



The following report is a pictorial and text account of procedures and operational techniques employed for a Storage Terminal, 42" Suction Line Repair utilising the Clock Spring repair system.

### PIPE PREPARATION



This shows the extent of the corrosion and condition of the "coal tar" coating on the pipe immediately after excavation.

Once the coating was removed another layer of corrosion scale needed to be removed.

As can clearly be seen the corrosion is extensive, this coupled with the "coal tar" coating made preliminary cleaning extremely difficult.

This area is indicative of the underground pipe section, where the coating had failed large areas of severe corrosion were located.



As is evident the corrosion had taken place due to failure of the coating the subsequent moisture ingress, entrapment and the consequential galvanic action.



**PREPARATION OF PIPE cont...**



In order to have an accurate preliminary NDT inspection all coating and corrosion scale was removed manually using hand tools. This avoided any further damage to the pipe until an accurate measurement of the remaining wall thicknesses could be ascertained.

Having carefully and gradually removed the scale and coating the underlying steel was exposed thus enabling the NDT inspection to take place.



With the preliminary areas of the pipe surface cleaned it was possible to NDT the worst areas of the pipe and to obtain clearance for power tools to be used to prepare the remaining pipe for the Clock Spring repair application.



**NDT INSPECTION**



This shows the NDT inspection process taking place.

External corrosion defects of up to 80% metal loss were identified.

With the NDT inspection completed and all parties concerned were satisfied the use of mechanical devices would cause no further penetration/perforation of the remaining wall thickness the work to prepare the complete pipe section for the Clock Spring repair installation could commence.





**PREPARATION OF PIPE - mechanical cleaning**



Here 2 pneumatic de-scaling guns are used in tandem with 3 x 7" grinding machines fitted with wire wheels, because of the electrical supply only three machines could operate at one time.

The surface was partially prepared to a NACE 3 standard.

After preparation with both hand and mechanical tools, a section of the pipe was cleaned to a NACE 3 standard. This process was long and arduous and required different techniques and tooling combinations to be utilised.

The cleaning of the pipe exposed the extent of the pitting and corrosion.





**PREPARATION OF PIPE - corrosion observations**



As can clearly be seen the pitting and general corrosion is extensive, all areas were cleaned at first by hand tools then by pneumatic de-scaling guns and finally grinding machines fitted with wire wheels.



More examples of the extent of corrosion and deep pitting, the vast majority of the severely corroded pipe had previously been buried in the concrete bund wall.



**PREPARATION OF PIPE – (Sand-blasting)**

Due to the surface extent of the corrosion and remaining length of the pipeline to be repaired it was decided in this instance to revert to sand-blasting for the remaining pipe section length.



Blasting crew in operation. This operation was by far the most expedient.

Here again the blasting crew on the pipe, notice the 8 Clock Spring wraps and 4 moulds already installed.





**CLOCK SPRING INSTALLATION**

Once the pipe had been prepared to an acceptable standard the Clock Spring system could be installed.

**Filling and Molding**



Due to the severe extent of the corrosion it was necessary to mold the Clock Spring filler to bring the surface of the pipe back to its original outer diameter.

**Stage 1:** Apply filler compound around the pipe in an even and uniform layer.



**Stage 2:** The filler is held within a 42" mold and secured with tensioning straps. This ensures the filler is equally distributed around the pipe and "fills" the corrosion pits.

As is visible here all surplus filler is extruded from the mold leaving a uniform surface for the Clock Spring installation.



**Stage 3:** After the filler compound has cured (30 minutes) the tensioning straps and mold can be removed.

The area is now ready for the Clock Spring coil to be installed.



**Filling and Molding cont...**



This shows the filler extruded from the sides of the mold.

This shows a girth weld being bridged, two Clock Springs are installed either side of the weld and the gap between them then filled with the filler. After this a Clock Spring wrap will "bridge" over the joint.



The cut for the coil to bridge the weld is made onsite using a Diamond cutting disc.





**Filling and Molding cont...**



These photographs show the application of more areas of filler both for the corrosion and around the pipes longitudinal weld seam.

This procedure is carried out on all longitudinal and spiral weld seams to avoid any gap and tenting underneath the coil when it is tightened over the weld seam.



Due to the severe circumferential extent of the corrosion in some areas it was necessary to apply filler to almost three quarters of the overall pipe circumference.



**CLOCK SPRING INSTALLATION**

**Clock Spring installation process**



Prior to the Clock Spring installation the surface of the pipe was finally cleaned with a solvent wipe. This process removes any grease or other forms of contamination which may have occurred during the blasting process.



After application of the filler the Clock Spring starter pad is applied. Due to the pipe diameter and clearance around and underneath the pipe the spool feeder installation method was used in this instance.



**CLOCK SPRING INSTALLATION**

**Clock Spring installation process cont...**



Installation of Clock Spring using the spool feed method.

Once the coil has been wound around the pipe and adhesive applied to the complete surface area of the coil, the sleeve is then slid and placed over the filler and onto the starter pad.



The coil is then tightened using the cinch bar to extrude all excess filler and adhesive and to ensure all voids are completely filled.



**CLOCK SPRING INSTALLATION**

**Cleaning and Coating**



The coil is then held in place with filament tape and allowed to cure (up to 2 hours). During this time all excess filler and adhesive is removed.

Coils are installed side by side to accommodate the complete repair length and external extent of the corrosion.



The final part of the installation procedure is to apply a suitable corrosion coating over the complete length of the reinforcement.