

June 2003

Subject: Servicing Hydraulic Controls for Gas Fuel Systems

Applies to: General Electric gas turbines: MS5001L & LA and MS3002F

Gas Fuel Controls: *Young & Franklin* Combined Gas Stop & Control Valve Assembly

Overview:

General Electric applied *Young & Franklin* combined gas stop and control valve (**GS&CV**) on gas turbines during the late 1960s and early 1970s. Hundreds of turbines were shipped during the era following the Northeast Blackout of 1965. The combined valves (nicknamed the “Iron Pants” for the shape of the valve body) were used primarily on both frame 5 generator drives and frame 3 compressor drives until the year 1970. These gas turbines had hydraulic positioning servos (**HPS**) that received pressure signals from another *Y&F* product called Fuel Regulator. These signals were called variable control oil (**VCO**) pressure and constant control oil (**CCO**) pressure.

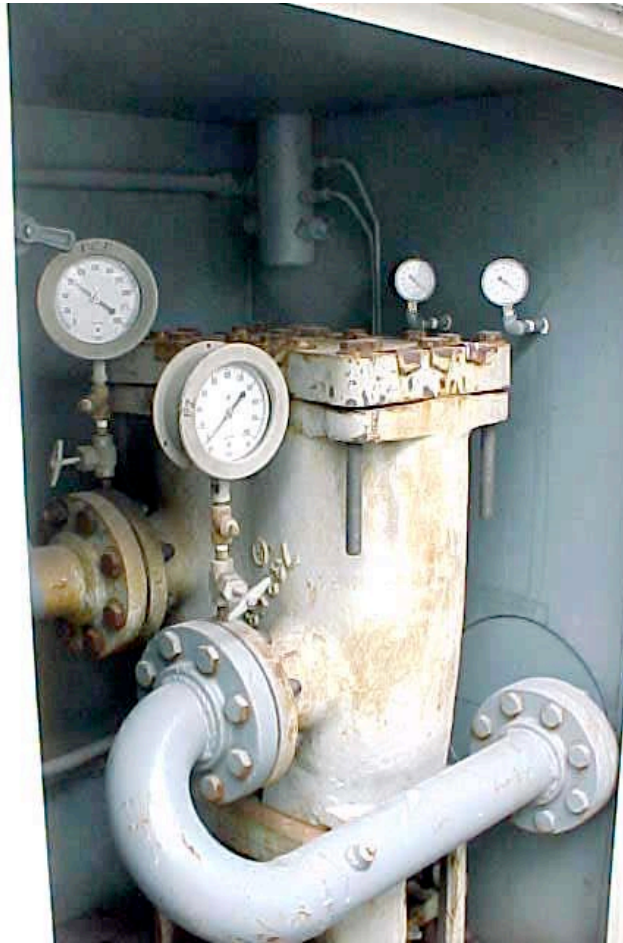


Fig. 1: Combined Gas Stop and Control Valve Assembly (Nicknamed the “Iron Pants)

The *Young & Franklin* hydraulic positioning servo (HPS) is a mechanical-hydraulic mechanism. VCO and CCO signals go from the Fuel Regulator directly to the device. The piston strokes **downward** when VCO pressure increases above 40 psig. At 200 psig, the piston will travel fully down to its bottom stop. Thus, a change in VCO pressure of 160 psig will result in a travel of .960 inches.

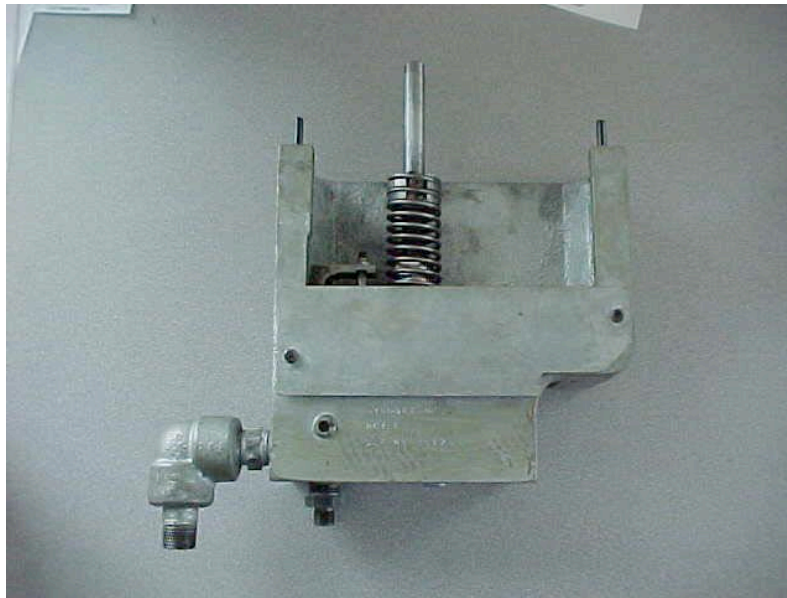


Fig. 2: Hydraulic Positioning Servo (after cleaning and servicing)

The HPS must be disassembled, cleaned and serviced periodically. The servo shown above must be removed from beneath the Gas Control Valve (GCV) as a sub-assembly. Once the front cover plate is removed, the nozzle and piston assembly (shown schematically in Fig. 3 below) require thorough cleaning. The o-ring must be replaced and the cylinder bore honed so that the piston moves freely up and down against the spring. Careful attention must be given to not disturb the adjusting spring and plug so as to not change the pre-load adjustment.

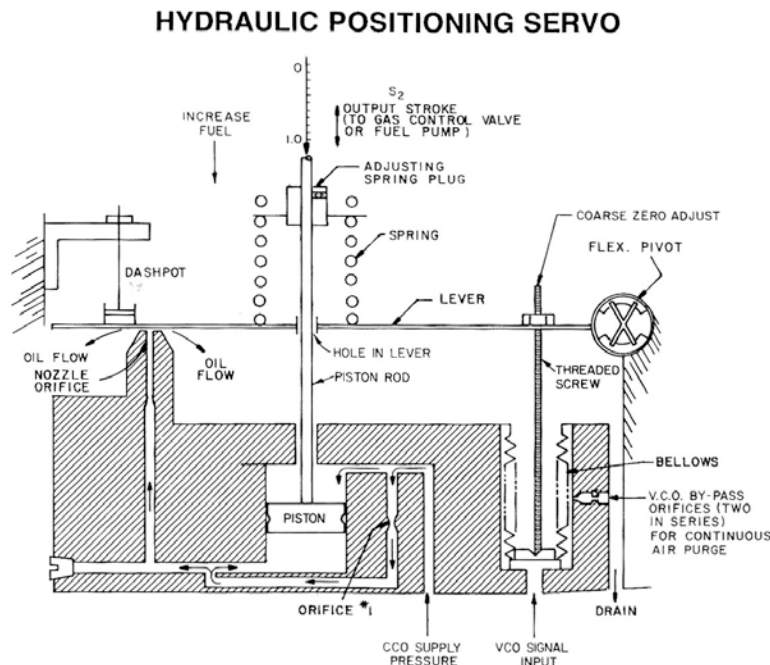


Fig. 3: Hydraulic Positioning Servo and Stroke versus VCO Pressure Graph

The gas fuel system shown in the schematic below requires precise action of three valves: Pressure Ratio Valve, Gas Stop Valve and Gas Control Valve. The gas flow is from **left to right** in the diagram, through the gas strainer, on through the valves to the fuel nozzles in the combustion system.

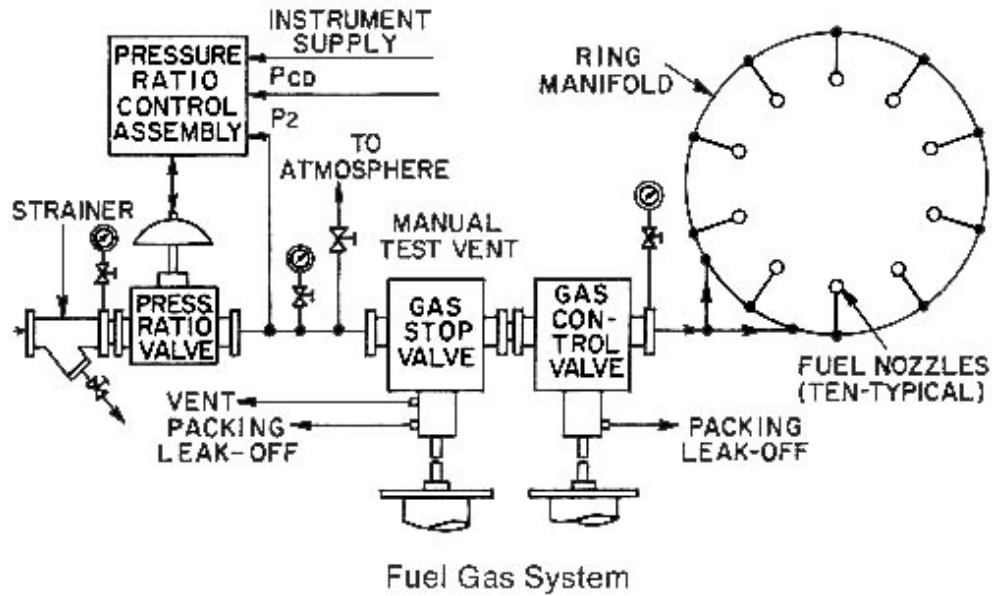


Fig. 4: Gas Fuel System Schematic

The hydraulic portion of the gas control valve (GCV) is shown below. The hydraulic positioning servo (HPS) shown to the left is connected by linkages to the gas control valve's pilot valve and piston. Friction-free and fast action is required for proper control of fuel flow.

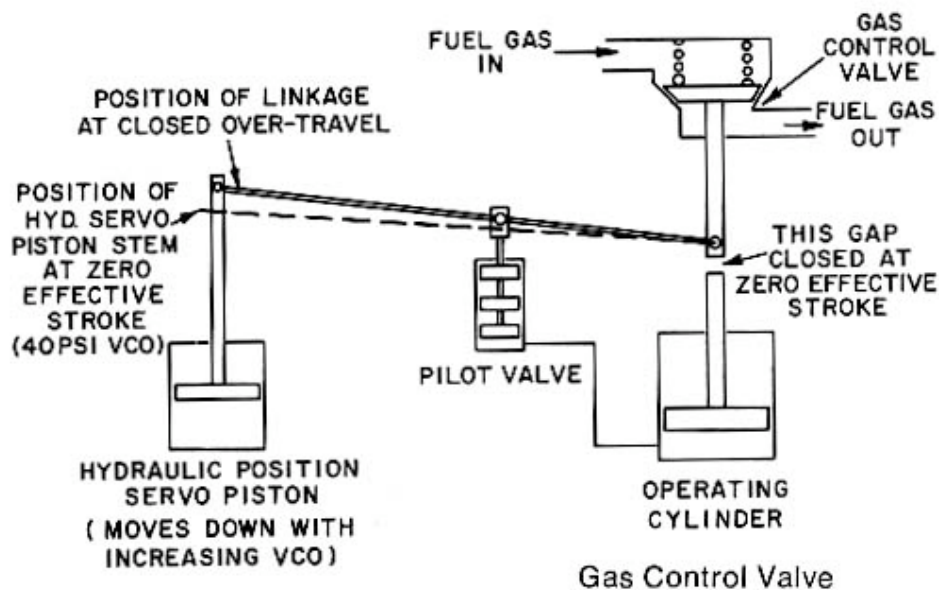


Fig. 5: Gas Control Valve Operation Schematic

The gas stop valve portion of the combined valve operates on hydraulic pressure from the main lube oil pump of the gas turbine (nominal 55 psig). This low-pressure oil requires large components, including the operating piston shown below. Carbon rings are used to seal the pressure and a spring the approximate size of those used in automobile suspension systems is used. The stop valve hydraulic components need to be periodically cleaned. The stop valve plug and seat need to be “lapped” to insure a positive sealing when closed. The spring provides “closed over-travel, COT” to the valve.



Fig. 6: Gas Stop Valve (piston and rings)

Servicing Gas Control Valves and Fuel Regulators:

Combined Gas Stop and Control Valves Assemblies need periodic servicing. The manufacturer, Young & Franklin, recommends that they be fully disassembled and cleaned every five years. This is particularly true of the Hydraulic Positioning Servo. Even when installed on *peaking* turbines that do not run for more a few hundred hours per year, these valves need to be serviced. Idle and standby situations can be even more “unforgiving” to cleanliness (build up of sludge) than continuous, base load operation for these valves.

Contact **David Lucier** if you need assistance troubleshooting or servicing your *Young & Franklin* valves.

Pond And Lucier, LLC has a full-service hydraulics lab in its new facility in Amsterdam, NY. Please contact us there on Tel: **518-843-3634** for details. Visit the **products** section of this website for a pricing list for components we service.