PA66 - Nylon 66

Facts:

PA66, Nylons are tough, ridged, have high tensile strength and good resistance to creep, excellent abrasion, chemical and heat resistance and a low coefficient friction.

The addition of fibres and fillers increases such properties as strength, stiffness and decreases moisture absorption.

PA66 competes with PA6 for most applications. PA66 is heavily used in the automotive industry, appliance housings and generally where impact resistance and strength are required.

Applications:

Automotive parts, roller skates, carpet, bike parts, kitchen items, sports equipment, tool housings and bearings.

Limitations:

- High moisture absorption
- Requires UV stabilisation
- High Shrinkage
- Attacked by oxidizing agents
- Attacked by strong acids and bases
- High notch sensitivity

vydyne 21SPC **data sheet**

general purpose high productivity

Product Description

Vydyne® 21SPC is a general purpose Nylon 66 resin. Available in natural color. It is designed principally for injection molding fabrication. This resin offers a well balanced combination of engineering properties characterized by high strength; rigidity; good toughness; high melt point; good surface lubricity; abrasion resistance; and resistance to many chemicals, solvents, gasoline, and machine and motor oils.

Vydyne 21SPC permits production of molded parts with good initial color plus good property and color retention when using regrind. This resin is recognized by Underwriters Laboratories and conforms to the requirements of many industrial, federal, and military specifications for premium-quality-general-purpose Nylon 66 resins.

Internally and externally lubricated for improved machine feed and exceptional mold release. Vydyne 21SPC is intended for use in high-productivity applications. In many applications, the molding cycle can be reduced because parts may be removed from the cavity at higher temperatures. In difficult molds where parts have a tendency to stick in the cavity, Vydyne 21SPC can reduce or eliminate the need for mold release sprays. Critical molded part dimensions should be checked against specifications before implementing shorter molding cycles on a routine production basis.

Typical Applications/End Uses

Vydyne 21SPC has been used in many molding applications such as terminal blocks, bearings, bushings, cams, electrical connectors and housings, electrical cable ties/tie straps, and many other hardware and general industrial parts.

Vydyne 21SPC Specifications and Regulations

ASTM
Conforms to ASTM D-4066 PA 0111

Federal*
Conforms to Federal Specification LP-410a

Military*
Conforms to Military Specification MIL-M-20693B

FDA
Complies with 21 CFR 177-1500

** Superseded by ASTM D-4066*

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Typical Properties for Vydyne 21SPC

Test temperature 23°C unless otherwise noted

Physical Properties	Test Conditions	Dry as Molded	Conditioned 2.5% Moisture
Specific Gravity (g/cm³)	ISO 1183	1.14	–
Mold Shrinkage (%)	ISO 294-4		
2 mm - Parallel		1.4	–
2 mm - Normal		1.6	–
Water Absorption @ 23°C (%)	ISO 62		
24 Hours		1.3	–
Equilibrium at 50% RH		2.4	–
Mechanical Properties	**Test Conditions**	**Dry as Molded**	**Conditioned 2.5% Moisture**
Tensile Strength @ Yield (MPa)	ISO 527	81	62
Tensile Strength @ Break (MPa)	ISO 527	–	–
Elongation @ Yield (%)	ISO 527	10	20
Elongation @ Break (%)	ISO 527	45	>100
Tensile Modulus (MPa)	ISO 527	3,000	1,400
Poisson's Ratio	ISO 527	0.4	–
Flexural Modulus (MPa)	ISO 178	2,900	1,370
Flexural Strength (MPa)	ISO 178	33	20
Notched Charpy Impact (KJ/M²)	ISO 179		
23°C		6.4	–
-30°C		5	–
Unnotched Charpy Impact (KJ/M²)	ISO 179		
23°C		NB	–
-30°C		NB	–
Notched Izod Impact (KJ/M²)	ISO 180	6	–
Thermal Properties	**Test Conditions**	**Dry as Molded**	**Conditioned 2.5% Moisture**
Melting Point (°C)	ISO 3146	260	–
Heat Deflection Temperature (°C)	ISO 75		
1.82 MPa		72	–
0.45 MPa		200	–
Vicat @ 50N (°C)	ISO 306	236	–
Coefficient of Linear Thermal Expansion	ISO 11359		
2 mm - Parallel, 23°C-55°C (10^{-5} mm/mm/°C)		1.1	–
2 mm - Normal, 23°C-55°C (10^{-5} mm/mm/°C)		1.2	–
Electrical Properties	**Test Conditions**	**Dry as Molded**	**Conditioned 2.5% Moisture**
Dielectric Strength (kV/mm) (step-by-step) 3.0 mm	IEC 60243	12	–
Volume Resistivity (ohm-cm x 10^{15}) 3.0 mm	IEC 60093	6	–
Comparative Tracking Index (volts) 3.0 mm	IEC 60112	> 600	–

Flammability Properties for Vydyne 21SPC

Flammability Properties	Test Conditions	Dry as Molded
Glow Wire Flammability Index (°C)	IEC 60695-2-12	
0.71 mm		–
1.5 mm		–
3.0 mm		–
Glow Wire Ignition Temperature (°C)	IEC 60695-2-12	
0.71 mm		–
1.5 mm		–
3.0 mm		–
Limiting Oxygen Index (%)	ASTM D-2863	26

Underwriters Laboratories Recognized Component Ratings

Yellow Card File Number E70062

Color: All

Parameters	Test Conditions	Thickness (mm)			
		0.4	0.71	1.5	3.0
Temperature Index (°C)	UL 746B				
Electrical		65	130	130	130
Mechanical w/Impact		65	75	75	75
Mechanical w/o Impact		65	85	85	85
Hot Wire Ignition (Rating)	UL 746A	–	4	3	2
UL94 Flammability Class (Rating)	UL Flame Test	V-2	V-2	V-2	V-2
High Amperage Arc Ignition (Rating)	UL 746A	–	0	0	0
High Volt Track Rate (Rating)	UL 746A	–	–	–	0
D495 Arc Resistance (Rating)	UL 746A	–	–	–	5
UL 746A Track Rate (CTI) (Rating)	UL 746A	–	–	–	0

Virgin and regrind up to 50% by weight have the same basic material characteristics.

All numerical flame spread ratings appearing in this data sheet are not intended to reflect hazards presented by this or any other material under actual fire conditions. Each end user should determine whether potential fire hazards are associated with the finished product and whether Vydyne resin is suitable for the particular use. Products made from Vydyne resins should not be exposed to open flames. In the case of direct exposure to open fire, Vydyne resins and products made therefrom can ignite and burn. Always store and use finished products in locations well away from open flames and sources of ignition.

Typical Molding Conditions for Vydyne 21SPC

Optimal processing conditions will depend on such features as machine size, screw design, die design, and material residence time. The settings below are a guide to achieving stable processing and good part quality. It is best to use a hand-held pyrometer to measure stock melt temperature in an air shot.

Suggested Machine Conditions

Melt Temperature, °C 275 to 305

Parameters	Machine Settings
Cylinder Settings °C	270 to 310
Mold Surface Temperature, °C	15 to 95
Injection Pressure, MPa	55 to 140
Holding Pressure, MPa	55 to 140
Injection Time, sec	< 1 to 2.5
Screw Back Pressure, MPa	0.2 to 1.0
Screw Speed, rpm	50 to 150
Cushion, mm	3.0 to 6.4
Clamp Pressure, tons/cm²	0.3 to 0.7

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Suggested Guidelines for Molding

1. Your Vydyne nylon resins arrive packaged in moisture-protected containers. If you do not open the original package prior to use, then drying is not necessary. However, if drying is necessary, we recommend that you use a dehumidified air-type dryer (desiccant bed) with a maximum air temperature of 70°C or 1 to 3 hours.

2. The recommended melt temperatures for Vydyne general-purpose resins are 275 to 305°C. Measure the stock in an air shot with a hand-held pyrometer. In addition to the barrel heater bands, screw back pressure and rotation speed add heat to the melt.

3. Maintain mold surface temperatures in a range of 15 to 95°C. We recommend temperatures on the high end, as the molding cycle allows, to aid in mold filling and to improve the appearance of the molded part.

4. Injection fill rates should be fast. Minimize the use of back pressure 0.2 to 1.0 MPa to yield a consistent melt and/or adequate mixing of color concentrates. Set the screw rotation speed at the minimum required to maintain the molding cycle (50 to 150 rpm).

5. Hold pressure should be set high enough to prevent screw bounce. Hold time should be set until the gate freezes.

6. Maintain your machine's shot-weight-to-barrel-size ratio at 40% to 80% of rated (polystyrene) capacity. A lower shot-to-barrel ratio results in excess residence time and polymer degradation, which can permanently embrittle the molded part. At a shot-to-barrel ratio above the recommended ratio, molding machinery is often unable to deliver a uniform melt or the desirable fast mold fill.

7. Regrind must be dry when molded. The preferred procedure is to grind and reuse immediately after molding. Regrind-to-virgin ratios of 25% or less have shown no significant property loss when properly molded. However, to ensure adequate performance of your molded part, determine acceptable levels for each application through actual part testing.

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