

# **DRY SYSTEMS TECHNOLOGIES®**

## **DRY SYSTEM® DIESEL POWER PACKAGE PERMISSIBILITY CHECKLIST M251-001-01**

Page 1 of 10

### **DST DRY SYSTEM® MODEL M251 MSHA APPROVED DIESEL POWER PACKAGE** Based on MSHA 7F-010-0 Approved DST Dry System®

**RETROFITTED TO AN  
ATLAS-COPCO WAGNER SCOOP  
WITH A  
150 HP CATERPILLAR 3306 PCNA DIESEL ENGINE**

**DRY SYSTEMS TECHNOLOGIES®**  
8102 Lemont Road, Suite 700  
WOODRIDGE, IL 60517, USA  
Phone: 630-427-2051 \* Fax: 630-427-1036  
E-mail: [eng@drysystemstech.com](mailto:eng@drysystemstech.com)

**DO NOT CHANGE WITHOUT MSHA APPROVAL**

REVISION 02 \* DATED September 2005

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Phone: 630-427-2051 \* Fax: 630-427-1036 \* E-mail: eng@drysystemstech.com

## **M251-001-01 \* PERMISSIBILITY CHECKLIST \* Page 2**

**DRY SYSTEM® DIESEL POWER PACKAGE FOR A 150 HP CATERPILLAR 3306 PCNA DIESEL ENGINE**

### **Caterpillar 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 **CATERPILLAR Model 3306 PCNA**, six-cylinder naturally aspirated diesel engine.

### **Air Intake System**

**NOTE: This DST Model M251 Diesel Power Package may/or may not use the Air Intake System that was originally supplied by the original equipment manufacturer. Please refer to the applicable Permissibility Checklist when checking the Air Intake System.**

### **DST Exhaust System**

The **Exhaust System of the Model M251 DST Dry System® of this Diesel Power Package** was derived from the MSHA Part 7F-010-0 Approved DST Diesel Power Packages. It includes a Caterpillar supplied water-cooled engine exhaust manifold and the following DST supplied components: A water-cooled manifold outlet elbow, a water-cooled catalyst, a second water-cooled elbow, a water-cooled bellows assembly, a heat exchanger with a water-cooled inlet/outlet box, an exhaust pipe, an exhaust flame arrestor, and a DPM filter housing with a disposable paper element DPM filter.

Illustrations No. 1, No. 2 and No. 3 on the following pages depict the components of the exhaust system.

3. [ ] All components appear to be the same as shown on Illustrations No. 1, No. 2 and No. 3 in this Permissibility Checklist. There is no visible damage, cracks or dents on the Exhaust System.  
*[WEEKLY]*
4. [ ] Illustration No. 1 depicts the first section of the Caterpillar and DST exhaust system components that are located between the exhaust ports of the Caterpillar diesel engine and the inlet of the manifold outlet elbow. All components appear as depicted and there is no visible damage, cracks or dents on the components.  
*[WEEKLY]*
5. [ ] Item No. 2 is a water cooled exhaust manifold. It is securely attached to the six exhaust ports of the Caterpillar diesel engine. Items No. 1 are three (3) Caterpillar supplied metal exhaust gaskets installed between the components. All fasteners and locking devices are in place and tight. (Joint "A").  
*[WEEKLY]*
6. [ ] A 0.0015" feeler gage cannot be inserted greater than 1/8" into the Joint "A".  
*[WEEKLY]*

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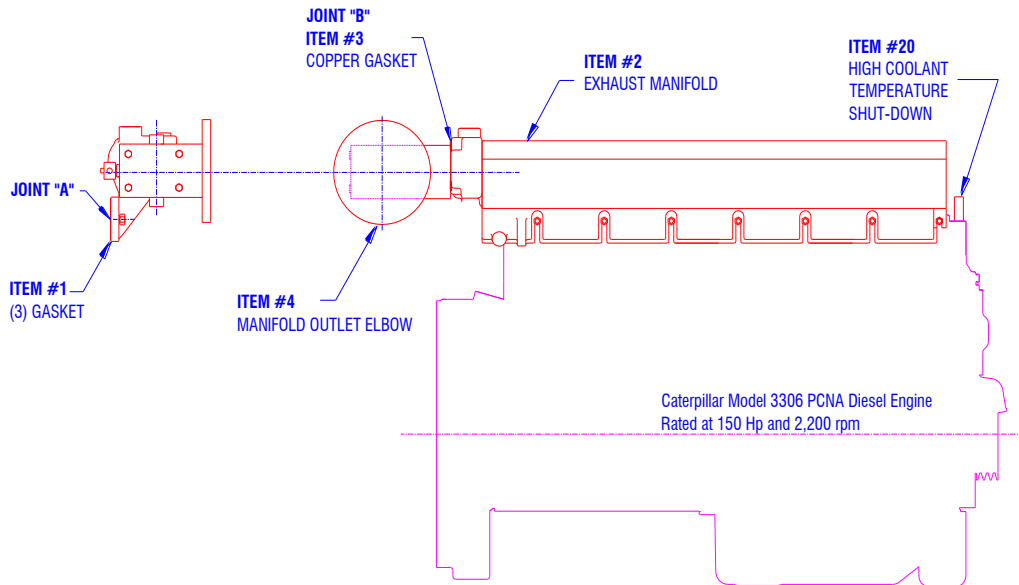


Illustration No. 1: Exhaust System from Engine Outlet to Manifold Outlet Elbow

7. [ ] Item No. 4 is a water cooled manifold outlet elbow. It is securely attached to the outlet of the  
[WEEKLY] exhaust manifold. Item No. 3 is a copper gasket installed between the components and all fasteners and locking devices are in place and tight. (Joint "B")
8. [ ] A 0.0015" feeler gage cannot be inserted greater than 1/8" into the Joint "B".  
[WEEKLY]
9. [ ] Illustration No. 2 depicts the second section of the DST exhaust system components that are  
[WEEKLY] located between the manifold outlet elbow and the inlet of the inlet outlet box. All components appear as depicted and there is no visible damage, cracks or dents on the components.
10. [ ] Item No. 21 is an optional flameproof port for monitoring the total backpressure and sampling  
[WEEKLY] of untreated (engine-out) carbon monoxide. It is tightly installed into the side port of the manifold outlet elbow. A hose is connected to the flameproof port and the center plug is securely held with a retaining ring. If not installed, a pipe plug must be securely installed into the port.

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DRY SYSTEM® DIESEL POWER PACKAGE FOR A 150 HP CATERPILLAR 3306 PCNA DIESEL ENGINE

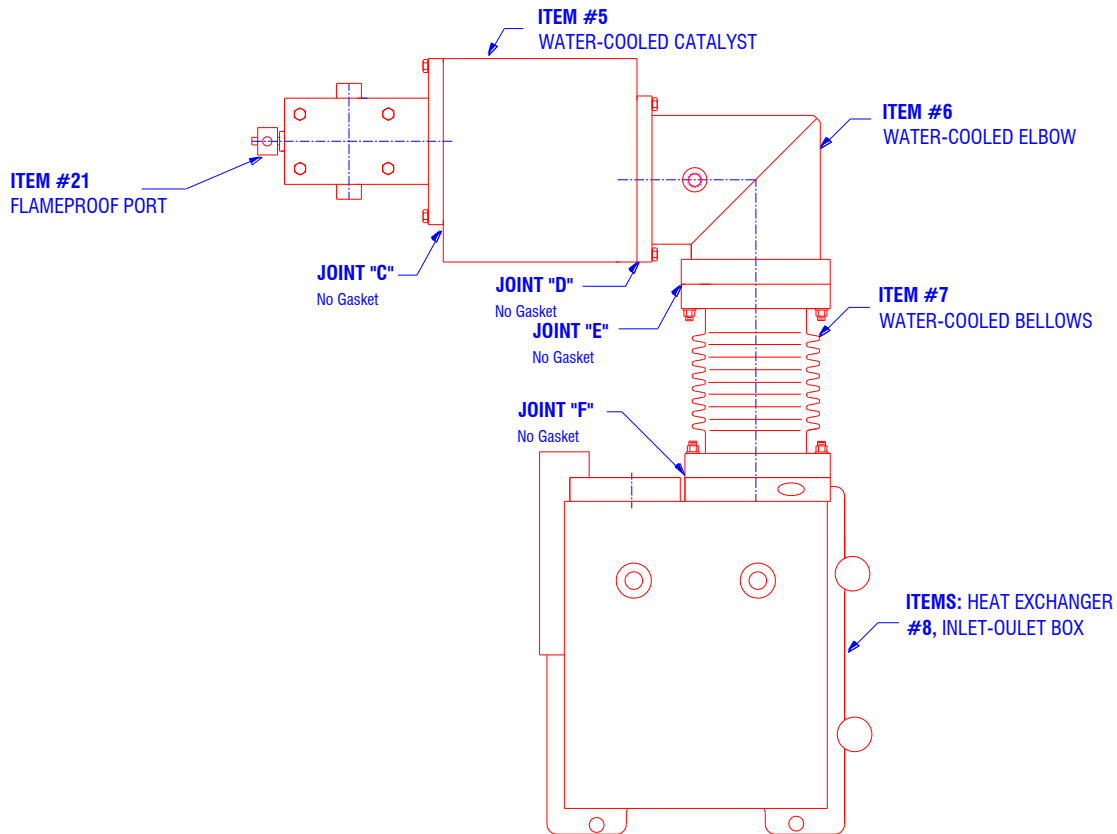


Illustration No. 2: Exhaust System from Manifold Outlet Elbow to Inlet-Outlet Box

11. [ ] Item No. 5 is a water-cooled catalyst assembly. It is securely attached to the outlet flange of the manifold outlet elbow. No gasket is installed between the components and all fasteners and locking devices are in place and tight. (Joint "C")  
[WEEKLY]
12. [ ] A 0.004" feeler gage cannot be inserted into the Joint "C".  
[WEEKLY]
13. [ ] Item No. 6 is a water-cooled elbow. It is securely attached to outlet of the catalyst. No gasket is installed between the components and all fasteners and locking devices are in place and tight. (Joint "D")  
[WEEKLY]

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14. [ ] A 0.004" feeler gage cannot be inserted into the Joint "D".  
*[WEEKLY]*
15. [ ] Item No. 7 is a water-cooled bellows assembly. It is securely attached to the outlet flange of the water-cooled elbow. No gasket is installed between the components and all fasteners and locking devices are in place and tight. (Joint "E")  
*[WEEKLY]*  
The bellows convolutes are not cracked or damaged and there is no indication of any coolant leaks.
16. [ ] A 0.004" feeler gage cannot be inserted into the Joint "E".  
*[WEEKLY]*
17. [ ] Check the bellows for damage. If there is damage to the convolutes or visible leaks to the bellows 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 "E" and "F" as described under No 16 and No 19.  
*[SEE NOTE]*
18. [ ] Item No 8 is the heat exchanger inlet-outlet box. The inlet flange is securely attached to the outlet of the bellows. No gasket is installed between the components and all fasteners and locking devices are in place and tight. (Joint "F")  
*[WEEKLY]*
19. [ ] A 0.004" feeler gage cannot be inserted into the Joint "F".  
*[WEEKLY]*
20. [ ] Illustration No. 3 depicts the third section of the exhaust system components that are located between the heat exchanger and the final exhaust pipe. All components appear as depicted and there is no visible damage, cracks or dents on the components.  
*[WEEKLY]*

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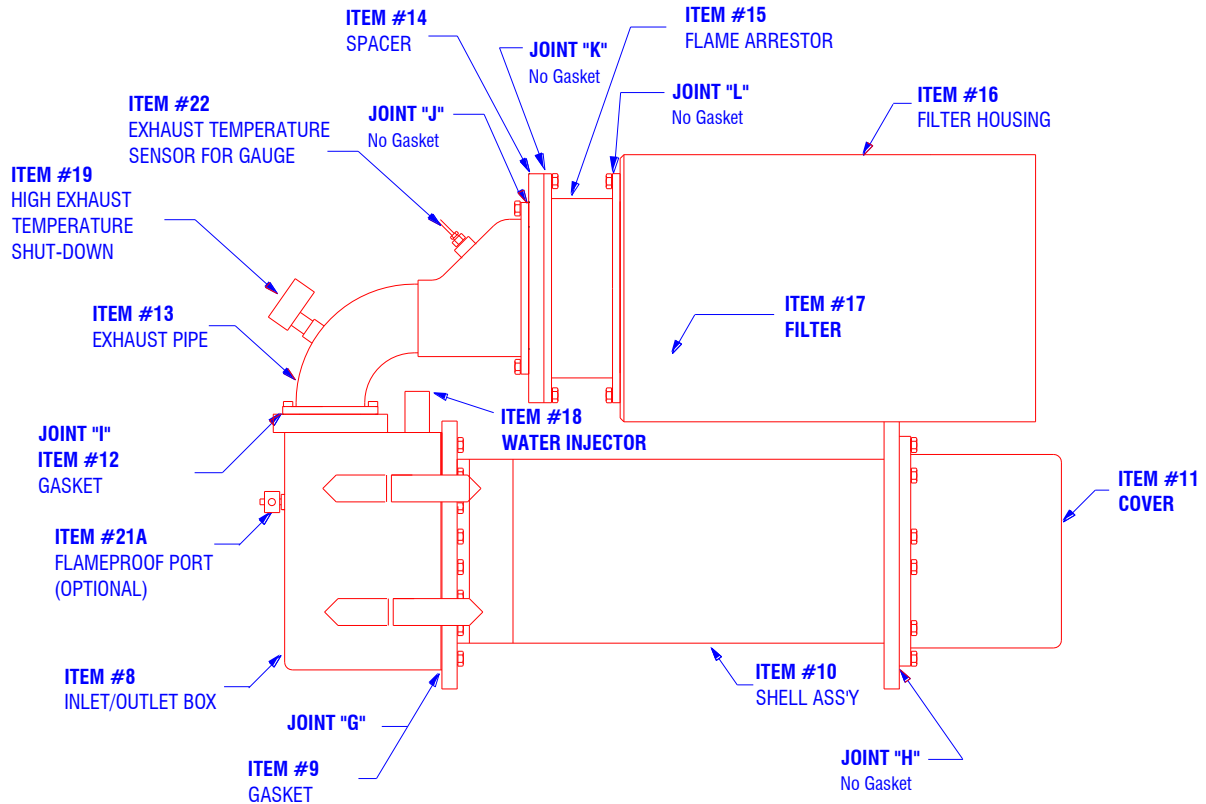


Illustration No 3: Exhaust System from Inlet-Outlet Box to Filter Housing

21. [ ] Item No. 8 is the inlet-outlet box. It is securely attached to Item No. 10, the shell assembly. Item No. 9 is a copper gasket installed between the components and all fasteners and locking devices are in place and tight. (Joint "G") Item No. 11 a cover. It is securely attached to the other end of the shell assembly. No gasket is installed between the components and all fasteners and locking devices are in place and tight. (Joint "H")  
 [WEEKLY]
22. [ ] A 0.0015" feeler gage cannot be inserted greater than 1/8" into the Joint "G". The Joint "H" is not considered flameproof and needs no check.  
 [WEEKLY]
23. [ ] Two (2) OPTIONAL flameproof ports (Item No. 21A) may be installed into the end of the inlet-outlet box. These OPTIONAL ports are used in conjunction with an OPTIONAL pressure differential gage monitoring the heat exchanger. If installed, check that they are tightly installed into the end ports of the inlet-outlet box. A hose is connected to each flameproof port and the center plug is securely held with a retaining ring. If not installed, pipe plugs must be securely installed into the ports.  
 [WEEKLY]

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24. [ ] Item No. 13 is an exhaust pipe. It is securely attached to the outlet flange of the inlet-outlet box. Item No. 12 is a copper gasket installed between the components and all fasteners and locking devices are in place and tight. (Joint "I").  
[WEEKLY]
25. [ ] A 0.0015" feeler gage cannot be inserted greater than 1/8" into the Joint "I".  
[WEEKLY]
26. [ ] Item No. 18 is a water injector. It is tightly installed into the pipe threaded fitting on top of the inlet-outlet box.  
[WEEKLY]
27. [ ] Item No. 19 is a high exhaust temperature shutdown valve. It is tightly installed into the pipe threaded port on top of the exhaust outlet elbow.  
[WEEKLY]
28. [ ] Item No. 22 is an optional exhaust temperature sensor for the gauge in the operator's cab. It is tightly installed into the pipe thread on top of the exhaust outlet elbow. If a sensor is not installed, a pipe plug must be installed securely into the port.  
[WEEKLY]
29. [ ] Item No. 14 is a spacer. It is securely attached to the outlet of the exhaust elbow and all fasteners and locking devices are in place and tight. No gasket is installed between the two components (Joint "J").  
[WEEKLY]
30. [ ] A 0.004" feeler gage cannot be inserted into the Joint "J".  
[WEEKLY]
31. [ ] Item No. 15 is an exhaust flame arrestor. It is securely attached to the spacer and all fasteners and locking devices are in place and tight. No gasket is installed between the two components (Joint "K").  
[WEEKLY]
32. [ ] A 0.004" feeler gage cannot be inserted into the Joint "K".  
[WEEKLY]
33. [ ] 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 gage will not pass through any of the triangular openings. The procedure is outlined on Illustration No. 4. Reinstall the exhaust flame arrestor, and make sure all fasteners and locking devices are in place and tight.  
[12 MONTHS]
34. [ ] Item No. 16 is an exhaust particulate filter housing. It is securely attached to the exhaust flame arrestor and all fasteners and locking devices are in place and tight. No gasket is used between the two components and the joint is not considered flame proof (Joint "L"). No further check is necessary on this joint.  
[WEEKLY]
35. [ ] Item No. 17 is a 16" exhaust particulate filter element and **must be marked "DST M30"**.  
[WEEKLY]

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36. [ ] Remove the exhaust DPM filter element from the exhaust filter housing. Avoid direct contact with diesel soot. Visually inspect the outlet side of the flame arrestor from the filter housing. There is no apparent damage to the crimped ribbon core of the exhaust flame arrestor. Visually inspect the exhaust DPM filter element for damage or leaks. Reinstall the DST exhaust DPM filter element into the exhaust filter housing, or replace with a new DST exhaust DPM filter element if necessary. **THE USE OF AFTERMARKET FILTERS WILL VOID THE MSHA APPROVAL.**
- [WEEKLY]*

### **DST Shut Down Devices**

37. [ ] Two safety shut-down valves are part of the DST Dry System, the high exhaust temperature shutdown valve (Item No. 19) is located on the exhaust pipe and the high coolant temperature shutdown valve (Item No. 20) is located near the thermostat housing of the Caterpillar diesel engine. See Illustrations No. 3 and No. 1. Both valves are tightly installed and connected to the safety shut-down system.
- [WEEKLY]*

38. The high coolant temperature safety shutdown valve must removed and tested every 6 months as described below:
- [EVERY 6 MONTHS]*

- a. [ ] Remove the high coolant temperature shutdown valve and the integral well. Plug the opening in the thermostat with a pipe plug while performing this test. Do not separate the valve from the well. Place high coolant temperature shutdown valve into a 50%-50% water & ethylene glycol mixture and heat the mixture. With the engine running the high coolant temperature shutdown valve must **open at 205° F and shut down the engine before exceeding 212° F.**
- b. [ ] Reinstall the high coolant temperature shutdown valve into the proper location. Make sure that the valve is tightly installed and connected to the safety shut-down system.

39. The high exhaust temperature shutdown valve must removed and tested every 6 months as described below:
- [EVERY 6 MONTHS]*

- a. [ ] Remove the high exhaust temperature shutdown valve with an integral well. Do not separate the valve from the well. Close the port in the exhaust pipe 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 temperature shutdown valve must **open between 275° F and 302° F and the engine must shut down before exceeding 302° F.**

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- b.     [   ]     **OPTIONAL:** This method of testing is intended to expose the high exhaust 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/outlet box. Remove the high exhaust temperature shutdown valve with an integral well. Do not separate the valve from the well. Close the high exhaust temperature shutdown valve port in the exhaust pipe 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 **open between 275° F and 302° F and the engine must shut down before exceeding 302° F.**
- c.     [   ]     Reinstall the high exhaust gas temperature shutdown valve and water cleaner injector into their proper locations. Make sure that the valve is tightly installed and connected to the safety shutdown system.

### **System Operation**

40.     [   ]     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 2,350 RPM  
*[WEEKLY]*
41.     [   ]     Run engine at high idle speed of 2,250-2,350RPM. The total intake restriction shown on the gauge in the operator's cab must not exceed 30 inches H<sub>2</sub>O and the total exhaust restriction shown on the gauge in the operator's cab must not exceed 34 inches H<sub>2</sub>O.  
*[WEEKLY]*

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### Flame Arrestor Inspection Procedure

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. These kinds of openings may have been caused by prying a screwdriver or another such object against or through the Flame Arrestor core during manufacturing or routine maintenance.
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 gage, sometimes called wire gage. The Plug Gage is to be mounted in a Gage Holder must project at least 1.0 inch out of the end.
  - b.) Grasp the gage holder lightly between the index finger and the thumb. Place the wire tip at the point in question, making sure the plug gage is vertical. Using only the weight of the gage and holder, see if it will enter the apparent gap. Do not attempt to wiggle or push the gage through the opening.
  - c.) If the plug gage 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 with the procedure described in section 5 a, b and c. In performing this check, the tip of the plug gage must be placed against a specific triangular opening. If this special care is not taken, the evaluation will be invalid.

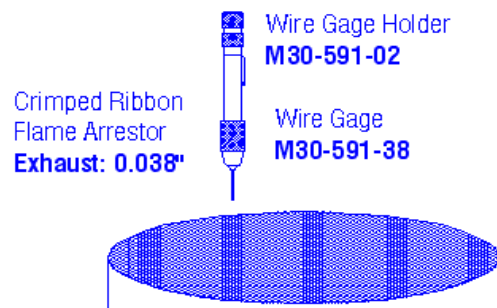


Illustration No 4: Flame Arrestor Checking Procedure  
**This Permissibility Checklist contains 41 Items on 10 Pages with 4 Illustrations.**

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