



Application Engineering Bulletin

Subject

**G8.3 and G8.3E Gas Compression
Technical Package**

This AEB is for the following applications:

☐ Automotive ☒ Industrial ☐ Marine

☐ G-Drive ☐ Genset

☐ Filtration ☐ Emissions Solution

Date: September 8, 2009

AEB Number 10.120

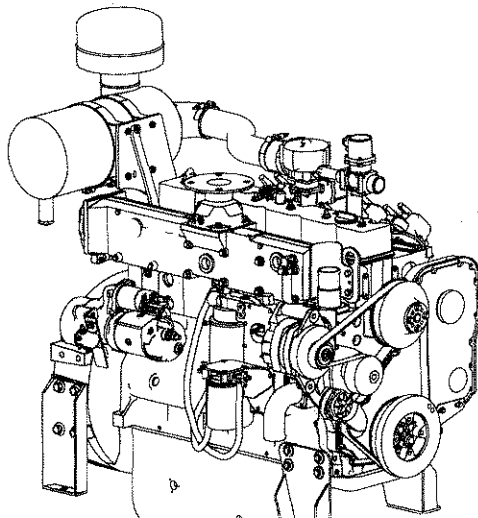
Engine Models included: G8.3 and G8.3E

Author: Cary McFarden, James Smithhisler

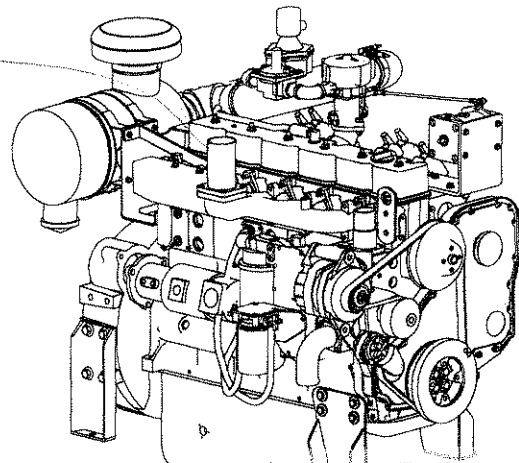
Approver: per Procedure 9183OPS-04-10-01

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This AEB supersedes AEB
10.120 published March, 2009.



G8.3E Air Fuel Ratio Controlled Engine



G8.3 Standard Engine

Purpose:

The purpose of this package is to provide information about the Cummins G8.3 and G8.3E natural gas engines required for gas compression applications and to provide information specific to the natural gas features of these engines.

Introduction:

This AEB introduces the G8.3 and G8.3E engines from Cummins Inc. to the Gas Compression Market. The G8.3 and G8.3E are four-stroke, 6 cylinder, natural gas engines. At the heart of these engines is the same Cummins C8.3 gas engine that has powered a range of transportation applications. The spark ignited, naturally aspirated G8.3 is available with horsepower ratings ranging from 135 @2200 RPM to 99 @1500 RPM at a 10.5:1 compression ratio. The G8.3E, also spark ignited and naturally aspirated, uses a feedback controlled fuel system and is available with horsepower ratings ranging from 118 horsepower rating @ 1800 RPM to 99 @1500 RPM at a 10.5:1 compression ratio. The G8.3E, equipped with an air fuel ratio controller and catalyst, is designed to meet a maximum 2 g/hp-hr NO_x, 4 g/hp-hr CO and 1 g/hp-hr VOC (Volatile Organic Compounds) emission requirements, and is capable of meeting lower emissions requirements. See the G8.3E FR curve listings on GCE for detailed information on product emissions capabilities. The G8.3 is also capable of meeting NSPS emissions standards with a customer supplied AFR controller and customer supplied catalyst.

The G8.3 and G8.3E are engineered for option compatibility, making more choices available among the various engine systems.

Please refer to the Base Engine Datasheet and Related FR options on the Global Customer Engineering (GCE) web site (www.gce.cummins.com) to complete the system design.

All information in this AEB is subject to change. If you have questions concerning this information, please contact the local distributor Application Engineer or CNGE Application Support.

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1 Ratings (HP)

Model	RPM	C/R	Horsepower
G8.3	2200	10.5:1	135
G8.3	1800	10.5:1	118
G8.3	1800	10.5:1	99
G8.3	1500	10.5:1	99
G8.3E	1800	10.5:1	118
G8.3E	1500	10.5:1	99

Consult www.gce.cummins.com for current ratings and possible changes.

2 Product Documentation

2.1 Service Publications

Parts Book: Parts Information is available on GCE on the Industrial Master Product Information page under the heading "Clovis CD (CNGE)".

O & M manual: 4021489

Mechanical Gas Fuel System Master Repair Manual: 4021404

QSOL: Information for operation and maintenance, troubleshooting and repair, and parts, can be located using an engine serial number.

2.2 Installation Drawings, FR Curves, and Base Data Sheets:

All available Installation Drawings, FR Curves, and Base Engine Data Sheets can be accessed at www.gce.cummins.com.

2.3 Application Engineering Bulletins (AEB) and Cummins Engineering Standards (CES):

All Application Engineering Bulletins can be accessed at www.gce.cummins.com; all applicable Cummins Engineering Standards can be accessed at www.pdm.cummins.com.

2.4 Additional References

The following OEM references are provided with new G8.3 and G8.3E engines when applicable and can aid with installation, initial start-up, and the continual operation of the engine. These references are to be used in supplement to the information provided by Cummins, Inc. The user of this document is responsible for determining the existence of current product documentation provided by Cummins, Inc. During the event that any discrepancies occur between these OEM references and the current product documentation provided by Cummins, Inc., the documentation provided by Cummins, Inc., shall always be used.

2.4.1 Altronic®

www.altroniccontrols.com or www.altronicinc.com

Form AIII II 4-92	Altronic® III Installation Instructions
Form All SM 12-96	Altronic® III Service Manual
Form CD200 3-05	CD200 Brochure
Form CD200 II 3-05	CD200 Installation Instructions

2.4.2 Asco®

www.ascovalve.com

Series 8010 Form No. V6927	Installation & Maintenance Instructions for General Purpose or Raintight / Explosion proof Solenoids
Form No. V6950R3	General Installation and Maintenance Instructions

2.4.3 **Fisher®**

<http://www.emersonprocess.com/fisher/oilandgas.html>

Bulletin 71.1:S300	S300 Series Direct-Operated Regulators
Form 5180	Instruction Manual - Type S301 and S302 Gas Regulators

2.4.4 **Impco®**

<http://www.impcotechnologies.com/>

2.4.5 **Maxitrol®**

www.maxitrol.com

MI2051	Capacity Charts for Gas Pressure Regulators
BULLETIN	Gas Appliance Pressure Regulators
MS2056- 04/04	Straight-Thru-Flow Design RV52, RV53, RV61, RV81, RV91, RV111, and RV131

2.4.6 **Murphy®**

www.fwmurphy.com

LM-92164N	Installation Instructions for Level Maintainers
M-7980N	M2582, M5081, and M5180 Series Electromechanical and Pneumatic, Fuel Gas Shut-off Valves Installation and Operation Instructions

2.4.7 **Pierce®**

www.thepiercecompany.com

GC979R5	Pierce Long Range Universal Governor
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2.4.8 **Stitt®**

<http://www.stitt-sparkplug.com>

PSIM-102000-5M	Professional Spark Plug Installation Manual for Integral Compressor Engines
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2.4.9 **Woodward®**

www.woodward.com

Product Specification 03255	L Series Air/Fuel Ratio Control
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3 Engine Features

3.1 Engine Envelope

3.1.1 Dry Exhaust

Overall Height (Approximate)	1259.2 mm [49.58 in]
Overall Length (Approximate)	1300.3 mm [51.19 in]
Overall Width (Approximate)	799.5 mm [31.48 in]

3.1.2 Wet Exhaust

Overall Height (Approximate)	1222 mm [48.11 in]
Overall Length (Approximate)	1547.63 mm [60.93 in]
Overall Width (Approximate)	802.37 mm [31.59 in]

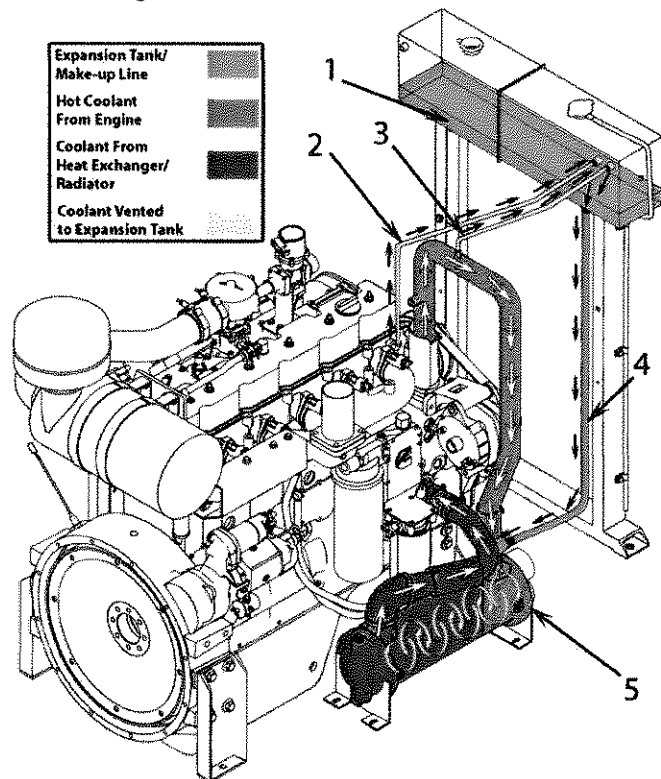
Consult www.gce.cummins.com for current installation drawings.

3.2 Cooling System

The G8.3 requires a positive deaeration cooling system design with a dedicated vent and fill line connection for the engine and radiator/expansion tank. Refer to AEB 24.18 - **Industrial Installation Requirements: LDI/MR/HD Cooling System Design** for more information on positive deaeration cooling systems. Refer to the applicable FR Curve and Base Engine Data Sheet for specific requirements of the engine cooling system.

3.2.1 Block Cooling Circuit

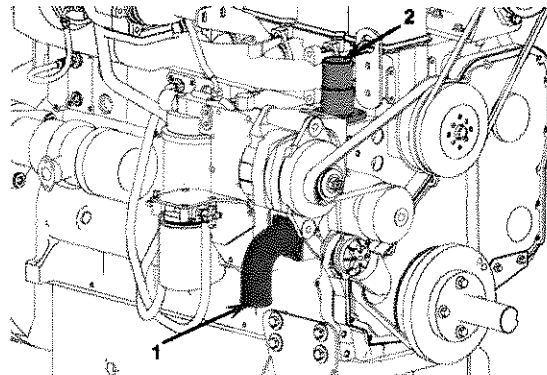
1. Expansion Tank
2. Engine Coolant Vent Line
3. Coolant Outlet Vent Line (Heat Exchanger Only)
4. Make-up Line
5. Heat Exchanger/Radiator



Typical Engine Cooling System Configuration

3.2.1.1 Block Cooling Connections

1. 2.25" Block Inlet Connection
2. 2.25" Block Outlet Connection



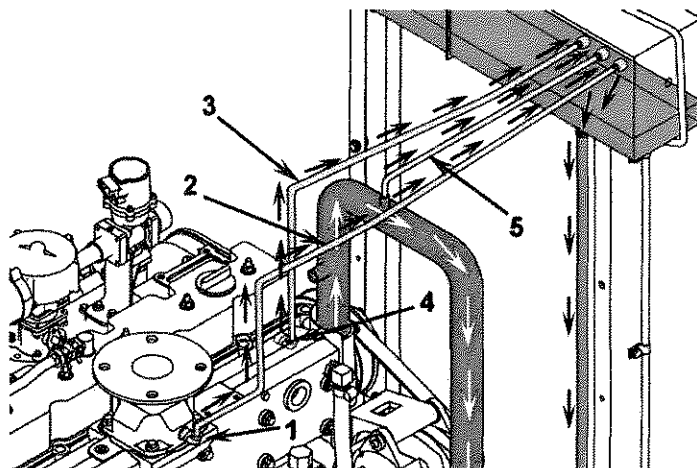
3.2.2 Wet Exhaust Manifold Requirements and Plumbing

3.2.2.1 Requirements – Wet Exhaust

The G8.3/G8.3E engine with a wet exhaust manifold requires dedicated vent lines for the exhaust manifold and cylinder head to the cooling system radiator/expansion tank. The vent lines must not TEE into each other. The outlet pipe should also be vented to the radiator/expansion tank. Refer to **AEB 24.18 - Industrial Installation Requirements: LDI/MR/HD Cooling System Design** for more information on positive deaeration cooling systems. Refer to the applicable FR Curve and Base Engine Data Sheet for specific requirements of the engine cooling system.

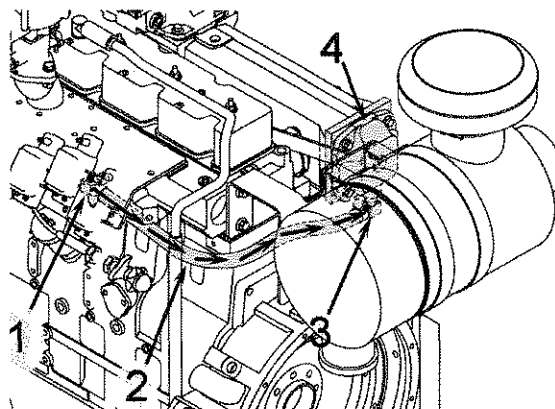
3.2.2.2 Vent Plumbing – Wet Exhaust

1. Wet Exhaust Manifold Vent Connection
2. Wet Exhaust Manifold Vent Line
3. Engine Coolant Vent Line
4. Engine Coolant Vent Line Connection
5. Coolant Outlet Pipe Vent Line (Heat Exchanger Only)



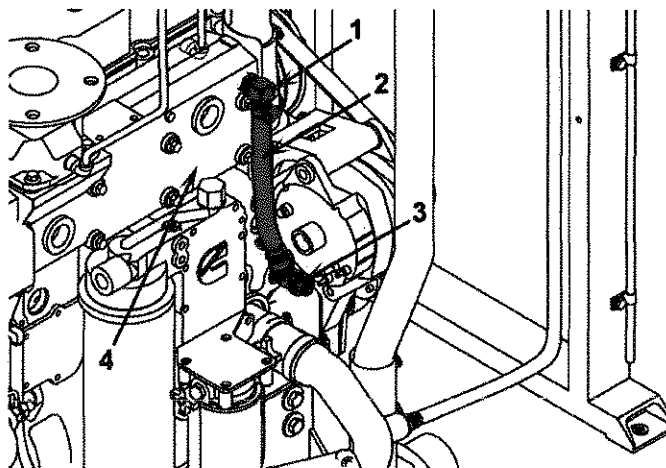
3.2.2.3 Inlet Plumbing – Wet Exhaust

1. Connection – Block
2. Hose
3. Connection – Exhaust Manifold
4. Cover, Wet Manifold



3.2.2.4 Outlet Plumbing – Wet Exhaust

1. Connection – Exhaust Manifold
2. Outlet Hose
3. Connection – Block
4. Wet Exhaust Manifold

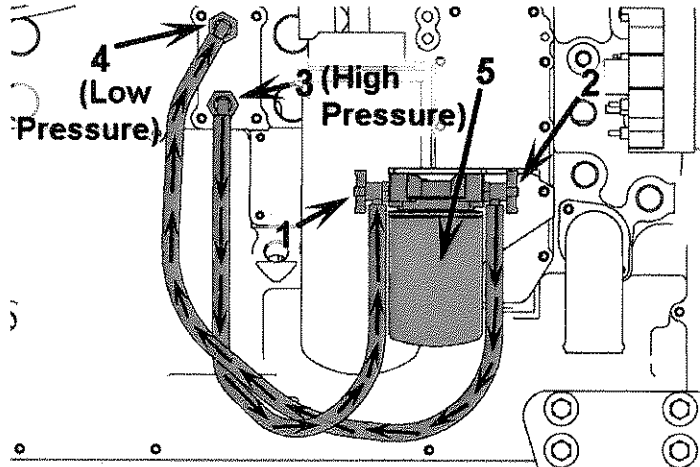


3.2.3 Coolant Filter – G8.3 and G8.3E

The coolant filter assembly is a corrosion resistor option supplied with a Fleetguard® WF2074 DCA4™ filter to protect against corrosion. Inlet and Outlet valves (1 and 2) have been installed to allow removal of water filter while engine is running or with minimal loss of coolant.

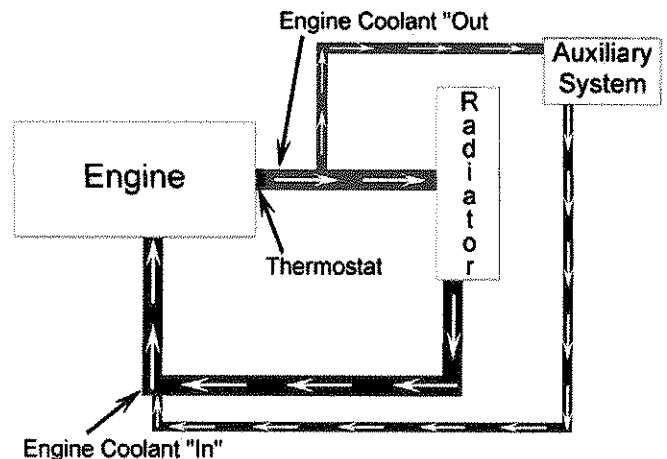
Removal Distance: 1.00"

1. Inlet Shutoff
2. Outlet Shutoff
3. "Out" From Block
4. Return to Block
5. Filter



3.2.4 Safe Draw Locations

Any coolant system draws for heat tracing or similar applications must be done in parallel with the engine cooling package. The first possibility to be considered for drawing coolant from the G8.3/G8.3E is to draw coolant from the engine "out" after the thermostat and return to the engine coolant "in", parallel to the cooling package.

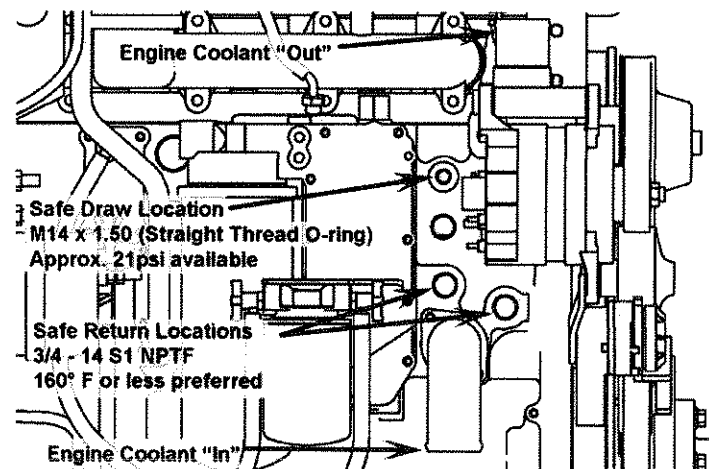


If coolant must be drawn from the engine side of the thermostat it should only be drawn from the M14 x 1.50 Straight Thread O-ring port just behind the alternator and returned to the 3/4 -14 S1 NPTF ports just above the engine coolant "in" adapter, as shown. Coolant must not be drawn or returned from any other ports on the engine because this can drastically alter flow uniformity and destabilize system flow.

The above options have inverse pressure/volumetric flow characteristics:

Pre-Thermostat: Higher pressure, lower volume (volume limited by fitting ID and external restrictions)

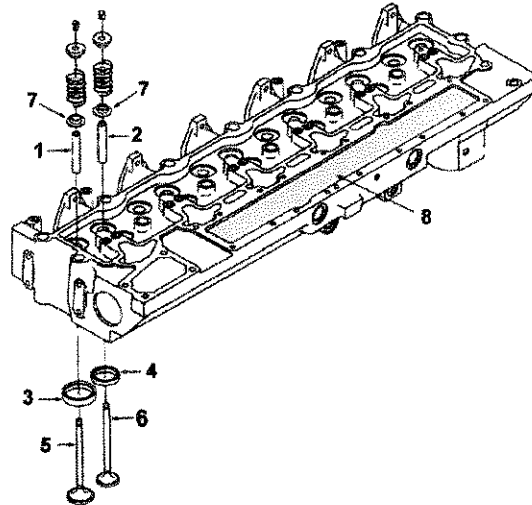
Post-Thermostat: Lower pressure, higher volume



3.3 Valve Train

Both the G8.3 and G8.3E utilize the same cylinder head configuration used on the automotive natural gas C8.3 engine. The intake manifold is integral to the cylinder head. Two M22 X 1.50 holes on the intake side of the head can be used access points for intake manifold pressure and temperature.

1. Valve Guide (Intake)
2. Valve Guide (Exhaust)
3. Valve Seat Insert (Intake)
4. Valve Seat Insert (Exhaust)
5. Valve (Intake)
6. Valve (Exhaust)
7. Valve Stem Seal (Intake and Exhaust)
8. Intake Manifold



3.4 Lubrication System

The lubrication system for the G8.3 and G8.3E is the standard C8.3 design. Lubricating oil requirements are listed in section 2 of Service Bulletin 3810340.

3.4.1 Oil Pan

Two oil pan options are available, high capacity and standard capacity.

Capacity (High – Low)

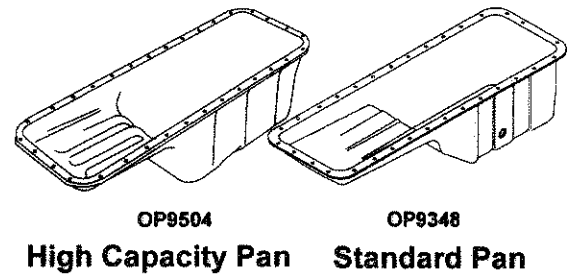
Large - OP9504: 32.18 – 19.87 liter [34 – 21 quarts]

Standard - OP9348: 18.93 – 15.14 liter [20 – 16 quarts]

Oil Drain locations

Large, M22 X 1.5 Bottom

Standard, M18 X 1.5 Intake Side

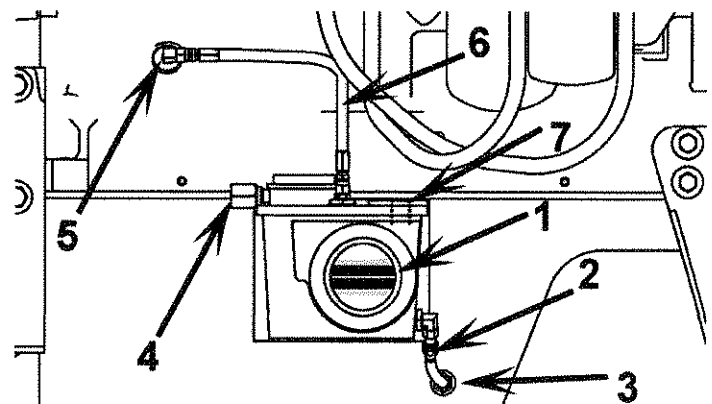


3.4.2 Oil Level Regulators

The G8.3/G8.3E may be up-fitted with an oil level regulator. **Caution must be exercised to insure that the G8.3/G8.3E is never ran with the crankcase in an overfill condition.** The guidelines and recommendations in this section must be followed to prevent downtimes and/or engine damage caused by running the engine with an incorrect oil level due to an improperly installed oil level regulator.

3.4.2.1 Typical Installation Overview

1. Oil Level Regulator Site Glass
2. Level Monitoring Hose: 1" dia.
3. Oil Pan Connection
4. Electrical Conduit
5. Recommended Crankcase Vent Line Connection Port in Block (7/8", Exhaust Side)
6. Crankcase Vent Line: 1/2" dia. Preferred, 3/8" dia. min.
7. Oil Inlet Connection (Fill From Oil Supply Tank)



**Oil Level Regulator – Typical Installation
(Murphy Model Shown)**

3.4.2.2 Summary of Installation Requirements/Recommendations

- = Recommendation
- = Requirement
- The G8.3/G8.3E must never be operated with the oil level in an overfilled state.
- On the G8.3/G8.3E a static setting of 2.5" below the oil pan mounting surface to the center of the regulator operating range may be used for initial set-up.
- The oil level regulator must be mounted on an adjustable mounting bracket or a pipe with universal mounting brackets so that the regulator running height can be adjusted.
- The oil level regulator should be mounted as close to the oil pan as possible.
- The oil level regulator vent must be plumbed to the engine crankcase with a 1/2" (3/8" min.) diameter hose rather than venting to atmosphere.
- The vent connection on the crankcase must be well above the regulated oil level.
- A regulator that provides a "High Zone Alarm/Shutdown" should be used as well as a "Low Zone Alarm/Shutdown" to prevent running with an overfilled crankcase.
- The monitoring hose must slope slightly downward and must not have any droop or low spots.
- All OEM requirements must be followed for the oil level regulator to be installed concerning inlet pressures, flow rates, and orifices from the clean oil supply reservoir.
- The oil supply hose from the clean oil reservoir must maintain a downward slope and must not have any droop or low spots.
- A shutoff valve must be installed between the clean oil reservoir and the oil level regulator.
- The shutoff valve from the clean oil reservoir must be closed during the running adjustment.
- The running oil level must be checked with the engine operating at rated speed and rated load. Readjust (if necessary) after filling the engine to the proper oil level.
- Engine protection shutoffs must be wired so that the fuel supply is disabled rather than disabling the ignition system.

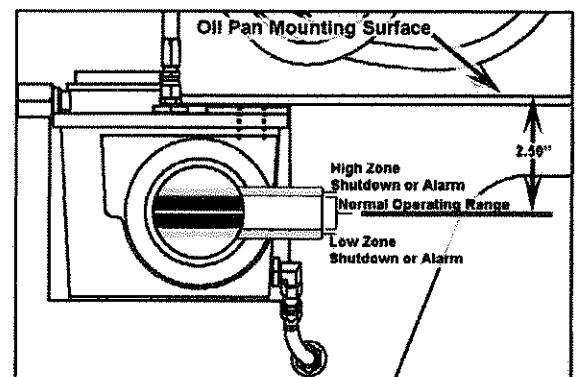
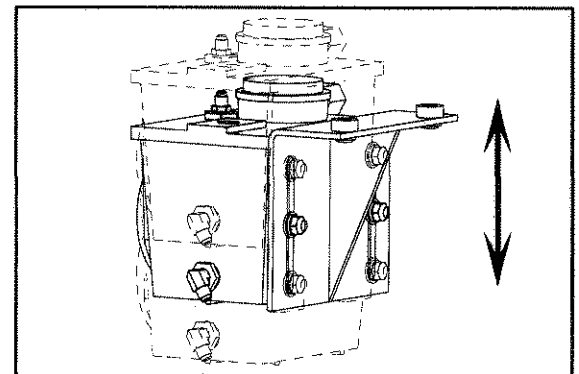
3.4.2.3 Typical Installation Procedure

Note: The following procedure is generic and is applicable to various oil level regulators. Be sure to reference the manufacturer instructions of the regulator to be installed to determine any additional procedures and requirements.

1. Install the oil level regulator using an adjustable mounting bracket or a pipe and pipe bracket.

Note: Excessive vibration can cause overfill.

2. With the engine NOT running adjust the regulator so that the center of the normal operating range of the oil level regulator indicator is 2.5" below the oil pan mounting surface.



3. Install the vent hose (1/2" dia. preferred, 3/8" dia. minimum) between the oil level regulator vent and the 7/8" port located on the exhaust side of the engine block.
Note: The vent connection on the crankcase must be well above the regulated oil level.

4. Install a 1" hose between the monitoring port on the oil level indicator and a port in the oil pan.
Note: The monitoring hose must slope slightly downward and must not have any droop or low spots.

5. Fill the crankcase to the proper oil level. **DO NOT OVERFILL.** When the oil level is correct the dipstick will indicate a level between "Full" and "Low" when the engine is at approximately 70° F.

Use the capacities below as a reference. Be sure to take into account that approximately 1 quart of oil remains in the pan after draining. New engines will also have approximately 1 quart of oil left in the pan due to dyno testing at the factory.

Capacity (High – Low)

Large - OP9504: 32.18 – 19.87 liter [34 – 21 quarts]

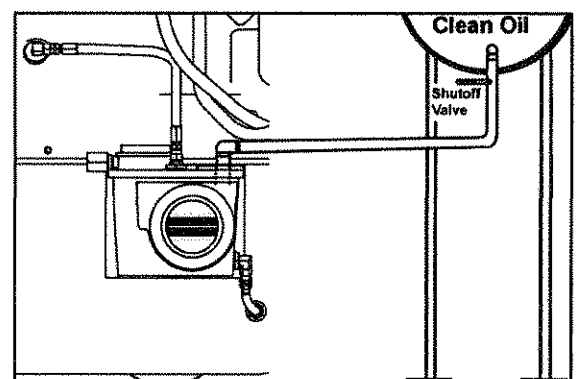
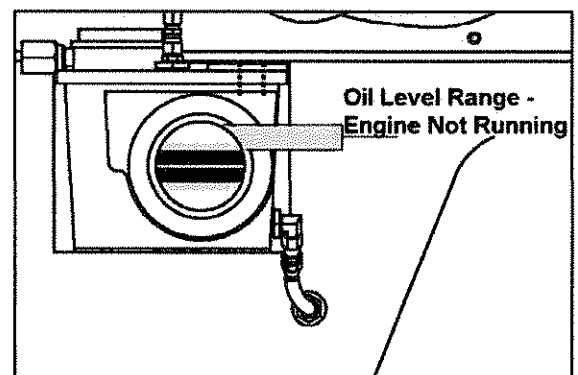
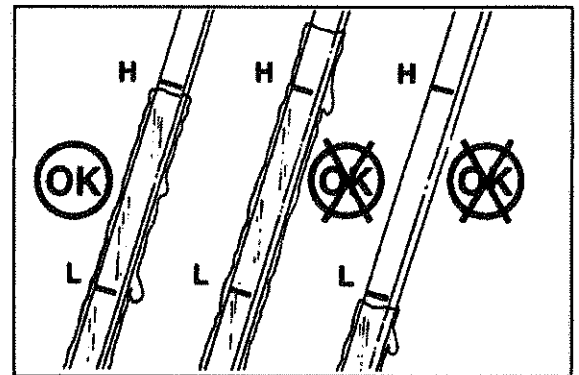
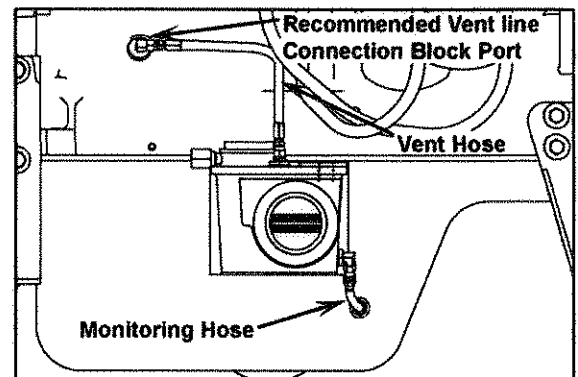
Standard – OP9348: 18.93 – 15.14 liter [20 – 16 quarts]

Note: After filling the crankcase to the proper level, the oil level regulator will show the oil level in or above the "High Zone" in the site glass while the engine is not running, this is a normal.

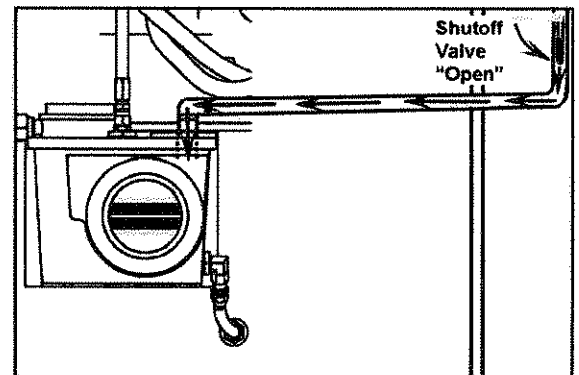
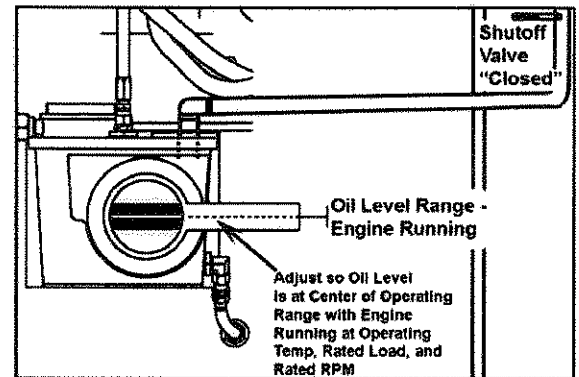
6. Connect a clean oil supply with a shutoff valve to the oil fill port on the oil level regulator. Refer to G/GTA8.3 O&M for lube oil specifications.
Note: The oil supply hose must maintain a downward slope and must not have any droop or low spots.

Warning: An overfill condition can be caused by excessive inlet pressure. Be certain to reference the documentation supplied with the oil level regulator being installed to determine the requirements for:

- Maximum inlet pressure
- Supply line sizes
- Supply line orifices
- Oil supply reservoir heights
- Oil Supply flow rates



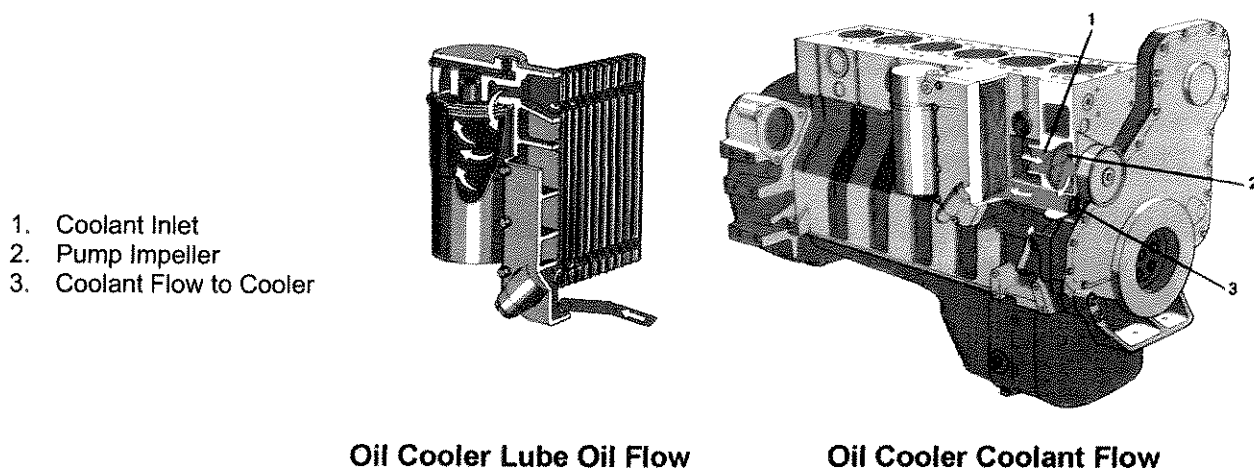
7. Leave the shutoff valve closed.
8. Start the engine and bring to operating temperature. With the engine at rated speed and load, adjust the oil level regulator so that the oil level in the site glass is at the center of the normal operating range.
9. Tighten the adjustment bolts to torque specified by mounting bracket manufacturer.
10. Shut off engine.
11. Open the shutoff valve on the clean oil supply reservoir.
12. Install the wiring. Refer to the wiring schematics provided with the oil level regulator being installed. Connect any shutoffs so that the fuel supply is disabled rather than disabling the ignition system.
13. Check functionality:
 - Follow the OEM instructions provided with the oil level regulator being installed to test the shutdown and/or alarm functions.
 - Start the engine and check that the oil level is maintained at the center of the operating range with the engine running at rated speed and load.
 - Shut the engine off, wait 10 minutes and then check the oil level with the dipstick to be certain that the oil level is between "Full" and "Low".



3.4.3 Oil Cooler and Filter

The oil cooler option is equipped with a single Fleetguard® LF3000 combination full flow and by-pass oil filter to provide advanced filtration and better engine protection during cold starts.

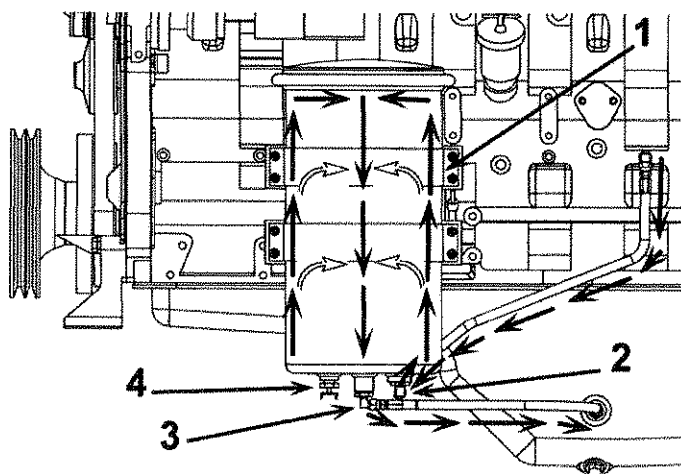
Oil Filter Removal Distance: 1.50"



3.4.4 Remote by-pass Oil Filter

The Fleetguard® LF750 by-pass oil filter is a secondary filtration unit providing additional engine oil filtering and adds 15.1 liters [4.0 U.S. gal.] to the lubrication system capacity.

1. LF750 by-pass oil filter assembly
2. Filter Inlet Connection
3. Filter Outlet Connection
4. Filter Drain/Petcock



3.5 Fuel System

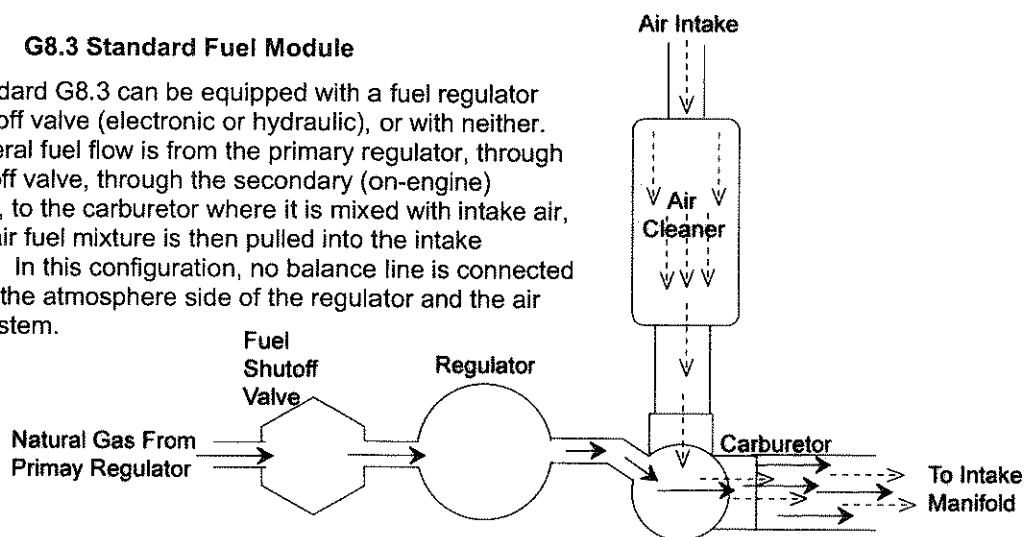
Currently, the industrial G8.3 uses two different fuel module designs: the standard fuel rating design (G8.3) and the Air Fuel Ratio (AFR) controlled fuel design (G8.3E). Each design has different components and performance requirements, refer to the applicable FR Curve and Base Engine Data Sheet for specific requirements. Additionally, a balance line is installed between the regulator and the port on the air inlet of the carburetor on the G8.3E. No balance line is installed on the G8.3.

3.5.1 G8.3 and G8.3E Fuel System Comparison/Contrast Table

Product Feature	G8.3	G8.3E
Fuel Regulator and Shutoff Valve	Factory Installed	Customer Must Install
Shutoff Valve Location	Upstream of Regulator	Downstream of Regulator
Balance Line	No	Yes
Air Fuel Ratio Controller	No	Yes
Carburetor	Impco® 200 standard	Impco® 200 standard
Fuel Pressure Inlet to Regulator Units	WC	PSI
Fuel Pressure Outlet from Regulator Units	WC	WC
Shutoff Valve Types Available	Electronic (12 and 24 Volt) and Hydraulic	Electronic 24 Volt Only
Gas Regulator Types	Maxitrol® RV53	Fisher® S301

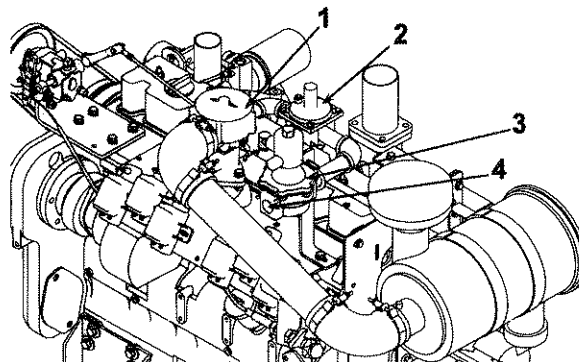
3.5.2 G8.3 Standard Fuel Module

The standard G8.3 can be equipped with a fuel regulator and shutoff valve (electronic or hydraulic), or with neither. The general fuel flow is from the primary regulator, through the shutoff valve, through the secondary (on-engine) regulator, to the carburetor where it is mixed with intake air, and the air fuel mixture is then pulled into the intake manifold. In this configuration, no balance line is connected between the atmosphere side of the regulator and the air intake system.



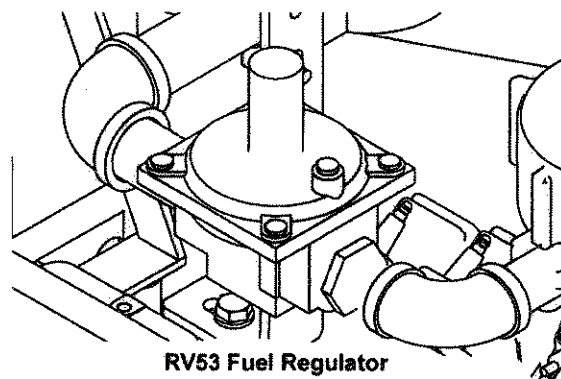
The G8.3 fuel system uses either an electronic or hydraulic fuel shutoff valve, engine mounted secondary Maxitrol® RV53 gas regulator and Impco® 200 standard carburetor. The fuel inlet to the shut off valve is 1" NPT. Field gas options are available. Use the Gas Analysis Web Tool on GCE (www.gce.cummins.com) to determine methane index number and low heat value.

1. Carburetor,
2. Gas Regulator
3. Fuel Shutoff Valve
4. Fuel Inlet Connection: 1" NPT



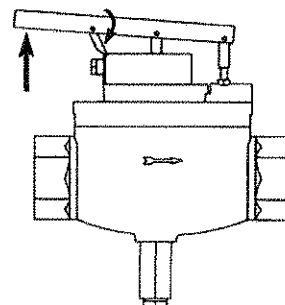
3.5.2.1 G8.3 Gas Regulator

- Maxitrol® RV53
- Straight-Thru-Flow Design
- Adjustable
- Designed to Provide High Capacities at Low Pressures
- 1" Inlet and Outlet
- Recommended for normal horizontal position only



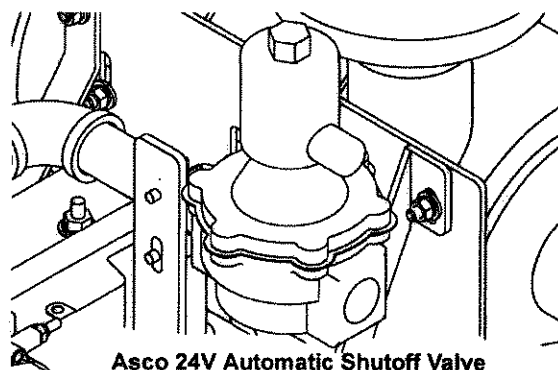
3.5.2.2 G8.3 Mechanical Fuel Shutoff Valve

- 1" NPT Fuel Inlet Connection
- Operated By Engine Oil Pressure
- Lever Can Be Mechanically Operated As A Primer Until Oil Pressure Fully Opens Valve



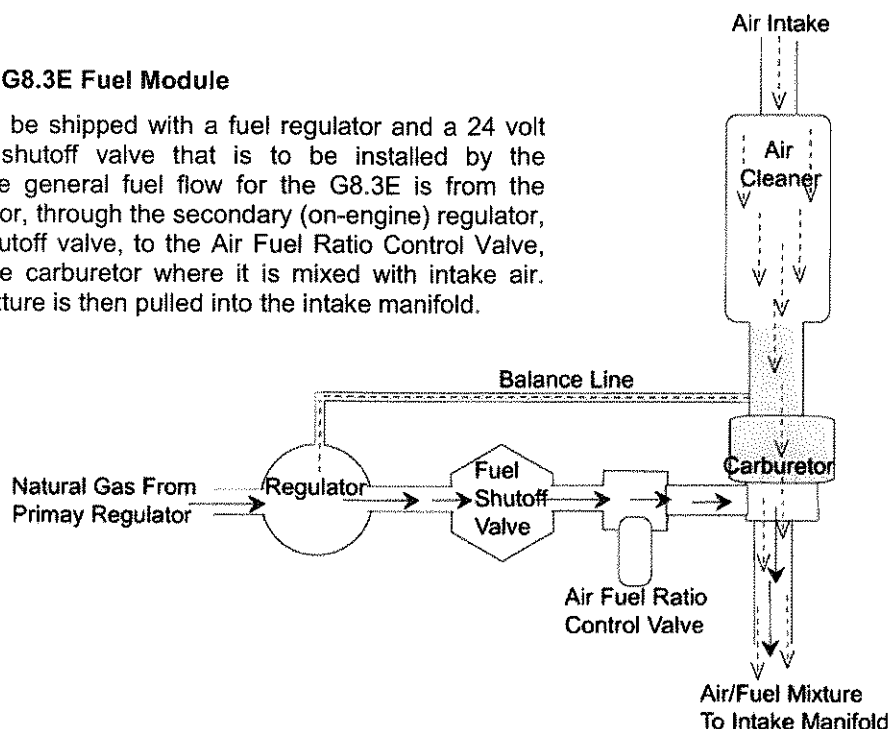
3.5.2.3 G8.3 Electrical Fuel Shutoff Valve

The electrical shut-off valve is an Asco® 24 Volt Automatic Shutoff Valve. The Fuel Valve Shutoff is to be wired into an engine shutdown safety panel and to shutdown safety devices such as low oil pressure or low water level switches. An override button that automatically returns to its normally open state is required to open the valve during starting operations.



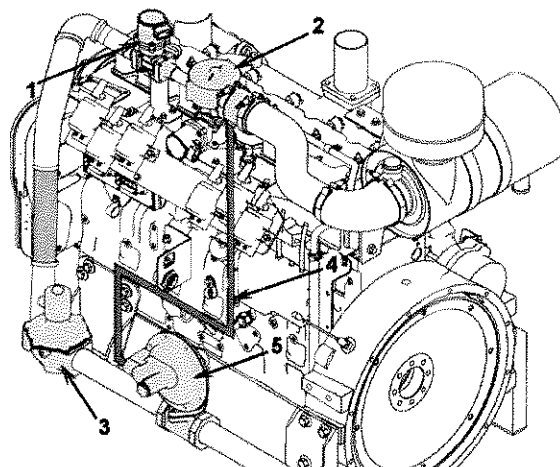
3.5.3 G8.3E Fuel Module

The G8.3E will be shipped with a fuel regulator and a 24 volt low pressure shutoff valve that is to be installed by the customer. The general fuel flow for the G8.3E is from the primary regulator, through the secondary (on-engine) regulator, through the shutoff valve, to the Air Fuel Ratio Control Valve, and then to the carburetor where it is mixed with intake air. The air fuel mixture is then pulled into the intake manifold.



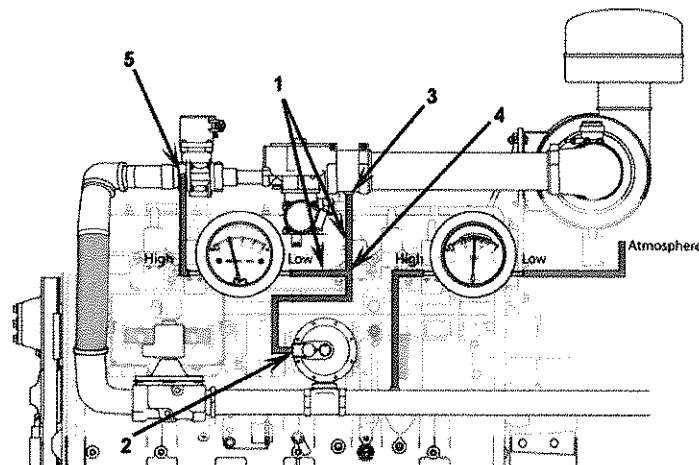
1. Air Fuel Ratio Control Valve
2. Carburetor
3. Fuel Shutoff Valve (Low Pressure)
4. Balance Line
5. Fuel Regulator

Note: The Fuel Shutoff Valve (3) is a low pressure valve and **MUST** be installed downstream from the regulator supplied with the engine. Failure to do so will create hard starting conditions and damage to the shutoff valve.



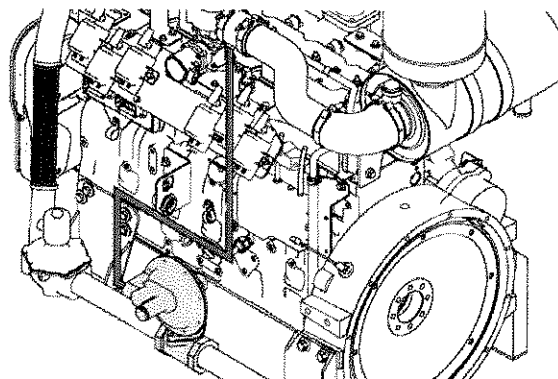
In this configuration, a 3/8" balance line (1) is to be installed by the customer between the regulator vent (2) and the balance line port on the carburetor (3). The balance line must have a "tee" and pressure tap (4) that will be used as the fuel pressure reference during regulator adjustments.

Note: Inlet pressure to the carburetor should be checked at the port prior to the inlet of the fuel control valve (5). Since the control valve can affect fuel pressure, pressure on the outlet side of the fuel control valve should not be used for regulator adjustments.



3.5.3.1 G8.3E Gas Regulator

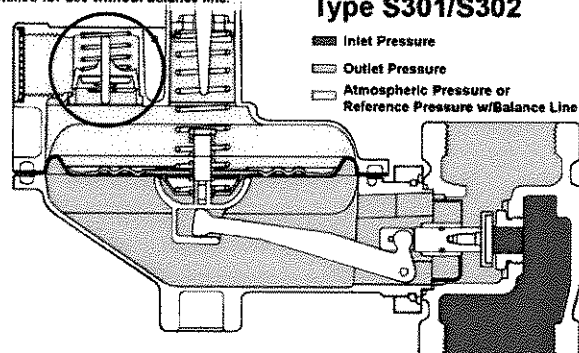
- Fisher® S301
- Shipped Loose, Customer Installed
- Adjustable
- 2" Inlet and Outlet
- Four Position Vent Mounting
- 360° Positioning of the Union Ring



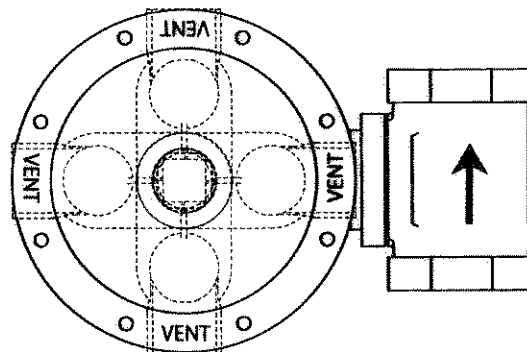
The Fisher® S301 regulator used on the G8.3E has a two-way stabilizer vent valve in the vent passage that must be removed when a balance line is installed. Failure to remove this valve when a balance line is used will hinder or prevent proper regulator adjustment. If a balance line is not installed and the vent is open to atmosphere the stabilizer valve can remain installed.

Two-way Stabilizer Vent Valve:
Removed for use with balance line.
Installed for use without balance line.

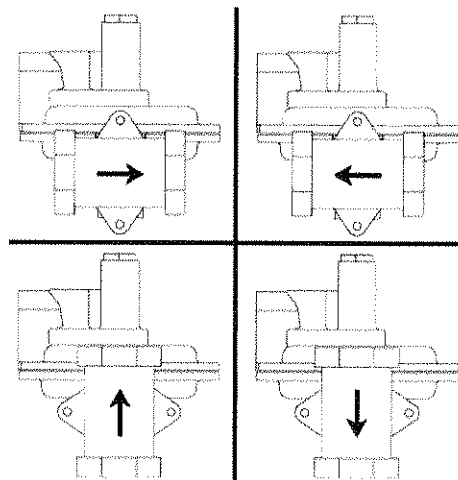
Fisher® Type S301/S302



The Fisher® S301 regulator vent can be mounted in four different positions by rotating the spring case in 90° increments.



The Fisher® S301 regulator can be mounted in the positions shown by rotating the body of the regulator.

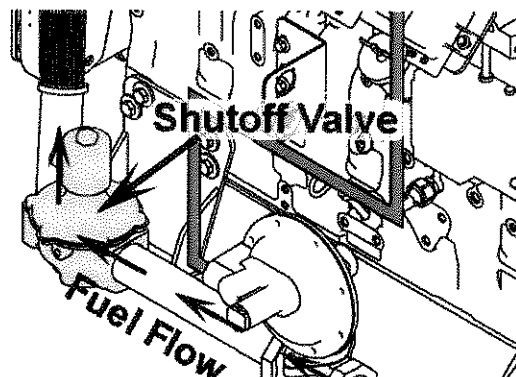


Refer to Fisher® Bulletin 71.1:S300 and the Fisher® S301 and S302 Instruction Manual, Form 5180, for further installation information.

3.5.3.2 G8.3E Electrical Fuel Shutoff Valve

The G8.3E is shipped with a 24 volt low pressure shutoff valve that is to be installed by the customer. The shutoff valve is to be wired so that the AFR control system can shut the engine down. (See wiring schematic)

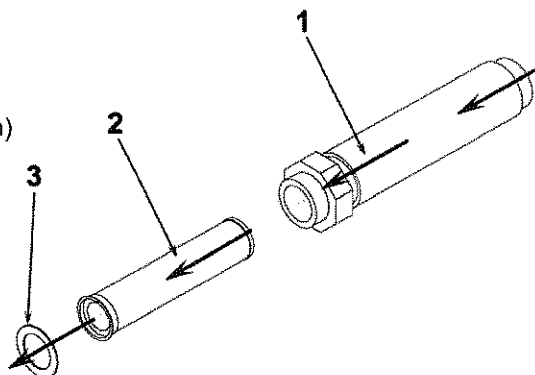
Note: On the G8.3E the fuel shutoff valve is a low pressure valve and **MUST** be installed downstream from the regulator supplied with the engine. Failure to do so will create hard starting conditions and damage to the shutoff valve.



3.5.4 Gas Filter (G8.3 and G8.3E)

Required. Inlet and outlet connections are 2" NPT. The filter should be mounted prior to the fuel shutoff valve and as close to the engine as possible. Inlet fuel pressure to the filter should not exceed 100 psi.

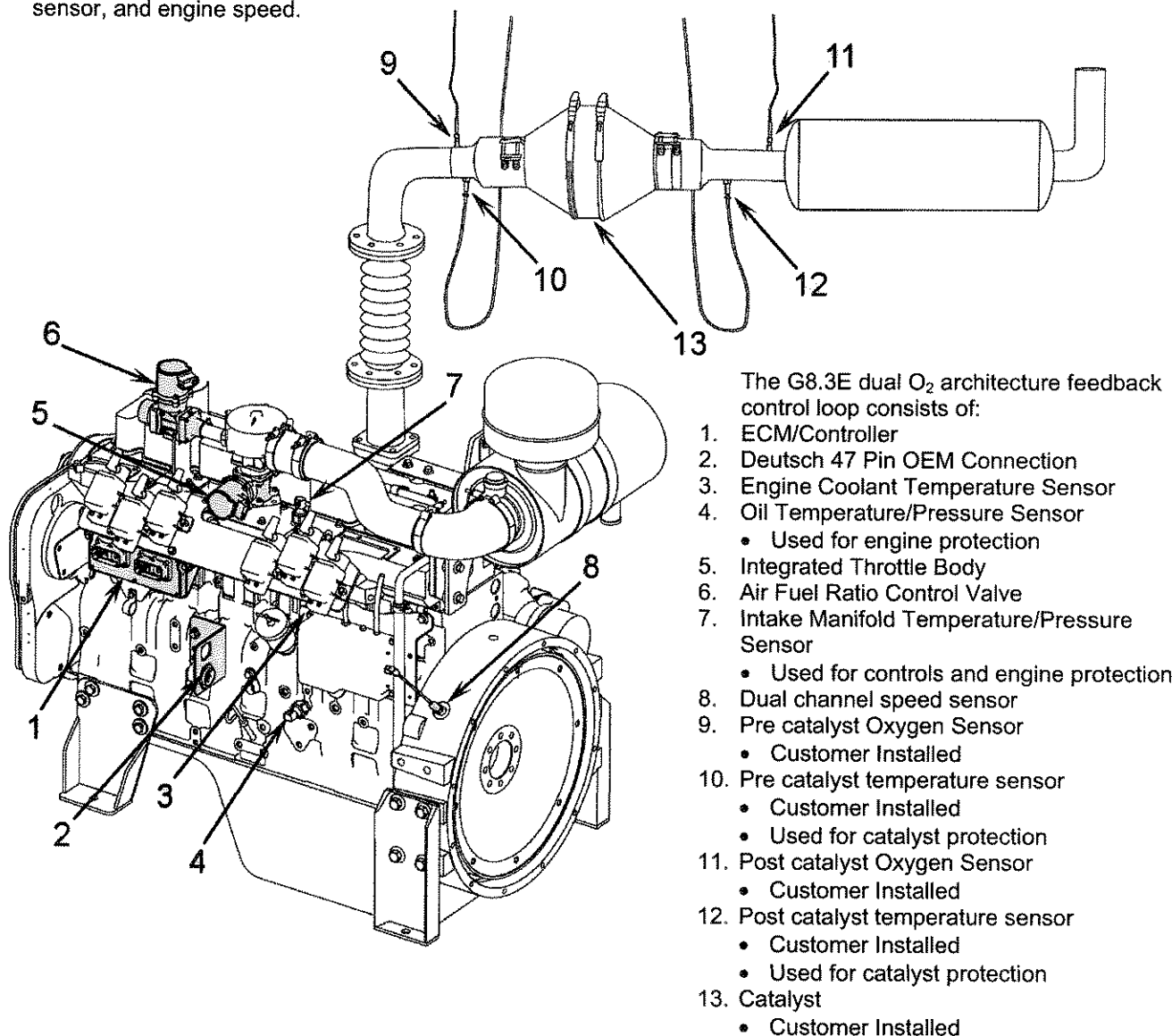
1. Housing
2. Filter Element (Efficiency: 90% @ 5 Microinch)
3. Seal



Note: Filter provided in option FF90025 cannot be used in place of a coalescent filter. A separate coalescent filter must be installed and maintained when any liquid is detected in the fuel.

3.5.5 G8.3E Air Fuel Ratio Control System

The G8.3E AFR control system uses a dual O₂ sensor architecture with catalyst to control exhaust emissions. The AFR Control System controls fuel flow based on input from pre and post catalyst exhaust O₂, intake manifold pressure, and engine temperature. The ECM/Controller opens or closes the fuel control valve (FCV) in the fuel line based on feedback from the O₂ sensors, engine coolant sensor, intake pressure and temperature sensor, and engine speed.



*Refer to AEB 24.52, **3 Way Catalyst, 3 Way Catalyst XL and 3 Way Catalyst XLS Installation Requirements**, for detailed information regarding exhaust system installation requirements for the G8.3E.

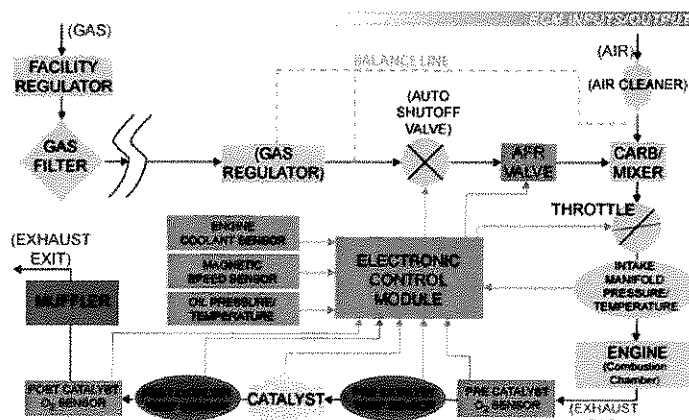
3.5.5.1 AFR INPUTS/OUTPUTS

The inputs for the AFR control system are:

- Intake Manifold Pressure and Temperature
- Engine Speed
- Oil Pressure and Temperature
- Coolant Temperature
- Pre Catalyst O₂
- Pre Catalyst Temperature
- Post Catalyst O₂
- Post Catalyst Temperature

The outputs for the AFR control system are:

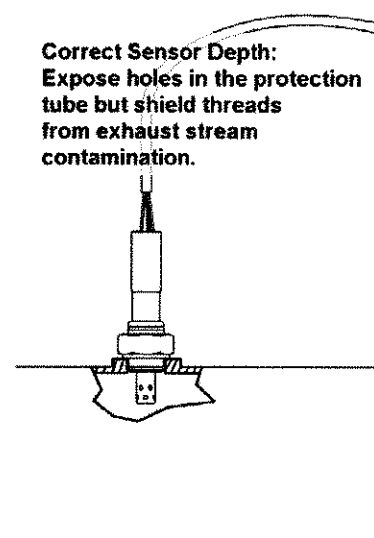
- Fuel Shutoff Valve
- Air Fuel Ratio (AFR) Control Valve
- Integrated Throttle Valve



3.5.5.2 Oxygen Sensor Installation Requirements

The G8.3E is shipped with two oxygen sensors that are to be installed by the customer.

- An O₂ sensor must be installed on both sides of the catalyst
- O₂ sensors should be mounted as vertical as possible
- Use an M18 X 1.5 stainless steel boss to mount the sensor (Customer Supplied)
- Sensor must be mounted to avoid or minimize the exposure of the ceramic element to water and other liquids
- Sensor depth must be enough to expose holes in the protection tube to the exhaust stream
- Sensor threads must not be exposed to exhaust gases



3.5.5.3 Temperature Sensor Installation Requirements

The G8.3E is shipped with two temperature sensors that are to be installed by the customer.

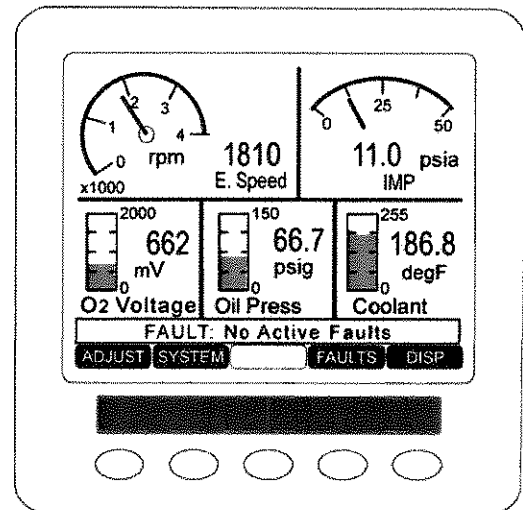
- A temperature sensor must be installed on both sides of the catalyst
- Use an M12 X 1.25 – 6g low carbon steel boss to mount each sensor (Shipped Loose)

3.5.5.4 ED3 Display

The G8.3E is shipped with an ED3 display that is to be installed by the customer. The ED3 Display is the user interface for the air/fuel ratio controller. The display shows:

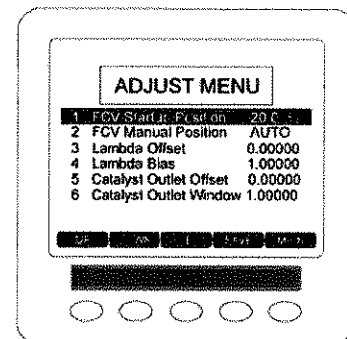
- Engine Speed
- Intake Manifold Pressure (psia)
- Oxygen Sensor Voltage
- Oil Pressure
- Coolant Temperature
- Fault Codes

The ED3 has several screens that show engine systems operating status and several screens used to fine tune the AFR control system to meet emission requirements.



The ED3 display is used to:

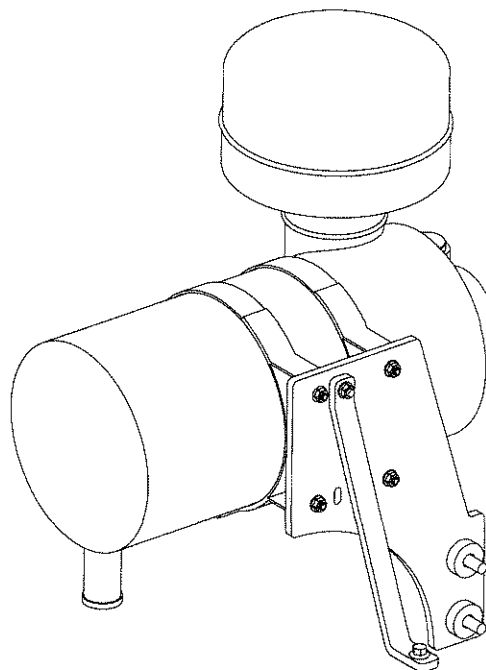
- Disable/re-enable post catalyst O₂ system control
- Manually operate fuel control valve (FCV)
- Adjust FCV startup position
- Adjust lambda offset/bias
- Adjust catalyst outlet offset/window
- Check for correct catalyst placement



3.6 Intake System

3.6.1 Air Cleaner

Applicable Engine Models: G8.3 and G8.3E
 Exhaust Type: Wet or Dry
 Air Inlet Diameter (MM): 4" O.D.
 Manufacturer: Fleetguard
 Model: AH19269
 Duty Rating: Heavy
 Restriction Indicator: 15" W.C.
 Air Flow Capability: 258 CFM @ 6" H₂O
 Aspiration: Naturally Aspirated



Applicable Engine Models	Wet/Dry Exhaust Manifold	Compressor/ Non Compressor	Flywheel Housing Applicable SAE #'s	Options
G8.3	Dry Only	Non Compressor	SAE 2 or SAE 3 Only	AC9199 (Mounting Bracket) AC9228 (Air Cleaner Assembly) CA9127 (Air Cleaner Plumbing)
G8.3	Wet Only	Non Compressor	SAE 1, SAE 2, SAE 3	AC9200 (Mounting Bracket) AC9228 (Air Cleaner Assembly) CA9126 (Air Cleaner Plumbing)
G8.3	Wet or Dry	Compressor	SAE 1, SAE 2, SAE 3	AC9209 (Mounting Bracket) AC9256 (Air Cleaner Assembly) CA9128 (Air Cleaner Plumbing)
G8.3E	Wet or Dry	Compressor	SAE 1, SAE 2, SAE 3	AC9209 (Mounting Bracket) AC9228 (Air Cleaner Assembly) CA9637 (Air Cleaner Plumbing)

3.7 Exhaust System

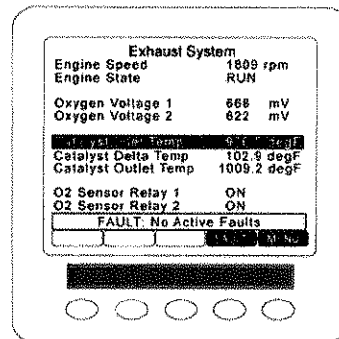
3.7.1 G8.3E Exhaust System Requirements

The G8.3E exhaust system has special requirements that must be considered during package design. The exhaust system requires a robust design that will inhibit exhaust system leaks over thousands of hours of operation because the AFR control system can be very sensitive to exhaust leaks. The exhaust system must be capable of handling environmental elements, engine vibrations, and exhaust temperatures without system degradation resulting in exhaust leaks. Refer to AEB 24.52, **3 Way Catalyst, 3 Way Catalyst XL and 3 Way Catalyst XLS Installation Requirements**, for detailed information regarding exhaust system installation requirements for the G8.3E.

3.7.2 G8.3E Catalyst Placement

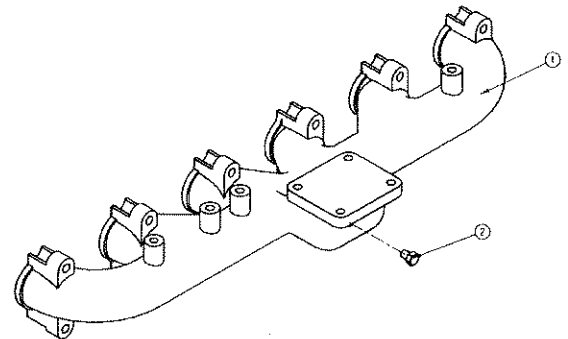
The minimum operating inlet temperature for the catalyst is 800°F and the maximum operating temperature is 1250°F. The package designer will need to determine approximate catalyst placement by measuring exhaust temperatures along the exhaust system while operating the engine at rated RPM and load prior to catalyst installation.

Correct catalyst placement can be later verified through the ED3 Exhaust System screen once the catalyst is installed and the engine is fully operational.



3.7.3 Dry Exhaust Manifold

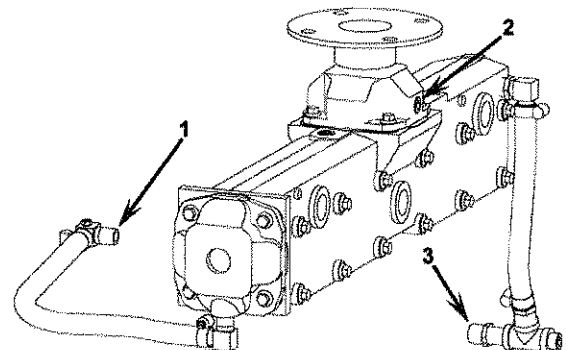
- Manifold (1) contains a 1/8" NPT hole to allow for temperature and pressure measurement. Stainless steel plug (2) is used to prevent exhaust leaks when hole is not in use.



3.7.4 Wet Exhaust Manifold

- Water cooled exhaust manifold
- No provisions for exhaust O2 access

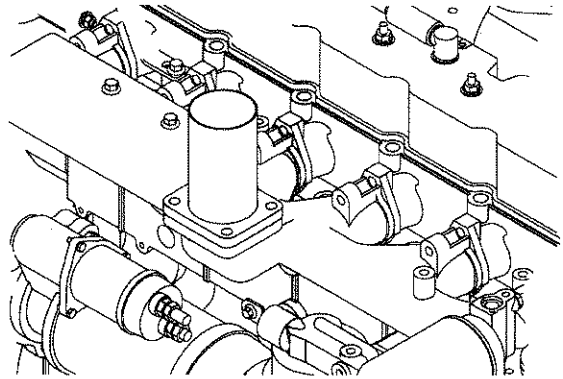
- Coolant Inlet from Intake Side of Cylinder Head.
- Vent Line Connection
- Exhaust Coolant Outlet



3.7.5 Exhaust Outlet Connection

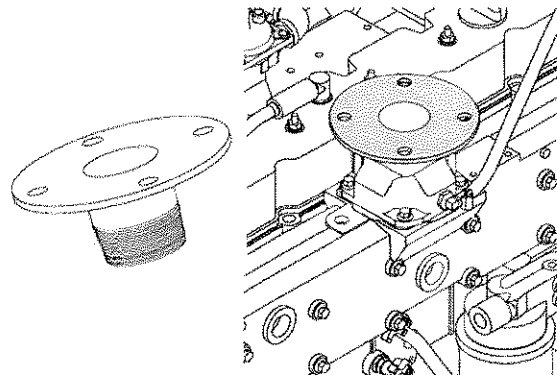
3.7.5.1 Dry Exhaust

- 3.00" outside diameter exhaust outlet.
- No provisions for exhaust O2 access



3.7.5.2 Wet Exhaust

- 4 Bolt Mounting Flange
- 6 In. Bolt Circle
- Rigid Connection
- No provisions for exhaust O2 access



3.8 Ignition System

The G8.3 is equipped with either the Altronic® III or Altronic® CD200 ignition system.

- Altronic® III: Option (IS9064)
- Altronic® III with CSA Approved Components: Option (IS9068)
- Altronic® CD200: Option (IS9081)

The G8.3E is equipped with the Altronic® CD200 ignition system.

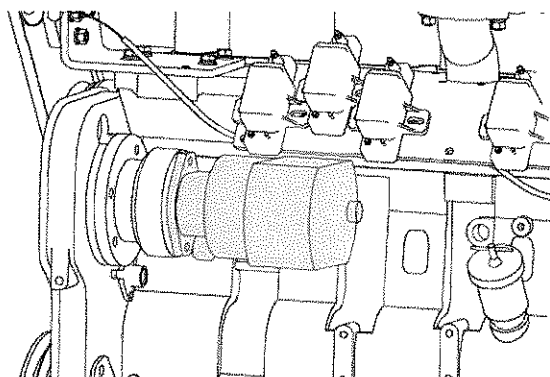
- Altronic® CD200 Option (IS9077)

3.8.1 Altronic® III

3.8.1.1 Alternator/Timing - Distribution Unit

The Altronic III units are self-powered, low tension, capacitor discharge ignition systems consisting of an 8-pole permanent magnet alternator and timing & distribution circuits. The alternator/timing - distribution unit has a sealed bearing construction and removable back cover.

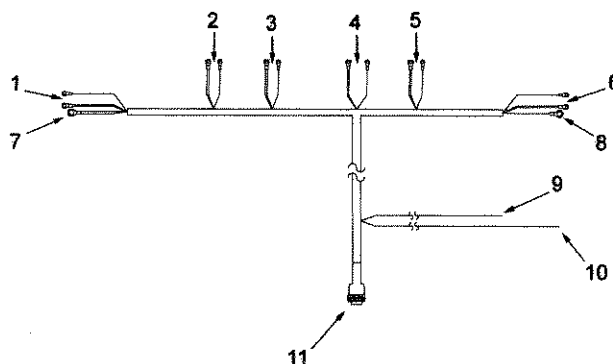
The Altronic III is CSA Certified: Class 1, Div. 2, Group D.



3.8.1.2 Primary Wiring

The primary wiring harness connects the Altronic unit to the terminals on each coil. One terminal of the coil is ground and the other terminal is control voltage supplied by the Altronic Unit. A "G" lead breaking out of the harness near the Altronic® alternator/timing - distribution unit can be used to disable the ignition system by switching it to ground.

1. Coil 1
2. Coil 2
3. Coil 3
4. Coil 4
5. Coil 5
6. Coil 6
7. Ground
8. Ground
9. Ground
10. "G" Lead (Ignition Shutdown)
11. Alternator/Timing - Distributor Unit Connector

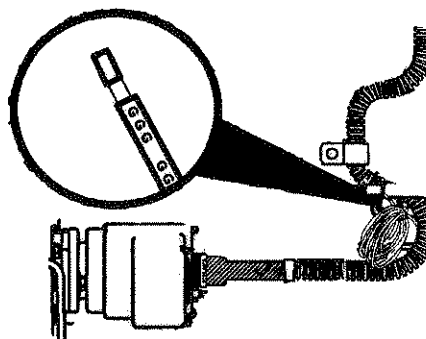


3.8.1.2.1 Shutdown Wiring

The "g" harness lead is the shutdown connection for the Altronic® III ignition system. It must be grounded to shut off the ignition.

Warning: Output voltage can be 80 to 225 volts and must be connected to proper instrumentation to avoid damage.

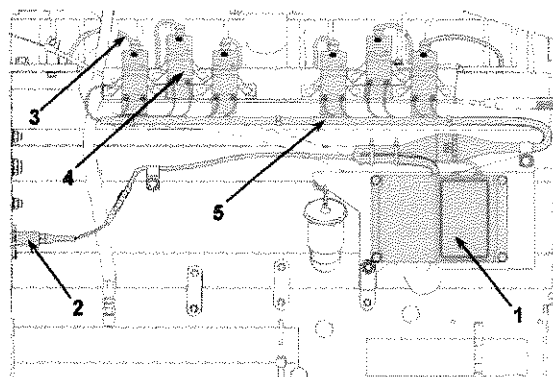
Refer to the original equipment manufacturer documentation for proper use. This wire is not factory modified unless connected to an instrument panel.



3.8.2 Altronic® CD200

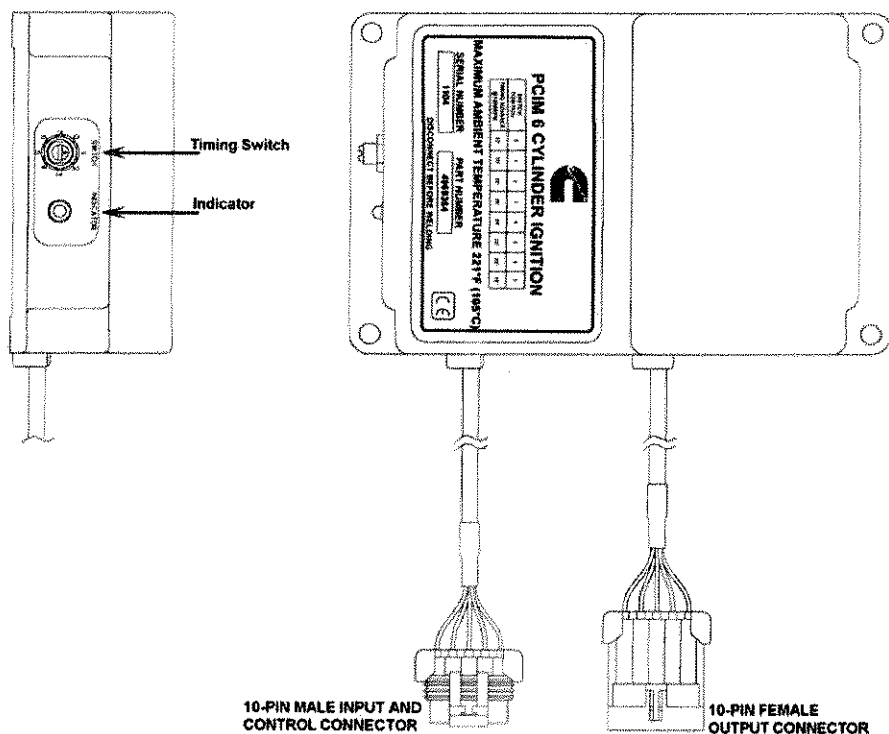
The CD200 Ignition System requires either a 12 or 24 volt DC (nominal) power supply.

1. Ignition Control Unit
2. Magnetic Pickup
3. Secondary Ignition Wire (6 count)
4. Ignition Coil (6 count)
5. Primary Wiring Harness



3.8.2.1 Altronic® CD200 Ignition Control Unit

The CD200 control unit steps up the DC supply voltage and switches the stored energy to the appropriate coil based on input signal from the magnetic pickup mounted on the back of the front gear cover. The CD200 control unit has a pick-up indicator for diagnostic purposes and a timing switch to allow limited changes to ignition timing. The adjustable timing range is determined during design by the pick-up sensor location, timing references on the camshaft gear, and the CD200 microcircuit logic.



3.8.2.1.1 CD200 Features

The CD200 is a programmable unit that can be accessed through a Windows™ based terminal program for monitoring and configuration. The configuration is pre-set by Cummins, Inc., based on performance characteristics and application requirements.

The pre-set configuration includes the following items:

- Timing curves vs. RPM
- Spark energy
- Individual cylinder timing adjustment
- Adjustable overspeed trip

The only adjustment available is the timing switch on the side of the CD200 unit. The timing is set by the factory on the position which sets the engine timing at the value specified by the FR Curve assigned to that engine. The timing should not require further adjustment unless the application (i.e. fuel composition) requires a change. Refer to **AEB 70.31, Stationary Natural Gas Fuel Quality and Performance**, and the gas analysis tool at www.gce.cummins.com, for proper timing values based on fuel quality.

The CD200 has comprehensive diagnostic capabilities that can be accessed either by using the Windows™ base terminal program or through "Flash" codes using the indicator on the side of the unit. Refer to Form CD200 II 3-05, CD200 Installation Instructions, for information on retrieving and interpreting the diagnostic codes.

The CD200 is available for shielded applications, but no shielded options currently exist for the G8.3 or G8.3E that utilize the CD200.

3.8.2.1.2 CD200 Ignition System Overview

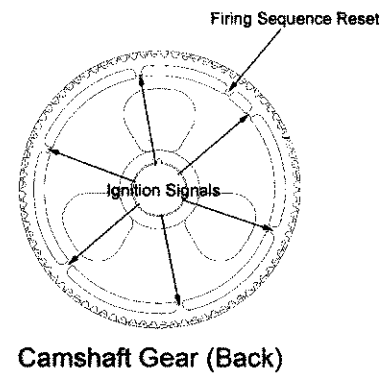
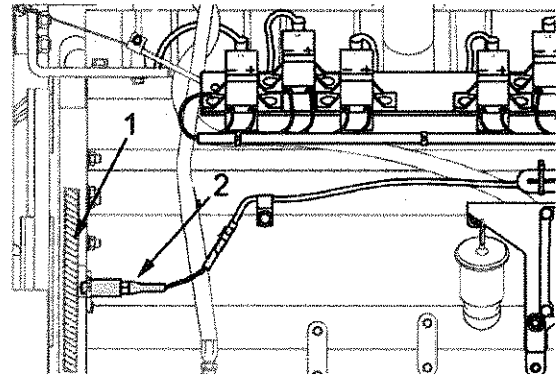
Product Feature

- Applies to 1-8 Cylinders
- Capacitor Discharge, High Energy Spark
- Accurate Timing – Camshaft References
- No Moving Parts
- Built-In Diagnostics
- Programmable Configuration* (Determined by Application)
- Available As Shielded or Unshielded
- Comprehensive Diagnostics
- Windows™ Based Terminal Program for Configuration* and Monitoring
- ModBus RTU (RS-485) Communications and Monitoring

* Configuration to be pre-set by Cummins, Inc, based on performance characteristics and application requirements.

3.8.2.2 Altronic® CD200 Magnetic Pick-Up Sensor

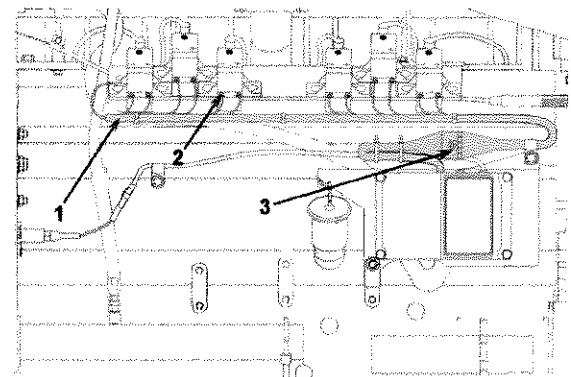
The magnetic pick-up (2) is mounted on the back of the front gear cover and is positioned so that the bosses on the back of the camshaft gear (1) will pass with an air gap not exceeding $.020" \pm .005"$. The magnetic pick-up generates a signal each time one of the bosses on the camshaft passes over it, indicating to the control unit the location of top dead center for each cylinder.



Camshaft Gear (Back)

3.8.2.3 Altronic® CD200 Primary Wiring

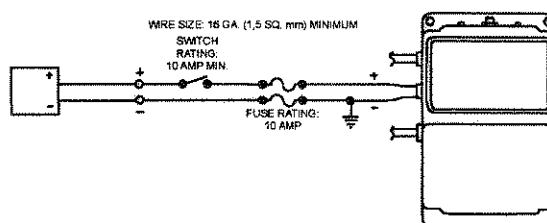
1. Primary Wiring Harness
2. Coil Connectors
3. Harness Ignition Connection



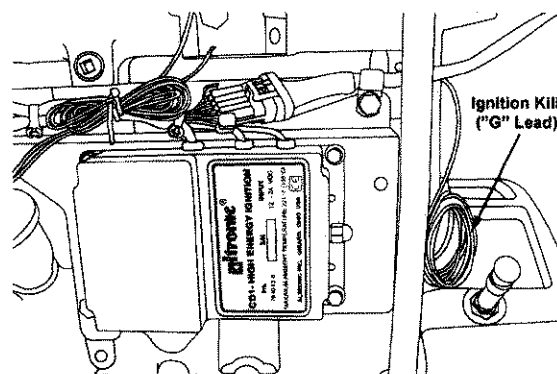
3.8.2.4 Altronic® CD200 Shutdown Wiring – G8.3

On the G8.3 The CD200 ignition system can be shut down two different ways:

1. Shutdown can be achieved by interrupting the DC power to the CD200 control unit through a normally open switch or relay with contacts rated 24 VDC, 10 amps. **Do not use a normally closed switch.**

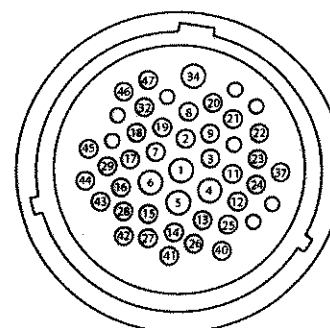


2. The "g" harness lead is the emergency shutdown connection for the Altronic® CD200 ignition system. It must be grounded to shut off the ignition. The "g" lead on a G8.3 is a white wire that is coiled and secured near the CD200 bracket.



3.8.2.5 Altronic® CD200 Shutdown Wiring – G8.3E

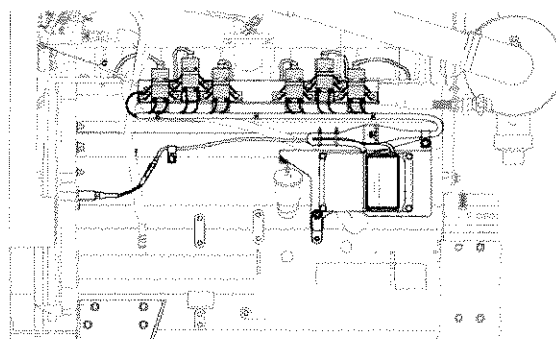
On the G8.3E, the emergency shutdown connection for the Altronic® CD200 ignition system is pin 21 in the 47 pin Deutsch connector. It must be grounded to shut off the ignition. (See the 47 Pin Deutsch connector details in the OEM wiring schematic on GCE.)



47 Pin Deutsch Connector on Engine

3.8.3 Ignition Coils (Altronic III and CD200)

Altronic® extended duration coils (350-600 microsecond) on each cylinder convert the control voltage supplied by the Altronic® unit to the higher voltage required at the spark plugs.

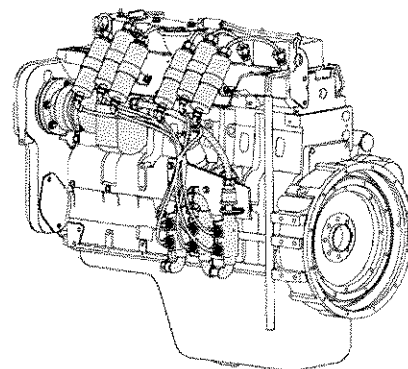
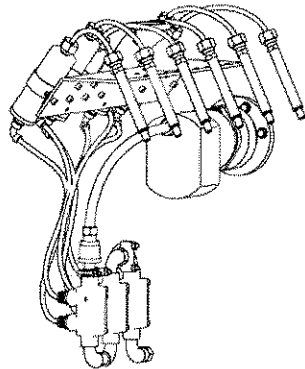


3.8.4 Spark Plugs

- Cummins C2000
- Unshielded
- M14 x 1.25 Thread Size
- 3/4" Thread Reach
- 13/16" Hex Size

3.8.5 Ignition System – Shielded (IS9068)

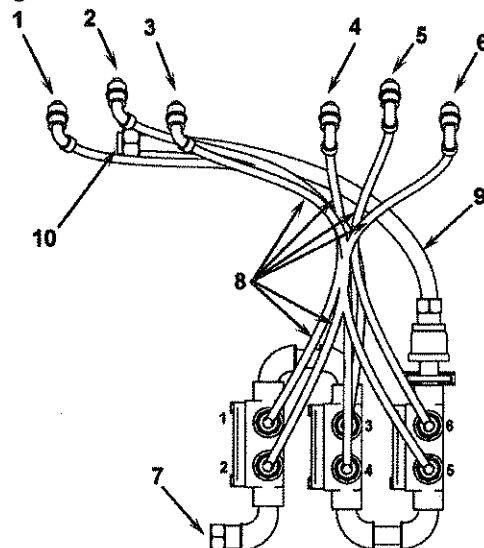
The shielded ignition for the G8.3 uses all components that are CSA Certified for Class 1, Div. 2, Group D hazardous areas.



3.8.5.1 Primary Wiring – Shielded

The primary wiring harness is contained in CSA approved conduit and housing. The harness connects the Altronic unit to the terminals on each coil. One terminal of the coil is ground and the other terminal is control voltage supplied by the Altronic Unit. A "G" lead accessed at the base of the junction block housing can be used to disable the ignition system by switching it to ground.

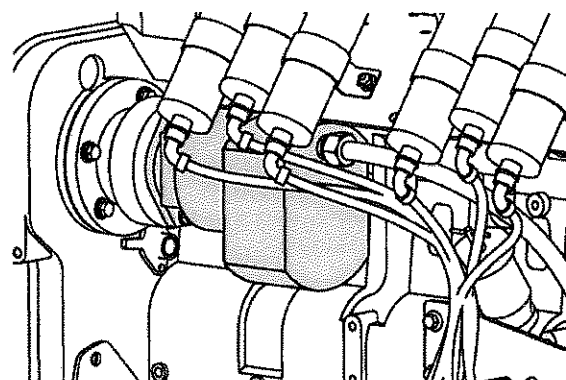
1. Coil 1
2. Coil 2
3. Coil 3
4. Coil 4
5. Coil 5
6. Coil 6
7. "G" Lead (Ignition Shutdown)
 - Use 3/8" CSA approved Liquid Tight Conduit.
8. Coil Wire Conduits
9. Alternator/Timing - Distributor Unit Conduit
10. Alternator/Timing - Distributor Unit Connector



3.8.5.2 Alternator/Timing - Distribution Unit – Shielded

The Altronic III units are self-powered, low tension, capacitor discharge ignition systems consisting of an 8-pole permanent magnet alternator and timing & distribution circuits. The alternator/timing - distribution unit has a sealed bearing construction and removable back cover.

The Altronic III is CSA Certified: Class 1, Div. 2, Group D.

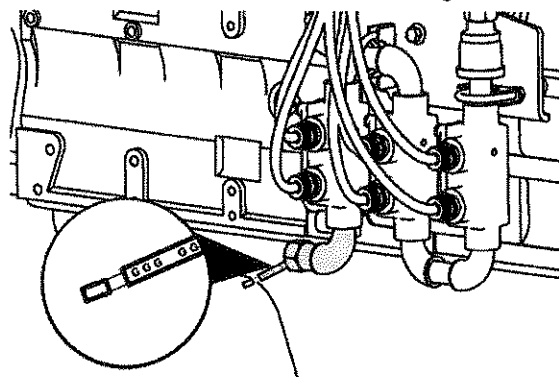


3.8.5.3 Shutdown Wiring – Shielded

The "g" harness lead is the shutdown connection for the Altronic® III ignition system. It must be grounded to shut off the ignition.

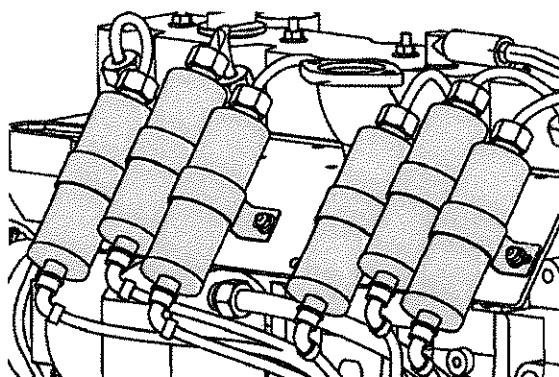
Warning: Output voltage can be 80 to 225 volts and must be connected to proper instrumentation to avoid damage.

The "g" lead is usually wired to the on/off switch, the instrument panel switch gages, or to some other safety device. The "g" lead is "open" for normal operation of the ignition system and is switched to ground to disable the ignition system. Refer to Form AIII II 4-92: Altronic® III Installation Instructions for proper use. This wire is not factory modified unless connected to an instrument panel.



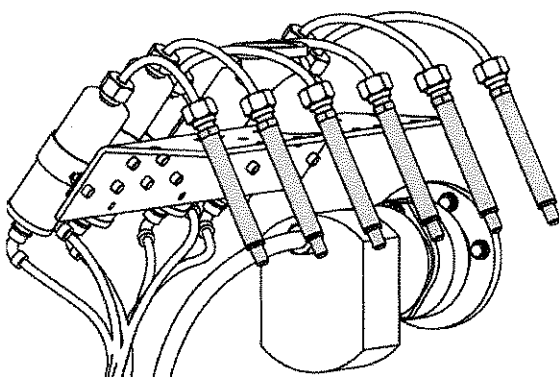
3.8.5.4 Ignition Coils – Shielded

Altronic® CSA certified standard duration coils on each cylinder convert the control voltage supplied by the Altronic® unit to the higher voltage required at the spark plugs.



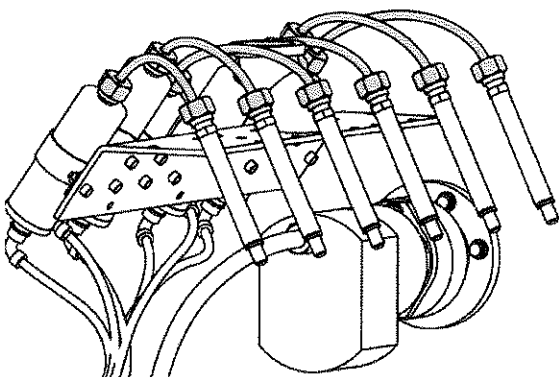
3.8.5.5 Spark Plugs – Shielded

- Stitt® S-R407XLBEX8.4
- Shielded
- M14 x 1.25 Thread Size
- 3/4" Thread Reach
- 13/16" Hex Size



3.8.5.6 Spark Plug Leads – Shielded

- CSA-Certified Shielded Spark Plug Leads
- Complies With Requirements For Class I, Division 2, Group D Hazardous Areas
- Stainless Steel-Jacketed
- Teflon Inner Liner
- Shielded Terminations
- Compatible with Shielded Altronic Ignition Coils And Shielded Spark Plugs With 3/4"-20 Connections.



3.9 Drive System

3.9.1 Flywheel Housing

The following flywheel housing options are available for the G8.3, G8.3E, or both:

Option Number	SAE #	Configuration	Engine Model	Material	Transmission Mounting Hole Thread/Count
FH9306	SAE 3	D551013CX03	G8.3	Aluminum	12 X M10X1.5
FH9355	SAE 3	D551013CX03, D551015CX03	G8.3 and G8.3E	Cast Iron	12 X M10X1.5
FH9358	SAE 1	D551013CX03, D551015CX03	G8.3 and G8.3E	Cast Iron	12 X 7/16 UNC
FH9506	SAE 2	D551013CX03, D551015CX03	G8.3 and G8.3E	Aluminum	12 X M10X1.5

The Flywheel Housings above all have the following common features

- Clutch Type: Dry
- Starter Bore Position: 49
- Flywheel To Block Mtg Pattern: 12 X M12 X1.75
- Starter Motor Flange SAE Type: SAE #3, 3bolt 120 Degree
- Starter Mounting Hole Thread Size: M12
- Tach Drive Location Size: Quad 4, 3/4-16 UNF
- Tach Sensor Mtg Hole Count: 1
- Engine Family: C Series, L Series

3.9.2 Flywheel

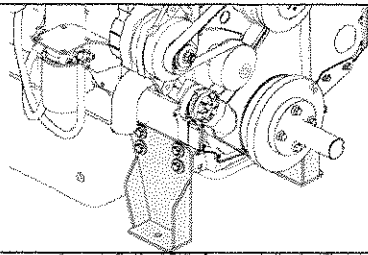
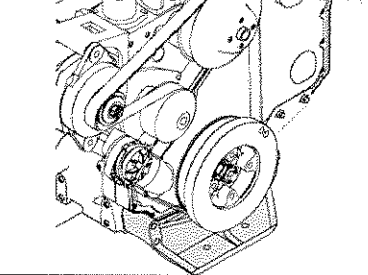
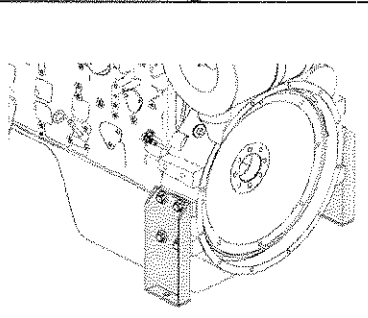
The following flywheel options are available for the G8.3, G8.3E, or both:

Option Number	SAE #	Configuration	Engine Models	Ring Gear Tooth Count	Pitch
FW9525	SAE 1	D551013CX03, D551015CX03	G8.3 and G8.3E	158	8/10
FW9857	SAE 3	D551013CX03, D551015CX03	G8.3 and G8.3E	127	8/10
FW9878	SAE 2	D551013CX03, D551015CX03	G8.3 and G8.3E	138	8/10

3.10 Mounting System

3.10.1 Assembly, Engine Mount

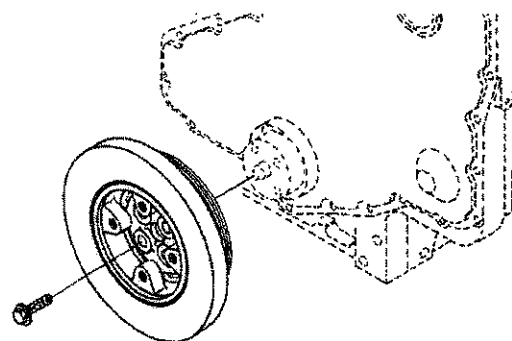
The following mount options are available for the G8.3 and G8.3E:

Front/Rear	Option Number	Description	Applicable Engine Models	Image
Front	EM9279	Two Piece Side Mount Front Engine Support	G8.3, G8.3E	
Front	EM9305	Single Piece Center Front Engine Support	G8.3, G8.3E	
Rear	RE9073	Used with SAE 1 Flywheel Housing	G8.3, G8.3E	
	RE9082	Used with SAE 2 Flywheel Housing	G8.3, G8.3E	
	RE9075	Used with SAE 3 Flywheel Housing	G8.3, G8.3E	

3.10.2 Vibration Damper (DA9237)

Rubber Vibration Damper with Front PTO Provision

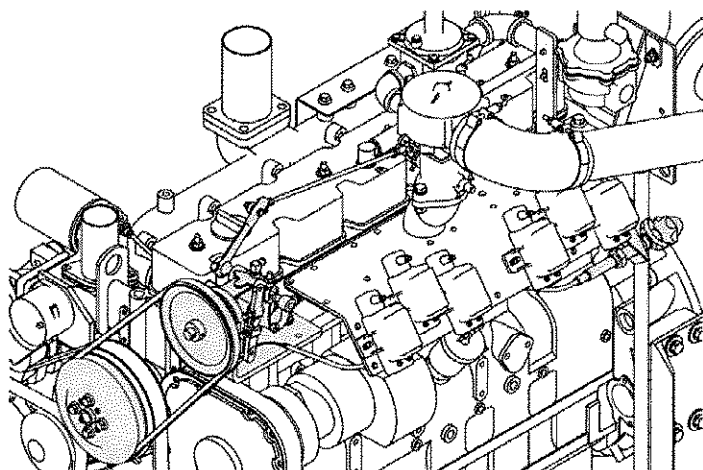
Damper Type: Rubber
 Damper Diameter (MM): 228.00
 Damper RPM Limitation: 2200 and Below
 Drive Pulley Diameter (MM): 199.42 Over 2.5 MM Balls
 FFOB to C/L First Pulley Groove (MM): 57.1
 Pulley Profile: Poly-V 8 Rib K
 Front PTO Provision: Yes
 PTO Pilot Diameter: 135mm
 PTO Mounting: M12 X 1.75-6h
 PTO Bolt Circle: 4 X 96.0



3.11 Governor

3.11.1 Mechanical – Pierce - G8.3

The Mechanical (Pierce) Governor is available for the G8.3. The Pierce centrifugal governor is mounted at the front of the intake side of the engine and is driven by a pulley mounted on the fan drive. The Pierce is a centrifugal speed governor that maintains constant engine speed at or below maximum load. The Pierce uses an oil supply (of the same weight as used in the engine) contained in its own housing. External linkages connect the governor to a lever on the throttle valve on the intake manifold. Engine speed is adjusted through a Vernier Cable located just beneath the intake cover.

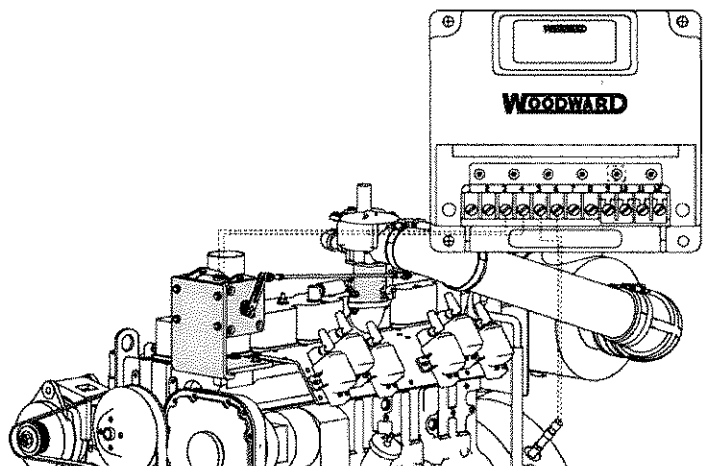


3.11.2 Electrical – Woodward 1712 and Woodward 1724 – G8.3

The Woodward 1712 (12 Volt) and Woodward 1724 (24 Volt) governors are available for the G8.3.

The Woodward Electrically Powered Governor (EPG) system requires three components for operation:

- Engine Speed Sensor mounted on the flywheel housing that sends engine speed information to the controller
- Speed controller that receives the engine speed signal and outputs control signals to the actuator
- Actuator that physically controls throttle position

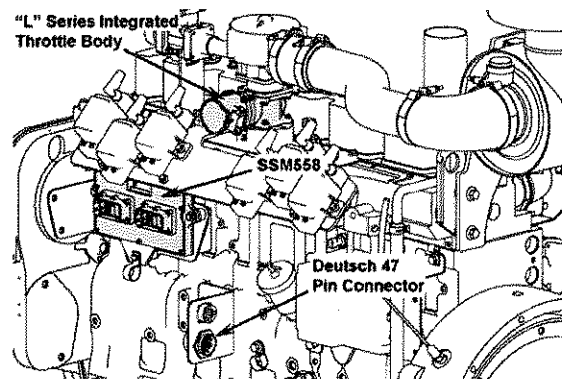


3.11.3 Woodward L-Series – G8.3E Only

The Woodward L Series is a 24V integrated throttle body and actuator assembly. Three options are available for speed control:

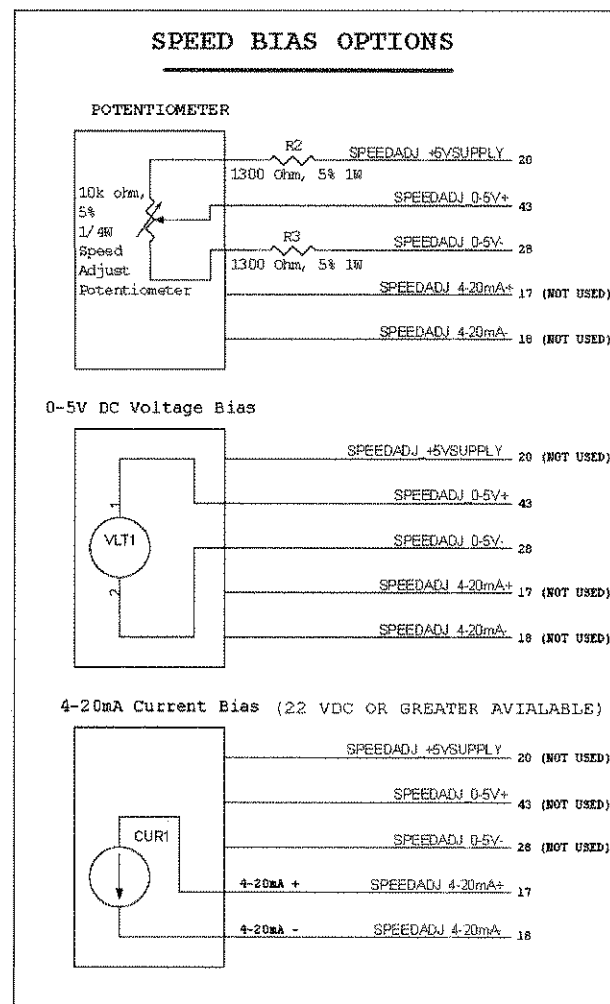
- Potentiometer
- 0 to 5 DC Voltage Bias
- 4 – 20 mA Current Bias*

The user interface for speed control must be connected through the 47 Pin Deutsch connector to the SSM558 engine control module (ECM). The Idle/Rated switch must be set to "Rated" and the oil temperature must be above the calibrated minimum level for speed bias controls to operate. **Refer to the OEM wiring schematic on GCE for specific wiring details on speed bias inputs and the Idle/Rated switch.**



Speed Bias options are calibration specific. The control module must be programmed for either 0 to 5 DC voltage bias or 4 – 20 mA current bias. **If speed bias requirements change after engine shipment from the factory the control module will require either replacement or reprogramming.**

*The 4 – 20 mA driver for speed bias must have a voltage sourcing capability of at least 22 VDC in order to drive a 20 mA input.



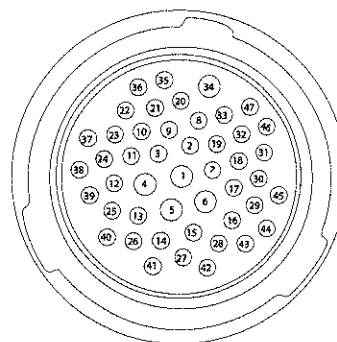
Speed Bias Options Schematic: Refer to the OEM wiring schematic on GCE for latest revision and specific details.

3.12 Electrical System – G8.3 and G8.3E

3.12.1 Deutsch 47 Pin Connector Socket (HD36-24-47SE-059)

On the G8.3E only, Engine System Controls and Status lamps are accessible through the HD36-24-47PE-059 connector (male) on the left hand side of the engine. An HD36-24-47SE-059 connector (female) and relay box must be wired to supply power and ground for the governor, ignition, and air fuel ratio system. System control and status are also provided through this connector. For details refer to the OEM wiring schematic on GCE.

Deutsch 47 Pin Connector socket
HD36-24-47SE-059
CONNECTOR ON WIRING HARNESS



Refer to the HD30 & HDP20 Series Technical Manual (available from LADD Industries) for assembly instructions, special tools, and product specifications.

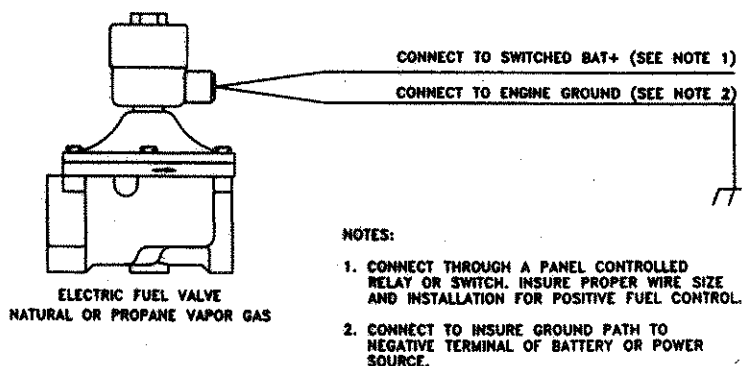
3.12.2 G8.3E OEM Interface Harness

The OEM Interface Harness Schematic is available at www.gce.cummins.com

3.12.3 Fuel Shutoff – G8.3 (Refer to OEM Schematic for G8.3E)

24 volts ASCO® Automatic Fuel Shutoff (Non-Shielded)

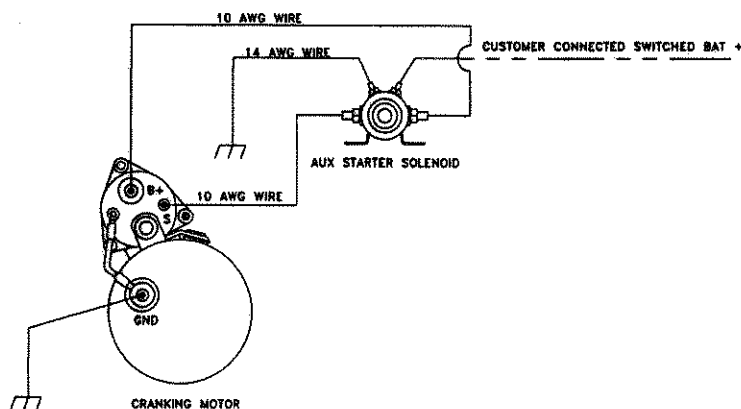
TYPICAL WIRING DIAGRAM (APPLY TO ENGINES SHIPPED WITH AN ELECTRIC FUEL VALVE INSTALLED). (ALL OTHER CONNECTIONS TO BE MADE BY THE CUSTOMER).



3.12.5.2 Starter with Auxiliary Solenoid

TYPICAL WIRING DIAGRAM

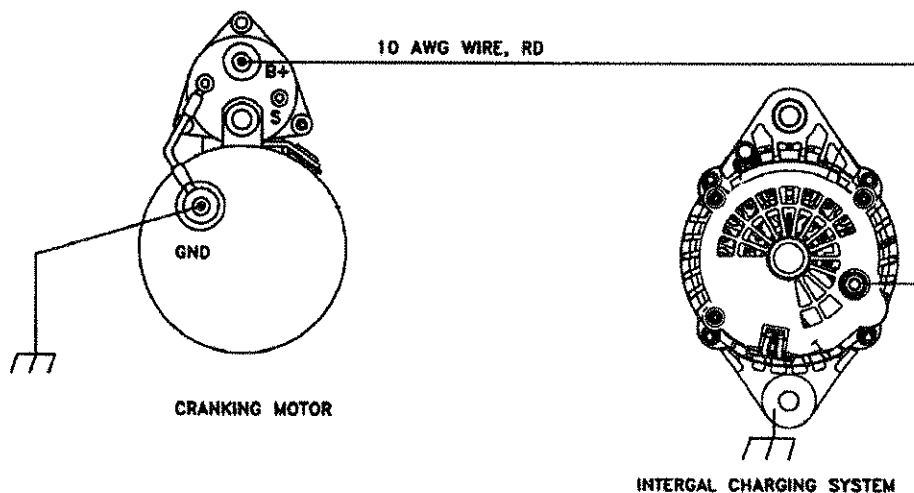
(APPLY TO ENGINES SHIPPED WITH STARTER AND AUX SOLENOID OR STARTER RELAY INSTALLED AND CONNECTED).
(STARTER WILL BE SHIPPED WITH A GROUND CABLE INSTALLED, AND AUX SOLENOID INSTALLED AND WIRED.
ALL OTHER CONNECTIONS TO BE MADE BY THE CUSTOMER).



3.12.5.3 Starter with Alternator

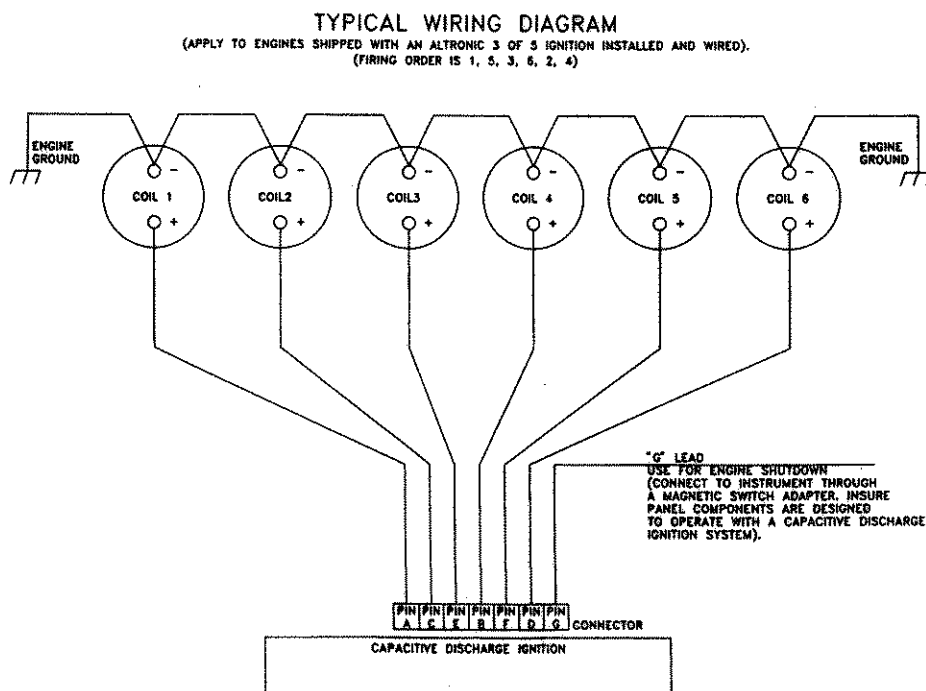
TYPICAL WIRING DIAGRAM

(APPLY TO ENGINES SHIPPED WITH STARTER AND ALTERNATOR INSTALLED AND WIRED.)
(ENGINE WILL BE SHIPPED WITH STARTER GROUND CABLE INSTALLED, WITH CHARGING CIRCUIT CABLE INSTALLED.)
(ALL OTHER CONNECTIONS TO BE MADE BY THE CUSTOMER).

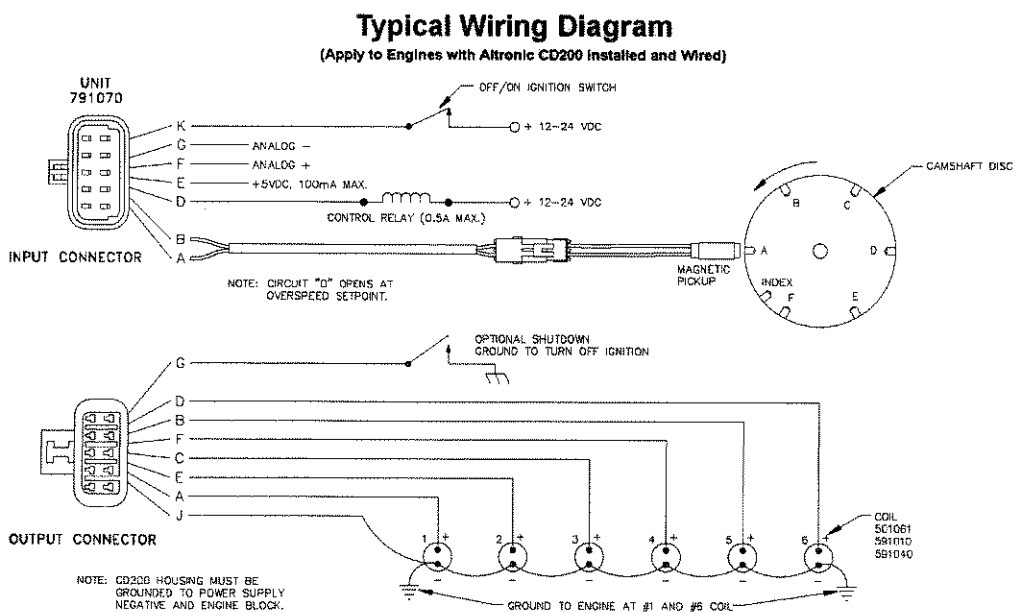


3.12.6 Ignition

3.12.6.1 Altronic III (G8.3 Only)



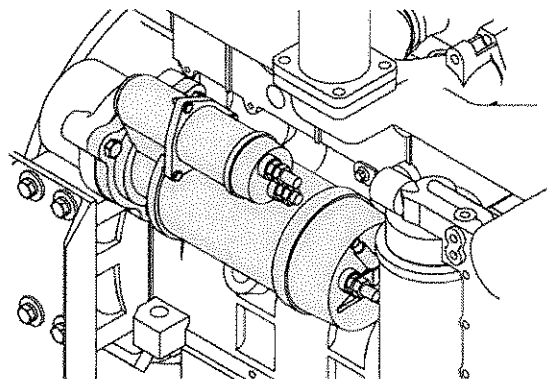
3.12.6.2 CD200 – G8.3 (Refer to OEM Schematic for G8.3E)



3.13 Starters

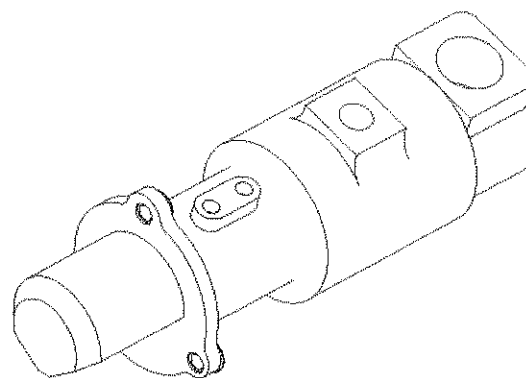
3.13.1 Electric (ST9283, ST9289)

- Mfg. Cummins
- Volt: 24 (ST9283 - G8.3 and G8.3E)
- Volt: 12 (ST9289 - G8.3 Only)
- Model/Type: 39 MT-HD
- Dia Pitch: 8/10
- Mt SAE: SAE #3 - 3 Bolt 120 degree
- Starter Style: Reduction

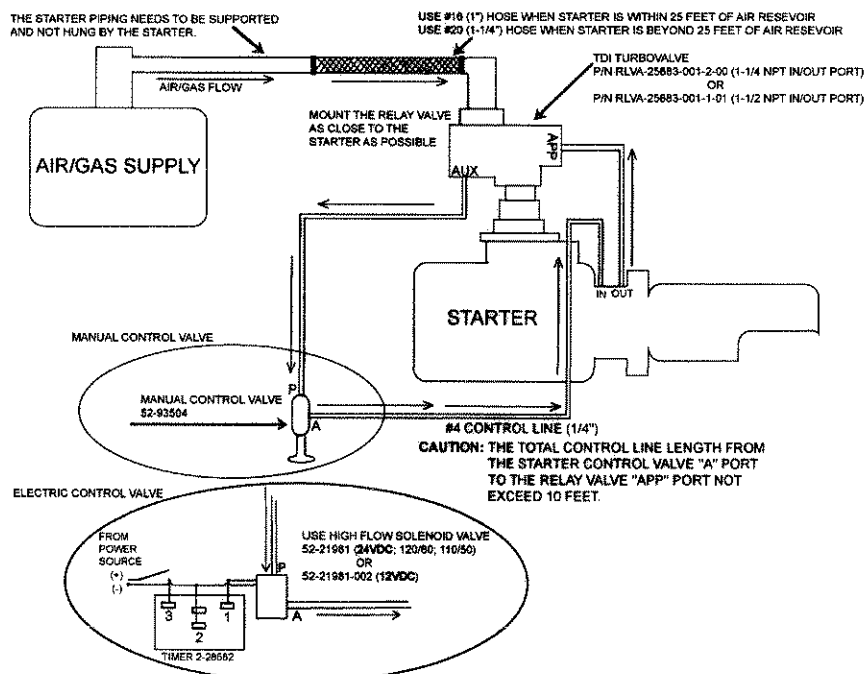


3.13.2 Air/Gas (ST9469 – G8.3 Only)

- Manufacturer: TDI
- Model: T30P
- Starter Type: Air or Natural Gas
- Starter Drive: Pre-Engaged
- Pinion Diametral Pitch: 8/10
- Operating Range: 40-150 PSIG
- Air Supply Inlet: 1" NPT
- Air Exhaust Outlet: 2" NPT



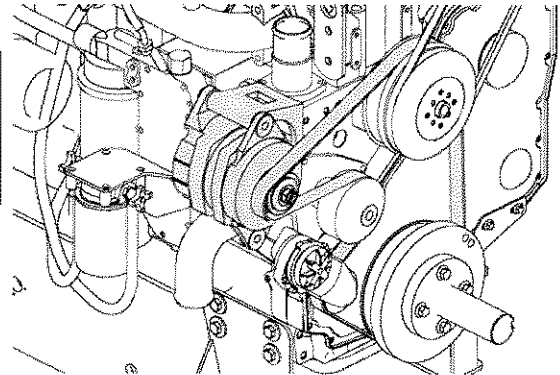
3.13.2.1 Air/Gas (ST9469) Typical Installation – Manual or Electrical Control



3.14 Alternator

The following alternator options are available for the G8.3 and G8.3E:

Option Number	Model	Voltage	Amperage	Applicable Engine Model
EE9244	Delco 24SI	12	100	G8.3
EE9247	Delco 24SI	24	70	G8.3, G8.3E

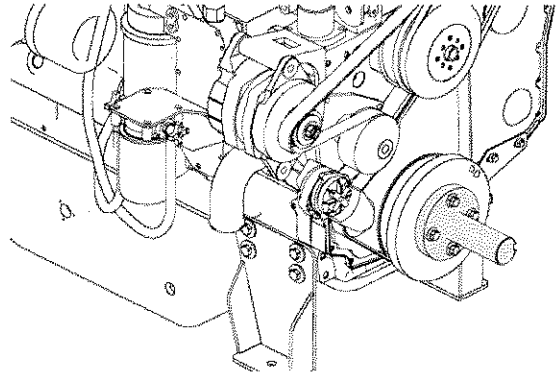


4 Accessories

4.1 Front PTO Adapter (AF9213)

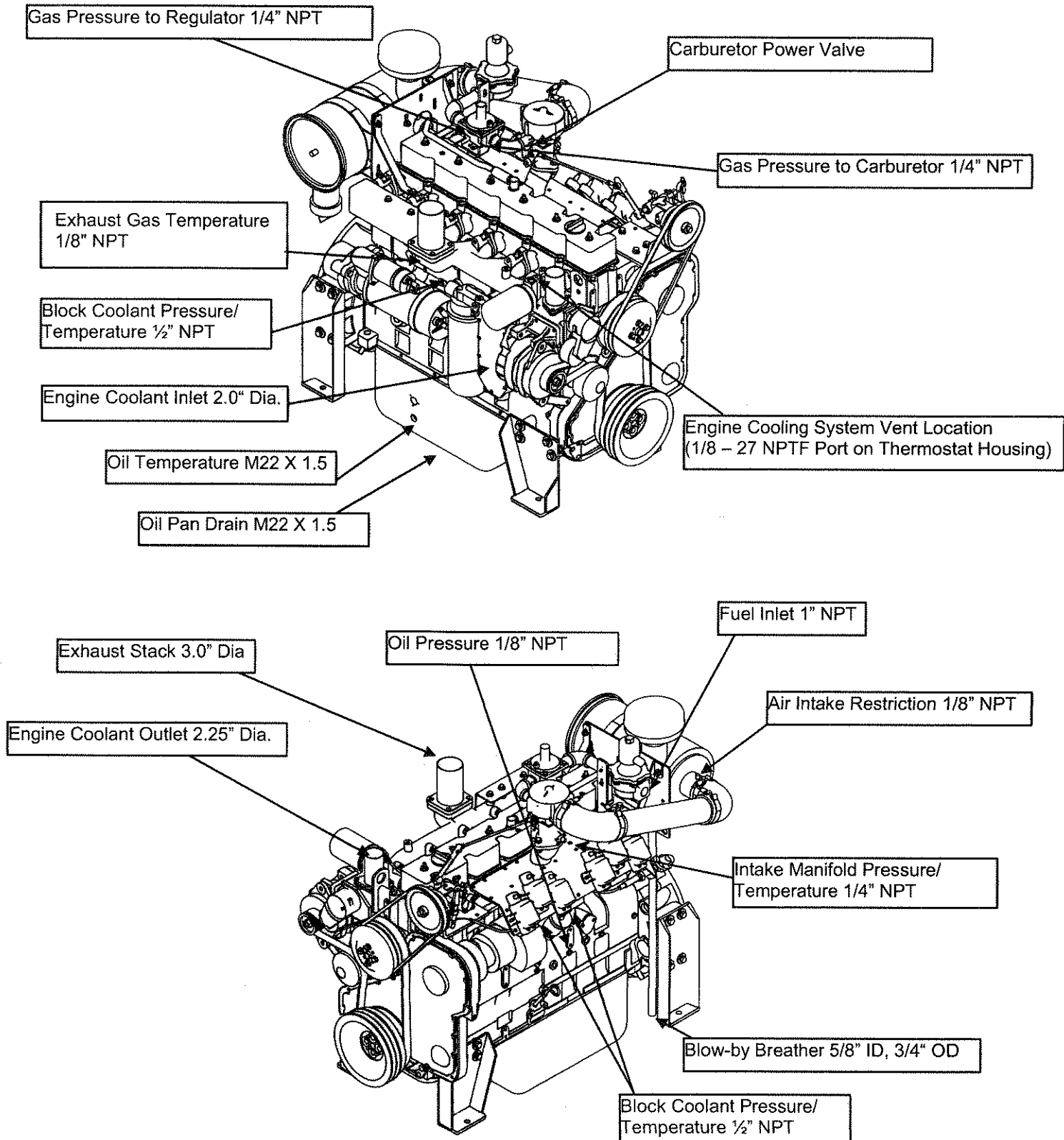
Requires Damper with Front PTO Provision (DA9237)

- PTO Manufacturer/Model: Stub Shaft
- Torque Limit (Lbs.Ft.): 229
- Mtg Bolt Holes : 4 X 13mm Equally Spaced
- Bolt Circle (mm) : 4 X 96
- Shaft Diameter (mm) : 50.85
- Keyway Size (mm): 12.7 X 107 X 7 Deep.
- Damper Mtg Face To End Of Shaft (mm) : 162

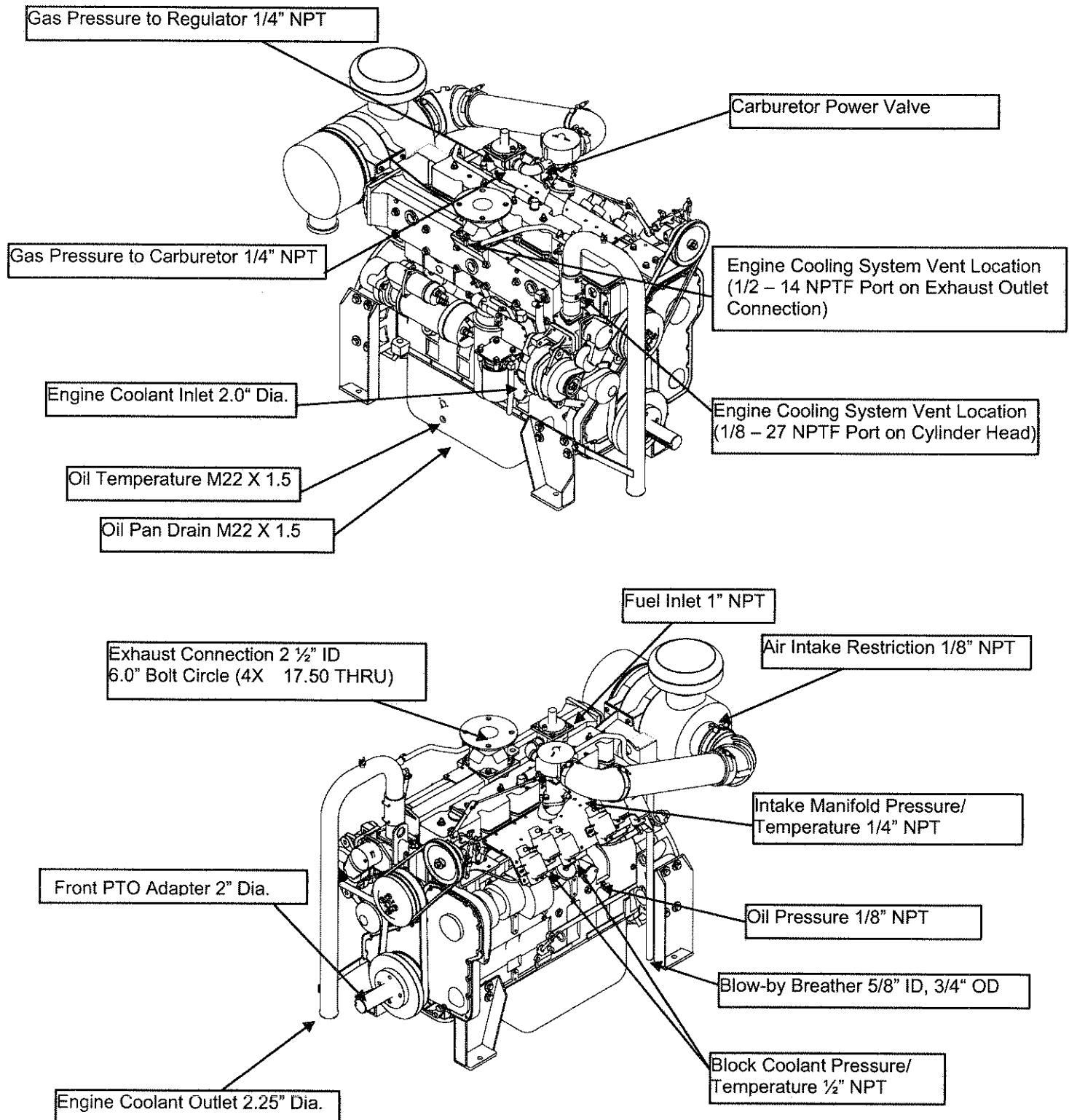


5 Appendix A - Engine Installation and Set Up Connect Points

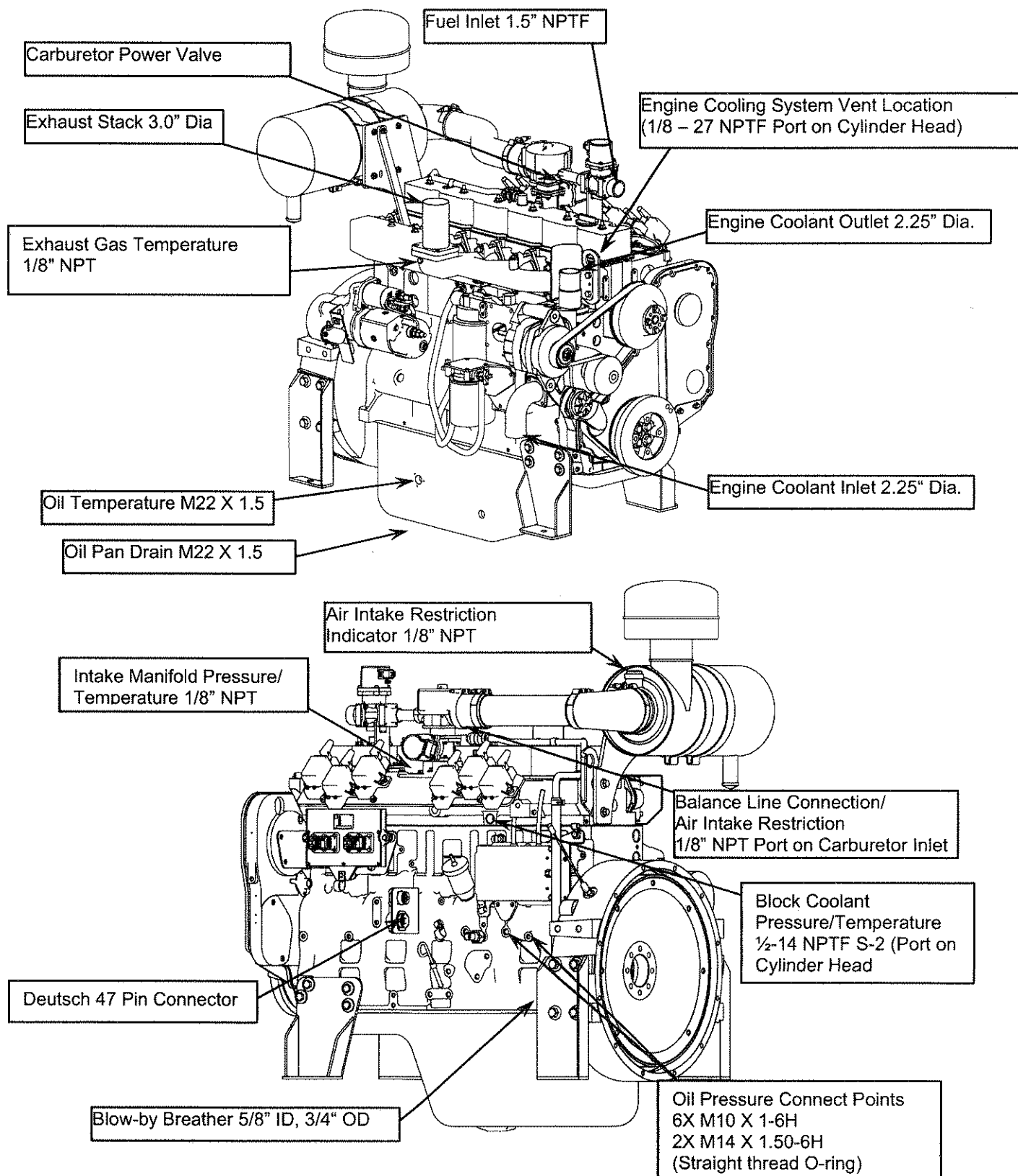
5.1 G8.3 (Dry Exhaust)



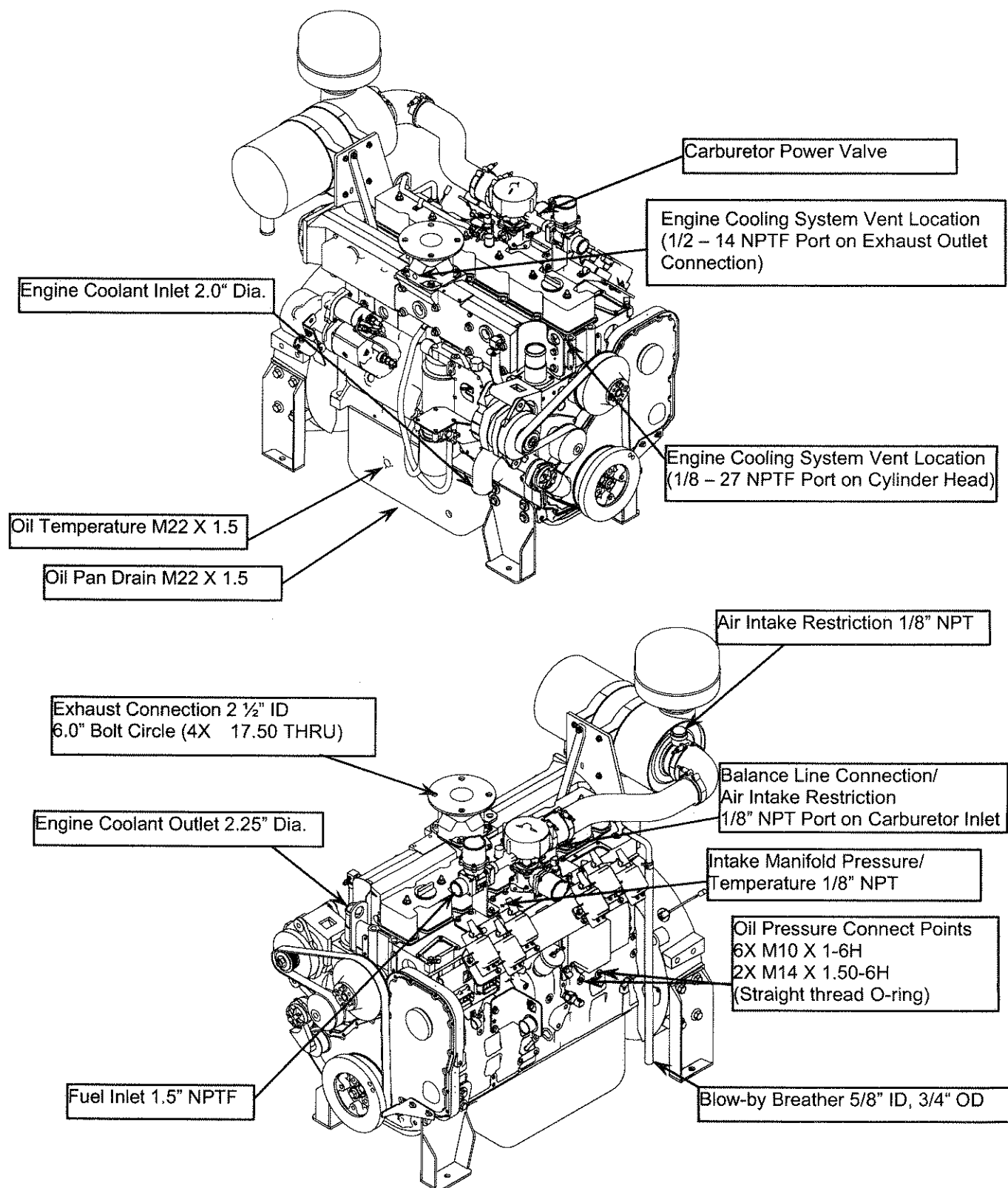
5.2 G8.3 (Wet Exhaust)



5.3 G8.3E (Dry Exhaust)



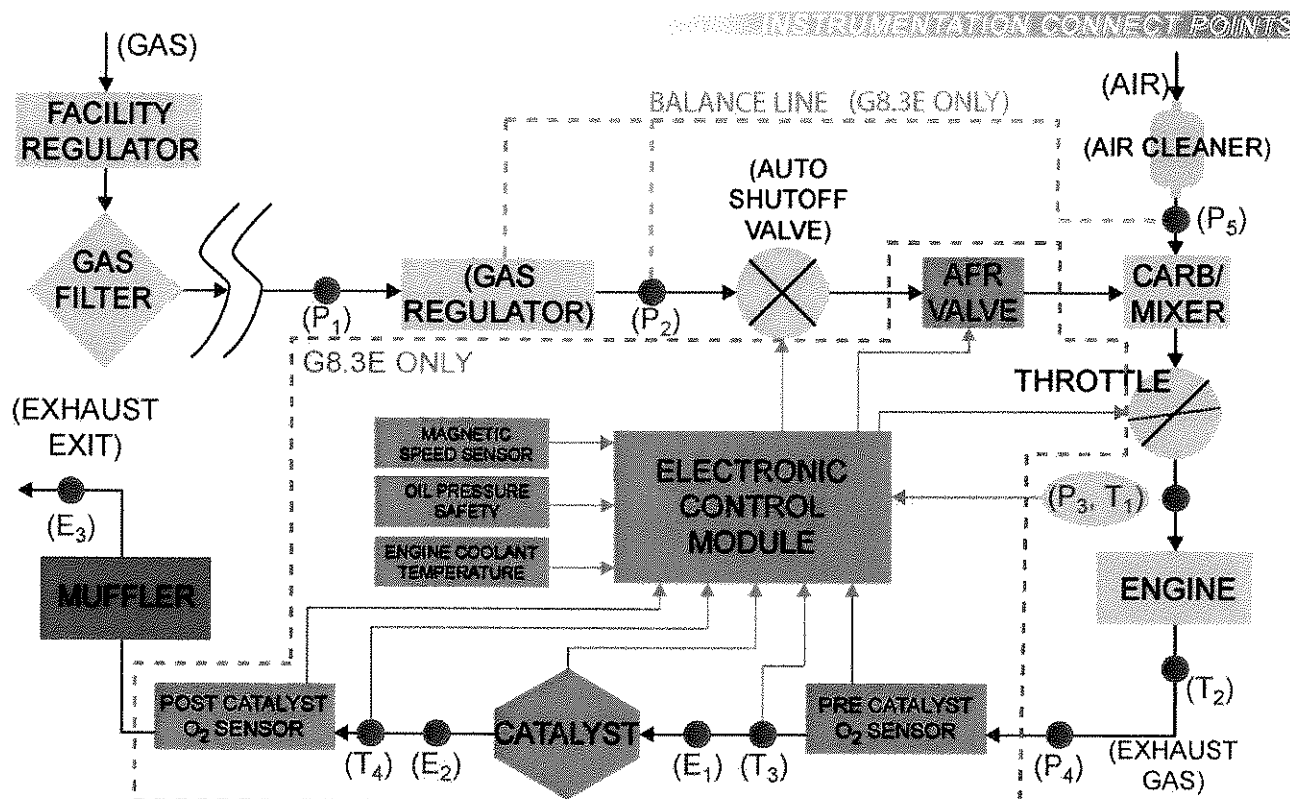
5.4 G8.3E (Wet Exhaust)



5.5 Measurement Points

Measurement Points are indicated in this section to determine required adapters, proper instrumentation, and general practices for data collection. Refer to the applicable Base Engine Data Sheet and FR curve for specific operating parameters.

5.5.1 Instrumentation Requirements Overview

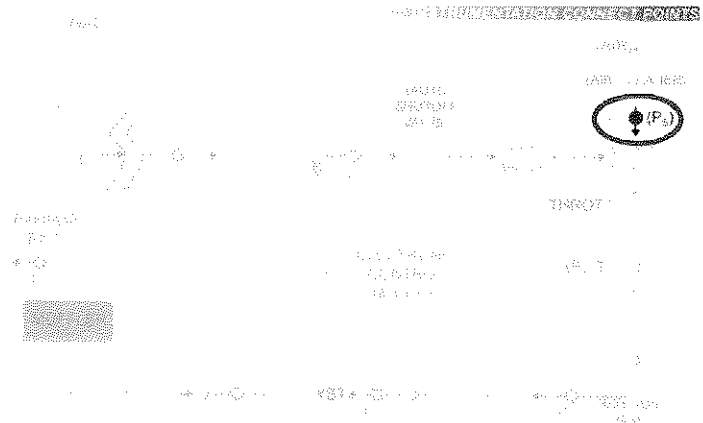


- (P₁) Fuel Pressure "In" to On-Engine Regulator – Pressure Gauge capable of reading 0-35" WC (G8.3) or 0-30 PSI (G8.3E)
- (P₂) Fuel Pressure "Out" of On-Engine Regulator – Pressure Gauge capable of reading 0-35" WC
- (P₃) Intake Manifold Pressure – Vacuum gauge capable of reading 0-101.6 kPa (0-30 in Hg) vacuum
- (P₄) Exhaust Back Pressure – Pressure Gauge capable of reading 50 mm Hg [2" Hg.]
- (P₅) Air Intake Restriction Indicator - Pressure gauge capable of reading 0-889 mm (0-35" WC)
- (T₁) Intake Manifold Temperature – Thermocouple and digital thermometer capable of reading 200° F
- (T₂) Stack Temperature – Thermocouple and digital thermometer capable of reading 2000° F
- (T₃) Catalyst Inlet Temperature - Thermocouple and digital thermometer capable of reading 2000° F
- (T₄) Catalyst Outlet Temperature - Thermocouple and digital thermometer capable of reading 2000° F
- (E₁) Emissions Check Point (Pre Catalyst) – Gas analyzer capable of reading NOX, CO, and O₂
- (E₂) Emissions Check Point (Post Catalyst) – Gas analyzer capable of reading NOX, CO, and O₂
- (E₃) Emissions Check Point (Post Catalyst) – Gas analyzer capable of reading NOX, CO, and O₂

5.5.2 Air Intake Restriction

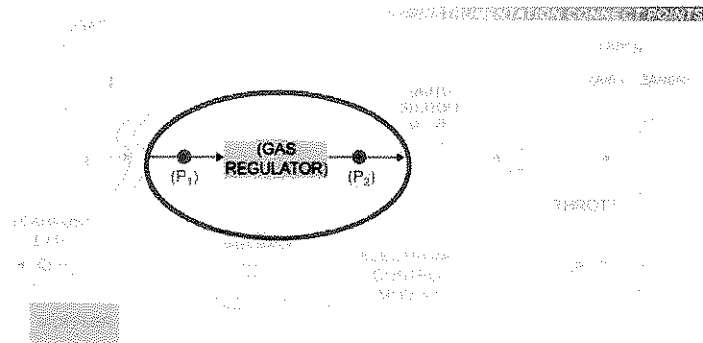
A water manometer or pressure gauge capable of reading 0-889 mm (0-35 in H₂O) vacuum is required to read intake restriction. The engine needs to be operating at rated RPM and full load to check the air intake restriction.

Maximum Allowable Intake Air Restriction:
Clean Element: 127 mm H₂O (5 in H₂O)
Dirty Element: 381 mm H₂O (15 in H₂O)



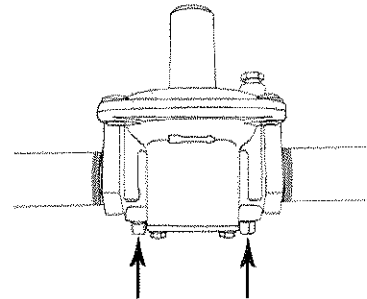
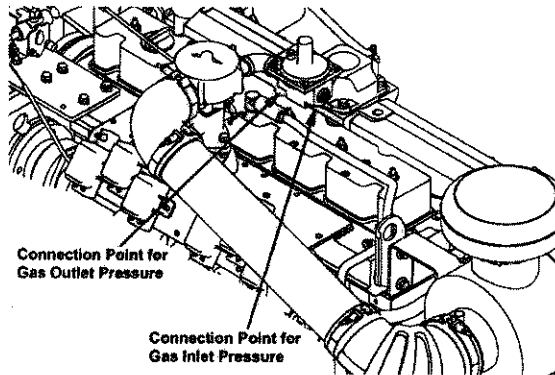
Engine		Location	Fitting Size(s)	Image
G8.3 & G8.3E		Air restriction indicator port in the air cleaner housing	1/8" NPT	
		Port at the bottom of the carburetor inlet	1/8" NPT	

5.5.3 Gas Pressure Connect Points



5.5.3.1 G8.3 Gas Pressure Connect Points

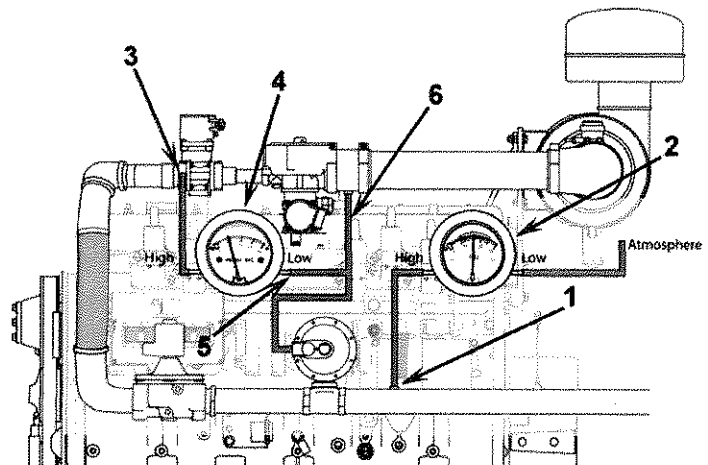
The installation points for gas pressures are at the 1/4 NPT ports on the bottom of the on-engine gas regulator. Water manometers or pressure gauges capable of reading 0-35" H₂O are required to measure inlet and outlet gas pressures.



Gas Pressure Connections

5.5.3.2 G8.3E Gas Pressure Connect Points

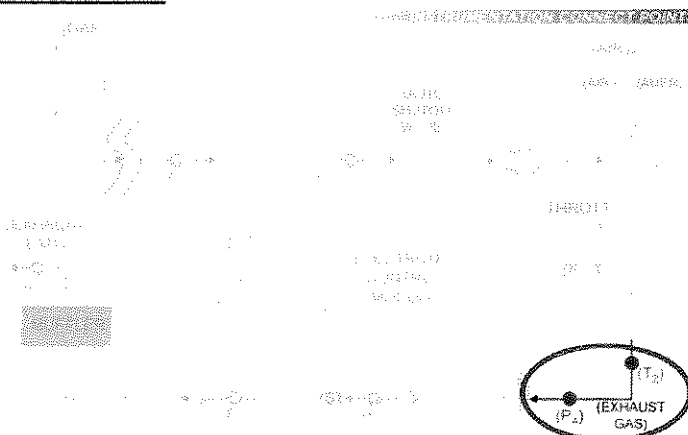
The regulator for the G8.3E engine is not installed on the engines at the factory. The regulator must be installed with both sides of the regulator supported. The piping going into the regulator will require a 3/8" pressure tap (1). A pressure gauge capable of reading 0-30 PSI (2) is required for pressure going into the regulator. Inlet pressure to the carburetor should be checked at the port prior to the inlet of the fuel control valve (3). A pressure gauge capable of reading 0-35" WC (4) is required to measure pressure to the carburetor. The gauge that measures fuel pressure to the carburetor should be connected so that the "Low" port (5) is connected to the balance line (6) between the on-engine regulator and the carburetor. The maximum length allowed for the balance line is 3 feet.



Note: Since the control valve can affect fuel pressure, pressure on the outlet side of the fuel control valve should not be used for regulator adjustments.

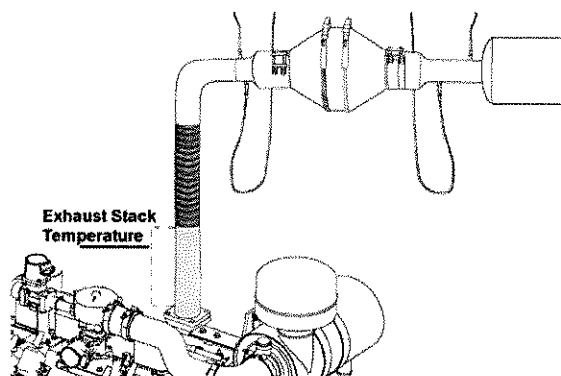
5.5.4 Exhaust Stack Temperature and Back Pressure

Exhaust stack temperature and back pressure are measured after the exhaust outlet and prior to the catalyst and/or muffler.



5.5.4.1 Exhaust Stack Temperature

Exhaust stack temperature can be measured at any point on the exhaust system that is within 12" of the exhaust outlet. No access points are provided on the engine. A 1/4" NPT port is required in the exhaust system to access exhaust stack temperature. Fittings used in the exhaust system should be stainless steel and high temperature anti-seize should be applied to threads of the fitting prior to installation. A 1/4" NPT stainless steel pipe plug should be installed in the fitting after testing to prevent exhaust leaks. High temperature anti-seize should also be applied to the threads of the stainless steel pipe plug prior to installation.

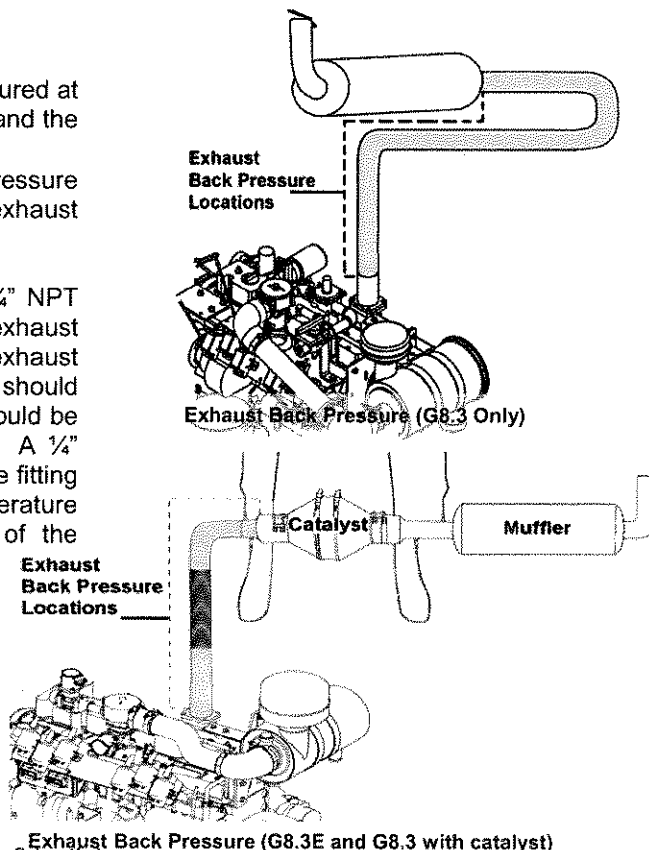


5.5.4.2 Exhaust Back Pressure

- **G8.3 Only** – Exhaust back pressure can be measured at any point between the exhaust outlet connection and the muffler.
- **G8.3E and G8.3 with catalyst** – exhaust back pressure can be measured at any point between the exhaust outlet connection and the catalyst.

No access points are provided on the engine. A 1/4" NPT port is required in the exhaust system between the exhaust outlet connection and the muffler/catalyst to access exhaust back pressure. Fittings used in the exhaust system should be stainless steel and high temperature anti-seize should be applied to threads of the fitting prior to installation. A 1/4" NPT stainless steel pipe plug should be installed in the fitting after testing to prevent exhaust leaks. High temperature anti-seize should also be applied to the threads of the stainless steel pipe plug prior to installation.

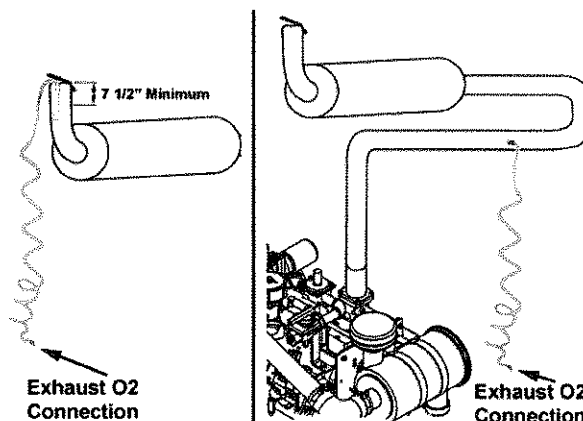
- Maximum Allowable Back Pressure:
6.8 kPa (2 in Hg.)



5.5.5 G8.3 Exhaust O₂

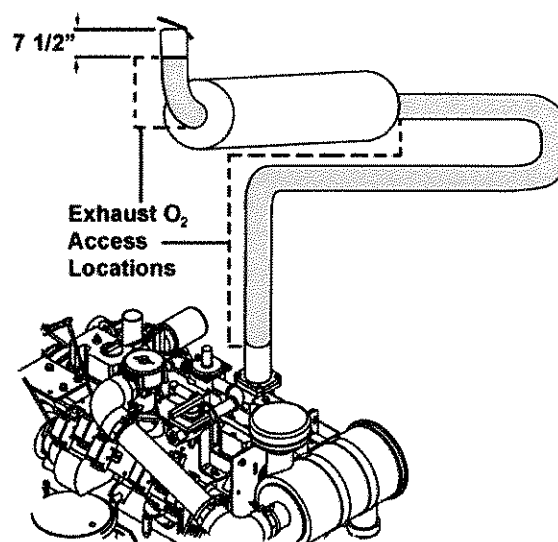
An Exhaust O₂ Meter is required to measure exhaust O₂. No access points are provided on the engine for exhaust O₂. A 10 ft. piece of 1/8" copper or stainless steel tubing coiled 7 or 8 times is required to connect to a 1/4" NPT port in the exhaust system or inserted in the exhaust outlet. A rubber hose connects the oxygen meter to the other end of the coiled tubing.

Fittings used in the exhaust system should be stainless steel and high temperature anti-seize should be applied to threads of the fitting prior to installation. A 1/4" NPT stainless steel pipe plug should be installed in the fitting after testing to prevent exhaust leaks. High temperature anti-seize should also be applied to the threads of the stainless steel pipe plug prior to installation.



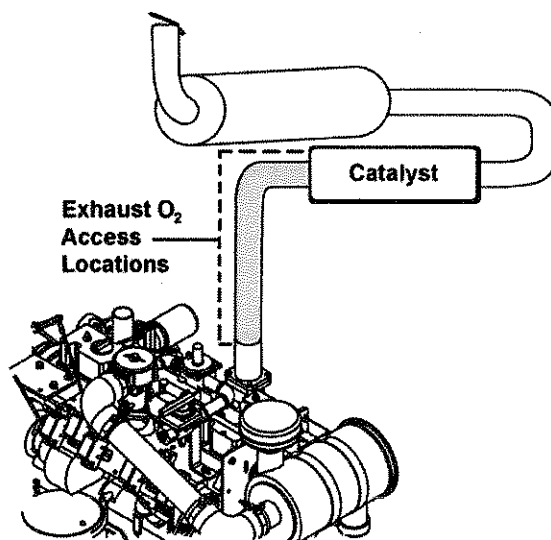
5.5.5.1 Exhaust O₂ Without Catalyst (G8.3 Only)

If a catalyst is not installed, the exhaust O₂ can be measured by inserting the coiled tubing (7 1/2" minimum) in the outlet of the exhaust system. Also, a 1/4" NPT port can be installed in the exhaust system between the exhaust outlet connection and the muffler to access exhaust O₂.



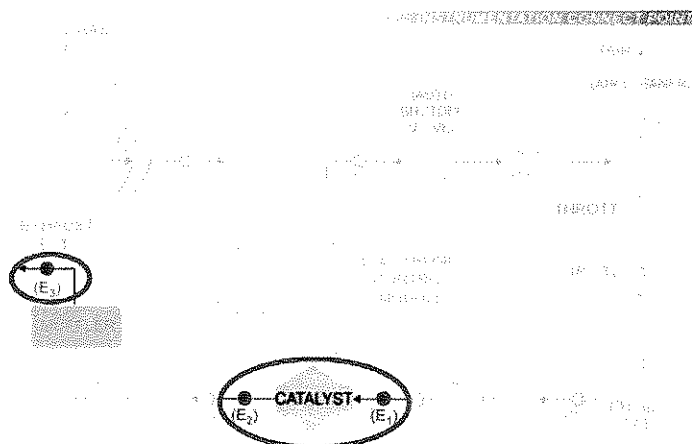
5.5.5.2 Exhaust O₂ With Catalyst (G8.3 Only)

If a catalyst is installed a 1/4" NPT port must be installed in the exhaust system between the exhaust outlet connection and the catalyst to access exhaust O₂.



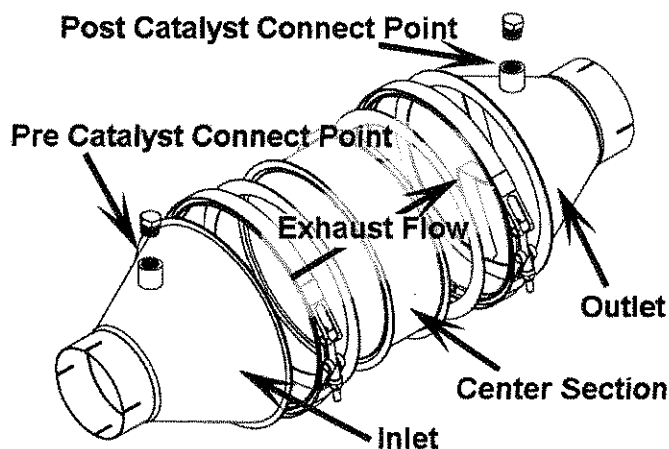
5.5.6 G8.3E Exhaust NO_x/CO/O₂

Three access points for exhaust emissions on the G8.3E are available: Two ports on the catalyst (Pre and Post) and the exhaust outlet itself (Post). The exhaust outlet should only be used when access to the post catalyst port is not available. Post catalyst emission measurements are required for the initial start up and adjustment procedure on the G8.3E. Pre catalyst emissions can be used for system diagnosis.



The installation point for pre and post catalyst NO_x/CO/O₂ is at the 1/2" NPT ports on the catalyst housing inlet and outlet. Fittings used in the exhaust system should be stainless steel and high temperature anti-seize should be applied to threads of the fitting prior to installation. High temperature anti-seize should also be applied to the stainless steel pipe plug during reinstallation.

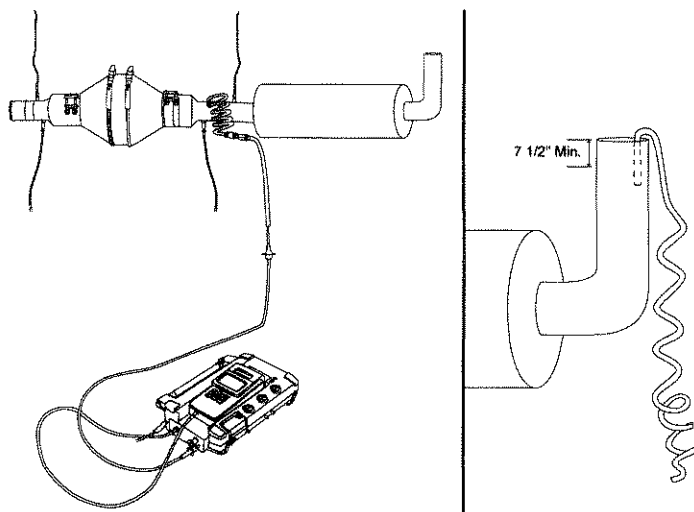
Caution: Pre Catalyst measurements may damage the gas analyzer if the sample is not properly diluted. Refer to analyzer documentation for gas sample dilution options.



Most of the emission measurements taken on the G8.3E will be post catalyst. An exhaust gas analyzer is required to measure exhaust NO_x, CO, and O₂. A 10 ft. piece of 1/8" copper or stainless steel tubing coiled 7 or 8 times is required to connect to the port in the exhaust outlet connection. A rubber hose connects the gas analyzer to the other end of the coiled tubing.

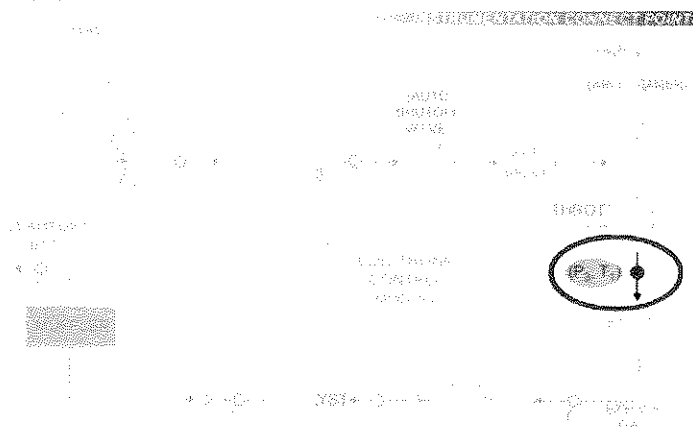
Note: The end of the coiled tubing must be capped off when not in use.

The coiled tubing may also be inserted (7 1/2" minimum) in the outlet of the exhaust system rather than connected to a port in the catalyst or exhaust piping. This should only be used when access to the catalyst port is not available.



5.5.7 Intake Manifold Pressure/Temperature

The installation point for the intake manifold pressure and temperature is a port in the intake manifold. A 0-101.6 kPa (0-30 in Hg) vacuum gauge is required to measure intake manifold pressure. An orifice is recommended to prevent gauge bounce. Tubing should be oil and gas resistant and able to withstand operating temperatures of the engine.



Engine		Location	Fitting Size(s)	Image
G8.3		Port in the intake manifold cover.	1/4" NPT	
G8.3E		Port in the intake manifold cover.	1/8" NPT	

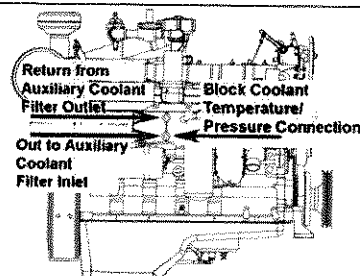
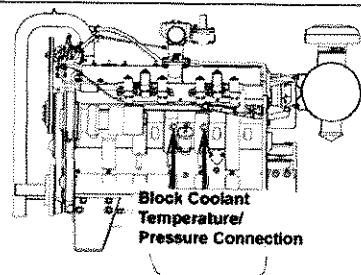
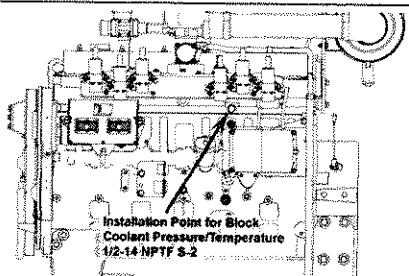
5.5.8 Oil Pressure

The installation points for oil pressure are ports in the block oil galley or ports on the lube oil cooler cover/filter head. An orifice is recommended to prevent gauge bounce. Tubing should be oil and gas resistant and able to withstand operating temperatures of the engine and engine oil.

Engine	Location	Fitting Size(s)	Image
G8.3 & G8.3E	Ports in the block oil galley	M10 X 1-6H or M14 X 1.50-6H straight thread O- ring	
	Alternate: Either of the ports on the lube oil cooler cover(not shown)	1/8" NPT	

5.5.9 Block Coolant Pressure and Temperature

The installation point for coolant pressure and temperature is dependant on the engine platform. Pipe joint compound should be applied to threads of the probe fitting prior to installation.

Engine	Temperature/ Pressure	Location	Fitting Size(s)	Image
G8.3	Temperature and Pressure	Port on the exhaust side of the block	½" NPT	
G8.3	Temperature and Pressure	Either port on the intake side of the block.	½" NPT	
G8.3 & G8.3E	Temperature and Pressure	Port on the intake side of the cylinder head	½-14 NPTF S-2	

6 Appendix B Operational Set Point and Engine Protection Shutdown Limits

6.1 G8.3 Operational Set Point Limits

Parameter	Responsibility	Operating Range	Alarm Limit	Shut Down Limit
Block Coolant Pressure @ Rated Speed	Customer	90 - 131 kPa [13 - 19 PSI]	69 kPa [10 PSI]	34 kPa F [5 PSI F]
Intake Manifold Pressure	Customer	Vacuum 0 - 27 in. Hg	NA	NA
Intake Manifold Temp	Customer	Ambient	NA	NA
Oil Temperature °F	Customer	88 - 102 °C [190 - 215 °F]	104 °C [220 °F]	107 °C R [225 °F R]
Blow-by	Customer	6" WC Max. (Use .302 orifice)	NA	NA

6.2 G8.3 Mandatory Engine Protection Shutdown Limits

Parameter	Responsibility	Operating Range	Alarm Limit	Shut Down Limit
Engine Coolant Temperature	Customer	79 - 91 °C [175 - 195 °F]	98 °C [208 °F]	102 °C R [215 °F R]
Oil Pressure @ Rated Speed	Customer	69 - 345 kPa [20 - 50 PSI]	103 kPa [15 PSI]	69 kPa F [10 PSI F]
Engine Operating Speed (RPM)	Customer	1500 - 2200	2250	2420 R
Exhaust Gas Temperature	Customer	621 - 732 °C [1150 - 1350 °F]	738 °C [1360 °F]	746 °C [1375 °F R]

Note: F = Falling

R = Rising

6.3 G8.3E Operational Set Point Limits

Parameter	Responsibility	Operating Range	Alarm Limit	Shut Down Limit
Block Coolant Pressure @ Rated Speed	Customer	90 - 172 kPa [13 - 25 PSI]	69 kPa [10 PSI]	34 kPa F [5 PSI F]
Intake Manifold Pressure	Customer	Vacuum 0 – 27 in. Hg	NA	NA
Blowby	Customer	NA	NA	6" WC Max. (Use .302 Orifice)

6.4 G8.3E Mandatory Engine Protection Shutdown Limits

Parameter	Responsibility	Operating Range	Alarm Limit	Shut Down Limit
Engine Operating Speed (RPM)	Cummins	1500 - 1800	NA	1980
Intake Manifold Temp	Cummins	< 54°C [< 130°F]	93°C [200°F]	96°C [205°F]
Engine Coolant Temperature (High)	Cummins	79 – 91°C [175 – 195°F]	96°C [204°F]	100°C R [212°F R]
Engine Coolant Temperature (Low)			54°C [130°F]	54°C [130°F]
Oil Pressure @ Rated Speed and Load (High)	Cummins	138 - 518 kPa [20 – 75 PSI]	883 ~ 965 kPa [128 ~ 140PSI]	883 ~ 965 kPa [128 ~ 140PSI]
Oil Pressure @ Rated Speed and Load (Low)			69 kPa [10 PSI]	69 kPa F [10 PSI F]
Oil Temperature °F (Sump)	Cummins	88 - 102°C [190 – 215°F]	104°C [220°F]	107°C R [225°F R]
Catalyst Inlet Temperature	Cummins	454 - 649°C [850 – 1200°F]	677°C [1250°F]	704°C [1300°F]
Catalyst Differential Temperature	Cummins	< 66°C [< 150°F]	66°C [150°F]	93°C [200°F]
Exhaust Gas Stack Temperature (Wet), Less than 12" from manifold	Customer	427 – 649°C [800 – 1200°F]	652°C [1205°F]	654°C [1210°F R]
Exhaust Gas Stack Temperature (Dry), Less than 12" from manifold	Customer	538 – 746°C [1000 – 1375°F]	749°C [1380°F]	752°C [1385°F R]

Note: F = Falling

R = Rising

7 Revision History

Date	Author	Decription	Page(s)
September 8, 2009	Cary McFarden	Add comment on G8.3 NSPS capabilities using a customer supplied AFR and Catalyst	1
		Added "(Heat Exchanger Only)" to images showing coolant outlet vent lines	7,8
		Added "Safe Draw" location for cooling system	9
		Changed reference to Lubricating oil requirements to "section 2 of Service Bulletin 3810340."	11
		Add oil level regulator installation instructions	11-14
		Added note about using a coalescent filter to Fuel Filter Section	20
		Change Air Cleaner Plumbing option for the G8.3E to "CA9637"	24
		Corrected CSA Approved Ignition Option to "IS9068"	27
		Change front mount option to "EM9305"	35
		Add Caution about possible gas analyzer damage if pre catalyst samples are taken without proper sample dilution.	53
		Added "Mandatory" to Engine Protection Shutdown Limits	56, 57
December, 2008	Cary McFarden	Added "maximum 2 g/hp-hr NO _x , 4 g/hp-hr CO and 1 g/hp-hr VOC" statement	1
		Change "Fisher® S302" to "Fisher® S301" in Table Section 3.5.1	12
		Change fuel pressure diagram to show connect point at the port on the fuel control valve.	14 and 45
		Add reference to AEB 24.52	17
		Add temperature sensor section 3.5.5.3	18
		Change reference from AEB 21.83 to AEB 24.52	21
		Changed Woodward Governor image to show a G8.3 Engine	32
		Change "water" to "coolant" on connect point diagrams Moved Exhaust Gas Temperature from Section 6.1 Operational Set Point Limits to Section 6.2 G8.3 Engine Protection Shutdown Limits	39 thru 42 51
April, 2008	Cary McFarden	Added G8.3E AFR Catalyst Engine Info	ALL
		Updated existing G8.3 Info due to running changes in production	ALL
		Added Appendix A - Engine Installation and Set Up Connect Points and Measurement Points Added Appendix B Operational Set Point and Engine Protection Shutdown Limits	39 thru 50 51, 52
Sep, 2005	Cary McFarden	Added Stitt® Web Address and Reference Manual due to the addition of Shielded Ignition System Section 3.9;	5
		Inserted Section 3.2.3: <u>Wet Exhaust Manifold Requirements and Plumbing</u> ; and	7
		Inserted Section 3.9: <u>Ignition System – Shielded</u>	19-20
Feb, 2005	Cary McFarden	Initial Release	