VOLKMANN
IDEAS AHEAD

VACUUM CONVEYORS
& BULK MATERIAL HANDLING SYSTEMS

Systems and solutions for the clean, efficient

and secure handling of bulk material

TABLE OF CONTENTS

What is vacuum conveying?

Transportation of bulk material

Vacuum conveyors are generally used to transport bulk materials. As a general rule, the term 'bulk materials' usually refers to powder and granules, wherein - up to a certain particle size - tablets, pills, capsules, flakes, pellets and even larger pieces are conveyed. Through the use of special vacuum generators which can achieve a high vacuum level, it is also possible to transport liquids and viscous media (for information, refer to the VOLKMANN wet vacuum).

In addition to the particle size of the solids (particle size distribution) the density of the bulk material plays an important role in vacuum conveying. In the extreme case, this can be in the range of approx. 3 lbs/ft^3 (e.g., fluidized pyrogenic silica) to approx. 806 lbs/ft3 (e.g. uranium compounds). However, the densities are most frequently in the range of between 6 to 150 lbs/ft^3.

VOLKMANN vacuum conveyors are constructed in a modular fashion and as a result, they can be adapted to the individual conveying task so that virtually all types of bulk materials can be conveyed. There are even special solutions for "critical materials", e.g. for wet, oily, adhesive, bridging, hygroscopic, poor-flowing and explosive materials. Even nanoparticles have been successfully transported pneumatically by vacuum.

Advantages

Unlike mechanical conveyors, a vacuum is the only item which is needed in order to move the material. It is possible to eliminate mechanical parts in the product stream. This vacuum technology operates in contrast to mechanical conveyors and offers numerous advantages:

- reliable – no wear and minimal maintenance as a result
- safe – elimination of potential sources of ignition (ATEX)
- throughout the entire process – dust free, gentle dense flow – and plug flow (segregation free)
- hygienic – when changing products
- efficient – simple, compact and light systems, also suited to mobile use.

In the conveying of critical bulk solids, there are often high demands in terms of the seal quality of the conveyor systems. In essence, this can be achieved more easily with negative pressure than with positive pressure or mechanical conveyors. As such, vacuum conveying is a particular form of pneumatic conveying. Due to the negative pressure, conveying by vacuum is a mode that is offered for all materials where escape into the environment should be avoided, whether this is to protect staff or the environment. In this way, vacuum conveying actively contributes toward the goal of achieving "Clean premises". In addition, it helps to avoid the build up of dust and in doing so, it reduces the risk of explosion through suspended particles. As a result of the modular structure, VOLKMANN vacuum conveyors can even be individually adapted for applications under containment conditions (closed systems). WIP (Wetting in place) and CIP (Cleaning in place) are examples for further stages of design.

Performance range

The only criteria that limits the application is the available pressure difference of 1 bar max. (i.e. the difference between the prevailing air pressure and 0 bar absolute) and – from the point of view of safeguarding against explosions – a small conveyor diameter is preferred and with it, the achievable maximum flow rate (depending on the individual case, currently limited to approx. 10 t/h). Conveying distances of up to 260 ft as well as conveying heights of up to 115 ft (and in some cases more). In most applications however, the distances run to 131 ft and heights extend to 65 ft.

Transportation of bulk material

Our database of over 2000 tested materials is constantly growing; however, we recommend that vacuum conveying trials are carried out in order to accurately determine the flow rate. This can be achieved in our laboratory and/or on-site. The number of parameters (specific to the bulk material and installation-related) are so diverse that advanced calculation of the flow rate can only be indicative.

Even chemically identical substances can behave very differently when conveyed as a result of various manufacturing processes. Our wealth of experience and the use of the existing test protocol allow us to create a feasibility analysis and size the project in advance, so that budget estimates can be made without delay. We offer project management, technical operations, design, manufacturing, commissioning and service – from one source. Prototypes for experimental purposes can be implemented at short notice. This summary brochure provides a brief insight into a variety of applications for vacuum conveying technology. On the one hand, there is an almost infinite number of possible combinations of modules (product feeding, conveyor pipe, vacuum pumps, separators, filters, type of aspiration, emptying/discharge) and on the other hand, the applications are extremely varied and diverse. When sizing the project, our engineers ask specific questions about process peripherals and the procedural workflows. It is only then possible to integrate the conveying task precisely into the production process. New challenges constantly lead to new ideas. As a result of in-house design, development and manufacturing, they can be implemented individually and in a short time. There is something special behind almost every application, from a simple system to the complete custom solution – clearly based on the motto: "ideas ahead".

Reference products from the fields of chemical, pharmaceutical and food

Chemical

Additive granules
Aerosil*
Activated carbon dust
Al2(OH)5C
Al2O3
Alkylphenol resin
Aluminum trihydroxide
Aluminum hydroxide
Aluminum silicate
Aminosulfonic acid
Barium sulfate
Bentonite
Bisphenol A
Fuller's earth
Boron nitride powder
Boric acid
Calcium carbonate
Calcium phosphate
Cellulose
Degalan*
Dicyandiamide powder
Iron oxide
Eudragit
Ferrocene
Lamp black (*Printex 80)
Glizonite
Urea
HDK*
Hexamethylentetramine
Hostanox*
Ion exchanger resin
Isophthalic acid
Potassium carbonate (pot ash)
Kaoline
Catalyst powder
Diatomite
Silicon dioxide
Carbon fibers
Rosin resin
Chalk
Copper chloride
Lithium carbonate
Calcium hydroxide
Magnesium hydroxide
Methyl cellulose
Micro silica
Sodium azide
Sodium bisulfate
Sodium carbonate
Sodium cyanate
Sodium metasilicate
Sodium nitrate
Nealite
Neopentyl glycol
Nitrolon
Nitrocellulose
Pancreatin powder
Pentaerythritol
Perlite
Phenolic resin
Phthalic anhydride
Polychloroprene chips
Polyethylene wax
Polystyrene
PTFE powder
Quartz mixtures
Soot
Sulfur powder
Silver oxide
Silicon carbide
Silicon dioxide (Aerosil*/HDK* etc.)
Silicon powder
Sipernat
Stearic acid
Syloid*
Talc
Teflon powder
Titanium dioxide
Clay
Clay silicate
Tricalcium phosphate
Uranium oxide
Wax pastilles
Washing powder beads
Bismuth
Tungsten carbide
Cellulose
Zeolite
Zinc oxide
Zinc stearate

Foods

Alfalfa
Flavoring powder
Bread improver
Bacon strips
Bentonite
Blood powder (animal feed)
Sherbet powder
Curry powder
Dextrose
Pea flour with bacon
Strawberry crisp
Ester gum (Harz)
Fat powder
Filtracel*
Fruit jelly granules
Fruit powder
Breakfast cereal flakes
Animal feed
Cookies (extruded)
Gelatine powder
Spice blends
Cloves
Glucose
Gum arabic powder
Decorating sugar

Chicken thighs
Hemp
Yeast extract
Millet
Dog food rings
Ginger
Ground coffee and beans
Freeze dried coffee
Cocoa
Calcium stearate
Potato starch
Cheese powder
Cherries (preserved)
Grated coconut
Coriander
Herb salt
Granulated sugar
Lactose
Licorice powder
Skimmed milk powder
Corn starch
Maltodextrin
Almond powder
Flour
Mentos*
Milk powder
Whey powder
Nutmeg
Sodium bicarbonate
Bicarbonate of soda
Paprika powder
Peppermint
Pepper powder
Horse feed additives
Chanterelle mushrooms
Popcorn
Icing sugar
Puffed rice
Rice/Millet
Reis Krispies
Beetroot mixture
Cream fat powder
Salt
Snuff
Chocolate sprinkles
Smarties / M&Ms
Breadcrumbs
Soybean
Soy flour
Sorbitol
Sauce powder
Diced bacon
Spinach-bacon powder
Trail mix
Soup powder mixtures
Sweetener
Tobacco
Tea (leaves/bales/cut)
Pet food
Tixosil*
Tricalcium phosphate
Trigarol*
Vitamin powder
Whole egg powder
Milk chocolate chunks
White cabbage
Wheat starch
Xanthan
Dark chocolate drops
Ground cinnamon
Cellulose
Sugar
Broken crackers

Pharmaceutical

Laxative granules
Acetylsalicylic acid
Agiolax*
API (active pharmaceutical ingredient)
Ascorbic acid powder
Barium sulfate powder
Benzimidazoles
Blood plasma (frozen)
Boric acid
Cellulose powder
Colistin sulfate
Curantyl
Dextrose
Pills
Globules
Glucose
Urea
Yeast
Hormones
Hypromellose
Potassium hydrogen carbonate
Capsules
Ceramic powder
Carbon granules
Kromasil C4*
Lactose
Magnesium stearate
Corn starch
Mannitol
Metamizole (dipyrone)
Microcrystalline cellulose
Sodium carbonate
Sodium citrate
Pancreatine
Pantoprazole
Paracetamol powder
Pentoxifylline
Herbal medicines
Pirosil
Posaconazole
Pyrazole
SE oxalate
Silicon dioxide
Siofor*
Sorbitol
Tablets
Vitamin C powder
Vivapur*
Soft gelatine capsules
API (active pharmaceutical ingredient)
Xanthan

Dye and coating powders

Bayoxide*
Decorative colouring powder
Dibromnitroaniline
Drylac
Iron oxide
Epoxy resin
Colour pigments/inks
Colour powder
Fritted glass
Glazing powder
Resin powder
Ceramic granules
Magnesium oxide
Oxazine colourant
Powder paint
Resicoat
Soot
Styrene/Acrylate polymers
Teflon powder
Titanium dioxide
Toner powder
Vestosint*
Water colour

Metal powder

Aluminum powder
Boron nitride
Bronze
CuF4*
Rotating dusts
Stainless steel powder
Iron powder
Erbium
Graphite powder
Green mixture metal (Cu, Pb, Sb, C, Sn)
Hart metal dust and granules
Cobalt powder
Copper powder
Magnesium turnings
Metal powder mixtures
Nickel-chromium powder
Palladium ash
Grinding dust
Silver powder
Steel granules
Strontium ferrite powder
Tantalum powder
Tungsten powder
Tungsten salt
Zinc powder

Plastic powder and granules

Acrylic powder
CR rubber granules
Dental pearls
EPDM granules
HDPE regrind
Fiberglass rubber mix
Rubber granules
PE-PP rubber
PE granules and semolina
Polyacrylic
Polyamide rods
Polyethylene resin
Polypropylene granules
Polyvinyl chloride
PS regrind
PTFE powder
PU granules
PVC powder

Mass parts and smallparts

Activated carbon pellets
Baypren chips*
Pills
Film-coated tablets
Hollow glassware
Grass seed
Infusion plugs
Capsules
Ceramic hollow cylinder
Plastic plates
Button cells (batteries)
Plastic caps
Pharmaceutical components
Salt tablets (for water treatment)
Tablets
Propellants
Closure caps
Soft gelatine capsules

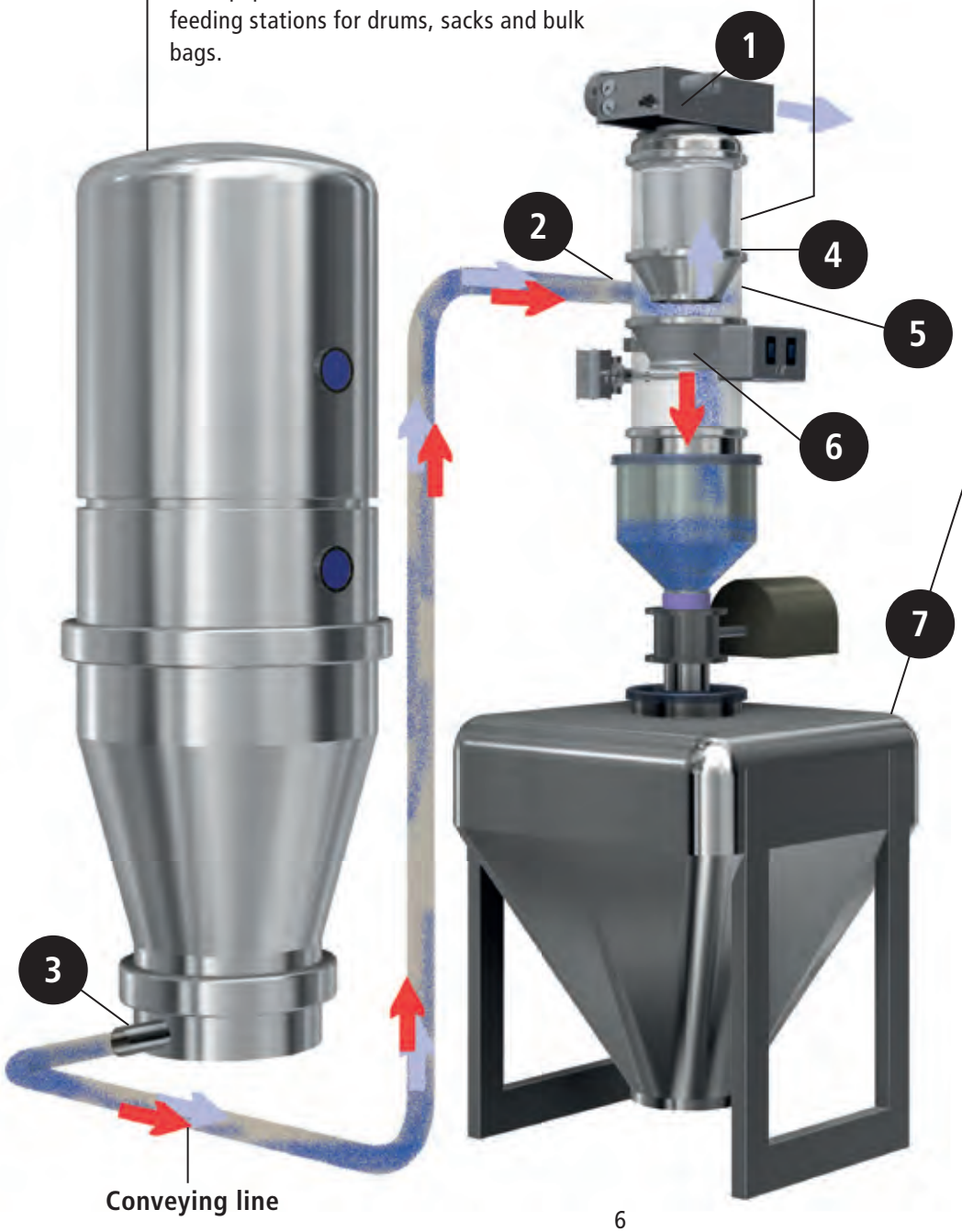
* some names are registered trademarks of the manufacturers

How vacuum conveyors work

Entrainment, transporting and feeding – VOLKMANN provides maximum benefit.

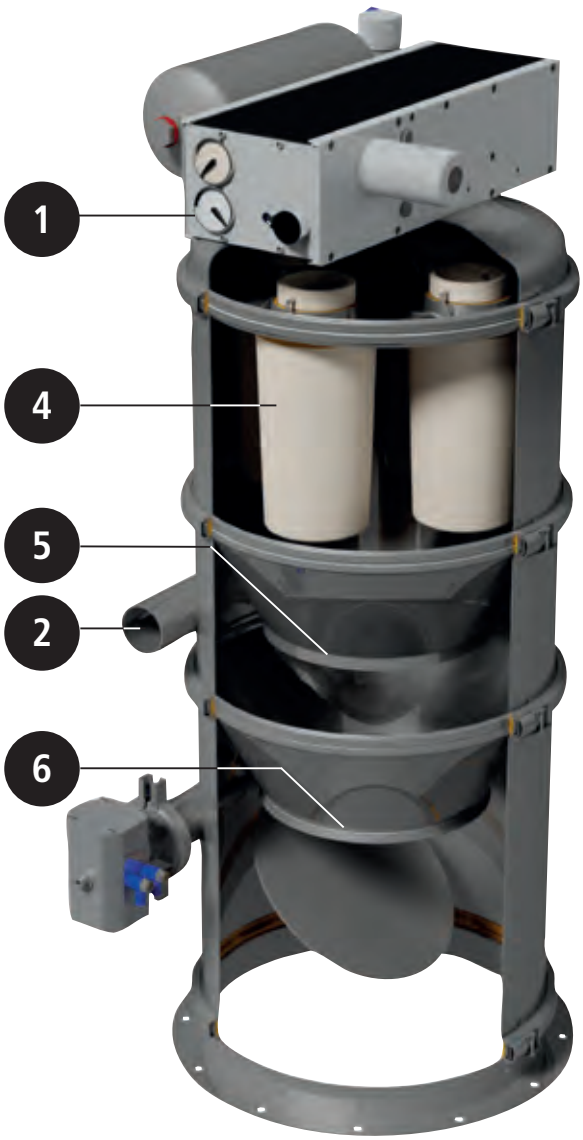
Entrainment
All materials can be entrained directly from production/processing plants and almost all forms of transport containers. For this we offer, among other things: manual suction lances, feeding and docking elements for on-site equipment, containers and silos, material feeding stations for drums, sacks and bulk bags.

Vacuum conveyors
The transported material is moved in small batch cycles and delivered to the receiving vessel.



Charging
The transported material is directly fed to the system or drum/container to be filled. This can be undertaken in a closed process, free from dust and contamination.

1. Vacuum pump
2. Intake opening
3. Product feeding station
4. Filter system
5. Separator
6. Discharge module
7. Receiving vessel



Working sequence

Vacuum pump ❶ produces negative pressure in the separating container of the vacuum conveyor so that air is sucked through the intake opening ❷ of a product feeding station ❸ and material for transportation is moved.

The air that is sucked in passes through the filter system ❹ inside the separating container. The entrained material is retained by the filter in the separator and it accumulates there. In the case of fine dust, a cyclone insert (used in the separator ❺) allows for higher flow rates in combination with the tangential intake. This is due to lower filter surface load.

After the separator container is filled, the vacuum pump is switched off. Within a short period of time, the vacuum in the separator automatically returns to atmospheric pressure. Now, the valve in the discharge module ❻ opens and the transferred material falls from the vacuum conveyor directly into the receiving vessel ❼.

When emptying, the filter cartridge is cleaned by a back flow pulse of compressed air. In this case, the filter cake (that may be covering the filter) is reliably removed. In order to ease the discharge of material in the case of heavily 'bridging' or adhesive material, VOLKMANN offers optional piston vibrators and fluidizing units.

After emptying is complete, the discharge valve closes and the conveying process begins again.

VOLKMANN vacuum conveyors transport a variety of substances through pipes or hoses in the suction air flow. Vacuum conveyors are universally suitable for powder, dust, pigments, granules, tablets, capsules, small parts etc. From fine dust (with a particle size of only 0.5 µm) through to plastic caps for infusion bottles. From lightweight fillers (with BD of only 3 lbs/ft^3) through to heavy metal powders with a bulk density of 620 lbs/ft^3. The conveyors are particularly easy to install and do not release material into the environment, even if leaks occur in the suction line. We invite you to check for yourself the versatility of vacuum transfer.

The advantages of VOLKMANN vacuum conveyors

- dust free, gentle conveying
- reliable, lightweight systems
- minimal servicing costs
- operation is virtually without any wear and tear
- simple installation, low operating costs
- recommended for all bulk materials:
  powder, dust, granules and small parts, regardless of whether the material is slightly fluid, bridge forming, sticky, flammable, toxic

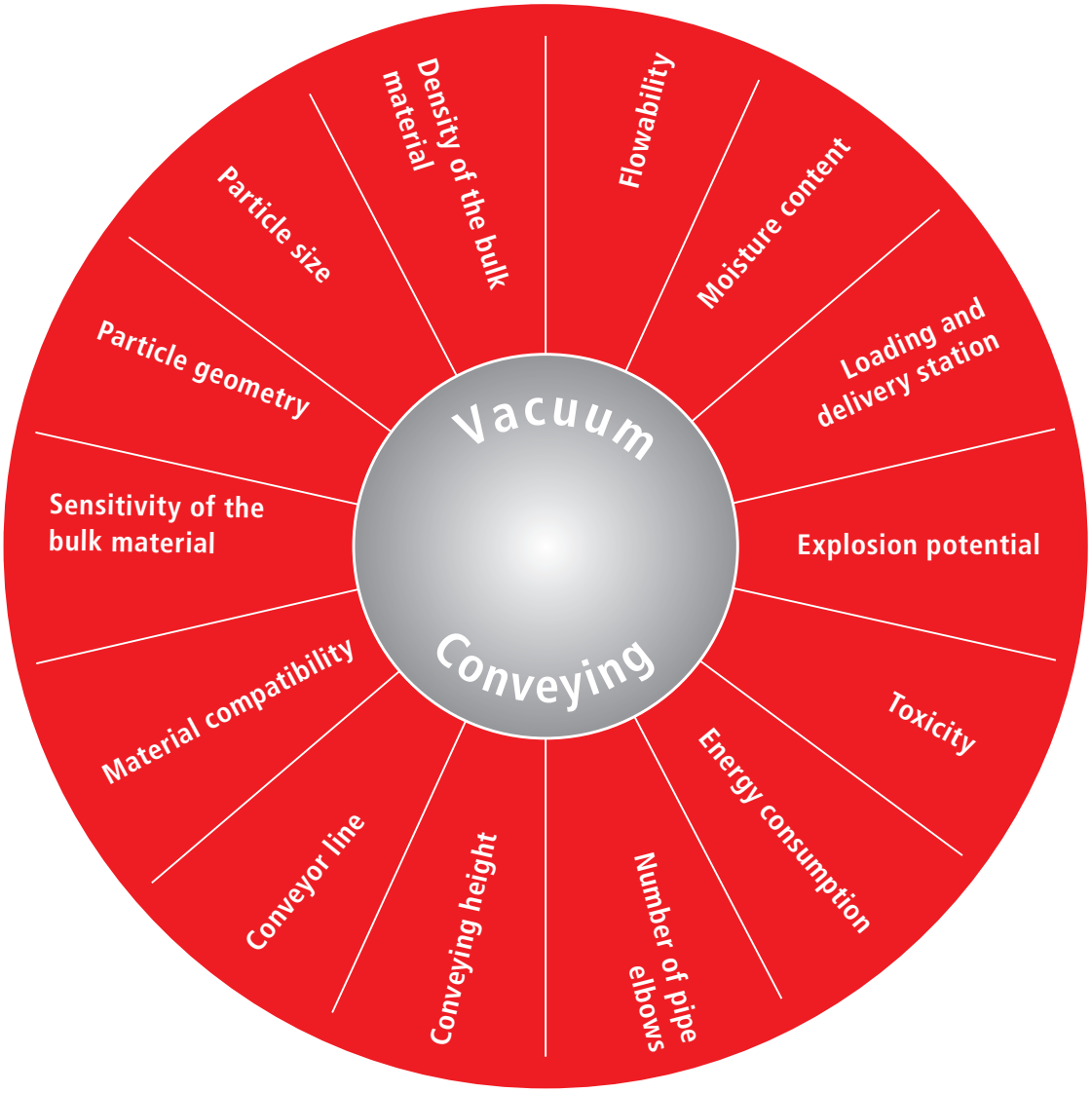
VOLKMANN vacuum conveyors in production processes

- **for the chemical industry:** robust and safe
- **for the pharmaceutical industry:** approved construction materials and the highest level of hygiene
- **for the food industry:** hygienic and inexpensive
- **for the paints and coatings industry:** quick cleaning without residue
- **can be supplied as ATEX approved vacuum conveyors**

How vacuum conveyors work

VOLKMANN
IDEAS AHEAD

Factors which influence pneumatic conveying



Possible conveying conditions in the conveyor line

Essentially, the overall difference in pressure in the conveyor line is a result of the quantity of the conveyed material in the line, its flow properties, the conveyor height (which has to be overcome) and the layout of the feeding station/line design. In addition, the vacuum generator must be able to overcome the overall pressure loss and at the same time, generate the necessary flow speed (air flow based on the conveyor line cross-section) in order to transport the conveyed material. For a stable conveying process, it is important that there is already a sufficient amount of additional diluting air generated in the product at the feeding station and/or the conveyor line. At the same time, the quantity of the added feeding air determines the condition of the conveyed product in the conveyor line. With the correct adjustment of the feeding system, the material can be conveyed very gently. Segregation is avoided, electrostatic charges are reduced and particular effects (such as the formation of 'angel hair' in plastics) are eliminated. Three conveying conditions can be set in the suction line:

Conveying by lean phase

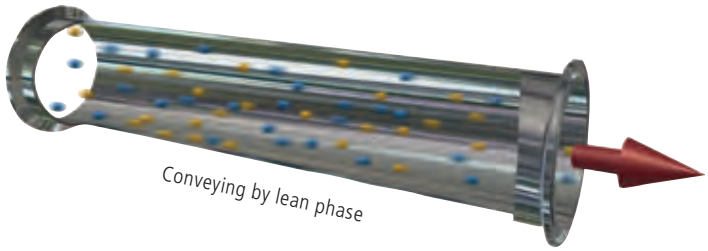
In conveying by lean phase, the speed of suction air w is much higher than the saltation velocity vS of the individual product particles. It is approximately 3,540 - 6,900 ft/min. The material load on the suction air is quite low. Depending on the characteristic curve of the vacuum generator that is used conveying by lean phase can often achieve maximum flow rates. In the case of sensitive material however, the high speeds can lead to increased particle abrasion, breakage of the particle and wear.

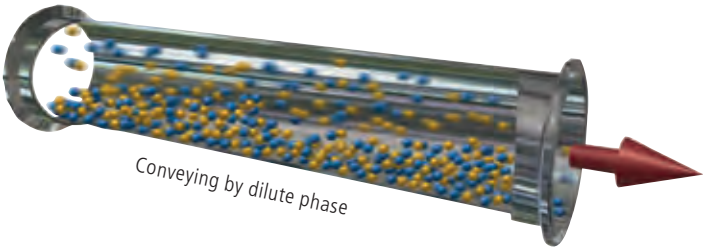
Conveying by dilute phase

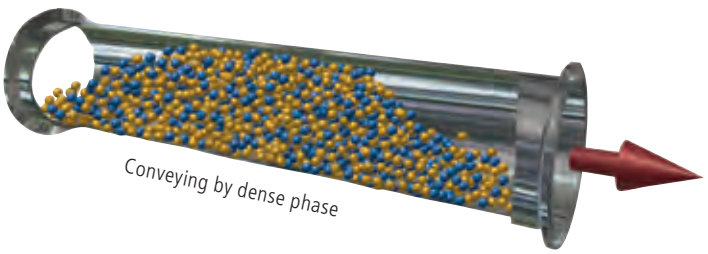
In a horizontal conveying pipe, if the air speed w is lowered to below 4,000 ft/min, the conveyed material increasingly falls into the lower half of the tube and it moves through the transport line in waves. The formation of the wave greatly depends on the product. It can form individual plugs or settle so far down the line that again, conditions for conveying by lean phase prevail above it as a result of cross-sectional narrowing of the line and an increase in vacuum air speed. The ratio of the speed of the material v to the speed of air w is less than 0.7. The material load is usually higher than when conveying by lean phase. Conveying by dilute phase is gentle on the product and in terms of the energy that is consumed, the most favorable type of conveying by vacuum.

Conveying by dense phase

If the material load is increased further and the air speed is reduced, individual plugs form in the conveyor line. Along the conveyor line, these fall away and they continually rebuild themselves. As such, even when conveying vertically, the stable transportation well of materials can be realized with an air velocity w that is still well way below the floating speed vS of the individual grain. The conveying of the plug is particularly gentle for the material. In order for the plug to be conveyed, suitable vacuum pumps must be selected to generate a high negative pressure with a sufficiently high air flow rate in order to prevent any blocking of the suction pipe. The air speed w is between 600 - 2000 ft/min, wherein the ratio of the material speed to the air speed is less than 0.5. The product mass flow rate can be up to one hundred times greater than the air mass flow rate. In terms of the energy that is needed, conveying by plugs is comparable to conveying by lean phase, because the required air flow rate is much smaller, but instead, pressure difference increases in the same proportion.


Conveying by lean phase


Conveying by dilute phase


Conveying by dense phase

Volkmann vacuum conveyors

Individual optimization

Often, the various processes (e.g. chemical engineering) mean that different powders and granules have to be conveyed with one conveyor (e.g. various colour and coating powders in the paint and coatings industry). The vacuum conveyor should then be set up as simply as possible and allow for easy disassembly and cleaning.

At the same time, the selected container material must be resistant to cleaning agents and corrosive chemicals. This is why the tried and tested stainless steel modular design is used. On the one hand, it ensures a quick changeover between product and on the other hand, it fulfills the high requirements of chemical, food and pharmaceutical processes. In addition, single stainless steel modules enable vacuum conveyors to be individually tailored according to the specific task.

VOLKMANN vacuum conveyors – your advantages as a client!

- unparalleled, flexible modular concept
- easy to take apart by hand and clean
- suitable for GMP applications
- superior filter technology
- individual adaptations, specifically tailored to the conveying task
- highly effective vacuum pumps
- no generation of heat
- quiet and extremely reliable operation
- light weight and compact design
- process engineering and support, directly from the manufacturer
- in-house manufacturing in Germany

Tangential inlet

Radial inlet

For reliable conveying, various radial and tangential suction port designs are available.

In particular, small conveyor units can be designed in conjunction with the multi-stage air-powered vacuum pumps. These can be used in a stationary or mobile situation. As high negative pressure may develop in the case of plug conveying, the container system must also be able to withstand the high vacuum levels. The transport capacity is catered for depending on the size of the separator container/filter surface, the vacuum pump, the design of the line and the quantity of feeding air that is added.

The conveyed material volume per suction cycle is then more or less constant for the respective system, so that the conveying capacity largely depends on the bulk density of the material and how the feeding of the product is designed.

Specific, accountable and creative

The system development process

Consultancy, development, manufacturing and service from one source.

Consultancy

Together with our clients, we establish the requirements and basic principles of the project. We employ highly trained professionals, who are very familiar with the use of conveyor technology, the handling of bulks and the need to guard against explosions, hygiene and automation. In the case of complex projects, we introduce project managers from our construction/development department to work in the team at an early stage.

Construction, development, project management

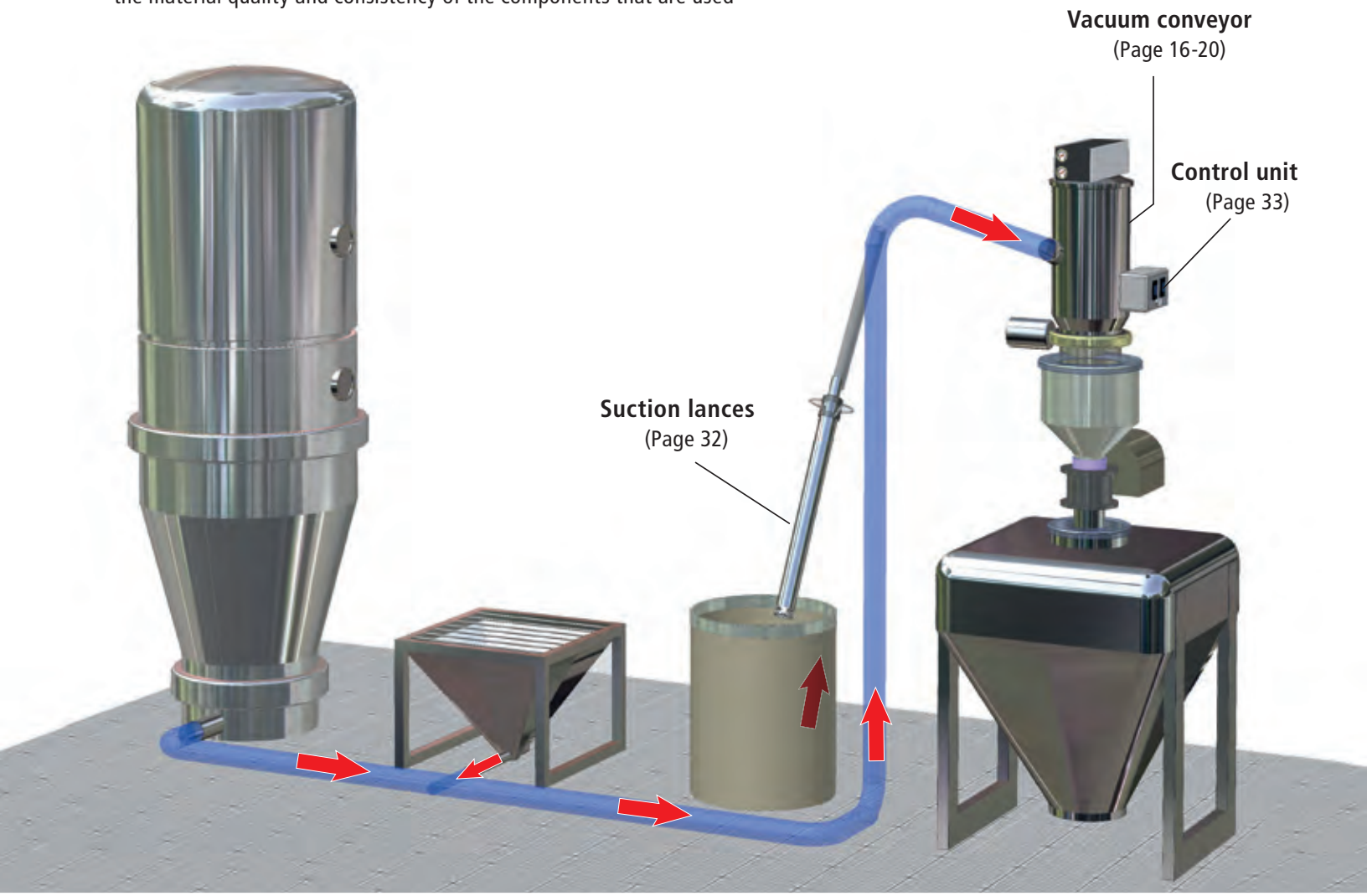
Our project team consisting of construction engineers, technicians and mechanical technicians, implement the requirements within the current scope. Together with the sales team, we maintain close contact with customers to ensure we only want to offer products which are really clean, safe and user-friendly.

Material flow

Feeding and delivery systems in a vacuum conveyor

VOLKMANN vacuum conveyors are used throughout industry where critical design makes a difference:

- high levels of hygiene when transporting materials
- easy dismantling and cleaning of all components that come into contact with the product
- high operational safety and reliability
- the avoidance of risks of explosion
- the material quality and consistency of the components that are used



Collection directly from:

- Feeding hoppers
- Bulk bags/FIBCs
- Silos
- Drums
- Sacks
- Sheets
- Belts
- Dryers
- Cutting systems
- Hall floors
- Trays
- Centrifuges

Direct loading of:

- Stirred tanks
- Reactors
- Bottling plants
- Weighing containers
- Sieve machines
- Mixers
- Tablet presses
- Bulk bags
- Bagging systems
- Drums
- Silos
- Preparation containers

Application examples:

The chemical, food and pharmaceutical industry

Vacuum conveyor in the food industry for conveying additives.

Vacuum conveyor with a powder lock for conveying pigments in a solvent atmosphere.

Loading a toner filling system.

PPC with a WIP function on a table press.

VOLKMANN vacuum conveyors can be found all over

Focus: Systems and complete solutions for applications involving chemicals,

Two vacuum conveyors for loading loss-in-weight feeders.

Emptying a dryer with a manual suction wand.

Emptying the drum and loading the mixer;
Emptying a fluidized bed dryer and filling the drum.

Vacuum conveyor for conveying pigments in the manufacturing of paint.

special materials, pharmaceuticals, food and pigments

Vacuum conveyor for automatically emptying a fluidized bed dryer. Product is dispensed via an immersion pipe into IBCs.

Conveying of cake/bread mixtures in the food industry.

Continuous charging of a mixing container and autoclave for manufacturing adhesives.

Vacuum conveyors in an outdoor installation, for charging silos.

Vacuum conveyor VS

The allrounder for the safe and hygienic handling of powder

The VS family of vacuum conveyors

- unique, modular design for a countless number of applications
- small and lightweight
- easy to install and operate
- simple and quick to dismantle without tools
- safe and reliably hygienic to clean

Its modular structure allows for task-specific configuration of the equipment. This also enables complex conveying tasks with difficult products to be reliably conveyed. We are happy to advise you concerning the precise configuration of the conveyor using our extensive product test database and expertise. Through actual trials of the conveyor involving your materials (either in our technical center or on your premises) you will gain confidence in our solution.

Your advantages as a client

- hygienic design of all components
- sophisticated filter technology
- no residuals of the product in the conveyor
- easy material discharge, large discharge valve openings
- flow rates 100 to 20,000 lbs/hr
- pneumatic systems, fail-safe controls
- electric vacuum pumps (optional)
- valves/fittings upon request, to your specifications

According to directive 94/9/EC, all VS conveyors are ATEX certified for assembly in zones 1, 2, 21 and 22. EC type approval certificate number TÜV 02 ATEX 7005 X. Special conditions apply for the safe use of the equipment.

Ex II 1 D c 80°C/II 2 D c 100°C

Ex - /II 2 GD c 100°C (T4)

Vacuum conveyor VS

Uniquely modular, operationally safe and user-friendly

Separator with a hygienic module system (pat.)
- four sizes: Ø 200, Ø 250, Ø 350 and Ø 450 mm
- modular segmented structure with a clamp ring system
- light-weight modules, easy to dismantle and clean
- stainless steel 1.4404/1.4435 (AISI 316L), 1.5 mm wall thickness
- ground surfaces Ra < 0.8 µm
- (or electropolished < 0.5 µm)
- coatings, as specified
- silicone seals (FDA), EPDM (FDA) or NBR

QX quick exchange filter system (pat.)
- quick exchange cartridge filter with a secure double seal
- hygienic seal gap between filter and plate
- long lasting sintered PE-HD cartridge filter (5 µm, FDA)
- Teflon-coated star filter cartridge (0.1 µm, FDA)
- stainless steel filter elements
- filter for materials hazardous to health
- filter bag with a Teflon membrane

Automatic filter cleaning
- back blowing air shock systems

Product suction ports
- suction port diameters Ø 25-100 mm
- radial suction module
- tangential suction module with or without a cyclone insert
- component reduced eco-module
- suction port, with an optional clamp connection

Container emptying
- discharge valve openings with a large flap diameter for fast emptying
- active discharge valve with pneumatically actuated flap
- large diameter butterfly vlaves
- fluidization and piston vibrators for improved material discharge
- individual valves and fittings as specified

Modules for connecting to the process
- flange and cone modules
- storage tanks with liquid flow
- textile sleeves, immersion pipes
- Individual modules and system integration

Vacuum pumps
- over 50 MULTIJECTOR® types for vacuum conveyors
- multi ejectors made entirely of stainless steel (CIP compatible)
- electric vacuum pumps (please ask)

Controls
- small pneumatic control units
- automatic control units with fill level monitoring
- preparation for PLC control units (on the part of the customer)

Accessories
- suction lances and balancers for manual operation
- product feed hopper
- suction hoses and pipes
- individual wall brackets or special frames
- stationary and mobile fixed height or lifting columns for vacuum conveyors

The patented *VS module connection* offers a high level of security
- hygienic design
- dust free operation
- assembly/disassembly without tools
- common captive seals
- electrical conductivity via the module joint connection in all operating modes without additional cable grounding

Vacuum conveyor PPC

The specialist for pharmaceutical applications

The PPC family of vacuum conveyors

This range has been specifically developed by VOLKMANN for applications which, in addition to simply conveying, require maximum quality in terms of surfaces and the features of all parts which come into contact with the product. They are mainly used in the field of the pharmaceutical industry and pigment processing and are characterized by their single-piece construction without additional modules. The structure of the equipment meets the highest hygiene requirements. Nevertheless, without the use of tools, they can be easily disassembled into their individual parts in just a few steps and easily cleaned or sterilized.

The conveyor construction is designed as electrically conductive throughout including the transferred product, it is built to be free of gaps and dead space. Build up of product residuals and pockets of dust/germs are avoided. PPCs empty the transported material via large hygienic butterfly valves.

PPC vacuum conveyors are offered as pre-configured units for the specific task. In addition to various pharmaceutical and/or electrically conductive filter systems (e.g. for explosive applications), they can be supplied with special clamp-connections, coatings and discharge flaps (according to customer requirements). For users in the field of pharmaceutical production, we are able to provide supplementary material/process analyses and selection procedures and can also prepare the documents which are necessary for a qualification. We also offer special services to support the validation of your production process.

According to directive 94/9/EC, all PPC conveyors are ATEX certified for assembly in zones 1, 2, 21 and 22. EC type approval certificate number TÜV 02 ATEX 7005 X. Special conditions apply for the safe use of the equipment.

Ex II 1 D c 80°C/II 2 D c 100°C
Ex - /II 2 GD c 100°C (T4)

VOLKMANN PPCs are WIP/CIP compliant

Our PPC vacuum conveyors are designed to be CIP compliant (CIP = Clean in Place). Together with you, we coordinate the scope of the CIP function precisely to your requirements and application.

Vacuum conveyor PPC

Application examples

Loading of the mixer using PPC.

PPC (WIP) for charging a tablet press.

PPC on a sieve machine.

Tool free assembly/disassembly of the butterfly discharge flap.

Emptying system with the highest hygiene requirements.

Vacuum conveyor INEX

Vacuum conveyor with an interting gas function: VOLKMANN INEX

With VOLKMANN INEX vacuum conveyors, material can be simply and safely transported in hazardous processing systems such as stirred tanks and reactors. This enables powder to be transferred in all dust and gas explosion zones.

VOLKMANN INEX vacuum conveyors for applications in explosive areas

- are constructed free of ignition sources
- operate pneumatically without electrics
- are electrically conductive throughout
- small fill volumes
- work with low transport speeds
- do not produce heat
- do not have hot surfaces
- do not have rotating parts
- are easy to control and operate.

Various alternative factors may require the inerting of the conveying process:
A) The product to be conveyed is to be fed into an area which is already inerted, e.g. a hammer mill which works under inert gas conditions.

B) Flammable gases/fluids or solvent-damp powder (hybrid mixes) may be jointly collected and conveyed (e.g. transferred from ATEX zone 1 or 2).

C) The product is to be introduced to ATEX zone 0 or 1 i.e. in a zone in which flammable gases are regularly present.

In case B, the entire conveying process should be carried out inertly as brush discharging are sources of ignition for explosive gases. In cases A and C it is sufficient if the separator container of the vacuum conveyor is inerted before emptying.

All VOLKMANN vacuum conveyors in the following series: 'INEX-VS', 'INEX-PPC' and 'INEX-Pressure rated' are certified according to directive 94/9/EC ATEX. EC type approval certificate number TÜV 03 ATEX 7017 X. Special conditions apply for the safe use of the equipment.

Ex II (1) G D (Abgabe) /
Ex II (1) D (2) G (Aufnahme) /
Ex II 2 G D c Tx (Tx in °C).

Bulk bag unloading stations

The bulk bag emptying station in the construction industry with massagers and lump breaker for products which do not flow easily.

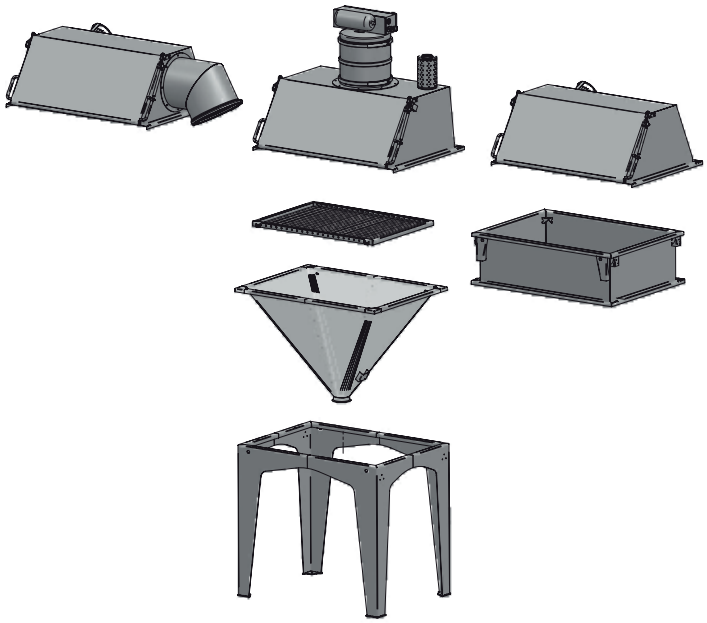
Bulk bag unloading station (BBU)

The BBU modular bulk bag unloading station has been optimized for dust-free operation in conjunction with vacuum conveyors. It can be used with almost all materials to be conveyed. In addition, products which do not easily flow can be securely discharged by means of the vibration unit and material massaging elements. In connection with VOLKMANN vacuum conveyors, it is possible to transfer materials in low-dust and low-contamination conditions. The BBU modular bulk bag emptying station is flexible. It can easily be adapted and optimized for the production environment.

- for bulk bags with a weight up to 2,000 lbs
- fork lift truck loading or using built in hoist
- dust-free docking
- dust collection when exchanging the empty bulk bag
- optional lump breaker
- combined systems are available incl. sack feed
- discharge flow aids

Feeding stations

Modular feeding station RNT 180.



Feeding stations

VOLKMANN offers a comprehensive range of product feeding stations and discharge stations for bulk materials contained in bags. Stations with different holding volumes are available: mini (1 ft³) to maxi (> 16 ft³ buffer). All stations are made in stainless steel by VOLKMANN. Upon request, all product contact parts can also be made from 316L (1.4404) stainless steel.

Individual feeding hopper

Mini product feeding station

Discharge station connected to the clients' process.

Product feeding station with an expansion to the holding volume complete with empty bag disposal port.

Bag feeding stations, lump breakers

Partially-automated bag feeding station featuring contained supply, dust extraction and an empty bag compressor.
The full bags are placed on the belt and by pressing a foot pedal, are transported into the emptying station via the conveyor belt. The operator pulls the bag into the emptying station, cuts it open empties it and folds up the bag. The emptied bag is then thrown into the empty bag compactor. As the empty bag compactor is filled, the safety door is closed and the empty bag compactor is started.

Containment product feeding stations

High quality powder and toxic dusts require dust-free handling. VOLKMANN's product feeding stations allow materials to be removed from bags, boxes, PE bags and small bags free from dust and contamination from the environment.

Lump breakers/Disintegrators

What good is a sophisticated delivery system if the flow of materials fails at the point where they are fed? VOLKMANN considers the entire process and also takes care of suitable conditioning of materials at the beginning of the process. Decisions as to whether the material should be fluidized, vibrated, stirred or even first reduced from fist-sized lumps to a transportable grain size are made, depending on each individual case.

Powder locks, double flap locks, pressure resistant and shock resistant vacuum conveyors

Double flap locks

Powder locks and/or double flap locks ensure that when filling containers, there is no direct contact between the container interiors of the unit to be charged and the surrounding environment. They also prevent hazardous substances from escaping.

VOLKMANN powder locks can be easily inerted so that no unwanted atmosphere (oxygen) passes from the lock into the receiving vessel. Through the lock, it is also possible to avoid carrying unwanted receiving vessel gases back through to the conveying process.

The special feature of VOLKMANN powder locks is the ability for it to couple directly to a standard conveyor.

Pressure resistant and shock resistant vacuum conveyors

If bulk material needs to be delivered directly into reactors and stirred tanks (which may be under pressure) the separating container of the conveyor should be designed as a pressure vessel (permissible pressure range -1 to +6 bar or -1 to +10 bar, various embodiments are available in accordance with the Pressure Equipment Directive). Similarly, specific safety requirements on the part of the client, or the concept for protecting against an explosion (as selected by the operator) may make the pressure-resistant and/or shock resistant construction of the vacuum conveyor system mandatory.

Pressure-resistant vacuum conveyors from VOLKMANN will comply with customized, safety requirements in every respect. They provide safety when handling bulk material.

Coatings

PPC containers which have a bonded ETFE coated liner , are exceptionally resistant to chemicals and are FDA approved.

PPC container with an outer coating.

Coatings

Cream fat powder with 70% fat, baked iron oxide, moist activated carbon coke - there are numerous examples of adherent and adhesive powder and bulk solids. A wide variety of conveyor coatings are used in order to transport these in a stable and secure way. For a clean separation (to avoid cross-contamination) and low residue, it is possible to change both the conveying method and liner materials.

For example, special coatings (e.g. Halar®) are used in corrosive environments. An inner coating protects the vacuum conveyor when corrosive powders are transported. If the atmosphere outside is also corrosive, the conveyor is also coated on the outside. Even the vacuum generator is available in an acid-resistant material.

In certain industries, certain material specifications have to be adhered to (even in non product contact parts). At VOLKMANN, our in house production ensures alternative materials can also be supplied (e.g. equipment that is completely copper-free).

Conweigh weighing and dosage systems, dosing powder locks

Weighing and dosing systems

VOLKMANN weighing and dosing conveyor systems are set up on the basis of the VS and PPC vacuum conveyors (with all their possibilities) and work gravimetrically. Special designs ensure the vacuum conveyor is isolated from external forces. Weighing occurs throughout the entire conveying cycle to accurately establish the precise weight of the material in the separator.

The target amount of material to be conveyed can be entered into the control unit via a touch screen display. Product collection is also possible from various discharge stations and this can be integrated into the control unit. In addition, 'recipes' can be created automatically with CONWEIGH.

The combined transfer-dosing system can be typically used with batch weights of over 4 lbs wherein materials (as is usual with vacuum conveyors) are delivered intermittently. The maximum quantity depends on the conveying capacity of the system. In the case of CONWEIGH, this is up to 4 t/hr. Depending on the design of the system, it can achieve an accuracy of 99 to 99.7% of the displayed value.

The design allows for simply and quick disassembly and cleaning of the VS and PPC conveyors.

Alternative dosing systems, e.g. differential dosing scales and other continuous dosing systems are also available in a package (when ordering a complete solution).

Rotary feeders

VOLKMANN dosing feeders are characterized by their hygienic design, the fact they are easy to disassemble and clean, as well as their safety when operated. They are designed and manufactured by VOLKMANN.

- available in a 4 and 6 inch connection diameter
- various rotors are available
- optional bearing clearance purging by air
- the drive can easily be removed for cleaning/servicing
- product product contact parts in AISI 316L stainless steel
- ATEX approved design max. zone within the valve 20 or 2; outside of the valve 21 or 1)
- type approval certificate number BVS 08 ATEX H 006 X
- Ex II 3/2G c T3; II 1/2D c 135°C
- individual tailoring is possible, e.g. clamp connections,
- special flange, rotor variants, special materials

Drum Emptying

Drum Emptying

Our systems for emptying bulk from drums either work by tilting and emptying the drums into a discharge station or by an automatic guided vertical suction wand. Alternatively, the feeding suction wand may be operated manually.

The systems work with a regulated suction air flow and by doing so, they avoid greater pressure on sensitive bulk materials, e.g. the pressure that can occur when tilting and decanting.

At the same time, under controlled environmental conditions, it is possible to seal the drum bags/liners for working in a closed system without restrictions.

Tablet conveyor

Loading a tablet packaging machine.

Product collection with a lance.

Film-coated tablets, coated and uncoated tablets, pills, capsules, oblongs (some of which feature a breaking notch).

Tablet conveyor

Whenever tablets have to be moved, other operational aspects have to be considered. Frequently, faults that may not be visible to the naked eye such as mechanical damage, broken edges, scratches, abrasions, discoloration (gray streaks), etc. to the tablet should be avoided . Tablet conveyors from VOLKMANN offer damage free transportation for a variety of sensitive tablets. They collect the tablets, e.g. from transport containers or directly from the tablet press and load dust-free containers, bottling or packaging systems. They are easy to install and offer reliable feeding, even with low ceiling heights.

VOLKMANN tablet conveyors have wear-free contact surfaces (either made from stainless steel, glass or special FDA-approved shock-absorbing coatings). Special gap-free and shock-minimizing hose systems act as transport lines. Tablets find their way into the separator via an inlet speed reducer and collect in the conveyor body. The suction air is directed to a second stage dust collection module and dust is held here-without being returned to the tablets. The vacuum pump switches off once the primary separator is full. The tablets are discharged directly into a blister packaging machine and/or into an intermediary buffer hopper.

The design of the tablet conveyor is determined by the application, the required conveying capacity and, above all, the tablet itself which is to be conveyed and the type of product feed/delivery. Clients do not only receive individually adapted conveyor systems from us, but also complete system solutions, e.g. for conveying and dosing their raw materials. Why not get in touch with us and take advantage of our many years of experience in the business of handling bulk materials for chemical, food and pharmaceutical industries.

Transparent vacuum conveyor system with a glass container.

WIP, CIP, containment

WIP/CIP

Since efficient cleaning of a conveyor is the requirement, PPC. (Pneumatic Pharma Conveyor) vacuum conveyors are usually selected in Wetting/ Washing In Place (WIP) or Cleaning in Place (CIP) applications.

WIP

Modified PPC vacuum conveyors have been in use for many years in places where, following the transportation of powder, all parts coming into contact with the product are purged in their installed state. Using special designs and hygienic valves, an effective wetting and flooding of all components takes place. All of the washing liquid is subsequently discharged. If desired, the filter may be replaced by a rinsing cover and the remaining separator is cleaned in place (CIP).

CIP

A "full" CIP variant is possible as a further enhancement in which the filter also remains in the system during the cleaning and drying. Here, success is achieved as a result of special washing nozzles, rinse cycles in different directions, the avoidance of pooling areas and special, hygienic drain valves.

Containment

The many cleaning options are also transferred to other solutions. In addition, VOLKMANN vacuum conveyors are already used in clean rooms and in rooms classified within OEB (Occupational Exposure Band) 4 (OEL 1-10 µg/m³).

Lifting columns and mobile frames

Lifting columns for vacuum conveyors

- the simple supply of material, the filling of containers and production systems
- quicker, more comfortable and more hygienic operation
- combination of mobile lifting columns and vacuum conveyors
- operated pneumatically, electrically or manually
- hygienic pharma designs
- individual interfaces and docking solutions are available
- various designs, all manufactured by VOLKMANN
- vacuum conveyors on mobile frames loading other systems

Fixed lifting/swivel column

Mobile lifting column with a swivel device

Platform frame with a parking position for PPC INEX

Industrial vacuum cleaners, grease, oil and liquid vacuum cleaners

Industrial vacuum cleaner for picking up swarf

Industrial vacuum cleaners

Handy standard models help keep your production clean and dry. Use our industrial vacuum cleaner to easily and reliably suck up and, if necessary, filter and directly transport your media into collection containers, collection bags, drums and machinery.

Even swarf can be collected reliably without any wear and tear. This means no further problems!

Grease removal and scavening

Grease, oil and liquid vacuum cleaners

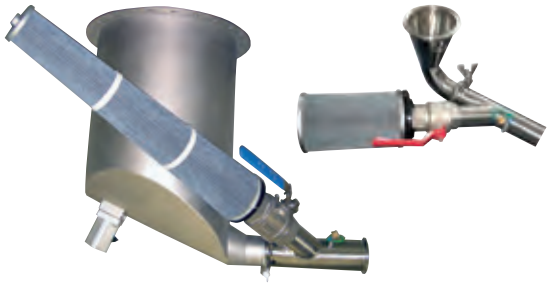
Application examples:

- processing fluids from a sump pan (collected in the production facility and pumped back to manufacturing facilities, ready filtered)
- collecting and recovering test petrol in engine test benches from pipes and mounting plates
- in the event of a disaster, sucking up and separating oils, petrol and kerosene from surfaces and water courses
- when servicing roller bearings, cleanly and simply separate grease into collection containers.
- conveyer height up to 9 m (depending on density and viscosity)
- suction capacity 0.35 - 7062 ft^3/hour

Oil and liquid transfer

Accessories for vacuum conveyors

Feeding elbows, suction lances, product points and suction hoses



Feeding elbows

Feeding elbows with air control valves allow precise volumes of feeding air to be added to the conveying line. The correct adjustment of the air supply valve is determined during the system commissioning. Special designs (e.g. with an inert gas connection) are also available.

Suction wands

- are available in different designs and materials:
- hygienic suction wands with a feeding element (POM FDA), stainless steel 316L, Ø 1-4 inch
- double wall suction wands with a feeding element for emptying lined drums and bags. The feeding air can flow to the intake opening through the gap into the double jacket without restrictions, fluidize the material to be collected and be carried away. Special designs are available e.g. with a inert gas connection.

Product collection points

VOLKMANN multi collection points systems make it possible for one or more vacuum conveying systems to connect to different collection stations. For example, by means of suction lance, a vacuum conveyor removes the same or different materials from connected silos, bulk bag stations, bag feeding stations or drums.
We provide standard equipment for 2-8 transport lines as well as individually coordinated systems according to your specifications.

Suction hoses

- Various materials and qualities:
- polyurethane or PVC
- FDA approved material as an standard
- vacuum resistant, lightweight and flexible
- electrically conductive/dissipative embodiments are available for all explosive zones

Accessories for vacuum conveyors

Pneumatic timer, control units, filters

Pneumatic timer

Our simple pneumatic timers control all VS and PPC vacuum conveyors and are available with plastic or stainless steel housing.
All times can be set manually. Can be used in explosive zones.

ET/ET advanced

The electro-pneumatic and intelligent compact control evaluates incoming signals from the fill level sensors as well as a start signal supplied by the customer. All functions can be set via the keypad and the text display.

Electric control units

We manufacture programmable logic controllers (PLC) for our conveyors, emptying and dosing systems in our own control unit workshop.

Filters for vacuum conveyors

We equip our vacuum conveyors with the best available filters for the respective application

- PE-HD filter elements from FDA compliant material with BIA approval (separation rate > 99.99%, for material > 5 µm)
- stainless steel filter cartridges
- star filter cartridges with an electrically conductive polyester fleece and PTFE membrane (FDA compliant, for material > 0.5 µm)
- bag filter with a PTFE membrane

With a high level of reliability and top separation rates, VOLKMANN offers durable filters which can be simply removed and cleaned.

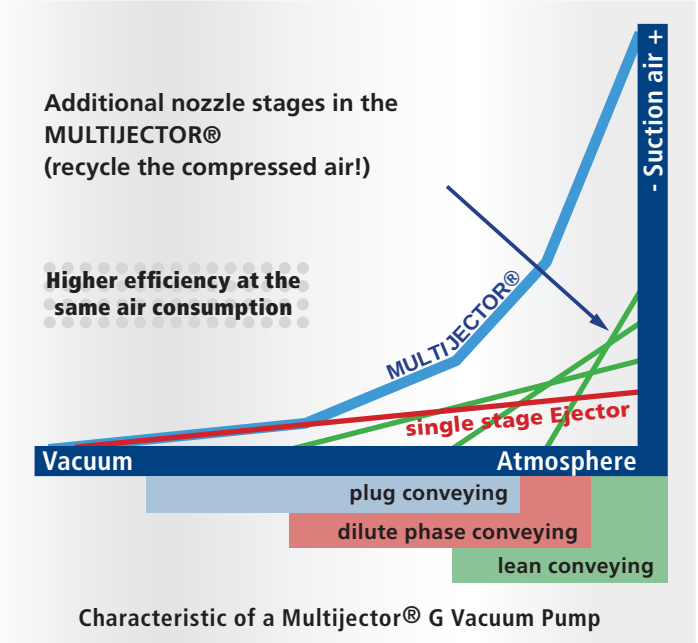
VOLKMANN Multijector®

VOLKMANN MULTIJECTOR® Vacuum pumps

The general advantages of compressed air-operated pumps are known: small size, lightweight, simple construction and wear-free / maintenance-free operation coupled with simple controls and installation in any position. The fact that they also work quietly and neither emit heat nor oil mist, particularly pleases users. However, in the case of large suction volumes, how do you ensure the ejectors are economical? A look at the design reveals how this is done: A classic ejector consists of a primary jet (injector), a mixing chamber and a diffuser. Compressed air is supplied through the primary jet, which greatly expands in the mixing chamber by entraining ambient air. This mix then leaves the ejector via the diffuser.

If one arranges additional jets behind the diffuser, it is possible to form additional jet stages. The air that is sucked in is mixed with the compressed air, this second-step then acts as "free" propelling jet and transforms the simple ejector into a real vacuum pump. The subsequent stages do not reach the high vacuum level of the first ejector stage though. The expanded effective suction cross-section however does achieve a far greater suction air flow but with a reduced vacuum level. And this is for free.

Nevertheless, the entire vacuum pump achieves the high vacuum of the first ejector stage, as the subsequent stages automatically disconnect from the vacuum chamber through non-return valves. The special jet geometry and flow management make our multijectors so uniquely efficient.



Characteristic of a Multijector® G Vacuum Pump

In some applications, we recommend that an electric vacuum pump is used, e.g. in the event of an insufficient compressed air supply provided by the customer or extremely long transport routes which, for stable conveying, make a large volume flow and a high vacuum necessary. We are happy to advise you concerning electric vacuum pumps, regardless of the manufacturer.

INQUIRY FORM
Application Specifications for Vacuum Conveying Tests and Quotations

VOLKMANN, Inc.
1900 Frost Road
Suite 102
Bristol, PA 19007 USA
Tel. 609 265 0101

This is an interactive form. Please complete, save and email to:
Email: USA@Volkmann.info
Or, if you prefer: Print, complete and FAX to: 609-265-0110.

1. Customer Information

Quotation Required By:_____

Contact person: _____
Company: _____ eMail: _____
Title: _____ Tel.: _____
Address: _____ Fax: _____
City: _____ State: _____ Zip/PC: _____ Country:_____

2. Conveying task

Conveying: Vertical : ____ ft ____ m Horizontal : _____ ft _____m Total Distance : _____ft _____ m

No. of Bends: _____ x 90° Desired transporting capacity: _____ ◯ lbs/hr ◯ kg/hr

Product pick-up location:_____

(e.g. suction from hoppers, bins, BB Unloader, bag dump stations (rip & tip), bulk bags, dryers, mixers, sieves, etc.)

Product discharging location:_____

(e.g. tablet press, blender, filling machine, IBC, drums, reactor, buffer hopper, container, etc.)

Additional Information: _____

_____

(Please give more precise statements about conditions such as pressure, temperatures, ascending steam, solvents, etc. if applicable.)

2.1. Ex-zones according to 94/9/EG directive (ATEX)

Will the unit be used in EX-area? ◯ NO, please continue with 2.2 ◯ YES – please specify:
Suction location: Class level_____ Installation location: Class level _____ Discharging location: Class level _____

2.2 Is the material combustible or potentially explosive?

Is the material ignitable? ◯ NO ◯ YES: Minimum Ignition Energy (MIE) is _____mJ

3. Material definition of the product to be conveyed

Trade name: _____ **Chemical designation:** _____ **Manufacturer:** _____

Particle size: _____min. _____ max. (please designate if size is stated in ◯ µm ◯ inches or ◯ mm)

Bulk density: _____ ◯ lbs/ft³ ◯ g/cc **Density** (basic material): _____ ◯ lbs/ft³ ◯ g/cc

Particle description: _____ **Particle geometry:** _____

Flowing characteristics (estimation): ◯ free flowing ◯ sticky ◯ bridges **Max. humidity content:** _____ %

Is the material hygroscopic, does it absorb humidity?	◯ NO	◯ YES
Is the material scouring/wearing?	◯ NO	◯ YES
Is the material sensitive to mechanical loads?	◯ NO	◯ YES

PLEASE ENCLOSE SAFETY DATA SHEET IF APPLICABLE

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?

☐ Stainless Steel AISI 316 L/1.4435-1.4404 ☐ Nickel-Plated Brass (MSV) ☐ Nitrile
☐ Silicone (VMQ) ☐ Ethylene-Propylene-Dien-Rubber (EPDM)
☐ Polyethylene (PEHD) ☐ Polyurethane (PUR)
☐ Others: _____

Which materials are **NOT** allowed to be used outside the product contacting area?: _____

Do you have special materials that should be used for the product contacting area of the Conveyor? ◯ NO ◯ YES

☐ Separator container: _____ ☐ Gaskets: _____ ☐ Others: _____

Are any special certificates necessary for the product contacting parts? ◯ NO ◯ YES: _____

Operative area of the unit (eventually tendency): ◯ Chemical ◯ Pharmaceutical ◯ Food ◯ Others: _____

Continued on next page

5. Information with regard to health risks, industrial safety and environmental protection

Is the material poisonous/toxic?	○ NO	○ YES	Is the material corrosive/caustic?	○ NO	○ YES
Does skin contact have to be avoided?	○ NO	○ YES	Does the material cause allergic reactions?	○ NO	○ YES
Is the material harmful to the environment?	○ NO	○ YES	Is the material hazardous for water?	○ NO	○ YES

6. Additional Comments: _____

_____

_____

_____

Important: If you send any sample material for testing, we need up front the material safety data sheet (MSDS) and, if approved, the material packed in a reusable packaging with return note. All samples, containers etc. will be sent back to the sender after the tests. The freight charges will be invoiced to the customer or sent collect to their freight account.

7. Hand Sketch

If you would like to submit a hand sketch in the space below, please print the form, complete your sketch and mail, FAX, or scan and email.

This inquiry form was completed on _____

By _____

VACUUM CONVEYORS

& BULK MATERIAL HANDLING SYSTEMS

Systems and solutions for the clean, efficient

and secure handling of bulk material

Demonstrations on site, tests, trials in the technical center

Do you want to know more about the possibilities of vacuum conveying? Talk to us about our workshops and seminars that are specially tailored to your industry. We will provide you with the necessary basic principles, show you the incredible range of vacuum conveyors and strive to meet the requirements for your specific applications.
Together we will look for perfect solutions, which will also help to increase product safety and quality, improve the working environment, ensure production processes and save costs.

Seminars and training

Individual seminars, lunch and learn sessions or visits to our facilities in either Bristol, PA or in Germany are available and encouraged. We are happy to teach existing or potential clients about VOLKMANN vacuum conveyors and to share our powder handling experiences first hand. Where product testing is undertaken a written test report and/or a video is supplied with our quotation.

VOLKMANN, Inc.
1900 Frost Road
Suite 102
Bristol, PA 19007 (USA)
+1-609-265-0101
+1-609-265-0110
usa@volkmann.info
www.volkmannusa.com

VOLKMANN GmbH
Schloitweg 17
59494 Soest (Germany)
+49 (0) 2921 96040
+49 (0) 2921 9604900
mail@volkmann.info
www.volkmann.info

VOLKMANN UK Limited
Unit 50, Cressex Enterprise Ctr.
Lincoln Road
High Wycombe
Bucks, HP12 3RL (Great Britain)
+44 (0) 1494 512228
mail.uk@volkmann.eu
www.volkmann.co.uk

VOLKMANN France Sarl
Creapole 1
32 rue de Tournenfils, Lot 6
91540 MENNECY (France)
+33 (0)164 572698
+33 (0)164 572038
france@volkmann.info
www.volkmann.info

VOLKMANN
IDEAS AHEAD