



VACUUM-JACKETED L-SERIES PIPING

Owner's and Installation Manual



Crane ChemPharma & Energy



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This document is intended for use with Technifab’s L-Series piping. It is important to read and understand this manual before installing or operating the pipe system.

Warning – indicates a potentially hazardous situation which, if not avoided, may result in death or serious injury.

Caution – indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

Safety

Warning – L-Series piping is NOT compatible with liquid oxygen or liquid hydrogen.

Caution – Care should be taken around pressure relief devices and gas vent line outlets in case cold cryogenic gas/liquid is expelled.

Caution – Technifab recommends routing the discharge lines from pressure relief devices to a safe place of discharge. The outlet of the discharge line should not be in a location where it could injure people or cause damage if a cryogen was to be expelled.

Consult the Cryogenic Equipment Safety and Handling Guide, LT-30084, for additional precautionary measures regarding your cryogenic piping system.

Introduction

Technifab's L-Series piping provides much better performance than traditional foam insulation and takes up minimal space. L-Series products are easy to install and are reusable/adaptable. They are available in 1", 2", and 3" nominal pipe sizes. Technifab calls these L-Series sizes "L100", "L200", and "L300".

L-Series products are designed for use at pressures up to 400 PSIG (see the *Technical Information* section). They can be adapted and used in many applications including liquid nitrogen, liquid argon, liquefied natural gas, and liquid carbon dioxide. L-Series products are great for use in the food and beverage, energy, manufacturing, and petrochemical industries.

The cost to install L-Series piping is comparable to most mechanical insulation systems, and installation services can be provided.

L-Series piping products have the following additional benefits and characteristics:

- Excellent flow capabilities.
- Designed and manufactured in accordance with ASME B31.3. Consult Technifab for installation requirements relating to obtaining ASME B31.3 certification.
- Durable, easy to install, and practically maintenance free.
- Chemical gettering and multi-layer insulation (MLI) provides long-term vacuum life – as long as 30 years is possible.

Technical Information

Specifications							
Size	Inner Pipe Size	Outer Pipe Size	Actual Flow Diameter	Standard Overall Lengths*	Hole Required to Accommodate Pump Out Port	Weight/Length (lbs/ft)	MAWP (PSIG)
L100	1" NPS	2" NPS	1.185"	2'-20' in 1' increments	4"	2.95	400
L200	2" NPS	3" NPS	2.245"		5"	5.34	400
L300	3" NPS	5" NPS	3.334"		7"	11.29	400

*Flexible section lengths: 1"-8', 2"-9', 3"-9'.

Performance Data								
Size	Pipe		Insulation Kits					
			Straight		Elbow		Tee	
	BTU/hr/ft	Watt/m	BTU/hr	Watt	BTU/hr	Watt	BTU/hr	Watt
L100	0.39	0.035	13	3.8	25	7.3	25	7.3
L200	0.65	0.058	25	7.3	50	14.6	50	14.6
L300	0.51	0.046	35	10.2	65	19.0	65	19.0

*Assuming LN2 saturated at 1 bar(a).

Pressure Drop (PSI/ft)*								
Size	Flow (gal/min)							
	2	5	10	25	50	75	100	150
L100		0.003	0.011	0.063	0.262	0.570	1.014	
L200				0.002	0.009	0.193	0.034	0.077
L300					0.001	0.003	0.005	0.011

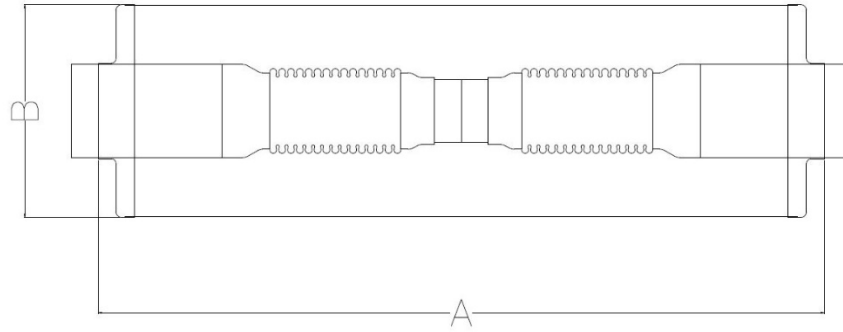
*Pressure drop numbers do not account for changes in elevation. Elevation changes result in 0.345 PSI of pressure drop per foot of elevation rise. Technifab recommends total pressure drop to be kept to 5 PSI or less.

General Installation

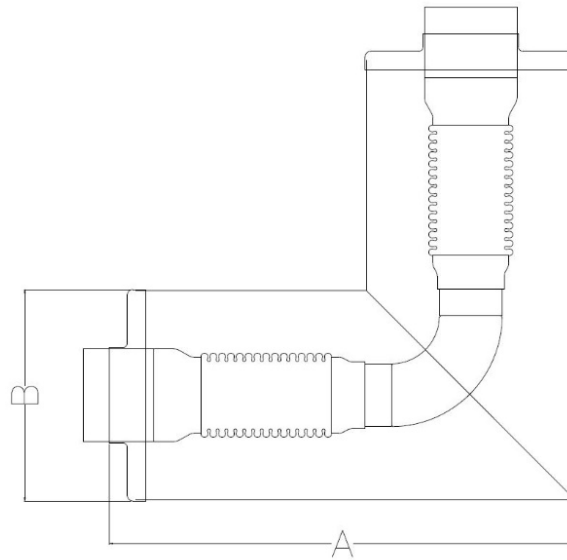
1. Inspect all products to ensure that no damage has occurred during shipping. If there is any damage, contact the shipping carrier and Technifab immediately.
2. Set up hangers, clamps, and/or rollers in the designed layout. Reference the chart below for support span information.

Recommended Maximum Support Spans			
Size	Weight w/o Joint Kits (lbs/ft)	Recommended Support Span	Maximum Support Span
L100	2.5	10'	12'
L200	4.7	10'	12'
L300	9.6	8'	10'

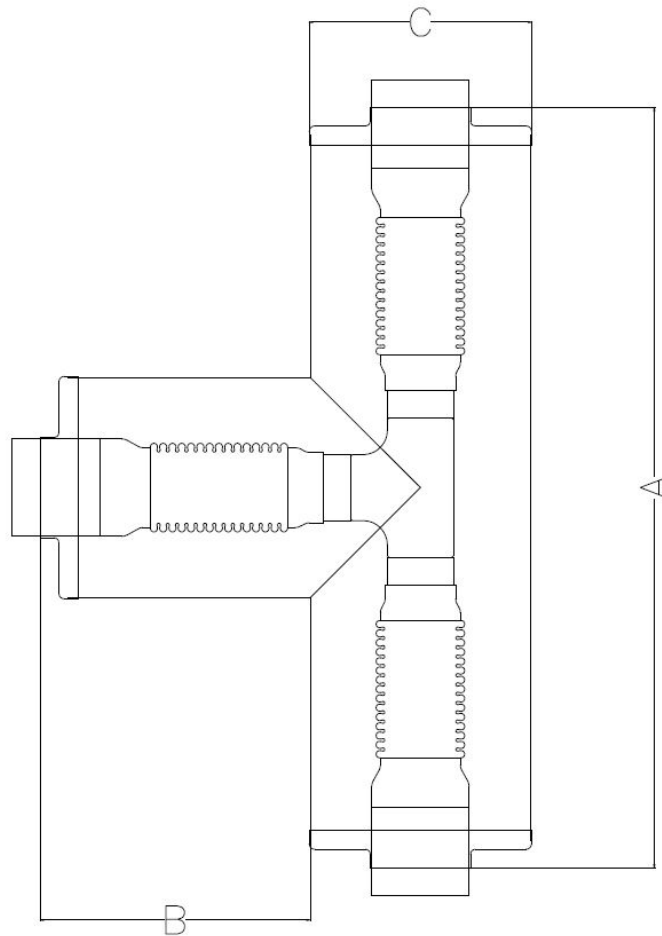
3. Install piping onto hangers, clamps, and/or rollers. Make sure that the installation method allows for the expansion and contraction of the piping. When using liquid nitrogen, the piping will expand/contract 3.7" for every 100' of length.
4. Pressure relief devices need to be installed in any section of piping where liquid can become trapped and vaporize into gas. When using a liquid cryogen, pressure relief devices must be installed on a 10"+ long riser in order to remain warm. See the *Safety* section for more information regarding pressure relief device safety.
5. After all pipe sections are in place and before welding, refer to the *Joint Kits* section. The following tables list dimensions for the various joint kits. There is also a table listing flexible line dimensions and their minimum bend radii.



Straight Joints		
Size	Dimension A	Dimension B
L100	22-3/8"	7-1/4"
L200	27-3/8"	8"
L300	30-1/2"	9-7/8"



Elbow Joints		
Size	Dimension A	Dimension B
L100	14-5/8"	7-1/4"
L200	17-5/8"	8"
L300	20-3/4"	9-7/8"

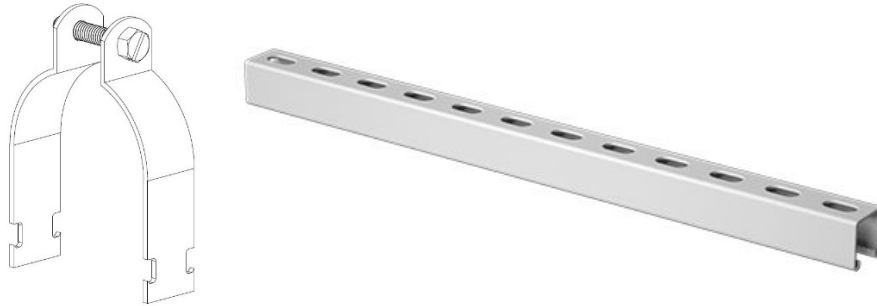


Tee Joints			
Size	Dimension A	Dimension B	Dimension C
L100	22-3/8"	7-1/2"	7-1/4"
L200	27-3/8"	9-3/4"	8"
L300	30-1/2"	11"	9-7/8"

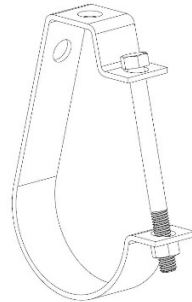
Flexible Lines			
Size	Outside Diameter	Overall Length	Minimum Bend Radius
L100	2.61"	8'	12"
L200	4.96"	9'	20"
L300	5.98"	9'	20"

Mounting Equipment

The following shows a type of clamp that can be used with strut to support and mount the pipe. This clamp allows the pipe to expand and contract along its axis.



Another type of pipe support/hanger known as a “J-Hanger” is shown below. Do not overtighten this hanger or the pipe will not be able to expand or contract.



System Layout

The following describes ways in which a system can be designed:

With flexible sections – Use rollers, pipe clamps, and/or hangers (see the *Mounting Equipment* section) to mount and support pipe sections in the desired layout. Flexible section will typically be installed at an elbow. The flexible section allows for expansion and contraction of the pipe system.

Without flexible sections – If not using flexible sections, extreme care must be taken to mount and support the pipe sections in a way that allows the pipe system to expand and contract. When using liquid nitrogen, the piping will expand/contract 3.7” for every 100’ of length. Care must be taken to ensure that mounting equipment and building features allow this change in length to occur.

Joint Kits

Installation kit(s) must be used for piping joint installation. Each installation kits includes:

- 4 boxes of foam insulation tape
- 2 tubes of silicone sealer
- 1 roll of aluminum foil tape
- 320” of MLI

The following table shows how many piping joints can be assembled with each installation kit:

Size	Joint Kits Assembled
L100	8
L200	6
L300	4

Straight Joint Kit

What is Included?

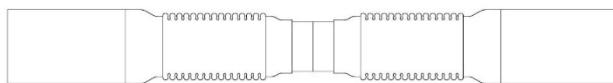
- Straight Joint Can Assembly

Caution – Steel edges and aluminum foil tape are sharp; use caution when handling.

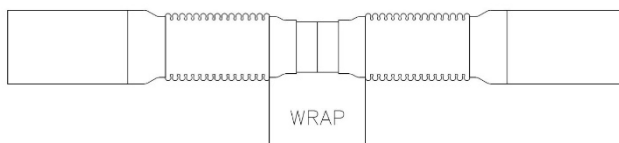
Caution – Excess heat from welding may cause vacuum loss in pipe.

Installation Steps:

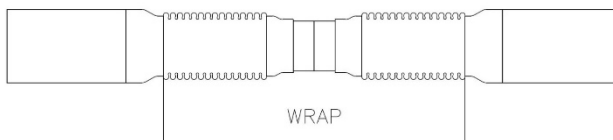
1. Slide the straight joint can on the end of one pipe section.
2. TIG weld the two pipe stub ends together.



3. Perform a pressure test per the *Bubble Leak Testing Procedure* section on the weld joint to check for leaks. If it does not pass, the weld must be reworked.
4. Wrap MLI over the section of pipe shown below. Do not exceed the diameter of the bellows. Use a piece of aluminum foil tape to keep the MLI from unwrapping.



5. Wrap one layer of aluminum foil tape over the bellows and MLI to aid in the removal of the foam insulation tape that is applied in the next step, in case it is not wrapped correctly.
6. Wrap foam insulation tape over the section of pipe shown below. Do not exceed the outer diameter of the pipe, or the straight joint can will need disassembled in order to install correctly.



7. Wrap a layer of aluminum foil tape over the foam insulation tape from the previous step.

8. Slide the straight joint can over the joint. If the can does not slide over the insulation wrap, disassembly of the straight joint can may be required.
9. Make sure the straight joint can is centered over the joint.
10. Caulk all seams with silicone sealer.

Elbow Joint Kit

What is Included?

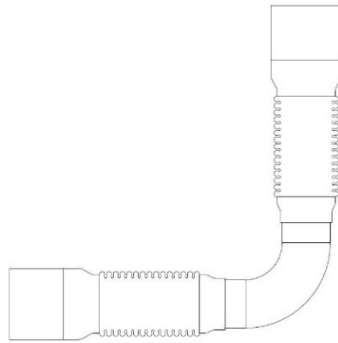
- Elbow Joint Can Assembly
- Elbow Connector

Caution – Steel edges and aluminum foil tape are sharp; use caution when handling.

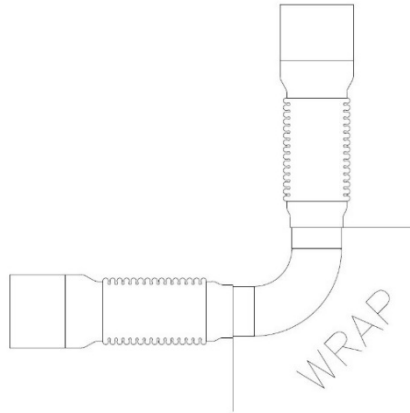
Caution – Excess heat from welding may cause vacuum loss in pipe.

Installation Steps:

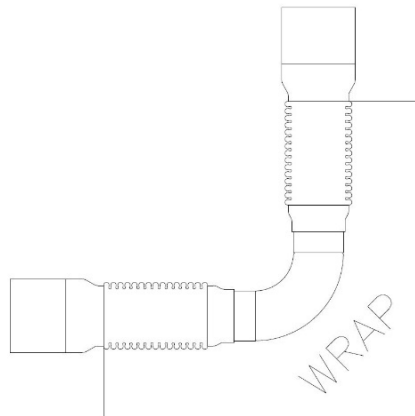
1. Slide the elbow joint cans on the ends of both pipe sections.
2. TIG weld the two pipe stub ends together with the included elbow connector.



3. Perform a pressure test per the *Bubble Leak Testing Procedure* section on the weld joints to check for leaks. If they do not pass, the welds must be reworked.
4. Wrap MLI over the section of pipe shown below. Do not exceed the diameter of the bellows. Use a piece of aluminum foil tape to keep the MLI from unwrapping.



5. Wrap one layer of aluminum foil tape over the bellows and MLI to aid in the removal of the foam insulation tape that is applied in the next step, in case it is not wrapped correctly.
6. Wrap foam insulation tape over the section of pipe shown below. Do not exceed the outer diameter of the pipe, or the elbow joint can will need disassembled in order to install correctly.



7. Wrap a layer of aluminum foil tape over the foam insulation tape from the previous step.
8. Slide both parts of the elbow joint can over the joint. If the cans do not slide over the insulation wrap, disassembly of the elbow joint can may be required.
9. Install the two parts of the elbow joint can together by sliding the end with the tabs into the other can (the tabs should go on the inside). Line up the two holes and screw together.
10. Caulk all seams with silicone sealer.

Tee Joint Kit

What is Included?

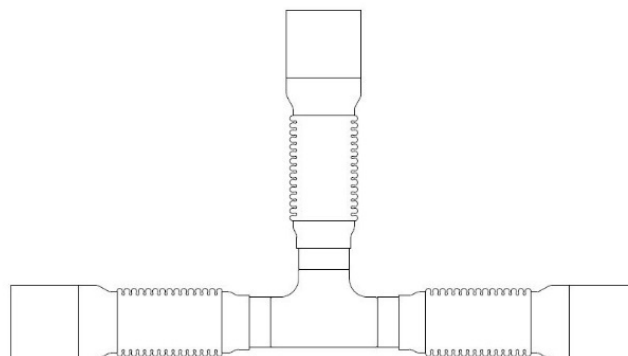
- Tee Joint Can Assembly
- Tee Connector

Caution – Steel edges and aluminum foil tape are sharp; use caution when handling.

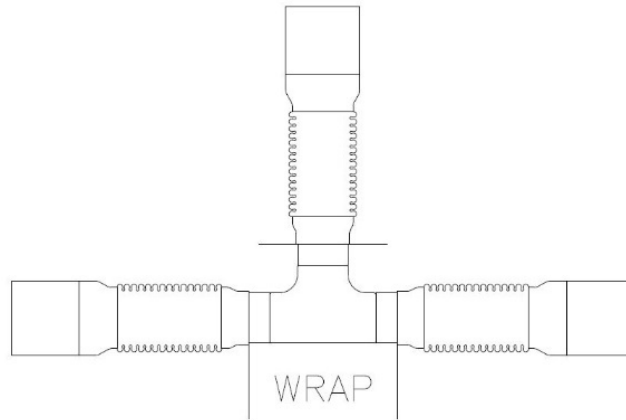
Caution – Excess heat from welding may cause vacuum loss in pipe.

Installation Steps:

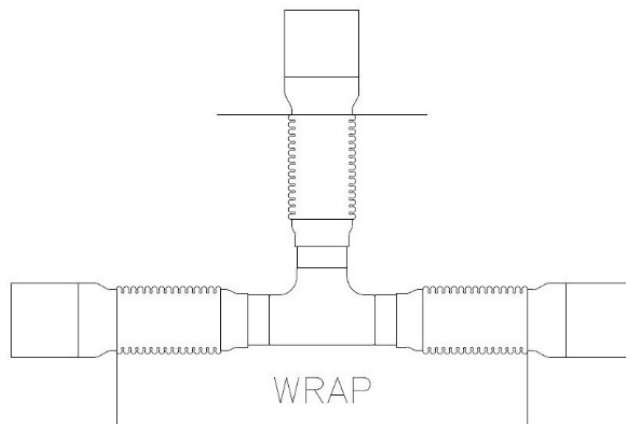
1. Standard tee joint cans come preassembled for a common L-Series size interfacing with the tee in all 3 directions (i.e. all legs of the tee joint can are either L100, L200, or L300). If a tee joint can is being installed in which the legs have multiple sizes (i.e. the tee being installed is for an L300 header and the tee has an L200 drop), the standard can must be disassembled and the can end cap corresponding to the smaller leg (L200 in this example) must be replaced. In this example, a can end cap capable of adapting down to L200 would be provided separately. A washer would also be included in order to adapt the inner tee.
2. Slide the short leg of the tee joint can on the end of the section of pipe that is vertical in the picture below.
3. Slide the end caps for the long leg of the tee joint can onto the sections of pipe that are horizontal in the picture below.
4. TIG weld the three pipe stub ends together with the included tee connector.



5. Perform a pressure test per the *Bubble Leak Testing Procedure* section on the weld joints to check for leaks. If they do not pass, the welds must be reworked.
6. Wrap MLI over the section of pipe shown below. Do not exceed the diameter of the bellows. Use a piece of aluminum foil tape to keep the MLI from unwrapping.



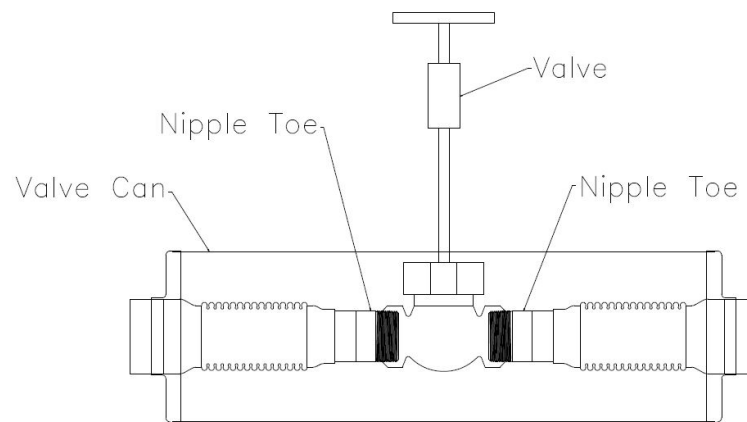
7. Wrap one layer of aluminum foil tape over the bellows and MLI to aid in the removal of the foam insulation tape that is applied in the next step, in case it is not wrapped correctly.
8. Wrap foam insulation tape over the section of pipe shown below. Do not exceed the outer diameter of the pipe, or the tee joint can will need disassembled in order to install correctly.



9. Wrap a layer of aluminum foil tape over the foam insulation tape from the previous step.
10. Slide the short leg of the tee joint can over the joint. If the can does not slide over the insulation wrap, disassembly of the tee joint can may be required.

11. Install the long leg of the tee joint can onto the pipe by:
 - a. Putting the rigid foam insulation over the insulation wrap.
 - b. Wrapping the rolled sheet metal cylinder over the rigid foam insulation.
 - c. Screwing the rolled sheet metal cylinder and the end caps together.
12. Once the long leg of the tee joint can is in place and centered over the joint, slide the short leg of the tee joint can over the insulation wrap until it mates up with the long leg of the tee joint can (the tabs should go on the outside). Line up the two holes and screw together.
13. Caulk all seams with the silicone sealer.

Valve Kit



What is Included?

- Valve Can Assembly
- Nipple Toes (2)
- Valve

Caution – Steel edges and aluminum foil tape are sharp; use caution when handling.

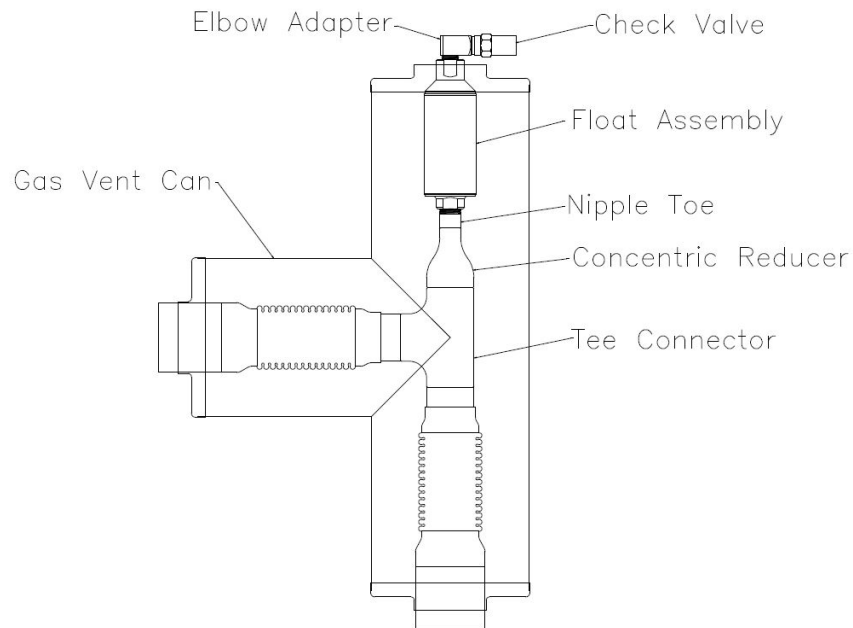
Caution – Excess heat from welding may cause vacuum loss in pipe.

Caution – Follow this procedure. Heat from welding could damage the valve if this procedure is not followed.

Installation Steps:

1. Slide the end caps for the valve can onto both sections of pipe.
2. TIG weld a nipple toe to each pipe stub end.
3. Assemble both threaded connections using Teflon thread tape.
4. Perform a pressure test per the *Bubble Leak Testing Procedure* section to check for leaks. If the assembly does not pass, it must be reworked.
5. Wrap MLI over the straight section of pipe from start-of-bellows to start-of-bellows. Do not exceed the diameter of the bellows. Use a piece of aluminum foil tape to keep the MLI from unwrapping.
6. Wrap one layer of aluminum foil tape over the bellows and MLI to aid in the removal of the foam insulation tape that is applied in the next step, in case it is not wrapped correctly.
7. Wrap foam insulation tape over the straight section of pipe from end-of-bellows to end-of-bellows. Do not exceed the outer diameter of the pipe.
8. Wrap a layer of aluminum foil tape over the foam insulation tape from the previous step.
9. Install the valve can onto the pipe by:
 - a. Putting the rigid foam insulation over the insulation wrap.
 - b. Wrapping the rolled sheet metal cylinder over the rigid foam insulation.
 - c. Screwing the rolled sheet metal cylinder and the end caps together.
10. Make sure the valve can is centered over the joint.
11. Caulk all seams with the silicone sealer.

Gas Vent Kit



What is Included?

- Gas Vent Can Assembly
- Tee Connector
- Concentric Reducer
- Nipple Toe
- Float Assembly
- Elbow Adapter
- Check Valve

Note: The gas vent kit comes standard with a check valve. If the operating pressure of the system is greater than 60 PSIG, a pressure relief valve of a suitable set pressure must be used in lieu of this check valve. Contact Technifab for assistance in specifying this set pressure.

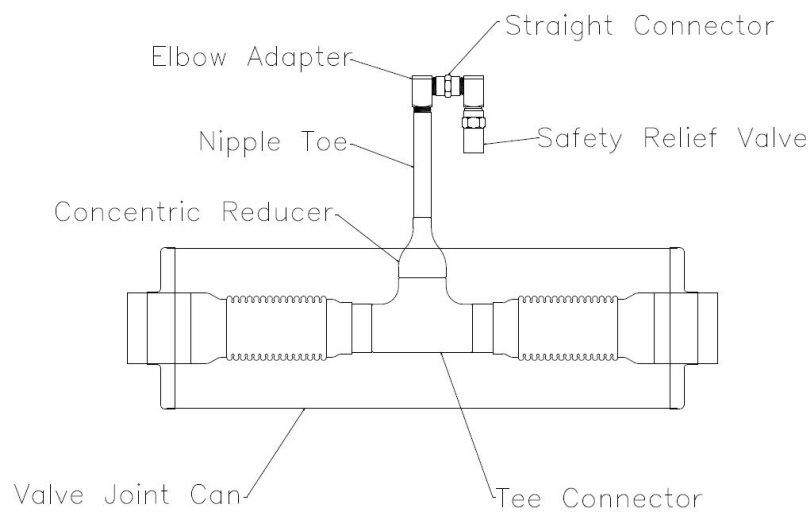
Caution – Steel edges and aluminum foil tape are sharp; use caution when handling.

Caution – Excess heat from welding may cause vacuum loss in pipe.

Installation Steps:

1. Slide the short leg of the gas vent can on the end of the section of pipe that is horizontal in the picture above.
2. Slide the end cap for the long leg of the gas vent can onto the section of pipe that is vertical in the picture above.
3. TIG weld all non-threaded connections together.
4. Assemble all threaded connections using Teflon thread tape.
5. Perform a pressure test per the *Bubble Leak Testing Procedure* section to check for leaks. If the assembly does not pass, it must be reworked.
6. Wrap MLI over all non-VJ sections, excluding the float assembly, elbow adapter, and check valve. Do not exceed the diameter of the bellows. Use a piece of aluminum foil tape to keep the MLI from unwrapping.
7. Wrap one layer of aluminum foil tape over the bellows and MLI to aid in the removal of the foam insulation tape that is applied in the next step, in case it is not wrapped correctly.
8. Wrap foam insulation tape over all non-VJ sections and the bellows. Do not exceed the outer diameter of the pipe.
9. Wrap a layer of aluminum foil tape over the foam insulation tape from the previous step.
10. Slide the short leg of the gas vent can over the joint. If the can does not slide over the insulation wrap, disassembly of the gas vent can may be required.
11. Install the long leg of the gas vent can onto the pipe by:
 - a. Putting the rigid foam insulation over the insulation wrap.
 - b. Wrapping the rolled sheet metal cylinder over the rigid foam insulation.
 - c. Screwing the rolled sheet metal cylinder and the end caps together.
12. Once the long leg of the gas vent can is in place and centered over the joint, slide the short leg of the gas vent can over the insulation wrap until it mates up with the long leg of the gas vent can (the tabs should go on the outside). Line up the two holes and screw together.
13. Caulk all seams with the silicone sealer.

Relief Valve Kit



What is Included?

- Valve Can Assembly
- Tee Connector
- Concentric Reducer
- Nipple Toe
- Elbow Adapter (2)
- Straight Connector
- Safety Relief Valve

Note: The relief valve kit comes with a safety relief valve rated for 150 PSIG. If the application requires a different pressure rating, contact Technifab for assistance.

Caution – Steel edges and aluminum foil tape are sharp; use caution when handling.

Caution – Excess heat from welding may cause vacuum loss in pipe.

Installation Steps:

1. Slide the end caps for the valve can onto both sections of pipe.
2. TIG weld all non-threaded connections together.
3. Assemble all threaded connections using Teflon thread tape.
4. Perform a pressure test per the *Bubble Leak Testing Procedure* section to check for leaks. If the assembly does not pass, it must be reworked.
5. Wrap MLI over the straight section of pipe from start-of-bellows to start-of-bellows. Do not exceed the diameter of the bellows. Use a piece of aluminum foil tape to keep the MLI from unwrapping.
6. Wrap one layer of aluminum foil tape over the bellows and MLI to aid in the removal of the foam insulation tape that is applied in the next step, in case it is not wrapped correctly.
7. Wrap foam insulation tape over the straight section of pipe from end-of-bellows to end-of-bellows. Do not exceed the outer diameter of the pipe.
8. Wrap a layer of aluminum foil tape over the foam insulation tape from the previous step.
9. Install the valve can onto the pipe by:
 - a. Putting the rigid foam insulation over the insulation wrap.
 - b. Wrapping the rolled sheet metal cylinder over the rigid foam insulation.
 - c. Screwing the rolled sheet metal cylinder and the end caps together.
10. Make sure the valve can is centered over the joint.
11. Caulk all seams with the silicone sealer.

Bubble Leak Testing Procedure

This section outlines the recommended procedure for bubble leak testing welded joints:

1. Allow the weld joint to cool down to ambient temperature.
2. Mix a solution of soap and water in a spray bottle.
3. Seal and internally pressurize the section of piping that the weld joint is associated with. Technifab recommends pressurizing the piping to approximately 50 PSIG.
4. While the piping is pressurized, spray the weld joint with the soap and water solution.
5. Carefully observe the weld joint, looking for any bubbles at the weld joint location. If bubbles are present, the weld joint will need reworked. If no bubbles are present, the weld joint is acceptable.

Note: This Bubble Leak Testing Procedure does not meet ASME B31.3 requirements for pressure testing. If ASME B31.3 certification is required, consult Technifab for additional pressure testing requirements relating to obtaining this certification.

Maintenance

Technifab recommends that the customer inspect each piping system annually to ensure that it is operating at peak performance. This maintenance includes:

- Checking the piping system for leaks.
- Inspecting all vent outlets and all pressure relief device outlets for obstruction or contamination, both of which could prevent operation.

Pressure relief devices should be physically checked for operation every 5 years.

If needed, Technifab offers a full line of replacement components. Please contact us for additional information.

Warranty and Service

A copy of the warranty for this system and its associated components are shipped with the order. Copies may also be obtained directly from Technifab.

We continuously seek to improve our products, and customer feedback is an essential element of this process. Should any issue arise regarding the performance of this product, please notify us immediately at:

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