

EXHAUST SYSTEM

DESCRIPTION

The exhaust manifold is a one-piece casting incorporating flanged pipes, secured by bolts to the left-hand side of the cylinder head. The manifold is attached direct to the cylinder head making a gas tight joint without the aid of gaskets or jointing medium.

EXHAUST MANIFOLD

Removal

1. Remove the fuel injection pipes (page 22 of section 2).
2. Disconnect the front exhaust pipe from the manifold.
3. Remove the bolts and lock washers securing the manifold to the cylinder head, and lift away the manifold.

Inspection

1. Examine the manifold for cracks, particularly around the attaching flanges.
2. Check for distortion of the joint face on a surface plate. Slight distortion can be corrected with a fine cut file.

Installation

Note the following:

1. Ensure that the manifold joint faces are clean and free from burrs.
2. Tighten the manifold securing screws to a torque of 25 lbs/ft.
3. Check the manifold attaching nuts after the engine has warmed up.

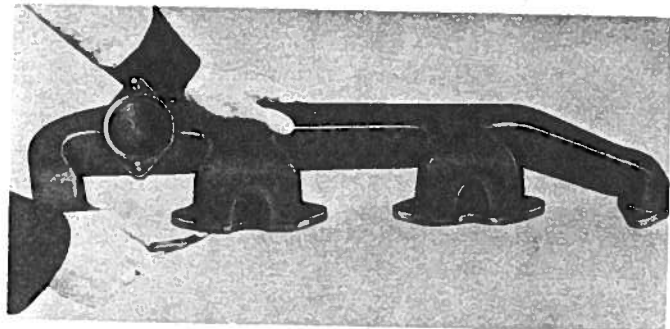


Fig. 1. Checking an exhaust manifold for distortion

EXHAUST MANIFOLD (WATER COOLED)

A water cooled exhaust manifold is fitted to engines equipped for marine use or heat exchanger cooling. The exhaust manifold chamber is surrounded by a casing which retains the coolant. The coolant is the raw water from the heat exchanger unit which passes from the heat exchanger through the outer cavity of the exhaust manifold and is then exhausted.

Remove Exhaust Manifold

1. Drain the raw water from the cooling system, the raw water pump end cover must be removed for this operation. The pump is situated at the front of the engine, on the right hand side of the engine when viewed from the rear.
2. Disconnect the exhaust pipe from the manifold by removing the six screws from the rear end of the manifold.
3. Slacken the hose clamp and remove exhaust water pipe from rear of manifold.
4. Slacken the hose clamps which retain the water supply hose and remove the hose.
5. Remove the two 3/8" screws which secure the oil filter to the bracket which is fixed to the exhaust manifold. Care must be taken at this stage to remember the oil filter is not firmly fixed to the engine.
6. Support the manifold and remove the screws which secure it to the cylinder head, care must be taken not to damage the fuel pipes from fuel pump to injectors, on some engines the pipe clamps are fitted to the exhaust manifold fixing screws.

7. Remove manifold and manifold gasket, if fitted.

Inspection

1. Remove the loose scale and carbon that may have accumulated on the internal walls of the exhaust manifold.
2. Clean all traces of the gasket, if fitted, from the exhaust manifold, and also cylinder head.
3. Examine the manifold for cracks, particularly around the attaching flanges.
4. Make up and fit a plate suitable for sealing the entire exhaust end of the manifold, a rubber gasket is recommended to obtain a seal between the plate and manifold. Remove the water inlet and outlet elbows from the manifold castings, make a plate and fit as above, covering the water outlet. The water inlet should be covered with a plate similar to that used on the outlet, but with a fitting suitable for connecting to an air supply. Do not cover the ports which fit adjacent to the cylinder head.
5. Immerse the exhaust manifold in a container of hot water 180° - 200°F and pressurise by hand or foot pump (Not works air line) to 30 P.S.I. It is essential that hot water be used as this simulates actual operating conditions, if the manifold should have any leaks air will be observed escaping either from the ports or the exterior of manifold.
6. Remove manifold from water tank remove fittings and blanking plates, dry manifold with compressed air.
7. Check for distortion of the joint face on a surface plate. Slight distortion can be corrected with a fine cut file.

Installation

1. Ensure that the manifold joint faces are clean and free from burrs.
2. Install manifold gasket in place, this can be achieved by inserting fixing screws, and spring washers into holes in manifold and laying gasket in place, located by screws.
3. Offer manifold to cylinder head and secure with screws which are not injector pipe bracket attaching points.
4. Re-fit injector pipe brackets taking care to refit clamps in the original position, this positioning is important in order to prevent vibration of pipes.
5. Tighten manifold securing screws to a torque of 25 lb. ft.
6. Re-fit oil filter to mounting bracket on front of exhaust manifold.
7. Re-fit after inspection coolant supply hose and clips, tighten hose clips.
8. Re-fit after inspection exhaust water pipe and tighten clips.
9. Re-fit the exhaust pipe to manifold.
10. Before starting engine check that the end cover has been refitted to the raw water pump, after engine has been run check tightness of all fixings and that no water or exhaust leaks exist.

SECTION 6

EXHAUST SYSTEM

Contents

Exhaust Manifold

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EXHAUST MANIFOLD

EXHAUST MANIFOLD (DESCRIPTION)

1. The Bedford 220 and 330 cu in engines use either an air cooled or a water cooled exhaust manifold.
2. The air cooled exhaust manifold is a one piece casting secured by four and eight bolts or studs for 220 and 330 cu in engines respectively. A gas tight joint is ensured by the use of gaskets between the cylinder head and exhaust manifold jointing faces, although on early engines the manifold was attached direct to the cylinder head.
3. There are two types of outlet on the air cooled exhaust manifolds, one for automotive engines (a) and a vertical outlet (b) for industrial engines.

a. Automotive



b. Industrial



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4. On marine engines a water cooled exhaust manifold is used. The exhaust manifold chamber is surrounded by a casing which retains the coolant. The coolant is the raw water from the heat exchanger unit which passes from the heat exchanger through the outer cavity of the exhaust manifold and is then exhausted.



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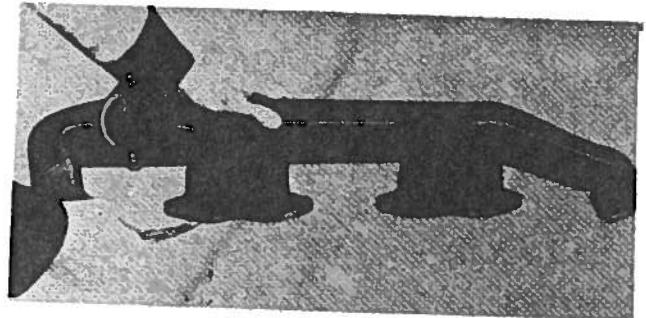
EXHAUST MANIFOLD (REMOVAL)

5. Air Cooled. If the engine is installed in a machine disconnect any exhaust pipe from the manifold. Remove and discard the manifold securing nuts or bolts. The manifold can now be removed from the engine.

6. Water Cooled. If the engine is installed in a vessel the raw water coolant must be drained before attempting any removal, this is detailed in 5.6000.
7. Disconnect the exhaust pipe from the manifold by removing the six screws from the rear end of the manifold.
8. Slacken the hose clamps and remove the exhaust water pipe from the rear of the manifold.
9. Slacken the hose clamps, which retain the supply hose, remove hose.
10. Remove the two 1/4" screws which secure the oil filter to the bracket which is fixed to the exhaust manifold. Care must be taken at this stage to remember that on early engines, the oil filter is not firmly fixed to the engine.
11. Support the manifold and remove the screws which secure it to the cylinder head, care must be taken not to damage the fuel pipes from fuel pump to injectors, on some engines the pipe clamps are fitted to the exhaust manifold fixing screws.
12. Remove manifold and manifold gasket, if fitted.

EXHAUST MANIFOLD (INSPECTION AND OVERHAUL)

13. Air Cooled. Examine the manifold for cracks, particularly around the attaching flanges.
14. Check for distortion of the joint face on a surface plate. Slight distortion can be corrected with a fine cut file.



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15. Water Cooled. Remove the loose scale and carbon that might have accumulated on the internal walls of the exhaust manifold.
16. Clean all traces of the gasket, if fitted, from the exhaust manifold, and also the cylinder head.
17. Examine the manifold for cracks, particularly around the attaching flanges.
18. Make up and fit a plate suitable for sealing the entire exhaust end of the manifold, a rubber gasket is recommended to obtain a seal between the plate and manifold. Remove the water inlet and outlet elbows from the manifold casting, make a plate and fit as above over the water outlet. The water inlet should be covered with a similar plate but with a fitting suitable for connecting an air supply. Do not cover the ports which fit adjacent to the cylinder head.
19. Immerse the exhaust manifold in a container of hot water 82°-88°C (180°-200°F) and pressurise by hand or foot pump (not a works air line) to 207 KPa (30 P.S.I.). It is essential that hot water is used

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as this simulates actual operating conditions, if the manifold should have any leaks air will be observed escaping either from the ports or the exterior of the manifold.

20. Remove the manifold from the water tank, remove the fittings and blanking plates. Dry the manifold with compressed air.

21. Check the manifold for distortion of the joint face on a surface plate. Slight distortion can be corrected with a fine cut file.

EXHAUST MANIFOLD (REFITTING)

22. **Air Cooled.** Ensure that the manifold joint faces are clean and free from burrs.

23. Fit the manifold together with gaskets and secure with the retaining screws. Tighten the screws to a torque of 34 Nm (25 lb ft).

24. **Water Cooled.** Ensure that the manifold joint faces are clean and free from burrs.

25. Fit the manifold gaskets in place, this can be achieved by inserting the fixing screws and spring

washers into holes in the manifold and laying the gaskets in place, located by the screws.

26. Offer the manifold to the cylinder head and secure with screws which are not injector pipe bracket attaching points.

27. Refit the injector pipe brackets taking care to refit the clamps in their original positions, this positioning is important in order to prevent the vibration of the pipes.

28. Tighten the manifold securing screws to a torque of 34 Nm (25 lb ft).

29. Refit the oil filter to its mounting bracket on front of the exhaust manifold.

30. Inspect the coolant supply hose and clips and refit, tighten hose clips.

31. Refit after inspection the exhaust water pipe and tighten clips.

32. Refit the exhaust pipe to the manifold.

33. Before starting the engine, check that the end cover has been refitted to the raw water pump, this is detailed in 5.6000. After the engine has been run, check the tightness of all fixings and that no water or exhaust leaks exist.