



Thermal Expansion of FRP Composite Pipe When Encased in Concrete

The embedment or encasement of **filament wound** FRP composite pipe in concrete is a non-design issue for small diameter pipe. The exterior winding pattern on the outside of filament wound pipe serves as a multitude of locking ridges between the encasing concrete and the FRP composite pipe. Thus, the FRP composite pipe becomes a monolithic structure with the concrete.

As long as the FRP pipe is made with a resin matrix that has a higher tensile elongation than the concrete, the thermal expansion and contraction forces of the FRP pipe are effectively transmitted to the concrete. The thermal expansion and contraction of the concrete becomes the controlling design.

The monolithic function probably applies for all filament wound FRP composite pipe 20" in diameter and smaller. With the many mechanical locking "ribs" per axial inch on the outside of the filament wound pipe the smaller diameter FRP pipe almost acts like FRP reinforcing bars. In the case of the FRP pipe, since it is corrosion resistant - there also are no corrosion products forming at the interface between the concrete and the FRP composite laminates.

This same mechanical "locking" phenomenon does not exist for centrifugally cast FRP composite pipe, and all thermoplastic plastic extruded pipe; because of their smooth exteriors, and the use of internal mold releases. (These mold releases eventually migrate to the interface between the concrete and the pipe).

The mechanical locking between the pipe and the concrete also does not occur with metallic pipe such as carbon steel, stainless steel, ductile iron, aluminum, etc. FRP composite pipe does not require cathodic protection.

The interface where FRP composite pipe enters and exits the concrete encasement should include provisions to allow piping flexibility. The use of an elastomeric material at this interface, along with means to limit the pipe in distortion, should be addressed by the engineer of the piping system.

In summary: When **filament wound** FRP composite pipe is embedded or encased in poured concrete structures, no special design considerations need to be given to the differences in thermal expansion and contraction between the two materials.