Construction Sealants

Pioneered by GE.
Refined by GE.

Structural Glazing

Weatherseal

Insulating Glass

Glazing

Specialty

Coatings

imagination at work

"Firsts"

Patented the process allowing for the industrial production of silicones in 1940.

Provided the U.S. Military, during WWII, with a synthetic product superior to natural rubber.

Crafted the soles on Neil Armstrong's space boots.

A History of "Firsts"

Rooted in innovation and historical "firsts," today's family of GE sealants is at the forefront of the ever-inventive, increasingly demanding architecture found across the globe. New or remedial, straightforward or complex, GE sealants deliver results for a wide range of application challenges.

More than 70 years ago, GE's commitment to innovation fueled the discovery of silicone. From the time silicone's unique ability to resist weather, remain durable, and perform under the harshest of conditions was first realized until now, the sealants team has researched, pioneered, and delivered solutions with silicone that have turned innovative designs into lasting and durable structures.

Today, the steadfast commitment to silicone innovation continues with a wide variety of product offerings, organized into five product families:

- Structural glazing
- Weathersealing
- Insulating Glass
- Glazing
- Coatings
- Specialty applications

To help ensure a project's success from inception to completion, this vast array of products is complemented by superior technical assistance. With decades of experience working on some of the world's most innovative structures, the sealants team ranks among the most knowledgeable and well versed in the industry.

70 Years of Silicone Innovations

1938

The "Silicone Project" starts within the Research Laboratory at the General Electric Company in Schenectady, New York.

1940

GE scientist E.G. Rochow discovers and patents the "direct process" for making methylchlorosilanes, a key building block of all silicone products.

1942

GE responds to a call from the war effort and creates silicone products to meet a need within U.S. Military operations (gaskets and wires).

1944

GE begins commercial production of silicones. By the end of the 1940s, GE cures silicones with organic peroxides, leading to the development of heat cured rubber, used widely today in automotive and medical devices.

1947

GE opens its first silicone plant in Waterford, New York. The plant still operates today and is responsible for a significant portion of the world's silicone.

1963

GE works to develop applications for the construction industry. SCS1200, a silicone used as a replacement for putty, is introduced by GE and widely adopted before more advanced uses are considered.

1969

From helmet to glove to boot, Apollo 11 astronauts use GE silicone to walk on the moon.

Pioneering Silicone: From Boots to Bombers

GE has a deep history of pioneering some of the first silicone innovations. Seeds for GE's global sealants and adhesives business began more than 70 years ago with a dedicated research effort called the "Silicone Project." Out of a laboratory in upstate New York, a team of GE scientists led by E.G. Rochow discovered and patented the "direct process" for making silicone into a useable substance, making modern day commercialized distribution of this important material possible.

In the decades that followed, GE research honed silicone's unique adhesive and protective properties into some of the first material applications, making it essential for two global events, whose success announced silicone's full potential to the world:

- **In 1944, the U.S. Military requested a "material that behaved like rubber that had long life at high temperature."**[i] Savvy with six years of research in the notebooks, GE was one step ahead, and able to meet their needs quickly by developing a silicone for heat-resistant gaskets for B-29 bombers and stronger, more flexible, water-resistant wiring for warships.[ii]
- **When the U.S. Space Program was looking for materials that could withstand unpredictable climates, rocky terrains, and extreme temperature shifts in their plight to bring man to the moon**, once again, GE was ahead of the curve. GE silicone was used to develop heat shields for the vessels and satellites and protective shields for the boots and space suits worn by Neil Armstrong and his fellow astronauts.

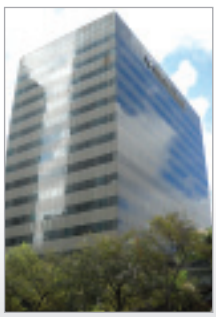
These early innovations by GE paved the way for ever more complex solutions, proving silicone's tremendous protective and adhesive qualities, and drawing lasting interest from architects seeking to leverage this new polymer to create increasingly imaginative designs. This history of "firsts" and the innovations that followed distinguish the sealants team as leading experts in the field of construction sealants and adhesives.

1974

Chicago Art Institute, the world's first 4-sided SSG building without safety mechanisms, is completed thanks to input from GE consultants and the use of GE silicone.

1980

Soaring to new heights, the world's first four-sided SSG high-rise is constructed using GE structural silicone at 800 Brickell Ave. in Miami, Florida.



1980s

GE introduces high-strength, two-part silicone technology used for insulating glass and structural glazing applications, fundamentally changing the way glass and facades are fabricated.

1990s

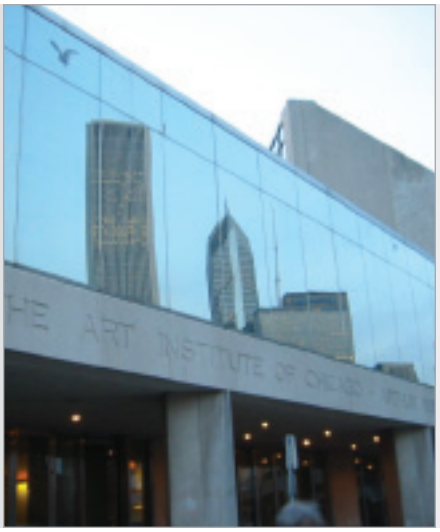
GE introduces non-stain silicone technology for sealing of natural stones, while allowing for a cleaner-looking facade.

2008

The world's tallest four-sided structurally glazed facade with the highest observation view, the Shanghai World Financial Center, is completed using GE structural sealant, weathersealant, and non-stain sealants.

2010

The next generation of design flexibility for innovative, world-class architecture, GE SSG4600 UltraGlaze* structural glazing sealant/adhesive, is launched.



First Four-Sided Silicone Structural Glazing Project

From 1973-1975, GE worked with architects and designers to complete the Chicago Art Institute, the world's first four-sided silicone structural glazing (SSG) project that did not incorporate safety mechanisms. Nothing but GE silicone holds the glass to the building, a feat others in the industry would not attempt at the time. Standing fast on the shores of Lake Michigan, withstanding blustery winters with blowing snow and rain, GE SCS2000 SilPruf* has showcased low-temperature flexibility as well as the beauty of bonding two materials together solely with silicone for 35 years, and counting.

Structural Glazing: Making the "Impossible" Possible

Once deemed too risky to employ without safety mechanisms, freestanding SSG projects are now accepted industry practive thanks in large part to GE's essential role in the construction of the world's first four-sided SSG project without safety mechanisms—the Chicago Art Institute. GE silicone was used to structurally glaze the building, constructed from 1973 to 1975. In the years since this pivotal milestone, the team has continued to push the boundaries. GE structural glazing sealants have been used on awe-inspiring structures such as the Shanghai World Financial Center (China), Sears Tower (United States) and Bahrain Financial Harbour (Bahrain).†

GE's contributions to the evolution of silicone predate the industry. Its long history of market "firsts" and transformative milestones forever changed modern day construction; by honing silicone's unique properties, GE enabled architects to realize feats previously thought impossible, and protect existing structures from elements once believed unstoppable.

This incredible legacy continues today as GE sealants and adhesive products address the needs of the increasingly demanding and imaginative designs.

Innovative Solutions Around the Globe

GE sealants' contribution to modern construction is unparalleled. From pioneering *firsts* to breaking barriers, the sealants team's role in creating innovative solutions and providing superior technical expertise is best showcased in its many successful projects from around the globe.

Lotus Temple†: Protecting Unique Beauty – In 2006, after twenty years of exposure to New Dehli's pollution and hosting more than 4 million visitors a year, the Lotus Temple's pristine white marble cladding was losing its luster. 21,000 meters (68,900 feet) of the existing sealant—all tucked between the flower-like curves and slopes on the exterior of the building—needed replacing. GE SCS9000 Silpruf* NB, a substitute for organic sealants in a range of applications, was selected for the project. It is specially formulated to reduce, and often eliminate, dirt pick-up, surface streaking and staining on many substrates.

Shanghai World Financial Center†: Achieving New Heights – Not only can the sealants team boast participation in the first four-sided SSG project without safety mechanisms, they were also selected for use in the world's tallest completed building with the highest observation view, the Shanghai World Financial Center. The complexity of the building design for this awe-inspiring, 101-story mixed-use skyscraper required a structural glazing silicone system delivering outstanding strength, durability and weatherability. GE UltraGlaze* was used to structurally glaze the building prior to its opening in 2008.

Empire State Building†: Withstanding Harsh Conditions – When the Empire State Building was in need of weathersealing, its owners turned to GE sealants. GE silicone is an excellent choice for a wide range of weatherproofing applications due to its outstanding weather resistance, durability, adhesion and high movement capability. Because the sealant was being applied to natural stone, it was critical that a non-staining sealant be used. For this hallmark project completed in 2009, GE SCS9000 SilPruf* NB was used for joint sealant installation and window repairs. GE Weatherseal products provide the two most critical attributes of effective weathersealing products: long-term efficacy in sealing out air and water; and the ability to withstand weather and atmospheric conditions without degradation. During this project, SCS9000 withstood a set of brutal tests simulating gale-force winds and torrential rains, demonstrating the stability of the product.

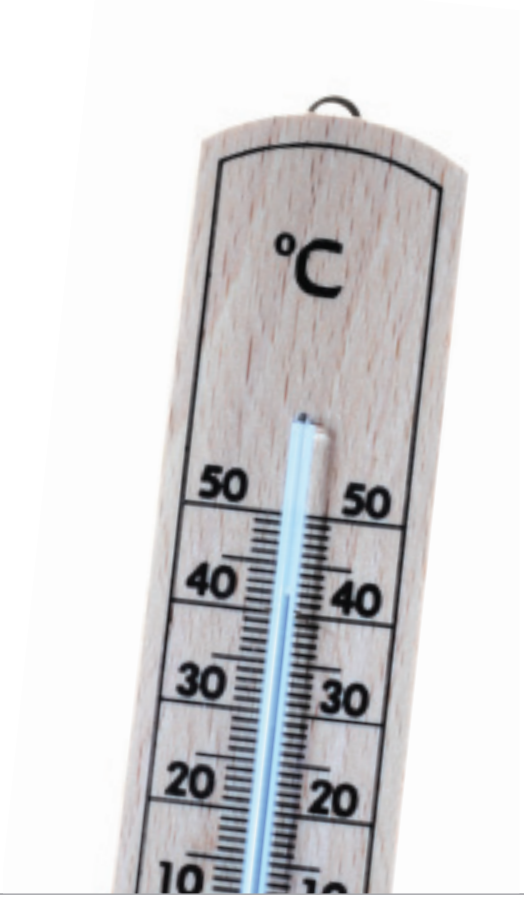
Silicone. Long Lasting Durability No Matter the Conditions.

While towering skyscrapers and mirrored marvels stand as testament to the team's prowess in developing products for silicone structural glazing, it also boasts an equally impressive track record of creating innovative products used in weathersealing, glazing, insulating glass, and other specialty applications. Outstanding durability, flexibility, and movement capability are fundamental to the high performance of GE sealants, making it an exceptional choice for architects, builders, and restoration firms.

The same extraordinary requirements that dictated the use of silicones for connectors, heat shields and "moon boots" in space flight, where scientists were required to protect spacecraft against the destructive effects of extremely high and low temperatures, are readily translatable to construction applications. One look around some of the world's most notable buildings and the conditions they endure and it is easy to understand why GE silicone's protective properties make it one of the most essential compounds for modern day construction, as well as remediation and protection of existing buildings.

Chemically, silicone is quite different from all other materials. It is this difference that gives it its unique combination of properties—properties that permit silicone to perform in many applications where no other elastomer can be used. For the same reason, silicone retains high-temperature properties without breaking down.

The most outstanding property of silicone rubber is its excellent resistance to temperature extremes.



Low Temperature Flexibility–

GE silicone remains permanently flexible, without hardening, at extremely low temperatures, an important consideration when bonding two materials together with differing coefficients of thermal expansion. While silicone provides a flexible foundation for movement, even in freezing conditions, other sealants can become brittle and crack, reducing the safety factor of the structure.

For more than 30 years, the Ohio Bell Telephone building† has stood as a four-sided SSG project with segmented, curved and out-sloped glazing. Year after year, it stands, aside the bitter lakefront effect winters of Lake Erie.† It has even withstood extreme temperatures as low as the record setting –20ºF reached in January 1994, as well as 21 plus feet of snow covering the ground in February 1993.[iii]

High Temperature Stability–

GE silicone is resistant to extremely high temperatures and does not break down with exposure to ultra-violet rays. At elevated temperatures, the tensile strength, elongation and abrasion resistance of silicone rubber is far superior to that of most organic rubbers. In fact, after heat aging, conventional rubber can harden, crack and decompose while silicone rubber remains unaffected. So, it's no wonder that Dubai, a desert climate and one of the fastest growing international cities, is home to many new and fascinating structures, created with silicone. In the late 1970s, the world-class architecture firm, 3D International,† utilized the temperature resistance of GE silicone to design the Galadari Corniche Complex (Hyatt Regency)†. The fact that, after 30 years of high heat and desert conditions it still appears as beautiful and sound as it was the day it was built, lends credence to the durability of silicone .

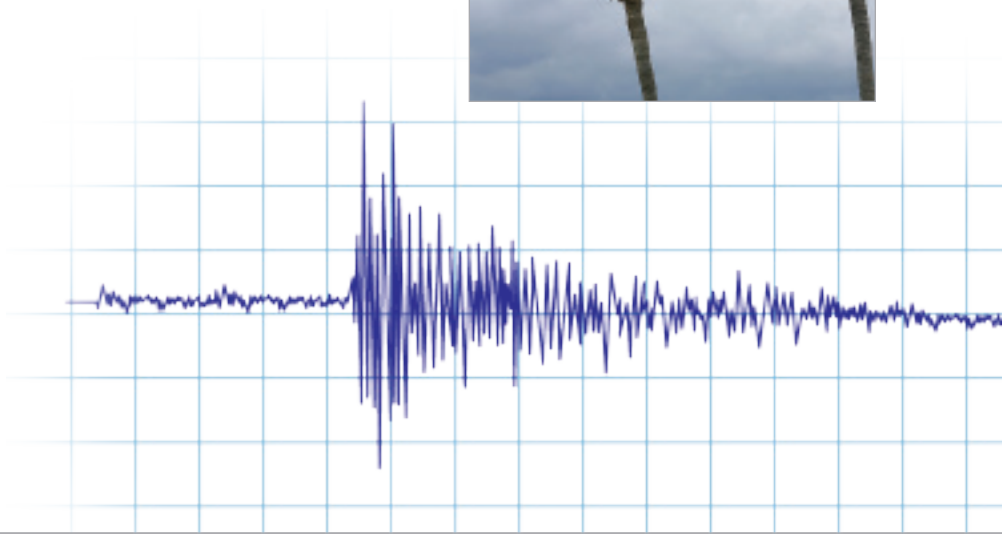
Silicone rubber provides long-term durability and stability, combating severe climatic conditions.

Flex with Seismic Shifts – GE silicone's resilient flexibility provides a cushioned foundation when bonded to aluminum curtainwalls to reduce the potential of glass breakage making it an exceptional choice for many structures within "earthquake zones." The properties inherent in silicone provide the basis for strength and durability. With high tensile-adhesion strength, silicone is capable of withstanding extreme forces and pressures without tearing or rupturing. What's more, silicone's high inner-tear strength makes it capable of resisting tear propagation and maintaining performance integrity if inadvertently damaged. In seismic racking studies performed by the Architectural Engineering Department at The Pennsylvania State University, seismic performance of SSG curtain wall systems was simulated. Full-scale, two-sided and four-sided SSG mock-ups comprised of multiple glass lites or panels were tested under cyclic racking displacements to determine serviceability and ultimate behavior responses. The studies, in which a GE one-part silicone was used, concluded that SSG systems can perform favorably in seismic events over conventional dry-glazed systems.[iv]

For years, GE silicone has been used across the globe on buildings in several quake zones including the circum-Pacific seismic belt, where about 81 percent of the world's largest earthquakes occur.[v] Greater Los Angeles is home to several of the earliest uses of four-sided SSG, including the eye-catching Crystal Cathedral[†] in Anaheim, which used GE silicone sealant and has been standing for over 30 years and counting.

Endure High Wind – Due to silicone's permanent flexibility, it can absorb and endure severe impact, without tearing or rupturing, giving it the capability to withstand hurricane-force winds. By combining long-term durability and stability, silicone delivers a high safety factor, a critical consideration in areas prone to severe climatic conditions.

Hong Kong offers one of the world's most impressive skylines, yet it lies in a tropical belt that's impacted by low pressure systems that can intensify into the world's most powerful typhoons. In 1982, Sir Norman Foster's famous HSBC Tower opened and in spite of typhoon winds through the years, the building sealed with GE silicone sealant has remained intact.



GE Sealants: Europe/Middle East/Africa/India

An impressive line of innovative products in structural glazing, weathersealing, insulating glass, glazing, coatings, and specialty applications, combined with a team of technical experts and leading industry warranties helps ensure project success. From a project's inception to completion, the sealants team offers superior technical assistance. With decades of experience on some of the world's most innovative and picturesque structures, the team provides a wealth of knowledge and support to deliver results.

A summary of the technical assistance provided by the team is below. Technical support is available throughout the process.

1. Project Review – Reviews project details to assist with proper product selection based on usage criteria, specifications and customer needs.

2. Drawing Review – Reviews all drawings and details to help identify the required contact width and configuration of the structural silicone based on project performance requirements and installation considerations.

3. Lab Testing – Tests all substrates to be used in the project that the sealant is to bond to, or will come in contact with, in the factory or on the jobsite.

4. Project Report – Provides written test result reports that detail product recommendations and recommended substrate preparation for consideration in the project.

5. Quality Control – Develops easy-to-follow QC testing (including adhesion testing) and documentation procedures to help ensure consistent performance from inception to completion.

6. Project Warranty – Once steps 1-5 are satisfactorily completed, offers extended warranties for long-term assurance.

Structural Glazing

Formulated for outstanding durability, excellent joint movement capability and weather resistance, GE structural glazing products provide properties ideal for many of the unique and challenging architecture demands around the globe.

Weatherseal

GE weatherseal products are designed with attributes that allow for the long-term protection of the building envelope.

Insulating Glass

GE insulating glass products are engineered with the strength and adhesion properties critical to long-term performance.

Glazing

GE glazing sealants' fast-cure properties provide rapid adhesion build and a long-lasting bead that can accommodate a wide range of movement.

Specialty

GE specialty products include a variety of sealants and adhesives to meet a broad spectrum of sealing and adhesion requirements.

Coatings

GE silicone coatings provide outstanding durability and excellent weather resistance with virtually no effects from natural weathering.

For more information about GE Construction Sealants or to see a detailed description of GE sealants and adhesives available in Europe/Middle East/Africa/India, visit www.ge.com/silicones.
A GE Construction Sealants product catalog is available by request from your sales representative. For global product availability, contact customer service.
Customer Service: 00 800 4321 1000 | Technical Services: Europe & Africa: +31 164 292 600, Middle East: +971 4 886 2070, India: +91 44 304 120 77

[ii] Liebhafsky, Herman A., Liebhafsky, Sybil Small, Wise, George. Silicones Under the Monogram. A Story of Industrial Research. New York: John Wiley & Sons, Inc., 1978.

[iii] U.S. Department of Commerce National Oceanic & Atmospheric Administration. National Environmental Satellite, Data, and Information. http://cdo.ncdc.noaa.gov/climatenormals/clim20/oh/331657.pdf

[iv] Memari, Ali.M., Chen, Xuezhen, Kremer, Paul A., and Behr, Richard A., "Seismic Performance of Structural Silicone Glazing Systems, ," Proceeding of the Symposium on Durability of Building and Construction Sealants and Adhesives, June 15-16, 2005, Reno, NV

[v] USGS website: http://earthquake.usgs.gov/learn/faq/?categoryID=11&faqID=95

[†] The buildings, fabricators and architectural firms mentioned herein are provided solely as historical background information. This advertisement does not constitute an endorsement from such parties.