

QUADRO PROCESS PRODUCTIVITY SOLUTIONS

For over 30 years, Quadro has made an unparalleled commitment to delivering the highest production efficiencies, product quality and consistency to market leaders in the Pharmaceutical, Food, Fine Chemical, Personal Care and Cosmetics industries worldwide.



With the engineering experience gained from developing reliable application-specific solutions for major processors in more than 80 countries, our knowledge of size reduction and dispersion is unmatched. In fact, meeting the evolving needs of our customers drives the development of some of the industry's most advanced processing technologies and systems – such as the *Quadro® Comil®*, *Quadro® FlexSift*, *Quadro® Fine Grind*, *Quadro Ytron®* in-line mixers, dispersers and emulsifiers, *Quadro® ShearFX*, *Quadro® HV-Emulsifier* and *Quadro Vac®* vacuum transfer systems.

Since 1976, Quadro has led the industry in research & development. Through the Quadro R&D Test Center we work



directly with our customers to run real-world tests of their processes on the latest Quadro equipment. The result has been technical breakthroughs that have changed the way many of our customers manufacture, and led to new global processing industry standards.

As the world's leading supplier of size reduction technology – with a vast global network of agents, distributors, OEMs and partners – Quadro provides a level of service and technical support that is unequalled in the industry. Our passion for technology is exceeded only by our dedication to meeting the needs of our customers.



SIZE REDUCTION • FLUID MIXING • PNEUMATIC TRANSFER



LOCAL REPRESENTATIVE



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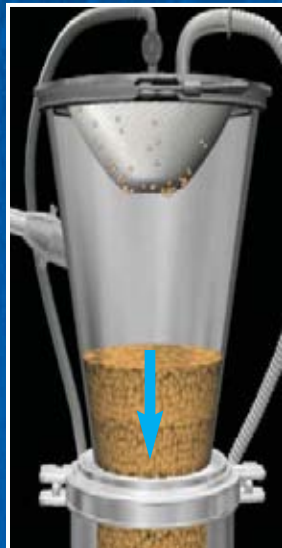
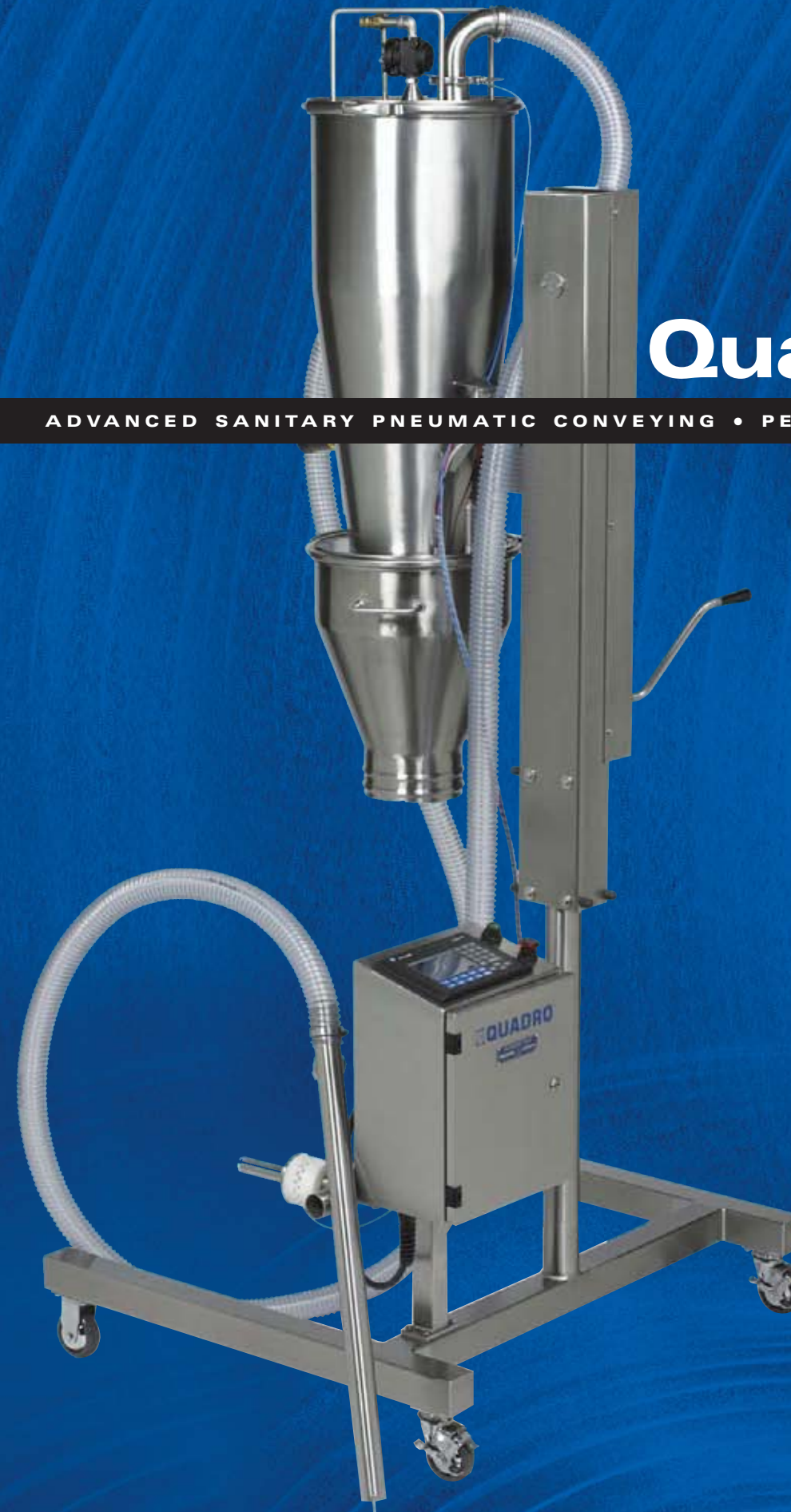
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QVACGEN09

Quadro Vac®

ADVANCED SANITARY PNEUMATIC CONVEYING • PERFORMANCE & FLEXIBILITY



Sanitary Pneumatic Conveying

The *Quadro Vac*®, all stainless steel construction, has the following features and benefits which make operation user-friendly, efficient and ultra-convenient:

- **Easy-to-clean** – modular unit dismantles quickly, in minutes – perfectly suited for the Pharmaceutical, Food and Dairy industries.
- **Operator-friendly** – easy set-up and operation decreases learning curve by 50%.
- **Rugged mechanism** – maximum reliability with minimum maintenance.
- **Simple, adjustable "air logic controls"** – non-electrical, spark-free.
- **Auto-cycle, self-cleaning filter backwash.**
- **Lightweight material "pick-up" wand or integrateable with bag dump stations.**
- **Low noise vacuum pump will save 80% in operating costs when compared to Venturi vacuum systems.**
- **FDA compliant materials (stainless steel construction and finish).**
- **Can easily be adapted** – to Comil®, FlexSift, Ytron product lines and/or completely integrated dust-free process systems.

Design Options

- Vacuum sources – various pumps (or Venturi for certain applications depending on plant air availability) with optional noise reduction systems.
- Various filters to match product – conical, multi-bag, cartridge or HEPA.
- PLC compatible controls and Programmer User Interface (stores up to 200 product handling programs).
- Bag dump stations and feed bins, metering equipment (dosing/weighing systems), and wide range of feeding systems for hard-to-convey materials.
- Portable stands, pin-mount and ceiling-mount.
- Rotary airlock discharge.
- USDA and 3A standards compliance.
- Silicone-lined receiver for tablet conveying.
- In-line security sifting and delumping capabilities, plus metal detecting and capturing systems.
- Engineered design customization, on-demand.
- ATEX certified.

Quadro Vac® Pneumatic Conveyor

- 1 Transition Shroud
- 2 Vacuum Isolation Valve
- 3 Lightweight Pick-up Wand
- 4 Vacuum Hose
- 5 Hand Actuated Lift (available in electric and pneumatically actuated format)
- 6 User-friendly User Interface Control Panel



TECHNICAL SPECIFICATIONS

Model	803	810	820	830		
Capacities	lbs/hr	up to 395*	up to 2000*	up to 2500*	up to 4500*	
	kg/hr	180*	900*	1136*	2041*	
Inlet to Outlet	Height	in	22.25	39.3	47.7	54
		mm	565	99.7	1085	1371
Diameter	in	8	17.7	17.7	17.7	
	mm	203	450	450	450	
Volume	ft ³	0.11	0.36	0.71	1.07	
	L	3	10	20	30	

Height = Total Height (including maintenance height for cap removal).

Diameter = Top Diameter.

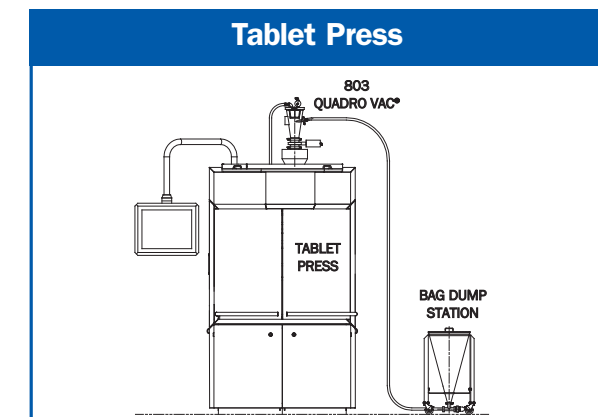
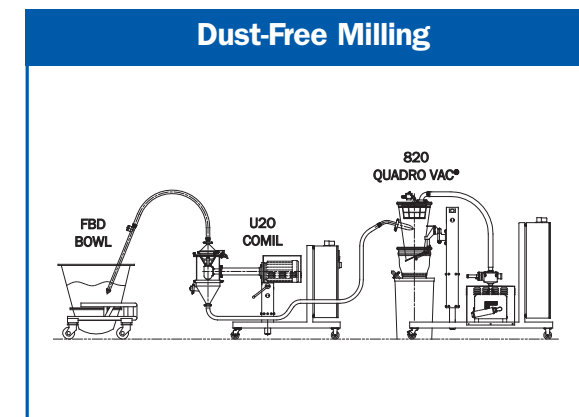
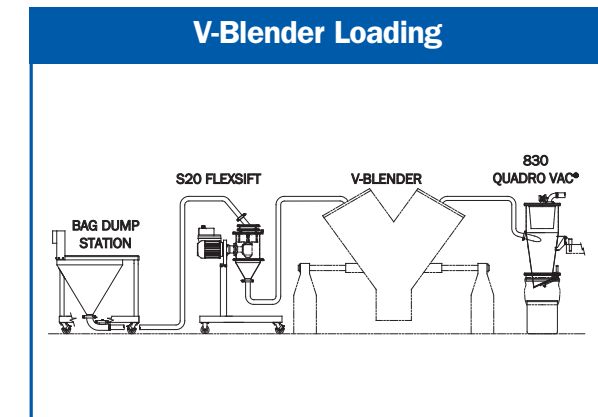
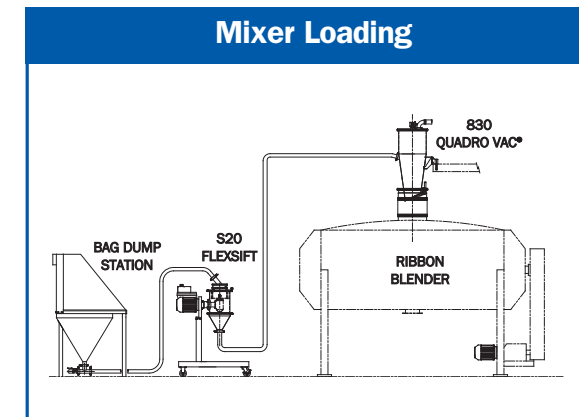
*Capacities are dependant on product and/or overall transfer distances.

SPECIAL TESTING



To guarantee that you achieve precise results, Quadro encourages all customers to take advantage of free process testing at our R&D Test Center. Quadro can also offer a rental *Quadro Vac*® for product testing at your facility. Our qualified personnel will assist you in training your operators to use the machine and maximize the full potential the *Quadro Vac*® offers.

TYPICAL QUADRO VAC® APPLICATIONS



WHY VACUUM CONVEY?

Vacuum conveying provides a dust-free material transfer system in a fully contained and gentle manner. Benefits of vacuum conveying include:

- Minimal maintenance required.
- Negligible product degradation and/or segregation.
- Easy installation, commissioning and operation.
- Versatile material transfer capabilities for a wide range of powders, pigments, etc., typically with bulk densities ranging from 0.16 to 1.9 g/cc.
- Particularly suited to prevent operator exposure to dangerous products (toxic materials, API's) and/or flammable products.
- Minimize or even eliminate operator injury resulting from repetitive handling of heavy bags and/or awkward-to-lift products.

Vacuum Conveying Principles

Vacuum conveying process is a rather simple proposition – a negative pressure differential is created (via a pump, blower or Venturi) within a transportation line (typically pipe or hose) generating sufficient air flow to aspire material from a source (i.e. bin or bulk bag) and deliver it to its destination (such as an IBC). Usually, the material being conveyed is processed through equipment such as a mixer, a mill or a dryer before being transferred to its destination. In order to collect the final product, a receiver equipped with a filter separates the material from the air stream it travels in. **Figure 2** shows a typical pharmaceutical application.



Figure 2 – Sample Pharmaceutical Application

Dilute vs. Dense Phase Conveying

Dilute Phase Conveying – is based on the transportation of material suspended in an air stream inside the conveying line (**Figure 3**).

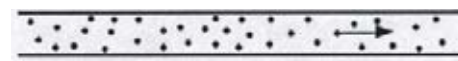


Figure 3 – Dilute Flow

- Dilute phase conveying air velocities: 2500 - 6500 FPM.
- Typical Materials: flours, starches, fine chemicals, granules and pellets (wide range of bulk over medium distances, typically 15m horizontally by 10m high).
- Capacities: 220 - 4400 lbs/hr (100 - 2100 kg/hr).

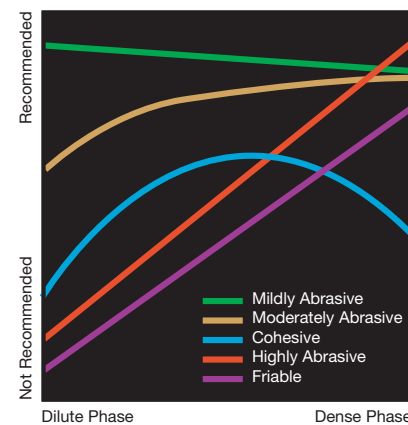


Figure 4 – Dilute vs. Dense Flow

Dense Phase Conveying – is experienced when the material concentration versus gas (i.e. air) volume and velocity is too great for the product to remain in suspension, resulting in material being deposited on the bottom of the pipe or hose (**Figure 5**). A typical form of dense phase conveying is called “plug” conveying which occurs when material accumulates in the pipe to form plugs (**Figure 6**).

- Dense phase conveying air velocities: 200 - 3000 FPM.
- Typical Materials: are generally heavier (high bulk densities) and degrade more easily, or are friable and abrasive such as sugar, pharmaceuticals, food, dairy powders, detergents and other products that tend to be hygroscopic.



Figure 5 – Fluidized Dense Flow

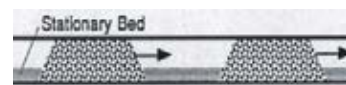


Figure 6 – Plug Dense Flow

VACUUM CONVEYING - DESIGN PARAMETERS

Dust-free pneumatic conveying systems, such as the *Quadro Vac*®, are driven by product-operator relationships – whether to protect workers from day-to-day handling of heavy products, material toxicity, explosiveness or flammability, or to protect products from their surroundings during handling and transferring (i.e. hygroscopic materials). The three factors to consider when designing a pneumatic conveying system are:

- Economic
- Ergonomic
- Product Variables

System selection is directly proportional to product characteristics and desired system performance. Main parameters to consider are:

- Bulk Density – weight of product per volume (g/cc or lbs/ft³) fundamental to product flow, capacity and efficiency – heavier products (higher bulk density), require more air velocity.
- Particle size and transfer rate desired – Air Flow and Air Velocity are critical for successful lift and transfer of products.
- Material flowability, bridging, compaction, attrition.
- Overall transfer distance = length + height + number of bends. Line pressure losses, caused primarily by vertical rise and directional changes, determine air velocity needed, pump size and conveying pipe/hose diameter required. Long radius elbows and a minimum number of bends decrease pressure losses.
- Air-to-cloth ratio – air filter type and size are directly proportional to the pump size (larger filter area is required to prevent premature filter blinding).
- Product's source and final destination (i.e. bins, super sacks, granulators, fluid bed dryers, IBC's, silos, etc.).
- Type of feeding equipment and/or pick-up method (pick-up wand, screw conveyor or gravity fed).

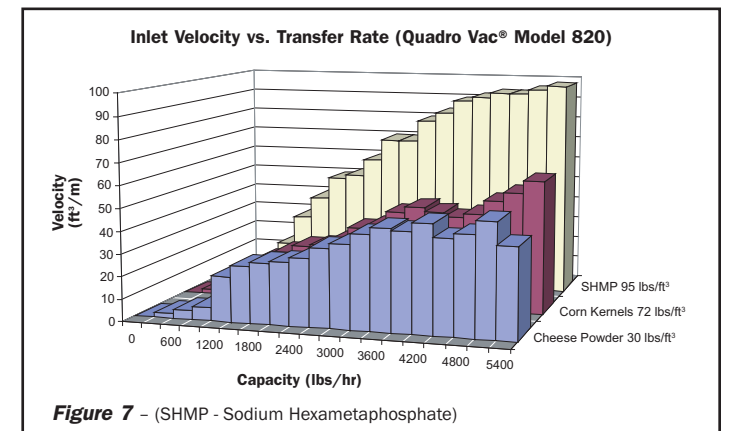
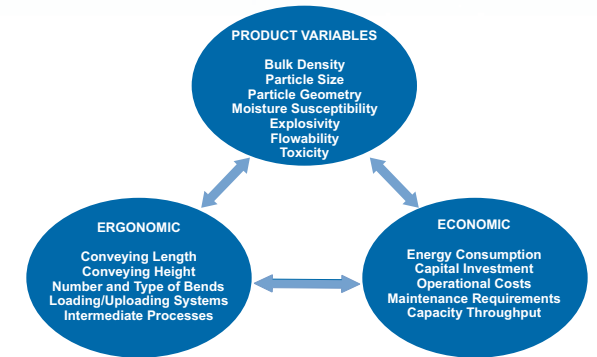


Figure 7 – (SHMP - Sodium Hexametaphosphate)

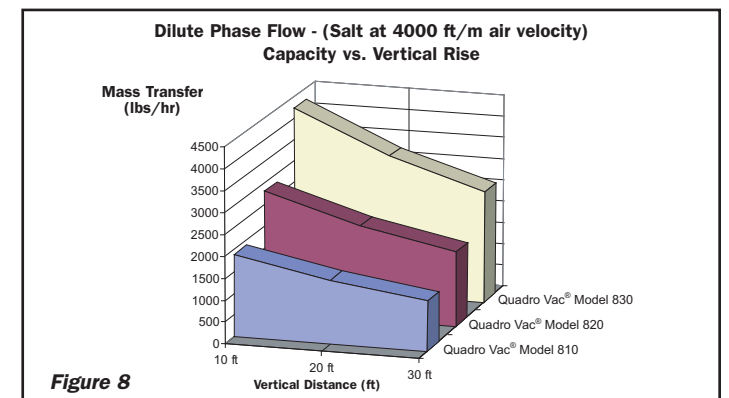


Figure 8

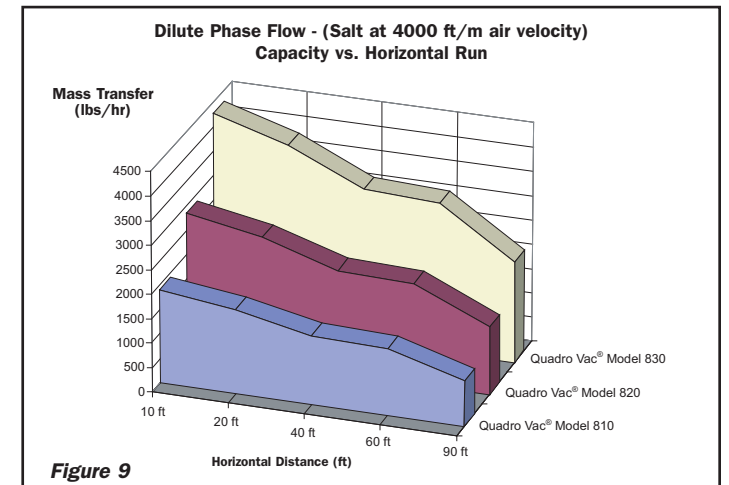


Figure 9

CONTROLS: ELECTRIC

Electric controls provide the User with the benefits of utilizing a touch screen PLC User Interface, with the added benefit of programming conveying parameters specific to each product being transferred by the same system. This is a significant advantage for installations requiring the transfer of varying products with different bulk densities.

Quadro Vac® User Interface Package

Allen Bradley's PanelView 550 with MicroLogix 1500
 CSA/UL NEMA 4X S.S. Enclosure
 Local Operator Controls
 Standard Duty (1.0 Service Factor)

Total Control and Security

- Interfaces with *Quadro Vac®* via a built-in Human Interface Graphic Display – flexible control over all machine functions.
- Adjustable cycle parameters to suit a variety of products.
- Multiple levels of security can be set by the customer.

Easy Set-up

- Same pneumatic connections as *Quadro Vac®* Air Logic Controls.
- One-touch control parameter adjustment.
- Can be mounted in a remote location.
- Electrical requirements – standard 120V, 15 amp service.
- Easy download of cycle parameters and product numbers set-up through a Microsoft® Excel file.

Versatile

- Stores programming details: up to 200 different product recipes.



CONTROLS: PNEUMATIC

Pneumatic controls are powered by a single-source air supply, which governs all conveying functions (**Figure 10**). It is typically safer, as it does not utilize electrics and is more maintenance-friendly due to fewer controls required, thus reducing possible component failure. Best solution for XP designs and ATEX requirements.

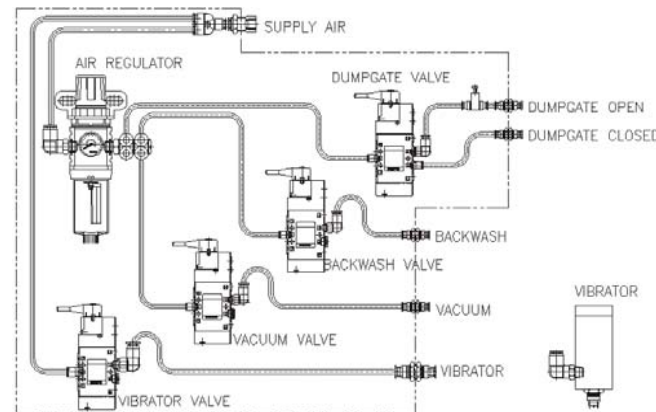


Figure 10 - Pneumatic Controls Layout

Quadro® Lift - Accessory

Versatile

- Vertical column swivels 360° for easy access.
- Raise or lower process equipment for easy maintenance and/or cleaning.
- Compact size – requires minimal floor space.
- Freedom of movement – equipped with two rigid and two swivel/brake non-marking elastomer casters.

Easy-to-Clean

- Totally enclosed lifting mechanism.
- High quality sanitary finish.

Durable

- Stainless steel construction.
- Utilizes a rugged ball screw actuator with an integral brake inside the base.
- Rated for up to 1500 lbs (680 kg).
- Rollers used in the mechanism to ensure smooth, easy operation and long service life.
- Requires minimal maintenance.



HOW IT WORKS

The *Quadro Vac®* Sanitary Pneumatic Conveyor utilizes vacuum to transfer materials from a source (drum, hopper, super-sack, IBC, wet granulator, fluid bed dryer, etc.) into a receiving vessel (IBC, drum, silo, bag filler, mixer, granulator, dryer, tablet press, etc.) typically installed in-line with other process equipment such as fluid bed dryers, Comils® (conical mills), etc.

Step 1 – Vacuum Cycle

A vacuum pump (1) or other vacuum source (blower, Venturi, etc.) generates a suction effect inside the *Quadro Vac®* hopper (2). Once a vacuum has been established, air or other gas medium is drawn through the conveying line/hose (3) and product is aspirated from a feeding source (4). The air stream generated inside the conveying hose transports the material into the *Quadro Vac®*'s receiving hopper.

Step 2 – Fill Cycle

Incoming material being carried by the air stream enters the *Quadro Vac®* hopper at a tangential angle to the vessel (5) where a “cyclone” effect assists in product flow and aids in separating the material from the conveying air. Inside the receiving hopper, a filter (6) further separates the fine particles from the air stream.

Step 3 – Discharge (or Dump) Cycle

When the *Quadro Vac®* hopper is full, the vacuum isolation valve opens and the separated material is discharged from the hopper. Once the dump gate is opened (7) product is allowed to flow into the receiving vessel (8). Dump gate opening and closing timing sequence can be adjusted using the air logics control panel or utilizing the *Quadro Vac®*'s PLC controls to suit the material(s) needs.

Step 4 – Self-Cleaning Cycle

After product is discharged from the hopper, the filter (6) is cleaned via back-wash air pulse. Once the filter wash pulse is complete, both the dump gate and the vacuum isolation valve close creating a vacuum inside the hopper and the cycle begins again. Duration between fill and dump cycles can be programmed into the control PLC as duration is product-dependent.

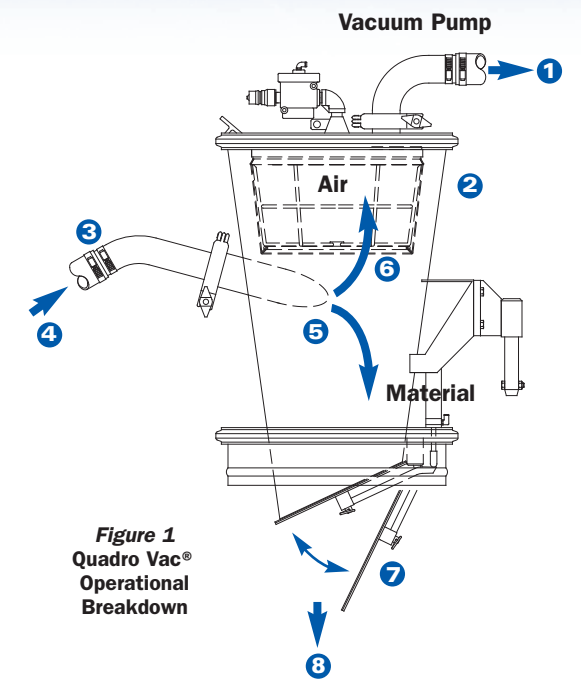


Figure 1
 Quadro Vac®
 Operational
 Breakdown

