



SCR (Steel Cylinder Reinforcement)



History

Many pipelines currently in operation have become structurally deficient due to corrosion, erosion, or other causes such as:

- Manufacturing defects
- Incorrect installation
- Age

Owners are frequently dependent on these systems and are unable to interrupt service. As a result, the owner is often forced to reduce the operating pressure as a short term remedy until the system can be repaired or replaced.



Risk



- Growth of our cities is encroaching on these same high risk pipelines with schools, highways & structures in close proximity.
- Many pipelines located in active seismic conditions are also at risk.
- New technologies provide great information about pipeline condition but even knowing a pipeline is in jeopardy the owner may not be able to repair or replace the section when the system's continuous operation is crucial to their demand.

These conditions dictate a need for added protection to avert potentially catastrophic results



Interior Repair Methods



There are several “trenchless” systems developed for structural repair of pipelines. However, these systems generally require an extended shutdown and dewatering. The owner should also carefully consider the history of the system to assure it will result in a cost effective service life. Common systems include:

- Steel tunnel liners
- Laminated Carbon Fiber Reinforced Plastics



Exterior Repair Methods



Common external repair methods include:

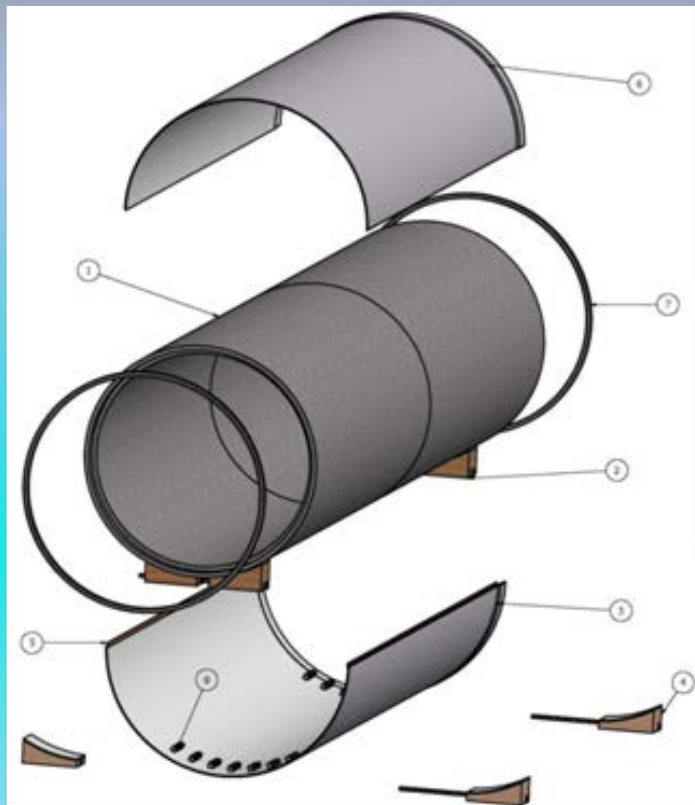
- 1) External reinforcing bars
- 2) Reinforced Concrete Encasement
- 3) Carbon Fiber Reinforced Plastics

These repair methods have varying degrees of success but do not share the history or predictable longevity of the steel pipe or SCR. The SCR longevity is further enhanced by its easy adaptability to corrosion monitoring and cathodic protection.



SCR (Steel Cylinder Reinforcement)

For Pipeline Repair or Upgrades



Patent Pending (SCR) Steel Cylinder Reinforcement system to reinforce existing pipelines

Steel Cylinder Reinforcement (SCR)		
Parts List		
ITEM	QTY	DESCRIPTION
1	1	EXISTING (HOST) PIPELINE
2	4	SUPPORT BLOCKS, HOST PIPELINE
3	1	SCR BOTTOM HALF
4	4	SUPPORT BLOCKS, SCR BOTTOM
5	2	LONG SEAM BACKING BAR
6	1	SCR TOP HALF
7	2	SCR SEAL RING
8	VARIES	ANNULAR SPACER BLOCKS



Steel Pipe is a Known Quantity

The use of steel pipelines dates back to 1858 and has proven to be a very reliable product. The SCR shapes and contours are easily fabricated and have very few limitations relative to diameter or wall thickness which allows the designer to provide an economical system best suited to their project needs.





SCR Installation Sequence

Illustrated by a full scale demonstration

1) Clean host pipe, support and install shrink sleeves at seal locations



2) Install annular spacer blocks to provide minimal spacing then bottom half of pipe section



3) Install spacer blocks then top half of pipe section





SCR Installation Continued

4) Weld two longitudinal seams to create a flexible cylinder enclosure



5) Install temporary seals at each end of enclosure



6) Insert seal retaining rings





SCR Installation Continued



7) Install retaining bars



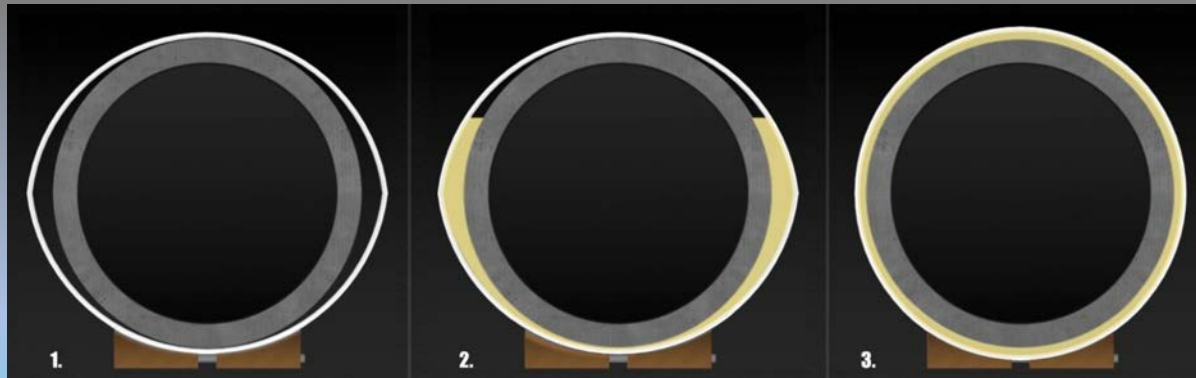
8) Fill annular space with nonshrink grout, vent air then pressurize until initial set. This will maintain rounding of the SCR cylinder.



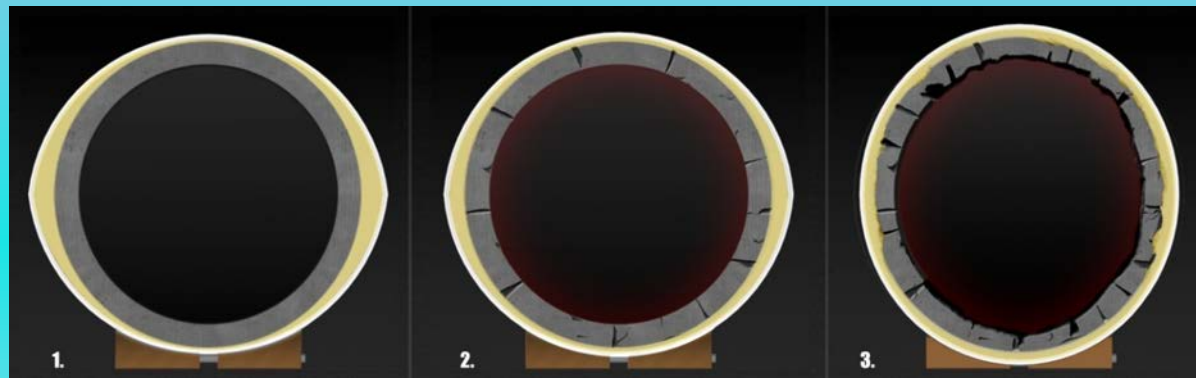
9) Remove seals and install a subsequent SCR



Pressurized Grout and Seals



This exaggerated view demonstrates that our pressurized grout and seals round and maintain cylinder roundness.



Without pressurization the steel cylinder would ultimately be forced to round after the host pipe structure fails, which would cause nonsymmetrical loading to the cylinder.



SCR Components



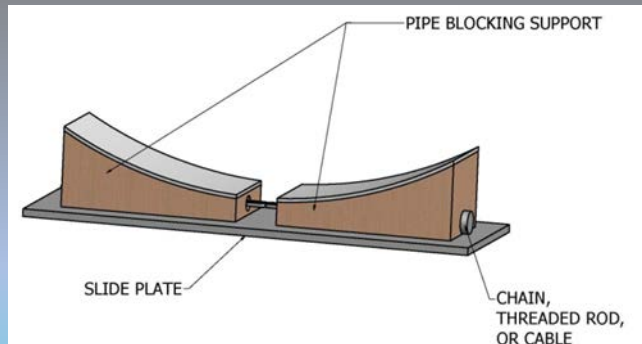
The temporary components are specifically designed to allow for this rounding.

Rounding of the enclosure is very important in order to optimize/minimize the required cylinder thickness and assure the host pipe stresses are transferred symmetrically to the new enclosure.

This is what separates SCR from a pipe casing.



Pipe Support



Pipe supports are a critical component to this application. The SCR system incorporates a custom designed support system intended for the heavy loads of an operating pipeline. The supports perform the following:

- 1) Transfer the loads to the pipe foundation
- 2) Supports can be hydraulic or mechanical operated
- 3) Detachable block connectors can be removed after an adequate amount of backfill has been placed.
- 4) System simplifies transferring the support to subsequent sections



SCR Terminations

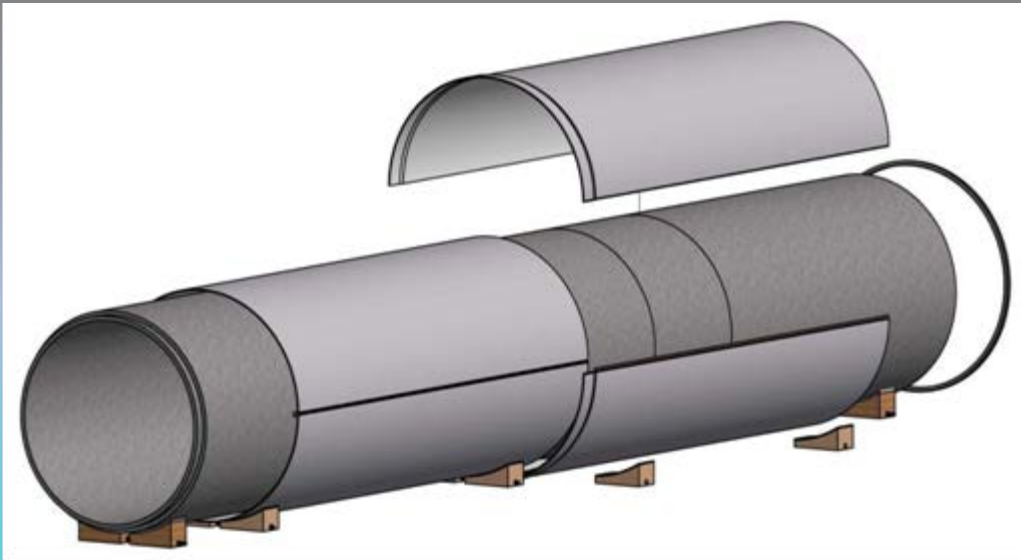


Terminations are performed by one of two methods:

- 1) Assuming the host pipe is water tight then utilize a shrink sleeve which transitions from the SCR to the host pipe. The cavity created by the sleeve will be filled by the same nonshrink grout.
- 2) Connect to a host pipe joint by welding



SCR Multiple Cylinder Application



SCR details and options:

- 1) Can utilize single 5' to 20' sections and incorporate welded lap joints for a continuous sealed reinforcement to a pipeline.
- 2) Lap joints would extend over the preceding plain/spigot end as described by American Water Works Association (AWWA) Standards.
- 3) Butt welded joints may also be used.
- 4) Subsequent cylinders will only require a seal at one end to facilitate pressure grouting and rounding.



Engineering Considerations

- 1) Cylinders should arrive on site with a hold back and approved protective coating. Hold back surfaces should be field patched with a compatible coating.
- 2) The annular grout should have an alkalinity exceeding PH 11 to provide passivation of the steel.
- 3) The designer should carefully evaluate the condition of the existing pipeline prior to installing this system.
- 4) The deteriorated host pipeline may not be stable after excavation while under operation.
- 5) The pressurized grout process will exert external loading on the host pipeline. This may require the host pipeline to remain under operating pressure.
- 6) The SCR can be fabricated to custom diameters and does not have a specific size limitation. Although the designer should verify the annular space is large enough to accommodate pipe irregularity and alignment issues.



Conclusion



The SCR system provides a means for a permanent external structural **reinforcement** to existing pipelines of all material types. The system can provide this **repair** while potentially avoiding a system outage. SCR provides a great **remedy** when host pipe deficiencies are intermittent in nature. In addition, the exterior coating combined with the ease to incorporate cathodic protection adds further **dependability**.

SCR, A REHABILITATION SOLUTION



Questions?

