Inspection and Maintenance Manual

Clarke Fire Protection Products

C139459 rev B
23 December 2024

Inspections Procedures and Maintenance Requirements for Clarke Fire Protection Products.

Table of Contents

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1. Introduction

This manual is designed to provide comprehensive information and guidance on the installation, operation, and maintenance of Clarke Fire Protection Products diesel drivers. We recommend reading through the entire manual before beginning any procedures to familiarize yourself with the product and its features. For any additional information or support, please refer to the contact details provided below.

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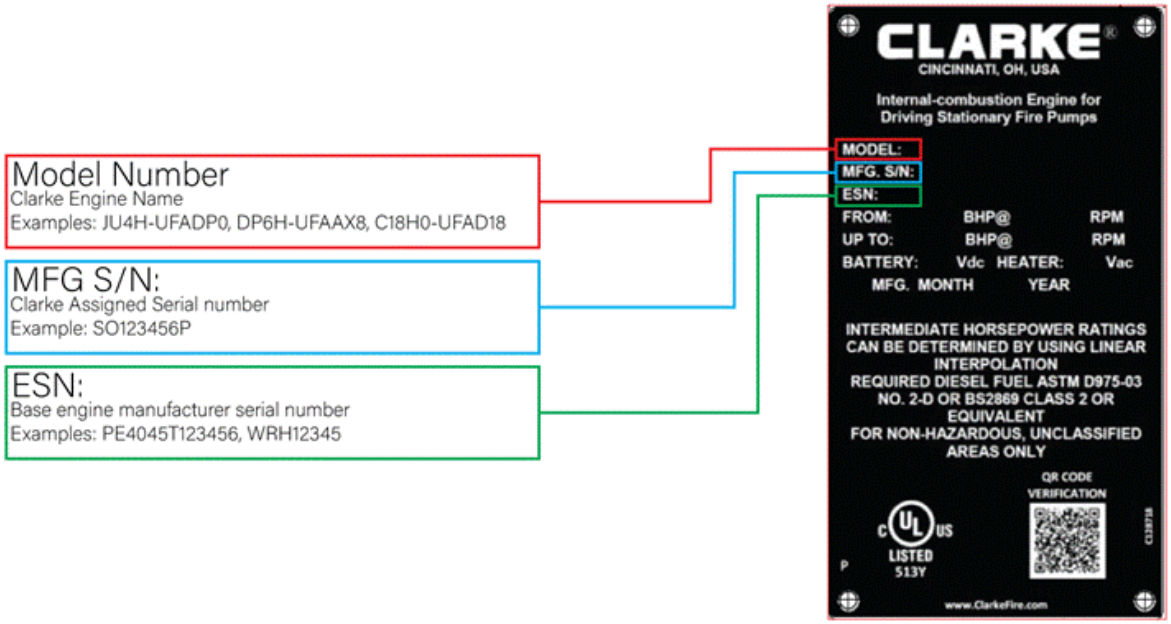
1.1. Engine Identification

There are two identification plates attached to each engine.

1. **Clarke Identification Plate:** Clarke Fire Engine Model, Serial Number, Rating and Date of Manufacture are shown on this identification plate.



Engine Series	Plate Location
Electronic / JU	Stiffening plate that connects the two mounting feet at the rear of the engine.
Electronic / JW, JX	Right rear engine mount.
Electronic / C13	Left rear engine mounting foot
Electronic / C18	Left rear engine mounting foot
Electronic / C32	Left rear engine mounting foot.
Mechanical / JU, JW	Stiffening plate that connects the two mounting feet at the rear of the engine.
Mechanical / JW	Right rear engine mount.
Mechanical / Hyundai-Doosan	Right rear engine mount.
Mechanical / Kohler	Brace under the instrument panel.

2. **Base Engine Manufacturer Identification Plate:** Engine Manufacturer Serial Number, Engine Manufacturer Model Number.

Engine Series	Plate Location
Electronic / JU	Right side of the cylinder block behind the fuel filter.
Electronic / JW, JX	Left side of the engine between the intake manifold and starting motor.
Electronic / C13	Right side of the engine, at the rear of the cylinder head, just below the rocker cover.
Electronic / C18	Left-hand side of the engine forward of the air intake.
Electronic / C32	Righthand side of the engine, on the center valve cover
Mechanical / JU, JW	Right side of the cylinder block behind the fuel filter.

Engine Series	Plate Location
Mechanical / JW	Left side of the engine between the intake manifold and starting motor.
Mechanical / Hyundai-Doosan	Left side of the engine near the front mount just above the oil pan rail.
Mechanical / Kohler	Right side of the engine behind cooling loop.

Directions are viewed as facing the engine flywheel.

1.2. Instrument Panels

MECAB Instrument Panel	TSP-M	Powerview Instrument Panel	TSP-E
			

1.3. Storage Preparation

All Clarke fire pump engines are shipped from Clarke with storage preparation that is effective for one year if the engine is stored in an indoor, dry environment. After one year storage period and every year thereafter, additional preservation service must be performed.

Please review the long-term storage instructions and then complete the web-form to submit a record to Clarke for future service inquiries. (Long-term storage form: https://clarkefire.com/home/service/installation-guides/long-term-storage-procedures)

IMPORTANT
Long-term storage must be properly documented and submitted to Clarke for warranty to be honored.

Long-Term Storage Instructions

Engine Storage *(John Deere, Kohler, and Hyundai (Doosan) Engine Models)*

- **Long Term Storage:** Extended Storage Maintenance Procedure
  It is recommended that a Clarke Service Dealer perform the steps outlined in this section.

  1. Drain the engine oil and change the oil filter.
  2. Refill the engine crankcase with MIL-L-21260 preservative oil.
  3. Change the fuel filters.
  4. Install the coolant plugs and install coolant (Clarke Coolant C12E170).
  5. Remove the protection from the intake and exhaust openings.
  6. Prepare a preservative fuel container as a fuel source using a fuel conditioner mixture of C02686 or C02687 with ONLY Diesel #2 fuel or “Red” diesel fuel (ASTM D-975) or EN 590. (Refer to Section 4.1 for Fuel Specification.)
  7. Disconnect the coupling or drive shaft from the pump.
  8. Start and run the engine at a slow speed for 1-2 minutes being careful not to exceed the normal operating temperature.
  9. Drain the oil and coolant.
  10. Replace the protective plugs that were used for shipping and storage.
  11. Attach to the engine a visible card, specifying “ENGINE WITHOUT OIL” DO NOT OPERATE”.

  IMPORTANT
  THIS TREATMENT MUST BE REPEATED EVERY YEAR.

- **Putting Engine into service after additional preservation service.**
  To restore the normal operation running conditions of the engine, carry out the following:

  1. Fill the engine sump with the normal recommended oil, to the required level.
  2. Remove the protective plugs used for shipping and storage.
  3. Refill cooling water to proper level.
  4. Remove the card “ENGINE WITHOUT OIL, DO NOT OPERATE”.
  5. Follow all steps of the Installation Instructions when the engine will be put into service.

Engine Storage *(Caterpillar Engine Models)*

- **Long Term Storage:** Extended Storage Maintenance Procedure
  It is recommended that a Clarke Service Dealer perform the steps outlined in this section.

  1. Clean the engine of any dirt, rust, grease, and oil. Inspect the exterior. Paint areas that contain paint damage with a good quality paint.
  2. Remove dirt from the air cleaners. Check all seals, gaskets, and the filter element for damage.
  3. Apply lubricant to all points in this Operation and Maintenance Manual, "Maintenance Interval Schedule".
  4. Drain the crankcase oil. Replace the crankcase oil and change the oil filters. For the proper procedure, refer to this Operation and Maintenance Manual.
     If the engine is equipped with an air starting motor, fill the reservoir with the following mixture: 50 percent volatile corrosion inhibitor oil (VCI oil) and 50 percent engine oil.
  5. Add VCI oil to the crankcase oil. The volume of VCI oil in the crankcase oil should be 3 to 4 percent. Note: If the engine crankcase is full, drain enough engine oil so the mixture can be added.
  6. Remove the air filter elements. Turn the engine at cranking speed with the throttle control in FUEL OFF position. Use a sprayer to add a mixture of 50 percent VCI oil and 50 percent engine oil into the air inlet or turbocharger inlet. Note: The mixture of VCI oil can be added to the inlet by removing the plug for checking turbocharger boost pressure. The minimum application rate for the VCI oil mixture is 5.5 mL per L (3 oz per 1000 cu in) of engine displacement.
  7. Use a sprayer to apply a mixture of 50 percent VCI oil and 50 percent crankcase oil into the exhaust openings. The minimum application rate for the oil mixture is 5.5 mL per L (3 oz per 1000 cu in) of engine displacement. Seal the exhaust pipe and seal any drain holes in the muffler.
  8. Remove the fuel from the secondary fuel filter housing. Alternately, empty and reinstall the spin-on fuel filter element in order to remove any dirt and water. Drain any sleeve metering fuel pump. Clean the primary fuel filter. Fill with calibration fluid or kerosene. Install the primary fuel filter and operate the priming pump. This procedure will send clean oil to the secondary filter and the engine.
  9. Spray a thin amount of a mixture of 50 percent VCI oil and 50 percent engine oil onto the following components: flywheel, ring gear teeth and starter pinion. Install the covers in order to prevent evaporation of the vapors from the VCI oil.
  10. Apply a heavy amount of Cat Multipurpose Grease (MPGM) to all outside parts that move, such as rod threads, ball joints, linkage. Note: Install all covers. Ensure that tape has been installed over all openings, air inlets, exhaust openings, the flywheel housing, the crankcase breathers, the dipstick tubes. Ensure that all covers are airtight and weatherproof. Use a waterproof weather resistant tape such as Kendall No. 231 or an equivalent. Do not use duct tape. Duct tape will only seal for a short time.
  11. Under most conditions, removing the batteries is the best procedure. As an alternative, place the batteries in storage. As needed, periodically charge the batteries while the batteries are in storage. If the batteries are not removed, wash the tops of the batteries until the tops are clean. Apply an electrical charge to the batteries in order to obtain a specific gravity of 1.225. Disconnect the battery terminals. Place a plastic cover over the batteries. Note: For additional information, refer to Special Instruction, SEHS7633, "Battery Test Procedure".
  12. Loosen all belts.
  13. Place a waterproof cover over the engine. Ensure that the engine cover is secure. The cover should be loose enough to allow air to circulate around the engine in order to prevent damage from condensation.
  14. Attach a tag with the storage date to the engine.
  15. Remove the waterproof cover at 2 month or 3 month intervals in order to check the engine for corrosion. If the engine has signs of corrosion, repeat the protection procedure.
- **Removal from Storage:** Putting Engine into service after additional preservation service.
  To restore the normal operation running conditions of the engine, carry out the following:

  1. Remove all outside protective covers.
  2. Change the oil and filters.
  3. Check the condition of the fan and alternator belts. Replace the belts, if necessary. Refer to this Operation and Maintenance Manual, "Belts - Inspect/Adjust/Replace" for the correct procedure.
  4. Replace the fuel filter elements.
  5. Remove the plastic covers from the air cleaner elements.
  6. Use a bar or a turning tool in order to turn the engine in the normal direction of rotation. The procedure ensures that no hydraulic locks or resistance exist.
  7. Before starting the engine, remove the valve cover or covers. Put a large amount of engine oil on the camshaft, cam followers, and valve mechanism in order to prevent damage to the mechanism.
  8. Pressure-lubricate the engine before starting the engine. Pressure lubricating the engine ensures immediate lubrication and prevents damage to the engine during the first few minutes of engine operation. If the engine is not equipped with a prelube pump, contact your Cat dealer for information about lubrication of the engine before starting the engine.
  9. Check the condition of all rubber hoses. Replace any worn hoses. Replace any damaged hoses.
  10. Before start-up, test the cooling system for a 3 percent to a 6 percent concentration of coolant conditioner. Add liquid coolant conditioner or a coolant conditioner element, if equipped. Test the coolant mixture for proper nitrite level. If necessary, adjust the coolant mixture. Prime the engine with clean diesel fuel before starting.
  11. Ensure that the cooling system is clean. Ensure that the system is full. Ensure that the system has the correct amount of supplemental cooling system conditioner.
  12. On the first day of operation, check the entire engine several times for leaks and correct operation. If the engine was removed from storage in which temperatures of less than -12°C (10°F) were encountered, refer to Service Manual, SEBU5898, "Cold Weather Recommendations Operation and Maintenance".

1.4. Installation Instructions

Correct installation and operating instructions are included with every Clarke engine, when shipped from our factory. Proper adherence to Clarke's pre-startup installation guideline and operations manual, found in the red document bag, will help guarantee the engine's performance in an emergency operating condition.

1.4.1. Installation Instructions - C136757 rev C

Clarke Operation and Maintenance Manual and other important engine reference documents, are shipped with each engine in the protective storage pouch attached to the side of the engine. Please review all provided shipping documents before installing the engine.

1. Secure pump set to foundation and complete installation in accordance with pump manufacturer’s instructions. Perform engine to pump coupling alignment. Lubricate driveshaft universal joints with NLGI grade #1 or #2 grease at the (3) zerk fittings.
2. Install the heat exchanger discharge piping.

The discharge pipe should be no smaller than the outlet connection on the heat exchanger. Discharge water piping should be installed in accordance with applicable codes. All plumbing connecting to the heat exchanger must be secured to minimize movement by the engine. Cooling loop water pressure to the heat exchanger must not exceed the limit that is stated on the heat exchanger supplied with the engine.

3. Install zinc electrode into heat exchanger (do not use sealing tape), plugs into the charge-air cooler if equipped, and close draincocks.
4. Engine is typically provided with premixed coolant installed. If engine is not provided with coolant or there is a need to top off, fill engine cooling system with Clarke Coolant C12E170. The only acceptable substitute is COOL-GARD II TY26575.
5. Engine is shipped with oil installed. For make-up oil specifications refer to Lubrication System.
6. Connect fuel supply and return line to fuel supply tank plumbing. Reference the Fuel System section of the Installation and Operation Data for piping size, maximum allowable fuel pump suction, and maximum allowable fuel head requirements. Fill supply tank with ONLY #2 diesel fuel (ASTM D-975) or EN 590 diesel fuel, bleed supply system of air and check for leaks.

WARNING
Biodiesel fuel is not recommended for stand-by equipment that can have minimal fuel consumption (such as standby generators, fire protection, etc.)

7. Remove protective covering on air cleaner element.
8. Connect jacket water heater (if supplied) to AC power source. Connect the supplied heater connection wire directly to a customer supplied electrical junction box. The electrical supply requirements are indicated on the connection box. Connect to the heater directly to the junction box at the end of the heater only. Supply wiring should never be routed through the engine gauge panel. Severe damage to critical engine control components could result. Energize heater only after coolant is filled.
9. Connect exhaust system to flexible connection on the engine. The exhaust system plumbing must be supported by the building structure and not the engine. The exhaust flexible connection is provided only for the purpose of thermal expansion and vibration isolation, not for misalignment or directional change.
10. Make electrical (DC) connections between the engine gauge panel terminal strip and the fire pump controller per the fire pump controller manufacturer's instructions.
11. Service the engine batteries.
    - **Activation of Dry Batteries**
      a. Use premix battery grade electrolyte (Specific Gravity: 1.265). Each 8D battery will take approximately 18 qts (16.5 L) of electrolyte.
      b. Remove the six vent caps for each battery.
      c. With proper safety gear (eye protection, gloves, etc.) carefully fill each of the six cells to cover the plates and just below the vent well. **DO NOT OVERFILL!**
      d. Re-install vent caps.
      e. New batteries must be properly activated and charged for at least 24 hours. Undercharged batteries may cause damage to the electrical system and could prevent the engine from starting.
      f. After initial charge, check level of electrolyte in all cells. If required, add additional electrolyte to bring all levels to the bottom of the vent wells. **DO NOT OVERFILL!** If batteries require top-off while in service, add water. **DO NOT ADD ACID.**
    - **Connect battery cables**
      Connect cables between engine and batteries only after electrolyte is installed and fully charged. *(Charge batteries for a minimum of 24 hours.)* Connect negative battery cables to the identified ground lug on engine. Connect each positive battery cable to each identified lug. For engines with two starters the cables connect directly to each starter. For engines with one starter, the cables connect directly to each start contactor.

CAUTION
All engines accelerate rapidly to Rated Speed. Prior to the initial startup of the engine, hold up on manual stop switch or manual stop lever and crank for 15 seconds to circulate lubrication. It is recommended that during the initial running of the engine since the sprinkler lines may not be completely full; throttle the discharge control valve to slow the rate of fill, so as not to "shock" the system.

IMPORTANT
In order to obtain prompt Warranty Service and to comply with Emissions regulations, this engine must be registered to the final installation name and address.

2. Pre-Startup Inspection

The Pre-Startup Inspection is to be completed by pump dealers or installing contractors. This process is to ensure the engine and associated components are installed correctly and fully operational before scheduling the Startup Inspection, which is the commissioning of the engine.

- Pre-Startup Webform: https://clarkefire.com/home/service/startup-information/startup-authorization
- Pre-Startup PDF: C13272

The requirements of the Pre-Startup Inspection include 2 sections:

- **Equipment Identification**
  Pump, Fire Pump Controller, and Engine specific data should be annotated as described in Equipment Identification [7].
- **Static Checks**
  Inspection items described in Static Checks [7] should be verified.

3. Startup Inspection

The startup inspection is a scheduled commissioning event, performed by trained personnel to ensure the engine and associated components are installed correctly and fully operational. The startup inspection checklist is located on ClarkeFire.com/SUI. The pdf document C13273 can be downloaded for onsite completion. The hand-written form is optional, Clarke startup policy requires the information to be submitted through the digital online form. Engine Startup Inspections are important to verify equipment correctness and operation. The Clarke warranty is activated by the submission of the startup inspection form.

- Startup Webform: https://clarkefire.com/home/service/startup-information/start-up-inspection-(s.u.i.)-checklist
- Startup PDF: C13273

The requirements of the startup inspection include 4 sections:

- **Equipment Identification**
  Pump, Fire Pump Controller, and Engine specific data should be annotated as described in Equipment Identification [7].
- **Static Checks**
  Inspection items described in Static Checks [7] should be verified.
- **Running Checks**
  Inspection items described in Running Checks [15] should be verified.
- **Final Inspection**
  Items described in Final Inspection [22] should be accurately completed.

4. Inspection Requirements

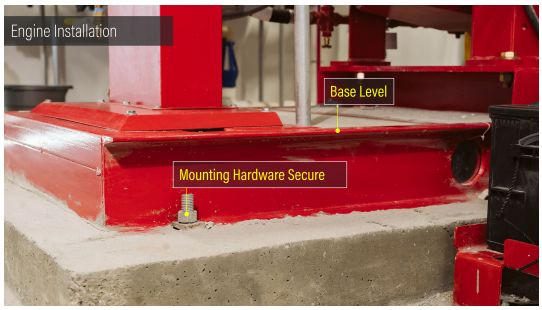
4.1. Equipment Identification

1. **Facility Identification**
   Facility name, location, site contact, and phone number should be annotated.
2. **Engine Information**
   Engine model number, serial number, and Speed (RPM) information should be verified to ensure that you received the correct engine model and RPM setting.
3. **Pump Information**
   Record the Pump manufacturer, model, serial number, rating, pressure, and speed from the manufacturer's data tag located on the pump.
4. **Pump Controller Information**
   Record the Pump Controller manufacturer, model, and serial number from the manufacturer's data tag located on the pump controller.

4.2. Static Checks

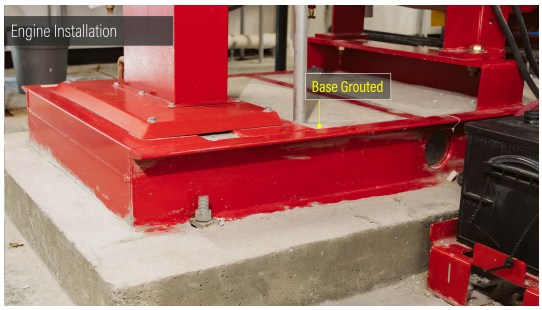
4.2.1. Unit Mounted and Secured

1. **Mounting Hardware**



Clarke Fire provides beveled washers with the base.

2. **Ensure the base is grouted.**



Fill the base with non-shrinking grout to add mass to the system and help absorb vibration.

3. **Pump Set is Properly Protected.**
   Ensure the pump set is properly protected and temperature controlled if necessary. Pump room or pump house should maintain a temperature above 40°F (4°C). Engines are not designed to be installed outside.

4.2.2. Service Driveshaft or Coupling

WARNING
Before removing the driveshaft guard turn off the pump controller battery chargers and disconnect the negative battery cable from both batteries to prevent the engine from starting.

IMPORTANT
Before beginning driveshaft alignment checks and making any necessary corrections, retorque all driveshaft connection bolts and lubricate the driveshaft bearings.

NOTICE
When installing the driveshaft, it is recommended that a medium strength thread-locker (Loctite 243–blue) be used in the assembly and torquing of all hardware. This may be purchased as part C126758, 50ml bottle.

1. **Retorque Connection Bolts**
   - Driveshaft to Flywheel Adapter Disc or Torsional Coupling
   - Driveshaft to Pump Companion Flange

   Refer to engine model specific Operation and Maintenance Manual for torque specifications.

   NOTICE
   Four of the hi-tensile bolts and/or nuts, that are used to connect the driveshaft to the drive disc and that connect the driveshaft to the pump companion flange, will require a “crow’s foot” wrench attached to a standard torque wrench in order to apply the required tightening torque. A standard socket will not work due to close proximity of the bolts and/or nuts with the driveshaft yoke. The tightening torque values listed for these bolts and/or nuts have been corrected for using a “crow’s foot” adapter which extends the standard torque wrench’s length.

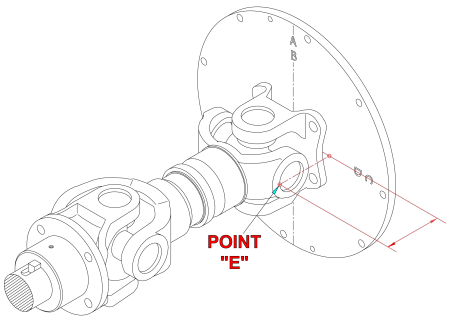
2. **Lubricate the Driveshaft**
   Cross and bearing and sliding splines contain only enough grease to provide protection during shipment. It is necessary to lubricate by zerk fittings prior to start-up to avoid premature failure.
   Use a good quality lithium base E.P. grease meeting N.L.G.I. grade 2. Several greases meeting these specifications Lubriplate 1200-2, Shell Alvania EP2 or Mobil Mobilux EP2. Add lubricant to universal joint until clean lubricant appears at all four bearing seals and until lubricant appears at pressure relief hole for spline lubrication on variable length shafting. It may be necessary, while applying grease gun pressure, to move the drive shaft from side to side to allow greater thrust clearance on a seal end that is not purging.
3. **Alignment Check**
   To check the alignment of the pump shaft and engine crankshaft centerline for proper Parallel Offset and Angular Tolerance, the driveshaft must be installed between the flywheel adapter disc (or torsional coupling) and the pump companion hub on the pump shaft. For proper procedure to take the pump the pump out of service refer to Pump, Engine, and Controller Maintenance and Operation Manuals. Before removing the driveshaft guard, disable the controller battery chargers and disconnect the negative battery cables from all batteries.
   The following procedure outlines alignment checks for an engine installed with its crankshaft centerline elevation above the pump shaft centerline. **For an engine installed with its crankshaft centerline elevation below the pump shaft centerline, the measurement locations of Step C (Point "H") and Step D (Point "J") should be mirrored.** Point "H" will be measured underneath the driveshaft and Point "J" will be measured above the driveshaft.

   NOTICE
   A torsional coupling does not have letters AB or CD stamped on the assembly. When performing the alignment procedure, on an engine utilizing a torsional coupling, use the images provided to ensure the driveshaft is in the proper orientation. Step A & B the driveshaft internal yoke should be in a horizontal orientation. Step C & D the driveshaft internal yoke should be in a vertical orientation.

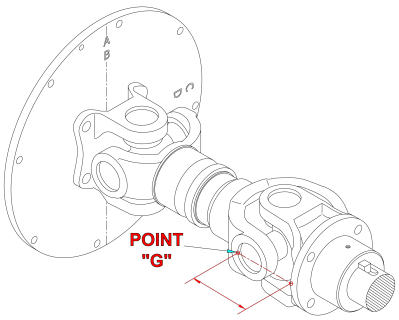
   1. **Step A**: Horizontal Parallel Offset
      a. Rotate the shaft so the reference "AB" on the flywheel adapter disc is in the 12 O'clock position.
      b. Measure from the face of the flywheel adapter disc to Point "E" (The furthermost point on the bearing bore diameter). This measurement should be equal to the value in the table below.

      Refer to engine model specific Operation and Maintenance Manual for measurement detail.
   2. **Step B**: Horizontal Angular Alignment
      - Measure from the mating surface of the pump companion hub to Point "G" (The furthermost point on the bearing bore diameter). This measurement must be equal to the measurement at Point "E" $\pm$ 0.5mm.

      Refer to engine model specific Operation and Maintenance Manual for measurement detail.



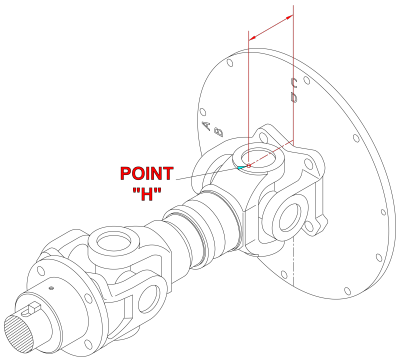
Step A - Point "E"



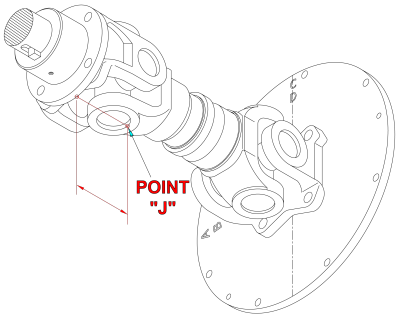
Step B - Point "G"

3. **Step C**: Vertical Parallel Offset
   a. Rotate the shaft 90° so the reference "CD" on the flywheel adapter disc is in the 12 O'clock position.
   b. Measure from the face of the flywheel adapter disc to Point "H" (The furthermost point on the bearing bore diameter). This measurement should be equal to the value in the table below.

4. **Step D**: Vertical Angular Alignment
   - Measure from the mating surface of the pump companion hub to Point "J" (The furthermost point on the bearing bore diameter). This measurement must be equal to the measurement at Point "H" ± 1mm.



Step C - Point "H"



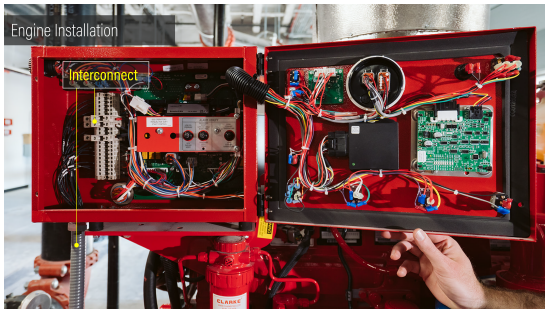
Step D - Point "J"

4. Reinstall all guards before reconnecting the battery cables.

Other Coupling Types: Consult Factory or Clarke website at www.clarkefire.com for additional information.

4.2.3. Electrical System Inspection

1. **Controller Wired**
   Every engine has a dedicated terminal strip that is referred to as the interconnect. The interconnect terminals will have contractor installed wiring that connects the engine to the pump controller, allowing them to communicate. A pump controller may have more terminals than is required by the specific engine. Refer to the table below to determine what interconnect terminals are required.



Interconnect wiring connections.

Pin	Description	I/O	+/-	Note
1	Fuel and Water Solenoid	I	+	Utilized by all engines.
2	Engine Run Signal	O	+	
3	Engine Overspeed	O	+	
4	Low Oil Pressure	O	-	
5	High Engine Temp	O	-	
6	Battery Charger Set #1 System Batt Voltage #1		+	
8	Battery Charger Set #2 System Batt Voltage #2		+	
9	Start Circuit Starter #1	I	+	
10	Start Circuit Starter #2	I	+	
11A	Main Engine Ground		-	
11B	Main Engine Ground		-	
12	Energized to Stop Fuel Solenoid	I	+	
301	Alternate ECM	O	-	Utilized by electronic engines only.
302	Fuel Injection Malfunction	O	-	
303	Single ECM Failure (Warning)	O	-	Utilized on electronic engines only.
304	Double ECM Failure (Failure)	O	-	
305	Low Suction Alarm	O	-	Utilized by Suction (-S) PLD engines only.
310	High Raw Water Temp	O	-	Utilized by all engines.
311	Low Raw Water Flow	O	-	
312	Low Engine Coolant Temperature Alarm	O	-	
401	Air Filter Restriction	O	-	Special Option Only.
402	Oil Filter Differential Pressure	O	-	
403	Fuel Filter Differential Pressure	O	-	
501	Oil Temperature, High	O	-	
601	Oil Level, Low	O	-	
602	Coolant Level, Low	O	-	

IMPORTANT
Interconnect wiring connections shall be made using stranded wire.

NOTICE
Refer to pump controller manufacturer's instructions for minimum size requirements.

2. **Engine Harness Check**
   Precautions for Welding – Always disconnect engine harness connector before welding. High currents or electrostatic discharge in electronic components from welding may cause permanent damage. Connect welder ground close to the welding point and be sure electrical components are not in ground path.

If harnesses are removed for welding or installation, ensure all connectors are secured and completely seated.

- ECM Connections
- Instrument Panel Harness Connectors
  Primary Engine Harness, Engine Harness, Alternate Engine Harness, Primary Application Harness, Alternate Application Harness, and Power Harness.

3. **Batteries Serviced**

   1. Batteries Filled

      Activation of Dry Batteries

      Reference Document C131885

      a. Use premix battery grade electrolyte (Specific Gravity: 1.265). Each 8D battery will take approximately 18 qts (16.5 L) of electrolyte.
      b. Remove the six vent caps for each battery.
      c. With proper safety gear (eye protection, gloves, etc.) carefully fill each of the six cells to cover the plates and just below the vent well. **DO NOT OVERFILL!**
      d. Re-install vent caps.
      e. New batteries must be properly activated and charged for at least 24 hours. Undercharged batteries may cause damage to the electrical system and could prevent the engine from starting.
      f. After initial charge, check level of electrolyte in all cells. If required, add additional electrolyte to bring all levels to the bottom of the vent wells. **DO NOT OVERFILL!** If batteries require top-off while in service, add water. **DO NOT ADD ACID.**

   2. Connected to the Engine

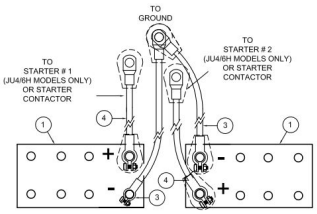
      Battery Connections

      Reference Document C131885

12V 8D BATTERY KIT, CLAKE P/N: C07844 (FIGURE 1)

Item	Clarke P/N	QTY	Description
1	C07633	2	Battery 12V - 8D 1200 CCA DRY
2	C072584	1	Battery Rack
3	C071171	2	Battery Cable - Negative/Ground
4	C071172	2	Battery Cable - Positive/Starter

Figure 1:
12V Negative Ground System

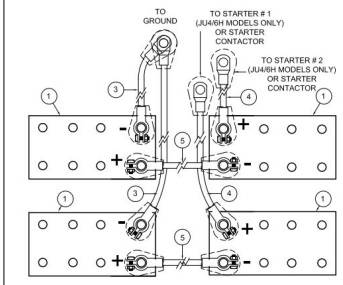


NOTE: CABLES NOT TO SCALE

24V 8D BATTERY KIT, CLAKE P/N: C07688 (FIGURE 2)

Item	Clarke P/N	QTY	Description
1	C07633	4	Battery 12V - 8D 1200 CCA DRY
2	C072584	2	Battery Rack
3	C071171	2	Battery Cable - Negative/Ground
4	C071172	2	Battery Cable - Positive/Starter
5	C07631	2	Battery Cable - Negative to Postive

Figure 2:
24V Negative Ground System
ALL 24V ENGINE MODELS EXCEPT C32H0

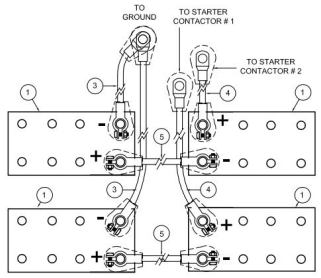


NOTE: CABLES NOT TO SCALE

24V 8D BATTERY KIT, CLAKE P/N: C073490 (FIGURE 3)

Item	Clarke P/N	QTY	Description
1	C07633	4	Battery 12V - 8D 1200 CCA DRY
2	C072584	2	Battery Rack
3	C073488	2	Battery Cable - Negative/Ground
4	C073489	2	Battery Cable - Positive/Starter
5	C07631	2	Battery Cable - Negative to Postive

Figure 3:
24V Negative Ground System
C32H0 MODELS ONLY



NOTE: CABLES NOT TO SCALE

   3. Charged for 24 hours
      New batteries must be properly activated and charged for at least 24 hours. Undercharged batteries may cause damage to the electrical system and could prevent the engine from starting.

4. **Engine Jacket Water Heater connected to AC Power**
   AC Wiring Diagram

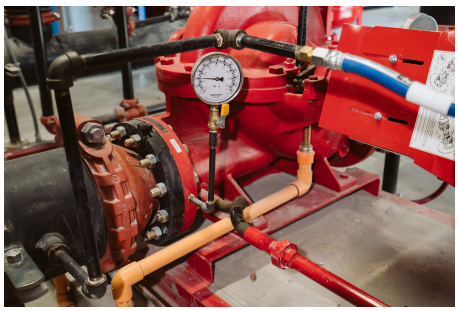
- C073339 - AC Wiring, DT2H & C32 with High Limit Thermostat
- C073198 - AC Wiring, 115/230 VAC Heater with High Limit Thermostat
- C07651 - AC Wiring, 115/230 VAC Heater

WARNING
Only energize the heater when the coolant is filled. During filling of the cooling system, air pockets may form. The system must be purged of air prior to being put in service. Refer to the engine operations manual for coolant purging procedures.

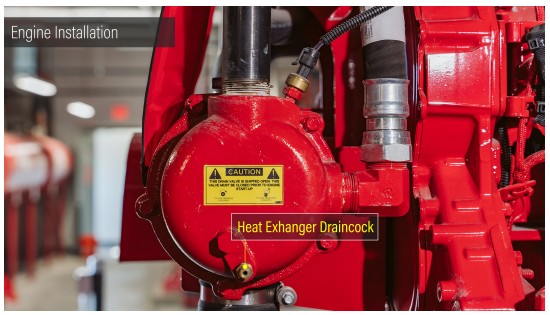
The engine instrument panel should not be used as a junction box for the heater AC wiring. The electrical supply requirements are indicated on the connection box.

4.2.4. Cooling System Inspection

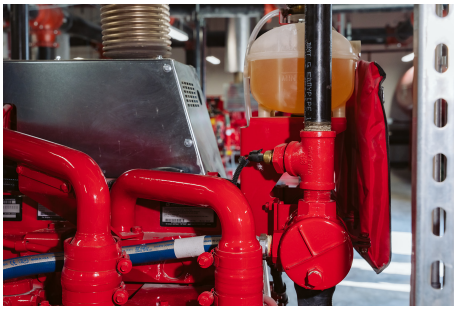
1. **Cooling System Connections Properly Installed**
   Cooling-loop inlet and Heat Exchanger outlet. The discharge pipe should be no smaller than the outlet connection on the heat exchanger. Discharge water piping should be installed in accordance with applicable codes. Clarke recommends that discharge water should be piped to an open waste cone. All plumbing connecting to the heat exchanger must be secured to minimize movement by the engine. Cooling loop water pressure to the heat exchanger must not exceed the limit that is stated on the heat exchanger supplied with the engine.



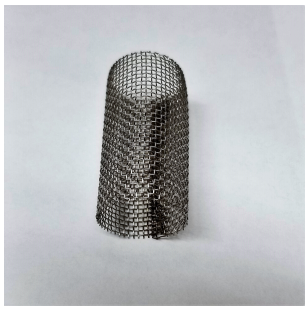
2. **Draincocks Closed. Plugs and Electrode Installed**
   Ensure the draincocks are closed on the Heat Exchanger and CAC. *(Drainplugs installed if equipped)* Refer to the engine operations manual, installation instructions for further detail.



3. **Confirm cooling loop raw water solenoid is operational**
   If equipped. Radiator engines and most engines utilized on a vertical turbine application will not have a cooling loop raw water solenoid.
4. **Cooling System filled to proper level**
   During filling of the cooling system, air pockets may form. The system must be purged of air prior to being put in service. Refer to the engine operations manual for coolant purging procedures.
   Use Clarke coolant part number C12E170, the only acceptable replacement is COOL-GARD II part number TY26575.



5. **Clean the Y-Strainers**
   Remove the Y-strainer screen, clean thoroughly and re-install.



6. **Radiator Requirements (If equipped)**
   Inspect for leaks, coolant level, loose fasteners, loose belts, and damaged fan blades. Remove any ice, snow, leaves, or other debris that could hinder proper operation.

4.2.5. Exhaust System Inspection

1. **Exhaust Sized Correctly**
   The exhaust backpressure calculator located on ClarkeFire.com can be used to confirm the exhaust system is sized properly.
2. **Exhaust Support**
   The exhaust system plumbing must be supported by the building structure and not the engine.
3. **Exhaust Engine Connection**
   The exhaust flexible connection is provided only for the purpose of thermal expansion and vibration isolation, not for misalignment or directional change. Exhaust piping inside the building should be insulated for personnel safety.
4. **Rain Protection**
   Engine exhaust should be piped to safe location and have rain protection.

4.2.6. Fuel System Inspection

Flexible Fuel Connectors

Fuel Tank

1. **Flexible Fuel Connectors**
   Connect fuel supply and return flexible connectors to fuel supply tank plumbing. Reference the Fuel System section of the Installation and Operation Data Sheet (included in the shipping documents that come with the engine) for piping size, maximum allowable fuel pump suction, and maximum allowable fuel head limits. Do not use copper based or galvanized material for any component of a diesel fuel system.
2. **Supply Connection**
   The fuel supply tank connection should be no lower than the level of the engine fuel transfer pump. Refer to Installation and Operation Data for maximum allowable height.
3. **Verify Fuel Return Line Check Valve Direction**
   Check valves are not required on Clarke Fire Engines.
   If a check valve is installed, ensure it is installed in the correct direction.
4. **Fuel Tank**
   - Fill supply tank with #2 diesel fuel.
     All diesel fire pump drivers manufactured by Clarke are designed, tested, and warranted for use only with No. 2-D S15 Diesel Fuel conforming to ASTM International D-975 or British Standard BS2869 Class A2 Fuels oils for agricultural, domestic and industrial engines and boilers – Specification. Therefore, 100% petroleum fuel shall be used whenever possible. For Clarke's engine manufacturers diesel fuel statements, including the use of biodiesel, please refer to: Diesel Fuel Requirements (www.clarkefire.com/diesel-fuel-requirements).

- Fuel supply level must meet applicable code requirements.
- Drain water and sediment from tank.
- Bleed supply system of air and check for leaks.

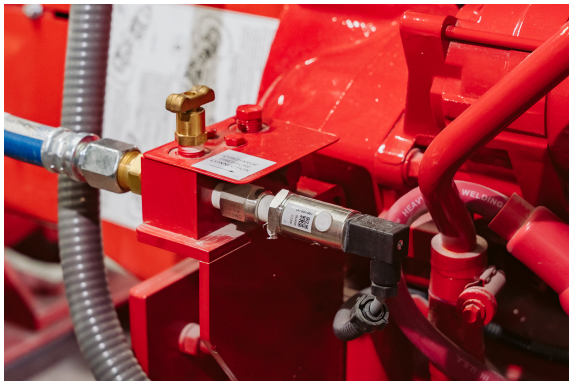
4.2.7. Air Supply Inspection

1. **Air Filter Installed**
   Do not run the engine without air filter installed. Ensure the protective covering is removed. If the engine will be subjected to harsh conditions during final construction do not remove protective covering until engine is ready to run.
2. **Adequate Air Supply**
   The pump room ventilation calculator located on ClarkeFire.com can be used to confirm the required amount of air (CFM) for combustion air flow and for the dissipation of engine radiated heat. You will find Engine Combustion Air Flow and Radiated Heat on the Clarke model specific Installation & Operation (I&O) datasheet. Record the size of the louvers.

4.2.8. Lubrication System Inspection

- **Verify Engine Oil Level**
  Refer to the engine operations manual for engine oil specifications. If engine oil has been drained for shipping purposes, refer to the operations manual for oil type, capacity, and filling procedure.

4.2.9. PLD System Inspection



1. **Discharge Sensing Line Connection (If Equipped)**
   The single discharge pressure control sensing line shall be connected in the region between the pump discharge flange and the check valve.
2. **Suction Sensing Line Connection (If Equipped)**
   The single suction pressure limiting control sensing line shall be connected in the immediate region upstream of the pump inlet.
3. **Sensing Line Bleeding**
   Bleed the air out of the PLD sensing line at the PLD manifold.

Reference PLD Brochure Document C133760

4.3. Running Checks

Complete the following running checklist items after the static checks are finished.

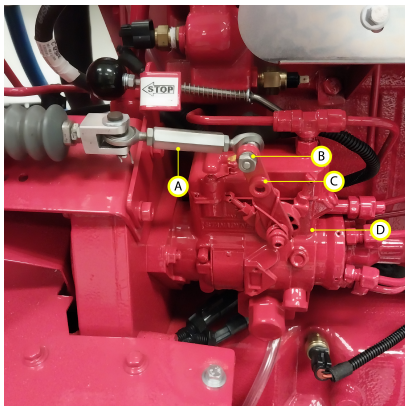
4.3.1. Initial Starting Procedure

CAUTION
All engines accelerate rapidly to Rated Speed. Prior to the initial startup of the engine, hold up on manual stop switch or manual stop lever and crank for 15 seconds to circulate lubrication. It is recommended that during the initial running of the engine, since the sprinkler lines may not be completely full; throttle the discharge control valve to slow the rate of fill, so as not to “shock” the system.

IMPORTANT
When engine is running make sure that the coolant temperature, oil pressure and raw cooling water flow are within the limits specified on the relevant Installation & Operation Data Sheet.

Mechanical Engine Start at Idle

- **Mechanical Engine Idle**
  1. Remove the nut (B) from the fuel injection pump throttle linkage (A).
  2. Disconnect the throttle linkage (A) from the fuel injection pump throttle (C).
  3. Allow the fuel injection pump throttle (C) to move to the idle position.
  4. Turn Off the pump controller.
  5. Place the engine instrument panel in the manual mode.
  6. Start and run the engine for 5 minutes at idle.
  7. Stop the engine.
  8. Reconnect the throttle linkage (A) to the fuel injection pump throttle (C).
  9. Place the engine instrument panel and pump controller in the automatic mode position.



(A) - Throttle Linkage

(B) - Connection Nut

(C) - Fuel Injection Pump Throttle

(D) - Fuel Injection Pump

Electronic Engine Soft Start

During installation of the sprinkler system or initial commissioning, it may be desirable to start the engine at a reduced speed. Reducing the speed reduces the pressure of the pump discharge. This allows leak detection to be performed at reduced system pressure and reduces the likelihood of water hammer at start.

- **Electronic Engine Soft Start**
  Start the engine with soft start if equipped.

Engine	Instrument Panel	Speed Control	Soft Start
John Deere	Powerview Instrument Panel	Constant Speed	Not available.
John Deere	Powerview Instrument Panel	Variable Speed (PLD)	Menu Selection. See below.
C13, C32	Powerview Instrument Panel	Constant Speed	Menu Selection. See below.
C18	Powerview Instrument Panel	Constant Speed	Physical Switch. See below.
C13, C18, C32	Powerview Instrument Panel	Variable Speed (PLD)	Menu Selection. See below.
C13, C18, C32	TSP-E	All	Menu Selection. See below.
John Deere	TSP-E	Variable Speed (PLD)	Menu Selection. See below.
John Deere	TSP-E	Constant Speed	Not available.

TSP-E - Soft Start

Soft Start

The Soft Start Screen displays an option to initiate a soft start sequence. Performing a soft start will allow the engine operator to verify operation, check for leaks, and any other faults before running at full speed.

Figure 1. Soft Start Screen

To initiate a Soft Start:

1. Place the Pump Controller in the Off position.
2. Place the TSP-E mode selector in the Manual Mode position.
3. Navigate to the Soft Start Screen.
4. Crank the Engine. The engine will run at idle.
5. Press "Begin Soft Start" button to begin the soft start process.
6. The engine will slowly accelerate from idle to rated speed.
   To stop the engine, press the manual stop button.

IMPORTANT
Place the Pump Controller and TSP-E mode selector in Automatic after maintenance and manual running is finished.

Powerview Instrument Panel - Soft Start

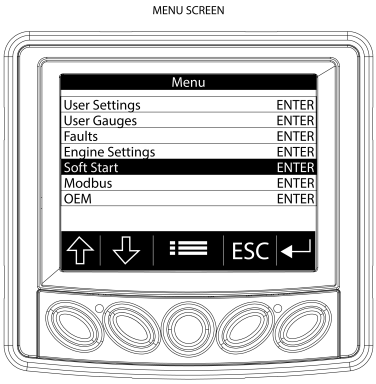
The following engines assembled with a Powerview Instrument Panel can active a soft start through the PV380 menu.

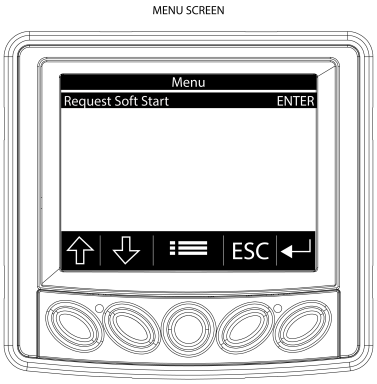
(John Deere Variable Speed, C18 Variable Speed, All C13, and All C32 models)

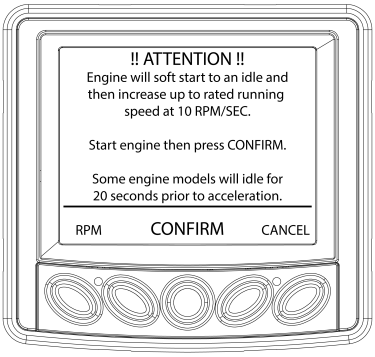
To use the feature:

1. Switch the main fire pump controller to the OFF position.
2. Switch the MODE SELECTOR to MANUAL RUN.
3. Press the “menu key” on the PV380.
4. Toggle down the list of menu options and highlight “Soft Start”, then press the “Enter” key.
5. The next screen will display one choice, “Request Soft Start”. Press the “Enter” key.
6. The next screen will allow initiation of Soft Start or the choice to cancel the process. To proceed with the Soft Start, crank and start the engine with one of the Manual Crank switches on the front of the panel.

The engine will start and run at the minimum operating speed until the “Confirm” key is pressed. Once the “Confirm” key is pressed, the engine will increase speed at the rate of 10 rpms per second until it reaches rated speed. *[minimum operating speed: (CAT: 1100 RPM)(John Deere: 1300 RPM)]*



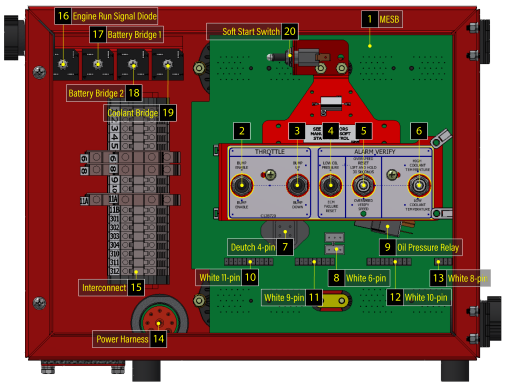




Powerview Instrument Panel - Soft Start (C18 Constant Speed)

C18 constant speed models assembled with a Powerview Instrument Panel can active a soft start by the following procedure.

C18 Constant Speed Soft Start - C072745



To activate the soft start on C18 constant speed engines.

1. Place the Pump Controller in OFF.
2. Locate the momentary soft start switch inside the engine instrument panel, near the top center. (20)
3. Hold the Soft Start Switch while manually starting the engine at the engine instrument panel.

Holding the switch will keep the engine speed at 1100 rpm. When released the engine will increase 10 rpm per second until reaching the rated speed.

Engines not equipped with Soft Start

Hold the manual stop while manually cranking the engine to allow fluids to circulate throughout the engine before starting the engine at full speed.

4.3.2. Manual Start at Engine Instrument Panel

- Manual Start at Engine Instrument Panel

- **Duration**: Run the engine until reaching typical operating temperature (reference I&O Data).
- **Procedure:** Place the Pump Controller in the OFF position. Follow the starting procedure as outlined in the engine operations manual.
- **Manual Crank #2:** Repeat the starting procedure on Manual Crank #2. Wait 15 seconds between start attempts.
- **Alternate ECM:** On Electronic Engines, while the engine is stopped, change the ECM position to ALTERNATE. Verify the speed and no active alarms. Stop the engine and switch back to Primary.

Inspection Items

1. **Cooling Loop Raw Water Solenoid**
   If equipped. Radiator engines and most engines utilized on a vertical turbine application will not have a cooling loop raw water solenoid.
   Verify the cooling loop solenoid is operational. (if equipped)
2. **Raw Water Discharge**
   Verify the raw water discharge. If the discharge is piped to an open drain, inspect the free flow of water to visually verify the heat exchanger is meeting minimum flow requirements. If the discharge is piped back to a suction reservoir, inspect the sight glass and temperature indicator.
   Heat Exchanger minimum flow requirements are published on the engine installation and operations data sheet. (I&O data)
3. **Engine Gauges**
   Verify the engine gauges are functioning correctly.
4. **Leaks**
   Verify there are no leaks of fuel, water, or exhaust.

4.3.3. Manual Start at Pump Controller

- Manual Start at Pump Controller

- **Duration:** 10 to 20 seconds runtime
- **Procedure:** Place the Pump Controller in the Manual Mode position. Place the Engine Instrument Panel in the AUTOMATIC MODE. Follow the starting procedure as instructed by the pump controller manufacturer.
- **Manual Crank #2:**Repeat the starting procedure on Manual Crank #2. Wait 15 seconds between start attempts.

4.3.4. Automatic Start at Pump Controller

- Automatic Start

- **Duration:** Multiple engine runs will be required to complete alarm verifications and pump flow tests.
- **Procedure:** Place the Pump Controller in the Manual Mode position. Place the Engine Instrument Panel in the AUTOMATIC MODE. Follow the starting procedure as instructed by the pump controller manufacturer using a test feature or pressure drop.
- **Manual Crank #2:**Repeat the starting procedure on Manual Crank #2. Wait 15 seconds between start attempts.

Engine Full Load Inspection

1. **Engine RPM at Full Load**
   Record engine speed while operating at full load.
2. **Engine Oil Pressure at Full Load**
   Record engine oil pressure while operating at full load.
3. **Engine Coolant Temperature at Full Load**
   Record engine coolant temperature while operating at full load.
4. **Engine Damper Temperature at Full Load**
   Record engine damper temperature while operating at full load. Use an infrared temperature gun, also known as a laser thermometer or non-contact thermometer to measure the temperature of the engine damper. If the engine vibration damper temperature exceeds 200°F [93°C] there could be a possible torsional issue and you need to consult the pump manufacturer. *The damper is located behind the belt guard.*

4.3.5. Alarm Verifications

1. **Low Engine Coolant Temperature**

Engine Instrument Panel	Procedure
Electronic / TSP-E	With the engine NOT running (0 rpm), Press the gear button. Press the VERIFICATION TESTS button. Enter 8705 and press OK. Press the RUN TEST in the LOW ENGINE TEMP. box. The engine temperature gauge will highlight yellow and display a VERIFICATION of the LOW ENGINE TEMPERATURE ALARM. Approximately 30 seconds after the RUN TEST button is pressed, the warning message and alarm to fire pump controller will turn off. Reset the main fire pump controller.
Electronic / Powerview	With the engine NOT running (0 rpm), hold the low engine coolant temperature switch in the “down” position. The coolant temperature signal will be defaulted to less than 90°F. Continue holding the low engine coolant temperature verify switch down for 20 seconds until the alarm is indicated at the controller at interconnect terminal #312. Reset the pump controller.
Mechanical / TSP-M	With the engine NOT running (0 rpm), Press the gear button. Press the VERIFICATION TESTS button. Enter 8705 and press OK. Press the RUN TEST in the LOW ENGINE TEMP. box. The engine temperature gauge will highlight yellow and display a VERIFICATION of the LOW ENGINE TEMPERATURE ALARM. Approximately 30 seconds after the RUN TEST button is pressed, the warning message and alarm to fire pump controller will turn off. Reset the main fire pump controller.
Mechanical / MECAB	With the engine NOT running (0 rpm), set the Low Engine Coolant Temperature DIP switch to “ON”. (white slider to the right) Set white DIP switch slider to “OFF” (left) when simulation is complete. Reset the main pump controller to re-instate normal operation of engine and controller.

2. **High Engine Coolant Temperature**

Engine Instrument Panel	Procedure
Electronic / TSP-E	With the engine running, Press the gear button. Press the VERIFICATION TESTS button. Enter 8705 and press OK. Press the RUN TEST in the HIGH ENGINE TEMP. box. The engine temperature gauge will highlight yellow and display a VERIFICATION of the HIGH ENGINE TEMP ALARM. Approximately 30 seconds after the RUN TEST button is pressed, the warning message and alarm to fire pump controller will turn off. Reset the main fire pump controller.
Electronic / Powerview	With the engine running from the main pump controller, lift HIGH ENGINE COOLANT TEMPERATURE VERIFY SWITCH in the “up” position. The coolant temperature signal will be defaulted to greater than 250°F. Continue holding the HIGH ENGINE COOLANT TEMPERATURE VERIFY SWITCH for up to 3-5 minutes until the alarm is indicated at the controller at interconnect terminal #5. Reset the main pump controller.
Mechanical / TSP-M	With the engine running, Press the gear button. Press the VERIFICATION TESTS button. Enter 8705 and press OK. Press the RUN TEST in the HIGH ENGINE TEMP. box. The engine temperature gauge will highlight yellow and display a VERIFICATION of the HIGH ENGINE TEMP ALARM. Approximately 30 seconds after the RUN TEST button is pressed, the warning message and alarm to fire pump controller will turn off. Reset the main fire pump controller.
Mechanical / MECAB	With the engine running, set the High Engine Coolant Temp DIP switch to “ON”. (white slider to the left) Wait for 30 seconds and controller alarm will activate. Set white DIP switch slider to “OFF” (right) when simulation is complete. Reset the main pump controller to re-instate normal operation of engine and controller.

3. **Low Oil Pressure**

Engine Instrument Panel	Procedure
Electronic / TSP-E	With the engine running, Press the gear button. Press the VERIFICATION TESTS button. Enter 8705 and press OK. Press the RUN TEST in the LOW OIL PRESS. box. The engine temperature gauge will highlight yellow and display a VERIFICATION of the LOW OIL PRESS ALARM. Approximately 30 seconds after the RUN TEST button is pressed, the warning message and alarm to fire pump controller will turn off. Reset the main fire pump controller.
Electronic / Powerview	With the engine running from the main pump controller, lift HIGH ENGINE COOLANT TEMPERATURE VERIFY SWITCH in the “up” position. The coolant temperature signal will be defaulted to greater than 250°F. Continue holding the HIGH ENGINE COOLANT TEMPERATURE VERIFY SWITCH for up to 3-5 minutes until the alarm is indicated at the controller at interconnect terminal #5. Reset the main pump controller. *It may be necessary to disable the PLD to activate the Low Oil Pressure alarm.*
Mechanical / TSP-M	With the engine running, Press the gear button. Press the VERIFICATION TESTS button. Enter 8705 and press OK. Press the RUN TEST in the LOW OIL PRESS. box. The engine temperature gauge will highlight yellow and display a VERIFICATION of the LOW OIL PRESS ALARM. Approximately 30 seconds after the RUN TEST button is pressed, the warning message and alarm to fire pump controller will turn off. Reset the main fire pump controller.
Mechanical / MECAB	With the engine running from the main pump controller, on JU, DP6H, DQ6H, DR8H, & DS0H engines jumper the “WK” terminal to engine ground. On DT2H engine models jumper the two terminals of the oil pressure switch.

4. **Over Speed Shutdown Verification**

Engine Instrument Panel	Procedure
Electronic / TSP-E	*(If the engine is a PLD, disable the PLD by unplugging the transducer at the PLD manifold.)* With the engine running, Press the gear button. Press the VERIFICATION TESTS button. Enter 8705 and press OK. Press the RUN TEST in the ENGINE OVER SPEED. box. The engine will shutdown at 67% of OS shutdown threshold. PRESS the Overspeed Reset button on the top left of the tachometer. Reset the main fire pump controller.
Electronic / Powerview / Constant Speed	Hold the OVERSPEED VERIFICATION SWITCH in the “down” position. Start the engine via the pump controller; The engine will shutdown immediately 30 rpm below rated speed. The controller will indicate an alarm at interconnect terminal #3. After verification of overspeed, lift the OVERSPEED RESET SWITCH in the “up” position for 30 seconds and reset the pump controller.
Electronic / Powerview / Variable Speed	Disable the PLD by disconnecting the PLD harness from the engine instrument panel. Hold the OVERSPEED VERIFICATION SWITCH in the “down” position. Start the engine via the pump controller; The engine will shutdown immediately 30 rpm below rated speed. The controller will indicate an alarm at interconnect terminal #3. After verification of overspeed, Reset Overspeed on the engine instrument panel digital display and then lift the OVERSPEED RESET SWITCH in the “up” position for 30 seconds and reset the pump controller.
Mechanical / TSP-M	With the engine running, Press the gear button. Press the VERIFICATION TESTS button. Enter 8705 and press OK. Press the RUN TEST in the ENGINE OVER SPEED. box. The engine will shutdown at 67% of OS shutdown threshold. PRESS the Overspeed Reset button on the top left of the tachometer. Reset the main fire pump controller.
Mechanical / MECAB	Hold the OSV switch in the up position. Start the engine from the pump controller. Lift the OS reset switch for 5 seconds. Reset the FP controller.

5. **Low Raw Water Flow**

Engine Instrument Panel	Procedure
Electronic / TSP-E	With the engine running, Press the gear button. Press the VERIFICATION TESTS button. Enter 8705 and press OK. Press the RUN TEST in the LOW RAW WATER FLOW box. The engine temperature gauge will highlight yellow and display a VERIFICATION of the LOW RAW WATER FLOW ALARM. Approximately 30 seconds after the RUN TEST button is pressed, the warning message and alarm to fire pump controller will turn off. Reset the main fire pump controller.
Electronic / Powerview	With the engine running, Locate the ball valve on the automatic side of the cooling loop. SLOWLY rotate the valve handle clockwise to decrease water flow until the alarm is indicated at the pump controller. Upon alarm activation return the valve to the normal open position. Reset the fire pump controller.
Mechanical / TSP-M	With the engine running, Press the gear button. Press the VERIFICATION TESTS button. Enter 8705 and press OK. Press the RUN TEST in the LOW RAW WATER FLOW box. The engine temperature gauge will highlight yellow and display a VERIFICATION of the LOW RAW WATER FLOW ALARM. Approximately 30 seconds after the RUN TEST button is pressed, the warning message and alarm to fire pump controller will turn off. Reset the main fire pump controller.
Mechanical / MECAB	With the engine running, Locate the ball valve on the automatic side of the cooling loop. SLOWLY rotate the valve handle clockwise to decrease water flow until the alarm is indicated at the pump controller. Upon alarm activation return the valve to the normal open position. Reset the fire pump controller.

6. High Raw Water Temperature

Engine Instrument Panel	Procedure
Electronic / TSP-E	With the engine running, Press the gear button. Press the VERIFICATION TESTS button. Enter 8705 and press OK. Press the RUN TEST in the HIGH RAW WATER TEMP box. The engine temperature gauge will highlight yellow and display a VERIFICATION of the HIGH RAW WATER TEMP ALARM. Approximately 30 seconds after the RUN TEST button is pressed, the warning message and alarm to fire pump controller will turn off. Reset the main fire pump controller.
Electronic / Powerview	With the engine running, jump the two terminals of the high raw water temp switch for 30 seconds.
Mechanical / TSP-M	With the engine running, Press the gear button. Press the VERIFICATION TESTS button. Enter 8705 and press OK. Press the RUN TEST in the HIGH RAW WATER TEMP box. The engine temperature gauge will highlight yellow and display a VERIFICATION of the HIGH RAW WATER TEMP ALARM. Approximately 30 seconds after the RUN TEST button is pressed, the warning message and alarm to fire pump controller will turn off. Reset the main fire pump controller.
Mechanical / MECAB	With the engine running, jump the two terminals of the high raw water temp switch for 30 seconds.

7. Alternate ECM Alarm

Engine Instrument Panel	Procedure
Electronic / TSP-E	With the engine not running, place the TSP-E ECM Selector switch in the Alternate position. Verify the ‘warning – operating on alternate ECM' message is displayed and an alarm is sent to the pump controller via interconnect terminal 301.
Electronic / Powerview	With the engine not running, place the engine instrument panel ECM Selector switch in the Alternate position. Verify the ‘warning – operating on alternate ECM light is illuminated and an alarm is sent to the pump controller via interconnect terminal 301.
Mechanical / TSP-M	NA
Mechanical / MECAB	NA

8. ECM Warning & Failure

Engine Instrument Panel	Procedure
Electronic / TSP-E	With the engine NOT running (0 rpm), Press the gear button. Press the VERIFICATION TESTS button. Enter 8705 and press OK. Press Next Page. Press the RUN TEST in the ECM Warning box. The display will go to the home screen and display a verification warning message for ECM Alarm. An alarm will be sent to the fire pump controller on interconnect terminal #303. The alarm will be active for approximately 30 seconds. Follow the pump manufacturer’s instructions to reset the fire pump controller to re-instate normal operation. (This typically involves cycling to the off position.) **Wait until the verification is complete and the panel has returned to its normal operating state before continuing.**
Electronic / Powerview / John Deere	With the engine NOT running (0 rpm), Lift up on the MANUAL STOP SWITCH for at least 2 minutes. Upon 2 minutes the BASE will indicate a failure of ONE ECM via terminal 303 to the controller. Continue holding the MANUAL STOP SWITCH for an additional 2 minutes, after which the BASE will indicate a failure of BOTH ECMs. After simulation is complete, release the MANUAL STOP SWITCH. Place BOTH ECMs back into service by activating the ECM FAILURE RESET SWITCH for 3 seconds. Reset the pump controller.
Electronic / Powerview / CAT	With the engine NOT running (0 rpm), Lift up on the OVERSPEED RESET SWITCH for at least 2 minutes. Upon 2 minutes the BASE will indicate a failure of ONE ECM via terminal 303 to the controller. Continue holding the MANUAL STOP SWITCH for an additional 2 minutes, after which the BASE will indicate a failure of BOTH ECMs. After simulation is complete, release the OVERSPEED RESET SWITCH. Place BOTH ECMs back into service by activating the ECM FAILURE RESET SWITCH for 3 seconds. Reset the pump controller.
Mechanical / TSP-M	NA
Mechanical / MECAB	NA

9. **Over-Crank Test (Fail to Start)**

Engine Instrument Panel	Procedure
Electronic / TSP-E	1. With the engine not running, place the TSP mode selector in the Automatic Mode. 2. Press the gear icon on the Home Screen. 3. Press the Verification Tests button on the Settings Menu Screen. 4. Enter 8705 on the Password Screen. Press OK. 5. Press “Run Test” for Fail to Start. 6. Initiate a pump controller automatic start sequence to start the 3-minute attempt to start cycle. Selecting the Fail to Start test will activate a 30 second timer in which a pressure-drop or automatic start sequence should be initiated at the pump controller. • If a pump controller automatic start sequence is initiated during the TSP's Fail to Start 30-second timer, and the Engine Run (interconnect terminal 1) or either the Crank 1 (interconnect terminal 9) or Crank 2 (interconnect terminal 10) inputs transition to the Active state, then the 30-second timer shall be reset. • If the Crank 1 (interconnect terminal 9) or Crank 2 (interconnect terminal 10) inputs do not transition between active and inactive states during the pump controller's typical 15-second crank and rest cycles, and the TSP's Fail to Start 30-second timer expires, the TSP Fail to Start test will be aborted, and the TSP-E will return to normal operation. • If the TSP mode selector switch is changed to the Manual Mode position or the Engine Run (interconnect terminal 1) transitions to the inactive state during the test, the TSP Fail to Start test will be aborted, and the TSP-E will return to normal operation. • Once the sixth crank termination state has been reached, the TSP Fail to Start test will be completed, and the TSP-E will return to normal operation.
Electronic / Powerview / John Deere	Lift and hold the MANUAL STOP SWITCH to prevent the engine from starting during the cycle-crank testing. Ensure that the MANUAL STOP SWITCH is held for the entire 15 second duration of each of the 6 crank attempts. Each time while the engine is resting for 15 seconds in between crank attempts, release the MANUAL STOP SWITCH for 3 seconds. Before the engine cranks again, activate the MANUAL STOP SWITCH and continue holding throughout the crank attempt, releasing in between each time.
Electronic / Powerview / CAT	Lift and hold the OVERSPEED RESET SWITCH to prevent the engine from starting during the cycle-crank testing. Ensure that the OVERSPEED RESET SWITCH is held for the entire 15 second duration of each of the 6 crank attempts. Each time while the engine is resting for 15 seconds in between crank attempts, release the OVERSPEED RESET SWITCH for 3 seconds. Before the engine cranks again, activate the OVERSPEED RESET SWITCH and continue holding throughout the crank attempt, releasing in between each time.
Mechanical / TSP-M	NEVER shut off the fuel supply to the engine to prevent it from starting. **ETS**: Use manual stop override to prevent the engine from starting during the cycle-crank testing. Override must be held continuously each time the engine attempts a crank start. This will allow the engine to crank only but will prevent it from running. **ETR**: Disconnect J3 wiring connector. Reconnect after testing is complete.
Mechanical / MECAB	NEVER shut off the fuel supply to the engine to prevent it from starting. **ETS**: Use manual stop override to prevent the engine from starting during the cycle-crank testing. Override must be held continuously each time the engine attempts a crank start. This will allow the engine to crank only but will prevent it from running. **ETR**: Hold the Overspeed Reset Switch during the entire crank cycle.

10. **Fuel Injection Malfunction - Low Fuel Pressure (KA4H Only)**

Engine Instrument Panel	Procedure
Electronic / Powerview	NA
Mechanical / TSP-M	With the engine running from the main pump controller, disconnect “J3” wiring connector (blue and purple wires) inside engine panel. This will de-energize and simulate failure of electric fuel transfer pump. Wait until the alarm is indicated on the screen and at the controller at interconnect terminal #302 Reconnect J3 wiring connector after completion of test. Follow manufacturer’s instructions to reset the main fire pump controller and re-instate normal operation of engine and controller.
Mechanical / MECAB	With the engine running, jumper between the “C” and the “NC” terminals of the fuel pressure switch located near the fuel transfer pump outlet. Alarm will be indicated at interconnect terminal #302. Reset the pump controller to re-instate normal operation of engine and controller.

11. **Snapshot**

Engine Instrument Panel	Procedure
Electronic / TSP-E	After all verification tests are completed and the engine running at normal pump conditions, the Snapshot button can be pressed on the Verification Screen. The Snapshot will record and timestamp engine parameters as proof of running conditions during the verification tests. The initial snapshot will change the icon from black to white.
Electronic / Powerview	NA
Mechanical / TSP-M	After all verification tests are completed and the engine running at normal pump conditions, the Snapshot button can be pressed on the Verification Screen. The Snapshot will record and timestamp engine parameters as proof of running conditions during the verification tests. The initial snapshot will change the icon from black to white.
Mechanical / MECAB	NA

4.4. Final Inspection

After completion of running tests, ensure the following items are completed and verified.

1. **Clean the Y-Strainer:** Remove the Y-Strainer screen element, clean, and install.
2. **Cooling Loop Manual Valves:** Confirm the positions of the cooling loop manual ball valves.
3. **Engine Mode Selector:** Confirm the engine mode selector is left in AUTOMATIC.
4. **Annotations**
   - Final Hour Meter Reading - Record engine hours from instrument panel.
   - Work Performed By - Technician performing inspection.
   - Comments - Installation errors, defects, or concerns.
   - Pump Dealer Information - Company supplying pump package.
   - Service Dealer Information - Company performing the startup inspection.
   - Email
     - Email Acknowledgement to.
     - Email Copy of the form to.

5. Maintenance Requirements

Clarke Fire and NFPA 25 Maintenance requirements.

- Maintenance Schedule Checklist (C137684) does not need to be submitted but it is available for record keeping purposes.
- https://clarkefire.com/home/service/installation-guides/maintenance

5.1. Weekly Maintenance

- **Static Checks**
  Before running the engine, visual inspections, verifications, and checks should be performed in accordance with NFPA 25: 8.2 and Clarke Fire requirements.

Table 1. Pump House Conditions

Item	Action
Ambient Air Temperature, Pump Room	• Heat is adequate, not less than 40F for pump room with diesel engine-driven pumps with engine heaters. *[8.2.2 (1)a]*
Air Louvers	• Ventilating louvers are free to operate. *[8.2.2 (1)c]*
Floor Drain	• Excessive water does not collect on the floor. *[8.2.2 (1)d]*
Guard, Driveshaft	• Coupling or driveshaft guard is in place. *[8.2.2 (1)e]*

Table 2. Diesel Engine System Conditions

Item	Action
Engine Instrument Panel	• Mode selector switch is in auto position. *[8.2.2 (4)b]* • Not in Auto Warning Light *[CF]* • All alarm pilot lights are off. *[8.2.2 (4)f]* • Engine running time meter is reading. *[8.2.2 (4)g]*
Batteries, Engine	• Electrolyte level in batteries is within acceptable range. *[8.2.2 (4)k]* • Battery terminals are free from corrosion. *[8.2.2 (4)l]* • Battery voltage readings are within acceptable range. *[8.2.2 (4)c]* • Battery charging current readings withing acceptable range. *[8.2.2 (4)d]* • Pump controller battery pilot lights are on, or battery failure lights are off. *[8.2.2 (4)e]*
Oil System	• Oil Level is within acceptable range. *[8.2.2 (4)i]*
Coolant System	• Coolant level is within acceptable range. *[8.2.2 (4)j]* • Coolant Hoses: check for rips, splitting, collapses, or bulges. *[CF]* • Block heater is operating. *[8.2.2 (4)m]*
Fuel System	• Fuel Tank is at least two-thirds full. *[8.2.2 (4)a]* • Remove Water from Fuel Filter *[CF]* • Check Governor Run-Stop Solenoid on mechanical fuel injected engines. *[CF]*
Raw Water	• Cooling Loop Manual Valves in the proper position. *[CF]* • Check and Clean Y-Strainer Screens. *[CF]*
Air	• Air Filter: check for rips, crushed elements, or extreme dirt. *[CF]* • Engine Crankcase Breather: check for blockages and not kinked. *[CF, 8.1.1.2]*

- **Running Checks**
  A weekly no-flow test should be performed in accordance with NFPA 25: 8.3.2 and Clarke Fire requirements.

Table 3. Weekly No-Flow Test

Starting Method	• The test shall be conducted by starting the pump automatically. *[8.3.2.2]* • Qualified personnel shall be in attendance. *[8.3.2.7]* • Use of automatic timers do not eliminate the need to have qualified personnel present during the test. *[8.3.2.7.1]*
Test Duration	• The diesel pump shall run a minimum of 30 minutes. *[8.3.2.4]* • Clarke recommends exercising the engine in accordance with NFPA 25's recommendation of 30 minutes per week at a no-flow condition. 30 Minutes is enough time to ensure everything is working correctly. Clarke Fire Protection Products are designed and capable of running for long durations and high flow conditions in the event of a fire. However, there is no benefit in running the engine longer than 30 Minutes at no-flow conditions during the weekly exercise. In addition to the weekly exercise, it is expected that the engine will be run under loads in accordance with the authority having jurisdiction for initial acceptance and annual flow tests. Operating the engine in excess of these requirements may result in a non-warrantable incident.

Table 4. Running Checks - Weekly

Item	Action
Engine Starting	• Observe the time for engine to crank. *[8.3.2.9 (3)a]* • Observe the time for engine to reach running speed. *[8.3.2.9 (3)b]*

Engine Operating Parameters	• Observe Engine Gauges *[8.3.2.9 (3)c]*
	  • Engine Oil Pressure
	  • Speed Indicator
	  • Coolant Temperature
	  • Oil Temperature (if applicable)

Running Checks	• The discharge temperature of the water shall be monitored and the pump shut down if necessary to prevent exposing the pump and driver to excessive temperatures. *[8.3.2.1.2.2]* • Cooling Loop Raw Water Solenoid, verify operation. *[CF]* • Inspect Heat Exchanger cooling water flow. *[8.3.2.9 (3)e]* • Check for excessive noise, adequate ventilation, missing items, fluid leaks. *[CF]* • Record Abnormalities. *[8.3.2.9 (3)d]*

5.2. 6-Month Maintenance

Additional inspection items should be completed twice a year in addition to the weekly maintenance requirements.

- **6-Month Maintenance Inspection**

Table 5. 6-Month Maintenance

Item	Action
Belts	• Inspect belt condition for signs of fraying or cracks. • Inspect the alignment of the belt. • Verify the tension of the belt.
Driveshaft or Coupling	• Inspect driveshaft U-Joints. • Check coupling setscrew.
Fuel Lines	• Inspect flexible fuel connectors at engine fuel manifold. • Inspect fuel lines, piped from fuel tank to the engine.

5.3. 1-Year Maintenance

Annual flow test and maintenance should be performed in accordance with NFPA 25 8.3.3 and Clarke Fire requirements.

- **Static Checks**
  Before running the engine, visual inspections, verifications, and checks should be performed in accordance with NFPA 25: 8.3.6 and Clarke Fire requirements.

Table 6. Static Checks - Annual

Item	Action
Pump Room Conditions	• Pump room environmental conditions should be inspected such as Heating, Ventilation, Illumination. *[8.3.6.3]*

Engine Inspection	• Mounting Isolators. Check rubber isolators under engine feet if applicable. *[CF]*
	• Wiring System. Check engine harness connections and interconnect wiring condition. *[CF]*
	• Batteries should be inspected annually. *[8.1.1.2.15]*
	  • Test the specific gravity, state of charge, and charger rates of the batteries.
	  • Clean the terminals of any corrosion.
	  • Ensure the cranking voltage exceeds 9V on a 12V system or 18V on a 24V system.
	  • Ensure that only distilled water is used in batteries.
	• All flexible hoses and connections shall be tested annually for cracks and leaks. *[8.1.1.2.11]*
	• Exhaust systems, drain condensate traps, and silencers should be inspected annually. *[8.1.1.2.13]*
	• Fuel tanks should be tested annually for water and foreign materials. *[8.1.1.2.9]*
	• Fuel tank vents and overflow piping shall be inspected annually for obstructions. *[8.1.1.2.10]*

- **Annual Maintenance**
  Maintenance items should be completed in accordance with NFPA 25: 8.3.3 & table 8.1.1.2

Table 7. Maintenance - Annual

Item	Action
Air System	• Air Filter. Clean or Replace. *[CF]* • Measure backpressure on engine turbo. *[8.1.1.2.14]*

Fuel System	• Fuel Filters. Replace. *[CF]*
	• Clean the fuel lift pump strainer. **(Only applicable to DP and DQ engine models.) [CF]*
	• Diesel fuel shall be tested for degradation. *[8.3.4.1]*
	  • If found deficient, fuel shall be reconditioned or replaced, tank shall be cleaned internally, and the engine fuel filters shall be changed. *[8.3.4.1.1]*
	  • After restoration, fuel shall be tested every 6 months until experience indicates fuel can be stored a minimum of 1 year. *[8.3.4.1.2]*

Item	Action
Coolant System	• Coolant. Replace. *[CF]* Use Clarke Coolant (part # C054129). The only acceptable substitute is COOL-GARD II (part # TY26575). • Heat Exchanger Anode. Check, replace. *[CF]*
Oil System	• Oil. Replace. *[CF]* • Oil Filters. Replace. *[CF, 8.1.1.2.18]*
Driveshaft	• Engine and Pump alignment verification. *[8.3.4.1.2]* • Lubricate driveshaft U-Joints. *[CF]*
Engine Instrument Panel	• Simulate Alarm Conditions *[8.3.3.14]* • Supervisory signal circuitry shall be tested annually for high cooling water temperature. *[8.1.1.2.8]* • Test Alternate ECM and sensors. *[8.3.3.17]*

- **Annual Flow Test**
  An annual flow test of the pump assembly should be completed by qualified personnel in accordance with NFPA 25: 8.3.3.
  For Diesel motor-driven pumps, do not shut down the pump until it has run for 30 minutes. *[8.3.3.10(4)]*

5.4. 2-Year Maintenance

Two-year maintenance should be completed in accordance with Clarke Fire requirements.

- 2-Year Maintenance

Table 8. Maintenance - 2-Year

Item	Action
Air System	• Air Filter. Replace. *[CF]*
Coolant System	• Coolant Hoses. Replace. *[CF]* • Thermostat, Engine. Replace. *[CF]* • Water pump impellor (JU4 & JU6). Check, replace. *[CF]*
Belt	• Belts. Replace. *[CF]*
Batteries	• Batteries. Replace. *[CF]*

5.5. 5-Year Maintenance

Five-year maintenance should be completed in accordance with Clarke Fire requirements.

- 5-Year Maintenance

Table 9. Maintenance - 5-Year

Item	Action
Torsional Coupling	• Torsional Coupling. Replace if applicable. *[CF]*

5.6. As-needed Maintenance

As-needed maintenance should be completed on engine operator's discretion.

- NSR Heat Exchanger Maintenance - refer to document C139149 for NSR cleaning procedure.
- Radiator Cleaning - Radiator cores can be pressure washed with a mild non-caustic detergent. Regulate maximum pressure to approximately 100 psi and aim the stream perpendicular to the core to prevent fin damage.

5.7. Component Replacement Testing Requirements

Component replacement testing requirements in accordance with NFPA 25: 8.6

Replacement parts shall be provided that will maintain the listing for the fire pump component assembly. *[8.6.3]*

- Component Replacement Testing Requirements

Table 10. Component Replacement Testing Requirements

Component	Action	Test
Driveshaft or Coupling	Adjustment, Repair, or Replace	Perform Flow test - NFPA 25: 8.3.3
Engine	Rebuild or Replacement	Perform Acceptance Test - NFPA 20: 14
Fuel Transfer Pump	Adjustment, Repair, or Replace	Perform No-Flow test - NFPA 25: 8.3.2
Fuel Injector or ECM	Adjustment or Replace	Perform Flow test - NFPA 25: 8.3.3
Cooling System	Repair, Rebuild, or Replace	Perform Flow test - NFPA 25: 8.3.3
Fuel Filter	Repair or Replace	Perform No-Flow test - NFPA 25: 8.3.2
Air Intake System	Repair or Replace	Perform No-Flow test - NFPA 25: 8.3.2
Battery Charger (Alternator)	Repair, Rebuild, or Replace	Perform No-Flow test - NFPA 25: 8.3.2

Component	Action	Test
Electric System	Repair or Replace	Perform No-Flow test - NFPA 25: 8.3.2
Lubrication Oil Filter	Repair or Replace	Perform No-Flow test - NFPA 25: 8.3.2
Engine Baseplate	Repair	Perform No-Flow test - NFPA 25: 8.3.2 Alignment Inspection
Engine Baseplate	Replace	Perform Flow test - NFPA 25: 8.3.3 Alignment Inspection
Engine Foundation	Repair	Perform No-Flow test - NFPA 25: 8.3.2 Alignment Inspection

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