

Vacuum Control Systems

For Precise Forming Section Process Control

Total wet end control for better formation, high productivity and improved quality

Benefits:

- Better vacuum control produces more consistent formation and a higher quality product.
- Improved machine runnability with fewer web breaks.
- The systems approach provides complete wet end control to assure optimized vacuum performance.

An increasingly critical element in process organization

As the demand for greater production and higher quality increases, so does the need for precise and reliable vacuum control. Wet end vacuum control is often neglected. But a correctly designed vacuum control system contributes significant to machine runnability—and final product quality. This is particularly true as high operating speeds require elevated vacuum levels and

stock, and freeness fluctuations increase due to greater recycled fiber use.

A vacuum control system must provide precise vacuum control and react quickly to changes in air flow and sheet consistency. If not, vacuum surges can cause exiting sheet moisture variations, pin-holing, two-sidedness, poor formation, loss of fines and fillers—or even web breaks, and in extreme cases, wire stalling.

The heart of a vacuum system is the vacuum valve and its control. Fast response and accuracy are essential in a vacuum valve, but operational reliability is also critical.

Valves and controls should be matched to a correctly-designed separator, dropleg, and header system. The blower and vacuum pump must supply sufficient vacuum to each low and high vacuum position.

Taking this total system approach to vacuum control will help ensure higher system performance, greater system reliability, and fewer problems during start-up and operation.

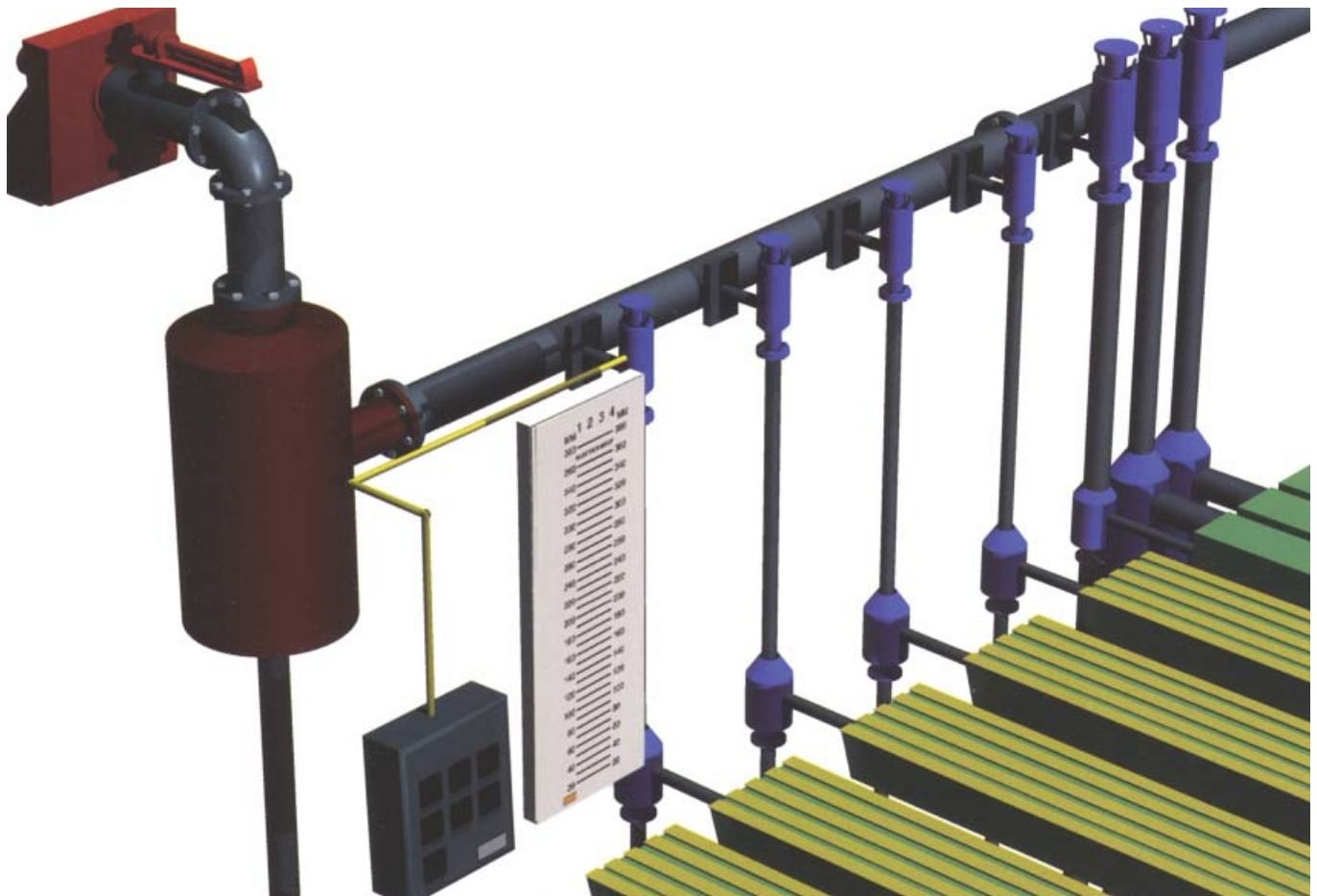


Fig. 1: A typical Kadant AES vacuum control system, which provides precisely-metered vacuum for more consistent formation.

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V1000 Vacuum Control Valves

Automatic response, higher precision, greater reliability

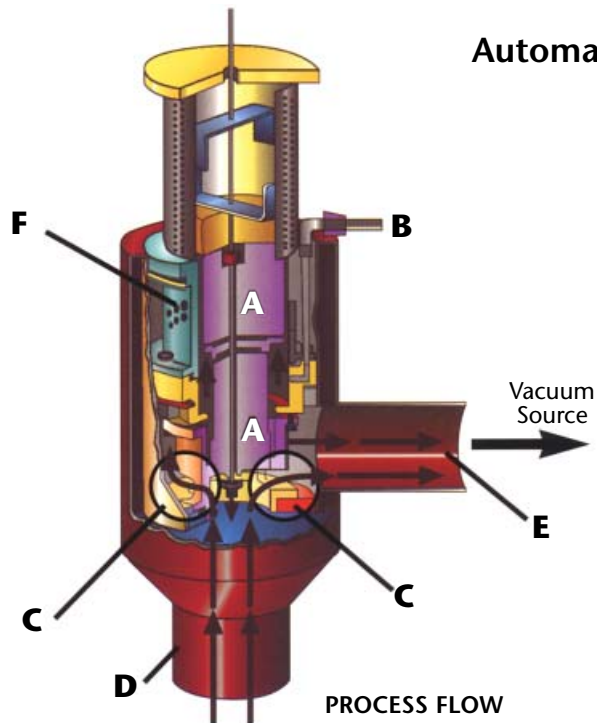


Fig. 2: How the V1000 reaches a setpoint

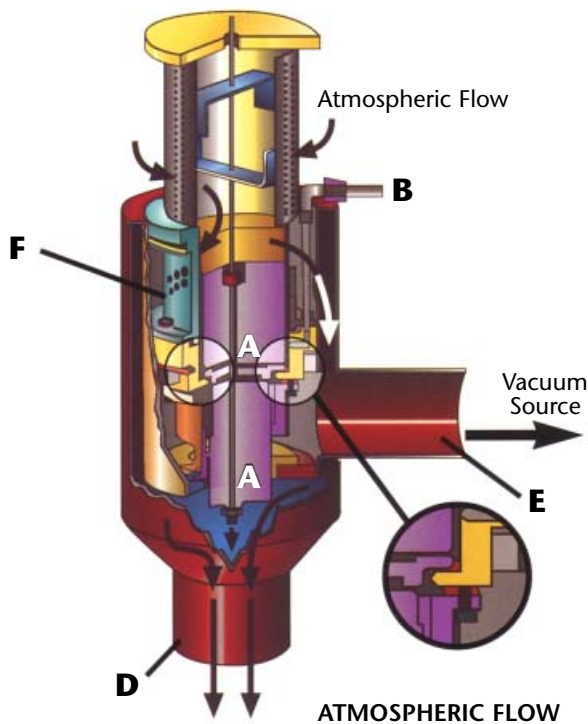


Fig. 3: How the V1000 goes into airbreak

Benefits:

- Automatically maintains set vacuum level despite fluctuations in stock and vacuum supply.
- High precision: setpoints maintained to ± 0.5 " H₂O (12 mm WC.)
- Low and high vacuum capability allows use in virtually any forming section.
- Heavy-duty stainless steel construction—developed specifically for paper mill environments—minimizes plugging and maintenance.
- Simplicity—a single, compact valve unit provides the same level of vacuum control as a multiple conventional valve system.
- Valves can be controlled remotely from machine room floor, or DCS; individual valves do not have to be reset by hand.
- Valves are easily retrofitted onto existing vacuum supply systems.

Better vacuum control means higher quality

Precise vacuum control is essential for consistent dewatering and formation. However, most vacuum is controlled by butterfly or v-port valves, which lack the responsiveness and precision needed to properly react to constantly-fluctuating vacuum requirements.

To provide the vacuum control papermakers need, Kadant AES developed the V1000 valve. Unlike butterfly and v-port valves, the V1000 is designed specifically for controlling vacuum in paper machine forming sections. The V1000 automatically maintains vacuum at a specified setpoint, despite continually changing stock freenesses and vacuum supply levels, due to the force balance control principle. The external sensor and controller provided with the Electronic Interface System is the only control system required for setpoint change.

The V1000—fast, precise, automatic response.

Figs. 2 and 3 describe how the V1000 works. Fig. 2 shows the two back-to-back piston assemblies (A) with different size pistons and rolling diaphragms. When the regulated air pilot for the vacuum setpoint (B) is introduced between the two diaphragms, the force imbalance causes the piston assembly to float upward, uncovering (C) in the lower sleeve. These slots let air flow from the regulated vacuum chamber (D) to the high vacuum header (E). When the regulated vacuum chamber reaches setpoint vacuum, the piston assembly is in a force balance equilibrium.

The valve also accommodates fluctuations in vacuum supply. A high vacuum level in the regulated vacuum chamber (stand-pipe) will pull the piston assembly down, closing off more of the slot area to the vacuum header. A lower vacuum lets the piston move upward, uncovering more slot area.

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V1000 Vacuum Control Valves

Fig. 3: How the V1000 goes into airbreak

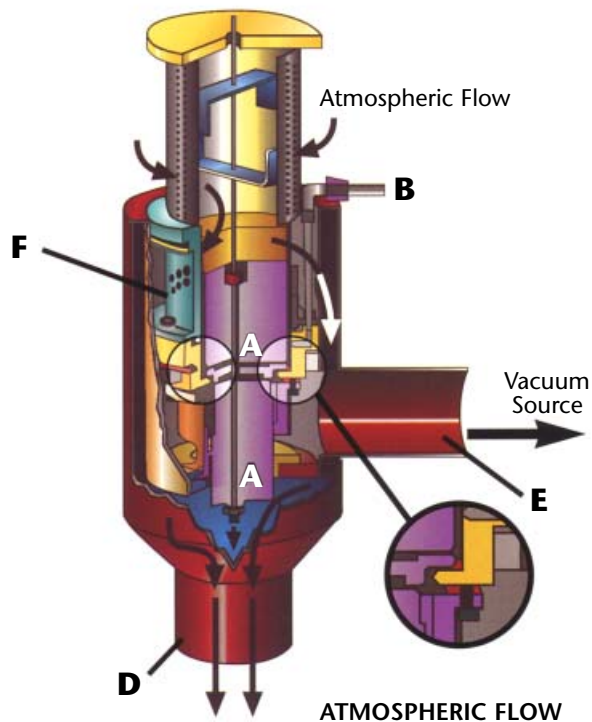


Fig. 3 indicates what happens if vacuum remains above the set-point after all the lower sleeve slots are closed. (Note: this feature is not available on 8" valves.) The piston assembly continues to roll down until the upper diaphragm has uncovered enough holes (F) to allow in atmospheric air that breaks the high vacuum, unlike a single butterfly or v-port valve.

Therefore, the V1000 offers true "set-and-forget" vacuum control. Since vacuum acts directly on the bottom piston, the V1000 responds more quickly to vacuum changes than a manually-actuated valve. The V1000 is also more precise than conventional butterfly valves; it maintains setpoints to ± 0.5 " H₂O (12 mm WC).

Designed specifically for mill environments

Valve bodies and wetted parts are made of 316 stainless steel. Large valve orifices and an integral water spray assembly help prevent clogging, even with difficult furnishes. When maintenance is required, the entire valve assembly can be isolated and removed in two minutes for cleaning, inspection or replacement.

Available in four standard sizes—3", 4", 6" and 8"—the V1000 valve can be fitted to existing vacuum systems with only minor modifications.

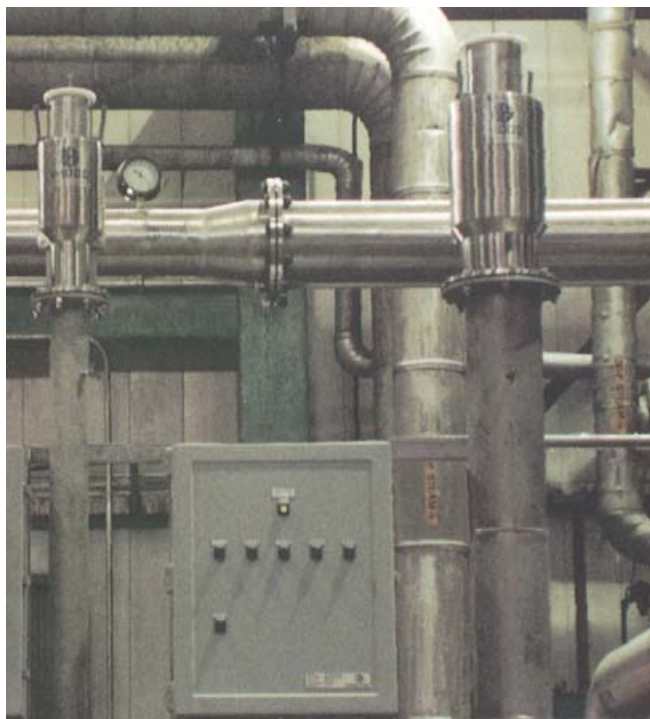


Fig. 5: V1000 valves—in 3" (left) and 4" sizes - installed in a Kadant AES designed vacuum system

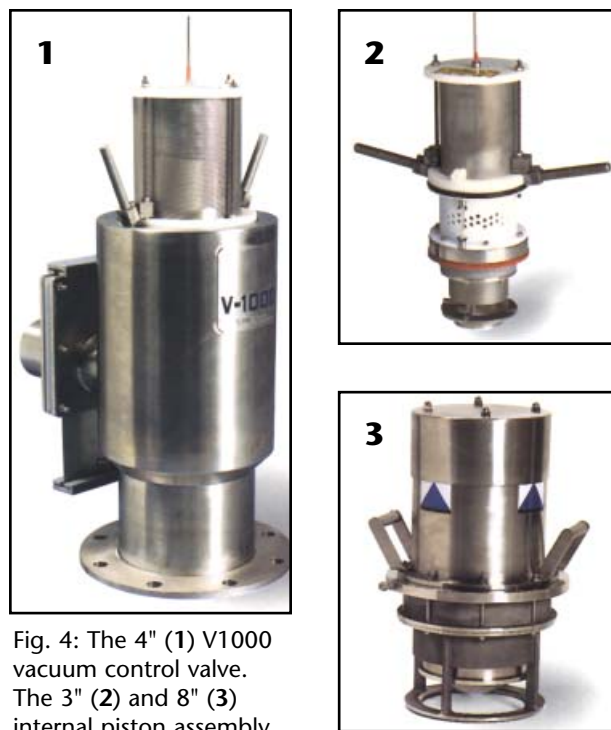


Fig. 4: The 4" (1) V1000 vacuum control valve. The 3" (2) and 8" (3) internal piston assembly

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Electronic Interface Systems (EIS)

Complete vacuum control and integration

Better vacuum control means higher quality

Electronic Interface Systems (EIS) control packages are designed specifically for the V1000. EIS allows pneumatic/electronic communication with valves to provide even more accurate and consistent control of vacuum levels. EIS also lets you link valves to the mill-wide DCS systems for optimum vacuum control. So, for the first time, you can fully integrate vacuum control into the complete papermaking process.

Four control solutions

There are four levels of EIS control: two (the E1 or E2) can be linked to existing DCS systems, and two (E3 or E4) provide stand-alone, closed-loop vacuum control.

The E1 allows remote adjustment of vacuum setpoints. The system uses a custom-calibrated Kadant AES current-to-pressure transducer that converts a 4/20 mA signal into the pneumatic signal which operates the V1000 valve. Mills must supply a 4/20 mA signal to each I/P transducer.

The E2 combines the E1 with a Kadant AES pressure-to-current transducer, which is pneumatically piped to the process standpipe. It requires a 4/20 mA input signal for each valve, and provides a 4/20 mA output signal that corresponds to the process vacuum range.

The E3 is a stand-alone system for mills that cannot supply a 4/20 mA signal. It consists of a V1000E2 panel and a remotely-located (typically on the tending side) single-loop PID controller panel that lets the operator view process vacuum, and easily make setpoint changes (see fig. 6.)

The E4 lets mills introduce an alternative input signal into the PID control panel loop—typically a 4/20 mA process variable like consistency measurement. It's essentially an E3 system—but with the P/I output signal connected to a process display for visual feedback of stepfool or other control box vacuum.

Benefits:

- Allows vacuum setpoint adjustment from remote locations.
- A single E1, E2, or E3 system can control up to 12 valves.
- E1 or E2 systems can be directly linked to existing mill-wide DCS process control systems.
- E3 or E4 models provide stand-alone, closed-loop vacuum control.



Fig. 6: The EIS V1000E3 five-zone controller panel

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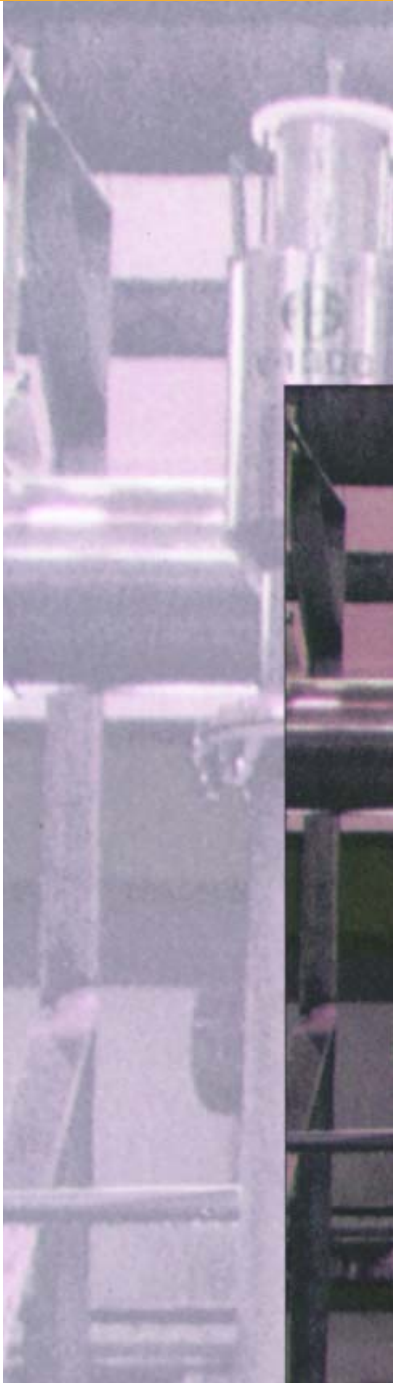
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The single source supplier

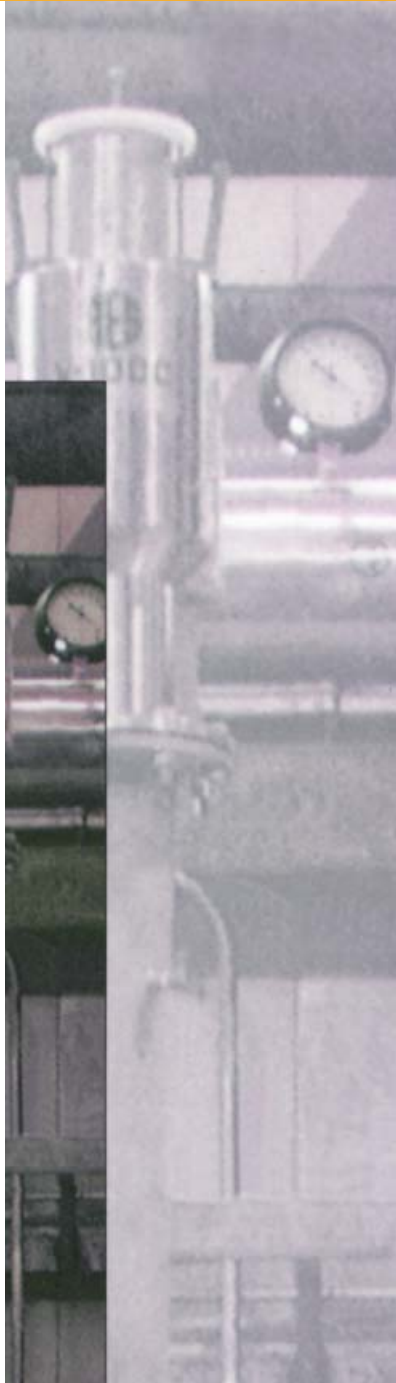


If you're serious about maximizing the contribution forming section dewatering makes to your process, talk to Kadant AES.

Kadant AES designs, supplies and supports completely integrated vacuum systems. As a single source resource, we're uniquely qualified to help you optimize your wet end control.

Our expertise covers every aspect of the forming process. Therefore, we can supply you with complete application support. That means everything from process knowledge, to system design, high performance vacuum components, and service.

The result is a fully integrated solution to total wet end control—and a forming section that optimizes mill efficiency and product quality.



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