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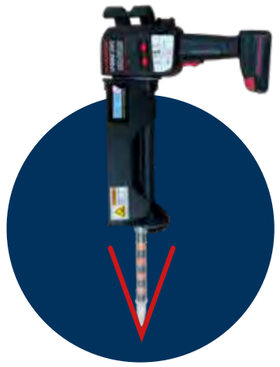
DINITROL COMPACT PUSH DISPENSER

CHALLENGES OF APPLYING HIGH VISCOSITY 2K ADHESIVES WITH A DISPENSER

CONTENT

01. INTRODUCTION

The use of 1K moisture curing adhesives is limited **when thick-film bonding with a high adhesive content** is required. This is due to the fact that the moisture must diffuse from the outside to the inside in order for the adhesive to cure. The curing speed decreases with increasing curing, which means long service lives until the adhesive bond can be fully stressed. If the accessibility of air humidity through narrow gaps (ratio of gap width to depth) is small and only on one side, it can happen that an adhesive in the core does not cure at all. In these cases, it is advisable to use a 2-component adhesive that is **independent of air humidity**. **A secure bond is achieved in a defined time and downtimes are reduced.**



The processing of 2 components and their homogeneous mixing is somewhat more complicated. This article outlines the challenges and corresponding solutions in the development of the DINITROL Compact Push dispenser.

Advantage of the DINITROL system solution: Access to narrow areas combined with guaranteed curing.

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02. THE CHALLENGES

If larger quantities of adhesive are required, gluing machines with hobbocks holding between 20 and 200 litres of adhesive are generally used. This is mainly the case for new vehicles (trains, buses, etc.). However, such systems are expensive and usually stationary. The advantage of a dispenser is that it is not stationary and **can therefore be used anywhere**, e.g. for repairing/replacing windscreens on trams, trains and buses in depots, so that they **can quickly return to passenger service and earn money**.

ERGONOMICS

The biggest challenges for a 2K handheld processing device are weight, size and ease of use. In addition, the device must be within a certain price range, which is a real challenge given the rather low average quantities (the dispenser is used for several years).

PACKAGING/SHELF LIFE/ PORTION SIZE

Most 2K adhesives are probably applied from plastic cartridges, which are generally suitable for low-viscosity components. In addition, most cartridge systems require a mixer to mix the two components. For our high-viscosity adhesives, only one system was considered, which automatically leads to a supply chain dependency in terms of availability.

Since plastic cartridges are not diffusion-tight for moisture, the cartridges must also be vacuum-sealed in an aluminised plastic bag. However, the shelf life is shorter than in a foilwrap. The filling and the cartridge itself are quite expensive. No suitable cartridge was available for the 600 ml portion size.

MIXING / MIXER

In order to make full use of the positive properties of the adhesive, a 100 % mixture of the two components is required. There are two types of mixers: dynamic mixing (mixing the second component into the first) and static mixing (mixing elements through which both components are pressed). Static mixers can generate very high forces (e.g. 30 bar), depending on the viscosity of the components and the length of the mixer, which depends on the mixing effect. This places demands on the load capacity of the mixer, the force to be achieved by the dispenser and ultimately influences the weight of the dispenser itself. Another challenge for mixers and dispensers is the temperature-dependent viscosity of the 2 components. The challenge is even greater when the viscosities of the 2 components are very different.

03. THE RESULT

The DINITROL Compact Push Dispenser was developed for DINITROL adhesives which react with air and moisture and are accelerated by the addition of the B component. This offers a **safety advantage** as the adhesive also cures without B-component. The selected mixing ratio is 10:1. The DINITROL adhesive that can be applied with this dispenser are described in detail on the following pages.

In order to keep the length of the dispenser as short as possible, a 580 ml foilwrap with a diameter of 60 mm is used - the standard diameter is 49 mm. The B component is also used from a small foilwrap with a diameter of 19 mm. Foilwraps have the advantage that the components have a **longer shelf life**, filling is **cheaper and less waste** is produced compared to the use of cartridges.

Old cartridge system

New foilwrap system

The foilwraps are inserted into the permanently usable aluminium cartridge, which contains the pistons that can be pushed back together with the foilwraps. The pistons are not rigidly attached to the racks to prevent the foilwraps from jamming or bursting. The coupled racks push the pistons forward in parallel so that the same volume of A and B is always conveyed. This is the most precise type of dosage (volume dosage), more precise than gear/gear dosage in adhesive application machines.

After inserting the foilwraps into the aluminium cartridge (Figures 2 and 3), the assembly is placed on the cartridge (Figure 4). Simply pull the racks back by pressing the release lever, insert the loaded cartridge into the cartridge holder, push the racks forward and lock the release lever again. You can now start to apply the adhesive. The whole process takes only 30 seconds.

Figures 2+3: Foilwraps A and B in the aluminium cartridge

Fig. 4: Manifold on aluminium cartridge

The manifold is equipped with cutters for the foilwraps (Figure 5), so that they do not have to be cut open by hand, which saves time and avoids dirty hands. Large openings and a pin ensure a high flow rate and prevent the openings from being blocked by the foilwrap film. The actual task of the manifold is to insert the B-component into the A-component at the right place, which is not trivial.

Fig. 5: Manifold with piercings for the foilwraps

The mixer was specially designed for this application and allows an adhesive output of 300 ml/min at room temperature and 600 ml/min at 30 – 35 °C material temperature. In view of the high viscosity of the adhesives, this is a revolution. In this way, even large components such as the windscreen of a train can be securely bonded without the use of machines. This is only possible due to the large diameter of the mixer and its mode of operation.

Fig. 6: Visible mixing elements in the mixer

The mixer has special mixing elements (Figure 6), whose mixing effect is improved compared to conventional ones, so that the length of the mixer or the number of elements is relatively small. The phenomenon of a static mixer being inflated or the adhesive in the mixer tube flowing past the mixing elements unmixed is eliminated as the adhesive is directed to the centre of the mixer. The layer separation, which can occur with this phenomenon, is eliminated and with it the need for a support pipe for the mixer.

Fig. 7: Mixer with M20 thread

As an additional feature, we have equipped the mixer with an M20 thread (Figure 7), onto which all standard nozzles can be screwed. This allows the user to create any desired bead geometry.

When the adhesive has been squeezed out, the racks are retracted and the cartridge can be removed from the dispenser. Now the manifold is removed from the cartridge, leaving the squeezed foilwraps in the manifold (Figure 8). If you want to continue working, you can reuse the mixer and the manifold, of course within the time specified by the adhesive. Only two empty foilwraps are produced as waste and the entire changeover process takes just one minute.

Figure 8: Squeezed foilwraps at the manifold

04. SUMMARY AND ADVANTAGES

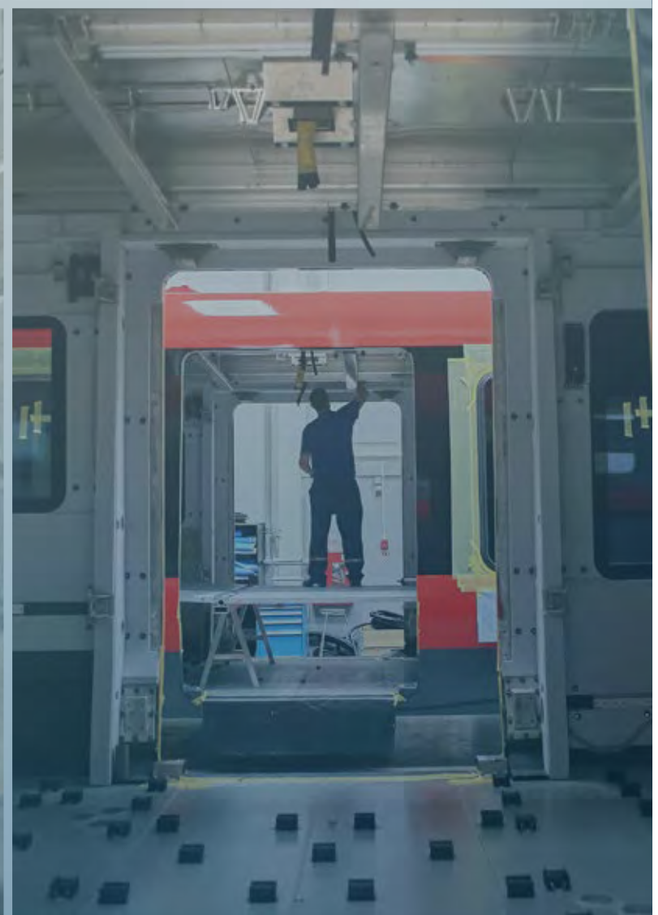
In summary, it can be said that all the challenges of manual application of 2-component adhesives were solved very well. The focus was on application and handling for the user - also with regard to the robustness of the dispenser – as well as the overall system in the application. From 100% mixing (open and cross-linking times) to assembly, processing and retooling. These times are between 30 and 60 seconds. This dispenser can be dropped without breaking and is therefore a reliable companion in the daily working environment.

ADVANTAGES OF THE 2K CORDLESS GUN

- **Extremely powerful, low weight**
  High material output approx. 300 – 600 ml/min.*
- **Compact and efficient**
  Optimised hose foilwrap geometry:
  638 ml total filling capacity,
  212 mm shortened total length,
  Ø 60 mm (A component), 19 mm (B component)
- **Quick charger**
  Short charging time approx. 20 min.
- **High battery capacity**
  Approx. 17 sets with one battery charge
- **Time savings and reduced downtime**
  Easy operation, very fast material change, both foilwrap open automatically
- **Best adhesive properties**
  Due to guaranteed perfect mixing
- **Long service life, no material wear**
  Due to the very robust workmanship, hardened material does not cause any damage to the dispenser
- **Economic efficiency and reusability**
  The DINITROL Mixer and DINITROL Manifold can be reused for larger adhesive volumes (observe pot life)
- **Very low waste volume**
  Both foilwraps are pressed out completely

Click here for work instructions

05. THE RIGHT ADHESIVE

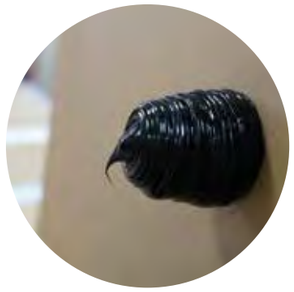


DINITROL

DINITROL 516 A/B

2-COMPONENT MS POLYMER

The 2-component adhesive system DINITROL 516 A/B consists of a moisture-curing polyurethane adhesive and a reactive accelerator paste. The 2K structural adhesive is suitable for industrial, semi-structural bonding, for example in special container construction, for floor rail, window and floor plate bonding as well as for front mask and side wall bonding in rail vehicles.



OUTSTANDING STABILITY

FAST CURING
and cut-resistant after approx. 90 min.

BONDING OF LARGE GEOMETRIES

Advantages of the 2K structural adhesive

- **Optimal processing time**
  Approx. 30 min, twice the open time compared with standard products
- **Perfect, continuous adhesive**
  Free of flaws, no CO2 bubbles
- **Simultaneous bonding and sealing**
  Possible in one step
- **OEM approved**
  e.g. used by well-known rail vehicle manufacturers
- **Hardens independently of humidity**
- **Reduction of cycle times**
  Reduced drive-away/shift times, vehicle ready for operation faster
- **Reliable bonding over time**
  Thanks to controlled strength build-up

More product info

APPLICATION AREAS

TECHNICAL DATA

Characteristic feature

The A-component DINITROL 516 A is a polyurethane adhesive that cures through air humidity to an elastomer with the familiar good adhesive and mechanical properties even without an accelerator paste. The reactive accelerator paste DINITROL 516 B was developed to achieve curing independently of the ambient humidity and the bonding geometry. Both products are compatible with each other. The use of the B component enables early handling of the components. A particular advantage of this 2K system is that no CO2 is produced when the 2K adhesive hardens. This enables bubble-free bonding and grouting in just one work step.

Processing

Application takes place via commercially available mixing systems. DINITROL 516 A is conveyed from hobbocks, DINITROL 516 B is conveyed from hobbocks or cartridges. The mixing ratio is between 100:6 and 100:10. Mixing is done by special static mixers (>18 elements).
For manual application, DINITROL 516 A/B (MV 100:10) is processed with the DINITROL Compact Push Dispenser (2K cordless gun). Use at room temperature.
The surfaces to be bonded must be cleaned and pre-treated according to our recommendations. The use of DINOL products is only suitable for experienced users. Preliminary tests are recommended for special applications.

Repair

In the event of a necessary repair, the old polyurethane bead is cut down to 1 to 2 mm after cutting out the component (possibly shortly before rebonding). The new bonding should be carried out within 6 hours. The cut-down bead is reactivated with DINITROL 540 reactivator and a lint-free paper cloth or application foam. The new adhesive must be applied to the dried old bead within 10 minutes. If 10 minutes are not sufficient, reactivation can be repeated.

Further information

The following documents are available online and on request:
- Safety Data Sheet
- PUR pretreatment table
- Work instructions DINITROL Compact Push Dispenser

Transport

Transport conditions between 0 and 35 °C. During transport, temperatures may be higher or lower (2 – 4 days). In this case, the material must be acclimatised to room temperature before application: for drums, hobbocks and foilwraps on pallets, this takes 1 – 2 days. For individual hobbocks and foilwraps, it takes 3 – 4 hours.

Approvals and Testing

- Requirements acc. to EN 45545-2:2016-02, table 5, R1 HL1-2, R7 HL1-3.
- Adhesive properties acc. To DIN 6701-3 available on request.
- Aging tests against cleaning agents available upon request.

TECHNICAL DATA

DINITROL 516 A/B	reactive polyurethane
Appearance	black paste
Density	approx. 1.2 g/cm³
DINITROL 516 B	reactive paste
Appearance	white paste
Density	approx. 1.45 g/cm³
Mixing ratio	100 : 6 to 100: 10 (516 A: 516 B) (V/V)
DINITROL 516 A/DINITROL 516 B	
Resistance	Very good
Processing time/temperature (times may vary depending on the processing equipment used):	
Mixing ratio 100: 10 (V/V)	30 – 40 minutes
Mixing ratio 100: 6 (V/V)	40 – 50 minutes
Operating temperature limits	15 – 35 °C
Shore A hardness (DIN 53505)	approx. 55
Tensile strength (DIN 53504)	> 7 MPa
Elongation at break (DIN 53504)	> 400 %
Tear resistance (DIN 53515)	approx. 10 N/mm
Tensile shear strength (DIN EN 1465)	> 5 MPa
Tensile shear strength (DIN EN 1465) after 6 hours	> 1.3 MPa
Shear module (DIN 54451)	approx. 1.3 MPa
Throughput speed (DIN 60093)	approx. 10^6 Ωcm
Glass transformation temperature	approx. - 50 °C
Temperature resistance long-term short term (approx. 1 hour)	 < 90 °C < 130 °C
Shelf life (storage at < 25 °C)	Hobbock and foilwrap: 12 months (A comp.), 15 months (B comp.)

* At 23 °C/50 % rel. humidity

DINITROL 516 A
Restricted to professional users. Danger; Resp. Sens. 1; H334; EUH204; As from 24 August 2023 adequate training is required before industrial or professional use.

For safety information, refer to the safety data sheet or the label on the packaging.

APPLICATION EXAMPLES

Special container construction, floor rail bonding, window bonding, floor plate bonding, front panel bonding for rail vehicles, side wall bonding, etc.

ATTACHMENT PARTS: RAIL BONDING

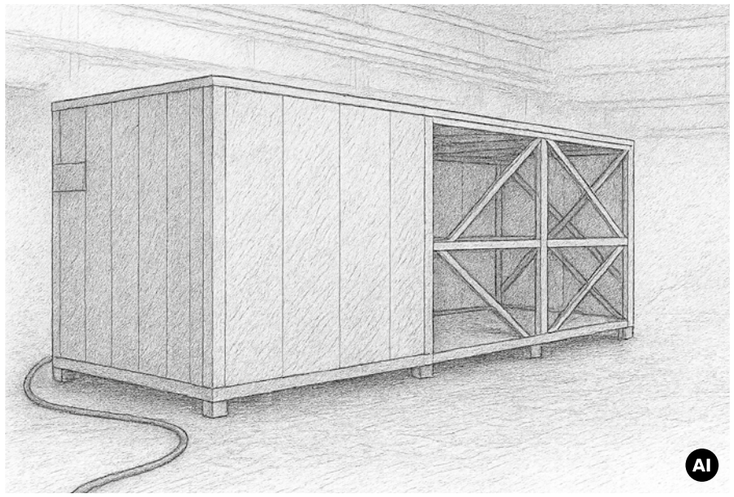
- Thick-layer bonding of floor rails in vehicle fittings, e.g. airline rails
- Production, new construction
- Removal, repair
- Application of DINITROL 516 A/B
  in the plant: using a robot or manually with a machine
  for repairs: manually with a machine or by hand application
- Compensation of unevenness/bodyshell tolerances
- Long processing time with strength in time, defined
- Fast curing
- Solvent-free, humidity-independent
- Shorter cycle times in new construction, shorter drive-away times after development or repair

DETACHABLE PARTS: POP-UP ROOFS

- Bonding and sealing in one work step of e.g. pop-up roofs
- Production, new construction
- Removal, repair
- Application of DINITROL 516 A/B
  in the plant: using a robot or manually with a machine
  for repairs: manually with a machine or by hand application
- Compensation of unevenness/bodyshell tolerances
- No stress cracks due to elastic bonding
- Long processing time with strength in time, defined
- Fast curing
- Solvent-free, humidity-independent
- Shorter cycle times in new construction, shorter drive-away times after development or repair

CONTAINER CONSTRUCTION: SPECIAL CONTAINERS

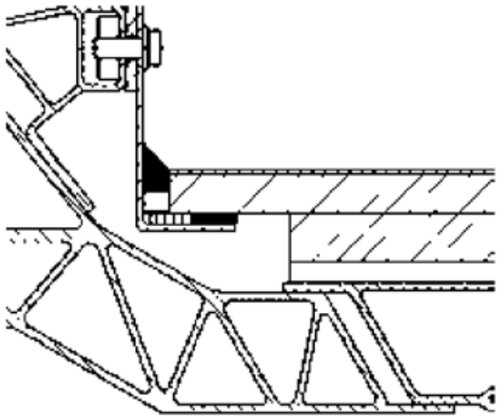
- Thick-layer bonding, e.g. for container removal, vehicle bodies, etc.
- Production, new construction
- Removal, repair
- Application of DINITROL 516 A/B
  in the plant: using a robot or manually with a machine
  for repairs: manually with a machine or by hand application
- Compensation of unevenness/bodyshell tolerances
- Long processing time with strength in time, defined
- Fast curing
- Solvent-free, humidity-independent
- Shorter cycle times in new construction, shorter drive-away times after expansion or repair



APPLICATION EXAMPLES

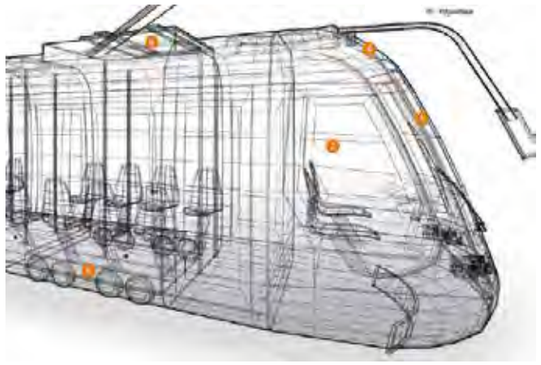
FLOORING BONDING

- Thick-layer bonding of floor panels
- Production, new construction
- Removal, repair
- Application of DINITROL 516 A/B
  in the plant: using a robot or manually with a machine
  for repairs: manually with a machine or by hand application
- Compensation of unevenness/bodyshell tolerances
- 2K technology enables fast drying
- Long processing time with strength in time, defined
- Solvent-free, not dependent on humidity
- Shorter cycle times in new construction, shorter drive-away times
  after development or repair



DIRECT GLAZING

- Thick-layer bonding of windows to the vehicle body
- Production, new construction
- Repair
- Application of DINITROL 516 A/B
  in the plant: using a robot or manually with a machine
  for repairs: manually with a machine or by hand application
- Long processing time with strength in time, defined
- Solvent-free, not dependent on humidity
- Shorter cycle times in new construction, shorter drive-away times
  after repair < 6h



FRONT MASK AND SIDE WALL PANEL

- Thick-layer bonding of front mask and panels to vehicle body
- Production, new construction
- Removal, repair
- Application of DINITROL 516 A/B
  in the plant: using a robot or manually with a machine
  for repairs: manually with a machine or by hand application
- No stress cracks in the components thanks to elastic thick-layer bonding
- Long processing time with strength in time, defined
- Solvent-free, independent of humidity
- Shorter cycle times in new construction, shorter drive-away times after
  development or repair

THIN-LAYER AND SURFACE BONDING

- Attachments, brackets, strips, commercial vehicles
- Transfer of greater forces possible through thin-layer bonding
- Utilisation of larger surfaces thanks to 2K curing, thus ensuring
  a fast curing time
- Application of DINITROL 516 A/B
  in the plant: using a robot or manually with a machine
  for repairs: manually with a machine or by hand application
- Reduced idle time and faster drive-away time
- Energy saving, fast drying
- Solvent-free, independent of humidity

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