  D. 1"
- Two-pound systems allow the installation of a smaller pipe size inside a structure.  
 A. True  B. False
- When installing a two-pound system, a two-pound delivery regulator is installed in place of the second stage regulator.  
 A. True  B. False
- When using a two-pound system, a line pressure regulator is mounted downstream of the appliances.  
 A. True  B. False
- The line pressure regulator is equipped with a vent limiting device and performs similar to that of an appliance regulator.  
 A. True  B. False
- Depending on the model of tankless water heater, it can be vented either vertically or horizontally.  
 A. True  B. False
- Vent terminals vary with manufacturers but are interchangeable from manufacturer to manufacturer.  
 A. True  B. False
- Using the example in question 3, what size piping would be required for the main trunk line inside the structure if a two-pound system was used?  
 A. 3/4"  B. 3/8"  C. 1/2"  D. 1"
- A side-out vent terminal must be at least \_\_\_\_\_ from any door, window, or gravity inlet into the building.  
 A. 1 foot  B. 2 feet  C. 3 feet  D. 4 feet
- All terminal bottoms must be \_\_\_\_\_ inches above normal snow line or no less than \_\_\_\_\_ inches above grade.  
 A. 24, 24  B. 12, 12  C. 36, 36  D. 18, 18
- Do not install vent terminations directly above windows or doors  
 A. True  B. False