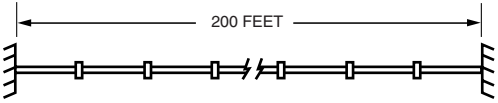
THERMAL MOVEMENT:

A sufficient amount of coupling joints must be provided to accommodate the calculated movement (expansion or contraction) in a pipe run or segment thereof.

EXAMPLE:

A 200 foot long straight run of 4" steel cut grooved pipe between anchor points. Minimum Temperature: 40°F. (at time of installation). Maximum Oper. Temperature: 160°F.



Thermal expansion tables show this system will expand a total of 1.80" due to the temperature change.

DESIGN QUESTION:

How many couplings are required to account for the thermal growth?

AVAILABLE LINEAR MOVEMENT PER FLEXIBLE COUPLING:

Using the table on the previous page, we see that there is 0.188" linear movement per coupling (4" Flexible Coupling)

COUPLINGS REQUIRED

As indicated above, the total movement is 1.80". Thus, the number of couplings is determined as follows:

No. of Couplings = Tot. Movement / Avail. Movement per Coupling

FOR OUR EXAMPLE:

No. of Couplings = (1.80") / (0.187") = 9.6,
Therefore 10 couplings are needed

POSITION OF COUPLINGS

In order for the couplings to provide for the movement indicated by the above example, it would be necessary to install all couplings with the maximum gap between pipe ends. Conversely, if the thermal movement was contraction due to a reduction of system temperature, the coupling joints would have be installed with the pipe ends butted, thus accommodating the “shrink” of the pipe system.

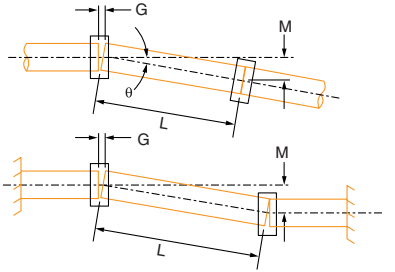
In either case the pipe run in question would have to be anchored at the proper locations to direct pipe system expansion or contraction into the coupling joints.

As can be seen from the above example, the pipe end gap within the coupling joint must be considered when designing a grooved-end pipe system to accommodate thermal movement. The couplings do not automatically provide for expansion and contraction of piping.

MISALIGNMENT & DEFLECTIONS:

The angular movement capability of the Gruvlok coupling permits the assembly of pipe joints where the piping is not properly aligned. At least two couplings are required to provide for lateral pipe misalignment. Deflection (longitudinal misalignment) may be accommodated within a single coupling as long as the angle of deflection does not exceed the value shown in the coupling performance data for the particular size and coupling type.

A pipe joint that utilizes the angular deflection capability of the Gruvlok coupling will react to pressure and thermal forces dependent upon the manner in which it is restrained. An unrestrained joint will react to these forces by straightening, thus reducing, if not eliminating, the deflection at the joint. If joint deflection has been designed into the pipe layout and must be maintained, then sufficient anchors must be provided to resist the lateral forces and hold the joint in the deflected condition.



The amount of deflection from pipe run centerline can be calculated utilizing the following equations:

$$M = L (\sin \theta)$$
$$\theta = \text{ArcSin} (G/D)$$
$$M = (G \times L)/D$$

WHERE:

M = Misalignment (inches)

G = Maximum Allowable Pipe End Movement (Inches) as shown under "Performance Data" (Value to be reduced by Design Factor)

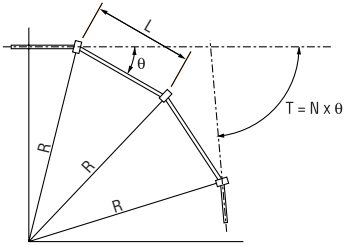
θ = Maximum Deflection (Degrees) from centerline as shown under "Performance Data" (Value to be reduced by Design Factor)

D = Pipe Outside Diameter (Inches)

L = Pipe Length (Inches)

CURVE LAYOUT:

Utilizing the angular deflection at each coupling joint curves may be laid out using straight pipe lengths and Gruvlok Couplings.



This example shows how to calculate the curve radius, required pipe lengths, and number of required couplings.

$$R = L / (2 \times \sin(\theta/2))$$
$$L = 2 \times R \times \sin(\theta/2)$$
$$N = T / \theta$$

WHERE:

N = Number of Couplings

R = Radius of Curve (feet)

L = Pipe Length (feet)

θ = Deflection from centerline (Degrees) of each Coupling (See coupling performance data, value to be reduced by Design Factor)

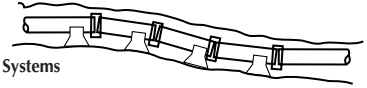
T =Total Angular Deflection of all Couplings.

DRAINAGE, BURIED SYSTEMS, ETC.:

The flexible design of the Gruvlok coupling makes it ideal for use in a wide variety of systems in which random changes of the pipe direction can be accommodated by the Gruvlok coupling's angular deflection capability rather than requiring the use of special fittings.

Pitched drainage systems, buried pipe systems where pipe laying conditions are subject to settlement, and exposed pipe systems laid on rough ground are but a few of the many types of pipe installations that present conditions where the functional capability of the Gruvlok coupling are useful.

Pitched for Drainage

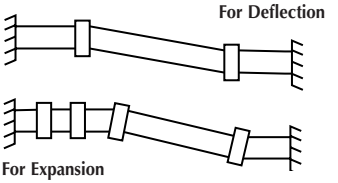


Buried Pipe Systems

COMBINED LINEAR & ANGULAR MOVEMENT:

The clearance in the grooved coupling joint, will allow a limited capability for combined linear and angular movement. A partially deflected joint will not provide full linear movement capability. A fully detected coupling joint provides no linear movement capability. The Gruvlok coupling will not allow for both maximum linear and maximum angular movement simultaneously.

In systems where both are expected, additional joints may be required.



NOTE: Fully Deflected Joint Will Not Allow For Linear Expansion.

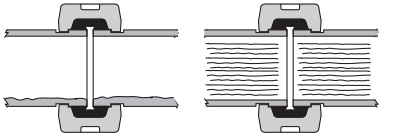
In the example above, two couplings were added to account for thermal expansion and the other couplings accommodate only the misalignment.

The additional stress from the combined movement is therefore relieved.

ROTATIONAL MOVEMENT:

Piping systems designed with Gruvlok Couplings can accommodate minor rotational movement from thermal expansion, settlement, vibration, or other similar movements. However, Gruvlok Couplings ***should never be used as a continuous swivel joint.***

EXAMPLE:



Utilizing the rotational capability of the Gruvlok Coupling, the pipe life of a slurry or similar coarse material piping system can be extended.

For pipe rotation, the system must be shut down and internal pressure relieved.

The pipe may then be rotated one-quarter turn, the couplings retightened, and service resumed. If performed on a regular basis, pipe rotation will evenly distribute wear over the entire inner surface of the pipe.