TURBINE TIPS
Turbine Tips provided by Pond and Lucier, LLC. ®
634 Plank Road, Suite 103 Clifton Park, NY 12065
Phone: 518.371.1971 Fax: 518.371.1756 E-mail: pal@pondlucier.com

March 2003

Subject: Troubleshooting a Malfunction of the Liquid Fuel Purge Valve
Applies to: General Electric Model Series MS5001, 6001 and 7001 gas turbines

If you have a GE gas turbine with dual-fuel (gas/oil) capability and a single liquid fuel purge valve VA19-1, the following scenario can occur.

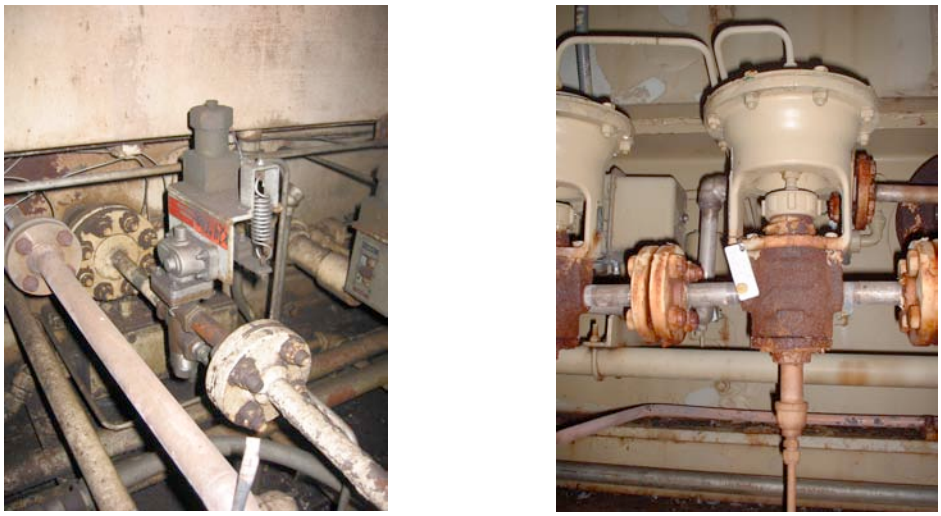

Fig. 1: Some typical VA19-1 liquid fuel purge valves

Problem: During the season's first use of fuel oil, a problem occurred when an MS7001 customer started up their unit. The shaft speed would start to oscillate during startup acceleration. The speed was so unstable at full-speed-no-load (FSNL) that the fuel had to be transferred to natural gas to allow for synchronization. Once a few megawatts were

established, the fuel could be transferred safely to oil and loading could proceed.

Solution: In consultation with PAL engineering, many things were checked by the customer including bypass valve calibration, fuel clutch slippage, servo valve replacement, and bypass valve damage or wear. Control constant and IO configuration constants were checked and found to be set correctly. At FSNL, the fuel flow (governed by speed control FSR - FSRN) was gagged by manually lowering FSR. This eliminated the oscillation by removing FSRN as the minimum fuel governor. This eliminated the fuel delivery system as the source of the oscillation and pointed towards speed control and/or another system as the culprit.

The cause of the problem was traced to the VA19-1 liquid fuel primary purge valve. The valve was open during fuel oil operation, when it should have been closed. Normally the liquid fuel purge air system is vented to atmosphere via this three-way air valve. The closed valve allowed high pressure atomizing air to reverse bias the purge air check valves on one or more combustors. This allowed momentary pulses of pressurized air to override the fuel flow to the combustors causing a sudden drop in energy delivered to the turbine from those combustors. The loss of energy delivered resulted in a drop in turbine speed and a subsequent loss in PCD and atomizing air pressure. The drop in speed caused the speed control loop to boost FSR and hence the fuel pressure delivered to each combustor. This increase in fuel pressure coupled with the loss in purge air pressure caused the purge check valves to shut off the air flow and allowed fuel oil to resume its flow to the combustor. The resulting increase in speed set up the conditions for the oscillations to continue until the speed was locked in by the grid or locked out by manually gagging FSR.

Later that day the customer serviced the VA19-1 valve and found a problem with the actuator, which they fixed. The unit was started up on fuel oil. It reached FSNL smoothly and was synchronized without further incident.

Discussion: The consequences of miss-operation of the VA19 valves could be catastrophic. During fuel oil operation, with this valve open, if any one of the purge air check valves had failed (which they are prone to

do), fuel oil could have filled the purge piping and backed up into the atomizing air compressor. Fortunately, the operators saw the high pressure in the purge system and diagnosed the failed valve before any damage occurred.

Recommendations:

- On all gas turbine units, implement an enhanced preventative maintenance program on all air-operated valves associated with the liquid fuel and gas fuel systems including all air-operated purge valves, bypass and isolation valves, false-start drain valves, solenoid valves, pressure regulators, fuel and purge check valves and distributor valves.

- In the absence of limit switches, add key valve position points to the operator's data sheets to verify during hourly walk-down of the units.

- Review control system alarm logic for purge air pressure transmitters and add instrumentation and alarms as necessary to annunciate when incorrect pressures are present during gas, liquid, and fuel transfer operation.

For more information or for assistance in troubleshooting controls problems, please contact Pond And Lucier, LLC.