47-HF Series

ChemTemp Hybrid Epoxy Novolac DTM/Liner

Chem-Temp 47-HF Series is a thin film 2-K Hybrid Epoxy Novolac DTM/ Liner Coating that offers exceptional temperature and chemical protection. Specifically formulated for tank linings, vessels, and pipelines, 47-HF Series provides superior barrier properties against acidic, caustic, and high heat environments. Chem-Temp 47-HF Series also offers excellent adhesion and corrosion resistance with a temperature rating of 300˚F for immersion (350°F for some cargoes/services) and 450˚F for dry heat or CUI services, making it the premium choice for high performance against corrosive cargo.

Tech Specs

Heat Resistance:	350˚F for immersion services
	450˚F for dry heat services
Vehicle Type:	Hybrid Epoxy Novolac
Reducer:	Not Normally Required
If desired:	#740S (slow)
	#740M (medium)
	#740F (Fast)
Mix Ratio:	4:1 Base to Activator
Base:	47-HF-####
Activator:	47-AHF-100
Pot Life:	3 Hours @ 77˚F (Decreases in higher temperatures)
Volume Solids:	70%
Theoretical Coverage:	1122ft^2 /gal. @ 1 mil DFT
VOC:	<247 g/L
Flash Point:	24˚F (Lowest Flashing Component)

Dry Film Thickness:	10-18 mils DFT in 2 coats
Wet Film Thickness:	8.6 – 12.9 mils WFT per coat
Dry-time:	Normal
To Touch:	4 Hours
To Recoat:	Minimum – 3 Hours
	Maximum – 36 Hours
Full Cure:	7 Days or 24 Hours after final coat when force cured
Shelf Life:	2 Years Minimum
Finish:	Eggshell
Color:	Standard and Custom
Packaging:	5 Gallon & 1 Gallon Kits
Storage Temperature:	20˚F - 110˚F
Application Temperature:	
Ambient:	45˚F Minimum
Substrate:	40˚F - 100˚F

Surface Preparation

All surfaces should be clean, dry and free of all foreign contaminants.
A SSPC-SP1 Solvent Cleaning with Highland 901 Cleaning Solvent is recommended before blasting or other cleaning method.

Carbon Steel - Immersion:
Obtain a 2-3 mil angular blast profile using one of the recommended methods below.
Best: A SSPC-SP5/NACE 1 White Metal Blast Cleaning is recommended for maximum coating performance and longevity.
Good: A SSPC-SP10/NACE 2 Near White Metal Blast Cleaning provides good results.

Carbon Steel - Non-Immersion:
Obtain a 2-3 mil angular blast profile using one of the recommended methods below.
Best: A SSPC-SP10/NACE 2 Near White Metal Blast Cleaning is recommended for maximum coating performance and longevity.
Good: A SSPC-SP6/NACE 3 Commercial Blast Cleaning provides good results.

Galvanized Steel:
Contact a Highland representative as recommendation will vary depending on substrate and exposure conditions.

Note: Allow one week at 77˚F before being put into service (unless force cured). The second coat/topcoat must be applied within 36 hours at 77˚F or the surface will need to be scuffed.

Mixing & Application

Mixing: Highland 47-HF Series needs to be thoroughly mixed using mechanical agitation. Mix entire contents of Part "A" Activator with Part "B" Base (4:1 by volume) Product is ready to spray after proper mixing and a 30 minute induction period.

Reduction: Reduction is not required, if desired, reduce by 0% - 10% with Highland #740 reducer.

Highland 47-HF Series is designed for spray application. To ensure optimal performance, apply according to recommendations below.

Airless Gun:	Graco 205-591
Pump:	30:1/45:1/60:1
Tip Range:	3.013 – 4.017
Pump Pressure:	1,800 psi Minimum
Hose:	3/8 inch ID
Brush or Roller:	Both are acceptable for touch up.

Conventional Gun:	DeVilbiss MBC-510
Fluid Tip:	E
Air Cap:	704
Atomizing Pressure:	70 psi
Pot Pressure:	15-20 psi
Hose:	1/2 inch
Clean Up:	Highland #901 Cleaning Solvent

Typical Systems

Standard/Immersion Service: Apply 8-18 mils DFT of 47-HF Series in 2 coats at 6-9 mils per coat directly to prepared steel.

Highland 47-HF Series may also be topcoated with a variety of Highland Topcoats. Contact your Highland representative for details.

Advantages

- Next generation polymer technology specifically engineered for heat stability and chemical resistance
- Dry heat stability up to 450°F, immersion up to 300°F (350°F for some cargoes/services)
- Superior resistance to a wide variety of chemicals and solvents
- Superior abrasion resistance
- Superior adhesion even over marginally prepared surfaces
- Excellent corrosion resistance
- Ease of application
- Specially engineered inert filler package provides superior barrier properties
- Superior substrate wetting provides excellent adhesion and corrosion protection
- Ultra-high crosslink density provides a tough durable film with long lasting protection

Performance Data

Adhesion (ASTM D 4541) – Commercial Blast	> 1800 psi
Abrasion Resistance (ASTM D 4060) 1000 Cycles, 1000g load	Excellent – 124 mg loss
Humidity Resistance (ASTM 4585) 3000 hours	Excellent – No blistering or other defects observed
Salt Spray Resistance (ASTM B 117) 3000 hours	Excellent - <1 mm creep from scribe, no blistering

Chemical Resistance (ASTM D 1308)	Excellent – MEK – No defects observed 25% H_2SO_4 – Slight discoloration, no other defects observed 25% NaOH – slight loss of gloss, no other defects observed
Pencil Hardness (ASTM D 3363)	6H
Elongation (ASTM D 522)	5%

Independent Test Data

RAE Engineering and Inspection Ltd. May 2011

NACE TM0185 – Evaluation of Internal Plastic Coatings for Corrosion Control of Tubular Goods by Autoclave Testing.

Adhesion

Method: ASTM D4541 – Standard Test Method for Pull-Off Strength

System: Two coats 47 Series @ 8 mils DFT per coat applied to:
1) SSPC-SP6 Commercial Blast prepared steel
2) No surface preparation

Result: 1) No less than 1400 psi with SPPC-SP6 Commercial Blast
2) No less than 1000 psi with no surface preparation.

Chemical Immersion

Method: Continuous Immersion at 93°C (200°F)

System: Two coats 47 Series @ 8 mils DFT per coat applied to SSPC-SP5 White Metal Blast prepared steel. Cured 14 days at 21°C (70°F).

Result: No cracking, lifting, or delamination after 60 days of continuous exposure.

Reagents: 10% methanol, 50% methanol, 10% sulfuric acid, 25% sulfuric acid, 10% sodium hydroxide, 50%Sodium hydroxide.

Heat Resistance

Method: Continuous heat exposure at 232°C (450°F)

System: Two coats 47 Series @ 8 mils DFT per coat applied to:
1) SSPC-SP56 Commercial Blast prepared steel
2) No surface preparation
3) No surface preparation with tight rust.

Cured 14 days at 21°C (70°F).

Result: No cracking, lifting, or delamination of the film after 3000 hours of continuous exposure.

Acid Condensation Bath

Method: Coated panels exposed to a condensation bath with 50% sulfuric acid and water. The test duration was 1000 hours total at 177°C (350°F) and the panels were scribed with an "X" to evaluate corrosion. The acid bath was performed in an enclosed apparatus that retained the sulfuric acid condensation, and the panels were suspended in the headspace.

System: Single coat as well as two coats 47 Series @ 8 mils DFT per coat applied to SSPC-SP6 Commercial Blast prepared steel. Cured 24 hours at 21°C (70°F).

Result: No rust creepage, softening, cracking or delamination of the film after 1000 hours of continuous exposure.

Sulfuric Acid Spot Testing

Method: Continuous heat at 177°C (350°F) for 1500 hours. After 1500 hours, spot testing was performed with 98% sulfuric acid for 72 hours.

System: Two coats 47 Series @ 8 mils DFT per coat applied to SSPC-SP6 Commercial Blast prepared steel. Cured 24 hours at 21°C (70°F).

Result: No softening or cracking of the film (some discoloration was observed.

Charter Coating Services Ltd. July 2011

Method: NACE TM0185 – Evaluation of Internal Plastic Coatings for Corrosion Control of Tubular Goods by Autoclave Testing.

Test Conditions:
Temperature: 45°C/ 203°F
Pressure: 1800 psi
Gas Phase: 5% H_2S, 5% CO_2, 90% CH_4
Organic Phase: Toluene: Xylene 1:1 ratio
Aqueous Phase: 5% NaCl
Duration: Cycle 1 - 96 hours/ Cycle 2 – additional 48 hours (rapid depressurization)

System: Two coats 47 Series @ 5-8 mils DFT per coat applied to SSPC-SP 5 White Metal Blast prepared steel.

Cycle 1 Results:
Blistering – the test panel remained free of blisters in all three phases
Adhesion – The maintained an A rating in all three phases
Depressurization – no effect from 1500psi to atmospheric over duration of 120 minutes

Cycle 2 Results: (Additional 48 Hours Test with Rapid Decompression from 1800psi to atmospheric in 5 Minutes at 95°C/203°F)
Blistering – The coating showed reactions to the rapid decompression condition as indicated by minor blistering (D#6), the blisters did not extend to substrate. No holidays were detected.
Adhesion – The coating maintained excellent adhesion (rating A) after exposure.

Safety Information

- Use normal precautions such as gloves, facemasks and barrier creams.
- Adequate ventilation must be maintained. In confined areas, applicators must wear constant flow airline respirators.
- If product comes into contact with skin, wash thoroughly with lukewarm water or diluted Boric Acid, and obtain immediate medical attention.
- This product contains FLAMMABLE materials. Keep away from sparks and open flames. Observe NO SMOKING regulations.
- All electrical equipment and installations should conform to NEC regulations. In areas where explosion hazards exist, applicators should be required to use nonferrous tools, and to wear conductive, non sparking shoes.
- Observe low flash regulations.
- Refer to Safety Data Sheet (SDS) for complete safety instruction