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Reboiler and C100 Shutdowns

Greetings,

Today we looked at the relationship between the Gas Compressor VSD and the High Temperature Shutdown for the Reboiler.

We did not find the problem.

OBSERVATIONS

1. The Reboiler can be started normally and brought up to temperature.
2. The Amine and Reflux pumps can be started.
3. The Amine and Reflux can be maintained at stable flow rates.
4. When the VSD is powered up, however, an interference pattern is created. (This can be verified by trending the Reboiler temperature and the Amine flow rate. Both of these variables oscillate wildly.)
5. The interference causes the Moore Temperature controller and the Wonderware screen to show wildly fluctuating temperatures.
6. As soon as the temperature hits one of the shutdown setpoints, the Moore controller shuts down the Reboiler.
7. After the Reboiler shuts down, the temperature and Amine readings return to the values they were showing before the drive was energized.
8. If the shutdown condition is cleared at the Moore temperature controller, the temperature readings again begin fluctuating wildly until the Reboiler again shuts down.
9. If we disconnect the wiring between the VSD and the PLC we still see the same problem. **I would like to double-check this.**
10. **If we disconnect the wiring that connects the Moore Temperature Controller to the PLC, however, we do not see any variation in temperature at the Moore controller and we can power up the drive without any problem. I would like to double-check this, also.**

ANALYSIS

It seems pretty obvious to me that we are either seeing some sort of interference or some sort of interaction between the drive and something else: the effects are too abrupt and too predictable to be anything else. I am having trouble, however, narrowing down the source of the problem. Here are the main possibilities as I see them.

Interference on 4-20 mA wiring

If the 4-20 mA wiring is run too close to a high-voltage AC power source, an inductive signal can be generated in the wiring which will be seen as electrical noise and will cause the temperature signal to fluctuate.

The guys at the plant looked at the wiring and said it didn't look like it ran near any 480 VAC power lines. One way to check whether there is interference on the wiring would be to run an analog cable out across the ground directly from the Moore controller to the PLC and see if the problem persists. Or better yet, a 4-20 mA simulator could be connected right at the PLC. This would eliminate all of the wiring between the controller and the PLC as a possible source.

Interference on TC wiring

Thermocouple wiring is much more susceptible to noise than the shielded analog cable used in 4-20 mA loops. If there were some sort of interference between the thermowell and the controller then both the controller and Wonderware would pick up the same signal.

One way to check this would be to disconnect the thermocouple wires from the Moore controller. A temperature simulator could be placed on the input wires to the controller and a steady signal could be simulated. This would allow the Reboiler to run while the DC voltage signal could be read from the TC wires. The electrician would look for any fluctuation in the DC signal when the drive is started.

Different Power Supply Voltages

The Moore temperature controller wants to drive the loop with a 30 VDC power supply, but the PLC likes to drive analog inputs with its own 24 VDC power supply. We checked the wiring and everything is wired correctly, but the voltage mismatch might be contributing to the problem.

To eliminate the problem, either a current-to-current isolator would need to be installed, or, better yet, a new temperature transmitter and thermocouple could be installed in a spare thermowell. By installing a new temperature transmitter, the shutdown string could be isolated from the Wonderware status/alarm wiring. This way, even if there were some short term oscillation in the temperature, the Reboiler would continue to run.

Drive Power-line Harmonics

VSDs are notorious for introducing harmonics upstream of the drive that can cause power quality problems for all sorts of solid state devices.

With that said, the variations we are seeing are transient, not steady-state. So I don't really suspect a harmonics problem at this point. Besides, the PLC has a surge suppressor / power line filter that filters the power feeding the PLC.

(Now that I think of it, the input to the PLC from the Reboiler temp is sourced from the Reboiler, not the PLC, so it is not a part of the filtered power. This would be another good reason to install a new temperature transmitter.)

Neutral or Grounding

Duane (my boss) says he has seen neutral, grounding and bonding problems plague facilities when they are not installed correctly.

I guess it would be a good idea to have your electrician look over the installation and double-check that everything was installed according to code. He should especially check that all of the neutral and ground connections are clean and tight, that everything is properly bonded, and the neutral wires are not undersized. It wouldn't be a bad idea to check the phase balance on the 480 VAC distribution lines, either.

MOVING FORWARD

1. Electrician to double-check grounding and bonding.
2. Try to further isolate the source of the problem through the use of a 4-20 mA simulator, a Fluke Digital Multimeter (like a fluke 87), and a temperature calibrator.
3. Possibly run an analog cable directly from the PLC to the Moore controller.
4. If number 2 above indicates a power supply problem, consider installing a new temperature transmitter.
5. If none of the above yield results, we may have to revisit the VSD / harmonics problem.

Our shop might be willing to rent you the calibration equipment if you need it. If you are interested I can ask Duane about our rates.

Please let me know how I can help you next.

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