Free Valve Actuator - G5

Technical Specifications
2012-09-29

Actuator Dimensions

Height: 43 mm
Width: 34 mm
Length: 36 mm
Weight: 240 g

Actuator Connections

Air connections: High pressure inlet and outlet on top of actuator. Connections are sealed with O-rings for rail assembly. The air-rail is fixating the actuator. Air does not need to contain oil-mist, the actuator is lubricated by engine oil.

Hydraulic connection: High pressure inlet on top of actuator. Connection is sealed with O-ring for rail assembly (no threads). Maximum allowed solid particle size is ≤10 μm.

Hydraulic oil: Engine internal oil circuit. Oiling need < 0.5 liter per hour and actuator (recirculated to engine sump). Maximum allowed solid particle size: ≤10 μm

Hydraulic fail-safe: Hydraulic pressure release in case of piston contact.

Electrical connections: 1 cable plus common ground.

Cable dimensions: 260mm, Ø1.2 mm.

Solenoid resistance: 5 Ω

Voltage: 14 V
**Operational Characteristics**

Min recommended air pressure: 3 bar (low rpm and load)

Max recommended air pressure: 16 bar (high rpm and load)

Opening force per bar air pressure: 77 N

Max opening force: 1232 N

Hydraulic pressure: min 4 bar recommended

Valve lift: max 13 mm

Temperature: max 150°C.

**Valve position sensor**

Position: Integrated inside actuator assembly

Weight: 15 g static weight (no influence on actuator performance)

Accuracy: 0.1 mm

Delay: <10 us

Sampling rate: 1 sample per crank angle degree (recommended)

ECU drivers: One per engine

ECU input channel: One for 2 sensors

Voltage: 14 V

Power consumption: <0.3 W per valve
Typical data for a 2.0L, 16 valve 4 cylinder Cargine equipped engine

Valve diameter: 32 mm Intake, 28 mm Exhaust

Spring pre-tension: 115 N (less with pneumatic spring at lower rpm and load)

Spring constant: 11 N/mm (less with pneumatic spring at lower rpm and load)

Pneumatic spring: Optional. Reduces energy consumption and increase rpm capability

Air pressure inlet valve: 4 bar (inlet valve and exhaust valve at part load)

Rise time 1-8 mm: 2.5 ms

Fall time 8-1 mm: 2.6 ms

Activation delay: 4.5 ms

Seating velocity: Adjustable at time of installation typically 0.1 – 0.5 m/s (at >40 deg C)

Cold start capability: -40 deg C

Max rpm at low temp: 2500 (under -20 C during the first 30 seconds after start up)

Max rpm: 6700 rpm, limited by metal spring rate. 9000 rpm with pneumatic spring

Cycle-to-cycle variations: Opening and closing time, less than +/- 0.05 ms. Valve lift, less than +/- 0.2 mm at 10 mm

Compressor type: Belt driven multi-piston swash plate with variable displacement

Compressor displacement: 40-120 cc (typical)

Compressor rpm: engine rpm

Valve train (compressor) energy consumption: Examples - 0.85 bar FMEP (4 valves per cylinder, 2000 rpm, 2 bar IMEP). 1.05 bar FMEP (4 valves per cylinder, 2000 rpm, 8 bar IMEP). The average driving cycle energy consumption of the Cargine Free valve train is equivalent to a state-of-the-art roller/rocker valve system. Furthermore, by utilizing skip cycle or two valve openings per cylinder at lower rpm/load, drastic reduction in energy consumption can be obtained.

Sensors: 16 valve positions sensors. 4 pressure sensors for air and oil. Further sensor needs are covered by already installed engine sensors.
**OBD and control possibilities**

- Continuous valve lift and pneumatic pressure monitoring

- Secondary exhaust lambda diagnostic measurement and feedback on an individual cylinder basis.

- Flywheel speed/acceleration analysis for cylinder balancing

- Extensive limp home strategies possibilities

Specification subject to change without further notice – Ängelholm 2012-09-29