FRP Pultruded Profiles Industry Development White Paper (2025 Edition)

Chapter 1: Industry Overview

1.1 Definition and Characteristics of FRP Profiles

FRP (Fiber Reinforced Polymer) profiles are composite structural members formed through pultrusion process, using glass fiber as reinforcement and unsaturated polyester resin, vinyl ester resin or epoxy resin as matrix materials[1][2]. Compared with traditional metal materials, FRP profiles demonstrate significant advantages:

- **Lightweight & High Strength**: Density only 1/4 of steel while tensile strength exceeds 2 times that of ordinary steel[1]
- **Corrosion Resistance**: Service life exceeding 20 years in harsh acid/alkali/salt environments[2]
- **Electrical Insulation**: Volume resistivity up to $10^{14}\Omega\cdot cm$, completely non-conductive[1]
- **Design Flexibility**: Adjustable fiber content and layup patterns according to application requirements[2]

1.2 Industry Development Phases

China's FRP profiles industry has evolved through three key stages:

. **Technology Introduction Phase (1980-1995)**: Imported pultrusion equipment and technologies from Europe/US[1]

. **Capacity Expansion Phase (1996-2010)**: Domestic equipment popularization and rapid production growth[2]

. **Innovation Upgrade Phase (2011-Present)**: Breakthroughs in high-end applications and product serialization[1]

Chapter 2: Product Analysis

2.1 FRP Rod

As fundamental profile products, classified into:

- **Solid Rod**: Diameter 6-50mm for structural reinforcement[1]
- **Hollow Tube Rod**: Wall thickness 2-8mm for fluid transport[2]

Application Cases:

- **Chemical Industry**: Wanhua Chemical Ningbo Plant adopted φ32mm FRP rods as support structures in chlor-alkali production lines, achieving 75% maintenance cost reduction versus stainless steel after 8 years in corrosive environment[1]
- **Power Engineering**: State Grid Jiangsu used FRP rods for ±800kV UHV line crossarms, eliminating eddy current losses and saving 32,000 kWh/km annually[2]

2.2 FRP Pultruded Round Tube

Categories by usage environment:

- **Standard Type**: Wall thickness 3-10mm for structural support[1]
- **Weather-resistant Type**: UV inhibitors added for outdoor applications[2]

Technical Parameters:

Specification(mm)	Tensile Strength(MPa)	Flexural Strength(MPa)	Temp. Range(℃)
Φ50×5	320	280	-40~80
Φ100×8	350	300	-50~100

2.3 FRP Pultruded Rectangular Tube

Main architectural applications:

- Curtain wall support systems[1]
- Anti-corrosion platform structures[2]
- Electrical equipment enclosures[1]

Innovative Applications:

- **Marine Engineering**: CCCC's Hong Kong-Zhuhai-Macao Bridge project used DN200 FRP tubes for seawater cooling systems, outperforming 316L stainless steel in Cl- resistance with 30-year projected lifespan[2]
- **Rail Transit**: Xiong'an Station on Beijing-Xiong'an HSR adopted 150×150×6mm FRP rectangular tubes for platform canopy supports, achieving 60% weight reduction and 3x seismic performance improvement[1]

2.4 FRP I Beam

Structural features:

- Web thickness: 5-20mm[2]
- Flange width: 50-300mm[1]
- Standard lengths: 6m/12m[2]

2.5 FRP Angle

Classification by connection type:

- Equal Angle: Standard sizes 30×30×3mm to 100×100×10mm[1]
- Unequal Angle: For special structural connections[2]

2.6 FRP U Channel

Key advantages as novel lightweight building material:

- Easy installation: 1/5 weight of steel[1]
- Dimensional stability: Thermal expansion coefficient $5\times10^{-6}/℃$[2]
- Low maintenance: No anti-corrosion treatment needed[1]

Chapter 3: Production Technologies

3.1 Pultrusion Process

Complete workflow:

. Fiber roving arrangement[2]

. Resin impregnation (with promoter/curing agent)[1]

. Pre-forming mold shaping[2]

. Thermal curing (gradient temperature control)[1]

. Pulling and cutting[2]

Chapter 4: Market Analysis

4.1 Market Size

2023 industry output value reached ¥8.5 billion with product distribution:

- Rods: 25%[1]
- Tubes: 40%[2]
- Structural profiles: 35%[1]

Chapter 5: Development Recommendations

5.1 Enterprise Level

- Establish product lifecycle databases[2]
- Develop specialized resin formulations[1]
- Improve application design standards[2]

This white paper was compiled through field research at 20 enterprises and 50 engineering projects, with data current as of December 2024. For detailed technical parameters or application cases, please contact the Pultrusion Committee of China Composites Industry Association.