



Think Safety!

A Publication Of The West Virginia Propane Gas Association

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Are You Performing All The Steps In Setting A Tank?

Fall is just around the corner. With fall comes tank sets. Are you doing the job correctly?

There are several important steps in setting a tank—determining the load, sizing the tank, sizing the line, installing the line.

Once the tank is put in place, the job is still not complete. A pressure test and leak test must be conducted to make sure the system is sound.

When the installation is complete it is also a good idea to make sure the customer is familiar with propane and your company's emergency procedures.

If one of those steps is skipped or performed incorrectly, problems may occur down the road.

This issue of *Think Safety* will fo-

cus on several components of setting the tank and correctly sizing a system.



Determining The Load:

The first step in sizing a system is determining the

total load to be placed on the system. Determine this

number by adding the BTU input of all appliances to be included on the system. This sum is your total BTU load. The BTU input of an appliance should be available on its nameplate.



add appliances in the future. This is an especially important consideration for the indoor piping.

Consider that many of today's appliances require more BTUs than their predecessors. For instance, tankless water heaters often have a much larger BTU capacity than conventional gas water heaters. Many homes have larger gas ranges than those of the past as well.

Don't forget to build some growth into the system in case the customer decides to



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Sizing The Tank:

It is important to think of worst-case scenarios when sizing propane storage tanks. The outside temperature and the volume of liquid in the tank both greatly affect the rate at which liquid propane will be vaporized for use by household appliances.

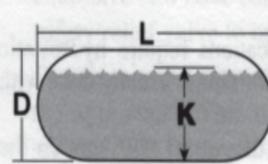
When propane vapor is withdrawn from the tank the pressure is lowered causing the liquid to boil in an effort to replace the pressure. The liquid is heated by the air outside through the "wetted" portion of the tank, or the part of the tank in contact with the liquid.

This heat is needed to bring the propane to a boil. Since the vapor absorbs

only a small amount of heat, the liquid content of the tank has a great impact on the vaporization rate as does the outside air temperature. A lower air temperature provides less heat to heat the liquid propane.

In West Virginia, most vaporization problems occur with 100 lb cylinders, though the problem could occur with large tanks if the BTU load exceeds the capacity of a tank to produce vapor in low temperatures. A tank should be sized to allow sufficient vaporization at lower volumes of liquid. The charts at the right provide vaporization information for 100 lb cylinders and other tanks.

Determining Propane Vaporization Capacity "Rule of Thumb" Guide for ASME LP-Gas Storage Containers



Where
D = Outside diameter in inches
L = Overall length in inches
K = Constant for percent volume of liquid in container

Percentage of Container Filled	K Equals	*Propane Vaporization Capacity at 0°F (in BTU/hr.)
60	100	D X L X 100
50	90	D X L X 90
40	80	D X L X 80
30	70	D X L X 70
20	60	D X L X 60
10	45	D X L X 45

*These formulae allow for the temperature of the liquid to refrigerate to -20°F (below zero), producing a temperature differential of 20°F for the transfer of heat from the air to the container's "wetted" surface and then into the liquid. The vapor space area of the vessel is not considered. Its effect is negligible.

Sizing The Line:

Correct line size is one of the most critical components to a properly operating propane system. It is

also the component most often sized incorrectly.

An undersized line can lead to frequent service

calls, damage to the appliance or home and even safety concerns as it restricts operating pressure to the appliance. Low operating pressure affects the fuel-air combustion ratio and increases the emittance of carbon monoxide.

Use the following simple method to assure the selection of the correct sizes of piping and tubing for LP-



Gas vapor systems. Piping between first and second

stage regulators is considered, as well as low pressure (inches water column) piping between second stage or integral twin stage regulators and appliances.

Instructions:

Determine the total gas demand for the system by adding, up the BTU/hr input from the appliance nameplates and adding demand as appropriate for future appliances.

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Sizing The Line:

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For second stage or integral twin stage piping:

Measure length of piping required from outlet of regulator to the appliance *furthest away. No other length is necessary to do the sizing.*

Make a simple sketch of the piping.

Determine the capacity to be handled by each sec-

tion of piping. For example, the capacity of the line between the second stage regulator and the first appliance must handle the total demand of all the appliances; the capacity of the line in the next section must also be able to handle the gas flow of all the appliances it feeds.

Using Table 3 select

proper size of tubing or pipe for each section of piping, using values in BTU/hr for the length determined from step #2-A. If exact length is not on chart, use next longer length. *Do not use any other length for this purpose!* Simply select the size that shows at least as much capacity as needed for each piping section.

For piping between first and second stage regulators:

For a simple system with only one second stage regulator, merely measure length of piping required between outlet of first stage regulator and inlet of second stage regulator. Select piping or tubing required from Table 1.

Table 1 – First Stage Pipe Sizing (Between First and Second Stage Regulators)

10 PSIG Inlet with a 1 PSIG Pressure Drop
Maximum capacity of pipe or tubing, in thousands of BTU/hr or LP-Gas

Size of Pipe or Copper Tubing, Inches	Length of Pipe or Tubing, Feet*										
	10	20	30	40	50	60	70	80	90	100	
Copper Tubing (O.D.)	3/8	558	383	309	265	235	213	196	182	171	161
	1/2	1387	870	700	599	531	481	443	412	386	365
	5/8	2360	1622	1303	1115	988	896	824	767	719	679
	3/4	3993	2475	2205	1887	1672	1515	1394	1297	1217	1149
Pipe Size	1/2	3339	2295	1843	1577	1398	1267	1165	1084	1017	961
	3/4	6982	4799	3854	3298	2923	2649	2437	2267	2127	2009
	1	13153	9040	7259	6213	5507	4989	4590	4270	4007	3785
	1-1/4	27004	18560	14904	12756	11306	10244	9424	8767	8226	7770
	1-1/2	40461	27809	22331	19113	16939	15348	14120	13136	12325	11642
	2	77924	53556	43008	36809	32623	29559	27194	25299	23737	22422
		125	150	175	200	225	250	275	300	350	400
Copper Tubing (O.D.)	3/8	142	130	118	111	104	90	89	89	82	76
	1/2	323	293	269	251	235	222	211	211	185	172
	5/8	601	546	502	467	438	414	393	375	345	321
	3/4	1018	923	843	790	740	700	664	634	584	543
Pipe Size	1/2	852	772	710	660	619	585	556	530	488	454
	3/4	1780	1613	1484	1381	1296	1224	1162	1109	1020	949
	1	3354	3039	2796	2601	2441	2305	2190	2089	1922	1788
	1-1/4	6887	6240	5741	5340	5011	4733	4495	4289	3945	3670
	1-1/2	10318	9349	8601	8002	7508	7092	6735	6426	5911	5499
	2	19871	18005	16564	15410	14459	13658	12971	12375	11385	10591

Table 3 – Second Stage or Integral Twin Stage Pipe Sizing

11 Inches Water Column Inlet with a 1/2 Inch Water Column Drop
Maximum capacity of pipe or tubing in thousands of BTU/hr of LP-Gas

Size of Pipe or Copper Tubing, Inches	Length of Pipe or Tubing, Feet*										
	10	20	30	40	50	60	70	80	90	100	
Copper Tubing (O.D.)	3/8	49	34	27	23	20	19	—	—	—	
	1/2	110	76	61	52	46	42	38	36	33	
	5/8	206	151	114	97	86	78	71	67	62	
	3/4	348	239	192	164	146	132	120	113	105	
	7/8	536	368	296	253	224	203	185	174	161	
Pipe Size	1/2	291	200	161	137	122	110	102	94	87	
	3/4	608	418	336	287	255	231	212	198	185	
	1	1146	788	632	541	480	435	400	372	349	
	1-1/4	2353	1617	1299	1111	985	892	821	764	717	
	1-1/2	3525	2423	1946	1665	1476	1337	1230	1144	1074	
	2	6789	4666	3747	3207	2842	2575	2369	2204	2068	
		125	150	175	200	225	250	275	300	350	400
Copper Tubing (O.D.)	3/8	—	—	—	—	—	—	—	—	—	
	1/2	—	—	—	—	—	—	—	—	—	
	5/8	—	—	—	—	—	—	—	—	—	
	3/4	—	—	—	—	—	—	—	—	—	
	7/8	—	—	—	—	—	—	—	—	—	
Pipe Size	1/2	74	67	62	58	54	51	48	46	43	
	3/4	155	141	129	120	113	107	101	97	89	
	1	292	265	244	227	213	201	191	182	167	
	1-1/4	600	544	500	465	437	412	392	374	344	
	1-1/2	899	815	749	697	654	618	587	560	515	
	2	1731	1569	1443	1343	1260	1190	1130	1078	992	

* Total length of piping from outlet of regulator to appliance furthest away.

Poly Tubing:

The upturn in copper prices has driven propane companies to use poly-pipe in situations where they had never used it before.

Poly pipe is very durable as long as it is not exposed to sunlight. Its aversion to light necessitates a slightly different type of installation. At the regulator on

each end of the yard line, the poly must pass through a riser. This riser protects the tubing from the sun as well as lawn equipment. One end of the riser is attached to the regulator while the other end is buried.

A metal tracer tape or wire should be buried

slightly above the poly tubing. This tape or wire has a dual purpose. It allows the poly tubing to be located with a metal detector, and it provides warning to people digging near the gas line.

Like copper tubing, poly must be correctly sized to meet the load.



Familiarize The Customer With Propane:

When the installation is complete and all system tests successfully performed the customer should be familiarized with propane and all company safety procedures.

Introduce the customer to the smell of odorized propane with use of scratch and sniff literature or by introducing a small amount of propane into the atmosphere.

Make sure the customer

is given safety literature that explains what to do in case a leak is detected. If you do not have literature available, carefully explain leak procedures in detail and make sure the customer understands the procedures. Many accidents can be prevented just by strict adherence to this step. Be sure to record any literature or instructions given to the customer concerning safety issues.

Show the customer where the emergency phone numbers for your company can be found on the tank.



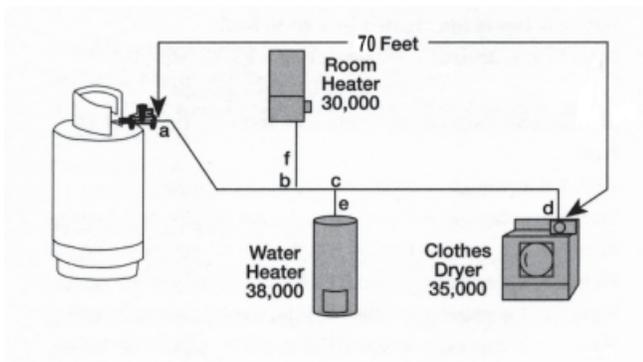
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Training Quiz

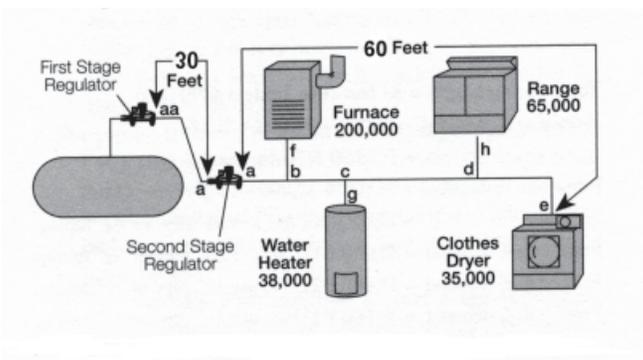
Name _____ Social Security Number _____

- The first step in sizing a system is determining the load to be placed on the system.
 - True
 - False
- Determine the load on a system by ____ of all appliance to be placed on the system.
 - Adding the BTU input
 - Guessing the BTU input
 - Adding the BTU output
 - Guessing the BTU output
- The system should be sized to fit only the appliances currently included in the system.
 - True
 - False
- The vaporization rate of a tank is affected by what factors.
 - Volume of liquid in tank
 - BTU draw on tank
 - Price of tea in China
 - A and B
- When propane vapor is withdrawn from a tank it causes the pressure inside the tank to increase.
 - True
 - False
- What is the correct line size for section a to b in the following example?



- 3/8"
- 1/2"
- 3/4"
- 1"

- What is the correct first-stage line size for the following two-stage system?



- 3/8"
- 1/2"
- 3/4"
- 1"

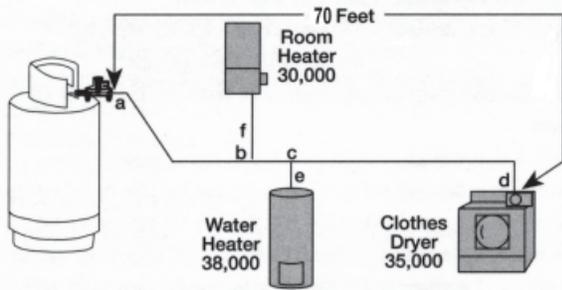
- In the example for question 7, what minimum line size would be required for section a-e?

- 3/8"
- 1/2"
- 3/4"
- 1"

Training Quiz Answers

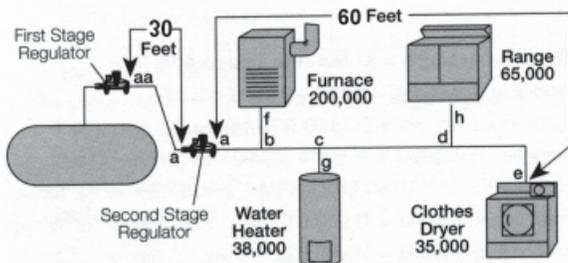
Name _____ Social Security Number _____

- The first step in sizing a system is determining the load to be placed on the system.
 A. True B. False
- Determine the load on a system by ____ of all appliance to be placed on the system.
 A. Adding the BTU input B. Guessing the BTU input C. Adding the BTU output D. Guessing the BTU output
- The system should be sized to fit only the appliances currently included in the system.
 A. True B. False
- The vaporization rate of a tank is affected by what factors.
 A. Volume of liquid in tank B. BTU draw on tank C. Price of tea in China D. A and B
- When propane vapor is withdrawn from a tank it causes the pressure inside the tank to increase.
 A. True B. False
- What is the correct line size for section a to b in the following example?



- A. 3/8" B. 1/2" C. 3/4" D. 1"

- What is the correct first-stage line size for the following two-stage system?



- A. 3/8" B. 1/2" C. 3/4" D. 1"

- In the example for question 7, what minimum line size would be required for section a-e?

- A. 3/8" B. 1/2" C. 3/4" D. 1"