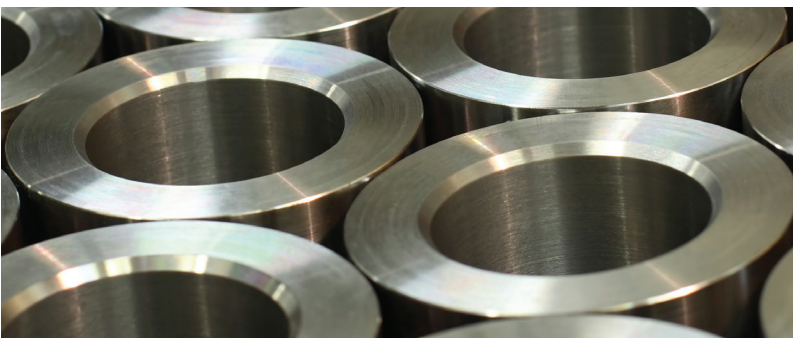


Stepan Polyesters for Industrial Coatings



Founded in 1932 in Chicago, IL, USA, Stepan Company is a publicly traded manufacturer of specialty and intermediate chemicals. These products include commercial and industrial surfactants, nutritional oils, polyester polyols for rigid and flexible foam, coatings, adhesives, sealants, and polyurethane elastomers. Stepan's commitment to the global polyester polyol market has been complemented with recent acquisitions of manufacturing facilities in Europe and the United States bringing our global footprint for polyester polyols production to five sites.

STEPANPOL® aliphatic polyester polyols offer greater light stability and non-yellowing properties while providing durability, solvent resistance, and tear strength.

STEPANPOL® aromatic polyester polyols use several aromatic acids. Phthalic anhydride is also utilized to take advantage of ortho-ester linkages for enhanced hydrolytic stability. All of these polyesters offer diverse substrate adhesion while improving abrasion resistance and overall hardness.

STEPANPOL polyester polyols for polyurethane coatings

Stepan is dedicated to being a global leader in esterification as reflected in the product line – our focus is on polyester polyols as raw materials. This includes offering polyester polyol technical support. Stepan is a global company and as the Company grows and expands, customers can expect to purchase the same STEPANPOL grades produced regionally.

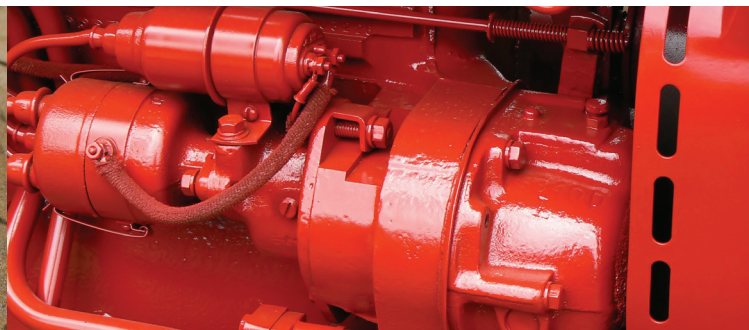
Stepan offers a broad range of aliphatic and aromatic products including many prepolymer grade products. The “P” in the name of certain products, such as STEPANPOL PC-1015P-120, stands for prepolymer grade, meaning that these are neutralized to slow their reactivity particularly for use in making prepolymers or other resin types such as polyurethane dispersions.

Stepan is committed to innovation in the polyurethane coatings market with dedicated R&D resources in each region.

Helpful Information

Equivalent Weight = Molecular Weight / Functionality
Equivalent Weight = 56100 / (OH Number + Acid Number)

% OH = OH Number / 33

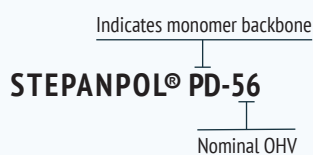
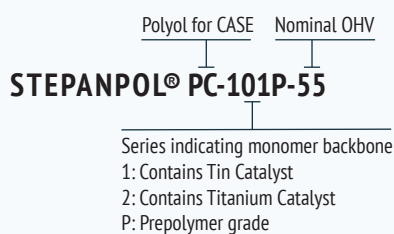


Aromatic Polyester Polyols

Aromatic Polyester Polyols			TYPICAL CHEMICAL PROPERTIES*			
STEPANPOL® Products	Region	Performance Features	Backbone	Viscosity at 25°C (cP)	Average Molecular Weight	Hydroxyl Value (mgKOH/g)
STEPANPOL PS-2002	A E C	Improve adhesion to metal	DEG-PA	26000	575	195
STEPANPOL PS-3152	A E C	Improve adhesion to metal, relatively low viscosity with high hydroxyl content	DEG-PA	2800	350	320
STEPANPOL PS-1752	A E C	Increases wetting and flexibility, low viscosity	DEG-PA	3900	640	175
STEPANPOL BC-180	A E C	Contains bio-content material, imparts low viscosity and improves wetting	Proprietary	3300	700	180
STEPANPOL PH-56	A E C	Excellent adhesion and impact performance, hard weatherable coatings, very good chemical/stain resistance	HDO-PA	2885 at 80°C	2000	56
STEPANPOL PC-1028-115	A E	Excellent adhesion and impact performance, hard weatherable coatings, very good chemical/stain resistance	HDO-PA	2100 at 60°C	980	115
STEPANPOL PC-1028P-210	A E	Excellent adhesion and impact performance, hard weatherable coatings, very good chemical/stain resistance	HDO-PA	500 at 60°C	540	210
STEPANPOL PC-1035-55	A E	Hardness, hydrolysis and oxidation resistance	HDO-Az/PIA	4050 at 60°C	2040	55
STEPANPOL PC-1021P-70	A E	Balance of hardness and toughness, oxidation resistance, UV stable	BDO-AA/PIA	1900 at 60°C	1600	70
STEPANPOL PC-5010P-35	A E	Excellent adhesion profile and very good chemical/stain resistance	Proprietary	26000 at 80°C	3200	35
STEPANPOL PC-5020-130	A E	High tensile strength and broad adhesion profile, higher modulus and tensile strength in concrete coatings	Proprietary	482	660	130
STEPANPOL PC-5020-160	A E	High tensile strength and broad adhesion profile, higher modulus and tensile strength in concrete coatings	Proprietary	2450	750	160
STEPANPOL PC-5030-270	A E	Good pigment wetting and low viscosity	Proprietary	1750	500	270
STEPANPOL PC-5060-165	A E	Broad adhesion profile, low viscosity	Proprietary	5000 at 25°C	750	165
STEPANPOL PC-5070P-56	A E	Good adhesion to aluminum	Proprietary	7000 at 75°C	2000	56
STEPANPOL PD-56	A E C	Broad adhesion profile, excellent impact resistance	DEG-PA	4150 at 80°C	2000	56
STEPANPOL PD-195	A E	Broad adhesion profile	DEG-PA	26000	575	195
STEPANPOL PD-320	A E	Broad adhesion profile	DEG-PA	2800	350	320
STEPANPOL PDP-70	A E C	Imparts low viscosity, flexibility, and ester/ether compatibility	Proprietary	1900	1600	70
STEPANPOL PHN-56	A E C	High gloss, excellent adhesion, excellent abrasion and chemical/stain resistance	HDO/NPG-PA	21700 at 80°C	2000	56
STEPANPOL PN-110	A E C	High gloss, hardness, excellent adhesion, excellent impact resistance, very good chemical/stain resistance	NPG-PA	15000 at 100°C	1020	110
STEPANPOL PS-4002	A	Very low viscosity	DEG-PA	1300	300	400

A=Americas E=Europe C=Asia

*Property values are typical and based on product concentration and/or mathematical and statistical calculations.



Series	Backbone	Series	Backbone	Series	Backbone
101	EG/AA	1017	EG/PG/AA	PD	DEG/PA
102	BD/AA	1021	BD/IPA/AA	PN	NPG/PA
105	HD/AA	1028	HD/PA	PH	HD/PA
107	NPG/AA	1035	HD/AzA/IPA	PHN	HD/NPG/PA
1011	DEG/AA	1040	BD/EG/AA	BC	Biocontent
1015	HD/NPG/AA	5000	Proprietary	PS	Polyester

Aliphatic Polyester Polyols

			TYPICAL CHEMICAL PROPERTIES*			
STEPANPOL® Products	Region	Performance Features	Backbone	Viscosity at 60°C (cP)	Average Molecular Weight	Hydroxyl Value (mgKOH/g)
STEPANPOL PC-1011-45	A E	General purpose, good adhesion, good impact and abrasion resistance	DEG-AA	1425	2490	45
STEPANPOL PC-1011-55	A E C	General purpose, good adhesion, good impact and abrasion resistance	DEG-AA	1075	2040	55
STEPANPOL PC-1011P-110	A E	General purpose, good adhesion, good impact and abrasion resistance	DEG-AA	775 at 40°C	1020	110
STEPANPOL PC-1011P-210	A E	General purpose, good adhesion, good impact and abrasion resistance	DEG-AA	250 at 40°C	540	210
STEPANPOL PC-2011-45	A E	General purpose, good adhesion, good impact and abrasion resistance	DEG-AA	1425	2490	45
STEPANPOL PC-2011-225	A E	General purpose, good adhesion, good impact and abrasion resistance	DEG-AA	500 at 25°C	500	225
STEPANPOL PC-1015P-35	A E	High gloss, durability, adhesion, very good chemical resistance	HDO/NPG-AA	4000	3200	35
STEPANPOL PC-1015-55	A E	High gloss, durability, adhesion, very good chemical resistance	HDO/NPG-AA	1350	2040	55
STEPANPOL PC-1015P-120	A E	High gloss, durability, adhesion, very good chemical resistance	HDO/NPG-AA	350	940	120
STEPANPOL PC-1017P-55	A E	Tensile and tear strength, solvent and oxidation resistance	EG/PG-AA	1200	2040	55
STEPANPOL PC-2017P-35	A E	Tensile and tear strength, solvent and oxidation resistance	EG/PG-AA	2520	3200	35
STEPANPOL PC-2017P-144	A E	Tensile and tear strength, solvent and oxidation resistance	EG/PG-AA	230	780	144
STEPANPOL PC-101P-55	A E C	Great hardness and impact resistance, good stain resistance	EG-AA	1200	2040	55
STEPANPOL PC-201P-110	A E	Great hardness and impact resistance, good stain resistance	EG-AA	400	1020	110
STEPANPOL PC-201-165	A E C	Great hardness and impact resistance, good stain resistance	EG-AA	350 at 45°C	680	165
STEPANPOL PC-102P-34	A E	Balance of hardness and flexibility, good chemical and stain resistance	BDO-AA	5000	3200	34
STEPANPOL PC-102-56	A E	Balance of hardness and flexibility, good chemical and stain resistance	BDO-AA	685 at 73°C	2000	56
STEPANPOL PC-102P-110	A E	Balance of hardness and flexibility, good chemical and stain resistance	BDO-AA	320	1020	110
STEPANPOL PC-202P-110	A E	Balance of hardness and flexibility, good chemical and stain resistance	BDO-AA	322	1020	110
STEPANPOL PC-1040-55	A E	Balance of tensile/tear strength and flexibility, very good gloss	EG/BDO-AA	655 at 73°C	2040	55
STEPANPOL PC-1040P-55	A E C	Balance of tensile/tear strength and flexibility, very good gloss	EG/BDO-AA	1300	2040	55
STEPANPOL PC-1040P-110	A E	Balance of tensile/tear strength and flexibility, very good gloss	EG/BDO-AA	350	1020	110
STEPANPOL PC-105P-30	A E	Broad adhesion profile, impact resistance, good balance of hardness/flexibility, very good chemical/stain resistance	HDO-AA	5500	3740	30
STEPANPOL PC-205P-30	A E C	Broad adhesion profile, impact resistance, good balance of hardness/flexibility, very good chemical/stain resistance	HDO-AA	3500 at 80°C	3740	30
STEPANPOL PC-105P-42	A E	Broad adhesion profile, impact resistance, good balance of hardness/flexibility, very good chemical/stain resistance	HDO-AA	2650	2670	42
STEPANPOL PC-205P-56	A E	Broad adhesion profile, impact resistance, good balance of hardness/flexibility, very good chemical/stain resistance	HDO-AA	2800 at 80°C	2000	56
STEPANPOL PC-105P-110	A E	Broad adhesion profile, impact resistance, good balance of hardness/flexibility, very good chemical/stain resistance	HDO-AA	295	1020	110
STEPANPOL PC-107P-55	A E	Durability, excellent impact resistance, high gloss, very good stain and chemical resistance	NPG-AA	2300	2040	55
STEPANPOL PC-107-110	A E	Durability, excellent impact resistance, high gloss, very good stain and chemical resistance	NPG-AA	565	1020	110
STEPANPOL PC-207-125	A E	Durability, excellent impact resistance, high gloss, very good stain and chemical resistance	NPG-AA	6700 at 25°C	900	125
STEPANPOL PC-5100P-56	A E	Flexibility, can be formulated for soft touch coatings	Proprietary	11000 at 23°C	2000	56

A=Americas E=Europe C=Asia

*Property values are typical and based on product concentration and/or mathematical and statistical calculations.

Higher Functional Polyester Polyols

			TYPICAL CHEMICAL PROPERTIES*			
STEPANPOL® Products	Region	Performance Features	Backbone	Viscosity at 25°C (cP)	Average Molecular Weight	Hydroxyl Value (mgKOH/g)
STEPANPOL PC-5040-167	A E	Great balance of hardness and flexibility, excellent impact performance, chemical/stain resistance, aliphatic	Proprietary	460 at 73°C	680	167
STEPANPOL PC-5050P-60	A E	Solvent resistance and flexibility, aliphatic	Proprietary	1750 at 60°C	2300	60
STEPANPOL PC-5080-215	A E	UV stability and mar resistance, flexibility, aromatic	Proprietary	30000 at 23°C	1050	215
STEPANPOL PC-5080-285	A E	Hardness and chemical resistance, excellent impact and abrasion resistance, chemical/stain resistance, aromatic	Proprietary	5500 at 60°C	900	285
STEPANPOL PC-5090P-56	A E	Tensile and tear strength, solvent and oxidation resistance, primary and secondary hydroxyls, aliphatic	Proprietary	1300	2000	56
STEPANPOL PC-5110-58	A E	Flexibilizing resin, aliphatic	Proprietary	21500	2500	58

A=Americas E=Europe C=Asia

*Property values are typical and based on product concentration and/or mathematical and statistical calculations. Note: functionality > 2

Statistical Performance Trends in a Standard Formulation

Property*	60° Gloss	Crosshatch Adhesion	Impact Resistance	Pendulum Hardness	Pencil Hardness	Taber Abrasion	MEK Double Rub	Stain Resistance	Chemical Resistance
Increasing OHv (56 → 110)	0	-2	0	+2	-1	-1	+1	0	+2
PA Resin	+2	0	0	-2	+1	+1	0	+2	0
Higher Functional Resin	0	+2	0	0	0	+2	+2	+2	+2

*Property values are typical and based on product concentration and/or mathematical and statistical calculations.

Variable/Same Performance

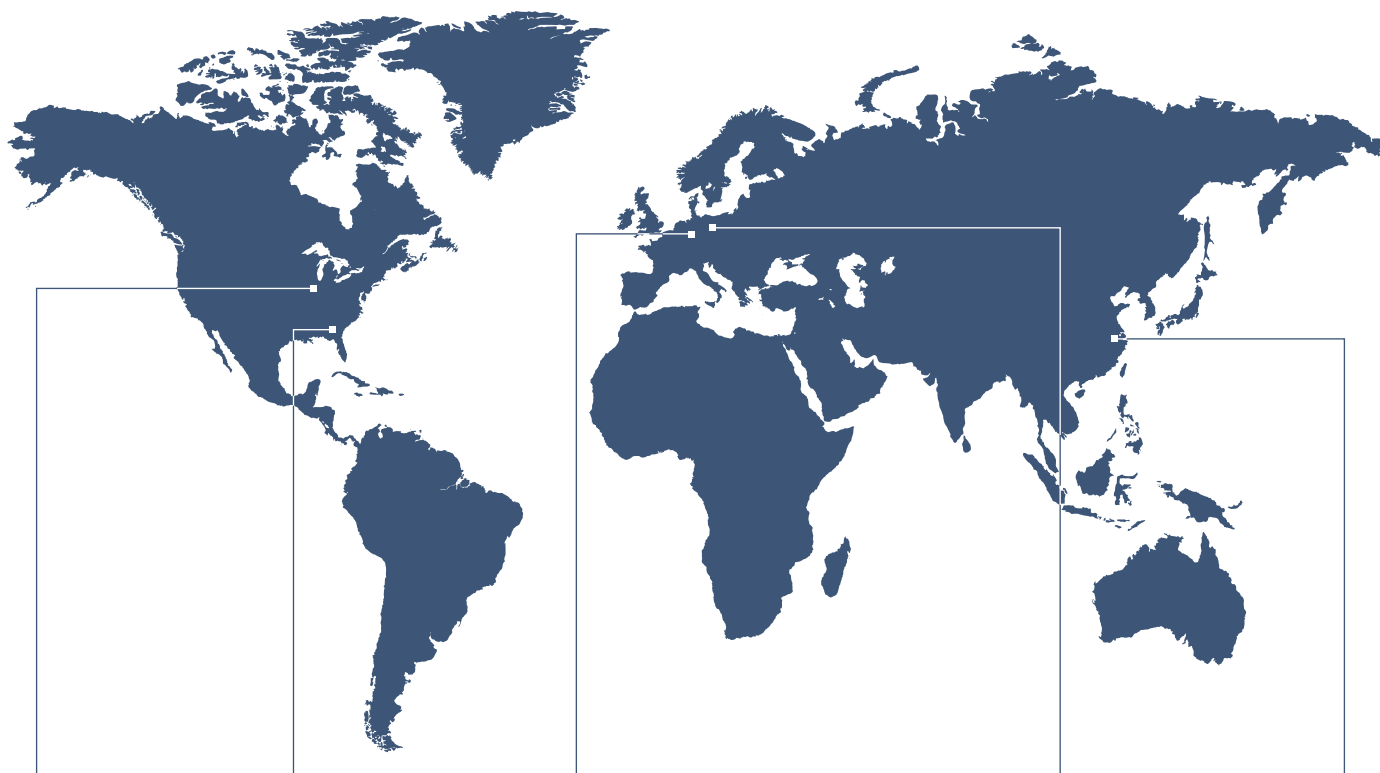
Inverse Correlation

Direct Correlation

Insufficient Data for Rating

Statistical product-property trends have been charted above. These findings result from a product screening in a basic 2K solventborne industrial coatings formulation using HDI biuret indexed at 1.1 and cured for 7 days on multiple metal substrates. The columns note the different testing that was performed and the rows represent three statistically significant groups: (1) as hydroxyl value increases from 56 OHv to 110 OHv, (2) PA containing resins, and (3) higher functionality (>2) polyesters. A +1 or +2 indicates a positive testing correlation showing these groups performed better, or increasing the hydroxyl value improved the results. Negative values indicate that an inverse correlation was found meaning these groups performed worse in testing. Example: Crosshatch adhesion and increasing hydroxyl value from 56 OHv to 110 OHv shows a -2 value. To improve crosshatch adhesion, a polyester with a 56 OHv would give better results than a 110 OHv product. A zero indicates that there was not enough test data to make a statistical conclusion (black) or no correlation was found (yellow).





Millsdale, IL, USA
 ■ Production Plant
 ■ Pilot Reactors



Columbus, GA, USA
 ■ Production Plant, liquid and powder products



Wesseling, Germany
 ■ Production Plant



Brzeg Dolny, Poland
 ■ R&D Center
 ■ Production Plant



Nanjing, China JV
 ■ R&D Center
 ■ Production Plant
 ■ Esterification Pilot Reactor
 ■ Propoxylation Pilot Reactor

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