EBAA IRON Connections™
TECHNICAL DATA FOR THE WATER & WASTEWATER PROFESSIONAL

GENERAL INFORMATION FOR THE APPLICATION OF FLEX-TEND® FLEXIBLE EXPANSION JOINTS

INTRODUCTION

Flex-Tend flexible expansion joints have a proven record of providing protection for pipelines subject to subtle or sudden movement. As with all products used in the water and wastewater industry, protection is optimized with the selection of the proper assembly incorporated into a sound design. This paper is intended to provide assistance in both of these areas.

WHERE AND WHY

Flex-Tend flexible expansion joints, Flex 900 ball joints, and Ex-Tend 200 linear expansion joints are members of a family of products designed to relieve stresses and strains on piping systems. Whenever a pipeline is subject to lateral and or vertical shearing strains, a double ball style Flex-Tend is generally the best choice. These assemblies are able to accommodate direct shearing forces by having a ball joint on each end of an integral expansion joint. Since this is the most often used configuration, it will be the main focus of this bulletin. The most common applications of double ball assemblies are:

1. Shear planes between adjacent structures.
2. Shear planes between structures and soil.
3. Shear planes within the soil itself.

Looking at each of these in closer detail, one can see that the Flex-Tend is not just a west coast "seismic joint" as it is often described. Shear loading between adjacent structures is a potential problem anywhere. Between storage tanks and adjacent valve vaults or adjacent tanks is one example. Between bridge abutments and the bridge deck is another. Structure to structure shear can also be present within a building as in the case of a base isolation design.
Shear forces between structures and soil are present in cases such as pile supported buildings and non-supported piping. This is obviously aggravated by poor or unstable soils. Expansive clay soils adjacent to structures can also create tremendous shear loads with changes in soil moisture content. Storage tanks subject to initial settlement or earthquake induced flexing need to have a means to isolate the structure from the underground piping. Venting structures within landfills is another example of structure to soil shear in which the double ball Flex-Tend has been used.
Shear within the soil is not just a problem along earthquake fault lines. This form of loading is present whenever a pipeline crosses from stable to unstable soils such as swamps, landfills, and dissimilar soils. Transitions between undisturbed soil and areas of fill are also potential planes of shear.
In short, any area where relative displacement can impose undue shear stress on a pipeline is a good place for a double ball Flex-Tend.

PROPER PLACEMENT

The best product, installed in the wrong place, is as good as no Flex-Tend at all.

In keeping with the focus of this paper, we can see that the double ball flexible expansion joint can best do its job when placed as close as practical to the plane of shear. When protection is needed between a structure and the soil the most common plane of high shear potential is at the face of the building or its foundation. Fault crossings and other areas of soil displacement dictate that the Flex-Tend assembly be placed across the shear plane when possible. Remember, the Flex-Tend is designed to withstand the forces involved in both buried and above ground piping movement. Common piping products such as repair type couplings and fittings are not.

PUTTING IT ALL TOGETHER

In order to provide the desired level of protection, the Flex-Tend requires the assistance of the adjacent piping. Under normal circumstances, pipelines are designed as an essentially static structure. When designing for anticipated movement of the line, several additional factors enter the arena.

1. Adjacent piping must be strong enough to transfer loading to the Flex-Tend. Ductile iron pipe, steel pipe, and PVC pressure pipe of a minimum wall thickness equivalent to that of DR 18 are acceptable. Cast iron pressure pipe, cast soil pipe, drain-waste-vent (DWV) PVC and polyethylene pipe are examples of materials that may not have the strength to

withstand the forces of movement.

2. The joints of the adjacent piping must be restrained. Deflection of the ball portion of the Flex-Tend assembly is typically accompanied by axial motion. With this in mind, one can see that it is necessary to restrain adjacent pipe and fitting joints to prevent separation of the line at these locations. The Flex-Tend assembly is self restrained to prevent pull out past full expansion and is provided with the appropriate restraint device when a mechanical joint connection is specified. Contact EBAA for assistance in selecting the restraint products needed to complete the system.

3. Axial expansion forces must be accommodated. The Flex-Tend, like any other joint capable of expansion, attempts to expand when pressurized. This force is the product of the pressure and the area of the expansion joint. When incorporated into a piping system, thrust blocking or other means may be needed to isolate this force from the remaining system. In some instances, it may be desirable to provide temporary rodding of the Flex-Tend assembly during high pressure testing of the line. Obviously, this temporary restraint must be roved after the test when the line is put into service at an operating pressure presumably lower than the test pressure.

4. Pipe supports and hangers must not impede the movement of the Flex-Tend assembly. In most applications, the flexible expansion joint is acting to isolate relative movements. As such, each end of the unit must be supported independently. Again, let the Flex-Tend act as a point of isolation and don't let surrounding structures or supports interfere in its function.

5. Above ground applications such as lines crossing a bridge are of particular concern. The design must accommodate the thrust force described above as well as provide proper support of the piping. Thermal movement, lateral movement, and in some applications seismic induced motion must be considered. Hangers and supports must act not only as guides but must also be designed to prevent excessive lateral or vertical movement of the pipe joints. We suggest that the engineer contact associations such as the Ductile Iron Pipe Research Association or Uni-Bell PVC Pipe Association as well as pipe hanger manufacturers for specific recommendations and assistance.

FURTHER CONSIDERATIONS

The material of the adjacent piping often dictates the selection of end connections for the Flex-Tend. Flange ends are most commonly used with steel piping where the pipe can be cut at the desired location and a weld on flange is then attached. The assembly is simply bolted to the mating flange. Ductile iron and PVC pipe are easily connected to using the standardized mechanical joint and suitable restraint as mentioned above. Both mechanical joint and flanged ends are commonly available on the Flex-Tend. We can easily provide a unit having a flange on one end and a mechanical joint on the other.

Other end configurations are available on most of the sizes and assemblies for a nominal set up and machining fee. These include grooved joints, special classes of flanges (other than the standard class 150), and restrained plain ends. Please contact EBAA for pricing and availability of these configurations.

The question of electrical insulation or continuity has often pesented itself. Insulation of the Flex-Tend unit from the remaining piping is easily accomplished by simply using insulating spools on the end connection bolts. With its coating of 15 mils of fusion bonded epoxy, having a dielectric strength of 1000 volts per mil, no additional insulation such as phenolic gaskets is necessary. Bonding jumpers for electrical continuity can be applied either in the field or at the time of assembly.

SPECIAL CONFIGURATIONS

Although this paper has concentrated on the double ball Flex-Tend keep in mind that the components used in assembly can be mixed and matched in numerous combinations. If a special need should arise, feel free to call and discuss it with the engineering staff at EBAA. We may not be able to accommodate every need but we are willing to try.

SUMMARY

Flex-Tend flexible expansion joints offer engineers a strong and compact system to provide movement in many pipelines. Shear stress, bending moments, and axial strain can be relieved with the proper unit installed in the proper location. Feel free to contact EBAA for further assistance in your particular application.

REFERENCES

ASCE, Pipeline Crossings, American Society of Civil Engineers, New York, NY, 1991

