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## Nylon 11 Coatings Physical / Chemical Resistance Properties

The general physical properties of Nylon 11 coatings properly applied with primer and temperature are as follows:

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<b>Melting Point</b>	363-367°F (irrespective of type of powder)
<b>Specific Gravity at 68°F</b> Coating in natural powders Coating in fine powder, white Coating in ES powder, white	0.0376 lb/in <sup>3</sup> 0.0385 lb/in <sup>3</sup> 0.0403 lb/in <sup>3</sup>
<b>Solubility</b> Solvent for tests and analysis  Solvent for stripping	metacresol; sulphuric acid, formic acid, alcohol-phenol mixtures  Inpro CL, Turco 5061
<b>Water absorption to saturation</b> At 68°F and 65% RH At 68°F and 100% RH At 212°F and 100% RH (boiling water)	0.9 to 1.1% (1 according) 1.6 to 1.9% (1 to the type) 2.4 to 3.0% (1 of powder)
<b>Shore D hardness</b> at 68°F, measured at a thickness greater than 0.2 inches to eliminate the influence of the substrate	75
<b>Hardness</b> measured with a Persoz pendulum at 68°F (AFNORT 30-016)	190
<b>Rockwell hardness</b> , R scale, ASTM D 785 at 68°F measured at a thickness greater than 0.2 inches to eliminate the influence of the substrate	106
<b>Surface hardness</b> according to DIN 53-456 at 68°F 10 sec. under load	11,600 PSI
<b>Scratch resistance</b> measured with the Clemm apparatus; load necessary to introduce a scratch which reaches the underlying metal for a coating of 0.016 inch thickness	13.3 lbf
<b>Shear strength</b> , ASTM D 732	5076-6092 PSI
<b>Impact resistance</b> Projectile with hemi-spherical head, 0.98 inches diameter, weighing 4.41 lbf., falling from height of 19.7 inches, horizontal coating 0.01 inches thick	Excellent no fracture of the coating and metal not bared after impact

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**Impact resistance (cont.)**

ATO test; cylindrical bar, 0.98 inches diameter, weighing 4.72 lbf, falling from 5.12 inches on to a coating 0.01 inches thick applied to a tubular substrate at a rate of 30 impacts per minute

After 4,000 impacts the coating is not fractured; the tubular substrate is deformed and the coating develops a matt finish

**Abrasion resistance**

Taber abrasimeter (wheel type CS 17, load 2.21 lbf) loss of weight after 1,000 turns  
 coefficient of friction

Excellent  
 1.76 to 2.82 x 10<sup>-4</sup> oz.  
 0.10 – 0.30 (according to test conditions)

**Tensile strength** ASTM D 638 (Measured on a Stripped coating)

Tensile strength at yield  
 Elongation at yield  
 Tensile strength at break

4496-4786 PSI  
 18-24%  
 5656-6817 PSI

**Specific heat**

0.499 btu/lb °F

**Thermal conductivity**

2.01 btu in/ft<sup>2</sup>h°F  
 Between 323 and 443°K (122 & 338°F)

**Latent heat of fusion**

35.98 btu/lb

**Coefficient of linear expansion** ASTM D 696

5.055 x 10<sup>-5</sup> / °F (-22 to 104°F)  
 8.33 x 10<sup>-5</sup> / °F (104 to 248°F)

**Inflammability** ATM D 635 (measured at a Thickness greater than 0.12 inches to eliminate the influence of the substrate)

self-extinguishing

**Transverse of volume resistivity**

ASTM D 257 at 68°F and 65% RH at 500V

8.89 x 10<sup>14</sup>ohms / in<sup>2</sup> / in

**Surface resistivity**

ASTM D 257 at 68°F and 65% RH at 500V

2.4 x 10<sup>14</sup>ohms

**Dielectric constant**

10<sup>2</sup>Hz  
 10<sup>6</sup>Hz

3.9  
 3.1

**Tangent of the angle of loss (power factor)** at 68°F and 65% RH at 1,000 V R.M.S. with a current of 1,000 Hz

0.05

**Resistance to surface tracking**

DIN 53-480, KA method

Grade KA3c

**Dielectric strength** measured at 68°F and 65% RH

Influence of the thickness studied on a natural coating:

0.008 in.	1.34 KV / .001 in.
0.017 in.	0.98 KV / .001 in.
0.028 in.	0.88 KV / .001 in.
0.035 in.	0.84 KV / .001 in.

Influence of color (pigments and colorants) studied at a thickness of 0.016 in.

Natural	0.99 KV / .001 in.
grey 49	0.775 KV / .001 in.
red 16	0.767 KV / .001 in.
black 26	0.288 KV / .001 in.

NOTE: From the point of view of electric insulation, the coating is completely satisfactory when its dielectric strength exceeds 0.457 KV / .001 in.

**Resistance to boiling water**

Excellent adhesion after 2,000 hours; with a special surface preparation this adhesion will be sustained for much longer; consult us for further details

**Resistance to outdoor exposure  
And Ultra-Violet radiation**Very good in white, black Y and pastel-colored coatings  
Bray's red color is not subject to UV deterioration  
(chalking or cracking)**Resistance to salt spray**No corrosion after 2,000 hours exposure  
(ASTM B117 or AFNOR X 41-002)**Resistance to sea water**

No corrosion after 10 years exposure

**CHEMICAL PROPERTIES OF THE COATING**

In general, Nylon 11 coatings have good resistance to inorganic salts, alkalis, most solvents and to organic acids. Greater caution must be observed in uses involving inorganic acids, phenols and certain chlorinated solvents. In such cases, it is advisable to consult Bray Inside Sales Department, specifying the practical problem involved; e.g. the temperature and chemical composition of the liquid or gas. Practical tests have shown that Nylon 11 coatings have excellent resistance to chemical solutions provided the material coated is properly prepared.

The following is a summary of Nylon 11 resistance to various chemicals, as a function of temperature.

A – Recommended, generally little or minor effect based on valve usage experience and recommendations from suppliers.

B – May sometimes be used depending on the conditions of application such as concentration and temperature. Testing is recommended before full scale usage.

N – Not recommended for usage.

BLANK – Insufficient evidence available.

	Concentration	68°F	104°F	140°F	194°F
<b>Inorganic bases</b>					
Ammonia	Liquid or gas	A	A		
Ammonium hydroxide	Concentrated	A	A	A	A
Potassium hydroxide	50%	A	B	N	N
Sodium hydroxide	5%	A	A	B	
Sodium hydroxide	10%	A	B	B	
Sodium hydroxide	50%	A	B	N	N
<b>Inorganic acids</b>					
Chromic acid	10%	N	N	N	N
Hydrochloric acid	1%	A	B	N	N
Hydrochloric acid	10%	A	B	N	N
Nitric acid	all concentrations	N	N	N	N
Phosphoric acid	50%	A	B	N	N
Sulfur trioxide		B	N	N	N
Sulfuric acid	1%	A	B	B	N
Sulfuric acid	10%	A	B	N	N
<b>Inorganic salts</b>					
Alum	Concentrated solutions	A	A	A	
Aluminum sulfate	Or slurries	A	A	A	A
Ammonium nitrate	"	A	A	A	
Ammonium sulfate	"	N	A	B	
Barium chloride	"	A	A	A	A
Calcium arsenate	"	A	A	A	
Calcium chloride	"	A	A	A	A
Calcium sulfate	"	A	A	B	
Copper sulfate	"	A	A	A	A
Diammonium phosphate	"	A	A	B	
Magnesium chloride	50%	A	A	A	A
Potassium ferrocyanide	concentrated solutions	A	A	A	
Potassium nitrate	or slurries	A	B	N	N
Potassium sulfate	"	A	A	A	A
Sodium silicate	"	A	A	A	A
Sodium sulfide	"	A	B	B	
Sodium carbonate	"	A	A	B	N
Sodium chloride	saturated concentrated	A	A	A	A
Trisodium phosphate	solutions or slurries	A	A	A	A
<b>Other inorganic products</b>					
Agricultural sprays		A	A		
Bleach solution		B	N	N	N
Bromine		N	N		
Chlorine		N	N	N	N
Fluorine		N	N	N	N
Hydrogen		A	A	A	A
Hydrogen peroxide	20 vol.	A	B		
Mercury		A	A	A	A
Oxygen		A	A	B	N
Ozone		B	N	N	N
Potassium permanganate	5%	N	N		
Sea water		A	A	A	A
Soda water		A	A	A	A
sulfur		A	A		

	Concentration	68°F	104°F	140°F	194°F
<b>Other inorganic products (cont'd)</b>					
Water		A	A	A	A
<b>Organic bases</b>					
Aniline	Pure	B	N	N	N
Diethanolamine	20%	A	A	A	B
Pyridine	Pure	B	N	N	N
Urea		A	A	B	B
<b>Organic acids and anhydrides</b>					
Acetic acid		B	N	N	N
Acetic anhydride		B	N	N	N
Citric acid		A	A	B	N
Formic acid		N	N	N	N
Lactic acid		A	A	A	B
Oleic acid		A	A	A	B
Oxalic acid		A	A	B	N
Picric acid		B	N	N	N
Stearic acid		A	A	A	B
Tartaric acid	Saturated solution	A	A	A	B
Uric acid		A	A	A	B
<b>Hydrocarbons</b>					
Acetylene		A	A	A	
Benzene		A	A	B	
Butane		A	A	A	
Cyclohexane		A	A	B	
Decalin		A	A	A	B
Freon 12		A			
Freon 22		A			
Hexane		A	A	A	
Methane		A	A	A	
Naphthalene		A	A	A	B
Propane		A	A	A	
Styrene		A	A		
Tolunene		A	A	B	B
xylene		A	A	B	B
<b>Alcohols</b>					
Benzyl alcohol					
Butanol					
Ethanol					
Glycerine					
Glycol					
Methanol					
<b>Aldehydes and Ketones</b>					
Acetaldehyde	Pure	A	B	B	
Acetone		A	A	B	N
Benzaldehyde		A	B	N	
Cyclohexanone		A	B	N	
Formaldehyde	Technical	A	B	N	
Methylethylketone		A	A	B	N
Methylisobutylketone		A	A	B	N

	Concentration	68°F	104°F	140°F	194°F
<b>Chlorinated solvents</b>					
Carbon tetrachloride		N			
Methyl bromide		A	N		
Methyl chloride		A	N		
Perchloroethylene		A	A	B	
Trichlorethane		B	N		
Trichlorethylene		A	B		
<b>Phenols</b>					
		N	N	N	N
<b>Salts, Esters, Ethers</b>					
Amyl acetate		A	A	A	B
Butyl acetate		A	A	A	B
Diethyl ether		A			
Diethylphosphate		A	A	A	B
Diethylphthalate		A	A	A	
Ethyl acetate		A	A	A	
Fatty acid esters		A	A	A	A
Methyl acetate		A	A	A	
Methyl sulfate		A	B		
Tributylphosphate		A	A	A	B
Tricresylphosphate		A	A	A	B
<b>Various organic compounds</b>					
Anethole		A			
Carbon disulphide		A	B	N	
Diacetone alcohol		A	A	B	N
Dimethyl formamide		A	A	B	
Ethylene chlorhydrin		N	N		
Ethylene oxide		A	A	B	N
Furfural		A	A	B	N
Glucose		A	A	A	A
Tetraethyl lead		A			
Tetrahydrofurane		A	A	B	
<b>Various products</b>					
Beer		A			
Cider		A			
Crude petroleum		A	A	A	
Diesel fuel		A	A	A	
Fruit juices		A	A		
Fuel oil		A	A	A	A
Greases		A	A	A	A
Ground-nut oil		A	A		
High octane petrol		A	A	A	
Kerosene (paraffin)		A	A	A	
Linseed cake		A	A	A	A
Milk		A	A	A	A
Mustard		A			
Normal petrol		A	A	A	
Oils		A	A	A	A
Sea water		A	A	A	
Sewer gas		A	A		
Soap solution		A			

	Concentration	68°F	104°F	140°F	194°F
<b>Various Products (cont'd)</b>					
Solutions or emulsions of:					
2.4 - D	Agricultural sprays	A			
D.D.T. or Lindane	Agricultural sprays	A			
Hydroxy-quinoline	Agricultural sprays	A			
Solvent naphtha		A	A	A	
Stearin		A	A	A	
Turpentine		A	A	A	
Vinegar		A			
Wine		A			