



ACRONAL[®] PRO 770

Acrylic Dispersion for Improved Metal Protection

May 2020

Agenda

- ACRONAL® PRO 770 introduction
- Direct-to-metal benchmarking data
- Regulatory and commercial status
- Q&A



Focus Applications for Waterborne DTM Technologies

C1-C2:
2-5 yrs. service in internal spaces w/ natural atmospheres & possible condensation or external spaces w/ limited environmental factors

C2-C3:
5-15 yrs. service in areas including external urban and industrial atmospheres w/ moderate SO2 pollution

**ISO 12944-2



Gas cylinders



Tanks



Refineries, plants



Offshore



Radiator coatings



Container coatings



Infrastructure



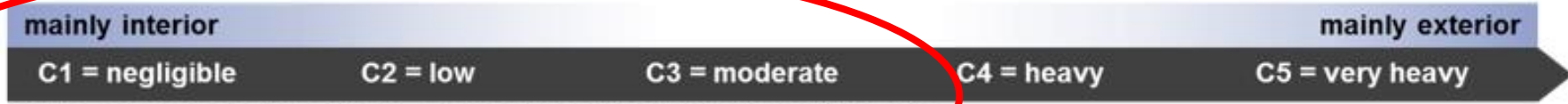
- Air conditioned/ heated rooms with low humidity
- Very dry or very cold climate

- Non heated rooms, e.g. gymnasiums, storages
- Dry or cold climate with low pollution

- Rooms with occasional condensation, e.g. food production
- Moderate climate & moderate pollution

- Cities with high level of air pollution
- Frequent condensation, e.g. production facilities, swimming pools

- Coastal areas, cities with very high level of air pollution, marine areas
- Very frequent condensation, and high pollution, e.g. mines



Corrosiveness of atmosphere, increasing anticorrosion requirements

Source: DIN EN ISO 9223

Trends impacting waterborne DTM innovation



Protect & Perform

- Improved performance through corrosion resistance and UV degradation
- Increased durability of coatings through improved gloss, chemical and UV/weather resistance



Value Engineering

- Thinner film builds or reduction of the number of coats
- Ease of maintenance (faster repair and return to service)
- Reduced cost, increased throughput and ease of application through better coverage with reduced paint usage, and elimination of coating layers



Sustainability

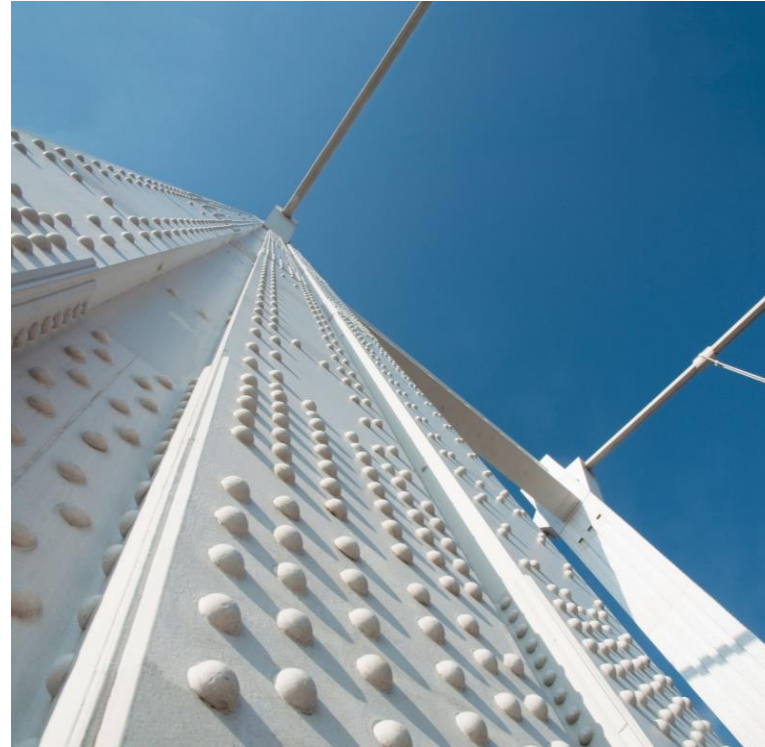
- Movement away from conventional crosslinking technology
- Low / Zero VOC coatings

ACRONAL® PRO 770

APEO- and zinc- free acrylic dispersion for primers and DTM

Benefits

- Superior corrosion protection
- Good early water and humidity resistance
- Good adhesion to various metal substrates
- Excellent application properties
- Easy to formulate



Physical Properties

Values

N.V.	50%
Viscosity	300 – 1,000 cps
pH	7.0 – 8.3
Freeze-thaw stable	no
MFFT	~19 °C
Appearance	Milky white emulsion

Suitable for applications including:

- Interior/exterior industrial and institutional maintenance
- Interior/exterior general industrial metal
- Direct-to-metal (DTM) protective

Waterborne DTM Benchmarking Study

Tested more than 20 competitive resins alongside ACRONAL PRO 770

Scope

- ▶ 1K waterborne acrylic direct-to-metal (DTM)
- ▶ Competitive resins were formulated per manufacturer's recommended SPF without addition of corrosion inhibitors, adhesion promoters, etc.

Round 1 Performance Testing

- ▶ Corrosion Resistance
- ▶ Chemical Resistance
- ▶ Adhesion
- ▶ Humidity



Round 2 Performance Testing

- ▶ Block Resistance
- ▶ Hardness
- ▶ Weatherability
- ▶ Flexibility

Cold Rolled Steel

Aluminum

Avg DFT: 1.9 mils

Starting point formulation

ACRONAL PRO 770 White DTM Formulation

Materials	Pounds	Gallons
GRIND		
DI Water	85.48	10.25
Dispex® Ultra PX 4575	22.12	2.48
Hydropalat® WE 3650	2.01	0.25
Foamaster® MO NDW NC	3.02	0.41
DMEA (50% in Water)	1.01	0.13
Ti-Pure1 R-900	195.09	5.84
HIGH SHEAR DISPERSE FOR 30 MINUTES at 3400 RPM		
LET DOWN		
ACRONAL PRO 770	567.16	64.74
Grind (add grind to resin)	308.72	19.36
DI Water	45.25	5.43
DB (diethylene glycol monobutyl ether)	65.36	8.21
FoamStar® SI 2210	2.01	0.25
Flash-X2 150	5.03	0.53
DMEA (50% in Water)	2.01	2.01
Rheovis® PU 1191 (50% in DB)	10.06	1.22
Total	1005.60	100.00

Formulation Attributes	
Solids	49.3%
PVC	15.9%
VOC (calculated)	185 g/L

Summary of Benchmarking Results from Top Performing Resins

Resin	Adhesion	Humidity	Chemical	Corrosion	Hardness	Flex	Block
JONCRYL PRO 1524	Green	Green	Green	Yellow	Green	Red	Red
ACRONAL PRO 770	Green	Green	Green	Green	Yellow	Yellow	Yellow
Competitor B	Yellow	Green	Yellow	Green	Yellow	Yellow	Yellow
Competitor D	Yellow	Yellow	Yellow	Green	Yellow	Green	Yellow
Competitor E	Yellow	Yellow	Yellow	Yellow	Green	Green	Green
Competitor F	Yellow	Green	Green	Yellow	Yellow	Yellow	Yellow

BASF's ACRONAL PRO 770 is a top performer across multiple categories

Formulation matters!

A BASF acrylic dispersion in two formulations after ASTM B-117



Formulation A (235 hrs)



Formulation B (375 hrs)

Adhesion: ASTM D3359



Wet

Dry



Adhesion: ASTM D3359

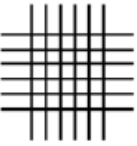
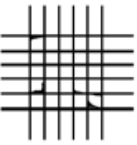
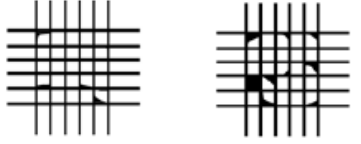
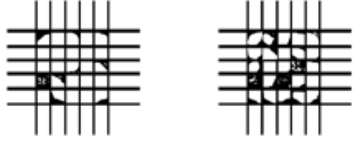
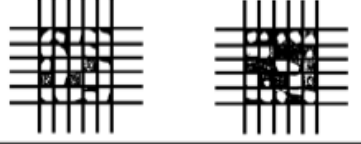
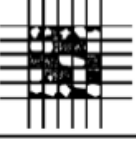
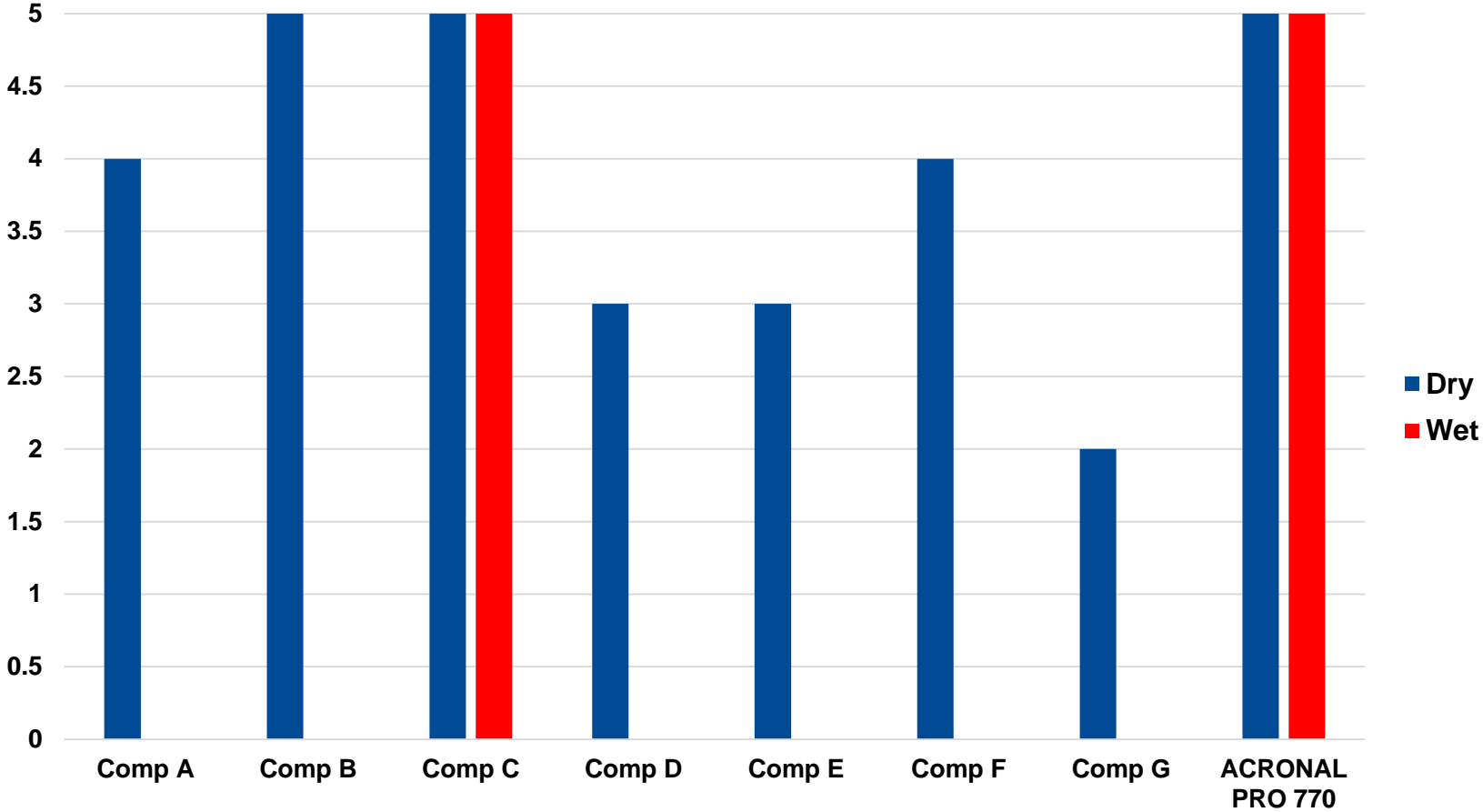
CLASSIFICATION OF ADHESION TEST RESULTS		
CLASSIFICATION	PERCENT AREA REMOVED	SURFACE OF CROSS-CUT AREA FROM WHICH FLAKING HAS OCCURRED FOR SIX PARALLEL CUTS AND ADHESION RANGE BY PERCENT
5B	0% None	
4B	Less than 5%	
3B	5 - 15%	
2B	15 - 35%	
1B	35 - 65%	
0B	Greater than 65%	

FIG. 1 Classification of Adhesion Test Results

Adhesion Testing: ASTM D3359(B)

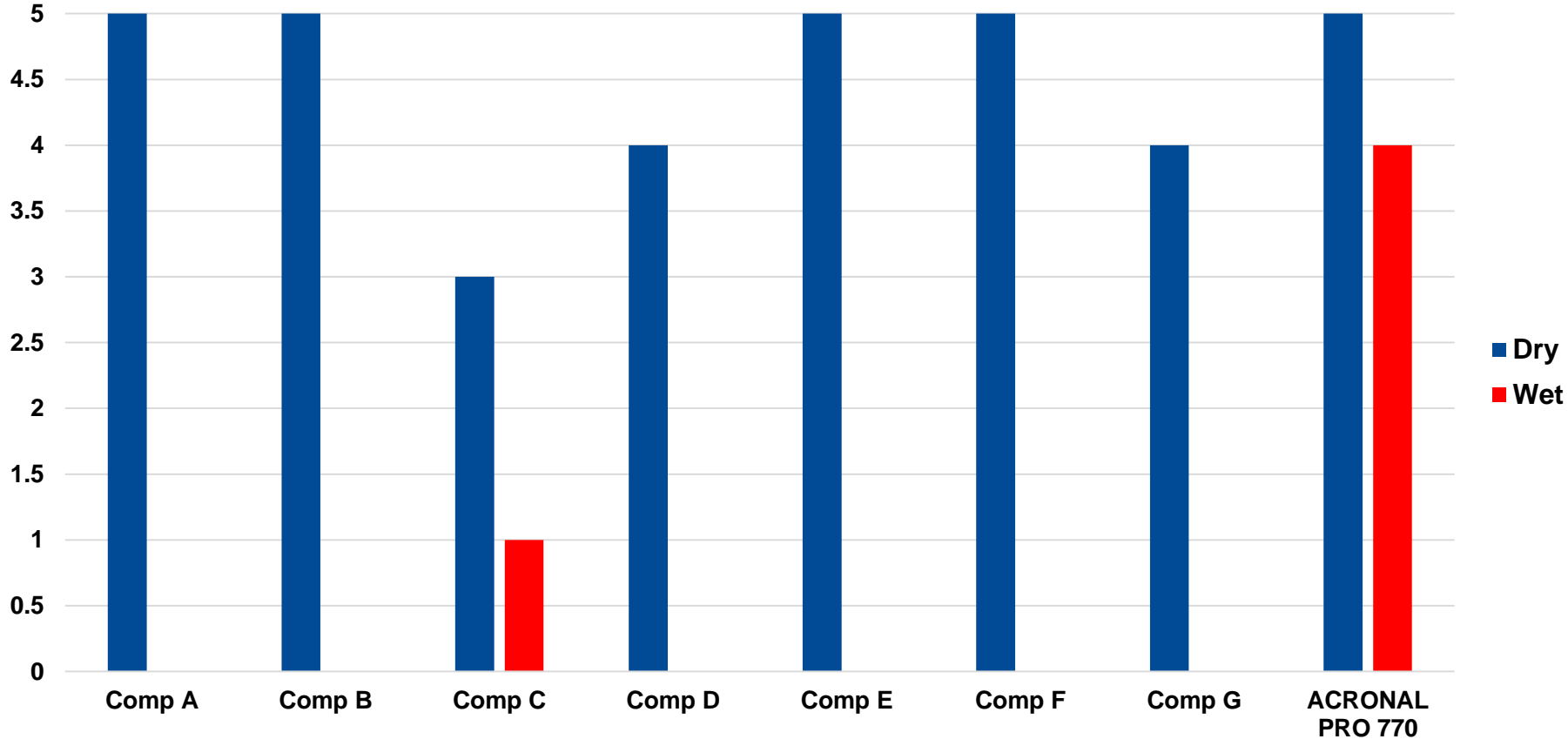
Adhesion to CRS



ACRONAL PRO 770 offers best-in-class dry AND wet CRS adhesion

Adhesion Testing: ASTM D3359(B)

Adhesion to Aluminum



ACRONAL PRO 770 is the only resin that showed good wet adhesion to aluminum

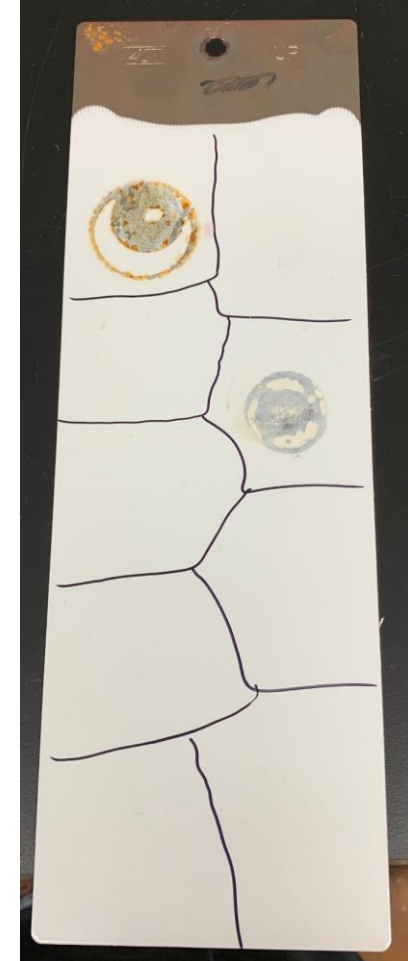
ACRONAL PRO 770

Adhesion to Difficult Substrates

	Dry Adhesion		Wet Adhesion	
Substrate	X-Scribe	2mm Crosshatch	X-Scribe	2mm Crosshatch
Galvanneal	pass	5	pass	5
UP CRS	pass	5	pass	5
Electrogalvanized	pass	5	pass	5
Blasted Hot-Rolled Steel	pass	5	pass	5
PC Plastic	pass	2-3	pass	2-3
PC/ABS Plastic	pass	3-4	pass	3-4

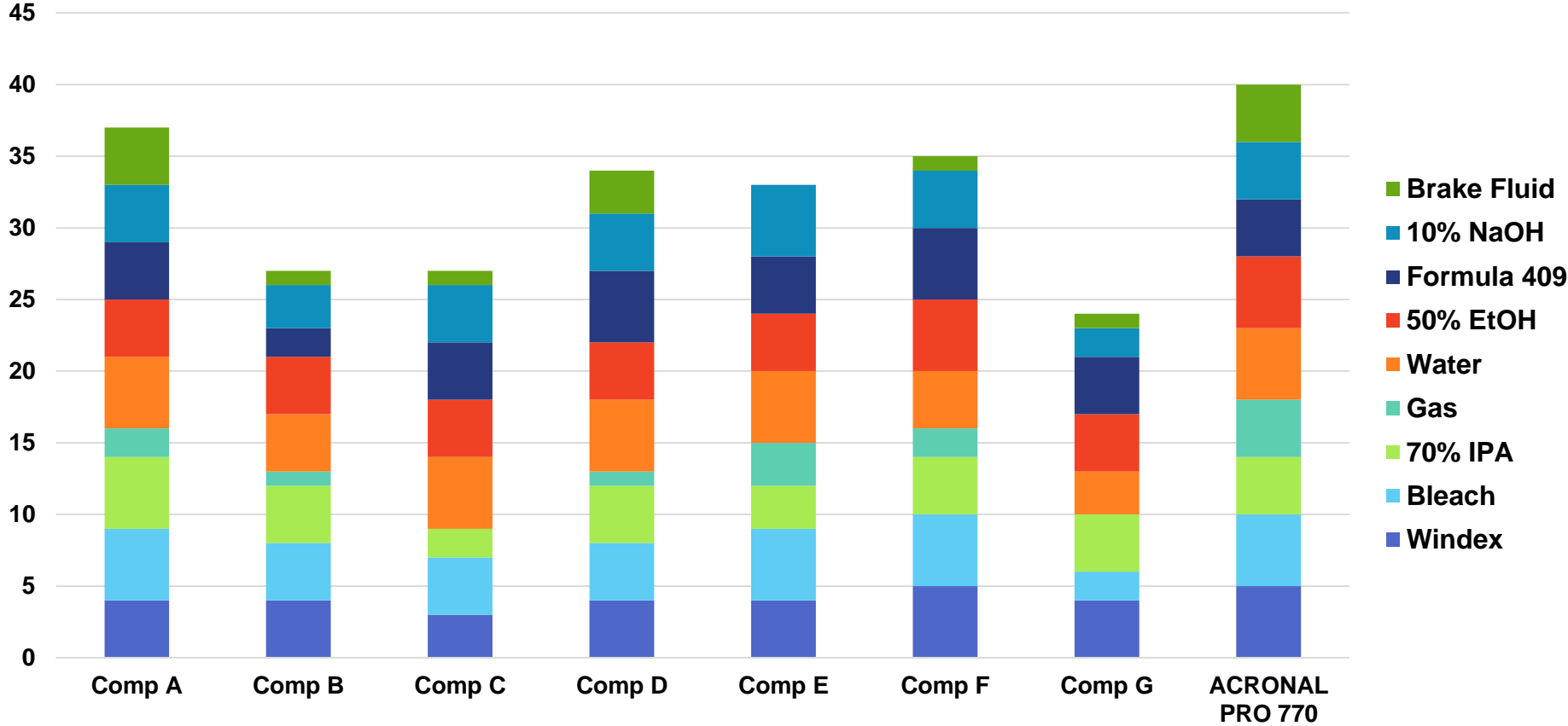
Chemical Resistance: ASTM D1308

- Brake Fluid
- 10% Sodium Hydroxide
- Formula 409
- 50% Ethanol
- Water
- Gasoline
- 70% IPA
- Clorox Bleach
- Windex



Chemical Resistance: ASTM D1308

Chemical Resistance



Perfect score is 45/45 - ACRONAL PRO 770 is top performer at 40 points

Humidity: ASTM D1735

- 100% Relative Humidity at 100°F
 - ▶ Accelerated Testing
 - Runs 24/7
 - Provides Performance Data Very Fast
 - ▶ Industry Standard



Joncryl PRO 1522 on Steel
for 412 hours



Acronal PRO 770 on Steel
for 552 hours



Humidity: ASTM D1735 (100% 100°F)



Competitive resin A
250 hours



ACRONAL PRO 770
550 hours

ACRONAL PRO 770 shows minimal blistering after 550 hours

Corrosion: ASTM B117

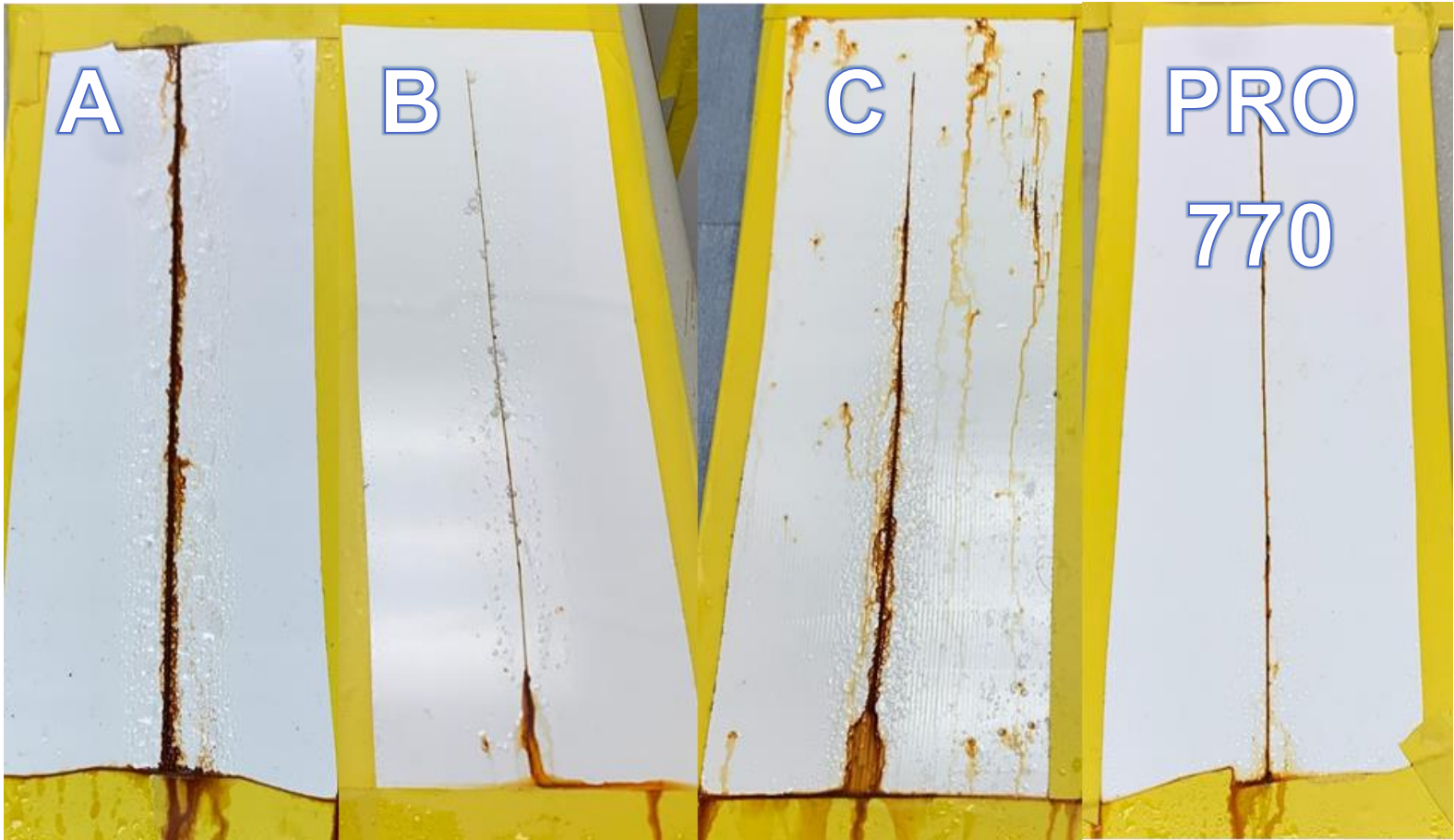
- 5% NaCl at 95°F
 - ▶ Accelerated Testing
 - Runs 24/7
 - Provides Performance Data Very Fast
 - ▶ Industry Standard



Two resins on steel for 281 hours: very different results

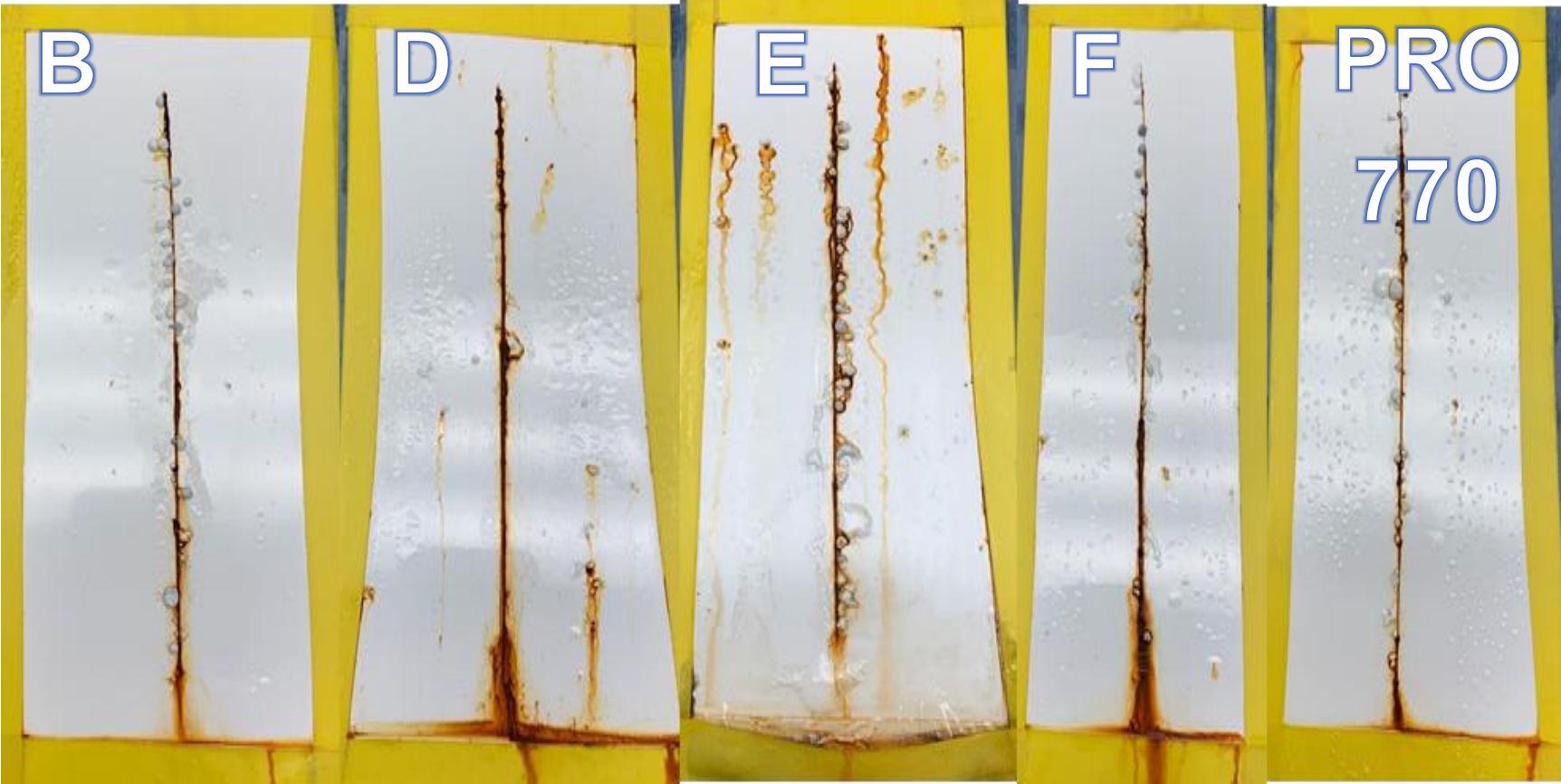


Corrosion: ASTM B-117 (48 hours only)



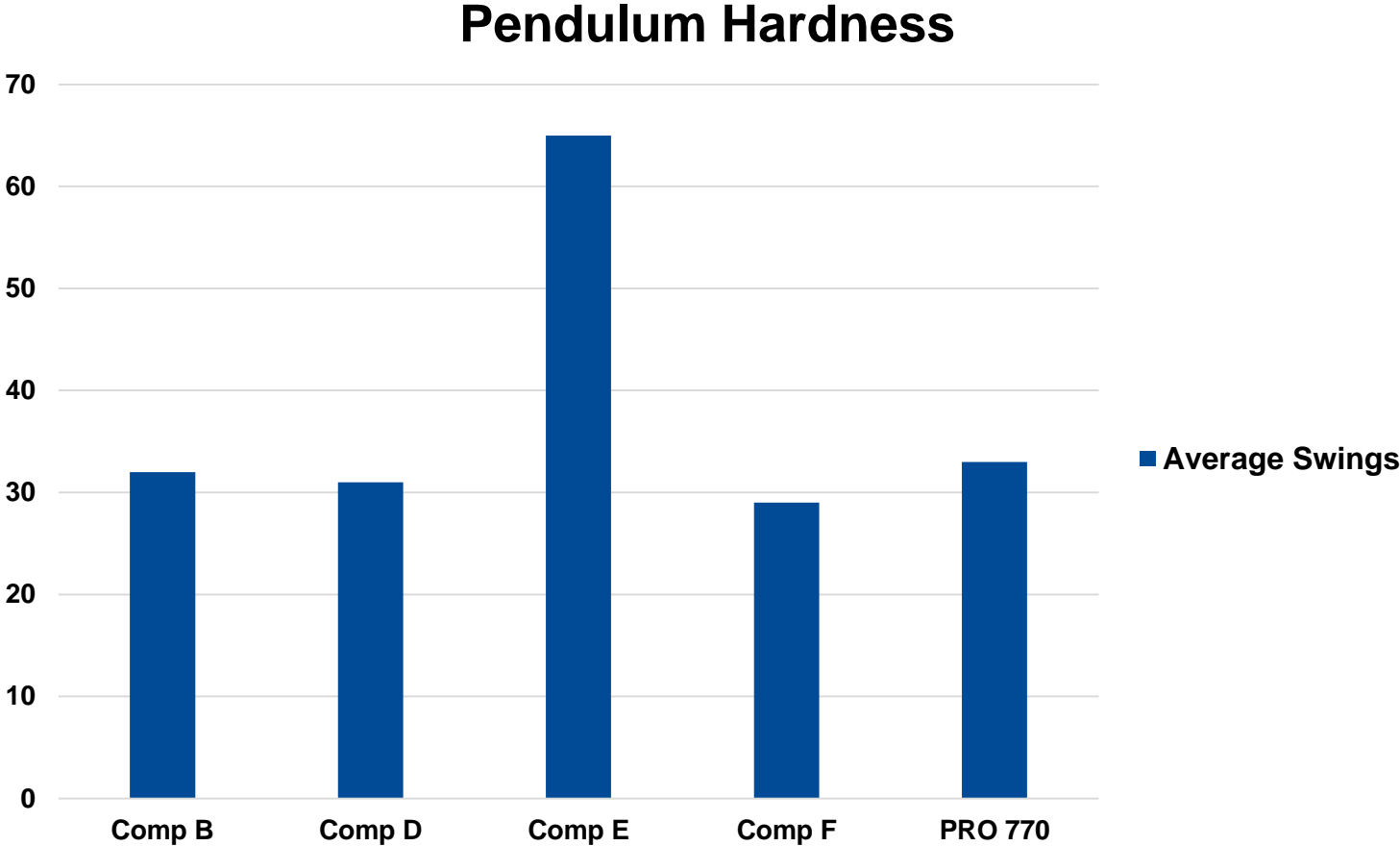
Only top performing resins made it to round 2 of benchmarking (here: resin B & PRO 770)

Corrosion: ASTM B-117 (375 hours)



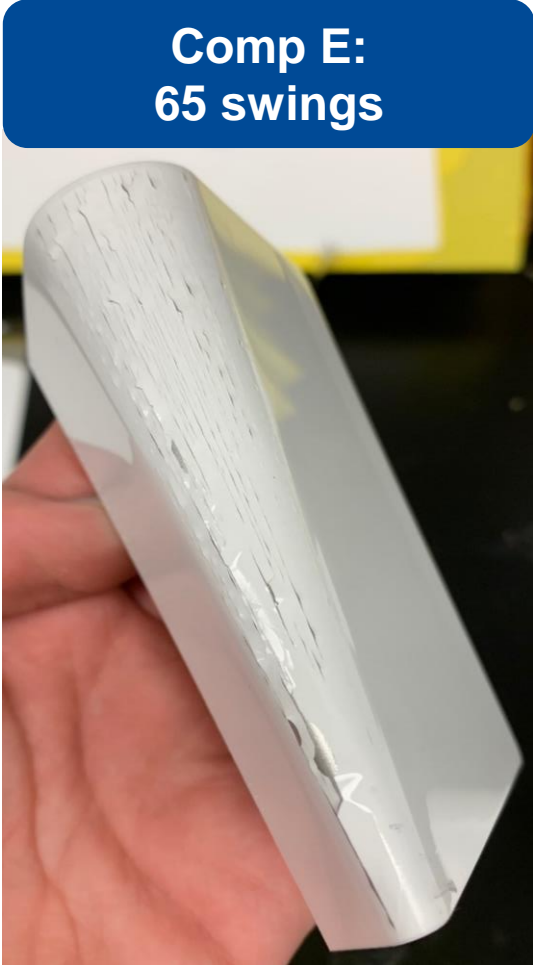
PRO 770 is best-in-class at 375 hours, with limited corrosion at the scribe

Hardness



ACRONAL PRO 770 has typical hardness BUT...

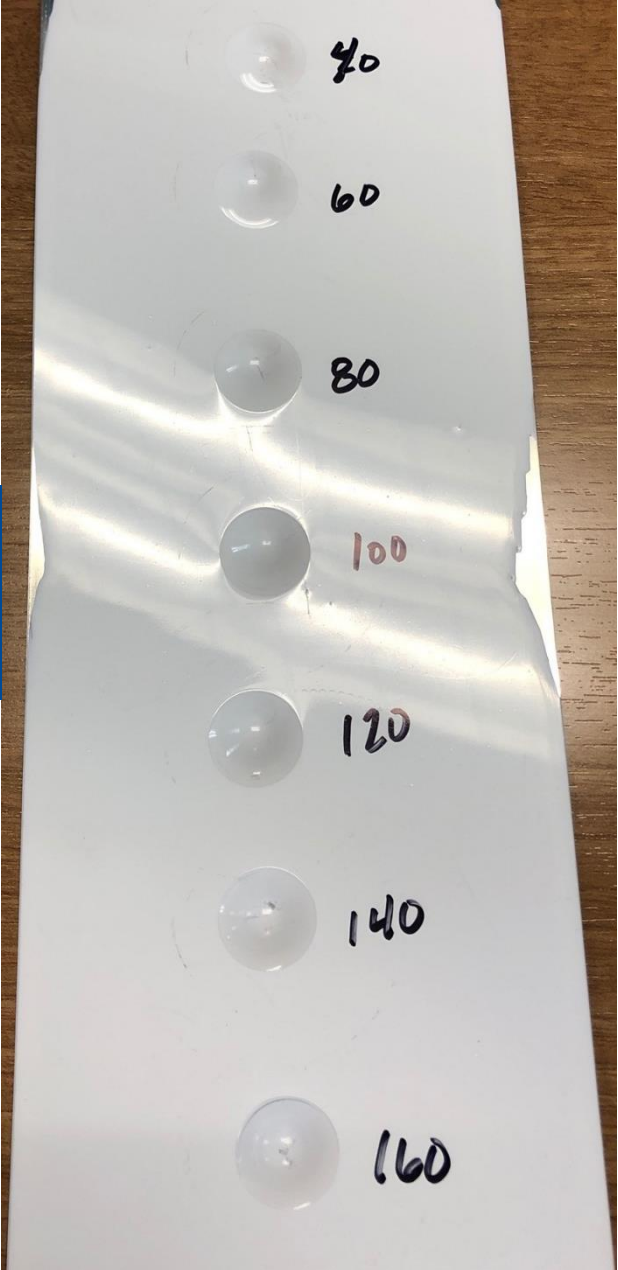
Flexibility: ASTM D552



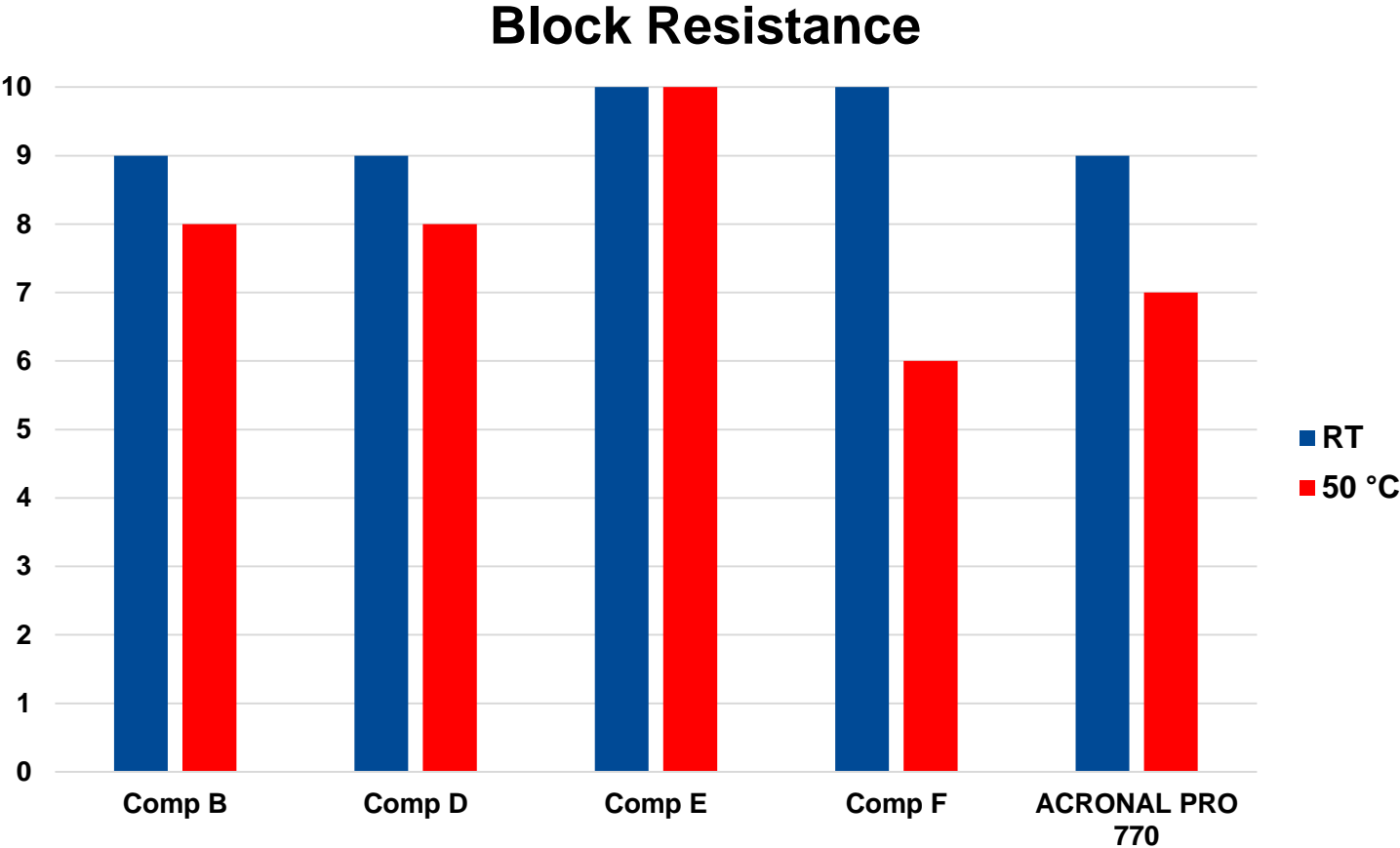
...PRO 770 achieves a balance of hardness and flexibility – no cracking

Direct Impact Resistance

We see some thinning of the coating at 140 and 160 lbs, however, no cracking seen.

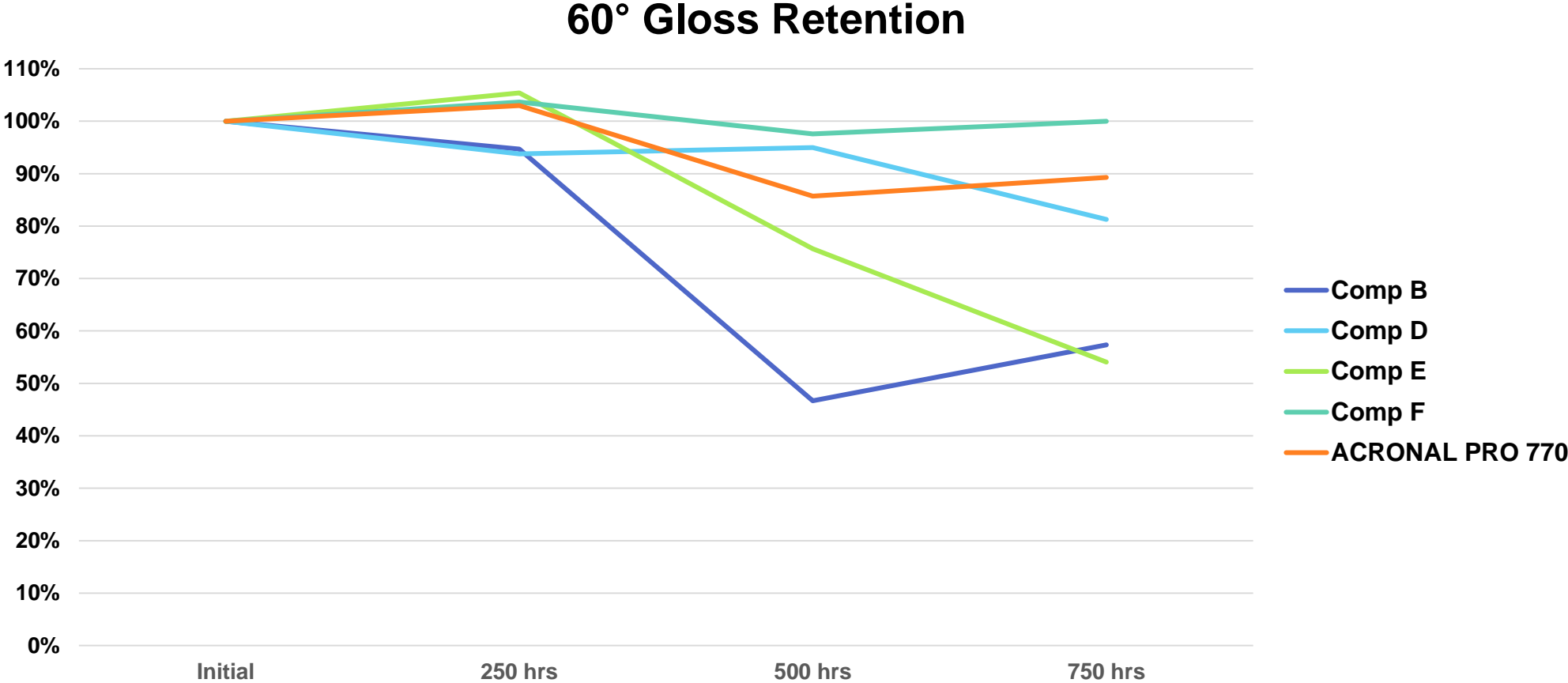


Block Resistance: ASTM D4946



Block resistance on par with competition

Weathering: QUV



ACRONAL PRO 770 retains 90% gloss at 750 hours

Regulatory and Commercial Status

- PRO 770 is manufactured in NA and has TSCA polymer exemption status
- In the process of DSL listing in Canada
- Available to sample now

Q & A

ACRONAL PRO 770 Benefits

- Superior corrosion resistance in DTM formulation for C2-C3 applications: fewer coats needed in the field
- Versatile: can be formulated as a primer for C3+ applications
- Excellent application properties (spray, dip, roll, etc.)
- Saves formulation cost: no need for corrosion inhibitors





We create chemistry