



# | Gates

## BASIC CONCEPT

At the most basic level, a gate is an object which permits passage into or through an enclosure. Gates as they apply to pneumatic conveying/material handling are no different. At the most basic level, Gates open and close a path of material flow. The most effective means of accomplishing this task is using a sliding blade which moves across the gate opening to block the path of material flow. The most basic gates are simply just this. A basic shut off gate consists of a thin blade which is enclosed inside a body. The body creates an enclosed space which can be open and closed by the blade. This type of gate is simple to construct and operate; however, it is not perfect and can only be used in certain applications. Other applications demand that the gate be able to provide seals against product leaks, seals to prevent pressure loss (or vacuum loss) or special considerations to reduce wear.

## LEAKS

A simple shut off gate is prone to leaks in certain situations. It will adequately perform its function if the material is coarse (large enough to bridge the small gaps inside the gate) and is installed in a gravity feed line. If the material is fine and/or the line is under pressure (or vacuum), there will be leaks. This is the reason why a few other gates exist for pneumatic conveying and material handling applications. Each type provides a different configuration to offer a various seals in order to match the requirements of the system they are to be installed into.

## Around Blade (Top to Bottom)

Seals are often necessary in order to prevent material or air leakage between the inlet of the gate or outlet of the gate. This is important especially in low pressure pneumatic conveying systems, as the air pressure at the inlet, will tend to drive material through any available openings, resulting in potential product loss, as well as a loss of air pressure within the conveying line. In such cases, a gate with a tight seal around the blade opening would be required.

## Along Blade (Internal and External)

As the blade slides back and forth, it will be prone to drag material along with it, from inside the gate opening to the outside. This results in product loss. When inside a pressure system, the losses will be greater as material will be driven through any gaps between the blade and the slot it passes through in the gate body. To prevent these leaks, scrapers can be placed in advance of the blade opening to clean the blade and prevent material from being pulled out, while a tight seal on the top, bottom and sides of the blade will eliminate any gaps through which material can pass under pressure.

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### **Air Purge**

In situations where the leakage of material from the gate orifice to the body (along the blade) may be especially problematic, an Air Purge System can be incorporated. This system applies a positive pressure to the gate body. The pressure is set slightly higher than what the conveying system is run at. This creates a differential pressure between the gate body and the gate orifice. Since air will tend to pass from the region of higher pressure (body) to the region of lower pressure (orifice), material will be prevented from leaking, as well as from being pulled through any seals along the blade as there will be a constant flow of air in the opposite direction.

### **Through Body (internal to Atmosphere)**

Material or Air pressure leakage from the interior of the valve (orifice) to Atmosphere also needs to be addressed. This can be a concern since material leaking out often becomes waste (cannot be reintroduced into the process). Create a potentially dangerous dust hazard and can contaminate the surrounding environment. This issue can vary with the varying gate construction method and the methods used to seal any joints or seams.

## **REACTIONS TO MATERIAL FLOW**

### **Blade Deflection**

The most critical and most vulnerable part of the gate is the blade. If the gate is required to cut through a static or moving head of material, the blade can be subject to a variety of forces which could cause the blade to deflect from its intended path, or even permanently bend. It is very important to know if the gate will be closing on a head of material, as this will influence the selection of the gate and any necessary options.

Another important consideration when selecting a gate is the weight of the material which will be passing through it, and if the gate will be required to support a column of this material in the closed position. This is very important since if overlooked, the weight of the material resting on the blade may cause the blade to bend causing leaks, or worst case, fail completely, which could not only create material wastage, but also pose a significant safety risk.

In order to combat both problems various methods of support are used. Some gates utilize full length blade supports and guides, which support the blade along the edges along the entire length. The supports/guides can be metal, or a low friction plastic. These supports/guides can also be an integral part of the sealing mechanism to prevent pressure and material loss. Due to the design, these types of supports introduce an element of friction on the blade. Typically, this is not a major concern as the gate manufacturer will have compensated for this in their valve design, however, can lead to problems if the gate is cycled at a rate higher than it is intended for.

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Rollers can also be used to support the blade. Rollers tend to be more robust and are used in applications which require additional support such as those for the aggregates industry. Rollers can be constructed from various materials such as Teflon, Nylon or Steel, and are intended to provide support to the blade while also eliminating the friction that is present if using solid guides.

### **Wear**

Anytime a material moves in contact with another there will be wear. Depending on the materials in contact, the wear may occur on one surface or another, or on both. This is true for gates as well. Wear will occur on the gate surfaces or on the material passing through it, or on both; however, steps can be taken to reduce the amount of wear, or to control the wear.

The blade is the central component of the gate and due to its operation, is exposed to the material stream and is subject to wear. Gates are designed to reduce the amount of wear on the blade in order to increase the life of the gate. When in the open state, the blade should be fully retracted outside of the material path, so that no material encounters the blade.

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