CONTINENTAL CONTROLS CORPORATION

ISO 9001 CERTIFIED
US PATENT #6, 978, 774, B2

FOR RICH OR LEAN BURN ENGINES

ECV5 EMISSIONS CONTROL VALVE

Air-Fuel Ratio Control For Gas Engines

BENEFITS

- MAINTAINS EMISSONS COMPLIANCE EVEN WITH CHANGES IN SPEED AND LOAD
- WIDE RANGE LOAD CONTROL
- FULL AUTHORITY
- FULLY AUTOMATIC
- COMPLETE INSTALLATION KIT
- HMI DISPLAY CAPABILITY
- CATALYST TEMPERATURE MONITORING
- HANDLES CHANGES IN GAS BTU
- CONTROLS RICH OR LEAN BURN ENGINE
- CAN BUS J-1939
- CSA CLASS 1 DIVISION 2 APPROVED

EMISSIONS REQUIREMENT

The ECV5 valve offers full authority fuel control for almost any size of gas engine. The variable pressure control technique allows for rapid and precise control.

CONTINENTAL CONTROLS SOLUTION

While ensuring peak operating efficiency, Continental Controls offers a complete system that maintains compliance of emissions for gas engines with the most severe local, state, and federal regulations.

The ECV5 controls fuel pressure to a CCC mixing venturi to achieve the lowest possible emissions under all load conditions. The ECV5 can also be used as the primary fuel valve controlling fuel to the carburetor on an aftermarket AFR installation. Simply stated, the ECV5 is an electronic variable pressure regulator that varies fuel pressure to the engine based on input from a Wide Band Oxygen Sensor (UEGO). The ECV5 also can accept oxygen sensor data from the CCC Catalyst Monitor via CAN bus to dynamically adjust the Oxygen Sensor setpoint based on changing oxygen sensor data or catalyst conditions.

ECV5 with ECVI display (not shown but included are the wide band oxygen sensor and the installation kit.)

ECV5 THEORY OF OPERATION

The ECV5 is the culmination of years of development of an advanced gas valve with a high-level mechanical design and sophisticated electronics with superior application specific software. The seamless integration of these design aspects into a single product has helped establish the ECV5 as the leading controller for reducing emissions for gas engines.

The ECV5 efficiently manages emissions by precisely controlling fuel flow entering the engine, ranging from no flow to maximum flow; this ensures the valve will operate within its effective range, even in challenging scenarios involving significant deltas in gas Btu. This capability allows the valve to rapidly adjust fuel flow in response to load variations, ensuring emissions remain within required limits under all conditions

Unlike many of the valves used in competing emissions control systems, the ECV5 has been specifically designed for reciprocating engines using gaseous fuels. It is not a modified pressure regulator, a biasing restrictor, or a valve borrowed from a different market sector or manufacturer; the valve was completely designed by Continental Controls Corporation for a specific application. Every valve is manufactured at our plant in San Diego California, including all CNC machined components and electronic assemblies.

HOW THE SYSTEM WORKS

The ECV5 is an electronically controlled valve that functions as a zero-pressure regulator with droop eliminated. A high accuracy, low-pressure transducer is embedded in the valve to sense the discharge pressure, which is the gas injection pressure to the carburetor or mixing venturi device.

INCREASED CATALYTIC CONVERTER LIFE

To optimize the reduction of NOx, CO, and NMHCs, the ECV5 is employed in a rich burn engine equipped with a 3-Way Catalytic converter in the exhaust. An oxygen sensor is positioned ahead of the converter in the exhaust stream. By controlling the air-fuel mixture, the ECV5 maintains extremely accurate control of the oxygen content in the exhaust at location of the oxygen sensor's. This precision not only maximizes catalyst effectiveness—enabling the system to comply with the strictest emissions standards—but also prolongs the lifespan of the catalyst.

REDUCED EMISSIONS

The ECV5 significantly reduces fuel system response lag by controlling oxygen level around its sensor setpoint. The valve can consistently keep oxygen content in the exhaust within the NSCR compliance window for 3-way catalysts or at the desired control point for other applications. This capability ensures optimal emissions control or maximum efficiency depending on the ECV5's control setpoint.

INSTALLATION

The ECV5 system is easy to install and simple to set up for any engine. The optional complete kit includes: wiring, cables, sensors, a cat monitor, and a display unit. The figure above illustrates the wiring necessary to fully implement the system.

TRANSIENT LOAD RESPONSE

The valve boasts exceptional speed, transitioning from open to closed in under 50ms, resulting in a highly responsive pressure regulator. In the event of a load transient, fuel flow changes are instantly detected, and the valve swiftly adjusts its position to minimize the transient's impact. Therefore, the engine remains compliant throughout the transient and quickly stabilizes itself.

GAS SUPPLY PRESSURE

The minimum gas supply pressure required is the sum of the gas injection pressure and the pressure drop across the valve. The valve pressure drop depends on the flow through the valve, as illustrated in the adjacent diagram. Ideally, the supply pressure should be regulated to enable the ECV5 to operate within the 50% to 75% range when the engine is at full load.

CLOSED LOOP PRESSURE CONTROL

The proportional and integral control provide a rapid responding, no-droop pressure regulator. The ECV5 has two main operating modes; Default Mode and AFR (Air-Fuel Ratio) Mode.

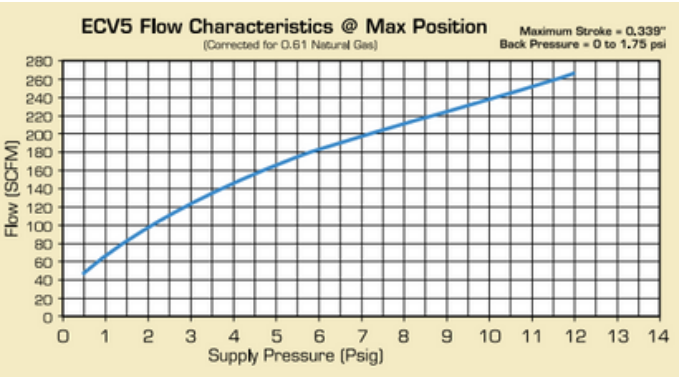
On startup, it works in Default Mode and follows the default pressure setpoint. Upon receiving valid oxygen sensor signal, it switches to AFR Mode and uses dynamically derived pressure setpoint.

DUAL BANK ENGINES

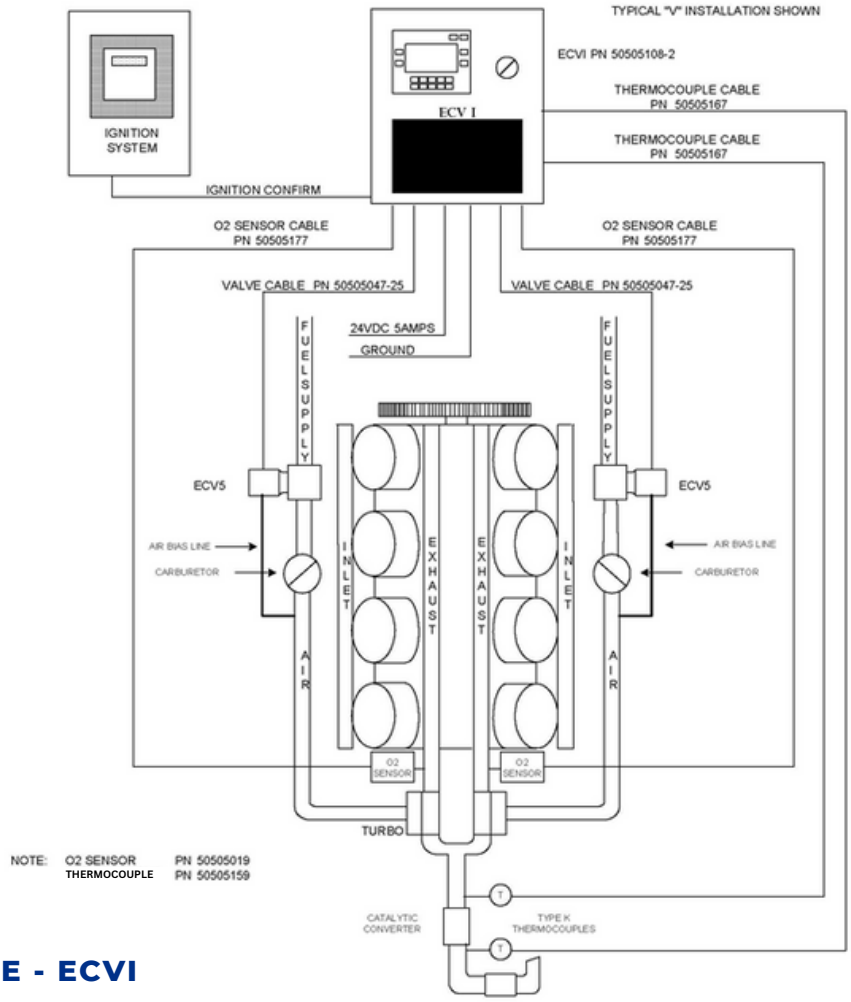
Dual bank engines with a single point of fuel injection and a single turbocharger are connected like a single bank engine. A dual bank engine with a turbocharger and an oxygen sensor on each bank will require an ECV5.

TURBO CHARGED ENGINES

The fuel system of engines turbocharged after the carburetor will be connected like the naturally aspirated engines. When the turbocharger is placed before the carburetor, a reference line must be connected from the air inlet of the carburetor to the reference port on the ECV5 to control on fuel above the boost pressure.



Note: As can be seen from the chart above, if the injection pressure is 0.5 and the gas flow is 60 scfm, 1 psi of of gas pressure is required.



INTERFACE - ECVI

The ECVI (Emissions Control Valve Interface) Unit serves as the user interface for the system, monitoring its operation while displaying all relevant data. It enables users to modify key control setpoints and parameters including oxygen sensor setpoint, Default Sensor setpoint, etc. The unit includes a display panel featuring gauges, bar graphs, and numeric values. Users can monitor the system's operation by selecting one of the available screens for real-time display of parameters:

- Gas injection pressure and its setpoint
- Oxygen sensor voltage and its setpoint
- Valve position
- Default pressure
- Pre and post catalyst temperature
- Exhaust Dp sensor

The ECVI provides the ability to alert over-temperature alarms or initiate shutdowns to protect the catalytic converter from damage. It monitors temperature increases within the catalyst due to exothermic reactions. The differential temperature is displayed and logged to USB flash drive. Additionally, the ECVI comes equipped with a serial port for MODBUS communication and an ethernet port for MODBUS TCP to allow it to interface with other control and data logging systems.

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