

FRP Unlimited, 6th International Conference

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FRP equipment in cement plant: focus on technical applications

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Selip Company Profile

Founded: 1961

Headquarters: 43012 Fontanellato, Parma, Italy

Subsidiary: 00040 Ariccia, Rome, Italy

Staff: 70 people

Turn Over 2008: € 13.5m

Products ID: FRP Tanks, Scrubbers, Stacks, Filters,
Decaners, FGD Spray Headers, Special
Works and Military applications

Qualifications: ISO 9001:2000, Specialised company
as § 19 BWHG released by TÜV SÜD

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- Customer's Needs & Targets
- FRP Chimney
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- FRP Recycle Piping
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Introduction

- In 2006, Selip S.p.A. signed a contract for the production and delivery of FRP equipment for a cement plant in Scotland
- Selip was awarded the project after the Audit and qualification by the final customer (Lafarge)
- Design phase started in May 2006
- **Selip has a wealth of expertise working on this type of project since 1986**

Project's Site location



Customer's Needs & Targets

- High resistance to withstand the process conditions, especially corrosion
- High mechanical performance to withstand the site weather conditions
- Short delivery time: design, manufacturing and installation
- **Low global costs: purchase, installation and maintenance**
- Long shelf life

FRP Chimney

Design Data:

Total height: 75m (105m from the ground)

Self-supported height: 30m

Internal diameter: 3000mm

Working Temperature: 62°C

Working Pressure: - 5mbar

Resin type: Vinyl Ester



FRP Chimney

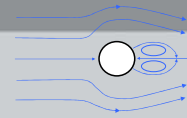
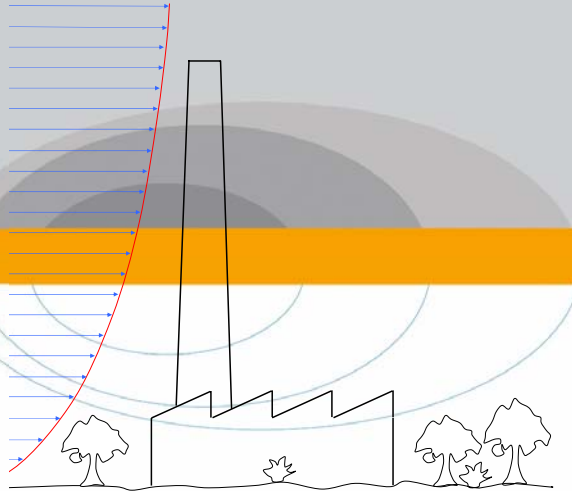
Design critical points

- Design Wind speed: 220 Km/h
Basic Wind speed: 85 Km/h
- Low Working temperature under condensate temperature
->acid moisture
->high corrosion environmental
- Interfaces FRP-steel frame
& FRP-concrete absorber



Structural Analysis - Wind Action

Design Wind Speed: 220Km/h



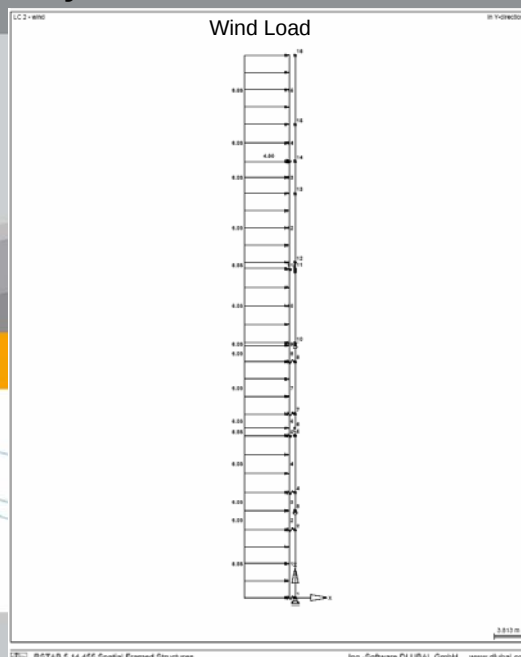
Chimney section



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Structural Analysis



RSTAB 5.14.455 Special Framed Structures Ing.-Software Dlubal GmbH www.dlubal.com

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Structural Analysis

- The most critical stack point to design, was the area where the FRP stack comes out from the steel frame



Question:

- Which is the most suitable technical system to connect together over 75 metres of stack, to withstand the high critical design conditions, to make the installation easier and save time?
- We started our evaluation based on our previous experience evaluating the following 4 options:

Option 1: Installed inside steel frame

Advantages:

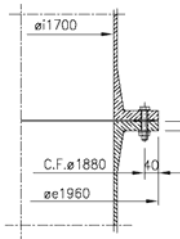
- It is possible to reach over 100 metres in height
- Independent Stack sections

Disadvantages:

- Tollerances on Interface

Steel Frame –FRP Stack

Flanged joint



Granarolo Project, Bologna, Italy

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Option 2: Installed inside steel frame

Advantages:

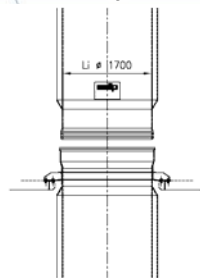
- It is possible to reach over 100 metres in height
- Independent Stack sections

Disadvantages:

- Tollerances on Interface

Steel Frame –FRP Stack

Socket joint



Gioia Tauro, Reggio Calabria, Italy

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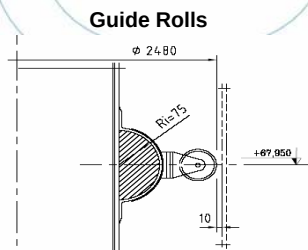
Option 3: Installed inside Steel Pipe

Advantages:

- It is possible to reach over 100 metres in height
- No interface tolerance
- Problem between FRP internal liner and external steel pipes

Disadvantages:

- **Difficult to perform inspection and maintenance activities**



Waste Incinerator Plant, Hamburg, Germany

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Option 4: Self Standing

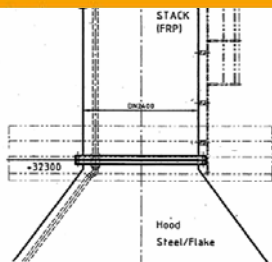
Advantages:

- No interface tolerances problem
- Easy and fast installation

Disadvantages:

- Small stack - max 20-30 Metres high

Scrubber-FRP Stack flanged connection



FGT Project, Humanne, Czech Republic

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Chosen System: Mixed Solution

Why a mixed connection solution on this project?

- The adopted technical solution has all the positive aspects of each type of connection
- 105 metres in Height
- Minimize points of interface steel-FRP (three guided points)
- Easy and quick installation
- Minimum steel structure (up to 70 meters high)
- Utilize 100% of the mechanical performance of both, FRP and steel

Joint types

- The stack is composed of seven stack sections connected by three different types of joint:



Scrubber insertion



Socket joint



Laminated joint

Manufacturing Technology

- **Liner: Hand lay-up**



- To withstand bending action, displacement, the adopted manufacturing technology is filament winding alternate to unidirectional fibre to increase the strength in the axial direction

- **Structure: Filament Winding + Unidirectional**



Pre-assembling in Selip factory

- Seven stack sections were pre-assembled and marked in the Selip factory to guarantee the perfect axial alignment on site



On Site Installation: Lamination Area



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On Site Installation: Transport from the Selip factory in Rome to the site



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On Site Installation: Stack Section Positioning



On Site Installation: Laminating Joints



On Site Installation: First stack section positioning



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On Site Installation: Lifting Second and third stack section



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**On Site Installation:
Socket connection on second and third stack sections**



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On Site Installation: Guided Points



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On Site Installation: Lifting last stack section



FRP Storage Tanks (no. 5)

Design Data:

Capacity: 314m³

Height: 20m

Internal diameter: 4500mm

Working Temperature: ambient

Working Pressure: atmospheric

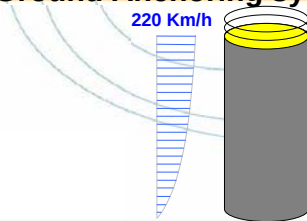
Resin type: Vinyl Ester+Antiabrasion filler



FRP Storage Tanks (no. 5)

Design critical points

- Design Wind speed 220Km/h
- Basic Wind speed 85Km/h
- Delivery and Logistics
- **Ground Anchoring system**



Logistics - Delivery from Italy to Scotland



Logistics - Delivery from Italy to Scotland



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On Site Installation: FRP Storage Tanks (no. 5)



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FRP Recycle Piping

Design Data:

Internal diameter: 600mm

Design Temperature: 80°C

Design Pressure: 10bar

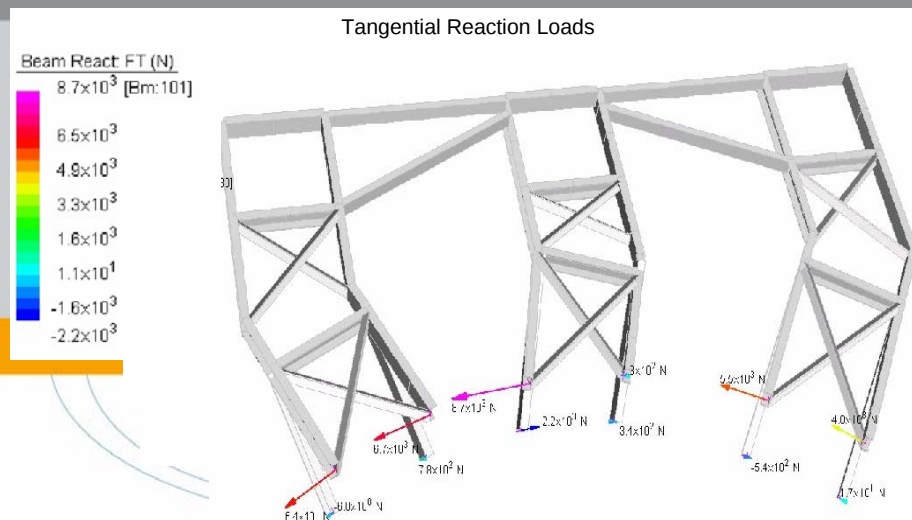
Resin type: Vinyl Ester+Antiabrasion filler



Design critical points

- Slurry internal corrosion and erosion
- Design Wind speed 220Km/h
- Basic Wind speed 85Km/h
- Engineering and design of support points

Structural Analysis



On Site Installation: FRP Recycle Piping



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On Site Installation: FRP Recycle Piping



Suction lines



Discharge lines

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Conclusions

- The project ended in June 2007
- The complete plant has been operating successfully since November 2007
- This project incorporates the latest state of the art advances in terms of design, raw materials and manufacturing technology
- This is one of the most cutting edge applications recently constructed using composite materials



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Ladies and gentlemen, thank you for your attention!

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