# Composite Materials Engineering: FRP and GRP Selection, Fabrication and Inspection

11 – 15 October 2027
Paris - Right Bank business hotel



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## Introduction:

Composite materials now carry process fluids, seawater and chemicals as GRP pipe, wound tanks, pultruded gratings and repair wraps, yet many plants still buy, install and accept them with habits formed on metal equipment. The result is weeping GRP joints, crazed tank liners, disbonded wraps and laminates accepted on trust. This Core Concept course equips engineers and inspectors to specify fibres, resins and fabrication routes for FRP and GRP equipment, judge laminate quality and set acceptance criteria. Participants finish with a Composite Specification and Laminate Integrity Plan for a case application from their own site.

## Course Objectives:

- Specify fibre type, resin system, reinforcement form and core for a given duty and justify the choice against metallic alternatives
- Interpret ply orientation, fibre volume fraction and design allowables on FRP and GRP drawings and vendor datasheets
- Match hand lay-up, spray-up, filament winding, pultrusion, infusion and prepreg routes to part geometry and laminate quality needs
- Define joining, installation and hydrostatic proof requirements for GRP and GRE piping, tanks, gratings and strengthening systems
- Recognise ageing, fabrication flaws and damage modes in laminates using visual checks and NDT methods suited to composites
- Compile a Composite Specification and Laminate Integrity Plan with hold points, acceptance criteria and re-examination intervals

## Target Audience:

- Piping and rotating-equipment engineers who specify or approve GRP and GRE pipe, fittings and vessels
- Corrosion and integrity engineers who weigh composite options against lined or alloy equipment for aggressive fluids
- Civil and structural engineers who design or accept FRP gratings, pultruded profiles and bonded strengthening works
- Maintenance planners and supervisors who install, repair and recommission composite equipment
- QA/QC inspectors who witness fabrication, check laminates and examine composites during operation

## Course Outline:

### Day 1: Composite Fundamentals: Fibres, Resins and Cores

- Glass, Carbon, Aramid and Basalt Fibre Properties and Cost Trade-Offs
- Polyester, Vinyl Ester, Epoxy and Phenolic Thermoset Resin Systems
- Reinforcement Forms: Chopped Strand Mat, Woven Roving and Unidirectional Fabric
- Sandwich Construction with Honeycomb, Polyurethane Foam, Balsa and Syntactic Cores
- Composite Versus Metallic Alternatives: Corrosion Allowance and Life-Cycle Cost Matrix

### Day 2: Laminate Behaviour, Design Basics and Fabrication Routes

- Anisotropic and Orthotropic Laminate Behaviour and Ply Orientation at 0, 45 and 90 Degrees
- Design Basics: Allowable Strain, Creep, Cyclic Loading and Temperature Derating
- Hand Lay-Up and Spray-Up: Fibre-to-Resin Ratio and Workmanship Controls
- Filament Winding over a Rotating Mandrel and Pultrusion of Structural Profiles
- Resin Infusion, Vacuum Bagging and Prepreg Curing Compared

### Day 3: Industrial Applications, Joining and Installation

- GRP and GRE Pipe Systems: Pressure Class, Stiffness Class and Fittings
- Filament-Wound GRP Storage Tanks and FRP Gratings for Corrosive Areas
- FRP Strengthening of Concrete and Metal Members with Bonded Plates and Wraps
- Joint Types: Adhesive Bonded, Butt-and-Strap Laminated, Flanged and Mechanical Couplings
- Installation Practice: Bedding, Supports, Thrust Restraint and Hydrostatic Proof Pressurisation

### Day 4: Ageing, Laminate Flaws, NDT and Repair

- Chemical Resistance Tables, UV Exposure, Moisture Uptake and Osmotic Blistering
- Damage Modes: Matrix Micro-Cracking, Fibre-Matrix Debonding, Delamination and Fibre Pull-Out
- Fabrication Flaws: Dry Spots, Voids, Resin Starvation, Crazing and Impact Damage
- NDT of Composites: Ultrasonic, Thermography, Shearography and X-Ray Radiography
- Composite Repair Wraps for Corroded Pipe to ASME PCC-2 at Overview and Laminate Patch Repairs

### Day 5: Case Work and the Composite Specification and Laminate Integrity Plan

- Case Study: Composite Solution for a Seawater Intake or Chemical Process Line
- Fibre, Resin and Fabrication Route Decision Matrix with Life-Cycle Justification
- Hold-Point Schedule: Barcol Hardness, Cure Checks and Visual Acceptance Criteria
- Risk-Based Re-Examination Intervals for GRP Pipe, Tanks and Repair Wraps
- Composite Specification and Laminate Integrity Plan Presentation and Peer Review

## Skills You Will Gain:

- Composite Specification
- Laminate Datasheet Review
- Fabrication Route Matching
- GRP Joint Design Review
- Laminate Flaw Recognition
- Composite NDT Method Choice
- Repair Wrap Evaluation
- Hold-Point Scheduling

## Why Attend This Course:

- Return with a Composite Specification and Laminate Integrity Plan built around an application from your own plant or project
- Question vendor datasheets and fabrication records on fibre content, cure and ply orientation with confidence
- Cut joint leaks and early laminate damage by fixing installation and hydrostatic proof requirements before work starts
- Compare practice with piping, civil and QA/QC peers from water, chemical, energy and construction sectors

## Conclusion:

Composite equipment performs as designed when fibre, resin, fabrication route and joint are matched to the duty and every laminate is checked against clear criteria. The week moves from fibres, resins and cores through laminate behaviour, design allowables and fabrication routes to GRP and GRE piping, wound tanks, gratings, bonded strengthening and installation, then to ageing, laminate flaws, NDT and repair wraps. The final day turns this material into a Composite Specification and Laminate Integrity Plan for a real application, reviewed by peers.