EMIT Total Solution

Installation Manual
Caterpillar 3300 Engines
Full Panel

August 2016

TABLE OF CONTENTS

CONVENTIONS USED

Within an instructional section:

Bold text refers to required tools.

Underlined text refers to EMIT item numbers, kit components, or assembly components.

Italicized text refers to items or parts already existing on the engine, compressor, or panel.

	Important notes or warnings

	Tips, examples, and suggested practices

ENGINE CONDITION

For proper controller operation, it is critical that the engine be in good operational condition. Verify the following before running the EMIT ETS control system:

- Valves are adjusted to engine specification.
- Spark plugs are properly gapped, in good condition, and torqued to engine specifications.
- Cylinder compression is within engine specification.
- Regulators are in good condition and fuel pressure is set to factory specification.
- Fuel connections are secure and leak-free.
- If using spark plugs not included with the system, they must be a resistor-type spark plug.
- Exhaust gaskets and flanges are installed properly, and there are no exhaust leaks present.
    - Any exhaust leak, even minor, may result in the undesired emissions reduction performance.

CLASS 1, DIVISION 2 NOTICE

This apparatus is suitable for use in Class 1, Division 2, Groups A, B, C & D, or unclassified locations.

WARNING

IT IS IMPORTANT TO READ AND UNDERSTAND ALL THE INSTRUCTIONS AND WARNINGS LISTED IN THIS MANUAL BEFORE USING OR INSTALLING THE ETS SYSTEM.

FAILURE TO FOLLOW INSTALLATION INSTRUCTIONS MAY LEAD TO ENGINE DAMAGE AND PERSONAL INJURY TO OPERATORS OR NEARBY PERSONNEL.

DO NOT CUT HOLES IN THE EIM ENCLOSURE OR THE WARRANTY WILL BE VOIDED.

EXPLOSION HAZARD - DO NOT DISCONNECT WHILE CIRCUIT IS LIVE UNLESS AREA IS KNOWN TO BE NON-HAZARDOUS.

DO NOT OPEN OR REMOVE COVER UNLESS THE POWER IS DE-ENERGIZED OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.

EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS 1, DIVISION 2.

THE INSTALLER SHOULD BE FAMILIAR WITH AND OBSERVE ALL LOCAL, STATE, AND FEDERAL CODES.

EXPOSURE TO SOME CHEMICALS MAY DEGRADE THE SEALING PROPERTIES OF MATERIALS USED IN THE FOLLOWING DEVICE: PANASONIC EW TX2SA-5V.

EXTERNAL LABEL

EMIT Technologies, Inc. **IP 54**

Conforms to ANSI/ISA Std 12.12.01

Certified to CSA Std C22.2 No. 213

ETL CLASSIFIED
C ETL LISTED US
Intertek
4008500

EIM	P/N: 20200	12-30V, 1A	Class 1, Div. 2, Groups A, B, C, & D	Amb. Temp. -40 to 149ºF (-40 to 65ºC)
AFRCA	P/N: 20230	12-30V, 6A	Class 1, Div. 2, Groups A, B, C, & D	Amb. Temp. -40 to 149ºF (-40 to 65ºC)
EMD	P/N: 20240	12-30V, 1A	Class 1, Div. 2, Groups A, B, C, & D	Amb. Temp. -40 to 149ºF (-40 to 65ºC)
AFRCL	P/N: 20250	12-30V, 3A	Class 1, Div. 2, Groups A, B, C, & D	Amb. Temp. -40 to 149ºF (-40 to 65ºC)
ICM2–8	P/N: 20290	12-28V, 5A	Class 1, Div. 2, Groups A, B, C, & D	Amb. Temp. 14 to 158ºF (-10 to 70ºC), Code T4
ICM2–16	P/N: 20300	12-28V, 5A	Class 1, Div. 2, Groups A, B, C, & D	Amb. Temp. 14 to 158ºF (-10 to 70ºC), Code T4

WARNING: EXPOLOSION HAZARD – DO NOT DISCONNECT WHILE CIRCUIT IS LIVE UNLESS AREA IS KNOWN TO BE NON-HAZARDOUS.
WARNING: DO NOT OPEN OR REMOVE COVER UNLESS THE POWER IS SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.
WARNING: EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS 1, DIVISION 2.

ATTENTION: RISQUE D'EXPLOSION – NE PAS DÉBRANCHER LORSQUE LE CIRCUIT EST SOUS TENSION SAUF SI RÉGION EST CONNU POUR ÊTRE NON DANGEREUX.
ATTENTION: NE PAS OUVRIR LE CAPOT OU MOINS QUE LE ALIMENTATION EST COUPÉE OU DE LA RÉGION EST CONNUE POUR ETRE NON DANGEREUX.
ATTENTION: RISQUE D'EXPLOSION – SUBSTITUTION DE COMPOSANTS PEUT NUIRE À LA CONFORMITÉ CLASSE 1, DIVISION 2.

Cet appareil convient pour une utilisation en Classe 1, Division 2, les emplacements Groupes A, B, C & D ou non classifiés.

ATTENTION

IL EST IMPORTANT DE LIRE ET COMPRENDRE TOUTES LES INSTRUCTIONS ET MISES EN GARDE CONTENUES DANS CE MANUEL AVENT D'UTILISER OU D'INSTALLER LE ETS SYSTÈME.

LE NON-RESPECT DES INSTRUCTIONS D'INSTALLATION PEUT ENTAÎNER DES DOMMAGES AU MOTEUR ET DE BLESSURES POUR LES OPÉRATEURS OU LE PERSONNEL À PROXIMITÉ.

NE PAS PERCER DES TROUS DANS L'ENCEINTE EIM OU LA GARANTIE SERA ANNULÉE.

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RISQUE D'EXPLOSION – SUBSTITUTION DE COMPOSANTS PEUT NUIRE À LA CONFORMITÉ CLASSE 1, DIVISION 2.

L'INSTALLATEUR DOIT CONNAÎTRE ET RESPECTER TOUTES LES RÉGLEMENTATIONS LOCALES, ÉTATIQUES ET FÉDÉRALES CODES.

EXPOSITION À CERTAINS PRODUITS CHEMIQUES PEUT DÉGRADER LES PROPRIÉTÉS D'ÉTANCHÉITÉ DES MATÉRIAUX UTILISÉS DANS L'APPAREIL SUIVANT: PANASONIC EW TX2SA-5V.

ÉTIQUETTE EXTERNE

EMIT Technologies, Inc. **IP 54**

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INSTALLATION OVERVIEW

The installation will cover the general following steps, each outlined below

1. Disconnect and lock out all power and fuel sources
2. Physical panel installation and routing stainless lines
3. Physical ETS engine component installation
4. Wiring skid components into panel
5. Wiring ETS harnesses into panel
6. Power on panel and verify basic functionality
7. Verify annunciator sensor settings and shutdowns
8. Ignition encoder calibration
9. Start engine

BEFORE INSTALLING

At one point during installation (ICM2 encoder calibration) the engine will have to be at TDC compression of the reference cylinder. If a magneto was previously used on the engine, it can save time to put the engine at TDC compression before removing the magneto. To do this, crank or otherwise turn the engine until the flywheel is at 0 degrees. Check the magneto window, and if the red lines are aligned, or the inner red line is directly between the two outer red lines, the engine is at TDC compression. If not, turn the flywheel again until the above condition is met. After at TDC compression, do not crank the engine until the calibration is completed later.

After the above is compete, disconnect and lock out all power and fuel sources.

PANEL INSTALLATION

MOUNTING THE PANEL

In general, it is easiest to mount the panel to angle iron that is welded to the engine skid and is drilled to match the mounting hole pattern of the annunciator skirt. If desired, EMIT can provide these mounting feet- they are not included in a standard annunciator purchase. To mount the panel to the engine skid:

	Before welding, ensure that the area is clear of explosive gases and that no flammable liquid is present on the skid

	Before placing mount feet, ensure ample room is present to the left and behind the panel to provide space for the panel door to open and for plumbing of the pressure tubing

1. Weld the mount feet to the engine skid
2. Place the annunciator panel on top of the mount feet
3. Bolt the panel to the mount feet using no less than four 3/8” grade 8 bolts tightened to a torque of 33ft-lbs

STAINLESS TUBING CONNECTIONS

Stainless tubing can be connected through the side of the annunciator skirt or directly to the pressure sensor up under the rear of the panel. If the panel is configured to have tubing connected through the side of the annunciator skirt, tubing labels will be placed on the annunciator skirt, else they will be on the bottom side of the upper enclosure. To land the stainless tubing connection:

	When tightening the tubing connection, be sure to use two wrenches: one to tighten the nut and another to relieve stress from the pressure sensor or other components on the same tubing line

1. Insert the tube into the fitting to maximum depth
2. Rotate the tube fitting nut until finger tight
3. Tighten the tube fitting nut one and one-quarter turns from finger tight (TFFT)
4. Repeat for additional tubing connections

GOVERNOR INSTALLATION

GOVERNOR SENSORS AND END DEVICES

MIXER/THROTTLE BODY ASSEMBLY

The mixer/throttle body assembly is to be installed on the intake manifold of the engine using the bolts provided. Below are install notes:

- Torque 5/16" bolts to 13 ft-lbs
- Torque 3/8" bolts to 23 ft-lbs
- If more than one mounting orientation is possible with the kit provided, the mixer/throttle body assembly should be installed in the orientation which places the axis of the throttle shaft as close to horizontal as possible.
- Use only black pipe or brass fittings when plumbing the fuel line
    - Under no circumstances should galvanized fittings be used to install the fuel piping.
- Install the AFRC digital power valve as close to the mixer as possible.

To install the mixer/throttle body assembly on the engine the following tools are required and will appear **bold**:

- **½" Drive Ratchet**
- **Flat Head Screw Driver**
- **9/16" End Wrench**
- **Putty Knife**
- **Teflon Tape**

	Do not use galvanized fittings for fuel piping! The fuel will cause the galvanized coating to corrode and fall free which may cause engine damage.

	A rag may be placed in the intake port of the engine while scraping away the old intake gasket to prevent debris from falling into the intake manifold.

	The following pictures detailing the installation of the mixer/throttle body assembly are shown for a G3304NA, but the principles of the installation extend to all CAT3300 models.

Additionally, installation of the mixer/throttle body assembly will require the following components which will appear underlined. Existing components will appear *italicized*.

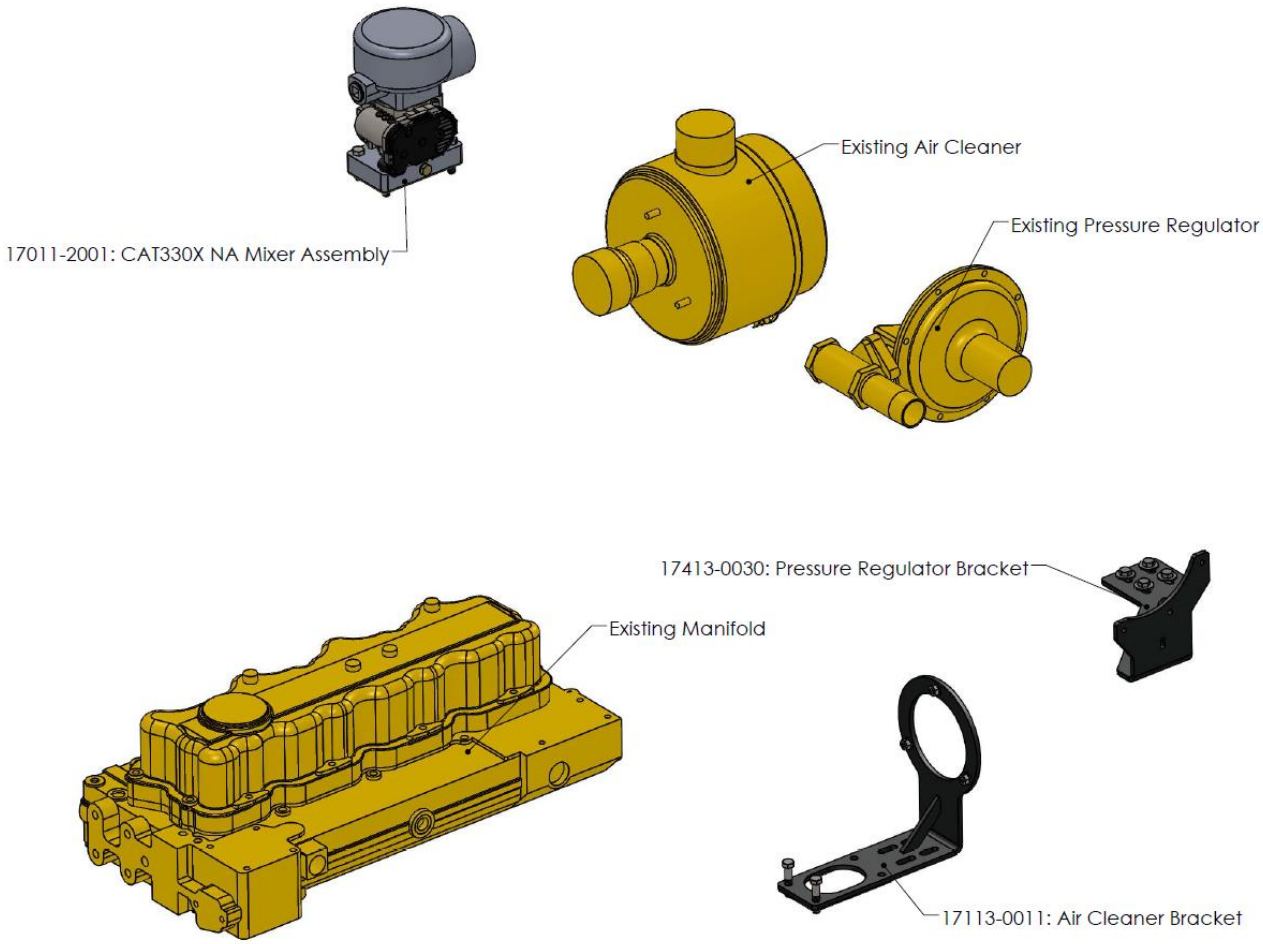


Figure 1. Governor Mixer/Throttle Body Assy Components

For G3304 NA, G3304B NA, G3306 NA, G3306B NA Models (All "B" Models)

To mount the mixer/throttle body assembly to the engine:

⚠	Do not let debris of any sort fall into the manifold! Loose objects in the manifold are likely to be drawn into the cylinder with a fresh air charge and may cause engine damage. Place a rag in the manifold opening to prevent this, and be sure to remove it before completing the installation.

- Begin by removing the existing mixer, throttle, balance line, *Existing Pressure Regulator* and bracket, *Existing Air Cleaner* and bracket, and fuel piping between the mixer and *Existing Pressure Regulator*. Set the *Existing Pressure Regulator* and *Existing Air Cleaner* aside for later use. Use the **Putty Knife** to scrape away the old gasket.
    - 3306NA - No need to remove the *Existing Air Cleaner* or bracket.

- Place the gasket from Air Cleaner Bracket (17113-0011) in position on the *Existing Manifold*.

- 3306NA - When finished with this step, skip ahead three steps to installing the mixer assembly.

- Place Air Cleaner Bracket (17113-0011) on the *Existing Manifold*.

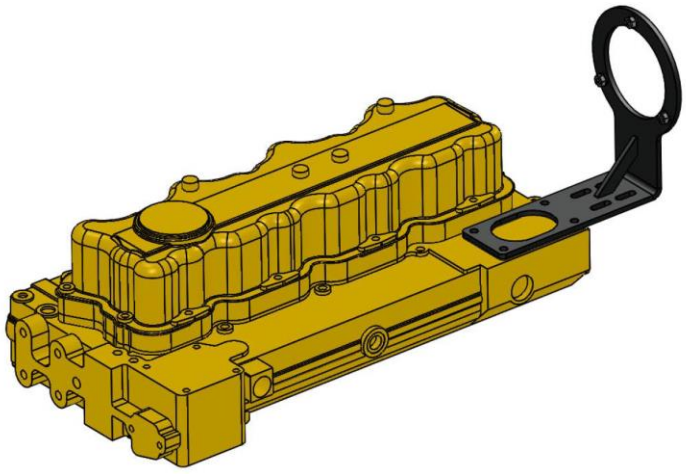


Figure 2. Air Cleaner Bracket Installation on Manifold

- Place the gasket from CAT330X NA Mixer Assembly (17011-2001) over Air Cleaner Bracket (17113-0011).

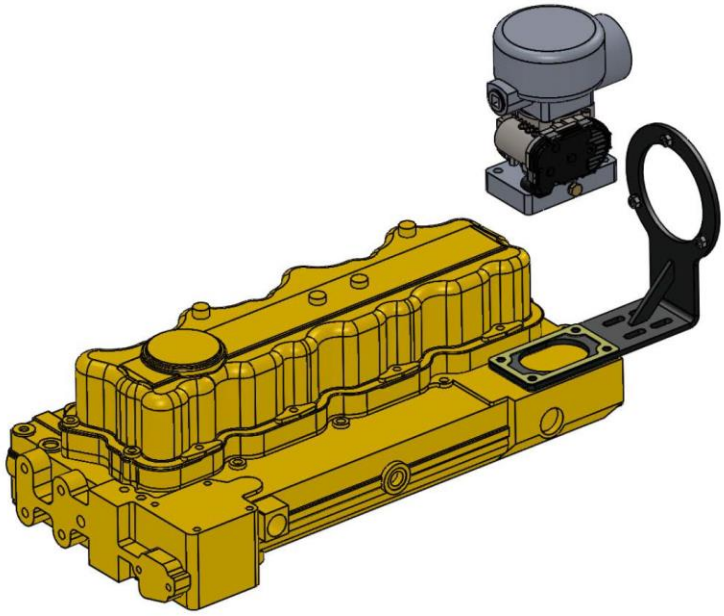


Figure 3. Install Gasket

- Using two bolts from Air Cleaner Bracket (17113-0011) and the two longest bolts of CAT330X NA Mixer Assembly (17011-2001), fasten Air Cleaner Bracket (17113-0011) and CAT330X NA Mixer Assembly (17011-2001) to *Existing Manifold*.
    - 3306NA - Use only the bolts included in the Mixer Assembly kit. Before fastening CAT330X NA Mixer Assembly (17011-2001) to *Existing Manifold* reinstall the *Existing Pressure Regulator* bracket in its original position, and install the existing fuel mixer inlet elbow in the inlet of CAT330X NA Mixer Assembly (17011-2001). Skip ahead two steps to re-install the *Existing Air Cleaner*.

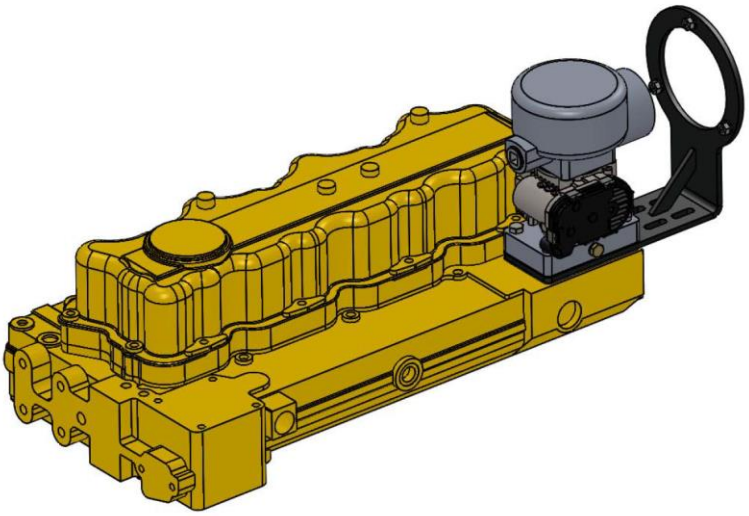


Figure 4. Install Mixer/Throttle Body Assy

- Fasten Pressure Regulator Bracket (17413-0030) to Air Cleaner Bracket (17113-0011).

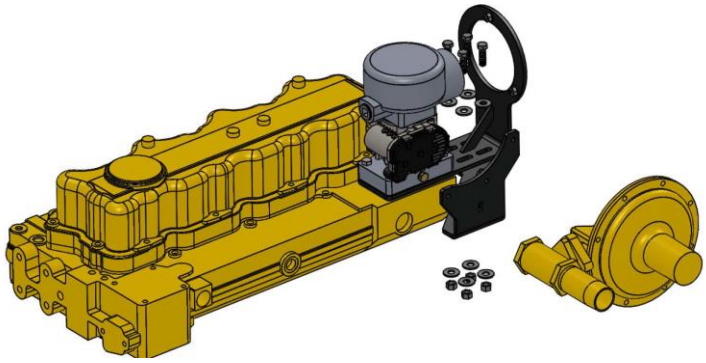


Figure 5. Install Pressure Regulator Bracket

- Fasten the *Existing Pressure Regulator* to Pressure Regulator Bracket(17413-0030).
    - 3306NA - Instead of Pressure Regulator Bracket (17413-0030) fasten to the *Existing Pressure Regulator* bracket. Skip ahead two steps to removing fuel plug.

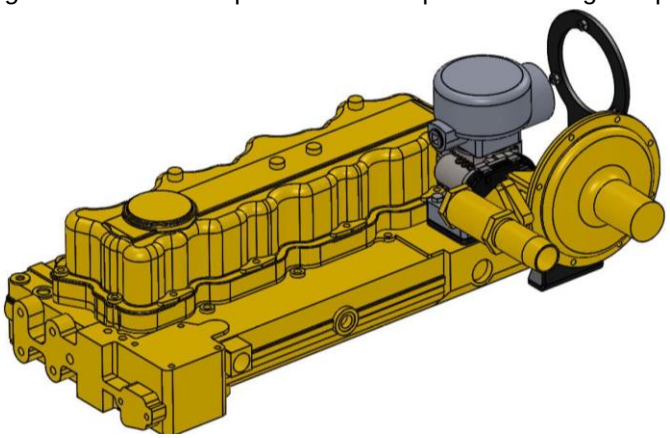


Figure 6. Reinstall Pressure Regulator

- Install the *Existing Air Cleaner* on Air Cleaner Bracket (17113-0011).

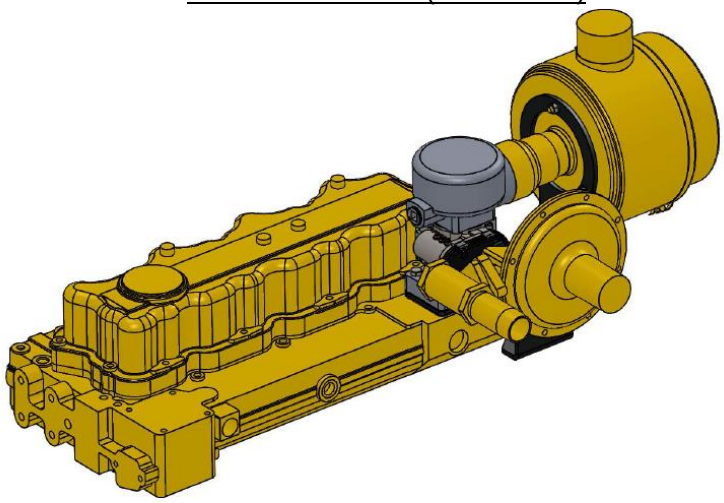


Figure 7. Reinstall Air Cleaner

- Using the **1/2" Drive Ratchet,** remove the plug from the fuel inlet of CAT330X NA Mixer Assembly (17011-2001). Install fuel piping between *Existing Pressure Regulator* and CAT330X NA Mixer Assembly (17011-2001) as required and reinstall balance line. If installing an AFRC, place the fuel valve as close to the mixer inlet as possible.

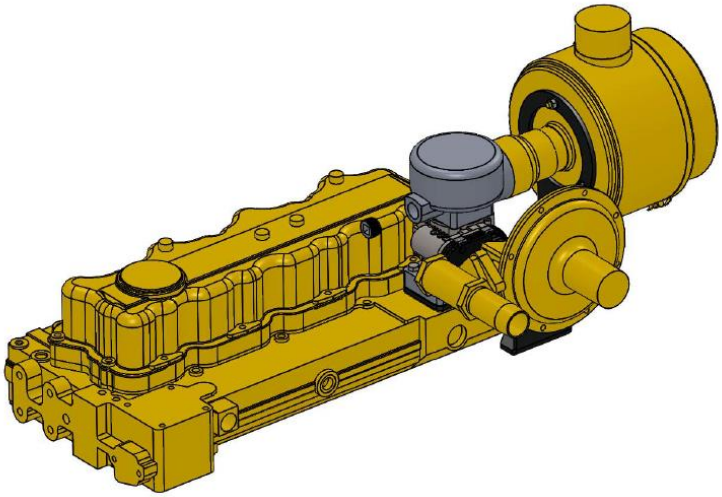


Figure 8. Remove Fuel Inlet Plug from Mixer

For G3306 TA AND G3306B TA Models

To mount the mixer/throttle body assembly on the engine:

- Begin by removing the existing mixer, throttle, balance line, and fuel piping between the mixer and *Existing Pressure Regulator*. Set the *Existing Pressure Regulator* aside for later use. Use the **Putty Knife** to scrape away the old gasket.

- Place the gasket from Air Cleaner Bracket (17113-0011) in position on the *Existing Manifold*.

- Using the bolts included in the kit, fasten CAT330X NA Mixer Assembly (17011-2001) to *Existing Manifold*.

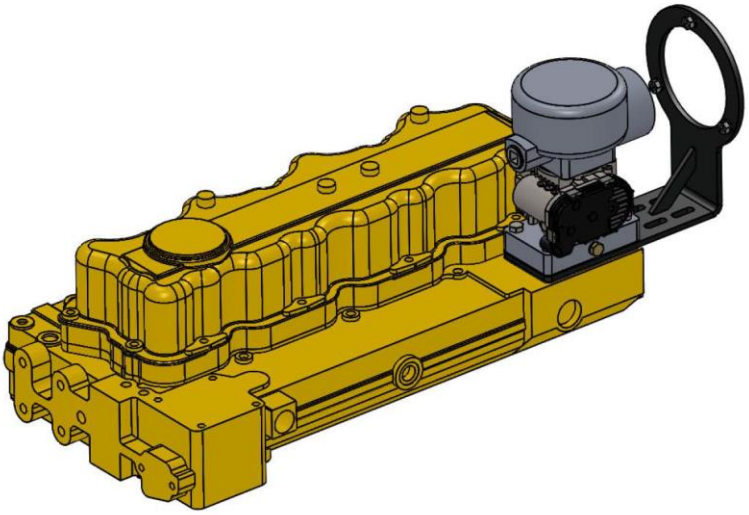


Figure 9. Install Mixer Assembly

- Using the **1/2" Drive Ratchet**, remove the plug from the fuel inlet of CAT330X NA Mixer Assembly (17011-2001). Install fuel piping between *Existing Pressure Regulator* and CAT330X NA Mixer Assembly (17011-2001) as required and reinstall balance line. If installing an AFRC, place the fuel valve as close to the mixer inlet as possible.

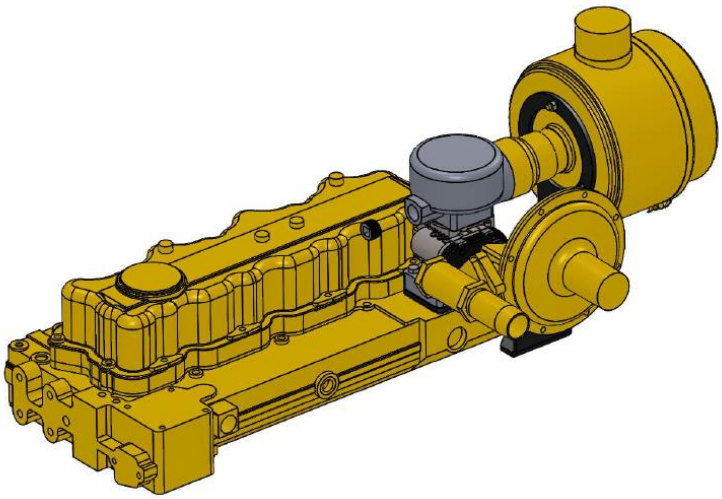


Figure 10. Remove Mixer Plug and Install Piping Between Regulator and Mixer

MAGNETIC PICKUP

- Identify a *5/8"-18 threaded location* directly over the flywheel teeth and remove the placeholder cap, if necessary.
- Thread the magnetic pickup into the identified location until the sensor makes contact with the flywheel teeth.
- Rotate the magnetic pickup out 1/4 turn after making contact with the flywheel.
    - 1/4 turn will provide a gap of 0.013".
- Secure the position of the magnetic pickup using the jam nut on the sensor.
- Carefully route the integrated harness to the Governor module assembly installation location.
    - Avoid routing near ignition or alternator wires.

AFRC INSTALLATION

AFRC SENSORS AND END DEVICES

DIGITAL POWER VALVE

- Install the 0.75” Digital Power Valve (12014) as close to the inlet of the mixer as space will allow through either a 3/4” pipe elbow or 3/4" pipe nipple.
    - The pipe fitting size should match the piping size of the mixer gas inlet.
    - The valve might already be part of the mixer assembly
- Position the plug connection so that it is directly on top of the valve housing.

⚠	Do not over tighten the threads on female threaded valve body. The pipe could interfere with the actuating device of the valve.

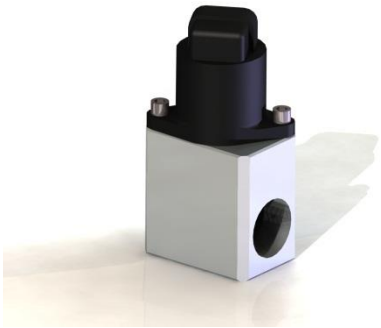


Figure 11. 3/4" NPT Inline Valve (12014)

OXYGEN SENSORS

The AFRC requires two oxygen sensors: one pre-catalyst and one post-catalyst.

For the pre-catalyst O2 sensor:

- The mounting location should be as close to the engine exhaust manifold as possible.
- The sensor location chosen should allow for easy access.
- The location chosen should not subject the exterior shell of the sensor to an ambient air temperature greater than 350ºF.
- Do not mount vertical/above exhaust as the heat rise may damage harness.
- Do not mount directly below exhaust as condensation may damage sensor element.

For the post-catalyst O2 sensor:

- Install to either the outlet nipple of the catalyst housing or in the tailpipe.
    - If installing in the tailpipe, the sensor should be installed at least 16” from the exit of the tailpipe.
    - The post-catalyst oxygen sensor requires the “necked” or “throttled” flow found in the outlet nipple or tailpipe. It will not function properly if installed in the main body of the housing.
- If no 18mm port is available, an 18mm weldment will need to be installed (Item 13020).

	Sensor replacement is recommended every 2,000 hours or as performance of sensor dictates.

	Use only a moly-graphite based anti-seize (Loctite 51605) on the sensor threads. Any other anti-seize compound may poison the oxygen sensor or catalyst!

THERMOCOUPLES

The AFRC requires two type-k thermocouples: one pre-catalyst and one post-catalyst.

- Install the 1/2" NPT compression fittings pre- and post-catalyst as close to the catalyst as possible.
- Insert the thermocouple probes into the compression fittings and tighten the fittings to secure the thermocouples in place.

	Mark one of the thermocouple harnesses at the thermocouple end and at the connection end to differentiate between the pre-catalyst and post-catalyst thermocouples when wiring the AFRC.

DIFFERENTIAL PRESSURE SENSOR (OPTIONAL)

The catalyst differential pressure sensor (13208) is installed by running stainless tubing from each side of the catalyst to the respective ports of the sensor.

Follow the requirements below for proper catalyst differential pressure installation:

- Secure the pressure transducer assembly to a nearby structure, such as a handrail or optional EMIT flange-mount arm.
    - Do not leave the assembly supported only by the stainless tubing.
- The mounting location of the sensor should be placed in an elevated position above the catalyst access ports to allow any condensation to drain out of the tubing and away from the sensor.
- The sensor should be oriented with the pressure ports of the sensor horizontally level.
    - The body, or center portion, of the sensor can be installed vertically in any orientation.
- The mounting location chosen should not subject to an ambient air temperature greater than 185ºF.
    - Do not mount directly vertical/above catalyst housing as the heat will likely exceed the temperature range of the sensor.
- 3/8”, or larger, stainless tubing is recommended to avoid excessive condensation buildup or freezing.

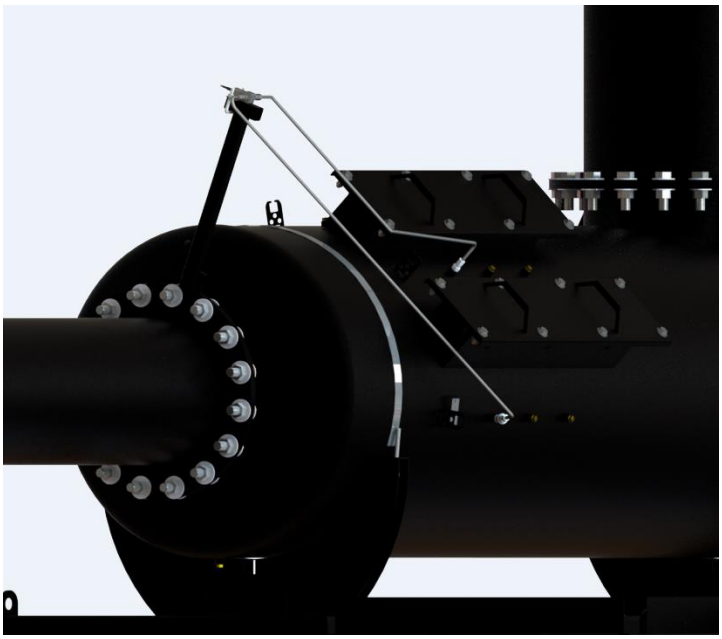


Figure 12. Proper Differential Pressure Sensor Mounting (Angled View)

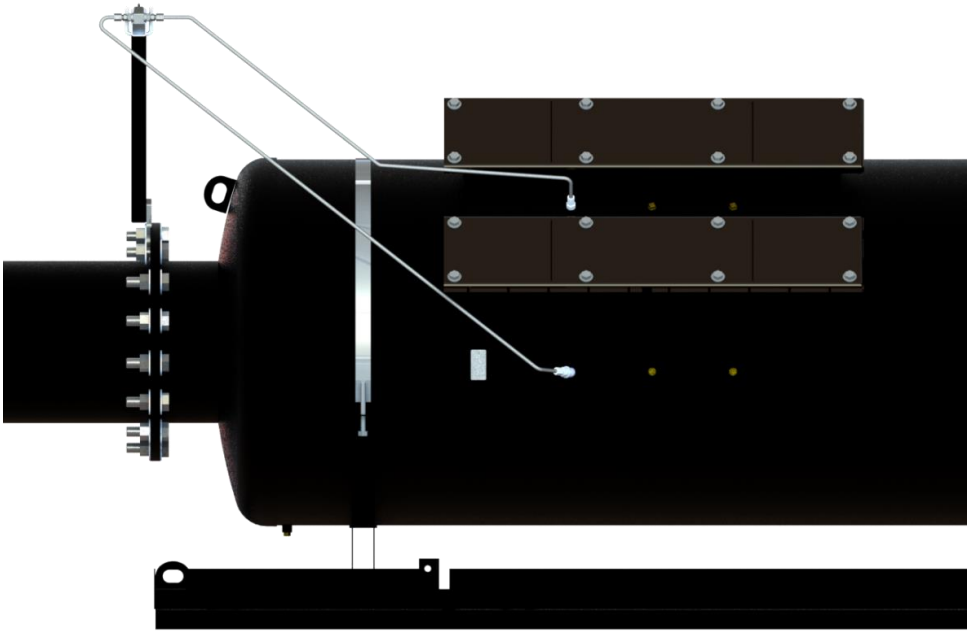


Figure 13. Proper Differential Pressure Sensor Mounting (Side View)

⚠	Stainless tubing less than 3/8” may result in false readings due to condensation build up

⚠	It is the installer’s responsibility to ensure the continuous ambient temperature the sensor is exposed to is less than 185°F. Exceeding this value will damage the sensor.

IGNITION INSTALLATION

MOUNTING THE IGNITION MODULE

For G3304 NA, G3306 NA, G3306 TA (non-B) Models

The ignition module may be mounted directly to the magneto drive of the engine using the bolts included in the kit. The recommended torque for the 3/8" mounting bolt is 23 ft-lbs. To install:

- Remove the current magneto or cover plate and scrape away the existing gasket.
- Place the new gasket in position and align the Oldham coupling of the ignition module with that of the magneto drive on the engine.
- Bolt the ignition module to the engine using the included bolts.
    - The ignition can be installed in any orientation, the position of the input does not matter because the "zero point" will be digitally saved later.

Calibrating the ICM2 later will be easier if the magneto is removed at TDC of the compression stroke (With the red marks near aligned and the flywheel at zero degrees)

For G3304B NA, G3306B NA, G3306B TA Models

No current "B" configurations of Caterpillar G3300's utilize a magneto drive. In order to drive the ignition module, a drive adaptor must be installed near the oil filter onto what was previously used as a governor drive. To install the ignition module drive adaptor the following tools and components are required and will appear **bold**:

- **9/16" x 3/8" Drive Socket**
- **15/16" x 3/8" Drive Socket**
- **3/8" Ratchet Wrench**
- **3/4" End Wrench**
- **9/16" End Wrench**

Additionally, installation of the drive adapter will require the following components which will appear underlined. Existing components will appear *italicized*.

To install the drive adaptor:

- Begin by removing five *existing exterior bolts*, the *existing governor drive cover plate*, and the *existing water pump bolt*.

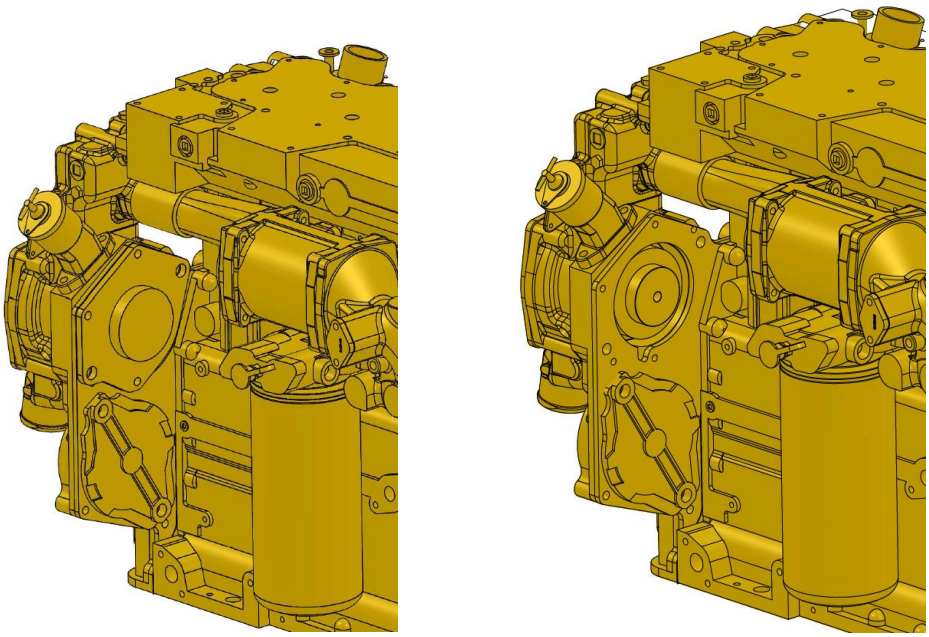


Figure 14. Remove Existing Governor Drive Plate

- Apply Loctite 263 Thread locker (14358) to Bolt Drive (14347), then install Bolt Drive (14347) in place of the existing water pump bolt using the **¾" End Wrench**. Install to a torque of $23\ ^{+3}_{-3}\ ft \cdot lbs$.

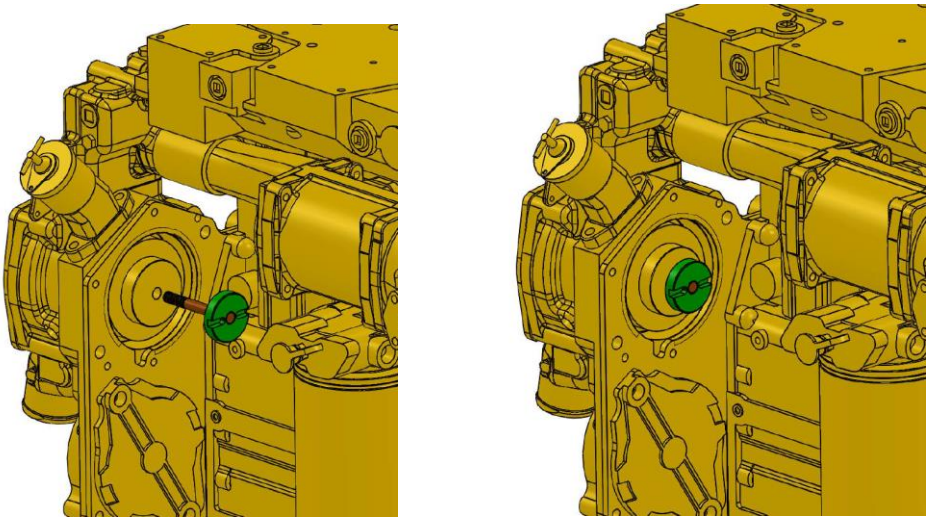


Figure 15. Install Bolt Drive

- Place Governor Drive Profile Gasket, CAT3300 (14353) in position.

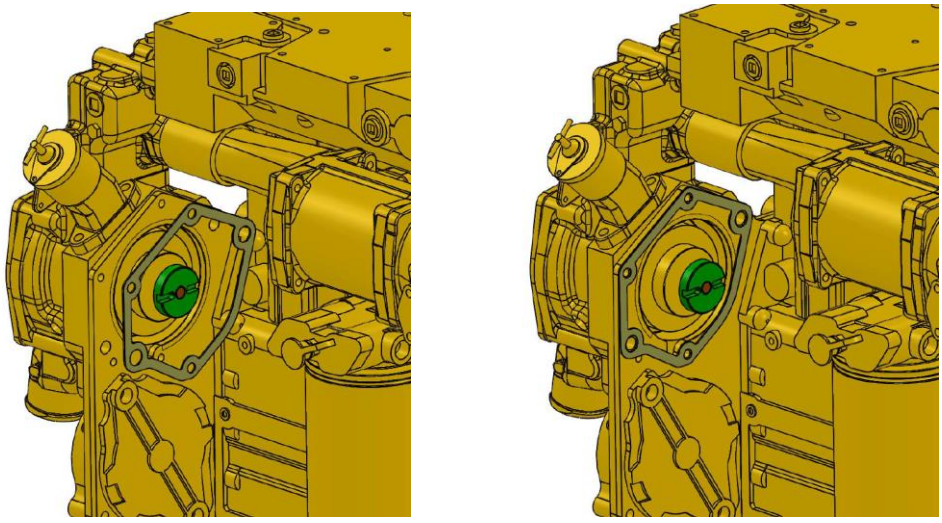


Figure 16. Install Gasket

- Place Large Flange 72mm Bore (14348) and associated components in position.

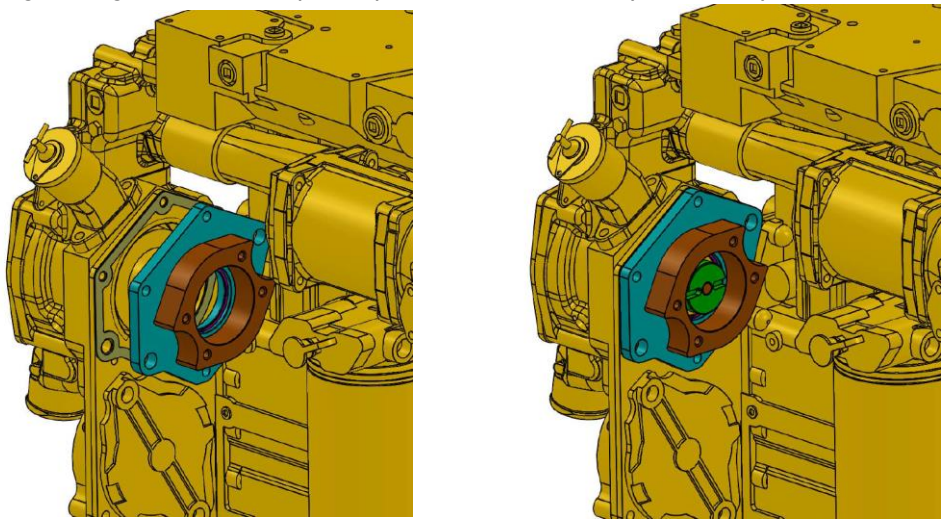


Figure 17. Install Flange

- Bolt Large Flange 72mm Bore (14348) and associated components in place. Torque recommendations are 23 ft-lbs for 3/8” bolts and 40 ft-lbs for 5/8” bolts.

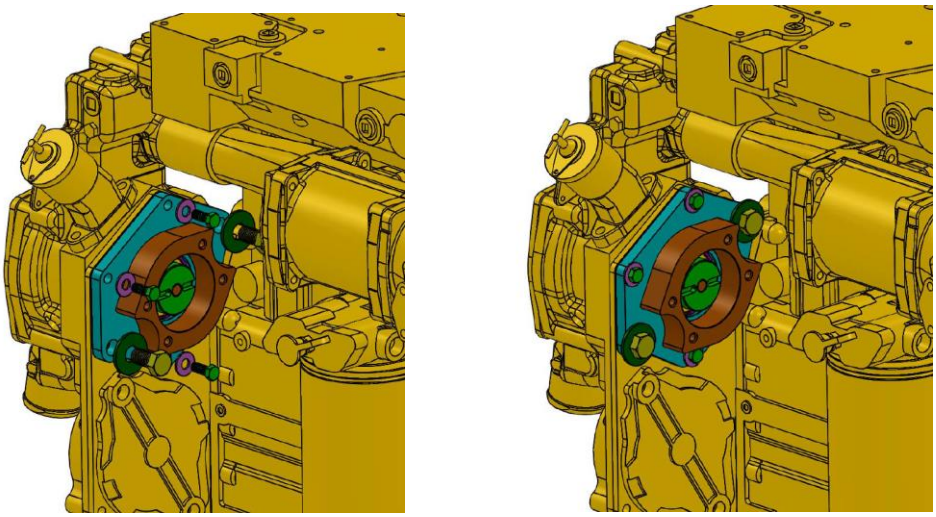


Figure 18. Secure Flange with Hardware

- Position and fasten Gasket, ICM2 Adaptor, SAE “A” Flange (14355) to Adaptor Block (14350) until ready to install driven components.

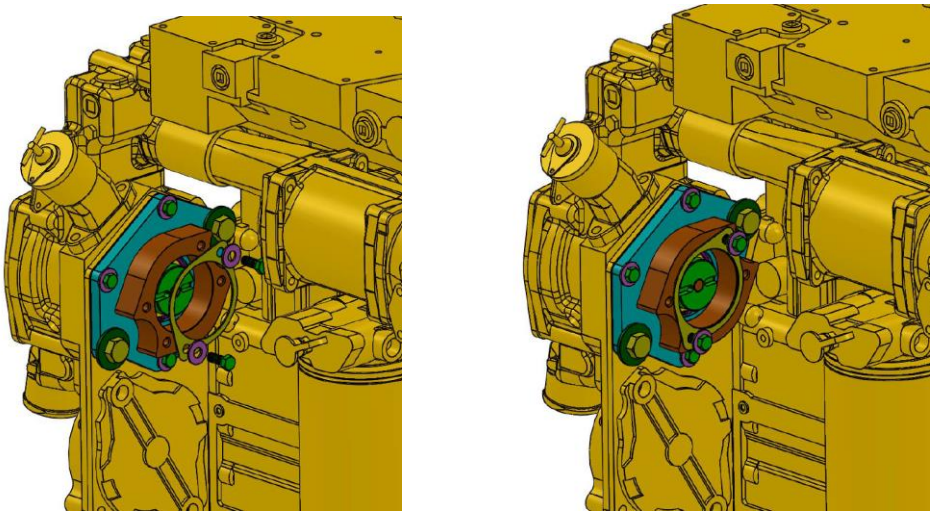


Figure 19. Drive Adapter Gasket

IGNITION COMPONENTS

IGNITION COILS

- Mount the ignition coils to the existing *coil rail* on top of the manifold using the existing *hardware*.

SPARK PLUGS

- Install the spark plugs provided in the kit.
  - The spark plugs should be gapped to 0.022".
  - Torque the spark plugs to 30 ft-lbs.

IGNITION PRIMARY WIRE – "COIL" HARNESS

The ignition module includes a single ignition coil harness to support up to six cylinders for the G3300 application.

- Carefully route the harness from the Ignition enclosure to the *coil rail*.
- Secure the coil harness with P-clamps, where applicable.
- The common power lead within the coil harness is red and jumps from the (+) terminal of each coil
- The other six leads within the coil harness are of varying jacket colors and are connected to negative terminals of each coil.
- After wiring the coils, secure the wiring using zip ties or P-clamps.

⚠	The ignition system uses negative-side, or low-side, switching to control the coils. The power lead (red) is jumped to the (+) terminals for all coils, and the (-) leads are wired to the individual wires of the ignition harness.
⚠	For wiring on the G3304, the black and brown coil connections on the ends of the primary harness need to be taped, folded, and secured. Extra care should be taken to isolate the red wires as they will be at battery potential when the engine is running.

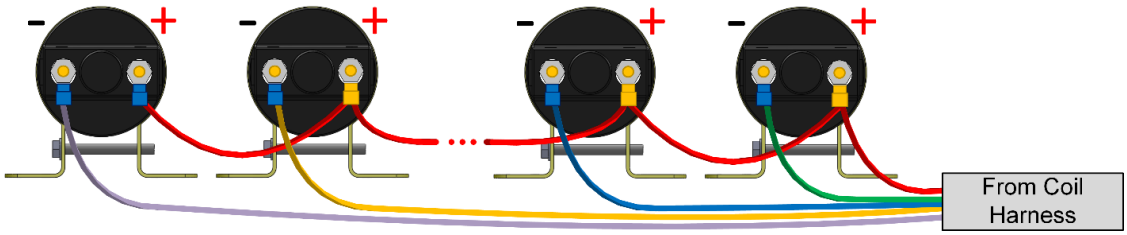


Figure 20. Ignition Coil Wiring Example

Cylinder #	Wire Color (Negative) – G3306	Wire Color (Negative) – G3304
1	Black	**No Connect, Tape and Secure**
2	White	White
3	Green	Green
4	Orange	Orange
5	Blue	Blue
6	Brown	**No Connect, Tape and Secure**

Table 1. Ignition Primary Negative Wiring Colors

IGNITION SECONDARY WIRES

- Apply a small amount of dielectric grease to both ends of the ignition secondary wires and install between the ignition coil and spark plug for each cylinder.
- When connecting secondary wires between the ignition coil and the spark plug, it is important to completely seat the connection on each end.
    - The connector should click, or pop, into place.
- The secondary wires should be positioned so they are kept approximately two inches from the chassis.

"POWER/COMM" HARNESS

The ignition Power/Comm harness contains two harnesses on the same connector that are responsible for powering the ignition module and interfacing with the other ETS modules and Annunciator.

- Carefully route both the orange harness and the black harness from the ignition enclosure to the *instrumentation panel*.
- Secure the Power/Comm harness with P-clamps, where applicable.
- Wire the orange power harness to the location indicated on the wiring diagram (appropriate fuse block and ground location in panel power block)
- Wire the black harness to the terminal blocks indicated on the wiring diagram.
    - Note that the items shown "optional" below are generally not used in an EMIT Panel

Jacket Color	Wire Color	Function
Orange	Red	Supply - Battery +
Orange	Black	Supply - Battery –
Black	Red	Alarm Output (Optional)
Black	Black	Tachometer Output (Optional)
Black	White	Shutdown Input
Black	Green	CAN CMN Communication
Black	Blue	CAN L Communication
Black	Yellow	CAN H Communication

Table 2. Power/Comm Harness Pinout

WIRING

WIRING GUIDELINES

Standard wiring harnesses are constructed with FEP insulation and a FEP jacket rated at 200ºC. This product has excellent resistance to oils, aliphatic hydrocarbons, heat, weather, acids, alkalis as well as oxidation. This product also has superior abrasion and flame resistance. Harnesses are also available with an armored jacket. The wiring connections to the ETS modules are connected to removable plugs via screw terminals. Each plug is labeled with the appropriate pin numbers and corresponding wire colors to ease installation. The following are important guidelines for wiring the ETS modules to the engine:

- Do not install the system with power applied.
- If not enclosed in conduit, the wiring harness should be securely attached to the supporting structure using tie wraps, p-clamps, or mounting brackets.
- Long, unsupported wire runs should be avoided.
- Keep all wiring away from hot or moving parts and all ignition wires.
- All wiring splice connections should be soldered and protected with heat shrink tubing, with the exception of thermocouples.
- Thermocouple wires should be spliced only when necessary, using approved procedures.
- Properly connect all wires before energizing the power connections.
- Care should be taken when making connections to the terminal blocks to allow for excess wire for the front cover to be folded back up and secured in place. This prevents strain on the connections.
- Shielding wire must be grounded to the available lugs inside the back of the enclosure or to shielding terminals.
- All electrical components must share a common ground.

	Armored harnesses include a stainless steel overbraid. Use appropriate tools for cutting harness to length or removing excess overbraid material.

PANEL WIRING

GENERAL WIRING GUIDELINES

	Do not wire the panel until the area is known to be non-hazardous

On the panel wiring diagram provided, note that the field wiring from the skid is indicated with dashed lines.

When routing cables to the bottom-left terminal block group, note that a grounding bar is available to connect the drain (bare) wires to ground.

POWER WIRING

Before wiring the panel, the battery box should be disconnected and locked out. Additionally, the panel main power fuse (furthest left) should be removed.

Wire the main power and ground into the panel and attach as indicated on the wiring diagram, with power into fuse F1.

ANNUNCIATOR ANALOG AND DIGITAL SENSORS

The analog sensors will be pre-wired at the factory. Digital sensors should be wired as specified by the wiring diagram provided with the panel. Sensors will route to terminal blocks on the bottom-left of the panel.

If additional analog or digital sensors are added in the field, route to an appropriate free location on the annunciator and set up as noted on the annunciator quick start guide.

ANNUNCIATOR THERMOCOUPLES

Route annunciator thermocouples up the far right channel in the panel and into the appropriate location on the annunciator, as specified by the wiring diagram provided with the panel. If any additional thermocouples are needed, wire in the same track to an appropriate free location.

FUEL VALVE AND STARTER

The fuel valve and starter are driven by relays located in the main terminal block and should be wired as indicated in the wiring diagram. The fuel valve can be set up to be latched on during operation, or briefly latched closed during shutdown. For momentary-latching relays the coil may be driven directly by an annunciator output instead of through a relay.

ETS SYSTEM COMPONENTS AND END DEVICES

The ETS system components are pre-wired in the system. The only items field-wired are the end devices listed below. All wires that run to the panel are shown on the provided panel wiring diagram.

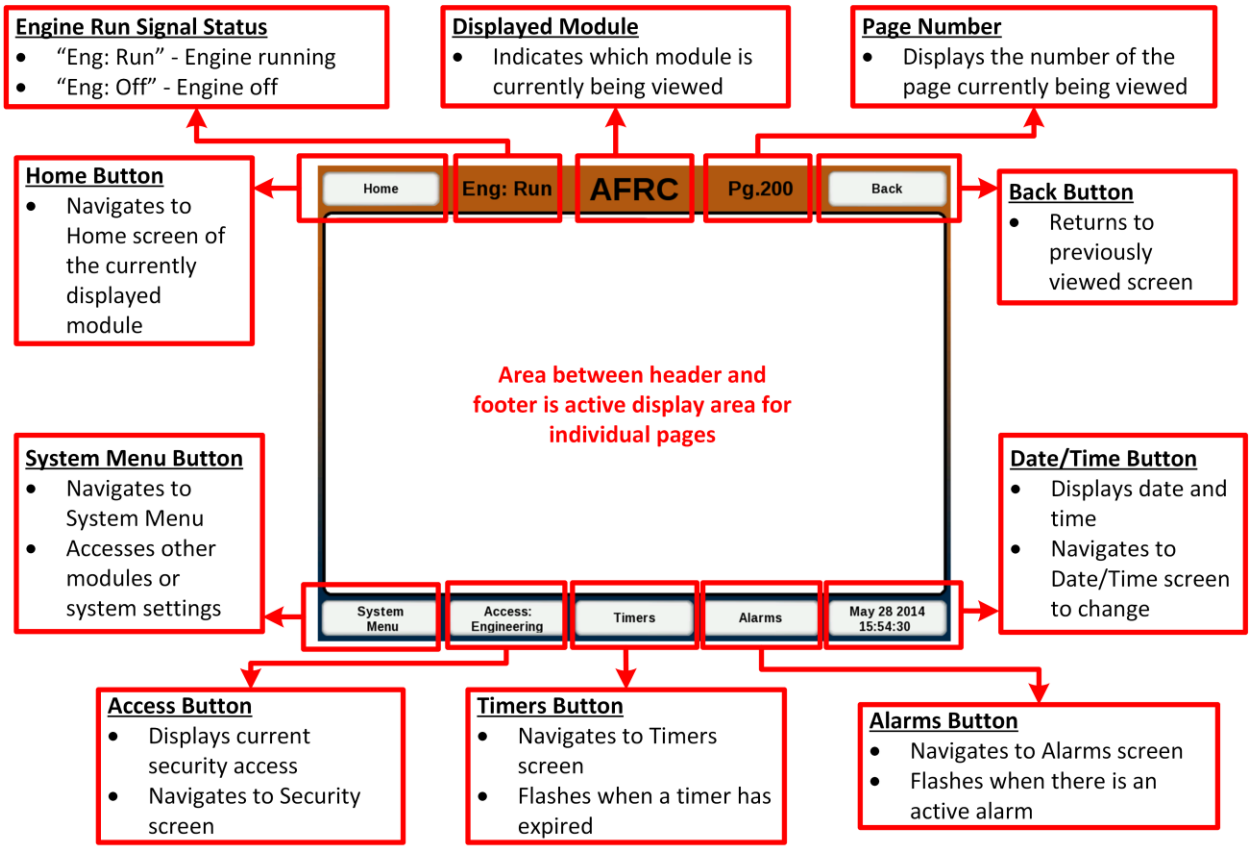
- Governor throttle body and MPU- Wire to proper terminal blocks as in wiring diagram
- ICM2 power / comm harness- Wire to proper terminal blocks as in wiring diagram
- ICM2 coil wiring- Wire as shown in the quick start guide
- AFRC sensor wiring- Wire to proper terminal blocks as in wiring diagram

INITIAL POWER-UP

After verifying that all wiring is well connected and secured, reconnect the battery (the fuel should still be locked out). Install the main fuse in the panel and turn on the power switch. All modules in the panel (EIM, Governor, AFRC, and Annunciator) should have a power light, along with the ICM2 on the engine. If not, check for blown fuses and shorts in the non-working area.

After the EIM boots, review the UI overview below then move on to the settings verifications in the subsequent sections.

USER INTERFACE



USER INTERFACE ELEMENTS

Button	Example	Description
Button (Sensitive)	Open	• Light grey. Active and selectable.
Button (Insensitive)	Open	• Dark grey. Disabled and cannot be selected.
Combobox	Diff Pressure	• Light grey. Displays selected value. • Hold finger on button and slide to selection.
Toggle Button	Auto Vs. Manual	• Pressing the button changes the text of the button. The text of the button indicates the current status.
Enable Button	X Vs. X	• Dark grey indicates button is enabled or "on". • Light grey indicates button is disabled or "off".

EIM INITIAL SETUP

SECURITY ACCESS

- Press the 'Access: Operator' button in the footer of the display
- Using the keypad on the screen, enter the Engineering security password, then press the 'Submit' button
    - Passwords for the system are included on a card with the EIM
- The 'Access:' button will now display 'Access: Engineering' after successfully entering the password

DATE AND TIME

- Press the button displaying the date and time in the lower right corner of the display
- Use the buttons and keypad to set the current date and time
    - Time is in 24-hour format
- Press the 'Submit' button when completed

ANNUNCIATOR SETTING VERIFICATION

After booting, enter the “Engineering” access password and navigate to the Annunciator screen on the EIM. Select “Setup” then “Inputs Setup”. The Annunciator was likely factory configured, but verify each input to make sure the configuration matches the skid. In particular:

- Analog Inputs- Verify the low/high shutdown values
- Digital Inputs- Verify that each “Normally Open” or “Normally Closed” setting is correct
- Thermocouples- Verify the low/high shutdown values

After verifying the above, go back to the annunciator home screen and select the left box. No ‘A’ contacts should be faulted unless expected to be.

Note that the gauges will show a red or yellow bar for the alarm range.

TESTING THE FUEL VALVE AND SHUTDOWN PINS

Note: the fuel should be shut off upstream of the electric fuel valve.

If using a fuel valve that only latches closed:

- Press ‘Reset’. Assuming no ‘A’ contacts are faulted, the light tower will turn green. Manually open the fuel valve. Go to the EIM home screen. The Ignition should say ‘Ready to Start’.
- Press ‘Stop’. The fuel valve should close electrically. The ignition should say ‘Externally Disabled’.

If using a (DC) fuel valve that is held open during run:

- Press ‘Reset’. Assuming no ‘A’ contacts are faulted, the light tower will turn green. The fuel valve should open electrically. Go to the EIM home screen. The Ignition should say ‘Ready to Start’.
- Press ‘Stop’. The fuel valve should close electrically. The ignition should say ‘Externally Disabled’.

GOVERNOR SETTING VERIFICATION

Navigate to the governor home screen. Select the left box and change the speed or pressure setpoint if desired (for ‘Auto’ switch setting).

From the governor home screen, go to “Setup” then “Throttle Calibration”. Click “Calibrate Now”. The calibration should take about 10 seconds to compete. During the test, the current position should change, and when finished should be 0%.

After calibration, clear any governor alarms and they should remain cleared. If calibration fails, or an alarm comes back, verify the throttle body wiring.

IGNITION ENCODER CALIBRATION

	If using annunciator auto-start, it should be turned off during this procedure. It can be re-enabled when encoder calibration is completed.

Make sure the engine is at TDC of the compression stroke of cylinder 1. Navigate to the ignition home screen, followed by “Setup and Testing”, then “Encoder Install Calibration”. Click “Start Calibration” if ready. Reset the annunciator, and crank the engine for several seconds by holding the “Start” button. The screen should change from “Calibration Active: Yes” to “No”. If the result is “PASS”, the calibration was completed successfully.

Press ‘Stop’ to stop the annunciator to return to the stopped state.

STARTING THE ENGINE

At this point, the engine can be started.

1. Reactivate the fuel source
2. Put the governor switch in “Idle”
3. Press “Reset” on the annunciator. The light tower should stay green.
4. Press “Start” to crank and start engine

DIAGNOSING STARTING ISSUES

Check each of the following:

Annunciator

- Make sure the fuel valve stays open while the light tower is green. If not, verify the fuel valve wiring

Ignition

- The ignition status should go from “Ready to Start” to “Engine operation detected” (or equivalent) while cranking. If it stays at “Externally Disabled” check the shutdown lead wiring and the annunciator state. If it stays at “Ready to Start”, verify the coupling is physically connected.
- While not cranking, the ignition screen “Engine off diagnostics and testing” can be used to test each cylinder. Test a cylinder one at a time by detaching a secondary lead, connecting to a spare spark plug, holding to the engine block, and having an assistant select that cylinder to test. The plug should spark, which verifies the primary and secondary wiring and the coil. Also verify the wiring and firing order during this process.

Governor

- During cranking, the throttle position should go to a fixed starting position, which is usually 20% by default.
    - Some engines might need more or less fuel during cranking, which can be adjusted on the “Engineering Setup” of the governor
- If the RPM stays at 0 during cranking, verify the magnetic pickup installation and wiring. A multimeter on the MPU wires should pick up some AC voltage during cranking, which shows the MPU works.

AFTER STARTING THE ENGINE

AFRC AUTOCONTROL ADJUSTMENT

- Wait for engine to reach its normal operating temperature and load.
- Adjust the fuel pressure to the mixer until the “Actual” O2 sensor reading is stable within +/- 10 mV of the default “Target” of 777 mV.
- Change the control mode from “Manual” to “Engaged” by toggling the button in the upper right corner of the AFRC home screen.
- AutoControl will calculate and adjust the “Target”.
- Using an exhaust gas analyzer, read the post-catalyst emissions.
- If a different NOx/CO emissions balance is desired, adjust the “Rich/Lean” balance as needed.

    - Allow for up to 10 minutes for AutoControl to settle before making any additional adjustments.
    - Repeat process as needed.
- If the valve position is near the top or bottom after setting up the AFRC, adjust the fuel pressure as needed.

IGNITION TIMING FINE-TUNING (OPTIONAL)

As a final step, a timing light should be used to fine-tune the calibration of the ignition. **With the engine running**, navigate from the **Ignition Home** screen to “Setup and Testing” then “Timing Calibration and Tachometer Output”. On the left half of the screen the current total timing is displayed. Use the “Decrease Offset” and “Increase Offset” buttons to adjust the offset. Once the timing light matches the displayed total timing, the ignition is calibrated. This should only have to be done once after install.

GOVERNOR PRESSURE CONTROL

If the engine is operating well at this point, the pressure control on the governor can be enabled if desired.

Navigate to the governor home screen, select “Setup” followed by “Governor Setup”. On step 2, select the pressure control type desired and the target setpoint. On the following page enter the additional parameters required, using on-screen help as needed.

After submitting, when the governor switch is in “Auto”, the governor will change speed for changes in suction or discharge pressure.

FOR MORE INFORMATION

The following sources are available for more information

KNOWLEDGE BASE

Visit the knowledge base at

http://forum.emittechnologies.com/knowledgebase/

to read articles on the setup and use of parts of the ETS system.

TECHNICAL FORUM

The technical forum at

http://forum.emittechnologies.com/

can be used to ask and view questions and suggestions about EMIT products.

HELP VIDEOS

Follow the Youtube link on the bottom of http://www.emittechnologies.com/ to visit the EMIT Youtube channel which has various help videos.

EMIT TECHNICAL SUPPORT

Contact EMIT at 307-673-0883 for additional support

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