Pipe Support

When designing the hangers, supports and anchors for a grooved-end pipe system, the piping designer must consider certain unique characteristics of the grooved type coupling in addition to many universal pipe hanger and support design factors. As with any pipe system, the hanger or support system must provide for

1) the weight of the pipe, couplings, fluid & pipe system components;

2) reduce stresses at pipe joints; and

3) permit required pipe system movement to relieve stress.

The following factors should be considered when designing hangers and supports for a grooved-end pipe system.

PIPE HANGER SPACING:

The following charts show the maximum span between pipe hangers for straight runs of standard weight steel pipe filled with water or other similar fluids.

Do not use these values where critical span calculations are made or where there are concentrated loads between supports.

For straight runs without concentrated loads and where full linear movement is ***NOT*** required use the table on right.

Hanger Spacing
Linear Movement Not Req'd

Nominal Pipe Size Range	Maximum Span Between Supports
In./DNmm	*Feet/meters*
1 *25*	7 *2.6*
1¼-2 *32-50*	10 *3.0*
2½-4 *65-100*	12 *3.7*
5-8 *125-200*	14 *4.3*
10-12 *250-300*	16 *4.9*
14-16 *350-400*	18 *5.5*
18-24 *450-600*	20 *6.1*

For straight runs without concentrated loads and where full linear movement ***IS*** required use the table below.

Hanger Spacing - Flexible System, Steel Pipe
Full Linear Movement Is Req'd
Average Hangers Per Pipe Length Evenly Spaced

Nominal Pipe Size Range	Pipe Length in Feet/Meters									
In.	*7*	*10*	*12*	*15*	*20*	*22*	*25*	*30*	*35*	*40*
DNmm	*2.1*	*3.3*	*3.7*	*4.6*	*6.1*	*6.7*	*7.6*	*9.1*	*10.7*	*12.2*
1-2 *25-50*	1	2	2	2	3	3	4	4	5	6
2½-4 *65-100*	1	1	2	2	2	2	2	3	4	4
5-24 *125-600*	1	1	1	2	2	2	2	3	3	3

HANGER SPACING - RIGID SYSTEMS
SUGGESTED MAXIMUM SPAN BETWEEN SUPPORTS

Nominal Size	STEEL PIPE Suggested Maximum Span Between Supports-Feet/Meters						COPPER TUBE	
	Water Service			Air Service			Water Service	Gas & Air Service
In./DNmm	*	**	***	*	**	***	**	**
1 *25*	7 *2.1*	9 *2.7*	12 *3.7*	9 *2.7*	10 *3.0*	12 *3.7*	–	–
1¼ *32*	7 *2.1*	11 *3.4*	12 *3.7*	9 *2.7*	12 *3.6*	12 *3.7*	–	–
1½ *40*	7 *2.1*	12 *3.7*	15 *4.6*	9 *2.7*	13 *4*	15 *4.6*	–	–
2 *50*	10 *3*	13 *4*	15 *4.6*	13 *4*	15 *4.6*	15 *4.6*	9 *2.7*	12 *3.6*
2½ *65*	11 *3.4*	15 *4.6*	15 *4.6*	14 *4.3*	17 *5.1*	15 *4.6*	9 *2.7*	12 *3.6*
3 OD *65*	11 *3.4*	15 *4.6*	15 *4.6*	14 *4.3*	17 *5.1*	15 *4.6*	–	–
3 *80*	12 *3.7*	16 *4.8*	15 *4.6*	15 *4.6*	19 *5.7*	15 *4.6*	10 *3*	14 *4.2*
3½ *90*	13 *4*	18 *5.4*	15 *4.6*	15 *4.6*	21 *6.3*	15 *4.6*	–	–
4 *100*	14 *4.3*	18 *5.4*	15 *4.6*	17 *5.2*	21 *6.4*	15 *4.6*	12 *3.7*	17 *5.1*
4¼ *100*	14 *4.3*	18 *5.4*	15 *4.6*	17 *5.2*	19 *5.7*	15 *4.6*	–	–
5 *125*	16 *4.9*	20 *6.0*	15 *4.6*	20 *6.1*	24 *7.3*	15 *4.6*	13 *4*	18 *5.7*
5¼ *125*	15 *4.6*	18 *5.5*	15 *4.6*	19 *5.2*	22 *6.6*	15 *4.6*	–	–
5½ *125*	16 *4.9*	19 *5.8*	15 *4.6*	20 *6.1*	24 *7.3*	15 *4.6*	–	–

* Spacing by ANSI-B31.1 Power Piping Code.

** Spacing by ANSI-B31.9 Building Service Piping Code, (1996 Edition), Fig. 921.1.3c, Table a, 250 psi and Fig. 921.1.3D, table a

*** Spacing by NFPA-13 Installation of Sprinkler Systems, (1999 Edition), Table 6-2.2.

HANGER SPACING - RIGID SYSTEMS
SUGGESTED MAXIMUM SPAN BETWEEN SUPPORTS

Nominal Size	STEEL PIPE Suggested Maximum Span Between Supports-Feet/Meters						COPPER TUBE	
	Water Service			Air Service			Water Service	Gas & Air Service
In./DNmm	*	**	***	*	**	***	**	**
6	17	21	15	21	26	15	14	21
150	*5.2*	*6.3*	*4.6*	*6.4*	*7.8*	*4.6*	*4.2*	*6.3*
6¼	16	20	15	20	24	15	–	–
150	*4.9*	*6.0*	*4.6*	*6.1*	*7.3*	*4.6*		
6½ OD	17	21	15	21	25	15	–	–
150	*5.2*	*6.3*	*4.6*	*6.4*	*7.6*	*4.6*		
8	19	23	15	24	29	15	–	–
200	*5.8*	*6.9*	*4.6*	*7.3*	*8.7*	*4.6*		
10	19	25	15	24	33	15	–	–
250	*5.8*	*7.5*	*4.6*	*7.3*	*9.9*	*4.6*		
12	23	26	15	30	36	15	–	–
300	*7*	*7.8*	*4.6*	*9.1*	*10.8*	*4.6*		
14	23	26	15	30	37	15	–	–
350	*7*	*7.8*	*4.6*	*9.1*	*11.1*	*4.6*		
16	27	26	15	35	40	15	–	–
400	*8.2*	*7.8*	*4.6*	*10.7*	*12.0*	*4.6*		
18	27	27	15	35	42	15	–	–
450	*8.2*	*8.1*	*4.6*	*10.7*	*12.6*	*4.6*		
20	30	27	15	39	45	15	–	–
500	*9.1*	*8.1*	*4.6*	*11.9*	*13.5*	*4.6*		
24	32	26	15	42	48	15	–	–
600	*9.8*	*7.8*	*4.6*	*12.8*	*14.7*	*4.6*		

* Spacing by ANSI-B31.1 Power Piping Code.

** Spacing by ANSI-B31.9 Building Service Piping Code, (1996 Edition), Fig. 921.1.3c, Table a, 250 psi and Fig. 921.1.3D, table a

*** Spacing by NFPA-13 Installation of Sprinkler Systems, (1999 Edition), Table 6-2.2.

Considerations for the Hanging or Supporting of Grooved Piping Systems

Grooved piping products have a very good maintenance track record out in the field. Whenever there is a "perceived" problem with installed grooved product, a high percentage are often related to the hanging or supporting method or application chosen. Although supported very similarly to welded piping systems, a few considerations should be given to assure the proper selection and application of hangers and supports used on a grooved piping system such as Anvil's Gruvlok® brand.

REVIEW REQUIREMENTS AND LOGISTICS

A variety of hangers and supports are typically used on grooved piping systems, ranging from a simple band hanger, clevis hanger, and trapeze supports to more intricate rack designs using structural steel or a mechanical framing/strut system. All of these are acceptable hanging or supporting methods but they are dependent on the project's type, design and specification requirements. With this in mind, a vital first step is to refer to the project and code requirements when choosing the proper hanging or supporting method.

Project logistics is another consideration regardless of system type. Quite often hangers and supports are an after thought on a project simply because the big-ticket items, such as labor, major equipment and schedule, are the focus of the project team. However, hangers and supports are one of the first components needed on a project since you cannot hang pipe without them.

In nearly every hanger or support assembly there are three components that make up the assembly. These components are an upper attachment (beam or structural attachment), intermediate attachment (rod, couplings, eye nuts, etc.) and the lower attachment (pipe clamps, U-bolts, trapezes). See accompanying illustrations for examples of typical assemblies. All three components should arrive on the project site together and early. To save costly field labor hours, consideration might be given to having the hangers or supports preassembled by the manufacturer or fabricated in the contractor's shop. Components can also be bundled and tagged by system or area of the project so they can be easily assembled and located on-site.

MAKE A MATCH

The type of grooved coupling used on a project is the next consideration to choosing the correct hanger or support method. The proper maximum spacing allowables governed by project specifications, the applicable code and/or the hanger manufacturer's recommendations all must also be reviewed. Flexible couplings used on horizontal runs of pipe need to be supported at every coupling and usually require intermediate supports to satisfy the maximum spacing allowable requirements. Rigid couplings, on the other hand, can be hung or supported based on the maximum spacing requirements only. In addition, wherever there is a change in direction of the piping system a hanger or support is usually required immediately following that change in direction and then the system is hung or supported accordingly.

Considerations for the Hanging or Supporting of Grooved Piping Systems

PRESSURE POINT

System pressurization should also be reviewed when choosing the proper hanging or support method. As the couplings are installed, the pipe ends can either be butted up tight to one another or a gap can exist. Once the system is pressurized, those areas or joints where the pipe ends are butted up tight and held by a grooved coupling can "pop" or grow to the maximum gap depending on the coupling chosen. The joint at a flexible grooved coupling can expand about 1/4" at each coupling whereas the joint at a rigid grooved coupling can grow about 3/32". If there is a long run of horizontal or vertical pipe with multiple joints the overall length of the system will grow depending upon which grooved coupling you have chosen.

For example, if you have a grooved piping system that is 400 ft. long there will be roughly 19 grooved joints (assuming 21 ft. lengths of pipe are used). If you multiply the number of joints by the growth of each joint you can determine the overall growth of the system due to pressurization. If it is a flexible system, 19 joints x .25" = 4.75" of overall growth. A rigid system would be 19 joints x .0938" = 1.78" of overall growth.

As one can see, this growth due to pressurization can have a significant impact on the hangers or supports used on a project. One way to avoid this growth is to install the grooved joints at full gap so that pressurization has no impact at testing or start up. If this is not possible, then periodic air pressurization as the system is installed will expand the grooved joints to full gap and the hangers or supports can be adjusted accordingly.

HOT AND COLD

Thermal expansion is another important consideration when choosing hangers or supports for a grooved system. This is especially important on hot systems versus chilled systems since the amount of thermal expansion will be greater on hot systems as opposed to the thermal contraction that will occur on chilled systems. This is all due to the temperature variation from ambient conditions when the pipe is installed to operating conditions.

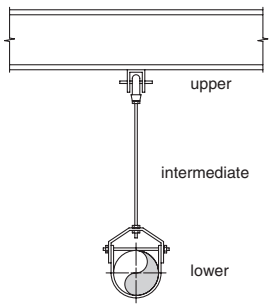
For example, if you again take 400 ft. of grooved piping, let us assume the system is heating hot water that will operate at 170°F. The pipe is installed under ambient conditions assumed to be at 70°F so you have a 100°F variation in temperature. At 70°F the pipe has a coefficient of thermal expansion of 0.0 in/ft but at 170°F the pipe has a coefficient of thermal expansion of 0.0076 in/ft. To determine the total thermal expansion of the pipe from ambient temperature to operating temperature you multiply the length of pipe by the coefficient of thermal expansion. In this case 400 ft. x 0.0076 in/ft. = 3.04 in. In other words the pipe has grown in length over 3 inches because of the thermal expansion.

This is significant growth especially if there is a change of direction at the end of the 400 ft. pipe run or there are branch lines coming off the main run. If this thermal growth exceeds the allowable deflection of a grooved joint, especially where a change of direction or a branch line connects, then problems could occur. Thermal growth cannot be stopped. It can only be controlled by the use of anchors and expansion joints or expansion loops.

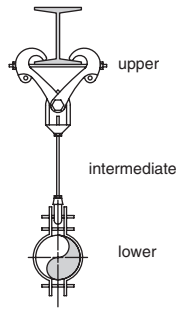
Considerations for the Hanging or Supporting of Grooved Piping Systems

It is also important to hang or support the pipe with rolls or slides and use guides to control the thermal expansion of the pipe into an expansion joint or expansion loop. The use of static hangers, such as clevis hangers, should not be considered on pipe that is thermally expanding. When using trapeze hangers for multiple systems it is important to have "like" systems on the trapeze, that is, systems that are operating near the same temperature. If you combine hot systems with cold systems on a trapeze, the thermal expansion of the hot system can cause the trapeze to possibly twist and fail or excessive stress could be induced on the grooved joints on all of the systems on the trapeze. Hot systems should be hung or supported independently of cold or ambient systems or a means should be provided, such as pipe rolls or pipe slides, to allow the hot systems to thermally expand on the trapeze.

If the pipe is a vertical riser then consideration must be given to the use of spring hangers to allow the pipe to grow vertically up or down depending upon how the pipe is anchored while still supporting the pipe. Vertical pipe thermally expands the same amount as horizontal pipe and this has to be taken into consideration relating to supports, expansion joints or expansion loops. If the vertical pipe is supported by friction/riser clamps only and the pipe expands vertically upward, the clamps will grow with the pipe off the penetration or supporting structure and no longer provide support. If the growth is downward, the friction clamps resting on the penetration or supporting structure can either fail or the pipe may overcome the friction force and push it's way through the clamp as the pipe thermally expands downward. In either case the clamps are no longer supporting the pipe as intended and this may induce excessive stress on the grooved joints.



Clevis Hanger Assembly



Double Bolt Pipe Clamp Assembly

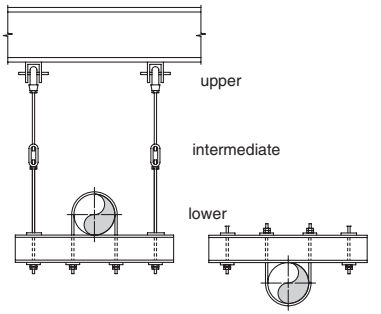
Whether it is horizontal or vertical grooved pipe, growth of the piping system due to pressurization and thermal expansion must be considered. On hot systems, both must be taken into account and added together to determine the overall growth of the system and the effect on the hangers or supports that are used. In the previous examples, pressurization expansion on the 400 ft. run of pipe was 4.75" for a flexible joint system and 1.78" for a rigid joint system and the thermal expansion was 3.04". Adding these combinations together would result in

Considerations for the Hanging or Supporting of Grooved Piping Systems

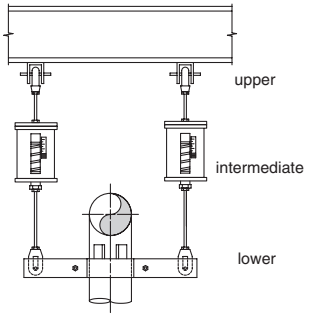
a total pipe growth of 7.79" for a flexible system or 4.82" for a rigid system, regardless of the horizontal or vertical orientation of the pipe. Again, this is a significant amount of growth relating to hangers and supports and the resulting stresses induced on grooved joints.

CONSIDER SOME RESTRAINT

Although grooved systems in seismic zones perform extremely well, consideration should be given to how a grooved system is seismically restrained. If you have growth due to pressurization and/or thermal expansion consideration should be given on how to restrain the system while still allowing growth to occur. Seismic restraints in the longitudinal direction of a long pipe run may restrict the growth of the pipe inducing stresses into the grooved couplings. Seismic restraints in the lateral direction should have little impact on expansion except where the system has a change in direction. If the seismic restraints are placed laterally after a change in direction at the end of a long run of pipe, the expansion of the long pipe run may be restricted and this could induce excessive stress into the grooved joints.



Trapeze Assembly



Spring Riser Hanger Assembly

By reviewing the couplings to be used on a project, pressurization, thermal expansion and seismic restraints, one can best determine the proper selection and application of hangers and supports for a grooved piping system. This will, in turn, help ensure that grooved piping systems will continue to enjoy a solid reputation in the areas of maintenance and downtime.