

Use of Refillable Cartridge Systems for 1C and 2C Applications

In the production of individual parts and small quantities or in flexible manufacturing processes, the application of 1-component (1C) and 2-component (2C) adhesives continues to be carried out using a cartridge – for economic reasons, among others. But is this still in keeping with the times? And how can the associated ecological disadvantage be compensated?

Nowadays, numerous adhesive applications are automated. Short cycle times, a high degree of application accuracy and speed, but above all very high levels of reproducibility are just some examples of the advantages.

However, a basic prerequisite here is that the production process is suitable for jus-

tifying the high investment sums incurred with automation. Many manufacturers – such as those operating in special vehicle construction, buses, rail vehicles, trailers, semi-trailers, mobile homes, etc. – face other challenges, such as:

- personalised and customised products,
- single unit production (stand-alone production),
- low unit quantities,
- flexible manufacturing processes.

We are clearly referring here to manual workstations for adhesive application with higher consumption quantities. But that is just the first step. Selecting the system



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Figure 1 > Used 2C cartridges with static mixer

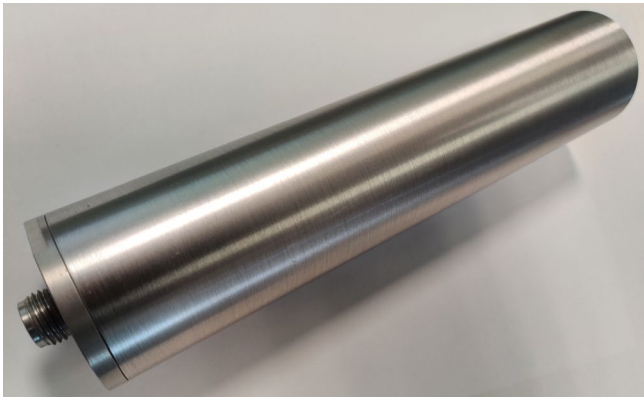


Figure 2 > Refillable cartridge

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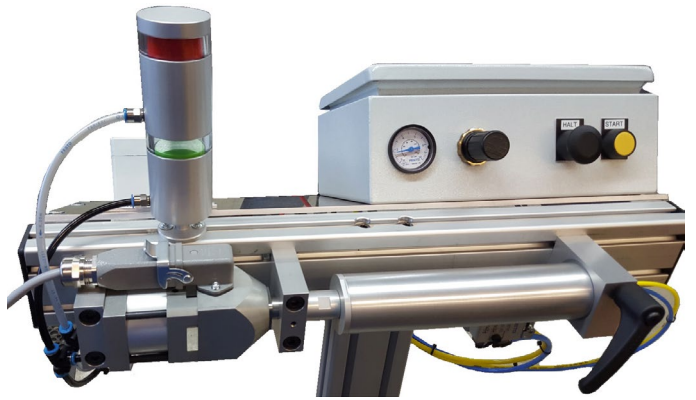


Figure 3 > Cartridge filling station

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concept is much more difficult, and becomes even more complex depending on the choice of adhesive, whether this is 1C, 2C or 1C + booster, or even heated. There are currently only two basic processes to choose from:

1. manual 1C or 2C system (fixed or mobile),
2. using cartridges.

These types of 1C, 2C or 1C + booster manual systems require a not insignificant investment, which some companies prefer to avoid – in particular when they are just introducing a new product. This often results in the decision to use adhesives from the cartridge. This decision is understandable on a short-term basis, but it also has far-reaching consequences in the long term. Firstly, it is quickly apparent that the production area is becoming cluttered with boxes of used cartridges piling up (Figure 1).

However, this is just one upshot of this decision. The following points must also be taken into consideration:

- Cartridge goods are generally more expensive than goods supplied in drums (high daily consequential costs).
- Extensive space is required for the boxes delivered.
- Space is wasted on site due to used cartridges.
- The amount of waste generated by empty cartridges is ecologically questionable, as the empty cartridges have to be disposed of. At the same time, costs are incurred for their disposal as hazardous waste.
- The processing speed is not always satisfactory because the cartridges are either made of plastic or very thin-walled aluminum tubing, which means that high squeezing forces cannot be

achieved. This has a significant effect on the cycle time.

- the case of heated systems, so-called preheating boxes are required in order to bring the cartridge up to processing temperature.

However, the processing of adhesives and sealants from cartridges does have advantages that should not be ignored, such as:

- no complex technology,
- low new investment costs,
- no requirement for rigid material hoses on the application valve, which restrict freedom of movement,

- only one compressed air hose to the cartridge gun,
- maximum flexibility.

An alternative technology is described in the following, which compensates for the ecological and economic disadvantages that arise in the majority of cases with a standard cartridge.

Technology for the use of refillable cartridges

An alternative technology is described in the following, which compensates for the



Figure 4 > Pumping stations for the individual containers

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ecological and economic disadvantages that arise in the majority of cases with a standard cartridge.

● **1C systems**

This type of refillable cartridge is universally applicable with all common 1C adhesives and sealants, and is produced from a suitable material. These cartridges are preferably manufactured from aluminium for weight reasons, although they could also be made of stainless steel if the material requires it. The external dimensions correspond to the standard 1C cartridges and can therefore be processed using standard cartridge guns (Figure 2).

It is now only necessary to install a standardised pump station to pump the material from the delivery container, which can be a 20, 30, 50 or 200 L system depending on the planned material requirement. Finally, a cartridge filling station is needed (Figure 3). Usually, at least two refillable cartridges are used so that one can be filled at a time while the other is in use.

A further advantage of such a technique is particularly apparent with very high



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Figure 5 > Pneumatically-operated cartridge gun

viscosity adhesives and sealants. In the case of these adhesives, which are gen-

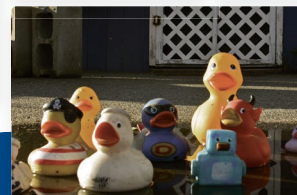
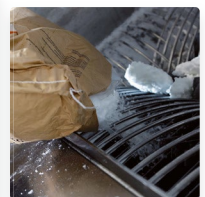
erally supplied in aluminium cartridges, the cartridge is usually heated to bring

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* Acetyl tributyl citrate, Tributyl citrate, Diethyl hexyl adipate (DEHA/DOA), Triacetin, epoxidized Soybean oil (ESBO), Diisononyl phthalate (DINP), Triethyl citrate



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Figure 6 > 2C cartridge unit

the material up to processing temperature, which makes it necessary to invest in a cartridge pre-heating box. If a corresponding cartridge filling unit is used, the material is filled directly at operating temperature.

However, it has to be pointed out a major disadvantage with the standard cartridges used for heated systems. As previously mentioned, such adhesives and sealants are highly viscous and it is necessary to set relatively high processing temperatures in order to achieve a reasonable processing speed. However, it is not uncommon for this to be just below the reaction temperature. But if an attempt is made to increase the processing speed by using cartridge guns with higher ratios, this often comes with a risk of the delivery cartridges bursting and causing contamination, and therefore resulting in a cartridge gun failure. The significantly thicker-walled, refillable cartridges also allow

discharge with higher-ratio, pneumatically operated cartridge guns.

● **2C systems or 1C PU + booster**

As with the single component systems, most adhesives permit use in 2C or 1C PU + booster systems with refillable cartridges. A suitable pumping station is required for both components, depending on the mixing ratio (Figure 4). These will ideally already be on site for the direct manual or automated application, whereby they could also operate the filling stations. Based on the same functional principle as the 1C systems, a filling station and a suitable pneumatically-operated 2C cartridge gun (Figure 5) are now also required. With such a concept, the complete 2C cartridge unit is changed from the pneumatically-operated cartridge guns (Figure 6 and Figure 7).

It is important that both cartridge parts are separate from each other, so that both

chambers can be filled separately. Only in this way is it possible to avoid an unwanted reaction of both components.

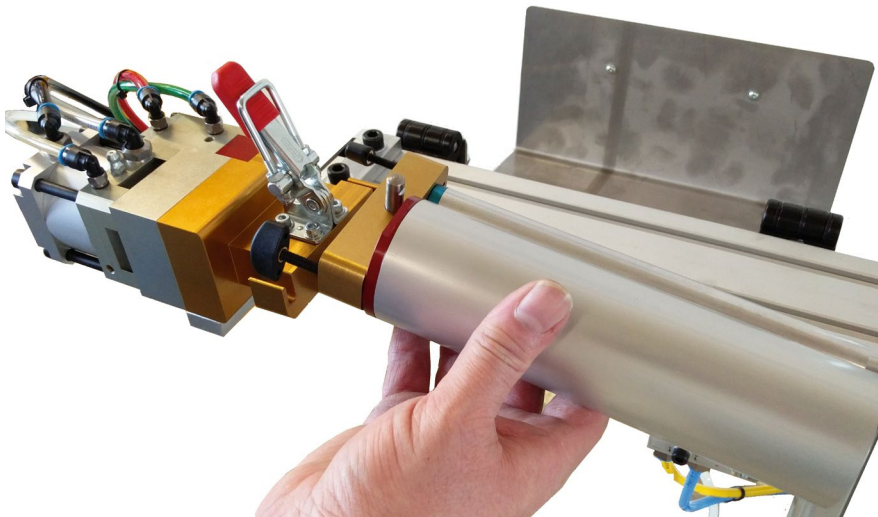
Conclusions

With many applications, the use of such technologies can be the right step through which to reconcile economic and ecological aspects.

In many applications, the use of the presented technologies can be the right step to reconcile economic and ecological aspects. In summary, the following advantages can be mentioned:

- use of a proven technology through the application of cartridge systems,
- easy to use,
- straightforward technology,
- manageable investment,
- more economical purchase of materials,
- less complex logistics,
- significant reduction of special waste (adhesives, plastic cartridges and static mixers) and disposal costs,
- space saved at the workplace (no need to store full and used cartridges).

With 2C systems, the static mixers can be used multiple times (within the open time), because it is only the cartridge unit that is changed. //



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Figure 7 > Changing the cartridge unit in the filling station

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