

*BLM # 82/B*

## ENGINE COOLING SYSTEMS

### RUST PREVENTION

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#### 1. GENERAL

1.01 This section provides information on rust prevention in water cooling systems of automotive type engines and of portable air compressors in order to preserve their efficiency and to minimize any tendency toward deterioration and clogging.

1.02 This information is provided for the use of garage attendants, motor vehicle inspector repairmen, operators of motor vehicles and any others who may be required to examine and service the cooling systems.

#### 2. MATERIALS

2.01 BELL SYSTEM RUST INHIBITOR. Supplied in powdered form in three-ounce containers for use in protecting the cooling system against rusting when no anti-freeze is used. If unavailable, a five-ounce container of Du Pont No. 7 Acid and Rust Inhibitor supplied in powdered form may be substituted (not to be confused with

Du Pont No. 7 Anti-Rust and Water Pump Lubricant which is a liquid).

2.02 OXALIC ACID of the ordinary variety, such as is used by painters as a bleach and which is readily available, is meant where such material is mentioned in this section. It is a white substance and may be in either crystalline or powder form. It is used as an aid in the removal of rust accumulations in the cooling system.

2.03 The WASHING SODA and KEROSENE mentioned in this section are of the common variety in general use.

#### 3. SAFETY PRECAUTIONS

3.01 The rust inhibitors, oxalic acid and washing soda all are poisonous if taken internally. Always take precautions in handling and storing them to prevent their being taken internally. Immediately after handling any of them, thoroughly wash your hands. If thought necessary, rubber gloves and goggles should be worn when handling these materials.

3.02 If necessary to remove the radiator cap to examine a hot radiator, be sure that there is no pressure in the cooling system which would blow out the hot liquid when the cap is removed. Place a thick towel or other heavy cloth over the radiator cap. Then loosen cap to first notch and release pressure before removing cap to avoid any eruption of the hot liquid from the radiator.

#### 4. GENERAL PRECAUTIONS

4.01 When adding water to a cooling system, whenever possible, use only clean, fresh, soft water. When additional materials are required in the cooling systems, use only approved materials.

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**4.02** Do not use alkaline or acid materials including the washing soda or oxalic acid, mentioned in this section, in cooling systems of engines having aluminum cylinder heads or other aluminum parts exposed to the liquids as such materials might attack the aluminum. Whenever such cooling systems are encountered follow the engine manufacturer's recommendations in regard to the use of inhibitors and cleansing materials.

**4.03** When grease is required to lubricate the water circulating pump shaft, use a water-proof grease. Do not force lubricant into the cooling system by over-lubrication as this, in time, is likely to cause a clogged radiator.

**4.04** Keep cooling system free from leaks at all times. Pump packing nuts should not be pulled up too tight. If moderate pressure on packing does not stop leakage repack the gland. Do not tighten pump packing gland nuts while engine is running.

**4.05** Whenever a hose connection is removed inspect and, if the interior is disintegrating or the hose is in an otherwise poor condition, replace it. Particles from a disintegrating hose may cause clogging of the radiator.

**4.06** Air trapped in the cooling system prevents complete filling and this may result in serious overheating later. After refilling the radiator of a drained cooling system, run the engine to warm the liquid sufficiently so that the thermostat is opened allowing any air that might be trapped in the engine block to escape. After this has been done examine the radiator and add liquid if necessary.

### 5. RUST PREVENTION IN COOLING SYSTEMS OF NEW VEHICLES

**5.01** When a new motor vehicle or other apparatus with an engine having a water cooling system is received it should be carefully inspected for leaks and made tight. New equipment is sometimes delivered with a rust inhibitor in the cooling system. If it is known to contain a satisfactory inhibitor and no anti-freeze is required, no further treatment is necessary.

**5.02** If the system contains only plain water, or if there is any doubt as to its contents, completely drain the system. If anti-freeze is re-

quired follow instructions in section entitled "Anti-freeze Solutions." If no anti-freeze is required then, according to the capacity of the cooling system add rust inhibitor, bearing in mind Paragraph 4.02, as follows:

#### CAPACITY LESS THAN 23 QUARTS

One Package

#### CAPACITY LARGER THAN 23 QUARTS

Two Packages

This material may be put into the radiator filler opening in the form in which it is supplied. After the inhibitor has been added, fill the radiator with fresh water keeping in mind Paragraph 4.06.

### 6. RUST PREVENTION IN COOLING SYSTEMS OF VEHICLES ALREADY IN SERVICE

**6.01** In territories where no anti-freeze is used in the radiator the cooling systems should be inspected at intervals of approximately six months. Inspection of cooling systems containing anti-freeze is covered in the section entitled "Anti-freeze Solutions."

**6.02** Evaporation of the radiator liquid does not affect the rust inhibitor. Therefore, it will be unnecessary to add more rust inhibitor unless loss has occurred by leakage or other causes, or the system has been drained and refilled with water only. If a considerable amount of solution is lost through leakage and there is some doubt as to the strength of the inhibitor solution, drain the system if it contains no anti-freeze, refill with water and add an inhibitor as described in Paragraph 5.02. If it contains anti-freeze do not add inhibitor. See section entitled "Anti-freeze Solutions."

**6.03** If the liquid in the cooling system appears rusty, but the engine has shown no tendency to overheat, whether or not it contains anti-freeze, run engine until liquid is hot and drain system immediately. Refill in accordance with Paragraph 5.02.

**6.04** If the system is dirty and there is a tendency for the engine to overheat, clean the system as follows, bearing in mind Paragraph 4.02.

(a) Drain cooling system.

(b) Obtain one quart kerosene and one-half pound washing soda for each gallon of cooling system capacity.

- (c) Pour the kerosene into the radiator.
- (d) Dissolve the washing soda in a bucket of hot water and pour it also into the radiator taking care not to spill any on finished surfaces.
- (e) Fill radiator with water and if practicable operate vehicle in regular service.
- (f) When vehicle returns at end of one day's service or after the cleansing solution has been allowed to circulate in the system for several hours, run engine, with radiator covered if necessary, until water reaches boiling point and immediately drain liquid. Then reverse flush the cooling system as described under (g) to (i), inclusive.
- (g) Reverse flushing radiator.

- (1) Remove the upper and lower radiator hoses and see that the radiator cap is in place.
- (2) Attach an outlet hose at the top of the radiator.
- (3) Attach a length of hose in good condition to the lower radiator outlet connection and insert a flushing tool in this hose.

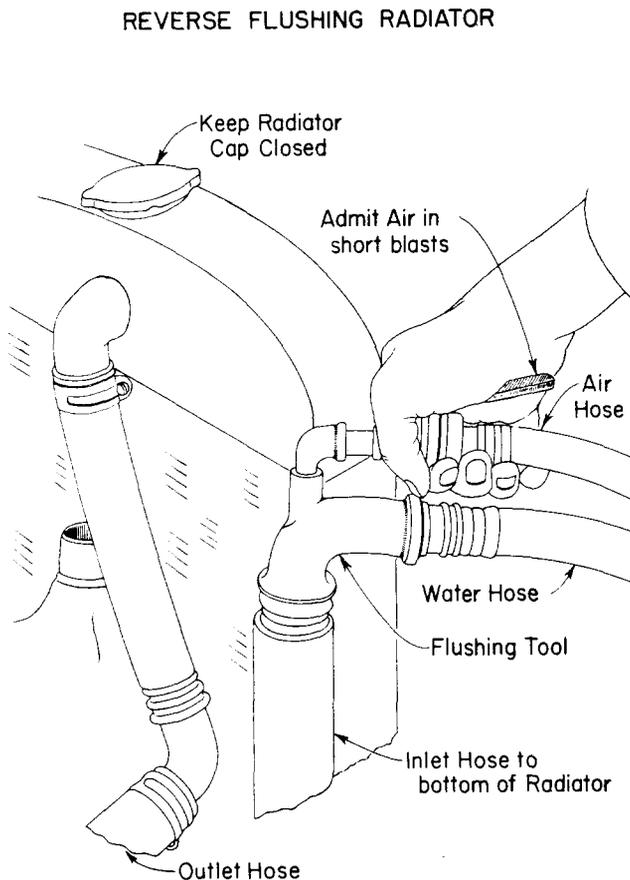


Fig. 1

A flushing tool such as is shown in the illustration following has been found satisfactory for this operation. Such a tool may be obtained locally.

- (4) Connect the water hose of the flushing tool to a water supply and the air hose to a compressed air line. If compressed air is unavailable, reasonably good results will be obtained by thorough flushing with only water.
- (5) Turn on the water and when the radiator is full, turn on the air in short blasts allowing the radiator to fill between blasts of air.

**Caution: Apply air gradually as a clogged radiator will stand only a limited pressure.**

- (6) Continue this reverse flushing until the water from the outlet hose runs clear.
- (h) Reverse flushing cylinder block and cylinder head.
- (1) Remove the thermostat. Then attach a hose in good condition to the water outlet connection at the top of the engine and

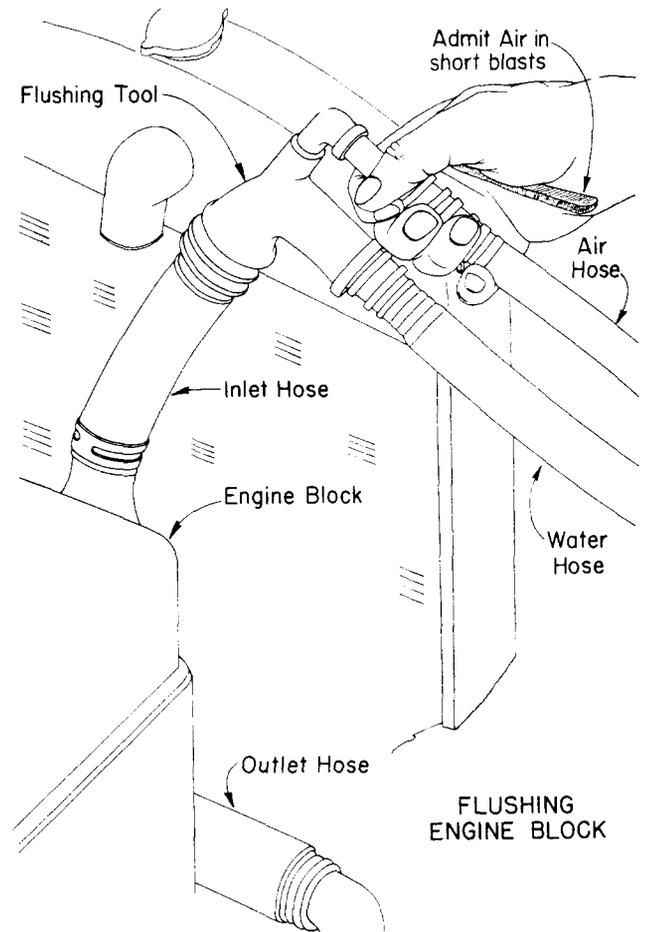


Fig. 2

another hose to the water pump inlet. If there is a water heater and it is not planned to flush it separately, see that all valves in the water line's are open. If it is planned to flush the heater separately, close all the valves.

(2) Insert flushing tool in the inlet hose.

(3) If cold water is used be sure engine is cool before flushing. Turn on the water and when the engine water jacket is full turn on the air in short blasts. If compressed air is unavailable, reasonably good results will be obtained by thorough flushing with only water.

(4) Continue this reverse flushing until the water from the outlet hose runs clear.

(i) Reverse flushing hot water heater.

(1) In order to flush the heater core open all the valves in the water lines, remove the hose lines, apply the flushing tool to its water outlet connection and flush as in the case for the radiator, Paragraph 6.04 (g).

**6.05** Replace excessively worn pump parts, tighten fan belt and repack pump if necessary.

**6.06** Before reinstalling the thermostat examine it to see whether it is in good working condition. This can be done by submerging it in hot water. If the thermostat does not open fully at about 170° F. for vehicles using alcohol, or about 190° F. for other vehicles, and is not closed when cool, it should be replaced with a good one.

**6.07** Before reinstalling the hose lines examine them. If the interior of the hose is worn or

disintegrated or the hose is in an otherwise poor condition, replace it with new hose.

**6.08** After restoring the hose connections close drains and follow instructions under Paragraph 5.02.

## **7. TREATMENT OF COOLING SYSTEMS WHICH OVERHEAT**

**7.01** Cooling systems which overheat because of a clogged condition should first be treated as described in Paragraph 6.04. If after such treatment difficulty is still experienced the system should be cleaned as follows:

(a) Drain radiator and remove the thermostat.

(b) Bearing in mind Paragraph 4.02, dissolve one-half pound oxalic acid for each gallon of cooling system capacity in a bucket of hot water and pour the solution into the radiator taking care not to spill any on finished surfaces.

(c) Fill radiator with water, and if practicable operate vehicle in regular service.

(d) When vehicle returns at end of one day's service or after the cleansing solution has been allowed to circulate in the system for several hours, run engine, with radiator covered if necessary, until water reaches boiling point and immediately drain liquid.

(e) Then reverse flush system as described in Paragraphs 6.04 to 6.08, inclusive.

**7.02** In severe cases it may be necessary to repeat the treatments alternating between the use of the kerosene-washing soda mixture and oxalic acid solution. Do not mix the oxalic acid solution with the kerosene-washing soda mixture.