



## DeCORE AFCI-45

**DeCORE AFCI-45** is an anionic **amine-free**, water-soluble, multi-metal corrosion inhibitor recommended to protect a variety of metals including aluminum, copper, brass, bronze, steel, cast iron, ferrous and non-ferrous metals in aqueous systems. **DeCORE AFCI-45** is also a very effective hydrotrope for alkaline systems.

### SPECIFICATIONS

Appearance @ 25° C:	Clear yellow liquid
Color (Gardner):	5 max.
% Solids:	43.0% - 47.0%
pH (as is):	9.0 – 11.0

**SOLUBILITY** (10% by weight): DeCORE AFCI-45 is soluble in water, alcohols and glycols. It is insoluble or dispersible in solvents and oils.

### TYPICAL PROPERTIES

Density @ 25°C                      ~1.0 g/ml

- Corrosion inhibitor for metal in aqueous systems at pH  $\geq$  7
- Effective on multiple metals including aluminum, brass & copper
- Prevents flash rust on steel
- Not stable in acid systems
- Low – moderate foaming
- Hydrotrope for alkaline systems
- Biodegradable
- Amine-free
- Azole-free
- Non-phenolic
- Phosphate-free
- Boron-free
- Nitrite-free

### APPLICATIONS

- Alkaline metal cleaners
- Synthetic coolants & cutting fluids
- Industrial cooling towers
- Water based lubricants
- Low foam alkaline cleaners
- Radiator fluids & cleaners
- Water based paints & coatings

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**Corrosion Testing using DeCORE AFCI-45**

**Metal Panel Submersion Test at Room Temperature**

The bottom half of each metal panel was submerged in solution containing 0.25% - 1.0% DeCORE AFCI-45 by weight, in hard water (100 ppm as CaCO<sub>3</sub> & 71 ppm as chloride) at room temperature. The top half of the panel was exposed to the vapor phase in closed glass containers. All results are after 12 weeks elapsed.

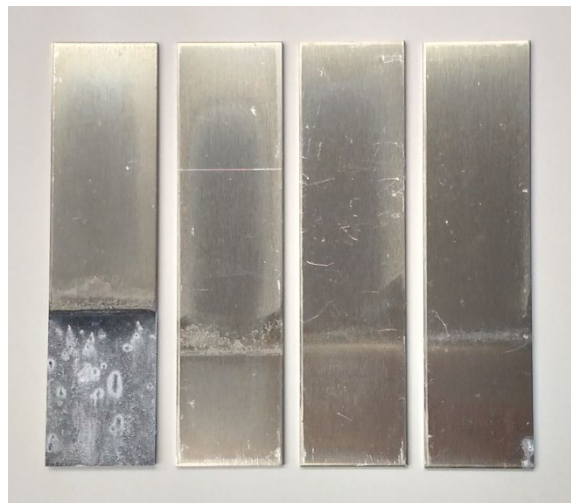
**Steel Panels: SAE 1010 Cold rolled steel (mild carbon)**

No Inhibitor    1.0%    0.5%    0.25%



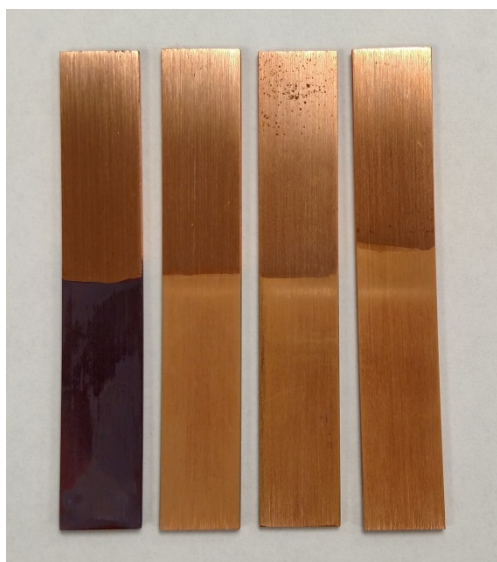
**Aluminum Panels, #2024 Bare Aluminum**

No Inhibitor    1.0%    0.5%    0.25%



**Copper Panels: #110 Copper (99.95% Cu)**

No Inhibitor    1.0%    0.5%    0.25%



**Brass Panels: #260 Brass Alloy (30% Zn / 70% Cu)**

No Inhibitor    1.0%    0.5%    0.25%



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## Metal Panel Submersion Test at Elevated Temperature & High Chloride Environments

### Test Conditions

Hard Water Solutions: 300 ppm as CaCO<sub>3</sub> & 210 ppm as chloride

DeCORE AFCI-45 level tested: 1.0% by weight (0.5% active)

Solution pH: Solutions were adjusted with 0.1N NaOH from pH 6.25 to pH 8.75 – 9.0.

Time/Temperature: 24 hours @ Room Temperature (RT) & 200°F

The bottom half of each metal panel was submerged in solution whereas the top half of the panels were exposed to the vapor phase in closed glass jars. Controls do not contain corrosion inhibitor.

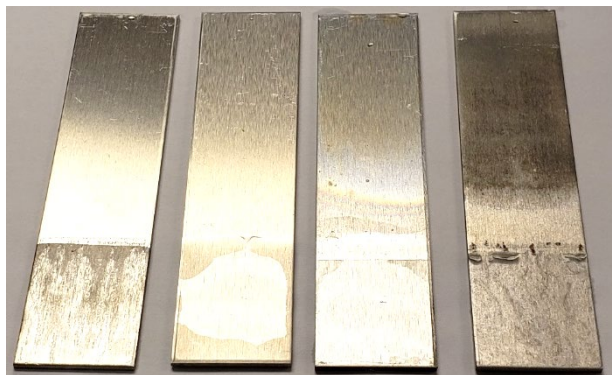
The following results indicate DeCORE AFCI-45 is an effective inhibitor for multiple metals under these test conditions.

**Panels from left to right: RT control, RT w/inhibitor, 200°F w/inhibitor, 200°F control**

#### Steel Panels: SAE 1010 Cold rolled steel (mild carbon)



#### Aluminum Panels, #2024 Bare Aluminum



#### Copper Panels: #110 Copper (99.95% Cu)



#### Brass Panels: #260 Brass Alloy (30% Zn / 70% Cu)



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## **DeCORE AFCI-45: Flash Rust Prevention**

Flash rust can occur on steel after any wet method of surface preparation as the surface dries. It can occur quickly – within minutes- or at most, after a few hours. The following quick-screen test shows that DeCORE AFCI-45 is an effective flash rust inhibitor for cold rolled steel.

First Beaker: Acidified tap water (pH 7.01) with a few drops of a 10% citric acid solution to final pH 5.35

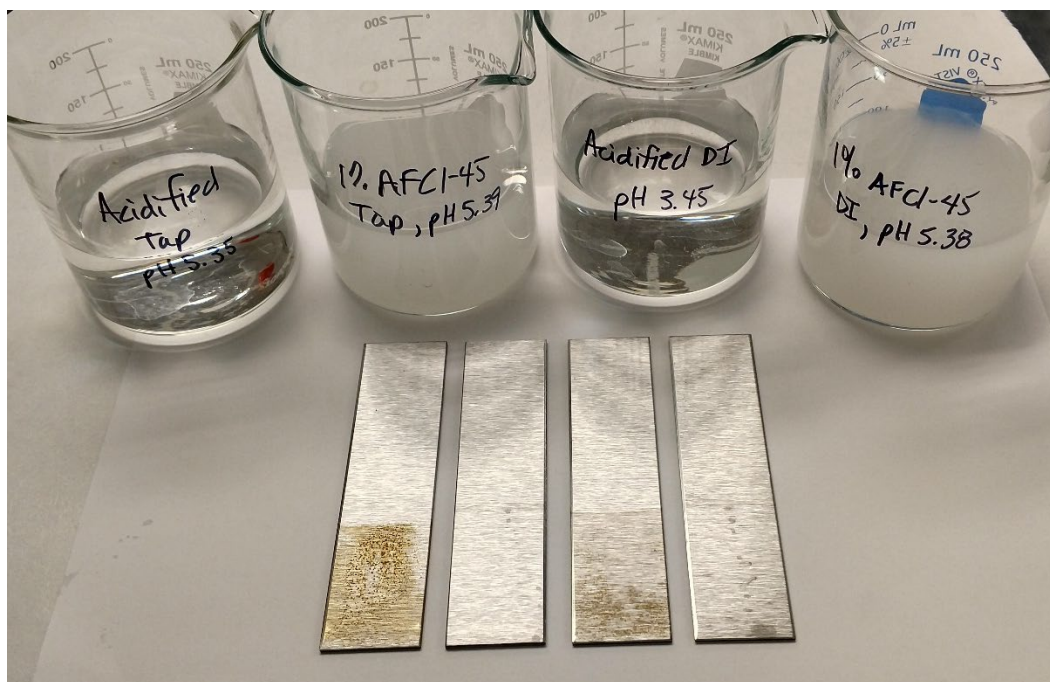
Second Beaker: 1% by weight DeCORE AFCI-45 added to acidified tap water to final pH 5.39

Third Beaker: Acidified distilled water (pH 5.53) with a few drops of a 10% citric acid solution to final pH 3.45

Fourth Beaker: 1% by weight DeCORE AFCI-45 added to acidified distilled water to final pH 5.38

A cold rolled steel panel was placed into each solution and allowed to soak for ~1 hour at room temperature without covering the beakers. No rust was observed in the liquid phase on any of the panels prior to removing from solution. The steel panels were removed and allowed to air dry without rinsing.

Flash rust forms on the panels without DeCORE AFCI-45 present in solution within a few minutes of air drying. **No flash rust forms on the panel with DeCORE AFCI-45 present.**



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## ASTM D-1384 Corrosion Test for Engine Coolants in Glassware

Independent laboratory testing of DeCORE AFCl-45 was conducted in duplicate at 2.0% by weight in 98% ethylene glycol (Defcool-2, Defcool-3) and compared to a commercial coolant (Defcool-1) containing 98% ethylene glycol and typical OAT corrosion inhibitors.

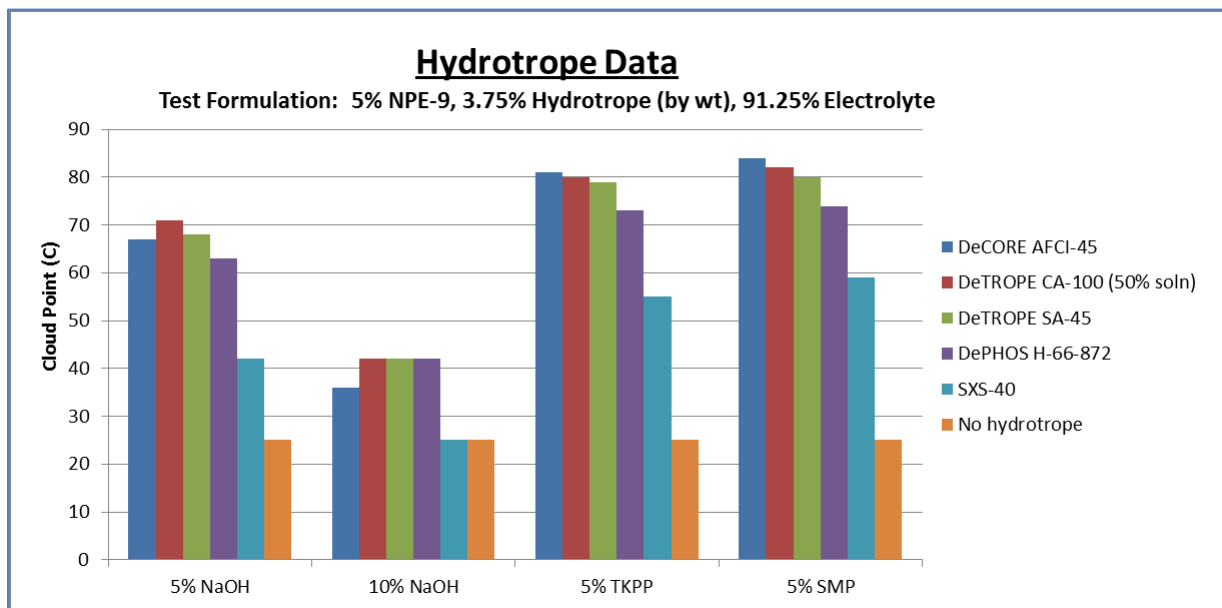
ASTM-3184 Test Results	Defcool-1	Defcool-2	Defcool-3	Average	Max. Acceptable Weight Loss
Copper specimen - Wt. Change (mg)	1.1 mg	3.9	4.5	4.2	10 mg
Solder specimen- Wt. Change (mg)	54.8 mg	55.1	55.5	55.3	30 mg
Brass specimen- Wt. Change (mg)	0.6 mg	4.7	4.6	4.7	10 mg
Steel specimen - Wt. Change (mg)	0.1 mg	1.3	0.4	0.9	10 mg
Cast Iron specimen - Wt. Change (mg)	-0.2 mg	-0.4	-1.5	-0.95	10 mg
Cast Aluminum specimen - Wt. Change (mg)	-1.9 mg	-2.8	-3.7	-3.3	30 mg

As per D-1384 method, positive values are weight loss & negative values are weight gain. D1384 - 336 hours @ 88C, 100 ml/min, Air.

## Hydrotrope Data

DeCORE AFCl-45 is also an excellent hydrotrope for alkaline systems as shown in the graph below. Performance was determined and compared to several other DeForest hydrotropes and to SXS-40.

Each hydrotrope was solubilized in a caustic or alkaline electrolyte solution followed by addition of nonylphenol ethoxylate (NPE-9.5). Each sample was heated to the temperature at which the NPE-9.5 clouds out of solution. The higher the cloud point temperature, the more efficient the hydrotrope.



**Key:** NaOH = Sodium Hydroxide, SMP = Sodium Metasilicate Pentahydrate, TKPP = Tetrapotassium Pyrophosphate

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