Abrasive Blast Machine Retrofit

Electronics Inc.
Blast Cleaning Control

A Low Profile MagnaValve was retrofit onto a Pangborn machine at EMI in South Bend, Indiana. According to Jerry Sheyka, President of EMI, "EMI has used MagnaValves for six years. During this period, we experienced no downtime of any kind. However, the major advantage has been the cost savings due to less energy consumption. The wheel units had to work "less hard". The valves literally paid for themselves in the first year of operation. The savings over the next five years enabled us to equip our other machines with MagnaValves. We were able to pass on a substantial savings to our customers as well."

This installation guide will show how to replace the mechanical media (grit) valve on a wheel type blast cleaning machine with the 110 Vac Low Profile MagnaValve. The most important reasons for this type of upgrade are:

a) to eliminate the high-maintenance air cylinder and mechanical valve,
b) to provide highly controllable shot flow rates,
c) to reduce labor, media and energy costs, and
d) to provide an automatic alarm to alert the operator to replenish the shot/grit supply.

The MagnaValve has no moving parts because it operates on a magnetic principle. A permanent magnet is used to hold the shot in the MagnaValve. Application of control power will cancel, or neutralize, the magnetic field and allow shot to flow. When there is no power applied to the MagnaValve, the shot does not flow due to the holding power of the permanent magnets.

The machine receiving the new MagnaValve is a RotoPeen system from Pangborn Corporation that was modified to blast clean 20 foot lengths of round pipe. It is a single-wheel 20-horsepower pass-through cabinet design as shown in Figure 1.

Figure 1. Pangborn RotoPeen machine ready for MagnaValve

The following text and photos will review the MagnaValve installation. The entire project required less than one day for the conversion. The shop was also introduced to the Almen strip and Almen gage for measuring blast stream intensity to help meet requirements of the ISO 9000 program for process control and documentation.

An air cylinder was used to open-close the original mechanical valve as shown in Figure 2. This air cylinder was controlled by the operator using a simple 2-way air valve with a hand lever. The air cylinder would move the mechanical valve from its closed to an open position. The amount of opening was pre-set by the operator by adjusting a nut on the linkage of the air cylinder to limit the stroke of the air cylinder.

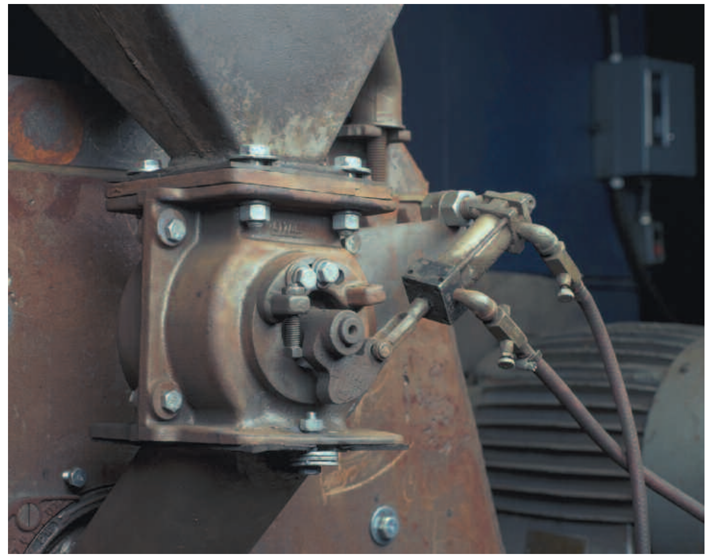

Figure 2. Photo of mechanical valve with air cylinder

A conventional panel ammeter (0-30 Amps) was used to indicate motor amps and relative shot flow rate. Figure 3 shows an ammeter reading of approximately 8 amps, the no-load or no shot

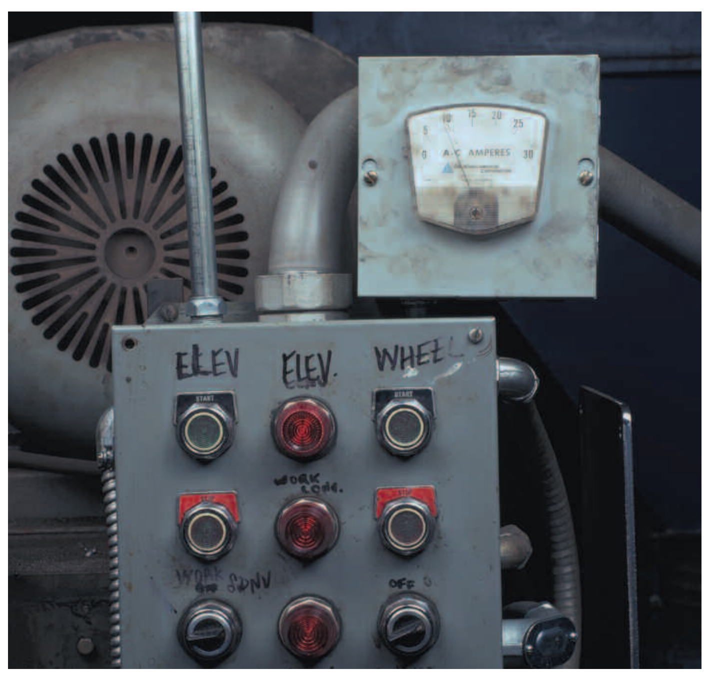

Figure 3. Original control panel and ammeter 0-30 amp range

flow condition. It is not uncommon for these meters to be inaccurate due to the metallic dust that collects inside the meter movement thereby preventing proper amperage display.

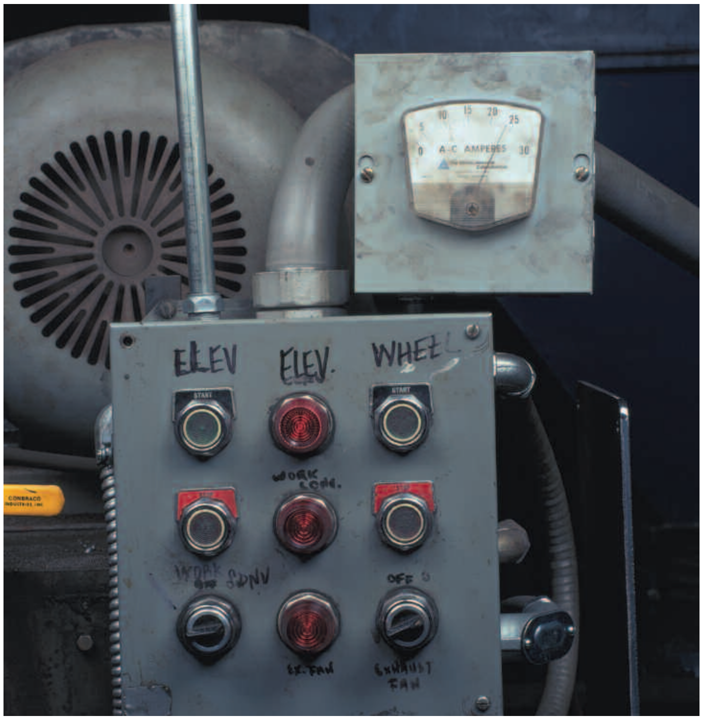

Figure 4. Ammeter showing operating amps

Figure 4 shows the original operating amperage condition (in this case, approximately 24 amps). The operator was unaware if this meter was calibrated or accurate. Later tests indicated that it was off by 4 amps.

Figure 5. Removing feedspout to wheel

Figure 5 - the first step in removing the old mechanical valve is to remove the feedspout going to the wheel inlet. First, remove the four bolts attaching the feedspout to the bottom of the mechanical valve.

Caution: Be sure the wheel is not rotating. Precautions should be taken to prevent any inadvertent operation of the machine during maintenance. Follow all safety precautions and instructions shown on the machine or in the owners manual.

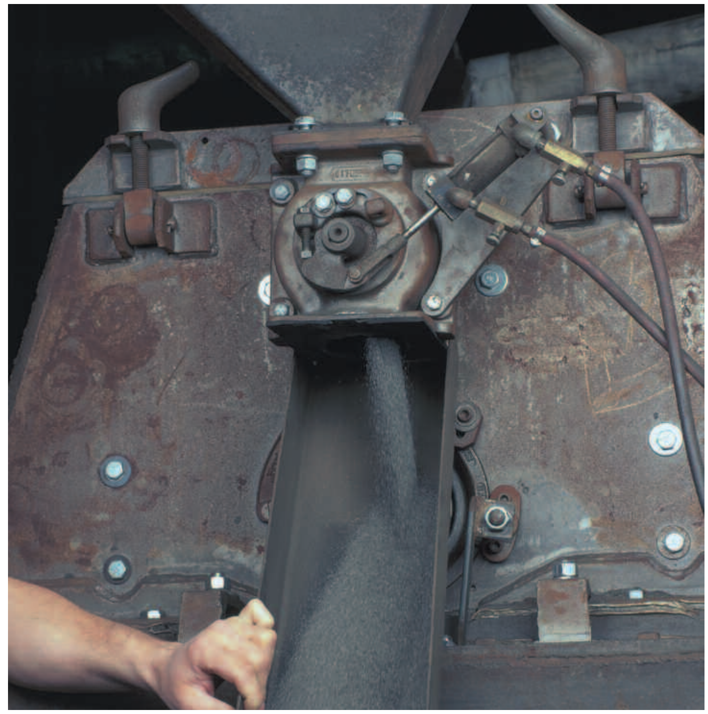

Figure 6. Drain the shot from the hopper

Figure 6 - some machines will have a slide gate or maintenance gate located above the mechanical valve. This should be closed to allow removal of the mechanical valve without draining the shot from the hopper. If the machine does not have a slide gate (this machine did not), you must drain the hopper into a suitable container. Drain the shot from the hopper using a hose or chute to guide the shot into a drum or receptacle.

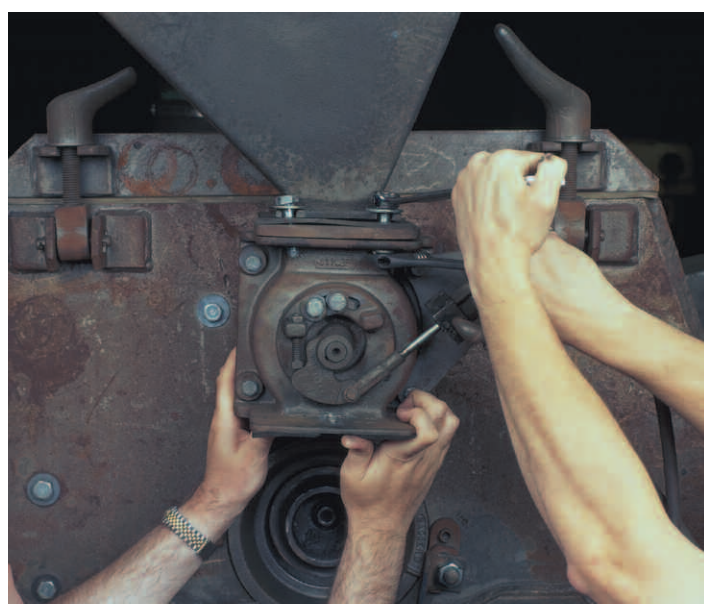

Figure 7. Loosen bolts on top of valve

Figure 7 - next, remove air hoses from air cylinder and terminate air supply line coming from the air compressor. With the slide gate

closed (if available) or with the hopper empty, you can now loosen the bolts from the top of the mechanical valve.

Figure 8. Remove the old valve

Figure 8 - once the bolts are removed you can extract the valve from the machine. Be careful. The valve is heavy and may have some shot in it that can spill out upon removal.

Figure 9. Our adapter kits make installation easy, even on older equipment.

Figure 9 - EI has adapter plates that will compensate for the bolt hole locations and vertical spacing needed by the MagnaValve.

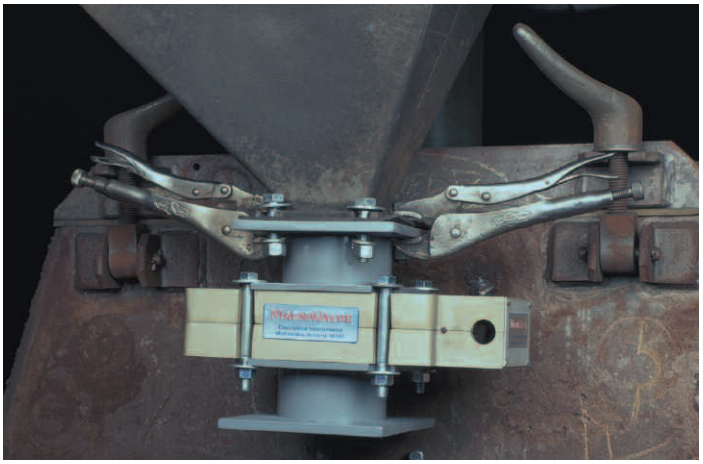

Figure 10. Temporarily hold MagnaValve in position with vise-grips and then install bolts

Figure 10 - the adapter plates should be pre-installed onto the MagnaValve so that it can be installed as a single unit, replacing the mechanical valve. The entire MagnaValve assembly can be temporarily positioned and held into place by using vise-grips or similar pliers and then the bolts can be installed and tightened.

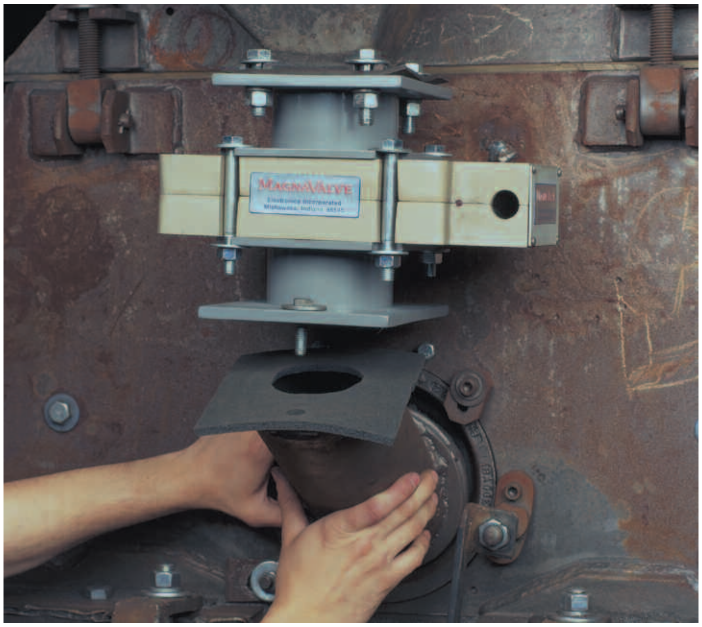

Figure 11. Re-install feedspout to wheel

Figure 11 - the feedspout can now be reinstalled easily since it will bolt directly to the special adapter plate. Be sure to use a rubber gasket between the adapter plate and the feedspout. Do not use silicon rubber or any other adhesive since that will make removal for inspection difficult.

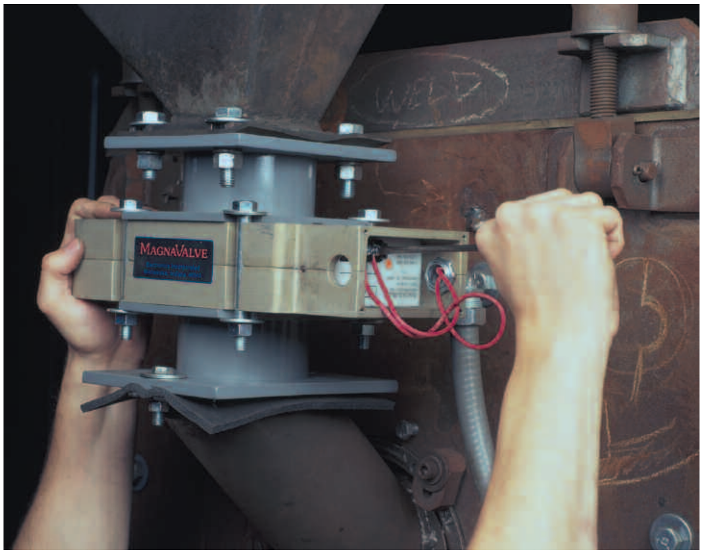

Figure 12. Attaching two wires from Model AC MagnaValve Controller

Figure 12 - only two wires are needed for connection to the MagnaValve. The wire gage should meet local wiring code. Typically, 16AWG machine tool wire is used. These wires should be routed in either flexible or rigid conduit. In some installations where the conduit for the solenoid for the air cylinder is nearby, it is possible to re-use the conduit for the MagnaValve wires. **Caution: Be sure to**

disconnect the opposite end of the solenoid wiring since the wires will have to be re-routed to the screw terminals of the AC controller. Failure to do this will apply 120Vac to the MagnaValve causing instant failure (and a brilliant fireworks display).

Figure 13. Installation of electrical control panel with AC controller mounted on side

Figure 13 - a new electrical panel was used in this installation and it was mounted to a sturdy plate prior to performing the wiring. Some installations will have adequate room in the existing electrical panel; however, you should be sure that the electrical panel is suitable (dust tight, proper location for operator viewing, and properly ventilated to prevent excess temperature above 140 degrees F.)

Figure 14. Panel ammeter original wiring

Figure 14 - this is a rear view of the panel ammeter showing the connections to the meter lugs coming from the current transformer secondary. Remove one of the meter wires to allow installation of a wiring loop to the current shunt mounted on the rear of the AC Controller.

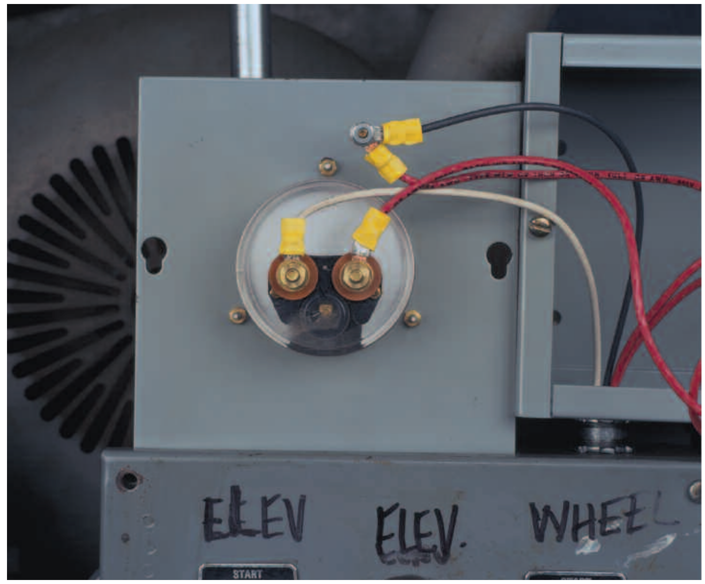

Figure 15. Splice for AC controller shunt

Figure 15 - attach the loose current transformer wire to one of the AC controller shunt wires and attach the other AC controller shunt wire to the meter lug. This procedure allows the AC controller shunt to be in series with the existing panel meter so that both of them receive the (transformed) motor current (0-5 Amps). If the panel meter is to be eliminated, then connect the two current transformer output wires directly to the AC controller shunt.

Figure 16. Original factory 100 amp setting

Figure 16 - apply control power circuit. **Caution: Be sure all wiring has been properly completed and that no shock hazard exists.** The AC controller is factory set to display 100.0 Amps for full

scale when connected to a 100:5 ratio current transformer. You can check the setting of the display range by turning the set point knob fully clockwise and holding the display toggle switch to the right.

Figure 17. Set to 30.0 full scale

Figure 17 - since this application uses a 30:5 ratio current transformer, the AC controller must be adjusted to read 30.0 full scale. With the setpoint knob fully clockwise, push and hold the display toggle switch to the right. This display will presently show 100.0. Continue holding the display toggle switch to the right. Slowly adjust the "coarse display" trimpot until you see 30.0 in the digital display. For finer adjustment you can also use the "fine display" trimpot. Release the display toggle switch.

Figure 18 - start the wheel motor and place a clamp-on type ammeter on the motor leads to confirm calibration of both the panel ammeter and the AC controller display. Note: the AC controller has been factory set for zero and span. Do not readjust these trimpots. Since there is no shot flow rate yet the ammeter readings will show the no load or no flow rate values. Also, note that the clamp-on ammeter and the AC Controller digital display shows the no-load motor amperage to be about 8.8 amps, while the panel meter shows over 9 amps.

The last step of the installation is to adjust the AC controller to the same operating amperage noted before at the beginning of the installation, 24 amps. Push and hold the display toggle switch to the right and turn the setpoint knob until the value 24.0 appears in the display. Release the display toggle switch and notice that the display returns to show the no load amperage. Activate the MagnaValve, either by pushing the AC mode switch located near the setpoint knob to the "on" position, or put the mode switch in the ready position and activate the blast machine automatic cycle. The enable green LED on the front of the AC controller will come on and the valve red

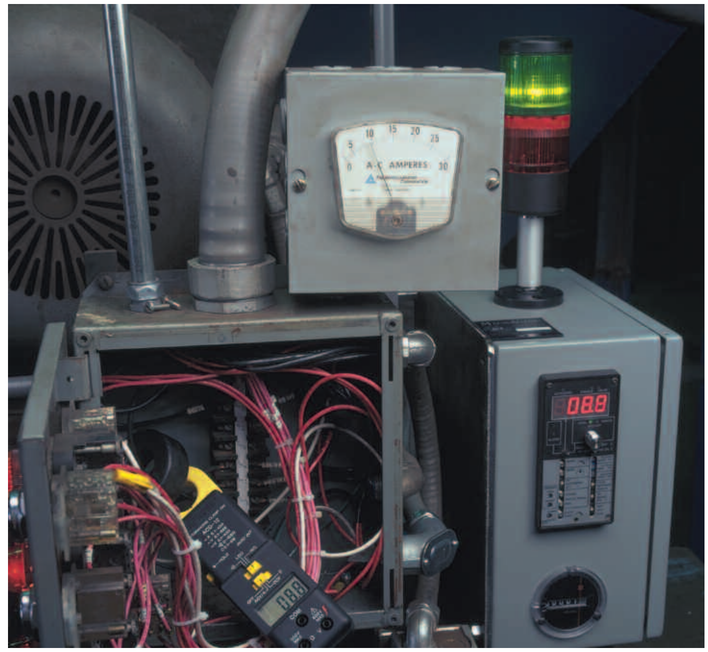

Figure 18. Clamp-on ammeter for calibration

LED will start to blink, indicating that the valve is receiving power pulses to allow shot to flow. After a few seconds the motor current will rise to the setpoint value, in this case 24.0 amps. It is normal for the digital display to vary by ±0.2 amps. If the variation is greater than this refer to the installation manual for the AC controller.

Figure 19. Final setting at 20 amps

Figure 19 - after several pipes have been cleaned at the standard conveyor speed, the setpoint knob should be adjusted to try different flow rates and see the effect on cleaning rates. It was determined that on this machine the flow rate could be turned down to 14 amps at the original conveyor speed and still obtain

proper cleaning. Then the conveyor was turned up to maximum speed and the flow rate increased to pull 20 amps. The result was a doubling of production rate and approximately 25% less shot was consumed (broken). Additionally, longer life can be expected for the wheel components and the blast cabinet and conveyor. These cost savings in consumables and less maintenance due to air cylinder repair will help pay for the MagnaValve installation in a very short time.

The installation also included an alarm horn and a highly visible pedestal mounted light stalk with green indicator to indicate shot flow and a red blinking indicator to indicate an alarm condition (such as no shot-flow). The elapsed abrasive-on time meter was included to verify the increased productivity and reduced downtime.

Figure 20. Almen strip attached to pipe

Figure 20 - once the final conveyor speed and shot flow rate (motor amps) has been determined, you can use the standard Almen strip (SAE specification J442) to check for proper operation. The Almen strip, shown here mounted with four hold-down screws onto a standard Almen holder that has been welded into place on the pipe, is the industry standard test for the shot peening and blast cleaning intensity. The Almen test strip is blasted on one side only and then removed from the holder. When released from the hold-down screws, the strip will curve since it is stretched on its top side.

The amount of this curvature, called arc height, is an indication of the blast stream intensity. The arc height is measured on an Almen gage and can be placed onto a standard SPC process control chart. There are three strip thicknesses to choose from for low intensity (N), medium intensity (A), and high intensity (C). Most abrasive blast cleaning is performed at high intensity with the "C" strip.

The advantage of using the Almen strip method lies in its ability to detect the many changes that can occur in a blast machine cleaning operation. Many quality departments are demanding some type of real time process control to meet the customer's requirements for documentation. Instead of relying upon the operator's judgment of cleanliness, the Almen strip method can provide a scientific basis for qualifying the machine. The following changes that can be detected by the Almen method:

a. wrong shot size added to machine (check the bag or drum for correct size)

b. wrong shot size, dust collector not removing all small or broken shot

c. wrong shot hardness (check the bag or drum for correct hardness)

d. incomplete coverage, due to exposure time, shot flow rate adjustment, or improper targeting

e. improper targeting caused by worn wheel blades or control cage out of adjustment

Almen strips are an inexpensive way to demonstrate that the blast cleaning machine is running properly. If your Almen strip readings are not consistent, then you know that something is wrong and additional investigation is needed. Almen strips provide clear evidence of proper (or improper) machine operation and can contribute to an ISO 9000 or Q 9000 quality program as a standard operating procedure.

For additional information on the Almen method, see SAE J443 Use of Standard Almen Strip for Shot Peening Intensity Control (available from SAE) or contact Electronics Incorporated:

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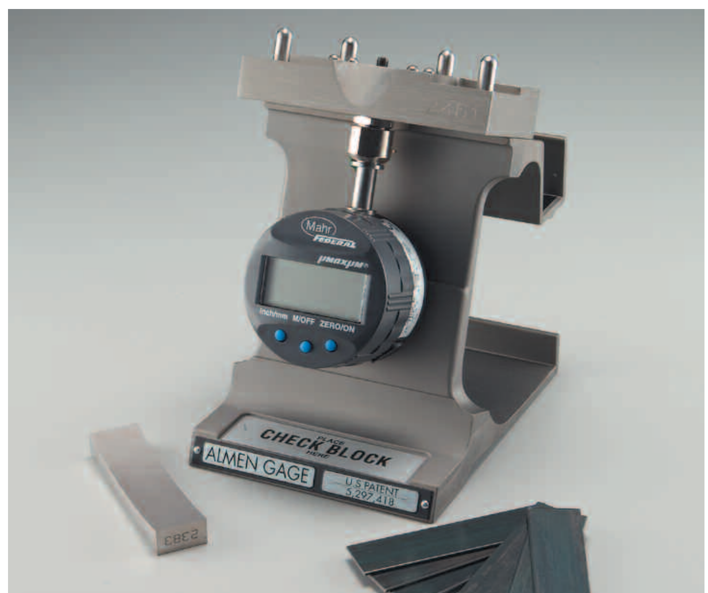

Electronics Inc. Almen strips and gage

NOTE: A 110 Vac Low Profile MagnaValve was used in the Pangborn machine at EMI. Electronics Inc. (EI) also manufactures 24 Vdc MagnaValves and controllers. The MagnaValve's ability to work with 24 Vdc power meets the worldwide progression toward lower voltage for safety. It also enables EI to reduce the size and weight of their products, allowing the controls to fit into smaller electrical cabinets. Contact EI at 574-256-5001 or 1-800-832-5653 to discuss the best MagnaValve for your application.

Electronics Inc.
Blast Cleaning Control

MagnaValve™

Energy Savings Formula for Blast Cleaning

- **The MagnaValve's efficient use of media reduces media costs and disposal fees.**
- **The MagnaValve requires less maintenance so that valuable production time is spent making products, not fixing equipment. Maintenance crews and production managers appreciate its dependability and ease of use.**
- **The MagnaValve can reduce the load on a large horsepower motor and thereby reduce energy consumption. See the formula below.**

Because energy waste can be found in most businesses, there are tremendous opportunities for reducing energy consumption and thereby reducing costs. The over-consumption of energy is often hidden. Sometimes it's part of a practice that has been used for years and never exposed to newer processes. This article will address blast cleaning—a process that can be updated by using shot flow valves. The result is a considerable savings in energy and money.

Over the last 50 years, more than 20,000 abrasive blast cleaning machines were produced by companies such as Wheelabrator-Frye, Pangborn and others. They are found in the steel industry, automotive, construction and many others. The amazing fact is not that so many were built, but that they are still being used today. The vogue for years was to build machines with large wheel motors, (75, 100 and 125 HP), and with multiple wheels (6, 8 and 10). The shot flow method used was semi-fixed mechanical. A slide gate with an air actuated dipper valve turned on and off the shot and also controlled the flow rate (pounds per minute). More often than not, the slide gate was set once and forgotten because re-adjusting it was difficult and time consuming. The result was that all product, regardless of size and composition, received the same cleaning treatment.

With the advent of the MagnaValve™, a custom shot flow program can be created for each product or product type. Most modern abrasive blast cleaning machines are designed with 40 to 60 HP wheel motors with variable speed wheels and MagnaValves. It's very easy to retrofit a MagnaValve to an older machine and reduce the load on large motors through shot flow control.

So now we have an opportunity: How much can be saved by reducing the load on an 100 HP motor? Follow the formula below to see how much energy (and money) can be saved by reducing the load from 100 HP to 60 HP.

This article and energy savings formula, by Dave Eggleston, was originally published in the Spring 2004 Shot Peener magazine.

Energy savings formula

Reducing the load on 100 HP motors to 60 HP

1. Express HP in KW - 100 HP is 80 KW, 60 HP is 48 KW
2. Determine how many hours per year the motor will run. We'll use: 150 hours per month x 12 months = 1800 hours per year.
3. Plug in the cost of electricity in your area. In the United States, the cost of electricity can run from $.04 to $.10/WKH. We'll use $.06 for our examples.

Energy costs of a 100 HP motor	Energy costs of a 60 HP motor
80 KWH x 1800 hours/year x $.06 KWH = $8,640.00/year	48 KWH x 1800 hours/year x $.06 KWH = $5,184.00/year

That is a costs savings of $3,456.00 a year.

On an 8-wheel machine, a savings of $27,648.00 can be achieved in one year.

The easiest way to achieve shot flow control, and thereby reduce energy consumption on a large HP motor, is with a valve and controller like the MagnaValve.

A MagnaValve with controller will cost about $4,000.00/wheel or $32,000 for our example.

Payback comes in only 14 months!

Electronics Inc.
Blast Cleaning Control

MagnaValve™

Blast Cleaning Case Study

MagnaValve reduces maintenance for Australian automotive foundry

The foundry used grit valves and the valves caused many problems including breakdowns and the resulting labour hours spent on maintenance. Since the installation of the MagnaValves, the foundry has not had a single valve breakdown.

—Nathan Dalton
Blastmaster

The maintenance staff at an automotive foundry in Fishermans Bend, Victoria, Australia was frustrated by the numerous breakdowns of the grit valves on their monorail eight wheel shot blast machine. The problems were linked to the mechanical shot control/shut off valves seizing due to metal dust ingress into the moving parts, and shot leakage during shut down. The valve seizures resulted in the blast machines going out of service, often two or three times per week. Each breakdown required a high volume of labor to get the valve operational, plus the lost production time while the machine stood idle. Leaking valves can fill a wheel assembly with shot, making motor restart impossible until the wheel housing is cleaned out either by strip-down or contractor services. The busy foundry needed to run several shifts a day so this became an expensive problem.

The foundry's maintenance team contacted Blastmaster, a MagnaValve distributor in Adelaide, Australia, for a solution. After a successful in-house trial period with the MagnaValve, the team ordered eight of the magnetic valves. Blastmaster designed the first retrofit kit for the valves and the foundry built the remaining retrofit kits. "The customer found the installation easy, straight-forward and it didn't take a lot of time," said Nathan Dalton with Blastmaster.

Seven months after the MagnaValve installation, Blastmaster reported the following outcomes at the foundry:

- Not one breakdown or stoppage
- Highly controllable shot flow rates to each wheel
- Consistent wheel motor loadings ensuring shot intensity is the same day after day
- Precision electronic flow rate adjustment when required
- No flooding of the wheel housing due to shot leakage
- No wear by shot flow is evident
- Electrical interference from the heavy foundry environment has not affected the controller or valve functions in any way

About the MagnaValve

MagnaValves use a strong permanent magnet and electro-magnet design to regulate the flow of steel shot in blast cleaning or shot peening machines. When no power is applied to the MagnaValve, the permanent magnet stops all flow. With power applied, the magnetic field is neutralized and shot is allowed to flow through the valve.

Benefits of the MagnaValve

- Maintenance-free—no moving parts
- Cost savings from the efficient use of media and lower media disposal fees
- Optimizes the load of large horsepower motors thereby reducing energy consumption
- Control options available to suit many different applications
- No risk of machine malfunction due to running out of shot during procedure
- Confidence that product was blast cleaned properly
- Compliance to specifications is readily attainable
- Requires less operator time
- Available in 24 Vdc and 110 Vac models
- Works with most steel media sizes
- Environmentally-responsible—conserves energy and media (less media in landfills)
- Over 26 years of proven performance in the field
- Trusted by OEMs and end-users worldwide
- Available for wheel and air blast machines

The 24 Vdc controller and MagnaValve for wheel machines. A 110 Vac MagnaValve and controller are also available.

Electronics Inc.
Blast Cleaning Control

The MagnaValve is manufactured by Electronics Inc. For more information on our complete line of MagnaValves, contact us by phone, mail or email:

1-800-832-5653 or 1-574-256-5001
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