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Eastman Tetrashield™ IC3020 protective resin system

Optimizing corrosion resistance in direct-to-metal applications with the addition of zinc-free corrosion inhibitors

Eastman Tetrashield™ IC3020 protective resin system is a highly durable polyester designed to enhance coating performance and increase the application window for protective and maintenance coatings in industrial plants, equipment, and infrastructure. Tetrashield IC3020 can be used for both 2K topcoats and direct-to-metal (DTM) monolayer coating formulations.

One of the challenges in industrial and protective applications is to have a resin system that can achieve corrosion resistance over multiple substrates. Tetrashield IC3020 intrinsically provides corrosion resistance properties in industrial applications for the DTM market. The addition of zinc-free corrosion inhibitors in combination with Tetrashield IC3020 further improves corrosion resistance over shot-blasted and cold-rolled steel, enabling formulation flexibility to tailor performance to the application.

Formulations

The corrosion inhibitors provide the formulator two different mechanisms to improve corrosion performance. The inorganic additive, Halox® CW-2230, provides a typical passivation mechanism in addition to ion exchange benefits, which will further prevent corrosion at the metal-paint interface. Halox 650 is a diacid functional organic additive that improves coating adhesion, which results in reduced corrosion failures. Halox CW-2230 and Halox 650 should be used at a fixed level of 6 wt% and 1.5 wt% of total formulation weight, respectively.

Formulations (see Table 1) were prepared by grinding a mill base with a Dispermat high-speed mixer. The mill base is then let down by adding more resin, surface additives, and solvent. Cross-linker was added to the A component, starting the curing reaction. The formulations were sprayed in a humidity- and temperature-controlled environment (75°F, ~50% RH) at 35 seconds, Ford cup No. 4 viscosity using a conventional spray gun.

Table 1. IC3020 starting point formula containing zinc-free corrosion inhibitors

Compound	Wt%	Description	Supplier
Mill base—Part A			
Tetrashield IC3020	18.61	Polyester resin	Eastman
Zoldine® MS Plus	0.71	Moisture scavenger	Angus
DISPERBYK-164	0.55	Wetting and dispersing agent	BYK
BYK-A501	0.53	Air release additive	BYK
Crayvallac® Ultra	0.75	Rheology modifier	Arkema
Ti-Pure™ R960	13.70	Pigment	Chemours
Vulcan® XC72R GP 3921	0.18	Carbon black pigment	Cabot
Microtalc IT Extra	3.54	Pigment extender	Elementis
Microdol™ Extra	9.39	Pigment extender	Omya
Halox® CW-2230	6.00	Inorganic anticorrosion pigment	ICL
Halox® 650	1.50	Organic corrosion inhibitor	ICL
MAK	8.13	Solvent	Eastman
Letdown—Part A			
Tetrashield IC3020	10.14	Polyester resin	Eastman
BYK-306	0.05	Surface additive	BYK
BYK-392	0.73	Antipopping additive	BYK
Tinuvin® 292	0.38	UV absorber	BASF
Tinuvin® 400	0.46	UV absorber	BASF
1% DBTDL in A100	1.90	Catalyst solution	Various
MAK	0.00	Solvent	Eastman
Cross-linker—Part B			
Desmodur® N3390 BA/SN	15.40	Cross-linker	Covestro
Thinner—Part B			
MAK	7.36	Solvent	Eastman
Total	100.00		

Note: For formulas made without anticorrosive additives, Microdol Extra and Microtalc IT Extra pigment extender were both increased in proportion to maintain P/B.

Table 2. IC3020 formula parameters

Parameter	Value
NCO:OH	1.10
Wt% solids	73.00
Vol. % solids	58.19
PVC	0.25
P/B	0.86

Figure 1. 1,250-hour salt spray (ASTM B117)

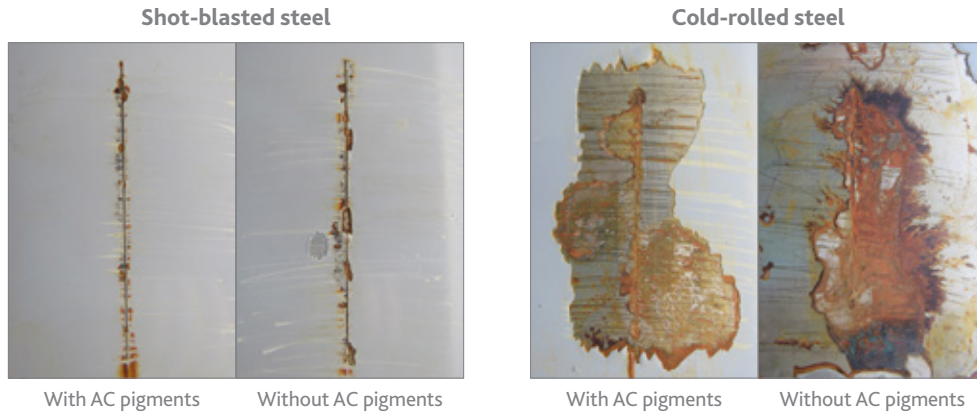


Table 3. Data

Substrate	Shot-blasted steel		Cold-rolled steel	
	With	Without	With	Without
AC pigments				
DFT (mils)	4.15	4.48	4.62	5.53
Initial gloss (60°)	84.2	84.5	86.8	85.1
Face blistering	10	8F	10	10
Scribe creep (mm)	0.6	1.2	22	45

Summary

Tetrashield IC3020 is recommended for DTM applications over shot-blasted steel and meets most performance specifications required in the protective market. For improved performance over shot-blasted and cold-rolled steel, the addition of corrosion inhibitors is recommended. Corrosion improvement using IC3020 and corrosion inhibitors is not limited to shot-blasted and cold-rolled steel, and improvements may be noticeable on multiple metal substrates. The use of Tetrashield IC3020 in combination with Halox CW-2230 and Halox 650 zinc-free corrosion inhibitors has been found to be very effective. Specific levels of these corrosion inhibitors should be determined experimentally with the specific developmental formulation for the intended application to ensure properties meet performance specifications.



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