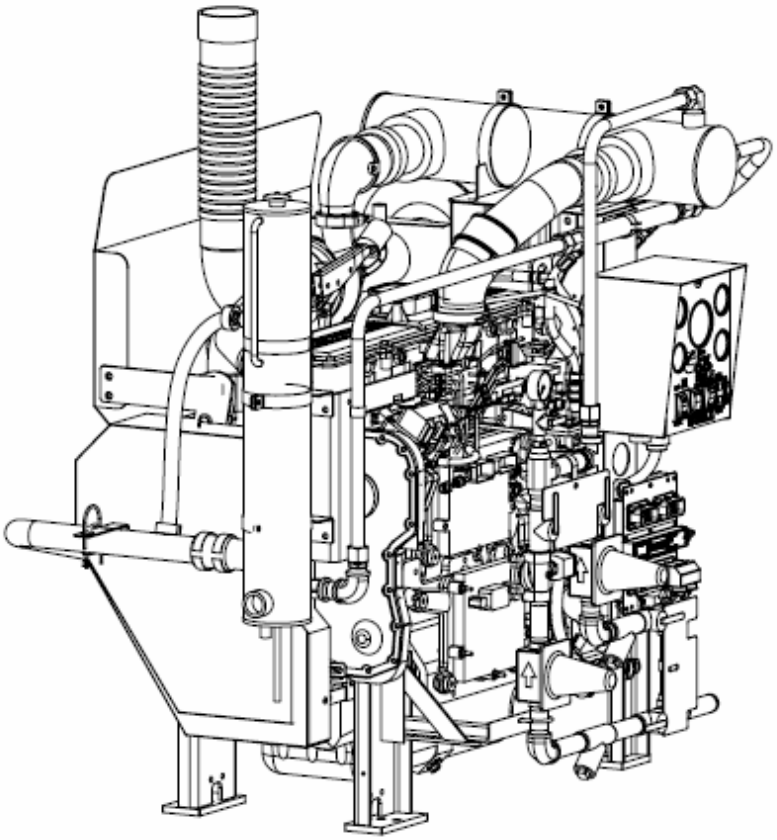
CFP9E SERIES

Operation & Maintenance Manual

Fire Pump Drive Engines



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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; or
- Starting batteries
- Coolant heaters are covered for 12 months.

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.

Section 1 - Safety

1.1 Introduction

Cummin's Fire Power 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 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 to 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 cause 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: Perform a walk around inspection and alert all area personnel that the equipment will be starting before manual operation.

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 the 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.

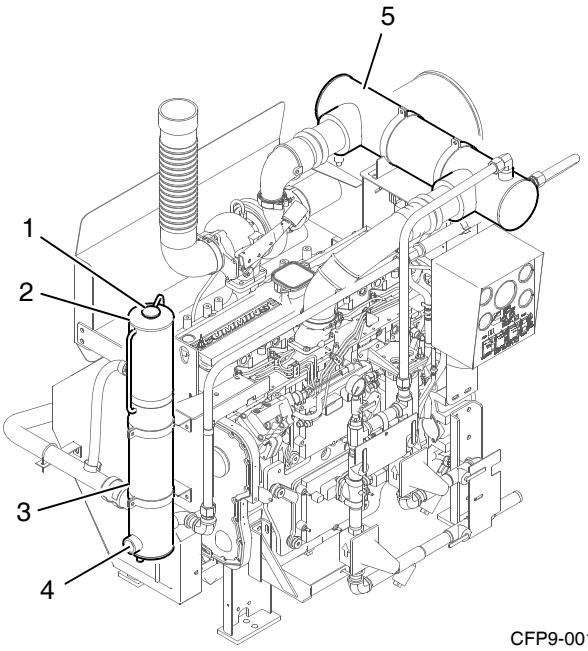
Section 2 - Description

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.

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.



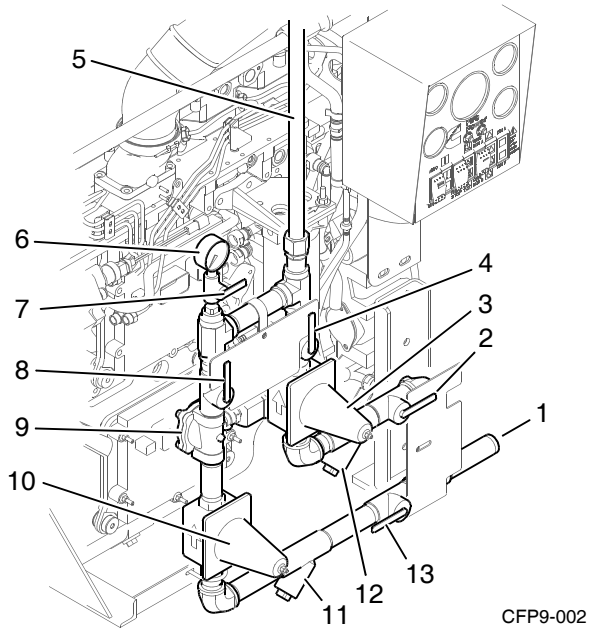
1. Coolant Fill Cap
2. Coolant Expansion Tank
3. Coolant Heat Exchanger
4. Heat Exchanger Discharge
5. Charge Air Cooler (CAC) Heat Exchanger

Figure 2-1 Heat Exchanger Tanks

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.

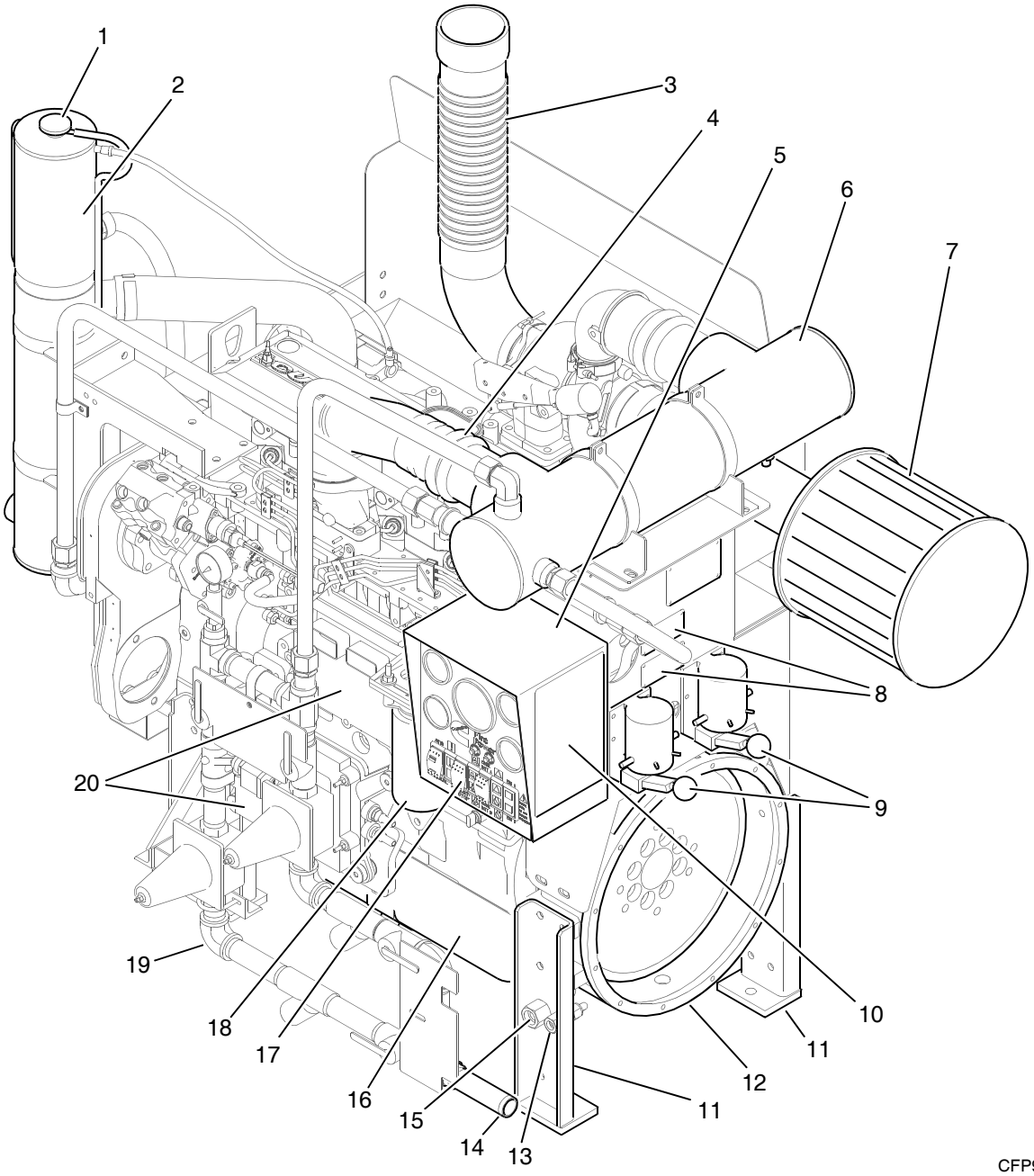
2.2 Fire Pump Engines

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.



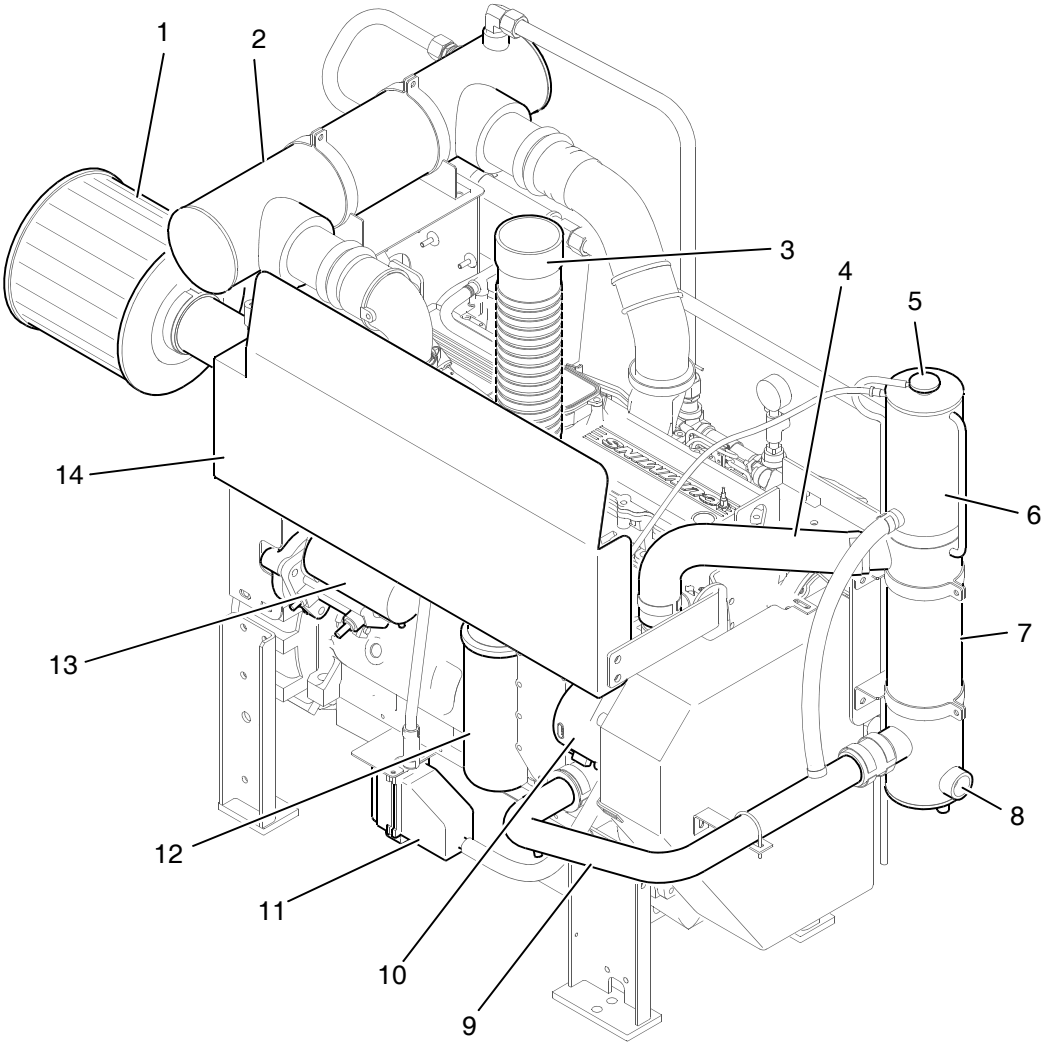
1. 1" NPT Raw Water Inlet
2. Bypass Water Inlet Valve
3. Bypass Water Pressure Regulator
4. Bypass Water Outlet Valve
5. Pipe To Heat Exchanger
6. Water Supply Pressure Gauge
7. Pressure Gauge Isolation Valve
8. Normal Water Outlet Valve
9. Normal Water Solenoid Valve
10. Normal Water Pressure Regulator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

Figure 2-2 Raw Water Cooling Loop Manifold



1. Coolant 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 Element
8. Engine Speed Setting Plates
9. Battery Starter Contactors
10. Manual Start Instruction Decal
11. Engine Supports
12. Flywheel Housing
13. Fuel Return Outlet
14. Raw Water Inlet
15. Fuel Inlet
16. Oil Pan and Drain
17. Operator Control Panel
18. Fuel Filter or Filter/Separator
19. Cooling Loop Manifold Piping
20. Electronic Control Modules (ECMs)

Figure 2-3 Engine Components - Instrument Panel Side



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

Figure 2-4 Engine Components - Turbocharger Side

This product meets Tier 3 emission levels. This turbocharged engine requires charge air cooling (CAC) and fuel cooling.

No deviations are permitted without prior written approval. These engines are to be used only for fire protection applications. Refer to Figure 2-1, Figure 2-2, Figure 2-3 and Figure 2-4.

2.3 Operator Control Panel

The operator control panel is mounted on the flywheel end on the left (fuel pump) side of the engine. Refer to Section 4 - Controls for additional information.

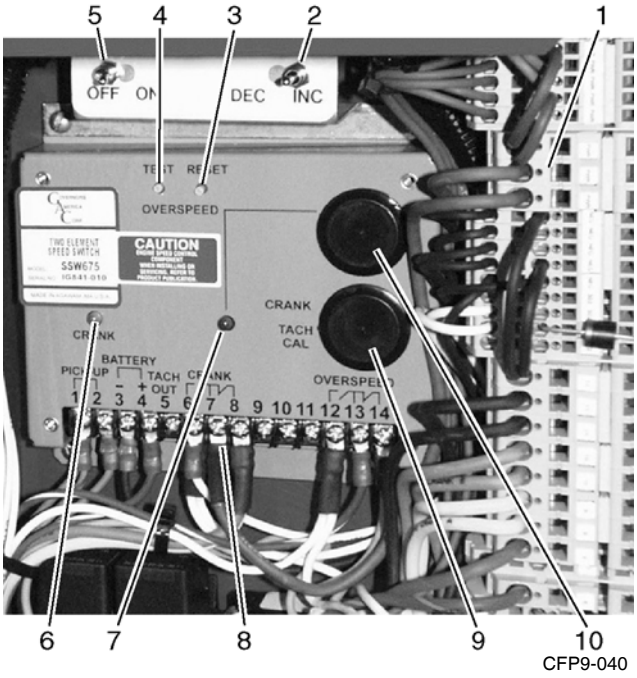
The operator control panel contains controls for starting, monitoring engine performance and controlling fire pump engine operation.

2.3.1 Overspeed Switches

Each engine is equipped with an electronic overspeed module which activates the fuel pump solenoid valve and ECM ignition to shut off the engine when the RPM exceeds a preset limit. The overspeed switch senses engine speed during the start cycle and stops the starting motor cranking cycle. Refer to Figure 2-5.

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.



1. Spring Clamp Terminal Blocks
2. Speed Increase/Decrease Toggle Switch
3. RESET Button
4. TEST Button
5. Diagnostic ON/OFF Toggle Switch
6. CRANK Termination or RUN Signal Indicator LED (Factory Use Only)
7. Overspeed Indicator LED
8. Pre-wired Terminals
9. Crank Terminate Potentiometer Cover
10. Overspeed Potentiometer Cover

Figure 2-5 Engine Overspeed Control Module

2.4 Fire Pump Controller

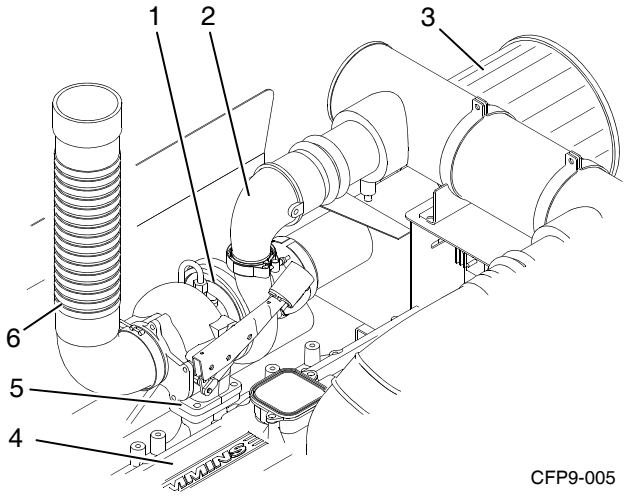
Fire pump controller is not supplied by Cummins Fire Power, or Cummins, Inc. The fire pump controller starts the engine automatically when a remote fire demand signal is initiated and automatically shuts down the engine when the fire demand signal is discontinued.

The engine may be started locally in the Manual Mode and shut down using the operator control panel Stop Switch or by returning the switch back to automatic mode.

NOTE: *Pressure recorders are available to provide a permanent record of water pressure fluctuations and engine starts. Sequential starting is available for multiple-pump installations to prevent all pumps from starting simultaneously.*

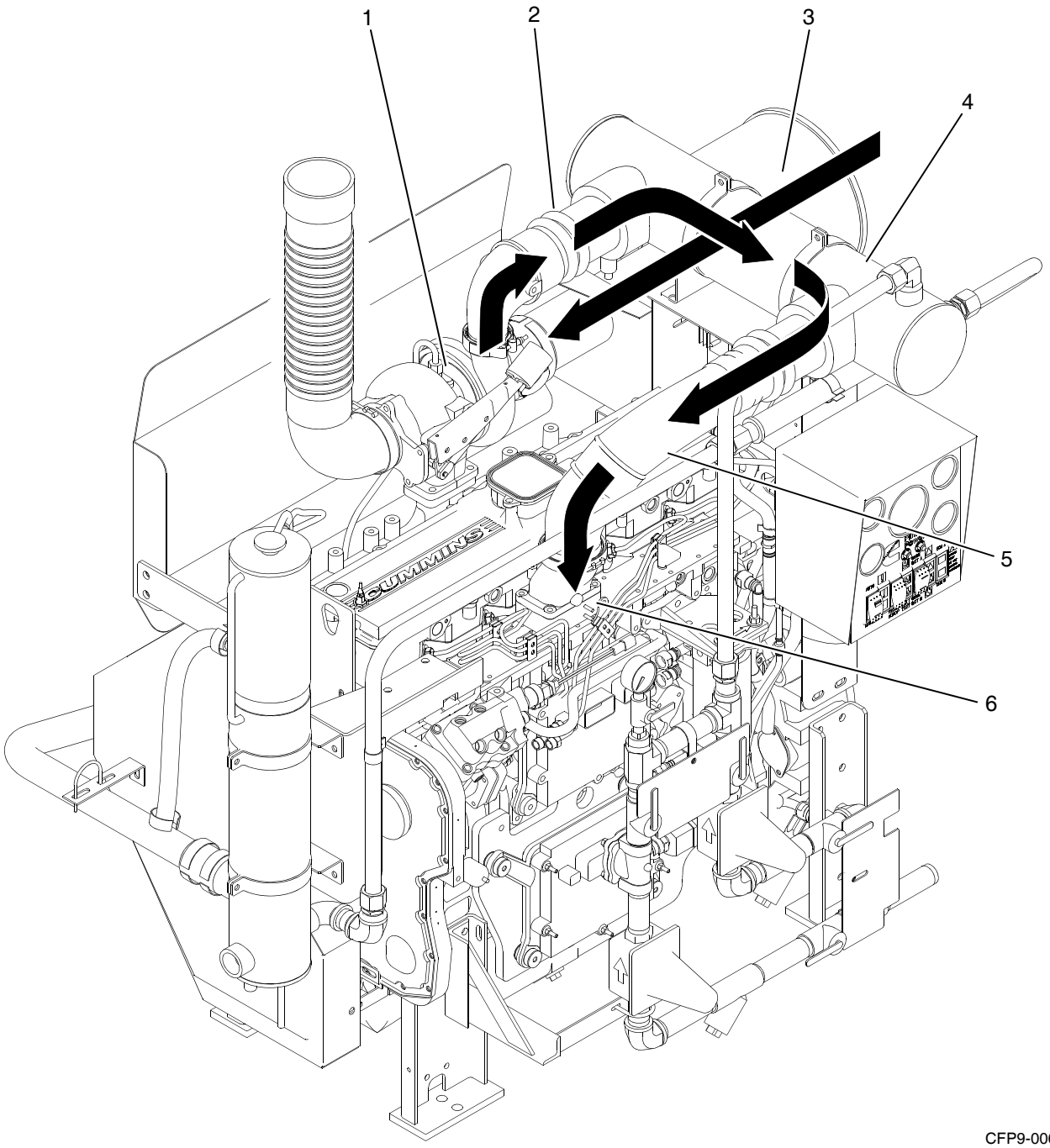
2.5 Air Intake System

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 2-6 and Figure 2-7.



1. Turbocharger
2. Turbo Connection to Charge Air Cooler
3. Intake Air Cleaner
4. Valve Cover
5. Exhaust Manifold
6. Exhaust Flex Connection

Figure 2-6 Turbocharger and Exhaust Manifold

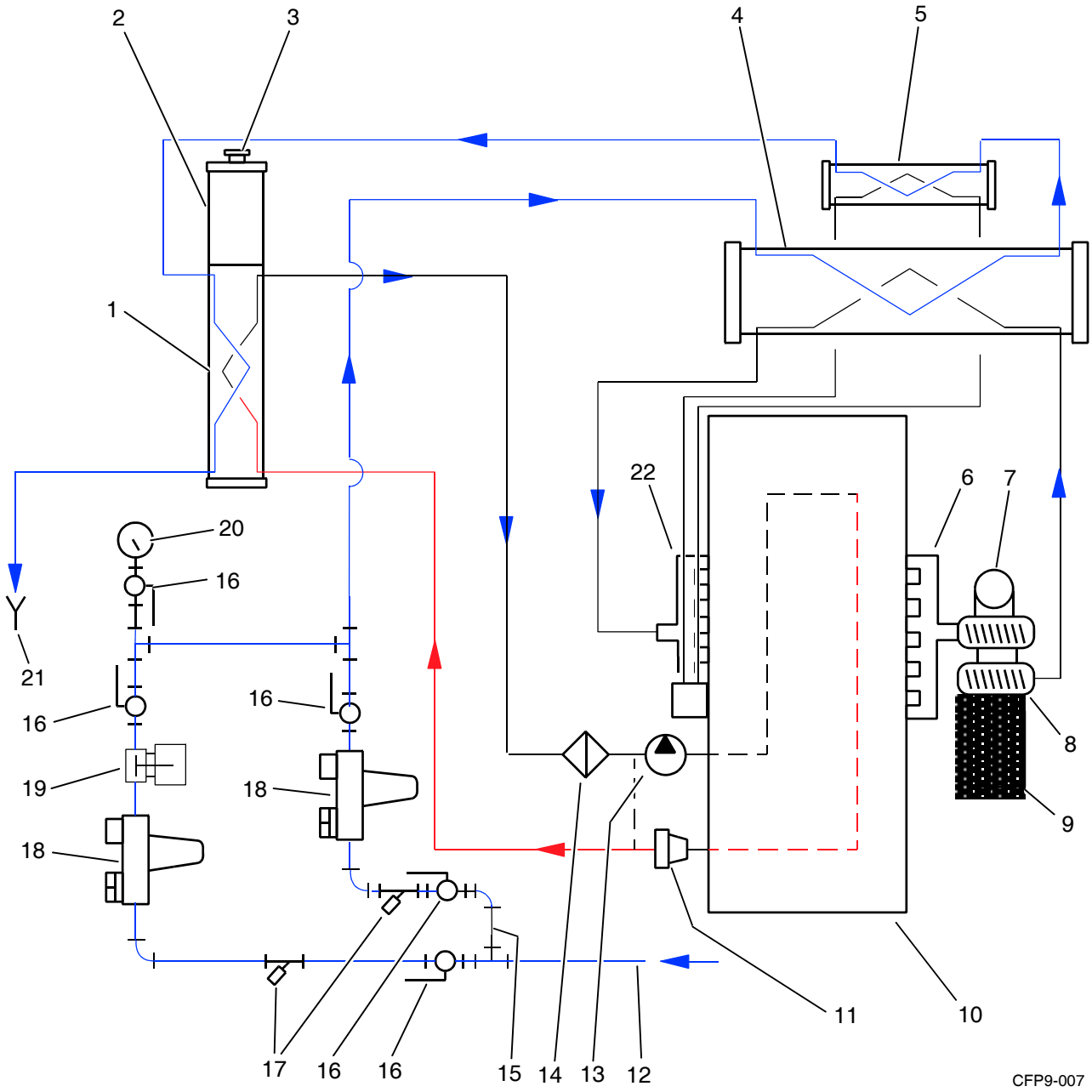


1. Turbocharger
2. Air Hose To Charge Air Cooler
3. Intake Air Cleaner
4. Charge Air Cooler (CAC) Heat Exchanger
5. Charge Air Cooler Hose
6. Combustion Air Intake Manifold

Figure 2-7 Engine Air Intake and Charge Air Cooling Flow Diagram

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.



1. Coolant Heat Exchanger
2. Coolant Expansion Tank
3. Coolant 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. 185° F. Thermostat
12. Raw Water Inlet Pipe
13. Coolant Pump
14. Coolant Filter
15. Bypass Piping
16. Manual Shut-off Valve
17. Raw Water Wye 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 2-8 Engine Cooling System Flow Diagram

Water entering the cooling system through the 1” NPT 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 2-1, Figure 2-2 and Figure 2-7.

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 Fuel Cooling Heat Exchanger and the Engine Coolant Heat Exchanger. The raw water exits the Coolant Heat Exchanger through a 1-1/4” NPT 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 Assembly Diagram, Raw Water Piping. Refer to National Fire Protection Association NFPA20 Chapter 11 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.*

When the raw water piping is installed, adjust both pressure regulator set points before operating the pump.

1. The upper line is the bypass line. The bypass line outlet valve should be closed.

2. 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 Engine Data Sheets 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 107° C (225° F). 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 percent antifreeze and 50 percent water. The coolant level should be maintained just below the fill neck of the coolant supply tank.

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

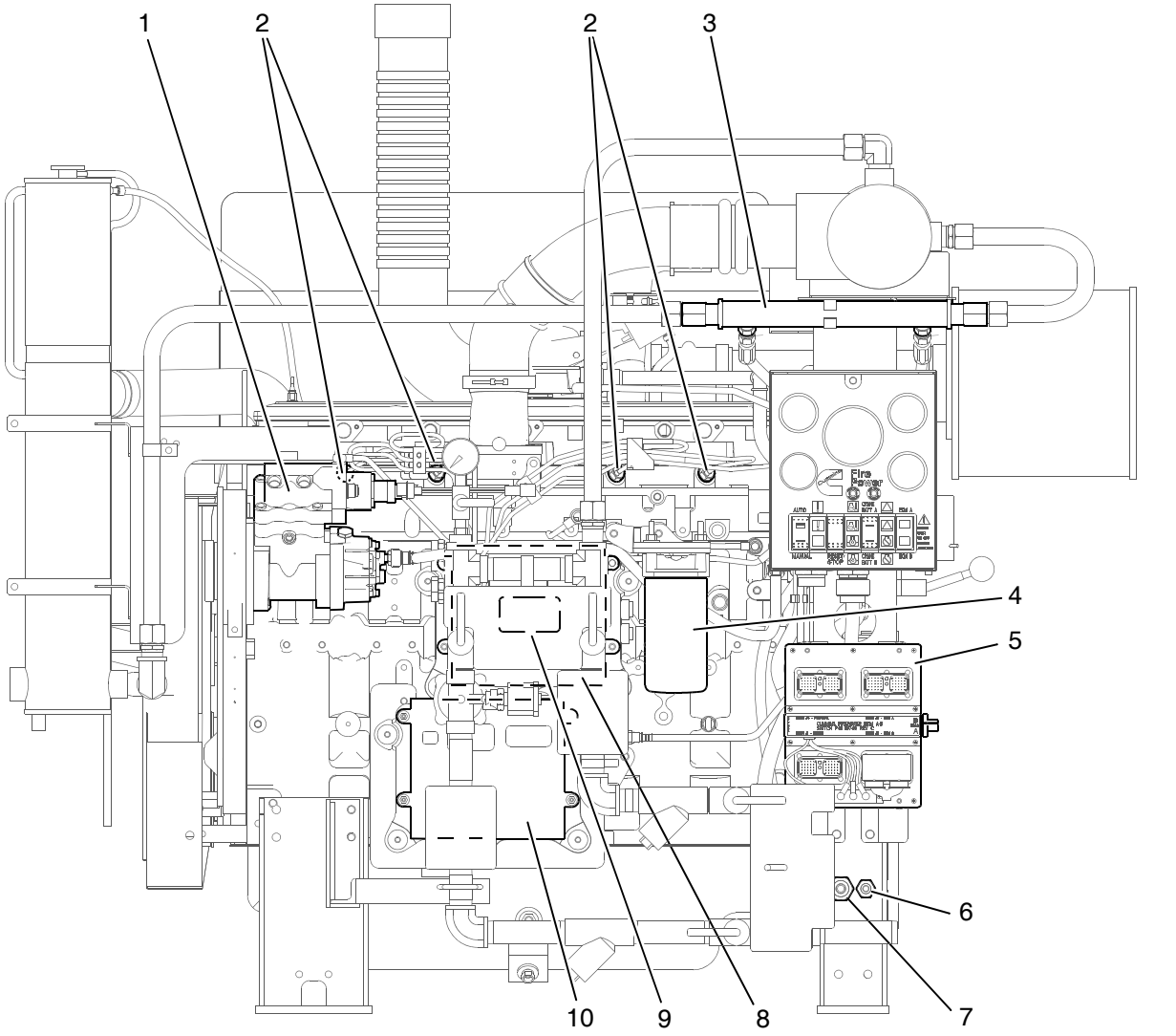
A fuel cooling heat exchanger maintains fuel temperature to meet the maximum allowable fuel inlet temperature (71° C (160° F)). Performance of the fuel cooling system is critical to engine durability, performance and emissions compliance.

2.7.1 Fuel Supply and Drain Location

The fuel supply and return connections are located on the rear (flywheel end) left (injection pump side) engine support. Refer to Figure 2-9.

2.8 High Pressure Common Rail (HPCR) Fuel System

The fire pump engine is equipped with an electronic fuel system that delivers precise fuel quantities with precise injection timing at high injection pressures. The system consists of a high pressure pump (up to 1100 BAR) that supplies a common fuel rail and accumulator manifold feeding 6 high-pressure electronic controlled injectors to provide precise fuel metering and timing. The system is controlled by the Engine Control module CM850 for fueling and timing based on temperature, altitude, boost pressure, and throttle position. Refer to Figure 2-9.

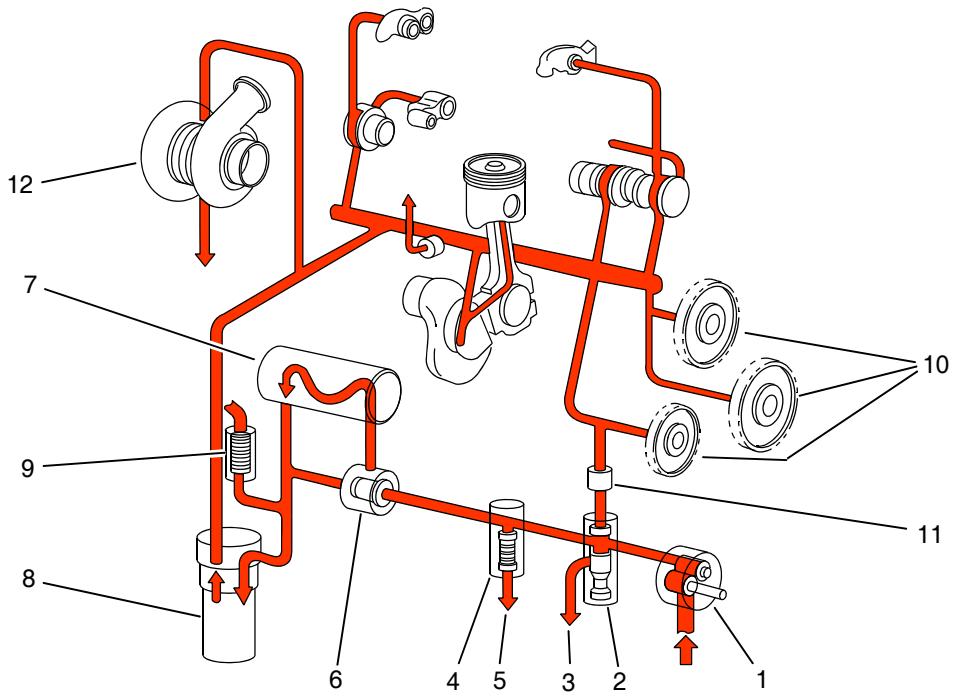


1. High Pressure Fuel Pump
2. Injector (4)
3. Fuel Cooling Heat Exchanger
4. Fuel Filter or Filter/Separator
5. ECM Selector Panel and Switch
6. Fuel Return Connection
7. Fuel Supply Connection
8. ECM Module A
9. Lift Pump (behind ECM A)
10. ECM Module B

Figure 2-9 Fuel System Components - High Pressure Common Rail (HPCR)

With the High Pressure Common Rail (HPCR) fuel system, fuel priming is required for conditions such as: initial start-up, running out of fuel and maintenance of fuel system components (i.e., filter change). A 12 VDC fuel lift pump is standard.

NOTE: *The system will prime a totally dry fuel system in 120 seconds or less. Applications with remote fuel tank requires a fuel lift pump (supplied). Lift pump run time is limited to two minutes.*



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 2-10 Flow Diagram - Engine Lubricating Oil System (typical)

2.9 Engine Oil System

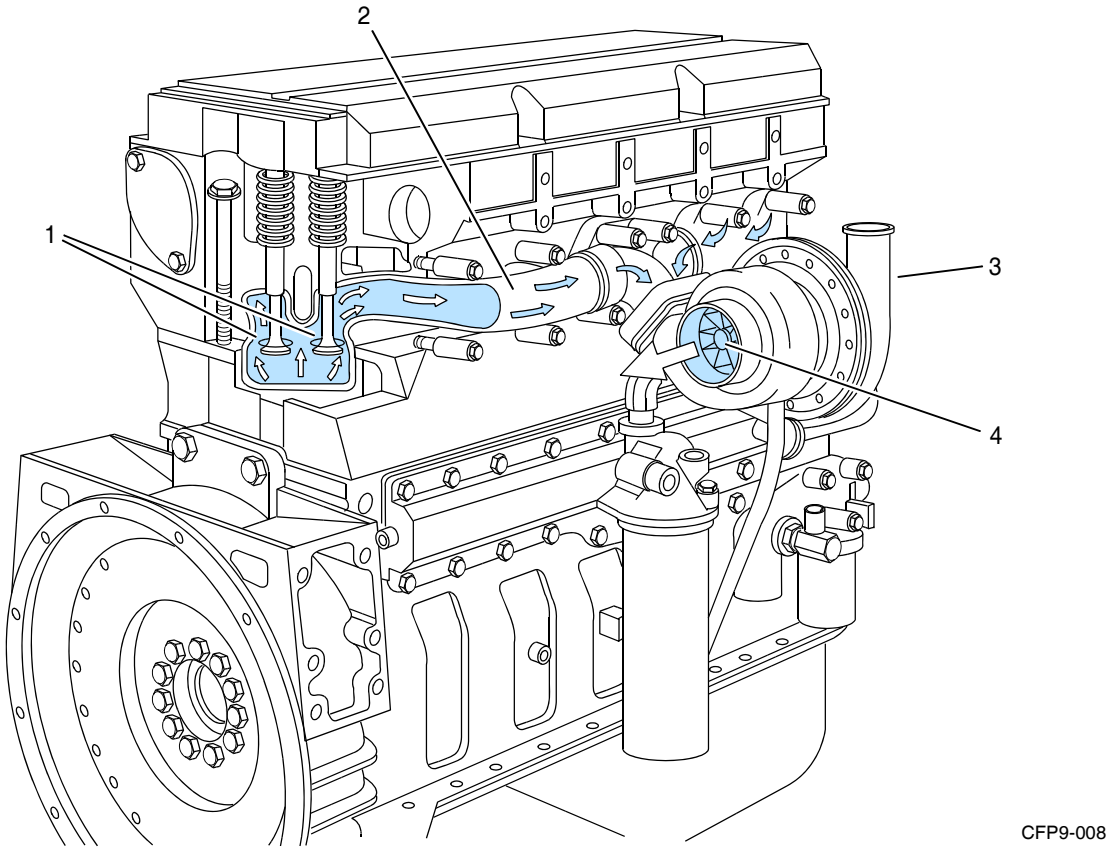
The Engine Oil System lubricates moving internal engine parts (pistons, piston arms, valves, cam shafts, drive shafts and bearings). The oil pump circulates oil from the oil pan, through the oil filter and into engine areas where friction may develop. Refer to Figure 2-10.

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.

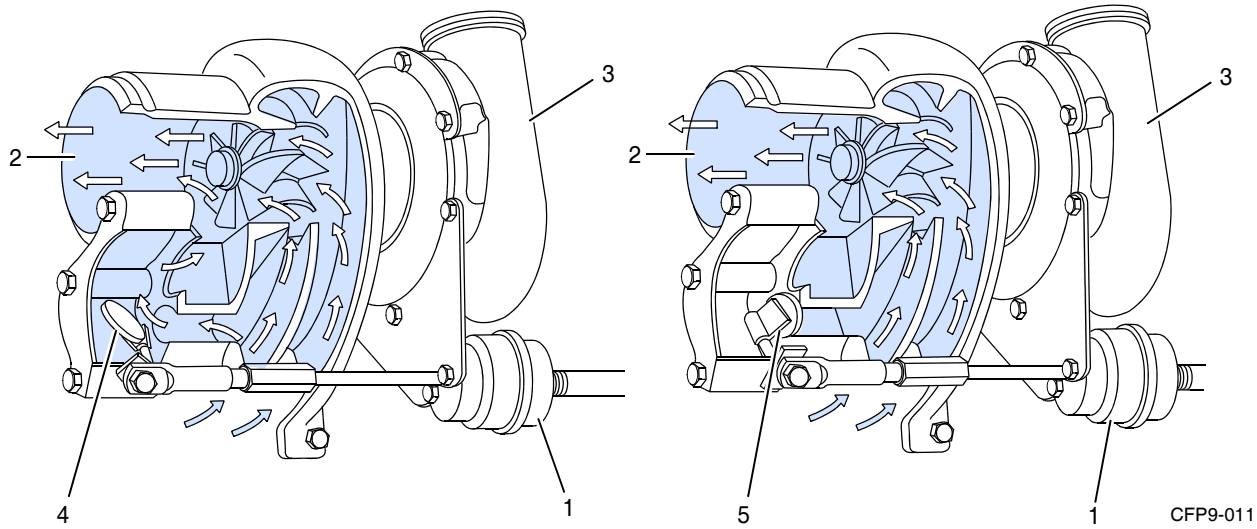
2.10 Exhaust System

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 2-11, and Figure 2-12.



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

Figure 2-11 Flow Diagram - Exhaust System (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 2-12 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.

3.1.1 Damage During Shipping

File a *Claim For Damages* with the carrier, if your equipment was received damaged or not received at all. Notify Cummins Fire Power, or Cummins Inc. as soon as possible to determine if a replacement item or repair is required.

3.1.2 Claim Filing Procedure

The following information is required if a claim is filed:

1. A *Claim Statement* describing the damaged or lost merchandise and how the claim was determined.

2. A *Bill of Lading* or *Freight Bill* is required as proof of who transported the freight.

3. A noted *Freight Bill* or *Inspection Report Copy*, as evidence of loss or damage.

4. *Invoice Copy* or other documents establishing the cost to you of the freight lost or damaged, or an *Invoice for Repairs*.

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.

3.2.1 Site Considerations

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

CAUTION

Avoid installation in a dusty or dirty environment. Provide adequate physical protection from other physical damage as may be present in the specific location.

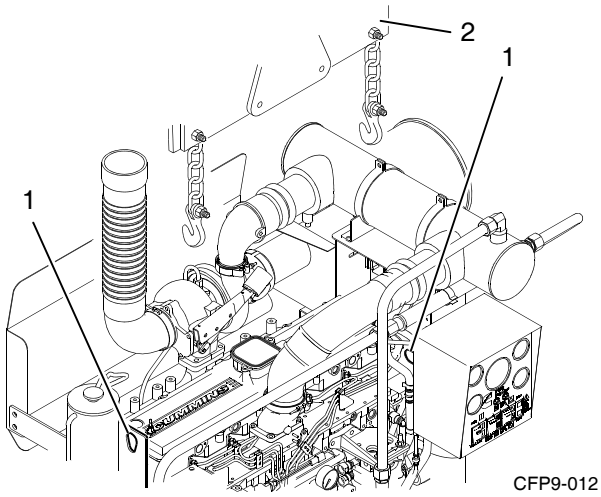
Refer to National Fire Protection Association NFPA 20, Chapter 11 for US installation and applicable local code requirements.

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.

IMPORTANT: *Ensure that the lifting device or forklift is capable of handling the package weight and size requirements.*

2. If the engine is lifted separately, use the lifting hooks (supplied with the engine) and a spreader bar to position the engine. Refer to Figure 3-1.

   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. Refer to the layout drawings supplied with this manual for lifting points.



1. Lifting Lug
2. Lifting Spreader Bar

Figure 3-1 Engine Lifting lugs (Engine Only)

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.

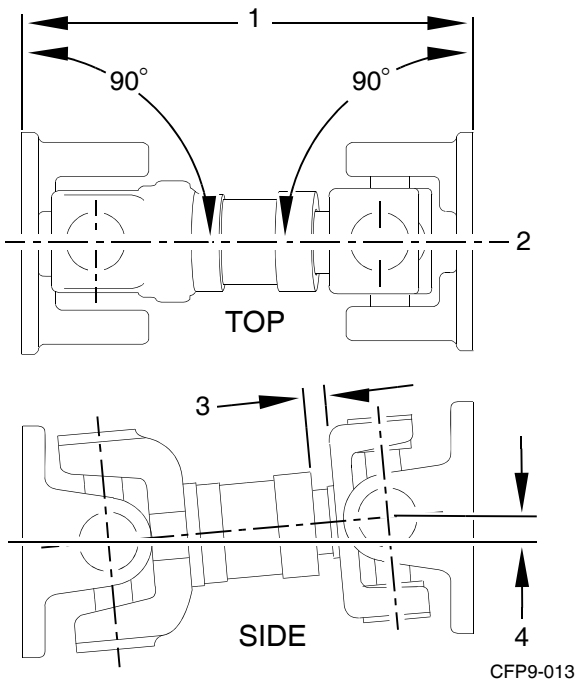
4. Position the engine center line to align the engine drive shaft with the fire pump drive. Ensure that the engine and pump are correctly aligned.

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

   b. Align engine center line to pump center line within ± .03 inch. Refer to Figure 3-2.

   c. The pump center line to the engine crankshaft center line (in vertical plane) is to be .25 inch: +0, -.25 inch offset.

   d. Drive shaft mounting flanges must be parallel.



1. Planes Must Be Parallel
2. Align Both Mounting Center lines to ± .03”
3. Distance to Equal Half of Total Travel
4. .25”: +0, -.25” Offset

Figure 3-2 Drive Coupling Alignment

5. Check that the fire pump is properly installed per the pump manufacturer’s specifications.

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

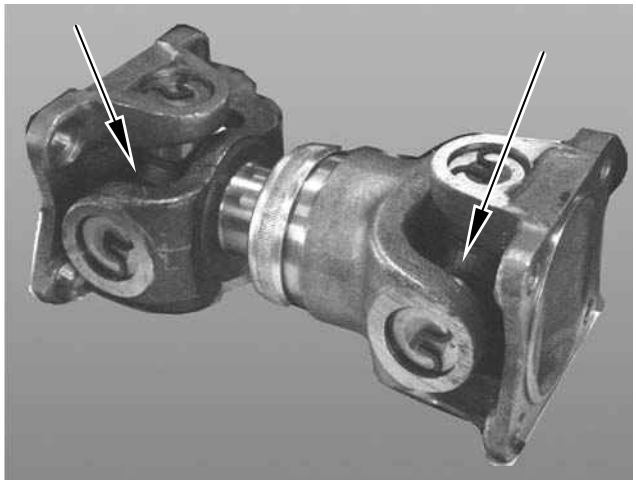


Figure 3-3 Drive Coupling Grease Fittings

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

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

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

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

   b. Add grease to the universal joint grease fittings.

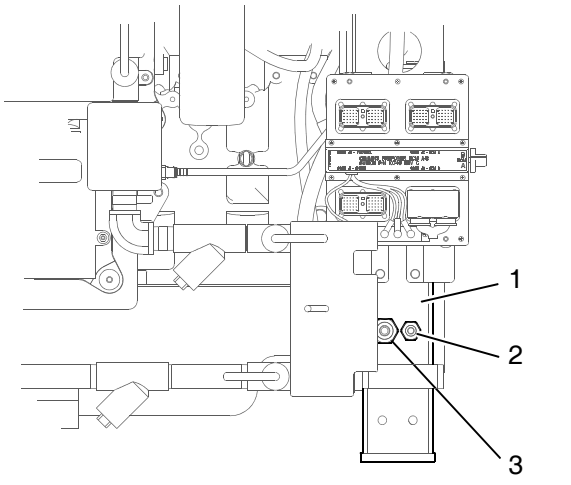
   c. Wipe excess grease from the grease fittings.

NOTE: *Cummins Fire Power, or Cummins Inc. recommends using a good quality semi-synthetic, molybdenum-fortified NLGI #2 lithium complex grease which protects from -54° to 400° F such as Valvoline Durablend®.*

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

3.3 Fuel Supply Installation

1. Install an elevated no. 2 diesel fuel tank or other fuel supply arrangement which is compatible with ASTM no. 2 diesel fuel specifications.



1. Engine Pedestal Leg
2. 1/2” Fuel Return Connection
3. 5/8” Fuel Supply Connection

Figure 3-4 Fuel Line Supply and Return Hoses

NOTE: *The fuel supply line at the fuel tank must be higher than the fuel intake port on the engine fuel filter or filter/separator. Ensure that the fuel system is installed in a safe and effective manner.*

2. Size the fuel tank for the maximum expected full-load engine operation period with the initial fuel level at the minimum level for refueling.

3. Install a 1/2“NPT (minimum) fuel return line. Route this line to the bottom of the fuel tank in order to minimize the return head. Refer to Figure 3-4.

4. Install a 5/8” NPT (minimum) fuel supply line to the fire pump engine.

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 3-5.

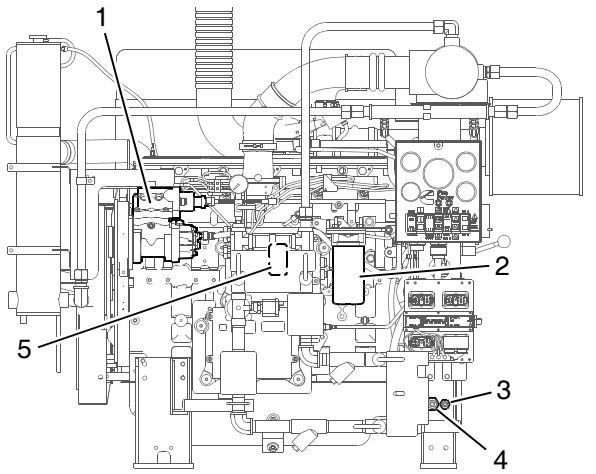
A Water Separator must be integrated into the fuel delivery system of the fire pump engine. A Fuel Filter/Water Separator may be installed directly on the unit in the primary fuel filter location, or a separate filter/separator may be installed in the fuel delivery system near the fire pump engine assembly.

1. Ensure that the filter/separator is free of water by opening the fuel filter/water separator drain at the bottom of the filter. Refer to 6.3.5 Fuel System Inspections for additional information.

2. Drain the fuel into a container until no water is present. Dispose of the contaminated fuel in accordance with local environmental regulations.

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.



1. High Pressure Fuel Pump
2. Fuel Filter or Filter/Separator
3. Fuel Return Connection
4. Fuel Supply Connection
5. Lift Pump (behind ECM A)

Figure 3-5 Engine Fuel System Components

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

Raw water circulated through the system cools the charge air cooler (CAC) heat exchanger, the fuel cooling heat exchanger, and the engine coolant heat exchanger fluid. Raw water supplied from the fire pump water source prior to the pump discharge flange, is forced through the cooling system to the various heat exchangers. Refer to Figure 3-6 and Figure 3-7.

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.*

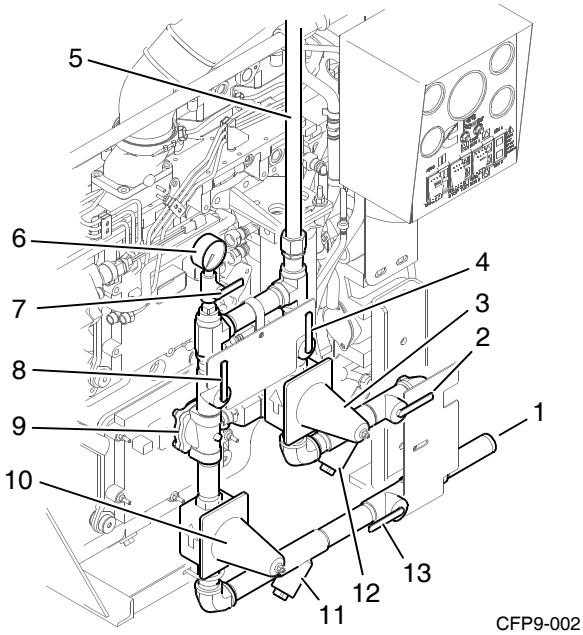
CAUTION

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.

3.4.1 Install Raw Water Piping

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.*

1. Provide 1-1/4” NPT raw water discharge line at the outlet of the engine coolant heat exchanger. Refer to Figure 3-7.



1. 1” NPT Raw Water Inlet
2. Bypass Water Inlet Valve
3. Bypass Pressure Regulator/Strainer
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/Strainer
11. Normal Water Wye Strainer
12. Bypass Water Wye Strainer
13. Normal Water Inlet Valve

Figure 3-6 Raw Water Cooling Loop Manifold

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

2. Provide a raw water supply line to the 1” NPT raw water inlet.

NOTE: *The water supply set points have been set by the manufacturer during engine assembly and testing.*

3. 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 psig) or slightly less water pressure, during manufacture and testing. 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 curve and data sheets for details.

4. Use a 5 gallon container to measure and time the flow from discharge pipe.

   Flow rate = time to fill container/container size.

   Example: Time to fill 5 gallon container = 15 seconds.

   Divide 15 by 5 = 3 (seconds per gallon).

   Divide 60 seconds by 3 = 20 gallons per minute.

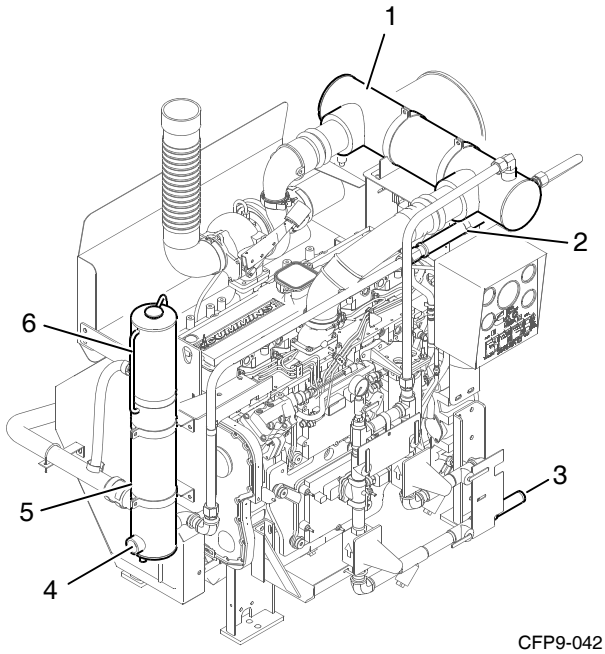
5. Adjust both pressure regulators to a pressure that will provide a flow rate at or above the specifications.

   The minimum raw water flow rate is 20 GPM @ 50F, 30 GPM @ 70F, and 40 GPM @ 90F.

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.*

NOTE: *When running, the engine should stabilize between 180° F and 185° F. The flow rate may need to be increased if the temperature stabilizes above this range. Do not exceed 60 psi.*

NOTE: *Excess cold (40° F to 75° F) raw water flow can cause condensation inside the charge air cooler.*



1. Charge Air Cooler (CAC) Heat Exchanger
2. Fuel Cooling Heat Exchanger
3. 1” NPT Raw Water Inlet
4. 1-1/4” NPT Raw Water Discharge
5. Coolant Heat Exchanger
6. Coolant Expansion Tank

Figure 3-7 Cooling Loop Heat Exchangers

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.*

3.5 Battery Selection

The minimum recommended reserve capacity (SAE RC) and cold cranking ampere (SAE CCA) values for a particular engine can be found on the engine curve and data sheets. RC and CCA definitions can be found in SAE standard J537. All battery information is for lead/acid batteries.

3.5.1 Battery Requirements

One set of 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, NFPA 20, Chapter 11 and Section 1 - Safety of this manual for additional battery installation information.

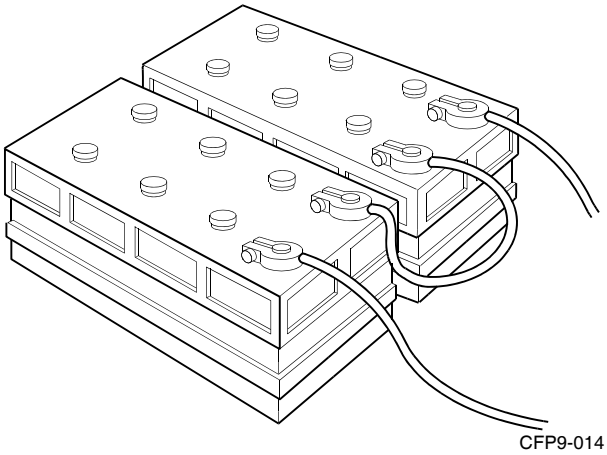


Figure 3-8 Series Battery Connection - 24 VDC

IMPORTANT: *Batteries must meet the requirement listed in 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. Always disconnect the negative battery cable first and reconnect it last.

CAUTION

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

NOTE: *Use the inductive charging-cranking systems analyzer, Cummins Part Number 3377193, to test the output amperage of either maintenance-free or conventional vent cap batteries. Follow the instructions provided with the test equipment.*

3.5.2 Battery Installation

Install the Loose Wire Kit per instructions on Cummins Drawing 9768. If purchased, install the optional Battery Cable Kit (Cummins Fire Power Part No. 9614). Otherwise, install equivalent customer supplied wiring. Install battery sets in a well ventilated or otherwise protected location.

NOTE: *There are two possible heavy-duty battery connections: Battery terminal and clamp or threaded battery terminal and nut.*

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

2. Locate the batteries near the engine or increase the size of the conductors as required by applicable codes. Ensure that the batteries are configured properly for standard 12 VDC operations or optional 24 VDC operations. Refer to Figure 3-8.

3. Check the battery cables and connections.

NOTE: *Coat the terminals with petroleum jelly to prevent corrosion. Install the cables and tighten the battery connections.*

3.5.3 Auxiliary Battery Starting

If a battery charging system is not provided, the engine can be started using charged batteries.

NOTE: *For maintainable lead acid batteries supplied by Cummins Fire Power, or Cummins Inc., check the state of charge by measuring battery cell specific gravity. Refer to Battery Testing in Section 6 - Maintenance for additional information.*

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.

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 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.

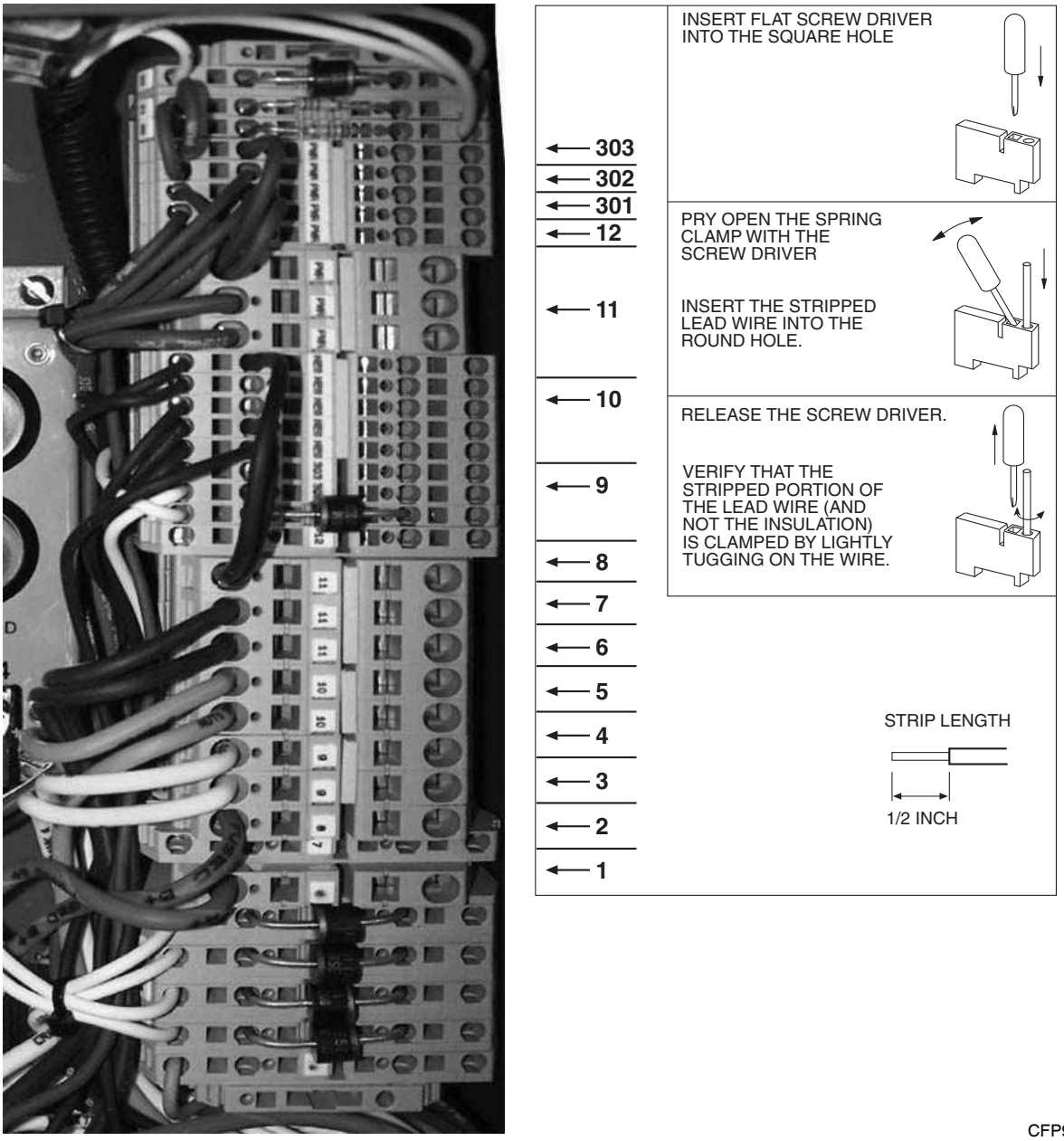


Figure 3-9 Termination Blocks and Wiring Decal

3. Connect the following wires to the Fire Pump Engine Instrument Panel per the engine electrical diagrams. Refer to Figure 3-9.

   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 Terminate 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 switch 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 110 ± 13 kPa (16 ± 2 psig) Set Point.

e. TB-5: Connect the High Water 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 switch 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. 6. Check that both voltmeters on the local control panel indicate the approximate battery voltage.

3.7 Coolant System Preparation

The fire pump engine coolant and lubrication system was initially filled during manufacture and testing.

CAUTION

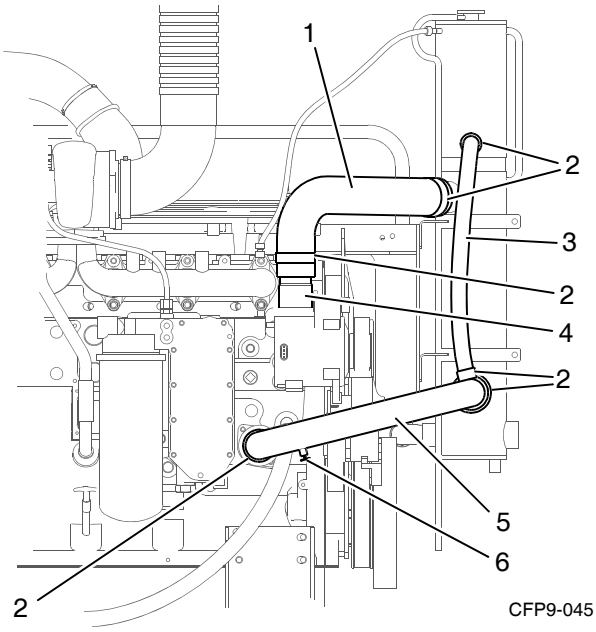
Ensure that all coolant and lubrication systems have been filled to the proper level before operation.

1. Inspect the engine coolant hoses and hose clamps. Ensure that all coolant hoses and clamps are properly installed and water tight. Refer to Figure 3-10 and Figure 3-11.

2. Ensure that the engine coolant is at the correct level prior to operation.

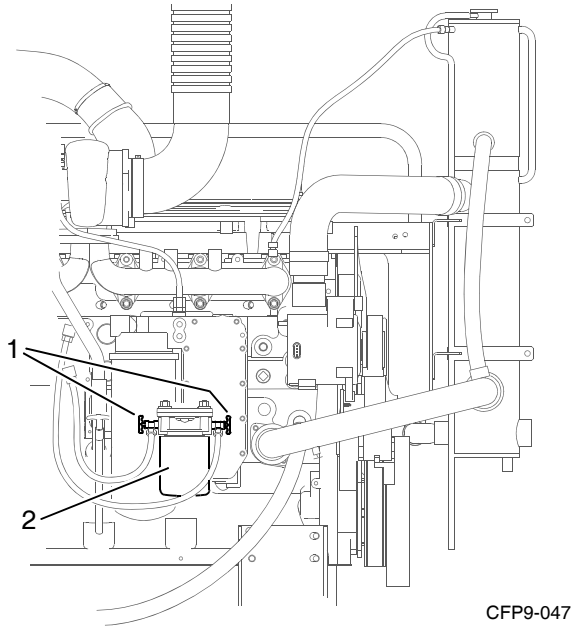
   a. If engine coolant temperature is below 50° C (122° F), remove the expansion tank pressure cap. Coolant should be visible when looking into the expansion tank. Add coolant as required. DO NOT OVERFILL! Refer to Figure 3-12.

NOTE: *Supplemental engine coolant should be a mixture of 50% ethylene glycol antifreeze and 50% water to avoid engine damage. Refer to Antifreeze information found in Section 6 - Maintenance for additional information.*



1. Upper Coolant Hose
2. Hose Clamps
3. Coolant Expansion Tank Fill Hose
4. Thermostat Housing
5. Lower Coolant Hose
6. Coolant Drain Valve

Figure 3-10 Coolant Hoses and Clamps

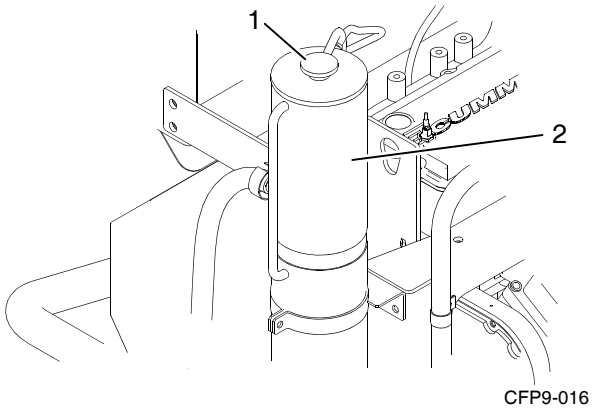


1. Coolant Filter
2. Coolant Filter Valves

Figure 3-11 Coolant Circulation System

b. Install the pressure/fill cap on the coolant expansion tank.

c. Check and correct any cooling system leaks.



1. Coolant Expansion Tank Pressure/Fill Cap
2. Engine Coolant Expansion Tank

Figure 3-12 Engine Coolant Expansion Tank

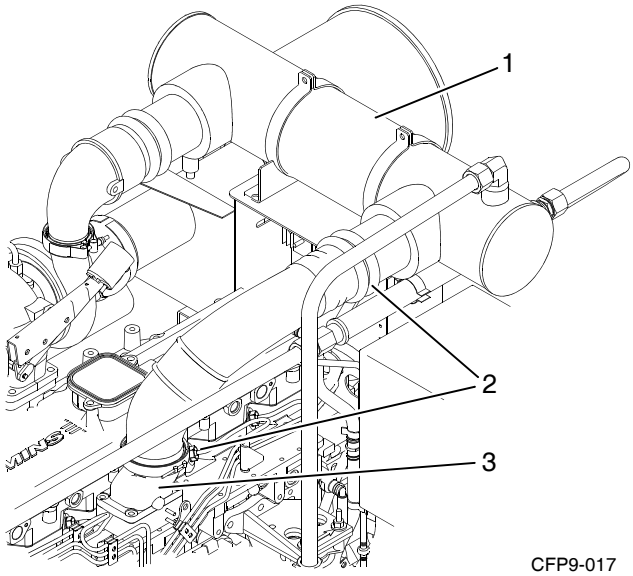
CAUTION

The coolant filter valves must be in the ON position to prevent engine damage.

d. Ensure that the coolant filter valves are open. If required, turn the valves to the ON position. Refer to Figure 3-11.

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

   Ensure that water is present in the engine heater before plugging in the heater element.



1. Charge Air Cooler Heat Exchanger
2. CAC Tubing and Clamps
3. Intake Manifold

Figure 3-13 Charge Air Cooler Tubing

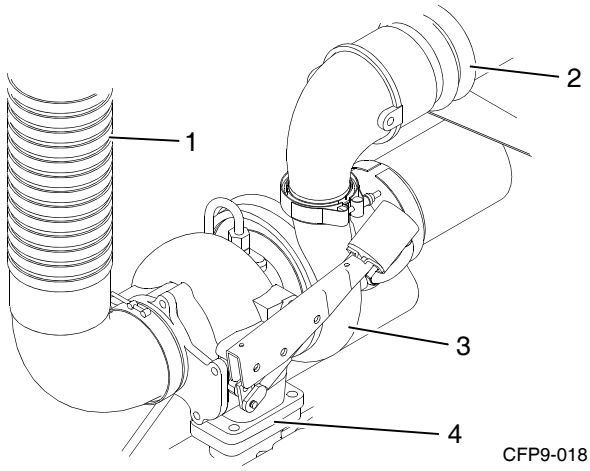
3.8 Charge Air Cooler System

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 3-13 and Figure 3-14.

1. 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 8 N-m (72 in-lb).

2. After the engine starts, a whistling noise may indicate an air leak from the turbocharger to discharge elbow connection, loose hose clamps, damaged manifold seals, missing hose clamps, or hose punctures.

3. Inspect for damage. Tighten loosen clamps. Torque hose clamp screws to 8 N-m (72 in-lb).



1. Exhaust Flex Connection
2. CAC Tubing
3. Charge Air Turbocharger
4. Exhaust Manifold

Figure 3-14 Turbocharger and CAC Piping

3.9 Engine Oil System Preparation

The fire pump engine was initially lubricated during manufacture and testing.

CAUTION

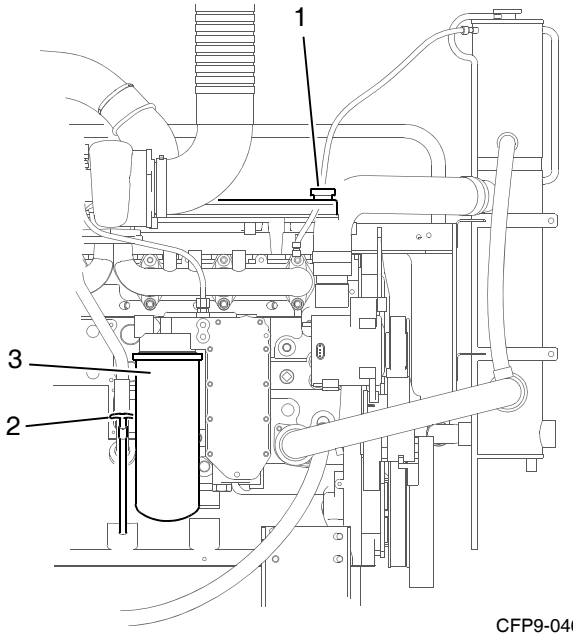
Some regulatory and shipping restrictions may require that all lubricants, fuels and coolants be drained for transport. Ensure that all cooling and lubrication systems have been filled to the proper level before operation.

1. Check the oil level using the crankcase dip stick before operating. Refer to Figure 3-15.

2. Fill the crankcase at the oil fill port, to the “H” mark on the dipstick with engine oil. Refer to Figure 3-15.

NOTE: *Do not use special “break-in” engine oils for new or rebuilt Cummins engines. Use the same type of oil during the “break-in” as used in normal operation.*

NOTE: *Using multi-viscosity engine oil can improve oil consumption control and improve engine cranking in cold temperatures while maintaining lubrication at high operating temperatures. Cummins Inc. recommends Valvoline Premium Blue® 15W-40 oil for most climates.*



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

Figure 3-15 Oil Filter and Oil Level Dipstick

3. The turbocharger has been lubricated during manufacture and testing.

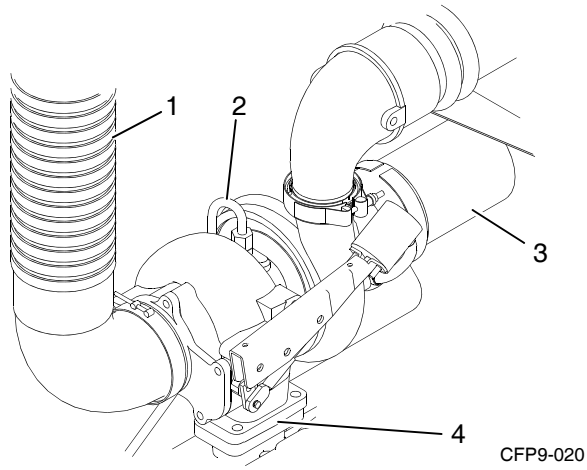
   a. Remove the air filter element.

   b. Rotate the turbine wheel to allow oil to enter the bearing housing. Any excess oil will drain through the oil drain line. Refer to Figure 3-16 and Figure 3-17.

   c. Lubricate the bearings by pouring 59 to 89 ml (2 to 3 oz.) of clean engine lubricating oil into the turbocharger oil supply line fitting.

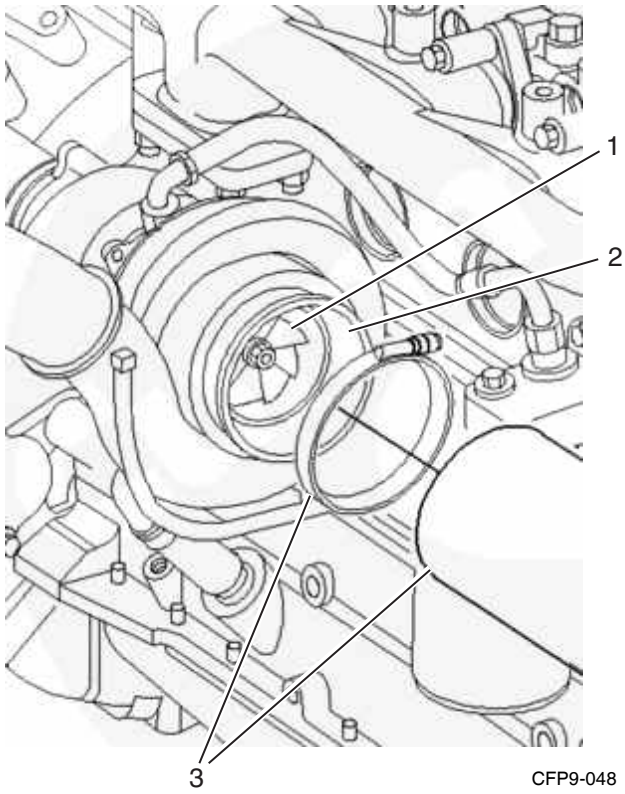
   d. Reconnect the turbocharger oil inlet line.

   e. Install the air intake filter assembly.



1. Exhaust Flex Connection
2. Turbocharger Oil Line
3. Turbocharger Air Intake
4. Exhaust Manifold

Figure 3-16 Turbocharger Oil Line Location



1. Turbocharger Turbine Wheel
2. Turbocharger Intake Housing
3. Air Intake Tube and Clamp

Figure 3-17 Turbocharger Turbine Wheel (typical)

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.

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

6. Lubricate grease fittings on the auxiliary drive shaft.

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

7. Ensure that the engine exhaust pipe exhausts to atmosphere away from other building air intake piping.

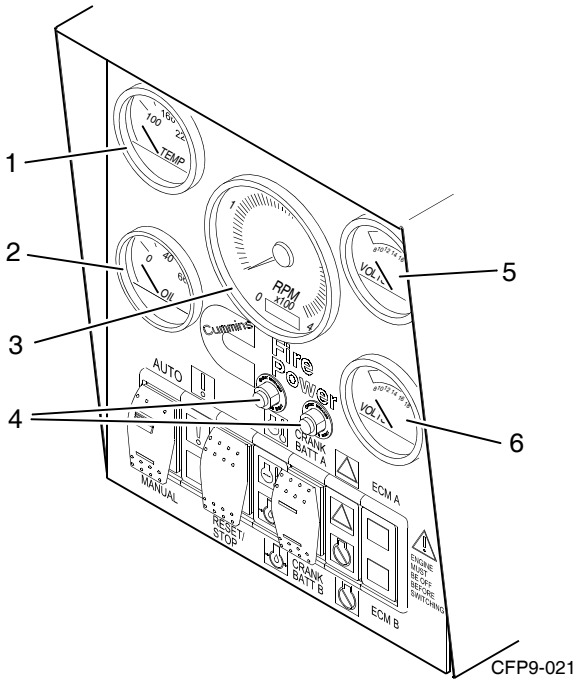
3.11 Engine Start Test

Perform the following engine start test after completing all preliminary setup procedures, previously covered. Additional engine start tests and speed adjustment procedures are explained in Section 5 - Operation.

WARNING

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

The object of this test is to check that the engine starts and operates normally with oil pressure being displayed and raw water flow being established to the coolant heat exchanger. Operation at the factory-adjusted rated speed is also checked.



1. Water Temperature Gauge
2. Engine Oil Pressure Gauge
3. Tachometer
4. Circuit Breaker
5. Battery "A" Voltmeter
6. Battery "B" Voltmeter

Figure 3-18 Operator's Control Panel

1. To start the engine from the Fire Pump Controller Panel:

   a. The AUTO Mode Switch position is the default operating position.

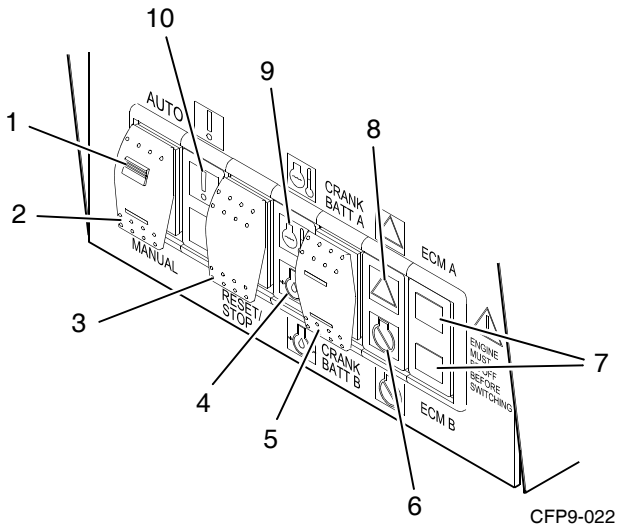
   b. Place the AUTO/MANUAL Mode Switch on the operator's Instrument Panel in the AUTO Mode position. Refer to Figure 3-18 and Figure 3-19.

   c. Start the engine by initiating an engine start signal from the Fire Pump Controller Panel.

NOTE: *The fire pump engine will crank automatically when either solenoid A or solenoid B is selected at the fire pump control panel.*

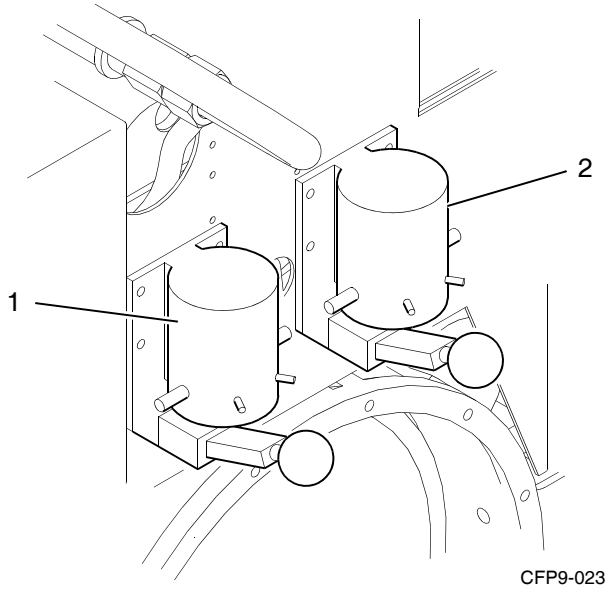
2. To start the engine from the Operator's Control Panel:

   a. Disengage the AUTO/MANUAL Switch Locking Button and place the switch in the MANUAL Mode position.



1. ON/OFF Switch Locking Button
2. ON/OFF Switch (AUTO MANUAL)
3. Overspeed RESET/STOP Switch
4. Low Oil Pressure Warning Lamp
5. Crank Battery A/B Momentary Start Switch
6. ECM Engine Shut Down Lamp (red)
7. ECM A/B Indicator Lamps
8. ECM Warning Lamp (amber)
9. High Water Temperature Warning Lamp
10. Overspeed Warning Lamp

Figure 3-19 Operator's Controls



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

Figure 3-20 Manual Starter Contactors

b. Place the AUTO/MANUAL Start Switch on the operator's Instrument Panel in the MANUAL START position.

c. Press downward on either CRANK BATT A/B Rocker Switch to start the engine.

3. To start the engine using the Manual Override Contactor A/B Levers:

a. Place the AUTO/MANUAL Start Switch on the operator's Instrument Panel in the MANUAL START position.

b. Press downward on either Manual Override Contactor A/B Lever to start the engine. Refer to Figure 3-20.

c. Release the Contactor Lever immediately after the engine starts.

4. Check that the engine starts and operates at rated speed.

5. The engine may be stopped locally by pressing and holding the Overspeed RESET/STOP Switch until the engine stops.

3.11.1 Engine Will Not Start

If the engine still will not start, refer to Section 7 - Troubleshooting for possible causes.

3.11.2 Engine Starts

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 Lamp is illuminated for 15 seconds, STOP THE ENGINE immediately! Continued operation without proper lubrication will cause engine damage.

1. Immediately check that oil pressure is displayed at the pressure gauge within a few seconds. Ensure that the oil pressure is between 276-414 kPa (40-60 psi).

   If oil pressure is not within the rated range, troubleshoot per Engine Oil Pressure High or Engine Oil Pressure Low in Section 7 - Troubleshooting.

2. 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.

    a. Ensure that raw water is flowing through the heat exchanger and water pressure shown on the local pressure gauge is no more than 414 kPa (60 psig). The minimum raw water flow rate is 20 GPM @ 50F, 30 GPM @ 70F, and 40 GPM @ 90F.

CAUTION

If the water temperature gauge is not reading properly or if the Water Temperature Lamp is illuminated for 15 seconds, STOP THE ENGINE immediately! Continued operation without proper cooling water will cause engine damage.

3. Ensure that engine operating temperature stabilizes between 82° and 95° C (180° and 203° F).

    a. If 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.

4. Operate the engine for 8 to 10 minutes.

5. Inspect for leaks, unusual noises, or other indications of incorrect operation.

6. Shut off the engine by pressing and holding the Overspeed RESET/STOP Switch.

7. Check that raw water flow stops automatically shortly after the engine stops.

8. Correct any problems found during the inspection before proceeding.

9. Check the engine lubricating oil level at the crankcase dip stick. Top off if necessary.

10. Check the coolant expansion tank level. Top off if necessary.

11. Check the raw water wye strainers. Clean the strainers as required per the instructions in Section 6 - Maintenance.

12. Perform engine speed control and safety system tests per the instructions in Section 5 - Operation.

Section 4 - Controls

4.1 Operator Control Panel

The operator control panel is mounted on the flywheel end of the engine.

The instrument panel contains controls for starting, monitoring engine performance and controlling fire pump engine operation. Refer to Figure 4-1.

4.1.1 Coolant Temperature Gauge

The Coolant Temperature Gauge displays the temperature of the coolant circulating through the fire pump engine. The gauge works in unison with the High Water Temperature Alarm Sensor to the fire pump controller at terminal TB-5. This 0 VDC grounded signal is present when the engine is running and the coolant temperature has risen above the 93° C (200° F) Set Point.

When the engine starts, immediately check that raw water flow is established through the heat exchangers. Raw water flow should be established immediately but some delay may occur before the flow exits the coolant heat exchanger drain connection. Stop the engine if the water temperature alarm is illuminated for more than 15 second.

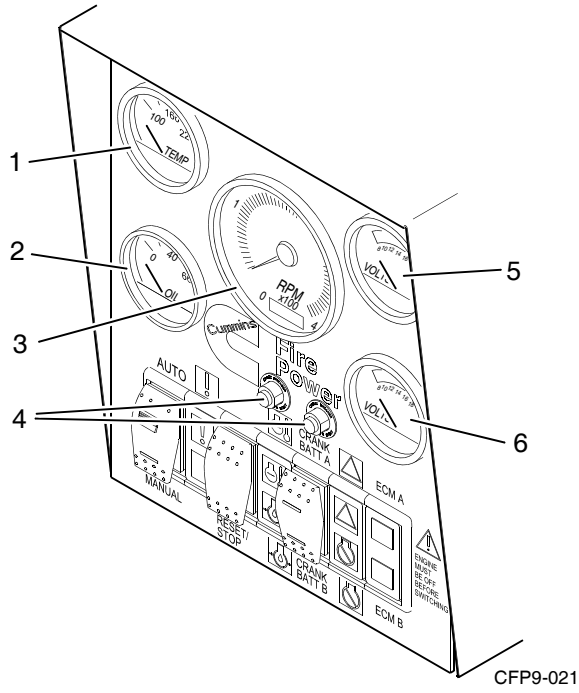
CAUTION

If the coolant temperature exceeds the high coolant temperature set point, the High Coolant Temperature Warning Lamp is illuminated. The engine will continue to operate but immediate attention is necessary in order to prevent extensive damage to the engine or catastrophic engine failure.

4.1.2 Engine Oil Pressure Gauge

The Engine Oil Pressure Gauge displays the engine oil pressure. The gauge works in unison with the Low Oil Pressure Alarm Input from sensor TB-5. The 0 VDC grounded signal is terminated when the oil pressure has dropped below the 110 kPa (16 psig) set point.

When the engine starts, immediately check that oil pressure is displayed. It should be on-scale within a few seconds. If oil pressure is not present or if the Low Oil Pressure Lamp does not go out, stop the engine and troubleshoot per the instructions in Section 7 - Troubleshooting.



CFP9-021

1. Coolant Temperature Gauge
2. Engine Oil Pressure Gauge
3. Tachometer
4. Circuit Breaker
5. Battery “A” Voltmeter
6. Battery “B” Voltmeter

Figure 4-1 Instrument Panel

CAUTION

Warning Lamp is illuminated. The engine will continue to operate but immediate attention is necessary in order to prevent extensive damage to the engine or catastrophic engine failure.

4.1.3 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). The Tachometer works in unison with the Engine Overspeed Alarm Input from sensor TB-3. This 12 VDC signal is present when the overspeed switch has operated.

CAUTION

If this event occurs, the fire pump engine will stop to avoid fire system over-pressurization. The fault must be corrected and the local RESET Button must be pressed in order to restart the engine.

NOTE: *The Run Speed and Engine Overspeed Set Point are displayed on the Factory Setting Tag, on the side of the operator instrument panel.*

NOTE: *Electronically controlled engines should operate within a few RPM of the rated speed whether the engine is fully loaded or unloaded. If it becomes necessary to adjust the engine's actual speed to match the rated value, refer to Rated Speed Set Point Adjustment in Section 5 - Operation.*

4.1.4 Battery A and B Voltmeters

The Battery Voltmeters display the charge status (VDC) of the relative battery connections. Permanently installed redundant battery charging systems with connections at TB-6 and TB-8 (+) and TB-11 (-) should also be used for remote battery voltage indications at the fire pump control system or elsewhere.

NOTE: *The two voltmeters may differ slightly due to calibration differences between the meters. Normal differences in battery condition may also cause indication differences. These are normal differences and require no action.*

4.1.5 Circuit Breaker Switches

The engine control panel has two manual-reset type, 30 A Circuit Breakers. They protect against a catastrophic failure, such as a direct battery-terminal ground fault or a battery charger malfunction. One breaker is for Battery A, and the other breaker is for Battery B.

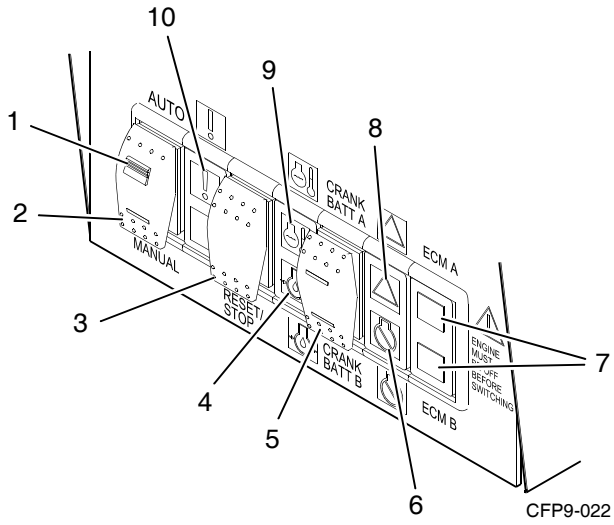
NOTE: *If one of the circuit breakers trips, locate and repair the source of the fault before pressing the RESET Button.*

4.1.6 AUTO/MANUAL Mode Switch

The AUTO/MANUAL Mode Switch determines whether the engine starts and is controlled by the operator (MANUAL) or by an automatic signal from the fire pump controller (AUTO). Refer to Figure 4-2.

The Manual Mode is typically used for engine setup, testing and maintenance procedures. The AUTO Mode is used to start the engine under the control of the fire pump control system (in the absence of a live operator).

In the AUTO mode, the fire pump engine stops upon loss of signal power from the fire pump controller.



1. ON/OFF Switch Locking Button
2. AUTO MANUAL Mode Switch
3. Overspeed RESET/STOP Switch
4. Low Oil Pressure Warning Lamp
5. Crank Battery A/B Momentary Start Switch
6. ECM Engine Shut Down Lamp (red)
7. ECM A/B Indicator Lamps
8. ECM Warning Lamp (amber)
9. High Coolant Temperature Warning Lamp
10. Overspeed Warning Lamp

Figure 4-2 Operator Panel Controls

4.1.7 Overspeed Warning Lamp

The Overspeed Warning Lamp is illuminated whenever the engine RPM rate exceeds the factory set Engine Overspeed Set Points. The lamp is not lit when the engine is operating within the normal engine RPM range. Refer to Figure 4-2.

NOTE: *The Run Speed and Engine Overspeed Set Point are displayed on the Factory Setting Tag, on the side of the operator instrument panel. Refer to Figure 4-3.*

4.1.8 Engine Overspeed Warning Lamp

The Overspeed Sensor monitors engine speed during the start cycle and engine operation. The remote Overspeed Alarm Input from the engine controller is connected to terminal TB-3. The speed switch is factory programmed to enable at 115% rated engine speed. If the engine RPM's exceed 115% rated speed, the engine Overspeed Warning Lamp is illuminated and the engine will shut down.

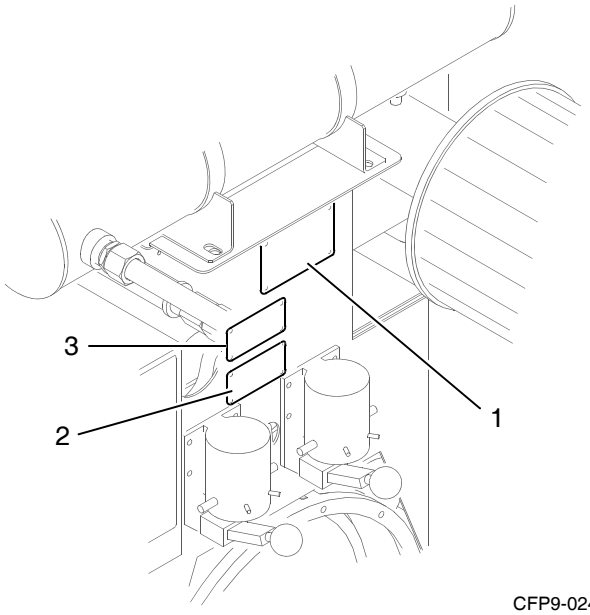
NOTE: *The overspeed switch has been set at the factory during assembly and testing. It should not require additional programming unless the pump operating speed is changed.*

CAUTION

If the Overspeed Sensor is tripped, the fire pump engine will stop to avoid catastrophic failure. The fault must be corrected and the local RESET Button must be pressed in order to restart the engine.

4.1.9 Overspeed RESET/STOP Switch

Pressing the Overspeed RESET Switch after correcting an engine overspeed shutdown, resets the operator controls, allowing subsequent restart of the fire pump engine.



1. Engine Serial Number Plate
2. Field Engine Speed and Overspeed Settings
3. Factory Engine Speed and Overspeed Settings

Figure 4-3 Engine Settings Plates

4.1.10 High Coolant Temperature Warning Lamp

The High Coolant Temperature Lamp is lit whenever the engine is running and the coolant temperature has risen above the 93° C (200° F) Set Point.

IMPORTANT: *If high coolant temperature lamp does not go out, stop the engine and troubleshoot per the instructions in Section 7 - Troubleshooting.*

CAUTION

If the coolant temperature exceeds the high coolant temperature set point, the high coolant temperature warning lamp is illuminated. The engine will continue to operate but immediate attention is necessary in order to prevent extensive damage to the engine or catastrophic engine failure.

4.1.11 Low Oil Pressure Warning Lamp

The Low Oil Pressure Warning Lamp is switch activated at a falling pressure of 110 kPa (16 psig), and deactivates at a rising pressure of 83 kPa (12 psig) Set Point. (When the engine is not running, the Low Oil Pressure Lamp will be illuminated). When a Low Oil Pressure condition exists, the Low Oil Pressure Lamp on the Engine Control Panel will illuminate.

IMPORTANT: *If oil pressure is not present or if the Low Oil Pressure Lamp does not go out, stop the engine and troubleshoot per the instructions in Section 7 - Troubleshooting.*

CAUTION

If the engine oil pressure drops below the minimum oil pressure set point, the low oil pressure warning Lamp is illuminated. The engine will continue to operate but immediate attention is necessary in order to prevent extensive damage to the engine or catastrophic engine failure.

4.1.12 CRANK BATT A/B Switch

The fire pump engine requires (2) 12 VDC lead/acid core batteries for standard 12V operation. If using the optional 24VDC operation, (2) sets of (2) 12VDC lead/acid core batteries are required with each pair wired in series to produce 24 VDC. The batteries can be supplied by Cummins Inc. or by the customer.

The CRANK BATT A and CRANK BATT B Momentary Start Switches initiate an immediate engine start using the selected A or B Crank Battery.

4.1.13 ECM Fault Code Lamps

The AMBER Engine Warning Lamp and the RED Engine Shutdown Lamp serve three purposes:

1. To alert the operator of an engine malfunction. Refer to Figure 4-2.

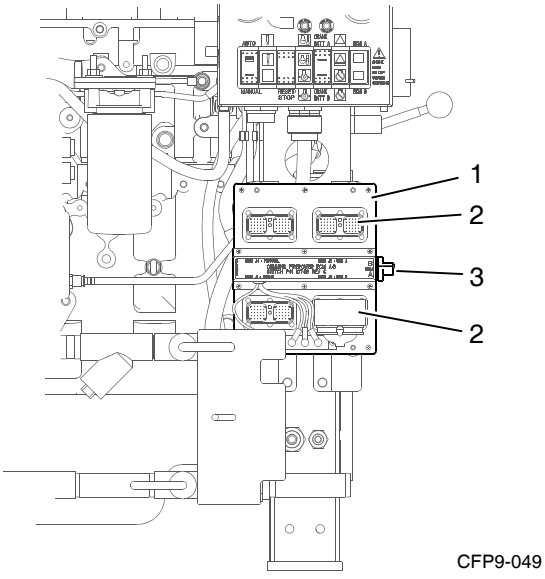
   An illuminated AMBER Lamp indicates an engine malfunction that requires timely operator attention.

2. An illuminated RED Lamp indicates an engine malfunction that requires immediate and decisive operator response.

3. To flash out a 3-digit diagnostic fault code, which can then be used to help describe the nature of the engine malfunction. Refer to Section 5 - Operation for Fault Code Information.

4.1.14 ECM A/B Indicator Lamps

The two ECM Indicator Lamps show the position of the ECM Switch. If the ECM Switch is in the ECM A (normal) position, ECM A is controlling the engine, and the ECM A lamp is illuminated. Refer to Figure 4-2 and Figure 4-4.



1. ECM Selector Panel
2. ECM Harness Connections
3. ECM A/B Selector Switch

Figure 4-4 ECM Selector Panel and Switch

If the ECM Switch is in the ECM B (alternate) position, ECM B is controlling the engine, and the ECM B lamp is illuminated. Terminal 301 will be active (ground) for remote annunciation.

4.2 Electronic Control Module

The system has an electronically controlled fuel injection system that optimizes fuel economy and reduces exhaust emissions. It does this by controlling the torque and horsepower curve, AFC function, engine high speed, low idle, and load speed. Refer to Figure 4-5.

The engine control system is an electronically operated fuel control system that also provides many operator or equipment features. The base functions of the control system include: Fueling and timing control, limiting the engine speed operating range between the low and high-idle set points and reducing exhaust emissions while optimizing engine performance.

The control system uses inputs from the operator and engine sensors to determine the fuel amount and timing required to operate at the desired engine speed. The ECM is the control center of the system. It processes all of the inputs and sends commands to the fuel system, vehicle, and engine control devices.

The ECM performs diagnostic tests on most of its circuits and will activate a fault code if a problem is detected in one of these circuits.

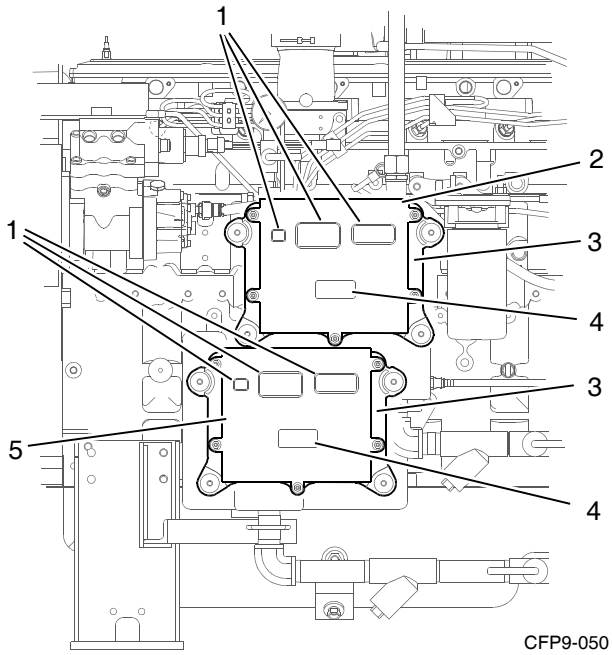
Active fault codes will cause a diagnostic lamp to activate to signal the driver. The ECM can communicate with the Insite™ service tool and some other engine controllers.

4.2.1 ECM Data Plate

The ECM Data Plate shows information about the ECM and how the ECM was programmed. The data plate is located on the front of the ECM. Refer to Figure 4-5.

The following information is available on the ECM Data Plate: ECM Part Number (PN), ECM Serial Number (SN), ECM Date Code (DC), Engine Serial Number (ESN), ECM Code: Identifies the software in the ECM.

NOTE: *Have the ECM code for your engine available when communicating with a Cummins Authorized Repair Location.*



1. ECM Harness Connections
2. Electronic Control Module (ECM) A
3. ECM Cooling Plate
4. ECM Data Plate
5. Electronic Control Module (ECM) B

Figure 4-5 Electronic Control module (ECM)

4.3 Overspeed Switch

The overspeed switch senses engine speed during normal operation and during the start cycle. The switch deactivates the fuel pump solenoid valve and shuts off the engine whenever the speed exceeds the overspeed set point. Refer to Figure 4-6.

NOTE: *The overspeed switch is set during manufacture and test procedures and typically does not require setup at installation.*

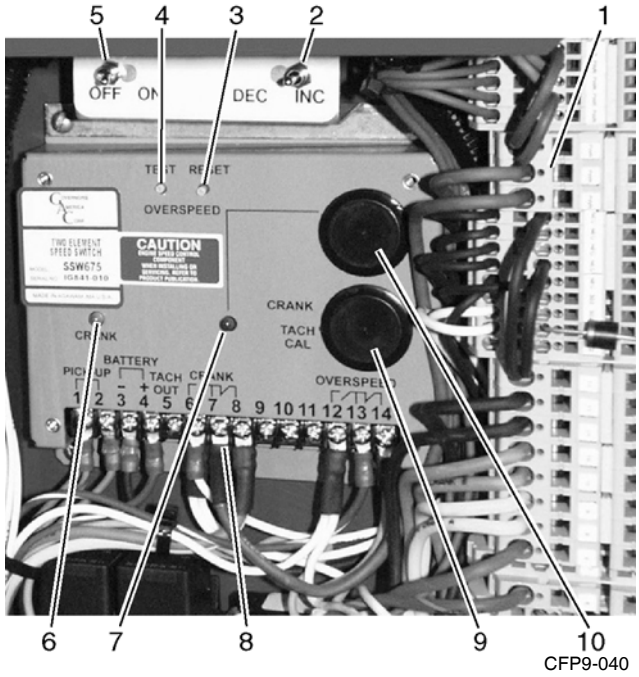
1. Use the Adjustment and Test Procedure in Section 6 - Maintenance to change the set point.

2. Repeat the adjustments and checks until the desired set point is demonstrated. When the overspeed set point is set, check that the engine operates normally while not in the Test Mode.

NOTE: *The overspeed set point must be set at between 115 and 120% of the engine's rated speed.*

The speed switch located on the engine's local control panel has a TEST button which lowers the currently adjusted overspeed by 20%.

Thus, an overspeed set point of 2112 rpm would be reduced to (2112 * 0.8) = 1689 RPM when the test button is pressed.



1. Spring Clamp Terminal Blocks
2. Speed Increase/Decrease Toggle Switch
3. RESET Button
4. TEST Button
5. Diagnostic ON/OFF Toggle Switch
6. CRANK Termination or RUN Signal Indicator LED (Factory Use Only)
7. Overspeed Indicator LED
8. Pre-wired Terminals
9. Crank Terminate Potentiometer Cover
10. Overspeed Potentiometer Cover

Figure 4-6 Engine Overspeed Control Module

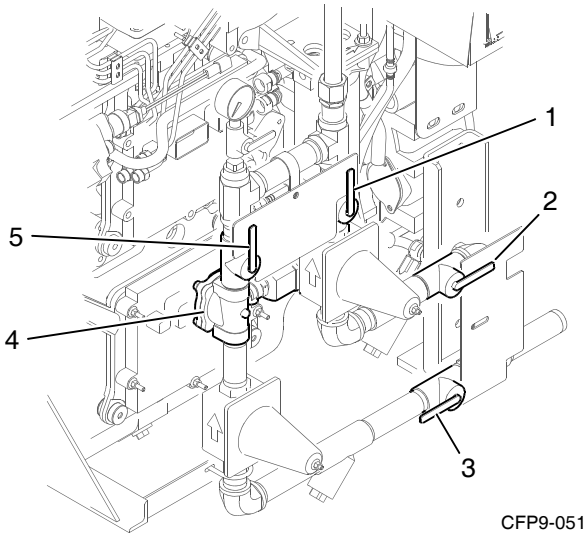
4.4 Raw Water Flow Control Valves

The engine 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 4-7.

The manual raw water valves control whether the Automatic or Bypass lines are supplying water.

1. 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 (pump controller) operation.



1. Bypass Water Outlet Valve
2. Bypass Water Inlet Valve
3. Normal Water Inlet Valve
4. Normal Water Solenoid Valve
5. Normal Water Outlet Valve

Figure 4-7 Raw Water Flow Control Valves

4.5 Engine Protection System

The engine ECM monitors any engine abnormalities, and displays active faults via the AMBER Warning Lamp and the RED Shutdown Lamp on the operator instrument 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 such derate or shutdown protection. The engine will run to destruction. Therefore, preventive maintenance is essential.

4.5.1 Engine Protection Fault

When an Engine Protection Fault (EPF) occurs, a corresponding Warning Lamp is illuminated on the operator's instrument panel. If an overspeed situation exists, the EPF automatically shuts down the fuel supply solenoid valve.

The EPF System uses a combination of any of the following engine controller sensor inputs:

1. Low Coolant Temperature (lamp warning).
2. High Coolant Temperature (lamp warning).
3. Low Coolant Level (lamp warning).
4. Low Oil Pressure (lamp warning)
5. Low Oil Level (lamp warning)

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

5.2 General Operating Information

Cummins Fire Pump Engines are tested before being shipped from the factory. The engine operating speed must be set per the pump RPM requirements.

NOTE: *The engine speed set points are displayed on the Factory and Field Setting Plates, located on the flywheel end of the engine.*

5.3 Remote Starting Procedure

If the AUTO/MANUAL Mode Switch is in the AUTO Mode position, the pump engine starts automatically upon receipt of the start command from the customer installed pump control panel. The AUTO Mode is the default switch position.

NOTE: *The AUTO/MANUAL Rocker Switch Locking Button must be disengaged to place the switch in the MANUAL Mode.*

The remote start command consists of a CRANK Signal from the pump controller. When the pump has started, the CRANK TERMINATE Signal is sent to the pump controller to indicate that the engine is running and to discontinue the CRANK Signal.

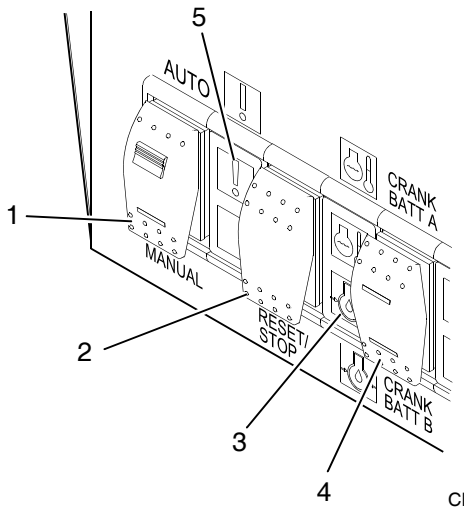
NOTE: *How the crank and crank terminate signals are displayed depends upon the fire pump control panel manufacturer. This indication should be checked in the event that an automatic start is initiated. If the signal is not present, the engine can be started locally using the Local Starting Procedure in this section.*

To start the engine from the Fire Pump Controller Panel:

1. Place the AUTO/MANUAL Mode Switch on the operator's Instrument Panel in the AUTO Mode position. Refer to Figure 5-1.

2. Start the engine by initiating an engine CRANK Signal from the Fire Pump Controller.

   a. When the engine starts, a CRANK TERMINATE Signal is sent to the fire pump control panel, indicating that the engine is running.



1. AUTO/MANUAL Rocker Switch
2. STOP/RESET Switch
3. Low Oil Pressure Warning Lamp
4. Battery A/B Switch
5. Overspeed Warning Lamp

Figure 5-1 Instrument Panel Switch Module

CAUTION

If the Crank Terminate Signal is absent, the engine starter motor will continue to operate. Shut the engine off immediately to avoid damaging the starter motor or the starter motor gears.

b. If the signal is not present, the engine can be started locally using the Local Starting Procedure in this section.

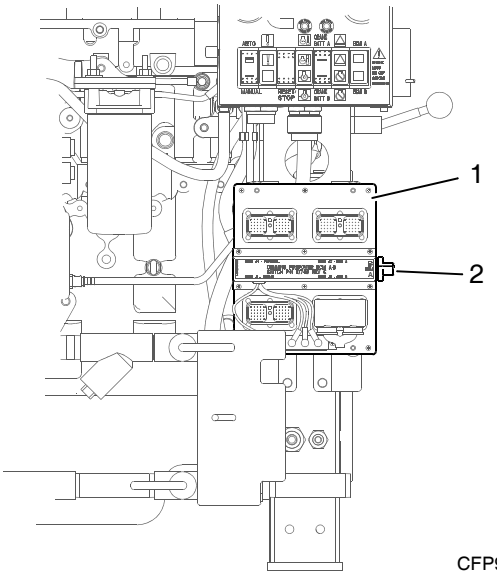
3. The engine continues to operate as long as the RUN signal is present. When the RUN signal is terminated by the fire pump control panel, the engine stops immediately.

4. The engine may be stopped locally by pressing the STOP/RESET Rocker Switch.

5.4 Local Starting Procedure

The fire pump engine can be started locally from the operator control panel for testing and maintenance. To start the engine from the Operator Control Panel:

1. Place the ECM A/B Selector Switch in the desired operating position (ECM A is the normal position, ECM B is the alternate position). Refer to Figure 5-2.



1. ECM Selector Panel
2. ECM A/B Selector Switch

Figure 5-2 ECM Selector Panel and Switch

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

2. Disengage the AUTO/MANUAL Switch Locking Button.

3. Place the AUTO/MANUAL Mode Switch in the MANUAL position. Refer to Figure 5-1.

4. Observe the battery voltages displayed on the engine instrument panel. Use the battery with the highest indicated voltage.

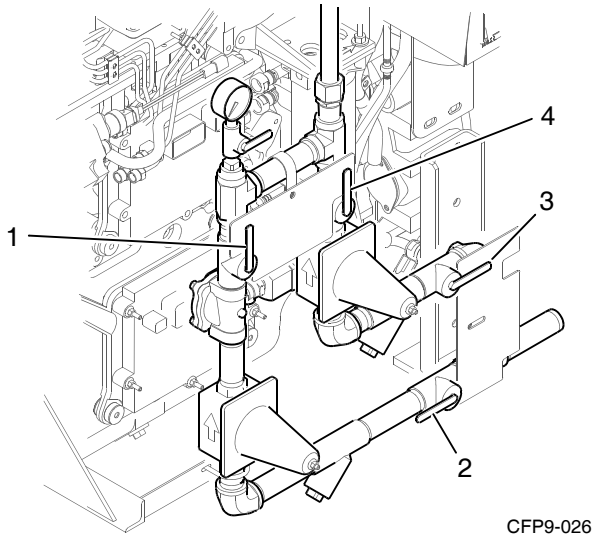
5. Press either the CRANK BATT A or CRANK BATT B Switch to start the engine.

a. Depress the selector 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.*



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

Figure 5-3 Raw Water Manual Valves (open)

NOTE: *Engines used in fire pumps or standby service are expected to accelerate from crank to full load within a short period of time.*

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

6. Stop the engine locally by pressing the STOP/RESET Rocker Switch.

5.5 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. The following procedure outlines an Emergency Manual Mode Electrical Start.

1. Open both manual bypass valves in the raw water supply loop. Refer to Figure 5-3.

2. Place the ECM A/B Selector Switch into the desired operating position. Refer to Figure 5-2.

3. Disengage the AUTO/MANUAL Switch Locking Button.

4. Place the AUTO/MANUAL Mode Switch on the Operator's Control Panel in the MANUAL position. Refer to Figure 5-1.

5. Observe the battery voltages displayed on the engine instrument panel. Use the battery with the highest indicated voltage.

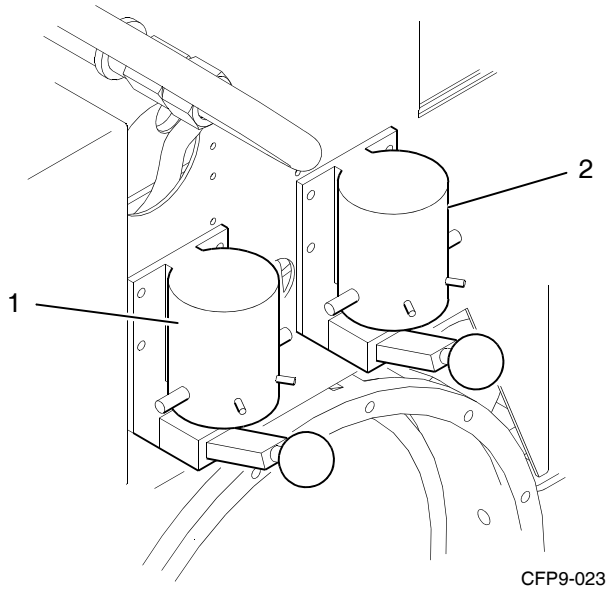
6. Press downward on either Battery A or Battery B Contactor Lever to start the engine. Refer to Figure 5-4.

   a. If Crank Solenoid Lever A does not engage the starter, repeat using Crank Solenoid Lever B.

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.*

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 (electrical starting motors only).



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

Figure 5-4 Manual Starter Contactors

b. Release the Contactor Lever immediately after the engine starts.

7. Check that the engine starts and operates at rated speed.

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

8. The engine may be stopped locally by pressing the STOP/RESET Rocker Switch.

5.6 Engine Operating Speed

The Engine Operating Speed was factory set during manufacturing and test procedures. It may, however, be necessary to adjust the operating speed based on the fire pump application.

If the speed does not match the Engine RPM shown on the Factory Settings Plate, refer to Section 6 for adjustment procedures.

5.7 Overspeed Set Point

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. Refer to Section 6 - Maintenance for adjustment procedures.

5.8 Crank Terminate Set Point

The Crank Terminate Signal informs the pump controller that the engine has started and discontinues the pump controller crank signal. The crank terminate signal was factory set at the manufacturer. Refer to Section 6 - Maintenance for set point adjustment and testing procedures.

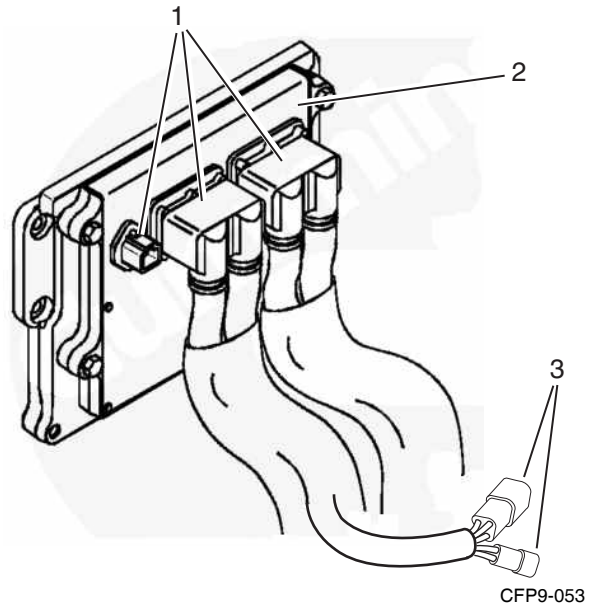
5.9 ECM Fault Code Lamps

The Electronic Control Module can display and record operation irregularities, which are displayed as fault codes on the operator instrument panel. Fault codes can be read using the two ECM lamps on the operator instrument panel or with an Insite™ Diagnostic Reader. Refer to Figure 5-5

NOTE: *Not all engine irregularities are shown as fault codes.*

The AMBER engine warning lamp and the RED engine shutdown lamp serve three purposes:

1. An illuminated AMBER Lamp indicates an engine malfunction that requires timely operator attention. Refer to Figure 5-6.



1. ECM Harness Connections
2. Electronic Control Module (ECM) A
3. Diagnostic Reader Plug-ins

Figure 5-5 ECM Diagnostic Reader Plug-ins

2. An illuminated RED Lamp indicates an engine malfunction that requires immediate and decisive operator response.

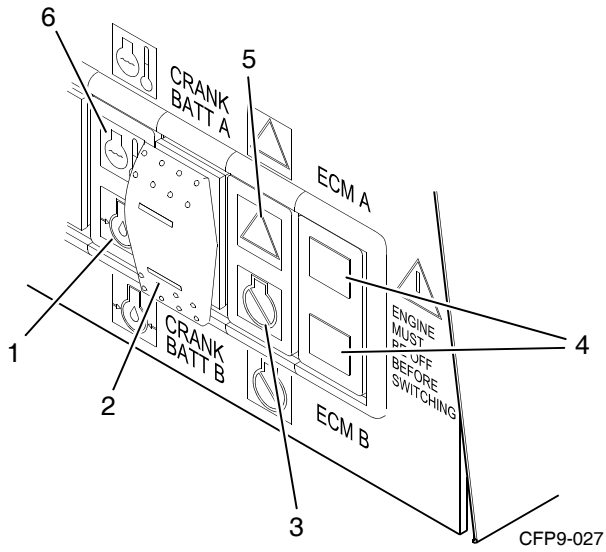
3. To flash out a 3-digit diagnostic fault code, which can then be used to help describe the nature of the engine malfunction. When either of the RED or AMBER lamps is illuminated, the fault code can be determined as follows:

   a. The AUTO/MANUAL switch must be placed in the MANUAL position with the engine NOT running.

   b. Open the engine control panel and place the Diagnostic ON/OFF Switch in the ON position.

   c. The RED and AMBER Fault Code Lamps will immediately begin to flash the 3-digit diagnostic code.

      The AMBER lamp will blink once to indicate the beginning of a 3-digit code.



1. High Water Temperature Warning lamp
2. Low Oil Pressure Warning Lamp
3. Crank Battery A/B Momentary Start Switch
4. ECM Engine Shut Down Lamp (red)
5. ECM Warning Lamp (amber)
6. CM A/B Indicator Lamps

Figure 5-6 Instrument Panel Indicator Lamps

For example: For a fault code of 241, the RED Lamp will blink 2 times to indicate the first digit, pause, blink 4 times to indicate the second digit, pause, then blink 1 time to indicate the third and final digit.

The AMBER lamp will then flash once, indicating the end of the three digit code.

4. If there is more than one fault code present, press the INC/DEC Toggle Switch to the INC position to proceed to the next 3-digit fault code. Refer to the Fault Code Chart to identify the 3-digit code.

5. If the Diagnostic Switch is placed in the ON position and both the RED and AMBER Lamps remain lit (do not flash), then there are no active fault codes present.

IMPORTANT: *Return the Diagnostic Switch to the OFF position before attempting to start the engine.*

5.10 Isolated Acceptance Testing

The following tests demonstrate the MANUAL Local Start, operation, and shutdown of the fire pump from the engine's local Starter Solenoid Controls.

1. Demonstrate that the engine will not operate in the event of blown fuses or other faults in the local control panel.

2. Demonstrate manual engine speed control.

3. Demonstrate manual raw water valve operations to the engine cooling system.

4. Demonstrate the manual local start, operation, and shutdown of the fire pump from the engine's control panel.

5. Demonstrate that the engine starts, operates at speed, and stops in the event that the fire pump controller is not functioning.

6. Demonstrate the start of the fire pump engine using each battery set separately.

7. Demonstrate that the fire pump engine alternator operates while the engine is running.

8. Demonstrate that any customer supplied battery charging systems operate when the engine is not running.

9. Demonstrate engine start-up, operation, and shutdown of the engine with each of the redundant ECM.

10. Check that engine fault codes are not being set during normal operations.

5.10.1 Integrated Acceptance Testing

The following tests outline integrated acceptance testing.

1. Demonstrate the start-up, operation, and shutdown of the fire pump engine in response to operations of the customer-installed fire pump controller. Perform this testing with the testing of the fire pump controller.

2. Demonstrate that the fire pump controller provides design indications and/or alarms for simulated engine oil pressure, water temperature, and overspeed faults.

3. Demonstrate the actual operation of the crank terminate output from the overspeed switch.

4. Participate in any flushing, pressure testing, flow testing, or capacity testing required for the fire protection system.

5. Complete the Cummins Fire Power Start-Up Inspection (SUI) Checklist. This is available on the Cummins Fire Power web site www.CumminsFirePower.com).

6. When these items have been demonstrated, contact operating personnel responsible for fire protection system that engine is ready for service.

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, the fire pump or cause severe 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 if the operator is to get optimum satisfaction from its use. The maintenance department needs daily running reports from the operator to make necessary adjustments in the time allocated.

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

Comparison and intelligent interpretation of the weekly report, along with a practical follow-up action, will eliminate most failures and emergency repairs. Report to the maintenance department any of the following conditions:

1. Low engine oil pressure.
2. Low power.
3. Power increases or engine surge.
4. Erratic or no speed control or frequent shutdowns.
5. Any warning lamps flashing or staying illuminated.
6. Abnormal water or oil temperature.
7. Unusual engine noise.
8. Excessive smoke.
9. Excessive use of coolant, fuel, or engine oil.
10. Any fuel, water-cooling loop, engine coolant, fuel or engine oil, leaks.
11. Loose or damaged parts.
12. Worn or damaged belts.

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, to 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, 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 endplay, 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 Filter and Piping

1. The frequency of cleaning or replacing the air cleaner filter element is determined by the conditions in which the engine operates. Refer to Figure 6-1.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. Refer to Figure 6-1.

   a. Some serviceable filter elements can be cleaned and reused if not damaged.

NOTE: *Cummins recommends using Air Cleaner Element CFP p/n 9606.*

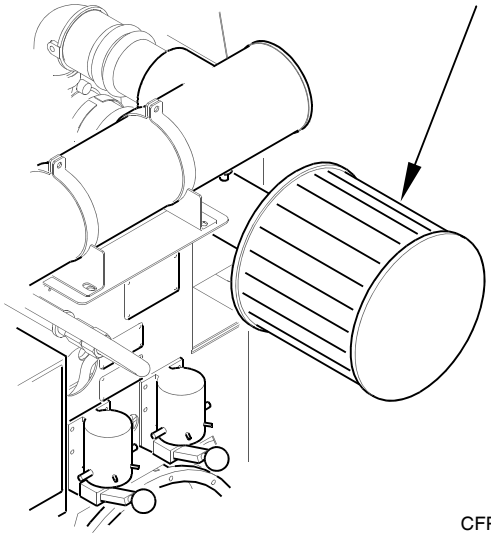


Figure 6-1 Air Intake Filter

   b. Check that the filter service indicator has not popped up, indicating a filter blockage.

   c. 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.

2. Replace damaged air filter or hoses, and tighten loose clamps, as necessary, to prevent the air system from leaking. Torque hose clamps to 8 N-m (72 in-lb).

6.3.3 Cooling System

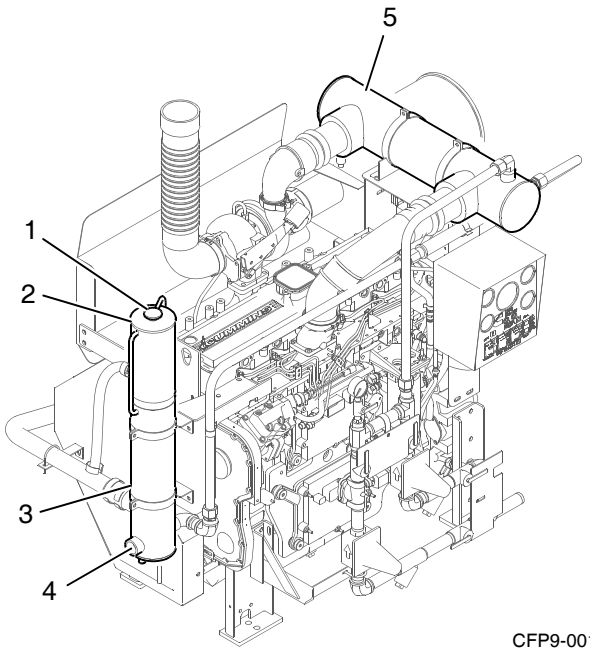
CAUTION

Do not remove a pressure 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.

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.

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



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

Figure 6-2 Heat Exchanger Tanks

   a. Tighten the hose clamps as necessary.

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

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

   a. Ensure that the coolant level is visible just below the filler neck.

   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.*

NOTE: *Cummins recommends using Fleetguard® ES Compleat™ Ethylene-Glycol (EG) or Fleetguard® Propylene-Glycol (PG) Plus™ Antifreeze/Coolants. Both products are available in concentrated or premixed formulations.*

3. 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.

4. Check for soft, overly pliant hoses, oxidation, and loose hose clamps. Torque hose clamps to 8 N-m (72 in-lb). Replace damaged hoses and clamps as required.

5. 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.

CAUTION

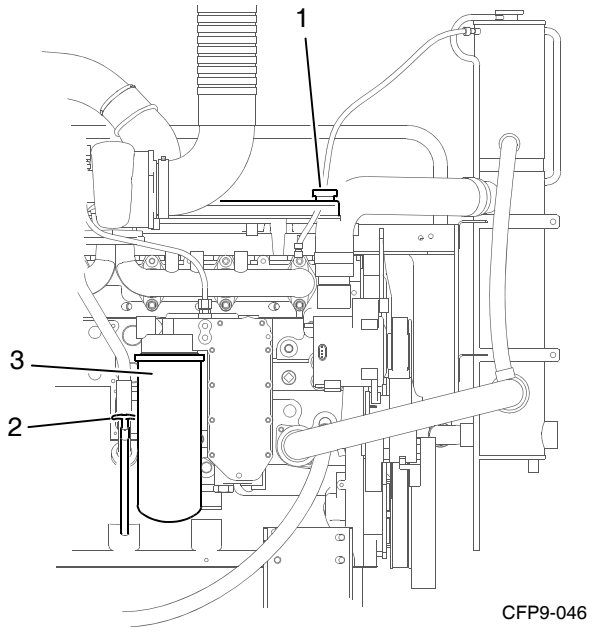
Never operate the engine with oil level below the L (low) mark or above the H (high) mark. Poor engine performance or engine damage can occur.

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 6-3.

   a. If the oil level is excessively high, refer to Oil Level Rises in Section 7 - Troubleshooting.

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



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

Figure 6-3 Oil Level Dipstick

c. If the oil levels are consistently below normal after a fill, check for leaks, loose or damaged gaskets, or oil in the water system. Troubleshoot per Engine Oil Consumption Excessive in Section 7 - Troubleshooting.

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

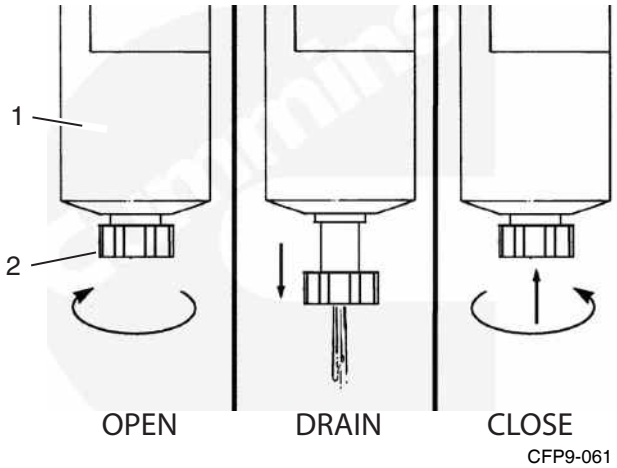
   Keep the oil level as near as possible to the “full” mark on the dipstick by adding the same quality and brand of oil.

NOTE: *Cummins recommends using Valvoline® Premium Blue S.A.E. 15W-40 Multi-viscosity Engine 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. Fuel Filter/Water Separator Canister
2. Drain Valve

Figure 6-4 Engine Fuel Filter/Water Separator

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.

3. Drain the Fuel Filter/Water Separator.

NOTE: *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.*

   a. Open the drain valve: Turn the valve counterclockwise approximately 3-1/2 turns until the valve drops down 25.4 mm (1 in.) and draining occurs. Drain the Fuel Filter/Water Separator until clear fuel is visible. Refer to Figure 6-4.

   b. Close the drain valve: Lift the valve and turn it clockwise until it is hand-tight. Do not overtighten the valve. Overtightening can damage the threads.

c. Dispose of the contaminated fuel in accordance with local environmental regulations.

NOTE: *Cummins recommends using Fleetguard (Cummins) fuel filter/water separator FF9587 or equivalent in the primary fuel filter location.*

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, and make sure that the exhaust pipes are not heating surrounding areas excessively. Repair any leaks immediately.

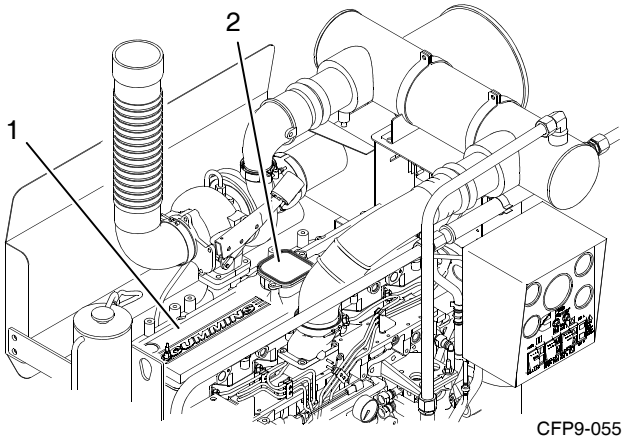
6.3.7 Electrical Supply and Controls

Check the terminals on the starting batteries for clean and tight connections. Loose or corroded connections create resistance which can hinder starting.

6.3.8 Crankcase Breather

1. Inspect the crankcase breather for a worn or damaged hose, sludge, blockage, or dirt buildup. Refer to Figure 6-5.

2. Clean the breather if obstructed or blocked. Replace worn or damaged breather as required.



1. Valve Cover
2. Crankcase Breather

Figure 6-5 Crankcase Breather

6.3.9 Clean Raw Water Strainers

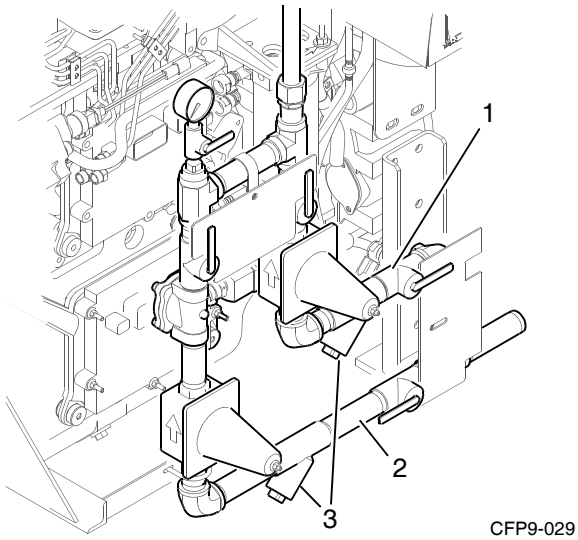
The (2) raw water wye strainers (one on the normal line and 1 on the bypass line) should be cleaned weekly, to remove sediment. Refer to Figure 6-6.

1. Ensure that the bypass line valves are closed and the normal line valves are open.

2. For each raw water strainer, remove the plug.

3. Inspect and remove any debris.

4. Install the strainer plugs.



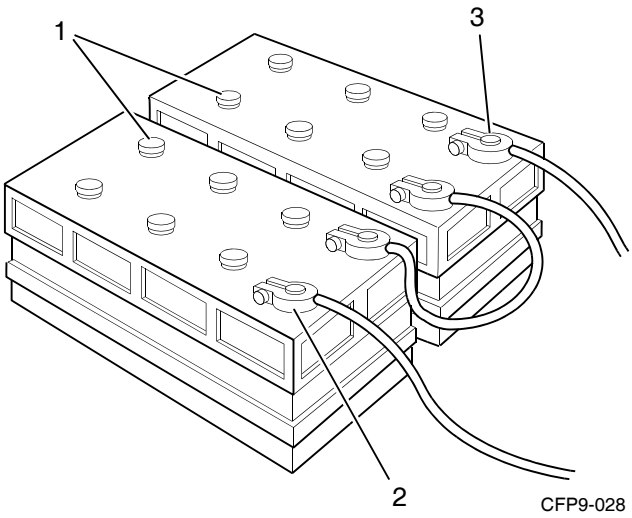
1. Bypass Water Line
2. Normal Water Line
3. Raw Water Wye Strainers

Figure 6-6 Raw Water Wye Strainers

6.3.10 Check Battery Condition

Weak or undercharged starting batteries are the most common cause of standby power system failures. Even when kept fully charged and maintained, lead-acid starting batteries are subject to deterioration over time and must be periodically replaced when they no longer hold a proper charge.

Only a regular schedule of inspection and testing under load can prevent engine starting problems. Use a manual battery load tester to verify the condition of each starting battery. Inspect the condition of the batteries, the electrical cables and the engine ground lug. Refer to Figure 6-7.



1. Battery Cell Covers
2. Negative Battery Terminal
3. Positive Battery Terminal

Figure 6-7 Optional 24 VDC Battery Connection

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. Refer to Figure 6-7.

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. Include 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 (1/4 lb. baking soda to one quart 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. Check also the insulation resistance to ground. Correct any electrical faults.

   Continuity should be in the single digit ohms or less. Resistance to ground should be in the mega-ohm range. Refer to the Vendor supplied literature for additional information.

6.3.11 Engine Run Testing

Fire pump engines on continuous standby must be able to go from a cold start to being fully-operational in a matter of seconds. This can impose a severe burden on engine parts. The engine normally starts automatically in an emergency situation, upon receipt of the start command from the fire pump controller.

Regular operation keeps engine parts lubricated, prevents oxidation of electrical contacts, uses up fuel before it deteriorates, and, in general, helps provide reliable engine starting.

1. Start 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 10 PSI.

8. Check coolant temperature 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 inlet air restriction 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 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 6-8.

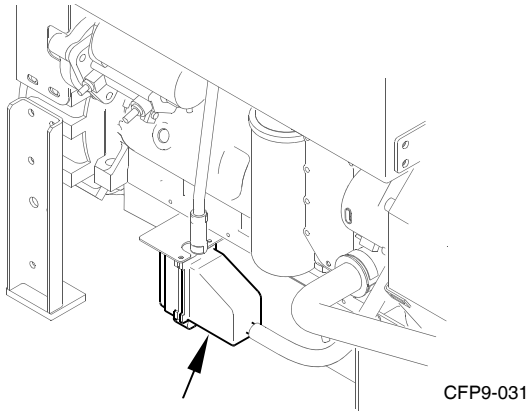


Figure 6-8 Engine Heater

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

6.3.13 Check Antifreeze

Antifreeze is essential in any climate. It broadens the operating temperature range by lowering the coolant freezing point and raising its boiling point. The corrosion inhibitors also protect the cooling system components from corrosion and provide longer component life.

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 wit local environmental regulations.

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%.

1. Check the antifreeze concentration using a refractometer (such as Fleetguard® Part No. CC2800.

IMPORTANT: *Floating-ball type density testers or hydrometers are not accurate enough for use with heavy-duty diesel cooling systems.*

a. At least twice per year.

b. At every subsequent oil drain interval, if the concentration is above 3 units.

c. Whenever coolant is added to the cooling system between filter changes.

6.3.14 Air Cleaner Service Indicator

Turbocharged engines must be operated at rated RPM and full load to check maximum intake air restriction. Replace the air filter per the manufacturer's recommendation as required.

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. Contact with exposed or moving components can cause personal injury.

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

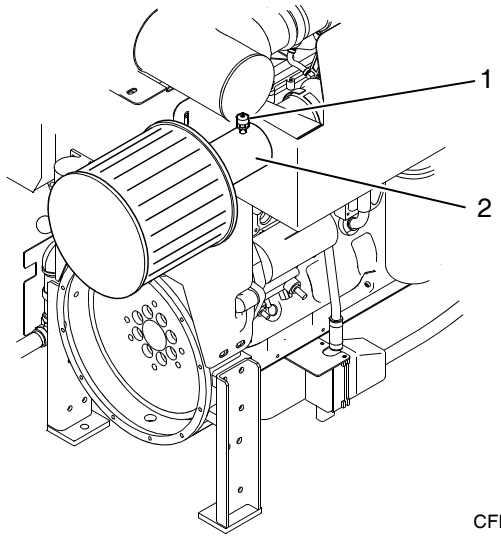
NOTE: *Follow the manufacturer's instructions when cleaning or replacing the air cleaner element. Do not remove the felt washer from the indicator. The felt washer absorbs moisture.*

1. The air cleaner service indicator is actuated when excessive air restriction has occurred at the air cleaner. Refer to Figure 6-9.

   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.

NOTE: *Cummins recommends using Air Cleaner Element CFP p/n 9606.*

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



1. Air Cleaner Service Indicator
2. Air Filter Mounting Tube

Figure 6-9 Air Cleaner Service Indicator

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

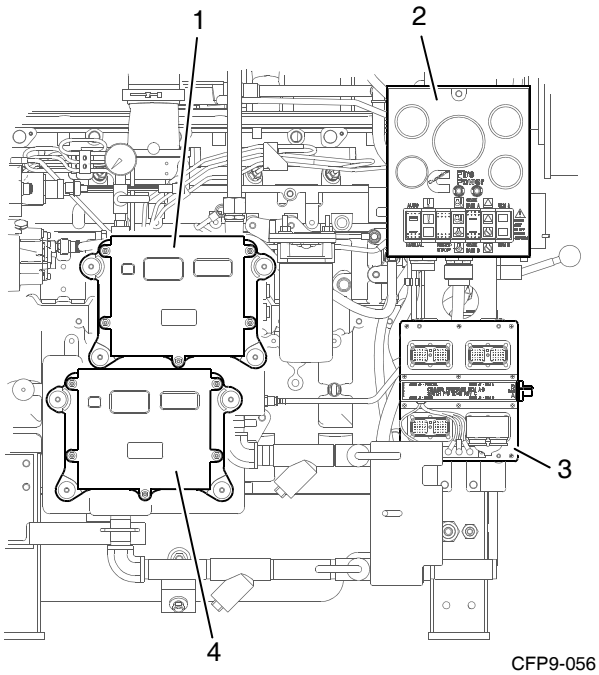
AVOID SERVICING complex components such as: ECM controllers, printed circuit boards, and, programmable controllers, not specifically authorized by the manufacturer. Contact the local Cummins Authorized Repair Location before performing any extensive maintenance.

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, terminal panels, and electrical plug-ins, for secure, clean electrical contacts, worn or damaged insulation, burnt wires, broken wires and loose connections. Refer to Figure 6-10.



1. ECM A
2. Operator's Control Panel
3. ECM Selector Panel and Switch
4. ECM B

Figure 6-10 Electrical Control Modules

a. Clean and tighten any loose electrical connections.

b. Replace worn, damaged, burnt or poorly insulated wiring immediately.

c. Refer to the OEM Vendor supplied literature for recommended maintenance procedures.

IMPORTANT: *Solid state or sealed electrical components have no user serviceable parts. Contact your local Cummins Authorized Repair Location for additional information.*

d. Repair or replace damaged components using recommended Recon® or Cummins service parts only. Refer to Section 8 - Component Parts and Assemblies or contact a Cummins Authorized Repair Location.

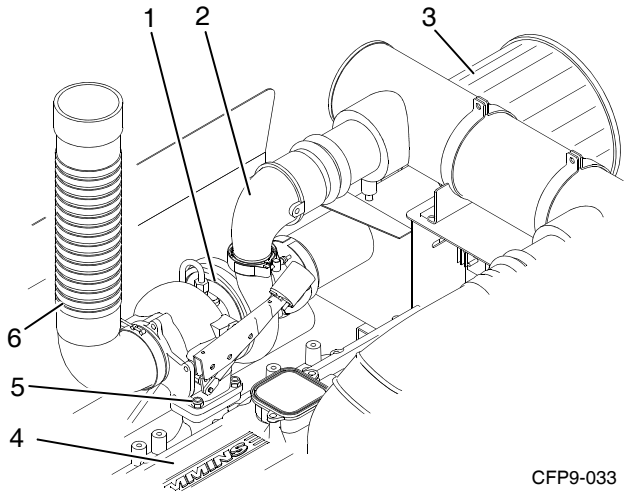
3. Inspect electrical terminal connectors on the instrument panel for burnt, loose, damaged or broken contacts.

4. Inspect the function of all gauges, voltmeters, switches, warning lamps and circuit breakers. Replace panel components, breakers and warning lamps as required.

6.4.2 Turbocharger Mounting Nuts

Check the turbocharger mounting nuts. Refer to Figure 6-11.

Torque the mounting nuts to 65 N-m (50 ft-lb).



1. Turbocharger
2. Air Hose to Charge Air Cooler
3. Intake Air Cleaner
4. Valve Cover
5. Turbocharger Mounting Nuts
6. Exhaust Flex Connection

Figure 6-11 Turbocharger

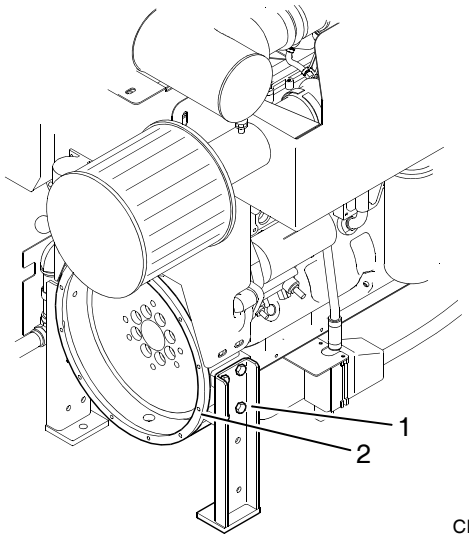
6.4.3 Engine Mounting Bolts

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 mounts for cracks or loose bolts. Refer to Figure 6-12.

2. Check the torque on the engine mounting bolts. Torque the support bracket to engine mounting cap screws to 47 N-m (35 ft-lb).



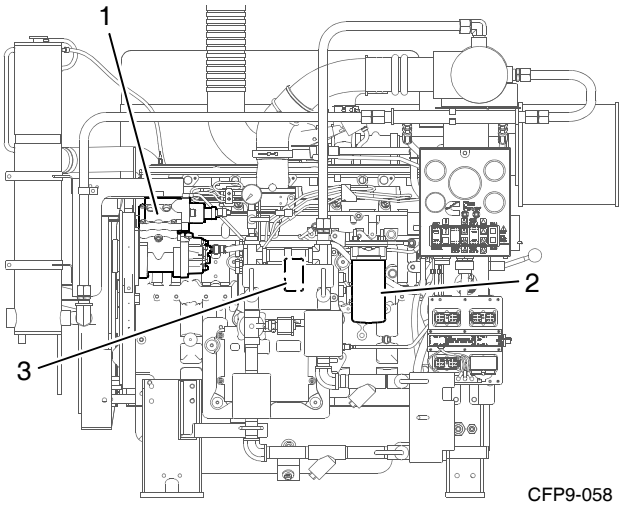
1. Engine Mounting Bracket
2. Flywheel Housing

Figure 6-12 Engine Mounting Bracket

6.4.4 Inspect Fuel Pumps

1. Inspect the fuel injection pump mounting nuts, including the support bracket, for loose or damaged hardware. Refer to Figure 6-13.

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



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

Figure 6-13 Fuel Pumps

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. Do not use oil after it has been drained from the oil pan.*

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 water temperature reaches 70° C (158° F). Shut the engine off.

3. Place an appropriate container under the oil pan drain plug. Refer to Figure 6-14.

   The CFP9E engine models have a 5.75 gallon (21.8 L) oil 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 6-15.

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

   b. Use a filter wrench to remove the filter.

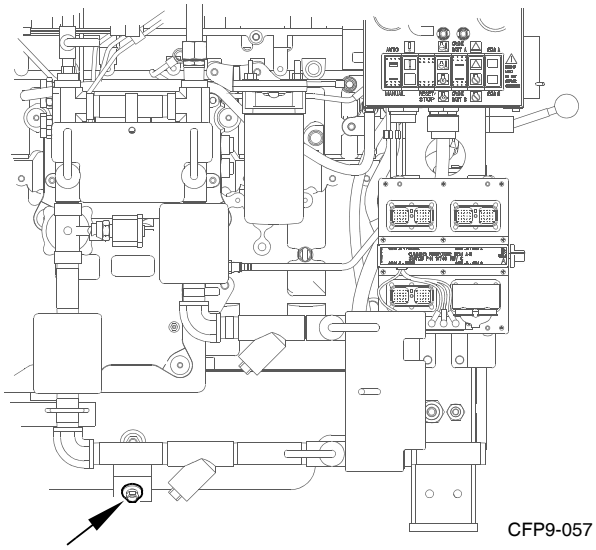
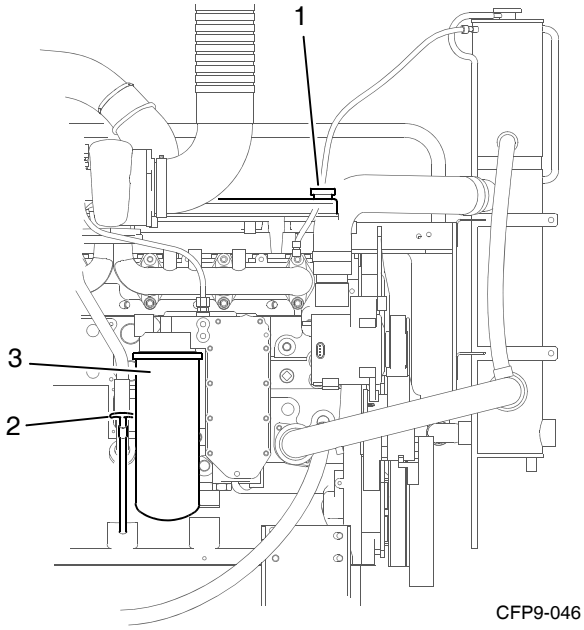


Figure 6-14 Oil Pan Drain Plug

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 engine oil to the replacement filter gasket before installing the filter.



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

Figure 6-15 Oil Filter and Oil Level Dipstick

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

7. Center the filter ring on the threaded mounting nipple. Screw the filter canister onto the mounting flange until the gasket is snug against he 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 Fleetguard Lube Oil Filter LF9009.*

8. Check and clean the oil pan drain plug threads and sealing surface. Install the oil pan drain plug. Torque the plug to 50 N-m (37 ft-lb).

9. Add a high-quality 15W-40 multi-viscosity engine oil, such as Cummins Premium Blue®, or its equivalent.

10. Fill the engine to the proper level with clean oil at the fill port. Refer to Figure 6-15.

    The CFP9E engine models have a 5.75 gallon (21.8 L) oil capacity.

NOTE: *Capacities assume standard pan. Total system assumes standard pan plus filter.*

⚠ 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.

11. Stop the engine.

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

13. Check the oil level again. Add oil as necessary to bring the oil level to the H (high) mark on the dipstick. Refer to Figure 6-15.

6.4.6 Change Fuel Filter of Filter/Separator

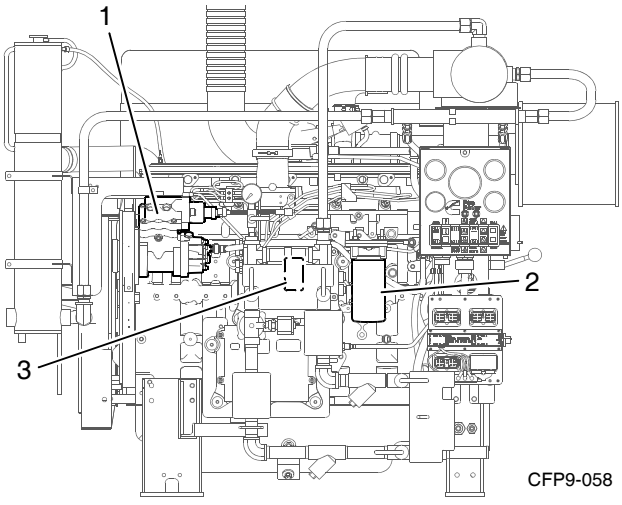
WARNING

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, fire hazard or fatality.

1. Shut off the engine.
2. Close any OEM fuel valves (if equipped) to prevent fuel from draining or siphoning.
3. Clean the area around the fuel filter head.
4. Remove the spent filter canister using a filter wrench. Refer to Figure 6-16.
5. Clean the filter mounting head surface of sludge buildup and foreign particles. Ensure mating gasket surfaces are clean.



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

Figure 6-16 Fuel Filter or Filter/Separator

6. Lubricate the gasket seal with clean S.A.E. 15W-40 engine oil.

NOTE: *Cummins recommends using Fleetguard (Cummins) fuel filter/water separator FF9587 or equivalent in the primary fuel filter location.*

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.

8. Open the fuel supply valves (optional).
9. Press either the CRANK BATT A or CRANK BATT B Switch to start the engine.
10. Depress the selector 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 ramp 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 universal joint grease fittings. Refer to Figure 6-17.

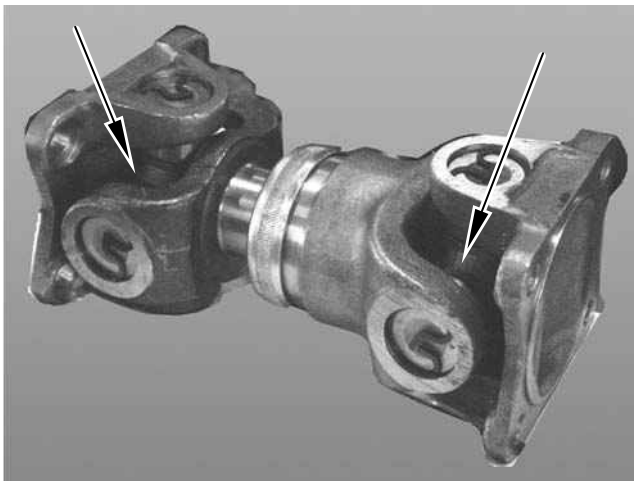


Figure 6-17 Drive Coupling Grease Fittings

NOTE: *Cummins, Inc recommends using a good quality semi-synthetic, molybdenum-fortified NLGI #2 lithium complex grease which protects from -54° to 400° F such as Valvoline Durablend®.*

4. Wipe excess grease from the grease fittings.

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 Engine Operation Checks

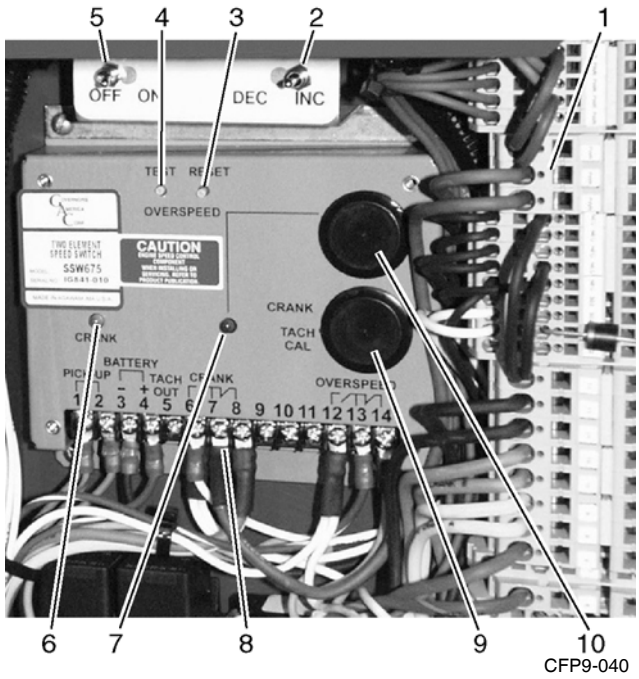
The following service procedures ensure that the engine starts and operates properly under normal conditions.

6.4.8.1 Crank Termination Set Point

The Speedswitch Crank Termination Set Point is factory set at 650 rpm, and should not be changed from this value. Refer to Figure 6-18.

If the crank termination set point must be set, proceed as follows:

1. Open the engine control panel and remove the crank terminate potentiometer cover. There will be 2 potentiometers visible. The Crank Terminate Potentiometer is the upper one.



CFP9-040

1. Spring Clamp Terminal Blocks
2. Speed Increase/Decrease Toggle Switch
3. RESET Button
4. TEST Button
5. Diagnostic ON/OFF Toggle Switch
6. CRANK Termination or RUN Signal Indicator LED (Factory Use Only)
7. Overspeed Indicator LED
8. Pre-wired Terminals
9. Crank Terminate Potentiometer Cover
10. Overspeed Potentiometer Cover

Figure 6-18 Engine Overspeed Control Module

2. This is a 30-turn potentiometer. The Crank Terminate Potentiometer must be set to 14 turns clockwise.

3. To ensure that the potentiometer is set at 0 turns: Rotate the potentiometer 30 turns counterclockwise. The potentiometer will not be damaged by turning it past its zero-point.

4. After setting the Crank Terminate Potentiometer at 0 turns, turn the potentiometer 14 turns clockwise.

5. Replace the cover. The Crank Terminate Potentiometer is now set at approximately 650 rpm.

6.4.8.2 Engine Speed Calibration

If the speed does not match the Engine RPM shown on the Factory Settings Plate, use the following method to set the engine speed using the INC/DEC Speed Switch on the engine speed controller panel.

1. Remove the cap screw from the operator's instrument face plate, allowing the face plate to gently drop down supported by the hinge.

2. Start the engine using the local start method.

3. Observe that the engine starts and accelerates to the speed set point listed on the Factory Settings Plate.

4. 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.

5. Move the Engine Speed Toggle Switch to the required INC (increase) or DEC (decrease) pole position. Refer to Figure 6-18.

NOTE: *Each time the Speed INCREASE/ DECREASE Toggle Switch is briefly moved to the minus (-) position, the idle speed is decreased by 10 RPM. When the switch is briefly moved to the plus (+) position, the idle speed is increased by 10 RPM. Holding the toggle switch in either the INC or DEC position ramps the engine speed in the selected direction.*

   a. To increase the speed, move the double pole, return-to center, toggle switch to the INC position until the rated speed is reached. Refer to Figure 6-18.

   b. To decrease the speed, move the double pole, return-to center, toggle switch to the DEC position until the rated speed is reached.

6. Stop the engine.

7. Start the engine.

8. Observe that the engine starts and accelerates to the rated speed set point.

9. The engine speed set point calibration is required for both the ECM A and ECM B subsystems.

10. Repeat steps 2 through 8 while the ECM selector switch is set to ECM-B.

11. Close the panel and tighten the enclosure cap screw to secure the panel face.

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

6.4.8.3 Overspeed Set Point Adjustment

The Engine Overspeed Set Point was set by Cummins Fire Power during manufacturing and test procedures. It may be necessary to adjust the overspeed set point based on the actual fire pump application.

1. Open the engine instrument panel and remove the Overspeed Potentiometer Cover. Refer to Figure 6-18.

2. Place the engine in the MANUAL position by switching the MANUAL/AUTO Switch to the MANUAL position.

NOTE: *The Test Button reduces the actual overspeed set point by a value of 20%.*

3. Start the engine and adjust the engine speed to the system design pump speed. Refer to Section 6.4.8.2 Engine Speed Calibration for additional information.

4. Press and hold the test button. If the engine remains running, slowly turn the Over Speed Potentiometer counterclockwise until the engine stops. Remember to keep the test button depressed during this adjustment procedure. The speed switch is now set for the correct overspeed RPM.

NOTE: *Turning the potentiometer clockwise raises the set speed and counterclockwise lowers the set speed.*

5. Press the Reset button on the speed switch or front panel so the engine can be restarted.

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

Alternate Overspeed Set Point Adjustment procedure (without the test button)

1. Remove the drive-shaft or stub-shaft coupling to prevent overspeeding the pump. Refer to appropriate driveline drawings in Section 8 - Component Parts and Assemblies.

2. Open the engine instrument panel and remove the Overspeed Potentiometer Cover. Refer to Figure 6-18.

3. Place the engine in MANUAL position by switching the MANUAL/AUTO Switch to the MANUAL position.

4. Calculate the actual overspeed setting.

   a. Determine required pump speed (example: 1760 RPM).

   b. Calculate actual overspeed setting (example: 1760 X 120% = 2112 RPM).

5. Start the engine and adjust the engine speed to the calculated overspeed. (2112 RPM in the example above). Refer to Section 6.4.8.2 Engine Speed Calibration for additional information.

6. If the engine remains running, slowly turn the Over Speed Potentiometer counterclockwise until the engine stops. The speed switch is now set for the correct overspeed RPM.

NOTE: *Turning the potentiometer clockwise raises the set speed and counterclockwise lowers the set speed.*

7. Press the Reset button on the speed switch or front panel so the engine can be restarted.

8. Readjust the engine speed to the proper pump speed (1760 RPM in the example above).

9. Reconnect the pump drive-shaft or stub-shaft coupling. Refer to appropriate driveline drawings in Section 8 - Component Parts and Assemblies.

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

6.4.9 Coolant Pump/Alternator Belt Inspection

For CFP9E models, a single belt drives both the water pump and the alternator

CAUTION

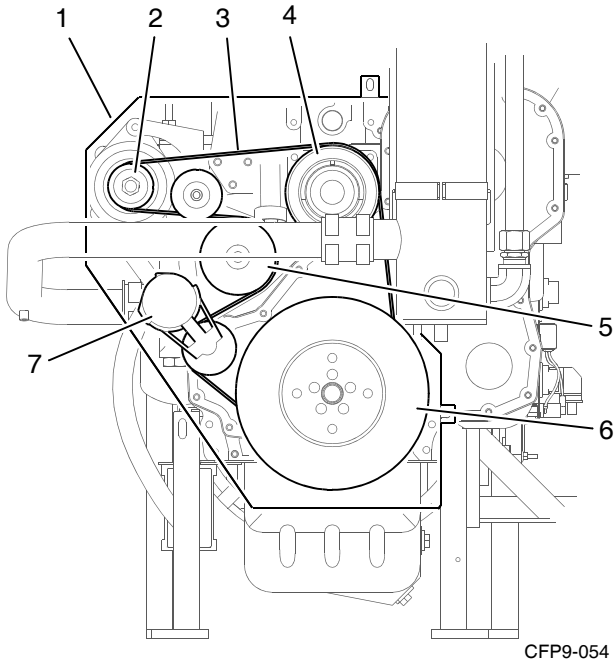
Belt damage can be caused by, incorrect tension, incorrect size or length, pulley misalignment, incorrect installation, severe operating environment, and oil or grease on the belt or pulley.

1. Place the AUTO/MANUAL Rocker Switch in the MANUAL position.

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

CAUTION

Disconnect both batteries (negative cable first) before performing service on the Fire Pump Engine or on any of its controls.



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

Figure 6-19 Coolant Pump/Alternator Belt

3. Remove the belt guard bolts and the belt guard. Set aside for later installation. Refer to Figure 6-19.

4. Visually inspect the belt for frayed, worn, missing pieces or cracked belt surfaces. Check the belt for intersecting cracks. Refer to Figure 6-19.

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 has pieces of material missing.*

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 batteries (negative cable first) before performing service on the Fire Pump Engine or on any of its controls.

1. Check the poly-vee coolant pump belt tension. Refer to Figure 6-19.

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 fan and alternator pulleys.

   b. Belt tension should be between 360 to 490 N-m (266 to 361 ft-lb).

NOTE: *The belt must not touch the bottom of the pulley grooves nor protrude more than 3 mm (3/32 in) above the top of the groove.*

3. 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.

4. 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.

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

6. Use a 3/8” drive ratchet or breaker bar to rotate the tensioner slowly away from the belt.

   If the arm rotates with any roughness or hesitancy, replace the tensioner.

7. Check the belt tensioner cap screw torque. The screw should be torqued to 43 N-m (32 ft-lb).

6.4.11 Heat Exchanger Pressure Test

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

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

1. Install a 1-1/4” tubing adapter at the raw water outlet of the heat exchanger.

2. Install a pressure test setup with 700 kPa (100 psi) pressure gauge at the 1” tubing adapter raw water inlet to the heat exchanger.

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

   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 the test equipment.

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

6.4.12 Turbocharger Inspection

1. Visually inspect the air intake filter and piping for dirt buildup, blockage, wear points, soft hoses, loose clamps, or punctures. Refer to Figure 6-20.

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

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

3. 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.

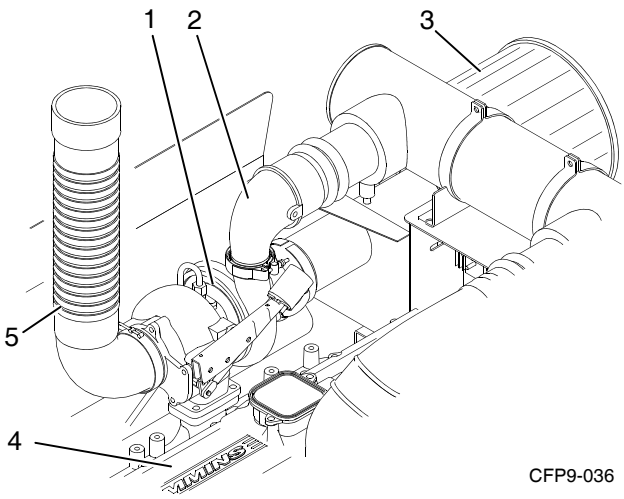
   Disassemble and clean, as required.

4. Remove the air intake and the exhaust piping.

5. Remove the exhaust pipe from the turbocharger.

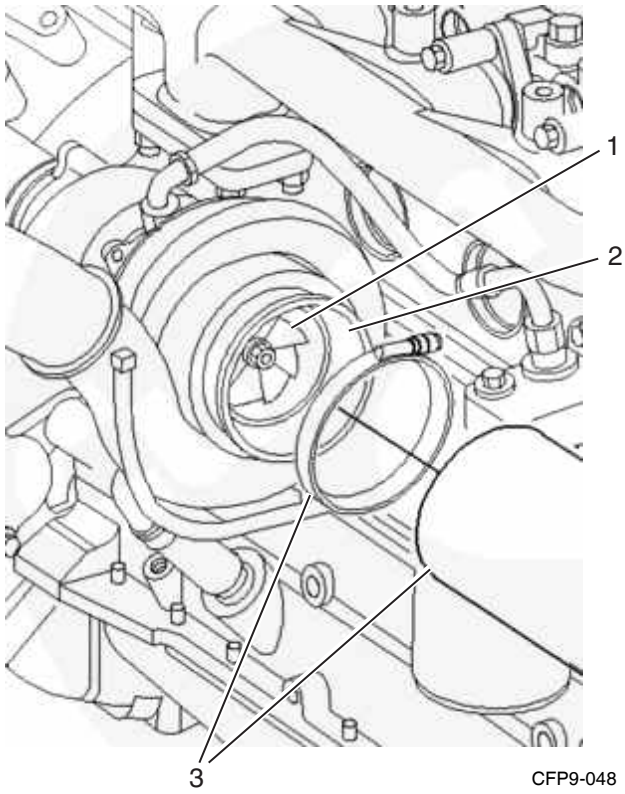
6. Inspect the turbocharger turbine wheel for cracks in the housing or turbine blades, missing blades, mechanical binding, eccentric motion or excessive end-play. Refer to Figure 6-21

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.*



1. Turbocharger
2. Air Hose to Charge Air Cooler
3. Intake Air Cleaner
4. Valve Cover
5. Exhaust Flex Connection

Figure 6-20 Turbocharger Connections



1. Turbocharger Turbine Wheel
2. Turbocharger Intake Housing
3. Air Intake Tube and Clamp

Figure 6-21 Turbocharger Turbine Wheel (typical)

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

7. Reinstall the air intake filter and the exhaust piping. Tighten the clamps. Torque loosened clamps to 8 N-m (72 in-lb).

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 Water Pump Inspection

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

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

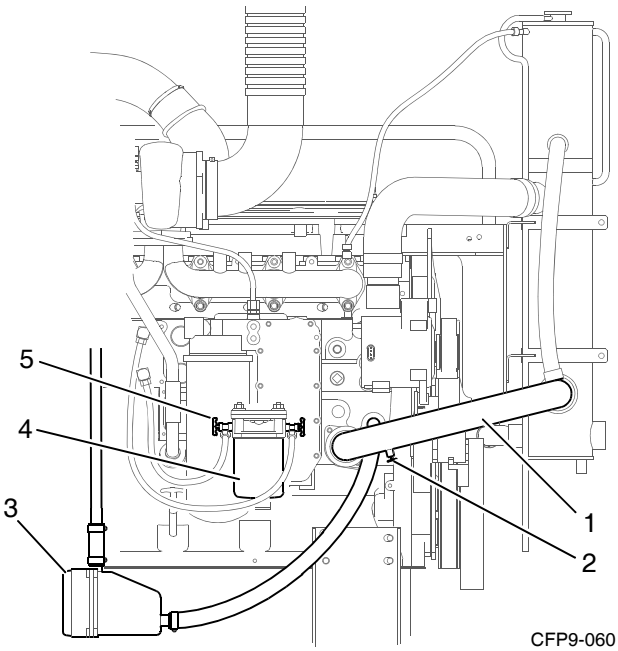
6.5.2 Drain and Flush Cooling System

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 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.



1. Lower Coolant Hose
2. Coolant Drain Valve
3. Engine Heater
4. Coolant Filter
5. Coolant Filter Shut Of Valves

Figure 6-22 Engine Coolant Drains

2. Unplug the engine heater power supply before draining the cooling system. Refer to Figure 6-22.

3. Place a container that will hold at least 15 gallons of liquid, under the coolant drain valve. Refer to Figure 6-22.

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.

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

6. Disconnect either end of the engine heater coolant hose and drain the engine heater. Refer to Figure 6-22.

7. 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.*

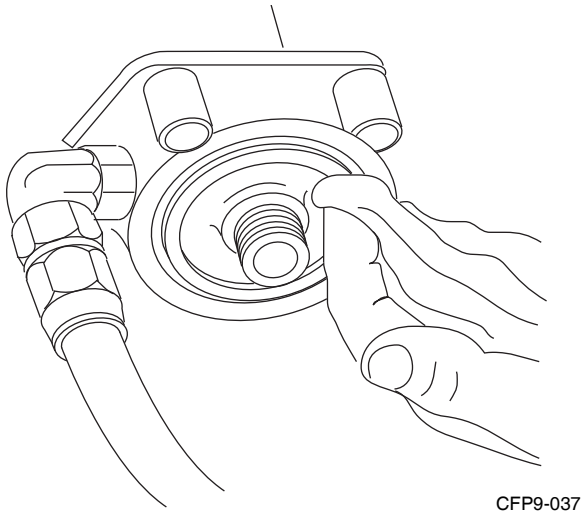
8. When the flushing water has fully drained, use a filter wrench to remove the water coolant filter from the filter housing.

   a. Clean the filter housing gasket mount of dirt buildup, oxidation or particulate matter with a clean cloth. Refer to Figure 6-23.

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

   c. 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.

NOTE: *Cummins recommends using Fleetguard Cooling Water Filter WF2074.*



CFP9-037

Figure 6-23 Filter Housing Gasket Mount

CAUTION

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

9. If using a soapy water solution, flush again with clear water. Allow time for the water to fully drain.

CAUTION

Handling and disposing of used antifreeze can be subject to federal, state, and local laws and regulations. Use authorized waste disposal facilities, including civic amenity sites and garages providing authorized facilities for the receipt of used antifreeze. If in doubt, contact local authorities or the EPA for guidance as to proper handling of used antifreeze.Reconnect the engine heater coolant hose and close the drain petcock and the lower coolant tube petcock.

NOTE: *During filling, air must be vented from the engine coolant passages. The air vents through the coolant filler port. The system has a design fill rate of 10 liters/minute (2.8 gal/min).*

10. Fill the coolant tanks with low-silicate antifreeze that meets ASTM 4985 test (GM 6038 M spec.) criteria. 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.

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 (-90° F)	68% = -63° C (-82° F)

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.

CAUTION

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

11. Check the condition of the filler cap.
    a. If the filler 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 filler cap.
12. Operate the engine until it reaches a temperature of 82° C (180° F), and check for coolant leaks.
13. Ensure that the coolant level is just below the filler 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 vale lash settings. The recommended maintenance is beyond the scope of this manual.

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.

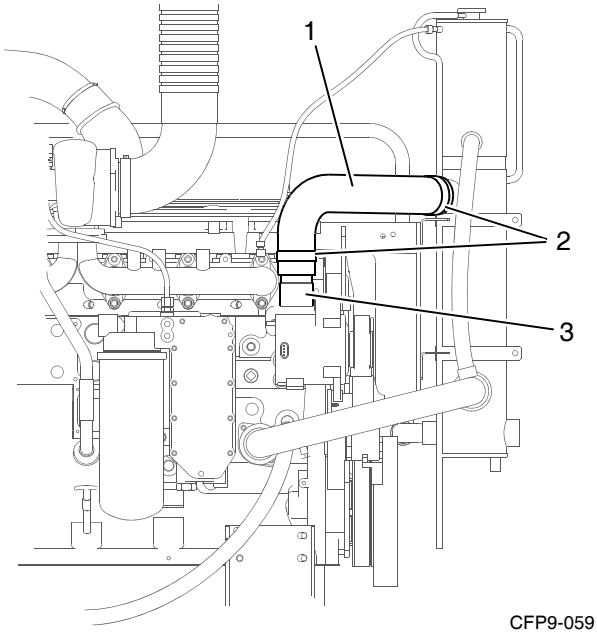
6.6.1 Coolant Thermostat Removal/Installation

The thermostat regulates the temperature of the engine coolant circulating through the engine cooling system.

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 the upper coolant hose.
2. Remove the (2) thermostat housing flange cap screws and the thermostat flange. Refer to Figure 6-24.
3. Remove the thermostat and gasket from the housing.
4. Clean the housing flange faces of dirt buildup, oxidation and sludge.



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

Figure 6-24 Thermostat Housing

5. Install the thermostat in the housing.

NOTE: *EC 1722 Kit contains Cummins approved thermostat and thermostat seal.*

6. Install a new thermostat seal on the thermostat housing flange surface.
7. Replace the thermostat flange and cap screws.

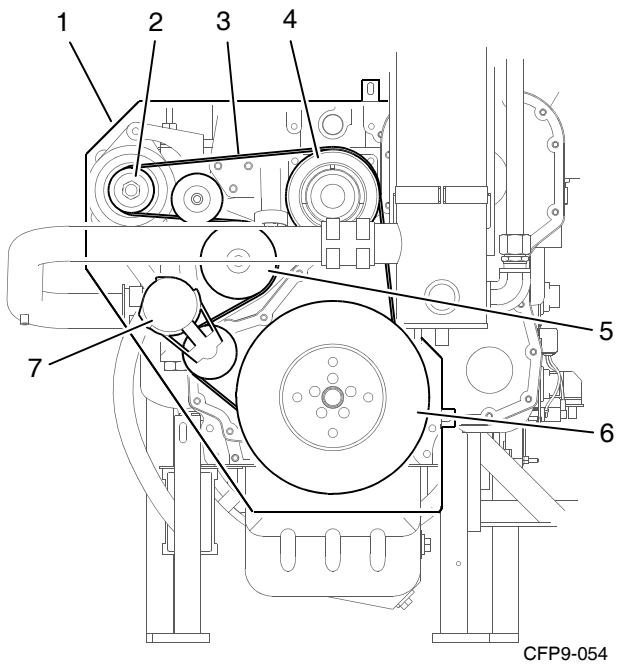
6.6.2 Coolant Pump/Alternator Belt Replacement

Replace the Coolant Pump/Alternator Belt if it is cracked, frayed or has pieces of material missing.

CAUTION

Disconnect both batteries (negative cable first) before performing service on the Fire Pump Engine or on any of its controls.

1. Remove the belt guard. Refer to Figure 6-25.
2. Use a 3/8” drive ratchet or breaker bar to rotate the tensioner arm away from the belt and remove the belt.



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

Figure 6-25 Coolant Pump/Alternator Belt

3. Check the belt tensioner cap screw torque. The screw should be torqued to 43 N-m (32 ft-lb).

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 tension 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.

CAUTION

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

12. Reinstall the belt guard.

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. Place the AUTO/MANUAL Rocker Switch in the MANUAL position.

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

CAUTION

Batteries must be disconnected before performing service on the Fire Pump Engine or on any of its controls. Wear safety glasses when disconnecting batteries!

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

4. Open the coolant filter shutoff valve. Refer to Figure 6-26.

5. Drain the coolant system per the instructions in Section 6.5.2.

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 6-27.

7. Disconnect raw water inlet and outlet fittings from the heat exchanger. Refer to Figure 6-27.

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

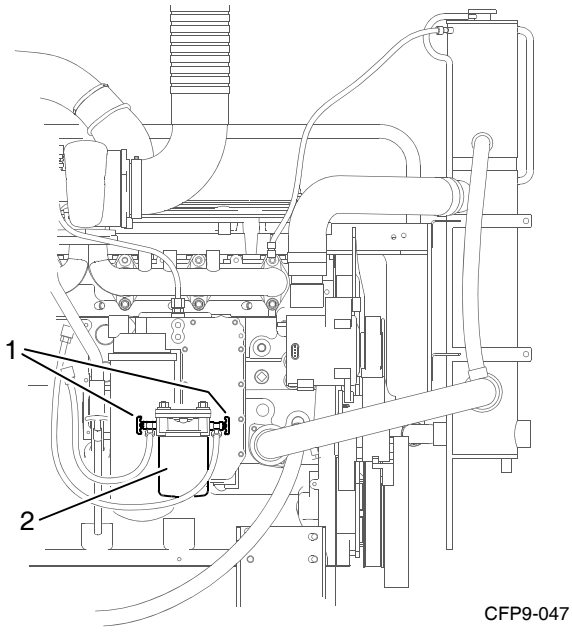
9. Provide support for the heat exchanger in order to avoid dropping it. Remove the charge air heat exchanger from the mounting plates.

WARNING

Cleaning chemicals may be caustic and cause skin irritation. Follow the instructions on cleaning containers for protective clothing. 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 ar cooler will result. Follow the directions provided by the cleaning solution manufacturer.



1. Coolant Filter Valves
2. Coolant Filter

Figure 6-26 Coolant Filter & Shut-off Valves

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.

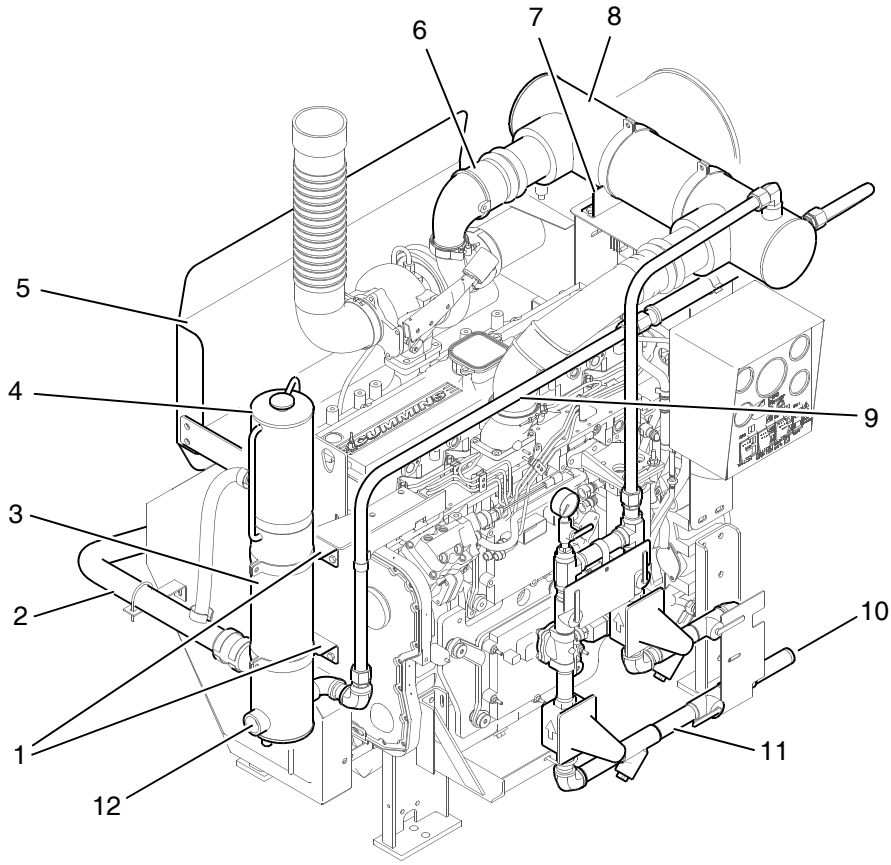
CAUTION

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.



1. Coolant Heat Exchanger Mounting Brackets
2. Lower Water Return Tubing
3. Coolant Heat Exchanger
4. Coolant Expansion Tank
5. Manifold Heat Shield
6. Charge Air Hose from Turbocharger
7. Charge Air Heat Exchanger Mounting Brackets
8. Charge Air Heat Exchanger
9. Connecting Pipe
10. Raw Water Inlet
11. Raw Water Cooling Loop
12. Raw Water Outlet

Figure 6-27 Cooling Loop and Heat Exchangers

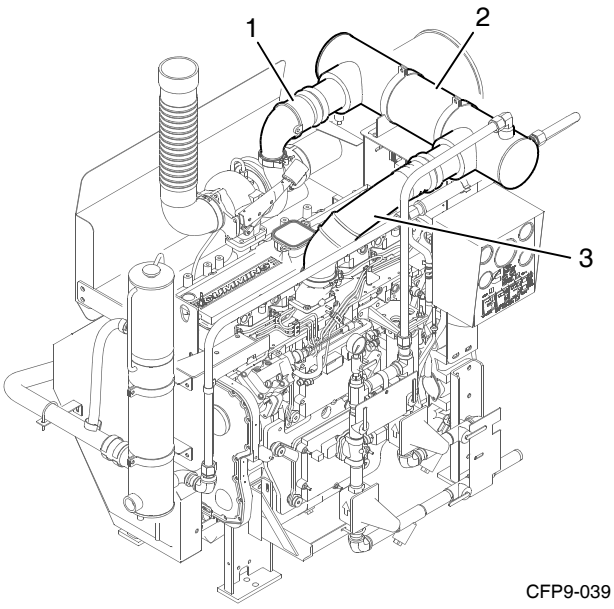
15. Depending on the condition of the heat exchanger:

    a. Perform the Pressure Test outlined in this section

    b. Reassemble the coolant heat exchangers, coolant tubing and water-cooling loop lines per the instructions outlined in Section 6.5.2

6.6.3.1 Charge Air Heat Exchanger Installation

1. Provide support for the coolant heat exchanger in order to avoid dropping it.
2. Position the heat exchanger and clamps on the engine's mounting bracket and hand tighten the mounting bolts. Refer to Figure 6-27.
3. Align the heat exchanger with the required hose connections and tighten the hose clamp fasteners. Refer to Figure 6-28.
4. Reinstall all water supply and drain fittings. Use Teflon™ pipe tape to prevent leaks. Torque the hose clamp screws to 8 N-m (71 in-lb).
5. When the charge air heat exchanger hose clamps and cooling water lines are secure, tighten the mounting bracket bolts.



1. Charge Air Tubing from Turbocharger
2. Charge Air Heat Exchanger
3. Charge Air Tubing to Inlet Manifold

Figure 6-28 Charge Air Tubing Lines

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

7. 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 nontechnical 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 Operation and Maintenance Manual, Industrial and Power Generation QSL9 Engines, Bulletin No. 4021518 or contact the Cummins Customer Assistance Center at 1-800-DIESELS (1-800-343-7357).

It is beyond the scope of this manual to cover all of the various problems that may affect engine performance.

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, 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.

Table of Contents

CFP9E Fault Code Chart

FAULT CODE (LAMP)	SPN FMI	J1939 SPN DESCRIPTION	Cummins DESCRIPTION
111 (Red)	629 12	Controller #1	Engine Control Module Critical internal failure - Bad intelligent Device or Component
115 (Red)	612 2	System Diagnostic Code # 2	Engine Speed/Position Sensor Circuit lost both of two signals from the magnetic pickup sensor - Data Erratic, Intermittent, or incorrect.
122 (Yellow)	102 3	Boost Pressure	Intake Manifold Pressure Sensor Circuit - Voltage Above Normal, or Shorted to High Source.
123 (Yellow)	102 4	Boost Pressure	Intake Manifold Pressure Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
124 (Yellow)	102 16	Boost Pressure	Intake Manifold 1 Pressure - Data Valid but Above Normal Operational Range - Moderately Severe Level
131 (Red)	91 3	Accelerator Pedal Position	Accelerator Pedal or Lever Position Sensor Circuit - Voltage Above Normal, or Shorted to High Source
132 (Red)	91 4	Accelerator Pedal Position	Accelerator Pedal or Lever Position Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
133 (Red)	974 3	Remote Accelerator	Remote Accelerator Pedal or Level Position Sensor Circuit - Voltage Above Normal, or Shorted to High Source
134 (Red)	974 4	Remote Accelerator	Remote Accelerator Pedal or Level Position Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
135 (Yellow)	100 3	Engine Oil Pressure	Oil Pressure Sensor Circuit - Voltage Above Normal, or Shorted to High Source
141 (Yellow)	100 4	Engine Oil Pressure	Oil Pressure Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
143 (Yellow)	100 18	Engine Oil Pressure	Oil Pressure Low - Data Valid but Below Normal Operational Range - Moderately Severe Level
144 (Yellow)	110 3	Engine Coolant Temperature	Coolant Temperature Sensor Circuit - Voltage Above Normal or Shorted to High Source
145 (Yellow)	110 4	Engine Coolant Temperature	Coolant Temperature Sensor Circuit - Voltage Below Normal or Shorted to Low Source
146 (Yellow)	110 16	Engine Coolant Temperature	Coolant Temperature High - Data Valid but Above Normal Operational Range - Moderately Severe Level
147 (Red)	91 1	Accelerator Pedal Position	Accelerator Pedal or Level Position Sensor Circuit - Abnormal Frequency, Pulse Width, or Period
148 (Red)	91 0	Accelerator Pedal Position	Accelerator Pedal or Level Position Sensor Circuit - Abnormal Frequency, Pulse Width, or Period
151 (Yellow)	110 0	Engine Coolant Temperature	Coolant Temperature Low - Data Valid but Above Normal Operational Range - Most Severe Level
153 (Yellow)	105 3	Intake Manifold #1 Temperature	Intake Manifold Air Temperature Sensor Circuit - Voltage Above Normal, or Shorted to High Source
154 (Yellow)	105 4	Intake Manifold #1 Temperature	Intake Manifold Air Temperature Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
155 (Yellow)	105 0	Intake Manifold #1 Temperature	Intake Manifold Air Temperature High - Data Valid but Above Normal Operational Range - Most Severe Level
187 (Yellow)	3510 4	5 Volts DC Supply	Sensor Supply Voltage #2 Circuit - Voltage Below Normal, or Shorted to Low Source
193 (Yellow)	520199 3	Cruise Control	Cruise Control (Resistive) Signal Circuit - Voltage Above Normal, or Shorted to High Source
194 (Yellow)	520199 4	Cruise Control	Cruise Control (Resistive) Signal Circuit - Voltage Below Normal, or Shorted to Low Source

CFP9E Fault Code Chart (Continued)

FAULT CODE (LAMP)	SPN FMI	J1939 SPN DESCRIPTION	Cummins DESCRIPTION
195 (Yellow)	111 3	Coolant Level	Coolant Level Sensor Circuit - Voltage Above Normal, or Shorted to High Source
196 (Yellow)	111 4	Coolant Level	Coolant Level Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
197 (Yellow)	111 18	Coolant Level	Coolant Level - Data Valid but Below Normal Operational Range - Moderately Severe Level
199 (Yellow)	1661 4	Engine Automatic Start Lamp	Engine Automatic Start Lamp Driver Circuit - Voltage Above Normal, or Shorted to High Source
211 (None)	1484 31	J1939 Error	Additional Auxiliary Diagnostic Codes logged - Condition Exists
212 (Yellow)	175 3	Oil Temperature	Engine Oil Temperature Sensor #1 Circuit - Voltage Above Normal, or Shorted to High Source
213 (Yellow)	175 4	Oil Temperature	Engine Oil Temperature Sensor #1 Circuit - Voltage Below Normal, or Shorted to Low Source
214 (Yellow)	175 0	Oil Temperature	Engine Oil Temperature - Data Valid but Above Normal Operational Range - Most Severe Level
221 (Yellow)	108 3	Barometric Pressure	Barometric Pressure Sensor Circuit - Voltage Above Normal, or Shorted to High Source
222 (Yellow)	108 4	Barometric Pressure	Barometric Pressure Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
227 (Yellow)	3510 3	5 Volts DC Supply	Sensor Supply Voltage #2 Circuit - Voltage Above Normal, or Shorted to High Source
231 (Yellow)	109 3	Coolant Pressure	Coolant Pressure Sensor Circuit - Voltage Above Normal, or Shorted to High Source
232 (Yellow)	109 4	Coolant Pressure	Coolant Pressure Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
233 (Yellow)	109 18	Coolant Pressure	Coolant Pressure - Data Valid but Below Normal Operational Range - Moderately Severe Level
234 (Red)	190 0	Engine Speed	Engine Speed High - Data Valid but Above Normal Operational Range - Most Severe Level
235 (Yellow)	111 1	Coolant Level	Coolant Level Low - Data Valid but Below Normal Operational Range - Most Severe Level
237 (Yellow)	644 2	External Speed Input	External Speed Input (Multiple Unit Synchronization) - Data Erratic, Intermittent, or Incorrect
238 (Yellow)	3511 4	System Diagnostic Code # 1	Sensor Supply Voltage #3 Circuit - Voltage Below Normal, or Shorted to Low Source
239 (Yellow)	3511 3	System Diagnostic Code # 2	Sensor Supply Voltage #3 Circuit - Voltage Above Normal, or Shorted to High Source
241 (Yellow)	84 2	Wheel-based Vehicle Speed	Vehicle Speed Sensor Circuit - Data Erratic, Intermittent, or Incorrect
242 (Yellow)	84 10	Wheel-based Vehicle Speed	Vehicle Speed Sensor Circuit tampering has been detected - Abnormal Rate of Change
244 (Yellow)	623 4	Red Stop Lamp	Red Stop Lamp Driver Circuit - Voltage Below Normal, or Shorted to Low Source
245 (Yellow)	647 4	Fan Clutch Output Device Driver	Fan Control Circuit - Voltage Below Normal, or Shorted to Low Source
249 (Yellow)	171 3	Ambient Air Temperature	Ambient Air Temperature Sensor Circuit - Voltage Above Normal, or Shorted to High Source

CFP9E Fault Code Chart (Continued)

FAULT CODE (LAMP)	SPN FMI	J1939 SPN DESCRIPTION	Cummins DESCRIPTION
256 (Yellow)	171 4	Ambient Air Temperature	Ambient Air Temperature Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
261 (Yellow)	174 16	Fuel Temperature	Engine Fuel Temperature - Data Valid but Above Normal Operational Range - Moderately Severe Level
263 (Yellow)	174 3	Fuel Temperature	Engine Fuel Temperature Sensor #1 Circuit - Voltage Above Normal, or Shorted to High Source
265 (Yellow)	174 4	Fuel Temperature	Engine Fuel Temperature Sensor #1 Circuit - Voltage Below Normal, or Shorted to Low Source
268 (Yellow)	94 2	Fuel Delivery Pressure	Fuel Pressure Sensor Circuit - Data Erratic, Intermittent, or Incorrect
271 (Red)	1347 4	Fuel Pump Pressurizing Assembly #1	High Fuel Pressure Solenoid Valve Circuit - Voltage Below Normal, or Shorted to Low Source
272 (Red)	1347 3	Fuel Pump Pressurizing Assembly #1	High Fuel Pressure Solenoid Valve Circuit - Voltage Above Normal, or Shorted to High Source
281 (Red)	1347 7	Fuel Pump Pressurizing Assembly #1	High Fuel Pressure Solenoid Valve #1 - Mechanical System Not Responding Properly or Out of Adjustment
284 (Red)	1043 4	Internal Sensor Voltage Supply	Engine Speed/Position Sensor (Crankshaft) Supply Voltage Circuit - Voltage Below Normal, or Shorted to Low Source
285 (Yellow)	639 9	SAE J1939 Datalink	SAE J1939 Multiplexing PGN Timeout Error - Abnormal Update Rate
286 (Yellow)	639 13	SAE J1939 Datalink	SAE J1939 Multiplexing Configuration Error - Out of Calibration
287 (Red)	91 19	Accelerator Pedal Position	SAE J1939 Multiplexing Accelerator Pedal or Level Sensor System Error - Received Network Data in Error
288 (Red)	974 19	Remote Accelerator	SAE J1939 Multiplexing Remote Accelerator Pedal or Level Data Error - Received Network Data in Error
292 (Red)	441 14	Auxiliary Temperature 1	Auxiliary Temperature Sensor Input #1 - Special Instructions
293 (Yellow)	441 3	OEM Temperature	Auxiliary Temperature Sensor Input #1 Circuit - Voltage Above Normal, or Shorted to High Source
294 (Yellow)	441 4	OEM Temperature	Auxiliary Temperature Sensor Input #1 Circuit - Voltage Below Normal, or Shorted to Low Source
295 (Yellow)	108 2	Barometric Pressure	Barometric Pressure Sensor Circuit - Data Erratic, Intermittent, or Incorrect
296 (Red)	1388 14	Auxiliary Pressure	Auxiliary Pressure Sensor Input #1 - Special Instructions
297 (Yellow)	1388 3	Auxiliary Pressure	Auxiliary Pressure Sensor Input #2 Circuit - Voltage Above Normal, or Shorted to High Source
298 (Yellow)	1388 4	Auxiliary Pressure	Auxiliary Pressure Sensor Input #2 Circuit - Voltage Below Normal, or Shorted to Low Source
319 Maint.	251 2	Real Time Clock Power	Real Time Clock Power Interrupt - Data Erratic, Intermittent, or Incorrect
322 (Red)	651 5	Injector Cylinder #1	Injector Solenoid Cylinder #1 Circuit - Current Below Normal, or Open Circuit
323 (Red)	655 5	Injector Cylinder #5	Injector Solenoid Cylinder #5 Circuit - Current Below Normal, or Open Circuit
324 (Red)	653 5	Injector Cylinder #3	Injector Solenoid Cylinder #3 Circuit - Current Below Normal, or Open Circuit

CFP9E Fault Code Chart (Continued)

FAULT CODE (LAMP)	SPN / FMI	J1939 SPN DESCRIPTION	Cummins DESCRIPTION
325 (Red)	656 5	Injector Cylinder #6	Injector Solenoid Cylinder #6 Circuit - Current Below Normal, or Open Circuit
331 (Red)	652 5	Injector Cylinder #2	Injector Solenoid Cylinder #2 Circuit - Current Below Normal, or Open Circuit
332 (Red)	654 5	Injector Cylinder #4	Injector Solenoid Cylinder #4 Circuit - Current Below Normal, or Open Circuit
334 (Yellow)	110 2	Engine Coolant Temperature	Coolant Temperature Sensor Circuit - Data Erratic, Intermittent, or Incorrect
338 (Yellow)	1267 3	Vehicle Accessories Relay Driver	Idle Shutdown Vehicle Accessories Relay Driver Circuit - Voltage Above Normal, or Shorted to High Source
339 (Yellow)	1267 4	Vehicle Accessories Relay Driver	Idle Shutdown Vehicle Accessories Relay Driver Circuit - Voltage Below Normal, or Shorted to Low Source
341 (Yellow)	630 2	Calibration Memory	Engine Control Module data lost - Data Erratic, Intermittent, or Incorrect
342 (Yellow)	630 13	Calibration Memory	Electronic Calibration Code Incompatibility - Out of Calibration
343 (Red)	629 12	Controller #1	Engine Control Module Warning internal hardware failure - Bad intelligent Device or Component
349 (Yellow)	191 16	Transmission Output Shaft Speed	Transmission Output Shaft Speed - Data Valid but Above Normal Operational Range - Moderately Severe Level
351 (Red)	627 12	Controller #1	Injector Power Supply - Bad Intelligent Device or Component
352 (Red)	3509 4	5 Volts DC Supply	Sensor Supply Voltage #1 Circuit - Voltage Below Normal, or Shorted to Low Source
386 (Yellow)	3509 3	5 Volts DC Supply	Sensor Supply Voltage #1 Circuit - Voltage Above Normal, or Shorted to High Source
415 (Yellow)	100 1	Engine Oil Pressure	Oil Pressure Low - Data Valid but Below Normal Operational Range - Most Severe Level
418 Maint.	97 15	Water in Fuel Indicator	Water in Fuel Indicator High - Data Valid but Above Normal Operational Range - Least Severe Level
422 (Yellow)	111 2	Coolant Level	Coolant Level - Data Erratic, Intermittent, or Incorrect
425 (Yellow)	175 2	Oil Temperature	Engine Oil Temperature - Data Erratic, Intermittent, or Incorrect
428 (Yellow)	97 3	Water in Fuel Indicator	Water in Fuel Sensor Circuit - Voltage Above Normal, or Shorted to High Source
429 (Yellow)	97 4	Water in Fuel Indicator	Water in Fuel Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
431 (Yellow)	558 2	Accelerator Pedal Low Idle Switch	Accelerator Pedal or Lever Idle Validation Circuit - Data Erratic, Intermittent, or Incorrect
432 (Red)	558 13	Accelerator Pedal Low Idle Switch	Accelerator Pedal or Lever Idle Validation Circuit - Our of Calibration
435 (Yellow)	100 2	Engine Oil Pressure	Oil Pressure Sensor Circuit - Data Erratic, Intermittent, or Incorrect
441 (Red)	168 18	Electrical Potential (Voltage)	Battery #1 Voltage Low - Data Valid but Below Normal Operational Range - Moderately Severe Level
442 (Red)	168 16	Electrical Potential (Voltage)	Battery #1 Voltage High - Data Valid but Above Normal Operational Range - Moderately Severe Level

CFP9E Fault Code Chart (Continued)

FAULT CODE (LAMP)	SPN FMI	J1939 SPN DESCRIPTION	Cummins DESCRIPTION
449 (Red)	157 0	Injector Metering Rail #1 Pressure	Fuel Pressure High - Data Valid but Above Normal Operational Range - Moderately Severe Level
451 (Red)	157 3	Injector Metering Rail #1 Pressure	Injector Metering Rail #1 Pressure Sensor Circuit - Voltage Above Normal, or Shorted to High Source
452 (Red)	157 4	Injector Metering Rail #1 Pressure	Injector Metering Rail #1 Pressure Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
488 (Red)	105 16	Intake Manifold	Intake Manifold #1 Temperature - Data Valid but Above Normal Operational Range - Moderately Severe Level
489 (Yellow)	191 18	Transmission Output Shaft Speed	Transmission Output Shaft Speed - Data Valid but Below Normal Operational Range - Moderately Severe Level
497 (Yellow)	1377 2	Switch Circuit	Multiple Unit Synchronization Switch Circuit - Data Erratic, Intermittent, or Incorrect
523 (Yellow)	611 2	System Diagnostic code #1	OEM Intermediate (PTO) Speed switch Validation - Data Erratic, Intermittent, or Incorrect
527 (Yellow)	702 3	Circuit - Voltage	Auxiliary Input/Output #2 Circuit - Voltage Above Normal, or Shorted to High Source
528 (Yellow)	93 2	Switch - Data	Auxiliary Alternate Torque Validation Switch - Data Erratic, Intermittent, or Incorrect
529 (Yellow)	703 3	Circuit - Voltage	Auxiliary Input/Output #3 Circuit - Voltage Above Normal, or Shorted to High Source
546 (Yellow)	94 3	Fuel Delivery Pressure	Fuel Delivery Pressure Sensor Circuit - Voltage Above Normal, or Shorted to High Source
547 (Yellow)	94 4	Fuel Delivery Pressure	Fuel Delivery Pressure Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
551 (Yellow)	558 4	Accelerator Pedal Low Idle Switch	Accelerator Pedal or Lever Idle Validation Circuit - Voltage Below Normal, or Shorted to Low Source
553 (Yellow)	157 16	Injector Metering Rail #1 Pressure	Injector Metering Rail #1 Pressure High - Data Valid but Above Normal Operational Range - Moderately Severe Level
554 (Red)	157 2	Injector Metering Rail #1 Pressure	Fuel Pressure Sensor Error - Data Erratic, Intermittent, or Incorrect
559 (Red)	157 18	Injector Metering Rail #1 Pressure	Injector Metering Rail #1 Pressure High - Data Valid but Below Normal Operational Range - Moderately Severe Level
584 (Yellow)	677 3	Starter Solenoid Lockout Relay Driver Circuit	Starter Relay Circuit - Voltage Above Normal, or Shorted to High Source
585 (Yellow)	677 4	Starter Solenoid Lockout Relay Driver Circuit	Starter Relay Circuit - Voltage Below Normal, or Shorted to Low Source
595 (Yellow)	103 16	Turbocharger #1 Speed	Turbocharger #1 Speed High - Data Valid but Above Normal Operational Range - Moderately Severe Level
596 (Yellow)	167 16	Alternate Potential (voltage)	Electrical Charging System Voltage High - Data Valid but Above Normal Operational Range - Moderately Severe Level
597 (Yellow)	167 18	Alternate Potential (voltage)	Electrical Charging System Voltage High - Data Valid but Below Normal Operational Range - Moderately Severe Level
598 (Red)	167 1	Alternate Potential (voltage)	Electrical Charging System Voltage High - Data Valid but Below Normal Operational Range - Most Severe Level
599 (Red)	640 14	Engine External Protection Input	Auxiliary Commanded Dual Output Shutdown - Special Instructions
649 Maint.	1378 31	Engine Oil Change Interval	Change Lubricating Oil and Filter - Condition Exists
687 (Yellow)	103 18	Turbocharger #1 Speed	Turbocharger #1 Speed Low - Data Valid but Below Normal Operational Range - Moderately Severe Level

CFP9E Fault Code Chart (Continued)

FAULT CODE (LAMP)	SPN FMI	J1939 SPN DESCRIPTION	Cummins DESCRIPTION
689 (Red)	190 2	Engine Speed	Primary Engine Speed Sensor Error - Data Erratic, Intermittent, or Incorrect
691 (Red)	1172 3	Turbocharger #1 Compressor Inlet Temp	Turbocharger #1 Compressor Inlet Temperature Sensor Circuit - Voltage Above Normal, or Shorted to High Source
692 (Red)	1172 4	Turbocharger #1 Compressor Inlet Temp	Turbocharger #1 Compressor Inlet Temperature Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
697 (Yellow)	1136 3	Sensor Circuit - Voltage	ECM Internal Temperature Sensor Circuit - Voltage Above Normal, or Shorted to High Source
698 (Yellow)	1136 4	Sensor Circuit - Voltage	ECM Internal Temperature Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
719 (Yellow)	22 3	Crankcase Pressure	Extended Crankcase Blow-by Pressure Circuit - Voltage Above Normal, or Shorted to High Source
729 (Yellow)	22 4	Crankcase Pressure	Extended Crankcase Blow-by Pressure Circuit - Voltage Below Normal, or Shorted to Low Source
731 (Red)	723 7	Engine Speed Sensor #2	Engine Speed/Position #2 mechanical misalignment between camshaft and crankshaft sensors - Mechanical System Not Responding Properly or Out of Adjustment
757 (Red)	2802 31	Electronic Control Module	Electronic Control Module data lost - Condition Exists
778 (Yellow)	723 2	Engine Speed Sensor #2	Engine Speed Sensor (Camshaft) Error - Data Erratic, Intermittent, or Incorrect
779 (Yellow)	703 11	Auxiliary Equipment Sensor Input	Warning Auxiliary Equipment Sensor Input #3 (OEM Switch) - Root Cause Not Known
951 (None)	166 2	Cylinder Power	Cylinder Power Imbalance Between Cylinders - Data Erratic, Intermittent, or Incorrect
1117 (None)	627 2	Power Supply	Power Lost With Ignition On - Data Erratic, Intermittent, or Incorrect
1139 (Red)	651 7	Injector Cylinder #1	Injector Cylinder #1 - Mechanical System Not Responding Properly or Out of Adjustment
1141 (Red)	652 7	Injector Cylinder #2	Injector Cylinder #2 - Mechanical System Not Responding Properly or Out of Adjustment
1142 (Red)	653 7	Injector Cylinder #3	Injector Cylinder #3 - Mechanical System Not Responding Properly or Out of Adjustment
1143 (Red)	654 7	Injector Cylinder #4	Injector Cylinder #4 - Mechanical System Not Responding Properly or Out of Adjustment
1144 (Red)	655 7	Injector Cylinder #5	Injector Cylinder #5 - Mechanical System Not Responding Properly or Out of Adjustment
1145 (Red)	656 7	Injector Cylinder #6	Injector Cylinder #6 - Mechanical System Not Responding Properly or Out of Adjustment
1239 (Yellow)	2623 3	Accelerator Pedal Position	Accelerator Pedal or Lever Position Sensor #2 Circuit - Voltage Above Normal, or Shorted to High Source
1241 (Yellow)	2623 4	Accelerator Pedal Position	Accelerator Pedal or Lever Position Sensor #2 Circuit - Voltage Below Normal, or Shorted to Low Source
1242 (Red)	91 2	Accelerator Pedal Position	Accelerator Pedal or Lever Position Sensor #1 and #2 - Data Erratic, Intermittent, or Incorrect
1256 (Yellow)	1563 2	Control Module Identification Input State	Control Module Identification Input State Error - Data Erratic, Intermittent, or Incorrect
1257 (Red)	1563 2	Control Module Identification Input State	Control Module Identification Input State Error - Data Erratic, Intermittent, or Incorrect
1852 (Yellow)	97 16	Water in Fuel Indicator	Water in Fuel Indicator - Data Valid but Above Normal Operational Range - Moderately Severe Level

CFP9E Fault Code Chart (Continued)

FAULT CODE (LAMP)	SPN FMI	J1939 SPN DESCRIPTION	Cummins DESCRIPTION
1911 (Yellow)	157 0	Injector Metering Rail	Injector Metering Rail #1 Pressure - Data Valid but Above Normal Operational Range - Most Severe Level
2111 (Yellow)	52 3	Coolant Temperature	Coolant Temperature #2 Sensor Circuit - Voltage Above Normal, or Shorted to High Source
2112 (Yellow)	52 4	Coolant Temperature	Coolant Temperature #2 Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
2113 (Yellow)	52 16	Coolant Temperature	Coolant Temperature #2 - Data Valid but Above Normal Operational Range - Moderately Severe Level
2114 (Red)	52 0	Coolant Temperature	Coolant Temperature #2 - Data Valid but Above Normal Operational Range - Most Severe Level
2115 (Yellow)	2981 3	Coolant Pressure	Coolant Pressure #2 Circuit - Voltage Above Normal, or Shorted to High Source
2116 (Yellow)	2981 4	Coolant Pressure	Coolant Pressure #2 Circuit - Voltage Below Normal, or Shorted to Low Source
2117 (Yellow)	2981 18	Coolant Pressure	Coolant Pressure #2 - Data Valid but Below Normal Operational Range - Moderately Severe Level
2182 (Yellow)	1072 3	Engine Brake Output #1	Engine Brake Actuator Driver #1 Circuit - Voltage Above Normal, or Shorted to High Source
2183 (Yellow)	1072 4	Engine Brake Output #1	Engine Brake Actuator Driver #1 Circuit - Voltage Below Normal, or Shorted to Low Source
2185 (Red)	3512 3	System Diagnostic code #1	Sensor Supply Voltage #4 Circuit - Voltage Above Normal, or Shorted to High Source
2186 (Red)	3512 4	System Diagnostic code #1	Sensor Supply Voltage #4 Circuit - Voltage Below Normal, or Shorted to Low Source
2195 (Red)	703 14	Auxiliary Equipment Sensor	Auxiliary Equipment Sensor Input #3 Engine Protection Critical - Special Instructions
2215 (Red)	94 18	Fuel Delivery Pressure	Fuel Pump Delivery Pressure - Data Valid but Below Normal Operational Range - Moderately Severe Level
2216 (Yellow)	94 1	Fuel Delivery Pressure	Fuel Pump Delivery Pressure - Data Valid but Above Normal Operational Range - Moderately Severe Level
2217 (Red)	630 31	Calibration Memory	ECM Program Memory (RAM) Corruption - Condition Exists
2249 (Red)	157 1	Injector Metering Rail #1 Pressure	Injector Metering Rail #1 Pressure - Data Valid but Below Normal Operational Range - Most Severe Level
2261 Maint.	94 15	Fuel Delivery Pressure	Fuel Pump Delivery Pressure - Data Valid but Above Normal Operational Range - Least Severe Level
2262 Maint.	94 17	Fuel Delivery Pressure	Fuel Pump Delivery Pressure - Data Valid but Below Normal Operational Range - Least Severe Level
2263 (Yellow)	1800 16	Battery Temperature	Battery Temperature - Data Valid but Above Normal Operational Range - Moderately Severe Level
2264 (Yellow)	1800 18	Battery Temperature	Battery Temperature - Data Valid but Below Normal Operational Range - Moderately Severe Level
2265 (Yellow)	1075 3	Electric Lift Pump for Engine Fuel	Fuel Priming Pump Control Signal Circuit - Voltage Above Normal, or Shorted to High Source
2266 (Yellow)	1075 4	Electric Lift Pump for Engine Fuel	Fuel Priming Pump Control Signal Circuit - Voltage Below Normal, or Shorted to Low Source
2292 (Yellow)	611 16	Fuel Inlet Meter Device	Fuel Inlet Meter Device - Data Valid but Above Normal Operational Range - Moderately Severe Level
2293 (Yellow)	611 18	Fuel Inlet Meter Device	Fuel Inlet Meter Device flow demand lower than expected - Data Valid but Below Normal Operational Range - Moderately Severe Level

CFP9E Fault Code Chart (Continued)

FAULT CODE (LAMP)	SPN / FMI	J1939 SPN DESCRIPTION	Cummins DESCRIPTION
2311 (Red)	633 / 31	Fuel Control Valve #1	Fueling Actuator #1 Circuit Error - Condition Exists
2321 (Red)	190 / 2	Engine Speed	Engine Speed / Position Sensor #1 - Data Erratic, Intermittent, or Incorrect
2322 (Red)	723 / 2	Engine Speed Sensor #2	Engine Speed / Position Sensor #2 - Data Erratic, Intermittent, or Incorrect
2345 (Yellow)	103 / 10	Turbocharger #1 Speed	Turbocharger speed invalid rate of change detected - Abnormal Rate of Change
2346 (Red)	2789 / 15	System Diagnostic Code #1	Turbocharger Turbine Inlet Temperature (Calculated) - Data Valid but Above Normal Operational Range - Least Severe Level
2347 (Red)	2790 / 15	System Diagnostic Code #1	Turbocharger Turbine Outlet Temperature (Calculated) - Data Valid but Above Normal Operational Range - Least Severe Level
2363 (Yellow)	1073 / 4	Engine Compression Brake Output #2	Engine Brake Actuator Circuit #2 - Voltage Below Normal, or Shorted to Low Source
2365 (Yellow)	1112 / 4	Engine Brake Output #3	Engine Brake Actuator Driver Output #3 Circuit - Voltage Below Normal, or Shorted to Low Source
2367 (Yellow)	1073 / 3	Engine Compression Brake Output #2	Engine Brake Actuator Circuit #2 - Voltage Above Normal, or Shorted to High Source
2368 (Yellow)	1112 / 3	Engine Brake Output #3	Engine Brake Actuator Driver Output #3 Circuit - Voltage Above Normal, or Shorted to High Source
2372 (Yellow)	95 / 16	Engine Duel Filter Differential Pressure	Fuel Filter Differential Pressure - Data Valid but Above Normal Operational Range - Moderately Severe Level
2373 (Yellow)	1209 / 3	Exhaust Gas Pressure	Exhaust Gas Pressure Sensor Circuit - Voltage Above Normal, or Shorted to High Source
2374 (Yellow)	1209 / 4	Exhaust Gas Pressure	Exhaust Gas Pressure Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
2375 (Yellow)	412 / 3	Exhaust Gas Recirculation Temperature	Exhaust Gas Recirculation Temperature Sensor Circuit - Voltage Above Normal, or Shorted to High Source
2376 (Yellow)	412 / 4	Exhaust Gas Recirculation Temperature	Exhaust Gas Recirculation Temperature Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
2377 (Yellow)	647 / 3	Fan Clutch Output Device Driver	Fan Control Circuit - Voltage Above Normal, or Shorted to High Source
2425 (Yellow)	730 / 4	Intake Air Heater #2	Intake Air Heater #2 Circuit - Voltage Below Normal, or Shorted to Low Source
2426 (Yellow)	730 / 3	Intake Air Heater #2	Intake Air Heater #2 Circuit - Voltage Above Normal, or Shorted to High Source
2555 (Yellow)	729 / 3	Intake Air Heater Driver #1	Intake Air Heater #1 Circuit - Voltage Above Normal, or Shorted to High Source
2556 (Yellow)	729 / 4	Intake Air Heater Driver #1	Intake Air Heater #1 Circuit - Voltage Below Normal, or Shorted to Low Source
2557 (Yellow)	697 / 3	Auxiliary PWM Driver #1	Auxiliary PWM Driver #1 - Voltage Above Normal, or Shorted to High Source
2558 (Yellow)	697 / 4	Auxiliary PWM Driver #1	Auxiliary PWM Driver #1 - Voltage Below Normal, or Shorted to Low Source
2963 (Red)	110 / 15	Engine Coolant Temperature	Engine Coolant Temperature High - Data Valid but Above Normal Operational Range - Lease Severe Level
2973 (Yellow)	102 / 2	Boost Pressure	Intake Manifold Pressure Sensor Circuit - Data Erratic, Intermittent, or Incorrect

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.	Check the condition of the batteries. Replace any defective batteries.
	Voltage regulator malfunction.	Test the alternator electrically. Contact an Authorized Cummins Repair Facility. Replace alternator 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.* **NOTE:** *If only one battery is maintaining charge, go to Only One Battery is Charging with the Engine Running.*	Battery cables or connections are loose, broken, or corroded (excessive resistance).	Check the battery cables and connections. Ensure that all connections are free of corrosion and that no cables are broken.
	Alternator rotor is not rotating.	Test the alternator mechanically. If the alternator shaft does not spin freely because of a bad bearing, replace the alternator. If the alternator does not turn because of a bad drive belt, replace the drive belt. Refer to Section 6 - Maintenance. If the alternator does not charge because of poor drive belt tension, adjust belt tension. Refer to Section 6 - Maintenance. If the alternator pulley spins freely on the shaft because of a broken key, replace the alternator. Contact an Authorized Cummins Repair Facility.
	Battery isolator input has faulted.	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.
	Alternator excitation is lost.	Test alternator electrically. Replace the alternator diode as necessary. Speed Failed - Fused relay Locate and repair the open circuit or short to ground in the alternator excitation wiring as necessary.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.2 Neither Battery is Charging with the Engine Running (continued)	Alternator internal voltage regulator is malfunctioning.	Test the alternator electrically. If required, replace the alternator. Contact an Authorized Cummins 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.* **NOTE:** *If neither battery is maintaining charge, go to Neither Battery is Charging with the Engine Running.*	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 clean and that no cables are broken. Remove the battery isolator. Test the internal diodes for open circuit or short to ground. Replace the battery isolator as necessary.
7.1.4 Voltage Indications Differ **NOTE:** *The two voltmeters may differ slightly due to calibration differences between the meters. Normal differences in battery condition may also cause differences in indication. These are normal differences and require no action.*	Voltmeter is providing false indication. One battery is discharged or failing. Circuit Breaker 1 or Circuit Breaker 2 is tripped. Open circuit or short to ground in indicator wiring. Voltmeter has failed.	See Voltage Indications Differ in this section. Check battery condition. Replace failing battery elements. 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 fuse. If the circuit breaker trips again, locate and correct the overload or repair the short circuit. Locate and repair the electrical fault. Remove wiring at the voltmeter and apply test voltage. Replace the faulted voltmeter as necessary.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.5 Coolant Contamination	Coolant is rusty and has debris.	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 anti-freeze and water per the instructions in Section 6 - Maintenance. Drain and flush the cooling system per the instructions in Section 6 - Maintenance.
	Engine oil cooler is leaking oil into the coolant. Coolant begins to have the texture and color of chocolate pudding.	Check the engine oil cooler for coolant leaks and cracks. Replace the oil cooler gasket or other parts as necessary. Refill with correct mixture of anti-freeze and water. If the problem persists, the cylinder block may be cracked or porous. Contact the 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 Section 6 - Maintenance. 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. Check and, if required, replace the zinc plug. Refill with correct mixture of anti-freeze and water per the instructions in Section 6 - Maintenance. Refill with correct mixture of anti-freeze and water per the instructions in Section 6 - Maintenance.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.5 Coolant Contamination (continued)	Coolant is inadvertently contaminated with unknown liquids.	Drain and flush the cooling system. Refill with correct mixture of antifreeze and water per the instructions in Section 6 - Maintenance. Contact an Authorized Cummins Repair Facility.
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.
	Inadvertent 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, (Cummins Fire Power Part No. 11407). Add coolant as required and check engine operation.
	Mechanical coolant leak.	Inspect the engine for coolant leaking from 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 local control panel. The lamp 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.*	Engine is overheating.	Refer to the Coolant Temperature Above Normal in this section.
	Raw water flow is improperly aligned.	Check that the raw water manifold is aligned for normal flow through the solenoid valve (preferred) or bypass flow around the solenoid valve (alternative). Align flow if required.
	Raw water pressure regulator is improperly adjusted. **NOTE:** *Pressure should not exceed 414 kPa [60 psig].*	Check the raw water pressure indication. If pressure is indicated but is low, adjust the regulator. If pressure is not indicated or is excessively low, go to raw water solenoid has failed.
	Raw water solenoid has failed.	If pressure is excessively low when aligned for normal flow, open the bypass valves. When practical, troubleshoot the raw water solenoid valve. Refer to Raw Water Solenoid Valve Fails to Operate in this section. If the solenoid valve operates, replace the pressure regulator. If pressure is excessively low when aligned for bypass flow, open the normal valves. Check the raw water wye strainer for blockage per the instructions in Section 6 - Maintenance. Clean the strainer if necessary. Check the raw water piping for blockage. Clean the piping if necessary.
	Raw water piping or heat exchanger is plugged.	Remove any blockage. Check for flow through the heat exchanger. Replace the heat exchanger as necessary.
	Coolant level is below specification.	Check the coolant level. If coolant level is excessively low, go to Excessive Coolant Loss in this section.
	Cooling system hose is collapsed, restricted, or leaking.	Inspect the hoses. Replace any damaged hoses as necessary.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.7 Coolant Temperature Above normal (continued)	Coolant thermostat is malfunctioning.	Remove and test the coolant thermostat per the instructions in Section 6 - Maintenance. Replace the defective thermostat.
	Coolant pump is malfunctioning.	Remove and inspect the water pump. Replace the defective coolant pump. Contact an Authorized Cummins 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 the Engine Oil Contaminated in this section.
	Coolant mixture of antifreeze and water is not correct.	Verify the concentration of antifreeze in the coolant. Add antifreeze or water to correct the concentration.
	Engine oil level is above or below specification.	Check the oil level per the instructions in Section 6 - Maintenance.
	Coolant temperature sender is malfunctioning.	Replace the temperature sender as necessary.
	Coolant temperature gauge is malfunctioning.	Replace the temperature gauge as necessary.
	Coolant temperature switch is malfunctioning.	Remove the temperature switch. Test the temperature switch. Repair or replace the switch, if necessary.
7.1.8 Coolant Temperature Below Normal	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 sender is malfunctioning.	Replace the temperature sender.
	Coolant temperature gauge is malfunctioning.	Replace the temperature gauge.
	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 electrically.	Replace the coolant heater.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.8 Coolant Temperature Below Normal (continued)	Electronic fault codes are active.	Refer to the Vendor supplied literature or contact an Authorized Cummins Repair Facility for Fault Codes.
	Coolant thermostat has failed open.	Test operation of the thermostat. Replace the thermostat per instructions in Section 6 - Maintenance as necessary.
	Coolant temperature sender is malfunctioning.	Replace the temperature sender.
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. Go 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 the 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.
7.1.10 Raw Water Solenoid Valve fails to Operate **NOTE:** *The raw water solenoid failure 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 close when the engine stops.	Replace the solenoid valve. Clean the raw water strainer more frequently. Increase the frequency of operational testing.
	Solenoid valve fails to energize.	Check electrical continuity and insulation from ground to the solenoid. Repair any open or short circuits in the wiring.
	Solenoid fails to open mechanically. **NOTE:** *Apply 12 VDC to standard operating systems or 24 VDC to optional operating systems.*	Apply temporary voltage to the solenoid. If the solenoid fails to operate, replace it. Contact an Authorized Cummins Repair Facility.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.11 Auto Start failure - Does not Crank on BATT A or B	The electrical connection from the fire protection system to terminal board has failed.	Test continuity and insulation from ground between the fire protection system and the engine control panel. Locate and repair any electrical fault in the field wiring or in the fire protection system panel.
	The electrical connection from terminal board to relay has failed.	Test continuity and insulation from ground between the terminal board and the relay. Locate and repair any electrical fault.
	Relay has failed.	Check de-energized continuity at relay. Replace relay if the circuit is open. Contact an Authorized Cummins Repair Facility.
	The Fire Protection System fails to produce either redundant start signal to the fire pump.	Locate and correct the common mode fault in the Fire Protection System.
7.1.12 Auto Start failure - Cranks but does not Start **NOTE:** *The fire pump engine will crank automatically when either solenoid A or solenoid B is selected at the fire protection system. 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 switch has activated. The overspeed lamp is illuminated on the local control panel.	Press the RESET switch on the local control panel.
	Control power from the Fire Protection System is not available at local control panel TB-1.	Locate and correct the fault in the Fire Protection System or the field wiring to the local control panel as necessary.
	Circuit Breaker CB is open in the local control panel.	Check whether Circuit Breaker CB at the local control panel is open. If open, reset the circuit breaker. Locate and correct any electrical faults in the control panel. Press the RESET Switch on the local control panel.
	The AUTO/MANUAL Mode Switch fails to select AUTO mode.	Open Circuit Breaker CB at the local control panel and test switch operation electrically as necessary. Replace the switch or repair other electrical faults as necessary. When done, close Circuit Breaker CB at the local control panel.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.12 Auto Start failure - Cranks but does not Start (continued)	The overspeed switch 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 switch. Repair any electrical faults. Test and adjust the overspeed setting. Refer to Overspeed Set Point Adjustment and Testing in Section 6 - Maintenance. Replace switch as necessary.
7.1.13 Auto Start failure - Engine Starts but Crank Terminate Does Not Occur	The overspeed switch not correctly adjusted or has failed.	With the engine running, verify speed sensor input to the overspeed switch. If signal is not present, see Speed Sensor Has Failed. The tachometer also indicates zero speed. Adjust the overspeed switch crank terminate set point. Replace the overspeed switch as necessary.
	Breaker has tripped. The raw water solenoid valve fails to open.	Open the raw water bypass valves. RESET breaker switch. Locate and repair any local electrical fault.
	The speed sensor has failed. The tachometer indicates zero RPM.	Locate and repair any electrical fault in the speed sensor circuitry. Replace the speed sensor as necessary.
	An electrical fault is present in the Fire Protection System.	Test continuity and insulation from ground between the fire protection system and the engine control panel. Locate and repair any electrical fault in the field wiring.
	An electrical fault is present between Control Panel and the Fire Protection System.	Test continuity and insulation from ground between the fire protection system and the engine control panel. Locate and repair any electrical fault in the field wiring.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.14 Manual Start Failure from Solenoid Lever - Does not Crank on A or B **NOTE:** *The fire pump engine will not crank locally when either solenoid lever is actuated.*	Crank Battery A and B switches failed to make contact.	Test electrical operation of Crank Batt A and B Switches. Replace the faulty switches as necessary.
	Both batteries dead.	Charge or replace batteries.
	Solenoid A/B failed to operate.	Test the electrical operation of the Solenoid A and Solenoid B. Replace the faulty solenoids as necessary.
	Starter motor has failed.	Replace the starter motor.
	An electrical fault is present 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.	Bar the engine over to break the seizure. Contact an Authorized Cummins Repair Facility.
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 control panel when either CRANK BATT A or CRANK BATT B is selected, however, it does start when a solenoid lever is actuated.*	The MANUAL Mode Rocker Switch contact fails to close.	Test the electrical operation of the AUTO/MANUAL Mode Switch. Replace the faulty switch as necessary.
	An electrical fault exists in the signal power circuit or the ground to the Relays.	Test continuity and insulation from ground between the AUTO/MANUAL Rocker Switch and the Relays. Check the relay connection to ground. Locate and repair any electrical fault.
	Breaker Switch has tripped. The raw water solenoid valve also fails to open.	Open the raw water bypass valves. Locate and repair any local electrical fault. RESET the Breaker Switch.
7.1.15 Manual Start Failure from Control Panel - Does not Crank on A or B (continued)	An electrical fault exists in the signal power circuit or the ground to the overspeed switch's crank circuit.	Test continuity and insulation from ground between breaker and the overspeed switch's crank circuit. Check the crank circuit output to the CRANK BATT Switches. Locate and repair any electrical fault.
	Overspeed switch crank circuit fails to reset with engine shutdown.	Test and adjust the crank setting as necessary. Refer to Overspeed Set Point Adjustment and Testing in Section 6 - Maintenance. Replace the overspeed switch as necessary.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.16 Engine Cranks Normally But Will Not Start (No Exhaust Smoke)	Electronic fault codes are active.	Refer to the Vendor supplied literature or contact an Authorized Cummins Repair Facility for Fault Codes.
	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 electronic control module (ECM) is low, interrupted, or open.	Check the battery connections, the fuses, and the battery supply circuit.
	No fuel in supply tank.	Check and replenish fuel supply. Check fittings and 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 Change Fuel Filter in Section 6 - Maintenance.
	Fuel grade is not correct for the application or the fuel quality is poor.	Operate the engine from a tank of high-quality no. 2 diesel fuel.
	Fuel injection pump is malfunctioning. Pump timing incorrect.	Contact an Authorized Cummins Repair Facility.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.16 Engine Cranks Normally But Will Not Start (No Exhaust Smoke) (continued)	Fuel tank is empty.	Fill the fuel supply tank.
	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 suction side of the fuel lift 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.
	Fuel lift pump is malfunctioning.	Check the fuel lift pump for correct operation. Check the pump output pressure. Replace the fuel lift pump if necessary.
	Injection pump drive shaft or drive shaft key is damaged.	Repair or replace the injection pump.
	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 rotation is not correct or not turning engine.	Check the direction of crankshaft rotation. Replace the starter motor as necessary. Contact an Authorized Cummins 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 doers 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 Star (continued)	Engine oil is the wrong grade or type.	Check the grade and type of oil. Refer to Engine Oil Recommendations and Specifications in Section 6 - Maintenance. If the wrong type or grade of oil is present, drain and replace it. Refer to Change Engine Oil and Filters in Section 6 - Maintenance.
	Engine temperature is too low.	Troubleshoot per Coolant Temperature Below Normal (Engine Off) in this section.
	Starter motor is malfunctioning.	Replace the starter motor. Contact an Authorized Cummins Repair Facility.
7.1.18 Engine Stops During Operation	Normal automatic mode shutdown occurs when the fire protection systems removes the signal power feed to the local control panel.	No action required. This is a desirable outcome.
	The selected engine 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 Diagnostic Fault Codes in the Vendor supplied literature or contact a Cummins Authorized Repair Facility.
	In the automatic mode, the signal power feed is lost from the fire protection system to the control panel.	Locate and correct the electrical fault in the fire protection system or the field wiring to the engine control panel.
	Circuit breaker on control panel tripped.	Locate and correct the electrical fault in engine control panel. RESET the tripped breaker.
	An overspeed trip has occurred. The overspeed trip lamp illuminated on the local control panel.	Remote indications may also be present. Overspeed switch failure has occurred. The trip indications may not be present. Go to Engine Overspeed Trip in this section.
	Power supply or grounding fault exists at the Electronic Control Module.	Locate and correct the electrical fault in the power supply or grounding for the ECM.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.18 Engine Stops During Operation (continued)	The selected ECM has failed.	Select the alternate ECM. Replace the failed ECM. Contact an Authorized Cummins 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 hole.	Clean the fuel tank breather.
	Fuel piping to engine is clogged.	Clean and repair engine fuel piping.
	The fuel filter is clogged.	Replace the fuel filter. Refer to Change Fuel Filter in Section 6 - Maintenance.
	Air is trapped in the low pressure fuel lines at the engine.	Bleed the fuel lines. Refer to Air in Fuel in Section 6 - Maintenance.
	Fuel lift pump has failed	Check the fuel lift pump for correct operation. Check the pump output pressure. Replace the fuel lift pump if necessary. Contact an Authorized Cummins Repair Facility.
	Fuel injection pump has failed.	Replace the fuel injection pump. Contact an Authorized Cummins Repair Facility.
	Electronic fault codes are active.	Refer to the Vendor supplied literature or contact an Authorized Cummins Repair Facility.
	Programmable parameters or selected features are not correct.	Check the programmable parameters and the selected features with an electronic service tool. Set the parameters and features again if necessary. Refer to a Cummins Authorized Repair Facility.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.19 Engine Will Not Reach Rated Speed (RPM)	Tachometer is not calibrated. Compare the tachometer reading with a hand held tachometer or an electronic service tool reading.	If out of calibration, calibrate the tachometer as necessary at the CAL adjustment on the back of the gauge. Refer to the Vendor supplied literature for additional information. Tachometer is malfunctioning. Replace the tachometer. Contact an Authorized Cummins Repair Facility.
	Engine power output is low.	Refer to the Engine Acceleration or Response Poor in this section.
	Fuel filter requires replacement.	Refer to Change Fuel Filter 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.
	Air-fuel tube leaking, waste gate diaphragm ruptured, or waste gate plumbing damaged.	Tighten the fittings, repair plumbing, replace waste gate diaphragm.
	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 of field wiring.	In the AUTO mode, the fire pump engine stops upon loss of signal power from the fire pump controller. Check stop circuit in Fire Pump Controller.
7.1.20 Engine Will Not Shut Off Remotely	Stop circuit malfunction in the fire pump controller of field wiring.	Correct any faults. Check for short to voltage on the signal wiring from the fire pump controller to the engine control panel. Correct any faults. Check operation of the switch contacts of the AUTO/MANUAL switch at the engine control panel. Replace the switch if the switch contacts fail to operate properly.
	Electronic fault codes are active.	Refer to the Vendor supplied literature or contact a Cummins Authorized Repair Facility.

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 an Authorized Cummins Repair Facility.
7.1.21 Engine Will Not Shut Off Locally	Inadvertent power source is present from the fire pump controller.	In the MANUAL Mode, the fire pump engine stops when the AUTO/MANUAL Switch is returned to the AUTO Mode. Check for inadvertent voltage on the wiring to terminal board at the engine control panel.
	Electronic fault codes are active.	Refer to the Vendor supplied literature or contact a Cummins Authorized Repair Facility.
	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 Check Air Cleaner Service Indicator in Section 6 - Maintenance. Replace the air filter as necessary.
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 Check Air Cleaner Service Indicator in Section 6 - Maintenance. Replace the air filter if required.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.23 Fuel or Engine Oil Leaking From Exhaust Manifold (continued)	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 seals and for leaks. Refer to the Turbocharger Leaks Engine Oil or Fuel symptom tree in this section.
7.1.24 Engine Oil is Contaminated	Bulk oil supply is contaminated.	Check the oil supply. Replace it is necessary. Drain the oil and replace with non-contaminated oil. Also, replace the oil filter. Refer to Change Engine Oil and Filters in Section 6 - Maintenance.
	Fuel is present in the engine oil.	Refer to the Fuel in Engine Oil in this section.
	Coolant is present in the engine oil.	Refer to the Coolant in Engine Oil symptom tree in this section.
	Metal is present in the engine oil.	Contact an Authorized Cummins 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 cocks leaks. Repair or correct any leaks.
	Crankcase ventilation system is plugged.	Check and clean the crank case breather and vent tube per the instructions in Section 6 - Maintenance.
	Turbocharger oil seal is leaking.	Check the turbocharger compressor and turbine seals. Contact an Authorized Cummins Repair Facility.
	Engine oil cooler is leaking.	Check for engine oil in the coolant. Refer to the Engine Oil in the Coolant in this section. Contact an Authorized Cummins Repair Facility.
	Engine oil does not meet specifications for operating conditions.	Change the oil and filters per the instructions in Section 6 - Maintenance.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.25 Engine Oil Consumption is Excessive (continued)	Engine oil drain interval is excessive.	Verify the correct engine oil drain interval. Refer to Change Engine Oil and Filters in Section 6 - Maintenance.
	Piston, cylinder liner, or piston rings are worn or damaged.	Check for air intake system leaks. Contact an Authorized Cummins 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 an Authorized Cummins Repair Facility.
7.1.26 Engine Oil in the Coolant	Bulk coolant supply is contaminated.	Check the coolant expansion tank per the instructions in Section 6 - Maintenance. Drain the coolant and replace with non-contaminated coolant. Refer to Drain and Flush Cooling System in Section 6. Replace the coolant filter. Refer to Change Coolant Filter in Section 6 - Maintenance.
	Engine oil cooler is malfunctioning.	Check the oil cooler. Contact an Authorized Cummins Repair Facility.
	Cylinder head gasket damaged or leaking.	Contact an Authorized Cummins Repair Facility.
	Cylinder head is cracked or porous.	Remove intake manifold. Remove exhaust manifold. Check for evidence of coolant leak. If necessary, operate engine at idle. Pressure-test the cylinder head. Contact an Authorized Cummins Repair Facility.
	Cylinder block is cracked or porous.	Remove the oil pan. Pressure-test the cooling system to check for leaks. Contact an Authorized Cummins Repair Facility.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.27 Engine Overspeed Trip **NOTE:** *An engine overspeed trip occurs when the engine's speed exceeds the value specified on the Factory Setting Tag described in Section 2 - Description. The trip isolates the fuel supply to the engine and it stops immediately. The trip is indicated on the local control panel and inside the local control panel on the speed switch. Additionally, a trip output is supplied to the fire protection system for remote display.*	Engine operated at too great a speed due to catastrophic load failure such as pipe break, pump mechanical failure, or loss of suction.	Correct the cause of the load failure. Contact a Cummins Authorized Repair Facility.
	Engine actually operated at too great a speed due to configuration error.	Check rated speed setting as specified on the Factory Setting Tag. Refer to Rated Speed Set Point Adjustment and Testing in Section 6 - Maintenance.
	Overspeed switch is set at too low a set point.	Check overspeed speed setting as specified on the Factory Setting Tag. Refer to Overspeed Set Point Adjustment and Testing in Section 6 - Maintenance.
	Speed switch wiring failure has occurred.	Check continuity and insulation from ground for the signal power wiring and ground wiring to the speed switch. Replace defective components and repair electrical faults.
	Speed switch failure has occurred.	If the speed switch fails to operate as per Overspeed Set Point Adjustment and Testing in Section 6 - Maintenance, replace the speed switch. Contact an Authorized Cummins Repair Facility.
7.1.28 Tachometer Does not Indicate Engine Speed	An electrical fault exists in the tachometer power and grounding circuits.	Check continuity and insulation from ground for the power wiring and ground wiring to the tachometer. Contact an Authorized Cummins Repair Facility. Replace defective components and repair electrical faults.
	An electrical fault exists in the speed sensor input circuit.	This fault may also cause a failure in the crank terminate signal to the fire protection system. Check continuity and insulation from ground for the speed sensor circuit. Contact an Authorized Cummins Repair Facility. Replace defective components and repair electrical faults.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.28 Tachometer Does not Indicate Engine Speed (continued)	The speed sensor has failed.	With the engine running, check the signal from the speed sensor with an oscilloscope or pulse counter. Replace the speed sensor is it has failed. Contact an Authorized Cummins Repair Facility.
	The tachometer has failed.	Check the operation of the tachometer with a pulse generator. Replace the tachometer is it has failed. Contact an Authorized Cummins Repair Facility.

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.

PART 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.

Section 8.5 - Assembly Drawings

Description	Drawing No.	Sheet No	Revision Level
Drawing, Installation, FirePump, CFP9E	8714		F
Options, Engine, FirePump, G-Drive, CFP9E	8739		A
Assembly, Engine Mounting, CFP9E	8907		B
Assembly, Air Cleaner, CFP83-F40, CFP9E	9531		D
Assembly, Air Filter Cover Implementation Date of April 2009	14798		B
Assembly, Heat Shield, Exhaust, CFP9E	8937		B
Assembly, Charge Air Cooling, CFP9E	10516		A
Assembly, Plumbing, CAC Heat Exchanger, CFP9E	10765		A
Assembly, Heat Exhcnager, CFP9E	8944		E
Assembly, Coolant Heater, CFP9E	13750		-
Assembly, Operator Station, CFP9E	9502		D
Assembly, Panel, Instrument, 12VDC	13236		-
Assembly, Panel, Instrument, 24VDC	13237		-
Assembly, Sensor Package, CFP9E	9574-01		B
Assembly, Fuel System CFP83, CFP9E	10762		E
Assembly, Pulley Guard, CFP9E	10920		D
Misc Piping, Cooling Loop, Raw Water, CFP9E	10764		C
Assembly, Raw Water Cooling, Loop 1"	9659		D
Assembly, Secondary ECM Mounting	10755		C
Assembly, ECM Switch	10748	1-4	D
Assembly, Harness, CFP9E	12857		A
Harness, CFP9E	12853	1-2	-
Harness, CFP9E	12854	1-2	-
Harness, CFP9E	12855	1-2	-
Harness, CFP9E	12856	1-2	-
Harness, Proximity Switch 12-24V	12865	1-2	A
Assembly, Secondary ECM, CFP Schematic	13958		-
Exhaust, 4" Bellows w/ Elbow	8780		D
Assembly, Drive Shaft & Guard	10165		A
Assembly, Stub Shaft, SAW #3, 2.25" QSB, QSC, 4B, 6B, 6C	8619		B
Kit, Loose Wires, 4B, 6B, 6C, QSB, QSL	9767		D
Schematic, Control Panel	10423	1-6	E
Harness, Engine	8513	1-2	L

The most current revisions to these drawings and related documents are accessible at: http://www.cumminsfirepower.com/products.html.

Section 8.5 - Assembly Drawings

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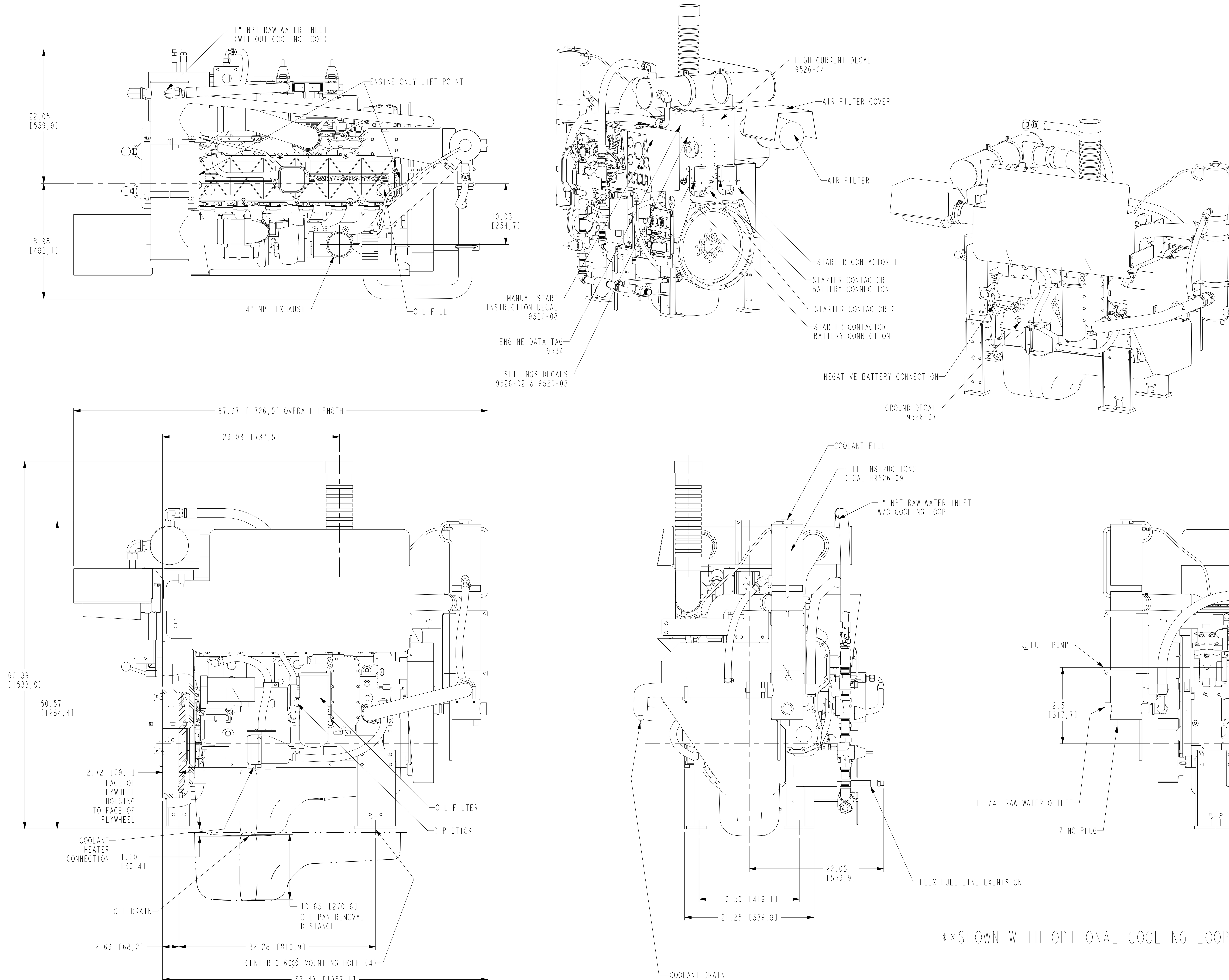

BILL OF MATERIAL			
ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	HARNESS, WIRING, INSTRUMENT PANEL, B SERIES, FIREPUMP	8513
2	1	ASSEMBLY, ENGINE, QSL8.9-C350, FIREPUMP	8739
3	1	ASSEMBLY, MOUNTING, ENGINE, FIREPUMP, 6C8.3	8907
4	1	ASSEMBLY, HEAT SHIELD, FIREPUMP, QSC8.3	8937
5	1	ASSEMBLY, HEAT EXCHANGER, CFP9E	8944
6	1	ASSEMBLY, OPERATORS STATION, QSCC8.3, FIREPUMP	9502
7	1	ASSEMBLY, AIR CLEANER, CFP9E, CFP8E, CFP83F40	9531
8	1	ASSEMBLY, SENSOR PACKAGE, CFP9E	9574
9	1	COOLING LOOP, 1" NPT, 12VDC, FIREPUMP	9659
10	1	ASSEMBLY, CHARGE AIR, CFP09E, FIREPUMP	10516
11	1	ASSEMBLY, SECONDARY ECM, CFP9E, FIREPUMP	10755
12	1	KIT, FUEL SYSTEM PLUMBING, CFP9E	10762
13	1	MISC PIPING, CFP9E, FIREPUMP	10764
14	1	ASSEMBLY, CAC PLUMBING, CFP9E, FIREPUMP	10765
15	1	ASSEMBLY, GUARD, PULLEY, QSC, FIREPUMP	10920
16	1	ASSEMBLY, VALVE COVER MODIFICATION, FIREPUMP, CFP9E	11917
17	1	ASSY, COOLANT HEATER, CFP9E	13750
18	1	COVER, AIR CLEANER, FITS 4" O.D. TUBING	14798
19	1	FLEX, EXHAUST, 4" CUFF, FIREPUMP	8780
20	1	STRAP, GROUNDING, WC90397-1	9757
21	1	KIT, WIRE, B & C	9767
22	1	CLAMP, T-BOLT, 4.03-4.34	13164-0425
23	1	BRACKET, COOLING LOOP SUPPORT, UPPER, CFP9E	13583
24	1	FUEL LINE, 12" EXTENSION, #8 FEM JIC X #8 221FR X 3/8" NPT	14400-007
25	1	FUEL LINE, 12" EXTENSION, #10 FEM JIC X #10 221FR X 1/2" NPT	14400-010
26	1	FILTER HEAD, CUMMINS	142784
27	1	FILTER, FUEL	FS1212

E (item 18)

F (item 23)

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AND UPFIT CENTER
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DEPERE, WISCONSIN

ASSEMBLY, POWER MODULE
CFP9E - F10-60

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

REV	ENF	DESCRIPTION OF REVISION	REV BY	DATE
F	2009-101	REV PER FUEL LINES, ADDED FUEL FILTER BRACKET	DAVE N	04MAY2009
E	2009-158	14798 WAS 13439. VIEW UPDATES	DAVE N	13APR2009
D		REPLACED COOLANT HEATER ASSY	S DUBICK	03/17/09

DWG UNITS: IN/LB/S	DRAWN BY: S.DANFORTH	DATE: 02NOV05
	PRO-ENGINEER	REF DRWG:
SCALE: 0.125	SHEET 1 OF 1	DRAWING NO: 8714
EST WEIGHT: 1999.036		

ENGINE ASSEMBLY
QSL 8.9 L
FIREPUMP CONFIGURATION
FIRE 38 QSL8.9 BASE ENGINE

AH 9154	AID, AIR HEATER STARTING	LA 9151	ARRANGEMENT, LIFTING
AP 9455	APPROVAL AGENCY	LF 9093	FILTER, FULL FLOW OIL
BR 9215	BREATHER, CRANKCASE	LG 90104	GAUGE, OIL LEVEL
CH 9066	AID, COOLANT HEATER STARTING	LO 9015	OIL, LUBRICATING
DF 9098	DRIVE, FRONT GEAR TRAIN	OB 9291	ARRANGEMENT, OIL FILL
DL 9146	LOCATION, FUEL DRAIN	OP 9338	PAN, OIL (OP9467 IS OPTIONAL)
DO 9900	SOFTWARE, CUSTOMER INTERFACE	RP 9043	VENT, ENGINE COOLANT
EE 9242	ALTERNATOR	SK 9022	ARRANGEMENT, SHIPPING
EH97403	MOUNTING, ALTERNATOR	SS 9459	PAINT
FA 9310	FAN DRIVE	ST 9239	MOTOR, STARTING
FF 9587	LOCATION, FUEL FILTER	SV 9001	VOLTAGE, ENGINE OPERATING
FH 9306	HOUSING, FLYWHEEL	TB91120	ARRANGEMENT, TURBOCHARGER
FI 9092	FITTING, FUEL INLET	TK 9022	COOLER, TORQUE CONVERTER OIL
FR91518	RATING, FUEL	VC 9156	ARRANGEMENT, VALVE COVER
FW 9829	FLYWHEEL	WF 9122	LOCATION, CORROSION RESISTOR
HC 9046	PLUMBING, CABIN HEATER	WI 9160	CONNECTION, WATER INLET
IC 9372	CONNECTION, AIR INTAKE	WO 9052	CONNECTION, WATER OUTLET
IT 9041	CONNECTION, AIR TRANSFER	XS 9258	CONNECTION, EXHAUST OUTLET

A
A

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	ENF	DESCRIPTION OF REVISION	BY	DATE
A	2009-158	GUAGE, OIL LEVEL WAS LG90012	DAVE N	15APR2009
A	2009-158	REV PER OIL PAN (OP9467 IS NOW OPTIONAL)	DAVE N	15APR2009

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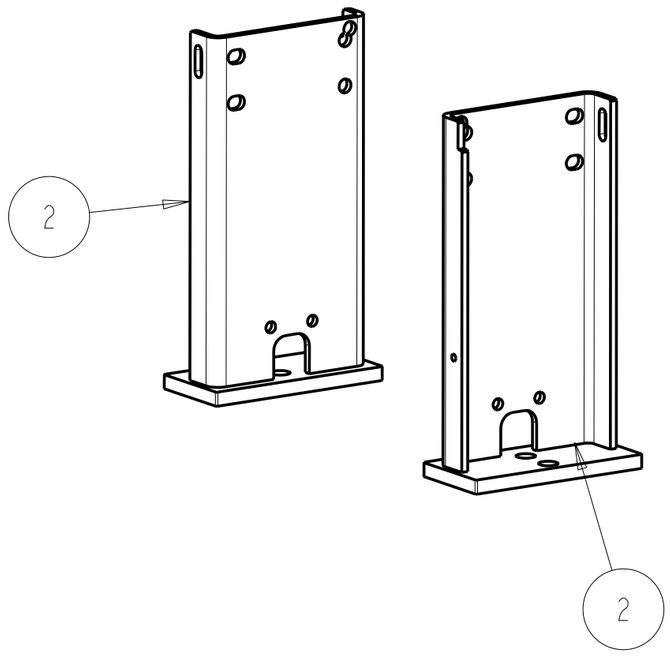
CUSTOM DESIGN AND
UPFIT CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

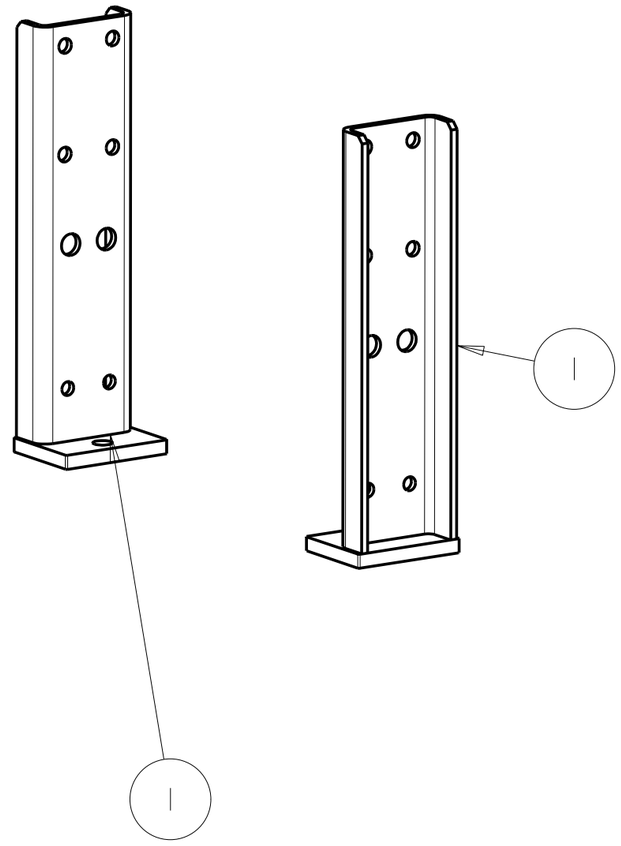
ASSEMBLY, ENGINE, CFP9E
FIREPUMP, QSL8.9

DWG UNITS: INCH/LB/S
DRAWN BY: MJD
AUTO CAD
DATE: 13 SEP 08
REF DRWG:
SCALE: NTS
EST WEIGHT: 1427
SHEET 1OF1
DRAWING NO: 8739

BILL OF MATERIAL

ITEM	QTY	DESCRIPTION	PART NUMBER
1	2	LEG, ENGINE SUPPORT, REAR, FIREPUMP, 6B/4B	8412
2	2	SUPPORT, ENGINE, FRONT, FIREPUMP, C8.3	8908





REV	DESCRIPTION OF REVISION	REV BY	DATE
B1	ADDED TOP VIEW	DAVE N	29APR05
A/B	REV PER FRONT SUPPORT	DAVE N	26AUG04

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	MACHINE TOLERANCES X : ± 1.5 X.X : ± 0.5 X.XX : ± 0.05
WELD TOLERANCES .X : ± 0.25 .XX : ± 0.12 .XXX : ± 0.06	WELDED TOLERANCES X : ± 5 X.X : ± 3 X.XX : ± 1.50

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NPOWER SYSTEMS
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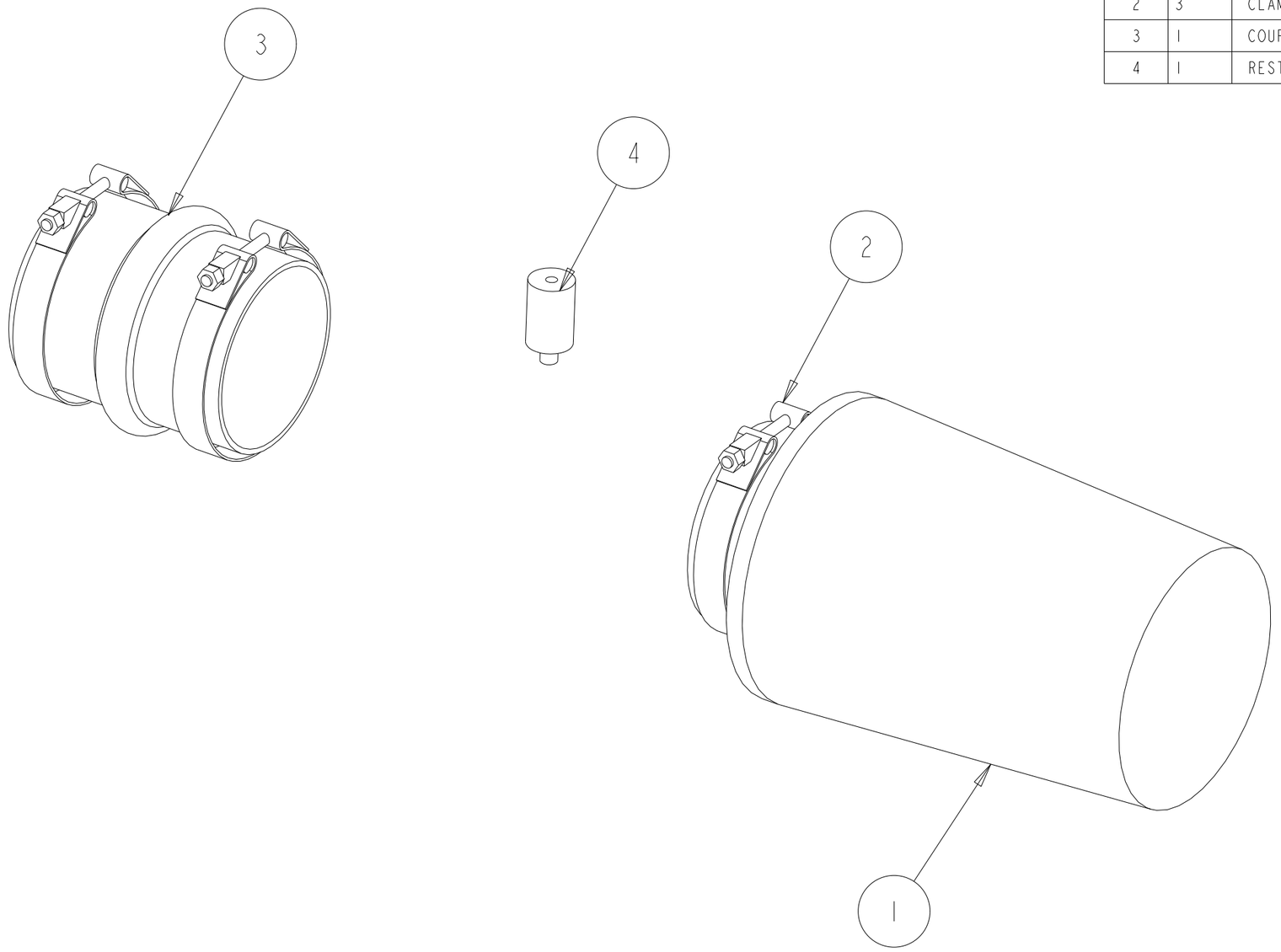
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

TITLE 1: ASSEMBLY, MOUNTING, ENGINE
TITLE 2: FIREPUMP, 6C8.3

DWG UNITS: IN/LB/S	DRAWN BY: DAVE N	DATE: 28APR2004
	APPD BY:	DATE:

EST WEIGHT: 238534.059	SCALE: 0.200	DO NOT SCALE	SHEET 1OF1	DRAWING NO: 8907	REV: B

BILL OF MATERIAL			
ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	AIR FILTER, 4" DIA. INLET, CFP59,6E,83,9E FIREPUMP	9606
2	3	CLAMP, T-BOLT, 4.28-4.59 AC400	13164-0450
3	1	COUPLING, RUBBER, 4", NELSON #89835K	89835K
4	1	RESTRICTION INDIACOR, 1/8" NPT	RAX00-2352



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	DESCRIPTION OF REVISION	REV BY	DATE
D	OMIT PN:9525 ENF PN:2008-275	MAC	10-14-2008
C	REV PER AIR CLEANER	DAVE N	13DEC06

NPower

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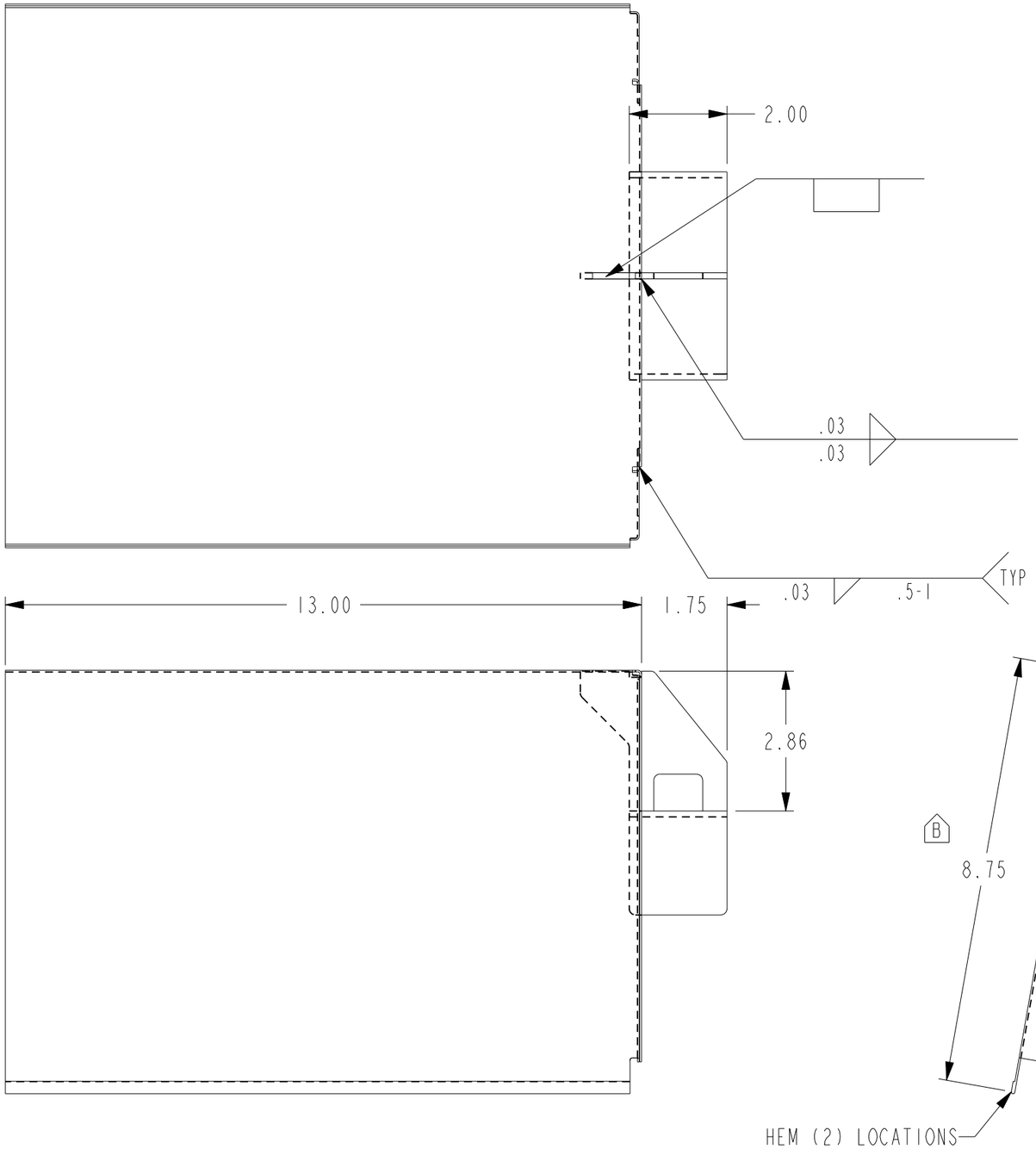
DEPERE, WISCONSIN

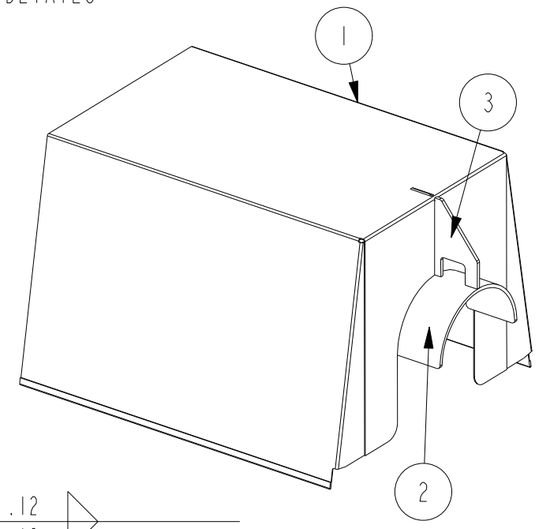
TITLE 1: ASSEMBLY, AIR CLEANER
TITLE 2: CFP9E, CFP8E, CFP83F40

DWG UNITS: IN/LB/S	DRAWN BY: DAVE N				DATE: 07JUL2004
	APPD BY:				DATE:
EST WEIGHT: 5.253	SCALE: 0.375	DO NOT SCALE	SHEET 1OF1	DRAWING NO: 9531	REV: D

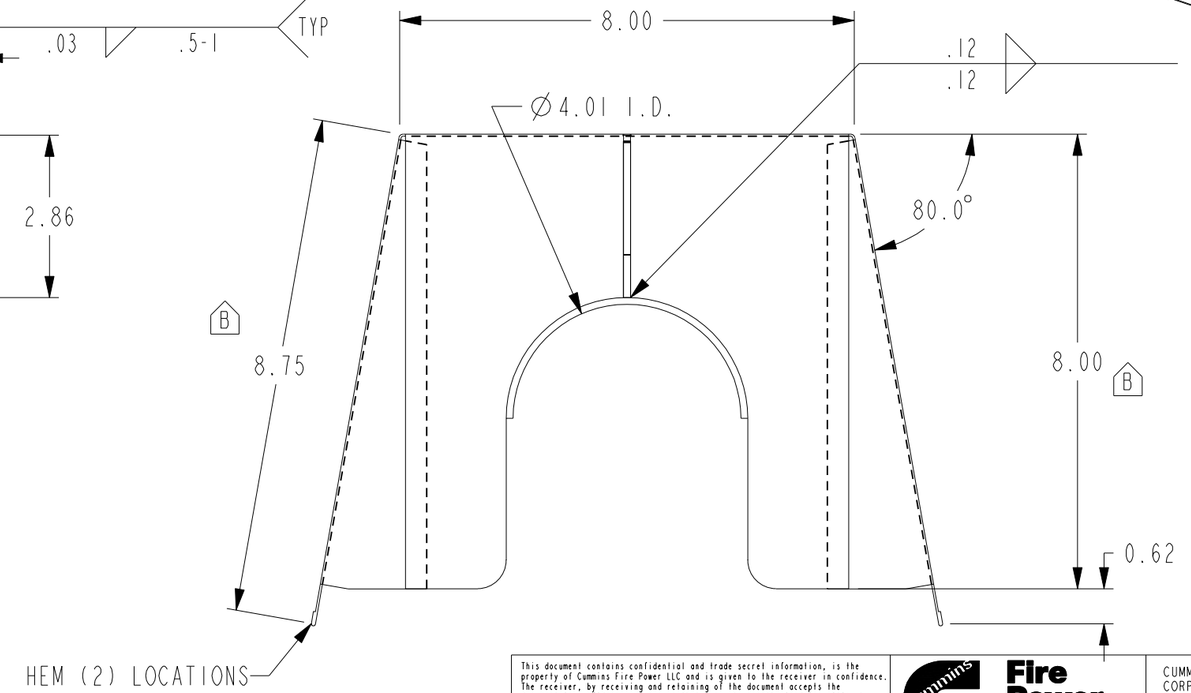
BILL OF MATERIAL			
ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	SHEET, 20 GA. HRS	14798_01
2	1	TUBING, HRS, 4.25" OD X 4.010 I.D.	14798_02
3	1	PLATE, HRS, 0.125"	14798_03

SEE SHEET 2 OF 2 FOR PART DETAILS





SCALE 0.200



NOTES:
1) MATERIAL: NOTED
2) ALL BENDS AT MINIMUM BEND RADIUS
3) REMOVE ALL BURS AND SHARP EDGES
4) FINISH CASE RED

REV	ENF	DESCRIPTION OF REVISION	REV BY	DATE
B	2009-250	8.75 WAS 6.75. 8.00 WAS 5.00	DAN	01-JUN-09
A	2009-245	PAGE 2 - 0.75 WAS 0.50	DAN	27-MAY-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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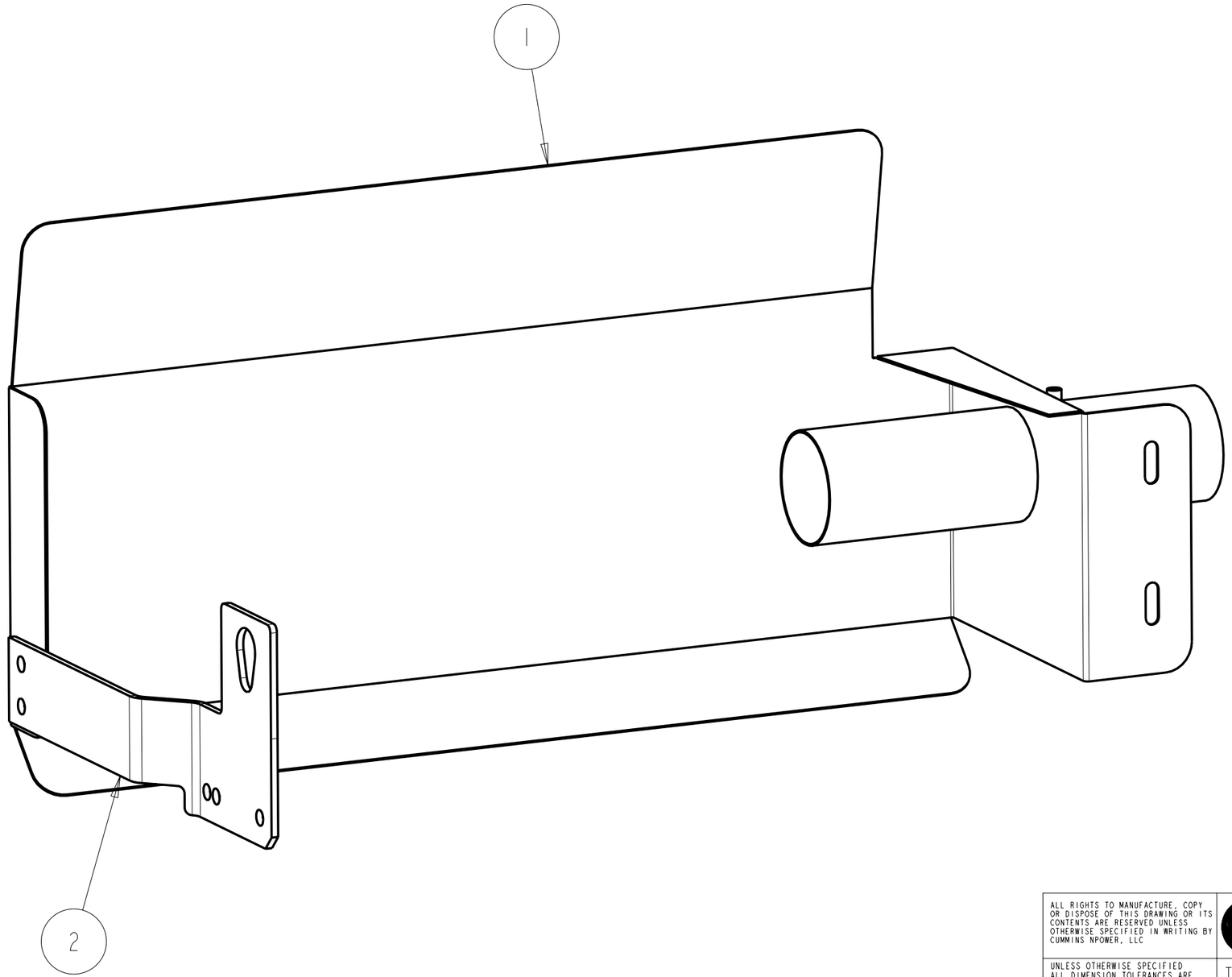
CUSTOM DESIGN
AND UPFIT CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

COVER, AIR CLEANER, FITS 4" O.D. TUBING

DWG UNITS: IN/LB/S	DRAWN BY: DAVE N	DATE: 03APR2009
	PRO-ENGINEER	REF DRWG: -
SCALE: 0.375	SHEET 1 OF 2	DRAWING NO: 14798
EST WEIGHT: 3.181		

BILL OF MATERIAL

ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	HEAT SHIELD, TURBO, QSC8.3, FIREPUMP	9530
2	1	BRACKET, MOUNTING, TURBO, FRONT, FIREPUMP, C8.3	8915



REV	DESCRIPTION OF REVISION	REV BY	DATE
B	GRAPHICS REVISION	DAVE N	06OCT05

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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DEPERE, WISCONSIN

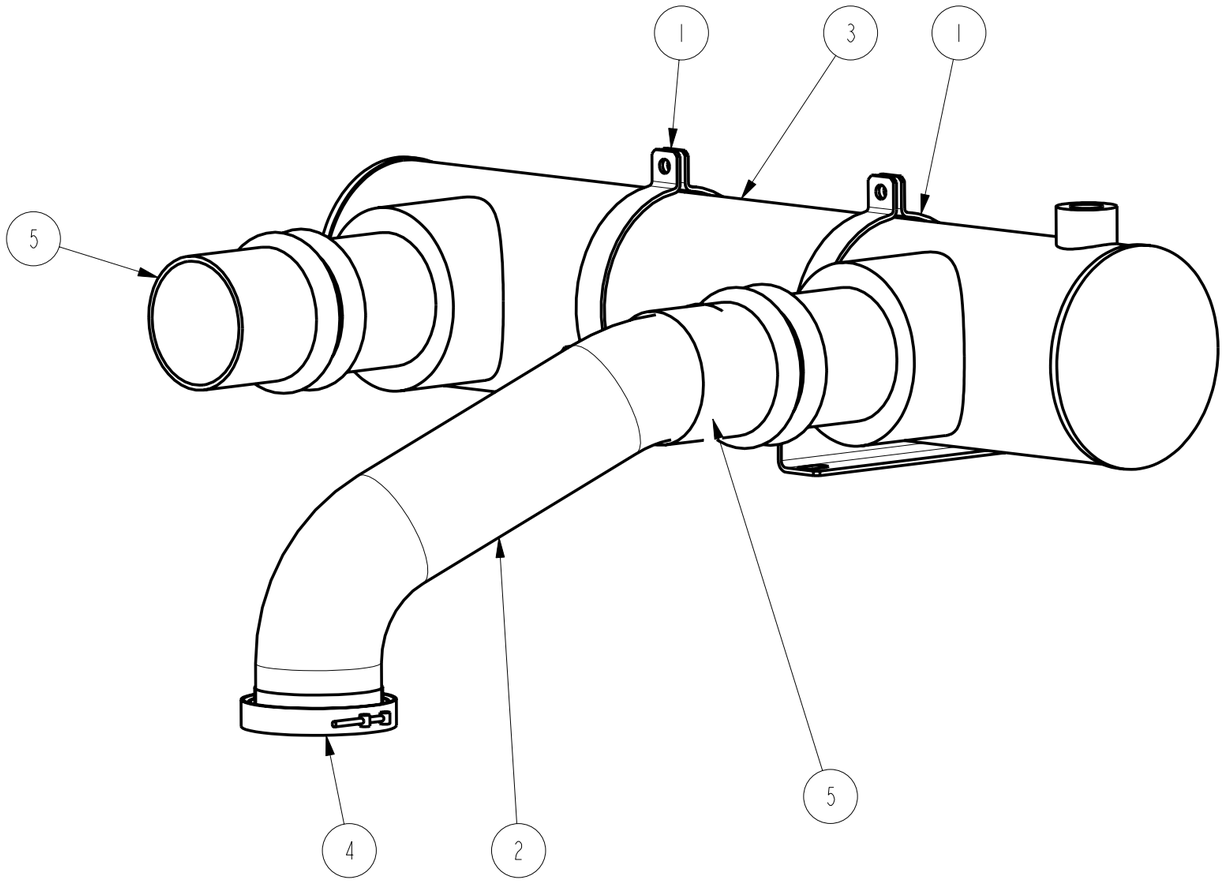
TITLE 1: ASSEMBLY, HEAT SHIELD
TITLE 2: FIREPUMP, QSC8.3

DWG UNITS: IN/LB/S	DRAWN BY: DAVE N	DATE: 07JUL2004
	APPD BY:	DATE:

EST WEIGHT: 34.424	SCALE: 0.250	DO NOT SCALE	SHEET 1OF1	DRAWING NO: 8937	REV: B

BILL OF MATERIAL

ITEM	QTY	DESCRIPTION	PART NUMBER
1	2	CLAMP, HEAT EXCHANGER, 6" DIA, CMAP #CP090496-2	8965
2	1	CAC CONNECTION, INTAKE SIDE, QSC/QSLT3 FIREPUMP	10517
3	1	CAC - SHELL & TUBE	8966
4	1	CLAMP, HALF MARMON	3905216
5	2	COUPLING, RUBBER, 3-1/2", CUMMINS 3071050	IC9159



REV	DESCRIPTION OF REVISION	REV BY	DATE
A	CREATED DRAWING	DAVE N	04NOV05

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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

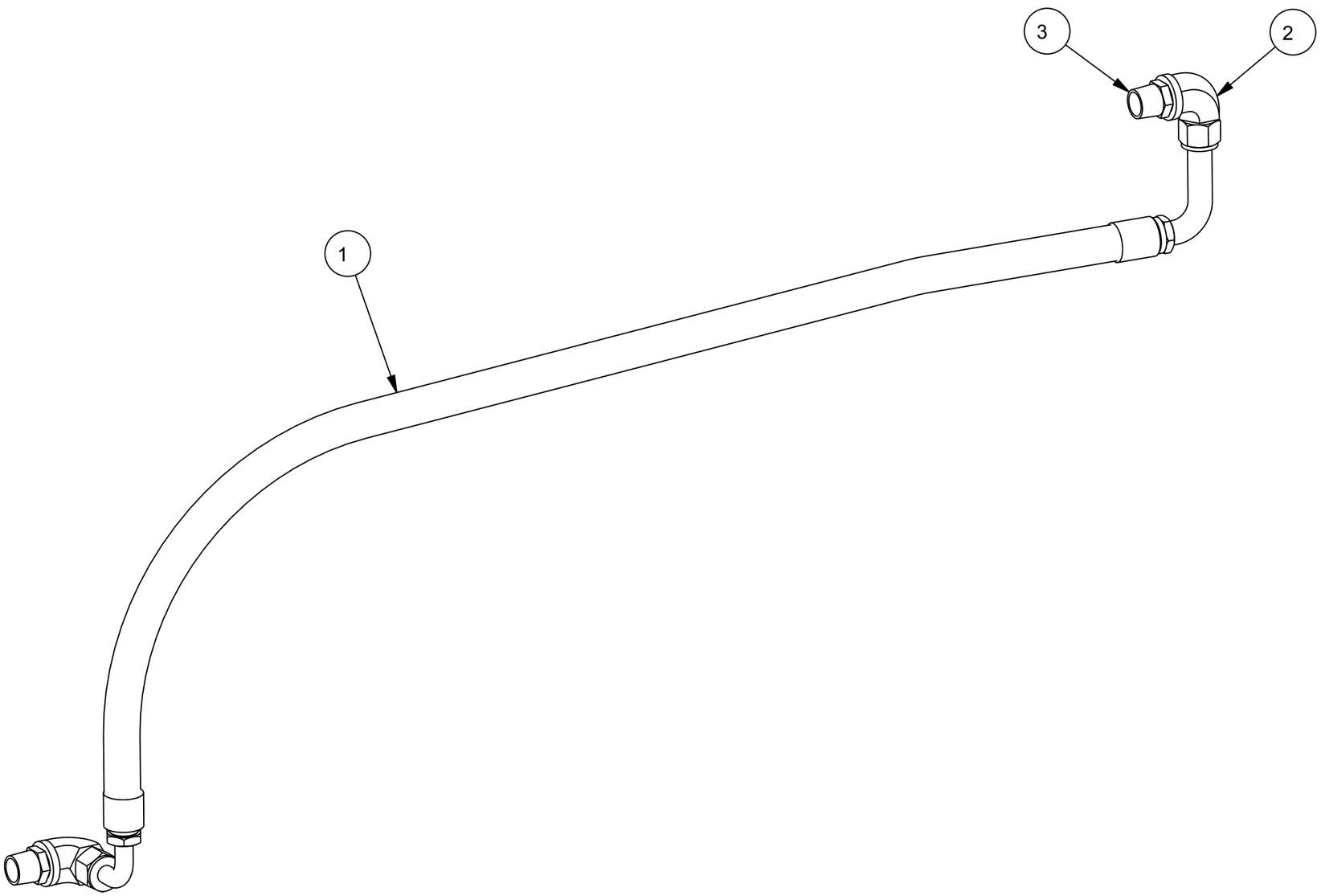
TITLE 1: ASSEMBLY, CHARGE AIR, CFP09E
TITLE 2: FIREPUMP

DWG UNITS: IN/LB/S	DRAWN BY: SD	DATE: 03NOV2005
	APPD BY:	DATE:

EST WEIGHT: 38.950	SCALE: 0.250	DO NOT SCALE	SHEET 1OF1	DRAWING NO: 10516	REV: A

BILL OF MATERIAL

ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	HOSE, WATER, CAC TO JWC, CFP9E	13580
2	2	ELB, 90 DEG, -16 NPT X -16 FMNPT	12195-16-16
3	2	FTG, STR, -16 JIC X -16 NPT	12238-16-16



REV	DESCRIPTION OF REVISION	REV BY	DATE
A	REPLACE FUEL COOLER & TUBES WITH HOSE	S DUBICK	10/01/08

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ±	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

REF. SCALES

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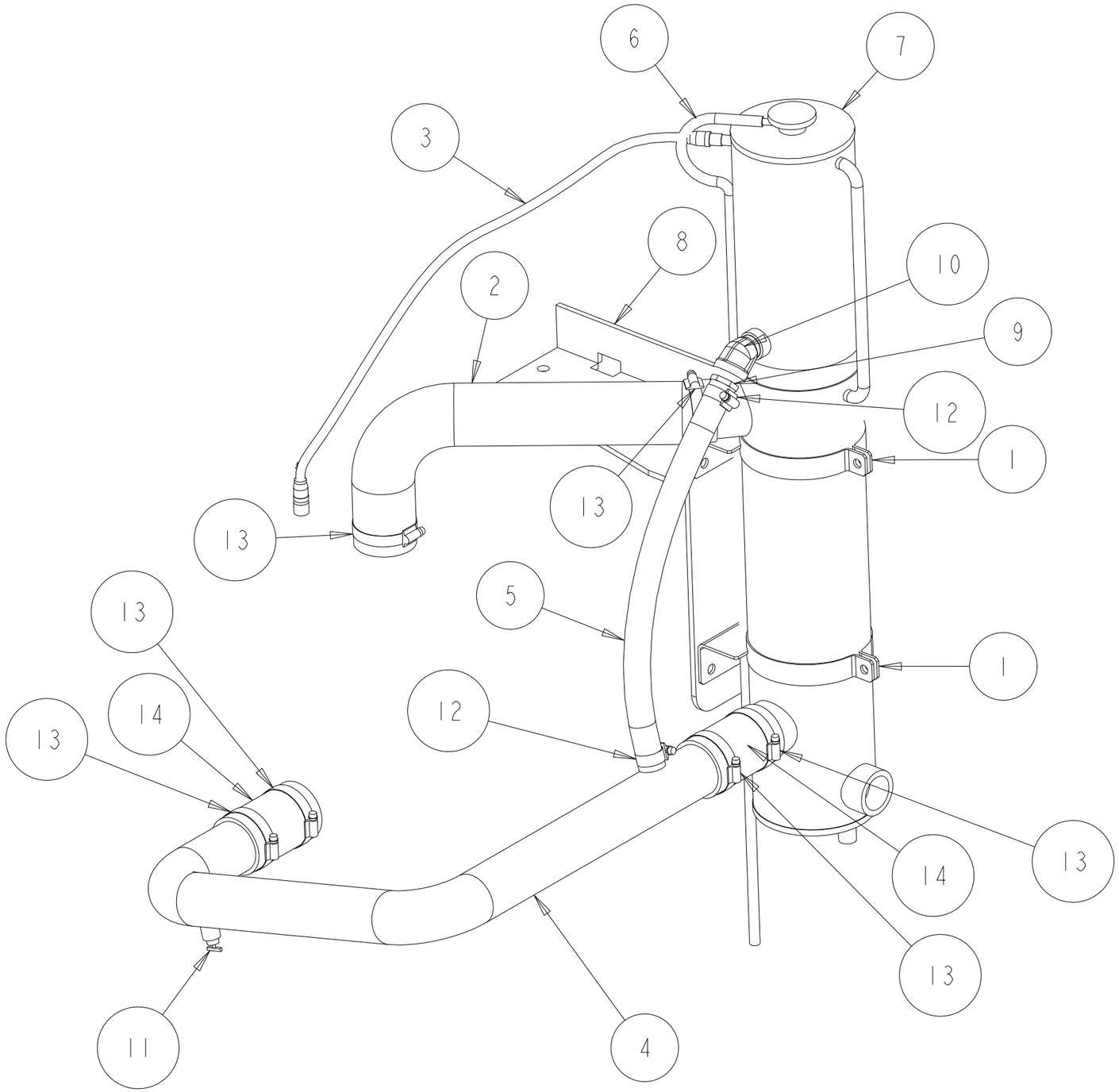
TITLE 1: ASSEMBLY, CAC PLUMBING, CFP9E
TITLE 2: FIREPUMP

DWG UNITS: IN/LB/S	DRAWN BY: DAVE N	DATE: 03MAR2006
	APPD BY: -	DATE: -

EST WEIGHT: 10.121	SCALE: 0.200	DO NOT SCALE	SHEET 1OF1	DRAWING NO: 10765	REV: A



BILL OF MATERIAL

	ITEM	QTY	DESCRIPTION	PART NUMBER
D	1	2	CLAMP, SUPPORT, HEAT EXCHANGER, CHAMP #300385	8819
	2	1	HOSE, WATER OUTLET, GATES #21418	8946
	3	1	ASSEMBLY, VENT LINE, 3/16" x 28", FIREPUMP	9658
E	4	1	TUBE, WATER INLET, CFP9E	12399
E	5	1	FILL HOSE, 3/4" ID X 18" LG	80232GL
	6	1	TUBE, OVERFLOW, 5/16" ID x 36" LG, #27003	8662
	7	1	HEAT EXCHANGER, FIREPUMP, 5" 2 PASS, VENDOR #CM012904-1	8687
	8	1	BRACKET, SUPPORT, HEAT EXCHANGER, FIREPUMP, C8.3	8922
E	9	1	FTG, STR, -12 BARB X -12 NPT	12548-12-12
E	10	1	ELBOW, 45°, 3/4"NOM, MNPTxFNPT, 150LB BLACK IRON	14204-12
	11	1	DRAIN VALVE, 1/4" NPT	80511
	12	2	CLAMP, ADJ, 1.00" NOM, .812 - 1.500	92216
	13	6	CLAMP, ADJ, 2.50" NOM, 2.062 - 3.000	92240
	14	2	HOSE, BULK, 2.25" X SIZE	77225GL-41N

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

REV	DESCRIPTION OF REVISION	REV BY	DATE
E	PARTS UPDATE	S DUBICK	02/02/09
D	CHANGE 8920, PARTS UPDATE	S DUBICK	10/15/08
A-C	MISC. REVISIONS	DAVE N	10/20/04

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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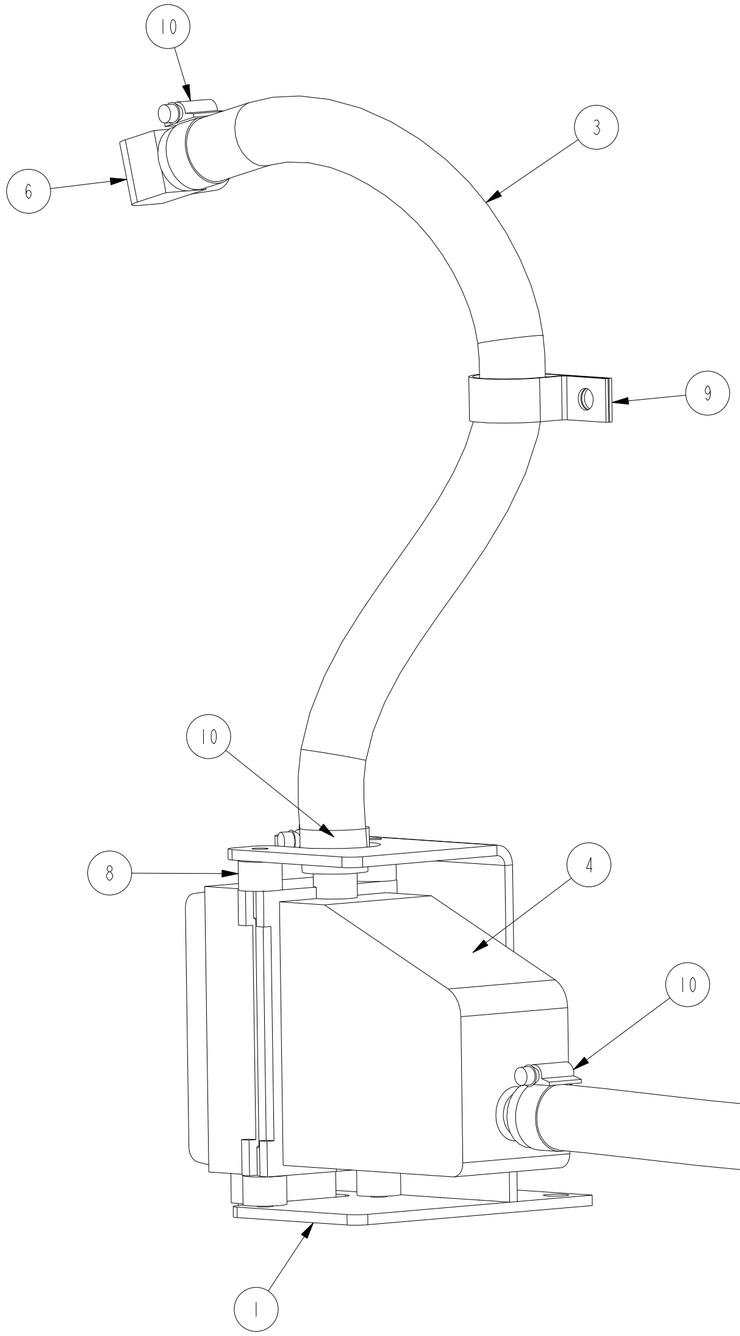
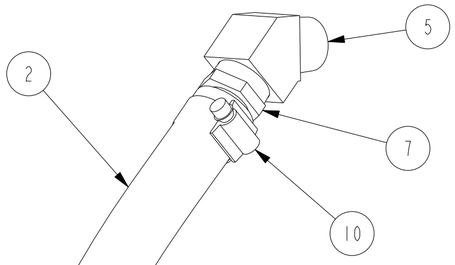
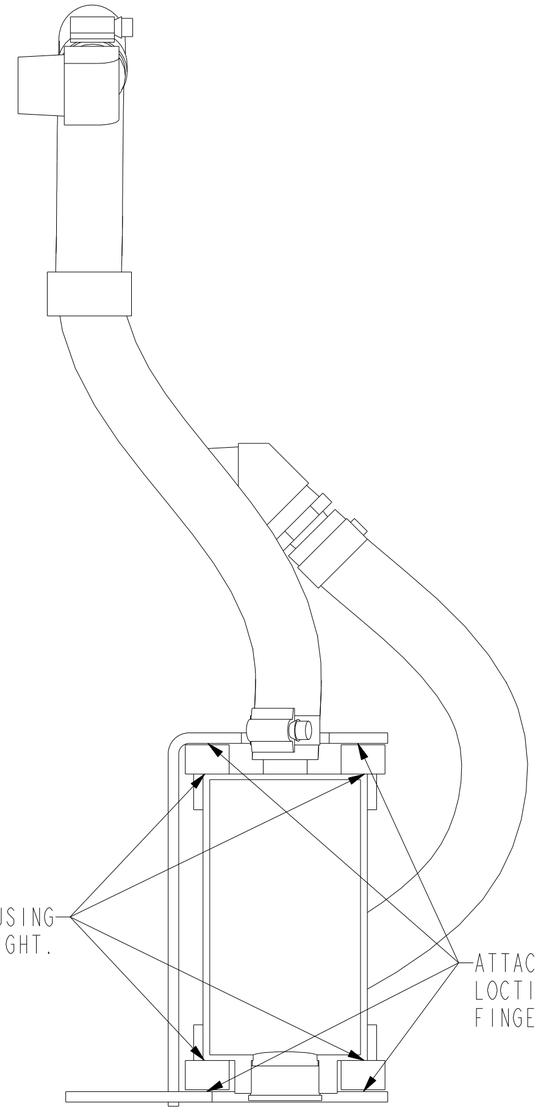
TITLE 1: ASSEMBLY, HEAT EXCHANGER
TITLE 2: CFP9E

DWG UNITS: IN/LB/S	DRAWN BY: DAVE N				DATE: 12MAY2004
	APPD BY:				DATE:
EST WEIGHT: 248.717	SCALE: 0.200	DO NOT SCALE	SHEET 1OF1	DRAWING NO: 8944	REV: E

BILL OF MATERIAL			
ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	BRACKET, COOLANT HEATER, CFP9E	13584
2	1	HOSE, SILICONE, 3/4" ID, 22.50"	14194
3	1	HOSE, SILICONE, 3/4" ID, 19.00"	14194
4	1	CIRCULATION HEATER, P&T #3315033, 2250W , 120V , 176° F	9599
5	1	ELB, 45 DEG, -12 NPT X -12 FMPT	12532-12-12
6	1	ELB, 90 DEG, -12 BARB X -12 NPT	12546-12-12
7	1	FTG, STR, -12 BARB X -12 NPT	12548-12-12
8	4	ISOLATOR, STUD MOUNT, 1/4-20, TECH PRODUCTS #51201	13102
9	1	CLAMP, P-STYLE, 1-1/4", LTL-SCPV20627	13746
10	4	CLAMP, ADJ, 1.00" NOM, .812 - 1.500	92216







INSTALL ISOLATORS (3) ON HEATER USING LOCTITE #425 BLUE, FINGER TIGHT.

ATTACH HEATER TO BRACKET USING LOCTITE #425 BLUE ON FASTENER, FINGER TIGHT + 1/8 TURN.

NOTE:
* ATTACH HOSE TO HEATER WITHOUT RADIAL TWIST ALLOWING HEATER TO SIT PARALLEL TO ENGINE.

REV	ENF	DESCRIPTION OF REVISION	REV BY	DATE

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

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

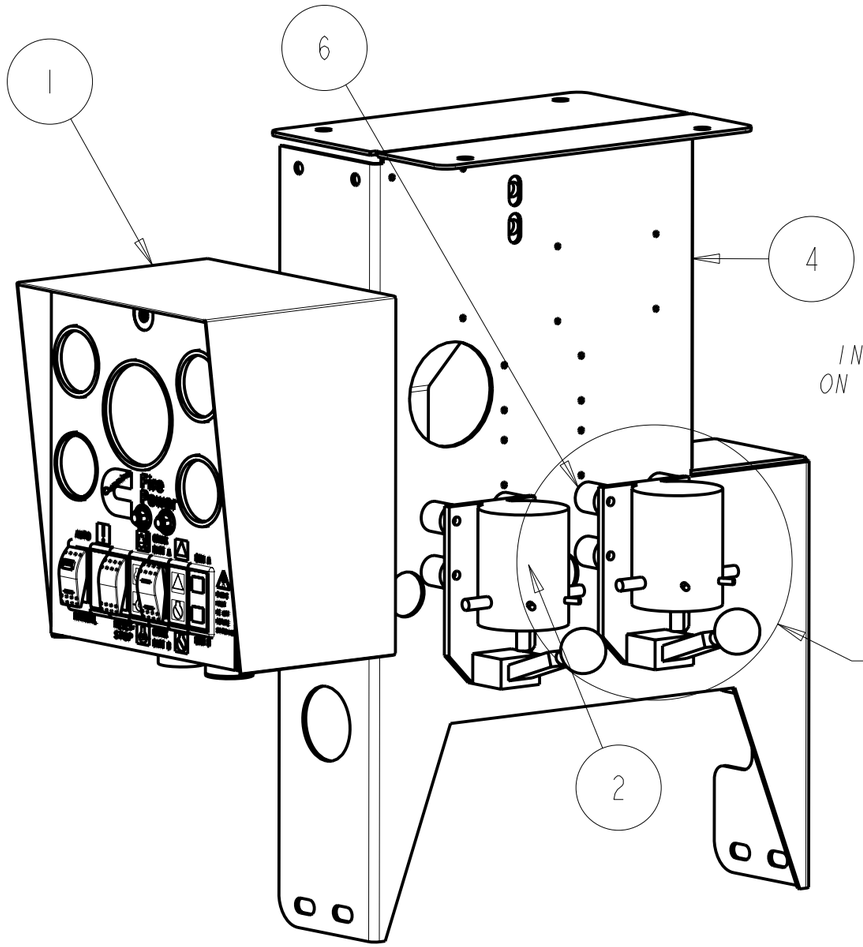
ASSY, COOLANT HEATER
CFP9E

DWG UNITS: IN/LB/S	DRAWN BY: S DUBICK	DATE: 03/12/09
	PRO-ENGINEER	REF DRWG:
SCALE: 0.500	SHEET 1 OF 1	DRAWING NO: 13750
EST WEIGHT: 42238.628		

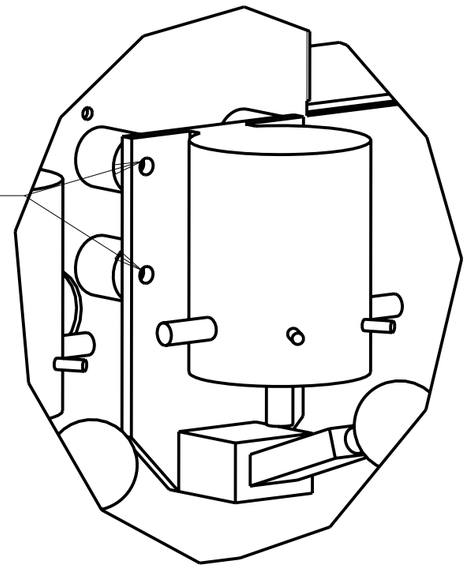
NOTE:
(D) 1. ITEM 1, P/N 13236 MAY NO LONGER BE INTERCHANGED WITH 8583

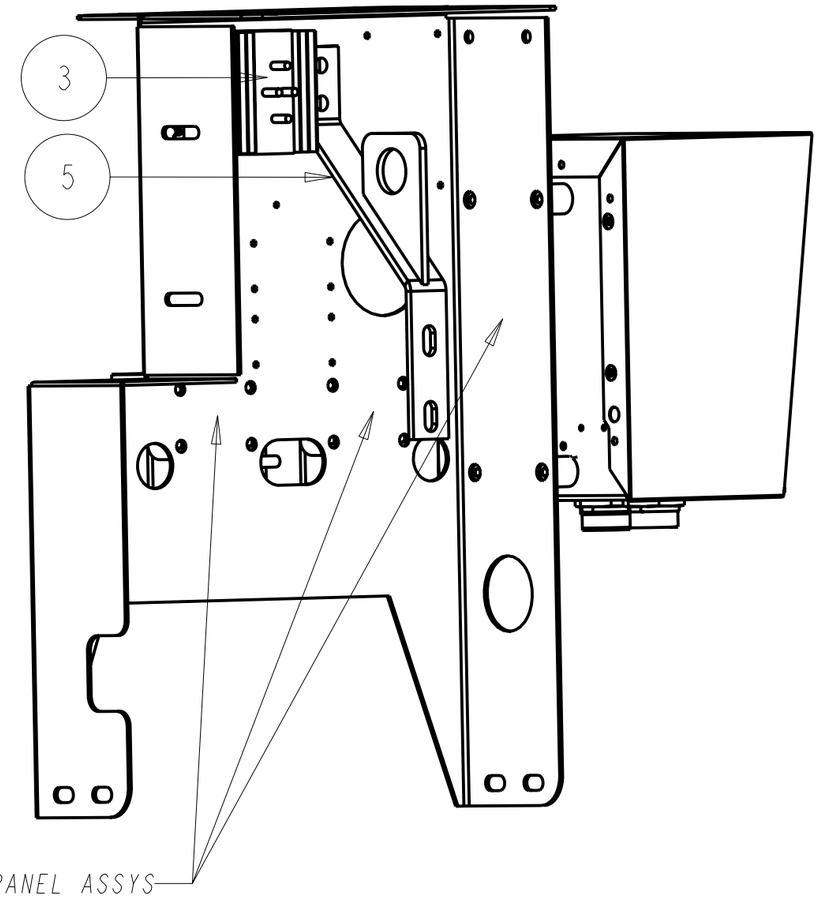
BILL OF MATERIAL

	ITEM	QTY	DESCRIPTION	PART NUMBER
(D)(C)	1	1	ASSEMBLY, INSTRUMENT PANEL, ISOLATED, FIREPUMP	13236
	2	2	CONTACTOR, MANUAL OVERIDE, FIREPUMP	8824
	3	1	BATTERY ISOLATOR, FIRE PUMP	8838
	4	1	BRACKET, MOUNTING, OPERATORS STATION, C8.3, FIREPUMP	9500
	5	1	BRACKET, STIFFENER, OPERATOR STATION, FIREPUMP	9501
(D)	6	8	ISOLATOR, PLATE MOUNT, 5/16-18x1x1 NEOPRENE, TECH PRODUCTS #51272	13011



DETAIL A
SCALE 0.400





REV	DESCRIPTION OF REVISION	REV BY	DATE
D	MODIFY ISOLATOR MTG SPEC, INST. PANEL	S DUBICK	18JUL08
C	ITEM 1, REPLACED 8583 WITH 10452	PATRICK S	05FEB07
A/B	REV PER MOUNTING BRACKET	DAVE N	07SEP04

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

REF. SCALES

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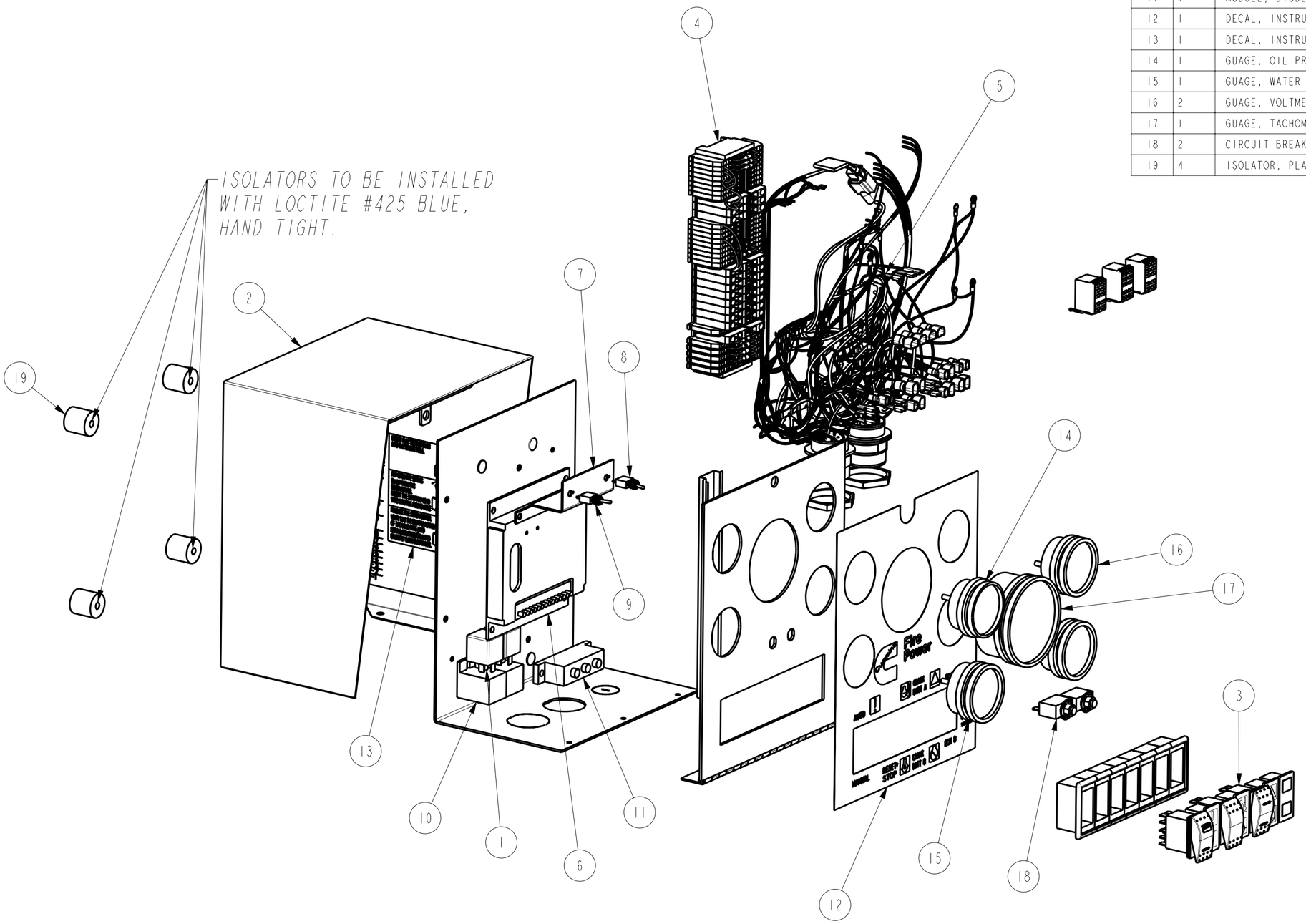
DEPERE, WISCONSIN

TITLE 1: ASSEMBLY, OPERATORS STATION, QSCC8.3
TITLE 2: FIREPUMP

DWG UNITS: IN/LB/S	DRAWN BY: DAVE N		DATE: 07JUL2004
	APPD BY:		DATE:
EST WEIGHT: 61.868	SCALE: 0.200	DO NOT SCALE	SHEET 1OF1	DRAWING NO: 9502	REV: D

BILL OF MATERIAL

ITEM	QTY	DESCRIPTION	PART NUMBER
1	2	RELAY, INSTRUMENT PANEL, 40 AMP, 12vdc	8857
2	1	ENCLOSURE, FIREPUMP INSTRUMENT	10454
3	1	ASSEMBLY, SWITCH GANG, FIREPUMP	11084
4	1	ASSEMBLY, TERMINALS, GAUGE PANEL, FIREPUMP	11137
5	1	ASSEMBLY, HARNESS, INSTRUMENT PANEL, FIREPUMP	11185
6	1	MODULE, OVERSPEED, FIREPUMP	8836
7	1	BRACKET, TOGGLE SWITCH MOUNTING, FIREPUMP GAUGE PANEL - E-ENG	8887
8	1	SWITCH, TOGGLE, MINIATURE, SUSTAINED ON-OFF-ON	8888
9	1	SWITCH, TOGGLE, MINIATURE, MOMENTARY (ON)-OFF-(ON)	8889
10	2	RELAY HOLDER, FIREPUMP	9528
11	1	MODULE, DIODE, INSTRUMENT PANEL, FIREPUMP	9529
12	1	DECAL, INSTRUMENT PANEL, FIREPUMP	10731
13	1	DECAL, INSTRUCTION, GAUGE PANEL	11136
14	1	GUAGE, OIL PRESSURE, 0-80 PSI, 12VDC, FIREPUMP	11194
15	1	GUAGE, WATER TEMPERATURE, 12VDC, FIREPUMP	11197
16	2	GUAGE, VOLTMETER 8-18VDC, FIREPUMP	11200
17	1	GUAGE, TACHOMETER/HOUR METER, FIREPUMP	11202
18	2	CIRCUIT BREAKER, INSTRUMENT PANEL, FIREPUMP	11203
19	4	ISOLATOR, PLATE MOUNT, 5/16-18x1x1 NEOPRENE, TECH PRODUCTS #51272	13011



NOTES:

* GAUGE PANEL EXPLOSION DEPICTED FOR SERVICE PART ID.
* WHERE APPLICABLE, SUB-ASSEMBLY DRAWINGS MAY BE REQUIRED FOR COMPONENT DETAILS.
* WIRING HARNESS IS NOT FIELD SERVICEABLE WITHOUT TRP ISSUED BY CUMMINS FIREPOWER IF APPLICABLE.

REV	DESCRIPTION OF REVISION	REV 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 ± 0.2 .XX ± 0.2
FORM TOLERANCES .X ± 0.8 .XX ± 0.4
FAB TOLERANCES .X ± 1.5 .XX ± 0.8

REF. SCALES

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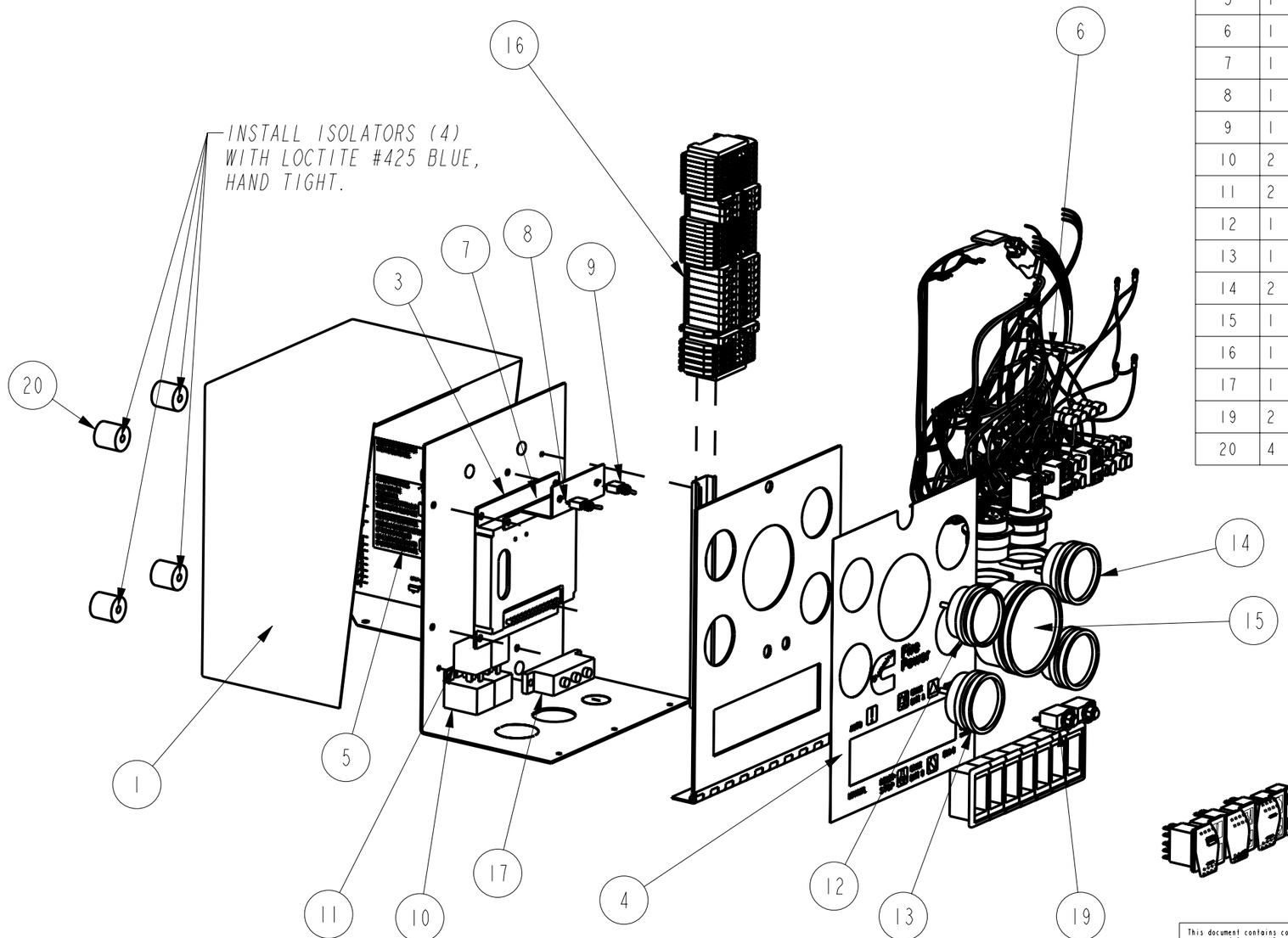
DEPERE, WISCONSIN

TITLE 1: ASSEMBLY, INSTRUMENT PANEL 12V, ISOLATED
TITLE 2: FIREPUMP

DWG UNITS: IN/LB/S	DRAWN BY: S.DANFORTH		DATE: 10JUL2006	
	APPD BY:		DATE:	
EST WEIGHT: 21.524	SCALE: 0.300	DO NOT SCALE	SHEET 1OF1	DRAWING NO: 13236	REV: _



BILL OF MATERIAL

ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	ENCLOSURE, FIREPUMP INSTRUMENT	10454
2	1	ASSEMBLY, SWITCH GANG 24VDC, FIREPUMP	11085
3	1	MODULE, OVERSPEED, FIREPUMP	8836
4	1	DECAL, INSTRUMENT PANEL, FIREPUMP	10731
5	1	DECAL, INSTRUCTION, GAUGE PANEL	11136
6	1	ASSEMBLY, HARNESS, INSTRUMENT PANEL, FIREPUMP	11185
7	1	BRACKET, TOGGLE SWITCH MOUNTING, FIREPUMP GAUGE PANEL - E-ENG	8887
8	1	SWITCH, TOGGLE, MINIATURE, MOMENTARY (ON)-OFF-(ON)	8889
9	1	SWITCH, TOGGLE, MINIATURE, SUSTAINED ON-OFF-ON	8888
10	2	RELAY HOLDER, FIREPUMP	9528
11	2	RELAY, INSTRUMENT PANEL, 40 AMP, 12vdc	8857
12	1	GUAGE, OIL PRESSURE, 0-80 PSI, 24VDC, FIREPUMP	11195
13	1	GUAGE, WATER TEMPERATURE, 24VDC, FIREPUMP	11198
14	2	GUAGE, VOLTMETER 16-32VDC, FIREPUMP	11201
15	1	GUAGE, TACHOMETER/HOUR METER, FIREPUMP	11202
16	1	ASSEMBLY, TERMINALS, GAUGE PANEL, FIREPUMP	11137
17	1	MODULE, DIODE, INSTRUMENT PANEL, FIREPUMP	9529
19	2	CIRCUIT BREAKER, INSTRUMENT PANEL, FIREPUMP	11203
20	4	ISOLATOR, PLATE MOUNT, 5/16-18x1x1 NEOPRENE, TECH PRODUCTS #51272	13011

NOTES:
GAUGE PANEL EXPLOSION DEPICTED FOR SERVICE PART IDENTIFICATION. WHERE APPLICABLE, SUB-ASSEMBLY DRAWINGS MAY BE REQUIRED FOR COMPONENT DETAIL(S). WIRING HARNESS IS NOT FIELD SERVICEABLE WITHOUT TRP ISSUED BY CUMMINS FIREPOWER IF APPLICABLE.

REV	DESCRIPTION OF REVISION	REV 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 .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

REF. SCALES

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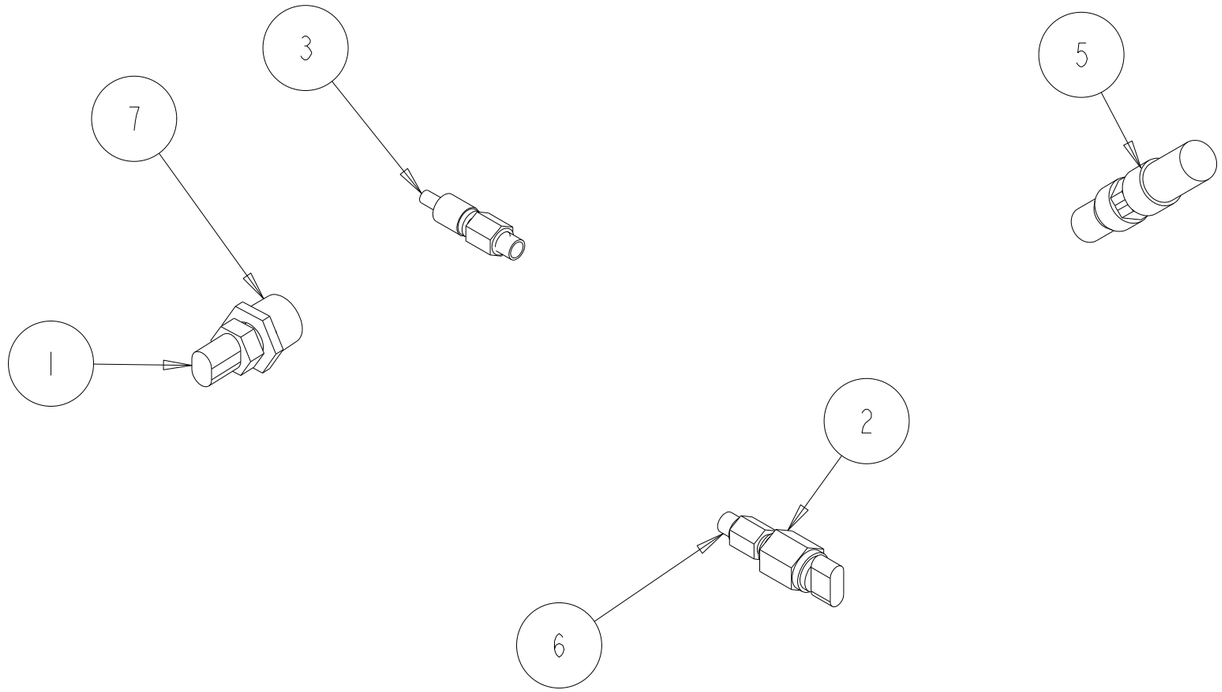
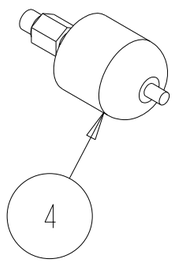
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

TITLE 1: ASSEMBLY, INSTRUMENT PANEL 24V, ISOLATED
TITLE 2: FIREPUMP

DWG UNITS: IN/LB/S	DRAWN BY: S DUBICK		DATE: 08/06/08
	APPD BY:		DATE:
EST WEIGHT: 20.096	SCALE: 0.200	DO NOT SCALE	SHEET 1OF1	DRAWING NO: 13237	REV: _





BILL OF MATERIAL

ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	SWITCH, WATER TEMP, 200F SETTING, CUMMINS #3408632	8860
2	1	SWITCH, OIL PRESSURE, 16 PSI, CUMMINS #3408607	8861
3	1	SENDER, WATER TEMPERATURE, DATCON #02025-00	8862
4	1	SENDER, OIL PRESURE, DATCON #02504-00	8863
5	1	SENSOR, MAG PICK UP	9569
6	3	FTG, STR, M10-1.0 ORB X -2 FMNPT	12181-M10-2
7	1	BUSHING, 1/2" x 3/4" NPT	LTL-SRB3412

REV				
	2008-441	UPDATE PER BUILD	S DUBICK	1/12/09
REV	ENF	DESCRIPTION OF REVISION	REV BY	DATE

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1° | IMPERIAL UNITS | METRIC UNITS

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, SENSOR PACKAGE CFP9E

DWG UNITS: IN/LB/S

DRAWN BY: DAVE N

PRO-ENGINEER

DATE: 21AUG2004

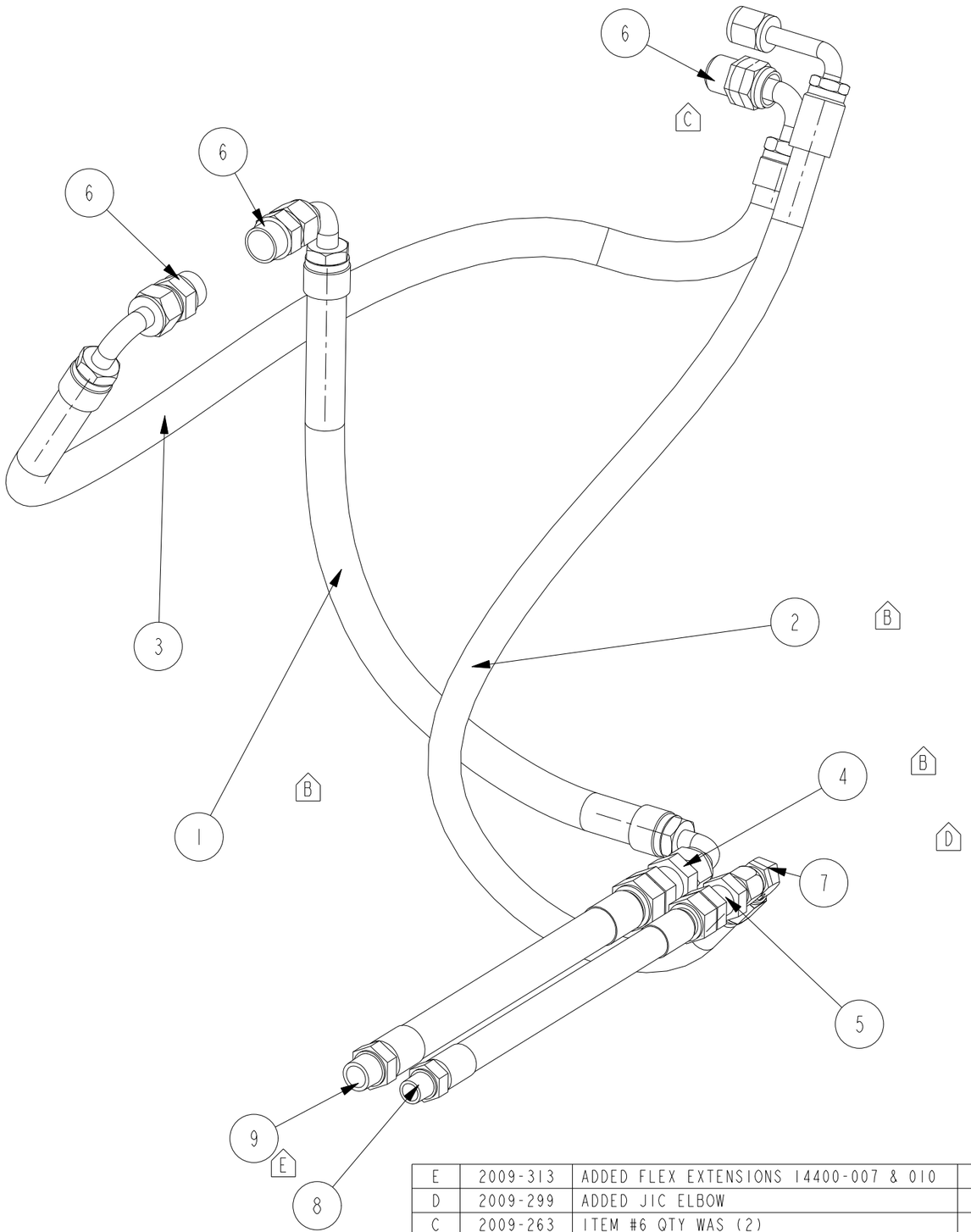
REF DRWG:

SCALE: 0.375

EST WEIGHT: 1.128

SHEET 1 OF 1

DRAWING NO: 9574-01



BILL OF MATERIAL

	ITEM	QTY	DESCRIPTION	PART NUMBER
A	1	1	HOSE, FUEL INLET, FILTER, CFP9E	13576
B	2	1	HOSE, FUEL RETURN, ENG - ECM, CFP9E	13577
B	3	1	HOSE, FUEL INLET, ENGINE, CFP9E	13576
B	4	1	FTG, BLKHD, -10 JIC	12227-10
B	5	1	FTG, BLKHD, -8 JIC	12227-8
C	6	3	FTG, STR, -10 JIC X -10 ORB	12235-10-10
D	7	1	ELB, 90 DEG, -8 JIC X -8 FJIC	12265-8-8
E	8	1	FUEL LINE, 12" EXTENSION, #8 FEM JIC X #8 221FR X 3/8" NPT	14400-007
	9	1	FUEL LINE, 12" EXTENSION, #10 FEM JIC X #10 221FR X 1/2" NPT	14400-010

REV	ENF	DESCRIPTION OF REVISION	REV BY	DATE
E	2009-313	ADDED FLEX EXTENSIONS 14400-007 & 010	DAN	20-JUL-09
D	2009-299	ADDED JIC ELBOW	DAN	26-JUN-09
C	2009-263	ITEM #6 QTY WAS (2)	DAN	04-JUN-09
B	2009-101	REV PER HOSES & BULKHEADS	DAVE N	04MAY2009
A		UPDATED FUEL LINES & CONNECTIONS	S DUBICK	10/01/08

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

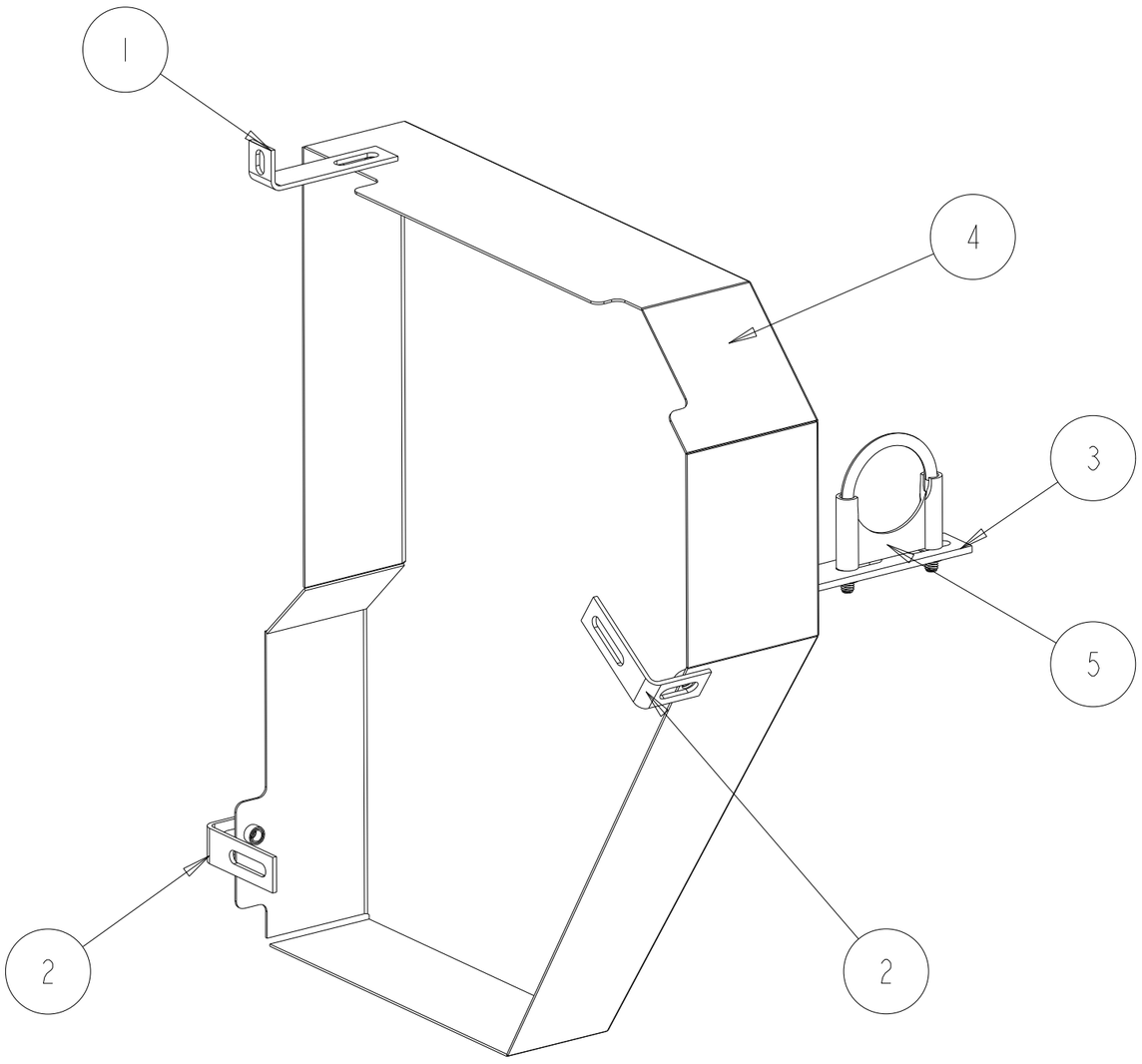
Cummins Fire Power

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, FUEL SYSTEM PLUMBING
CFP9E

DWG UNITS: IN/LB/S	DRAWN BY: S DUBICK	DATE: 10/01/08
	PRO-ENGINEER	REF DRWG:
SCALE: 0.333	SHEET 1 OF 1	DRAWING NO: 10762
EST WEIGHT: 8.763		



BILL OF MATERIAL

ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	BRACKET, MOUNTING, GUARD, FIREPUMP	8592
D 2	2	BRACKET, MOUNTING, GUARD, FIREPUMP	8593
3	1	BRACKET, MOUNTING, TUBE SUPPORT, FIREPUMP	9834
4	1	GUARD, PULLEY, CFP9E, FIREPUMP	10921
C 5	1	CLAMP,U-BOLT,GUILLOTINE, 2.25"	89542K

REV		DESCRIPTION OF REVISION		
D	2009-091	REV PER GUARD. REV BRKTS.	DAVE N	16APR2009
REV	ENF	DESCRIPTION OF REVISION	REV 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 .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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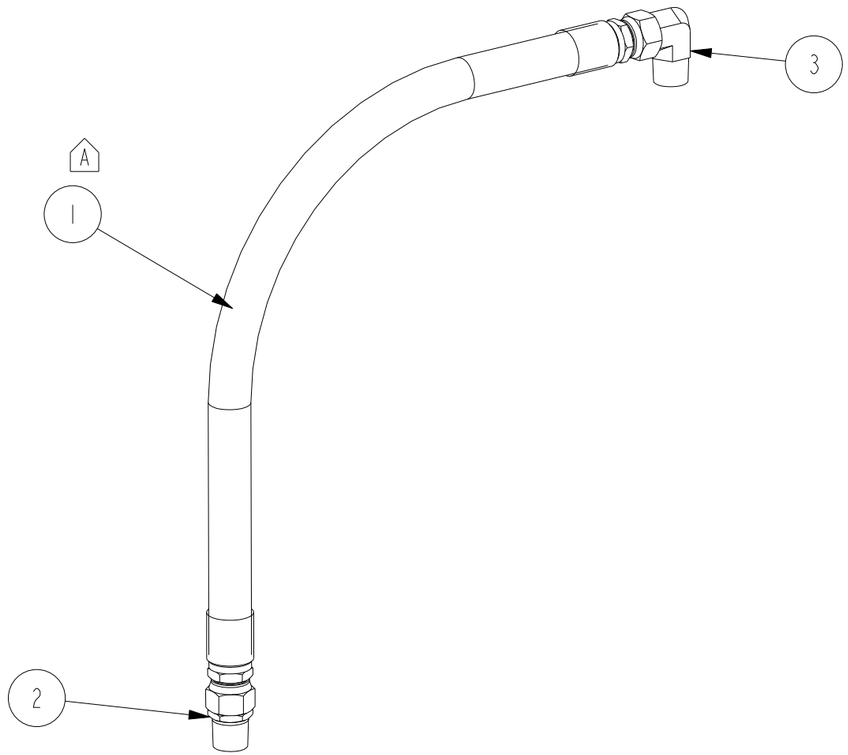
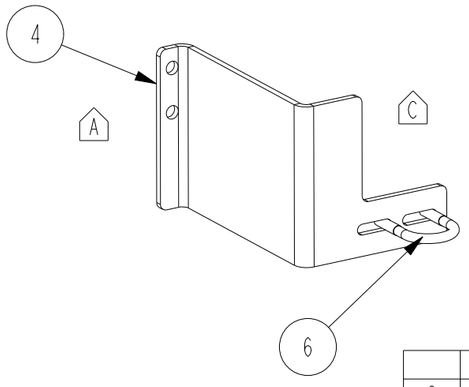
AND UPFIT CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

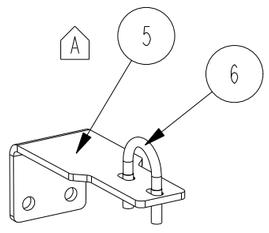
ASSEMBLY, GUARD, PULLEY, QSC FIREPUMP

DWG UNITS: IN/LB/S	DRAWN BY: DAVE N	DATE: 20JAN2005
PRO-ENGINEER		REF DRWG: .
SCALE: 0.250	SHEET 1 OF 1	DRAWING NO: 10920
EST WEIGHT: 12.891		



BILL OF MATERIAL			
ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	HOSE, WATER TO CAC, CFP9E	13579
2	1	ADAPTER, NPTM X JIC 37 DEG	11587
3	1	ELBOW, 1" NPTM X #16 JIC 37 DEG	11588
4	1	BRACKET, COOLING LOOP SUPPORT, LOWER1, CFP9E	13581
5	1	BRACKET, COOLING LOOP SUPPORT, LOWER2, CFP9E	13582
6	2	U-BOLT, 1" NPT, 3/8" x 1-1/2" x 2-1/2"	3043T37





REV		DESCRIPTION OF REVISION	REV BY	DATE
C	2009-091	REV PER BRACKET. 13583 MOVED TO MAIN ASSY	DAVE N	04MAY2009
REV	ENF	DESCRIPTION OF REVISION	REV 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 .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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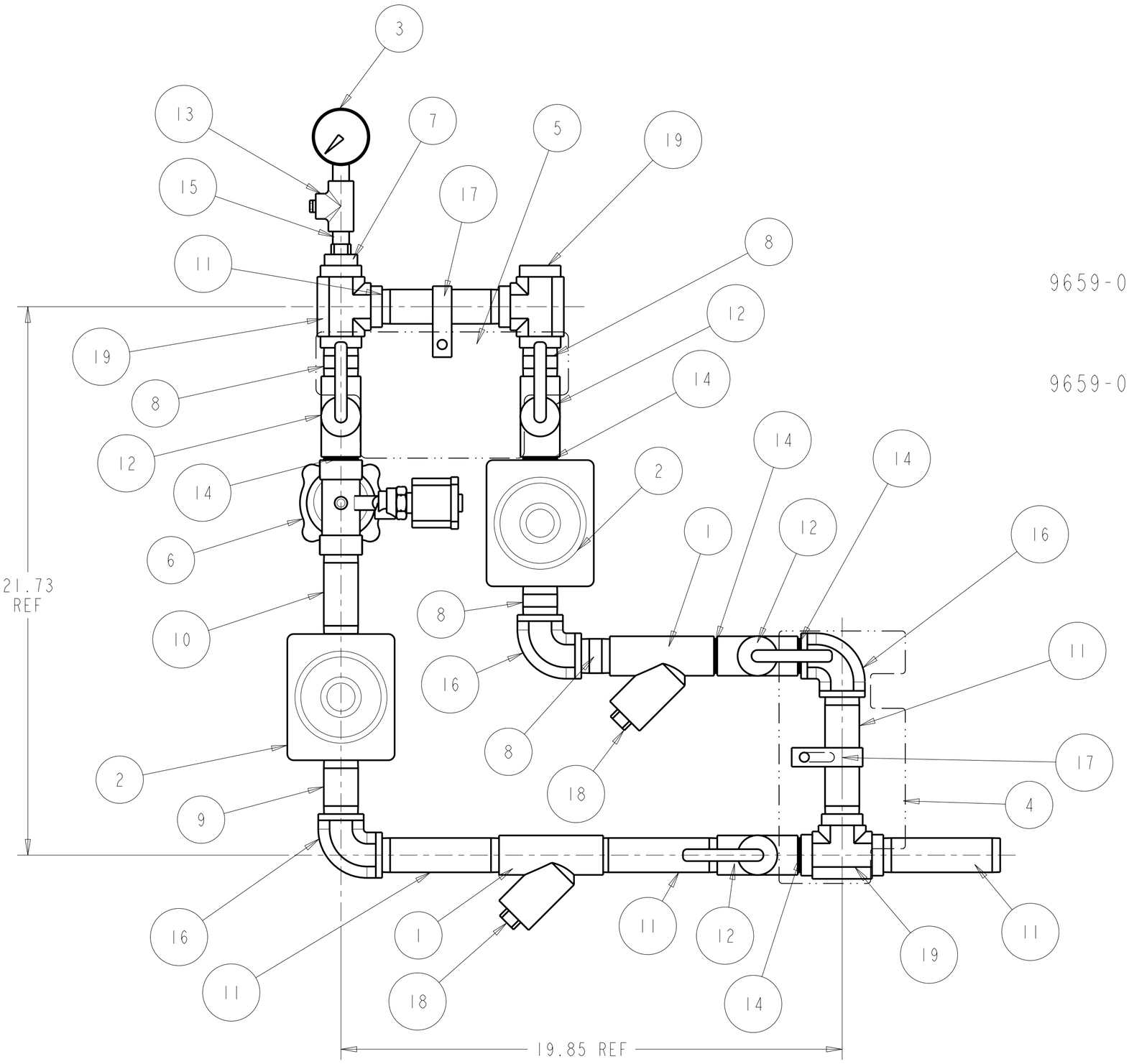
CUSTOM DESIGN
AND UPFIT CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

MISC PIPING, CFP9E
FIREPUMP

DWG UNITS: IN/LB/S	DRAWN BY: DAVE N	DATE: 06MAR2006
	PRO-ENGINEER	REF DRWG:
SCALE: 0.188	SHEET 1 OF 1	DRAWING NO: 10764
EST WEIGHT: 7.793		

VALVES SHOWN OPEN - NOT IN OPERATING POSITION
FOLLOW HANDLE ORIENTATION



BILL OF MATERIAL			
ITEM	QTY	DESCRIPTION	PART NUMBER
1	2	STRAINER, WITH PLUG, 1" NPT	1_77SM1
2	2	REGULATOR, 1" NPT, 400 PSI MAX, 25 TO 75 PSI OUT	1_N45DBU
3	1	GUAGE, PRESSURE, 1/4" NPT, 0-100 PSI RANGE	8892
4	1	TAG, COOLANT LOOP LABEL, VERTICAL MTG	10965
5	1	NAME PLATE, COOLING LOOP VALVE LABEL, NORMAL/CLOSED , EMERGENCY OPEN	9659-6
6	1	VALVE, SOLENOID, 1" NPT, 12VDC, 150 PSI MAX	8210G4-12VDC
7	1	REDUCER BUSHING, BLK, 1" NPT x 1/4" NPT	BBGB
8	4	NIPPLE, BLK, 1 X 2-1/2	BNGL
9	1	NIPPLE, BLK, 1 x 3-1/2"	BNGN
10	1	NIPPLE, BLK, 1 x 4-1/2	BNGR
11	5	NIPPLE, BLK, 1 x 6	BNGU
12	4	VALVE, BALL, 1" NPT	FA60203-1
13	1	VALVE, BALL, 1/4" NPT	FA60204-1
14	5	NIPPLE, BLK, 1 x Close	LTL-CPN1
15	1	NIPPLE, BLK, 1/4 X CLOSE	LTL-CPN14
16	3	ELBOW, BLK, 1" NPT	LTL-E190
17	2	CLAMP, 1-1/2"	LTL-SCPV24627
18	2	PLUG, BLK, 1" NPT	LTL-SCSP1
19	3	TEE, BLK, 1"	LTL-ST1

9659-01 FOR VERTICLE TURBINE PUMP:
REMOVE VALVE 8210G4 AND 4.5" LG NIPPLE
REPLACE WITH 9" LG NIPPLE BNGY9

9659-02 FOR 24vdc OPERATION:
REMOVE VALVE 8210G4-12vdc AND REPLACE
WITH #8210G4-24vdc

REV	DESCRIPTION OF REVISION	REV BY	DATE
D	REV PER PART NUMBERS	DAVE N	20SEP06

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 ± ⌭ 0.020, .XXX ± ⌭ 0.010; FAO TOLERANCES .XX ± ⌭ 0.030, .XXX ± ⌭ 0.030

METRIC UNITS: MACHINE TOLERANCES .X ± 0.2, .XX ± 0.2; FORM TOLERANCES .X ± ⌭ 0.5, .XX ± ⌭ 0.4; FAO TOLERANCES .X ± ⌭ 0.8, .XX ± ⌭ 0.8

REF. SCALES

Fire Power

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NPOWER SYSTEMS
DESIGN CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

TITLE 1: COOLING LOOP, 1", UPPER HX ORIENTATION
TITLE 2: FIREPUMP

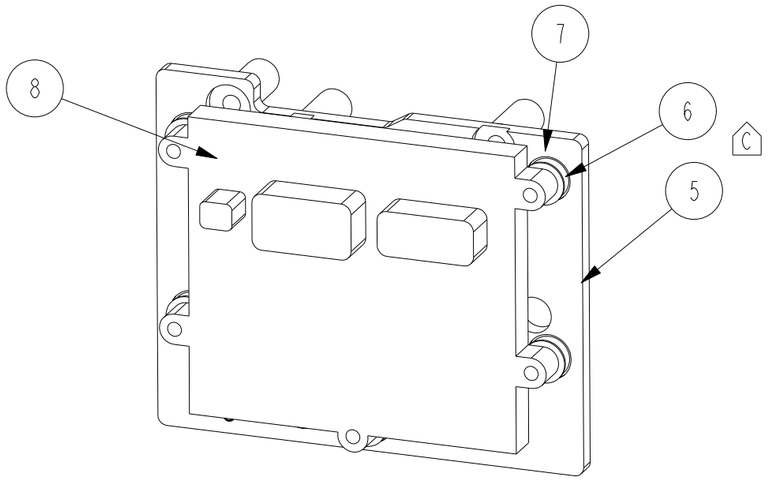
DWG UNITS: IN/LB/S	DRAWN BY: DAVE N		DATE: 06JAN2005
	APPD BY: -		DATE: -
EST WEIGHT: 53.400	SCALE: 0.300	DO NOT SCALE	SHEET 1OF1
	DRAWING NO: 9659		REV: D

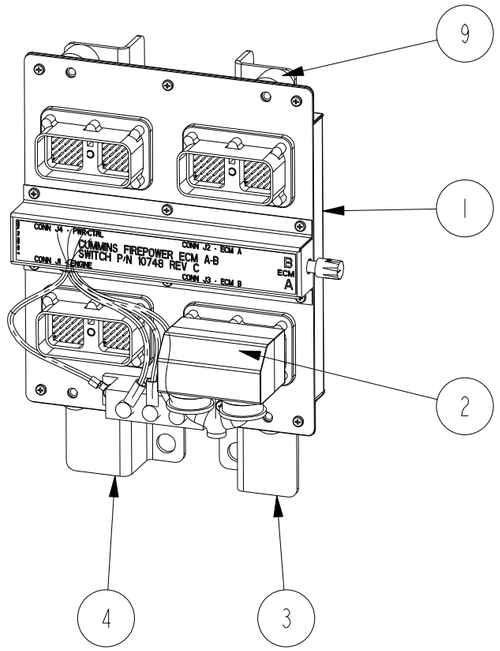
BILL OF MATERIAL

ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	ASSEMBLY, ECM SWITCH	10748
2	1	HARNESS, ECM, CFP9E (NOT SHOWN)	12857
3	1	BRACKET, MOUNTING, RH, ECM, CFP9E, FIREPUMP	10779
4	1	BRACKET, MOUNTING, LH, ECM, CFP9E, FIREPUMP	10780
5	1	BRACKET, SECONDARY ECM, CFP9E	14842
6	5	ISOLATOR, VIBRATION, CUMMINS NO 3955219	3955219
7	5	ISOLTATOR, VIBRATION, CUMMINS NO. 3955220	3955220
8	1	ECM MODULE, CUMMINS, #4921776	12726
9	4	ISOLATOR, #10 TAP & STUD, #AG-3904930	51156PS

C

C





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

REV	ENF	DESCRIPTION OF REVISION	REV BY	DATE
C	2009-101	REV PER ECM MTG. REMOVED ECM COOLER PLATE	DAVE N	20APR2009
C	2009-101	14842 WAS 10756	DAVE N	20APR2009

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CUSTOM DESIGN
AND UPFIT CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

ASSEMBLY, SECONDARY ECM, CFP9E
FIREPUMP

DWG UNITS: IN/LB/S

DRAWN BY: DAVE N

PRO-ENGINEER

DATE: 23FEB2006

REF DRWG:

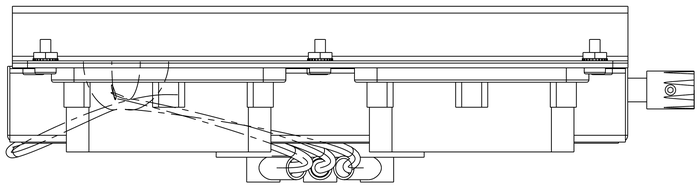
SCALE: 0.250

EST WEIGHT: 36.299

SHEET 1 OF 1

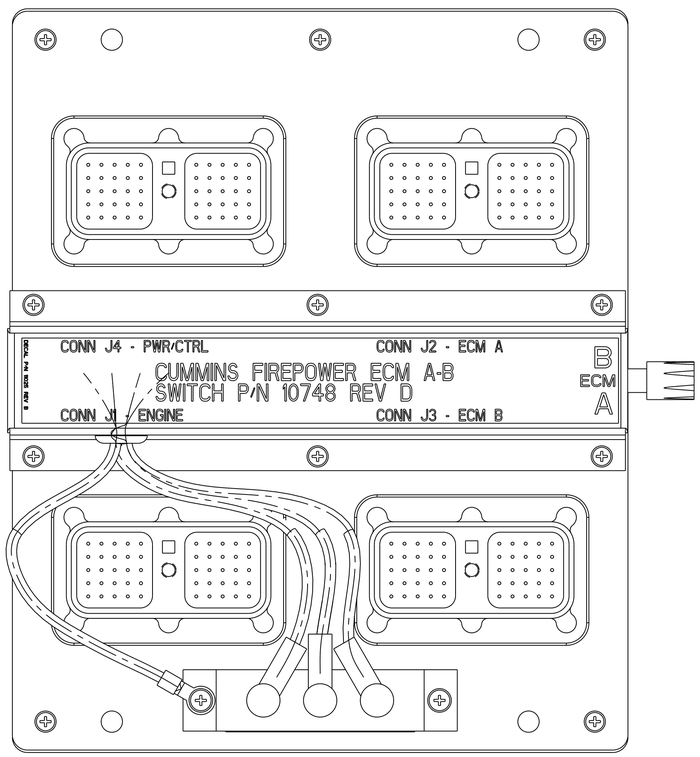
DRAWING NO: 10755

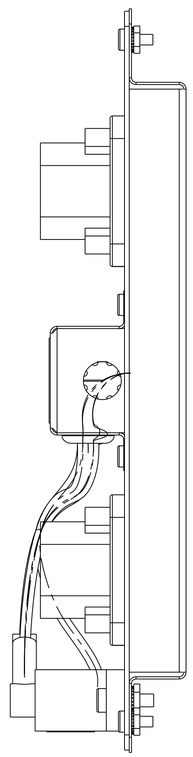
DESIGN INTELECTUAL PROPERTY BY CUMMINS NPOWER, LLC
ALL PRODUCTION RUNS WILL REQUEST LATEST DOCUMENTATION
SEE SHEET 2 FOR WAVE-SOLDER ASSEMBLY
SEE SHEET 3 FOR HAND-SOLDER OF LEADS
SEE SHEET 4 FOR COVER ASSEMBLY

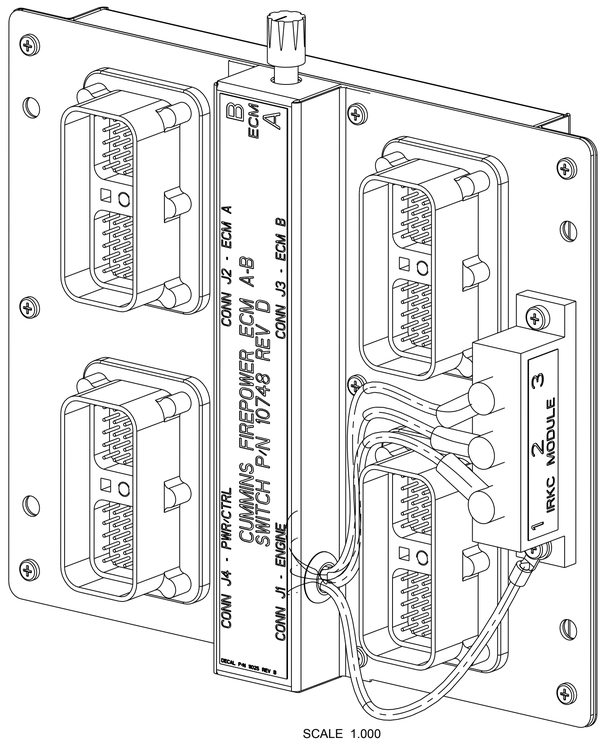


BILL OF MATERIAL

ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	PC BOARD	10749
2	1	INSULATING MEMBRANE, ECM SWITCH	10750
3	1	MOUNTING PLATE, ALUMINUM	10751
4	1	SWITCH, 78 POLE	10754
6	1	BACKING PLATE, ALUMINUM	10752
7	1	SWITCH COVER, ALUMINUM	10753
8	1	GROMMET, , MCMASTER CARR P/N 9307K21 OR EQUIV	9307K21
9	1	MODULE, DIODE, INSTRUMENT PANEL, FIREPUMP	9529
10	1	LEAD 10 AWG, COPPER, GXL INSULLATION, RED COLOR	10748_L1
11	1	LEAD 10 AWG, COPPER, GXL INSULLATION, BLACK COLOR	10748_L2
12	1	LEAD 10 AWG, COPPER, GXL INSULLATION, BLACK COLOR	10748_L3
13	1	LEAD, 10 AWG, COPPER, GXL INSULLATION, GREEN COLOR	10748_L4
14	11	NUT, HEX, NO 8-32 W/ RETENTION, WASHER	NUT-RETAINING_NO-8-32
15	2	NUT, HEX, NO 10-32 W/ RETENTION, WASHER	NUT-RETAINING_NO-10-32
16	11	SCREW, NO 8-32 X 3/8, MACHINE SCREW	SCREW_MACHINE_NO-8-32_X_38
17	2	SCREW, NO 10-32 X 5/8, MACHINE SCREW	SCREW_MACHINE_NO-10-32_X_625
18	24	SCREW, SELF-TAPPING, #6 MACHINE SCREW	SCREW_SELF-TAP_NO-6_X_38
19	1	DECAL, ECM A-B SWITCH, -	11025
21	3	BOOT, INSULATING, -0.25" ENTRY, RED	11052
22	1	CONNECTOR, 50 PIN	DRC20-50P-01
23	1	CONNECTOR, 50 PIN	DRC20-50P-02
24	1	CONNECTOR, 50 PIN	DRC20-50P-03
25	1	CONNECTOR, 50 PIN	DRC20-50P-04
26	1	KNOB, 0.50 DIA, 0.25 BORE, MCMASTER #6094K71 OR EQUAL	13626







SCALE 1.000

REV	DESCRIPTION OF REVISION	REV BY	DATE
D	REV PER KNOB. ADDED COATING NOTE	DAVE N	30SEP2008
C	REVISED PER ECN 2006-192	S.DANFORTH	22SEP2006
B	RELEASE FOR PRODUCTION	S.DANFORTH	12JUL2006
A	PROTOTYPE DRAWING	DAVE N.	

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE
ANGULAR DIMENSIONS in ° | IMPERIAL UNITS | METRIC UNITS
THIRD ANGLE PROJECTION
MACHINE TOLERANCES .XX in ± .030 .X in ± .1 ANGLE ± 1°
CMM TOLERANCES .XX in ± .005 .XXX in ± .002 ANGLE ± 0.5°
CAD TOLERANCES .XX in ± .010 .XXX in ± .005 ANGLE ± 1°

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875 LAWRENCE DRIVE
DEPERE, WISCONSIN

TITLE 1: ASSEMBLY, ECM SWITCH
TITLE 2:

DWG UNITS: IN/LB/S	DRAWN BY: SCOTT D		DATE: 21FEB2006	
	APPD BY: -		DATE: -	
EST WEIGHT: 6.709	SCALE: 1.000	DO NOT SCALE	SHEET 1OF4	DRAWING NO: 10748 REV: D

THIS SHEET FOR WAVE-SOLDER ASSEMBLY
ANY DEVIATION MUST BE APPROVED IN WRITING
EACH CONNECTOR MUST BE MECHANICALLY
BONDED TO ASSEMBLY WITH SELF-TAPPING SCREWS
PRIOR TO SOLDERING.

BILL OF MATERIAL

REV	ITEM	QTY	DESCRIPTION	PART NUMBER
	1	1	PC BOARD	10749
	2	1	INSULATING MEMBRANE, ECM SWITCH	10750
	3	1	MOUNTING PLATE, ALUMINUM	10751
C	4	1	SWITCH, 78 POLE	10754
	6	24	SCREW, SELF-TAPPING, #6 MACHINE SCREW	SCREW_SELF-TAP_NO-6_X_38
D	7	1	KNOB, 0.50 DIA, 0.25 BORE, MCMASTER #6094K71 OR EQUAL	13626
C	22	1	CONNECTOR, 50 PIN	DRC20-50P-01
C	23	1	CONNECTOR, 50 PIN	DRC20-50P-02
C	24	1	CONNECTOR, 50 PIN	DRC20-50P-03
	25	1	CONNECTOR, 50 PIN	DRC20-50P-04

D CONFORMAL COAT PCB
USING DOW 3-176S COATING MATERIAL.

SCALE 1.000

THIS VIEW EXPLODED FOR CLARITY OF
ASSEMBLY PROCESS AND COMPONENT LOCATION

Fire Power

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CORPORATE OFFICE
1600 BUERKLE ROAD
WHITE BEAR LAKE, MN
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NPOWER SYSTEMS
DESIGN CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

TITLE 1: ASSEMBLY, ECM SWITCH
TITLE 2:

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE
ANGULAR DIMENSIONS 1±°

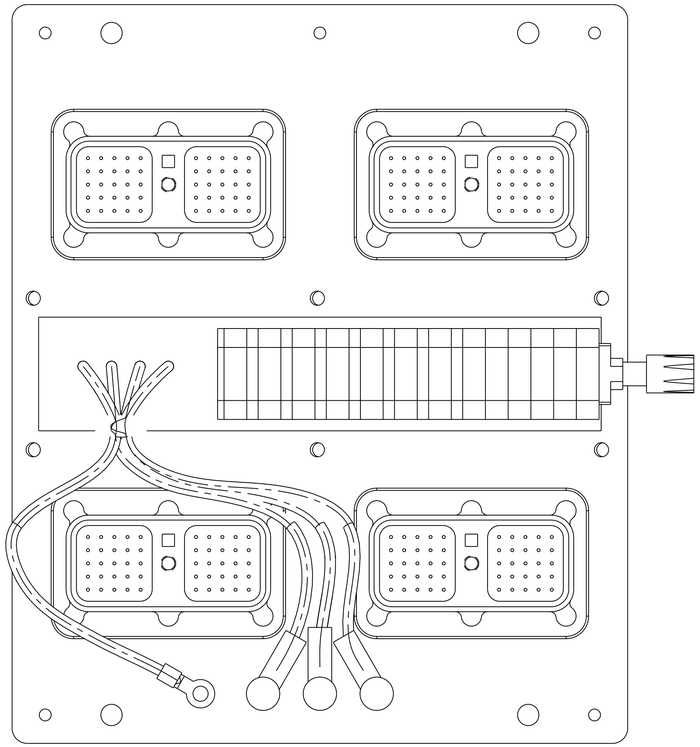
IMPERIAL UNITS	METRIC UNITS
MACHINE TOLERANCES .XX = ± 0.010 .XXX = ± 0.005	MACHINE TOLERANCES .X = ± 0.4 .XX = ± 0.2
FORM TOLERANCES .XX = ± 0.030 .XXX = ± 0.015	FORM TOLERANCES .X = ± 0.8 .XX = ± 0.4
FAB TOLERANCES .XX = ± 0.060 .XXX = ± 0.030	FAB TOLERANCES .X = ± 1.5 .XX = ± 0.8

THIRD ANGLE PROJECTION

REV	DESCRIPTION OF REVISION	REV BY	DATE
D	REV PER KNOB. ADDED COATING NOTE	DAVE N	30SEP2008
C	REVISED PER ECN 2006-192	S.DANFORTH	22SEP2006
B	RELEASED FOR PRODUCTION	S.DANFORTH	12JUL2006

DWG UNITS: IN/LB/S	DRAWN BY: SCOTT D		DATE: 21FEB2006	
	APPD BY: -		DATE: -	
EST WEIGHT: 6.709	SCALE: 0.750	DO NOT SCALE	SHEET 2OF4	DRAWING NO: 10748	REV: D

BILL OF MATERIAL			
ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	KNOB, 0.50 DIA, 0.25 BORE, MCMASTER #6094K71 OR EQUAL	13626
10	1	LEAD 10 AWG, COPPER, GXL INSULLATION, RED COLOR	10748_L1
11	1	LEAD 10 AWG, COPPER, GXL INSULLATION, BLACK COLOR	10748_L2
12	1	LEAD 10 AWG, COPPER, GXL INSULLATION, BLACK COLOR	10748_L3
13	1	LEAD, 10 AWG, COPPER, GXL INSULLATION, GREEN COLOR	10748_L4
21	3	BOOT, INSULATING, -0.25" ENTRY, RED	11052
22	1	CONNECTOR, 50 PIN	DRC20-50P-01
23	1	CONNECTOR, 50 PIN	DRC20-50P-02
24	1	CONNECTOR, 50 PIN	DRC20-50P-03
25	1	CONNECTOR, 50 PIN	DRC20-50P-04



EACH LEAD IS TO BE HAND SOLDERED
SOLDER TO BE ROHS COMPLIANT (LEAD FREE)
ALL FLUX TO BE REMOVED AFTER SOLDERING TO PREVENT CORROSION
GREEN LEAD FOR GROUND
RED LEAD FOR DIODE ANODE
BLACK LEADS FOR BATT 1 AND BATT 2
EACH LEAD MANUFACTURED WITH GXL WIRE AND #10 AWG X #10 RING TERMINAL. CRIMP TERMINAL ACCEPTABLE. SOLDER TERMINAL PREFERED.

REV	DESCRIPTION OF REVISION	REV BY	DATE
D	REV PER KNOB. ADDED COATING NOTE	DAVE N	30SEP2008
C	REVISE PER ECN 2006-192	S.DANFORTH	22SEP2006
B	RELEASE FOR PRODUCTION	S.DANFORTH	12JUL2006

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE:

ANGULAR DIMENSIONS ±°

THIRD ANGLE PROJECTION

IMPERIAL UNITS: DECIMAL TOLERANCES .XX± .02 / .XXX± .005 / FRACTIONAL TOLERANCES .XX± .03 / .XXX± .015 / ANGULAR TOLERANCES .XX± .03

METRIC UNITS: DECIMAL TOLERANCES .X± .5 / .XX± .13 / FRACTIONAL TOLERANCES .X± .8 / .XX± .38 / ANGULAR TOLERANCES .XX± .03

Cummins Fire Power

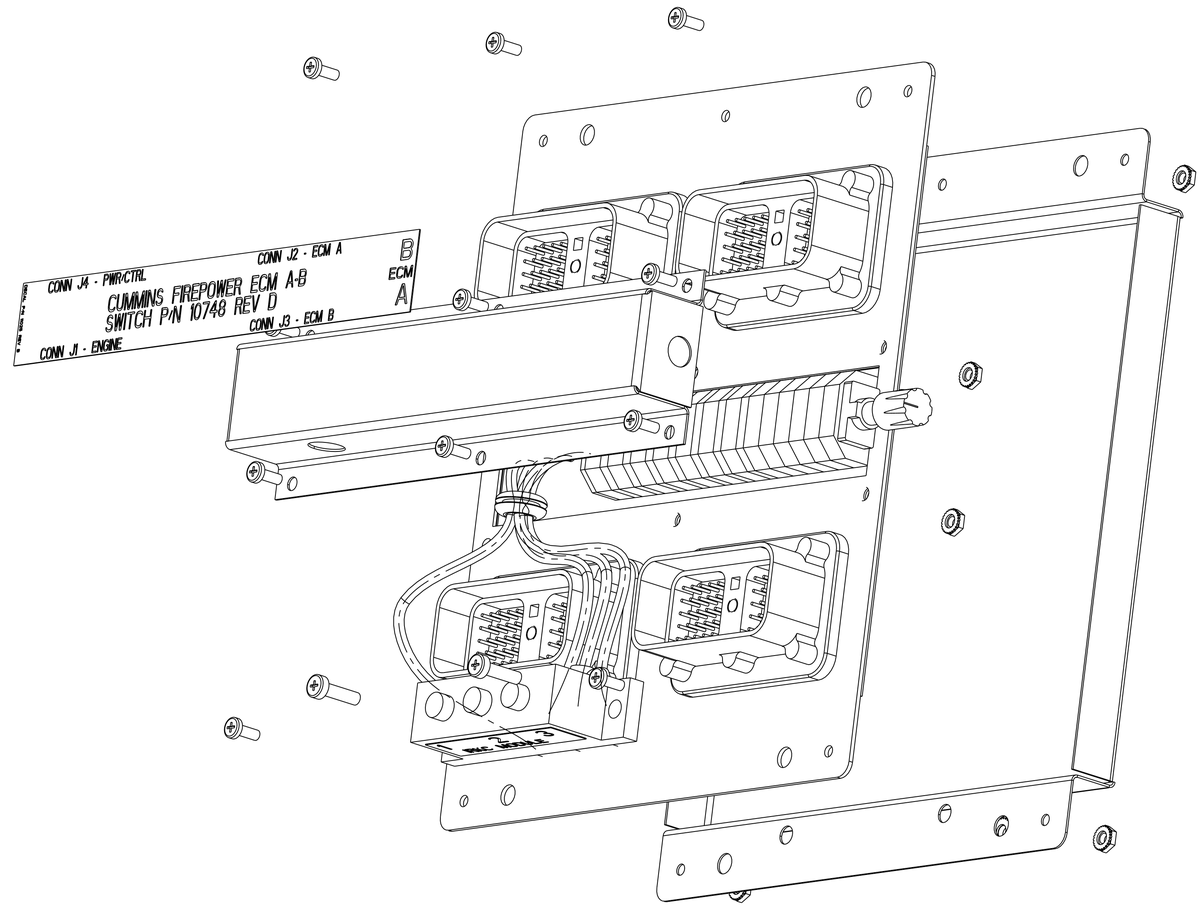
CUMMINS NPOWER, LLC
CORPORATE OFFICE
1600 BUERKLE ROAD
WHITE BEAR LAKE, MN
WWW.NPOWER.CUMMINS.COM

NPOWER SYSTEMS
DESIGN CENTER
825 LAWRENCE DRIVE
DEPERE, WISCONSIN

TITLE 1: ASSEMBLY, ECM SWITCH
TITLE 2:

DWG UNITS: IN/LB/S	DRAWN BY: SCOTT D			DATE: 21FEB2006	
	APPD BY: -			DATE: -	
EST WEIGHT: 6.709	SCALE: 1.000	DO NOT SCALE	SHEET 3OF4	DRAWING NO: 10748	REV: D

BILL OF MATERIAL			
ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	KNOB, 0.50 DIA, 0.25 BORE, MCMASTER #6094K71 OR EQUAL	13626
3	1	BACKING PLATE, ALUMINUM	10752
7	1	SWITCH COVER, ALUMINUM	10753
8	1	GROMMET, , MCMASTER CARR P/N 9307K21 OR EQUIV	9307K21
9	1	MODULE, DIODE, INSTRUMENT PANEL, FIREPUMP	9529
14	11	NUT, HEX, NO 8-32 W/ RETENTION, WASHER	NUT-RETAINING_NO-8-32
15	2	NUT, HEX, NO 10-32 W/ RETENTION, WASHER	NUT-RETAINING_NO-10-32
16	11	SCREW, NO 8-32 X 3/8, MACHINE SCREW	SCREW_MACHINE_NO-8-32_X_38
17	2	SCREW, NO 10-32 X 5/8, MACHINE SCREW	SCREW_MACHINE_NO-10-32_X_625
19	1	DECAL, ECM A-B SWITCH, -	11025



UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1° | IMPERIAL UNITS | METRIC UNITS

THIRD ANGLE PROJECTION

REV	DESCRIPTION OF REVISION	REV BY	DATE
D	REV PER KNOB. ADDED COATING NOTE	DAVE N	30SEP2008
C	REVISED PER ECN 2006-192	S.DANFORTH	22SEP2006
B	RELEASE FOR PRODUCTION	S.DANFORTH	12JUL2006

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NPOWER SYSTEMS
DESIGN CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

TITLE 1: ASSEMBLY, ECM SWITCH
TITLE 2:

DWG UNITS: IN/LB/S	DRAWN BY: SCOTT D	DATE: 21FEB2006
	APPD BY: -	DATE: -

EST WEIGHT: 6.709	SCALE: 1.000	DO NOT SCALE	SHEET 4OF4	DRAWING NO: 10748	REV: D

KIT INCLUDES

1) 12853 HARNESS, WIRE, SENSOR AND ACTUATOR
2) 12854 HARNESS, WIRE, ECM A
3) 12855 HARNESS, WIRE, ECM B
4) 12856 HARNESS, WIRE, OEM

REV	DESCRIPTION OF REVISION	BY	DATE
A	REMOVED P/N 12865 FROM KIT	KAK	08/06/08

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1°	IMPERIAL UNITS	METRIC UNITS
THIRD ANGLE PROJECTION		

Fire Power

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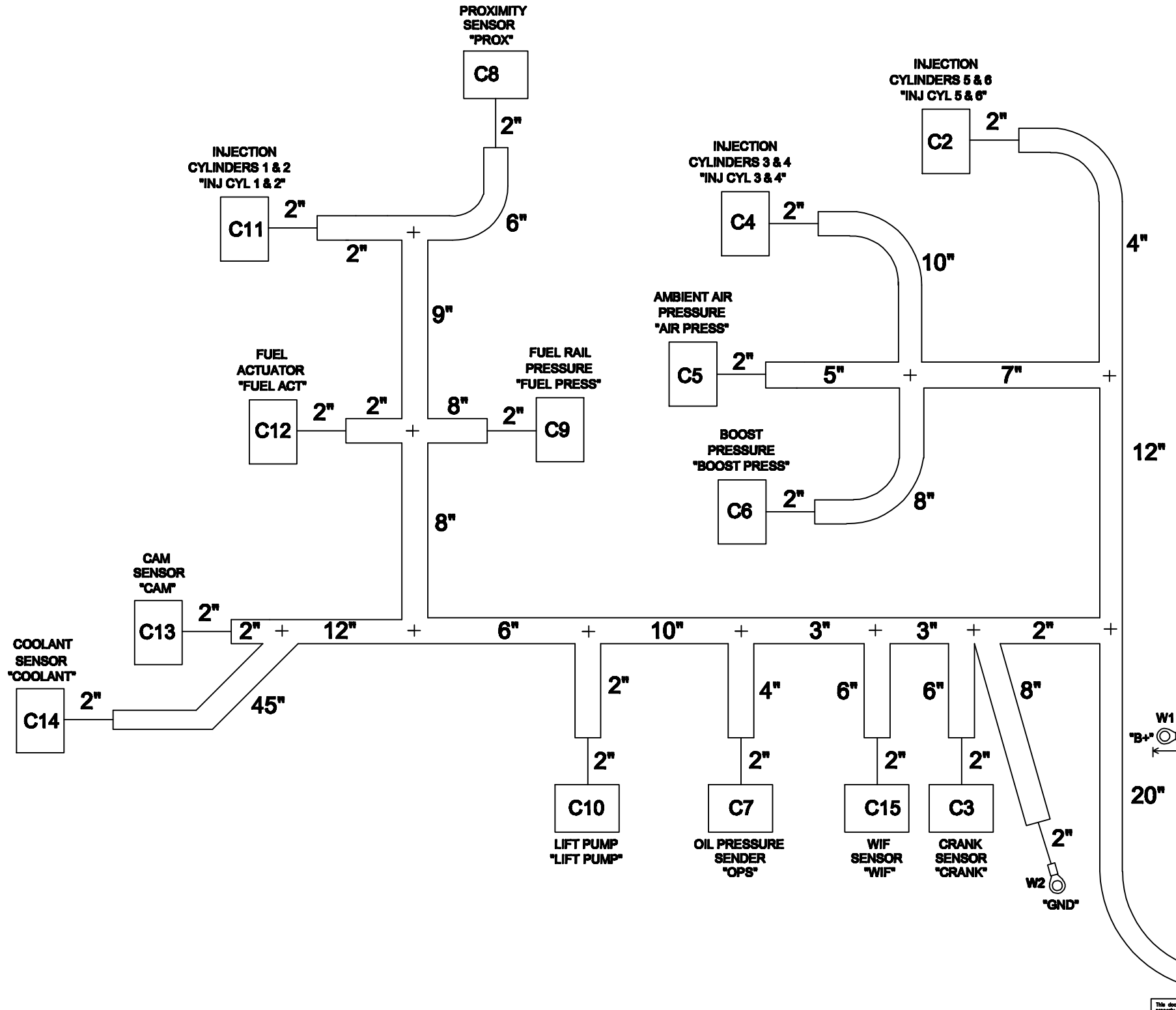
NPOWER SYSTEMS
DESIGN CENTER
675 LAWRENCE DRIVE
DEPERE, WISCONSIN

KIT, WIRE HARNESSES
QSL9 FIRE PUMP

DWG UNITS:	DRAWN BY: KAK			DATE: 02 MAY 2008	
	APPD BY:			DATE:	
EST WEIGHT:	SCALE:	DO NOT SCALE	SHEET 1OF1	DRAWING NO: 12857	REV: A



TAGS	QTY	SUB	CATALOG	MFG	DESC
C9	1	1	1-928-403-968	BOSCH	CONNECTOR, 3 POSITION, BLACK, CODE 11
		3	1-928-300-599	BOSCH	SEAL, BLUE
		3	1-928-498-062	BOSCH	TERMINAL, SOCKET, GOLD
C1	1	1	DRC26-505-01	DEUTSCH	50 PIN ECM CONNECTOR
		1	0528-001-5005	DEUTSCH	BACKSHELL, 90 DEGREE
		29	0462-201-3031	DEUTSCH	TERMINAL, SOCKET
		19	114017	DEUTSCH	PLUG, SEALING
C8	1	1	DT04-4P	DEUTSCH	CONNECTOR, 4 POSITION
		3	0460-202-16141	DEUTSCH	TERMINAL, PIN, NICKEL, 16-18AWG
		1	W4P	DEUTSCH	WEDGE
		1	114017	DEUTSCH	PLUG, SEALING
C15	1	1	DT06-2S-P012	DEUTSCH	CONNECTOR, 2 POSITION, BLACK
		1	0462-201-1631	DEUTSCH	TERMINAL, SOCKET, GOLD
		1	3656094	ELL-TRON	BOOT
		1	W2S-P012	DEUTSCH	WEDGE, GREEN
C12	1	1	DT06-2S-P012	DEUTSCH	CONNECTOR, 2 POSITION, BLACK
		1	W2S-P012	DEUTSCH	WEDGE, GREEN
		2	0462-201-1631	DEUTSCH	TERMINAL, SOCKET, GOLD
C10	1	1	DT06-2S-P012	DEUTSCH	CONNECTOR, 2 POSITION, BLACK
		1	W2S-P012	DEUTSCH	WEDGE, GREEN
		2	0462-201-16141	DEUTSCH	TERMINAL, SOCKET, NICKEL
		1	3656094	ELL-TRON	BOOT
C11,C2,C4	3	1	DTP06-4S-C015	DEUTSCH	CONNECTOR, 4 POSITION, PLUG
		4	0462-203-12141	DEUTSCH	TERMINAL, SOCKET, 12-14 AWG
		1	WP-4S	DEUTSCH	WEDGE, ORANGE
C7	1	1	56038149	ELL-TRON	
		3	JTP-1811-66AU-RWC	FRAMATOME	TERMINAL, SOCKET, GOLD
		1	3661835	ELL-TRON	BOOT
C5	1	1	56038150	FRAMATOME	CONNECTOR, 3 POSITION, KEY B
		3	JTP-1811-66AU-RWC	FRAMATOME	TERMINAL, SOCKET, GOLD
C13	1	1	56038152	FRAMATOME	CONNECTOR, 3 POSITION, KEY D
		3	JTP-1811-66AU-RWC	FRAMATOME	TERMINAL, SOCKET, GOLD
C3	1	1	56038152	FRAMATOME	CONNECTOR, 3 POSITION, KEY D
		3	JTP-1811-66AU-RWC	FRAMATOME	TERMINAL, SOCKET, GOLD
		1	3661835	FRAMATOME	
C14	1	1	12162194	PACKARD	CONNECTOR, 2 POSITION, METRI-PACK
		2	12124075	PACKARD	TERMINAL, SOCKET
		1	3656057	ELL-TRON	BOOT
C6	1	1	6098-0144	SUMITOMO	CONNECTOR, 4 POSITION, GRAY
		4	1410-0098	SUMITOMO	TERMINAL, GOLD, 18 AWG
		4	7165-0063	SUMITOMO	SEAL, LIGHT BLUE, 18 AWG
		1	6920-0081	SUMITOMO	WEDGE, 4 POSITION, ORANGE
		1	3656095	ELL-TRON	BOOT
W1	1	1	30703	WAYTEK	TERMINAL, RING, #10, INSULATED
W2	1	1	30706	WAYTEK	TERMINAL, RING, 3/8", INSULATED

NOTE: Loom with black nylon braid w/ red tracers; 28 mil minimum..
Prominently label all connectors as "indicated".

REV	DESCRIPTION OF REVISION	BY	DATE

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1°	IMPERIAL UNITS	METRIC UNITS
THIRD ANGLE PROJECTION		

Fire Power

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NPOWER SYSTEMS
DESIGN CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

HARNESS, WIRE, SENSOR AND ACTUATOR QSL9 FIRE PUMP

DWG UNITS:	DRAWN BY: KAK			DATE: 02 MAY 2008	
	APPD BY:			DATE:	
EST WEIGHT:	SCALE:	DO NOT SCALE	SHEET 10F2	DRAWING NO: 12853	REV:

CIRCUIT #	FROM	PIN1	TO	PIN2	WIRECOLOR	WIRESIZE	WIRE TYPE	TERM 1	TERM 2	STAMP	TWISTED PAIRS
1	C1	2	C10	1	WHITE	18 AWG	GXL	0462-201-3031	0462-201-16141	LIFT PUMP OUT	TWIST
2	C1	4	C10	2	WHITE	18 AWG	GXL	0462-201-3031	0462-201-16141	LIFT PUMP RET	
3	C1	1	C11	3	WHITE	16 AWG	GXL	0462-201-3031	0462-203-12141	CYL #1 OUT +	TWIST
4	C1	3	C11	4	WHITE	16 AWG	GXL	0462-201-3031	0462-203-12141	CYL #1 OUT -	
5	C1	5	C11	2	WHITE	16 AWG	GXL	0462-201-3031	0462-203-12141	CYL #2 OUT +	TWIST
6	C1	6	C11	1	WHITE	16 AWG	GXL	0462-201-3031	0462-203-12141	CYL #2 OUT -	
7	C1	39	C12	1	WHITE	18 AWG	GXL	0462-201-3031	0462-201-1631	FUEL ACT RET	TWIST
8	C1	40	C12	2	WHITE	18 AWG	GXL	0462-201-3031	0462-201-1631	FUEL ACT OUT	
9	C1	15	C13	3	WHITE	18 AWG	GXL	0462-201-3031	JTP-1811-66AU-RWC	CAM SIG	TWIST W/ CIRCUITS 30C & 31C
10	C1	29	C14	B	WHITE	18 AWG	GXL	0462-201-3031	12124075	COOLANT SIG	
11	C1	41	C2	3	WHITE	16 AWG	GXL	0462-201-3031	0462-203-12141	CYL #5 OUT +	TWIST
12	C1	43	C2	4	WHITE	16 AWG	GXL	0462-201-3031	0462-203-12141	CYL # 5 OUT -	
13	C1	46	C2	2	WHITE	16 AWG	GXL	0462-201-3031	0462-203-12141	CYL #6 OUT +	TWIST
14	C1	50	C2	1	WHITE	16 AWG	GXL	0462-201-3031	0462-203-12141	CYL #6 OUT -	
15	C1	7	C3	3	WHITE	18 AWG	GXL	0462-201-3031	JTP-1811-66AU-RWC	CRANK SIG	TWIST
16	C1	9	C3	2	WHITE	18 AWG	GXL	0462-201-3031	JTP-1811-66AU-RWC	CRANK RET	
17	C1	14	C3	1	WHITE	18 AWG	GXL	0462-201-3031	JTP-1811-66AU-RWC	CRANK SUPPLY	
18	C1	8	C4	3	WHITE	16 AWG	GXL	0462-201-3031	0462-203-12141	CYL #3 OUT +	TWIST
19	C1	10	C4	4	WHITE	16 AWG	GXL	0462-201-3031	0462-203-12141	CYL #3 OUT -	
20	C1	21	C4	2	WHITE	16 AWG	GXL	0462-201-3031	0462-203-12141	CYL #4 OUT +	TWIST
21	C1	30	C4	1	WHITE	16 AWG	GXL	0462-201-3031	0462-203-12141	CYL #4 OUT -	
22	C1	28	C5	3	WHITE	18 AWG	GXL	0462-201-3031	JTP-1811-66AU-RWC	AMBIENT SIG	
23	C1	18	C6	1	WHITE	18 AWG	GXL	0462-201-3031	1410-0098	BOOST SIG	
24	C1	20	C6	3	WHITE	18 AWG	GXL	0462-201-3031	1410-0098	IMT SIG	
25	C1	27	C7	3	WHITE	18 AWG	GXL	0462-201-3031	JTP-1811-66AU-RWC	OIL PRESS SIG	
26	W1		C8	3	WHITE	18 AWG	GXL	0462-201-3031	0460-202-16141	PROX SUPPLY	TWIST
27	C1	12	C8	2	WHITE	18 AWG	GXL	0462-201-3031	0460-202-16141	PROX SIG	
28	W2		C8	1	WHITE	18 AWG	GXL	0462-201-3031	0460-202-16141	PROX RET	
29	C1	16	C9	2	WHITE	18 AWG	GXL	0462-201-3031	1-928-498-062	FUEL PRESS SIG	
30	C1	19	SPL A	>	WHITE	18 AWG	GXL	0462-201-3031		SENSOR SUPPLY 2	
30A	C6	2	SPL A	<	WHITE	18 AWG	GXL	1410-0098		BOOST SUPPLY	
30B	C9	3	SPL A	<	WHITE	18 AWG	GXL	1-928-498-062		FUEL PRESS SUPPLY	
30C	C13	1	SPL A	<	WHITE	18 AWG	GXL	JTP-1811-66AU-RWC		CAM SUPPLY	TWIST W/ CIRCUITS 9 & 31C
31	C1	26	SPL B	>	WHITE	18 AWG	GXL	0462-201-3031		SENSOR RET 2	
31A	C6	4	SPL B	<	WHITE	18 AWG	GXL	1410-0098		BOOST RET	
31B	C9	1	SPL B	<	WHITE	18 AWG	GXL	1-928-498-062		FUEL PRESS RET	
31C	C13	2	SPL B	<	WHITE	18 AWG	GXL	JTP-1811-66AU-RWC		CAM RET	TWIST W/ CIRCUITS 30C & 9
31D	C15	2	SPL B	<	WHITE	18 AWG	GXL	0462-201-1631		WIF RET	
32	C1	31	SPL C	>	WHITE	18 AWG	GXL	0462-201-3031		SENSOR SUPPLY 1	
32A	C5	1	SPL C	<	WHITE	18 AWG	GXL	JTP-1811-66AU-RWC		AMBIENT SUPPLY	
32B	C7	1	SPL C	<	WHITE	18 AWG	GXL	JTP-1811-66AU-RWC		OIL PRESS SUPPLY	
33	C1	35	SPL D	>	WHITE	18 AWG	GXL	0462-201-3031		SENSOR RET 1	
33A	C5	2	SPL D	<	WHITE	18 AWG	GXL	JTP-1811-66AU-RWC		AMBIENT RET	
33B	C7	2	SPL D	<	WHITE	18 AWG	GXL	JTP-1811-66AU-RWC		OIL PRESS RET	
33C	C14	A	SPL D	<	WHITE	18 AWG	GXL	12124075		COOLANT RET	
34	C1	17	C15	1	WHITE	18 AWG	GXL	0462-201-3031	0462-201-1631	WIF SIG	

REV	DESCRIPTION OF REVISION	BY	DATE

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1°	IMPERIAL UNITS	METRIC UNITS
THIRD ANGLE PROJECTION		

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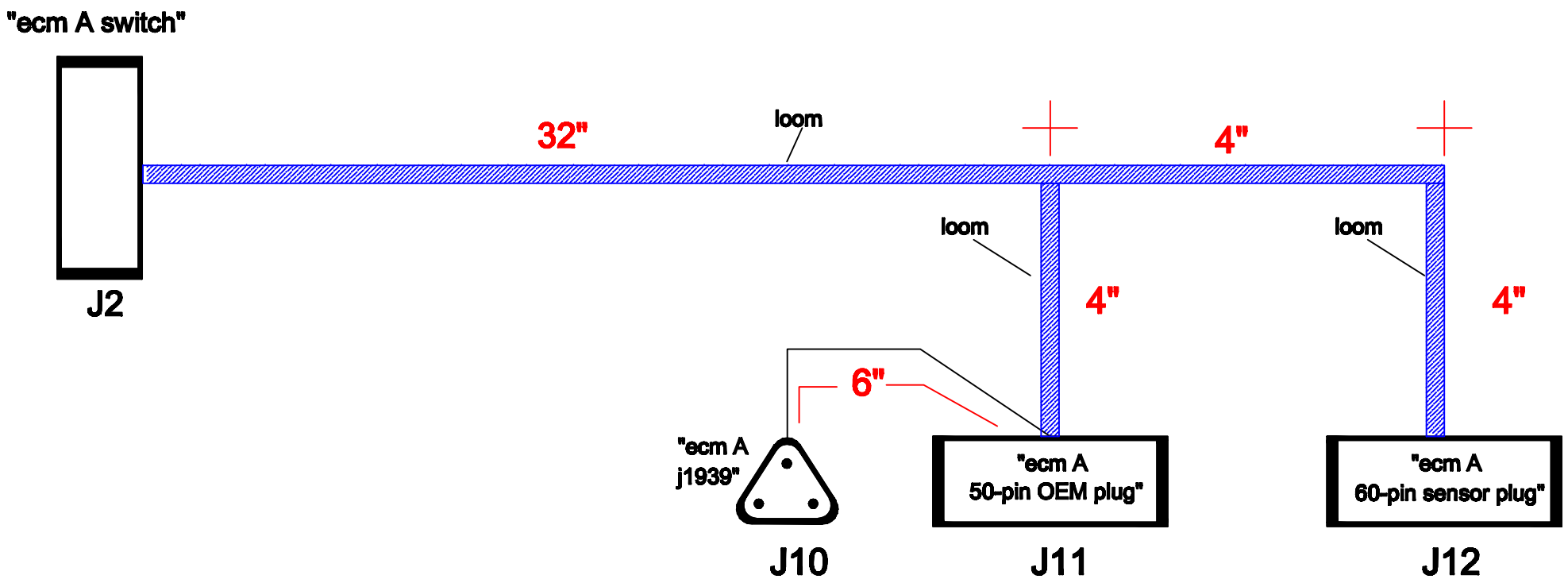
NPOWER SYSTEMS
DESIGN CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

HARNESS, WIRE, SENSOR AND ACTUATOR
QSL9 FIRE PUMP

DWG UNITS:	DRAWN BY: KAK	DATE: 02 MAY 2008
	APPD BY:	DATE:

EST WEIGHT:	SCALE:	DO NOT SCALE	SHEET 20F2	DRAWING NO: 12853	REV:

TAGS	QTY	SUB	CATALOG	MFG	DESC
J2	1	1	DRC26-50S-02	DEUTSCH	CONNECTOR, 50 POSITION, ECM
		1	0528-001-5005	DEUTSCH	BACKSHELL, 90 DEGREE
		40	0462-201-3031	DEUTSCH	TERMINAL, SOCKET
		10	114017	DEUTSCH	PLUG, SEALING
J11	1	1	DRC26-50S-04	DEUTSCH	CONNECTOR, 50 POSITION, ECM
		1	0528-001-5005	DEUTSCH	BACKSHELL, 90 DEGREE
		12	0462-201-3031	DEUTSCH	TERMINAL, SOCKET
		38	114017	DEUTSCH	PLUG, SEALING
J12	1	1	DRC26-60S-05	DEUTSCH	CONNECTOR, 60 POSITION, ECM
		1	0528-002-6005	DEUTSCH	BACKSHELL
		32	0462-201-3031	DEUTSCH	TERMINAL, SOCKET
		28	114017	DEUTSCH	PLUG, SEALING
J10	1	1	DT04-3P	DEUTSCH	CONNECTOR, J1939
		1	W3P	DEUTSCH	WEDGE
		3	0460-202-1631	DEUTSCH	TERMINAL, PIN, GOLD



NOTE: Loom with black nylon braid w/ red tracers; 28 mil minimum..
Prominently label all connectors as "indicated".

REV	DESCRIPTION OF REVISION	BY	DATE

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1°	IMPERIAL UNITS	METRIC UNITS
THIRD ANGLE PROJECTION		

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NPOWER SYSTEMS
DESIGN CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

HARNESS, WIRE, ECM A
QSL9 FIRE PUMP

DWG UNITS:	DRAWN BY: KAK		DATE: 02 MAY 2008	
	APPD BY:		DATE:	
EST WEIGHT:	SCALE: DO NOT SCALE	SHEET 10F2	DRAWING NO: 12854	REV:

CIRCUIT #	FROM	PIN1	TO	PIN2	WIRECOLOR	WIRESIZE	WIRETYPE	TERM 1	TERM 2	STAMP	TWISTED PAIRS
1	J2	47	J12	27	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	CRANK SIG	TWIST W/ CIRCUIT #3
2	J2	49	J12	48	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	CRANK RET	
3	J2	34	J12	16	WHITE	16 AWG	GXL	0462-201-3031	0462-201-3031	SENSOR SUPPLY 3	
4	J2	35	J12	26	WHITE	16 AWG	GXL	0462-201-3031	0462-201-3031	CAM SIG	TWIST W/ CIRCUIT #3
5	J2	36	J12	25	WHITE	16 AWG	GXL	0462-201-3031	0462-201-3031	FUEL PRESS SIG	
6	J2	37	J12	14	WHITE	16 AWG	GXL	0462-201-3031	0462-201-3031	WIF SIG	
7	J2	38	J12	44	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	IMT PRESS SIG	
8	J2	39	J12	37	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	SENSOR SUPPLY 2	
9	J2	40	J12	23	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	IMT TEMP SIG	
10	J2	26	J12	47	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	SENSOR RET 2	
11	J2	27	J12	13	WHITE	16 AWG	GXL	0462-201-3031	0462-201-3031	OIL PRESS SIG	
12	J2	28	J12	3	WHITE	16 AWG	GXL	0462-201-3031	0462-201-3031	AMBIENT SIG	
13	J2	29	J12	15	WHITE	16 AWG	GXL	0462-201-3031	0462-201-3031	COOLANT SIG	
14	J2	31	J12	33	WHITE	16 AWG	GXL	0462-201-3031	0462-201-3031	SENSOR SUPPLY 1	
15	J2	15	J12	38	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	SENSOR RET 1	
16	J2	18	J12	17	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	OIL PRESS SW	
17	J2	19	J12	2	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	FUEL ACT SIG	TWIST
18	J2	20	J12	32	WHITE	16 AWG	GXL	0462-201-3031	0462-201-3031	FUEL ACT RET	
19	J2	42	J12	1	WHITE	16 AWG	GXL	0462-201-3031	0462-201-3031	LIFT PUMP SUPPLY	TWIST
20	J2	44	J12	11	WHITE	16 AWG	GXL	0462-201-3031	0462-201-3031	LIFT PUMP RET	
21	J2	50	J12	45	WHITE	16 AWG	GXL	0462-201-3031	0462-201-3031	CYL #1 OUT +	TWIST
22	J2	30	J12	53	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	CYL #1 OUT -	
23	J2	10	J12	54	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	CYL #2 OUT +	TWIST
24	J2	1	J12	51	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	CYL #2 OUT -	
25	J2	21	J12	55	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	CYL #3 OUT +	TWIST
26	J2	41	J12	52	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	CYL #3 OUT -	
27	J2	48	J12	56	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	CYL #4 OUT +	TWIST
28	J2	43	J12	58	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	CYL #4 OUT -	
29	J2	46	J12	46	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	CYL #5 OUT +	TWIST
30	J2	6	J12	60	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	CYL # 5 OUT -	
31	J2	3	J12	57	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	CYL #6 OUT +	TWIST
32	J2	45	J12	59	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	CYL #6 OUT -	
34	J2	12	J11	12	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	PROX SIG	
36	J2	5	J11	43	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	STOP LAMP	
37	J2	25	J11	44	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	WARNING LAMP	
38	J2	14	J11	2	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	DIAG SW	
39	J2	4	J11	39	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	KEY SWITCH	
40	J2	24	SPLA	>	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	ECM RET	
40A	J11	4	SPLA	<	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	ISC 1 SW	
40B	J11	34	SPLA	<	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	ISC 1 RET	
41	J2	22	J11	25	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	DECREMENT SW	
42	J2	23	J11	24	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	INCREMENT SW	
43	J10	A	J11	46	WHITE	18 AWG	J1939	0460-202-1631	0462-201-3031	YELLOW	USE RAYCHEM 2019D0309 FOR J1939
44	J10	B	J11	47	WHITE	18 AWG	J1939	0460-202-1631	0462-201-3031	GREEN	
45	J10	C	J12	37	WHITE	18 AWG	J1939	0460-202-1631	0462-201-3031	SHIELD	

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1° | IMPERIAL UNITS | METRIC UNITS

THIRD ANGLE PROJECTION

REV	DESCRIPTION OF REVISION	BY	DATE

Fire Power

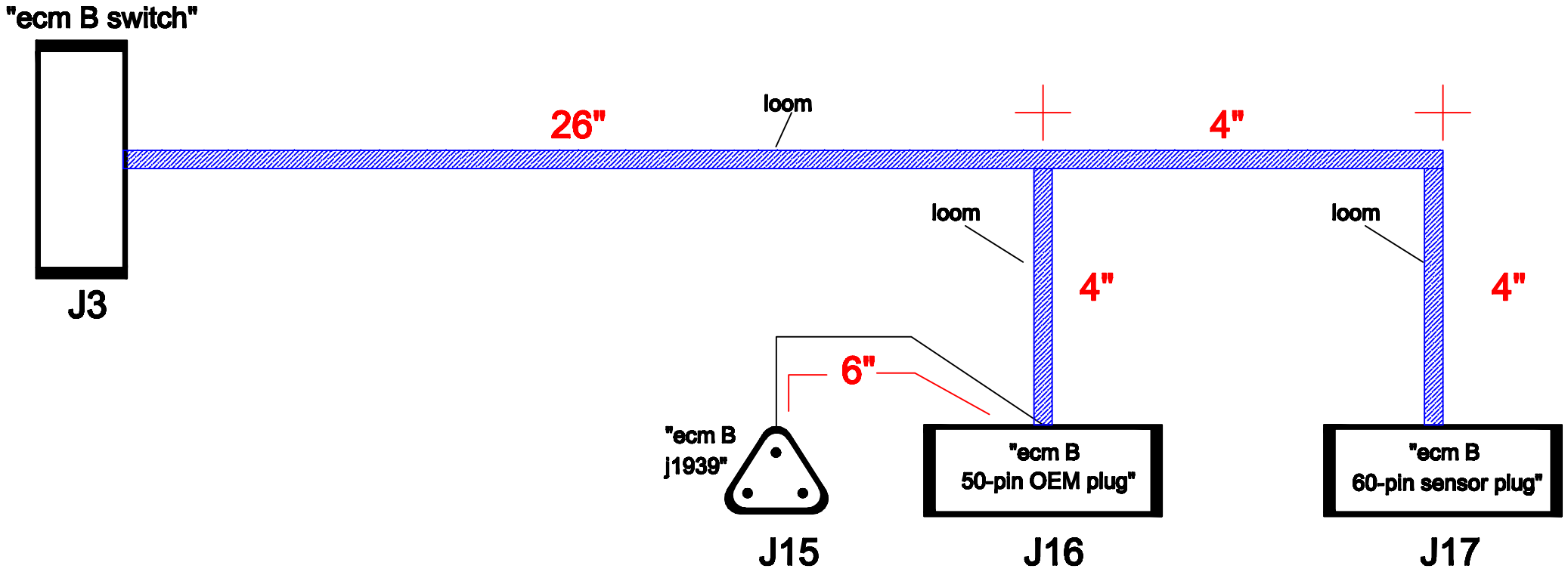
CUMMINS NPOWER, LLC
CORPORATE OFFICE
1600 BUERKLE ROAD
WHITE BEAR LAKE, MN
WWW.NPOWER.CUMMINS.COM

NPOWER SYSTEMS
DESIGN CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

HARNESS, WIRE, ECM A
QSL9 FIRE PUMP

DWG UNITS:	DRAWN BY: KAK			DATE: 02 MAY 2008	
	APPD BY:			DATE:	
EST WEIGHT:	SCALE:	DO NOT SCALE	SHEET 20F2	DRAWING NO: 12854	REV:

TAGS	QTY	SUB	CATALOG	MFG	DESC
J3	1	1	DRC26-50S-03	DEUTSCH	CONNECTOR, 50 POSITION, ECM
		1	0528-001-5005	DEUTSCH	BACKSHELL, 90 DEGREE
		40	0462-201-3031	DEUTSCH	TERMINAL, SOCKET
		10	114017	DEUTSCH	PLUG, SEALING
J16	1	1	DRC26-50S-04	DEUTSCH	CONNECTOR, 50 POSITION, ECM
		1	0528-001-5005	DEUTSCH	BACKSHELL, 90 DEGREE
		12	0462-201-3031	DEUTSCH	TERMINAL, SOCKET
		38	114017	DEUTSCH	PLUG, SEALING
J17	1	1	DRC26-60S-05	DEUTSCH	CONNECTOR, 60 POSITION, ECM
		1	0528-002-6005	DEUTSCH	BACKSHELL
		32	0462-201-3031	DEUTSCH	TERMINAL, SOCKET
		28	114017	DEUTSCH	PLUG, SEALING
J15	1	1	DT04-3P	DEUTSCH	CONNECTOR, J1939
		1	W3P	DEUTSCH	WEDGE
		3	0460-202-1631	DEUTSCH	TERMINAL, PIN, GOLD



NOTE: Loom with black nylon braid w/ red tracers; 28 mil minimum..
Prominently label all connectors as "indicated".

REV	DESCRIPTION OF REVISION	BY	DATE

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

Fire Power

CUMMINS NPOWER, LLC
CORPORATE OFFICE
1600 BUERKLE ROAD
WHITE BEAR LAKE, MN
WWW.NPOWER.CUMMINS.COM

NPOWER SYSTEMS
DESIGN CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

HARNESS, WIRE, ECM B
QSL9 FIRE PUMP

DWG UNITS:	DRAWN BY: KAK	DATE: 02 MAY 2008
	APPD BY:	DATE:

EST WEIGHT:	SCALE:	DO NOT SCALE	SHEET 10F2	DRAWING NO: 12855	REV:

CIRCUIT #	FROM	PIN1	TO	PIN2	WIRECOLOR	WIRESIZE	WIRE TYPE	TERM 1	TERM 2	STAMP	TWISTED PAIRS
1	J3	7	J17	27	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	CRANK SIG	TWIST W/ CIRCUIT #3
2	J3	9	J17	48	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	CRANK RET	
3	J3	14	J17	16	WHITE	16 AWG	GXL	0462-201-3031	0462-201-3031	SENSOR SUPPLY 3	
4	J3	15	J17	26	WHITE	16 AWG	GXL	0462-201-3031	0462-201-3031	CAM SIG	TWIST W/ CIRCUIT #3
5	J3	16	J17	25	WHITE	16 AWG	GXL	0462-201-3031	0462-201-3031	FUEL PRESS SIG	
6	J3	17	J17	14	WHITE	16 AWG	GXL	0462-201-3031	0462-201-3031	WIF SIG	
7	J3	18	J17	44	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	IMT PRESS SIG	
8	J3	19	J17	37	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	SENSOR SUPPLY 2	
9	J3	20	J17	23	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	IMT TEMP SIG	
10	J3	26	J17	47	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	SENSOR RET 2	
11	J3	27	J17	13	WHITE	16 AWG	GXL	0462-201-3031	0462-201-3031	OIL PRESS SIG	
12	J3	28	J17	3	WHITE	16 AWG	GXL	0462-201-3031	0462-201-3031	AMBIENT SIG	
13	J3	29	J17	15	WHITE	16 AWG	GXL	0462-201-3031	0462-201-3031	COOLANT SIG	
14	J3	31	J17	33	WHITE	16 AWG	GXL	0462-201-3031	0462-201-3031	SENSOR SUPPLY 1	
15	J3	35	J17	38	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	SENSOR RET 1	
16	J3	38	J17	17	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	OIL PRESS SW	
17	J3	39	J17	2	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	FUEL ACT SIG	TWIST
18	J3	40	J17	32	WHITE	16 AWG	GXL	0462-201-3031	0462-201-3031	FUEL ACT RET	
19	J3	2	J17	1	WHITE	16 AWG	GXL	0462-201-3031	0462-201-3031	LIFT PUMP SUPPLY	TWIST
20	J3	4	J17	11	WHITE	16 AWG	GXL	0462-201-3031	0462-201-3031	LIFT PUMP RET	
21	J3	1	J17	45	WHITE	16 AWG	GXL	0462-201-3031	0462-201-3031	CYL #1 OUT +	TWIST
22	J3	3	J17	53	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	CYL #1 CUT -	
23	J3	5	J17	54	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	CYL #2 OUT +	TWIST
24	J3	6	J17	51	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	CYL #2 CUT -	
25	J3	8	J17	55	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	CYL #3 OUT +	TWIST
26	J3	10	J17	52	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	CYL #3 CUT -	
27	J3	21	J17	56	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	CYL #4 OUT +	TWIST
28	J3	30	J17	58	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	CYL #4 CUT -	
29	J3	41	J17	46	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	CYL #5 OUT +	TWIST
30	J3	43	J17	60	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	CYL # 5 OUT -	
31	J3	46	J17	57	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	CYL #6 OUT +	TWIST
32	J3	50	J17	59	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	CYL #6 CUT -	
34	J3	12	J16	12	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	PROX SIG	
36	J3	45	J16	43	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	STOP LAMP	
37	J3	25	J16	44	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	WARNING LAMP	
38	J3	34	J16	2	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	DIAG SW	
39	J3	44	J16	39	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	KEY SWITCH	
40	J3	24	SPLA	>	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	ECM RET	
40A	J16	4	SPLA	<	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	ISC 1 SW	
40B	J16	34	SPLA	<	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	ISC 1 RET	
41	J3	22	J16	25	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	DECREMENT SW	
42	J3	23	J16	24	WHITE	18 AWG	GXL	0462-201-3031	0462-201-3031	INCREMENT SW	
43	J15	A	J16	46	WHITE	18 AWG	J1939	0460-202-1631	0462-201-3031	YELLOW	USE RAYCHEM 2019D0309 FOR J1939
44	J15	B	J16	47	WHITE	18 AWG	J1939	0460-202-1631	0462-201-3031	GREEN	
45	J15	C	J12	37	WHITE	18 AWG	J1939	0460-202-1631	0462-201-3031	SHIELD	

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1°	IMPERIAL UNITS	METRIC UNITS
THIRD ANGLE PROJECTION		

REV	DESCRIPTION OF REVISION	BY	DATE

Fire Power

CUMMINS NPOWER, LLC
CORPORATE OFFICE
1600 BUERKLE ROAD
WHITE BEAR LAKE, MN
WWW.NPOWER.CUMMINS.COM

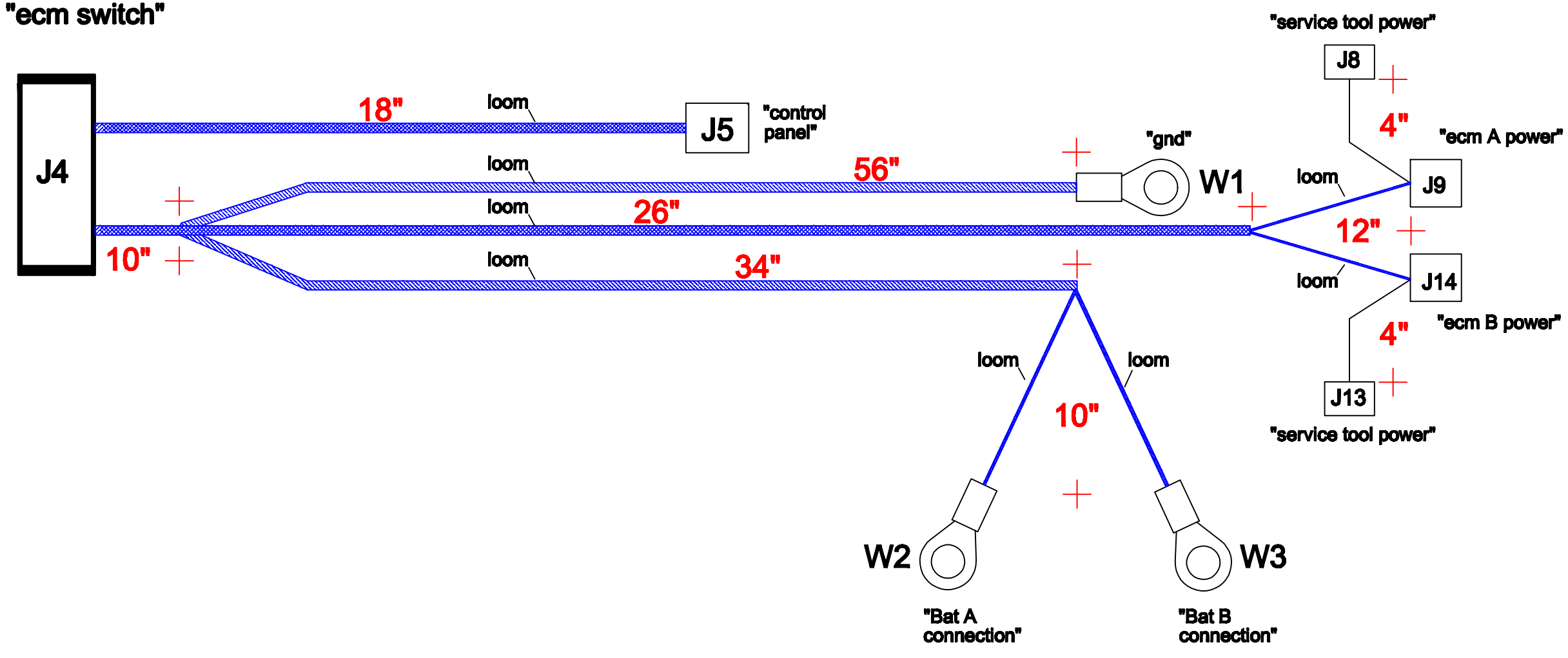
NPOWER SYSTEMS
DESIGN CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

HARNESS, WIRE, ECM B
QSL9 FIRE PUMP

DWG UNITS:	DRAWN BY: KAK	DATE: 02 MAY 2008
	APPD BY:	DATE:

EST WEIGHT:	SCALE:	DO NOT SCALE	SHEET 20F2	DRAWING NO: 12855	REV:

TAGS	QTY	SUB	CATALOG	MFG	DESC
J4	1	1	DRC26-50S-04	DEUTSCH	CONNECTOR, 50 POSITION, ECM
		1	0528-001-5005	DEUTSCH	BACKSHELL, 90 DEGREE
		49	0462-201-3031	DEUTSCH	TERMINAL, SOCKET
		1	114017	DEUTSCH	PLUG, SEALING
J5	1	1	HDP26-24-21SN	DEUTSCH	CONNECTOR, 21 POSITION
		9	0462-201-16141	DEUTSCH	TERMINAL, SOCKET, NICKEL
		12	114017	DEUTSCH	PLUG, SEALING
J8, J13	2	1	12010973	PACKARD	CONNECTOR, 2 POSITION
		2	12124587	PACKARD	TERMINAL, PIN
		2	12015193	PACKARD	SEAL, WEATHER
J8A, J13A	2	1	12015792	PACKARD	CONNECTOR, 2 POSITION
		2	12010300	PACKARD	PLUG, SEALING
J9, J14	2	1	DTP06-4S	DEUTSCH	CONNECTOR, 4 POSITION
		4	1062-12-0166	DEUTSCH	TERMINAL, SOCKET, NICKEL
		1	WP-4S	DEUTSCH	WEDGE LOCK
W1	1	1	32706	WAYTEK	TERMINAL, RING, 1/2", 10 AWG
W2, W3	2	1	32705	WAYTEK	TERMINAL, RING, 3/8", 10AWG



NOTE: Loom with black nylon braid w/ red tracers; 28 mil minimum.

Prominently label all connectros as "indicated".

Mate connectors J8A and J13A to J8 and J13.

REV	DESCRIPTION OF REVISION	BY	DATE

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1° | IMPERIAL UNITS | METRIC UNITS

THIRD ANGLE PROJECTION

Fire Power

CUMMINS NPOWER, LLC
CORPORATE OFFICE
1600 BUERKLE ROAD
WHITE BEAR LAKE, MN
WWW.NPOWER.CUMMINS.COM

NPOWER SYSTEMS
DESIGN CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

HARNESS, WIRE, OEM
QSL9 FIRE PUMP

DWG UNITS:	DRAWN BY: KAK		DATE: 02 MAY 2008	
	APPD BY:		DATE:	
EST WEIGHT:	SCALE: DO NOT SCALE	SHEET 10F2	DRAWING NO: 12856	REV:

CIRCUIT #	FROM	PIN1	TO	PIN2	WIRECOLOR	WIRESIZE	WIRE TYPE	TERM 1	TERM 2	STAMP
1	J4	1	J5	A	WHITE	18 AWG	GXL	0462-201-3031	0462-201-16141	STOP LAMP
2	J4	2	J5	C	WHITE	18 AWG	GXL	0462-201-3031	0462-201-16141	WARNING LAMP
3	J4	3	J5	K	WHITE	18 AWG	GXL	0462-201-3031	0462-201-16141	DIAG SW
4	J4	4	J5	X	WHITE	18 AWG	GXL	0462-201-3031	0462-201-16141	KEY SW
5	J4	5	J5	S	WHITE	18 AWG	GXL	0462-201-3031	0462-201-16141	ECM RET
6	J4	6	J5	P	WHITE	18 AWG	GXL	0462-201-3031	0462-201-16141	DECREMENT SW
7	J4	7	J5	M	WHITE	18 AWG	GXL	0462-201-3031	0462-201-16141	INCREMENT SW
8	J4	8	J5	F	WHITE	18 AWG	GXL	0462-201-3031	0462-201-16141	ECM A
9	J4	9	J5	H	WHITE	18 AWG	GXL	0462-201-3031	0462-201-16141	ECM B
10	W2		SPL A	>	ORANGE	10 AWG	GXL	32705		BAT A+
10A	J4	11	SPL A	<	ORANGE	20 AWG	GXL	0462-201-3031		BAT A+
10B	J4	12	SPL A	<	ORANGE	20 AWG	GXL	0462-201-3031		BAT A+
10C	J4	13	SPL A	<	ORANGE	20 AWG	GXL	0462-201-3031		BAT A+
10D	J4	14	SPL A	<	ORANGE	20 AWG	GXL	0462-201-3031		BAT A+
10E	J4	15	SPL A	<	ORANGE	20 AWG	GXL	0462-201-3031		BAT A+
10F	J4	16	SPL A	<	ORANGE	20 AWG	GXL	0462-201-3031		BAT A+
10G	J4	17	SPL A	<	ORANGE	20 AWG	GXL	0462-201-3031		BAT A+
10H	J4	18	SPL A	<	ORANGE	20 AWG	GXL	0462-201-3031		BAT A+
10J	J4	19	SPL A	<	ORANGE	20 AWG	GXL	0462-201-3031		BAT A+
10K	J4	20	SPL A	<	ORANGE	20 AWG	GXL	0462-201-3031		BAT A+
11	W3		SPL B	>	YELLOW	10 AWG	GXL	32705		BAT B+
11A	J4	21	SPL B	<	YELLOW	20 AWG	GXL	0462-201-3031		BAT B+
11B	J4	22	SPL B	<	YELLOW	20 AWG	GXL	0462-201-3031		BAT B+
11C	J4	23	SPL B	<	YELLOW	20 AWG	GXL	0462-201-3031		BAT B+
11D	J4	24	SPL B	<	YELLOW	20 AWG	GXL	0462-201-3031		BAT B+
11E	J4	25	SPL B	<	YELLOW	20 AWG	GXL	0462-201-3031		BAT B+
11F	J4	26	SPL B	<	YELLOW	20 AWG	GXL	0462-201-3031		BAT B+
11G	J4	27	SPL B	<	YELLOW	20 AWG	GXL	0462-201-3031		BAT B+
11H	J4	28	SPL B	<	YELLOW	20 AWG	GXL	0462-201-3031		BAT B+
11J	J4	29	SPL B	<	YELLOW	20 AWG	GXL	0462-201-3031		BAT B+
11K	J4	30	SPL B	<	YELLOW	20 AWG	GXL	0462-201-3031		BAT B+
12	J9	3	SPL C	>	RED	12 AWG	GXL	1062-12-0166		BAT +
12A	J9	4	SPL C	>	RED	12 AWG	GXL	1062-12-0166		BAT +
12B	J14	3	SPL C	>	RED	12 AWG	GXL	1062-12-0166		BAT +
12C	J14	4	SPL C	>	RED	12 AWG	GXL	1062-12-0166		BAT +
12D	J4	31	SPL C	<	RED	20 AWG	GXL	0462-201-3031		BAT +
12E	J4	32	SPL C	<	RED	20 AWG	GXL	0462-201-3031		BAT +
12F	J4	33	SPL C	<	RED	20 AWG	GXL	0462-201-3031		BAT +
12G	J4	34	SPL C	<	RED	20 AWG	GXL	0462-201-3031		BAT +
12H	J4	35	SPL C	<	RED	20 AWG	GXL	0462-201-3031		BAT +
12J	J4	36	SPL C	<	RED	20 AWG	GXL	0462-201-3031		BAT +
12K	J4	37	SPL C	<	RED	20 AWG	GXL	0462-201-3031		BAT +
12L	J4	38	SPL C	<	RED	20 AWG	GXL	0462-201-3031		BAT +
12M	J4	39	SPL C	<	RED	20 AWG	GXL	0462-201-3031		BAT +
12N	J4	40	SPL C	<	RED	20 AWG	GXL	0462-201-3031		BAT +
12P	J8	A	SPL C	>	RED	16 AWG	GXL	12124587		ECM A +
12Q	J13	A	SPL C	>	RED	16 AWG	GXL	12124587		ECM B +
13	W1		SPL D	>	GREEN	10 AWG	GXL	32706		GND
13A	J9	1	SPL D	>	GREEN	12 AWG	GXL	1062-12-0166		GND
13B	J9	2	SPL D	>	GREEN	12 AWG	GXL	1062-12-0166		GND
13C	J14	1	SPL D	>	GREEN	12 AWG	GXL	1062-12-0166		GND
13D	J14	2	SPL D	>	GREEN	12 AWG	GXL	1062-12-0166		GND
13E	J4	41	SPL D	<	GREEN	20 AWG	GXL	0462-201-3031		GND
13F	J4	42	SPL D	<	GREEN	20 AWG	GXL	0462-201-3031		GND
13G	J4	43	SPL D	<	GREEN	20 AWG	GXL	0462-201-3031		GND
13H	J4	44	SPL D	<	GREEN	20 AWG	GXL	0462-201-3031		GND
13J	J4	45	SPL D	<	GREEN	20 AWG	GXL	0462-201-3031		GND
13K	J4	46	SPL D	<	GREEN	20 AWG	GXL	0462-201-3031		GND
13L	J4	47	SPL D	<	GREEN	20 AWG	GXL	0462-201-3031		GND
13M	J4	48	SPL D	<	GREEN	20 AWG	GXL	0462-201-3031		GND
13N	J4	49	SPL D	<	GREEN	20 AWG	GXL	0462-201-3031		GND
13P	J4	50	SPL D	<	GREEN	20 AWG	GXL	0462-201-3031		GND
13Q	J8	B	SPL D	>	GREEN	16 AWG	GXL	12124587		ECM A GND
13R	J13	B	SPL D	>	GREEN	16 AWG	GXL	12124587		ECM B GND

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1°	IMPERIAL UNITS	METRIC UNITS
THIRD ANGLE PROJECTION	X.X ± 0.1 X.XX ± 0.05 X.XXX ± 0.010 X.XXXX ± 0.0050	X.X ± 0.1 X.XX ± 0.05 X.XXX ± 0.010 X.XXXX ± 0.0050

REV	DESCRIPTION OF REVISION	BY	DATE

Fire Power

CUMMINS NPOWER, LLC
CORPORATE OFFICE
1600 BUERKLE ROAD
WHITE BEAR LAKE, MN
WWW.NPOWER.CUMMINS.COM

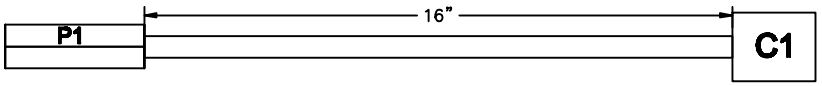
NPOWER SYSTEMS
DESIGN CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

HARNESS, WIRE, OEM
QSL9 FIRE PUMP

DWG UNITS:	DRAWN BY: KAK	DATE: 02 MAY 2008
	APPD BY:	DATE:

EST WEIGHT:	SCALE:	DO NOT SCALE	SHEET 2OF2	DRAWING NO: 12856	REV:

ITEM #	QTY	SUB	CATALOG	MFG	DESC
P1	1	1	E2EH-X3C1	OMRON	SWITCH, PROXIMITY, 2m CABLE, 12-24V
C1	1	1	DT06-4S	DEUTSCH	CONNECTOR, 4 POSITION
		3	0462-201-16141	DEUTSCH	TERMINAL, SOCKET, NICKEL
		1	W4S	DEUTSCH	WEDGE LOCK
		1	114017	DEUTSCH	PLUG, SEALING



CIRCUIT #	FROM	PIN1	TO	PIN2	WIRECOLOR	WIRESIZE	WIRE TYPE	TERM 1	TERM 2	STAMP
1	P1		C1	3	BROWN	28 AWG	PURCHASED LEAD		0462-201-16141	PROX SUPPLY
2	P1		C1	2	BLACK	28 AWG	PURCHASED LEAD		0462-201-16141	PROX SIG
3	P1		C1	1	BLUE	28 AWG	PURCHASED LEAD		0462-203-12141	PROX RET

OMRON P/N E2EH-X3C1-2M-U1
PREFERRED SUPPLIER: OMRON ELECTRONICS

NOTES: 1) Strip wire insulation 1/2" and fold back strands to double up in terminal.
2) Add self laminating label showing Cummins NPower and part number.

REV	DESCRIPTION OF REVISION	BY	DATE
A	ADDED PREFERRED VENDOR AND MANUFACTURER P/N	KAK	08/06/08

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1°	IMPERIAL UNITS	METRIC UNITS
THIRD ANGLE PROJECTION		

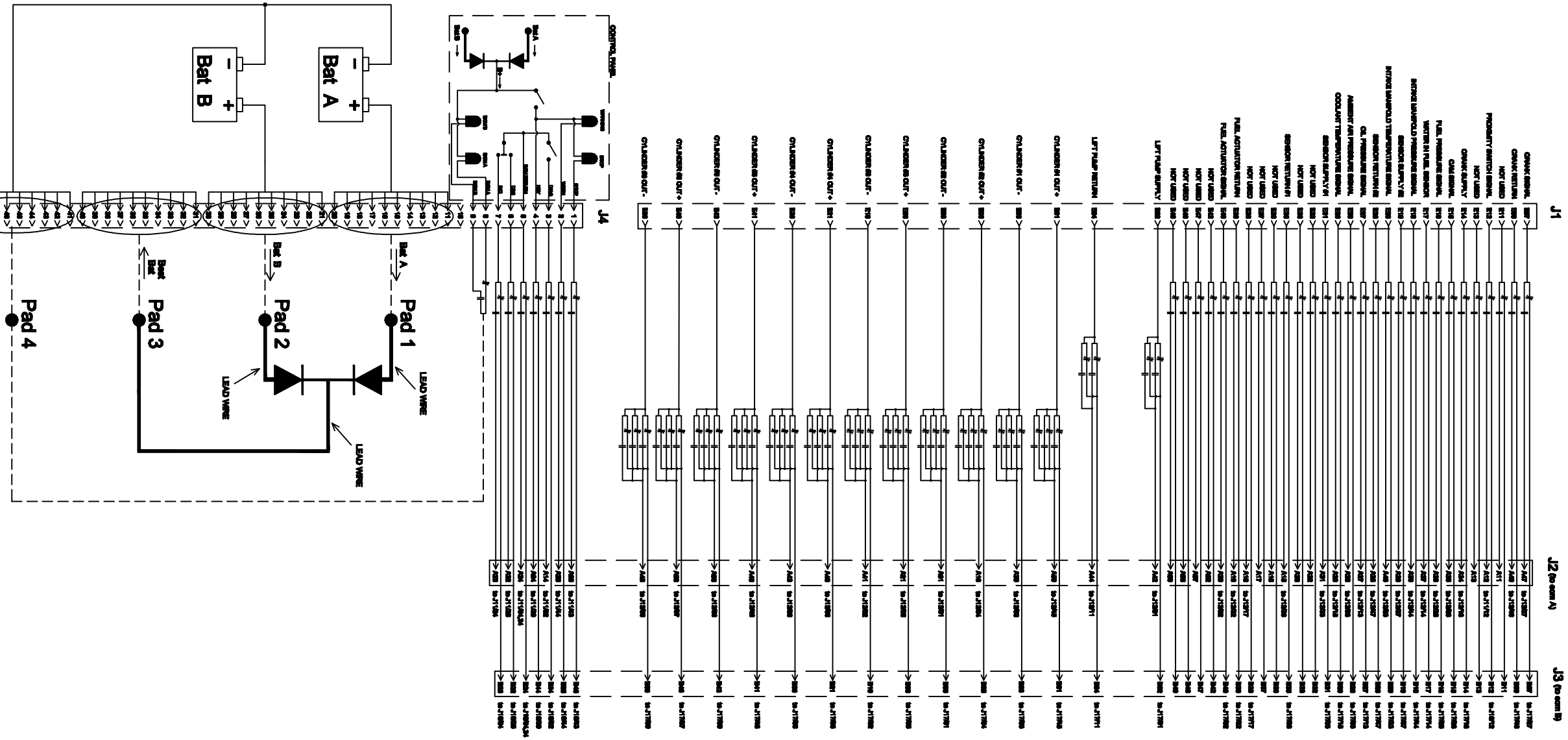
Fire Power

CUMMINS NPOWER, LLC
CORPORATE OFFICE
1400 BUERKLE ROAD
WHITE BEAR LAKE, MN
WWW.NPOWER.CUMMINS.COM

NPOWER SYSTEMS
DESIGN CENTER
675 LAWRENCE DRIVE
DEPERE, WISCONSIN

SWITCH, PROXIMITY, 12–24V, 2m CABLE, 3 WIRE
QSL9 FIRE PUMP

DWG UNITS:	DRAWN BY: KAK	DATE: 06 MAY 2008
	APPD BY:	DATE:
EST WEIGHT:	SCALE: DO NOT SCALE	SHEET 10F1
	DRAWING NO: 12865	REV: A



UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1°

THIRD ANGLE PROJECTION

IMPERIAL UNITS

METRIC UNITS

REV	DESCRIPTION OF REVISION	BY	DATE

Fire Power

CUMMINS NPOWER, LLC
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1600 BUERKLE ROAD
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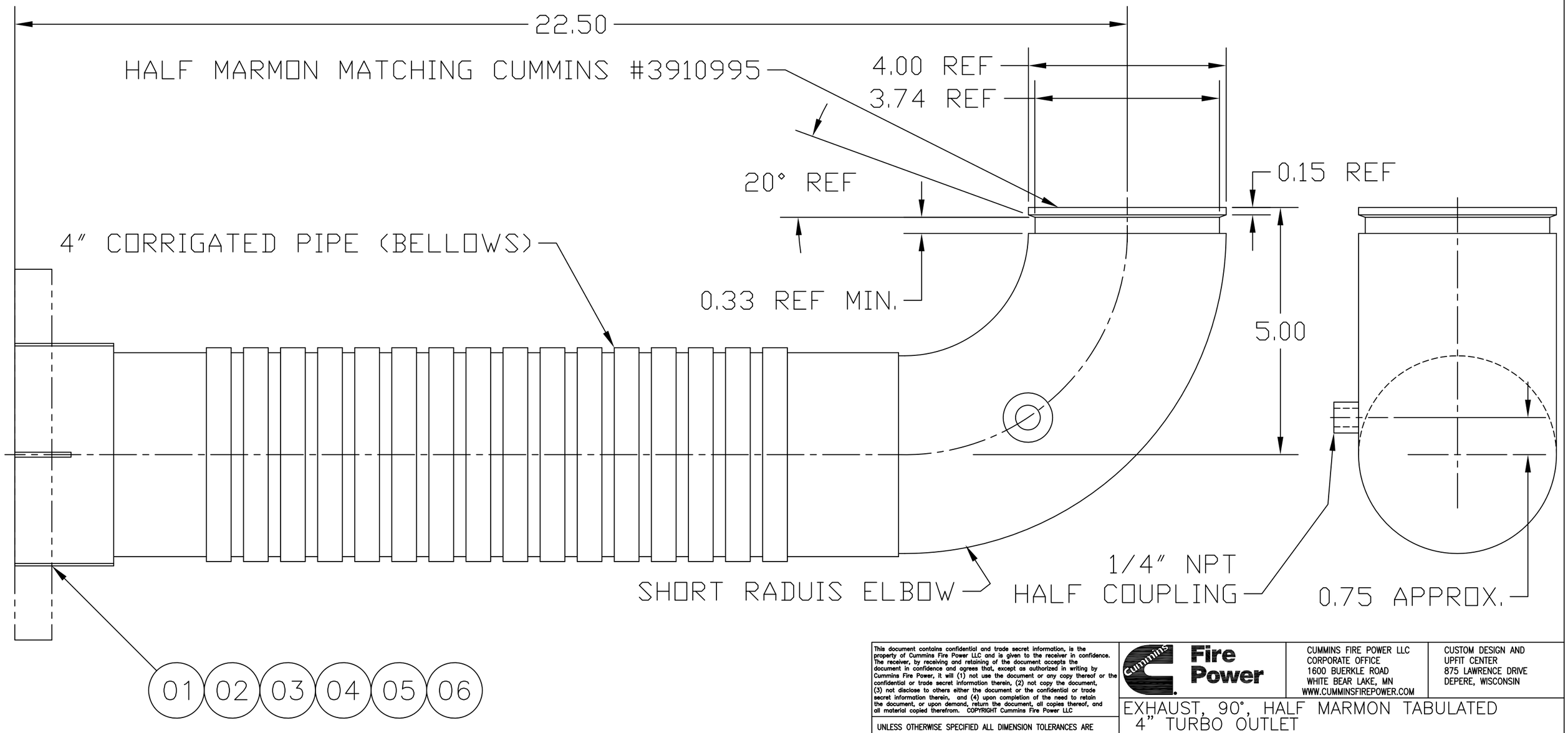
WWW.NPOWER.CUMMINS.COM

NPOWER SYSTEMS
DESIGN CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

SCHEMATIC, ECM SWITCH MAPPING
QSL9 FIREPUMP

DWG UNITS:	DRAWN BY: KAK			DATE: 12 NOV 2008
	APPD BY:			DATE:
EST WEIGHT:	SCALE:	DO NOT SCALE	SHEET 10F1	DRAWING NO: 13958 REV:

ITEM	QTY	DESCRIPTION	MATERIAL
01	A/R	4" MALE NPT	
02	A/R	4" I.D. CUFF	
03	A/R	4" (9" OD) 125# ANSI FLANGE	
04	A/R	5" (10" OD) 125# ANSI FLANGE	
05	A/R	6" (11" OD) 125# ANSI FLANGE	
06	A/R	8" (13–1/2" OD) 125# ANSI FLANGE	



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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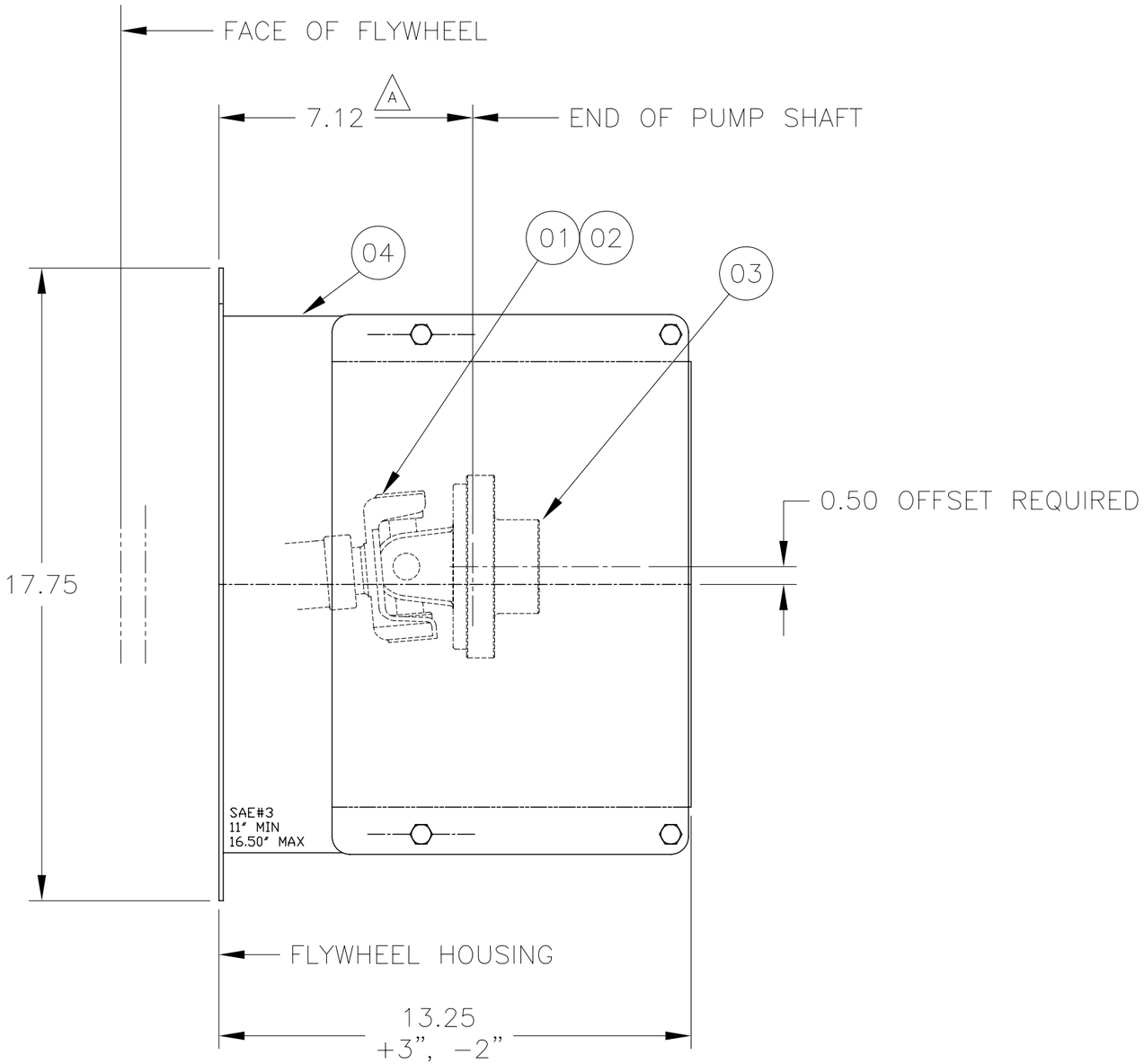
CUSTOM DESIGN AND
UPFIT CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

EXHAUST, 90°, HALF MARMON TABULATED 4" TURBO OUTLET

DWG UNITS: INCH/LB/S	DRAWN BY: DAVE N	DATE: 09MAR2004
	AUTO CAD	REF DRWG:
SCALE: 1/2	SHEET 10F1	DRAWING NO: 8780
EST WEIGHT:		

REV		DESCRIPTION OF REVISION	BY	DATE
D	2009–050	ADDED –04 & –05 & –06	DAN	11–NOV–09
REV	ENF	DESCRIPTION OF REVISION	BY	DATE

ITEM	QTY	DESCRIPTION	MATERIAL
01	1	U-JOINT ADAPT, SAE#3, HAYES #127513-02	8615
02	1	DRIVE SHAFT, 1480	8613
03	1	COMPANION FLANGE, SEE WO FOR BORE	8608-__
04	1	ASSEMBLY, TELESOPING GUARD, CFP59	9494



REV	DESCRIPTION OF REVISION	BY	DATE
A	7.12 WAS 7.25 PER 1480 MEAN LG OF 9.00"	JDT	10MAY07

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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DWG SCALE: 1/4	DRAWN BY: DAVE N	DATE: 20JUN2005
PLOT SCALE:	APPD BY:	DATE:

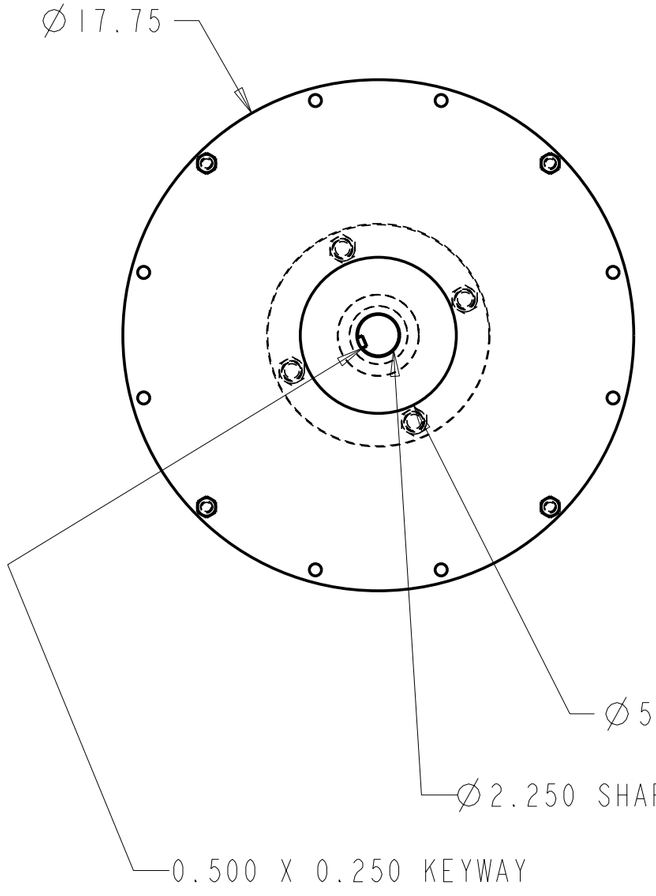
DESCRIPTION
ASSEMBLY, DRIVE SHAFT W/ GUARD

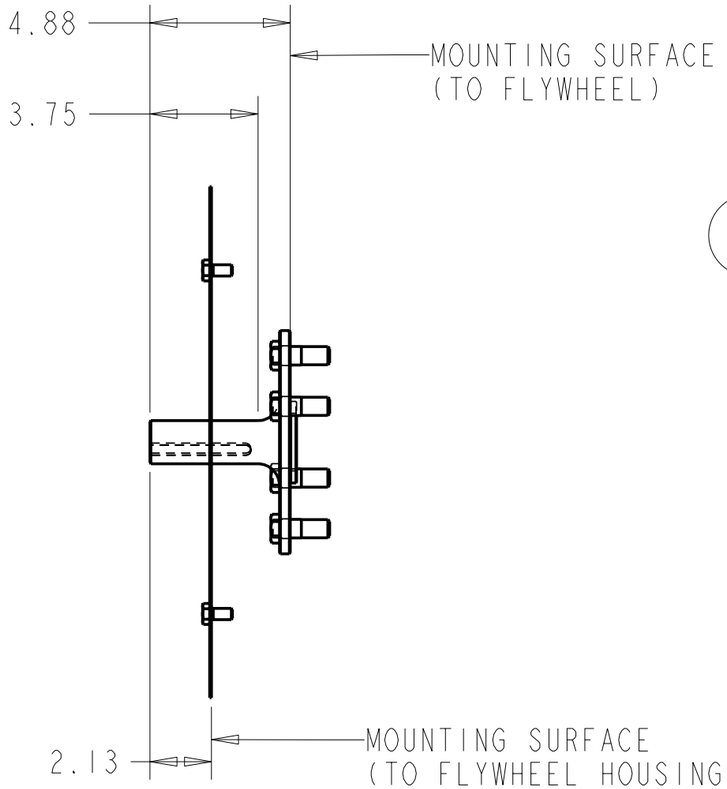
REFERENCE:
CFP59-83, 1480 DRIVE SHAFT

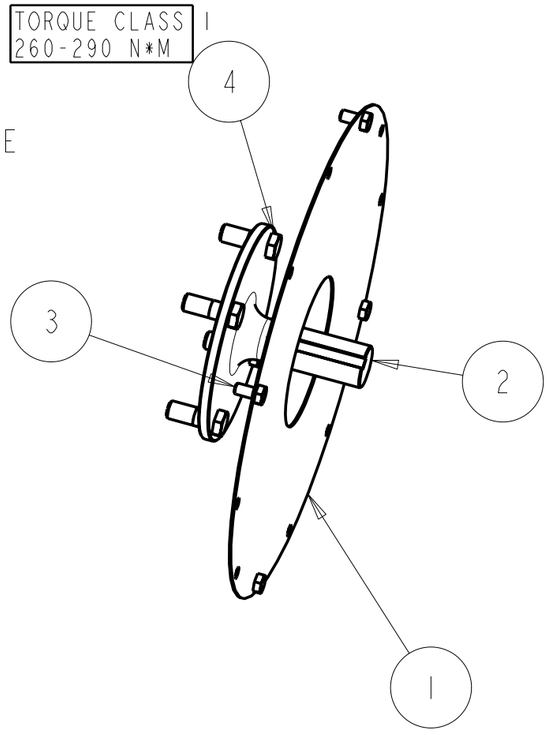
DRAWING NUMBER:
10165A

BILL OF MATERIAL

ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	GUARD, STUB SHAFT, SAE #3 FLYWHEEL, FIREPUMP	8611
2	1	STUB SHAFT, SAE #3 FLYWHEEL, HAYES #, FIREPUMP	9624
3	4	SCREW, CAP, HEX HEAD, M10 x 20	HHCS_M10_20
4	4	SCREW, CAP, HEX HEAD, M10 x 50	HHCS_M16_50







REV	DESCRIPTION OF REVISION	REV BY	DATE
B	GUARD WAS 9553	DAVE N	20JAN05
A	ADDED HARDWARE	DAVE N	21OCT04

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	MACHINE TOLERANCES X : ± 1.5 X.X : ± 0.5 X.XX : ± 0.05
WELD TOLERANCES X : ± 0.25 .XX : ± 0.12 .XXX : ± 0.06	WELDED TOLERANCES X : ± 5 X.X : ± 3 X.XX : ± 1.50

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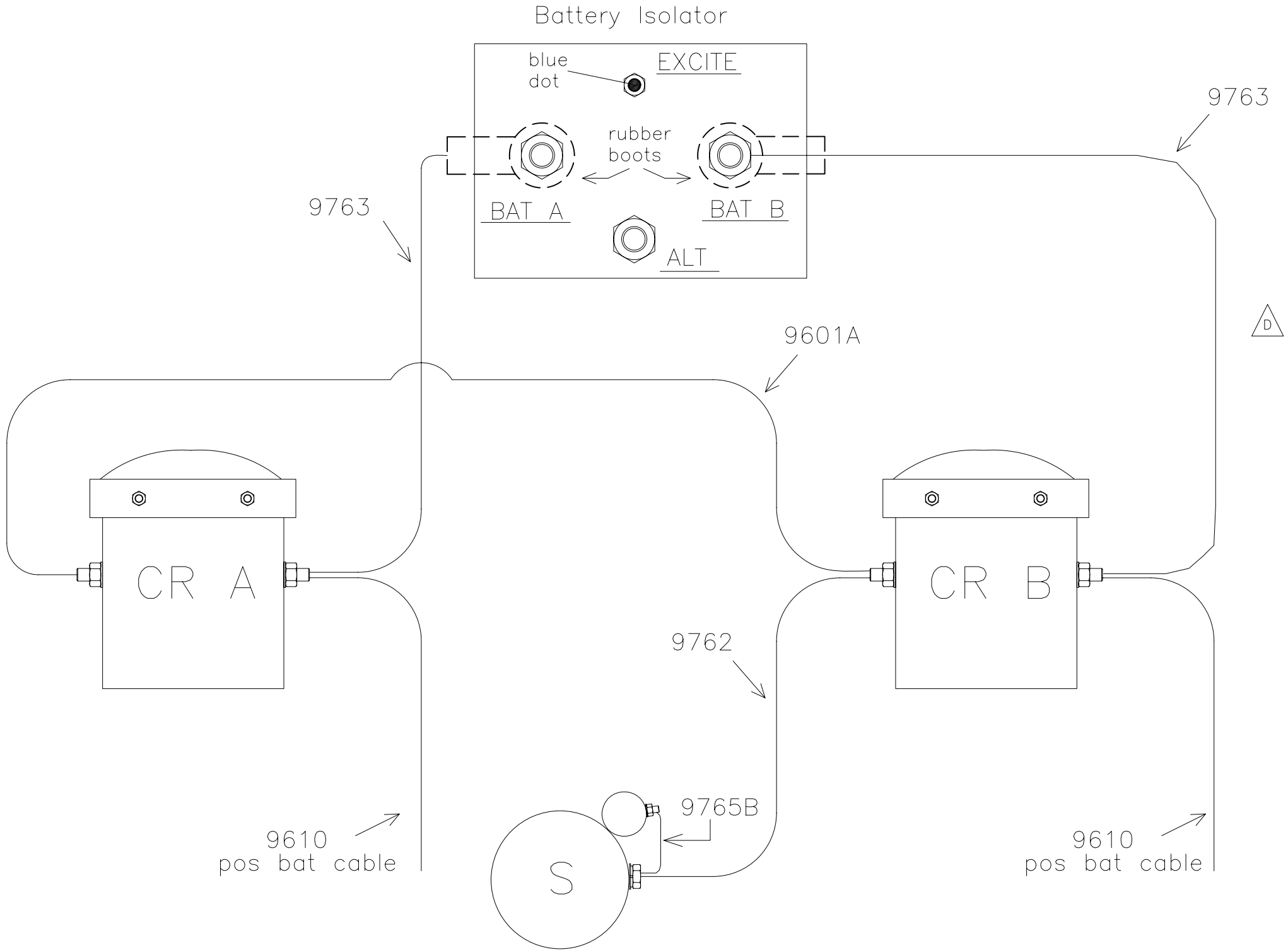
DEPERE, WISCONSIN

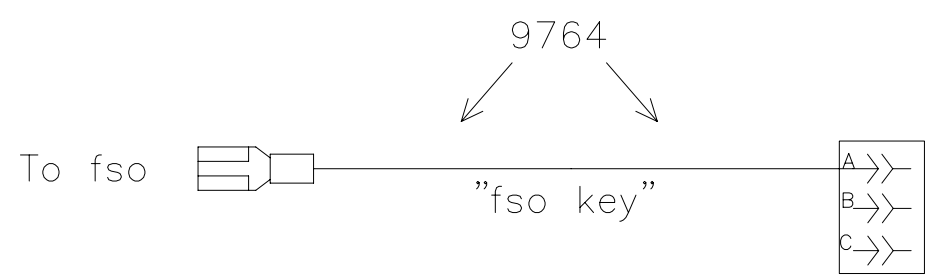
TITLE 1: ASSEMBLY, STUB SHAFT, 2.25" DIA
TITLE 2: FIREPUMP

DWG UNITS:	DRAWN BY: DAVE N	DATE: 15OCT2004
IN/LB/S	APPD BY: -	DATE: -

EST WEIGHT:	SCALE:	DO NOT SCALE	SHEET	DRAWING NO:	REV:
42238.628	0.200		1OF1	8619	B



P/N	DESCRIPTION	QTY
9601A	Cable, Battery Contactor Jumper	1
9762A	Cable, Contactor to Starter	1
△D 9763B	Cable, Isolator to Battery	2
9764	Wire, FSO Connector	1
9765B	Wire, Starter Solenoid Jumper	1
9609	Battery Cable Kit (optional)	1



(neg bat cable: 9611)
(not shown)

REV	DESCRIPTION OF REVISION	BY	DATE
D	CHANGED P/N 9763 TO REV B	RJS	6 NOV 06
C	CHANGED P/N 9765 TO REV B	RJS	25 JULY 06
B	P/N 9601 CHG'D TO REV A	RJS	30 NOV 05
A2	MOVED THE CR A–TO–CR B JUMPER	]RJS	2 JULY 05
A1	ADDED REV # TO THE P/N'S	RJS	17 JUNE 05
A	ADDED WIRING DIAGRAM	RJS	5 JAN 05

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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DEPERE, WISCONSIN

DWG SCALE:	DRAWN BY: RJS	DATE: 6 DEC 2004
PLOT SCALE:	APPD BY:	DATE:

DESCRIPTION
KIT, LOOSE WIRES

REFERENCE:
4B, 6B, 6C, QSB, & QSC

DRAWING NUMBER:
9767_D

BATTERY A+
PIN 16
RED/YLW
BATT A+
10AWG
CB 1
(30A)
RED/YLW VM A
RED/YLW
FUSED A+
TB 6
BATTERY B+
PIN 18
RED/ORNG
BATT B+
CB 2
(30A)
RED/ORNG VM B
NEGATIVE TO GND
PIN 14
BLACK
VOLTMETER BAT A
VOLTMETER BAT B
BEST BATTERY DIODE BLOCK
RED/ORNG
FUSED B+
TB 8
RED BAT POS
PIN 12
SWITCHED B+
SIGNAL PWR
PURPLE
PIN 17
PIN 13
RAW
RAW WATER SOLENOID
TB 1
ORANGE
AUTO
MANUAL
SW PWR
K1
TACH
GRAY/RED MPU +
WATER TEMP GUAGE
WHITE WTG
PIN 5
WATER TEMP SENDER
OIL PRESS GUAGE
WHITE OPG
PIN 4
OIL PRESS SENDER
TB 11
HIGH WATER TEMP LAMP
WHITE HWTL
D1
TB 5
PIN 7
HI WTR TEMP SW.
LOW OIL PRESS LAMP
WHITE LOPL
D2
TB 4
LO OIL PRESS SW
PIN 6
NEGATIVE SPLICE BLOCK
NEG
PIN G
SIGNAL POWER SPLICE BLOCK
SIGNAL POWER TO SHT 3
RESET/STOP
SIGNAL PWR
PURPLE
DS PWR
PUR/WH
OVERSPEED SWITCH
POWER
OVERSPEED
BLACK
WHITE
OVERSPEED LAMP
D3
TB 3
NEG
NEGATIVE SPLICE BLOCK
NEG TO SHT 3
PINK FSD/KEY
PIN X
KEY SWITCH (ELECTRONIC ENGINES)
PIN 3
FUEL SHUT-OFF (MECHANICAL ENGINES)
FOR FIREPUMP MODEL CFP59-F55, REF DWG 9926 FOR CUMMINS FIREPOWER-INSTALLED POWER-TO-STOP TIMER RELAY
CRANK
RELAY K2/TERM 86 (SEE SHEET 2)
WHT
CRANK TERM
D4
TB 2
REPLACEABLE DIODE
EXCITE
PIN 9
TO ALTERNATOR EXCITE
CRANK A
CRANK B
MANUAL CRANK BAT A
MANUAL CRANK BAT B
AUTO CRANK A
AUTO CRANK B
TB 9
TB 10
CRANK 'A' SOLENOID
CRANK 'B' SOLENOID
PIN 8
PIN 10
PIN 2
GRAY/BLK
MPU -
TO MAG PICK-UP
PIN 1
GRAY/RED
MPU +
MAG PICK-UP

TERMINAL BLOCK TB

CUSTOMER'S CONNECTIONS: WIRES SHALL BE 14AWG MIN.

ORANGE / AUTO	1	FIRE PUMP CONTROLLER SWITCHED B+
CRANK TERM	2	CRANK TERMINATE SIGNAL
OVERSPEED	3	OVERSPEED ALARM SIGNAL
LOPL	4	LOW OIL PRESSURE ALARM SIGNAL
HWTL	5	HIGH TEMP ALARM SIGNAL
RED/YLW FUSED A+	6	BATTERY 'A' + (BATTERY CHARGER)
	7	
RED/ORNG FUSED B+	8	BATTERY 'B' + (BATTERY CHARGER)
AUTO CRANK A	9	CRANK BATTERY 'A'
AUTO CRANK B	10	CRANK BATTERY 'B'
BLACK	11	GROUND
	12	
	301	
	302	
	303	

SIGNALS ARE ACTIVE HI (12 VOLTS)

SIGNALS ARE ACTIVE LOW (GND)

ELECTRONIC ENGINES ONLY SEE THIS DWG., SHT 2

A NOTES:
WIRE IS 14 AWG UNLESS OTHERWISE NOTED
RED TEXT = WIRE TAG
GREEN TEXT = WIRE COLOR
WIRE COLOR IS WHITE UNLESS OTHERWISE NOTED
D1 - D4: 6 Amp/400 Vpiv

REV	DESCRIPTION OF REVISION	BY	DATE
E	ADDED SHEETS 3, 4, 5, & 6	RJS	20 MAR 07
D	PIN 12 WAS PIN B	RJS	19 SEPT 06
C	REMOVED 5 AMP CIRCUIT BREAKER	RJS	27 JUNE 06
B	ADDED CONNECTION TO TERM 6 OF SPEED SWITCH	RJS	17 DEC 05
A	CHANGED WIRE GAUGES; CHG'D TB 1 LABELS	RJS	27OCT05

UNLESS OTHERWISE NOTED
ALL DIMENSIONS ARE IN INCHES
APPLY MACHINE TOLERANCES
.X = ± 0.05
.XX = ± 0.010
.XXX = ± 0.001
APPLY WELDED TOLERANCES
.X = ± 0.25
.XX = ± 0.13
.XXX = ± 0.05

Fire Power

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

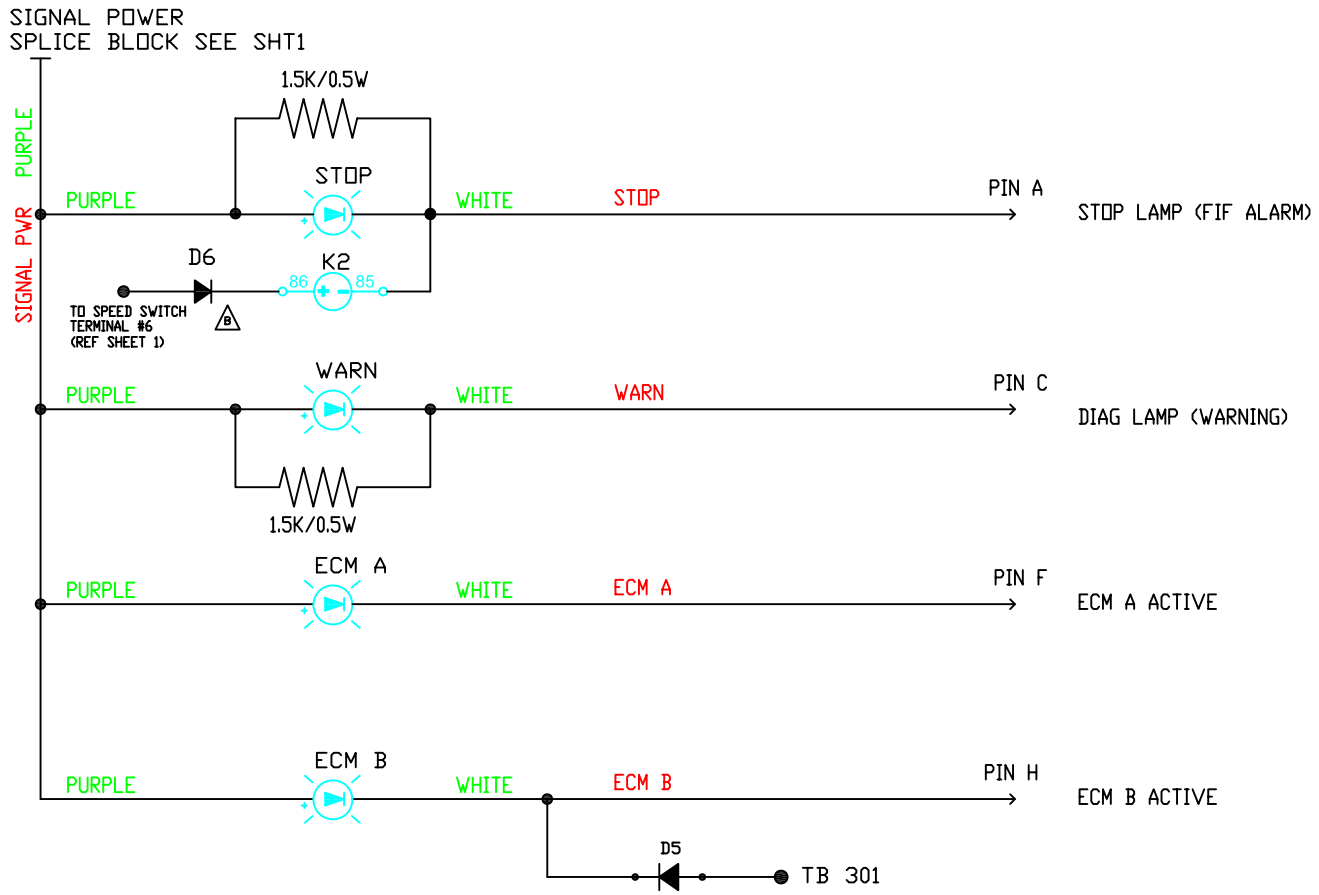
DWG SCALE: N/A	DRAWN BY: RJS	DATE: 06_OCT_2005	
PLOT SCALE: N/A	APPD BY: —	DATE: —	

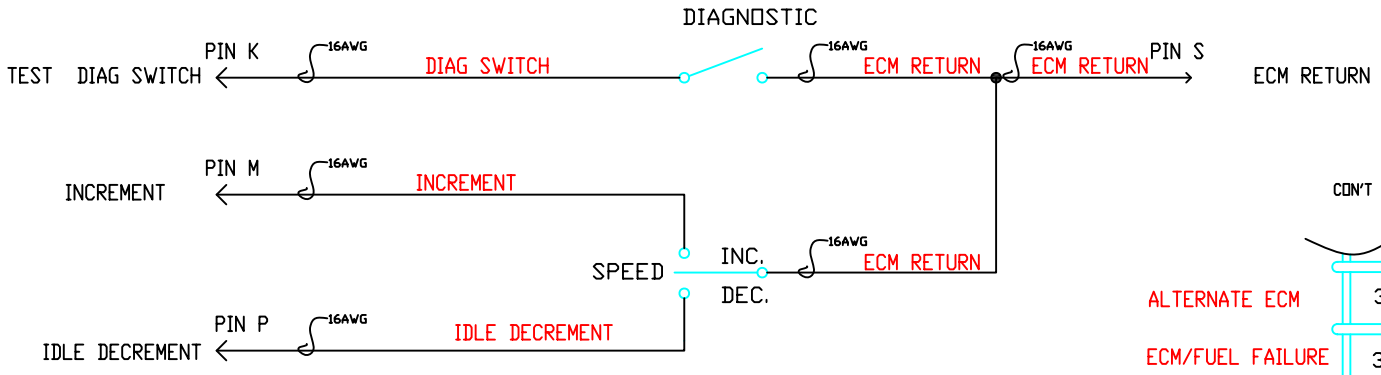
DESCRIPTION: SCHEMATIC,_CONTROL_PANEL

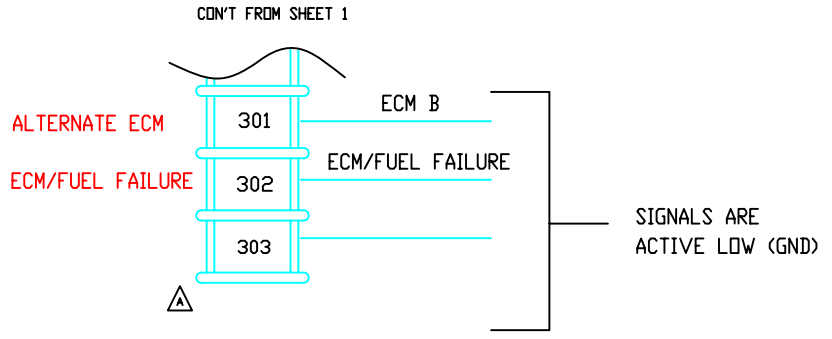
REFERENCE: FIREPUMP

DRAWING NUMBER: 10423E_SHT1

ADDITIONAL CIRCUITS FOR ELECTRONIC ENGINES







LEGEND:
K2 ECM/FUEL FAIL RELAY
R RESISTOR

NOTES: WIRE IS 14AWG UNLESS OTHERWISE NOTED
RED TEXT = WIRE TAG
GREEN TEXT = WIRE COLOR
WIRE COLOR IS WHITE UNLESS OTHERWISE NOTED
RESISTOR VALUE = 1.5Kohms, 1/2W
MINIMUM DIODE RATING: 6A/400V

REV	DESCRIPTION OF REVISION	BY	DATE
E	ADDED SHEETS 3, 4, 5, & 6	RJS	20 MAR 07
D	SEE SHT 1 FOR REV CHANGE	RJS	19 SEPT 06
C	REDREW	RJS	3 JULY 06
B	CHG'D WIRING OF K2	RJS	17 DEC 05
A	REF PAGE 1 REV NOTES	RJS	27 OCT 05

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

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DWG SCALE: N/A	DRAWN BY: RJS	DATE: 06_OCT_2005	
PLOT SCALE: N/A	APPD BY: —	DATE: —	

DESCRIPTION: SCHEMATIC;_CONTROL_PANEL

REFERENCE: FIREPUMP

DRAWING NUMBER: 10423E_SHT2

CONTROL PANEL
CONNECTOR

ALL MODELS EXCEPT:
CFP33-Fxx
CFP55-F55

1 MPU

2 MPU

MECHANICAL ENGINES — 3
ELECTRONIC ENGINES — X
FSO (SW B+); MECHANICAL
KEYSWITCH; ELECTRONIC

NC
(Energize to Run)

4 OIL PRES SENDER

5 WATER TEMP SENDER

6 OIL PRES SWITCH

C
A
B
SHOWN IN "LOW OIL PRESS" STATE
(or engine NOT running)

7 WATER TEMP SWITCH

C
A
B
SHOWN IN "NORMAL TEMP" STATE
(or engine NOT running)

8 CRANK BAT A

CR A

10 CRANK BAT B

CR B

STARTER
SOLENOID

S

STARTER

13 RAW +

RAW
WATER
SOLENOID

17 RAW -

NC
(Energize to Open)

9 ALT EXC (SW B+)

BATTERY ISOLATOR

B+

ALT

D

16 BAT A

18 BAT B

14 GND

POS NEG

BAT A

POS NEG

BAT B

REV	DESCRIPTION OF REVISION	BY	DATE
E	ADDED SHEETS 3, 4, 5, & 6	RJS	20 MAR 07
D	SEE SHT 1 FOR REV CHANGE	RJS	19 SEPT 06
C	REDRAW	RJS	3 JULY 06
B	CHG'D WIRING OF K2	RJS	17 DEC 05
A	REF PAGE 1 REV NOTES	RJS	27 OCT 05

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UNLESS OTHERWISE NOTED
ALL DIMENSIONS ARE IN INCHES
APPLY MACHINE TOLERANCES
.X ± 0.03
.XX ± 0.010
.XXX ± 0.005
APPLY SHEET METAL TOLERANCES
X ± 0.06
.XX ± 0.03
.XXX ± 0.015

CUMMINS INPOWER
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DWG SCALE: N/A
PLOT SCALE: N/A
DRAWN BY: RJS
APPD BY: –
DATE: 06_OCT_2005
DATE: –

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DESCRIPTION
ENGINE_SCHEMATIC
REFERENCE:
FIREPUMP

DRAWING NUMBER:
10423E_SHT3

CONTROL PANEL
CONNECTOR

MODELS:
CFP33-F10
CFP33-F20
CFP33-F30

(AFTER 10/1/2006)

1 MPU

2 MPU

3 FSO RELAY (SW B+)

R

12 FSO SOLENOID (B+)

R

PULL

"AUX"

"POS"

"NEG"

HOLD

NC INTERNALLY SWITCHED
(Energize to Run)

4 OIL PRES SENDER

5 WATER TEMP SENDER

6 OIL PRES SWITCH

C

A

B

SHOWN IN "LOW OIL PRESS" STATE
(or engine NOT running)

7 WATER TEMP SWITCH

C

A

B

SHOWN IN "NORMAL TEMP" STATE
(or engine NOT running)

8 CRANK BAT A

CR A

10 CRANK BAT B

CR B

STARTER
SOLENOID

S

STARTER

13 RAW +

RAW
WATER
SOLENOID

17 RAW -

NC
(Energize to Open)

9 ALT EXC (SW B+)

BATTERY ISOLATOR

B+

ALT

D

16 BAT A

18 BAT B

14 GND

POS

NEG

BAT A

POS

NEG

BAT B

REV	DESCRIPTION OF REVISION	BY	DATE
E	ADDED SHEETS 3, 4, 5, & 6	RJS	20 MAR 07
D	SEE SHT 1 FOR REV CHANGE	RJS	19 SEPT 06
C	REDRAW	RJS	3 JULY 06
B	CHG'D WIRING OF K2	RJS	17 DEC 05
A	REF PAGE 1 REV NOTES	RJS	27 OCT 05

UNLESS OTHERWISE NOTED
ALL DIMENSIONS ARE IN INCHES
APPLY MACHINE TOLERANCES
.X ± 0.030
.XX ± 0.010
.XXX ± 0.005
APPLY SM. BEND TOLERANCES
.X ± 0.5
.XX ± 0.25
.XXX ± 0.13

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875 LAWRENCE DRIVE
DEPERE, WISCONSIN
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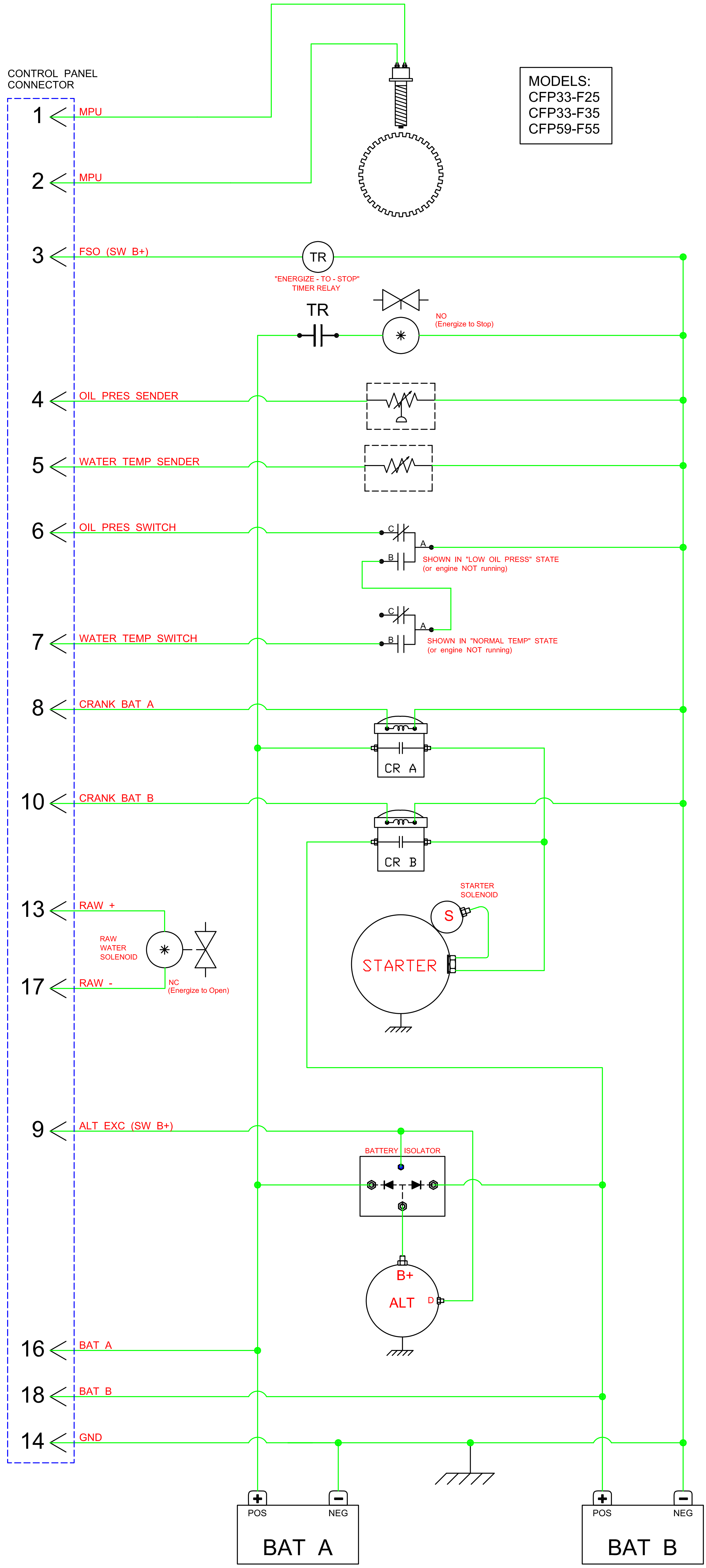
DWG SCALE: N/A
PLOT SCALE: N/A
DRAWN BY: RJS
APPD BY: –
DATE: 06_OCT_2005
DATE: –

DESCRIPTION
ENGINE_SCHEMATIC
REFERENCE:
FIREPUMP

DRAWING NUMBER:
10423E_SHT4



REV	DESCRIPTION OF REVISION	BY	DATE
E	ADDED SHEETS 3, 4, 5, & 6	RJS	20 MAR 07
D	SEE SHT 1 FOR REV CHANGE	RJS	19 SEPT 06
C	REDREW	RJS	3 JULY 06
B	CHG'D WIRING OF K2	RJS	17 DEC 05
A	REF PAGE 1 REV NOTES	RJS	27 OCT 05

UNLESS OTHERWISE NOTED
ALL DIMENSIONS ARE IN INCHES
APPLY MACHINE TOLERANCES
.X = ± 0.05
.XX = ± 0.010
.XXX = ± 0.001
APPLY WELDED TOLERANCES
.X = ± 0.25
.XX = ± 0.12
.XXX = ± 0.06

Fire Power

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DEPERE, WISCONSIN
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DWG SCALE: N/A | DRAWN BY: RJS | DATE: 06_OCT_2005
PLOT SCALE: N/A | APPD BY: – | DATE: –
DESCRIPTION: ENGINE_SCHEMATIC
REFERENCE: FIREPUMP
DRAWING NUMBER: 10423E_SHT5

MODELS:
CFP33-F10
CFP33-F20
CFP33-F30

(BEFORE 10/1/2006)

CONTROL PANEL CONNECTOR

1 MPU

2 MPU

3 FSO SOLENOID (SW B+)

"AUX" PULL "NEG" "POS" HOLD

NC INTERNALLY SWITCHED (Energize to Run)

4 OIL PRES SENDER

5 WATER TEMP SENDER

6 OIL PRES SWITCH

C A B

SHOWN IN "LOW OIL PRESS" STATE (or engine NOT running)

7 WATER TEMP SWITCH

C A B

SHOWN IN "NORMAL TEMP" STATE (or engine NOT running)

8 CRANK BAT A

CR A

10 CRANK BAT B

CR B

13 RAW +

RAW WATER SOLENOID

17 RAW -

NC (Energize to Open)

STARTER SOLENOID

S

STARTER

9 ALT EXC (SW B+)

BATTERY ISOLATOR

B+ ALT D

16 BAT A

18 BAT B

14 GND

POS NEG BAT A

POS NEG BAT B

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

CUMMINS NPOWER
COMPANY NOTICE
1600 BUERKLE ROAD
WHITE BEAR LAKE, MN
WWW.NPOWER.CUMMINS.COM

DWG SCALE: N/A
PLOT SCALE: N/A
DRAWN BY: RJS
APPD BY: –
DATE: 06_OCT_2005
DATE: –

DESCRIPTION
ENGINE_SCHEMATIC
REFERENCE:
FIREPUMP

DRAWING NUMBER:
10423_SHT6

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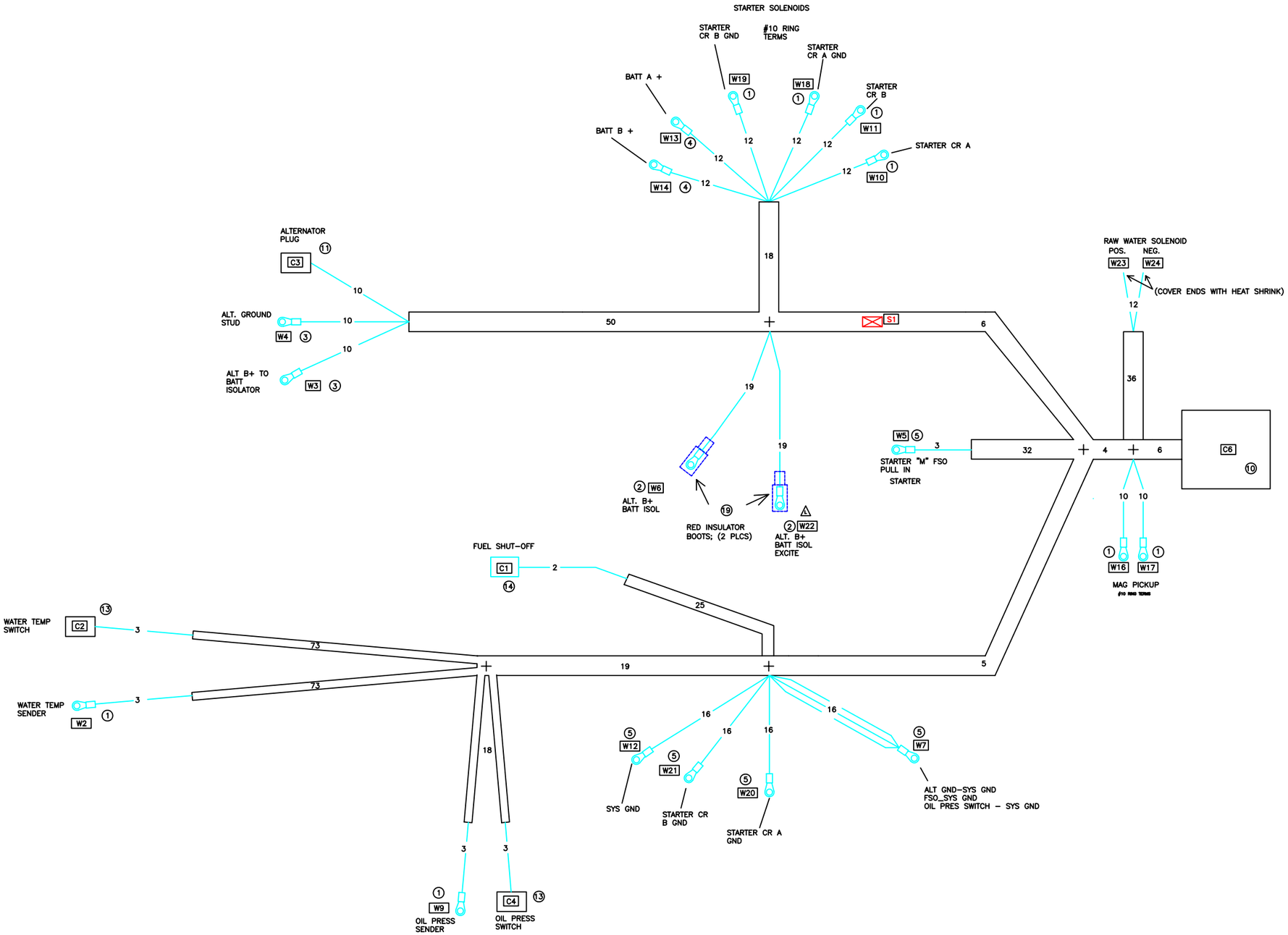
UNLESS OTHERWISE NOTED
ALL DIMENSIONS ARE IN INCHES
FRACTIONS ± 1/64
APPLY MACHINE TOLERANCES
TO ± 0.030
APPLY MACHINE TOLERANCES
X ± 0.25
XX ± 0.13
XXX ± 0.08

REV	DESCRIPTION OF REVISION	BY	DATE



THIS HARNESS TO BE OVER-BRAIDED WITH BLACK AND RED NYLON. ALL BLACK NYLON WILL BE CONSIDERED.

THIS HARNESS TO BE USED ON THE FOLLOWING FIREPUMP ENGINES ONLY - 4B, 6B, AND 6C

ALL DIMENSIONS IN INCHES

REV	DESCRIPTION OF REVISION	BY	DATE
L	REMOVED BAT ISOL EXCITE FUSE	RJS	25 OCT 06
K	W10 & W11 WERE 14 AWG	RJS	29 JUNE 06
J1	Chg'd red insulator boot p/n	RJS	21 March 05
J	REDREW TO FIT ECM ENGINES; ADDED ITEMS 19 & 20	RJS	4JAN05

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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DESIGN CENTER
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DEPERE, WISCONSIN
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DWG SCALE: –	DRAWN BY: SAH	DATE: 29JUN2004
PLOT SCALE: –	APPD BY: –	DATE: –

DESCRIPTION
WIRING_HARNESS_SCHEMATIC

REFERENCE:
FIRE_PUMPS_NON-3.3LITER

DRAWING NUMBER:
8513SHT1_L

CIRCUIT DATA

CIRCUIT NO.	FROM DESIGNATOR	FROM CAVITY POS./TERMINAL	TO DESIGNATOR	TO CAVITY POS./TERMINAL	WIRE COLOR	WIRE SIZE (AWG)	INSUL TYPE	STAMP
	C1	B	W5	1/2" RNG	WHT	16	SXL	FSO PULL-IN
	C1	C	W7	1/2" RNG	WHT	16	SXL	FSO GND
	C2	A	C4	B	WHT	16	GXL	OPS TO WTS
	C3	C	S1	-	WHT	16	SXL	EXCITE
	C4	A	W7	1/2" RNG	WHT	16	GXL	OPS GND
	S1	-	W22	1/4" RNG	WHT	16	SXL	BATT EXCITE
	C6	1	W16	#10 RING	WHT	16	SXL	MPU +
	C6	2	W17	#10 RING	WHT	16	SXL	MPU -
	C6	3	C1	A	WHT	16	SXL	FSO/KEY
	C6	4	W9	#10 RNG	WHT	16	SXL	OPG
	C6	5	W2	#10 RNG	WHT	16	SXL	WTG
	C6	6	C4	C	WHT	16	GXL	LOPL
	C6	7	C2	B	WHT	16	GXL	HWTL
	C6	8	W10	#10	WHT	10	SXL	CRANK A
K	C6	9	S1	-	WHT	16	SXL	EXCITE
K	C6	10	W11	#10 RING	WHT	10	SXL	CRANK B
K	C6	13	W23	NO TERM	WHT	14	SXL	RW SOL +
	C6	14	W12	1/2"	WHT	10	GXL	SYS GND
	C6	16	W13	3/8"	WHT	10	GXL	BATT A+
	C6	17	W24	NO TERM	WHT	14	SXL	RW SOL-
	C6	18	W14	3/8"	WHT	10	GXL	BATT B+
	W18	#10	W20	1/2" RNG	WHT	14	SXL	CRNK A GND
	W19	#10	W21	1/2" RNG	WHT	14	SXL	CRNK B GND
	W3	5/16" RNG	W6	1/4" RNG	WHT	6	GXL	ALT B+
	W4	5/16" RNG	W7	1/2" RNG	WHT	6	GXL	ALT GND

WIRING HARNESS CONTENT

REF NO.	SUPPLIER	SUPPLIER PART NO.	QTY.	DESCRIPTION
1			8	#10 RING TERMINAL
2			2	1/4" RING TERMINAL
3			2	5/16" RING TERMINAL
4			2	3/8" RING TERMINAL
5			5	1/2" RING TERMINAL
10	DEUTSCH	HDP26-24-19SN	1	MAIN CONNECTOR
11	PACKARD	12047950/12186566	1	ALT PLUG CONN. ASMBLY
13	PACKARD	12162280	2	WTS/OPS CONN. W/SOCKETS & SEAL
14	PACKARD	12015793	1	FSO CONN. W/SOCKETS
18			1	FUSE 6 AMP
19	stella-maris	400N9V02	2	RED INSULATOR BOOT

REV	DESCRIPTION OF REVISION	BY	DATE
L	REMOVED BAT ISOLATOR EXCITE FUSE	RJS	25 OCT 06
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APPLY WELDED TOLERANCES
X = ± 0.12
.XX = ± 0.12
.XXX = ± 0.06

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NPOWER SYSTEMS
DESIGN CENTER
575 LAWRENCE DRIVE
DEPERE, WISCONSIN

DWG SCALE:	DRAWN BY: SAH	DATE: 1 OCT 04
PLOT SCALE:	APPD BY:	DATE:

DESCRIPTION: WIRING HARNESS SCHEMATIC

REFERENCE: FIRE PUMP CONTROL PANEL

DRAWING NUMBER: 8513SHT2_L

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