

CASE STUDY NUMBER:	Case Study 15
DESCRIPTION:	14" ELBOW DIAMOND WRAP WITH STRONGBACK
CLIENT:	TENGIZCHEVROIL

SERVICE:	
Line size	14"
Design Pressure	4
Operating Pressure	1,1
Design Temperature	160
Operating Temperature	120
Material	SA-516 Gr 70N
Line Class	150

ANOMALY DESCRIPTION:

Operations reported a leak of flexorb. The external inspection found the leak through a hole with a diameter less than 1mm on the piping straight section 40mm wide within HAZ of the flange connection attachment weld. The leak was repaired temporarily for short-term period. Ultrasonic thickness test was performed within the leaking area and on the adjacent sections of the piping. Thickness of the damaged straight section was $T = 3.6 \div 4.6\text{mm}$, thickness of the adjacent sections is $T = 8.9 \div 9.6\text{mm}$.

ROOT CAUSES

At current, the damage mechanism is not identified.

INTEGRITY CONCERNS (INCLUDING PICTURES)

Original thickness of the damaged pipe section does not meet requirements of class 150K01 ($T = 7.92\text{mm}$). It is not possible to calculate the corrosion rate because the thickness initial value is uncertain. Due to this piping being below specification further deterioration of piping could cause worsening leaks and ultimately failure

Operations of the piping with these non-conformities is not allowed

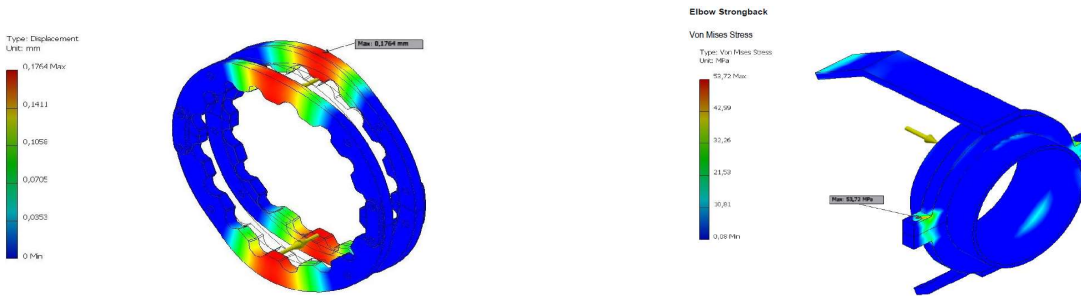


THE BERUSEAL SOLUTION (WITH PICTURES)

By Using a patch and strap the leak through the hole could temporarily be stopped to enable Beruseal to do a carbon fibre Composite repair to rebuild wall thickness and stop the leak (Diamond wrap can not be applied to leaking components unless leaks can be stopped)

Due to the wall loss being concentrated next to the welding, Beruseal designed and manufactured a strongback restraint system that would be able to withstand total circumferential failure of the welding. The strongback was a multi part system that would restrain the elbow together with the complete assembled flange.

An FEA analysis was performed to calculate stresses in the strongback components in the event of failure on the design pressure.



INSTALLATION PICTURES



CONCLUSION

A successful seal of the leak was achieved by the application of the patch to do a diamond wrap composite wrap and with the addition of the restraint system a permanent repair was implemented (20 year life expectancy)