

DRY SYSTEMS TECHNOLOGIES®

PERMISSIBILITY CHECKLIST M354-001-01

Page 1 of 12

DST DRY SYSTEM® MODEL M354 MSHA APPROVED DIESEL POWER PACKAGE

FPT N45MSTX20.50 DIESEL ENGINE

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REVISION 01 * DATED MAY 2015

FPT N45MSTX20.50 Diesel Engine

1. [] It has been determined that the area, in which tests are to be performed, is in **FRESH AIR.**
2. [] The machine is equipped with a **FPT Model N45MSTX20.50**, four-cylinder turbocharged and aftercooled diesel engine.

Air Intake System

The Air Intake System of this Power Package includes the following flameproof components: an intake manifold with an inlet gasket installed between the engine and the manifold, and a flame arrestor attached to the manifold inlet with a gasket installed between both components.

All additional components located upstream of the intake flame arrestor, including an adapter, a charge air cooler, a turbocharger compressor, an intake air cleaner and associated pipes, hoses and clamps are not considered flameproof components and do not need to be checked for permissibility.

3. [] **Illustration No. 1** depicts the air intake assembly. All components appear as depicted and there is no visible damage, cracks or dents on the components.
[WEEKLY]
4. [] Item No. 1 is a pipe plug. It is installed into the engine intake manifold and is tight.
[WEEKLY]
5. [] Item No. 2 is a gasket. It is securely installed between the inlet port of the FPT engine and the intake manifold.
[WEEKLY]
6. [] Item No. 3 is an intake manifold. It is securely attached to the air intake port of the FPT engine. The angle of the elbow may vary, depending on the application. All fasteners are in place and tight.
[WEEKLY]
7. [] A 0.0015" feeler gauge cannot be inserted greater than 1/8" into **Joint "A"**.
[WEEKLY]
8. [] Item No. 4 is a lock wire. It is installed on four studs that secure the intake manifold.
[WEEKLY]
9. [] Item No. 5 is a pipe plug. It is installed into the manifold and is tight.
[WEEKLY]
10. [] Item No. 6 is an optional flameproof port that may be installed into the manifold. This optional port is used to monitor the boost pressure on the air intake. If used, check that it is tightly installed. A hose is connected and the center plug is securely held in place with a retaining ring. If a flameproof port is not used, a pipe plug must be securely installed into the port.
[WEEKLY]

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M354-001-01 * PERMISSIBILITY CHECKLIST * Page 3

11. []
[WEEKLY]

Item No. 7 is a gasket. It is securely installed between the inlet port of the intake manifold and the flame arrestor. An additional gasket is secured between the adapter and the intake to the flame arrestor.

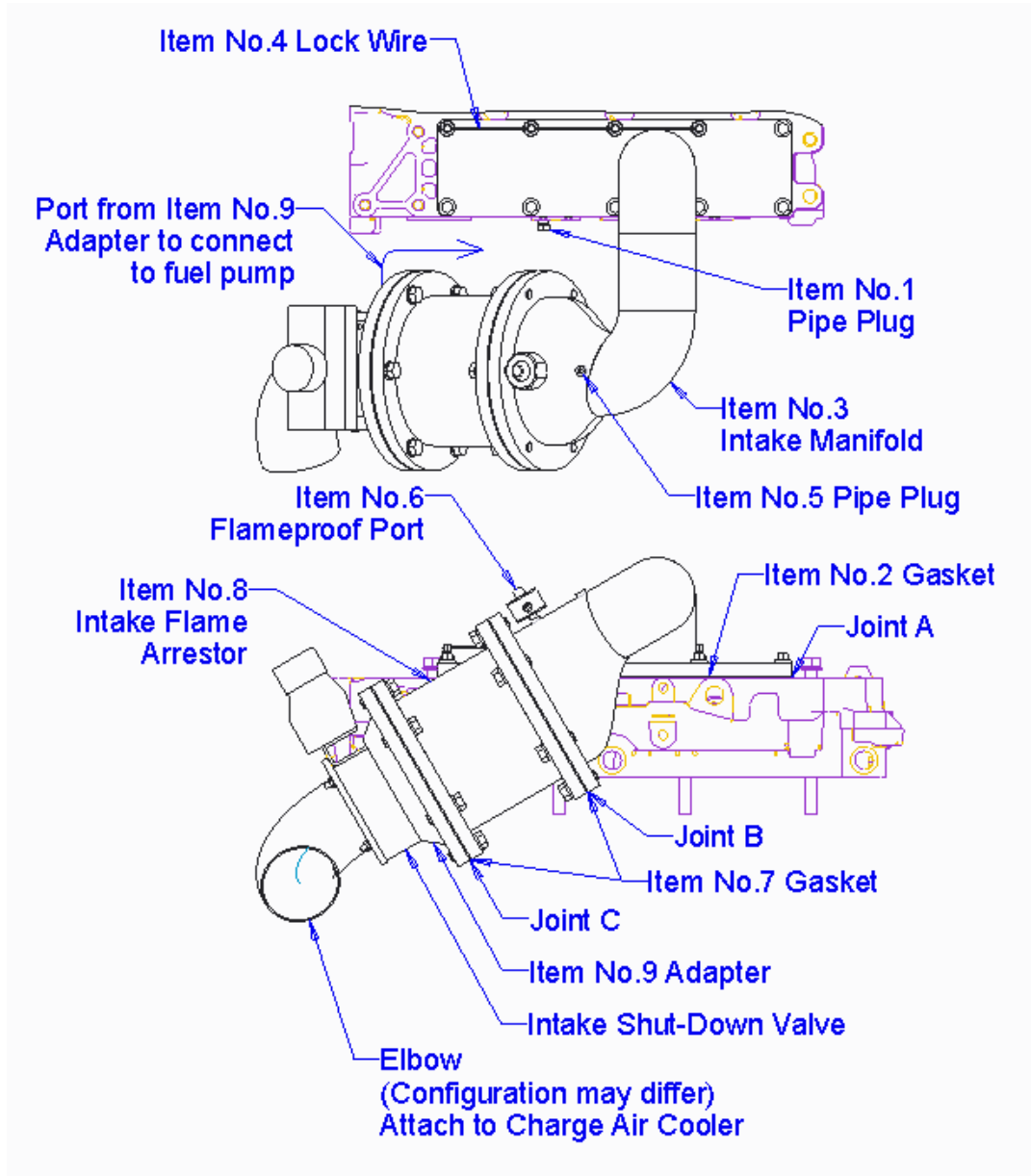


Illustration No. 1: Air Intake Assembly

12. []
[WEEKLY]

Item No. 8 is an intake flame arrestor. It is securely attached to the air intake port of the intake manifold. All fasteners and locking devices are in place and tight.

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REVISION 01 * DATED MAY 2015

13. [] A 0.0015" feeler gauge cannot be inserted greater than 1/8" into **Joint "B"**.
[WEEKLY]
14. [] Once every twelve-months, remove the intake flame arrestor. The flame arrestor core consists of a 4" wide stainless steel crimped ribbon element. There is no apparent damage and a 0.038" plug gauge will not pass through any of the triangular openings. The procedure is outlined on Illustration No. 5. When re-installing the flame arrestor & intake assembly, all fasteners and locking devices are in place and tight on both flanges. A 0.0015" feeler gauge cannot be inserted greater than 1/8" into **Joint "B"**. No further check is necessary on **Joint "C"**.
[12 MONTHS]
15. [] Item No. 9 is an adapter. It is attached to the inlet of the flame arrestor. It has a port that is connected to the injection pump with a hose. This supplies boost pressure to the injection pump. It is tightly installed.
[WEEKLY]
- No permissibility check is required on **Joint "C"**. No permissibility check is required on the air intake hoses, pipes, charge air cooler, or other components located upstream of the flame arrestor.

Exhaust System

The Exhaust System of this Power Package includes the following flameproof components: a water-cooled metallic surface insulation installed on the exhaust side of the engine, a water-cooled exhaust manifold with copper gaskets installed at its inlet, a water-cooled turbocharger with a gasket at its inlet, a water-cooled catalyst, a water-cooled elbow, a water-cooled bellows assembly, a water-cooled heat exchanger with inlet/outlet box, an exhaust flame arrestor, and a DPM filter housing with a disposable DST low temperature filter element.

16. [] **Illustration No. 2** depicts the manifold section of the exhaust system located between the exhaust ports of the diesel engine and the water-cooled elbow. All components appear as depicted and there is no visible damage, cracks, or dents on the components.
[WEEKLY]
17. [] Item No. 10 is water-cooled metallic insulation. It is installed on the exhaust side of the cylinder head. There is no apparent damage.
[WEEKLY]
18. [] Items No. 11 are four pipe plugs that are tightly secured in place.
[WEEKLY]
19. [] Items No. 12 are four copper gaskets. They are installed between the exhaust ports of the diesel engine and the exhaust manifold.
[WEEKLY]
20. [] Item No. 13 is a water-cooled exhaust manifold. It is securely attached to the exhaust ports of the FPT diesel engine. All fasteners are in place and tight.
[WEEKLY]
21. [] A 0.0015" feeler gauge cannot be inserted greater than 1/8" into the **Joint "D"**.
[WEEKLY]

22. [] Item No. 14 is a gasket. It is installed between the exhaust manifold and the turbocharger.
[WEEKLY]

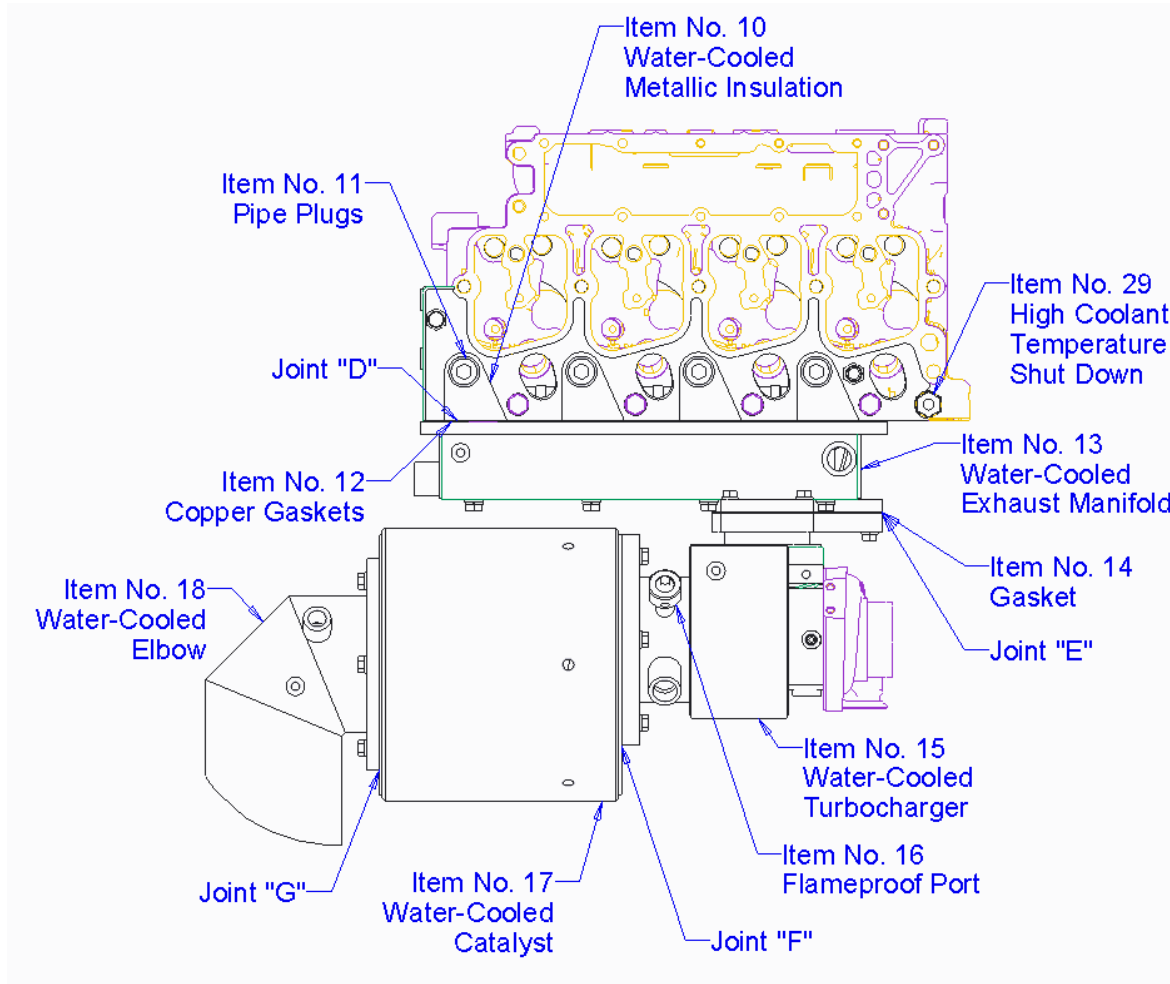


Illustration No. 2: Exhaust Assembly "A"

23. [] Item No. 15 is a water-cooled turbocharger. It is securely attached to the outlet port of the exhaust manifold. All fasteners and locking devices are in place and tight.
[WEEKLY]
24. [] A 0.0015" feeler gauge cannot be inserted greater than 1/8" into the **Joint "E"**.
[WEEKLY]
25. [] Item No. 16 is an optional flameproof port for monitoring the total backpressure and sampling of untreated (engine-out) carbon monoxide. It is tightly installed into the turbocharger. A hose is connected to the flameproof port and the center plug is securely held with a retaining ring. If a flameproof port is not installed, a pipe plug is securely installed into the port.
[WEEKLY]

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M354-001-01 * PERMISSIBILITY CHECKLIST * Page 6

26. [] Item No. 17 is a water-cooled catalyst. It is securely attached to the outlet of the
[WEEKLY] water-cooled turbocharger. No gasket is installed and all fasteners and locking devices are in place and tight.
27. [] A 0.004" feeler gauge cannot be inserted into the **Joint "F"**.
[WEEKLY]
28. [] Item No. 18 is a water-cooled elbow. It is securely attached to the outlet of the
[WEEKLY] catalyst. No gasket is installed and all fasteners and locking devices are in place and tight.
29. [] A 0.004" feeler gauge cannot be inserted into the **Joint "G"**.
[WEEKLY]
30. [] **Illustration No. 3** depicts the exhaust system components located between the water-
[WEEKLY] cooled elbow and the heat exchanger. All components appear as depicted and there is no visible damage, cracks, or dents on the components.

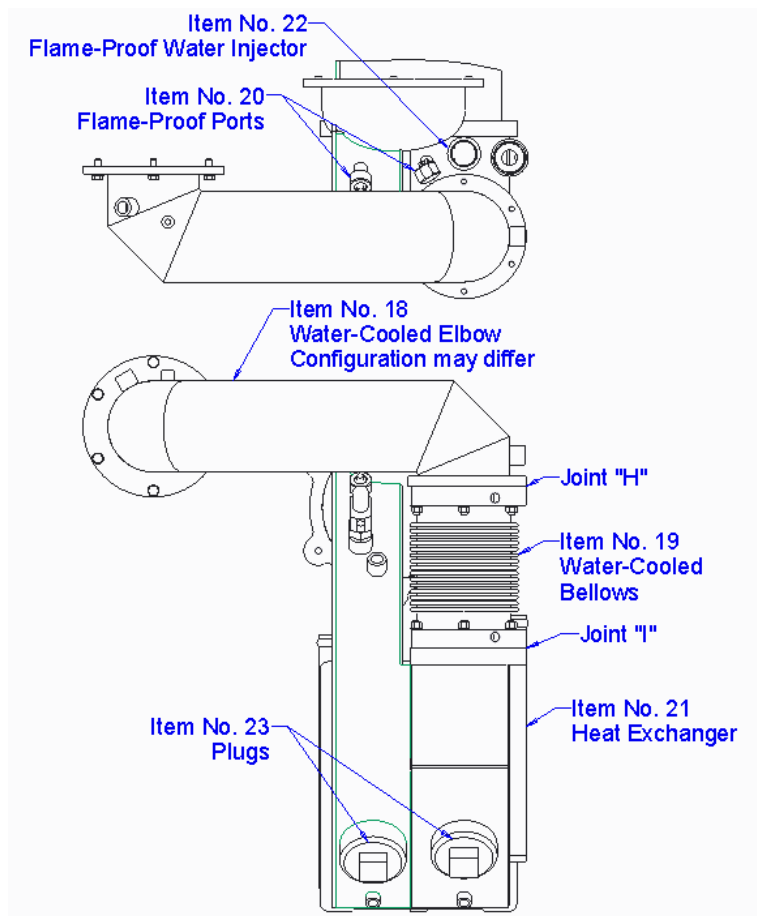


Illustration No. 3: Exhaust Assembly "B"

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M354-001-01 * PERMISSIBILITY CHECKLIST * Page 7

31. [] Item No. 19 is a water-cooled bellows assembly. It is securely attached to the outlet of the water-cooled elbow. No gasket is installed and all fasteners and locking devices are in place and tight. The bellows convolutes are not cracked or damaged and there is no indication of any coolant leak.
[WEEKLY]
32. [] A 0.004" feeler gauge cannot be inserted into the **Joint "H"**.
[WEEKLY]
33. [] Check the bellows for external damage. If there is damage to the convolutes or any visible coolant leaks are detected, replace the complete bellows assembly. After 24 months or 5,000 operating hours, remove and inspect the bellows assembly regardless of its apparent external condition. If there is damage to the inside convolutes or if leaks are detected, replace the complete bellows assembly. When re-installing the original or a replacement bellows assembly, all fasteners and locking devices are in place and tight on both flanges. Check the flame gap on Joints "G", "H", and "I" as described under No. 29, 32, and 36.
[SEE NOTE]
34. [] Items No. 20 are two (2) OPTIONAL flameproof ports that may be installed into the ports at the bellows assembly and the heat exchanger assembly. These OPTIONAL flameproof ports may be used in conjunction with an OPTIONAL pressure differential gauge for monitoring the heat exchanger pressures. If installed, check that flameproof ports are tightly installed into the bellows assembly and/or the heat exchanger assembly. If flameproof ports are not installed, pipe plugs are securely installed into the ports.
[WEEKLY]
35. [] Item No. 21 is the heat exchanger assembly. Its inlet flange is securely attached to the outlet of the water-cooled bellows. No gasket is installed and all fasteners and locking devices are in place and tight.
[WEEKLY]
36. [] A 0.004" feeler gauge cannot be inserted into the **Joint "I"**.
[WEEKLY]
37. [] Item No. 22 is the water injector. It is tightly installed into the pipe threaded fitting on top of the inlet flange of the heat exchanger.
[WEEKLY]
38. [] Items No. 23 are DST modified pipe plugs. They are installed in the heat exchanger and are tight.
[WEEKLY]

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REVISION 01 * DATED MAY 2015

39. []
[WEEKLY]

Illustration No. 4 depicts the exhaust system components located between the heat-exchanger and the exhaust filter. All components appear as depicted and there is no visible damage, cracks, or dents on the components.

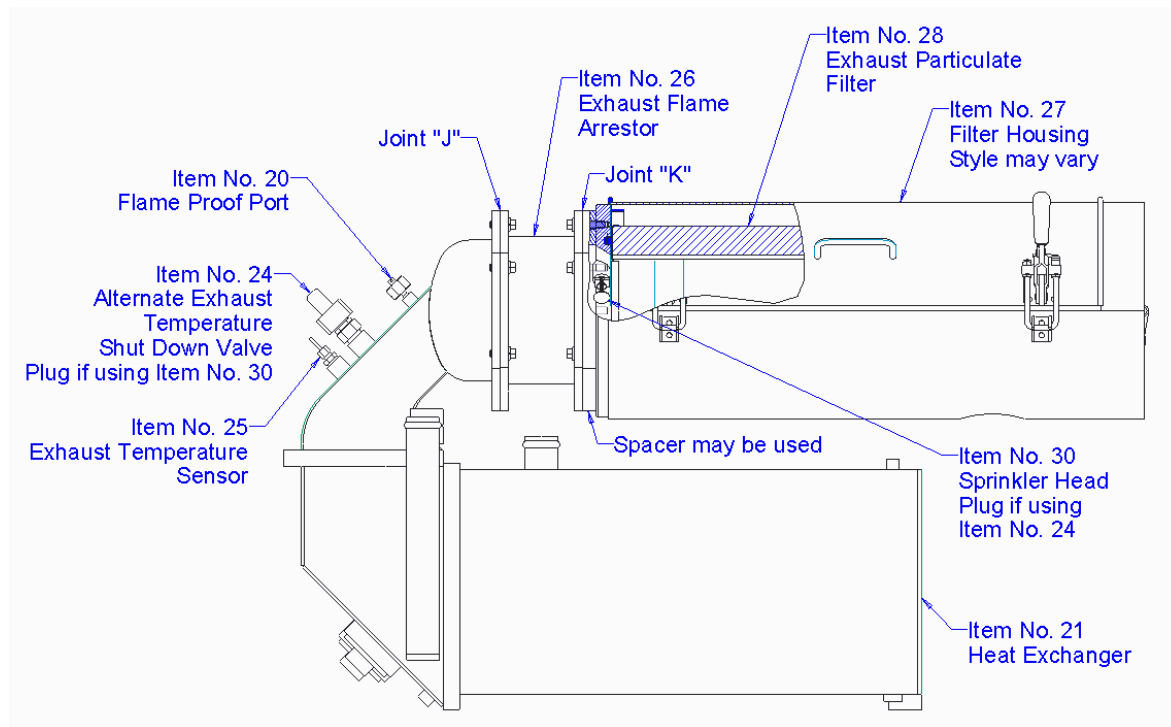


Illustration No. 4: Exhaust Assembly "C"

40. []
[WEEKLY]

Item No. 24 is an alternate exhaust temperature shutdown valve. It is tightly installed into the exhaust outlet elbow and is part of the safety shutdown system. If this shutdown valve is not used, a pipe plug is securely installed into the port and the sprinkler head is installed in the filter housing.

41. []
[WEEKLY]

Item No. 25 is an optional exhaust temperature sensor for the gauge in the operator's cab. If a sensor is not installed, a pipe plug is securely installed into the port.

42. []
[WEEKLY]

Item No. 26 is an exhaust flame arrestor. It is securely attached to the outlet flange of the heat exchanger assembly and all fasteners and locking devices are in place and tight.

43. []
[WEEKLY]

A 0.004" feeler gauge cannot be inserted into the **Joint "J"**.

44. []
[12 MONTHS]

Once every twelve months, remove the exhaust flame arrestor. The flame arrestor core consists of a 4" wide stainless steel crimped ribbon element. There is no apparent damage and a 0.038" plug gauge will not pass through any of the triangular

openings. The procedure is outlined on Illustration No. 5. When re-installing the exhaust flame arrester assembly, all fasteners and locking devices are in place and tight on both flanges. Check the flame gap on **Joint “J”** as described under No. 43. No further check is necessary on **Joint “K”**.

45. []
[WEEKLY]

Item No. 27 is an exhaust filter housing. It is securely attached to the exhaust flame arrester and all fasteners and locking devices are in place and tight. There is an optional spacer that may be installed between the flame arrester and filter housing. No gasket is used on these joints and they are not considered flame proof. No further check is necessary on **Joint “K”**.

46. []
[WEEKLY]

Item No. 28 is an exhaust particulate filter element and must be marked either **DRY SYSTEMS TECHNOLOGIES M30-411-01R** or **DRY SYSTEMS TECHNOLOGIES M40-416-01**.

47. []
[WEEKLY]

Remove the exhaust particulate filter from the exhaust filter housing. Avoid direct contact with diesel soot. The use of protective gloves is recommended. Visually inspect the outlet side of the flame arrester from the filter housing. There is no apparent damage to the crimped ribbon core of the exhaust flame arrester. Visually inspect the exhaust particulate filter for damage or leaks. Reinstall the exhaust particulate filter into the exhaust filter housing, or replace it with a new DST exhaust particulate filter if necessary. **THE USE OF AFTERMARKET FILTERS WILL VOID THE MSHA APPROVAL.**

Fuel System

48. []
[WEEKLY]

Illustration No. 5 depicts the fuel injection pump. The fuel injection rate adjustment mechanism and the engine governor setting are locked and sealed.

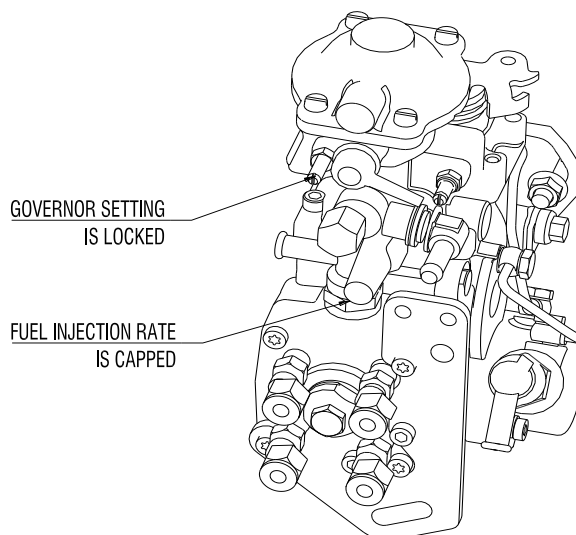


Illustration No. 5: Fuel Injection Pump

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Safety Shutdown Devices

49. [] Two temperature safety shutdown valves are part of the diesel power package. They are Item No.30 high exhaust temperature shutdown valve (sprinkler head) located on the exhaust filter housing inlet (or alternate Item No.24 on the heat exchanger outlet duct) and Item No.29 high coolant temperature shutdown valve located on the cylinder head. Both valves are tightly installed and connected to the safety shutdown system. The locations are depicted on Illustrations No. 2 and No. 4.
[WEEKLY]

50. [] Item No. 29 is a high coolant temperature safety shutdown valve. It must be removed and be tested every 6 months as described below:
[6 MONTHS]

Remove the high coolant temperature shutdown valve and the integral well. Plug the opening for the high coolant temperature shutdown valve with a pipe plug while performing this test. Do not separate the valve from the well. Place the high coolant temperature shutdown valve into a 50%-50% mixture of water & ethylene glycol and heat the mixture with the engine running. **The high coolant temperature shutdown valve must shut down the engine before the mixture temperature exceeds 212°F.**

- a. Reinstall the high coolant temperature shutdown valve into the proper location. Make sure the valve is tightly installed and connected to the safety shutdown system.
- b. With the engine shut down, remove the DPM filter from the housing. Check Item No. 30 sprinkler head for damage, loose parts, scale coating, or corrosion. Verify the bulb color is blue. The model number is Tyco 3231, and the temperature rating is 286°F. If the sprinkler head is used, confirm that the alternate Amot exhaust temperature shutdown valve Item No. 24 is not used and that a pipe plug is securely installed in its place.

Replacement procedure for a blown sprinkler head:

Remove the DPM filter from the housing.

Remove the blown sprinkler head from inside the filter housing.

Install a new Tyco 3231 sprinkler head.

Place the DPM filter in the filter housing. Close and properly secure the filter housing.

51. [] The alternate high exhaust temperature safety shutdown valve Item No. 24 must be removed and be tested every 6 months as described below:
[6 MONTHS]

- a. Remove the high exhaust gas temperature shutdown valve with an integral well. Do not separate the valve from the well. Close the port in the exhaust elbow with a pipe plug while performing this test. Place high exhaust temperature shutdown valve and well into a non-flammable liquid, such as non-flammable transmission fluid or non-flammable hydraulic fluid, and heat the fluid with the engine running. The high exhaust gas temperature shutdown valve must shut down the engine before the fluid exceeds 302°F.

- b. Optional: This method of testing is intended to expose the high exhaust gas temperature shutdown valve to the uncooled hot exhaust gases of the system instead of hot fluid. Remove hoses from water cleaner injector. Remove injector from heat exchanger inlet flange. Remove the high exhaust gas temperature shutdown valve with an integral well. Do not separate the valve from the well. Close the port in the exhaust elbow with a pipe plug while performing this test. Assemble a standpipe from pipe fittings. This standpipe should be threaded into the water injector location. Suspend the high exhaust gas temperature shutdown valve with the hoses attached into this standpipe. A temperature measurement device such as a thermocouple or thermometer should also be placed in the standpipe. Operate the engine at moderate speed to subject the high exhaust gas temperature shutdown valve to the uncooled gases. Monitor the temperature. The high exhaust gas temperature shutdown valve must shut down the engine before the exhaust gas temperature exceeds 302°F.
- c. Reinstall the high exhaust gas temperature shutdown valve into the proper location. Make sure that the valve is tightly installed and connected to the safety shutdown system.

System Operations Check

52. [] With the engine running at a moderate speed, activate the emergency shutdown valve. Upon activation, the intake air shutoff valve must operate immediately and **the engine must shut down within 15 seconds.**
[WEEKLY]
53. [] If equipped with an optional tachometer, with the engine running, the transmission in neutral, all accessories dis-engaged, and the throttle pedal fully depressed, the engine speed indicated on the gauge in the operator's cab does not exceed 2,530 rpm.
[WEEKLY]
54. [] Run the engine at torque stall. The total intake restriction shown on the gauge in the operator's cab must not exceed 18 inches H₂O and the total exhaust restriction shown on the gauge in the operator's cab must not exceed 40 inches H₂O.
[WEEKLY]

Flame Arrestor Inspection Procedure (Intake and Exhaust Flame Arrestor)

1. Remove the flame arrestor assembly.
2. Place the flame arrestor assembly on a flat surface with a contrasting background under the flame arrestor, such as brattice cloth or clean white cloth.
3. Adequate lighting is required. Cap lamp lighting is not sufficient.
4. Visually inspect each side of the flame arrestor for openings or spaces obviously greater than the triangular openings of the core.

5. Visually inspect each side of the core for places where the windings of the flame arrestor core appear to be separated such that gaps can be seen. If such gaps exist, they must be checked as following:
 - a.) The only measuring tool considered acceptable for performing this evaluation is a 0.038 inch diameter calibrated plug gauge. The plug gauge is to be mounted in a gauge holder and must project at least 1.00 inch out of the end.
 - b.) Grasp the gauge holder lightly between the index finger and the thumb. Place the wire tip at the point in question, making sure the plug gauge is vertical. Using only the weight of the gauge and holder, see if it will enter the apparent gap. Do not attempt to wiggle or push the gauge through the opening.
 - c.) If the plug gauge enters the opening, the flame arrestor core must not be used on permissible equipment.
6. Visually inspect the triangles in the flame arrestor core (both sides) for triangles that appear to be larger than the rest. If such conditions exist, these openings must be checked as previously described in section 5 a, b and c.
7. Finally, if the flame arrestor core passes all the above evaluations, a final check should be performed on at least 5 randomly selected triangles on each side of the core using the procedures described in section 5 a, b and c. In performing this check, the tip of the plug gauge must be placed against a specific triangular opening. If this special care is not taken, the evaluation will be invalid.

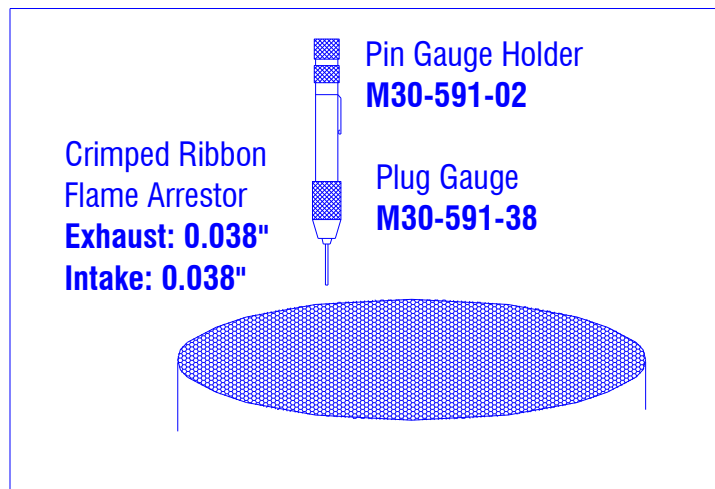


Illustration No. 6: Flame Arrestor Checking Procedure

This Permissibility Checklist contains 54 steps on 12 Pages with 6 Illustrations.

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