

Hi-Sil™, Ciptane™, and Silene™ Reinforcing Silica Products for Mechanical Rubber Goods

Hi-Sil™ and Silene™ silicas are white, synthetic, amorphous silicon dioxide. Hi-Sil™ is available in powder, pellet, and granular form. Silene™ silica is available in powder form. PPG silica products are used as a reinforcing filler in black, non-black, colored, and translucent industrial rubber and silicone compounds.

Mechanical Rubber Goods

Silene™ 732D and Hi-Sil™ 532EP are used in colored hose cover, wire insulation, sporting goods, and cable jacketing applications. Both products provide fast extrusion and calendaring, firmness of uncured stocks, smooth surfaces, flexibility, and resilience.

- **Fast, smooth extrusions, excellent flow**

Because of their lower surface area, Silene™ 732D and Hi-Sil™ 532EP do not exhibit an increase in stiffness and processing viscosity normally encountered with higher surface area silica products.

- **Faster curing**

Rubber compounds using Silene™ 732D and Hi-Sil™ 532EP exhibit cure rates much faster than those compounds using higher surface area silica products. Lower surface area silica is typically less reactive. This lower activity is less reactive to amines and zinc oxide that can reduce accelerator and activator effectiveness.

- **Improved dynamic properties**

Silene™ 732D and Hi-Sil™ 532EP have unique structures that give rubber products a high dynamic modulus with low stiffness, high resilience, low compression set, and low heat build up.

Hi-Sil™ 315G-D is used in dynamic applications such as NR and EPDM motor mounts to achieve low heat build-up, low compression-set, and high resilience. Hi-Sil™ 315 provides higher reinforcement than both Silene™ 732D and Hi-Sil™ 532EP due to its higher surface area. For internal mixer applications, Hi-Sil™ 315 exhibits fast incorporation into the polymer/s and excellent dispersion can be obtained even at mix times as short as two minutes. Both forms of Hi-Sil™ 315 (powder or granule) can be used in all polymer types either oil or non-oil extended. Hi-Sil™ 315 is used in non-tire automotive applications such as engine mounts, transmission belts, and colored hose covers. Other applications include: footwear and soling (transparent or colored), flooring for high hardness and abrasion resistance, mats, wire and cable coverings, specialty gloves, and automotive tire applications.

Hi-Sil 200 Series products include Hi-Sil™ 210, 233, and 243LD are often used in white or colored rubber applications where tensile strength, tear resistance, and abrasion resistance are critical to final product performance. Good heat age resistance and hot tear strength are added benefits when used with Carbon Black (example: N-347, N-358).

Hi-Sil™ HDP-320G silica is a synthetic, white, amorphous silicon dioxide granule or powder 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, flooring and molding, off road equipment (tire treads), passenger tire treads, and belting.

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.

Hi-Sil™ 134G is a white, synthetic, amorphous silicon dioxide in micro-granular form. It is used as a highly reinforcing filler in black, colored, and industrial rubber and highly filled tire tread formulations. It provides high tensile strength and tear and abrasion resistance.

Hi-Sil™ 190G is a highly reinforcing silica ideal for compounds designed for wear resistance such as footwear outsoles. Other possible applications for Hi-Sil 190G will involve a requirement for high tear resistance and includes many industrial rubber products such as conveyor belts, wire and cable, hose covers, oil well specialties, and others.

Ciptane™ I and Ciptane™ LP are mercapto-silane treated precipitated silicas. They provide greater rubber reinforcement than can be obtained with untreated silica fillers, and can eliminate the reinforcement gap which has existed between silica and carbon black. Rubber compounds based on Ciptane exhibit improved abrasion resistance, tensile strength and modulus, as well as low heat build-up, lower rolling resistance, and lower viscosity. Since Ciptane has already been reacted with a silane coupling agent, it eliminates the processing costs and production variability associated with separate addition of silane. Ciptane™ I is treated with 3% by weight mercapto-silane and is in low dusting pellet form and Ciptane™ LP is treated with 2.5% by weight mercapto-silane and is in bead form.

Rubber Processing Recommendations

For Hi-Sil™ and Silene™ products, 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.

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™, Silene™, and Ciptane™ Silica Grades Typical Properties and Characteristics

PPG Silica Grades	N ₂ Surface Area, BET-5 (m ² /g)	pH	Physical Form	Reinforcement
Silene™ 732D	30	8.5	Powder	Semi
Hi-Sil™ 532EP	55	8	Powder	Semi
Hi-Sil™ 315G-D	125	7	Powder & Granule	Reinforcing
Hi-Sil™ 900	133	7	Powder	Reinforcing
Hi-Sil™ 210	135	7	Pellet	Reinforcing
Hi-Sil™ 233	135	7	Powder	Reinforcing
Hi-Sil™ 243LD	135	7	Granule	Reinforcing
Ciptane™ I	135*	7	Pellet	Reinforcing, Mercapto-Silane
Hi-Sil™ 135	145	7	Powder	Reinforcing
Hi-Sil™ HDP-320G	160	7	Granule	Highly Reinforcing
Hi-Sil™ EZ 160G-D	160	7	Micro-Granule	Highly Reinforcing
Hi-Sil™ 132	170	7	Powder	Highly Reinforcing
Ciptane™ LP	175*	7	Bead	Highly Reinforcing, Mercapto-Silane
Hi-Sil™ 134G	180	6.5	Micro-Granule	Highly Reinforcing
Hi-Sil™ 915	195	7	Powder	Ultra Reinforcing
Hi-Sil™ 190G	195	7	Granule	Ultra Reinforcing

* Before treatment

Packaging

Silene™ 732D, Ciptane™, and Hi-Sil™ products are packaged as follows:

<u>Product</u>	<u>Net weight</u>	<u>Bag Construction</u>
Silene™ 732D	44 pounds (20Kg)	multi-wall paper bags
Hi-Sil™ 532EP	44 pounds (20Kg)	multi-wall paper bags
Hi-Sil™ 315	44 pounds (20Kg)	multi-wall paper bags
Hi-Sil™ 315G-D	55 pounds (25Kg)	multi-wall paper bags
Hi-Sil™ 210	44 pounds (20Kg)	polyethylene
Hi-Sil™ 210	50 pounds (22.7Kg)	polyethylene
Hi-Sil™ 243LD	44 pounds (20Kg)	polyethylene
Hi-Sil™ 243LD	50 pounds (22.7Kg)	multi-wall paper bags
Hi-Sil™ 233	44 pounds (20Kg)	multi-wall paper bags
Ciptane™ I	44 pounds (20Kg)	polyethylene
Hi-Sil™ 900	30 pounds (13.6Kg)	multi-wall paper bags
Hi-Sil™ 135	44 pounds (20Kg)	multi-wall paper bags
Hi-Sil™ HDP-320G	55 pounds (25Kg)	polyethylene
Hi-Sil™ 160G-D	55 pounds (25Kg)	multi-wall paper bags
Ciptane™ LP	44 pounds (20Kg)	multi-wall paper bags
Hi-Sil™ 134G	55 pounds (25Kg)	multi-wall paper bags
Hi-Sil™ 132	44 pounds (20Kg)	multi-wall paper bags
Hi-Sil™ 915	25 pounds (11.3Kg)	multi-wall paper bags
Hi-Sil™ 190G	44 pounds (20Kg)	polyethylene

Bulk shipments can be made in various forms such as Flexible Intermediate Bulk Containers (FIBC), truckload or railcar. Please consult with your Silica Sales Specialist or Silica Customer Service regarding bulk shipments

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™, Ciptane™, and Silene™ Silica products.

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



Europe

PPG Chemicals bv
P.O. Box 181
9930 AD Delfzijl
The Netherlands

PPG Industries, Inc.
Silica Products
440 College Park Dr.
Monroeville, PA 15146

Tel: +31-596-676710

Fax: +31-596-618166

Customer Service: 1-800-243-6745

Technical Service: 1-800-764-7369



Hi-Sil™, Ciptane™, and Silene™ Reinforcing Silica Products for Mechanical Rubber Goods

Statements and methods presented in this publication are based upon the best available information and practices known to PPG Industries at present, but are not representations or warranties of performance, result or comprehensiveness, nor do they imply any recommendations to infringe any patent or an offer of license under any patent.

© 2012 by PPG Industries, Inc.
Hi-Sil is a trademark of PPG Industries.

Revised 6/14/2012