1 General
1.1 Materials and installations shall be in accordance with the following industry and association standards.
   - ASME B31.1 Power Piping Code
   - ASTM Materials
   - AWS Welding

1.2 Expansion joints shall be designed for the following pressures and temperatures:
   1.2.1 High and low pressure steam: 150 PSIG, 600°F
   1.2.2 Condensate return: 100 PSIG, 250°F
   1.2.3 Consult Utilities Engineering if an application is believed to be outside of these conditions.

2 Slip Type Expansion Joints
2.1 Slip type expansion joints are the preferred type of expansion joints for all steam and condensate applications. Bellows type expansion joints may be used in safety relief valve discharge piping applications only.
2.2 All slip type expansion joints shall be selected for the appropriate traverse, with minimum 2” pre-compression.

2.3 Expansion joints shall be furnished with weld ends.

2.4 Steam expansion joints shall have a welded low point drip leg. The drip leg shall include a 1” welded connection on the bottom for manual blow down and rodding out, and another 1” connection about 3” up from the bottom for steam trap connection. Condensate expansion joints are not to have the drip leg.

2.5 If an anchor is provided with the expansion joint, the anchor base plate shall be shipped separate from the structural assembly, and the height of the assembly oversized by 1-1/2” to allow field adjustment for proper alignment of the joint.

2.6 If an anchor is not provided with the expansion joint, heavier expansion joints, typically 6” and larger, require a sliding support under the expansion joint to prevent cocking the slip. Consideration should be given to making this a guided support as well. Follow manufacturers’ recommendations.

2.7 Expansion joints shall be designed to inject packing under full line pressure. The packing cylinders on the expansion joint shall be furnished with an integral stainless steel shut off valve and must be accessible after installation.

2.8 Expansion joints shall be factory packed for the intended service with flake graphite injectable packing.

2.9 Sliding slip, stuffing box and traverse chamber shall be fabricated of ASTM A106 seamless pipe. Sliding slip shall be plated with a hard chrome material.

2.10 Guide insert materials shall be selected for the proper temperature range of the application. Non-metallic inserts typically are limited to 500°F, and metallic inserts necessary for applications above 500°F.

2.11 Expansion joints shall be provided with removable custom fitted insulated jackets.

2.12 Installation guidelines:
   2.12.1 Expansion joint and piping shall be properly aligned within the tolerance allowed by the manufacturer. Proof of proper alignment shall be made available to Owner upon request. In the case of replacing an existing joint, it cannot be assumed that the existing alignment was correct. The existing joint shall be removed, the piping properly aligned, and then the new joint installed and adjusted for proper alignment.

   2.12.2 Anchors, guides and supports shall be properly spaced per the manufacturers’ instructions and ASME B31.1 requirements. Refer to other sections of this guideline for anchors, guides and supports.

   2.12.3 Valves or other heavy accessories should not be installed in the pipe run between the expansion joints and the first guide. Where this is not possible, the valve or accessory must be supported on a sliding support.

   2.12.4 When welding, ground both sides of the expansion joint to prevent electrical arcing and subsequent damage of the sliding and sealing surfaces.

   2.12.5 Pipe shall be restrained to maintain travel on existing expansion joints when cutting an existing steam line.

   2.12.6 Install two 1” welded connections in piping adjacent to joint for pressure and temperature instrument connections.

   2.12.7 Installation in a manhole:
2.12.7.1 Installations using buried conduit system with expansion joints installed in a manhole or vault require guiding at the manhole wall. Properly sized and installed gland and link seals are considered adequate guiding.

2.12.7.2 Consideration should be given to installation of a "moment" guide within 10 ft. of the manhole wall. Moment guides should not be attached to the manhole wall.

2.12.7.3 When a manhole is used, provide power ventilation, an electrical receptacle and lighting inside the manhole.

2.13 Preferred Manufacturer & Model Number

2.13.1 Advanced Thermal Systems (ATS) Thermal Pak Series TP2 Slip Type Expansion Joints

3 Ball Joints

3.1 Ball joints shall be integral socket/retainer design.

Note: Designs using threaded retainer caps or bolted retainer flanges have disadvantages including requiring larger installation clearances and possibility of over tightening during installation or maintenance which can lead to freezing the ball in its socket.

3.2 Ball joints shall be furnished with weld ends.

3.3 Ball joints shall be designed to inject packing under full line pressure. The packing cylinders on the ball joint shall be furnished with an integral stainless steel shut off valve.

3.4 Ball joints shall be factory packed for the intended service with flake graphite injectable packing.

3.5 Pressure retaining components shall be carbon steel meeting ASTM requirements as specified in ASME B31.1. Ball sphere shall be plated with a hard chrome material.

3.6 Ball joints shall be provided with metal compression seals.

3.7 Ball joints shall be provided with removable custom fitted insulated jackets.

3.8 Installation guidelines:

3.8.1 Ball joints shall be installed per manufacturers’ recommendations with proper distances between ball joint centers.

3.8.2 Ball joints installed in the vertical position shall have the male ends pointed down.

3.8.3 Anchors, guides and supports shall be properly spaced per the manufacturer’s instructions and ASME B31.1 requirements. Refer to other sections of this guideline for anchors, guides and supports.

3.8.4 Valves and other heavy accessories should not be installed in the expansion link between the ball joints.

3.8.5 Cold positioning should be determined by the design engineer and included in the design drawings to allow proper installation. Consider thermal growth of the expansion link between the ball joints.

3.8.6 When welding, ground both sides of the ball joints to prevent electrical arcing and subsequent damage of the sealing surfaces.

3.9 Preferred Manufacturer & Model Number

3.9.1 Advanced Thermal Systems (ATS) Thermal Pak Series P2 Flexible Ball Joints

4 Anchors

4.1 Anchors shall be constructed of ASTM A36 structural carbon steel.

4.2 The anchor base plate shall be shipped separate from the structural assembly, and the height of the assembly oversized by 1-1/2” to allow field adjustment for proper alignment of the joint.

4.3 If a pipe spool is provided, it shall be fabricated of ASTM A106 seamless carbon steel pipe of the appropriate schedule for the anchor forces and piping system. The ends of the spool piece shall be machined and beveled for welding.

4.4 Installation guidelines:

4.4.1 When possible, the anchor base plate shall be imbedded in the concrete walls or floors of the tunnel, and the structural assembly welded to the base, with no bolts necessary in the installation.

4.4.2 When installing to an existing tunnel wall, two steel plates shall be used, one on the outside of the wall and one on the inside of the wall bolted together through the wall. The structural assembly is then welded to the base plate.

4.4.3 In all bolted installations stainless steel fasteners shall be used, of the dimensions recommended by the anchor manufacturer. The gap between the fastener and the base plate.
holes shall be no more than the gap recommended by the anchor manufacturer. Disc spring washers shall be used to maintain the design tension in the fasteners after thermal expansion.

4.4.4 Buried anchors shall have steel “ears” welded to the piping through which to transmit the force of expansion. The steel “ears” shall be imbedded in concrete. Concrete anchors shall be designed and load bearing soil compaction shall be capable of withstanding all anchor forces.

4.4.5 Anchors and adjacent piping shall be properly insulated.
4.5 Preferred Manufacturer & Model Number
4.5.1 Advanced Thermal Systems (ATS)
Figure 702 Pre-Engineered Anchors

5 Guides
5.1 Guides shall be fabricated of ASTM A36 structural carbon steel.
5.2 All guides shall be low friction sliding guided supports.
5.3 Low friction sliding guides shall include two ½” thick graphite plates creating the sliding surfaces.
5.4 Installation guidelines:
5.4.1 In order to maintain concentric alignment of piping as it expands into and out of expansion joints, two guides shall be employed into each joint, and on both sides of double expansion joints. One guide will not be acceptable as it will simply act as a fulcrum, not a guide.
5.4.2 Guides shall be properly spaced per the manufacturers’ instructions and ASME B31.1 requirements.
5.4.3 Steel guide bases shall be welded to the structural support steel. Bolted assemblies can loosen over time with thermal expansion and contraction.
5.4.4 Guides and adjacent piping shall be properly insulated.
5.5 Preferred Manufacturer & Model Number
5.5.1 Advanced Thermal Systems (ATS)
Figure 100-W & 101-W Low Friction Graphite Pipe Guides

6 Supports
6.1 Supports shall be of the low friction sliding design, rigidly supported from the bottom. Roller supports and trapeze-style supports are not acceptable as rollers tend to bind and trapeze-style supports force the pipes to move up and down as they swing.
6.2 Supports shall be fabricated of ASTM A36 structural carbon steel with two ½” thick graphite plates creating the sliding surface.
6.3 Installation guidelines:
6.3.1 Supports shall be properly spaced per the manufacturers’ instructions and ASME B31.1 requirements.
6.3.2 Steel support bases shall be welded to the structural support steel. Bolted assemblies can loosen over time with thermal expansion and contraction.
6.3.3 Supports and adjacent piping shall be properly insulated.
6.4 Preferred Manufacturer & Model Number
6.4.1 Advanced Thermal Systems (ATS)
Figure 200-W & 201-W Low Friction Graphite Pipe Supports