

SECTION X

OVERHAUL AND REBUILD

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X.1. - GENERAL

If the damage to the body unit has been so extensive that it cannot be reasonably covered by repair as given in Section 'B' (Body), advice should be sought from Lotus Cars (Service) Ltd. Full details of damage, direction of impact and extent of fracture must be given.

It is often found in more serious cases of accidental damage, that a complete replacement body unit proves a more economical proposition.

Assembly details and procedures are outlines on the ensuing pages, and it is assumed that all other units are undamaged or have been replaced.

X.2. - PREPARATION

It is necessary to support the body on two strong wooden trestles. At no time should the body be lifted by the wheel arches, radiator air intake or bumpers. It is as well to remember at this juncture, that if the car is positioned under a substantial beam or girder, engine installation will be greatly facilitated.

Doors, boot and bonnet:

Until the car is complete it is advisable to use care with these parts. Do not slam them unnecessarily or force the doors on their hinges. The bonnet should be removed for easier access to the engine compartment by releasing the prop from the bonnet fastening and the two pivot bolts from the forward sides.

X.3. - PAINTWORK

This should be protected at all stages of assembly by means of a dust sheet or similar covering. Do not use plastic covering as this could damage the paint.

X.4. - THREADS

Should it become necessary to replace a lost or damaged nut or bolt, check thread size carefully.

X.5. - SIDES

In the following instructions, references are made to the left-hand side and right-hand side of the car, these are seen from the driving position.

X.6. - ASSEMBLY

The following recommended assembly procedure and sequence should be adopted.

Front Suspension

The front suspension is handed and it is essential that the two assemblies are not mixed. On cars with 'bolt-on' wheels it should be noted that from the hub outwards, parts are not handed and therefore, not colour marked. Descriptions of the assembly of the right-hand side front suspension is as follows:-

- a. Select the hub assembly for the right-hand side marked with GREEN paint and offer to top wishbone which should be mounted on chassis, bolt lightly.
- b. Hange damper spring unit from chassis post and offer up wishbone assembly. Connect trunnion to bottom wishbone using the outer holes on the wishbone. Connect damper unit to wishbone using the rear holes of the wishbone.
- c. Unscrew track rod ends, screw-up exactly 25 turns, then connect track rod ends to the steering unit. Torque load the nuts to the loading given in 'Technical Data'.
- d. Connect brake hose to caliper, ensuring copper washers are seated correctly on each side.
- e. Assemble the left-hand side in a similar manner. Left-hand hub is marked with RED paint.
- f. See item 'e' under 'Final Assembly'.

Roll Bar

The roll bar cannot be assembled to the car the wrong way (providing force is not used) because of the angles of the chassis mounting to which the links are fitted. Fit the roll bar with the car on the ground.

Offer roll bar links into mounting points on chassis and bolt up. Swing roll bar forward until pegs on damper are in line with holes in roll bar. The sequence of fitting bushes from the top is as follows:-

steel washer, bush, steel washer, roll bar, steel washer, bush,
steel washer, locknut.

The fron suspension is not tightened and should be left with all four main wishbone nuts slack.

Engine/Gearbox

- a. Remove the starter motor, gearshift lever and the tunnel top.
- b. Lay propeller shaft in its tunnel and remove gearbox rear support from the chassis. Do not at this stage connect the propeller shaft to the differential unit.

- c. For engine fitting, it is essential that correct slinging is achieved. Two slings are used, one passing below the crankshaft pulley and behind both the dynamo and the water pump. The other sling is under the bell housing, taking care not to catch or damage the clutch fork. When the engine is lifted, it should be inclined downwards approximately 30° . With the engine unit in position, attach and secure both right and left-hand engine mountings. Refit starter motor and fuel feed pipe to pump.
- d. With the engine slings still in position, raise the engine/gearbox unit to the chassis and fit rear mounting. Connect rear end of propeller shaft to differential unit.
- e. Fill gearbox with the recommended oil, then refit the gearbox lever together with its sealing grommets. Ensure that large nylon gear lever cup is fully and correctly tightened down by use of a punch and hammer. Remove engine slings, refit tunnel top and gearshift lever locknut with knob.

Differential Unit

- a. Fill the differential unit to its correct level with one of the special oils as given under the heading 'Recommended Lubricants' in Section 'O'.
- b. Lift the differential unit into position from the left-hand side and adjust to give a clearance between the top of the unit and the chassis crossmember of $5/32$ in. (3.97 mm.) maximum and $3/32$ in. (2.38 mm.) minimum - ideally $1/8$ in. (3.17 mm). This may necessitate the removal of one of the two washers on either or both sides. A minimum of one washer must be left between the top lugs of the differential unit and the chassis crossmember and between the head of the bolt and the rubber mountings. It is essential that the large 2 in. (5 cm.) diameter washers are used and not substituted by others, as they serve a twofold purpose in being both spacers and stopping the rubber bushes from spreading. On cars equipped with a differential unit stiffening bracket, the same clearance between the top of the unit and the chassis crossmember (see above), will still apply but, a maximum of only ONE washer must be used. It is possible that no washers will be necessary, the bracket itself stopping the rubber bushes from spreading.
The bracket is fitted after the differential unit is in position. Before fitting the bolts ($5/16$ in. x $3/4$ in. UNC) which secure the bracket to the nosepiece of the differential unit, apply Loctite 'AV' to their threads.
- c. Attach the forward ends of the differential unit torque rods, following with the propeller shaft retaining nuts and bolts. Reconnect the left-hand lower wishbone, ensuring that the spacer washers are located between the wishbone and the bearing housing. Note that the long bolt is fitted towards the front of the car.

The torque rod rubbers (at the differential end) are assembled in the following sequence from the front:

Rubber bush (next to fixed washer), cup washer with large hole, differential unit lug, cup washer with large hole, rubber bush, cup washer with small hole, and finally the nut which should be torque loaded to the loading given in 'Technical Data'.

- d. Attach the outer end of the drive shaft to its Rotoflex coupling ensuring that the brake disc is running true within the caliper. Torque load the nuts to the loading given in 'Technical Data'.
- e. Jack up the left-hand bearing housing from below the damper, to enable the inner end of the drive shaft to be attached to the other Rotoflex coupling. It will be found easier to insert a bolt through the upper hole in the coupling and the lower hole in the driving flange, finger tightening this bolt. The other bolts can now be fitted by rotating the shaft around the one fixing bolt, inserting the bolts from the driving shaft side. Finally torque load all nuts to the loading given in 'Technical Data'.
- f. Fit handbrake rod to caliper, ensuring that the spacer is fitted in the clevis before attaching. Lubricate clevis and pin with Shell Retinax 'A' grease. Do not fully tighten nuts at this stage.
- g. Refit trim in boot (trunk) where this has been disturbed.
- h. Refit road wheels and lower car from chassis stands. Check security of wheel retaining nut(s) when the car is standing on its wheels.
- i. See item 'e' under 'Final Assembly'.

Rear Suspension

- a. Attach rear wishbones to their locations on the chassis, noting that the straight part is towards the rear of the car. Do not fully tighten bolts. Fit wishbone to rear bearing housing, again do not fully tighten the bolts. Remove split pin and castellated nut from the damper spindle.
- b. Insert a piece of wire through the split pin hole in the top of the damper spindle to guide the spindle through the hole in the body, then balance the assembly on a hydraulic jack and jack-up the assembly such that the spring is compressed sufficient for the second operator to pull the wire through the body. Remove wire, fit castellated nut and split pin to damper spindle when assembly is in its correct fitted location.

- c. The hole in the top spring abutment is 'D'-shaped, ensure this lines up with the damper spindle. Take care when using the jack as a reasonable amount of pressure is required to compress the spring.
- d. Ideally, the spring should be compressed before attempt to fit the assembly into the car. Car should be exercised when compressing the spring. Clamp the spring with spring compressing clamps.
- e. Tighten the wishbone bolts after the suspension assembly has been secured before removing jack. The drive shaft can be fitted to its coupling as given under 'Differential Unit'. When the suspension has been fitted to one side of the car, the same procedure must be adopted for the other side of the car.
- f. See item 'e' under 'Final Assembly'.

NOTE: The left-hand hub bearing housing and hub is coloured RED and the right-hand hub bearing housing and hub is coloured GREEN.

Handbrake Linkages

After fitting the handbrake rods to the calipers, all pivot points should be adequately lubricated with Shell Retinax 'A' grease. Adjustment is effected by first ensuring that the rods and cables are in the fully retracted position, i.e. that the rear brake discs are free to rotate, the, with the wheels in a horizontal position, carry out adjustment at the brake calipers by means of the knurled nuts to give a clearance of .010 in. (.254 mm.) maximum at one side of the disc. Ensure lever assembly fully returns. Any excess slack in the cable can now be taken up by the adjuster which is located in the R/H engine insulator support lug on the chassis.

Auxiliaries in Engine Bay

Fit exhaust system noting that no gasket is fitted between the exhaust manifold and the downpipe. Use Holts 'Firegum' as a sandwich between the two flanges. This material sets rather quickly so no time should be lost in assembling the downpipe to the manifold.

From below the car, fit intermediate pipe to downpipe, fit silencer assembly to intermediate pipe and into housing in body and connect straps. Check for clearance (.375 in.; 9.5 mm.) throughout entire length of exhaust system, finally tightening all bolts.

From approximately March 1969, fabricated exhaust manifolds are used, the fitting procedure for which is as follows:-

Fit gaskets to exhaust flanges on the cylinder head, then working from below the car, fit the appropriate manifold to flanges 1 and 4 and the other manifold to flanges 2 and 3. No force is required for this operation - it will be found that the manifolds fit quite easily to their respective flanges. Secure manifolds to the cylinder head with the 8 brass nuts.

Still working under the car, fit 'Y' box with its clip to the lower ends of the manifolds and to the intermediate pipe. Fit intermediate pipe into housing into the body underside, then connect straps.

Check for clearance (.375 in.; 9.5 mm.) throughout the entire length of the exhaust system, finally tightening all bolts.

Note that the clutch fluid pipe passes through the hole in the L/H chassis top (rearwards of the engine support lug), or below the engine in later cars.

All cars - working on the left-hand side of the engine, the following connections should be made.

- a. Heater hose to angled heater connection (ensure hoses do not chafe on any sharp projection. Heater connection is in rearmost hole of thermostat housing.
- b. Temperature sender unit and capillary into forward hole of thermostat housing. The capillary is clipped to the water valve, then 3 or 4 coils of approximately 2 in. (5 cm.) diameter added to take up flexible movement of the engine, thus avoiding breakage of the capillary at its junction with the sender unit. A further clip is added to the capillary utilising one of the screws which retains the chassis plate to the body.

Next connect cables to dynamo, yellow and green cable to small terminal, brown and yellow cable to large terminal.

On right-hand side of engine the following connections are made and it is advisable to do them in the order written below:-

- a. Connect starter cable to solenoid (black).
- b. Connect contact breaker cable (black and white) to distributor and high tension cable already fitted to distributor, into coil.
- c. Connect heater hose to its connection and tighten. Connect oil pressure feed pipe to union which is just in front of the distributor. Connect speedometer drive to gearbox.
- d. Fit clutch pipe to master cylinder and slave cylinder then clip on gearbox mounting bracket.

- e. Remove airbox outer cover by releasing the holding bolts. Do not disturb the backplate of the air box as the securing nuts which also retain the carburetter trumpets have been assembled with 'Loctite' to ensure the security of the nuts. The Weber carburetters are retained on the inlet manifold stubs by washers and nyloc nuts which are assembled in the following sequence from the carburetter flanges outwards:

plain washer, double spring washer, plain washer, nyloc nut.

Tighten all nuts to give a .040 in. (1.02 mm.) clearance in the coils of the spring washers, this in turn giving a designed total up-and-down movement at the trumpets of .125 in. (3.17 mm.).

With Zenith Stromberg Carburetters the clearance should be .070 in. (1.78 mm.). see also Section 'L' (Fuel System).

This flexible mounting of the carburetters is necessary to minimise frothing of petrol in the float chambers.

- f. Connect throttle cable.

- g. Connect choke cable by:-

1. Weber: Threading the inner cable through the holding bracket on the rear carburetter and outer cable, then pushing the inner cable into its nipple on the front carburetter. Ensure that the choke control on the fascia panel is pushed fully in, then secure the outer cable at the rear carburetter. Repeat the procedure for the front carburetter.
2. Zenith-Stromberg: looping the cable assembly and passing the inner cable through the cable mounting bracket on the front carburetter, then passing the inner cable through the choke lever. Mount the outer cable in the bracket boss. Feed the short piece of outer cable over the inner cable (below the bracket) into its boss, then route the cable up from the bottom of the bracket to pass between the fuel feed pipe and the air box to the left of the throttle return spring. Thread the inner cable through the nipple on the choke lever and the outer cable through the clip on the rear carburetter. Ensure that the choke control on the fascia panel is pushed fully in, then finally tighten both carburetters inner cable setscrews.

- h. Replace air box outer cover with its securing bolt(s) ensuring that the seal is in contact throughout its periphery, then tighten bolt(s). Attach air trunking to the air box with its clip. Connect fuel feed pipe from pump to carburetter, ensuring that fibre washers are correctly located.

Radiator

Fit radiator by inserting the mounting bolts through the top hole in the top bracket and centre hole in lower bracket. Connect bottom water hose to water pump and top hose between thermostat housing and radiator heater tank.

Final Assembly

- a. Check all oil levels using recommended lubricants (see Section 'O') and capacities (see 'Technical Data'). Bleed clutch, connect battery cables in boot and check radiator for correct coolant level and leaks. It is important to note polarity of the battery before connecting the cables (see Section 'M'). Incorrect connection of battery cables could result in damage to electrical equipment, particularly those fitted with transistors, i.e. radio and tachometer.
- b. Bleed brakes. Ensure fluid does not come into contact with body paintwork.
- c. Fit road wheels and adjust tyre pressures, including spare (see Section 'G' and 'Technical Data').
- d. Replace bonnet and attach its spring. Adjust the outer cable to remove any excess slackness in the inner cable, ideally allow 1/16 in. to 1/8 in. (1.59 mm. to 3.17 mm.) slackness which will allow the catches to return to the fully closed position without assistance.
- e. IMPORTANT
With the vehicle standing on its wheels, insert wood blocks beneath each front lower wishbone fulcrum and beneath each rear chassis leg adjacent to the wishbone pivot but NOT touching pivot. Load the vehicle with weights on the front and rear centre line until the blocks are just nipped, not bearing heavily down, then finally tighten all wishbones and suspension mountings and check steering geometry as given in 'Technical Data', ensuring that the steering tie-rods (see Section 'H') are of equal length. The height dimensions of the blocks should be:-
- | | | |
|-------|---|----------------------|
| Front | - | 6.1/8 in. (15.5 cm.) |
| Rear | - | 6 in. (15.2 cm.) |
- f. Engine is now ready for starting. Before switching 'on' ignition, press starter solenoid and turn engine over a few times to ensure oil has reached the bearings.

Switch on ignition and start engine (see 'Starting Procedure' in Owner's Handbook). Adjust slow running speed to between 800 r.p.m. and 900 r.p.m. The slow running speed can be adjusted by referring to Section 'L' of this Workshop Manual.

- g. If the engine or gearbox has been damaged and has been replaced, the following 'running-in' procedure should be adopted.

Road test and 'run-in' the car to the following recommendations:

The progressive 'running-in' of a new engine and transmission is very important, to ensure that both give smooth performance, durability and economy throughout their life.

The process of 'running-in' applies not only to the engine and transmission but also to many chassis components, such as wheel bearings and other moving parts. The process must be continued progressively during the first 1,000 miles (1,600 km.). It is important during the 'running-in' period that the engine is not overloaded, as would occur when ascending hills in top gear at low speed; always make use of the gearbox. It should be remembered that the gearbox will not be 'run-in' when constantly in top gear.

It is very important that the engine speed is kept moderate during the 'running-in' period, both on the road and when stationary. During the first 1,000 miles (1,600 km.) do NOT EXCEED an indicated engine speed of 3,000 r.p.m. on the tachometer.

On completion of the first 500 miles (800 km.) the car should be taken to a Lotus Dealer so that the 'free' service and inspection can be carried out.

If the car has been rebuilt by a non-Lotus Dealer, it is recommended that the advice of an approved Lotus Dealer is sought in checking the workmanship of the rebuild, especially with regard to safety.

Check door adjustment for closing and seather sealing.