

By Simon Frost, Technical Director  
Walker Technical Resources

## Solving Integrity Management Problems Using Technowrap Composite Repairs

The use of Technowrap composite repairs can provide E& P companies with engineered solutions to integrity management problems related to pipelines, piping systems, and vessels.

**T**echnowrap composite repairs have been in use successfully in oil and gas applications for more than seven years. They have been used in most service conditions including water, hydrocarbon, condensate, and gas transport applications. They have been applied on most plant components including pipework (not only straight section but bends, tees, reducers, etc.), pipelines, pressure vessels, and caissons restoring the damaged component to its original integrity. As an example of application, four illustrations are presented throughout the article highlighting the broad range in applications that Technowrap repairs have been applied.

There are several products within the Technowrap repair system range. All products consist of an E-glass fiber mat reinforcing an Epoxy matrix. The application of the repair is through hand lay-up, i.e. wrapping the reinforcement mat around the damaged area and then working in the resin into that reinforcement. The difference within the Technowrap product range is various fiber reinforcement architectures to optimize the design of the repair against the applied load conditions and component geometry. Also, there are three different Epoxy resin systems allowing flexibility in the application depending on the local environmental conditions. The range in design temperature of Technowrap products is from -20° to 220°C.



Before and after pictures of a 24-inch carbon steel pipeline operating at 60 bar transporting (dry) hydrocarbon gas

In general, all types of defects can be repaired with the exception of cracks. Both internal and external defects (within the pipe substrate) can be repaired. These types of defects include general wall loss corrosion, corrosion pitting, dents, gouges, and through-wall defects. Cracks in most circumstances cannot be repaired. The growth of cracks cannot be prevented by Technowrap composite repairs, primarily as the stiffness of the composite laminate is not sufficient to reduce significantly the stresses acting on the crack tip.

The lifetime of a Technowrap repair is not defined as temporary or permanent, as these terms are too ambiguous. Rather, Technowrap repairs are designed for a pre-defined lifetime determined by the end user.

Technowrap repairs are resistant to most environments common in oil and gas applications. They have excellent resistance to straight chain and cyclic hydrocarbons. As a rough guide pH is a good measure of chemical compatibility. Between a pH of 3 and 10 Technowrap repairs are resistant to most environments. Alcohols and aromatics are the only molecular types that require compatibility consideration for Technowrap repairs. However, in all general statements



Before and after pictures of a 16-inch, 8-inch carbon steel tee which had suffered external corrosion due to corrosion under insulation. The operating conditions were 46 bar with the service medium, hydrocarbon gas.

All figures are courtesy of Walker Technical Resources



Before and after pictures of a 16-inch flare line operating at 7 bar and 2000C which had suffered internal erosion

on compatibility, it must be remembered that chemical resistance is a strong function of both temperature and concentration of the molecular type present.

The design of a Technowrap composite repair answers the following questions;

- Is the repair strong enough in both axial and hoop directions?
- Will the repair remain bonded to the surface?
- Is the extent of repair sufficient to ensure load transfer between repair and substrate?

Each repair design is bespoke depending on the design conditions, the component geometry, and the nature of the defect requiring repair.

For internal defects, the application of a Technowrap repair will not stop the corrosion. Therefore when designing the repair, the growth of the internal defect must be considered, implying that the size of the defect used in the design is that size at the end of the required repair lifetime. Also, internal defects may grow to become through wall and therefore this change in defect type also must be accounted for in the design.

For external defects, the application of a Technowrap repair will prevent further corrosion and the size of the defect at the time of application should be used in the design. It should be noted that the repair acts as a corrosion protection barrier to the underlying steel substrate.

The range of Technowrap products are fully qualified to the relevant standards governing the use of composite repairs, ISO/TS 24817 and ASME PCC-2. The most important aspect of repair system qualification is that the repair, surface preparation procedure, and substrate is the unit that is qualified. A change in any one of these three variables implies that the repair system has changed and therefore the repair system must be re-qualified.

Surface preparation procedure is clearly one of the most important variables in the performance of composite repairs. The same procedure as used in the field must also be used to qualify the repairs. In general, grit blasting is the preferred surface preparation procedure as this produces the best surface profile and cleanliness in terms of adhesion. However, often in the field grit blasting is not practical and therefore the Technowrap range of repair products is also qualified for hand prepared surfaces.

Installation is the most critical step in the application of composite repairs. If the surface preparation and other installation issues are not according to the correct guidance, then the repair will leak or fail no matter how well it has been designed. The following installation guidance is followed for all Technowrap repairs:

- The surface preparation procedure used in the field has been fully qualified through standard qualification procedures.
- A method statement for the installation procedure is always provided prior to application.


- The training requirements of all applicators is to according to ISO/TS 24817.
- Technowrap repairs are always applied by trained, competent applicators.

Technowrap repairs are fully qualified to ISO/TS 24817 and ASME PCC-2, are designed on a bespoke basis and are always installed by trained applicators. Based on this credence of quality in all aspects of application, Technowrap repairs come with a guarantee of performance up to the lifetime of the repair. As demonstration of this quality, Technowrap repairs are the only repair system to gain Lloyds type approval.

As such, the Technowrap repair range of products can be considered as an engineered solution to the repair of damaged or corroded



A repair applied to 2-meter diameter scrubber operating at 60 bar and 80°C

pipework (all components), pipeline, or vessel components. They are designed to return the damaged or defective component to its original design specification, i.e. reinstating its integrity. Through strict adherence to qualification, bespoke design, and quality of installation the Technowrap range of products can provide many solutions to integrity management problems. 

For more information contact the author at [simon.frost@wtr.uk.com](mailto:simon.frost@wtr.uk.com).