CHAPTER IV - Installation and Maintenance

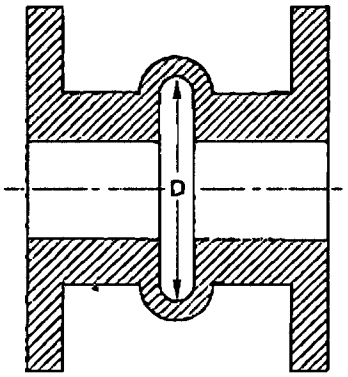
INTRODUCTION:

It can be stated generally that the proper location of rubber expansion joints is close to a main anchoring point. Following the joint in the line, a pipe guide or guides should be installed to keep the pipe in line and prevent undue displacement of this line. This is the simplest application of a joint, namely, to absorb the expansion and contraction of a pipeline between fixed anchor points.

A. ANCHORING AND GUIDING THE PIPING SYSTEM:

A.1. Anchors Are Required. Figure 5A illustrates a simple piping system. You will notice that in all cases solid anchoring is provided wherever the pipeline changes direction and that the expansion joints in that line are located as close as possible to those anchor points. In addition, following the expansion joints, and again as close as is practical, pipe guides are employed to prevent displacement of the pipeline. It should be pointed out that the elbows adjacent to the pump are securely supported by the pump base so that no piping forces are transmitted to the flanges of the pump itself. Anchors shown at the 90° and the 45° bend in the pipeline must be solid anchors designed to withstand the thrust developed in the line together with any other forces imposed on the system at this point.

A.2. Calculation of Thrust. When expansion joints are installed in the pipeline, the static portion of the thrust is calculated as a product of the area of the I.D. of the arch of the expansion joint times the maximum pressure (design or test) that will occur with the line. The result is a force expressed in pounds. **Refer to Figure 4.**



$$T = \frac{\pi}{4} (D)^2 (P)$$

T = THRUST
P = PSI
D = ARCH I.D.

Figure 4: Thrust Formula And The Location Of Expansion Joint Arch I.D.

A.3. Branch Connection Anchors. Figure 5B is another illustration of the proper anchoring that should be provided in a line with a branch connection. The anchor shown at the tee and elbow connections must be designed to withstand both the thrust and any other forces imposed on the system at these points. Again emphasis is placed on the relative location of the joints, their anchoring points and the pipe guides.

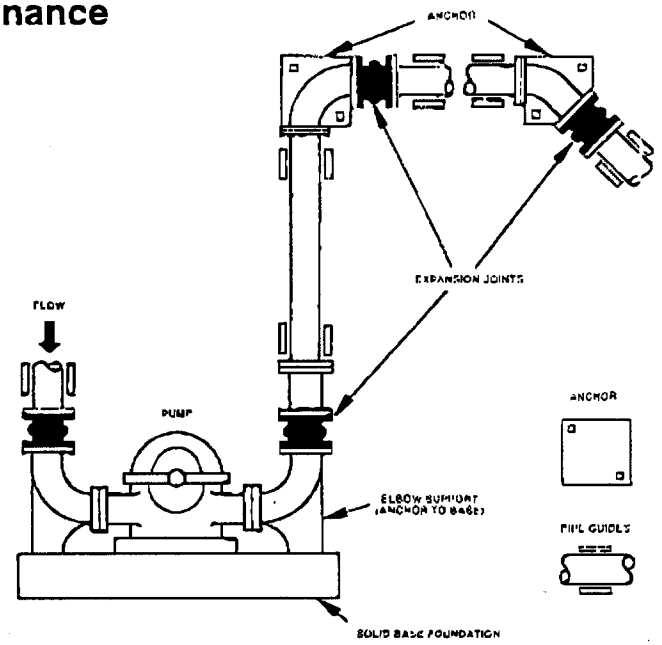


Figure 5A: Typical Piping Layout Utilizing Expansion Joints When Equipment And Piping Are Properly Anchored

B. CONTROL UNITS:

B.1. Definition and Purpose. A control unit assembly is a system of two or more control rods (tie rods) placed across an expansion joint from flange to flange to minimize possible damage to the expansion joint caused by excessive motion of the pipeline. This excessive motion could be caused by the failure of an anchor or some other piece of equipment in the pipeline. Figure 6 shows the proper assembly of an expansion joint with control unit details. The control rod assemblies are set at the maximum allowable expansion and/or contraction of the joint and will absorb the static pressure thrust developed at the expansion joint. When used in this manner, they are an additional safety factor, minimizing possible failure of the expansion joint and possible damage to the equipment. Control units will adequately protect the joints, but the user should be sure that pipe flange strength is sufficient to withstand total force that will be encountered. **The term "Control Unit" is synonymous with the term "Tie Rod" as defined by the standards of the Expansion Joint Manufacturer's Association (EJMA).**

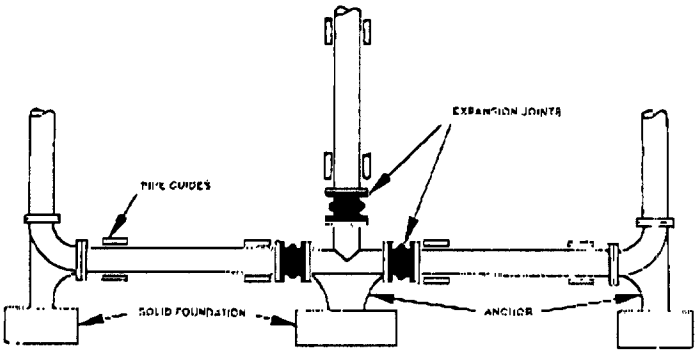


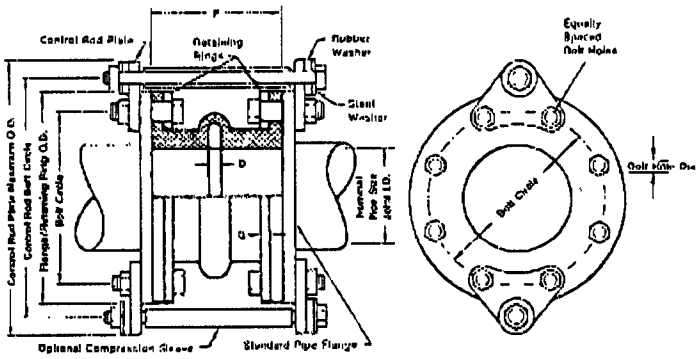
Figure 5B: Typical Piping Layout Utilizing Expansion Joints And The Proper Use Of Anchors In Branch Locations

B.2. Use in Restraining the Piping System. Control units may be required to limit both extension and compression movements.

B.2.A. Extension. Control units must be used when it is not feasible in a given structure to provide adequate anchors in the proper location. In such cases, the static pressure thrust of the system will cause the expansion joint to extend to the limit set by the control rods which will then preclude the possibility of further motion that would over-elongate the joint. Despite the limiting action that control rods have on the joint, they must be used when proper anchoring cannot be provided. It cannot be emphasized too strongly that rubber expansion joints, by virtue of their function, are not designed to take end thrusts and, in all cases where such are likely to occur, proper anchoring is essential. If this fact is ignored, premature failure of the expansion joint is a foregone conclusion.

B.2.B. Compression. Pipe sleeves can be installed over the control rods. The purpose of the sleeve is to prevent excessive compression in the expansion joint. The length of this pipe sleeve should be such that the expansion joint cannot be compressed beyond the maximum allowable compression figure stated by the manufacturer. **See Table V and Figure 6.**

Figure 6: Expansion Joint With Assembly/Installation Of Control Unit Components



B.3. Specifications. For control unit dimensional specifications see Appendix C. These specifications are recommended for standard construction type expansion joints. The exact number of control rods should be selected on the basis of the actual design/test pressure of the system. Always specify the mating flange thickness when ordering control unit assemblies. **See Appendix D.**

B.4. Illustration of the Use of Control Rods. Figure 5C demonstrates the type of piping connections that must be used in the event it is impossible to employ anchoring. The anchor point at the upper 90° elbow in the discharge line has been eliminated. (It is shown in Figure 5A.) In this situation, it is necessary to employ properly designed control units with the joints located in this non-anchored line. Without the use of these control units, the pipeline between the pump and the anchor, at the 45° bend, would be severely displaced due to elongation in the flexible rubber expansion joint. This elongation would proceed until the joints rupture. The use of control units in this case permits expansion of the pipeline in both the vertical and horizontal direction between the pump and the anchor, at the 45° bend. However, it does preclude the possibility of contraction in these respective lines as the further extension of the expansion joint is impossible because of the control units.

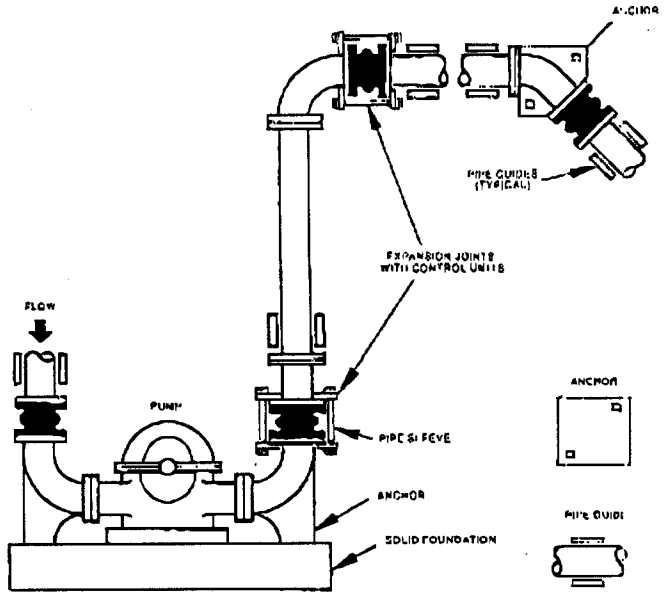


Figure 5C: Typical Piping Layout Showing The Use Of Control Units With The Expansion Joints When Proper System Anchoring Is Limited

C. OTHER INSTALLATIONS:

C.1. Vibration Mounts Under Foundation. Figure 5D shows a very common pump installation. Instead of being mounted on a solid foundation, the pump is supported off the floor on vibration mounts. There is nothing wrong with this type of installation. The supplier of the vibration mounts should be made aware of the fact that these mounts must be designed not only to support the weight of the pump, its motor and base, but must also absorb the vertical thrust that will occur in both the suction and discharge lines. To calculate thrust see Chapter IV, Section A.2. It should also be noted that the thrust in the respective pipelines will exert a force on the inlet and outlet flanges of the pump, and the pump manufacturer should be contacted to determine whether or not the pump casing is strong enough to withstand this force. If this is not done, it is very possible that this force can be large enough to crack the connecting flanges.

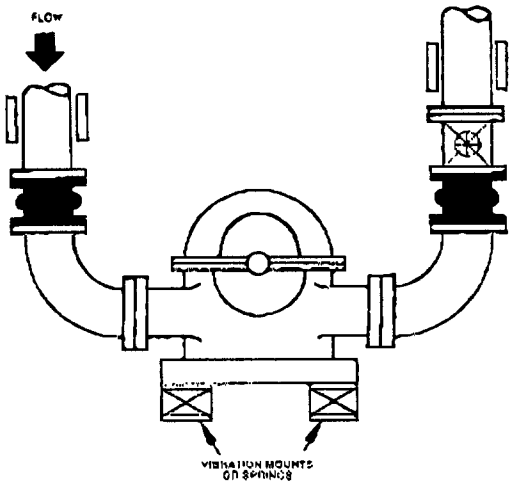


Figure 5D: Typical Pump Installation With Expansion Joints Utilizing Vibration Mounts

Figure 5E: Superior Installation With Pump Base Independently Supported

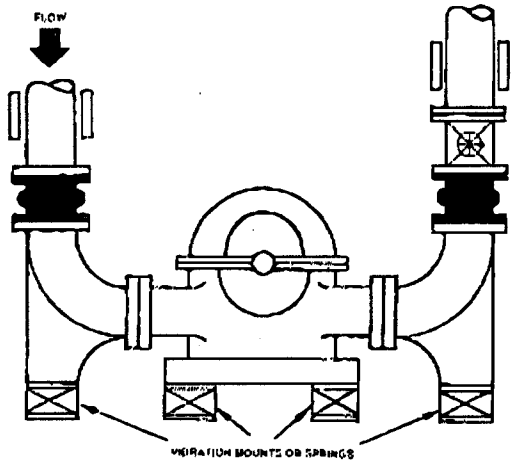
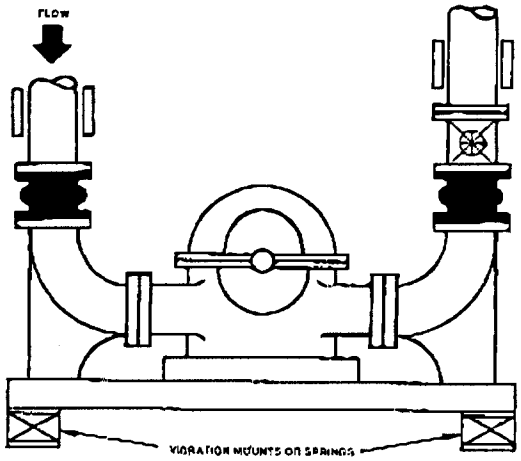


Figure 5F: Use Of A Secondary Unit Base For Pump And Piping



C.2. Vibration Mounts or Springs Under Base and Anchor. A variation of the design as shown in Figure 5D is illustrated in Figure 5E. An improved installation is shown here. The vibration mounts under the pump base need only support the pump, its motor and base. The vibration mounts under the elbow supports can then be designed to withstand the thrust developed in the suction and discharge lines, respectively.

C.3. Secondary Base. See Figure 5F. In this installation, a complete secondary base is provided for the pump base and the two elbow supports. This secondary base is equipped with vibration mounts to isolate it from the floor. Once again, these mounts must be designed to take into account all of the loads and forces acting upon the secondary base. These obviously are the weight of the equipment plus the thrusts developed in the suction and discharge lines.

D. INSTALLATION INSTRUCTIONS FOR NON-METALLIC EXPANSION JOINTS:

D.1. Service Conditions. Make sure the expansion joint rating for temperature, pressure, vacuum and movements match the system requirements. Contact the manufacturer for advice if the system requirements exceed those of the expansion joint selected. Check to make sure the elastomer selected is chemically compatible with the process fluid or gas.

D.2. Alignment. Expansion joints are normally not designed to compensate for piping misalignment errors. Piping should be lined up within 1/8". Misalignment reduces the rated movements of the expansion joint and can induce severe stress and reduce service life. Pipe guides should be installed to keep the pipe aligned and to prevent undue displacement. **See Chapter IV, Section A and Table IV.**

D.3. Anchoring. Solid anchoring is required wherever the pipeline changes direction, and expansion joints should be located as close as possible to anchor points. If anchors are not used, the pressure thrust may cause excessive movements and damage the expansion joints. **See Chapter IV, Section A & B for Anchoring, Guiding and Control Rods.**

D.4. Pipe Support. Piping must be supported so expansion joints do not carry any pipe weight.

D.5. Mating Flanges. Install the expansion joint against the mating pipe flanges and install bolts so that the bolt head and washer are against the retaining rings. If washers are not used, flange leakage can result - particularly at the split in the retaining rings. Flange-to-flange dimensions of the expansion joint must match the breech type opening. Make sure the mating flanges are clean and flat-face type or no more than 1/16" raised-face type. Never install expansion joints that utilize split retaining rings next to wafer-type check or butterfly valves. Serious damage can result to a rubber joint of this type unless installed against full face flanges.

D.6. Tightening Bolts. Tighten bolts in stages by alternating around the flange. If the joint has integral fabric and rubber flanges, the bolts should be tight enough to make the rubber flange O.D. bulge between the retaining rings and the mating flange. Torque bolts sufficiently to assure leak-free operation at hydrostatic test pressure. Bolt torquing values are available from most manufacturers. If the joint has metal flanges, tighten bolts only enough to achieve a seal and never tighten to the point that there is metal-to-metal contact between the joint flange and the mating flange.

D.7. Storage. Ideal storage is a warehouse with a relatively dry, cool location. Store flange face down on a pallet or wooden platform. Do not store other heavy items on top of an expansion joint. Ten year shelf-life can be expected with ideal conditions. If storage must be outdoors joints should be placed on wooden platforms and should not be in contact with the ground. Cover with a tarpaulin.

D.8. Large Joint Handling. Do not lift with ropes or bars through the bolt holes. If lifting through the bore, use padding or a saddle to distribute the weight. Make sure cables or forklift tines do not contact the rubber. Do not let expansion joints sit vertically on the edges of the flanges for any period of time.

D.9. Additional Tips.

D.9.A. Do not insulate over a non-metallic expansion joint; however, if insulation is required, it should be made removable to permit easy access to the flanges. This facilitates periodic inspection of the tightness of the joint bolting.

D.9.B. It is acceptable (but not necessary) to lubricate the expansion joint flanges with a thin film of graphite dispersed in glycerin or water to ease disassembly at a later time.

D.9.C. Do not weld in the near vicinity of a non-metallic joint.

D.9.D. If expansion joints are to be installed underground or will be submerged in water, contact manufacturer for specific recommendations.

D.9.E. If the expansion joint will be installed outdoors, make sure the cover material will withstand ozone, sunlight, etc. Materials such as Neoprene and Chlorobutyl are recommended. Materials painted with weather-resistant paint will give additional ozone and sunlight protection.

D.9.F. Check the tightness of leak-free flanges two or three weeks after installation and re-tighten if necessary.

> ***WARNING:*** *Expansion joints may operate in pipelines or equipment carrying fluids and/or gases at elevated temperatures and pressures and may transport hazardous materials. Precautions should be taken to protect personnel in the event of leakage or splash.* ***See Chapter II, Section P.*** *Rubber joints should not be installed in inaccessible areas where inspection is impossible. Make sure proper drainage is available in the event of leakage when operating personnel are not available.*

D.10. Control Rod Installation. Also see Chapter II, O.2. Control Unit Assemblies.

D.10.A. Assemble expansion joint between pipe flanges to the manufactured face-to-face length of the expansion joint. Include the retaining rings furnished with the expansion joint.

D.10.B. Assemble control rod plates behind pipe flanges as shown. Flange bolts through the control rod plate must be longer to accommodate the plate. Control rod plates should be equally spaced around the flange. Depending upon the size and pressure rating of the system, 2, 3 or more control rods may be required.

D.10.C. Insert control rods through top plate holes. Steel washers are to be positioned at the outer plate surface. An optional rubber washer is positioned between the steel washer and the outer plate surface. **(See Figure 6.)**

D.10.D. If a single nut per unit is furnished, position this nut so that there is a gap between the nut and the steel washer. This gap is equal to the joint's maximum extension (commencing with the nominal face-to-face length). To lock this nut in position, either "stake" the thread in two places or tack weld the nut to the rod. If two jam nuts are furnished for each unit, tighten the two nuts together, so as to achieve a "jamming" effect to prevent loosening. **Note: Consult the manufacturer if there is any question as to the rated compression and elongation. These two dimensions are critical in setting the nuts and sizing the compression pipe sleeves.**

D.10.E. If there is a requirement for compression pipe sleeves, ordinary pipe may be used and sized in length to allow the joint to be compressed to its normal limit. **(See Figure 6.)**

D.10.F. For reducer installations, it is recommended that all control rod installations be parallel to the piping.

D.11. Location. The expansion joint should always be installed in an accessible location to allow for future inspection or replacement.

E. INSPECTION PROCEDURE FOR EXPANSION JOINTS IN SERVICE:

The following guide is intended to assist in determining if an expansion joint should be replaced or repaired after extended service.

E.1. Replacement Criteria. If an expansion joint is in a critical service condition and is five or more years old, consideration should be given to maintaining a spare or replacing the unit at a scheduled outage. If the service is not of a critical nature, observe the expansion joint on a regular basis and plan to replace after 10 years service. Applications vary and life can be as long as 30 years in some cases.

E.2. Procedures.

E.2.A. Cracking. Cracking, checking or crazing may not be serious if only the outer cover is involved and the fabric is not exposed. If necessary, repair on site with rubber cement where cracks are minor. Cracking where the fabric is exposed and torn indicates the expansion joint should be replaced. Such cracking is usually the result of excess extension, angular or lateral movements. Such cracking is identified by: (1) a flattening of the arch, (2) cracks at the base of the arch, and/or (3) cracks at the base of the flange. To avoid future problems, replacement expansion joints should be ordered with control rod units.

E.2.B. Blisters, Deformation, Ply Separation. Some blisters or deformations, when on the external portions of an expansion joint, may not affect the proper performance of the expansion joint. These blisters or deformations are cosmetic in nature and do not require repair. If major blisters, deformations and/or ply separations exist in the tube, the expansion joint should be replaced as soon as possible. Ply separation at the flange O.D. can sometimes be observed and is not a cause for replacement of the expansion joint.

E.2.C. Metal Reinforcement. If the metal reinforcement of an expansion joint is visible through the cover, the expansion joint should be replaced as soon as possible.

E.2.D. Dimensions. Any inspections should verify that the installation is correct that there is no excessive misalignment between the flanges and that the installed face-to-face dimension is correct. Check for over-elongation, over-compression, lateral or angular misalignment. If incorrect installation has caused the expansion joint to fail, adjust the piping and order a new expansion joint to fit the existing installation.

E.2.E. Rubber Deterioration. If the joint feels soft or gummy, plan to replace the expansion joint as soon as possible.

E.2.F. Leakage. If leakage or weeping is occurring from any surface of the expansion joint, except where flanges meet, replace the joint immediately. If leakage occurs between the mating flange and expansion joint flange, tighten all bolts. If this is not successful, turn off the system pressure, loosen all flange bolts and then re-tighten bolts in stages by alternating around the flange. Make sure there are washers under the bolt heads, particularly at the split in the retaining rings. Remove the expansion joint and inspect both rubber flanges and pipe mating flange faces for damage and surface condition. Repair or replace as required. Also, make sure the expansion joint is not over-elongated as this can tend to pull the joint flange away from the mating flange resulting in leakage. If leakage persists, consult the manufacturer for additional recommendations.

CHAPTER IV - Installation and Maintenance

INTRODUCTION:

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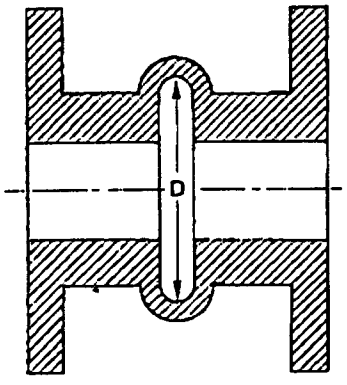

$$T = \frac{\pi}{4} (D)^2 (P)$$

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A.3. Branch Connection Anchors. Figure 5B is another illustration of the proper anchoring that should be provided in a line with a branch connection. The anchor shown at the tee and elbow connections must be designed to withstand both the thrust and any other forces imposed on the system at these points. Again emphasis is placed on the relative location of the joints, their anchoring points and the pipe guides.

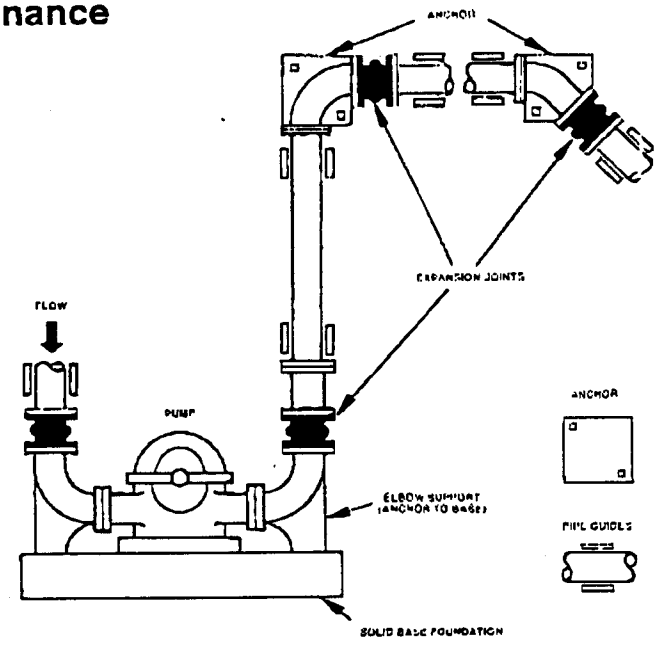

Figure 5A: Typical Piping Layout Utilizing Expansion Joints When Equipment And Piping Are Properly Anchored

B. CONTROL UNITS:

B.1. Definition and Purpose. A control unit assembly is a system of two or more control rods (tie rods) placed across an expansion joint from flange to flange to minimize possible damage to the expansion joint caused by excessive motion of the pipeline. This excessive motion could be caused by the failure of an anchor or some other piece of equipment in the pipeline. Figure 6 shows the proper assembly of an expansion joint with control unit details. The control rod assemblies are set at the maximum allowable expansion and/or contraction of the joint and will absorb the static pressure thrust developed at the expansion joint. When used in this manner, they are an additional safety factor, minimizing possible failure of the expansion joint and possible damage to the equipment. Control units will adequately protect the joints, but the user should be sure that pipe flange strength is sufficient to withstand total force that will be encountered. **The term "Control Unit" is synonymous with the term "Tie Rod" as defined by the standards of the Expansion Joint Manufacturer's Association (EJMA).**

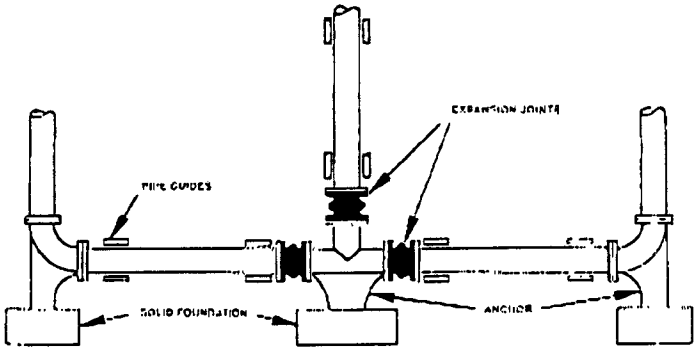

Figure 5B: Typical Piping Layout Utilizing Expansion Joints And The Proper Use Of Anchors In Branch Locations

B.2. Use in Restraining the Piping System. Control units may be required to limit both extension and compression movements.

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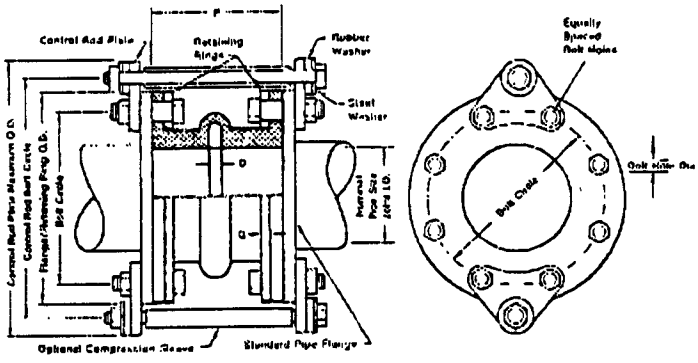
Figure 6: Expansion Joint With Assembly/Installation Of Control Unit Components



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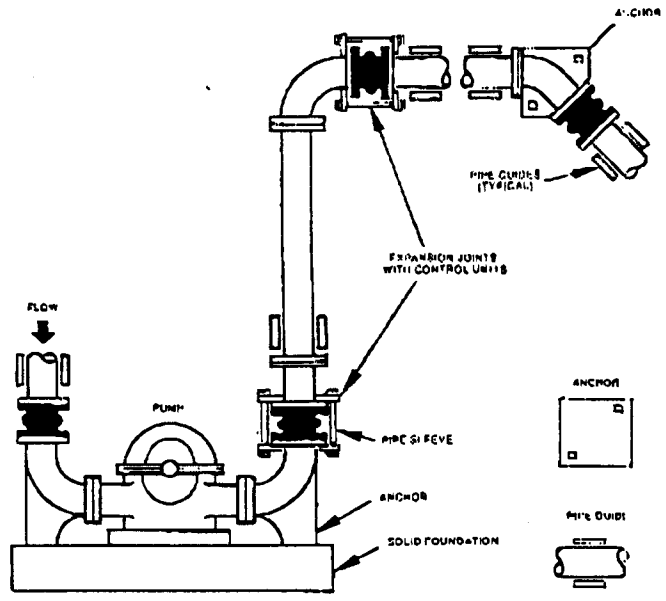
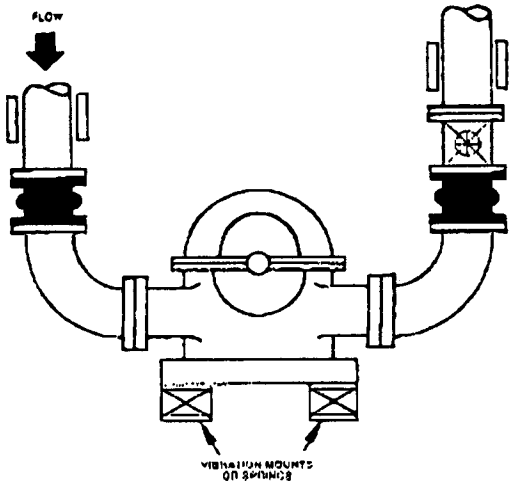


Figure 5C: Typical Piping Layout Showing The Use Of Control Units With The Expansion Joints When Proper System Anchoring Is Limited

C. OTHER INSTALLATIONS:

C.1. Vibration Mounts Under Foundation. Figure 5D shows a very common pump installation. Instead of being mounted on a solid foundation, the pump is supported off the floor on vibration mounts. There is nothing wrong with this type of installation. The supplier of the vibration mounts should be made aware of the fact that these mounts must be designed not only to support the weight of the pump, its motor and base, but must also absorb the vertical thrust that will occur in both the suction and discharge lines. To calculate thrust see Chapter IV, Section A.2. It should also be noted that the thrust in the respective pipelines will exert a force on the inlet and outlet flanges of the pump, and the pump manufacturer should be contacted to determine whether or not the pump casing is strong enough to withstand this force. If this is not done, it is very possible that this force can be large enough to crack the connecting flanges.



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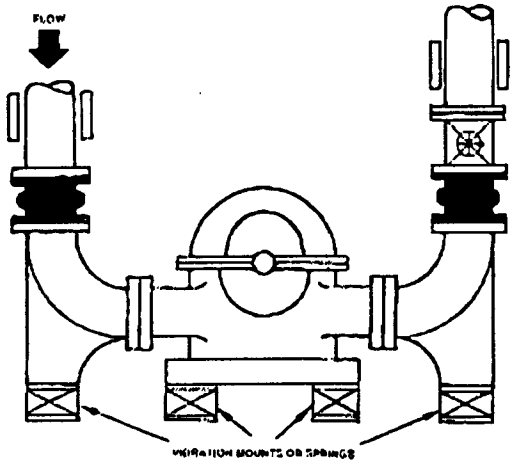
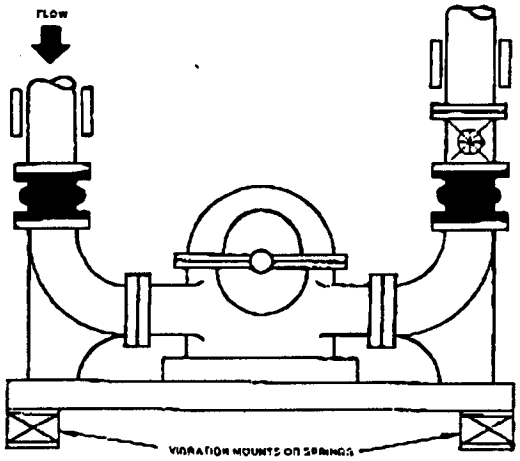


Figure 5F: Use Of A Secondary Unit Base For Pump And Piping



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D.3. Anchoring. Solid anchoring is required wherever the pipeline changes direction, and expansion joints should be located as close as possible to anchor points. If anchors are not used, the pressure thrust may cause excessive movements and damage the expansion joints. **See Chapter IV, Section A & B for Anchoring, Guiding and Control Rods.**

D.4. Pipe Support. Piping must be supported so expansion joints do not carry any pipe weight.

D.5. Mating Flanges. Install the expansion joint against the mating pipe flanges and install bolts so that the bolt head and washer are against the retaining rings. If washers are not used, flange leakage can result - particularly at the split in the retaining rings. Flange-to-flange dimensions of the expansion joint must match the breech type opening. Make sure the mating flanges are clean and flat-face type or no more than 1/16" raised-face type. Never install expansion joints that utilize split retaining rings next to wafer-type check or butterfly valves. Serious damage can result to a rubber joint of this type unless installed against full face flanges.

D.6. Tightening Bolts. Tighten bolts in stages by alternating around the flange. If the joint has integral fabric and rubber flanges, the bolts should be tight enough to make the rubber flange O.D. bulge between the retaining rings and the mating flange. Torque bolts sufficiently to assure leak-free operation at hydrostatic test pressure. Bolt torquing values are available from most manufacturers. If the joint has metal flanges, tighten bolts only enough to achieve a seal and never tighten to the point that there is metal-to-metal contact between the joint flange and the mating flange.

D.7. Storage. Ideal storage is a warehouse with a relatively dry, cool location. Store flange face down on a pallet or wooden platform. Do not store other heavy items on top of an expansion joint. Ten year shelf-life can be expected with ideal conditions. If storage must be outdoors joints should be placed on wooden platforms and should not be in contact with the ground. Cover with a tarpaulin.

D.8. Large Joint Handling. Do not lift with ropes or bars through the bolt holes. If lifting through the bore, use padding or a saddle to distribute the weight. Make sure cables or forklift tines do not contact the rubber. Do not let expansion joints sit vertically on the edges of the flanges for any period of time.

D.9. Additional Tips.

D.9.A. Do not insulate over a non-metallic expansion joint; however, if insulation is required, it should be made removable to permit easy access to the flanges. This facilitates periodic inspection of the tightness of the joint bolting.

D.9.B. It is acceptable (but not necessary) to lubricate the expansion joint flanges with a thin film of graphite dispersed in glycerin or water to ease disassembly at a later time.

D.9.C. Do not weld in the near vicinity of a non-metallic joint.

D.9.D. If expansion joints are to be installed underground or will be submerged in water, contact manufacturer for specific recommendations.

D.9.E. If the expansion joint will be installed outdoors, make sure the cover material will withstand ozone, sunlight, etc. Materials such as Neoprene and Chlorobutyl are recommended. Materials painted with weather-resistant paint will give additional ozone and sunlight protection.

D.9.F. Check the tightness of leak-free flanges two or three weeks after installation and re-tighten if necessary.

> ***WARNING:*** *Expansion joints may operate in pipelines or equipment carrying fluids and/or gases at elevated temperatures and pressures and may transport hazardous materials. Precautions should be taken to protect personnel in the event of leakage or splash.* ***See Chapter II, Section P.*** *Rubber joints should not be installed in inaccessible areas where inspection is impossible. Make sure proper drainage is available in the event of leakage when operating personnel are not available.*

D.10. Control Rod Installation. Also see Chapter II, O.2. Control Unit Assemblies.

D.10.A. Assemble expansion joint between pipe flanges to the manufactured face-to-face length of the expansion joint. Include the retaining rings furnished with the expansion joint.

D.10.B. Assemble control rod plates behind pipe flanges as shown. Flange bolts through the control rod plate must be longer to accommodate the plate. Control rod plates should be equally spaced around the flange. Depending upon the size and pressure rating of the system, 2, 3 or more control rods may be required.

D.10.C. Insert control rods through top plate holes. Steel washers are to be positioned at the outer plate surface. An optional rubber washer is positioned between the steel washer and the outer plate surface. **(See Figure 6.)**

D.10.D. If a single nut per unit is furnished, position this nut so that there is a gap between the nut and the steel washer. This gap is equal to the joint's maximum extension (commencing with the nominal face-to-face length). To lock this nut in position, either "stake" the thread in two places or tack weld the nut to the rod. If two jam nuts are furnished for each unit, tighten the two nuts together, so as to achieve a "jamming" effect to prevent loosening. **Note: Consult the manufacturer if there is any question as to the rated compression and elongation. These two dimensions are critical in setting the nuts and sizing the compression pipe sleeves.**

D.10.E. If there is a requirement for compression pipe sleeves, ordinary pipe may be used and sized in length to allow the joint to be compressed to its normal limit. **(See Figure 6.)**

D.10.F. For reducer installations, it is recommended that all control rod installations be parallel to the piping.

D.11. Location. The expansion joint should always be installed in an accessible location to allow for future inspection or replacement.

E. INSPECTION PROCEDURE FOR EXPANSION JOINTS IN SERVICE:

The following guide is intended to assist in determining if an expansion joint should be replaced or repaired after extended service.

E.1. Replacement Criteria. If an expansion joint is in a critical service condition and is five or more years old, consideration should be given to maintaining a spare or replacing the unit at a scheduled outage. If the service is not of a critical nature, observe the expansion joint on a regular basis and plan to replace after 10 years service. Applications vary and life can be as long as 30 years in some cases.

E.2. Procedures.

E.2.A. Cracking. Cracking, checking or crazing may not be serious if only the outer cover is involved and the fabric is not exposed. If necessary, repair on site with rubber cement where cracks are minor. Cracking where the fabric is exposed and torn indicates the expansion joint should be replaced. Such cracking is usually the result of excess extension, angular or lateral movements. Such cracking is identified by: (1) a flattening of the arch, (2) cracks at the base of the arch, and/or (3) cracks at the base of the flange. To avoid future problems, replacement expansion joints should be ordered with control rod units.

E.2.B. Blisters, Deformation, Ply Separation. Some blisters or deformations, when on the external portions of an expansion joint, may not affect the proper performance of the expansion joint. These blisters or deformations are cosmetic in nature and do not require repair. If major blisters, deformations and/or ply separations exist in the tube, the expansion joint should be replaced as soon as possible. Ply separation at the flange O.D. can sometimes be observed and is not a cause for replacement of the expansion joint.

E.2.C. Metal Reinforcement. If the metal reinforcement of an expansion joint is visible through the cover, the expansion joint should be replaced as soon as possible.

E.2.D. Dimensions. Any inspections should verify that the installation is correct that there is no excessive misalignment between the flanges and that the installed face-to-face dimension is correct. Check for over-elongation, over-compression, lateral or angular misalignment. If incorrect installation has caused the expansion joint to fail, adjust the piping and order a new expansion joint to fit the existing installation.

E.2.E. Rubber Deterioration. If the joint feels soft or gummy, plan to replace the expansion joint as soon as possible.

E.2.F. Leakage. If leakage or weeping is occurring from any surface of the expansion joint, except where flanges meet, replace the joint immediately. If leakage occurs between the mating flange and expansion joint flange, tighten all bolts. If this is not successful, turn off the system pressure, loosen all flange bolts and then re-tighten bolts in stages by alternating around the flange. Make sure there are washers under the bolt heads, particularly at the split in the retaining rings. Remove the expansion joint and inspect both rubber flanges and pipe mating flange faces for damage and surface condition. Repair or replace as required. Also, make sure the expansion joint is not over-elongated as this can tend to pull the joint flange away from the mating flange resulting in leakage. If leakage persists, consult the manufacturer for additional recommendations.