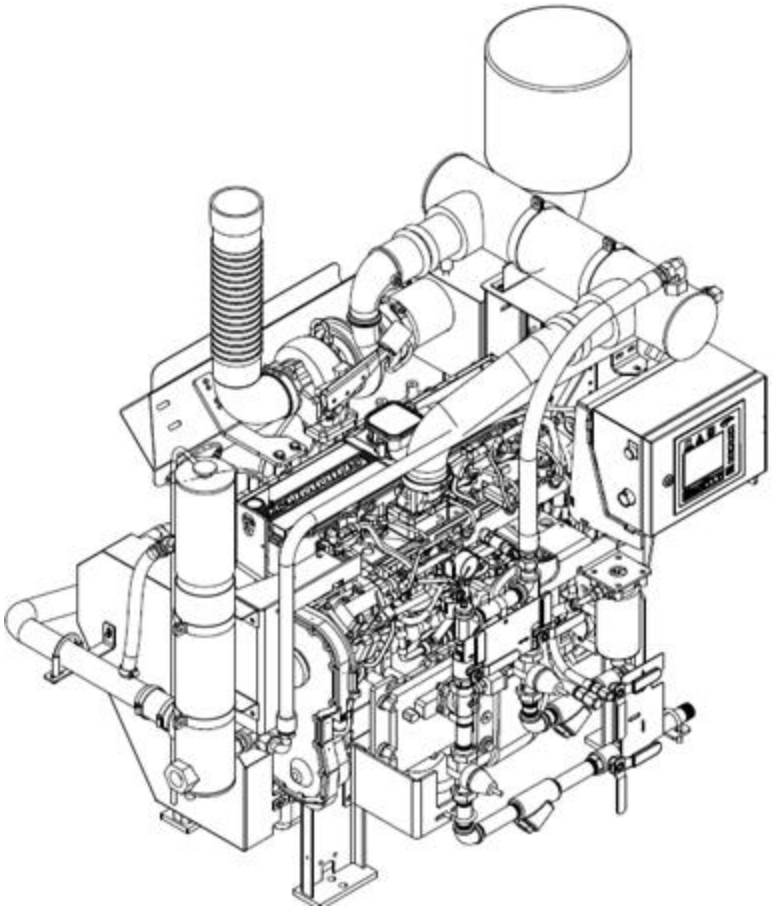
CFP11E SERIES

Fire Power

Operation & Maintenance Manual

Fire Pump Drive Engines



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English Version

This manual contains proprietary information to equipment produced by Cummins Fire Power or Cummins Inc. and is being supplied solely for the purpose of operating, maintaining, and servicing the fire pump engine purchased from Cummins Fire Power.

Warranty Information

LIMITED WARRANTY

EXCLUSIVE EXPRESS LIMITED WARRANTY: Cummins Fire Power (CFP), division of Cummins NPower, LLC expressly warrants to the original end consumer only that, for a period not to exceed the earlier of two (2) years or 2000 hours of use from the start-up date (or, if the original end consumer fails to register as purchaser with CFP, six (6) months from CFP shipment date), the diesel fire pump drivers, manufactured and sold by CFP, shall be free from defects in material and workmanship when used and serviced in accordance with the Operations and Maintenance Manual for the applicable Cummins Fire Pump engine model (the "Exclusive Warranty"). The Exclusive Warranty is nontransferable and shall immediately terminate and be of no further force or effect upon the sale, lease, assignment, transfer or other disposition by an original end consumer of a Cummins Fire Pump engine that contains a diesel fire pump driver covered by this Exclusive Warranty. Nothing contained herein shall be construed to extend the Exclusive Warranty, and the Exclusive Warranty shall not be extended to:

- Maintenance, adjustment, installation or start-up costs;
- Diesel fire pump driver failure due to normal wear, accident, misuse, abuse, neglect, improper installation or a defect attributable to a Cummins Fire Pump engine;
- Alterations or modifications not authorized in writing by CFP;
- Additional components added to a diesel fire pump driver package subsequent to shipment of the engine;
- Starting batteries;
- Coolant heaters (12 months coverage).

DISCLAIMER OF WARRANTIES: Except for the Exclusive Warranty provided above, which is in lieu of all other express and implied warranties, CFP EXPRESSLY DISCLAIMS ALL EXPRESS AND IMPLIED WARRANTIES, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

LIMITATION AND EXCLUSION OF REMEDIES: All claims under this Exclusive Warranty shall be deemed waived by the original end consumer if not submitted to CFP or an authorized distributor within thirty (30) days of initial discovery that a diesel fire pump driver is not conforming to the Express Warranty. The original end consumer's remedy under this Exclusive Warranty is limited, in CFP's reasonable discretion, to repair, replacement or other appropriate adjustment of a nonconforming diesel fire pump driver determined, upon CFP's inspection, to have been properly installed, maintained and operated in accordance with the Operations and Maintenance Manual furnished by CFP. IN ANY EVENT, **CFP SHALL NOT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.**

The Cummins Industrial Warranty covers the base engine for a period of time not to exceed the earlier of two (2) years or 2000 hours of operation from the date of delivery and start-up of the engine. Reference bulletin numbers 3381321 US/Canada & 3381322 Outside US/Canada. Cummins Fire Power components are warranted for a period of time not to exceed the earlier of two (2) years or 2000 hours of operation from the start-up date of the fire pump system, and the coverage includes travel time and mileage for the first year of the Limited Warranty, and repair or replacement of parts and reasonable cost of labor. The Cummins Fire Power Limited Warranty does not cover failures or damage due to abuse or neglect and including, but not limited to: shipping damage, improper storage, improper installation, unauthorized modification or lack of maintenance. Cummins Fire Power is not responsible for incidental or consequential damages.

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Section 1 - Safety

1.1 Introduction

Cummin's Fire Power Manuals and Engine Manuals should be considered part of the equipment. Keep the manuals with the equipment. If the equipment is traded or sold, give the manuals to the new owner.

All personnel responsible for the operation and maintenance of the equipment should read and thoroughly understand this manual.

1.2 Advisory and Cautionary Statements

Advisory and Cautionary Statements are used throughout this manual to call attention to special information, correct operating procedures, and safety precautions.

NOTE: *A general advisory statement relating to equipment operation and maintenance procedures.*

IMPORTANT: *A specific advisory statement intended to prevent damage to the equipment or associated components.*

Cautionary Statements consist of two levels:

WARNING

Indicates the presence of a hazard which CAN cause severe personal injury.

CAUTION

Indicates the presence of a hazard which CAN cause personal injury or equipment damage.

1.3 Safety Precautions

Warning: Read and understand all of the safety precautions and warnings before performing any repair. This manual contains the general safety precautions that must be followed to provide personal safety. When they apply, special safety precautions are included with operating procedures.

Warning: Before manual operation, perform a walk around inspection and alert all area personnel that the equipment will be starting.

Warning: Do not operate faulty or damaged equipment. Ensure that all hoses, pipe connections, clamps, and guards are in place and securely fastened. Electrical components should be kept in good working condition and repaired immediately by qualified personnel.

Warning: After performing maintenance, remove all tools and foreign materials, reinstall and securely fasten ALL guards, covers, and protective devices.

Warning: Exposed in-running belt nips can cause severe personal injury or dismemberment. Ensure that guards are in place and securely fastened before operation.

Warning: Rotating drive shafts can lacerate, dismember, or cause strangulation. Keep hands, body parts, long hair, or loose-fitting clothing clear at all times.

Warning: Never attempt to manually clean a machine while it is operating or in standby mode.

Warning: Never open ports on tanks or piping while the engine is operating. Contact with pressurized agents can cause severe personal injury.

Warning: Relieve all pressure in the air, oil, and cooling systems before any lines, fittings, or related items are removed or disconnected.

Caution: Engine fuel is flammable when in contact with electrical spark or flame sources. Remove all sources of spark or flame from the work area.

Caution: Always use the same fastener part number (or equivalent) when replacing fasteners.

Caution: Some state and federal agencies in the USA have determined that used engine oil can be carcinogenic and can cause reproductive toxicity. Dispose of waste oil in accordance with applicable requirements.

Section 2 - Description

2.1 Introduction

This manual contains information for the correct operation and maintenance of a Cummins Fire Pump Engine. Read and follow all safety instructions. Refer to the General Safety Instructions in Section 1 - Safety.

This manual covers installation, operation, and maintenance of specific engine models. Most illustrations are representations that are common between both models. Where differences occur, refer to Section 8 - Component Parts and Assemblies for model specific information.

Keep this manual with the equipment. If the equipment is traded or sold, give the manual to the new owner.

Cummins Fire Power, Cummins NPower, and Cummins Inc. reserve the right to make changes at any time without obligation. If any differences are found between an engine and the information in this manual, contact the local Cummins Authorized Repair Location.

The latest technology and the highest quality components were used to produce this engine. When replacement parts are needed, we recommend using only genuine Cummins or ReCon® exchange parts.

2.2 Fire Pump Engines

Cummins complete line of fire pump engines have been approved as packaged units (engine and all accessories) by Factory Mutual Approvals and listed by Underwriter's Laboratories, Inc. and Underwriter's Laboratories of Canada.

No deviations are permitted without prior written approval. These engines are to be used only for fire protection applications.

NOTE: *Refer to the model specific Engine Data Sheet in Section 8 - Component Parts and Assemblies for emission levels.*

2.3 Engine Digital Control Panel

The engine digital control panel is mounted on the left side of the engine at the flywheel end. Refer to Section 4 - Controls for additional information.

The engine digital control panel contains controls for starting, monitoring engine performance, and controlling fire pump engine operation.

2.3.1 Overspeed Function Feature

Each engine is equipped with an electronic overspeed control which activates the fuel pump solenoid valve and ECM ignition to shut off the engine when the RPM exceeds a preset limit. The overspeed control senses engine speed during the start cycle and stops the starting motor cranking cycle.

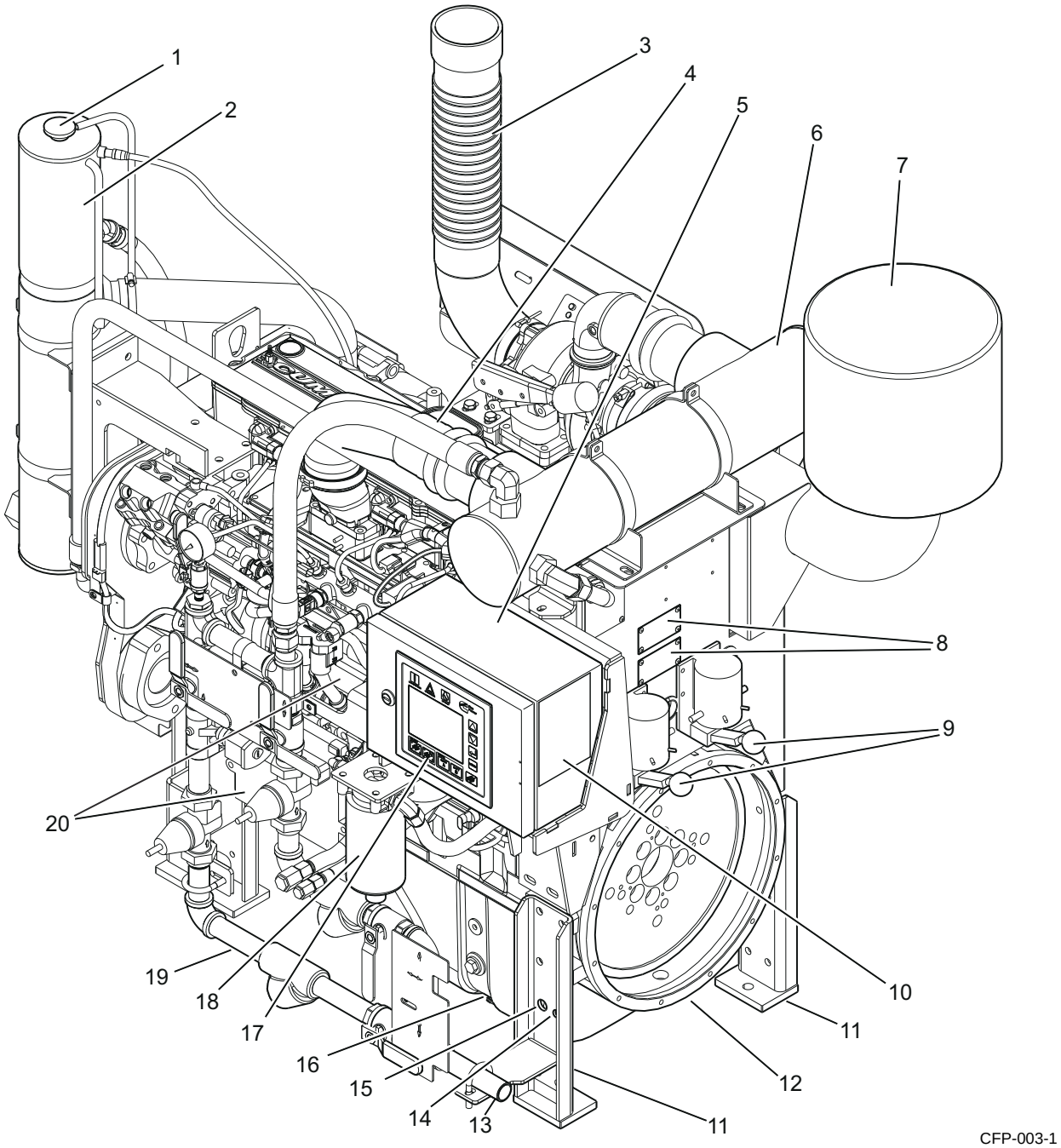
2.3.2 Operating Speed

All Cummins fire pump engines are shipped from the factory adjusted to the requested operating speed (RPM). Final operating speed adjustment must be made during the in-service inspection to obtain the required operating speed specified by the pump manufacturer.

2.4 Fire Pump Controller

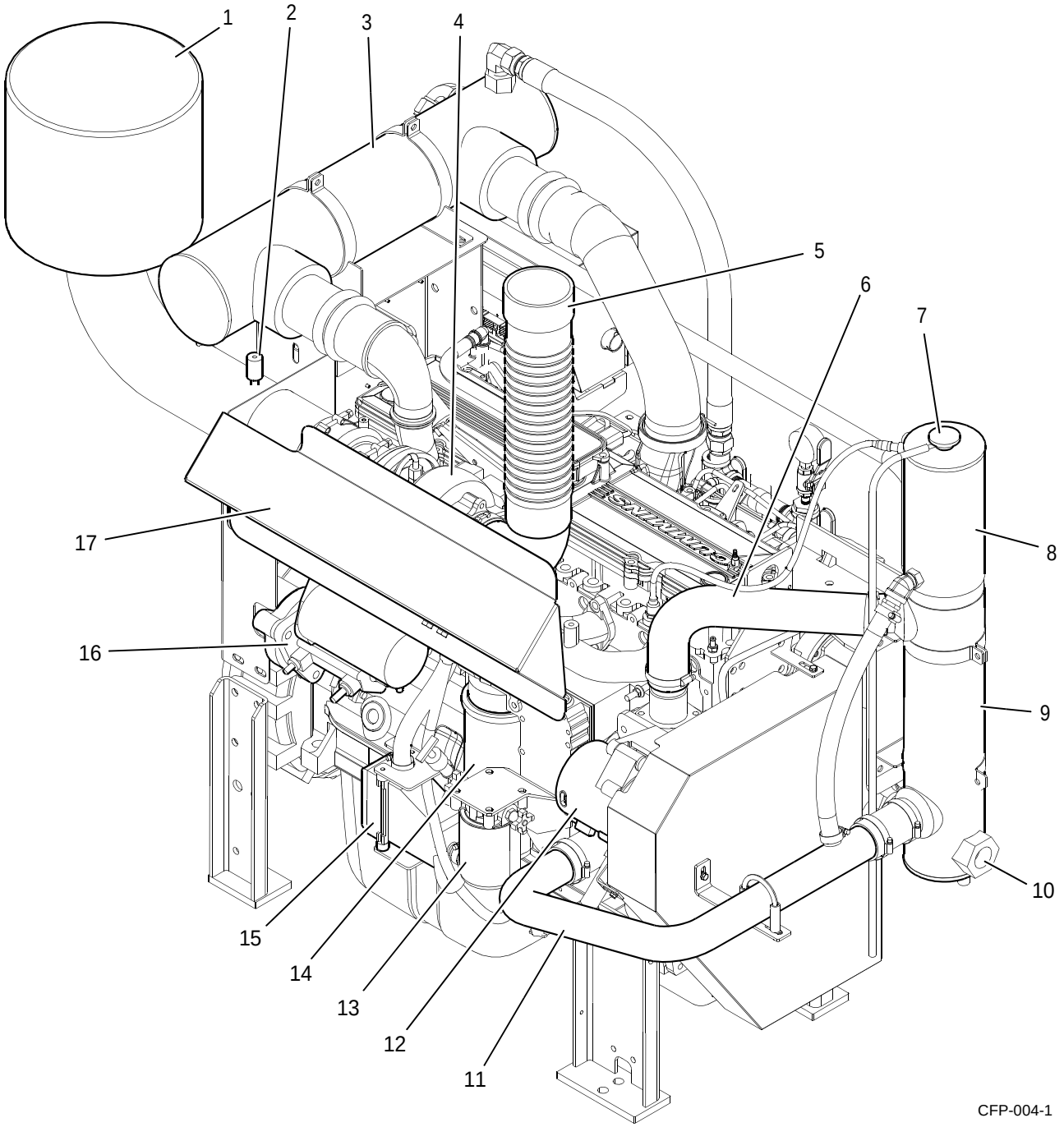
The fire pump controller is not supplied by Cummins Fire Power or Cummins Inc. The fire pump controller starts the engine automatically when a remote fire demand signal is initiated and automatically shuts down the engine when the fire demand signal is discontinued.

The engine may be started locally in the manual mode and shut down using the engine digital control panel stop button.



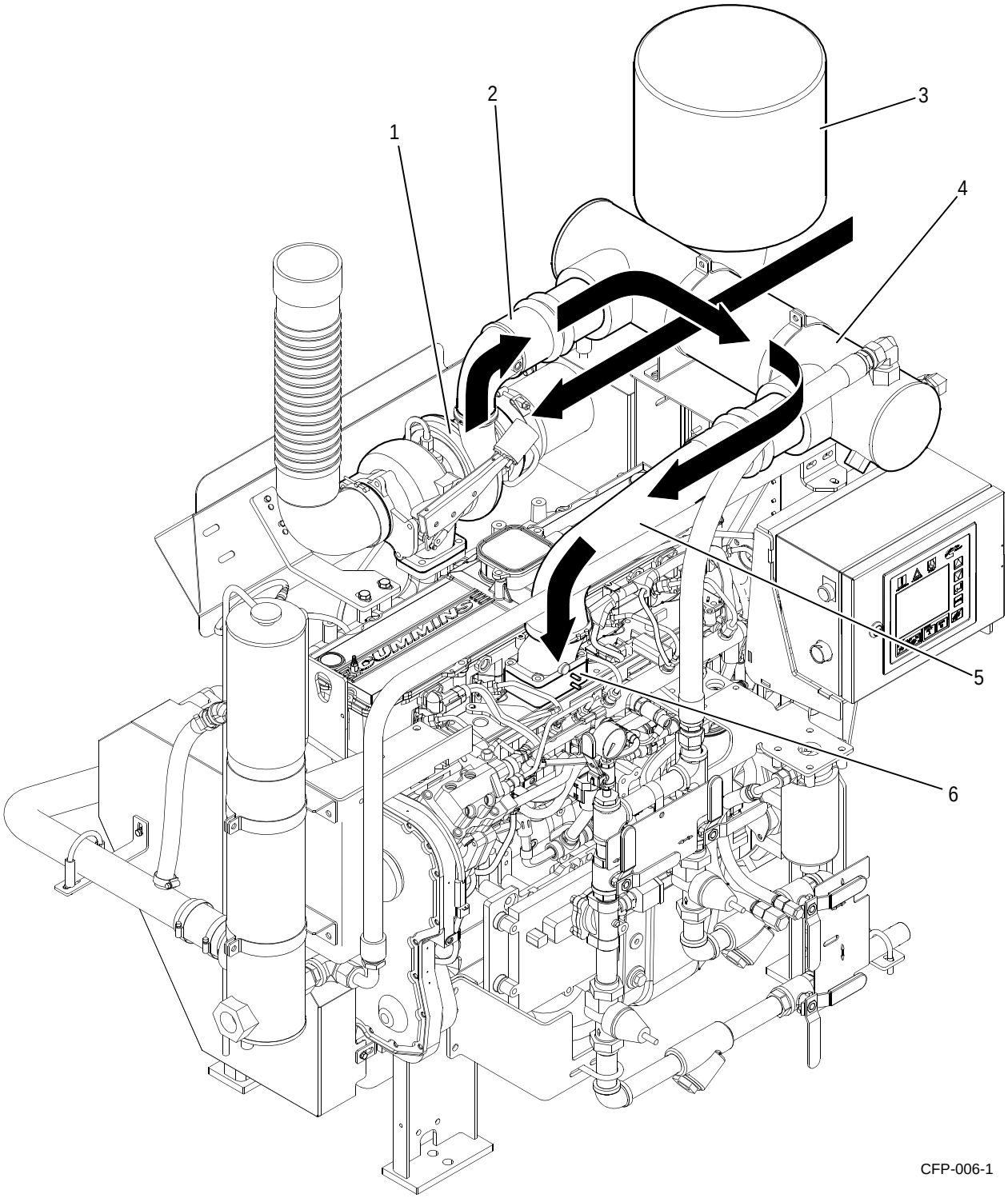
1. Coolant Pressure/Fill Cap
2. Coolant Expansion Tank
3. Exhaust Flex Connection
4. Charge Air Cooler Hose
5. Terminal Box
6. Charge Air Cooler (CAC) Heat Exchanger
7. Air Cleaner Assembly
8. Engine Speed Setting Plates
9. Battery Starter Contactors
10. Manual Start Instruction Decal
11. Engine Supports
12. Flywheel Housing
13. Raw Water Inlet
14. Fuel Return Outlet (optional location)
15. Fuel Inlet (optional location)
16. Oil Pan and Drain
17. Engine Digital Control Panel
18. Fuel Filter or Filter/Separator
19. Cooling Loop Manifold Piping (optional)
20. Electronic Control Modules (ECMs)

Figure 2-1 Engine Components - Engine Digital Control Panel (EDCP) Side (CFP9E shown)



1. Air Cleaner Assembly
2. Air Cleaner Service Indicator
3. Charge Air Cooler (CAC) Heat Exchanger
4. Turbocharger
5. Exhaust Flex Connection
6. Upper Coolant Hose/Tube
7. Coolant Pressure/Fill Cap
8. Coolant Expansion Tank
9. Coolant Heat Exchanger
10. Heat Exchanger Raw Water Discharge
11. Lower Coolant Hose/Tube
12. Alternator
13. Coolant Filter
14. Engine Oil Filter
15. Engine Coolant Heater
16. Starter Motor
17. Manifold Heat Shield

Figure 2-2 Engine Components - Turbocharger Side (CFP9E shown)



1. Turbocharger
2. Air Hose to Charge Air Cooler
3. Air Cleaner Assembly
4. Charge Air Cooler (CAC) Heat Exchanger
5. Charge Air Cooler Hose
6. Combustion Air Intake Manifold

Figure 2-3 Engine Air Intake and Charge Air Cooling Flow Diagram (typical)

2.5 Air Intake System

The air intake system supplies combustion air to the fire pump engine cylinders. The air filter prevents particulate matter from entering the air intake. Combustion air drawn into the system by the turbocharger is directed through the Charge Air Cooler (CAC) heat exchanger for cooling before entering the intake manifold where the charge air is mixed with fuel. Refer to Figure 2-3.

2.6 Raw Water Cooling System

The fire pump raw water supply provides cooling water for the engine heat exchanger system. A water-to-air Charge Air Cooler (CAC) heat exchanger, reduces the combustion air temperature at the intake manifold. A low charge air temperature (requirement of 60° C (140° F), with 25° C (77° F) ambient) meets emission levels, while improving engine performance and efficiency.

Water entering the cooling system through the raw water inlet first circulates through the charge air cooler heat exchanger, cooling the compressed air from the turbocharger outlet ducting. The cooled combustion air exits the CAC outlet duct to the engine air intake manifold. Refer to Figure 2-4.

NOTE: *The raw water supply must be immediately available when the engine is started.*

The raw water from the CAC heat exchanger then passes through the engine coolant heat exchanger. The raw water exits the coolant heat exchanger through a discharge connection.

IMPORTANT: *If the piping will be supplied by the customer, provide raw water supply piping and components equivalent to components supplied by Cummins Fire Power and as shown in the Assembly Diagram, Raw Water Piping. Refer to National Fire Protection Association NFPA 20 for US installation requirements. When choosing components for the raw water supply and bypass, ensure that the internal cross sectional area of the component is at least as large as the recommended pipe size.*

1. When the raw water piping is installed, adjust both pressure regulator set points (optional raw water manifold) before operating the pump.
2. The upper line is the bypass line. The bypass line outlet valve should be closed.
3. The lower line with the solenoid valve is the normal inlet line. The pressure gauge isolation valve must be open. The normal water inlet line valve should be open.

IMPORTANT: *Monitor the oil pressure and coolant temperature gauges frequently. Refer to Lubricating Oil System Specifications or Cooling System Specifications in the model specific Engine Data Sheet in Section 8 - Component Parts and Assemblies for recommended operating pressures and temperatures. Shut off the engine if any pressure or temperature does not meet the specifications.*

Maximum engine coolant temperature should not exceed the temperature listed on the Engine Data Sheet found in Section 8 - Component Parts and Assemblies. The coolant expansion pressure/fill cap must meet the minimum pressure of 10 kPa (15 psi).

The engine coolant system contains a mixture of at least 50% antifreeze and 50% water. The coolant level should be maintained so it is visible in the coolant level sight gauge.

CAUTION

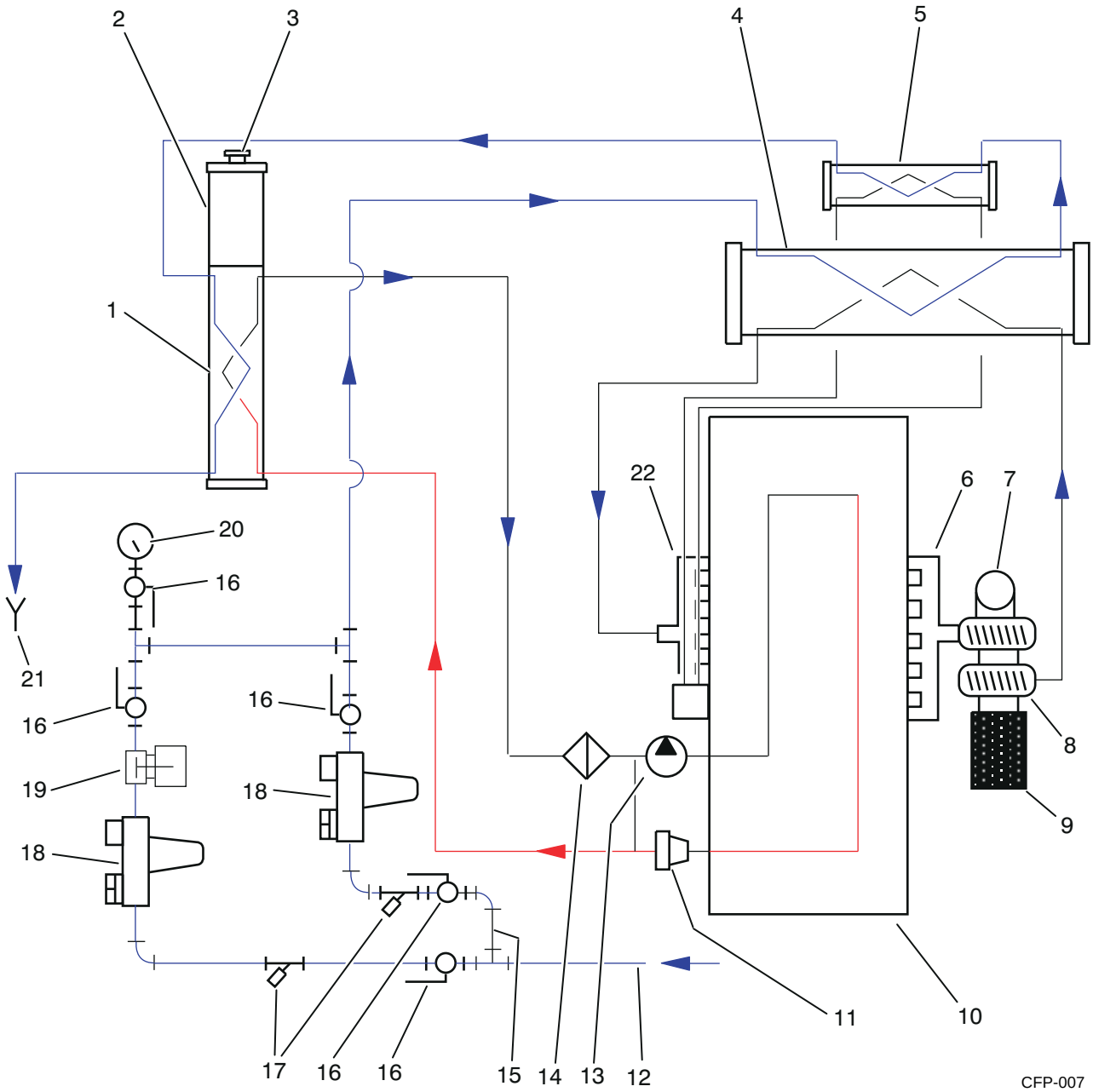
Continuous operation with low coolant temperature (below 70° C [158° F]) or high coolant temperature (above 107° C [225° F]) can damage the engine. Verify raw water pressure and flow.

2.7 Fuel Cooling System (for CFP11E only)

A fuel cooling heat exchanger maintains fuel temperature to meet the maximum allowable fuel inlet temperature (71° C [160° F]). Performance of the fuel cooling system is critical to engine durability, performance, and emissions compliance.

2.8 Fuel Supply and Drain Location

The fuel supply and return connections are centrally located on the engine digital control panel side. Refer to Figure 2-1. Refer to the model specific Engine Data Sheet in Section 8 - Component Parts and Assemblies for the maximum allowable fuel tank supply locations above the fuel pump.

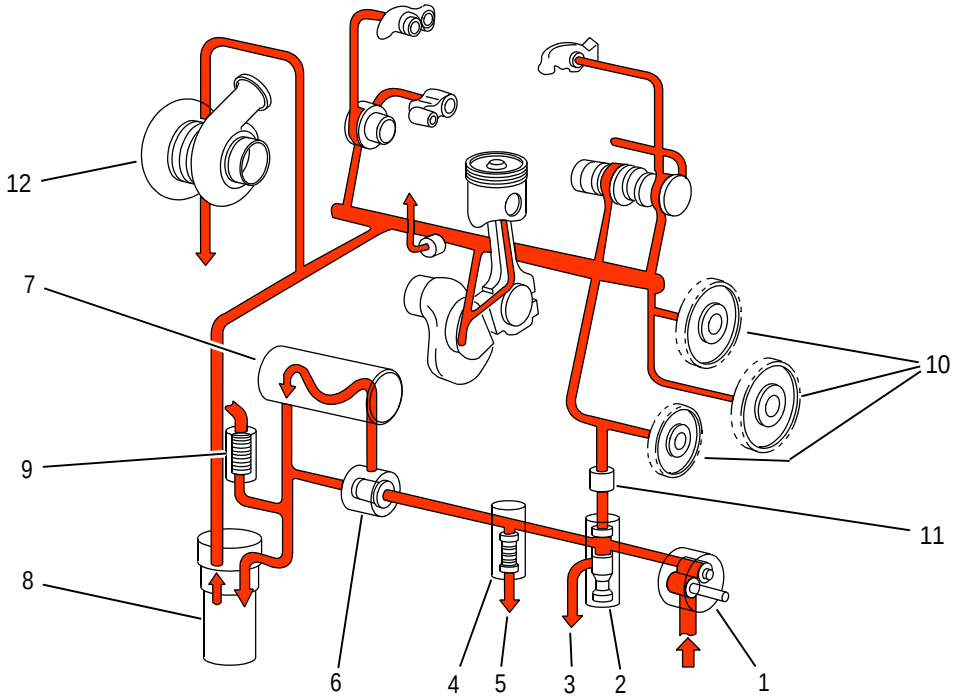


1. Coolant Heat Exchanger
2. Coolant Expansion Tank
3. Coolant Pressure/fill Cap
4. Charge Air Cooler
5. Fuel Cooling Heat Exchanger
6. Exhaust Manifold
7. Exhaust Flex Connection
8. Turbocharger
9. Air Filter
10. Engine Block
11. Thermostat
12. Raw Water Inlet Pipe
13. Coolant Pump
14. Coolant Filter
15. Bypass Piping
16. Manual Shut-off Valve
17. Raw Water Strainer
18. Raw Water Pressure Regulator
19. Raw Water Solenoid Valve
20. Raw Water Pressure Gauge
21. Raw Water Drain Line
22. Combustion Air Intake Manifold

Figure 2-4 Engine Cooling System Flow Diagram (typical)

2.9 Fuel System

The fire pump engine is equipped with an electronic fuel system to provide fuel metering and timing. The system is controlled by the Engine Control Module (ECM) for fueling and timing based on temperature, altitude, pressure, and throttle position. Refer to Figure 2-1.



1. Oil Pump
2. Pressure Regulator Valve
3. Oil Return to Pan
4. High Pressure Relief Valve
5. Oil Return to Pan
6. Oil Thermostat
7. Oil Cooler
8. Combination Oil Filter
9. Filter Bypass Gears
10. Idler Gears
11. Viscosity Sensor
12. Turbocharger

Figure 2-5 Engine Lubricating Oil System Flow Diagram (typical)

2.10 Engine Oil System

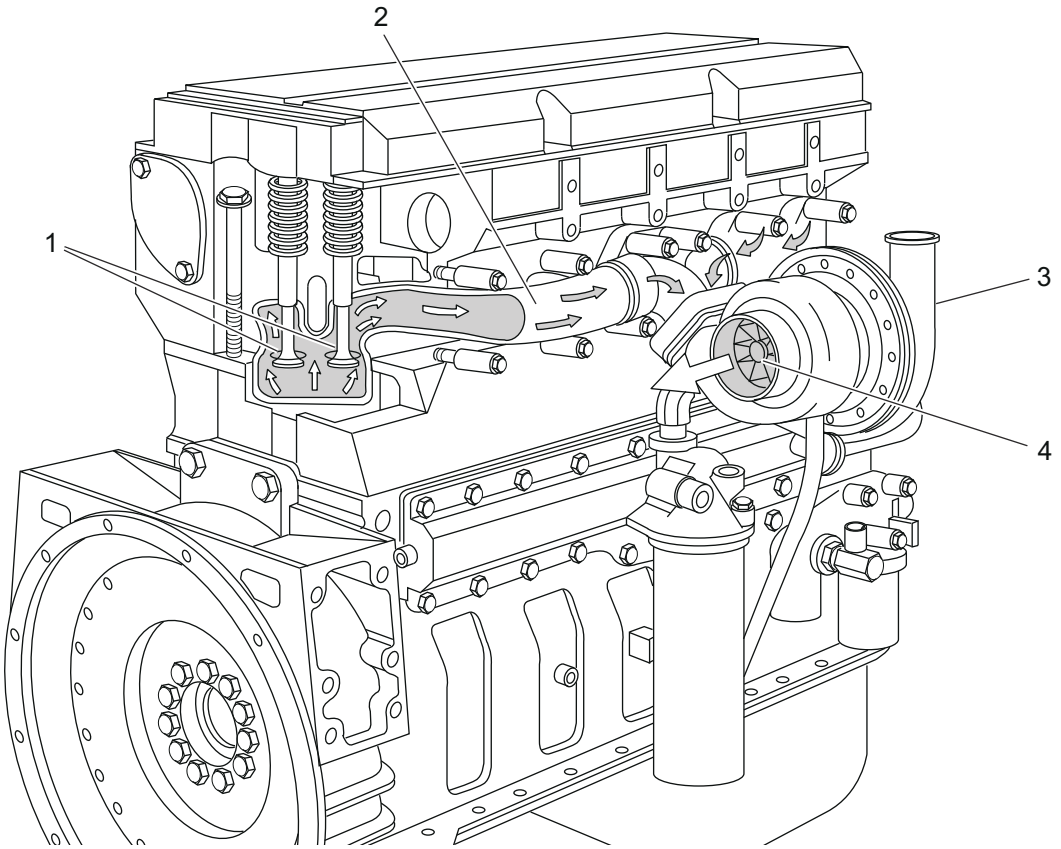
The engine oil system lubricates moving internal engine parts (pistons, piston arms, valves, cam shafts, drive shafts, and bearings). The oil pump circulates oil from the oil pan, through the oil filter, and into engine areas where friction may develop. Refer to Section D of the Cummins Engine Operation and Maintenance Manual for additional information. Refer to Figure 2-5.

Typically, engine oil has been added during manufacture and testing procedures, however, shipping restrictions can affect whether the oil is maintained in the engine or drained for shipment.

Check the oil level at the dipstick. Add oil as necessary to bring the oil level to the H (high) mark on the dipstick. Refer to Figure 3-6.

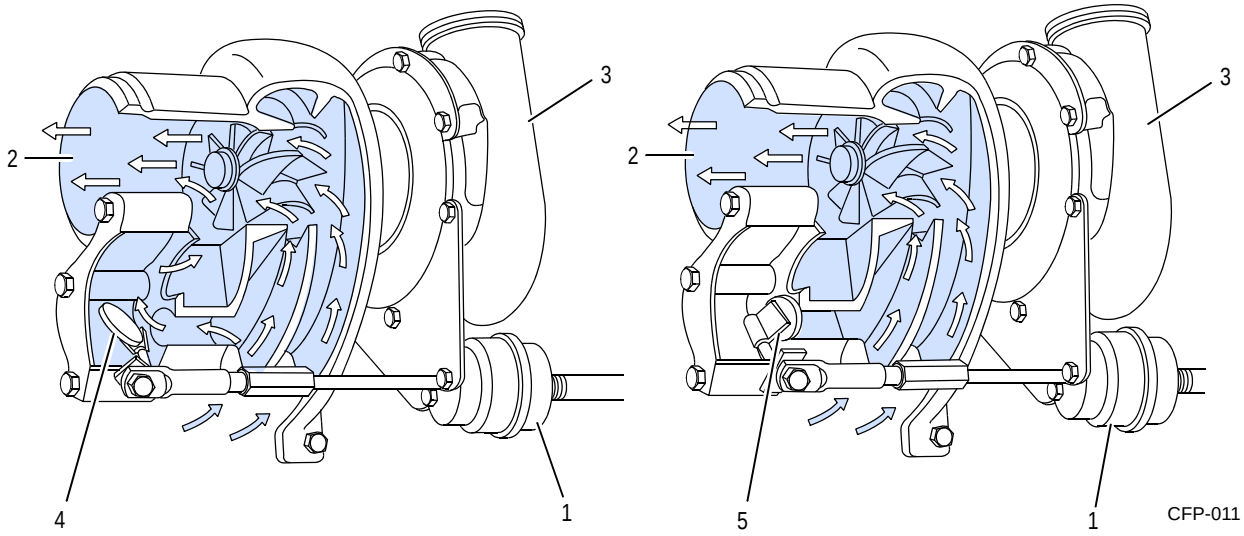
2.11 Exhaust System

The exhaust system removes engine exhaust from the cylinders after the combustion process. The exhaust discharges from the exhaust manifold, passes through (drives) the turbocharger, and exits through the exhaust flex-pipe. Refer to Figure 2-6 and Figure 2-7.



1. Exhaust Valve Ports
2. Engine Exhaust Manifold
3. Combustion Air to Charge Air Cooler
4. Turbocharger Turbine

Figure 2-6 Exhaust System Flow Diagram (typical)



1. Wastegate Actuator Cylinder
2. Exhaust Flow to Flex Pipe
3. Combustion Air to Charge Air Cooler
4. Wastegate OPEN
5. Wastegate CLOSED

Figure 2-7 Turbocharger Exhaust Flow Diagram (typical)

Section 3 - Installation

3.1 Receiving and Handling Information

Cummins Fire Power Pump Engines are pre-assembled and tested before shipment. Parts not shipped attached to the engine are sometimes shipped individually. The equipment was thoroughly inspected and prepared for shipping before it was turned over to the carrier.

1. Carefully remove the components from the shipping container. Remove crating, shipping tape, braces, and tie-downs.

2. Inspect the equipment for damage that may have occurred in shipping.

3. Check each item carefully against the shipping manifest or bill of lading.

3.2 Site Preparation

This section provides instructions for the initial installation, adjustment, and testing of the Cummins Fire Pump Engine. Appropriate portions of this section should be used when returning the engine to operation after overhaul or major maintenance.

The site should be clean and relatively level. Clear the proposed equipment area of overhanging obstructions and obstacles protruding from the floor.

Raw water piping should be installed by trained technicians familiar with local, state, and federal codes and regulations, per the equipment layouts supplied by Cummins Fire Power or Cummins Inc.

Refer to the general fire pump and engine layout drawings for installation dimensions supplied with this manual.

Refer to National Fire Protection Association NFPA 20 for US installation and applicable local code requirements and NFPA 25 for inspection, testing, and maintenance requirements.

1. Lay out a designated center line on the site floor. Find the center line of the engine drive shaft. Lay out a center line on the cross frame members.

2. If the engine is assembled with the drive line, pump, and mounting base, use the lifting points provided on the mounting base or lift the entire skid using an approved fork lift.

CAUTION

Ensure that the lifting device is capable of safely lifting the weight of the engine or the combined weight of the assembled pump base, drive line, and pump. Refer to the bill of lading for combined shipping weights.

3. Position the engine as required for the interface with the fire pump, water piping, fuel piping, exhaust, and air system connections.

3.2.1 Drive Shaft Installation

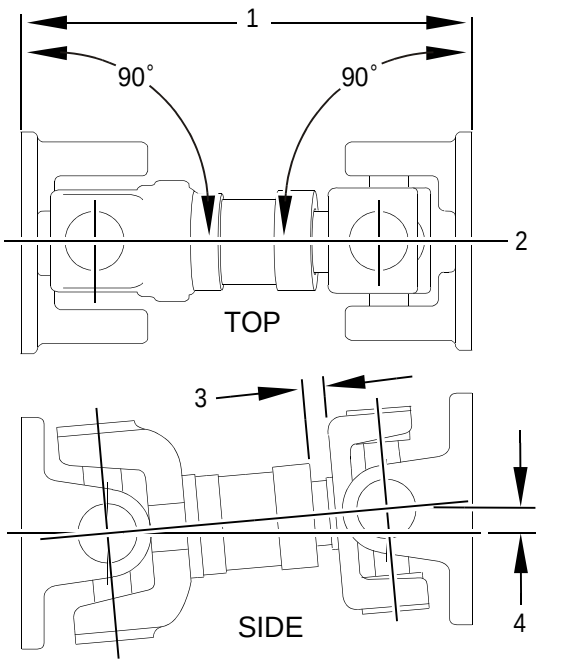
1. Position the engine center line to align the engine drive shaft with the fire pump drive. Ensure that the engine and pump are correctly aligned.

   a. Ensure engine position is centered on frame side to side within ± .76 mm (.03 in) by measuring outside of frame side to engine support leg mounting pad. (Compare the two front engine supports and two back engine supports).

   b. Align engine center line to pump center line within ± .76 mm (.03 in). Refer to Figure 3-1.

   c. The pump center line to the engine crankshaft center line (in vertical plane) is to be 2° +/- 1°.

   d. Drive shaft mounting flanges must be parallel.



1. Planes Must Be Parallel
2. Align Both Mounting Center lines to ± .76 mm (.03 in)
3. Distance to Equal Half of Total Travel
4. 2° +/- 1°

Figure 3-1 Drive Shaft Alignment

2. Lubricate the grease fittings on the drive shaft universal joint. Refer to Figure 3-2.

   a. Wipe the grease fittings and grease gun nozzle with a clean cloth.

   b. Add grease to the drive shaft universal joint grease fittings.

   c. Wipe excess grease from the grease fittings.

NOTE: *Cummins Fire Power or Cummins Inc. recommends using a good quality semi-synthetic, molybdenum-fortified NLGI #2 lithium complex grease.*

NOTE: *Some lubrication loss may occur during transport and storage. It is recommended that the drive shaft be re-lubricated upon installation.*

3. Check that the fire pump is properly installed per the pump manufacturer's specifications.

4. Connect the exhaust piping to a safe location, away from building air intake sources (air conditioners, windows, fresh air intake pipes, etc.).

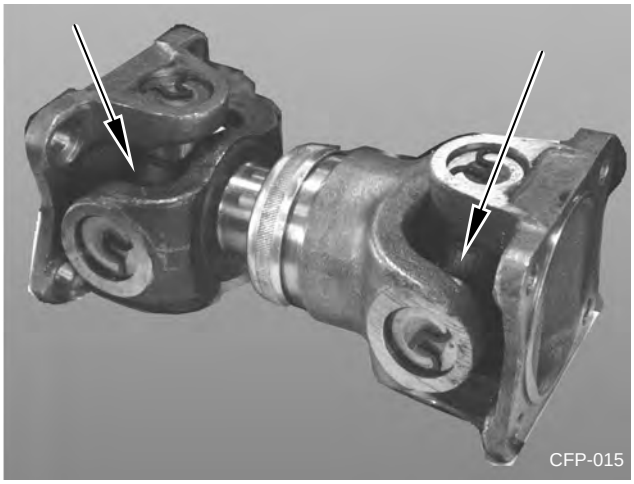


Figure 3-2 Drive Shaft Universal Joint Grease Fittings

5. Check that the alternator/coolant pump drive belt is properly installed.

6. Check that all hoses and tubes are properly installed and all clamps secure.

3.3 Fuel Supply Installation

1. Install a properly rated fuel tank per NFPA 20 guidelines.

2. Install a proper sized fuel line per the Engine Data Sheet in Section 8 - Component Parts and Assemblies.

NOTE: *DO NOT use copper or galvanized pipe for the fuel return or supply lines.*

3.3.1 Fuel System Preparation

The fire pump engine fuel system has been primed during manufacturing and test procedures. The engine is equipped with an electric lift pump which primes the fuel filter or filter/separator and high pressure fuel pump when the engine is cranked. Refer to Figure 2-1.

A water separator must be integrated into the fuel delivery system of the fire pump engine. A fuel filter/water separator may be installed directly on the unit in the primary fuel filter location, or a separate filter/separator may be installed in the fuel delivery system near the fire pump engine assembly.

CAUTION

Due to the precise tolerances of diesel injection systems, it is extremely important that the fuel be kept clean and free of dirt or water. Dirt or water in the system can cause severe damage to both the fuel pump and the fuel injectors.

3.3.2 Fuel Recommendations

WARNING

Do not mix gasoline, alcohol, gasohol, ethanol, or methanol with diesel fuel. This mixture will cause severe engine damage or explosion.

CAUTION

Use ONLY no. 2 diesel (ASTM no. 2D) fuel. Any adjustment to compensate for reduced performance with a fuel system using alternate fuel is not warrantable.

3.4 Raw Water Supply Installation

IMPORTANT: *The raw water supply must be immediately available when the engine is started. Ensure that the supply line valves are in the OPEN position.*

NOTE: *The velocity of the raw water should be as great as possible without exceeding the maximum allowable pressure shown in the appropriate Engine Data Sheet in Section 8 - Component Parts and Assemblies*

1. Provide a raw water discharge line at the outlet of the engine coolant heat exchanger and provide a raw water supply line to the raw water inlet per the model specific Engine Data Sheet in Section 8 - Component Parts and Assemblies. Refer to Figure 3-3.

NOTE: *Raw water outlet piping from the heat exchanger should be one pipe size larger than the supply piping.*

2. Check the pressure regulator setting with water flowing through the heat exchanger. If supplied as an option from CFP, both water pressure regulators have been set at 207 kPa (30 psi) or slightly less water pressure during manufacture and testing.

IMPORTANT: *The manual water valves for the automatic loop should remain OPEN at ALL times. The manual valves for the bypass loop should be CLOSED during automatic (pump controller) operation. When running, the engine should stabilize between temperatures identified on the model specific Engine Data Sheet. The flow rate may need to be adjusted to maintain desired engine temperature.*

NOTE: *Excessively cold (4° C to 23° C [40° F to 75° F]) raw water flow can cause condensation inside the charge air cooler.*

IMPORTANT: *Continuous operation with low coolant temperature (below 70° C [158° F]) or high coolant temperature (above 107° C [225° F]) can damage the engine.*

3. The raw water should be adjusted based on water flow rather than water pressure. The flow is dependent on the raw water temperature. Refer to the Engine Data Sheet in Section 8 - Component Parts and Assemblies for details.

4. Use an appropriate sized container to measure and time the flow from the discharge pipe.

   Flow rate = time to fill container/container size.

Example: Time to fill 19 liter (5 gal) container = 15 seconds.

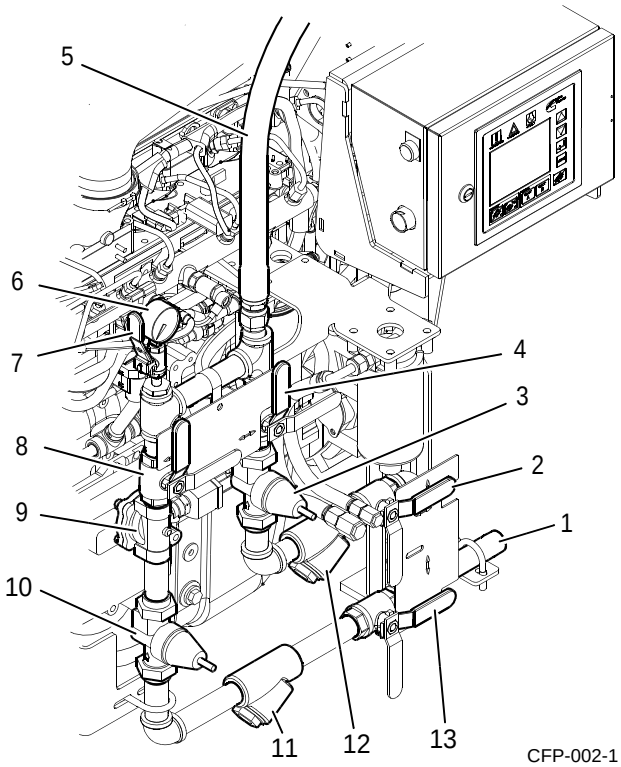
Divide 15 by 5 = 3 (seconds per liter [gal]).

Divide 60 seconds by 3 = 76 liters (20 gal) per minute.

5) Adjust both pressure regulators to a pressure that will provide a flow rate at or above the specifications.

CAUTION

When the raw water piping is installed, adjust both pressure regulator set points before operating the pump. Damage to the heat exchanger may occur from improperly regulated raw water supply pressure.



1. Raw Water Inlet
2. Bypass Water Inlet Valve
3. Bypass Pressure Regulator
4. Bypass Water Outlet Valve
5. Pipe To Heat Exchanger
6. Water Supply Pressure Gauge
7. Pressure Gauge Isolation Valve
8. Normal Water Outlet Valve
9. Solenoid Valve
10. Normal Pressure Regulator
11. Normal Water Strainer
12. Bypass Water Strainer
13. Normal Water Inlet Valve

Figure 3-3 Raw Water Cooling Loop Manifold

3.5 Battery Requirements

One set of lead /acid batteries must be supplied for the standard 12VDC operating voltage. Two redundant sets of batteries must be supplied for the optional 24 VDC operating voltage. Refer to National Fire Protection Association Standard NFPA 20 and Section 1 - Safety of this manual for additional battery installation information.

The minimum recommended reserve capacity (SAE RC) and cold cranking ampere (SAE CCA) values for a particular engine can be found on the Engine Data Sheet in Section 8 - Component Parts and Assemblies. RC and CCA definitions can be found in SAE Standard J537.

3.5.1 Battery Installation

1. Provide adequate room for servicing or replacing the batteries. Provide protection from extremes of temperature and weather.

2. Refer to National Fire Protection Association NFPA 20 for proper location of batteries and applicable local codes requirements. Ensure that the batteries are configured properly for standard 12 VDC operations or optional 24 VDC operations. Refer to Figure 3-4.

NOTE: *Coat the terminals with petroleum jelly to prevent corrosion. Tighten the battery connections.*

3. Install the Battery Cable Kit or equivalent customer supplied wiring.

IMPORTANT: *Batteries must meet the requirement listed in the electrical system specifications. Batteries may be supplied by Cummins Fire Power or Cummins Inc. as an option, or may be supplied by the customer.*

WARNING

Battery electrolyte (sulfuric acid) is highly caustic and can burn clothing and skin. Wear impervious neoprene gloves and safety goggles, or full face shield, when working with the batteries.

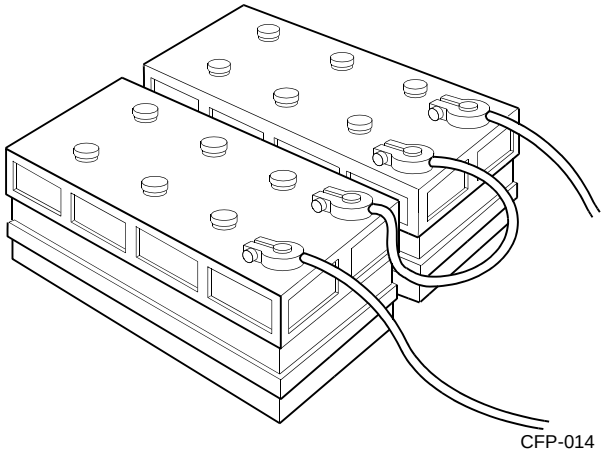


Figure 3-4 Series Battery Connection - 24 VDC

CAUTION

Do not connect battery charging cables to any electronic control system component. This can damage the electronic control system.

WARNING

Batteries can emit explosive gases during charging. Always ventilate the compartment before servicing the batteries. Remove sources of spark or open flame. To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.

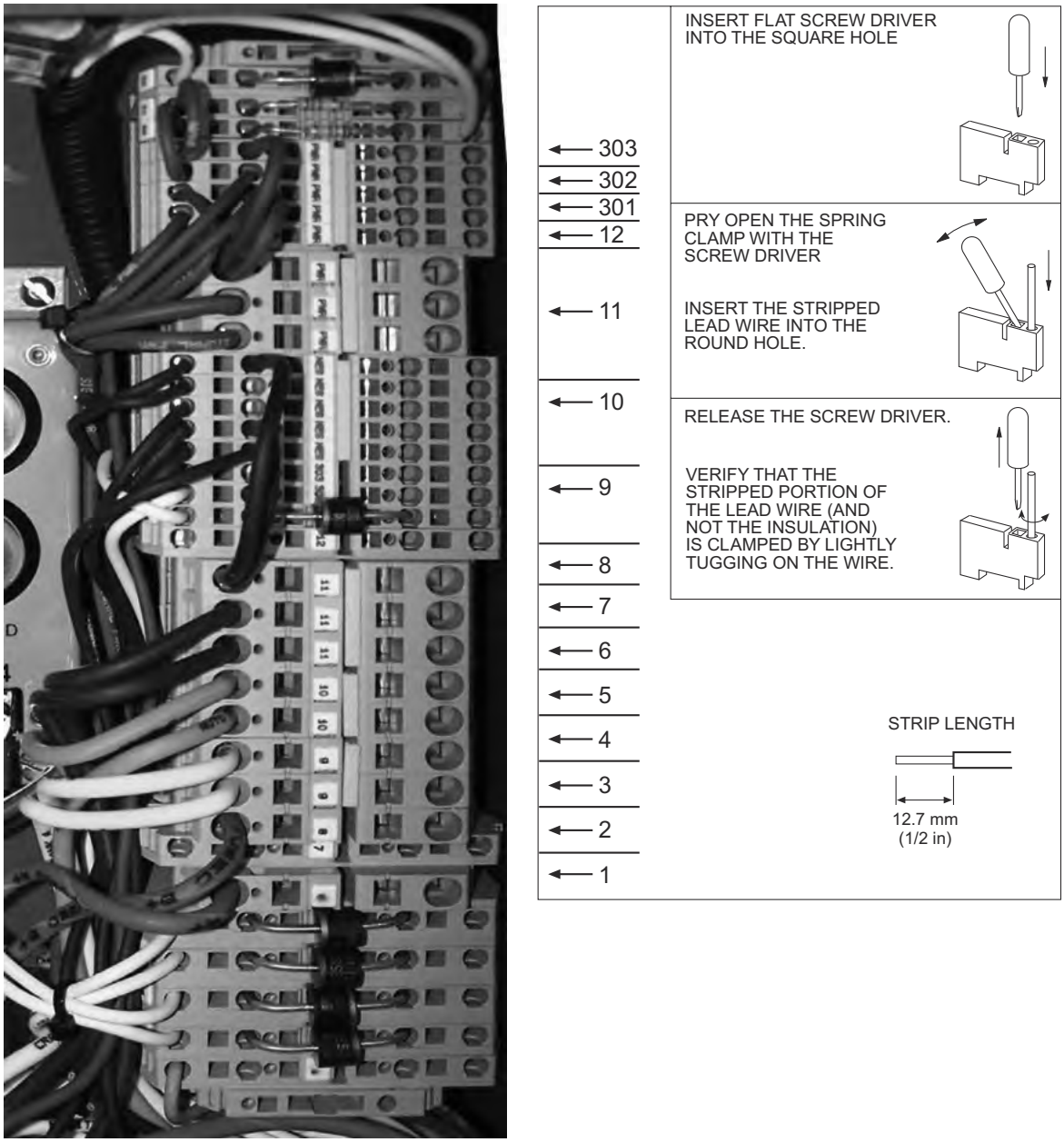


Figure 3-5 Termination Blocks and Wiring Decal

3.6 Signal and Control Installation

This section explains how to connect the controller wires to the terminal block.

CAUTION

If the batteries have been installed prior to the control wiring, disconnect the negative (-) cable first and then disconnect the positive (+) battery lead. Install the cables with the positive (+) cable first and the negative (-) cable last before testing.

NOTE: *Install signal and control wiring at the Terminal Board (TB). Refer to the terminal wiring schematic decal on the inside of the instrument enclosure.*

1. Ensure that the fire control system is properly installed and configured per the manufacturer's instructions. Refer to the wiring schematic drawings provided with the pump manual.

2. Complete the fire pump controller wiring (customer supplied) per the manufacturer's instructions.

3. Connect the following wires to the fire pump engine digital control panel per the engine electrical diagrams.

    a. TB-1: Connect the control power from the fire pump controller. This power source is necessary for fire pump operations while in the AUTO mode.

    b. TB-2: Connect the crank termination input signal for the fire pump controller. This signal is present when the engine is running. This signal indicates that the engine has started and that the crank command from the fire pump controller should stop immediately.

    c. TB-3: Connect the remote overspeed alarm input to the fire pump controller. This signal is present when the overspeed control module has operated. If this event occurs, the fire pump engine will stop.

    d. TB-4: Connect the low oil pressure alarm input from the fire pump controller. This 0 VDC grounded signal is present when the oil pressure has dropped below the 83 ± 13 kPa (12 ± 2 psi) set point.

    e. TB-5: Connect the high coolant temperature alarm input from the fire pump controller. This 0 VDC grounded signal is activated when the engine is running and the coolant temperature is at or above 93° C (200° F). The alarm will deactivate when the engine is running and the coolant temperature drops below 88° C (190° F).

    f. TB-6: Connect battery set A lead from the controller. The controller senses battery A charge state and charges the battery through this heavy gauge wire.

    g. TB-8: Connect battery set B lead from the controller. The controller senses battery B charge state and charges the battery through this heavy gauge wire.

    h. TB-9: Connect crank from battery A lead. During a cranking cycle, the controller energizes the coil of starter contactor A through terminal TB-9 to start the engine.

    i. TB-10: Connect crank from battery B lead. During a cranking cycle, the controller energizes the coil of starter contactor B through terminal TB-10 to start the engine.

    j. TB-11: Connect the battery ground lead from the controller. This heavy gauge wire provides a common ground between the engine and controller.

    k. TB-301: Connect the operating on alternate ECM lead. This 0 VDC ground signal is present when the engine's ECM selector is set to ECM-B.

    l. TB-302: Connect the ECM/fuel fault signal wire. This 0 VDC ground signal is present when the engine signals a trouble fault.

4. Ensure electrical continuity and adequate insulation resistance for the installed wiring.

5. Provide the initial charge on the redundant batteries per the battery charger's instructions.

6. Check that both voltmeters on the engine digital control panel indicate the approximate battery voltage.

3.7 Coolant System Preparation

The fire pump engine cooling and lubrication system was intially filled during manufacture and testing.

CAUTION

Ensure that all coolant systems have been filled to the proper level before operation by checking the coolant level sight gauge on the heat exchanger.

1. Inspect the engine coolant hoses and hose clamps. Ensure that all coolant hoses and clamps are properly installed and water tight.

2. The engine coolant heater must maintain an engine coolant temperature of 49° C (120° F) or above.

3. Ensure that coolant is present in the engine coolant heater before plugging the heater element into a dedicated circuit.

3.8 Charge Air Cooler System

The charge air cooler system reduces the temperature of the compressed combustion air from the turbocharger before entering the air intake manifold. Refer to Figure 2-1 and Figure 2-2.

Inspect the charge air cooler piping and hoses for loose/missing hose clamps, hose punctures, leaking manifold seals, or corrosion. Torque the hose clamps to the recommneded torque value. Refer to the Torque Table in Section 8.

3.9 Lubricating Oil System Preparation

CAUTION

Some regulatory and shipping restrictions may require that all lubricants, fuels, and coolants be drained for transport. Ensure that all lubrication systems have been filled to the proper level before operation.

1. Check the oil level using the crankcase dip stick before operating. Refer to Figure 3-6.

2. Fill the crankcase at the oil fill port to the “H” mark on the dipstick with engine oil.

NOTE: *Do not use special “break-in” oils for new or rebuilt Cummins engines. Use the same type of oil as used in normal operation. Cummins Inc. recommends Valvoline Premium Blue® 15W-40 oil.*

3.10 Pre-Start Inspections

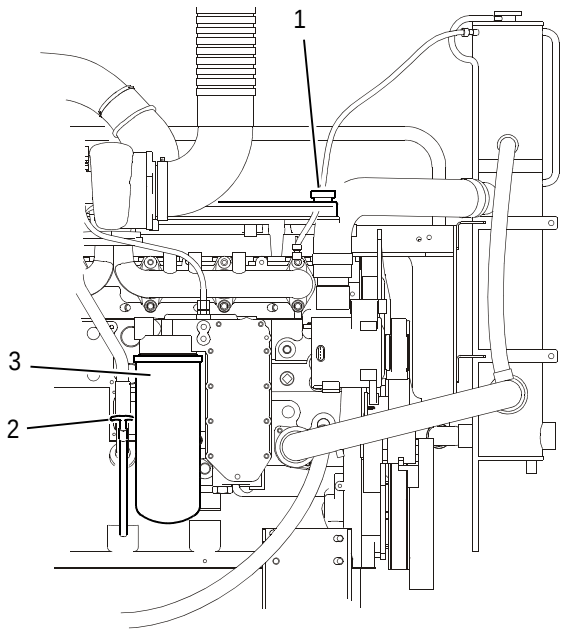
Perform a visual inspection as follows:

1. Check that there is no apparent damage and that all components are installed.

2. Check that the drive belt is properly installed.

3. Check that all hoses and tubes are properly installed.

4. Check that all electrical connections are properly installed.



1. Oil Fill Port (on valve cover)
2. Oil Level Dipstick
3. Engine Oil Filter

Figure 3-6 Oil Level Dipstick and Fill Port

5. Check that the fire pump is properly installed per the pump manufacturer’s instructions, is correctly aligned, and is free to rotate.

6. After completing preliminary set-up procedures, perform the engine start tests as outlined in detail in Section 5 - Operation

WARNING

Before operating the equipment, complete all safety checks, remove all tools and foreign objects from the equipment, and ensure that all

guards are in place and securely fastened. Alert area personnel that the equipment will be starting. Unintentional equipment start-up or contact with exposed or moving components can cause personal injury or equipment damage.

3.11 Engine Monitoring

When the engine starts it is important to monitor the oil and cooling water pressure gauges to ensure safe operation.

CAUTION

If the oil pressure is not displayed on the gauge or if the low oil pressure message is displayed within 15 seconds, STOP THE ENGINE immediately! Continued operation without proper lubrication will cause engine damage.

1. Immediately check that raw water flow is established through the coolant heat exchanger. Raw water flow should be established immediately, but some delay may occur before the flow exits the heat exchanger drain connection.

NOTE: Ensure that raw water is flowing through the heat exchanger and the water pressure shown on the local pressure gauge is no more than 414 kPa (60 psi). The minimum raw water flow rate is identified in the model specific Engine Data Sheet in Section 8 - Component Parts and Assemblies.

CAUTION

If the raw water flow is not evident at the discharge outlet or cone within 15 seconds, STOP THE ENGINE immediately! Continued operation without proper raw water flow will cause engine damage.

2. Ensure that the engine operating temperature stabilizes between applicable ranges as identified in the model specific Engine Data Sheet in Section 8 - Component Parts and Assemblies.

NOTE: If the temperature does not stabilize, stop the engine and refer to Coolant Temperature Above Normal or Coolant Temperature Below Normal (Engine Running) in Section 7 - Troubleshooting.

3. Operate the engine for 8 to 10 minutes.
4. Inspect for leaks, unusual noises, or other indications of incorrect operation.
5. Shut off the engine by pressing and holding the overspeed RESET/STOP switch.
6. Check that raw water flow stops automatically shortly after the engine stops.
7. Correct any problems found during the inspection before proceeding.
8. Check the engine lubricating oil level at the crankcase dip stick. Top off if necessary.
9. Check the coolant expansion tank level. Top off if necessary.
10. Check the raw water strainers. Clean the strainers as required per the instructions in Section 6 - Maintenance.
11. Perform engine speed control and safety system tests per the instructions in Section 5 - Operation.

Section 4 - Controls

4.1 Engine Digital Control Panel

The Engine Digital Control Panel (EDCP) contains controls for starting, monitoring engine performance, and controlling fire pump engine operation. Refer to Figure 4-1. In manual mode, the panel remains active as long as battery power is available. In auto mode, the panel is active when battery power is present on TB-1, otherwise it goes into standby mode after 30 minutes of no battery voltage on TB-1.

4.1.1 Warning Lamp

Illuminates (yellow) in the event that the ECM has sensed a non-mission disabling fault.

4.1.2 Fault Indicator Lamp

Indicates Fuel Injection Fault (FIF) and illuminates (red) in the event that the ECM has detected a fuel injection fault or primary sensor fault.

The engine digital control panel also sends a ground signal to terminal buss #302 which sends a signal to set off an alarm on the fire pump system controller to indicate a FIF fault.

4.1.3 Scroll Buttons

Used to scroll up or down when in the menus.

4.1.4 Enter Button

Used when making changes in the menu screen.

4.1.5 Menu Button

Opens the menu option on the display.

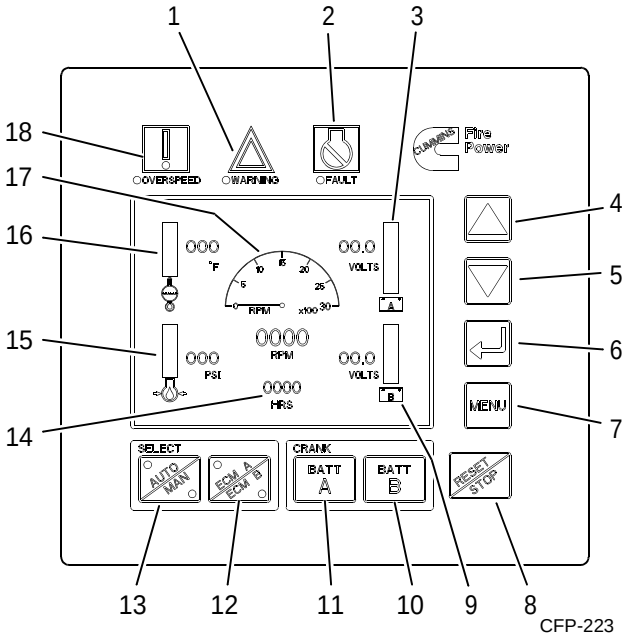
4.1.6 Overspeed RESET/STOP Switch

Used to shut off the engine at the engine digital control panel.

Pressing the overspeed RESET switch after correcting an engine overspeed shutdown resets the overspeed control module, allowing subsequent restarts of the fire pump engine.

4.1.7 Battery A and B Voltmeters

The battery voltmeters display the charge status (VDC) of the relative battery connections.



1. Warning Lamp
2. Fault Lamp
3. Battery “A” Voltmeter
4. Scroll UP Button
5. Scroll DOWN Button
6. ENTER Button
7. MENU Button
8. Overspeed RESET/STOP Switch
9. Battery “B” Voltmeter
10. Crank Battery B Momentary Start Button
11. Crank Battery A Momentary Start Button
12. ECM A/B Selector Switch & Indicator Lamps
13. AUTO/MAN Mode Switch & Indicator Lamps
14. Hour Meter
15. Engine Oil Pressure
16. Coolant Temperature
17. Tachometer
18. Overspeed Warning Lamp

Figure 4-1 Engine Digital Control Panel (EDCP)

4.1.8 Tachometer and Hour Meter

The Tachometer displays the engine speed in Revolutions Per Minute (RPM) whenever the engine is operating. The hour meter maintains a running total of the hours of operation (run time).

4.1.9 ECM A/B Indicator Lamps - Applicable on Electronic Engines

The ECM indicator lamps (yellow) will illuminate, indicating the ECM is being used to control the engine. If ECM A (normal position) is selected, ECM A is controlling the engine. Refer to Figure 4-1.

If ECM B (alternate position) is selected, ECM B is controlling the engine, and the EDCP will send a ground signal to terminal buss #301, which will send a signal to set off an alarm on the fire pump system controller to indicate that the engine is operating on the alternate ECM.

4.1.10 Crank Battery A or B Buttons

The CRANK BATT A or CRANK BATT B buttons initiate an immediate engine start (momentary start) using the selected A or B crank battery.

Crank A or B will energize battery contactor A or B, depending on which one is selected.

Both A and B buttons can be energized at the same time in the event both batteries are weak.

4.1.11 AUTO/MANUAL Mode

The AUTO/MANUAL mode determines whether the engine starts and is controlled by the operator (MANUAL) or by an automatic signal from the fire pump system controller (AUTO). The lamp (yellow) is illuminated, depending on which mode is selected.

The MANUAL mode is typically used for engine setup, testing, and emergency and maintenance procedures.

The AUTO mode is used to start the engine under the control of the fire pump control system. In the auto mode, the fire pump engine stops upon loss of signal power from the fire pump controller.

4.1.12 Coolant Temperature Gauge

The coolant temperature gauge displays the engine coolant temperature.

4.1.13 Engine Oil Pressure Gauge

The engine oil pressure gauge displays the engine oil pressure. The gauge is independent of the low oil pressure alarm.

4.1.14 Engine Overspeed Warning Lamp

The overspeed control module monitors engine speed. If the engine RPM's exceed 115% rated speed, the engine overspeed warning lamp is illuminated (yellow).

The Engine Digital Control Panel (EDCP) will send a power signal to terminal buss #3, which will send a signal to set off an alarm on the fire pump system controller, indicating that an overspeed condition has occurred.

The EDCP will automatically switch to MANUAL mode and will shut the engine down. After the overspeed has been reset by using the RESET/STOP switch on the EDCP, the engine operation will revert to the original AUTO mode position.

NOTE: *The engine will not be allowed to restart automatically from the fire pump system controller until the EDCP is reset.*

4.1.15 ECM Fault Code Lamps - Applicable on Electronic Engines

The amber engine warning lamp and the red engine shutdown lamp alert the operator of engine malfunctions that is categorized as follows:

1. An illuminated amber lamp indicates an engine malfunction that requires timely operator attention.

2. An illuminated red lamp indicates an engine malfunction that requires immediate and decisive operator response.

3. A 3-4 digit diagnostic fault code will display on the EDCP, which can then be used to help describe the engine malfunction. Refer to the Fault Code Chart in Section 7 - Troubleshooting.

4.1.16 Engine Stop Button

The engine stop button is located on the left side of the EDCP enclosure and is used to stop the operation of the engine in either manual or auto mode. The button must be pressed and held until the engine has stopped.

4.1.17 Engine Communications Port

This plug-in is located on the left side of the EDCP enclosure and is used for the communications connection port for Cummins Insite.

NOTE: *Insite is a Cummins Inc. computer software tool used to monitor or report engine performance criteria.*

4.1.18 Contractor Access Port

The contractor access knock-out is located on the lower side of the EDCP enclosure. This is the only 25.4 cm (1 in) knock-out provided for the installing contractor to connect the fire pump system controller to the EDCP.

IMPORTANT: *If this port is not used for the installation, all warranty on the fire pump engine will be void.*

4.1.19 Engine ECM Power Supply

This plug-in is located on the lower side of the EDCP enclosure. The power supply port supplies unswitched battery power to both ECM A and ECM B.

4.1.20 Engine Harness Connection

This plug-in is located on the lower side of the EDCP enclosure. The engine harness connection connects the panel to the power source, start contactors, magnetic pick-up, alternator, and other engine related functions controlled by the EDCP.

4.2 Electronic Control Module (ECM) - Applicable on Electronic Engines

The engine control system is an electronically operated fuel controls system. The ECM performs diagnostic tests on most of its circuits and will activate a fault code if a problem is detected.

4.3 Engine Protection System - Applicable on Electronic Engines

The engine ECM identifies any 3-4 digit engine fault codes and illuminates the appropriate amber warning lamp or red shutdown lamp on the operator engine digital control panel. Refer to Section 7 - Troubleshooting for additional fault code information.

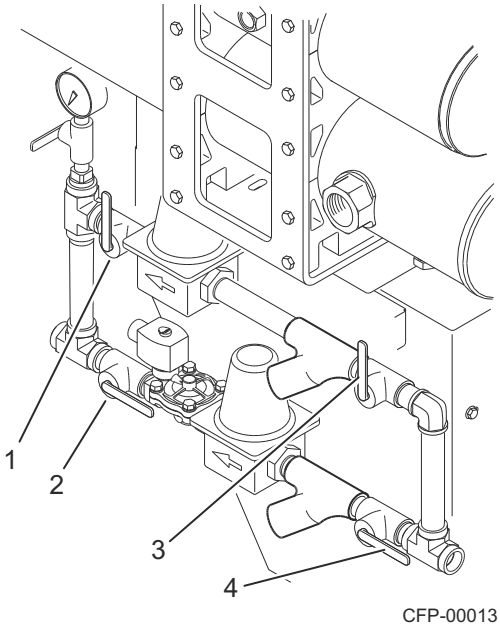
CAUTION

Normally, Cummins engines with ECMs have derate and shutdown protection calibrated into the ECM. However, the ECM on this Cummins engine has no derate or shutdown protection. The engine will run to destruction. Therefore, preventive maintenance is essential.

4.4 Raw Water Flow Control Valves

1. The fire pump system controller opens the raw water normal loop solenoid valve in either manual or automatic mode. In the OPEN position, water can flow through the heat exchangers. Refer to Figure 4-2. Manual raw water valves for the automatic loop should remain OPEN at ALL times.

2. Manual raw water valves for the bypass loop should be CLOSED during automatic (fire pump system controller) operation.



1. Bypass Raw Water Manual Outlet Valve
2. Normal Raw Water Manual Outlet Valve
3. Bypass Raw Water Manual Inlet Valve
4. Normal Raw Water Manual Inlet Valve

Figure 4-2 Normal Open Raw Water Manual Valves (typical)

Section 5 - Operation

5.1 Start-up Procedures

This section provides the operator with the information required to prepare the fire pump engine for normal operation, in a safe manner. This Operator's Manual is provided for your specific equipment and should be considered a part of that equipment. All personnel responsible for the operation and maintenance of the equipment should read and thoroughly understand this manual.

WARNING

Before preparing the equipment for normal production, complete all safety checks, remove all tools and foreign objects from the equipment, ensure all guards are in place and securely fastened, and alert area personnel that the equipment will be starting.

5.2 Remote Starting Procedure

To start the engine from the fire pump controller panel:

1. Press the AUTO/MANUAL mode switch on the engine digital control panel to place the engine in the AUTO mode position. Refer to Figure 4-1.
2. Start the engine by initiating an engine crank signal from the fire pump controller.

CAUTION

If the crank termination signal is absent, the engine starter motor will continue to operate. Shut the engine off immediately at the fire pump controller panel to avoid damage to the starter.

3. The engine continues to operate as long as the RUN signal is present. When the RUN signal is terminated by the fire pump control panel, the engine stops.
4. The engine may be stopped locally by pressing the engine stop button on the side of the engine digital control panel.

5.3 Local Starting Procedure

To start the engine locally from the engine digital control panel:

1. Press the AUTO/MANUAL mode switch on the engine digital control panel to the MANUAL mode position to place the engine in manual mode.
2. Press either the CRANK BATT A or CRANK BATT B button to start the engine.

5.4 Emergency Starting Procedure

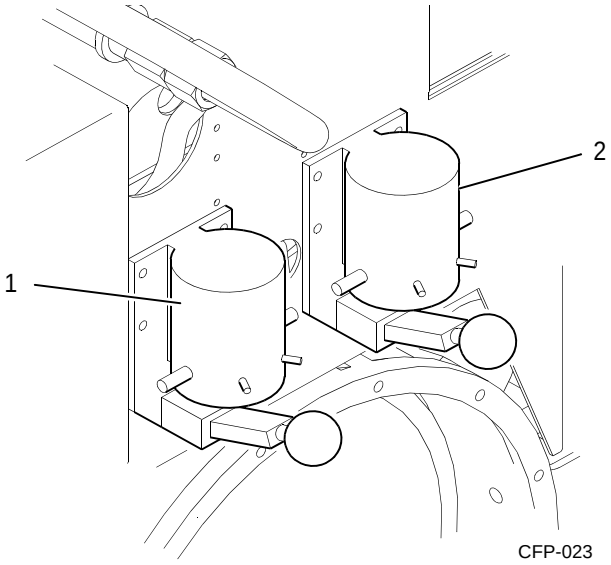
The engine starts automatically in the event of a fire emergency. However, if it fails to start automatically, the engine can be started locally from the engine digital control panel:

1. If necessary, open both manual bypass valves in the raw water supply manifold (if equipped). Refer to Figure 4-2.
2. Press the AUTO/MANUAL mode switch on the engine digital control panel to MANUAL mode position to place the engine in manual mode. Refer to Figure 4-1.
3. Press downward on the desired battery contactor lever for up to 15 seconds or until the engine starts. Repeat up to three times if necessary. Refer to Figure 5-1.
4. Release the contactor lever immediately after the engine starts.

CAUTION

To prevent damage to the starter, do not engage the starting motor more than 15 seconds. Wait 15 seconds between each attempt to start, up to six attempts.

5. The engine may be stopped locally by pressing and holding the stop button on the left hand side of the engine digital control panel enclosure.



1. Battery A Starter Contactor
2. Battery B Starter Contactor

Figure 5-1 Manual Starter Contactors (typical)

5.5 Engine Digital Control Panel Screens and Adjustments

The following menu screens are available for operator input and monitoring of engine parameters on the engine digital control panel menu screens.

5.5.1 Main Menu

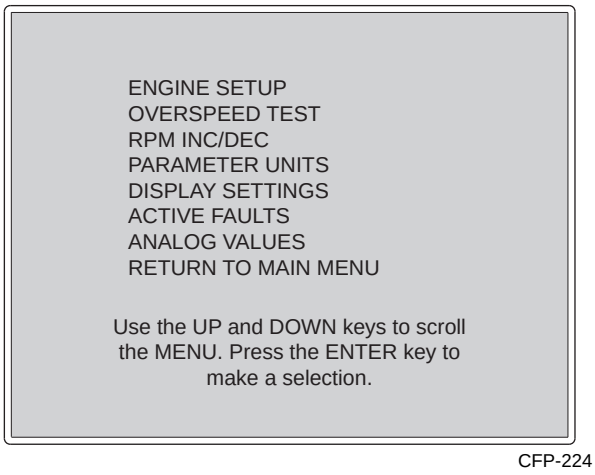


Figure 5-2 Main Menu Screen

This screen is the main menu screen for all functions.

5.5.2 Engine Set-up Screen

This screen is for Cummins Fire Power internal use.

5.5.3 Overspeed Test Screen

The engine overspeed set point was set during manufacturing and test procedures. It may, however, be necessary to adjust the overspeed set point based on the actual fire pump application.

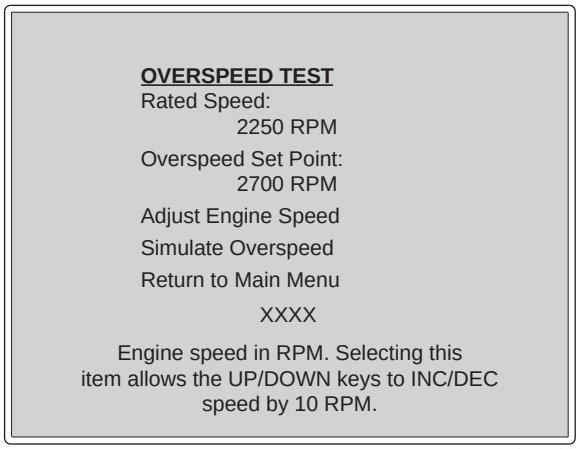


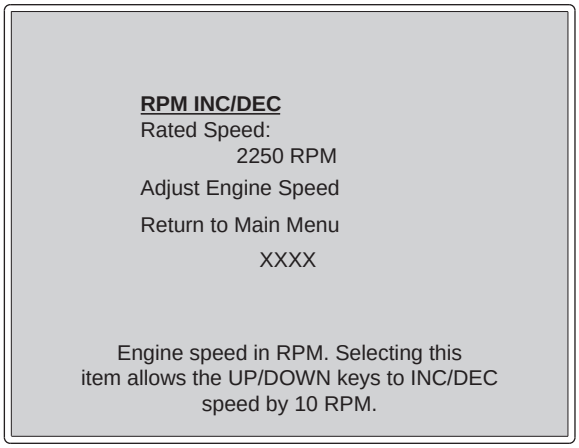
Figure 5-3 Overspeed Test Screen

The overspeed test screen will allow for two options to demonstrate overspeed:

1. Increment the engine speed up to reach the overspeed set point for the specific engine model. Example above identifies 2250 RPM.
2. Used to simulate overspeed for engine speed models above 2250 RPM or for instances when over-pressurizing of sprinkler systems can cause damage.

NOTE: *If Option 1 is selected, the engine speed will have to be manually reset back to pump rated speed after the overspeed test is completed. Use the RESET/STOP switch to reset the engine back to the original values.*

5.5.4 RPM INC/DEC Screen



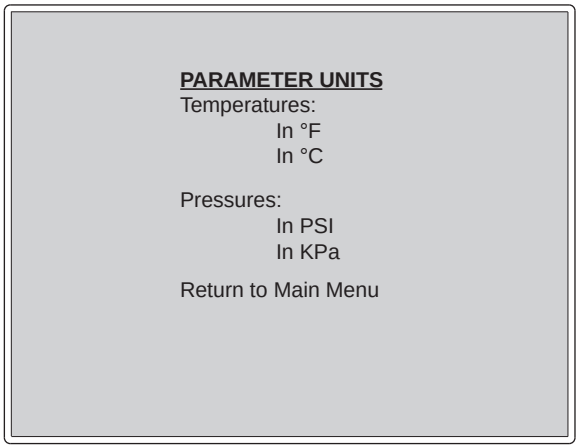
CFP-226

Figure 5-4 RPM INC/DEC Screen

This screen allows the operator to make on-site adjustments by incrementing or decrementing the engine operating speed of electronic engines. The engine operating speed was factory set during manufacturing and test procedures.

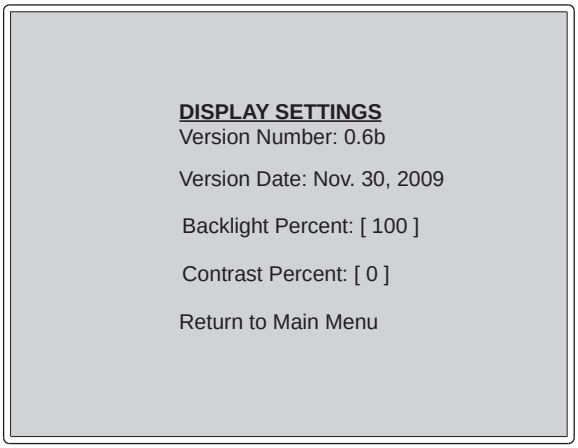
If the speed does not match the engine RPM shown on the factory setting plate, scribe the actual RPM on the field setting plate.

5.5.5 Parameter Units Screen



This screen will allow the operator to select Imperial or Metric units.

5.5.6 Display Settings Screen

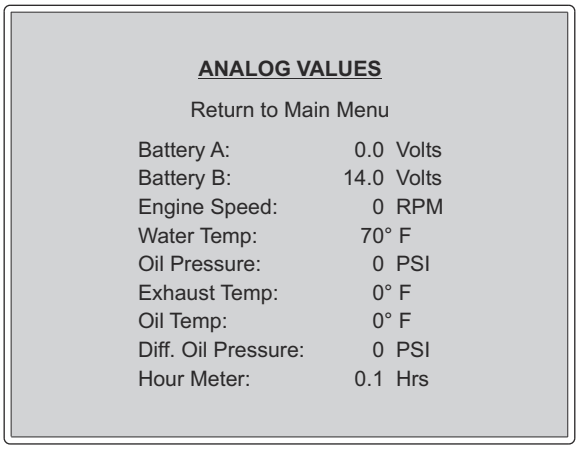


CFP-228

Figure 5-5 Display Settings Screen

This screen will enable adjustments to the backlight and contrast for optimal viewing in varying lighting environments. The version number of the EDCP software will be indicated on this screen.

5.5.7 Analog Values Screen



CFP-00012

This screen will provide analog output values for battery voltages, engine speed, water temperature, oil pressure and temperature, exhaust temperature, differential oil pressure, and hours of operation.

NOTE: *Metric or Imperial values can be changed using the Parametric Units screen.*

NOTE: *For exhaust temperature values less than 93° C (200° F), or not monitored, the value will be displayed as 0°. For oil temperature values less than 24° C (75° F), or not monitored, the value will be displayed as 0°.*

5.6 Active Fault Codes - Applicable on Electronic Engines

The Electronic Control Module (ECM) can display and record operation irregularities, which are displayed as fault codes on the engine digital control panel.

5.7 Field Acceptance Testing

The required tests are outlined in the NFPA 20 and NFPA 25 Standards and shall be performed to validate automatic and manual operational requirements for field acceptance testing.

Section 6 - Maintenance

6.1 Introduction

Before performing maintenance procedures, read and understand the Safety Section of this manual. Improper performance or lack of critical information could result in personal injury or equipment damage.

Cummins encourages our customers to perform maintenance and repairs whenever necessary. However, servicing complex components within the normal warranty period may void the Cummins warranty and any specified warranty extended by the manufacturer of OEM products.

Cummins recommends that the engine be maintained according to the maintenance schedule in this section.

Maintenance procedures should be performed by skilled technicians, who are familiar with the equipment, local regulations, and service procedures for fire pump engine and pump systems. Improper maintenance can damage the engine or fire pump, or cause personal injury.

IMPORTANT: *If your engine is equipped with a component or accessory not manufactured by Cummins Inc, refer to the component manufacturer's vendor supplied literature for specific maintenance recommendations.*

6.2 Engine Operation Report

The engine must be maintained in top mechanical condition. The maintenance department needs daily running reports from the operator to make necessary adjustments.

The weekly running report also helps to make provisions for more extensive maintenance, as the reports indicate the necessity.

Report to the maintenance department any of the following conditions:

1. Low engine oil pressure.
2. Engine surge.
3. Erratic operation or frequent shutdowns.
4. Any warning lamps flashing or staying illuminated.
5. Abnormal coolant or oil temperature.
6. Unusual engine noise or vibration.
7. Excessive smoke.
8. Excessive use of coolant, fuel, or engine oil.
9. Any fluid leaks.
10. Loose, worn, or damaged parts.

Maintenance Chart

NOTE: *All maintenance and inspections intervals are accumulative. When performing annual maintenance, also perform maintenance listed under daily, weekly, monthly, and 3 month intervals.*

Maintenance Record Form

Engine Serial Number:			Engine Model:		
Owner's Name:			Equipment Name/Number:		
Date	**Hours or Time Interval**	**Actual Hours**	**Check Performance**	**Performed By**	**Comments**

6.3 Weekly Maintenance

When the engine is running, be alert for mechanical problems that could create unsafe or hazardous conditions.

6.3.1 General Walk Around Inspection

The following areas should be inspected weekly to maintain safe and reliable operation.

1. Check fluid levels before starting the engine. Check oil pressure and coolant temperatures frequently. Most engine problems give an early warning.

    a. Look and listen for changes in engine performance, sound, or appearance that will indicate that service or repair is needed. Be alert for misfires, vibration, excessive exhaust smoke, loss of power, or increases in oil or fuel consumption.

    b. Check the engine appearance for excessive heat, wiring short circuits, excessive end-play, vibrations, excessive wear, excessive abrasion, damaged electrical wiring, or loose electrical wiring.

    c. Check the engine for odors of diesel fuel, burning rubber, electrical system failure, exhaust fumes, or smoke.

WARNING

Engine fuel is highly flammable and represents an extreme hazard for fire or explosion when exposed to electrical sparks or open flame. Clean up spilled fuel immediately. Keep sources of electrical spark or open flame away from a fuel source.

6.3.2 Air Cleaner Filter and Piping

The frequency of cleaning or replacing the air cleaner filter element is determined by the conditions in which the engine operates.

1. Visually inspect the air intake filter and piping daily for blockage, damage to piping, loose clamps, or punctures that can allow debris to enter the engine. If there is a blockage the service indicator will be activated. Refer to Figure 2-2.

NOTE: *Turbocharged engines must be operated at rated RPM and full load to check maximum intake air restriction.*

NOTE: *Cummins recommends using an air cleaner filter element, as listed on the model specific Engine Data Sheet in Section 8 - Component Parts and Assemblies.*

CAUTION

Never operate the engine without an air cleaner. Intake air must be filtered to prevent dirt and debris from entering the engine and causing premature wear. Dirt or foreign objects could cause engine damage.

2. The air cleaner filter service indicator is actuated when excessive air restriction has occurred at the air cleaner. Refer to Figure 2-2.

    a. If the red indicator flag is at the raised position in the window, clean or replace the air filter per the manufacturer's recommendation as required. Do not remove the felt washer from the indicator. The felt washer absorbs moisture.

    b. After the air cleaner has been serviced, push the flag in to reset the service indicator.

IMPORTANT: Maximum intake air restriction is 762 mm H_2O (25.0 in H_2O) for turbocharged engines

3. Check for corrosion under the clamps and hoses of the intake system piping. Corrosion can allow corrosive products and dirt to enter the intake system. Disassemble and clean as required.

4. Replace damaged air filter or hoses, and tighten loose clamps, as necessary, to prevent the air system from leaking. Torque hose clamps to the recommended torque value. Refer to the Torque Table in Section 8.

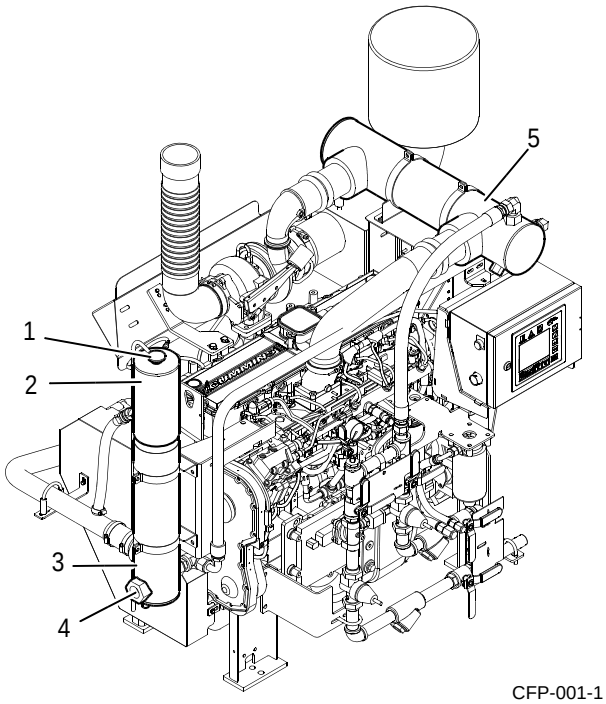
6.3.3 Cooling System

CAUTION

Do not remove a coolant pressure/fill cap from a hot engine. Shut down the engine and wait until the coolant temperature is below 50° C (120° F) before removing the pressure cap. Heated

coolant spray or steam can cause severe personal injury.

1. Inspect the raw water piping, coolant heat exchanger tanks, charge air cooling system, engine coolant hoses and hose clamps for loose fittings, leaks, damage, and corrosion.



CFP-001-1

1. Coolant Pressure/Fill Cap
2. Coolant Expansion Tank
3. Coolant Heat Exchanger
4. Raw Water Discharge Connection
5. Charge Air Cooler (CAC) Heat Exchanger

Figure 6-1 Cooling System Components

   a. Tighten the hose clamps as necessary

   b. Check for cracks, holes, or other damage. Repair or replace as necessary.

CAUTION

Never use a sealing additive to stop leaks in the cooling system. This can result in cooling system plugging and inadequate coolant flow, causing the engine to overheat.

2. With the coolant expansion tank at ambient temperature, press down, unscrew, and remove the pressure cap. Refer to Figure 6-1.

   a. Ensure that the coolant level is visible by checking the coolant level sight gauge.

   b. Add coolant as required. DO NOT OVERFILL!

NOTE: *Supplemental engine coolant should be a mixture of 50% ethylene glycol antifreeze and 50% water to avoid engine damage. Refer to antifreeze information in Section 6.5.2 Drain and Flush Cooling System.*

3. Check the antifreeze concentration at least 6 times a year or whenever coolant is added to the cooling system by using a refractometer (such as Fleetguard® Part No. CC2800).

4. Drain a small amount of coolant from the return line petcock and inspect the coolant for excessive rust or particulate matter. Change the coolant more frequently if particles are present.

CAUTION

Do not mix coolant brands or chemical solutions, as this could damage the cooling system. Keep a record of the coolant concentration and manufacturer with the engine maintenance records.

5. Check for soft, overly pliant hoses, oxidation, and loose hose clamps. Torque hose clamps to the recommended torque value. Refer to the Torque Table in Section 8. Replace damaged hoses and clamps as required.

6. Check the heat exchanger for leaks, damage, and dirt buildup. Clean and repair as required.

6.3.4 Engine Oil System

WARNING

Perform the specific checks in this section only after the engine is fully stopped. Unless tests require engine operation, disconnect the battery leads from the batteries (negative terminal first). Contact with exposed or moving components can cause severe personal injury.

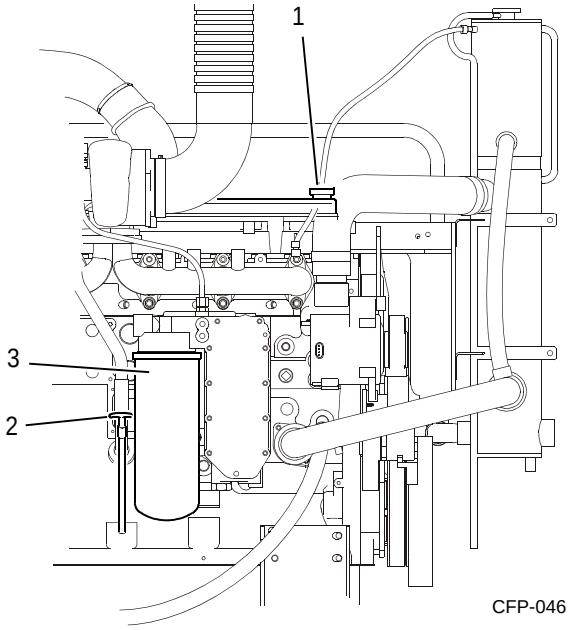
1. For accurate dipstick readings, shut off the engine and wait approximately 10 minutes to allow the oil in the upper portions of the engine to drain back into the crankcase.

2. Check the oil level at the engine dipstick. Refer to Figure 6-2.

   a. If the oil level is greater than the high mark (H), drain excess oil and recheck the level.

   b. If the oil level is consistently below normal after a fill, check for leaks, loose or damaged gaskets, or oil in the coolant system. Troubleshoot per Engine Oil Consumption Excessive in Section 7 - Troubleshooting.

   c. If the oil level is below the low mark (L), add the equivalent type oil.



1. Oil Fill Port (on valve cover)
2. Oil Level Dipstick
3. Engine Oil Filter

Figure 6-2 Oil Level Dipstick

NOTE: *Cummins recommends using Premium Blue S.A.E. 15W-40 Multi-viscosity Lubricating Oil or equivalent. Refer to the oil change interval and the procedures in Section 6.4.5 Engine Oil and Oil Filter Change.*

6.3.5 Fuel System Inspections

WARNING

Engine fuel is highly flammable and represents an extreme hazard for fire or explosion when exposed to electrical sparks or open flame. Clean up spilled fuel immediately. Keep sources of electrical spark or open flame away from a fuel source.

1. Shut off the engine.

2. Inspect the fuel supply line, return line, filter and fittings for cracks or abrasions.

   a. Ensure the lines are not rubbing against anything that could damage the fuel system hoses. Repair any leaks or alter line routing to eliminate wear immediately.

   b. Relieve fuel line pressure by carefully loosening the fuel inlet line.

NOTE: *Refer to the model specific Engine Data Sheet in Section 8 - Component Parts and Assemblies for Cummins recommended replacement components.*

6.3.6 Engine Exhaust System

With the engine operating, inspect the entire exhaust system, including the exhaust manifold, exhaust flex pipe, muffler, and piping.

Check for leaks at all connections, welds, gaskets, and joints. Make sure that the exhaust pipes are not heating surrounding areas excessively. Repair any leaks immediately.

6.3.7 Electrical Supply and Controls

Check the terminals on the starting batteries for clean and tight connections. Loose or corroded connections create resistance which can hinder starting. Inspect the Engine Digital Control Panel (EDCP) harness connections to be sure they are secure.

6.3.8 Crankcase Ventilation Hose

1. Inspect the crankcase ventilation hose for wear, damage, sludge, blockage, or dirt buildup. Refer to Figure 2-1.

2. Clean the ventilation hose if obstructed or blocked. Replace if worn or damaged, as required.

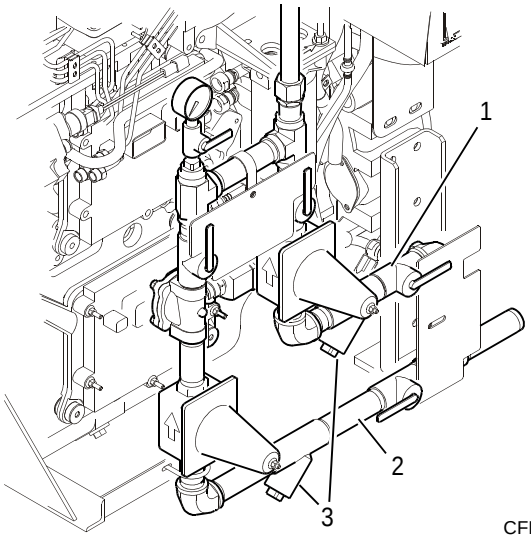
6.3.9 Clean Raw Water Strainers

The (2) raw water strainers should be cleaned weekly to remove sediment. Refer to Figure 6-3.

To clean the normal line strainer, ensure that the normal line valves are open and the bypass line valves are closed.

To clean the bypass line strainer, ensure that the bypass line valves are open and the normal line valves are closed.

1. For each raw water strainer, remove the plug.
2. Inspect and remove any debris.
3. Install the strainer plugs.
4. When finished, open the normal line valves and close the bypass line valves for normal operation.



1. Bypass Water Line
2. Normal Water Line
3. Raw Water Strainers

Figure 6-3 Raw Water Strainers

6.3.10 Check Battery Condition

CAUTION

Batteries can emit explosive gases during charging. To reduce the possibility of personal injury, always ventilate the battery compartment before servicing the batteries.

CAUTION

To reduce the possibility of arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.

1. Keep the batteries clean by wiping them with a damp cloth whenever dirt appears excessive.
2. Use a battery hydrometer to check the specific gravity of the electrolyte in each battery cell. A fully charged battery will have a specific gravity of 1.260. Charge the battery if the specific gravity reading is below 1.215.
3. Check battery wiring and cable connections for loose, corroded, worn, or damaged cables. Check both connectors at the alternator, battery connections, and engine grounding lug (near starter motor).
   a. If the battery cables are corroded, remove the battery cable clamps, starting with the negative (-) battery cable.
   b. Use fine emery cloth or a wire brush to clean the cable clamps and battery cables. The metal should be shiny.
   c. Wash the battery terminals with a solution of baking soda and water - 2 oz (1/4 cup) baking soda to .94 liter (1 qt) of water.
   d. Be careful to prevent the solution from entering the battery cells, and flush the batteries with clean water when done.
   e. After cleaning the connections, coat the terminals with a light application of petroleum jelly.
   f. Reinstall and tighten the cable clamps.

WARNING

Battery electrolyte (sulfuric acid) is highly caustic and can burn clothing, the skin, or cause blindness. Wear protective clothing, impervious neoprene gloves, safety goggles, or full-face shield when working with the batteries.

4. Check the electrolyte level in the batteries monthly. If low, fill the battery cells to the bottom of the filler neck with distilled water.

5. Check for continuity between terminals using a digital multimeter or other test equipment. Also check the insulation resistance to ground. Correct any electrical faults.

6.3.11 Engine Test Run

1. Start the engine at least once a week for a minimum of 30 minutes with as much load as possible. Periods of no-load operation should be held to a minimum, because unburned fuel tends to accumulate in the exhaust system.

2. Refer to the instructions in Section 5 - Operation.

3. Check that the engine starts and operates at the recommended fire pump speed specification.

4. Engine oil pressure must be indicated on the gauge within 15 seconds after starting.

5. Run the engine no less than 30 minutes to attain normal running temperature. Observe that the engine is operating at proper operating speed.

6. Check unusual engine noise. Listen for any unusual engine noise which can indicate that service is required.

7. Ensure oil pressure is greater than 69 kPa (10 psi).

8. Check that the coolant temperature is between 70° C (158° F) and 107° C (225° F).

9. Check that both battery voltmeters indicate 12 VDC for standard or 24 VDC for optional operating systems.

10. Check that the air filter service indicator has not popped-up; indicating an air filter blockage. Replace the air filter as required.

11. End test run by pressing and holding the overspeed RESET/STOP switch until the engine stops.

6.3.12 Engine Coolant Heater

NOTE: *Perform this inspection procedure 24 hours after shutting off the engine.*

The engine coolant heater must maintain an engine coolant temperature of 49° C (120° F) or above. The engine block must be warm to the touch in the water jacket areas. Refer to Figure 2-2.

If the heater does not appear to be working correctly, contact a Cummins Authorized Repair Location.

6.4 Annual Maintenance

All checks or inspections listed under previous maintenance intervals must also be performed at this time, in addition to those listed under this maintenance interval.

6.4.1 Electrical Components

CAUTION

AVOID SERVICING complex components such as: printed circuit boards, programmable controllers, and ECM's not specifically authorized by Cummins Inc. Contact a Cummins Authorized Repair Location before performing any extensive maintenance.

CAUTION

To reduce the possibility of arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.

1. Remove the battery terminal cables, starting with the negative (-) cable first.

2. Inspect the electrical wiring harness, electrical terminal connections, and electrical plug-ins for secure, clean electrical contacts, worn or damaged insulation, burnt wires, broken wires, and loose connections. Refer to Figure 2-1

   a. Clean and tighten any loose electrical connections.

   b. Repair or replace worn, damaged, burnt, or poorly insulated wiring immediately. Refer to Section 8 - Component Parts and Assemblies.

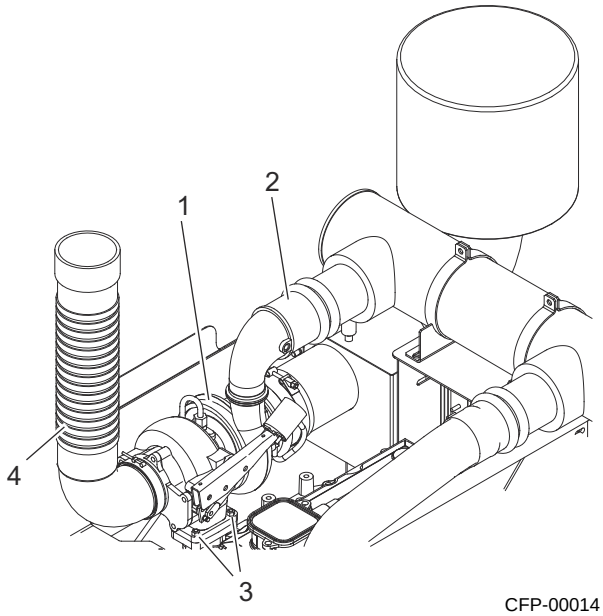
IMPORTANT: *Refer to the vendor supplied literature for recommended maintenance procedures.*

3. Inspect the function of all gauges, voltmeters, switches, and warning lamps on the Engine Digital Control Panel (EDCP). Replace the EDCP if any are not functioning properly.

6.4.2 Turbocharger Mounting Nuts

1. Check the turbocharger mounting nuts. Refer to Figure 6-4.

2. Torque the mounting nuts to the recommended torque value. Refer to the Torque Table in Section 8.



1. Turbocharger
2. Air Hose to Charge Air Cooler
3. Turbocharger Mounting Nuts
4. Exhaust Flex Connection

Figure 6-4 Turbocharger (typical)

6.4.3 Engine Mounting Bolts

CAUTION

Loose engine mount bolts or damaged brackets can cause engine misalignment or excessive vibration. These conditions can cause engine or pump damage.

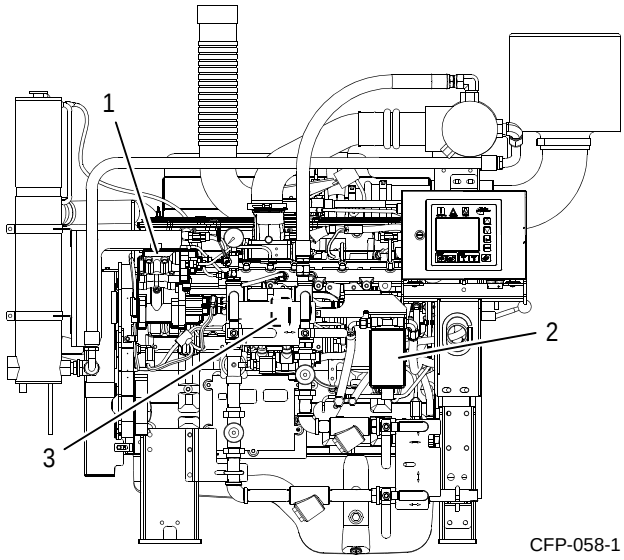
1. Inspect all engine supports for cracks or loose bolts. Refer to Figure 2-1 for the location of the engine supports.

2. Check the torque on the engine support mounting bolts. Torque the engine mounting cap screws to the support bracket. Refer to the Torque Table in Section 8 for recommended torque values.

6.4.4 Inspect Fuel Pumps and Filters

1. Inspect the fuel injection pump mounting nuts, including the support bracket, for loose or damaged hardware. Refer to Figure 6-5.

2. Inspect the fuel line hoses and fuel filters for wear, damage, loose fittings, and leaks. Repair or replace damaged hoses and filters as required.



1. Fuel Pump
2. Fuel Filter or Filter/Separator
3. Lift Pump (behind ECM A)

Figure 6-5 Fuel Pumps (typical))

6.4.5 Engine Oil and Oil Filter Change

Engine oil becomes contaminated and essential oil additives are depleted with use. The amount of contamination is related to the total amount of fuel and oil consumed. Change the oil at least once annually.

NOTE: *For composite oil pans, always use a new sealing washer on the oil drain plug. Hold the external locking nut in place while tightening the oil drain plug.*

1. Change the oil and the oil filter to remove the contaminants suspended in the oil.

IMPORTANT: *If the engine oil is drained from the oil pan to make an engine repair, new oil must be used.*

NOTE: *Cummins does not recommend exceeding 600 hours on oil change intervals.*

WARNING

To reduce the possibility of personal injury, avoid direct contact of hot oil with your skin. Some state and federal agencies have determined that used engine oil can be carcinogenic. Prolonged, repeated contact can cause skin disorders or other bodily injury. Wash thoroughly after contact. Avoid inhalation of vapors and ingestion of used engine oil. Dispose of the oil in accordance with local environmental regulations.

2. Operate the engine until the coolant temperature reaches 70° C (158° F). Shut the engine off.

3. Place an appropriate container under the oil pan drain plug. Refer to the model specific Engine Data Sheet in Section 8 - Component Parts and Assemblies for oil pan capacity.

4. Remove the oil drain plug and drain the oil immediately to make sure all the oil and suspended contaminants are removed from the engine.

5. Remove the oil filter. Refer to Figure 6-6.

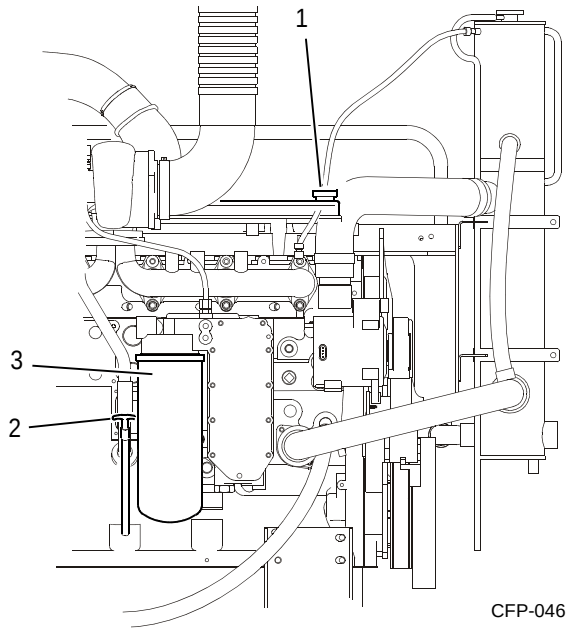
   a. Clean the area around the engine oil filter canister.

   b. Use a filter wrench to remove the filter.

   c. Remove and discard the O-ring seal if it has remained attached to the mounting flange. Clean the filter mounting flange with a clean lint-free cloth.

   d. Apply a light film of 15W-40 lubricating oil to the replacement filter gasket before installing the filter.

6. Fill the oil filter with a high-quality 15W-40 multi-viscosity lubricating oil, such as Premium Blue®, or its equivalent.



1. Oil Fill Port (on valve cover)
2. Oil Level Dipstick
3. Engine Oil Filter

Figure 6-6 Oil Filter and Oil Level Dipstick

7. Center the filter ring on the threaded mounting nipple. Screw the filter canister onto the mounting flange until the gasket is snug against the mounting flange. Then tighten an additional 1/4 turn.

CAUTION

Mechanical over-tightening can distort the threads or damage the filter element seal.

NOTE: *Cummins recommends using oil filter replacement parts as outlined in the model specific Engine Data Sheet in Section 8 - Component Parts and Assemblies.*

8. Check and clean the oil pan drain plug threads and sealing surface. Install the oil pan drain plug. Torque the plug to the recommended torque value per the Engine Manual.

9. Fill the engine to the proper level with clean, high quality 15W-40 oil at the fill port. Refer to Figure 6-6.

CAUTION

If no oil pressure is noted within 15 seconds after the engine is started, shut down the engine to reduce the possibility of internal damage.

10. Stop the engine.

11. Wait approximately 15 minutes to let the oil drain from the upper parts of the engine.

12. Check the oil level again. Add oil as necessary to bring the oil level to the H (high) mark on the dipstick.

6.4.6 Change Fuel Filters

WARNING

Engine fuel is highly flammable and represents an extreme hazard for fire or explosion when exposed to electrical sparks or open flame. Clean up spilled fuel immediately. Keep sources of electrical spark or open flame away from a fuel source.

WARNING

Do not open the fuel filter/water separator drain valve or dismantle the fuel lines on the high-pressure fuel system with the engine running. High pressure fuel spray from and operating engine can cause serious personal injury or fire hazard.

1. Shut off the engine.

2. Close any fuel valves (if equipped) to prevent fuel from draining or siphoning.

3. Clean the area around the fuel filter or fuel/water separator heads.

NOTE: *Refer to the model specific Engine Data Sheet in Section 8 - Component Parts and Assemblies for filter replacement recommendations.*

4. Remove the spent filter canisters using a filter wrench. Refer to Figure 2-1.

5. Clean the filter mounting head surfaces of sludge buildup and foreign particles. Ensure mating gasket surfaces are clean.

6. Lubricate the gasket seals with clean S.A.E. 15W-40 lubricating oil.

7. Center the filter ring on the threaded mounting nipple. Screw the filter canister onto the mounting flange until the gasket is snug against the mounting flange, then tighten an additional 1/4 turn.

8. Open the fuel supply valves (if equipped).

CAUTION

Mechanical over-tightening can distort the threads or damage the filter element seal.

9. Press either the CRANK BATT A or CRANK BATT B button to start the engine to allow the fuel to flow through the system.

10. Depress the contactor switch for up to 15 seconds or until the engine starts. Repeat up to three times, if necessary.

CAUTION

To prevent damage to the starter, do not engage the starting motor more than 15 seconds. Wait 15 seconds between each start attempt.

IMPORTANT: *If the engine does not start after three attempts, check the fuel supply system. Absence of blue or white exhaust smoke during cranking indicates no fuel is being delivered.*

NOTE: *Engines used in fire pumps or standby service are expected to immediately accelerate from crank to full load.*

6.4.7 Output Shaft Lubrication

It is recommended that proper lubrication to drive shafts and output shafts is to be completed on a regular schedule.

1. Remove the output shaft guards.

2. Wipe the grease fittings and grease gun nozzle with a clean cloth to avoid contamination.

3. Add grease to the drive shaft universal joint grease fittings. Refer to Figure 3-2.

4. Wipe excess grease from the grease fittings

NOTE: *Cummins Inc recommends using a good quality semi-synthetic, molybdenum-fortified NLGI #2 lithium complex grease which protects from -47° to 204° C (-54° to 400° F).*

6.4.8 Engine Operation Checks

The following service procedures ensure that the engine starts and operates properly under normal conditions.

WARNING

Before equipment operation, ALL guards, covers, and protective devices MUST BE in place and securely fastened. Serious personal injury could result from contact with exposed or moving components.

6.4.8.1 Crank Termination Set Point

The speed switch crank termination set point is factory set at 600 RPM and should not be changed from this value.

6.4.8.2 Engine Speed Calibration

If the speed does not match the engine RPM shown on the factory settings plate, Refer to Section 5.5.4 RPM INC/DEC Screen on the engine digital control panel.

1. Start the engine using the local start method.
2. Observe that the engine starts and accelerates to the speed set point listed on the factory settings plate.
3. Monitor engine speed on the tachometer. Record the observed engine speed.

   If the speed does not ramp up to the setting shown on the factory settings plate, the engine operating speed set point must be calibrated.
4. Depress the up (increase) and down (decrease) arrows on the EDCP display to set the desired speed. Refer to Figure 4-1.

NOTE: *Each time the speed INCREASE/DECREASE arrow is depressed, the idle speed is increased or decreased by 10 RPM. Holding the arrows in either the INC or DEC position ramps the engine speed in the selected direction.*

5. Stop the engine.
6. Start the engine.
7. Observe that the engine starts and accelerates to the rated speed set point.
8. The engine speed set point calibration is required for both the ECM A and ECM B subsystems.
9. Repeat steps 2 through 6 while the ECM selector switch is set to ECM B.

IMPORTANT: *Never switch from ECM A to ECM B while the engine is running.*

IMPORTANT: *The final pump speed is typically set while the pump is flowing 150%.*

6.4.9 Coolant Pump/Alternator Belt Inspection

On some engine models, the pump and alternator belt drives both the pump and alternator.

CAUTION

Belt damage can be caused by, incorrect tension, incorrect size or length, pulley misalignment, incorrect installation, severe operating environment, and oil or grease on the belt or pulley.

1. Place the AUTO/MANUAL mode switch in the MANUAL position.
2. Disconnect both batteries at their terminals. Remove the negative (-) cable first. Install the negative (-) cable last.
3. Remove the belt guard bolts and the belt guard. Set aside for re-installation. Refer to Figure 6-7.
4. Visually inspect the belt for frayed, worn, missing pieces, or cracked belt surfaces. Check the belt for intersecting cracks.

NOTE: *Transverse cracks (across the belt width) are acceptable. Longitudinal cracks (direction of belt length) that intersect with transverse cracks are not acceptable. Replace the belt if it is cracked, frayed, or damaged.*

5. If the belt condition is acceptable, check the belt tension.

NOTE: *Belts with glazed or shiny surfaces indicates belt slippage. Correctly installed and tensioned belts will show even pulley and belt wear.*

6.4.10 Coolant Pump/Alternator Belt Tension

CAUTION

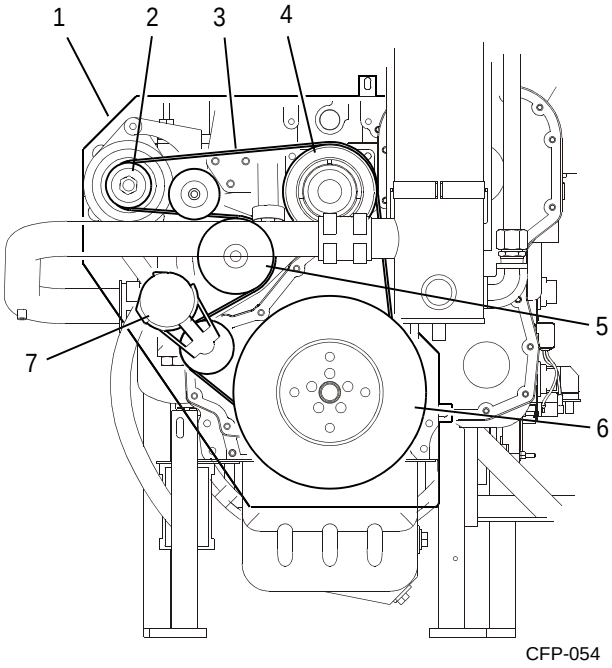
Disconnect the batteries (negative cable first) before performing service on the fire pump engine or on any of its controls.

1. Check the coolant pump drive belt tension.

2. Use the Cummins belt tension gauge, Part No. 3822524, to measure the drive belt tension.

   a. Measure the belt tension in the center span of the belt between the idler and alternator pulleys.

   b. Belt tension should be set and checked per the Engine Operation Manual.



1. Belt Guard
2. Alternator Pulley
3. Drive Belt
4. Idler Pulley
5. Coolant Pump Pulley
6. Balancer Pulley
7. Belt Tensioner

Figure 6-7 Coolant Pump/Alternator Belt (typical)

3. The deflection method can also be used to measure drive belt tension.

   a. Measure the belt tension in the center span of the belt between the alternator and idler pulleys.

   b. If belt deflection is more than one belt thickness per foot of pulley center-to-center distance, adjust the belt tension.

6.4.11 Heat Exchanger Pressure Test

This test is required if internal leakage in the heat exchanger is suspected. It may be performed prior to removal from the engine.

NOTE: *Use Teflon™ tape or other pipe sealant when installing the test setup in order to prevent leaks.*

NOTE: *The size of fittings required on the water outlets and inlets are listed on the model specific Engine Data Sheet in Section 8 - Component Parts and Assemblies.*

1. Install an adapter at the raw water outlet of the heat exchanger.

2. Install a pressure test setup with 689 kPa (100 psi) pressure gauge at the raw water inlet to the heat exchanger.

3. Apply air pressure at 414 kPa (60 psi).

   a. Isolate the pressure source and monitor the pressure gauge for 5 minutes.

   b. There should be no change in pressure for the duration of the test.

4. After testing, release the pressure. Remove the tubing adapters, plug, and test equipment.

5. If leakage is detected, the heat exchanger must be replaced.

6.4.12 Turbocharger Inspection

1. Visually inspect the filter and piping for dirt buildup, blockage, wear points, soft hoses, loose clamps, or punctures. Refer to Figure 6-4.

2. Replace damaged filters, pipes, or hoses, and tighten loose clamps, as necessary, to prevent the air system from leaking.

3. Check that the filter service indicator has not indicated a filter blockage. Clean or replace blocked filters.

4. Check for corrosion under the clamps and hoses of the intake system piping. Corrosion can allow foreign particles and dirt to enter the intake system.

5. Disassemble and clean, as required.

6. Remove the air intake and exhaust piping from the turbocharger.

7. Inspect the turbocharger turbine wheel for cracks in the housing or turbine blades, missing blades, mechanical binding, eccentric motion, or excessive end-play.

8. Replace the turbocharger if damage, excessive end-play, binding, wear, or eccentric motion is found. Contact a Cummins Authorized Repair Location for replacement.

IMPORTANT: *The turbocharger must be removed for replacement or rebuild if the clearance is beyond the limits, the housing is cracked, or the turbine wheel is damaged.*

9. Reinstall the air intake filter and exhaust piping. Tighten the clamps. Torque loosened clamps to the recommended torque value. Refer to the Torque Table in Section 8.

6.5 Every 2 Years or 2000 Hours

All checks or inspections listed under daily or previous maintenance intervals must also be performed at this time, in addition to those listed under this maintenance interval.

6.5.1 Coolant Pump Inspection

1. Inspect the coolant pump for eccentric motion, mechanical binding, excessive end play, seal damage, and grease or coolant leakage around the pump shaft.

2. Replace with a new or rebuilt pre-lubricated unit as necessary. Contact a Cummins Authorized Repair Location for replacement.

6.5.2 Drain and Flush Cooling System

The cooling system must be clean to work properly. If the system shows excessive mineral buildup, particulate matter, scale, oxidation, or oil contamination, drain and flush the cooling system. If the coolant is excessively dirty or is mixed with oil, contact a Cummins Authorized Repair Facility.

WARNING

Do not remove the pressure/fill cap from a hot engine. Shut down the engine and wait until the coolant temperature is below 50° C (120° F) before removing the pressure cap. Heated coolant spray or steam can cause severe personal injury.

1. Press down, unscrew, and remove the coolant expansion tank pressure/fill cap. The cap must be removed to allow air to vent the cooling system during the draining process.

2. Disconnect the engine coolant heater power supply before draining the cooling system. Refer to Figure 6-8.

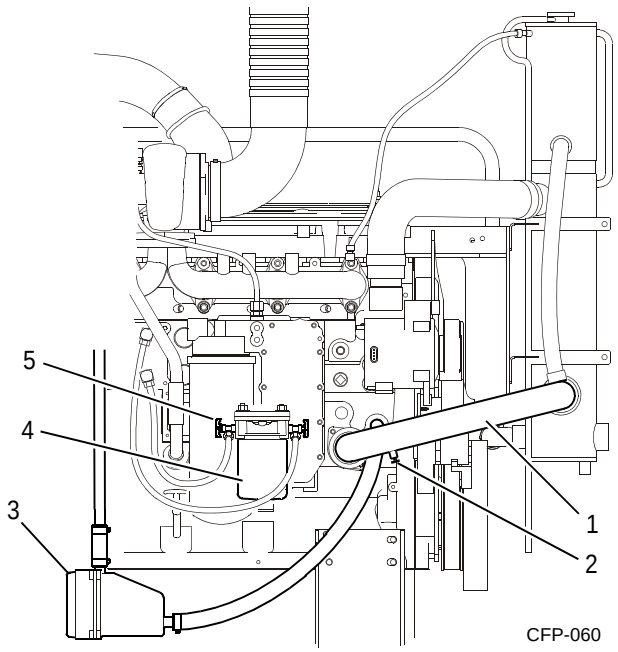
3. Place a container that will hold at least 57 liters (15 gal) of liquid under the coolant drain valve.

4. Ensure that the coolant filter shut-off valves are OPEN.

5. Open the drain petcock on the lower coolant tube, allowing the coolant to drain into the waste container.

6. When the system is empty, move the container under the engine coolant heater.

7. Disconnect either end of the engine heater coolant hose and drain the engine heater.



1. Lower Coolant Tube
2. Coolant Drain Petcock
3. Engine Coolant Heater
4. Coolant Filter
5. Coolant Filter Shut-off Valve

Figure 6-8 Engine Coolant Drain

CAUTION

Coolant is toxic. Avoid prolonged and repeated skin contact with used antifreeze - wash thoroughly after contact. Prolonged, repeated contact can cause skin disorders. Dispose of waste antifreeze in accordance with local environmental regulations.

NOTE: *During filling, air must be vented from the engine coolant passages. The air vents through the coolant filler port. The fill rate can be found in the model specific Engine Data Sheets in Section 8 - Component Parts and Assemblies.*

8. Flush with clean fresh water or heavy-duty heat exchanger cleaner. Follow the manufacturer's directions on the product container.

NOTE: *Some cooling system cleaners or commercial solvents require a soapy water rinse after use. Follow the directions on the cleaning solution or solvent.*

CAUTION

Over-concentration of antifreeze or use of high-silicate antifreeze can damage the engine. Do not use more than 50% antifreeze in the mixture unless additional freeze protection is required. Antifreeze at 68% concentration provides the maximum freeze protection, and must never be exceeded under any condition. Antifreeze protection decreases above 68%.

9. When the flushing water has fully drained, use a filter wrench to remove the water coolant filter from the filter housing.

    a. Clean the filter housing gasket mount of dirt buildup, oxidation, or particulate matter with a clean cloth.

    b. Coat the replacement filter gasket with a light coating of 15W-40 lubrication oil.

10. Center the filter ring on the threaded mounting nipple. Screw the filter canister onto the mounting flange until the gasket is snug against the mounting flange, then tighten an additional 1/4 turn. If using a soapy water solution, flush again with clear water. Allow time for the water to fully drain.

CAUTION

Mechanical over-tightening can distort the threads or damage the filter element seal.

NOTE: *Recommendations on filter replacements and fill rates can be found on the model specific Engine Data Sheet in Section 8 - Component Parts and Assemblies.*

11. Reconnect the engine heater coolant hose and close the drain petcock on the lower coolant tube.

NOTE: *During filling, air must be vented from the engine coolant passages. The air vents through the coolant filler port. The fill rate can be found in the model specific Engine Data Sheet in Section 8 - Component Parts and Assemblies.*

12. Fill the coolant tanks with the proper antifreeze. Use a mixture of 50% water and 50% ethylene-glycol base or propylene-glycol antifreeze (or

pre-mixed solution) to protect the engine to -37° C (-34° F) year-around.

CAUTION

Use soft or distilled water in the coolant mixture. Contaminants in hard water neutralize the corrosion inhibitor components. Water must not exceed 300-ppm hardness or contain more than 100 ppm of either chloride or sulfate.

CAUTION

Never use a sealing additive to stop leaks in the cooling system. This can result in cooling system blockage or restricted coolant flow, causing the engine to overheat.

NOTE: *Cummins Inc. recommends using Fleetguard® ES COMPLEAT™ Ethylene-Glycol (EG) or Fleetguard® Propylene-Glycol (PG) Plus™ Antifreeze/Coolants. Both products are available in concentrated or pre-mixed formulations. Use a 50% concentration level (40% to 60% range) of ethylene-glycol or propylene-glycol in most climates. Contact your local Cummins Authorized Repair Location for additional information.*

Ethylene-Glycol	Propylene-Glycol
40% = -23° C (-10° F)	40% = -21° C (-6° F)
50% = -37° C (-34° F)	50% = -33° C (-27° F)
60% = -54° C (-65° F)	60% = -54° C (-65° F)
68% = -71° C (-96° F)	68% = -63° C (-82° F)

CAUTION

The system must be filled properly to prevent air locks. During filling, air must be vented from the engine coolant passages.

13. Check the condition of the pressure/fill cap.

    a. If the pressure/fill cap seal is worn, damaged, missing, or the pressure spring is damaged or shows signs of sticking, replace the filler cap.

    b. Install the expansion tank fill cap.

14. Operate the engine until it reaches a temperature of 82° C (180° F), and check for coolant leaks.

15. Ensure that the coolant level is just below the fill neck.

6.6 Every 4 Years or 5000 Hours

All maintenance checks and inspections listed in previous maintenance intervals must also be performed at this time.

Cummins recommends performing maintenance on valve lash settings.

CAUTION

Disconnect both batteries (negative cable first) before performing service on the fire pump engine or on any of its controls. Wear safety glasses when disconnecting batteries!

CAUTION

Valve lash maintenance should be performed by a skilled technician. Improper maintenance can damage the engine or cause severe personal injury. Contact your local Cummins Authorized Repair Location before performing any extensive maintenance.

6.6.1 Coolant Thermostat Removal/Installation

The thermostat regulates the temperature of the engine coolant circulating through the engine cooling system. Refer to the Engine Manual for complete instructions.

CAUTION

Always use the correct thermostat, and never operate the engine without a thermostat installed. The engine can overheat if operated without a thermostat because the path of least resistance for the coolant is through the bypass to the pump inlet.

1. Remove the upper coolant hose clamps and upper coolant hose at the thermostat housing.

2. Remove the (2) thermostat housing flange cap screws and the thermostat flange. Refer to Figure 6-9.

3. Remove the thermostat and gasket from the housing.

4. Clean the housing flange faces of dirt buildup, oxidation, and sludge.

5. Install the thermostat in the housing.

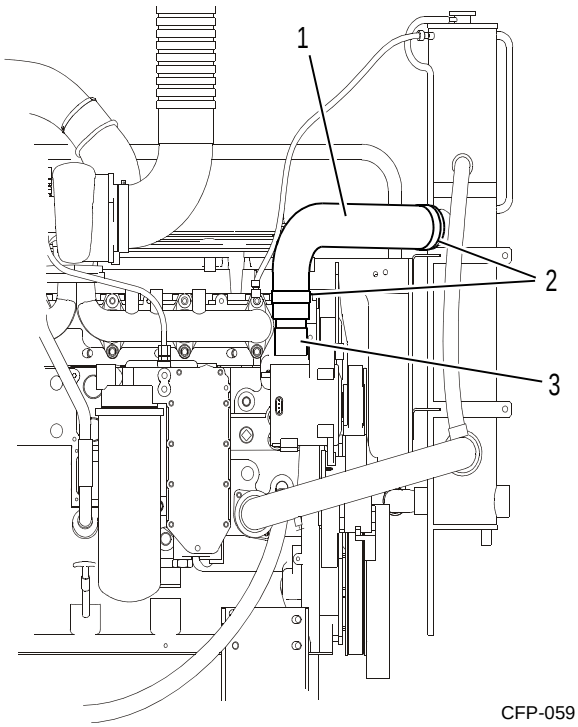
NOTE: *Recommendations on thermostat replacement components can be found on the model specific Engine Data Sheet in Section 8 - Component Parts and Assemblies.*

6. Install a new thermostat seal on the thermostat housing flange surface.

7. Replace the thermostat flange and cap screws.

6.6.2 Coolant Pump/Alternator Belt Replacement

Replace the coolant pump/alternator belt if it is cracked, frayed, or has pieces of material missing.



1. Upper Coolant Hose
2. Hose Clamp
3. Thermostat Housing

Figure 6-9 Thermostat Housing

1. Remove the belt guard. Refer to Figure 6-7.

2. Use a 3/8” drive ratchet or breaker bar to rotate the tensioner arm away from the belt and remove the belt.

3. Check the belt tensioner cap screw torque. For recommended torque values, refer to the Torque Table in Section 8.

4. Check the tensioner arm, pulley, and stops for cracks. If any cracks are noticed, the tensioner must be replaced.

5. Verify that the tensioner arm stop is not in contact with the spring casing stop. If either stop is touching, the tensioner must be replaced.

6. Inspect the tensioner for evidence of the tensioner arm contacting the tensioner cap.

   If there is evidence of the two areas making contact, the pivot tube bushing has failed and the tensioner must be replaced.

7. Check the tensioner bearing.

   a. Rotate the belt tensioner pulley. The pulley should spin freely with no mechanical binding, eccentric motion, or excessive end-play.

   b. If the arm rotates with mechanical binding, eccentric movement, or excessive end play, replace the tensioner.

8. Inspect the clearance between the tensioner spring case and the tensioner arm for uneven bearing wear.

   If the clearance exceeds 3 mm (0.12 in) at any point, the tensioner must be replaced as a complete assembly. Contact a Cummins Authorized Repair Location for replacement.

NOTE: *Experience has shown that tensioners generally will show a larger clearance gap near the lower portion of the spring case, resulting in the upper portion rubbing against the tensioner arm. Always replace the belt when a tensioner is replaced.*

9. After checking the torque, use a 3/8” drive ratchet or breaker bar to rotate the tensioner slowly away from the area of belt contact.

10. Install the replacement drive belt.

CAUTION

To prevent pulley or belt damage, do not roll a belt over the pulley or pry it on with a tool. Move the tensioner arm away from the belt area before installing the drive belt.

11. Check the location of the drive belt on the belt tensioner pulley. The belt should be centered on, or centered close to, the middle of the pulley.

12. Reinstall the belt guard.

CAUTION

Unaligned belts, either too far forward or backward, can cause belt wear, belt roll-off failures or increase uneven tensioner bushing wear.

6.6.3 Charge Air Cooler (CAC) Heat Exchanger

The charge air cooler heat exchanger should be removed and cleaned internally at least once every four years.

1. Press the AUTO/MANUAL switch to select the MANUAL position.

2. Disconnect both batteries at their terminals. Remove the negative (-) cable first. Install the negative (-) cable last.

3. Shut off the manual raw water and bypass water hand valves on the cooling loop water supply.

4. Open the coolant filter shut-off valve.

5. Drain the coolant system per the instructions in Section 6.5.2 Drain and Flush Cooling System.

6. When the tanks are empty, disconnect the inlet and outlet piping from the charge air cooler tubing to the heat exchanger. Refer to Figure 2-1 and Figure 2-2.

7. Disconnect the raw water inlet and outlet fittings from the charge air heat exchanger and the coolant heat exchanger.

8. Remove the heat exchanger mounting bracket bolts from the mounting bracket and set aside for later reuse.

9. Provide support for the heat exchanger in order to avoid dropping it. Remove the charge air heat exchanger from the mounting plates.

WARNING

Cleaning chemicals may be caustic and cause skin irritation. Follow the instructions on cleaning containers. Wear protective clothing, eye wear, and rubber gloves when working with cleaning solutions. Dispose of solvents and cleaning solutions properly.

CAUTION

Do not use caustic cleaners to clean the charge air cooler. Damage to the charge air cooler will result. Follow the directions provided by the cleaning solution manufacturer.

10. Flush the charge air cooler internally with cleaning solution in the opposite direction of normal air flow.

11. Shake the charge air cooler and lightly tap on the tank ends with a rubber mallet to dislodge trapped debris. Continue flushing until all debris or oil is removed.

CAUTION

Wear appropriate eye and face protection when using compressed air. Flying debris and dirt can cause personal injury.

12. After the charge air cooler has been thoroughly cleaned of all oil and debris with solvent, wash the charge air cooler internally with hot, soapy water to remove the remaining solvent.

13. Rinse thoroughly with clean water.

14. Blow compressed air into the charge air cooler in the opposite direction of normal air flow until the charge air cooler is dry internally.

15. Depending on the condition of the heat exchanger:

    a. Perform the pressure test outlined in Section 6.4.11 Heat Exchanger Pressure Test.

    b. Reassemble the CAC heat exchangers, coolant tubing, and water-cooling loop lines

per the instructions outlined in Section 6.5.2 Drain and Flush Cooling System.

16. Provide support for the coolant heat exchanger in order to avoid dropping it.

17. When the charge air heat exchanger hose clamps and cooling water lines are secure, tighten the mounting bracket bolts.

18. Open the cooling loop raw water supply manual valves and check for leaks.

19. After completing all service work, start the engine and check for air leaks, loose clamps, and blowby.

Section 7 - Troubleshooting

7.1 Troubleshooting

The following information is intended as a guide to troubleshooting some common non-technical equipment problems. Many problems can be resolved using corrective maintenance, adjustment, or minor repair. Refer to the vendor supplied literature, electrical schematics, and mechanical prints for additional information.

For engine related issues, refer to the Operation and Maintenance Manual or contact the Cummins Customer Assistance Center at 1-800-DIESELS (1-800-343-7357).

WARNING

The status checks should be performed ONLY by a qualified technician. Contact with exposed electrical components could cause extreme personal injury or death.

WARNING

Before equipment operation, ALL guards, covers, and protective devices MUST BE in place and securely fastened. Serious personal injury could result from contact with exposed or moving components.

CAUTION

AVOID SERVICING complex components such as: printed circuit boards, programmable controllers, and ECM's not specifically authorized by Cummins Inc. Contact a Cummins Fire Power Customer Service Department toll free at 1-800-343-7357 before performing any extensive maintenance.

CAUTION

Never climb or stand on the equipment frame, guards, or enclosures. Contact with exposed or moving components can cause personal injury or equipment damage.

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Troubleshooting Chart

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.1 Alternator Overcharging with the Engine Running **NOTE:** *If the batteries are overcharged while the engine is not running, troubleshoot the customer supplied battery charging system.*	Batteries have failed.	Replace the alternator and batteries. Test the battery changer electrically. Replace the battery changer as necessary.
7.1.2 Neither Battery is Charging with the Engine Running **NOTE:** *If one or both batteries do not charge with the engine stopped, troubleshoot the customer supplied battery charging system.*	Battery cables or connections are loose, broken, or corroded (excessive resistance). Alternator not functioning. Battery isolator input has faulted. Alternator internal voltage regulator is malfunctioning.	Check the battery cables and connections. Ensure that all connections are free of corrosion and that no cables are broken. Replace the alternator. Contact a Cummins Authorized Repair Facility. Test continuity from the alternator to the battery isolator input. Repair any open circuit. Test continuity through the battery isolator. If an internal open circuit exists, replace battery isolator. Test the alternator electrically. If required, replace the alternator. Contact a Cummins Authorized Repair Facility.
7.1.3 Only One Battery is Charging with the Engine Running **NOTE:** *If one or both batteries do not charge with the engine stopped, troubleshoot the customer supplied battery charging system.*	Battery has failed. Battery cables or connections are loose, broken, or corroded (excessive resistance). Battery isolator has failed.	Check battery charge. Check the battery cables and connections. Ensure connections are clean and that no cables are broken. Replace the battery isolator as necessary.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.4 Voltage Indications Differ **NOTE:** *Normal differences in battery condition may cause differences in indication. These are normal differences and require no action.*	One battery is discharged or failing.	Check battery condition. Check wiring for corrosion. Ensure good electrical contact. Charge discharged batteries by running the engine or with an external battery charger. If the battery does not charge with the engine running, go to Only One Battery is Charging with the Engine Running. Check for apparent wire damage or shorts to grounds. Replace the failed battery if necessary.
	Open circuit or short to ground in indicator wiring.	Locate and repair the electrical fault.
7.1.5 Coolant Contamination	Coolant is rusty or contaminated.	Drain and flush the cooling system per the instructions in Section 6 - Maintenance. Replace the coolant water filter per the instructions in Section 6 - Maintenance. Refill with correct mixture of antifreeze and water per the instructions in Section 6 - Maintenance. If the problem persists, the cylinder block may be cracked or porous. Contact a Cummins Authorized Repair Facility.
	Coolant heat exchanger is leaking raw water into the coolant. Coolant volume increases and pressure is relieved when the unit is operating. Antifreeze concentration decreases.	Drain and flush the cooling system per the instructions in 6.5.2 Drain and Flush Cooling System in Section 6. Perform a pressure test of the raw water side of the heat exchanger. If the heat exchanger leaks, it should be replaced. Check and adjust raw water pressure regulator set points.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.5 Coolant Contamination (continued)		Check and replace the zinc plug, if required. Refill with correct mixture of anti-freeze and water per the instructions in Section 6 - Maintenance.
7.1.6 Excessive Coolant Loss	Adequate coolant was not added following previous maintenance activities.	Check the coolant level. Add coolant as required and check engine operation. If coolant loss persists, check for other problems.
	Coolant leak is present.	Inspect the engine for coolant leaking from drain cocks or vents. Close the leaking drain or vent. Add coolant as required and check engine operation.
	Cooling system hose is leaking.	Check the condition of the hoses. Replace and/or tighten loose hose clamps. Replace any damaged hoses as necessary. Add coolant as required and check engine operation.
	Pressure cap is malfunctioning or has low-pressure rating.	Check that the pressure cap does not relieve coolant under normal operating conditions. Replace a leaking pressure cap. Add coolant as required and check engine operation.
	Manifold coolant leak.	Inspect the engine for coolant leaking from the manifold, expansion and pipe plugs, fittings, engine oil cooler, water pump seal, cylinder block, and other components that have coolant flow. Repair leaking components. Add coolant as required and check engine operation.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.7 Coolant Temperature Above Normal **NOTE:** *The thermostat's normal operating temperature range is 82°-95° C (180°-203° F).The high water temperature lamp on the engine digital control panel only illuminates if the engine is running. If the lamp is illuminated or if temperature is otherwise excessive, the engine should be stopped as soon as practical and the problem corrected.*	Incorrect raw water flow.	Measure raw water flow and adjust per Engine Data Sheet values in Section 8 - Component Parts and Assemblies. Check the raw water piping for blockage. Clean the piping if necessary.
	Raw water pressure regulator is improperly adjusted. **NOTE:** *Pressure should not exceed 414 kPa (60 psi).*	Check the raw water pressure gauge. If pressure is inadequate, adjust the regulator.
	Raw water solenoid has failed. (Applicable to Horizontal Pump installations only)	Replace the solenoid.
	Coolant level is low.	Refill to proper level.
	Cooling system hose is collapsed, restricted, or leaking.	Inspect the hoses. Replace any damaged hoses as necessary.
	Coolant thermostat is malfunctioning.	Remove and replace the defective thermostat.
	Coolant pump is malfunctioning.	Contact a Cummins Authorized Repair Facility.
	Contaminated coolant.	Refer to Coolant Contamination in this section. Contact a Cummins Authorized Repair Facility.
	Engine oil is contaminated with coolant or fuel.	Check the appearance of the engine oil. If the color and texture is abnormal, refer to Engine Oil is Contaminated in this section.
	Coolant mixture of antifreeze and water is not correct.	Verify the concentration of antifreeze in the coolant. Correct the concentration as necessary..
	Coolant temperature switch is malfunctioning.	Repair or replace the switch.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.8 Coolant Temperature Below Normal when Engine is not Running	The standard 120 VAC or optional 240 VAC power supply to the coolant heater is not connected.	Connect the power supply. Correct any electrical faults in the supply circuit.
	The heater's overload thermostat has operated.	Ensure that there is coolant in the heater. Allow time for the automatic overload reset to occur.
	Coolant temperature switch is malfunctioning.	Ensure good wiring contact is maintained during operation. Replace the temperature switch as necessary.
	Coolant is not free to circulate through the heater.	Ensure that the coolant hoses are clear. Repair or replace hoses as necessary.
	The coolant heater has failed.	Replace the coolant heater.
	Coolant thermostat has failed.	Test operation of the thermostat. Replace the thermostat per instructions in Section 6 - Maintenance as necessary.
7.1.9 Raw Water Drain Steaming **NOTE:** *The raw water drain from the coolant heat exchanger may steam if raw water flow is inadequate when the engine is running. It may also steam shortly after the engine is stopped. If coolant is leaking into the raw water drain piping, the steaming may last for some time while the engine cools. Antifreeze may also be observed in the raw water drain.*	Raw water flow did not start when the engine started.	Check engine coolant temperature. Refer to Coolant Temperature Above Normal in this section.
	Engine coolant is leaking into the raw water piping in the coolant heat exchanger.	Remove the coolant heat exchanger and perform a pressure test. Refer to Section 6 - Maintenance. If pressure is not maintained, replace the heat exchanger.
	Raw water flow not adequate.	Compare actual flow rate against required flow rate - adjust regulators to required flow.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.10 Raw Water Solenoid Valve Fails to Operate (Applicable to Horizontal Pump Installations) **NOTE:** *The raw water solenoid may fail to open or to close. The normally closed valve may fail to open when the engine starts. This fault will prevent raw water flow through the normal valves. Bypass flow should be aligned in this event. The valve may also fail to close because of mechanical blockage. In this event, the raw water flow from the heat exchanger does not stop when it should. Depending upon the fire protection system piping, the open solenoid valve may drain all water from the fire protection system piping that is higher than the engine's piping.*	Solenoid valve fails to operate. **NOTE:** *Apply 12 VDC to standard operating systems or 24 VDC to optional operating systems.*	Clean the raw water strainer more frequently. Increase the frequency of operational testing. Check electrical continuity and insulation from ground to the solenoid. Repair any open or short circuits in the wiring. Apply temporary voltage to the solenoid. If the solenoid fails to operate, replace the solenoid valve. Contact a Cummins Authorized Repair Facility.
7.1.11 Auto Start Failure - Does not Crank on Battery A or B	The electrical connection from the fire protection system controller to the terminal board has failed. The electrical connection from the terminal board to the solenoid has failed. The fire protection system controller fails to produce either redundant start signal to the fire pump.	Test continuity and insulation from the ground between the fire protection system controller and the engine digital control panel. Locate and repair any electrical fault in the field wiring or in the fire protection system controller. Test continuity and insulation from the ground between the terminal board and the solenoid. Locate and repair any electrical fault. Locate and correct the common mode fault in the fire protection system controller.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.12 Auto Start Failure - Cranks but does not Start **NOTE:** *The fire pump engine will crank automatically when either contactor A or contactor B is selected at the fire protection system controller. However, the engine does not start. The engine will start locally. If local starting problems are identified, go to the applicable Manual Start Failure troubleshooting table.*	The overspeed control module has activated. The overspeed lamp is illuminated on the engine digital control panel.	Press the RESET switch on the engine digital control panel.
	Crank termination signal from the Engine Digital Control Panel (EDCP) is not received by the fire protection system controller.	Verify the signal from the fire protection system controller or the field wiring to the engine digital control panel is adequate. Replace the EDCP as necessary.
	The AUTO/MAN mode switch fails to select AUTO mode.	Replace the engine digital control panel or repair other electrical faults as necessary.
	The overspeed control module has failed. **NOTE:** *Check system basics* *- Battery voltage level* *- Fuel supply* *- Crank speed* *Reference base engine T/R manual.*	Check power and grounding to the overspeed control module. Repair any electrical faults. Test the overspeed setting. 4.1.6 Overspeed RESET/STOP Switch in Section 4. Replace module as necessary.
7.1.13 Auto Start Failure - Engine Starts but Continues to Crank	The crank termination signal has failed.	With the engine running, verify tachometer is reading speed.
	The tachometer indicates zero RPM.	Replace the EDCP as necessary. Contact a Cummins Authorized Repair Facility.
7.1.14 Manual Start Failure from Contactor Lever - Does not Crank on A or B **NOTE:** *The fire pump engine will not crank locally when either contactor lever is actuated.*	Crank battery A or B contactor fails to make contact.	Replace the faulty contactor as necessary.
	Both batteries dead or not connected.	Check wiring connections. Charge or replace the batteries.
	Starter motor has failed.	Replace the starter motor.
	An electrical fault exists in the power or ground circuit for the starter motor.	Test continuity and insulation from ground between the battery splice, the ground connection, and the starter motor. Locate and repair any electrical fault.
	Engine is seized.	Contact a Cummins Authorized Repair Facility.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.15 Manual Start Failure from Control Panel - Does not Crank on A or B **NOTE:** *The fire pump engine will not crank locally from the engine digital control panel when either CRANK BATT A or CRANK BATT B is selected, however, it does start when a contactor lever is actuated.*	The AUTO/MANUAL mode switch contact fails to close.	Test the electrical operation of the AUTO/MANUAL mode switch. Replace the engine digital control panel.
	An electrical fault exists in the signal power circuit or the ground to the solenoids.	Test continuity and insulation from the ground between the AUTO/MANUAL switch and the solenoids. Check the solenoid connection to the ground. Locate and repair any electrical fault.
	Overspeed switch crank circuit fails to reset with engine shutdown.	Test the crank setting as necessary. Refer to 4.1.6 Overspeed RESET/STOP Switch in Section 4. Replace the overspeed switch as necessary.
7.1.16 Engine Cranks Normally but will not Start (No Exhaust Smoke)	Electronic fault codes are active.	Refer to the model specific Fault Code Chart in this section or contact a Cummins Authorized Repair Facility for assistance.
	Electronic Control Module (ECM) is locked up.	Disconnect the battery cables for 30 seconds. Then reconnect the battery cables and start the engine.
	Battery voltage supply to the ECM is low, interrupted, or open.	Check the battery connections, fuses, and battery supply circuit.
	No fuel in supply tank.	Check and replenish the fuel supply. Check the fittings, hose connections, and hose conditions.
	Air is in the fuel system.	Check for air in the fuel system. Tighten or replace the fuel connections, fuel lines, fuel tank stand pipe, and fuel filters as necessary. Vent air from the system.
	Fuel drain line is restricted.	Check the fuel drain lines for restriction. Clear or replace the fuel lines, check valves, or tank vents as necessary.
	Fuel filter is clogged.	Replace the fuel filter. Refer to 6.4.6 Change Fuel Filters in Section 6.
	Fuel grade is not correct for the application or fuel quality is poor.	Operate the engine from a separate tank of high-quality no. 2 diesel fuel.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.16 Engine Cranks Normally but will not Start (No Exhaust Smoke) (continued)	Fuel injection pump or fuel lift pump is malfunctioning. Pump timing incorrect.	Contact a Cummins Authorized Repair Facility.
	Fuel pump overflow valve is malfunctioning.	Check the overflow valve. Replace if necessary.
	Fuel suction line is restricted.	Check the fuel suction line for restriction.
	Fuel connections on the fuel pump are loose.	Tighten all the fuel fittings and connections between the fuel tanks and fuel lift pump.
	Fuel suction stand pipe in the fuel tank is broken.	Check and repair the stand pipe, if necessary.
	Fuel supply is not adequate.	Locate and correct the restriction in the customer supplied fuel lines to the engine.
	Fuel tank air breather is blocked.	Clean the fuel tank breather.
	Injection pump drive shaft or drive shaft key is damaged.	Repair or replace the injection pump or contact a Cummins Authorized Repair Facility.
	Fuel injectors are plugged.	Replace the fuel injectors.
	Moisture is in the wiring harness connectors.	Dry the connectors with Cummins electronic cleaner, Part Number 3824510.
	Starter motor is malfunctioning.	Check the direction of crankshaft rotation. Replace the starter motor as necessary. Contact a Cummins Authorized Repair Facility.
7.1.17 Engine Cranks Slowly but does not Start **NOTE:** *Typical engine cranking speed is 120 RPM. Engine cranking speed can be checked with a hand-held tachometer, stroboscope, or electronic service tool.*	The battery cable connections are loose, broken, or corroded, creating excessive resistance.	Check the battery cables and connections. Ensure that connections are clean and tight.
	The battery is not properly charged or has failed.	Recharge the battery. If the battery does not take the charge, replace it.
	Engine oil level is too high.	Check the oil level per instructions in Section 6 - Maintenance. Drain any excess oil.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.17 Engine Cranks Slowly but does not Start (continued)	Engine oil is the wrong grade or type.	Check the grade and type of oil. Refer to 6.3.4 Engine Oil System in Section 6 - Maintenance.
		If the wrong type or grade of oil is present, drain and replace it. Refer to 6.4.5 Engine Oil and Oil Filter Change in Section 6 - Maintenance.
	Starter motor is malfunctioning.	Replace the starter motor. Contact a Cummins Authorized Repair Facility.
7.1.18 Engine Stops During Operation	Normal automatic mode shutdown occurs when the fire protection system controller removes the signal power feed to the engine digital control panel.	No action required. This is a desirable outcome.
	The selected Electronic Control Module (ECM) has detected a serious fault condition. The ECM's STOP light is displayed.	For instructions on how to read active fault codes, Refer to the model specific Fault Code Chart in this section or contact a Cummins Authorized Repair Facility for assistance.
	In the automatic mode, the signal power feed is lost from the fire protection system controller to the engine digital control panel.	Locate and correct the electrical fault in the fire protection system controller or the field wiring to the engine digital control panel.
	An overspeed trip has occurred. The overspeed trip lamp is illuminated on the engine digital control panel.	Remote indications may also be present. Overspeed switch failure has occurred. The trip indications may not be present.
	Power supply or grounding fault exists at the ECM.	Locate and correct the electrical fault in the power supply or grounding for the ECM.
	The selected ECM has failed.	Select the alternate ECM. Replace the failed ECM. Contact a Cummins Authorized Repair Facility.
	Fuel tank level is low.	Fill the fuel tank. Fill and bleed the fuel lines to the engine.
	Clogged fuel tank air breather hose.	Clean the fuel tank breather.
	Fuel piping to engine or fuel filter is clogged.	Clean and repair engine fuel piping. Replace the fuel filter.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.18 Engine Stops During Operation (continued)	Air is trapped in the low pressure fuel lines at the engine.	Bleed the fuel lines.
	Electronic fault codes are active.	Refer to the model specific Fault Code Chart in this section or contact a Cummins Authorized Repair Facility for assistance.
7.1.19 Engine will not Reach Rated Speed (RPM)	Tachometer is not reading correctly or is erratic. Compare the tachometer reading with a hand held tachometer or an electronic service tool reading.	Replace the engine digital control panel or contact a Cummins Authorized Repair Facility for assistance.
	Fuel filter requires replacement.	Refer to 6.4.6 Change Fuel Filters per the instructions in Section 6 - Maintenance.
	Fuel grade not correct for the application, or fuel quality is poor.	Operate the engine with a good quality no. 2 diesel fuel.
	Fuel suction line is restricted.	Check the fuel suction line for restriction.
	Charge air cooler restricted.	Inspect the air cooler for internal and external restrictions. Replace the restricted cooler if necessary.
	Fuel supply is not adequate.	Locate and correct the restriction in the fuel lines to the engine.
	Stop circuit malfunction in the fire pump controller or field wiring.	In AUTO mode operation, the fire pump engine stops upon loss of signal power from the fire pump controller. Check the stop circuit in the fire pump controller.
7.1.20 Engine will not Shut Off Remotely	Stop circuit malfunction in the fire pump controller or field wiring.	Check for short to voltage on the signal wiring from the fire pump controller to the engine digital control panel. Correct any faults. Check operation of the AUTO/MANUAL switch at the engine digital control panel. Replace the engine digital control panel if necessary.
	Electronic fault codes are active.	Refer to the model specific Fault Code Chart in this section or contact a Cummins Authorized Repair Facility for assistance.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.20 Engine will not Shut Off Remotely (continued)	Engine running on fumes drawn into the air intake.	Identify and isolate the source of the combustible fumes. Contact a Cummins Authorized Repair Facility.
7.1.21 Engine will not Shut Off Locally	Power source has not been removed by the fire pump controller.	Depress and hold the stop button on left side of the engine digital control panel until the engine is stopped. Check for inadvertent voltage on the wiring to terminal board at the engine control panel.
	Electronic fault codes are active.	Refer to the model specific Fault Code Chart in this section or contact a Cummins Authorized Repair Facility for assistance.
	Engine running on fumes drawn into the air intake.	Identify and isolate the source of the combustible fumes.
7.1.22 Fuel Consumption is Excessive	Fuel is leaking.	Check the fuel lines, fuel connections, and fuel filters for leaks. Check the fuel lines to the supply tanks. Repair any leaks.
	Poor-quality fuel is being used.	Assure good-quality no. 2 diesel fuel is being used.
	Defective or clogged injection nozzle.	Replace the defective or clogged injection nozzle.
	Injection pump is adjusted incorrectly, causing excessive injection.	Adjust or replace the injection pump.
	Air intake or exhaust leaks.	Check for loose or damaged piping connections and missing pipe plugs. Check the turbocharger and exhaust manifold mounting. Repair any leaks.
	Air intake system restriction is above specification.	Check the air intake system for restriction. Refer to 6.3.2 Air Cleaner Filter and Piping in Section 6. Replace the air filter as necessary.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.23 Fuel or Engine Oil Leaking From Exhaust Manifold	Intake air restriction is high.	Check the air intake system for restriction. Refer to 6.3.2 Air Cleaner Filter and Piping in Section 6. Replace the air filter if required.
	Turbocharger drain line is restricted.	Remove the turbocharger drain line and check for restriction. If required, clean or replace the drain line.
	Turbocharger oil seal is leaking.	Check the turbocharger for oil seal leaks.
7.1.24 Engine Oil is Contaminated	Oil supply is contaminated.	Check the oil supply. Replace it as necessary. Drain the oil and replace with non-contaminated oil. Also, replace the oil filter. Refer to 6.4.5 Engine Oil and Oil Filter Change in Section 6.
	Fuel is present in the engine oil.	Contact a Cummins Authorized Repair Facility.
	Coolant is present in the engine oil.	Contact a Cummins Authorized Repair Facility.
	Metal is present in the engine oil.	Contact a Cummins Authorized Repair Facility.
7.1.25 Engine Oil Consumption is Excessive	Verify the oil consumption rate.	Check the amount of oil added versus the operating hours.
	Engine crankcase overfilled.	Remove excess oil and recalibrate dipstick.
	External engine leak is present.	Inspect the engine and its components for seal, gasket, tappet cover, oil cooler, or drain cock leaks. Repair or correct any leaks.
	Crankcase ventilation system is plugged.	Check and clean the crankcase ventilation hose per the instructions in Section 6 - Maintenance.
	Turbocharger oil seal is leaking.	Check the turbocharger compressor and turbine seals. Contact a Cummins Authorized Repair Facility.
	Engine oil cooler is leaking.	Check for engine oil in the coolant. Refer to Lubrication Oil in the Coolant in this section. Contact a Cummins Authorized Repair Facility.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.25 Engine Oil Consumption is Excessive (continued)	Engine oil does not meet specifications for operating conditions.	Change the oil and filters per the instructions in Section 6 - Maintenance.
	Engine oil drain interval is excessive.	Verify the correct engine oil drain interval. Refer to 6.4.5 Engine Oil and Oil Filter Change in Section 6.
	Piston, cylinder liner, or piston rings are worn or damaged.	Check for air intake system leaks. Contact a Cummins Authorized Repair Facility.
	Piston rings are not seated correctly (after an engine rebuild or piston installation).	Check blowby. If blowby is excessive, check the piston rings for correct seating. Contact a Cummins Authorized Repair Facility.
7.1.26 Lubrication Oil in the Coolant	Coolant is contaminated.	Drain the coolant and replace with non-contaminated coolant. Refer to 6.5.2 Drain and Flush Cooling System in Section 6. Replace the coolant filter.
	Engine oil cooler is malfunctioning (CFP11E).	Check the oil cooler. Contact a Cummins Authorized Repair Facility.
	Cylinder head gasket is damaged or leaking.	Contact a Cummins Authorized Repair Facility.
	Cylinder block or head is cracked or porous.	Contact a Cummins Authorized Repair Facility.

CFP11E Fault Code Chart

FAULT CODE (LAMP)	SPN FMI	Cummins DESCRIPTION
111 (Red)	629 12	Engine Control Module - Critical Internal Failure
112 (Red)	635 7	Engine Timing Actuator is not Responding to ECM Commands
113 (Yellow)	635 3	Engine Timing Actuator Circuit - Shorted High
114 (Yellow)	635 4	Engine Timing Actuator Circuit - Shorted Low
115 (Red)	190 2	Engine Speed/Position Sensor Circuit - Lost Both of Two Signals from the Magnetic Pickup Sensor
116 (Red)	156 3	Fuel Timing Pressure Sensor Circuit - Shorted High
117 (Red)	156 4	Fuel Timing Pressure Sensor Circuit - Shorted Low
118 (Yellow)	135 3	Fuel Pump Delivery Pressure Sensor Circuit - Shorted High
119 (Yellow)	135 4	Fuel Pump Delivery Pressure Sensor Circuit - Shorted Low
121 (Yellow)	190 10	Engine Speed/Position Sensor Circuit - Lost One of Two Signals from the Magnetic Pickup Sensor
122 (Yellow)	102 3	Intake Manifold Pressure Sensor #1 Circuit - Shorted High
123 (Yellow)	102 4	Intake Manifold Pressure Sensor #1 Circuit - Shorted Low
131 (Red)	91 3	Accelerator Pedal Position Sensor Circuit - Shorted High
132 (Red)	91 4	Accelerator Pedal Position Sensor Circuit - Shorted Low
133 (Red)	974 3	Remote Accelerator Pedal Position Sensor Circuit - Shorted High
133 (Red)	29 3	Remote Accelerator Pedal Position Sensor Circuit - Shorted High
134 (Red)	974 4	Remote Accelerator Pedal Position Sensor Circuit - Shorted Low
134 (Red)	29 4	Remote Accelerator Pedal Position Sensor Circuit - Shorted Low
135 (Yellow)	100 3	Engine Oil Pressure Sensor Circuit - Shorted High
141 (Yellow)	100 4	Engine Oil Pressure Sensor Circuit - Shorted Low
143 (Yellow)	100 18	Engine Oil Pressure Low - Warning
143 (White)	100 1	Engine Oil Pressure Low - Warning
144 (Yellow)	110 3	Engine Coolant Temperature Sensor Circuit - Shorted High
145 (Yellow)	110 4	Engine Coolant Temperature Sensor Circuit - Shorted Low

CFP11E Fault Code Chart (Continued)

FAULT CODE (LAMP)	SPN FMI	Cummins DESCRIPTION
147 (Red)	91 8	Accelerator Pedal Position Sensor Circuit - Low Frequency
148 (Red)	91 8	Accelerator Pedal Position Sensor Circuit - High Frequency
151 (Red)	110 0	Engine Coolant Temperature High - Critical
151 (White)	110 0	Engine Coolant Temperature High - Critical
153 (Yellow)	105 3	Intake Manifold Temperature Sensor #1 Circuit - Shorted High
154 (Yellow)	105 4	Intake Manifold Temperature Sensor #1 Circuit - Shorted Low
155 (Red)	105 0	Intake Manifold Temperature #1 High - Critical
155 (White)	105 0	Intake Manifold Temperature #1 High - Critical
187 (Yellow)	620 4	Sensor Supply Voltage #2 Circuit - Shorted Low
211 (None)	1484 31	Additional OEM/Vehicle Diagnostic Codes have been Logged
212 (Yellow)	175 3	Engine Oil Temperature Sensor Circuit - Shorted High
213 (Yellow)	175 4	Engine Oil Temperature Sensor Circuit - Shorted Low
214 (Red)	175 0	Engine Oil Temperature High - Critical
219 (Maint.)	1380 17	Low Oil Level in the Centinel Makeup Oil Tank
219 (White)	1380 1	Low Oil Level in the Centinel Makeup Oil Tank
221 (Yellow)	108 3	Ambient Air Pressure Sensor Circuit - Shorted High
222 (Yellow)	108 4	Ambient Air Pressure Sensor Circuit - Shorted Low
223 (Yellow)	1265 4	Engine Oil Burn Valve Solenoid Circuit - Shorted Low
225 (Yellow)	1266 4	Engine Oil Replacement Valve Solenoid Circuit - Shorted Low
227 (Yellow)	620 3	Sensor Supply Voltage #2 Circuit - Shorted High
231 (Yellow)	109 3	Engine Coolant Pressure Sensor Circuit - Shorted High
232 (Yellow)	109 4	Engine Coolant Pressure Sensor Circuit - Shorted Low
233 (Red)	109 1	Engine Coolant Pressure Low - Warning
233 (Yellow)	109 18	Engine Coolant Pressure Low - Warning

CFP11E Fault Code Chart (Continued)

FAULT CODE (LAMP)	SPN FMI	Cummins DESCRIPTION
234 (Red)	190 0	Engine Speed High - Critical
235 (Red)	111 1	Engine Coolant Level Low - Critical
235 (White)	111 1	Engine Coolant Level Low - Critical
237 (Yellow)	644 2	External Speed Input (Multiple Unit Sychronization) - Data Incorrect
241 (Yellow)	84 2	Vehicle Speed Sensor Circuit - Data Incorrect
242 (Yellow)	84 10	Vehicle Speed Sensor Circuit - Tampering has been Detected
245 (Yellow)	647 4	Fan Clutch Circuit - Shorted Low
254 (Red)	632 4	Fuel Shut-off Valve Circuit - Shorted Low
254 (None)	632 4	Fuel Shut-off Valve Circuit - Shorted Low
255 (Yellow)	632 3	Fuel Shut-off Valve Circuit - Shorted High
259 (Red)	632 7	Fuel Shut-off Valve - Stuck Open
261 (White)	174 0	Fuel Temperature High - Warning
263 (Yellow)	174 3	Fuel Temperature Sensor Circuit - Shorted High
265 (Yellow)	174 4	Fuel Temperature Sensor Circuit - Shorted Low
284 (Yellow)	1043 4	Engine Speed/Position Sensor #1 (Crankshaft) Supply Voltage Circuit - Shorted Low
285 (Yellow)	639 9	SAE J1930 Multiplexing PGN Timeout Error
286 (Yellow)	639 13	SAE J1930 Multiplexing PGN Configuration Error
287 (Red)	91 19	SAE J1930 Multiplexing Accelerator Pedal Sensor System Error
288 (Red)	974 19	SAE J1930 Multiplexing Remote Throttle Data Error
292 (White)	1083 14	Auxiliary Temperature Sensor Input #1 Engine Protection - Critical
293 (Yellow)	1083 3	Auxiliary Temperature Sensor Input #1 Circuit - Shorted High
294 (Yellow)	1083 4	Auxiliary Temperature Sensor Input #1 Circuit - Shorted Low
295 (Yellow)	108 2	Ambient Air Pressure Sensor Circuit - Data Incorrect
296 (White)	1084 14	Auxiliary Pressure Sensor Input #2 Engine Protection - Critical

CFP11E Fault Code Chart (Continued)

FAULT CODE (LAMP)	SPN FMI	Cummins DESCRIPTION
297 (Yellow)	1084 3	Auxiliary Pressure Sensor Input #2 Circuit - Shorted High
298 (Yellow)	1084 4	Auxiliary Pressure Sensor Input #2 Circuit - Shorted Low
299 (None)	1384 31	Engine Shutdown Commanded by J1939
311 (Yellow)	651 6	Injector Solenoid Valve Cylinder #1 Circuit - Grounded Circuit
312 (Yellow)	655 6	Injector Solenoid Valve Cylinder #5 Circuit - Grounded Circuit
313 (Yellow)	653 6	Injector Solenoid Valve Cylinder #3 Circuit - Grounded Circuit
314 (Yellow)	656 6	Injector Solenoid Valve Cylinder #6 Circuit - Grounded Circuit
315 (Yellow)	652 6	Injector Solenoid Valve Cylinder #2 Circuit - Grounded Circuit
316 (Yellow)	931 3	Fuel Supply Pump Actuator Circuit - Shorted High
318 (Yellow)	931 7	Fuel Supply Pump Actuator - Mechanically Stuck
319 (None)	251 2	Real Time Clock - Power Interrupt
321 (Yellow)	654 6	Injector Solenoid Valve Cylinder #4 Circuit - Grounded Circuit
322 (Yellow)	651 5	Injector Solenoid Valve Cylinder #1 Circuit - Open Circuit
323 (Yellow)	655 5	Injector Solenoid Valve Cylinder #5 Circuit - Open Circuit
324 (Yellow)	653 5	Injector Solenoid Valve Cylinder #3 Circuit - Open Circuit
325 (Yellow)	656 5	Injector Solenoid Valve Cylinder #6 Circuit - Open Circuit
331 (Yellow)	652 5	Injector Solenoid Valve Cylinder #2 Circuit - Open Circuit
332 (Yellow)	654 5	Injector Solenoid Valve Cylinder #4 Circuit - Open Circuit
341 (Yellow)	630 2	Engine Control Module - Data Lost
343 (Yellow)	629 12	Engine Control Module - Warning Internal Hardware Failure
346 (Yellow)	630 12	Engine Control Module - Warning Software Error
349 (Yellow)	191 16	Transmission Output Shaft (Tailshaft) Speed High - Warning
349 (Yellow)	191 0	Transmission Output Shaft (Tailshaft) Speed High - Warning
352 (Yellow)	1079 4	Sensor Supply Voltage #1 Circuit - Shorted Low

CFP11E Fault Code Chart (Continued)

FAULT CODE (LAMP)	SPN FMI	Cummins DESCRIPTION
378 (Yellow)	633 5	Fueling Actuator #1 Circuit - Open Circuit
379 (Yellow)	633 6	Fueling Actuator #1 Circuit - Grounded Circuit
384 (Yellow)	626 11	Start Assist Device Control Circuit Error (Ether Injection)
386 (Yellow)	1079 3	Sensor Supply Voltage #1 Circuit - Shorted High
387 (Yellow)	1043 3	Accelerator Pedal Position Sensor Supply Voltage Circuit - Shorted High
394 (Yellow)	635 5	Tiiming Actuator #1 Circuit - Open Circuit
395 (Yellow)	635 6	Tiiming Actuator #1 Circuit - Grounded Circuit
396 (Yellow)	1244 5	Fueling Actuator #2 Circuit - Open Circuit
397 (Yellow)	1244 6	Fueling Actuator #2 Circuit - Grounded Circuit
398 (Yellow)	1245 5	Timing Actuator #2 Circuit - Open Circuit
399 (Yellow)	1245 6	Timing Actuator #2 Circuit - Grounded Circuit
415 (Red)	100 1	Engine Oil Pressure Low - Critical
418 (None)	97 15	Water in Fuel Indicator High - Maintenance
422 (Yellow)	111 2	Engine Coolant Level Sensor Circuit - Data Incorrect
423 (Yellow)	156 2	Fuel Timing Pressure or Timing Actuator Stuck
426 (None)	639 2	SAE J1939 Datalink - Cannot Transmit
426 (Yellow)	639 2	SAE J1939 Datalink - Cannot Transmit
427 (None)	639 9	SAE J1939 Not Fast Enough
428 (Yellow)	97 3	Water in Fuel Sensor Circuit - Shorted High
429 (Yellow)	97 4	Water in Fuel Sensor Circuit - Shorted Low
431 (Yellow)	558 2	Accelerator Pedal Idle Validation Circuit - Data Incorrect
431 (Yellow)	91 2	Accelerator Pedal Idle Validation Circuit - Data Incorrect
432 (Red)	558 13	Accelerator Pedal Idle Validation Circuit - Out of Calibration
432 (Red)	91 13	Accelerator Pedal Idle Validation Circuit - Out of Calibration

CFP11E Fault Code Chart (Continued)

FAULT CODE (LAMP)	SPN FMI	Cummins DESCRIPTION
433 (Yellow)	102 2	Intake Manifold Pressure Sensor Circuit - Data Incorrect
434 (Yellow)	627 2	Power Lost without Ignition Off
435 (Yellow)	100 2	Engine Oil Pressure Sensor Circuit - Data Incorrect
441 (Yellow)	168 18	Battery #1 Voltage Low - Warning
441 (None)	168 1	Battery #1 Voltage Low - Warning
442 (Yellow)	168 16	Battery #1 Voltage High- Warning
442 (Yellow)	168 0	Battery #1 Voltage High- Warning
443 (Yellow)	1043 4	Accelerator Pedal Position Sensor Supply Voltage Circuit - Shorted Low
449 (Yellow)	94 16	Fuel Pressure High - Warning
451 (Yellow)	157 3	Injector Metering Rail #1 Pressure Sensor Circuit - Shorted High
452 (Yellow)	157 4	Injector Metering Rail #1 Pressure Sensor Circuit - Shorted Low
455 (Red)	633 3	Fuel Control Valve Circuit - Shorted High
466 (Yellow)	1188 4	Turbocharger #1 Wastegate Control Circuit - Shorted Low
467 (Yellow)	635 2	Timing Rail Actuator Circuit - Data Incorrect
468 (Yellow)	633 2	Fuel Rail Actuator Circuit - Data Incorrect
482 (Yellow)	94 18	Fuel Pressure Low - Warning
483 (Yellow)	1349 3	Injector Metering Rail #2 Pressure Sensor Circuit - Shorted High
484 (Yellow)	1349 4	Injector Metering Rail #2 Pressure Sensor Circuit - Shorted Low
485 (Yellow)	1349 16	Injector Metering Rail #2 Pressure High - Warning
486 (Yellow)	1349 18	Injector Metering Rail #2 Pressure Low - Warning
487 (None)	626 1	Start Assist Device - Canister Empty (Ether Injection)
489 (Yellow)	191 18	Transmission Output Shaft (Tailshaft) Speed Low - Warning
489 (Yellow)	191 1	Transmission Output Shaft (Aux Gov) Speed Low - Warning
496 (Yellow)	1043 11	Engine Speed/Position Sensor #2 (Camshaft) Supply Voltage

CFP11E Fault Code Chart (Continued)

FAULT CODE (LAMP)	SPN FMI	Cummins DESCRIPTION
497 (Yellow)	1377 2	Multiple Unit Sychronization Switch Circuit - Data Incorrect
514 (Red)	633 7	Fuel Control Valve - Mechanically Stuck
527 (Yellow)	702 3	Auxiliary Input/Output #2 Circuit - Shorted High
528 (Yellow)	93 2	OEM Alternate Torque Validation Switch - Data Incorrect
529 (Yellow)	703 3	Auxiliary Input/Output #3 Circuit - Shorted High
546 (Yellow)	94 3	Fuel Delivery Pressure Sensor Circuit - Shorted High
547 (Yellow)	94 4	Fuel Delivery Pressure Sensor Circuit - Shorted Low
551 (Yellow)	558 4	Accelerator Pedal Idle Validation Circuit - Shorted Low
551 (Red)	91 4	Accelerator Pedal Idle Validation Circuit - Shorted Low
553 (Yellow)	157 16	Injector Metering Rail #1 Pressure High - Warning Level
553 (Red)	157 0	Injector Metering Rail #1 Pressure High - Warning Level
554 (Yellow)	157 2	Fuel Pressure Sensor Error
555 (Yellow)	1264 16	Engine Blowby - Warning Level
555 (White)	1264 0	Engine Blowby - Warning Level
581 (Yellow)	1381 3	Fuel Supply Pump Inlet Pressure Sensor Circuit - Shorted High
582 (Yellow)	1381 4	Fuel Supply Pump Inlet Pressure Sensor Circuit - Shorted Low
583 (Yellow)	1381 18	Fuel Supply Pump Inlet Pressure Sensor Low - Warning Level
595 (Yellow)	103 16	Turbocharger #1 Speed High - Warning Level
596 (Yellow)	167 16	Electrical Charging System Voltage High - Warning Level
597 (Yellow)	167 18	Electrical Charging System Voltage Low - Warning Level
598 (Red)	167 1	Electrical Charging System Voltage Low - Critical Level
611 (None)	1383 31	Engine Hot Shutdown
649 (None)	1378 0	Change Lubricating Oil and Filter
719 (Yellow)	1264 3	Crankcase Blowby Pressure Sensor Circuit - Shorted High

CFP11E Fault Code Chart (Continued)

FAULT CODE (LAMP)	SPN FMI	Cummins DESCRIPTION
729 (Yellow)	1264 4	Crankcase Blowby Pressure Sensor Circuit - Shorted Low
753 (None)	723 2	Engine Speed/Position #2 - Cam Sync Error
755 (Yellow)	157 7	Injector Metering Rail #1 Pressure Malfunction
758 (Yellow)	1349 7	Injector Metering Rail #2 Pressure Malfunction
951 (None)	166 2	Cylinder Power Imbalance Between Cylinders

Section 8 - Component Parts and Assemblies

8.1 Part Ordering Information

Replacement parts for the Cummins Inc. equipment are manufactured to the same quality standards and specifications as the original equipment. Unapproved substitution may result in poor performance, reduced service life, lost production, or unsafe operation.

Cummins Inc. relies on the best and most cost effective shipping methods, unless specific instructions or requirements are requested by the customer. When ordering parts, please be prepared to provide the following information.

PARTS REQUESTS REQUIRE:

1. Model and serial number.
2. Part description by name or number.
3. Quantity required.
4. Purchase order number.

NOTE: *A purchase order number is desirable, even if the part(s) are supplied on a Returned Goods Authorization (RGA) issue number. A purchase order number helps Cummins NPower Inc. and its customer track the parts and necessary credits.*

8.2 Routine Service and Parts

Personnel at Cummins Authorized Repair Locations can assist you with the correct operation and service of your engine. Cummins has a worldwide service network of more than 5,000 Distributors and Dealers who have been trained to provide sound advice, expert service, and complete parts support.

Check the telephone directory yellow pages or refer to the directory in this section for the nearest Cummins Authorized Repair Location.

8.3 Emergency Repairs and Technical Service

The Cummins Customer Assistance Center provides a 24-hour, toll free telephone number to aid in technical and emergency service when a Cummins Authorized Repair Location can not be reached or is unable to resolve an issue with a Cummins product.

If assistance is required, call Toll-Free: 1-800-DIESELS (1-800-343-7357). Includes all 50 states, Bermuda, Puerto Rico, Virgin Islands, and the Bahamas.

Outside of North America contact your Regional Office. Telephone numbers and addresses are listed in the International Directory.

Refer also to the Cummins Inc. web site at www.cummins.com.

8.4 Recommended Spares Inventory

To minimize downtime and increase productivity, Cummins Inc. recommends maintaining a stock of spare parts critical to uninterrupted engine operation. Shipping costs can be lower using ground transportation rather than overnight or next day air freight. For this reason Cummins Inc. can provide a list of recommended spare parts. Contact the Cummins Authorized Repair Location for additional information.

8.5 Parts and Drawing Sections Included:

15499 Fire Power Pump Engine Model CFP11E

CFP11E Engine Data Sheet

Engine Data Sheet
Cummins Fire Power
De Pere, WI 54115
http://www.cumminsfirepower.com

Drawing No. 9727
Rev. K

Basic Engine Model
CFP11E-F10, F20

Curve Number:	**FR - 20091**
CPL Code:	**2829**
Engine Family:	**Construction**
Revision Date:	**March 2010**

Configuration Number: **D353014CX03**
Installation Drawing: **15551**

General Engine Data

Type	4 Cycle; In-Line; 6 Cylinder	
Aspiration	Turbocharged, Chrg Air Cooled	
Bore & Stroke - in. (mm)	4.92 x 5.79	(125 x 147)
Displacement - $in.^3$ (litre)	660	(10.8)
Compression Ratio	16.3:1	
Valves per Cylinder - Intake	2	
- Exhaust	2	
Maximum Allowable Bending Moment @ Rear Face of Block - lb.-ft. (N-m)	1000	(1356)

Air Induction System

Max. Temperature Rise Between Ambient Air and Engine Air Inlet - °F (°C)	30	(16.7)
Maximum Inlet Restriction with Dirty Filter - in. H_2O (mm H_2O)	25	(635)
Recommended Air Cleaner Element - (Standard) K&N (CFP)	RU-3220	(9608)
- (Optional) Industrial 2 stage.(FLG)	AF26124 / AF26125	

Lubrication System

Oil Pressure Range at Rated - PSI (kPa)	35	(241) Nominal
Oil Capacity of Pan (High - Low) - U.S. quarts (litre)	36-32	(45-38)
Total System Capacity - U.S. Gal. (litre)	6.9	(26.1)
Recommended Lube Oil Filter Fleetguard (Cummins)	LF9001	(3101869)

Cooling System

Raw Water Working Pressure Range at Heat Exchanger - PSI (kPa)	60	(413) MAX
Recommended Min. Water Supply Pipe Size to Heat Exchanger - in. (mm)	1.00	(25.40)
Recommended Min. Water Disch. Pipe Size From Heat Exchanger - in. (mm)	1.25	(31.75)
Coolant Water Capacity (Engine Side) - U.S. gal. (litre)	2.5	(9.5)
Standard Thermostat - Type	Modulating	
- Range - deg F (deg C)	180-200	(82-93)
Minimum Raw Water Flow		
with Water Temperatures to 90 °F (32 °C) - U.S. GPM (litre/s)	40	(2.52)
Recommended Cooling Water Filter Fleetguard (Cummins)	WF2075	(3100308)

A jacket water heater is mandatory on this engine. The recommended heater wattage is 2250 down to 40 °F (4 °C).

Exhaust System

Max. Back Pressure Imposed by Complete Exhaust System in in. H_2O (kPa)	40.8	(10.2)
Exhaust Pipe Size Normally Acceptable - in. (mm)	5.0	(127)

Noise Emissions

Top	101.4 dBa
Right Side	104.1 dBa
Left Side	104.2 dBa
Front	104.6 dBa
Exhaust	121.0 dBa

The noise emission values are estimated sound pressure levels at 3.3 ft. (1 m.).

CFP11E Engine Data Sheet (Continued)

Fuel Supply / Drain System	**1470**	**1760**	**2100**
CFP11E-F20 Nominal Fuel Consumption - Gal./hr. (L/hr)	17.1 (64.8)	20.2 (76.4)	17.4 (65.8)
CFP11E-F10 Nominal Fuel Consumption - Gal./hr. (L/hr)	15.1 (57.0)	17.8 (67.2)	16.0 (60.5)
Fuel Type	Number 2 Diesel Only		
Minimum Supply Line Size - in. (mm)	0.5	(12.70)	
Minimum Drain Line Size - in. (mm)	0.375	(9.53)	
Maximum Fuel Height above C/L Fire Pump ft (m)	20	(6)	
Recommended Fuel Filter - Primary	Fleetguard (Cummins)	FS1000	(3329289)
- Secondary	None		
Maximum Restriction @ Lift Pump-Inlet - With Clean Filter - in. Hg (mm Hg)	4.0	(102)	
Maximum Restriction @ Lift Pump-Inlet - With Dirty Filter - in. Hg (mm Hg)	8.0	(203)	
Maximum Return Line Restriction - Without Check Valves - in. Hg (mm Hg)	2.5	(64)	
Minimum Fuel Tank Vent Capability - ft^3/hr (m^3/hr)	30	(0.90)	
Maximum Fuel Temperature @ Lift Pump Inlet - ^oF (^oC)	160	(71)	

Starting and Electrical System	**12V**	**24V**
Min. Recommended Batt. Capacity - Cold Soak at 0^oF (-18^oC) or Above		
Engine Only - Cold Cranking Amperes - (CCA)	1875	1250
Engine Only - Reserve Capacity - Minutes	850	430
Battery Cable Size (Maximum Cable Length Not to Exceed 5 ft. [1.5 m] AWG)	00	00
Maximum Resistance of Starting Circuit - Ohms	0.001	0.0017
Typical Cranking Speed - RPM	120	120
Alternator (Standard), Internally Regulated - Ampere	100	70
Wiring for Automatic Starting (Negative Ground)	Standard	
Reference Wiring Diagram	16260	

Performance Data

All data is based on the engine operating with fuel system, water pump, lubricating oil pump, air cleaner, and alternator; not included are compressor, fan, optional equipment, and driven components. Data is based on operation at SAE standard J1394 conditions of 300 ft. (91.4 m) altitude, 29.61 in. (752 mm) Hg dry barometer, and 77 ^oF (25 ^oC) intake air temperature, using No.2 diesel or a fuel corresponding to ASTM-D2.

Altitude Above Which Output Should be Limited - ft. (m)	300	(91.4)
Correction Factor per 1000 ft. (305 m) above Altitude Limit	3%	
Temperature Above Which Output Should be Limited - ^oF (^oC)	77	(25)
Correction Factor per 10 ^oF (11 ^oC) Above Temperature Limit	1%	(2%)

Exhaust Emissions (EPA Tier T2) [Reference Emissions Data Doc. 9803]	**g/kW-hr**	**g/BHP-hr**
Hydrocarbons (HC/OMHCE)	0.22	0.16
Oxides of Nitrogen (NOx)	5.39	4.02
Non-Methane Hydrocarbons + NOx (NMHC+NOx)	5.61	4.18
Carbon Monoxide (CO)	1.00	0.75
Particulate	0.14	0.10

CFP11E Engine Data Sheet (Continued)

FM Approved and UL Listed Ratings for CFP11E-F10, F20

Engine Speed - RPM	**1470**	**1760**	**2100**
CFP11E-F20 Output - BHP (kW)	**364 (271)**	**424 (316)**	**360 (268)**
Ventilation Air Required for Combustion - CFM (litre/sec)	740 (349)	875 (413)	854 (403)
Exhaust Gas Flow - CFM (litre/sec)	1890 (892)	2180 (1,029)	2009 (948)
Exhaust Gas Temperature - ^{o}F (^{o}C)	977 (525)	954 (512)	844 (451)
Engine Heat Rejection to Coolant- BTU/min. (kW)	4750 (83)	5100 (90)	9265 (163)
Engine Heat Rejection to Ambient - BTU/min. (kW)	1500 (26)	1580 (28)	1435 (25)
CFP11E-F10 Output - BHP (kW)	**320 (239)**	**373 (278)**	**331 (247)**
Ventilation Air Required for Combustion - CFM (litre/sec)	649 (306)	769 (363)	825 (389)
Exhaust Gas Flow - CFM (litre/sec)	1663 (785)	1943 (917)	1857 (877)
Exhaust Gas Temperature - ^{o}F (^{o}C)	946 (508)	917 (492)	779 (415)
Engine Heat Rejection to Coolant- BTU/min. (kW)	4649 (82)	5102 (90)	4792 (84)
Engine Heat Rejection to Ambient - BTU/min. (kW)	1400 (25)	1490 (26)	1412 (25)

All Data is Subject to Change Without Notice.

Director of Engineering: Jim Vanden Boogard

Cummins Fire Power, De Pere, WI 54115 U.S.A.

Torque Table

Cap Screw Markings and Torque Values

CAUTION

Always use a cap screw of the same measurement and strength as the cap screw being replaced. Using the wrong cap screws can result in engine damage.

Always use the torque values listed in the following tables when specific torque values are not available.

When the ft-lb value is less than 10, convert the ft-lb value to in-lb to obtain a better torque with an in-lb torque wrench. Example: 6 ft-lb equals 72 in-lb.

Metric Cap Screw Identification

Sample:	**M8-1.25 x 25**		
Value:	**M8**	**1.25**	**X 25**
Meaning:	Major thread diameter in millimeters	Distance between threads in millimeters	Length in millimeters

Metric Cap Screw Head Markings

Metric cap screws and nuts are identified by the grade number stamped on the head of the cap screw or on the surface of the nuts.

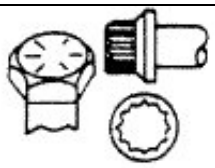
Commercial Steel Class	**8.8**	**10.9**	**12.9**
Caps Screw Head Markings			

US Customary Cap Screw Identification

Sample:	**5/16 x 18 x 1-1/2**		
Value:	**5/16**	**18**	**1-1/2**
Meaning:	Major thread diameter in inches	Number of threads per inch	Length in inches

U.S. Customary Cap Screw Head Markings

U.S. Customary cap screws are identified by radial lines stamped on the head of the cap screw.

SAE Grade 5 w/ three lines	**SAE Grade 8**
	

Torque Table (Continued)

Metric Cap Screw Torque Values (lubricated threads)

Class:	8.8				10.9				12.9			
Diameter	Cast Iron		Aluminum		Cast Iron		Aluminum		Cast Iron		Aluminum	
mm	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb
6	9	5	7	4	13	10	7	4	14	9	7	4
7	14	9	11	7	18	14	11	7	23	18	11	7
8	23	17	18	14	33	25	18	14	40	29	18	14
10	45	33	30	25	65	50	30	25	70	50	30	25
12	80	60	55	40	115	85	55	40	125	95	55	40
14	125	90	90	65	180	133	90	65	195	145	90	65
16	195	140	140	100	280	200	140	100	290	210	140	100
18	280	200	180	135	390	285	180	135	400	290	180	135
20	400	290	—	—	550	400	—	—	—	—	—	—

U.S. Customary Cap Screw Torque Values (lubricated threads)

Grade:	SAE Grade 5				SAE Grade 8			
Cap Screw Body Size	Cast Iron		Aluminum		Cast Iron		Aluminum	
	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb
1/4-20	9	7	8	6	15	11	8	6
1/4-28	12	9	9	7	18	13	9	7
5/16-18	20	15	16	12	30	22	16	12
5/16-24	23	17	19	14	33	24	19	14
3/8-16	40	30	25	20	55	40	25	20
3/8-24	40	30	35	25	60	45	35	25
7/16-14	60	45	45	35	90	65	45	35
7/16-20	65	50	55	40	95	70	55	40
1/2-13	95	70	75	55	130	95	75	55
1/2-20	100	75	80	60	150	110	80	60
9/16-12	135	100	110	80	190	140	110	80
9/16-18	150	110	115	85	210	155	115	85
5/8-11	180	135	150	110	255	190	150	110
5/8-18	210	155	160	120	290	215	160	120
3/4-10	325	240	255	190	460	340	255	190
3/4-16	365	270	285	210	515	380	285	210
7/8-9	490	360	380	280	745	550	380	280
7/8-14	530	390	420	310	825	610	420	310
1-8	720	530	570	420	1100	820	570	420
1-14	800	590	650	480	1200	890	650	480

Description	Drawing No.	Sheet No	Revision Level	Change Date
Drawing, Installation, Fire Pump, CFP11E (QSM)	15551		F	
Options, Engine, Fire Pump, Construction, CFP11E (QSM)	8740		H	
Assy, Engine Mounting CFP11E	8773			
Assembly, Heat Exchanger QSM	8792		H	
Assembly, Heat Exchanger Support QSM	15616		-	
Assembly, Heat Shield	16690			
Assembly, Pulley Guard	9631			
Assembly, Air Cleaner	16694			
Assembly, Charge Air Cooling, QSM11	8969		B	
Assembly, Plumbing, CAC Heat Exchanger, QSM	11048		E	
Assembly, Coolant Heater, QSM	8950		F	
Assembly Sensor Package, QSM11	15603		A	
Assembly, Operator's Station QSM11	15507		B	
Assembly, All Component top Level Assy consisting of:	CFP11E-AC-2013			
Assembly, Panel, Digital Electronic	22791		-	
Assembly, Harness, CFP11E	21224		B	
Kit, Loose Wires, QSM Fire Pump	16232		-	
Kit, Fuel Lines CFP11E	15209			
Misc Piping, Cooling Loop, Raw Water	11049		C	
Assembly, Raw Water Cooling Loop 1"	9659		G	
Assembly, Stub-Shaft, SAE#3, 2.25"	9679		D	
General Layout, Fire Pump, CFP11E	16018	1-4	C	
Schematic, Control Panel, Electronic	16260	1-7	D	3/14

Also see Engine Identification and System Diagrams in Sec 2.
The most current revisions to these drawings and related documents accessible at: http://www.cumminsfirepower.com/products.html.

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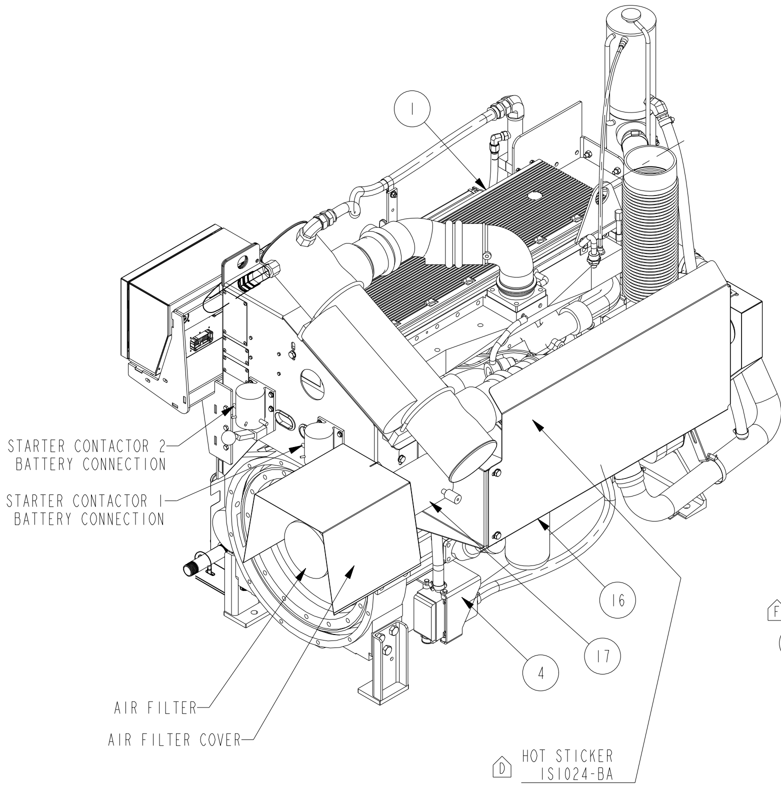

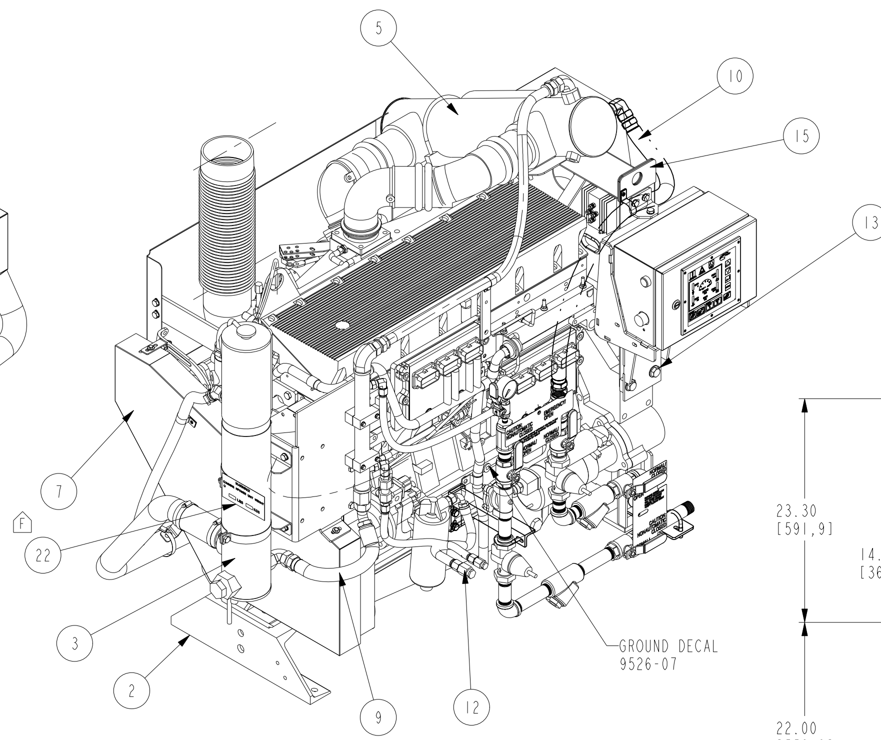

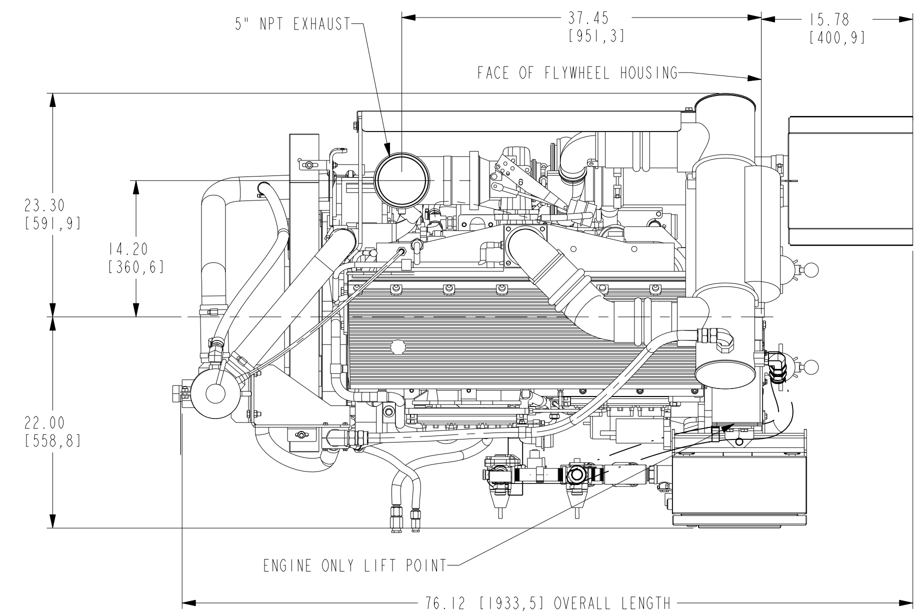

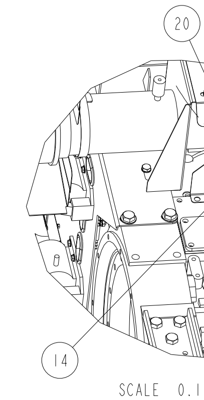

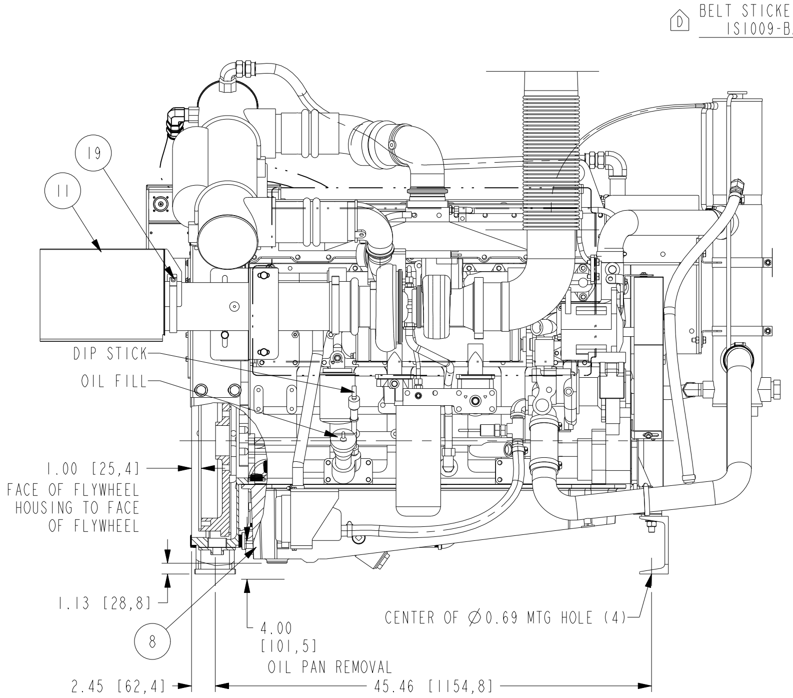

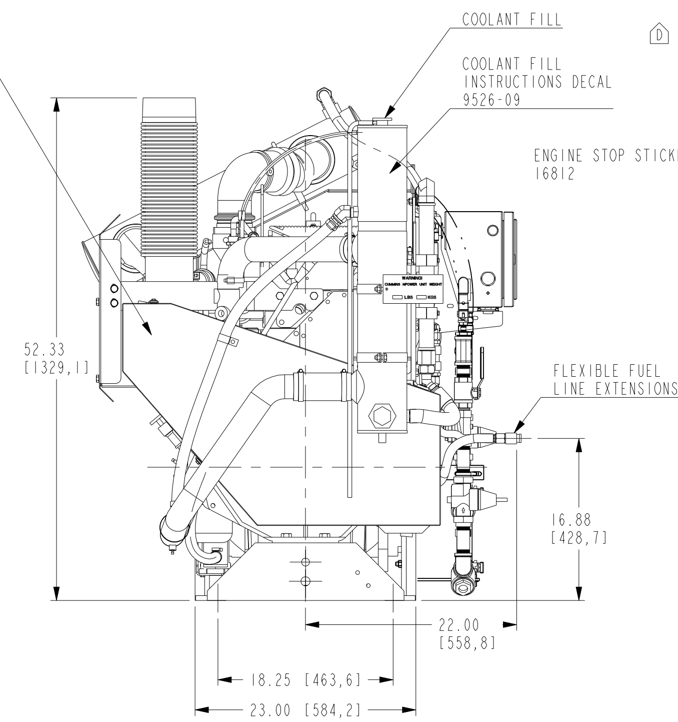

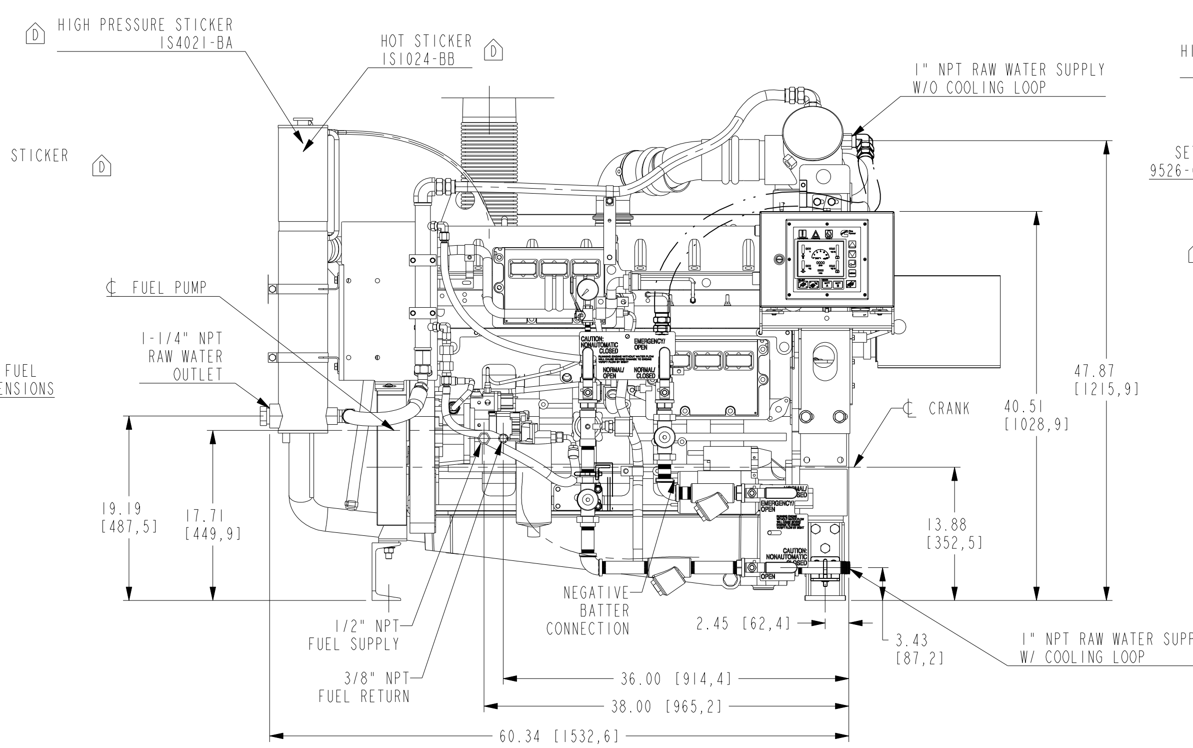

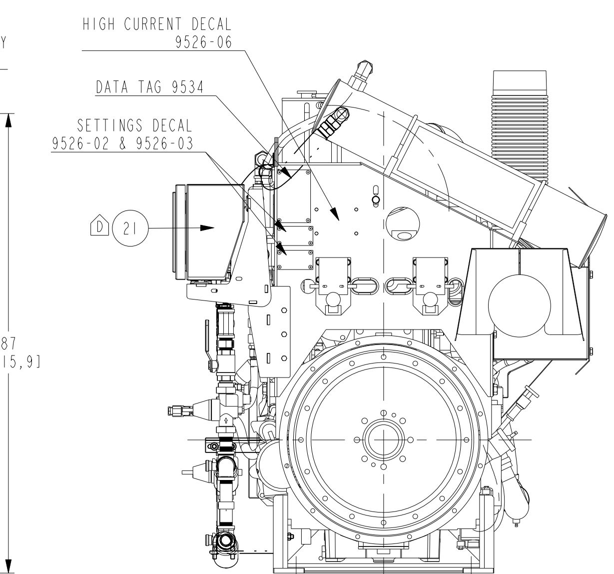

BILL OF MATERIAL

ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	ASSEMBLY, ENGINE, QSM11, FIREPUMP	8740
2	1	ASSEMBLY, MOUNTING, ENGINE, CFP11E	8773
3	1	ASSEMBLY, HEAT EXCHANGER, CFP11E	8792
4	1	ASSEMBLY, COOLANT HEATER, CFP11E, 2250W 120V 60HZ	8950
5	1	ASSEMBLY, CHARGE AIR COOLER, CFP11E, FIREPUMP	8969
6	1	EXHAUST,L 90 HALF MARMON, 5" MALE NPT	9514-01
7	1	ASSEMBLY, PULLEY GUARD, CFP11E	9631
8	1	COOLING LOOP, 1" NPT HX, FIREPUMP	9659
9	1	ASSEMBLY, CAC WATER CONNECTION, CFP11E	11048
10	1	ASSEMBLY, MISC PIPING, CFP11E	11049
11	1	COVER, AIR CLEANER, FITS 5" O.D. TUBING	14799
12	1	KIT, FUEL LINES, CFP11E, F10/20 - EXT ONLY	15209
13	1	ASSEMBLY, OPERATOR STATION, CFP11E	15507
14	1	KIT, SENSOR & ADAPTER, CFP11E	15603
15	1	ASSEMBLY, HEAT EXCHANGER SUPPORT, CFP11E	15616
16	1	ASSEMBLY, HEAT SHIELD, CFP11E	16690
17	1	ASSEMBLY, AIR CLEANER, CFP11E	16694
E 18	1	KIT, WIRE HARNESS, CFP11E	21224
19	1	CLAMP, T-BOLT, 5.00-5.31	13164-0525
20	1	HEAT SHIELD, SENSOR, CFP11E	15625
21	1	DECAL, MANUAL START/STOP, ELECTRONIC ENGINES	15749
22	1	TAG, ENGINE WEIGHT	16825

REV	ECO	DESCRIPTION OF REVISION	REV BY	DATE
F	2012-281	ADDED TAG 16825	PBS	13JUL2012
E	2012-058	REPLACE 16136 WITH 21224	S DUBICK	27FEB2012
D	2011-057	UPDATE STICKERS PER SIX SIGMA	S DUBICK	11MAY2011

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1°	MACHINED SURFACES	IMPERIAL UNITS	METRIC UNITS
THIRD ANGLE PROJECTION	125	MACHINE TOLERANCES .XX = ± 0.010 .XXX = ± 0.005 FORM TOLERANCES .XX = ± 0.030 .XXX = ± 0.015 FAB TOLERANCES .XX = ± 0.060 .XXX = ± 0.030	MACHINE TOLERANCES .X = ± 0.4 .XX = ± 0.2 FORM TOLERANCES .X = ± 0.8 .XX = ± 0.4 FAB TOLERANCES .X = ± 1.5 .XX = ± 0.8

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1600 BUERKLE ROAD
WHITE BEAR LAKE, MN
WWW.CUMMINSFIREPOWER.COM

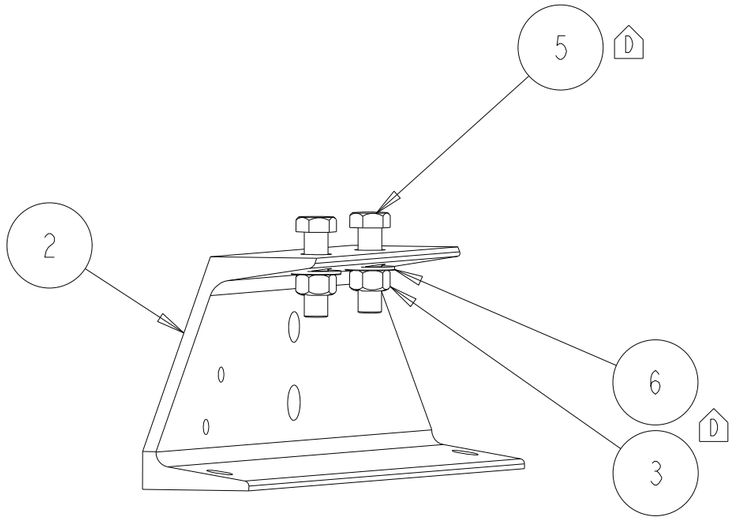
CUSTOM DESIGN
AND UPFIT CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

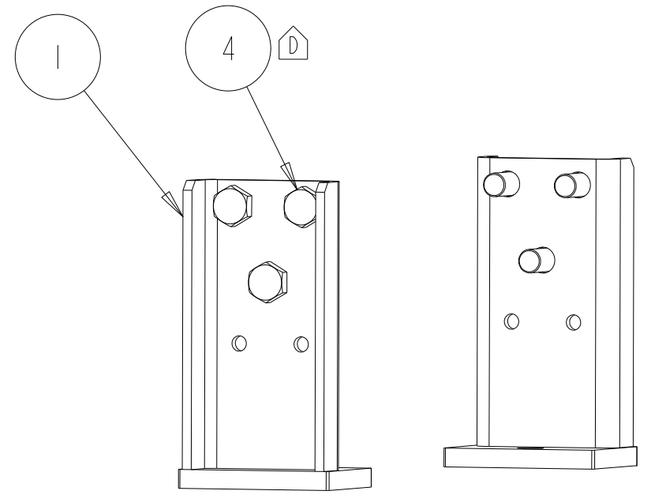
ASSEMBLY, POWER MODULE
CFP11E-F10/20

DWG UNITS: IN/LB/S	DRAWN BY: DAN PRO-ENGINEER	DATE: 21-SEP-09 INIT ECO:
SCALE: 0.100 EST WEIGHT: 2795.000	SHEET 1 OF 1	DRAWING NO: 15551

BILL OF MATERIAL

ITEM	QTY	DESCRIPTION	PART NUMBER
1	2	SUPPORT, ENGINE, REAR, FIREPUMP, L10/QSM11	8781
2	1	BRACKET, SUPPORT, ENGINE, FRONT, FIREPUMP, QSM11	8783
3	2	NUT,HEX,PT, .63-11	20130-063
4	6	SCREW,HH, 0.63-11x1.25	20263-125
5	2	SCREW,HH, 0.63-11x2.25	20263-225
6	2	WASHER,FLAT,SMALL, 0.63	20010-063





REV	ECO	DESCRIPTION OF REVISION	REV BY	DATE
D	2011-057	ADD FASTENERS PER SIX SIGMA	S DUBICK	11-MAY-11

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1°

THIRD ANGLE PROJECTION

IMPERIAL UNITS	METRIC UNITS
MACHINE TOLERANCES .XX = ± 0.010 .XXX = ± 0.005	MACHINE TOLERANCES .X = ± 0.4 .XX = ± 0.2
FORM TOLERANCES .XX = ± 0.030 .XXX = ± 0.015	FORM TOLERANCES .X = ± 0.8 .XX = ± 0.4
FAB TOLERANCES .XX = ± 0.060 .XXX = ± 0.030	FAB TOLERANCES .X = ± 1.5 .XX = ± 0.8

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CUSTOM DESIGN
AND UPFIT CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

ASSEMBLY, MOUNTING, ENGINE CFP11E

DWG UNITS: IN/LB/S

DRAWN BY: DAVE N

PRO-ENGINEER

DATE: 12APR2004

INIT ECO:

SCALE: 0.250

EST WEIGHT: 30.967

SHEET 1 OF 1

DRAWING NO: 8773

PN8740
SO35246
ModelQSM11
ConfigD353014CX03

Option	Desc
FIRE 24	QSM11
AD 2061	PULLEY,ACCESSORY
AP 2077	APPROVAL,AGENCY
BB 2712	BLOCK,CYLINDER
BB 2737	PLUMBING,CYLINDE
BR 2033	BREATHER,CRANKCA
BR 2722	PLUMBING,CRC BRE
CH 2021	AID,COO HEATER S
CI 2705	PLUMBING,CPR AIR
CP 2063	COMPRESSOR,AIR
CP 2709	MOUNTING,AIR COM
DA 2078	DAMPER,VIBRATION
DF 2036	DRIVE,FRO GER TR
DL 2031	LOCATION,DRAIN
DO 2422	SOFTWARE,CUS INT
DP 2701	DRIVE,FUEL PUMP
EA 2036	ACCESSORIES,ELEC
EB 2047	BRAKE,ENGINE
EC 2701	THERMOSTAT
EE2069	Alternator, 12V, 100A, Delco 24SI
EH 2154	MOUNTING,ALTERNA
EH 2735	DRIVE,ALTERNATOR
EM 2038	SUPPORT,FRONT EN
FA 2118	DRIVE,FAN
FCXJ 2	CALIBRATION,FUEL
FCZ 3	CALIBRATION,FUEL
FF 2241	FILTER,FUEL
FF 2743	FITTING,FUEL PUM
FH 2158	HOUSING,FLYWHEEL
FP 2954	PUMP,FUEL
FP 2957	COUPLING,FUEL PU
FR20091	RATING,FUEL
FT20072	PLUMBING,FUEL
FW 2141	FLYWHEEL
GG 2701	COVER,FRONT GEAR
HC 2001	PLUMBING,CABIN H
IC 2068	CONNECTION, AIR I
IT 2002	CONNECTION, AIR T
LA 2053	ARRANGEMENT,LIFT
LC 2766	HEAD,OIL FILTER
LF 2054	FILTER,FULL FLOW
LG 2066	GAUGE,OIL LEVEL
LP 2711	PUMP,LUBRICATING
LT 2025	LITERATURE
NN 2713	NAMEPLATE
OB 2430	ARRANGEMENT,OIL
OB 2701	COVER,HAND HOLE
OP 2103	PAN,OIL
PH 2017	LOCATION,ENG CNT
PH 2810	MODULE,ENGINE CO
PP 2829	PARTS,PERFORMANC
PP20007	TURBOCHARGER
PU 2002	PULLEY,ACCESSORY
PW 2079	POWER,PROGRAMMAB
RL 2711	LEVER,ROCKER
RP 2708	PLUMBING,RADIATO
SC20698	SOFTWARE,CALIBRA
SK 2003	ARRANGEMENT,SHIP
SK 2705	BRACKET,SHIPPING
SM 2704	MOUNTING,STARTIN
SS 1097	PAINT
ST 2025	MOTOR,STARTING
TB 2287	ARRANGEMENT,TURB
TB 2723	MOUNTING,EXHAUST
TB 2731	MOUNTING,INTAKE
TH 2086	HOUSING,THERMOST
TH 2762	PLUMBING,THM HOU
TP 2810	PLUMBING,TURBOCH
VC 2086	COVER,VALVE
WF 2031	RESISTOR,CORROSI
WH 2702	PLUMBING,OIL COO
WP 2020	PUMP,WATER
WP 2703	ARRANGEMENT,WATE
WR 2045	HARNESS,ENG CNT
WR 2732	HARNESS,ETR CNT
XS 2017	CONNECTION,EXHAU

BUILT BEFORE JANUARY 1, 2007

NOTES:

GENERIC CALIBRATION (DO2374) REPLACED WITH X-CAL REV F DATED 11/08/2004 BY CUMMINS FIREPOWER / CUMMINS NPOWER ON ASSEMBLY LINE

X-CAL REV F REPLACED BY X-CAL REV L DATED 08/23/2005 TO SOLVE MISFIRE SITUATION

PIR (PRODUCT INCIDENT REPORT) # RGJ051019-01 FILED BY BOB JANQUART

X-CAL REV F REPLACED BY RELEASED INCAL DO2422 IN SEPTEMBER 2005 INCAL RELEASE

DO2422 REPLACED BY X-CAL REV S DATED 12/20/2005 BY CUMMINS NPOWER / CUMMINS FIREPOWER. X-CAL REVISION S (FINAL REVISION TO CORRECT SENSOR GLOBAL DEFAULT ISSUE). X-CAL REV S SCHEDULED TO BE RELEASED AS DO 2422 REV B FEBRUARY 2006

PN8740
SO35246
ModelQSM11
ConfigD353014CX03

Option	Desc
FIRE 24	QSM11
AD 2061	PULLEY,ACCESSORY
AP 2119	APPROVAL,AGENCY
BB 2712	BLOCK,CYLINDER
BB 2816	PLUMBING,CYLINDE
BR 2033	BREATHER,CRANKCA
BR 2722	PLUMBING,CRC BRE
CH 2021	AID,COO HEATER S
CI 2705	PLUMBING,CPR AIR
CP 2063	COMPRESSOR,AIR
CP 2709	MOUNTING,AIR COM
DA 2078	DAMPER,VIBRATION
DF 2036	DRIVE,FRO GER TR
DL 2031	LOCATION,DRAIN
DO 2422	SOFTWARE,CUS INT
DP 2701	DRIVE,FUEL PUMP
EA 2043	ACCESSORIES,ELEC
EB 2047	BRAKE,ENGINE
EC 2701	THERMOSTAT
EE2069	Alternator, 12V, 100A, Delco 24SI
EG 2706	PANEL,ENGINE INS
EH 2154	MOUNTING,ALTERNA
EH 2735	DRIVE,ALTERNATOR
EM 2038	SUPPORT,FRONT EN
FA 2118	DRIVE,FAN
FCXL 90	CALIBRATION,FUEL
FCZ 3	CALIBRATION,FUEL
FF 2241	FILTER,FUEL
FF 2743	FITTING,FUEL PUM
FH 2158	HOUSING,FLYWHEEL
FP 2954	PUMP,FUEL
FP 2957	COUPLING,FUEL PU
FR20091	RATING,FUEL
FT20097	PLUMBING,FUEL
FW 2141	FLYWHEEL
GG 2701	COVER,FRONT GEAR
HC 2001	PLUMBING,CABIN H
IC 2068	CONNECTION,AIR I
IT 2005	CONNECTION,AIR T
LA 2053	ARRANGEMENT,LIFT
LC 2766	HEAD,OIL FILTER
LF 2054	FILTER,FULL FLOW
LG 2141	GAUGE,OIL LEVEL(LG2068 OPTIONAL)
LP 2711	PUMP,LUBRICATING
LT 2025	LITERATURE
NN 2713	NAMEPLATE
OB 2430	ARRANGEMENT,OIL
OB 2701	COVER,HAND HOLE
OP 2103	PAN,OIL (OP2149 OPTIONAL)
PH 2028	LOCATION,ENG CNT
PH 2856	MODULE,ENGINE CO
PP 2829	PARTS,PERFORMANC
PP20007	TURBOCHARGER
PP20056	MOUNTING,CYLINDE
PU 2002	PULLEY,ACCESSORY
PW 2180	POWER,PROGRAMMAB
RL 2711	LEVER,ROCKER
RP 2708	PLUMBING,RADIATO
SC20751	SOFTWARE,CALIBRA
SD 2707	SWITCH,OIL PRESS
SK 2003	ARRANGEMENT,SHIP
SK 2705	BRACKET,SHIPPING
SM 2704	MOUNTING,STARTIN
SS 2083	PAINT
ST 2025	MOTOR,STARTING
TB 2287	ARRANGEMENT,TURB
TB 2723	MOUNTING,EXHAUST
TB 2731	MOUNTING,INTAKE
TH 2086	HOUSING,THERMOST
TH 2762	PLUMBING,THM HOU
TP 2810	PLUMBING,TURBOCH
VC 2086	COVER,VALVE
WF 2031	RESISTOR,CORROSI
WH 2702	PLUMBING,OIL COO
WP 2020	PUMP,WATER
WP 2703	ARRANGEMENT,WATE
WR 2045	HARNESS,ENG CNT
XS 2017	CONNECTION,EXHAU

BUILT AFTER JANUARY 1, 2010

REV	DESCRIPTION OF REVISION	BY	DATE
H	ADDED LITERATURE	S DUBICK	08-04-10
G	UPDATE ENGINE SPEC	S DUBICK	03-18-10

UNLESS OTHERWISE NOTED
–
ALL DIMENSIONS ARE IN INCHES
–
APPLY MACHINE TOLERANCES
.X = ± 0.06
.XX = ± 0.010
.XXX = ± 0.001
–
APPLY WELDED TOLERANCES
.X = ± 0.25
.XX = ± 0.12
.XXX = ± 0.06

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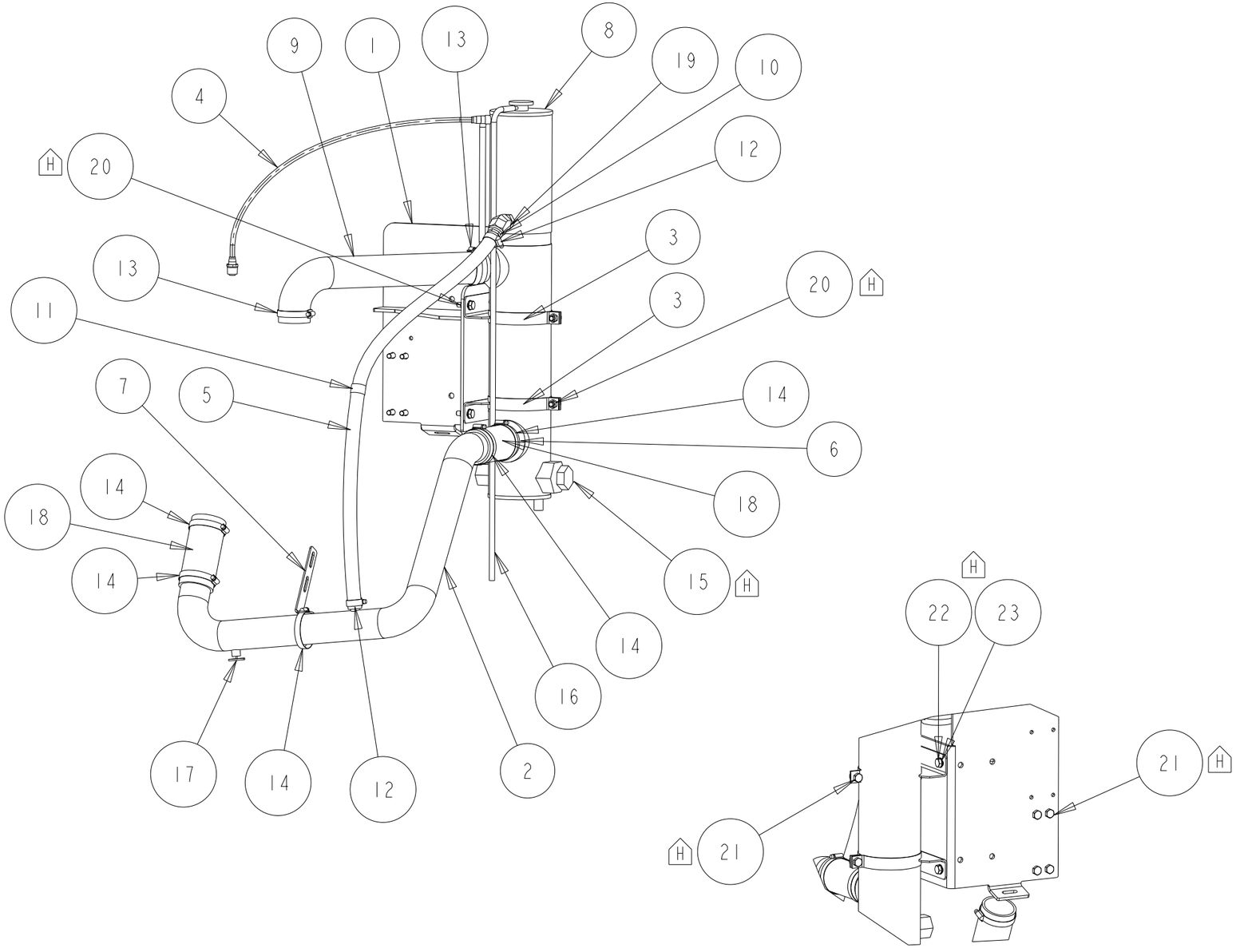
CUMMINS FIRE POWER
DESIGN CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN
WWW.CUMMINSFIREPOWER.COM

DWG SCALE: NTS	DRAWN BY: DAVE N	DATE: 23SEP2004
PLOT SCALE:	APPD BY:	DATE:

DESCRIPTION
ASSEMBLY, ENGINE, QSM11

REFERENCE:
CFP11E-F10/20

DRAWING NUMBER:
8740



BILL OF MATERIAL

ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	BRACKET, SUPT, HEAT EXCHANGER, CPF11	8789
2	1	TUBE, WATER OUTLET, QSM11, FIREPUMP	8793
3	2	CLAMP, SUPPORT, HEAT EXCHANGER, CHAMP #300385	8819
4	1	ASSEMBLY, VENT LINE, 3/16" x 32", FIREPUMP	9543
5	1	FILL HOSE, 3/4" ID X 20" LG #70232GL, -	80242GL_8792
6	1	BUSHING, 2.25" X 2.50"	904
7	1	BRACKET, MOUNTING, TUBE SUPPORT, FIREPUMP	8657
8	1	HEAT EXCHANGER, 5" DIA., 2-PASS, INTEGRAL TOP TANK	8687
9	1	HOSE, WATER OUTLET, FIREPUMP, CFP11E	8794
10	1	FTG, STR, -12 BARB X -12 NPT	12548-12-12
11	1	CLAMP, LOOM, 1", LTL-SCPV16627	13745
12	2	CLAMP, WORM, .88 - 1.25	14990-12
13	2	CLAMP, WORM, 1.81 - 2.75	14990-36
14	5	CLAMP, WORM, 2.06 - 3.00	14990-40
15	1	PLUG, NPT, PLASTIC, -20 (1-1/4") NPT	15255-20
16	1	TUBE, OVERFLOW, 5/16" ID x 36" LG, #27003	27003_8792
17	1	DRAIN VALVE, 1/4" NPT	80511
18	2	HOSE,DAYCO GOLD LABEL, 2.50" ID X 6" LG	77250GL-6IN
19	1	ELBOW, STREET, 45 DEG, STEEL, PARKER OR EQUIV.	LTL-SE3445
20	6	NUT,HEX,PT, M10-1.50	20140-M10
21	6	SCREW,HH, M10-1.50x25	20310-025
22	4	SCREW,HH, M10-1.50x30	20310-030
23	4	WASHER,FLAT, M10	20020-M10

H NOTE: APPLY THREAD SEALANT TO ALL NPT THREADS.

REV	ECO	DESCRIPTION OF REVISION	REV BY	DATE
H	2011-057	ADD FASTENERS PER SIX SIGMA	S DUBICK	11-MAY-11

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1°

THIRD ANGLE PROJECTION

IMPERIAL UNITS
MACHINE TOLERANCES
.XX = ± 0.010
.XXX = ± 0.005
FORM TOLERANCES
.XX = ± 0.030
.XXX = ± 0.015
FAB TOLERANCES
.XX = ± 0.060
.XXX = ± 0.030

METRIC UNITS
MACHINE TOLERANCES
.X = ± 0.4
.XX = ± 0.2
FORM TOLERANCES
.X = ± 0.8
.XX = ± 0.4
FAB TOLERANCES
.X = ± 1.5
.XX = ± 0.8

Cummins Fire Power

CUMMINS FIRE POWER LLC
CORPORATE OFFICE
1600 BUERKLE ROAD
WHITE BEAR LAKE, MN
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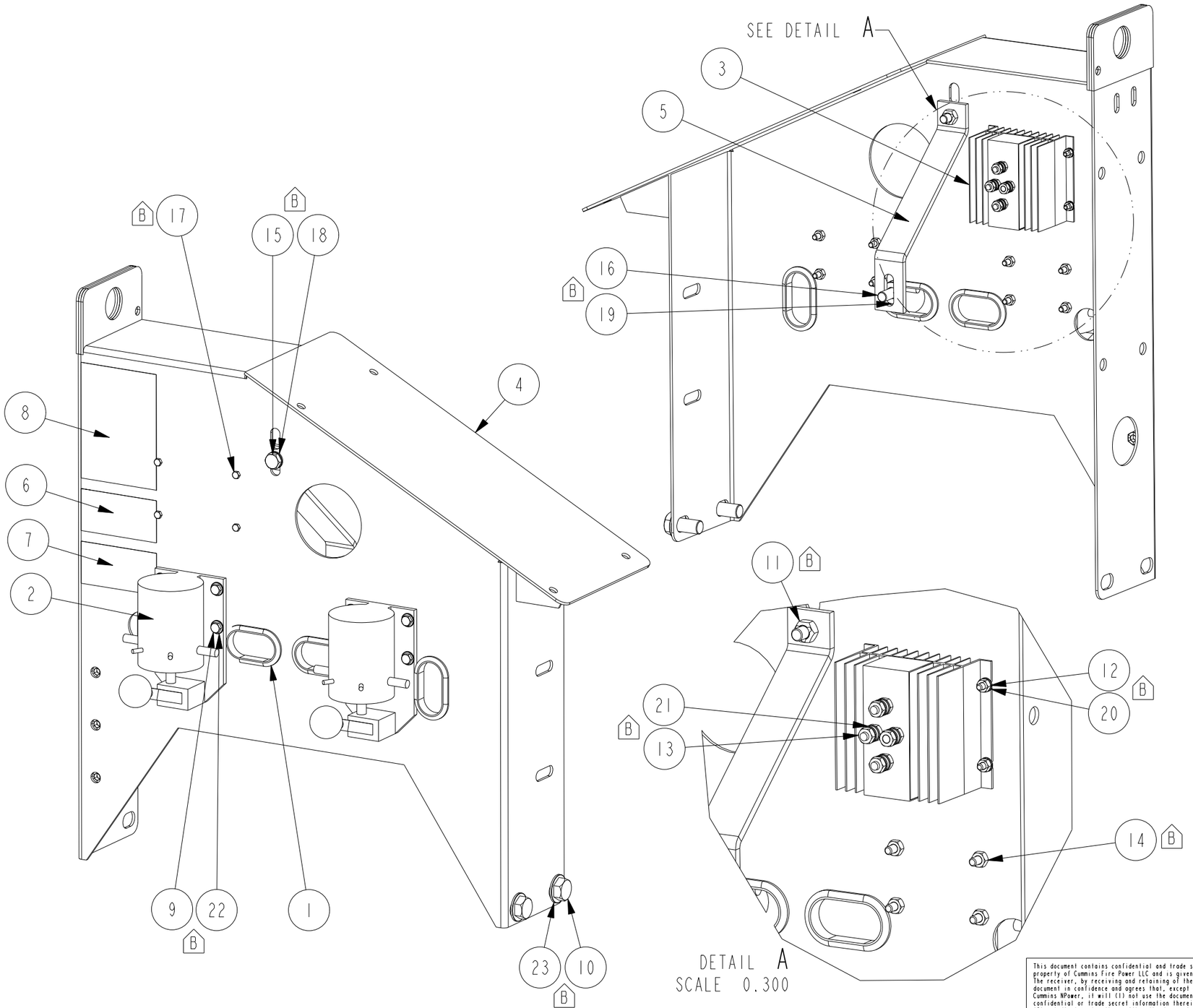
CUSTOM DESIGN
AND UPFIT CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

ASSEMBLY, HEAT EXCHANGER
CFP11E

DWG UNITS: IN/LB/S
DRAWN BY: DAVE N
PRO-ENGINEER
DATE: 07MAR2004
INIT ECO:
SCALE: 0.100
EST WEIGHT: 105.563
SHEET 1 OF 1
DRAWING NO: 8792



DETAIL A
SCALE 0.300

BILL OF MATERIAL

ITEM	QTY	DESCRIPTION	PART NUMBER
1	3	GROMMET, 1.5 x 2.75 OVAL	508-1057
2	2	CONTACTOR, MANUAL OVERIDE, CFP	8824
3	1	BATTERY ISOLATOR, FIRE PUMP	8838
4	1	BRACKET, MOUNTING, OPERATORS STATION, QSMII	9511
5	1	BRACKET, STIFFENER, OPERATOR STATION, QSMII	9512
6	1	FACTORY SETTINGS TAG, FIREPUMP	9526-02
7	1	FIELD SETTINGS TAG, FIREPUMP	9526-03
8	1	DATA TAG, FIREPUMP	9534
9	8	SCREW,HH, 0.25-20x1.00	20225-100
10	2	SCREW,HH, 0.63-11x1.25	20263-125
11	1	NUT,HEX,PT, M10-1.50	20140-M10
12	4	NUT,HEX, M5-0.8	20120-M5
13	8	NUT,HEX, M6-1.0	20120-M6
14	8	NUT,HEX, 0.25-20	20100-025
15	1	SCREW,HH, M10-1.50x30	20310-030
16	1	SCREW,HH, M12-1.75x25	20312-025
17	4	SCREW,HH, M5-0.80x16	20305-016
18	1	WASHER,FLAT, M10	20020-M10
19	1	WASHER,FLAT, M12	20020-M12
20	4	WASHER,FLAT, M5	20020-M5
21	8	WASHER,FLAT, M6	20020-M6
22	8	WASHER,FLAT,SMALL, 0.25	20010-025
23	2	WASHER,FLAT,SMALL, 0.63	20010-063

REV	ECO	DESCRIPTION OF REVISION	REV BY	DATE
C	2012-467	DELETED RIVITS	PBS	23OCT2012
B	2011-057	ADD FASTENERS PER SIX SIGMA	S DUBICK	11-MAY-11

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1° | IMPERIAL UNITS | METRIC UNITS

THIRD ANGLE PROJECTION

MACHINE TOLERANCES
.XX : ± 0.010
.XXX : ± 0.005
FORM TOLERANCES
.XX : ± 0.030
.XXX : ± 0.015
FAB TOLERANCES
.XX : ± 0.060
.XXX : ± 0.030

MACHINE TOLERANCES
.X : ± 0.4
.XX : ± 0.2
FORM TOLERANCES
.X : ± 0.8
.XX : ± 0.4
FAB TOLERANCES
.X : ± 1.5
.XX : ± 0.8

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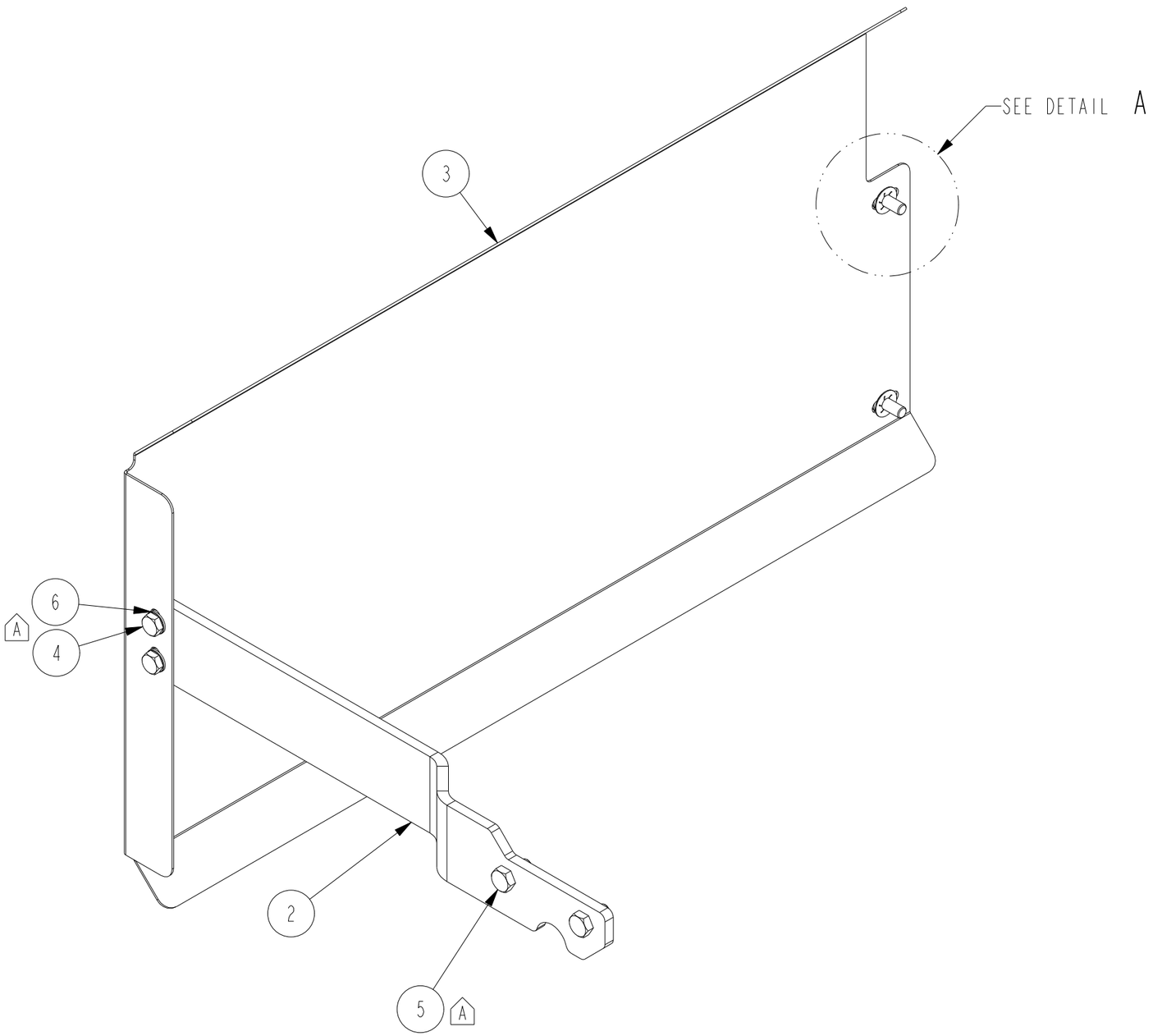
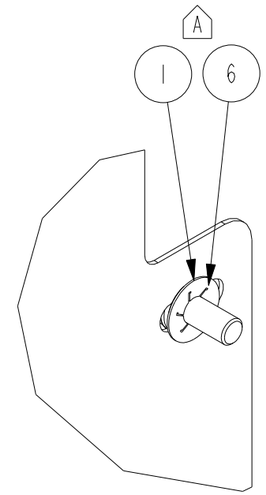
CUSTOM DESIGN
AND UPFIT CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

ASSEMBLY, HEAT EXCHANGER SUPPORT CFP11E

DWG UNITS: IN/LB/S
DRAWN BY: DAN
DATE: 22-SEP-09
PRO-ENGINEER
INIT ECO:
SCALE: 0.200
EST WEIGHT: 68.309
SHEET 1 OF 1
DRAWING NO: 15616



BILL OF MATERIAL			
ITEM	QTY	DESCRIPTION	PART NUMBER
1	4	WASHER, RETAINING, M10	16662-13
2	1	BRACKET, HEAT SHIELD MOUNTING, CFP11E	16691
3	1	HEAT SHIELD, CFP11E	16693
4	4	SCREW,HH, M10-1.50x25	20310-025
5	2	SCREW,HH, M12-1.75x25	20312-025
6	8	WASHER,FLAT, M10	20020-M10



TYPICAL FASTENERS
DETAIL A
SCALE 0.500

REV	ECO	DESCRIPTION OF REVISION	REV BY	DATE
A	2011-057	UPDATE FASTENERS PER SIX SIGMA	S DUBICK	11-MAY-11

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1°	IMPERIAL UNITS	METRIC UNITS
THIRD ANGLE PROJECTION	MACHINE TOLERANCES .XX : ± 0.010 .XXX : ± 0.005 FORM TOLERANCES .XX : ± 0.030 .XXX : ± 0.015 FAB TOLERANCES .XX : ± 0.060 .XXX : ± 0.030	MACHINE TOLERANCES .X : ± 0.4 .XX : ± 0.2 FORM TOLERANCES .X : ± 0.8 .XX : ± 0.4 FAB TOLERANCES .X : ± 1.5 .XX : ± 0.8

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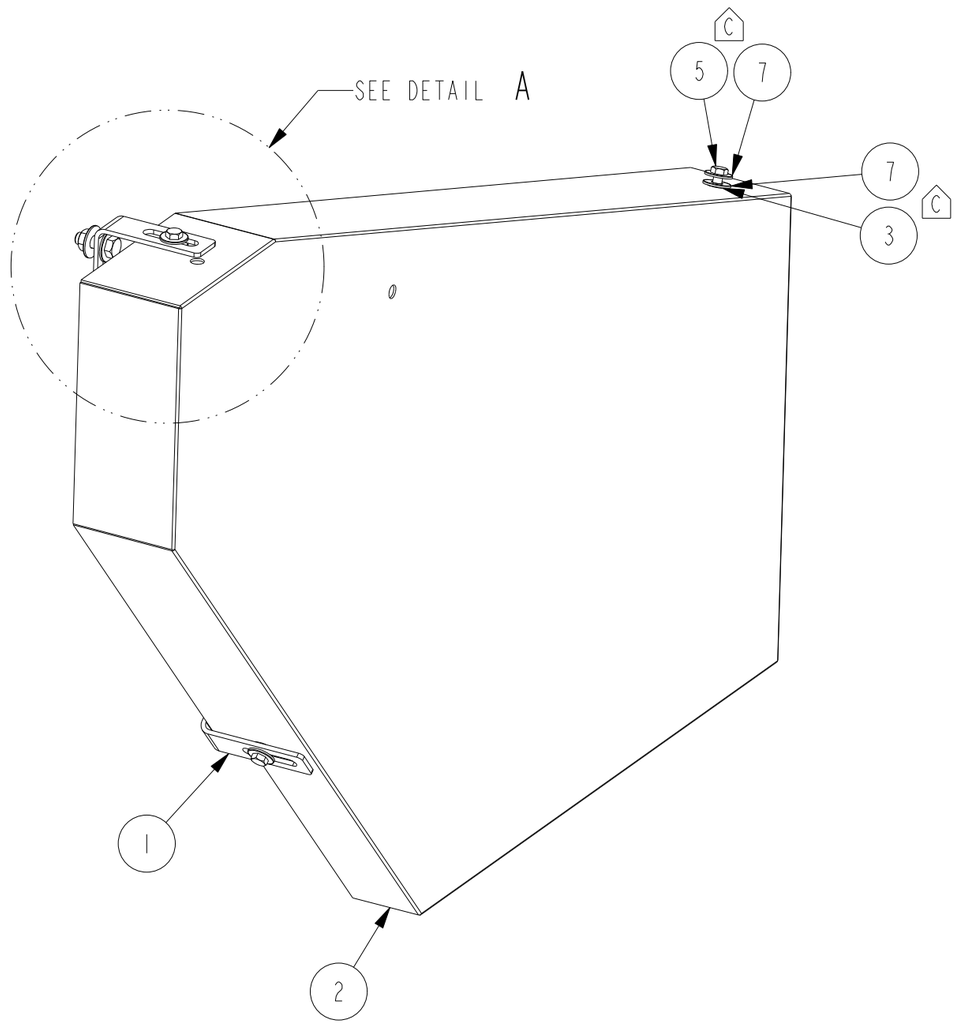
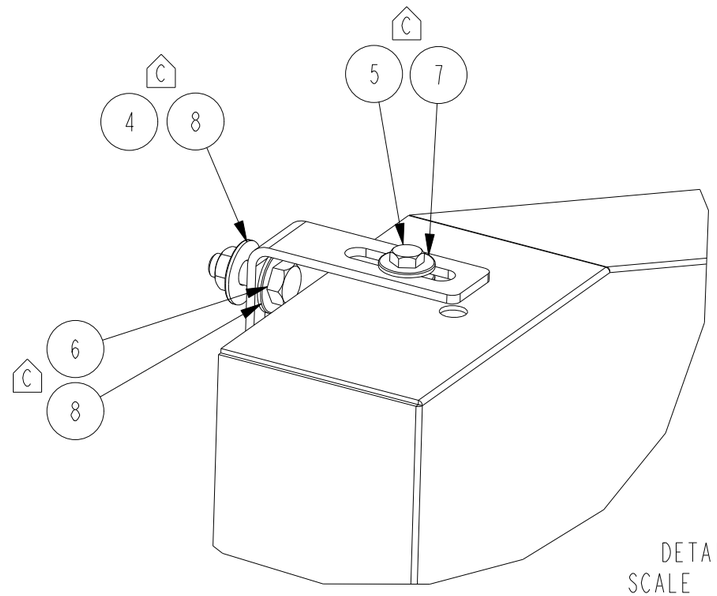
CUSTOM DESIGN
AND UPFIT CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

ASSEMBLY, HEAT SHIELD
CFP11E

DWG UNITS: IN/LB/S	DRAWN BY: DAN	DATE: 19-FEB-10
	PRO-ENGINEER	INIT ECO:
SCALE: 0.250	SHEET 1 OF 1	DRAWING NO: 16690
EST WEIGHT: 0.000		

BILL OF MATERIAL			
ITEM	QTY	DESCRIPTION	PART NUMBER
1	2	BRACKET, MOUNTING, GUARD, FIREPUMP	8593
2	1	GUARD, PULLEY, FIREPUMP, L10/QSM11	9632
3	3	WASHER, RETAINING, M6	16662-11
4	1	NUT,HEX,PT, M8-1.25	20140-M8
5	3	SCREW,HH, M6-1.00x16MM	20306-016
6	1	SCREW,HH, M8-1.25x25	20308-025
7	6	WASHER,FLAT, 0.25	20000-025
8	2	WASHER,FLAT, 0.31	20000-031





DETAIL A
SCALE 0.500

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1° | IMPERIAL UNITS | METRIC UNITS

THIRD ANGLE PROJECTION

	IMPERIAL UNITS	METRIC UNITS
MACHINE TOLERANCES	.X : ± 0.010 .XXX : ± 0.005	.X : ± 0.4 .XX : ± 0.2
FORM TOLERANCES	.XX : ± 0.030 .XXX : ± 0.015	.X : ± 0.8 .XX : ± 0.4
FAB TOLERANCES	.XX : ± 0.060 .XXX : ± 0.030	.X : ± 1.5 .XX : ± 0.8

REV	ECO	DESCRIPTION OF REVISION	REV BY	DATE
C	2011-057	UPDATE FASTENERS PER SIX SIGMA	S DUBICK	11-MAY-11

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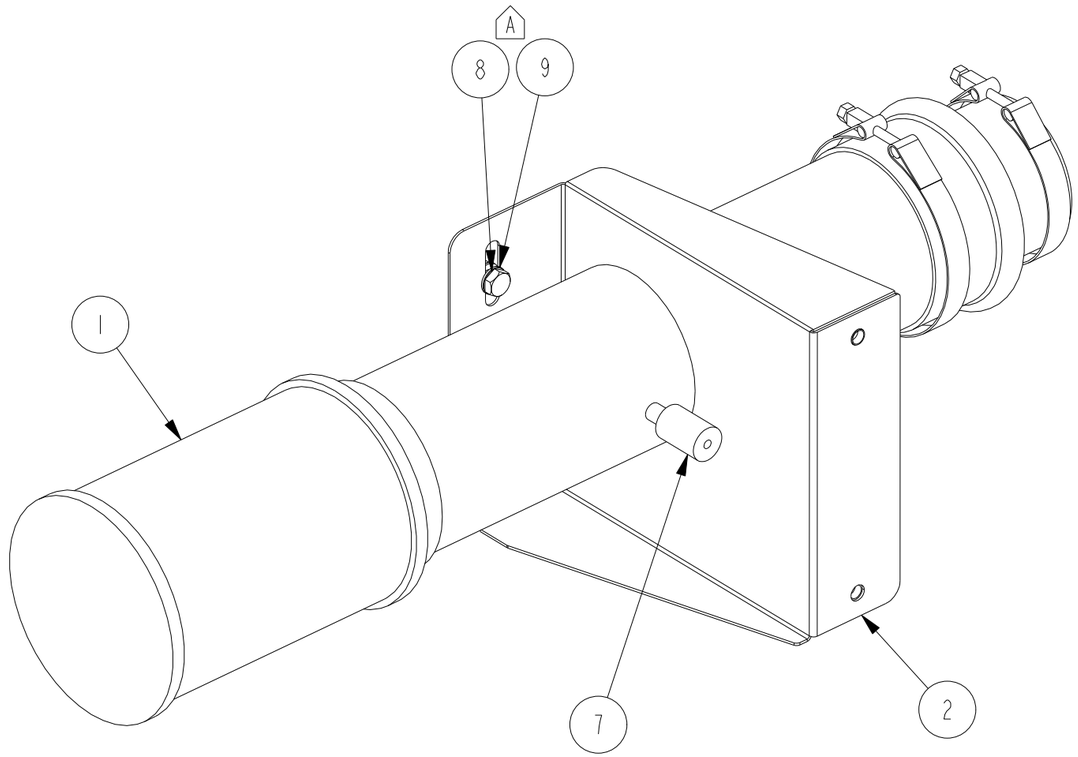
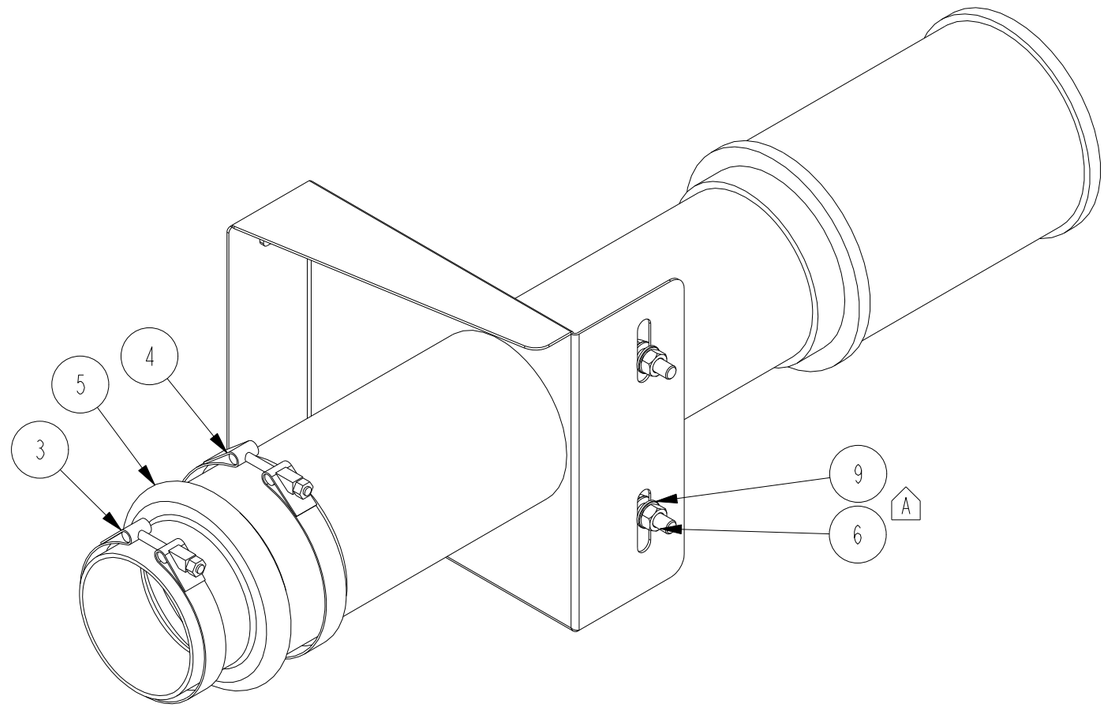
AND UPFIT CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

ASSEMBLY, PULLEY GUARD
CFP11E

DWG UNITS: IN/LB/S	DRAWN BY: DAVE N	DATE: 25OCT2005
	PRO-ENGINEER	INIT ECO:
SCALE: 0.250	SHEET 1 OF 1	DRAWING NO: 9631
EST WEIGHT: 13.853		





BILL OF MATERIAL

ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	AIR FILTER, 5" DIA. INLET, CFPIIE FIREPUMP	9608
2	1	AIRCLEANER MOUNTING, CFPIIE	16692
3	1	CLAMP, T-BOLT, 4.28-4.59	13164-0450
4	1	CLAMP, T-BOLT, 5.28-5.59	13164-0550
5	1	COUPLING, RUBBER, 4"x5", NELSON #89845K	89845K
6	2	NUT,HEX, M10-1.50	20120-M10
7	1	RESTRICTION INDICATOR, 1/8" NPT	RAX00-2352
8	2	SCREW,HH, M10-1.50x30	20310-030
9	4	WASHER,FLAT, M10	20020-M10

REV	ECO	DESCRIPTION OF REVISION	REV BY	DATE
A	2011-057	ADD FASTENERS PER SIX SIGMA	S DUBICK	11-MAY-11

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1° | IMPERIAL UNITS | METRIC UNITS

THIRD ANGLE PROJECTION

MACHINE TOLERANCES .XX : ± 0.010 .XXX : ± 0.005
FORM TOLERANCES .XX : ± 0.030 .XXX : ± 0.015
FAB TOLERANCES .XX : ± 0.060 .XXX : ± 0.030

MACHINE TOLERANCES .X : ± 0.4 .XX : ± 0.2
FORM TOLERANCES .X : ± 0.8 .XX : ± 0.4
FAB TOLERANCES .X : ± 1.5 .XX : ± 0.8

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CUSTOM DESIGN
AND UPFIT CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

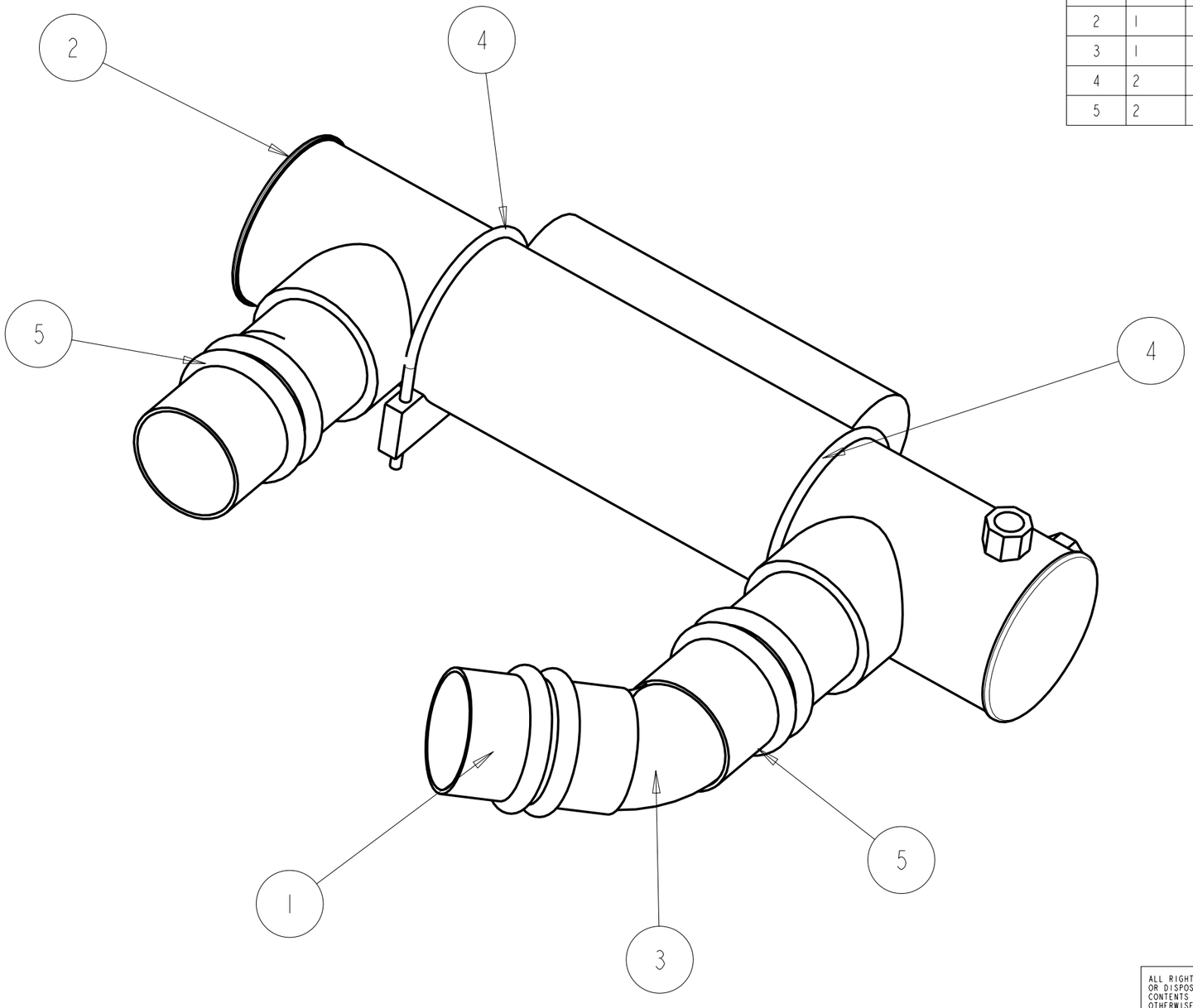
ASSEMBLY, AIR CLEANER CFPIIE

DWG UNITS: IN/LB/S | DRAWN BY: DAN | DATE: 19-FEB-10

PRO-ENGINEER | INIT ECO:

SCALE: 0.250 | SHEET 1 OF 1 | DRAWING NO: 16694

EST WEIGHT: 13.530



BILL OF MATERIAL

ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	COUPLING, RUBBER, MODIFIED CUMMIN NO. 3071049, FIREPUMP	8573
2	1	COOLER, CHARGE AIR, FIREPUMP, QSB5.9	8968
3	1	ELBOW, CAC, 4" DIA, 4-1/2" R., FIREPUMP	8949
4	2	U-BOLT CLAMP, 6.0"	89560K
5	2	COUPLING, RUBBER, 4", CUMMINS 3071049	IC2069

REV	DESCRIPTION OF REVISION	REV BY	DATE
B	REV PER CLAMPS	DAVE N	03MAR05
A	REV PER HEAT EXCHANGER	DAVE N	09SEP04

UNLESS OTHERWISE SPECIFIED
ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1°

IMPERIAL UNITS	METRIC UNITS
MACHINE TOLERANCES .X : ± 0.06 .XX : ± 0.010 .XXX : ± 0.001 WELD TOLERANCES X : ± 0.25 .XX : ± 0.12 .XXX : ± 0.06	MACHINE TOLERANCES X : ± 1.5 X.X : ± 0.5 X.XX : ± 0.05 WELDED TOLERANCES X : ± 5 X.X : ± 3 X.XX : ± 1.50

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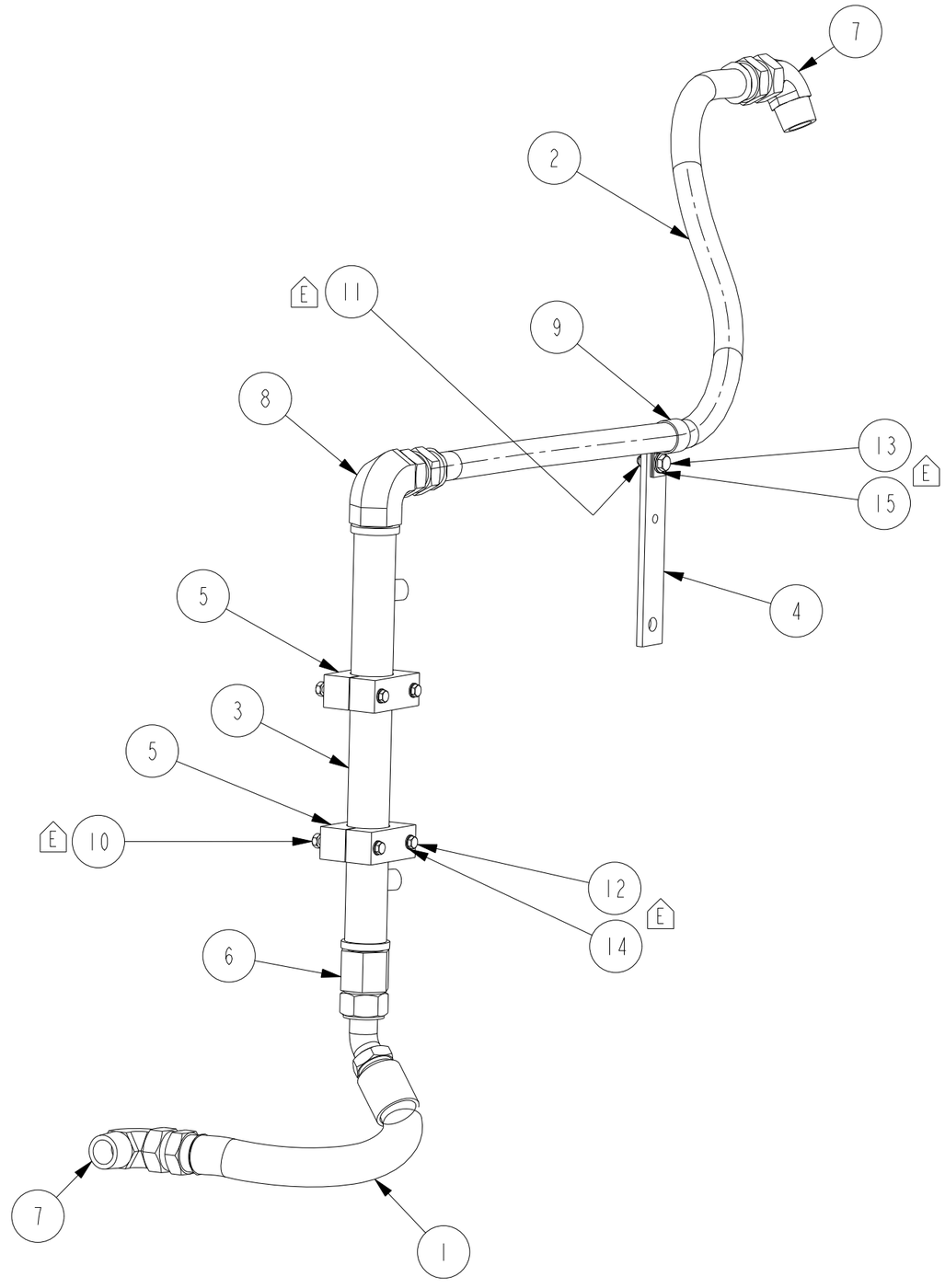
NPOWER SYSTEMS
DESIGN CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

TITLE 1: ASSEMBLY, CHARGE AIR COOLER, QSM11
TITLE 2: FIREPUMP

DWG UNITS:	DRAWN BY: DAVE N	DATE: 21JUN2004
IN/LB/S	APPD BY:	DATE:

EST WEIGHT:	SCALE:	DO NOT SCALE	SHEET	DRAWING NO:	REV:
42238.628	0.250		1OF1	8969	B



BILL OF MATERIAL

ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	HOSE, WATER, 16 JIC BOTH ENDS	11086-01
2	1	HOSE, WATER, 16 JIC BOTH ENDS	11086-02
3	1	FUEL COOLER, 1" NPT, VEMDOR #CM090204-1	9586
4	1	BRACKET,HOSE,SUPPORT,CFP11E, FIREPUMP	11524
5	2	CLAMP,HOSE,1.50 DIA,PLASTIC	11530
6	1	FTG, STR, -16 JIC X -16 FMNPT	12240-16-16
7	2	ELB, 90 DEG, -16 JIC X -16 NPT	12270-16-16
8	1	ELB, 90 DEG, -16 JIC X -16 FNPT	12273-16-16
9	1	CLAMP, LOOM, 1", LTL-SCPV16627	13745
10	4	NUT,HEX, M6-1.0	20120-M6
11	1	NUT,HEX, M8-1.25	20120-M8
12	4	SCREW,HH, M6-1.00x70MM	20306-070
13	1	SCREW,HH, M8-1.25x25	20308-025
14	4	WASHER,FLAT, M6	20020-M6
15	2	WASHER,FLAT, M8	20020-M8

E NOTE: APPLY THREAD SEALANT TO ALL NPT THREADS.

REV	ECO	DESCRIPTION OF REVISION	REV BY	DATE
E	2011-057	ADD FASTENERS PER SIX SIGMA	S DUBICK	11-MAY11

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1°

THIRD ANGLE PROJECTION

IMPERIAL UNITS	METRIC UNITS
MACHINE TOLERANCES .XX : ± 0.010 .XXX : ± 0.005	MACHINE TOLERANCES .X : ± 0.4 .XX : ± 0.2
FORM TOLERANCES .XX : ± 0.030 .XXX : ± 0.015	FORM TOLERANCES .X : ± 0.8 .XX : ± 0.4
FAB TOLERANCES .XX : ± 0.060 .XXX : ± 0.030	FAB TOLERANCES .X : ± 1.5 .XX : ± 0.8

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CUSTOM DESIGN
AND UPFIT CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

ASSEMBLY, CAC WATER CONNECTION
CFP11E

DWG UNITS: IN/LB/S

DRAWN BY: DAVE N

DATE: 14DEC2006

PRO-ENGINEER

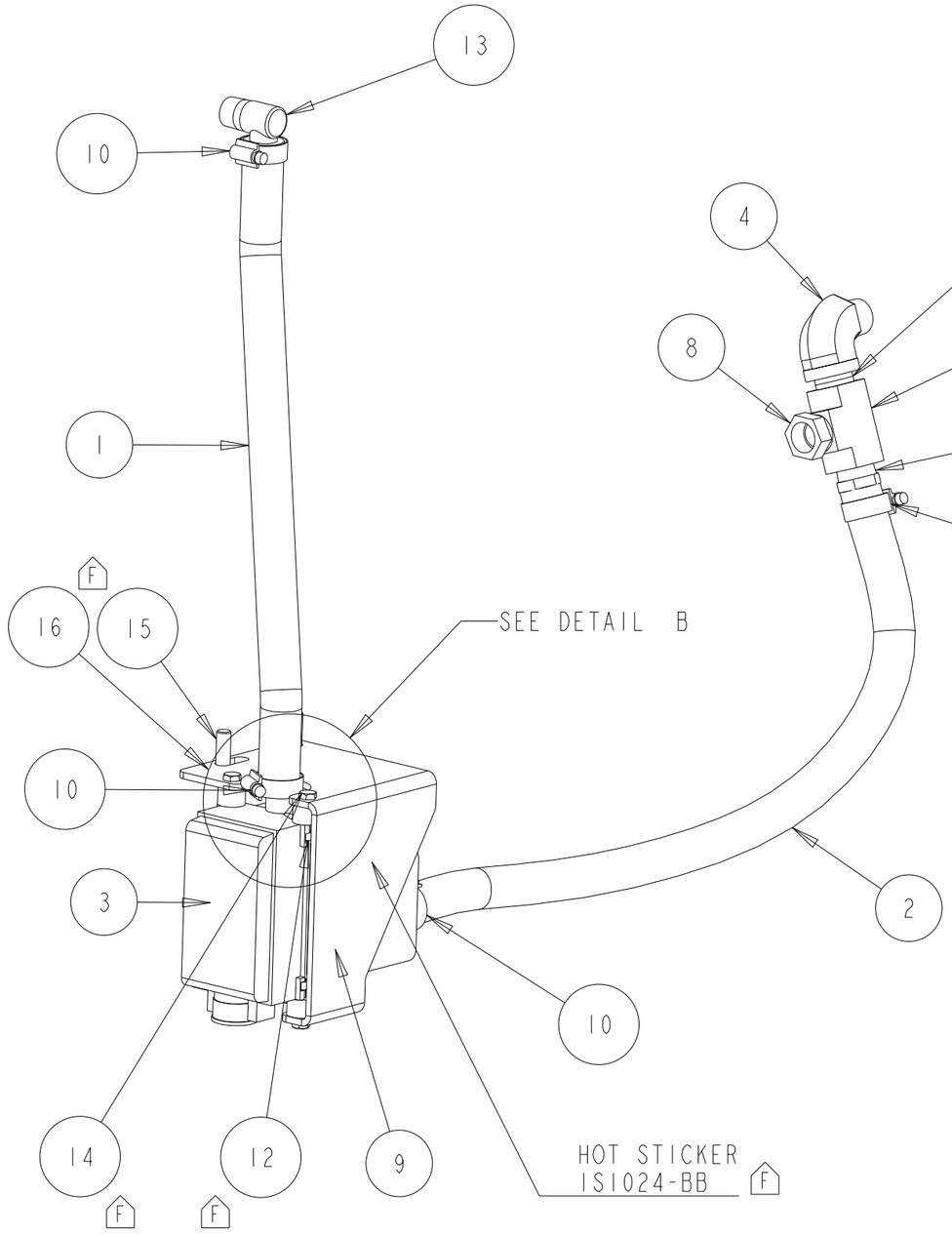
INIT ECO:

SCALE: 0.200

EST WEIGHT: 9.905

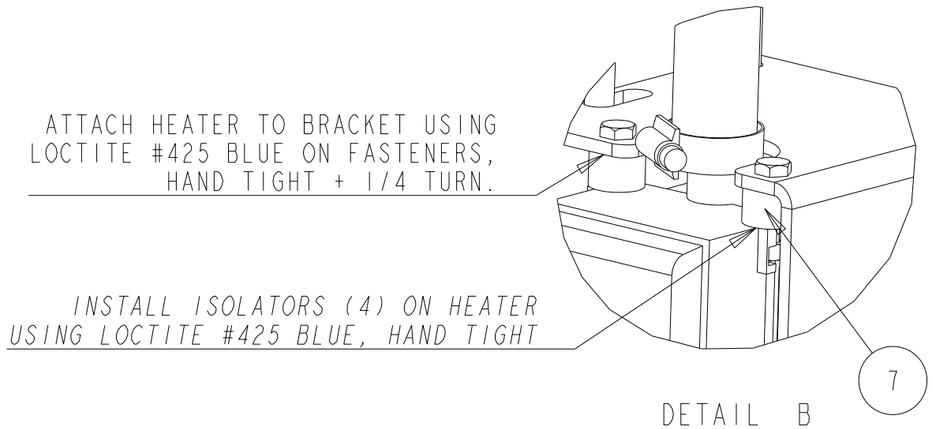
SHEET 1 OF 1

DRAWING NO: 11048



BILL OF MATERIAL

ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	HOSE, INLET, 80242GL X 26" LG	8951
2	1	HOSE, OUTLET, #80242GL X 27" LG, FIREPUMP	8952
3	1	CIRCULATION HEATER, P&T #3315033, 2250W , 120V , 176° F	9599
4	1	ELB, 90 DEG, -12 NPT X -12 FMNPT	12195-12-12
5	1	TEE, UNION, -12 NPT	12531-12
6	1	FTG, STR, -12 BEAD X -12 NPT	12545-12-12
7	4	ISOLATOR, STUD MOUNT, 1/4-20, TECH PRODUCTS #51201	13102
8	1	BUSH, RED, -12 NPT X -8 FNPT	14783-12-8
9	1	BRACKET, COOLANT HEATER, ISOLATED, OIL PAN FLANGE MOUNT	14821
10	4	CLAMP, WORM, .88 - 1.25	14990-12
11	1	NIPPLE, MARINE GRADE, 3/4" X 1-3/8"	15761
12	4	NUT,HEX, 0.25-20	20100-025
13	1	ADAPTER, 1/2" NPT X 3/4" 90° BARB	R-269HB-12-8
14	4	SCREW,HH, 0.25-20x0.50	20225-050
15	2	SCREW,HH, M10-1.50x30	20310-030
16	2	WASHER,FLAT, M10	20020-M10



DETAIL B
SCALE 0.500

F NOTE: APPLY THREAD SEALANT TO ALL NPT THREADS.

REV	ECO	DESCRIPTION OF REVISION	REV BY	DATE
F	2011-057	ADD FASTENERS PER SIX SIGMA	S DUBICK	11-MAY-11

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1°

THIRD ANGLE PROJECTION

IMPERIAL UNITS	METRIC UNITS
MACHINE TOLERANCES .XX : ± 0.010 .XXX : ± 0.005	MACHINE TOLERANCES .X : ± 0.4 .XX : ± 0.2
FORM TOLERANCES .XX : ± 0.030 .XXX : ± 0.015	FORM TOLERANCES .X : ± 0.8 .XX : ± 0.4
FAB TOLERANCES .XX : ± 0.060 .XXX : ± 0.030	FAB TOLERANCES .X : ± 1.5 .XX : ± 0.8

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CUSTOM DESIGN
AND UPFIT CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

ASSEMBLY, COOLANT HEATER
CFP11E

DWG UNITS: IN/LB/S

DRAWN BY: DAVE N

PRO-ENGINEER

DATE: 24MAY2004

INIT ECO:

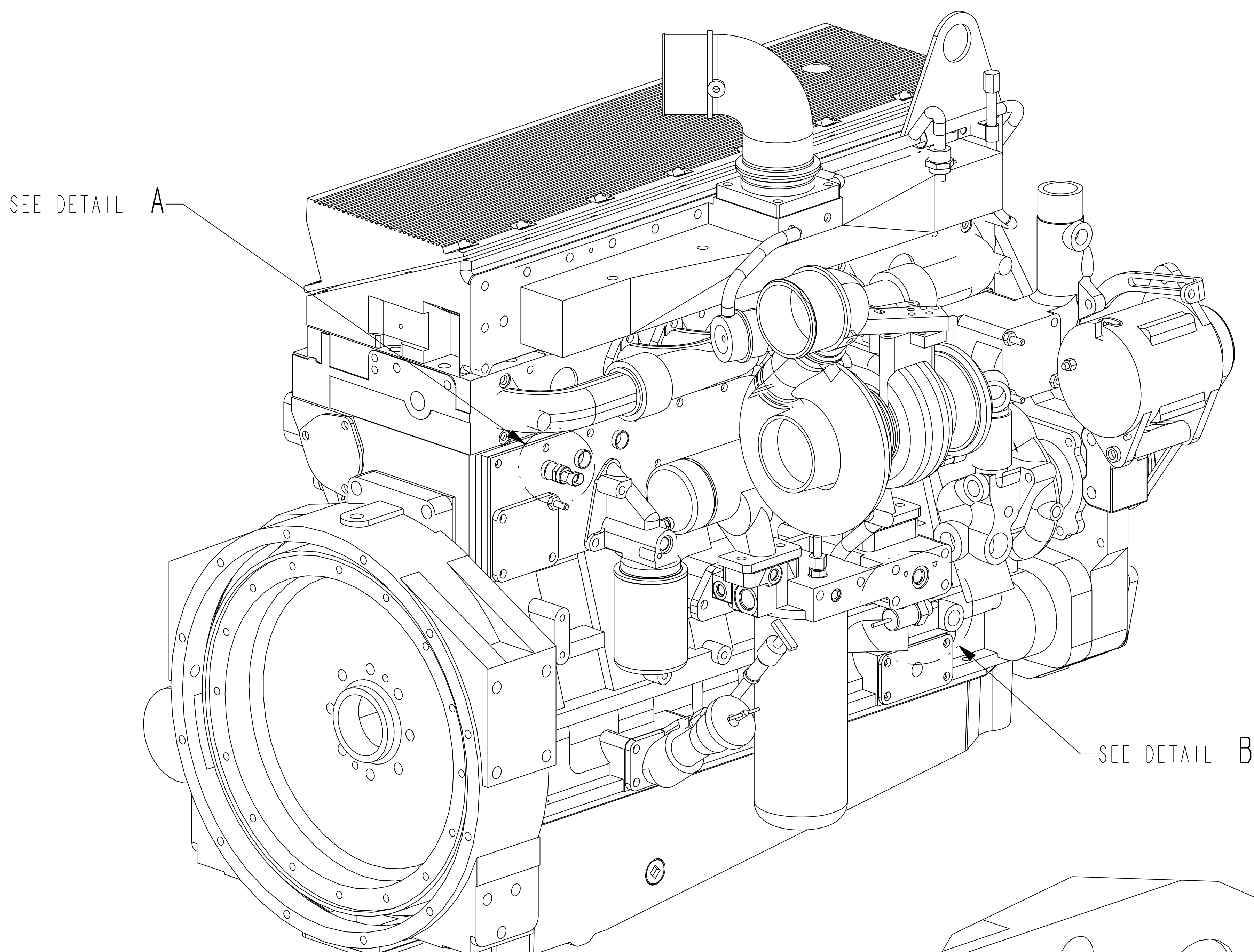
SCALE: 0.250

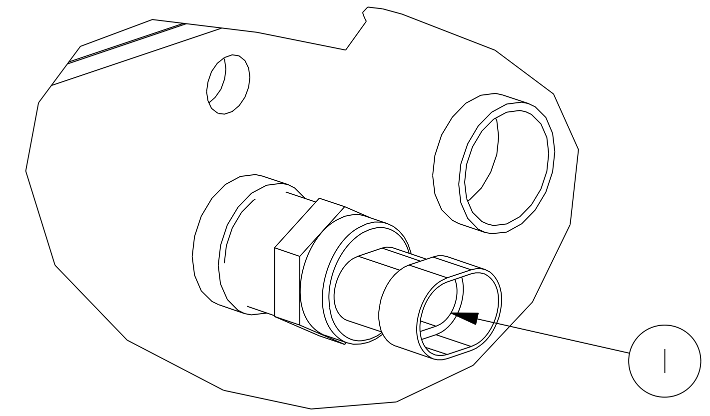
EST WEIGHT: 9.541

SHEET 1 OF 1

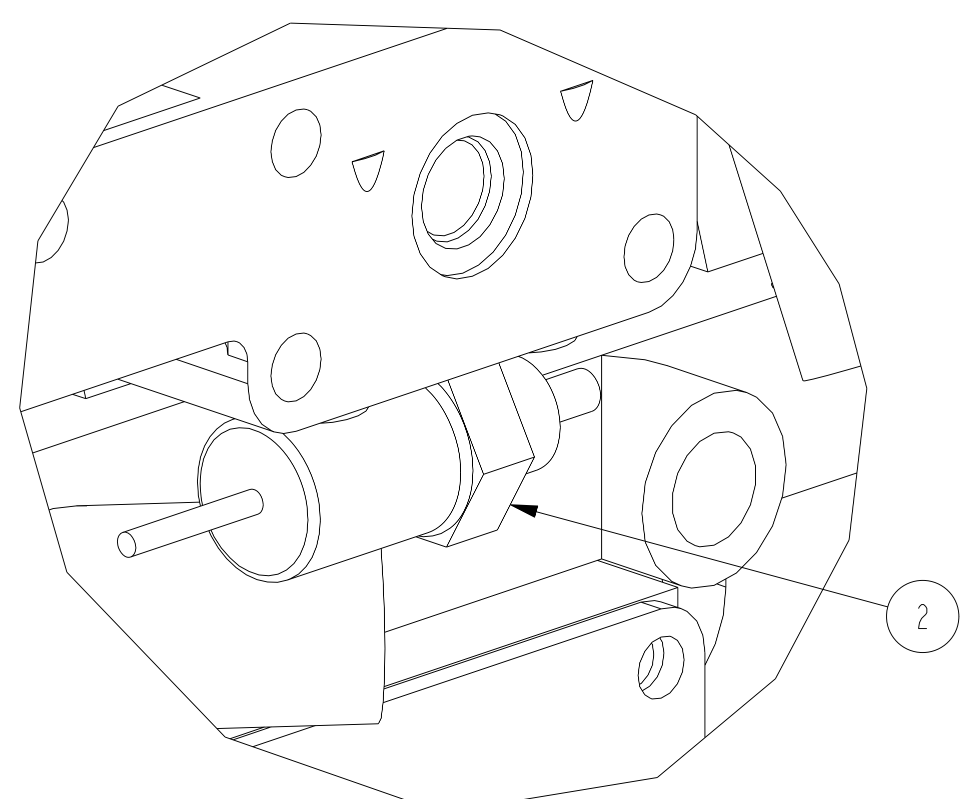
DRAWING NO: 8950

BILL OF MATERIAL			
ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	SWITCH, WATER TEMP, 200F SETTING, #3408632	8860
2 (A)	1	SWITCH, LOW COOLANT TEMP, 110 DEGREE F SET POINT	18105





DETAIL A
SCALE 0.750



DETAIL B
SCALE 0.750

NOTE:
1. OIL PRESSURE SENSORS COME ON ENGINE

REV	ENF	DESCRIPTION OF REVISION	REV BY	DATE
A	2010-567	ADDED ITEM 18105.	PBS	20DEC2010

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1°	IMPERIAL UNITS	METRIC UNITS
THIRD ANGLE PROJECTION	MACHINE TOLERANCES .XX = ± 0.010 .XXX = ± 0.005 FORM TOLERANCES .XX = ± 0.030 .XXX = ± 0.015 FAB TOLERANCES .XX = ± 0.060 .XXX = ± 0.030	MACHINE TOLERANCES .X = ± 0.4 .XX = ± 0.2 FORM TOLERANCES .X = ± 0.8 .XX = ± 0.4 FAB TOLERANCES .X = ± 1.5 .XX = ± 0.8

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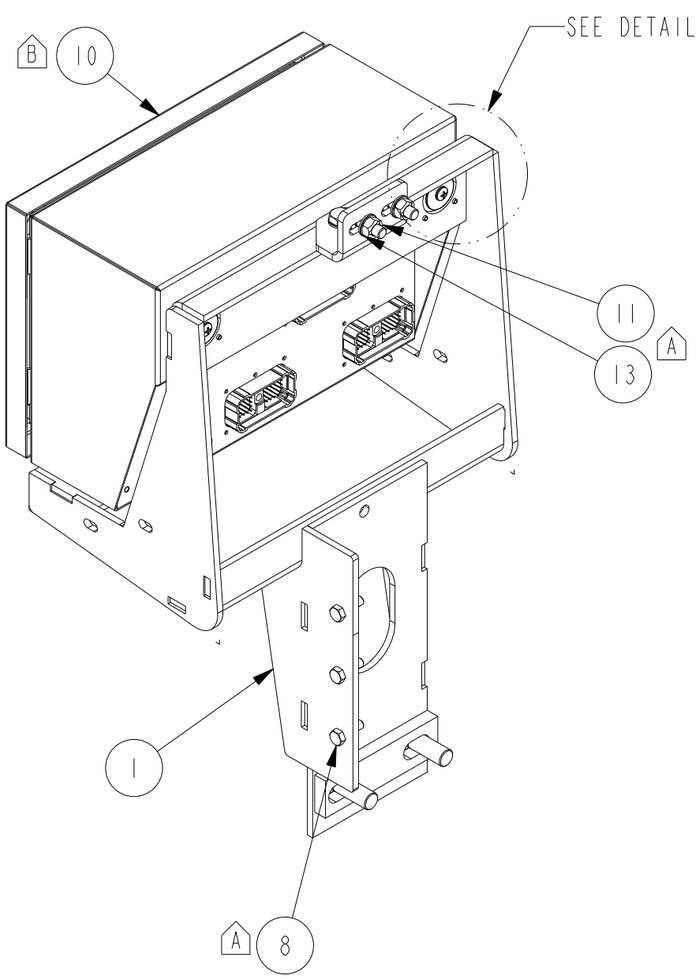
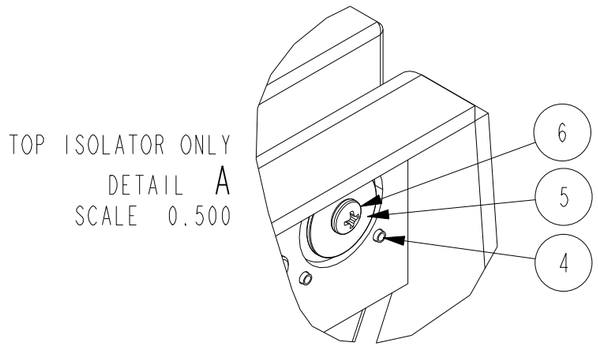
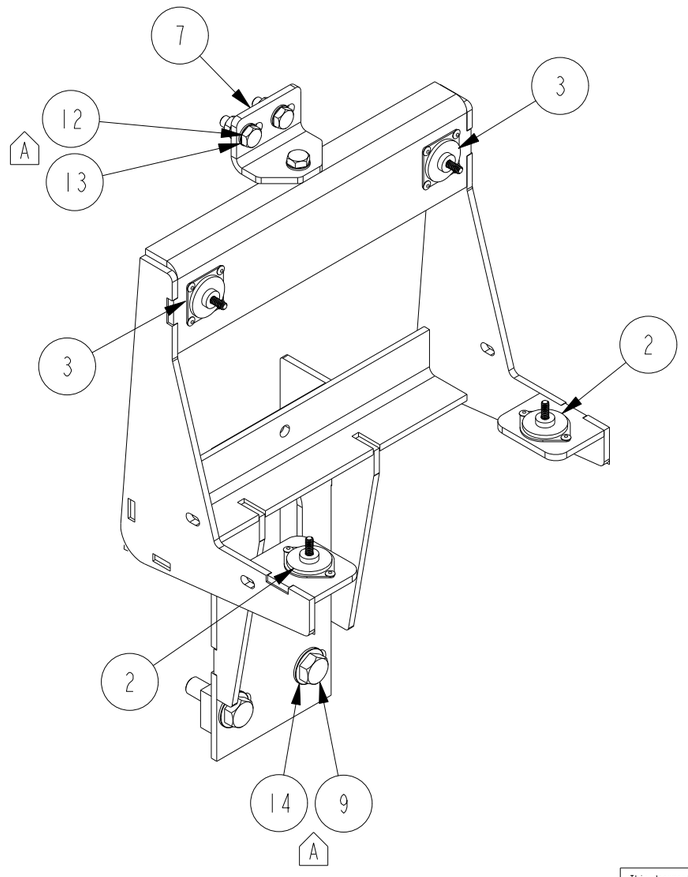
CUSTOM DESIGN
AND UPFIT CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

KIT, SENSOR & ADAPTER
CFP_11E

DWG UNITS: IN/LB/S	DRAWN BY: MAC	DATE: 17SEPT2009
	PRO-ENGINEER	REF DRWG: -
SCALE: 0.150	SHEET 1 OF 1	DRAWING NO: 15603
EST WEIGHT: 3.061		







BILL OF MATERIAL

ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	WELDMENT, OPERATOR STATION MOUNTING, CFPIIE	15074
2	2	ISOLATOR, PLATE MOUNT, 3 LB (YELLOW MARK)	15400
3	2	ISOLATOR, PLATE MOUNT, 6 LB (RED MARK)	15412
4	12	RIVET, ALUMINUM, STEEL SHANK, 0.156 DIA, 0.25-0.38 GRIP	15414
5	2	FENDER WASHER, 0.281 X 1.25	15421
6	4	SCREW, SELF LOCKING, 0.25-20 X 1.00, PH OR BH	15422
7	1	BRACE, KNEE	15479
8	3	SCREW,HH, 0.31-18x1.00	20231-100
9	2	SCREW,HH, 0.63-11x2.00	20263-200
B 10	1	DIGTAL CONTROL PANEL, ELECTRONIC CFP ENGINES	21315
11	3	NUT,HEX,PT, M10-1.50	20140-M10
12	3	SCREW,HH, M10-1.50x30	20310-030
13	5	WASHER,FLAT, M10	20020-M10
14	2	WASHER,FLAT,SMALL, 0.63	20010-063

REV	ECO	DESCRIPTION OF REVISION	REV BY	DATE
B	2012-058	REPLACE 15137 WITH 21315	S DUBICK	27-FEB-12
A	2011-057	ADD FASTENERS PER SIX SIGMA	S DUBICK	11-MAY-11

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1°

THIRD ANGLE PROJECTION

MACHINED SURFACES: 125

	IMPERIAL UNITS	METRIC UNITS
MACHINE TOLERANCES	.XX : ± 0.010 .XXX : ± 0.005	.X : ± 0.4 .XX : ± 0.2
FORM TOLERANCES	.XX : ± 0.030 .XXX : ± 0.015	.X : ± 0.8 .XX : ± 0.4
FAB TOLERANCES	.XX : ± 0.060 .XXX : ± 0.030	.X : ± 1.5 .XX : ± 0.8

Cummins Fire Power

CUMMINS FIRE POWER LLC
CORPORATE OFFICE
1600 BUERKLE ROAD
WHITE BEAR LAKE, MN
WWW.CUMMINSFIREPOWER.COM

CUSTOM DESIGN
AND UPFIT CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

ASSEMBLY, OPERATOR STATION CFPIIE

DWG UNITS: IN/LB/S

DRAWN BY: DAN

PRO-ENGINEER

DATE: 03-SEP-09

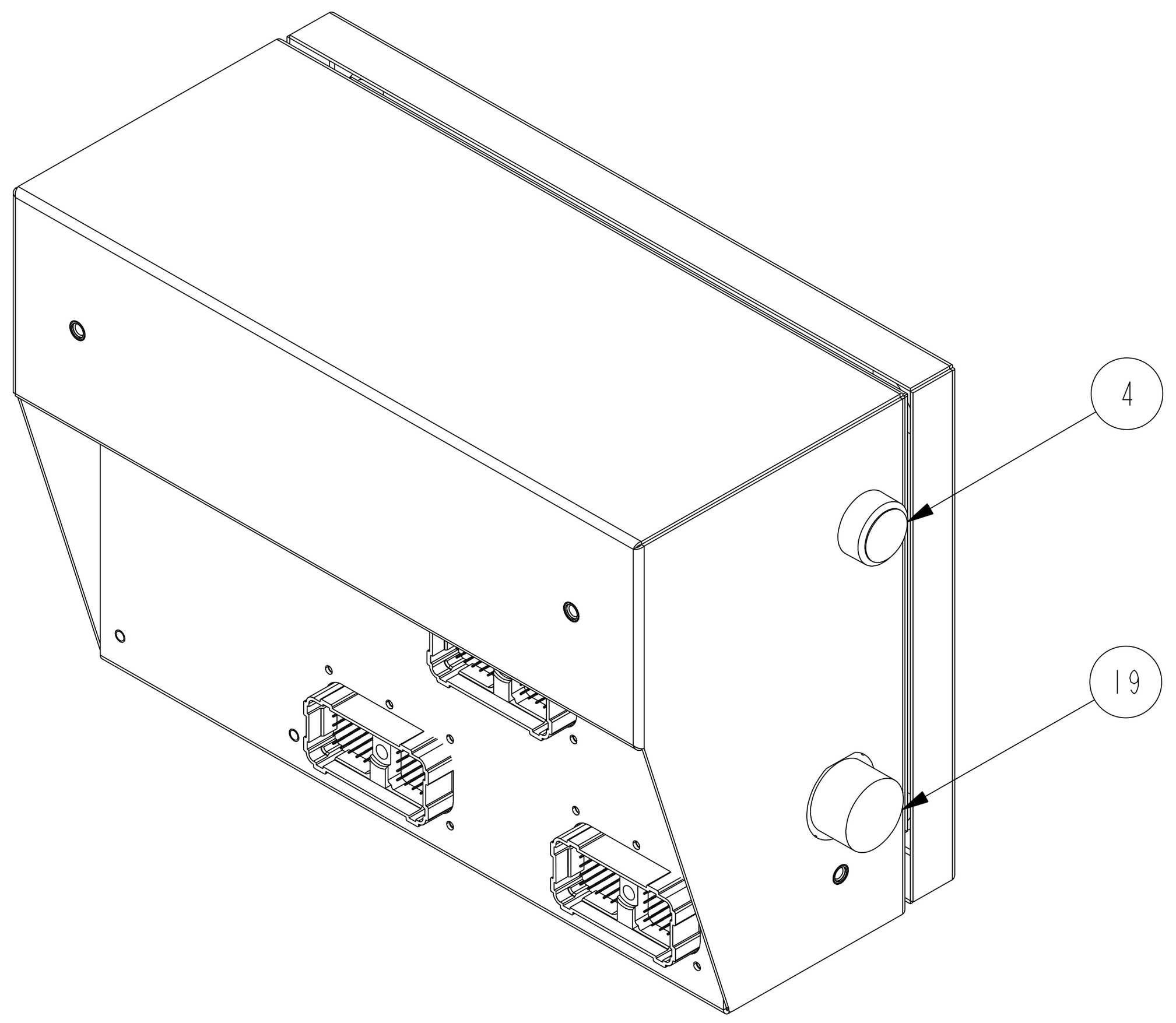
INIT ECO:

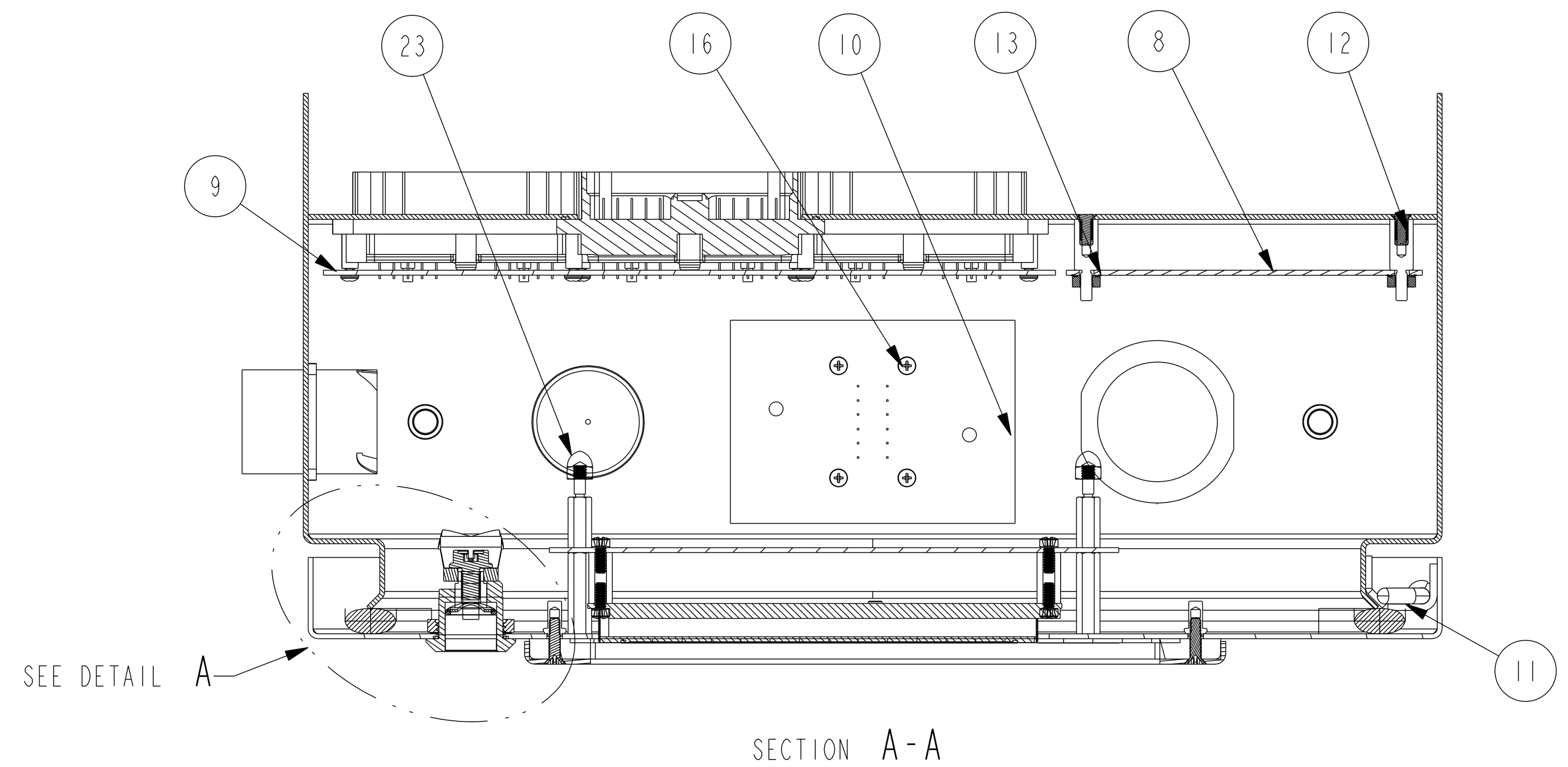
SCALE: 0.200

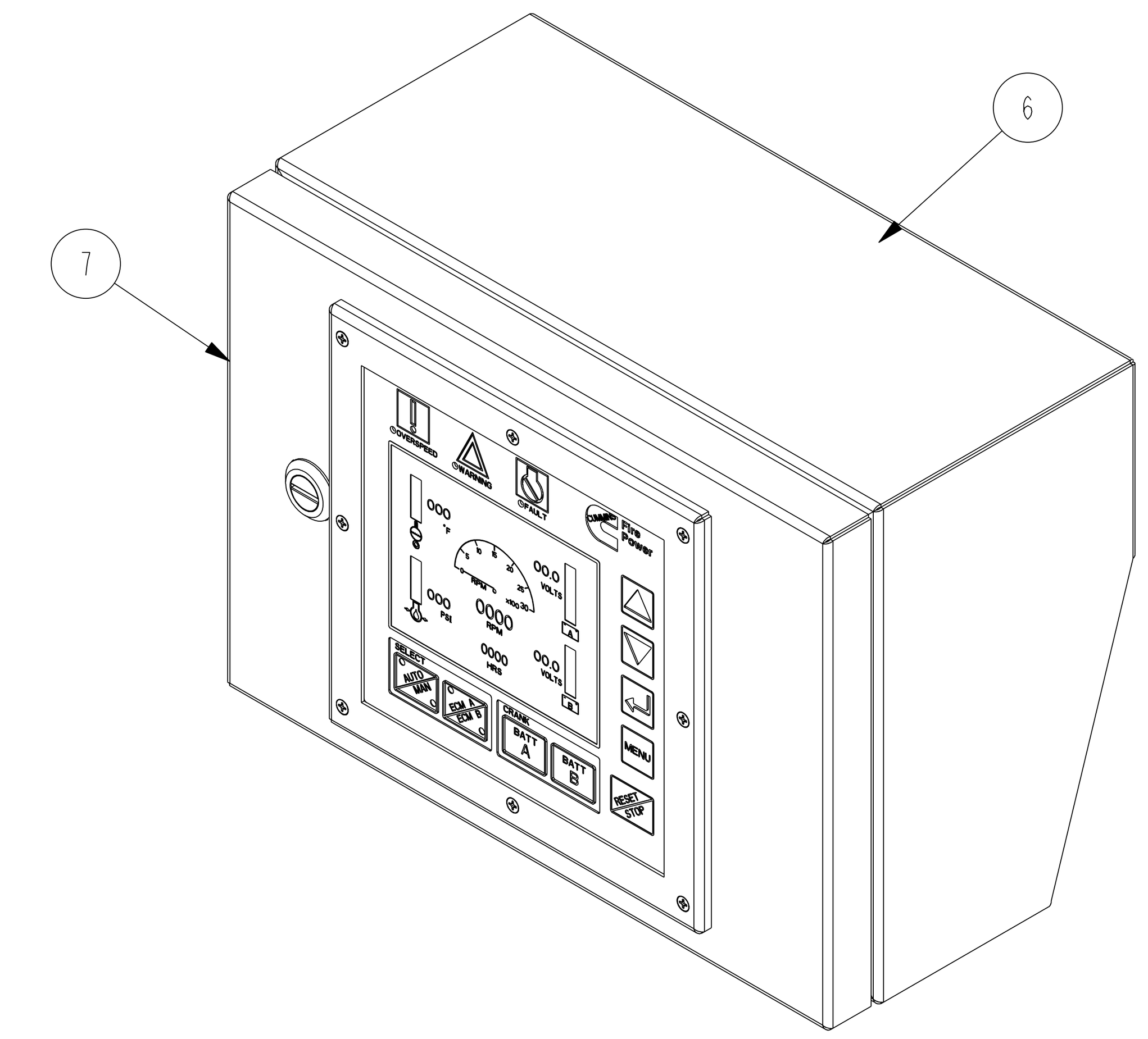
EST WEIGHT: 57.259

SHEET 1 OF 1

DRAWING NO: 15507



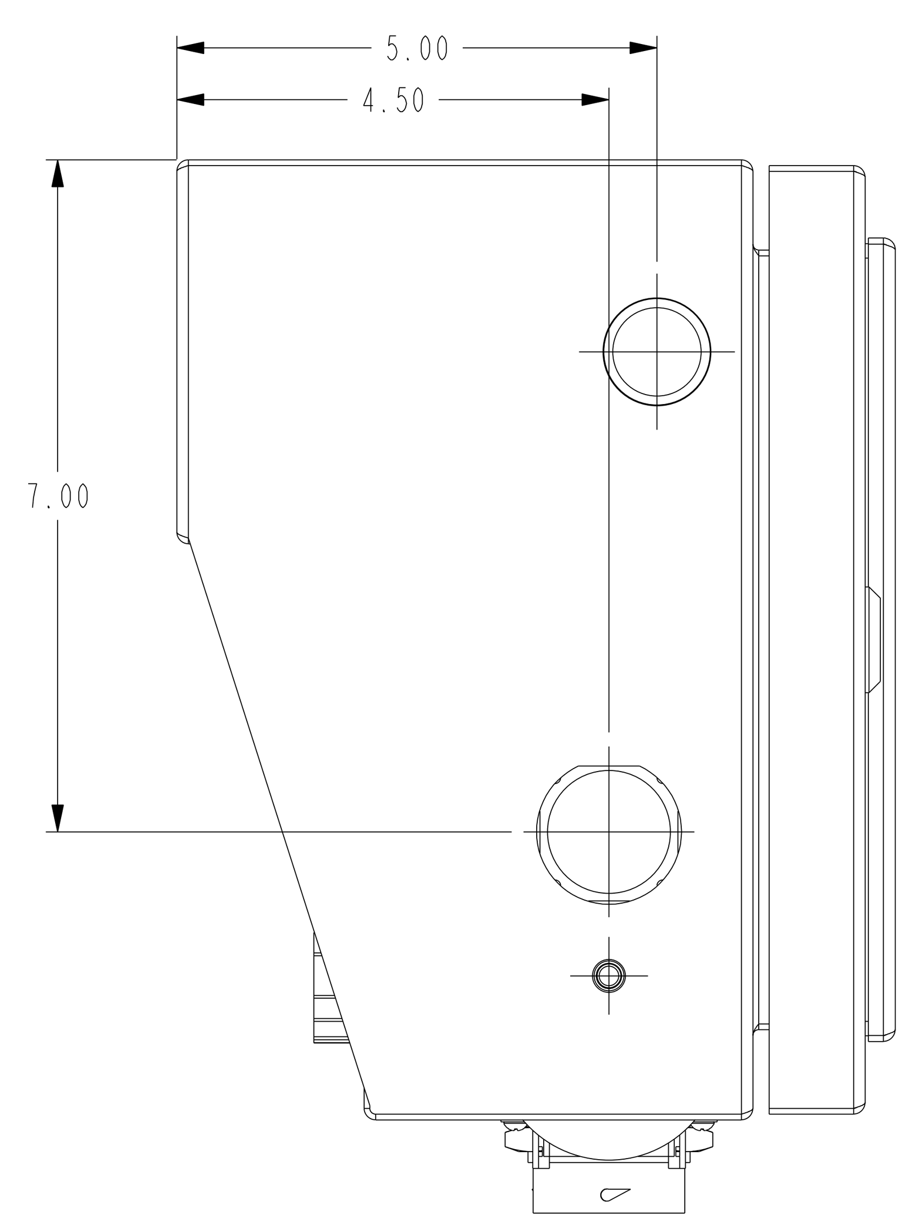


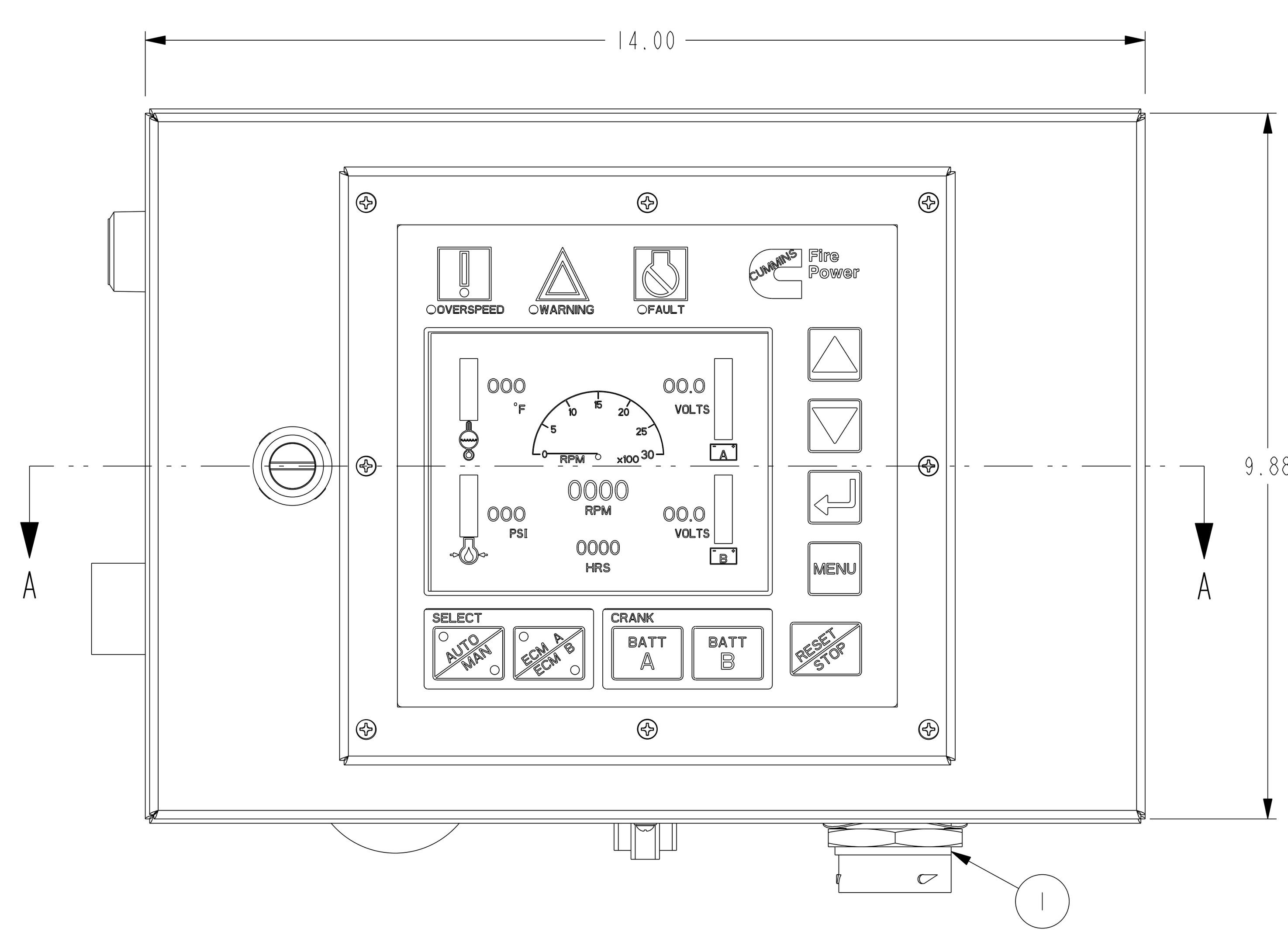


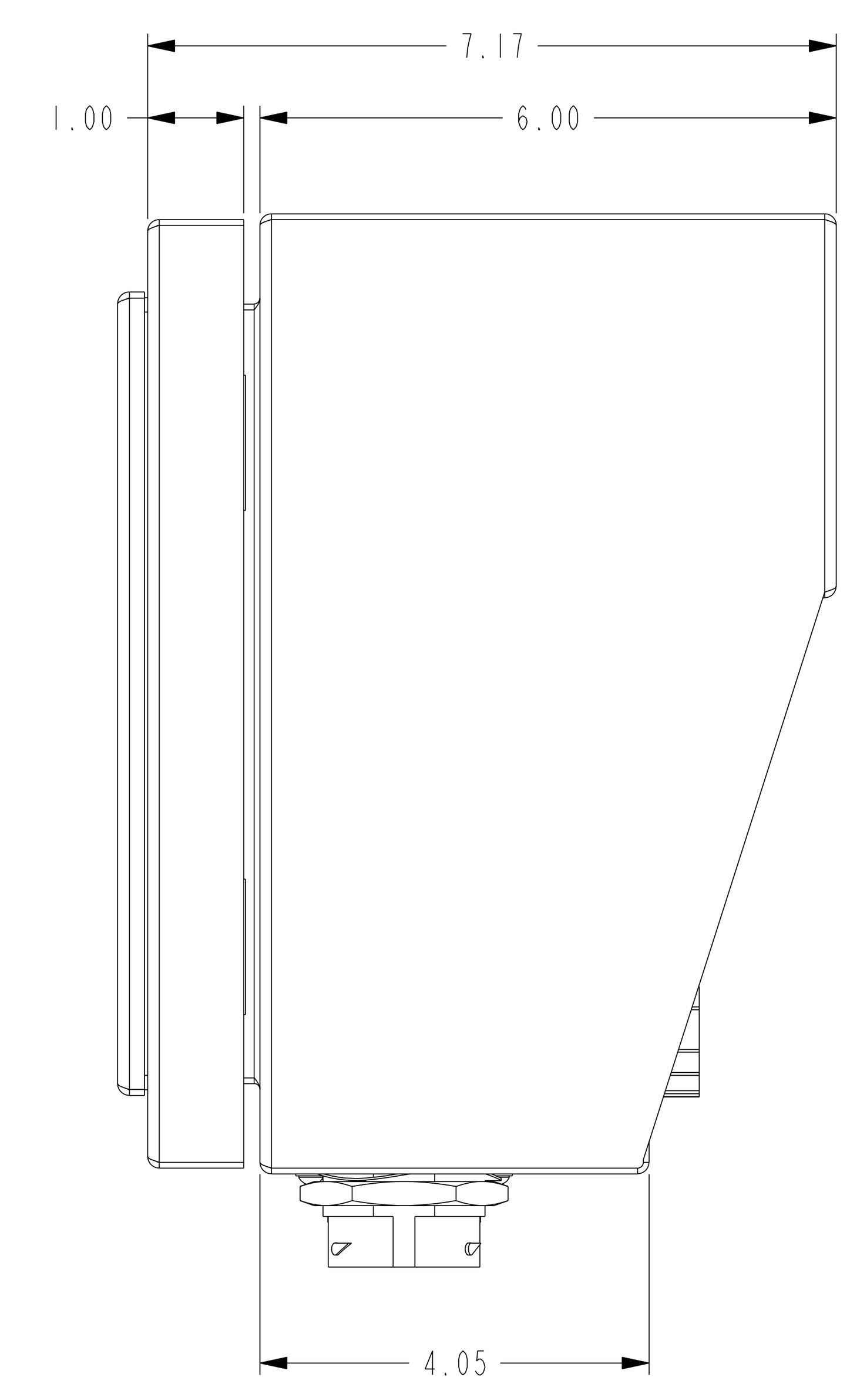
ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	ASSY,BULKHEAD WIRING, DIGITAL PANEL, BULKHEAD TO POWER PCB	15156
2	1	CABLE, DIGITAL PANEL, POWER PCB TO DISPLAY PCB	15157
3	1	CABLE, DIGITAL PANEL, POWER PCB TO ECM SWITCH PCB	15158
4	1	ASSY, WIRING, DIGITAL PANEL, ENGINE STOP SWITCH	15160
5	1	DIAGNOSTICS, DIGITAL PANEL, RECEPTACLE AND CABLE	15161
6	1	WELDMT, DIGITAL PANEL, BOX, ELECTRONIC	15569
7	1	ASSEMBLY, DOOR, CONTROL PANEL	15575
8	1	POWER PCB, DIGITAL PANEL, ELECTRONIC	15153
9	1	SWITCH PCB, DIGITAL PANEL, MODULE, ECM	15154
10	1	POWER MODULE ECM , DIGITAL PANEL, ELECTRONIC	15155
11	2	HINGE, ASSEMBLY W/PIN, MILD STEEL, EMKA 1069-U2	15573_02
12	9	STANDOFF HEX M/F,8-32, ALUM. .63"L	15579
13	9	NUT, 8-32, W/TOOTH WASHER, ZNC -PLTD	15582
14	2	WASHER, 5/32"I.D x 5/16"O.D. x .02TK, STNL STL	15588
15	2	SCREW, 6-19 x 3/8"L, FH PHILIPS HD, STNL STL	15590
16	16	SCREW, 1/4"-20 SELF TAPPING, STNL STL	15591
17	1	RECEPTACLE, W/FLANGE 50 PIN,BLACK, CRC SERIES, DEUTSCH, DRC22-50P01	15593
18	1	RECEPTACLE, PCB MOUNT, 12 PINS STRAIGHT DT-SERIES, DEUTSCH, DT15-12P	15594
19	1	CONNECTOR, RECEPTACLE SQ. FLANGE HD10 SERIES, DEUTSCH, HD10-9-1939P	15596
20	1	RECEPTACLE, W/FLANGE 50 PIN,BLACK, CRC SERIES, DEUTSCH, DRC22-50P03	15599
21	1	PLUG, LIQUID TIGHT, HEYCO, 3837	15645
22	1	RECEPTACLE, W/FLANGE 50 PIN,BLACK, CRC SERIES, DEUTSCH, DRC22-50P02	15657
23	4	NUT, ACORN,SELF-LOCKING, 8-32, 18-8 STNL STL	17149

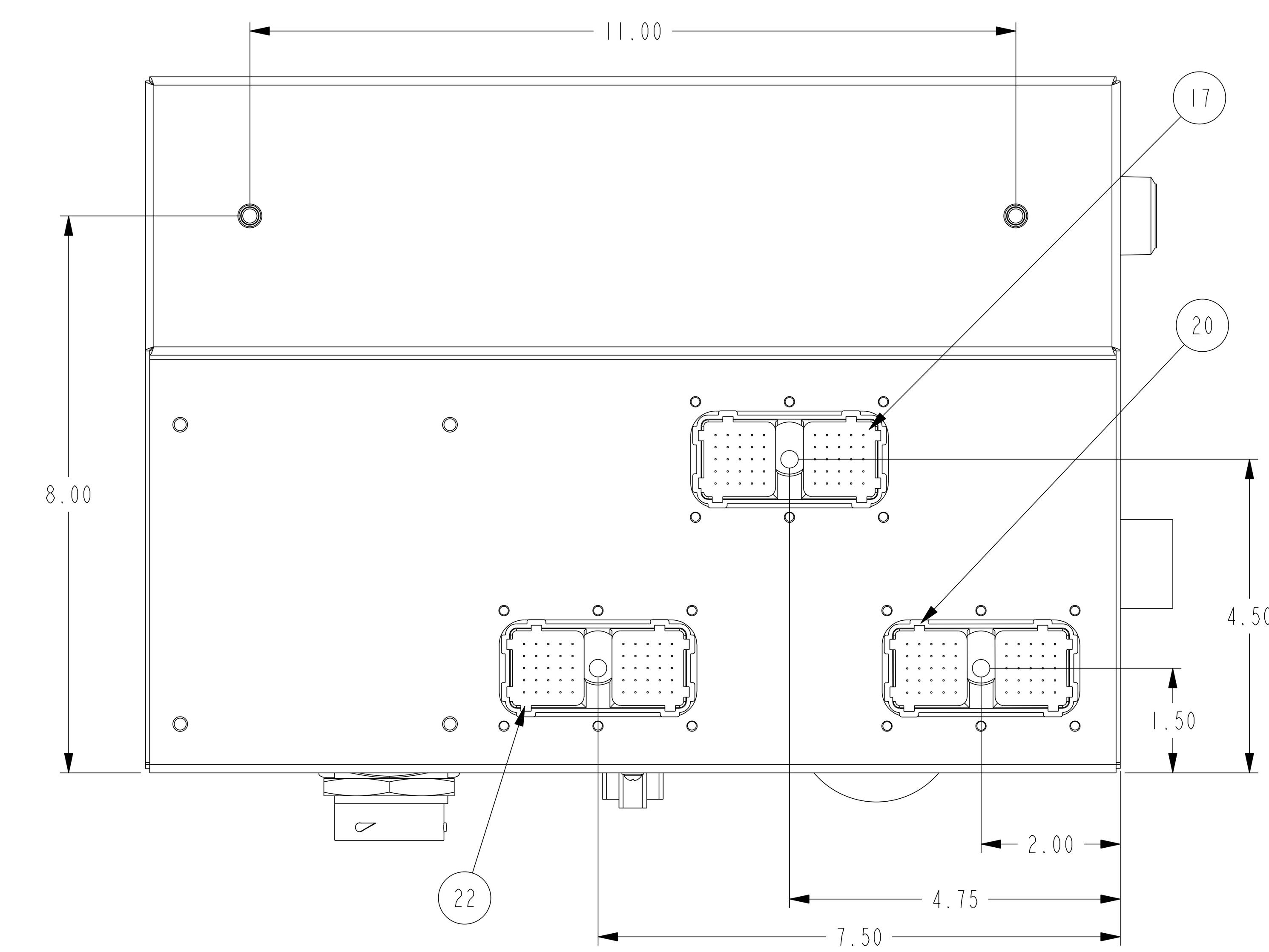
BILL OF MATERIAL

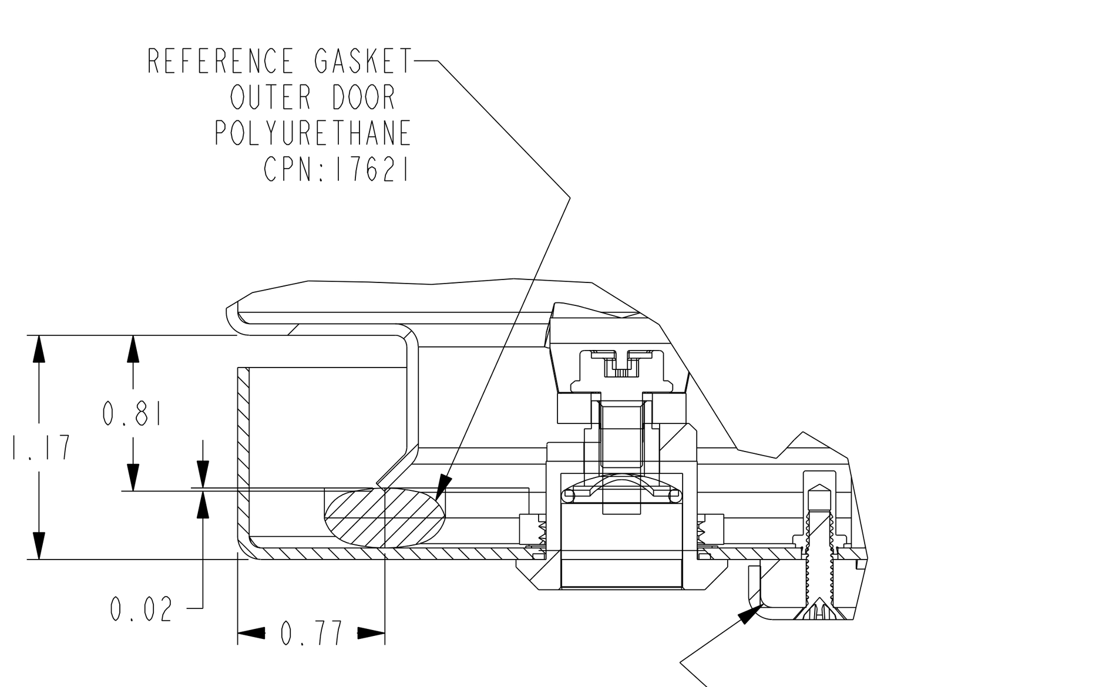
*** BOM IS FOR REFERENCE ONLY ***



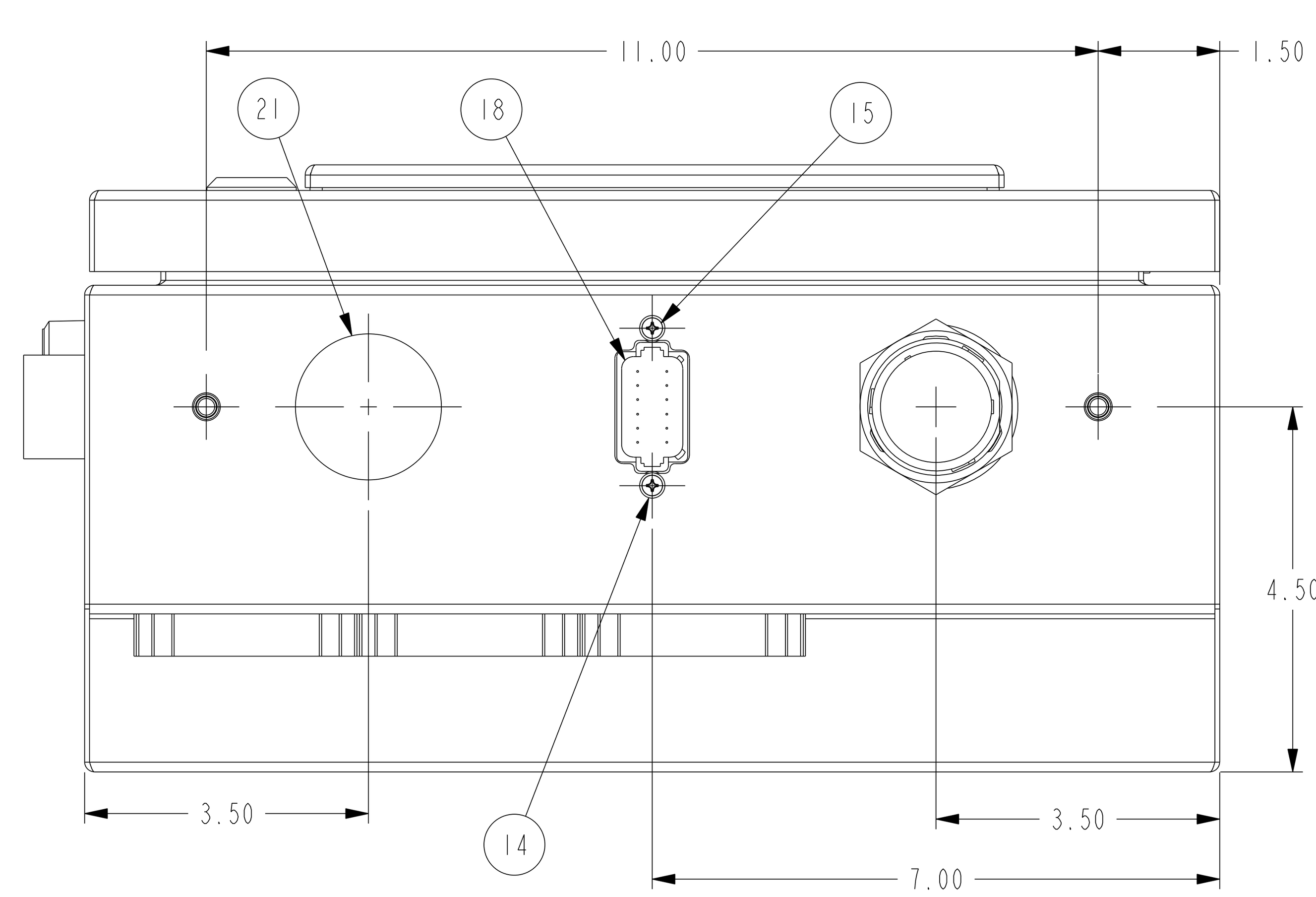








DOOR GASKET DETAIL A
SCALE 1.000



NOTES:
1. FINISH ON STEEL COMPONENTS:
   COAT PER CUMMINS SPEC ES044 CUMMINS RED
2. TYPE 4X INDOOR USE CONSTRUCTION
3. UPDATED SOFTWARE

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE
ANGULAR DIMENSIONS ± 1° | MACHINED SURFACES 125 | IMPERIAL UNITS: MACHINE TOLERANCES .XX = ± 0.010, .XXX = ± 0.005; FORM TOLERANCES .XX = ± 0.030, .XXX = ± 0.015; FAB TOLERANCES .XX = ± 0.060, .XXX = ± 0.030 | METRIC UNITS: MACHINE TOLERANCES .X = ± 0.4, .XX = ± 0.2; FORM TOLERANCES .X = ± 0.8, .XX = ± 0.4; FAB TOLERANCES .X = ± 1.5, .XX = ± 0.8

THIRD ANGLE PROJECTION

Fire Power
CUMMINS FIRE POWER LLC
CORPORATE OFFICE
1600 BUERKLE ROAD
WHITE BEAR LAKE, MN
WWW.CUMMINSFIREPOWER.COM

CUSTOM DESIGN
AND UPFIT CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

ASSEMBLY, DIGITAL CONTROL PANEL
ELECTRONIC CFP ENGINES

DWG UNITS: IN/LB/S	DRAWN BY: S DUBICK	DATE: 21-SEP-12
	PRO-ENGINEER	INIT ECO: 2012-348
SCALE: 0.500	SHEET 1 OF 1	DRAWING NO: 22791
EST WEIGHT: 16.468		

REV	ECO	DESCRIPTION OF REVISION	REV BY	DATE

KIT INCLUDES

1) 16137 HARNESS, WIRE, SENSOR AND ACTUATOR
2) 16138 HARNESS, WIRE, ECM A
3) 16139 HARNESS, WIRE, ECM B
4) 21225 HARNESS, WIRE, POWER
5) 16141 HARNESS, WIRE, INTERFACE

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1°

THIRD ANGLE PROJECTION

IMPERIAL UNITS	METRIC UNITS
MACHINE TOLERANCES XX = ± 0.010 XXX = ± 0.005	MACHINE TOLERANCES X = ± 0.4 XX = ± 0.2
FORM TOLERANCES XX = ± 0.030 XXX = ± 0.015	FORM TOLERANCES X = ± 0.8 XX = ± 0.4
FAB TOLERANCES XX = ± 0.060 XXX = ± 0.030	FAB TOLERANCES X = ± 1.5 XX = ± 0.8

REV	ECO	DESCRIPTION OF REVISION	BY	DATE

Cummins Fire Power

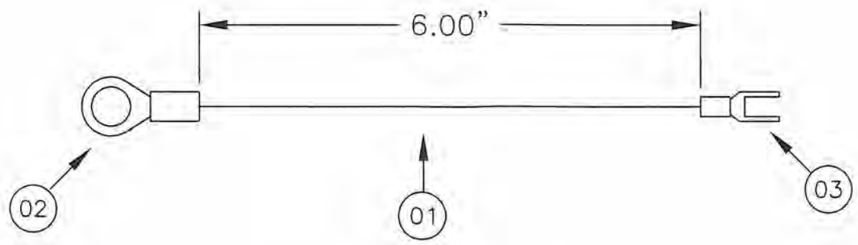
CUMMINS FIRE POWER LLC
CORPORATE OFFICE
1600 BUERKLE ROAD
WHITE BEAR LAKE, MN
WWW.CUMMINSFIREPOWER.COM

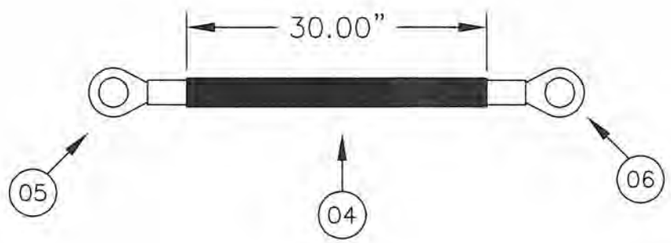
CUSTOM DESIGN AND
UPFIT CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

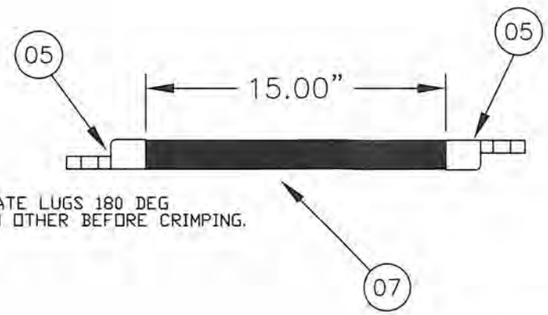
KIT, WIRE HARNESSES
QSM11 FIRE PUMP DRIVER

DWG UNITS: INCH/LB/S	DRAWN BY: BG	DATE: 1FEB2012
	AUTO CAD	INIT ECO: 2012-049
SCALE:	SHEET 1OF1	DRAWING NO: 21224
EST WEIGHT:		

TAGS	QTY	SUB	CATALOG	MFG	DESC
1	1	6"	WL10-9	WAYTEK	WIRE, GXL, WHITE, 10 AWG
2	1	1	32706	WAYTEK	TERMINAL, RING, 1/2", 10 AWG, INSULATED
3	1	1	52717-2	AMP	TERMINAL, SPADE, #10
4	1	34"	WC00-0	WAYTEK	CABLE, WELDING, 2/0 AWG, BLACK
5	3	1	36534	WAYTEK	TERMINAL, EYELET, HEAVY DUTY, 3/8", 2/0 AWG, NON-INSULATED
6	1	1	36535	WAYTEK	TERMINAL, EYELET, HEAVY DUTY, 1/2", 2/0 AWG, NON-INSULATED
7	1	20"	WC00-0	WAYTEK	CABLE, WELDING, 2/0 AWG, BLACK







NOTE: ROTATE LUGS 180 DEG
FROM EACH OTHER BEFORE CRIMPING.

NOTES: 1) USE RED HEAT SHRINK ON ALL BATTERY CABLE TERMINALS.

REV	ENF	DESCRIPTION OF REVISION	BY	DATE

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1°	IMPERIAL UNITS	METRIC UNITS
THIRD ANGLE PROJECTION	MACHINE TOLERANCES .XX = ± 0.010 .XXX = ± 0.005 FORM TOLERANCES .XX = ± 0.030 .XXX = ± 0.015 FAB TOLERANCES .X = ± 0.060 .XX = ± 0.030	MACHINE TOLERANCES .X = ± 0.4 .XX = ± 0.2 FORM TOLERANCES .X = ± 0.8 .XX = ± 0.4 FAB TOLERANCES .X = ± 1.5 .XX = ± 0.8

Fire Power
CUMMINS FIRE POWER LLC
CORPORATE OFFICE
1600 BUERKLE ROAD
WHITE BEAR LAKE, MN
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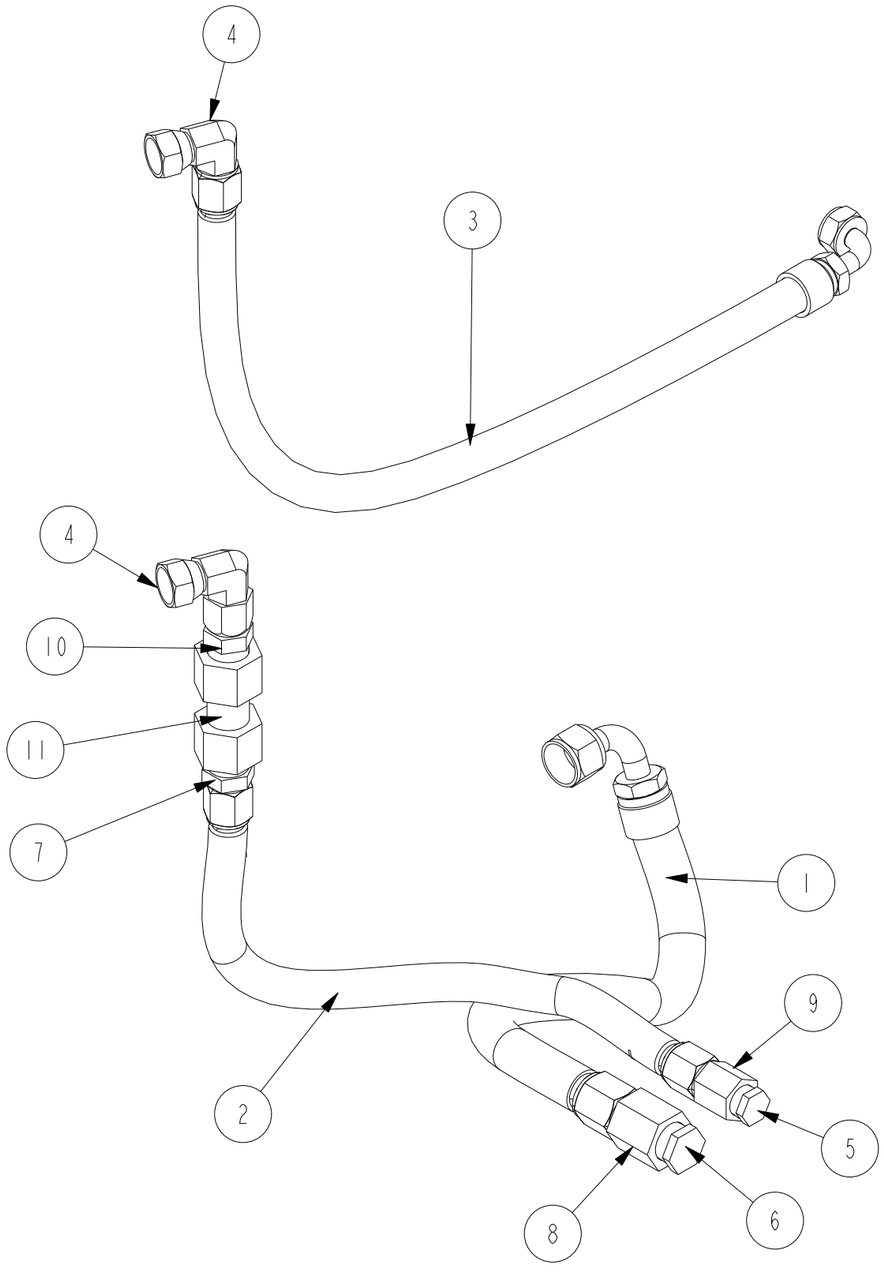
CUSTOM DESIGN AND
UPFIT CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

CABLES, BATTERY
CFP MODELS 9E AND 11E

DWG UNITS: INCH/LB/S	DRAWN BY: KAK	DATE: 10 DEC 2009
	AUTO CAD	REF DRWG:
SCALE:	SHEET 10F1	DRAWING NO: 16232
EST WEIGHT:		



BILL OF MATERIAL

ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	ASSEMBLY, HOSE, FUEL LINE, CFPIIE SUPPLY	15278
2	1	ASSEMBLY, HOSE, FUEL LINE, CFPIIE RETURN	15279
3	1	ASSEMBLY, HOSE, FUEL LINE, CFPIIE JUMPER	15282
4	2	ELBOW, #8 FLARE X FLARE SWIVEL	8_C6X-S
5	1	PLUG. PIPE, -6 NPT	12210-6
6	1	PLUG. PIPE, -8 NPT	12210-8
7	1	FTG, STR, -8 JIC X -8 NPT	12238-8-8
8	1	FTG, STR, -10 JIC X -8 FMNPT	12240-10-8
9	1	FTG, STR, -8 JIC X -6 FMNPT	12240-8-6
10	1	FTG,STR, -8 FMJIC X -8 NPT	12250-8-8
11	1	VALVE,CHECK,BRASS, 1/2" FNPT X FNPT	14412

C NOTE: APPLY THREAD SEALANT ON ALL NPT THREADS.

REV	ECO	DESCRIPTION OF REVISION	REV BY	DATE
C	0211-057	ADD NOTE	S DUBICK	11-MAY-11

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1°

THIRD ANGLE PROJECTION

IMPERIAL UNITS	METRIC UNITS
MACHINE TOLERANCES .XX : ± 0.010 .XXX : ± 0.005	MACHINE TOLERANCES .X : ± 0.4 .XX : ± 0.2
FORM TOLERANCES .XX : ± 0.030 .XXX : ± 0.015	FORM TOLERANCES .X : ± 0.8 .XX : ± 0.4
FAB TOLERANCES .XX : ± 0.060 .XXX : ± 0.030	FAB TOLERANCES .X : ± 1.5 .XX : ± 0.8

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1600 BUERKLE ROAD
WHITE BEAR LAKE, MN
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CUSTOM DESIGN
AND UPFIT CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

KIT, FUEL LINES, CFPIIE
F10/20 - EXT ONLY

DWG UNITS: IN/LB/S

DRAWN BY: DAN

DATE: 08-JUL-09

PRO-ENGINEER

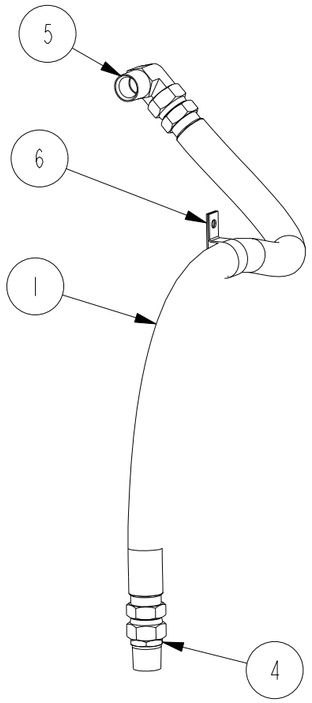
INIT ECO:

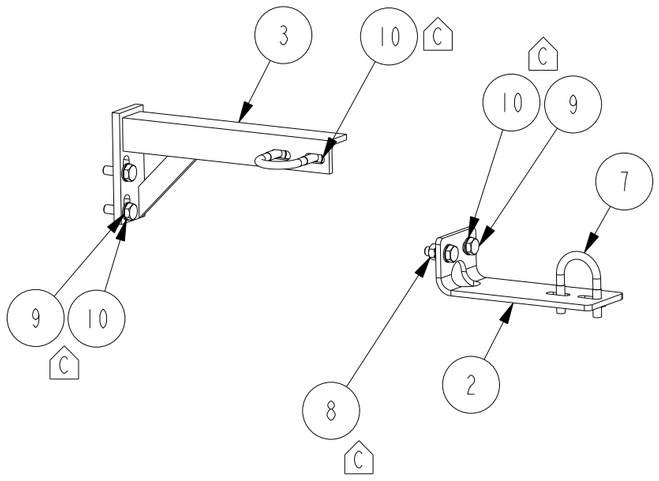
SCALE: 0.333

EST WEIGHT: 10.480

SHEET 1 OF 1

DRAWING NO: 15209





BILL OF MATERIAL			
ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	HOSE, WATER, 16 JIC BOTH ENDS	11086-03
2	1	BRACKET, RAW WATER COOLING, 8" LG, FIREPUMP	8814
3	1	BRACKET, MOUNTING, COOLING LOOP, M11, FIREPUMP	9755
4	1	ADAPTER, NPTM X JIC 37 DEG	11587
5	1	ELBOW, 1" NPTM X #16 JIC 37 DEG	11588
6	1	CLAMP, P-STYLE, 1-1/2", LTL-SCPV24627	13747
7	2	U-BOLT, 1" NPT, 3/8" x 1-1/2" x 2-1/2"	3043T37
8	2	NUT,HEX,PT, M10-1.50	20140-M10
9	4	SCREW,HH, M10-1.50x30	20310-030
10	8	WASHER,FLAT, M10	20020-M10

C NOTE: APPLY THREAD SEALANT ON ALL NPT THREADS.

REV	ECO	DESCRIPTION OF REVISION	REV BY	DATE
C	0211-057	ADD FASTENERS PER SIX SIGMA	S DUBICK	11-MAY-11

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1° | IMPERIAL UNITS | METRIC UNITS

THIRD ANGLE PROJECTION

MACHINE TOLERANCES .XX : ± 0.010 .XXX : ± 0.005
FORM TOLERANCES .XX : ± 0.030 .XXX : ± 0.015
FAB TOLERANCES .XX : ± 0.060 .XXX : ± 0.030

MACHINE TOLERANCES .X : ± 0.4 .XX : ± 0.2
FORM TOLERANCES .X : ± 0.8 .XX : ± 0.4
FAB TOLERANCES .X : ± 1.5 .XX : ± 0.8

Cummins Fire Power

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1600 BUERKLE ROAD
WHITE BEAR LAKE, MN
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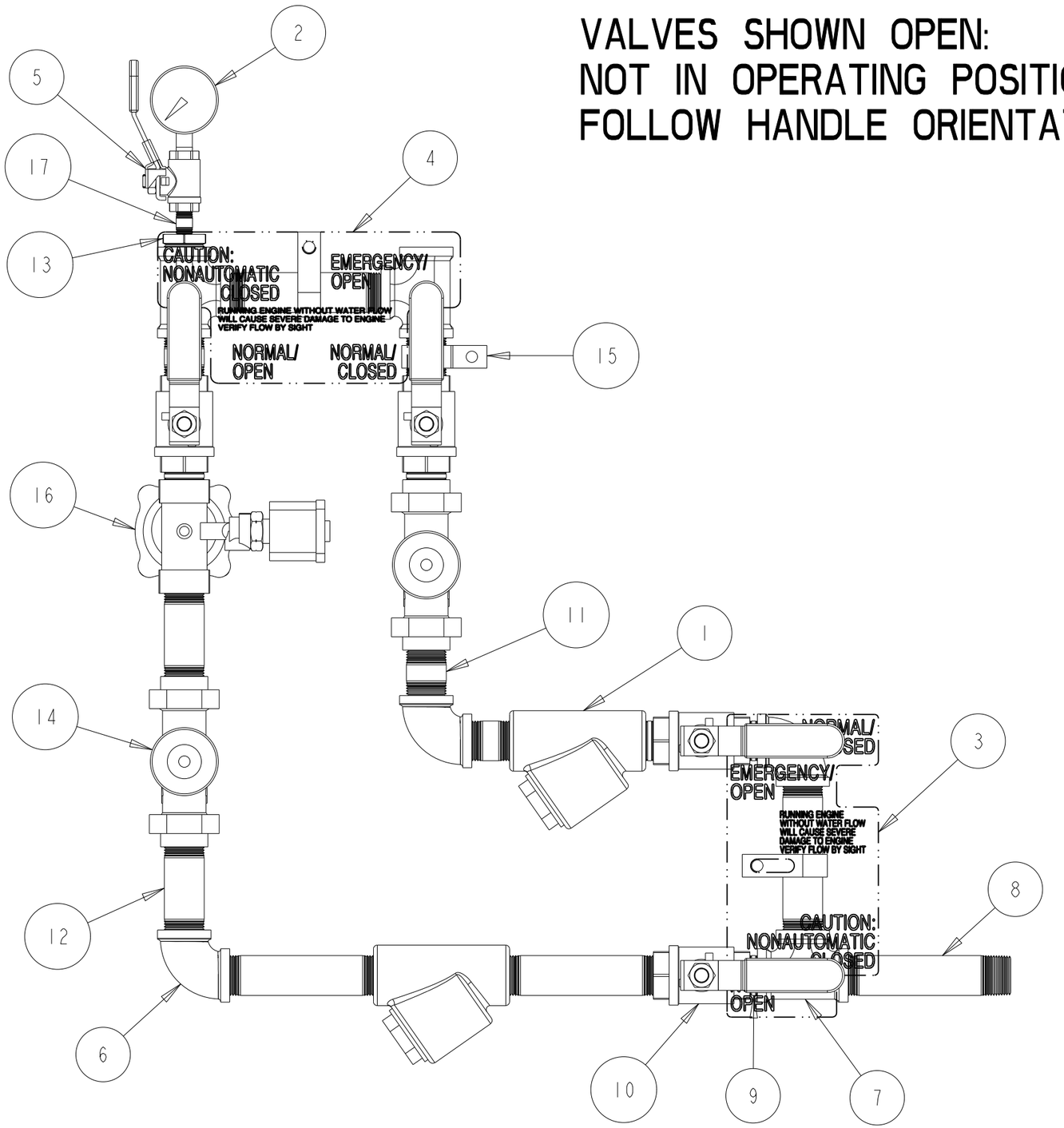
CUSTOM DESIGN
AND UPFIT CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

ASSEMBLY, MISC PIPING
CFP11E

DWG UNITS: IN/LB/S
DRAWN BY: DAVE N
PRO-ENGINEER
DATE: 14DEC2006
INIT ECO:
SCALE: 0.150
EST WEIGHT: 6.428
SHEET 1 OF 1
DRAWING NO: 11049

VALVES SHOWN OPEN:
NOT IN OPERATING POSITION
FOLLOW HANDLE ORIENTATION



BILL OF MATERIAL			
ITEM	QTY	DESCRIPTION	PART NUMBER
1	2	STRAINER, 1" NPT, WATTS 1_77S-MI	1_77S-MI
2	1	GAUGE, PRESSURE, 1/4" NPT, DPGI-2 1/2, 0-100 PSI, (WATTS)	8892
3	1	DECAL, COOLING LOOP VALVES, VERTICAL MTG	10965
4	1	DECAL, COOLING LOOP VALVES, EMERGENCY OPEN	10966
5	1	VALVE, BALL, 1/4" NPT FEMALE	FA60204-1
6	3	ELBOW, 90°, 1" NPTF, BLK IRON	LTL-E190
7	3	TEE, 1" NPT, BLK IRON	LTL-ST1
8	5	NIPPLE, 1" NPT x 6", BLK IRON	BNGU
9	5	NIPPLE, 1" NPT x CLOSE, BLK IRON	LTL-CPN1
10	4	VALVE, BALL, 1" NPTF, BRASS	FA60203-1
11	4	NIPPLE, 1" NPT x 2-1/2", BLK IRON	BNGL
12	2	NIPPLE, 1" NPT x 4", BLK IRON	13738
13	1	BUSHING, REDUCER, 1" NPT x 1/4" NPT, BLK IRON	BBGB
14	2	REGULATOR, 1" NPT, UNION ENDS, 400 PSI MAX, 25-75 PSI OUT	1_45BDU-MI
F 15	3	CLAMP, P-STYLE, 1-1/2", 13747	LTL-SCPV24627
16	1	VALVE, SOLENOID, BRASS, 1" NPT, 12VDC, 150 PSI, (ASCO)	8210G004-12V
17	1	NIPPLE, 1/4" NPT x 1 1/2", BLK STEEL	LTL-CPN1411 2

9659-01 FOR VERTICLE TURBINE PUMP:
REMOVE 8210G4, BNGR & (1) CPNI NIPPLE
AND REPLACE WITH BNGY NIPPLE

9659-02 FOR 24VDC OPERATION:
REMOVE VALVE 8210G4-12VDC AND REPLACE
WITH 8210G4-24VDC.

G

NOTE:
1. PRESSURE REGULATORS TO BE SET AT 60 PSI
2. TEST FINAL ASSEMBLY AT 90 PSI

REV	ECO	DESCRIPTION OF REVISION	REV BY	DATE
G	2012-547	ADDED TESTING NOTE	PBS	20NOV2012
F	2012-230	MADE LTL-SCPV24627 QTY 3.	S DUBICK	15JUN2012

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1° | MACHINED SURFACES 125 | IMPERIAL UNITS: MACHINE TOLERANCES .XX ± 0.010, .XXX ± 0.005; FORM TOLERANCES .XX ± 0.030, .XXX ± 0.015; FAB TOLERANCES .X ± 0.060, .XX ± 0.030 | METRIC UNITS: MACHINE TOLERANCES .X ± 0.4, .XX ± 0.2; FORM TOLERANCES .X ± 0.8, .XX ± 0.4; FAB TOLERANCES .X ± 1.5, .XX ± 0.8

THIRD ANGLE PROJECTION

Cummins Fire Power

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CORPORATE OFFICE
1600 BUERKLE ROAD
WHITE BEAR LAKE, MN
WWW.CUMMINSFIREPOWER.COM

CUSTOM DESIGN
AND UPFIT CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

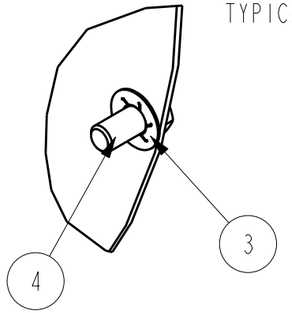
COOLING LOOP, 1" NPT HX
FIREPUMP

DWG UNITS: IN/LB/S | DRAWN BY: S DUBICK | DATE: 10/20/08

PRO-ENGINEER | INIT ECO:

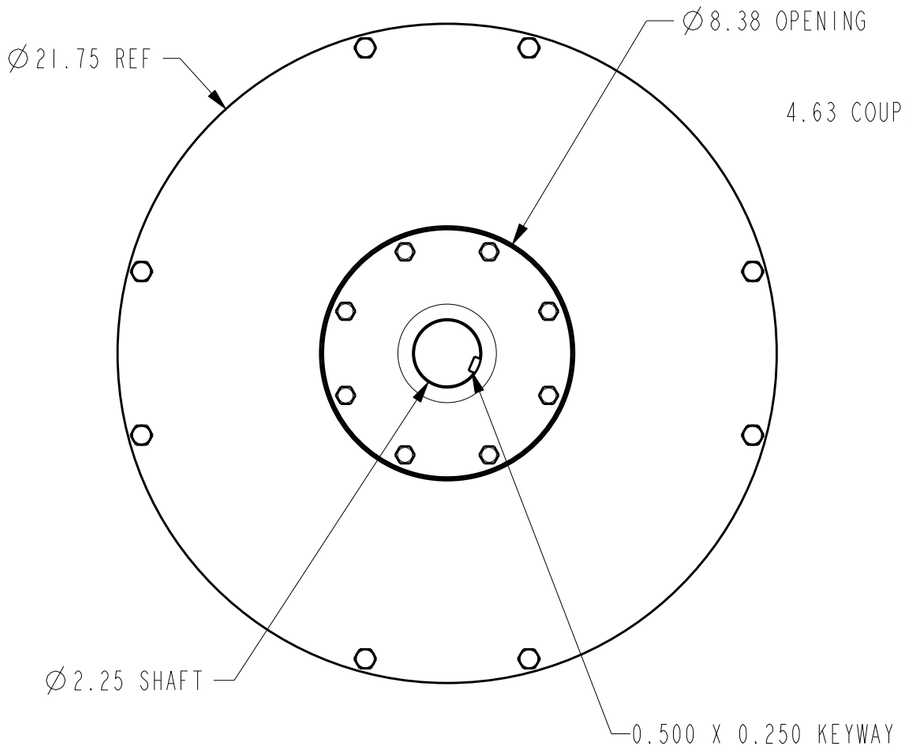
SCALE: 0.250 | EST WEIGHT: 53.400 | SHEET 1 OF 1 | DRAWING NO: 9659

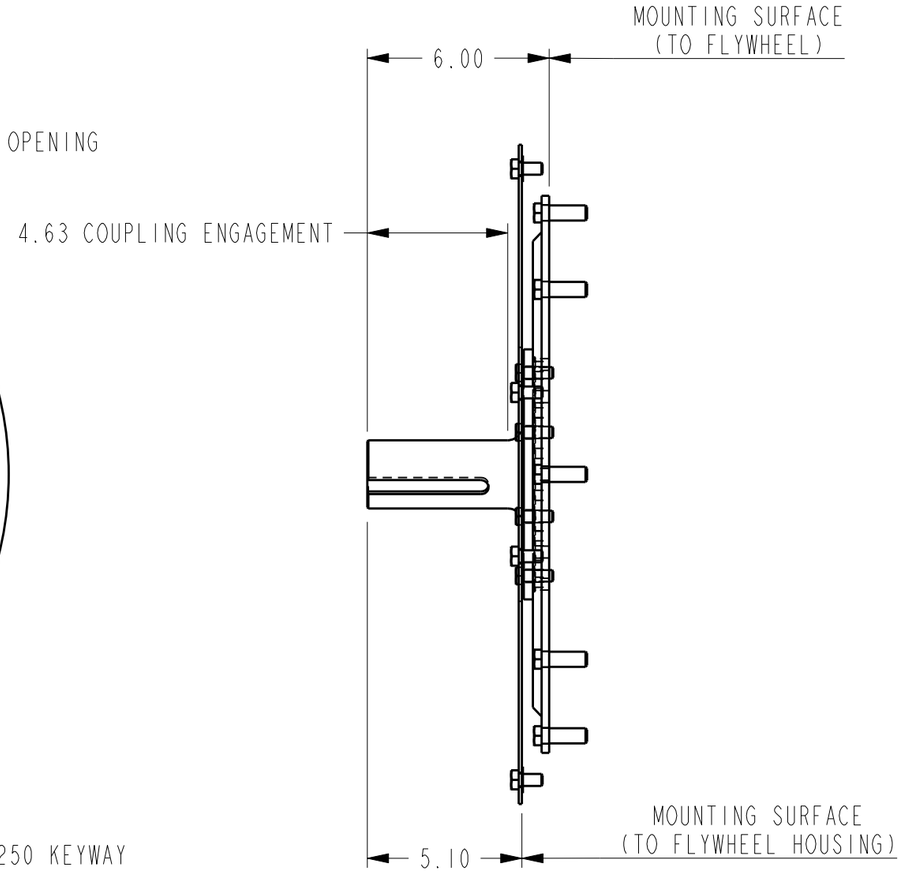
TYPICAL GUARDING FASTENERS
SCALE 0.500

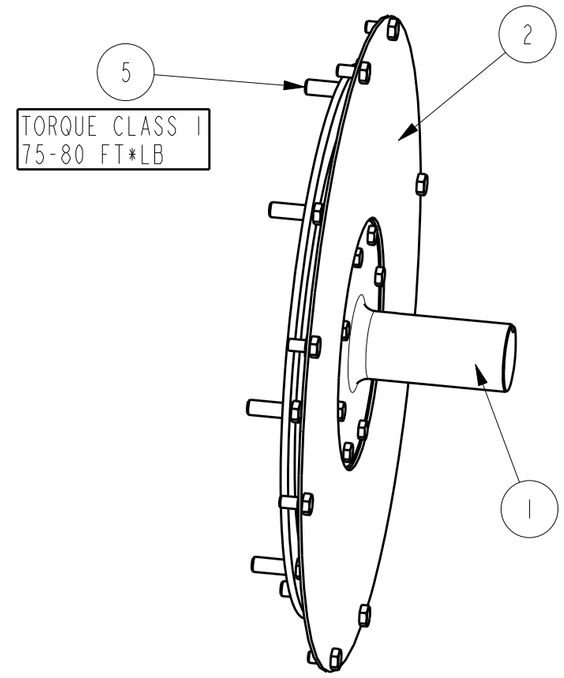


BILL OF MATERIAL

ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	ASSEMBLY, SAE 14, 2.25" DIA STUB SHAFT, CFP11E SERIES	14956
2	1	PLATE, STUB SHAFT GUARD, SAE #1, HAYES #127807, FIREPUMP	9557
3	8	RETAINING WASHER, PUSHNUT, 7/16" BOLT	16662-07
4	8	SCREW, CAP, HEX HEAD, 7/16-14 UNC	HHCS_0437_0075
5	8	SCREW, CAP, HEX HEAD, 1/2-13 UNC X 1.50"	HHCS_0500_0150







Ⓒ NOTES:
1. MASS: 47.9 LBS, INERTIA: 113.46 LB.IN^2

REV	ECO	DESCRIPTION OF REVISION	REV BY	DATE
D	2010-098	ADDED RETAINING FASTENERS	DAN	04-MAR-10
C	2009-620	ADDED MASS & INERTIA DATA	S DUBICK	12/28/09

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1°	IMPERIAL UNITS	METRIC UNITS
THIRD ANGLE PROJECTION	MACHINE TOLERANCES .XX = ± 0.010 .XXX = ± 0.005 FORM TOLERANCES .XX = ± 0.030 .XXX = ± 0.015 FAB TOLERANCES .XX = ± 0.060 .XXX = ± 0.030	MACHINE TOLERANCES .X = ± 0.4 .XX = ± 0.2 FORM TOLERANCES .X = ± 0.8 .XX = ± 0.4 FAB TOLERANCES .X = ± 1.5 .XX = ± 0.8

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875 LAWRENCE DRIVE
DEPERE, WISCONSIN

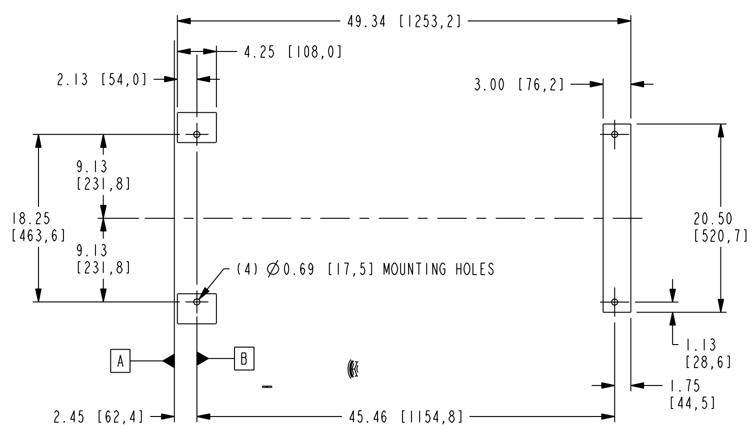
ASSEMBLY, STUB SHAFT, SAE#1
FIREPUMP, CFP11E

DWG UNITS: IN/LB/S	DRAWN BY: DAVE N	DATE: 20JUN2005
	PRO-ENGINEER	INIT ECO:
SCALE: 0.200	SHEET 1 OF 1	DRAWING NO: 9679
EST WEIGHT: 60.031		

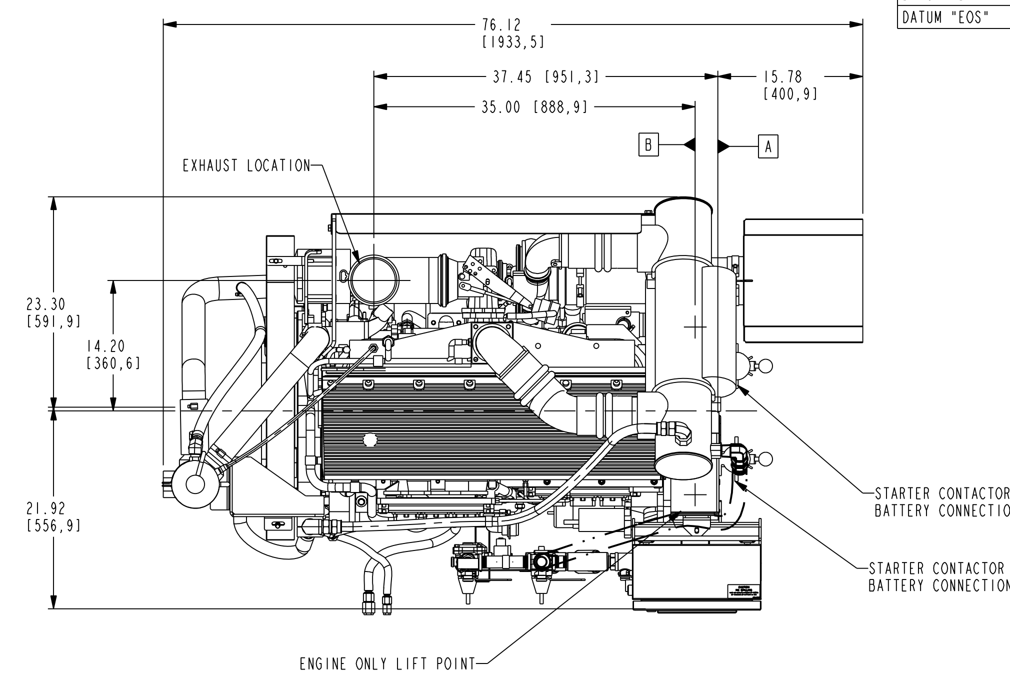
CFP11E CONNECTION INFORMATION	
SAE #1	FLYWHEEL HOUSING
1/4" NPT	FUEL INLET
3/8" NPT	FUEL OUTLET
1" NPT	RAW WATER INLET
1 1/4" NPT	RAW WATER DISCHARGE
120 / 240 VAC	COOLANT HEATER (2250 WATTS)
5" DIA NPT, CUFF, OR FLANGE	EXHAUST CONNECTION

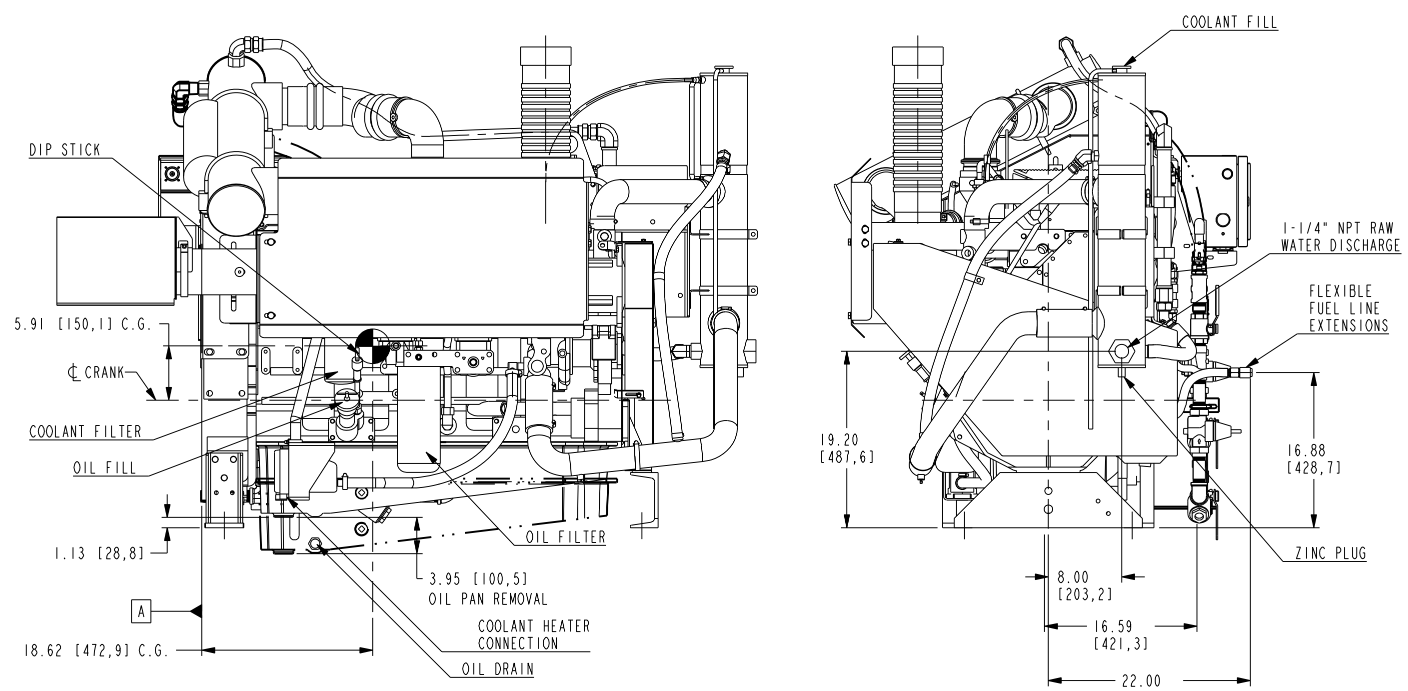
NOTES:
1. ALL PLUMBING MUST BE SUPPORTED AND/OR ISOLATED SO THAT NO WEIGHT OR STRESS IS APPLIED TO ANY ENGINE COMPONENT.
2. REFER TO ENGINE DATA SHEET FOR CUSTOMER CONNECTION RECOMMENDATIONS.
3. DO NOT SCALE DRAWING.
4. DRAWING SUBJECT TO CHANGE WITH OUT NOTICE.

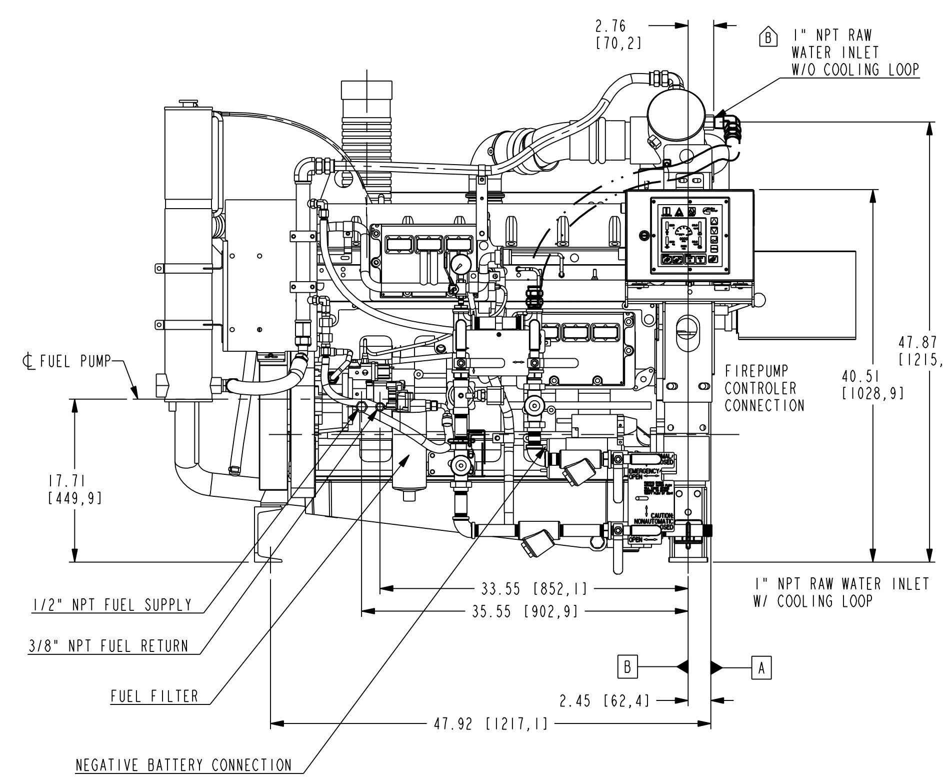
LEGEND AND DATUM IDENTIFIER	
SHEET #1	INSTALLATION DRAWING
SHEET #2	GENERAL ARRANGEMENT - HORIZONTAL SPLIT CASE PUMP BASE OPTION
SHEET #3	GENERAL ARRANGEMENT - VERTICAL TURBINE PUMP BASE OPTION
SHEET #4	DRIVE LINE OPTIONS
DATUM "A"	FACE OF FLYWHEEL HOUSING
DATUM "B"	REAR LEG BOLT LOCATION
DATUM "C"	FLYWHEEL MOUNTING SURFACE
DATUM "D"	UJOINT ADAPTER MOUNTING SURFACE
DATUM "EOS"	END OF PUMP SHAFT

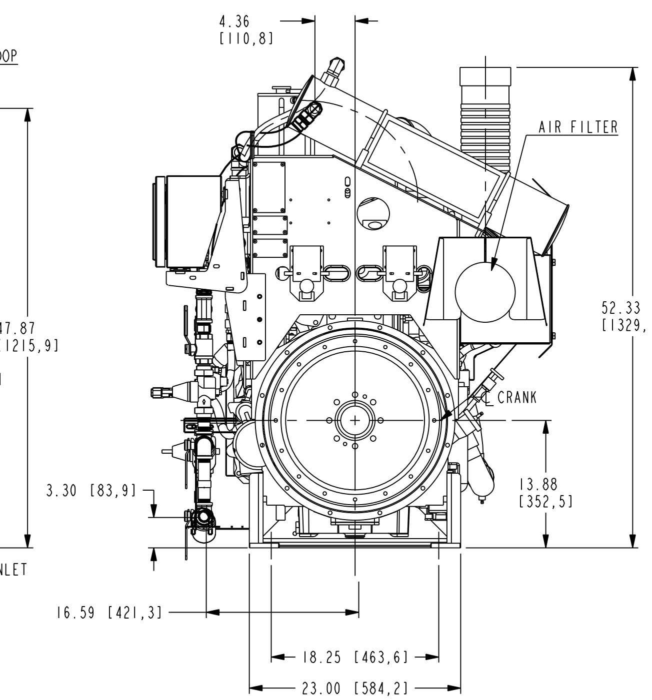


ENGINE FOOT PRINT









**SHOWN WITH OPTIONAL COOLING LOOP

REV	ECO	DESCRIPTION OF REVISION	REV BY	DATE
C	2010-544	FRAME NOTES, PG 2	S DUBICK	12-06-10
B	2010-522	CHANGE WATER INLET LOCATION FOR CUSTOMER SUPPLIED COOLING LOOP	S DUBICK	11-16-10
A	2010-015	OMIT NON-LIST DRIVE SHAFT ADDED U-JOINT ADAPTER: 15501 ADDED DRIVE SHAFT: 13422 CHG DRIVE SHAFT: 13430 WAS 13421 CHG COMP. FLG: 10015 WAS 10005 CHG GUARD: 16381 WAS 14161	MAC	03-15-10

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1° | IMPERIAL UNITS | METRIC UNITS

THIRD ANGLE PROJECTION

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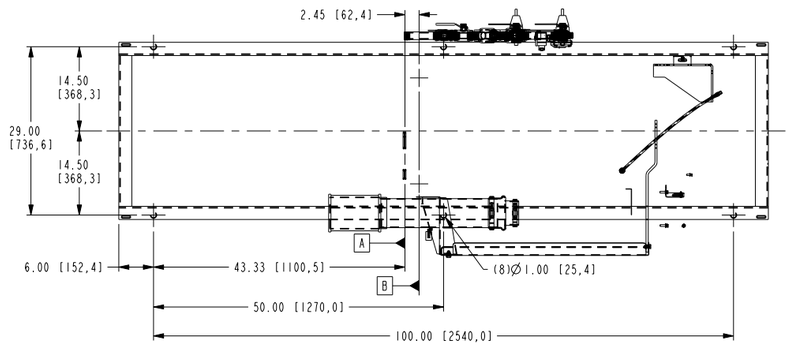
DEPERE, WISCONSIN

GENERAL ARRANGEMENT
CFP11E-F10/20

DWG UNITS: IN/LB/S	DRAWN BY: DAN	DATE: 19-NOV-09
	PRO-ENGINEER	REF DRWG:
SCALE: 1.000	SHEET 1 OF 4	DRAWING NO: 16018
EST WEIGHT: VARIES		

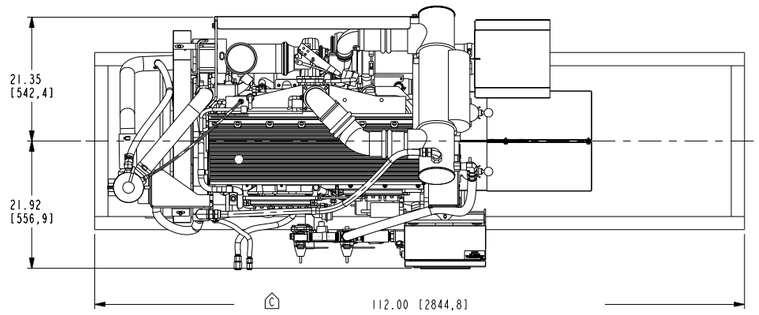
CFP11E CONNECTION INFORMATION	
SAE #1	FLYWHEEL HOUSING
1/2" NPT	FUEL INLET
3/8" NPT	FUEL OUTLET
1" NPT	RAW WATER INLET
1-1/4" NPT	RAW WATER DISCHARGE
120 / 240 VAC	COOLANT HEATER (2250 WATTS)
5" DIA NPT, CUFF, OR FLANGE	EXHAUST CONNECTION

LEGEND AND DATUM IDENTIFIER	
SHEET #1	INSTALLATION DRAWING
SHEET #2	GENERAL ARRANGEMENT - HORIZONTAL SPLIT CASE PUMP BASE OPTION
SHEET #3	GENERAL ARRANGEMENT - VERTICAL TURBINE PUMP BASE OPTION
SHEET #4	DRIVE LINE OPTIONS
DATUM "A"	FACE OF FLYWHEEL HOUSING
DATUM "B"	REAR LEG BOLT LOCATION
DATUM "C"	FLYWHEEL MOUNTING SURFACE
DATUM "D"	UJOINT ADAPTER MOUNTING SURFACE
DATUM "EOS"	END OF PUMP SHAFT

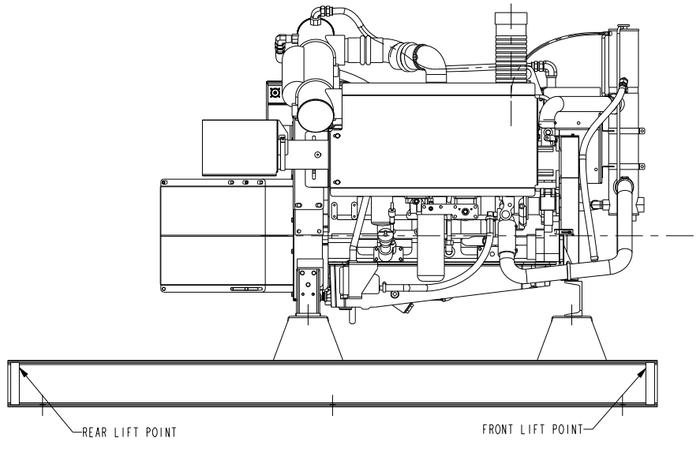


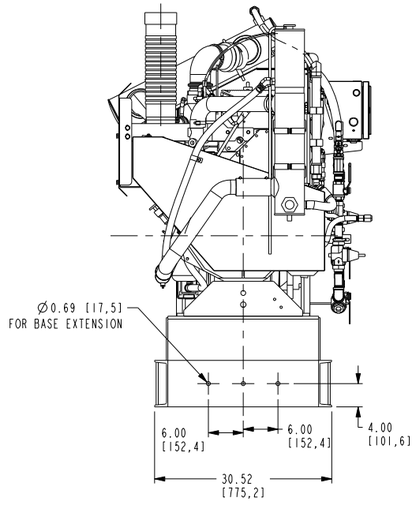
SECTION A-A

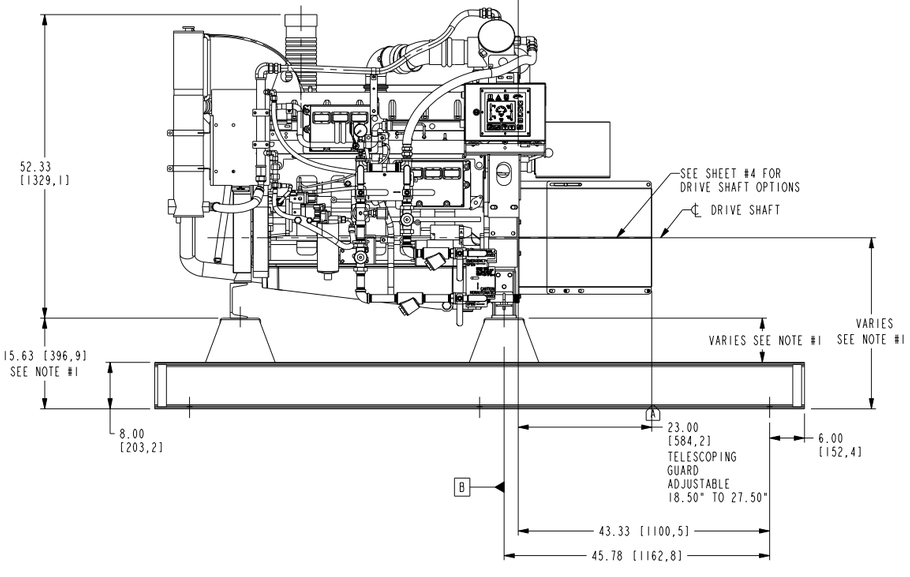
Ⓒ *** FRAME DIMENSIONS MAY CHANGE PER PUMP OPTION SELECTED ***



*** FRAME LENGTH MAY CHANGE PER PUMP OPTION SELECTION ***







NOTES:
1. RISER HIEGHT VARIES TO ACCOMDATE CUSTOMER SUPPIED PUMPS
2. REFERENCE OWERS MANUAL FOR DRIVE SHAFT ALIGNMENT SPECS
3. DO NOT SCALE DRAWING.
4. DRAWING SUBJUECT TO CHANGE WITHOUT NOTICE.
5. REFERENCE SHEET #1 FOR BASE FIRE PUMP INTERFACE

REV	ECO	DESCRIPTION OF REVISION	REV BY	DATE
C	2010-544	FRAME NOTES	S DUBICK	12-06-10
A	2010-015	OMIT NON-LIST DRIVE SHAFT ADDED U-JOINT ADAPTER: 15501 ADDED DRIVE SHAFT: 13422 CHG DRIVE SHAFT: 13430 WAS 13421 CHG COMP. FLG: 10015 WAS 10005 CHG GUARD: 16381 WAS 14161	MAC	02-15-10

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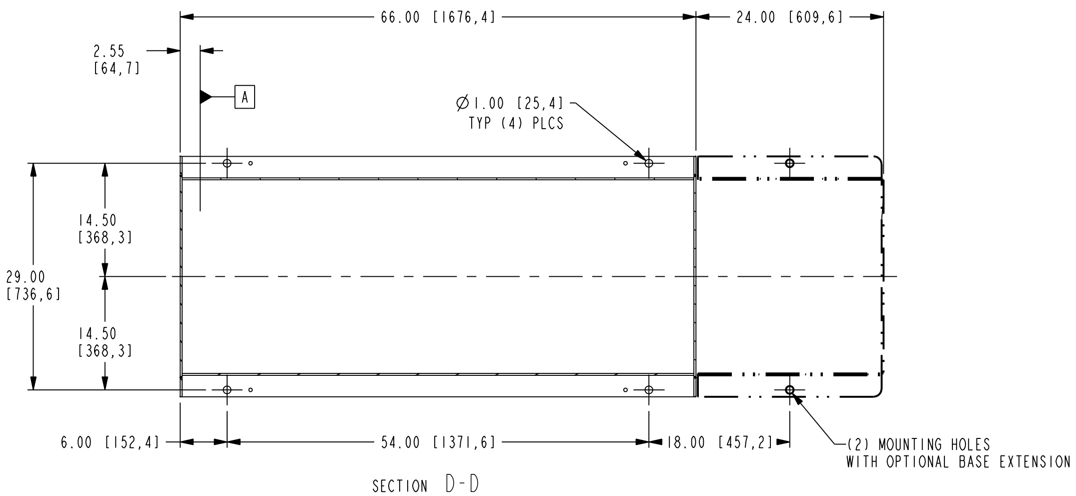
GENERAL ARRANGEMENT
CFP11E-F10/20

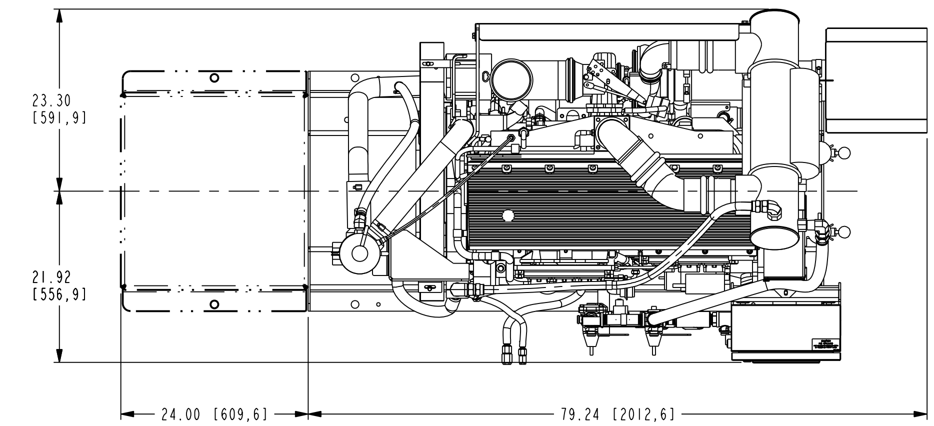
UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE:
ANGULAR DIMENSIONS ± 1°
THIRD ANGLE PROJECTION
IMPERIAL UNITS: WHOLE NUMBERS ±1.000; X.X ±0.100; X.XX ±0.010; X.XXX ±0.005
METRIC UNITS: WHOLE NUMBERS ±1.000; X.X ±0.100; X.XX ±0.010; X.XXX ±0.005

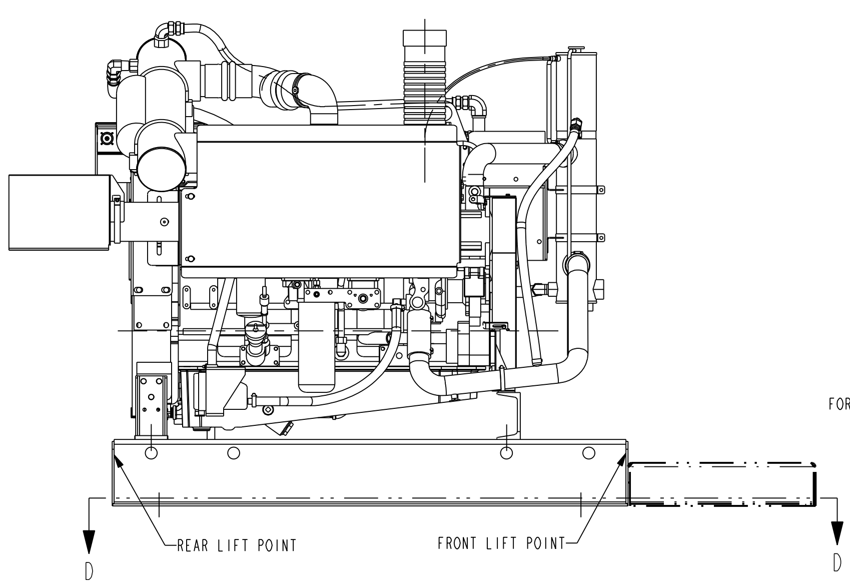
DWG UNITS: IN/LBS
DRAWN BY: DAN
DATE: 19-NOV-09
PRO-ENGINEER
REF DRWG:
SCALE: 1.000
SHEET 2 OF 4
EST WEIGHT: VARIES
DRAWING NO: 16018

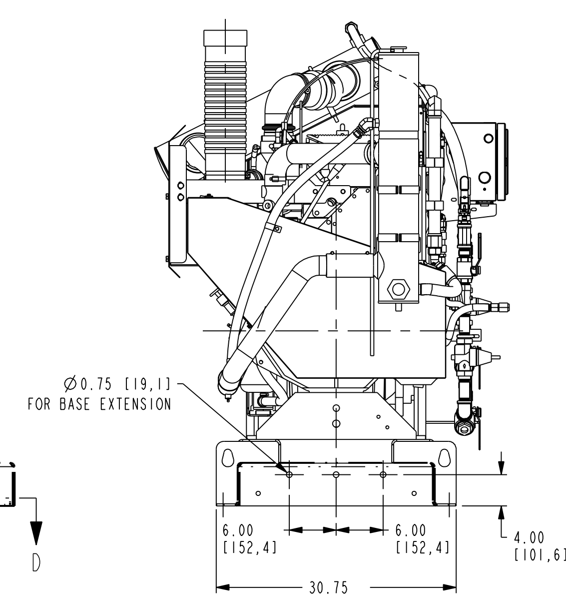
CFP11E CONNECTION INFORMATION	
SAE #1	FLYWHEEL HOUSING
1/2" NPT	FUEL INLET
3/8" NPT	FUEL OUTLET
1" NPT	RAW WATER INLET
1-1/4" NPT	RAW WATER DISCHARGE
120 / 240 VAC	COOLANT HEATER (2250 WATTS)
5" DIA NPT, CUFF, OR FLANGE	EXHAUST CONNECTION

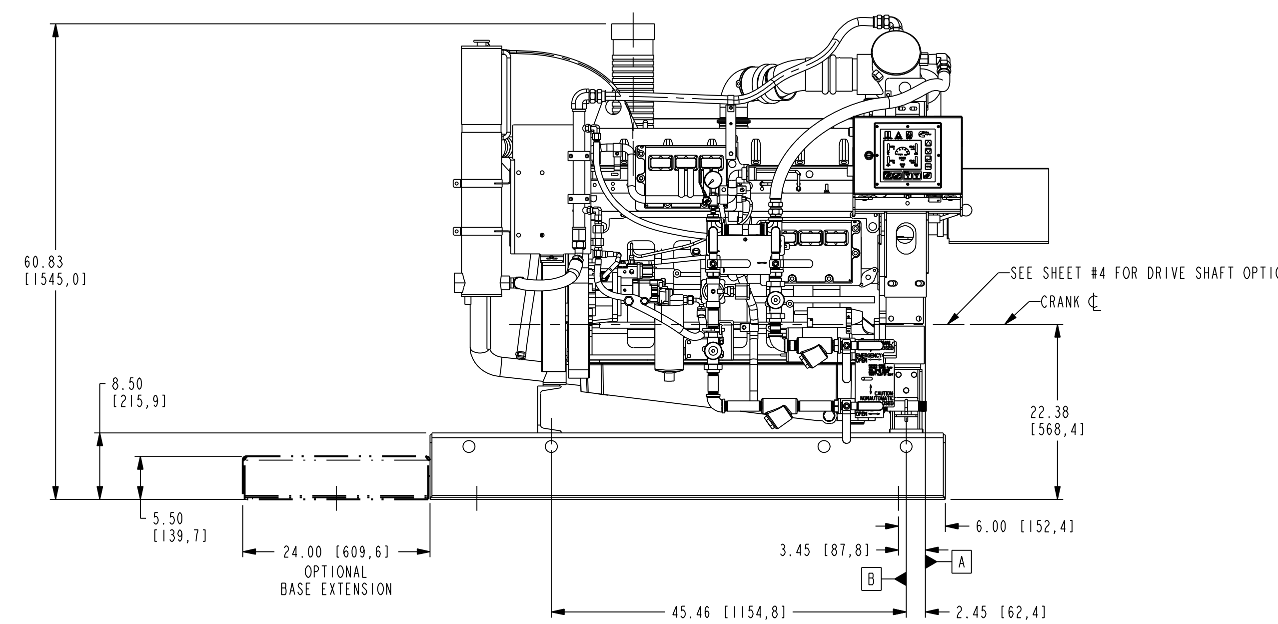
LEGEND AND DATUM IDENTIFIER	
SHEET #1	INSTALLATION DRAWING
SHEET #2	GENERAL ARRANGEMENT - HORIZONTAL SPLIT CASE PUMP BASE OPTION
SHEET #3	GENERAL ARRANGEMENT - VERTICAL TURBINE PUMP BASE OPTION
SHEET #4	DRIVE LINE OPTIONS
DATUM "A"	FACE OF FLYWHEEL HOUSING
DATUM "B"	REAR LEG BOLT LOCATION
DATUM "C"	FLYWHEEL MOUNTING SURFACE
DATUM "D"	UJOINT ADAPTER MOUNTING SURFACE
DATUM "EOS"	END OF PUMP SHAFT











NOTE:
1. TORSIONAL ANALYSIS REQUIRED FOR VERTICAL TURBINE INSTALLATION
2. REFERENCE OWNERS MANUAL FOR DRIVE SHAFT ALIGNMENT SPECS
3. DO NOT SCALE DRAWING.
4. DRAWING SUBJECT TO CHANGE WITHOUT NOTICE.
5. REFERENCE SHEET #1 FOR BASE FIREPUMP INTERFACE

REV	ENF	DESCRIPTION OF REVISION	REV BY	DATE
A	2010-015	OMIT NON-LIST DRIVE SHAFT ADDED U-JOINT ADAPTER: 15501 ADDED DRIVE SHAFT: 13422 CHG DRIVE SHAFT: 13430 WAS 13421 CHG COMP. FLG: 10015 WAS 10005 CHG GUARD: 16381 WAS 14161	MAC	15FEB2010

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1°	IMPERIAL UNITS	METRIC UNITS
THIRD ANGLE PROJECTION	MACHINE TOLERANCES .XX : ± 0.010 .XXX : ± 0.005 FORM TOLERANCES .XX : ± 0.030 .XXX : ± 0.015 FAB TOLERANCES .XX : ± 0.060 .XXX : ± 0.030	MACHINE TOLERANCES .X : ± 0.4 .XX : ± 0.2 FORM TOLERANCES .X : ± 0.8 .XX : ± 0.4 FAB TOLERANCES .X : ± 1.5 .XX : ± 0.8

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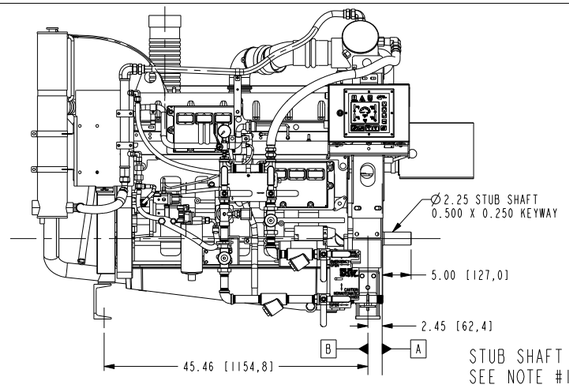
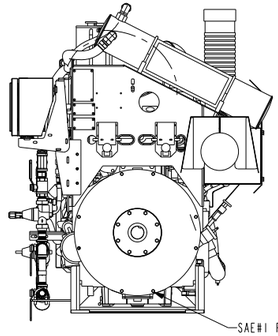
DEPERE, WISCONSIN

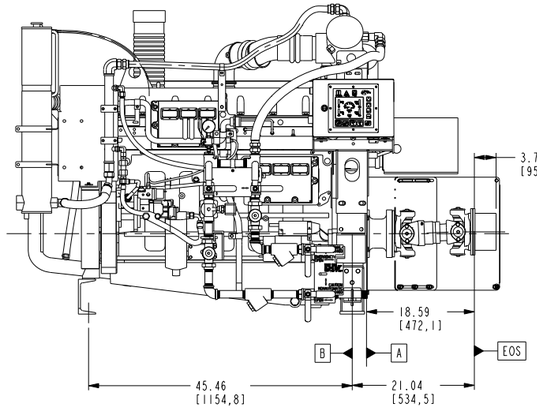
GENERAL ARRANGEMENT
CFP11E-F10/20

DWG UNITS: IN/LB/S	DRAWN BY: DAN	DATE: 19-NOV-09
	PRO-ENGINEER	REF DRWG:
SCALE: 1.000	SHEET 3 OF 4	DRAWING NO: 16018
EST WEIGHT: VARIES		

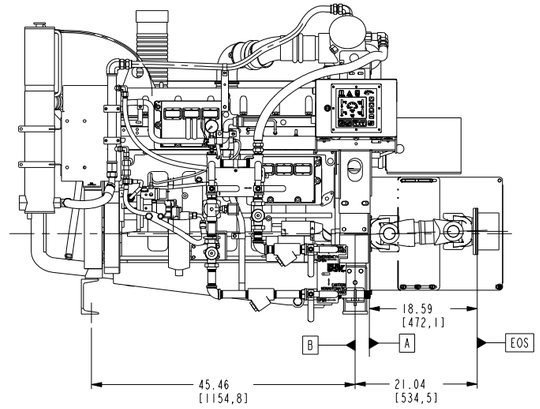


STUB SHAFT OPTION
SEE NOTE #1

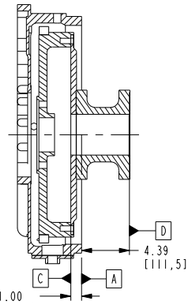




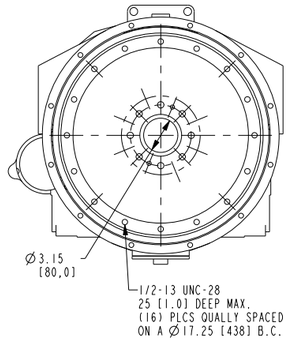
UL-LISTED 1810
SHORT COUPLED SHAFT



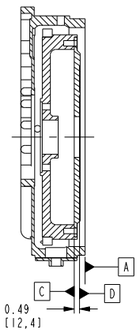
UL-LISTED 3172
SHORT COUPLED SHAFT



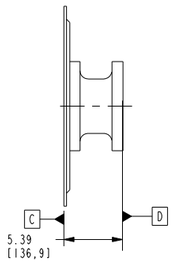
FLYWHEEL HOUSING
WITH FLYWHEEL
AND U-JOINT ADAPTER
(1810 SHAFT)

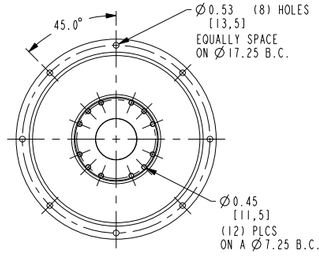


FLYWHEEL HOUSING
WITH FLYWHEEL
(FLYWHEEL ADAPTER
NOT SHOWN)

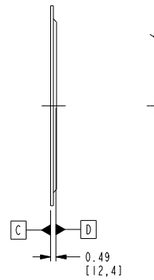


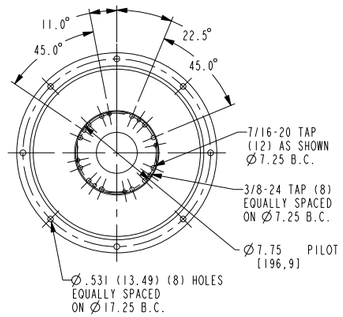
FLYWHEEL HOUSING
WITH FLYWHEEL
AND U-JOINT ADAPTER
(3172 SHAFT)



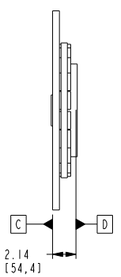


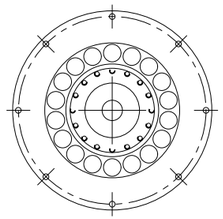
U-JOINT ADAPTER DETAIL
1810 SHAFT



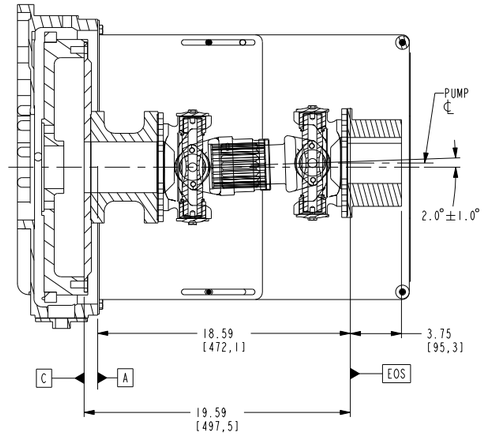


U-JOINT ADAPTER DETAIL
3172 SHAFT

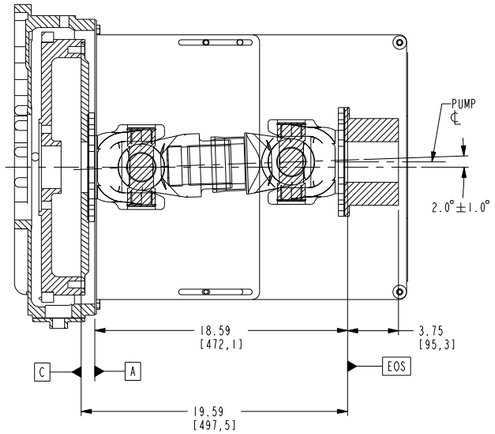




TORSIONAL COUPLING DETAIL



UL-LISTED 1810
SHORT COUPLED SHAFT
SCALE: 0.1875" = 1"
EST WEIGHT = 78 LBS (35 KG)



UL-LISTED 3172
SHORT COUPLED SHAFT
SCALE: 0.1875" = 1"
EST WEIGHT = 74 LBS (33 KG)

NOTE:
1. TORSIONAL ANALYSIS REQUIRED FOR VERTICAL TURBINE INSTALLATION
   ***ADD 1.08" FOR TORSIONAL COUPLING
2. REFERENCE OWNERS MANUAL FOR DRIVE SHAFT ALIGNMENT SPECS
3. DO NOT SCALE DRAWING.
4. DRAWING SUBJECT TO CHANGE WITHOUT NOTICE.
5. REFERENCE SHEET #1 FOR BASE FIREPUMP INTERFACE

LEGEND AND DATUM IDENTIFIER	
SHEET #1	INSTALLATION DRAWING
SHEET #2	GENERAL ARRANGEMENT - HORIZONTAL SPLIT CASE PUMP BASE OPTION
SHEET #3	GENERAL ARRANGEMENT - VERTICAL TURBINE PUMP BASE OPTION
SHEET #4	DRIVE LINE OPTIONS
DATUM "A"	FACE OF FLYWHEEL HOUSING
DATUM "B"	REAR LEG BOLT LOCATION
DATUM "C"	FLYWHEEL MOUNTING SURFACE
DATUM "D"	UJOINT ADAPTER MOUNTING SURFACE
DATUM "EOS"	END OF PUMP SHAFT

CFP DRIVE SHAFT MATRIX

ENGINE MODEL	CFP F-RATINGS W/MULTIPLE SHAFTS		
	RPM 1470	RPM 1760	RPM 2100
CFP11E-F10	3172 SHAFT	3172 SHAFT	1810 SHAFT
CFP11E-F20	3172 SHAFT	3172 SHAFT	1810 SHAFT

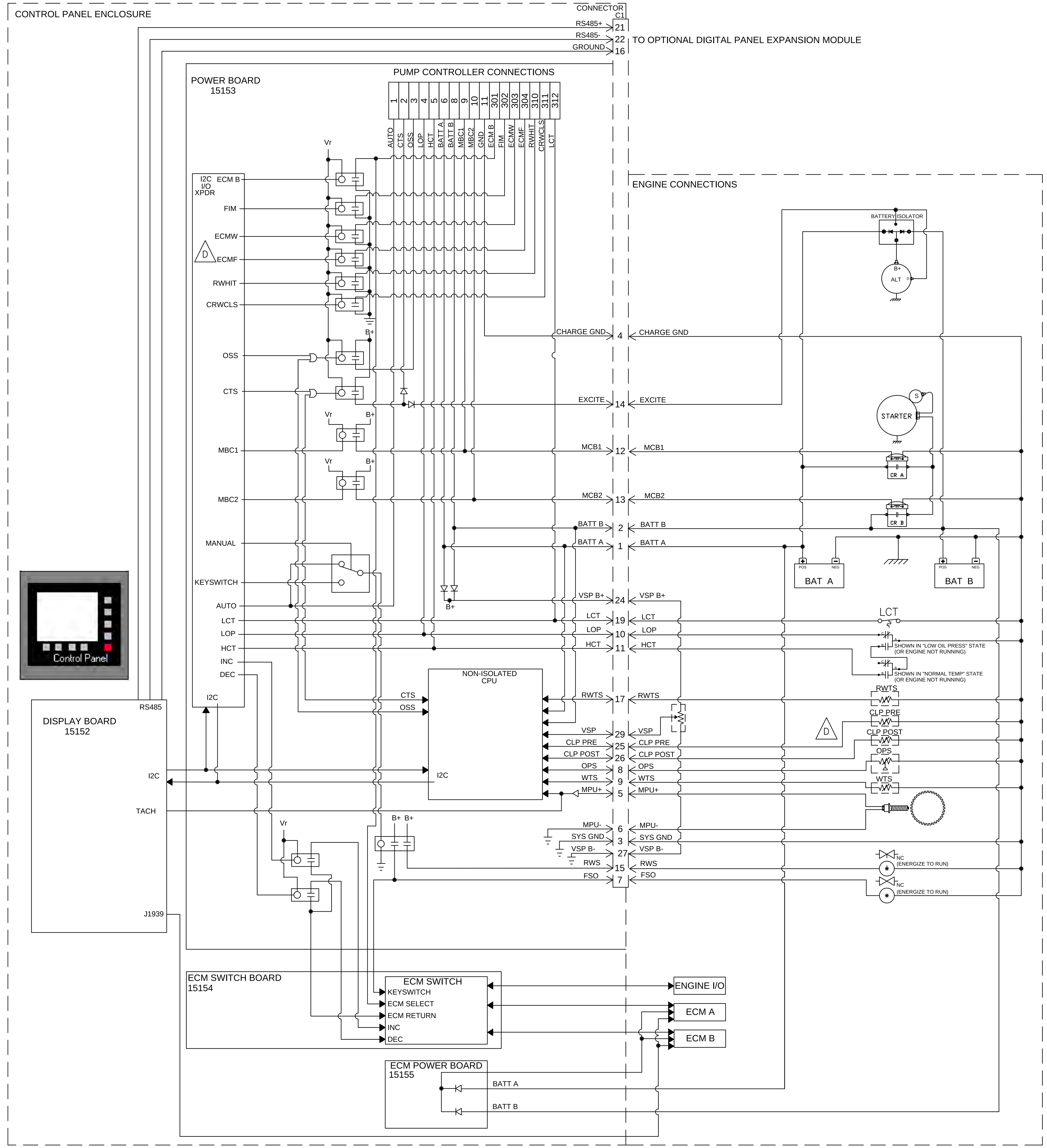
REV	ENF	DESCRIPTION OF REVISION	REV BY	DATE
A	2010-015	OMIT NON-LIST DRIVE SHAFT ADDED U-JOINT ADAPTER: 15501 ADDED DRIVE SHAFT: 13422 CHG DRIVE SHAFT: 13430 WAS 13421 CHG COMP. FLG: 10015 WAS 10005 CHG GUARD: 16381 WAS 14161	MAC	15FEB2010

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE
ANGULAR DIMENSIONS ± 1° | IMPERIAL UNITS | METRIC UNITS
THIRD ANGLE PROJECTION

CUMMINS FIRE POWER LLC CORPORATE OFFICE 1600 BUERKLE ROAD WHITE BEAR LAKE, MN WWW.CUMMINSFIREPOWER.COM	CUSTOM DESIGN AND UPFIT CENTER 870 LAWRENCE DRIVE DEPERE, WISCONSIN

GENERAL ARRANGEMENT
CFP11E-F10/20

DWG UNITS: IN/LB/S	DRAWN BY: DAN	DATE: 19-NOV-09
PRO-ENGINEER		REF DRWG:
SCALE: 0.100	SHEET 4 OF 4	DRAWING NO: 16018
EST WEIGHT: VARIES		



LEGEND:

- OSS = OVER SPEED SWITCH
- CTS = CRANK TERMINATION SWITCH
- MBC1 = MAIN BATTERY CONTACTOR 1
- MBC2 = MAIN BATTERY CONTACTOR 2
- LCT = LOW COOLANT TEMPERATURE
- HCT = HIGH COOLANT TEMPERATURE
- LOP = LOW OIL PRESSURE
- FSO = FUEL SHUT OFF
- RWS = RAW WATER SOLENOID
- VSP = VARIABLE SPEED PRESURE
- DOP PRE = DIFFERENTIAL OIL PRESSURE PRE
- DOP POST = DIFFERENTIAL OIL PRESSURE POST
- OPS = OIL PRESSURE SENDER
- WTS = WATER TEMPERATURE SENDER
- MPU = MAGNETIC PICK-UP
- RWHIT = RAW WATER HIGH INLET TEMP
- CRWCLS= CLOGGED RAW WATER COOLING LOOP STRAINER
- CLP PRE = COOLING LOOP PRESSURE PRE STRAINER
- CLP POST = COOLING LOOP PRESSURE POST STRAINER
- RWTS = RAW WATER TEMPERATURE SENDER
- ECMW = ELECTRONIC CONTROL MODULE WARNING
- ECMF = ELECTRONIC CONTROL MODULE FAILURE

NOTES:
1) SEE SHEET 2 FOR CFP5E ECM SWITCH SCHEMATIC
2) SEE SHEET 3 FOR CFP7E ECM SWITCH SCHEMATIC
3) SEE SHEET 4 FOR CFP9E ECM SWITCH SCHEMATIC
4) SEE SHEET 5 FOR CFP11E ECM SWITCH SCHEMATIC
5) SEE SHEET 6 FOR CFP15E ECM SWITCH SCHEMATIC
6) SEE SHEET 7 FOR CFP23E ECM SWITCH SCHEMATIC

REV	ENF	DESCRIPTION OF REVISION	BY	DATE
D	2014-107	ADDED COOLING LOOP SENSORS	RMJ	21FEB2014
C		ADDED LOW COOLANT TEMP SWITCH WIRING.	KAK	03DEC2013
B	2011-307	MODIFIED SHEET 7, CFP23E	S DUBICK	12-JAN-12
A	2011-189	ADDED RS485 WIRES.	PBS	15JUN2011

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE
ANGULAR DIMENSIONS ± 1° | IMPERIAL UNITS | METRIC UNITS
THIRD ANGLE PROJECTION

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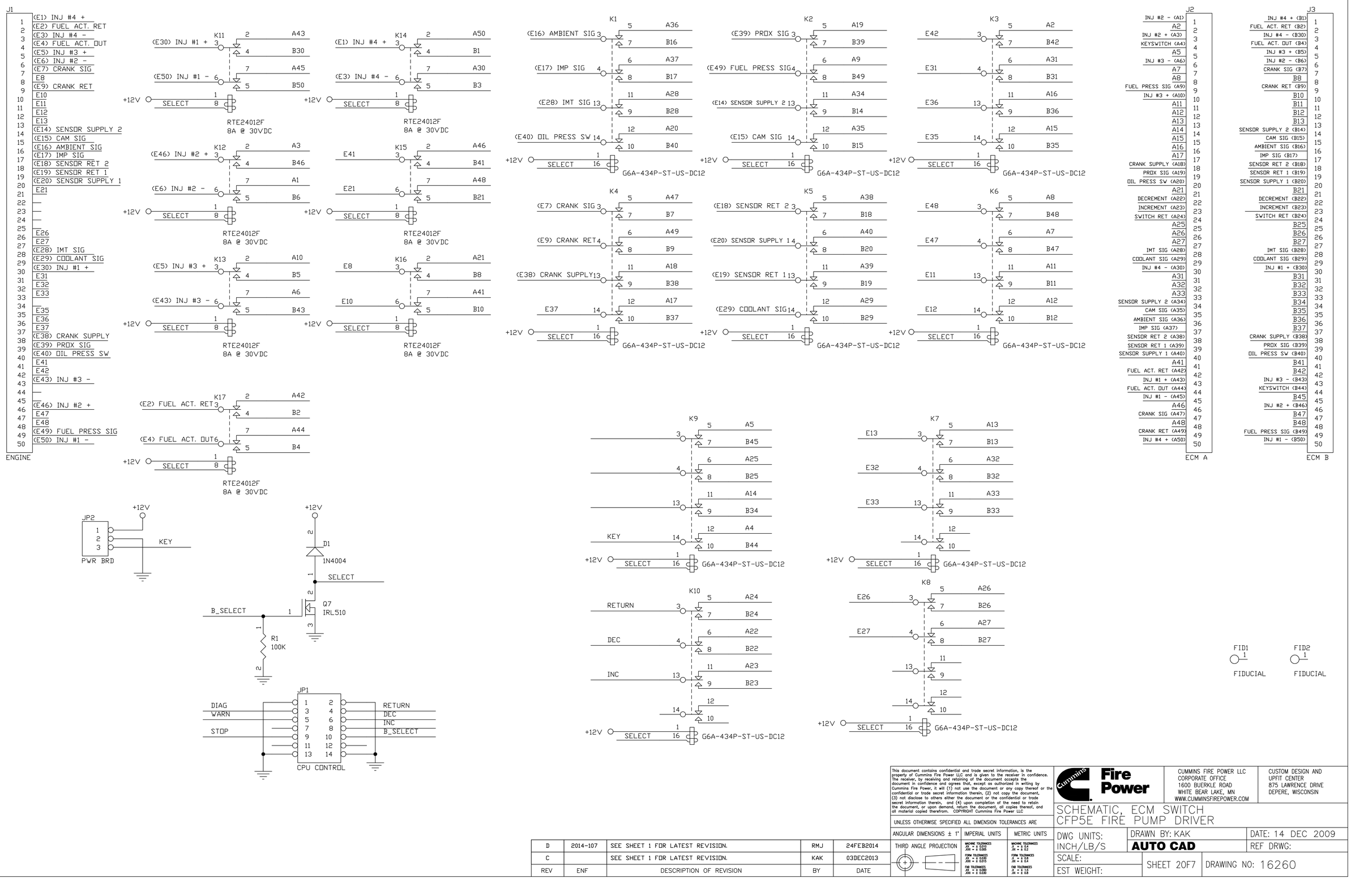
DEPERE, WISCONSIN

SCHEMATIC, FIRE PUMP DRIVERS
CFP MODELS: 5E, 7E, 9E, 11E, 15E, 23E

DWG UNITS: INCH/LB/S	DRAWN BY: KAK	DATE: 14 DEC 2009
	AUTO CAD	REF DRWG:
SCALE:	SHEET 1OF7	DRAWING NO: 16260
EST WEIGHT:		



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ANGULAR DIMENSIONS ± 1°

IMPERIAL UNITS

MACHINE TOLERANCES
.XX = ± 0.010
.XXX = ± 0.005

FORM TOLERANCES
.XX = ± 0.010
.XXX = ± 0.010

PAD TOLERANCES
.XX = ± 0.030
.XXX = ± 0.030

METRIC UNITS

MACHINE TOLERANCES
.X = ± 0.4
.XX = ± 0.2

FORM TOLERANCES
.X = ± 0.4
.XX = ± 0.2

PAD TOLERANCES
.X = ± 1.5
.XX = ± 0.8

THIRD ANGLE PROJECTION

REV	ENF	DESCRIPTION OF REVISION	BY	DATE
D	2014-107	SEE SHEET 1 FOR LATEST REVISION.	RMJ	24FEB2014
C		SEE SHEET 1 FOR LATEST REVISION.	KAK	03DEC2013

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SCHEMATIC, ECM SWITCH CFP5E FIRE PUMP DRIVER

DWG UNITS: INCH/LB/S

DRAWN BY: KAK

AUTO CAD

DATE: 14 DEC 2009

REF DRWG:

SCALE:

EST WEIGHT:

SHEET 20F7

DRAWING NO: 16260

REV	ENF	DESCRIPTION OF REVISION	BY	DATE
D	2014-107	SEE SHEET 1 FOR LATEST REVISION.	RMJ	24FEB2014
C		SEE SHEET 1 FOR LATEST REVISION.	KAK	03DEC2013

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1°	IMPERIAL UNITS	METRIC UNITS
THIRD ANGLE PROJECTION	MACHINE TOLERANCES .XX = ± 0.010 .XXX = ± 0.005 FORM TOLERANCES .XX = ± 0.030 .XXX = ± 0.015 FAB TOLERANCES .XX = ± 0.060 .XXX = ± 0.030	MACHINE TOLERANCES .X = ± 0.4 .XX = ± 0.2 FORM TOLERANCES .X = ± 0.8 .XX = ± 0.4 FAB TOLERANCES .X = ± 1.5 .XX = ± 0.8

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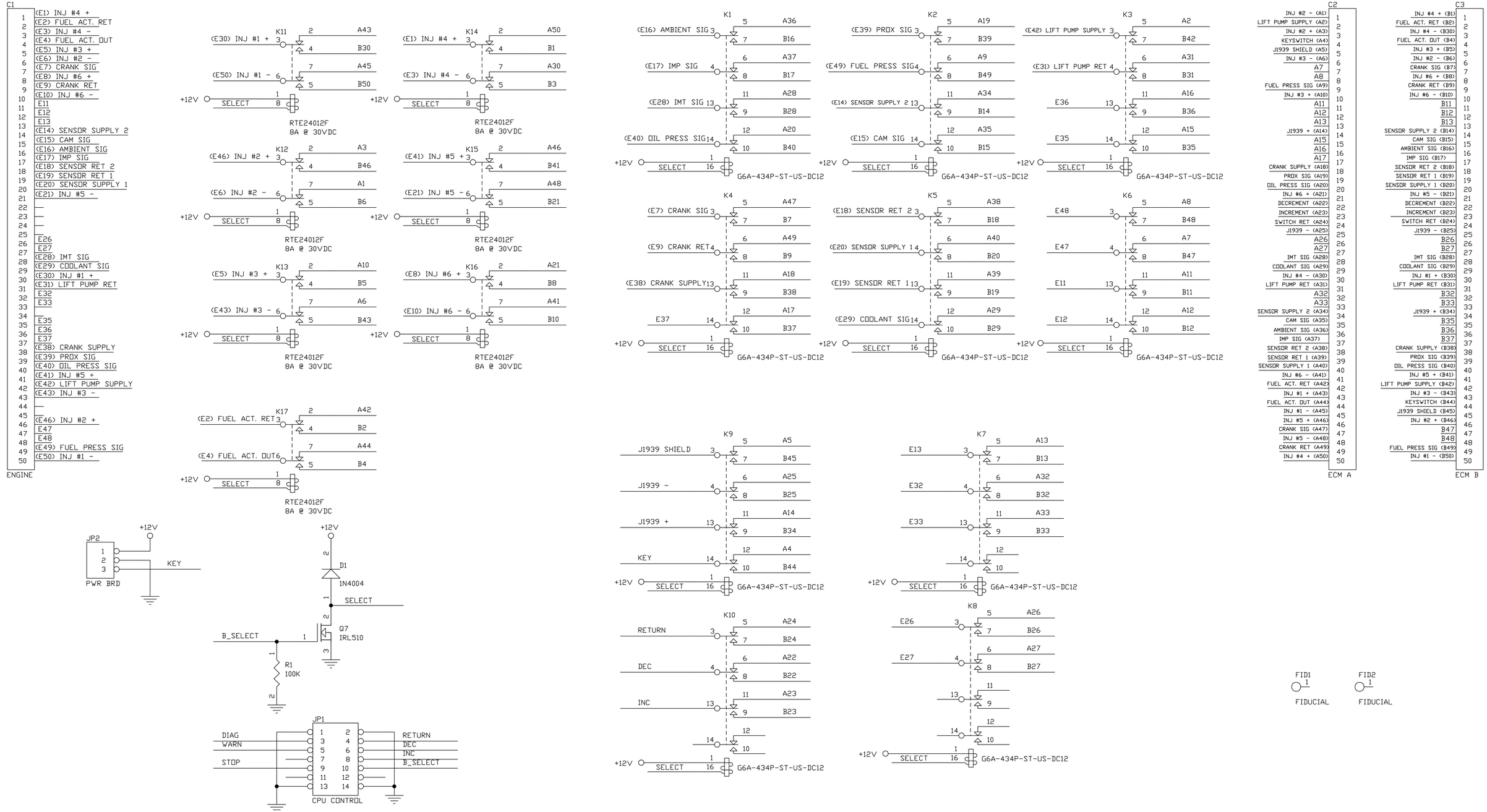
SCHEMATIC, ECM SWITCH CFP7E FIRE PUMP DRIVER

DWG UNITS: INCH/LB/S	DRAWN BY: KAK	DATE: 14 DEC 2009
	AUTO CAD	REF DRWG:
SCALE:	SHEET 3OF7	DRAWING NO: 16260
EST WEIGHT:		



REV	ENF	DESCRIPTION OF REVISION	BY	DATE
D	2014-107	SEE SHEET 1 FOR LATEST REVISION.	RMJ	24FEB2014
C		SEE SHEET 1 FOR LATEST REVISION.	KAK	03DEC2013

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1°

THIRD ANGLE PROJECTION

IMPERIAL UNITS	METRIC UNITS
MACHINE TOLERANCES .XX = ± 0.010 .XXX = ± 0.005 FORM TOLERANCES .XX = ± 0.030 .XXX = ± 0.015 FAB TOLERANCES .XX = ± 0.060 .XXX = ± 0.030	MACHINE TOLERANCES .X = ± 0.4 .XX = ± 0.2 FORM TOLERANCES .X = ± 0.8 .XX = ± 0.4 FAB TOLERANCES .X = ± 1.5 .XX = ± 0.8

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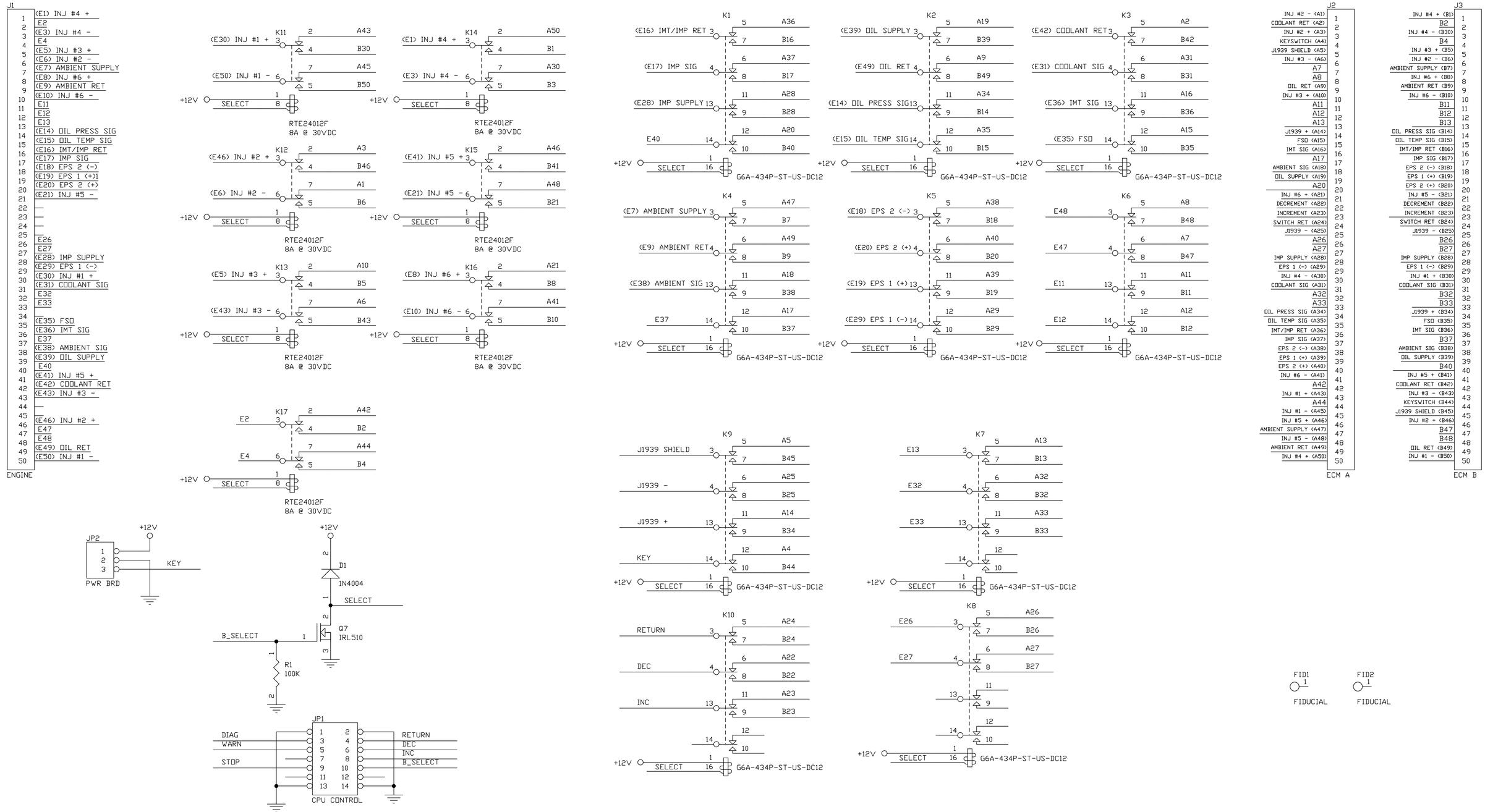
SCHEMATIC, ECM SWITCH CFP9E FIRE PUMP DRIVER

DWG UNITS: INCH/LB/S	DRAWN BY: KAK	DATE: 14 DEC 2009
	AUTO CAD	REF DRWG:
SCALE:	SHEET 40F7	DRAWING NO: 16260
EST WEIGHT:		



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IMPERIAL UNITS: MACHINE TOLERANCES .X = ± 0.010, .XXX = ± 0.005; FORM TOLERANCES .XX = ± 0.020, .XXX = ± 0.015; FAB TOLERANCES .XX = ± 0.060, .XXX = ± 0.030

METRIC UNITS: MACHINE TOLERANCES .X = ± 0.4, .XX = ± 0.2; FORM TOLERANCES .X = ± 0.4, .XX = ± 0.4; FAB TOLERANCES .X = ± 1.5, .XX = ± 0.8

THIRD ANGLE PROJECTION

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C		SEE SHEET 1 FOR LATEST REVISION.	KAK	03DEC2013

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SCHEMATIC, ECM SWITCH CFP11E FIRE PUMP DRIVER

DWG UNITS: INCH/LB/S

DRAWN BY: KAK

DATE: 14 DEC 2009

AUTO CAD

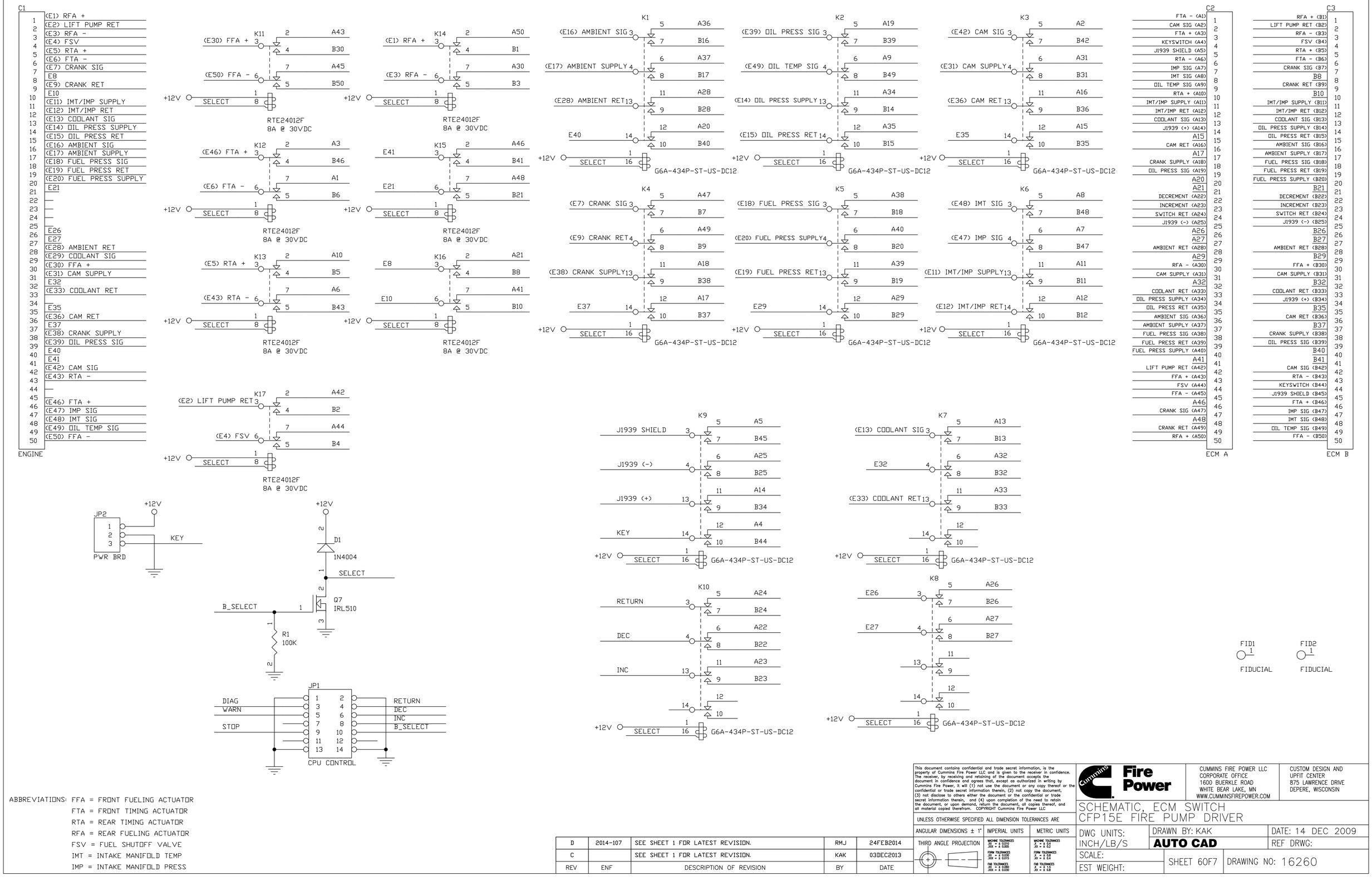
REF DRWG:

SCALE:

EST WEIGHT:

SHEET 50F7

DRAWING NO: 16260



ABBREVIATIONS: FFA = FRONT FUELING ACTUATOR
FTA = FRONT TIMING ACTUATOR
RTA = REAR TIMING ACTUATOR
RFA = REAR FUELING ACTUATOR
FSV = FUEL SHUTOFF VALVE
IMT = INTAKE MANIFOLD TEMP
IMP = INTAKE MANIFOLD PRESS

REV	ENF	DESCRIPTION OF REVISION	BY	DATE
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FORM TOLERANCES
.XX = ± 0.020
.XXX = ± 0.010
FAB TOLERANCES
.XX = ± 0.060
.XXX = ± 0.030

METRIC UNITS
MACHINE TOLERANCES
.X = ± 0.4
.XX = ± 0.2
FORM TOLERANCES
.X = ± 0.8
.XX = ± 0.4
FAB TOLERANCES
.X = ± 1.5
.XX = ± 0.8

THIRD ANGLE PROJECTION

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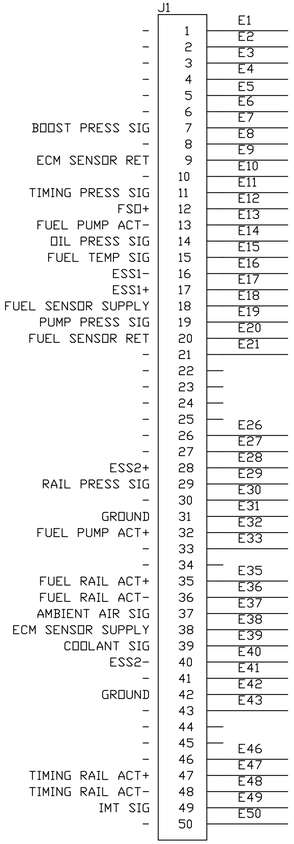
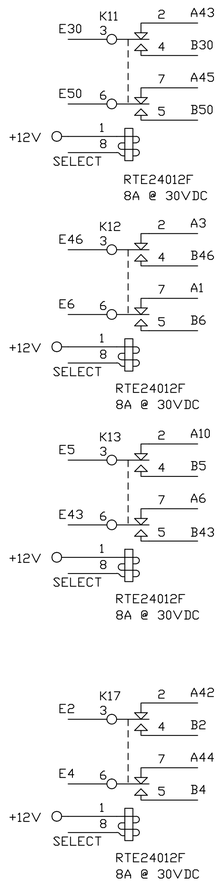
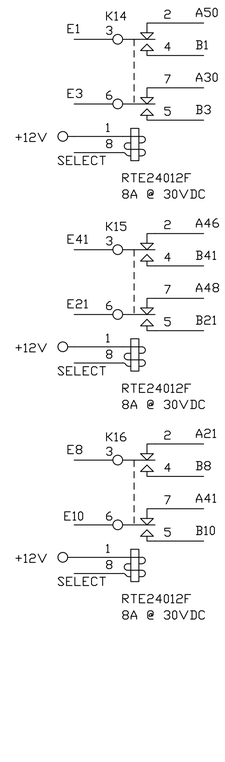
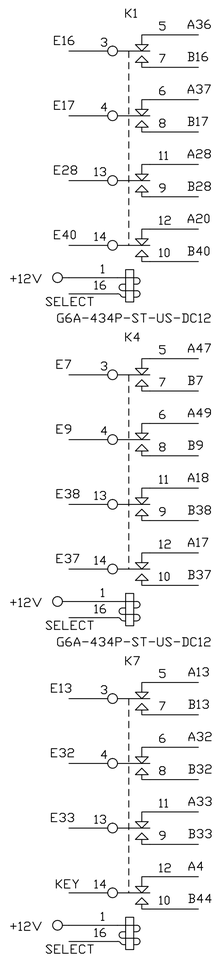
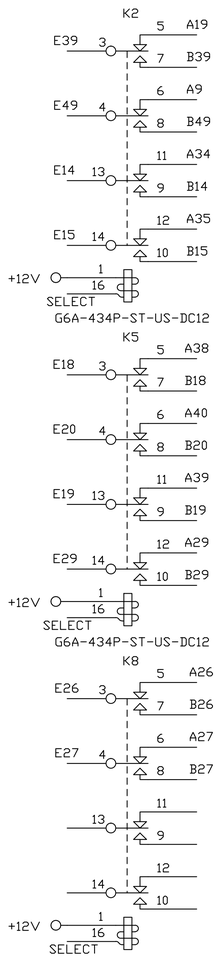
DWG UNITS: INCH/LB/S
DRAWN BY: KAK
AUTO CAD
DATE: 14 DEC 2009
REF DRWG:
SCALE:
EST WEIGHT:
SHEET 6OF7
DRAWING NO: 16260

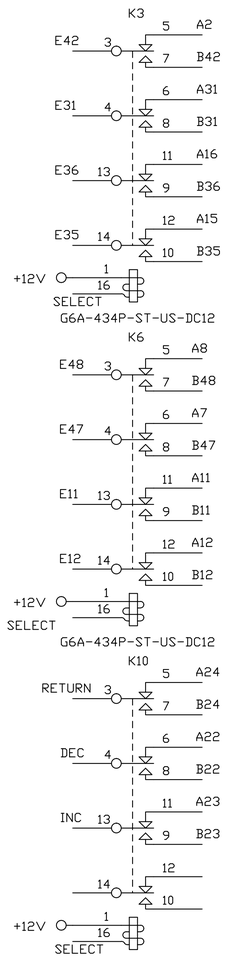


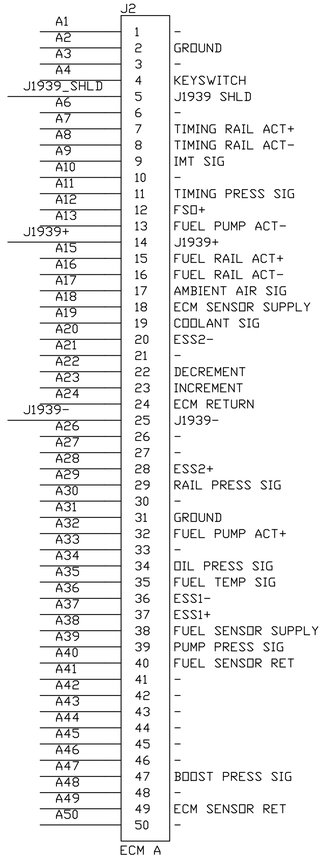


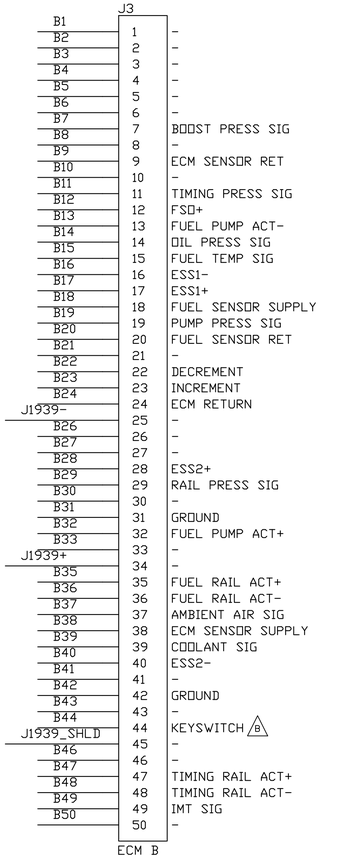


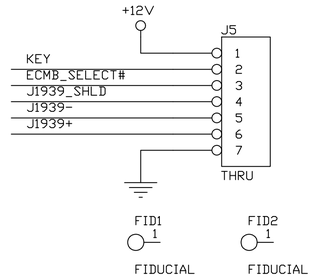


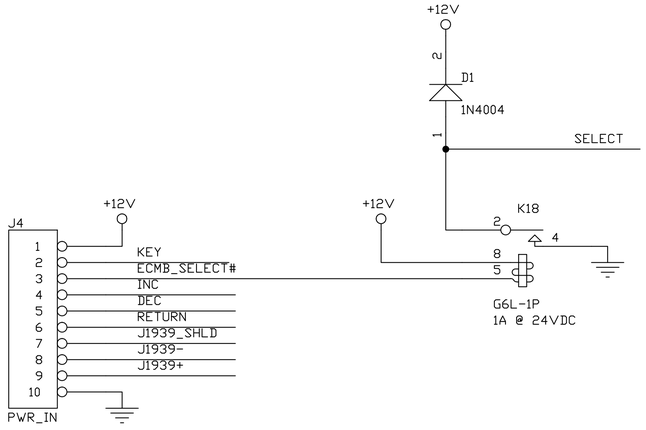












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THIRD ANGLE PROJECTION

MACHINE TOLERANCES .XX = ± 0.010 .XXX = ± 0.005
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FAB TOLERANCES .XX = ± 0.060 .XXX = ± 0.030
MACHINE TOLERANCES .X = ± 0.2 .XX = ± 0.2
FORM TOLERANCES .X = ± 0.4 .XX = ± 0.4
FAB TOLERANCES .X = ± 1.5 .XX = ± 0.8

REV	ENF	DESCRIPTION OF REVISION	BY	DATE
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C		SEE SHEET 1 FOR LATEST REVISION.	KAK	03DEC2013

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SCHEMATIC, ECM SWITCH CFP23E FIRE PUMP DRIVER

DWG UNITS: INCH/LB/S
DRAWN BY: KAK
DATE: 14 DEC 2009
AUTO CAD
REF DRWG:
SCALE:
EST WEIGHT:
SHEET 7OF7
DRAWING NO: 16260