



SILICONE PRODUCTS IN PUBLIC PASSENGER TRANSPORT

HCR Excellence Wacker 2024/04/16

Andreas Wiegrefe .E-Mail: andreas.wiegrefe@hubner-group.com . Mobile: +49 160 90764964



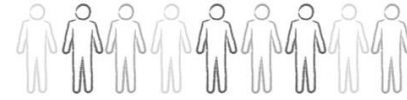
AGENDA

1. Introduction of HÜBNER: Who we are and what we are doing
2. Overview of Silicone Products
3. Disadvantages of Silicone Products
4. Advantages of Silicone Products
5. Applications in Public Transport
6. Future Trends
7. Conclusion

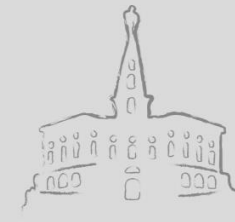
THE HÜBNER GROUP AT A GLANCE

1 Group
with more than
30 locations

Approx. **3,500** employees



50 NATIONALITIES



HEADQUARTERS
in Kassel
Founded **1946**

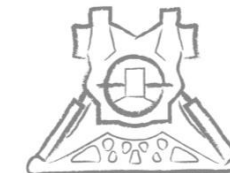
- **1 VERTICAL SILICONE EXTRUDER**
- **1 HORIZONTAL SILICONE EXTRUDER**
- **1 VERTICAL IR CHANNEL**
- **1 HORIZONTAL IR CHANNEL**
- **1 HOT AIR CHANNEL**



- 1979** Brazil
- 1995** USA (SC)
- 1997** Hungary
- 2002** China
- 2003** Sweden
- 2004** France & Italy
- 2011** India & UK
- 2012** South Africa
- 2013** Malaysia
- 2016** Turkey
- 2019** Poland
- 2020** South Korea
- 2021** USA (TN) & Netherlands

REVENUE
of the Group
472 million
Euro (2023)

Approx. **1,000**
patents worldwide



NEARLY

5,000
**ARTICULATION
SYSTEMS**

FOR BUSES (2022)

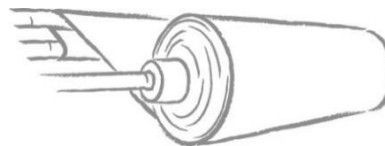
1.65 million meters
RUBBER PROFILES
PER YEAR



WORLDWIDE MORE THAN

20,000
**GANGWAY
SYSTEMS**

SUPPLIED FOR
RAIL VEHICLES (2022)



2.5 million m²
OF COATED FABRIC
ANNUALLY

- **10 COATING MACHINES**
- **2 SOAKING MACHINES**
- **4 VULCANISATION MACHINES (ROTOR CURE)**
- **2 CALANDER**
- **1 VULCANISATION CABINET**



PTO



MOBILITY: PART OF THE MEGATREND

• PRODUCTS FOR RAILWAY VEHICLES

- high-performance gangway systems
- chassis technology for rail bogies,
- displays and driver assistance systems for railway vehicles, door safety systems,
- quick-change window systems,
- interior and exterior parts of railway vehicles
- articulation and entry systems for trams.



• PRODUCTS FOR BUSES

- articulation systems
- complete gangway systems including the bellow
- safety-critical articulation system.
- entry systems, door safety systems,
- interior and exterior parts,
- protective and sealing components
- chassis technology.



• AIRPORT TECHNOLOGY PRODUCTS

- Folding canopies for passenger boarding bridges
- Kinematic systems & drive systems
- High fire-resistant materials



• PRODUCTS AND CONCEPTS FOR COMMERCIAL VEHICLES

- Chassis technology for commercial vehicles
- High-safety control units
- Elastomer solutions
- Interior & exterior
- Protection & sealing





TRULY TOUGH SILICONE PRODUCTS



PTO



HÜBNER

2. OVERVIEW OF SILICONE PRODUCTS

Common Applications Across Industries:

The omnipresence of silicone can be found in many different sectors:

- automotive
- electronics
- healthcare sector
- building industry
- food industry
- transport industry
- personal transport industry (rail, bus, aviation, marine)
- and even more



3. DISADVANTAGES OF SILICONE PRODUCTS

Cost:

- Higher production costs compared to some alternative materials
- May impact overall manufacturing expenses

Limited Strength

- Silicone's lower tensile strength compared to certain materials
- Potential limitations in heavy-duty applications

Environmental Impact / Sustainability

- Challenges in silicone disposal and recycling
- CO₂ balance

Slipperiness

- Slippery nature of silicone surfaces
- Potential safety concerns, especially in areas where slip resistance is crucial



4. ADVANTAGES OF SILICONE PRODUCTS



Chemical resistance

- Silicone elastomers are resistant to many organic chemicals and to aqueous solutions of dilute acids and bases.
- Resistance to corrosion



UV and weathering resistance

- Silicones have exceptionally high UV resistance.



Electrical properties

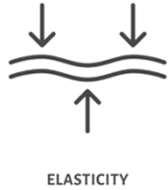
- Silicones are electrically insulating materials.



Hydrophobicity and waterproofing

- Silicone rubbers are water-repellent materials.

4. ADVANTAGES OF SILICONE PRODUCTS



Elasticity, Flexibility

- Silicone elastomers are extremely elastic materials
- Adaptability to various shapes and forms in passenger transport applications
- Reduces the need for multiple components
- Enhanced design possibilities



No hazards ingredients

- Halogen free
- Non-toxic nature of silicone



Translucency and color ability

- Silicone elastomers are translucent. By blending them color pastes, they can be dyed to almost any desired color.

4. ADVANTAGES OF SILICONE PRODUCTS



Temperature resistance

- The outstanding material properties of silicones include their flexibility and their resistance over a wide temperature range. Typical continuous operating temperatures of silicone elastomers are -45 °C to 180 °C.



STRONG & DURABLE

Durability

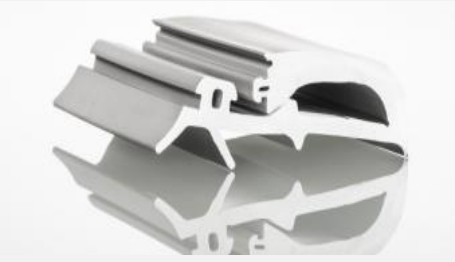
- Silicone rubbers are strength and resistance to wear and tear.
- Long lifespan, reducing the need for frequent replacements
- Low maintenance requirement



**FLAME
RESISTANCE**

Flame retardancy

- Silicones are inherently flame-retardant polymers. The autoignition temperature of silicone elastomers is approx. 350 °C. The gases formed are non-corrosive and non-toxic.
- For the rail industry the NFPA130 (USA) and the European EN45545-2/2020 are the most important standards.



5. APPLICATIONS IN PUBLIC TRANSPORT

APPLICATIONS IN RAIL:

Interior Components:

- Seating materials and cushioning for passenger comfort.
- Silicone gaskets for doors and windows, contributing to a quiet and smooth ride.

Exterior Components:

- Weatherproofing materials, enhancing durability against environmental factors.
- Seals for electrical components, ensuring safety and reliability.





© WEGU Schwingungsdämpfung GmbH

5. APPLICATIONS IN PUBLIC TRANSPORT

APPLICATIONS IN RAIL:

High-Temperature Applications:

- Silicone used in engine components due to its temperature resistance.
- Insulation materials to prevent heat transfer and enhance safety.

Vibration Dampening:

- Silicone mounts and buffers to reduce vibrations, enhancing the overall passenger experience.

Spread of Flame



Cone Calorimeter



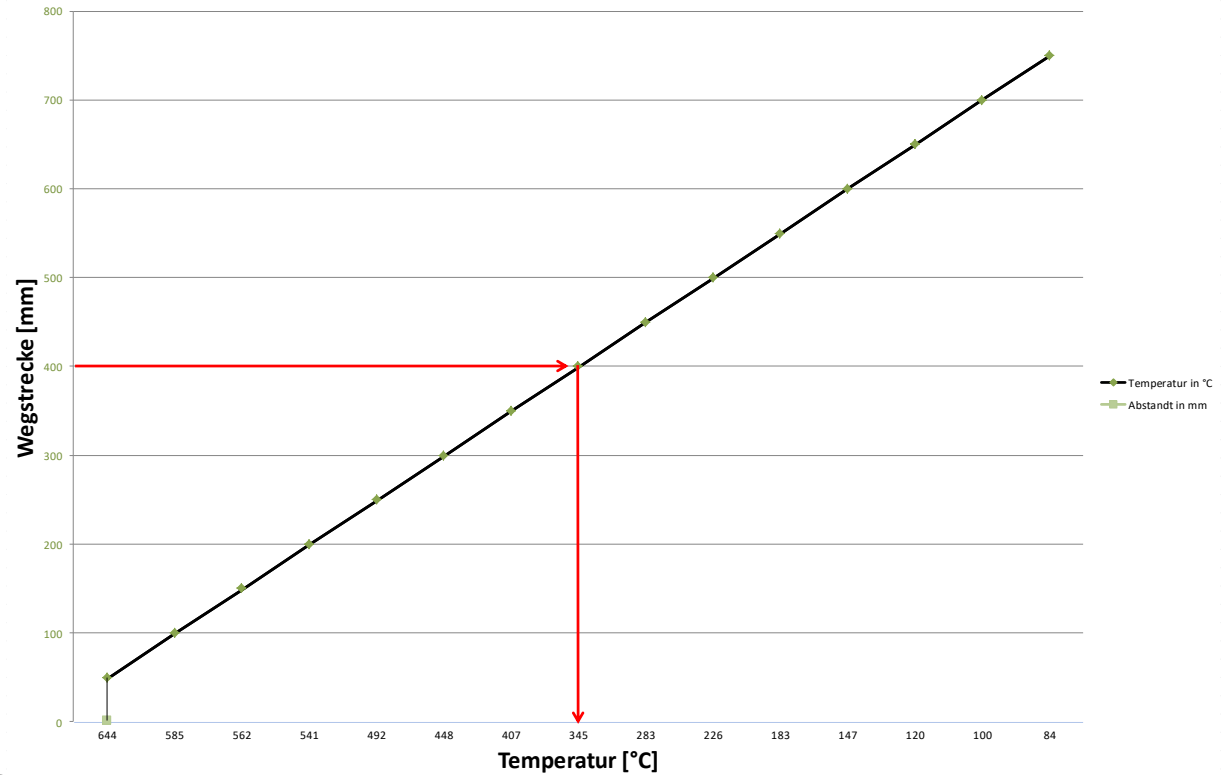
Smoke and Tox



5. APPLICATIONS IN PUBLIC TRANSPORT

Fire standard RAIL: EN45545-2/2023

Temperaturverlauf beim Spread of Flame



© by currenta

5. APPLICATIONS IN PUBLIC TRANSPORT

APPLICATIONS IN BUS:

Seating and Interiors:

- Silicone materials in bus seat cushions for improved comfort.
- Interior seals and gaskets for noise reduction and passenger well-being.

Exterior Components:

- Silicone weatherstrips and seals for doors and windows, enhancing bus durability.
- Engine components benefiting from silicone's temperature resistance.



5. APPLICATIONS IN PUBLIC TRANSPORT

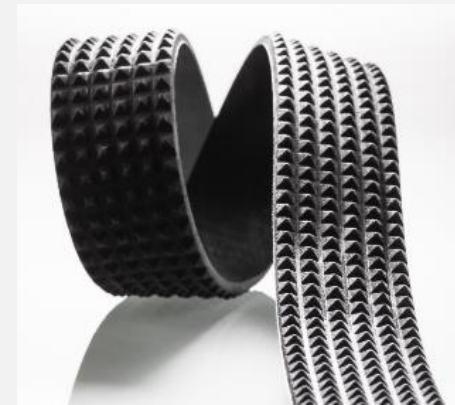
APPLICATIONS IN BUS:

Electrical Insulation:

- Silicone used in wiring and electrical components for insulation and safety.
- Applications in electronic systems for smoother operation.

Flexible Bus Designs:

- Silicone's flexibility enabling innovative and streamlined bus designs.
- Reduced weight and improved aerodynamics through silicone components.



5. APPLICATIONS IN PUBLIC TRANSPORT

Fire Standard BUS: ECE R118 (annex VI, VII, VIII)

Annex VI:

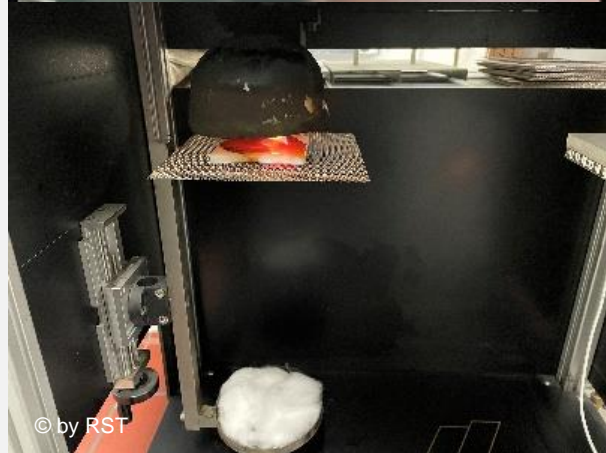
- Test to determine the horizontal burning rate of materials (comparable to FMVSS 302; U.T.A.C. 18-502 T1; DIN 75200; ISO 3795).
- This test method applies for materials of all types of motor vehicles, including passenger cars.
- If materials fulfill the requirements of annex VIII they automatically fulfill the requirements of this test.

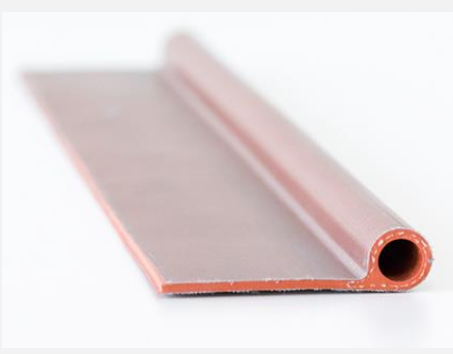
Annex VII:

- Test to determine the melting behavior of materials (comparable to U.T.A.C.-18-502 T2; NF P 92-505). (30 kW/m²)

Annex VIII:

- Test to determine the vertical burning rate of materials (comparable to ISO 6941).
- Alternatively, to annexes VII and VIII the flame spread test according to ISO 5658-2 is permitted (CFE \geq 20 kW/m², no burning drops).





© Rubicon

5. APPLICATIONS IN PUBLIC TRANSPORT

APPLICATIONS IN AVIATION:

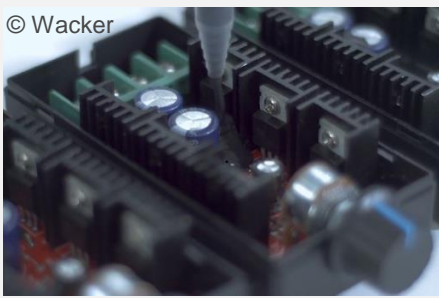
Aircraft Seals:

- Silicone seals in doors, windows and access panels for air and water tightness.
- Contribution to cabin pressurization systems.

Engine Components:

- High-temperature resistant silicone used in gaskets and seals.
- Insulation materials to withstand extreme engine temperatures.





© WEGU Schwingungsdämpfung GmbH



5. APPLICATIONS IN PUBLIC TRANSPORT

APPLICATIONS IN AVIATION:

Electronics and Wiring:

- Silicone used for electrical insulation in avionics.
- Wiring protection and vibration dampening with silicone components.

Exterior Coatings:

- Weather-resistant silicone coatings for aircraft exteriors.
- Protection against corrosion and environmental factors.

5. APPLICATIONS IN PUBLIC TRANSPORT

APPLICATIONS IN MARINE:

Marine Seals and Gaskets:

- Silicone seals and gaskets for watertight compartments, ensuring ship integrity.
- Resistance to saltwater and harsh marine conditions.

Engine Room Components:

- Silicone used in engine components due to its high-temperature resistance.
- Insulation materials for improved safety and performance.



5. APPLICATIONS IN PUBLIC TRANSPORT

APPLICATIONS IN MARINE:

Deck and Hull Protection:

- Silicone-based coatings for protection against corrosion.
- Weather-resistant applications on ship decks and hulls.

Electrical Systems:

- Silicone used in marine-grade electrical insulation.
- Wiring and connectors benefiting from silicone's resistance to saltwater exposure.



6. FUTURE TRENDS

Advancements in Silicone Technology:

- A lot of new research and innovations in silicone material science are ongoing like antibacterial and antiviral properties.
- Improvement of performance and versatility of silicone products.

Smart Integration:

- Applications in sensor technologies and data analytics.

Eco-Friendly Silicone:

- New developments in environmentally friendly silicone formulations.
- The industry is endeavoring to solve the environmental problems associated with silicone production.
- New recycling possibilities

Customization and 3D Printing:

- New trends in customized silicone products through 3D printing technology.

Hydrogen application:

- New materials for deep temperature with no diffusions of H₂

7. CONCLUSION

Applications of Silicone Products in Passenger Transport:

- Seals and Gaskets
 - Contribution to air and water tightness in doors, windows, safety edges, electric shielding, membranes, diaphragms, seals, gaskets in high temperature environments (e.g. under the hood) and other applications.
- Interior Components
 - Use in seating, armrests, thermal insulation, acoustic & vibration insulation, gap covers, shields, protectors and other interior elements for enhanced comfort.
- Exterior Components
 - Applications in exterior parts for durability and weather resistance like bellows, damping, shields, profiles, fairings.





MANY THANKS FOR YOUR ATTENTION!



PTO



HUBNER

THE HÜBNER GROUP: WIDE-RANGING EXPERTISE UNDER ONE ROOF

WHERE YOU CAN FIND HÜBNER QUALITY – EVEN WITHOUT THE HÜBNER NAME



HÜBNER Photonics

