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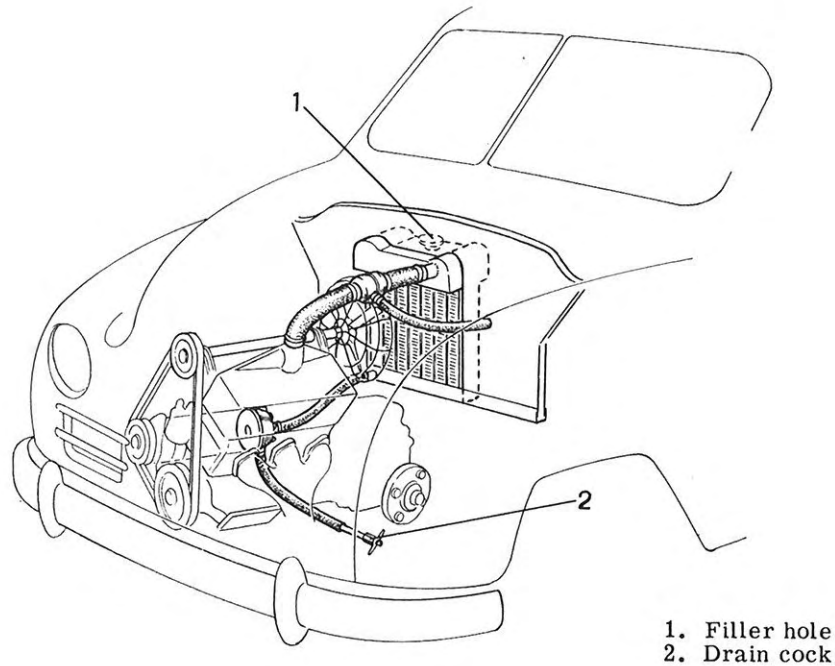


Fig. 1. Cooling system

1. DESCRIPTION

1.1. General

The Saab 93 has a liquid-cooled engine, the cooling system consisting of the engine cooling jacket, radiator, pump, thermostat and hoses. The system also includes a belt-driven fan which forces air through the radiator. The layout of the system is shown in Fig. 1.

In direct connection with the cooling system there is a unit for heating the car, the so-called fresh-air heater.

1.2. Radiator

The radiator consists of an upper and a lower tank, which are interconnected by a tubular core.

The radiator is fitted with a pressure cap and thus the coolant temperature can be kept very high, 95°C (200°F) and above, without appreciable loss of coolant from the system.

1.3. Pump

The coolant pump is of centrifugal type and is combined with the generator. The pump impeller is attached to the rotor shaft.

1.4. Thermostat

The thermostat is of aneroid type. It starts to open at a temperature of about 85°C (185°F).

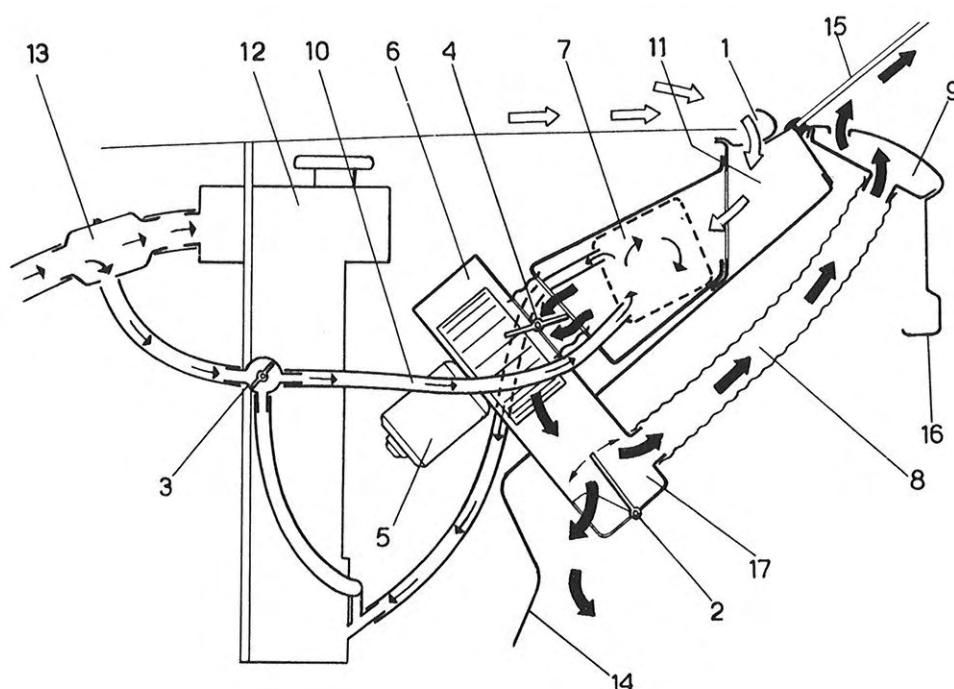
On the inlet side, the thermostat is provided with a connection for the by-pass line, which is connected in parallel with the radiator and through which the water flows until the thermostat opens.

1.5. Cooling fan

The cooling fan is located in front of the radiator and is belt-driven by the engine.

The fan shaft is carried in ball bearings built into a bracket which is mounted on top of the cylinder head.

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The numbers refer to the text, point 1.6.

Fig. 2. Fresh air heater, principle of operation

1.6. Fresh-air heater

The fresh-air heater is a separate system which is connected to the cooling system, see Fig. 2.

Air enters through the air intake 1 in front of the windshield into a collecting chamber 11 formed by the body plates. The encased heating element 7 is placed in front of this chamber inside the engine compartment. The air is heated when it passes through the element, which is heated by coolant and whose temperature can be regulated by means of control 3.

This control operates the cock 3 in the radiator bypass line, to which the element is connected. After passing through the heating element, the air flows into the car through the fan housing 6, which encloses the fan and is fitted with two dampers. The first damper 4 controls the air flow, and the second damper 2, which is located in a distribution casing 17 above the accelerator pedal, controls the

distribution of the air current. The air current can be led either down towards the floor or up to the defroster boxes 9 under the instrument panel. In the latter case the air flows up through a number of slots towards the windshield over its whole width and also towards the door windows through a hole on each side of the instrument panel.

When the car is travelling at more than 50 km/h. (30 m.p.h.), the relative wind is usually sufficient for satisfactory operation of the fresh-air heater. Thus the fan need only be used when the car is being driven at relatively low speed.

On hot summer days the fan can be used to blow air into the car for greater comfort at low speeds. In this case, of course, the control marked "Warm - Cold" should be in the upper position. Intermediate positions of the control marked "Floor - Defroster" distribute the air between floor and windshield outlets.

2. TECHNICAL DATA

Capacity of cooling system:

Excluding heating system	litres	6.0
	(U.S. gall.)	1.6
Including heating system	litres	6.8
	(U.S. gall.)	1.8

Thermostat opening range 85-93°C (185-200°F)

Radiator pressure cap opens at 0.25 - 0.30 kg/sq. cm (3.5 - 4.5 lbs/sq. in.).

Do not use too strong a concentration of glycol in the coolant, as the glycol reduces the cooling of the engine. The freezing point in the above table gives the temperature at which ice crystals begin to form in the cooling system.

The use of alcohol as an anti-freeze agent is not recommended as the alcohol evaporates at a relatively low temperature.

Water - ethylene glycol mixtures

Vol. % ethylene glycol	Freezing point		Boiling point		Specific gravity
	°C	°F	°C	°F	
10	- 4	+ 25	101	214	1.012
20	- 10	+ 14	102	216	1.027
30	- 17	+ 1	103	217	1.041
40	- 26	- 15	104	219	1.055
50	- 39	- 39	106	223	1.068
60	- 56	- 69	109	228	1.076

3. WORK ON CAR

3.1. Cleaning

The coolant should be drained off twice a year, spring and fall. When this is done, the system should be thoroughly cleaned before filling with new coolant.

1. Drain off coolant. Location of drain cock is shown in Fig. 1.
2. Flush out system with clean water.
3. Fill system with clean water to which commercial solvent has been added. Follow the maker's instructions.
4. Screen off the radiator and warm up the engine.
5. Stop the engine and wait a few minutes before draining off the coolant.
6. Flush the system again with clean water, flushing engine and radiator separately.

This flushing should be done against the normal direction of flow of the coolant, and thus the engine cooling jacket should be flushed downwards through

the upper cooling-water pipe, whereas the radiator should be flushed upwards through the lower connecting pipe. Loosen the hose clamps and remove the hoses before flushing.

7. Clean and inspect the water pump. See point 4.2.
8. Clean and inspect the cock in the line to the fresh-air heater.
9. Flush out the heater element opposite to the normal direction of circulation.
10. Fit the hoses and check the system for leaks.

When cleaning the cooling system, make sure that the radiator overflow pipe is not blocked.

If the cooling system is cleaned regularly as described above, it does not usually cause any trouble.

If the cleaning procedure described above should not be sufficient to remove deposits in the radiator, then the radiator should be removed from the car and entrusted to a radiator specialist.

4. INSPECTION WORK

4.1. Radiator

4.1.1. Removal of radiator

1. Drain off coolant.
2. Loosen hose clamps at radiator and pull off hoses.
3. Loosen the two bolts holding the radiator to the radiator frame.
4. Loosen the radiator frame stay at the front.

Bend the radiator frame carefully forward so that the stay can be extracted from its hole.

5. Loosen the two bolts which hold the radiator to the radiator support member.
6. Press the radiator frame carefully forward and move the radiator backwards until the upper pipe clears the frame and the radiator can be removed. See Fig. 3.

Always take great care when working with the radiator so as to avoid causing damages and leakage.

4.1.2. Inspection and sealing of radiator

Check that the radiator does not leak, for instance by immersing it in water after sealing the pipe openings, and then testing it with compressed air (max. pressure 1 kg/cm², 14 lbs/sq. in.).

In the event of leakage, repair the radiator by soldering. "Repairs" by means of patent substances added to the coolant may only be done in an emergency. These substances may cause blockage of jackets and pipes and impede circulation.

The cells of the radiator core may sometimes become blocked by dust, insects, etc, to such an extent that the air flow through them is reduced. In such cases the radiator core should be blown clean with compressed air.

4.1.3. Installation of radiator

1. Mount the radiator in place and screw it to the radiator member and frame after fitting the stay into the hole.
2. Tighten the nuts on the radiator frame stay.
3. Connect the hoses. Make sure that they are well stretched so that there are no folds, and tighten the clamps securely.

4.2. Coolant pump

4.2.1. Removal of coolant pump

1. Drain off coolant. Location of drain cock is shown in Fig. 1
2. Loosen hose clamps at pump and pull off hoses.
3. Loosen generator adjusting and fixing screws and remove V-belt from generator pulley. See Fig. 4.
4. Disconnect the cables from the generator and remove generator with pump from car. Note that the generator should be removed from the car when working on the pump, as this greatly simplifies the work.
5. Remove the pump cover 3, Fig. 5, by undoing the two screws 1 and nuts 2 which hold it onto the pump casing 7.
6. Screw the pump impeller off the generator shaft.
7. Remove pump casing 7.
8. Remove brass washer 8 from generator shaft. Don't forget the shim 9 behind the washer.
9. Remove the seal 5, which is fitted to the impeller shaft.

4.2.2. Installation of coolant pump

1. After thoroughly cleaning and inspecting all parts, slide shim 9, Fig. 5 onto generator shaft.
2. Place the brass washer 8 on generator shaft.
3. Place pump casing against generator. Note direction of discharge opening, see Fig. 5.
4. Slide seal 5 onto impeller shaft.
5. Screw impeller onto generator shaft.
6. Secure pump cover. Don't forget gasket between cover and pump casing.
7. Install generator with pump in car.
8. Connect coolant hoses. Fill with coolant and check for leaks.
9. Fit the V-belt and tension it, see Fig. 4, and connect up generator cables.

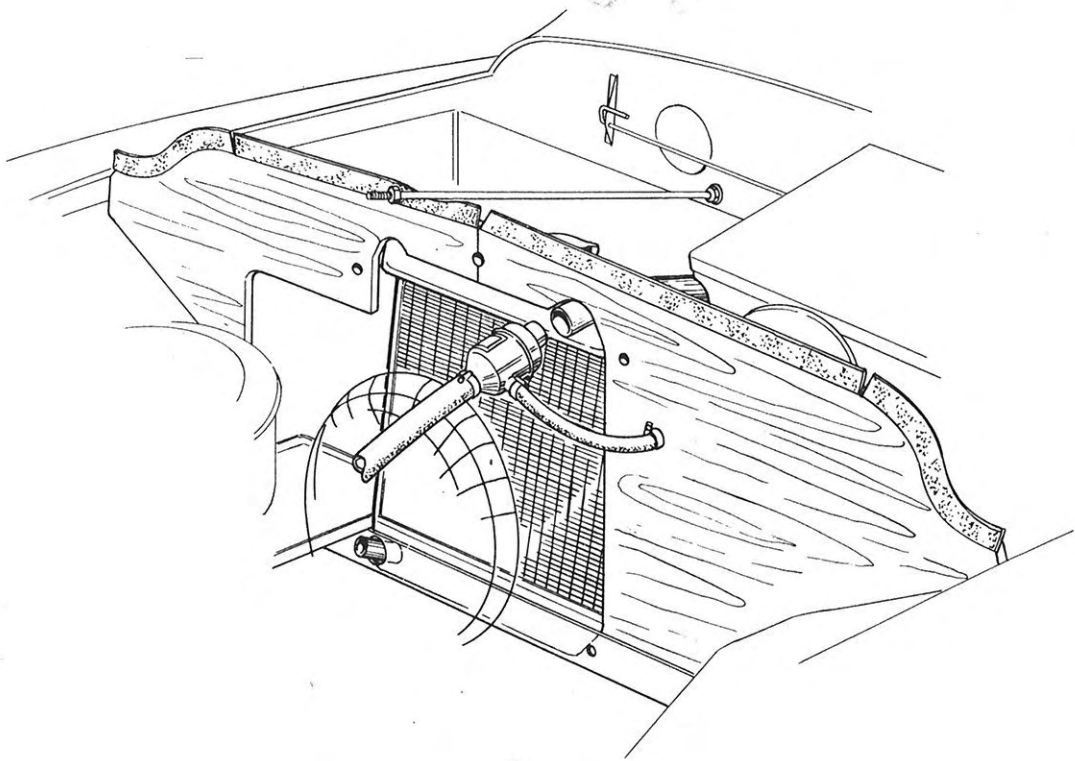
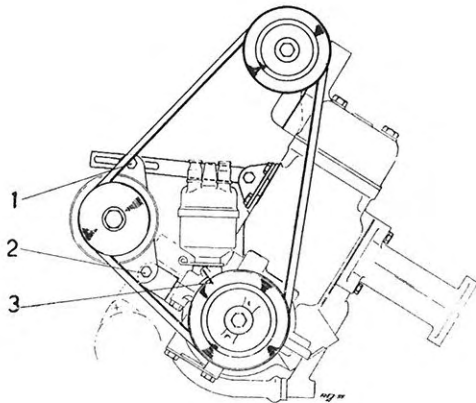


Fig. 3. Removal of radiator



1. Adjusting screw
2. Fixing screws
3. Marks for ignition setting

Fig. 4. Generator adjusting and fixing screws

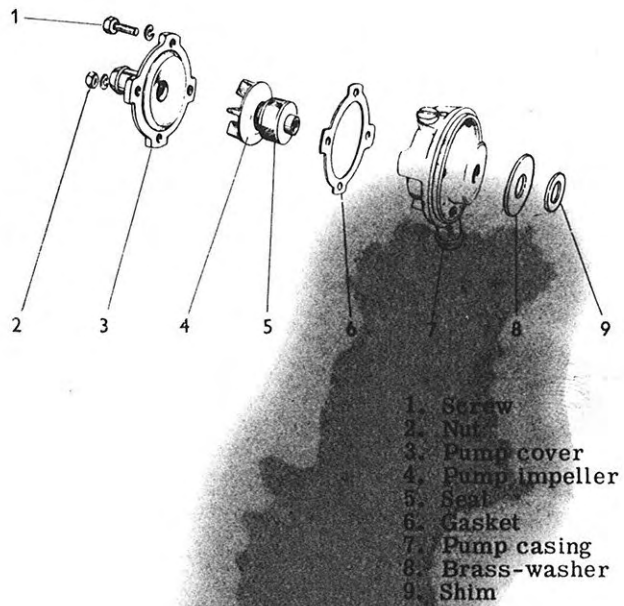


Fig. 5. Coolant pump, removed from generator

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4.3. Cooling fan

Removal and installation of cooling fan with shaft and bearings is described in Chapter 2, Engine, point 3.2.

4.4. Fresh-air heater

4.4.1. Removal of element in fresh-air heater

1. Open engine hood and then turn hood lock handle to the closed position, that is, to the left.
2. Drain off the coolant and disconnect the two hoses from the element.
3. Remove the self-tapping screws which hold the protective casing onto the cowl. The casing with the element inside it can then be removed forwards - upwards.

Note that the hood lock must be closed.

4. Collect the two slit rubber washers fitted in the recess for the hood lock in the casing.
5. Remove the element from the casing after loosening screws and locking wire.

To install the element, reverse the above procedure. After filling with coolant, check that the hose clamps are properly tightened so that no leakage may occur.

4.4.2. Removal of fan motor

1. Disconnect fan motor cable.
2. Remove screws which hold front wall of fan housing, then lower motor and front wall so that the impeller screw can be loosened from the shaft.
3. Remove motor with housing wall from engine compartment. If necessary remove also impeller.
4. Remove screws which hold motor to wall.

To install the motor, reverse the above procedure. The fan motor ground wire should be inspected before installation. Make sure that good contact is obtained.

In connection with the work described above, the controls for the fresh-air heater should be inspected and, if necessary, adjusted and lubricated.