

Chapter 6

Clutch

6-1

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Degrees of difficulty

Easy, suitable for novice with little experience



Fairly easy, suitable for beginner with some experience



Fairly difficult, suitable for competent DIY mechanic



Difficult, suitable for experienced DIY mechanic



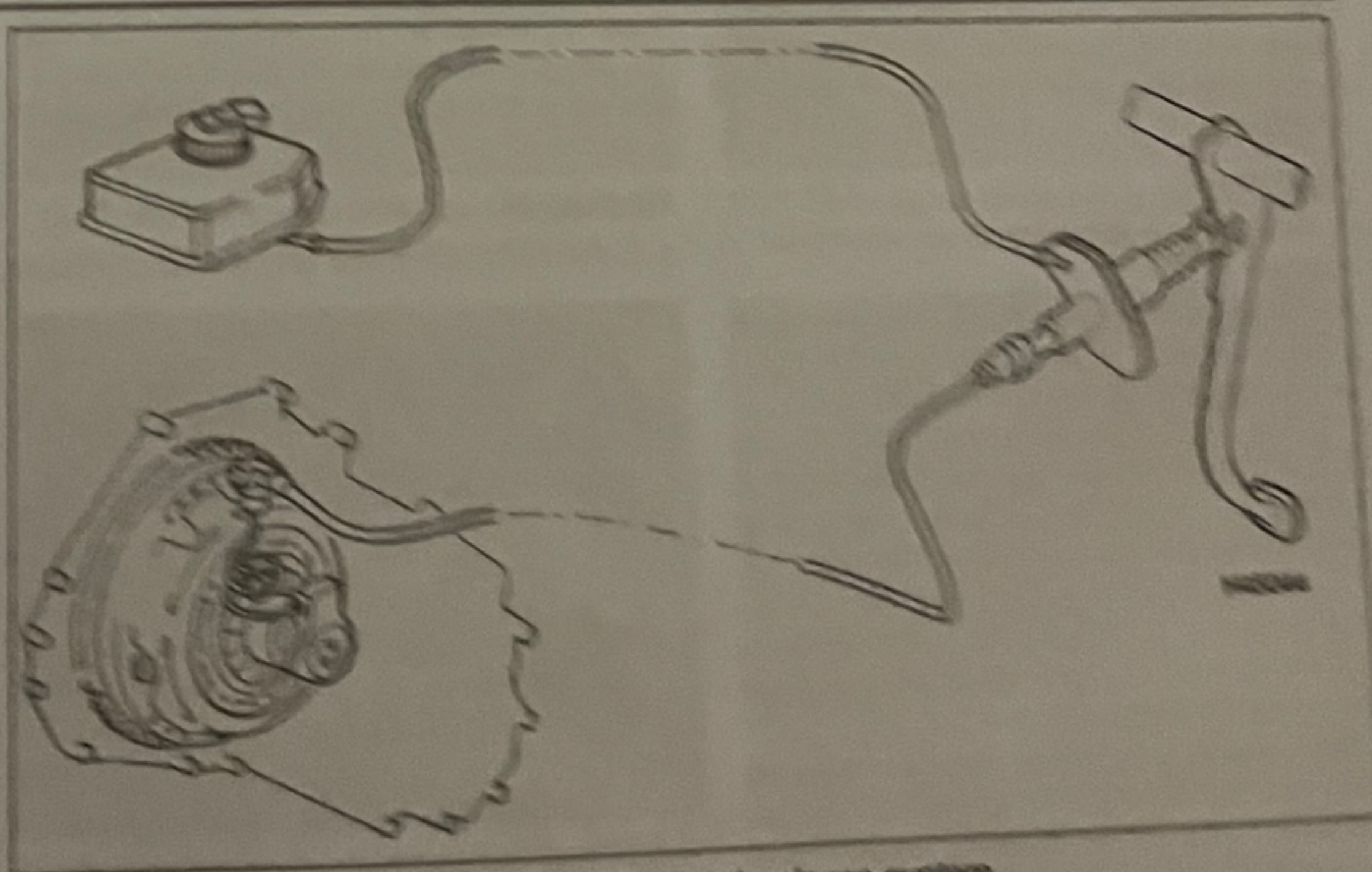
Very difficult, suitable for expert DIY or professional



Specifications

System type	Single dry-plate clutch with diaphragm spring, operated by master/slave cylinder hydraulic release system	
Friction plate		
Diameter:		
Petrol	228 mm	
Diesel	240 mm	
Thickness:		
New	7.3 mm	
Minimum	5.5 mm	
Hydraulic release mechanism		
Slave cylinder stroke	6.0 mm	
Master cylinder piston diameter	15.87 mm	
Torque wrench settings	Nm	lbf/ft
Clutch master cylinder mounting bracket to bulkhead	24	18
Pressure plate retaining bolts	30	23
Securing nuts	20	15
Securing screws	10	7
Slave cylinder	32	24
Slave unit stud bolts*	20	15
Slave unit bolts		

The hydraulic clutch system is of single plate type, and consists of the following main components: the clutch pedal, master cylinder, release bearing/slave cylinder, friction plate, and pressure plate with its integral diaphragm spring and cover (see illustration). The friction plate is free to slide along the splines of the transmission input shaft. This is held in position between the flywheel and the pressure plate by the pressure exerted on the pressure plate by the diaphragm spring. Friction lining material is riveted to both sides of the friction plate. Spring cushioning between the friction linings and the hub absorbs transmission shocks, and helps to ensure a smooth take-up of power as the clutch is engaged.



1.1 Hydraulic clutch release system



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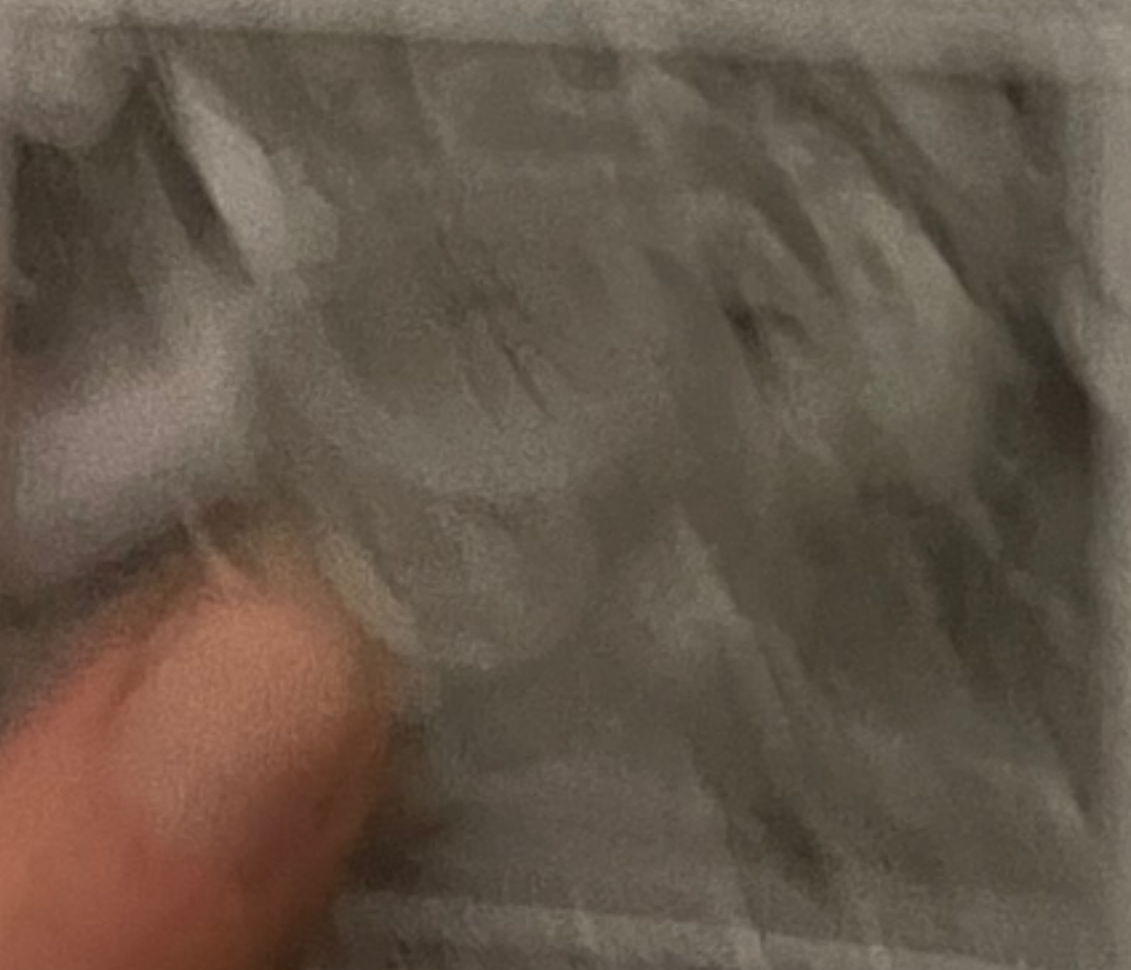


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3 The diaphragm spring is mounted on pins, and is held in place in the cover by annular fulcrum rings.

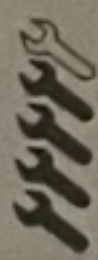
4 Effort is transmitted from the clutch pedal to the master cylinder, mounted on the rear of the engine compartment bulkhead, via a pushrod. The master cylinder piston forces hydraulic fluid through a supply pipe to the slave cylinder, which is located inside the transmission casing, mounted concentrically over the transmission input shaft. The fluid forces the piston out of the slave cylinder, thus actuating the release bearing.

5 When the clutch pedal is depressed, the release bearing is forced to slide along the input shaft sleeve, to bear against the centre of the diaphragm spring, thus pushing the centre of the diaphragm spring inwards. The diaphragm spring acts against a circular fulcrum ring in the cover. When the centre of the spring is pushed in, the outside of the spring is pushed out, so allowing the pressure plate to move backwards away from the friction plate.

6 When the clutch pedal is released, the diaphragm spring forces the pressure plate into contact with the friction linings on the friction plate. This simultaneously pushes the friction plate forwards on its splines, forcing it against the flywheel. The friction plate is now firmly sandwiched between the pressure plate and the flywheel, and drive is taken up.

7 The fluid used in the hydraulic clutch system is the same as that used in the braking system; hence fluid is supplied to the master cylinder from a tapping on the brake fluid reservoir. The clutch hydraulic system must be sealed before work is carried out on any of its components and then, on completion, topped-up and bled to remove any air bubbles. Details of these procedures are given in Section 6 of this Chapter.

2 Clutch pedal – removal and refitting



Note: The clutch pedal is part of the pedal bracket assembly and cannot be removed separately.

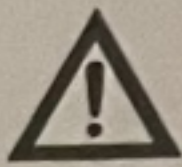
Removal

- 1 Remove the facia panel as described in Chapter 11.
- 2 On right-hand drive models, from inside the engine bay, remove the cover from the top of the engine and the intake manifold.
- 3 On left-hand drive models, remove the battery, then undo the retaining bolts/nuts and remove the central electric unit and fuse holder from the left-hand side top strut mounting.
- 4 From inside the engine bay, undo the four retaining nuts from the pedal bracket assembly. **Note:** Two of the nuts are the clutch master cylinder retaining nuts.
- 5 From inside the vehicle, undo the retaining bolts and remove the knee shield from across the lower part of the steering column and bulkhead.

6 Disconnect the wiring connector from the pedal switch, then undo the retaining bolts securing the pedal bracket to the facia mounting crossmember.

7 Unhook the spring from the clutch pedal, remove the securing clip and withdraw the pivot pin.

8 Undo the lower steering column shaft joint securing bolt, and detach it from the splines on the steering rack. **Note:** Do not prise open the joint to remove (see Chapter 10 for further information).



Warning: As the steering column is moved away from the bulkhead, take care that the upper and lower parts of the steering column do not separate, see Chapter 10.

9 Undo the retaining bolts from the facia mounting crossmember, then withdraw the crossmember to allow enough room to withdraw the pedal bracket assembly from the footwell.

Refitting

10 Refitting is a reversal of removal procedure. Ensure that the pedal return spring is correctly fitted and all retaining bolts are tightened to the specified torque.

3 Clutch assembly – removal, inspection and refitting

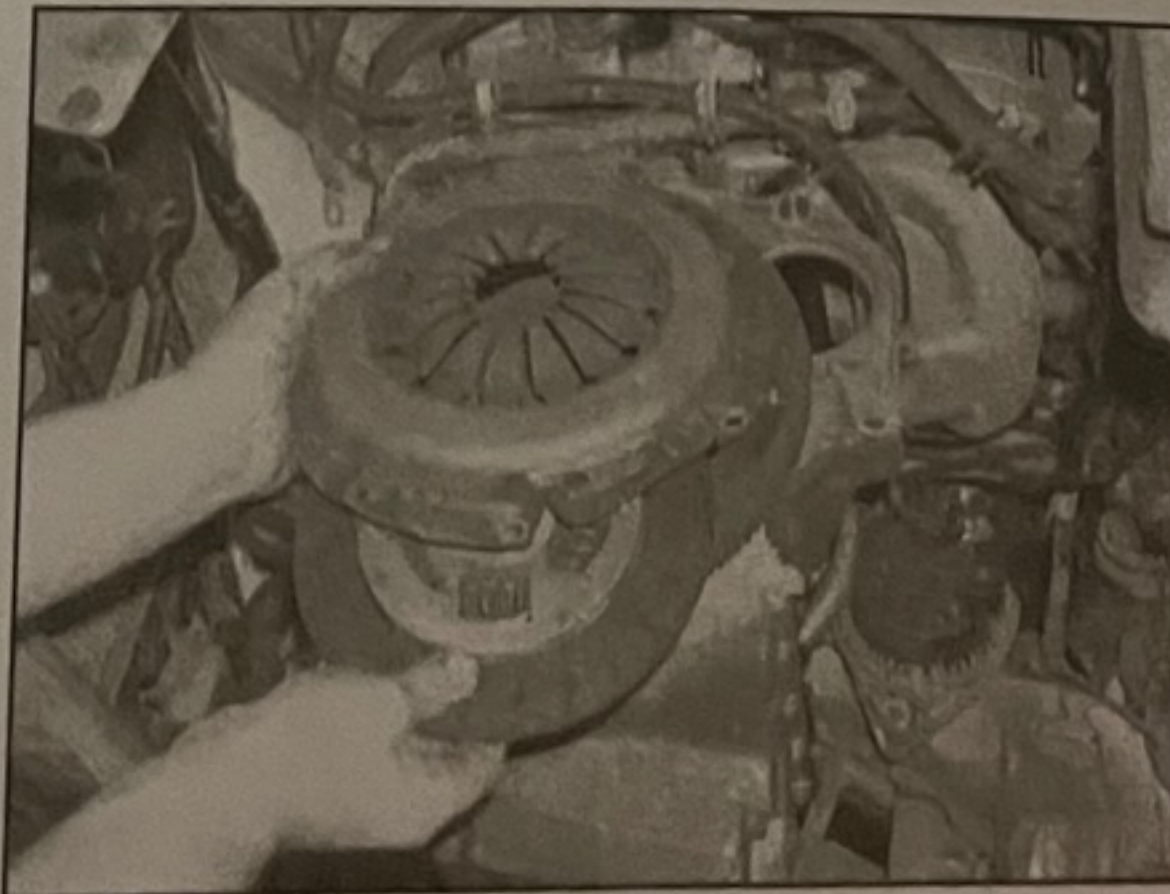


Warning: Dust created by clutch wear and deposited on the clutch components may contain asbestos, which is a health hazard. DO NOT blow it out with compressed air, nor inhale any of it. DO NOT use petrol or petroleum-based solvents to clean off the dust. Brake system cleaner or methylated spirit should be used to flush the dust into a suitable receptacle. After the clutch components are wiped clean with clean rags, dispose of the contaminated rags and cleaner in a sealed, marked container.

Note: Although some friction materials may no longer contain asbestos, it is safest to assume that they DO, and to take precautions accordingly.

Removal

- 1 Unless the complete engine/transmission



3.5 Lift off the pressure plate, then recover the friction plate, noting its orientation

is to be removed from the car and taken to a major overhaul (see Chapter 11). The clutch can be accessed by removing the transmission, as described in Chapter 11. Before disturbing any of the components, mark the relationship between the pressure plate, friction plate and flywheel.

3 To aid the removal of the pressure plate, the flywheel should ideally be locked in position by bolting a locking tool to one of the transmission mounting holes, and engage it with the flywheel ring gear. If a flywheel locking tool is not available, the crankshaft (and hence the flywheel) can be held stationary using a wrench and an assistant will be required to complete the task.

4 Working diagonally across the pressure plate, progressively slacken the mounting bolts, half a turn at a time, until they can be removed by hand.

5 With all the bolts removed, lift off the clutch assembly. Be prepared to catch the friction plate as the cover assembly is lifted from the flywheel, and note which way round the friction plate is fitted (see illustration).

Inspection

Note: Due to the amount of work necessary to remove and refit clutch components, it is usually considered good practice to renew the clutch friction plate, pressure plate assembly and release bearing as a matched set, even if only one of these is actually worn enough to require renewal.

6 When cleaning clutch components, observe the warning at the beginning of this Section regarding the hazards of handling the friction materials contained in clutch components. Remove dust using a clean, dry cloth, and working in a well-ventilated atmosphere.

7 Check the friction plate facings for signs of wear, damage or oil contamination. If the friction material is cracked, burnt, scored or damaged, or if it is contaminated with oil or grease (shown by shiny black patches), the friction plate must be renewed.

8 If the friction material is still serviceable, check that the centre boss splines are unworn, that the torsion springs are in good condition and securely fastened, and that all the rivets are tightly fastened. If any wear or damage is found, the friction plate must be renewed.

9 If the friction material is fouled with oil, this must be due to an oil leak from the crankshaft left-hand oil seal, from the sump-to-cylinder block joint, or from the transmission input shaft; renew the seal or repair the joint, as appropriate, as described in Chapter 2A, 2B or 7A before installing the new friction plate.

10 Check the pressure plate assembly for obvious signs of wear or damage; shake it to check for loose fulcrum rings, and check the drive straps for wear or damage. The pressure plate must be fitted to the cover (such as a deep

yellow or blue disc spring is worn or is in any way damaged, the assembly should be replaced. 11 Examine the pressure plate for signs of cracking or discoloration; if the pressure plate is flat and free from signs of cracking, minor damage may be polished away. 12 Check the surface of the flywheel for any sign of cracking or surface itself. Signs of cracking or any doubt must be referred to the manufacturer's guidance.

Refitting

Standard

13 On re-assembly, ensure that the surfaces of the pressure plate and friction plate are completely clean and free from grease. Lubricate the hub assembly with grease. 14 Offer the hub assembly to the flywheel, observe the alignment, and show where the flywheel is fitted (see illustration).

15 Re-fit the flywheel, align the flywheel with the original position, and the pressure plate must be fitted to the flywheel. 16 Tighten the pressure plate bolts, and the flywheel must be aligned with the original position.

17 Check the flywheel for signs of wear, damage or oil contamination. If the flywheel is cracked, burnt, scored or damaged, or if it is contaminated with oil or grease (shown by shiny black patches), the flywheel must be renewed.

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yellow or blue discoloration). If the diaphragm spring is worn or damaged, or if its pressure is in any way suspect, the pressure plate assembly should be renewed.

11 Examine the machined bearing surfaces of the pressure plate and of the flywheel (see illustration); they should be clean, completely flat and free from scratches or scoring. If either is discoloured from excessive heat or shows signs of cracks it should be renewed, although minor damage of this nature can sometimes be polished away using emery paper.

12 Check that the release bearing contact surface rotates smoothly and easily, with no sign of noise or roughness, and that the surface itself is smooth and unworn, with no signs of cracks, pitting or scoring. If there is any doubt about its condition, the bearing must be renewed; refer to Section 4 for guidance.

Refitting

Standard clutch

13 On reassembly, ensure that the bearing surfaces of the flywheel and pressure plate are completely clean, smooth and free from oil or grease. Use solvent to remove any protective grease from new components.

14 Offer up the friction plate so that its spring hub assembly faces away from the flywheel; observe any manufacturer's markings which show which way around the plate should be fitted (see illustration).

15 Refit the pressure plate assembly to the flywheel, engaging it with its locating dowels; align the marks made on dismantling if the original pressure plate is being re-used. Fit the pressure plate bolts, hand-tightening them only at this stage, so that the friction plate can be rotated to aid alignment, if necessary.

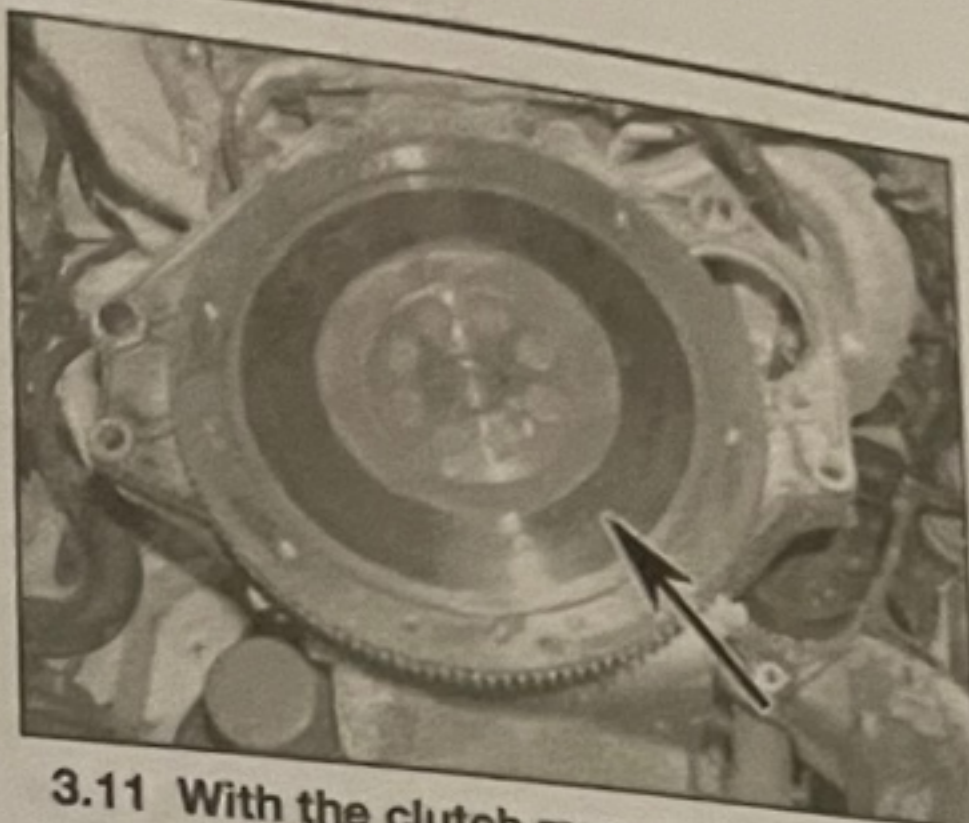
16 The friction plate must now be centralised inside the pressure plate assembly, so that when the transmission is refitted, the input shaft will pass through the splines at the centre of the friction plate. This can be achieved by passing a large screwdriver or wrench extension bar through the friction plate and into the hole in the crankshaft; the friction plate can then be moved around until it is centred over the crankshaft hole. Alternatively, a universal clutch alignment tool can be used; these can be obtained from most car accessory shops. Ensure that the friction plate is correctly aligned before proceeding.

When the pressure plate bolts are tightened in sequence and to the specified torque, the friction plate is centralised.

If applicable, remove the flywheel alignment tool.

Apply a thin smear of high melting-point grease to the splines of the friction plate and the transmission input shaft.

20 Refit the transmission as described in Chapter 7A.



3.11 With the clutch removed, check the machined surface of the flywheel (arrowed)

Self Adjusting Clutch (SAC)

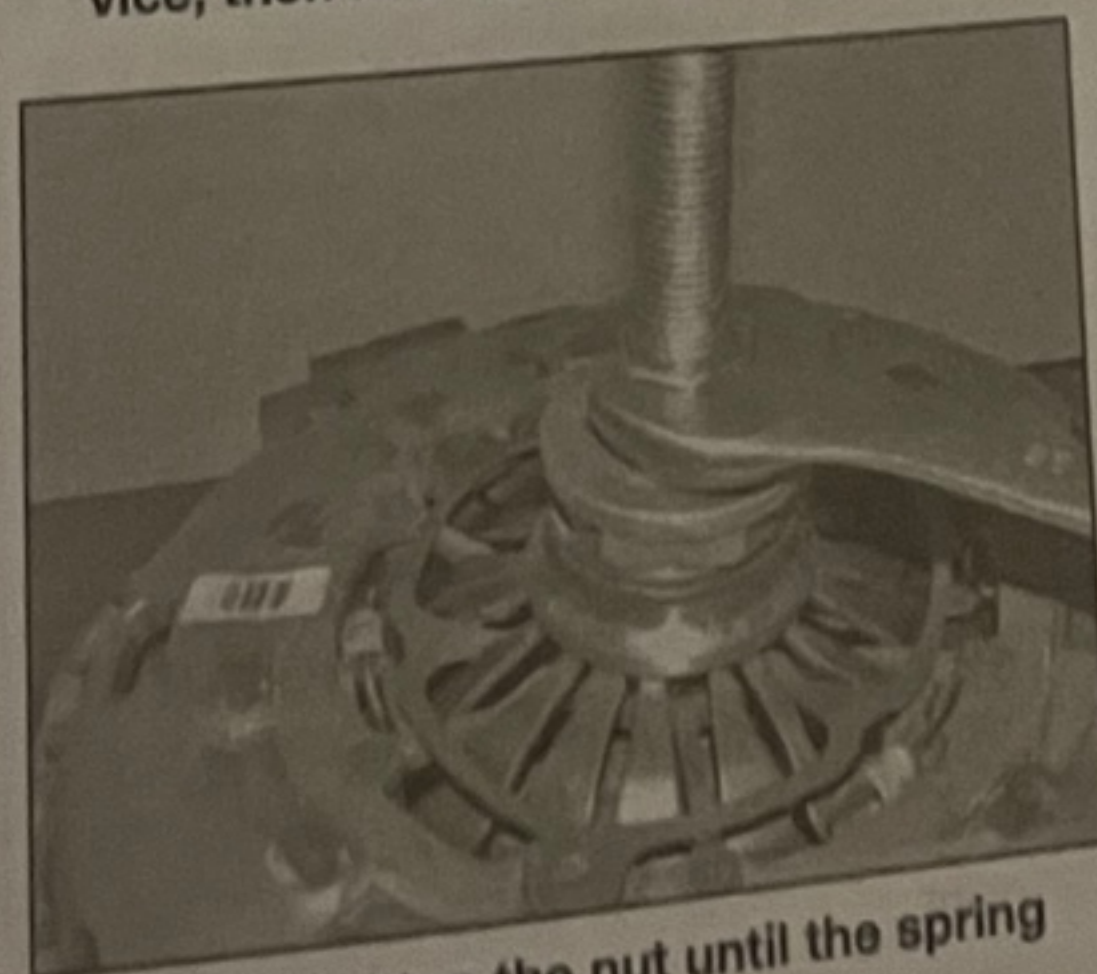
21 The clutch pressure plate is unusual, as there is a pre-adjustment mechanism to compensate for wear in the friction plate (this is termed by Saab as a self-adjusting clutch (SAC), which is slightly ambiguous as all hydraulic clutches are essentially self-adjusting). However, this mechanism must be reset before refitting the pressure plate. A new plate may be supplied preset, in which case this procedure can be ignored.

22 A large diameter bolt (M14 at least) long enough to pass through the pressure plate, a matching nut, and several large diameter washers, will be needed for this procedure. Mount the bolt head in the jaws of a sturdy bench vice, with one large washer fitted.

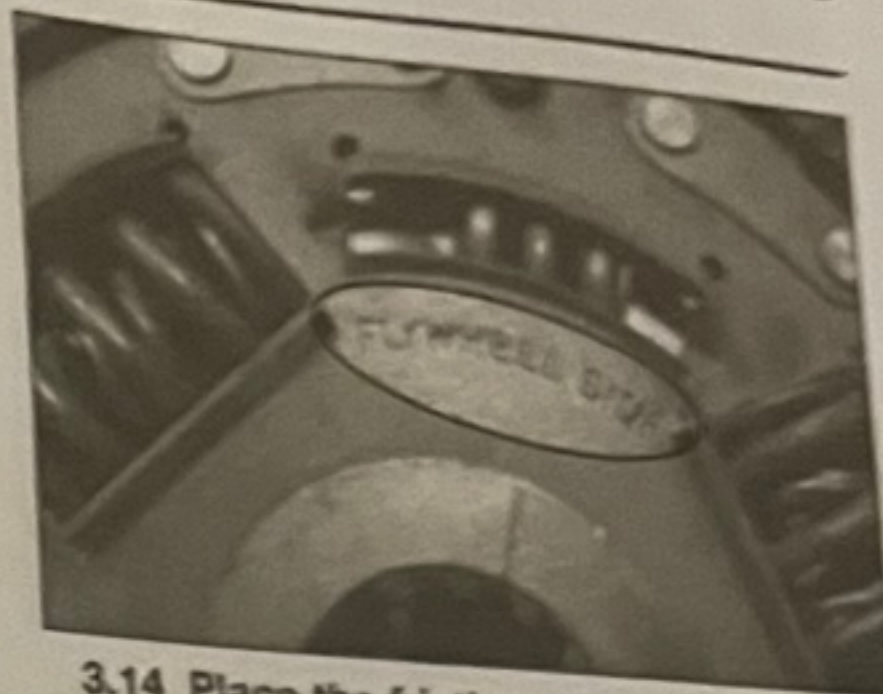
23 Offer the plate over the bolt, friction plate surface facing down, and locate it centrally over the bolt and washer – the washer should bear on the centre hub (see illustration).



3.23 Mount a large bolt and washer in a vice, then fit the pressure plate over it



3.25a Tighten the nut until the spring adjuster is free to turn...



3.14 Place the friction plate against the flywheel; the stamped lettering FLYWHEEL SIDE should face towards the flywheel

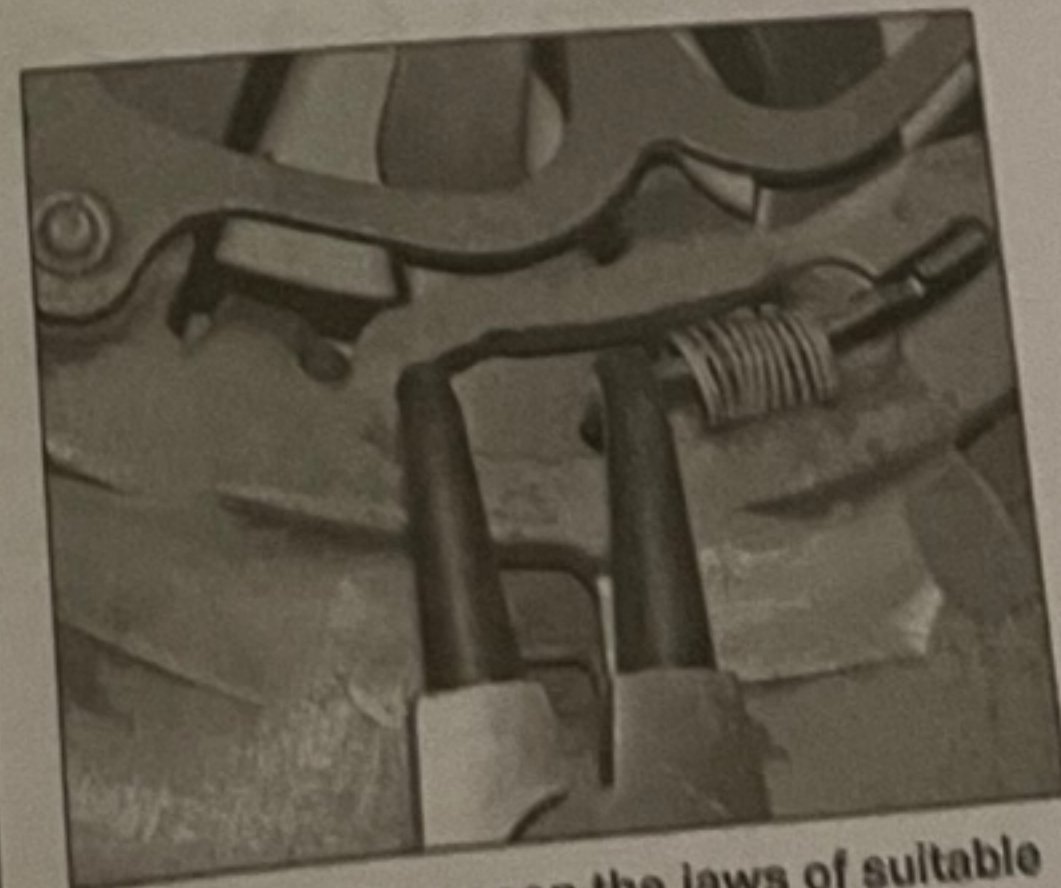
24 Fit several further large washers over the bolt, so that they bear on the ends of the spring fingers, then add the nut and tighten by hand to locate the washers (see illustration).

25 The purpose of the procedure is to turn the plate's internal adjuster disc so that the three small coil springs visible on the plate's outer surface are fully compressed. Tighten the nut just fitted until the adjuster disc is free to turn. Using a pair of thin-nosed, or circlip, pliers in one of the two windows in the top surface, open the jaws of the pliers to turn the adjuster disc anti-clockwise, so that the springs are fully compressed (see illustrations).

26 Hold the pliers in this position, and then unscrew the centre nut. Once the nut is released, the adjuster disc will be gripped in position, and the pliers can be removed. Take the pressure plate from the vice, and it is ready to fit.



3.24 Fit large washers and a nut to the bolt and hand-tighten



3.25b ... then open the jaws of suitable pliers to compress the springs



3.20 The lettering 'transmission side' or 'Getriebeseite' on the friction plate must face towards the transmission

27 On reassembly, ensure that the friction surfaces of the flywheel and pressure plate are completely clean, smooth, and free from oil or grease. Use solvent to remove any protective grease from new components.

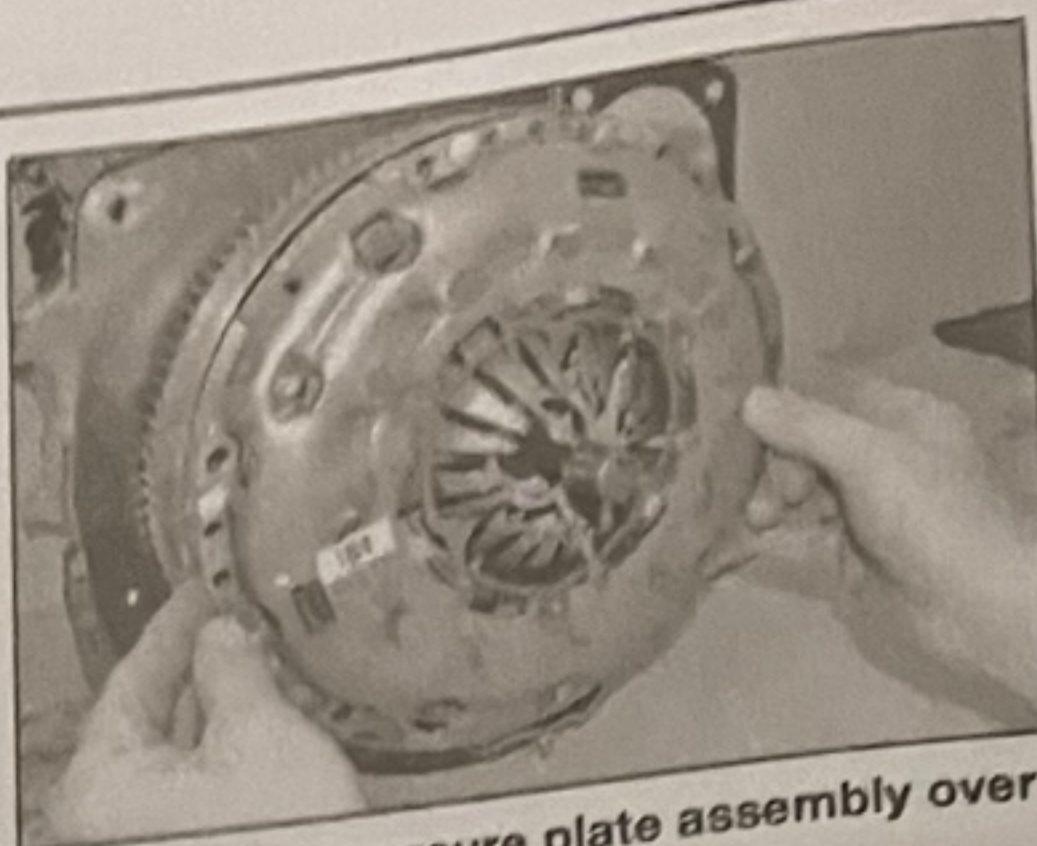
28 Lightly grease the teeth of the friction plate hub with high melting-point grease. Do not apply too much; otherwise it may eventually contaminate the friction plate linings.

29 Locate the friction plate on the flywheel, making sure that the lettering 'transmission side' or 'Getriebeseite' points towards the transmission (see illustration).

30 Refit the pressure plate assembly, aligning the marks made on dismantling (if the original pressure plate is re-used). Apply a little thread-locking compound then refit the pressure plate bolts, but tighten them only finger-tight so that the friction plate can still be moved (see illustration).

31 The friction plate must now be centralised so that, when the transmission is refitted, its input shaft will pass through the splines at the centre of the friction plate.

32 Centralisation can be achieved by passing a screwdriver or other long bar through the friction plate and into the hole in the crankshaft. The friction plate can then be moved around until it is centred on the crankshaft hole. Alternatively, a clutch-aligning tool can be used to eliminate the guesswork; these can be obtained from most accessory shops (see illustration).



3.30 Fit the pressure plate assembly over the friction plate

33 When the friction plate is centralised, tighten the pressure plate bolts evenly and in a diagonal sequence to the specified torque setting.

34 Refit the transmission as described in Chapter 7A.

4 Clutch slave cylinder/ release bearing – removal and refitting

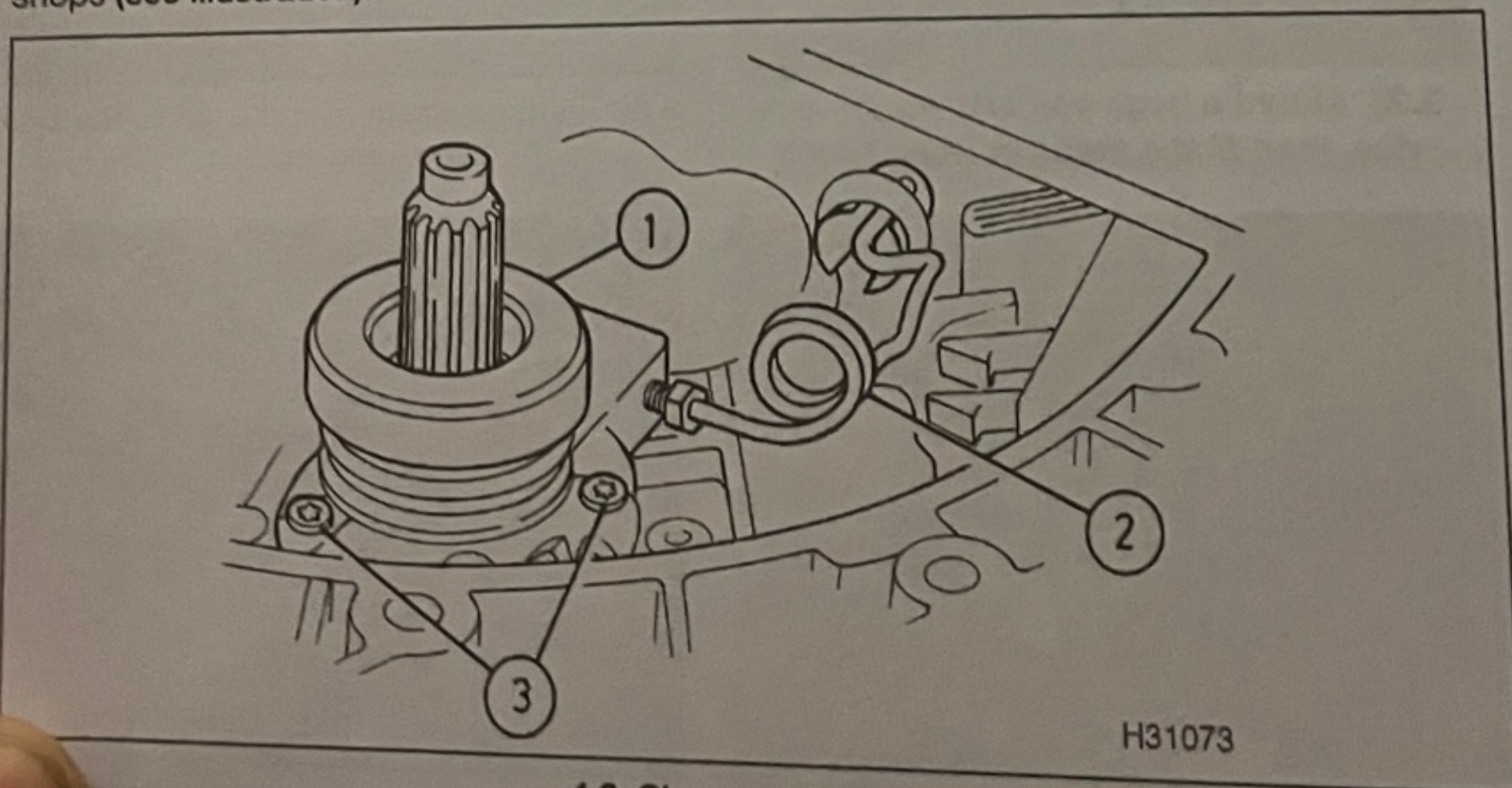
Note: The clutch slave cylinder and thrust release bearing are integrated and can only be purchased as a complete assembly.

Removal

1 Unless the complete engine/transmission unit is to be removed from the car and separated for major overhaul (see Chapter 2C), the clutch release cylinder can be reached by removing the transmission only, as described in Chapter 7A.

2 Wipe clean the outside of the slave cylinder then slacken the union nut and disconnect the hydraulic pipe. Wipe up any spilt fluid with a clean cloth.

3 Unscrew the three retaining bolts and slide the slave cylinder from the transmission input shaft (see illustration). Where applicable, remove the sealing ring, which is fitted between the cylinder and transmission housing and discard it; a new one must be used on refitting. Whilst the cylinder is removed, take care not to allow any debris to enter the transmission unit.



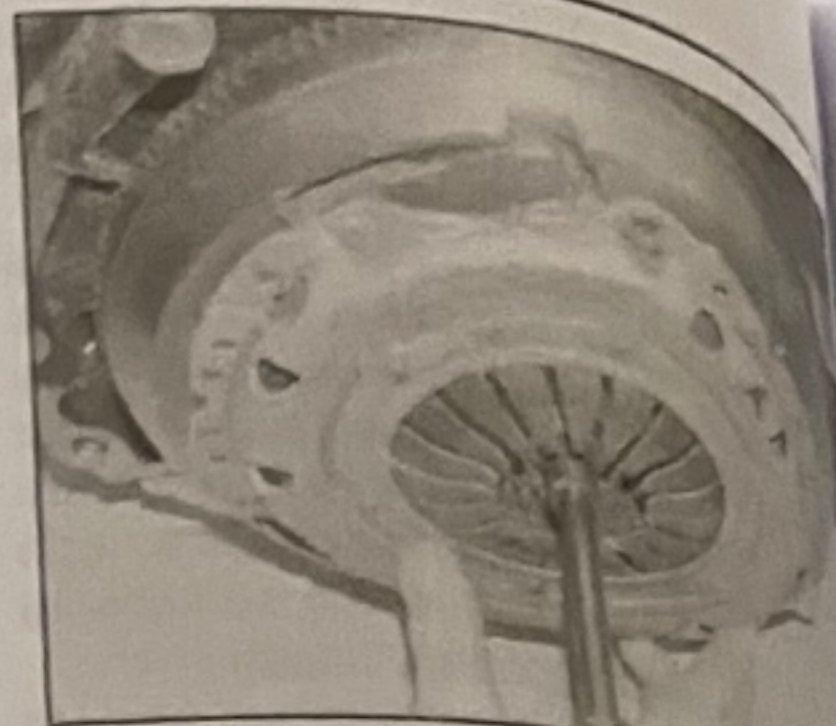
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4.3 Slave cylinder

1 Release bearing

2 Hydraulic fluid pipe

3 Securing screws



3.32 Centralise the friction plate using a clutch aligning tool or similar

4 The slave cylinder is a sealed unit and cannot be overhauled. If the cylinder has failed or the release bearing is noisy, it must be renewed.

Refitting

5 Ensure the slave cylinder and transmission mating surfaces are clean and dry, then fit a new sealing ring to the transmission recess.

6 Lubricate the slave cylinder recess with a smear of transmission oil then carefully ease the cylinder along the input shaft and correctly seated in its groove then refit the slave cylinder retaining bolts and tighten them to the specified torque.

7 Reconnect the hydraulic pipe to the slave cylinder, tightening its union nut to the specified torque.

8 Prime and bleed the slave cylinder with hydraulic fluid, as described in Section 6.

9 Refit the transmission unit as described in Chapter 7A.

5 Clutch master cylinder – removal and refitting

Removal

1 Remove the cover from the battery, then disconnect the battery negative cable and position it away from the terminal.

2 Referring to Chapter 11 for guidance, remove the sound insulating trim panel from underneath the facia, on the driver's side.

3 At the connection point between the master cylinder link rod and the clutch pedal, use a pair of long-nosed pliers to remove the link rod from the spigot, and then pull off the link rod. Also release the clutch pedal return spring.

4 As a precaution, place a dustsheet under the clutch pedal in the footwell, to catch any hydraulic fluid spillage.

5 On right-hand drive models, from inside the engine bay, remove the cover from the top of the intake manifold.

6 On left-hand drive models, from inside the engine bay, undo the retaining bolts and remove the central electric unit and fuse box from the left-hand side top strut mounting.

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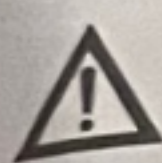
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Warning: Observe the warnings given in Section 6, regarding the hazards of handling hydraulic fluid.

7 From inside the engine bay, seal the flexible supply hose from the fluid reservoir, using a proprietary brake hose clamp between the fluid reservoir and the master cylinder.

8 Release the hose clip, and pull the supply hose off the master cylinder port. Be prepared for a small amount of hydraulic fluid loss; position a container or a wad of rags underneath the joint to catch any spillage.

9 Slide out the retaining clip and free the hydraulic delivery pipe from the front of the master cylinder (see illustration). Plug the pipe end and master cylinder port to minimise fluid loss and prevent the entry of dirt. Where applicable, recover the sealing ring from the union and discard it; a new one must be used on refitting. Refit the retaining clip to the master cylinder groove, to prevent loss of the clip.

10 Remove the two nuts from the retaining bolts, and lift the master cylinder away from the bulkhead, guiding the link rod through the aperture. Recover the gasket and inspect it for damage; renew it if necessary.

Refitting

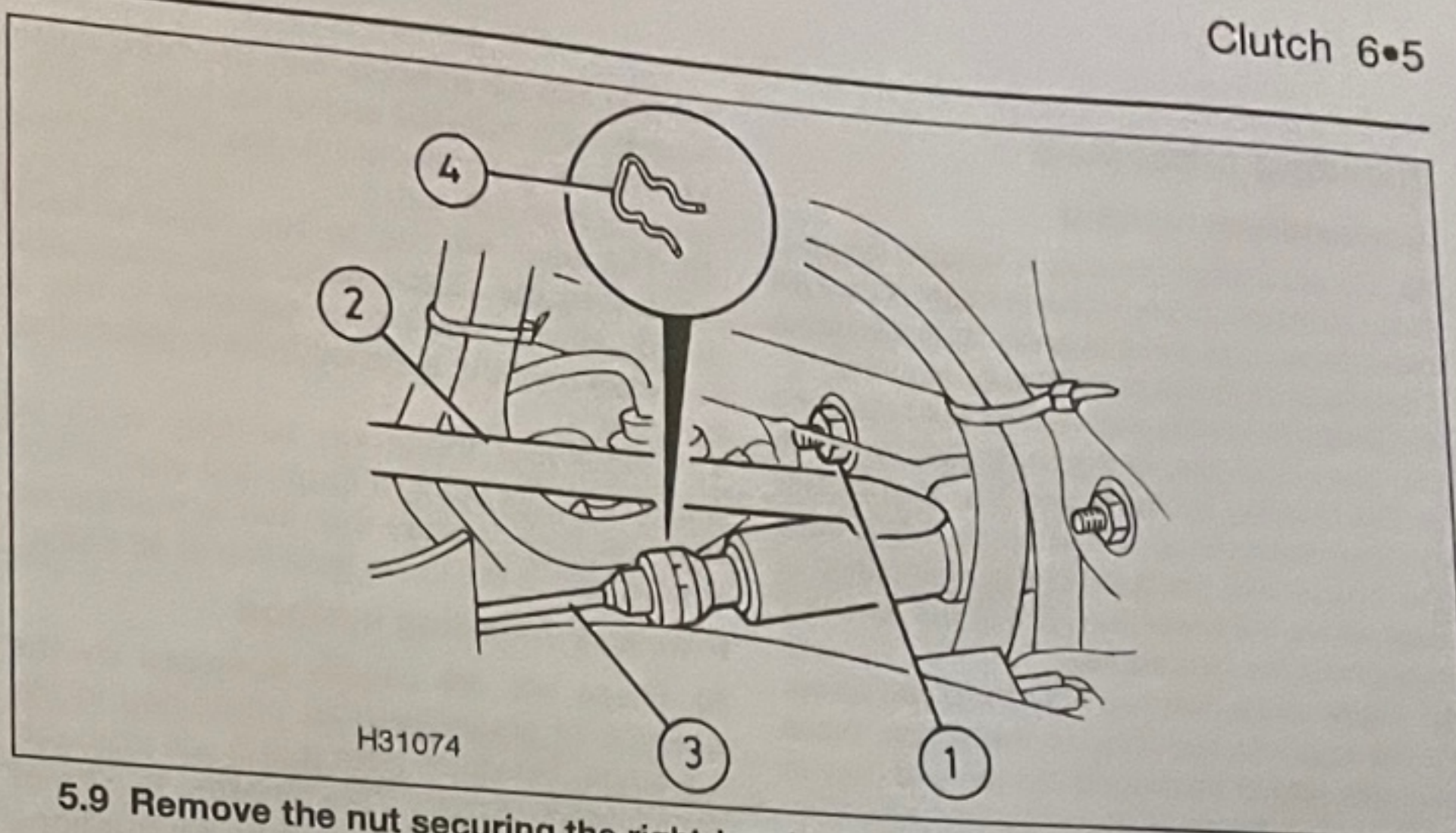
11 Refit the master cylinder by following the removal procedure in reverse. Noting the following points:

- Make sure the delivery pipe to the master cylinder is secured correctly in position with the retaining clip.
 - Observe the specified torque wrench setting when tightening the master cylinder-to-pedal bracket nuts.
- On completion, refer to Section 6 and bleed the hydraulic system.

Clutch hydraulic system – bleeding



Warning: Hydraulic fluid is poisonous; thoroughly wash off spills from bare skin without delay. Seek immediate medical advice if any fluid is swallowed or gets into the eyes. Certain types of hydraulic fluid are inflammable, and may ignite when brought into contact with hot components. When servicing any hydraulic system, it is safest to assume that the fluid IS inflammable, and to take precautions against the risk of fire as though it is petrol that is being handled. It is also hygroscopic (absorbs moisture from the air); excess moisture content lowers the fluid boiling point to an unacceptable level, resulting in a loss of hydraulic pressure. Old fluid may have suffered contamination, and should not be re-used. When topping-up or renewing the fluid, always use the recommended grade, and ensure that it comes from a freshly opened sealed container.



5.9 Remove the nut securing the right-hand side of the clutch pedal/master cylinder bracket to the rear of the engine compartment bulkhead

1 Securing nut

2 Supply hose

3 Delivery pipe

4 Retaining clip

General information

1 The correct operation of any hydraulic system is only possible after removing all air from the components and circuit; this is achieved by bleeding the system.

2 The manufacturer's stipulate that the system must be initially bled by the 'back-bleeding' method using Saab special bleeding equipment. This entails connecting a pressure bleeding unit containing fresh brake fluid to the release cylinder bleed screw, with a collecting vessel connected to the brake fluid master cylinder reservoir. The pressure bleeding unit is then switched on, the bleed screw is opened and hydraulic fluid is delivered under pressure, backwards, to be expelled from the reservoir into the collecting vessel. Final bleeding is then carried out in the conventional way.

3 In practice, this method would normally only be required if new hydraulic components have been fitted, or if the system has been completely drained of hydraulic fluid. If the system has only been disconnected to allow component removal and refitting procedures to be carried out, such as removal and refitting of the transmission (for example for clutch renewal) or engine removal and refitting, then it is quite likely that normal bleeding will be sufficient.

4 Our advice would therefore be as follows:

- If the hydraulic system has only been partially disconnected, try bleeding by the conventional methods described in paragraphs 10 to 15, or 16 to 19.
- If the hydraulic system has been completely drained and new components have been fitted, try bleeding by using the pressure bleeding method described in paragraphs 20 to 22.
- If the above methods fail to produce a firm pedal on completion, it will be necessary to 'back-bleed' the system using Saab bleeding equipment, or suitable alternative equipment as described in paragraphs 23 to 28.

5 During the bleeding procedure, add

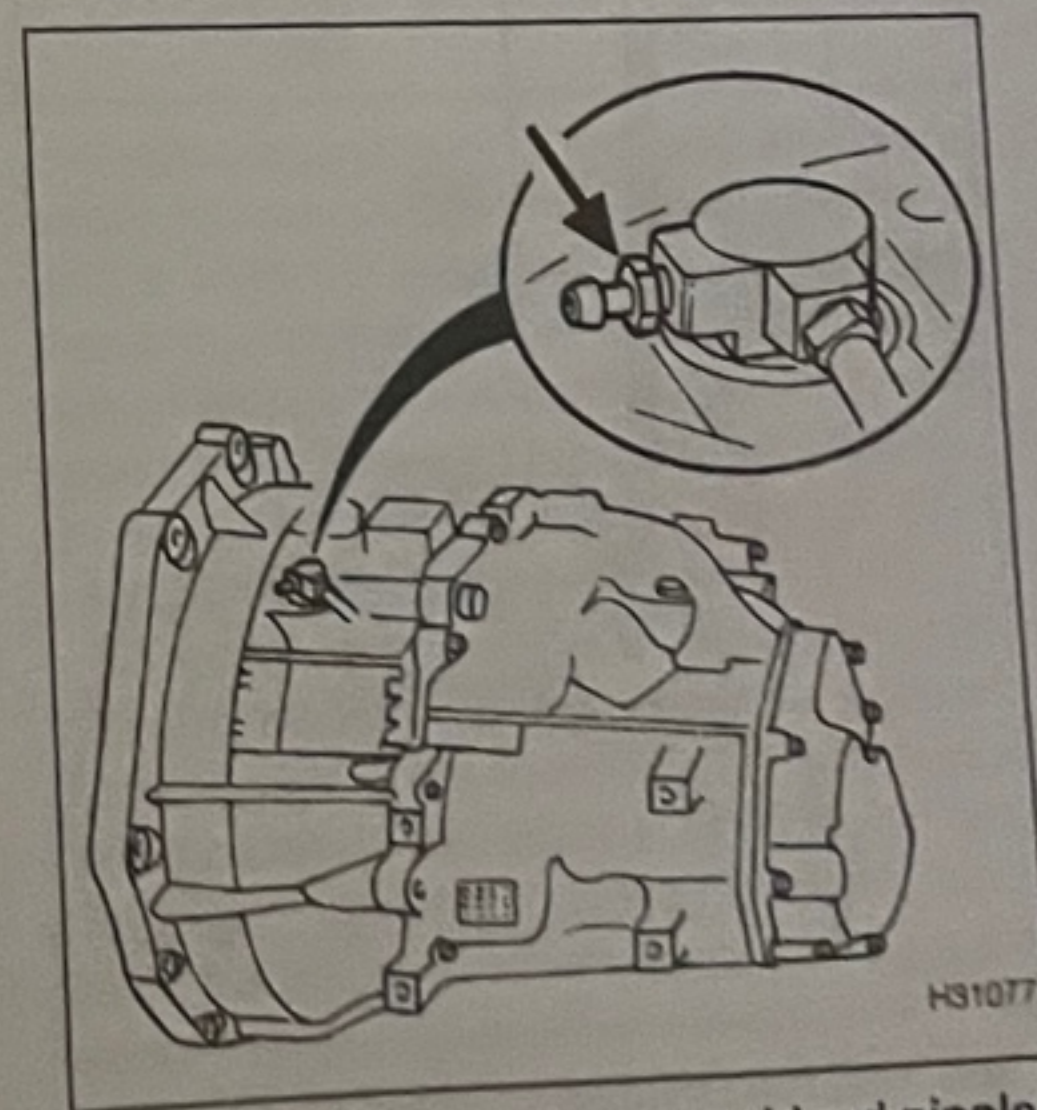
only clean, unused hydraulic fluid of the recommended type; never re-use fluid that has already been bled from the system. Ensure that sufficient fluid is available before starting work.

6 If there is any possibility of incorrect fluid being already in the system, the hydraulic circuit must be flushed completely with uncontaminated, correct fluid.

7 If hydraulic fluid has been lost from the system, or air has entered because of a leak, ensure that the fault is cured before continuing further.

8 The bleed screw is located in the hose end fitting which is situated on the top of the transmission housing (see illustration). On some models access to the bleed screw is limited and it may be necessary to jack up the front of the vehicle and support it on axle stands so that the screw can be reached from below, or remove the battery and battery box as described in Chapter 5A, so that the screw can be reached from above.

9 Check that all pipes and hoses are secure, unions tight and the bleed screw is closed. Clean any dirt from around the bleed screw.



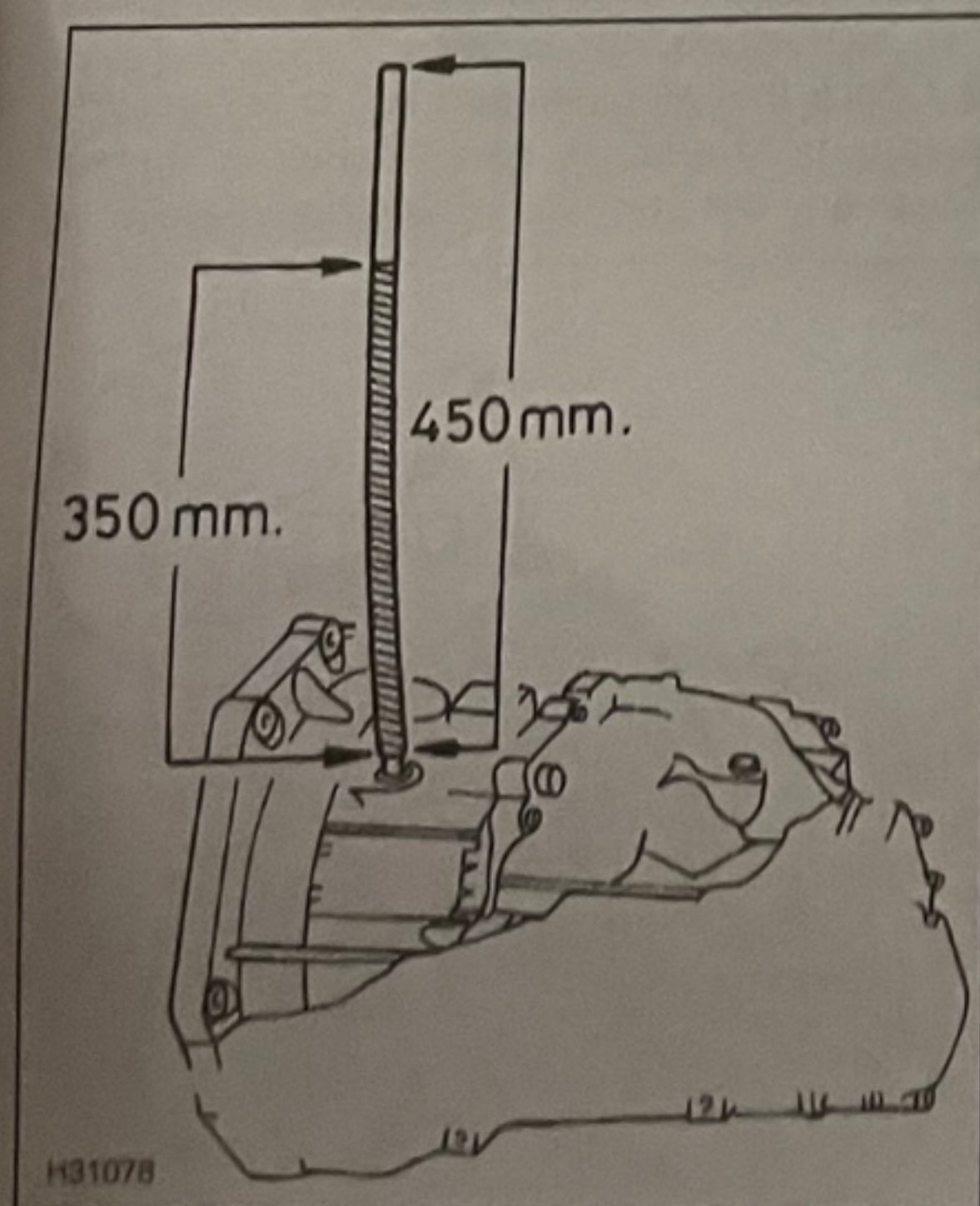
6.8 Clutch hydraulic system bleed nipple (arrowed)

Bleeding procedure**Conventional method**

- 10 Collect a clean glass jar, a suitable length of plastic or rubber tubing which is a tight fit over the bleed screw, and a ring spanner to fit the screw. The help of an assistant will also be required.
- 11 Unscrew the master cylinder fluid reservoir cap (the clutch shares the same fluid reservoir as the braking system), and top the master cylinder reservoir up to the upper (MAX) level line. Ensure that the fluid level is maintained at least above the lower level line in the reservoir throughout the procedure.
- 12 Remove the dust cap from the bleed screw. Fit the spanner and tube to the screw, place the other end of the tube in the jar, and pour in sufficient fluid to cover the end of the tube.
- 13 Have the assistant fully depress the clutch pedal several times to build-up pressure, and then maintain it on the final downstroke.
- 14 While pedal pressure is maintained, unscrew the bleed screw (approximately one turn) and allow the compressed fluid and air to flow into the jar. The assistant should maintain pedal pressure and should not release it until instructed to do so. When the flow stops, tighten the bleed screw again, have the assistant release the pedal slowly, and recheck the reservoir fluid level.
- 15 Repeat the steps given in paragraphs 13 and 14 until the fluid emerging from the bleed screw is free from air bubbles. If the master cylinder has been drained and refilled allow approximately five seconds between cycles for the master cylinder passages to refill.

Using a one-way valve kit

- 16 As their name implies, these kits consist of a length of tubing with a one-way valve fitted, to prevent expelled air and fluid being drawn back into the system; some kits include a translucent container, which can be positioned



6.37 Fill the hose to a height of 350 mm (measured from the bleed nipple) with new brake fluid

so that the air bubbles can be more easily seen flowing from the end of the tube.

- 17 The kit is connected to the bleed screw, which is then opened.
- 18 The user returns to the driver's seat, depresses the clutch pedal with a smooth, steady stroke, and slowly releases it; this is repeated until the expelled fluid is clear of air bubbles.

- 19 Note that these kits simplify work so much that it is easy to forget the clutch fluid reservoir level; ensure that this is maintained at least above the lower level line at all times.

Pressure-bleeding method

- 20 These kits are usually operated by the reservoir of pressurised air contained in the spare tyre. However, note that it will probably be necessary to reduce the pressure to a lower level than normal; refer to the instructions supplied with the kit.
- 21 By connecting a pressurised, fluid-filled container to the clutch fluid reservoir, bleeding can be carried out simply by opening the bleed screw and allowing the fluid to flow out until no more air bubbles can be seen in the expelled fluid.
- 22 This method has the advantage that the large reservoir of fluid provides an additional safeguard against air being drawn into the system during bleeding.

'Back-bleeding' method

- 23 The following procedure describes the bleeding method using Saab equipment. Alternative equipment is available and should be used in accordance with the maker's instructions.

- 24 Connect the pressure hose (88 19 096) to the bleed screw located in the hose end fitting situated on the top of the transmission housing (see Illustration 6.8). Connect the other end of the hose to a suitable pressure-bleeding device set to operate at approximately 2.0 bars.

- 25 Attach the cap (30 05 451) to the master cylinder reservoir, and place the hose in a collecting vessel.

- 26 Switch on the pressure bleeding equipment, open the bleed screw, and allow fresh hydraulic fluid to flow from the pressure bleeding unit, through the system and out through the top of the reservoir and into the collecting vessel. When fluid free from air bubbles appears in the reservoir, close the bleed screw and switch off the bleeding equipment.

- 27 Disconnect the bleeding equipment from the bleed screw and reservoir.

- 28 Carry out a final conventional bleeding procedure as described in paragraphs 10 to 15, or 16 to 19.

All methods

- 29 When bleeding is complete, no more bubbles appear and correct pedal feel is restored, tighten the bleed screw securely (do not overtighten). Remove the tube and spanner, and wash off any spilt fluid. Refit the dust cap to the bleed screw.

- 30 Check the hydraulic fluid level in the

master cylinder reservoir, and top up if necessary (see Weekly checks).

- 31 Discard any hydraulic fluid that has been bled from the system; it will not be fit for reuse.
- 32 Check the operation of the clutch. If the clutch is still not operating satisfactorily after a reasonable repetition of the bleeding procedure may be due to master cylinder/release cylinder seals.

Priming the slave cylinder

- 33 Providing that the slave cylinder has been removed from the transmission during servicing or repair, the procedure described in the preceding sub-section should ensure that all air to be expelled from the clutch hydraulic system. If however, a large amount of fluid has been drained from the slave cylinder, allowing it to enter, or if a new slave cylinder has been fitted, the procedures described may not be sufficient to purge all the air from the slave cylinder. This is because the bleed nipple is positioned at the point where the hydraulic fluid enters the top of the slave cylinder - fluid is not forced through the slave cylinder during the bleeding process and the cylinder is not fully primed with hydraulic fluid. Consequently, some air may remain inside the slave cylinder housing.

- 34 To overcome this, the slave cylinder must be primed before the transmission is refitted to the transmission, as follows.

- 35 Take a 450 mm length of 8 mm diameter clear plastic hose and fit it to the slave cylinder bleed nipple.

- 36 Open the bleed nipple then press the release bearing along the input shaft sleeve towards the transmission, so that the piston is pushed fully into the slave cylinder. Catch the fluid ejected from the hose in a container.

- 37 Hold the hose vertically, and then fill it to a height of 350 mm (measured from the bleed nipple) with new brake fluid (see Illustration 6.37).

- 38 Connect a foot pump or bicycle pump to the end of the hose, ensuring a good seal. Gradually apply pressure to the hose using the pump until the brake fluid flows into the slave cylinder.

- Allow the piston to be pushed out of the slave cylinder to the end of its travel, but no further. The resistance felt at the pump should increase when the piston reaches the end of its travel.

- 40 Press the release bearing back along the input shaft sleeve towards the transmission so that the piston is pushed back fully into the slave cylinder. Allow the air bubbles now flowing through the brake fluid to escape from the end of the plastic hose.

- 41 Repeat the steps described in paragraphs 34 and 35 until no more air escapes from the slave cylinder.

- 42 Leave the piston fully retracted inside the slave cylinder, then disconnect and remove the plastic hose. Refit the transmission as described in Chapter 7A, without disturbing the slave cylinder. On completion, bleed the entire hydraulic system as described in the previous sub-sections.