



## ENVIRO PROTECT NR 988 AR GLASS FLAKE<sup>®</sup> CHEMICAL and ABRASION RESISTANT FLAKE COATING

November 2016

### Epoxy Novolac Based Chemical and Abrasion Resistant Glass Flake Coating

### Typical Liquid Resin Properties

### Applications Areas and Benefits

### NR 988 AR Chemical and Abrasion Resistant Flakeline

Enviro Protect 9887 AR is a novolac-based epoxy vinyl ester ECR glass flake designed to provide exceptional chemical and mechanical properties at higher temperatures. It's formulation has also wear resistant nano silicone and nano flake ingredients. 988 AR resin offers a high resistance to solvents and chemicals, good retention of strength and toughness at elevated temperatures, and excellent resistance to acidic oxidizing environments between Ph 0 and PH 14. For extreme chemical resistance it is formulated with ECR Glass Flake.

Property	Value
Density, 25°C/77°F	1.4 g/mL
Dynamic Viscosity, 25°C/77°F	12,000 mPa.s
Kinematic Viscosity	10.250 cSt
Styrene Content	10%
Shelf Life: Dark, 21°C/66°F	12 months (between 10 °C and 21°C)

- All FGD System Applications such as electrofilter bag houses, raw gas channels, GGH, absorber towers, washed gas channels, SGH Units, FGD Stack, and many other high performance requirements.
- FGD System emergency storage tanks, gypsum storage tanks, lime stone slurry feed tank, mill recycle sump, mile scale preparation tanks, gypsum and limestone slurry preparation areas, trench areas.
- Suitable for such applications as high temperature chlorination or caustic scrubbing and storage, industrial waste treatment facilities and solvent/extraction processes used in all industry
- Used for hydrochloric acid transport, tank, truck and railcar linings and gasohol storage.
- An economical alternative to exotic alloys by allowing the use of lower-cost
- Resists solvents, chemicals, and acidic oxidizing environments to provide long lasting, reliable equipment for corrosive materials.
- Retains strength and toughness at elevated temperatures which enables users to operate the equipment in a variety of applications.
- Contains only 10 weight percent styrene, resulting in reduced styrene emissions and allows fabricators to meet California's South Coast Air Quality Management District Rule 1162.
- 988 AR can be applied with glass mat, glass veil for MR systems up to un limited thickness.
- 988 AR can also be top coated with 990 S flake or 990 nano flake to form non-sticky surfaces
- 988 AR also adheres to rubber surfaces very well. This makes the 988 ideal product to repair the rubber linings.
- Adjustable summer and winter time cure schedule
- 988 AR does not promote the fire, in case of fire on FGD system
- **Temperature Resistance:** Continuous dry temperature resistance is 210 °C, intermittent temperature resistance is 235°C and continuous wet temperature resistance is 135 °C
- ASTMD – 6137 Test for %20 [H2SO4] Sulfuric Acid Resistance at 93°C Wet and 177°C dry for FGD Environment-----PASS



**Surface  
Preparation and  
Detailed  
Application**

**Product Properties**

**Please refer to Enviro Protect 988 AR Flakeline Application Guideline**

**Typical Properties 988 AR Resin with ECR Glass F**

Property	SI	US Standard	Test Method
Comprehensive Strength	89,4 MPa	13.000 psi	ASTM C - 579
Tensile Strength	86 MPa	12.473 psi	ASTM D-638/ISO 527
Tensile Modulus	3.9 GPa	5.6x 10 <sup>5</sup> psi	ASTM D-638/ISO 527
Tensile Elongation, Yield	1-2%	1-2%	ASTM D-638/ISO 527
Coefficient of Expansion	4.6x10 <sup>-5</sup> cm/cm/°C		ASTM C - 531
Coefficient of Expansion	12- 15x10 <sup>-6</sup> in/in/°F		ASTM D - 696
Flexural Strength	130 MPa	19,000 psi	ASTM D-790/ISO 178
Flexural Modulus	3.6 GPa	5.2 x 10 <sup>5</sup> psi	ASTM D-790/ISO 178
Elongation at Break	%1.5	%1.5	ASTM C - 307
Density	1.3 g/cm <sup>3</sup>	1.3 g/cm <sup>3</sup>	ASTM D-792/ISO 1183
Volume Shrinkage	8.3%	8.3%	ASTM C 1241
Heat Distortion Temperature	260°C	500°F	ASTM D-648 Method A/ISO 75
Glass Transition Temperature,	280°C	536°F	ASTM D-3419/ISO 11359-2
Glass Content	%75	%75	
Barcol Hardness	40	40	ASTM D-2583/EN59
Shore D Hardness	80-85	80-85	ASTM D-2240
Sulfuric Acid Resistance for FGD SYSTEM %20 H <sub>2</sub> SO <sub>4</sub> Concentration at 93°C and 177°C	PASS	PASS	ASTMD-6137
Adhesion to steel	17,23 MPa	2500 PSI	ASTM D-4541
Taber Abrasion cs 17 wheel 1000 gram load	20 mg	20 mg	ASTMD -4060
%33 Hydrochloric Acid (HCl) resistance for tank coating concentration at 93°C and 177°C	PASS	PASS	ASTMD-5499

**NOTE:** This product contains Styrene Monomer which has **28°C** Flash Point (**Flammable**) product. Styrene Monomer is also heavier than air and **toxic**. Because of this it is collected on the ground. To avoid it's **flammability** and **toxicity**, during the application full face styrene mask must be worn, working environment must be ventilated well, and all spark sources must be eliminated.  
**Please refer to product MSDS for further information.**

## Application Properties

Enviro Protect 988 AR Flakeline application shall be applied by the Applicator Company using employees trained in the appropriate application procedures. It is strongly advised that both supervisory and application personnel on site shall have attended a Flakeline Applicator Training Program.

Surface temperature must always be a minimum of 3°C (5°F) above dew point. The relative humidity during application and curing should not exceed 80%. This product will cure up to -5°C adequately. But, below 10°C (50°F) for maximum performance winter accelerator must be added. Without winter accelerator ambient curing temperatures should be above 10°C (50°F). Dehumidification (DH) air conditioning and/or heating equipment may be necessary to control environmental conditions.

For summer time above 35°C the application shall be made under good ventilation, if necessary, summer decelerator shall be used.

***For detailed surface preparation and application, please refer to product application guideline***

## PRODUCT CHARACTERISTIC

APPLICATION	ENVIRO PROTECT 988 AR GLASS FLAKE
Colour	White and grey
Solid Volume	%90
Density	1,3 gr/cm3
Flash Point	Part A 28°C, Part B 50°C, Mixed 28°C
VOC (EPA Method 24)	260 gram/Litre
Gloss level	Top Coat is Very Glossy
Application Thickness	From 400 microns up to unlimited thickness depends on working condition of system
Average Application Thickness	For general Applications minimum two coats total 1500 microns average is recommended
Minimum and Maximum Single Coat Application Thickness	Between 400 and 1000 microns
Recommended Thickness	1500 microns
Mix Ratio	Part A / Part B: 50/1
Method of Application	Airless Pump, Brush, Trowel, Roller NozzleTip Range 0.7-1.0 mm ( 28-40 thou). Total output pressure at spray tip is not less than 150 kg/cm2
Thinner	Enviro T Sol Diluent
Working Pot Life	90 minute (10°C), 60 minute (20°C), 45 minute (30°C) Above 35°C we provide slowing additive free of charge Below 10°C we provide accelerator free of charge
Recoat Time (10 °C)	8 hours – 5 days
Recoat Time (20 °C)	6 hours – 4 day
Recoat Time (30 °C)	4 hour – 2 days
Recoat Time for Outdoor Applications	Direct or indirect or cloudy outdoor applications must be recoated within 4 hours. Indoor applications taking direct sunlight must be recoated within 4 hours.
Touch Dry Time	8 hours (10°C), 4 hours ( 20°C), 3 hour (30°C)
Hard Dry Time	12 hours (10°C), 8 hours ( 20°C), 6 hours (30°C)
Time to replace for service	72 hours (10°C), 48 hours (20°C), 24 hours (10°C)

## Chemical Resistance

## CHEMICAL RESISTANCE

- 1: Long term resistant with continuous contact and immersion  
2: Short term resistant with clean up within 24 hours  
3: Not resistant

CHEMICALS	ENVIRO PROTECT 988 AR GLASS FLAKE
All FGD Chemicals	1
Sulfuric Acid Resistance for FGD SYSTEM %20 H <sub>2</sub> SO <sub>4</sub> Concentration at 93°C and 177°C. ASTM D-6137	1
Hydrochloric Acid(37%) [HCl]	1
Fertilizer Chemicals	1
Sulfuric Acid(98%) [H <sub>2</sub> SO <sub>4</sub> ]	2
Sulfuric Acid(85%) [H <sub>2</sub> SO <sub>4</sub> ]	1
Sulfuric Acid(50%) [H <sub>2</sub> SO <sub>4</sub> ]	1
Sulfuric Acid(10%) [H <sub>2</sub> SO <sub>4</sub> ]	1
Hidrojen Sülfür(98, 50%) [H <sub>2</sub> S]	1
Phosphoric Acid(98%) [H <sub>3</sub> PO <sub>4</sub> ]	2
Methanol [CH <sub>3</sub> OH]	3
Sea Water, Sea Water steam, vapour	1
Sodium Chloride [NaCl]	1
Sodium Hydroxide(50%) [NaOH]	1
Beer, Şugar, Glucose	1
Ammonium Sulfate[(NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub> ]	1
Sodium Hypochlorite(15%) [NaClO]	1
Water treatment chemicals	1
De-ionized water	1

**NOTE 1:** If you need %98 Sulfuric Acid Resistance, use Enviro Protect 4354 MR Glass Flake or Enviro Protect 1354 Glass Flake

**NOTE 2:** If you need to check more chemicals, please refer to chemical resistance chart or contact with us

**Flakeline Coating:** Many FGD Systems all over the world uses Glass Flake Linings. Because glass flake linings are very efficient concerning the high temperature and gasses. Glass Flake linings have millions of flakes in the structure. This flakes overlap with each other and form un-permeable surfaces against the chemicals and gases at high temperature.

In 2000 microns coating there should be between 750-1000 flakes which are overlapped with each other and forms very firm surface which do not permit gases and chemicals in. This overlapping flake also resist to abrasion and cracking.

**AR Flakeline:** Abrasion resistant version of flakeline

**Nano flake:** Nano sized flakes in cooperated in the structure of flakeline which forms non-stick and abrasion resistant surface.

**Nano Slip:** Nano sized silicone beads in cooperated in the structure of top coat which forms non-stick and abrasion resistant surface

**ECR Glass Flake:** Excellent Acid Resistant Glass Flake or Mat or Veil

**C Glass Flake:** General Chemical Resistant Glass Flake or Mat or Veil

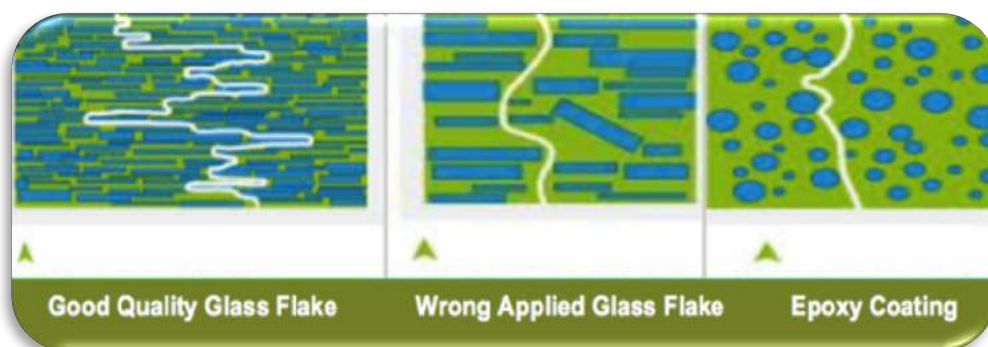
**E Glass Flake:** Electrical and thermal

performance Glass Flake or Mat or Veil

**Mica Flakes:** Alkaline Resistant Glass Flake or Mat or Veil.

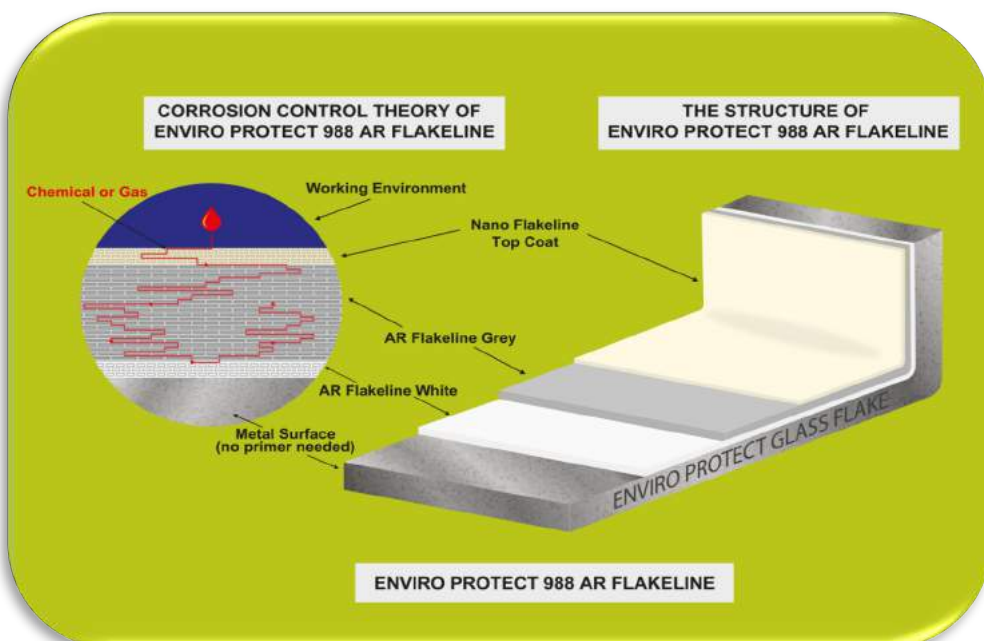
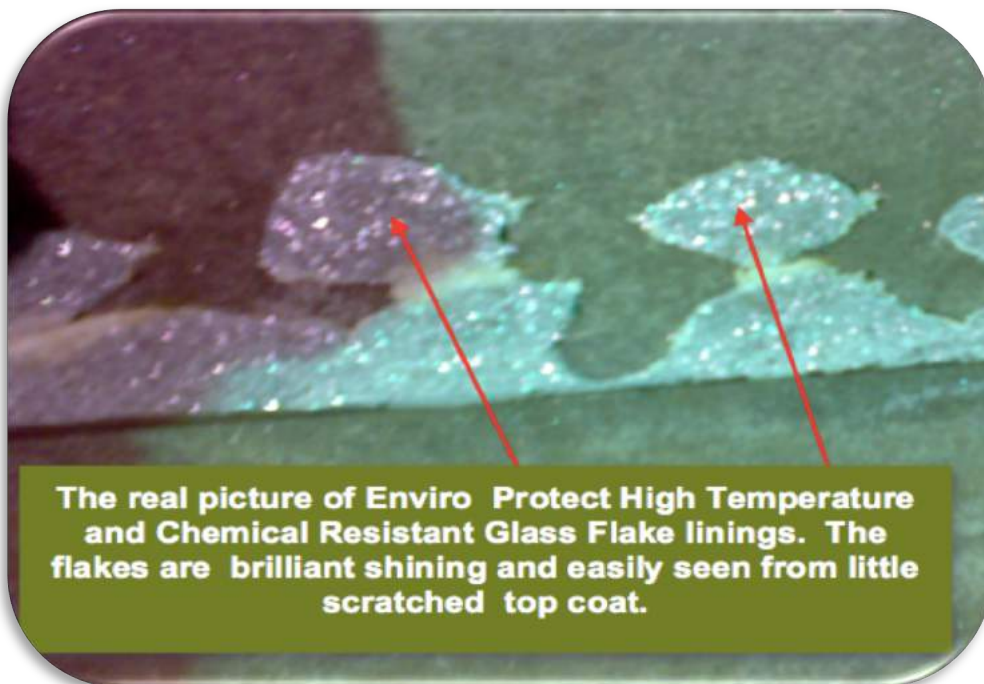
**Glass Mat:** Made from fiberglass uniformly distributed and bonded together like a cloth which absorb resins to form laminate section of MR Coating

**Glass Veil:** Made from fiberglass uniformly distributed and bonded together like a tulle which absorb resins to improve surface quality of MR VEIL Coating





## The Corrosion Control Theory of Enviro Protect Flakeline Coating



**This product can be used both on metal and concrete surfaces. Both surfaces shall be blasted and cleaned. Although concrete surfaces require primer, metal surfaces do not require primer**

## Safety and Handling Consideration

This product contains ingredients which could be harmful if mishandled. Contact with skin and eyes should be avoided and necessary protective equipment and clothing should be worn.

Enviro Protect maintains Material Safety Data Sheets on all of its products. Material Safety Data Sheets contain health and safety information for your development of appropriate product handling procedures to protect your employees and customers.

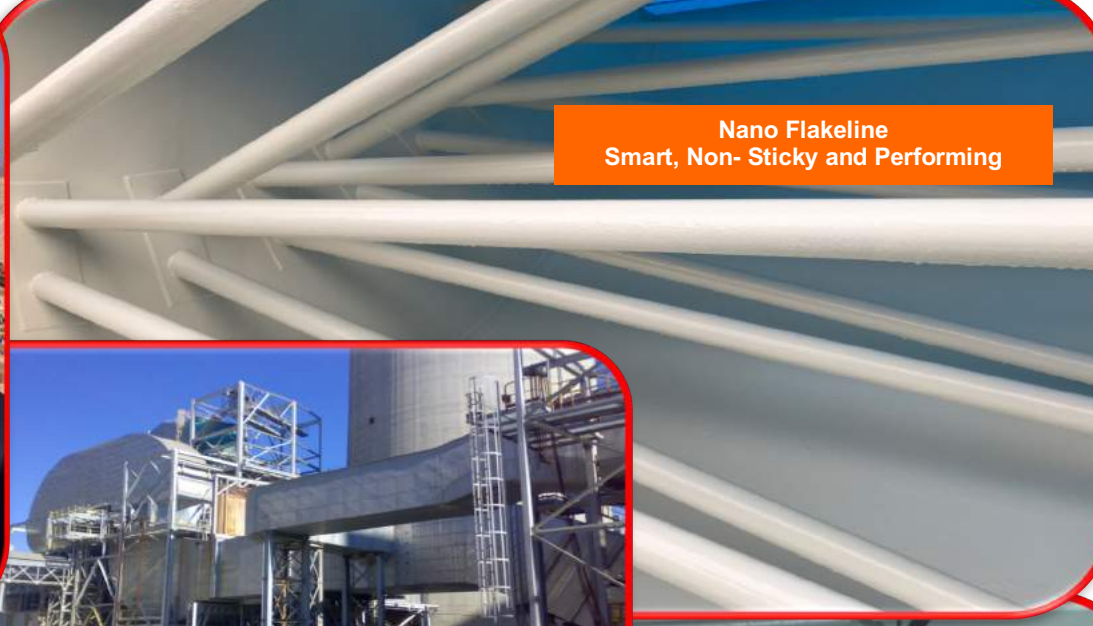
Our Material Safety Data Sheets should be read and understood by all of your supervisory personnel and employees before using products in your facilities.

Drums - Store at temperatures below 21°C/69°F. Storage life decreases with increasing storage temperature. Avoid exposure to heat sources such as direct sunlight or steam pipes. To avoid contamination of product with water, do not store outdoors. Keep sealed to prevent moisture pick-up and monomer loss. Rotate stock.

If stored as mentioned above the shelf life is minimum 6 months

## Recommended Storage:





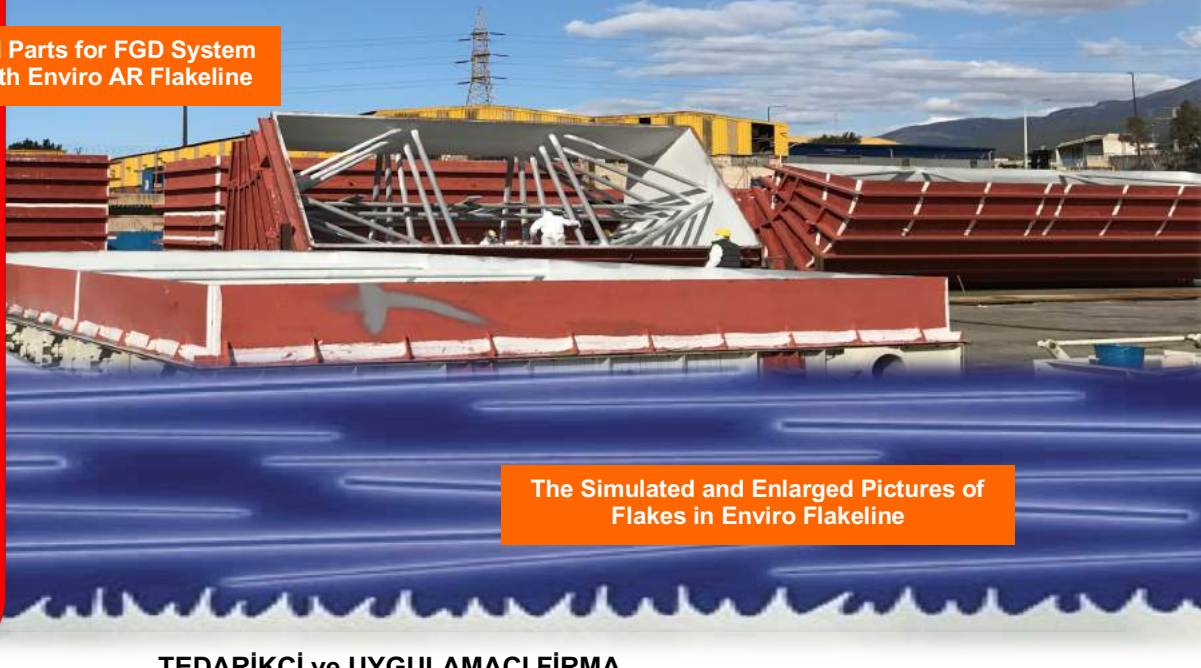
Nano Flakeline  
Smart, Non- Sticky and Performing



GGH Gas Duct Coated with  
Enviro AR Flakeline



Fabricated Parts for FGD System  
Coated with Enviro AR Flakeline



The Simulated and Enlarged Pictures of  
Flakes in Enviro Flakeline