# Highland International 74-HF Series Chem-Temp Epoxy Performance Criteria

## Adhesion

**Method**: ASTM D4541
**System**: Two coats 74 Series @ 8 mils DFT per coat applied to:
1) SSPC-SP5 White Metal prepared steel
2) SSPC-SP6 Commercial Blast prepared steel
3) no surface preparation
Cured 14 days at 21°C (70°F)
**Result**: 1) No less than 1200 psi with SSPC-SP5 White Metal blast
2) No less then 1000 psi with SSPC-SP6 Commercial Blast
3) No less than 900 psi with no surface preparation

## Chemical Immersion

**Method**: Continuous Immersion at 93°C (200°F)
**System**: Two coats 74 Series @ 8 mils DFT per coat applied to SSPC-SP5 White Metal 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 260°C (500°F)
**System**: A Single coat as well as two coats 74 Series @ 8 mils DFT per coat applied to:
1) SSPC-SP6 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 or delamination of the film after 3000 hours of continuous exposure.

## Acid Condensation Bath

**Method**: Coated panels exposed to a condensation bath with 50% sulphuric 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**: A Single coat as well as two coats 74 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% sulphuric acid for 72 hours.
**System**: Two coats 74 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).

## Elongation

**Method**: ASTM D 522.
**System**: A single coat as well as two coats 74 Series @ 8 mils DFT per coat applied to steel Q Panel.
**Result**: Pass 1" Mandrel
Elongation at 8 mils: 4.98%
Elongation at 16 mils: 6.70%

## Abrasion Resistance

**Method**: ASTM D 4060 (CS-17 Wheel, 1000 gram load).
**System**: A single coat 74 Series @ 8 mils DFT.
**Result**: Average 83 mg loss after 1000 cycles.

## Independent Testing - Autoclave at 275°F

**Method**: NACE TM0185 - Evaluation of Internal Plastic Coatings for Corrosion Control of Tubular Goods by Autoclave Testing.
**Test Conditions:**
Temperature: 135°C (275°F)
Pressure: 110 psig
Gas Phase: 5% hydrogen sulphide ($H_2S$), 5% carbon dioxide ($CO_2$), 90% methane (CH4)
Organic Phase: 50% kerosene, 50% toluene
Aqueous Phase: 5% NaCl
Duration: 4 days at temperature and pressure
**System**: Two coats 74 Series @ 5 - 8 mils DFT per coat applied to SSPC-SP5 White Metal Blast prepared steel. Cured 7 days at 21°C (70°F)
**Result**: Blistering: The test panel remained free of blisters in all three phases.
Adhesion: The panel maintained an A rating in all three phases.
Coating Impedance: The 74 Series maintained excellent impedance in the Organic (10.2) and Gas (10.5) phases with only a slight decrease observed in the Aqueous (8.7) phase. Results indicate that good barrier properties remain across all three phases of exposure.
Undercreep: No undercreep was observed at the edge of the panel.

## Independent Testing - Autoclave at 350°F

**Method**: NACE TM0185 - Evaluation of Internal Plastic Coatings for Corrosion Control of Tubular Goods by Autoclave Testing.
**Test Conditions:**
Temperature: 177°C (350°F)
Pressure: 240 psig
Gas Phase: 5% hydrogen sulphide ($H_2S$), 5% carbon dioxide ($CO_2$), 90% methane (CH4)
Organic Phase: 50% kerosene, 50% toluene
Aqueous Phase: 5% NaCl
Duration: 4 days at temperature and pressure
**System**: Two coats 74 Series @ 5 - 8 mils DFT per coat applied to SSPC-SP5 White Metal Blast prepared steel. Cured 7 days at 21°C (70°F)
**Result**: Blistering: The test panel remained free of blisters in all three phases.
Adhesion: The panel maintained an A rating in all three phases.
Coating Impedance: The 74 Series maintained excellent impedance in the Organic (10.0) and Gas (10.6) phases with only a slight decrease observed in the Aqueous (9.4) phase. Results indicate that good barrier properties remain across all three phases of exposure.
Undercreep: No undercreep was observed at the edge of the panel.