# MAINTENANCE AND TROUBLE DIAGNOSIS FOR PNEUMATIC KILN INSTRUMENTATION

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## DRY KILN PNEUMATIC RECORDER-CONTROLLERS

Maintenance Of:

A. Air System

1. The supply air for kiln instrumentation should be supplied by a separate compressor. This will allow the kiln operator better control of the air quality. The compressor should be capable of maintaining 25# psi and 6 C.M.F. A good air filtration system, like the A-13 See-Thru, is necessary to ensure clean air. Twenty-five percent (25%) of all instrument failures are due to contaminated air supply.

B. Capillary Systems

1. Dry systems require little maintenance other than insuring that they will not catch on a charge being moved in or out of the kiln.

2. Wet systems require more attention than dry systems, because of the environment of their bulb. The wet bulb wick MUST be changed at the beginning of every charge, or every two weeks on long drying schedules. The acids that accumulate between the wet bulb and the wick will corrode through the bulb in a relatively short time if they are not removed. Rotating the wet bulb 1/4 of a turn annually will extend the life of the bulb dramatically. Wet bulb wicks currently cost $.90 each and a new fifty foot wet system costs approximately $400.00. The cost of a new system plus the lost drying time makes changing wicks a critical preventative maintenance step.

C. Diaphragms

1. Diaphragm values require only a visual inspection to see that diaphragm rubbers are not leaking, valve stems are not bent and packing glands are not leaking.

2. Motor lever assemblies should be checked for leaking diaphragms and for proper alignment with ventilator rods.

Trouble Diagnosis Of:

A. Air System

1. If there is no air signal on the supply gauge, check the air compressor and related equipment.

2. If there is no air signal on heat or spray gauge when kiln temperature is below the set point, remove the air line from the instrument air filter and place a 1/8" pipe plug in the air filter. If the gauge then shows a signal the problem is not in the instrument, but in the air line or diaphragm in the diaphragm valve. If, after plugging the air filter, the air gauge does not show a signal, the problem is internal. Leave the plug in the air filter, remove the instrument chart, chart plate, and lower cover plate. Trace the air line from the gauge you are having a problem with to determine which air valve is related to it. Remove the air valve from the valve block with a 1/2" wrench. Seal the top and bottom ports of the valve block with your fingers. If you now get an air signal, clean the air valve in solvent and replace it in the valve block. If you do not get an air signal equal to what you had with your fingers on the valve block ports, install a new air valve. (All air valves should be torqued to 20#). If you did not get an air signal when you sealed the ports of the valve block, you are not getting air to the valve block which means you have restriction in the orifice of the supply line that brings the air from the supply gauge to valve block. Remove the 3" long screw that fastens the supply air button to the manifold directly above the supply gauge. Pull the air button away from the manifold far enough that you can insert the end of a piece of .016 piano wire to clean the orifice. This wire only has to be inserted 1/8" or less to clean the orifice. Replace the 3" screw, making sure the gaskets are in place, and take care not over tighten the screw. Once again place your fingers over the ports of the valve block to insure that you cleared the restriction. If your air problem involves the vent gauge the preceding procedures still apply but they must also include the possibility of a problem in the reverse relay. The vent gauge should not show an air signal until the wet bulb set point is reached and the ventilators are open. If the vents will not close and you can get a good air signal by sealing the ports of the valve block related to vent gauge, replace the reversing relay. If at any time you seal the ports of a valve block, with the related air filter plugged, and you can definitely feel air pressure but the air gauge does not show it, replace the air gauge.

Vent/spray differential may have to be adjusted as the air valves and reversing relay wear. When the kiln starts to vent and spray at the same time, the differen-

tial must be reset. Turn the screw on the green spiral lift plate clock-wise to increase the differential or counter clock-wise to decrease it.

3. There are two Air Valve options for the Moore Instruments, the #3 and the #10. The #3 Air Valve has an internal seat angle of 30 degrees. The #10 Air Valve has an internal seat angle of 10 degrees. The #3 Air Valve has a faster "On-Off" action and is normally used to control venting and steam spraying in the kiln. The #10 Air Valve has a much slower "On-Off" action and is generally used only on the heat systems. The #10 Air Valve, because of its slower action, smooths out steam flow placing less demand on the boiler. This closer heat control will be indicated by a flatter line on the instrument chart.

4. Reverse Relays are used to invert the air signal of the vent gauge from a "Normally On" to a "Normally Off" signal. When a relay fails the vents will not close. Relays are calibrated to specific air signal requirements and any field adjustments will change the speed of the venting and alter the vent/spray differential. When replacing a relay, always use a 3/8" wrench on the air line and a 1/ wrench on the relay to avoid twisting the air line or breaking the bellows screw.

B. Capillary Systems

1. Dry bulb systems are not subjected to nearly as severe of an environment as wet bulb systems. If a dry system pen will not come up to set point temperature, it probably has been damaged during loading or unloading of the kiln. If the dry pen does not recover full temperature after a fan reversal it is a sign of an air flow problem inside the kiln, bent baffles or a poorly stacked load. If the dry pen continues to climb past the set point and the related heat gauge shows no air signal, you have a diaphragm valve that is either out of adjustment and not closing fully or the disc and seat assembly is leaking steam into the coils. Disc and seat leaks can be detected with a mechanics stethoscope.

2. Wet system failures are the most common instrument problem. If the wet system pen will not reach the set point, remove the wick from the bulb. In a short time the wet pen should climb to the same temperature as the dry pen. If the wet pen does not climb, the system is losing its charge and must be replaced. If the wet pen temperature, without the wick, matches the dry pen but still will not reach the desired set point with the wick in place, there is too much water flowing to the water box or the vents are not closing. If the wet pen is indicating a higher temperature than the set point, there is not enough water flow to the water box to keep the wick damp.

C. Diaphragm Valves

1. Diaphragm valves must be adjusted after they are installed. The valves should start to open with 3-4# air signal and a standard valve will be full open at 5-6#. A modulating valve should start to open at 3# and be full open at 15#. If the heat gauge on the instrument is calling for heat, but the pen is not coming up to the desired set-point, check the diaphragm rubber for leaks. If no leak is found in the diaphragm, check the air line from the instrument to the diaphragm for leaks.

D. Motor Levers and Vents

1. If the vents will not open and you have a good air signal from the vent gauge, check the motor lever diaphragm and the air line leading to it for leaks.

2. If vents appear to hang-up while operating, check the alignment of the control rods and of the vent lid to its frame.

Option Features:

A. Modulation

1. The objective of a modulation control system is to keep the kiln temperature constant. This is accomplished by injecting heat into the kiln at exactly the same rate it is being dissipated. The two variables of this system are the modulation adjustment in the instrument and the diaphragm valve spring tension. *Modulating diaphragm valves should start to open at 3# psi and be fully open at 15# psi. The proper modulation setting and valve spring tension balance will take some experimentation to achieve. Once the balance has been found, the instrument heat gauge should show a constant 3# psi to 5# psi air signal.

* Placing an air gauge in the air line on top of the diaphragm valve will help make this adjustment.

B. CAM

1. Cam control is a valuable asset if the kiln is running a repetitious schedule. Cam systems are mechanical and generally present no problems, however, care must be used during installing and removing cams, as not to disturb other adjacent instrument components. Cams should not be cut with too fast of a temperature increase. It is possible to put the cam arms at a mechanical disadvantage and damage the arms or chart drive with too fast of a rise.

C. Ink Systems

1. There are currently two types of ink systems available. The Posi-Flow system has the ink supply mounted inside the instrument. The ink travels through a vinyl tube to the pen point by capillary action. If the instrument is subjected to low temperatures the vinyl tubing may become stiff and affect the pen reading.

The second ink system is similar to the old style "V" pen, but with a fiber tip. This system draws a line identical to the Posi-Flow pens. Ink is loaded as in the "V" pens, but the tip meters the flow. One filling of the pen will last about twelve weeks on a weekly chart.

While all pneumatic kiln instrumentation functions basically the same, the mechanics of their individual systems vary. What has been listed here is a general guide to some of the more common problems. With a little time and a careful analysis, most instrument problems can be solved in the field by the kiln operator. Do not hesitate to call the manufacturer of your instruments for assistance in solving problems.