EVONIK INDUSTRIES

Semi-bulk packaging for fine-particle SIPERNAT® products

Technical Information 1321

Evonik. Power to create.

The packaging and emptying methods described here currently only apply to products that have been produced and filled by Evonik at the Wesseling plant.

SIPERNAT® in **F**lexible **I**ntermediate **B**ulk **C**ontainers (FIBC) is a packaging option that closes the gap between the traditional SIPERNAT® packaging, the 10 kg paper bag, and SIPERNAT® as loose bulk material in silo trucks (see **Figure 1**). The fine-particle SIPERNAT® grades are a special range of the SIPERNAT® products offered in FIBCs, which will be described in this TI.

A two-cubic-meter flexible container is used. The FIBC has a central filling spout on top and a central discharge spout on the bottom. It has four lifting loops sewn into the top corners that are used to suspend the FIBC while it is being emptied. When the FIBC is suspended in this way, the discharge spout in the bottom hangs freely and allows SIPERNAT® to be emptied.

A specially developed FIBC is used to take account of the bulk properties of fine-particle SIPERNAT® products, so the packaging costs are more expensive than for bagged goods. Depending on the means of transport used and the SIPERNAT® grade, the capacity utilization of the means of transport may differ.

A special emptying tool was developed to ensure that the FIBC can be emptied easily and with as little dust as possible. This **P**owder **E**mptying **Sy**stem (PESy) can be connected in a dust-proof way while the FIBC is still closed and allows the product to be emptied once the FIBC is opened.

Figure 1 FIBC with SIPERNAT®

For this purpose, the PESy is connected to a double diaphragm pump operated with compressed air, a pneumatic suction conveyer, or another device that generates a vacuum (e. g. Ystral Conti TDS). The fluidization of the content of the FIBC enabled by the PESy ensures that the container is emptied completely with very little manual assistance.

The PESy offers the following benefits:
Dust-free discharge
Little manual work
(compared to bagged product)
Faster discharge
(in relation to the quantity of SIPERNAT®)
Low investment costs
(Evonik provides the PESy free of charge)
Safety due to the FIBCs ability to conduct static electricity
Low risk of contamination
(when bags are cut open, shreds of paper may contaminate the contents)

The FIBC

The FIBC is made from polypropylene flat yarn mesh with an additional liner that prevents dust emissions. The individual lengths of fabric are sewn with special sealing materials in such a way that the seams are also dust-proof.

When SIPERNAT® is handled, rather high electrostatic charges can occur (see Fine Particles bulletin series No. 62 "Synthetic silicas and electrostatic charges"). Therefore the FIBC is made from a special electrostatic conductive material ($R_A \leq 10^8\ \Omega$), which meets the requirements for FIBC Type C.

The electrostatic conductivity of the FIBC is important to prevent dangerous sparking (e. g., near solvents or other flammable media) and to protect the persons handling the product.

The FIBC is completely conductive, which means that it has to be grounded while it is being emptied. When this is done, the FIBC can no longer charge. Consequently, the FIBC may also be used in explosion zone 1[1], an area where dangerous explosive gas atmospheres occur occasionally (e. g., close to containers with content like Zone 0). The FIBC may also be used in ex-zone 2[1], an area where dangerous explosive dust atmospheres occur occasionally. Non-conductive containers this size may not be used in these zones[1].

[1] According to the explosion guidelines of BG Chemie, Germany

However, the FIBC may not be used in ex-zone 0[1], an area where dangerous explosive gas at-mospheres exist constantly, or for long periods (predominantly). For example, inside containers containing flammable liquids with a flash point below their processing temperature).

The dimensions of the containers are customized to the respective means of transport. The FIBCs used in Europe and intended for overseas export are suitable for transport in ISO shipping containers, thus ensuring that the capacity of the available means of transport is well utilized. The standard here is the 2 m^3 FIBC (see **Figure 2**).

Figure 2
2 m^3 – FIBC containing SIPERNAT®

The dimensions of the FIBC are 1050 mm x 1050 mm x 2000 mm; **Table 1** contains the filling volumes. Because of the technology, the dimensions of the filled and palletized FIBC may differ from the stated production dimensions of the packaging. We will be happy to provide the respective detailed dimensions on request.

The discharge device

A discharge device, the PESy (Powder Emptying System) was developed for simple, dust-free emptying of the FIBC (See **Figure 3**).

Figure 3
PESy (**P**owder **E**mptying **Sy**stem) US-Patent 5 746 347, EP-Patent 0 761 566

The PESy allows the closed FIBC to be connected to a flexible conveying line with no dust and to be opened only when the dust-free connection has been made. It is also possible to fluidize the SIPERNAT® in the FIBC when the PESy is inserted into the open FIBC. Compressed air or an inert gas can be used for this purpose–in both cases the customer's specific dew point requirements must be considered. Fluidization improves the flow of the SIPERNAT® significantly and it is then an easy matter to empty the product from the FIBC. If, in exceptional cases, bridges form, they can be broken down with very little mechanical agitation.

To empty the FIBC, connect the PESy to a conveying system that generates a slight vacuum so that the SIPERNAT® is sucked out of the FIBC. The system can be, for example, double diaphragm pumps operating with compressed air, a pneumatic suction conveyor, or a self-priming processing device, such as the Ystral Conti TDS.

Evonik provides customers with the PESy to use with SIPERNAT® at no cost. The customer must provide the other equipment to empty the FIBCs with the PESy (e. g., cross-beam, crane, safety frame, controller for the fluidization rate, conveyor line, conveying machine). On request, Evonik will provide the PESy and also a safety frame with a controller to adjust the fluidization rate to purchase.

[1] According to the explosion guidelines of BG Chemie, Germany

Emptying

To empty the FIBC, lift it by the four loops on the top corners using a lifting yoke with safety hooks (see **Figure 4**). This is necessary so that the four loops on the corners of the FIBC are raised vertically. If the loops were to be pulled together towards the middle, this would make emptying the FIBC much more difficult. For safety reasons the raised FIBC should be positioned over a frame. In many countries – such as Germany – standing beneath a suspended load is prohibited. This frame is necessary, because someone must go under the FIBC to connect and open it (see **Figure 5**).

Ultimately, it is the operator's responsibility to find out about local safety regulations and to take the necessary measures.

When the FIBC is positioned above the frame – the FIBC must not sit on the safety frame – (see **Figure 6**) it has to be grounded (see **Figure 7**), otherwise, as mentioned above, quite high electrostatic charges can occur. When this has been done, the PESy can be connected.

Figure 4
Lifting yoke with safety hooks

Figure 5
Safety frame to empty FIBC

Figure 6
FIBC before emptying

Figure 7
Grounding the

The discharge spout is fixed with two Velcro® fasteners. The Velcro® fastener directly on the base closes the FIBC discharge spout. The second Velcro® fastener is used to bind the spout together into a "gooseneck." To insert the PESy into the spout, first open the outer Velcro® fastener holding the gooseneck and pull the spout straight (see **Figure 8**).

Now open the Velcro® fastener wide enough so that the cross section of the spout is open. Insert the PESy into the spout as far as possible with the movable carriage of the PESy in its front position (see **Figure 9**).

Figure 8
Opening the gooseneck

Figure 9
Inserting the PESy into the discharge spout

Now tighten the Velcro® fastener tightly so that it sits in the groove on the carriage, holds the PESy in the spout, and seals the spout against the PESy (see **Figure 10**).

Figure 10
Fixing the PESy to the discharge spout of the FIBC

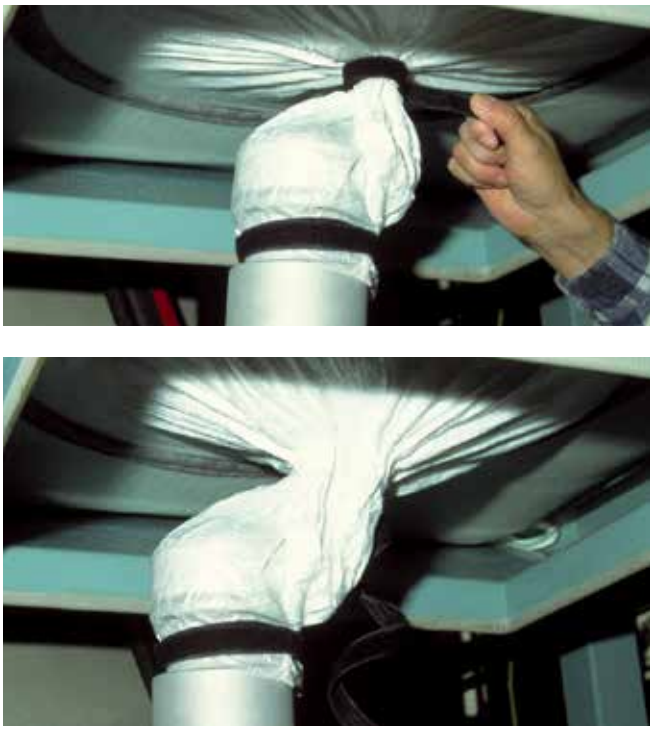


Figure 11
Opening the discharge spout

The PESy connected to the flexible conveying hose is now a sealed connection to the FIBC. Now open the top Velcro® fastener that closes the FIBC. Pull the spout straight, which opens the spout (see **Figure 11**). This allows the PESy to be inserted into the FIBC through the carriage fixed to the FIBC. To do this, loosen the screw on the carriage and slide the inside tube of the PESy upward. Tighten the screw on the carriage again in the end position (see **Figure 12**).

Figure 12
Inserting the PESy into the FIBC

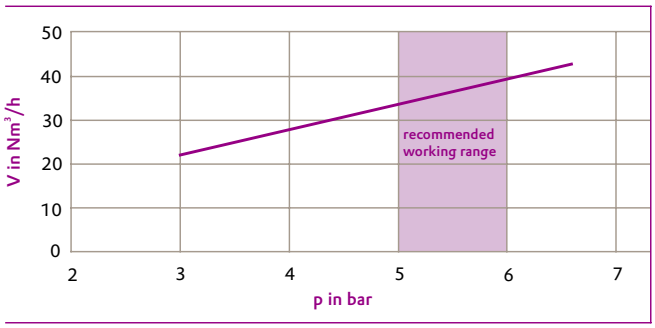
The head of the PESy is now positioned directly above the base of the FIBC and the fluidization gas is able to loosen up the SIPERNAT®. If the PESy is not pushed upward, the fluidization cannot work effectively.

Open the valve to blow in the fluidization gas and switch on the conveying system. The rate of fluidization is adjusted via a controller with a clock generator that allows pulse and pause times of between 0.1 and 30 seconds to be set. Hence the fluidization gas is fed in so that the pulses achieve optimum fluidization (see **Figure 13**). A guiding value is a pulse time (valve open) of 0.5–1.0 seconds and a pause time (valve closed) of 5–10 seconds. However, the exact pulse and pause times must be adjusted individually on start-up. The aim is to adjust the fluidization so that the SIPERNAT® is loosened up as little as possible but, at the same time, so that the FIBC is emptied as quickly and safely as possible.

For safety reasons, continuous fluidization with no product flow should not exceed 2 minutes. If this time is exceeded, it can cause leaks in the FIBC.

The diagram in **Figure 14** shows the volumetric air flow during PESy fluidization in relation to the set air pressure. The volumetric air flows must be calculated to determine the required compressed air capacities with the respective pulse-pause time ratio.

Figure 14
Volumetric air flow during PESy fluidization



This means that 39 Nm³/h of air at 6 bar is to be provided during the fluidization pulse. However, for example with fluidization of 1 second pulse and 9 seconds pause, the resulting air consumption is just 3.9 Nm³/h. To actually provide this air volume on the PESy during the short pulse, the solenoid valve and the feed hose must not be too small. An inner diameter of 12 mm has proven to be suitable. The distance between the solenoid valve and the PESy should also not exceed 5 meters.

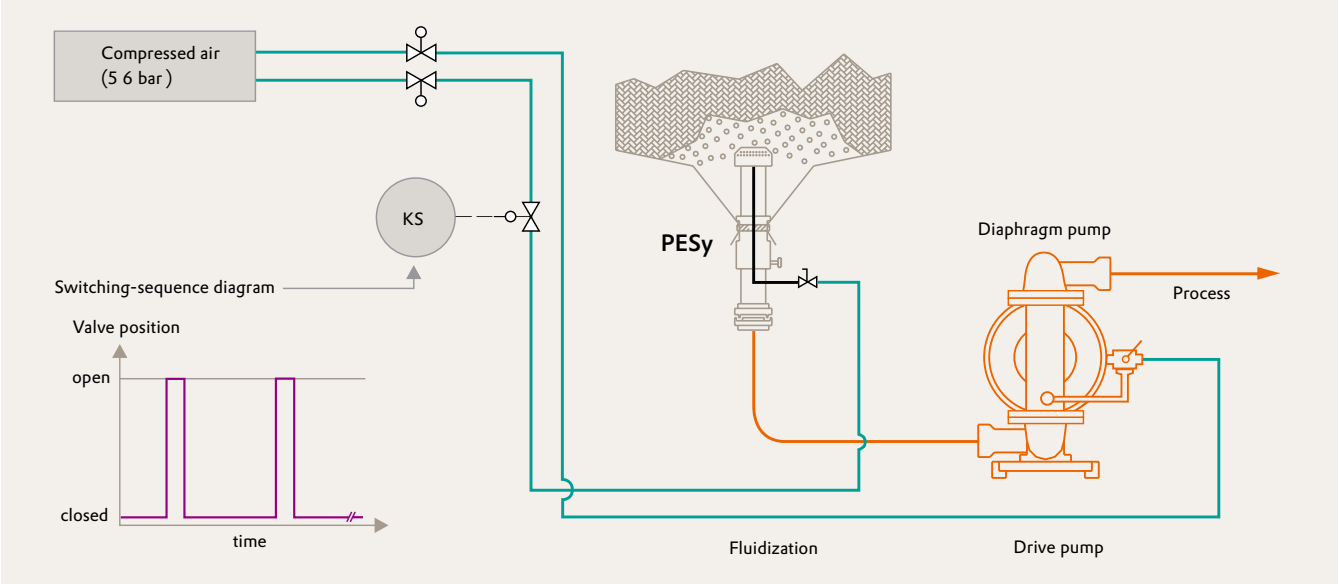


Figure 13
Position of the PESy during emptying with pulsing fluidization

Now empty the SIPERNAT® from the FIBC. This is done usually without the need for any mechanical support (see **Figure 15**). However, at the start and end of the emptying process a little mechanical agitation may be necessary to support the process.

Figure 15
FIBC during emptying

Figure 16
FIBC towards the end of the emptying process

If, however, bridges should form during emptying, you can easily break these up by lowering the FIBC on to the safety frame briefly so that the side walls bulge out. When you have done this, raise the FIBS again to allow the base to take a slight cone shape (see **Figure 16**).

An alternative to this is brief (max. 2 minutes) continuous fluidization of the FIBC with the flow interrupted. This slight overpressure also causes the side walls to expand outward, thus causing the product bridges to collapse. However, experience has shown that this is necessary only in exceptional cases.

When the FIBC is empty, pull the PESy downward so that the spout is also largely emptied. To do this, loosen the screw on the carriage and pull the inside tube of the PESy out (see **Figure 17**).

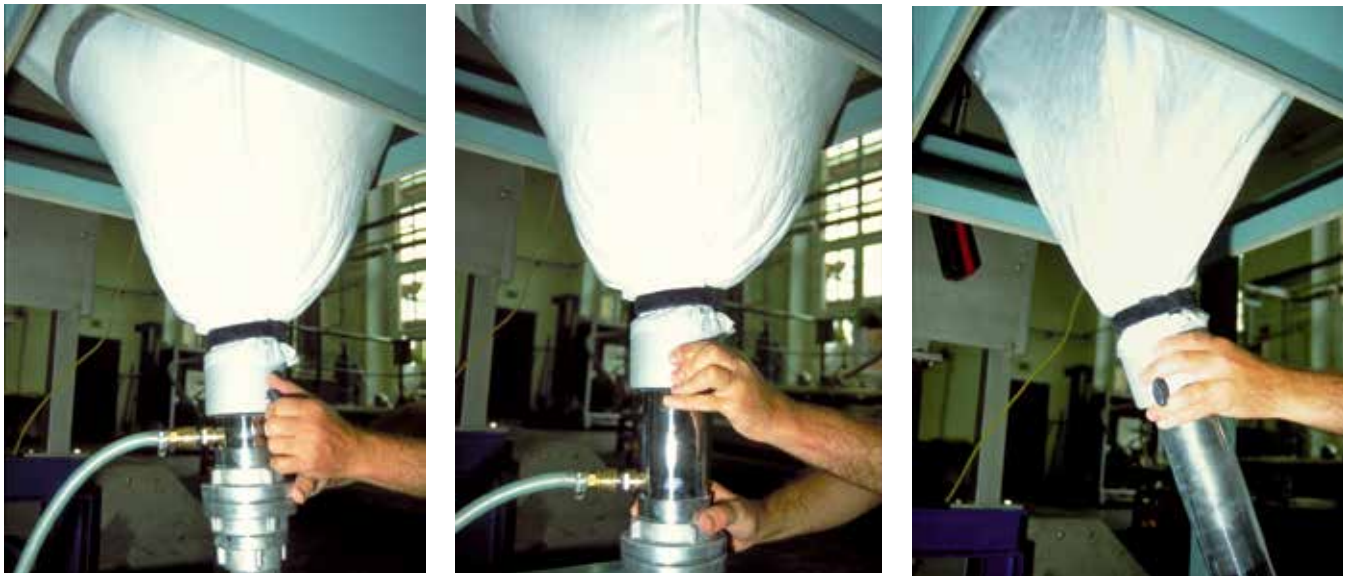


Figure 17
Withdrawing the PESy at the end of the emptying process

Now stop fluidization. While the conveying system remains switched on for a moment the FIBC is drawn together. When this has happened sufficiently, switch off the conveying system and close the FIBC again with the top Velcro® fastening (see **Figure 18**).

Figure 18
Closing the discharge spout

You can now loosen the bottom Velcro® fastening and completely remove the PESy from the spout (see **Figure 19**). Now tighten the bottom Velcro® fastening and use it to form a gooseneck that closes the FIBC in a dust-proof manner (see **Figure 20**).

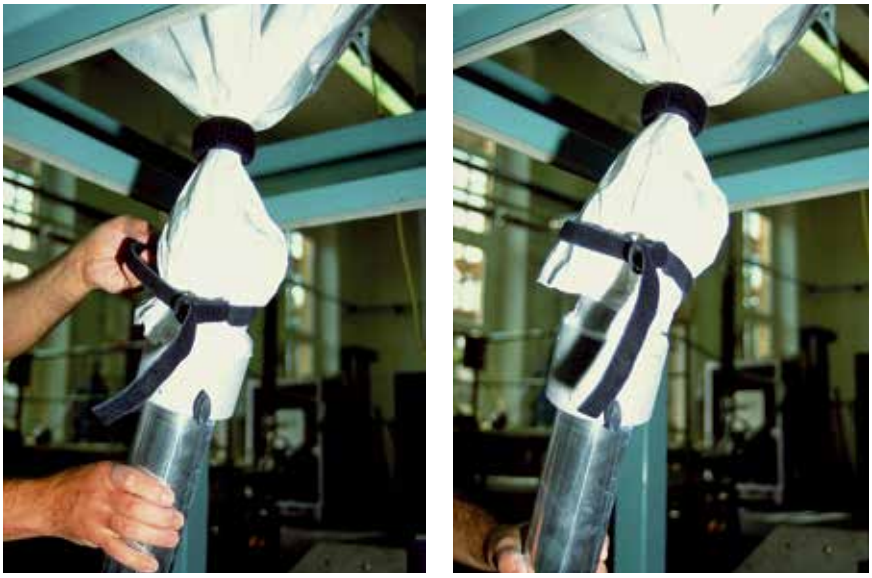


Figure 19
Removing the PESy from the discharge spout

Figure 20
Tying the gooseneck for dust-proof closure of the FIBC after it has been emptied

When you have done this, lower the FIBC and remove it from the lifting device (see **Figure 21**). Emptying is now complete.

Figure 21
Removing the empty FIBC from the lifting device

For quality reasons FIBCs are offered only as disposable containers. In Germany, the empty FIBCs can be disposed of via our partner at RIGK. Please contact our sales/customer service if you have any questions in this regard.

Tests in a pilot plant and at customers' premises have shown emptying times (pure conveying times to empty a 2 m^3 FIBC) of between 15 and 45 minutes, depending on the conveying system. If a self-priming processing machine, such as the Ystral Conti TDS, is used, remember that the suction capacity decreases as the viscosity increases, which increases the emptying time. Emptying times of between 45 and 90 minutes have been observed in these cases.

Safety information:
The FIBC must be grounded during filling and emptying (Type C).

The safe working load (SWL) is 500 kg (SF5).

Figures 22, **23**, and **24** illustrate some variations for using various conveying systems together with the SIPERNAT® FIBC and the PESy.

Figure 22
Emptying a FIBC with a double diaphragm pump operated with compressed air

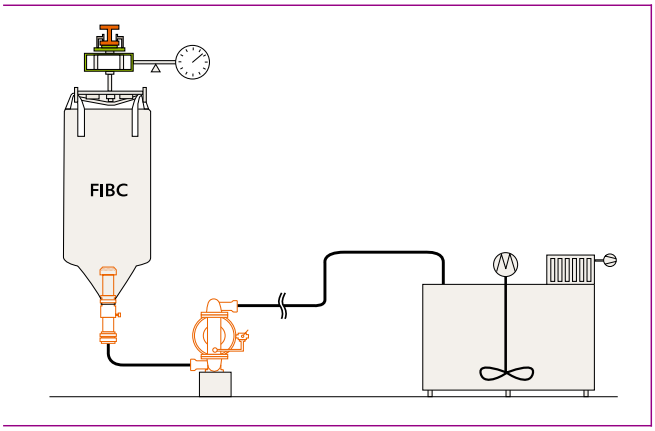


Figure 23
Emptying a FIBC with a pneumaticsuction conveyor system

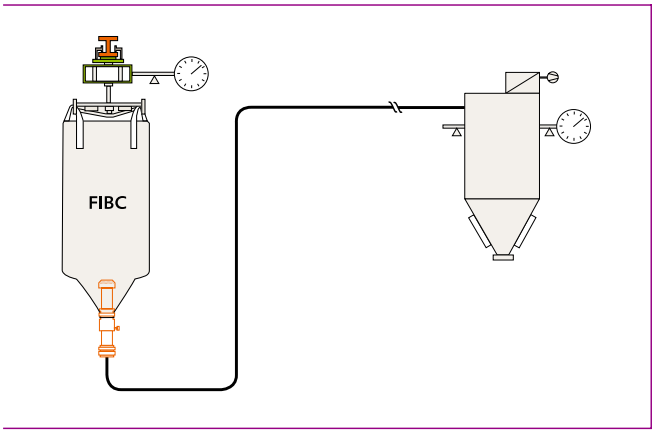
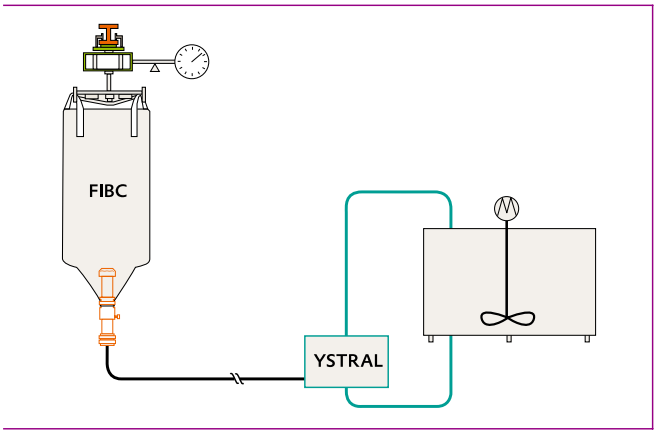


Figure 24
Emptying a FIBC with a Ystral Conti TDS



The products

As long as they have been prepared for delivery from our Wesseling supply plant, the products listed in **Table 1** are available in the described FIBC. If necessary, other products are available in FIBC on request.

Table 1
Filling weights of the FIBCs by product

The following fine-particle SIPERNAT® products are currently available in the described FIBC (effective January 2011; exclusively at the Wesseling plant):

Product	Filling weight in 2 m^3-FIBC
SIPERNAT® 320 DS	370 kg
SIPERNAT® 383 DS	370 kg
SIPERNAT® D 17	500 kg
SIPERNAT® 22 S	400 kg

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