

Hi-Sil™ EZ 160G-D

Highly Reinforcing Silica Product

Typical Properties and Characteristics

Hi-Sil™	Surface Area, BET-5	pH	Na ₂ SO ₄ wt. %	Apparent Tamped Density	Specific Gravity	Manufacturing Location
EZ 160G-D	160 m ² /g	6.5	2.0 Max	275 g/L	2.1	Delfzijl, The Netherlands

Registration Numbers

231-545-4	European EINECS
CAS No. 112926-00-8	Synthetic Precipitated Amorphous Silica
CAS No. 7631-86-9	TSCA Chemical Substance Inventory (SiO ₂)



Hi-Sil™ EZ 160G-D silica is a synthetic, white, amorphous silicon dioxide micro-granule that is highly reinforcing and dispersible in most polymers and polymer blends. This silica product is finding uses in many types of rubber goods such as conveyor belt covers, off road equipment (tire treads), passenger tire treads, and belting.

The following pages provide some general rubber formulations to provide an idea of the reinforcing capability of Hi-Sil™ EZ 160G-D. While our mixing and testing are performed using Good Laboratory Practices and follow ATSM procedures, results may vary from lab to lab.

Rubber Processing Recommendations

For Hi-Sil™ EZ 160G-D, it is recommended that the silica be added as early as possible in the mixing schedule. Ideally, the silica should be added at the same time as the polymer(s) and before the addition of process oil to allow time for silica incorporation into the polymer(s). For high loadings of silica, split additions are recommended...first addition with the polymer(s) and the second with the process oil. For loadings of high density - low dust silica granules, a single addition can be made with the polymer/s and just before process oil addition.

Split oil additions are recommended to maintain a high viscosity as increased shear aids in silica dispersion. Granules and pellets tend to need slightly more mixing time to disperse than milled powders.

Note: Silica incorporation time and dispersion in rubber will vary based on internal mixer type and rotor design.

Black Conveyer Belt Cover (NR/BR) *This compound was mixed in a 2-wing lab internal mixer*

Formula: SMR CV60 – 80, BR 1208 – 20, Vanox® ZMTI – 1.1, N-330 Carbon Black – 10, Hi-Sil™ silica – 40, Vanplast® R – 2, Sundex 790 – 15, Santoflex® 6PPD – 2.5, ZnO – 3, RM Sulfur – 2.5, Santocure® MBS – 1.4, Perkacit® TMTD – 0.2

NR/BR Summary: Hi-Sil™ EZ 160G-D provides excellent crack growth, abrasion, and high tear resistance. Tensile strength and elongation provide adequate reinforcement for this type of formulation. Processing viscosity and scorch safety are good.

Compound Testing

MS at 121C, T5, m.m.	14.2	<u>Original</u>	
ML(1+4) 100C MU	75.4	Tensile Strength, MPa	24.0
Percent Dispersed (Dispergrader - 100X)	99.0	Elongation, %	774
		300% Modulus	4.3
		Hardness, Shore A	62
<u>MDR 2000 @ 157C, 1° arc</u>			
Ts2	0.9	<u>Oven Aged 70 hours @ 110C</u>	
T90	4.6	Tensile Strength, MPa	13.0
		Elongation, %	247
Abrasion Resistance DIN - loss mm ³	132	200% Modulus, MPA	10.2
		Hardness, Shore A	75
D-Flex Crack Growth, 100K cycles, mm	5.4	Tear Resistance, Die C (N/mm)	75.7

Black Conveyer Belt Cover (SBR) *This compound was mixed in a 2-wing lab internal mixer*

Formula: Copo 1500 SBR - 100, Flectol TMQ – 2, N-330 Carbon Black – 50, N-550 Carbon Black – 15, Hi-Sil™ silica – 50, Stearic Acid – 2, Cumar MH – 10, Calsol 510 (NAPH Oil) – 10, Sunproof Reg. wax – 2, Santoflex® 6PPD – 2.5, ZnO – 4, RM Sulfur – 0.5, Santogard PVI – 0.2, Santocure® TBBS – 3, Perkacit® TMTD – 1

SBR Summary: Hi-Sil™ EZ 160G-D provides excellent crack growth, abrasion, and good tear resistance. Original and heat aged tensile strength and elongation provide adequate reinforcement for this type of formulation. Processing viscosity and scorch safety are good.

MS at 130C, T5, m.m.	30+	<u>Original</u>	
ML(1+4) 100C MU	54.4	Tensile Strength, MPa	18.6
Percent Dispersed (Dispergrader - 100X)	97.0	Elongation, %	910
		Hardness, Shore A	56
<u>MDR 2000 @ 157C, 1° arc</u>			
Ts2	4.9	<u>Oven Aged 70 hours @ 110C</u>	
T90	9.0	Tensile Strength, MPa	18.7
		Elongation, %	740
Tear Resistance, Die C (N/mm)	52.6	Hardness, Shore A	67
D-Flex Crack Growth, 100K cycles, mm	6.7	Abrasion Resistance DIN, Loss mm ³	136

General Colored EPDM *This compound was mixed in a 2-wing lab internal mixer*

Formula: Keltan® 2630A - 100, Yellow Iron Oxide – 6, PEG 3350 – 2, Hi-Sil™ silica – 50, AC-617 Polyethylene – 3, Calsol® 510 (NAPH Oil) – 20, Wingtack® 95 – 2, Stearic Acid – 2, ZnO – 5, Spider Sulfur – 0.5, Perkacit® TETD – 3, Perkacit® ZDMC – 3, Sulfasan DTDM – 1

General EPDM Summary: Hi-Sil™ EZ 160G-D provides good tensile and tear strength, and elongation (original and heat aged) provide adequate reinforcement for this type of formulation. Processing viscosity and scorch safety are good.

Compound Testing

MS at 130C, T5, m.m.	10.8	<u>Oven Aged 70 hours @ 110C</u>	
ML(1+4) 100C MU	53.2	Tensile Strength, MPa	17.9
		Elongation, %	601
<u>MDR 2000 @ 165C, 1° arc</u>		300% Modulus, MPA	5.7
Ts2	1.5	Hardness, Shore A	82
T90	6.8		
		<u>Oven Aged 168 hours @ 110C</u>	
<u>Original</u>		Tensile Strength, MPa	17.5
Tensile Strength, MPa	18.0	Elongation, %	584
Elongation, %	715	300% Modulus, MPA	6.8
300% Modulus	2.7	Hardness, Shore A	83
Hardness, Shore A	74		
Tear Resistance, Die C (N/mm)	30.9		

Highly Loaded Oil Extended EPDM (peroxide cure)

This compound was mixed in a 2-wing lab internal mixer

Formula: Keltan® 5531A - 200, Permanax® ODPA – 2, UM Blue powder – 3, Hi-Sil™ silica – 75, Vanox® ZMTI – 2, ZnO – 1, Saret® 500 – 2.8, Vul-Cup® 40KE - 5

High loaded EPDM Summary: Hi-Sil™ EZ 160G-D provides good crack growth resistance. Tensile and tear strength, and elongation (original and heat aged) provide adequate reinforcement for this type of formulation. Processing viscosity is manageable and scorch safety is good.

ML(1+4), 100°C, MU	90	<u>Tensile Properties - Original</u>	
MS at 130°C, TS5, m.m.	>30	Tensile Strength, MPa	18.7
Specific Gravity, water	1.044	Elongation, %	823
Percent Dispersed (Dispergrader 100X)	99.7	300% Modulus, MPa	3.1
		Durometer, Shore A	63
Rheometer (MDR 2000) at 160°C, 1° arc (Reversion)			
TS2, m.m	1.1	<u>Tensile Properties Oven Aged 72 hrs. @ 110C</u>	
TC90, mm	12.6	Tensile Strength, MPa	18.8
		Elongation, %	694
Tear Resistance, Die C, N/mm	34.1	300% Modulus, MPa	4.3
		Durometer, Shore A	64
DeMattia Flex, 100,000 cycles (mm)	8.9		
		<u>Tensile Properties Oven Aged 168 hrs. @ 110C</u>	
DIN Abrasion Loss, mm3	158	Tensile Strength, MPa	17.7
		Elongation, %	710
		300% Modulus, MPa	4.1
		Durometer, Shore A	65

Off The Road Tread *This compound was mixed in a 2-wing lab internal mixer*

Formula: SMR CV60 - 100, Flectol® Pastilles – 1, N231 Carbon Black – 50 & 25, Hi-Sil™ silica – 25, PEG 3350 – 1, Stearic Acid – 2, Picco 6100 – 8, Santoflex® 6PPD – 2, ZnO – 3, RM Sulfur – 1, Santocure MBS – 1, Santocure® TBBS – 2, Perkacit® TB_zTD – 0.2

OTR Summary: The addition of Hi-Sil™ EZ 160G-D to an all black tread improves tear resistance, heat aged tensile properties, rebound, and abrasion resistance. Dynamic properties are similar to an all black compound.

	<u>160G-D</u>	<u>N-231</u>		<u>160G-D</u>	<u>N-231</u>
<u>Processing</u>			<u>Tensile Properties - Original</u>		
ML(1+4)	61.5	57.7	Tensile Strength, MPa	28.9	27.7
MS @ 130 °C, T5	30+	21.7	Elongation, %	564	529
Density	1.110	1.104	100% Modulus, MPa	2.6	2.9
			300% Modulus, MPa	11.1	13.6
<u>MDR 200 @ 138 °C</u>			Hardness, Shore A	69	71
TS2	24.0	11.9			
TC90	37.0	22.8	<u>Tensile Properties - Oven Aged 168 hours @ 90 °C</u>		
			Tensile Strength, MPa	22.8	20.9
<u>Tear Resistance, Die C (N/mm)</u>	142.8	119.5	Elongation, %	446	380
<u>Molded Groove Tear Resistance</u>			100% Modulus, MPa	3.2	4.2
Energy @ average load (J)	2.7	1.6	300% Modulus, MPa	13.6	18.0
			Hardness, Shore A	70	75
<u>Rebound (Zwick)</u>			Compression Set (Method B) (%)	59.3	60.5
Ambient Temp. (%)	54.4	48.2			
Hardness, Ambient Temp.	66	69	DIN Abrasion Resistance, Loss mm ³	139	155
Rebound, 100 °C (%)	69.2	64.8			
Hardness, 100 °C	62	62	D-Flex, 100,00 Cycles, mm	11.6	14.2
<u>Goodrich Flexometer, Stroke: 22.5%, Load: 1.0 MPa, Temp: 100C</u>					
Static Compression %	21.1	19.9			
Dyn Comp Final %	13.1	11.4			
Permanent Set %	5.1	6.2			
Heat Build Up, °C	20	23			

Packaging

Hi-Sil™ EZ 160G-D granule is packaged in 25 Kg (55 pound) paper bags. The bags are palletized in a 10X3 pattern with 30 bags per pallet (750 Kg or 1,653 pounds). Hi-Sil™ EZ 160G-D granule is also available in 20 Kg (44 pound) polyethylene bags, the bags are palletized in a 10*3 pattern with 30 bags per pallet. Hi-Sil™ EZ 160G-D granule is available in FIBC's (650 Kg or 1,433 pounds) and (2*350 Kg or 1,542 pounds).

Pallets containing paper and polyethylene bags are stretch wrapped in plastic film to protect against moisture pick up and shifting during transporting and storage.

Storage

To ensure product integrity PPG recommends that our silica products be stored under dry, clean conditions and protected against exposure to other substances.

Since silica may pick up moisture we also recommend that products that are stored more than one year, from date of manufacture, be re-tested for moisture content.

There is no shelf life limit when stretch-wrapped palletized units or bags are kept under the above stated conditions.

Safety and Health Effects



PPG Industries Inc. is committed to the safe handling of chemicals at every step of the process, from manufacturing and distribution through education of the end user. Our participation in the American Chemistry Council's *Responsible Care*® Program is evidence of our commitment to the health, safety and welfare of our employees and the industry. PPG Industries Inc. recommends thoroughly reading and understanding the product labels, Material Safety Data Sheets, and other safety information about the product prior to use or handling. Product health and safety information should be made available to your employees and customers.

Samples and Service

PPG's Technical Service specialists are available for consulting on the use, handling and storage of Hi-Sil™ EZ 160G-D Silica product.

Gallon containers and bag-size samples are available upon request from Technical Service.



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