Innovative Adhesive Systems for *Sandwich* Production

Competence **PUR**
KLEIBERIT Adhesives is modern and future oriented with special adhesives for industrial applications. In the meantime, approx. 60,000 tons of adhesives are produced at the production location in Weingarten/Karlsruhe Germany for use in the automotive – parquet – window – door – furniture – building and textile industries.

The company, founded in 1948 by the Dr. Werner Fred Klingele and Max Georg Becker families, now undertakes international challenges under the managing director and shareholder Klaus Becker-Weimann. As approx. 80% of the adhesives are exported worldwide, subsidiaries were founded in France, UK, USA, Canada, Singapore, China, Japan and Russia over the years. 550 employees are employed internationally. A network of 70 Engineers are available for technical advice.

Due to the shareholders willingness to invest, the site in Weingarten has been expanded to a modern production facility including a high rack warehouse containing 6,000 spaces. A modern new Technical Center, where the latest adhesive technologies are shared with international customers, was opened in May 2009.

The KLEIBERIT FASTteam specialises in bonds for the Filter, Automotive, Sandwich and Textile field and is available to apply its expertise to the realisation of your complex projects.

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Overview

Core Materials and Surface Layers 4 - 5
KLEIBERIT Adhesive Systems 6 - 9
Application Methods 10 - 13
Adhesive Overview 14 - 16
KLEIBERIT Adhesives worldwide 17
Core Materials and Surface Layers…

for Sandwich Panels and Lightweight Panels

Materials and their characteristics

Together with the unique characteristics of the individual constructive elements, KLEIBERIT’s innovative adhesive systems provide for highly flexible and durable bonds.

Core materials

- Aluminium honeycomb
- Plastic honeycomb
- Foam core
- Wood core
- Paper honeycomb
- Mineral wall

Surface Layers

- Aluminium
- Steel
- Stainless Steel
- GPR
- GRP
- HPL
- Plexiglass
- ABS
- MDF
- Plywood, etc.
Sandwich Panel Construction

Sandwich panels and lightweight panels are made up of multi-layer construction. Depending on the application, different core materials are bonded with different surface layers. The sandwich panel first gets its high load capacity and rigidity as a result of bonding the shear connected core with the surface layers.

Modern lightweight panels feature high strength, lightweight components, versatile design and are cost-effective. Their excellent form stability, torsional stiffness and high load capacity make it possible for use in transportation and construction as well as in machine and plant construction.

Together with the unique characteristics of the individual constructive elements, KLEBERIT’s innovative adhesive systems provide for highly flexible bond and guarantees long-lasting functionality.

Applications

KLEBERIT, an experienced adhesive supplier and source of ideas, develops individual and tailor made adhesives together with their customers.

Application Fields

- Automotive
- Air-conditioning
- Train interiors
- Shipbuilding
- Interior partition walls
- Building facades
- Furniture parts
KLEIBERIT® Adhesive-Systems

Bonding Surface Layers with Core Materials

1C und 2C PUR-Adhesive Systems

KLEIBERIT is able to offer panel producers a complete range of products to satisfy the individual demands of customers. For sandwich panel production, the operator has the perfectly suited KLEIBERIT 1C or 2C PUR adhesive system available.

The KLEIBERIT range includes filled and unfilled systems, foaming and non foaming systems to suit the varying production lines supplied into this industry. Furthermore, KLEIBERIT continues to develop and investigate new formulations to maximise the adhesive and ultimately the finished panel’s performance. The main 2C PUR systems that are used in this industry are:

**High foaming systems** - these rely on the foaming of the adhesive to penetrate into the core material and fill any voids between the surface layer and core material.

**Non-foaming or slightly foaming systems** - are used for non-permeable core materials or honeycomb material.

KLEIBERIT PanelPUR A2

Since 1.10.2010, CE-labelling according to EN 14509 for self-supporting metal-sandwich insulation panels will be mandatory in the EU. Mineral-wool panel manufacturers will only have the opportunity to label their products according to EN 14509 Class A2 if the appropriate adhesive-systems are used.

For compliance with EN 14509 A2, KLEIBERIT has developed the new 1C and 2C PanelPUR A2 series with low calorific value (PCS).

- This allows the filled KLEIBERIT 577.1 good processing with spray application, e.g. jet stream, due to the low viscosity at room temp.
- Excellent and stable processing properties
- Increased application quantities possible due to low PCS values
- Excellent tensile strength
- DUR2 and Wedge tested
**KLEIBERIT** 983.2 has a very long open time, thermo-activating properties and a good bead positioning which allows for variability between adhesive application and the delivery of the metal surface layer, which is especially advantageous in discontinuous production and for variable double belt line speeds in continuous production, e.g. breaks, very slow operation or if there is a large distance from the portal where the adhesive is applied.

**Thermo-activated 2C PUR-Adhesive**

- **Mineral wool and coilcoating steel cover layers bonded with PanelPUR A2 KLEIBERIT 983.2.**
- **Aluminium honeycomb bonded with aluminium cover layers with KLEIBERIT 543.8 2C PUR adhesive.**

The advantage of thermo-activated adhesive is the long open time which is available when the adhesive is applied as a bead or with a roller with simultaneous short process cycles. The layers are pressed for approx. 5 minutes at 65°C. The finished panel can be further processed directly out of the press.
KLEIBERIT® Adhesive-Systems
Bonding Surface Layers with Core Materials

UV Stable 2C PUR-Adhesive

- Numerous design possibilities through transparent, lightfast adhesive joints.
- Individual, decorative solutions through various colours. Elastic glue joints for good adhesion to a variety of substrates.

Transparent lightweight elements
**KLEIBERIT PUR-Hotmelts**

With product group **706**, KLEIBERIT offers multiple application-oriented products.

**KLEIBERIT 706.0** is established in the market as a successful, universal PUR surface adhesive with a wide bonding spectrum.

**KLEIBERIT 706.2** shows especially good wetting on difficult to bond substrates.

**KLEIBERIT 706.5/706.8** or **706.6** can be used for applications with high memory effect.

The combination of good processing characteristics like smooth application texture, string free and roller stability is convincing.

**KLEIBERIT 706.9** is a product for bonding materials with high memory effect at high temperatures. Tolerances which often occur in the production of framed honeycomb panels are securely covered.

Numerous market requirements of particular types can be solved with KLEIBERIT flat lamination adhesives. Special products have the following characteristics:

- Fire retardant
- UV stable
- High temperature resistance

This is only a small extract from the comprehensive KLEIBERIT product range for flat lamination. Realize innovation through working together with KLEIBERIT.
The choice of 2C PUR adhesive is influenced by the type of mixing and application method.

**Standard Bead Application:** Components A and B are mixed in a permanent static mixer and bead applied through a traversing head, the adhesive is applied to the skin on the bottom of the panel and to the core material for the top of the panel.

**Teflon Bead Head:** Components A and B are mixed in a disposable static mixer, the head is made from Teflon and is easily interchangeable thus allowing fast curing systems to be used.

**High Pressure Spray Application:** Components A and B are processed in a high pressure mix system and sprayed on the top and bottom cover layers.

**Standard Spray Application:** Components A and B are processed in a low pressure system and sprayed with air pressure on the top and bottom cover layers.

**Wiper:** Components A and B are bead applied onto the skin of the panel separately and mixed on the skin using a wiper.

After mixing and dosing it is essential that the cure speed is tuned to match ...

a) The line speed and the length of line in order to ensure that the open time of the adhesive has not been expired.

b) The pressing time and temperature, to ensure sufficient curing has taken place to allow the panel to be cut and handled without any delaminating.

Combined with the experience and laboratory data of the adhesive performance an adhesive recommendation can be made.
When selecting the adhesive the following parameters must be considered to ensure the correct choice of adhesive for the production line:

- Adhesive mixing and dosing method
- Adhesive application temperature
- “A” portal distance top
- “B” portal distance bottom
- Maximum and minimum line speed
- Pressing temperature
- Temperature of cover layers
- Application amount/substrate

Cleaning

**KLEIBERIT 820.0** for daily cleaning of non-cured adhesive in the hose and application unit.

**KLEIBERIT 825.0** for daily storage of application units with uncured adhesive.

**KLEIBERIT 826.0** for cleaning components contaminated with cured material. Please note that the components must be heated up to 180 °C until all traces of the cured material has been removed.

Manual Application

For manual application with a spatula, universal types with longer open time are available.
Application Methods

Roller application with PUR-Hotmelt

KLEIBERIT PUR-Hotmelts

Roller applicators are predominantly in use in bonding large areas and less flexible materials. Typical examples are all types of multi layer sandwich elements.

Flat laminating of large areas such as chipboard with more flexible materials such as foils and papers can be done using wide slot nozzles.

KLEIBERIT PUR-HM’s are applied either with conventional equipment by heated roller applicator or applied in a foamed form by slot nozzle.

This foaming is achieved with specially designed application machinery which adds argon or nitrogen to the molten adhesive. The PUR-HM is then applied to the honey comb via slot nozzle and remains as a flange at the comb walls. This increases the bonding area and therefore the bonding strength.

Advantages:
• economical consumption of the adhesive
• larger bonding surface, due to bulge formation
• even application to the honey comb, no leaking into the cells
• optimal adhesive application as excess spread is avoided

Pressing:
The pressing of the elements is done via press calendars or roller presses. After pressing, the boards can be stacked immediately in the appropriate stacking systems.

Application
The application temperature of reactive PUR hotmelts is usually between +120 °C and +140 °C.

The PUR-HM is melted in its original delivery container using special equipment and is then pumped through heated pipes to the application roller. The adhesive is applied to the substrate via direct contact with the application roller.
The covering substrate is then either applied by hand or machine and the required pressure is applied via the press rollers. This process is mainly used for very large areas using rigid materials.

With slot nozzle systems the adhesive is usually applied to the flexible rolled up material and the online pressing is done immediately afterwards via large area calendars.

The maximum line speed is max. 80 m/min.

**Cleaning**

After completion of work the application rollers have to be cleaned completely with KLEIBERIT 761.8 Cleaner or 761.5. Remaining hot melt in pipes and melting vessels should be kept under air and humidity tight condition.

Slott nozzle openings can be sealed airtight and therefore remaining hot melt can be left inside the system. Any other remaining PUR hot melt should be cleaned off with KLEIBERIT 761.7 Cleaner.

PUR hot melt, which is left to cross-link can only be removed mechanically.
### KLEIBERIT PUR-HM for Sandwich and Panel Production:

<table>
<thead>
<tr>
<th>Product</th>
<th>Viscosity at 120°C [mPa·s]</th>
<th>Viscosity at 140°C [mPa·s]</th>
<th>Open Time [min]</th>
<th>Shore A/D 1d</th>
<th>Shore A/D 7d</th>
<th>Wood based material panels</th>
<th>Solid wood</th>
<th>Veneer</th>
<th>Steel</th>
<th>Aluminium</th>
<th>Epoxy lacquers</th>
<th>Polyester fibre glass compounds</th>
<th>PVC / ABS</th>
<th>HPL / CPL Panels</th>
<th>Insulating material (polystyrene) hard foam</th>
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</thead>
<tbody>
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<td>700.5</td>
<td>6.000</td>
<td>3.000</td>
<td>2.5</td>
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<td>96/36</td>
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<td>706.0 (ME)*</td>
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<td>3-4</td>
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<td>4</td>
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<td>709.1</td>
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</tbody>
</table>

* All products also as microemission version available

The technical data were determined according to KLEIBERIT’s test procedures!

During application, a minimum temperature of 18 °C for the substrates as well as the working environment is necessary. Avoid drafts!
### Application Methods

<table>
<thead>
<tr>
<th>PVC foil</th>
<th>Sanding paper</th>
<th>Honeycomb panels</th>
<th>Flame retardant material</th>
<th>Impermeable Materials</th>
<th>HPL / Alu. PVC</th>
<th>Application Methods</th>
<th>Characteristics Advantages</th>
<th>Application Fields</th>
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<tbody>
<tr>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Spray</td>
<td>Extremely tacky, good wetting even on difficult substrates</td>
<td>Polystyrene, wood and wood based materials, PVC, aluminium, sheet metal</td>
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<tr>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Spray</td>
<td>Highly resilient bond, low process temperature</td>
<td>Veneer on wood based materials, carpet on Baypreg® panels, trunk flooring</td>
</tr>
<tr>
<td>✔️</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Spray, Nozzle</td>
<td>Very high green strength, very high green strength, suitable slot nozzle, very good doctor blade, can be applied with roller</td>
<td>Microemission, universal PUR</td>
</tr>
<tr>
<td>✔️</td>
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<td></td>
<td></td>
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<td>✔️</td>
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<td></td>
<td>Spray, Nozzle</td>
<td>Very high green strength, very high green strength, suitable slot nozzle, very good doctor blade, can be applied with roller</td>
<td>Microemission, universal PUR</td>
</tr>
</tbody>
</table>

### Before application, acquire and observe the individual data sheet!

- The statements made herein are based on field experience and our own tests. The information is no characteristic assurance in sense of the newest BGH legal requirements.
- As we have no influence on the variety of materials nor their processing, we can not accept liability for the above statements or our free advice given by our technical team.
- We recommend in any case to conduct individual tests to establish suitability.

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**KLEIBERIT® PUR-HM for Sandwich and Panel Production:**

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### KLEIBERIT 1C PUR for Sandwich and Panel Production

<table>
<thead>
<tr>
<th>Product</th>
<th>Colour</th>
<th>Viscosity [mPa·s]</th>
<th>Density [g/cm³]</th>
<th>Open time [min]</th>
<th>Pressing time [h]</th>
<th>Properties</th>
<th>Application fields</th>
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<tbody>
<tr>
<td>502.1</td>
<td>transparent</td>
<td>6.600</td>
<td>1.07</td>
<td>50</td>
<td>2 - 4</td>
<td>Elastic transparent glue line</td>
<td>Laminate bonding of wooden materials, sandwich panels</td>
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<td>6.600</td>
<td>1.07</td>
<td>65</td>
<td>2.5 - 4</td>
<td>Very short pressing time</td>
<td>Laminate bonding of wooden materials, sandwich panels</td>
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<tr>
<td>502.5</td>
<td>amber</td>
<td>6.000</td>
<td>1.10</td>
<td>120</td>
<td>6 - 8</td>
<td>Elastic whitish glue line, long open time</td>
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<td>1.08</td>
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<td>Laminate bonding of wooden materials, sandwich panels</td>
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<td>120</td>
<td>4 - 6</td>
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<td>Laminate bonding of wooden materials, sandwich panels</td>
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<td>503.5</td>
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<td>6.800</td>
<td>1.10</td>
<td>120 (humidified)</td>
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<td>7.000</td>
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<td>1.12</td>
<td>7</td>
<td>8 min (40% humidified)</td>
<td>Flexible glue line</td>
<td>Sandwich-Elements</td>
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<td>2</td>
<td>Medium hard glue line</td>
<td>Sandwich-Elements, Alu-Honeycomb</td>
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</table>

### KLEIBERIT 2C PUR for Sandwich and Panel Production

<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>541.6</td>
<td>beige</td>
<td>30.000</td>
<td>1.59</td>
<td>541.7</td>
<td>4 : 1</td>
<td>45 min</td>
<td>D 82</td>
<td>Long pot life for manual application</td>
<td>Moulding material and adhesive</td>
</tr>
<tr>
<td>542.6</td>
<td>beige</td>
<td>12.000</td>
<td>1.50</td>
<td>542.7</td>
<td>5 : 1</td>
<td>5 h</td>
<td>A 90</td>
<td>Flexible glue line</td>
<td>Laminate bonding of coated metal or plastic layers onto insulation cores</td>
</tr>
<tr>
<td>542.8</td>
<td>beige</td>
<td>10.000</td>
<td>1.47</td>
<td>542.9</td>
<td>5 : 1</td>
<td>7 h</td>
<td>A 85</td>
<td>Flexible glue line</td>
<td>Sandwich-Elements</td>
</tr>
<tr>
<td>543.8</td>
<td>beige</td>
<td>6.600</td>
<td>1.42</td>
<td>543.9</td>
<td>100 : 25</td>
<td>50 min</td>
<td>D 70</td>
<td>Thermo-activated</td>
<td>Sandwich-Elements</td>
</tr>
<tr>
<td>578.8</td>
<td>transparent</td>
<td>4.000</td>
<td>1.08</td>
<td>578.0</td>
<td>100 : 170</td>
<td>30 sec Start time Adhesion-free: 38 sec</td>
<td>Foamed adhesive</td>
<td>Continuous Sandwich panel production</td>
<td></td>
</tr>
<tr>
<td>596.6</td>
<td>beige</td>
<td>11.000</td>
<td>1.45</td>
<td>596.7</td>
<td>100 : 25</td>
<td>60 min</td>
<td>D 76</td>
<td>For roller application</td>
<td>Galvanised metal layers to wood particle boards</td>
</tr>
</tbody>
</table>
### PanelPUR A2 Series

KLEIBERIT 2C PUR-Adhesives for continuous lamination of mineral wool panels class A2 according to EN 13 501-1

<table>
<thead>
<tr>
<th>Comp. A</th>
<th>Type</th>
<th>Application Technology</th>
<th>Mixing Ratio (A/B) by weight</th>
<th>PCS Calorific Value [MJ/kg]</th>
<th>Viscosity at @20°C [A/B] [mPas]</th>
<th>Application Temperature (A/B) [°C]</th>
<th>Start Time (80 g mixture at 20°C) [sec]</th>
<th>Tack-free Time (80 g mixture at 20°C) [sec]</th>
<th>Press Time* [min]</th>
</tr>
</thead>
<tbody>
<tr>
<td>508.9</td>
<td>1C PUR</td>
<td>spray or bead system</td>
<td>n.a. (10% water mist)</td>
<td>21.5</td>
<td>10,000</td>
<td>20-30</td>
<td>n. a.</td>
<td>n. a.</td>
<td>6 at 45°C</td>
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<tr>
<td>570.2</td>
<td>2C PUR</td>
<td>spray system (e.g. PUMA / Robor)</td>
<td>100:40</td>
<td>16.5</td>
<td>9,500/300</td>
<td>20-30</td>
<td>20</td>
<td>90</td>
<td>3-4 at 45°C</td>
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<tr>
<td>570.5</td>
<td>2C PUR</td>
<td>bead system</td>
<td>100:36</td>
<td>17</td>
<td>6,000/300</td>
<td>20-30</td>
<td>18</td>
<td>120</td>
<td>3-4 at 45°C</td>
</tr>
<tr>
<td>570.9</td>
<td>2C PUR</td>
<td>spray system (e.g. PUMA / Robor)</td>
<td>100:56</td>
<td>17</td>
<td>3,000/300</td>
<td>20-30</td>
<td>20</td>
<td>47</td>
<td>3-4 at 45°C</td>
</tr>
<tr>
<td>577.1</td>
<td>2C PUR</td>
<td>jet stream application head (high pressure system)</td>
<td>100:62</td>
<td>17.5</td>
<td>2,400/300</td>
<td>20-30</td>
<td>18</td>
<td>50</td>
<td>3-4 at 45°C</td>
</tr>
<tr>
<td>577.9</td>
<td>2C PUR</td>
<td>spray system (e.g. PUMA / Robor)</td>
<td>100:40</td>
<td>18</td>
<td>14,000/300</td>
<td>20-30</td>
<td>33</td>
<td>110</td>
<td>4 at 45°C</td>
</tr>
<tr>
<td>578.1</td>
<td>2C PUR unfilled</td>
<td>spray or wiper system</td>
<td>100:115</td>
<td>27.2</td>
<td>350/300</td>
<td>20-30</td>
<td>10</td>
<td>25</td>
<td>3-4 at 45°C</td>
</tr>
<tr>
<td>578.5</td>
<td>2C PUR unfilled</td>
<td>jet stream application head (high pressure system)</td>
<td>100:140</td>
<td>26.8</td>
<td>170/1,000</td>
<td>20-30</td>
<td>29</td>
<td>63</td>
<td>3-4 at 45°C</td>
</tr>
<tr>
<td>983.2</td>
<td>2C PUR thermo activated</td>
<td>spray system (e.g. PUMA / Robor)</td>
<td>100:48</td>
<td>17</td>
<td>7,000/300</td>
<td>20-30</td>
<td>90</td>
<td>270</td>
<td>4 at 60°C</td>
</tr>
</tbody>
</table>

* Press time depends on machine setup and processing conditions

**Notes**
KLEIBERIT® Adhesives worldwide

KLEIBERIT Adhesives (Head Office)
KLEBCHEMIE M. G. Becker GmbH & Co. KG
Weingarten/Germany

KLEIBERIT Adhesives UK
Coalville, Leicestershire, UK

KLEIBERIT Chimie S.a.r.l.
Reichstett, France

KLEIBERIT Adhesives USA Inc.
Waxhaw, North Carolina, USA

KLEIBERIT Adhesives of Canada Inc.
Toronto, Ontario, Canada

KLEIBERIT AUSTRALIA Pty Ltd.
Sydney, Australia

KLEIBERIT Russia
Moscow, Russia

KLEIBERIT Adhesives Japan
Osaka, Japan

KLEIBERIT Adhesives Beijing Co., Ltd.
Beijing, China

KLEIBERIT Adhesives Asia Pte. Ltd.
Singapore, Singapore

KLEIBERIT Adhesives India Private Ltd.
Bangalore, India

KLEIBERIT Kimya San. ve Tic. A.Ş.
Istanbul, Turkey

KLEIBERIT Bel
Minsk, Belarus

KLEIBERIT-UKRAINE LLC.
Kiev, Ukraine

KLEIBERIT do Brasil Comércio de Adesivos e Vernizes Ltda.
Curitiba, Brasil

KLEIBERIT Adhesives México S.A. de C.V.
Mexico City, Mexico