Combined Stop/Ratio and Control Gas Valve for Frame 6 Applications

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Young & Franklin, Inc.

League City, Texas
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Early Shop – 1930’s

*Est. 1918
Current A&T Facility
GE Frame Gas Fuel Control Methodology

• Iterative Design Process
  – Heavy Duty Gas Turbines inherited many proven Steam Turbine design characteristics
  – Extensive pre-production field trials validate new designs
  – Early designs preceded industry standards (FCI, NACE, API)

• Discrete Control Functions
  – Stop/Ratio -> Pressure
  – Gas Control -> Flow (choked)
Gas Fuel Control Valves

6000 series

Used on Fuel Regulator models

Evolution 6000 -> 6500 -> 8000 -> 9000 -> 9500 series

9500 series

Used on Speedtronic models
Combined Gas Fuel Control Valve

General Features

- Dual body: Fuel Stop-Speed Ratio and Control Valve
- NACE compliance and up to 3” internal trim
- ANSI B16.5 300# 3” flanges
- Low (55psig) and High (120psig) Control Oil for Trip
- Explosion Rating UL/CSA Class 1 Division II

Fuel Regulator Machines
- Hydraulic Position Servos (open loop operation)

Speedtronic Machines
- Electronic Servos (LVDT feedback)
- Lube Oil Tank Drain
Three functions in one package (speed, isolation, load)

- **Speed/Ratio Function** is plug modulation to provide pressure regulation in the fuel system. The pressure value is determined as a function of the turbine speed and is typically called “P2 or Inter-stage Pressure”.

- **Stop/Isolation Function** of the combined valve is to isolate the gas supply from the turbine in an emergency shutdown situation (Trip). The Stop and Speed Ratio functions are accomplished by same trim components.

- **Control Function** is plug modulation to control flow rate of the pressure regulated gas under choked conditions (ie downstream independence).
Design Internals
Packing Details

Valve Stem Packing Arrangement
LVDT
Hydraulic Cylinder
Servo Valve
Hydraulic Filter Assembly
Schematic

9500 SERIES—STOP/RATIO & CONTROL VALVE HYDRAULIC SCHEMATIC
Factory Testing

**Basic Testing Requirements**

- Supply Hydraulic: 1200± 50psig @ 6gpm
- Supply Hydraulic: 0-55psig @ .5gpm
- Supply Air: 0-200psig @ 1.67scfm (100scfh)
- Turbo32 Compatible Test Oil
- High Speed Strip Recorder
- 3 Channel LVDT Signal Conditioning
- Hydraulic Servo Driver (Triple 8mA Coil)
**ACCEPTANCE TEST PROCEDURE**  
Model 9500E101 REV C

<table>
<thead>
<tr>
<th>STOP/RATIO VALVE ASSEMBLY</th>
<th>TEST DATA</th>
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<tbody>
<tr>
<td>9500E101-G</td>
<td>Rev. ___ Unit Serial No. ___ Casting No. ___</td>
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<tr>
<td>Cylinder Mfg. ___</td>
<td>Cylinder Serial No. ___</td>
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<td>Purchase Order No. ___</td>
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<td>Stop/Ratio LVDTs Mfg. ___</td>
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<td>Control LVDTs Mfg. ___</td>
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6. INITIAL ADJUSTMENTS
6.1 Preliminary Tests and Checks
   No Cause for Rejection

6.2 Stop Ratio Valve Position Indicator & LVDT Adjustments
6.2.1 Clearance between S/R Valve Stem and Retracted Cylinder Rod ___04+___01
6.2.2 Stroke Indicator Set with Zero Valve Stem Clearance
6.2.3 LVDT's have Free Movement
6.2.4 Reading of LVDT#1 with S/R Valve Closed Position
6.2.5 Reading of LVDT#2 with S/R Valve Closed Position

6.3 GCV Position Indicator & LVDT Adjustments
6.3.1 Clearance between GCV Stem and Retracted Cylinder Rod ___04+___01
6.3.2 Stroke Indicator Set with Zero Valve Stem Clearance
6.3.3 LVDT's have Free Movement
6.3.4 Reading of LVDT#1 with GCV Valve Closed Position
6.3.5 Reading of LVDT#2 with GCV Valve Closed Position

7. FLUSHING INSTRUCTIONS
   Assembly Flushed as Instructed

8. OPERATING TESTS AT ATMOSPHERIC PRESSURES
8.1 Hydraulic Trip Relay Tests
8.1.2 Oil temperature ___°F
8.1.3 Trip Oil Supply 55 psi
8.1.3.1 Trip Pilot starts to move ___20 psi maximum
8.1.3.2 Trip Pilot maximum travel ___25 psi maximum
8.1.4 Total stroke of the trip relay spool ___566/540 inches
8.1.5 Leakage at 55 psi ___150 cc/min maximum
8.1.6 Leakage at 55 psi & 1200 psi control ___25 cc/min maximum
8.1.7.1 Trip Pilot starts to close ___13 psi minimum
8.1.7.2 Trip Pilot at zero stroke ___7 psi minimum
8.1.8 Friction at trip position (8.1.3.1-8.1.7.2) ___6 psi maximum
8.1.9 Friction at reset position (8.1.3.2-8.1.7.1) ___6 psi maximum
ACCEPTANCE TEST PROCEDURE
Model 9500E101 REV C

8.2 Stop/Start Valve Friction Tests
8.2.1 Valve has smooth operation
8.2.2 Valve stroke
8.2.3.1 Valve starts to open
8.2.3.2 Valve fully open
8.2.4.1 Valve starts to close
8.2.4.2 Valve at zero stroke
8.2.5 Friction at zero stroke (8.2.3.1-8.2.4.2)
8.2.6 Friction at max. stroke (8.2.3.2-8.2.4.1)

8.3 Gas Control Valve Friction Tests (3.00 Inch Control Valves)
8.3.1 Valve has smooth operation
8.3.2 Valve stroke
8.3.3.1 Valve starts to open
8.3.3.2 Valve at maximum travel
8.3.4.1 Valve starts to close
8.3.4.2 Valve at zero stroke
8.3.5 Friction at zero stroke (8.3.3.1-8.3.4.2)
8.3.6 Friction at max. stroke (8.3.3.2-8.3.4.1)

9.0 OPERATING TESTS AT ELEVATED PRESSURE (200 PSIG)
9.1 Stop/Start Valve
9.1.1.1 Valve starts to open
9.1.1.2 Valve at maximum travel
9.1.2.1 Leaksages - Valve body/pipe plugs/flanges
9.1.3 Packing leakoff at 75% stroke
9.1.4 Valve Plug Assembly
9.1.5 Trip Time

9.2 Gas Control Valve
9.2.1.1 Valve starts to open
9.2.1.2 Valve at maximum travel
9.2.2.1 Leaksages - Valve body/pipe plugs/flanges
9.2.3 Packing leakoff at 75% stroke
9.2.4 Valve Plug Assembly

10. CYLINDER LEAKAGE CHECK:
10.1 With 55 psi Trip Oil & 1200 psi Supply Oil
11. PROTECTION FOR TRANSPORTATION AND STORAGE:
After test, prepare valve for shipment, sealing all openings.

*NOTE: All "Naco" Valves require the attachment of Hardness Check Sheet.
Maintenance Tips

• Calibration
  - LVDT Alignment
  - Effective Zero Stroke
  - Control Range

• Control Oil
  - Ruggles-Klingemann Valve
  - Flushing Block
  - Servo Filters
  - Main Filter Replacement
Maintenance Tips

- Cylinder Gap
  - Stem Stop Setting

- Valve wear
  - Stem Packing
  - Stem Bushings
  - Seat Leakage
World’s “Worst” Returned Valve to Y&F
(30 years of service w/NO R&O)
Older European Gas Turbine Valve: Reconditioned by Young & Franklin
Y&F Products on GE Turbines

Frame 6001 (Series A-B)

- Inlet Guide Vane Actuator
- Liquid Fuel Oil Stop Valve
- Liquid Fuel Oil Bypass Valve
- Combined Control and Stop/Ratio Valves
- Hydraulic Ratchet Sequencing Valve
- Control and Stop/Ratio Valves
- Splitter and Transfer Valves

Frame 6001 (Series C-FA)

- Inlet Guide Vane Actuator
- Liquid Fuel Oil Stop Valve
- Liquid Fuel Oil Bypass Valve
- Hydraulic Ratchet Sequencing Valve
- Splitter and Transfer Valves
- Control and Stop/Ratio Valves
## Replacement Parts List

<table>
<thead>
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<th>Part Number-GE</th>
<th>Part Number-Y&amp;F</th>
<th>Description</th>
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<td>312A6077-P001</td>
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<td>SERVO VALVE</td>
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Questions?

Young & Franklin Inc.
is available to assist you with
diagnosing problems and replacement parts.

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