Introduction

FRP Has been used successfully in power plant applications for many years

• Gas Ducting
• Storage Tanks
• Reactors
• Piping
• Other Unique Applications
STANDARD CONSTRUCTION
CORROSION RESISTANT LAMINATE

2 Ply 1.5oz/ft.² Glass Mat

10 Mil Veil

Exterior "Top Coat" or Veil as Required

One Mat Ply or More for Corrosion Allowance as Required

Mat Alternating with Woven Roving or Filament Winding as Required

Process Side

Corrosion Barrier Portion  Structural Portion

100 Mils Minimum
Carbon Fiber or Filler For Electrical Conductivity
Abrasion Resistant Filler as Required.
SUCCESSFUL APPLICATION

- RESIN SELECTION
- DESIGN / ENGINEERING
- INTERFACES
- FABRICATION
- INSTALLATION
- INSPECTION
RESIN SELECTION

- CHEMICAL SERVICE
  - CONCENTRATION (MAX./ MIN.)
  - TEMPERATURE (OPERATING-MAX./ MIN.)
  - UPSETS
  - FLAME RETARDANCY
  - ABRASION
  - INSULATION
  - MANUFACTURING PROCESS
TYPICAL FABRICATION TECHNIQUES

• HAND LAY-UP/CONTACT MOLDING
• SPRAY-UP
• FILAMENT WINDING
• CONTINUOUS PULTRUSION
• RESIN TRANSFER MOLDING
• VACUUM INFUSION
• PRESS MOLDING
Design Process

- Requirements (Specs, Process Conditions, Manf Process, etc…)
- History
- Laminate Types
- Analysis Methods
- Level of Expertise
- Interface Points
- Factors of Safety
- Erection/Handling Considerations
Engineering Process

- Laminate Types
  - Type 1
  - Type 2
  - Type 10
  - FW
  - Cored
  - Corrosion Barrier
  - Dual Lam
Engineering Process

- Analysis Methods
- Classical
- Laminate Analysis
  - Trilam
  - Vector Lam
- Testing
- FEA
  - Algor, Ansys, Caesar, Solidworks, NASTRAN, more
- Consultants
Engineering Process

Basic Composite Design
- Directional Strength and Stiffness
- X, Y, Z
- Fiber Concentration
- Volume vs Mass Fraction
- Thermal Expansion
INDUSTRY SPECIFICATION FOR FRP EQUIPMENT

- ASME RTP-1, the standard for reinforced thermoset plastic corrosion resistant equipment code
- ASME B31.3 process piping code
- ASME Section X (10)
- ASTM D3299 – Above Ground Vertical Filament Wound Tanks
- ASTM D4097 – Above Ground Vertical Contact Molded Tanks
- ASTM D2996 – Filament Wound pipe
- ASTM D2310 – Machine-made Pipe
- ASTM D3982 – Contact Molded Duct and Hoods
- ASTM D4024 – Reinforced Thermosetting Plastic (RTP) Flanges
- ASTM D6041 – Contact Molded Pipe and Fittings
- ASTM D5364 - Chimney Liners
- API 12P
INSPECTION OF FRP EQUIPMENT OF FRP EQUIPMENT

WHEN SHOULD IT BE DONE?
• DURING AND AFTER FABRICATION
• WHEN RECEIVED AND INSTALLED
• AFTER A PERIOD OF USE
• CHANGING SERVICE

MOST COMMON TESTS
• BARCOL HARDNESS
• VISUAL
• ACOUSTIC EMISSION
• ULTRASOUND
• INFRA RED
FRP ADVANTAGES

• No Electrochemical Corrosion
• High Strength and Stiffness for Low Weight
• Tailored Mechanical Properties
• Tailored Corrosion Resistance
• Ease of Repair/Rework
Applications

Wet ESP (B&D Plastics)

JBR Slurry Strainer (NMR)

Chiyoda JBR
Flue Gas

Flue Stack Liner (Augusta)
Applications

Chiyoda JBR

Outlet Duct (NMR)

Spray Header
Thank You!

World Leader in Resin Technology