

How To... Design An Energy Efficient Vacuum Conveying System

Get Professional Advice

A well-designed, properly installed resin conveying system is a real asset that will pay significant dividends. Consult with a NOVATEC systems specialist for professional advice. The following list identifies some of the initial information that will be required to provide an energy efficient system to satisfy your needs.

- What do you hope to accomplish with the system?
- Will the system be in a new or existing facility?
- Do you want all new equipment or do you prefer to utilize existing handling equipment where possible?
- Does the new system have to be compatible with any existing communication protocols?
- How many, what kind and what size of processing machines need to be supplied with material?
- Do you have a general layout of machine location?
- How many and what kind of materials will be processed? (including regrind)
- Do you know the usage requirements for each material and/or each machine?
- Will there be any powders or very dust regrind processed?
- Will there be any abrasive materials being conveyed?
- Is additive/color feeding or blending required?
- From where will the materials be sourced? (Gaylords, bulk bags, surge bins, silos)
- Is drying or crystallizing required?
- Do you have a budget range for the project?
- When do you hope to have the system operational?

Your responses to the initial question above may lead to many more questions. The more information you provide to your systems specialist, the better prepared they will be to provide you with a system that meets all of your present and future expectations.

After considering the responses to the questions above, recommendations will be offered and choices must be made about which system features and components should be included.

TIP! Do not under size pumps... they will work harder and increase energy usage.

Choose a Common or Dedicated Line System

(See page 119)

- **A Common Line System** – typical for multiple station, single-material systems
- **Dedicated Line System** – typically used by processors with dedicated high throughput of multiple materials where purging is required

Calculating 'Equivalent' Conveying Distance

Rules for Calculating Equivalent Distance:

- 1 horizontal foot of tubing = 1 equivalent foot
- 1 vertical foot of tubing = 2 equivalent foot
- Each 90° elbow = 20 equivalent feet
- Each foot of flex hose = 3 equivalent feet
- Average railcar is 66' long
- Avoid up-slopes (rise) in material lines
- Avoid multiple bends after exiting a take-off box

Remember to consider obstacles that stand in the way of conveying and air lines such as HVAC ducts and walls, etc.

TIP! Minimize bends, flex hose and vertical lifts to improve efficiency and minimize pumps.

Choosing the Correct Vacuum Pumps

Positive displacement vacuum pumps are designed for high throughput/long distance conveying.



(See pump curves page 191)

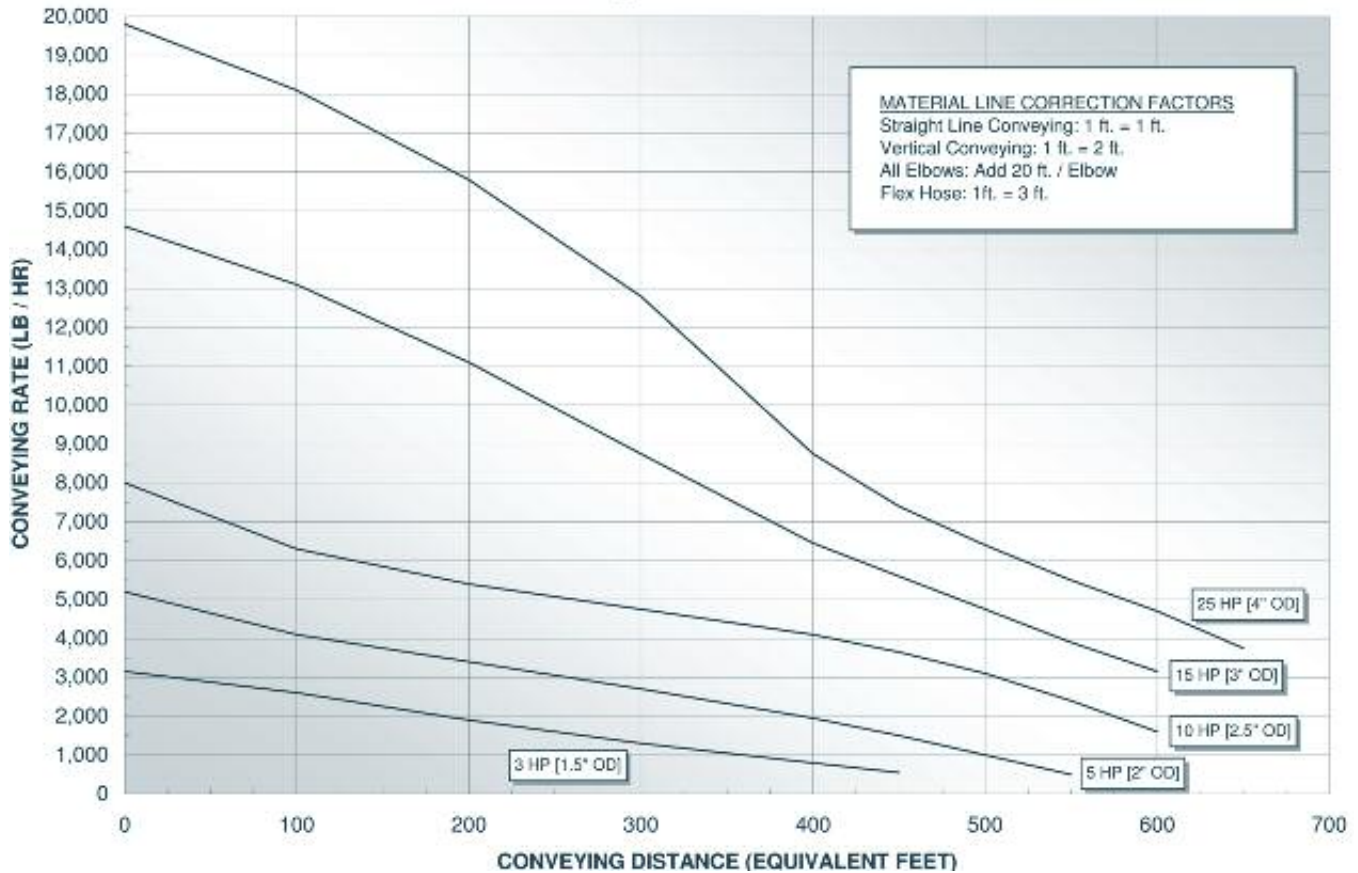
Regenerative blower vacuum pumps are better suited for low to moderate throughputs and/or short to moderately long conveying distances.



TIP! The importance of a vacuum breaker valve:

- Allows the pump to run on, past system demand
- Eliminates rapid start/stop cycles, saving energy
- Extends pump life by cooling and lessening wear

Vacuum Displacement Pump Conveying Rates for Free-Flowing Plastic Pellets @ 38 lb./cu. ft.



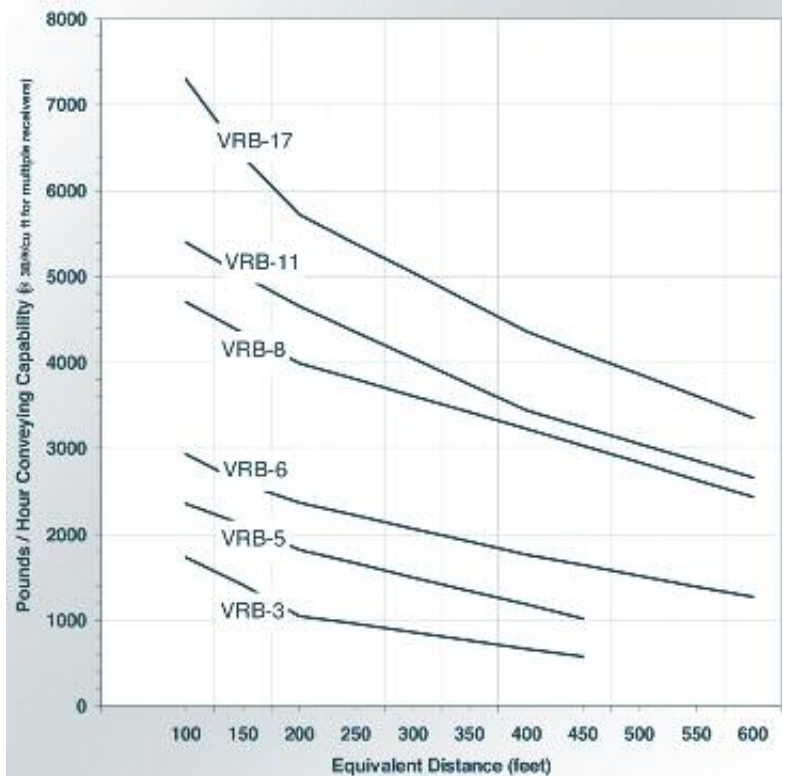
MATERIAL LINE CORRECTION FACTORS
 Straight Line Conveying: 1 ft. = 1 ft.
 Vertical Conveying: 1 ft. = 2 ft.
 All Elbows: Add 20 ft. / Elbow
 Flex Hose: 1ft. = 3 ft.

Application Notes:

1. Curves reflect combined throughput performance with more than one receiver.
2. For single receiver systems, performance will be lower.
3. Listed distance figures are 'equivalent'... be sure to add:
 - a. 2 feet for every vertical foot
 - b. 20 feet for every bend
 - c. 3 feet for each foot of flex hose
4. Vacuum pumps should be located within 50 ft. of station that is furthest from the material source.
5. Always consult your Novatec system specialist when using these charts.

TIP! Keep pump filters clean and empty cyclone dust collector pan to maximize pump efficiency.

Vacuum Regenerative Blower Pump Conveying Rates for Free-Flowing Pellets @ 38 lb./cu. ft.



HOW TO ...

Choosing the Correct Receiver

TIP!

• Larger receivers are better

- Cycle fewer times and increase pump capacity
- Reduce wear and tear on pumps and valves

- Stainless steel is the most durable material for most applications
- Abrasive materials require custom options to be added to the receiver which may include:
 - Thick-wall wear plates
 - Electro-less nickel plating
 - Ceramic coatings

Tangential inlet with flapper and gasket minimizes material degradation and allows use with a common line and central material selection manifold system.

Neoprene seal on dump throat assures no loss of vacuum.

When powders (like PVC) are being conveyed, specify powder receivers which are designed with special filters and blowback to avoid clogging and maintain energy efficiency.

No-tools access for cleanout is important.



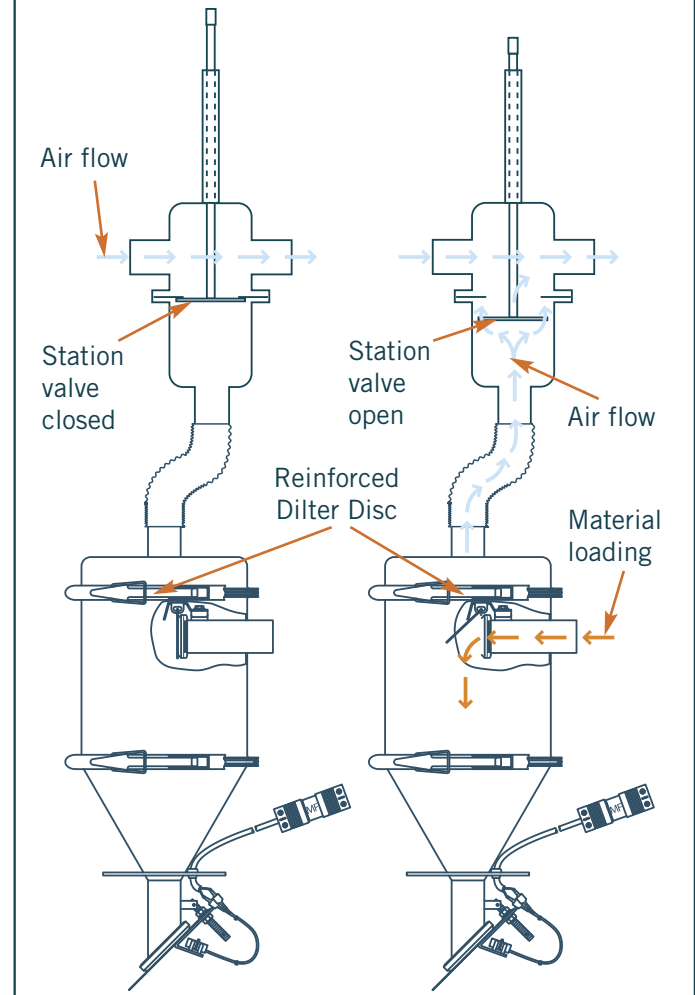
Machine mount models are supplied with a height-adjustable photo eye level sensor, base plate adapter, dump valve and quick disconnect clamps for easy clean out.

The Function of Station T Valves

A Station T Valve is Required at Each Receiver

When the disc is seated in the closed position, the vacuum passes through the sequencing valve. When the valve receives a signal to load the receiver, the disc opens, allowing vacuum to pull material into the receiver. A reinforced filter disc, in the receiver, allows air to pass through it while keeping the pellets from being drawn into the vacuum line.

Station T Valve Operation



TIP!

Station Valve Operation Indicators

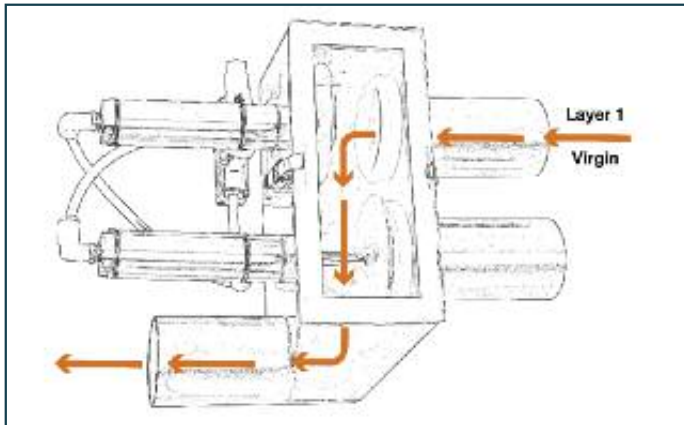
These provide a handy visual indication of whether a station is operating properly. If the indicator is always in the raised position, the receiver will never load.

Always provide clean, dry, oil-free compressed air to ensure proper operation of station valves.



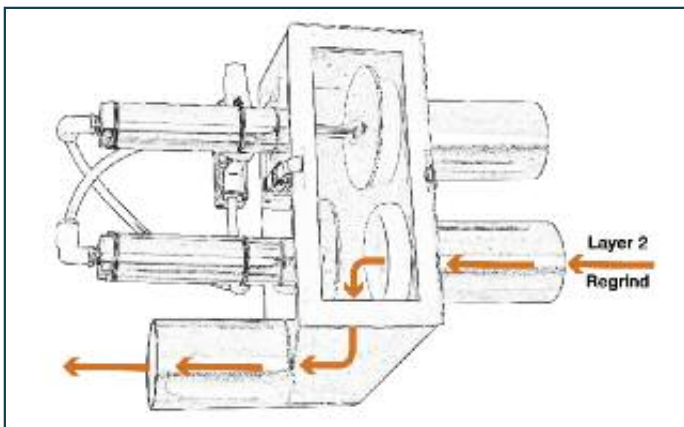
Proportioning/Layering of Materials

Simple proportioning/layering of materials, like virgin and regrind, can be accomplished with the use of an external proportioning valve. This reliable device can be added to the material inlet of any receiver. The internal valves open and close to allow the desired proportions of the materials to be introduced into the receiver.



External proportioning valve layers materials & works with receivers and loaders.

TIP! Clear polycarbonate window in proportioning valve allows visual confirmation of proper layering.



Blowback Maximizes Air Flow and Minimizes Labor

When processing materials that are prone to dusting, it is important to provide blowback at each receiver. Blowback is generated from an accumulator tank on the receiver and forces a blast of air down through a filter in the top of the receiver. This clears dust buildup and greatly reduces the need to manually remove the filter for cleaning.

Blowback clears dust from receiver filter and improves pump efficiency.

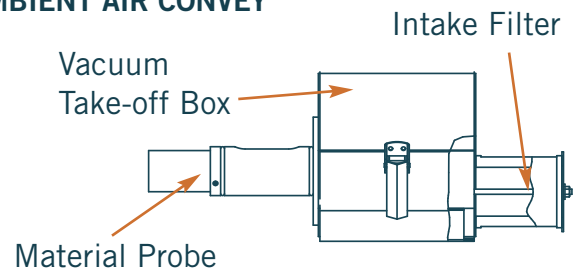


Choose Ambient or Dry Air Conveying

Vacuum conveying requires that air must enter the material conveying line at the material source so the vacuum can pull the material to its destination. That air can be either ambient air or dry air.

- **Ambient Air Conveying** - is typically used when conveying materials that do not readily pick up moisture. In this case, the vacuum take-off box at the material source is fitted with a simple cartridge filter or a fine mesh screen through which ambient air is pulled into the material line. The filter or screen ensures that unwanted contaminants do not enter the material stream.

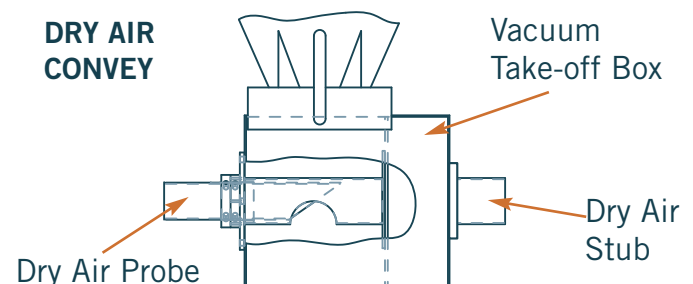
AMBIENT AIR CONVEY



Open valve on probe at least 50%. Higher air flow allows material to move more efficiently.

- **Dry Air Conveying** - is recommended when the material being processed is very sensitive to moisture pickup, like nylon, PET, PC, etc. This often depends on how critical the specifications are for the end product. Dry air conveying is accomplished simply by closing the conveying loop to the take-off box below the drying hopper. For added dryness, recirculate the dryer return air through the conveying loop.

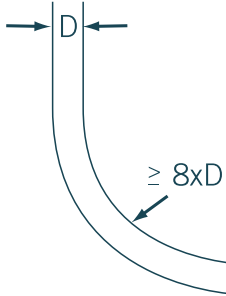
TIP! To save energy, use dry air convey only where required.



Avoid Line Plugging By Purging Material Lines

Plugged Conveying Lines

If conveying lines are not purged of material after each cycle, material can buildup inside conveying lines and form plugs.

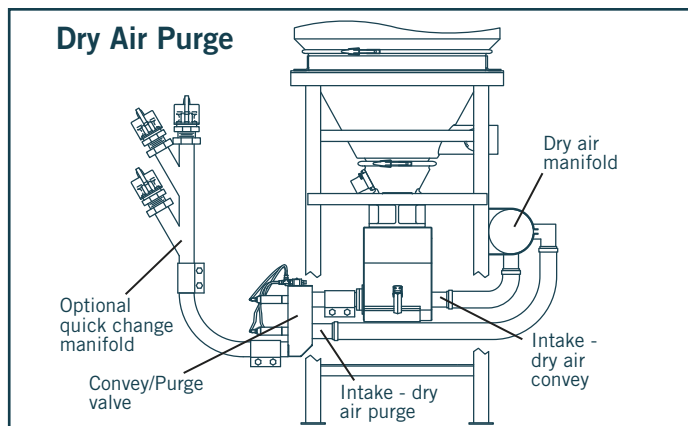
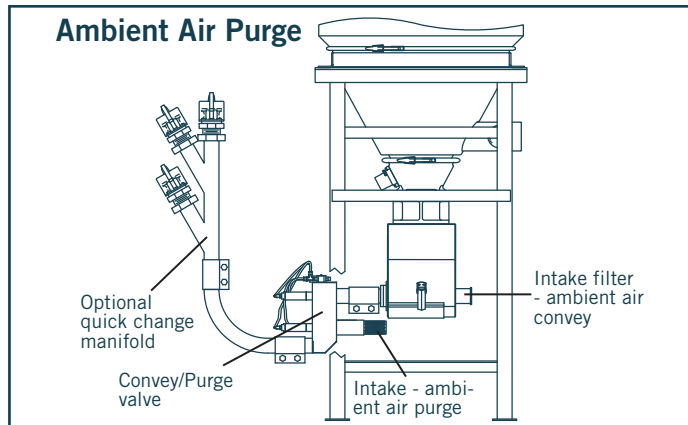


TIP! Material line radii should be greater or equal to 8 times the line diameter to minimize plugging.

Purge Valves Clear Material out of Conveying Lines

A purge valve is connected to the vacuum take-off box beneath a drying hopper so that after the dried material is conveyed to the process machine, the valve switches and either ambient or dry air is pulled through the material line to clear any buildup. This also preserves material proportions when conveying from a blender. CAUTION! Separation may occur requiring the use of a mixer at the machine throat.

TIP! Only use purge where necessary because it reduces energy efficiency.



Control Choices

NOVATEC has an impressive legacy of customer and process-oriented control solutions. These include a wide variety of control platforms with both standard and custom programs for total system integration.

The current NOVATEC offerings include:

FlexBus System

Add as-you-grow system with the most requested features for 1 Pump and up to 20 receivers.



FlexTouch Controls

For 1-3 pumps and 5 to 33 receivers with monochrome or color touch screens.

FlexXpand Controls

Big system color touch screen control with expansion possibilities. Start with 5 pumps and up to 16 or 32 receivers and expand up to 20 pumps and 120 receivers.



TIP! Always consider future expansion and compatibility with existing plant protocol when choosing a conveying control system.



FlexNet Distributed I/O Control

Mitsubishi platform with 10.4" color touch screen for 8 pumps and 48 receivers or 16 pumps and 96 receivers. Full control over all system functions.

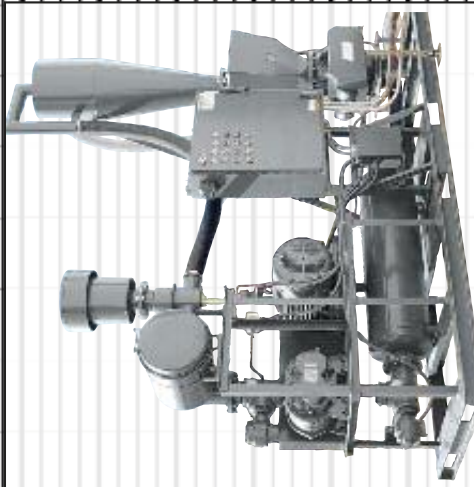
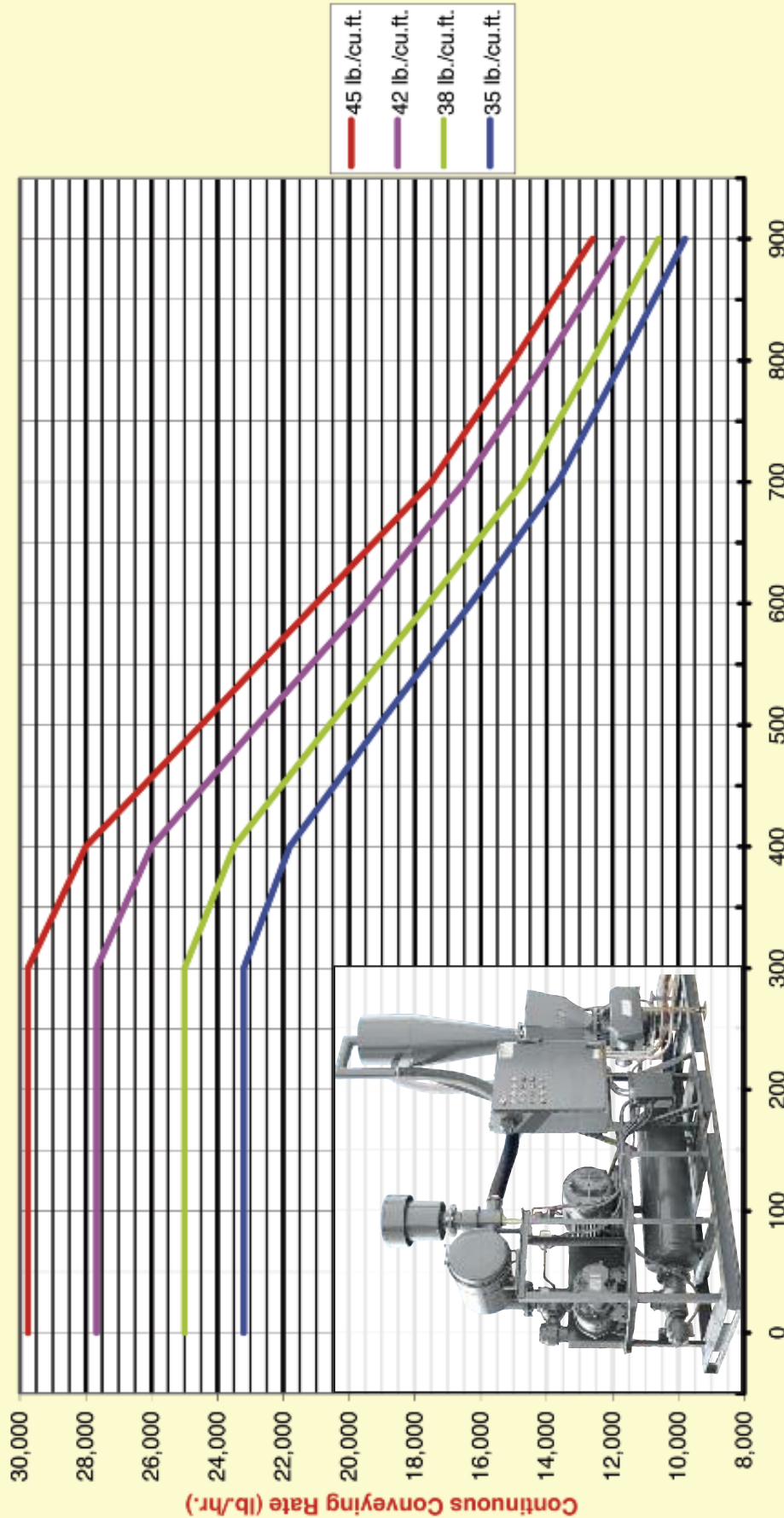
Custom control solutions can be supplied based on all major platforms... Mitsubishi, Siemens, GE, or A/B Rockwell.

Fixed Basic Packages

- For 1 or 2 pumps and up to 16 stations
- Siemens Touch Screen Controls
- For 4-6 pumps and 8-48 stations

How To... Estimate Conveying Rate for Railcar Unloader

CONTINUOUS VACUUM PRESSURE 40 HP RAILCAR UNLOADER - 4" Sch. 10
 Based on long radius bends for directional changes (no sloping pipes) .
 Proper acceleration lengths before and after direction changes,
 free flowing material and proper air adjustment.



Conveying Distance In Equivalent Feet
 1 Ft. Horizontal = 1 Equivalent Ft, 1 Ft. Vertical = 2 Equivalent Feet,
 90 Degree Elbow = 20 Equivalent Feet, 1 Ft. Flex Hose = 3 Equivalent Feet
 Average railcar is 66' long