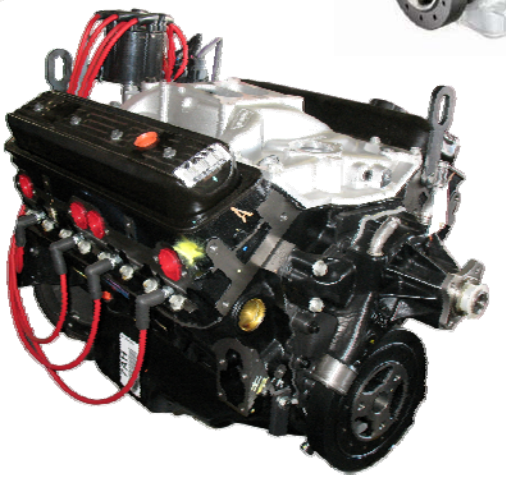
UE Powertrain
Buck's Engines

Emission Related Installation Instructions For WHG Engines Non-Commercial Fuels

Rev1- March, 2012



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405-601-1000

INSTALLATION OF CERTIFIED ENGINES

Thank you for your recent purchase of a Bucks Engines Stationary Certified industrial Engine (SCE).

These instructions are intended to give the installer of the engine all of the information that is necessary to properly install the engine and related components into the equipment chassis. The United States Environmental Protection Agency (EPA) requires that the manufacturer of the engine provide installation instructions to the equipment manufacturers as defined in the Code of Federal Regulations (40CFR 1048.130).

Failing to follow these instructions when installing a certified engine violates federal law (40CFR 1068.105(b)), subject to fines or other penalties as described in the Clean Air Act.

This engine is certified to be used in constant speed only mobile or stationary equipment applications. Do not install this engine for use in any variable speed applications!

This industrial engine comes fully equipped and certified with a complete emissions control system which includes the fuel system, sensors and actuators, a fully integrated engine management system, and an exhaust after treatment system including a three-way catalyst. When this industrial engine is correctly installed by an Original Equipment Manufacturer (OEM), it will meet or exceed the 2007 Tier 3 Emission Standards for Large Spark Ignited (LSI) engines established by the US Environmental Protection Agency (EPA) and the California Air Resources Board (CARB). This engine has been certified to the following exhaust emission standards, including appropriate deterioration factors, over the regulated useful lifetime of seven (7) years or 5000 hours, whichever occurs first:

HC+NOx: 2.7 g/kW-hr
CO: 4.4 g/kW-hr

Emissions compliance throughout the useful lifetime requires proper engine maintenance. Please refer to the maintenance schedule in the service manual for details.

NOTICE OF IMPORTANT REQUIREMENTS OF CERTIFIED ENGINES

Important Notice- The required Emissions Control Information label has been placed on this certified engine during Bucks assembly process. If you install the engine is away the makes the engine's emission control information label hard to read during normal engine maintenance, you must place a duplicate label on the equipment, as described in the Code of Federal Regulations (40CFR 1068.105).

Important Notice- This engine uses a crankcase recirculation system that routes all crankcase gasses back to the engine intake air system. The EPA and CARB require every certified industrial engine to have a closed crankcase and no crankcase emissions may be vented to the atmosphere as described in the Code of Federal Regulations (40CFR 1048.115). Please refer to the Intake Air System section included in these instructions for details.

Important Notice- To meet EPA exhaust emissions field testing requirements it is important that the OEM design the exhaust system so that a 20-centimeter extension can be temporarily installed on the equipment's exhaust outlet. The extension is required in order to prevent dilution of the exhaust sample with ambient air during the exhaust emissions test.

Important Notice- The EPA and CARB require that Bucks Engines warranty all emissions related components for part of the engines full useful lifetime as defined in 40CFR Part 1048.120. Please refer to the Emissions Related Warranty Statement included in the sale of all new engines for further details. Warranty for non-critical emissions components will be as defined in the individual purchase agreement.

SYSTEM OVERVIEW

This engine comes equipped with a PG-08 electronic control system. It provides accurate, reliable, and durable control of fuel, spark, and air over the service life of the engine in the extreme operating environment found in heavy-duty, under hood, on-engine electronic controls.

PG-08 is a closed loop system utilizing a catalytic muffler to reduce the emission level in the exhaust gas. In order to obtain maximum effect from the catalyst, an accurate control of the air fuel ratio is required. A small engine control module (SECM) uses two heated exhaust gas oxygen sensors (HEGO) in the exhaust system to monitor exhaust gas content. One HEGO is installed in front of the catalytic muffler and one is installed after the catalytic muffler.

The fuel control logic employs a closed-loop exhaust gas oxygen control algorithm in order to compensate for fuel system tolerances, aging, altitude, and fuel composition. The algorithm utilizes dual heated exhaust gas oxygen (HEGO) sensors with an output that switches high and low at stoichiometry. When operated on Natural Gas, the control logic compensates for variations in fuel temperature as measured at the mixer inlet.

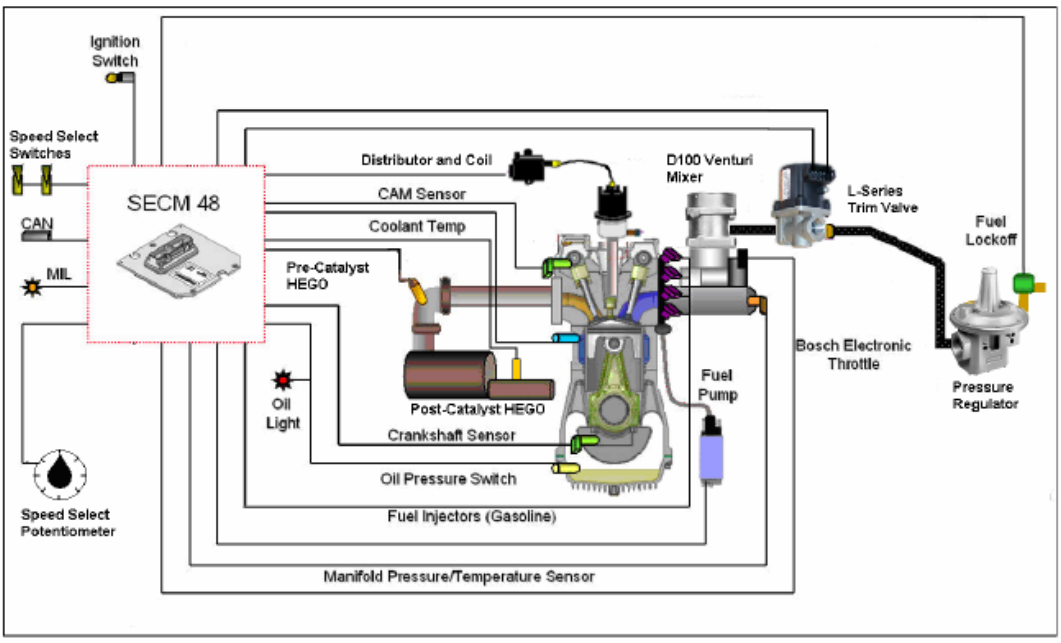


Figure 1- PG-08 Fuel System Engine in Certified Engines

To calculate any necessary corrections to the air fuel ratio, the SECM uses a number of different sensors to gain information about the engine's performance. Engine speed is monitored by the SECM through a variable reluctance (VR) or Hall Effect sensor. Intake manifold air temperature and absolute pressure are monitored with a TMAP sensor. PG-08 is a drive-by-wire (DBW) system connecting the accelerator pedal to the electronic throttle through the electrical harness; mechanical cables are not used. A throttle position sensor (TPS) monitors throttle position in relation to the accelerator pedal position sensor (APP) command. Even engine coolant temperature and adequate oil pressure are monitored by the SECM. The SECM controller has full adaptive learning capabilities, allowing it to adapt control function as operating conditions change. Factors such as ambient temperature, fuel variations, ignition component wear, clogged air filter, and other operating variables are compensated.

BATTERY SETUP

1. Engine Electrical System is 12 volt D.C. Negative Ground

2. Engine Battery Should be 650CCA or Greater. Never disconnect battery when running. A good battery should be attached to the engine at all times.

3. Connect positive (+) red wire to positive (+) terminal on battery

4. Connect negative (-) black wire to negative (-) terminal on battery.

INTAKE AIR SYSTEM

The intake system should be sealed between the mixer inlet and the filter. Proper clamps should be used to ensure unfiltered air is not drawn into the system. Use piping with minimum diameter equal to mixer inlet. When in an enclosure it can sometimes be necessary to use an externally mounted filter. It can be beneficial to engine life and performance to draw in air from the coolest location possible.

A fresh air inlet to the crank case should be plumbed in to ensure proper use of the PCV system. This tube should be attached to the intake system before the

air enters the mixer but after the air has been filtered. The PCV valve itself should be routed directly to the intake manifold.

NATURAL GAS FUEL SYSTEM

Natural gas fuel requires minimum 55% methane. Energy content should be 800 to 1400 BTU per cubic foot. Buck's recommends a natural gas fuel filter at the inlet. Maximum allowable H2S is 55ppm.

The mixer should be mounted vertically onto throttle body adapter and air hose for connection to air cleaner should be routed smoothly. Fuel fittings between mixer and regulator should be used with no reduction of fuel flow area and no more than one single 90 degree fitting.

Figure 2- Mixer

SECM

The SECM should be mounted with the rubber to protect from vibration. Figure 7 illustrates typical SECM mounting bracket that is used to mount the SECM to the truck. The SECM is bolted to the mounting bracket with rubber shock mounts to withstand vibration from the engine. This bracket is then mounted directly to the truck chassis, in a location normally under the intake manifold. Figure 8 shows the shock mount hardware.

- Insert the rubber grommet into the SECM flange
- Insert the aluminum-mounting guide into the grommet
- Place a flat washer on top of the grommet then insert the bolt and tighten to the mounting bracket using specified torque values. (9~11N.m)

Figure 7- SECM

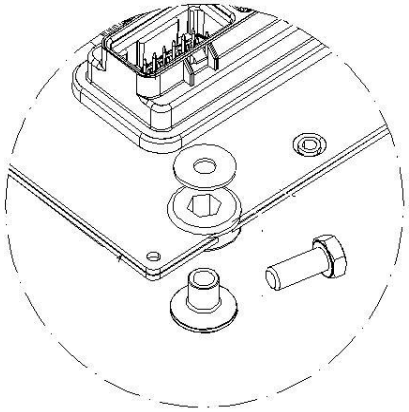


Figure 8- SECM mounting hardware

PRE-CATALYST OXYGEN SENSOR

Apply an adequate amount of anti-seize compound to the threads of the oxygen sensor and install the sensor in the O2 sensor bung located on the exhaust manifold adapter. Tighten the sensor to the specified torque value. (45~55Nm) See Figure 9.

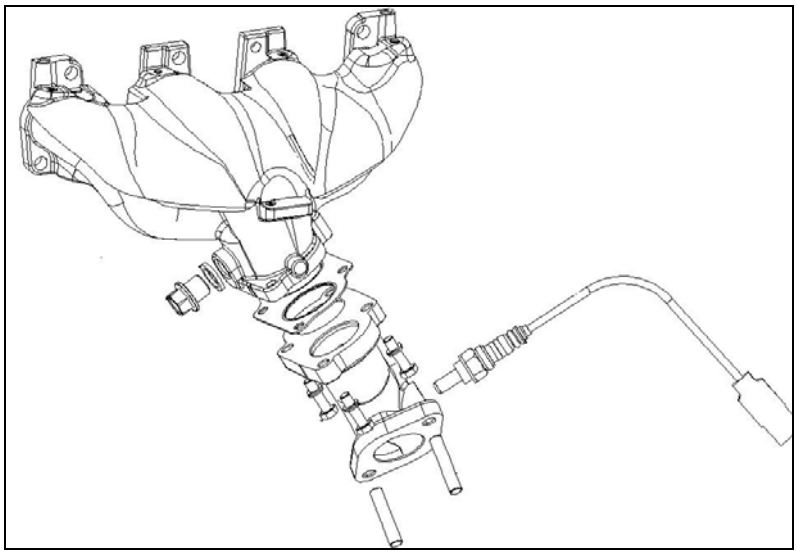


Figure 9- Oxygen Sensor

POST-CATALYST OXYGEN SENSOR

In general, the sensor installation point must be tested sufficiently by the customer for function and durability. There shall be no possibility of exhaust leaks upstream of the sensor as exhaust pulsations can draw in ambient air, leading to erroneous measurements.

Installation in the exhaust line must be at a point guaranteeing representative exhaust gas composition whilst also satisfying the specified temperature limits. The active sensor ceramic element is heated up quickly. This means that the sensor installation location must be selected to minimize exhaust-side stressing with condensation water in order to prevent ceramic element crack.

Design measures:

- Locate sensor as close to the catalytic converter outlet as possible, without exceeding max. allowed temperature range
- Attempt to achieve rapid heating-up of the exhaust pipes in the area in front of the sensor.
- The exhaust pipe in front of the sensor should not contain any pockets, projections, protrudings or edges etc to avoid accumulation of condensation water. A downside slope of the pipe is recommended.
- The use of a sensor type with double protection tube can give a better protection of the sensor ceramic against condensation water drops. In this case make sure, that the front hole of the double protection tube does not point against exhaust gas stream.

System measures:

- Never switch on sensor heating before engine starting.
- Delayed switch-on or power control of the sensor heater (e.g. as a function of engine and ambient temperature), so that the max. allowed ceramic temperature is not exceeded as long as there is condensation water present.

Installation angle should be inclined at least 10° towards horizontal (electrical connection upwards). Thus preventing the collection of liquids between sensor housing and sensor element during the cold start phase. Other installation angles must be inspected and tested individually.

Avoid inadmissible heating up of the sensor cable grommet, particularly when the engine has been switched off after running under max. load conditions.

The use of cleaning/greasing fluids or evaporating solids at the sensor plug connec- tion is not permitted.

Assemble with high temperature resistant grease on the screw-in thread. Tightening torque: 40-60 Nm, material characteristics and strength of the thread must be appropriate. Recommended material for the thread boss in the exhaust pipe is Temperature resistant stainless ferritic steel, e.g. X 5 CrNi 18 9, DIN 17440 1.4301 or 1.4303 or SAE 30304 or SAE 30305 (US standard)

As far as possible, the sensor's protection tube is to protrude completely into the exhaust-gas flow. The protection-tube crimping welding area is not to be subjected to the flow of hot exhaust gas, but is to be protected by using a slightly protruding counter-thread. Thread boss dimensions should be as shown in figure 10, note that sensor thread must be covered completely.

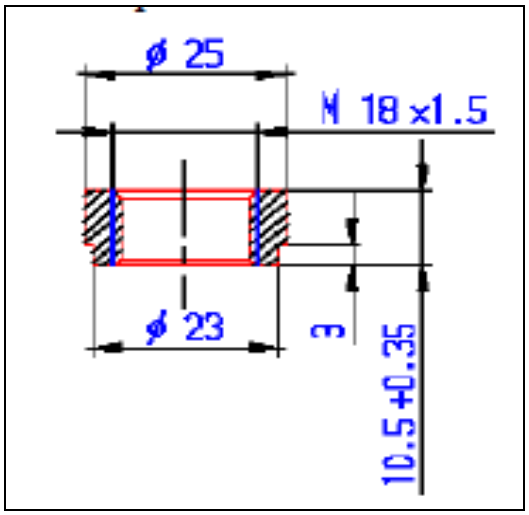


Figure 9- Sensor thread boss dimensions

There is to be no possibility of the sensor protection tube contacting the opposite side of the exhaust pipe. A waterproof electrical connectors version is required.

The sensor must be covered when underseal (wax, tar, paint etc.) or spray oil is applied to the vehicle. The influence of contamination which enters the exhaust gas through the intake air or as a result of fuel, oil, sealing materials etc., and thus reaches the sensor is application specific and must be determined by customer tests.

The sensor must not be exposed to strong mechanical shocks (e.g. while the sensor is installed). Otherwise the sensor element may crack without visible damage at the sensor housing.

For physical reasons the sensor needs ambient air at its reference gas side. Replacement of the air volume inside the sensor must be guaranteed by a sufficient air permeability of the wires and the connectors between sensor and ECU. The breathability should be higher than 1 ml/minute at a test pressure of 100mbar.

Underfloor installation of the sensor remote from the engine requires an additional check of the following points:

- positioning of the sensor with respect to stone impact hazard
- positioning and fixing of cable and connector with respect to mechanical damage, cable bending stress and thermal stress.

The sensor cable must be routed so, that it is free of bends, mechanical tension, and chafing points. Consider the movement of the exhaust system in relation to the vehicle body. The cable and connector should not be subjected to excessive temperatures that could cause damage.

Additional instructions for the installation downstream of the catalytic converter

- Between catalyst and sensor location absolute gas tightness of the exhaust system must be ensured.
- When the sensor is installed in the exhaust pipe there should be no disconnectable connections between catalytic converter and sensor (e.g. flange, clamp-screw joint).
- In order to protect the active sensor ceramic against condensation water from the exhaust gas side the sensor heater voltage must be power controlled after cold start of the engine. During the condensation water phase the ceramic temperature should be kept at approx. 150°C-300°C. The corresponding control parameter must be determined according to application.
- The sensor should be mounted as close to the outlet of the catalytic converter as possible without exceeding sensor maximum temperatures.
- The sensor should be mounted as far from the exhaust pipe outlet as possible to avoid dilution from ambient air. Minimum distance between sensor and exhaust outlet should be 400 mm.

CATALYTIC MUFFLER

A very important component in a low emission engine is the catalytic converter. Bucks Engines use a “three-way” catalytic converter. For this type of catalytic converter to work properly, the following two criteria must be met:

1.) The air-to-fuel ratio must oscillate between rich and lean.
2.) The catalyst substrate (also known as a “brick,” located inside the converter shell) must be kept hot.

Mounting the catalytic converter in the proper location will control the substrate temperature. To quickly heat up the catalyst and to ensure an effective operating temperature, the center of the substrate must be located a minimum of 27 inches and a maximum of 70 inches downstream of the exhaust manifold flange. 2 inch diameter pipe should be used before the catalyst. This measurement is made along the length of the exhaust pipe and must take all bends and curves into consideration. Figure 3 depicts an example catalytic converter setup.

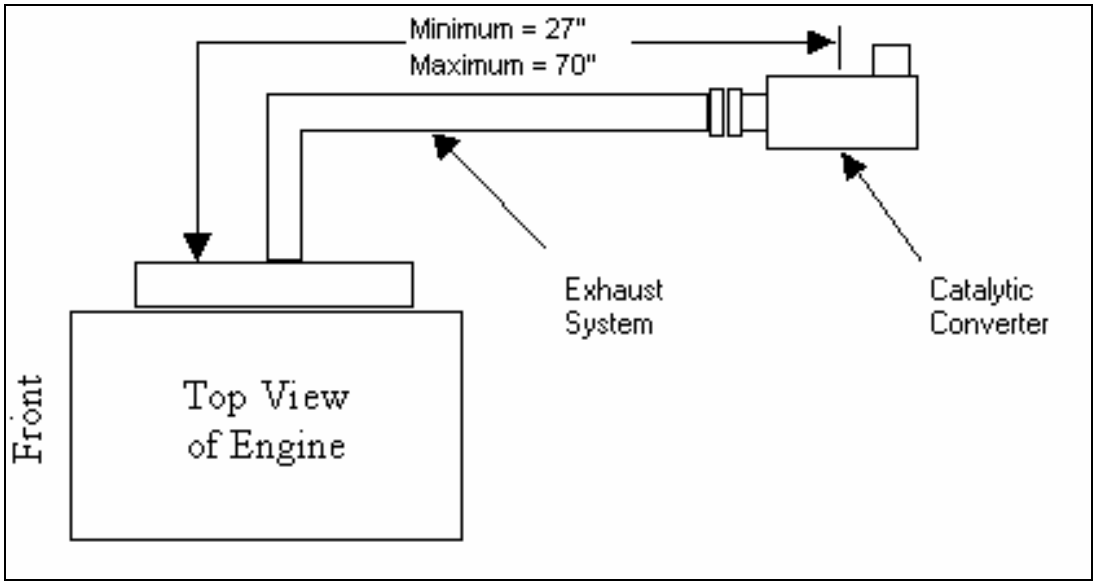


Figure 10- Catalytic converter mounting

NOTE: Bucks suggests that the pipe between the catalyst and muffler or the pipe after the catalyst muffler is made of 409 stainless steel or equivalent material that will last for the engine's useful life (5000 hours or 7 years, whichever comes first). This pipe must be supplied and

warranted by the OEM. Be aware that the catalyst internal temperatures may exceed 1600 degrees F. All joints must be leak free throughout the useful life of the engine. Use good engineering judgment when designing the exhaust system for your equipment.

Because the catalyst can reach excessive temperatures during normal operation, care should be taken during the installation. Do not install catalyst near flammable material. Protect equipment components with heat shielding. Install catalyst in an open area with good air circulation.

MALFUNTION INDICATOR LIGHT (MIL)

This certified engine includes on board diagnostic systems designed to detect system malfunctions and illuminate a malfunction indicator light (MIL). The illumination of the MIL indicates the engine control system is measuring conditions that may cause the not to operate properly or cause damage to the engine. MI-07 systems are equipped with built-in fault diagnostics. Detected system faults can be displayed by the Malfunction Indicator Lamp (MIL) as Diagnostic Fault Codes (DFC) or flash codes, and viewed in detail with the use of the Service Tool software. When the ignition key is turned on, the MIL will illuminate and remain on until the engine is started. Once the engine is started, the MIL lamp will go out unless one or more fault conditions are present. If a detected fault condition exists, the fault or faults will be stored in the memory of the small engine control module (SECM). Once an active fault occurs the MIL will illuminate and remain ON. This signals the operator that a fault has been detected by the SECM.

ADJUSTABLE PARAMETERS ON NON-COMMERCIAL FUELS

This engine has been certified by the US EPA to be operated on pipeline quality commercial Natural Gas fuels as well as non-commercial Natural gas fuels including Well Head Natural Gas.

Bucks Engines has performed extensive testing and has developed fuel mixture adjustments for the use of non-commercial natural gas. Several parameters are adjustable to compensate for changes in fuel energy content.

WARNING: ADJUSTMENTS MADE TO THE FUEL DELIVERY SYSTEM WILL INFLUENCE THE TAILPIPE EXHAUST EMISSIONS. IT IS THE OWNER/OPERATOR'S RESPONSIBILITY TO TEST THE SPECIFIC FUEL TYPE AT EACH SITE OFINSTALLATION AND DETERMINE HE CORRECT FUEL SYSTEM SETTINGS.

THIS ENGINE IS CERTIFIED TO OPERATE IN APPLICATIONS USING NONCOMMERCIAL FUEL. MALADJUSTMENT OF THE ENGINE IS A VIOLATION OF FEDERAL LAW SUBJECT TO CIVIL PENALTY.

Fuel Pressure

Fuel pressure can be increased or decreased with the fuel pressure regulator. Unscrew the cap from the top of the regulator. A large plastic screw inside will allow adjustment of the fuel pressure. Fuel pressure should be adjusted near 50% speed/load.

FUEL PRESSURE SETUP

1. Verify that the natural gas supply pressure from the "main" to the Maxitrol R600S regulator is in the range of 10-15 inH_20 referenced to atmosphere.
2. Check the power valve on carburetor and verify that it is at the widest open (full rich) position prior to installing the carburetor on the engine.
3. Verify that there are no fuel leaks prior to starting the engine. Prepare to start the engine.

4. Operating the engine on natural gas fuel, start the engine and permit the engine to warm up until the coolant temperature (ECT on Mototune display) is approximately 167°F (75°C).
5. While the engine is idling, disconnect both dither valves by removing the electrical connectors. This may set an error code, but the system will operate only temporarily in this condition.
6. For an initial setpoint, adjust the Maxitrol R600S regulator output pressure per the guidelines in **Table A-1 or A-2** below. If the outlet pressure is not at the proper setpoint, remove the threaded plug from the top of the regulator and turn the adjuster screw. Turning the screw *in* raises the output pressure, turning the screw *out* reduces the outlet pressure. If you do not know the general fuel quality, start with 3 inH_20 outlet pressure.
7. Place the spring cap and gasket back on the top of the regulator. If these are not sealed properly, it can cause operating problems.
8. Plug in the dither valves before continuing adjustment procedure.

TABLE A-1 GM 3.0L
FUEL QUALITY vs NATURAL GAS REGULATOR OUTLET SETTINGS

FUEL QUALITY	R600S REGULATOR INLET PRESSURE	R600S INITIAL REGULATOR OUTLET PRESSURE SETTING.
1400 BTU/cuft	15 inH_20	-0.25” ± 0.25 inH_20
1200 BTU/cuft	15 inH_20	1.0” ± 0.25 inH_20
1000 BTU/cuft	15 inH_20	3” ± 0.25 inH_20
900 BTU/cuft	15 inH_20	4” ± 0.25 inH_20
800 BTU/cuft	15 inH_20	5.9” ± 0.25 inH_20

TABLE A-2 GM 5.7L AND 4.3L
FUEL QUALITY vs NATURAL GAS REGULATOR OUTLET SETTINGS

FUEL QUALITY	R600S REGULATOR INLET PRESSURE	R600S INITIAL REGULATOR OUTLET PRESSURE SETTING.
1400 BTU/cuft	15 inH_20	1.0” ± 0.25 inH_20
1200 BTU/cuft	15 inH_20	1.0” ± 0.25 inH_20
1000 BTU/cuft	15 inH_20	3.0” ± 0.25 inH_20
900 BTU/cuft	15 inH_20	4.0” ± 0.25 inH_20
800 BTU/cuft	15 inH_20	6.0” ± 0.25 inH_20

9. Start the laptop computer and open the Mototune display. Go to the screen and clear the dither valve fault.
10. Next, observe the Mototune Service Tool to monitor Duty Cycle % on the Mototune display. The dither valves should be operating with a duty cycle of 30-50% nominal.
11. If the duty cycle is not between 30-50%, and the engine is not operating at or near Phi=1, the idle screw will need adjustment. (See *Idle Mixture Adjustment* section below.)

12. Stop the engine if this is the only procedure performed, or leave the engine running and continue onwards.
13.

Idle Mixture Adjustment

Idle mixture adjustment can be made using the idle screw. It is located on the side of the mixer and is marked “IDLE”. Turning it to the right richens the mixture at and around idle speed. Settings should be made at idle.

Table B-1 GM 3.0L and GM 4.3L Recommended Adjustment Starting Point Settings Idle Mixture Adjustment Non-Commercial Grade Fuel

GAS BTU	Turns Out
1400	5.0 – 6.0
1200	5.0 - 6.0
1000	4.0 - 4.5
800	1.0 - 2.0

Table B-2 GM 5.7L Recommended Adjustment Starting Point Settings Idle Mixture Adjustment Non-Commercial Grade Fuel

GAS BTU	Turns Out
1400	3.5 - 4.5
1200	3.0 - 4.0
1000	4.0 - 5.0
800	1.5 - 2.5

The CA225 mixer requires adjustment of the idle mixture screw to assure optimal emissions and performance. This adjustment accounts for minor part-to-part variations in the fuel system and assures stable performance of the engine at idle. Reference **Table B-1 or B-2** for initial starting set points, you will need the MotoService Tool Display for final adjustment.

When using *non-commercial grade fuel* the idle mixture adjustment screw does not need to be tamper-proofed and will require adjustment whenever the fuel composition is changed.

When adjusting the idle mixture, follow the procedures below.

1. After installing a new mixer, operate the engine on natural gas fuel. Start the engine and permit the engine to warm up until the coolant temperature (ECT on Mototune display) is approximately 167°F (75^{o} C).
2. Operate the engine at no load.
3. Mototune display parameter Gaseous Fuel Control must display “Closed Loop.”
4. Use the Mototune Service Tool to monitor Duty Cycle % on the Mototune display.
5. To adjust the idle mixture screw, use a standard screwdriver. Turning the screw in (clockwise) should increase the duty cycle; turning the screw out (counter-clockwise) should decrease the duty cycle.
6. Adjust the idle mixture screw on the mixer until a reading of **40-45%** is reached for the FTV Duty Cycle in Closed Loop Idle. If engine idle performance is unstable, screw the idle screw in slightly to see if stability is obtained, but in no case should duty cycle exceed 60%.

7. Increase RPM above idle momentarily (*rev the engine*) then return to idle RPM. The duty cycle setting should remain within the adjustment range (**40-45%**).
8. If the FTV duty cycle reading is above **45%** adjust the idle adjustment screw outward and re-check the duty cycle reading. Continue to do this until the FTV duty cycle reading is within the optimum range (**40-45%**). A duty cycle measurement at Closed Loop Idle of **30-60%** is acceptable if the optimum range of **40-45%** cannot be reached through adjustment. If the FTV duty cycle cannot be adjusted below **60%**, the mixer is faulty and should be replaced.
9. Turn the ignition key to the **OFF** position to shut down the engine.

Air Fuel Mixture Power Valve

The mixture of air to fuel can be adjusted on the mixer. Below the fuel inlet on the mixer is an adjustable knob labeled “R” for rich and “L” for lean. The power valve should only be adjusted under a minimum 50% load factor and should only be used as a coarse adjustment of the fuel system.

Table C-1 GM 3.0L - Recommended Adjustment Settings
Non-Commercial Grade Fuel

GAS BTU	IDLE FUEL PRESSURE	POWER VALVE SETTING
1400	0.0" w.c.	100 %
1200	1.1" w.c.	100%
1000	3.0" w.c.	75-100%
800	5.8" w.c.	100%

Table C-2 GM 4.3L - Recommended Adjustment Settings
Non-Commercial Grade Fuel

GAS BTU	IDLE FUEL PRESSURE	POWER VALVE SETTING
1400	1.0" w.c.	50 %
1200	1.0" w.c.	100%
1000	3.0" w.c.	100%
800	6.0" w.c.	100%

Table C-3 GM 5.7L - Recommended Adjustment Settings
Non-Commercial Grade Fuel

GAS BTU	IDLE FUEL PRESSURE	POWER VALVE SETTING
1400	1.0" w.c.	100 %
1200	1.0" w.c.	100%
1000	3.0" w.c.	100%
800	6.0" w.c.	100%

Adjustments to power valve should be made after the fuel pressure and idle air settings have been set and should be adjusted until dither valve duty cycle is near 45%.

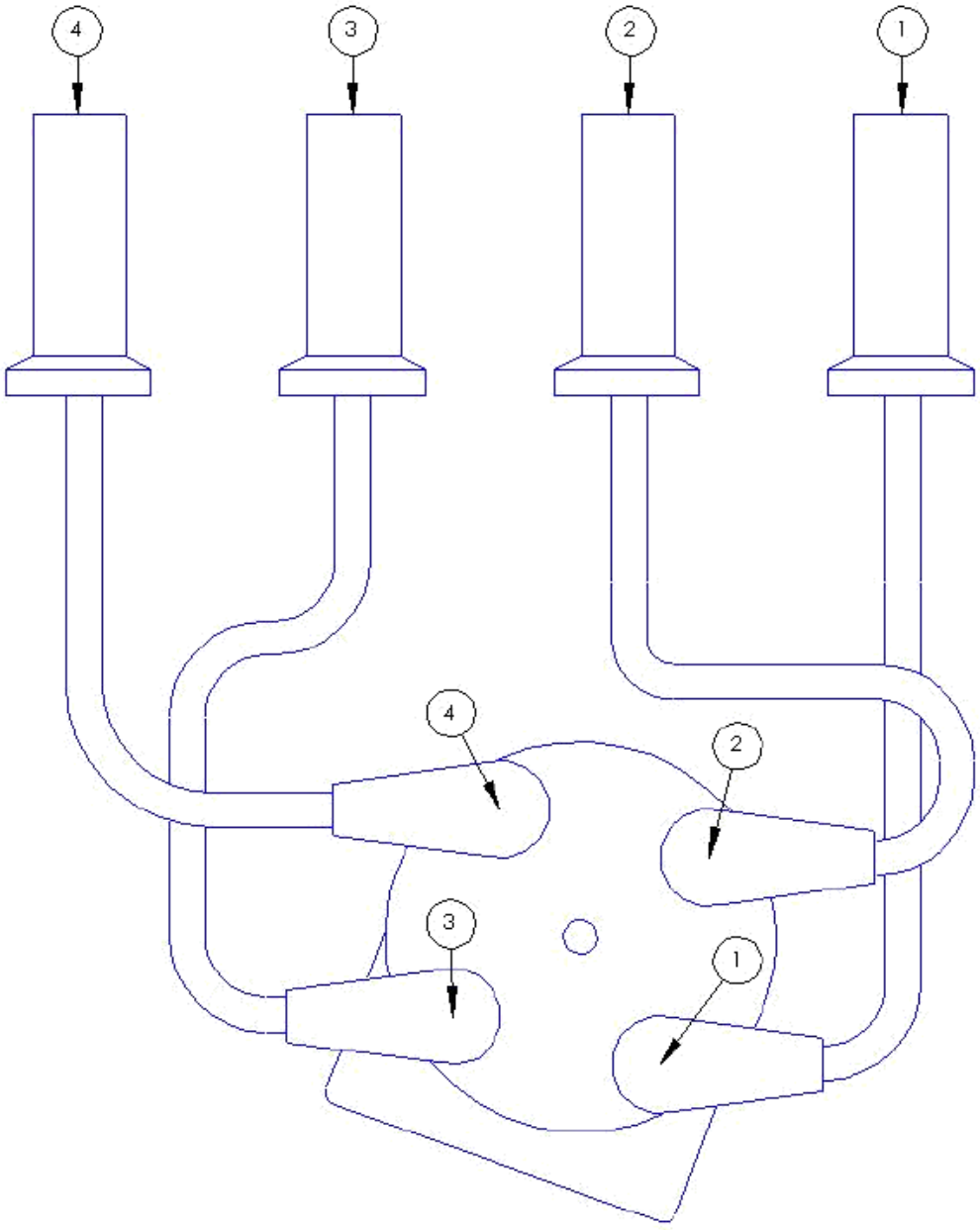
Loaded Operation, High Power System Check

Now that the basic fuel pressure is set and the engine is running stable, the high power loaded operation should be checked. In general, the power valve setting should be adjusted wide open and not changed. If there is a problem with fuel control, a combination of power valve adjustment and fuel pressure adjustment can be used to bring the system into stable operation and closed loop control. The engine will need to be loaded to check the operation at higher power. If the engine cannot be loaded, the only place the power valve should be set is wide open.

1. Start the engine and bring it up to normal operating temperature and closed loop operation. Make sure the fuel pressure gauge is connected to the regulator fuel outlet.
2. Open the Mototune display and inspect parameter Gaseous Fuel Control must display “Closed Loop”.
3. Use the Mototune service tool to monitor Duty Cycle %, closed loop status and equivalence ratio on the Mototune display.
4. Load engine to a mid-load point at the rated rpm. Usually an applied load that achieves a manifold pressure of 55-65 kPa is sufficient for the mid-load operating point.
5. Inspect the Mototune display to verify that the engine is operating within 5% of stoich (0.9 < phi < 1.10) and that the FTV duty cycle is within the range of **40-45%.** If it is not, verify fuel pressure and power valve setting. If the regulator outlet fuel pressure is operating within the guidelines in **Table A** and the engine is outside the duty cycle window of 30-60%, the fuel pressure will need to be adjusted. Verify the power valve is full open before any adjustments are made.
6. If the duty cycle is below the 30% duty cycle threshold, it needs more fuel supply pressure. To increase the fuel pressure, remove the threaded cap on the R600S regulator and screw the spring stop *in* (clockwise) to raise the fuel pressure. Do not bottom out the spring. Observe the fuel pressure and FTV duty cycle while performing this operation. Keep raising the fuel pressure until the FTV duty cycle is > 35%.

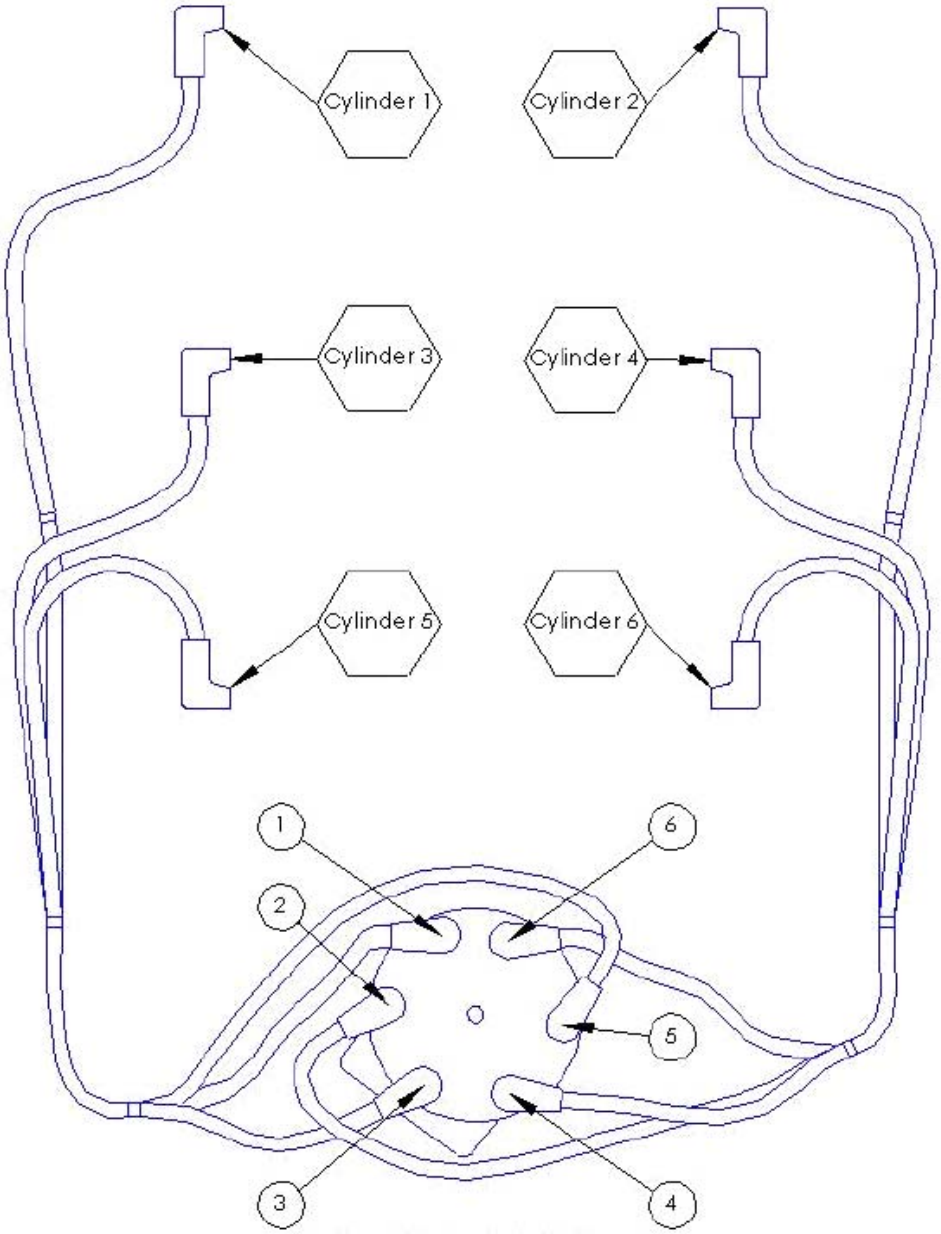
7. If the duty cycle is above the 60% duty cycle threshold, it needs less fuel supply pressure. To reduce the fuel pressure, remove the threaded cap on the R600S regulator and screw the spring stop *out* (counterclockwise) to reduce the fuel pressure. Do not let the spring and screw stop fall out of the regulator. Observe the fuel pressure and FTV duty cycle while performing this operation. Keep lowering the fuel pressure until the FTV duty cycle is < 55%.
8. If the fuel pressure has been adjusted in Step 7 above, a recheck of the idle screw position should be performed. Repeat Steps 1-9 in the Idle Mixture Adjustment section if the fuel pressure has been reset.
9. The last step is a check at full rated power or as close to full load as the test setup can reproduce this condition. Typically, the full power test should be performed with a manifold pressure of 75 kPa or greater. Repeat Steps 1-7 above.
10. At no time during the adjustment procedure is it recommended that the engine be run at extremely rich or lean points during the adjustment procedure. It there is a problem, shut the engine down and find out the cause of the condition. Fix the condition before continuing the adjustment procedure.
11. If the FTV cannot be brought into adjustment by altering the fuel pressure, the power valve may be used as a “Coarse” adjustment see **Table C-1, C-2, or C-3** above. It is recommended that the fuel pressure be altered first before the power valve is used. The power valve will not help if the engine is operating lean. Opening the power valve richens the engine, closing the power valve leans the engine out.
12. Turn the ignition key to the OFF position to shut down the engine.
13. If the mixer cannot be adjusted within these guidelines, please contact Buck’s Engines technical service for advice.

3.0L Engine Spark Plug Wire Routing Diagram



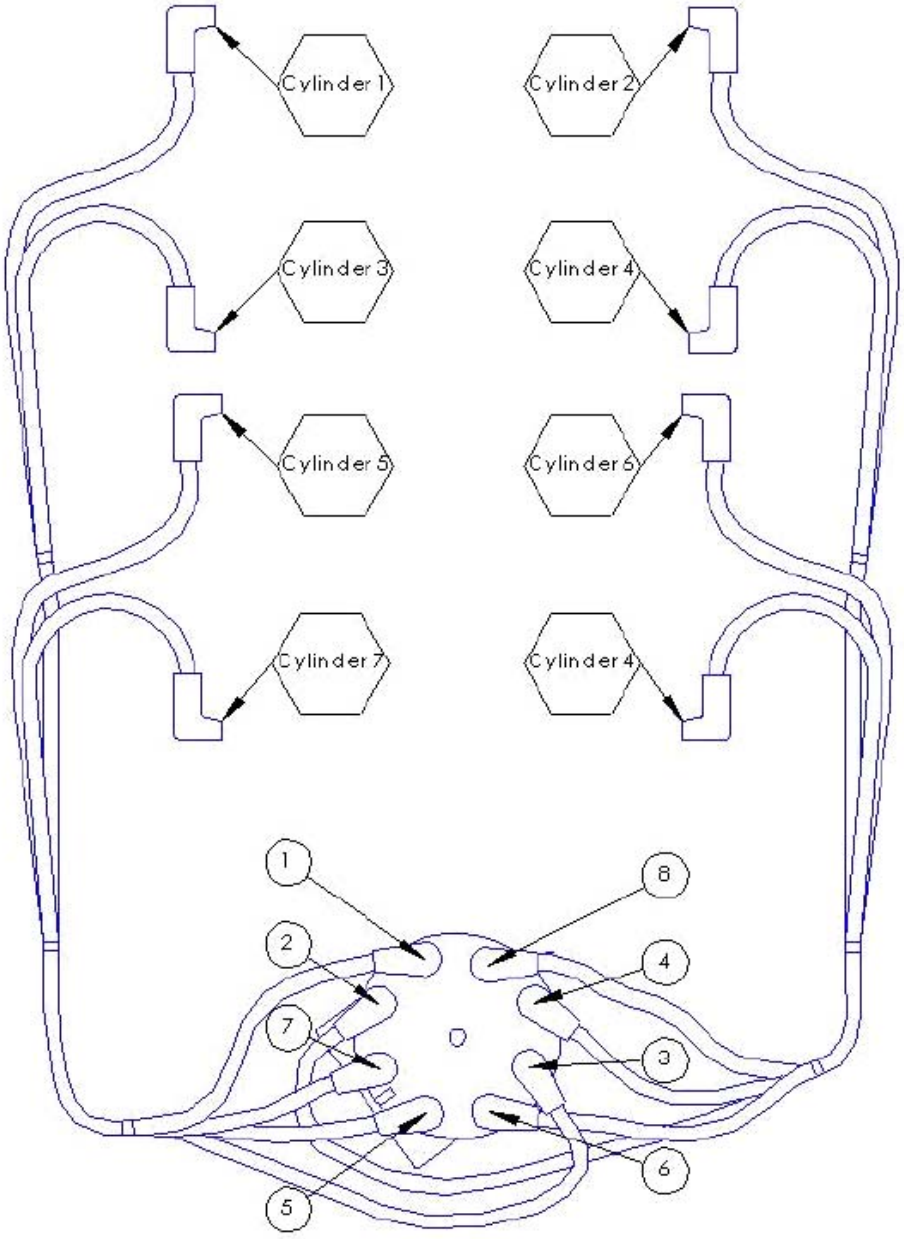
Firing Order: 1-3-4-2

4.3L Spark Plug Wire Routing Diagram



Firing Order: 1-6-5-4-3-2

5.7L Engine Spark Plug Wire Routing Diagram



Firing Order: 1-8-4-3-6-5-7-2