SECTION L2 — COOLING SYSTEM

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Description

The engine cooling system comprises two principal components; a brass matrix and a centrifugal pump. The pump is driven by the crankshaft through single or twin 'Vee'-belts. **On S1 cars** fitted with power-assisted steering and **on all S2 cars** twin belts are used.

A balanced, five-bladed fan is mounted on the pump shaft and is driven by the pump driving belts.

On standard S1 cars a steam valve incorporated in the radiator header tank maintains the cooling system at atmospheric pressure. **On all S2 cars and S1 cars** fitted with the Rolls-Royce Interior Cooling System the pressure is maintained at 7 lb/sq.in.

On assembly, the system is filled with a mixture of water and 25 per cent anti-freeze. This mixture is adequate for use in temperatures down to 10 deg. F, but for complete protection in more severe weather conditions, a higher percentage of anti-freeze is necessary.

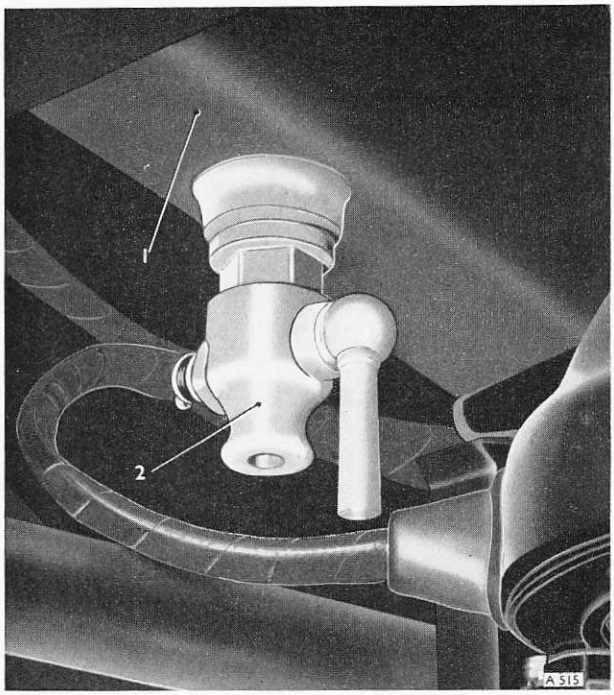

Fig. L1 Radiator drain tap — S1 cars

1. RADIATOR BOTTOM TANK 2. DRAIN TAP — 'OFF' POSITION

In addition to providing protection against frost, approved anti-freeze contains inhibitors to prevent corrosion of the coolant passages; it is therefore essential to use an anti-freeze mixture all the year round in all parts of the world; water alone must never be used. In hot climates, anti-freeze has the additional advantage of raising the boiling point of the coolant.

One of the inhibitors, NaMBT (sodium mercapto-benzothiazole), is consumed during the first 1500 miles in the life of a car. This should be replenished from the sachet of NaMBT supplied with each new car. Whenever any part of the cooling system is renewed, a fresh sachet of NaMBT should be added to the coolant.

These sachets can be obtained from Rolls-Royce Limited.

Due to deterioration of the inhibitors, the cooling system should be flushed annually and the coolant renewed (see page L18).

On S1 cars, coolant from the pump is circulated through a water gallery running along the exhaust side of the cylinder block.

The gallery is made of brass and along its upper surface slots of irregular length are provided to ensure even distribution of coolant around the exhaust valve seats. Coolant returns from the cylinder block past the thermostatic valve and into the radiator header tank. Coolant from the cylinder block also circulates around the carburetter choke thermostat housing in the induction manifold and is returned to the system through a $\frac{1}{2}$ in. dia. pipe connecting the manifold to the coolant pump.

On S2 cars, coolant from the pump is delivered through transfer tubes in the pump casing, and circulates around the 'wet' cylinder liners. Coolant leaves the cylinder block through passages cast integrally with the inlet manifold and flows past the thermostat valve to the radiator header tank.

Under cold ambient conditions, the closed thermostat assists rapid warming-up by causing the warm coolant from the engine to by-pass the radiator. This is achieved by passing the coolant through a hose from the thermostat housing direct to the pump. The warm coolant is then recirculated through the engine.

TSD 729

On all S1 and S2 cars a coolant temperature indicator mounted on the facia is electrically operated by a bimetallic transmitter unit screwed into the thermostat housing. The indicator registers the coolant temperature when the ignition is switched on and registers 'Hot' when the ignition is off. The bimetallic transmitter is a sealed unit and if faulty must be renewed. If a unit is suspected of being faulty, its performance should be checked against that of an instrument known to be in good condition.

Cooling System — to drain

The cooling system should contain anti-freeze and if it is intended to use the coolant again, it should be drained into a clean container and stored.

To drain the system, remove the radiator filler cap and open all the drain taps.

On S1 cars two drain taps are provided, one tap is fitted to the radiator bottom tank and the other to the cylinder block (see Figs. L1 and L2).

On S2 cars three drain taps are provided, one tap is fitted to the radiator bottom tank and one tap is fitted to each cylinder bank (see Figs. L3 and L4).

Cooling System — to flush

Remove the radiator cap and open all the drain taps situated on the cylinder block or radiator bottom tank.

Radiator

Remove the hoses, fit a waste pipe to the upper connection and apply water under pressure through the lower connection. Mains water pressure should remove any sediment in approximately half an hour.

Engine

Remove the drain tap(s) from the cylinder block, remove the thermostat cover and withdraw the thermostat, then re-fit the cover: **on S2 cars** note the position of the thermostat in the body to ensure correct re-fitting.

Fit a suitable waste pipe and apply water under pressure to each drain tap aperture in turn; continue flushing for approximately half an hour or until the water runs clear.

Re-fit the drain tap(s) to the cylinder block and re-fit the thermostat; fit the cover, using a new gasket.

Examine all the rubber hoses and re-fit if in a serviceable condition. Renew any hose which shows signs of deterioration.

Using a fresh anti-freeze mixture fill the system slowly in order to avoid air locks.

To ensure uniform distribution of the anti-freeze mixture throughout the system, start the engine and allow time for it to reach normal operating temperature; stop the engine and again check the level of the coolant.

Examine all hoses for leaks.

Under no circumstances must any strong alkaline compound or detergent be used to clean the system. Several such compounds are available but their use must be carefully avoided as they have a detrimental chemical action on aluminium alloys.

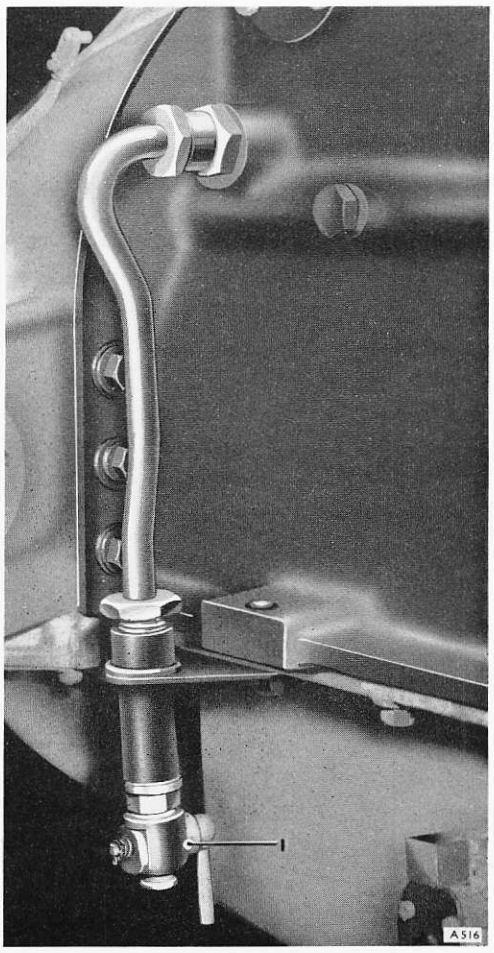

Fig. L2 Cylinder block drain tap — S1 cars

1. DRAIN TAP

SECTION L3—RADIATOR

Description

The dimensions of matrices fitted to S1 and S2 cars are as follows:

	Surface Area	*Dimensions*
Silver Cloud and Bentley S1 Silver Cloud II and Bentley S2 Phantom V	449·675 sq.in.	22·625 in. × 19·875 in. × 2·283 in.
Continental S1	420·350 sq.in.	20·150 in. × 19·875 in. × 2·283 in.
Continental S2	400·000 sq.in.	20·125 in. × 19·875 in. × 2·283 in.

The radiator is mounted on a Silentbloc-bushed bracket which is secured by a single bolt to a bracket welded to the front cross member. The assembly is supported by tubular struts, attached by weld nuts to the support straps which are sweated to the header and bottom tanks (see Fig. L5).

A transverse tubular strut, bolted between the upper ends of the longer diagonal struts, increases stability; further stabilising struts are fitted between the Silentbloc-bushed bracket and each valance panel.

The radiator is provided with a pressure control valve which is fitted into the header tank. The valves control the pressure by releasing excess steam past a spring-loaded seat into an escape pipe which is open to the atmosphere.

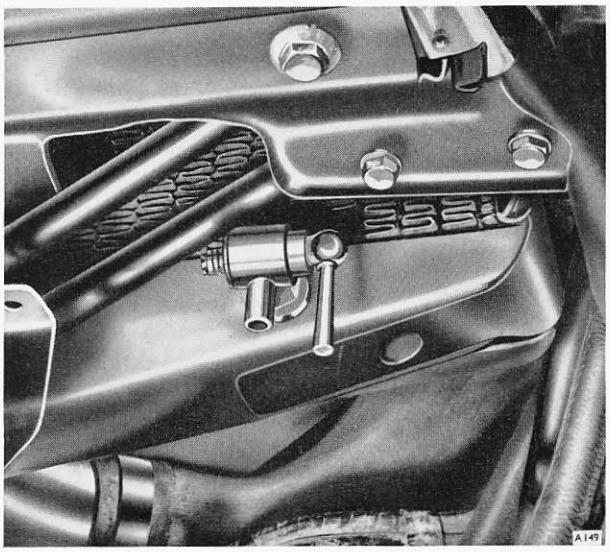

Fig. L3 Radiator drain tap — S2 cars

On standard S1 cars, the control valve operates at atmospheric pressure.

On S1 cars fitted with a refrigeration unit, the control valve operates between $6\frac{1}{4}$ and $7\frac{1}{4}$ lb/sq.in.

On all S2 cars, the A.C. Delco control valve operates between $6\frac{1}{4}$ and $7\frac{1}{4}$ lb/sq.in. and in addition contains a reversible seal which acts as a vacuum valve, which opens at 1 lb/sq.in. below atmospheric pressure. If this valve is found to be faulty it should be discarded and new one fitted.

A feature of the radiator is the provision for direct return of coolant from the car heating and de-misting systems. The coolant is returned direct to the **bottom** tank by brass pipes which are brazed to blind adapters attached to the header tank. A negligible amount of coolant is allowed to enter the header tank through a $\frac{1}{16}$ in. (0·062 in.) bleed hole in each adapter which is provided to eliminate air locks in the return pipes.

Rubber hoses are used to connect the radiator to the coolant pump; these are secured in position by worm drive clips.

On S1 cars, both radiator pipes are brass and have an outside diameter of $1\frac{1}{4}$ in. and are of 18 S.W.G. (0·048 in.).

On S2 cars, both radiator pipes are brass and have an outside diameter of $1\frac{1}{2}$ in.; the header tank pipe being 18 S.W.G. (0·048 in.) while the bottom tank pipe is of 20 S.W.G. (0·036 in.).

A large bakelite radiator filler cap, which screws into the filler boss, has coarse threads for quick removal.

The engine should at all times be stopped before the filler cap is removed.

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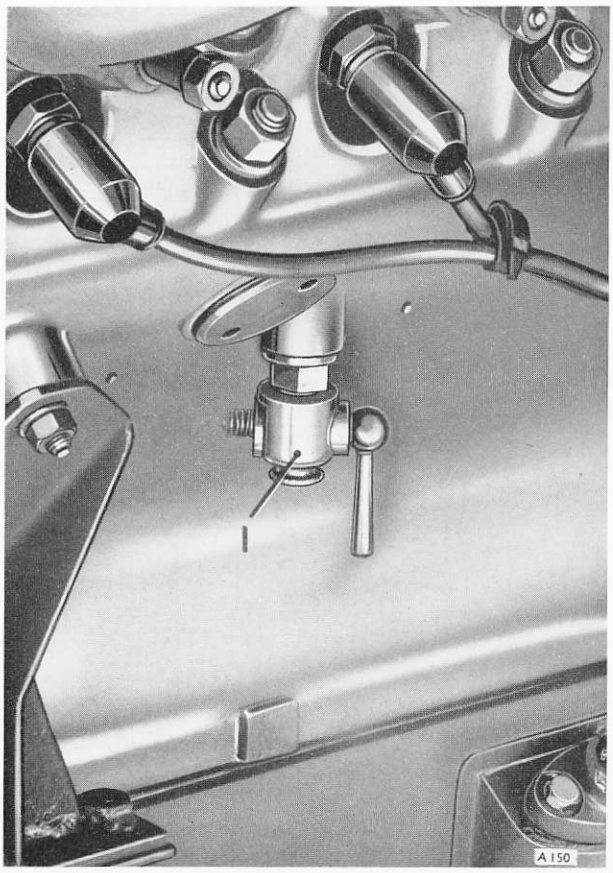

Fig. L4 Cylinder block drain tap — S2 cars

1. DRAIN TAP

Radiator — to remove

Care must be taken when removing the radiator to avoid accidental damage to chromium surfaces and paintwork.

Drain the coolant into a clean container (see Cooling System — to drain).

Unlock the bonnet on both sides and remove the bonnet assembly.

Slacken the worm drive clips and remove the hoses from the header and bottom tanks.

On S1 cars, remove the heater and de-mister hoses from the return pipes on the radiator.

Remove the front apron and radiator shell.

Remove the bolts securing the radiator tubular stays to the valance panels.

Support the radiator and remove the bolt from the Silentbloc bush.

Remove the radiator from the car.

Radiator — to fit

Fit the radiator, reversing the procedure given for its removal, noting the following points.

Examine all hoses for deterioration and if they are not in a serviceable condition, new ones should be fitted.

Fill the system with fresh coolant containing the correct percentage of anti-freeze mixture: the coolant should be poured in slowly in order to avoid air locks.

Radiator — to flow-test

A flow test can be carried out while the radiator is in position in the car. A simple reservoir is necessary for this operation and can be constructed as described in the following paragraph.

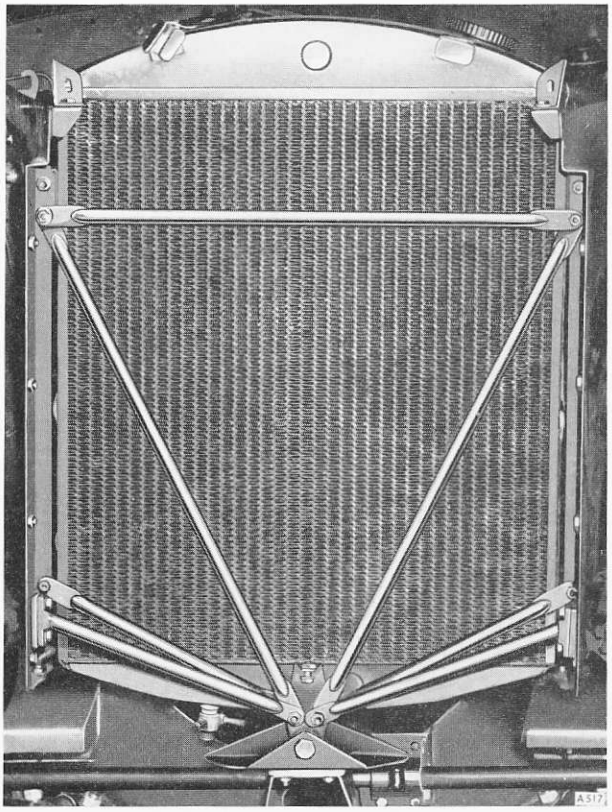

Fig. L5 Radiator matrix supports

TSD 729

Obtain an 18-gallon container, such as a clean oil drum from which the top has been removed, and weld a length of tube into the bottom of the container to serve as an outlet pipe (the tube should be 2 in. long and have an internal diameter of 1 in.). Using suitable hoses and clips, attach to the outlet pipe a sight glass of the same bore, approximately 4 in. long.

Mount the container on a suitable stand so that the centre of the container is 3 ft. above the radiator inlet pipe (see Fig. L6) and connect the lower end of the sight glass to the inlet pipe on the radiator header tank.

Fit suitable rubber bungs or caps to the radiator outlet pipe on the bottom tank. Rubber bungs or caps will also be required for the heater and de-mister pipes on S1 cars.

Pour water into the container until both the radiator matrix and the container are full.

Remove the bung from the radiator outlet pipe then record the time taken for the **container only** to drain by observing cessation of flow through the sight glass.

If the radiator is in 100 per cent condition the time taken for the 18-gallon container to drain is as follows:

Silver Cloud and Bentley S1 Silver Cloud II and Bentley S2 Phantom V	54 seconds
Bentley Continental S1	50 seconds
Bentley Continental S2	48 seconds

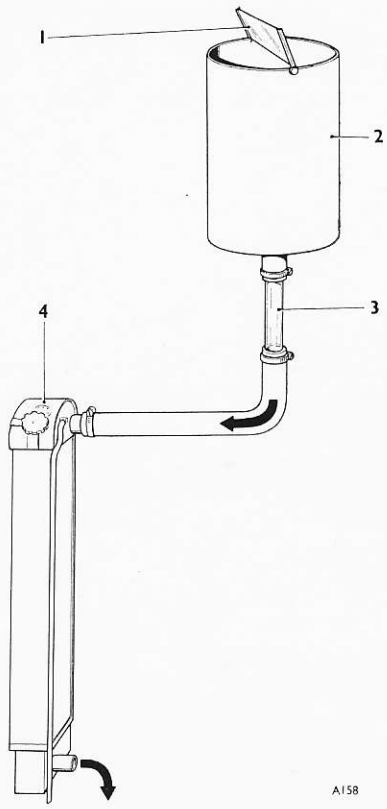

Fig. L6 Matrix flow testing rig

1. MIRROR
2. 18 GALLONS CONTAINER
3. OBSERVATION TUBE
4. RADIATOR

If the flow time exceeds the above figures by 25 per cent, a restriction in the system is indicated and must be cleared.

SECTION L4 — THERMOSTAT

Description

The thermostat comprises a sealed brass bellows which is held in position in a bridge piece by an adjusting screw and a lock-nut. The bridge piece is secured to the thermostat body by four screws.

A dished valve, which seats on top of the thermostat body, is sweated to the upper end of a spindle which passes through the body and is attached at its lower end to the top face of the bellows (see 1, Fig. L7).

The valve incorporates a vent hole containing a 'jiggle' pin. This vent allows air to escape while the cooling system is being replenished, thus avoiding air locks. When the system is full, the 'jiggle' pin rises to close the vent against the passage of coolant (see Fig. L7).

An increase in temperature of the coolant causes the bellows to expand and open the valve. A decrease in temperature causes the bellows to contract and close the valve.

Movement of the valve is thus proportional to the coolant temperature and controls the flow of coolant through the thermostat housing to suit the cooling requirements of the engine.

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The valve has a minimum stroke of 0·275 in. and is 1·310 in. in diameter. The bore of the coolant passage in the main body of the thermostat is 1·251 in. in diameter.

The by-pass valve is fully open when the dished valve is closed (see 4, Fig. L7) and allows the coolant to circulate around the engine only, excluding the radiator.

Thermostat — to remove

Drain approximately half the coolant into a clean container.

Remove the four $\frac{1}{4}$ in. setscrews (or nuts on S1 cars) securing the thermostat cover to the housing and move the cover to one side. It is not necessary to remove the hose as it is sufficiently flexible to allow the desired movement (see Fig. L8).

Remove the thermostat housing. Two 3 B.A. tapped holes are provided in the thermostat body to allow bolts to be fitted for easy withdrawal.

A number of thermostats were supplied with 2 B.A. holes and so, to avoid damage to the holes, care must be taken to ascertain the size of withdrawal bolts required before attempting removal. Under no circumstances must a screwdriver or similar tool be used to lever out the thermostat.

Thermostat — to test

A thermostat which is suspected of being faulty can be tested as follows.

Suspend the thermostat and a thermometer in a container of water so that they are completely immersed; they must not be allowed to touch the bottom of the container as this will cause a false reading.

Gradually heat the water and stir it to ensure that the water and thermostat are of a uniform temperature. Note the temperature at the point when the valve begins to open; movement of the valve should be smooth.

The opening temperature setting has been accurately determined by the manufacturers and no attempt should be made to adjust the thermostat.

If the thermostat does not function correctly, do not attempt to repair it; a new one must be fitted.

On S1 cars, the thermostat is marked either 'Summer' or 'Winter'. The 'Summer' thermostat is the standard fitting; the 'Winter' unit is provided for use in countries which experience severe winter conditions.

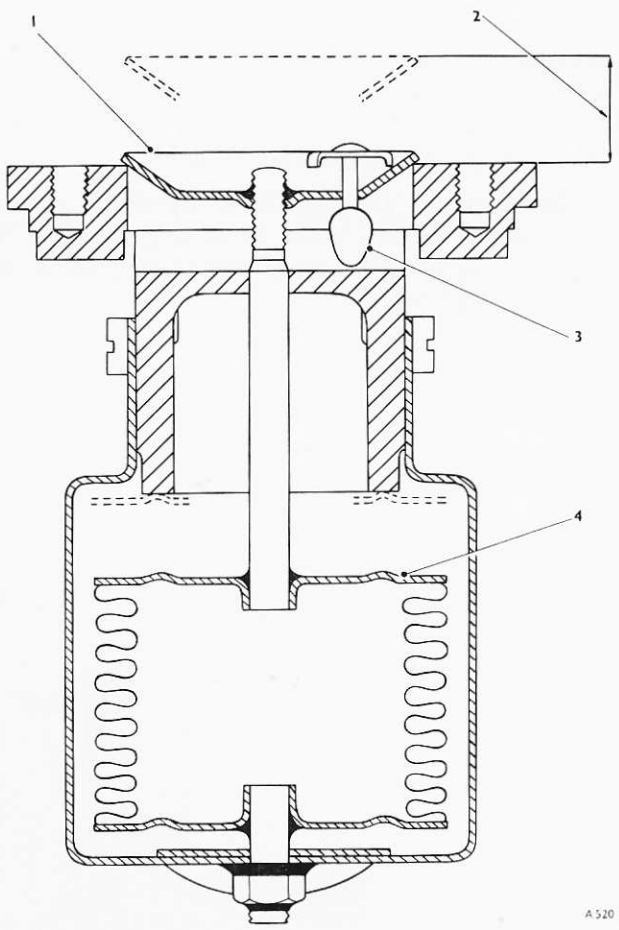

Fig. L7 Sectional view of thermostat

1. VALVE
2. 0·257 IN. MINIMUM STROKE
3. JIGGLE PIN
4. BY-PASS VALVE

The valve of a 'Summer' thermostat should open between 75 and 77 deg. C (167 and 170 deg. F); the by-pass valve should be fully closed at 96 deg. C (205 deg. F).

The valve of a 'Winter' thermostat should open between 84 and 86 deg. C (183 and 188 deg. F); the by-pass valve should be fully closed at 104 deg. C (219 deg. F).

TSD 729

On S2 cars, the thermostats are marked with their opening temperature range on the body upper face. The standard fitting is the unit marked 'opens 66–70 deg. C' (151–158 deg. F). The by-pass valve should be fully closed at 85 deg. C (185 deg. F).

The thermostat provided for use during the winter in Canada is marked 'opens 76–80 deg. C' (169–176 deg. F). The by-pass valve should be fully closed at 95 deg. C (203 deg. F).

Thermostat — to re-fit

Insert the thermostat into its housing. A slot provided in the thermostat body enables it to register with a locating screw in the housing and so ensure correct positioning of the unit.

Lightly smear a new cover joint with 'Wellseal' and fit the joint and cover to the housing. Secure the cover in position by progressively tightening the four $\frac{1}{4}$ in. setscrews on S2 cars (or nuts on S1 cars).

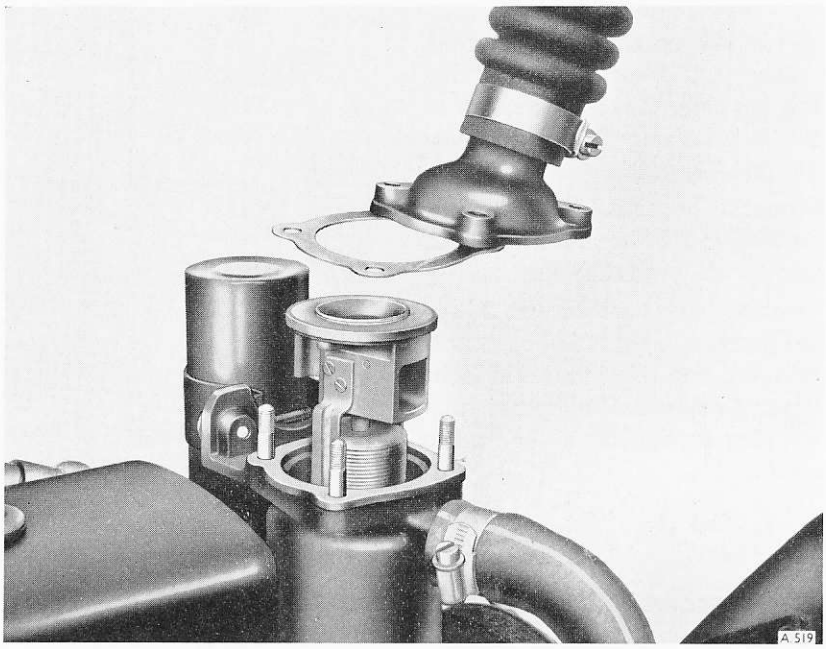

Fig. L8 Access to thermostat

SECTION L5 — COOLANT PUMP

Description

The coolant pump is belt driven at approximately 0·85 times the engine speed. The pump draws coolant from the bottom tank of the radiator matrix and distributes it under pressure to the water gallery in the cylinder block. The coolant re-enters the radiator header tank past the open thermostat, or by-passing the radiator through the thermostat by-pass, according to the coolant temperature.

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Pressure of the pump discharge to the engine is as follows:

S1 cars 20 lb/sq.in. at 3200 pump r.p.m.

S2 cars 15 lb/sq.in. at 2500 pump r.p.m.

The main body of the pump is a cast iron housing, which **on S1 cars** comprises the pump chamber. The pump chamber **on S2 cars** is a separate aluminium casing which also incorporates the inlet pipes and delivery ports. The casing is independently secured to the engine crankcase.

A double ball race, retained in the housing by spring rings, supports a shaft, on the end of which is pressed an impeller; a driving spider or adapter is pressed onto the outer end. These are an interference fit on the shaft and no other means of retention is necessary.

On S1 cars fitted with refrigeration, the adapter is integral with the shaft (see Fig. L9). This shaft is supported by a ball bearing at the forward end and a smaller bearing towards the inner end. An impeller is pressed on to the end of the shaft.

On all cars a driving pulley and fan extension cone are secured to the spider or adapter by four $\frac{5}{16}$ in. U.N.F. setscrews.

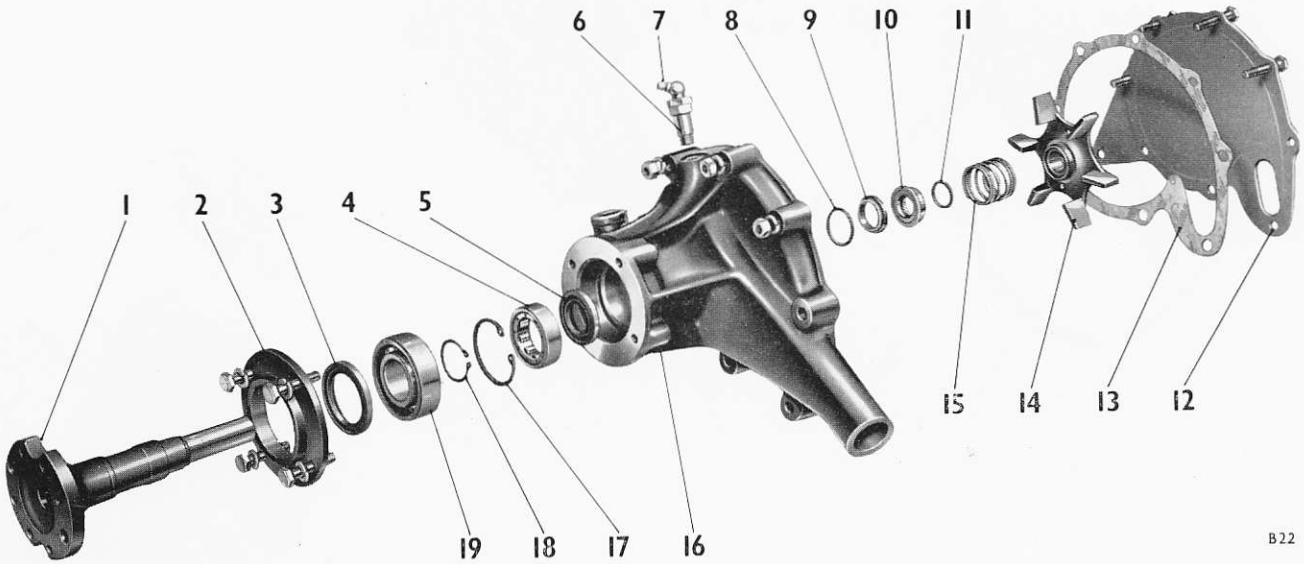


Fig. L9 Exploded view S1 cars — coolant pump with refrigeration

1. IMPELLER SHAFT
2. OIL SEAL HOUSING
3. OIL SEAL
4. REAR BEARING
5. OIL SEAL
6. GREASE NIPPLE EXTENSION
7. GREASE NIPPLE
8. SEALING RING
9. STATIONARY SEAL RING
10. ROTARY SEAL RING
11. SHAFT SEAL
12. BACKING PLATE
13. PLATE JOINT
14. IMPELLER
15. 'FLEXIBOX' SPRING
16. PUMP CASING
17. BEARING CIRCLIP
18. BEARING CIRCLIP
19. FRONT BEARING

The methods of sealing adopted for the three pumps differ as follows:

S1 cars — without refrigeration (see Figs. L10 and L11):

A stainless steel coil spring is mounted on the shaft between the impeller and rotary seal ring. The spring exerts a pressure of 8–10 lb. on the 'Flexibox' seal assembly and prevents coolant leakage along the shaft. A 'Klingerit' joint is bolted between the housing and a backing plate.

S1 cars — with refrigeration (see Figs. L9 and L12):

Coolant sealing is the same as above but as separate bearings are used, seals are mounted on the shaft forward of the front ball bearing and to the rear of the inner roller bearing.

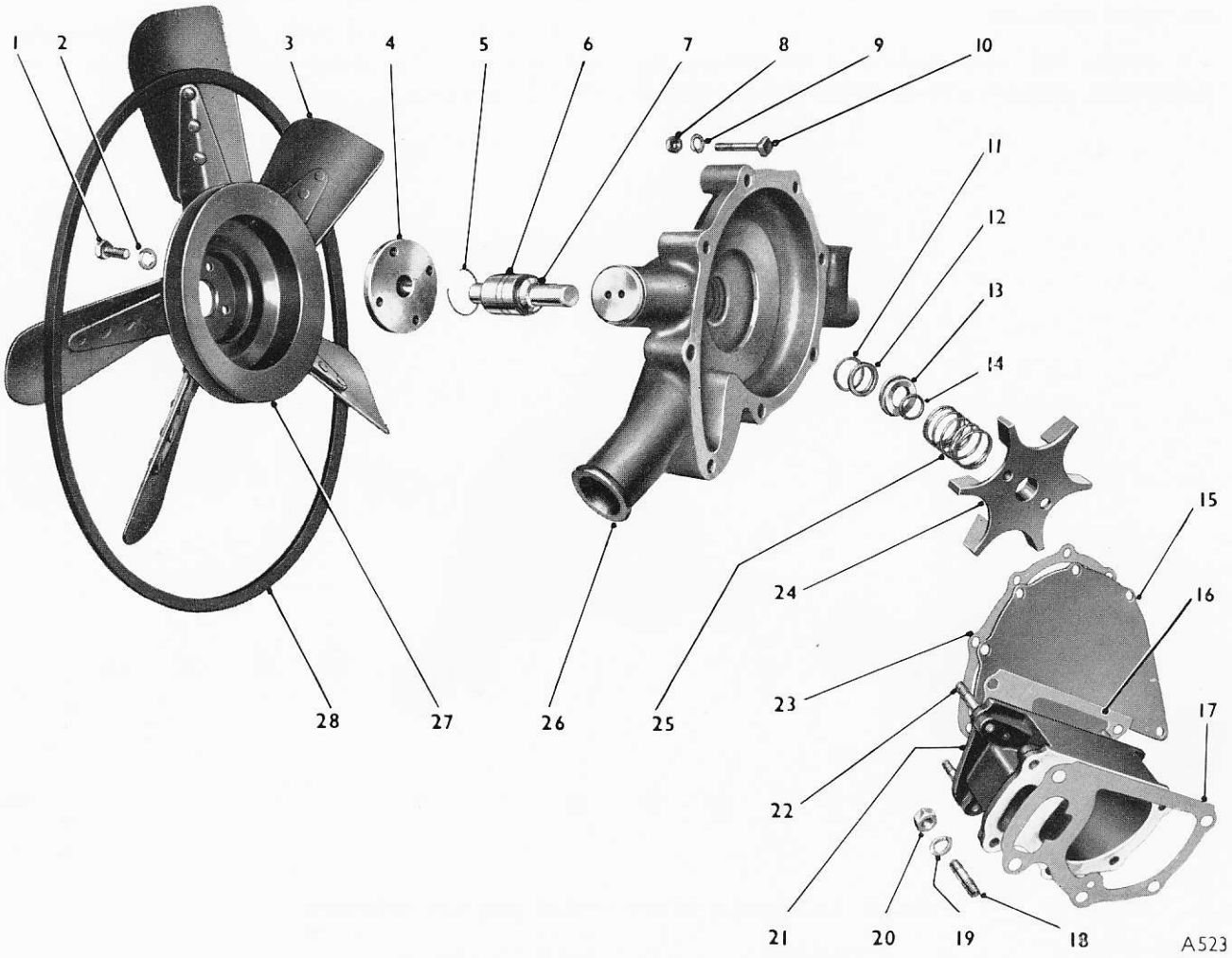
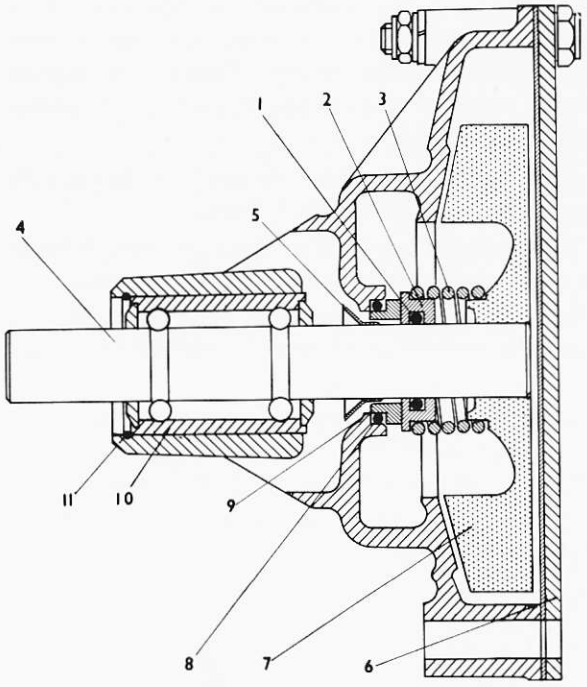


Fig. L10 Exploded view S1 cars — coolant pump without refrigeration

1. SETSCREW
2. WASHER
3. ASSEMBLY — FAN BLADES
4. ADAPTER — FAN PULLEY
5. CIRCLIP
6. SHAFT AND BEARING ASSEMBLY
7. BRASS FLINGER
8. NUT
9. WASHER
10. RETAINING BOLT
11. COVER SEAL
12. STATIONARY SEAL RING
13. ROTARY SEAL
14. SHAFT SEAL
15. COVER PLATE
16. PUMP TO ADAPTER JOINT
17. ADAPTER TO CYLINDER BLOCK JOINT
18. STUD
19. WASHER
20. NUT
21. ADAPTER
22. PUMP TO ADAPTER STUD
23. COVER PLATE JOINT
24. IMPELLER
25. 'FLEXIBOX' SEAL SPRING
26. PUMP CASING
27. PULLEY
28. FAN BELT



B 18

Fig. L11 Sectional view S1 cars — coolant pump without refrigeration

1. SEALING RING
2. ROTARY SEAL RING
3. SPRING
4. SHAFT
5. FLINGER
6. BACKING PLATE
7. IMPELLER
8. SEALING RING
9. STATIONARY SEAL RING
10. BEARING ASSEMBLY
11. CIRCLIP

S2 cars (see Figs. L13 and L14):

A gland is mounted on the shaft between the impeller and thrust collar. The gland comprises a rubber shell with an integral stainless steel spring and a plastic thrust face (see Fig. L15). A 'Klingerit' joint is fitted between the bearing housing and pump casing (see Fig. L13).

Coolant Pump — to remove

S1 cars

Drain the coolant into a clean container. Slacken the generator bracket bolts and remove the adjustable support nut and bolt at the backing plate.

Move the generator towards the engine and remove the generator driving belt.

Remove the setscrews securing the fan and pulley to the adapter flange, then remove the fan and pulley.

Slacken the two worm drive clips securing the by-pass hose to the pump and thermostat housing and remove the hose and clips.

Unscrew the union nut connecting the induction manifold return line to the coolant pump; move the line to one side.

Slacken the worm drive clip retaining the hose to the pump inlet pipe and detach the hose.

Remove the nuts and lock-washers from the cylinder block adapter studs.

Withdraw the assembly, taking care to avoid damaging the radiator matrix.

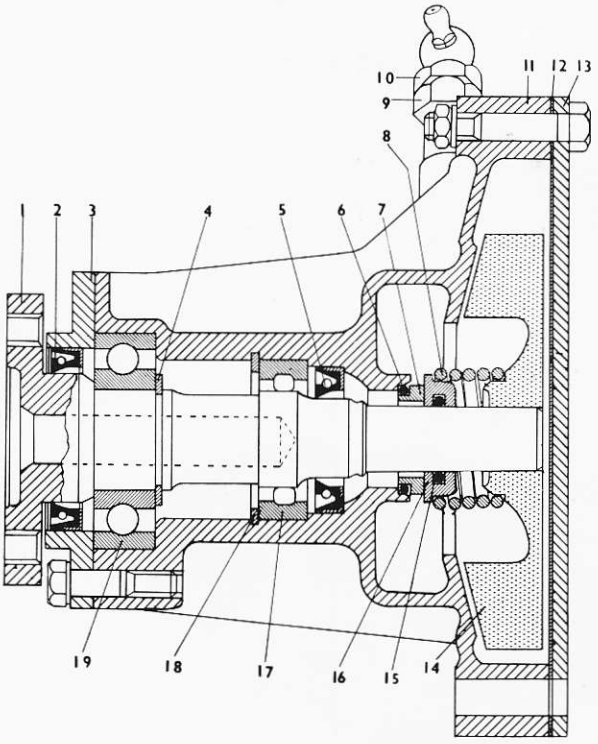


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Fig. L12 Sectional view S1 cars — coolant pump with refrigeration

1. IMPELLER SHAFT
2. SEAL
3. SEAL HOUSING
4. CIRCLIP
5. SEAL
6. STATIONARY SEAL RING
7. SEALING RING COVER
8. 'FLEXIBOX' SPRING
9. GREASE NIPPLE EXTENSION
10. GREASE NIPPLE
11. PUMP CASING
12. JOINT PLATE
13. BACKING PLATE
14. IMPELLER
15. SEALING RING
16. ROTARY SEAL RING
17. REAR BEARING
18. CIRCLIP
19. FRONT BEARING

S2 cars

For normal service operations, including reconditioning, it is not necessary to remove the pump casing from the engine; all moving parts can be removed complete with the bearing housing.

Drain the coolant into a clean container by means of the taps provided on each side of the cylinder block and at the base of the radiator.

Remove the bolts securing the generator, detach the driving belts and move the generator to facilitate access to the coolant pump.

Unscrew the setscrews securing the pulley and fan to the spider; remove the pulley and fan.

Unscrew the setscrews securing the generator bracket and bearing housing, also the remaining setscrew which is one of the screws securing the pump casing to the engine crankcase. A light tap with a mallet is usually sufficient to 'crack' the joint between the housing and the casing. Detach the bearing housing together with all moving parts of the pump. Discard the 'Klingerit' joint.

If it is necessary to remove the pump casing from the engine, the procedure is as follows:

Slacken the clip and disconnect the hose between the pump casing and the radiator bottom tank.

Remove the setscrews and plain washers and detach the connection between the thermostat by-pass hose and the pump casing.

Disconnect the heater matrix return pipe union from the casing.

Remove the two $\frac{5}{16}$ in. U.N.F. setscrews and washers securing the top of the casing to the engine.

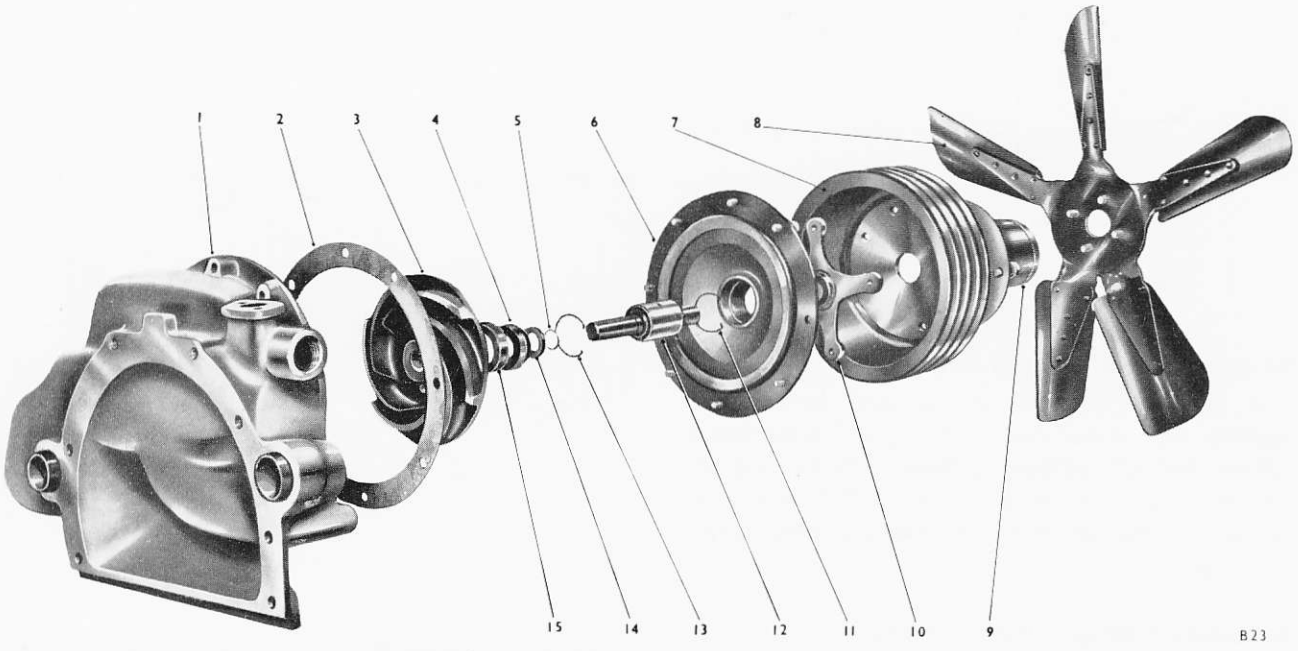

Fig. L13 Exploded view S2 cars — coolant pump

1. VOLUTE CASING
2. 'KLINGERIT' JOINT
3. IMPELLER
4. GLAND
5. SPRING RING
6. BEARING HOUSING
7. PULLEY
8. FAN
9. FAN EXTENSION CONE
10. SPIDER
11. CIRCLIP
12. BEARING ASSEMBLY
13. CIRCLIP
14. THRUST COLLAR
15. GLAND COVER

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TSD 729

Remove the four remaining $\frac{5}{16}$ in. U.N.F. setscrews and washers securing the casing to the engine, then detach the pump casing, together with the 'Neoprene' sealing strip which runs along its lower edge.

Coolant Pump — to dismantle

S1 cars — without refrigeration

Special tool required — RH.570 Universal Extractor.

Remove the four $\frac{1}{4}$ in. U.N.F. bolts, nuts and washers retaining the pump backing plate. Discard the joint.

Withdraw the impeller from the shaft using special tool RH.570 in conjunction with two $\frac{5}{16}$ in. holes tapped through the impeller (see Fig. L16).

Remove the 'Flexibox' seal, coil spring and the stainless steel rotary seal ring which contains a rubber seal.

Two tapped holes are provided in the adapter flange for extraction purposes.

Withdraw the adapter flange from the shaft using special tool RH.570 (see Fig. L17).

Remove the spring ring from the outer end of the bearing housing bore.

Support the housing to enable the shaft assembly to be tapped out with the aid of a cylindrical drift, pressing on the edge of the bearing.

It is not necessary to remove the brass flinger which is pressed on the spindle, behind the bearing assembly.

The assembly contains 'Retinax' lubricant and should not be washed.

Remove the 'Morganite' stationary seal from the boss in the casing.

Due to its fragile nature, a new flinger must always be used with a new spindle assembly.

The friction is confined between the rotary seal ring bearing on the 'Morganite' seal and no moving part is in contact with the pump body.

It is not advisable to use the old adapter flange with a new shaft assembly as the interference fit is lost when the shaft and the flange are separated.

When re-fitting the shaft, use a complete unit which includes the brass flinger.

The old impeller can be used on a new shaft if in good condition and the bore is not oversize, i.e. the interference fit is not lost.

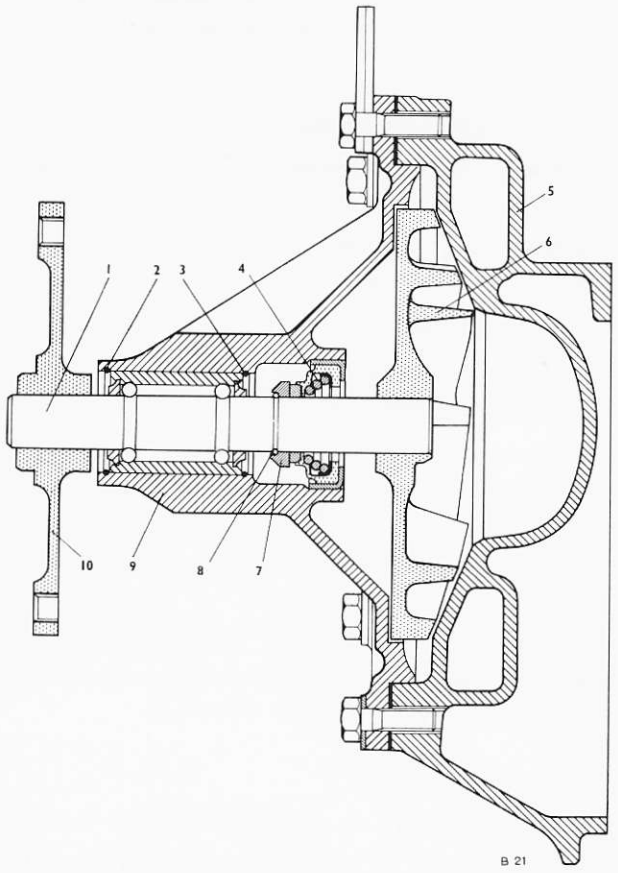

Fig. L14 Sectional view S2 cars — coolant pump

1. ASSEMBLY SHAFT AND BEARING
2. SPRING RING
3. SPRING RING
4. SPRING
5. PUMP CASING
6. IMPELLER
7. THRUST COLLAR
8. SNAP RING
9. HOUSING
10. SPIDER

The shaft diameter should be 0·6267 in. —0·0005 in. and the bore diameter of both the impeller and adapter flange 0·625 in. + 0·0005 in.

Both the impeller and flange have to be pressed into position on the shaft.

The 'Flexibox' gland spring has a free length of 1·650 in. and is compressed to a working length of 0·738 in. to exert 8–10 lb. pressure on the gland.

It is of the utmost importance that the bearing faces of the rotary and the stationary seals are perfectly flat and square to the bore axis. Fit a new seal ring.

A light smear of petroleum jelly applied to the shaft seal rubber and cover seal rubber will facilitate assembly.

S1 cars — with refrigeration

Special tool required — RH.570 Universal Extractor.

Remove the setscrews and washers securing the pulley to the pump shaft.

Remove the pulley.

Remove the grease nipple and adapter to avoid damage during servicing.

Remove the four $\frac{1}{4}$ in. U.N.F. bolts, washers and nuts securing the backing plate and joint to the pump casing.

Remove the backing plate and discard the 'Klingerit' joint.

Using special tool RH.570, draw the impeller off the shaft. (It may be necessary to run a tap through the extraction holes to clear corrosion).

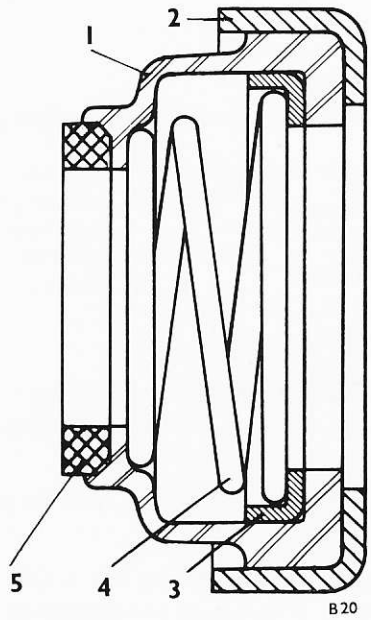

Fig. L15 Sectional view S2 cars — sealing gland

1. SEAL
2. COVER
3. INNER SHELL
4. SPRING
5. THRUST COLLAR

Remove the four $\frac{1}{4}$ in. U.N.F. setscrews and spring washers securing the seal housing to the pump casing. (Make use of the two scollops in the end of the shaft to facilitate access to the tapped holes for the set-screws).

Support the pump casing. Tap out the shaft from the casing using a hide mallet. Remove the circlips from the shaft.

Support the seal housing and press the shaft out of the bearing and housing. Press out the seal from the housing and remove the circlip from the bore of the pump casing.

Remove the carbon gland and rubber ring from the counterbore of the pump casing.

The roller bearing is removed by tapping with a drift, using the seal as a cushion.

Examine and clean all parts; renew any part that is damaged.

S2 cars

Special tools required:

RH.7098 — Universal Extractor
RH.7099 — Spider Extractor

For normal service operations, the bearing housing will already have been separated from the pump casing.

Draw the spider off the shaft using special tool RH.7099 (see Fig. L18).

Draw the impeller off the shaft using special tool RH.7098 (see Fig. L19).

If the spider, impeller and shaft conform to the following dimensions, they may be used for further service:

Spider bore	... ...	0·6250 in. to 0·6255 in.
Spider end of shaft	...	0·6262 in. to 0·6267 in.
Impeller bore	... ...	0·6200 in. to 0·6205 in.

Remove the spring ring which retains the bearing in the housing.

Support the bearing housing to enable the bearing assembly to be driven out with a mallet. During this operation, the thrust collar will sustain damage through contact with the inner spring ring in the housing bore and must be renewed.

Examine the shaft and bearing for wear or damage. The assembly contains 'Retinax' lubricant; no attempt should be made to wash it.

If the existing shaft is suitable for further service, the snap ring should not be disturbed.

Using a suitable drift, tap the gland and gland cover out of the housing bore; these parts must be renewed.

Remove the inner spring ring from the housing. Examine it for damage sustained through contact with the thrust collar; if necessary, it should be renewed.

Coolant Pump — to assemble

S1 cars — without refrigeration

Before assembling the pump, the joint face should be cleaned to remove any part of the old joint. Any damage marks should be polished out to ensure a good sealing.

Stretch the new cover sealing ring into position on the stationary seal ring and press the assembly into the counterbore of the pump body.

Using a cylindrical hollow drift, tap the shaft assembly, longer end first, into the bearing housing of the casing and re-fit the spring ring into the groove.

Press the adapter flange into position on the shaft until $\frac{1}{8}$ in. (0·125 ± 0·005 in.) of the shaft protrudes through the outer end of the flange.

Assemble the shaft rubber seal into the groove of the stainless steel rotary ring and press the assembly over the shaft, so that the wide face presses against the sealing face of the 'Morganite' stationary seal. Place the seal pressure spring against the shoulder of the rotary seal ring and press the impeller squarely on the shaft until the end of the impeller is just flush with the end of the shaft.

Assemble the backing plate to the pump casing using a new 'Klingerit' joint coated with 'Wellseal' but do not tighten the four $\frac{1}{4}$ in. U.N.F. bolts until the pump has been mounted on the studs, so that the plate can be evenly tightened down. A new 'Klingerit' joint, similarly coated, must be used between the pump and the cylinder block adapter.

S1 cars — with refrigeration

Before assembly clean the pump face to remove any part of the old joint which may have remained; remove any damage marks.

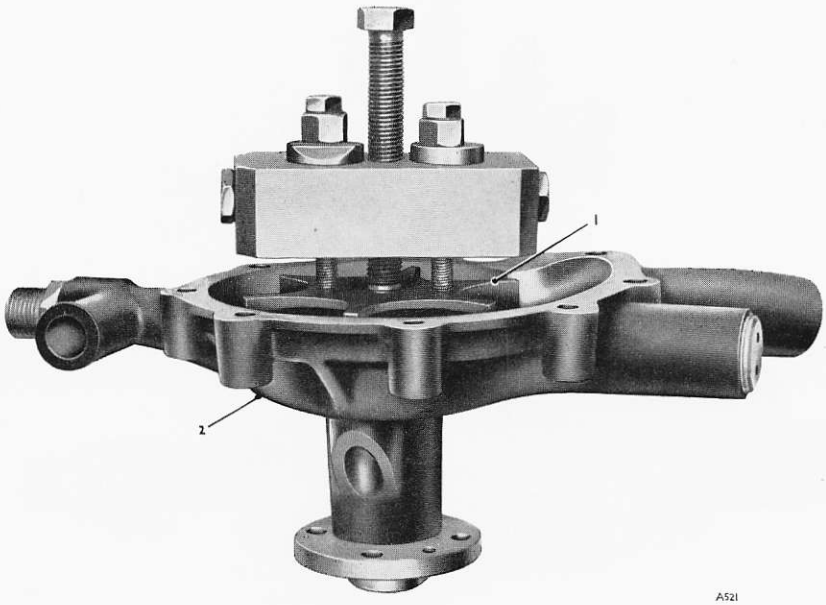

Fig. L16 Extraction of impeller — S1 cars (Special tool RH.570)

1. IMPELLER 2. PUMP CASING

Press the small oil seal into position in the pump casing using minimum pressure to prevent damage to the rubber. Pack the roller bearing with Retinax 'A' grease, and press the roller bearing into position in the pump casing. Fit the large bearing retaining circlip into the groove in the casing bore.

Fill the bearing housing with Retinax 'A' grease but allow for insertion of the pump shaft.

Fit the seal into the seal housing. The rubber part should be level with the outer edge of the housing. Smear the seal bore with a film of petroleum jelly.

Press the bearing onto the shaft and fit the smaller circlip into the groove on the shaft.

Fit the larger rubber ring onto the carbon gland and press the assembly with the rubber ring leading into the counterbore of the casing.

Polish the hardened thrust face of the seal rotary ring to ensure it is free from scratch marks. Use grade 3/0 emery polishing cloth for this operation.

Press the assembled shaft into position in the pump casing and secure it with the four setscrews and washers, making use of the scollops on the end of the shaft provided to facilitate access to the tapped holes in the pump body.

Fit the end of the rotary seal ring into one end of the spring, the other end of which is fitted onto the impeller spigot. Smear the bore of the impeller with a light coating of grease and press the impeller into position on the shaft.

The face of the impeller must lie flush with the end of the shaft.

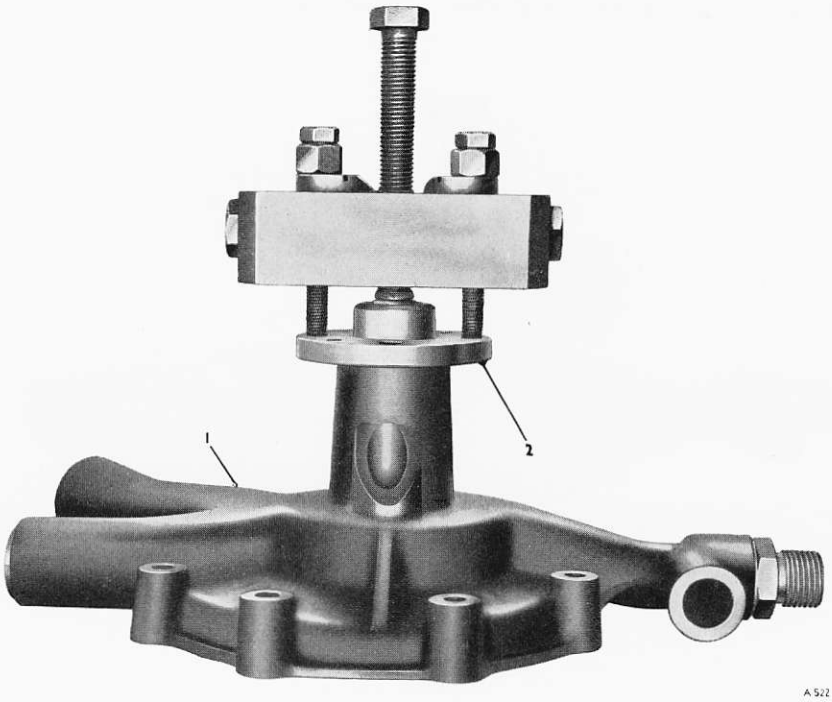

Fig. L17 Extraction of adapter flange (Special tool RH.570)

1. PUMP CASING
2. ADAPTER FLANGE

Fit the backing plate to the pump casing, using a new joint coated with 'Wellseal'. Do not tighten the four $\frac{1}{4}$ in. U.N.F. bolts until the pump has been mounted on the studs, so that the plate can be evenly tightened down.

A new joint, similarly coated, must be fitted between the pump and the cylinder block adapter.

S2 cars

Before assembly clean the joint faces to remove any part of the old joint which may have remained; remove any damage marks. Fit a bearing retaining spring ring in the inner groove in the housing bore.

Insert the longer end of the shaft assembly into the outer end of the housing bore. Using a mallet, drive the bearing into the bore to seat against the inner spring ring, then fit a second bearing retaining spring ring.

If a new shaft is to be fitted, press a new snap ring onto the inner end of the shaft so that it locates in the groove.

If the existing shaft is to be used, the snap ring will already be in position.

Examine the new thrust collar to ensure that its thrust face is free from damage. Fit the collar on the shaft with its chamfered face touching the snap ring. Using a cylindrical drift, sharply tap the thrust collar so that the snap ring locates the counterbore in the collar. Examine the assembly through the inspection ports in the housing to ensure that the snap ring and collar are correctly located.

Examine the new gland cover to ensure that it is free from damage then insert a new gland. Smear the outside of the gland cover with 'Wellseal' and place the unit over the inner end of the shaft with its plastic thrust face towards the thrust collar. Press the unit into the housing bore so that the gland cover is flush with the end of the counterbore.

Ensure that the outer end of the shaft and the bore of the spider are free from burrs and lightly smear the contact surfaces with Retinax 'A' grease. Press the spider into position on the shaft until the shaft protrudes $\frac{1}{8}$ in. (0·125 in.) from the outer face of the spider.

Ensure that the inner end of the shaft and the bore of the impeller are free from burrs and lightly smear the contact surfaces with Retinax 'A' grease. Press the impeller into position on the shaft so that the inner face of the impeller is flush with the end of the shaft.

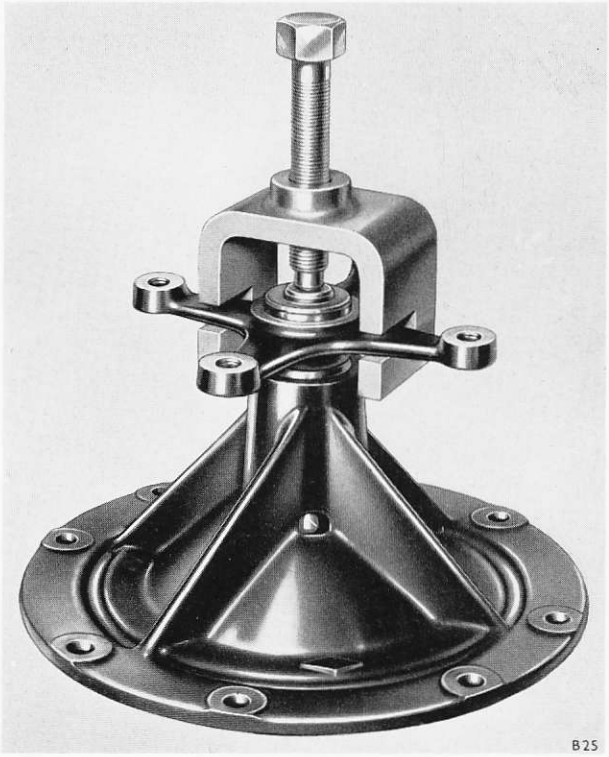

Fig. L18 Extractor — Coolant pump driving spider (S2 cars) (RH.7099)

Spin the assembly to ensure that the shaft rotates freely.

Coolant Pump — to fit

Refrigerated and non-refrigerated S1 cars

Connect the hoses and induction manifold return pipe union nut. Re-fit the fan pulley and blade assembly, tightening the setscrews evenly. Re-fit the generator adjusting bracket and fan belt. Adjust the fan belt tension, with the use of a spring balance midway between the generator and fan pulley. Check that an 18 lb. pull will give $\frac{1}{2}$ in. deflection of the belt.

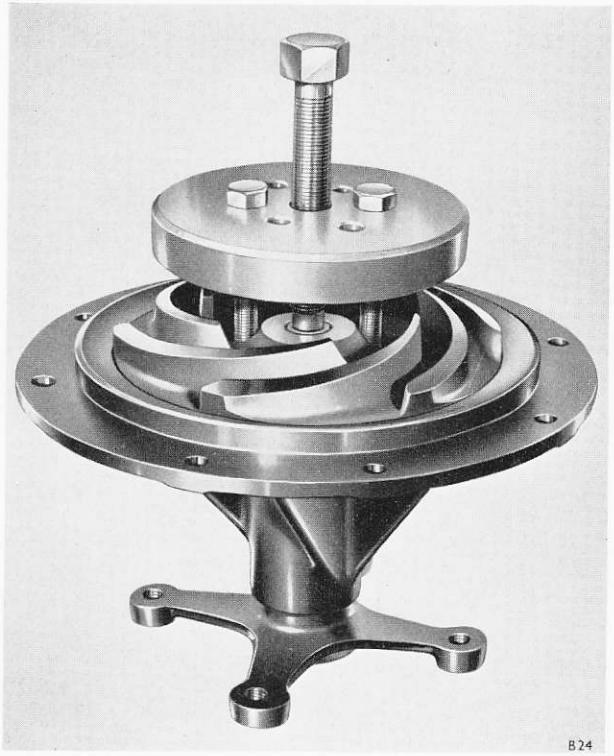

Fig. L19 Extractor — Coolant impeller

Too slack an adjustment of the fan belt will cause the belt to slip at high speed, resulting in squealing, overheating, and premature wear of the pump shaft bearings.

Fill the cooling system and examine the system for leaks.

S2 cars

If the pump casing has been detached from the engine, it should be re-fitted by reversing the procedure for removal described earlier.

Use a fine carborundum stone to remove any burrs which may exist on the joint face of the pump casing.

Fit a new 'Klingerit' joint on the face of the bearing housing and press the housing into position in the casing.

Secure the generator bracket and the housing to the casing with the following setscrews and washers:

One $\frac{5}{16}$ in. U.N.F. setscrew $3\frac{1}{2}$ in. long, one plain washer.

Four $\frac{1}{4}$ in. U.N.F. setscrews $\frac{7}{8}$ in. long, four plain washers.

Three $\frac{1}{4}$ in. U.N.F. setscrews 1 in. long. (No washers are required for these generator bracket setscrews).

Secure the driving pulley, extension cone and fan assembly to the spider with four $\frac{5}{16}$ in. U.N.F. setscrews and plain washers.

Re-fit the generator and generator driving belts. Adjust the tension of the driving belts so that an applied force of 6 lb. causes each belt to deflect $\frac{3}{8}$ in. at the centre of the run between the compressor and generator pulleys (cars fitted with refrigeration) or the coolant pump and generator pulleys (non-refrigerated cars).

Re-fit and adjust the steering pump driving belts so that an applied force of 8 lb. at the centre of the run between the coolant pump and steering pump pulleys causes each belt to deflect $\frac{3}{8}$ in.

Re-fill the cooling system and carefully examine all joints and hoses for leaks.

SECTION L6 — ANTI-FREEZE

On leaving the factory, the cooling systems of new cars are filled with a 25 per cent anti-freeze mixture conforming to British Standards Specification 3150 : 1959 (previously known as British Ministry of Supply Specification DTD 779). Anti-freeze mixtures to this specification can be identified by the specification number which is marked on the container.

Only anti-freeze mixtures conforming to the above specification are approved by Rolls-Royce Limited, and Bentley Motors (1931) Limited, and should the

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TSD 729

cooling system require replenishing, an anti-freeze mixture to this specification should be used.

Important: Do NOT mix different types of anti-freeze at any time.

Anti-freeze mixtures to the above specification can be obtained from:

Rolls-Royce Limited
Spares Department
Pym's Lane
Crewe

Rolls-Royce Limited
Repair Department
Hythe Road
Willesden
London. N.W.10.
(Counter service only)

In addition to providing protection against frost, anti-freeze contains inhibitors which prevent corrosion of the cooling system; it is therefore essential to use an anti-freeze mixture all the year round in all parts of the world; water alone must never be used. In hot climates the anti-freeze acts as a corrosion inhibitor and raises the boiling point of the coolant.

The following chart indicates the temperature at which anti-freeze mixtures of various concentrations begin to freeze.

Percentage concentration	25%	30%	35%	40%	45%	50%
Freezing point (deg. Fahrenheit)	10	4	−3	−9	−22	−35
Degrees of frost (Fahrenheit)	22	28	35	41	54	67
Degrees of frost (Centigrade)	12	16	19	23	30	37
Quantity of anti-freeze (pints)						
S1 cars	7·0	8·4	9·8	11·2	12·6	14·0
S2 cars	5·3	6·3	7·4	8·4	9·5	10·5

The above temperatures are those at which small ice crystals begin to form, a further reduction in temperature causing the mixture to solidify as the minimum safety limit is approached. For example, ice crystals will not form in a 25 per cent anti-freeze mixture unless the temperature falls below 10 deg. F (−12 deg. C).

The percentage concentration of anti-freeze in the coolant can be obtained as follows:

Using a suitable hydrometer, measure the specific gravity of the coolant. At the same time, measure the temperature of the coolant with an accurate thermometer; the coolant temperature indicator on the facia of the car is not suitable for this purpose.

Plot the obtained temperature against the obtained specific gravity on the graph in Figure L20. The nearest diagonal line to the plotted position corresponds to the percentage concentration of anti-freeze in the coolant; each diagonal line is marked with its equivalent concentration at the top of the graph.

Example

Specific gravity of coolant	1·05
Temperature of coolant	95 deg. F (35 deg. C)

Plotting these figures on the graph in Figure 20 produces a point on the diagonal line marked 40 per cent.

The coolant is thus a 40 per cent anti-freeze mixture and will protect the system against frost down to a temperature of −9 deg. F (−23 deg. C).

A mixture of this strength could safely be topped-up with water only if it is unlikely that temperatures in the area would fall as low as −9 deg. F (−23 deg. C).

If it is at all likely that this low temperature be approached, the system must be replenished only with 40 per cent anti-freeze mixture.

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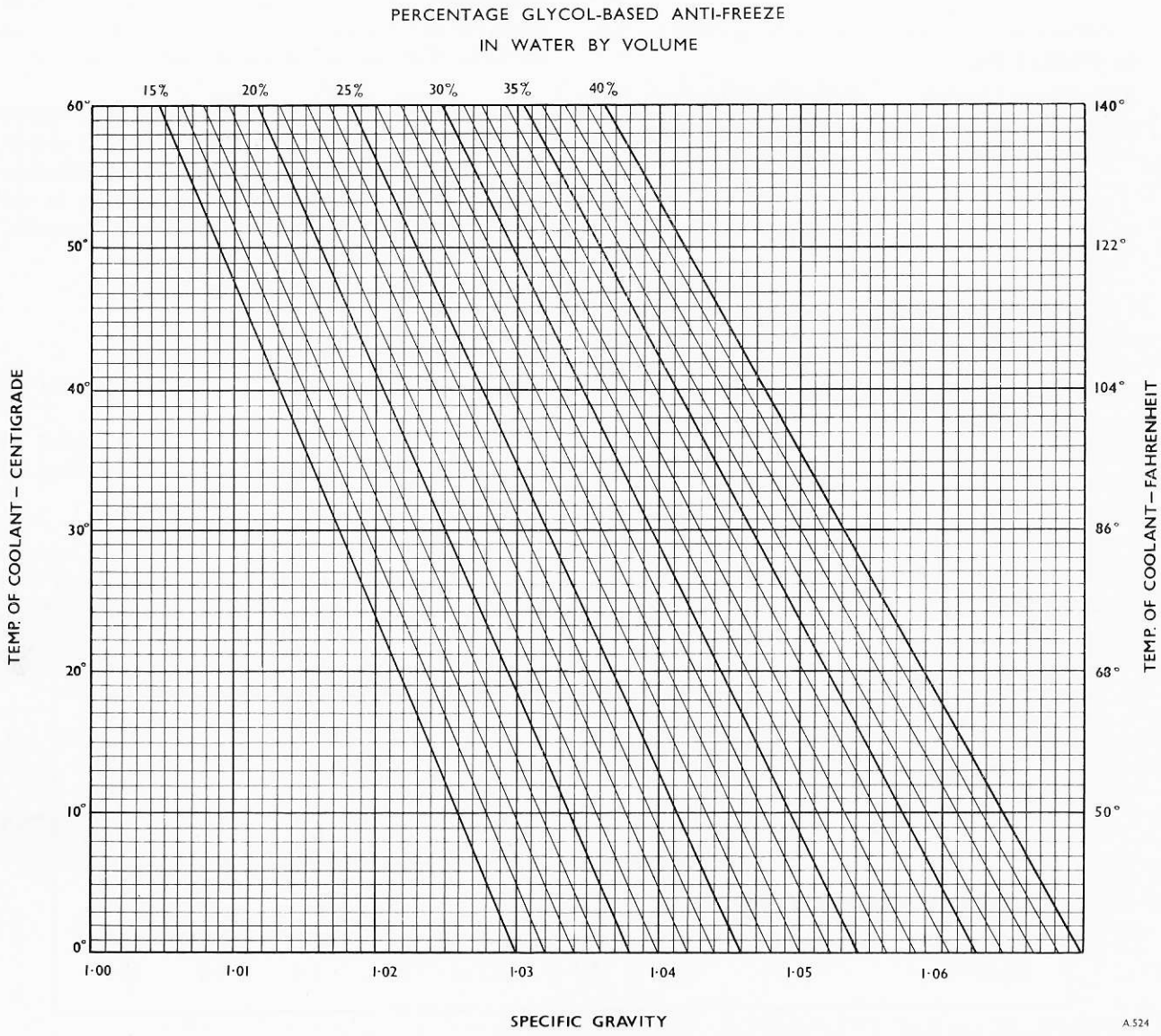

Fig. L20 Anti-freeze chart

TSD 729

CHAPTER L

ENGINE COOLING SYSTEM

SECTION L 1 — DATA

(Page L 1 in Workshop Manual)

For S3 cars read as follows

Capacity	**Imperial**	U.S.	**Litres**
Silver Cloud III, Bentley S3, Bentley Continental S3	22 pints	26·41 pints	12·50
Phantom V	23 pints	27·60 pints	13·07
Pump	Centrifugal		
Pump drive	Twin belts	46·00 in × 0·406 in.	
Fan	Five blade	18 in. diameter	
Thermostat	'Summer' opening temperature of 82°C to 86°C 'Winter' opening temperature of 87°C to 89°C		
Radiator	Fixed shutters		

SECTION L 3 — RADIATOR

Description

(Page L 4 in Workshop Manual)

For S3 cars read as follows

The dimensions of the radiator matrices are as follows

	Surface area	**Dimensions**
Silver Cloud III and Bentley S3	420·000 sq.in.	21·150 in. × 19·875 in. × 2·283 in.
Phantom V	449·675 sq.in.	22·625 in. × 19·875 in. × 2·283 in.
Continental S3	400·000 sq.in.	20·125 in. × 19·875 in. × 2·283 in.

On all S2 cars

(Page L4 inWorkshop Manual)

For S3 cars the second paragraph is not applicable.

The remaining information in this Section which applies to S2 cars is also applicable to S3 cars.

SECTION L 4 — THERMOSTAT

Description

(Page L6 in Workshop Manual)

For S3 cars read as follows

The thermostat comprises a cast body having a bridge piece on top; into this bridge piece is screwed a stud to act as a fixed piston. A dished valve, which seats on the underside of the thermostat body, incorporates a cylinder enclosing the piston, and carrying a wax filled capsule in its base. The valve is held in the closed position by a spring which is retained by a 'U' piece, the latter also serving as a guide for the cylinder.

The valve incorporates a vent hole containing a 'jiggle' pin. This vent allows air to escape while the cooling system is being replenished, thus avoiding air locks. When the system is operating, the 'jiggle' pin rises to close the vent against the passage of coolant.

An increase in coolant temperature causes the wax capsule to expand and force the valve downward off its seat.

A decrease in temperature causes the wax to contract and under the action of the spring the valve closes.

The valve is thus sensitive to the coolant temperature and controls the flow of coolant through the thermostat housing to suit the cooling requirements of the engine.

The bore of the coolant passage in the main body of the thermostat is 1·406 in. in diameter.

When the dished valve is closed, the by-pass valve is fully open, and allows the coolant to circulate around the engine only, excluding the radiator. The by-pass valve closes when the temperature reaches 93·3°C to 96·1°C, and allows all the coolant to pass through the radiator.

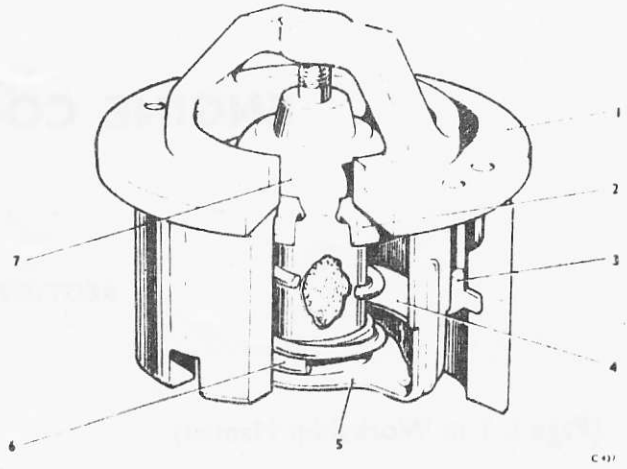

Fig. L1 (S) Sectional view of thermostat

1 THERMOSTAT BODY
2 THERMOSTAT VALVE
3 BY-PASS VALVE
4 BY-PASS PORT
5 'U' PIECE
6 THERMOSTAT VALVE RETURN SPRING
7 WAX FILLED CAPSULE

Thermostat — To test

On S2 cars

(Page L8 in Workshop Manual)

On S3 cars, the thermostats are marked with their opening temperature range on the base of the wax filled bulb.

The standard thermostat unit is marked 82°C or 180 F. The by-pass valve is fully closed at 93°C to 96°C.

The thermostat provided for use in very cold conditions is marked 87·7°C or 190°F.

With this thermostat the by-pass valve fully closes at 98·8°C.

The remaining information in this Section which applies to S2 cars is also applicable to S3 cars.

SECTION L 5 — COOLANT PUMP

(Page L8 in Workshop Manual)

All information which applies to the S2 coolant pump is also applicable to the S3 coolant pump.