System Overview

I. Theory of Operation

When a fully charged CAS system is triggered “on”, 3300 psig air is immediately throttled down to approximately 100 psig in the Mechanical Pressure Regulator. Accompanying this reduction in pressure is a huge reduction in temperature; Regulator outlet temperatures of -150^0 F are not uncommon.

During operation as the storage cylinders are evacuated the pressure in them decreases resulting in a very rapid, near adiabatic expansion of the remaining air. Accompanying this expansion is a corresponding drop in the temperature of the air remaining in the cylinder. The reduced throttling effect that occurs in the Mechanical Regulator due to decreased pressure differential (outlet pressure remains constant as inlet pressure is reduced) is offset by the reduction in the temperature of the air entering the Mechanical Regulator.

The very low temperature medium pressure air stream is then throttle one more time in the Electronic Pressure Regulator before being discharged into the engine air intake tract. The throttling effect that occurs here is small compared to that which occurs at the Mechanical Pressure regulator but, similar in nature.

The end result of these expansion processes is that the charge air temperature entering an engine is dramatically lower than can be achieved with conventional MAP increasing technologies (supercharging and/or turbocharging with after-cooling). Hence very high charge densities can be attained at relatively low MAP levels.

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II. Hardware Functionality

The following is a step by step explanation of what occurs when a CAS system transitions from an “off” to an “on” mode.

Step 1 – Opening Gate Valve on Cylinder: The first 1-1/2 to 2 turns CCW of the Handle on a CAS Gate Valve (GV-625) opens a pilot hole within the valve that allows a reduced amount of airflow to exit the valve and pressure downstream components all the way to the Safety Shut-off Valve (SOL-1440). This results in the pressure in the Cylinder equalizing with that between the Valve and the Mechanical Regulator (REG-625) at approximately 3200 – 3300 psig and the pressure between the Mechanical Regulator and the Safety Shut-off to Stabilize at approximately 100 psig (actual value varies with system configuration). This “filling” process is accomplished in a matter of several seconds if the primary is fully open.

Once the line feeding the Mechanical Regulator is fully pressurized the Gate Valve Handle can be turned an additional 5 – 6 turns CCW to fully open the main exit passage in the Valve.

Step 2 – Arming the System: With the system fully pressurized and the Gate Valve(s) fully open the system can be armed with the main power switch. Doing so energizes the Boost Control Unit (BCU-030) which in turn drives the EPR to the ***Motor Position*** that has been programmed into the BCU.

Step 3 – Triggering the System: With the system charged and armed triggering the BCU with an “on” command causes the Safety Shut-off Valve to open, air to pass through the EPR and the Isolation Valve in the Ejector to shut, resulting in the engine running solely on air being supplied by the CAS system. The EPR motor position will remain stationary with air flowing for the period of time programmed into the ***Motor Delay*** function.

Step 4 – Boost Tracking : Once the ***Motor Delay*** period has been exceeded the BCU drives the EPR motor open or shut in an attempt to attain and maintain the MAP target that has been programmed into the BCU. Adjustments are continually made 100 times per second until the “on” command is released.

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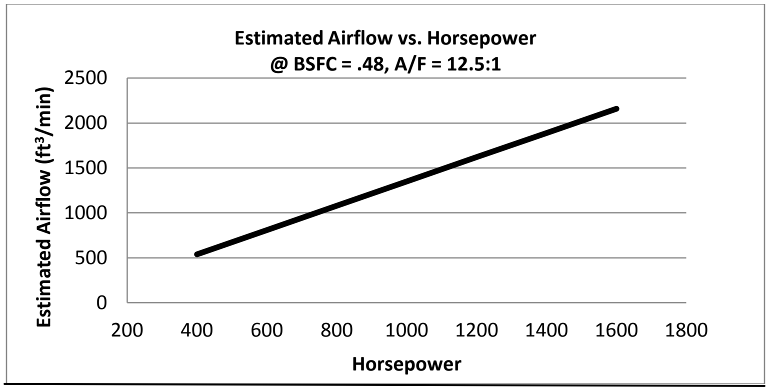
Step5 – Return to Quiescent : Once the “on” command has been terminated the Safety Shut-off is closed, the Ejector Isolation Valve is opened, returning the engine to normally aspirated operation and the EPR returns to the ***Motor Position*** location that is programmed in the BCU.

Step 6 – Run Termination: When not in use the Gate Valve handle should be turned fully CW to isolate the cylinder contents from downstream components. If the system is not to be used for an extended period it is recommended that the air trapped between the outlet of the Gate Valve and the Safety Shut-off be vented using the Schrader Valve that is located in the Mechanical Regulator outlet fitting.

III. Operational Requirements

Step1 – Determining Required Flow Capability: System sizing and equipment selection requires first determining airflow requirements based upon horsepower targets. The chart below provides a reasonable estimation of airflow requirement as a function of horsepower.



Step2 – Determining Storage Capacity Requirements : The accompanying chart below displays run time as a function of horsepower (based upon the calculations performed in Step 1). In all instances it is recommended that on-vehicle storage capacity be at least 25% greater than what is expected to be consumed during operation.

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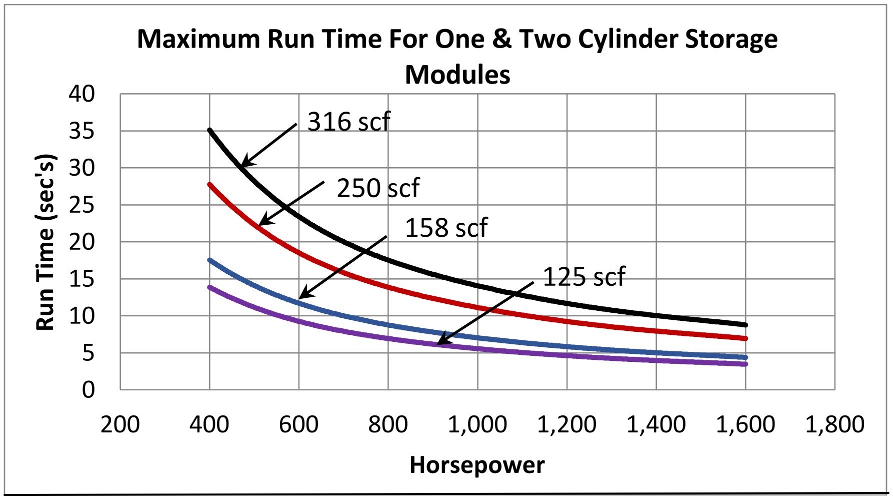

IV. System Installation

Installation of a compressed air supercharging system involves the careful layout and integration of three main groups of components or “Modules” into a vehicle; Air Storage, Air Metering and Boost Control. Detailed instructions for the installation of each of these modules are available from CAS.

V. System Tuning

Boost Control Modules are pre-programmed with baseline settings that are typically common to most applications. Additional program and track tuning will be required to correctly tune a system for each application. A detailed tuning instruction document is available from CAS.

VI. System Troubleshooting

Most system level performance issues are traceable to calibration errors or, incorrect component/system selection for a specific application. If however, a system has worked well previously and is suddenly exhibiting performance issues or a component is obviously not operating correctly, service may be in order. A detailed troubleshooting document is available from CAS.

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VII. Component Servicing

Most CAS components are field serviceable; however, some require specialized tools that are not commonly available. Disassembly, inspection and reassembly instructions, as well as Assembly drawings detailing replaceable subcomponents are available from CAS for all major components.