Successful Strategies in Automating PVC Dry Blend Production
PVC – anything but out.

PVC remains to be the raw material with excellent properties and an exceptional price-to-performance ratio. Worldwide, more than 20 million tons of PVC is processed each year, and that rate is expected to keep growing.

Over a third of PVC material is processed into pipes and fittings; the rest is used to make hard and soft profiles, cables and hoses. The basic ingredient for these products is dry blend, prepared in a heater-cooler mixer.

Possibilities and opportunities for automation.

Regardless of your end product, PVC has to be fed into the heater-cooler mixer along with fillers, TiO₂, stabilizers, additives, modifiers, plasticizers and color pigments as a precise batch formula.

Integrating all the raw materials into the automated process ensures processing in accordance with the exact recipe. In addition to quality assurance, other benefits include a high degree of flexibility and reduced material loss.

AZO develops individual concepts tailored exactly to your needs.

The requirements to be met by a system for feeding a heater-cooler mixer can vary substantially depending on the final product and each individual plant layout.

We plan your specific system according to the number of ingredients involved in the formulation and the sequence of additions, batch frequency and throughput, how often the formulation is changed, whether premixed compounds are used, and if the recipe calls for liquids additions.

Another important consideration is the available space where the system is to be installed.

The following pages contain examples that illustrate various AZO solutions for automating dry blend production.

Assure your product quality and streamline your process with AZO.
Handling PVC and filler as major ingredients.

Feeding PVC and filler from storage silos.

In dry blend production, the major bulk products are delivered by trucks or rail cars and stored in outdoor silos. These bulk materials are off-loaded into the maintenance-free aluminum silos using a pneumatic conveying system. PVC can be handled successfully without the need for a special discharge system. This can be attributed to the good flow characteristics of the material. However, product feeders offer the best method for consistent and accurate feeding of the vacuum weighing systems.

For filler and particularly for TiO₂, properly dimensioned vibration bottoms are necessary. The AZO vibration bottoms offer many key advantages including quiet operation, low energy use, and reliable material flow. In both cases, precision dosing units are required for feeding the vacuum weighing systems.

AZO silo systems are equipped with standard “auto-clean” bin vent filters.

All storage silo accessories such as level indicators, access hatch, PRV, ladder, safety guard rails, and discharge systems are provided as required.

Advantages of AZO silos, right to the point:
- Maintenance-free aluminum construction
- Universal design with standard accessories
- Available with discharge systems for all types of bulk materials

Advantages of AZO vacuum weighing system, right to the point:
- Reduced height and floor space required because no surge hoppers are required
- Precise weighing and high throughput rates achieved simultaneously
- Flexible and expandable with AZO’s multi-port valve and piping arrangement

Mixer feeding with vacuum weighing systems.

The vacuum weighing systems developed by AZO present significant advantages in product transfer to the heater-cooler mixers:
- Reduced height and floor space required because no surge hoppers are required
- Precise weighing and high throughput rates achieved simultaneously
- Flexible and expandable with AZO’s multi-port valve and piping arrangement
New mixing system for dry blend used in the production of window profiles.

Integrating a mixing system into an existing building is a challenging task for the system supplier. In this case, the customer required maximum flexibility, total automation, and ingredient batching in accordance to the exact formula.

PVC is transferred from the outdoor silos to the scale by the vacuum weighing system – directly, without using surge hoppers.

Dedicated convey lines and product feeders from each silo, along with AZO’s multi-port valve are used prior to the vacuum scale to obtain the highest degree of accuracy and flexibility.
Filler and TiO₂ are pneumatically transferred from outdoor silos into supply bins located in the upper level of the mixing tower. From the supply bins, vibrating dosing screws are used for precise feeding to the batch scale.

Stabilizers and modifiers, received in bulk bags or containers are elevated via freight lift to the staging area at the upper level of the mixing tower. As with filler and TiO₂, these materials are fed from each supply bin with the use of a vibrating dosing screw to the batch scale for precise weighing.

Advantages of this heater-cooler mixer feeding system, right to the point:

- Simplest version because minor and semi-bulk components are added at the uppermost level
- Maximum reliability because all raw materials are available at a level above the mixer
- Precise dosing and weighing accuracy through vibration screws for filler, TiO₂, stabilizers, and modifiers
- No off-spec batches because mixer filling starts after all ingredients are preweighed in accordance with recipe tolerances

Example
Limited building height: ground level supply of ingredients.

Ground level storage and supply of additives, stabilizers and modifiers.

A unique challenge exists when designing a heater-cooler mixer feed system to fit within a building that has limited height. The ingredients are stored and supplied at the ground level. Pneumatic conveying systems transport the additives into batch bins above the scales.

PVC is transferred from the outdoor silos directly to a vacuum weighing system above the heater-cooler mixer. Dedicated convey lines and product feeders from each silo, and AZO’s multi-port valve are used prior to the vacuum scale to obtain the highest degree of accuracy and flexibility.

If necessary, “double-batching” can be done to increase throughput, and to realize savings in energy consumption. In this case, a vacuum conveyor scale is positioned above the cooler mixer for PVC.
Filler and TiO₂ are pneumatically transferred from outdoor silos into supply bins located in the upper level of the mixing tower. From the supply bin, vibrating dosing screws are used for precise weighing in the batch scale.

Stabilizers and modifiers are received in portable mini silos, bulk bags or bags, and picked up at the ground level for pneumatically conveyed into supply bins. The materials are fed from each supply bin with the use of a vibrating dosing screw for precise weighing in the batch scale.

Example 2

Advantages of this heater-cooler mixer feeding system, right to the point:

• Ground-level product supply, with pneumatic transfer to elevated supply bins

• Pneumatic conveying of semi-bulk and minor ingredients to the weighing level

• Low overall equipment stack-up for limited building height

• To-the-gram weighing of additives

• Loss-in-weight scaling with high-precision dosing units

• “Double-batching” for higher throughput and energy savings

Heater-cooler mixer feeding and mixer surge hopper
Design your own formulas by using many different ingredients – with the AZO COMPONENTER®.

Maximum flexibility through formula composition using many different ingredients – with the AZO COMPONENTER®.

Where process requirements involve many micro and minor ingredients used for individual formulations, the AZO COMPONENTER® offers the ideal solution for heater-cooler mixer feeding: fully automatic dosing and weighing with the highest degree of accuracy.

PVC and, in some cases, filler are transferred via vacuum weighing systems from the outdoor silos directly to the scales above the heater-cooler mixer. Dedicated convey lines and product feeders from each silo, along with AZO’s multi-port valve are used prior to the vacuum scale to obtain the highest degree of accuracy and flexibility.
Stabilizers, modifiers, TiO₂ and other additives in bags or bulk bags are transported via freight lift to the upper level of the mixing tower and there filled into the dosing bins of the AZO COMPONENTER®. Vibratory dosing screws meter material to individual mobile scales according to formula. The feeding into the mixer is based on temperature as required by the recipe.

The mobile scales discharge through a straight vertical chute directly to the mixer. This makes it possible to reduce overall building height.

Plasticizers and liquid additives are stored in tanks, plastic containers, and drums at the ground floor level and pumped directly to batch scales via the special AZO liquid’s dosing manifold.

Advantages of this heater-cooler mixer feeding system, right to the point:

- Automated selection out of many ingredients with the AZO traveling COMPONENTER® scale
- Precise automatic dosing and weighing of additives using the AZO COMPONENTER®
- Infinite number of minor ingredients with the feed stations arranged in a linear configuration
- Charging of the various ingredients into the mixer can be in any sequence
- Pneumatic transfer of raw materials and additives to the upper level of the mixing tower
Fully automatic feeding of multiple mix high frequency out of many ingredients –

PVC is transferred from the outdoor silos to the scale via the vacuum weighing system. Dedicated convey lines and product feeders from each silo, along with AZO’s multi-port valve are used prior to the vacuum scale to obtain the highest degree of accuracy and flexibility.

TiO₂ is supplied in bulk bags and pneumatically transferred to a supply bin above the dedicated scale hopper.

Fully automatic heater-cooler mixer feed system used by a leading manufacturer of window profiles in the United States.

Throughput of up to 10 batches per hour in each mixer – and consistent high quality. This was the requirement for the fully automated system from AZO.

Staging and introduction of modifiers, stabilizers and other additives

Simultaneous weighing of additives and modifiers prior to collection by the traveling COMPONENTER® scale

Feeding of two mixer lines with high batch frequency via the AZO COMPONENTER®
Stabilizers, modifiers and other additives are delivered in bulk bags and pneumatically conveyed without contamination into respective in-door silos. These ingredients are then precisely weighed with simultaneous scales automatically. The individual micro and minor ingredient scales discharge into a traveling scale and then feed directly into either of the two mixers by gravity.

Liquid additives are stored at the ground floor level in tanks, plastic containers and drums. With the use of an AZO special manifold valve, liquids are dosed directly into scales hoppers.

Pigments are automatically weighed by a micro ingredient scale, and fed into the mixer. The choice of five different colors makes it possible to cover a broad spectrum of shades.

Advantages of this heater-cooler mixer feeding system, right to the point:

- Fully automated system with a large number of batches per hour
- High degree of efficiency through feeding several mixer lines at the same time
- Weighing and feeding of raw materials and additives without contamination
- Dosing and weighing of pigments to-the-gram
- Fast batching due to simultaneous weighing
- The AZO COMPONENTER® for feeding multiple mixer lines
- Only one surge hopper for each ingredient

Example 4

Feeding into two heater-cooler mixers
Receiving and storing of liquid ingredients.

Plasticizers in liquid form are delivered by truck and stored in tanks. The storage tanks are equipped with point level and continuous inventory monitoring.

Weighing and dosing of plasticizers is done automatically using a liquids scale. The preweighed liquids are automatically dosed into the mixer according to the exact recipe.

With AZO, all liquid ingredients can be integrated into the automatic process.

In some cases, plasticizers and liquid additives are delivered in drums or containers, and then also pumped into the liquids scales.

The loss-in-weight scaling systems feed highly viscous micro ingredients into the mixer. Dosing accuracy on specifically designed systems is within one gram.

Heating and insulating of the micro ingredient scales is available to improve the handling and flow into the mixers.
Feeding color pigments into the mixer.

Operator-guided pigment dosing with automatic tracking.

Frequent formulation changes can sometimes require weighing the color pigments at an operator-guided dosing station. Hand-weighed pigments are filled into individual batch pouches and then automatically introduced directly to the mixer. The use of bar codes serves to monitor and document the weighing step and eliminates operator errors. The timing belt automatically introduces prepared pigment pouches to the mixer at the correct time and sequence.

Automatic addition of pigments.

Pigment additions can be completely automated, especially where frequent changes are not required. The pigments are stored in mini “use bins”. High precision dosing is accomplished with the use of vibratory dosing screws. Accurately weighed pigments are then feed directly to the mixing process in accordance after the mixing process is complete, the finished batch is discharged into surge hoppers. Pneumatic conveying systems gently transfer the dry blend into storage silos or homogenizing silos.

Advantages of the AZO system, right to the point:

• Integration of all components, including liquids, into the automated process
• Reliable handling of viscous and highly viscous liquids
• Staging of pigments via operator guidance
• Flexibility with receiving and filling

Handling of the prepared dry blend.

After the mixing process is complete, the finished batch is discharged into surge hoppers. Pneumatic conveying systems gently transfer the dry blend into storage silos or homogenizing silos.

The dry blend can be transferred to filling lines for containers or bulk bags, or into silos for bulk loading of trucks or rail cars.

The homogenizing silos are allocated to particular productions. Special equipment enables blending of many batches.

Automated weighing station for five pigments

Filing of semi bulk bags and containers for international storage
Automated systems for extruder feeding.

Gentle handling without segregation enables consistent product quality to very high standards.

Pneumatic collective feed systems are highly suitable for transferring dry blend from the silos to the extruders with a great degree of reliability and flexibility. Electronic monitoring systems allow accurate tracking and increased up-time.

Dust-free feeding is ensured by ample-sized filters suited to the specific dry blend handled. Filter and receivers are equipped with auto-clean feature.
Reliability and process vision with AZO control systems technology

The AZO control system provides optimum production reliability and process insight.

The mixer feed system and actual mixing process are controlled and monitored in accordance with the exact recipe from the process automation control center. From here, recipes can be selected from the menu screen and automatically scheduled for production.

Fully automatic production process.

The total production process is automatically controlled on the basis of effective batch priority and efficient resource utilization (scale, silo). In addition, special software is available to allocate all process resources and optimize the overall system throughput.

For each batch order, a weighing document is prepared which contains all the information required for future reference and to enable complete documentation of the production process as a whole.

Advantages of the AZO systems for process control and visualization, right to the point:

• The sequence of the mixing operation is optimized to meet the exact recipe requirement
• The temperature development in the mixer is displayed on the computer system graphics
• Mixer filling starts only after all ingredients have been weighed within the set tolerances
• Batch documentation provides information on ingredient usage and for ingredient tracking
• Convenient maintenance and service programs ensure optimum system performance and „up-time”
• Absolute service and support for your operations with dedicated service personnel and on-line modem

Reliability and flexibility.

At any time, the actual status of ingredient feeding can be viewed from the computer monitor. Any deviation from a set point value is immediately displayed as an alarm for corrective action. Subsequent feeding into the extrusion lines is also continuously monitored.

This achieves utmost reliability of ingredient supply to the process. The documentation of formula composition and batch completion allows tracking of the dry blend production process, and further helps demonstrate the quality of the end product.

In the process control center, the mixing status is monitored and the recipe management is performed.

Process visualization, with language conversion capability

The temperature profile in the mixer is graphically illustrated.

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AZO – your partner with confidence, capability and experience.

We at AZO know the ropes. Again and again over the decades, we have come up with new ideas and trend-setting technologies.

Vacuum weighing systems and COMPONENTER® technologies hard to imagine being without – bear the trademark “Invented by AZO”.

As world leaders of complete integrated systems, we offer dry blend producers a comprehensive range of machines and system components.

Profit through flexibility, efficiency and economy. Turn to AZO.

Cyclone screeners
For removing agglomerates after the cooling-mixing process.

Automatic feeding systems
For reliable dry blend supply to extruders. Large dimensioned filters with auto-clean feature to ensure trouble-free operation.

Filter systems
Such as ventilation filters for silos and filters for hoppers with mechanical dedusting or compressed-air cleaning are offered by AZO. All filters conform to the stringent technical regulations and industry standards in the materials handling field. Ample filter area is selected based in the specific materials to handle. Filter media and performance is based on your particular process application.

Rotary feeders
For feeding bulk material into pneumatic vacuum or pressure conveying systems, we offer an extensive range of drop-through and blow-through rotary valves of different materials and in several versions.

Two-way pipe diverters
Serve to distribute and converge product streams within pneumatic conveying systems.

Mechanical level indicators
As reliable high or low levels for silos and surge bins.