

Contents

1.	General information
2.	Application
3.	Special notes
4.	Characteristics
5.	Dangerous goods regulation
6.	Properties
7.	Mixing ratio
8.	Processing
9.	Adjustment of viscosity
10.	Auxiliary products
11.	Cleaning
12.	Drying conditions
13.	Standard packing
14.	Storing properties
15.	Further literature
16.	Further products for the PCB production Further products for the electronics/electrical engineering industries

# Silicone-Rubber Casting Compound VU 4691 E

**white-grey**

Index E = elastic

- **extraordinarily high temperature resistance (insulating class C: > 180 °C)**
- **high elasticity and tear resistant**
- **suitable for repair work**
- **excellent dielectric properties**
- **especially suited for the use in sensor technology**
- **addition cross-linking**

Please read this technical report and the material safety data sheet (EEC 91/155) carefully before using the product.

## 1. General Information

The silicone-rubber casting compound **VU 4691 E** is a solvent-free, white-grey, addition cross-linking 2-pack casting compound on organo-poly-siloxan basis, curing both at room temperature and by applying heat.

## 2. Application

On account of the excellent thermal stability (insulating class C: > 180 °C) and the very high elasticity, the silicone-rubber casting compound **VU 4691 E** is suited as:

- 2.1** Casting compound for sensor technology
- 2.2** Temperature resistant sealing compound
- 2.3** Casting and embedding material for high-quality temperature and shock-sensitive electronic components that must not be subjected to heat development in the curing phase or shrinkage-pressure load during operation, owing to thermal shocks (for instance sensors, glass diodes, ferrite cores)
- 2.4** Embedding compound for temperature feelers, heating elements, metal-cased capacitors, mini transformers, luminous signs, cables and cable terminals
- 2.5** Protection of electric units and components from the effects of moisture

- 2.6 Casting compound for hermetically encapsulated housings because, contrary to condensation cross-linking types, no low-molecular separation products originate in the curing phase with addition cross-linking silicone-rubber casting compounds, that could cause a resoftening (reversion) of the casting compound in hermetically encapsulated housings
  - 2.7 Casting compound for solenoids, induction and transformer coils
  - 2.8 Casting compound for HF-parts (e. g. high-frequency coils)
  - 2.9 Casting compound for hybrid integrated circuits
  - 2.10 Elastic covering for windings, particularly for coil ends of electromotors with high thermal load (for windings)
  - 2.11 Rubber-elastic mould material for various casting resins (pilot lots, prototypes, model castings)
  - 2.12 Release agent for plastic foam application
- 

### 3. Special notes

**VU 4691 E** is an addition cross-linking silicone-rubber casting compound, i. e. contrary to condensation cross-linking silicone-rubber casting compounds, no low molecular separation products originate in the curing phase that could cause a resoftening (reversion) of the casting compound in hermetically encapsulated housings.

For the application in the field of optical sensors, we recommend the use of the silicone-rubber casting compound **VT 3601 E** that has a very high transparency and light transmission. The silicone-rubber casting compound **VT 3601 E** is built up on the same basis but does not contain any fillers and has similar properties as **VU 4691 E**.

- 3.1 When casting and embedding electronics that are not hermetically encapsulated, we recommend the use of the following condensation cross-linking silicone-rubber casting compounds:

**VU 4692:** 2-pack casting compound, **white-grey**, condensation cross-linking, medium viscosity, still good flowability which stands out for an especially good thermal conductivity.

**VU 4693:** same as VU 4692, but **white**.

- 3.2 For areas of application in which the use of silicone-free products is required (for instance telecommunication systems) and the temperature resistance does not have to be so high but which call for a high degree of elasticity, we recommend the use of the following casting resins/ casting compounds on polyurethane resin base:

**VT 3406 KK:** On account of the extraordinarily high transparency (**index KK = crystal-clear**), the 2-pack casting resin **VT 3406 KK** is ideally suited for the field of the optoelectronics and particularly for the casting of optical sensors. **VT 3406 KK** is elastic and suited for insulating class Y = 90 °C.

**VT 4440/71 SB-E:** 2-pack casting compound, **black, self-extinguishing** (index SB = hardly combustible), corresponds to the best non-inflammability class V-0 as per UL 94, **free from halogen-containing fire-proofing agents**, elastic (index E), excellently suited for the casting of electronic components that must not be subjected to shrinkage pressure load and heat development, suited for insulating class E = 120 °C.

#### Series VU 4452

**VU 4452/61 HE:** 2-pack Wepuran-casting compound, low viscosity, **blue**, highly elastic adjustment (index HE), therefore particularly suited for **sensor technology**. As far as highly elastic casting compounds are concerned, an extraordinarily high insulating class E = 120 °C.

**VU 4452/71 HE:** Same as VU 4452/61 HE, but medium viscosity.

**Series VU 4453**

- VU 4453/61 HE:** 2-pack Wepuran-casting compound, **blue**, highly elastic (index HE), curing even at room temperature, good flowability, specially suited for embedding sensitive electronic components that must not be subjected to heat development and/or shrinkage pressure load in the curing phase. Excellent humidity resistance, very good dielectric even under thermal load, insulating class Y = 90 °C.
- VU 4403/61 HE:** Same as VU 4453/61 HE, but not coloured; natural colour: **grey-beige**.
- VU 4443/61 HE:** Same as VU 4453/61 HE, but **black**.
- VU 4453/41 HE-NV:** Same as VU 4453/61 HE, but low viscosity (index NV).
- VU 4453/71 HE-T:** Same as VU 4453/61 HE, but thixotropic (index T). Excellently suited for the application with dispensers. Owing to the thixotropy, a run-out (e. g. from plugs) after the casting is practically impossible).
- VU 4453/71 SHE:** Same as VU 4453/61 HE but very high elasticity (index SHE). If a high permanent elasticity but not a high temperature stability is required, VU 4453/71 SHE can replace the much more expensive silicone-rubber casting compounds in many fields of application. Suited for temperature from -40 °C to +90 °C.
- VU 4473/41 HE-NV:** Same as VU 4453/41 HE-NV, but grey, approximately RAL 7044.
- VU 4473/41 HE-NV-LT:** Same as VU 4473/41 HE-NV, but longer pot-life (index LT).

Special technical reports on these products are available upon request.

---

**4. Characteristics**

- 4.1 Colour/appearance** : colourless-transparent
- 4.2 Solid contents** [% by weight] : 99 ± 1  
(1 h/125 °, 1 g weighed quantity tray of 40 mm Ø), mixture
- 4.3 Viscosity at 20 °C** [mPas] : 16000 ± 2000  
(measured with Haake RV 20 \*, PK 1-1°, D = 50 s<sup>-1</sup>), mixture
- 4.4 Specific gravity at 20 °C**  
DIN 53 217, part 2 :  
component A [g/cm<sup>3</sup>] : 1,25 ± 0,05  
cross-linker (VN 4691 E) [g/cm<sup>3</sup>] : 0,70 ± 0,05  
mixture [g/cm<sup>3</sup>] : 1,23 ± 0,05
- 4.5 Pot life of mixture**  
DIN 55 945 [min] : approx. 90  
(at room temperature 18 - 23 °C; set-up quantity 500 g)

\* Viscosity measuring unit supplied by: Haake Mess-Technik GmbH + Co  
Dieselstr. 4, D-76227 Karlsruhe  
phone: (0721) 4094-0  
fax: (0721) 4094-360, telex: 7 826 739

## 5. Dangerous goods regulations

Detailed specifications of safety precautions, environmental protection, waste disposal, storage, handling, exhaust air regulations as well as other characteristics can be found in the material safety data sheet EEC 91/155.

When using chemicals, the common precautions should be carefully noted.

---

## 6. Properties

The silicone-rubber casting compound **VU 4691 E** stands out for the following properties:

### 6.1 General properties

- good flowability, hence easy processing
- curing even at room temperature possible
- addition cross-linking; no low-molecular separation products originate in the curing phase that could cause resoftening (reversion) in hermetically encapsulated housings
- very low heat development in the curing phase
- low volume shrinkage after curing
- high elasticity for compensating material strain under thermal shock loads
- excellent temperature stability (insulating class C: > 180 °C), i. e. short-time thermal loads up to about 250 °C possible
- very little tendency to embrittlement, not even at temperatures for below freezing (to about -40 °C)
- excellent dielectric properties in a wide temperature range
- in the event of electrical breakdowns or the burning of silicone-rubber, no conductive carbon but non-conductive silicic dioxide remains
- good protection from shock, impact and vibration
- excellent corona and glow resistance
- solvent-free, therefore practically no nuisance caused by smell and no attack on solvent-sensitive plastics
- sectile, that means when replacing components it is possible to cut the cast-coated component free using a sharp cutting/scratching tool and then replace it. Casting can be resumed after the replacement has been completed.
- white-grey colouring, offering a reliable sight-protection

### 6.2 Physical and mechanical properties

Property	Testing method	Result
Shore-A-hardness after 8 days at room-temperature	DIN 53 505	approx. 65
Water absorption	DIN 53 495 (24 h storing in distilled water at 23 °C)	0,011 (%)
Tensile strength	DIN 53 504	4,3 N/mm <sup>2</sup>
Elongation at break	DIN 53 504	130 %
Insulation class	VDE 0530	C: > 180 °C (up to approx. 250 °C)
Temperature index	DIN IEC 216	TI 180 °C

### 6.3 Electrical properties

Property	Testing method	Result
Dielectric strength	VDE 0303, part 2	31 kV/mm
Surface resistance	VDE 0303, part 3	$3,5 \times 10^{11}$ Ohm
Specific volume resistivity	VDE 0303, part 3	$2,0 \times 10^{14}$ Ohm x cm
Tracking resistance	IEC 112	CTI > 600

---

## 7. Mixing ratio

**Component A (VT 3501 E) : cross-linker VN 4691 E = 150 : 8 (parts by weight)**

The two components (resin component A and the cross-linker) are already packed in the correct mixing ratio.

The volume of the container of component A is sufficient to accommodate the total quantity of component B.

For mixing we recommend using mechanical stirring equipment, with a preferable stirring time of 10 minutes.

Our **technical information sheet TI 15/10**: "Processing of 2-pack systems" gives detailed advice on correct mixing.

We would gladly send you this **TI 15/10** on request. In our report manual, this technical information is filed under group 15.

---

## 8. Processing

### 8.1 Manual processing

In the case of manual processing, the casting can be effected after thorough and perfect mixing of the resin component A (**VU 4691 E**) with the cross-linker **VN 4691 E**. As air inclusions affect the final properties of the casting, make sure that no air is stirred into the material during the mixing process. In order to remove any air inclusions as effectively as possible, it is suggested to evacuate the casting compound before or after the casting phase. The processing time (pot life) is about 90 minutes. During this period of time, the viscosity will increase. Therefore the batch volume should be just sufficient to render perfect processing during the pot-life possible.

### 8.2 Processing in mixing and dosing units

The use of mixing and dosing equipment guarantees independence of the pot-life. Since the mixing ratio (refer to item 7 „mixing ratio“) is indicated in parts by weight, the corresponding proportioning quantities have to be converted by means of the specific gravities of the component A and of the cross-linker **VN 4691 E** when volumetric mixing and dosing equipment is used.

Capable manufacturers of such equipment can be named upon request.

**NOTE:** In our Technical Information **TI 15/2**: „Selection criteria and processing instructions for casting compounds/casting resins“ you will find more detailed information regarding processing, properties and application.

The **TI 15/2** will be made available to you upon request. In our report manual, this Technical Information is filed under group 15.

## 9. Adjustment of viscosity

The silicone-rubber casting compound **VU 4691 E** is adjusted to generally enable processing in the condition supplied.

**ATTENTION:** It is not possible to use solvent or any other thinners in order to reduce viscosity.

---

## 10. Auxiliary products

### 10.1 Sealing mastic for casting moulds

For the sealing of the casting moulds and/or cable outlets, we recommend the use of our sealing mastic **EH 13.271**, a sealing mastic that is characterized by the following properties:

solvent-free, self-adhesive, permelastastic, easily deformable and highly temperature-resistant.

### 10.2 Grip coating

Generally, silicone-rubber casting compounds do not have good adhesion so that the base on which a good adhesion is to be effected has to be pre-treated with a grip coating. We suggest to use our grip coating **G 4660**.

A single application (spreading, spraying, dipping) of the grip coating **G 4660** onto the cleaned and degreased base results in a white, non-adhesive film after the drying phase; together with an addition cross-linking silicone-rubber, this film creates a highly adhesive connection in the polymerization.

Special technical reports on these products are available upon request. They are filed under group 4 and 13, respectively, in our report manual.

---

## 11. Cleaning

For the cleaning of the implements we recommend the use of our cleaning agent **R 13.780**. Cleaning should take place immediately after processing, because with increased curing cleaning is becoming more difficult.

A special technical report on this product is available on request. In our report manual this report is filed under group 13.

**ATTENTION:** Do not use the cleaning agent as thinner or for cleaning of hands.

---

## 12. Curing conditions

Curing takes place at room temperature. For the achievement of optimum properties, we suggest postbaking and application of heat, respectively. The following conditions should be adhered to:

Temperature:	25 °C	60 °C	100 °C
Time:	24 h	approx. 30 min.	approx. 10 min

---

## 13. Standard packing

The silicone-rubber casting compound **VU 4691 E** is packed for delivery as follows:

Component A: **VU 4691 E**: one way steel drum of 30 kg = 1 selling unit  
Cross-linker: **VN 4691 E**: can of 1,6 kg = 1 selling unit

Smaller packages are possible, but will entail corresponding surcharges for small packaging and/or packing costs.

## **14. Storing properties**

In a cool, dry place, sealed original packings can be stored for at least 9 months.  
**In accordance with DIN ISO 9000 ff, labels show expiry dates.**

**ATTENTION:** Storage temperatures of more than +25 °C affect the storing stability.

---

## **15. Further literature**

In addition to the recommendations given in this technical report, we can provide our own technical publications which give highly detailed information on the application and processing of our products.

### **Report 103:**

Protective lacquers and casting compounds for inserted printed circuit boards (in German)

### **Report 131 E:**

New casting compounds and conformal coatings for sensor technology

### **Technical Information TI 15/2 E:**

Selection criteria and processing advice for casting compounds/casting resins

### **Technical Information TI 15/10 E:**

Processing of 2-pack systems

---

## **16. Further products for the PCB production**

We boast a wide range of **etch resists, plating resists, solder resists, marking inks (photo-imageable, UV curing, purely thermal curing) as well as peelable solder resists, carbon-conductive inks, via hole fillers (purely thermal curing) and further auxiliary products for circuit printing**

Special technical reports on these products are available on request.

---

## **17. Further products for the electronics/electrical engineering industries**

For the production and processing of assembled printed circuits and for electrical engineering we recommend the following products:

### **17.1 Chip adhesives**

1-pack systems, thermally curing, for fixing SMD components before wave soldering.

### **17.2 Solder pastes**

Thermoplastic and conventional systems for fixing and connecting SMD components.

### **17.3 Conformal coatings**

Protective lacquers for assembled PCBs on the basis of polyurethane, polyacryl and epoxy resins.

### **17.4 Casting compounds**

Cold and thermal curing casting compounds for casting assembled PCBs, print and mini transformers, transformers and solenoids on the basis of epoxy, polyurethane and silicone-rubber.

### 17.5 Adhesives and adhesive lacquers

For numerous adhesion techniques in the electronics and the electrical engineering industries.

### 17.6 Casting resins

For impregnating and insulating of all kinds of coil shells, particularly for small anchors with a high number of revolutions.

### 17.7 Electro pastes

Cementing compounds for coil shells and solenoids, also for anchor and electro adhesives for the mechanical engineering industry.

### 17.8 Impregnating varnishes

Impregnating varnishes for all kinds of coil shells, particularly for transformer coils.

### 17.9 Auxiliary products for the electronics

Chipping lacquers, sealing agents, mould-release agents, cleaning agents, ink strippers, etc.

Special technical reports on these products are available on request.

We are prepared to assist you in solving your problems and look forward to receiving your inquiry. On request we will send you publications and samples free of charge.

Our verbal and written advice is given to the best of our knowledge and is not binding, also with regard to possible third-party proprietary rights. This advisory service, however, does not exempt the user of our products from performing his own tests in view of the application intended. A possible liability is confined to the value of the goods supplied by us and applied by the user. We guarantee the perfect quality of our products in compliance with our terms and conditions of sale and delivery.

**The following schedule will inform you about the casting resins and casting compounds, respectively, which can be especially recommended for the field of sensor technology:**

range of application range of temperature	– optical sensors – displays	– contact sensors – capacitive sensors – temperature sensors and a lot more	– sensors with UL-standards (V-0)
-40 ° bis +90 °C	<b>VT 3404</b> <b>VT 3406 KK</b>	<b>Series VU 4453</b>	<b>Series VU 4451 SB</b> <b>VU 4459/41 SV</b>
-40 ° bis +120 °C	<b>VT 3601 E</b>	<b>Series VU 4452</b>	<b>VU 4440/71 SB-E</b>
-40 ° bis +200 °C	<b>VT 3601 E</b>	<b>VU 4691 E</b>	--

- All casting compounds for sensor technology stand out for very good insulation properties as well as for high mechanical and chemical resistance.
- Due to the curing reaction already starting at room-temperature and the elastic properties, a very low shrinkage pressure is ensured. Furthermore, the casting compounds mentioned above are able to avoid or counter-balance material tensions and different thermal coefficients of expansion.
- The opaque casting compounds mentioned above (VU) also offer a reliable sight protection which can only be removed by destroying the sensor. Thus, valuable expertise is protected.



# Silicone-rubber casting compound VU 4691 E, white-grey

Edition LP 950709 E-0

## Revised characteristics/new colour adjustment VU 4671 E

### 4. Characteristics

Characteristic	VU 4691 E	VU 4671 E*
<b>Colour/appearance</b>	white-grey	grey
<b>Solids content</b> acc. to EN ISO 3251 (1 h/125 °C; 1 g weighed quantity, dish of 75 mm Ø)	99 ± 1% by weight	99 ± 1% by weight
<b>Viscosity at 20 °C</b> acc. to EN ISO 3219 (measured with Haake RV 20**, PK 1/1 °; D = 50 s-1) Mixture	16000 ± 2000 mPas	16000 ± 2000 mPas
<b>Density at 20 °C</b> DIN 53 217, part 2 Component A Cross-linker VN 4691 E Mixture	1.25 ± 0.05 g/cm <sup>3</sup> 0.97 ± 0.05 g/cm <sup>3</sup> 1.23 ± 0.05 g/cm <sup>3</sup>	1.25 ± 0.05 g/cm <sup>3</sup> 0.97 ± 0.05 g/cm <sup>3</sup> 1.23 ± 0.05 g/cm <sup>3</sup>
<b>Pot life of mixture</b> (at room temperature 18 – 23 °C; set-up quantity 500 g)	approx. 90 min	approx. 90 min

\*\* Viscosity measuring unit supplied by: Haake Mess-Technik GmbH + Co  
Dieselstraße 4, 76227 Karlsruhe, Germany  
Phone +49 – 7 21 – 40 94 – 0  
Fax +49 – 7 21 – 40 94 – 360

### 7. Mixing ratio

The two components are mixed in the following ratio:

Component A (VU 4671 E\*) : cross-linker VN 4671 E = 150 : 8

or

Component A (VU 4691 E) : cross-linker VN 4691 E = 150 : 8.

Please see also Item 7 "Mixing ratio" in the corresponding technical report on **VU 4691 E**.

\* The silicone-rubber casting compound **VU 4671 E** is the darker grey coloured adjustment of the casting compound **VU 4691 E** with otherwise identical properties. For details of the application, properties, processing, etc. please refer to the technical report on **VU 4691 E**.