

Hi-Sil™ EZ 160G 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 silica. While our mixing and testing are performed using Good Laboratory Practices and follow ATSM procedures, results may vary from lab to lab.



Hi-Sil EZ 160G Silica — Typical Properties	
N ₂ BET-5 Surface Area, m ² /g	160
CTAB Surface Area, m ² /g	160
pH	6.5
Na ₂ SO ₄ , weight %	2.0 Max
Apparent Tamped Density, g/L	275
Manufacturing Location	Lake Charles, LA USA

Rubber Processing Recommendations

For *Hi-Sil* EZ 160G silica, 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 Conveyor 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 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 121°C, T5, m.m.	14.2	<u>Original</u>	
ML(1+4) 100°C 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 @ 157°C, 1° arc</u>			
Ts2	0.9	<u>Oven Aged 70 hours @ 110°C</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 Conveyor 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 silica 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 130°C, T5, mm	30+	<u>Original</u>	
ML(1+4) 100°C MU	54.4	Tensile Strength, MPa	18.6
Percent Dispersed (Dispergrader - 100X)	97.0	Elongation, %	910
		Hardness, Shore A	56
<u>MDR 2000 @ 157°C, 1° arc</u>			
Ts2	4.9	<u>Oven Aged 70 hours @ 110°C</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, Calso® 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 silica 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 130°C, T5, mm	10.8	<u>Oven Aged 70 hours @ 110°C</u>	
ML(1+4) 100C MU	53.2	Tensile Strength, MPa	17.9
		Elongation, %	601
<u>MDR 2000 @ 165°C, 1° arc</u>		300% Modulus	5.7
Ts2	1.5	Hardness, Shore A	82
T90	6.8		
<u>Original</u>		<u>Oven Aged 168 hours @ 110°C</u>	
Tensile Strength, MPa	18.0	Tensile Strength, MPa	17.5
Elongation, %	715	Elongation, %	584
300% Modulus	2.7	300% Modulus, MPA	6.8
Hardness, Shore A	74	Hardness, Shore A	83
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 silica 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)		<u>Tensile Properties Oven Aged 72 hrs. @ 110°C</u>	
TS2, mm	1.1	Tensile Strength, MPa	18.8
TC90, mm	12.6	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. @ 110°C</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® TBZTD – 0.2

OTR Summary: The addition of *Hi-Sil* EZ 160G silica 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.

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

Hi-Sil™ EZ 160G

Highly Reinforcing HD Silica

TIRE

Product Safety and Regulatory Information

For the latest product safety and regulatory information, please reference the Product Safety Sheets at www.ppgsilica.com.

Samples

Samples are available per request from customer service.

Packaging

Standard packaging includes small bags and Flexible Intermediate Bulk Containers (FIBCs). Bags are unitized for shipping on pallets which are stretch wrapped with clear plastic film. FIBCs are single or double stacked on wood pallets. Please consult with Silica Customer Service or your Silica Sales Representative regarding additional packaging options including custom package sizes and bulk shipments.

Storage

To ensure product integrity, PPG recommends that our silica products be stored under dry, clean conditions, protected against exposure to direct sunlight and other substances, and used within twelve months of the date of manufacture.

Safety and Health Effects

PPG Industries recommends that, before use, anyone using or handling this product thoroughly read and understand the information and precautions on the label, as well as in other product safety publications such as the Material Safety Data Sheet. Any health hazard and safety information contained herein should be passed on to your customers or employees, as the case may be. The products mentioned herein can be hazardous if not used properly. Like all potentially hazardous materials, this product must be kept out of the reach of children.



PPG Industries

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