Reducing Sand Fines Through Classification

Longer dwell time, increased fluidizing air volume, and higher negative pressures will increase the volume of fines removed from the atmosphere.

MANY FOUNDRY MANAGERS and operators wonder about the possibility and/or effectiveness of using a fluid bed classifier to remove airborne sand fines. It's possible, but removing sand fines through the classifier depends on several process details.

1. DWELL TIME. The sand in a fluid-bed system resembles any liquid in a vessel. The faster that fluid is poured into the vessel, the faster the fluid will overflow: The dwell time in a fluid-bed classifier is determined by the rate that sand flows into the classifier. The inlet sand opening—butterfly or slide-gate—regulates sand flow into the classifier.

It is necessary to set the butterfly or slide-gate to regulate the sand flow, and the best way to set this is to prevent the blower from starting. Then, gain access to the sand inlet and make sure that all sand processing devices between the sand control valve are empty—screener and magnetic separators.

Set the unit to manual mode and turn on the magnetic separator and screener (if present.) **A**fter all of the sand is out of the screener, separator, and pipe, place one end of a chute under the sand inlet pipe and the other in a tared container that will hold 60 seconds of sand flow.

Open the sand control device for 60 seconds as the sand flows into the containers; wait until sand ceases to flow. **F**or example, you should have a flow rate of 333 lbs./min. for 10 tons per hour (333 lbs./min. × 60 min. = 19,980 lbs./min.) If the desired flow rate is not correct, it is necessary to adjust the sand control device, and retest.

Once the inlet valve is set to the designated sand-flow rate, the sand is in the classifier for the designated amount of dwell time. The average dwell time will be the amount the classifier holds, e.g., 20,000 lbs./hr. **D**well time for a 7,160-lb classifier will be 7,160/20,000 lbs./hr. = 0.358 lbs./hr. or 21.5 minutes (it will not be less.)

If the classifier also heats or cools, and the sand temperature is beyond the heating or cooling range of the classified at the set flow rate, the sand control device is programmed to close, giving the sand more time to heat or cool. This is likely to increase fines removal.

Generally, a classifier will have a 4-ft.-high expansion chamber immediately above the classifier exhaust connections. The diameter of the chambers is sized to reduce the exhaust air to a velocity of approximately 750 fpm, allowing coarser sand to drop back into the classifier.

Anything that reduces the flow of sand into the classifier while it is running will increase dwell time and fines removal.

2. FLUIDIZING AIR VOLUME. The design detail that controls the volume of fluidizing air is the open area of the blower inlet blast gate. Plugged fillers on the blower inlet also will reduce the fluidizing air. Individual blast gates below individual modules can redirect the flow of fluidizing air, or stop it completely if totally closed. **O**nce the classifier is filled with sand, the inlet blast gate usually is adjusted until the sand is bubbling about 6 inches in each module.

Palmer's HCCL-Series sand classifier system has four main components: a base or plenum chamber, into which fluidizing air is supplied by a blower; a fluidizing deck; a heat exchanger bundle; and a main body, which serves as a cover and pressure chamber. [PALMER MANUFACTURING & SUPPLY]

A higher volume of fluidizing air will cause sand bubbles to be higher and drive more fines into the head space. **S**o, the exhaust system will extract fines along with some larger-sized particles.

3. EXHAUST NEGATIVE PRESSURE. Increasing the fluidizing air will drive more fines into the head space, and with adequate exhaust it will remove more fines. **O**nce all modules are bubbling properly it is necessary to adjust the exhaust using the blast gates above the expansion chambers so that there is some measure of negative pressure in the head space. **G**enerally, -0.6 inches of water column is acceptable for silica sand. Higher-density sands may require more negative pressure, which will remove more fines.

If the fluidizing blower is off and the exhaust continues to draw air, negative pressure in the head space will increase unless a relief valve is installed. This will pull out additional fines while no sand is entering the classifier. The high-velocity air coming in through vents on the discharge end may create some low spots in the sand bed. This will then provide a path for fluidizing air to escape on start-up. The sand under the inlet may not fluidize and then the incoming sand will pile up there, stopping the flow of sand.

The exhaust system should have a relief valve so that no more than a -0.6 in. of water column is in the head space.

The **AFS GFN** and the % fines (i.e., the percentage retained on the 200-screen, 270- screen, and the pan) should be determined for the incoming and outgoing sand. The same test should be conducted on the material in any dedicated dust collector. There will always be some 140-screen sand in the "dust" if a high percentage of the 200, 270, and pan materials are being removed.

Increased dwell time, increased fluidizing air volume, and higher negative pressures all increase fines removal. Too high an exhaust velocity immediately above the classifier can remove an excessive amount of larger sand particles.

KEN STRAUSBAUGH is the Technical **S**ales & **S**ervice **M**anager with Palmer **M**anufacturing & **S**upply Inc. Learn more at www.palmermfg.com