WHITE PAPER
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DINITROL COMPACT PUSH DISPENSER

CHALLENGES OF APPLYING HIGH VISCOSITY 2K ADHESIVES WITH A PUSH 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 describes the challenges and problem solutions in the development of the DINITROL 2K COMPACT PUSH DISPENSER.

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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 hand 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).

ADHESIVE 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, there was really only one system to consider. They automatically become dependent on the supply chain with regard to the availability of such systems.

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 two 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 adhesives 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.

Components of the DINITROL COMPACT PUSH DISPENSER

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 bag 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 gluing machines.

After inserting the foilwraps into the aluminium cartridge (Figures 2 and 3), the manifold 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: Foilwrap 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 bag foil. 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 tips 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 foilwrasps 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.

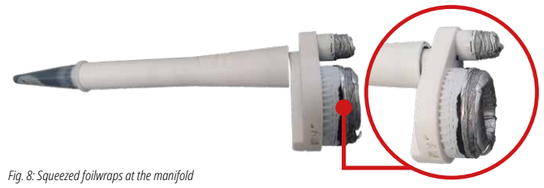


Fig. 8: Squeezed foilwraps at the manifold

04. SUMMARY AND ADVANTAGES

In summary, it can be said that all challenges were solved well or led to a feasible compromise. 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.

BENEFITS OF THE NEW SYSTEM

- **Very powerful, compact battery gun with relatively low weight**
  Approx. 4.39 kg
- **Improved mixing**
  Full adhesive properties such as open time and increase in strength
- **More capacity - Fewer change processes**
  638 ml now, 490 ml previously
- **Increased shelf life**
  From 9 months to 12–18 months (depending on the adhesive)
- **No packaging as a set**
  Fewer unnused components are thrown away
- **Less waste compared to cartridges**
  The foilwrap is completely squeezed out and therefore more environmentally friendly
- **Fewer accessories requireD**
  Retaining ring and cartridge are no longer required
- **High discharge rate**
  Approx. 300 ml/min at RT up to 600 ml/min at 30–35°C material temperature
  Triangular nozzle: Base 7 mm, height 11 mm ► 6.5 m length with one set,
  ► 3 m length/minute, 1 m in 20 s
- **Short charging time (approx. 20 minutes)**
  20 V battery, approx. 17 sets with one battery charge

05. ADHESIVES SUITABLE FOR PROCESSING

DINITROL 516 A/B

2-component system

The 2-component system DINITROL 516 A/B is used together with the corresponding pretreatment agents for bonding in vehicle construction and for industrial bonding in railway and bus construction.

- **Long open time, approx. 35 minutes**
- **Bonding with large geometries/large material usage**
- **No CO_2 blisters = no voids**
- **Bonding and sealing possible in one operation**
- **Adhesive characteristics are communicated, OEM approved**
- **Fast curing and strength build-up, independent of humidity**
- **Cycle time reduction (travelling times, shifting times, etc.)**
- **Reliable bonding in time**

Technical Details

Applications
The A component, DINITROL 516 A, is an polyurethane adhesive which, even without accelerator paste, cures due to the humidity to an elastomer with the well-known good adhesive and mechanical properties. The reactive accelerator paste DINITROL 516 B was developed in order to achieve curing regardless of the ambient humidity and the bond geometry. Both products are matching to each other. The use of the B component enables the components to be handled in an early stage. An particular advantage of this 2C system is: when the 2C adhesive hardens, no CO2 is produced. Bubble-free gluing and jointing is therefore possible, even in one operation.

Method of Use
It is applied using commercially available mixing systems. DINITROL 516 A is conveyed out of hobbocks, DINITROL 516 B is brought out of 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 is processed from a side by side cartridge (100: 10) with the required dispenser (DINITROL Cartridge Tool 2 C 20V Cordless).
The application takes place at room temperature. The surfaces to be bonded must be cleaned and pretreated according to our recommendations. The use of this product is suitable only for experienced users. Pre-tests are recommended for special applications.

Technical Data

DINITROL 516 A	reactive polyurethane
Appearance	black paste
Density	1.2 g/cm³
DINITROL 516 B	Accelerating paste
Appearance	white paste
Density	approx. 1.45 g/cm³
Density at 20°C	approx. 1.22 g/cm³
Mixing ratio	100 : 6 till 100 : 10 (516A : 516B) (V/V)
DINITROL 516 A / DINITROL 516 B	
Standing properties	very good
Open Time (the 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
Application temperature	15°C – 35°C
Shore A hardness (DIN 53505)	approx. 55
Tensile strength (DIN 53504)	> 7 MPa
Elongation at break (DIN 53504)	> 400%
Tear strength (DIN 53515)	approx. 10 N/mm
Lap-shear-strength (DIN EN 1465)	> 5 MPa
Tensile shear strength (DIN EN 1465) after 6 hours	> 1.3 MPa
Shear modulus (DIN 54451)	approx. 1.3 MPa
Volume resistivity (DIN 60093)	approx. 10⁶ Ωcm
Glas transition temperature	approx. - 50°C
Termperature resistants long-term short-term (approx. 1 h)	 < 90°C < 130°C
Shelf life (storage below 20°C)	Hobbock 12 months (A-Comp.), 15 months (B-Comp.) 9 Monate (Side-by-side Cartridge (A/B-Comp)
Available in	50 L & 25 L Hobbock (A-Comp.), 25 L Hobbock (B-Comp.), 490 ml Side-by-side Cartridge (A/B-Comp), 1 L PE Cartridges (B-Comp.)

At 23°C / 50% rf

Repair
If repairs are necessary, the old polyurethane bead is cut down to 1 up to 2 mm after the element has been removed (as soon as possible before re-gluing). The re-gluing should be carried out within 6 hours. The cut down old bead is reactivated beforehand with DINITROL 540 reactivator and a lint-free paper towel or applicator foam, and the new adhesive is applied to the flashed old bead within 10 minutes. A reactivation can be repeated.

Further information
The following documents are available on request:
- Safety data sheet
- DINOL pre-treatment chart
- Operation manual for DINITROL Cartridge Tool 2 C 20V Cordless + User video

Storage / Transport
Store between 0 and 35°C, in closed packaging. During transport these temperatures can be exceeded or fallen shortly below (2 – 4 days). In this case, the material must be acclimatized before application at room temperature. For barrels, hobbocks, foil wraps and cartridges on pallets, this takes 1 to 2 days. 3 up to 4 hours are required for single cartridges or foil wraps.

Comp. A - Hazards identification
2.1. Classification of the substance or mixture
GB CLP Regulation
Resp. Sens. 1; H334

Comp. B - Hazards identification
2.1. Classification of the substance or mixture
GB CLP Regulation
This mixture is not classified as hazardous in accordance with GB CLP Regulation.

For all relevant safety advices please read the material safety data sheet or the packaging label.

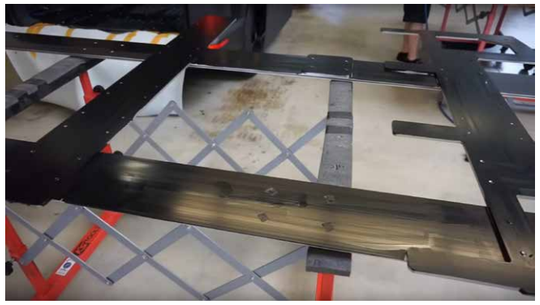
APPLICATION EXAMPLES

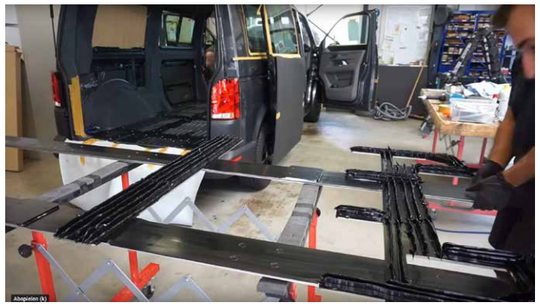
Attachment parts - Rail bonding

Challenges/requirements
- Long open time, approx. 35 minutes
- Time saving: Bonding and sealing possible in one step
- Fast curing and strength build-up = driving operation after 6h

Customer benefits
- Secure bonding in time
- Fast curing and strength build-up, independent of humidity
- Cycle time reduction (travel times, transfer times, etc.)
- Bondings with large geometries/large material consumption
- No CO_2 bubbles = No defects
- OEM approved

Solution: DINITROL 516 A/B
2-component system, which is used together with the appropriate pre-treatment agents for bonding in vehicle construction





Container construction

DINITROL 771 A IQ LOT/515 B

MS Polymer

DINITROL 771 A IQ LOT / 515 B is an accelerated adhesive based on MS polymer with long open time and accelerator component, which was specially developed for semi-structural bonds and seals. Further properties are:

- **Long open time < 30 min.**
- **Free of solvents, isocyanates and PVC → No hazards symbols**
- **Very good UV and aging resistance**
- **No formation of CO_2 → No formation of bubbles**
- **Very wide range of adhesion, often without adhesion promoter**
- **Permanently elastic between -40°C to + 120°C**
- **Can be painted over after skin formation (wet on wet) with the usual paint systems (preliminiary tests are essential)**

Technical Details

Product description
DINITROL 771 A IQ LOT / 515 B is an accelerated adhesive based on MS polymer with long open time and accelerator component, which was specially developed for semi-structural bonds and seals. Further properties are:

Areas of Applications
- Elastic bonding and sealing in buses, trains, caravans, motor homes and trucks
- All semi-structural bonding

Method of Use
DINITROL 771 A IQ LOT / 515 B is applied with the usual 2 C dispensers and 2 C pump systems at temperatures between + 15°C and 35°C. For sealing applications, DINITROL 771 A IQ LOT / 515 B should be removed within 20 minutes (at 23°C / 50% r.h.) and, if necessary, smoothed with a soap solution. Join the parts to be joined within the open time (<30 min at room temperature), higher temperatures reduce the open time.

The surfaces to be bonded must be clean, dry and free of dust and grease. In many cases, pretreatment with an adhesion promoter is not necessary, like aluminum, steel, glass, painted wood, etc., we recommend carrying out preliminary tests.

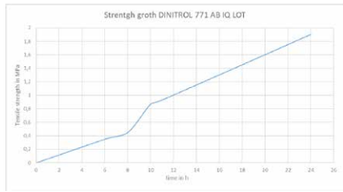
Storage
DINITROL 771 A IQ LOT: may be stored for 12 months in a closed (unopened) container or bag in a dry place at temperatures between + 5°C and + 25°C (cartridges 18 months). DINITROL 515 B: may be stored for 12 months in a closed (unopened) container or bag in a dry place at temperatures between + 5°C and + 25°C.

Safety precautions
No specific safety precautions required. Consult safety data sheet.

Technical Data

Colour		white, black
Base		MS polymer
Curing method		Moisture
Density A component Density B component		approx. 1.4 g/ml approx. 1.51 g/ml
Mixing ratio (volume/volume)		100:7 – 100:10
Tensile strength after 12 h (23°C, 50% r. h.)		approx. 1 MPa (MR 100:10)
Skin formation time (23°C/50% r. h.)		approx. 20 min.
Open time (23°C/50% R.H.)		< 30 min.
Shore A hardness (DIN 53505)		approx. 60
Volume change (DIN 52451)		< 3%
Green strength (Physica Rheometer MC100) (Tauy)		> 80 Pa
Tensile stress (100%) (DIN 53504/ISO 37)		approx. 1,7 MPa
Tensile stress at break (DIN 53504/ISO 37)		approx. 2.8 MPa
Elongation at break (DIN 53504/ISO 37)		approx. 210%
Lap shear stress (DIN 53283/ASTM D1002) (Alu-Alu; adh. thickness 2 mm, test speed 50 mm/min.)		approx. 2.5 MPa
Tear propagation (DIN 53515/ISO 34) (Typ C, test speed 500 mm/min.)		approx. 14 N/mm
E-Modulus (10%) (DIN 53504/ISO 37)		approx. 4.5 MPa
Solvent percentage		0%
Isocyanate percentage		0%
Temperature resistance		- 40°C to + 120°C
Temperature resistance	(max. 20 minutes)	+ 180°C
Application temperature		+5°C to +35°C
UV and weather resistance		Excellent
Available in		490 ml side by side cartridges, 28 kg hobbock

At 23°C / 50% r.h



Comp. A - Hazards identification
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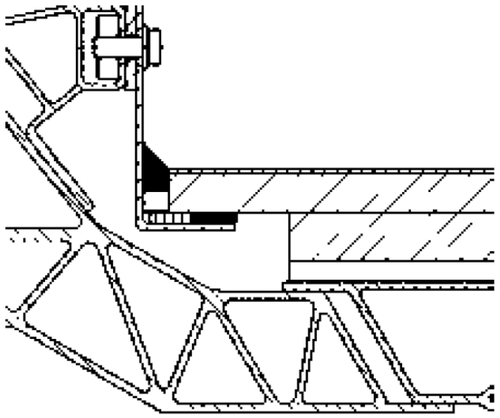
Comp. B - Hazards identification
2.1. Classification of the substance or mixture
This mixture is not classified as hazardous in accordance with GB CLP Regulation.

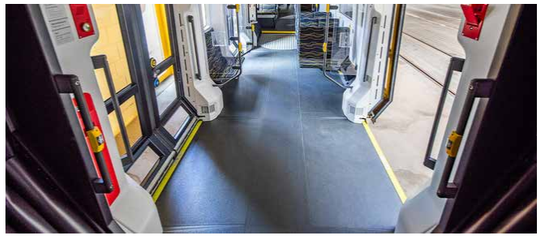
For all relevant safety advices please read the material safety data sheet or the packaging label.

APPLICATION EXAMPLES

Flooring bonding

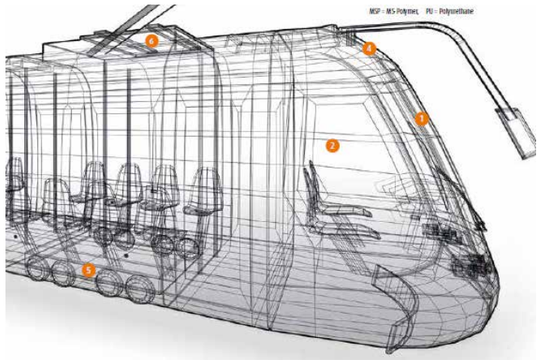
- Thick-layer bonding of floor panels
- Production, new construction, repair
- Repair
- Application of DINITROL 771 A IQ LOT/515 B, by robot or manually with machine in the plant, manually for repair with machine or manual application
- Compensation of unevenness/bodyshell tolerances
- Fast-drying thanks to 2K technology
- Long processing time with strength in time, defined
- Solvent and isocyanate-free, more temperature-independent
- Shorter cycle times in new construction





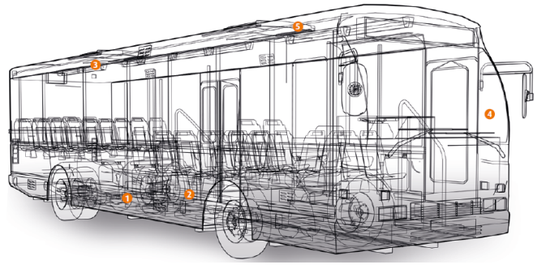
Direct glazing

- Thick-layer bonding of windows to the vehicle body
- Production, new construction
- Repair
- Application of DINITROL 771 A IQ LOT/515 B, by robot or manually with machine in the plant, manually for repair with machine or manual application
- Long processing time with strength in time, defined
- Solvent and isocyanate-free, more temperature-independent
- Shorter cycle times in new construction, shorter drive-away times after repair



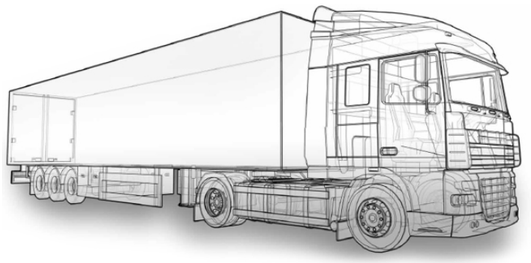
Front mask and side wall panel

- Thick-layer bonding of front mask and panels to vehicle body
- Production, new construction
- Repair
- Application of DINITROL 771 A IQ LOT/515 B, by robot or manually with machine in the plant, manually for repair with machine or manual application
- No stress cracks in the components thanks to elastic thick-layer bonding
- Long processing time with strength in time, defined
- Attachment of parts significantly shortened
- Solvent and isocyanate-free, more temperature-independent
- Shorter cycle times in new construction, shorter drive-away times after repair



Thin-layer and surface bonding

- Fixtures, 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 771 A IQ LOT/515 B, using a machine or cartridge
- Reduced idle time and faster drive-away time
- Energy saving, fast drying, more temperature-independent, solvent and isocyanate free
- Reduced emissions



QUESTIONS?

GET ADVICE FROM OUR EXPERTS NOW

We don't just have the best product for your requirements, but also competent contact persons for you – direct and in person.

For advice, please send an e-mail to **info@dinol.com.**

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