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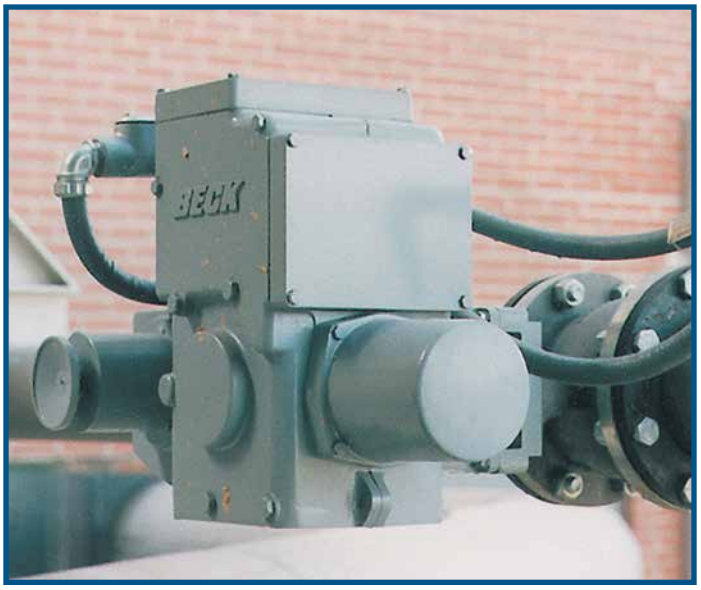
BECK® ELECTRIC ACTUATORS

FOR INDUSTRIAL PROCESS CONTROL



UTILITIES AND PROCESS INDUSTRIES

BECK VIDEO
Scan w/ Smartphone

Beck electric actuators provide stable, reliable process control.

Beck electric actuators are distinctly different from typical actuation systems which limit control reliability and require constant maintenance. Unlike conventional electric and pneumatic actuators, Beck actuators withstand years of continuous duty without maintenance, and provide precise, stable positioning in milliseconds to ensure accurate tracking of the input signal.

Beck offers a selection of versatile actuators designed for service on dampers, quarter-turn valves, globe valves, and special applications such as fluid couplings.

Beck actuators incorporate a no-burnout motor, an efficient spur gear actuator train, and accurate, durable electronics. This unique design eliminates the performance limitations typical of electric actuators, including overheating motors, worm gear wear-induced backlash, coasting, and other positioning inaccuracies.

Over years of use, these features have contributed to our customers' profit margins by improving process control performance. Today, as more and more facilities are investing in advanced control systems to further improve quality as well as reduce fuel, raw material and maintenance costs, Beck remains the economical choice over lower-priced alternatives. Beck actuators provide the reliability and performance necessary to maximize your investment in a control system.

Group 11 actuator on a fluid coupling.

Available for any level of automation.

Beck actuators can be specified and installed to match the performance of your control system at any level of automation. Each model is available with a variety of control options. Whether precise modulating control or reliable open / close functions are required, a Beck actuator can be equipped for the job.

Beck actuator on a louver damper.

The Beck motor

No Burnout, Continuous Duty

The unique motor is one of the features that sets Beck actuators apart from other typical electric actuators. Beck's no burnout motor ensures that the actuator is available 100% of the time. There are no duty cycle limitations typical of most electric actuators, so the Beck actuator tracks the control signal perfectly, greatly simplifying loop tuning.

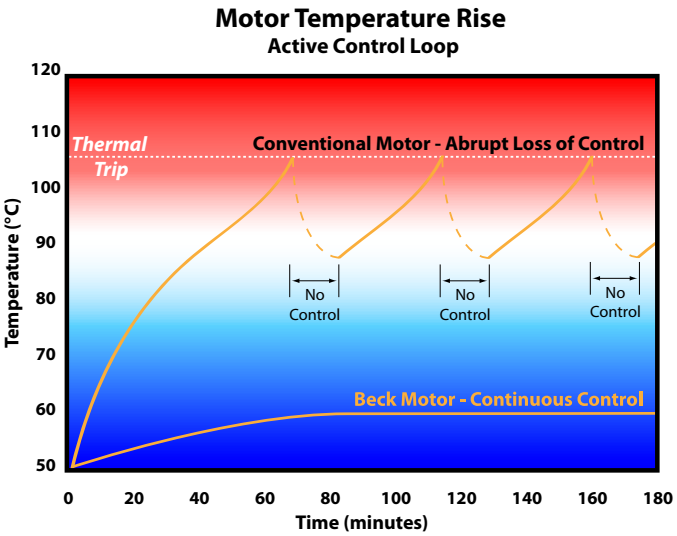
The Beck motor ...

- Starts and stops instantaneously and provides millisecond response to signal commands in a modulating control loop—eliminating deadtime, coast and overshoot.
- Provides extremely accurate, repeatable positioning with no required maintenance.
- Draws very low power, permitting easy integration with UPS systems.

And . . .

- Never overheats or burns-out; even under demanding modulating or stalled conditions.

Tested in an active modulating loop, conventional motors rose rapidly in temperature, tripping thermal overload devices and becoming unavailable for extended time intervals. Only the Beck motor remained stable for continuous operation.



Housing: Superior Protection and Convenient Access to Components

Beck actuators feature a cast aluminum body with individual compartments to protect components from moisture and dirt, and allow easy access for installation and calibration.

- Precision-machined aluminum alloy castings with corrosion-resistant polyurethane paint provide a rugged, dust-tight, weatherproof actuator body designed to meet Type 4 standards.
- Models approved for use in Hazardous classified locations are available.
- Individual compartments protect all major components: Motor, Digital Control Module (DCM), Contactless Position Sensor (CPS), gear train and installation wiring terminal board.
- Gasketed covers provide extra protection for abusive indoor environments and harsh outdoor climates.
- Each compartment can be accessed without exposing other components to the environment.
- Output and Handwheel shafts are sealed with weatherproof, double-lip cartridge seals.

Group 11 actuator with the gasketed control end cover removed.

Contact a Beck Sales Engineer to find out more about the best actuators for your installations.
Call 215-968-4600
E-mail: sales@haroldbeck.com

Digital Electronics: Repeatable Control, Simple Operation, and Diagnostic Capabilities

Beck actuators are equipped with field-proven electronics that provide excellent position control in response to modulating control signals. This maximizes control loop performance by ensuring that the actuator and damper respond exactly as the control loop requires.

The DCM is equipped with a local interface panel for pushbutton calibration functions without the need for external devices or software. A bank of LED diagnostic lights are provided to display a number of status conditions.

The DCM is also equipped with a HART communications interface to provide bidirectional digital communications with the DCM over the existing analog demand wiring—facilitating access to the added functions and information without interfering with control or requiring new wiring. Communications can be accomplished either remotely or locally using any standard HART-based communication tool.

In addition to HART, other DCM versions are available that support Foundation Fieldbus, Profibus PA or Modbus RTU communications. Modbus TCP (Ethernet) is supported using a Modbus RTU DCM along with an interface module. All interfaces are compatible with common asset management systems.

A serial interface also allows for actuator configuration changes, actuator information reporting and assistance in troubleshooting.

Beck's Contactless Position Sensor (CPS) also resides within the actuator, and provides reliable internal position feedback to the DCM for position control. The DCM also uses the sensor signal to source a 4–20 mA external position signal for remote monitoring of actuator position. Unlike typical position sensors, the CPS does not wear due to its contactless design.

HART COMMUNICATION PROTOCOL

Modbus MEMBER

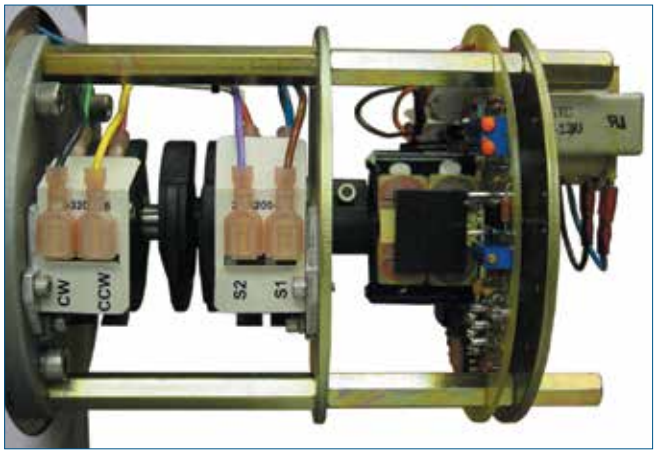
Travel Switches

Beck actuators include heavy-duty, single-pole, double-throw (SPDT) switch mechanisms for electrical over-travel protection. Switch cams will not slip because each is mounted to the shaft by an integral, tangential clamping means—with no set screws to mar the shaft.

Every actuator is equipped with two over-travel limit switches. Optionally, actuators can be equipped with up to four auxiliary switches that can be set to operate at any desired point of actuator travel, thus providing discrete inputs for control or indication.

Common throughout most Beck actuator models, the SPDT switches provide the following:

- A maximum rating of 6 A at 120 V ac (three times the maximum motor current for most models) to ensure long life.
- Auxiliary switches are field-adjustable with infinite positioning throughout the actuator's travel range.
- May initiate secondary functions or provide remote indication of actuator position.



Actuator Train: Power and Durability

Beck's durable gear train maintains accurate, consistent positioning even under the demanding conditions of an active control loop.

- Gear trains employ a unique, all spur gear construction using only heat-treated alloy steels and ductile iron.
- Efficient, wide-faced spur gears ensure long life and eliminate wear-induced backlash and positioning inaccuracies common in worm gear and "Scotch-yoke" designs.
- Integral self-locking mechanism ensures that actuators hold a minimum of 200% of rated torque with the motor de-energized.
- Durable design provides up to 4 days of protection against intermittent or extended accidental stalls.
- Stall protection is provided by the DCM. If the motor tries to run in one direction for more than 300 seconds, the DCM will shut off power to the motor and a status indication LED will activate indicating a stall.

Electric Handswitch: Timesaving Local Operation

The built-in electric Handswitch allows simple operation of the actuatorn device. This saves time during installation and troubleshooting, allowing on-line adjustments to be made quickly and easily by bypassing the electronics in the actuator and control system.

The Handswitch also serves as an electrical backup in the event of control system failure.

Manual Handwheel: Convenient Manual Control Without Declutch

An easy-to-turn spoke-free Handwheel is incorporated into the design to allow manual operation during installation or power outages.

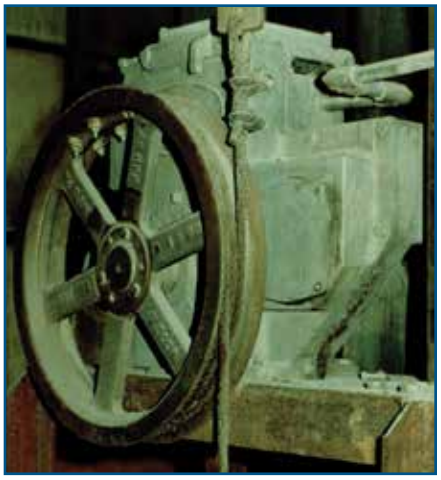
- Handwheel can be used to move dampers or valves to any position smoothly and easily—even under full load conditions.
- Mechanical stops in the housing prevent manual overtravel.
- The motor / Handwheel operates at 72 or 120 RPM and therefore poses no safety hazard.
- The Handwheel does not require excessive turning to move the load.

Chemical Plants

Valves and actuators in most chemical refining and processing plants are selected to survive conditions of corrosion, temperature extremes, and outdoor environments. Beck actuators meet these needs effectively, keeping out contaminants to allow the units to operate continuously under the worst external conditions.

Industrial Boilers

Many boilers are being upgraded with new control systems to improve combustion. Conventional actuators can compromise the effectiveness of these upgrades. Beck actuators complement newer control systems to improve fuel / air mixing and furnace pressure. They are also ideal for related applications such as feedwater and steam control.



Glass Furnaces

Used on fuel and combustion air valves, Beck actuators provide high accuracy and dependable operation in hot environments. Beck multi-revolution rotary actuators (as pictured above) are used for sliding-type furnace pressure dampers on melting furnaces. Improved pressure control optimizes combustion efficiency and inhibits refractory and other structural deterioration.

Waste Treatment Plants

Valve / actuator assemblies used to regulate process flow in waste treatment applications are vulnerable to failure caused by high duty cycles, constant seating of valves, and environmental hazards. Beck's motor and linkage system eliminates troublesome torque limiting switches to keep control systems on-line.

Cement Plants

Beck actuators have been used in more new cement plants and plant upgrades than any other brand. Exceptional longevity and control system compatibility have made Beck the choice in cement plants all across North and Central America.

Electric Utilities

Beck actuators are engineered to maximize the effectiveness of boiler control systems to improve overall system efficiency. Responsive modulating capability ensures accurate control on fan damper and valve applications, contributing to increased availability and longer boiler life.

Metals Refining Industries

The dependability, longevity and precise control capability of Beck actuators have made them the actuation method of choice for many steelmaking and aluminum reduction facilities. Beck actuators deliver maintenance-free operation in temperature extremes and dirty conditions.

Pulp and Paper Plants

Process valves in pulp and paper applications require tight position control to produce the highest quality product with minimum waste. Beck actuators move instantaneously in response to signal commands, and stop immediately without overtravel, ensuring a high level of product consistency.

Refineries

Most Beck actuators are available rated for use in hazardous locations, allowing for utilization in refineries on heaters and gas valves, as well as other applications.

Field-proven solutions to actuator control problems

Control loop performance is only as good as the performance of the final control element. It is a well-documented fact that many industrial control loops function poorly as a result of actuation problems. Beck actuators eliminate the problems caused by both pneumatic and typical electric actuators, and maximize the potential of control systems.

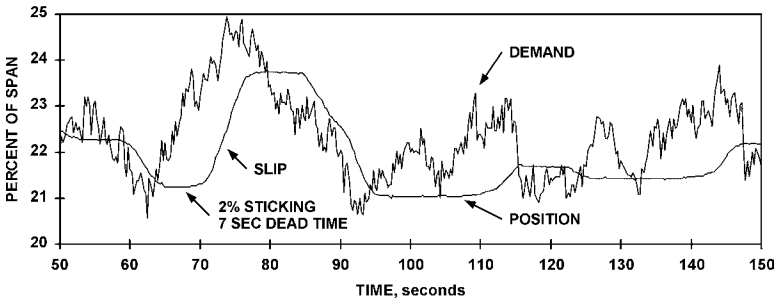
This is accomplished through the unique Beck design, which provides a number of key performance advantages including:

- Repeatable positioning down to 0.1% resolution
- Will not STICK, SLIP or OVERSHOOT
- Instantaneous starts and stops
- No performance degradation over time or with changing loads
- No duty cycle limitations
- Rated from (-40) to 85°C. (185°F.)
- Requires little or no maintenance

Unlike pneumatic actuators, Beck actuators provide consistent and precise performance over time regardless of changing process conditions.

Pneumatic actuators are subject to inherent characteristics that limit and disrupt control loop performance. Many recent developments in this technology center on advanced diagnostics to help detect and predict these problems, but the compressibility of air remains the major problem source. As such, the overall performance of pneumatic actuators varies as a function of frictional and dynamic load, process conditions, final control element condition, and the performance of actuator accessories like the I/P transducers, positioners, and boosters. This results in inconsistent and often wide deadbands, poor resolution, sluggish response, and overshoot. Even when pneumatic actuators perform well when new, these problems become increasingly prevalent and unpredictable over time. Heat, humidity, contamination, and air quality all serve to increase performance degradation and inconsistency, often making excessive maintenance necessary to maintain acceptable control.

"Stick and slip" is one of the most common pneumatic actuator problems. This condition occurs when an actuator builds pressure to overcome a static load (usually frictional, but not always). As the pressure builds, the final control element does not respond, and therefore the controller continues to increase the demand. When the air pressure is high enough to initiate movement, the actuator takes off and overshoots the correct position. This can result in "limit cycling"—causing the controller to continuously cycle.



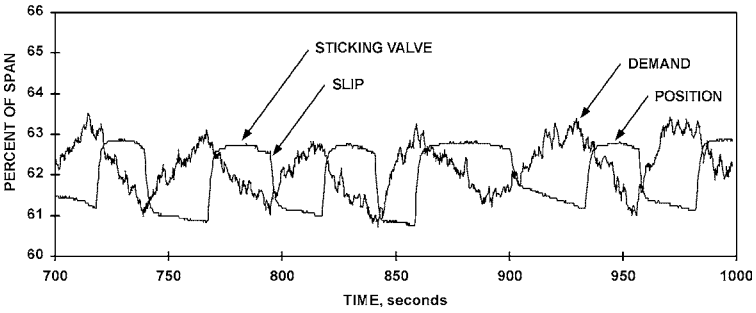
MACHINE CHEST CONSISTENCY CONTROL VALVE

Figure 1: *This data is from a consistency control loop in a North American paper mill. It demonstrates a classic stick and slip problem. As shown, a 2% change in demand was required to initiate response. In this case, the result was 7 seconds of dead time.*

Typical electric actuators have problems of their own. Many designs incorporate high-speed induction motors that do not stop instantaneously and require a limited duty cycle to prevent overheating. In addition, most utilize inefficient worm gears, which can wear quickly, particularly within actuators installed in active loops. These problems dictate the use of wide deadbands, which can severely limit the resolution of a final control element. Another significant concern is the overall reliability of typical electric actuators. The electronics often cannot withstand harsh environmental conditions and cause costly control downtime.

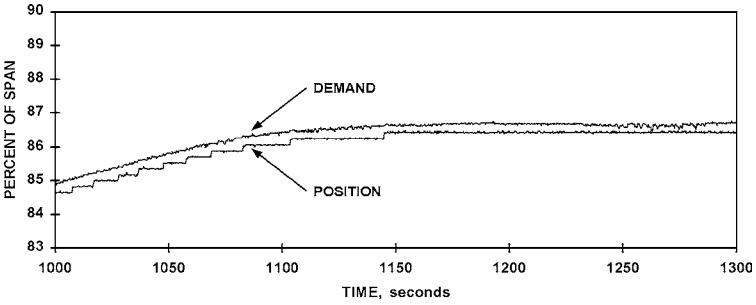
Beck actuators are designed to eliminate the problems of both pneumatic and conventional electric actuators. Beck actuators provide consistent and precise performance despite the effect of changing process conditions—without sticking, slipping or degrading over time.

Results on valves



STOCK-TO-KNOTTERS FLOW CONTROL VALVE

Figure 2A: *In this stock-to-knotters flow control valve application, the pneumatically actuated valve exhibited a 2% limit cycle. The resulting cycle in the stock flow upset the knotter throughput, often causing plugging to occur. The cycle also destabilized upstream consistency control, which further contributed to knotter plugging.*



KNOTTERS FEED PRESSURE CONTROL VALVE

Figure 2B: *A Beck actuator, installed on the same valve, was able to closely track the controller output. This not only enabled the mill to tune the loop more appropriately, but aided in redesigning the control strategy to be more effective. Part of the redesign included eliminating the stock flow loop and converting to a pressure control valve. Unlike the pneumatic actuator, the Beck actuator provides the resolution, consistency and instantaneous response necessitated by the fast dynamics of pressure control.*

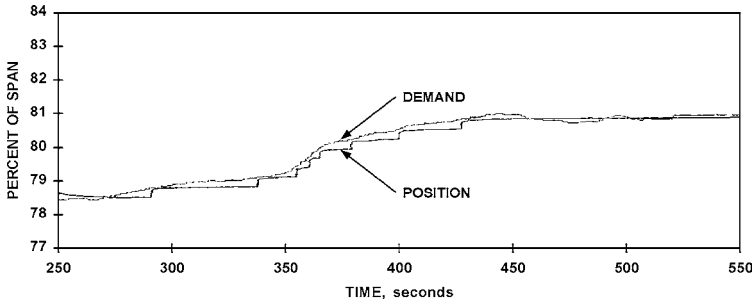
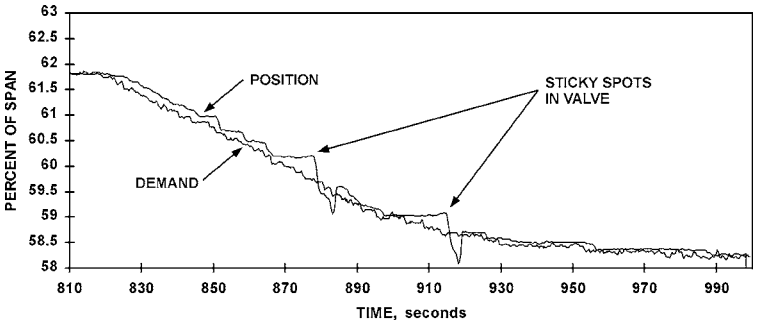


Figure 2C: *Even after eight years of difficult service, the Beck actuator performance is unchanged.*

MACHINE CHEST CONSISTENCY CONTROL VALVE

Figure 3: *In a thick stock dilution valve at another mill, this relatively new, pneumatically actuated valve performed adequately over much of its operating range. However, sticking occurred at approximately the 60% open position. This caused overshoot that affected the stock consistency. This subtle sticking problem is common and often develops quickly in new valves.*

The mill installed a Beck actuator to eliminate the problem. The instantaneous, full-torque starting capability of the Beck actuator ensures that if valve stiction is present, it will not affect positioning performance.



MACHINE CHEST STOCK CONSISTENCY

Figure 3A: *This curve shows the negative impact the subtle stick problem (see Figure 3) had on stock consistency.*

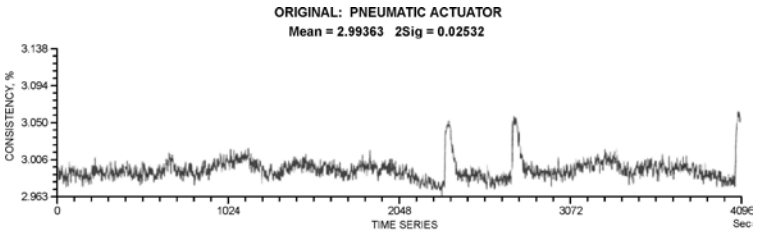
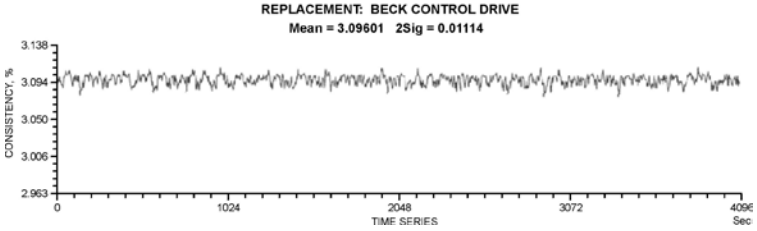


Figure 3B: *By installing a Beck actuator, the negative impact of the sticking problem was completely eliminated. In addition, the consistency meter was moved closer to the control valve reducing dead time. This, combined with the Beck actuator, yielded an overall improvement in consistency control.*



More field-proven results on dampers

Industrial facilities utilizing air flow and combustion control dampers continually invest in Beck actuators and realize long-term benefits. Below are a series of data charts that were generated by a large, coal-fired utility.

Figure 1A

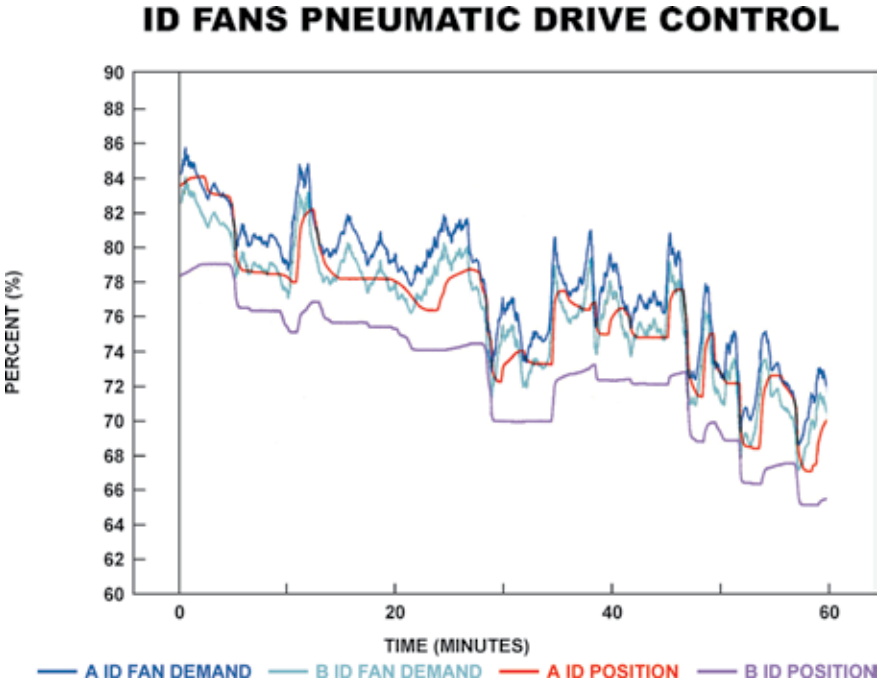


Figure 1A shows data for a boiler with dual ID dampers modulated with pneumatic actuators. Both dampers' actuators receive the same demand signal which is shown biased for clarity. The corresponding damper responses are shown as well. Neither damper actuator could follow the signal closely enough to provide good furnace pressure control. Additionally, although dampers, damper actuators and the controller demand signal are identical, the actuators performed differently from one another. This highlights not only poor response, but the typical inconsistent response of pneumatic actuators as well.

Figure 1B

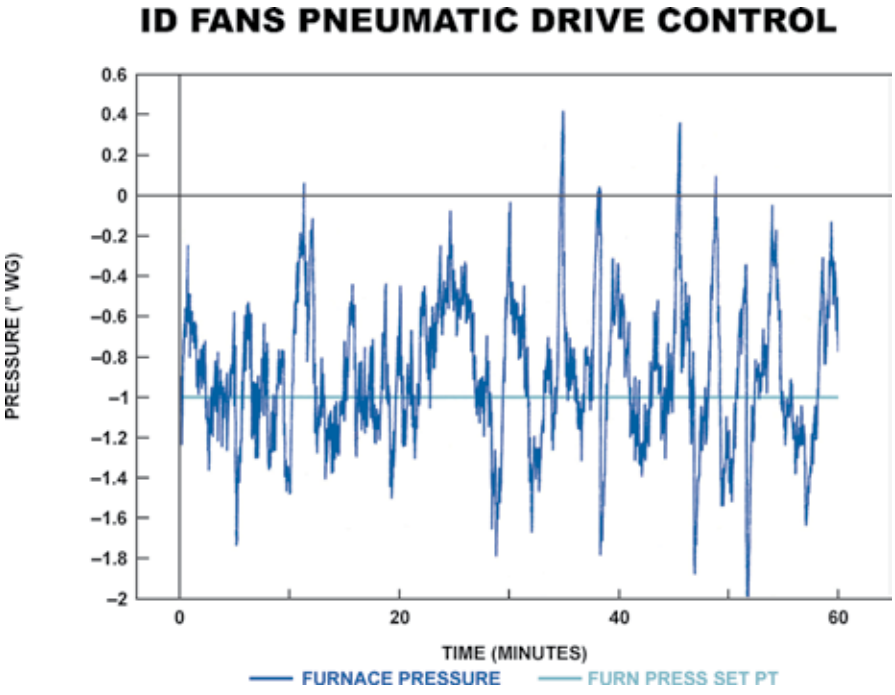


Figure 1B shows the resulting furnace pressure control with the pneumatic actuators in place. Note the following: 1) The pressure control is poor with a wide band of variability; 2) the furnace pressure occasionally goes positive; 3) the control setpoint is set at –1 inch of water column. Compare these results to Figure 2B after Beck actuators were installed.

Figure 2A

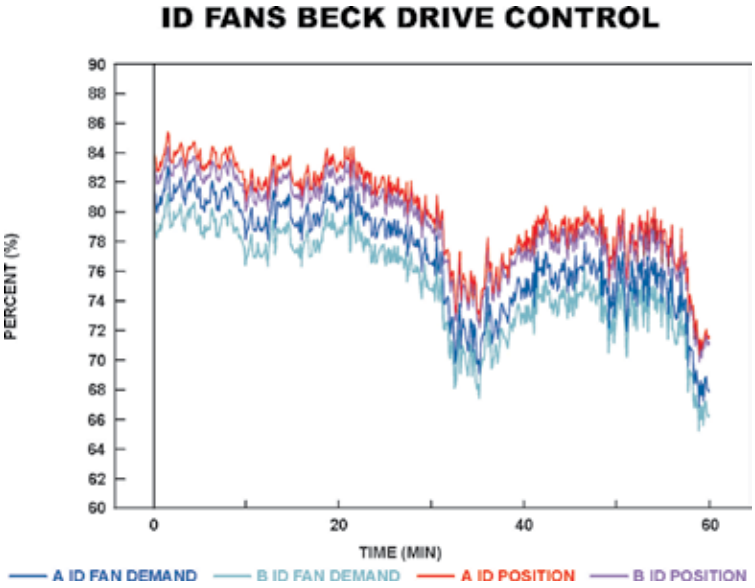


Figure 2A shows the response of the two ID dampers after Beck electric actuators were installed. As in Figure 1A, biases were added to all the signals for the sake of display clarity, but the two demand signals are identical and the position signals actually overlay the demand. Note how closely the damper position tracks the demand, allowing for optimal furnace pressure control.

Figure 2B

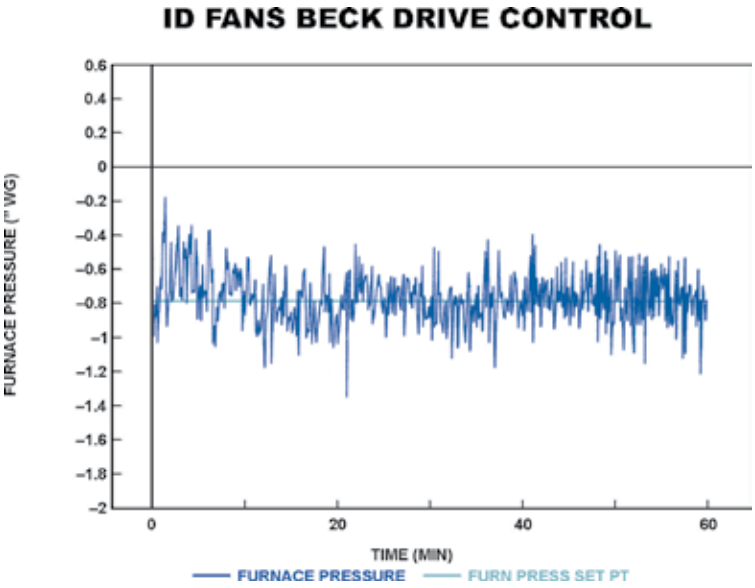


Figure 2B shows the furnace pressure control after the Beck actuators were installed. It is easy to see at a glance how much tighter the control results are compared to Figure 1B; however, it is also important to note the following: 1) Furnace pressure no longer makes positive excursions; 2) the loop setpoint has actually been moved from –1 in. WC to a more efficient –0.8 inches WC; 3) this data was collected after the Beck actuators were installed, but before any tuning or other changes were made.

Figure 2C

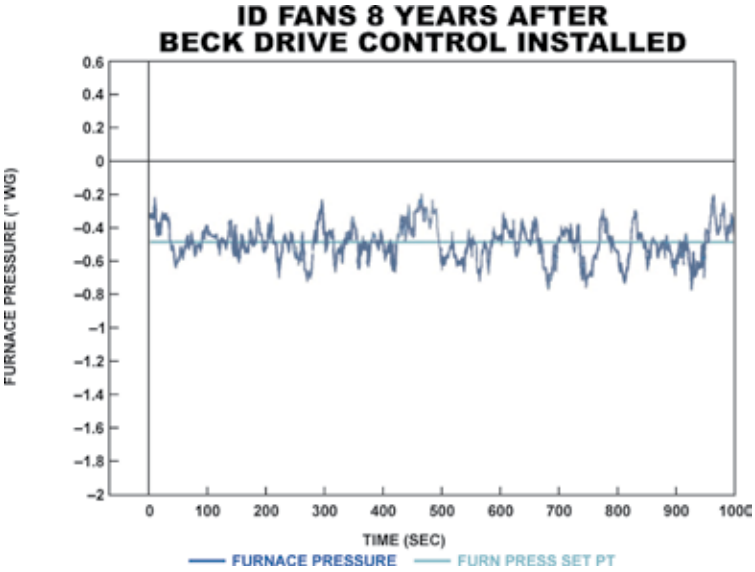


Figure 2C shows data collected on the ID dampers eight years after the Beck actuators were installed. Clearly, performance is still excellent. Further control improvements over the years allowed the furnace pressure setpoint to be moved from –0.8 inches WC to –0.5 inches WC; further accentuating the benefit of excellent damper control.

GENERAL SPECIFICATIONS

Actuator Power	
Model 11	120 V ac, single-phase, 60 Hz (50 Hz Optional) (208, 240, 380, 415, 480 & 575 V ac, 60 or 50 Hz Optional)
Model 14 & 29	120 V ac, single-phase, 60 Hz (50 Hz Optional) (240 V ac, single-phase, 60 or 50 Hz Optional)
Model 22-309	120 V ac, single-phase, 60 or 50 Hz (240 V ac Optional) (208, 240, 380, 416, 480, 575 V ac, three-phase, 60 or 50 Hz Optional)
Model 22-409	208 V ac, three-phase, 60 or 50 Hz (240, 380, 416, 480, 575 V ac Optional)
Model 22-809	480 V ac, three-phase, 60 or 50 Hz (208, 240, 380, 416, 575 V ac Optional)
Model 57	12–30 Vdc (12–48 Vdc; 208, 240, 380, 415, 480 or 575 Vac; 100–264 Vac Optional)
Model 31 & 75	120 V ac, single-phase, 60 Hz (50 Hz Optional)
Output Torque/Thrust	
Model 11	Up to 1,800 lb-ft (2440 N•m)
Model 14	Up to 4,000 lbs of thrust (17800 N)
Model 22	Up to 8,000 lb-ft (10846 N•m)
Model 29	Up to 6,100 lbs of thrust (27134 N)
Model 31	Up to 30 lb-ft (41 N•m)
Model 57	Up to 120 lb-ft (163 N•m)
Model 75	Up to 80 lb-ft (108 N•m)
Operating Conditions	
Models 11, 14, 22 & 29	–40° to 185° F (–40° to 85° C) –58° to 185° F (–50° to 85° C) - Optional (Low Temperature)
Model 31	–40° to 150° F (–40° to 65° C)
Model 57	–58° to 185° F (–50° to 85° C)
Model 75	–4° to 185° F (–20° to 85° C) - Standard –4° to 248° F (–20° to 120° C) - Optional (High Temperature) –58° to 185° F (–50° to 85° C) - Optional (Low Temperature)
Input Signal Options	4–20 mA or 1–5 V dc
Communication Interface Options	HART, Modbus RTU, Modbus TCP (Ethernet), Foundation Fieldbus, Profibus PA, local pushbutton/LEDs and DB9 Serial Commands
Position Feedback Signal	4–20 mA
Action on Loss of Input Signal	Stays in place (all models) or moves to a preset position (configurable with DCM-equipped models)
Action on Loss of Power	Stays in place
Enclosure	Type 4 or 4X (depending on specific model). IP66 or IP68 (model specific). Models approved for use in Hazardous classified locations are also available—contact a Beck Sales or Application Engineer for details.
Backup Power Unit (BPU)	Up to ~2.5 minutes backup time. Available with some models—contact a Beck Sales or Application Engineer for details.

HART COMMUNICATION PROTOCOL

Modbus MEMBER

BECK®

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5/21
Rev. 6.5