

Technowrap composite repairs for the maintenance of piping, pipelines, vessel or structural integrity

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COMPOSITE REPAIR TECHNOLOGY
INTEGRITY & MAINTENANCE SOLUTIONS



Introduction



This presentation will answer the following questions concerning composite repairs;

1. Company introduction
2. What are the details of WTR composite repairs?
3. Where can they be used?
4. Repair process
5. How to design?
6. How to install?
7. Examples of applications



Company profile



- Walker Technical Resources (WTR)
- Head Office located in Aberdeen, Scotland
- WTR have 12 years proven track record
- WTR employ 35 direct staff
- 14 Service Distributors in major Oil & Gas World locations (e.g. Norway, Middle East, Brazil, South Africa, Canada and USA (Technopipe))



Details of WTR composite repairs



WTR composite repairs (Technowrap™) consist of the following combination of materials;

Fibres: Glass or Carbon (various woven cloth architectures)

Resin (matrix): Epoxy (with various hardeners)

Primer: Adhesion promoting layer



Details of WTR composite repairs



Manufacturing/installation - either;

1. Hand applied, wet lay-up system, i.e. the resin is worked into the fibre reinforcement on site then directly applied (commonly used for pipework applications)

or

2. Plates/shells manufactured off site and then bonded onto component on site



Advantages of composite repairs



- No hot work
- Can be applied live
- Corrosion resistant
- Minimal facilities required
- Can repair most defect types and service conditions found in Oil and Gas applications



Where can they be used?



- Components that can be repaired using composite repairs include;
 - piping systems (all components, e.g. bends, tees, clamps, flanges)
 - pipelines
 - vessels (e.g. shells, supports, nozzle attachments)
 - risers/caissons
 - tanks
 - roofs, floors
 - beams
 - support members, struts

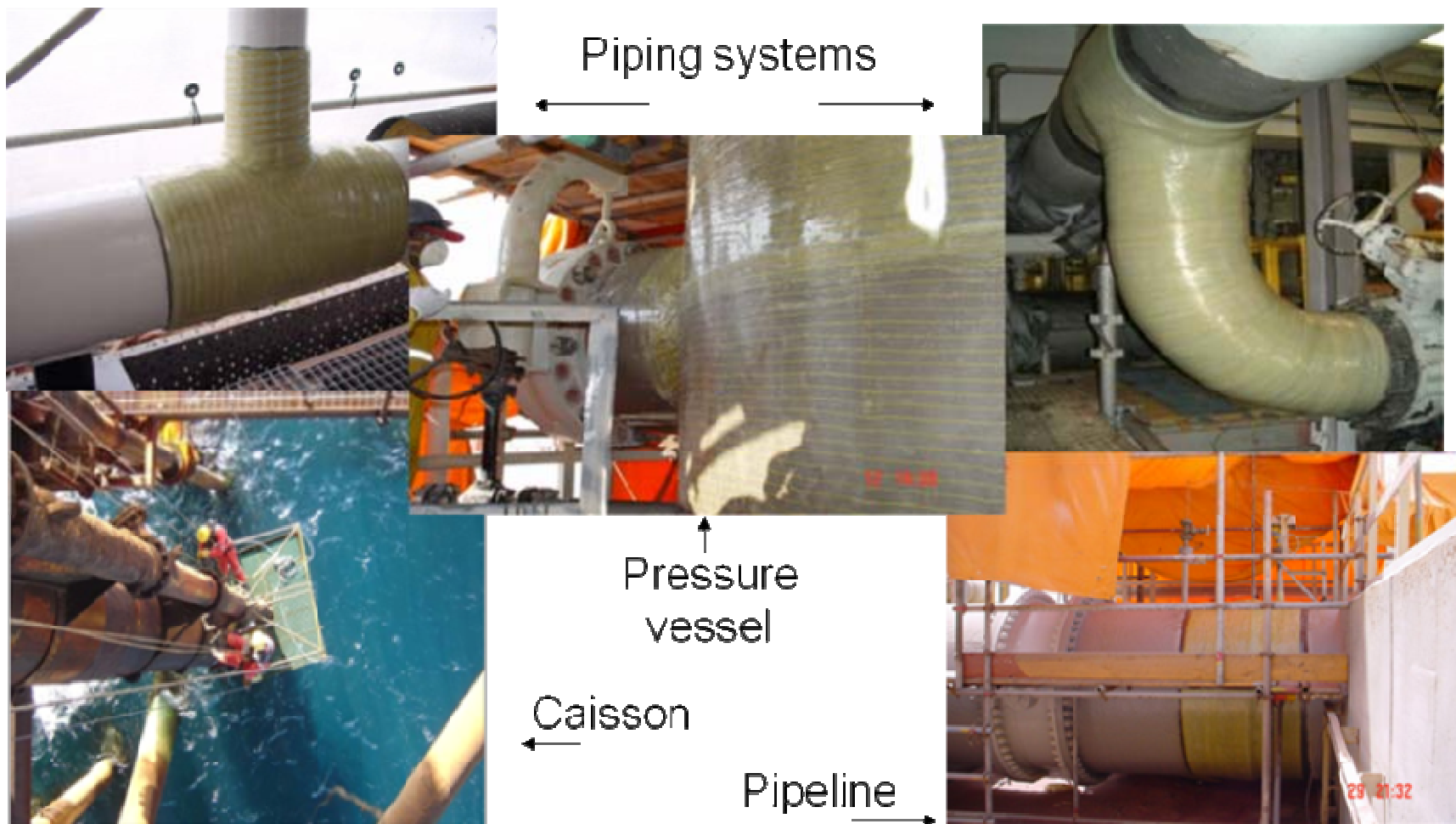


Where can they be used?



- Generic defect types that can be repaired include;
 - internal defects, e.g. corrosion pits
 - external defects, e.g. dents
 - through wall defects, e.g. leaks
- Generic defect types that may be repaired include;
 - cracks (under certain conditions (crack orientation, loads))

Where can they be used?



Where can they be used?

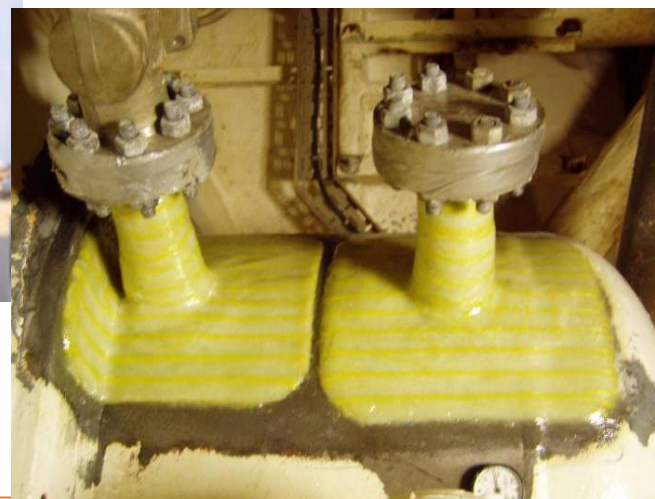


Tanks

Roof



Nozzles





Approach to applying composite repairs



1. Define and assess problem with Client
 - Client completes problem definition form
2. Design repair solution (according to relevant standard)
3. Installation
 - Mobilisation of trained applicators (either WTR staff or trained on-site personnel)
 - Application of repair to WTR QA method statement and procedures
4. Management of repairs
 - Close out report
 - Informing Clients of impending end of life of repair



How to qualify/design repairs?



Design of a composite repair answers the following questions;

- Is the repair strong enough in all loading directions? (strength calculation)
- Will the repair remain bonded to the surface ? (adhesion strength calculations)
- Is the extent of repair sufficient to ensure load transfer between repair and substrate?



Design scenarios



For internal defects and through wall defects, the application of a composite repair will not stop internal corrosion. Therefore need to assume that internal defect will grow through wall during design life

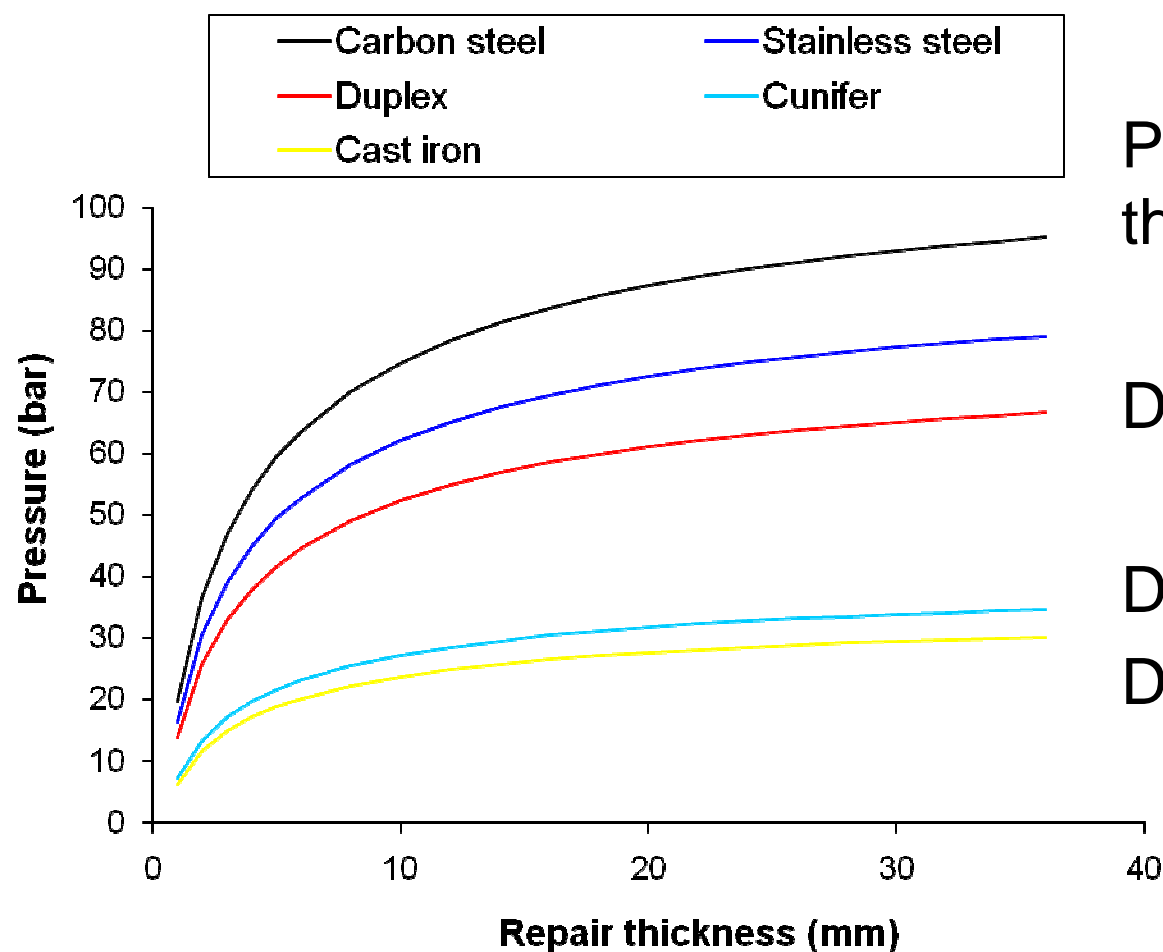
For external defects, the application of a composite repair will prevent further corrosion



Product qualification



- Repair/surface preparation/substrate is the indivisible unit, change any one of these three variables and the repair system must be re-qualified
- Technowrap™ repairs are qualified to surface preparation procedures, Sa2½, ST2 and ST3 – note, pressure containment capacity reduced with ST3 and significantly with ST2



Pressure against repair thickness

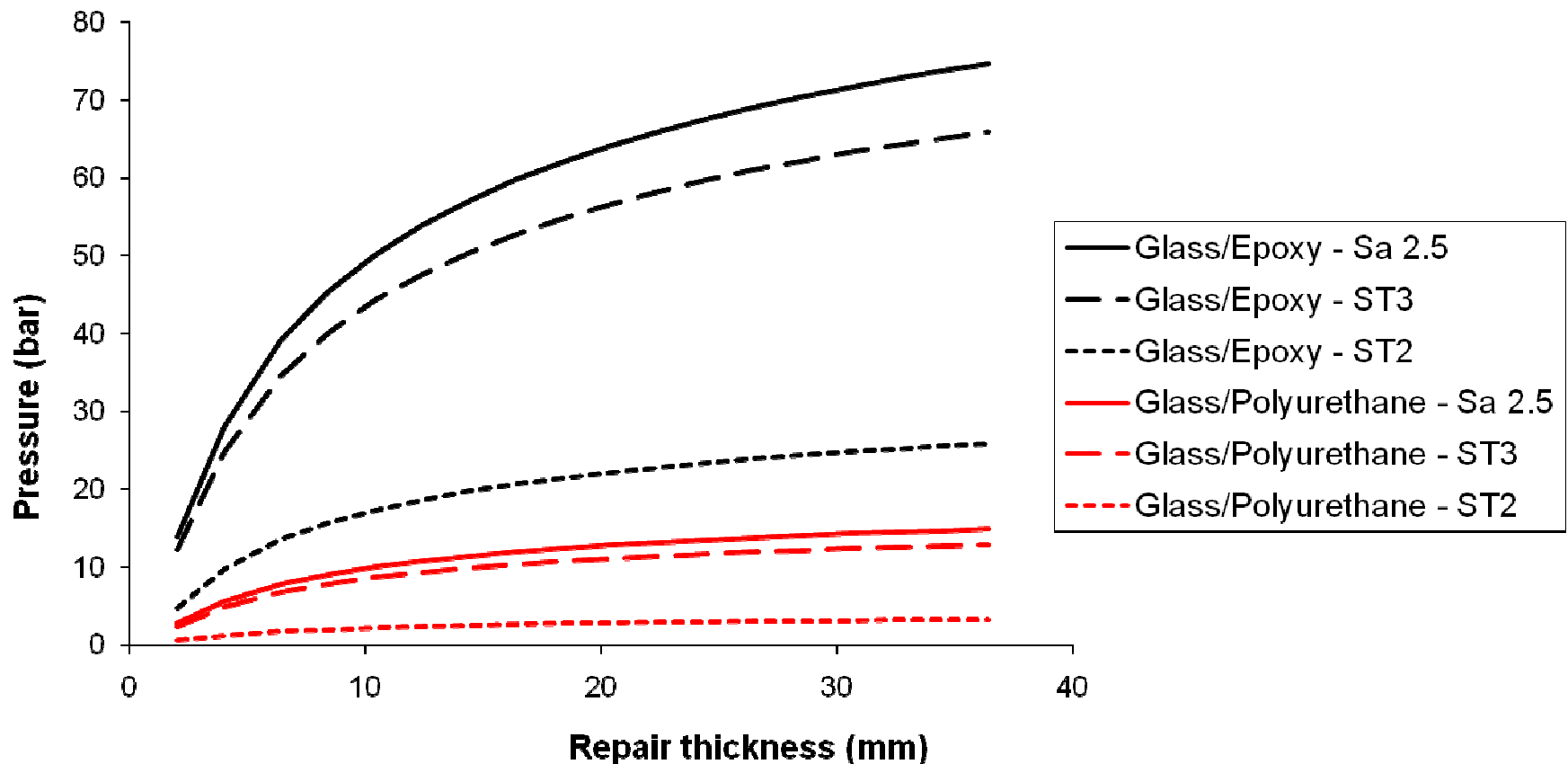
Different substrates

Defect diameter = 10 mm

Design life = 20 years

Effect of repair material and surface preparation procedure

Design pressure against repair thickness for a design lifetime of 20 years and a circular through wall defect of diameter 25 mm.





How to install repairs?



Most critical step in the use of composite repairs

- Get the surface preparation and other installation issues correct, if not, no matter how well designed the repair it will leak or fail!!
- Technowrap™ repairs are always applied by trained, competent applicators
- QA controls are always followed as defined in installation method statement



Product overview



Application	Product	Fibre type	Resin type
Piping, vessels	<u>Technowrap 2K™</u>	Glass (multi-axial woven cloth)	Epoxy
Pipelines	<u>Technowrap PRS™</u>	Glass (uni-axial woven cloth)	Epoxy
HP Pipelines	<u>Technowrap HP PRS™</u>	Carbon (uni-axial woven cloth)	Epoxy
Structures (beams, struts etc.)	<u>Technowrap Structural™</u>	Carbon (multi-axial woven cloth)	Epoxy
Potable water	<u>Technowrap Potable™</u>	Glass (multi-axial woven cloth)	Epoxy
Splashzone (wet surfaces)	<u>Technowrap Splashzone™</u>	Glass (multi-axial woven cloth)	Epoxy
Temporary repairs	<u>Technowrap Core™</u>	Glass (multi-axial woven cloth)	Polyurethane



Technowrap™ performance range



- Temperature range of -75 to 220°C / -103 to 428°F
- Pressure range tested up to 250 bar / 3625 psi
- Guarantee life-time up to 20 years
 - Long lifetimes supported by R and D programmes at Stress Engineering, Gas Technology Institute, Newcastle University, In-house



**Some examples of Technowrap™ applications follow
“highlighting the breadth and scope
of performance”...**



36 inch pipeline repair - PDO



- Service: Technowrap 2K™
- Defect Type: Internal corrosion (6 o'clock) and through-wall
- Pressure/Temp: 24 Bar / 82°C
- Application: 36" oil transport line (150 meters)



Wrapping lifted pipe
Pipe lifting achieved using pneumatic
air bags (either side of support)



Completed repair



Large diameter pipeline



- Service: Technowrap PRS™
- Defect Type: External corrosion
- Pressure/Temp: 15 Bar /50°C
- Application: 42" carbon steel, crude oil





Leak sealing application



- Service: Technowrap 2K TM and Technowrap 2K TM EX
- Defect Type: Through-wall, Corrosion Under Insulation (CUI)
- Pressure/Temp: 46 Bar /40°C
- Application: 16" x 8" carbon steel 'T' branch, hydrocarbon gas





Large diameter vessel



- Service: Technowrap 2K H.A.™
- Defect Type: Through-wall leak sealing
- Pressure/Temp: 60 Bar /80°C
- Application: 2.4m diameter scrubber





High temperature application



- Service: Technowrap 2K H.T.™
- Defect Type: Internal corrosion and through-wall
- Pressure/Temp: 6.8 Bar / 204°C
- Application: 16" flare line





Tank wall reinforcement



- Service: Technowrap Structural H.T.™
- Defect Type: Internal corrosion and through-wall
- Pressure/Temp: 0.5 Bar / 155°C
- Application: 28 meter diameter tank



- Service: Technowrap Structural 2K H.T.™
- Defect Type: Internal corrosion and through-wall
- Load/Temp: Unknown / 204°C
- Application: Roof rehabilitation





Conclusions



- The Technowrap™ range of engineered composite repair products that can meet the following requirements;
 - Pressures up to 250 bar (3600 psi)
 - Temperatures up to 220°C (425°F)
 - Strengthen most common structures
- A Technowrap™ repair comes with a guarantee of up to 20 years assuming the repairs are designed by WTR and are applied by WTR trained applicators
- Technowrap repair products are Lloyd's Register type approved and ABS approved