FGD System Guide

- ✓ System Guide
- ✓ Specific Product Fliers

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FGD System Guide

Flue Gas Desulfurization (FGD) systems are processes that clean or scrub exhaust gases from fossil fuels; typically coal-fired power plants. The exhaust gases are laden with high concentrations of sulfur dioxide which cannot be released into the atmosphere without treatment/removal. The process and associate equipment necessary for their effective removal involves a number of chemical make-up tanks, clarifiers, ductwork, reaction vessels (scrubber or absorber tower), and stacks.

The areas of exposure vary depending on the environment from high abrasion, high temperature, high acid condensing atmospheres, wet-dry cycling, temperature fluctuations, or any combination of these. Materials of construction and the appropriate severe service lining must be able to withstand these conditions to perform properly.

FGD Environment

Extreme abrasion

High temperature

Acid-condensing atmosphere

Wet-dry cycling

Temperature fluctuations

Carboline Company has been supplying high performance coatings and linings for severe service exposures like FGD for over 60 years. These tough demanding environments require linings that are also tough enough to handle it. The breadth of Carboline's product offering, coupled with the experience of tens of thousands of projects, and backed by a technical sales and service organization … second to none, makes Carboline a clear choice among specifiers and end-users for these demanding projects.

The FGD System Guide contained herein is the culmination of hundreds of products involving new technology developments, years of experience, and successful field projects that we know perform. Even though our product line is literally hundreds of products deep, we've created this guide to showcase only those products that have proven to perform in these environments.

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FGD System Guide

High Performance Linings for Severe Service

Ductwork / Scrubber Areas

Item	Exposures	Coating System
Inlet Ducts	Unscrubbed gas Low pH 275-375°F	**Plasite 4300** or **Plasite 4310** (for extra abrasion resistance)
Scrubbers	Low pH "Wet" environment Up to 150°F	**Walls: Plasite 4300** **Floors: Semstone 8084 Primer** and **Semstone 870 AFRC** (utilizing a reinforcing mesh with abrasion resistant fillers)
Outlet Ducts	Low pH "Wet" environment Up to 150°F Condensing acid exposures	**Plasite 4300** or **Plasite 4310** (for extra abrasion resistance)
By-pass Ducts	Unscrubbed (dry) gas Low pH 275-375°F	**Plasite 4300** or **Plasite 4310** (for extra abrasion resistance)
Mixing Zones	Outlet and By-pass duct exposures Wet-dry cycling Temperature excursions (not to exceed 460°F for 10 minutes)	**Plasite 4300** or **Plasite 4310** (for extra abrasion resistance)

Stack/Chimney Liner

Item	Exposures	Coating System
Steel Liner	Low pH Wet environment Up to 150°F Condensing acid exposures	**Plasite 4300** or **Plasite 4310** (for extra abrasion resistance)

FGD System Tankage

Item	Exposures	Coating System
Limestone Slurry Tanks	Ambient temperatures Highly alkaline Slurry, abrasive conditions, impact areas, high velocity	Walls: **Plasite 4300 or 4310** Floor: **Semstone 8084 Primer** and **Semstone 870 AFRC** (utilizing a reinforcing mesh with abrasion resistant fillers)
Auxillary Tanks **Bleed Tanks** **Clarifiers**	Various chemicals Ambient temperatures Some abrasion conditions	**Plasite 4550 S**

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Coating Systems for Atmospheric Service

Steel

Surface Prep (SSPC)	1st Coat	Mils (Microns)	2nd Coat	Mils (Microns)	3rd Coat	Mils (Microns)
Structural Steel, Piping, and Equipment						
SP 6	**Carbozinc 11 Series** *Inorganic Zinc*	2-3 (50-75)	**Carbothane 133 Series** *High-Build Urethane*	3-5 (75-125)		
SP 6	**Carbozinc 11 or 859 Series** *Zinc-Rich Primer*	2-3 (50-75)	**Carboguard 60 or 893** *Epoxy*	4-6 (100-150)	**Carbothane 134 Series** *Polyurethane*	2-2 ½ (50-62)
SP 6	**Carbozinc 859 Series** *Organic Zinc*	3-5 (75-125)	**Carboxane 2000 Series** *Hybrid Siloxane*	3-7 (75-175)		
High Temperature Applications (250-450°F)						
SP 10	**Carbozinc 11 Series** *Inorganic Zinc*	2-3 (50-75)	**Thermaline 4900 R** *Modified Silicone-Acrylic*	1-1.5 (25-37.5)		
High Temperature Applications (250-1000°F)						
SP 10	**Carbozinc 11 Series** *Inorganic Zinc*	2-3 (50-75)	**Thermaline 4000** *Inorganic Silicate*	4-5 (100-125)		
Insulated Piping and Equipment to 425°F/218°C – Steel						
SP 10	**Thermaline 450** *Novolac Epoxy*	4–6 (100-150)	**Thermaline 450** *Novolac Epoxy*	4–6 (100-150)		

Concrete

Exposure	Surface Prep	1st Coat	Mils (Microns)	2nd Coat	Mils (Microns)
Chemical/Water Exposure –Concrete					
Caustic, acid sumps, trenches, and neutralization pits	Blast	**Semstone 100** *Epoxy Sealer*	6-8 (150-200)	**Semstone 145 AFRC** *Aggregate-filled, reinforced, epoxy novolac*	60-125 (1500-3125)
Cooling Tower Basin, wet fly ash storage	Blast	**Phenoline 311** *Epoxy Primer*	2-3 (50-75)	**Reactamine 760** *Polyurethane Hybrid*	60-125 (1500-3125)
Floors outside chemical containment	Blast	**Semstone 100** *Epoxy Sealer*	6-8 (150-200)	**Semstone 140 AFC** *Epoxy aggregate filled*	60 (1500)

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Plasite 4300 Series Vinyl Esters

For FGD and other Severe Service

Plasite 4300 Series

High Performance Vinyl Esters

Description

Plasite 4300 Series are high performance, vinyl ester lining systems for severe chemical and high abrasion service. The vinyl ester resin has outstanding overall chemical resistance and very low permeability. Plasite 4300 Series includes 4300 or 4310. The 4310 is used where a higher degree of abrasion resistance is required. Plasite 4300 Series vinyl esters are specially formulated to withstand some of industry's most aggressive chemicals typically found in flue gas desulfurization (FGD) system exposures.

Specification Data

Pigments: Inert fillers and flakes
VOC: …… 57 g/l
Recommended DFT: 2-3 coats to achieve 35-45 mils
Temperature Resistance: Dry: 380°F; Wet: Depends on chemical and concentration
Minimum Cure Temperature: …….. 70°F
Elongation:……..…..…….. 1.5% (ASTM D638)
Thermal Shock: ……. Unaffected by -70°F to +200°F for 5 cycles; or 40 to 400°F for 10 cycles
Hardness….……Konig Hardness of 152 seconds (Glass Standard = 250 seconds) ASTM D4366
Abrasion Resistance: ASTM D4060 (1000 gm load, CS-17 wheel); (4300) 30 mg loss; and (4310) 8.5 mg loss.
Perm Test: …….. 0.0196 g/m^2/hr
Pot Life @ 75°F……..…..… 90 to 120 min
Shelf Life: …… 3 months @75°F
Steel Surface Preparation: SSPC-SP5 or SP10 depending on the service; with a 4-mil profile
Components: ……. Four
Color: …… Charcoal grey
Cure Times: Raising the substrate temperature is preferred ……@ 75°F …… 10 days
…… @110°F ……. 72 hrs
. ……@130°F ……. 18 hrs
..…….@150°F ……... 6 hrs
..…….@180°F …… 2.5 hrs

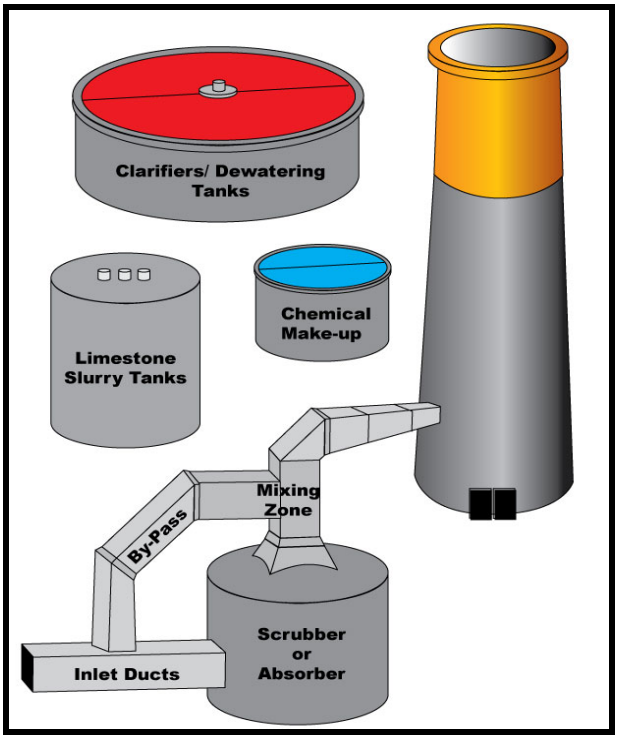
Features

- **Excellent resistance to chemical attack**
- **Excellent abrasion and impact resistance**
- **Exceptional thermal shock resistance**
- **Superior bonding qualities**
- **High cohesive strength**
- **Low permeability**

Uses

- **Inlet and outlet (FGD) ducts**
- **By-pass (FGD) ductwork**
- **FGD Absorber Units**
- **FGD Absorber Drain Tanks**
- **Mixing Zones**
- **Steel chimney liners**
- **Limestone Slurry Tanks**
- **Chemical Containment Areas**
- **Chemical Loading and Unloading Areas**

FGD Components



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Plasite 4550 S Reinforced Epoxy-Novolac

For FGD and other Severe Service

Plasite 4550 S

Reinforced Epoxy Novolac

Description

PLASITE 4550 S is a 100% solids, flake-reinforced, premium novolac epoxy coating designed for steel and concrete substrates in severe service conditions. It has excellent abrasion and impact resistance and exhibits extreme versatility to a wide variety of aggressive chemicals. It is applied by plural component or single component spray equipment, for a total thickness of 20-60 mils (500-1500 microns) in a single coat application for a variety of applications. Plasite 4550 S is well suited to withstand some of industry's most aggressive chemicals typically found in flue gas desulfurization (FGD) system exposures.

Specification Data

Solids by Volume: …….. 100%
VOC: ……..… 0.00 g/l
Recommended DFT: …….. single coat at 35-60 mils
Minimum Cure Temperature: …….. 50°F
Bond Strength: ……. 1700 psi
Tensile Strength: ...…..…… 7500 psi (ASTM D638)
Flexural Strength:….…… 10,800 psi (ASTM D790)
Flexural Modulus of Elasticity: ……..… 5.9 x 10^6 psi (ASTM D790)
Hardness: …….. 75 (ASTM D2240 Shore D)
Abrasion Resistance: Less than 30 mg loss per 1000 cycles using silicon carbide filler package); ASTM D4060 (1000 gm load, CS-17 wheel)
Pot Life @ 75°F……..…..…. 45 to 60 min
Shelf Life: …… 6 months @75°F
Steel Surface Preparation: …… SSPC-SP5 or SP10 depending on the service; with a 4-mil sharp angular profile
Colors: …….. Light Grey, Tile Red, Off-White
Cure Times: ..…… Dry to touch: 12 hours @75°F
……. Firm: 24 hours @75°F
…….……..For Service: 5 days @75°F

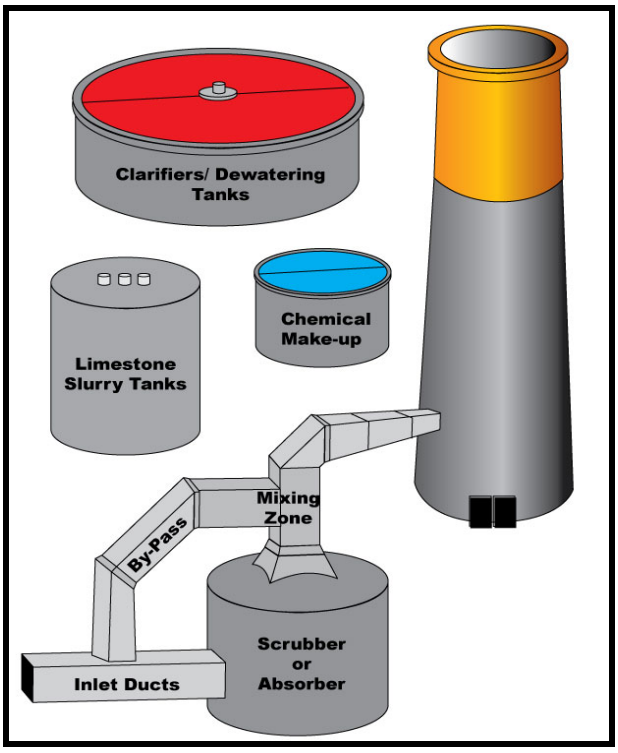
Features

- **Excellent resistance to chemical attack**
- **Excellent abrasion and impact resistance**
- **Solvent-free lining**
- **Superior bonding qualities**
- **High tensile and flexural strength**
- **Single-coat application**

Uses

- **Chemical storage tanks**
- **Limestone slurry tanks**
- **Chemical containment areas**
- **Chemical loading and unloading areas**
- **Wastewater clarifiers**
- **Oil or ethanol storage tanks**

FGD Components



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Abrasion Resistant Tank Lining

For FGD and other Severe Service

Semstone 870 (AFRC)

Aggregate-Filled Reinforced Vinyl Ester

Description

Semstone 870 AFRC is a high performance, vinyl ester lining system for high abrasion service. The vinyl ester resin has outstanding overall chemical resistance and very low permeability. The aggregate mix is a unique blend of high abrasion resistant fillers for performance and ease of use. In addition, a reinforcing mesh can be utilized to augment internal film strength for severe service. Semstone 870 AFRC is specially formulated to withstand some of industry's most aggressive chemicals, including a broad range of organic chemicals.

Physical Properties

Compressive Strength: ……..17,500 psi (ASTM C-579: AFC)

Tensile Strength….……..…..….Neat: 5,300 psi
(ASTM D-638) Reinforced: 10,000 psi

Flexural Strength…..……..…Neat: 8,200 psi
(ASTM D-790) Reinforced: 22,000 psi
(ASTM C-580) Aggregate Filled: 5,800 psi

Flexural Modulus of Elasticity...Neat: 10.9 x 10^5 psi
(ASTM D-790) Reinforced: 15.6 x 10^5 psi
(ASTM C-580) Aggregate Filled: 15.3 x 10^5 psi

Hardness…..…… Neat: 80 (ASTM D-2240, Shore D)

Abrasion Resistance … Less than 20 mg loss per 1000 cycle; ASTM D4060 (1000 gm load, CS-17 wheel)

Bond Strength……> 400 psi (100% concrete failure) (ASTM D-4541)

Water Vapor Transmission…….0.0120 grams/hr./ft^2 (ASTM E-96)

Permeability ……0.0042 perm. -in. (ASTM E-96)

Pot Life @ 75°F……..…..……45 to 60 min*

Cure Times @ 75°F (870)…..….Dry to Touch: 12 hrs
Firm: 24 hrs
Chemical Service: 48 hrs

Cure Times @ 60°F (870 CT)….Dry to Touch: 12 hrs
Firm: 24 hrs
Chemical Service: 48 hrs

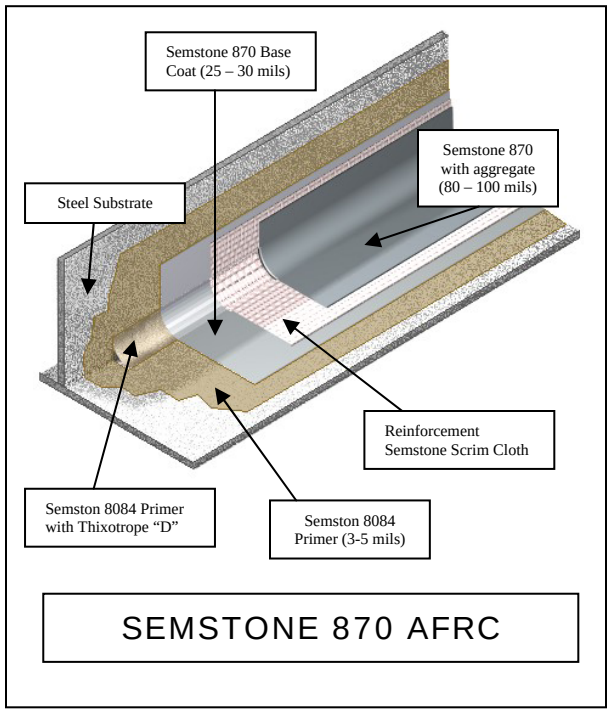
Features

- **Excellent resistance to chemical attack**
- **Excellent abrasion and impact resistance**
- **Exceptional thermal shock resistance**
- **Superior bonding qualities**
- **High cohesive strength**
- **Low permeability**
- **Low odor**

Uses

- **FGD Absorber Units**
- **FGD Absorber Drain Tanks**
- **Limestone Slurry Tanks**
- **Chemical Containment Areas**
- **Chemical Loading and Unloading Areas**

Tank Diagrams



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