GM Fuel System Startup/Setup Guide

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GM_Fuel_System_Guide_02-08

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This Fuel System Setup guide provides general instructions for setting up the Fuel System on a General Motors (GM) gaseous genset. It is essential that every person who works on or with the generator set be completely familiar with the contents of this manual, and that he/she carefully follows the instructions contained herein.

Each installation may require some modification of the suggested guidelines in this manual. Installations must be consistent with locally applicable standards and take into consideration safety guidelines and measures.

Following this guide will result in an efficient and reliable fuel setup for the genset. Carefully follow all procedures and safety precautions to ensure proper equipment operation and to avoid bodily injury. Read and follow the Safety Precautions section at the beginning of this manual.

IMPORTANT

Information in this publication represents data available at the time of print. MTU Onsite Energy reserves the right to change this publication and the products represented without notice and without any obligation or liability whatsoever.

All instructions and diagrams have been checked for accuracy and simplicity of application. However, the skills of the technician are most important. MTU Onsite Energy does not guarantee the result of any setup contained in this manual. Nor can MTU Onsite Energy assume responsibility for any injury or damage to property. Persons engaging in setup do so entirely at their own risk.

Figures

The following is a list of all figures contained in this manual.

Safety Precautions

IMPORTANT SAFETY INSTRUCTIONS

Electromechanical equipment, including generator sets, transfer switches, switchgear, and accessories, can cause bodily harm and pose life-threatening danger when improperly installed, operated, or maintained.

Dangers, Warnings and Cautions are used in this manual to alert the operator to special instructions concerning a particular procedure that may be hazardous if performed incorrectly. These safety alerts alone can not eliminate the hazards that they signal. Strict compliance to these special instructions and common sense operation are major accident prevention measures. Observe all warnings found on the equipment. Ensure that warning labels are legible and not obstructed by dirt, grease or other equipment. MTU Onsite Energy can not anticipate every possible circumstance that might involve a hazard. The warnings in this manual and on tags and decals affixed to equipment are, therefore, not all inclusive.

DANGER

Danger indicates the presence of a hazard that <u>will</u> cause severe personal injury, death, or substantial property damage.

WARNING

Warning indicates the presence of a hazard that <u>can</u> cause severe personal injury, death, or substantial property damage.

CAUTION

Caution indicates the presence of a hazard that <u>will or can</u> cause minor personal injury or property damage.

This symbol signifies high voltage.

The following safety rules should be strictly complied with:

FIRE HAZARD

Keep fire extinguishers in accessible locations. Use appropriate fire extinguishers as recommended by NFPA.

Remove all unnecessary grease and oil from the unit. Accumulated grease and oil can cause overheating and engine damage, which present a potential fire hazard.

When an open bottom base is used, the stationary engine generator assembly is to be installed over noncombustible materials. It should be located such that it prevents combustible materials or loose debris from accumulating under or inside the generator set.

Do not service the engine when any ignition source such as an open flame is present. "DANGER" signs must be placed to warn of the fire hazard. No work may be performed on the engine involving an ignition source such as open flames, cutting, welding, or grinding.

A fire extinguisher (dry chemical or carbon dioxide, CO2) must be immediately available to the mechanics while working. When liquefied or natural gas leaks or escapes, it can result in dangerous accumulations of gas, which might cause a serious flash or explosion. Careful ventilation of the area is mandatory in the event of a fuel leak.

FUEL SYSTEM

Gaseous, Natural Gas and Liquid Propane Gas are extremely flammable and vapors are EXPLOSIVE. Comply with all laws regulating the storage and handling of these fuels. Check for leaks frequently and correct such leakage immediately.

Do not smoke or use open flame at any time when fuel is being handled. Fuel vapors are both toxic and flammable.

Liquid petroleum gas (LPG) systems operate at tank pressures around 100 psi or above. The tank pressures are regulated down. Vaporized LPG systems operate at pressures near 6 oz., as do most natural gas systems.

Safety precautions when handling liquefied petroleum gas cannot be over-emphasized. There are state, county and city codes, and fire regulations covering the handling and storage of liquefied petroleum gas or natural gas. In addition to the safety suggestions in this manual, all local codes and fire regulations on this subject must be followed explicitly. Where local codes are more stringent than the suggestions in this manual, the local codes must be given priority.

Before proceeding with any engine service work, be certain that all switches are in the OFF position; disconnect battery ground cable, remove fuses in DC systems and turn off the battery charger. These safety suggestions apply to service of any engine using liquefied petroleum gas or natural gas fuel

regardless of the work to be performed. When servicing the engine, ensure that there is adequate ventilation. This is to avoid the accumulation of gas/air mixtures in and about the engine caused by undetected leaks.

Any service performed on the fuel system requires that:

- All threaded connections are sealed with proper pipe thread compound. Replace defective fittings and reseal all connections.
- Fuel system is checked for leaks. Leaks are not permissible. Odorants, which are strong smelling components (an odor similar to spoiled cabbage), are added to liquefied petroleum gas as a warning agent to indicate the leakage of even small quantities of gas.
- A soap solution applied with a soft brush will bubble to indicate leaks. Never use an open flame to check for leaks. All leaks must be sealed.
- All flexible fuel connections are checked, metallic and neoprene, with the soap solution.

It is important to remember that all gas fuel systems are pressurized. Be certain that the fuel valves are tightly closed and all fuel has been vented before starting any repair work on the fuel system.

Gaseous Fuel System Setup

GM Natural Gas & LPG Vapor Withdrawal Fuel Systems (3.0L, 4.3L, 5.0L, 5.7L, 8.1L)

GM engines may be fitted with a consistently variable venturi mixer or a fixed mixer system. See Figure 1-1 below.

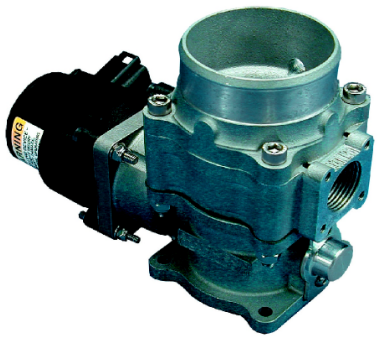


Figure 1-1:
Woodward L-Series with Fixed Venturi Mixer

Systems configured to run on LPV and NG fuel systems use the same fuel mixer.

Both the NG and LPV fuel system types are supplied with a low pressure regulator (LPR). These systems operate on a supply pressure of +7 to +11 inches of water column into the low pressure regulator.

8.1L GM engines equipped with a conventional variable venturi fuel mixer will use a Maxitrol RV series regulator. This regulator will be installed with the spring adjustment tower pointed up for NG fuel engines. For LPV fueled engines, the RV series regulator will be installed with the spring tower pointing down, and will have the spring removed from the spring tower. See Illustrations.

Figure 1-2: Maxitrol RV Series Regulator

GM 8.1L engines are configured in either naturally aspirated (NA) configurations or in turbocharged configurations. GM 8.1L engine configured as NA will use one of two fuel mixers. 8.1L engines rated for 80KW units will use a 225 series fuel mixer. 8.1L engines rated at 100KW or higher will use a 475 series fuel mixer.

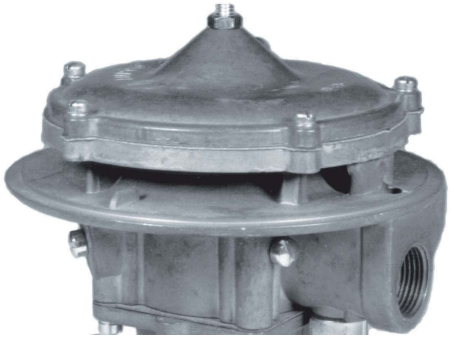


Figure 1-3: 225 Series Mixer

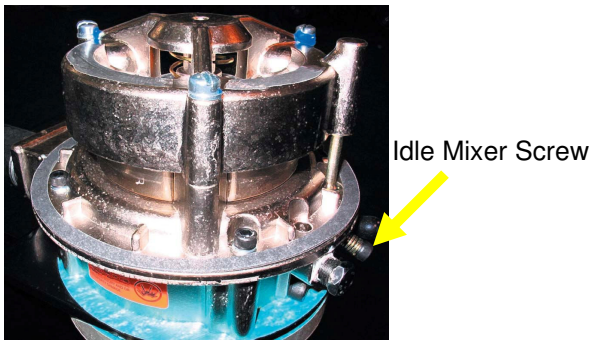


Figure 1-4: 475 Series Mixer

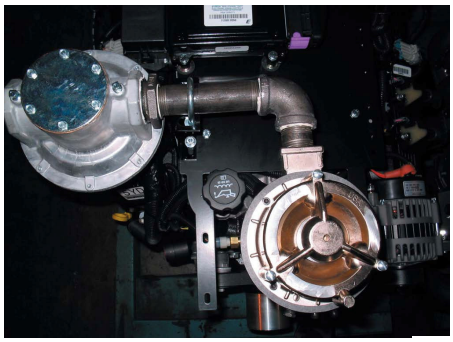


Figure 1-5: 8.1L 100KW-NA with 475 Series Mixer

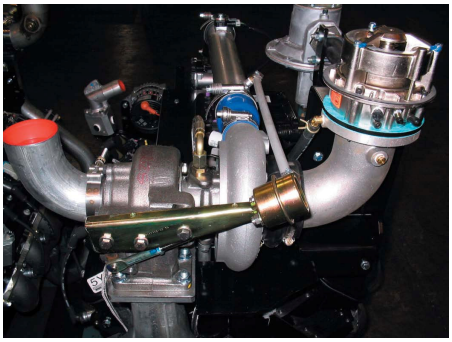


Figure 1-6: 8.1L Turbo – 475 Series Mixer

GM (3.0, 4.3, 5.0, & 5.7L) engines equipped with the Woodward fixed venturi fuel mixer will use a Maxitrol Z Series, or Zero Pressure (ZPR). This regulator will always be installed on the engine with the spring tower pointed up on engines equipped with NG and LPV fuel systems.

Figure 1-7: Maxitrol Z-Series Regulator – Model R600Z

NOTE: All GM engines equipped with NG and LPV fuel systems require that an engine hot test and fuel system setup procedure be performed with load prior to commissioning the engine into service. Proper setup of the engine's fuel system will insure the engine achieves maximum power performance for given conditions. The fuel system setup procedure is provided later on in this section.

GM LPG LIQUID WITHDRAWAL FUEL SYSTEMS (3.0L, 4.3L, 5.0L, 5.7L, 8.1L)

GM engines fitted with LPG liquid withdrawal (LPL) fuel systems will be fitted with an LPG converter regulator assembly. LPL fuel systems must reduce tank pressure to operating pressure while also converting liquid propane to vapor propane. This conversion is accomplished by running engine coolant through the LPL converter regulator assembly to heat and vaporize the liquid propane.

LPL fuel systems differ from LPV fuel systems in that the fuel supply pressure that the converter regulator assembly provides to the mixer is not adjustable. In order to be able to adjust the fuel system properly, LPL fuel mixers are equipped with a power enrichment valve that is adjusted during the fuel system setup procedure. See figures below.

Figure 1-8: LPL Converter Regulator Assembly

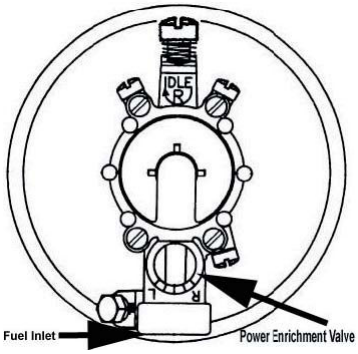


Figure 1-9: Fuel Enrichment Valve on LPL Fuel Mixer

GM NG & LPG FUEL SYSTEM SETUP PROCEDURES

All GM engines equipped with NG or LPG fuel systems must have their fuel systems setup prior to commissioning the engine into service. The following procedures are provided for setting up conventional variable venturi mixer and fixed venturi mixer systems.

The use of a wide range O2 sensor and water column pressure gauges are required to perform these setup procedures. Water column gauges or pressure gauges can be used. A Wide Range O2 Sensor Kit can be ordered from MTU Onsite Energy. The Wide Range O2 Sensor available through MTU Onsite Energy displays lamda and air fuel ratio. The following instructions reference Lamda, as this is a fixed value. The values indicated later are applicable regardless of what fuel system is being set up. This will

eliminate having to modify the Wide Range O2 Meter for Fuel type to display AFR correctly.

Wide Range O2 Sensor Parts (all required):
LM-1 Wide Range O2 Sensor Kit - P/N: 85606
Heat Sink Bung Extender - P/N: 85607

Figure 1-10: Pressure Gauge

Figure 1-11: 02 Meter

LM-1 Wide Range O2 Sensor Quick Start Guide

1. Verify that the included 9V battery is installed in the battery compartment on the bottom of the LM-1. The cover is located on the back of the unit. Install, if necessary.
2. Connect the power cable to the 12V power connector and connect the other end to the battery. Note that the 9V battery is for powering the LM-1 electronics and display, but it cannot power the oxygen sensor. You must have a 12V power supply available to power the oxygen sensor.
3. Do not connect the oxygen sensor yet.
4. Switch the meter on.

When connected to 12V power, the display will show:

Error 02 Heater open

When NOT connected to 12V power, the display will show:

No Sensor Power Connect 12V PWR

When receiving the 'No Sensor Power' message, verify good battery connection until the display shows 'Error 02' as noted above.

5. Switch the meter off after 10 seconds.
6. Connect the sensor to the sensor interface connector. The sensor must be exposed to air for the first time calibration.

7. Switch the meter on. The display should now read:

Warming up 57.6% Bat 13.1V

Indicating that the oxygen sensor is warming up to its optimum temperature. The display shows what percentage of the temperature is reached and what the battery voltage is that the meter sees on the power connector. The warm-up period will last for about 30 seconds for a cold sensor, depending on the sensor type used.

After the sensor is warmed up, the meter automatically calibrates the sensor heater controller to the particular sensor. During this 20 second period, the LM-1 collects and calculates sensor specific data required to quickly reach operating temperature in the future. After the first time use, the meter will use these values to regulate the sensor's temperature. During the heater calibration, the display will show:

Calib. Htr 9

Counting to 0. After that the display will show:

Calib. needed

NOTE: When using the Bosch Sensors (provided with LM-1 Kit if purchased through MTU Onsite Energy), the LM-1 may perform multiple calibration passes. This is normal and need not cause concern. When it completes, continue to Step 8.

8. Press the Calibration button. The meter will now calibrate itself by using air as a reference gas with a known oxygen content. After the calibration period is over (2-3 seconds), the instrument is ready to operate.
9. Attach the oxygen sensor 6 – 12" downstream of the exhaust Y.
10. The LM-1 is ready. Lamda measurements can now be taken.

OPERATION

1. Install the O2 sensor into the exhaust pipe in the standard M18x1.5 threaded O2 sensor boss provided. Make sure the O2 sensor tip protrudes into the exhaust stream.
2. Connect the meter as described above.
3. Allow the sensor to warm up for a few minutes prior to reading the display.
4. The LM-1 Wide Range O2 Meter displays in Lamda as well as Air/Fuel Ratio. If you are using a wide range O2 meter that displays in DC volts consult chart on next page to convert output voltage to Lamda. Both Phi and Lamda are ratios of the actual air/fuel ratio in respect to stoichiometric air/fuel ratio. Phi is Stoichiometric A/F ratio / Actual A/F ratio and Lamda is Actual A/F ratio / Stoichiometric A/F ratio.
5. Instructions to follow require the engine to see 100% full load. The fuel system can be set up using site load as 100% full load as long as the site load will **NEVER** increase. It is always recommended to use a load bank to achieve 100% full load for a proper fuel setup.

*****The following Fuel Setup procedures use Lamda values. Lamda values greater than 1.0 indicate a "lean" air/fuel mixture. Lamda values less than 1.0 indicate a "rich" air/fuel mixture. A slightly "rich" air/fuel mixture is recommended.**

EControls, Inc. NTK UEGO controller voltage to phi conversion chart.											
Voltage	Phi	Lamda	Voltage	Phi	Lamda	Voltage	Phi	Lamda	Voltage	Phi	Lamda
4.50	1.500	0.667	3.45	1.250	0.800	2.40	1.000	1.000	1.35	0.750	1.333
4.45	1.488	0.672	3.40	1.238	0.808	2.35	0.988	1.012	1.30	0.738	1.355
4.40	1.476	0.677	3.35	1.226	0.816	2.30	0.976	1.024	1.25	0.726	1.377
4.35	1.464	0.683	3.30	1.214	0.824	2.25	0.964	1.037	1.20	0.714	1.400
4.30	1.452	0.689	3.25	1.202	0.832	2.20	0.952	1.050	1.15	0.702	1.424
4.25	1.440	0.694	3.20	1.190	0.840	2.15	0.940	1.063	1.10	0.690	1.448
4.20	1.429	0.700	3.15	1.179	0.848	2.10	0.929	1.077	1.05	0.679	1.474
4.15	1.417	0.706	3.10	1.167	0.857	2.05	0.917	1.091	1.00	0.667	1.500
4.10	1.405	0.712	3.05	1.155	0.866	2.00	0.905	1.105	0.95	0.655	1.527
4.05	1.393	0.718	3.00	1.143	0.875	1.95	0.893	1.120	0.90	0.643	1.556
4.00	1.381	0.724	2.95	1.131	0.884	1.90	0.881	1.135	0.85	0.631	1.585
3.95	1.369	0.730	2.90	1.119	0.894	1.85	0.869	1.151	0.80	0.619	1.615
3.90	1.357	0.737	2.85	1.107	0.903	1.80	0.857	1.167	0.75	0.607	1.647
3.85	1.345	0.743	2.80	1.095	0.913	1.75	0.845	1.183	0.70	0.595	1.680
3.80	1.333	0.750	2.75	1.083	0.923	1.70	0.833	1.200	0.65	0.583	1.714
3.75	1.321	0.757	2.70	1.071	0.933	1.65	0.821	1.217	0.60	0.571	1.750
3.70	1.310	0.764	2.65	1.060	0.944	1.60	0.810	1.235	0.55	0.560	1.787
3.65	1.298	0.771	2.60	1.048	0.955	1.55	0.798	1.254	0.50	0.548	1.826
3.60	1.286	0.778	2.55	1.036	0.966	1.50	0.786	1.273	0.45	0.536	1.867
3.55	1.274	0.785	2.50	1.024	0.977	1.45	0.774	1.292	0.40	0.524	1.909
3.50	1.262	0.792	2.45	1.012	0.988	1.40	0.762	1.313	0.35	0.512	1.954
									0.30	0.500	2.000

NOTE: LAMDA VALUES ABOVE 1.0 INDICATE "LEAN". LAMDA VALUES BELOW 1.0 INDICATE RICH.

FUEL SYSTEM SETUP PROCEDURES FOR GM (8.1L – 225 MIXER) LP & NG (SEE TIMING INSTRUCTIONS ON PAGE 17)

1. Remove both inlet and outlet test port plugs on the Maxitrol regulator. Connect a manometer or other suitable measuring device to the inlet test port of the Maxitrol regulator. Connect a second manometer to the outlet test port of the Maxitrol regulator.
2. Install a Wide Range O2 Sensor into the exhaust pipe. Connect the wide range O2 6 – 12 inches downstream of any Y in the exhaust pipe, if so equipped. The sensor cannot be installed up stream of the turbocharger. Connect the Wide Range O2 Sensor to the wide range O2 module.
3. Start the engine and run with no load.
4. Make sure the inlet pressure to the Maxitrol is between 7 to 11 inches of positive water column. Adjust the regulator outlet pressure to 5 inches of positive water column +/- 1" of water column.
5. Run the engine with no load applied. Adjust the no-load mixture until the wide range O2 Lamda reading is 1.0 - .933 using the idle mixture screw.
6. Take the engine up to 25% load and observe the wide range O2 reading. Adjust the mixture using the idle mixture screw until the wide range O2 Lamda reading is 1.0 - .933.
7. Take the engine to full load, in 25% step increments, and observe the regulator inlet pressure and the wide range O2 output reading. The regulator inlet pressure should be a minimum of 7 inches of water column. If it is not check the fuel supply to the regulator for restrictions. Adjust the idle mixer screw to achieve a wide range O2 Lamda reading is 1.0 - .933.
8. Return to no load and observe the wide range O2 Lamda reading, 1.0 - .933. If the reading is not in the recommended range, readjust the idle mixture screw.
9. Revalidate the 100% load to ensure the wide range O2 Lamda reading is 1.0 - .933, readjust the idle mixer screw as required.
10. Return to no load and revalidate wide range O2 Lamda reading.

NOTE: For Dual Fuel configurations the final air fuel ratio adjustment should be done on Natural Gas first, then LP using the procedure outlined above for each fuel.

FUEL SYSTEM SETUP PROCEDURE FOR GM 8.1L 475 MIXER 100KW & 130KW LP & NG (SEE TIMING INSTRUCTIONS ON PAGE 17)

1. Remove both inlet and outlet test port plugs on the Maxitrol regulator. Connect a manometer or other suitable measuring device to the inlet test port of the Maxitrol regulator. Connect a second manometer to the outlet test port of the Maxitrol regulator.
2. Install a Wide Range O2 Sensor 6 – 12 inches downstream of the exhaust Y on a N/A engine or the same amount downstream of the turbocharger if so equipped. The sensor cannot be installed up stream of the turbocharger. Connect the Wide Range O2 Sensor to the wide range O2 module.

3. Start the engine and run with no load.
4. Make sure the inlet pressure to the Maxitrol is between 7 to 11 inches of positive water column. Adjust the outlet pressure to 2 1/2 inches of positive water column for a N/A engine and 3 inches of positive water column for a turbocharged engine. Shut off engine, remove the manometer from the regulator outlet test port, reinstall the plug, and restart engine.
5. Adjust the no-load mixture until the wide range O2 Lamda reading is 1.0 - .90 using the idle mixture screw.
6. Take the engine up to 25% load and observe the wide range O2 Lamda reading. Adjust the mixture using the idle mixture screw until the wide range O2 Lamda reads 1.02 - .955. Adjustment to the Regulator Outlet pressure may be required.

   NOTE: the high load regulator adjustment will affect the light load fuel mixture. If the mixture cannot be leaned out enough to reach .955 prior to checking the high load mixture, it is okay to proceed to the next step as long as the wide range O2 doesn't read under .913. **Under no circumstances should the load be increased if the wide range O2 Lamda reading is above 1.02 – it may be necessary to increase the regulator outlet pressure to reach 1.02 prior to increasing the load on the engine.**
7. Take the engine to full load in 25% step increases and observe the regulator inlet pressure and the wide range O2 output reading (on a turbocharged engine, it is recommended that the load be increased in steps up to 90% and the fuel mixture be adjusted as necessary to insure that the wide range O2 Lamda doesn't go over 1.02. The regulator inlet pressure should be a minimum of 7 inches of water column. If it is not check the fuel supply to the regulator for restrictions. Adjust the regulator outlet pressure until the wide range O2 Lamda reading is 1.02 - .955.

   NOTE: If you are unable to adjust the pressure low enough, and the regulator tower is pointing up, invert the regulator. This should drop the outlet pressure 1 1/2 to 2 inches of water column. Conversely, if you are unable to adjust the pressure high enough, and the regulator tower is pointing down, invert the regulator. This should increase outlet pressure by 1 1/2 to 2 inches of water column.
8. Return to no load and observe the wide range O2 Lamda reading. It should be 1.0 - .90. If it is not readjust the idle mixture screw.
9. Revalidate 25% load to ensure Wide Range O_2 Lamda reading is 1.02 - .955. Adjust regulator outlet pressure if necessary.
10. Revalidate full load to ensure the wide range O2 Lamda reading is .977 -.90.

NOTE: For Dual Fuel configurations the final air fuel ratio adjustment should be done on Natural Gas first, then LP using the procedure outlined above for each fuel.

8.1L TIMING INSTRUCTIONS

To change the engine timing from NG to LP fuel a ground wire will need to be added to one of the harness connectors. The connector is located on the right-hand side of the engine, near the foot of the engine. Once you locate the connector, find Pin D wire, cut the wire on the backside of the plug, then strip back and splice a new wire and lead to the ground. For Dual Fuel set up this ground wire will be run through a pressure switch.

Figure 1-12: Available 8.1L Fuel Connections

The 8 pin connector requires ground connection to pin D for LP fuel selection. The Standard set up is NG.

Figure 1-13: 8-Pin LP Fuel Connector

INITIAL FUEL SYSTEM ADJUSTMENT PROCEDURE FOR GM 3.0, 4.3, 5.0, 5.7 ENGINES WITH WOODWARD FIXED VENTURI AND ZERO PRESSURE REGULATOR FOR NG & LPG

The main adjustment screw (MAS) settings are measured from the MAS valve body (not the jam nut) to exterior end of the MAS screw. The zero-pressure regulator settings are measured from the top of the spring adjustment screw to the top of the spring tower.

These initial settings should get the engine up and running for final adjustment with an oxygen sensor. The MAS should be adjusted first with significant (75-90%) load on the engine. The ZPR should then be adjusted at no-load. One or two more iterations at full load for the MAS and no load for the ZPR should provide the correct air/fuel ratio over the entire operating range.

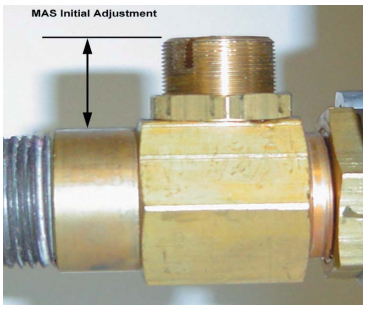
For dual-fuel configurations, the initial settings for dual-fuel NG and LP are the same as the single-fuel settings below. The final air/fuel ratio adjustments should be done on NG first, then LP, using the initial procedure above for each fuel.

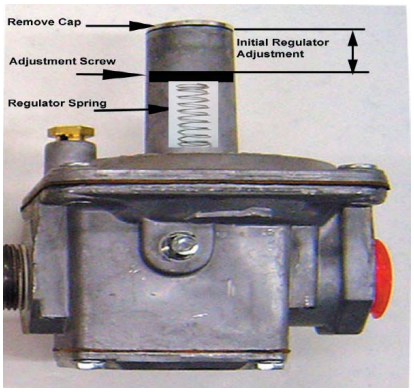
50mm L-Series GM 5.0 - 5.7L
NG: MAS 19mm, ZPR (Maxitrol R600Z) 16mm
LP: MAS 16mm, ZPR (Maxitrol R600Z) 14mm
Timing NG = 34 and LP = 32 Degrees BTDC

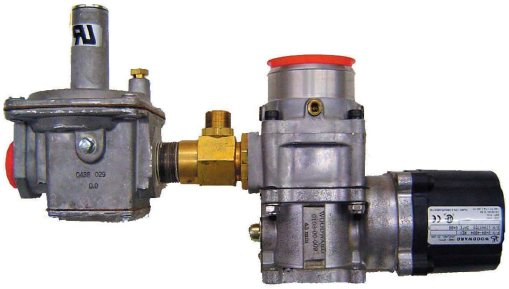
43mm L-Series GM 4.3L
NG: MAS 17mm, ZPR (Maxitrol R600Z) 16mm
LP: MAS 15mm, ZPR (Maxitrol R600Z) 14mm
Timing NG = 35 and LP = 26 Degrees BTDC

36mm L-Series GM 3.0L
NG: MAS 11mm, ZPR (Maxitrol R600Z) 16mm
LP: MAS 9.5mm, ZPR (Maxitrol R600Z) 14mm
Timing NG = 33 and LP = 26 Degrees BTDC

NOTE: Timing for Dual Fuel units is centered between the NG and LP timing.


MAS Initial Adjustment


Remove Cap
Adjustment Screw
Regulator Spring
Initial Regulator Adjustment



Fuel System Setup Procedure For GM 3.0, 4.3, 5.0, 5.7 Engines With Woodward Fixed Venturi and Zero Pressure Regulator For NG & LPG (to include LP liquid withdrawl)

1. Make initial MAS and ZPR adjustment. Install Wide Range O2 Sensor 6"-12" downstream of any Y in the exhaust pipe if so equipped. Connect Wide Range O2 Sensor to module. Start engine and run at no load until warm.
2. Raise engine load to 100%. Check wide range O2 Lamda reading. Adjust MAS to achieve 1.0 - .933 on wide range O2 module. Clockwise rotation of MAS will cause mixture to become more lean.
3. Return engine to no load. Check wide range O2 Lamda reading. Adjust ZPR to achieve 1.0 - .933. Clockwise rotation of the adjustment screw causes the mixture to become more rich. Make sure the adjustment tower cap is reinstalled prior to final reading.
4. Raise engine load again to 100%. Re-verify wide range O2 Lamda reading to be 1.0 - .933. Re-adjust MAS as necessary. Return to no load and re-verify wide range O2 reading. Adjust ZPR as necessary.

LP Liquid Withdrawal Fuel System Setup Procedure For GM 8.1L Engines Using Conventional Variable Venturi Mixer (225 and 475 Mixer)

1. Install a Wide Range O2 Sensor into the exhaust pipe 6 – 12 inches downstream of any Y in the exhaust pipe, if so equipped. The sensor cannot be installed up stream of the turbocharger. Connect the Wide Range O2 Sensor to the Wide Range O2 Sensor module.
2. Start the engine and run with no load.
3. Run the engine with no load applied. Adjust the no-load mixture until the wide range O2 Lamda reading is 1.0 - .913 using the idle mixture screw.
4. Take the engine up to 25% load and observe the wide range O2 Lamda reading. Adjust the mixture using the idle mixture screw until the display reads 1.0 - .933.
5. Take the engine to full load, in 25% step increments, and observe the wide range O2 Lamda output reading. Adjust the idle mixture screw on the mixer to achieve a reading of 1.0 - .933
6. Return to no load and observe the wide range O2 Lamda output reading. It should be 1.0 - .933. If it is not, readjust the idle mixture screw.
7. Revalidate full load to ensure the wide range O2 Lamda output reading is 1.0 - .933. Readjust idle mixture screw as required.
8. Return to no load and revalidate/adjust.

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