SILRES® H62 C

Silicone Resins

SILRES® H62 C is a liquid, solvent-free one-part heat-curing phenyl silicone resin formulation. The product is ideal to impregnate electrical coils of motors and generators. Besides SILRES® H62 C can be used to provide hydrophobic properties to porous materials and as binder for composites made of fibrous fillers, cloths, woven or non-woven reinforcing materials.

The formulation is ready-to-use and crosslinks under heat. While curing SILRES® H62 C does not release chemical byproducts, and hence a curing shrink is barely noticeable. The product also thermosets in thick layers, even when in contact with air.

Fully cured SILRES® H62 C has excellent electrical insulation properties and outstanding long-term heat resistance. It additionally shows high stability against weathering, moisture and UV light, and it can therefore be exposed continuously to constantly changing climatic conditions or UV radiation.

Properties

Uncured:

- Liquid, solvent-free formulation
- Based on silicone resins with phenyl and methyl groups
- Very low content of volatiles
- Optimized for vacuum pressure impregnation (VPI)
- To a certain degree also suitable for dipping and trickling impregnation
- Can be processed at temperatures up to a maximum of 80 °C to reduce viscosity
- Cures with almost no evolution of heat
- Recommended curing temperature for fast thermosetting: above 160 °C

Cured:

- Tack-free
- Excellent long-term heat stability (RTI: 239 °C)
- meets the requirements of insulation class N and R (DIN EN 60085), i.e. former insulation class C
- Conforms to the fire safety requirements defined in UL 94 V-0.

Specific features

- Electrically insulating
- Filler compatibility
- Hardness in the Shore D range
- Heat resistant
- Hydrophobic
- Liquid
- Low viscosity
- One-component
- Resistant to tracking and erosion
- Solvent-free
- UV & weathering-resistant

Technical data

Properties Uncured

Property	Condition	Value	Method
Viscosity, dynamic	80 °C	80 mPa·s	DIN EN ISO 3219
Colour	-	yellowish	-
Content of volatiles	200 °C | 1 h	≤ 1.5 wt. %	-
Density	25 °C	1.12 g/cm^3	DIN 51757
Supply form	-	Liquid	-
Viscosity, dynamic	25 °C	1150 mPa·s	DIN EN ISO 3219

These figures are only intended as a guide and should not be used in preparing specifications.

Properties Cured

Curing conditions: 16 hours at 200 °C in a circulating air oven, no post-curing.

Property	Condition	Value	Method
Ash content (after pyrolysis at 1000 °C)	-	approx. 58 wt. %	-
Carbon content (cured resin)	-	approx. 45 wt. %	-
Color	-	clear transparent, slightly yellowish	-
Density	25 °C	1.16 g/cm^3	DIN EN ISO 1183-1 A
Dielectric strength (surrounding medium: electrically insulating mineral oil)	50 Hz | 23 °C	27 kV/mm	IEC 60243-1
Dielectric strength (surrounding medium: silicone rubber, SIR)	50 Hz | 23 °C	82 kV/mm	IEC 60243-1
Flexural strength	25 °C	30 N/mm^2	DIN EN ISO 178
Hardness Shore D	-	65	DIN ISO 48-4
Thermal conductivity	50 °C	0.2 W/m.K	DIN 52612
Volume resistivity	23 °C	1.8 x 10e17 Ohmcm	IEC 62631-3-1

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Applications

- E-Drives (xEV/EV)
- Heating Elements
- Insulation & Impregnation of Generator Parts
- Laminates & Composites
- Traction Motors

Application details

- Impregnation agent for electrical coils and for porous materials
- Binder for laminates made of fibrous fillers, cloths, woven or non-woven reinforcing materials
- Typical fields of industrial applications: household appliances, mechanical engineering, automotive, electrical industry, railway industry

Processing

Handling & Curing

SILRES® H62 C is supplied as a ready-to-use formulation. The materials to be treated should be clean and free of dirt, rust, oil or grease. Though the 1-part heat-curing formulation is remarkable insensitive to curing inhibitors, it is recommended to run a small-scale test in order to check for each substrate's ability to inhibit cure. Examples of potentially inhibiting contaminants are sulfur containing materials, plasticizers, urethanes, amine containing materials and organometallic compounds – especially organotin compounds.

The curing time of SILRES® H62 C is highly dependent on temperature and on both the size and the heat sink properties of the parts being treated. The product is usually cured between 160 °C and 210 °C in order to secure a fast setting. Typical curing temperatures and resulting curing times are given in adjacent table.

Temperature	Gelling time	Minimum curing time [1]
120 °C	420 min.	-
150 °C	90 min.	600 min.
180 °C	40 min.	180 min.
200 °C	25 min.	120 min.

[1] Time to exceed Sh D 60

Typical Applications

1. Impregnation of Electrical Coils:
Due to its excellent electrical insulation properties and outstanding long-term heat resistance SILRES® H62 C is used for the impregnation of electrical coils in traction motors, electric drives and smoke-extraction motors. The silicone resin formulation is usually processed by vacuum pressure impregnation (VPI). However it is also possible to apply SILRES® H62 C by dipping and trickling.

Please note: impregnating electrical coils is a complex process that needs a thorough control of various process parameters, such as pre-heating the coils, the viscosity and condition of the impregnation agent, impregnation temperature, curing temperature, heating rate and temperature ramp, and other production line specific conditions. Therefore, the following indications are inteded as a guide only, and we recommend running preliminary tests to optimize the conditions of the particular process.

The following sequence illustrates a typical standard VPI process:

1. The electrical coil is heated up and dried at elevated temperature (120 - 200 °C / 4 - 12 hours, depending on the design and the dimension of the objects).
2. The hot stator is transferred into the impregnation vessel, where drying under vacuum (0.05 - 1 mbar) continues for several hours ("vacuum phase").
3. The impregnation vessel - still under vacuum - is then filled with warm (60-80 °C) SILRES® H62 C to completely cover the electrical coils. It is recommended to keep the vacuum at the same level as before.
4. This "wet vacuum phase" is continued until bubbling or foaming of the silicone resin stops, which can take up to 1 hour depending on both the dimension of the stators and the quality of drying (see steps 1 and 2).
5. To accelerate impregnation speed, pressure (up to 5 bar) is applied ("pressure phase") until impregnation is complete (1 - 6 hours; to be monitored by capacity measurements).
6. After draining the vessel excessive impregnation agent is allowed to drip off.
7. Finally the coils are transfered into a circulating air oven; typical curing conditions: 200°C, 12 hours, ideally under continuous rotation of the impregnated coils to secure a uniform silicone resin distribution inside the coil and to minimize drip off loss.

Important: in order to minimize the risk of crack formation due to the differing thermal expansion of the coil materials, the thickness of cured SILRES® H62 C should not significantly exceed 100 µm.

For further details, please revert to our brochure "SILRES® H62 C - IMPREGNATING RESIN FOR VACUUM PRESSURE IMPREGNATION (VPI)".

2. Composites Based on Fibres or Cloths
Since fully cured SILRES® H62 C provides water repellency, excellent electrical insulation properties, outstanding heat resistance and long term stability against weathering, moisture and UV light, the product can be used as a binder for composites based on fibres, cloths, woven or non-woven reinforcing materials. Besides it is possible to pyrolyze the respective composite materials at high temperature in order to obtain cohesively very strong composite ceramics.

Please note: best results are obtained with fabrics that are made from non-sized fibres or from fibres with epoxy-functional sizing agents.

For the manufacture of layered composites (e.g. based on glass fibre, carbon fibre, mineral fibre or stone fibre) the cloth or the fibre strand is impregnated with SILRES® H62 C either by spraying, or by running the reinforcing material through an impregnation bath. If necessary, the impregnation resin can be warmed to 60 °C prior use in order to improve penetration speed. Depending on the target shape of the laminate the wet fabric or fibre strand either is rolled-up in layers, or it is cut up into smaller pieces which in turn can be sandwiched, e.g. into a shaped press mold or as a flat fabric stack. Curing for 4 hours at high temperature (200 °C) and, if applicable, high pressure (e.g. 10 bar) gives the respective composite structure.

3. Hydrophobic Sealing of Tubular Heating Elements

Fully cured SILRES® H62 C provides high water repellency, excellent electrical insulation properties and outstanding heat resistance. It is therefore often used in combination with silicone rubber (e.g. ELASTOSIL® N 288, ELASTOSIL® E 10, ELASTOSIL® A 234 or ELASTOSIL® RT 706) for the hydrophobic sealing of tubular heating elements.

For this purpose the tubes ends are charged with a few milliliters of SILRES® H62 C after the tube has been equipped with the heating wire and filled with magnesium oxide powder that acts as heat transfer medium and as dielectric packing material for the wire. The liquid silicone resin formulation SILRES® H62 C impregnates the filler particles within a zone of a few millimeters and thus provides a durable moisture barrier after curing at the first heating cycle.

Packaging and storage

Storage

Store in a dry and cool place.

The 'Best use before end' date of each batch is shown on the product label.

Storage beyond the date specified on the label does not necessarily mean that the product is no longer usable. In this case however, the properties required for the intended use must be checked for quality assurance reasons.

Safety notes

Comprehensive instructions are given in the corresponding Material Safety Data Sheets. They are available on request from WACKER subsidiaries or may be printed via WACKER web site http://www.wacker.com.

QR Code SILRES® H62 C

For technical, quality or product safety questions, please contact:

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