Systems, solutions and know-how for the pneumatic transportation of powder, dust, pigments, granulated materials, tablets and capsules
VOLKMANN GmbH was founded in 1973 as a consulting firm for automation and economical production. Since 1979 Volkmann have built up its own innovative product range in the field of vacuum technology. Many inventions, protected by patents, confirmed Volkmann to be a leading manufacturer of Vacuum Conveyors, Vacuum Pumps and Vacuum Components, which have been designed specifically to suit the wide range of different duties and have set new benchmarks in relation to economy, quality and cost-performance-ratio.

The basis of this success has been the continuous development and innovative approach taken to satisfy the ever increasing variety of applications. Many of our products have become trend-setters in international industries, with high demands on special technical requirements.

Though the Volkmann company is growing rapidly and setting up a global network of agencies, associated partners and distributors, our principles and our relationship to customers are still guided by the vision of a family owned “German Mittelstand” business, where flexibility, quick actions and decision making come first and go hand in hand with superior quality and precisely engineered products.

Our modern CNC machinery, our stainless-steel welding expertise and our special machinery production facility enables us to offer bespoke solutions to our customers with individually adapted systems. The work of our engineers is supported by modern 3D-CAD systems.

We would be pleased, if this brochure gives you some ideas and suggestions on how Volkmann Vacuum Conveying systems can improve your company processes.

Talk to us about your special needs in the field of Vacuum Conveying.
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How a Vacuum Conveyor works

Vacuum conveyors transport powder, dust, pigments, granulated material, tablets, capsules, small parts etc. in a suction air stream under vacuum through hoses or pipes. They are easy to install and to operate. Even if leakages occur, no product can get into the environment because of the vacuum.

1. The vacuum pump (1) generates a vacuum in the Vacuum Conveyors separator tank. Air rushes in through the hose/pipe and the suction inlet (2) from the feeding point (3). The bulk material is aspirated and then carried in this air stream.

2. Inside the separator tank a filter module (4) separates air and product. The transported material is kept and collected in the separator. With fine dust a cyclone element (5) inserted into the separator provides higher transportation capacities because of a lower load of the filter elements.

3. When the separator is filled with product, the vacuum pump switches off, inside of the vacuum conveyor the pressure is balanced to surrounding area within tenths of a second. The separated material discharges from the vacuum conveyor through the discharge element (6) and falls directly into the unit or tank to be charged (7).

4. Along with the discharging the filter module is cleaned automatically by an air shock system. The occasional filter cake is released from the filter unit. Volkmann offers piston vibrators and fluidizing units to improve the discharging for sticky or highly bridging bulk materials.

5. After unloading the product the discharge element closes and the whole conveying cycle starts again.

Advantages of Vacuum Conveying

- dustfree material transfer, gentle to the material
- reliable low-weight systems
- little need for maintenance
- almost no wear in the whole process
- easy installation and control
- recommended for all types of bulks: from powder, pigments, dust and granulated material to small parts; flowing/bridging/sticky/inflammable/toxic ...
Vacuum Conveyors from Volkmann transport the most diverse materials: From fine dust with only 0.1 µm grain size up to plastic caps for medical infusions. From the lightest filling agents with only 0.05 kg/m³ up to metal powders with bulk density 10. See the variety of materials, with which Vacuum Conveyors can be used. And this is just a brief overview:

### Conveyed materials

**Chemicals**
- Activated carbon dust
- Aluminium chloride
- Aluminium hydroxide
- Bentonite
- Calcium carbonate
- Calcium hydroxide
- Clean sand
- Diatomite
- Dicyanodiame-powder
- Dutral TER 4038 PL
- Ferrocene
- Flame soot (Printex 80)
- HBMCG (NaCN)
- Hexamethylenetetramine
- Humid activated carbon coke
- Hydroxy ammonium sulphate
- Isophatic acid
- Iron powder
- Mowital
- Silicon carbide
- SiO₂
- Silicon powder
- Sodium azide (powder)
- Sodium carbonate (Na₂CO₃)
- Sodium nitrate
- Sodiumbisulfate
- Stearic acid
- Sulfamic acid
- TiO₂
- Washing-powder perls
- Zeolite
- Zinc stearate

**Pharmaceuticals**
- Agiolax (laxative)
- Ascorbic / citric acid mix
- Ascorbic acid powder
- Barium sulphate
- Cellulose powder
- Coal granule
- Colistin sulphate
- Filter cake (Chem.+Pharma)
- Garlic powder
- Laxative granule
- Magnesium
- Pankrethin
- Paracetamol powder
- Placebo preparation
- Potassium bicarbonate
- Sodium bicarbonate
- Sodium citrate (dry + humid)
- Sorbit
- Vegetable drugs
- Vitamin preparation

**Colours and coatings**
- Decoration dye powders
- Dibromonitroaniline
- Duroplastic coating powder (dye powder)
- Dye powders (diacetahile yellow etc.)
- Epoxy resin
- Styrolene / acrylate polymer
- Teflon powder
- Titanium dioxide
- Toner powder

**Small parts**
- Plastic closing caps
- Pharmaceutical parts (FDA)
- Glass hollow parts
- Explosive propellants
- Pharma capsules
- Round battery cells

**Food**
- Aroma powder in carrier
- Bacon
- Baking agent
- Beans
- Chanterelles
- Cheese powder
- Chicken wings
- Chocolate chunks
- Cinnamon
- Cocoa
- Coconut rasps
- Coriander
- Cream-fat-powder (75% fat)
- Crystal sugar
- Curry
- Dextrose
- Dog food (rings)
- Energy drink powder
- Fruit jelly granule
- Fruit powder
- Ginger
- Lactose
- Lucerne flour (Alfalfa)
- Millet
- Pepper
- Rice
- Sauerkraut
- Sugar
- Sugar powder
- Tea (different types)
- Tobacco powder
- Tricalciumphosphate
- Trigarol
- Wheat starch
- White cabbage
- Yeast

**Metal powders**
- Aluminium powder
- Cobalt metal powder
- Iron powder
- Magnesium chips
- Metal crystals
- Palladium ashes
- Silver powder
- Steel granule
- Strontium ferrite powder
- Tantalum metal powder
- Wolfram-metal powder
- Zinc powder

**Other**
- Bio filter stuff
- Cement clinker
- Corundum/corundum mix
- Electronic parts (recycling)
- Garden mould
- Grape pips
- Gypsum
- Gypsum (for prosthesis fabrication)
- Iron oxides, wood granule and minerals (casting auxiliary)
- Lava slag
- Micro glass balls
- Pearl soot
- Pebbles
- Piezo mass
- Quartz granule
- Quartz powder
- Sand-lime-mix
- Silica
- Welding powder

### Reference materials

- **20 – 10000 kg/h (44 - 22000 lbs/h)**
- up to **35 m high (115 ft)**
- and **80 m far (280 ft)**
Reference applications
Reference applications

Fig. 1: Filling of a mixing and a reaction vessel with flame soot, manganese dioxide and calcium carbonate. Continuously working tandem Vacuum Conveyor.

Fig. 2: Emptying of a dryer with a suction lance and following sieving and filling of a container.

Fig. 3: Filling of a tablet press with two Vacuum Conveyors VR315 in a special flat design; Pumps externally installed.

Fig. 4: Vacuum Conveyor VR450 mounted on a silo, 35 m conveying height; Pump externally installed.

Fig. 5: Filling of a mixer with a PPC Vacuum Conveyor; Transportation of Paracetamol powder from a barrel over a suction lance.

Fig. 6: Vacuum Conveyor VR450 for the mobile use; installed on a mobile hoist, adjustable height.

Fig. 7: Manual suction of high-quality palladium ashes off of oven tray and collection in barrels.

Fig. 8: Filling of a reaction vessel / mixer in a Phrama Process.

Fig. 9: Filling of toner powder into cartridges with a Vacuum Conveyor VR315.

Fig. 10: VR450 Vacuum Conveyor with weighing/dosing function for proportioned reactor filling, automatic batch dosage.

Fig. 11: Vacuum Conveyor for the transport of a sugar mixture into a rotation coater; to the coating of candies.

Fig. 12: Vacuum Conveyor with powder-lock function for the feeding of pigments in the dye/color industry. The pigments are transferred into a solvent atmosphere.

Fig. 13: Two Vacuum Conveyors for the filling of loss-in-weight feeders.

Fig. 14: Vacuum Conveyor for the batch feeding of pigments in the paint industry.

Fig. 15: Vacuum Conveyor for the automatic discharging of a fluidized bed dryer. Product delivery through an submersion tube into IBCs.
Influences on Vacuum Conveying

**Selection of the right Vacuum Conveyor**

First the parameters conveying distance and conveying height are determined as well as the desired conveying capacity. Some characteristics of the material help us to make a first estimate of the correct size of unit.

Then the required type of product loading and unloading are set. Is manual suction with suction lances desired e.g. from barrels or bags? Or is it necessary to do the material feeding automatically, e.g. from silos, Big Bags or process machinery? And how is the Conveyor to be connected to the unit which shall be loaded with the material? Mounted above without connection, flexible connection pipe or permanently fixed to it?

Further characteristics of the material as well as the surrounding conditions determine the exact design of a Vacuum Conveying system: How good is the pourability of the conveyed product? Does it have to be loosened up and/or fluidized, in order to flow and be conveyable? Is the product sensitive to humidity/moisture? Can it block in the transportation line? Is there a risk, that material properties change by transport, e.g. the grain size is reduced by grinding effects between the particles and the transportation system? Does the surface of the product have to be protected by special measures, in order to avoid scratches and other impairments on the product itself?

Aspects of health protection, explosion prevention and environmental protection play a further important role, in order to be able to offer safe working Vacuum Conveying equipment. Is the material harmful or toxic? How may one come in contact with the product? Which filter quality is necessary? Can the exhaust air of the Conveyor go back directly into the room or is a central exhaust air system necessary and present? Is the material explosive, can it be ignited? Are ignitable gases present or can these be emitted from the product itself? Which conditions are present at the product loading point and the unloading position? What is inside the unit to be fed? Are explosion zones defined?

The reverse case can be found regularly e.g. in pharmaceutical production: there the product is protected against the environment. Which materials may come in contact with the product which is conveyed? Are special material certificates necessary e.g. for a qualification/validation of the production process? We supply according to your requirements.

**Come and ask us** - we won’t leave you alone with all these questions. Do not buy a Vacuum Conveyor from a catalogue. Always contact the manufacturer for advice. Does he give you all the information you need for a safe and reliable process? We want you to work with a really reliable Vacuum Conveying system which helps you to produce efficiently and profitably and that you eliminate unnecessary risks inside your production works. Come and speak with us about your application – contact VOLKMANN.

Almost like Volkmann can not replace Volkmann.
Flight conveying
At flight conveying the air speed \( w \) is substantially larger than the \( v_S \) of the conveyed materials particle, where \( w \) is approx. 18 to 35 m/s. The loading ratio of the conveying air is quite small. Depending on the characteristic of the used vacuum generator, flight conveying usually provides the largest transportation capacities. However, sensitive materials should not be conveyed at high speeds to prevent particle abrasion or grain destruction.

Dilute phase conveying
If the air speed \( w \) is reduced to a value under 20 m/s, during horizontal or diagonal transportation the conveyed material drops more and more into the lower half of the transportation line. You find more material moving slowly on the bottom of the transportation line while above the bottom sediment a changing number of particles is conveyed at higher speeds. The way the dilute phase conveying occurs is strongly dependent on the products characteristics. In dilute phase conveying you often find areas where plugs can build up (e.g. at the entry of pipe bends) or where regular flight conveying occurs in the top half of the pipes. The material at the bottom of the pipe reduces the transportation lines area and causes a speed increase of the conveying air at certain points. The relationship of the materials speed \( v \) to air speed \( w \) is smaller than 0.7. The loading inside the transportation line usually is higher than at flight conveying. Vacuum Conveyors, which are adjusted to the dilute phase conveying, offer a very smooth and gentle handling of the material and the energetically most favourable kind of vacuum conveying.

Plug conveying (dense phase conveying)
If the product load of the transportation air is increased and the air speed reduced, plugs build up inside the conveying line. These plugs build up and disintegrate over the whole conveying length constantly. Therefore reliable working Vacuum Conveying systems can be realized with air speeds \( w \) far below the floating speed \( v_S \) of the single grain (\( v_S \) is the air speed required to suspend a particle in a vertical suction pipe). Plug conveying usually is the most gentle transportation method for sensitive materials. For plug conveying the vacuum generator should be able to produce high vacuum levels much above those of e.g. blowers. This prevents that the transportation line is blocked. Air speed \( w \) lies between 3 and 10 m/s, whereby the ratio of material velocity to transportation air speeds is below 0.5. The product flow-rate can be up to one hundred times larger than the air flow-rate (both in kg/h). Energetically, plug conveying and dilute phase conveying are comparable, since the necessary volumetric air flow is substantially smaller, but the pressure difference rises. The plug conveying is not only applicable with powders and granulates, but also for the transport of viscous or liquid media.
From single stage Venturis ...
The basic advantages of compressed air driven vacuum pumps are well known: small size, low weight, simple design, little maintenance and wear resisting operation put them in first place when it comes to pick-and-place applications. The easy installation, control and free positioning make work more easy. And the workers go for their quiet operation, neither heat emission nor oil mist. But how do you increase efficiency of such a Venturi? How to keep the high vacuum and same energy need but give you lots more of induced air (suction air)? Take a look at the picture of the MULTIJECTOR® to understand: A classical Venturi comes with a primary nozzle (injector), a secondary nozzle (diffuser) and a jet chamber (the gap between). The compressed air rushes through the primary nozzle, expands and accelerates, which causes a pressure drop. On its way towards the secondary nozzle it catches and mixes surrounding air and finally exits the Venturi through the secondary nozzle.

... to the MULTIJECTOR®
A MULTIJECTOR® comes with an advanced nozzle system, in which additional nozzles are placed in line with the primary and secondary nozzle. The suction air of each venturi stage mixed with the compressed air of the primary nozzle works as the gas jet for the following stage. For free and with no more air consumption. These additional Venturi stages don’t reach the high vacuum of the first, but their larger jet chambers produce an even higher suction volume. Still the vacuum pump reaches the high vacuum of the first Venturi stage, because flap valves close automatically in order of pressure balance between their certain Venturi stage and the collective vacuum chamber. 
The special design of nozzles and aerodynamics gives Volkmann MULTIJECTOR® vacuum pumps their unique efficiency: Common single stage Venturis perform at a ratio of 0.7:1 (suction air : needed compressed air). Modern Multijectors reach a ratio of up to 6:1. Take a MULTIJECTOR® and save compressed air.

Energy consumption only in the suction cycle of the conveyor
In a vacuum conveyor the Multijector is turned on only during the suction cycle. While discharging the separator, the Multijector can easily be switched off. It requires no starting time for the next cycle like electrical pumps, also it has no wear during start and stop. The Multijector saves about 1/3 of compressed air during discharging, while electrical pumps need to run continuously and require additional vacuum valves to shut off the vacuum conveyor during discharging.

Electrical vacuum pumps
Customers ask for electrical pumps rarely, we have to admit. Because of many cost saving advantages which our Multijectors offer especially for vacuum conveying. However, sometimes we suggest to use an electrical vacuum pump with our conveyors – e.g. if the compressed air supply on site is insufficient or at very long conveying distances. But you can be sure: we always do our best to find the optimum solution for your conveying application and consider your special demands and requirements.
**Multijector M-Series**

Multijector pumps of the M-series work with three ejector stages which are connected in a row. Their robust and compact aluminium casing makes the pump resistant even to strong mechanical loads. Nevertheless they are very light and offer considerable amounts of suction air at a small size. M-types are used with Volkman Vacuum Conveyors in the diameter 170 mm.

Our G-type Multijectors are four-stage ejectors and offer an even better efficiency especially at free aspiration and low vacuum. They consist of a light and nevertheless tough modular Aluminium design. They are the ideal choice for bigger transportation capacities. G-types are used for Vacuum Conveyors with diameter 250 mm and bigger. They are available with silencer or exhaust adaptor element.

**Multijector G-Series**

(1 bar = 100 kPa = 1000 mbar = 750 mmHg = 29,53 inHg = 14,5 psi)

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<th>Compr. air connect.</th>
<th>Pump width (mm)</th>
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(1 bar = 100 kPa = 1000 mbar = 750 mmHg = 29,53 inHg = 14,5 psi)

All technical data subject to change without notice.

**General data**

- **operating pressure:** 4 to 6 bar flow pressure (optimum 5.6 bar)
- **operating noise:** 55 to 78 dB(A)
- **Operation temperature:** -20 to +80 °C
- **Materials:** Al, PE-HD, NBR

**Multijector Vacuum Pumps completely in Stainless Steel upon request.**
Advantages of VOLKMANN Vacuum Conveyors:

- unique modular design with Clamp rings
- units easily taken into pieces and cleaned
- suitable for GMP-applications
- superior filters for vacuum conveying in different designs available
- individual custom made adaptations to fit the special application
- highly effective Multijector Vacuum pumps
- no heat emission
- quiet and reliable operation
- lightweight and compact size
- process engineering and support directly from the manufacturer

Quite often various production processes shall be handled by only one conveyor. This conveyor is therefore responsible for the handling/loading of the various different powders or granulates, e.g. in chemical process technology or in the color and lacquer industry, where different colors and dyes shall be transported. In such applications the design of the Vacuum Conveyor should permit an easy disassembling and cleaning.

At the same time the selected container material must be resistant against cleaning agents and aggressive chemicals. Therefore the **stainless-steel modular design** was chosen, which guarantees the fast product change on the one hand and on the other hand fulfils the high requirements to the hygiene at chemical-, pharmaceutical and food- processes. Additionally the modular design allows individual customizations of the conveying system as required. A typical example design of the suction inlet in a radial or tangential design, which can substantially influence the whole conveying process.

**Tangential suction connections** are chosen for reducing the filter load, e.g. if fine powders like TiO2 or toner powder are conveyed. The separating effect of the cyclone can be supported by inserting a funnel (so-called cyclone-insert). With powders with a large particle size distribution however the danger of the separation arising by the centrifugal energy is to be considered. This could be a problem e.g. within chemical-pharmaceutical applications, where substrate and active substance may not be separated.

In such cases and in cases with adhering/sticky material the **radial suction connection** is the better choice, since it does not come to a flow over larger areas of the separators interior surface. The material cannot build up on the wall and the mixture remains homogeneous due to turbulences like in a fluid bed. The filter load is larger with the radial suction inlet and must be compensated in some cases by more frequent emptying and cleaning cycles which lowers the suction capacity of the conveyor. The best application-oriented configuration of the Vacuum Conveyor and its modules can be found by suction trials.

In connection with our Multijector vacuum pumps particularly small Vacuum Conveying systems are available, which can be used both stationary or mobile. Since high vacuum levels might occur during the plug conveying, our Vacuum Conveyors all are vacuum proof for pressures down to -91 kPa (= 9 m water column).

In accordance to the size of the Separator Container, its suction inlet, the chosen filter and vacuum pump a certain transportation capacity is reached. The filling volume per suction cycle is constant, the transportation capacity depends strongly on the bulk density and other properties of the conveyed material as well as on the feeding situation of the transportation line.
Modular Vacuum Conveyors: The VR-Series
The most flexible Vacuum Conveyors available. Easy adaptations to fulfil the requirements of almost all industries. See page 14.

Vacuum Conveyors with one-piece separator elements: The PPC-Series
Their gap-free and all-accessible design as well as their absolute minimum of parts with product contact make our PPC Vacuum Conveyors the first choice for the Pharma- and Paint/Lacquer industry. See page 16.

Tablet Conveyors with Glass Separator
Careful transportation of sensitive tablets and other sensitive products with our transparent Vacuum Conveying system. See page 18.

Pressure-proof Vacuum Conveyors
The star of the vacuum conveyors because of its unique modular design. The VR series is used in all industries where bulk materials are conveyed. They are small and lightweight and come with many options to choose from to fulfill your demand for a high quality conveyor at a fair price and with quick delivery times (usually 2 weeks).

We do the product configuration for you and help to find the best suitable solution for your application on the basis of know-how, our product database or custom tests with your particular product.

Hints for preselection of the suitable equipment

1.) Choose the separator size according to the desired conveying capacity (multiply by 1.6 for twin systems):
   - VR 170: 40-600 kg/h (90–1320 lbs/h)
   - VR 315: 150–2500 kg/h (330–5500 lbs/h)
   - VR 450: 500–6500 kg/h (1100–14500 lbs/h)

2.) Select a suitable filter type from our huge variety for all sorts of bulks to fine dusts – is the bulk material harmful to materials or health? We have the right filters or use special elements according to your standards.

3.) How is the flowability of the material? Is a fluidizer or a piston vibrator necessary? May bridging occur, does the material stick to the separator or discharge element? We have standard parts and modules to cover all these aspects for perfect conveying and feeding and can apply special coatings etc.

4.) Do you need a separate control or any other accessory for your conveying application? We assist with standard + special parts, engineering and production.

All new VR Conveyors are ATEX certified in accordance with directive 94/9/EG for the Zones 1, 2, 20, 21 and 22. [Ex] II 1 D c 80°C / II 2 GD 100°C. (see page 20)
The modular design; shown for the Vacuum Conveyor VR315T
1 Pump-Cover-Combination with the air-shock system for filter cleaning
2 Filter module
3 Suction module
4 Discharge module
5 Base module

A huge variety of different functional modules is available for each VR Vacuum Conveyor. The VR series offers millions of possibilities.

This is only a small selection from our VR Vacuum Conveyor program – we are glad to assist you making your choice for the best conveyor for your application. More detailed information, data sheets and quotations with sketches available upon request by post, Fax or email.

Technical Data subject to change without notice.
**PPC pneumatic pharma conveyors**

from Volkmann were especially developed for all those applications, which require top quality materials, surfaces and characteristics of all parts, which come in contact with the conveyed materials. They are mainly used inside Pharmaceutical and Color/Lacquer industries because of their separator elements being built in a one-piece design – an optimum for such applications with frequent product changes, which require a quick reliable absolute cleaning of the Process machinery to prevent contamination of products. PPCs superior manufacturing quality and their gap-free design fulfils highest quality demands. Nevertheless, they are easily taken into pieces by hand without tools and can be cleaned quickly and can be sterilized.

The design is completely electrical conductive, free of gaps and doesn’t have any inaccessible spaces where the product might remain. PPC conveyors come with a huge butterfly valve at the discharge, which can be taken to pieces without tools.

PPC Vacuum Conveyors are offered as pre-configured units regarding the individual application. They are available in the diameters 170, 250, 315 and 450 mm. You can choose from different Pharma- or electrical-conductive filter systems (e.g. for the feeding of products into Zone 0 of reactors). Special coatings or clamp modules are available upon your request.

All new PPC Conveyors are ATEX certified in accordance with directive 94/9/EG for the Zones 1, 2, 20, 21 and 22. [Ex] II 1 D c 80°C / II 2 GD 100°C. (see page 20)

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**Four standard sizes:** Ø170, 250, 315, 450 mm

**One-piece separator container:**
AISI 316 L, electro-polished or mirror polished, Ra < 0.8 µm (< 0.5 µm), free of gaps, all accessible

**GMP design,** lightweight, easy to handle, for perfect assembling/disassembling by hand without tools and optimum cleaning, nevertheless durable for long-life operation.

**Absolute minimum of parts in contact with the conveyed product**

**Filter modules for quick change operation,** long lasting and cleanable filters, sintered FDA-approved HD-PE material, stainless steel filters, PTFE coated cartridges, HEPA filters available.

**Conveying capacities** from 100 kg/h up to 6 t/h

**Lightweight and easy to clean butterfly valves** at the product discharge, all metal parts with product contact in AISI 316 L

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**Volkmann PPCs**

are WIP/CIP-ready

We designed our PPC conveyors to meet CIP requirements (CIP = Clean in Place). Few accessories are needed to wash/clean and dry them in process.

We customize the conveyors on the standardized PPC platform technology and add all the individual accessories according to your special needs, as there are many different requirements on CIP and its grade of automation. Our Conveyors really fulfil the specifications you set and come with all necessary functions.
Special Conveyors for Pharma applications

1. Vacuum Conveyor PPC170K Vacuum pump mounted on its back, electrical control and suction lance.

2. PPC Separator with special ETFE-coating, chemically highly resistant, FDA approved material.

3. PPC315 in sterile design, complete with 3.1 B material certificates of all parts with product contact. Inclusive all Qualification-documents.

4. PPC315, PPC450 with special air-shock system for the transportation of pigments in the paint industry.

Technical Data subject to change without notice.
Vacuum Conveyors with glass-made container system and HEPA filter to fulfil the highest quality demands on the conveyed products surface.

Vacuum Conveyors for highly sensitive materials and applications, where contact between the conveyed goods and metal surfaces must be prevented.

Especially for: Film tablets
Coated and uncoated tablets
Dragees
Capsules
Sensitive bulk materials
Volkmann offers PPC- and Tablet-Conveyors with additional service in the field of Qualification. We support your Qualification team and provide you all necessary Qualification documents.

- User Requirement Specification
- Functional Specification
- Design Qualification (DQ)
- Factory Acceptance Test (FAT)
- Installation Qualification (IQ)
- Site Acceptance Test (SAT)
- Operation Qualification (OQ)
- Performance Qualification (PQ)
- Validation (by the user)

We help with further information, e.g. for doing the final Cleaning Validation (Surfaces in contact with the product for SWAB-method ...) or assist in setting up SOP’s.

System description

Tablets are one of the most difficult materials to be conveyed. Whenever they are to be transported, it is important to achieve the desired throughput but maintaining the quality of the conveyed material is also important and must be regarded very carefully. Mechanical damage, chipping, scratches, wear, colouring (grey-shadowed surface) etc which sometimes can not be seen at first glance have to be avoided.

Tablet Conveyors from Volkmann offer damage-free transport for many different and sensitive tablets. They pick up the tablets from containers or directly from the tablet presses and load containers and filling- or packaging machines dust-free. They are easy and flexible to install and offer a reliable and safe automatic material supply even with limited available room height.

In Volkmann Tablet Conveyors all contact surfaces are wear-free and are made from glass. For the transportation pipeline special gap-free and shock-minimizing hose systems are used. The tablets enter the conveyor through a deceleration device and are collected in the separator container. The air is moved-up during the suction cycle whereas possible dusts from the tablets are separated and collected in the filter module. After filling of the glass separator container the vacuum pump is switched off automatically. The tablets are discharged through a pinch valve, e.g. directly into a blister packaging machine or into an integrated glass buffer container. The glass design of the complete conveyor allows a real “transparent” production.

The application, the desired conveying capacity but especially the tablets to be conveyed themselves and the kind of loading and discharging determine the detail design of the Tablet Conveyor.

From us you don’t only get tailor-made conveyors but also complete system solutions e.g. for conveying and weighing of your materials. Talk to us and use our experience in the chemical/pharmaceutical bulk materials handling.
When powders and bulk materials are conveyed or loaded inside explosive and hazardous areas, special aspects have to be considered, as electric discharges caused by the electrostatically charged product are possible:

- What are the surrounding conditions at the loading and unloading point?
- Does the material itself bear an explosion risk? Is it inflammable?
- Is the product easy chargeable?
- What happens with the product during the transport and unloading?

Special measures can be necessary, if inflammable atmospheres and gases are present in addition to the conveyed material, if the minimum ignition energy (MIE) of the material is below a critical value (usually 1-3 mJ), if exothermal reactions take place or if bigger clouds of dust are generated during the discharge cycles of the conveyor.

Volkmann offers best practice solutions for such applications. All new Volkmann Vacuum Conveyors of the VR and PPC series can be regarded "explosion-proof", if the MIE of the conveyed materials is bigger than 3 mJ (after risk assessment also for materials with MIE > 1 mJ) and if no inflammable gases are present. Additionally, Volkmann offers special Vacuum Conveyors with inerting system for such applications, where solvents or inflammable gas atmospheres occur and need to be considered. These Special Conveyors can even load powders and granulate materials into reactors with a solvent/alcohol atmosphere inside (for Explosion Zone 0).

However, in such critical applications the conveyor is determined by local demands for the conveying task. The many advantages of Vacuum Conveyors shall be kept to make the work easier and safe, to the benefit of the work force and environment (no contamination or spill, easy and lightweight handling, perfect cleaning of all internal surfaces, GMP-conform design...). Only sometimes our „Maximum“-Conveyor in a pressure-proof design is necessary. Make it easy AND safe. You won’t just save money – your production-team will be happy to work with better and easy-to-use equipment.

Volkmann stands for engineering and bespoke fitted products. We design solutions in close cooperation with our customers worldwide. Talk to us and take advantage of our solution based on many years of experience in the chemical-, pharmaceutical- and food-industries.
Vacuum Conveyors for Inert Processes

The inerting of the Conveying Process can be necessary for different reasons:

A) the material, which is conveyed, has a minimum ignition energy (MIE) < 3 mJ. Under certain conditions the inerting only becomes necessary with MIE < 1 mJ. Talk to us.

B) Inflammable gases or liquids are present during the transportation (e.g. suction out of zone 0 or 1; powder alcohol mixtures etc.).

C) The material shall be transferred into zone 0 or 1, that means into a zone, in which inflammable gases occur on a regular basis.

In the cases A and B the complete vacuum transportation process should be done under inert conditions, since critically high electrostatic charges can occur (caused by the friction between of the conveyed product and the suction hose/tube). However, in practice you won’t find case A) too often, since the majority of usual materials has an MIE bigger than 3 mJ.

In the case C) the separator container of the Vacuum Conveyor is inerted in a special step of the conveying process. After the material is separated inside the Vacuum Conveyor, the suction inlet is locked by a valve and the product is set under vacuum inside of the conveyor. Then a pressure balance takes place with the selected inerting gas. Finally the Conveyor unloads the transported material under inert conditions. The Oxygen concentration can be monitored additionally.

Important!

1) If you want to work without inerting in the cases A-C, a comprehensive risk analysis (usually with instrumentation accompanied conveying tests) is accomplished. We offer special services.

2) Do not transfer the indicated values to vacuum conveying systems from other manufacturers! All constructions of our current Vacuum Conveyors were revised especially regarding the needs of applications with explosive materials.

Fig. 1: Vacuum Conveyor in Pharma design, with inertizing done at the suction lance and complete inerting sequence done by a pneumatic control. Multijector Vacuum pump inside the controller box.

Fig. 2-3: Mobile PPC Vacuum Conveyor with inerting function. For the feeding of powders and pellets into reactors inside a laboratory (multi purpose operation). Lightweight and flexible design for the safe loading of highly toxic materials.

Fig. 4: Feeding of a chemical mixer/reactor under atmospheric conditions. A pressure proof valve disconnects the Vacuum Conveyor during the positive pressure operation of the reactor. Additional safety valve (pressure control) mounted; pressure release valve possible. Pressure proof Vacuum Conveyors follow on the next pages.
If products shall be transported by a vacuum conveyor and be transferred directly into areas e.g. like reactors, which withstand positive interior pressure, then the separating container of the Conveyor is designed as a pressure vessel (permissible pressure range: -1 to +6 bar or -1 to +10 bar, different versions according pressure-equipment-directive 97/23/EG available. Container for the connection with standard flanges in diameter 150, 200, 250 and 300 mm available). Also the explosion prevention concept chosen by the operator and individual company-safety-guidelines can make such pressure resistant and/or pressure-shock proof Vacuum Conveyor designs necessary.

In the first step material is sucked into the separator while the pressure-proof discharge element is closed. In the next step, special pressure proof valves close the suction inlet and close the line towards the Vacuum pump. The filter is cleaned by an air-shock, which can be done with inerting gas.

By setting a delay between closing the inlet and shutting off the vacuum pump, the separators volume can be set under vacuum for a further reduction of the Oxygen content. If you give inert gas to the separator for providing the pressure balance to its surrounding, so the whole system can be inerted quite easily. The evacuation of the separator chamber and inerting can be repeated in each cycle for 2-3 times assisting a further Oxygen reduction.

Now the pressure balance between the Conveyor and the unit, which shall be fed, is provided. The Conveyors discharge valve opens and the transported material is transferred directly into the unit to be fed. An additional low-pressure back-blow system helps sticky material to fall out the Vacuum conveyors separator container more easily.

**Advantages of these VOLKMANN Conveyors**

- well established filter technology
- no product compression inside the conveyor
- easy and reliable discharging
- conveying capacities 100 to 4000 kg/h
- purely pneumatic operated systems
- electrical vacuum pumps upon request
- customized Valves/fitting as specified

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**VOLKMANN Vacuum Conveyors in pressure-proof design, with inverting function**

Vacuum Conveyor in pressure-resistant design for the feeding of pharmaceutical substances into reactors. With inverting function to feed materials into Zone 0. As the transported materials are harmful and toxic, a secondary filter unit is installed separate from the conveyor. Completely pneumatical control and compressed air (or N₂) driven Multijector Vacuum pump.

Vacuum Conveyor in pressure-resistant design. With inverting function for the powder transfer of chemicals into pressure-proof mixers (Zone 0). Completely pneumatical control and compressed air (or N₂) driven Multijector Vacuum pump. Valves at suction connection and discharge as specified by the customer.

Vacuum Conveyor with pressure-resistant powder lock, which disconnects the atmospheric part of the conveyor from the positive pressure part of the Reactor. With special inerting function.
Powder locks for Vacuum Conveyors

Powder locks are used for inward transfer of bulks into vessels and prevent direct contact between the vacuum conveyor and the vessel to be fed while the discharge cycle. They ensure that no aggressive or hazardous gases or dusts escape through the vacuum conveyor into the surroundings from the vessel to be filled.

VOLKMANN powder locks can be inerted easily to prevent gases (e.g. oxygen) to get into the vessel to be filled. Also the opposite direction of gas-flow (from the vessel towards the conveyor) can be eliminated by additional inerting after discharging the lock. Our powder locks can be combined with VR and PPC conveyors as separate modular elements to build a compact and secure vacuum conveyor with parts from only one manufacturer.

If necessary, Volkmann powder locks are available optional in 6 bar pressure proof and 10 bar pressure-shock proof design for the filling of reactors under positive pressures.

How powder locks work:

**Fig. 1:** The suction cycle of the vacuum conveyor is finished. Above the top valve the sucked-in material is ready to be discharged into the powder lock.

**Fig. 2-3:** The top valve opens and the bulk falls down into the lock. All the time the bottom valve is closed. Poor flowing and bridging material can be brought into and out of the powder lock by using a piston vibrator or fluidizing assistance (both are options).

**Fig. 4:** The top valve closes. The next suction cycle of the vacuum conveyor above the lock can start.

**Fig. 5-6:** If necessary, now the lock can be inerted. Accordingly, inside the powder lock a positive pressure can be built up to compensate pressure differences and feed pressurized vessels and/or to push the material out quicker.

**Fig. 7-8:** The bottom valve opens and the material is transferred into the vessel below. The top valve is closed all the time to prevent gases from inside the vessel from escaping through the vacuum conveyor into the surroundings.

**Fig. 9:** The bottom valve closes.

**Fig. 10:** If required, now all the gas inside the powder lock can be aspirated and a new inerting can be done. This prevents that critical gases can move upward from the powder lock into the conveyor during steps 2-4.
Conveying, weighing and dosing: VOLKMANN Vawidos

Volkmann Vacuum Conveyors with weighing and dosing function are built on the basis of VR and PPC conveyors, so the field of possible applications is wide spread. They work gravimetrically with the vacuum conveyor mounted on a special frame being decoupled completely from external forces and shocks. The filling weight is measured all-over the suction cycle. The special design and assembly offers the well known advantages, which come with all Volkmann Vacuum Conveying systems (easy accessibility and cleaning).

At an operating panel you just enter the desired target weight of the certain product or recipe to be conveyed/mixed. The control unit has got an internal product database, which stores up to 256 different components in its basic memory. For each component the maximum filling weight of the vacuum conveyor per suction cycle must be set to prevent over-filling. The whole weighing- and conveyor-control is integrated into the panel.

With the confirmation of the typed in target value the system works automatically and runs all suction cycles to reach the target weight. All functions are controlled: the vacuum pump, the air shock system, the discharge valve, secondary valves etc. You can connect the control panel to centralized units by different interfaces or integrate it into plant control systems (programming done in IEC1131).

During the conveying/weighing you can see the following information on the display: the present filling weight of the conveyor, the target weight given in, the weight remaining which still needs to be conveyed and the present conveying capacity in kg/min. (lbs/min.)

During the last suction cycle the product load in the suction line is lowered by secondary air for fine tuning and optimization of the final filling process. After discharging the final batch a counter measurement is done and you can read the total weight the system has conveyed. You get an alarm-signal, if the value is outside an indicated tolerance (the upper and lower tolerance can be product specific and are also in the memory of the control unit).

The measurement inaccuracy is below 0,1% of the measuring range. The vacuum conveyor by itself hits the target value at a tolerance of ± 50 to 200 grammes depending on the product – the display will show you this value after the final suction cycle. If your application requires lower tolerances, we can offer combinations with other weighing/dosing systems and to the planning and integration for you. Just ask us for our solution.

We engineer, produce and install customized solutions for your complete powder handling.

Volkmann Vawidos System for the feeding of a chemical reactor
Complete solutions for the powder handling

Improve your production conditions with a tailored powder handling system, engineered and built as a complete solution from one partner: Volkmann. Avoid unnecessary interfaces, intensive co-ordination work with different suppliers and safety risks with critical materials.

Our customized complete solutions give you a dust free handling beginning with the emptying of all sorts of containers up to the proportioned supply of materials into production processes.

The application picture and 3D-illustration shows a dust-free loading station for bags and small bins together with a Vacuum Conveyor, which feeds a gravimetric dosing station with Aluminium oxides. The material is given at a high accuracy into a local mixer. Inside the feeding station, the material is fluidised with Nitrogen, to improve its fluidity and lower the risk of ignitions during transportation. The feeding station has almost no residual material inside after the suction process. Operation under completely inert conditions is possible upon request.

Options: A partly automated self cleaning system is realizable depending on the transported materials. With toxic and highly effective substances the product contacting surfaces can be wetted completely with water or wash emulsion and can be prepared for more intensive cleaning. All relevant construction units can be dismantled without tools fast and cleaned simply.

Feasibility studies
More complex tasks are analysed and evaluated during a Feasibility-Study with a following risk analysis. We develop customised solutions which can be easily integrated into your production works. Teams for the assessment of explosion risks and independent consultants are available for your service.

Use our know-how for:
• Feasibility studies
• planning and engineering
• Realization with one partner
• Installation and on-site service
Automatic discharging of barrels, drums, bags, bins and containers

Product feeding stations

Bag emptying systems

Direct feeding into machines, mixers, presses, packaging machines etc.

Containment systems

- Dust-free material handling and product loading with full control
- Stop the difficult manual handling of all sorts of bulk materials which are packed in drums and containers
- Reduce health risks at your workplace
- Protect the environment from hazardous materials
- Increase the quality of work

Discharge products like powder, dust and granulated material directly from barrels, drums, bags, special bins and containers, even with plastic liners.

Just place the product container in the unloading system and start the transportation process. Different systems for different containers and FIBCs available. Select if you want to discharge the whole material e.g. from a drum or just to take out a certain measured quantity.

Unloading of material from the discharging station is done by a vacuum conveyor, which transports the material through a centrally positioned suction feeding lance or through special feeding adaptors for direct connection to bins. Adjustable paddles can be attached on automatic suction lances for emptying drums with different diameters, where this lance moves into the product, monitors the filling level by an integrated sensor and moves down automatically according to the level.

You can combine our units with process control systems and integrate remote controls or monitoring systems. All levels, alarms and error messages besides other required information can be transmitted by an interface for diagnosis.

Ask us for our solution how to pick up and convey the materials inside your production process.

Use our long year experience in powder handling.

Solutions from VOLKMANN for a better working environment.
VOLKMANN offers manual suction lances in different designs and materials:

- hygienic suction lances, stainless steel 304 or 316L, Ø 19, 25, 32, 40, 50, 75 and 100 mm.

- Suction lances with feeding element for secondary air (top picture) available in stainless steel 304 or 316L, Ø 32, 40, 50 and 75 mm.

- double suction lances with feeding element for the discharging of drums and bags (middle pictures). Secondary air fluidises the material at the entry of the inner pipe. The air is adjustable and comes through the gap between inner and outer pipe. Additional Conveying air can be supplied on a second adjustable inlet at the lances grip. Different designs available - talk to us. available in stainless steel 304 or 316L, Ø 32, 40, 50 and 75 mm.

- Special suction lances are manufactured according your requirements, e.g. with all necessary material certificates, in special materials, with coatings, in customized dimensions, with balancers, with inerting connection at the lance ...

We supply standardized and individually designed aspiration elements and feeding elbows for loading your material and make it flow for vacuum conveying. All elements are designed to fit into the available spaces for the requested product- and surrounding conditions. And they bring in the necessary additional conveying air, which makes poor flowing materials become fluid. Also available:

- product loading stations with inerting function, e.g. for products with a content of alcohol or solvents,
- product loading stations with sterile filters, which can be flanged directly to existing process machinery,
- product loading stations with submerging tube connections or with clamp elements for the flexible aspiration of products directly from bins/containers.
Filter systems for Vacuum Conveyors

Filters for Vacuum Conveyors
Fig. 1-2: Filter module VR/PPC 315
Fig. 3-5: Filter module VR/PPC 170

1• PE-HD filters, Ø40 x 60/200 mm, G 3/4" male thread, material UHMWPE (HDPE), FDA-approved material, pore size < 5 µm, BIA approved acc. DIN EN 60335-2-69 app. AA class M, filter rate >99.99%, filtration area 0.025 m² per filter (at 200 mm filter length), max. operation temperature 80°C, max. cleaning temperature 120°C (without load, max. 30 min)

2• PE-HD-AS filters, Ø40 x 200 mm, antistatic, G 3/4" male thread, Material UHMWPE (HDPE) with antistatic carbon, pore size < 5 µm, filter rate >99.99%, filtration area 0.025 m² per filter, max. operation temperature 80°C, max. cleaning temperature 120°C (without load, max. 30 min)

3• Stainless steel filters, Ø40 x 200 mm, G 3/4" male thread, material 1.4401 AISI 316, 5 µm mesh-size, 0.025 m² filtration area per filter, max. max. operation and cleaning temperatures both 200°C

4• Filter cartridges Ti07-1/2, electrical conductive polyester fabric with PTFE membrane, FDA-material, with open convolutions at the bottom, Ø120 x 200 mm, female thread RD72 mm in 1.4571, ZH 1/487 till 2003 U,S,G,C, DIN EN60335-2-69 app. AA class M, DMT <10⁸ Ohm, filter area 0.15 m² per cartridge, max. operation temperature 120°C

5• Filter cartridges Ti07, electrical conductive polyester fabric with PTFE membrane, FDA-material, with open convolutions at the bottom, Ø120 x 200 mm, female thread RD72 mm and bottom cap in 1.4571, ZH 1/487 till 2003 U,S,G,C, DIN EN60335-2-69 app. AA class M, DMT <10⁸ Ohm, filter area 0.3 m² per cartridge, max. operation temperature 120°C
Controls, mounting elements

Controls for Vacuum Conveyors
For our Vacuum Conveyors we offer an interesting variety of different control modules to control all functions of our Conveyors with a purely pneumatic system. A brief overview on different controls:

**Pneutimer T3S** (top): Pneumatic Timer-Control for the operation of all VR- and PPC Vacuum Conveyors. Stainless steel controller box. Suction and discharge times adjustable between 2-30 Seconds, pre-set and remaining Seconds clearly displayed for each cycle. On-Off switch, Pump delay time adjustable inside the controller box (the pump starts at a pre-set delay after the discharge element of the Vacuum Conveyor has been closed).

**Pneutimer T4S** (same outer design like T3S): same function like T3S, but with additional adjustable timer for an emptying cycle of the suction line (emptying valve for the suction line required).

**Pneutimer T1** (middle): Function like T3S but without pump delay. Durable plastic controller box with stainless steel mounting plate.

**Pneutimer T3** (same outer design like T1): Function like T3S.

**Pneutimer T2C** (bottom): Control for simple Vacuum Conveying systems with suction and discharge time adjustable and displayed (both 2-30 s) and connections for active discharge elements (discharge modules ZK..)

 Completely pneumatically working inerting controls with or without integrated Multijector vacuum pumps are available in different versions and safety standards.

We supply PLC Controls from simple and compact boxes up to systems with operator panels with graphic displays, bar-code readers and offer integration services to bring in such units into existing centralized manufacturing systems.

Mounting elements for Vacuum Conveyors
In our delivery program you will find different standard mounting elements, which are exactly adapted to our Vacuum Conveyor families. These can be mounted from above on supporting hoists and offer all necessary connections for the attachment of our timers and piston vibrators.

We recommend to attach the mounting elements to the lowest module of the Vacuum Conveyor. This prevents module damage during disassembly and ensures maintenance work during product changes or cleaning is completed quickly and safely.

We manufacture individual mounting elements, wall attachments, mobile hoists and trolleys for Vacuum Conveyors. All other necessary connections are made as desired. Fitting exactly, in the required materials, fast and at an acceptable price.
## Suction hoses

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</table>

### Stainless steel pipe-bends:
- Diameter from 19 to 100 mm
- Different material qualities available (1.4404, 1.4571)
- Different surfaces available (ground, electro-polished)
- Surface roughness < 0.8 µm.
- Bending radius = pipe diameter * 10
- Pipes end with straight connections for hoses or with clamp elements / sterile connectors
INQUIRY FORM
Material specification for Vacuum Conveying Trials and for Quotations. Please make a copy, fill in the information available and fax it to (++49) 2921 9604-900

1. Customer information
Contact person: ____________________________
Company: ________________________________
Department: ______________________________ Tel.: ____________________________
Address: ________________________________ Fax: ________________________________
Country/post code/place: ____________________, eMail: __________________________

2. Conveying task
Conveying height (↑): _______ m Overall conveying distance (↑→): _______ m No. of pipe-bends: ____ x ____ °
Desired transporting capacity: _____________ kg/h
Design of product charging location:
(e.g. suction from hoppers, casks, sacks, silos, Big-Bags, plant equipment (dryers, mixers etc.), emptying of sheet metal)
Design of product discharging location:
(e.g. loading of stirring vessels, mixers, filling machines, screening machines, tablet presses, weighing vessels, collecting containers etc.)
IMPORTANT: Please give more precise statements about pressures, temperatures, ascending steams, solvents etc. if necessary.
Will the unit be used in EX-area? O NO O YES: Suction place zone ____ , installation place zone ____ , charging into zone____
Is the material ignitable/explosive? O NO O YES Minimum ignition energy (MIE) of the products _______mJ

3. Material definition of the product to be conveyed
Trade name: ____________________________ Chemical designation: _____________
Manufacturer: __________________________
Particle size (please state in µm or mm) from _______________ up to _______________
Bulk density: ________________ kg/dm³ Density (basic material): ________________ kg/dm³
Max. humidity content: ______________ %

4. Material requirements of the Conveying System
Which of these materials are NOT allowed to be used for product contacting parts of the Conveying System?
O Stainless steel 1.4301/AISI 304 O Stainl.steel 1.4435 / AISI 316 L O Stainl.st.1.4571/AISI 316Ti
O Aluminium O nickel-plated brass O HDPE (PE-HD)
O Nitrile / NBR O Silicone O PUR (Polyurethane)
O Others: ______________________________________________________________________
Which materials are NOT allowed to be used outside the product contacting area?: ______________

5. Information with regard to health risks, industrial safety and environmental protection
Is the material poisonous/toxic? O NO O YES Is the material corrosive/caustic? O NO O YES
Does skin contact have to be avoided? O NO O YES Is the material inflammable? O NO O YES
Does the material cause allergic reactions? O NO O YES Is the material explosive? O NO O YES
Is the material harmful/ecologically harmful? O NO O YES Is the mat. hazardous for water? O NO O YES

NOTE: If you send sample material for testing, we need to get it packed in a reusable packaging and together with a safety data sheet. All samples, containers etc. will be sent back to the sender after the trials. The freight charges will be billed to the customer.

Date, SIGNATURE
Conveying tests and on-site demonstrations, seminars and customer training

Our partners and us would like to show you more of the world of vacuum conveying – also at your plant site. In our lab in Soest/Germany you can see our vacuum conveyors in action and get your hands on all equipment. Conveying tests and further ongoing evaluations can be done as special service either at your site or at our plant in Soest. You will receive a complete test summary and our complete quotation for a suitable system.

Would you like to know more about vacuum conveying and special applications? Contact us and ask for industrial seminars, training and company workshops tailored to your needs. We give you and your team the basic tools that you can see the areas in your plant where and how vacuum conveyors could increase production quality and safety: increase your production profit and save money by using Vacuum Conveyors from VOLKMANN.

Visit our Internet homepage
• new products and interesting applications
• actual brochures for download
• Internet-request forms for direct contact

http://www.Volkmann.info

VOLKMANN GmbH
Vakuumentchnik
Schloßweg 17
59494 Soest
Germany
Tel.  ++49 (0) 2921 96040
Fax  ++49 (0) 2921 9604900
eMail:  mail@volkmann.info

VOLKMANN UK Limited
Vacuum Technology
P.O. Box 2200
Marlow
Bucks, SL7 2LW
Great Britain
Tel.  ++44 (0) 1628 473193
Fax  ++44 (0) 1628 475265
eMail:  info.uk@volkmann-vacuum.com

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