



Important information for processors of moisture-curing polyurethane prepolymer adhesives

- ⇒ Processing instructions for Jowapur[®] and Jowat-PowerPUR[®] prepolymer adhesives

- ⇒ Information on maintenance and cleaning

- ⇒ Disposal considerations

- ⇒ Troubleshooting

More than adhesives – first class bonding

1. The chemistry of PUR prepolymers

"PUR prepolymers" is the term used in general for adhesives which are at room temperature liquid or highly viscous, and which can be processed without additional heat. Another distinction is frequently made between one-component, moisture-curing and two-component polyurethane adhesives.

The crosslinking reaction in a one-component system is triggered by water molecules from the ambient air or the substrates. In contrast, the crosslinking in a two-component system is achieved by a chemical reaction between the resin and the hardener component (both components are as a rule mixed before adhesive applications).

The PUR adhesives are very versatile high-performance adhesives because they offer different processing and reaction principles.

If we consider first of all the one-component systems, the crosslinking is here always set off by the reaction of the free isocyanate groups (NCO groups) with water molecules, splitting off carbon dioxide; this reaction forms a very stable urea bridge.

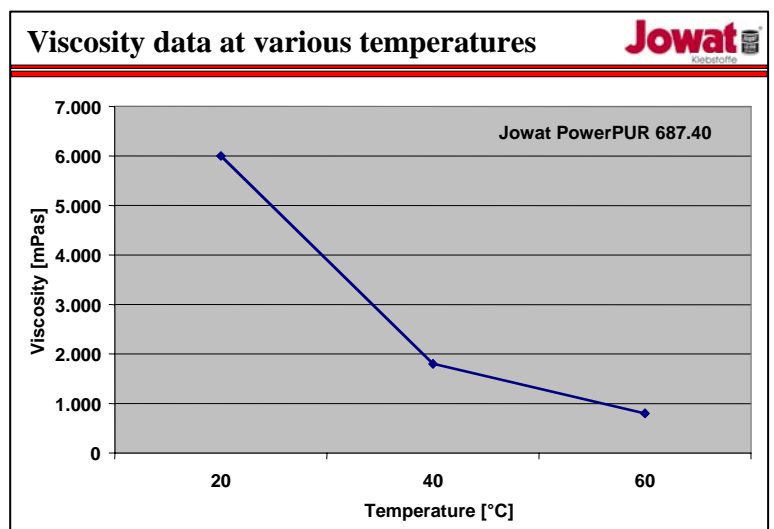
The reaction in a two-component system is very different: The resin component consists of polyoles, catalysts and possibly some other components. The hardener component consists of one or more isocyanates and possibly some additional components.

Both components are mixed only just before application onto the substrate. After mixing, the OH groups of the polyoles react with the isocyanate while forming urethane-bridges.

2. General instructions for processing

2.1 Storage/shelf life

At temperatures below +5 °C, the reactive components of the PUR prepolymer adhesive may crystallize. At higher temperatures, these crystals can dissolve again when the product is stirred. The viscosity decreases at higher temperatures. In general, the adhesive can be processed without stirring. The product should not be stored below +5 °C, preferably between +15 °C and +25 °C; if the storage temperatures are too high, this could also have a detrimental effect on the stability of the viscosity of these products.



When the temperatures are increased, the fact that the viscosity initially drops slightly, makes for an easier flow of these PUR prepolymer adhesives, and this may at first also facilitate processing. Longer exposures of the adhesive to higher temperatures, however, have to be avoided, since this may have a negative impact on the shelf life/storage performance due to the fact that the product may thicken.

When adhesive has been taken from a container, this has to be hermetically closed again, in order to prevent any air or humidity from entering, which can lead to a reaction of the adhesive in the container.

This would normally result in skin formation on the adhesive surface, and this skin must be removed before any further processing steps, otherwise the applicators would clog. If the adhesive is applied from bottles, the air can be squeezed out first before closing the bottle or it could be stored upside down, and any skin formation would take place away from the discharge side of the bottle.

Larger containers are usually integrated into closed supply circuits. In these cases, any air flow entering the units would run through air drying cartridges removing the humidity; these are installed on the container.



200 l Drum with drying cartridge

2.2 Open time

The open time covers the time between application of an adhesive until the pressure is fully applied. It is largely dependent on the moisture/humidity available (which could be from the substrates or adhesive, but also from the ambient air). The materials have to be assembled, and pressure has to be exerted, within this open time. If the duration is exceeded, the bond will no longer achieve sufficient strength. On the surface of the adhesive film or on the adhesive bead, a skin of already crosslinked adhesive will form and this prevents sufficient wetting of the parts to be bonded, and an optimum compound strength can no longer be achieved.

2.3 Pressing time

The pressing times required also depend largely on the moisture available and the temperature. This time can be roughly calculated by multiplying the indicated open time of a product by the factor 3, which - at a given temperature of 20 °C and a humidity of 65 % - would give the minimum pressing time. During the winter months, it may be necessary to set the pressing time for longer, due to the fact that the ambient air is dryer.

To speed up pressing, additional moisture can be added, by fogging the substrate or the adhesive film. This could reduce the pressing times by up to 20%.

If wood or wood-based substrates are to be bonded, the moisture content needs to be 9 % or above, because any percentage below this would mean adding moisture/fogging. If the wood moisture is above 15 % pressing times can be reduced, by up to 20 %, depending on the wood species. If the accelerating agent **Jowat® 685.00** is used to fog the surfaces, this may also reduce the pressing times by up to 40 %.

2.4 Cleaning

Tools which come into contact with PUR prepolymer adhesives have to be cleaned immediately after use. If the adhesive is not yet completely cured, the standard cleaner is **Jowat® -Thinner 401.30**.

If the adhesive has started to react, it can still be removed with the **Jowat® PUR Cleaner 402.30**.

Fully cured adhesive can only be removed by mechanical means.

In order to prevent the adhesive from sticking to the presses, worktops etc., it is recommended to protect these with a layer of silicone paper or similar protective foils, and/or to coat these surfaces with **Jowat® Separating Agent 901.00** (liquid) or **901.10** (pasty).

The applicator units are cleaned with the same cleaners. This process has to be carried out following instructions of the respective engineering companies.

Any machine that has been cleaned should not remain unfilled over a longer period of time. If it is not used, a unit can be filled with a desiccated, synthetic oil (e.g. **Jowat® Flushing Agent 403.30**).

2.5 Marking/labelling and disposal considerations

Because of their content in isocyanates, PUR prepolymer adhesives are classified as "harmful (Xn)". Any direct skin contact with not fully cured adhesive during processing has to be prevented. In case of spray application, minute adhesive particles represent a health risk if inhaled, and in this case, as well as when processing is done above +40 °C, a suitable respiratory protection has to be worn by operators. The precautions compiled in the corresponding Material Safety Data Sheets under Health and Safety considerations must be observed.

Spillages/leakages of **Jowapur®** Prepolymer adhesives may be contained with sawdust. It is recommended to place a basin with sawdust or water below the applicator units. When the adhesive is cured, it may undergo disposal as industrial waste (European Waste Disposal key number 080409).

2.6 Application of PUR prepolymer adhesives

If the adhesive is applied on a smaller scale, the manual application can be done by spatula, hand roller or small manual applicator. For large-scale applications, special bead applicator units are normally used. These are units which apply the adhesive from large containers via pumps and nozzles in bead form onto the component.

These machines guarantee that the adhesive will not be exposed to moisture, from container to applicator head. Any reaction of the adhesive with moisture within the unit is thereby prevented. When the daily operating shifts end, the applicator head with nozzles needs to be immersed in a basin with desiccated oil or protected against moisture/humidity by other suitable means.

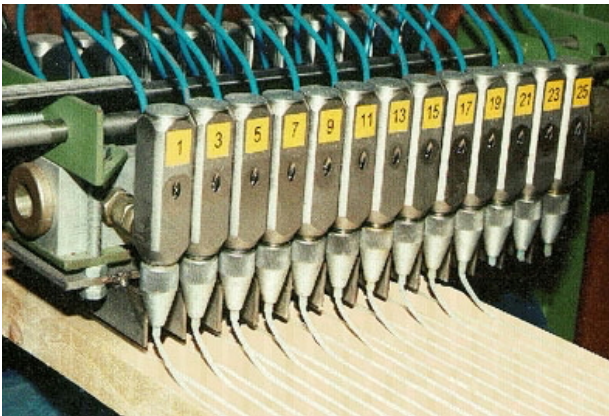


Photo: Oest



Photo: Seifert

3. Troubleshooting

Problem	possible causes and remedies
Joint opening Delamination	<ul style="list-style-type: none"> • imperfect match of surfaces ✓ Planeity, check planer blades • adhesive application insufficient ✓ check nozzles for clogging ✓ increase adhesive grammage • pressing times too short ✓ observe specified pressing times ✓ do not open/close press several times • wood moisture level wrong <li style="padding-left: 20px;">determine wood moisture with adequate moisture meter <li style="padding-left: 20px;">do not work with a wood moisture content below 9 % (read at 20 °C) • unsuitable ambient climate ✓ Please observe: the relative humidity can drop in winter below 50 % indoors, fog the surfaces to be bonded

Problem	possible causes and remedies
clogging	<ul style="list-style-type: none"> • adhesive has started to react ✓ avoid separating agents containing water make sure no air becomes trapped when coupling hoses or assembling the dry air cartridges, or after cleaning ✓ Keep containers closed
Clogging when a fibrefilled 1-component PUR adhesive is used	<ul style="list-style-type: none"> • Fibre deposits ✓ make sure no cavities exist in the glue station which are passed by the glue flow • Incompatibility of adhesives Adhesive pulls along fibres deposited by a previously used product. Clean valves.
Skin formation	<ul style="list-style-type: none"> • Moisture entering the adhesive has caused thickening ✓ Check dry air cartridge, refill if necessary ✓ Keep containers closed ✓ Tightly close lid and connections ✓ Inter gas blanketing only with air free of water or nitrogen (4.5 / 99,995 %).
Heavy foaming	<ul style="list-style-type: none"> • wood moisture content too high Wood moisture to be determined with suitable moisture meter. At 20 °C, this should be between 9 and 15 %. • Grammage too high ✓ Check amount applied • Pressure too high, adhesive gets squeezed out ✓ Control pressure
Adhesive penetrates into the wood	<ul style="list-style-type: none"> • wood moisture not high enough Take a reading of the wood moisture with a suitable device, do not operate below 9 % wood moisture at +20 °C Mist wood and wait for about 15 minutes bond when the moisture reads > 9 %, no wet wood bonding
Adhesive is thick and grainy	<ul style="list-style-type: none"> • Separating agent incompatible ✓ Use Jowat®-Separating agent 901.00 or 901.10 • Adhesive too cold ✓ Ideal processing temperature +15 °C to +20 °C
Colour fluctuations within the liquid adhesive	Colour differences develop due to sun exposure, long-time storage and integral colour fluctuations within the raw materials. This does not mean a change in quality.
Containers can not be emptied	<ul style="list-style-type: none"> • Drying cartridge plugged up ✓ Replace cartridge • Drying cartridge closed ✓ Open cartridge • Adhesive thickened ✓ see under skin formation