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DESCRIPTION

A common servo-assisted brake system is fitted to all Jaguar and Daimler Series III saloon cars. The fluid reservoir is integral with the master cylinder and is divided into two compartments, one supplying the front brakes and the other the rear brakes.

The two pipes from the master cylinder lead to each side of a Pressure Differential Warning Actuator (P.D.W.A.) in which a free piston, normally centrally located, is deflected to one side or the other if the pressure in one pipe differs from that in the second pipe.

In moving, the piston operates a switch which then completes the circuit to a warning light on the instument panel.

This warning light must also illuminate when the ignition switch is in position 3 (Start), to provide a check that the warning circuit is operating satisfactorily.

Failure to do so indicates a bulb or circuit fault. If the light remains on when the ignition switch is returned to position 2 (Ignition), then a brake fault is indicated and the car MUST NOT be driven until the fault is corrected.

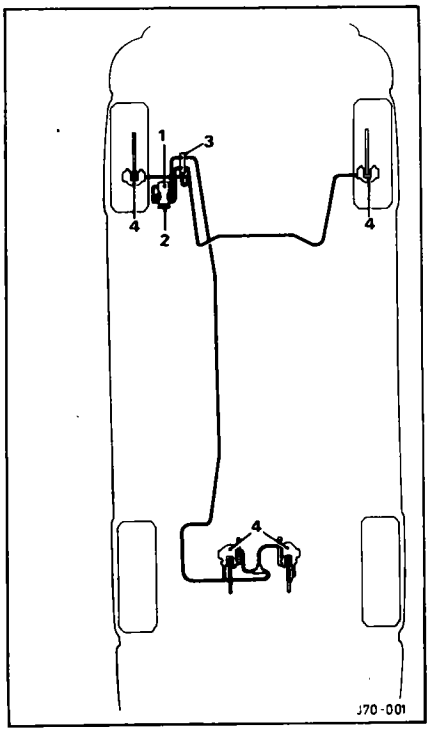


Fig. 1

KEY TO COMPONENT LOCATION

(See Fig. 1)

1. Brake fluid reservoir
2. Master cylinder
3. P.D.W.A. unit
4. Brake calipers

Two further pipes from the P.W.D.A. lead to the two front brakes and a third pipe connects with a T-piece mounted on the rear cross-member; another two pipes connect the T-piece with the two rear calipers, mounted on each side of the final drive unit.

Flexible hoses replace the pipes at each front caliper and a third hose is inserted between the front to rear pipe and the rear cross-beam.

A completely separate handbrake system operates small pads, at the rear discs, mechanically; self-adjusting mechanism maintains the correct clearance between released pads and discs and a manual adjustment is also provided. A switch mounted on the hand control completes a circuit to the handbrake warning lamp when the ignition is switched on and the handbrake is applied. It must extinguish when the handbrake is released or the ignition is switched off.

Operation of brake system (see Fig. 2)

On application of the brake pedal the servo unit, which is directly coupled to the master cylinder, transfers increased pedal pressure to the master cylinder primary piston 'A' causing the piston to move forward past the by-pass port 'P' to establish rear brake line pressure in chamber 'B'. Pressure from the primary cylinder return spring 'C' and rear brake line pressure force the secondary piston 'D' forward past the by-pass port 'P' to establish front brake line pressure in chamber 'E'.

Front and rear braking pressures enter the P.D.W.A. unit at ports 'F' and 'G', act on either end of the shuttle valve 'H' and travel to front and rear calipers via ports 'J' and 'K'. Should a fall in front or rear braking pressure occur the resultant pressure imbalance causes displacement of the shuttle valve, which in turn operates the switch 'L' and illuminates a warning light in the instrument panel. In order to reset the displaced shuttle valve the cause of fall in brake line pressure must first be established and rectified. During bleeding of the brake system which follows rectification the shuttle valve automatically resets, and extinguishes the warning light. Brake pressure entering the caliper 'M' forces the pistons 'T' out to act on the friction pads 'U' which in turn clamp the brake disc 'V'. On release of the brake pedal, brake line pressure collapses which allows the piston seals 'W' to retract the pistons into the caliper. Withdrawal of the pistons into the caliper is just sufficient for the friction pads to be in a relaxed position away from the disc. This sequence provides automatic adjustment for brake pad lining wear.

Should the brake servo unit become inoperative front and rear braking systems will still operate but at a greatly reduced brake line pressure. A divided brake fluid reservoir 'R' ensures that in the event of fluid loss to front or rear brake systems one pair of brake calipers will at all times be operative. The fluid level indicator 'S' provides visual warning to the driver should the level of fluid in the reservoir fall to an unsatisfactory level.

1983 M.Y. SPECIFICATION

Brakes — All Models

The brake system pressure differential warning actuator (P.D.W.A.) unit has been deleted.

NOTE: This deletion in no way affects the performance of the braking system as the conventional split system is retained.

All steel brake pipes on 1983 model year cars will be plastic coated. This will improve the corrosion resistance of the pipe work.

Brake Pad Material Change — All Models

A semi metallic brake pad lining was introduced from:-

VIN 354035

Identification of semi metallic pads is by the friction material code FER 3401 printed on the rear face of the material adjacent to the pad batch number.

Semi metallic pads may be used in vehicle sets as a retrospective fit on Jaguar vehicles with 4 pot caliper front brakes.

WARNING: Under no circumstances should semi metallic and non semi metallic brake pads be mixed.

Brake pads must be used in vehicle sets only.

It is therefore necessary to check lining specification **on the complete vehicle** before replacing brake pads in axle sets to ensure that mixing does not occur.

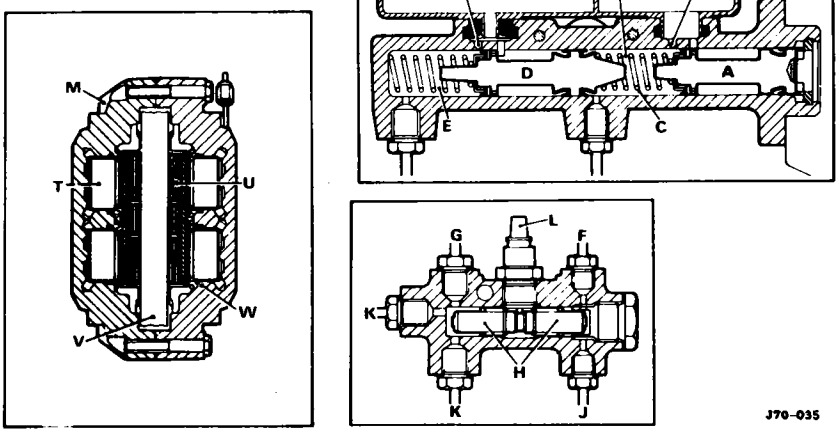


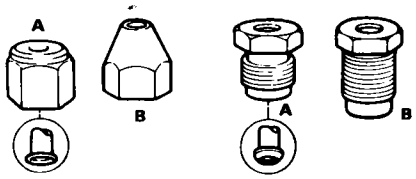
Fig. 2

Metrication

The examples shown in Figs. 3, 4 and 5 are intended as an aid to identification of brake components in metric form.

All metric pipe nuts, hose ends, unions and bleed screws are coloured black. The hexagon area of pipe nuts are indented with the letter 'M'.

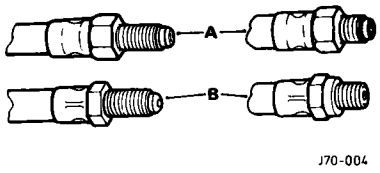
Metric and U.N.F. pipe nuts are different in shape and the female nut is always used with a trumpet flared pipe, the male nut always having a convex flared pipe.



A = Metric B = U.N.F.

Fig. 3

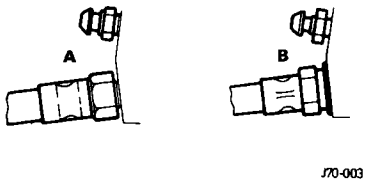
Hose ends differ slightly between metric and U.N.F.



A = Metric B = U.N.F.

Fig. 4

Copper gaskets are not used with metric hose and a gap exists between the hose end and cylinder.



A = Metric B = U.N.F.

Fig. 5

Metrication does not apply to the following brake components.

1. Rear calipers.
2. Handbrake calipers.
3. Feed pipes from rear three-way connector to rear calipers.
4. Three-way connector.

DATA

Front brakes—make and type	Girling, ventilated disc
Rear brakes—make and type	Girling, inboard disc
Handbrake—type	Mechanical, operating on rear discs
Disc diameter—front	283,8 mm (11.175 in)
—rear	263,8 mm (10.385 in)
Disc thickness—front	24,0 mm (0.945 in)
—rear	Normal 12,7 mm (0.5 in)
	Min. permissible 11,43 mm (0.45 in)
Master cylinder bore diameter	23,8 mm (0.937 in)
Hydraulic fluid specification	Castrol Girling Code 1735 (SAE J1703)
Main brake friction pad specification	Ferodo 2430 (slotted)
Handbrake friction pad specification	Mintex M68/1
Servo unit make	Girling

TORQUE WRENCH SETTINGS

ITEM	DESCRIPTION	TIGHTENING TORQUE		
		Nm	kgf m	lbf ft
Pedal box to body	5/16 in U.N.F. bolt	14,9 to 17,6	1,53 to 1,79	11 to 13
Brake pedal pivot pin	3/8 in U.N.F. nut	19,0 to 24,4	1,94 to 2,48	14 to 18
Brake pedal lever shaft locking pin	1/4 in U.N.C. bolt	2,7 to 3,4	0,28 to 0,34	2 to 2.5
Brake reservoir to bracket	1/4 in U.N.F. nut	2,7 to 3,4	0,28 to 0,34	2 to 2.5
Hydraulic connections for 3/16 in pipes	U.N.F.	8,5 to 9,5	0,87 to 0,96	6.3 to 7
	M 12	16,3 to 19,0	1,66 to 1,94	12 to 14
	M 10 male	9,0 to 11,0	0,93 to 1,10	6.7 to 8
	M 10 female	11,0 to 13,5	1,10 to 1,38	8 to 10
Rear 3-way connection	1/4 in U.N.F. nut	8,1 to 9,5	0,83 to 0,96	6 to 7
Front and rear hoses to bracket	M 10 nut	13,6 to 16,3	1,40 to 1,65	10 to 12
Handbrake cable locknut	1/16 in X 16 U.N.F. nut	9,5 to 13,6	0,97 to 1,38	7 to 10
Handbrake switch locknut	1/4 in U.N.F. nut	4,7 to 6,1	0,48 to 0,62	3.5 to 4.5
Handbrake to body	1/4 in U.N.F. bolt	8,1 to 9,5	0,83 to 0,96	6 to 7
Relay lever pivot	3/8 in U.N.F. bolt	29,8 to 35,2	3,05 to 3,59	22 to 26
Fork end assembly	1/4 in U.N.F. nut	8,1 to 9,5	0,83 to 0,96	6 to 7
Cable guide	No. 10 U.N.F. bolt	5,4 to 6,1	0,48 to 0,62	4 to 4.5
Abutment to body	1/4 in U.N.F. bolt	8,1 to 9,5	0,83 to 0,96	6 to 7
Master cylinder to booster	M 10 nut	21,1 to 26,5	2,14 to 2,70	15.5 to 19.5
Booster to pedal box	M 8 nut	11,0 to 13,5	1,10 to 1,38	8 to 10
P.D.W.A. to body	1/4 in U.N.F. nut	8,1 to 9,5	0,83 to 0,96	6 to 7
Front double-end union to body	M 10 nut	13,6 to 16,3	1,40 to 1,65	10 to 12
Brake light switch to bracket	1/4 in U.N.F. bolt	4,7 to 6,1	0,48 to 0,62	3.5 to 4.5
Rear cable to relay lever	1/4 in U.N.F. nut	8,1 to 9,5	0,83 to 0,96	6 to 7
Brake cable support plate to body	No. 10 U.N.F. bolt	5,4 to 6,1	0,56 to 0,62	4 to 4.5
Cable guide to plate	No. 10 U.N.F. bolt	5,4 to 6,1	0,56 to 0,62	4 to 4.5
Front caliper to stub axle carrier	M 12 bolt	67,8 to 81,3	6,91 to 8,29	50 to 60
Disc shield and clamp to stub axle carrier	1/4 in U.N.F. nut	6,1 to 7,5	0,62 to 0,76	4.5 to 5.0
Rear caliper to drive unit flange	7/16 U.N.F. bolt	66,4 to 74,5	6,78 to 7,60	49 to 55
Wheels nuts	Special nuts—set spanner to	61	6,23	45

CLEANING SOLVENTS

WARNING: Never use methylated spirit (denatured alcohol) for cleaning purposes. Use only Castrol/Girling brake cleaning fluid.

Throughout the following operations absolute cleanliness must be observed to prevent grit or other foreign matter contaminating the brake system. If the system is to be flushed or cleaned through, only Girling brake cleaner must be used. Brake system components must be washed and all traces of cleaner removed before reassembly.

All brake system rubber components must be dipped in clean brake fluid and assembled using the fingers only.

BRAKE FLUID

WARNING: During operations which necessitate the handling of brake fluid, extreme care must be observed; brake fluid must not be allowed to contact the car paintwork. In instances where this has occurred the contaminated area must immediately be cleaned, using a clean cloth and white spirit. This should be followed by washing the area with clean water. Methylated spirit (denatured alcohol) must not be used to clean the contaminated area.

SYMPTOM AND DIAGNOSIS CHART FOR HYDRAULIC BRAKE SYSTEM

SYMPTOM	DIAGNOSIS	ACTION
Fade	Incorrect pads. Overloaded vehicle. Excessive braking. Old hydraulic fluid.	Replace the pads, decrease vehicle load or renew hydraulic fluid as necessary.
Spongy pedal	Air in system. Badly lined pads. Weak master cylinder mounting.	Check for air in the system, and bleed if necessary. Check the master cylinder mounting, pads and discs and replace as necessary.
Long pedal	Discs running out pushing pads back. Distorted damping shims. Misplaced dust covers.	Check that the disc run out does not exceed 0.004 in. (0,101 mm). Rotate the disc on the hub. Check the disc/hub mounting faces.
Brakes binding	Handbrake incorrectly adjusted. Seals swollen. Seized pistons. Servo faulty.	Check and adjust handbrake linkage. Check for seized pistons. Repair or replace as necessary. Refer to servo chart.
Hard pedal—poor braking	Incorrect pads. Glazed pads. Pads wet, greasy or not bedded correctly. Servo unit inoperative. Seized caliper pistons. Worn shock absorbers causing wheel bounce.	Replace the pads or if glazed, lightly rub down with rough sandpaper. Refer to Servo chart, if servo is faulty. Check caliper for damage and repair as necessary. Fit new shock absorbers.
Brakes pulling	Seized pistons. Variation in pads. Unsuitable tyres or pressures. Worn shock absorbers. Loose brakes. Greasy pads. Faulty discs, suspension or steering.	Check tyre pressures, seized pistons, greasy pads or loose brakes; then check suspension, steering and repair or replace as necessary. Fit new shock absorbers.
Fall in fluid level	Worn disc pads. External leak. Leak in servo unit.	Check the pads for wear and for hydraulic fluid leakage. Refer to Servo chart.
Disc brake squeal—pad rattle	Worn retaining pins. Worn discs. Worn pads. Broken anti-chatter spring.	Renew the retaining pins, or discs. Fit new pads, or anti-chatter spring.
Uneven or excessive pad wear	Disc corroded. Disc badly scored. Incorrect friction pads.	Check the disc for corrosion, or scoring and replace if necessary. Fit new pads with correct friction material.
Brake warning light illuminated	Fluid level low, combination valve or P.D.W.A. unit operated. Short in electrical warning circuit.	Top up reservoir. Check for leaks in system and pads for wear. Check electrical circuit.

BRAKE SYSTEM

Bleed—all round 70.25.02

Bleeding the brake system is not a routine maintenance operation and should only be necessary when air has contaminated the fluid or a part of the system has been disconnected.

Bleeding

Ensure fluid reservoir is topped up with fluid of correct specification.
Attach bleeder tube to left-hand rear bleed screw, immerse open end of tube in small jar partially filled with clean brake fluid.
Position gear selector in neutral and run engine at idling speed.
Slacken left-hand rear bleed screw.
Operate brake pedal through full stroke until fluid issuing from tube is free of air bubbles.

NOTE: The fluid level in reservoir must be checked at regular intervals and topped up as necessary.

Keep pedal fully depressed and close bleed screw.
Repeat above operations on right-hand rear brake.
Continue above operations on remaining front brakes.
Check tightness of all bleed screws and fit protective caps.
Top up reservoir as necessary.

CAUTION: Brake fluid emitted from system during above check must NOT be put back into system.

Apply normal working load to brake pedal for several minutes, if pedal moves or feels spongy further bleeding of system is required.
When pedal 'feel' is satisfactory release handbrake; brake warning light should extinguish. If warning light remains illuminated carry out the following operation:
Operate brake pedal applying heavy pedal pressure, warning light should extinguish; if light remains illuminated carry out P.D.W.A. check operation, see operation 70.25.08.

BRAKE SYSTEM

Drain and flush 70.25.17

Service tool: Brake piston retractor tool 64932392

Draining

Slacken all road wheel nuts.
Jack up front of car and place on stands.
Jack up rear of car and place on stands.
Remove all road wheels.
Attach bleeder tube to rear left-hand caliper bleed screw with open end of tube in suitable container.
Slacken bleed screw.
Operate brake pedal slowly through full stroke, until 'rear' brake section of fluid reservoir is drained and fluid ceases to issue from bleed tube.
Remove rear left-hand caliper friction pads, see operation 70.40.03.

WARNING: Do not operate brake pedal while friction pads are removed.

Using special tool 64932392, lever pistons into bores expelling remaining trapped fluid into container.
Replace friction pads.

NOTE: It is not necessary to replace retaining pins and clips at this time.

Close bleed screw.
Discard expelled fluid.
Repeat draining operations on right-hand rear and front calipers.

Flushing

Fill fluid reservoir with Castrol/Girling brake flushing fluid.
Attach bleeder tube to rear left-hand caliper bleed screw with open end of tube in container.
Slacken bleed screw.
Operate brake pedal slowly through full stroke, until clear flushing fluid issues from tube.

NOTE: The fluid level in the reservoir must be checked at regular intervals and topped up as necessary.

Closed bleed screw and operate pedal two or three times.
Repeat above bleed operations on remaining rear and front calipers.
Carry out draining operations on rear brake calipers.
Secure rear friction pads with retaining pins and clips. Repeat draining operations on front brake calipers.
Secure front friction pads with retaining pins, clips and anti-chatter springs.
Close bleed screws on front and rear calipers.
Discard expelled flushing fluid.

Refilling

Fill brake reservoir with new brake fluid of correct specification.
Bleed brakes see 70.25.02.

NOTE: Prior to closing bleed screw during the bleeding of each caliper, check that issuing brake fluid is completely free of flushing fluid.

Refit road wheels to car.
Remove stands.

PRESSURE DIFFERENTIAL WARNING ACTUATOR

Test **70.25.14**

NOTE: Overhaul of the P.D.W.A. Unit is not possible, and the following test should be carried out at intervals detailed in the Maintenance Summary.

Operational check

Ensure car is adequately chocked.
Check brake fluid level and top-up if necessary.
On cars with automatic transmission ensure gear selector lever is in 'N' neutral or 'P' (Park).
Check that with ignition on and handbrake applied 'Park Brake Warning' light is illuminated.
Run engine at idle speed and release handbrake.
Apply heavy foot pressure to brake pedal.

NOTE: The brake pedal should be fully depressed and kept fully applied throughout the following operations.

Release any brake caliper bleed nipple just sufficiently to allow fluid to be expelled, and ensure ejected fluid is collected in a jar or waste rag.
'Brake Warning' light should illuminate.
Close bleed nipple.
Release and re-apply foot pressure to brake pedal.
'Brake Warning' light should extinguish.
Switch off engine and apply handbrake.
Top-up brake fluid reservoir.
Should warning light fail to illuminate when fluid is released, repeat test operations.
A new P.D.W.A. unit is required if warning light fails to illuminate during repeat operation.

PRESSURE DIFFERENTIAL WARNING ACTUATOR

Check and reset **70.25.08**

NOTE: Before commencing check and reset procedure ensure that car is adequately chocked and cars with automatic transmission have selector lever in 'P' or 'N' position.

Release handbrake: warning light should extinguish; if light remains illuminated carry out next operation.
Check brake reservoir fluid level, top up as necessary; if warning light remains illuminated, carry out remaining operation.

Disconnect electrical connector from P.D.W.A. Switch if warning light goes out P.D.W.A. has operated; if light remains illuminated check for 'short' in brake warning electrical circuit or a sticking reservoir fluid level switch.

NOTE: If P.D.W.A. unit has operated a major defect in the brake system is indicated.

Reset

Resetting of the P.D.W.A. unit is achieved automatically during bleeding of the brake system, which should only be carried out following rectification of defects that cause shuttle valve displacement.

BRAKE SERVO

Check and test procedure **70.50.05**

The following tests on the vacuum system should only be carried out with the hydraulic braking system in a satisfactory condition.

Servo test and check

Jack up front of car and confirm one wheel turns freely. Start engine, allow vacuum to build up and apply brake pedal several times. It should be possible to rotate wheel immediately pedal is released. If brakes bind, a defect within the servo unit is indicated.
With engine running apply brake pedal several times and check operation of pedal. If response is sluggish, check condition of vacuum hoses and servo unit air filter.
Allow vacuum to build up, switch off engine and operate brake pedal, approximately two or three applications should be vacuum assisted; less indicates a leaking vacuum system or inoperative non-return valve.
Switch off engine and operate brake pedal several times to evacuate vacuum in system. Hold a light foot pressure on pedal and start engine.
If servo is operating correctly, pedal will fall under existing foot pressure. If pedal remains stationary a leaking vacuum system is indicated.

HANDBRAKE CABLE

Adjust **70.35.10**

The handbrake cable adjustment linkage is situated on the underside of the floor panel below the handbrake lever.

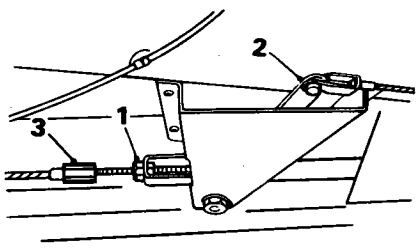


Fig. 6

To adjust, slacken the locknut (1, Fig. 6) at the forked end and remove the clevis pin (2, Fig. 6) securing the clevis to the handbrake lever.
Ensure that the levers at the calipers are in the 'Fully off' position by pressing towards the calipers.
Adjust the length of the cable by unscrewing the cable end (3, Fig. 6) to a point just short of where the caliper levers start to move.
Refit the clevis pin (2, Fig. 6) and tighten the locknut (1, Fig. 6).
Always use a new split pin to retain clevis pin.
No attempt must be made to place the cable under tension otherwise handbrake may bind.

BRAKE PADS—REAR

Remove and refit **70.40.03**

Service tool: Brake piston retractor tool 64932392

Removing

Jack up rear of car and place on stands, or raise car on ramp.

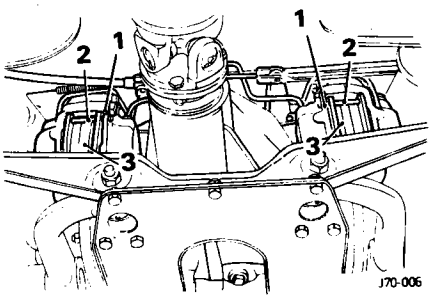


Fig. 7

Remove clips (1, Fig. 7) securing friction pad mounting pins.
Remove mounting pins (2, Fig. 7).
Withdraw friction pads (3, Fig. 7).

Refitting

NOTE: It is advisable to reduce the level of brake fluid in reservoir before fitting new pads.

If thickness of any pad is less than 4.0 mm (0.2 in) new pads MUST be fitted.
Using service tool 64932392 lever pistons into cylinder bores. Fit new brake pads, locate with mounting pins, ensure upper mounting pin enters caliper from centre line of car and lower mounting pin enters caliper from wheel side of car.
Fit retaining clips to pad mounting pins.
Top up brake fluid reservoir.
Remove stands.
Run engine and apply brake pedal several times until pedal feels solid.

BRAKE PADS—FRONT

Remove and refit **70.40.02**

Service tool: Brake piston retractor tool 64932392

Removing

Remove road wheel.
Remove clips (1, Fig. 8) securing retaining pins.
Remove retaining pins (2, Fig. 8).
Recover anti-chatter springs (3, Fig. 8).
Withdraw worn pads (4, Fig. 8).

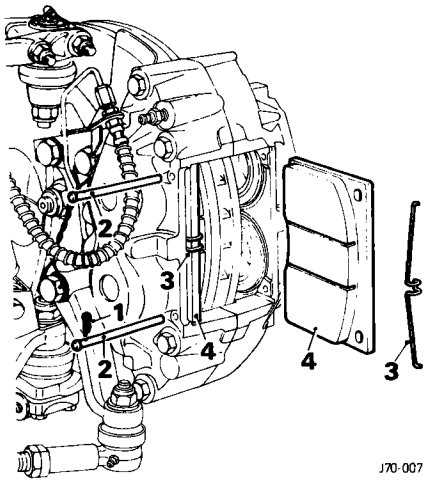


Fig. 8

Refitting

NOTE: It is advisable to reduce level of brake fluid in reservoir before fitting new pads.

If thickness of any pad is less than 4 mm (0.2 in) new pads MUST be fitted.
Lever pistons into cylinder bores using service tool 64932392.
Fit new brake pads to caliper.
Fit retaining pins.
Secure retaining pins with clips.
Fit anti-chatter springs.
Refit road wheel.
Top up brake fluid reservoir.
Run engine and apply brake pedal several times until pedal feels solid.

HOSES

General fitting and removal instructions **70.15.00**

Removing

Clean unions of hose to be removed.
Ensure pipe sealing plugs are at hand.
Fully release unions (1, Fig. 9) securing fluid pipes to hose ends.

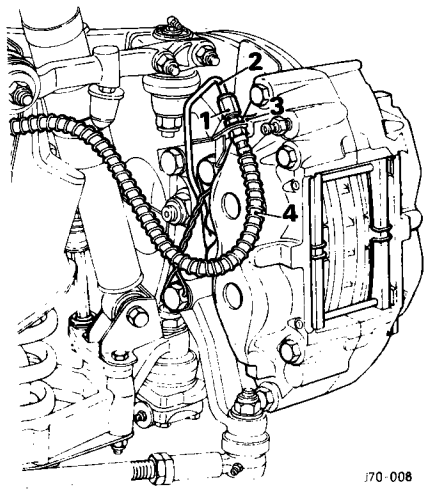


Fig. 9

Withdraw pipe unions (2, Fig. 9) from hose ends, plug pipes to prevent loss of fluid and ingress of dirt.
Remove locknuts (3, Fig. 9) securing hose ends to mounting brackets.
Remove hose (4, Fig. 9) from car.

Inspection

After thoroughly cleaning hose examine for any signs of deterioration or damage. If doubt exists, a new hose must be fitted.
Thoroughly clean bore of hose by feeding compressed air into one end of hose.

Refitting

Reverse removal operations.
Bleed brakes, see operation 70.25.02.

PIPE

General fitting and removal instructions **70.20.00**

Removing

Clean unions of pipe to be removed.
Ensure pipe sealing plugs are at hand.
Fully release pipe unions.
Withdraw pipe from car, plug open end of pipe remaining on car.

Inspection

Thoroughly clean bore of pipe by feeding compressed air into one end.
After thoroughly cleaning pipe examine for any sign of fracture or damage. If doubt exists, a new pipe must be fitted.

DISC SHIELD—FRONT

Remove and refit **70.10.18**

Removing

Remove road wheel.
Slacken upper bolt securing steering arm to stub axle carrier.
Remove locking wire securing caliper mounting bolts.
Remove upper caliper mounting bolt.
Remove clips (1, Fig. 10) securing lower, secondary and main shield assemblies to lower portion of stub axle carrier.
Withdraw lower and main shields (2, Fig. 10) from disc assembly.
Remove brake feed pipe between flexible pipe and caliper. Plug exposed ends to prevent ingress of dirt and loss of fluid.

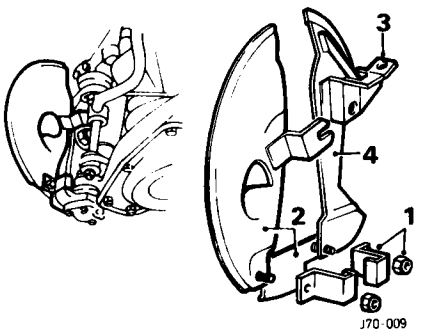


Fig. 10

Remove locknut (3, Fig. 10) securing brake hose union to secondary shield assembly; withdraw hose from securing bracket.
Withdraw shield (4, Fig. 10) from disc assembly.

Refitting

Reverse operations above, ensure brake hose is not twisted when securing to secondary shield bracket.
Fit new self-locking nuts to lower shield securing studs. Tighten steering arm bolt and caliper securing bolt to correct torque.
Refit road wheel.
Bleed brakes, see operation 70.25.02.

FRONT DISC

Remove and refit **70.10.10**

Removing

Remove brake caliper friction pads (1, Fig. 11), see operation 70.40.02.
Remove front hub, see operation 60.25.01.
Remove locking wire (2, Fig. 11) from caliper mounting bolts.

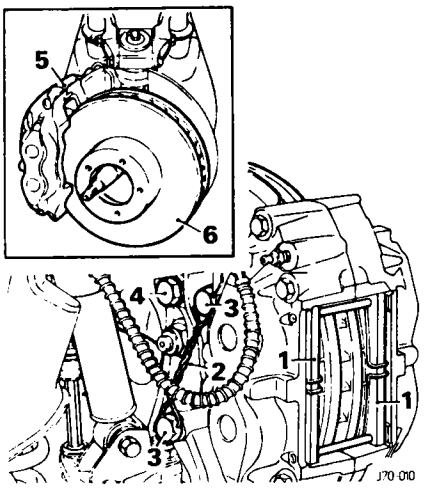


Fig. 11

Remove caliper mounting bolts (3, Fig. 11), recover and note position of shims located between steering arm and caliper.
Slacken bolt (4, Fig. 11) securing steering arm to hub carrier.
Gently easing caliper (5, Fig. 11) aside, remove disc (6, Fig. 11).

Inspection

Examine disc for cracks and heavy scoring; light scratches and scoring are not detrimental and may be ignored. If doubt exists a new disc should be fitted.

Refitting

If original disc is refitted reverse operations above and ensure caliper mounting bolts are tightened to the correct torque.
If new disc is fitted reverse operations above, ensuring mounting bolts are not wire locked.
Check gap between caliper abutments and disc face.
Gap on opposite sides of disc may differ by up to 0,25 mm (0.010 in) but gap on upper and lower abutment on same side of disc should be the same.
If disc is not central in caliper remove one caliper mounting bolt and add or withdraw shim required to centralize disc, refit caliper bolt.
Repeat above operation on remaining caliper mounting bolt.
Repeat gap check
Tighten caliper mounting bolts to correct torque and wire lock
Refit brake friction pads.

REAR DISCS

Remove and refit **70.10.11**

Removing

Place car on ramp, remove road wheel adjacent to brake disc to be removed.
Place rear of car on stands.
Remove brake caliper, see operation 70.55.03.
Remove shock absorber lower fulcrum pin (1, Fig. 12), recover distance piece and washers.

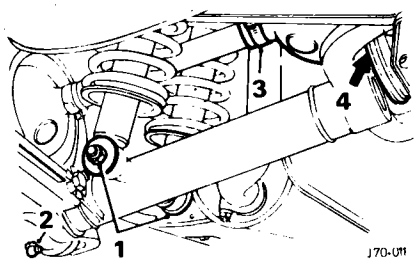


Fig. 12

Remove locking wire securing radius arm locking bolt (1, Fig. 13) and remove bolt.
Remove hub fulcrum shaft grease nipple (2, Fig. 12).
Place support blocks below hub.

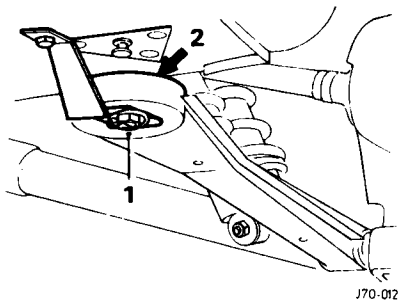


Fig. 13

Lower radius arm from spigot anchor point (2, Fig. 13).
Release clip (3, Fig. 12) securing inner universal joint cover, slide cover clear of joint.
Remove nuts securing universal joint to brake discs (4, Fig. 12).
Tap disc mounting bolts towards final drive unit.
Separate universal joint from brake disc, collect camber angle shims held on disc mounting bolts.
Jack up car sufficiently to allow removal of brake disc, lift out disc.

NOTE: Do not disturb shims mounted between final drive flange and brake disc.

Inspection

NOTE: The condition of discs are a vital factor in efficient functioning of the brakes.

Examine surface of disc, which should be smooth.
Scratches and light scoring are not detrimental after normal use.
Should doubt exist a new disc should be fitted.

Refitting

Locate new disc on mounting bolts, replace camber angle shims, fit universal joint over shims and tighten nuts to correct torque.
Check disc for run out, clamp dial test indicator to suspension unit cross-beam, position indicator rod against disc face and set reading to zero. Run out must not exceed 0,10 mm (0.004 in).
Offer brake caliper to mounting and secure with mounting bolts. Tighten to correct torque.
Check caliper centralization on brake disc. Dimensions between faces of disc and caliper abutments are to be equal within 0,25 mm (0.010 in). To adjust (if necessary) remove caliper and disc assembly, adding or withdrawing shims located between disc and axle unit output flange. Note thickness of shims added or withdrawn during this operation.

NOTE: On completion of centralization operation, (if necessary) add or withdraw a camber angle shim to size of centralization shim used in adjustment; e.g. if a 2,15 mm (0.06 in) shim was ADDED to centralization shims WITHDRAW same size shim from camber angle shims. If shims were WITHDRAWN in the centralization operation, ADD same size shim to camber angle shims. This operation corrects camber angle to that prior to the caliper centralization operation.

continued

Replace inner universal joint cover.

NOTE: Prior to fitting radius arm to body spigot, wirebrush spigot and smear with grease.
Refit radius arm locking bolt.
Wire lock caliper mounting bolts.

NOTE: Before refitting brake friction pads check pads for wear. Minimum thickness 4.0 mm (0.2 in).
Fit brake friction pads to caliper.
Refit handbrake caliper.
Fit brake feed pipe to caliper, tighten connector at three way union.
Refit suspension unit tie plate.
Bleed brakes.
Refit road wheel.
Check and if necessary adjust camber angle.

THREE-WAY CONNECTOR—REAR

Remove and refit **70.15.34**

Removing

Disconnect three feed pipe unions (1, Fig. 14) at connector, plug pipes to prevent loss of fluid and ingress of dirt.

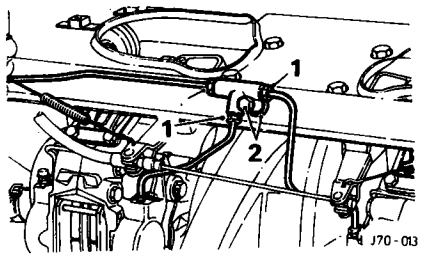


Fig. 14

Remove nut and bolt (2, Fig. 14) securing three-way connector to suspension unit, collect spacer and connector.

Refitting

Reverse removal operations, tightening nuts to correct torque and bleed system.

PRESSURE DIFFERENTIAL WARNING ACTUATOR

Remove and refit **70.25.13**

Removing

Disconnect battery.
Remove air cleaner cover and element where necessary to improve access (on R.H.D. cars only).

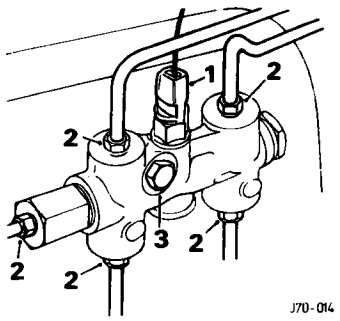


Fig. 15

Disconnect electrical lead (1, Fig. 15) from P.D.W.A. switch.
Disconnect all feed pipes (2, Fig. 15) from P.D.W.A. Plug pipes and P.D.W.A. unions to prevent loss of fluid and ingress of dirt.
Remove nut and bolt (3, Fig. 15) securing P.D.W.A. to wing valance.
Lift P.D.W.A. unit from car.

Refitting

Reverse operations above and bleed brakes.

TANDEM MASTER CYLINDER

Remove and refit **70.30.08**

Removing

Disconnect battery.
Remove reservoir cap and switch assembly (1, Fig. 16).

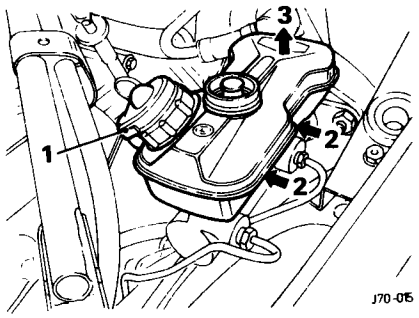


Fig. 16

Detach two spring clips and withdraw two retaining pins (2, Fig. 16).
Place suitable container in position to catch fluid.
Pull reservoir vertically away from master cylinder (3, Fig. 16).
Fit closing plugs to grommets in master cylinder ports.

NOTE: Before a master cylinder is removed from a direct acting servo it is imperative that the brake pedal is depressed and released at least 10 times. This is to ensure that no vacuum exists to operate the servo.
Operation of the servo when the master cylinder is not in place can cause its mechanism to travel past its normal limit. This can damage the servo beyond repair.
Disconnect master cylinder fluid delivery pipes, plug pipes to prevent ingress of dirt.
Remove nuts and washers securing master cylinder to servo unit.
Lift master cylinder from mounting studs.

Refitting

Fit replacement master cylinder over studs, replace washers and nuts, and tighten to correct torque.
Unplug delivery pipes and connect to master cylinder.
Prise grommets from master cylinder ports to reservoir.
Inspect ports for complete cleanliness and fit new grommets, lubricating them with brake fluid before insertion.
Press replacement reservoir into position.
Replace retaining pins and spring clips.
Fill reservoir to bottom of neck with recommended fluid (Castrol-Girling Universal Brake and Clutch Fluid).
Reconnect battery and bleed brakes.

FLUID RESERVOIR

Remove and refit **70.30.16**

Removing

Disconnect battery.
Remove reservoir cap and switch assembly (1, Fig. 16).
Detach two spring clips and withdraw two retaining pins (2, Fig. 16).
Place suitable container in position to catch fluid.
Pull reservoir vertically away from master cylinder (3, Fig. 16).
Fit closing plugs to grommets in master cylinder ports.

Refitting

Prise grommets from master cylinder ports.
Inspect ports for complete cleanliness and fit new grommets, lubricating them with brake fluid before insertion.
Press replacement reservoir into position.
Replace retaining pins and spring clips.
Fill reservoir to bottom of neck with recommended fluid (Castrol-Girling Universal Brake and Clutch Fluid).
Reconnect battery.
Bleed brakes.

PEDAL BOX

Remove and refit **70.35.03**

Removing

Disconnect battery.
Disconnect fluid delivery pipes from master cylinder, tape or plug pipes to prevent loss of fluid and ingress of dirt.
Peel cover from brake reservoir cap and disconnect leads from fluid level indicator switch.

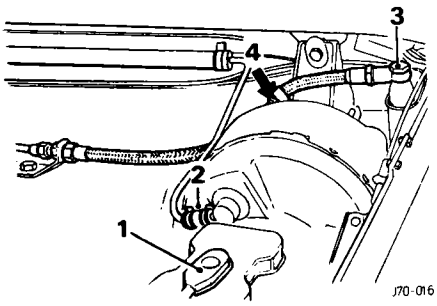


Fig. 17

Slacken clip (2, Fig. 17) securing brake vacuum hose to servo adaptor, slide hose from adaptor.

LEFT-HAND DRIVE CARS—Manual Transmission Only
Remove banjo bolt (3, Fig. 17) securing clutch slave cylinder hose to clutch master cylinder, recover copper washers and tape-up banjo union and master cylinder outlet.
Remove self-locking nut (4, Fig. 17) securing slave cylinder hose to pedal box; position hose clear of servo assembly.

RIGHT-HAND DRIVE CARS—Manual Transmission Only
Release nuts (1, Fig. 18) securing clutch feed pipe to master cylinder and slave cylinder hose, remove pipe from car. Tape-up open ends of pipe and master cylinder.

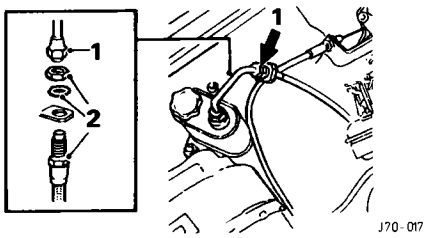


Fig. 18

Remove locknut (2, Fig. 18) securing slave cylinder hose to reservoir mounting bracket, disengage hose from bracket and tape-up open end of hose.
Remove self-locking nut (adjacent to clutch pedal housing) securing steering column lower mounting bracket to pedal box.

All Cars
Remove bolt, oval washer and spacer (1, Fig. 19) securing upper portion of pedal box to bulkhead.
Position driver's seat to rear as far as possible, remove seat cushion and lift out footwell carpets.
Remove brake stop light switch.

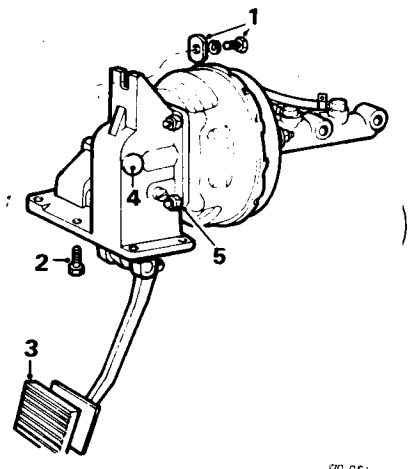


Fig. 19

Remove five bolts (2, Fig. 19) (right-hand drive cars), six bolts (left-hand drive cars), flat washers and spring washers securing pedal box base to bulkhead, recover clips retaining footwell noise absorbing mats.
Remove rubber pad (3, Fig. 19) from brake pedal.

Manual Transmission Cars Only
Remove nut and spring washer securing clutch pedal to operating lever, lift pedal from lever.

All Cars
Carefully raise servo unit, pedal box and master cylinder, draw complete assembly forward and lift from car.
Prise two rubber sealing plugs (4, Fig. 19) from sides of pedal box.
Remove split pin, washer and clevis pin securing brake pedal lever to servo operating rod.
Remove nuts (5, Fig. 19) securing pedal box to servo unit. Detach pedal box from servo unit.

Refitting

Reverse removal operations; fit new split pin to servo rod clevis pin.
Bleed clutch (manual transmission cars).
Bleed brakes.

HANDBRAKE LEVER ASSEMBLY

Remove and refit **70.35.08**

Removing

Disconnect battery.
Disconnect handbrake operating cable (1, Fig. 20) at under floor lever.

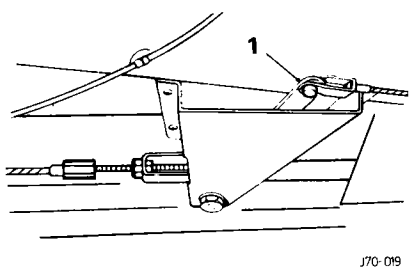


Fig. 20

Remove split pin, washer and clevis pin securing nylon roller to mounting bracket, withdraw roller.
Remove protective cover from nut securing nylon roller mounting bracket.
Remove nut securing roller mounting bracket.
Remove driver's side dash liner.
Remove steering column trim cover.

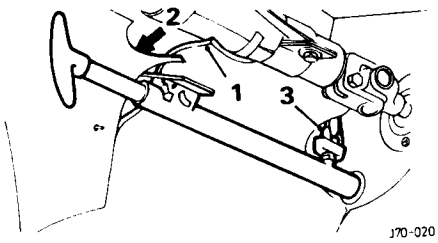


Fig. 21

Peel back trim (1, Fig. 21) covering handbrake mounting bracket securing bolts.
Remove bolts (2, Fig. 21) securing handbrake assembly to footwell side panel.
Noting terminal locations detach electrical leads (3, Fig. 21) from handbrake warning switch.

NOTE: If new handbrake assembly is to be fitted, remove warning switch from old handbrake.
Fit and adjust warning switch to new handbrake assembly.

Refitting

Reverse removal operations; fit new split pins to all clevis pins.

SERVO ASSEMBLY

Remove and refit **70.50.01**

Removing

Remove pedal box.
Remove nuts securing master cylinder to servo unit.
Detach master cylinder and vacuum pipe support bracket from servo unit.
Prise vacuum pipe connector from servo, recover rubber sealing washer.

Refitting

Reverse above operations, fit new sealing rubber to vacuum pipe connector.

HANDBRAKE CABLE ASSEMBLY

Remove and refit **70.35.16**

Removing

Set handbrake fully off.

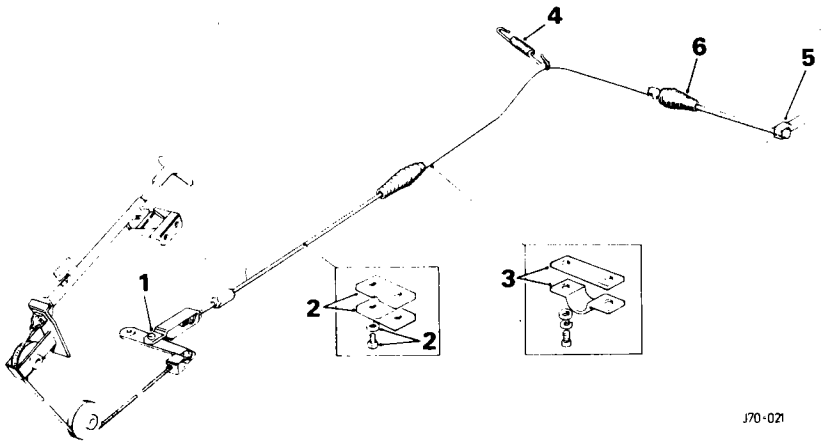


Fig. 22

Remove split pin, flat washer and clevis pin (1, Fig. 22) securing front yoke to lever.
Remove guide (2, Fig. 22) securing handbrake inner cable to underside of car body.
Remove guide (3, Fig. 22) securing outer cable to underside of car body.
Release guide spring (4, Fig. 22) from outer cable.
Remove split pin, flat washer and clevis pin (5, Fig. 22) securing rear yoke to handbrake caliper operating lever.
Slide rubber grommet (6, Fig. 22) clear of opposite handbrake lever, detach cable from lever.
Remove cable from car.

Refitting

Reverse removal operations; fit new split pins to clevis pins.
Check handbrake and adjust if necessary.

NON-RETURN VALVE

Remove and refit **70.50.15**

Removing

Slacken clips securing vacuum hoses to non-return valve.
Pull hoses from non-return valve, lift valve from car.

Refitting

Prior to refitting, blow through valve to test one way action.
Ensuring arrow stamped on barrel of valve points away from manifold vacuum hose, fit valve to hoses.
Fully tighten hose securing clips.

FRONT CALIPER

Remove and refit **70.55.02**

Removing

Slacken feed pipe union at caliper and disconnect feed pipe union (1, Fig. 23) at support bracket; plug pipe to prevent loss of fluid and ingress of dirt.

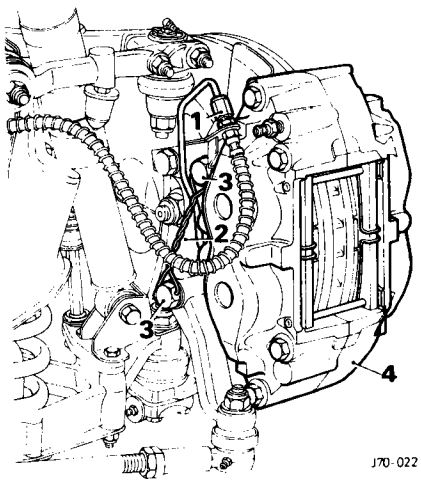


Fig. 23

Remove locking wire (2, Fig. 23) securing caliper mounting bolts.

CAUTION: Do not under any circumstances remove the four setbolts securing the two halves of caliper together.

Remove caliper mounting bolts (3, Fig. 23), note position and number of shims located between steering arm and caliper.
Withdraw caliper (4, Fig. 23) from disc.

Refitting

If original caliper is to be refitted, reverse removal operations, ensuring that shims are correctly replaced; if new caliper is fitted, carry out caliper/disc centralization.
Tighten mounting bolts to correct torque.
Bleed brakes.

REAR CALIPER

Remove and refit **70.55.03**

Removing

Remove handbrake caliper.
Slacken caliper feed pipe union at three-way connector (1, Fig. 24).

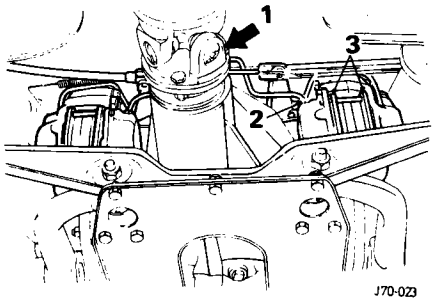


Fig. 24

Disconnect feed pipe at caliper (2, Fig. 24), swing pipe clear of caliper, plug holes to prevent ingress of dirt and loss of fluid.
Remove brake friction pads (3, Fig. 24).
Remove lock wire securing caliper mounting bolts.

CAUTION: Do not under any circumstances remove the four set bolts securing the two halves of caliper together.

Remove caliper mounting bolts.
Slide caliper around brake disc and withdraw through gap exposed by removal of tie plate.

Refitting

Offer caliper to mountings, fit mounting bolts and tighten to the correct torque.
Check that caliper is central of disc. Adjust as necessary, by adding or withdrawing brake disc shims.

NOTE: If adjustment is carried out camber angle must be checked as a final operation.

Wire lock caliper mounting bolts.

NOTE: Prior to fitting friction pads, check pads for wear, the minimum thickness being 4.0 mm (0.2 in)
Replace pads, feed pipe and handbrake caliper.
Bleed brakes.

HANDBRAKE MECHANISM

Remove and refit **70.55.04**

Removing

Place car on ramp; remove nuts and bolts securing tie plate to suspension unit, lift off tie plate.
Ensure handbrake is fully off. Remove clevis pin securing handbrake cable to caliper operating lever.
Detach handbrake cable from remaining operating lever (1, Fig. 25).

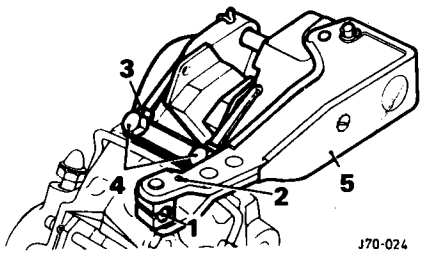


Fig. 25

Unclip return spring from handbrake operating lever (2, Fig. 25).
Bend back locking tabs (3, Fig. 25) securing handbrake caliper mounting bolts. Remove mounting bolts, tab washer and retraction lever (4, Fig. 25).
Slide caliper (5, Fig. 25) around brake disc and withdraw through gap exposed by removal of tie plate.

Refitting

If new pads are fitted, or mechanism overhauled, adjust caliper. Holding one pad carrier, rotate remaining one to give a dimension of 19,0 mm (0.75 in) between pad surfaces.
Refit caliper, mounting bolts and locking nuts.
Operate actuating lever until adjuster ratchet ceases to click, this adjusts pads to correct clearance.
Reverse remaining removal operations.

HANDBRAKE PADS

Remove and refit **70.40.04**

Removing

Remove handbrake caliper.
Remove nut and spring washer (1, Fig. 26) securing pads to brake pad carriers, remove pads (2, Fig. 26).

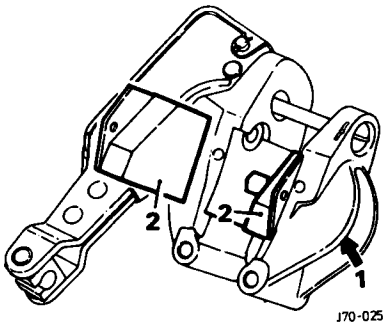


Fig. 26

Refitting

Holding one pad carrier, wind remaining one out two or three turns.
Fit new brake pads to carrier using new nut and spring washer.
Refit handbrake caliper.
Operate handbrake several times to adjust pads to correct clearance.

RESERVAC TANK (when fitted)

Remove and refit **70.50.04**

Removing

Jack up car, support on stands, and remove right hand front wheel.
Remove horn relay (1, Fig. 27).

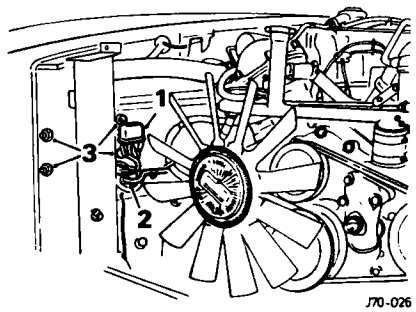


Fig. 27

Disconnect vacuum hose (2, Fig. 27) from reservac tank.
Remove nuts (3, Fig. 27) from securing straps, mounting reservac to wing valance.

Refitting

Reverse removal operations.

TANDEM MASTER CYLINDER

Overhaul **70.30.09**

Remove master cylinder.

NOTE: Overhaul of the master cylinder should be carried out with the work area, tools and hands in a clean condition.

Dismantling

Using suitable screwdriver, lever sealing grommets (1, Fig. 28) from master cylinder.

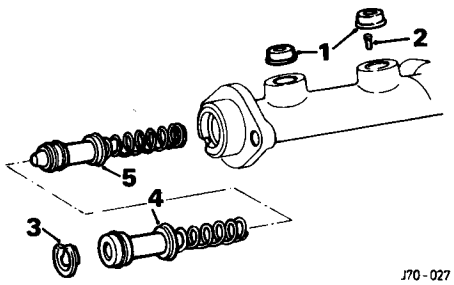


Fig. 28

Press primary piston into bore of cylinder and withdraw secondary piston stop pin (2, Fig. 28) from forward grommet housing.
Remove circlip (3, Fig. 28).
Tap flange end of cylinder on wooden block to remove primary piston and spring (4, Fig. 28), secondary piston and spring (5, Fig. 28).
It may prove necessary to feed compressed air into cylinder front delivery port.

NOTE: Once the piston assemblies are withdrawn the appropriate piston and spring must be kept together.
In the event of the springs being mixed, the secondary piston spring can be easily identified, it being slightly thicker and longer than the primary spring.

Remove spring, spring seat, recuperating seal and washer from secondary piston (1, Fig. 29).

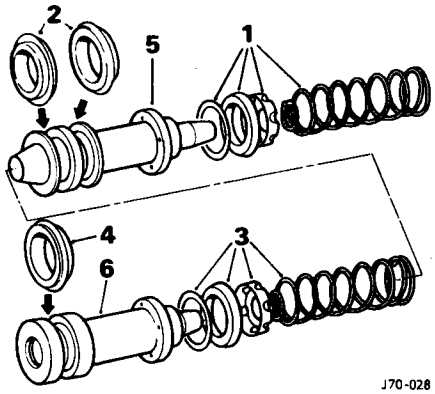


Fig. 29

Carefully prise seals (2, Fig. 29) from rear of secondary piston.
Remove spring, spring seat, recuperating seal and washer from primary piston (3, Fig. 29).
Carefully prise seal (4, Fig. 29) from rear of primary piston.
Discard all old seals and associated items that will be replaced by those contained within service kit.

continued

Inspection

Clean all parts with Girling cleaning fluid and dry with lint-free cloth.
Examine piston and bore of cylinder for visible score marks and corrosion.
If doubt exists as to condition of components, replace suspect item.

Reassembling

WARNING: To help prevent damage it is essential that generous amounts of clean brake fluid are used at all stages of seal assembly.

Carefully fit inner seal of secondary piston in locating groove, ensure seal lip faces forwards.
Fit remaining seal in locating groove, ensure seal lip faces towards primary piston, i.e. in opposite direction to seal.
Fit washer, recuperating seal, spring seat and spring over forward end of secondary piston.
Carefully fit rear seal of primary piston in locating groove, ensure seal lip faces forward, i.e. away from circlip.
Fit washer, recuperating seal, spring seat and spring over forward end of primary piston.
Generously lubricate bore of master cylinder with clean brake fluid.

WARNING: Adherence to the following instruction is vitally important. Failure to comply will result in damaged piston seals.

Secure master cylinder in vice and generously lubricate piston seals in new brake fluid. Offer secondary piston assembly (5, Fig. 29) to cylinder till recuperating seal rests centrally in mouth of cylinder. Ensuring seal is not trapped, slowly rotate and rock piston assembly whilst GENTLY introducing piston into cylinder bore.
Once recuperating seal enters bore of cylinder SLOWLY push piston into bore in one continuous movement.
Repeat lubrication and insertion with primary piston and spring (6, Fig. 29).
Pressing piston into bore of cylinder, fit circlip (3, Fig. 28).
Press primary piston into bore of cylinder to full extent, fit secondary piston stop pin (2, Fig. 28).
Fit sealing grommets (1, Fig. 28), master cylinder, lubricating with brake fluid.
Refit master cylinder.

PEDAL BOX

Overhaul **70.35.04**

Remove pedal box, see operation 70.35.03.

Dismantling

Carefully drift lower pivot shaft (1, Fig. 30) from pedal box, recover nylon washers from either side of lever boss (2, Fig. 30).

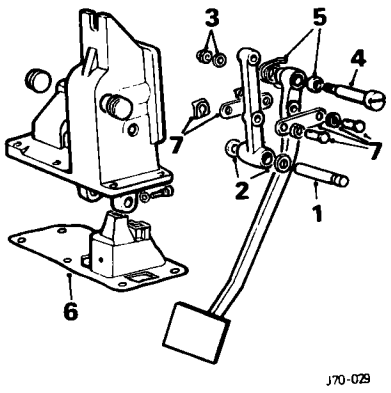


Fig. 30

Remove self-locking nut and flat washer (3, Fig. 30) securing pedal lever upper pivot shaft.
Using narrow drift, carefully remove upper pivot shaft (4, Fig. 30) from lever and pedal box.
Withdraw pedal lever assembly from box, recover nylon washers and return spring (5, Fig. 30).
Remove rubber boot (6, Fig. 30) by turning boot inside out and withdrawing over upper portion of levers.
Remove retaining clips, clevis pins and spring washers (7, Fig. 30) securing link arms to pedal levers.

Inspection

Clean all pedal lever components.
Examine pivot shafts, clevis pins, bushes and thrust washers for wear. Should doubt exist as to condition a new component must be fitted.

Reassembling

Slightly coat pivot shafts and thrust washers with grease.
Fit link arms to pedal lever, secure with clevis pins, spring washers and retaining clips (1, Fig. 31).

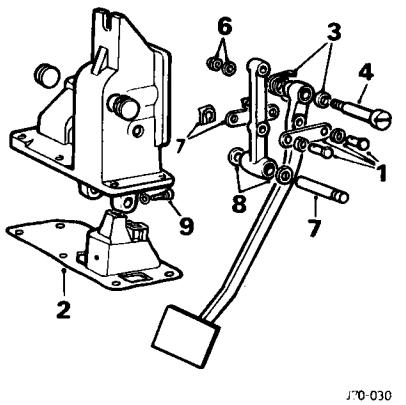


Fig. 31

Slide rubber boot (2, Fig. 31) over pedal levers, ensure that hole with side extensions fits over long pedal lever.
Position pedal lever return spring (3, Fig. 31) over extended boss of long lever, raise neck of rubber boot and locate spring hook over lever.
Position upper pivot shaft (4, Fig. 31) in one side of pedal box, enter shaft sufficient to allow nylon washer to locate on threaded portion of shaft.
Enter lever assembly into box, ensure return spring leg locates in guide channel.
Align pedal lever upper boss with upper shaft.
Enter shaft into boss, adjust nylon washer to locate over shaft.
Position second nylon washer between pedal box and extended boss of pedal lever.
Carefully push upper shaft fully home.
Position flat washer over shaft and secure with new locknut (6, Fig. 31).
Check operation of pedal lever, ensure lever operates freely.
Align small lever pivot boss with pedal box shaft mountings.
Ensuring that the groove in the lower pivot shaft aligns with the retaining pin locating hole, enter the shaft (7, Fig. 31) into the box.
Locate nylon washers (8, Fig. 31) on either side of lever boss and push pivot shaft fully home.
Align pivot shaft groove with retaining pin hole, test fit retaining pin (9, Fig. 31).
Check condition of servo/pedal box gasket and if necessary fit new gasket.
Refit pedal box.

SERVO ASSEMBLY

Overhaul **70.50.06**

The servo assembly is a sealed unit and overhaul is not possible. Should the operation of the servo unit deteriorate to an extent where braking efficiency is affected, a replacement unit must be fitted.

BRAKE CALIPER—FRONT

Overhaul **70.55.13**

Service tool: Piston clamp 18G 672

Remove front friction pads.
Remove front caliper.
Thoroughly clean caliper with Girling brake cleaner.

Dismantling

CAUTION: Under no circumstances must caliper halves be separated.

Remove spring clips (1, Fig. 32) securing piston dust covers.
Remove covers (2, Fig. 32) from pistons (3, Fig. 32).
Fit piston clamp to any half of caliper.
To expel pistons carefully feed compressed air into caliper fluid inlet port.
Remove pistons from caliper.

WARNING: Extreme care must be taken not to damage cylinder bore when extracting seals.

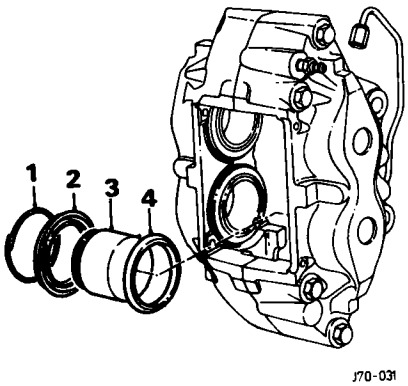


Fig. 32

Carefully prise seals (4, Fig. 32) from recess in cylinder wall.

Inspection

Using Girling brake cleaner thoroughly clean piston, cylinder bore and seal groove.
Examine piston and cylinder bore for signs of corrosion or scratches. Should doubt exist as to condition a new component must be fitted.

Assembling

Coat new seals in Girling brake disc lubricant.
Using fingers ONLY fit new seals (1, Fig. 33) to recess in cylinder bore.

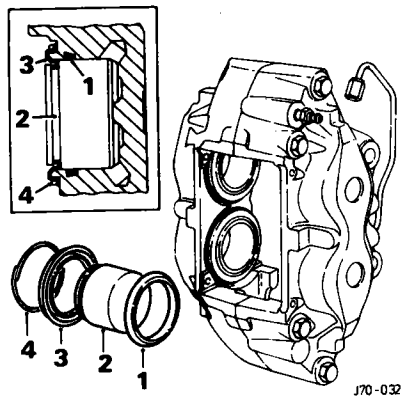


Fig. 33

Coat piston in clean disc brake lubricant.
Enter pistons (2, Fig. 33) into cylinder bores.
Fit new dust covers (3, Fig. 33) over pistons.
Push pistons fully home.
Locate dust cover over rim in caliper, secure with spring clips (4, Fig. 33).
Release piston clamp and fit to opposite half of caliper.
Repeat applicable operations on remaining two pistons.
Refit caliper to car.

BRAKE CALIPER—REAR

Overhaul **70.55.14**

Service tool: Piston clamp 18G 672

Remove rear brake caliper, see operation 70.55.03.
Thoroughly clean caliper using Girling cleaning fluid.

Dismantling

CAUTION: Under no circumstances must the caliper halves be separated.

Fit piston clamp to retain one piston in location.
Carefully feed compressed air into caliper fluid inlet port expelling one piston (3, Fig. 34).

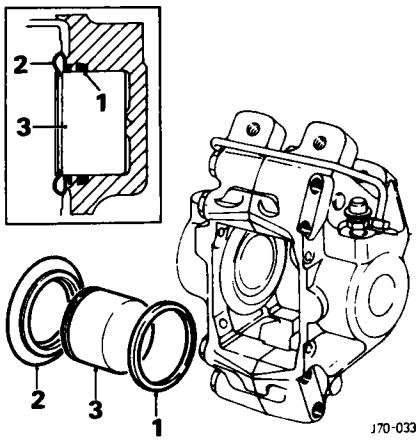


Fig. 34

Remove dust seal (2, Fig. 34) from piston and caliper cylinder bore.

WARNING: Extreme care must be taken not to damage the cylinder bore when extracting seal.

Carefully prise seal (1, Fig. 34) from recess in cylinder bore.

Inspection

Using Girling brake cleaner thoroughly clean piston, cylinder bore and seal recess.
Examine piston and cylinder for signs of corrosion or scratches. Should doubt exist as to condition, a new component must be fitted.

Assembly

Coat new seal with Girling disc brake lubricant.
Using 'fingers' ONLY fit new seal to recess in cylinder bore.
Locate dust cover in outer groove in cylinder bore.
Coat piston in clean disc brake lubricant.
Enter piston into cylinder bore through dust seal.
Locate dust seal into groove in piston.

Release piston clamp and fit to opposite side of caliper to press 'services' piston fully home.
Repeat applicable operations on remaining cylinder piston.
Remove piston clamp.
Refit rear brake caliper to car.