Silicone-based sealants and adhesives are much more than just sophisticated glue: they are a vital component of thousands of products, determining the way materials can be used together.

Silicones are revolutionising the technology of adhesion, opening up advanced design possibilities. From labels to airplanes, floor tiles to skyscrapers, silicone-based sealants and adhesive systems make our lives safer, more comfortable and more rewarding.

Extraordinary versatility

Silicones are extraordinarily versatile. They can bond materials together with enormous power or exceptional lightness, be designed for permanence or temporary adhesion. The excellent adhesion properties of silicones come from their chemical structure. This allows them to bind together materials that were traditionally difficult to unite – such as glass, metal and stone. With silicone technology, formulators are able to define the exact characteristics of the bond needed. In turn, these requirements depend on the product or application as well as how, where and for how long it will be used.

For certain applications, such as for masonry or machines, the bond must be permanent and extremely strong but in others, such as specialist tapes for medical devices, gentleness and softness are needed. For all applications, the nature of the bond has to be totally reliable.

Sealants and adhesives made of silicones are based on the same technology. While adhesives transfer forces from the piece being held on to the supporting structure, a sealant is designed in such a way so that only a minimum of force is transmitted. Thus, these adhesives are hard rubbers which have a high mechanical strength, whereas sealants are much softer.

Advances on traditional systems

Silicone bonds can be much stronger than traditional physical systems that rely on bolting or welding. They are materials of choice to work under great stress and pressure and in the most hostile environments of temperature range, abrasion or extreme climate, where normal techniques will fail.

More and more, complex units such as aircraft, motor vehicles and ships are ‘stuck’ together using silicone technology to achieve lightness while providing strength and absolute reliability.
In civil engineering, creative feats of architecture use silicones to secure wide expanses of glass while inside silicones reinforce safety by holding fittings and partitions firmly in place.

Electrical machines of all shapes and sizes depend on silicone systems to hold vital but sensitive components securely in place, to conduct or to block electricity and to help prevent damage or risk of fire.

Benefits of silicone-based adhesives and sealants

**Flexibility.** Many applications require a high degree of flexibility without compromising strength. Silicone-based adhesives can move with the expansion and contraction of surfaces over a wide range of temperatures. In construction, this means that materials stay affixed and absorb stress and movement to help structures stay strong and safe, whether it is a wooden floor, swimming pool, concrete bridge or skyscraper with a glass façade. The elastic nature of silicone materials in structural glazing applications can help reduce damage and physical harm from small to medium-scale earthquakes.

Structural glazing is the attachment of glass panels to a supporting structure using a structural silicone glazing adhesive/sealant. This technique uses both single layer monolithic glass and insulating glass. The insulating glass unit itself is made of two glass plates held in place by a silicone insulating glass sealant. The joints between the different glass units are sealed with a silicone weather seal. The weather sealant typically is softer rubber, because it must have movement capability while providing the structure with water tightness through thermal, live load and wind induced movements. The weather seal has an extremely important adhesive function.

**Outstanding performance.** The main advantage of silicones over other materials is their long-term performance. Silicone rubber retains its mechanical properties over the long term and does not become brittle, as some other materials may do. The adhesion will not weaken with exposure to either moisture or to UV irradiation. And the mechanical properties (elasticity, tensile strength, ultimate elongation and tear resistance) of silicone rubber do not change at low temperatures. They stay flexible even at -20°C or lower.

Strength and flexibility are also vital in many machines using metal parts. Differences in shape, stress and breaking point requirements have led to the wide usage of silicone technology to bond two metal surfaces. The type of bond can be more easily determined and the adhesives simpler to apply and faster to take effect.

**Resistance to temperature extremes.** Silicones – because of their chemical structure – resist extreme temperatures and continue to perform for much longer periods than other adhesives. They can withstand continuous service temperatures of 180°C and higher.

**Chemical resistance.** Silicone adhesives are resistant to aqueous solutions, dilute acids, bases and solvents. They may swell in certain organic solvents but their structure does not break down.

**Water resistance.** Silicones block the passage of water or other liquids and do not degrade with humidity. This is a crucial advantage for many safety and leisure applications including aquaria, underwater respiratory devices and nautical electronic equipment. Swimming pools use silicones to ensure long-term absence of leaks.
Water damage from rain is a major problem for buildings of all types. Silicone sealants and wall coatings help offset the depreciation of buildings due to water decay, corrosion and deterioration by providing a durable long-lasting watertight seal.

Gas and water vapour permeability. Although silicones block the passage of liquids, they can nevertheless let through water as vapour. This has many advantages for managing interior environments that need to be dry but have a healthy ambient humidity.

Durability. Silicone adhesive technologies are remarkably durable and stay in good condition over long periods. This enhances safety and cuts down repair costs. Lower maintenance reduces financial outlays and resource depletion.

Electrical conductivity. Silicones stay insulating over a very large temperature range – from 45° to 180°C – and are unaffected by water. These qualities make them particularly suitable for electrical equipment. Silicone technologies keep components securely in place. This can prevent possible damage not only from heat but also from unwanted transmissions of electricity that might lead to short-circuits and therefore performance breakdown or fire risks.

Thermal conductivity. Heat is a major factor in many structures and devices. Certain silicone adhesive products can conduct heat and therefore help to prevent warping, distortion or breakage of component surfaces. Silicone rubber itself is a good insulator (of both heat and electricity).

Transparency. Silicone adhesives may be opaque, coloured or transparent. This visual flexibility is a major advantage for aesthetics and for safety. Transparent adhesives, for example, do not impede sight of a lower surface through a bonded material – a benefit that is often crucial for electrical or medical devices.

Inertness. Silicones are non-reactive and can safely be used in highly sensitive applications. Specialty medical grade materials are excellent for medical applications ranging from fluid delivery to wound treatment. They are also simple to use and mostly do not require pre-mixing as with many other adhesive systems.

Typical applications of silicone sealants and adhesive systems:

- **Electrical and electronic equipment** - fasteners for circuits, wiring and other devices.

- **Construction** - structural glazing for façades, structural adhesives for panels and partitions, water and weather proofing materials, repair and replacement of failed organic sealants.

- **Automotive** - self-adhesive insulation mats, painting and lining films, exterior fitting adhesives.

- **Machinery** - super strong adhesives that bond metals of different contours.

- **Paper** - adhesive tape, memo notes, toy decals, labels, self-adhesive envelopes, printing papers.

- **Furniture** - double-sided carpet tapes and adhesives for office and domestic equipment.

- **Sanitary products** - disposable baby diapers, sanitary napkins, liners.

- **Foodstuffs** - wrapping and release papers, labels.

- **Healthcare** - medical tapes, self-adhesive patches, depilatory papers, labels.