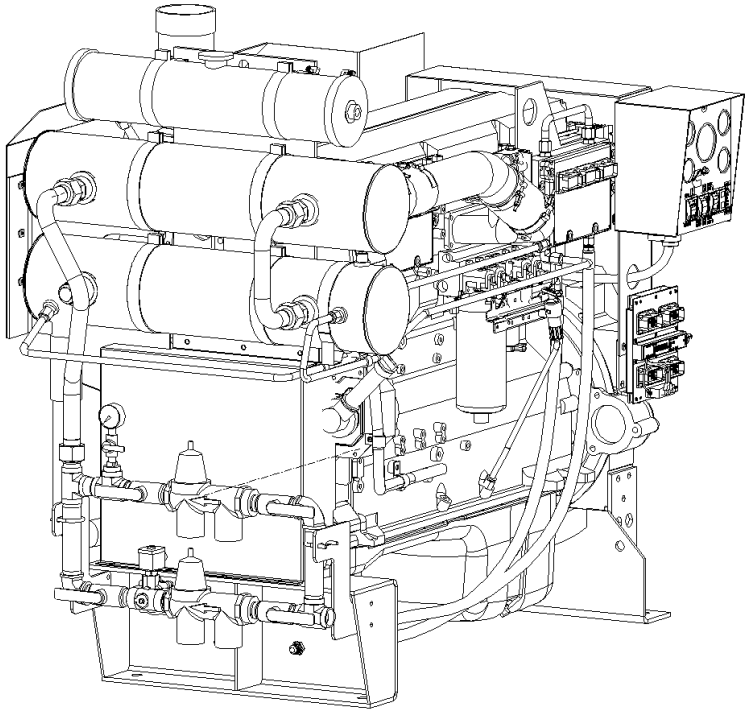
CFP15E SERIES

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.

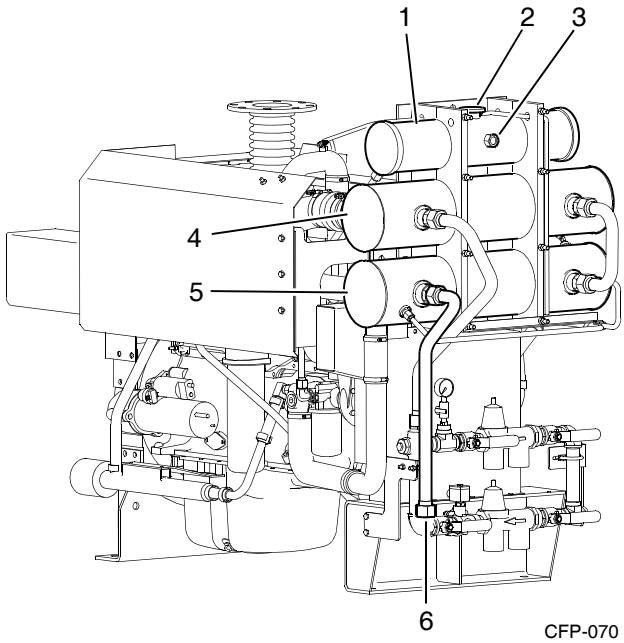
Section 2 - Description

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.



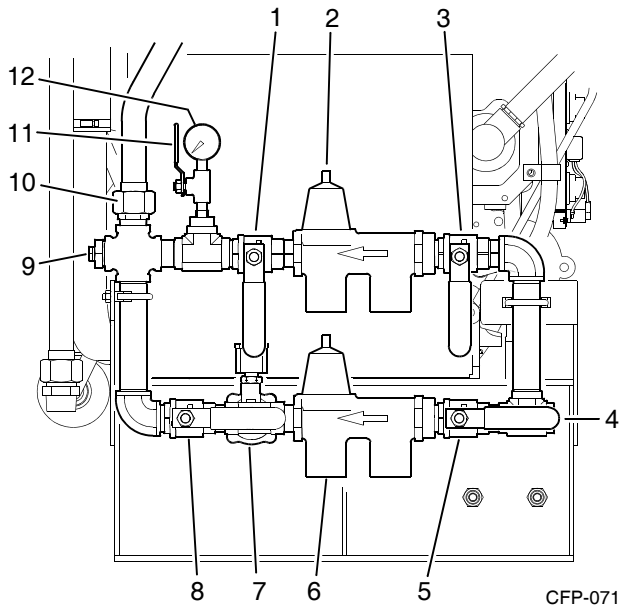
1. Coolant Expansion Tank
2. Coolant Fill Cap
3. Expansion Tank Level Sight Gauge
4. Charge Air Cooler (CAC) Heat Exchanger
5. Coolant/Fuel Heat Exchanger
6. Heat Exchanger Discharge

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.

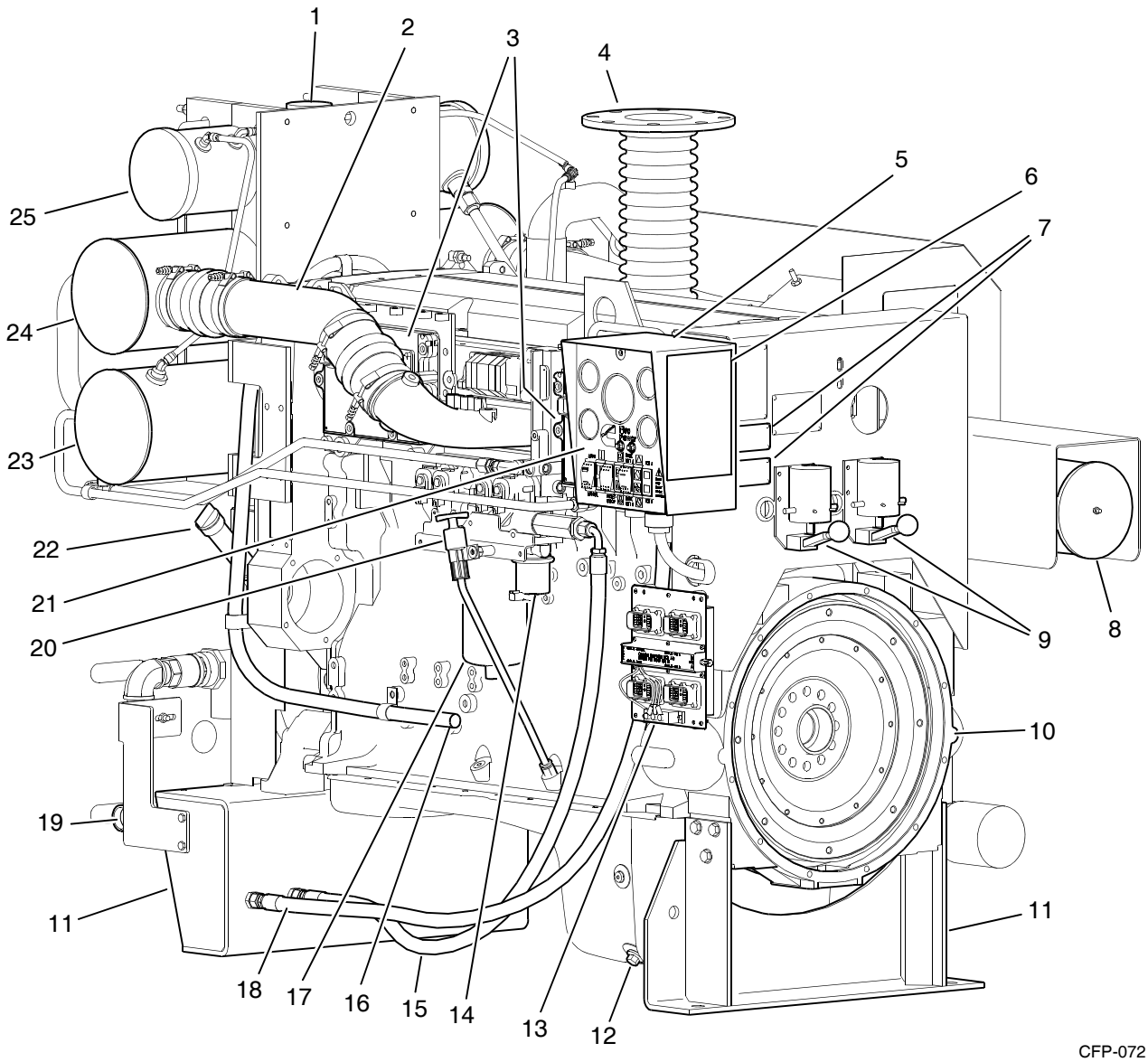
2.2 Fire Pump Engines

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.



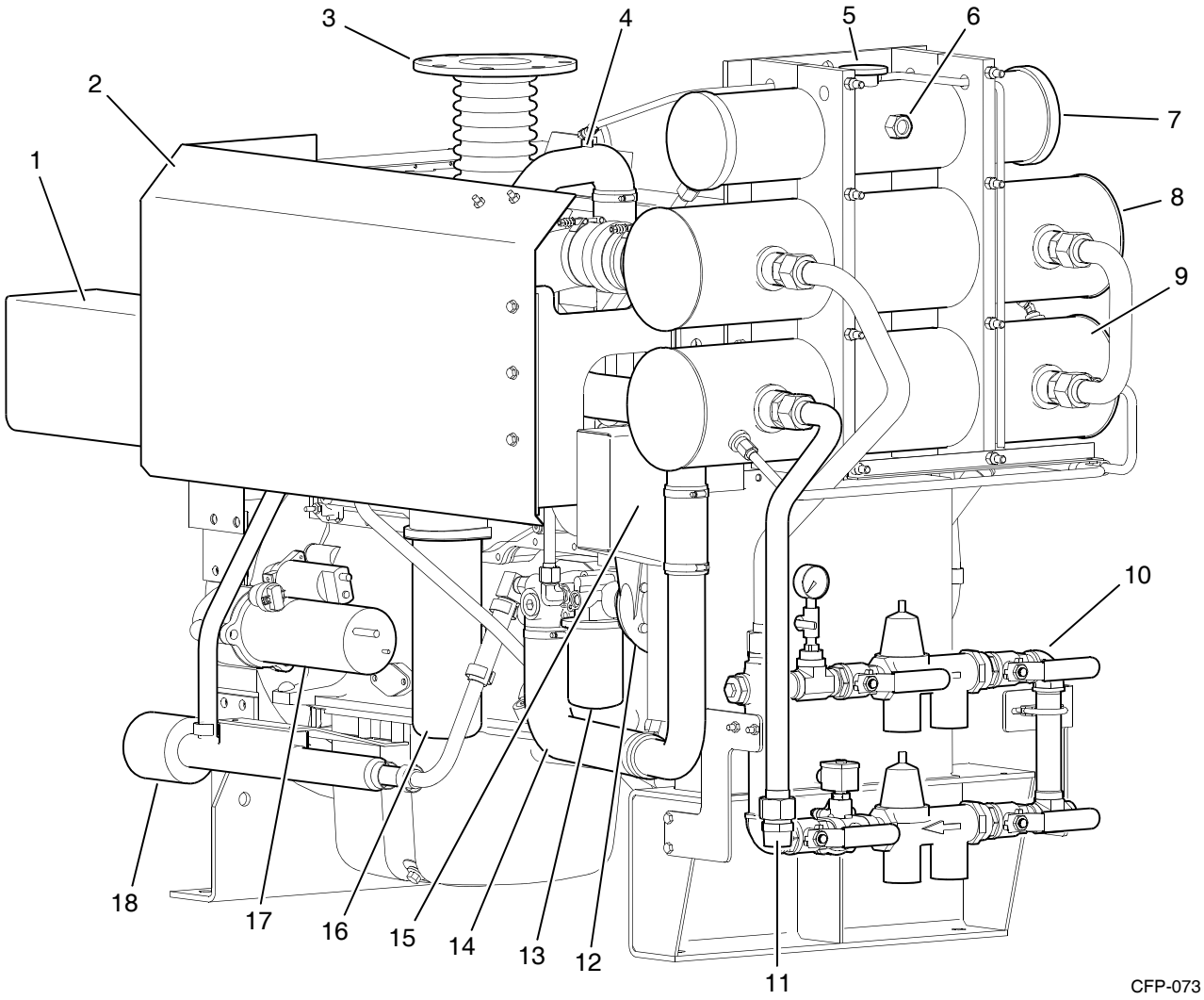
1. Bypass Water Outlet Valve
2. Bypass Pressure Regulator/Strainer
3. Bypass Water Inlet Valve
4. 1-1/4" NPT Raw Water Inlet
5. Normal Water Inlet Valve
6. Normal Pressure Regulator/Strainer
7. Normal Water Solenoid Valve
8. Normal Water Outlet Valve
9. Raw Water Drain Plug
10. Pipe To Heat Exchanger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

Figure 2-2 Raw Water Cooling Loop Manifold



1. Coolant Pressure/Fill Cap
2. Charge Air Cooler Pipe
3. Electronic Control Modules (ECMs)
4. Exhaust Flex Connection
5. Terminal Box (customer connection inside)
6. Manual Start Instruction Decal
7. Engine Speed Settings Plate
8. Air Cleaner
9. A/B Battery Starter Contactors
10. Flywheel Housing
11. Engine Supports
12. Oil Pan Drain
13. ECM Selector Panel and Switch
14. Fuel Lift Pump
15. Fuel Supply Line
16. Engine Breather Hose
17. Fuel Filter
18. Fuel Return Line
19. 1-1/4” NPT Raw Water Inlet
20. Oil Level Dip Stick
21. Operator’s Control Panel
22. Oil Fill Port
23. Coolant/Fuel Heat Exchanger
24. Charge Air Cooler (CAC) Heat Exchanger
25. Coolant Expansion Tank

Figure 2-3 Engine Components - Instrument Panel Side



1. Air Cleaner Assembly
2. Manifold Heat Shield
3. Exhaust Flex Connection
4. Upper Coolant Hose
5. Coolant Pressure/Fill Cap
6. Expansion Tank Level Sight Gauge
7. Coolant Expansion Tank
8. Charge Air Cooler (CAC) Heat Exchanger
9. Coolant/Fuel Heat Exchanger
10. Raw Water Manifold
11. 1-1/2” NPT Raw Water Outlet
12. Coolant Pump
13. Coolant Filter
14. Lower Coolant Hose
15. Alternator (under belt guard)
16. Engine Oil Filter
17. Starter Motor
18. Engine Heater

Figure 2-4 Engine Components - Turbocharger Side

Models CFP15E-F10 through F40 meet Tier 3 emission levels, while models CFP15E-F50 through F70 meet Tier 2 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 engine 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.

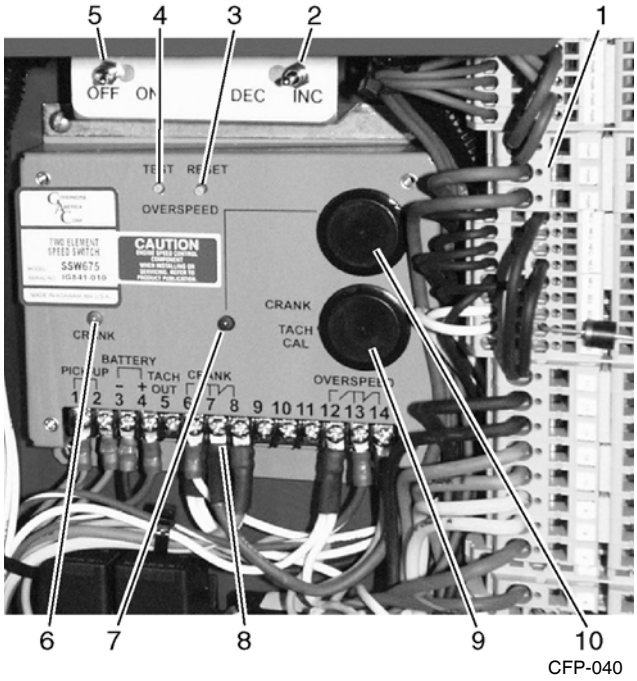
The operator control panel contains controls for starting, monitoring engine performance and controlling fire pump engine operation.

2.3.1 Overspeed Switche

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 starter 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.



CFP-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 2-5 Engine Overspeed Control Module

2.4 Fire Pump Controller

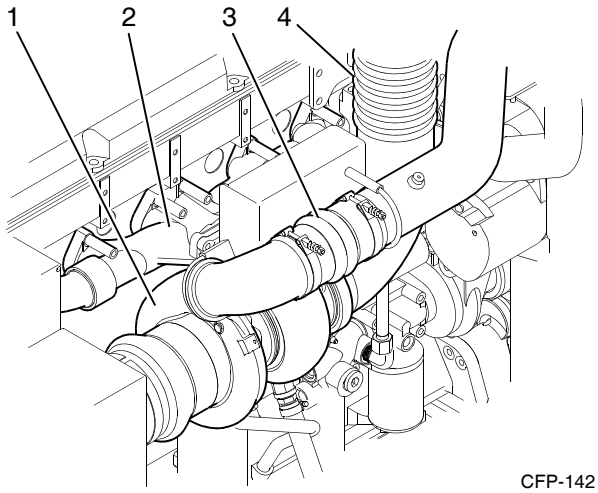
Fire pump controller is not supplied by Cummins Fire Power, or Cummins, Inc. The fire pump controller starts the engine automatically when a remote fire demand signal is initiated and automatically shuts down the engine when the fire demand signal is discontinued.

The engine may be started locally in the MANUAL Mode and shut down using the operator control panel AUTO/MANUAL Mode Switch by returning the switch 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

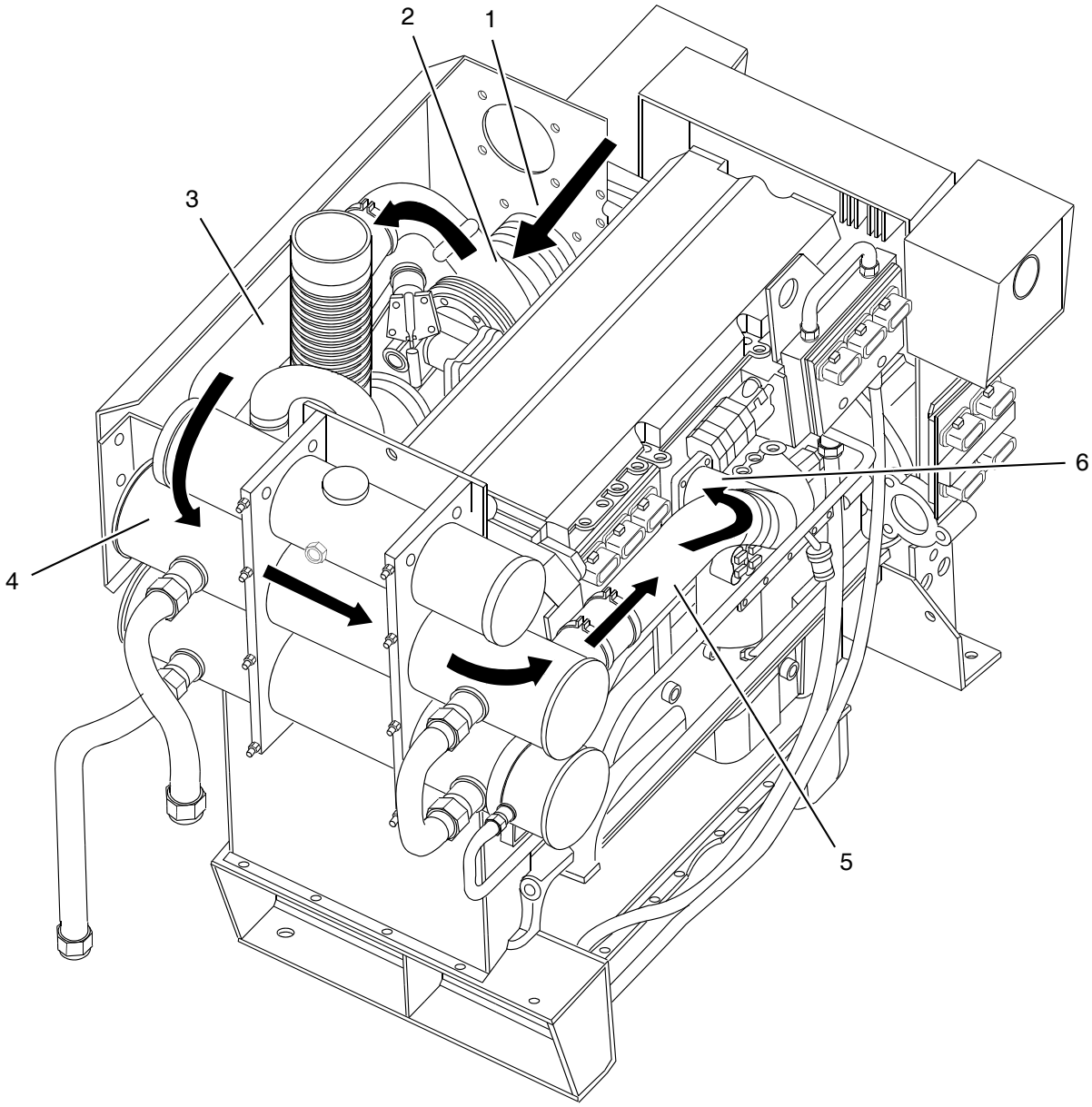
The Air Intake System supplies combustion air to the fire pump engine cylinders. The air filter prevents particulate matter from entering the air intake. Combustion air drawn into the system by the turbocharger is directed through the charge air cooler (CAC) heat exchanger for cooling before entering the intake manifold where the charge air is mixed with fuel. Refer to Figure 2-6 and Figure 2-7.



CFP-142

1. Turbocharger
2. Exhaust Manifold
3. Turbo Connection to Charge Air Cooler
4. Exhaust Flex Connection

Figure 2-6 Turbocharger and Exhaust Manifold



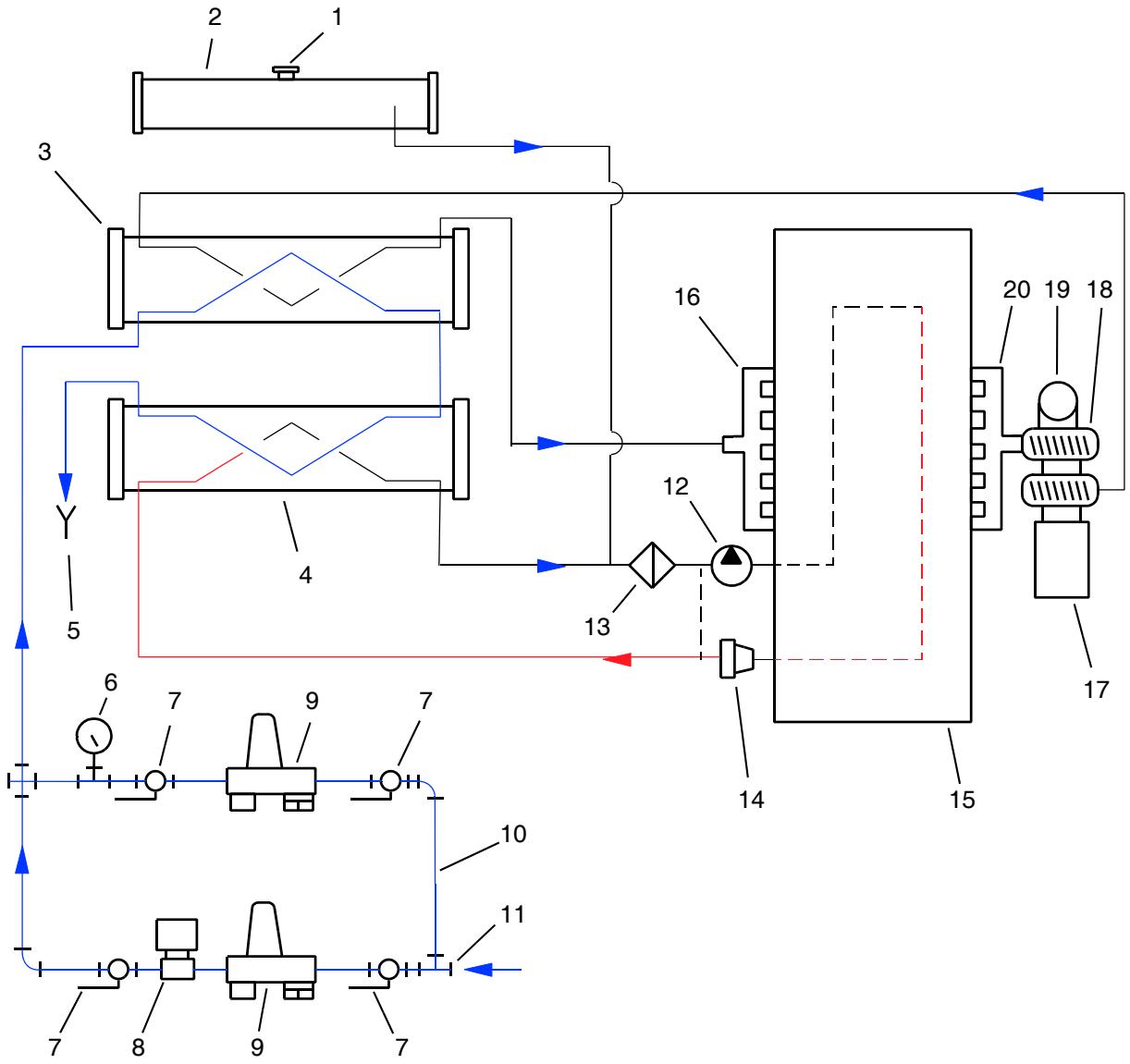
CFP-062

1. Filtered Intake Air from Air Cleaner
2. Turbocharger
3. Air Hose To Charge Air Cooler
4. Charge Air Cooler (CAC) Heat Exchanger
5. Charge Air Cooler Pipe
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.



CFP-063

1. Coolant Fill Cap
2. Coolant Expansion Tank
3. Charge Air Cooler (CAC) Heat Exchanger
4. Coolant/Fuel Heat Exchanger
5. Raw Water Drain Line
6. Raw Water Pressure Gauge
7. Manual Shut-off Valve
8. Raw Water Solenoid Valve
9. Raw Water Pressure Regulator/Strainer
10. Bypass Piping
11. Raw Water Inlet Pipe
12. Coolant Pump
13. Coolant Filter
14. 85° C (180° F) Thermostat
15. Engine Block
16. Combustion Air Intake Manifold
17. Air Filter
18. Turbocharger
19. Exhaust Flex Connection
20. Exhaust Manifold

Figure 2-8 Engine Cooling System Flow Diagram

Water entering the cooling system through the 1-1/4" NPT raw water inlet, first circulates through the charge air cooler (CAC) 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 enters the Coolant/Fuel Heat Exchanger. The raw water exits the Coolant/Fuel Cooler Heat Exchanger through the 1-1/2" NPT drain line. Refer to Figure 2-7.

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 raw 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 tank/fill cap must meet the minimum pressure of 10 kPa (15 psi).

The engine coolant system contains a mixture of at least 50% anti-freeze and 50% water. The coolant level should be maintained in or just below the coolant expansion tank level sight gauge.

CAUTION

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

2.7 Fuel Cooling System

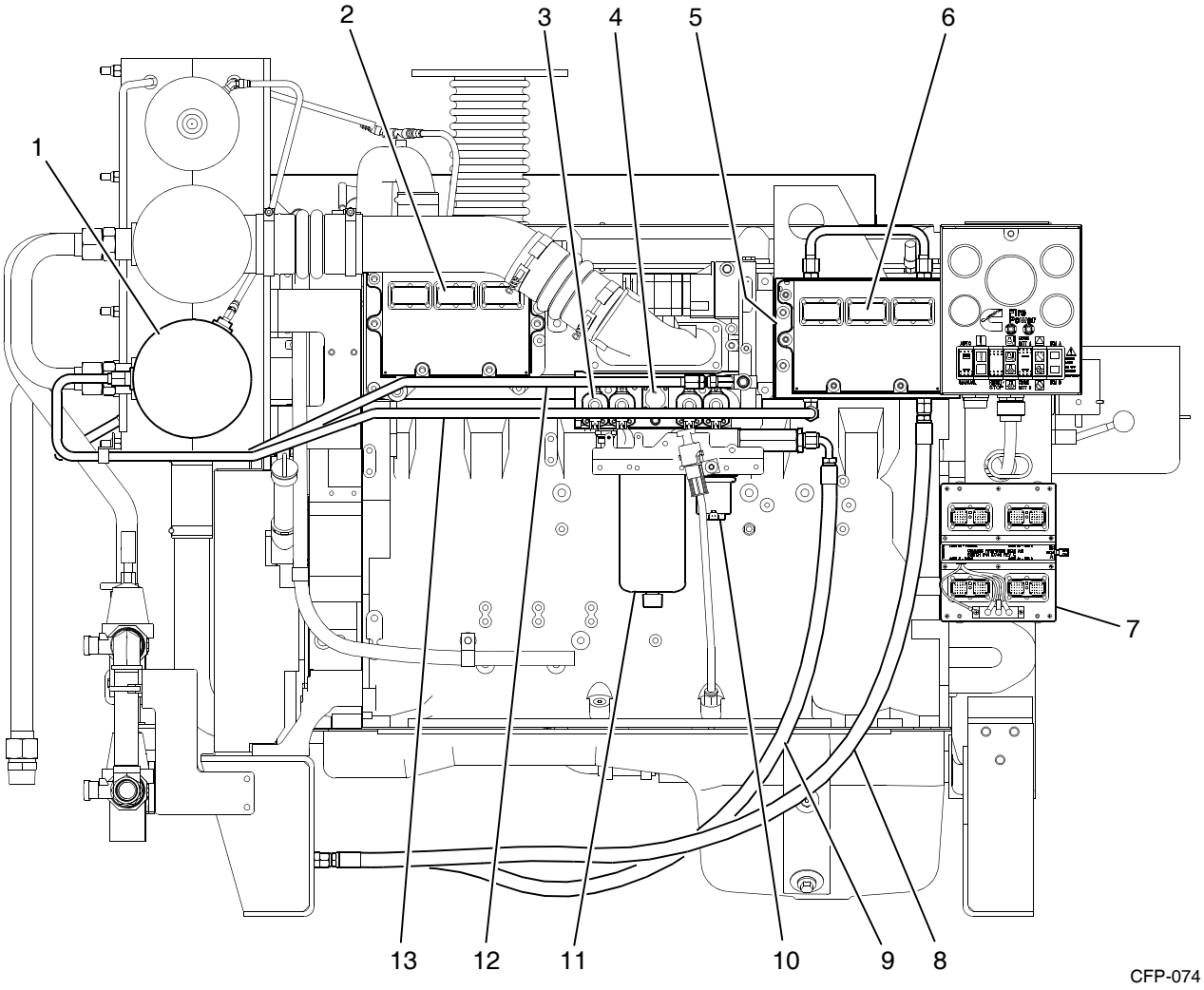
A combination coolant/fuel cooling heat exchanger maintains fuel temperature to meet the maximum allowable fuel inlet temperature (71° C (160° F)). Performance of the fuel cooling system is critical to engine durability, performance and emissions compliance.

2.7.1 Fuel Supply and Drain Location

The fuel inlet and drain connections are located at the front of the unit below the raw water manifold assembly. The fuel inlet line runs from the connection fitting directly to a Lift Pump and Fleetguard® 25 micron fuel filter instead of to an ECM cooling plate. Refer to Figure 2-9.

2.8 High Pressure Injector (HPI) 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 six (6) high-pressure unit injectors and an Integrated Fuel System Module (IFSM). The IFSM provides individual cylinder control fuel metering and injection timing and controls the fuel supply pump and regulator pressure using various system monitoring sensors. The system is controlled by CM570 Engine Control Modules (ECMs) for fueling and timing based on temperature, altitude, boost pressure, and throttle position. Refer to Figure 2-9.

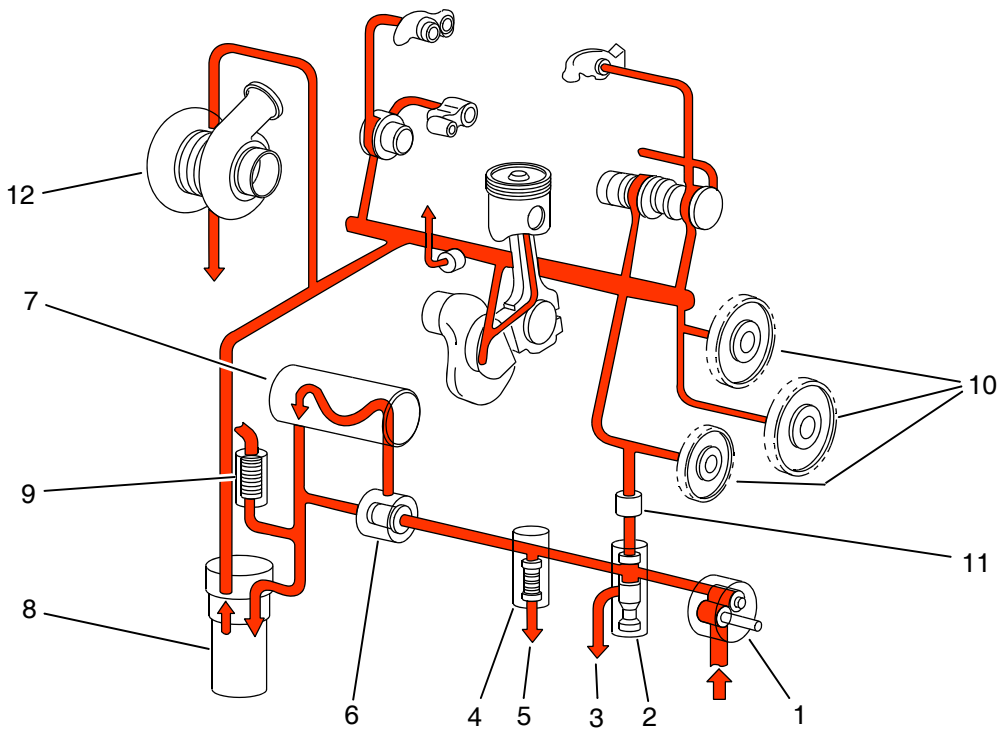


1. Coolant/Fuel Cooling Heat Exchanger
2. ECM Module A
3. Integrated Fuel System Module (IFSM)
4. Fuel Pump
5. ECM Cooling Plate
6. ECM Module B
7. ECM Selector Panel and Switch
8. Fuel Return Line
9. Fuel Supply Line
10. Fuel Lift Pump
11. Fuel Filter or Filter/Separator
12. Fuel Cooling Line To Heat Exchanger
13. Fuel Cooling Line From Heat Exchanger

Figure 2-9 Fuel System Components

With the HPI 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 24 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

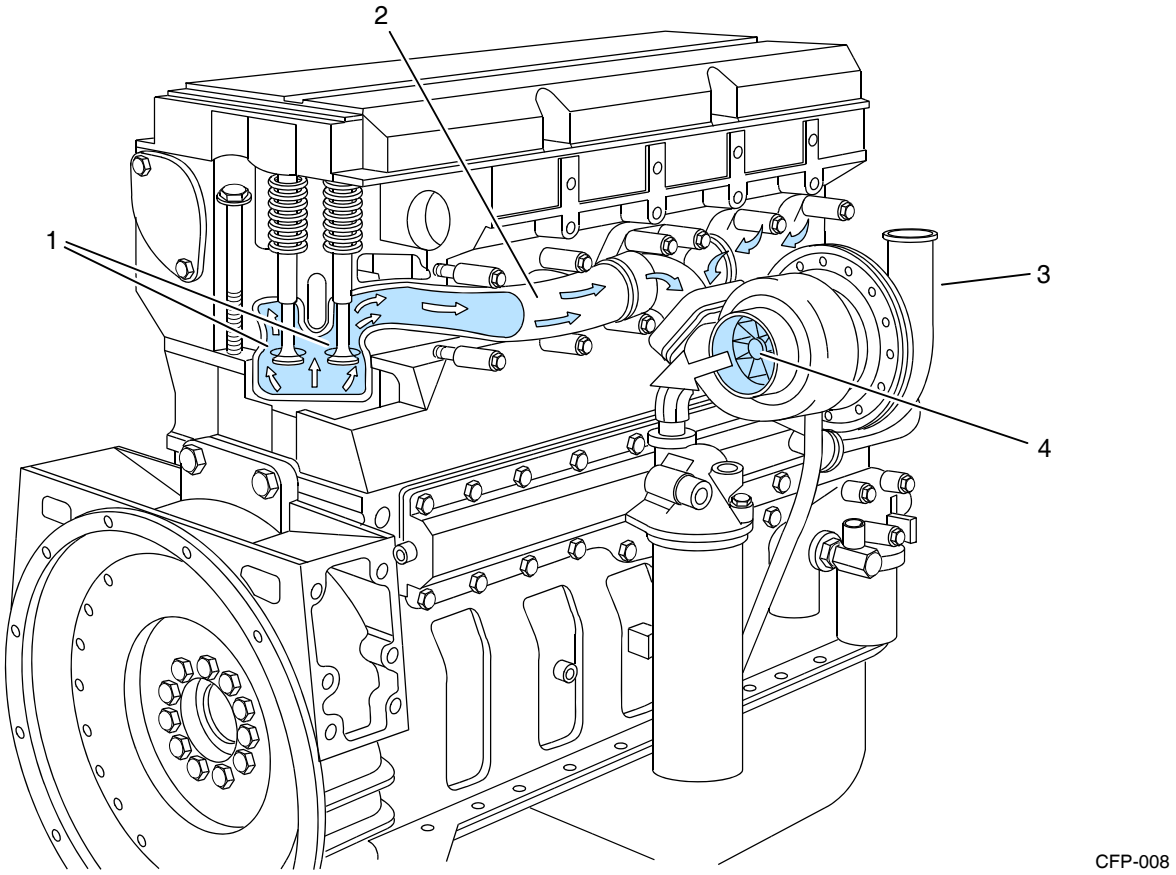
The Engine Oil System lubricates moving internal engine parts (pistons, piston arms, valves, cam shafts, drive shafts and bearings). The oil pump circulates oil from the oil pan, through the oil filter and into engine areas where friction may develop. Refer to Figure 2-10.

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.

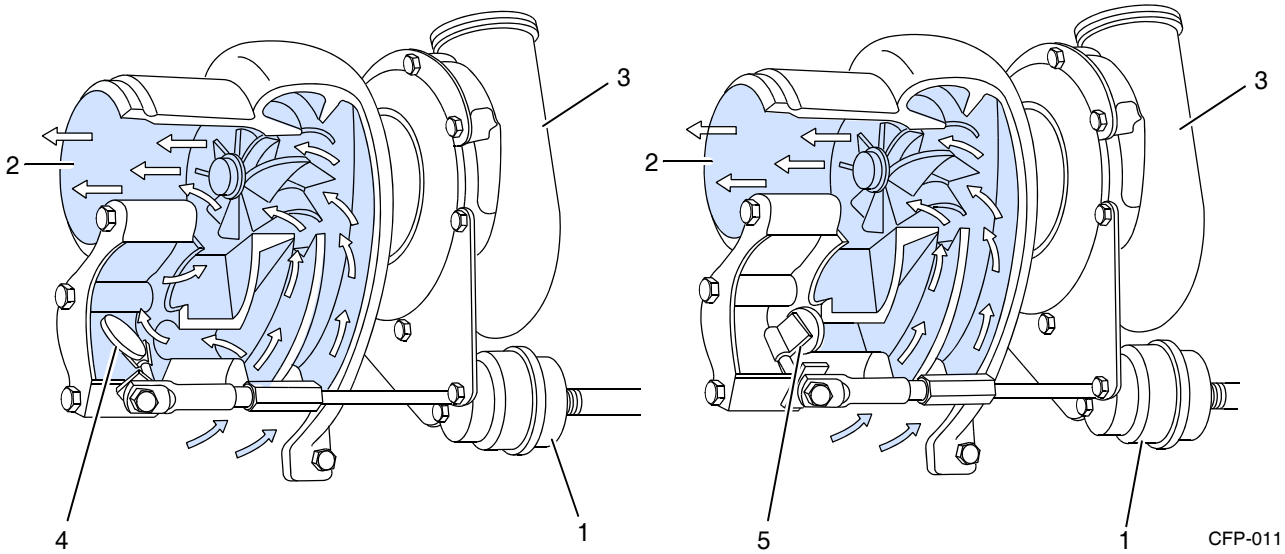
2.10 Exhaust System

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. 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.

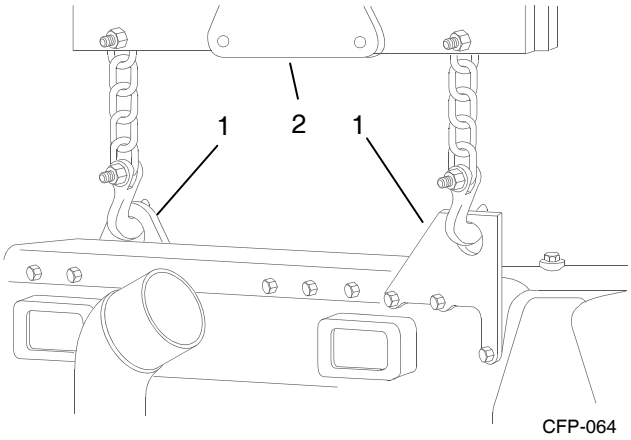
Refer to National Fire Protection Association NFPA 20, Chapter 11 for US installation and applicable local code requirements.

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.

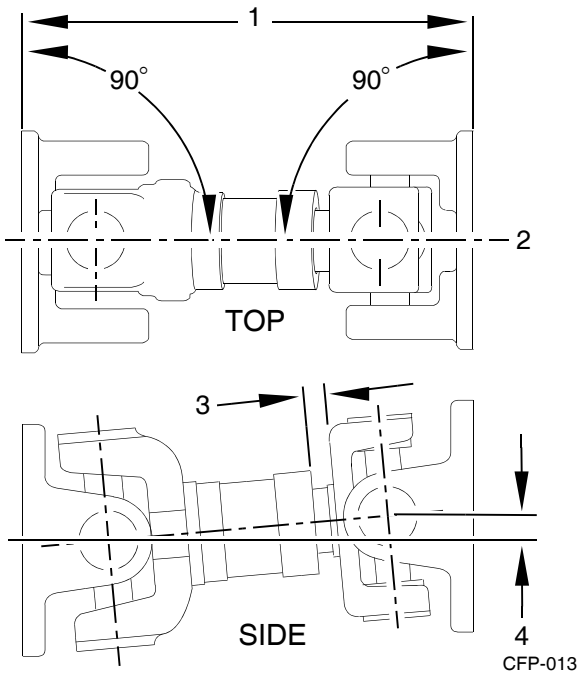
4. Position the engine center line to align the engine drive shaft with the fire pump drive. Ensure that the engine and pump are correctly aligned.

   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 crank 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.).

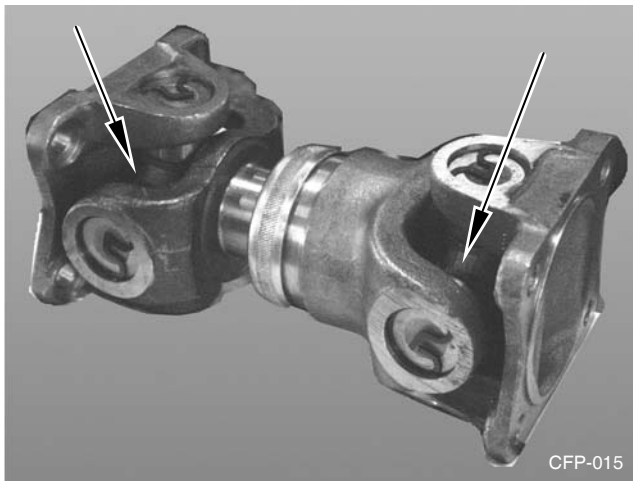


Figure 3-3 Drive Coupling Grease Fittings

7. Check that the alternator and coolant pump drive belts are 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.

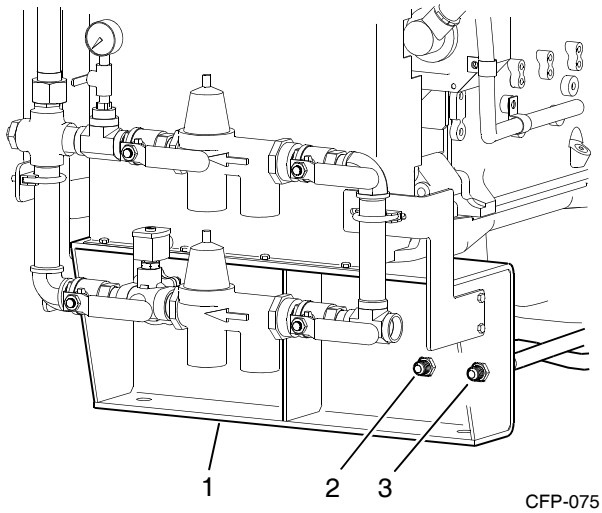
   c. Wipe excess grease from the grease fittings.

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.*

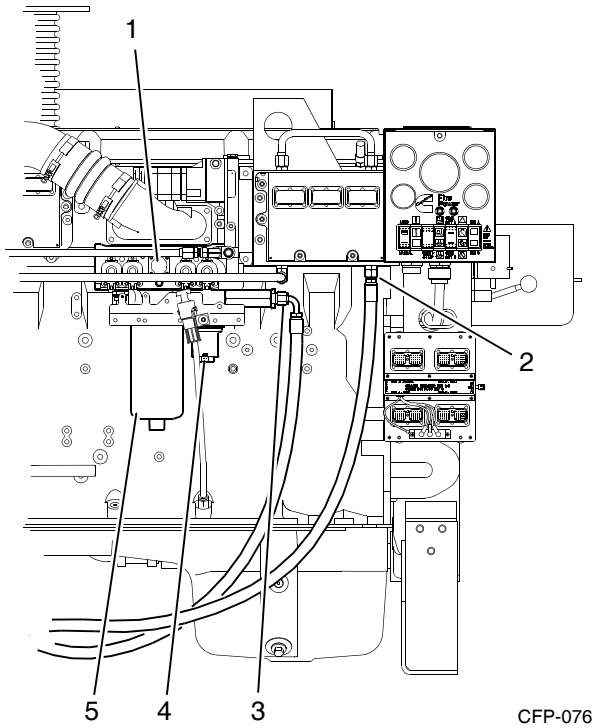
3.3 Fuel Supply Installation

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 Base Frame
2. 3/4” Fuel Inlet Hose
3. 3/4” Fuel Outlet Hose

Figure 3-4 Fuel Line Inlet and Outlet Hoses



1. Fuel Injection Pump
2. Fuel Return Connection
3. Fuel Supply Connection
4. Fuel Lift Pump
5. Fuel Filter or Filter/Separator

Figure 3-5 Engine Fuel Filter

NOTE: *The fuel supply line at the fuel tank must be higher than the fuel intake port on the engine fuel filter. 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 3/4“ 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 3/4” 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 primer 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.

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 coolant/fuel cooling heat exchange 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.*

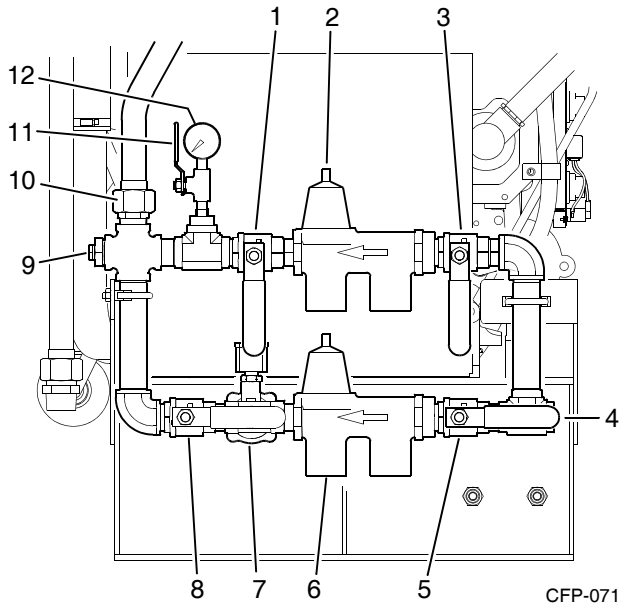
CAUTION

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 1-1/2” NPT raw water drain line at the outlet of the heat exchanger. Refer to Figure 3-6.



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

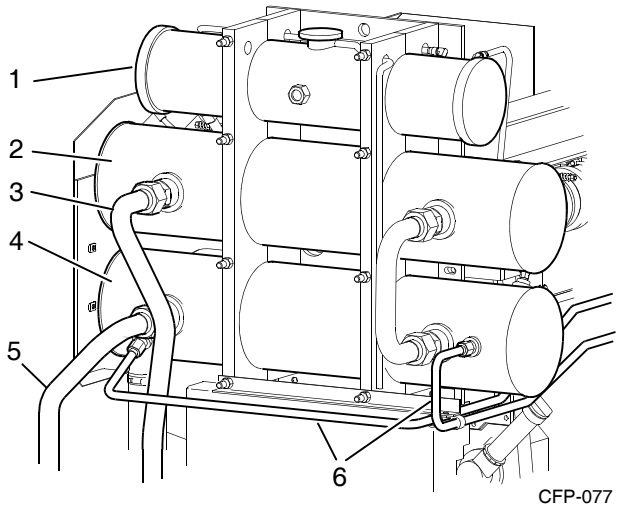
Figure 3-6 Raw Water Cooling Loop Manifold

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

2. Provide raw water supply line to the 1-1/4” NPT raw water cooling loop manifold.

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. Both raw water pressure regulators have been set at 207 kPa (30 psig) or slightly less 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 sheet for details.



1. Engine Coolant Expansion Tank
2. Charge Air Cooler (CAC) Heat Exchanger
3. Raw Water Inlet Pipe
4. Coolant/Fuel Cooler Heat Exchanger
5. Raw Water Outlet Pipe
6. Fuel Cooling Lines

Figure 3-7 Cooling Loop Heat Exchangers

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

   Flow rate = time to fill container/container.

   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 the flow rate at or above the specifications.

   The minimum raw water flow rate is 25 GPM@ 10° C (50° F), 30 GPM @ 21° C (70° F), and 35 GPM @ 32° C (90° F).

IMPORTANT: *The manual raw 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 82° C and 85° C (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 (4° C to 23° C (40° F to 75° F)) raw water flow can cause condensation inside the charge air cooler.*

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

3.5 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 sheet. RC and CCA definitions can be found in SAE standard J537. All battery information is for lead/acid batteries.

3.5.1 Battery Requirements

Two redundant sets of batteries must be supplied for the standard 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.

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.*

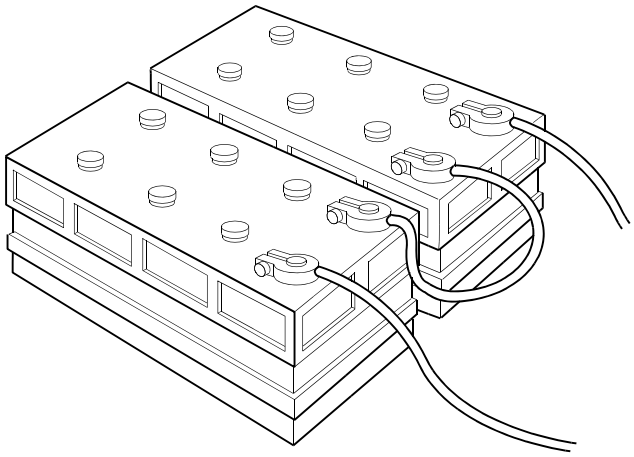


Figure 3-8 Series Battery Connection - 24 VDC

WARNING

Battery electrolyte (sulfuric acid) is highly caustic and can burn clothing, and skin. Wear acid impervious neoprene gloves, and safety goggles or full face shield, when working with the batteries. Always disconnect the negative (-) battery cable first and attach the negative (-) battery cable 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. 14852). 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 24 VDC standard 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.

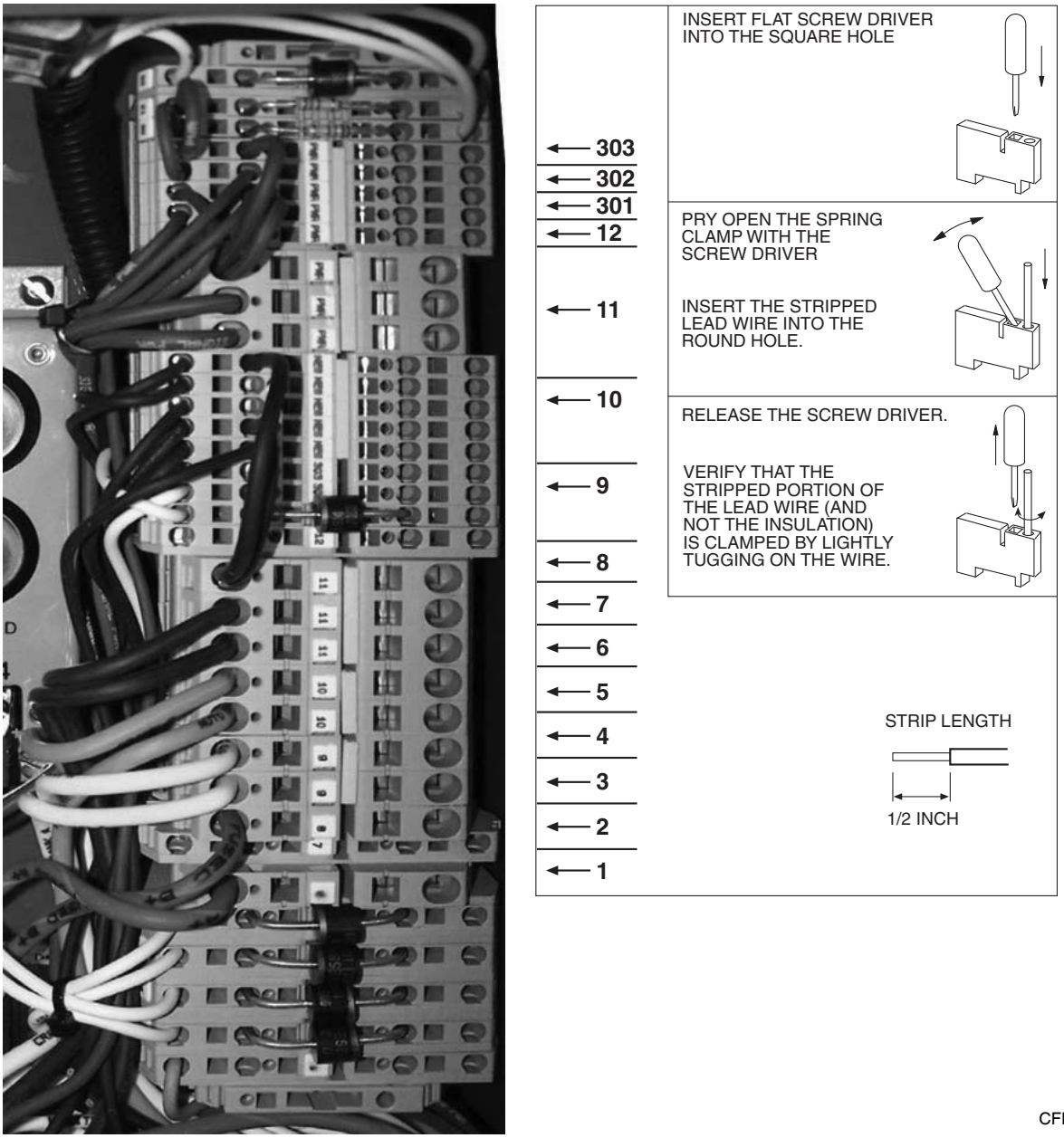


Figure 3-9 Termination Blocks and Wiring Decal

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

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 Coolant Temperature Alarm Input from the Fire Pump Controller. This 0 VDC grounded signal is activated when the engine is running and the coolant temperature is at or above 93° C (200° F). The alarm will deactivate when the engine is running and the coolant temperature drops below 88° C (190° F).

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

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

h. TB-9: Connect Crank From Battery A Lead. During a cranking cycle, the controller energizes the coil of Starter Contactor A through terminal TB-9 to start the engine.

i. TB-10: Connect Crank From Battery B Lead. During a cranking cycle, the controller energizes the coil of Starter Contactor B through terminal TB-10 to start the engine.

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

k. TB-301: Connect the "Operating On Alternate ECM" lead. This 0 VDC ground signal is present when the engine's ECM selector 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 operator's control panel indicate the approximate battery voltage.

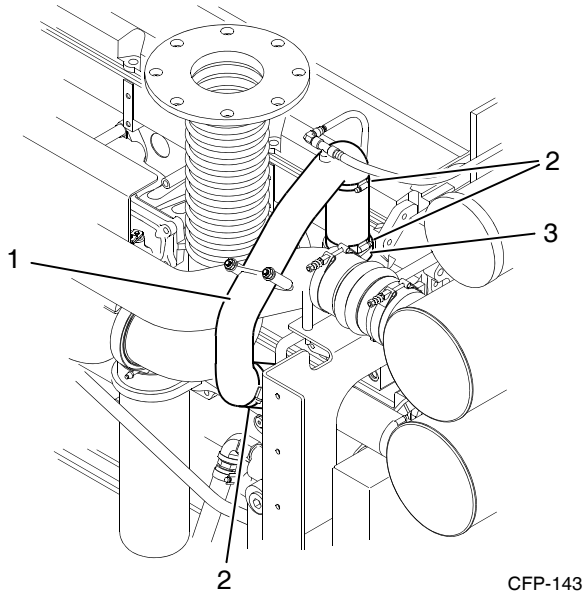
3.7 Coolant System Preparation

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

CAUTION

Ensure that all cooling 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 tight. Refer to Figure 3-10 and Figure 3-11.

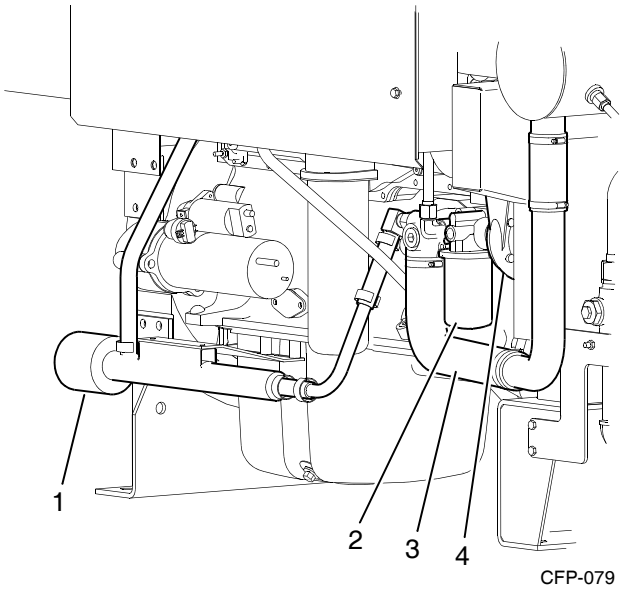


1. Upper Coolant Hose
2. Hose Clamps
3. Thermostat Housing Flange

Figure 3-10 Upper Cooling Hose Clamps

2. Ensure that the engine coolant level is visible at the center of the expansion tank sight gauge. Add coolant as required. DO NOT OVERFILL!

a. If engine coolant temperature is below 50° C (122° F), remove the expansion tank pressure/fill cap. Refer to Figure 3-12.



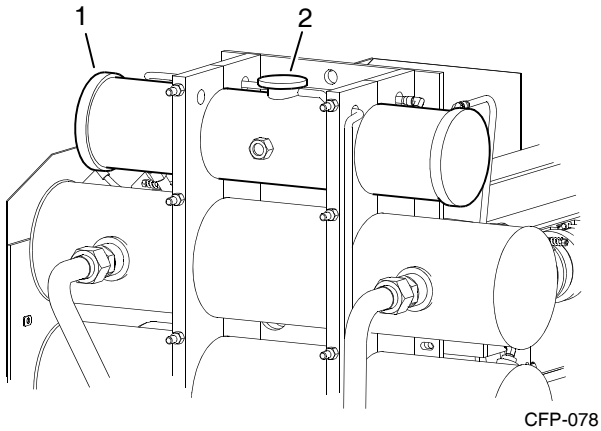
1. Engine Heater
2. Coolant Filter
3. Lower Coolant Hose
4. Coolant Pump

Figure 3-11 Coolant Circulation System

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

b. Check and correct any cooling system leaks.

c. Install the pressure/fill cap on the Coolant Expansion Tank.



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

Figure 3-12 Engine Coolant Expansion Tank

3. The engine coolant heater must maintain an engine coolant temperature of 49° C (120° F) or above. Refer to Figure 3-11.

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

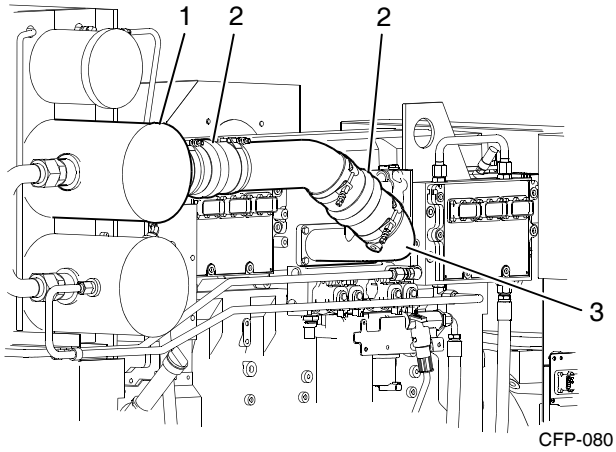
3.8 Charge Air Cooler System

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).

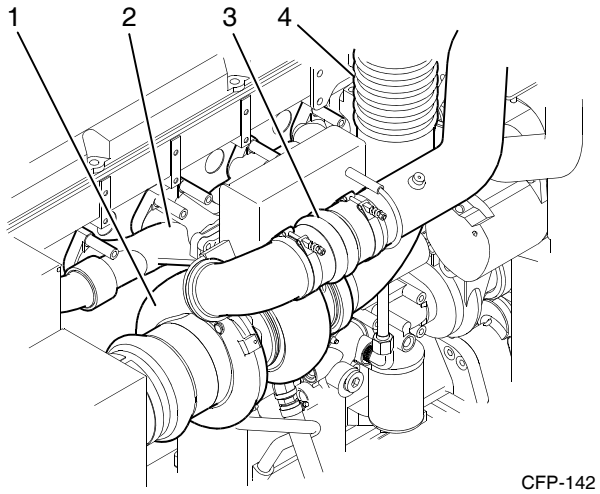
2. After the engine starts, a whistling noise may indicate an air leak from the turbocharger to discharge elbow connection, loose hose clamps, damaged manifold seals, missing hose clamps, or hose punctures.

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



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

Figure 3-13 Charge Air Cooler Tubing

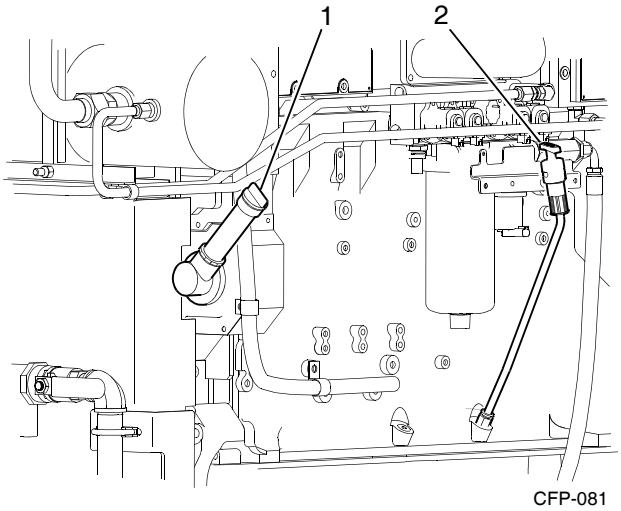


1. Charge Air Turbocharger
2. Exhaust Manifold
3. Charge Air Cooler (CAC) Tubing
4. Exhaust Flex Connection

Figure 3-14 Turbocharger and Charge Air Cooler (CAC) Piping

3.9 Lubricating Oil System Preparation

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



1. Oil Level Dipstick
2. Oil Fill Port

Figure 3-15 Oil Level Dipstick & Oil Fill Port

CAUTION

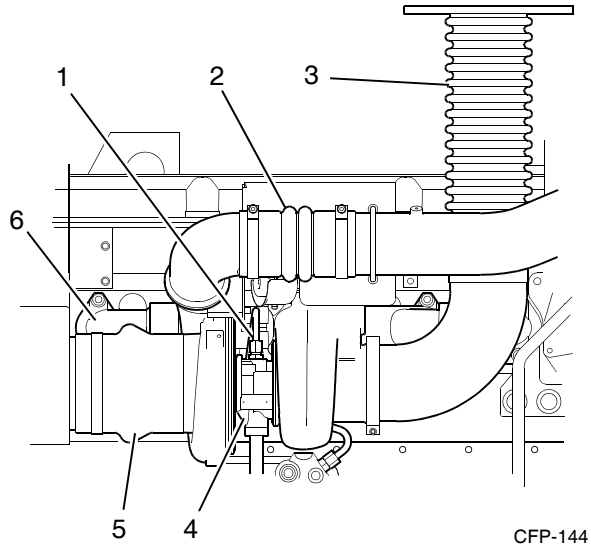
Some regulatory and shipping restrictions may require that all lubricants, fuels and coolants be drained for transport. Ensure that all cooling and lubrication systems have been filled to the proper level before operation.

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 lubricating oil. Refer to Figure 3-15.

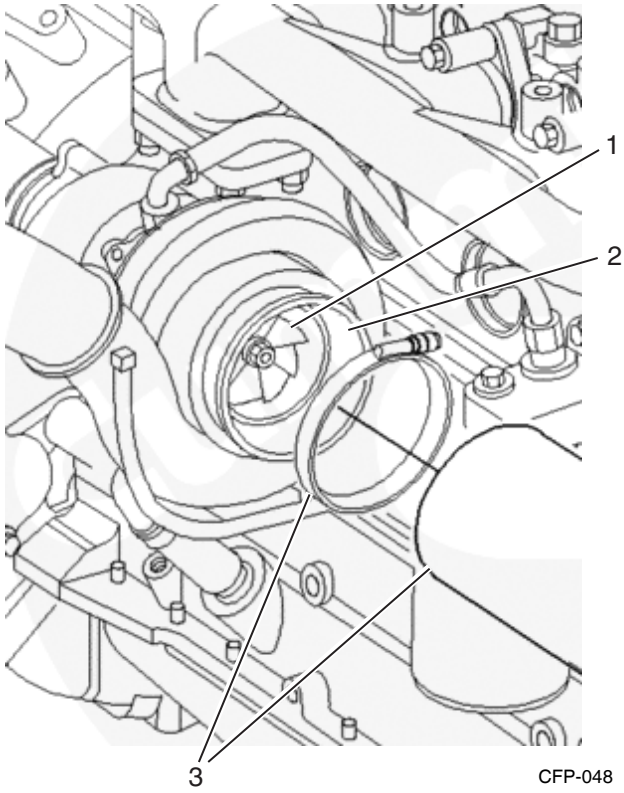
NOTE: *Do not use special "break-in" lubricating oils for new or rebuilt Cummins engines. Use the same type of oil during the "break-in" as used in normal operation.*

NOTE: *Using multi-viscosity lubricating 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. Turbocharger Oil Line
2. Charge Air Cooler (CAC) Tubing
3. Exhaust Flex Connection
4. Turbocharger
5. Turbocharger Air Intake
6. 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. The turbocharger has been lubricated during manufacture and testing. Refer to Figure 3-16.

   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 3-17.

   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.

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.

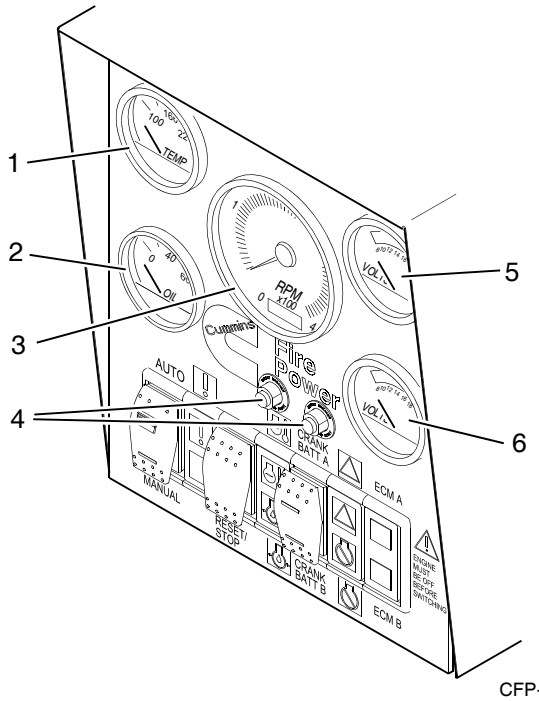
3.11 Engine Start Test

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.



CFP-021

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

Figure 3-18 Operator Control Panel - Instruments

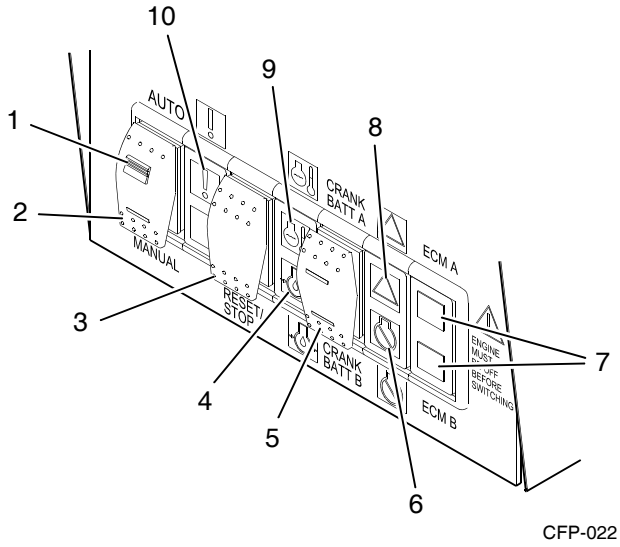
1. To start the engine from the Fire Pump Controller Panel:

   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 Control Panel.

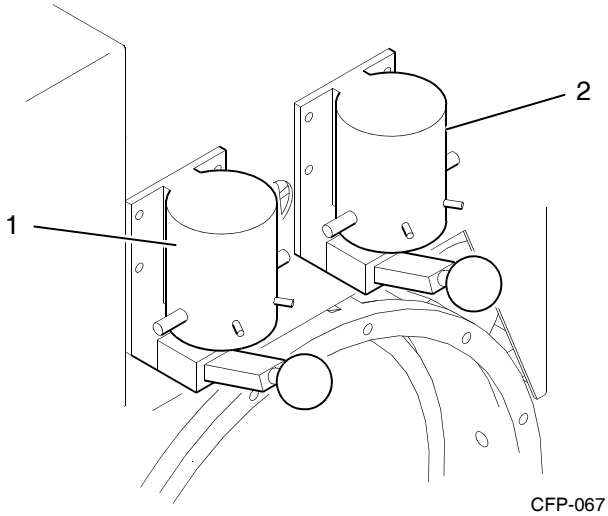
NOTE: *The fire pump engine will crank automatically when either solenoid A or solenoid B is selected at the fire pump controller panel.*



CFP-022

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 Coolant Temperature Warning Lamp
10. Overspeed Warning Lamp

Figure 3-19 Operator Control Panel - Controls



CFP-067

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

Figure 3-20 Manual Starter Contactors

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

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

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

c. Press downward on either CRANK BATT A/B 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

If the engine starts it is important to monitor the oil and raw water pressure gauges and coolant temperature gauge 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 Lubricating Oil Pressure High or Lubricating 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 25 GPM@ 10° C (50° F), 30 GPM @ 21° C (70° F), and 35 GPM @ 32° C (90° F).

CAUTION

If the coolant temperature gauge is not reading properly or if the Coolant Temperature Lamp is illuminated for 15 seconds, STOP THE ENGINE immediately! Continued operation without proper cooling 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 RESET/STOP Switch until the engine stops.

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 strainers. Clean the strainer 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 Operator Control Panel contains instruments and 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 Coolant 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 fuel/coolant heat exchanger. Raw water flow should be established immediately but some delay may occur before the flow exits the heat exchanger drain connection. Stop the engine if the coolant temperature alarm is illuminated for more than 15 second.

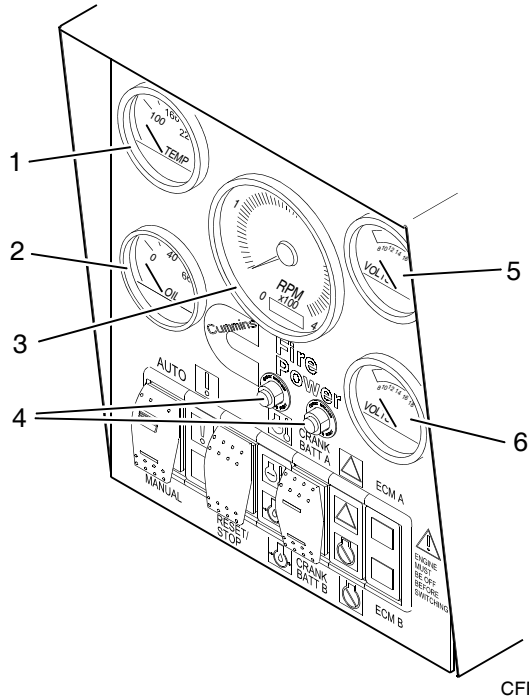
CAUTION

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 Lubrication Oil Pressure Gauge

The Lubrication Oil Pressure Gauge displays the lubricating 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.



CFP-021

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

Figure 4-1 Operator Control Panel - Instruments

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.

4.1.3 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 24 VDC signal is present when the overspeed switch has operated.

⚠ CAUTION

If an engine overspeed condition occurs, the fire pump engine will stop to avoid fire system overpressurization. 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 flywheel end of the unit.*

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.

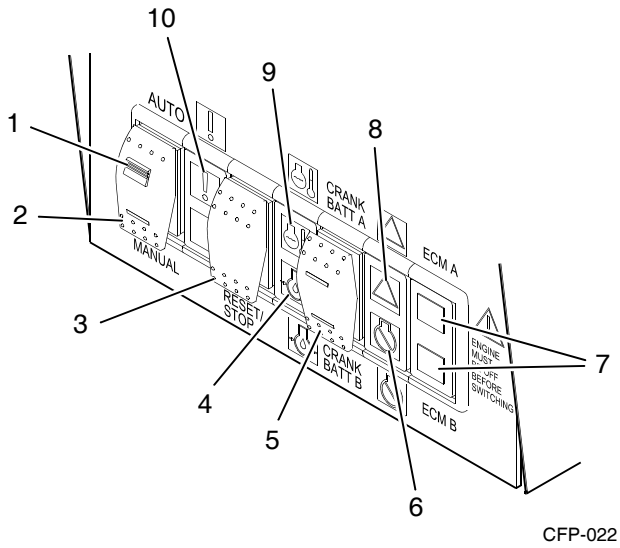
NOTE: *If one of the circuit breakers trips, locate and repair the source of the fault before pressing the RESET Button.*

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.

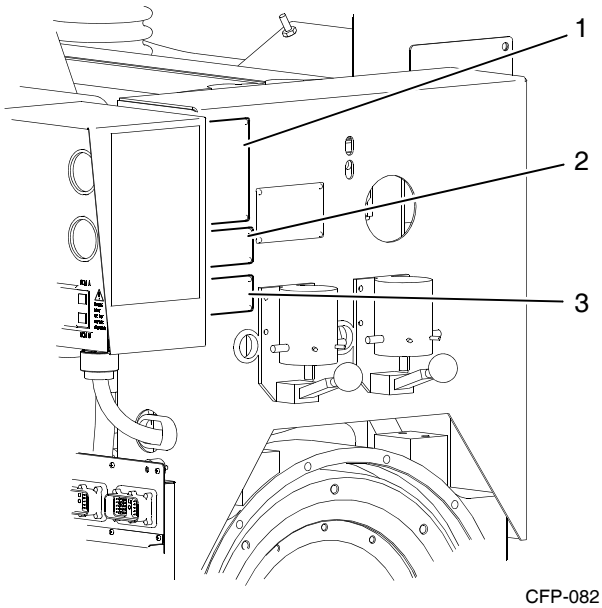


1. AUTO/MANUAL Mode Switch Locking Button
2. AUTO/MANUAL Mode Switch
3. Overspeed RESET/STOP Switch
4. Low Oil Pressure Warning Lamp
5. Crank Battery A/B Momentary Start Switch
6. ECM Engine Shut Down Lamp (red)
7. ECM A/B Indicator Lamps
8. ECM Warning Lamp (amber)
9. High Coolant Temperature Warning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

Figure 4-2 Operator Control 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.



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

NOTE: *The Run Speed and Engine Overspeed Set Point are displayed on the Factory Setting Tag, on the flywheel end of the unit. 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.

Once running, the engine may be stopped locally by pressing and holding the Overspeed RESET/STOP Switch until the engine stops.

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) sets of 12 VDC lead/acid core batteries, 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.

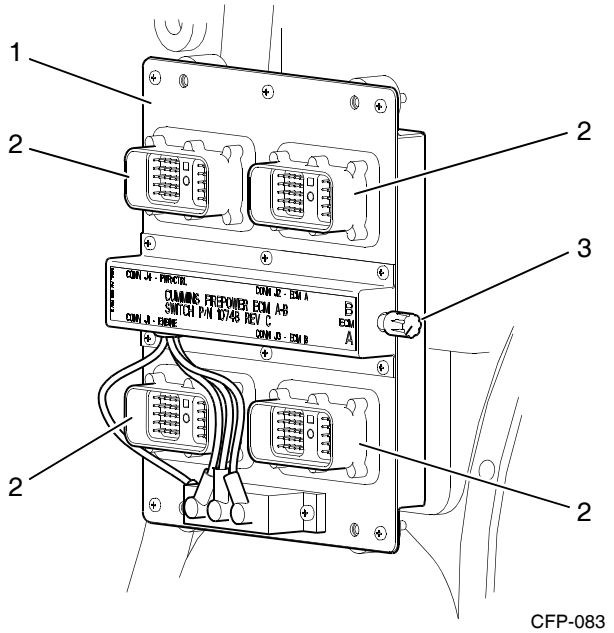
4.1.14 ECM A/B Indicator Lamps

The two ECM Indicator Lamps show the position of the ECM Selector Switch. If the ECM Selector 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.

If the ECM Selector 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 (ECM)

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.



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

Figure 4-4 ECM Selector Panel and Switch

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.

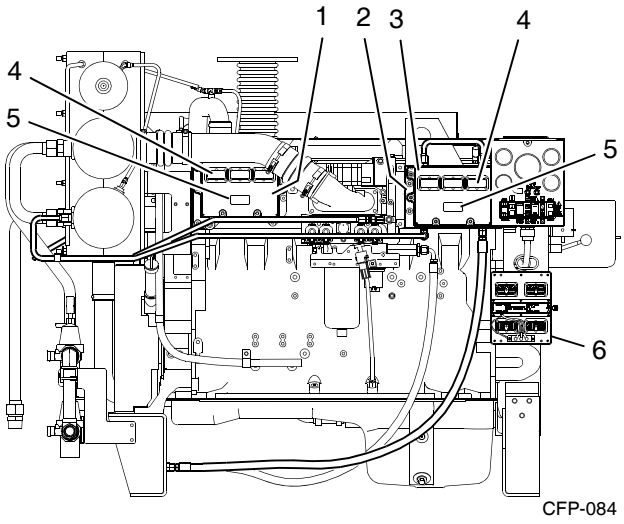
4.2.1 ECM Data Plate

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 4-6.

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.*



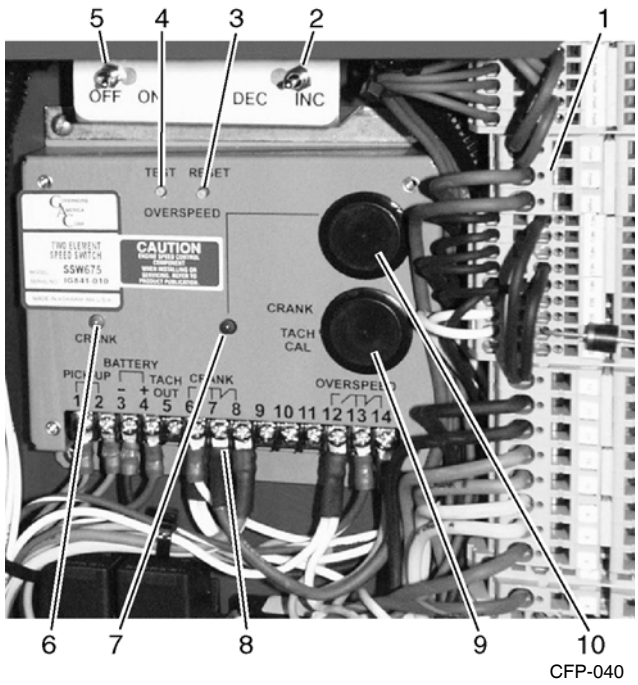
1. Electronic Control Module (ECM) A
2. ECM Cooling Plate
3. Electronic Control Module (ECM) B
4. ECM Harness Connections
5. ECM Data Plate
6. ECM Selector Plate and Switch

Figure 4-5 Electronic Control Modules (ECMs)

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. 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

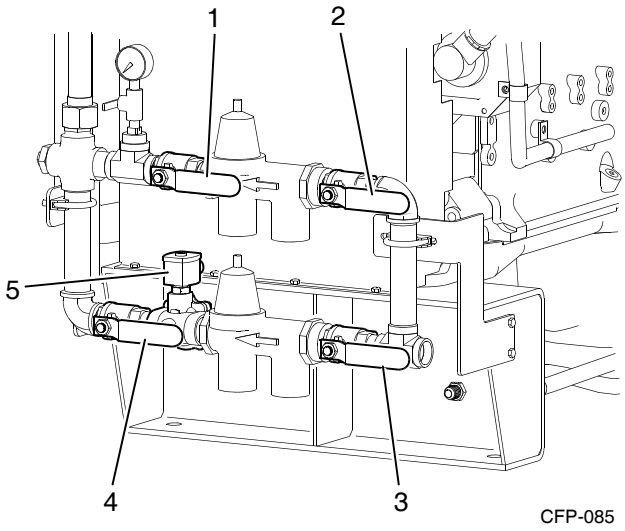
1. Use the Adjustment and Test Procedure in Section 6 - Maintenance to change the set point.

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

Figure 4-7 Raw Water Flow Control Valves

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, raw water can flow through the heat exchangers.

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

1. Manual valves for the Automatic Loop should remain OPEN at ALL times.

2. Manual valves for the Bypass Loop should be CLOSED during Automatic (pump controller) operation.

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)

6. Engine Overspeed (engine shutdown).

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 Setting Plate, located on the power takeoff 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 controller panel. The AUTO Mode position is the default switch position.

NOTE: *The AUTO/MANUAL Mode 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.

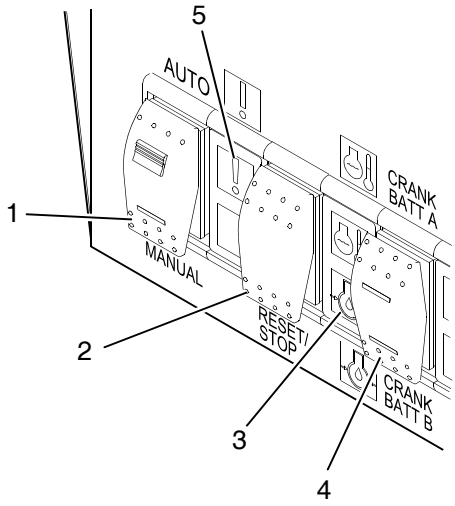
NOTE: *How the crank and crank terminate signals are displayed depends upon the fire pump controller manufacturer. This indication should be checked in the event that an automatic start is initiated. If the signal is not present, the engine can be started locally using the Local Starting Procedure in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

To start the engine from the Fire Pump Controller Panel:

1. Place the AUTO/MANUAL Mode Switch on the Operator's Control 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 Mode Switch
2. STOP/RESET Switch
3. Low Oil Pressure Warning Lamp
4. Battery A/B Switch
5. Overspeed Warning Lamp

Figure 5-1 Operator Control Panel Switches

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

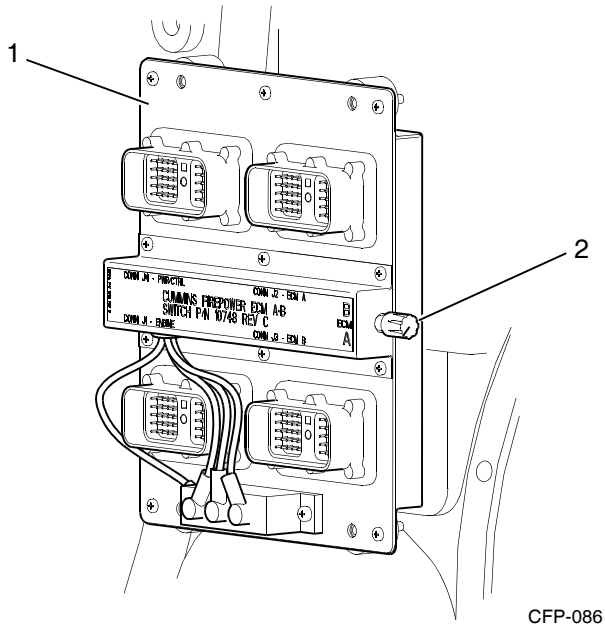
3. The engine continues to operate as long as the RUN signal is present. When the RUN signal is terminated by the fire pump controller, the engine stops immediately.

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

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 Mode 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.*

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.

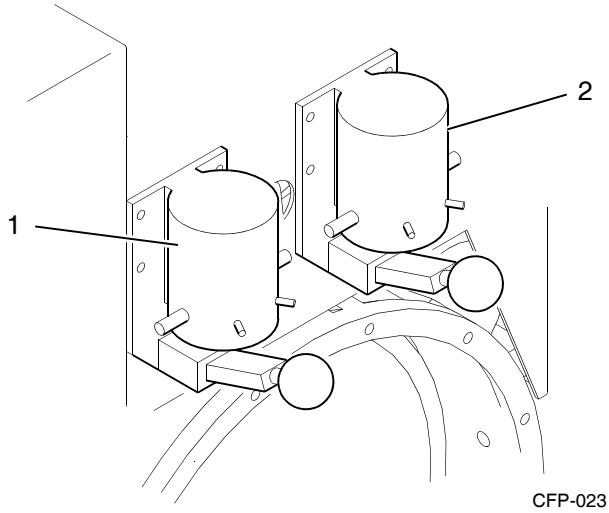
6. Stop the engine locally by pressing and holding STOP/RESET Rocker Switch until the engine stops.

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.

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



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

Figure 5-3 Manual Starter Contactors

3. Disengage the AUTO/MANUAL Mode 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 5-3.

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

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

CAUTION

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

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 - Maintenance 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.

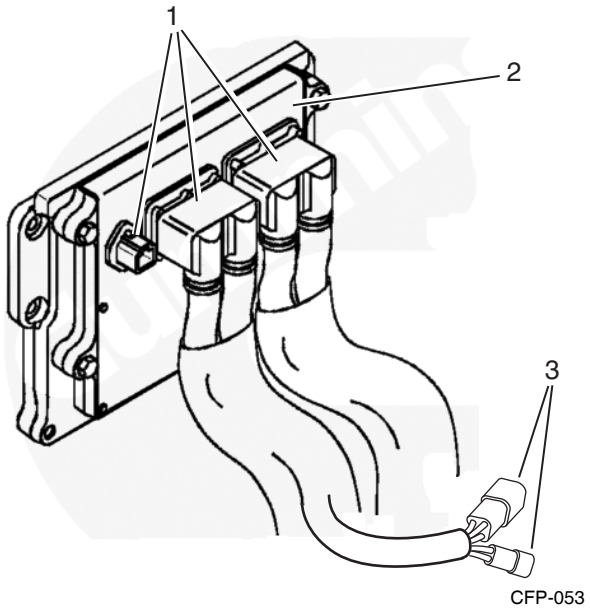
5.9 ECM Fault Code Lamps

The Electronic Control Module (ECM) can display and record operation irregularities, which are displayed as fault codes on the operator control 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 5-4.

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 5-5.



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

Figure 5-4 ECM Diagnostic Reader Plug-ins

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

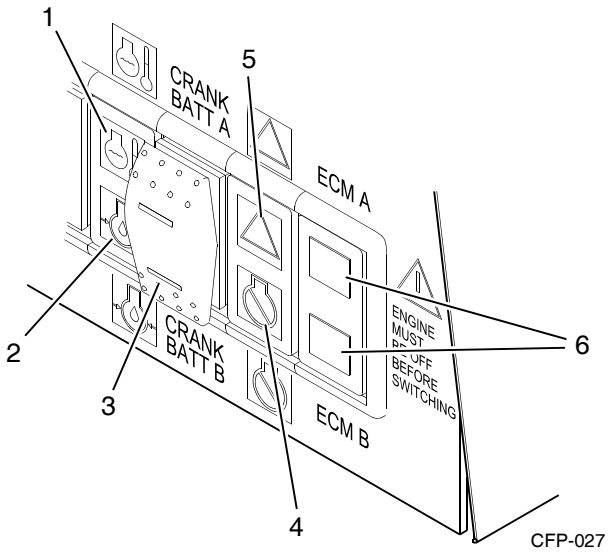
3. To flash out a 3-digit diagnostic fault code, which can then be used to help describe the nature of the engine malfunction. When either of the RED or AMBER lamps is illuminated, the fault code can be determined as follows:

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

   b. Open the operator control panel and place the Diagnostic ON/OFF Switch on the engine speed control panel in the ON position. Refer to Figure 5-6.

   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 Coolant 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. ECM A/B Indicator Lamps

Figure 5-5 Control Panel Indicator Lamps

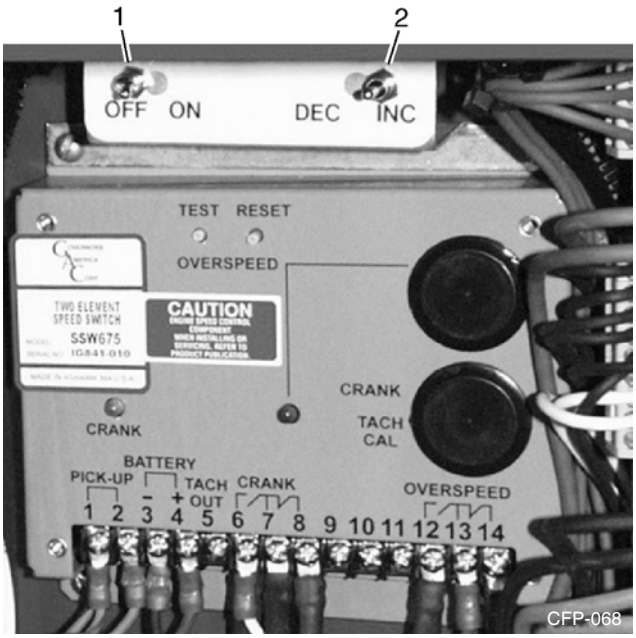
   For example: For a fault code of 241, the RED Lamp will blink 2 times to indicate the first digit, pause, blink 4 times to indicate the second digit, pause, then blink 1 time to indicate the third and final digit.

   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 Speed Increase/Decrease Toggle Switch on the engine speed control panel to the INC position to proceed to the next 3-digit fault code. Refer to the Fault Code Chart in Section 7 - Troubleshooting to identify the 3-digit code.

5. If the Diagnostic ON/OFF 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 ON/OFF Switch to the OFF position before attempting to start the engine.*



1. Diagnostic ON/OFF SwItch
2. Speed INC/DEC (Increase/Decrease) Switch

Figure 5-6 Engine Speed Control Panel

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 operator'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 ECMs.

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 coolant or oil temperature
7. Unusual engine noise
8. Excessive smoke
9. Excessive use of coolant, fuel, or engine oil
10. Any fuel, raw water, engine coolant, 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 Inc. recommends using K&N Serviceable RC-3070.*

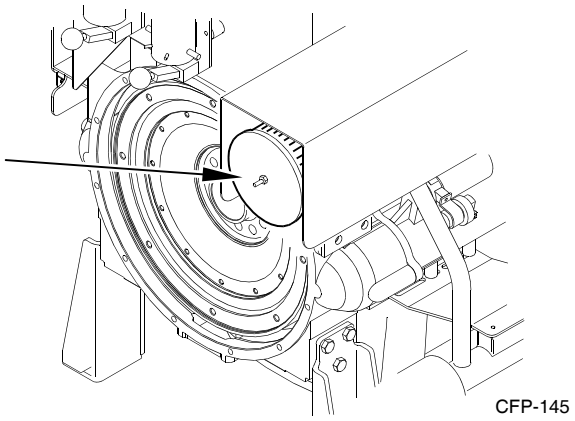


Figure 6-1 Air Filter

   b. Check that the filter blockage 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 pipes, 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

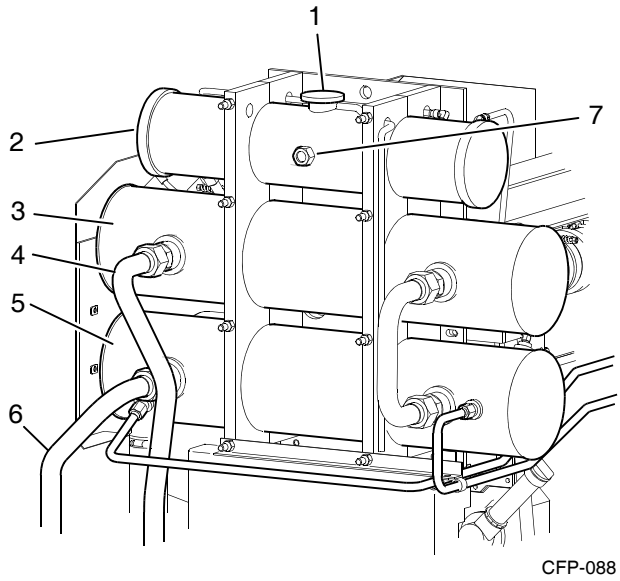
CAUTION

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, heat exchangers tanks, charge air cooling system, engine coolant hoses and hose clamps for loose fittings, leaks, holes, damage and corrosion.



1. Coolant Pressure/Fill Cap
2. Coolant Expansion Tank
3. Charge Air Cooler (CAC) Heat Exchanger
4. Raw Water Inlet Pipe
5. Coolant/Fuel Cooler Heat Exchanger
6. Raw Water Outlet Pipe
7. Coolant Level Sight Gauge

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/fill cap. Refer to Figure 6-2.

   a. Ensure that the coolant level is visible at the center of the coolant level sight gauge.

   b. Add coolant as required. DO NOT OVERFILL!

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

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 coolant/fuel 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

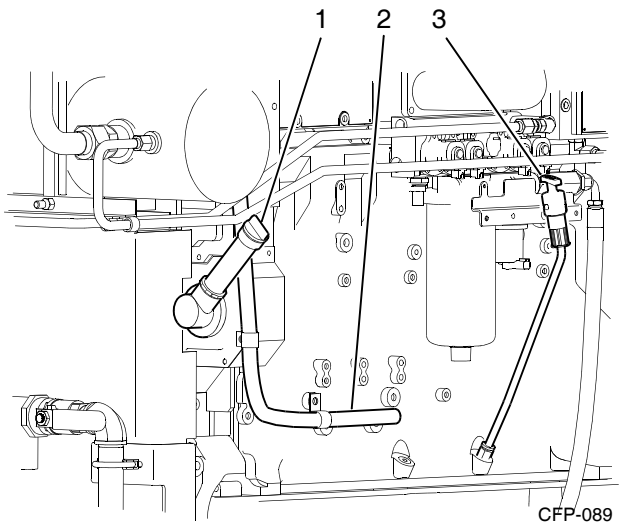
Never operate the engine with the oil level below the L (low) mark or above the H (high) mark. Poor engine performance or engine damage can occur.

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 Filler Tube
2. Crankcase Breather Tube
3. Oil Level Dipstick

Figure 6-3 Engine Oil Dipstick

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

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

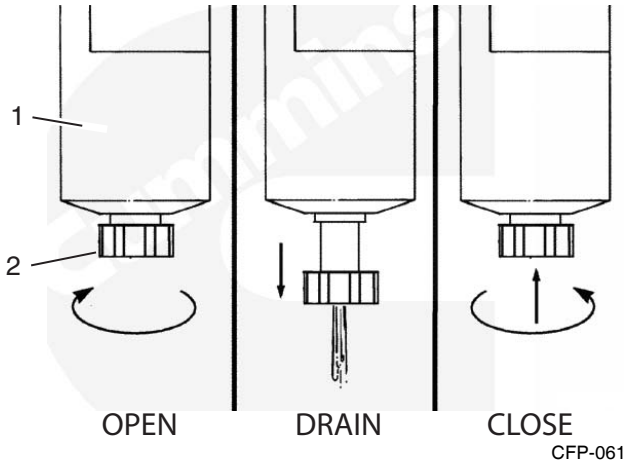
   Keep the oil level as near as possible to the “full” mark on the dipstick by adding the same quality and brand of oil.

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

6.3.5 Fuel System Inspections

WARNING

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



1. 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 FS1041 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 Tube

1. Inspect the crankcase breather tube for a worn or damaged hose, sludge, blockage, or dirt buildup. Refer to Figure 6-3.

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

6.3.9 Clean Raw Water Strainers

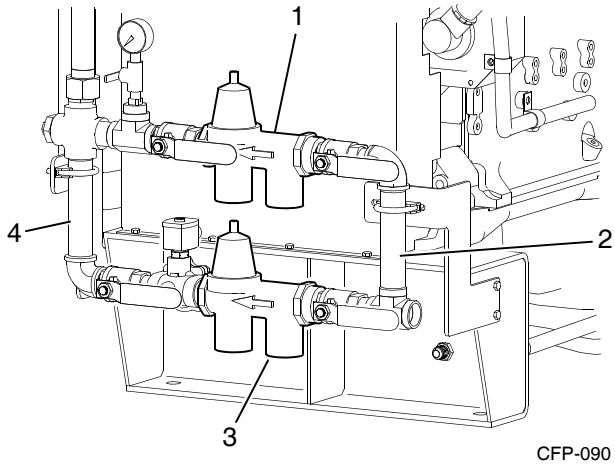
Each raw water strainer (one on the normal line and one on the bypass line) is part of the raw water pressure regulator/strainer assembly and should be cleaned weekly, to remove sediment. Refer to Figure 6-5.

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

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

3. Inspect and remove any debris.

4. Install the strainer plug.



1. Bypass Pressure Regulator/Strainer
2. Bypass Raw Water Line
3. Normal Pressure Regulator/Strainer
4. Normal Raw Water Line

Figure 6-5 Raw Water 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.

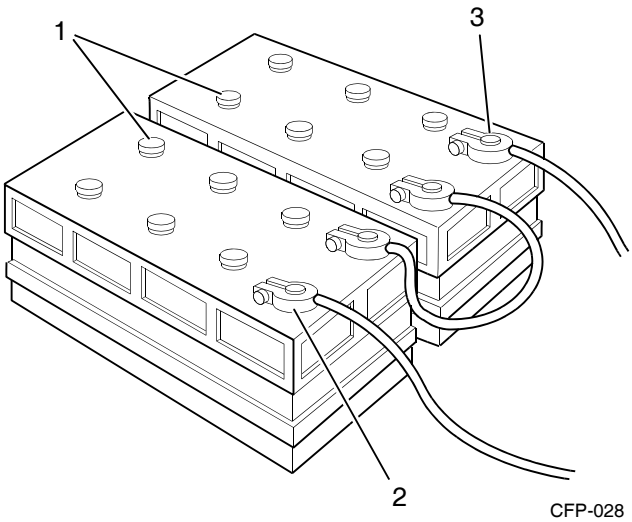
Only a regular schedule of inspection and testing under load can prevent engine starting problems. Use a manual battery load tester to verify the condition of each starting battery. Inspect the condition of the batteries, the electrical cables and the engine ground lug. Refer to Figure 6-6.

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

Figure 6-6 24 VDC Series Battery Connection

1. Keep the batteries clean by wiping them with a damp cloth whenever dirt appears excessive. Refer to Figure 6-6.

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 the positive (+) battery cable first followed by the negative (-) battery cable. 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 Test Run

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 is between 70° C (158° F) and 107° C (225° F).

9. Check that both battery voltmeters indicate 24 VDC.

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

11. Shut off the engine by pressing and holding the RESET/STOP Switch until the engine stops.

12. When finished, set the AUTO/MANUAL Mode Switch to AUTO.

6.3.12 Engine Coolant Heater

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

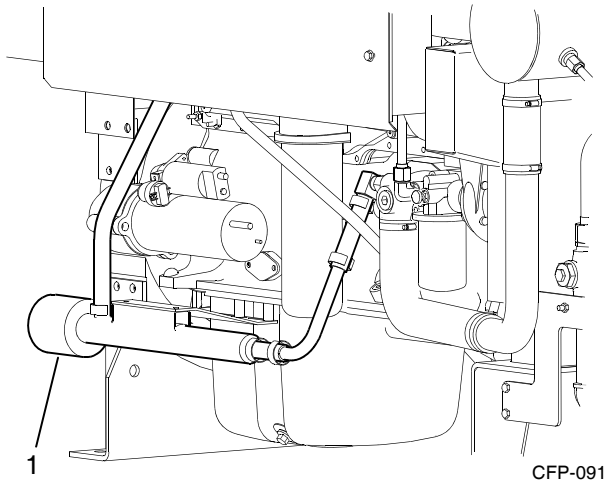


Figure 6-7 Engine Heater

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 6-7.

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.

   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.

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

6.3.14 Air Cleaner Service Indicator

Turbocharged engines must be operated at rated RPM and full load to check maximum intake air restriction. Clean or replace the air filter element 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.*

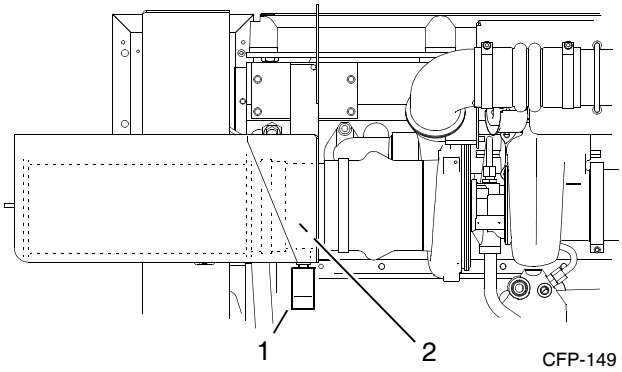
NOTE: *Follow the manufacturer's instructions when cleaning or replacing the air cleaner element. Do not remove the felt washer from the indicator. The felt washer absorbs moisture.*

1. The air cleaner service indicator is actuated when excessive air restriction has occurred at the air cleaner. Refer to Figure 6-8.

   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 K&N Serviceable/Disposable Air Cleaner Element RC-3070.*

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



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

Figure 6-8 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

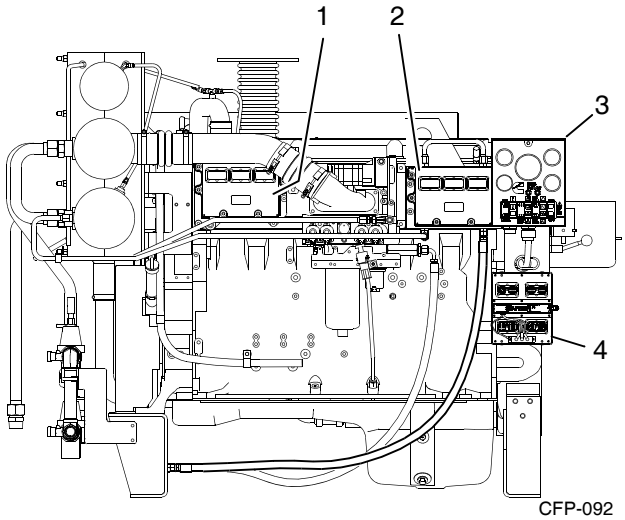
AVOID SERVICING complex components such as: ECM controllers, printed circuit boards, and, programmable controllers, not specifically authorized by the manufacturer. Contact the local Cummins Authorized Repair Location before performing any extensive maintenance.

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 6-9.



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

Figure 6-9 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.

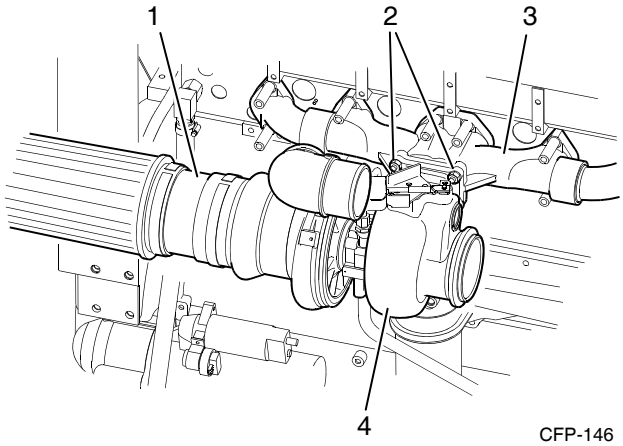
3. Inspect electrical terminal connectors on the instrument panel for burnt, loose, damaged or broken contacts.

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

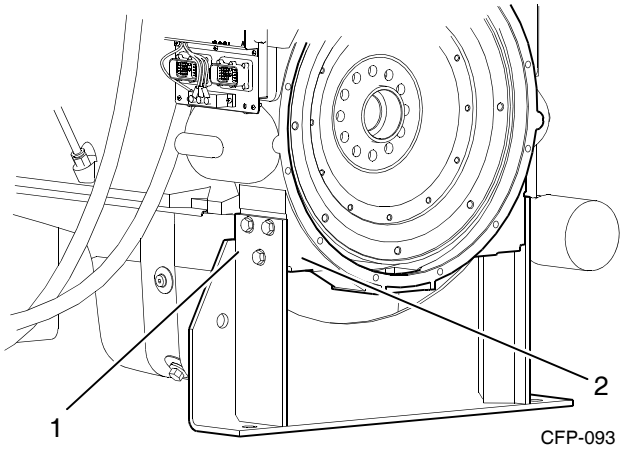
Check the turbocharger mounting bolts. Refer to Figure 6-10.

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



1. Filtered Intake Air Pipe to Turbocharger
2. Turbocharger Mounting Nuts (4)
3. Exhaust Manifold
4. Turbocharger

Figure 6-10 Turbocharger



1. Engine Mounting Bracket
2. Flywheel Housing

Figure 6-11 Engine Mounting Bracket

6.4.3 Engine Mounting Bolts

CAUTION

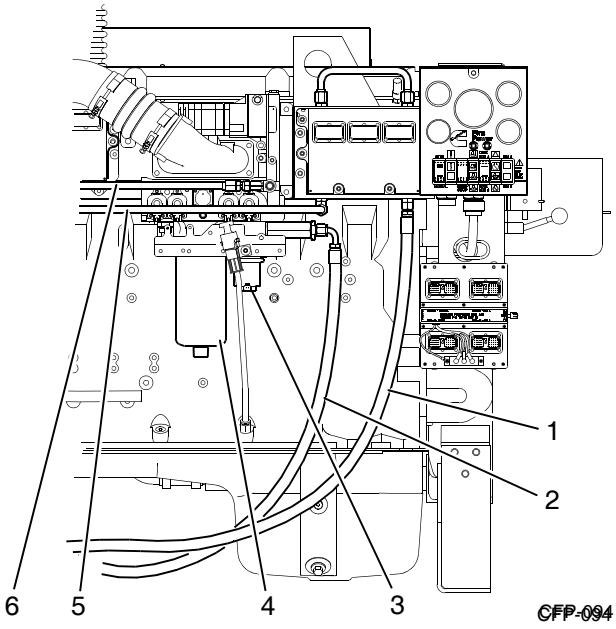
Loose engine mount bolts or damaged brackets can cause engine misalignment or excessive vibration. These conditions can cause engine or pump damage.

1. Inspect all engine mounts for cracks or loose bolts. Refer to Figure 6-11.

2. Check the torque on the engine mounting bolts. Torque the support bracket to engine mounting cap screws to 244 N-m (180 ft-lb).

6.4.4 Inspect Fuel Pump

1. Inspect the fuel injection pump mounting nuts, including the support bracket, for loose or damaged hardware. Refer to Figure 6-12.Inspect the fuel lines and hoses for wear damage, loose fittings and leaks. Repair or replace damaged lines and hoses as required.



1. Fuel Return Hose
2. Fuel Supply Hose
3. Lift Pump
4. Fuel Filter or Filter/Separator Canister
5. Fuel Cooling Line From Heat Exchanger
6. Fuel Cooling Line To Heat Exchanger

Figure 6-12 Fuel Pumps, Filter, Lines and Hoses

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.

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.

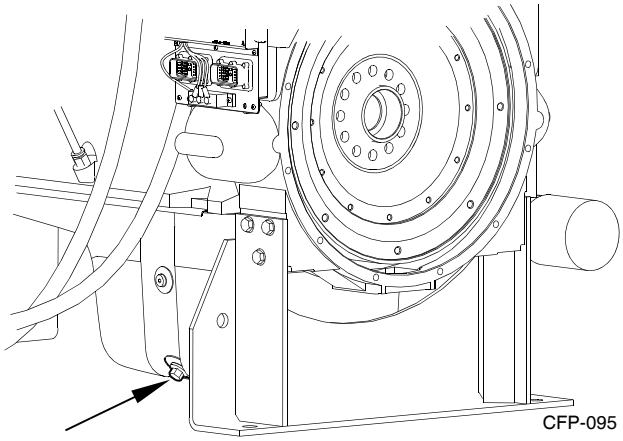


Figure 6-13 Oil Pan Drain Plug (right side shown)

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 that has been drained from the oil pan.*

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

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

3. Place an appropriate container under the oil pan drain plug. For improved access, the unit has a drain plug located on each side of the unit. Refer to Figure 6-13.

   The CFP15E engine models have a 13 gal oil capacity (48 - 52 qts (47 - 49 liters)).

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 6-14.

   a. Clean the area around the oil filter canister.

   b. Use a filter wrench to remove the filter.

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

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

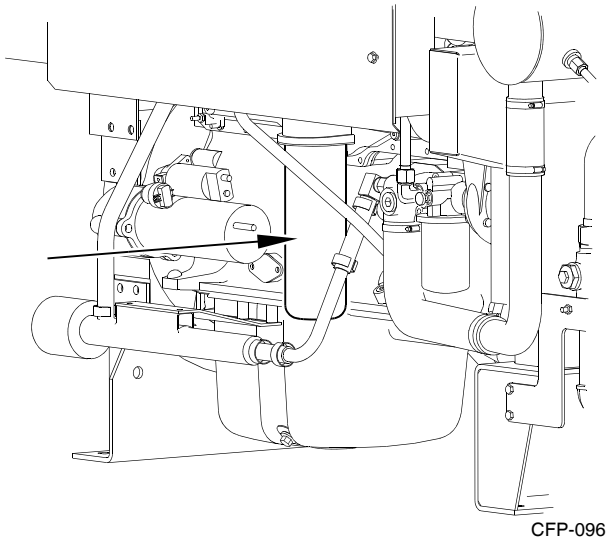


Figure 6-14 Oil Filter Canister

6. Fill the oil filter with a high-quality 15W-40 multi-viscosity lubricating 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 LF9000.*

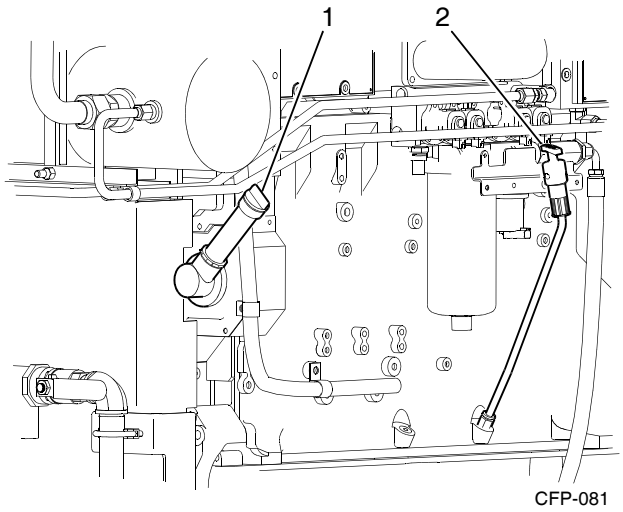
8. Check and clean the oil pan drain plug threads and sealing surface. Install the oil pan drain plug. Torque the plug to 50 N-m (37 ft-lb).

9. Add a high-quality 15W-40 multi-viscosity lubricating 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 CFP15E engine models have a 13 gal oil capacity (48 - 52 qts (47 - 49 liters)).

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



1. Oil Level Dipstick
2. Oil Fill Port

Figure 6-15 Oil Fill Port and Oil Level Dipstick

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.

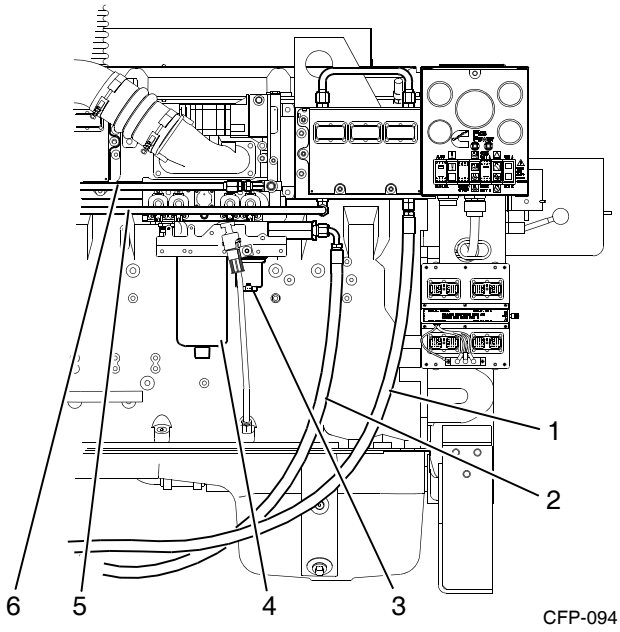
6.4.6 Change Fuel Filter or Filter Separator

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 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. Fuel Return Hose
2. Fuel Supply Hose
3. Lift Pump
4. Fuel Filter or Filter/Separator Canister
5. Fuel Cooling Line From Heat Exchanger
6. Fuel Cooling Line To Heat Exchanger

Figure 6-16 Engine Fuel Filter or Filter/Separator

1. Shut off the engine.

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

3. Clean the area around the fuel filter 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.

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

NOTE: *Cummins recommends using Fleetguard (Cummins) fuel filter/water separator FS1041 or equivalent in the primary fuel filter location.*

7. Center the filter on the threaded mounting stud. Screw the filter canister onto the mounting stud 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 (if equipped).

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.

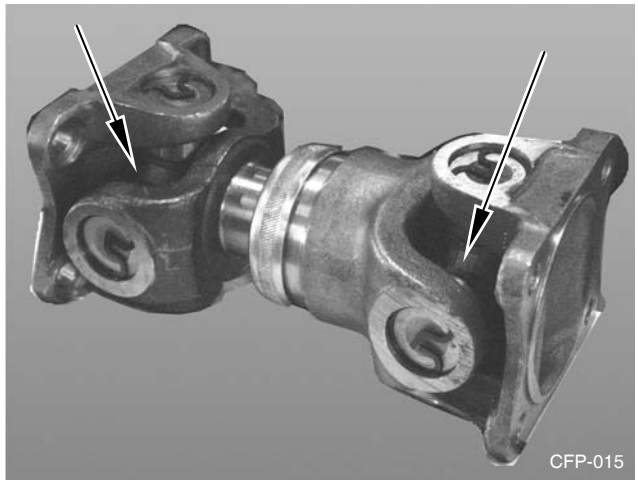


Figure 6-17 Drive Coupling Grease Fittings

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.

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:

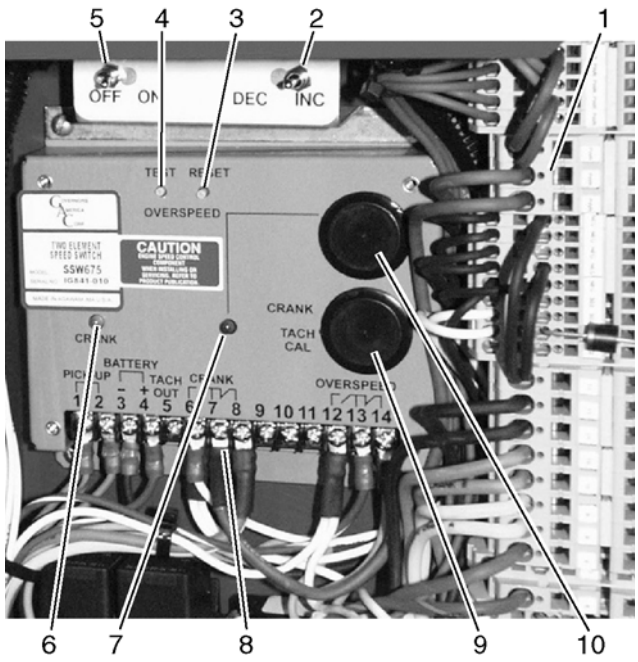
1. Open the engine control panel and remove the crank terminate potentiometer cover.

   There will be 2 potentiometers visible. The Crank Terminate Potentiometer is the upper one.

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.



CFP-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

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 control panel.

1. Remove the cap screw from the operator's control 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 INC/DEC Speed 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 INC/DEC Speed Switch to the INC position until the rated speed is reached. Refer to Figure 6-18.

   b. To decrease the speed, move the INC/DEC Speed 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 Firepower 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 Mode 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.*

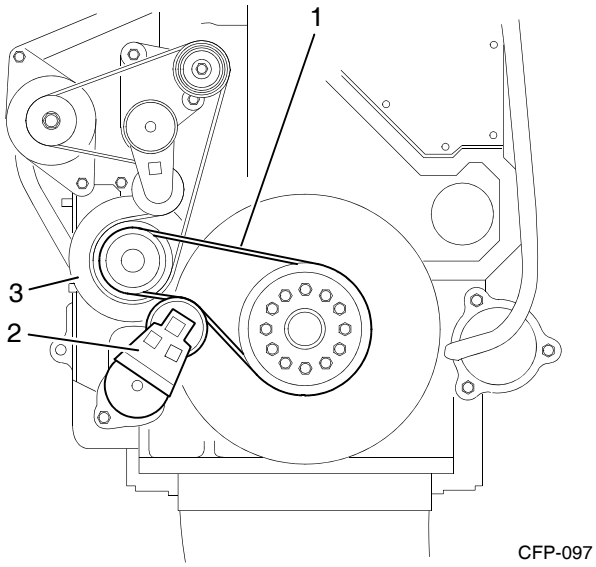
7. Press the Reset button on the speed switch or front panel so the engine can be restarted.

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 Belt Inspection



1. Coolant Pump
2. Coolant Pump Drive Belt
3. Tensioner Arm

Figure 6-19 Coolant Pump Drive Belt

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 surface or pulley.

1. Place the AUTO/MANUAL Mode 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.

3. Remove the belt guard bolts and the belt guard. Set aside for later installation.

4. Visually inspect the Coolant Pump 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 coolant pump 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 Belt Tension

Use the following procedure to properly tension the poly-vee, coolant pump belt.

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

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

a. Measure the belt tension in the center span of the coolant pump belt 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).

8. With the belt guard still removed, perform the alternator belt inspection.

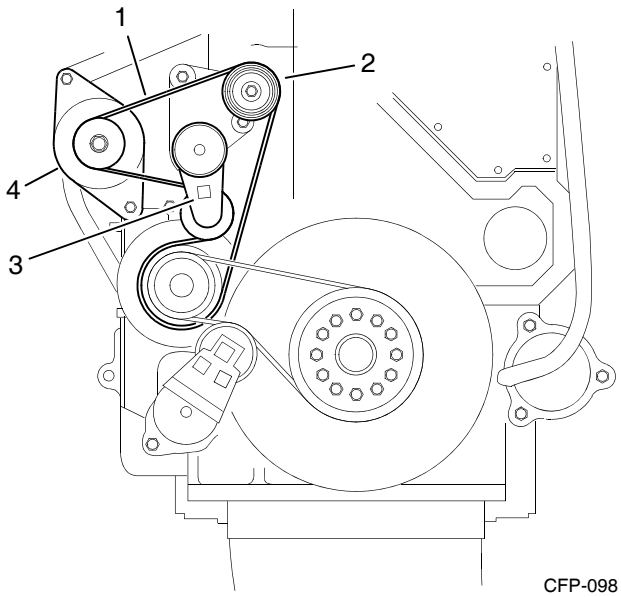
6.4.11 Alternator Belt Inspection

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 surface or pulley.

CAUTION

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



1. Alternator Drive Belt
2. Idler Pulley
3. Tensioner Arm
4. Alternator

Figure 6-20 Alternator Drive Belt

1. Visually inspect the alternator belt for frayed, worn, missing pieces or cracked belt surfaces. Check the belt for intersecting cracks. Refer to and Figure 6-20.

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 alternator belt if it is cracked, frayed or has pieces of material missing.*

2. 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.*

6.4.12 Alternator Belt Tension

An automatic tensioning arm controls the alternator belt tension. The belt-driven coolant pump drives the alternator using a belt, automatic tensioner, and idler pulley.

CAUTION

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

1. Determine the belt tension using Cummins belt tensioner gauge, Part No. 3822524, to measure drive belt tension. Belt tension should be in the range of, 360 to 490 N-m (266 to 361 ft-lb) at the center of the shaft span.

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.*

2. 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.

3. 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.

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

5. Use a breaker bar with a 3/8” ratchet to rotate the tensioner slowly away from the belt.

   If the arm rotates with any roughness or hesitancy, replace the tensioner. Torque the tensioner arm to 43 N-m (32 ft-lb).

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

6.4.13 Heat Exchanger Pressure Test

NOTE: *This test is required if internal leakage in either the charge air cooler (CAC) heat exchanger or coolant/fuel 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 1-1/2” 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 1-1/4” 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.

6.4.14 Turbocharger Inspection

1. Visually inspect the air filter and piping for dirt buildup, blockage, wear points, soft hoses, loose clamps, or punctures. Refer to Figure 6-21.

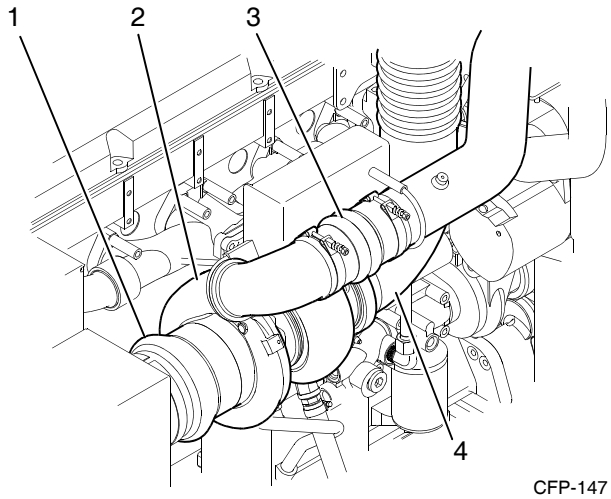
   Replace damaged air filter or pipes, and tighten loose clamps, as necessary, to prevent the air system from leaking.

2. Check that the air filter pop-up 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.



1. Filtered Air Plumbing to Turbocharger
2. Turbocharger
3. Air Pipe to Charge Air Cooler
4. Air Pipe to Exhaust Flex Connection

Figure 6-21 Turbocharger Connections

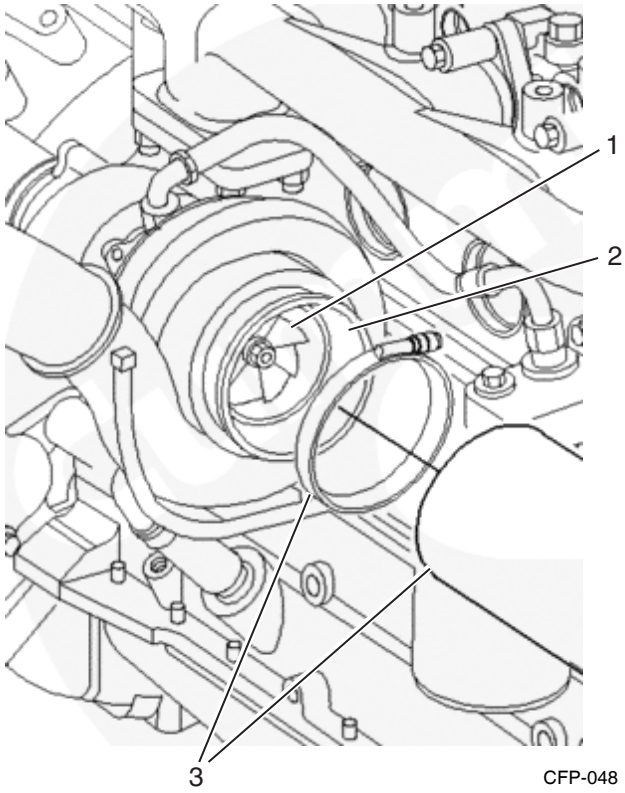
5. Remove the exhaust pipe from the turbocharger.

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 6-22.

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

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

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



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

Figure 6-22 Turbocharger Turbine Wheel

6.5 Every 2 Years or 2000 Hours

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

6.5.1 Coolant Pump Inspection

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

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

6.5.2 Drain and Flush Cooling System

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

WARNING

Do not remove the pressure 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.

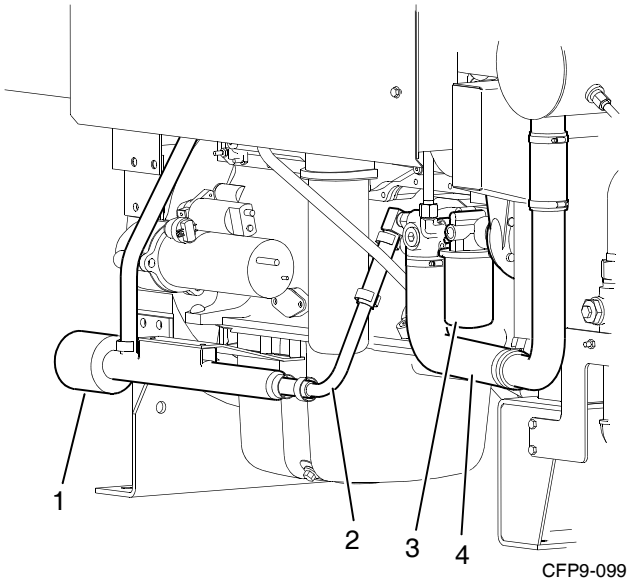
1. Press down, unscrew and remove the pressure/fill cap. The cap must be removed to allow air to vent the cooling system during the draining process.

2. Disconnect the engine heater power supply before draining the cooling system. Refer to Figure 6-23.

3. Place a container that will hold at least 15 gallons of liquid, under the engine heater coolant hose. Refer to Figure 6-23.

4. Disconnect either end of the engine heater coolant hose and allow the coolant to drain into the waste container. Refer to Figure 6-23.

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



1. Engine Heater
2. Engine Heater Coolant Hose
3. Coolant Filter
4. Lower Coolant Hose

Figure 6-23 Engine Coolant Drains

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

6. When the flushing water has fully drained, use a filter wrench to remove the 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 6-24.

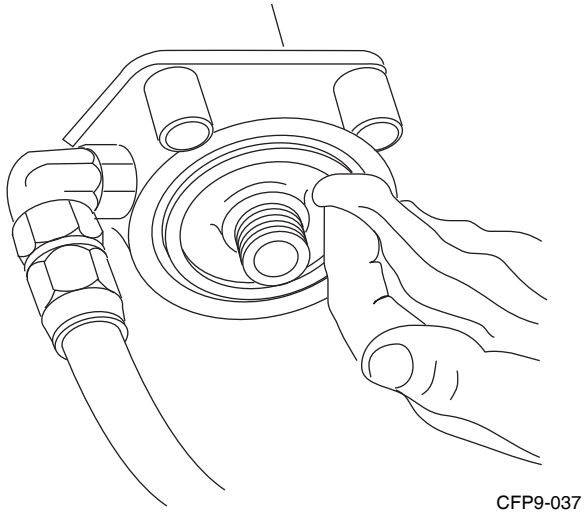


Figure 6-24 Filter Housing Gasket Mount

   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 Coolant Filter WF2126.*

CAUTION

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

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

8. Connect any disconnected lines or hoses.

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).*

9. 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.

10. 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.
11. Operate the engine until it reaches a temperature of 82° C (180° F), and check for coolant leaks.
12. 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

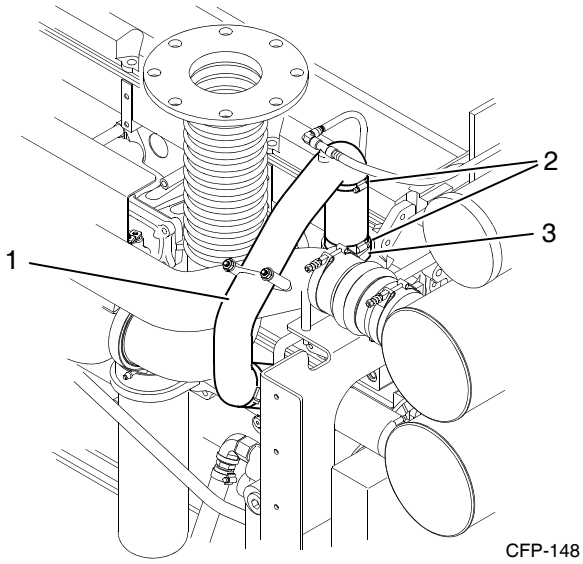
The thermostat regulates the temperature of the engine coolant circulating through the engine cooling system.

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 remove the upper coolant hose from the thermostat housing.

2. Remove the (2) thermostat housing flange cap screws and the thermostat flange. Refer to Figure 6-25.



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

Figure 6-25 Thermostat Housing

3. Remove the thermostat and gasket from the housing.

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

5. Install the thermostat EC1722 or equivalent 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 Belt Replacement

Replace the Coolant Pump 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 6-26.

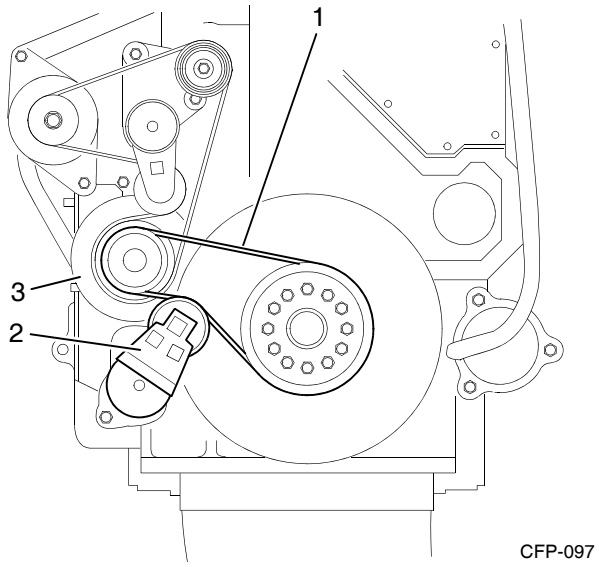
2. Use a 3/8” drive ratchet or breaker bar to rotate the tensioner arm away from the belt and remove the belt.

3. Check the belt tensioner cap screw torque. 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.



1. Coolant Pump
2. Coolant Pump Drive Belt
3. Tensioner Arm

Figure 6-26 Coolant Pump Drive Belt

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. Proceed to 6.6.3 Alternator Belt Replacement or reinstall the belt guard.

6.6.3 Alternator Belt Replacement

Replace the drive belt if it is cracked, frayed or has pieces of material missing.

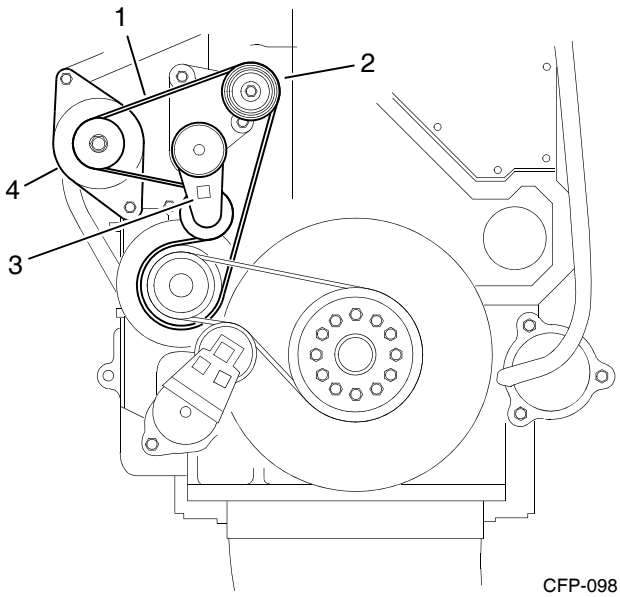
CAUTION

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

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

1. Use a 3/8” drive ratchet or breaker bar to rotate the tensioner arm away from the belt and remove the belt. Refer to Figure 6-27.

2. Rotate the backside idler pulley. The pulley should spin freely with no mechanical binding, eccentric motion or excessive end-play. Replace the idler pulley assembly if necessary.



1. Alternator Drive Belt
2. Idler Pulley
3. Tensioner Arm
4. Alternator

Figure 6-27 Alternator Drive 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, replace the tensioner.

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. 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. Replace the belt guard and tighten the cap screws to the proper torque value.

6.6.4 Charge Air Cooler 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 Mode Switch in the MANUAL position.

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

CAUTION

Both 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 normal and bypass raw water hand valves on the raw water manifold.

4. Disconnect the charge air inlet and outlet piping from the charge air cooler (CAC) heat exchanger. Refer to Figure 6-28.

5. Disconnect raw water inlet and outlet fittings from the charge air cooler (CAC) heat exchanger. Refer to Figure 6-28.

6. Provide support for the CAC heat exchanger in order to avoid dropping it.

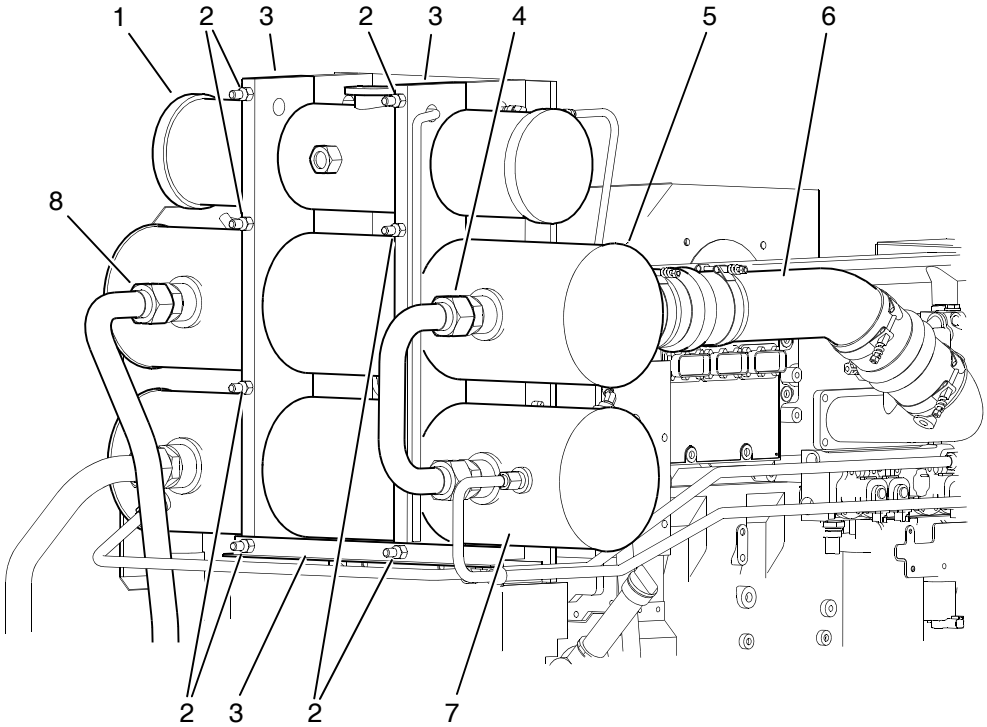
7. Remove the CAC heat exchanger mounting bracket bolts from the mounting bracket and remove the CAC heat exchanger from the mounting brackets.

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.



CFP-100

1. Coolant Expansion Tank
2. Mounting Bracket Nuts
3. Charge Air Cooler Mounting Brackets
4. Raw Water Outlet Fitting
5. Charge Air Cooler (CAC) Heat Exchanger
6. Charge Air Tubing to Engine
7. Coolant/Fuel Cooling Heat Exchanger
8. Raw Water Inlet Fitting
9. Charge Air Tubing from Turbocharger (not shown)

Figure 6-28 Charge Air Cooler (CAC) Heat Exchanger

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

9. 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.

10. 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.

11. Rinse thoroughly with clean water.

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

13. If internal water leakage is suspect, perform a pressure test on the heat exchanger. Refer to 6.4.13 Heat Exchanger Pressure Test.

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

15. Position the heat exchanger and clamps on the engine's mounting bracket and hand tighten the mounting bolts.

16. Align the heat exchanger with the required air hose connections and tighten the hose clamp fasteners. Refer to Figure 6-28.

17. 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).

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

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

20. 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 QSX15 Engines, Bulletin No. 3666423 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

CFP15E Fault Code Table

FAULT CODE (LAMP)	SID(S) PID(S) FMI	SPN FMI	Cummins DESCRIPTION
111 (Red)	S254 12	629 12	Engine Control Module - Critical Internal Failure
115 (Red)	P190 2	190 2	Engine Speed/Position Sensor Circuit - Lost both of two signals from the Magnetic Pickup Sensor
121 (Yellow)	P190 10	190 10	Engine Speed/Position Sensor Circuit - Lost one of two signals from the Magnetic Pickup Sensor
122 (Yellow)	P102 3	102 3	Intake Manifold Pressure Sensor #1 Circuit - Shorted High
123 (Yellow)	P102 4	102 4	Intake Manifold Pressure Sensor #1 Circuit - Shorted Low
131 (Red)	P091 3	091 3	Accelerator Pedal Position Sensor Circuit - Shorted High
132 (Red)	P091 4	091 4	Accelerator Pedal Position Sensor Circuit - Shorted Low
133 (Red)	P029 3	974 3	Remote Accelerator Pedal Position Sensor Circuit - Shorted High
134 (Red)	P029 4	974 4	Remote Accelerator Pedal Position Sensor Circuit - Shorted Low
135 (Yellow)	P100 3	100 3	Engine Oil Pressure Sensor Circuit - Shorted High
141 (Yellow)	P100 4	100 4	Engine Oil Pressure Sensor Circuit - Shorted Low
143 (Yellow)	P100 1	100 18	Engine Oil Pressure Low - Warning
144 (Yellow)	P110 3	110 3	Engine Coolant Temperature Sensor Circuit - Shorted High
145 (Yellow)	P110 4	110 4	Engine Coolant Temperature Sensor Circuit - Shorted Low
147 (Red)	P091 8	091 8	Accelerator Pedal Position Sensor Circuit - Low Frequency
148 (Red)	P091 8	091 8	Accelerator Pedal Position Sensor Circuit - High Frequency
151 (Yellow)	P110 0	110 0	Engine Coolant Temperature High - Critical
153 (Yellow)	P105 3	105 3	Intake Manifold Temperature Sensor #1 Circuit - Shorted High
154 (Yellow)	P105 4	105 4	Intake Manifold Temperature Sensor #1 Circuit - Shorted Low
155 (Red)	P105 0	105 0	Intake Manifold Temperature #1 High - Critical
187 (Yellow)	S232 4	620 4	Sensor Supply Voltage #2 Circuit - Shorted Low
211 (None)	S216 11	1484 31	Additional OEM/Vehicle Diagnostic Codes have been logged. Check other ECM's for DTC's.
212 (Yellow)	P175 3	175 3	Engine Oil Temperature Sensor Circuit - Shorted High
213 (Yellow)	P175 4	175 4	Engine Oil Temperature Sensor Circuit - Shorted Low

CFP15E Fault Code Table (Continued)

FAULT CODE (LAMP)	SID(S) PID(S) FMI	SPN FMI	Cummins DESCRIPTION
214 (Yellow)	P175 0	175 0	Engine Oil Temperature High - Critical
219 Maint.	P17 1	1380 17	Low Oil Level in the Centinel Makeup Oil Tank
221 (Yellow)	P108 3	108 3	Ambient Air Pressure Sensor circuit - Shorted High
222 (Yellow)	P108 4	108 4	Ambient Air Pressure Sensor circuit - Shorted Low
223 (Yellow)	S085 4	1265 4	Engine Oil Burn Valve Solenoid Circuit - Shorted Low
227 (Yellow)	S232 3	620 3	Sensor Supply Voltage #2 Circuit - Shorted High
234 (Red)	P190 0	190 0	Engine Speed High - Critical
235 (Yellow)	P111 1	111 1	Engine Coolant Level Low - Critical
241 (Yellow)	P084 2	084 2	Vehicle Speed Sensor circuit - Data Incorrect
242 (Yellow)	P084 10	084 10	Vehicle Speed Sensor Circuit - Tampering has Been Detected
245 (Yellow)	S033 4	647 4	Fan Clutch Circuit - Shorted Low
254 (Red)	S017 4	632 4	Fuel Shutoff Valve Circuit - Shorted Low
255 (Yellow)	S017 3	632 3	Fuel Shutoff Valve Circuit - Shorted High
259 (Yellow)	S017 7	632 7	Fuel Shutoff Valve - Stuck Open
284 (Red)	S221 4	1043 4	Engine Speed/Position Sensor #1 (Crankshaft) Supply Voltage Circuit - Shorted Low
285 (Yellow)	S231 9	639 9	SAE J1939 Multiplexing PGNTimeout Error
286 (Yellow)	S231 13	639 13	SAE J1939 Multiplexing Configuration Error
287 (Red)	P091 2	091 19	SAE J1939 Multiplexing Accelerator Pedal Sensor System Error
288 (Red)	P029 2	974 19	SAE J1939 Multiplexing Remote Throttle Data Error
293 (Yellow)	S154 3	1083 3	Auxiliary Temperature Sensor Input #1 Circuit - Shorted High
294 (Yellow)	S154 4	1083 4	Auxiliary Temperature Sensor Input #1 Circuit - Shorted Low
295 (Yellow)	P108 2	108 2	Ambient Air Pressure Sensor Circuit - Data Incorrect
297 (Yellow)	P223 3	1084 3	Auxiliary Pressure Sensor Input #2 Circuit - Shorted High
298 (Yellow)	P223 4	1084 4	Auxiliary Pressure Sensor Input #2 Circuit - Shorted Low

CFP15E Fault Code Table (Continued)

FAULT CODE (LAMP)	SID(S) PID(S) FMI	SPN FMI	Cummins DESCRIPTION
299 (Yellow)	S117 11	1384 31	Engine Shutdown Commanded by J1939
311 (Yellow)	S001 6	651 6	Injector Solenoid Valve Cylinder #1 Circuit - Grounded Circuit
312 (Yellow)	S005 6	655 6	Injector Solenoid Valve Cylinder #5 Circuit - Grounded Circuit
313 (Yellow)	S003 6	653 6	Injector Solenoid Valve Cylinder #3 Circuit - Grounded Circuit
314 (Yellow)	S006 6	656 6	Injector Solenoid Valve Cylinder #6 Circuit - Grounded Circuit
315 (Yellow)	S002 6	652 6	Injector Solenoid Valve Cylinder #2 Circuit - Grounded Circuit
319 Maint.	P251 2	251 2	Real Time Clock - Power Interrupt
341 (Red)	S253 2	630 2	Engine Control Module - Data Lost
343 (Red)	S254 12	629 12	Engine Control Module - Warning Internal Hardware Failure
346 (Yellow)	S253 12	630 12	Engine Control Module - Warning Software Error
349 (Yellow)	P191 0	191 16	Transmission Output Shaft (Tailshaft) Speed High - Warning
352 (Yellow)	S232 4	1079 4	Sensor Supply Voltage #1 Circuit - Shorted Low
378 (Red)	S018 5	633 5	Fueling Actuator #1 Circuit - Open Circuit
379 (Red)	S018 6	633 6	Fueling Actuator #1 Circuit - Grounded Circuit
386 (Yellow)	S232 3	1079 3	Sensor Supply Voltage #1 Circuit - Shorted High
387 (Yellow)	S221 3	1043 3	Accelerator Pedal Position Sensor Supply Voltage Circuit - Shorted High
394 (Red)	S020 5	635 5	Timing Actuator #1 Circuit - Open Circuit
395 (Yellow)	S020 6	635 6	Timing Actuator #1 Circuit - Grounded Circuit
396 (Yellow)	S083 5	1244 5	Fueling Actuator #2 Circuit - Open Circuit
397 (Yellow)	S083 6	1244 6	Fueling Actuator #2 Circuit - Grounded Circuit
398 (Yellow)	S084 5	1245 5	Timing Actuator #2 Circuit - Open Circuit
399 (Red)	S084 6	1245 6	Timing Actuator #2 Circuit - Grounded Circuit
415 (Yellow)	P100 1	100 1	Engine Oil Pressure Low - Critical
418 WIF/Maint.	P097 0	097 15	Water in Fuel Indicator High - Maintenance

CFP15E Fault Code Table (Continued)

FAULT CODE (LAMP)	SID(S) PID(S) FMI	SPN FMI	Cummins DESCRIPTION
422 (Yellow)	P111 2	111 2	Engine Coolant Level Sensor Circuit - Data Incorrect
426 (None)	S231 2	639 2	SAE J1939 datalink - Cannot Transmit
428 (Yellow)	P097 3	097 3	Water in Fuel Sensor Circuit - Shorted High
429 (Yellow)	P097 4	097 4	Water in Fuel Sensor Circuit - Shorted Low
431 (Yellow)	S230 2	558 2	Accelerator Pedal Idle Validation Circuit - Data Incorrect
432 (Yellow)	S230 13	558 13	Accelerator Pedal Idle Validation Circuit - Our of Calibration
433 (Yellow)	P102 2	102 2	Intake Manifold Pressure Sensor Circuit - Data Incorrect
434 (Yellow)	S251 2	627 2	Power Lost without Ignition Off
435 (Yellow)	P100 2	100 2	Engine Oil Pressure Sensor Circuit - Data Incorrect
441 (Yellow)	P168 1	168 18	Battery #1 Voltage Low - Warning
442 (Yellow)	P168 0	168 16	Battery #1 Voltage High- Warning
443 (Yellow)	S221 4	1043 4	Accelerator Pedal Position Sensor Supply Voltage Circuit - Shorted Low
449 (Red)	P094 0	094 16	Fuel Pressure High - Warning
451 (Red)	P157 3	157 3	Injector Metering Rail #1 Pressure Sensor Circuit - Shorted High
452 (Red)	P157 4	157 4	Injector Metering Rail #1 Pressure Sensor Circuit - Shorted Low
466 (Yellow)	S032 4	1188 4	Turbocharger #1 Wastegate Control Circuit - Shorted Low
482 (Red)	P094 1	94 18	Fuel Pressure Low - Warning
483 (Red)	P129 3	1349 3	Injector Metering Rail #2 Pressure Sensor Circuit - Shorted High
484 (Red)	P129 4	1349 4	Injector Metering Rail #2 Pressure Sensor Circuit - Shorted Low
485 (Red)	P129 0	1349 16	Injector Metering Rail #2 Pressure High - Warning
486 (Red)	P129 1	1349 18	Injector Metering Rail #2 Pressure Low - Warning
489 (Yellow)	P191 1	191 18	Transmission Output Shaft (Tailshaft) Speed Low - Warning
496 (Red)	S221 11	1043 11	Engine Speed/Position Sensor #2 (Camshaft) Supply Voltage
527 (Yellow)	P154 3	702 3	Auxiliary Input/Output #2 Circuit - Shorted High

CFP15E Fault Code Table (Continued)

FAULT CODE (LAMP)	SID(S) PID(S) FMI	SPN FMI	Cummins DESCRIPTION
528 (Yellow)	P093 2	093 2	OEM Alternate torque validation switch - Data Incorrect
529 (Yellow)	S051 3	703 3	Auxiliary Input/Output #3 Circuit - Shorted High
546 (Red)	P094 3	094 3	Fuel Delivery Pressure Sensor Circuit - Shorted High
547 (Red)	P094 4	094 4	Fuel Delivery Pressure Sensor Circuit - Shorted Low
551 (Yellow)	S230 4	558 4	Accelerator Pedal Idle Validation Circuit - Shorted Low
553 (Red)	P157 0	157 16	Injector Metering Rail #1 Pressure High - Warning Level
559 (Red)	P157 1	157 18	Injector Metering Rail #1 Pressure Low - Warning Level
581 (Yellow)	P015 3	1381 3	Fuel Supply Pump Inlet Pressure Sensor Circuit - Shorted High
582 (Yellow)	P015 4	1381 4	Fuel Supply Pump Inlet Pressure Sensor Circuit - Shorted Low
583 (Yellow)	P015 1	1381 18	Fuel Supply Pump Inlet Pressure Low - Warning Level
595 (Yellow)	P103 0	103 16	Turbocharger #1 Speed High - Warning Level
596 (Yellow)	P167 0	167 16	Electrical Charging System Voltage High - Warning Level
597 (Yellow)	P167 1	167 18	Electrical Charging System Voltage Low - Warning Level
598 (Red)	P167 1	167 1	Electrical Charging System Voltage Low - Critical Level
611 (None)	S151 11	1383 31	Engine Hot Shutdown
753 (Red)	S064 2	723 2	Engine Speed/Position #2 - Cam Sync Error
755 (Yellow)	P157 7	157 7	Injector Metering Rail #1 Pressure Malfunction
758 (Yellow)	P129 7	1349 7	Injector Metering Rail #2 Pressure Malfunction
951 (None)	P166 2	166 2	Cylinder Power Imbalance Between Cylinders

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 the 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 are 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 filter per the instructions in Section 6 - Maintenance. Refill with correct mixture of antifreeze 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. The engine oil cooler is part of the Coolant/Fuel Heat Exchanger Replace the oil cooler, gaskets, or other parts as necessary. Refill with correct mixture of antifreeze 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 antifreeze 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/fill 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, oil cooler, coolant 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 Coolant Temperature lamp is on the operator 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 (valves) are improperly aligned.	Check that the raw water valves are aligned for normal flow through the solenoid valve (preferred) or bypass flow around the solenoid valve (alternative). Align flow/valves if required.
	Raw water pressure regulator is improperly adjusted. **NOTE:** *Pressure should not exceed 414 kPa [60 psig].*	Check the raw water pressure gauge. 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 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 coolant pump is malfunctioning.	Remove and inspect the coolant 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.	For instructions on how to read active fault codes, see Section 5 - Operation, the fault code table in this chapter, or contact a Cummins Authorized Repair Facility.
	Coolant thermostat has failed open.	Test operation of the thermostat. Replace the thermostat per instructions in Section 6 - Maintenance as necessary.
7.1.9 Raw Water Drain Steaming **NOTE:** *The raw water drain from the Coolant/Fuel 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 24 VDC.*	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 controller to terminal board has failed.	Test continuity and insulation from ground between the fire protection system controller and the operator control panel. Locate and repair any electrical fault in the field wiring or in the fire protection system controller 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 Controller fails to produce either redundant start signal to the fire pump.	Locate and correct the common mode fault in the Fire Protection System Controller.
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 controller. However, the engine does not start. The engine will start locally. If local starting problems are identified, go to the applicable Manual Start Failure troubleshooting table.*	The overspeed switch has activated. The overspeed lamp is illuminated on the operator control panel.	Press the RESET switch on the operator control panel.
	Control power from the Fire Protection System Controller is not available at operator control panel TB-1.	Locate and correct the fault in the Fire Protection System Controller or the field wiring to the operator control panel as necessary.
	Circuit Breaker CB is open in the operator control panel.	Check whether Circuit Breaker CB at the operator 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 operator control panel.
	The AUTO/MANUAL Mode Switch fails to select AUTO mode.	Open Circuit Breaker CB at the operator 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 operator 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 Controller.	Test continuity and insulation from ground between the fire protection system controller and the operator control panel. Locate and repair any electrical fault in the field wiring.
	An electrical fault is present between Operator Control Panel and the Fire Protection System Controller.	Test continuity and insulation from ground between the fire protection system controller and the operator 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 AUTO/MANUAL Mode 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 Mode 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.
	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.	For instructions on how to read active fault codes, see Section 5 - Operation, the fault code table in this chapter, or contact a Cummins Authorized Repair Facility.
	Electronic control module (ECM) is locked up.	Disconnect the battery cables for 30 secs. 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 fuel quality is poor.	Operate the engine from a separate tank of high-quality no. 2 diesel fuel.
	Fuel injection pump is malfunctioning. Pump timing incorrect.	Contact an Authorized Cummins Repair Facility.
	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.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.16 Engine Cranks Normally But Will Not Start (No Exhaust Smoke) (continued)	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.
	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.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.18 Engine Stops During Operation	Normal automatic mode shut-down occurs when the fire protection system controller 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, see Section 5 - Operation, the fault code table in this chapter, or contact a Cummins Authorized Repair Facility.
	In AUTO mode, the signal power feed is lost from the fire protection system controller to the operator control panel.	Locate and correct the electrical fault in the fire protection system controller or the field wiring to the operator control panel.
	Circuit breaker on operator control panel tripped.	Locate and correct the electrical fault in operator control panel. RESET the tripped breaker.
	An overspeed trip has occurred. The overspeed trip lamp illuminated on the operator 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 (ECM).	Locate and correct the electrical fault in the power supply or grounding for the ECM.
	The selected ECM has failed.	Select the alternate ECM. Replace the failed ECM. Contact 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.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.18 Engine Stops During Operation (continued)	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.	For instructions on how to read active fault codes, see Section 5 - Operation, the fault code table in this chapter, or contact a Cummins Authorized 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.
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.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.19 Engine Will Not Reach Rated Speed (RPM) (continued)	Charge air cooler (CAC) heat exchanger restricted.	Inspect the charge air cooler/heat exchanger 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 AUTO mode operation, 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 mode switch at the operator control panel. Replace the switch if the switch contacts fail to operate properly.
	Electronic fault codes are active.	For instructions on how to read active fault codes, see Section 5 - Operation, the fault code table in this chapter, 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. Contact an Authorized Cummins Repair Facility.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.21 Engine Will Not Shut Off Locally	Inadvertent power source is present from the fire pump controller.	In MANUAL Mode operation, the fire pump engine stops when the AUTO/MANUAL Mode Switch is returned to the AUTO Mode. Check for inadvertent voltage on the wiring to terminal board at the operator control panel.
	Electronic fault codes are active.	For instructions on how to read active fault codes, see Section 5 - Operation, the fault code table in this chapter, 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.
	Incorrect injection timing.	Adjust injection timing.
	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.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.23 Fuel or Engine Oil Leaking From Exhaust Manifold	Intake air restriction is high.	Check the air intake system for restriction. Refer to Check Air Cleaner Service Indicator in Section 6 - Maintenance. Replace the air filter if required.
	Turbocharger drain line is restricted.	Remove the turbocharger drain line and check for restriction. If required, clean or replace the drain line.
	Turbocharger oil seal is leaking.	Check the turbocharger for oil seals and for leaks. Refer to the Turbocharger Leaks Engine Oil or Fuel symptoms entries 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.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
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.
	Lubricating 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.
	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.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.26 Lubrication 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.
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 controller 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.

Troubleshooting Chart (Continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
7.1.27 Engine Overspeed Trip (continued)	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 controller. Check continuity and insulation from ground for the speed sensor circuit. Contact an Authorized Cummins Repair Facility. Replace defective components and repair electrical faults.
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, CFP15E-F10-F40 (QSX)	8715		E
Options, Engine FirePump, G-Drive, CFP15E-F10-F40 (QSX)	8742		B
Drawing, Installation, FirePump, CFP15E-F50-F70 (QSX15-G9)	11711		E
Options, Engine FirePump, G-Drive, CFP15E-F50-F70 (QSX-G9)	11712		-
Assembly, Engine Mounting, CFP15E	10835		C
Assembly, Heat Exchanger CFP15E CFP15E-F10-F40 (QSX)	11492-01		N
Assembly, Heat Exchanger CFP15E CFP15E-F50-F70 (QSX)	11492-02		N
Assembly, Coolant Heater, CFP15E	10849		G
Tube, Piping Water	10915		C
Assembly, Raw Water Loop CFP15E	10913		F
Assembly, Raw Water Horizontal Loop 1 1/4"	10912		G
Assembly, Raw Water Vertical Loop 1 1/4"	11707		E
Assembly, Fuel Plumbing CFP15E	10842		H
Assembly, Guarding, CFP15E	10844		D
Assembly, Air Cleaner, CFP15E	10856		C
Assembly, Sensor Package, CFP15E	9572-01		C
Assembly, Operator Station, CFP15E	10826		G
Assembly, Panel, Instrument, 12VDC Effective Date to 08-08	10452		E
Assembly, Panel, Instrument, 12VDC Effective Date to 09-08	13236		-
Assembly, Panel, Instrument, 24VDC Effective Date to 08-08	10453		E
Assembly, Panel, Instrument, 24VDC Effective Date to 09-08	13237		-
Exhaust, 6" ASA Flange x 18"L, CFP15E-F10-F40	9514		D
Exhaust, 6" ASA Flange x 18"L, CFP15E-F50-F70	6735-35		AW
Exhaust, 6" ASA SLIP x 18"L, CFP15E-F50-F70	7833-09		G
Kit, Loose Wires, QSX Fire Pump	9768		F
Assembly, Redundant ECM CFP15E	10846		C
Assembly, Secondary ECM Switch	10748	1-4	D
Bracket, Lifting & ECM Mounting	10895		B
Assembly, ECM Cooler & Mount CFP15E	10900		B
Harness, CFP15E	11829-01	1-2	C
Harness, CFP15E	11829-02	1-2	C
Harness, CFP15E	11829-03	1-2	C
Harness, CFP15E	11829-04		C
Assembly, Secondary ECM, CFP15E Schematic	11829 Schem		-
Schematic, Control Panel	10423	1-6	E
Harness, Engine	8513	1-2	L
Assembly, Stub Shaft & Guard CFP15E	12590		-
Assembly, Stub Shaft	11940		A
Guard, Flywheel Stub Shaft CFP15E	12591		-
Assembly, Drive Shaft 1810	13422		
Assembly, Drive Shaft U3172	13430		-
Assembly, Telescoping Shaft Guard (1810)	14161		
Assembly, Telescoping Shaft Guard (U3172)	14156		-

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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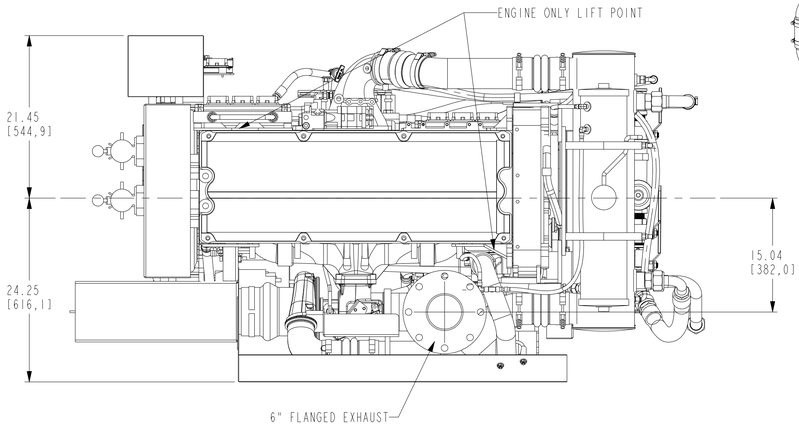
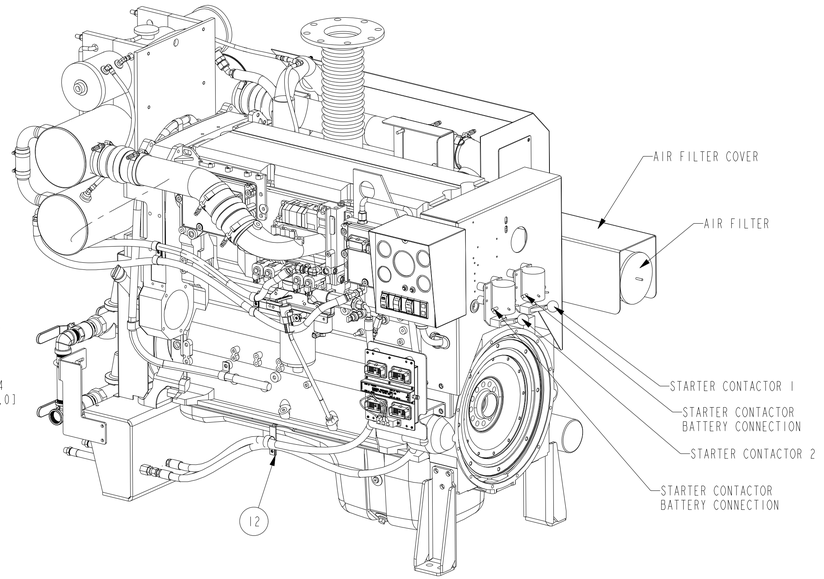
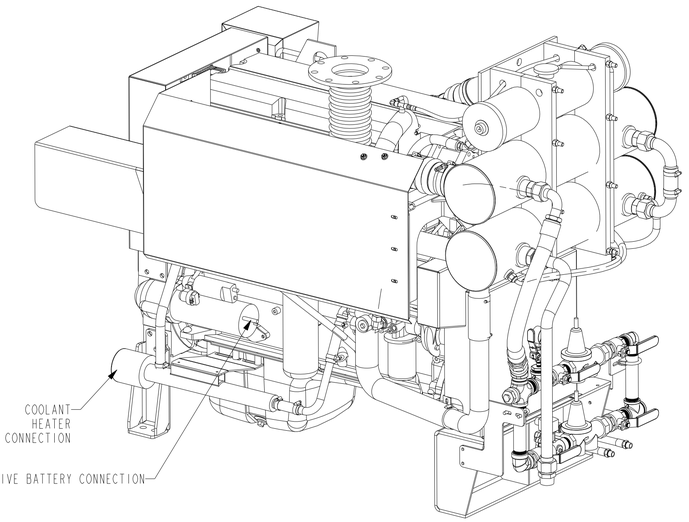
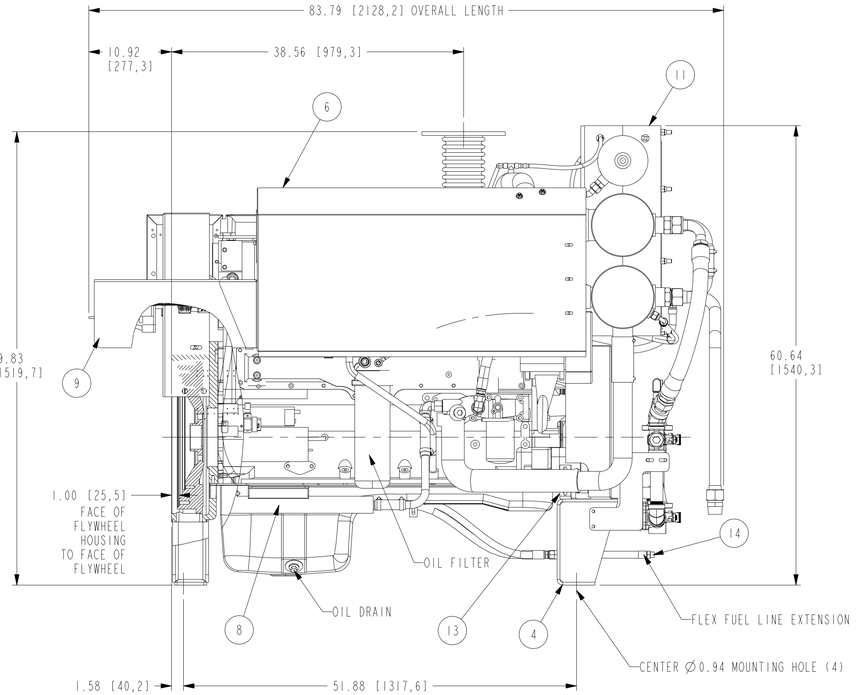
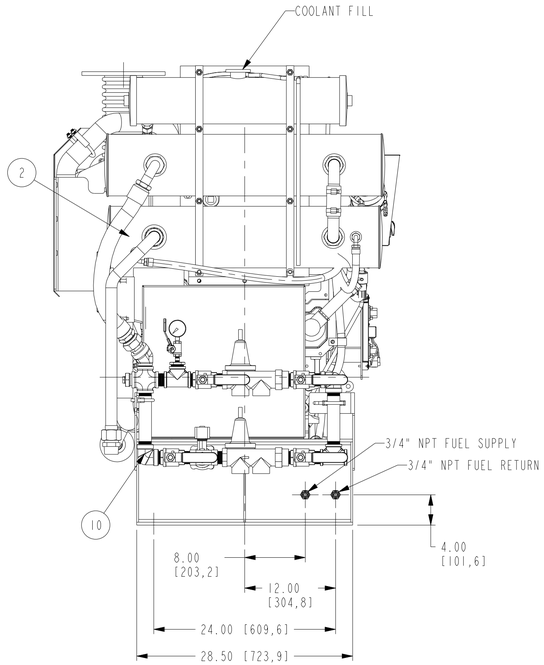
BILL OF MATERIAL			
ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	ENGINE, QSX15-C665, SPEC FOR FIREPUMP	8742_QSX15-C665
2	1	EXHAUST, 90, HALF MARMON, FIREPUMP, 5" TURBO OUTLET	9514-06
3	1	ASSEMBLY, OPERATORS STATION, QSX15, FIREPUMP	10826
4	1	ASSEMBLY, SUPPORT, CFP15E FIREPUMP	10835
5	1	ASSEMBLY, FUEL PLUMBING, CFP15E	10842
6	1	ASSEMBLY, GUARDING, CFP15E FIREPUMP	10844
7	1	ASSEMBLY, REDUNDANT ECM, CFP15E FIREPUMP	10846
8	1	ASSEMBLY, COOLANT HEATER, CFP15E FIREPUMP	10849
9	1	ASSEMBLY, AIR CLEANER, CFP15E, FIREPUMP	10856-01
10	1	MISC PIPING, CFP15, FIREPUMP	10913
11	1	ASSEMBLY, HEAT EXCHANGERS, CFP15E FIREPUMP	11492-01
12	1	BRACKET, MOUNTING, GUARD, FIREPUMP	8592
13	1	BRACKET, RADIATOR TUBE	11581
14	2	FUEL LINE, 12" EXTENSION, #10 FEM JIC X #10 22IFR X 3/4" NPT	14400-011

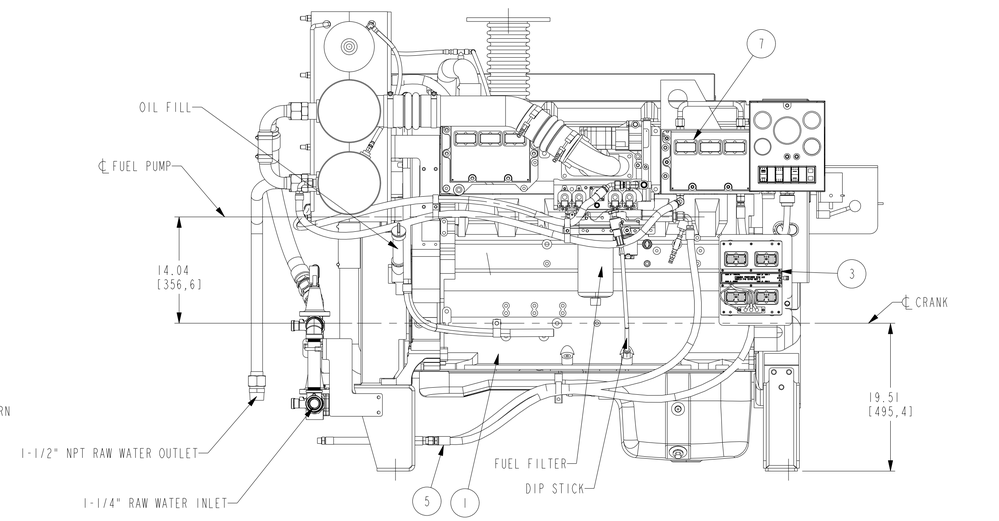












UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1°	IMPERIAL UNITS	METRIC UNITS
THIRD ANGLE PROJECTION	MACHINE TOLERANCES .XX ± 0.030 FOR TOLERANCES .XX ± 0.030	MACHINE TOLERANCES X.X ± 0.8 FOR TOLERANCES X.X ± 0.8

REV		DESCRIPTION OF REVISION	REV BY	DATE
D	2009-171	VIEW UPDATES, REV PER TITLE BLOCK	DAVE N	08MAY2009
REV	ENF	DESCRIPTION OF REVISION	REV BY	DATE

Cummins Fire Power

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

CUSTOM DESIGN
AND UPFIT CENTER
815 LAWRENCE DRIVE
DEPERE, WISCONSIN

ASSEMBLY, POWER MODULE
CFP15E-F10/20/30/40

DWG UNITS: IN/LB/S
DRAWN BY: S.DANFORTH
DATE: -
PRO-ENGINEER
REF DRWG:
SCALE: 0.100
EST WEIGHT: 4310.855
SHEET 1 OF 1
DRAWING NO: 8715

QTY	Option #	Desc	6 = Choice 7=Dependent	Effective date								
1	AB 1702	SUPPORT,ACCES	7	24-May-06								
1	AP 1114	APPROVAL,AGEN	6	14-Aug-06								
1	BB 1819	PLUMBING,CYLI	7	24-May-06	EE 1269	ALTERNATOR						
1	BB 1836	BLOCK,CYLINDE	7	4-Dec-06								
1	BR 1242	BREATHER,CRAN	6	24-May-06		4936879	1 ALTERNATOR					
1	CB 1707	DRIVE,ENGINE	7	24-May-06	==========							
1	CF 1069	MOUNTING,REF	6	24-May-06								
1	CH 1021	AID,COO HEATE	6	24-May-06	FP11065	PUMP,FUEL						
1	DA 1229	DAMPER,VIBRAT	6	24-May-06								
1	DF 1020	DRIVE,FRO GER	6	24-May-06		4025634	1 HOUSING,FILTER					
1	DL 1047	LOCATION,DRAI	6	10-May-07		4076587	1 GASKET,FUL CNT HOUSING					
1	DO 1449	SOFTWARE,CUS	6	14-Aug-06		4077088	1 MODULE,FUEL CONTROL					
1	EA 1040	ACCESSORIES,E	6	24-May-06	==========							
1	EA 1705	HARNESS,EXTEN	7	24-May-06								
1	EB 1203	BRAKE,ENGINE	6	24-May-06	LP 1718	PUMP,LUBRICATING OIL						
1	EC 1722	THERMOSTAT	7	24-May-06								
1	EE 1269	ALTERNATOR	6	24-May-06		3100445	1 PUMP,LUBRICATING OIL					
1	EH 1102	MOUNTING,ALTE	6	24-May-06		3681287	2 SHIM					
1	EH 1730	DRIVE,ALTERNA	7	24-May-06		3681288	2 SHIM					
1	EM 1356	SUPPORT,FRONT	6	24-May-06		3681289	2 SHIM					
1	FA 1464	DRIVE,FAN	6	24-May-06		3681290	2 SHIM					
1	FCPJ 30	CALIBRATION,F	7	14-Aug-06		3681291	2 SHIM					
1	FF 1280	FILTER,FUEL	6	24-May-06		3681292	2 SHIM					
1	FH11089	HOUSING,FLYWH	6	24-May-06		4059430	4 SCREW,HEX FLANGE HEAD C					
1	FP10244	MOUNTING,FUEL	7	24-May-06	==========							
1	FP11065	PUMP,FUEL	7	10-May-07								
1	FR10663	RATING,FUEL	6	14-Aug-06	ST 1408	MOTOR,STARTING						
1	FW 1022	FLYWHEEL	6	24-May-06								
1	FW 1701	MOUNTING,FLYW	7	24-May-06		3103950	1 MOTOR,STARTING					
1	GG 1729	COVER,FRONT G	7	24-May-06	==========							
1	IC 1057	CONNECTION,AI	6	24-May-06								
1	IC 1080	HOSE,AIR INTA	6	24-May-06	PP10263	TURBOCHARGER						
1	IC 1712	MOUNTING,INT	7	13-Sep-06								
1	IT 1014	CONNECTION,AI	6	24-May-06		3104738	4 NUT,LOCK					
1	LA 1099	ARRANGEMENT,L	6	24-May-06		3104793	1 TURBOCHARGER					
1	LA 1704	BRACKET,LIFTI	7	24-May-06		------	3104792	1 TURBOCHARGER				
1	LA 1707	MOUNTING,LIFT	7	24-May-06		3171368	1 GASKET,TURBOCHARGER					
1	LC 1734	COOLER,ENGINE	7	24-May-06		4965730	4 STUD					
1	LF 1238	FILTER,FULL F	6	24-May-06	==========							
1	LG 1035	GAUGE,OIL LEV	6	24-May-06								
1	LP 1718	PUMP,LUBRICAT	7	24-May-06								
1	NN 1701	NAMEPLATE	7	24-May-06								
1	OB 1400	ARRANGEMENT,O	6	24-May-06								
1	OB 1723	MOUNTING,OIL	7	24-May-06								
1	OP 1489	PAN,OIL	6	24-May-06								
1	PH 1763	MODULE,ENGINE	7	24-May-06								
1	PL 1703	PLUMBING,ENG	7	24-May-06								
B 1	PP43087	PARTS,PERFORM	7	24-May-06								
1	PP10161	GEAR,CAMSHAFT	7	24-May-06								
1	PP10263	TURBOCHARGER	7	14-Aug-06								
1	PW 1157	POWER,PROGRAM	6	14-Aug-06								
1	RL 1732	LEVER,ROCKER	7	24-May-06								
1	SC11472	SOFTWARE,CALI	7	14-Aug-06								
1	SK 1001	ARRANGEMENT,S	6	24-May-06								
1	SK 1701	BRACKET,SHIPP	7	24-May-06								
1	SM 1742	MOUNTING,STAR	7	24-May-06								
1	SS 1097	PAINT	6	24-May-06								
1	ST 1408	MOTOR,STARTIN	6	24-May-06								
1	SV 1002	VOLTAGE,ENGIN	6	24-May-06								
1	TB 1454	ARRANGEMENT,T	6	24-May-06								
1	TH 1160	HOUSING,THERM	6	24-May-06								
1	TP 1795	PLUMBING,TURB	7	24-May-06								
1	VC 1072	COVER,VALVE	6	24-May-06								
1	WF 1241	RESISTOR,CORR	6	24-May-06								
1	WI 1087	CONNECTION,WA	6	24-May-06								
1	WO 1123	CONNECTION,WA	6	24-May-06								
1	WP 1750	PUMP,WATER	7	24-May-06								
1	XS 1026	CONNECTION,EX	6	24-May-06								

REV	DESCRIPTION OF REVISION	BY	DATE
B	UPDATE OPTION NUMBERS	PBS	1MAY2008

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

Cummins Fire Power
CUMMINS NPOWER
CORPORATE OFFICE
1600 BUERKLE ROAD
WHITE BEAR LAKE, MN
WWW.NPOWER.CUMMINS.COM

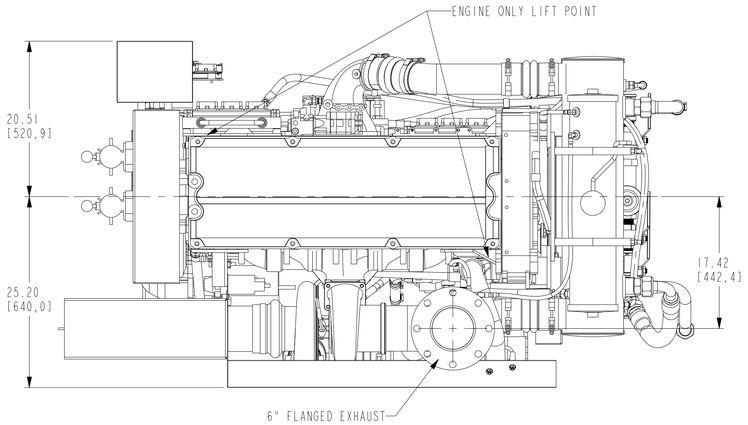
CUMMINS FIRE POWER
DESIGN CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN
WWW.CUMMINSFIREPOWER.COM

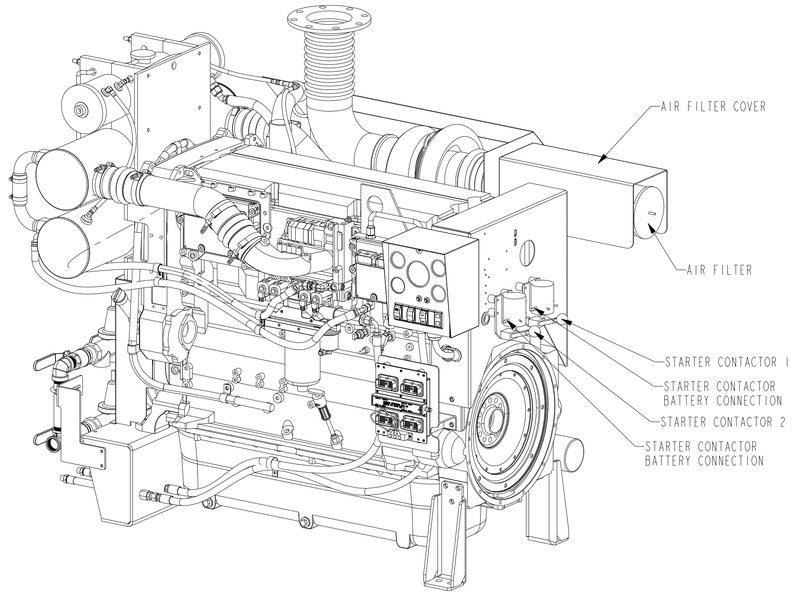
DWG SCALE: NTS	DRAWN BY: S.DANFORTH	DATE: 24AUG2006
PLOT SCALE:	APPD BY: S.DANFORTH	DATE: 07JUL2007

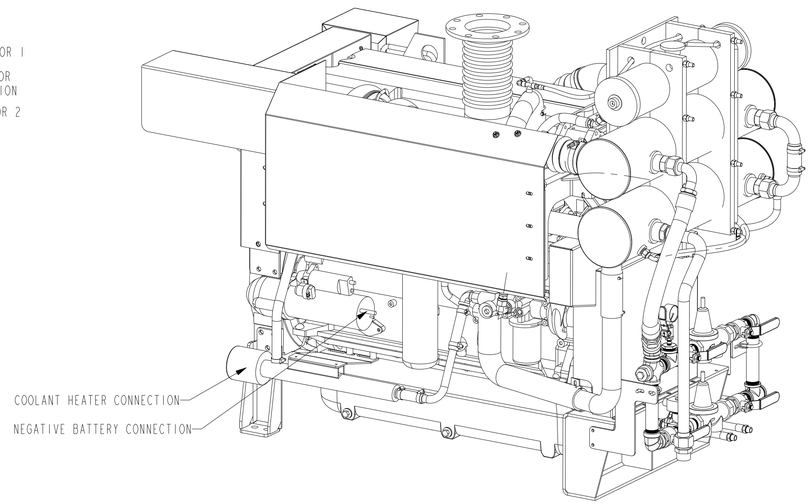
DESCRIPTION
SPECIFICATION, ENGINE ASSEMBLY

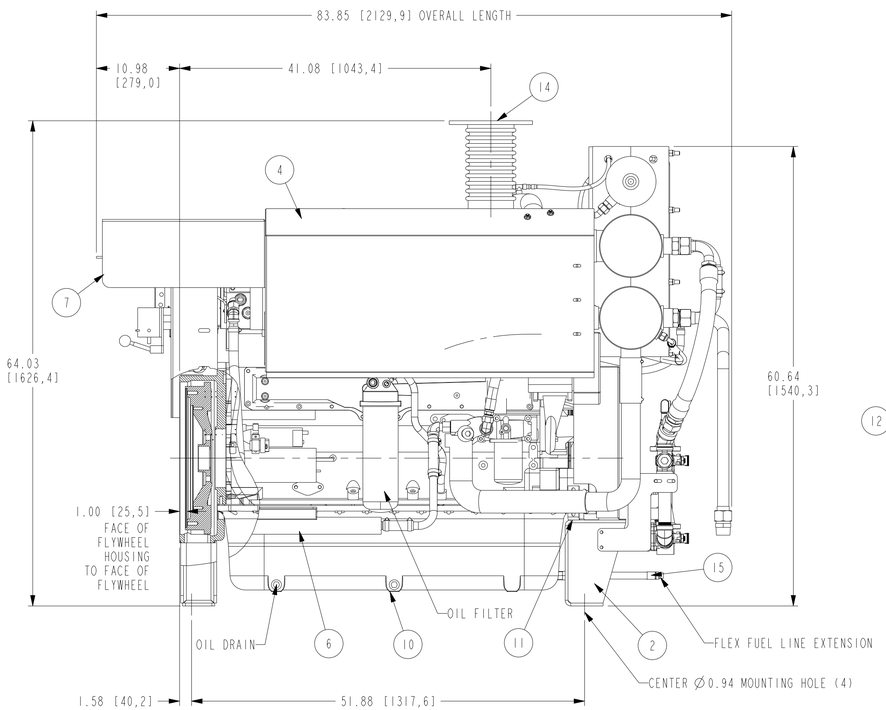
REFERENCE:	DRAWING NUMBER:
CFP15E–F10 – F40	8742

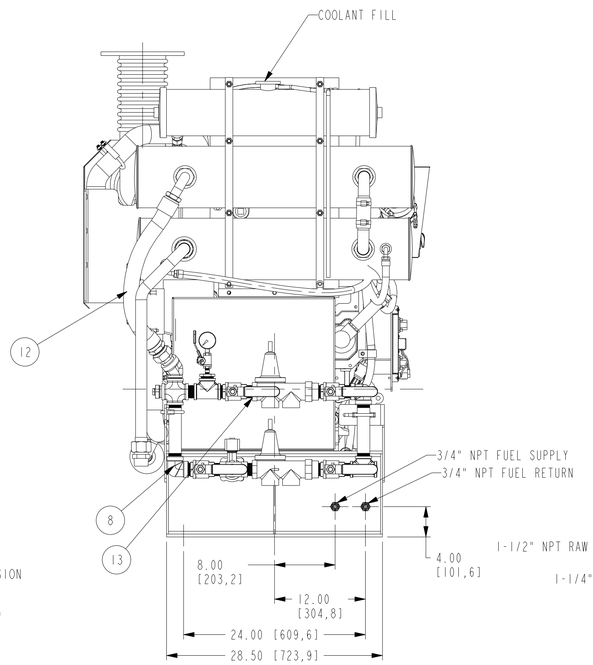
BILL OF MATERIAL			
ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	ASSEMBLY, OPERATORS STATION, QSX15, FIREPUMP	10826
2	1	ASSEMBLY, SUPPORT, CFP15E FIREPUMP	10835
3	1	ASSEMBLY, FUEL PLUMBING, CFP15E	10842
4	1	ASSEMBLY, GUARDING, CFP15E FIREPUMP	10844-02
5	1	ASSEMBLY, REDUNDANT ECM, CFP15E FIREPUMP	10846
6	1	ASSEMBLY, COOLANT HEATER, CFP15E FIREPUMP	10849
7	1	ASSEMBLY, AIR CLEANER, CFP15E, FIREPUMP	10856-02
8	1	MISC PIPING, CFP15, FIREPUMP	10913
9	1	ASSEMBLY, HEAT EXCHANGERS, CFP15E FIREPUMP	11492-02
10	1	ENGINE, QSX15-C665, SPEC FOR FIREPUMP	11712_QSX15-G9-755
11	1	BRACKET, RADIATOR TUBE	11581
12	1	DECAL, BELT ROUTING, CFP15E	11816
13	1	DECAL, VALVE ORIENTATION, CFP15E	11818
14	1	ELBOW, FLEX, 90° FLARED x FLANGE, 6" TURBO, GTE #10-761-618	13572
15	2	FUEL LINE, 12" EXTENSION, #10 FEM JIC X #10 22IFR X 3/4" NPT	14400-011

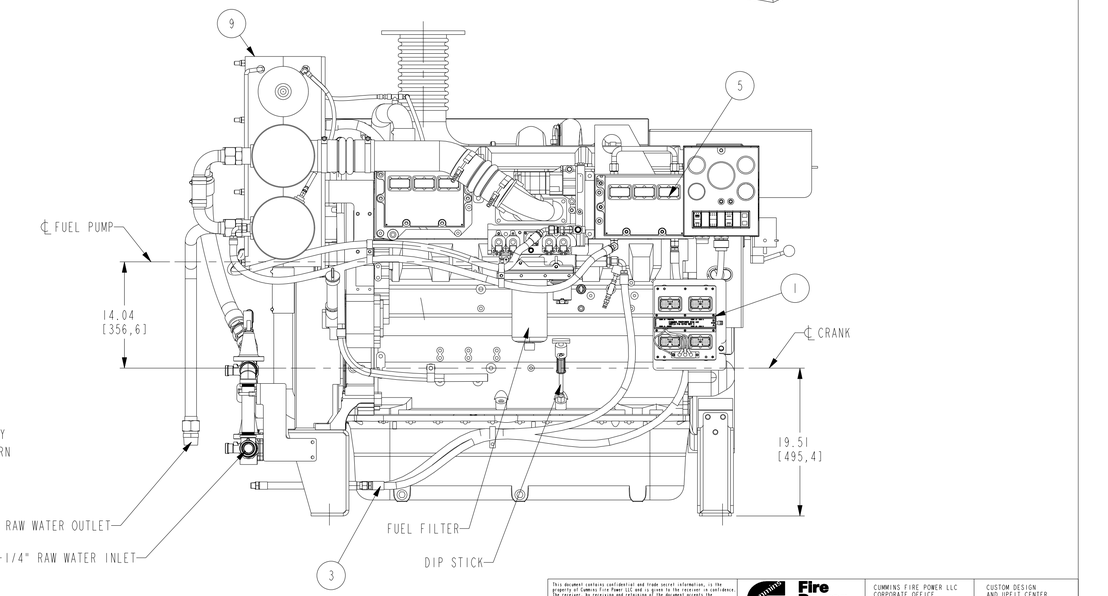












D	2009-171	VIEW UPDATES, REV PER TITLE BLOCK	DAVE N	08MAY2009	
REV	ENF	DESCRIPTION OF REVISION	REV BY	DATE	

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

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE
ANGULAR DIMENSIONS ± 1° | IMPERIAL UNITS | METRIC UNITS
THIRD ANGLE PROJECTION
DECIMAL TOLERANCES .X ± 0.030 | .XX ± 0.010 | .XXX ± 0.005 | FRACTIONAL TOLERANCES ± 1/64
DECIMAL TOLERANCES .X ± 0.75 | .XX ± 0.25 | .XXX ± 0.13 | ANGULAR TOLERANCES ± 1°

ASSEMBLY, POWER MODULE
CFP15E-F50/60/70 HIGH HORSE POWER

DWG UNITS: IN/LB/S
DRAWN BY: S.DANFORTH
PRO-ENGINEER
DATE: -
REF DRWG:
SCALE: 0.100
EST WEIGHT: 4219.488
SHEET 1 OF 1
DRAWING NO: 11711

QTY	Option #	Description	6 = Choice 7 = Dependent	Effective Date				
1	AB 1701	SUPPORT,ACCES	7	31-Oct-07				
1	AP 1066	APPROVAL,AGEN	6	31-Oct-07		**EE 1211**	**ALTERNATOR**	
1	BB 1809	PLUMBING,CYLI	7	31-Oct-07				
1	BB 1844	BLOCK,CYLINDE	7	31-Oct-07		3016627	1 ALTERNATOR	
1	BC 1006	COMPONENTS,BA	6	31-Oct-07				
1	BR 1252	BREATHER,CRAN	6	31-Oct-07				
1	CB 1704	DRIVE,ENGINE	7	31-Oct-07				
1	CH 1021	AID,COO HEATE	6	31-Oct-07		**FP11065**	**PUMP,FUEL**	
1	DA 1229	DAMPER,VIBRAT	6	31-Oct-07				
1	DL 1047	LOCATION,DRAI	6	31-Oct-07		4025634	1 HOUSING,FILTER	
1	DO 1512	SOFTWARE,CUS	6	31-Oct-07		4077088	1 MODULE,FUEL CONTROL	
1	EA 1705	HARNESS,EXTEN	7	31-Oct-07		4965689	1 GASKET,FUL CNT HOUSING	
1	EC 1722	THERMOSTAT	7	31-Oct-07				
1	EE 1211	ALTERNATOR	6	31-Oct-07				
1	EH 1099	MOUNTING,ALTE	6	31-Oct-07				
1	EH 1723	DRIVE,ALTERNA	7	31-Oct-07				
1	EM 1356	SUPPORT,FRONT	6	31-Oct-07				
1	FA 1464	DRIVE,FAN	6	31-Oct-07		**LP 1709**	**PUMP,LUBRICATING OIL**	
1	FCPG 25	CALIBRATION,F	7	31-Oct-07				
1	FF 1254	FILTER,FUEL	6	31-Oct-07		2864072	1 PUMP,LUBRICATING OIL	
1	FH11089	HOUSING,FLYWH	6	31-Oct-07		3102651	4 SCREW,HEX FLANGE HEAD C	
1	FP10245	MOUNTING,FUEL	7	31-Oct-07		3681287	2 SHIM	
1	FP11065	PUMP,FUEL	7	31-Oct-07		3681288	2 SHIM	
1	FR10549	RATING,FUEL	6	31-Oct-07		3681289	2 SHIM	
1	FW 1022	FLYWHEEL	6	31-Oct-07		3681290	2 SHIM	
1	FW 1701	MOUNTING,FLYW	7	31-Oct-07		3681291	2 SHIM	
1	GG 1727	COVER,FRONT G	7	31-Oct-07		3681292	2 SHIM	
1	IC 1064	CONNECTION,AI	6	31-Oct-07				
1	IC 1071	HOSE,AIR INTA	6	31-Oct-07				
1	IC 1712	MOUNTING,INT	7	31-Oct-07				
1	IT 1022	CONNECTION,AI	6	31-Oct-07				
1	LA 1094	ARRANGEMENT,L	6	31-Oct-07				
1	LA 1704	BRACKET,LIFTI	7	31-Oct-07		**ST 1408**	**MOTOR,STARTING**	
1	LA 1706	MOUNTING,LIFT	7	31-Oct-07				
1	LC 1729	COOLER,ENGINE	7	31-Oct-07		3103950	1 MOTOR,STARTING	
1	LF 1210	FILTER,FULL F	6	31-Oct-07				
1	LG 1090	GAUGE,OIL LEV	6	31-Oct-07				
1	LP 1709	PUMP,LUBRICAT	7	31-Oct-07				
1	LT 1070	LITERATURE	6	31-Oct-07				
1	NN 1701	NAMEPLATE	7	31-Oct-07				
1	OB 1397	ARRANGEMENT,O	6	31-Oct-07				
1	OP 1493	PAN,OIL	6	31-Oct-07		**PP10253**	**TURBOCHARGER**	
1	PH 1801	MODULE,ENGINE	7	31-Oct-07				
1	PP 8587	PARTS,PERFORM	7	31-Oct-07		3818824	4 NUT,HEXAGON FLANGE	
1	PP10203	GEAR,CAMSHAFT	7	31-Oct-07		4026884	1 GASKET,TURBOCHARGER	
1	PP10224	PISTON,ENGINE	7	31-Oct-07		4965730	4 STUD	
1	PW 1112	POWER,PROGRAM	6	31-Oct-07		4046132	1 TURBOCHARGER	
1	RL 1732	LEVER,ROCKER	7	31-Oct-07			4046127	turbo
1	RP 1003	PLUMBING,RADI	6	31-Oct-07				
1	SC11593	SOFTWARE,CALI	7	31-Oct-07				
1	SK 1018	ARRANGEMENT,S	6	31-Oct-07				
1	SK 1705	BRACKET,SHIPP	7	31-Oct-07				
1	SM 1742	MOUNTING,STAR	7	31-Oct-07				
1	SS 1097	PAINT	6	7-Feb-08				
1	ST 1408	MOTOR,STARTIN	6	31-Oct-07				
1	TB 1410	ARRANGEMENT,T	6	31-Oct-07				
1	TH 1156	HOUSING,THERM	6	31-Oct-07				
1	TP 1756	PLUMBING,TURB	7	31-Oct-07				
1	VC 1072	COVER,VALVE	6	31-Oct-07				
1	WF 1241	RESISTOR,CORR	6	31-Oct-07				
1	WI 1076	CONNECTION,WA	6	31-Oct-07				
1	WP 1733	PUMP,WATER	7	31-Oct-07				
1	XS 1065	CONNECTION,EX	6	1-May-08				

REV	DESCRIPTION OF REVISION	BY	DATE

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

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

REF. SCALES

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

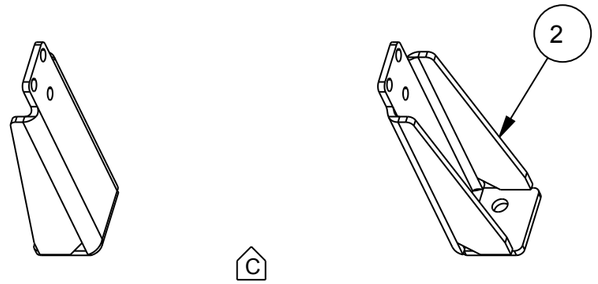
SPECIFICATION, ENGINE ASSEMBLY

DWG UNITS:	DRAWN BY: PBS			DATE: 05MAY2008	
	APPD BY:			DATE:	
EST WEIGHT:	SCALE:	DO NOT SCALE	SHEET 1OF1	DRAWING NO: 11712	REV:

REFERENCE BOX FOR BOLT TORQUE VALUES		
FRONT LEGS-PN:10836	BOLT, 3/4"10 x 2-3/4"L - PN:1717	375 FT/LBS
BACK LEGS-PN:13486	BOLT, 5/8"11 x 1-1/4"L - PN:1658	210 FT/LBS

BILL OF MATERIAL

ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	SUPPORT, ENGINE, FRONT, CFP15E FIREPUMP	10836
2	2	BRACKET, REAR LEG, CFP15E	13486



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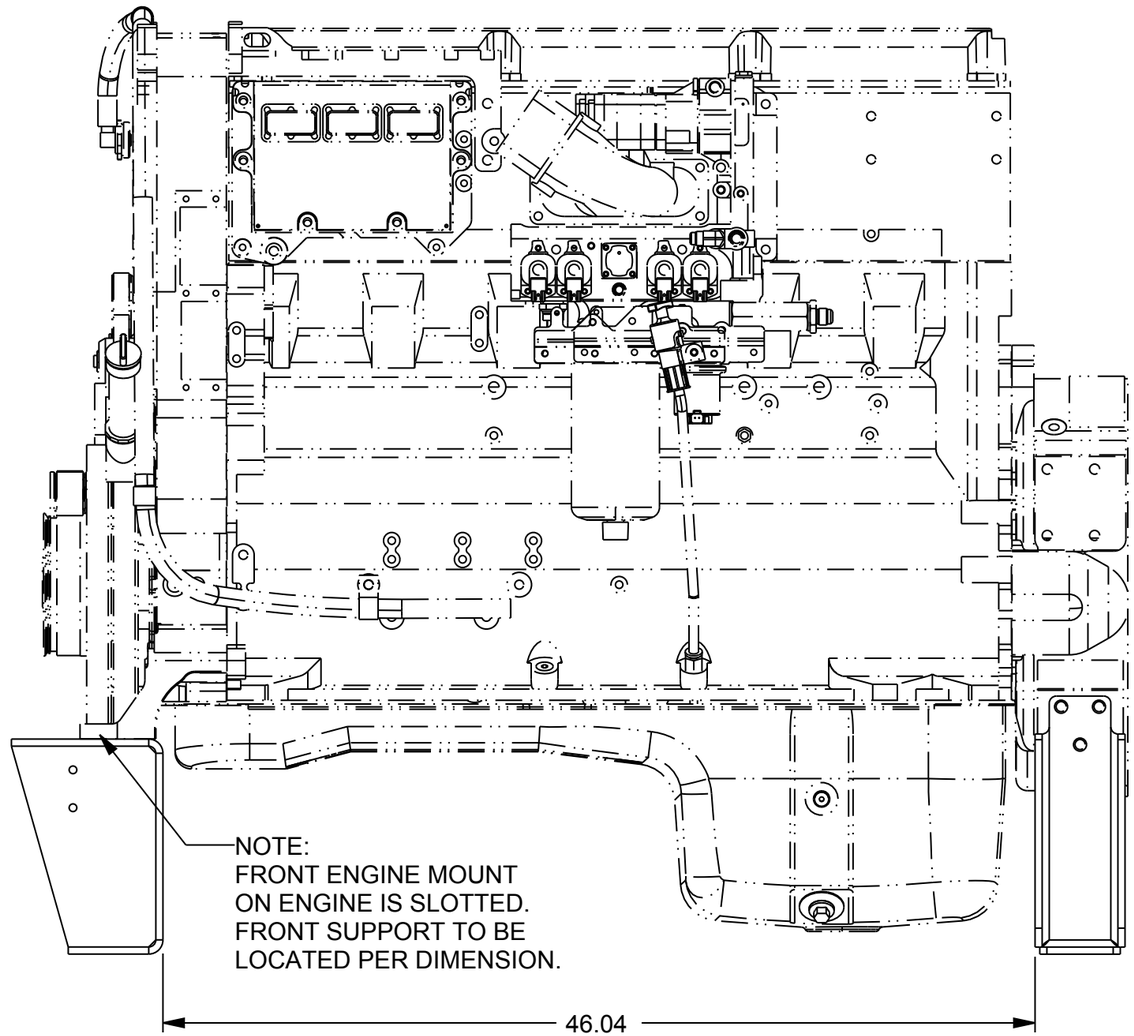
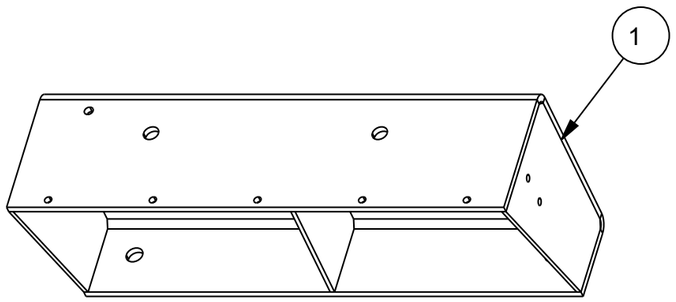




UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

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
		ADDED REFERENCE BOX FOR TORQUE SPEC.-NO ENF REQUIRED	MAC	01-12-2009
C	2008-501	REPLACED 10950 WITH 13486	S DUBICK	12/10/08

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

CUSTOM DESIGN
AND UPFIT CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

ASSEMBLY, SUPPORT CFP15E FIREPUMP

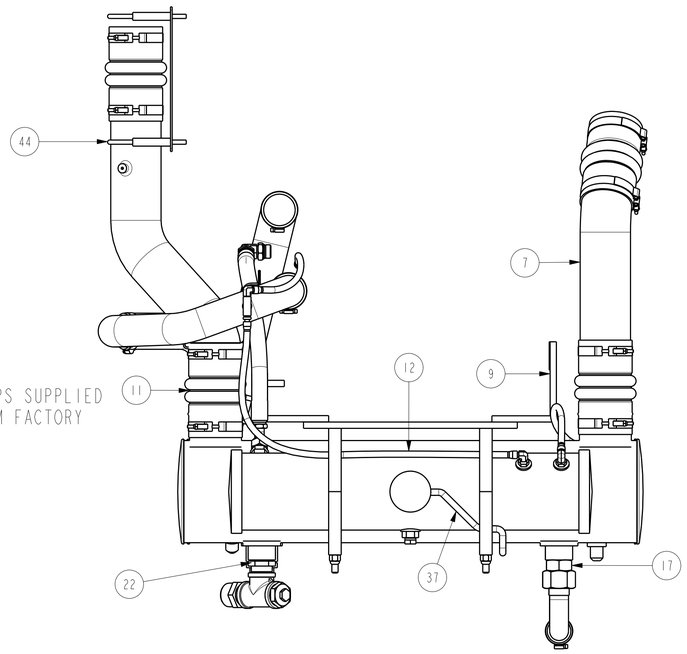
DWG UNITS: IN/LB/S	DRAWN BY: S.DANFORTH	DATE: APR2006
	PRO-ENGINEER	REF DRWG:
SCALE: 0.125	SHEET 1 OF 1	DRAWING NO: 10835
EST WEIGHT: 142.256		

NOTES:
ASSEMBLY DESIGNED TO BE BENCH ASSEMBLED
MOUNTING BRACKETS AND HEAT EXCHANGERS SHOULD
BE ASSEMBLED PRIOR TO MOUNTING ON ENGINE
LIFT HOLE PROVIDED FOR SUSPENDING WITH JIB CRANE

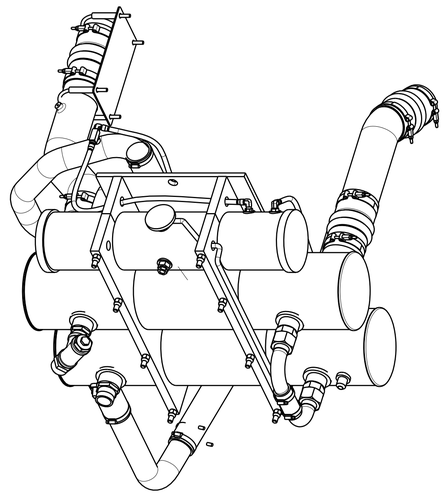
MOST PORTS ARE ORB, NOT NPT
ORB PORTS DO NOT GET THREAD SEALER
A BACKUP WRENCH IS NEEDED ON ALL PORTS
ALL ORB PORTS ARE TO HAVE O-RING GREASED PRIOR
TO ASSEMBLY OF ADAPTER INTO PORT FOR SEALING PURPOSES

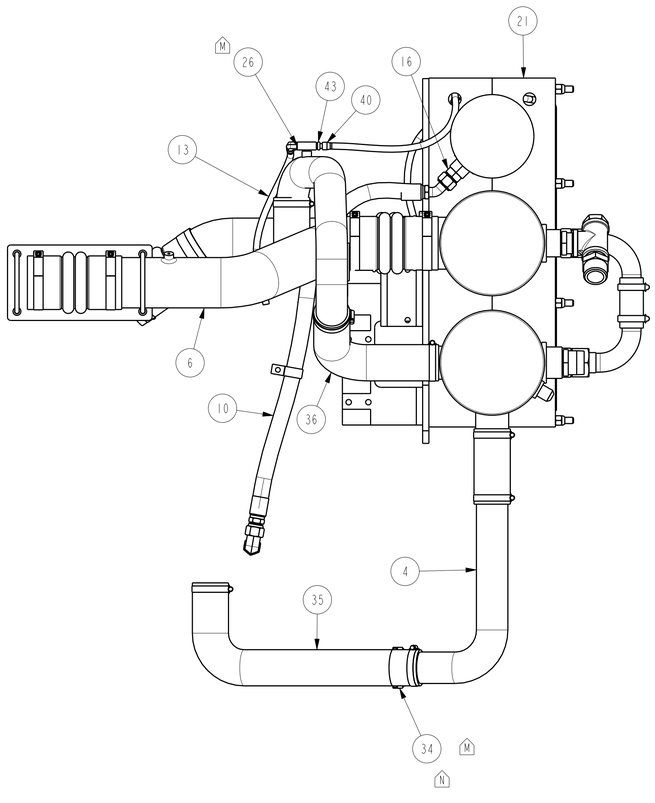
ALL -20 AND -24 FITTINGS ARE TO BE TIGHTENED
TO 1 FFFT (FLAT FROM FINGER TIGHT)

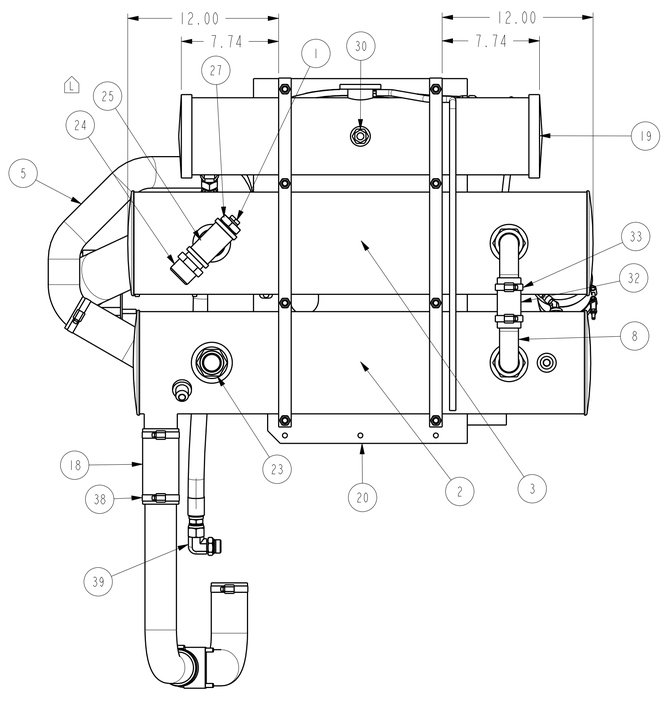
ALL -6 ORB FITTINGS ARE TO BE 1.5 FFFT

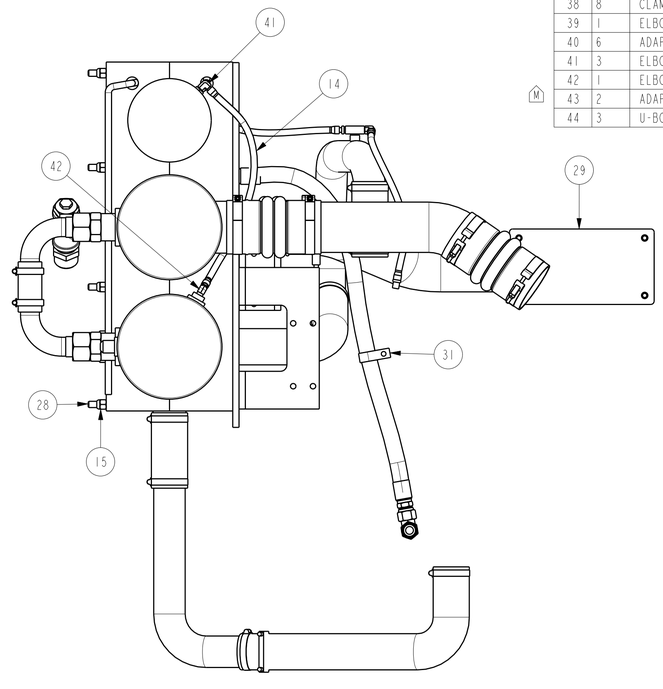


CAC HOSE & CLAMPS SUPPLIED
WITH ENGINE FROM FACTORY









NOTES:

1. ALL FITTINGS TO BE POSITIONED AS SHOWN.
2. ALL PARTS TO BE CLEAN BEFORE ASSEMBLY.
3. ALL OPENINGS ARE TO BE CAPPED OR PLUGGED AFTER ASSEMBLY.
4. CHECK ALL FITTINGS FOR O-RING BEFORE MAKING CONNECTIONS.

BILL OF MATERIAL

	ITEM	QTY	DESCRIPTION	PART NUMBER
L	1	1	PLUG, ZINC W/ BRASS SUPPORT, 1/2" NPT, CHAMP #500129	9750
	2	1	COOLER, JACKET WATER, CFP15 E FIREPUMP	10847
	3	1	HEAT EXCHANGER, CAC,, CFP15E FIREPUMP	10848
	4	1	TUBE, ENGINE COOLANT, LOWER, CFP15E	10891
	5	1	TUBE, COOLANT, UPPER, CFP15E FIREPUMP	10892
	6	1	TUBE, CAC, TURBO SIDE, CFP15E FIREPUMP	10893
	7	1	TUBE, CAC, IM SIDE, CFP15E FIREPUMP	10894
	8	2	ELBOW, RAW WATER, FLARE X HOSE BEAD, STEEL, HX TO HX	10905
	9	1	WELDMENT, HEAT EXCHANGER MOUNTING, -	11486
	10	1	HOSE, WATER FILL, CFP15E	12950
L	11	1	HUMP HOSES & SPRING CLAMPS, SUPPLIED ON ENGINE SPEC.	IC_1080
	12	1	HOSE, VENT LINE, 1/4" ID x 30"	R-801-4
	13	1	HOSE, VENT LINE, 1/4" ID x 14"	R-801-4
	14	1	HOSE, VENT LINE, 1/4" ID x 18"	R-801-4
	15	8	1/2-13 NUT, -	1_2_13_NC_NUT
	16	1	ADAPTER, MALE JIC 37 DEG X MALE SAE ORB, -12	12235-12-12
	17	2	ADAPTER, MALE JIC 37 DEG X MALE SAE ORB, -24-20	12235-24-20
	18	2	HOSE, CONNECTION, 2.5 ID X 6", 77250GL	8933
	19	1	TANK, SURGE, CFP15E, FIREPUMP	10865
	20	1	DETAIL, BRKT, HX MOUNTING, CFP15E FIREPUMP	11487
	21	4	BRACKET, HEAT EXCHANGER MOUNTING, BACK	11488
L	22	1	FTG, ORB (M) x NPT (M), 20-1 1/4	12163-20-20
L	23	1	FTG, ORB (M) x NPT (M), 24-1 1/2	12163-24-24
L	24	1	FTG, STR, -24 JIC X -20 NPT	12238-24-20
L	25	1	TEE, 1 1/4" NPT FEMALE, BLK STEEL	12386
M	26	1	TEE, M BRANCH, -4 NPT	12533-4
L	27	1	FITTING, REDUCER, 1 1/4 MALE NPTF X 1/2 FEMALE NPTF	12710
	28	8	1/2-13X12 THREADED STUD, 1-1/2" THREAD ON EACH END	12791
	29	1	BRACKET, CAC SUPPORT, CFP15E LOW HORSE POWER	12886
	30	1	SIGHT GLASS, 1/2" NPT	12979
	31	1	CLAMP,P-STYLE,1-1/4", CAN ORDER LTL-SCPV20627 AS ALTERNATE	13746
	32	1	HOSE, SILICONE, 1.50" I.D. DAYCO 78150GL	14931
	33	2	CLAMP, WORM, 1 3/4" NOM., 2 1/8" HOSE OD	14990-28
N	34	1	U-BOLT, 2.50 DIA, PLATED	16530
	35	1	HOSE, RUBBER, 2.50 90 DEGREE, GATES 21115	21115
	36	1	HOSE, RUBBER, 2.50 90 DEGREE, GATES 21891	21891
	37	1	DRAIN LINE HOSE, 5/16" ID HOSE	27003_X_72INCH
	38	8	CLAMP, WORM, 2 1/2" I.D. 2 7/8" O.D. HOSE, 2.06 - 3.00	14990-40
	39	1	ELBOW, 90 DEG, JIC X METRIC PORT, PARKER OR EQUIV.	12275-12m27
	40	6	ADAPTER, 1/4" HOSE X 1/4" NPT	R-30882-4-4
	41	3	ELBOW, 3/4" NPT X #4 FLARE	R-149F-4-4
	42	1	ELBOW 45°, 3/4" NPT X #4 FLARE	R-159F-4-4
M	43	2	ADAPTER, FLARED, 1/4" NPT x #4 FLARE	R-48F-4-4
	44	3	U-BOLT, 4"	U400

LOW HORSE POWER CFP15E-F10/20/30/40

REV	ENF	DESCRIPTION OF REVISION	REV BY	DATE
N	2010-049	16530 WAS U250	DAN	29-JAN-10
M	2009-593	12533-4 WAS LTL-28282. ADDED U250	DAN	18-NOV-09
L1	2009-537	RE-ORIENTATED PLUMBING TEE ON HX INLET	DAN	03-NOV-09
L	2009-349	REMOVE 3071049 & 12975-0425 FROM BOM (ON ENGINE). 10915 ADDED ANODE COMPONENTS TO MAKE COOLING LOOP OPTIONAL	S DUBICK	09/16/09

CUMMINS FIRE POWER LLC
CORPORATE OFFICE
1600 BUERKLE ROAD
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875 LAWRENCE DRIVE
DEPERE, WISCONSIN

ASSEMBLY, HEAT EXCHANGER
CFP15E F10-F40

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE
ANGULAR DIMENSIONS ± 1°
THIRD ANGLE PROJECTION
IMPERIAL UNITS: MACHINE TOLERANCES .XX ± 0.030; FOR TOLERANCES .XXX ± 0.010; FOR TOLERANCES .XXXX ± 0.005
METRIC UNITS: MACHINE TOLERANCES X ± 0.8; FOR TOLERANCES X.X ± 0.25; FOR TOLERANCES X.XX ± 0.13

DWG UNITS: IN/LB/S
DRAWN BY: S.DANFORTH
PRO-ENGINEER
DATE: -
REF DRWG:
SCALE: 0.166
SHEET 1 OF 1
EST WEIGHT: 436.278
DRAWING NO: 11492-01

NOTES:
ASSEMBLY DESIGNED TO BE BENCH ASSEMBLED
MOUNTING BRACKETS AND HEAT EXCHANGERS SHOULD
BE ASSEMBLED PRIOR TO MOUNTING ON ENGINE
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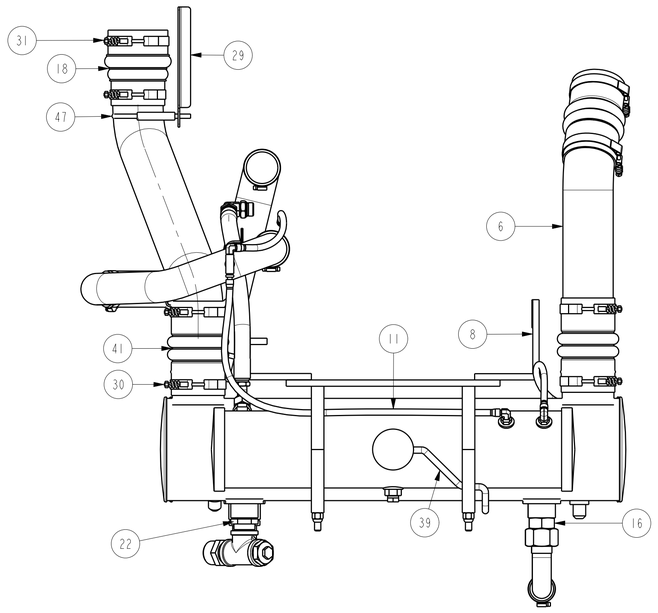
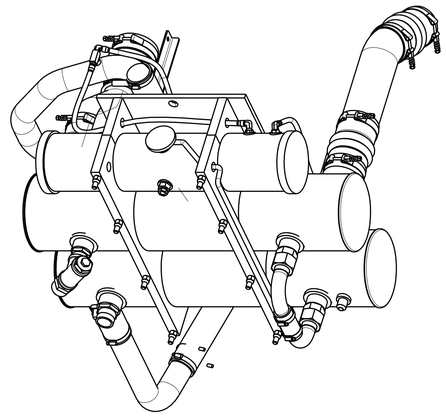
TO 1 FFFT (FLAT FROM FINGER TIGHT)

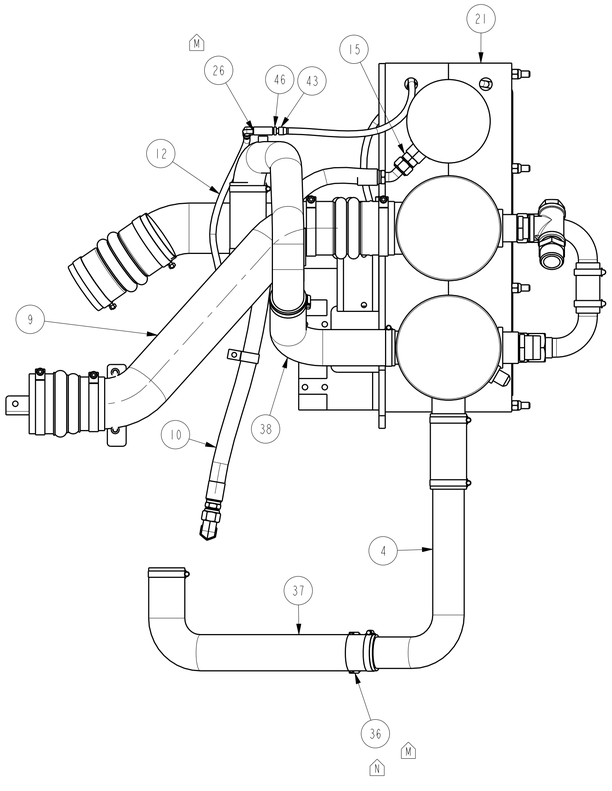
ALL -6 ORB FITTINGS ARE TO BE 1.5 FFFT

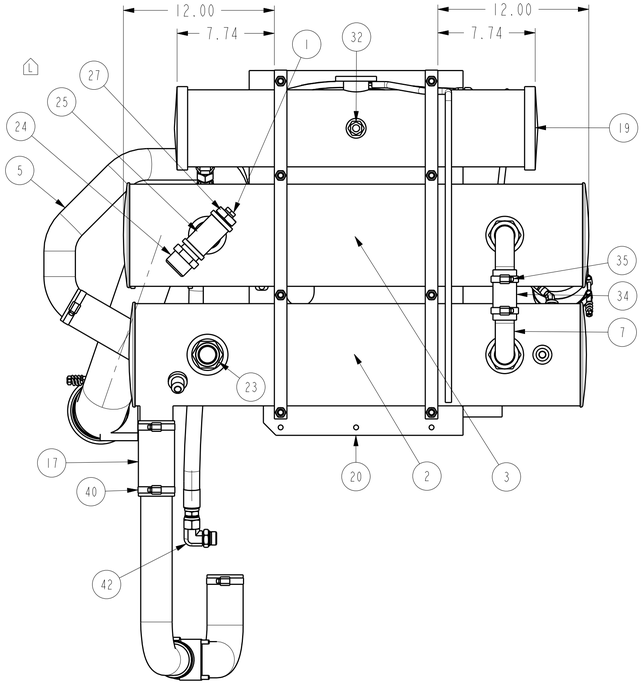


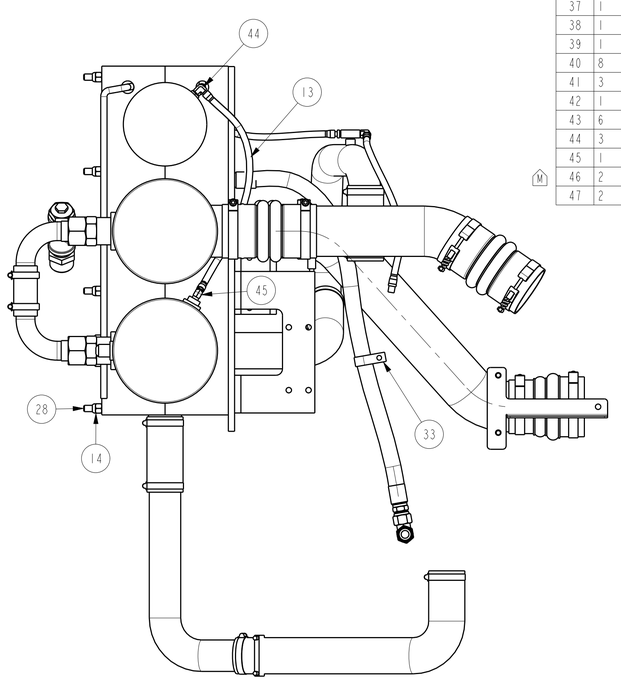


BILL OF MATERIAL

	ITEM	QTY	DESCRIPTION	PART NUMBER
L	1	1	PLUG, ZINC W/ BRASS SUPPORT, 1/2" NPT, CHAMP #500129	9750
	2	1	COOLER, JACKET WATER, CFP15 E FIREPUMP	10847
	3	1	HEAT EXCHANGER, CAC,, CFP15E FIREPUMP	10848
	4	1	TUBE, ENGINE COOLANT, LOWER, CFP15E	10891
	5	1	TUBE, COOLANT, UPPER, CFP15E FIREPUMP	10892
	6	1	TUBE, CAC, IM SIDE, CFP15E FIREPUMP	10894
	7	2	ELBOW, RAW WATER, FLARE X HOSE BEAD, STEEL, HX TO HX	10905
	8	1	WELDMENT, HEAT EXCHANGER MOUNTING, -	11486
	9	1	TUBE, CAC OUT, CFP15E-F50 thru F70	11718
	10	1	HOSE, WATER FILL, CFP15E	12950
	11	1	HOSE, VENT LINE, 1/4" ID x 30"	R-801-4
	12	1	HOSE, VENT LINE, 1/4" ID x 14"	R-801-4
	13	1	HOSE, VENT LINE, 1/4" ID x 18"	R-801-4
	14	8	1/2-13 NUT, -	1_2_13_NC_NUT
	15	1	ADAPTER, MALE JIC 37 DEG X MALE SAE ORB, -12	12235-12-12
	16	2	ADAPTER, MALE JIC 37 DEG X MALE SAE ORB, -24-20	12235-24-20
	17	2	HOSE, CONNECTION, 2.5 ID X 6", 77250GL	8933
	18	1	HOSE, COVOLUTED SILICONE CHARGE AIR	10459
	19	1	TANK, SURGE, CFP15E, FIREPUMP	10865
	20	1	DETAIL, BRKT, HX MOUNTING, CFP15E FIREPUMP	11487
	21	4	BRACKET, HEAT EXCHANGER MOUNTING, BACK	11488
L	22	1	FTG, ORB (M) x NPT (M), 20-1 1/4	12163-20-20
L	23	1	FTG, ORB (M) x NPT (M), 24-1 1/2	12163-24-24
L	24	1	FTG, STR, -24 JIC X -20 NPT	12238-24-20
L	25	1	TEE, 1 1/4" NPT FEMALE, BLK STEEL	12386
M	26	1	TEE, M BRANCH, -4 NPT	12533-4
L	27	1	FITTING, REDUCER, 1 1/4 MALE NPTF X 1/2 FEMALE NPTF	12710
	28	8	1/2-13X12 THREADED STUD, 1-1/2" THREAD ON EACH END	12791
	29	1	BRACKET, CAC SUPPORT, HHP, CFP15E	12885
	30	7	CLAMP, SPRING LOADED T-BOLT, 4.03-4.33	12975-0425
	31	1	CLAMP, SPRING LOADED T-BOLT, 4.53-4.83	12975-0475
	32	1	SIGHT GLASS, 1/2" NPT	12979
	33	1	CLAMP,P-STYLE,1-1/4", CAN ORDER LTL-SCPV20627 AS ALTERNATE	13746
	34	1	HOSE, SILICONE, 1.50" I.D. DAYCO 78150GL	14931
	35	2	CLAMP, WORM, 1 3/4" NOM., 2 1/8" HOSE OD	14990-28
N	36	1	U-BOLT, 2.50 DIA, PLATED	16530
	37	1	HOSE, RUBBER, 2.50 90 DEGREE, GATES 21115	21115
	38	1	HOSE, RUBBER, 2.50 90 DEGREE, GATES 21891	21891
	39	1	DRAIN LINE HOSE, 5/16" ID HOSE	27003_X_72INCH
	40	8	CLAMP, WORM, 2 1/2" I.D. 2 7/8" O.D. HOSE, 2.06 - 3.00	14990-40
	41	3	HOSE, HUMP, 4" ID x 7.5"L, CAC	3071049
	42	1	ELBOW, 90 DEG, JIC X METRIC PORT, PARKER OR EQUIV.	12275-12m27
	43	6	ADAPTER, 1/4" HOSE X 1/4" NPT	R-30882-4-4
	44	3	ELBOW, 3/4" NPT X #4 FLARE	R-149F-4-4
	45	1	ELBOW 45°, 3/4" NPT X #4 FLARE	R-159F-4-4
M	46	2	ADAPTER, FLARED, 1/4" NPT x #4 FLARE	R-48F-4-4
	47	2	U-BOLT, 4"	U400







HIGH HORSE POWER CFP15E-F150/60/70

NOTES:

1. ALL FITTINGS TO BE POSITIONED AS SHOWN.
2. ALL PARTS TO BE CLEAN BEFORE ASSEMBLY.
3. ALL OPENINGS ARE TO BE CAPPED OR PLUGGED AFTER ASSEMBLY.
4. CHECK ALL FITTINGS FOR O-RING BEFORE MAKING CONNECTIONS.

REV	ENF	DESCRIPTION OF REVISION	REV BY	DATE
N	2010-049	16530 WAS U250	DAN	29-JAN-10
M	2009-593	12533-4 WAS LTL-28282. ADDED U250	DAN	18-NOV-09
L1	2009-537	RE-ORIENTATED PLUMBING TEE ON HX INLET	DAN	03-NOV-09
L	2009-349	ADD ANODE COMPONENTS FOR COOLING LOOP OPTION	S.DUBICK	09/16/09

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE
ANGULAR DIMENSIONS ± 1°
THIRD ANGLE PROJECTION
IMPERIAL UNITS: MACHINE TOLERANCES .xx ± 0.010; .xxx ± 0.005; FOR TAPPED HOLES .xx ± 0.010; .xxx ± 0.005
METRIC UNITS: MACHINE TOLERANCES .x ± 0.2; FOR TAPPED HOLES .x ± 0.2; .xx ± 0.1

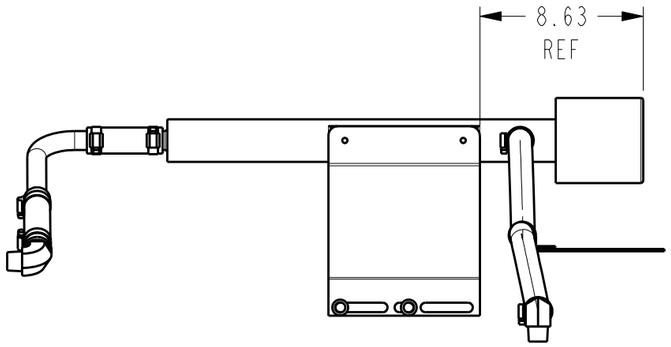
Fire Power

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

CUSTOM DESIGN
AND UPFIT CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

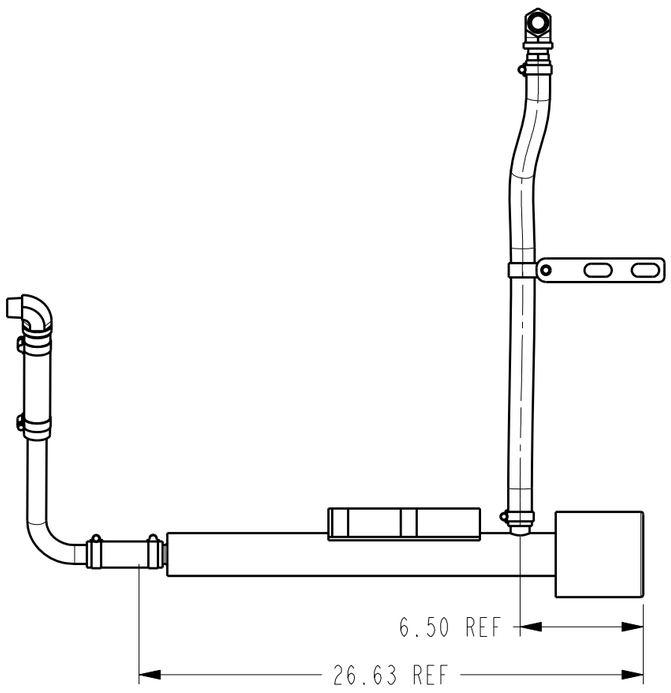
ASSEMBLY, HEAT EXCHANGER
CFP15E F50-F70

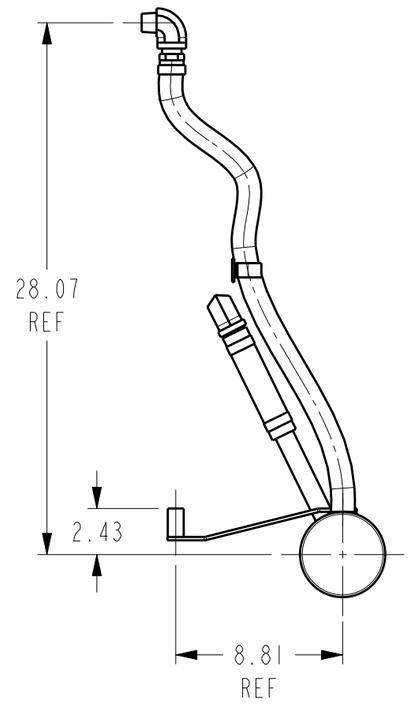
DWG UNITS: IN/LB/S
DRAWN BY: S.DANFORTH
DATE: -
PRO-ENGINEER
REF DRWG:
SCALE: 0.166
SHEET 1 OF 1
DRAWING NO: 11492-02
EST WEIGHT: 678.728

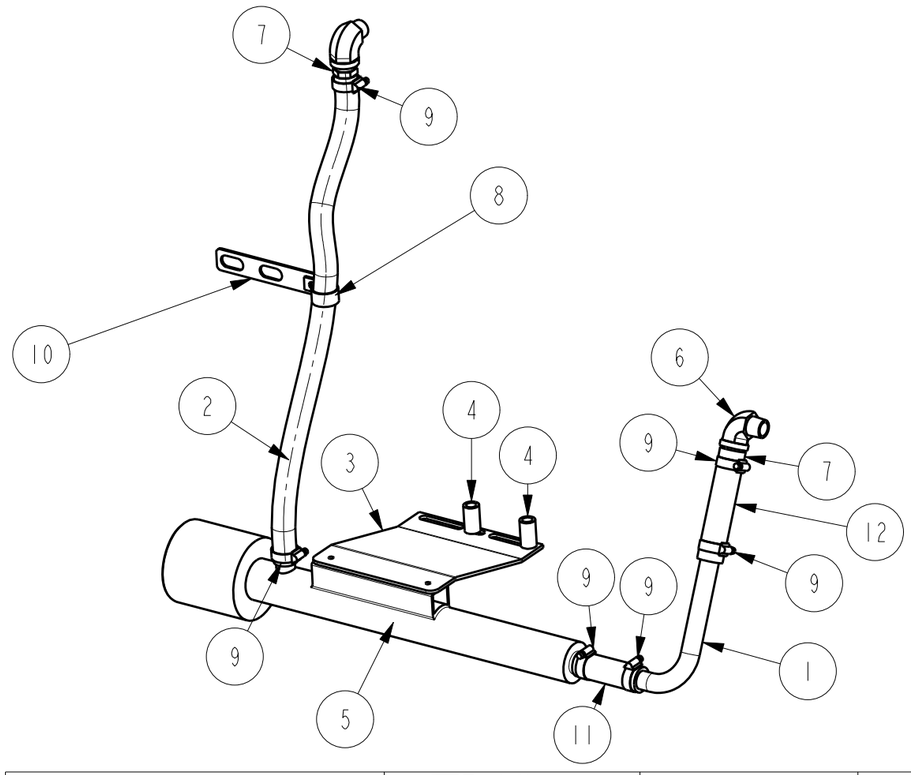


BILL OF MATERIAL

	ITEM	QTY	DESCRIPTION	PART NUMBER
	1	1	TUBE, LOWER, COOLANT HEATER, QSX15-C, HOLLAND CO	10610
G	2	1	HOSE, SILICONE HI-TEMP, 1" ID, 78100GL x 30"	78100GL-30INCH
	3	1	BRACKET, COOLANT HEATER, MULTI-UNIT	8143
	4	2	SPACER, MOUNTING, SECONDARY ECM	9508
	5	1	HEATER, COOLANT, 3000W, ADJ. VOLTAGE, WATLOW 3-10-42-5PA	11577
G	6	2	ELB, 90 DEG, -12 NPT X -12 FMNPT	12195-12-12
	7	2	FTG, STR, -10 BEADx-.75 NPT	12545-16-12
G	8	1	CLAMP,P-STYLE,1-1/4", CAN ORDER LTL-SCPV20627 AS ALTERNATE	13746
	9	6	CLAMP, WORM, 1" NOM., 1 3/8" HOSE OD	14990-16
G	10	1	BRACKET, COOLANT HEATER HOSE STAND OFF	16527
	11	1	HOSE, SILICONE, HI-TEMP, 1", P/N 78100GL X LENGTH	78100GL-41NCH
	12	1	HOSE, SILICONE, HI-TEMP, 1", P/N 78100GL X LENGTH	78100GL-61NCH







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

ASSEMBLY, COOLANT HEATER
CFP15E

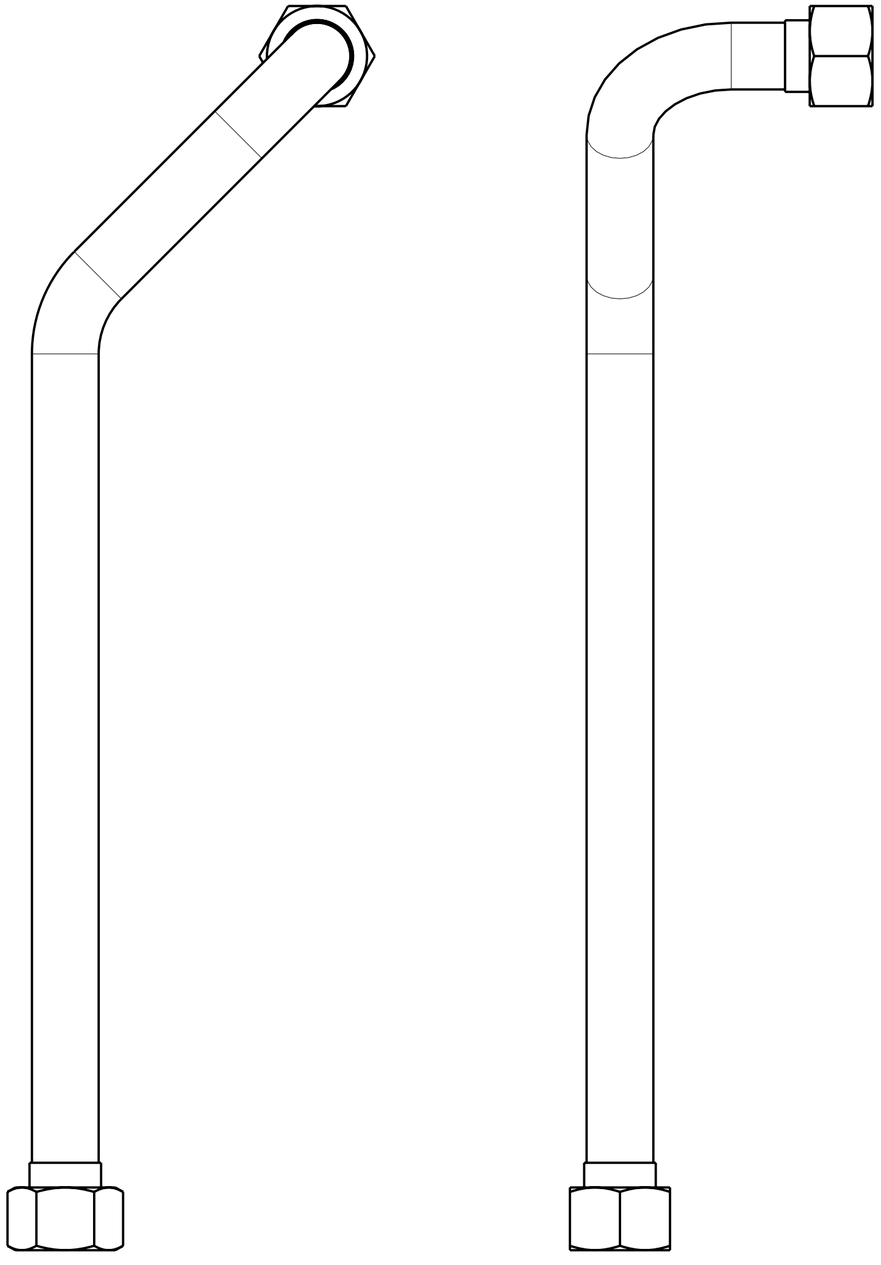
DWG UNITS: IN/LB/S | DRAWN BY: S. DANFORTH | DATE: 18NOV2005
PRO-ENGINEER | REF DRWG:
SCALE: 0.125 | SHEET 1 OF 1 | DRAWING NO: 10849
EST WEIGHT: 24.780

REV	ENF	DESCRIPTION OF REVISION	REV BY	DATE
G	2010-049	ADDED 12195-12-12, 16527 & 13746. REV HOSE.	DAN	29-JAN-10
F	2009-349	CORRECTED FITTING ORIENTATION	S DUBICK	09/16/09

BEND LOCATION INFO				CORRESPONDING BEND MACHINE INFO					
LOC NUM	LOC X	LOC Y	LOC Z	OFFSET	TWIST	RADIUS	ANGLE		REF MACH NUM
1	0.000	0.000	0.000						
2	0.000	0.000	4.500	2.000		2.500	90.000		1
3	-5.657	-5.657	4.500	4.464	90.000	2.500	45.000		2
4	-5.657	-25.657	4.500	18.964					3

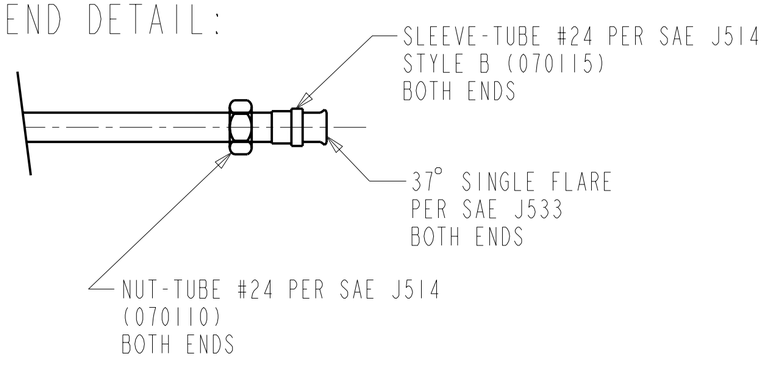
INSPECTION NOTE
1 - TUBE ENDS TO BE CAPPED. CAPS MUST SEAL THE TUBE ID AND REMAIN IN PLACE DURING NORMAL SHIPPING AND HANDLING. 2 - FINISHED TUBE MUST BE MARKED WITH CUMMINS NPOWER PART NO. 3 - ANY BRAZED END FITTING TO BE SILVER BRAZED

MATERIAL NOTE	
HYDRAULIC TUBING MATERIAL	Steel
SAE GRADE	316_SS
OUTER DIAMETER	1.500
WALL THICKNESS	0.063
CENTERLINE BEND RADIUS	2.500
TENSILE STRENGTH (PSI)	
MAX PRESSURE (PSI)	



NOTES:
1) TUBE ENDS TO BE CAPPED. CAPS MUST SEAL THE TUBE ID AND REMAIN IN PLACE DURING NORMAL SHIPPING AND HANDLING.
2) FINISHED TUBE MUST BE MARKED WITH CUMMINS NPOWER PART NUMBER.
3) ANY BRAZED END FITTING TO BE SILVER BRAZED.

TUBE END DETAIL:



REV	DESCRIPTION OF REVISION	REV BY	DATE
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

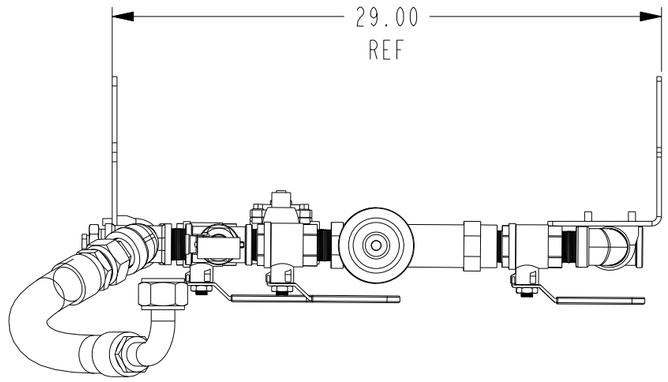
REF. SCALES

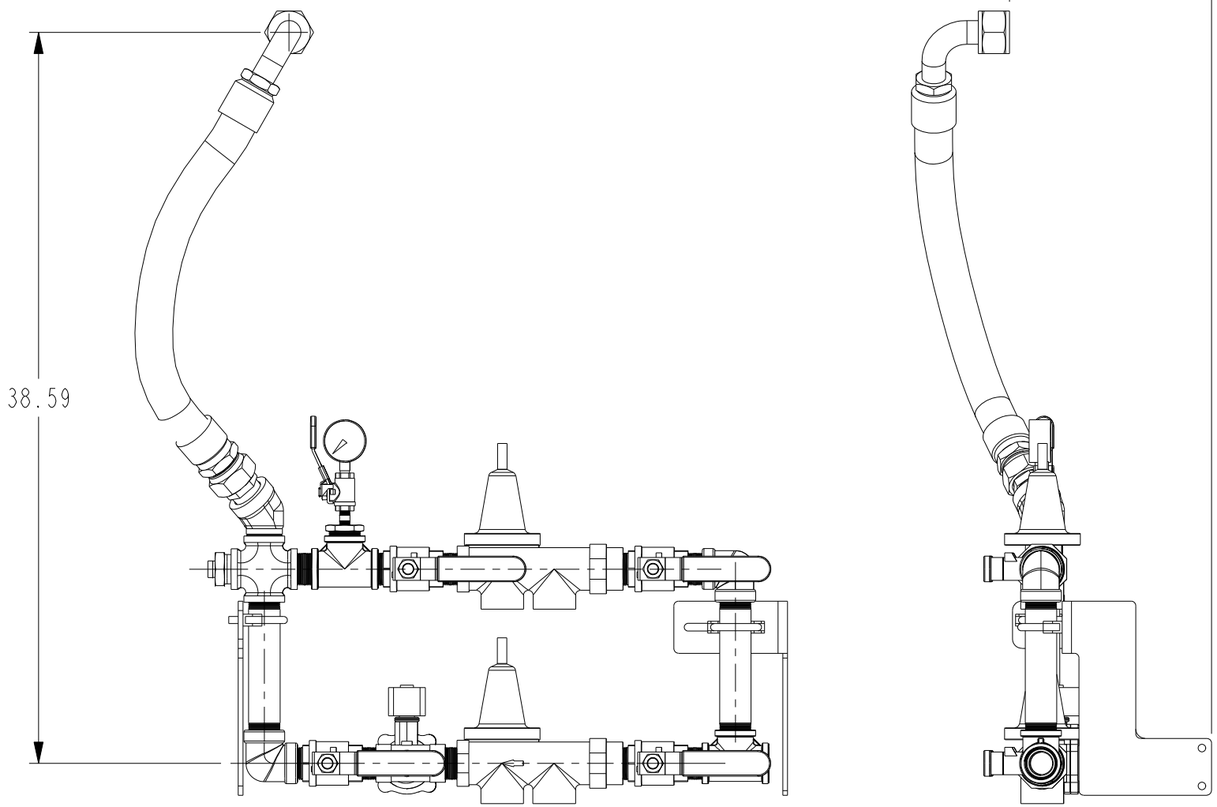
CUMMINS NPOWER, LLC
CORPORATE OFFICE
1600 BUERKLE ROAD
WHITE BEAR LAKE, MN
WWW.NPOWER.CUMMINS.COM

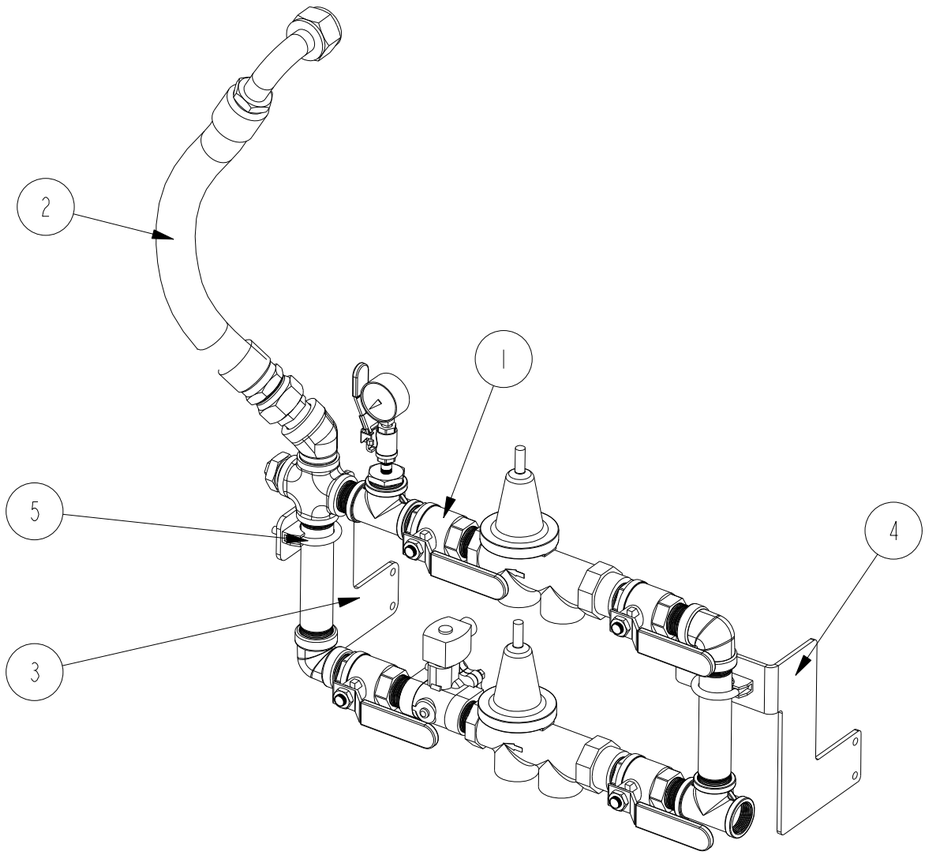
NPOWER SYSTEMS
DESIGN CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

TITLE 1: TUBE, MISC PIPING, CFP15
TITLE 2: FIREPUMP

DWG UNITS: IN/LB/S	DRAWN BY: DAVE N			DATE: 04MAY2006	
	APPD BY: -			DATE: -	
EST WEIGHT: 6.620	SCALE: 0.380	DO NOT SCALE	SHEET 1OF1	DRAWING NO: 10915	REV: C







BILL OF MATERIAL

ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	ASSEMBLY, COOLING LOOP, 1-1/4", HORIZONTAL PUMP	10912
2	1	HOSE, RAW WATER, 28" O.A.L. PARKER 601	14932
3	1	BRACKET, RAW WATER COOLING, 8" LG, FIREPUMP	10916
4	1	BRACKET, RAW WATER COOLING, FIREPUMP	11579
5	2	U-BOLT, 1.75", -	517134

E

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

MISC PIPING, CFP15
FIREPUMP

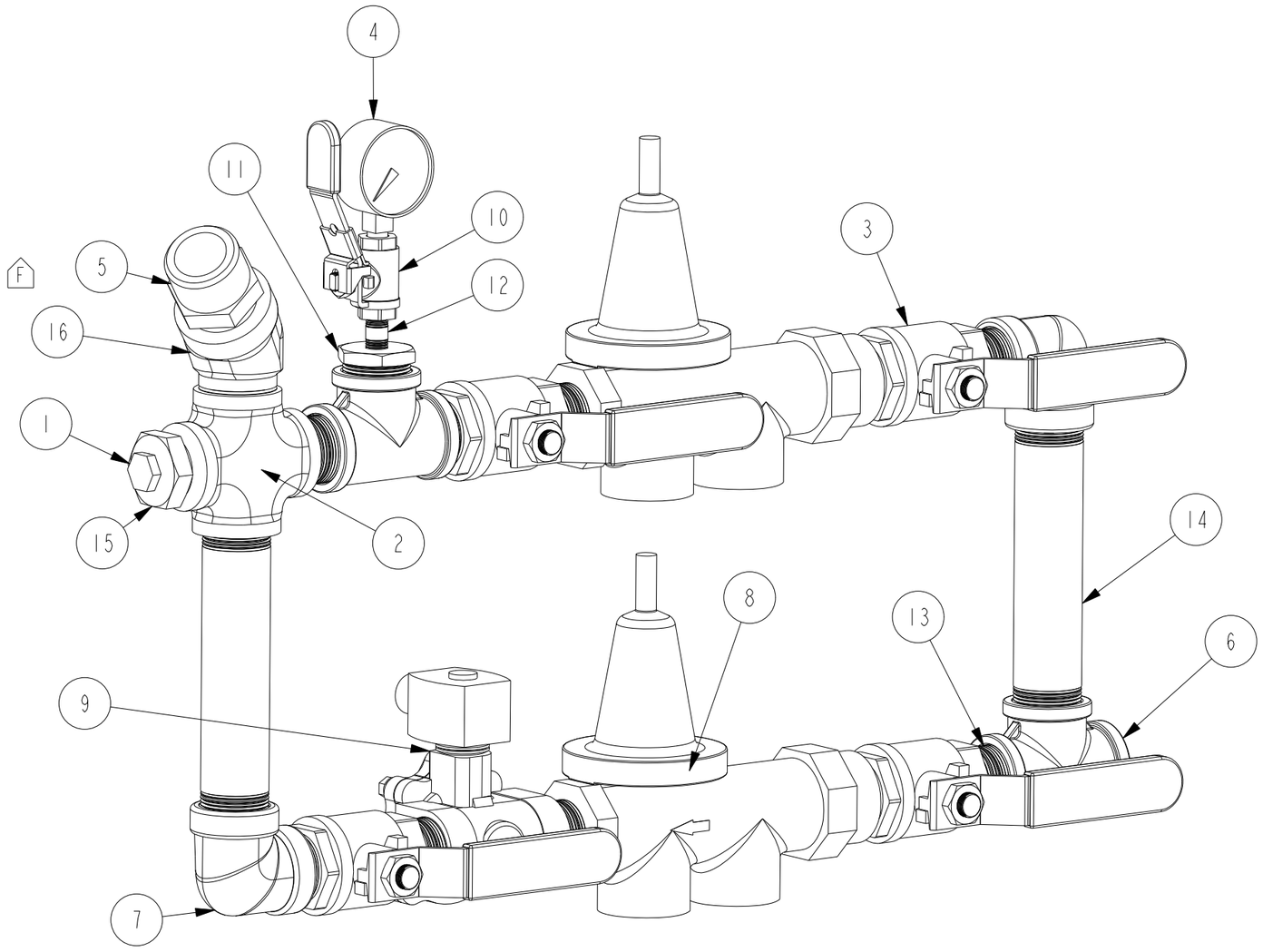
DWG UNITS: IN/LB/S | DRAWN BY: DAVE N | DATE: 04MAY2006

PRO-ENGINEER | REF DRWG:

SCALE: 0.125 | SHEET 1 OF 1 | DRAWING NO: 10913

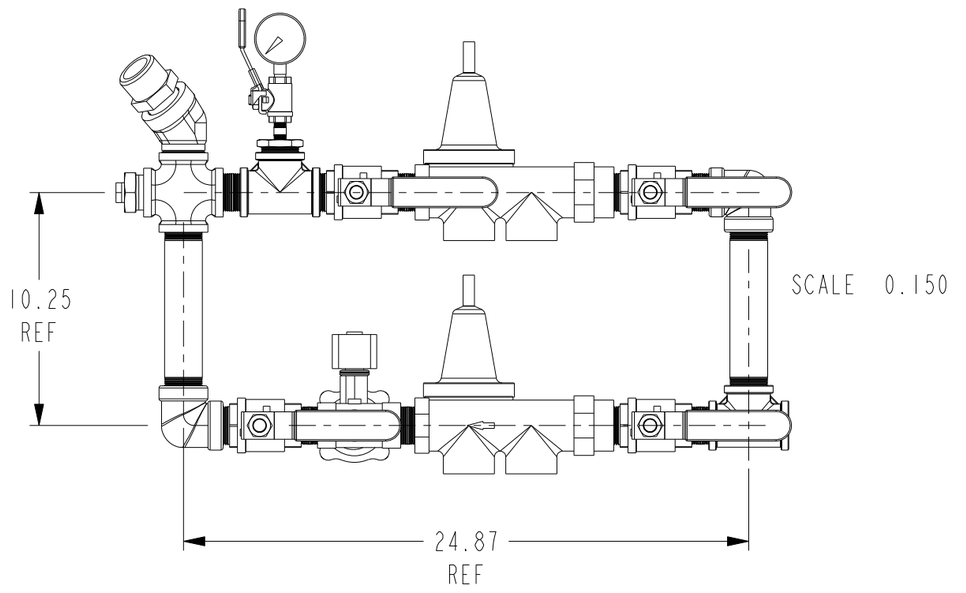
EST WEIGHT: 89.475

REV				
E	2009-171	HOSE WAS TUBE #10905	DAVE N	07MAY2009
REV	ENF	DESCRIPTION OF REVISION	REV BY	DATE



BILL OF MATERIAL

	ITEM	QTY	DESCRIPTION	PART NUMBER
	1	1	PLUG, ZINC W/ BRASS SUPPORT, 1/2" NPT, CHAMP #500129	9750
	2	1	CROSS, THREADED, 1_1/4" NPT	12708
	3	4	BALL VALVE, 1_1/4 NPT MALE X FEMALE	12709
	4	1	GUAGE, PRESSURE, 1/4" NPT, 0-100 PSI RANGE	8892
F	5	1	FTG, STR, -24 JIC X -20 NPT	12238-24-20
	6	2	TEE, 1 1/4" NPT FEMALE, BLK STEEL	12386
	7	2	ELBOW, 1 1/4" NPT FEMALE, BLK STEEL	12387
	8	2	REGULATOR/STRAINER, 1-1/4" NPT, WATTS 1_1-4_25AUB-Z3	12388
	9	1	VALVE, SOLENOID, 1-1/4" NPT, 24VDC, 150 PSI, ASCO 8210G008	12389
	10	1	VALVE, BALL, 1/4" NPT FEMALE, .	12390
	11	1	BUSHING, REDUCING, 1 1/4" X 1/4" NPT, BLK STEEL	12391
	12	1	NIPPLE, 1/4" NPT x 1 1/2", BLK STEEL	12392
	13	6	NIPPLE, 1 1/4" NPT X 2", BLK STEEL	12394
	14	2	NIPPLE, 1 1/4" NPT X 8", BLK STEEL	12395
	15	1	FITTING, REDUCER, 1 1/4 MALE NPTF X 1/2 FEMALE NPTF	12710
F	16	1	ELBOW, 45° 1-1/4" MNPTxFNPT, 150LB BLACK IRON	14204-20



UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1° | IMPERIAL UNITS | METRIC UNITS

THIRD ANGLE PROJECTION

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

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

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CUSTOM DESIGN
AND UPFIT CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

ASSEMBLY, COOLING LOOP, 1-1/4" HORIZONTAL PUMP

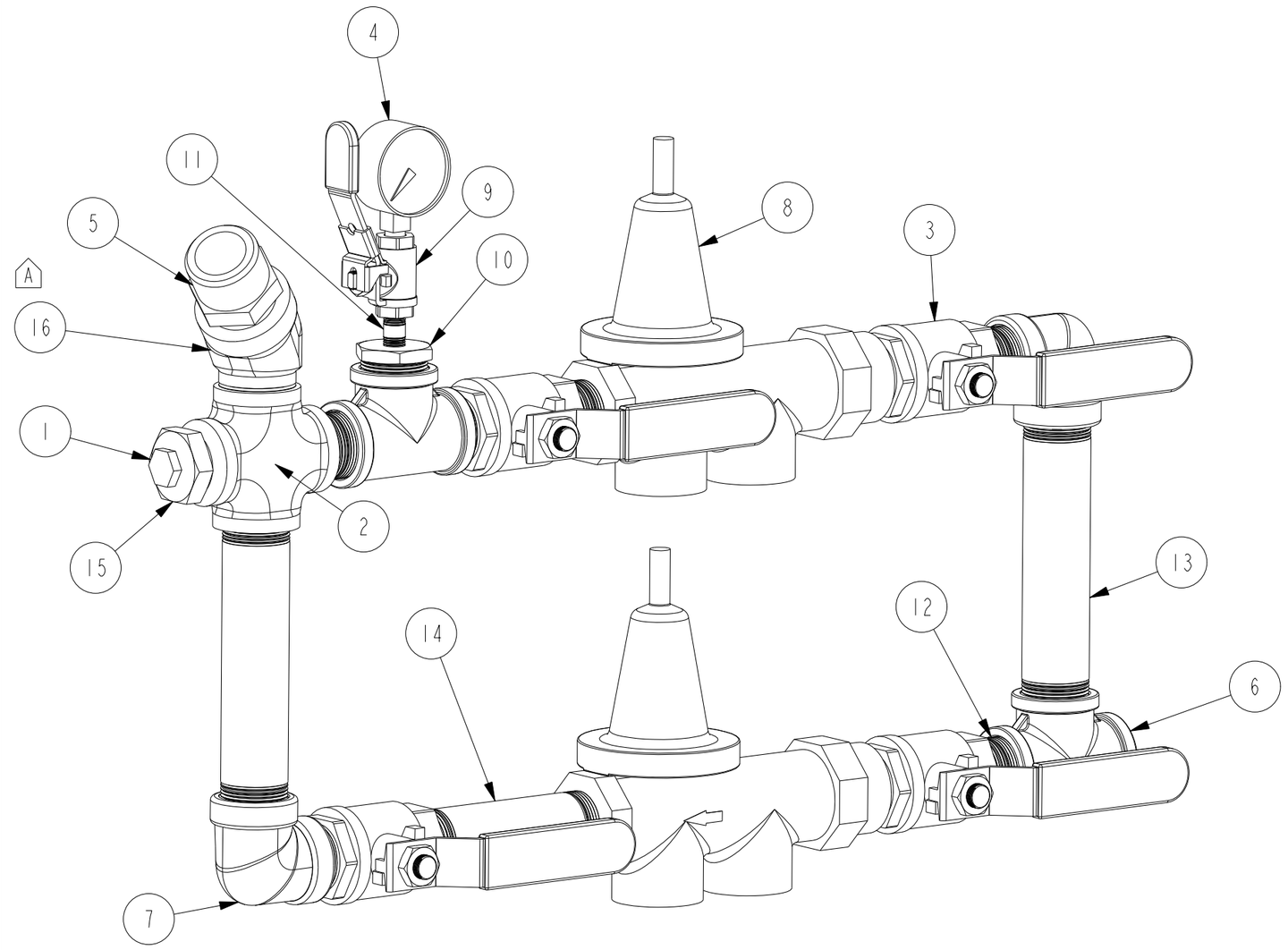
DWG UNITS: IN/LB/S | DRAWN BY: S DUBICK | DATE: 11/11/08

PRO-ENGINEER | REF DRWG:

SCALE: 0.300 | SHEET 1 OF 1 | DRAWING NO: 10912

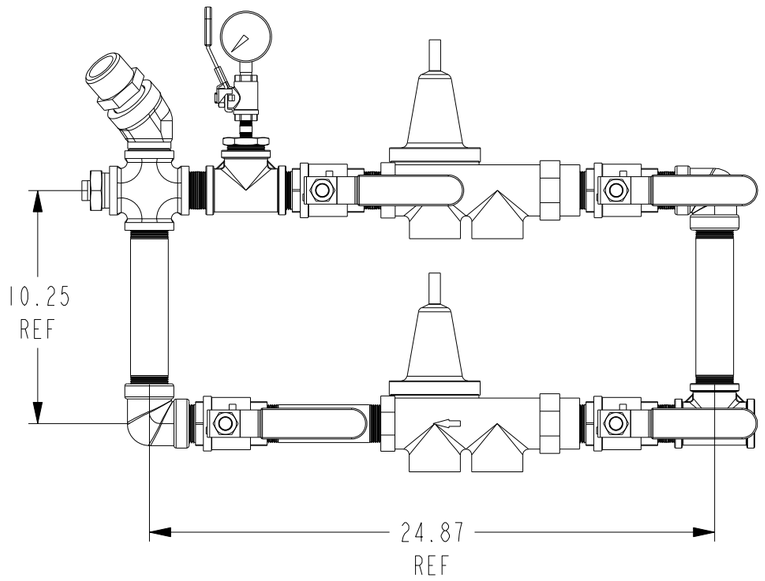
EST WEIGHT: 67.265

REV		DESCRIPTION OF REVISION	REV BY	DATE
F	2009-171	ADDED 45 DEGREE ELBOW	DAVE N	07MAY2009
E		UPDATE WITH CNP PART NUMBERS	S DUBICK	11/11/08
REV	ENF	DESCRIPTION OF REVISION	REV BY	DATE



BILL OF MATERIAL

ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	PLUG, ZINC W/ BRASS SUPPORT, 1/2" NPT, CHAMP #500129	9750
2	1	CROSS, THREADED, 1_1/4" NPT	12708
3	4	BALL VALVE, 1_1/4 NPT MALE X FEMALE	12709
4	1	GUAGE, PRESSURE, 1/4" NPT, 0-100 PSI RANGE	8892
A 5	1	FTG, STR, -24 JIC X -20 NPT	12238-24-20
6	2	TEE, 1 1/4" NPT FEMALE, BLK STEEL	12386
7	2	ELBOW, 1 1/4" NPT FEMALE, BLK STEEL	12387
8	2	REGULATOR/STRAINER, 1-1/4" NPT, WATTS 1_1-4_25AUB-Z3	12388
9	1	VALVE, BALL, 1/4" NPT FEMALE, .	12390
10	1	BUSHING, REDUCING, 1 1/4" X 1/4" NPT, BLK STEEL	12391
11	1	NIPPLE, 1/4" NPT x 1 1/2", BLK STEEL	12392
12	4	NIPPLE, 1 1/4" NPT X 2", BLK STEEL	12394
13	2	NIPPLE, 1 1/4" NPT X 8", BLK STEEL	12395
14	1	NIPPLE, 1 1/4" NPT X 6", BLK STEEL	12396
15	1	FITTING, REDUCER, 1 1/4 MALE NPTF X 1/2 FEMALE NPTF	12710
A 16	1	ELBOW, 45° 1-1/4" MNPTxFNPT, 150LB BLACK IRON	14204-20



SCALE 0.150

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
A	2009-171	ADDED 45 DEGREE ELBOW	DAVE N	07MAY2009

Cummins Fire Power

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CORPORATE OFFICE
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WHITE BEAR LAKE, MN
WWW.CUMMINSFIREPOWER.COM

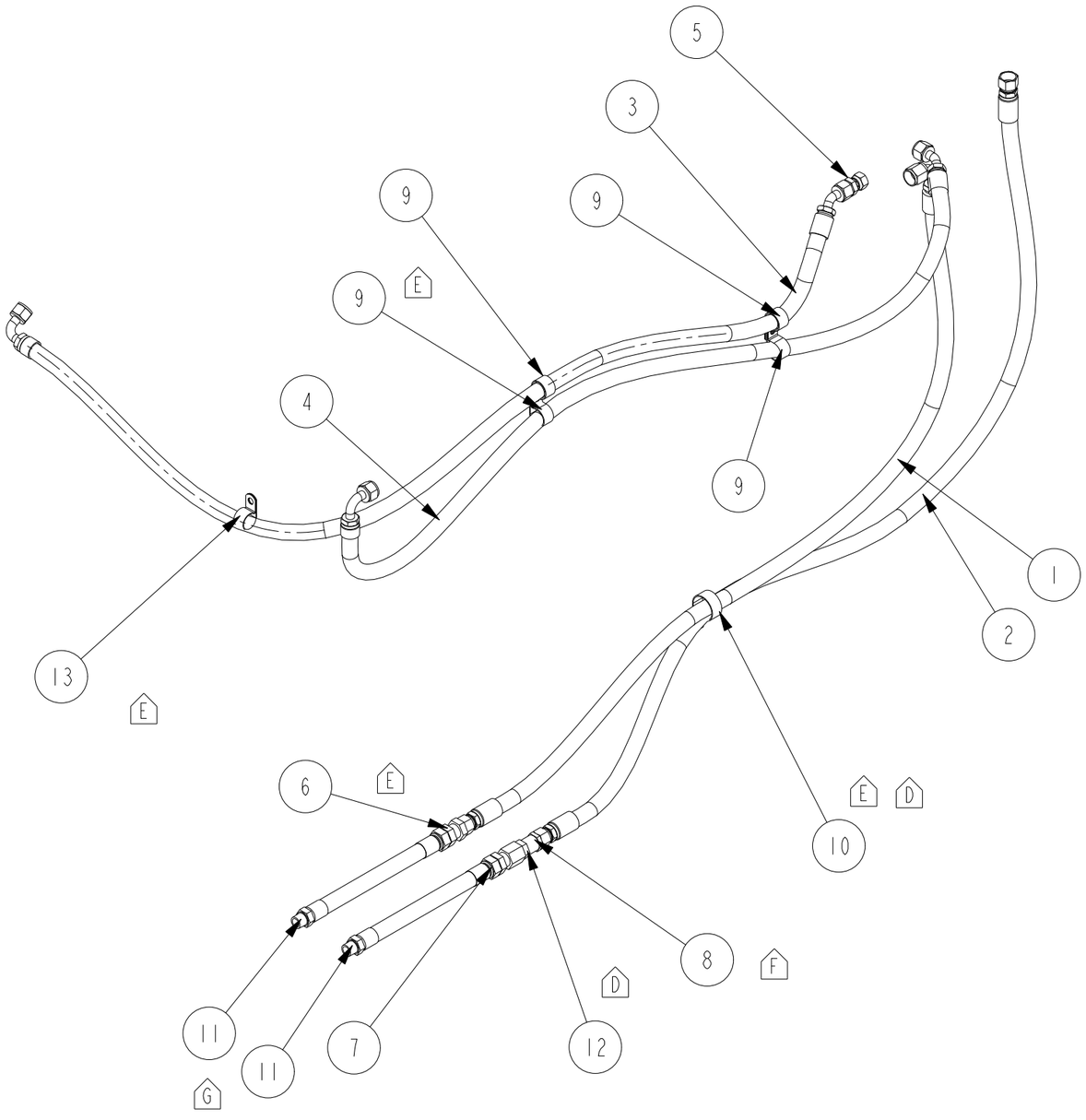
CUSTOM DESIGN
AND UPFIT CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

ASSEMBLY, COOLING LOOP, 1-1/4" VERTICAL PUMP

DWG UNITS: IN/LB/S | DRAWN BY: S DUBICK | DATE: 11/11/08

PRO-ENGINEER | REF DRWG:

SCALE: 0.300 | EST WEIGHT: 67.265 | SHEET 1 OF 1 | DRAWING NO: 11707



BILL OF MATERIAL			
ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	HOSE, FUEL, CFP15E FIREPUMP	10925
2	1	HOSE, FUEL, CFP15E FIREPUMP	10926
3	1	HOSE, FUEL COOLER INPUT, CFP15E	12523
4	1	HOSE, FUEL COOLER, RETURN, CFP15E	12524
5	1	ADAPTER, EXPANDER, 10 JIC X 8 JIC, PARKER 10-8 XHX6 OR EQUIV.	12137-10-8
E	6	1	FTG, BLKHD, -10 JIC	12227-10
7	1	FTG, BLKHD, -10 JIC X -8 FMNPT	12230-10-8
F	8	1	FTG, STR, -10 FLR X -8 FMNPT	12552-10-8
E	9	4	CLAMP, LOOM, 1", LTL-SCPV16627	13745
E	10	1	CLAMP, P-STYLE, 1-1/2", LTL-SCPV24627	13747
G	11	2	FUEL LINE, 12" EXTENSION, #10 FEM JIC X #10 221FR X 3/4" NPT	14400-011
12	1	VALVE,CHECK,BRASS, 1/2" MNPT X MNPT	14411
13	1	CLAMP, P-STYLE, 1" W/ 0.50 HOLE, LTL-CCV1717	14554

REV	ENF	DESCRIPTION OF REVISION	REV BY	DATE
G	2009-313	ADDED FLEX EXTENSIONS 14400-011	DAN	20-JUL-09
F	2009-322	ADDED 12552-10-8 ADAPTER	DAN	15-JUL-09
E	2009-064	REV PER LOOM CLAMPS & HOSE ENDS	DAN	12FEB2009
D	2008-476	ADDED PN: 14411	MAC	01FEB2009

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

Cummins Fire Power

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1600 BUERKLE ROAD
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CUSTOM DESIGN
AND UPFIT CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

ASSEMBLY, FUEL PLUMBING
CFP15E

DWG UNITS: IN/LB/S

DRAWN BY: S DUBICK

PRO-ENGINEER

DATE:

REF DRWG:

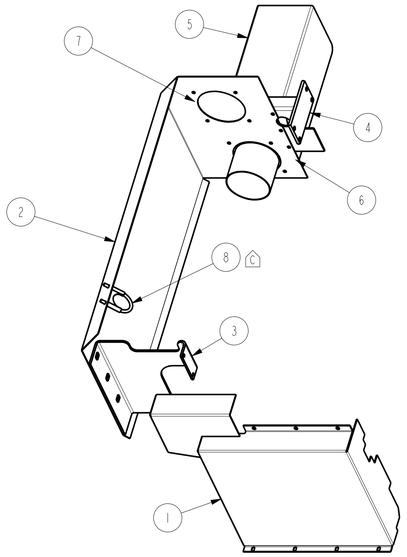
SCALE: 0.125

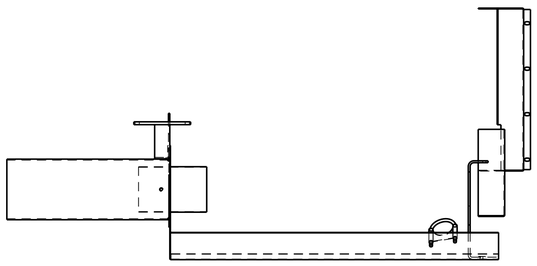
EST WEIGHT: 76.054

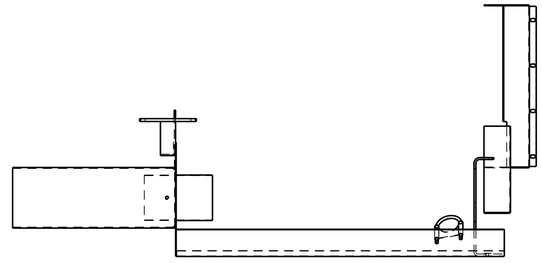
SHEET 1 OF 1

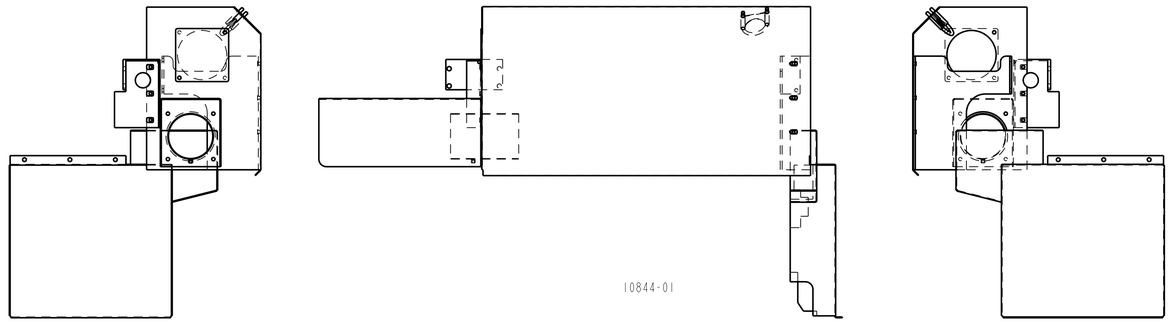
DRAWING NO: 10842

BILL OF MATERIAL			
ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	GUARD BELT, ASSEMBLY, CFPI5E	10838
2	1	WELDMENT, HEAT SHIELD, CFPI5E FIREPUMP	10845
3	1	BRACKET, GUARD MOUNTING, HEAT SHIELD, FRONT, CFPI5E FIREPUMP	10884
4	1	BRACKET ASSEMBLY, OPERATOR SIDE, CFPI5E	10885
5	1	SHROUD, INTAKE, CFPI5E-F30	11715
6	1	SHROUD, INTAKE, HD AIR CLEANER, CFPI5E	12881
7	1	PLATE, BLOCK OFF, CFPI5E-F30	11717
8	1	U-BOLT CLAMP 2.75 DIA TUBE	U-BOLT_275

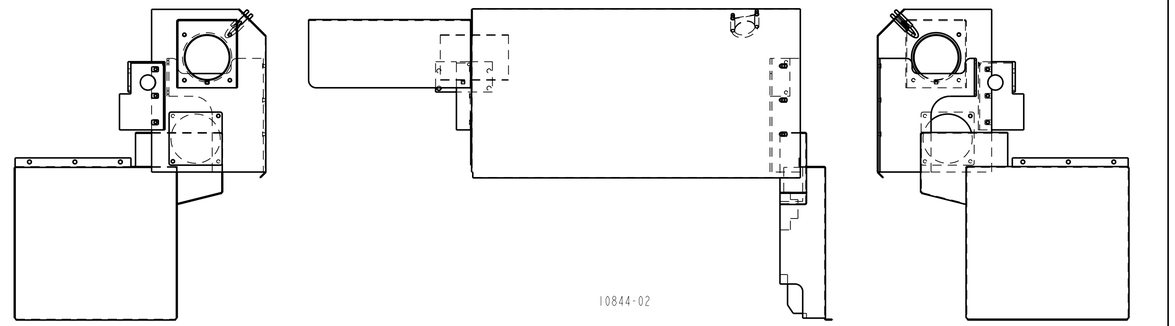




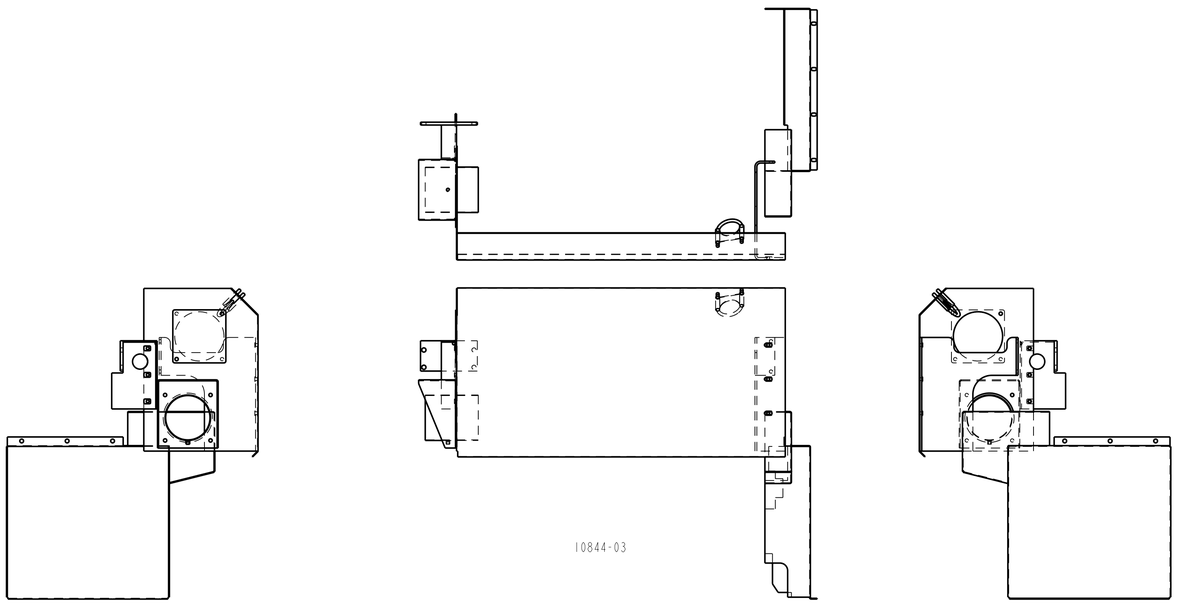




10844-01



10844-02



10844-03

REV	DESCRIPTION OF REVISION	REV BY	DATE
C	MODIFIED 10845, 11715-01, ADDED U-BOLT	S DUBICK	15AUG08
B	ADDED-03 VERSION	S DUBICK	12JUN08

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

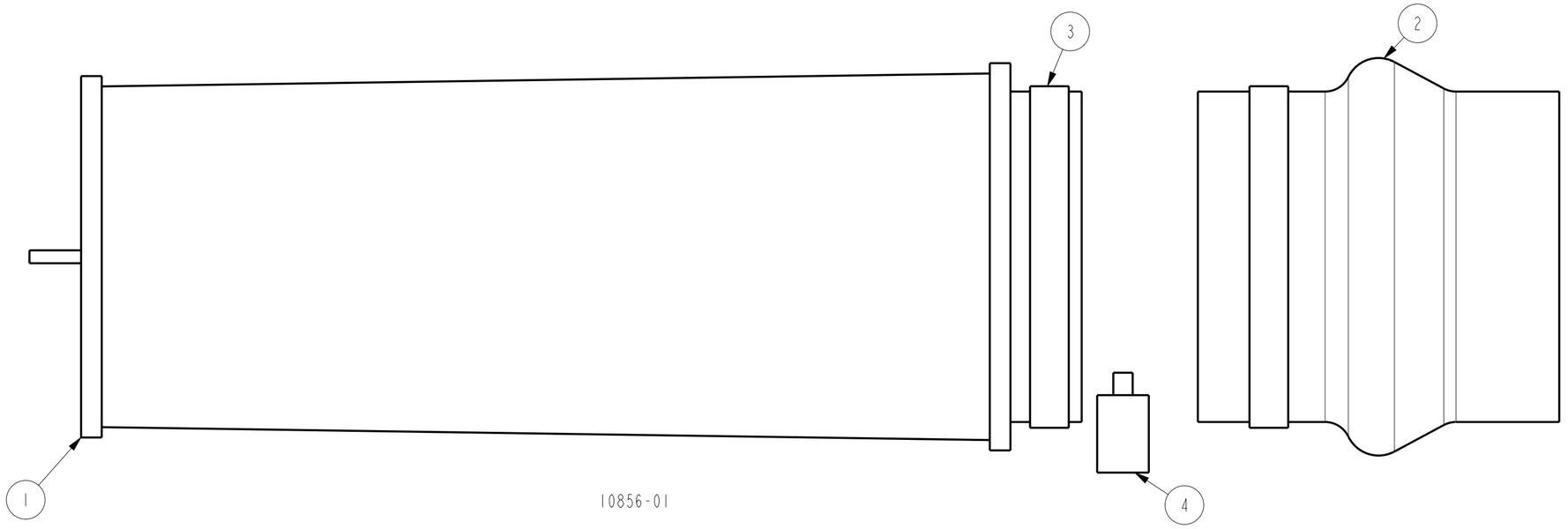
CUMMINS NPOWER, LLC CORPORATE OFFICE 1600 BUERKLE ROAD WHITE BEAR LAKE, MN WWW.NPOWER.CUMMINS.COM		NPOWER SYSTEMS DESIGN CENTER 815 LAWRENCE DRIVE DEPERE, WISCONSIN
TITLE 1: ASSEMBLY, GUARDING TITLE 2: CFPI5E FIREPUMP		
DWG UNITS: IN/LB/S	DRAWN BY: S.DANFORTH	DATE: -
	APPD BY: -	DATE: -
EST WEIGHT: 78.254	SCALE: 0.100 / DO NOT SCALE / SHEET 1OF1	DRAWING NO: 10844 / REV: C

10856-01 BILL OF MATERIAL

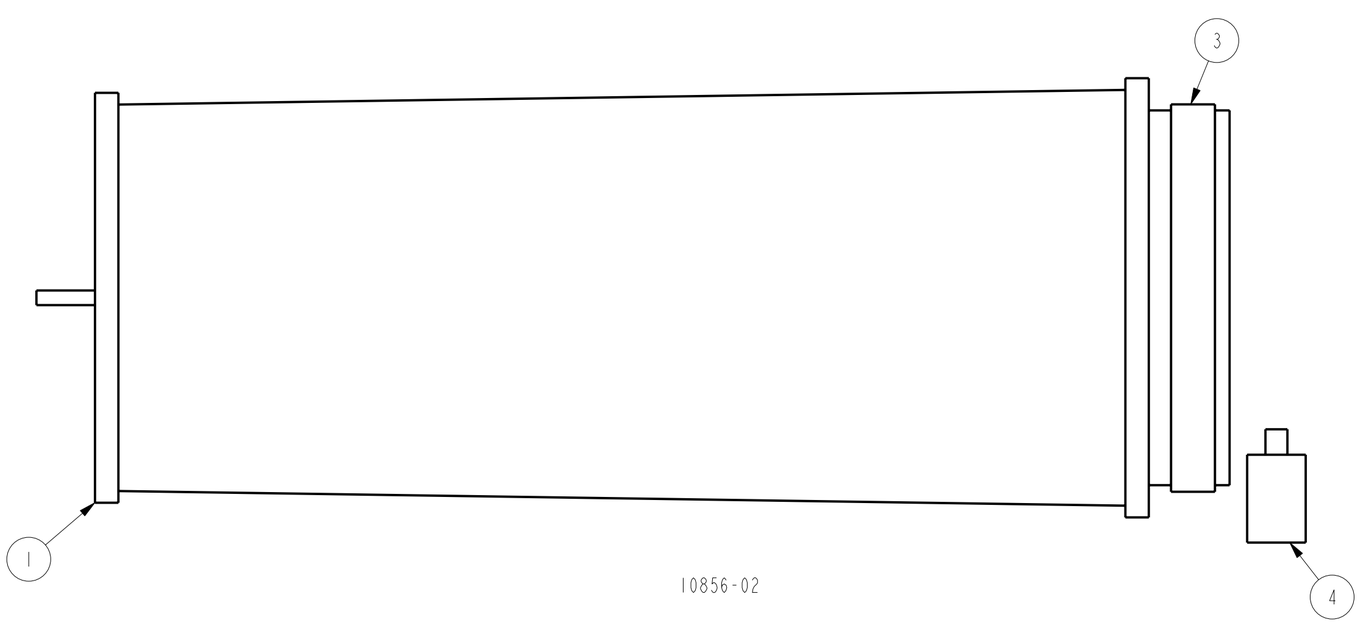
ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	ELEMENT, FILTER, CFPI5E, SPECIAL	10857
2	1	HUMP-HOSE 6" NOMINAL, NELSON 89839K OR EQUIV	89839K
3	2	CLAMP, 6" NOMINAL	AC600
4	1	RESTRICTION INDIACOR, 1/8" NPT	RAX00-2352

10856-02 BILL OF MATERIAL

ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	ELEMENT, FILTER, CFPI5E, SPECIAL	10857
2	1	HUMP-HOSE REDUCER, 6.0" TO 5.5"	89849K
3	2	CLAMP, 6" NOMINAL	AC600
4	1	RESTRICTION INDIACOR, 1/8" NPT	RAX00-2352



10856-01



10856-02

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

REV	DESCRIPTION OF REVISION	REV BY	DATE
C	REMOVE (1) CLAMP	S DUBICK	04APR2008
B	ADDED -02 VERSION, DELETED NOTE	PBS	25JUN2007
A	ADDED NOTE	PBS	11MAY2007

ANGULAR DIMENSIONS ± 1°
THIRD ANGLE PROJECTION
IMPERIAL UNITS
MACHINE TOLERANCES .XX ± 0.010 .XXX ± 0.005
FORM TOLERANCES .XX ± 0.030 .XXX ± 0.015
FAB TOLERANCES .XX ± 0.060 .XXX ± 0.030
METRIC UNITS
MACHINE TOLERANCES .X ± 0.2 .XX ± 0.12
FORM TOLERANCES .X ± 0.8 .XX ± 0.4
FAB TOLERANCES .X ± 1.5 .XX ± 0.8

REF. SCALES

Fire Power

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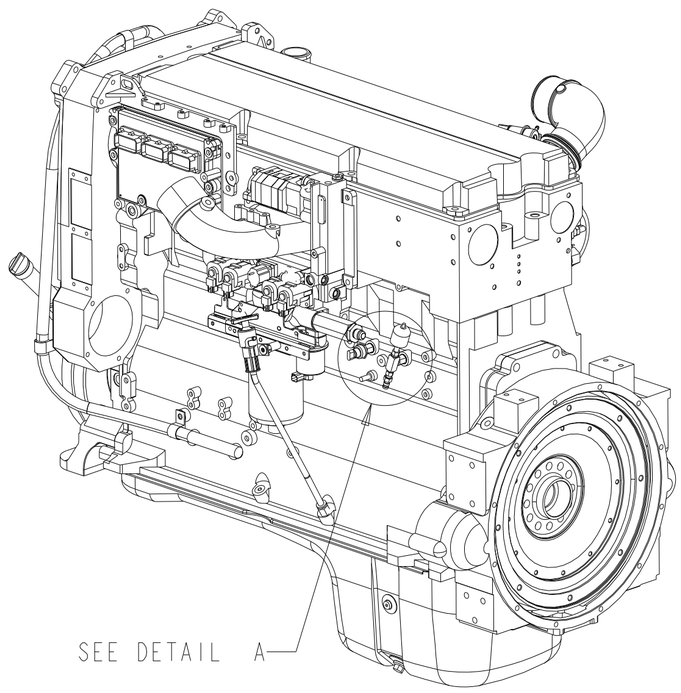
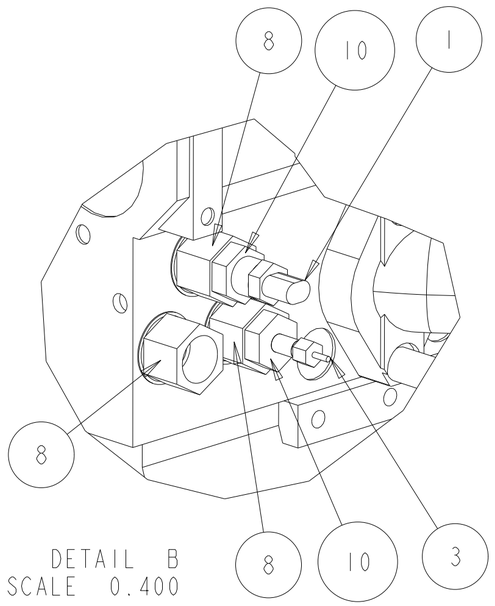
NPOWER SYSTEMS
DESIGN CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

TITLE 1: ASSEMBLY, AIR CLEANER, CFPI5E
TITLE 2: FIREPUMP

DWG UNITS: IN/LB/S	DRAWN BY: S.DANFORTH			DATE: APR 2006	
	APPD BY:			DATE:	
EST WEIGHT: 7.562	SCALE: 0.500	DO NOT SCALE	SHEET 1OF1	DRAWING NO: 10856-02	REV: C

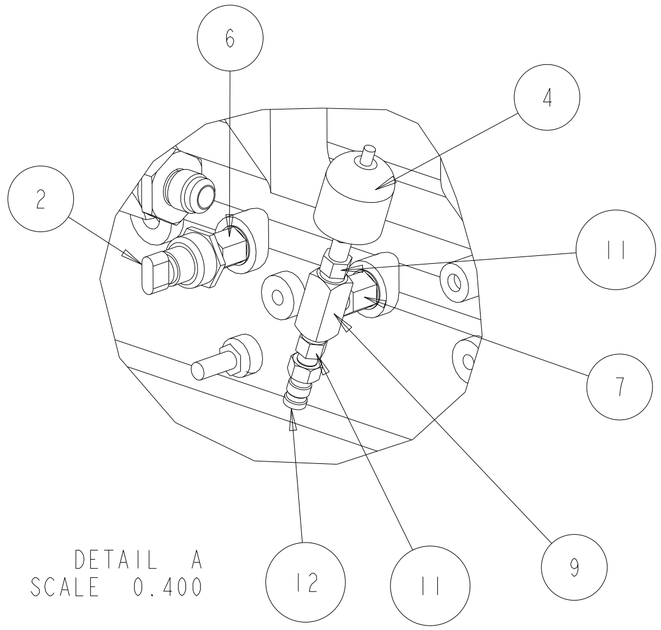




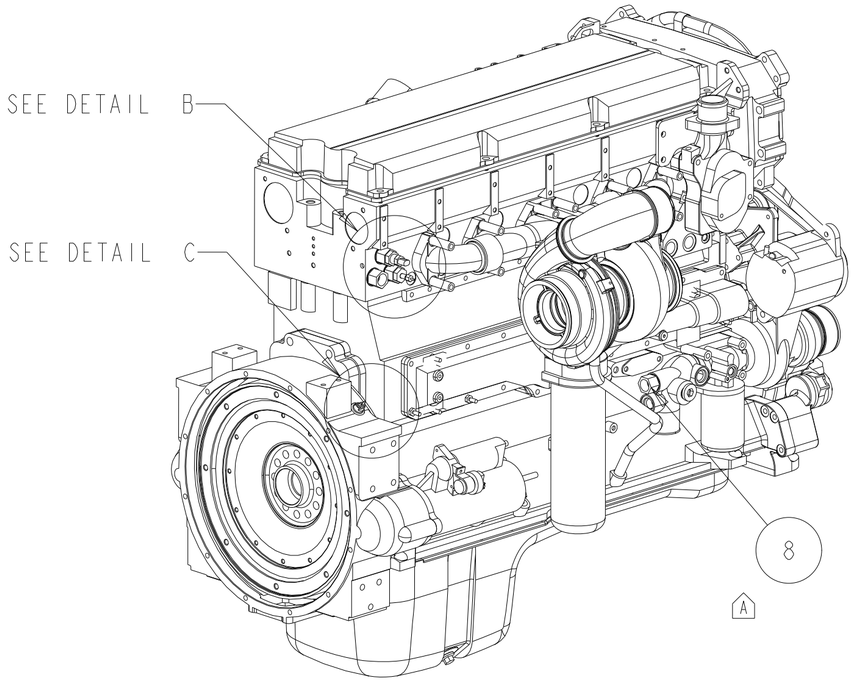
DETAIL B
SCALE 0.400

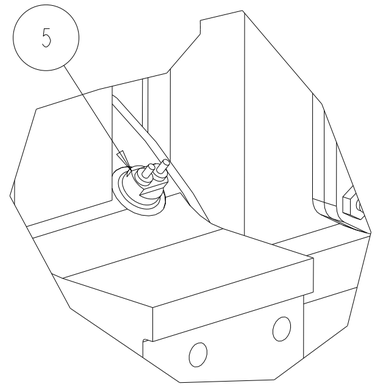
BILL OF MATERIAL

ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	SWITCH, WATER TEMP, 200F SETTING, #3408632	8860
2	1	SWITCH, OIL PRESSURE, 16 PSI, #3408607	8861
3	1	SENDER, WATER TEMPERATURE, DATCON #02022-00	8862
4	1	SENDER, OIL PRESURE, DATCON #02504-00	8863
5	1	SENSOR, MAG PICK UP, #5MT2005	9569
6	1	FTG, STR, M14 ORR X -2 FNPT	12181-M14-2
7	1	FTG, STR, M14 ORR X -4 FNPT	12181-M14-4
8	4	FTG, STR, M27 ORR X -12 FNPT	12181-M27-12
9	1	TEE,MALE BRANCH,1/4", NPT, BRASS	14409-4
10	2	BUSHING, REDUCER, -12 NPT X -2 FNPT	14783-12-2
11	2	BUSHING, REDUCER, -4 NPT X -2 FNPT	14783-4-2
12	1	CONNECTOR, QUICK DISCONNECT	3377244



DETAIL A
SCALE 0.400





DETAIL C
SCALE 0.400

REV		DESCRIPTION OF REVISION	REV BY	DATE
A	2009-322	12181-M27-12 QTY WAS (3)	DAN	14-JUL-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 ± 0.015 .XXX ± 0.075
PAD TOLERANCES .XX ± 0.020 .XXX ± 0.050

MACHINE TOLERANCES .X ± 0.2 .XX ± 0.1
FORM TOLERANCES .X ± 0.4 .XX ± 0.4
PAD TOLERANCES .X ± 0.5 .XX ± 0.5

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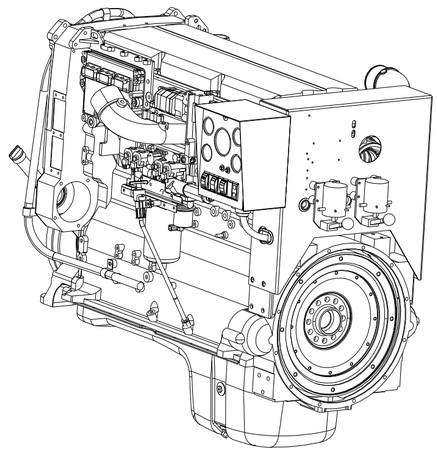
AND UPFIT CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

ASSEMBLY, SENSOR PACKAGE CFP15E

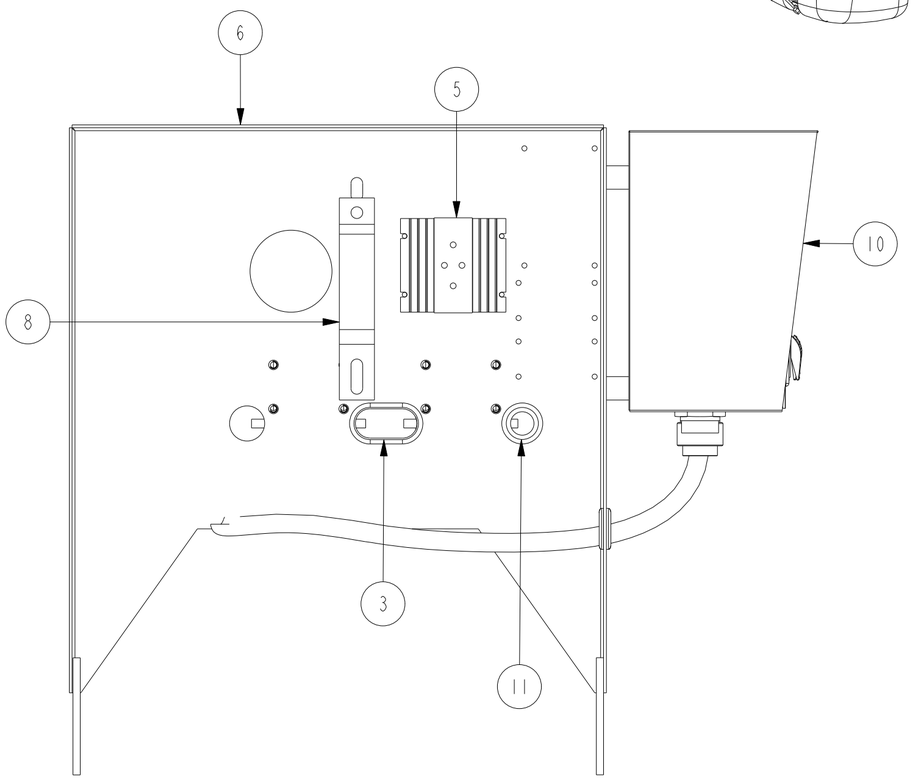
DWG UNITS: IN/LB/S
DRAWN BY: S DUBICK
DATE: 04/10/09
PRO-ENGINEER
REF DRWG:
SCALE: 0.100
EST WEIGHT: 4.606
SHEET 1 OF 1
DRAWING NO: 9572-01

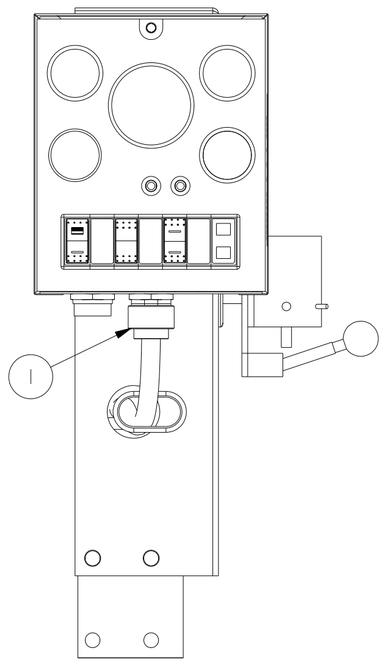
SEQUENCE OF ASSEMBLY
1.) ADD ISOLATOR, CONTACTORS, GROMMETS TO PANEL
2.) ADD SPACER AND ECM A-B SWITCH BRKT TO FLYWHEEL HOUSING WITH LOWER SCREWS ONLY.
3.) ADD SUB-ASMY PER STEP 1. TO ENGINE
4.) ADD GAUGE PANEL AND SENSORS
5.) ADD WIRING HARNESS

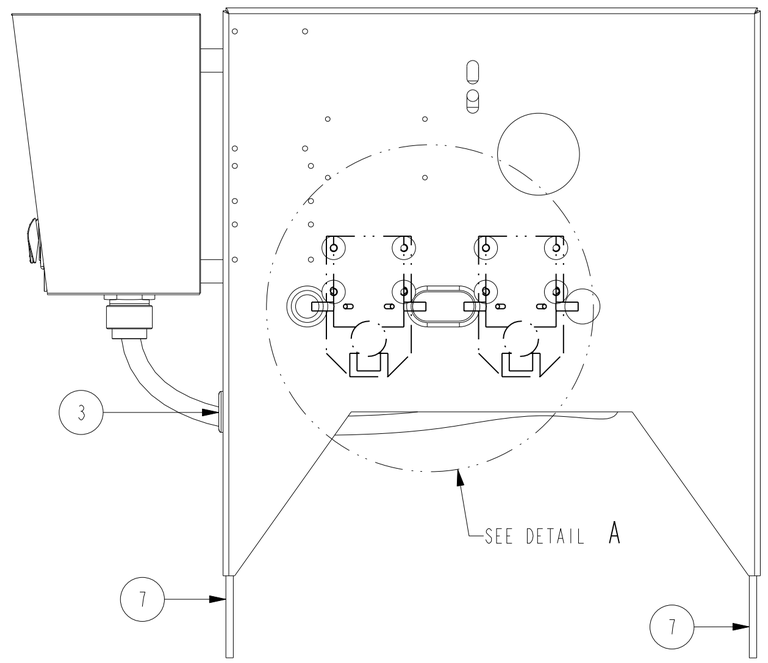


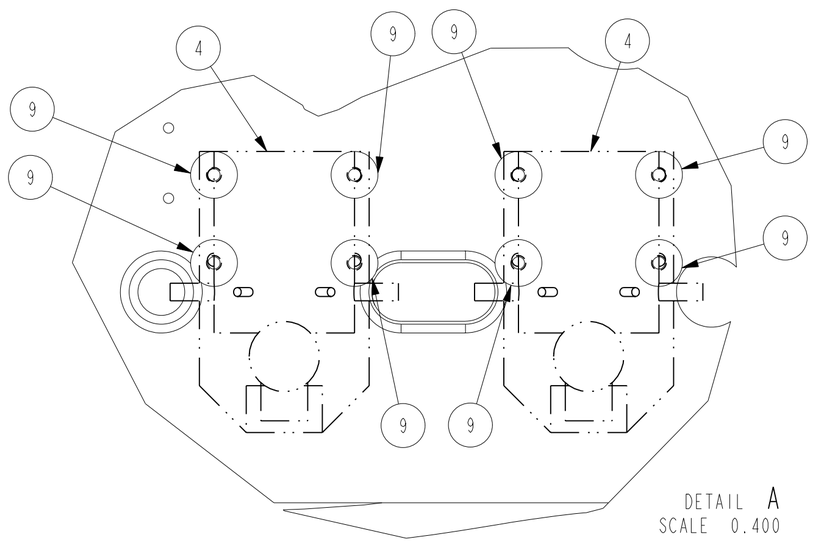
BILL OF MATERIAL

	ITEM	QTY	DESCRIPTION	PART NUMBER
	1	1	HARNESS, WIRING, INSTRUMENT PANEL, B SERIES, FIREPUMP	8513
G	2	1	ASSEMBLY, SENSOR PACKAGE, CFPI5E	9572-01
F	3	2	GROMMETT	508-1057
	4	2	CONTACTOR, MANUAL OVERIDE, FIREPUMP	8824
	5	1	BATTERY ISOLATOR, FIRE PUMP	8838
	6	1	BRACKET, MOUNTING, OPERATORS STATION, CFPI5E FIREPUMP	10827
	7	2	SPACER, OPERATORS STATION, CFPI5E FIREPUMP	10843
	8	1	BRACKET, STIFFENER, OPERATOR STATION, CFPI5E FIREPUMP	11580
	9	8	ISOLATOR, PLATE MOUNT, 5/16-18x1x1 NEOPRENE, TECH PRODUCTS #51272	13011
F	10	1	ASSEMBLY, CONTROL PANEL, 24V, FIRE PUMP	13237
F	11	1	GROMMETT, BUNA-N RUBBER, 1-1/2 HOLE, PN:9307K74	14188









DETAIL A
SCALE 0.400

REV	DESCRIPTION OF REVISION	REV BY	DATE
G	CHANGE SENSOR ASSEMBLY	S DUBICK	13APR09
F	UPDATED PANEL & ISOLATORS PN 14188 WAS 19447	S DUBICK	07NOV08

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 : ± 0.2 .XX : ± 0.12
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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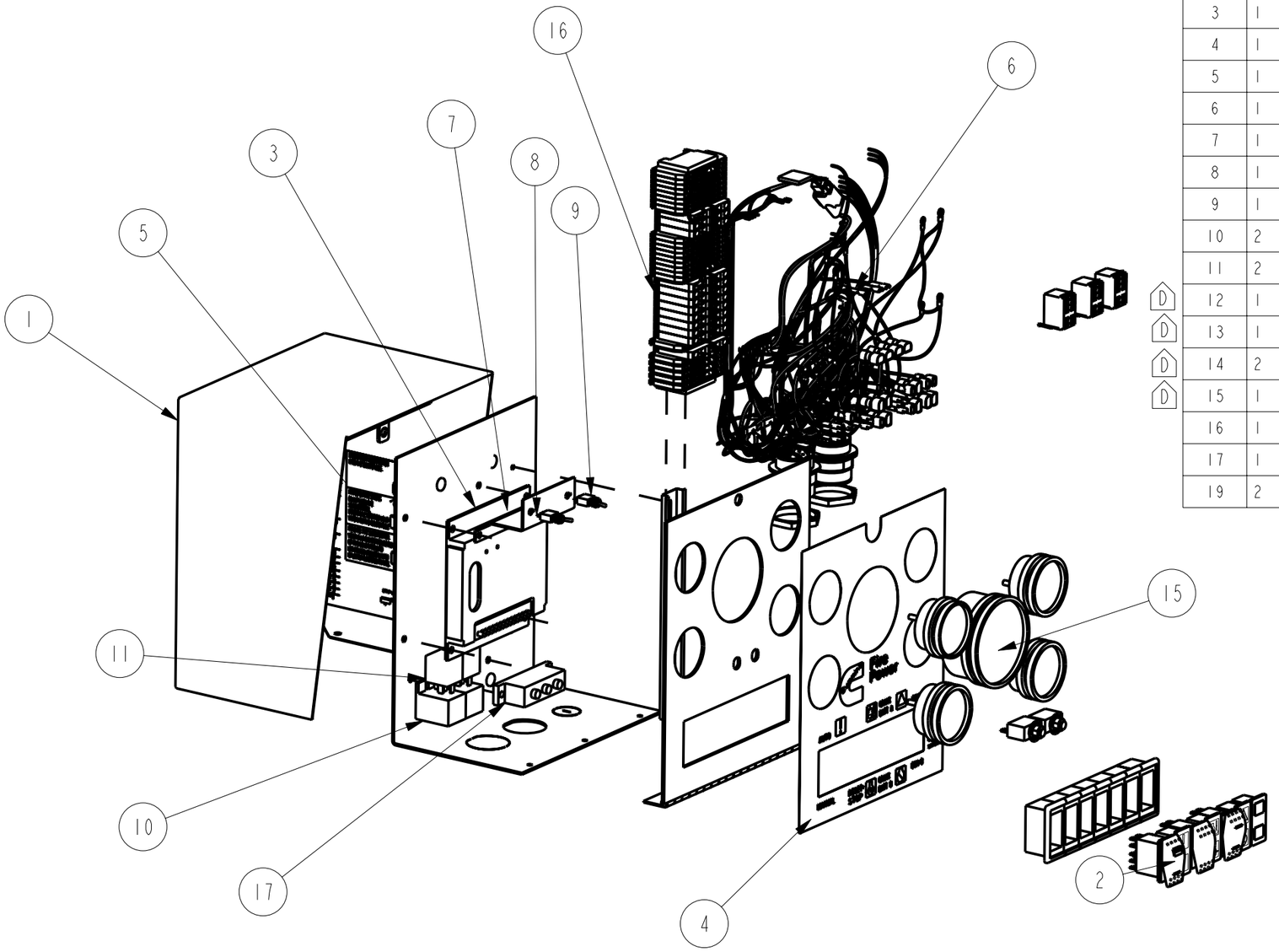
DEPERE, WISCONSIN

TITLE 1: ASSEMBLY, OPERATORS STATION, QSX15
TITLE 2: FIREPUMP

DWG UNITS: IN/LB/S	DRAWN BY: DAVE N			DATE: 18JUN2004	
	APPD BY:			DATE:	
EST WEIGHT: 56.308	SCALE: 0.200	DO NOT SCALE	SHEET 1OF1	DRAWING NO: 10826	REV: G



BILL OF MATERIAL

ITEM	QTY	DESCRIPTION	PART NUMBER
E 1	1	ENCLOSURE, FIREPUMP INSTRUMENT	10454
2	1	ASSEMBLY, SWITCH GANG, FIREPUMP	11084
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
D 12	1	GUAGE, OIL PRESSURE, 0-80 PSI, 12VDC, FIREPUMP	11194
D 13	1	GUAGE, WATER TEMPERATURE, 12VDC, FIREPUMP	11197
D 14	2	GUAGE, VOLTMETER 8-18VDC, FIREPUMP	11200
D 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

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
E	MODIFIED 10454	S DUBICK	28MAY08
D	CORRECTED GAUGE P/N'S	S.DANFORTH	02JAN07
C	REDRAWN AND RELEASED	ANTONIO G.	25SEP06
B	REVISED TERMINAL STRIP	S.DANFORTH	
A	PROTOTYPE RELEASE	S.DANFORTH	10JUL2006

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

REF. SCALES

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NPOWER SYSTEMS
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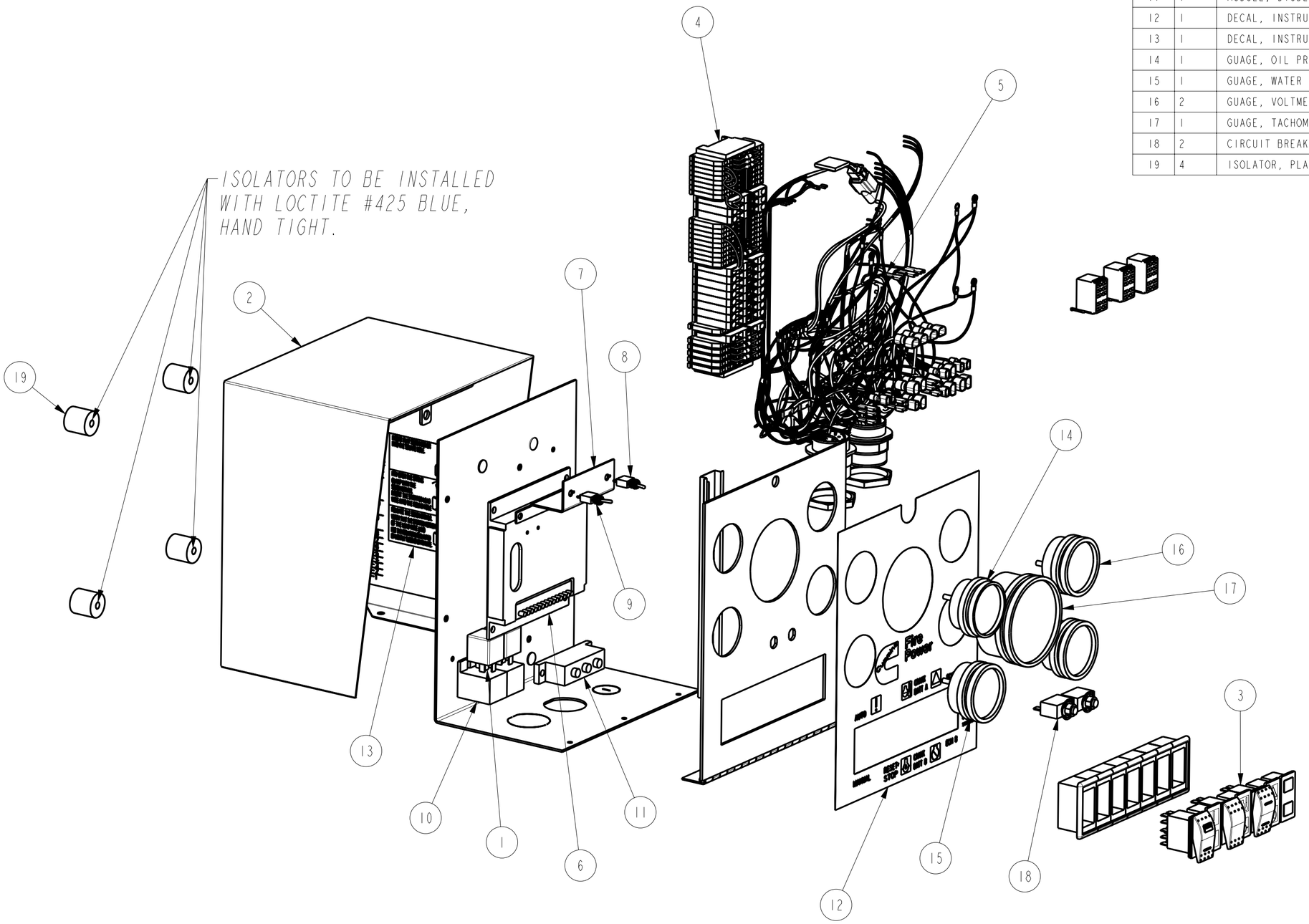
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

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

DWG UNITS: IN/LB/S	DRAWN BY: S.DANFORTH				DATE: 10JUL2006
	APPD BY:				DATE:
EST WEIGHT: 21.524	SCALE: 0.200	DO NOT SCALE	SHEET 1OF1	DRAWING NO: 10452	REV: E

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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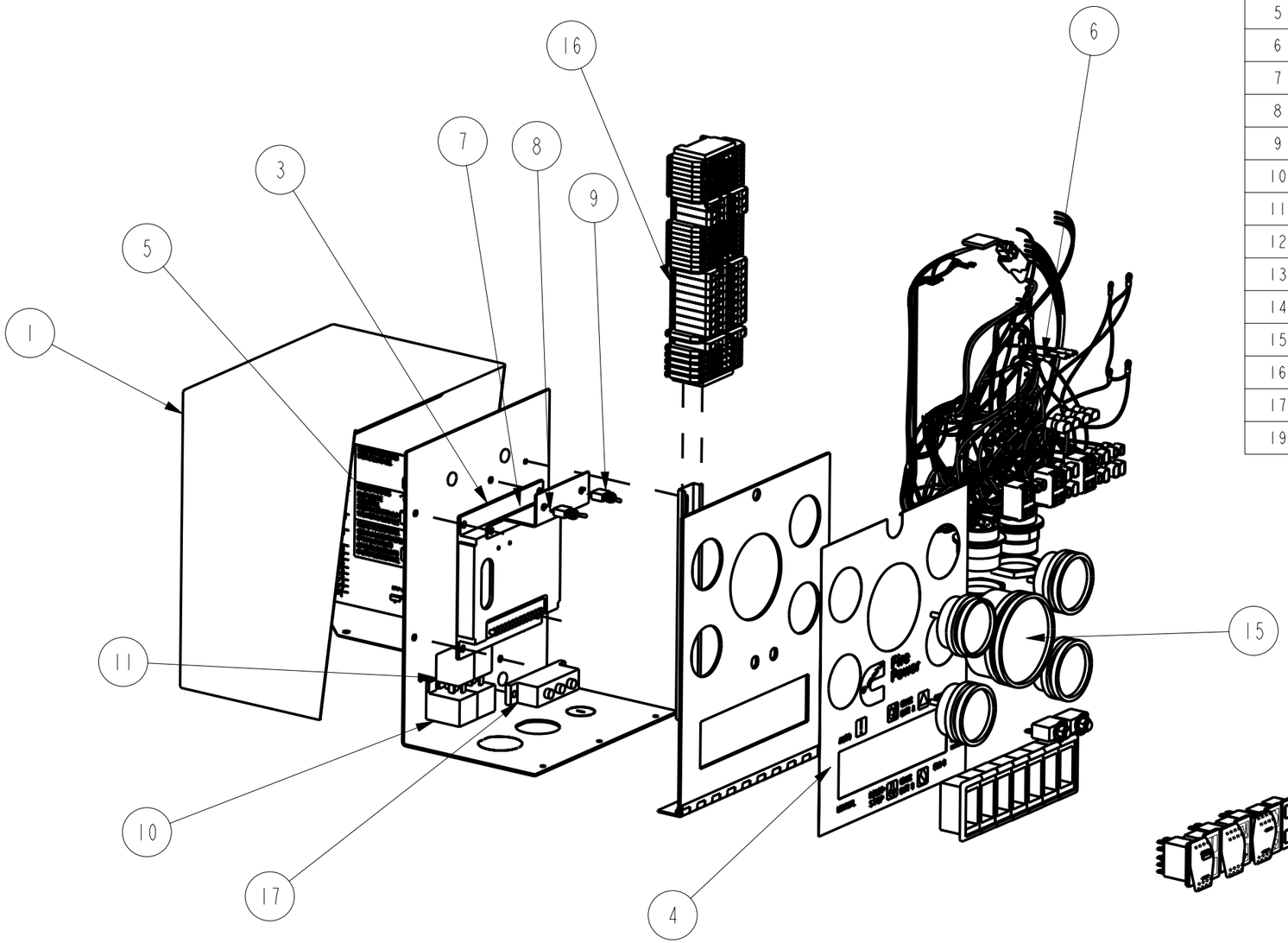
NPOWER SYSTEMS
DESIGN CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

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

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
E	MODIFIED 10454	S DUBICK	28MAY08
D	11085 WAS 11084	S.DANFORTH	02JAN07
C	REDRAWN AND RELEASED	ANTONIO G.	25SEP06
B	REVISED TERMINAL STRIP	S.DANFORTH	
A	PROTOTYPE RELEASE	S.DANFORTH	10JUL2006

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

REF. SCALES

Fire Power

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1600 BUERKLE ROAD
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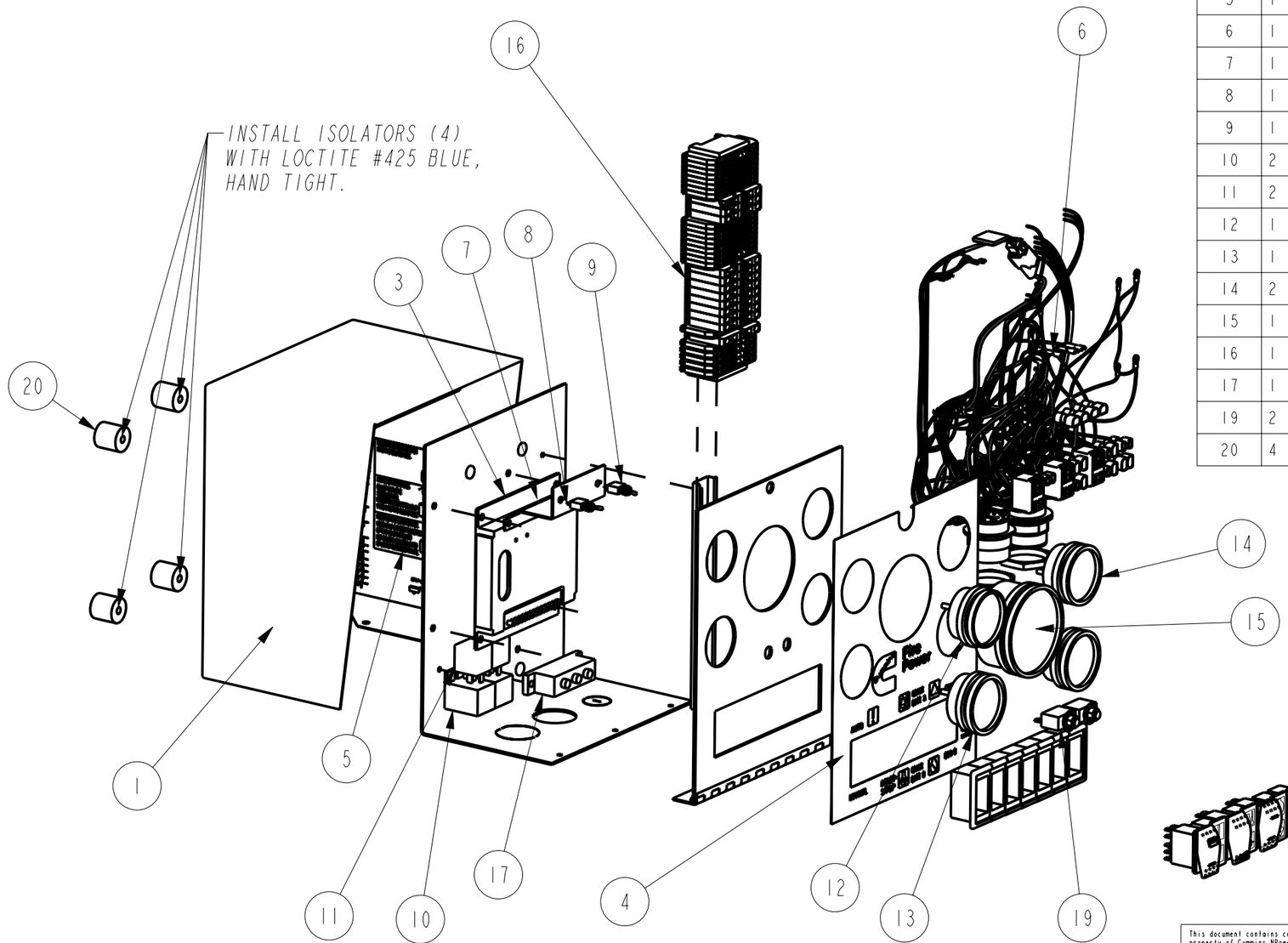
NPOWER SYSTEMS
DESIGN CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

TITLE 1: ASSEMBLY, INSTRUMENT PANEL
TITLE 2: FIREPUMP

DWG UNITS: IN/LB/S	DRAWN BY: S.DANFORTH			DATE: 10JUL2006
	APPD BY:			DATE:
EST WEIGHT: 20.096	SCALE: 0.200	DO NOT SCALE	SHEET 1OF1	DRAWING NO: 10453 / REV: E



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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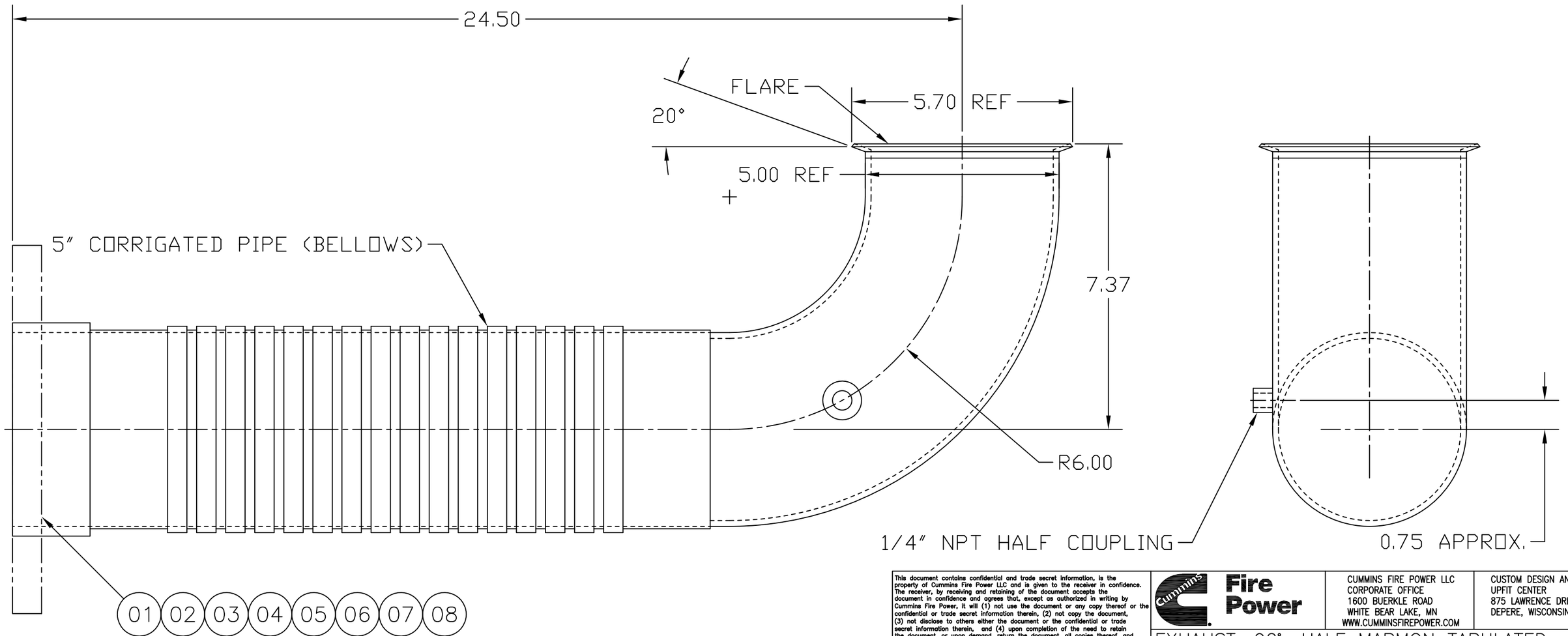
NPOWER SYSTEMS
DESIGN CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

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: _

ITEM	QTY	DESCRIPTION	MATERIAL
01	A/R	5" MALE NPT	
02	A/R	5" I.D. CUFF	
03	A/R	5" 125# ANSI FLANGE	
04	A/R	6" MALE NPT	
05	A/R	6" I.D. CUFF	
06	A/R	6" 125# ANSI FLANGE	
07	A/R	8" (13–1/2" OD) 125# ANSI FLANGE	
08	A/R	10" (16" 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

Fire Power

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

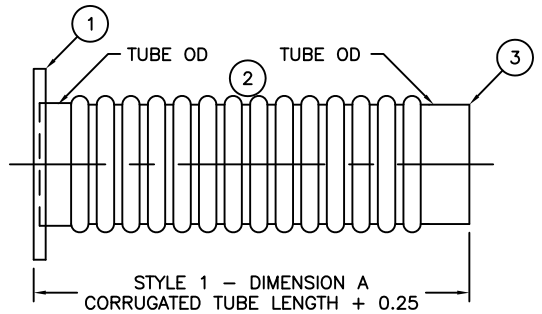
CUSTOM DESIGN AND
UPFIT CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

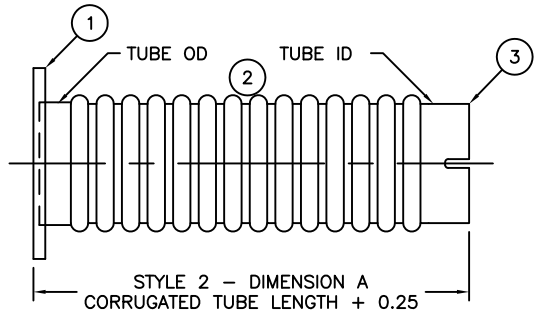
EXHAUST, 90°, HALF MARMON TABULATED 6" TURBO OUTLET

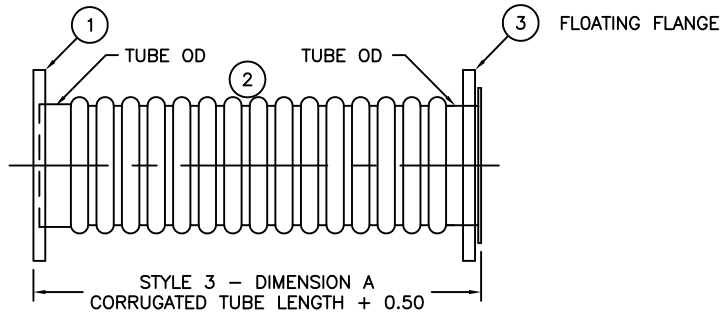
DWG UNITS: INCH/LB/S	DRAWN BY: DAVE N	DATE: 23JUN2004
	AUTO CAD	REF DRWG:
SCALE: 3/8	SHEET 10F1	DRAWING NO: 9514
EST WEIGHT:		

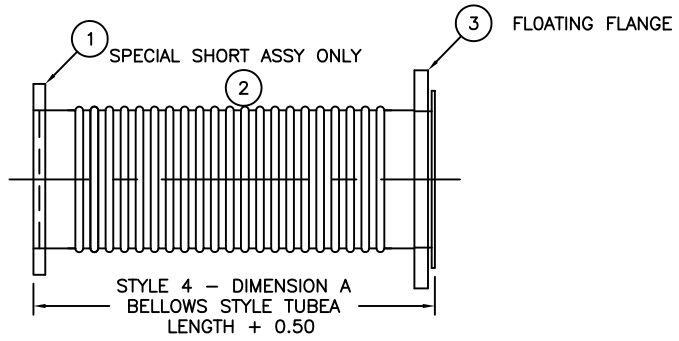
REV	ENF	DESCRIPTION OF REVISION	BY	DATE
D	2009-050	ADDED -07 & -08	DAN	11-NOV-09

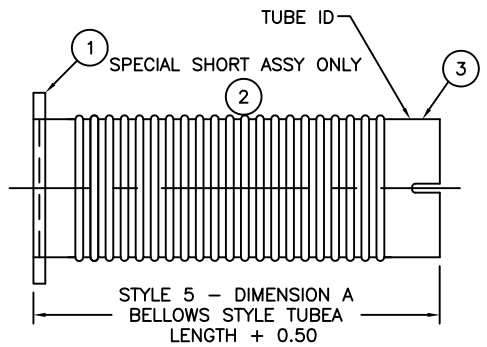
ITEM	QTY	DESCRIPTION	MATERIAL 1	MATERIAL 2	MATERIAL 3	DIMENSION A	
01	A/R	FLEX TUBE ASSEMBLY 4.0 NOM – STYLE 2	6457–01 (4" ASA)	4"NOM CORRUGATE	4.0 ID TUBE	24.00	
02	A/R	FLEX TUBE ASSEMBLY 6.0 NOM – STYLE 2	6449–03 (8" ASA)	6"NOM CORRUGATE	6.0 ID TUBE	24.00	A
03	A/R	FLEX TUBE ASSEMBLY 6.0 NOM – STYLE 3	6347–03 (6" ASA)	6"NOM BELLOWS	6256–06 (5" ASA)	12.00	B
04	A/R	FLEX TUBE ASSEMBLY 6.0 NOM – STYLE 3	6347–03 (6" ASA)	6"NOM CORRUGATE	6256–06 (5" ASA)	13.88	B
05	A/R	FLEX TUBE ASSEMBLY 6.0 NOM – STYLE 2	7236–01 (12"ASA)	6"NOM CORRUGATE	6.0 ID TUBE	46.50	B
06	AR	FLEX TUBE ASSEMBLY 5.0 NOM – STYLE 1	6724–01 NOTE 6	5"NOM CORRUGATE	5.0 OD TUBE	18.00	C
07	A/R	FLEX TUBE ASSEMBLY 3.0 NOM – STYLE 2 – 316SS	6457–04 (4" ASA)	3"NOM CORRUGATE	3.0 ID TUBE	16.00	D
08	A/R	FLEX TUBE ASSEMBLY 6.0 NOM – STYLE 3	7461–01 (10"ASA)	6"NOM CORRUGATE	6724–02 NOTE 6	38.44	E
09	A/R	FLEX TUBE ASSEMBLY 5.0 NOM – STYLE 2	6449–02 (8" ASA)	5"NOM CORRUGATE	5.0 ID TUBE	19.50	F AF
10	A/R	FLEX TUBE ASSEMBLY 4.0 NOM – STYLE 2	6347–01 (6" ASA)	4"NOM CORRUGATE	4.0 ID TUBE	18.00	F
11	A/R	FLEX TUBE ASSEMBLY 4.0 NOM – STYLE 2	6457–01 (4" ASA)	4"NOM CORRUGATE	4.0 ID TUBE	18.00	F
12	A/R	FLEX TUBE ASSEMBLY 4.0 NOM – STYLE 2	6256–01 (5" ASA)	4"NOM CORRUGATE	4.0 ID TUBE	18.00	G
13	A/R	FLEX TUBE ASSEMBLY 4.0 NOM – STYLE 2	6449–01 (8" ASA)	4"NOM CORRUGATE	4.0 ID TUBE	18.00	G
14	A/R	FLEX TUBE ASSEMBLY 5.0 NOM – STYLE 2	7236–02 (12"ASA)	5"NOM CORRUGATE	5.0 ID TUBE	33.50	H
15	A/R	FLEX TUBE ASSEMBLY 6.0 NOM – STYLE 3	6724–02 NOTE 6	6"NOM CORRUGATE	6347–03 (6" ASA)	35.00	J
16	A/R	FLEX TUBE ASSEMBLY 6.0 NOM – STYLE 3	6449–03 (8" ASA)	6"NOM CORRUGATE	6724–02 NOTE 6	18.00	K
17	A/R	FLEX TUBE ASSEMBLY 6.0 NOM – STYLE 1	6724–02 NOTE 6	6"NOM CORRUGATE	6.0 OD TUBE	24.00	L
18	A/R	FLEX TUBE ASSEMBLY 6.0 NOM – STYLE 3	6724–02 NOTE 6	6"NOM CORRUGATE	6347–03 (6" ASA)	36.00	L2
~~19~~	~~A/R~~	~~FLEX TUBE ASSEMBLY 2.5 NOM – STYLE 5~~	~~2.5 SCH40 PIPE~~	~~2.5 NOM FLEX~~	~~N/A~~	~~15.0~~	M P
20	A/R	FLEX TUBE ASSEMBLY 6.0 NOM – STYLE 3	6724–02 NOTE 6	6"NOM CORRUGATE	6347–03 (6" ASA)	30.00	N
21	A/R	FLEX TUBE ASSEMBLY 6.0 NOM – STYLE 1	6347–03 (6" ASA)	6"NOM CORRUGATE	6.0 OD TUBE	26.00	N
22	A/R	FLEX TUBE ASSEMBLY 5.0 NOM – STYLE 2	7461–02 (10"ASA)	5"NOM CORRUGATE	5.0 ID TUBE	33.50	1
23	A/R	FLEX TUBE ASSEMBLY 8.0 NOM – STYLE 4	6449–05 (8" ASA)	8"NOM BELLOW	6449–05 (8" ASA)	12.00	2
24	A/R	FLEX TUBE ASSEMBLY 4.0 NOM – STYLE 2	6347–01 (6" ASA)	4"NOM CORRUGATE	4.0 ID TUBE	17.00	3 AF
25	A/R	FLEX TUBE ASSEMBLY 5.0 NOM – STYLE 2	6256–02 (5" ASA)	5"NOM CORRUGATE	5.0 ID TUBE	44.00	4
26	A/R	FLEX TUBE ASSEMBLY 5.0 NOM – STYLE 2	6449–02 (8" ASA)	5"NOM CORRUGATE	5.0 ID TUBE	18.00	5
27	A/R	FLEX TUBE ASSEMBLY 5.0 NOM – STYLE 2	7236–02 (12"ASA)	5"NOM CORRUGATE	5.0 ID TUBE	18.00	6
28	A/R	FLEX TUBE ASSEMBLY 6.0 NOM – STYLE 2	7461–01 (10"ASA)	6"NOM CORRUGATE	N/A	18.00	Q
29	A/R	FLEX TUBE ASSEMBLY 5.0 NOM – STYLE 2	6449–02 (8" ASA)	5"NOM CORRUGATE	5.0 ID TUBE	33.50	R
30	A/R	FLEX TUBE ASSEMBLY 3.0 NOM – STYLE 2	6457–04 (4" ASA)	3"NOM CORRUGATE	3.0 ID TUBE	12.00	S
31	A/R	FLEX TUBE ASSEMBLY 4.0 NOM – STYLE 2	6457–01 (4" ASA)	4"NOM CORRUGATE	4.0 ID TUBE	14.00	T
32	A/R	FLEX TUBE ASSEMBLY 4.0 NOM – STYLE 2	6457–01 (4" ASA)	4"NOM CORRUGATE	4.0 ID TUBE	12.00	U
33	A/R	FLEX TUBE ASSEMBLY 6.0 NOM – STYLE 2	6449–03 (8" ASA)	6"NOM CORRUGATE	6.0 ID TUBE	18.00	V
34	A/R	FLEX TUBE ASSEMBLY 5.0 NOM – STYLE 2	7461–02 (10"ASA)	5"NOM CORRUGATE	5.0 ID TUBE	22.00	W
35	A/R	FLEX TUBE ASSEMBLY 6.0 NOM – STYLE 2	6347–03 (6" ASA)	6"NOM CORRUGATE	6.0 ID TUBE	18.00	X
36	A/R	FLEX TUBE ASSEMBLY 4.0 NOM – STYLE 2	6449–01 (8" ASA)	4"NOM CORRUGATE	4.0 ID TUBE	25.75	Y
37	A/R	FLEX TUBE ASSEMBLY 4.0 NOM – STYLE 2	6347–01 (6" ASA)	4"NOM CORRUGATE	4.0 ID TUBE	29.00	Z AF
38	A/R	FLEX TUBE ASSEMBLY 5.0 NOM – STYLE 2	6449–02 (8" ASA)	5"NOM CORRUGATE	5.0 ID TUBE	16.50	AA AB AF
39	A/R	FLEX TUBE ASSEMBLY 5.0 NOM – STYLE 2	6449–02 (8" ASA)	5"NOM CORRUGATE	5.0 ID TUBE	14.50	AB
40	A/R	FLEX TUBE ASSEMBLY 4.0 NOM – STYLE 2	6347–01 (6" ASA)	4"NOM CORRUGATE	4.0 ID TUBE	30.00	AC
41	A/R	FLEX TUBE ASSEMBLY 4.0 NOM – STYLE 5	6347–01 (6" ASA)	4"NOM BELLOWS	4.0 ID TUBE	8.00	AD
42	A/R	FLEX TUBE ASSEMBLY 6.0 NOM – STYLE 2	7461–01 (10"ASA)	6"NOM CORRUGATE	6.0 ID TUBE	18.00	AE
43	A/R	FLEX TUBE ASSEMBLY 6.0 NOM – STYLE 3	7461–04 (10"ASA)	10"NOM BELLOWS	7236–03 (12"ASA)	18.00	AE
44	A/R	FLEX TUBE ASSEMBLY 6.0 NOM – STYLE 3	7461–01 (10"ASA)	6"NOM CORRUGATE	6.0 ID TUBE	46.50	AE
45	A/R	FLEX TUBE ASSEMBLY 3.0 NOM – STYLE 2	6256–01 (5" ASA)	3"NOM CORRUGATE	2.9 ID TUBE	18.00	AE
46	A/R	FLEX TUBE ASSEMBLY 6.0 NOM – STYLE 4	7461–01 (10"ASA)	6"NOM BELLOWS	3026235 (6"CUM)	9.90	AE
47	A/R	FLEX TUBE ASSEMBLY 6.0 NOM – STYLE 3	7236–01 (12"ASA)	6"NOM CORRUGATE	3026235 (6"CUM)	18.00	AE
48	A/R	FLEX TUBE ASSEMBLY 5.0 NOM – STYLE 2	6449–02 (8" ASA)	5"NOM CORRUGATE	5.0 ID TUBE	18.00	AE
49	A/R	FLEX TUBE ASSEMBLY 5.0 NOM – STYLE 2	6449–02 (8" ASA)	5"NOM CORRUGATE	5.0 ID TUBE	15.00	AE
50	A/R	FLEX TUBE ASSEMBLY 6.0 NOM – STYLE 3	7236–01 (12"ASA)	6"NOM CORRUGATE	6347–03 (6"ASA)	18.00	AE
51	A/R	FLEX TUBE ASSEMBLY 8.0 NOM – STYLE 3	7461–03 (10"ASA)	8"NOM CORRUGATE	7461–03 (10"ASA)	18.00	AE
52	A/R	FLEX TUBE ASSEMBLY 6.0 NOM – STYLE 1	3026235 (6"CUM)	6"NOM CORRUGATE	4.0 ID TUBE	18.00	AE
53	A/R	FLEX TUBE ASSEMBLY 6.0 NOM – STYLE 3	6449–03 (8" ASA)	6"NOM CORRUGATE	3026235 (6"CUM)	18.00	AE
54	A/R	FLEX TUBE ASSEMBLY 4.0 NOM – STYLE 2	6347–01 (6" ASA)	4"NOM CORRUGATE	4.0 ID TUBE	25.75	AG
55	A/R	FLEX TUBE ASSEMBLY 6.0 NOM – STYLE 2	7461–01 (10"ASA)	6"NOM CORRUGATE	6.0 ID TUBE	46.50	AH
56	A/R	FLEX TUBE ASSEMBLY 4.0 NOM – STYLE 2	6347–01 (6" ASA)	4"NOM CORRUGATE	4.0 ID TUBE	9.00	AI
57	A/R	FLEX TUBE ASSEMBLY 6.0 NOM – STYLE	6449–03 (8" ASA)	6"NOM CORRUGATE	6.0 ID TUBE	13.25	AJ
58	A/R	FLEX TUBE ASSEMBLY 4.0 NOM – STYLE 2	6449–01 (8" ASA)	4"NOM CORRUGATE	4.0 ID TUBE	28.00	AK
59	A/R	FLEX TUBE ASSEMBLY 6.0 NOM – STYLE 3	6347–01 (6" ASA)	6"NOM CORRUGATE	3026235 (6"CUM)	18.00	AI
60	A/R	FLEX TUBE ASSEMBLY 4.0 NOM – STYLE 2	6347–01 (6" ASA)	4"NOM CORRUGATE	4.0 ID TUBE	13.50	AM
61	A/R	FLEX TUBE ASSEMBLY 4.0 NOM – STYLE 2	6256–01 (5" ASA)	4"NOM CORRUGATE	4.0 ID TUBE	13.50	AN
62	A/R	FLEX TUBE ASSEMBLY 3.0 NOM – STYLE 2	6155–01 (3" ASA)	3"NOM CORRUGATE	3.0 ID TUBE	12.00	AO
63	A/R	FLEX TUBE ASSEMBLY 6.0 NOM – STYLE 2	7236–01 (12"ASA)	6"NOM CORRUGATE	6.0 ID TUBE	48.38	AP
64	A/R	FLEX TUBE ASSEMBLY 5.0 NOM – STYLE 2	7461–02 (10"ASA)	5"NOM CORRUGATE	5.0 ID TUBE	18.00	AQ
65	A/R	FLEX TUBE ASSEMBLY 5.0 NOM – STYLE 2	6449–02 (8" ASA)	5"NOM CORRUGATE	5.0 ID TUBE	13.50	AR
66	A/R	FLEX TUBE ASSEMBLY 5.0 NOM – STYLE 2	6449–02 (8" ASA)	5"NOM CORRUGATE	5.0 ID TUBE	12.00	AS
67	A/R	FLEX TUBE ASSEMBLY 6.0 NOM – STYLE 2	7236–01 (12"ASA)	6"NOM CORRUGATE	6.0 ID TUBE	18.00	AT
68	A/R	FLEX TUBE ASSEMBLY 4.0 NOM – STYLE 2	6256–01 (5" ASA)	4"NOM CORRUGATE	4.0 ID TUBE	33.25	AU
69	A/R	FLEX TUBE ASSEMBLY 6.0 NOM – STYLE 4	7461–01 (10"ASA)	6"NOM BELLOWS	3026235 (6"CUM)	18.00	AV
70	A/R	FLEX TUBE ASSEMBLY 4.0 NOM – STYLE 2	6256–01 (5" ASA)	4"NOM CORRUGATE	4.0 ID TUBE	23.75	AW

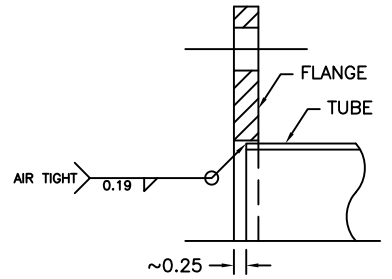












TYPICAL WELD PROCEDURE

FILET WELD INSIDE INSTEAD OF OUTSIDE TO REDUCE CHANCE OF BLOW THROUGH

NOTES:
1) REMOVE BURRS AND SHARP EDGES
2) FLANGE FACES MUST BE FLAT AND FREE OF SPLATTER AFTER WELDING
3) MULTIPLE FLANGE ASSEMBLIES ORIENT HOLE ON HOLE UNLESS NOTED
4) ALL FLEX TUBES ARE 409 STAINLESS STEEL UNLESS NOTED ON ORDER
5) REF 7666 FOR SLIP AND 7830 FOR PIPE THREAD FLEX TUBES
6) FLANGE BOLT PATTERNS AS FOLLOWS:
   6256 PIPE FLANGE 5 BOLT PATTERN
   6347 PIPE FLANGE 6 BOLT PATTERN
   6449 PIPE FLANGE 8 BOLT PATTERN
   6457 PIPE FLANGE 4 BOLT PATTERN
   6724 PIPE FLANGE SPECIAL Q19/Q30 BOLT PATTERN
   7236 PIPE FLANGE 12 BOLT PATTERN
   7461 PIPE FLANGE 10 BOLT PATTERN

REV	ENF	DESCRIPTION OF REVISION	BY	DATE
–	–	–	–	–
–	–	–	–	–
–	–	–	–	–
–	–	–	–	–
–	–	–	–	–
–	–	–	–	–
AW	2009–600	ADDED ITEM 70, 23.75 LNG, 5 ASA, 4 CORR,4 TUBE	HGP	29JAN2010
AV	2010–005	ADDED ITEM 69, 18 IN LONG,NEW BORDER	HGP	08JAN2010

REV	ENF	DESCRIPTION OF REVISION	BY	DATE
AU	2009–374	ADDED ITEM 68, 5" FLG TO 4 COR–4 INCH TUBE 33.25 L	HGP	19OCT2009
AT	2009–480	ADDED ITEM 67, 12" FLG TO 6 COR–6 INCH TUBE 18 L	HGP	14SEP2009
AS	2009–467	ADDED ITEM 66, 8" FLG TO 5 COR–5 INCH TUBE 12L	HGP	08SEP2009
AR	2009–454	ADDED ITEM 65, 5" FLG TO 8" FLG X 13.50" LONG	GVD	26AUG2009
AQ	2009–305	ADDED ITEM 64, 5" FLG TO 10" FLG X 18" LONG	HGP	30JUN2009
AP	2009–036	ADDED ITEM 63, 12" FLG TO 6" FLEX	HGP	26MAR2009
AO	–	ADDED ITEM 62, 3" NOM FLEX TUBE	HGP	22JAN2009
AN	–	ADDED ITEM 61	PBS	30DEC2008

ANGULAR DIMENSIONS ± 1° | IMPERIAL UNITS | METRIC UNITS

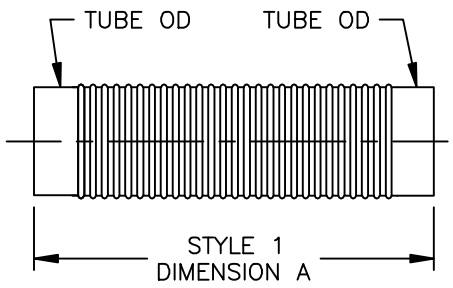
UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

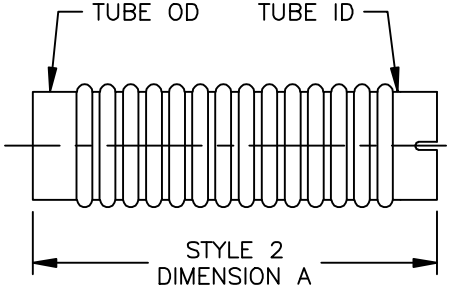
THIRD ANGLE PROJECTION

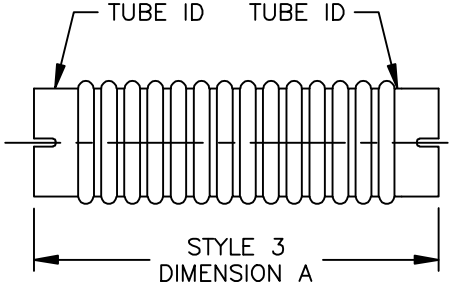
CUMMINS NPOWER LLC CORPORATE OFFICE 1600 BUERKLE ROAD WHITE BEAR LAKE, MN WWW.CUMMINSPOWER.COM	CUSTOM DESIGN AND UPFIT CENTER 875 LAWRENCE DRIVE DEPERE, WISCONSIN

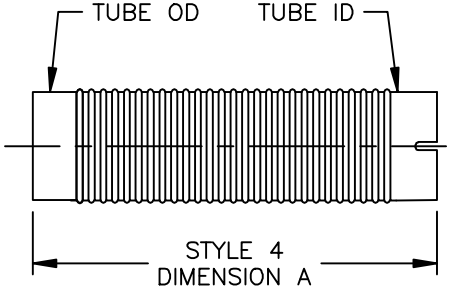
FLEX TUBE,FLANGE EXHAUST,TABULATED

DWG UNITS: INCH/LB/S	DRAWN BY: KLEE	DATE: 20DEC1996
AUTO CAD		REF DRWG: –
SCALE: 1/2	SHEET 10F1	DRAWING NO: 6735
EST WEIGHT: –		









	PART NO.		DESCRIPTION	END 1	END 2	DIM A	ENGINE/ASS'LY
	7833	−01	FLEX CONNECTOR, 5.0"NOM BELLOWS TUBE −STYLE 4	5.00 OD	5.00 ID	13.50	QSM11/7773
	7833	−02	FLEX CONNECTOR, 4.0"NOM CORRUGATED TUBE −STYLE 2	4.00 OD	4.00 ID	18.00	QSC300/7870
	7833	−03	FLEX CONNECTOR, 4.0"NOM CORRUGATED TUBE −STYLE 2	4.00 ID	4.00 ID	18.00	6C8.3/7926
	7833	−04	FLEX CONNECTOR, 3.0"NOM BELLOWS TUBE −STYLE 1	3.00 OD	3.00 OD	9.75	BLOUNT 7960
	7833	−05	FLEX CONNECTOR, 4.0"NOM CORRUGATED TUBE −STYLE 3	4.00 ID	4.00 ID	17.00	L10−8014
	7833	−06	FLEX CONNECTOR, 3.5"NOM CORRUGATED TUBE −STYLE 2	3.50 OD	3.50 ID	18.00	6BTA−7640−05
	7833	−07	FLEX CONNECTOR, 3.5"NOM BELLOWS TUBE −STYLE 4	3.50 OD	3.50 ID	9.00	6BTA−7640−06
A	7833	−08	FLEX CONNECTOR, 6.0"NOM CORRUGATED TUBE −STYLE 3	6.00 ID	6.00 ID	18.00	−
B	7833	−09	FLEX CONNECTOR, 6.0"NOM CORRUGATED TUBE −STYLE 2	6.00 ID	6.00 ID	18.00	QSX15/11235
C	7833	−10	FLEX CONNECTOR, 5.0"NOM CORRUGATED TUBE −STYLE 3	5.00 ID	5.00 ID	18.00	GTA38 GS3/11420
D	7833	−11	FLEX CONNECTOR, 6.0"NOM BELLOWS TUBE −STYLE 4	6.00 OD	6.00 ID	12.00	−
E	7833	−12	FLEX CONNECTOR, 4.0"NOM CORRUGATED TUBE −STYLE 3	4.00 ID	4.00 ID	18.00	−
F	7833	−13	FLEX CONNECTOR, 4.0"NOM CORRUGATED TUBE −STYLE 3	4.00 ID	4.00 ID	20.00	−
G	7833	−14	FLEX CONNECTOR, 3.0"NOM CORRUGATED TUBE −STYLE 3	3.00 ID	3.00 ID	13.00	−
G	7833	−15	FLEX CONNECTOR, 3.0"NOM CORRUGATED TUBE −STYLE 3	3.00 ID	3.00 ID	16.00	−
G	7833	−16	FLEX CONNECTOR, 3.0"NOM CORRUGATED TUBE −STYLE 3	3.00 ID	3.00 ID	20.00	−
	7833	−17	FLEX CONNECTOR, __"NOM CORRUGATED TUBE −STYLE	−.00 ID	−.00 ID	−−.00	−
	7833	−18	FLEX CONNECTOR, __"NOM CORRUGATED TUBE −STYLE	−.00 ID	−.00 ID	−−.00	−
	7833	−19	FLEX CONNECTOR, __"NOM CORRUGATED TUBE −STYLE	−.00 ID	−.00 ID	−−.00	−
	7833	−20	FLEX CONNECTOR, __"NOM CORRUGATED TUBE −STYLE	−.00 ID	−.00 ID	−−.00	−

NOTES:
1) REMOVE ALL BURRS AND SHARP EDGES
2) ALL FLEX TUBE TO BE 409 SS UNLESS NOTED ON PURCHASE ORDER
3) REF 6735 FLANGED AND 7830 THREADED CONNECTORS

REV	DESCRIPTION OF REVISION	BY	DATE
G	ADDED ITEMS 14 THRU 16	DWW	14APR2008
F	ADD ITEM 13	PBS	06MAR2008
E	ADD ITEM 12	PBS	24OCT2007
D	ADD ITEM 11	PBS	18APR2007
C	ADD ITEM 10	PBS	26FEB2007
B	ADD ITEM 09	CMC	20FEB2007
A	ADD ITEM 08	CMC	9OCT2006
5	ADD ITEM 07	MAS	03/28/2003
4	ADD ITEM 06	MAS	02/28/2003
3	ADD ITEM 05	MAS	01/16/2003
2	ADD ITEM 04	MAS	09/26/2002
1	ADD ITEM 03	MAS	08/28/2002

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

REF. SCALES

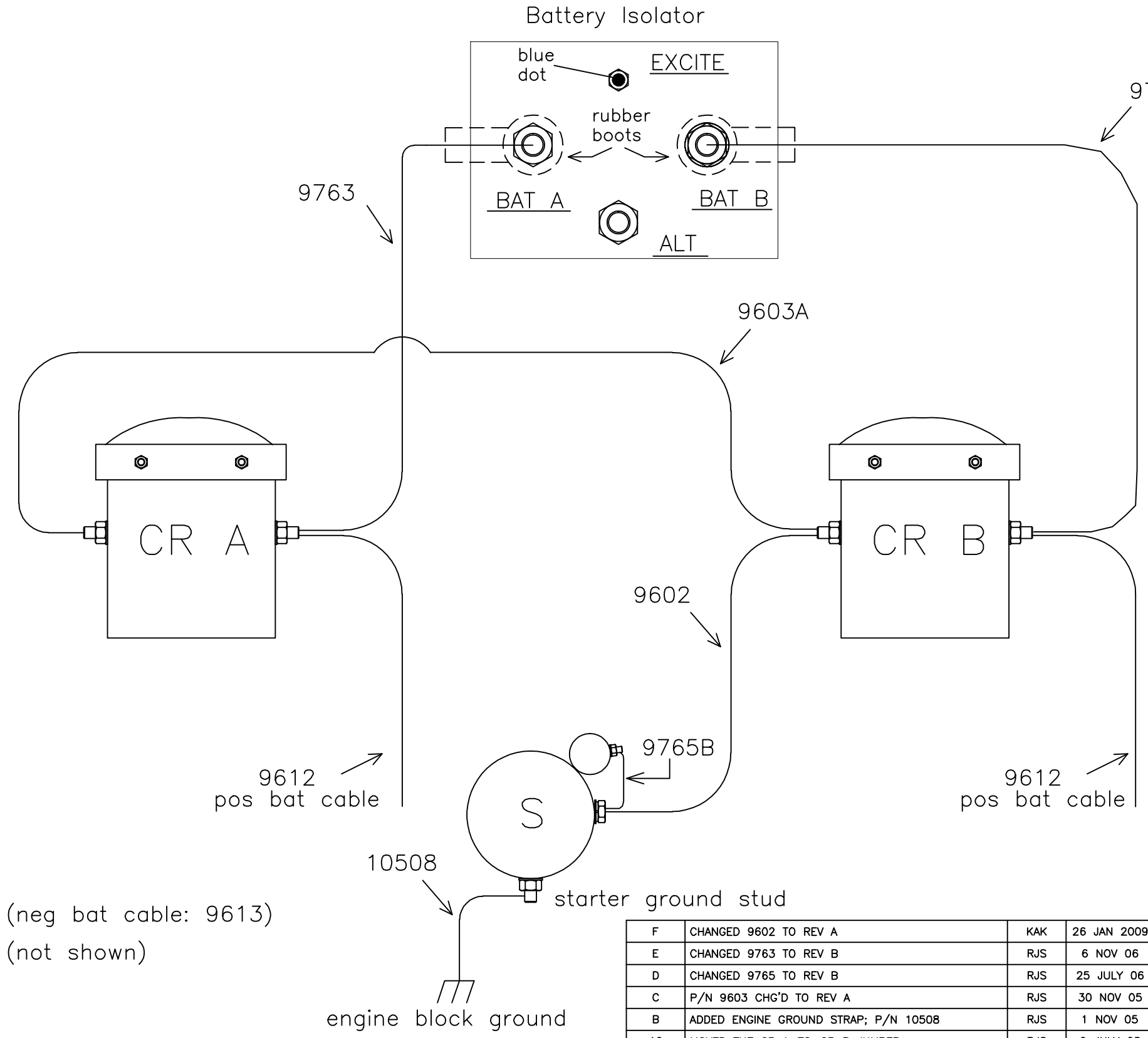
NPower

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

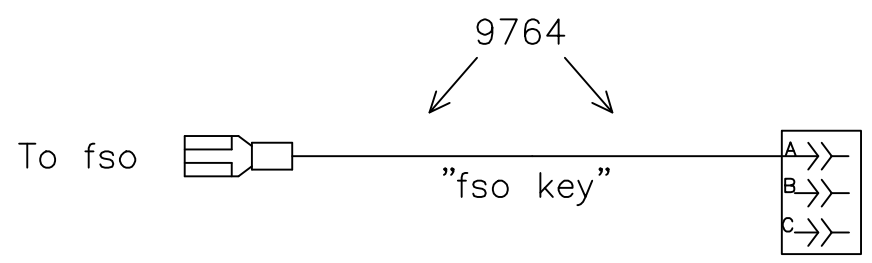
FLEX CONNECTOR, SLIP EXHAUST (TABULATED)

DWG UNITS:	DRAWN BY: MAS			DATE: 04/24/2002	
	APPD BY:			DATE:	
EST WEIGHT:	SCALE: NTS	DO NOT SCALE	SHEET 10F1	DRAWING NO: 7833	REV: G



(neg bat cable: 9613)
(not shown)

P/N	DESCRIPTION	QTY
△F 9602A	Cable, Contactor to Starter	1
9603A	Cable, Battery Contactor Jumper	1
9763B	Cable, Isolator to Battery	2
9764	Wire, FSO Connector	1
9765B	Wire, Starter Solenoid Jumper	1
10508	Engine Ground Strap	1
9614	Battery Cable Kit (optional)	1



REV	DESCRIPTION OF REVISION	BY	DATE
F	CHANGED 9602 TO REV A	KAK	26 JAN 2009
E	CHANGED 9763 TO REV B	RJS	6 NOV 06
D	CHANGED 9765 TO REV B	RJS	25 JULY 06
C	P/N 9603 CHG'D TO REV A	RJS	30 NOV 05
B	ADDED ENGINE GROUND STRAP; P/N 10508	RJS	1 NOV 05
A2	MOVED THE CR A–TO–CR B JUMPER	RJS	2 JULY 05
A1	ADDED REV LEVLES TO 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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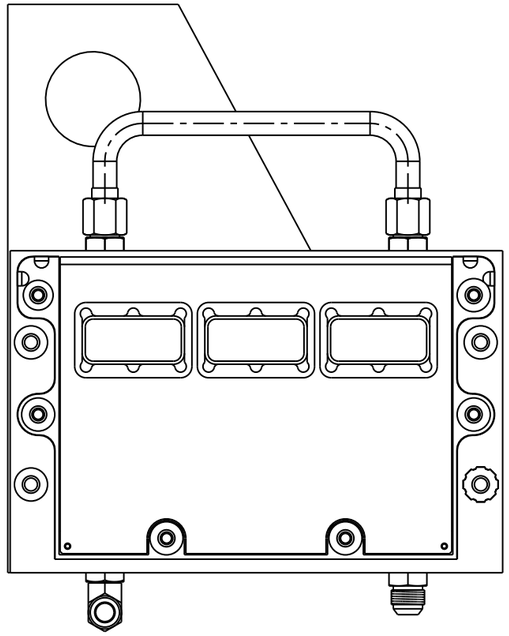
DEPERE, WISCONSIN

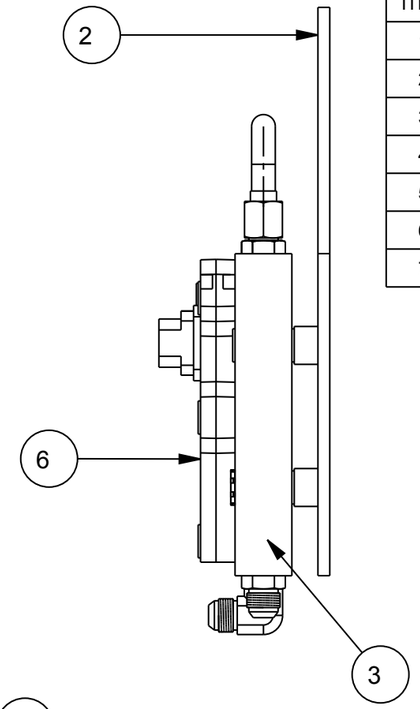
DWG SCALE:	DRAWN BY: RJS	DATE: 6 DEC 2004
PLOT SCALE:	APPD BY:	DATE:

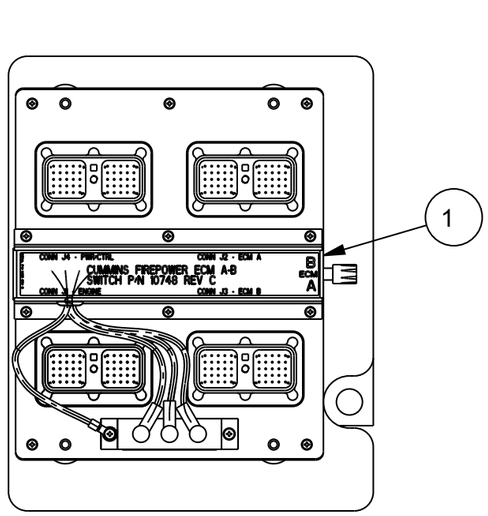
DESCRIPTION
KIT, LOOSE WIRES

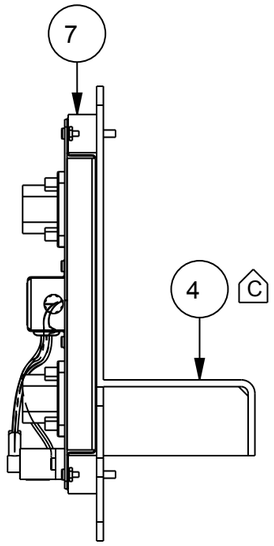
REFERENCE:
QSM11, QSX15, QSK23

DRAWING NUMBER:
9768_F









BILL OF MATERIAL			
ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	ASSEMBLY, ECM SWITCH	10748
2	1	PLATE, LIFTING AND ECM MTG, CFP15E FIREPUMP	10895
3	1	ASMY, ECM COOLER AND MOUNT, CFP15E FIREPUMP	10900
4	1	BRACKET, MTG, ECM SWITCH BOX, CFP11E, CFP15E	11058
5	1	HARNESS, ECM; QSX FIREPUMP	11829
6	1	ECM, CM570, CECO 3681405	3681405
7	4	ISOLATOR, #10 TAP & STUD, #AG-3904930	51156PS

HARDWARE REFENCE	
PART NUMBER	DESCRIPTION
68810	BOLT, HD CAP, M12-1.75 x 35
67519	BOLT, HD CAP, M10-1.50 x 60
67574	BOLT, HD CAP, M8-1.25 x 45

NOTE:
1. 11829 NOT SHOWN IN DRAWING VIEWS

		ADDED HARDWARE REFERENCE BLOCK NO ENF REQUIRED	MAC	01-15-2009
C	2008-501	ADDED ECM BRACKET, OBSOLETE 11502	S DUBICK	12/10/08
REV	ENF	DESCRIPTION OF REVISION	REV BY	DATE

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ±± °

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

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

CUSTOM DESIGN
AND UPFIT CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

ASSEMBLY, REDUNDANT ECM
CFP15E FIREPUMP

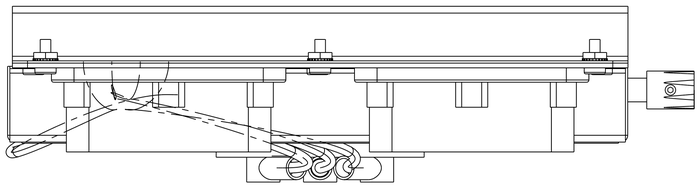
DWG UNITS: IN/LB/S | DRAWN BY: S.DANFORTH | DATE: -

PRO-ENGINEER | REF DRWG:

SCALE: 0.250 | SHEET 1 OF 1 | DRAWING NO: 10846

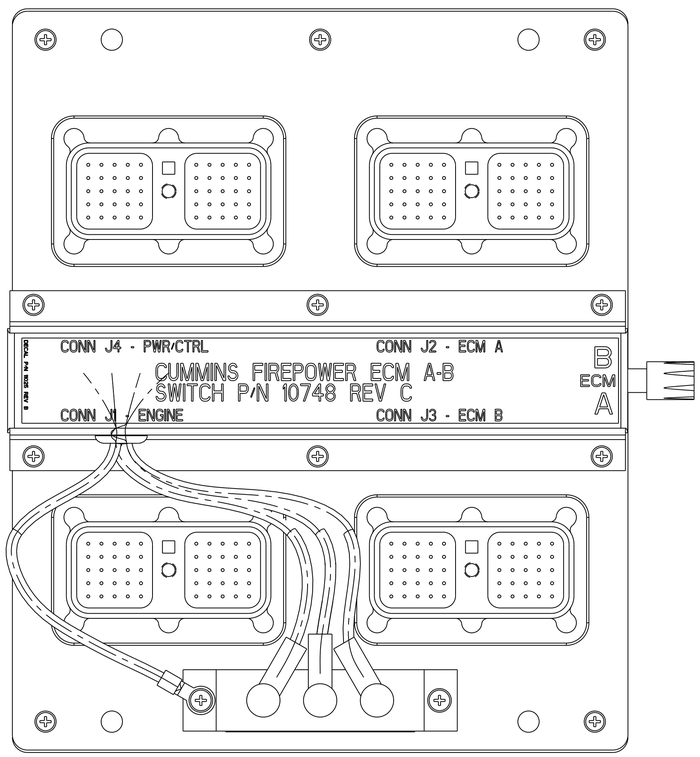
EST WEIGHT: 67.605

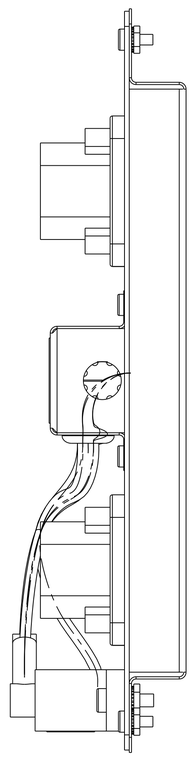
DESIGN INTELECTUAL PROPERTY BY CUMMINS NPOWER, LLC
ALL PRODUCTION RUNS WILL REQUEST LATEST DOCUMENTATION
SEE SHEET 2 FOR WAVE-SOLDER ASSEMBLY
SEE SHEET 3 FOR HAND-SOLDER OF LEADS
SEE SHEET 4 FOR COVER ASSEMBLY

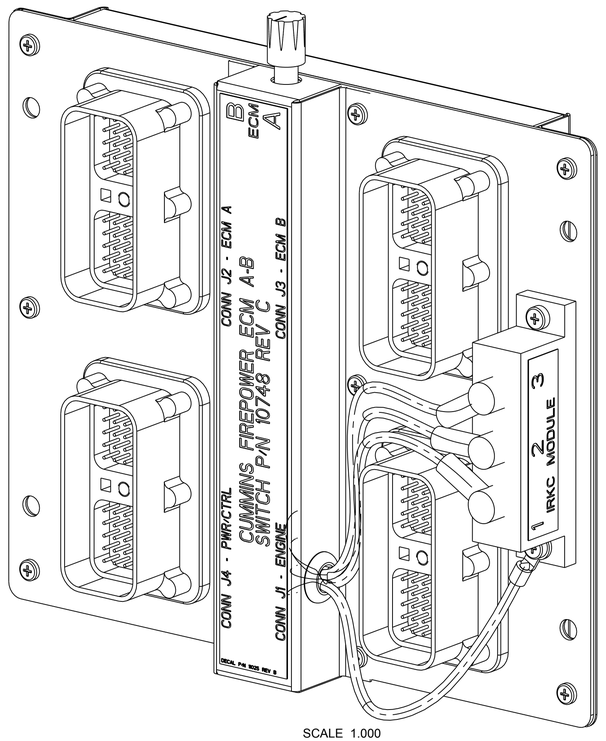


BILL OF MATERIAL

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 ±° | IMPERIAL UNITS | METRIC UNITS

THIRD ANGLE PROJECTION

MACHINE TOLERANCES
.XX ± .03
.XXX ± .010
.XXXX ± .0005

SHEET TOLERANCES
.XX ± .06
.XXX ± .030
.XXXX ± .0010

REF SCALES	
Cummins 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

TITLE 1: ASSEMBLY, ECM SWITCH
TITLE 2:

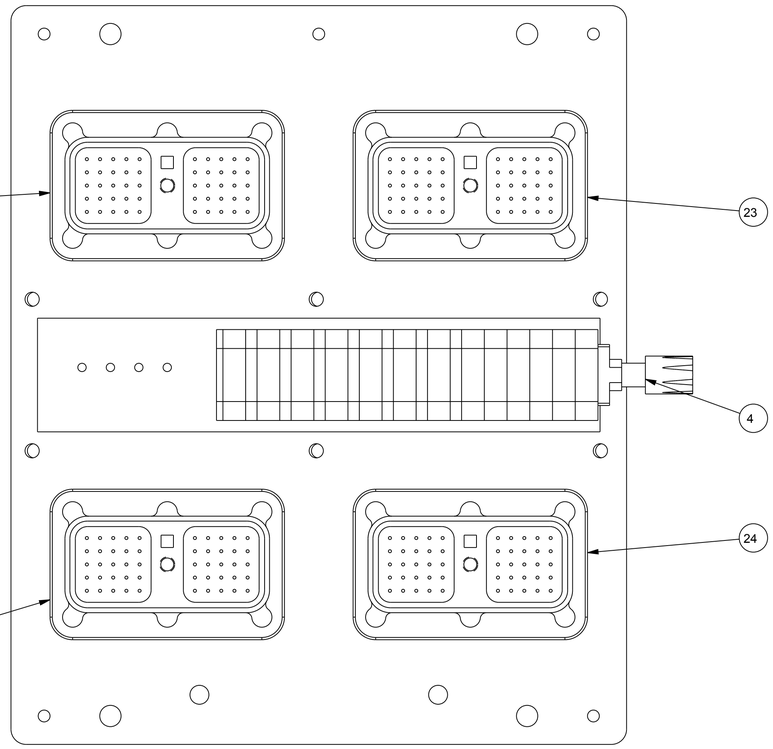
DWG UNITS: IN/LB/S	DRAWN BY: SCOTT D			DATE: 21FEB2006	
	APPD BY: -			DATE: -	
EST WEIGHT: 6.709	SCALE: 1.000	DO NOT SCALE	SHEET 1OF4	DRAWING NO: 10748	REV: D

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.

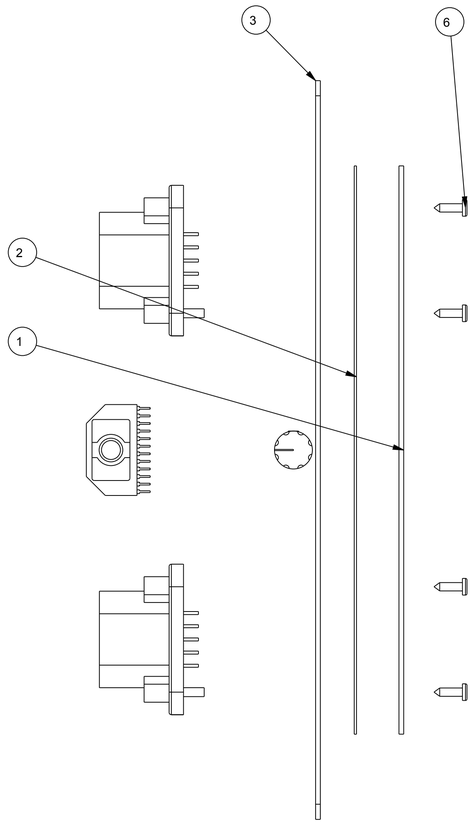
BILL OF MATERIAL

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

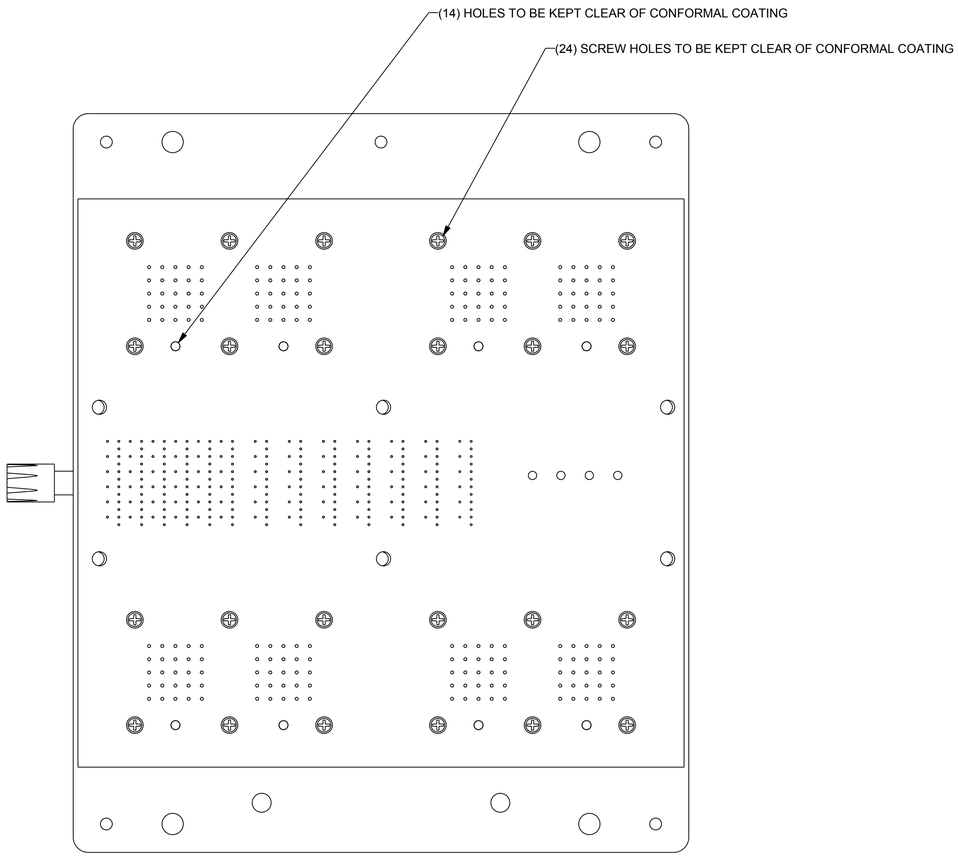
D CONFORMAL COAT PCB
USING DOW 3-176S COATING MATERIAL.



SCALE 1.000



THIS VIEW EXPLODED FOR CLARITY OF
ASSEMBLY PROCESS AND COMPONENT LOCATION



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

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS in ° | IMPERIAL UNITS | METRIC UNITS

THIRD ANGLE PROJECTION

NONE TOLERANCES .XX +/- .02
.X +/- .1
.XXX +/- .005
FRACTIONS +/- 1/64

NONE TOLERANCES XX.X +/- 0.5
X.XX +/- 0.25
XXX.X +/- 0.13
FRACTIONS +/- 1/64

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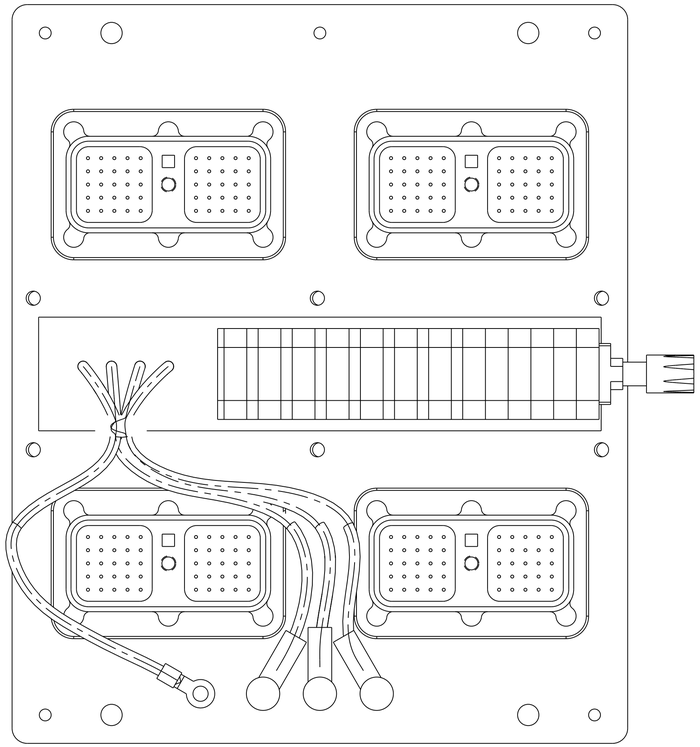
CORPORATE OFFICE
1600 BUERKLE ROAD
WHITE BEAR LAKE, MN
WWW.NPOWER.CUMMINS.COM

NPOWER SYSTEMS
DESIGN CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

TITLE 1: ASSEMBLY, ECM SWITCH
TITLE 2:

DWG UNITS:	DRAWN BY: SCOTT D		DATE: 21FEB2006	
IN/LB/S	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 ± .010 FRACTIONAL TOLERANCES .XX ± .03 .XXX ± .005 .XXXX ± .0005

METRIC UNITS: DECIMAL TOLERANCES .X ± .5 .XX ± .25 FRACTIONAL TOLERANCES .X ± .5 .XX ± .13

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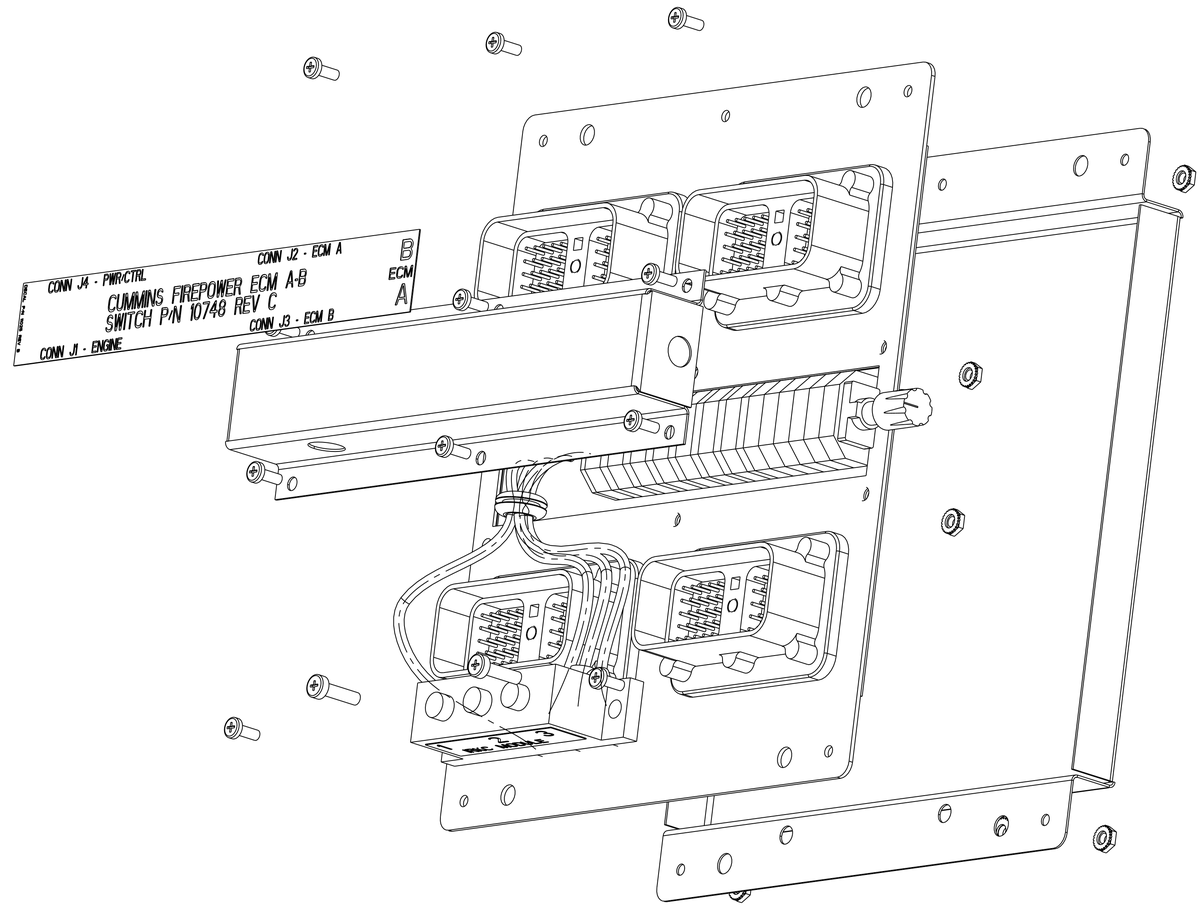
NPOWER SYSTEMS
DESIGN CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

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 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



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

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS in ° | IMPERIAL UNITS | METRIC UNITS

THIRD ANGLE PROJECTION

WORKING TOLERANCES .XX +/- 0.02
.XXX +/- 0.005
CMM TOLERANCES .XX +/- 0.01
.XXX +/- 0.005
CAD TOLERANCES .XX +/- 0.00
.XXX +/- 0.000

WORKING TOLERANCES XX +/- 1.0
CMM TOLERANCES XX +/- 0.5
CAD TOLERANCES XX +/- 0.0

REF. SCALES

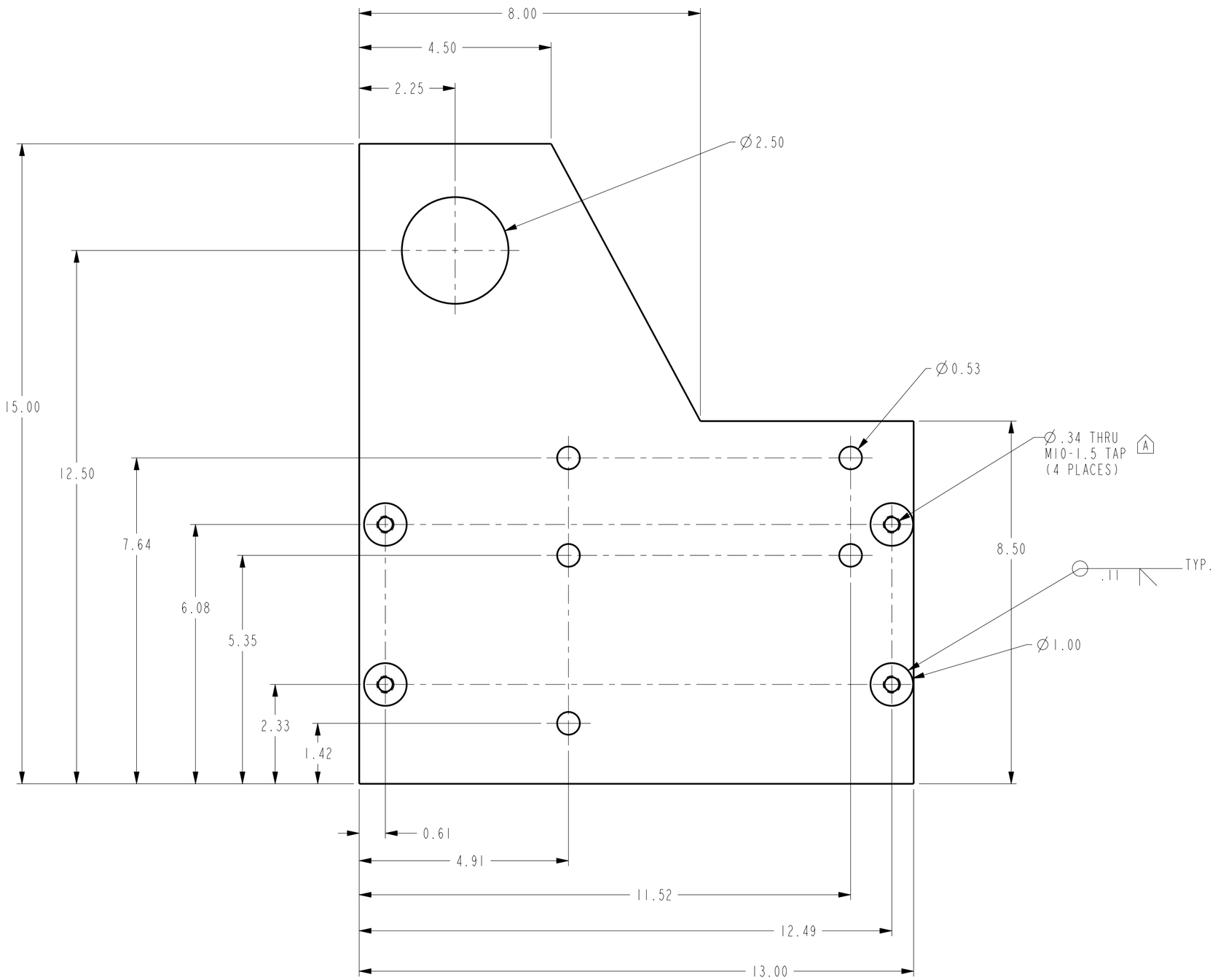
CUMMINS NPOWER, LLC
CORPORATE OFFICE
1600 BUERKLE ROAD
WHITE BEAR LAKE, MN
WWW.NPOWER.CUMMINS.COM

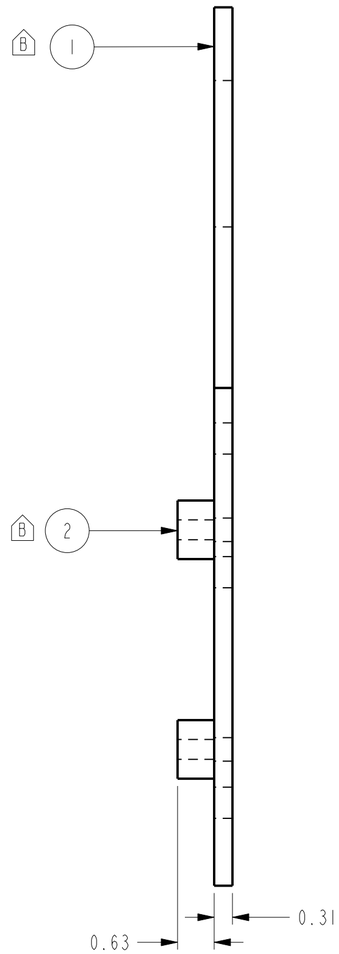
NPOWER SYSTEMS
DESIGN CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

TITLE 1: ASSEMBLY, ECM SWITCH
TITLE 2:

DWG UNITS:	DRAWN BY: SCOTT D		DATE: 21FEB2006	
IN/LB/S	APPD BY: -		DATE: -	
EST WEIGHT: 6.709	SCALE: 1.000	DO NOT SCALE	SHEET 4OF4	DRAWING NO: 10748 REV: D

BILL OF MATERIAL			
ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	DETAIL, BRACKET, CFP15E FIREPUMP	10895-01
2	4	DETAIL, BRACKET, CFP15E FIREPUMP	10895-02





NOTES:
MATERIAL: A-36
BREAK ALL EDGES
FINISH: CUMMINS FIREPOWER RED

REV	DESCRIPTION OF REVISION	REV BY	DATE
B	ADDED REF. BALLON	S DUBICK	13MAR2008
A	ADDED M10 TAP NOTE	PBS	10MAY2007

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

REF. SCALES

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

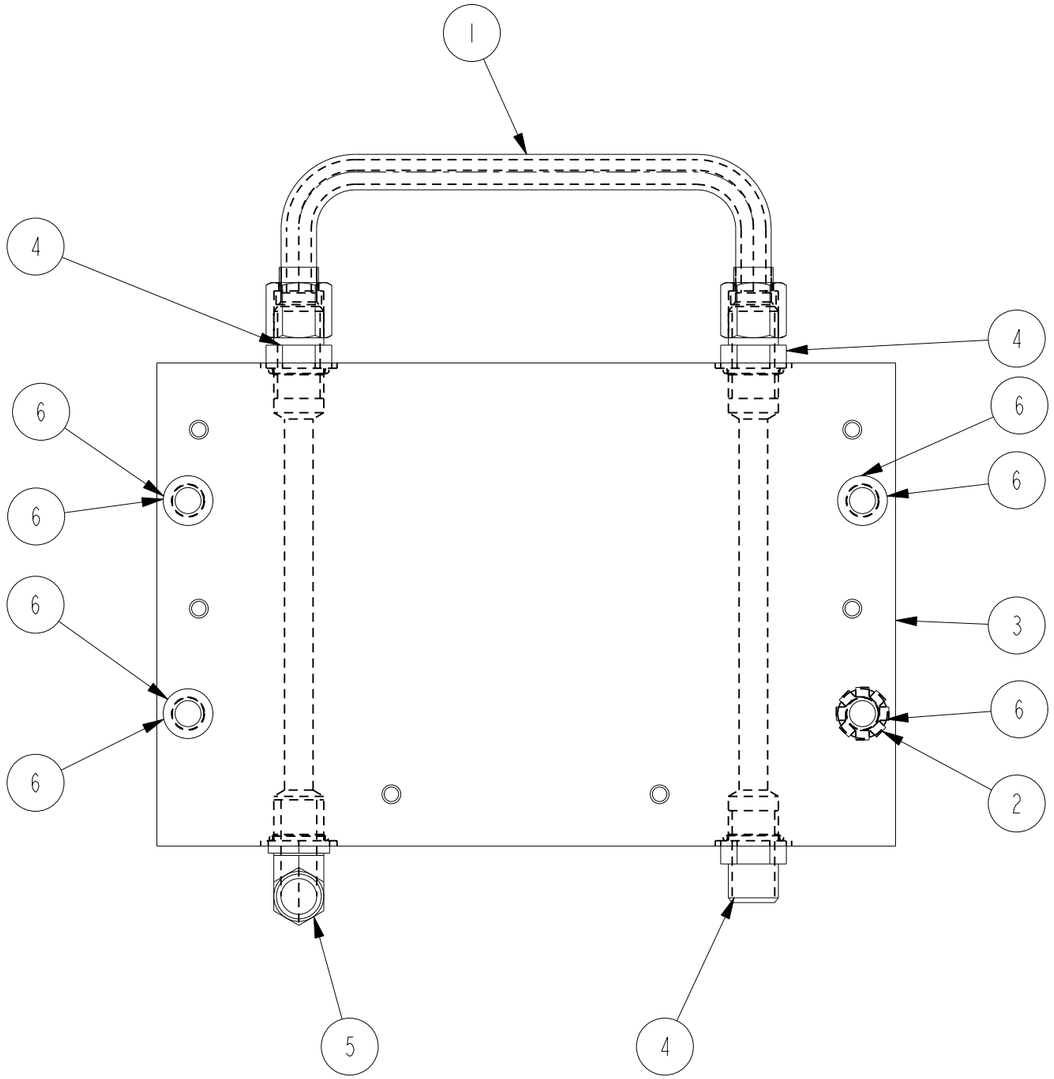
TITLE 1: PLATE, LIFTING AND ECM MTG
TITLE 2: CFP15E FIREPUMP

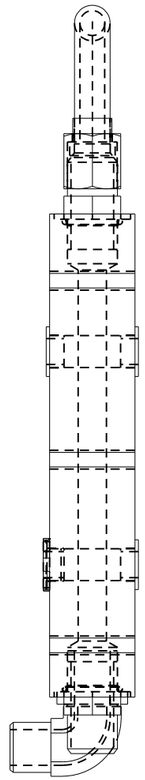
DWG UNITS: IN/LB/S	DRAWN BY: S.DANFORTH	DATE: -
	APPD BY: -	DATE: -

EST WEIGHT:	SCALE:	DO NOT SCALE	SHEET	DRAWING NO:	REV:
13.279	0.500		1OF1	10895	B

BILL OF MATERIAL

ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	TUBE, FUEL, -10 JIC 1010	10902
2	1	WASHER, GROUNDING, CECO # 3335562	3335562
3	1	MANIFOLD, ECM COOLING, CFP15E FIREPUMP	10901
B 4	3	FTG, STR, -10 JIC X -10 ORB	12235-10-10
B 5	1	ELB, 90 DEG, -10 JIC X -10 ORB	12268-10-10
6	7	WASHER, INSULATING, CECO # 3335561	3335561





UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1°

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

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

THIRD ANGLE PROJECTION

REV	ENF	DESCRIPTION OF REVISION	REV BY	DATE
B	2009-273	12268-10-10 WAS 10_C50X-5. 12235-10-10 WAS 10_F50X-S	DAN	14-JUL-09

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

ASMY, ECM COOLER AND MOUNT CFP15E FIREPUMP

DWG UNITS: IN/LB/S

DRAWN BY: S.DANFORTH

PRO-ENGINEER

DATE: 03MAY2006

REF DRWG:

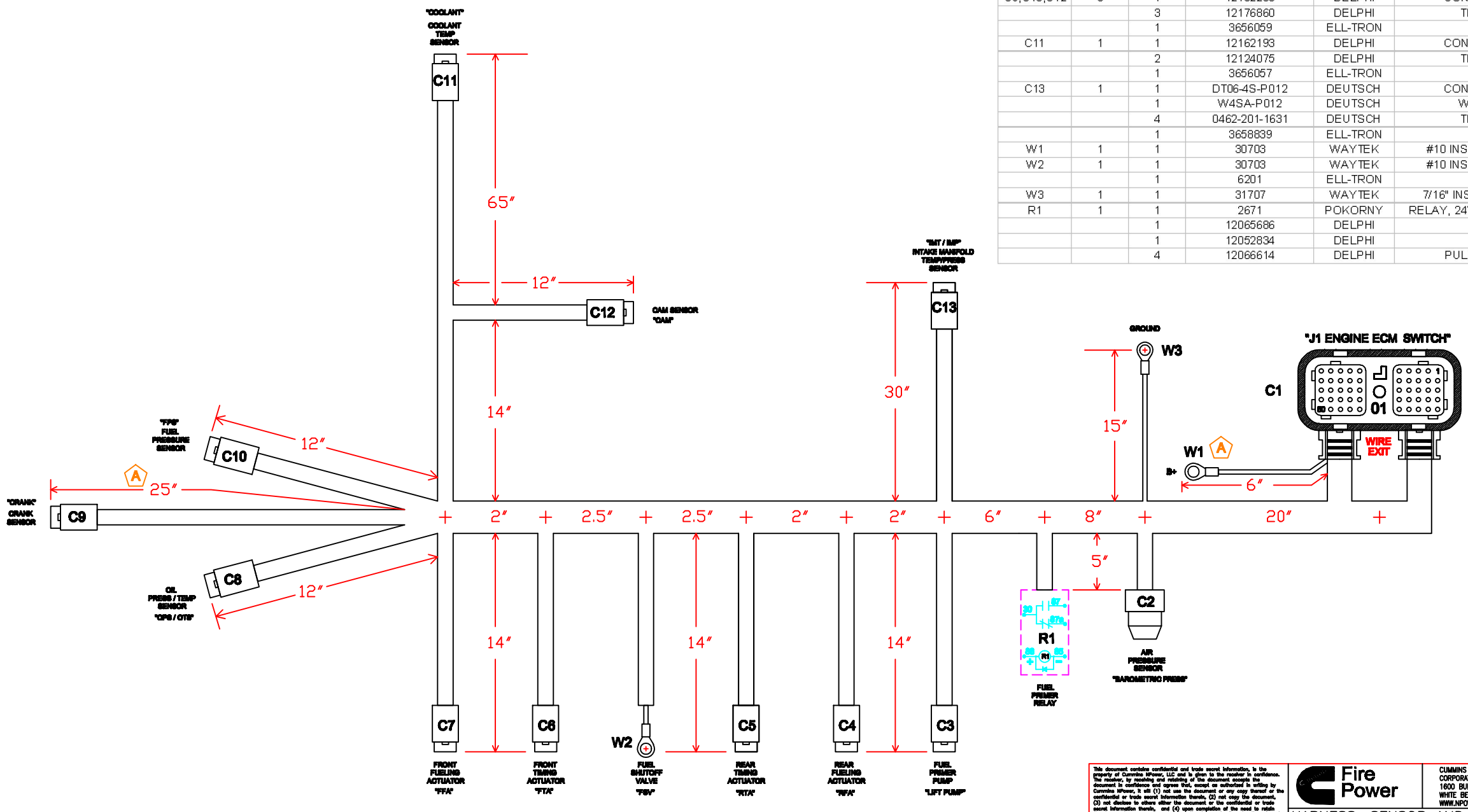
SCALE: 0.375

EST WEIGHT: 45.490

SHEET 1 OF 1

DRAWING NO: 10900

TAGS	QTY	SUB	CATALOG	MFG	DESC
C1	1	1	DRC26-50S-01	DEUTSCH	CONNECTOR, 50 POSITION, ECM
		1	0528-001-5005	DEUTSCH	BACKSHELL, 90 DEGREE
		32	0462-201-2031	DEUTSCH	TERMINAL, SOCKET
		18	114017	DEUTSCH	PLUG, SEALING
C2	1	1	56038150	FRAMATOME	CONNECTOR, 3 POSITION
		3	JTP-1811-66AU-RWC	FRAMATOME	TERMINAL, SOCKET
		1	366835	ELL-TRON	BOOT
C3	1	1	DT06-2S	DEUTSCH	CONNECTOR, 2 POSITION
		1	W2S	DEUTSCH	WEDGELOCK
		2	0462-201-16141	DEUTSCH	TERMINAL, SOCKET
C4,C7	2	1	DT06-2S-P012	DEUTSCH	CONNECTOR, 2 POSITION
		1	W2SB-P012	DEUTSCH	WEDGELOCK KEY B
		2	0462-201-1631	DEUTSCH	TERMINAL, SOCKET
		1	3660334	ELL-TRON	BOOT
C5,C6	2	1	DT06-2S-P012	DEUTSCH	CONNECTOR, 2 POSITION
		1	W2SD-P012	DEUTSCH	WEDGELOCK KEY D
		2	0462-201-1631	DEUTSCH	TERMINAL, SOCKET
		1	3660334	ELL-TRON	BOOT
C8	1	1	DT06-4S-P012	DEUTSCH	CONNECTOR, 4 POSITION
		1	W4SD-P012	DEUTSCH	WEDGELOCK KEY D
		4	0462-201-1631	DEUTSCH	TERMINAL, SOCKET
		1	3658839	DEUTSCH	BOOT
C9,C10,C12	3	1	12162280	DELPHI	CONNECTOR, 3 POSITION
		3	12176860	DELPHI	TERMINAL, SOCKET
		1	3656059	ELL-TRON	BOOT
C11	1	1	12162193	DELPHI	CONNECTOR, 2 POSITION
		2	12124075	DELPHI	TERMINAL, SOCKET
		1	3656057	ELL-TRON	BOOT
C13	1	1	DT06-4S-P012	DEUTSCH	CONNECTOR, 4 POSITION
		1	W4SA-P012	DEUTSCH	WEDGELOCK KEY A
		4	0462-201-1631	DEUTSCH	TERMINAL, SOCKET
		1	3658839	ELL-TRON	BOOT
W1	1	1	30703	WAYTEK	#10 INSULATED RING TERMINAL
W2	1	1	30703	WAYTEK	#10 INSULATED RING TERMINAL
		1	6201	ELL-TRON	BOOT
W3	1	1	31707	WAYTEK	7/16" INSULATED RING TERMINAL
R1	1	1	2671	POKORNY	RELAY, 24VDC, DIODE SUPPRESSION
		1	12065686	DELPHI	RELAY SOCKET
		1	12052834	DELPHI	CPA
		4	12066614	DELPHI	PULL TO SEAT TERMINAL



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

(A) Prominently label all connectors as "indicated".

REV	DESCRIPTION OF REVISION	BY	DATE
C	CHANGED WIRE TO SHIELDED CABLE ON PRIMARY SENSORS	KAK	28 AUG 2008
B	NO CHANGE, UPDATES TO OTHER DWG'S	KAK	03 MAR 2008
A	W1 LENGTH & TERM CHANGE, C9 LENGTH CHANGE, CONN LABELS	KAK	12 NOV 2007

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

Fire Power

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

HARNESS, SENSOR AND ACTUATOR QSX15 FIREPUMP

DWG UNITS:	DRAWN BY: RJS			DATE: 15 AUG 2007	
	APPD BY:			DATE:	
EST WEIGHT:	SCALE:	DO NOT SCALE	SHEET 10F2	DRAWING NO: 11829-01	REV: C

CIRCUIT #	FROM	PIN1	TO	PIN2	WIRECOLOR	WIRESIZE	WIRE TYPE	TERM 1	TERM 2	STAMP	TWISTED PAIRS	
1	R1	86	SPL A >		WHITE	18	GXL	12066614		RLY PWR		
2	R1	30	SPL A >		WHTIE	18	GXL	12066614		RLY PWR		
3	W1		SPL A <		WHITE	18	GXL	30703		RLY PWR		
4	R1	85	C1	5	WHITE	18	GXL	1206614	0462-201-2031	RLY RET		
5	R1	87	C3	1	WHITE	18	GXL	1206614	0462-201-16141	LIFT PUMP SUPPLY		
6	W2		C1	4	WHITE	18	GXL	30703	0462-201-2031	FSO		
7	C2	A	C1	16	WHITE	18	GXL	JTP-1811-66AU-RWC	0462-201-2031	AMBIENT SUPPLY	TWIST	
8	C2	B	C1	26	WHITE	18	GXL	JTP-1811-66AU-RWC	0462-201-2031	AMBIENT RET		
9	C2	C	C1	13	WHITE	18	GXL	JTP-1811-66AU-RWC	0462-201-2031	AMBIENT SIG		
10	C3	2	SPL B >		WHITE	18	GXL	0462-201-16141		LIFT PUMP RET		
11	W3		SPL B <		WHITE	14	GXL	31707		LIFT PUMP RET		
12	C4	1	C1	43	WHITE	18	GXL	0462-201-1631	0462-201-2031	RFA -	TWIST	
13	C4	2	C1	8	WHITE	18	GXL	0462-201-1631	0462-201-2031	RFA +		
14	C5	1	C1	50	WHITE	18	GXL	0462-201-1631	0462-201-2031	RTA -	TWIST	
15	C5	2	C1	46	WHITE	18	GXL	0462-201-1631	0462-201-2031	RTA +		
16	C6	1	C1	10	WHITE	18	GXL	0462-201-1631	0462-201-2031	FTA -	TWIST	
17	C6	2	C1	21	WHITE	18	GXL	0462-201-1631	0462-201-2031	FTA +		
18	C7	1	C1	30	WHITE	18	GXL	0462-201-1631	0462-201-2031	FFA -	TWIST	
19	C7	2	C1	41	WHITE	18	GXL	0462-201-1631	0462-201-2031	FFA +		
20	C8	1	C1	42	WHITE	18	GXL	0462-201-1631	0462-201-2031	OIL PRESS SUPPLY	TWIST	
21	C8	2	C1	39	WHITE	18	GXL	0462-201-1631	0462-201-2031	OIL PRESS RET		
22	C8	3	C1	40	WHITE	18	GXL	0462-201-1631	0462-201-2031	OIL PRESS SIG		
23	C8	4	C1	38	WHITE	18	GXL	0462-201-1631	0462-201-2031	OIL TEMP SIG		
24	C9	A	C1	37	WHITE	18	BELDON CABLE P/N 9365 (C)	12176860	0462-201-2031	CRANK SUPPLY		
25	C9	B	C1	27	BLACK	18		12176860	0462-201-2031	CRANK RET		
26	C9	C	C1	47	RED	18		12176860	0462-201-2031	CRANK SIG		
27			SPL B >		DRAIN	18						
28	C10	A	C1	18	WHITE	18	GXL	12124075	0462-201-2031	FUEL PRESS SUPPLY	TWIST	
29	C10	B	C1	20	WHITE	18	GXL	12124075	0462-201-2031	FUEL PRESS RET		
30	C10	C	C1	19	WHITE	18	GXL	12124075	0462-201-2031	FUEL PRESS SIG		
31	C11	A	C1	15	WHITE	18	GXL	12124075	0462-201-2031	COOLANT RET	TWIST	
32	C11	B	C1	7	WHITE	18	GXL	12124075	0462-201-2031	COOLANT SIG		
33	C12	A	C1	14	WHITE	18	BELDON CABLE P/N 9365 (C)	12176860	0462-201-2031	CAM SUPPLY		
34	C12	B	C1	17	BLACK	18		12176860	0462-201-2031	CAM RET		
35	C12	C	C1	2	RED	18		12176860	0462-201-2031	CAM SIG		
36			SPL B >		DRAIN	18						
37	C13	1	C1	32	WHITE	18	GXL	0462-201-1631	0462-201-2031	IMT SUPPLY	TWIST	
38	C13	2	C1	36	WHITE	18	GXL	0462-201-1631	0462-201-2031	IMT RET		
39	C13	3	C1	35	WHITE	18	GXL	0462-201-1631	0462-201-2031	IMP SIG		
40	C13	4	C1	33	WHITE	18	GXL	0462-201-1631	0462-201-2031	IMT SIG		

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

REV	DESCRIPTION OF REVISION	BY	DATE
C	CHANGED WIRE TO SHIELDED CABLE ON PRIMARY SENSORS	KAK	28 AUG 2008
B	NO CHANGE, UPDATES TO OTHER DWG'S	KAK	03 MAR 2008
A	W1 LENGTH & TERM CHANGE, C9 LENGTH CHANGE, CONN LABELS	KAK	12 NOV 2007

ANGULAR DIMENSIONS ± 1° | IMPERIAL UNITS | METRIC UNITS

THIRD ANGLE PROJECTION

Fire Power

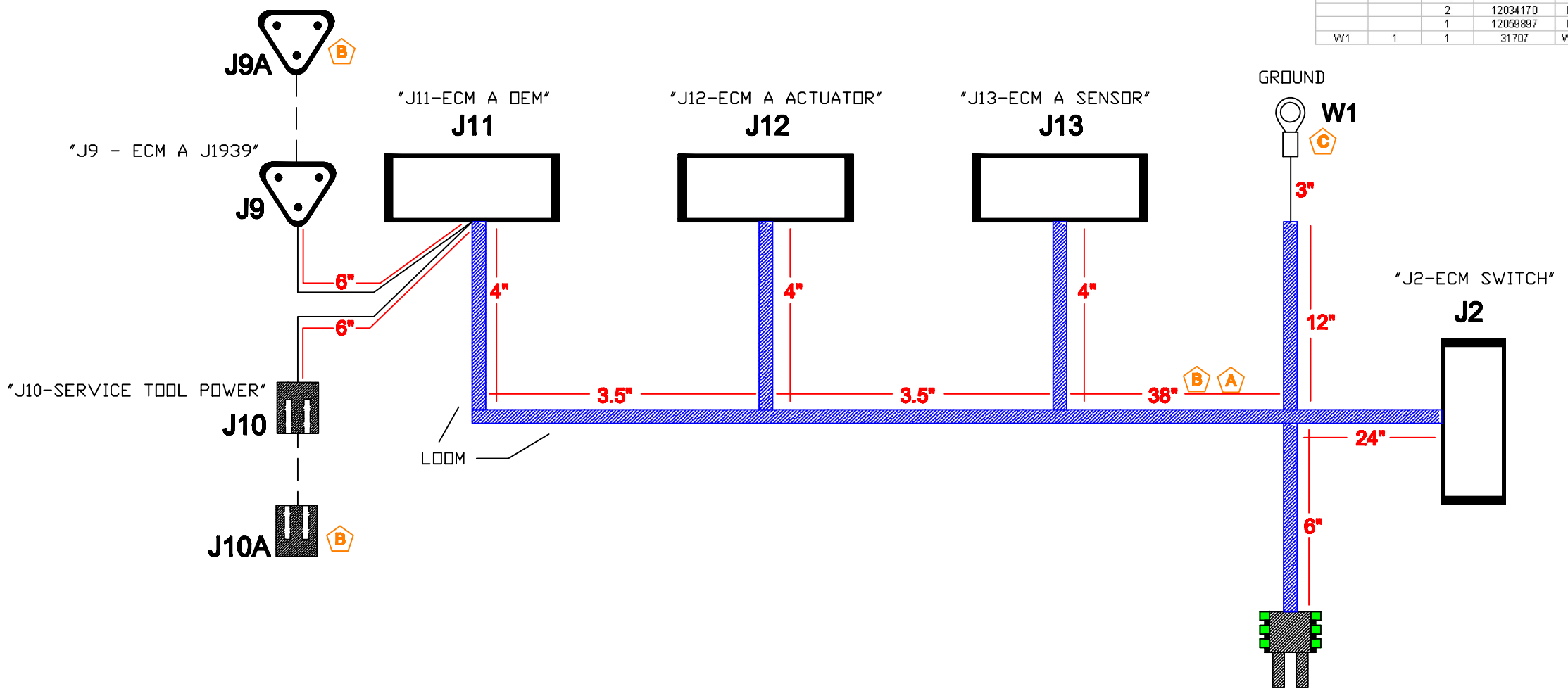
CUMMINS NPOWER, LLC
CORPORATE OFFICE
1600 BUERKLE ROAD
WHITE BEAR LAKE, MN
WWW.NPOWER.CUMMINS.COM

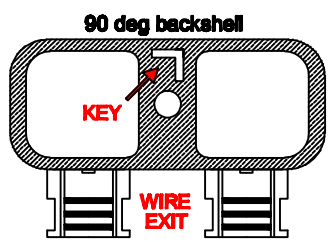
NPOWER SYSTEMS
DESIGN CENTER
575 LAWRENCE DRIVE
DEPERE, WISCONSIN

HARNESS, SENSOR AND ACTUATOR
QSX 15 FIREPUMP

DWG UNITS:	DRAWN BY: RJS		DATE: 15 AUG 2007
	APPD BY:		DATE:
EST WEIGHT:	SCALE: DO NOT SCALE	SHEET 20F2	DRAWING NO: 11829-01 / REV: C

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
		39	0462-201-2031	DEUTSCH	TERMINAL, SOCKET
		11	114017	DEUTSCH	PLUG, SEALING
J9	1	1	DT04-3P	DEUTSCH	CONNECTOR, 3 POSITION
		1	W3P	DEUTSCH	WEDGE
		3	0460-202-16141	DEUTSCH	TERMINAL, PIN
J9A	1	1	DT06-3S	DEUTSCH	CONNECTOR, 3 POSITION
		1	W3S	DEUTSCH	WEDGE
		3	114017	DEUTSCH	PLUG, SEALING
J10	1	1	12010973	DELPHI	CONNECTOR, 2 POSITION
		2	12015323	DELPHI	SEALS
		2	12089040	DELPHI	TERMINAL, PIN
J10A	1	1	12015792	DELPHI	CONNECTOR, 2 POSITION
		2	12010300	DELPHI	PLUG, CAVITY
J11	1	1	DRC26-50S-01	DEUTSCH	CONNECTOR, 50 POSITION, ECM
		1	0528-001-5005	DEUTSCH	BACKSHELL, 90 DEGREE
		21	0462-201-2031	DEUTSCH	TERMINAL, SOCKET
		29	114017	DEUTSCH	PLUG, SEALING
J12	1	1	DRC26-50S-02	DEUTSCH	CONNECTOR, 60 POSITION, ECM
		1	0528-001-5005	DEUTSCH	BACKSHELL
		10	0462-201-2031	DEUTSCH	TERMINAL, SOCKET
		40	114017	DEUTSCH	PLUG, SEALING
J13	1	1	DRC26-50S-03	DEUTSCH	CONNECTOR, 50 POSITION, ECM
		1	0528-001-5005	DEUTSCH	BACKSHELL, 90 DEGREE
		22	0462-201-2031	DEUTSCH	TERMINAL, SOCKET
		28	114017	DEUTSCH	PLUG, SEALING
J19	1	1	12052613	DELPHI	CONNECTOR, 480 METRI-PACK
		2	12052139	DELPHI	TERMINAL, SOCKET
		2	12034170	DELPHI	SEALS
		1	12059897	DELPHI	TPA
W1	1	1	31707	WAYTEK	RING TERMINAL





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

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

REV	DESCRIPTION OF REVISION	BY	DATE
C	ADDED W1 AND SHIELDED CABLE ON PRIMARY SENSORS	KAK	03 MAR 2008
B	ADDED MATING SEALING CONNECTORS J9A AND J10A; LENGTH CHANGE	KAK	03 MAR 2008
A	LENGTH CHANGE TO HARNESS BODY	KAK	12 NOV 2007

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, ECM A
QSX15 FIREPUMP

DWG UNITS:
DRAWN BY: RJS
DATE: 15 AUG 2007
APPD BY:
DATE:
EST WEIGHT:
SCALE:
DO NOT SCALE
SHEET 10F2
DRAWING NO: 11829-02
REV: C

FROM	PIN1	TO	PIN2	WIRECOLOR	WIRESIZE	WIRE TYPE	TERM 1	TERM 2	STAMP	TWISTED PAIRS
J2	47	J13	2	WHITE	18	GXL	0462-201-2031	0462-201-2031	COOLANT SIG	TWIST
J2	35	J13	13	WHTIE	18	GXL	0462-201-2031	0462-201-2031	COOLANT RET	
J2	13	J13	6	WHITE	18	GXL	0462-201-2031	0462-201-2031	AMBIENT SIG	TWIST
J2	36	J13	17	WHITE	18	GXL	0462-201-2031	0462-201-2031	AMBIENT SUPPLY	
J2	26	J13	31	WHITE	18	GXL	0462-201-2031	0462-201-2031	AMBIENT RET	
J2	34	J13	11	WHITE	18	BELDON CABLE P/N 9365 (C)	0462-201-2031	0462-201-2031	CAM SUPPLY	
J2	37	J13	21	BLACK	18		0462-201-2031	0462-201-2031	CAM RET	
J2	42	J13	50	RED	18		0462-201-2031	0462-201-2031	CAM SIG	
		SPL A >		DRAIN	18					
J2	17	J13	41	WHITE	18	BELDON CABLE P/N 9365 (C)	0462-201-2031	0462-201-2031	CRANK SUPPLY	
J2	27	J13	32	BLACK	18		0462-201-2031	0462-201-2031	CRANK RET	
J2	7	J13	47	RED	18		0462-201-2031	0462-201-2031	CRANK SIG	
		SPL A >		DRAIN	18					
J2	32	J13	37	WHITE	18	GXL	0462-201-2031	0462-201-2031	IMT SUPPLY	TWIST
J2	33	J13	38	WHITE	18	GXL	0462-201-2031	0462-201-2031	IMT SIG	
J2	15	J13	39	WHITE	18	GXL	0462-201-2031	0462-201-2031	IMP SIG	
J2	16	J13	40	WHITE	18	GXL	0462-201-2031	0462-201-2031	IMT RET	
J2	38	J13	27	WHITE	18	GXL	0462-201-2031	0462-201-2031	FUEL PRESS SUPPLY	TWIST
J2	39	J13	29	WHITE	18	GXL	0462-201-2031	0462-201-2031	FUEL PRESS SIG	
J2	40	J13	30	WHITE	18	GXL	0462-201-2031	0462-201-2031	FUEL PRESS RET	
J2	18	J13	42	WHITE	18	GXL	0462-201-2031	0462-201-2031	OIL TEMP SIG	TWIST
J2	19	J13	43	WHITE	18	GXL	0462-201-2031	0462-201-2031	OIL PRESS RET	
J2	20	J13	44	WHITE	18	GXL	0462-201-2031	0462-201-2031	OIL PRESS SIG	
J2	2	J13	45	WHITE	18	GXL	0462-201-2031	0462-201-2031	OIL PRESS SUPPLY	
J2	44	J12	33	WHITE	18	GXL	0462-201-2031	0462-201-2031	FSO	
J2	10	J12	3	WHITE	18	GXL	0462-201-2031	0462-201-2031	LIFT PUMP RET	
J2	21	J12	6	WHITE	18	GXL	0462-201-2031	0462-201-2031	RFA +	TWIST
J2	6	J12	16	WHITE	18	GXL	0462-201-2031	0462-201-2031	RFA -	
J2	41	J12	7	WHITE	18	GXL	0462-201-2031	0462-201-2031	FTA -	TWIST
J2	48	J12	8	WHITE	18	GXL	0462-201-2031	0462-201-2031	FTA +	
J2	43	J12	9	WHITE	18	GXL	0462-201-2031	0462-201-2031	FFA -	TWIST
J2	46	J12	10	WHITE	18	GXL	0462-201-2031	0462-201-2031	FFA +	
J2	3	J12	26	WHITE	18	GXL	0462-201-2031	0462-201-2031	RTA +	TWIST
J2	45	J12	36	WHITE	18	GXL	0462-201-2031	0462-201-2031	RTA -	
J2	5	J11	6	WHITE	18	GXL	0462-201-2031	0462-201-2031	STOP LAMP	
J2	25	J11	16	WHITE	18	GXL	0462-201-2031	0462-201-2031	WARNING LAMP	
J2	14	J11	44	WHITE	18	GXL	0462-201-2031	0462-201-2031	DIAGNOSTIC SWITCH	
J2	4	J11	38	WHITE	18	GXL	0462-201-2031	0462-201-2031	KEYSWITCH	
J2	24	SPL B <		WHITE	18	GXL	0462-201-2031		ECM RETURN	
J11	9	SPL B >		WHITE	18	GXL	0462-201-2031		ECM RETURN	
J11	23	SPL B >		WHITE	18	GXL	0462-201-2031		ISC 1	
J2	22	J11	24	WHITE	18	GXL	0462-201-2031	0462-201-2031	DECREMENT SWITCH	
J2	23	J11	14	WHITE	18	GXL	0462-201-2031	0462-201-2031	INCREMENT SWITCH	
J19	B	SPL C >		GREEN	10	GXL	12052139		ECM GND	
J11	29	SPL C <		GREEN	18	GXL	0462-201-2031		ECM GND	
J11	30	SPL C <		GREEN	18	GXL	0462-201-2031		ECM GND	
J11	39	SPL C <		GREEN	18	GXL	0462-201-2031		ECM GND	
J11	40	SPL C <		GREEN	18	GXL	0462-201-2031		ECM GND	
J11	50	SPL C <		GREEN	18	GXL	0462-201-2031		ECM GND	
J10	B	SPL C <		GREEN	18	GXL	12089040		ECM GND	
J19	A	SPL D >		RED	10	GXL	12052139		ECM POWER	
J11	18	SPL D <		RED	18	GXL	0462-201-2031		ECM POWER	
J11	28	SPL D <		RED	18	GXL	0462-201-2031		ECM POWER	
J11	7	SPL D <		RED	18	GXL	0462-201-2031		ECM POWER	
J11	8	SPL D <		RED	18	GXL	0462-201-2031		ECM POWER	
J11	17	SPL D <		RED	18	GXL	0462-201-2031		ECM POWER	
J10	A	SPL D <		RED	18	GXL	12089040		ECM POWER	
J9	A	J11	46	YELLOW	18	RAYCHEM	0460-202-16141	0462-201-2031	J1939	
J9	B	J11	37	GREEN	18	J1939 P/N	0460-202-16141	0462-201-2031	J1939	
J9	C	J11	36	SHIELD	18	2019D0309	0460-202-16141	0462-201-2031	J1939	
(C) W1		SPL A <		WHITE	14	GXL	31707		GND	

REV	DESCRIPTION OF REVISION	BY	DATE
C	CHANGED WIRE TO SHIELDED CABLE ON PRIMARY SENSORS	KAK	28 AUG 2008
B	ADDED MATING SEALING CONNECTORS J9A AND J10A	KAK	03 MAR 2008
A	LENGTH CHANGE TO HARNESS BODY	KAK	12 NOV 2007

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

Fire Power

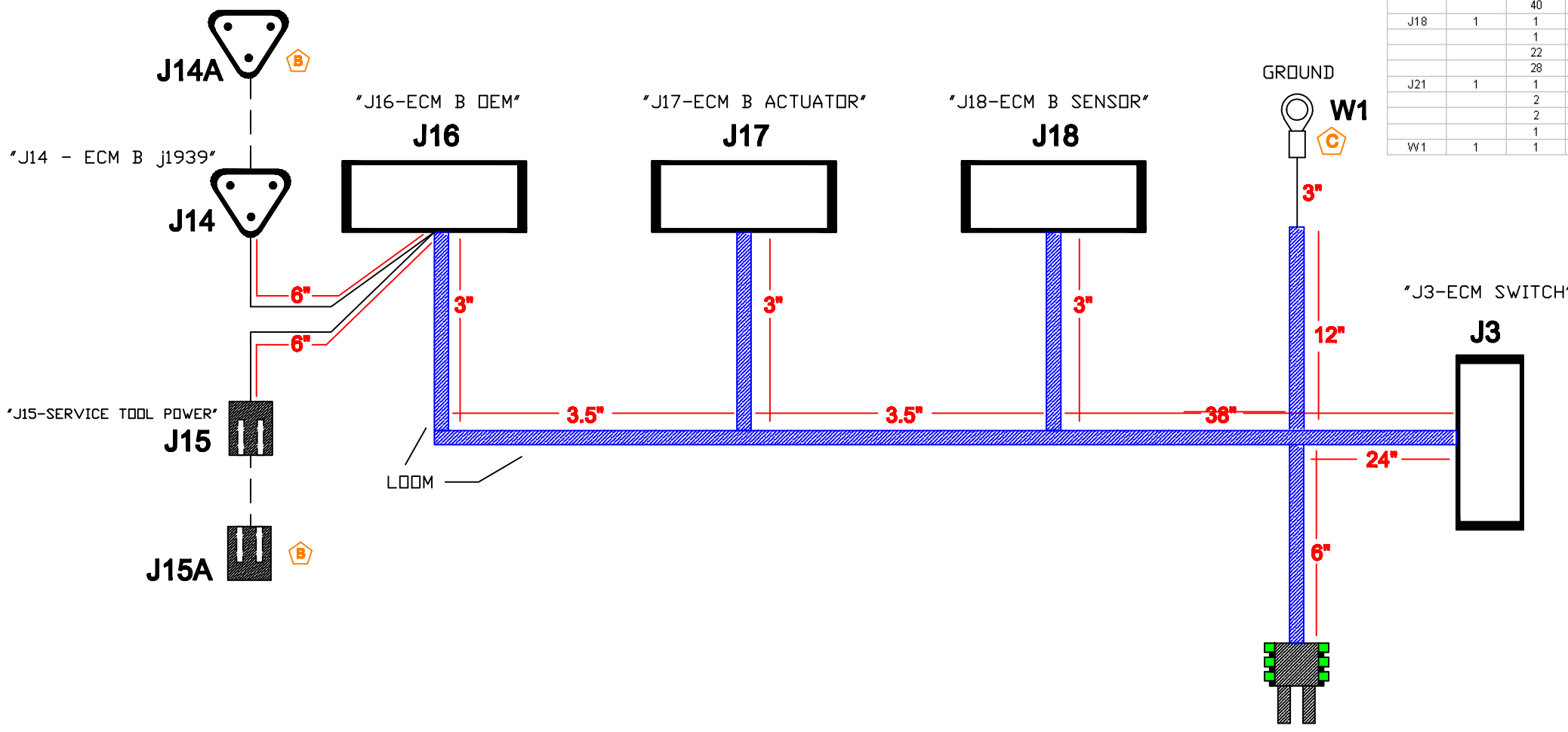
CUMMINS NPOWER, LLC
CORPORATE OFFICE
1600 BUERKLE ROAD
WHITE BEAR LAKE, MN
WWW.NPOWER.CUMMINS.COM

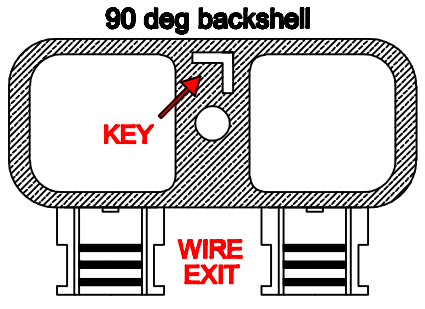
NPOWER SYSTEMS
DESIGN CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

HARNESS, ECM A
QSX15 FIREPUMP

DWG UNITS:	DRAWN BY: RJS		DATE: 15 AUG 2007	
	APPD BY:		DATE:	
EST WEIGHT:	SCALE: DO NOT SCALE	SHEET 20F2	DRAWING NO: 11829-02	REV: C

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
		39	0462-201-2031	DEUTSCH	TERMINAL, SOCKET
		11	114017	DEUTSCH	PLUG, SEALING
J14	1	1	DT04-3P	DEUTSCH	CONNECTOR, 3 POSITION
		1	W3P	DEUTSCH	WEDGE
		3	0460-202-16141	DEUTSCH	TERMINAL, PIN
J14A	1	1	DT06-3S	DEUTSCH	CONNECTOR, 3 POSITION
		1	W3S	DEUTSCH	WEDGE
		3	114017	DEUTSCH	PLUG, SEALING
J15	1	1	12010973	DELPHI	CONNECTOR, 2 POSITION
		2	12015323	DELPHI	SEALS
		2	12089040	DELPHI	TERMINAL, PIN
J15A	1	1	12015792	DELPHI	CONNECTOR, 2 POSITION
		2	12010300	DELPHI	PLUG, CAVITY
J16	1	1	DRC26-50S-01	DEUTSCH	CONNECTOR, 50 POSITION, ECM
		1	0528-001-5005	DEUTSCH	BACKSHELL, 90 DEGREE
		21	0462-201-2031	DEUTSCH	TERMINAL, SOCKET
		29	114017	DEUTSCH	PLUG, SEALING
J17	1	1	DRC26-50S-02	DEUTSCH	CONNECTOR, 60 POSITION, ECM
		1	0528-001-5005	DEUTSCH	BACKSHELL
		10	0462-201-2031	DEUTSCH	TERMINAL, SOCKET
		40	114017	DEUTSCH	PLUG, SEALING
J18	1	1	DRC26-50S-03	DEUTSCH	CONNECTOR, 50 POSITION, ECM
		1	0528-001-5005	DEUTSCH	BACKSHELL, 90 DEGREE
		22	0462-201-2031	DEUTSCH	TERMINAL, SOCKET
		28	114017	DEUTSCH	PLUG, SEALING
J21	1	1	12052613	DELPHI	CONNECTOR, 480 METRI-PACK
		2	12052139	DELPHI	TERMINAL, SOCKET
		2	12034170	DELPHI	SEALS
		1	12059897	DELPHI	TPA
W1	1	1	31707	WAYTEK	RING TERMINAL





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

REV	DESCRIPTION OF REVISION	BY	DATE
C	CHANGED WIRE TO SHIELDED CABLE ON PRIMARY SENSORS	KAK	28 AUG 2008
B	ADDED MATING SEALING CONNECTORS J14A AND J15A	KAK	03 MAR 2008
A	NO CHANGE - RELEASE FOR PRODUCTION	KAK	12 NOV 2007

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

Fire Power

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

NPOWER SYSTEMS
DESIGN CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

HARNESS, ECM B
QSX15 FIREPUMP

DWG UNITS:
DRAWN BY: RJS
DATE: 15 AUG 2007
APPD BY:
DATE:
EST WEIGHT:
SCALE:
DO NOT SCALE
SHEET 10F2
DRAWING NO: 11829-03
REV: C

FROM	PIN1	TO	PIN2	WIRECOLOR	WIRESIZE	WIRE TYPE	TERM 1	TERM 2	STAMP	TWISTED PAIRS
J3	7	J18	2	WHITE	18	GXL	0462-201-2031	0462-201-2031	COOLANT SIG	TWIST
J3	15	J18	13	WHTIE	18	GXL	0462-201-2031	0462-201-2031	COOLANT RET	
J3	13	J18	6	WHITE	18	GXL	0462-201-2031	0462-201-2031	AMBIENT SIG	TWIST
J3	16	J18	17	WHITE	18	GXL	0462-201-2031	0462-201-2031	AMBIENT SUPPLY	
J3	26	J18	31	WHITE	18	GXL	0462-201-2031	0462-201-2031	AMBIENT RET	
J3	14	J18	11	WHITE	18		0462-201-2031	0462-201-2031	CAM SUPPLY	
J3	17	J18	21	BLACK	18	BELDON CABLE P/N	0462-201-2031	0462-201-2031	CAM RET	
J3	2	J18	50	RED	18	9365	0462-201-2031	0462-201-2031	CAM SIG	
		SPL A >		DRAIN	18					
J3	37	J18	41	WHITE	18		0462-201-2031	0462-201-2031	CRANK SUPPLY	
J3	27	J18	32	BLACK	18	BELDON CABLE P/N	0462-201-2031	0462-201-2031	CRANK RET	
J3	47	J18	47	RED	18	9365	0462-201-2031	0462-201-2031	CRANK SIG	
		SPL A >		DRAIN	18					
J3	32	J18	37	WHITE	18	GXL	0462-201-2031	0462-201-2031	IMT SUPPLY	TWIST
J3	33	J18	38	WHITE	18	GXL	0462-201-2031	0462-201-2031	IMT SIG	
J3	35	J18	39	WHITE	18	GXL	0462-201-2031	0462-201-2031	IMP SIG	
J3	36	J18	40	WHITE	18	GXL	0462-201-2031	0462-201-2031	IMT RET	
J3	18	J18	27	WHITE	18	GXL	0462-201-2031	0462-201-2031	FUEL PRESS SUPPLY	TWIST
J3	19	J18	29	WHITE	18	GXL	0462-201-2031	0462-201-2031	FUEL PRESS SIG	
J3	20	J18	30	WHITE	18	GXL	0462-201-2031	0462-201-2031	FUEL PRESS RET	
J3	38	J18	42	WHITE	18	GXL	0462-201-2031	0462-201-2031	OIL TEMP SIG	TWIST
J3	39	J18	43	WHITE	18	GXL	0462-201-2031	0462-201-2031	OIL PRESS RET	
J3	40	J18	44	WHITE	18	GXL	0462-201-2031	0462-201-2031	OIL PRESS SIG	
J3	42	J18	45	WHITE	18	GXL	0462-201-2031	0462-201-2031	OIL PRESS SUPPLY	
J3	4	J17	33	WHITE	18	GXL	0462-201-2031	0462-201-2031	FSO	
J3	5	J17	3	WHITE	18	GXL	0462-201-2031	0462-201-2031	LIFT PUMP RET	
J3	8	J17	6	WHITE	18	GXL	0462-201-2031	0462-201-2031	RFA +	TWIST
J3	43	J17	16	WHITE	18	GXL	0462-201-2031	0462-201-2031	RFA -	
J3	10	J17	7	WHITE	18	GXL	0462-201-2031	0462-201-2031	FTA -	TWIST
J3	21	J17	8	WHITE	18	GXL	0462-201-2031	0462-201-2031	FTA +	
J3	30	J17	9	WHITE	18	GXL	0462-201-2031	0462-201-2031	FFA -	TWIST
J3	41	J17	10	WHITE	18	GXL	0462-201-2031	0462-201-2031	FFA +	
J3	46	J17	26	WHITE	18	GXL	0462-201-2031	0462-201-2031	RTA +	TWIST
J3	50	J17	36	WHITE	18	GXL	0462-201-2031	0462-201-2031	RTA -	
J3	45	J16	6	WHITE	18	GXL	0462-201-2031	0462-201-2031	STOP LAMP	
J3	25	J16	16	WHITE	18	GXL	0462-201-2031	0462-201-2031	WARNING LAMP	
J3	34	J16	44	WHITE	18	GXL	0462-201-2031	0462-201-2031	DIAGNOSTIC SWITCH	
J3	44	J16	38	WHITE	18	GXL	0462-201-2031	0462-201-2031	KEYSWITCH	
J3	24	SPL B <		WHITE	18	GXL	0462-201-2031		ECM RETURN	
J16	9	SPL B >		WHITE	18	GXL	0462-201-2031		ECM RETURN	
J16	23	SPL B >		WHITE	18	GXL	0462-201-2031		ISC 1	
J3	22	J16	24	WHITE	18	GXL	0462-201-2031	0462-201-2031	DECREMENT SWITCH	
J3	23	J16	14	WHITE	18	GXL	0462-201-2031	0462-201-2031	INCREMENT SWITCH	
J21	B	SPL C >		GREEN	10	GXL	12052139		ECM GND	
J16	29	SPL C <		GREEN	18	GXL	0462-201-2031		ECM GND	
J16	30	SPL C <		GREEN	18	GXL	0462-201-2031		ECM GND	
J16	39	SPL C <		GREEN	18	GXL	0462-201-2031		ECM GND	
J16	40	SPL C <		GREEN	18	GXL	0462-201-2031		ECM GND	
J16	50	SPL C <		GREEN	18	GXL	0462-201-2031		ECM GND	
J15	B	SPL C <		GREEN	18	GXL	12089040		ECM GND	
J21	A	SPL D >		RED	10	GXL	12052139		ECM POWER	
J16	18	SPL D <		RED	18	GXL	0462-201-2031		ECM POWER	
J16	28	SPL D <		RED	18	GXL	0462-201-2031		ECM POWER	
J16	7	SPL D <		RED	18	GXL	0462-201-2031		ECM POWER	
J16	8	SPL D <		RED	18	GXL	0462-201-2031		ECM POWER	
J16	17	SPL D <		RED	18	GXL	0462-201-2031		ECM POWER	
J15	A	SPL D <		RED	18	GXL	12089040		ECM POWER	
J14	A	J16	46	YELLCW	18	RAYCHEM J1939 P/N	0460-202-16141	0462-201-2031	J1939	
J14	B	J16	37	GREEN	18	2019D0309	0460-202-16141	0462-201-2031	J1939	
J14	C	J16	36	SHIELD	18		0460-202-16141	0462-201-2031	J1939	
W1		SPL A <		WHITE	14	GXL	31707		GND	

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

REV	DESCRIPTION OF REVISION	BY	DATE
C	CHANGED WIRE TO SHIELDED CABLE ON PRIMARY SENSORS	KAK	28 AUG 2008
B	ADDED MATING SEALING CONNECTORS J14A AND J15A	KAK	03 MAR 2008
A	NO CHANGE, RELEASE FOR PRODUCTION	KAK	12 NOV 2007

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

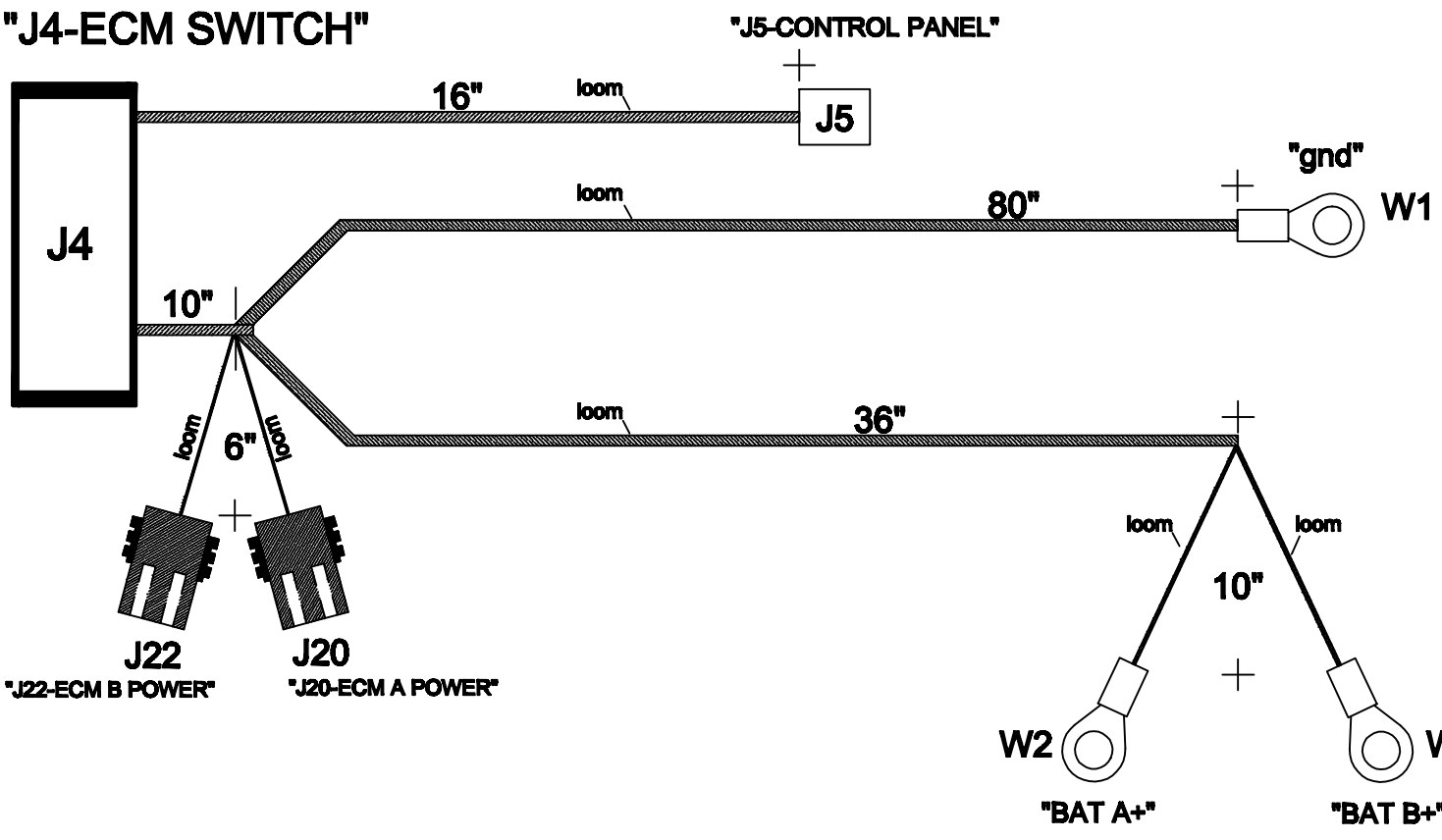
NPOWER SYSTEMS
DESIGN CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

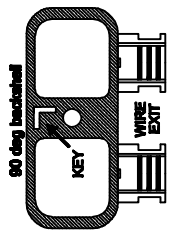
HARNESS, ECM B
QSX15 FIREPUMP

DWG UNITS:	DRAWN BY: RJS	DATE: 15 AUG 2007
	APPD BY:	DATE:

EST WEIGHT:	SCALE:	DO NOT SCALE	SHEET 2OF2	DRAWING NO: 11829-03	REV: C

FROM	TO	WIRE	WIRE LABEL	NOTE
				J4
J4/1	J5/A	18 AWG White	J5/A	RED LAMP
J4/2	J5/C	18 AWG White	J5/C	YELLOW LAMP
J4/3	J5/K	18 AWG White	J5/K	DIAG
J4/4	J5/X	18 AWG White	J5/X	KEY
J4/5	J5/S	18 AWG White	J5/S	RETURN
J4/6	J5/P	18 AWG White	J5/P	DEC
J4/7	J5/M	18 AWG White	J5/M	INC
J4/8	J5/F	18 AWG White	J5/F	ECM A
J4/9	J5/H	18 AWG White	J5/H	ECM B
J4/10	not used			
J4/11	W2	ten 20 awg ORANGE wires from J4/11 - J4/20 spliced together to **one** 10 awg ORANGE wire called W2	J5/A	BAT A+
J4/12				
J4/13				
J4/14				
J4/15				
J4/16				
J4/17				
J4/18				
J4/19				
J4/20				
J4/21	W3	ten 20 awg YELLOW wires from J4/21-J4/30 spliced together to **one** 10 awg YELLOW wire called W3	J5/A	BAT B+
J4/22				
J4/23				
J4/24				
J4/25				
J4/26				
J4/27				
J4/28				
J4/29				
J4/30				
J4/31	J20(a) & J22(a)	ten 20 awg RED wires from J4/31-J4/40 spliced together to **one** 10 awg RED wire for J20(a) and **one** 10 AWG Red wire for 22(a)		Best Bat + to ecm
J4/32				
J4/33				
J4/34				
J4/35				
J4/36				
J4/37				
J4/38				
J4/39				
J4/40				
J4/41	W1 & J20(b) & J22(b)	ten 20 AWG Green wires from J4/41-J4/50 spliced together to **one** 10 AWG Green wire for W1, **one** 10 AWG Green wire for J20(b), and **one** 10 AWG Green wire for J22(b)		Bat gnd
J4/42				
J4/43				
J4/44				
J4/45				
J4/46				
J4/47				
J4/48				
J4/49				
J4/50				





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

Prominently label all connectros as "indicated".

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1° | IMPERIAL UNITS | METRIC UNITS

THIRD ANGLE PROJECTION

EST WEIGHT:

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, OEM
QSX15 FIREPUMP

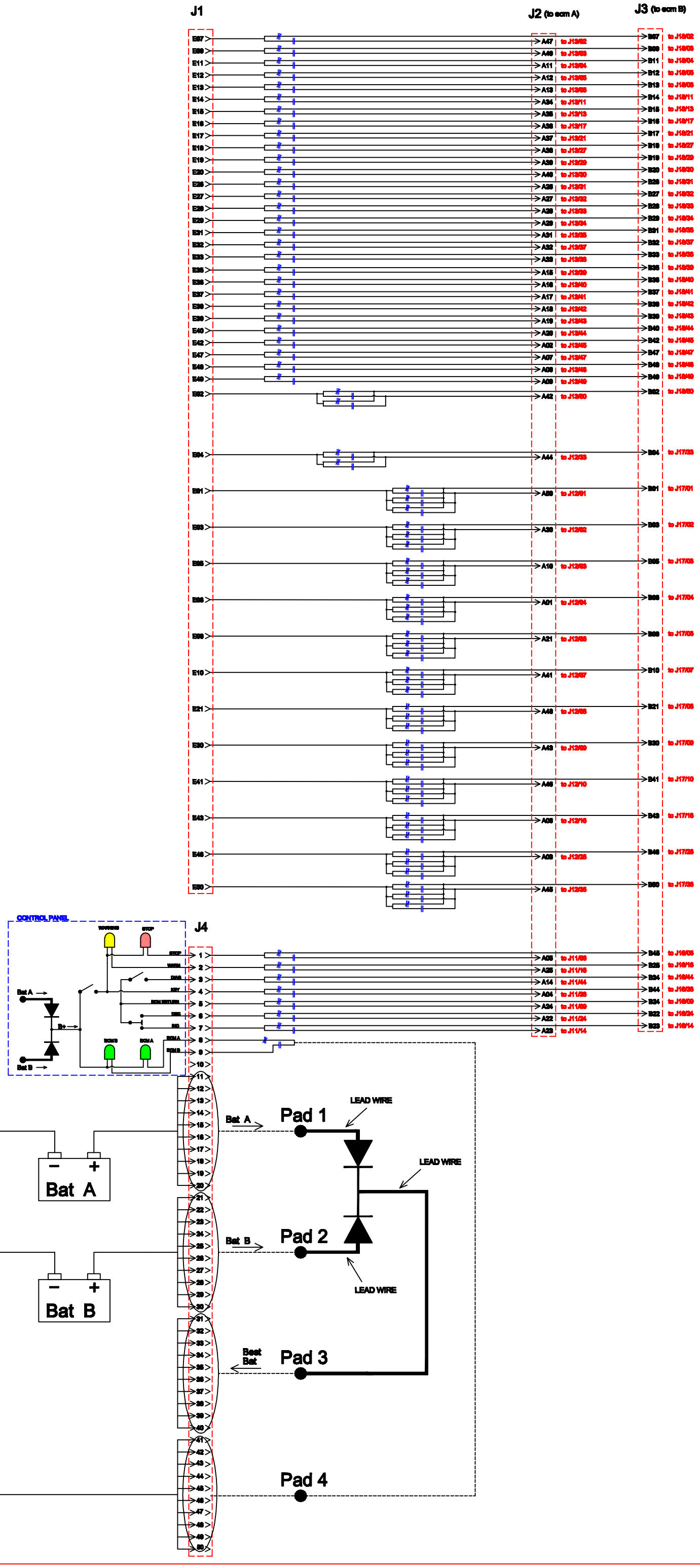
DWG UNITS:

DRAWN BY: RJS | DATE: 15 AUG 2007

APPD BY: | DATE:

SCALE: | DO NOT SCALE | SHEET 10F1 | DRAWING NO: 11829-04 | REV: c

REV	DESCRIPTION OF REVISION	BY	DATE
C	NO CHANGE, UPDATES TO OTHER DWG'S	KAK	28 AUG 2008
B	NO CHANGE, UPDATES TO OTHER DWG'S	KAK	03 MAR 2008
A	NO CHANGE, RELEASE FOR PRODUCTION	KAK	12 NOV 2007



CUMMINS INC.
CUMMINS POWER GENERATION
1400 BUERKLE ROAD
WHITE BEAR LAKE, MN
WWW.CUMMINSPOWER.COM

CUMMINS INC.
DESIGN & DEVELOPMENT
875 LAWRENCE DRIVE
DE PERE, WISCONSIN
WWW.CUMMINSPOWER.COM

UNLESS OTHERWISE NOTED
ALL DIMENSIONS ARE IN INCHES
ANGULAR ± 0.5 DEG
.XX = ± 0.03
.XXX = ± 0.010
APPLY WELDING TOLERANCES
.XX = ± 0.06
.XXX = ± 0.03

DWG SCALE:
PLOT SCALE:
DRAWN BY: RJS
APPD BY:
DATE: 15 AUG 2007
DATE:

DESCRIPTION
ECM SWITCH MAPPING

REFERENCE:
QSX 15

DRAWING NUMBER:
11829 SCHEMATIC

REV	DESCRIPTION OF REVISION	BY	DATE

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

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
		SIGNALS ARE ACTIVE HI (12 VOLTS)
LOPL	4	LOW OIL PRESSURE ALARM SIGNAL
HWTL	5	HIGH TEMP ALARM SIGNAL
		SIGNALS ARE ACTIVE LOW (GND)
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	ELECTRONIC ENGINES ONLY SEE THIS DWG., SHT 2
	303	

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

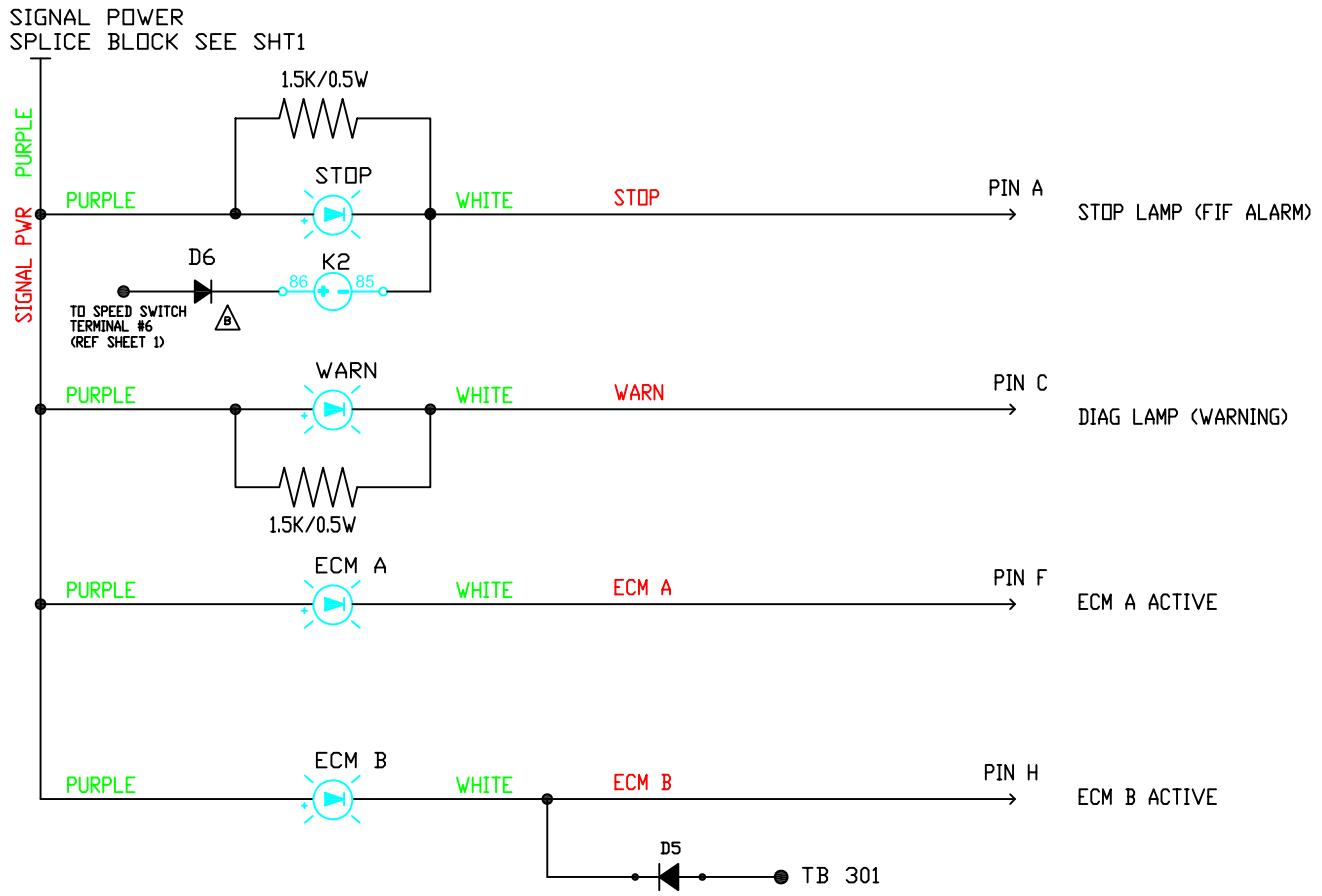
REV	DESCRIPTION OF REVISION	BY	DATE
E	ADDED SHEETS 3, 4, 5, & 6	RJS	20 MAR 07
D	PIN 12 WAS PIN B	RJS	19 SEPT 06
C	REMOVED 5 AMP CIRCUIT BREAKER	RJS	27 JUNE 06
B	ADDED CONNECTION TO TERM 6 OF SPEED SWITCH	RJS	17 DEC 05
A	CHANGED WIRE GAUGES; CHG'D TB 1 LABELS	RJS	27OCT05

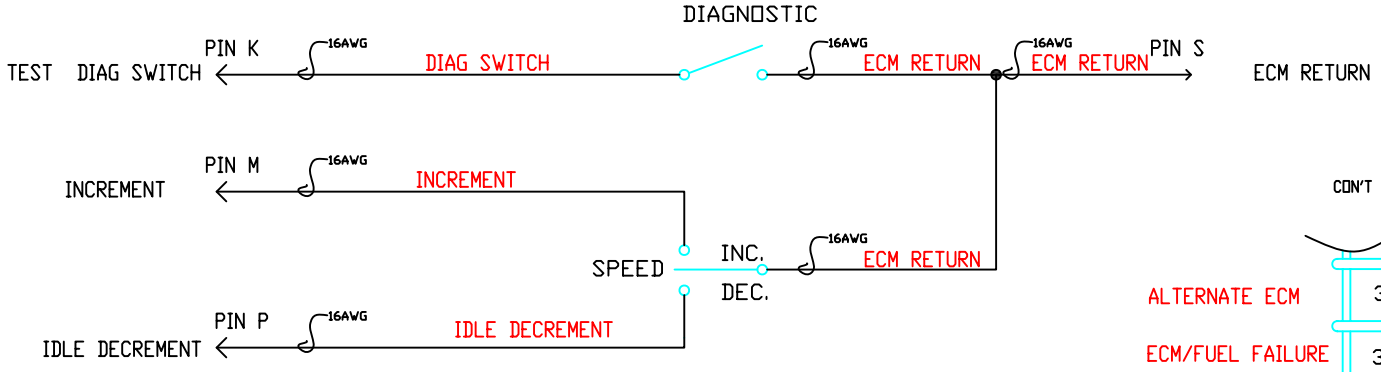
UNLESS OTHERWISE NOTED
ALL DIMENSIONS ARE IN INCHES
APPLY MACHINE TOLERANCES
.X = ± 0.05
.XX = ± 0.010
.XXX = ± 0.001
APPLY WELDED TOLERANCES
.X = ± 0.25
.XX = ± 0.13
.XXX = ± 0.05

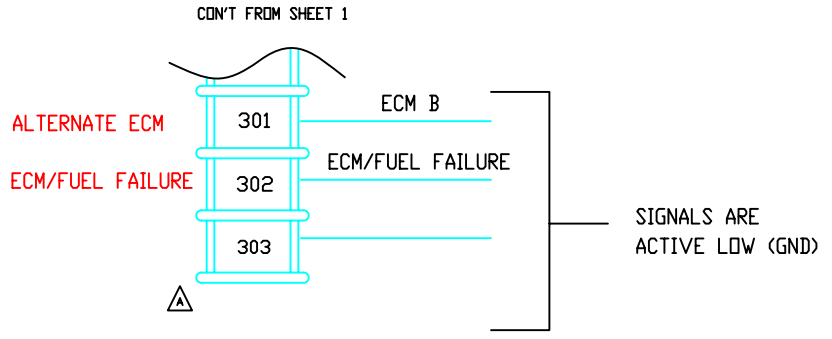
Fire Power
CUMMINS NPOWER CORPORATE OFFICE 1600 BUERKLE ROAD WHITE BEAR LAKE, MN WWW.NPOWER.CUMMINS.COM
CUMMINS FIRE POWER DESIGN CENTER 875 LAWRENCE DRIVE DEPERE, WISCONSIN WWW.CUMMINSFIREPOWER.COM

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 ± 0.125
XX ± 0.030
XXX ± 0.010
APPLY SHEET METAL TOLERANCES
X ± 0.25
XX ± 0.13
XXX ± 0.08

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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

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DRAWING NUMBER:
10423E_SHT3

MODELS:
CFP33-F10
CFP33-F20
CFP33-F30

(AFTER 10/1/2006)

CONTROL PANEL CONNECTOR

1 MPU
2 MPU
3 FSO RELAY (SW B+)
12 FSO SOLENOID (B+)
4 OIL PRES SENDER
5 WATER TEMP SENDER
6 OIL PRES SWITCH
7 WATER TEMP SWITCH
8 CRANK BAT A
10 CRANK BAT B
13 RAW +
17 RAW -
9 ALT EXC (SW B+)
16 BAT A
18 BAT B
14 GND

R
PULL
"AUX"
"POS"
"NEG"
HOLD
NC INTERNALLY SWITCHED
(Energize to Run)
C
A
B
SHOWN IN "LOW OIL PRESS" STATE
(or engine NOT running)
SHOWN IN "NORMAL TEMP" STATE
(or engine NOT running)
CR A
CR B
STARTER SOLENOID
S
STARTER
RAW WATER SOLENOID
NC
(Energize to Open)
BATTERY ISOLATOR
B+
ALT
D
POS
NEG
BAT A
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
APPLY SHEET METAL TOLERANCES
.X ± 0.06
.XX ± 0.03
.XXX ± 0.015

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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_SHT4

CONTROL PANEL
CONNECTOR

MODELS:
CFP33-F25
CFP33-F35
CFP59-F55

1 MPU

2 MPU

3 FSO (SW B+)

TR
"ENERGIZE - TO - STOP"
TIMER RELAY

TR

NO
(Energize to Stop)

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

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 ± 0.030
XX ± 0.010
XXX ± 0.005
APPLY WELDED TOLERANCES
X ± 0.13
XX ± 0.25
XXX ± 0.13

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_SHT5

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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 +

17 RAW -

RAW WATER SOLENOID

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

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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:
10423_SHT6

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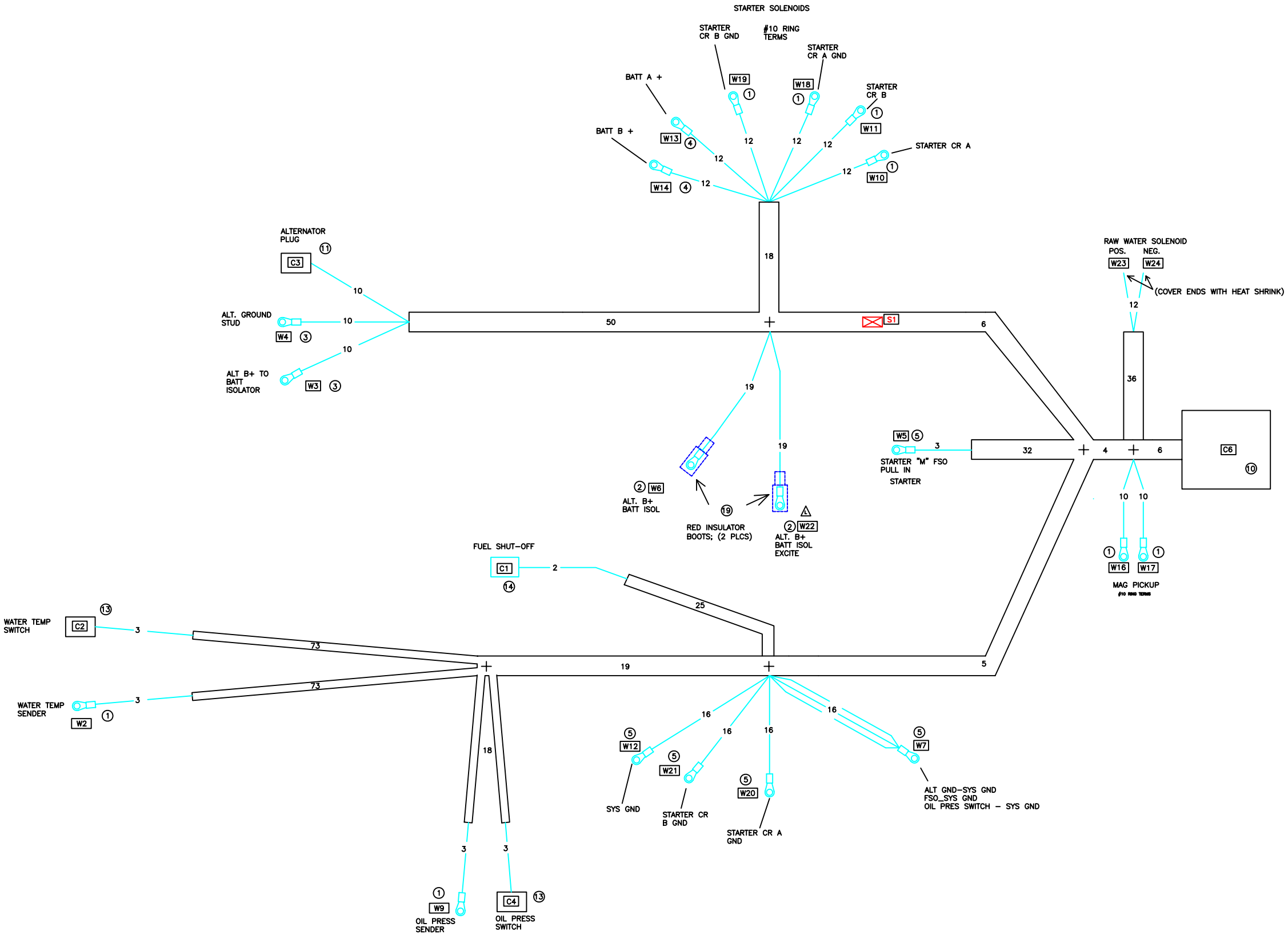
UNLESS OTHERWISE NOTED
ALL DIMENSIONS ARE IN INCHES
FRACTIONS ± 1/64
APPLY MACHINE TOLERANCES
TO ± 0.030
APPLY MACHINE TOLERANCES
X ± 0.03
XX ± 0.010
XXX ± 0.005

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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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 +
K	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
K	W10 & W11 WERE 14 AWG	RJS	29 JUNE 06
J1	Chg's Item 19 p/n; Deleted Item 20	RJS	21 March 05
J	ADDED ITEMS 19 & 20	RJS	4JAN05

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APPLY MACHINE TOLERANCES
X = ± 0.06
.XX = ± 0.010
.XXX = ± 0.001
APPLY WELDED TOLERANCES
X = ± 0.12
.XX = ± 0.12
.XXX = ± 0.06

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

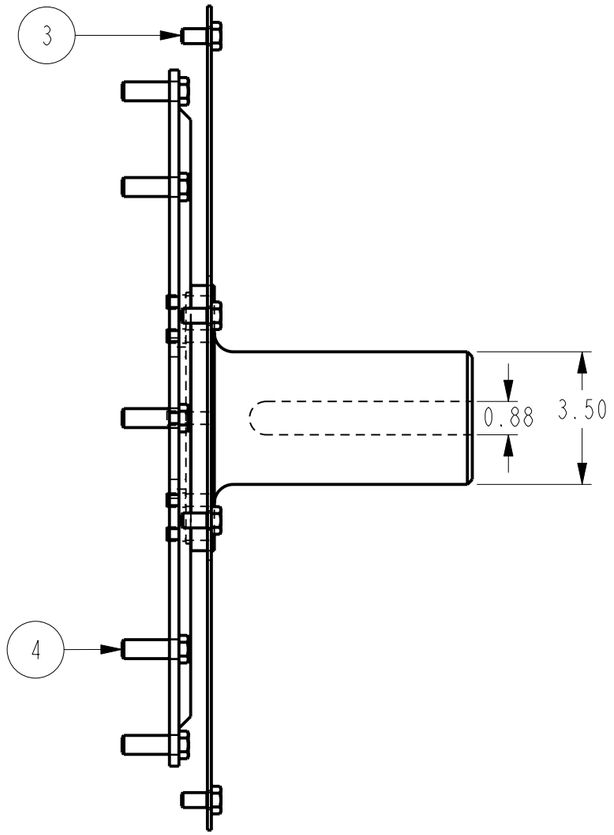
DESCRIPTION: WIRING HARNESS SCHEMATIC

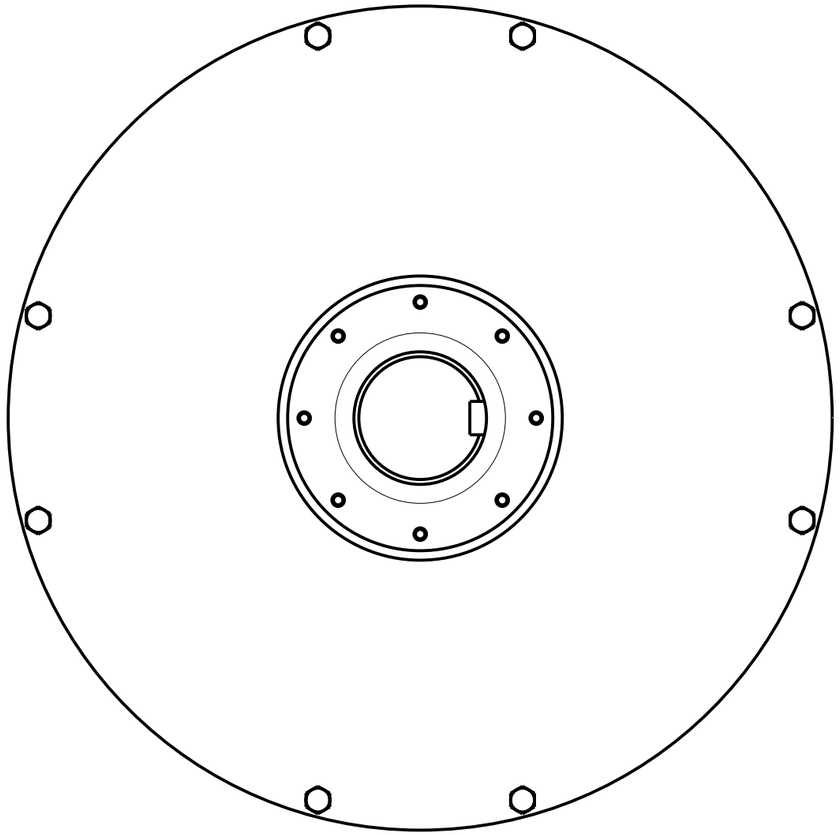
REFERENCE: FIRE PUMP CONTROL PANEL

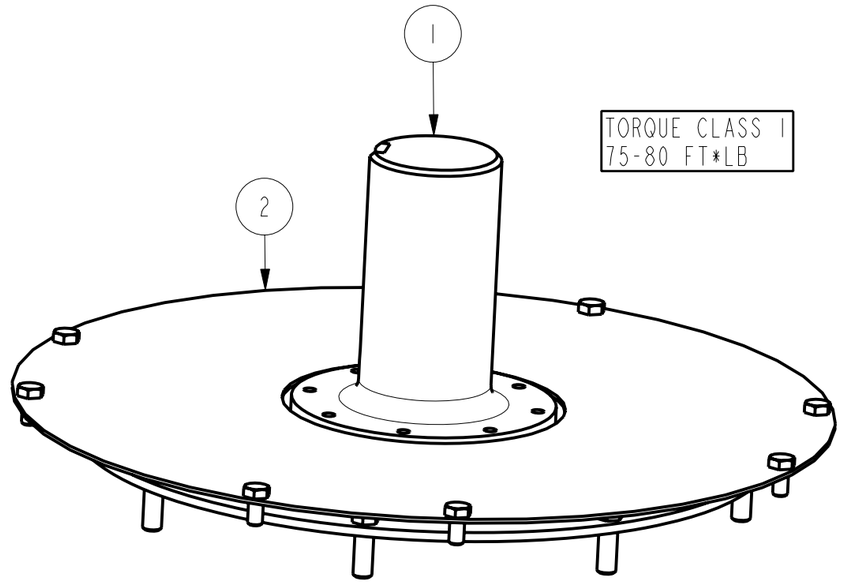
DRAWING NUMBER: 8513SHT2_L

BILL OF MATERIAL

ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	ASSEMBLY, STUB SHAFT, SAE #1, 3.5" DIA	11940
2	1	GUARD, FLYWHEEL, SAE#1, CFP15E	12591
3	8	SCREW, CAP, HEX HEAD, 7/16-14 UNC x 0.75"	HHCS_0437_0075
4	8	SCREW, CAP, HEX HEAD, 1/2-13 UNC X 1.50"	HHCS_0500_0150







REV	DESCRIPTION OF REVISION	REV BY	DATE
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

REF. SCALES

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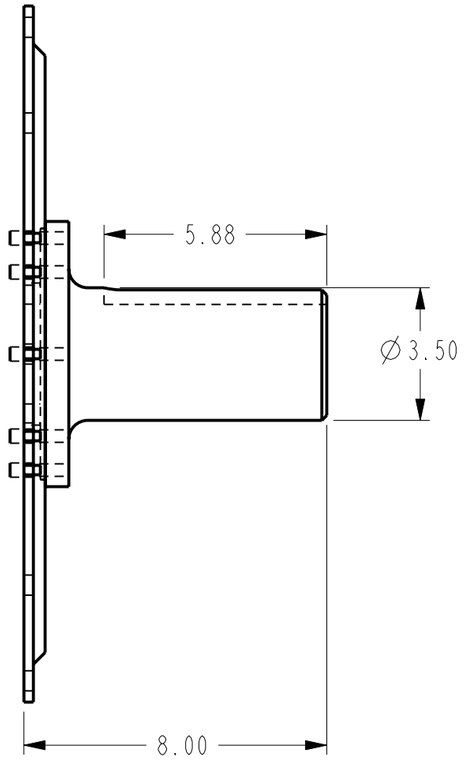
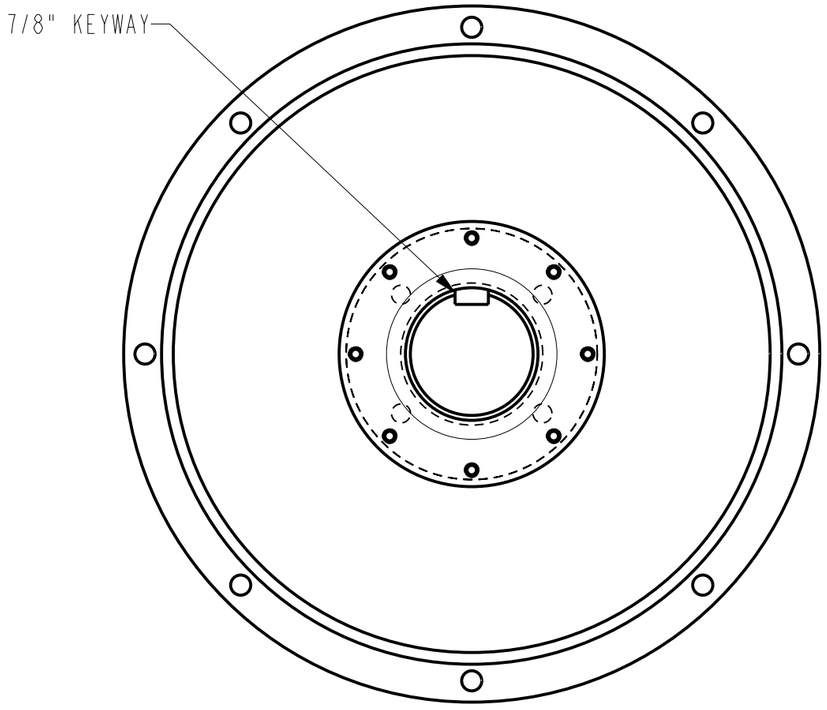
TITLE 1: ASSEMBLY, STUB SHAFT WITH GUARD
TITLE 2: FIREPUMP, CFP15E

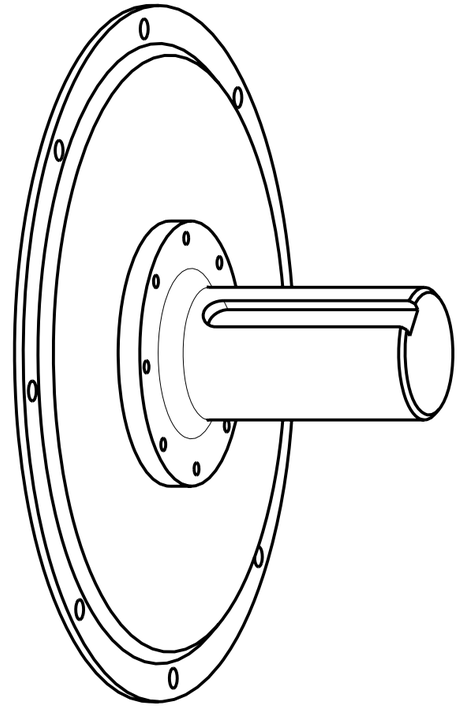
DWG UNITS: IN/LB/S	DRAWN BY: S.DANFORTH				DATE: 17JAN2008
	APPD BY: -				DATE: -
EST WEIGHT: 71.028	SCALE: 0.250	DO NOT SCALE	SHEET 1OF1	DRAWING NO: 12590	REV: _

BILL OF MATERIAL

ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	ADAPTER, U-JOINT, SAE #1, HAYES #127830, FIREPUMP	9842
2	1	STUB SHAFT, HAYES, 128745	11941







REV	DESCRIPTION OF REVISION	REV BY	DATE
A	RELEASE TO PRODUCTION	MJD	01-07-08

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

REF. SCALES

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NPOWER SYSTEMS
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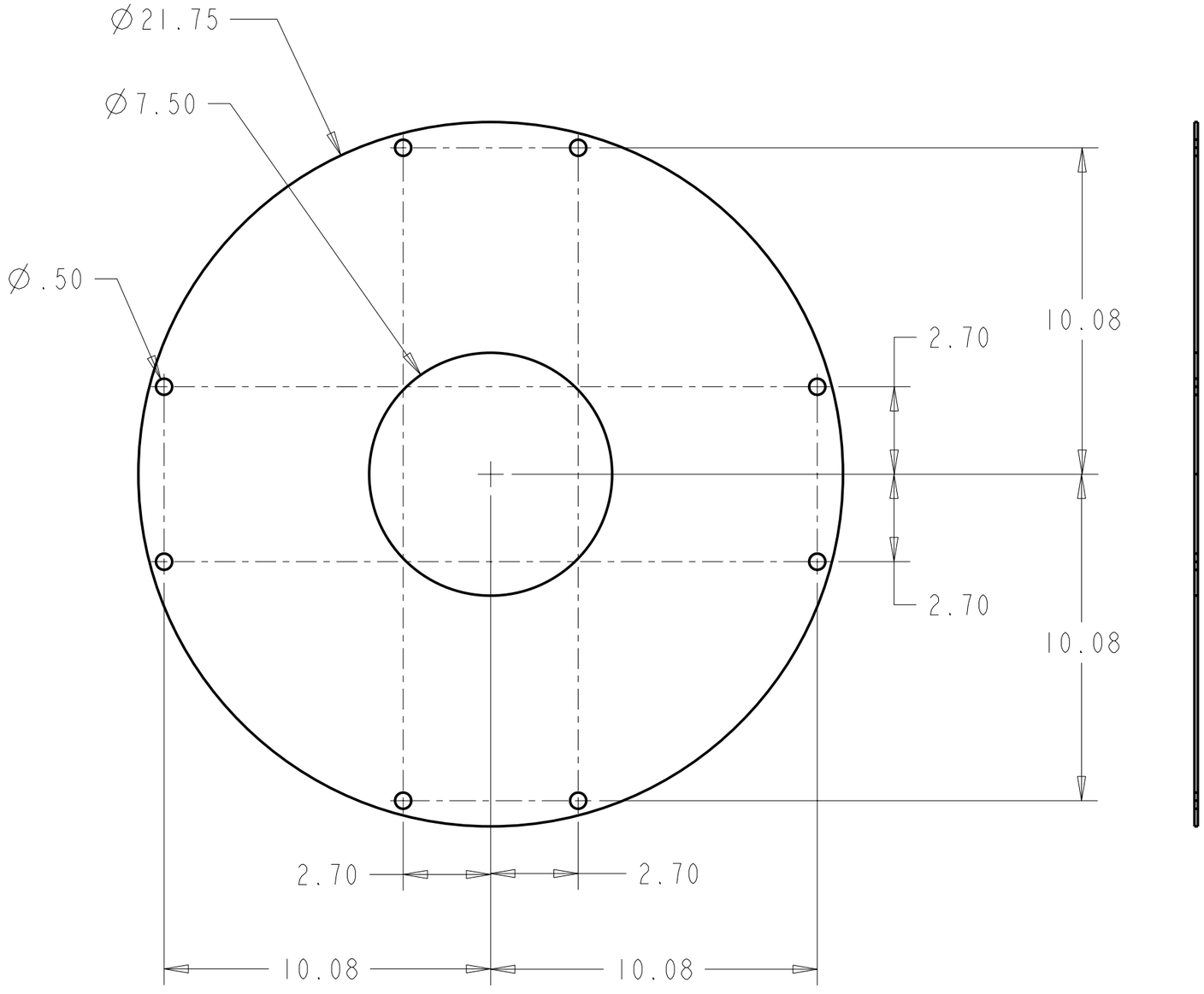
DEPERE, WISCONSIN

TITLE 1: ASSEMBLY, STUB SHAFT
TITLE 2: SAE #1, 3.5" DIA

DWG UNITS: IN/LB/S	DRAWN BY: PBS		DATE: 28-OCT-07
	APPD BY: -		DATE: -
EST WEIGHT: 59.627	SCALE: 0.250	DO NOT SCALE	SHEET 1OF1
DRAWING NO: 11940	REV: A		



NOTES:
1) MATERIAL: 14 GA. HRS
2) ALL BENDS AT MINIMUM BEND RADIUS
3) REMOVE ALL BURS AND SHARP EDGES
4) PRIME AND PAINT FIRE ENGINE RED

REV	DESCRIPTION OF REVISION	REV BY	DATE
A			

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

Fire Power

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WHITE BEAR LAKE, MN
WWW.NPOWER.CUMMINS.COM

NPOWER SYSTEMS
DESIGN CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

TITLE 1: GUARD, FLYWHEEL, SAE#1
TITLE 2: CFP15E

DWG UNITS: IN/LB/S	DRAWN BY: S.DANFORTH		DATE: 17JAN2008
	APPD BY:		DATE:
EST WEIGHT: 9.826	SCALE: 0.250	DO NOT SCALE	SHEET 1OF1
DRAWING NO: 12591	REV: _		

MASS ELASTIC DATA
STIFFNESS K = 0.023 DEG/100 LBFT
INERTIA Wr^2 = 3.05 LBxFT²

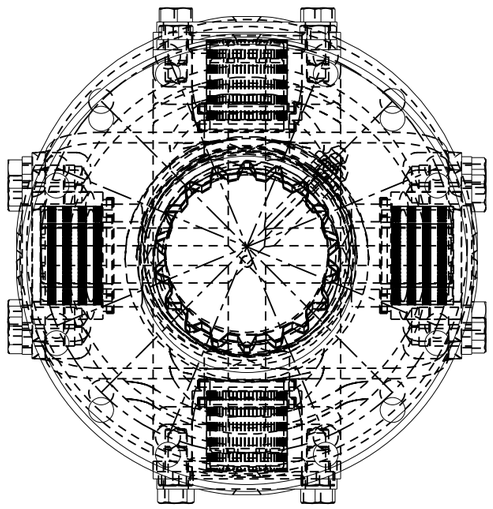
WEIGHT = 78.0 LB

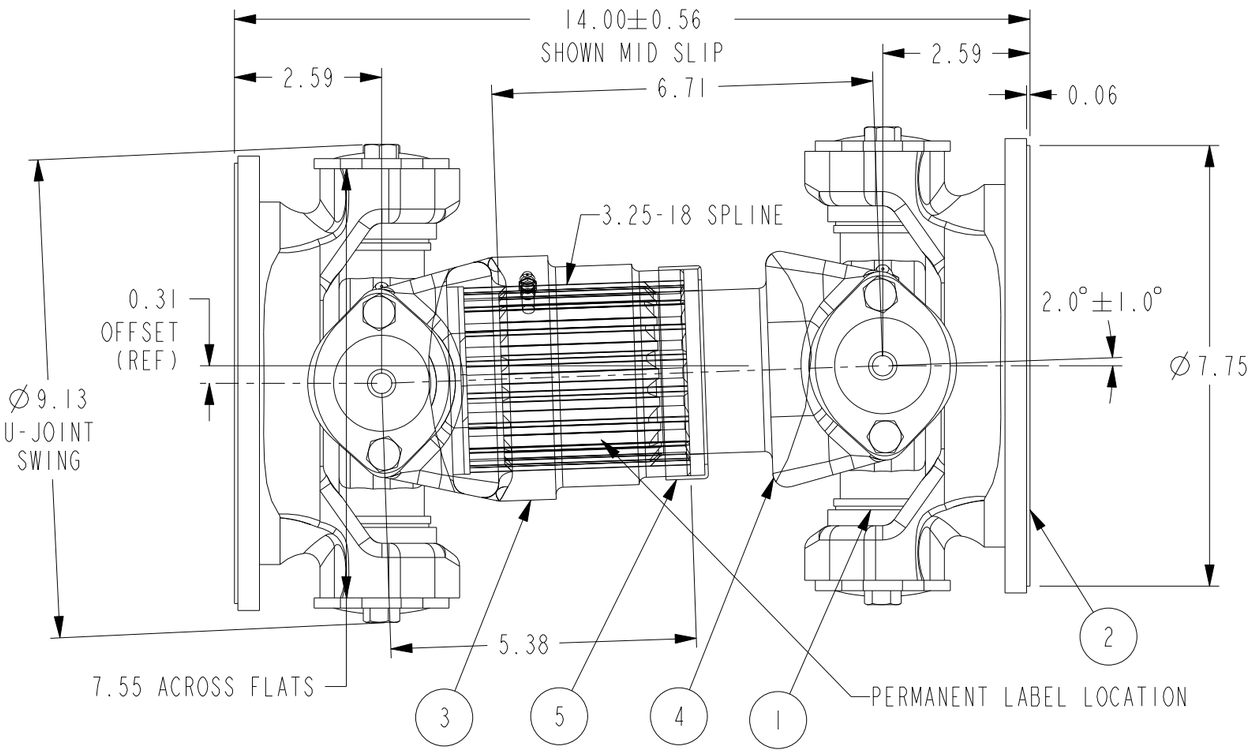
UL LISTED VENDOR P/N 906052-1
ASSEMBLED AND BALANCED
P/N: 311929-001 (NO SERVICEABLE PARTS)

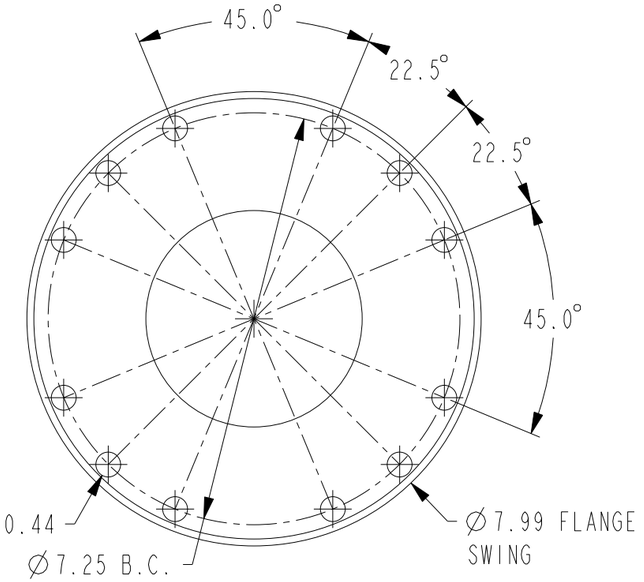
BOLT KIT:
P/N 300-1009 (THRU HOLE)
P/N 300-1010 (TAPPED HOLE)

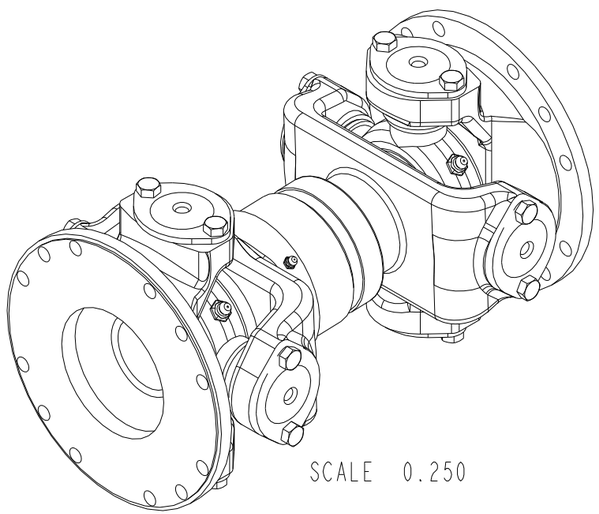
UL LISTED RPM	UL LISTED TORQUE
1470	1525
1760	1525
2100	1525

ITEM	P/N	DESCRIPTION	QTY
1	5-281X	U-JOINT	2
2	6.5-2-359	FLANGE YOKE	2
3	6.5-3-1451KX	SLIP YOKE	1
4	6.5-82-511-1	STUB YOKE	1
5	D6E	DUST CAP	1



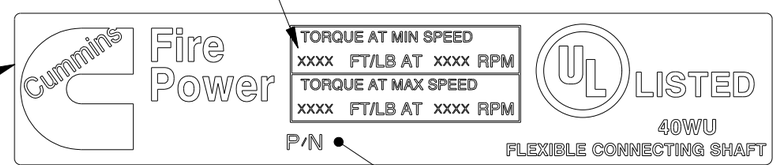






SCALE 0.250

CFP#14346 LABEL PROVIDED WITH:
MFG-P/N-DATE CODE, MAX
VALUE, AND SERIAL NUMBER
(APPLIED BY SHAFT VENDOR)



SCALE 2.000

REV		DESCRIPTION OF REVISION	REV BY	DATE
B	2009-090	ADDED DIMS. REV CHART	DAVE N	25MAR2009
A	2009-006	REV PER TITLE BLOCK. ADDED P/N	DAVE N	03FEB2009

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

DRIVESHAFT, 1810, SHORT COUPLED
UL LISTED FOR FIREPUMP SERVICE

DWG UNITS:
DRAWN BY: GVD
DATE: 19AUG2008
PRO-ENGINEER
REF DRWG:
SCALE: 0.375
EST WEIGHT: 78.000
SHEET 1 OF 1
DRAWING NO: 13422

MASS ELASTIC DATA
STIFFNESS K = 0.028 DEG/100 LBFT
INERTIA Wr^2 = 1.642 LBxFT^2

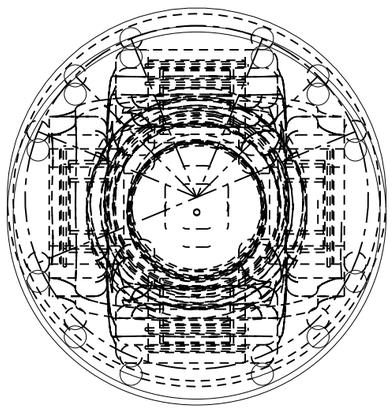
WEIGHT = 74.0 LB

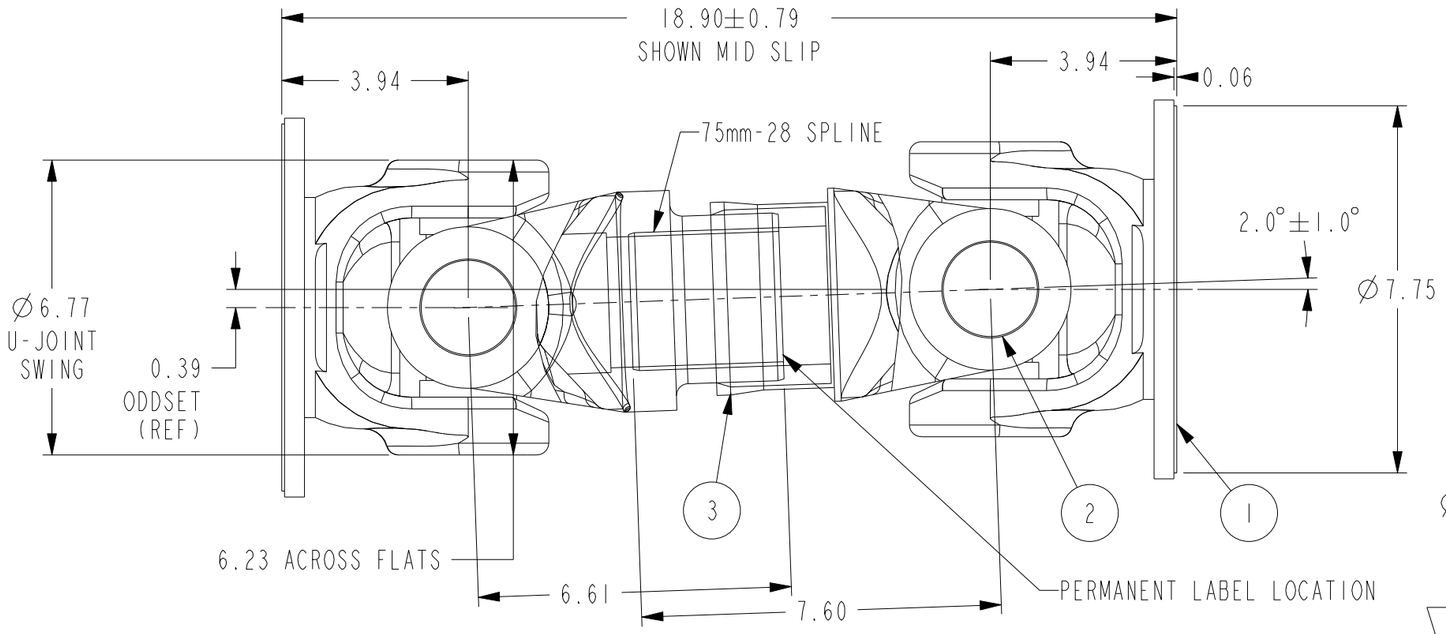
UL LISTED VENDOR P/N 12-003581I (B)
ASSEMBLED AND BALANCED
P/N: 311959-001 (NO SERVICEABLE PARTS)

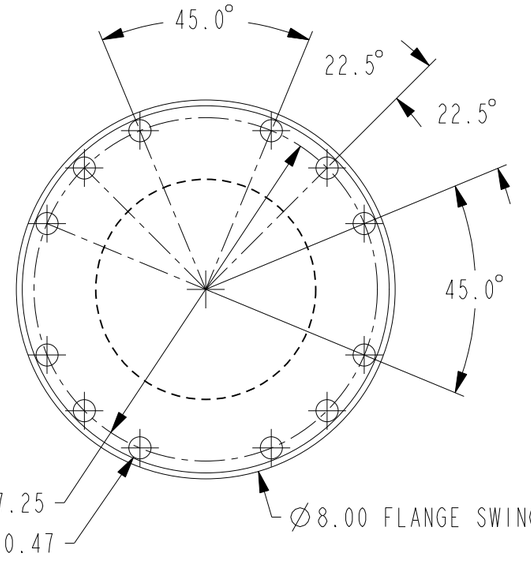
BOLT KIT:
P/N 300-1009 (THRU HOLE)
P/N 300-1010 (TAPPED HOLE)

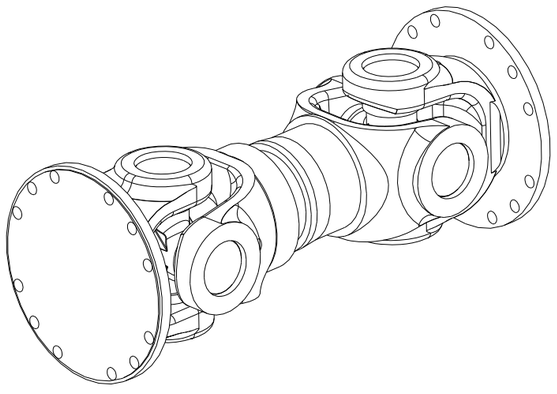
UL LISTED RPM	UL LISTED TORQUE
1470	2200
1800	2163

ITEM	P/N	DESCRIPTION	QTY
1	1109-90196	FLANGE YOKE	2
2	1116-90117	U-JOINT	2
3	1105-90434	CENTER SECTION	1
4			
5			





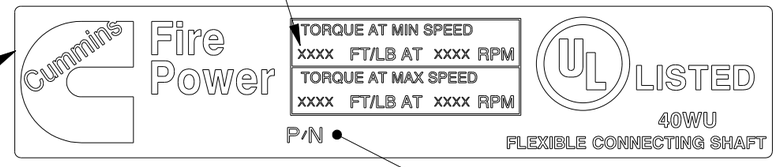




SCALE 0.188

XXXX = VALUES PER CHART
(4) PLACES

CFP#14346 LABEL PROVIDED WITH:
MFG-P/N-DATE CODE, CHART
VALUES, AND SERIAL NUMBER
(APPLIED BY SHAFT VENDOR)



SCALE 2.000

REV	ENF	DESCRIPTION OF REVISION	REV BY	DATE
B	2009-090	REV P/N. ADDED DIMS. RFEV CHART	DAVE N	25MAR2009
A	2009-006	REV PER TITLE BLOCK. ADDED P/N	DAVE N	03FEB2009

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 .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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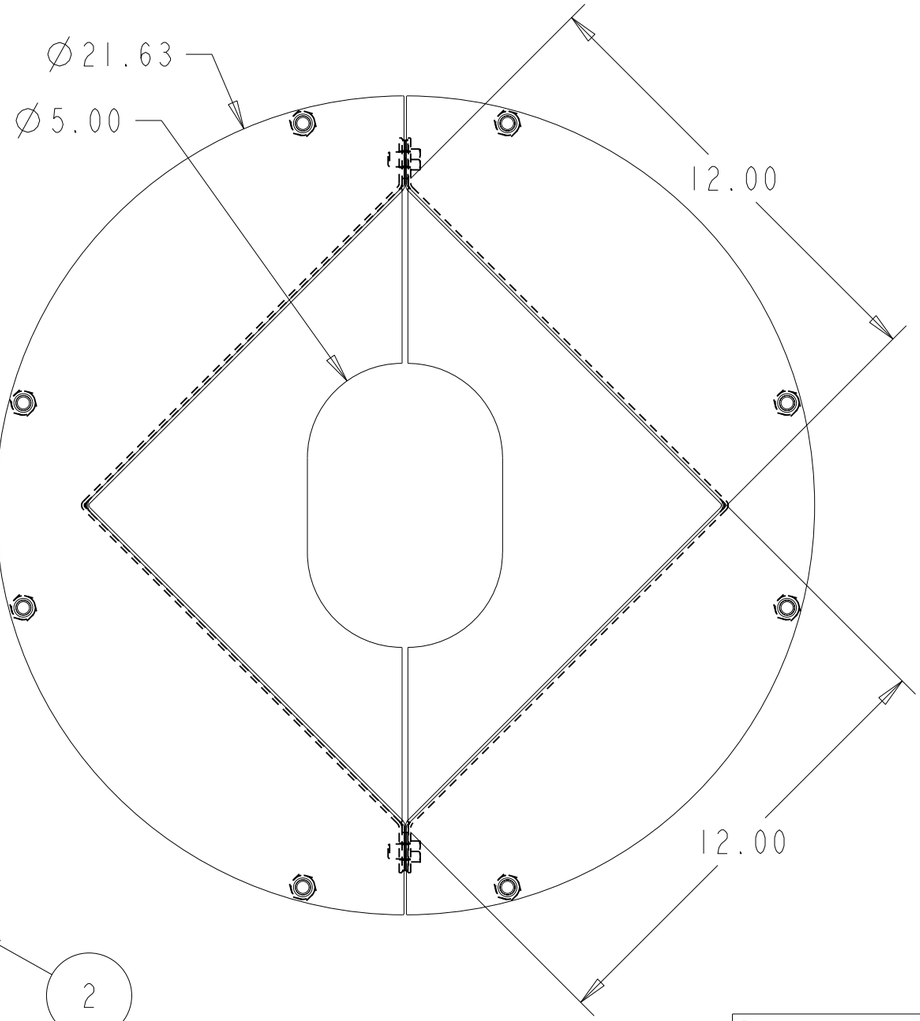
CUSTOM DESIGN
AND UPFIT CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

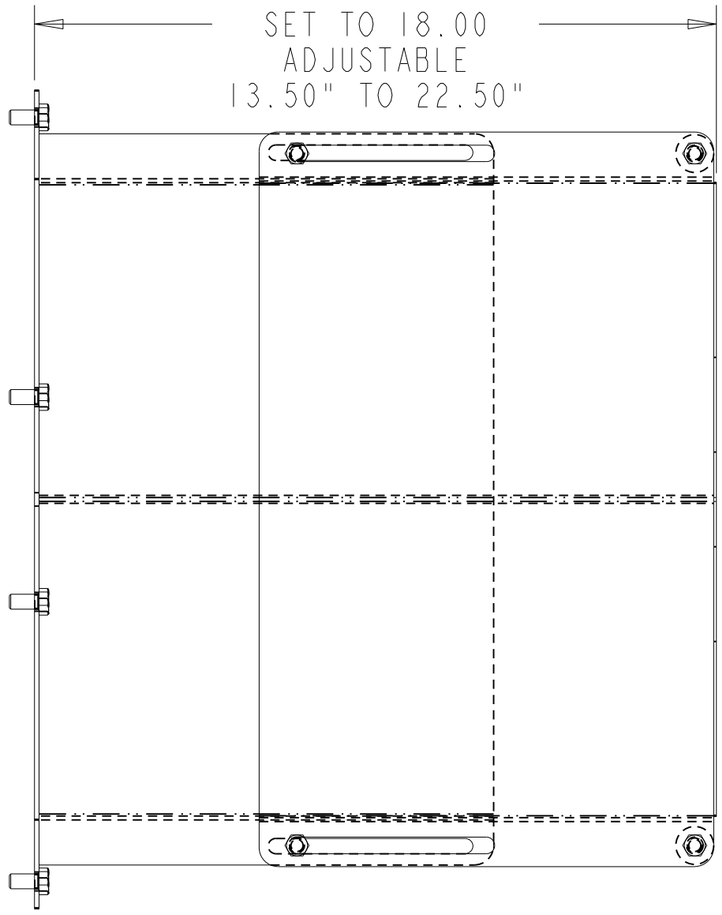
SHAFT, U3172, SHORT COUPLED
UL LISTED FOR FIREPUMP SERVICE

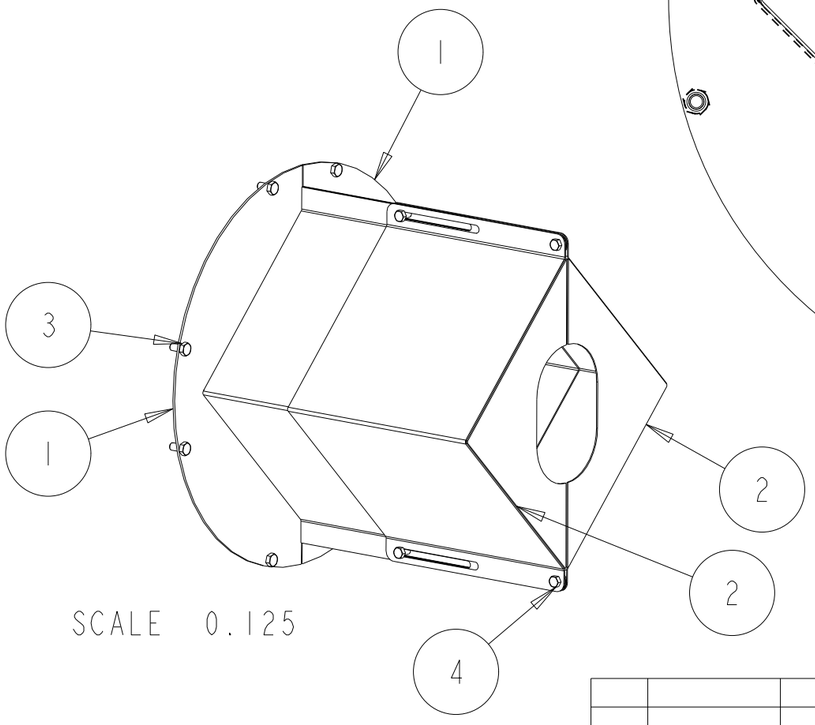
DWG UNITS:	DRAWN BY: GVD	DATE: 19AUG2008
	PRO-ENGINEER	REF DRWG:
SCALE: 0.313	SHEET 1 OF 1	DRAWING NO: 13430
EST WEIGHT: 74.000		

BILL OF MATERIAL

ITEM	QTY	DESCRIPTION	PART NUMBER
1	2	WELDMENT, SPLIT BACK PLATE, SHAFT GUARD, TELESCOPING, SIZE 1-X, SHORT COUPLED SH	14238
2	2	COVER, TELESCOPING, SHAFT GUARD, FIREPUMP SIZE X	14148
3	8	SCREW, CAP, HEX HEAD, M10 x 20	HHCS_M10_20
4	4	SCREW, CAP, HEX HEAD, M8 x 20	HHCS_M8_20







SCALE 0.125

REV	ENF	DESCRIPTION OF REVISION	REV BY	DATE

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1°

THIRD ANGLE PROJECTION

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

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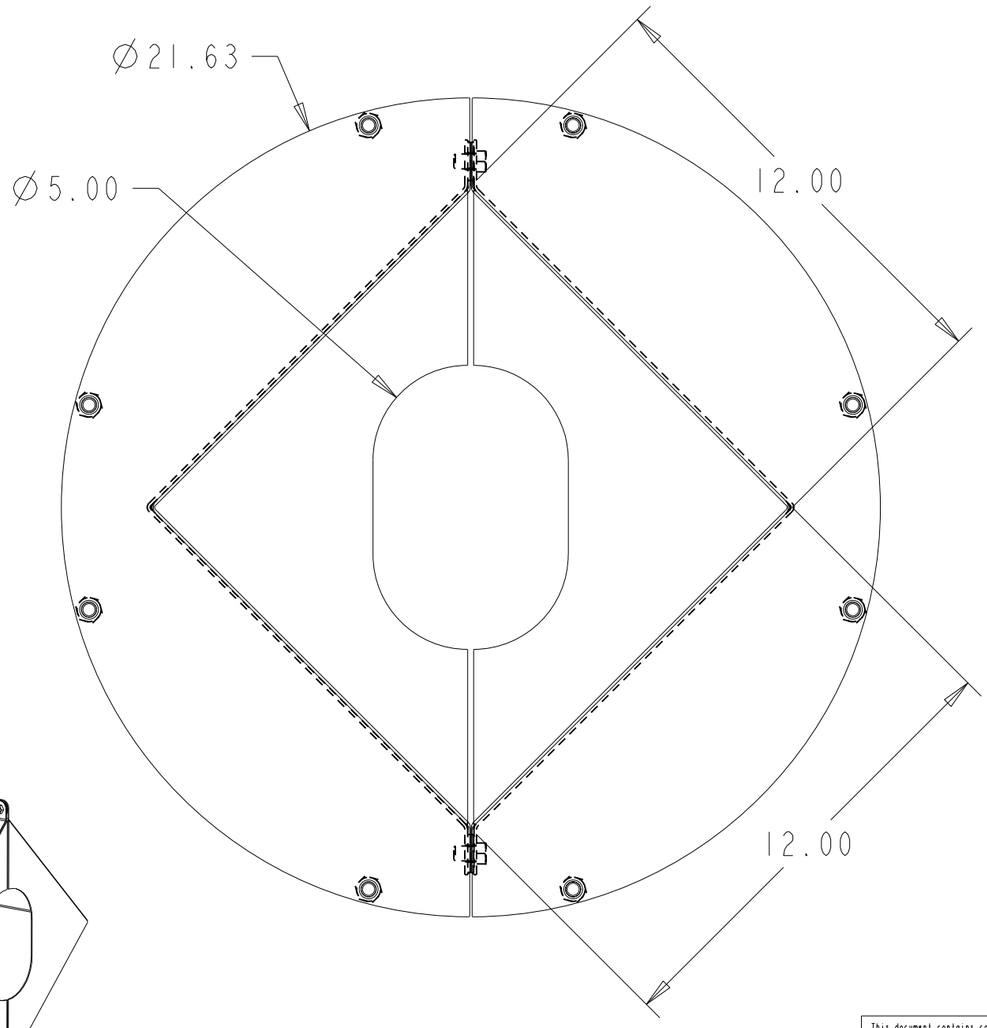
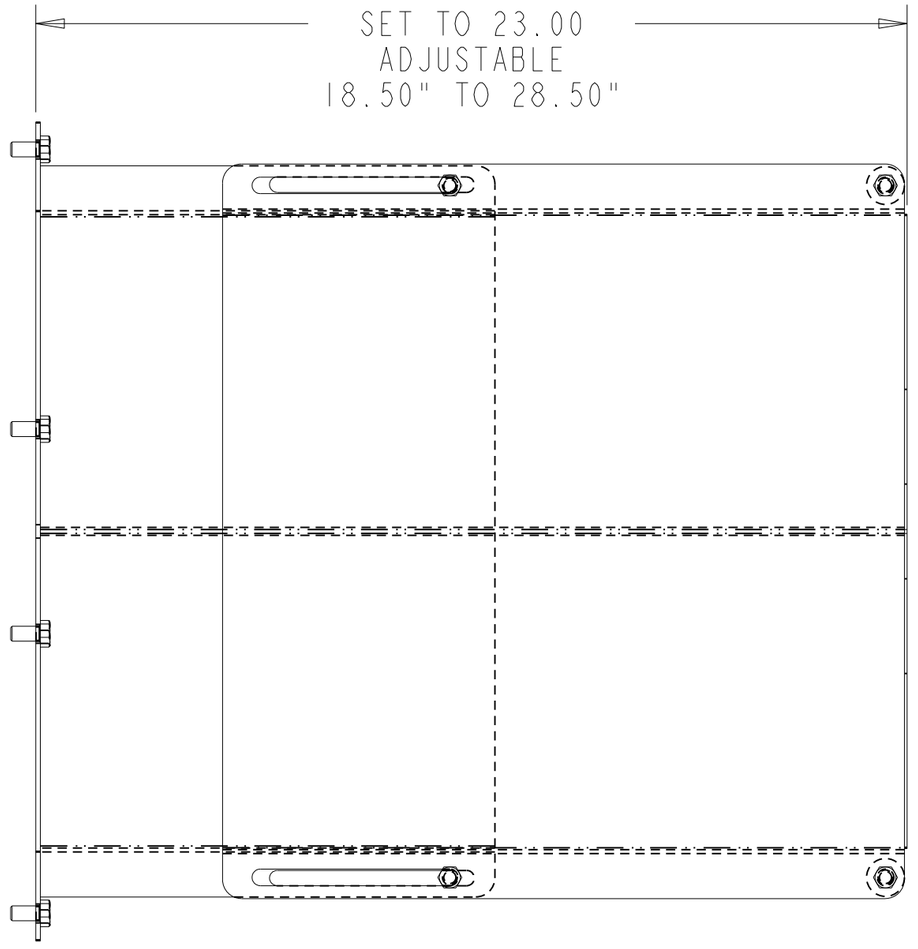
CUSTOM DESIGN
AND UPFIT CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

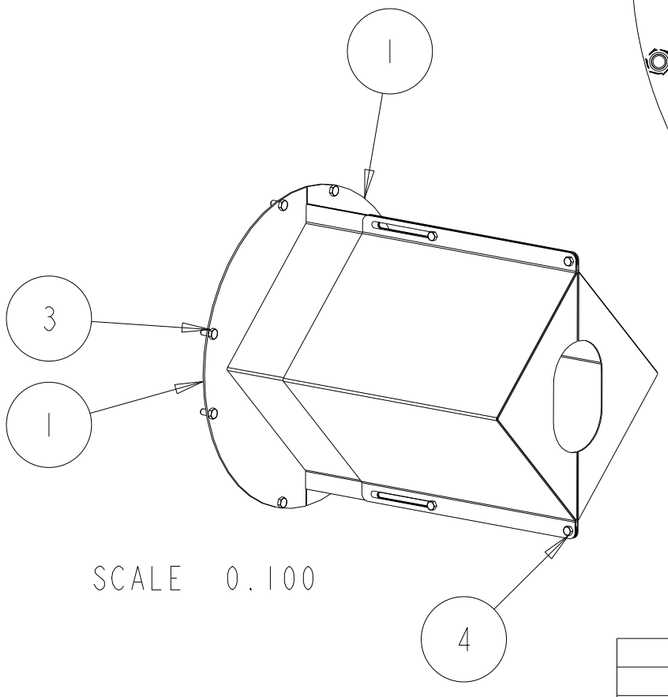
ASSEMBLY, SHAFT GUARD, TELESCOPING, SIZE 1-XL SHORT COUPLED SHAFT

DWG UNITS: IN/LB/S	DRAWN BY: DAVE N	DATE: 11DEC2008
	PRO-ENGINEER	REF DRWG:
SCALE: 0.250	SHEET 1 OF 1	DRAWING NO: 14161
EST WEIGHT: 28.276		

BILL OF MATERIAL			
ITEM	QTY	DESCRIPTION	PART NUMBER
1	2	WELDMENT, SPLIT BACK PLATE, SHAFT GUARD, TELESCOPING, SIZE 1-XL, SHORT COUPLED S	14238
2	2	COVER, TELESCOPING, SHAFT GUARD, FIREPUMP SIZE XL	14237
3	8	SCREW, CAP, HEX HEAD, M10 x 20	HHCS_M10_20
4	4	SCREW, CAP, HEX HEAD, M8 x 20	HHCS_M8_20







SCALE 0.100

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

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CUSTOM DESIGN
AND UPFIT CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

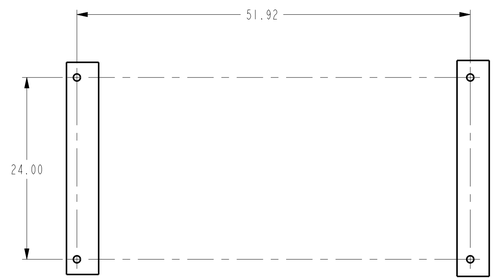
ASSEMBLY, SHAFT GUARD, TELESCOPING, SIZE 1-XL SHORT COUPLED SHAFT

DWG UNITS: IN/LB/S	DRAWN BY: DAVE N	DATE: 11DEC2008
	PRO-ENGINEER	REF DRWG:
SCALE: 0.250	SHEET 1 OF 1	DRAWING NO: DRAWING NO: 14156
EST WEIGHT: 28.276		

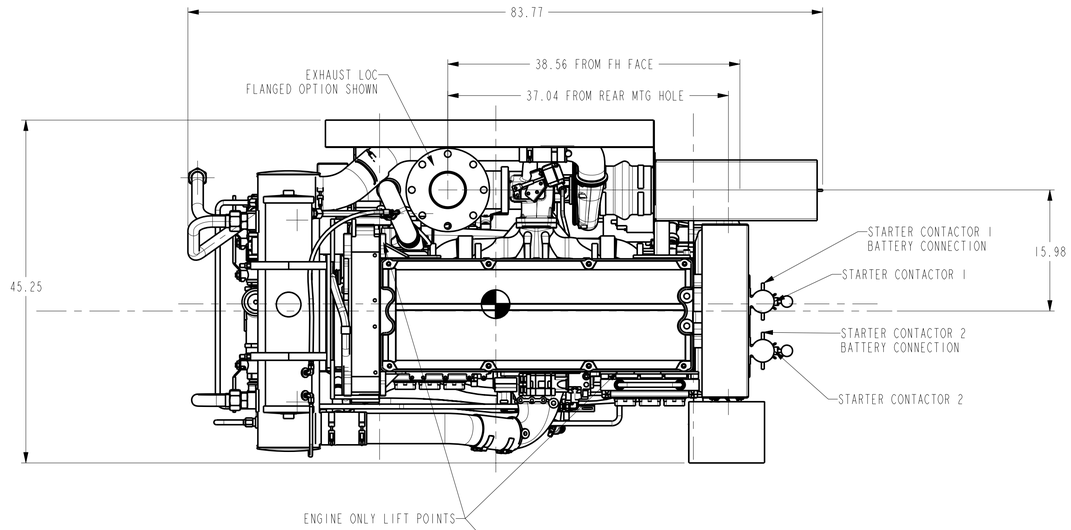
CFP15E CONNECTION INFORMATION

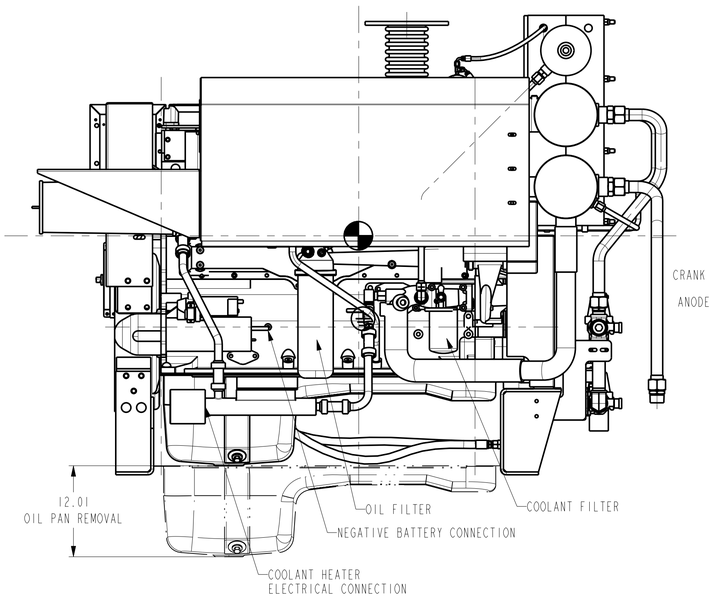
SAE #1	FLYWHEEL HOUSING
3/4" NPT	FUEL INLET
3/4" NPT	FUEL OUTLET
1 1/4" NPT	RAW WATER INLET
1 1/2" NPT	RAW WATER DISCHARGE
120 / 240 VAC	COOLANT HEATER (3000WATTS)
6" DIA NPT, CUFF, OR FLANGE	EXHAUST CONNECTION
OPTIONAL DRIVESHAFT	8.5C WING BEARING TYPE
OPTIONAL STUB SHAFT	3.5" DIAMETER (88.9MM)

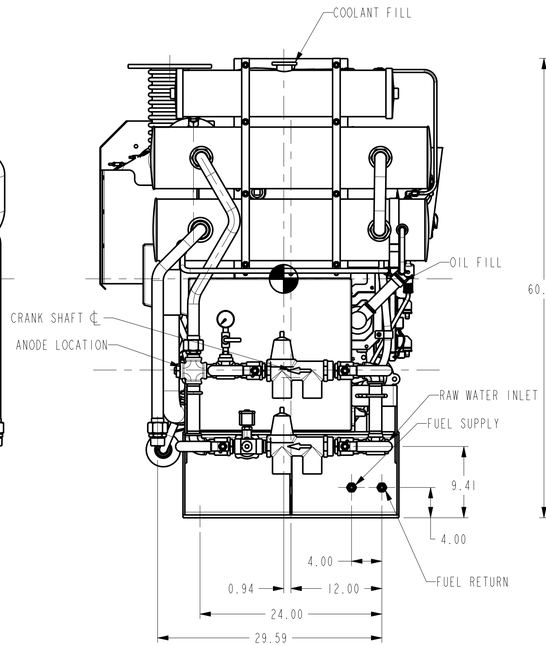
NOTES:
1. ALL PLUMBING MUST BE SUPPORTED AND/OR ISOLATED SO THAT NO WEIGHT OR STRESS IS APPLIED TO ANY ENGINE COMPONENT.
2. REFER TO ENGINE DATA SHEET FOR CUSTOMER CONNECTION RECOMMENDATIONS.
3. DO NOT SCALE DRAWING.
4. DRAWING SUBJECT TO CHANGE WITH OUT NOTICE.

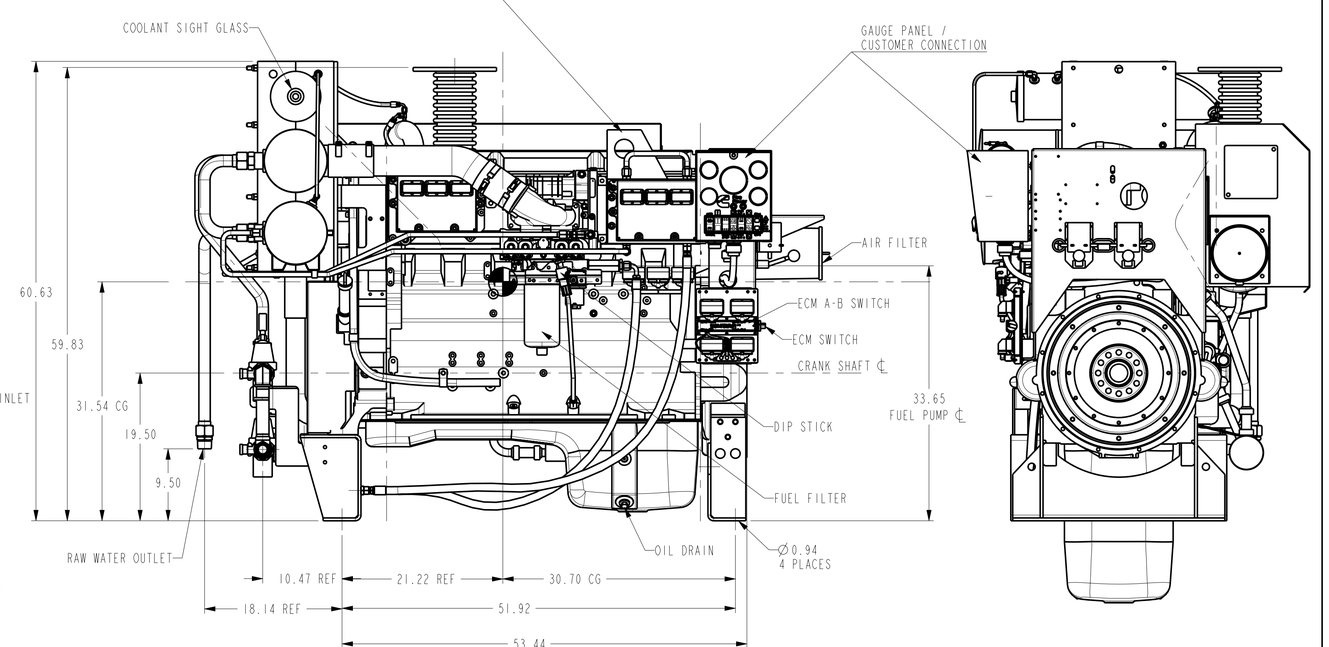


ENGINE FOOT PRINT









ENGINE ONLY DETAILS FOR CFP15E-F10 THRU F40
SEE SHEET 2 FOR CFP15E-F50 THRU F70.
CHANGES TO CFP5E-F50-70 INCLUDE TALLER
EXHAUST BELLOWS, HIGH MOUNTED AIR FILTER
AND LARGER OIL SUMP

REV	DESCRIPTION OF REVISION	REV BY	DATE
B	DRAWING UPDATES	S DUBICK	02/18/08

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

REF. SCALES

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NPOWER SYSTEMS
DESIGN CENTER
815 LAWRENCE DRIVE
DEPERE, WISCONSIN

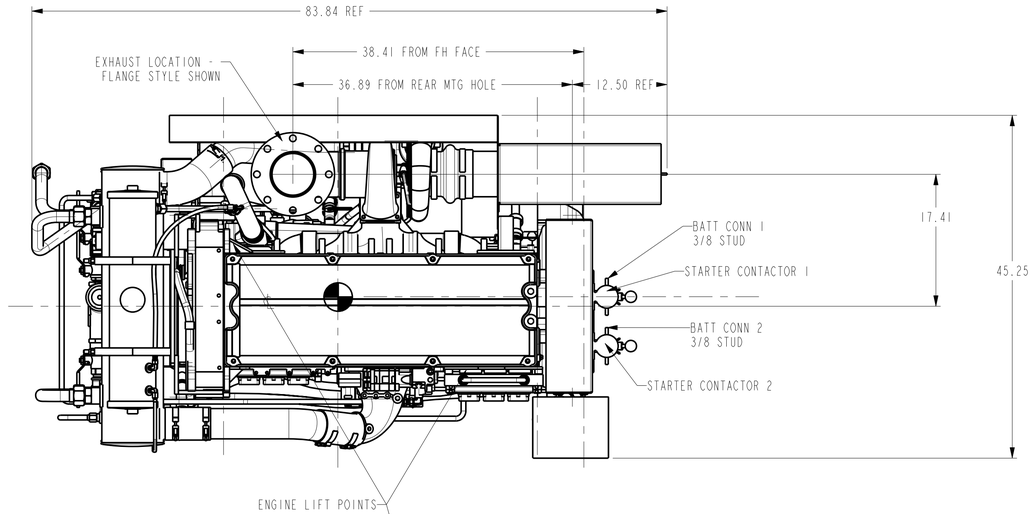
TITLE 1: GENERAL ARRANGMENT, INSTALLATION
TITLE 2: CFP15E F10 - F40 AND F50 - F70

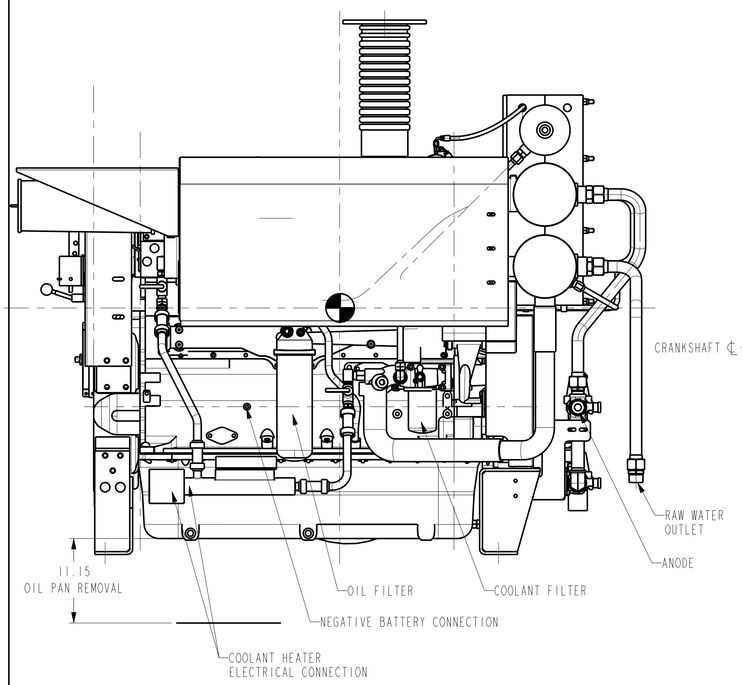
DWG UNITS: IN/LB/S	DRAWN BY: S. DANFORTH		DATE: -		
	APPD BY: -		DATE: -		
EST WEIGHT: VARIES	SCALE: 0.100	DO NOT SCALE	SHEET 1OF6	DRAWING NO: 11656	REV: B

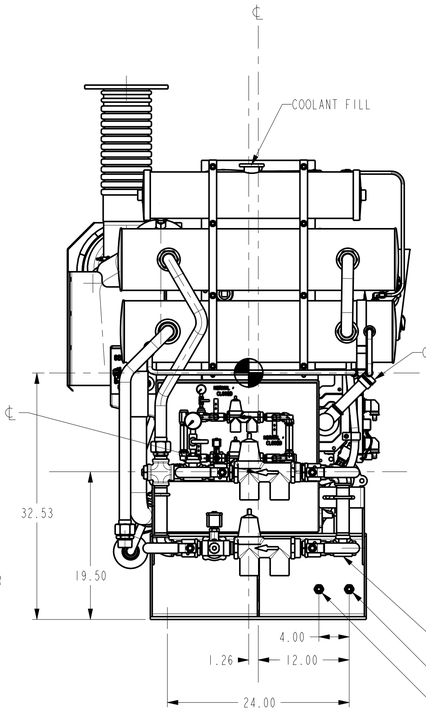
CFP15E CONNECTION INFORMATION

SAE #1	FLYWHEEL HOUSING
3/4" NPT	FUEL INLET
3/4" NPT	FUEL OUTLET
1 1/4" NPT	RAW WATER INLET
1 1/2" NPT	RAW WATER DISCHARGE
120 / 240 VAC	COOLANT HEATER (3000WATTS)
6" DIA NPT, CUFF, OR FLANGE	EXHAUST CONNECTION
OPTIONAL DRIVESHAFT	8.5C WING BEARING TYPE
OPTIONAL STUB SHAFT	3.5" DIAMETER (88.9MM)

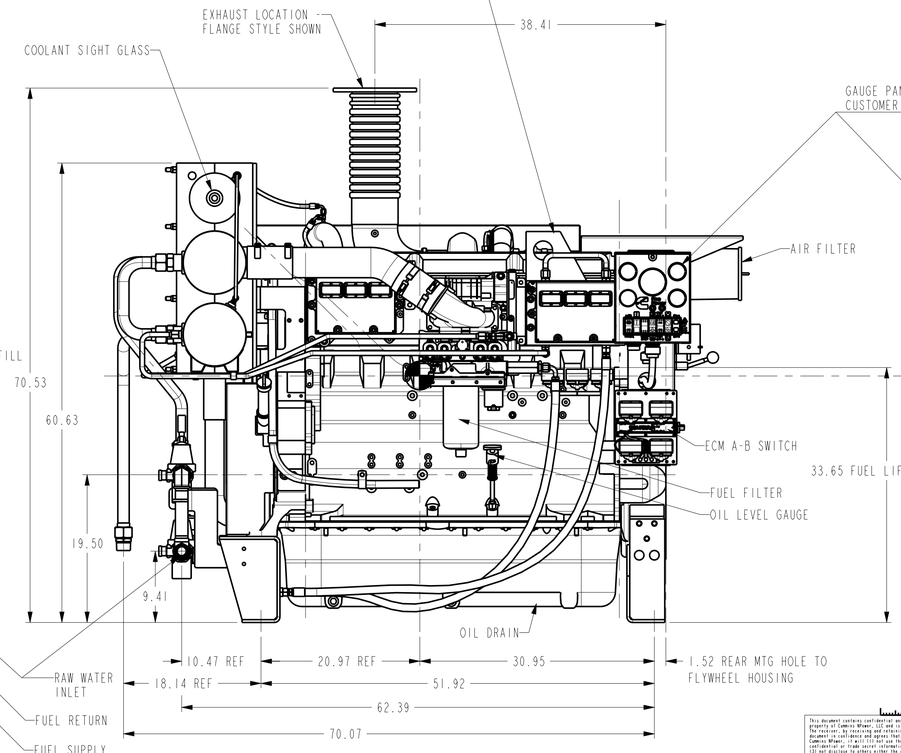
NOTES:
1. ALL PLUMBING MUST BE SUPPORTED AND/OR ISOLATED SO THAT NO WEIGHT OR STRESS IS APPLIED TO ANY ENGINE COMPONENT.
2. REFER TO ENGINE DATA SHEET FOR CUSTOMER CONNECTION RECOMMENDATIONS.
3. DO NOT SCALE DRAWING.
4. DRAWING SUBJECT TO CHANGE WITH OUT NOTICE.

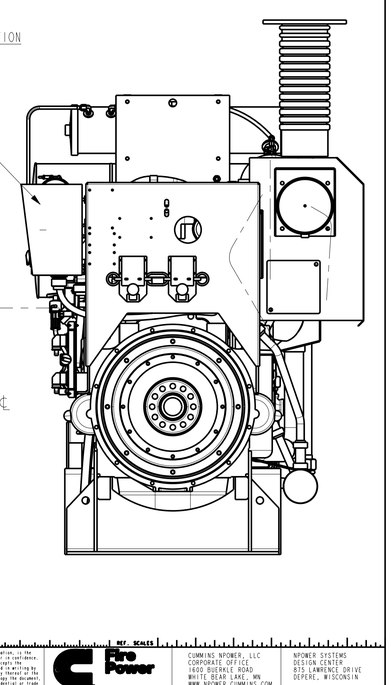






ENGINE ONLY DETAILS FOR CFP15E-F50 THRU F70
SEE SHEET 1 FOR CFP15E-F10 THRU F40.
CHANGES TO CFP5E-F50-70 INCLUDE TALLER EXHAUST BELLOWS, HIGH MOUNTED AIR FILTER AND LARGER CAPACITY OIL SUMP





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

REV	DESCRIPTION OF REVISION	REV BY	DATE
B	DRAWING UPDATES	S DUBICK	02/18/08

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NPOWER SYSTEMS
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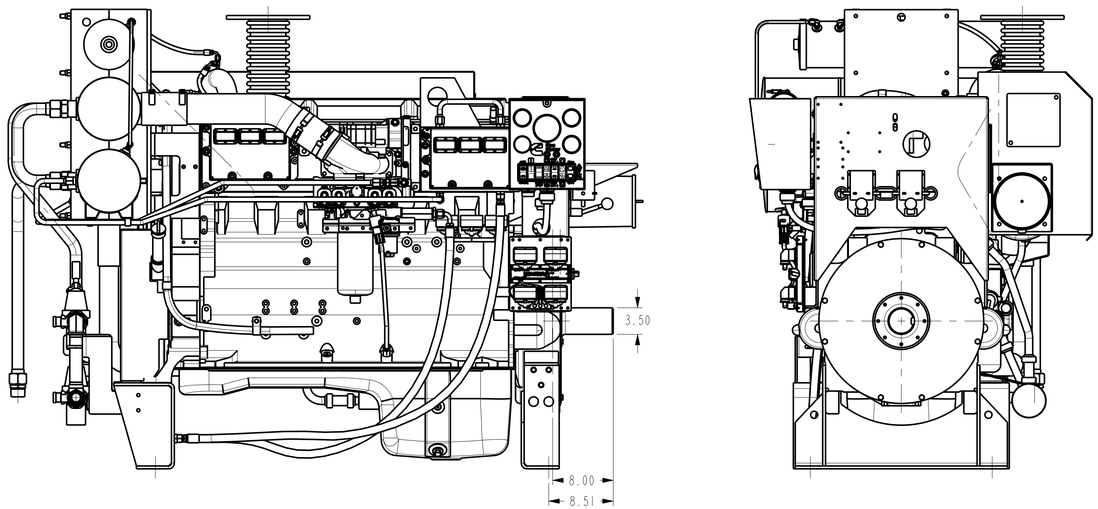
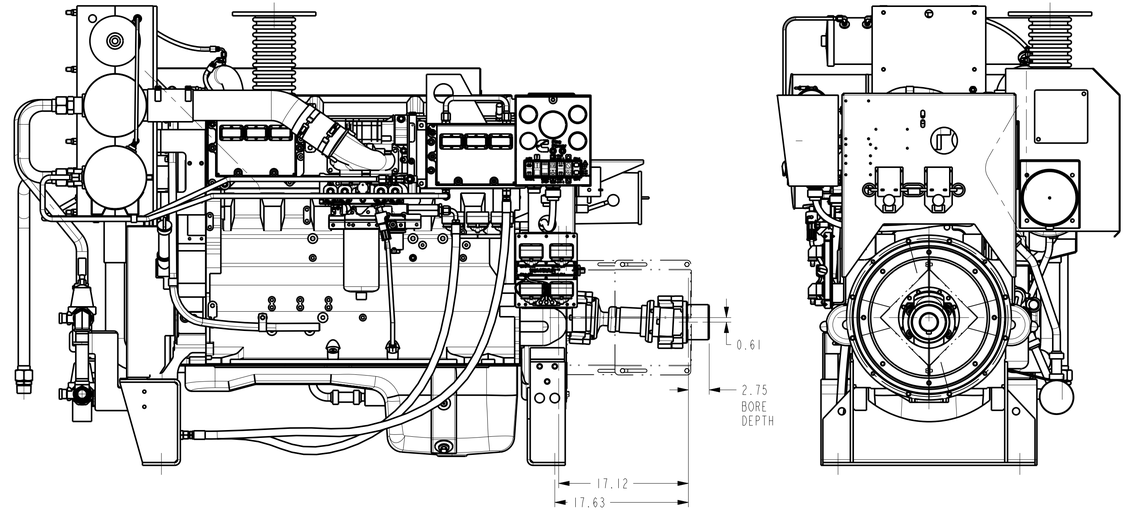
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

TITLE 1: GENERAL ARRANGMENT, INSTALLATION
TITLE 2: CFP15E F10 - F40 AND F50 - F70

DWG UNITS: IN/LB/S	DRAWN BY: S. DANFORTH		DATE: -
	APPD BY: -		DATE: -
EST WEIGHT: VARIES	SCALE: 0.100	DO NOT SCALE	SHEET 2OF6
	DRAWING NO: 11656		REV: B

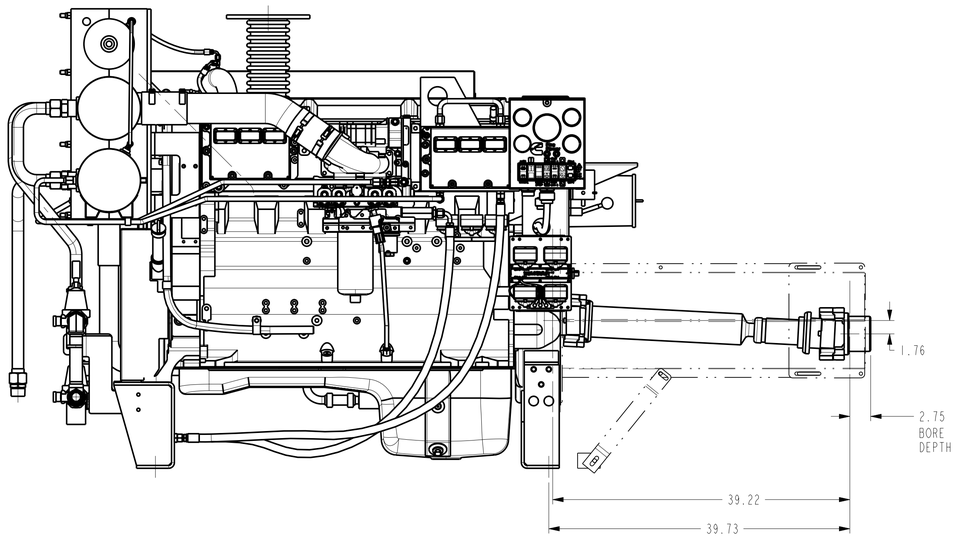


STANDARD STUB SHAFT SHOWN



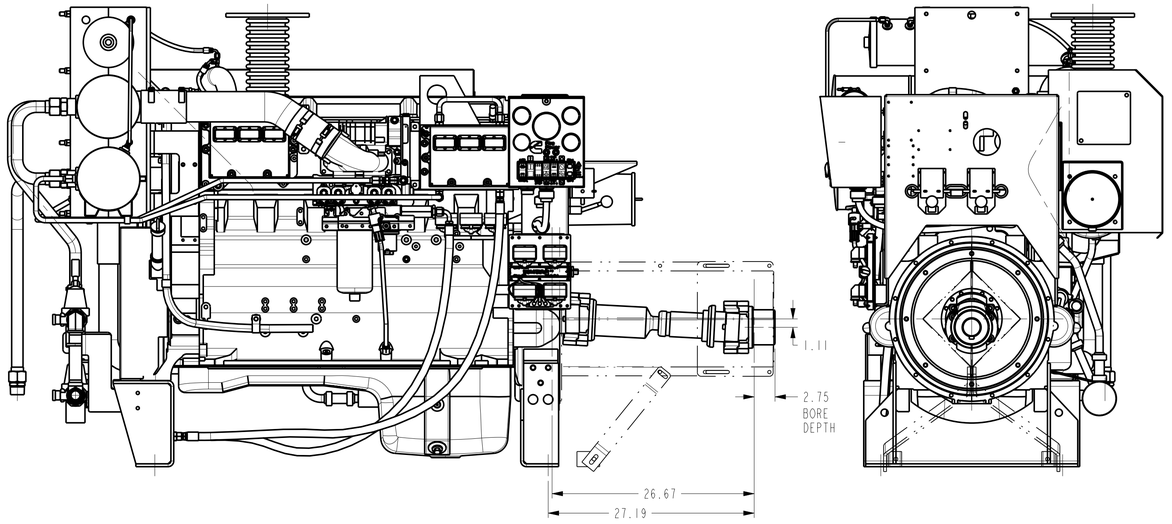
STANDARD SC DRIVESHAFT SHOWN

3.0° MAX., 1.0° MIN.



STANDARD 36" DRIVESHAFT SHOWN

3.0° MAX., 1.0° MIN.



STANDARD 24" DRIVESHAFT SHOWN

3.0° MAX., 1.0° MIN.

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1°

IMPERIAL UNITS: MACHINE TOLERANCES .XX = ± 0.02; FOR TOLERANCES .XXX = ± 0.005; FOR TOLERANCES .XXXX = ± 0.0050

METRIC UNITS: MACHINE TOLERANCES X = ± 0.5; FOR TOLERANCES X.X = ± 0.25; FOR TOLERANCES X.XX = ± 0.25

THIRD ANGLE PROJECTION

REV	DESCRIPTION OF REVISION	REV BY	DATE
B	DRAWING UPDATES	S DUBICK	02/18/08

REF. SCALES

CUMMINS NPOWER, LLC
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WWW.NPOWER.CUMMINS.COM

NPOWER SYSTEMS
DESIGN CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

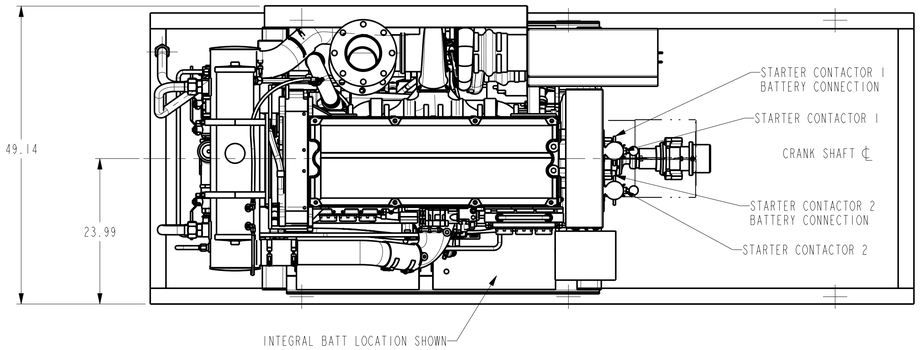
TITLE 1: GENERAL ARRANGMENT, INSTALLATION
TITLE 2: CFPI5E F10 - F40 AND F50 - F70

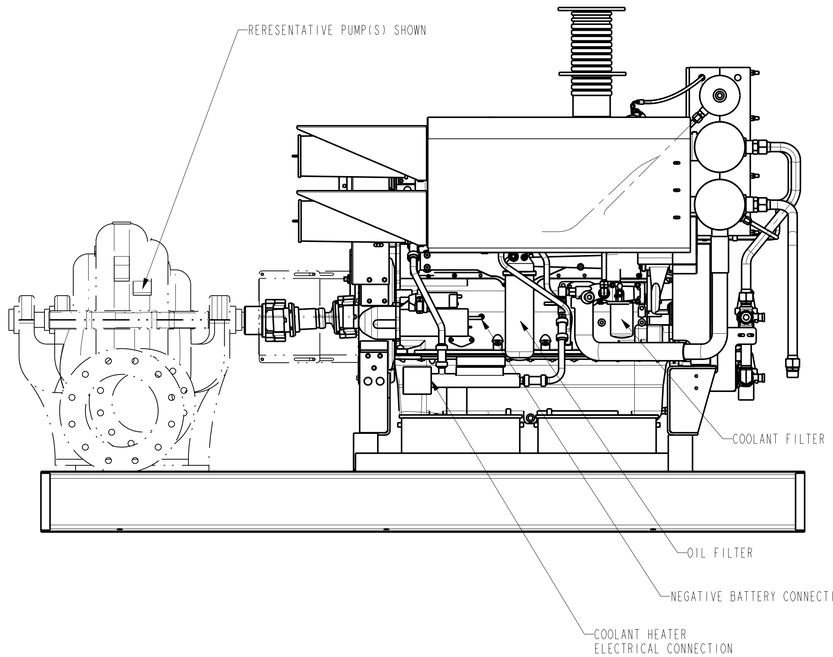
DWG UNITS: IN/LB/S	DRAWN BY: S. DANFORTH		DATE: -		
	APPD BY: -		DATE: -		
EST WEIGHT: VARIES	SCALE: 0.100	DO NOT SCALE	SHEET 30F6	DRAWING NO: 11656	REV: B

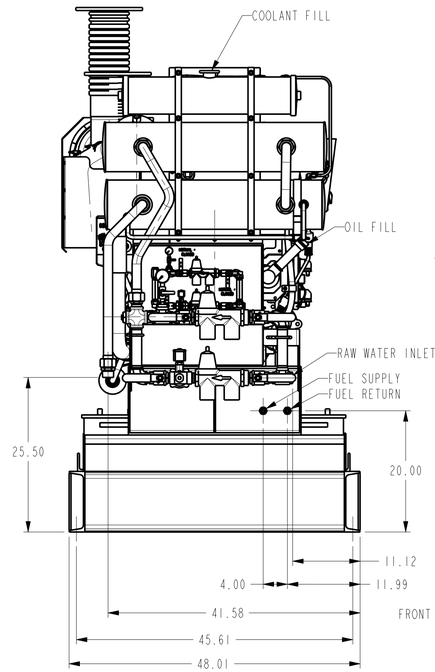
CFP15E CONNECTION INFORMATION

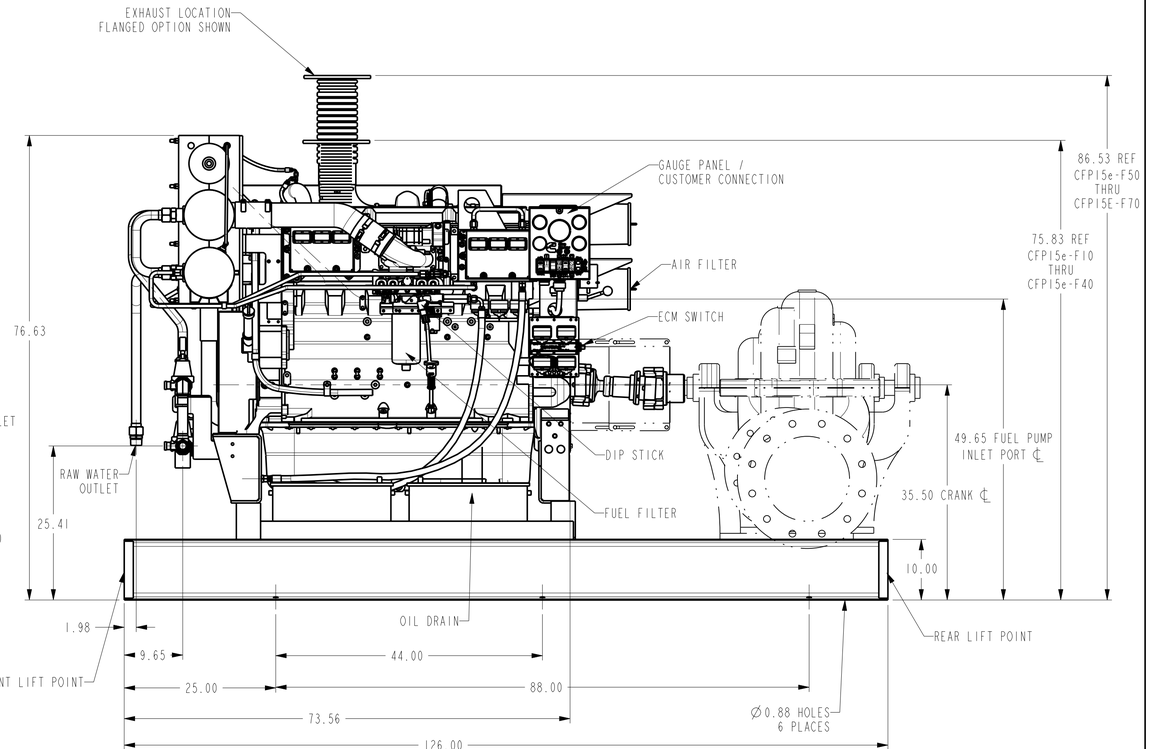
SAE #1	FLYWHEEL HOUSING
3/4" NPT	FUEL INLET
3/4" NPT	FUEL OUTLET
1 1/4" NPT	RAW WATER INLET
1 1/2" NPT	RAW WATER DISCHARGE
120 / 240 VAC	COOLANT HEATER (3000WATTS)
6" DIA NPT, CUFF, OR FLANGE	EXHAUST CONNECTION
OPTIONAL DRIVESHAFT	8.5C WING BEARING TYPE
OPTIONAL STUB SHAFT	3.5" DIAMETER (88.9MM)

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









NOTE:
BOTH ASSEMBLIES SHOWN. CFP15E-F10 THRU F40 TIER 3
AND CFP15E-F50 THRU F70 TIER 2
OPTIONAL DRIVELINE EQUIPMENT SHOWN
REPRESENTATIVE PUMP SHOWN

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

	IMPERIAL UNITS	METRIC UNITS
MACHINE TOLERANCES (1 PLACE)	.X ± 0.100	.X ± 2.50
TOOL TOLERANCES (2 PLACES)	.XX ± 0.030	.XX ± 0.75
TOOL TOLERANCES (3 PLACES)	.XXX ± 0.010	.XXX ± 0.25

REV	DESCRIPTION OF REVISION	REV BY	DATE
B	DRAWING UPDATES	S DUBICK	02/18/08

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DWG UNITS: IN/LB/S	DRAWN BY: S. DANFORTH		DATE: -	
	APPD BY: -		DATE: -	
EST WEIGHT: VARIES	SCALE: 0.080	DO NOT SCALE	SHEET 40F6	DRAWING NO: 11656 REV: B

CFP15E CONNECTION INFORMATION

SAE #1	FLYWHEEL HOUSING
3/4" NPT	FUEL INLET
3/4" NPT	FUEL OUTLET
1 1/4" NPT	RAW WATER INLET
1 1/2" NPT	RAW WATER DISCHARGE
120 / 240 VAC	COOLANT HEATER (3000WATTS)
6" DIA NPT, CUFF, OR FLANGE	EXHAUST CONNECTION
OPTIONAL DRIVESHAFT	8.5C WING BEARING TYPE
OPTIONAL STUB SHAFT	3.5" DIAMETER (88.9MM)

NOTES:
1. ALL PLUMBING MUST BE SUPPORTED AND/OR ISOLATED SO THAT NO WEIGHT OR STRESS IS APPLIED TO ANY ENGINE COMPONENT.
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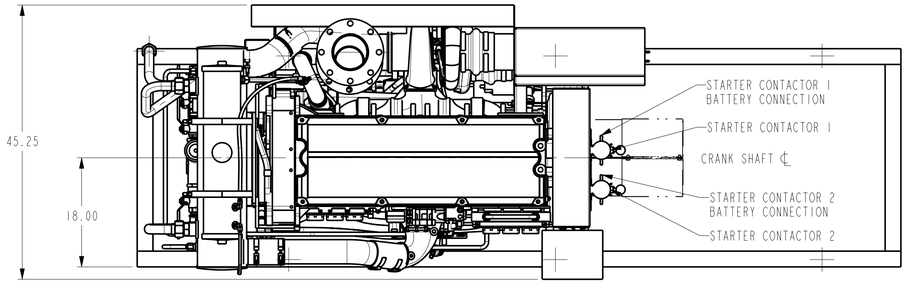
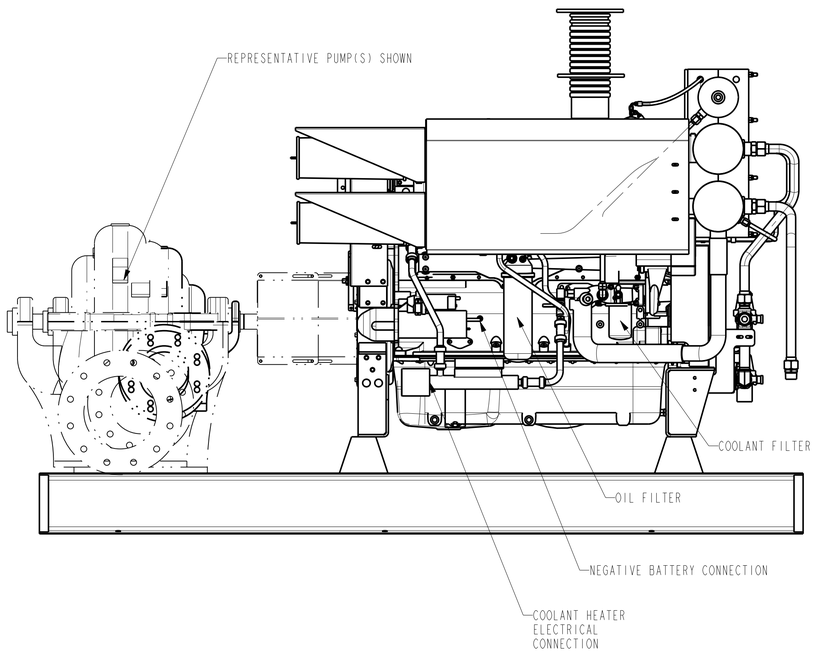
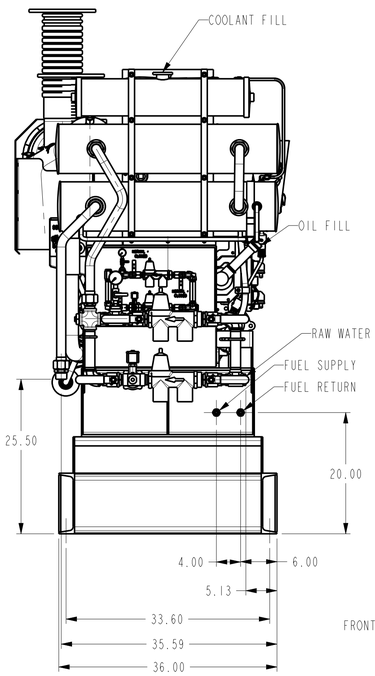
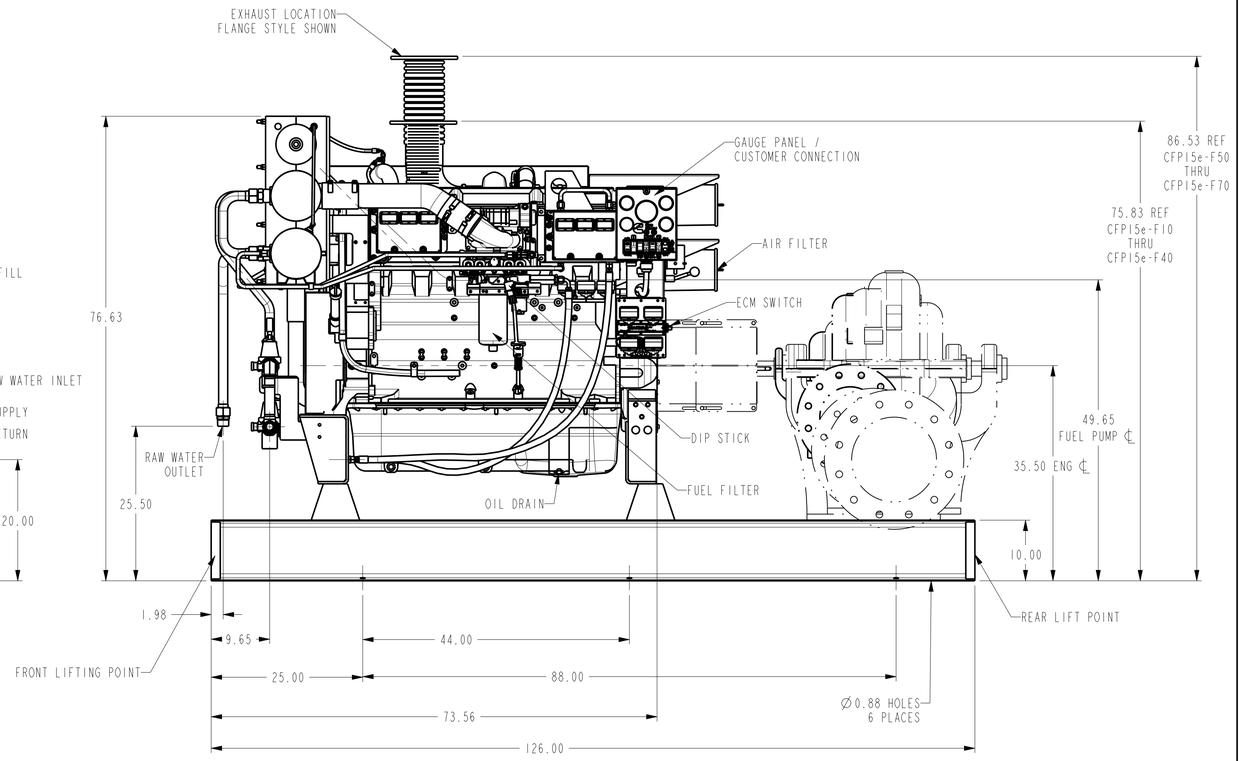
3. DO NOT SCALE DRAWING.
4. DRAWING SUBJECT TO CHANGE WITH OUT NOTICE.
5. SEE SHEET 1 FOR OIL PAN REMOVAL REQUIREMENTS.









NOTE:
BOTH ASSEMBLIES SHOWN. CFP15E-F10 THRU F40 TIER 3 AND CFP15E-F50 THRU F70 TIER 2
OPTIONAL DRIVELINE EQUIPMENT SHOWN
REPRESENTATIVE PUMP SHOWN

REV	DESCRIPTION OF REVISION	REV BY	DATE
B	DRAWING UPDATES	S DUBICK	02/18/08

REF. SCALE 1

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NPOWER SYSTEMS DESIGN CENTER 815 LAWRENCE DRIVE DEPERE, WISCONSIN

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1° | IMPERIAL UNITS | METRIC UNITS

THIRD ANGLE PROJECTION

TITLE 1: GENERAL ARRANGMENT, INSTALLATION
TITLE 2: CFP15E F10 - F40 AND F50 - F70

DWG UNITS: IN/LB/S | DRAWN BY: S. DANFORTH | DATE: -
APPD BY: - | DATE: -
EST WEIGHT: VARIES | SCALE: 0.080 | DO NOT SCALE | SHEET 50F6 | DRAWING NO: 11656 | REV: B

CFP15E CONNECTION INFORMATION

SAE #1	FLYWHEEL HOUSING
3/4" NPT	FUEL INLET
3/4" NPT	FUEL OUTLET
1 1/4" NPT	RAW WATER INLET
1 1/2" NPT	RAW WATER DISCHARGE
120 / 240 VAC	COOLANT HEATER (3000WATTS)
6" DIA NPT, CUFF, OR FLANGE	EXHAUST CONNECTION
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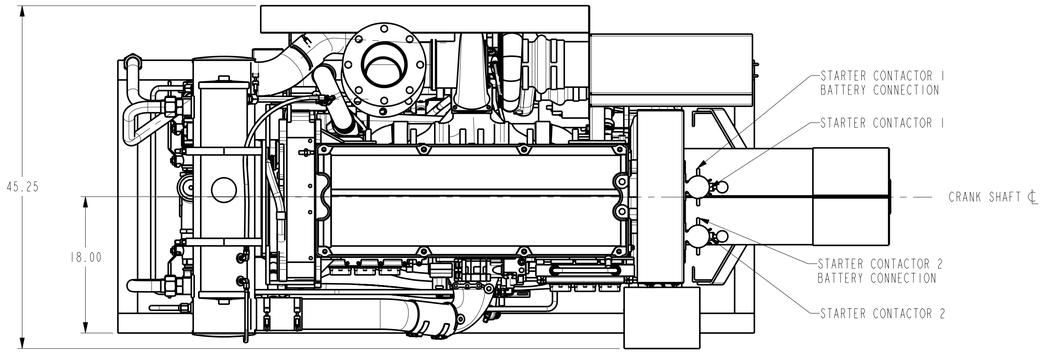
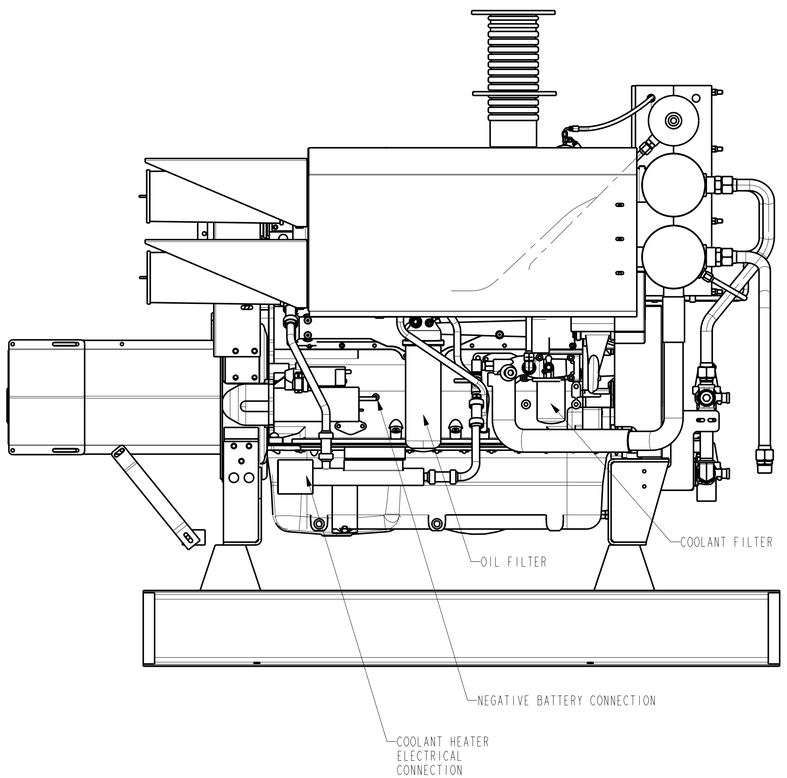
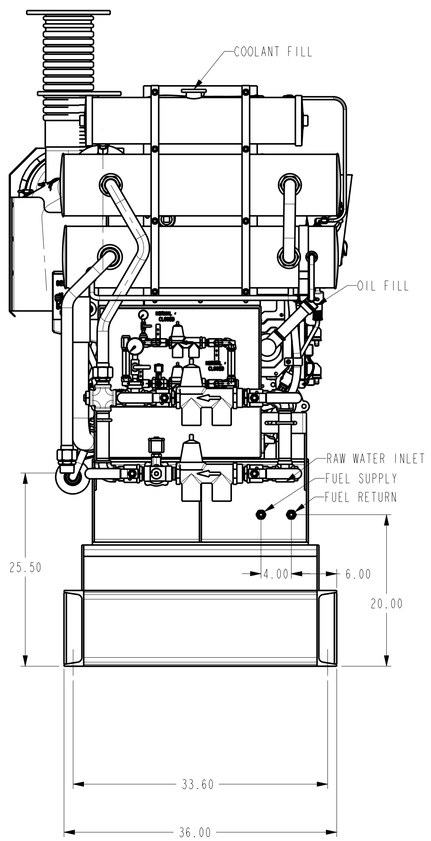
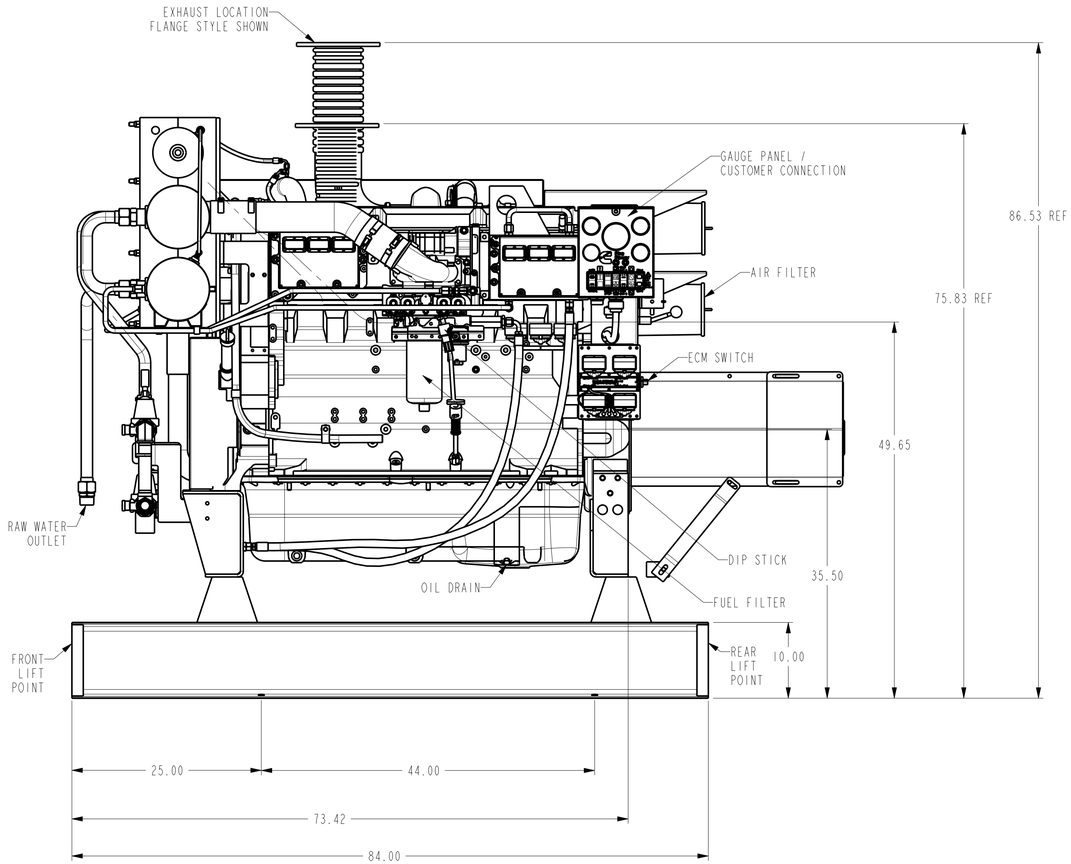
OPTIONAL STUB SHAFT	3.5" DIAMETER (88.9MM)









UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ±	IMPERIAL UNITS	METRIC UNITS
	.X ±0.03	.X ±0.8
	.XX ±0.010	.XX ±0.25
	.XXX ±0.0050	.XXX ±0.127

THIRD ANGLE PROJECTION

REV	DESCRIPTION OF REVISION	REV BY	DATE
B	DRAWING UPDATES	S DUBICK	02/18/08

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TITLE 1: GENERAL ARRANGMENT, INSTALLATION
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DWG UNITS: IN/LB/S	DRAWN BY: S. DANFORTH		DATE: -
	APPD BY: -		DATE: -
EST WEIGHT: VARIES	SCALE: 0.100	DO NOT SCALE	SHEET 6OF6
DRAWING NO: 11656	REV: B		

Lubricating Oil System Specifications

Recommended lube oil filter	Fleetguard 3101869

	Metric	**US**
Oil pressure range at rated	276-414 kPa	40-60 PSI
Oil capacity of pan (high - low)	34-30 liter	9.0-8.0 U.S. Gal
Total system capacity	36.7 liter	9.7 U.S. Gal.

Cooling System Specifications

Recommended Coolant Filter	Fleetguard

	Metric	**US**
Maximum raw water working pressure range at heat exchanger	414 kPa	60 PSI
Recommended minimum water supply pipe size to heat exchanger	25.4 mm D.	1.0 in. D.
Recommended minimum water discharge pipe size from heat exchanger	31.2 mm D.	1.25 in. D.
Coolant water capacity (engine side)	9.5 liter	2.5 U.S. Gal.
Modulating thermostat range	82-93 ^{o}C	180-200 ^{o}F
Minimum raw water flow with water temperatures to 90 ^{o}F (32^{o}C)	2.5 liter/s	40 U.S. GPM

Air Intake System Specifications

NOTE: Engine intake air must be filtered to prevent dirt and debris from entering the engine. If intake air piping is damaged or loose, unfiltered air will enter the engine and cause premature wear.

Recommended air cleaner element	(Standard) K&N (Optional) Donaldson

	Metric	**US**
Maximum temperature rise between ambient air and engine air inlet	15 ^{o}C	30 ^{o}F
Maximum inlet restriction with dirty filter	635 mm H_2O	25 in. $_2$O H

Exhaust System Specifications

	Metric	**US**
Maximum exhaust back pressure imposed by complete exhaust system	10.2 kPa	40.8 in. H_2O
Exhaust pipe size normally acceptable	127 mm D.	5 in. D.

General Engine Data **NOTE**: The following engine and system specification data is extracted from the curves and data sheets that were current when this document was prepared. Refer to www.CumminsFirePower.com if current information is required. Refer to the base engine troubleshooting and repair manual for base engine coverage (see Service Literature in Engine Manual).

Type	4 Cycle; In-Line; 6 Cylinder
Firing Order	1-5-3-6-2-4
Rotation, Viewed from the Front of the Engine	Clockwise
Compression Ratio:	17.0:1
Valves per cylinder: Inlet/Exhaust	2 / 2
Cummins Base Engine Fuel Rating	FR - 10663
Cummins Engine Co. Base Engine	QSX15 Industrial
Installation Drawing	8715
Configuration Number	D103007CX03
Fuel System	HPI Electronic
Aspiration	Turbocharged, Charge Air Cooled

	Metric	**US**
Bore	137 mm	5.39 in.
Stroke	169 mm	6.65 in.
Displacement	15 liter	915 $in.^3$
Intake Valve Clearance	0.36 mm	0.014 in
Exhaust Valve Clearance	0.69 mm	0.027 in
Dry Weight lb (kg)	1813 kg	4029 lb
Wet Weight lb (kg)	1881 kg	4179 lb

NOTE: The engine features a no-adjust overhead. The valve train is designed such that adjustment of the valve lash is not required for normal service during the first 5,000 hours. The valve train operates acceptably within the limits of 0.152- to 0.381-mm [0.006- to 0.015-in] intake valve lash and 0.381- to 0.762-mm [0.015- to 0.030in] exhaust valve lash.

Fuel System Specifications

Fuel	Type	Number 2 Diesel
Recommended primary fuel filter	Fleetgard	3104081

	Metric	**US**
Minimum supply line size	19.05 mm D.	0.75 in. D.
Minimum drain line size	19.05 mm D.	0.75 in.D.
Maximum fuel line length between supply tank & fuel pump	12 m	40 ft.
Maximum fuel height above C/L crankshaft	3048 mm	120 in.
Maximum restriction @ lift pump-inlet - with clean filter	152 mm Hg	6 in. Hg
Maximum restriction @ lift pump-inlet - with dirty filter	254 mm Hg	10 in. Hg
Maximum return line restriction - without check valves	229 mm Hg	9 in. Hg
Minimum fuel tank vent capability	2.10 m^3/hr	70 ft^3/hr
Maximum fuel temperature @ lift pump inlet	71 ^oC	160 ^oF

Electrical System Specifications

Start Circuit

The start circuit consists of a single starter motor and redundant starter control relays as well as using redundant power sources 24 V (optional) comprised of 12 V wet type storage batteries (optional at shipment).

The battery, starter and starter solenoid positive terminals are booted with a non-conducting cover or otherwise insulated from unintended grounding. Battery cable leads from the batteries to the designated connection points in the starting circuit are minimum 6.53 mm D. (No. 2 AWG), neoprene or rubber insulated with a 1.5 mm (0.060 in.) minimum insulation thickness rated 80°C (176 ^{o}F) minimum. The starter and starter solenoid are all metal enclosed.

Wiring for automatic starting (negative ground)	Standard
Reference wiring diagram	10423 (see Section 8.5)
B.C.I. Group Size	8D

		24V
Minimum recommended battery cold cranking amperes (CCA)(1)		700 Amps
Minimum recommended battery reserve capacity		800 Minutes
Maximum resistance of starting circuit		0.0017 Ohms
Typical cranking speed		120 RPM
Alternator (standard), internally regulated		70 Amps
Battery Cable Size (Metric) (For less than 1.5 meters long)		10.6 mm D.
Battery Cable Size (US) (For less than 5 feet long)		00 AWG

(1) Cold soak at -18 ^{o}C (0 ^{o}F) or above

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