

## Clock Spring® Crack Arrestor

Clock Spring® refers to a family of related fiber glass-and-resin matrix products developed by NCF Industries Inc. under a contract with the Gas Research Institute (GRI). It is used to repair blunt defects in pipes or arrest ductile fractures in high-pressure gas pipelines. The system operates by transferring the hoop stress from the defect, through high compressive strength filler material to the composite sleeve (Clock Spring®) wrapped around, and bonded to the pipe. As a crack arrestor, the composite absorbs the energy of the fracture arresting the crack.

The composite is e-glass and polyester resin. All the e-glass fibers are continuous strands aligned in the hoop direction providing a tensile strength of 80,000 psi. The resin in the composite protects the glass strands and provides the shape memory that aids in installation.

There is no need for welding or cutting the pipeline, increasing safety and eliminating environmental risk and release of greenhouse gases.

Clock Spring® is shown in Figure 1. It consists of unidirectional glass embedded in a polyester resin. The final installation will consist of 12 wraps for a repair and 2-12 wrap units placed side-by-side, for arresting cracks.



A typical composite sleeve installation consists of three parts;

1. a composite structure of unidirectional glass fibers and a polymer base
2. an adhesive system
3. a high compressive strength load transferring compound.

The Crack Arrestor can be wrapped around new or existing steel pipelines at specified intervals, without cutting the pipe or removing it from service. The strength of the glass fiber and memory of the composite combine to provide the barrier needed to stop the explosive propagation of cracks, limiting repair costs and the potential for damage. In most applications, two units are placed side-by-side to ensure that the crack can be fully arrested.

## CRACK ARRESTOR INSTALLATION

The ease of installation makes the composite sleeve crack arrestor system effective. These units can be installed on the pipeline without the need to cut the pipe, or for any heavy equipment or skilled labor.

A typical installation consists of locating and cleaning the area where the Crack Arrestor will be installed (Figure 2). Filling the voids under the composite sleeve with high compressive strength filler material will transfer the loads from the pipe to the externally applied composite.



Figure 2



Figure 3

With the inner edge of the composite secured to the starter pad the composite can be wrapped and tightened onto the pipe (Figure 3). Two 12-wrap units are used, side-by-side, in crack arrest applications. Excess adhesive and filler will extrude out the edge of the unit ensuring a fully filled, tight fit. The adhesive will cure in about two hours and the installation can be re-coated and backfilled. The entire installation takes less than 45 minutes.