

## CASE STUDY

## Shanghai World Financial Center



Soaring to an impressive height of 492 meters (1,600 feet), with 101 above-ground floors, the Shanghai World Financial Center (SWFC) is among the tallest, most intricately designed buildings in the world. The building's striking profile is that of a square prism, intersected by two sweeping arcs to form the building's signature opening: a vertically-evolving six-sided shape that resembles the ancient Chinese symbol of the earth. Here, at 472 meters (located on the 100th floor), the architectural vision for the building to serve as a symbolic link between heaven and earth is realized.

## 101 Floors of Earthquake-, Weather-, and Wind-Resistant Symbolism

*Unique Design Emphasizing Tower's Link between "Heaven and Earth" Is Made Possible by GE Sealants*

### THE CHALLENGE:

#### Extreme Conditions Necessitate High-Strength SSG Solution

An impressively large, more than 120,000 square meter (1.3 million square feet) curtainwall system made from 10,000 four-glass-panel-unitized frames produces the tower's elegant profile and tapered façade, making it the largest four-sided structural glazed curtainwall in the world. Construction of this architectural feat posed extraordinary challenges to Gartner Shanghai (Permasteelisa Group), the largest curtainwall fabricator in the world. Earthquakes, typhoon-level winds, extreme weather conditions, and ultra-violet exposure demanded an inventive structural design and an advanced silicone structural glazing (SSG) solution.

### THE SOLUTION:

#### GE SSG4400: Powerful Performance for SWFC's Demanding Design Requirements

After a thorough review, Gartner Shanghai selected GE SSG4400 UltraGlaze\*, a high-strength, two-part silicone elastomeric sealant/adhesive, to construct the tower's complex curtainwall system. With high mechanical strength and long-term durability, flexibility and stability, SSG4400 created a lasting bond between the glass and the SWFC's aluminum frame, delivering a high safety factor to the design, and exceeding the required safety guidelines by five times.

Location:	Lujiazui Finance and Trade Zone Center, Pudong District, Shanghai, China
Challenge:	Reach record-breaking height and realize innovative design while helping protect against earthquakes, severe wind loads, and effects of inclement weather.
Number of Floors:	101 floors above ground, 3 floors underground.
Building Height:	492 meters
Structure:	Steel reinforced concrete structure and steel-framed structure(s).
Products:	GE SSG4400 UltraGlaze*, GE SSG4800J UltraGlaze*, GE SCS2900 UltraPruf*, GE SCS9000 SilPruf* NB



imagination at work

SSG4400's fundamental properties allow it to endure severe impact, reducing potential for damage brought on by extreme winds, precipitation, and range of seismic activity, all quite common in Shanghai.

Using SSG4400 also helped improve the project's overall production schedule. Fabrication of this impressively large curtainwall was completed in just two years to meet the project's demanding timeline, thanks in large part to SSG4400's adjustable cure time coupled with rapid adhesion build and low pumping pressure. These attributes supported factory conditions to allow quicker assembly and creation of fabricated units that could then be transported to the jobsite for erection onto the façade.

### 30-Year History Pioneering Structural Glazing Solutions Provides Customer Assurance

Distinguished by more than 30 years of pioneering silicone structural glazing solutions, the sealants team of technical experts offered deep category experience and a complete offering of silicone products, known for outstanding weather resistance, durability, adhesion, and flexibility as well as excellent performance on complex and unique building structures around the globe.

"GE Toshiba Silicones (now GE-branded sealants) provided us with diversified grades of sealants from which we selected the material candidates that best met the design challenges of the SWFC," said Ted Graban, General Manager of Gartner Shanghai (Permasteelisa Group). "In modern construction, the quality and technology of the sealant materials are the keys for high-tech curtainwalls. The team of experts behind GE sealants has a proven track record in delivering in both categories and therefore is a trusted partner."

### On-Site Visits From GE Sealants Technical Experts Exceed Quality Control Measures

GE sealants are only one part of this successful equation. From the project's inception to its completion, the deep category experience from the sealants experts proved essential. The experts offered critical guidance on design calculations, drawing reviews and performed ongoing adhesion tests to meet quality control measures. The sealants team even went a step beyond by visiting Gartner Shanghai's manufacturing site to train and monitor their operators and to help start up pumping equipment.

"The team of technical experts for GE sealants responded to unique design requirements and implemented focused on-site trainings and oversight that were instrumental in the success of this project. Their deep expertise and attention to design and quality control ensured that the construction of the SWFC went smoothly and was completed two weeks ahead of schedule enabling us to cut costs and generate income ahead of expectations," says Daniel Choi, Senior Project Manager, Gartner Shanghai.

### GE Sealants Offer System Compatibility & Provide Long-Term Sustainability

Due to the inclusion of stone on the structure, GE SCS9000 SilPruf\* NB, a 100 percent silicone, non-staining weatherproofing sealant was chosen. As a substitute to organic sealants, SCS9000 is formulated to reduce or eliminate dirt-pickup, surface streaking, and substrate staining. As an excellent choice for weathersealing, SCS9000 also provides long-term efficacy in sealing out air and water; and the ability to withstand weather and atmospheric conditions without degradation.

A high-performance GE silicone insulating glass sealant was also used to seal the double-paned glazing unit (DGU) on the tower. The sealant provides effective insulation against hot and cold weather, increasing heating and air-conditioning efficiency and significantly reducing the loss of energy and attendant costs, helping in the fight to curb global warming.

#### THE RESULT:

### Flourishing Commerce Center Becomes a Global Magnet and Is Named 2008 Best Skyscraper

Named 2008's Best Skyscraper by the Council on Tall Buildings and Urban Habitat, an international group of architects and engineers, the SWFC is today one of the most recognized buildings in the world, attracting some of the world's largest and most successful financial services firms. It's inventive design, soaring height, and glistening frame is a testament to the lasting efficacy of GE sealants and the multi-faceted experience of its team of technical experts.

Thanks to the adhesive, flexible, and protective properties of GE sealants, the SWFC's awe-inspiring design will live among the heavens for years to come.

**Pioneered by GE. Refined by GE.** With a history of dedication to innovation and excellence, today's family of GE sealant products address a wide variety of the ever-inventive, increasingly demanding architecture found around the world. Outstanding durability, flexibility, and movement capability are fundamental to the high performance of GE sealants. With decades of experience, in new and remedial applications, on some of the world's most innovative structures, the sealants team provides knowledge and comprehensive support to help ensure a project is successful.

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