Section L — COOLING SYSTEM — ALL MODELS

INDEX

LIST OF ILLUSTRATIONS

Water pump—Petrol models

To remove **Operation L/2**

The following procedure for removing the water pump will be modified if an engine governor or heater unit is fitted. See Section T for details of these items of optional equipment.

1. Partially drain off the coolant.
2. Slacken the dynamo mounting bolts and adjusting link bolts and push the dynamo inwards.
3. Slacken the lower clip on the top hose and the clip securing the inlet manifold hose to the inlet elbow on the thermostat housing.
4. Remove the thermostat housing from the cylinder head complete with thermostat, outlet pipe, inlet elbow and joint washer.
5. Remove the copper tube and rubber joint ring from either the bottom face of the thermostat housing or the top face of the water pump casing.
6. Remove the fan blade, pulley (and distance piece if fitted).
7. Slacken the clip securing the bottom hose to the water pump inlet pipe and remove the bolt securing the pipe to the front cover.
8. Remove the water pump complete with joint washer and inlet pipe; as the pump casing is spigoted in the block, it will be necessary to oscillate it slightly as it is removed.
9. Remove the inlet pipe from the water pump.
10. The water pump may now be overhauled, Operation L/6, or exchanged for a Service Pump Assembly, obtainable from our Spares Department.

The Service Assembly comprises only the following parts:

Water pump casing
Spindle, fan hub and bearing complete
Carbon ring and seal
Impeller
Spring washer } Locating the
Set bolt } spindle bearing

Pumps must be stripped to this condition before they are returned for exchange.

To strip **Operation L/4**

1. Remove the bearing location bolt, place the pump in a vice and drift out the impeller bearing and spindle as an assembly from the pump body and from hub.
2. Cut through the seal and remove from spindle, insert the spindle into the water pump body, so that the impeller is in the position of the fan pulley. The spindle and bearing may now be drifted out of the impeller.

To assemble **Operation L/6**

1. Examine the spindle and bearing assembly; it need not be renewed if the bearing is satisfactory and the spindle is free from excessive corrosion. Clean any corroded portion of the spindle and paint with chlorinated rubber primer to prevent further action. (Part No. 261483 for half-pint tin). As an alternative, good quality aluminium paint or other anti-corrosive paint can be used in place of a rubber primer.
2. Insert a few drops of thick oil in the location hole in the bearing.

3. Press the spindle and bearing assembly into the front of the pump body with the longer end of the spindle leading. Locate it with the set bolt and spring washer.

4. If the fan pulley hub has been removed, it must be pressed on to the spindle to a set dimension between the front face of the pulley hub and the mounting face of the water pump casing. This dimension must be: 4.140 in. (105 mm) on 1954-58 models or 4.215 in. (107 mm) on 1948-53 models.

   Care must be taken to set the hub to the correct dimension. When pressing on the hub, the spindle must be supported, to prevent pressure falling on the location set bolt.

5. On 1954-58 models, fit the carbon ring and seal into the bore of the pump body with the carbon ring to the rear, and fit the rubber water deflector washer.

   On 1948-53 models fit the carbon ring and seal into the bore of the impeller with the carbon ring to the front.

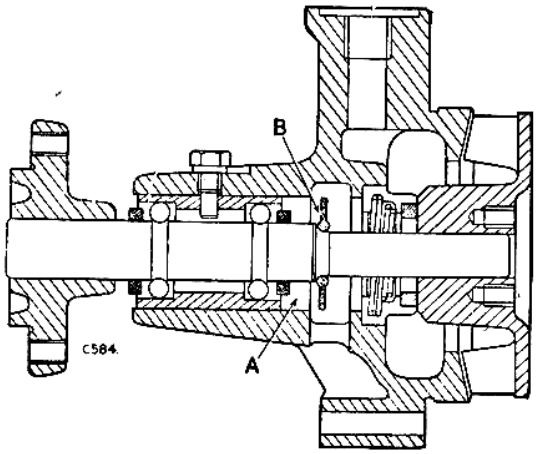


Fig. L-1. Cross-section of water pump, Petrol Models.

A—Through bore housing.
B—Water deflector washer

6. Press the impeller on to the spindle until there is .020 in. (0,5 mm) clearance between the vanes and the pump body face (check with a feeler gauge). The impeller must be a *press fit* on the spindle. If the impeller is loose on the spindle, replace either part as necessary.

7. Refit the inlet pipe to the water pump.

To refit **Operation L/8**

To refit the water pump to the engine, reverse the removal procedure, noting the following points:—

1. Renew both joint washers.

2. When fitting the fan pulley, first engage the fan belt in the pulley groove.

3. On completion, run the engine and check and rectify any leaks.

Thermostat, Petrol models

If the thermostat becomes faulty in operation, overheating of the engine will usually result. To check the thermostat, remove it from its housing and run the engine; if the overheating is eliminated, the unit is faulty and must be renewed. Further tests may be made by immersing the thermostat in hot water, whereon expansion of the bellows should commence between 162°F (72°C) and 171°F (77°C) and be completed at 191°F (88°C).

To renew **Operation L/10**

1. Partially drain off the coolant and remove the top hose.

2. Remove the water outlet pipe from the top of the thermostat housing.

3. Lift out the thermostat from the housing, together with a fibre joint washer, above and below its flange.

4. Fit the new thermostat, together with two new joint washers.

5. Replace the water outlet pipe and top hose.

6. Refill the coolant system to the bottom of the radiator filler neck and check for leaks.

Water pump, Diesel models

To remove **Operation L/12**

1. Partially drain off coolant.

2. Slacken the dynamo mounting bolts and adjusting link bolts and push the dynamo inwards.

3. Disconnect the hoses from pump.

4. Remove the fan blade, pulley and distance piece.

5. Remove the water pump complete with joint washer.

6. The water pump may now be overhauled or exchanged for a Service Pump Assembly, obtainable from our Spares Department.

   The Service Assembly comprises only the following parts:

   Water pump casing
   Spindle, fan hub and bearing complete
   Carbon ring and seal
   Impeller
   Spring washer } Locating the
   Set bolt } spindle bearing

   Pumps must be stripped to this condition before they are returned for exchange.

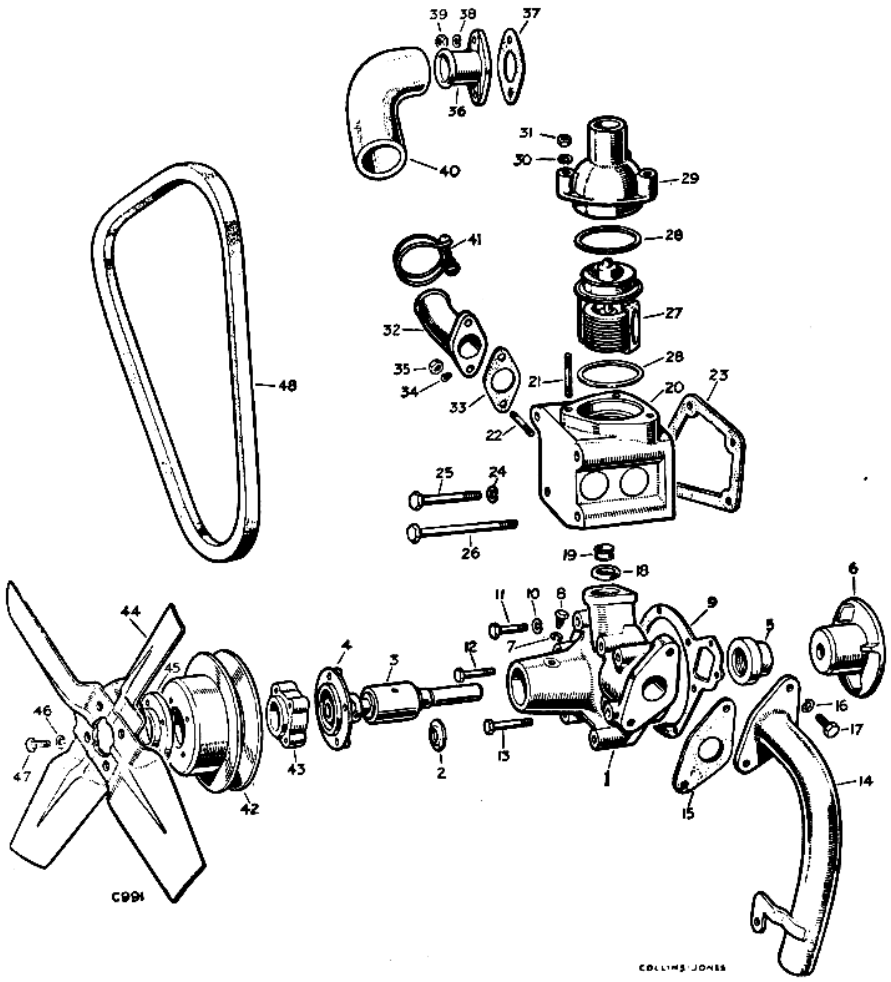


Fig. L-2—Layout of water pump, thermostat and coolant pipes, Petrol Models.

1 Water pump casing
2 Water deflector washer
3 Pump spindle and bearing
4 Hub for fan
5 Carbon ring and seal unit
6 Impeller for pump
7 Spring washer } Locating
8 Set bolt } bearing casing
9 Joint washer for water pump
10–13 Fixings for water pump
14 Inlet pipe for water pump
15 Joint washer for inlet pipe
16–17 Fixings for pipe
18 Rubber joint ring } Connecting water pump
19 Copper tube } to thermostat housing
20 Thermostat housing assembly
21 Stud for outlet pipe
22 Stud for inlet pipe
23 Joint washer for thermostat housing
24–26 Fixings for thermostat housing
27 Thermostat
28 Fibre washer for thermostat
29 Water outlet pipe, thermostat to radiator
30–31 Fixings for outlet pipe
32 Water inlet elbow to thermostat
33 Joint washer for inlet elbow
34–35 Fixings for elbow
36 Water outlet pipe from manifold
37 Joint washer for outlet pipe
38–39 Fixings for water outlet pipe
40 Rubber hose } Connecting water pipe
41 Clip for hose } to inlet elbow
42 Fan pulley
43 Distance piece for fan pulley
44 Fan blade
45 Reinforcing plate for fan blade
46–47 Fixings for fan blade and pulley
48 Fan and dynamo belt

To strip **Operation L/14**

1. Remove the bearing location bolt, place the pump in a vice and drift out the impeller bearing and spindle as an assembly from the pump body and from hub.

2. Cut through the seal and remove from spindle, insert the spindle into the water pump body, so that the impeller is in the position of the fan pulley. The spindle and bearing may now be drifted out of the impeller.

To assemble **Operation L/16**

1. Examine the spindle and bearing assembly; it need not be renewed if the bearing is satisfactory and the spindle is free from excessive corrosion. Clean any corroded portion of the spindle and paint with chlorinated rubber primer to prevent further action. (Part No. 261483 for half-pint tin.) As an alternative, good quality aluminium paint or other anti-corrosive paint can be used in place of a rubber primer.

2. Insert a few drops of thick oil in the location hole in the bearing.

3. Press the spindle and bearing assembly into the front of the pump body with the longer end of the spindle leading. Locate it with the set bolt and spring washer.

4. If the fan pulley hub has been removed, it must be pressed on to the spindle to a set dimension between the front face of the pulley hub and the mounting face of the water pump casing. This dimension must be: 3.453 in. (86,36 mm). Care must be taken to set the hub to the correct dimensions. When pressing on the hub, the spindle must be supported, to prevent pressure falling on the location set bolt.

5. Fit the carbon ring and seal into the bore of the pump body with the carbon ring to the rear.

6. Press the impeller on to the spindle until there is .020 in. (0,5 mm) clearance between the vanes and the pump body face (check with a feeler gauge). The impeller must be a *press fit* on the spindle. If the impeller is loose on the spindle, replace either part as necessary.

7. Refit the inlet pipe to the water pump.

To refit **Operation L/18**

To refit the water pump to the engine, reverse the removal procedure, noting the following points:—

1. Renew joint washer.

2. When fitting the fan pulley, first engage the fan belt in the pulley groove.

3. On completion, run the engine and check and rectify any leaks.

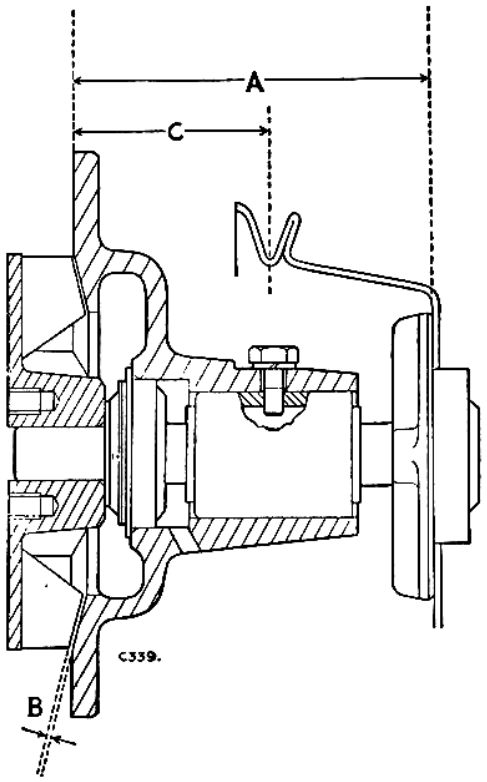


Fig. L-3—Cross-section of water pump, Diesel Models

A—3.453 in. (86 mm) B—.020 in. (0,508 mm)
C—1.875 in. (47,625 mm)

Thermostat, Diesel models

If the thermostat becomes faulty in operation, overheating or overcooling of the engine may result. To check the thermostat, remove it from its housing and run the engine; if the coolant temperature remains unchanged, the unit is faulty and should be renewed. See important note on page L-8.

Further tests may be made by immersing the thermostat in hot water, whereon expansion of the bellows should commence between 164°F (73°C) and 173°F (78°C) and be complete at 193°F (89°C).

To renew **Operation L/20**

1. Partially drain off the coolant, disconnect the top and by-pass hoses from the thermostat cover —also the heater hose if fitted—and remove the cover.

2. Lift out the thermostat from its housing and fit the new one.

3. Replace the top cover and re-connect the hoses.

4. Refill the coolant system to the bottom of filler neck and check for leaks.

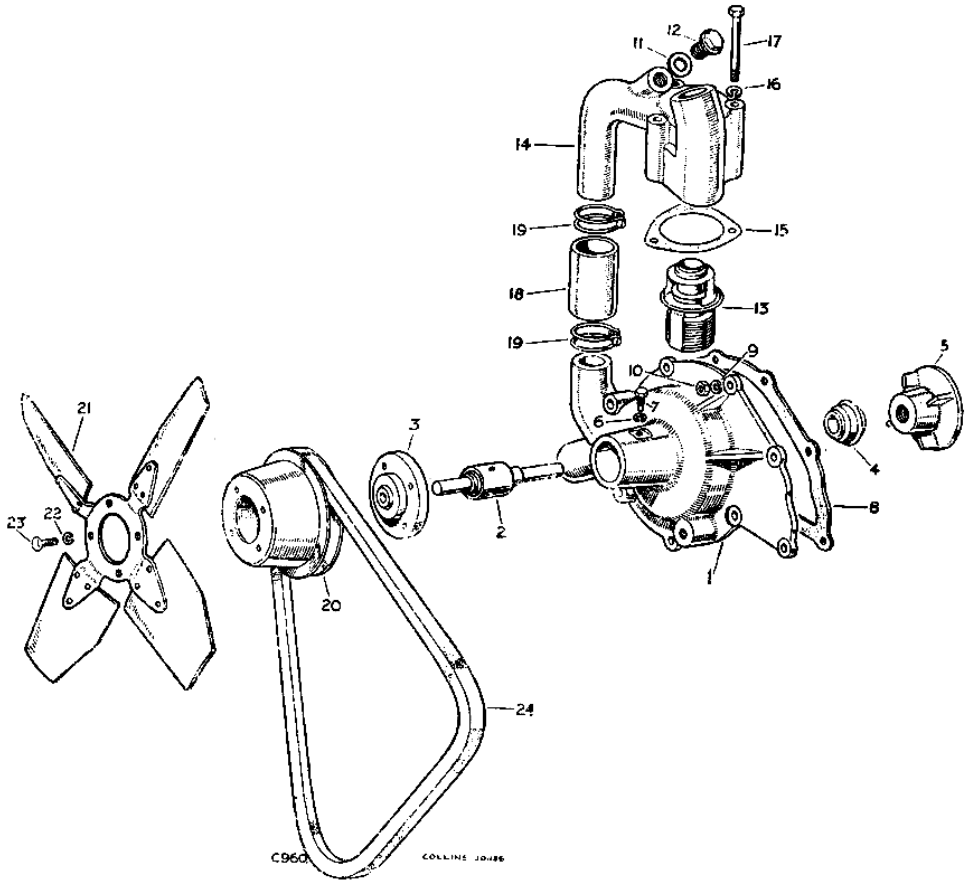


Fig. L-4—Layout of pump, thermostat and fan, Diesel Models.

1 Water pump casing
2 Spindle and bearing assembly
3 Pulley hub
4 Seal
5 Impeller
6 Spring washer } locating spindle
7 Set bolt } and bearing
8 Joint washer
9 Spring washer } for
10 Nut } casing
11 Joint washer for plug } for heater return in
12 Plug } water outlet pipe
13 Thermostat
14 Outlet pipes and cover
15 Joint washer for cover
16 Spring washer } for
17 Set bolt } casing
18 By-pass hose
19 Clip
20 Pulley
21 Fan blades
22 Spring washer } for fan
23 Set bolt } blades
24 Driving belt

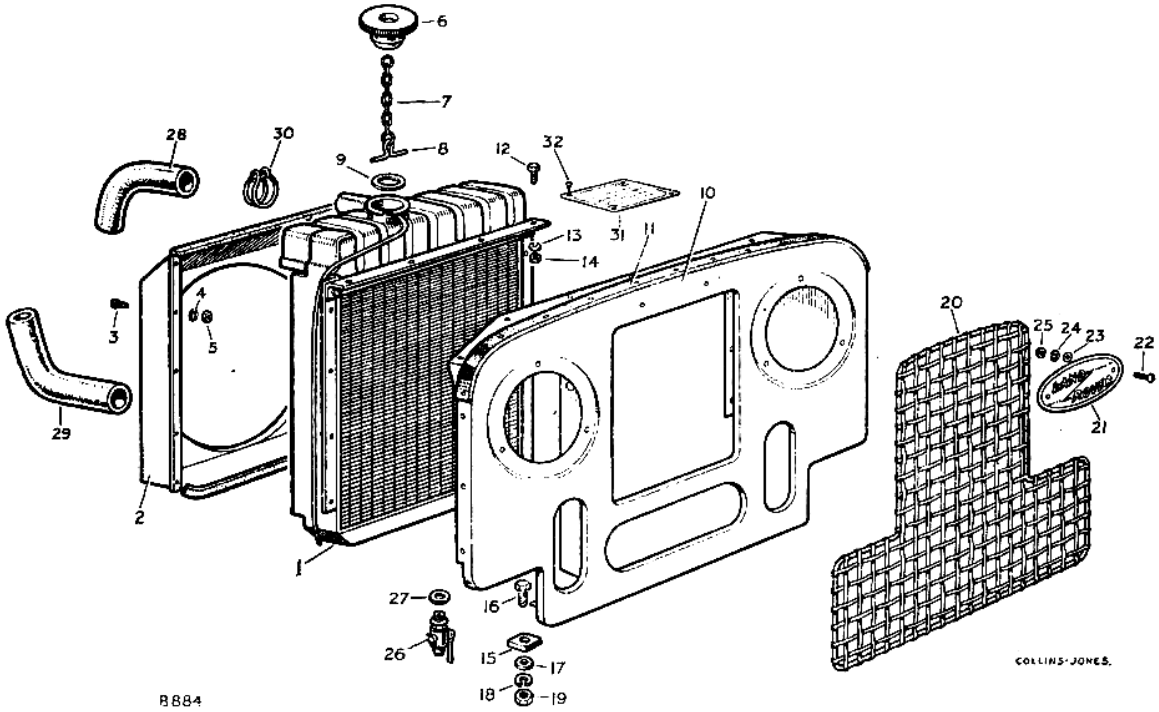


Fig. L-5—Layout of radiator and grille panel.

1 Radiator block assembly
2 Cowl for fan
3–5 Fixings for cowl
6 Filler cap for radiator
7 Chain for filler cap
8 Retainer for chain
9 Joint washer for filler cap
10 Radiator grille panel assembly
11 Bonnet rest strip
Bifurcated rivet fixing strip
12–14 Fixings for radiator block
15–19 Fixings for grille panel
20 Grille for radiator
21 "Land-Rover" name plate
22–25 Fixings for grille and name plate
26 Drain tap for radiator
27 Joint washer for drain tap
28 Hose for radiator, top
29 Hose for radiator, bottom
30 Clip for radiator hoses
31 Oil recommendation plate
32 Drive screw fixing plate

Visual inspection

It is a good plan to inspect the cooling system at the same time as the engine oil level is checked; such care would largely prevent the possibility of a sudden and costly delay due to coolant loss and consequent engine damage. Attention should be paid to the following points:—

1. Water level in radiator—to the bottom of the filler neck.
2. Condition of all hoses—freedom from cracks and hose clips tight.
3. Any water leaks.
4. Check that the drain taps are fully closed.

As the cooling system is pressurised, the vehicle must not be run without the radiator cap in position. When removing cap follow instructions on top.

Tests and adjustments

Fan belt

The fan belt is of the "V" type, drive is on the sides of the belt and it is not therefore necessary to adjust it tightly and so put an excessive load on the water pump and dynamo bearings; the tension is correct when the belt can be depressed $\frac{5}{16}$ to $\frac{7}{16}$ in. (8 to 11 mm)—Diesel models, and $\frac{1}{2}$ to $\frac{3}{4}$ in. (12 to 19 mm)—Petrol models by thumb pressure between the fan and crankshaft pulleys. The procedure for adjustment is as follows:—

Slacken the dynamo pivot bolts and the bolt securing the dynamo to the adjusting link. Move the dynamo outwards until the tension is correct and re-tighten the bolts.

Thermostat

See pages L-2 and L-4 of this section.

Draining the cooling system

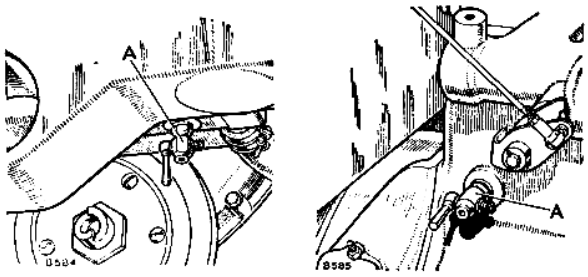
The cooling system should be drained and flushed out at least twice each year in the following manner:

1. Remove the radiator filler cap.
2. Open the water drain taps at the bottom of the radiator and on the left-hand side of the cylinder block.
3. When the water flow has ceased, insert a piece of wire in each tap to make sure that a blockage has not been caused by rust or scale.
4. Place a hose in the radiator filler neck and fill the system; adjust the flow of water to equal that draining from the taps.
5. Run the engine for a short time to ensure thorough cleaning of the whole system.
6. Stop the engine, remove the hose and close the taps. Refill the system with clean water to the bottom of the filler neck and replace the filler cap.

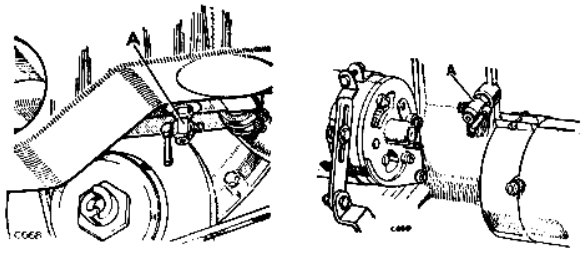
The total capacity of the cooling system is: Petrol and Diesel models—17 Imperial pints (9,7 litres).

Note: Use soft water wherever possible; if the local water supply is hard, clean rain or distilled water should be used.

7. Run the engine until working temperature is reached and top the water level as necessary.



A—Drain taps—Petrol Models.



A—Drain taps—Diesel Models.

Fig. L-6—Radiator drain taps.

Cleaning radiator—externally

In the event of the cooling gills of the radiator becoming blocked with dirt, straw, etc., they should be cleaned by means of compressed air or water pressure applied from the rear, so forcing the foreign matter out through the front of the radiator. Never use a metal implement for this purpose or serious damage may result to the radiator core.

Frost precautions

In cold weather, when the temperature may drop to or below freezing point, precautions must be taken to prevent freezing of the water in the cooling system.

A thermostat is fitted in the system and it is therefore possible for the radiator block to freeze in cold weather even though the engine running temperature is quite high; for this reason the use of an anti-freeze mixture is essential.

Only high quality inhibited glycol-based solutions should be used.

When the temperature is between 32° F and 0° F (0° C and minus 17 C) use one part of anti-freeze to four parts of water.

Proceed as follows:—

1. Ensure that the cooling system is leak-proof; anti-freeze solutions are far more "searching" at joints than water.
2. Drain and flush the system. See "Draining the cooling system"
3. Mix the solution to the required strength in a separate container and refill the system.

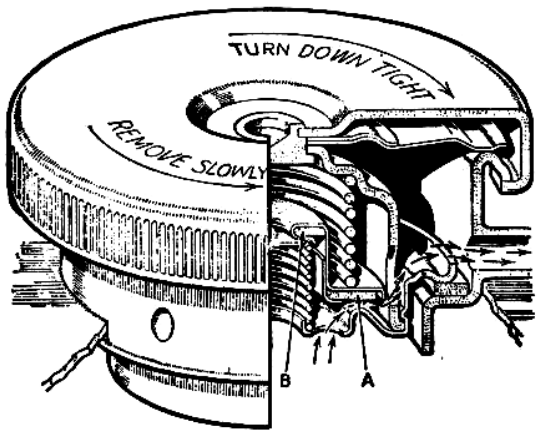


Fig. L-7—Radiator filler cap.

A—Pressure relief valve (steam escape).
B—Depression relief valve.

4. Run the engine to ensure good circulation of the mixture.

If the vehicle is to be stored in cold weather, unless it is kept in a well-heated garage or anti-freeze solution has been used, the cooling system must be completely drained.

Radiator

To remove **Operation L/22**

1. Drain off the coolant.

   Note: Diesel models only—Disconnect the lead coupling the two batteries.

2. Disconnect the top and bottom hoses from the radiator.
3. On 1954-58 models disconnect the side lamp leads at snap connectors at each side of the grille panel assembly and the front lamp harness from the junction box at right-hand side of scuttle, then pull the wiring clear to front of engine.

   On 1948-53 models disconnect the headlamp and horn wiring from the junction box on the dash panel and pull the wiring clear to the front of the engine.
4. Remove the radiator grille and chaff guard (if fitted) from the grille panel complete with the name plate.
5. Remove the fan blades.
6. Remove the bolts securing the front apron and remove panel. Remove the bolts securing the grille panel to the front cross-member and front wings.
7. Lift the radiator, grille panel and headlamps assembly upward, then forward to clear the vehicle.
8. Remove the rubber buffers from beneath the grille panel.
9. Remove the radiator block from the grille panel.
10. Remove the drain tap and joint washer from the bottom of the radiator block.
11. Remove the filler cap, complete with the joint washer, retainer and chain.

To refit **Operation L/24**

1. Reverse the removal procedure, replacing the rubber buffers, if necessary, and connecting the wiring in accordance with the appropriate wiring diagram—Section P.

It is important to fully tighten the radiator cap. As the cooling system is pressurised, the radiator cap must be fully tightened, not left loose or just turned to the first stop, but tightened right down by turning clockwise as far as possible.

Failure to do so will result in the water rapidly boiling away with possible seizure and damage to the engine due to overheating.

It is equally important to take great care when removing the radiator filler cap, especially when the engine is hot, to avoid steam which may be blown out with considerable force.

When removing the filler cap, first turn it anti-clockwise to the stop and allow all pressure to escape before pressing it down and turning further in the same direction to lift it off.

Important

On no account must Diesel engines be run without water circulating through the cylinder block and cylinder head even for a few seconds, since lacquer formation would quickly render the injectors useless.

When water is drained a label must be attached to the steering column stating: "No water in cooling system—on no account must the engine be started until the cooling system is refilled."

DEFECT LOCATION

Symptom, Cause and Remedy

A—EXTERNAL LEAKAGE

1. Loose hose clips—*Tighten.*
2. Defective rubber hose—*Renew.*
3. Damaged radiator seams—*Rectify.*
4. Excessive wear in the water pump—*Renew.*
5. Loose core plugs—*Renew.*
6. Damaged gaskets—*Renew.*
7. Leak at the heater connections or plugs—*Rectify.*
8. Leak at the water temperature gauge plug—*Tighten.*
9. Diesel only—leak from either of the four small holes in L.H. side of cylinder block—*Fit new sealing rings to liner Section A.*

B—INTERNAL LEAKAGE

1. Defective cylinder head gasket—*Renew, check engine oil for contamination and refill as necessary.*
2. Cracked cylinder bore or liner—*Renew cylinder block (or Diesel) liner.*
3. Loose cylinder head bolts—*Tighten. Check engine oil for contamination and refill as necessary.*

C—WATER LOSS

1. Overfilling—*See Instruction Manual for filling instructions.*
2. Boiling—*Ascertain the cause of engine overheating and correct as necessary.*
3. Internal or external leakage—*See items* A *and* B.
4. Restricted radiator or inoperative thermostat—*Flush radiator and renew the thermostat as necessary.*

D—POOR CIRCULATION

1. Restriction in system—*Check hoses for crimps, and flush the radiator.*
2. Insufficient coolant—*Replenish.*
3. Inoperative water pump—*Renew.*
4. Loose fan belt—*Adjust.*
5. Inoperative thermostat—*Renew.*

E—CORROSION

1. Excessive impurity in the water—*Use only soft, clean water (rainwater is satisfactory).*
2. Infrequent flushing and draining of system—*The cooling system should be drained and flushed thoroughly at least twice a year.*
3. Incorrect anti-freeze mixtures—*Certain anti-freeze solutions have a corrosive effect on parts of the cooling system. Only good glycol-base solutions should be used.*

F—OVERHEATING

1. Poor circulation—*See item* D.
2. Dirty oil and sludge in engine—*Flush and refill.*
3. Radiator fins choked with chaff, mud, etc.—*Use air pressure from the engine side of the radiator and clean out passages thoroughly.*
4. Incorrect injection pump or ignition timing—*Section A.*
5. Incorrect valve timing—*Section A.*
6. Low oil level—*Replenish.*
7. Tight engine—*New engines are very tight during the "running-in" period and moderate speeds should be maintained for the first* 1,000 *miles* (1.500 *km*).
8. Choked or damaged exhaust pipe or silencer—*Rectify or renew.*
9. Dragging brakes—*Check cause—Section H.*
10. Overloading vehicle—*In the hands of the operator.*
11. Driving in heavy sand or mud—*In the hands of the operator*
12. Engine labouring on grades—*In the hands of the operator.*
13. Low gear work—*In the hands of the operator.*
14. Excessive engine idling—*In the hands of the operator.*

G—OVERCOOLING

1. Defective thermostat—*Renew.*

DATA

Capacity of cooling system—

Petrol and Diesel models
17 Imperial pints (9,75 litres)

Radiator

Filler cap pressure valve opens at:
- Petrol models .... 3.25 to 4.25 lb/sq. in. (0,22 to 0,29 Kg/cm²)
- Diesel models .... 10 lb/sq.in. (0,703 Kg/cm²)

Filler cap vacuum valve opens at .... 1 lb/sq.in. (0,07 Kg/cm²)

Thermostat

Type ... . Bellows

Opening temperature—
Petrol models
- Commences at .... 162° to 171°F (72°-77°C)
- Fully open at .... 191°F (88°C)

Opening temperature—
Diesel models
- Commences at .... 164° to 173°F (73°-78°C)
- Fully open at .... 193°F (89°C)

Water pump

Type .... Centrifugal impeller

Dimensions between front face of pulley and mounting face of pump body:
- 1948-53 Petrol models 4.215 in. (107 mm)
- 1954-58 Petrol models 4.140 in. (105 mm)
- Diesel models .... 3.453 in. (86 mm)

Clearance between impeller vanes and pump body .... .020 in. (0,5 mm)

Section N — EXHAUST SYSTEM

INDEX

LIST OF ILLUSTRATIONS

Exhaust system, early 1954

Front exhaust pipe

To remove — **Operation N/10**

1. Remove the clamping flange between the front exhaust pipe and the silencer.
2. Remove four nuts and spring washers securing the exhaust pipe to the exhaust manifold.
3. Withdraw the exhaust pipe complete with joint washer.

To refit — **Operation N/12**

1. Replace the exhaust pipe by reversing the removal procedure.

Exhaust silencer (R.H.D. models only)

To remove — **Operation N/14**

1. Jack up the rear of the vehicle and place jacking stands under the rear axle casing.
2. Remove both rear wheels.
3. Disconnect front exhaust pipe from silencer.
4. Remove the clips securing the front end of silencer unit to the support plate.
5. Remove the saddle securing the tail pipe to the tail pipe support bracket.
6. Withdraw the silencer unit complete by manoeuvring it past the right-hand road spring.

To refit — **Operation N/16**

1. Replace the exhaust silencer by reversing the removal procedure.

Exhaust silencer (L.H.D. models only)

To remove — **Operation N/18**

1. Jack up the rear of the vehicle and place jacking stands under the axle casing.
2. Remove the rear left-hand wheel.
3. Disconnect the front exhaust pipe from silencer.
4. Remove the clips securing the front end of the silencer unit to the support plate.
5. Remove the two bolts and self-locking nuts securing the silencer to the rubber support strip.
6. Remove the saddle securing the tail pipe to the tail pipe support bracket.

Land-Rover 107 only—

7. Remove the saddle securing the silencer to the chassis frame.
8. Remove two bolts securing one of the extremities of the rear axle check strap to the chassis side member. Remove the shock absorber top fixing bolt and slacken the lower one. Swing the shock absorber downwards.
9. Withdraw the silencer unit complete.

To refit — **Operation N/20**

1. Replace the exhaust silencer by reversing the removal procedure, taking care to tighten the shock absorber securing bolts with the vehicle resting on the ground.

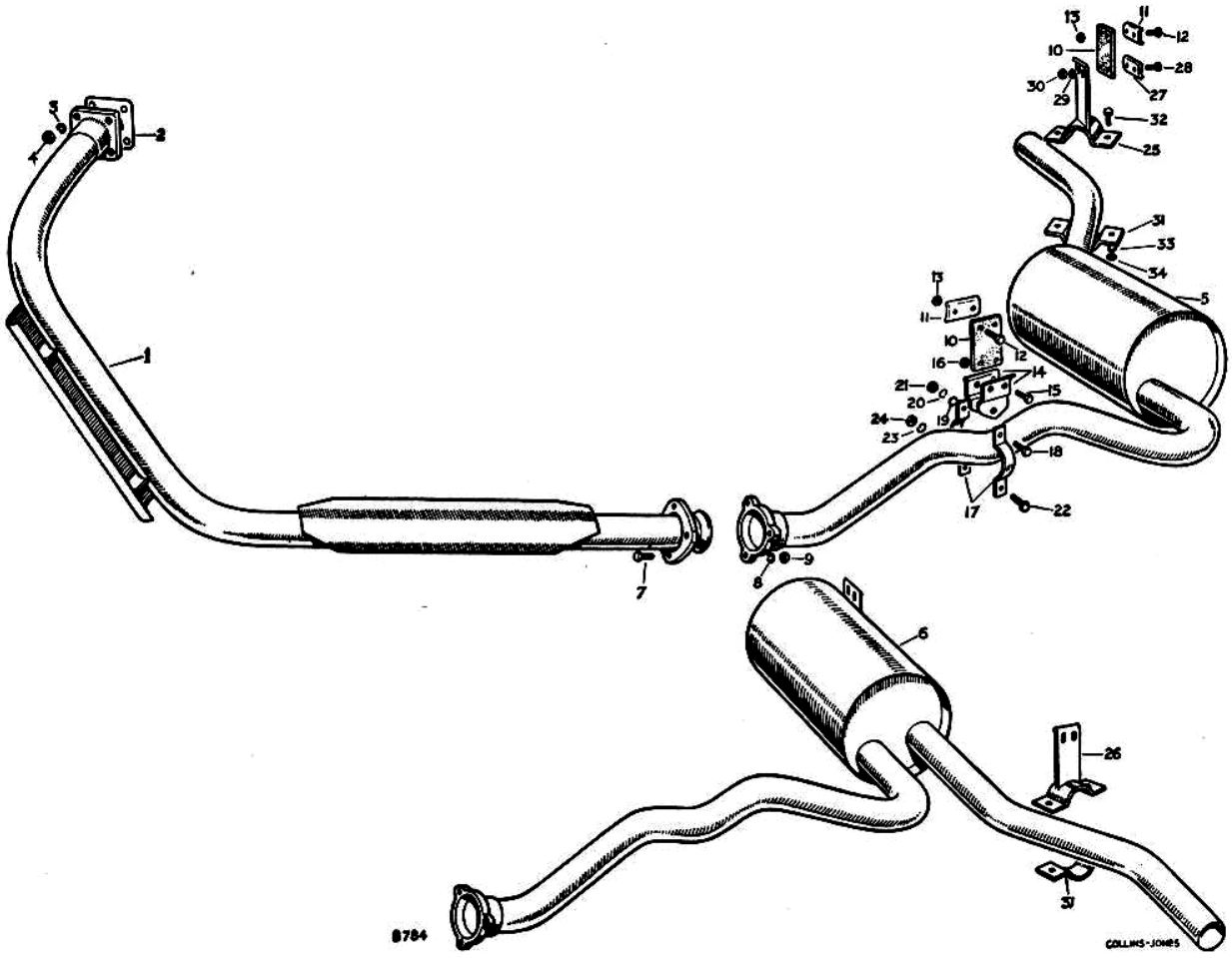


Fig. N-1—Layout of exhaust system, early 1954.

1	Front exhaust pipe complete
2	Joint washer for exhaust pipe
3–4	Fixings for exhaust pipe
5	Exhaust silencer complete
6	Exhaust silencer complete
7–9	Fixings for silencer
10	Flexible mounting for exhaust pipe
11–13	Fixings for flexible mounting
14	Plate for flexible mounting
15–16	Fixings for plate
17	Pipe clamp
18–21	Fixings for pipe clamp
22–24	Fixings for pipe clamp
25	Clamp bracket for exhaust pipe
26	Clamp bracket for exhaust pipe
27–30	Fixings for clamp bracket
31	Saddle for clamp bracket
32–34	Fixings for saddle

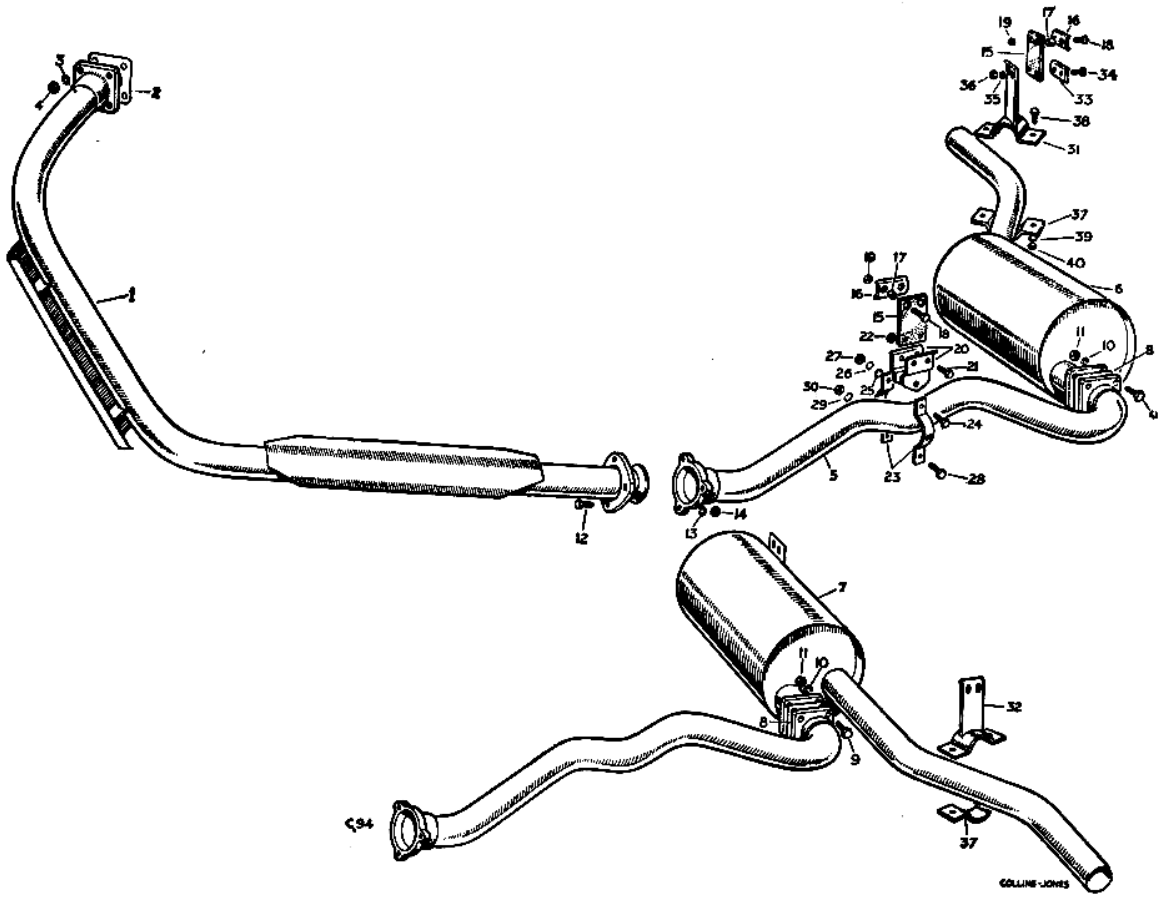


Fig. N-2—Layout of exhaust system, late 1954 onwards, Petrol and Diesel models.

1 Front exhaust pipe
2 Joint washer for front pipe
3 Spring washer } Exhaust pipe
4 Nut } to manifold
5 Intermediate exhaust pipe
6 Silencer complete- -R.H.D.
7 Silencer complete—L.H.D.
8 Joint washer
9 Bolt
10 Spring washer } Intermediate pipe to silencer
11 Nut
12 Bolt
13 Spring washer } Front pipe to intermediate
14 Nut } pipe
15 Flexible mounting
16 Clamp plate
17 Distance piece } Flexible mounting to chassis
18 Bolt } frame
19 Self-locking nut
20 Plate for flexible mounting
21 Bolt } Plate to
22 Self-locking nut } flexible mounting
23 Pipe clamp
24 Bolt
25 Shakeproof washer } Pipe clamp to flexible
26 Spring washer } mounting
27 Nut
28 Bolt
29 Spring washer } Pipe clamp to exhaust pipe
30 Nut
31 Clamp bracket—R.H.D.
32 Clamp bracket—L.H.D.
33 Clamp plate
34 Bolt } Clamp bracket to flexible
35 Plain washer } mounting
36 Self-locking nut
37 Saddle for clamp bracket
38 Bolt
39 Spring washer } Saddle to clamp bracket
40 Nut

Exhaust system late 1954 onwards

Front exhaust pipe

To remove **Operation N/22**

1. Remove securing bolts at front exhaust pipe and intermediate pipe joint.
2. Remove nuts and spring washers securing pipe at exhaust manifold.
3. Withdraw the exhaust pipe and joint washer.

To refit **Operation N/24**

Reverse the removal procedure.

Intermediate exhaust pipe

To remove **Operation N/26**

1. Remove securing bolts at front exhaust pipe and silencer.
2. Remove supporting clamp and withdraw intermediate exhaust pipe.

To refit **Operation N/28**

1. Reverse the removal procedure, leaving the supporting clamps loose until the pipe has been secured firmly to front exhaust pipe and silencer.

Exhaust silencer (R.H.D. models only)

To remove **Operation N/30**

1. Remove the bolts securing intermediate pipe to silencer and release support saddle from silencer tail pipe, keeping silencer supported by hand.
2. Withdraw silencer assembly.

To refit **Operation N/32**

Reverse removal procedure, ensuring that the bolts securing intermediate pipe to silencer are fully tightened before finally clamping the tail pipe support.

Exhaust silencer (L.H.D. models only)

To remove **Operation N/34**

1. Remove bolts securing intermediate pipe to silencer.
2. Keeping the silencer supported, release the supporting strap for silencer right-hand side and saddle clamp on tail pipe, then withdraw silencer assembly.

To refit **Operation N/36**

1. Fit the silencer in position and loosely support by means of supporting strap and saddle clamp.
2. Secure the intermediate pipe to silencer.
3. Finally tighten bolts securing support strap and saddle clamp.

Section K — CHASSIS

INDEX

LIST OF ILLUSTRATIONS

Frame alignment

To check **Operation K/10**

Figs. K-2 (Land-Rover 80, 86 and 88), K-3 and K-4 (Land-Rover 107 and 109) show the various dimensions that should be used as a guide in checking frame alignment. Fig. K-1 illustrates the diagonal measurements which may be taken to check the frame for "squareness". Extreme care must be taken when checking for malalignment.

When the body is removed, the frame may easily be checked against the measurements in Figs. K-1, K-2, K-3 and K-4. If the body is in position, measurements may be taken with the aid of a plumb-bob and chalk as follows:—

1. Place the vehicle on a level floor.
2. Hold the plumb line against one of the measuring points, with the bob slightly above the floor; mark the floor directly beneath the bob.
3. Repeat for other measuring points.
4. Move the vehicle away and measure between the chalk marks.

Care should be taken when measuring diagonals, that exactly corresponding points are used on each side of the frame.

Front bumper

The channel-section front bumper is bolted to the chassis side members, so that it may be removed to facilitate repair after accidental damage.

Rear drawbar

The rear drawbar is bolted to the chassis frame, so that it may be removed to facilitate repair after accidental damage.

Battery and air cleaner support

To remove **Operation K/12**

1. Remove the air cleaner. Section M.
2. Disconnect the battery cables.
3. Remove the battery cover.
4. Remove the battery.
5. Remove the battery and air cleaner support from the chassis frame (this action releases the battery earth lead).

To replace **Operation K/14**

Reverse the removal procedure.

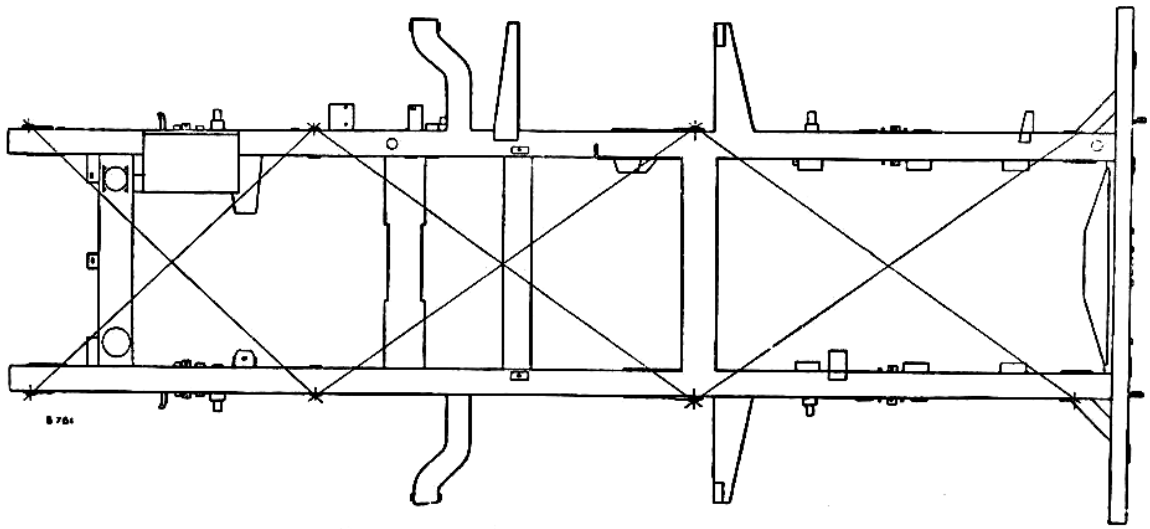


Fig. K-1—Chassis frame diagonal measurements.

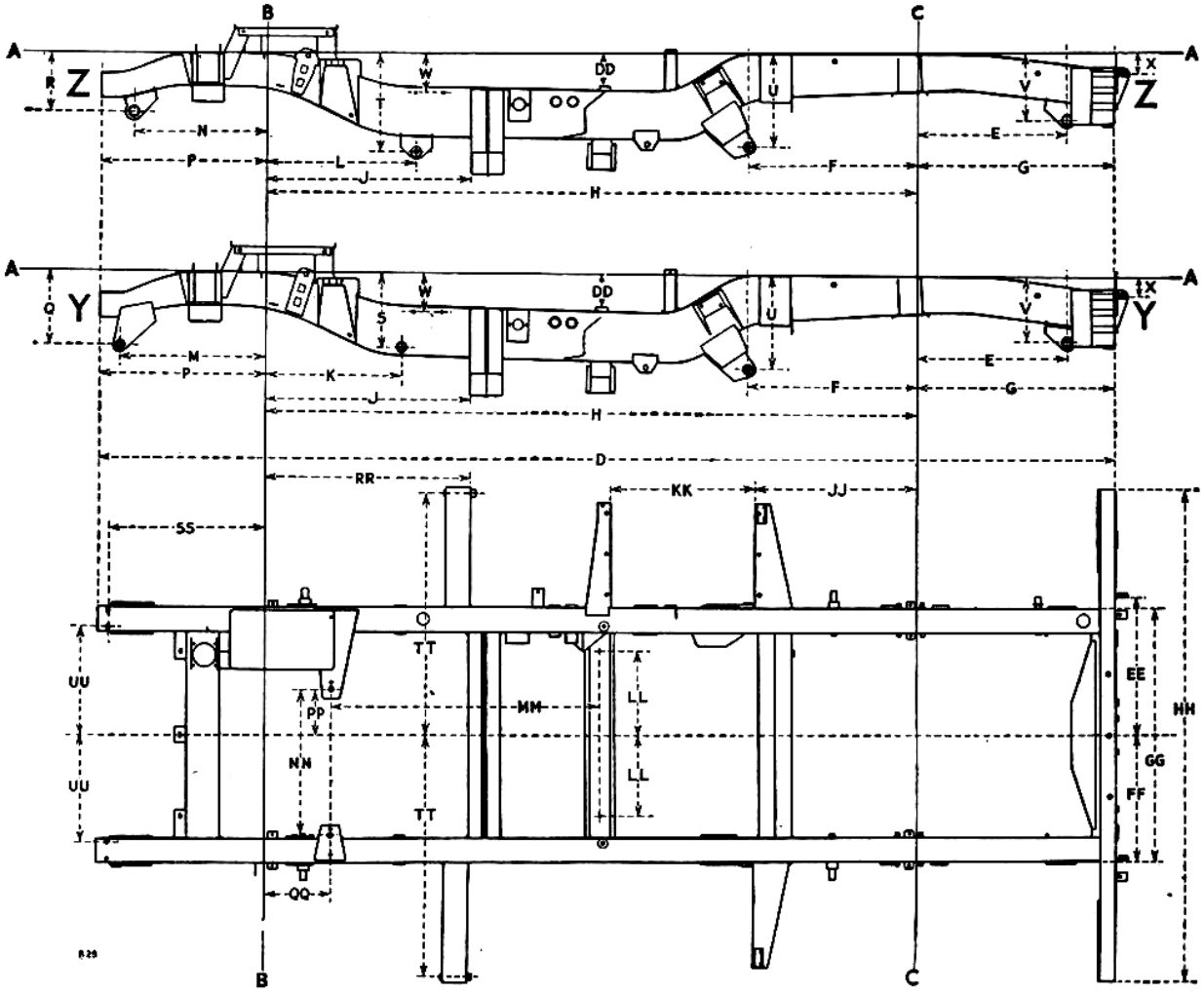


Fig. K-2—Chassis frame dimensions (Land-Rover 80)

Z—Vehicles numbered prior to 06113530, 06200410 and 06300031

Y—Vehicles numbered 06113530, 06200410 and 06300031 onwards

AA—Datum lines
BB—Centre-line of front axle
CC—Centre-line of rear axle
D—125 $\frac{31}{32}$ in. (3,193 m)
E—19 in. (483 mm)
F—21 in. (533 mm)
G—25 $\frac{1}{16}$ in. (637 mm)
H—80 in. (2,032 m)
J—24$\frac{3}{4}$ in. (629 mm)
K—16$\frac{5}{8}$ in. (422 mm)
L—18 in. (457 mm)
M—18 in. (457 mm)
N—16$\frac{5}{8}$ in. (422 mm)
P—20 $\frac{11}{16}$ in. (523 mm)
Q—9 in. (228,6 mm)
R—7$\frac{1}{8}$ in. (181 mm)
S—9 in. (228,6 mm)
T—11$\frac{3}{4}$ in. (298 mm)
U—11$\frac{1}{4}$ in. (286 mm)
V—7 $\frac{27}{32}$ in. (199,2 mm)
W—4$\frac{3}{4}$ in. (120,6 mm)
X—2 $\frac{1}{16}$ in. (52,4 mm)
DD—3 $\frac{29}{32}$ in. (99,2 mm)
EE—16 $\frac{15}{16}$ in. (430 mm)
FF—15$\frac{1}{4}$ in. (387 mm)
GG—31 in. (787 mm)
HH—60$\frac{1}{4}$ in. (1,537 m)
JJ—20 in. (508 mm)
KK—17$\frac{3}{4}$ in. (451 mm)
LL—10$\frac{1}{8}$ in. $\pm \frac{1}{32}$ (257,2 mm $\pm$0,8 mm)
MM—32$\frac{7}{8}$ in. $\pm \frac{1}{32}$ (834,9 mm $\pm$0,8 mm)
NN—17$\frac{3}{4}$ in. $\pm \frac{1}{32}$ (450,7 mm $\pm$0,8 mm)
PP—5$\frac{1}{2}$ in. (139,7 mm)
QQ—8 in. (203,2 mm)
RR—25 in. (635 mm)
SS—19 $\frac{11}{32}$ in. (491 mm)
TT—29 $\frac{7}{16}$ in. $\pm \frac{1}{64}$ (747,6 mm $\pm$0,4 mm)
UU—13 $\frac{1}{16}$ in. $\pm \frac{1}{32}$ (331,7 mm $\pm$0,8 mm)

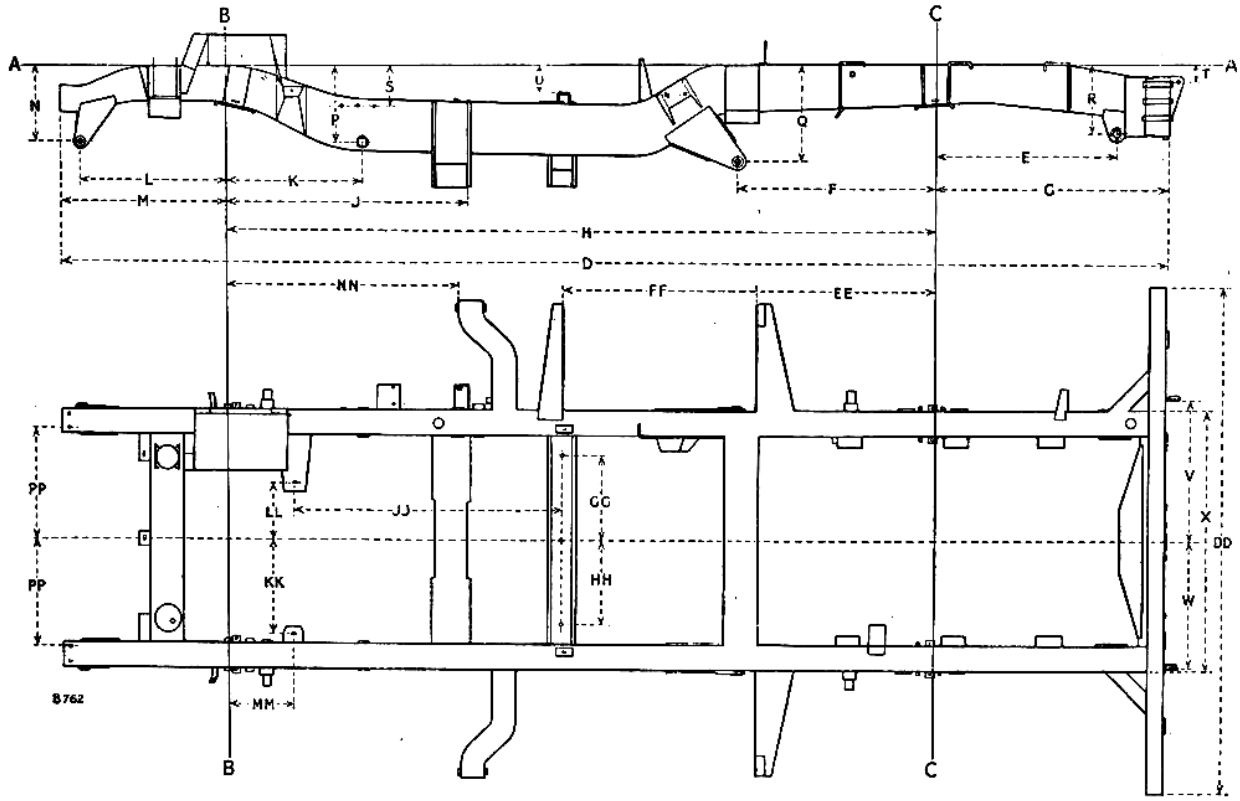


Fig. K-3—Chassis frame dimensions (Laud-Rovers 86 and 88).

AA—Datum line
BB—Centre line of front axle
CC—Centre line of rear axle
D—134 $\frac{31}{32}$ in. (3,42 m)
E—21 $\frac{1}{4}$ in. (540 mm)
F—24 in (610 mm)
G—28 $\frac{1}{64}$ in. (713 mm)
H—86 in. (2,18 m)—86 Models
88 in. (2,23 m)—88 Models
J—29 $\frac{1}{4}$ in. (743 mm)—86 Models
31 $\frac{1}{4}$ in. (793,7 mm)—88 Models
K—16 $\frac{5}{8}$ in. (422 mm)—86 Models
18 $\frac{5}{8}$ in. (473,1 mm)—88 Models
L—18 in. (457 mm)—86 Models
17 in. (431,8 mm)—88 Models
M—20 $\frac{37}{64}$ in. (523 mm)—86 Models
18 $\frac{37}{64}$ in. (472,2 mm)—88 Models
N—9 in. (229 mm)
P—9 in. (229 mm)
Q—11 $\frac{7}{16}$ in. (291 mm)
R—7 $\frac{49}{64}$ in. (182 mm)
S—4 $\frac{3}{4}$ in. (121 mm)
T—2 $\frac{1}{16}$ in. (52 mm)
U—3 $\frac{11}{64}$ in. (80,56 mm)
V—16 $\frac{49}{64}$ in. (430 mm)
W—15 $\frac{1}{4}$ in. (387 mm)
X—31 in. (787 mm)
DD—60 $\frac{1}{8}$ in. (1,53 m)
EE—21 $\frac{3}{4}$ in. (552 mm)
FF—23 $\frac{1}{8}$ in. (587) mm)
GG—10 $\frac{1}{8}$ in. ± $\frac{1}{32}$ (257 mm ± 0,8)
HH—10 in. ± $\frac{1}{32}$ (254 mm ± 0,8)
JJ—32 $\frac{7}{8}$ in. ± $\frac{1}{32}$ (835 mm ± 0,8)
KK—11 $\frac{9}{16}$ in. (294 mm)
LL —6 $\frac{9}{16}$ in. (167 mm)
MM—8 in. (203 mm)—86 Models
10 in. (254 mm)—88 Models
NN—28 $\frac{1}{4}$ in (718 mm)—86 Models
30 $\frac{1}{4}$ in. (765,2 mm)—88 Models
PP—13 $\frac{1}{16}$ in. ± $\frac{1}{64}$ (332 mm ± 0,50)

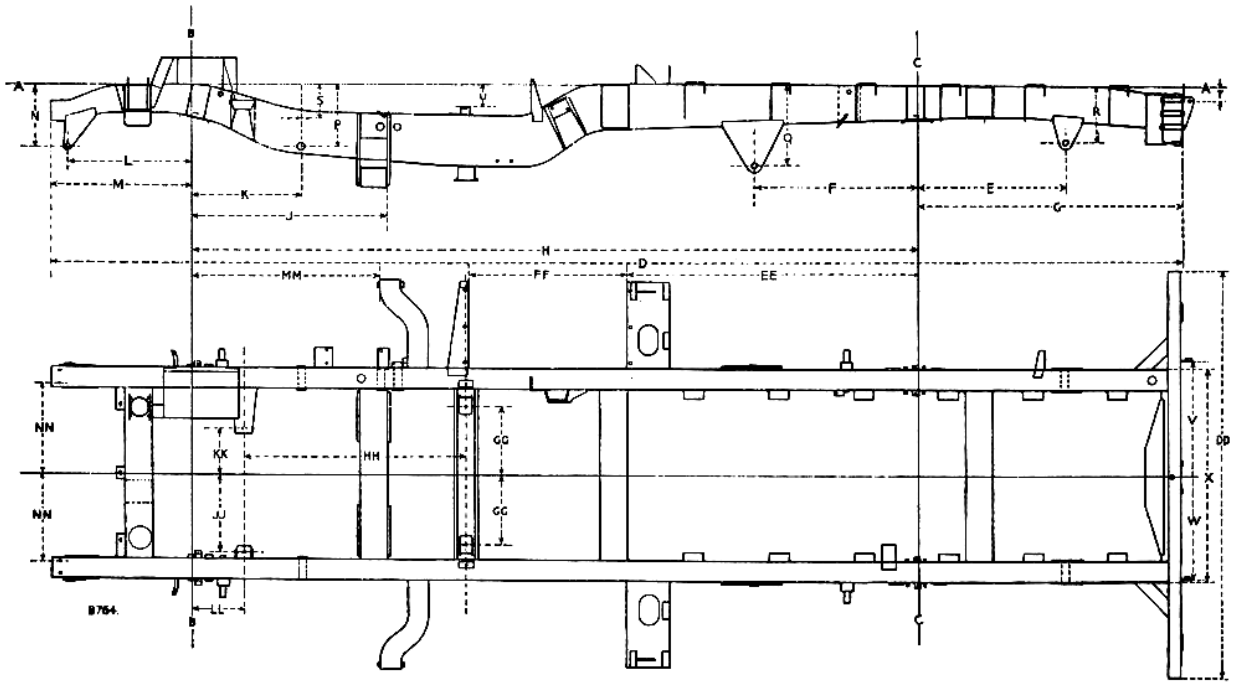


Fig. K-4—Chassis frame dimensions (Land-Rovers 107 and 109).

AA—Datum line
BB—Centre line of front axle
CC—Centre line of rear axle
D—166 $\frac{11}{64}$ in. (4,24 m)
E—21$\frac{1}{4}$ in. (540 mm)
F—24 in. (610 mm)
G—39$\frac{1}{4}$ in. (1,00 m)
H—107 in. (2,717 m)—107 Models
109 in. (2,768 m)—109 Models
J—29$\frac{1}{4}$ in. (743 mm)—107 Models
31$\frac{1}{4}$ in. (793,8 mm)—109 Models
K—15$\frac{3}{4}$ in. (422 mm)—107 Models
18$\frac{5}{8}$ in. (473,1 mm)—109 Models
L—18 in. (457 mm)—107 Models
17 in. (431,8 mm)—109 Models
M—20 $\frac{17}{64}$ in. (523 mm)—107 Models
18 $\frac{41}{64}$ in. (472,2 mm)—109 Models
N—9 in. (229 mm)
P—9 in. (229 mm)
Q—11 $\frac{11}{16}$ in. (297 mm)
R—8 $\frac{1}{16}$ in. (205 mm)
S—4$\frac{3}{4}$ in. (121 mm)
T—2 $\frac{1}{16}$ in. (52 mm)
U—3 $\frac{11}{64}$ in. (80,5 mm)
V—16 $\frac{49}{16}$ in. (430 mm)
W—15$\frac{1}{4}$ in. (387 mm)
X—31 in. (787 mm)
DD—60$\frac{1}{2}$ in. (1,53 m)
EE—42$\frac{3}{8}$ in. (1,086 m)
FF—23$\frac{1}{8}$ in. (587 mm)
GG—10$\frac{1}{8}$ in. ± $\frac{1}{32}$ (257 mm ± 0,8)
HH—32$\frac{7}{8}$ in. ± $\frac{1}{32}$ (835 mm ± 0,8)
JJ—11 $\frac{9}{16}$ in. (294 mm)
KK—6 $\frac{9}{16}$ in. (167 mm)
LL—8 in. (203 mm)—107 Models
10 in. (228,6 mm)—109 Models
MM—28$\frac{1}{4}$ in. (718 mm)—107 Models
30$\frac{1}{4}$ in. (768 mm)—109 Models
NN—13 $\frac{1}{16}$ in. ± $\frac{1}{64}$ (332 mm ± 0,50)

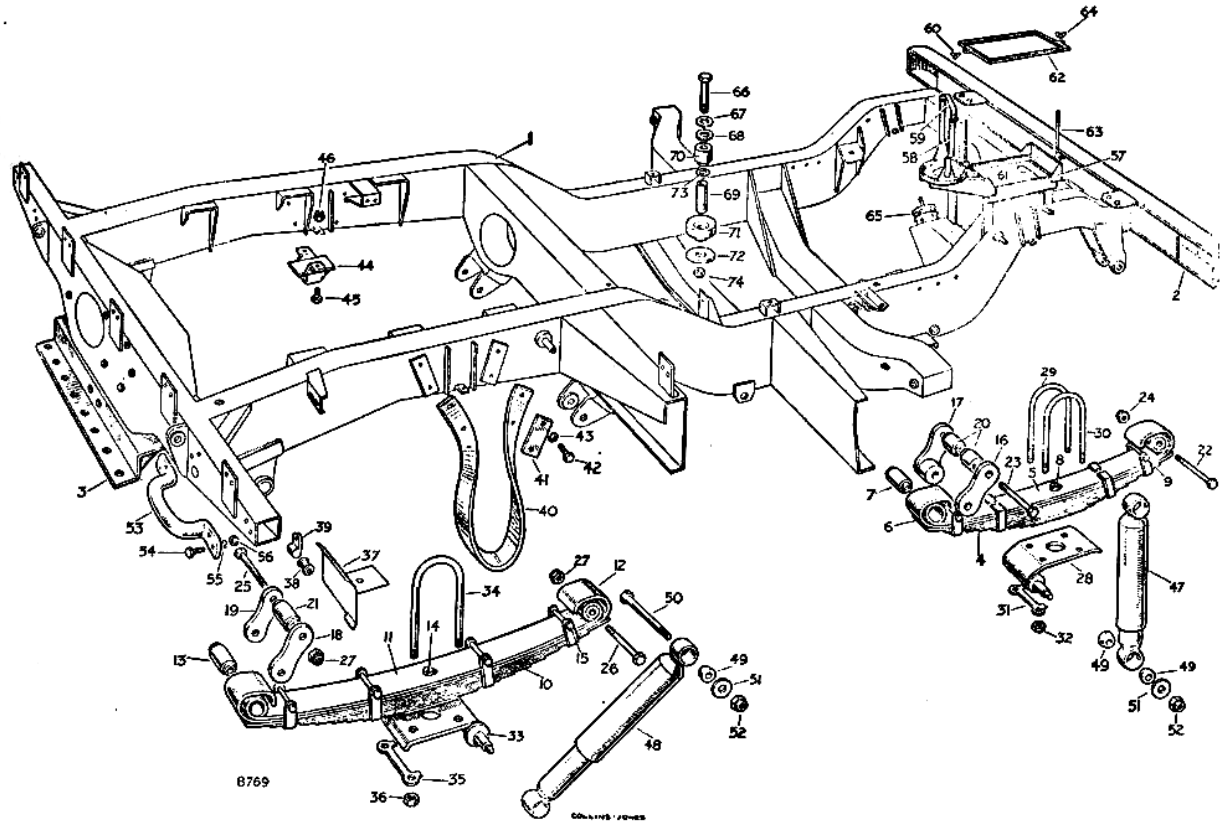


Fig. K-5—Layout of chassis frame.

1 Chassis frame
2 Front bumper
3 Rear draw bar
4 Road spring complete, front, driver's
5 Main leaf } For front
6 2nd leaf } spring
7 Bush for front spring
8 Dowel for front spring
9 Bolt } For spring
Nut } clip
10 Road spring complete, rear, driver's
11 Main leaf } For rear
12 2nd leaf } spring
13 Bush for rear spring
14 Dowel for rear spring
15 Bolt } For
Nut } spring clip
16 Shackle plate, tapped } For
17 Shackle plate, plain } front springs
18 Shackle plate, tapped } For
19 Shackle plate, plain } rear springs
20 Bush in chassis frame, front spring
21 Bush in chassis frame, rear
22 Shackle pin, front
23 Shackle pin, springs to frame, front
24 Self-locking nut, front
25 Shackle pin, rear
26 Shackle pin, springs to frame, rear
27 Self-locking nut, rear
28 Bottom plate for front spring, R.H.
29–32 Fixings for front springs
33 Bottom plate for rear spring, R.H.
34–36 Fixings for rear springs
37 Shield for brake pipe, R.H.
38 Rubber grommet for brake pipe
39 Clip for grommet
40 Check strap for rear axle
41 Plate for check strap
42–43 Fixings for check strap
44 Rubber buffer for axles, front and rear
45–46 Fixings for buffers
47 Shock absorber, front
48 Shock absorber, rear
49 Rubber bush for shock absorbers
50–52 Fixings for shock absorbers
53 Lifting handle, rear
54–56 Fixings for handles
57 Battery casing and air cleaner support complete
58 Air cleaner clamp, side
59 Air cleaner clamp, top
60 Wing nut for clamp
61 Rubber strip for battery
62 Battery cover
63 Battery fixing rod
64 Wing nut fixing battery
65 Suspension rubber for engine, front
66 Bolt, rear
67 Plain washer, top
68 Rubber washer
69 Distance tube
70 Top rubber
71 Bottom rubber
72 Plain washer, bottom
73 Shim
74 Special nut
} Fixing engine unit to chassis frame at front and rear