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Installation of Model VLP MagnaValve on Abrasive Blast Cleaning Machine

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This article will explain how to replace the mechanical media (grit) valve on a wheel type blast cleaning machine with the new MagnaValve automatic media regulator. The two most prominent reasons for this type of upgrade are:

a) to eliminate maintenance required for the air cylinder that operates the mechanical valve and

b) to provide an automatic alarm to alert the operator to replenish the shot/grit supply.

The MagnaValve has no moving parts; 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 modified to blast clean 20 foot lengths of round pipe. It is a single wheel, 20 horsepower, pass-thru cabinet design as shown in Figure 1.

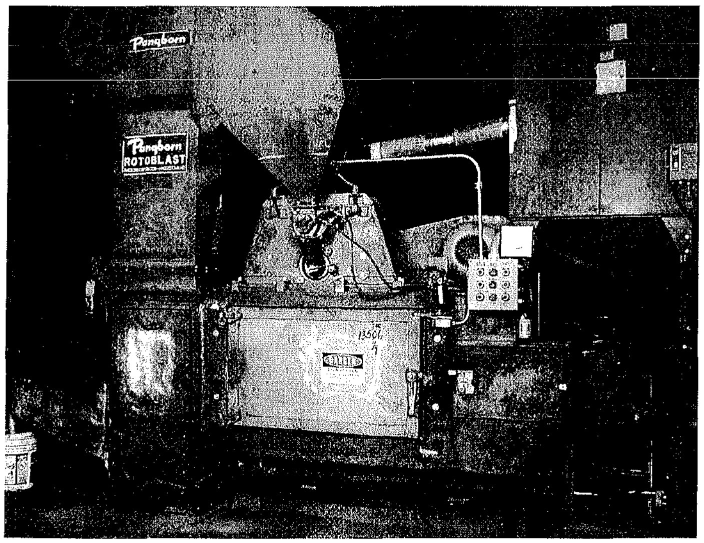


Figure 1. Pangborn RotoPeen machine ready for MagnaValve

The following text will describe each of the remaining photos in three sections, before, during and after the installation of the MagnaValve. 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

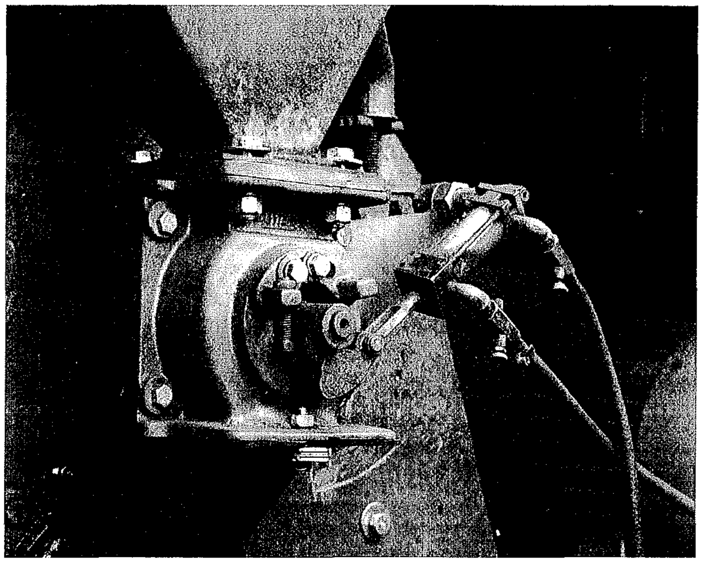


Figure 2. Photo of mechanical valve with air cylinder

from its closed to 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.

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 flow condition. It is not uncommon for these meters to be

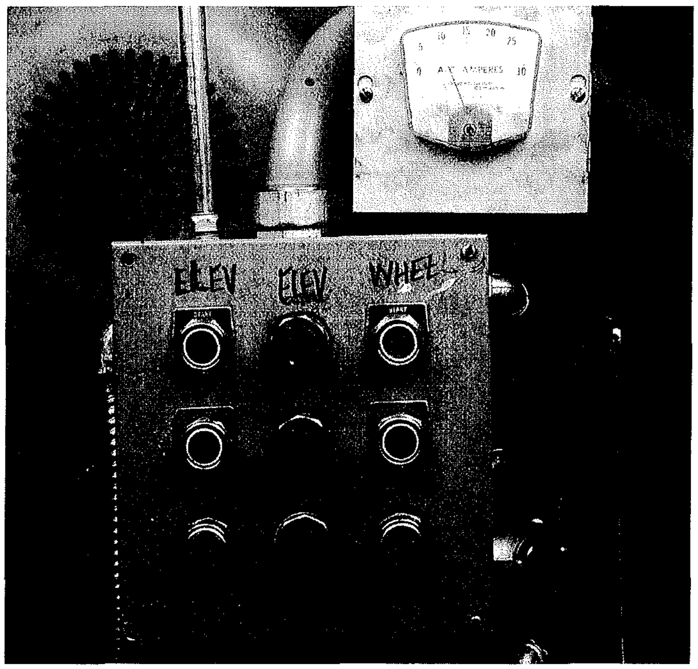


Figure 3. Original control panel and ammeter 0-30 amp range

inaccurate due to the metallic dust that collects inside the meter movement thereby preventing proper amperage display.

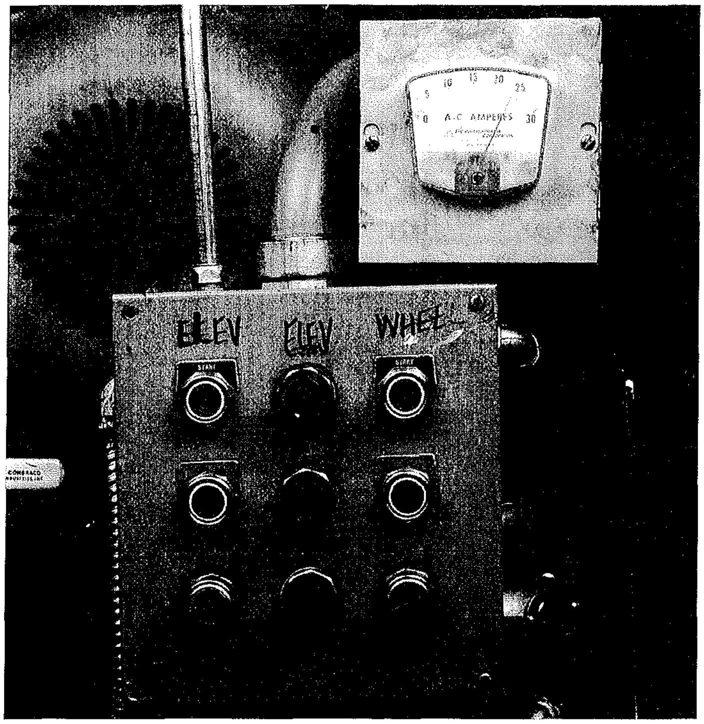


Figure 4. Ammeter showing operating amps

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.

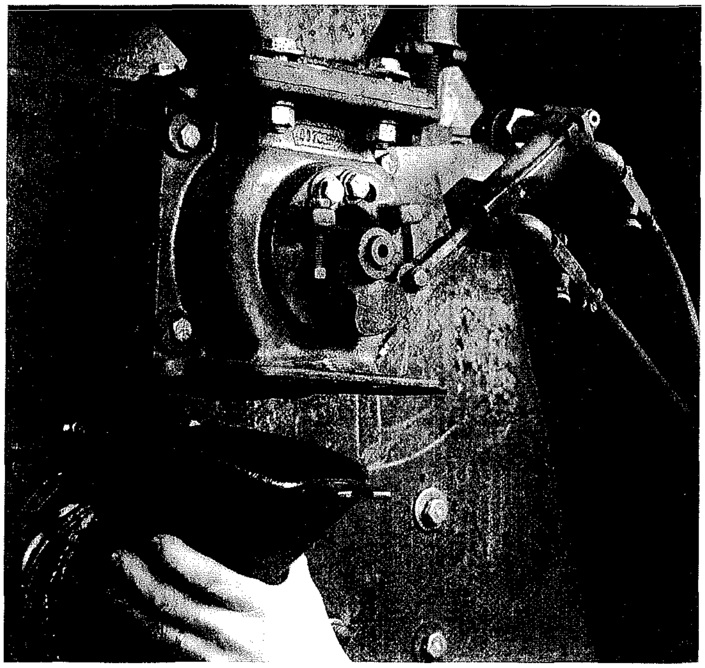


Figure 5. Removing feedspout to wheel

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.

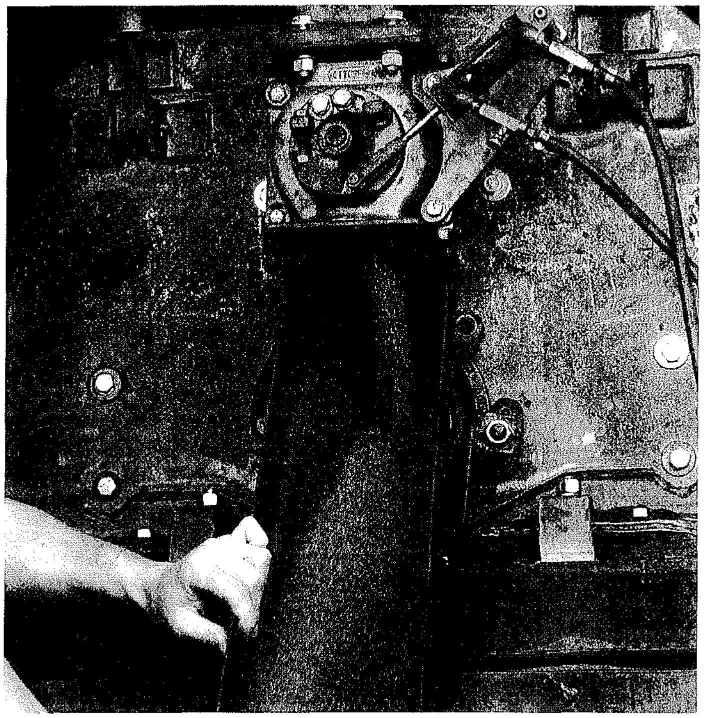


Figure 6. Drain the shot from the hopper

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.

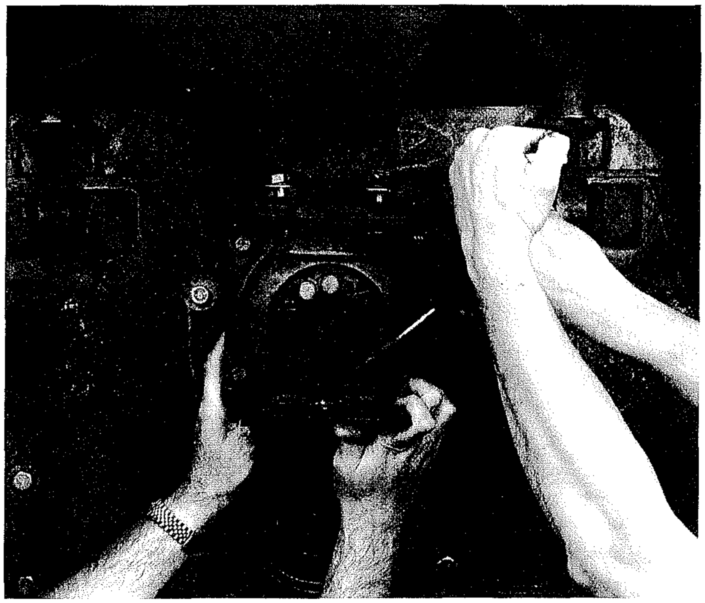


Figure 7. Loosen bolts on top of valve

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.

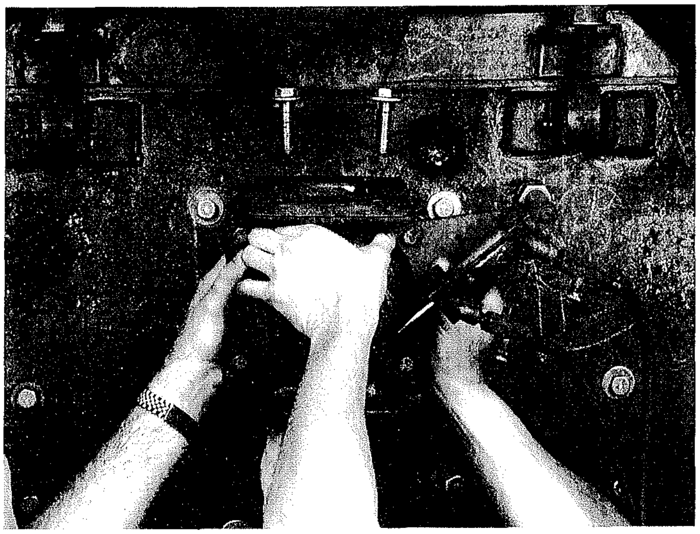


Figure 8. Remove the old valve

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 may spill out upon removal.

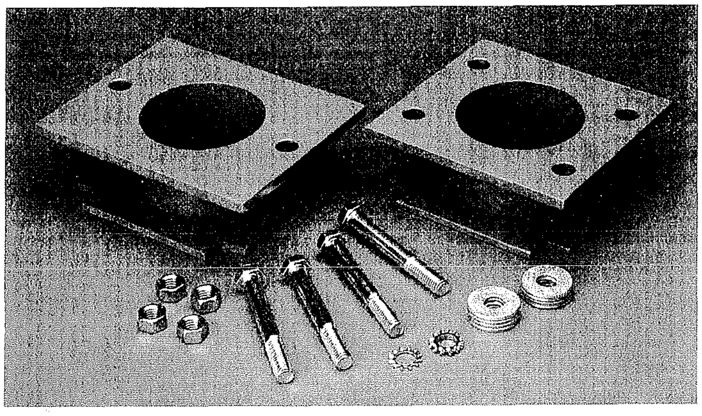


Figure 9. Adapters and bolts

Figure 9 - special adapter plates can be fabricated that will compensate for the bolt hole locations and vertical spacing needed by the MagnaValve.

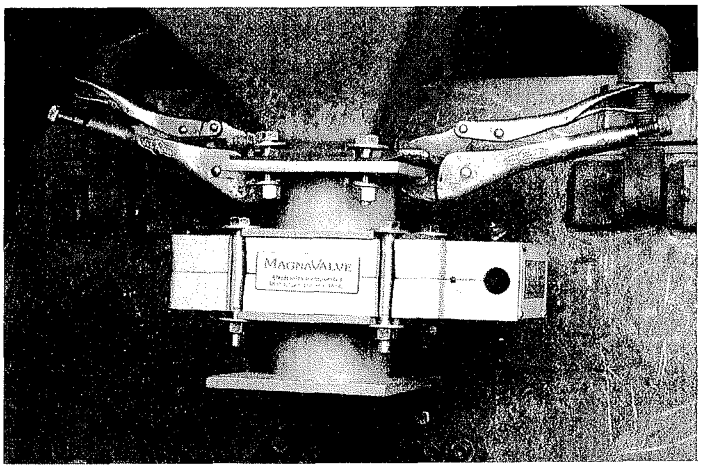


Figure 10. Temporarily hold MagnaValve in position with vise-grips and then install bolts

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-grip or similar pliers and then the bolts can be installed and tightened.

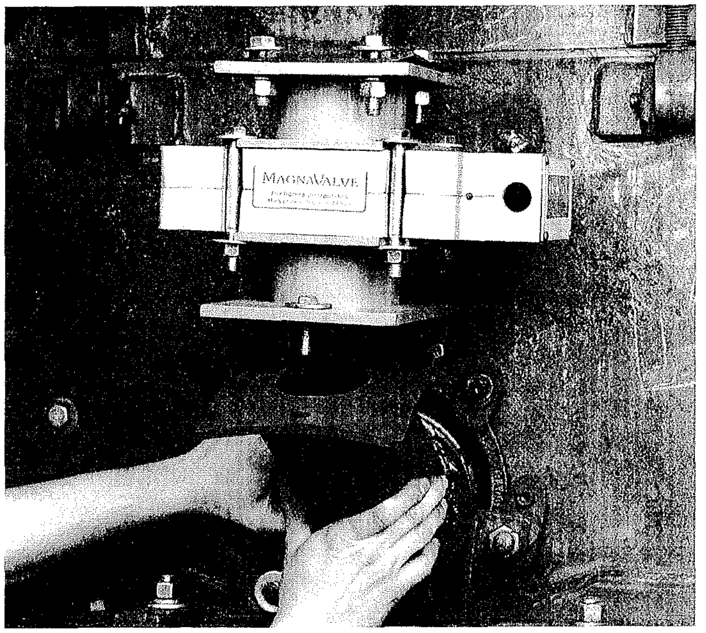


Figure 11. Re-install feedspout to wheel

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.

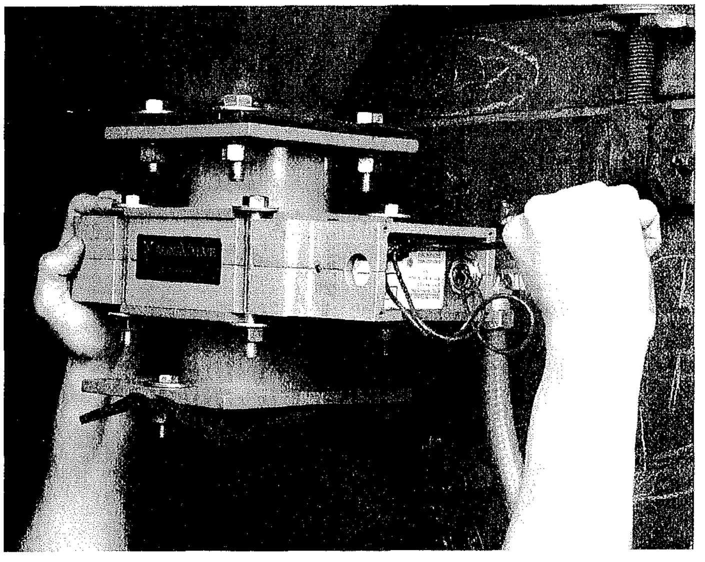


Figure 12. Attaching 2-wires from Model AC MagnaValve Controller

Figure 12 - only two wires are needed for connection to the MagnaValve. The wire gage should meet local wiring code, usually 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.

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).

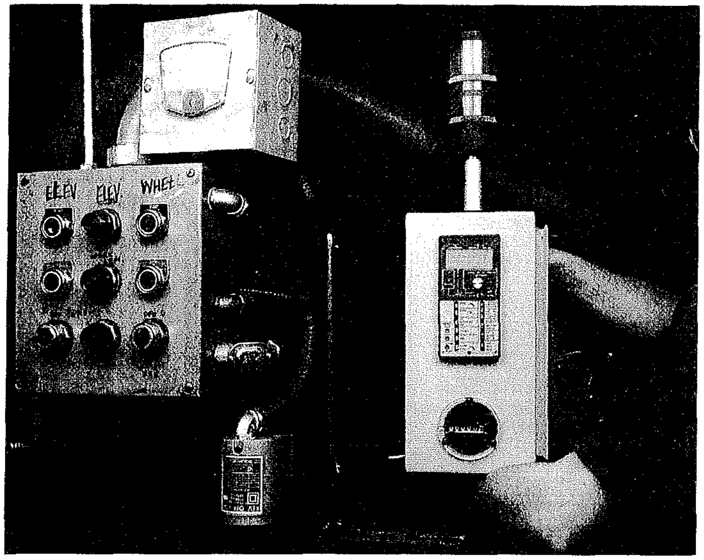


Figure 13. Installation of electrical control panel with AC controller mounted on side

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.)

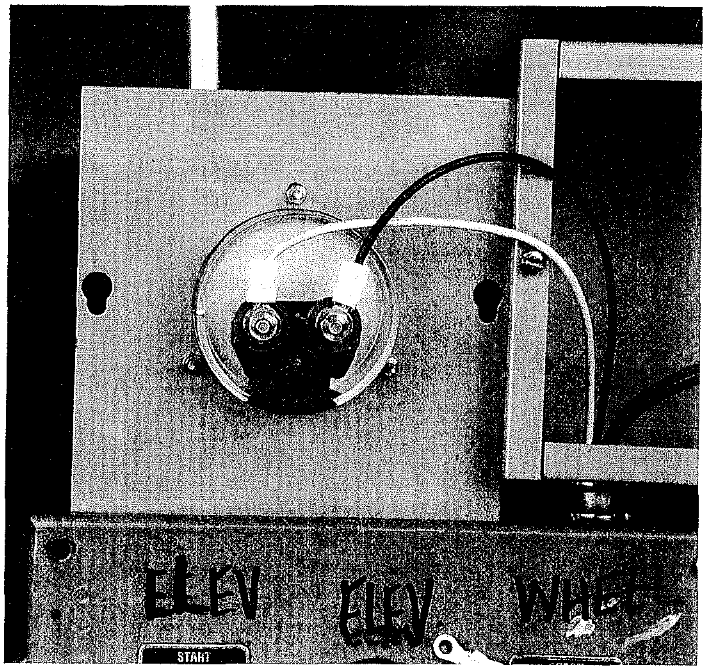


Figure 14. Panel ammeter original wiring

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.

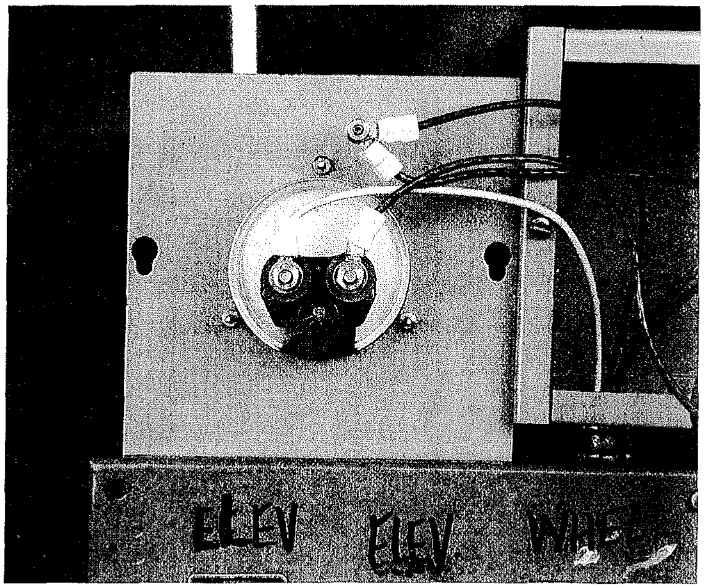


Figure 15. Splice for AC controller shunt

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.

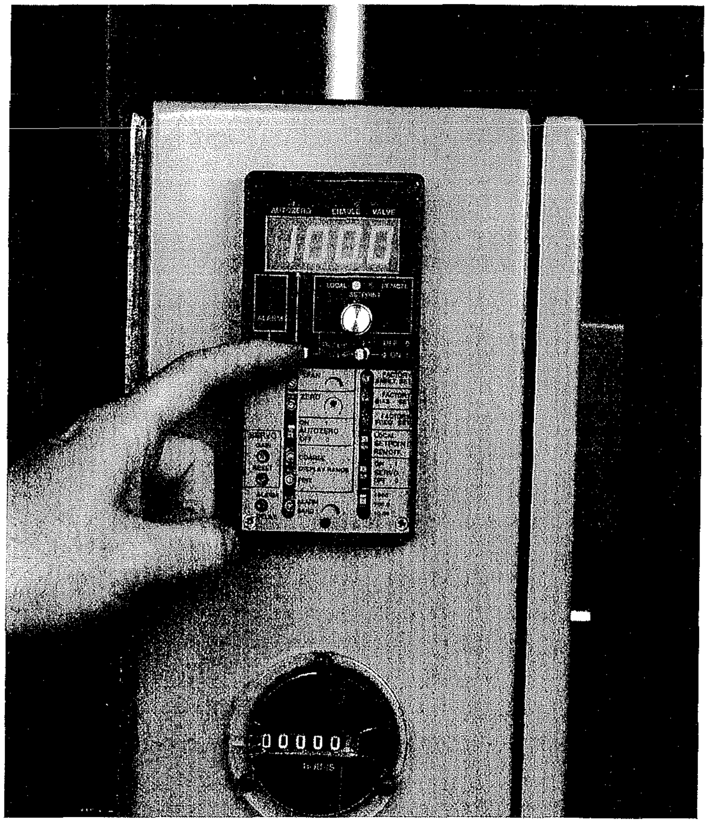


Figure 16. Original factory 100 amp setting

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.

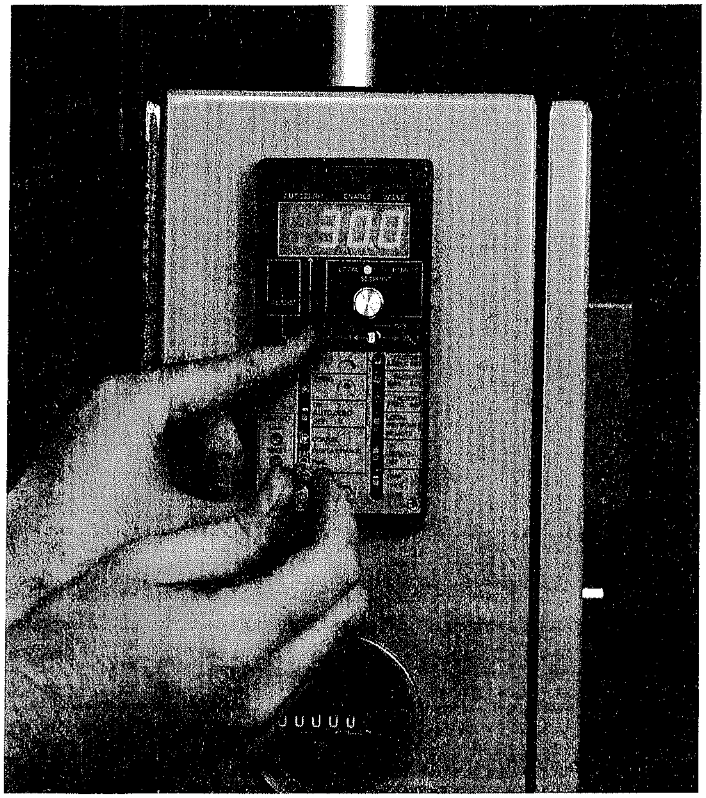


Figure 17. Set to 30.0 full scale

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 using 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 LED will start

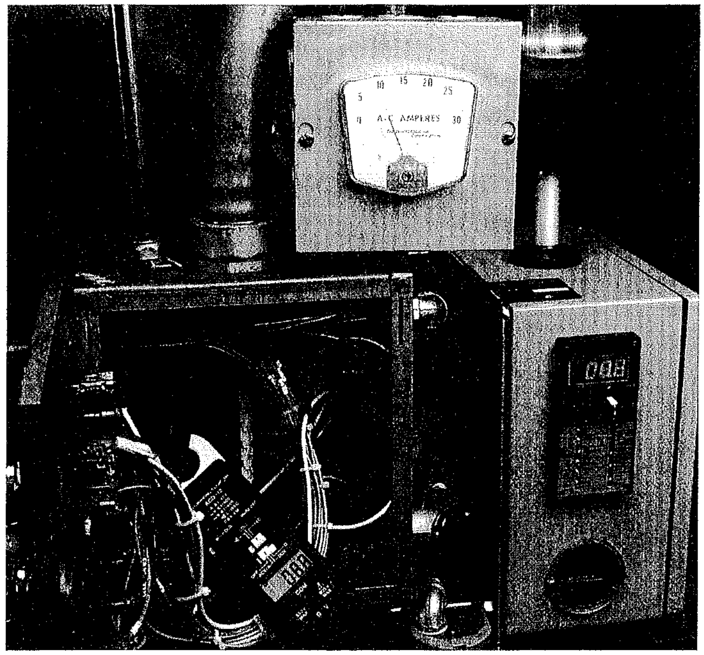


Figure 18. Clamp-on ammeter for calibration

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.

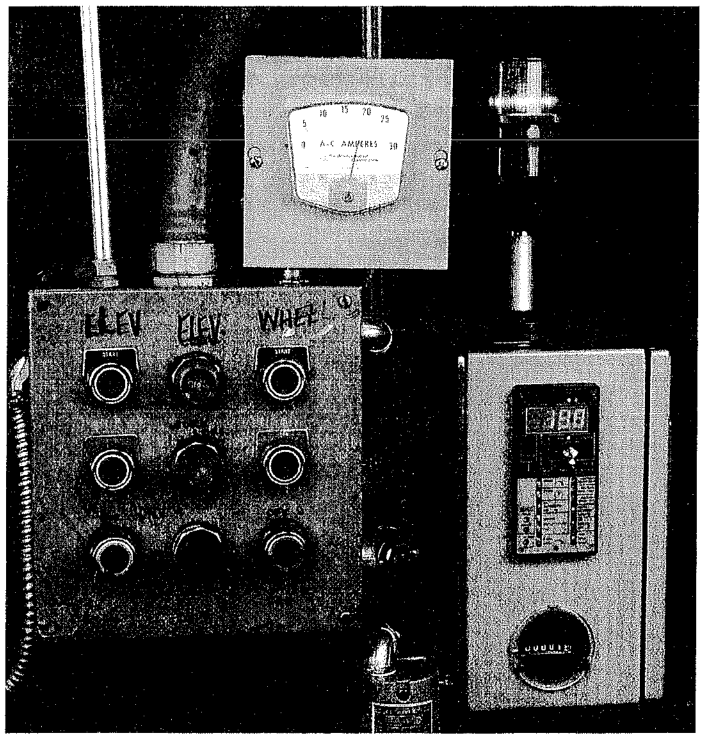


Figure 19. Final setting at 20 amps

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 of the shot is being 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.

This 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.

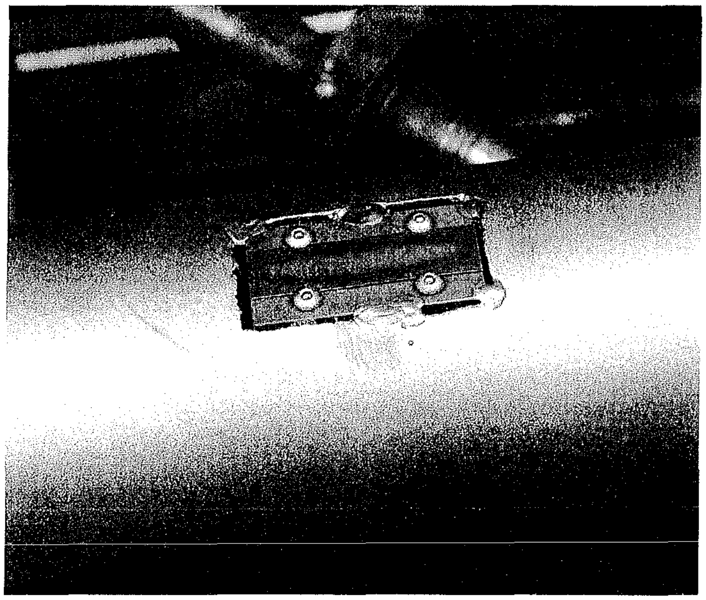


Figure 20. Almen strip attached to pipe

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 J-442) 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. Once 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 and the value, as measured on a standard Almen gage, 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 customer requirements for documentation. Instead of relying upon the operator's judgement of "cleanliness" the Almen strip method can provide a scientific basis for qualifying the machine.

It's as easy as taking your temperature each morning. 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

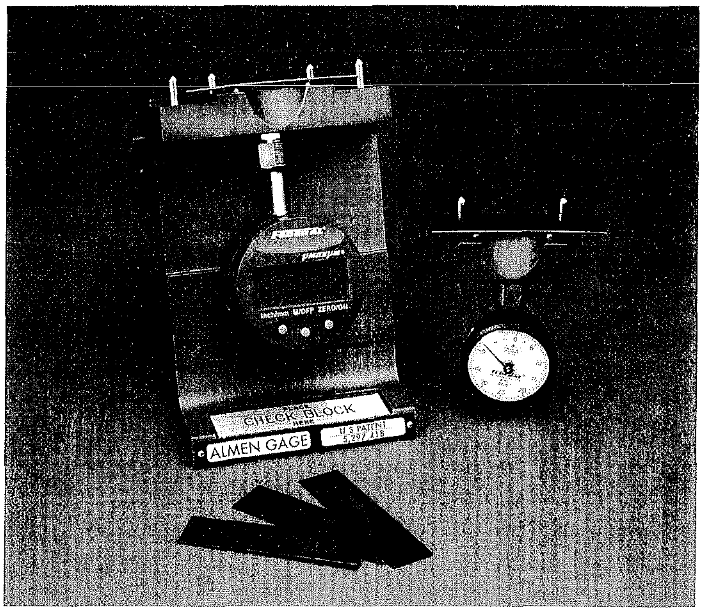
c. wrong shot hardness (check the bag or drum for correct hardness)

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

d. 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. It is similar to taking your body temperature each morning and charting the results. If your temperature is abnormal, you may not know exactly what is wrong, but you certainly know that something is wrong and additional investigation is needed. If your Almen strip readings are not the same each morning, 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 J-443 Use of standard Almen Strip for Shot Peening Intensity Control available from SAE or from Electronics Incorporated for $31.50. ❍



Standard digital-style Almen gage, Almen strips, and the Almen gage Jr., a smaller portable gage.