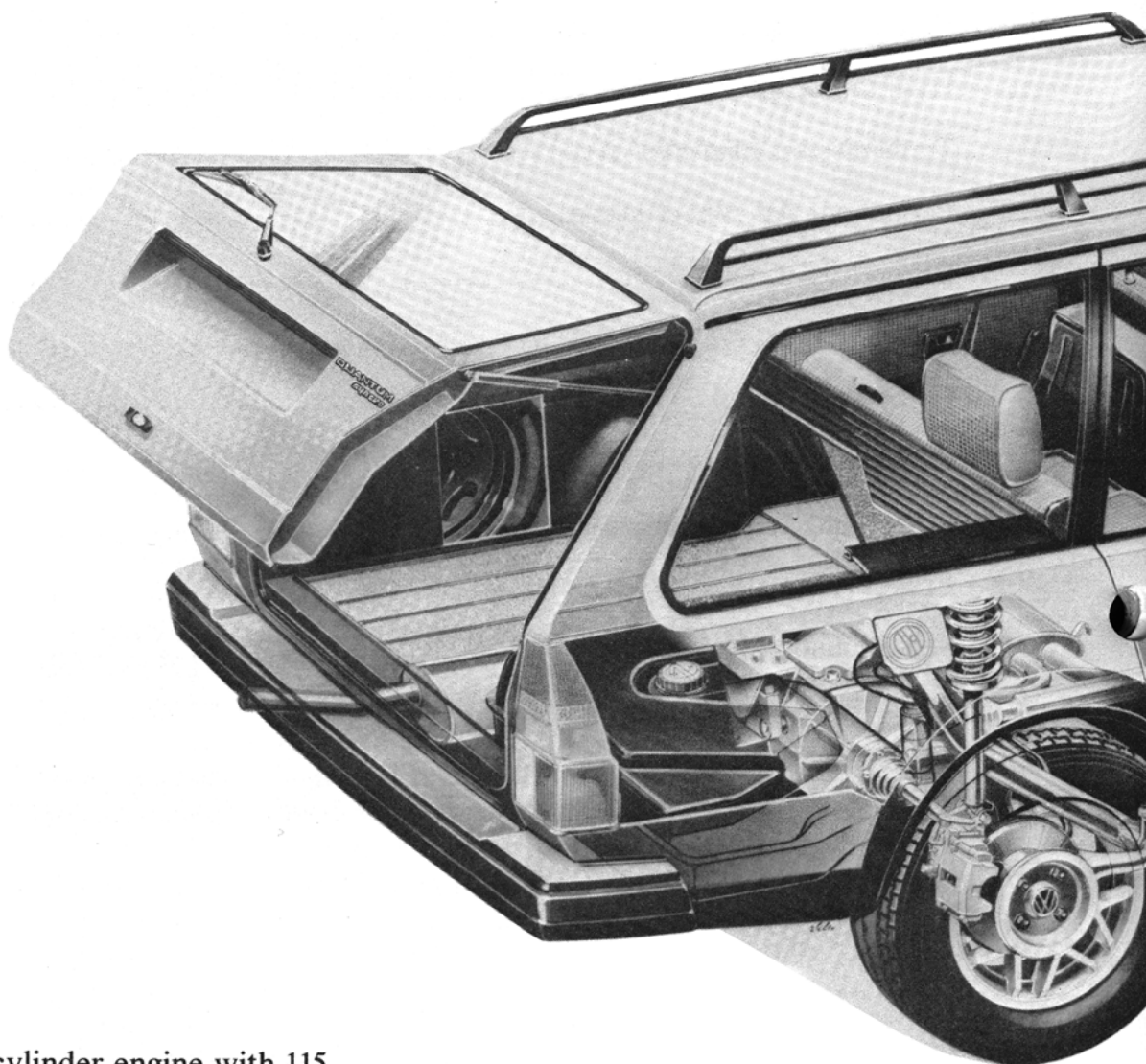


Special Features .....	2
Engine .....	4
Fuel System .....	5
Exhaust System .....	7
Hydraulic Clutch .....	8
Transmission Features .....	9
Permanent All Wheel Drive .....	14
Differential Locks .....	18
Driveshaft .....	28
Front Suspension .....	30
Rear Suspension .....	31
Wheel and Tire Specifications .....	37
Brakes .....	38
Self Adjusting Handbrake .....	40
Brake Pressure Regulator .....	45
Special Tools .....	46

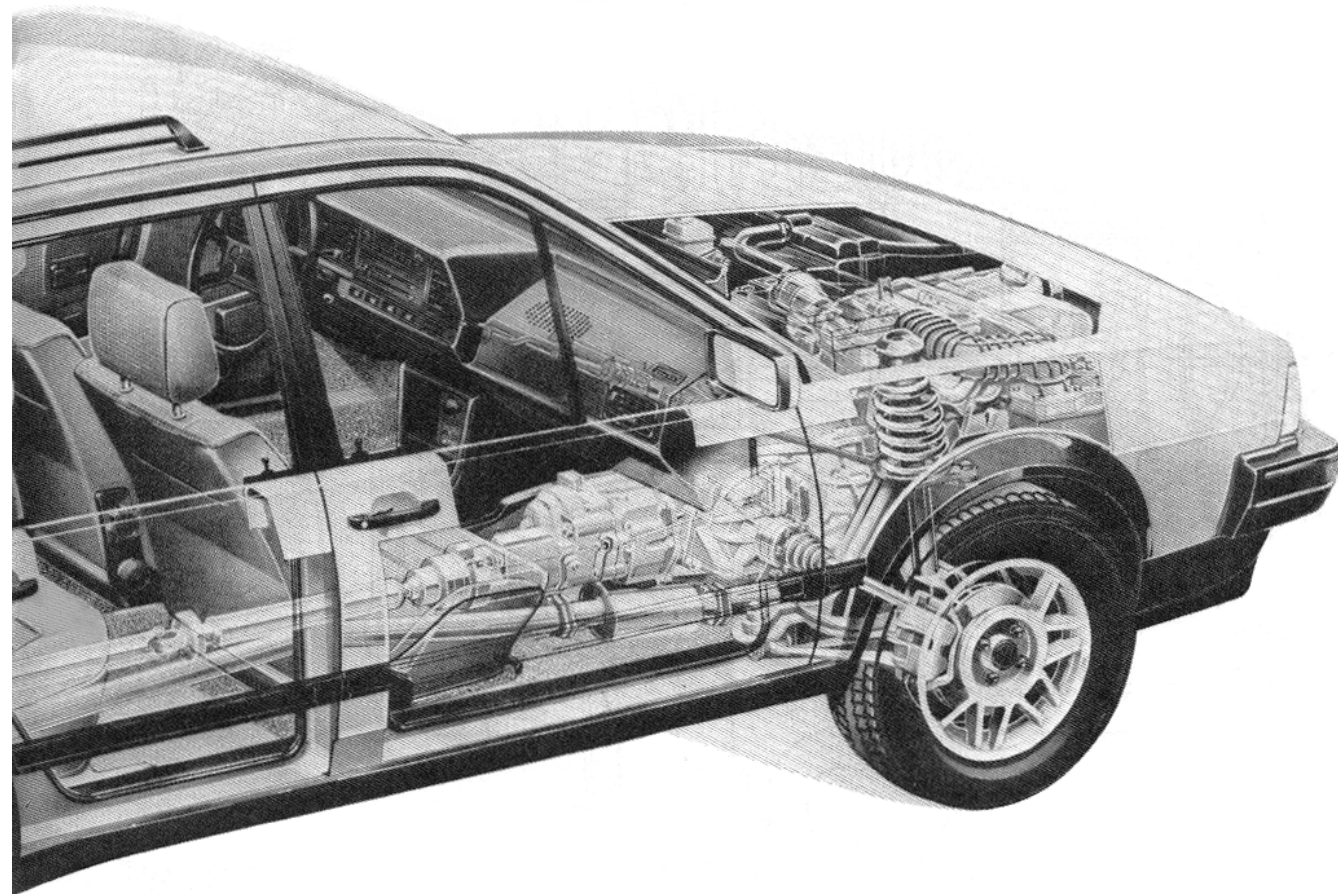
# Special Features

---

The Quantum Syncro combines the outstanding advantages of permanent all wheel drive with a number of exclusive features.



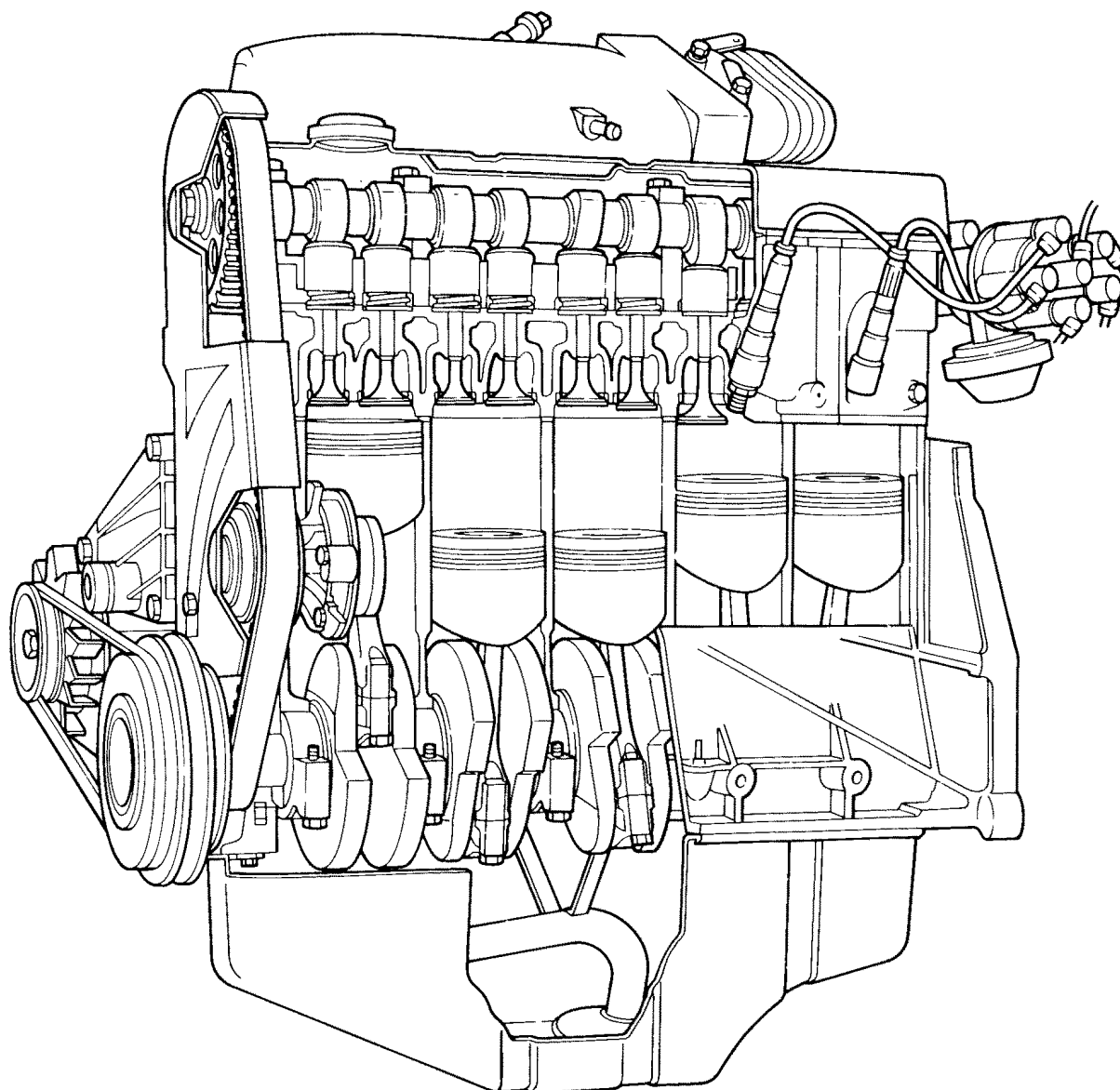
- Powerful 2.2 liter, 5 cylinder engine with 115 horsepower.
- 18.5 gallon fuel tank.
- Hydraulically operated clutch.
- Close ratio 016 5-speed manual transmission.
- Permanent all wheel drive with individual center and rear differential lock engagement.
- Power steering.
- Four wheel disc brakes with asbestos free brake pads.



- Track correcting, semi-trailing control arm rear suspension.
- Dual brake circuit with self-adjusting hand-brake.
- Black roof rails, rain channels, window frame trim and wheel housing moldings.
- Large front spoiler and wide belt moldings.
- 6J x 14 light alloy wheels with 195 x 60HR 14 tires.

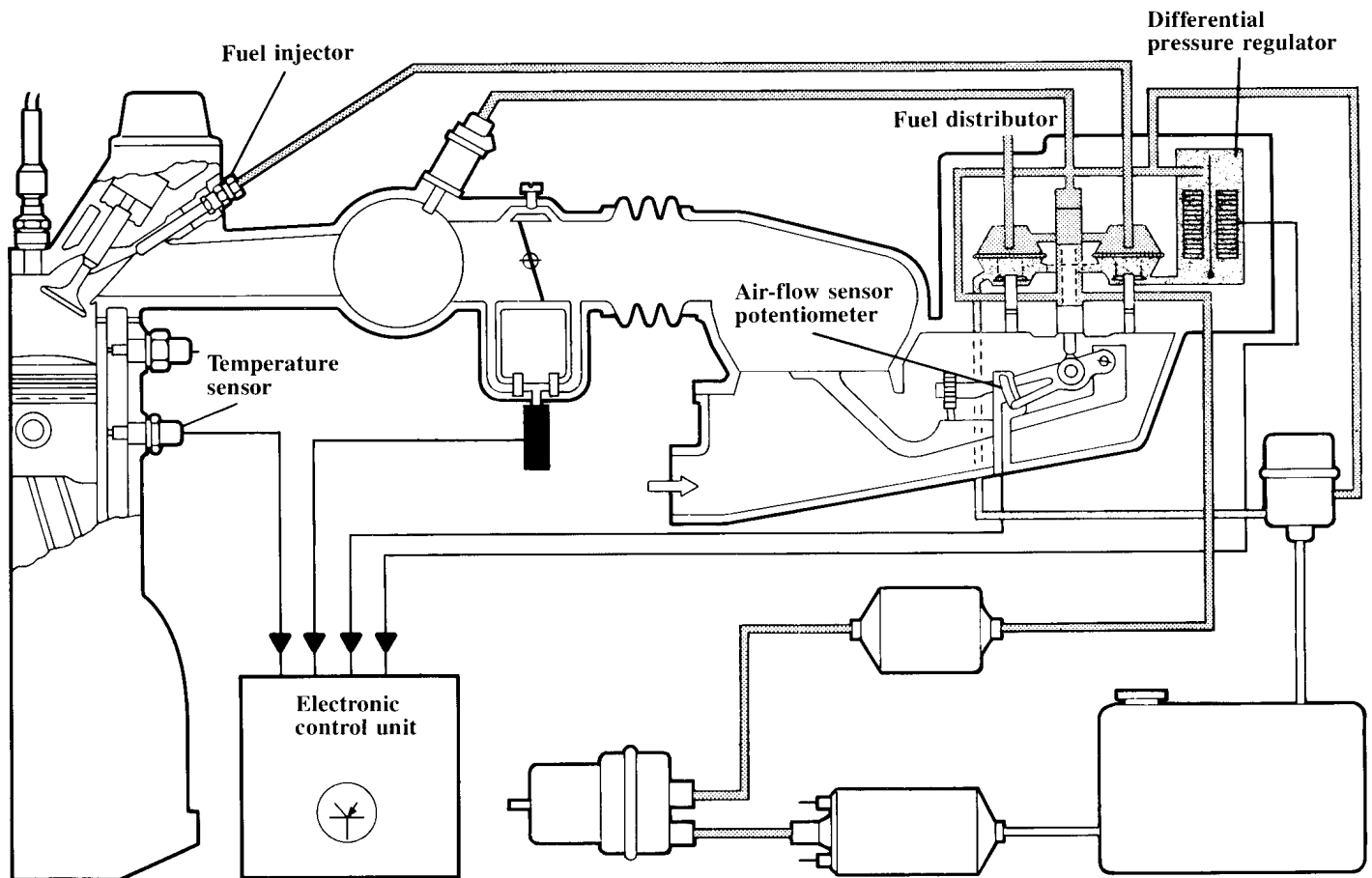
# Engine

---



The Quantum Syncro continues to use the reliable 2.2 liter, 5 cylinder engine used in the GL Sedan. Improvements in the exhaust system, the use of a larger intake air filter housing, and a modified ignition advance curve have resulted in higher horsepower output.

Bore	3.19" (81.0mm)
Stroke	3.4" (86.4mm)
Displacement	136 C.I. (2226cc)
Compression Ratio	8.5 to 1
H.P. @ RPM (SAE net)	115 @ 5500
Max. Torque Lbs.-Ft. @ RPM	126 @ 3000



The Syncro features CIS-Electronic Fuel Injection with electronically controlled idle stabilization.

Idle Speed  $800 \pm 70$  @  $28\% \pm 2\%$  duty cycle of idle stabilization valve.

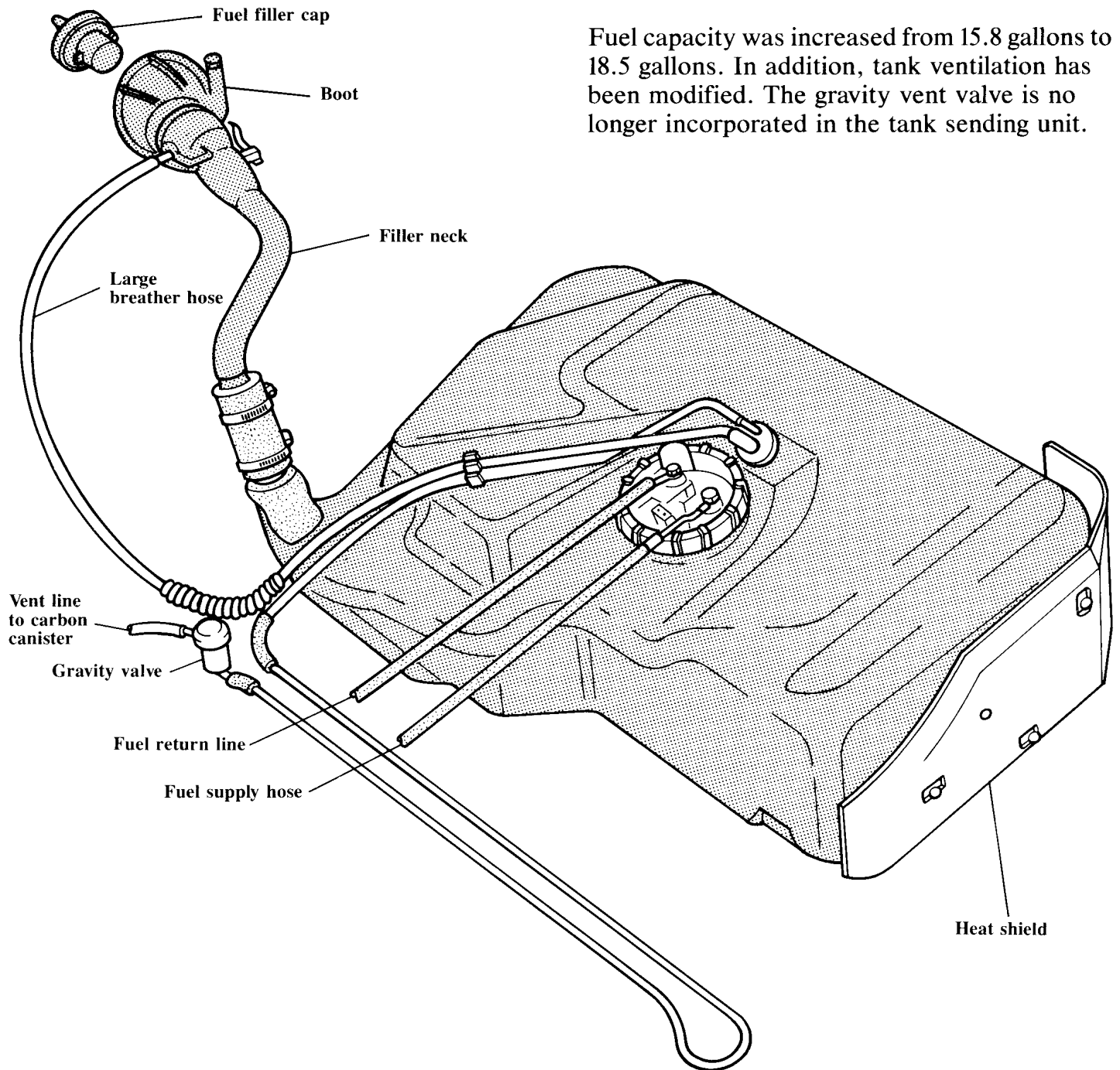
Ignition Timing  $6^\circ \pm 2^\circ$  BTDC

The system also features deceleration fuel shutoff along with altitude compensation.

Idle mixture (CO% content)  $0.75\% \pm .045\%$

Note:  
mA value fluctuates. See Quantum Repair Manual Microfiche for adjustment specification and procedure.

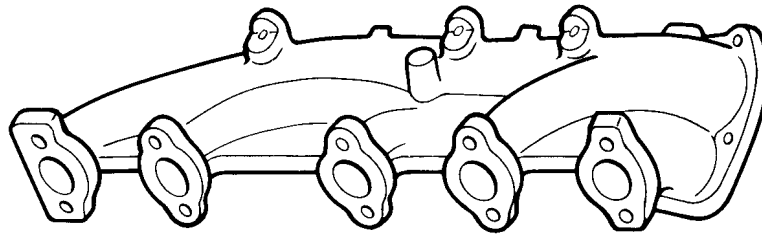
# Fuel System



Fuel capacity was increased from 15.8 gallons to 18.5 gallons. In addition, tank ventilation has been modified. The gravity vent valve is no longer incorporated in the tank sending unit.

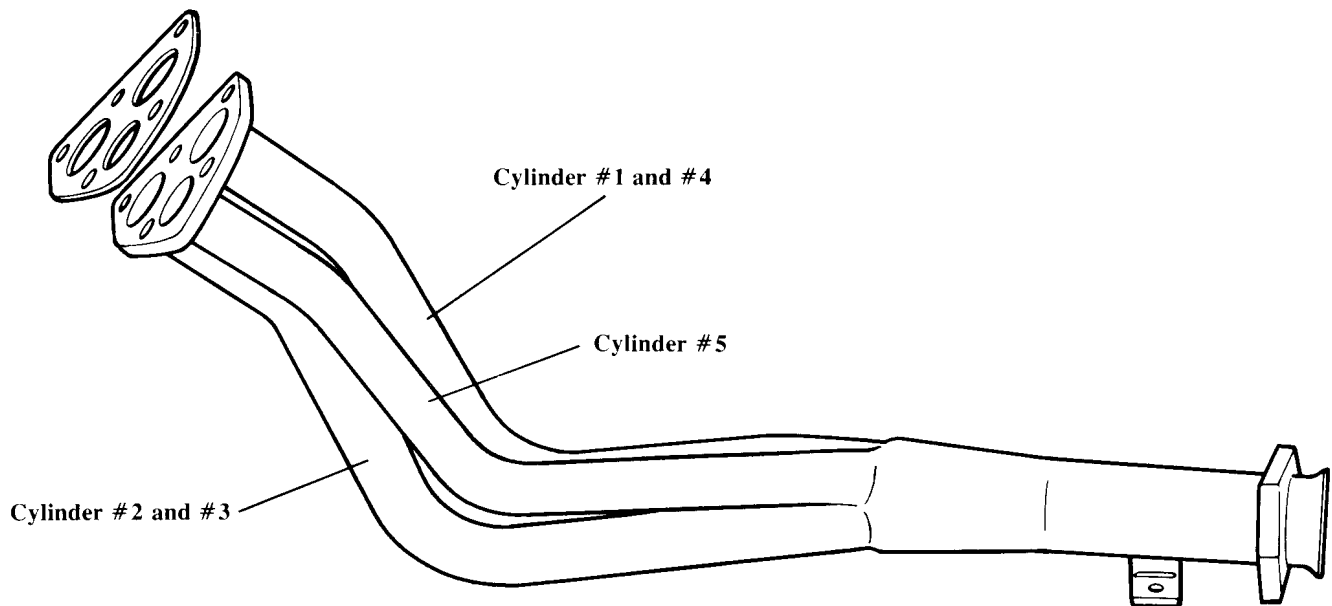
Any vapors in the tank are routed through a vent line through the gravity valve to the carbon canister in the right front wheel housing.

# Exhaust System

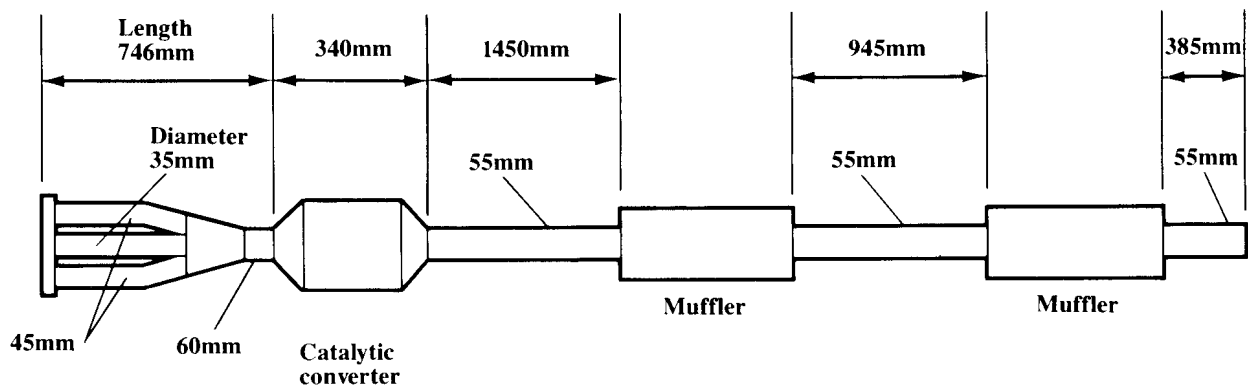


Part of the increase in horsepower is the result of a new exhaust manifold and collector pipe. The triple pipe manifold is made of special gray cast iron and is lighter than a conventional twin pipe manifold in spite of its three outlets.

The triple pipe exhaust manifold makes it possible to separate the exhaust gases coming from the cylinders. Because of this arrangement, engine breathing has been improved.

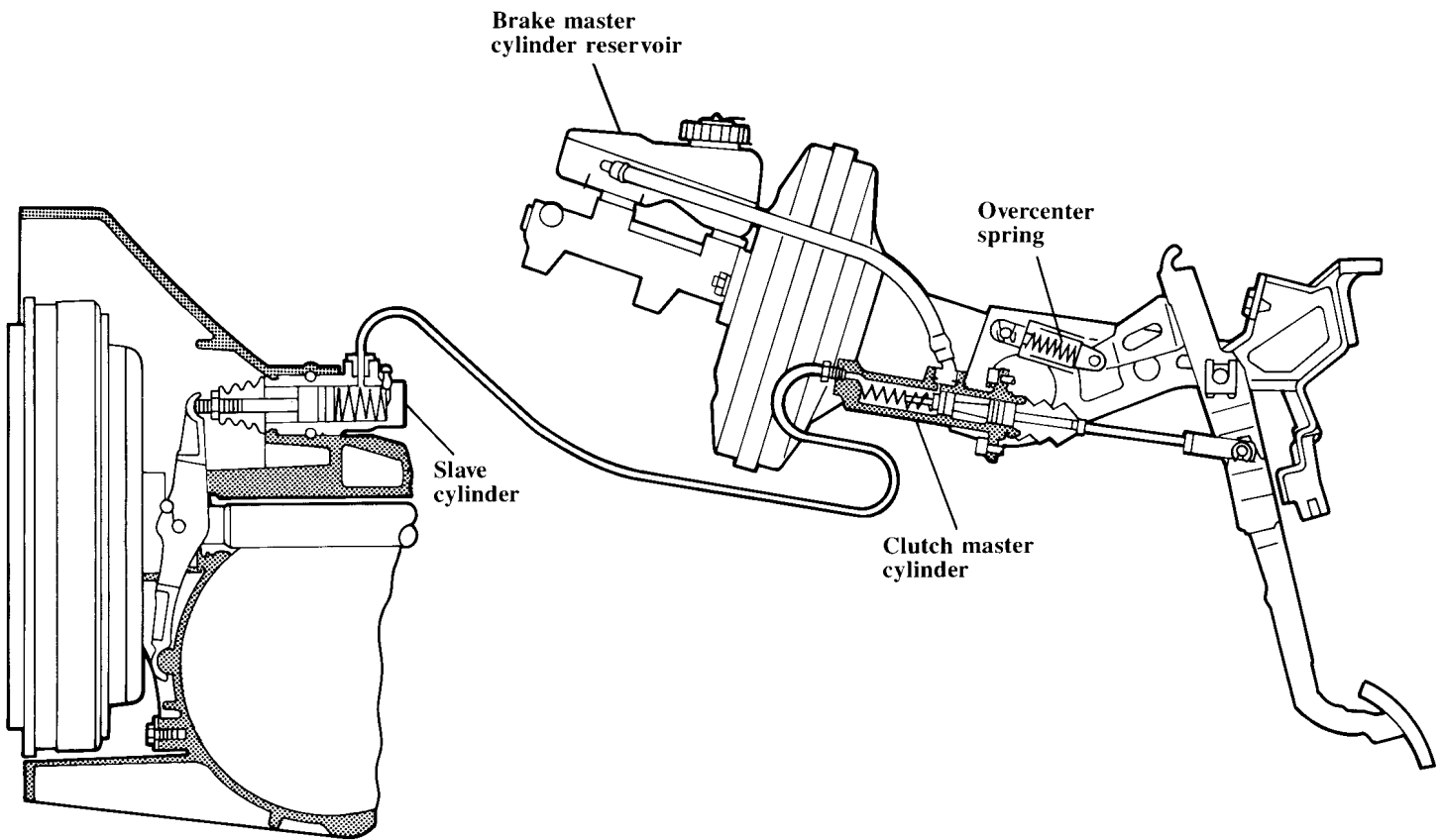


Additional attention to detail in exhaust system component length and diameter has further enhanced the engine's breathing capability.



# Hydraulic Clutch

---



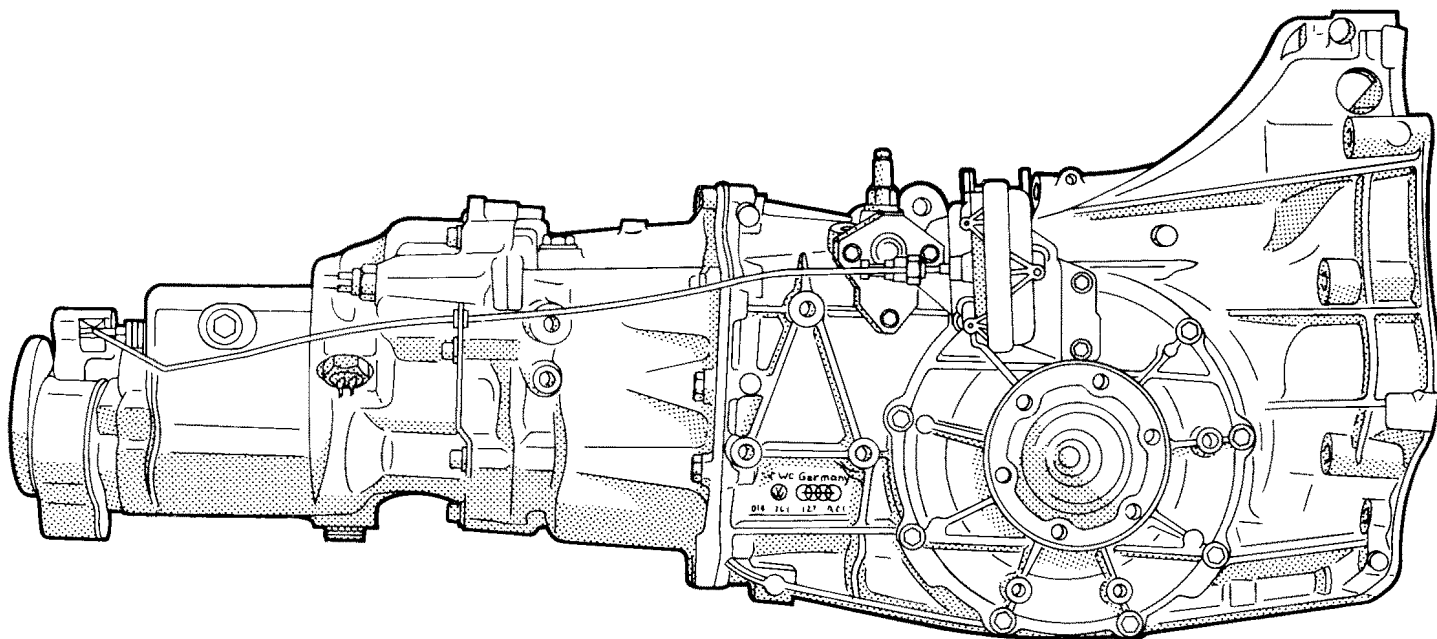
The Quantum Syncro is equipped with a hydraulically operated clutch. As in the past, an overcenter spring assists foot pressure when depressing the pedal.

To operate the clutch, brake fluid from the brake master cylinder reservoir is used. When the clutch pedal is depressed, the piston in the master cylinder forces fluid into the slave cylinder.

The piston in the slave cylinder moves the clutch release bearing and the clutch is disengaged.

There is a spring in the slave cylinder that insures that the clutch release bearing rests constantly on the clutch diaphragm spring. This feature eliminates the need for clutch adjustment.





The 016 transmission used in the Quantum Syncro is all new for Volkswagen.

This transmission features synchronizers in all forward gears and also in reverse.

The standard production transmission was modified to allow the addition of a center

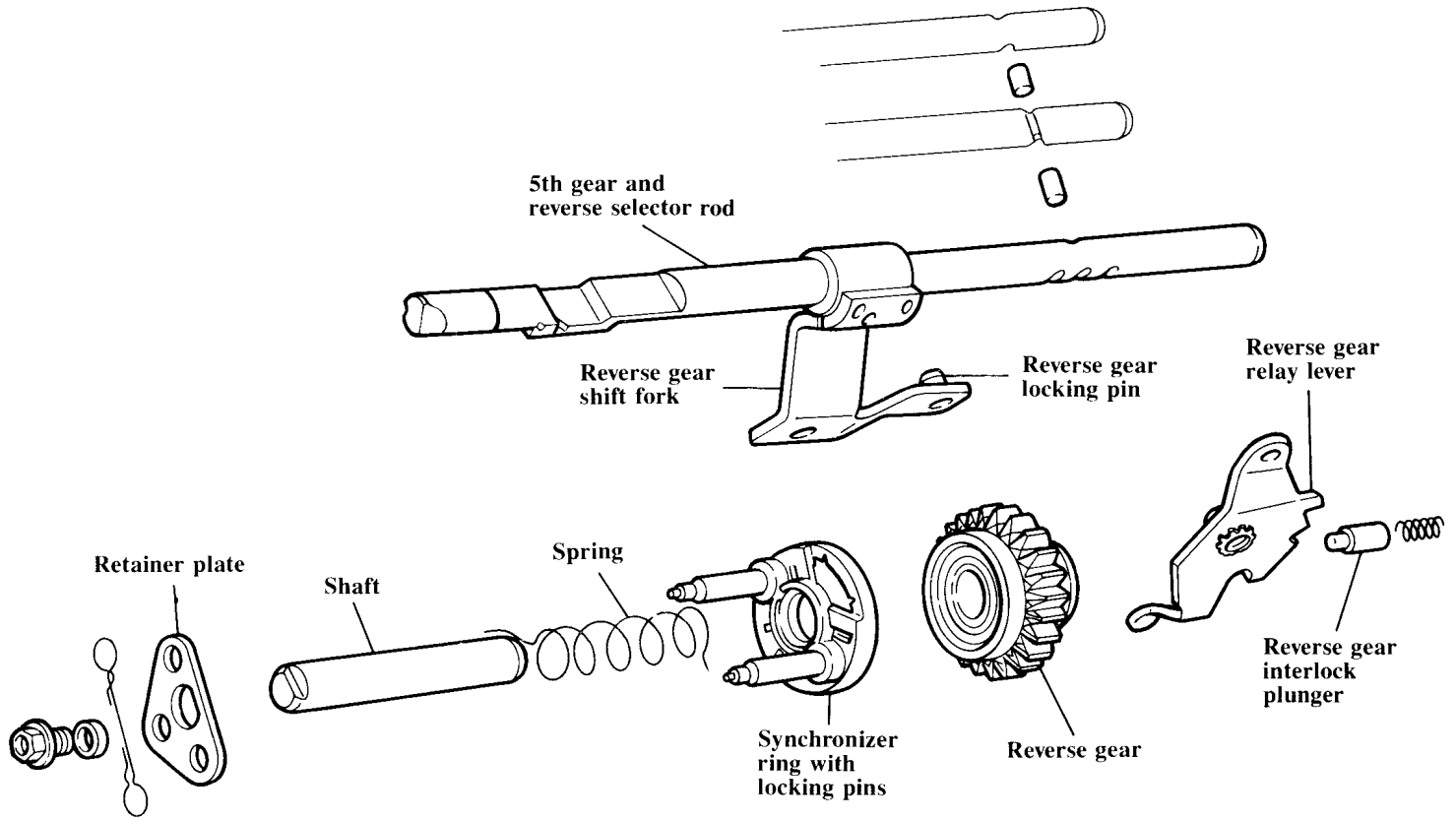
differential and a driveshaft to the rear wheels. This compact package requires only a minimum number of additional components which means only a small increase in weight.

Gear ratios for the 016 have been carefully determined to meet the needs of the Syncro.

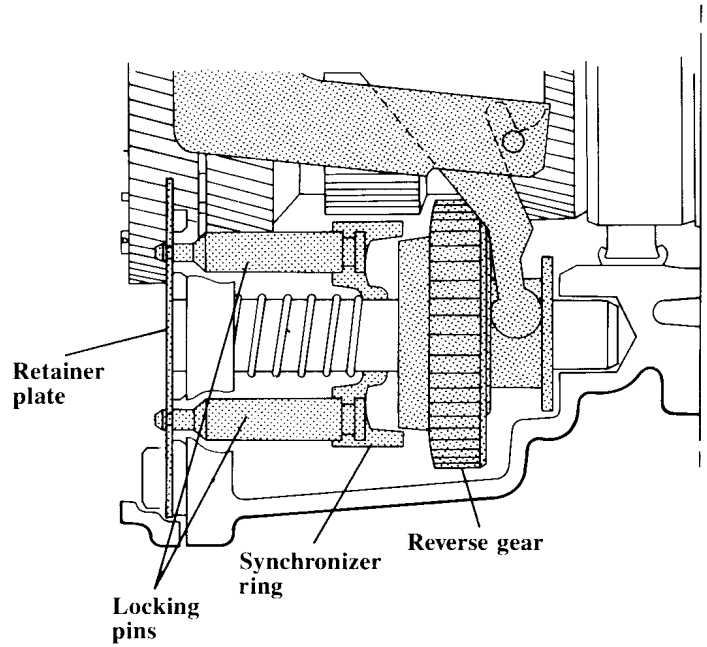
#### Gear ratios

Code No.	1st gear	2nd gear	3rd gear	4th gear	5th gear	Reverse gear	Final drive
AAU	3.60	2.13	1.46	1.07	0.83	3.50	4.11

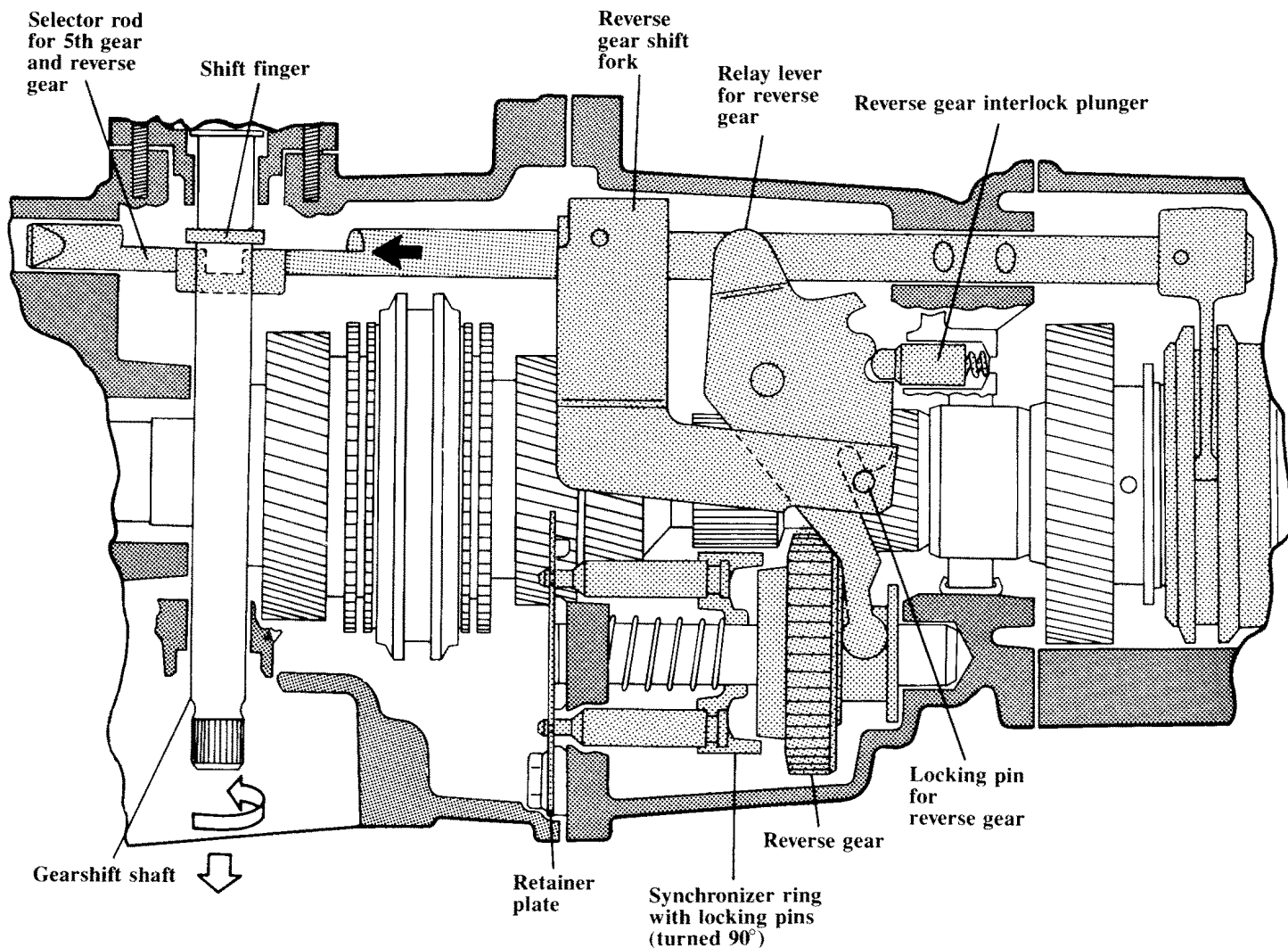
# Reverse Gear



The 016 transmission features a unique synchronizer for reverse gear. This design uses a synchronizer ring with lock pins and a reverse gear with a tapered synchronizer surface. Because this is the only gear in the transmission that is not in constant mesh, a synchronizer is beneficial in allowing smooth and quiet engagement of reverse gear.



# Reverse Gear Engagement

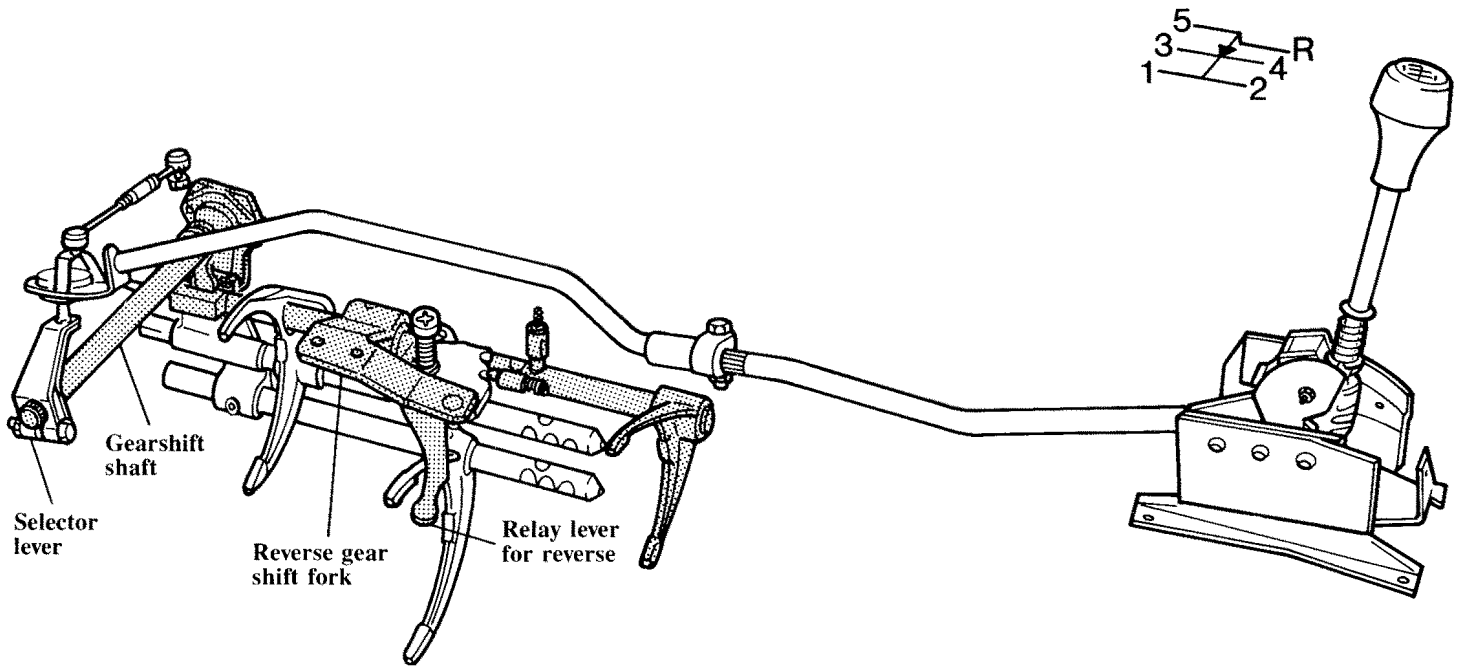


When reverse gear is selected, the gearshift shaft rotates, and the shift finger moves the selector rod for reverse to the left.

The locking pin on the reverse gear shift fork engages the relay lever, and the relay lever pulls reverse gear into engagement.

The retainer plate keeps the synchronizer ring from turning because the pins go through holes in the plate. The locking pins become centered in the retainer plate as spring pressure is exerted, and reverse gear is stopped so it engages quietly.

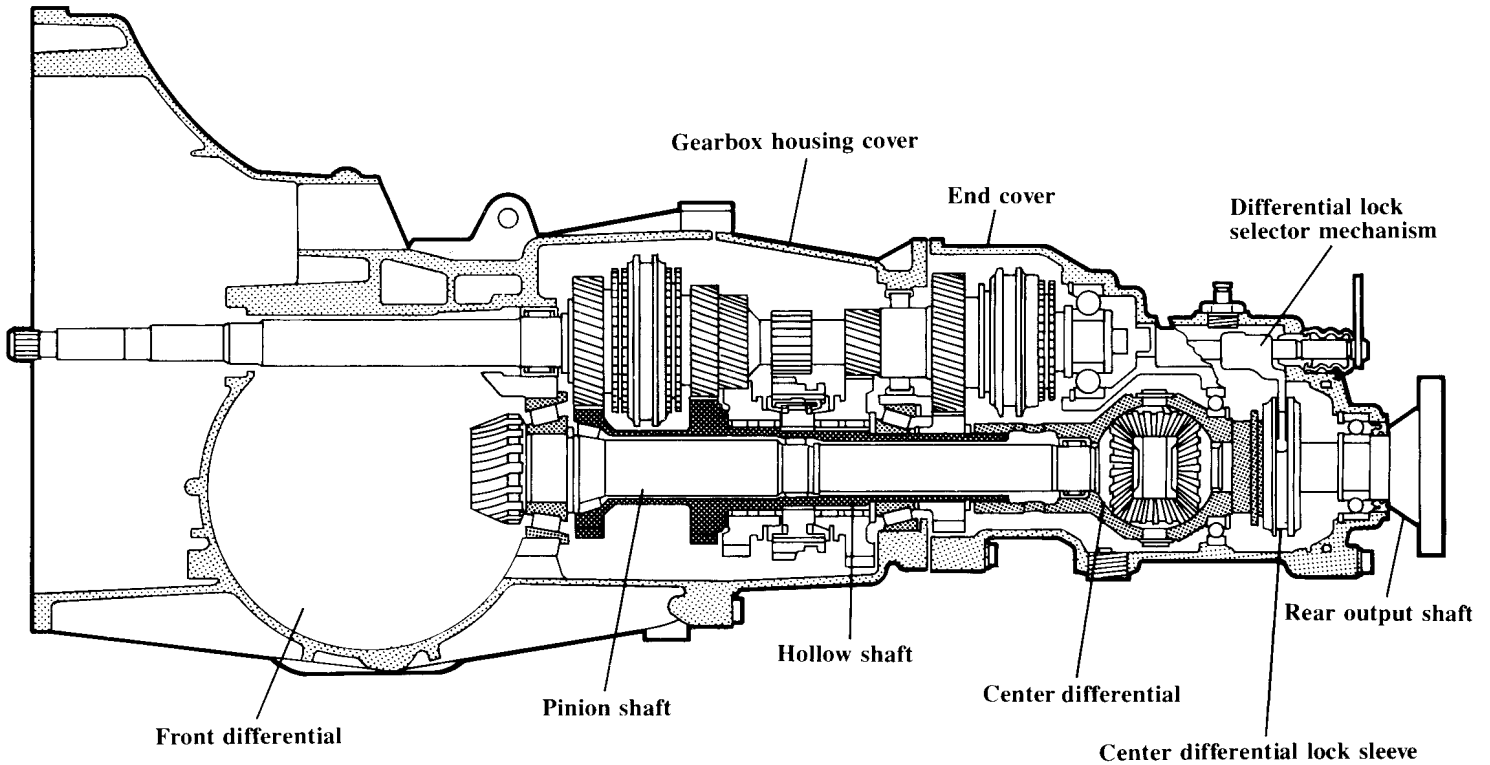
# Shift Mechanism



The shifter for the 016 transmission is connected to the gearshift shaft located inside the transmission housing cover. During gear selection, the shift finger on the gearshift shaft engages the appropriate selector rod.

The detent for 5th gear and side pressure spring are incorporated into the gearshift shaft assembly.

Although the shift fork for 5th gear and the shift fork for reverse gear are located on a common selector rod, the detent makes it impossible to shift directly from 5th gear into reverse.



Power flow through the transmission is similar to conventional 5 speed transmissions, with one exception.

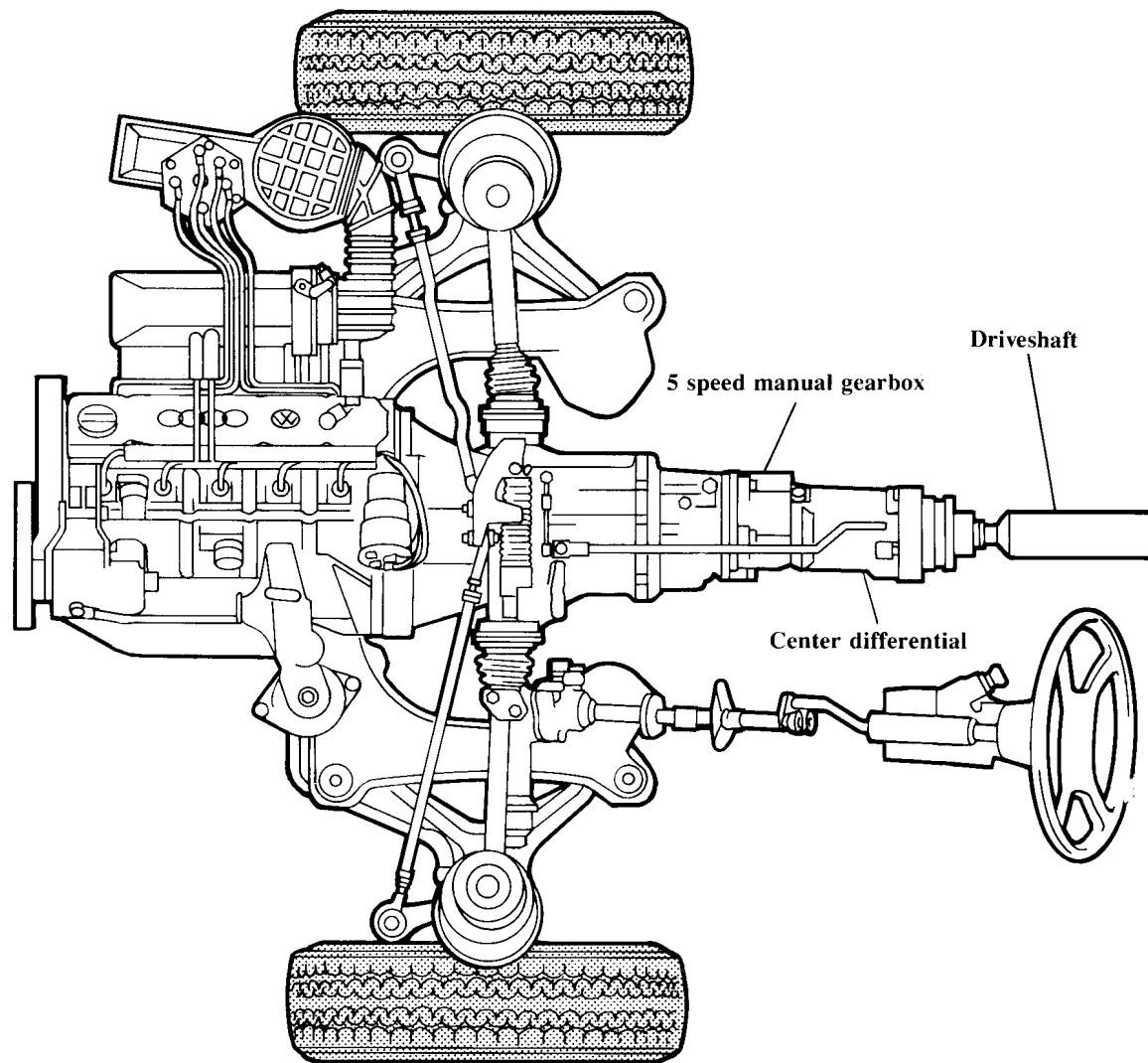
Inside the transmission, a hollow shaft delivers power through the gears to the center differential. Power is then transmitted to the

front axle differential pinion shaft and to the driveshaft to the rear axle.

The pinion shaft is supported by a tapered roller bearing in the transmission housing and by two needle bearings, one in the hollow shaft and one in the center differential housing.

# Permanent All Wheel Drive

---



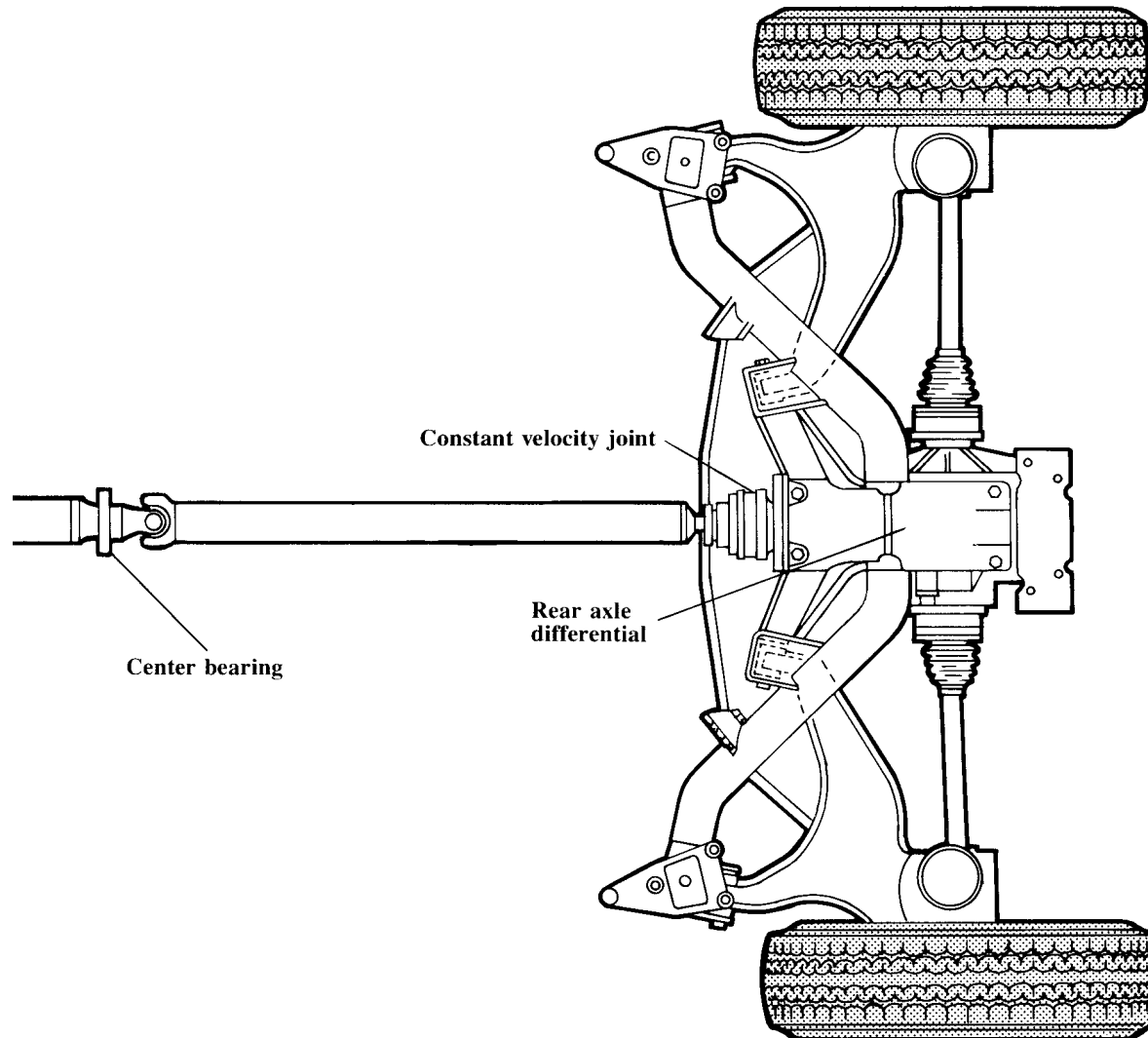
The Syncro all wheel drive uses three differentials, one for each drive axle and an additional one between the front and rear axles. It is this center differential, which is integrated into the transmission, that provides the Syncro's outstanding handling characteristics.

In contrast with other designs, all four wheels on the Syncro are driven constantly. An advantage

is realized because when a wheel is driven, there is always a certain amount of slip between the tire and the road surface, even when the road is completely dry.

If the amount of force a wheel must transfer to the road becomes less, the slip is less. As tire slip decreases, total power transfer can be increased, providing improved traction. On the Syncro,

# Permanent All Wheel Drive

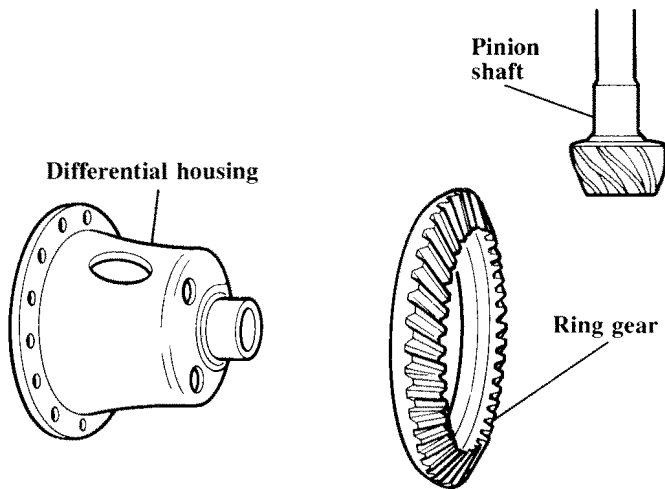


engine power is divided among all four wheels, rather than between just two, decreasing this unwanted slip. There is only a slight increase in friction because a transfer case is not used. But, because tire slip is less, these frictional losses are more than compensated for.

The all wheel drive feature minimizes the tendency of the car to lose traction on wet roads, maintaining directional stability and steering control.

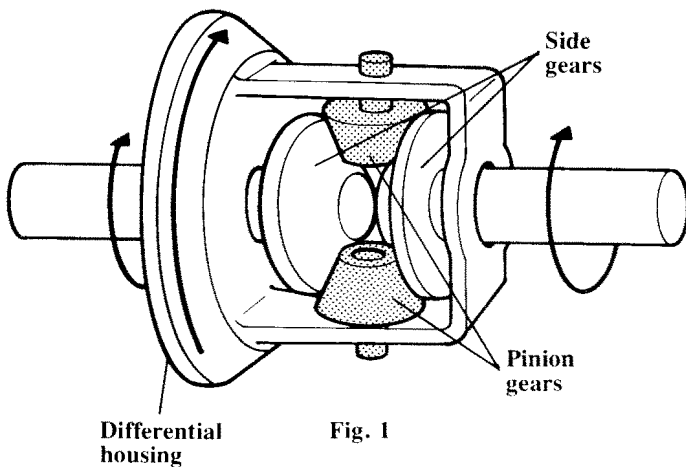
In addition, both the center and rear differentials are capable of being locked. However, because high steering effort would result, the differential at the front axle cannot be locked.

# Differential Operation



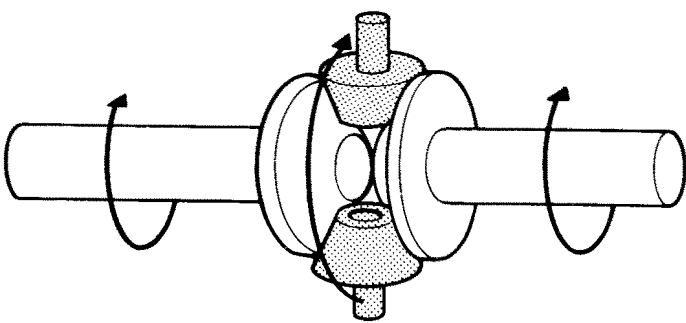
In order to fully understand the Syncro all wheel drive and the operation of the differential locking devices, it is important to understand how a differential works.

The pinion shaft receives engine power from the transmission and drives the differential ring gear. Because the ring gear is bolted to the differential housing, the two rotate together.



When the differential housing rotates, the two pinion gears and their shaft also rotate. (Fig. 1)

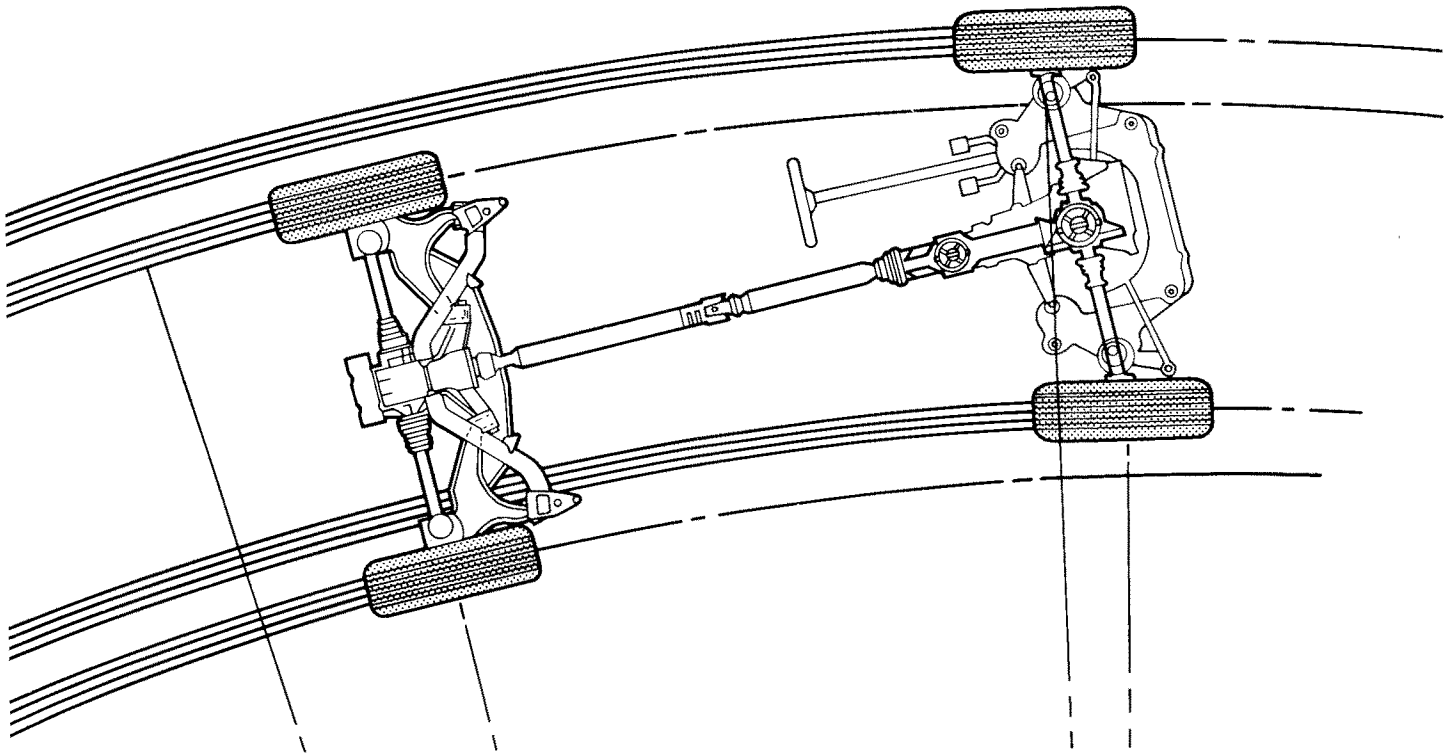
Because the two differential side gears are meshed with the pinion gears, the side gears must also rotate. They drive the axles and the car moves.



When the car is going straight ahead, there is no difference in speed between the two drive wheels and no differential action need occur. (Fig. 2)



# Differential Operation



However, when the car negotiates a turn, the differential must compensate for the difference in travel and thus RPMs of the two wheels. If, for example, the driven wheels are rigidly connected, the inside drive wheel would have to match the greater speed of the outside wheel. This would result in the inside wheel slipping or scrubbing on the road, resulting in poor ride and excessive tire wear. The differential prevents this.

When the car is going through a turn and the differential housing rotates, the pinion gears rotate on their shaft (Fig. 3). This occurs because the pinion gears must walk around the slower turning differential side gear connected to the inside wheel. This means they carry additional rotary motion to the faster-turning outer wheel during the turn. So, as the car is turning, the differential can compensate for the speed

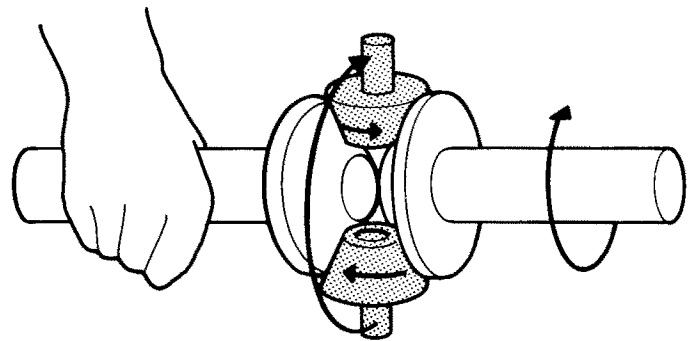
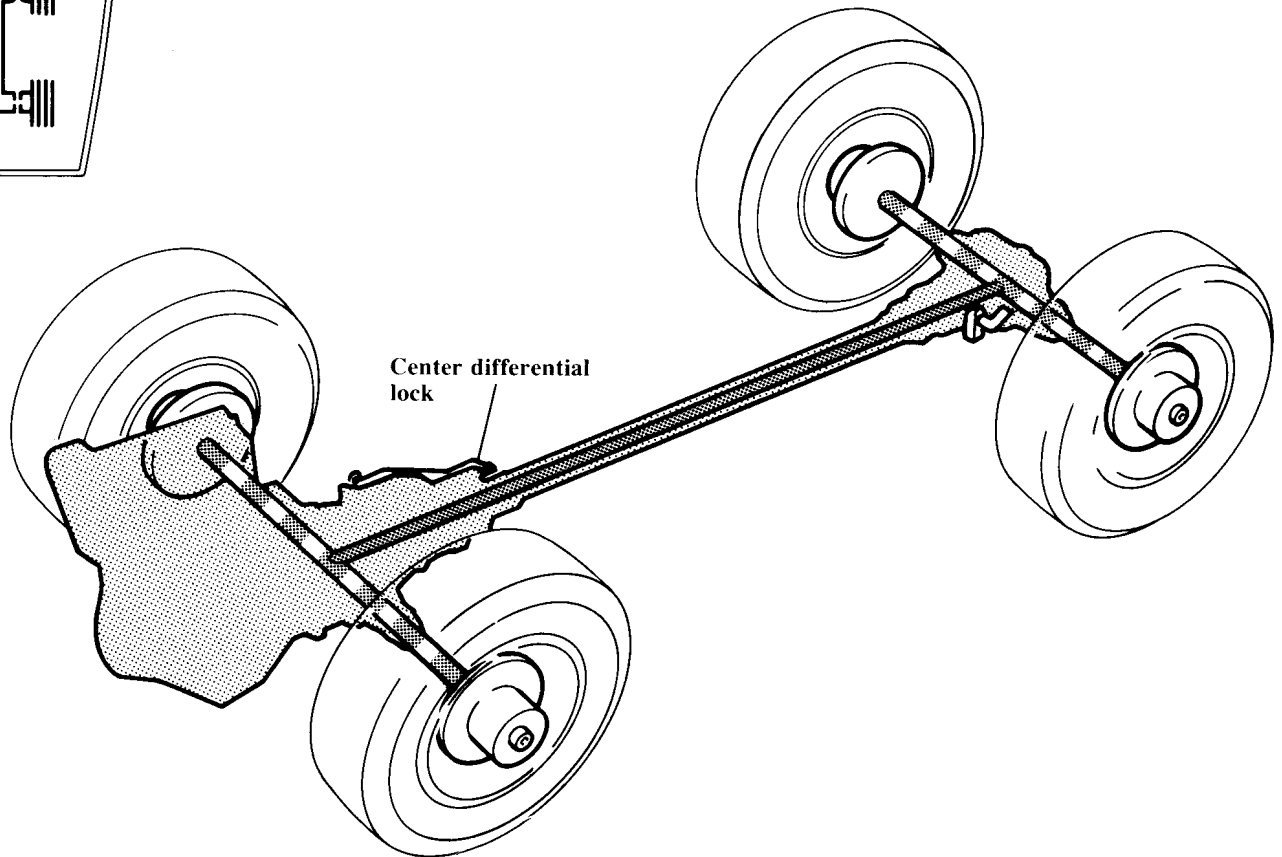
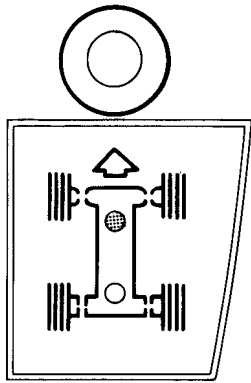


Fig. 3

difference between the two wheels, resulting in optimum traction and ride quality.

Because the Syncro has full time all wheel drive, it is advantageous to have three differentials because during turns, not only do the outside wheels travel further than the inside wheels but the front wheels travel further than the rear wheels.

# Center Differential Lock



A conventional differential provides the same torque to both wheels of an axle. But the wheel having the least friction on the road determines the amount or force being transferred.

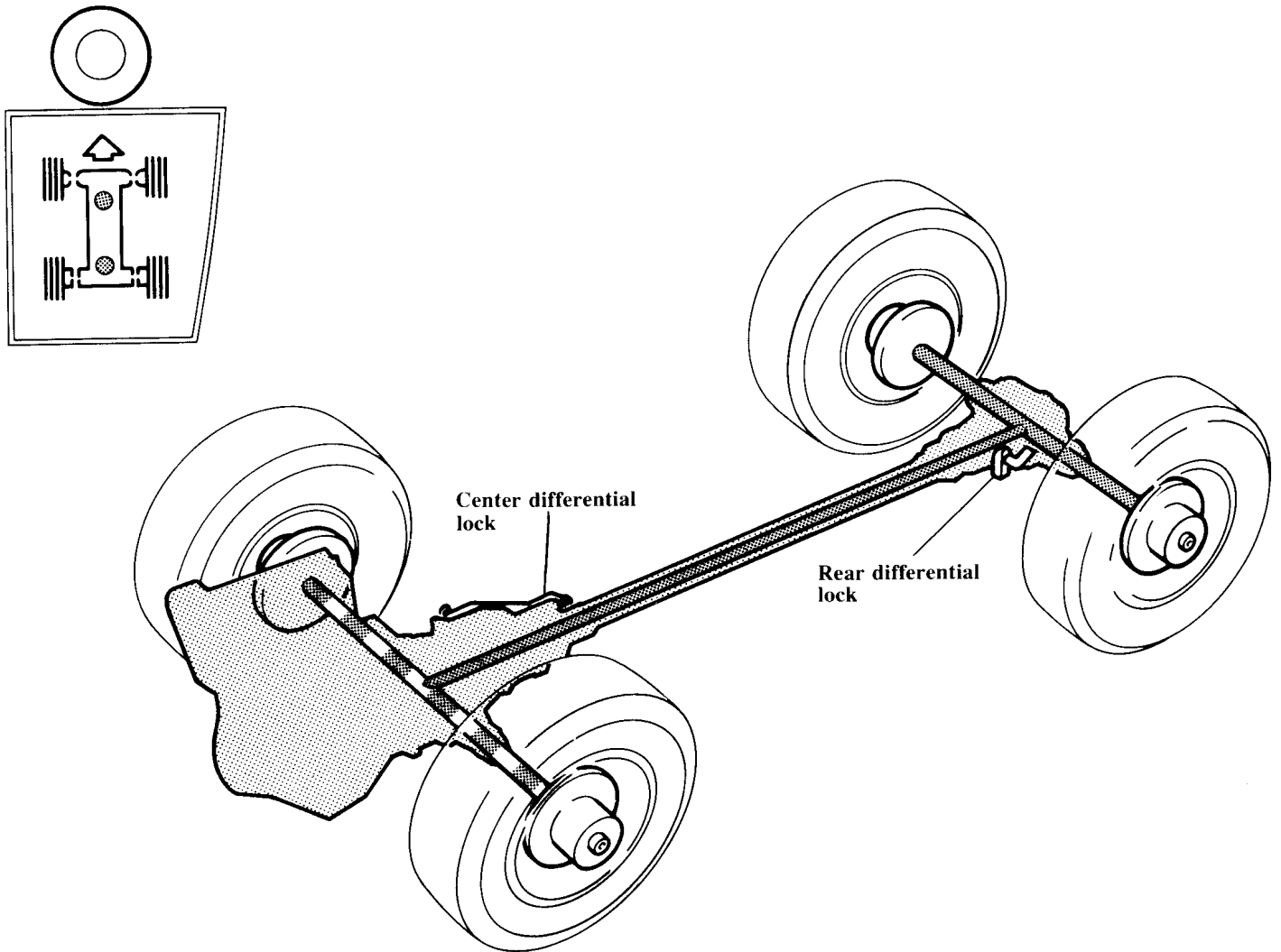
When one wheel loses traction, the differential no longer distributes power to the other wheel of that drive axle. The result is that the car gets stuck when one wheel spins in the mud, ice or snow.

On the Syncro, the differential lock overrides the principle of the differential and physically connects the wheels of the axle together.

Pulling the lock engagement knob to the first detent locks the center differential. With the center differential locked, power is transmitted equally to the front and rear differentials.

The center differential lock should be engaged if the car is being driven slowly and is in danger of becoming stuck on snowy, icy, or muddy road surfaces.

# Center and Rear Differential Locks

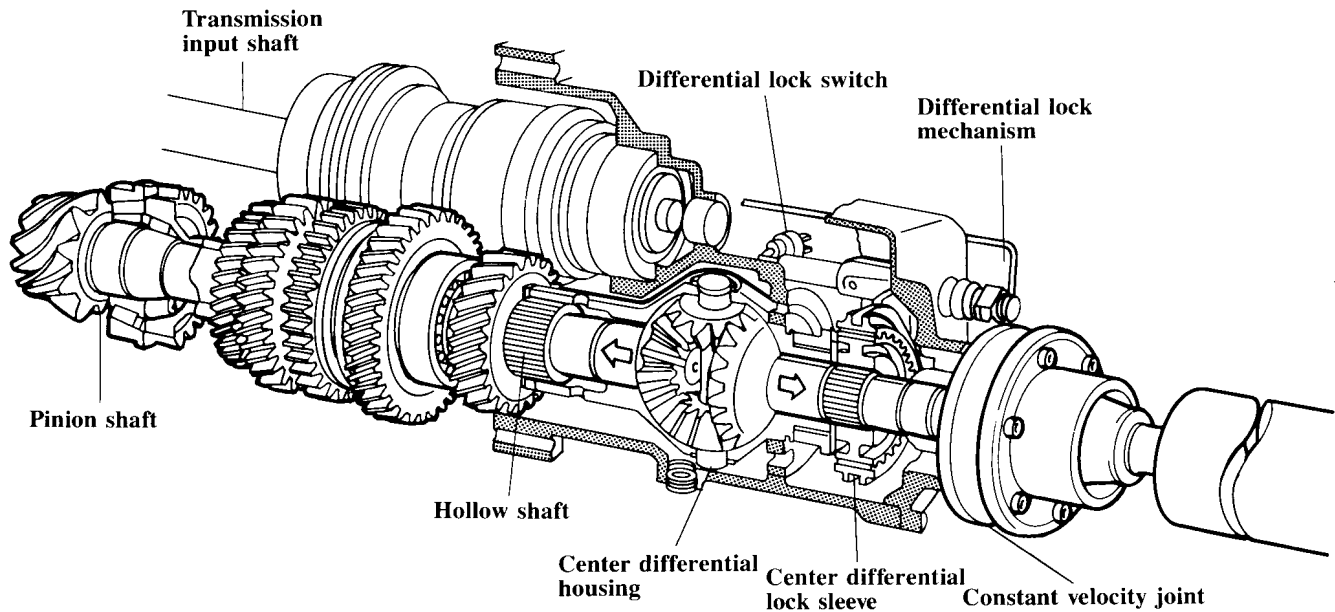


When the differential lock knob is pulled to the second detent, the rear differential is locked in addition to the center differential. In this position, no differential action can take place in either the rear axle or between the front and rear axle differentials, although differential action still occurs between the two front wheels.

With both differentials locked, at least three wheels, both rear and one front must spin before traction is lost completely.

Because the differentials are unable to compensate for cornering when locked, low speed vehicle maneuverability is reduced. Both differential locks should be engaged if the car has become stuck on the road shoulder, in ice, snow, or mud. The locks should not be engaged in city traffic, or on dry curving roads.

# Center Differential Lock



The heart of the Syncro's unique all wheel drive is the center differential.

Engine power is transmitted from the transmission input shaft, through the selected gear set to the hollow shaft and from there to the center differential.

The center differential transfers the driving forces equally, to the pinion shaft and the rear driveshaft (arrows).

The center differential pinion gears provide for speed differences between the front and rear axle drives, just like a conventional differential.

To engage the center differential lock, the shift rod moves the shift fork to the left.

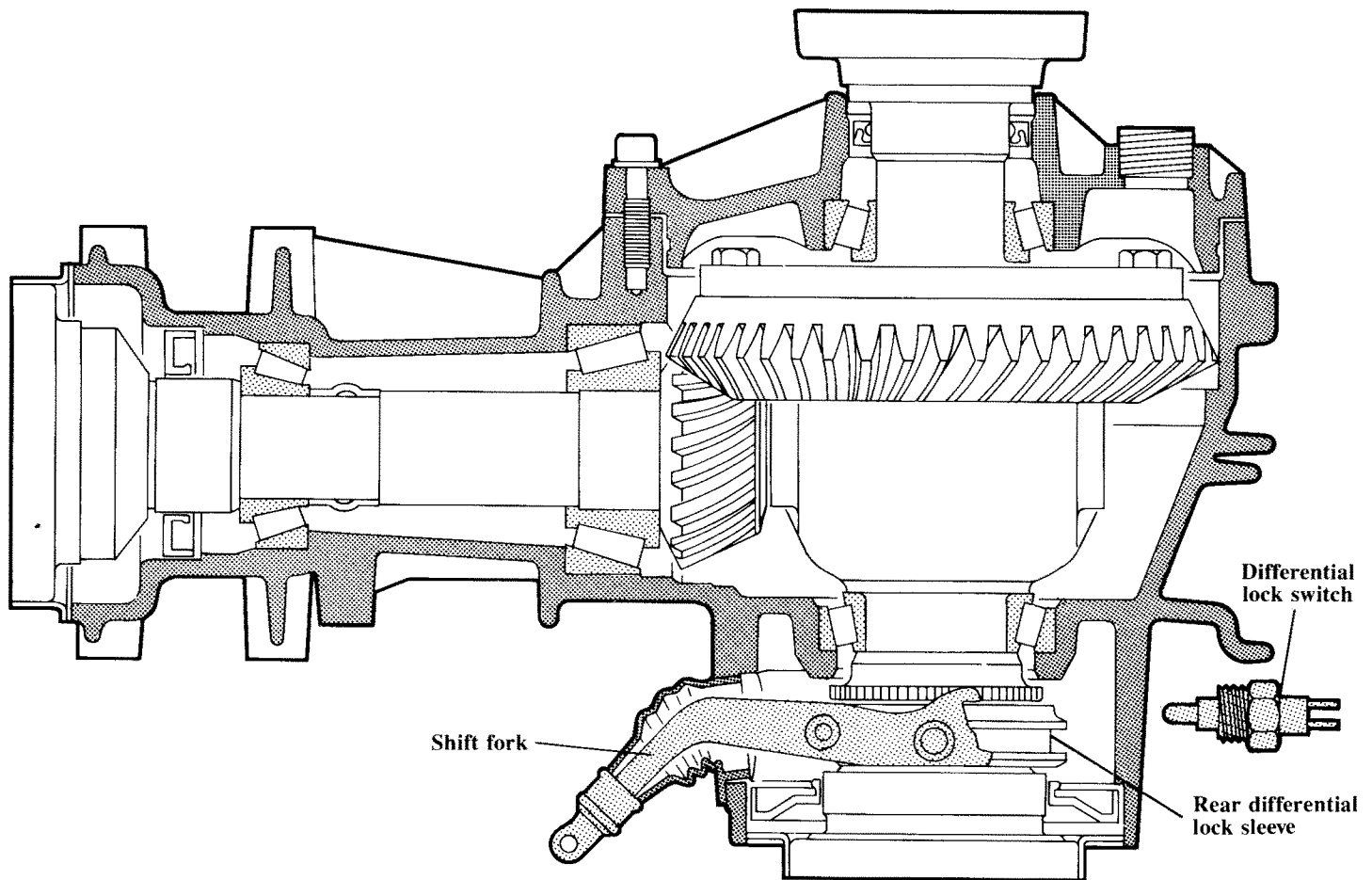
The shift fork pushes the lock sleeve into engagement with the differential housing splines and the center lock is engaged.

Now, the pinion shaft and the driveshaft to the rear wheels are locked together and turn at the same speed.

During engagement, if the locking mechanism becomes "tooth to tooth", the lock will engage when a difference in speed takes place through the pinion gears.

When the center differential is locked, the center differential lock switch is activated, and the center differential light on the indicator panel is illuminated.

# Rear Differential Lock



The rear axle differential provides for speed differences between the two rear wheels. Like the center differential, it can also be locked.

When the rear axle differential lock is engaged, the shift fork pushes the lock sleeve into engagement with the splines on the differential housing, effectively eliminating the differential action between the rear wheels.

When the shift fork moves, the rear axle differential lock switch is operated via a pin. This illuminates the second warning light on the indicator panel.

As with the center differential, the rear differential lock may not engage instantly if “tooth to tooth” contact occurs.

# Lock Operation

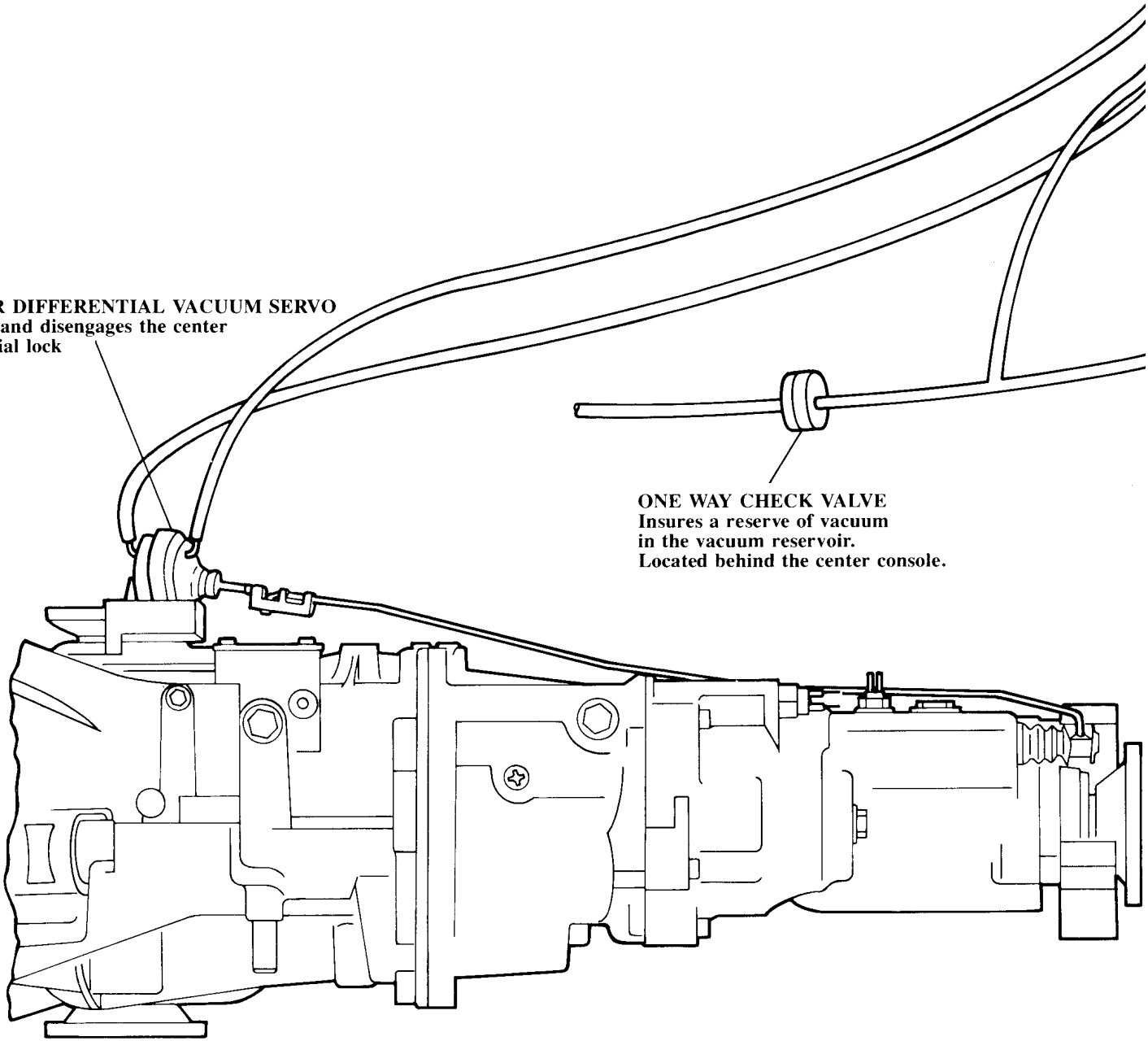
---

The differential locks are vacuum operated.

The two stage switch allows the center differential to be locked, either by itself or along with the rear axle differential.

**CENTER DIFFERENTIAL VACUUM SERVO**  
Engages and disengages the center differential lock

**ONE WAY CHECK VALVE**  
Insures a reserve of vacuum in the vacuum reservoir.  
Located behind the center console.



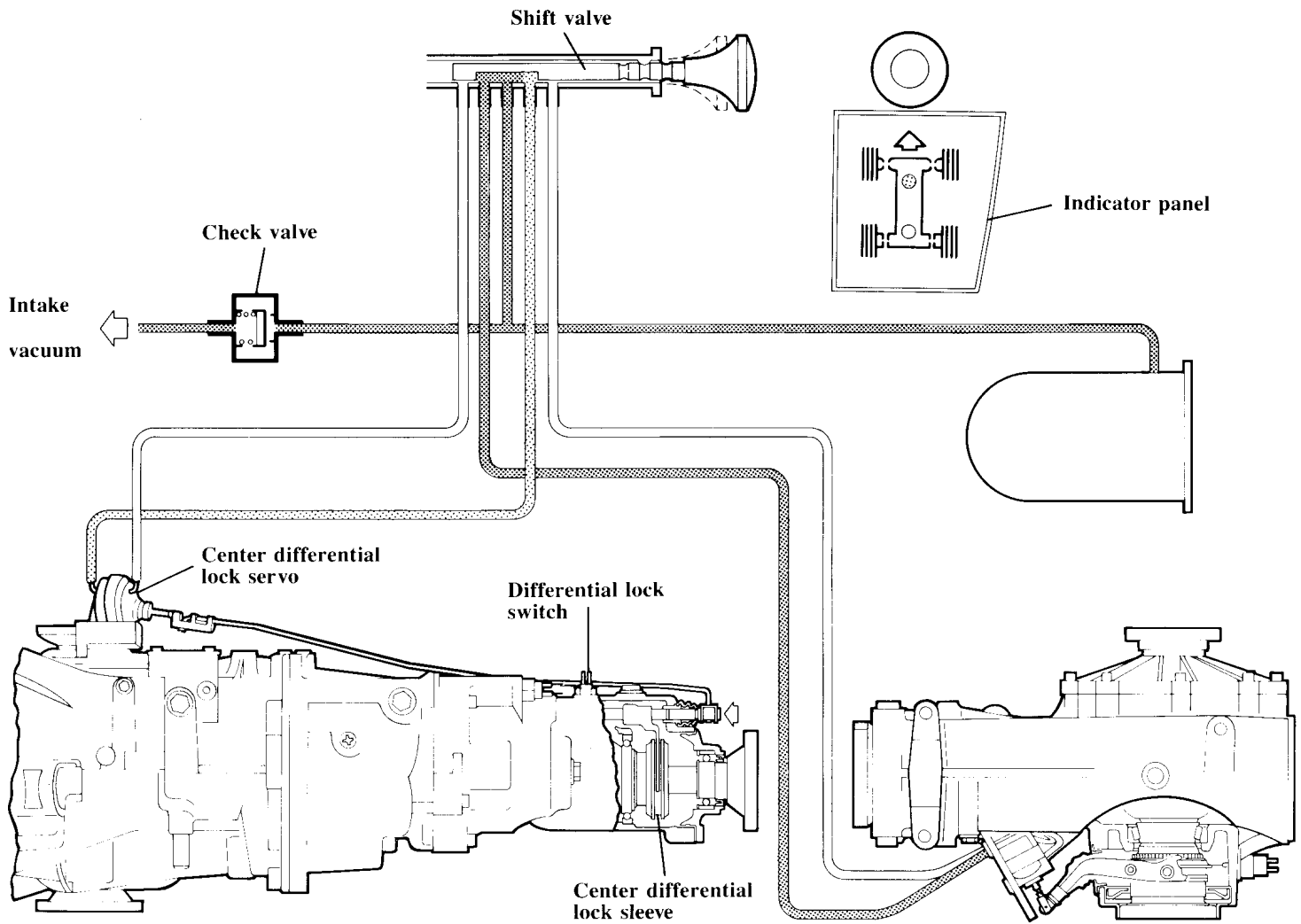
# Lock Operation

**TWO STAGE SWITCH**  
Directs the vacuum  
to the vacuum servos

**VACUUM RESERVOIR**  
Stores a reserve vacuum  
for 2 or 3 operations.  
Located in the spare tire well.

**REAR AXLE DIFFERENTIAL  
VACUUM SERVO**  
Engages and disengages the  
rear axle differential lock.

# Center Differential Lock Engagement



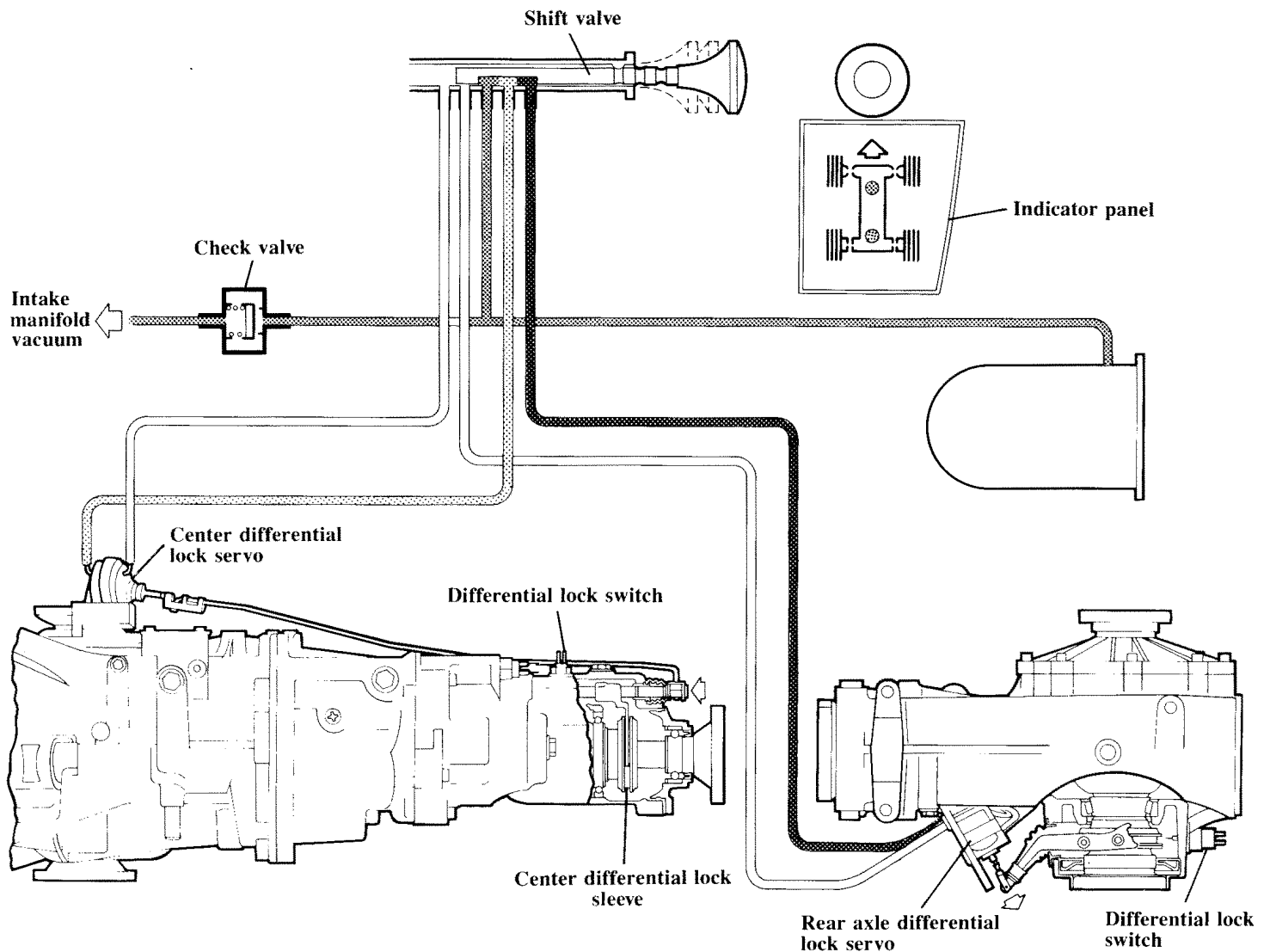
When the shift valve is pulled to the first detent, intake manifold vacuum is directed to the engagement side of the center differential lock vacuum servo. The diaphragm in the servo is pulled and the center differential lock is engaged via the linkage.

At the same time, the warning lamp on the indicator panel is illuminated by the center differential lock switch.

Vacuum is also directed to the disengagement side of the rear axle differential lock.



# Center and Rear Differential Lock Operation



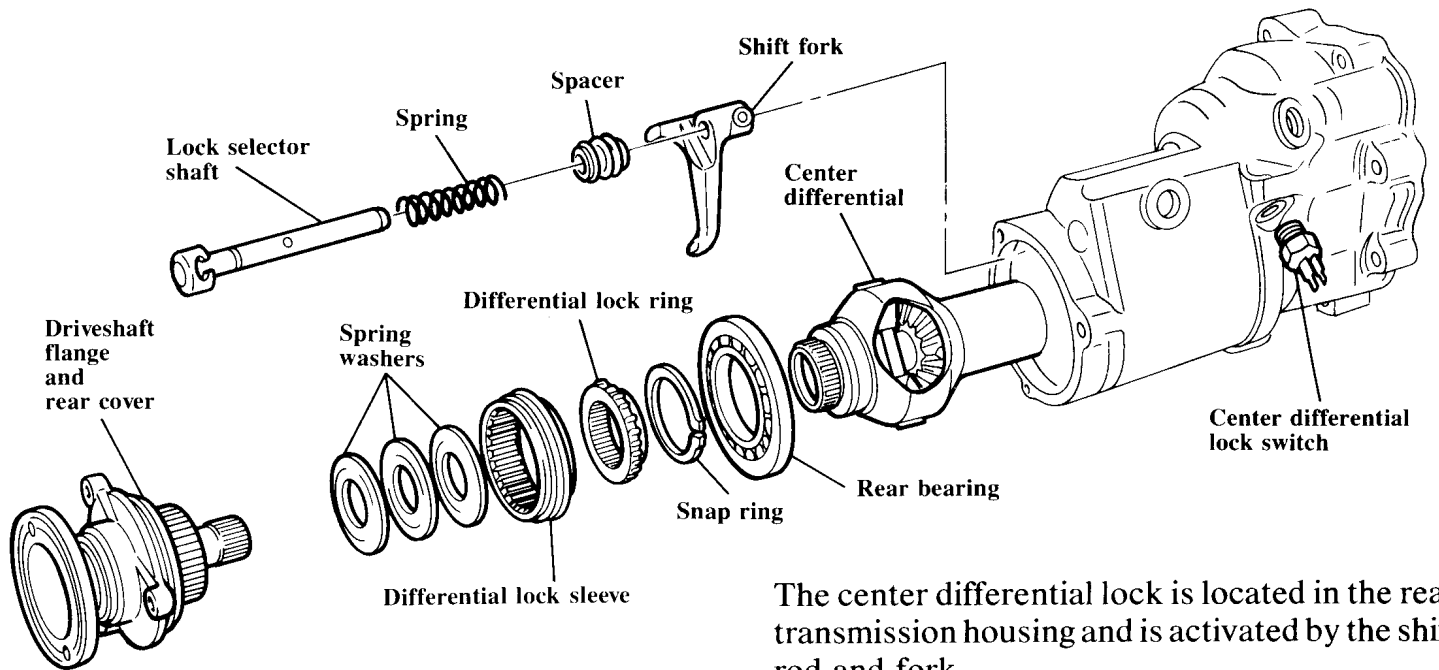
When the shift valve is pulled to the second detent, manifold vacuum is directed to the engagement sides of both the center and rear axle differential lock servos.

Both diaphragms are pulled, engaging both differential locks through the appropriate linkages. At the same time, both warning lamps on the indicator panel are illuminated.

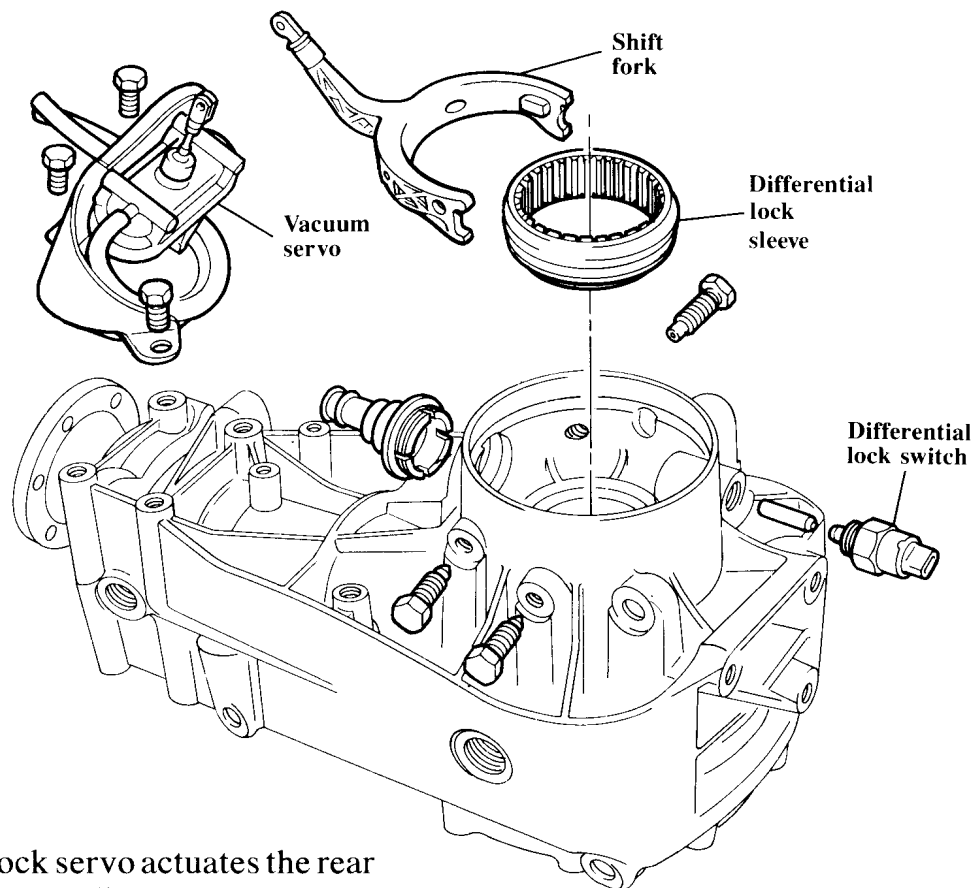
When the shift valve is pushed all the way in, vacuum is directed to the disengagement sides of both servos, and the locks are released.

Differential action can once again occur in the center differential and in the rear axle.

# Differential Lock Components

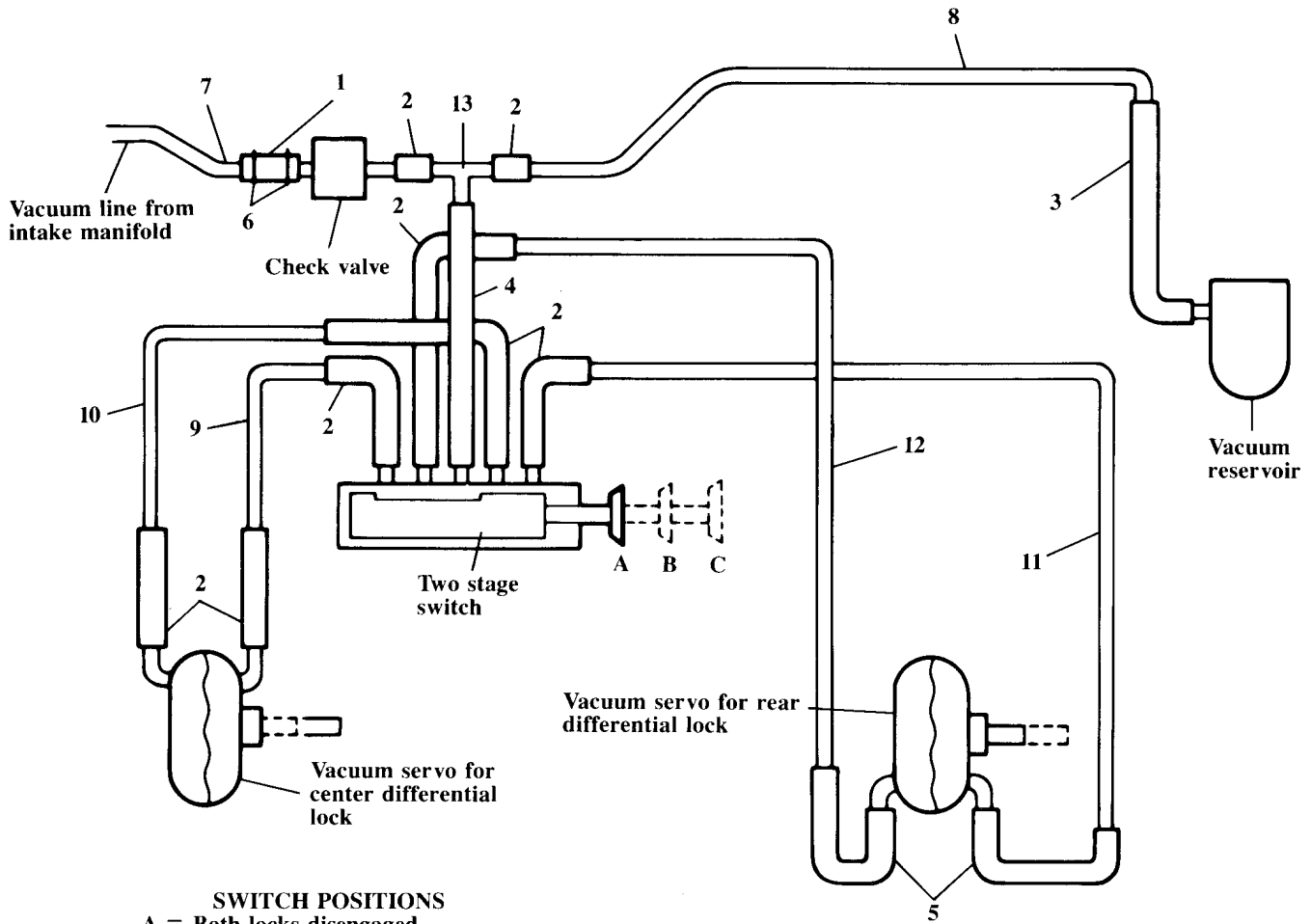


The center differential lock is located in the rear transmission housing and is activated by the shift rod and fork.



The rear differential lock servo actuates the rear lock directly. There is no adjustment necessary to either of the lock linkages.

# Vacuum Hoses and Tubing



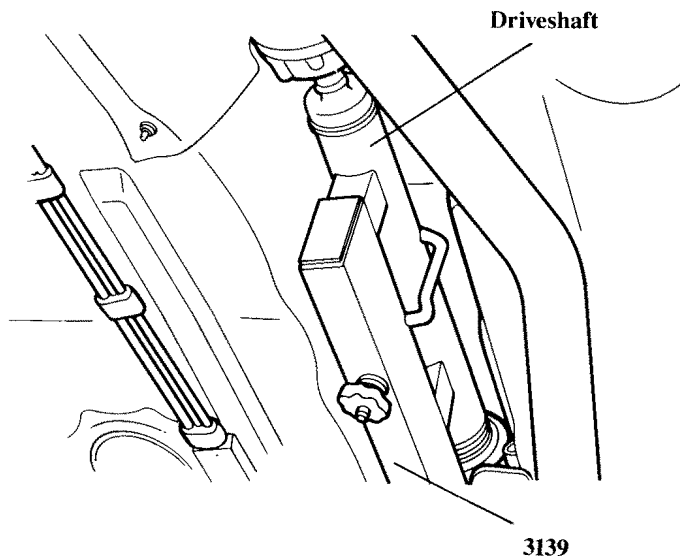
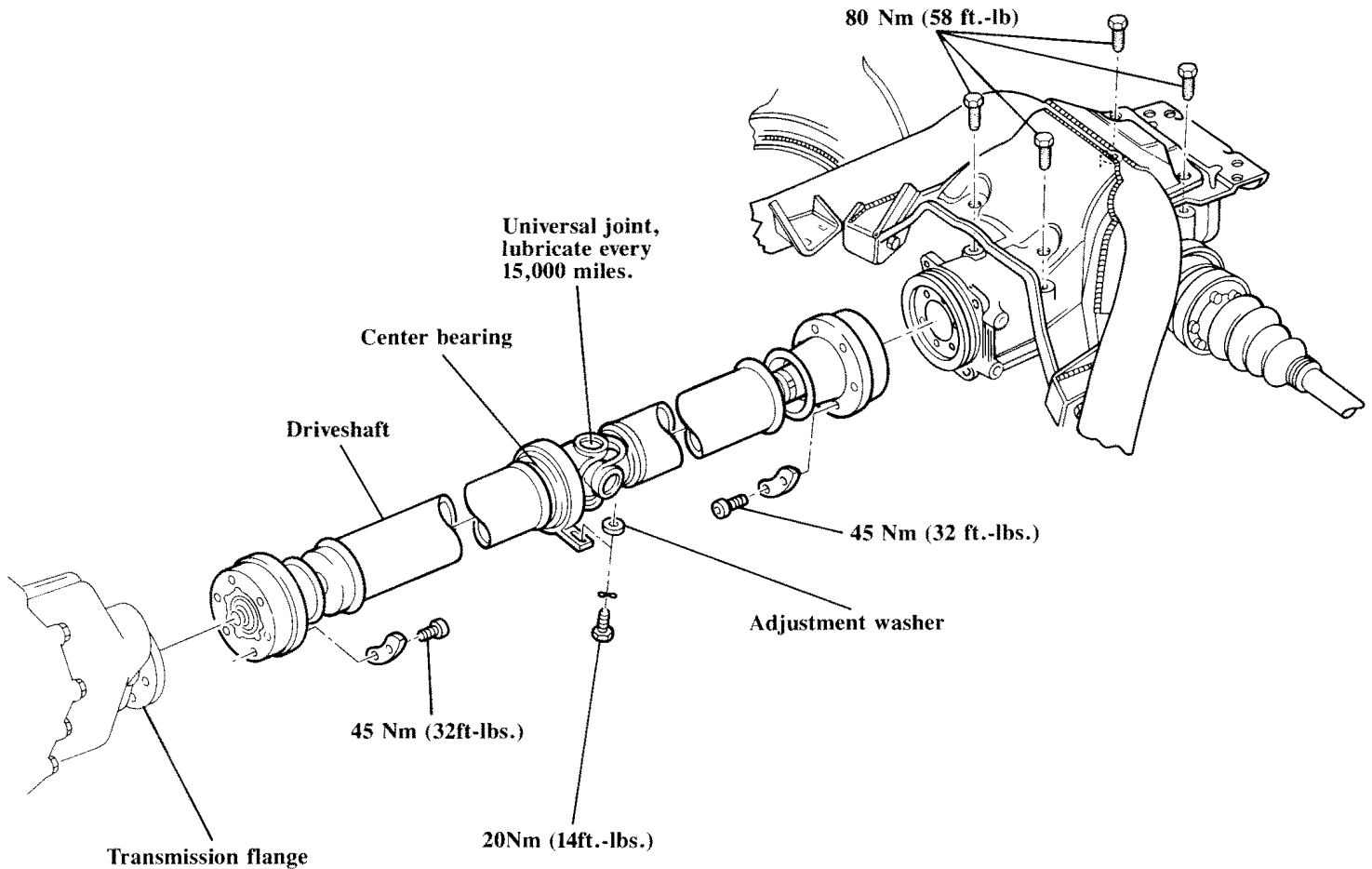
**SWITCH POSITIONS**  
 A = Both locks disengaged  
 B = Center differential lock engaged  
 C = Both differential locks engaged

Hoses 3.5 x 2				
No.	Length mm/in.	Color	Qty.	Part No.
1	45/1¾	black	1	N20 353.5*
2	100/4	black	8	
3	330/13	black	1	
4	220/8½	black	1	
5	565/22¼	black	2	
6	Hose clip		2	311 133 343 A

Tubing 4 x 1				
No.	Length mm/in.	Color	Qty.	Part No.
7	1540/60½	white	1	N 20 139.1*
8	2820/111	white	1	
9	810/32	red	1	
10	810/32	light green	1	
11	2060/81	yellow	1	
12	2060/81	blue	1	
13	T piece		1	113 201 943 B

\* As service parts, only black hose or white tubing is supplied.  
 When installing, cut hose or tube to length and mark with a strip of adhesive tape of appropriate color.

# Driveshaft



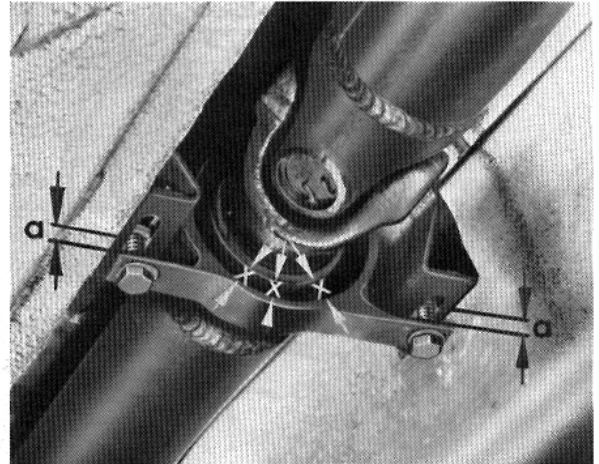
Install and tighten tool 3139 before removing driveshaft to prevent damage to the CV joints. Spare parts are not available for the driveshaft. If shaft or joints are damaged, complete driveshaft must be replaced.

Whenever the driveshaft is removed, it will have to be readjusted. To adjust the driveshaft:

- Clamp tool 3139 to driveshaft and tighten bolts.

- Measure clearance “a” and install appropriate shim from the chart.
- Install shims and torque center bearing bolts to 20 Nm (14 ft-lbs).

Dimensions a mm	Thickness mm	Part No.
0-3	—	—
3.1-5	2	857 521 143
5.1-7	4	857 521 143A
7.1-9	6	857 521 143B
9.1-11	8	857 521 143C
11.1-13	10	857 521 143D



The shim will preload the driveshaft to compensate for settling of the body.

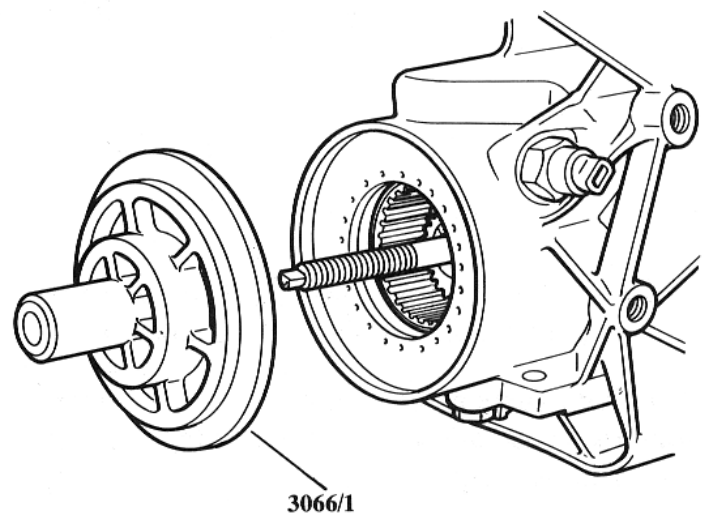
With tool 3139 in position, the lateral (side to side) adjustment of the driveshaft is made automatically.

If internal transmission or rear differential repairs are necessary, the complete transmission or rear differential must be exchanged.

However, replacement of some external oil seals is possible. Two new tools have been introduced for seal replacement.

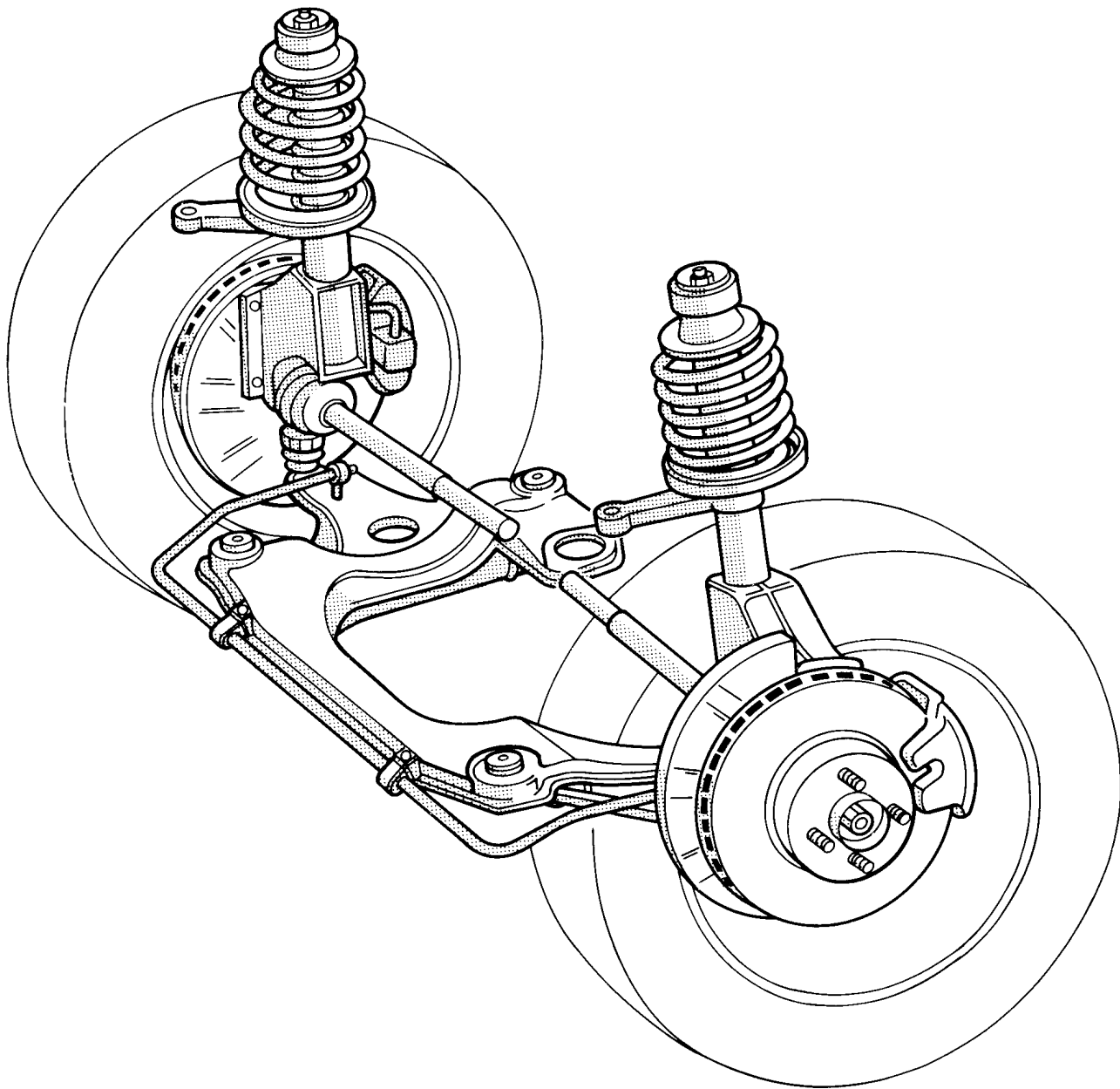
To replace the rear differential drive flange oil seal:

- Remove old seal
- Install threaded sleeve, tool 3066
- Tool 3066/1 is used to pull the new seal into position



# Front Suspension

---

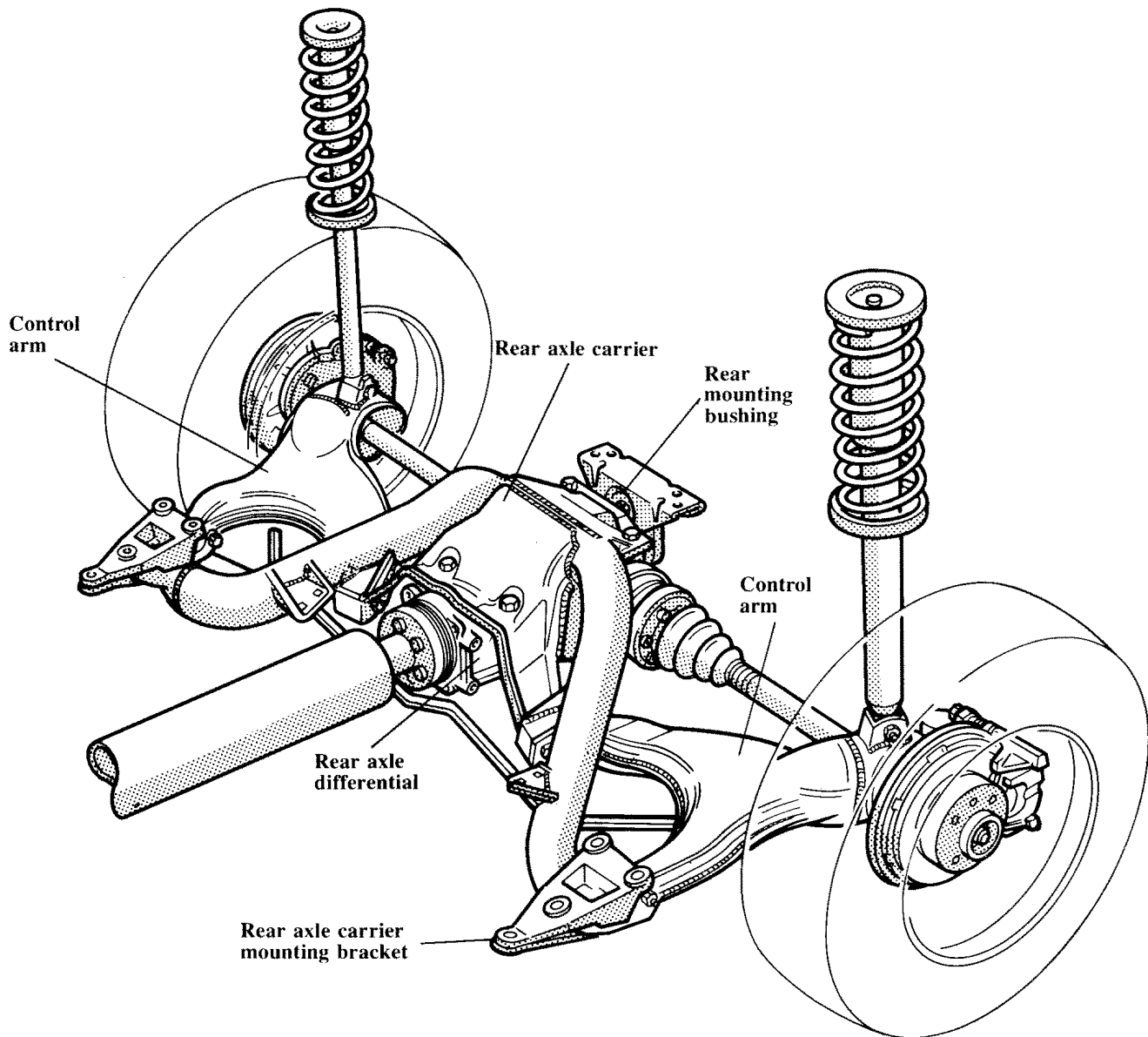


The front suspension components have been modified specially to suit the needs of the all wheel drive Syncro.

In addition to a larger 26mm stabilizer bar, the front suspension incorporates track-stabilizing negative steering roll radius with power assisted

rack and pinion steering to maintain directional stability under all driving conditions.

Additionally, the Mark II disc brake calipers, brake discs, wheel hubs and splash shields have all been modified for the Syncro, as have the shock and spring rates.



The rear axle and suspension are a totally new design, featuring diagonal semi-trailing control arms. The rear axle carrier is bolted directly to the rear axle differential to form a single rigid unit.

The front of the axle carrier is attached to mounting brackets by two bonded rubber bushings. The brackets are then bolted to the body.

At the rear, the final drive is attached to the body crossmember by a single bonded rubber bushing.

The rear suspension struts have been designed with new springs and dampening rates to match the new rear suspension.

# Rear Suspension

As with all Quantum models, the Syncro uses the unique track correcting rear suspension.

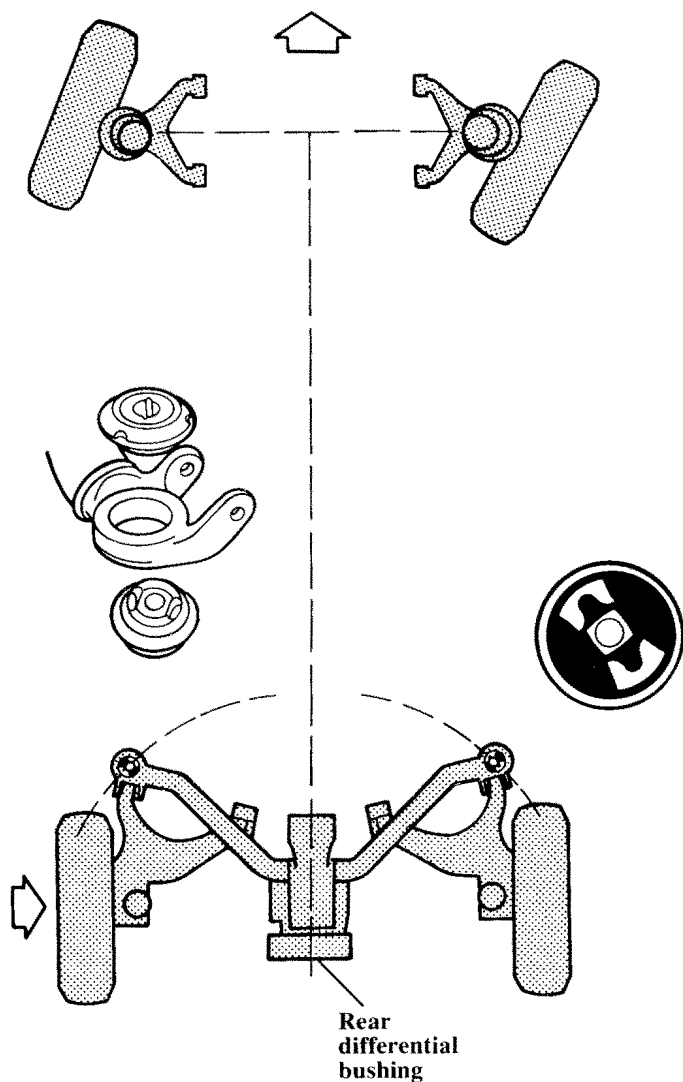
The bushings that attach the rear axle carrier pivot, thus countering the steering effect of the rear axle.

During cornering, when the rear axle is subjected to lateral forces, the bushings deflect to minimize toe changes at the rear wheels.

The entire assembly moves in an arc with the rear differential bushing as the center point.

The two front mounting bushings are a two piece design. They are shaped to allow two air gaps.

During replacement, these bushings must be carefully installed because of their importance to the operation of the track correcting feature.

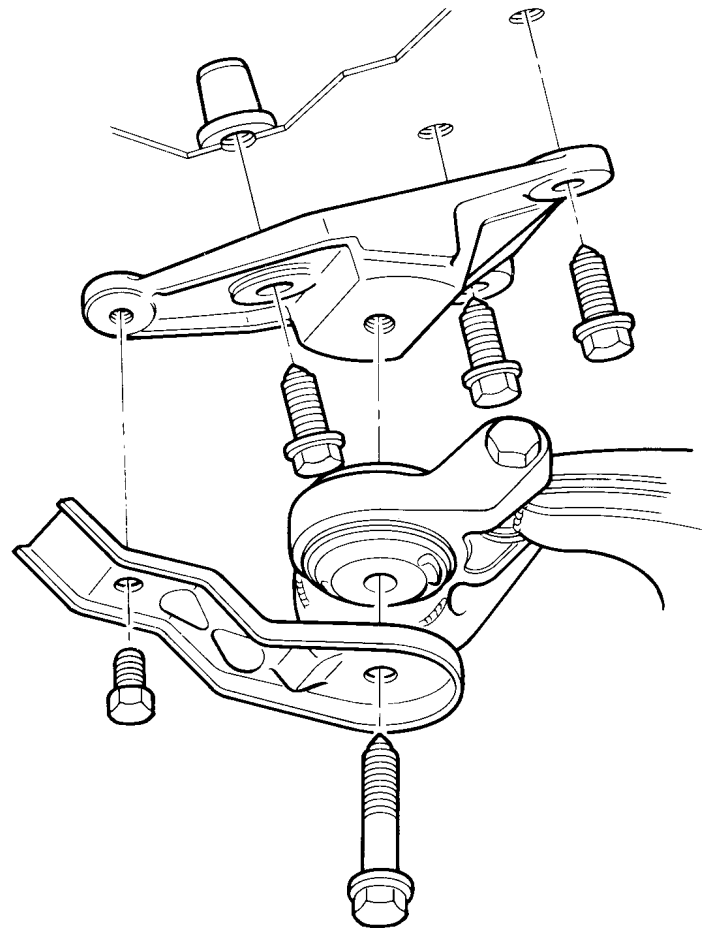




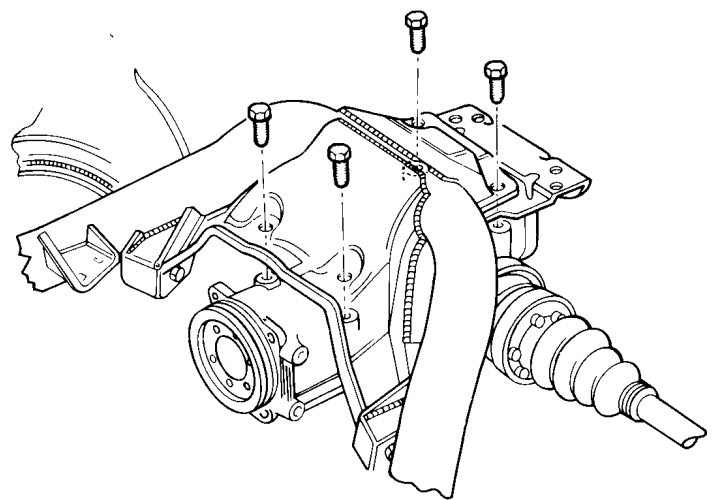
# Rear Suspension

Each side of the axle carrier itself is bolted to a bracket which is then bolted to the body. The three holes in each mounting bracket are elongated to allow for toe adjustments to the rear axle assembly.

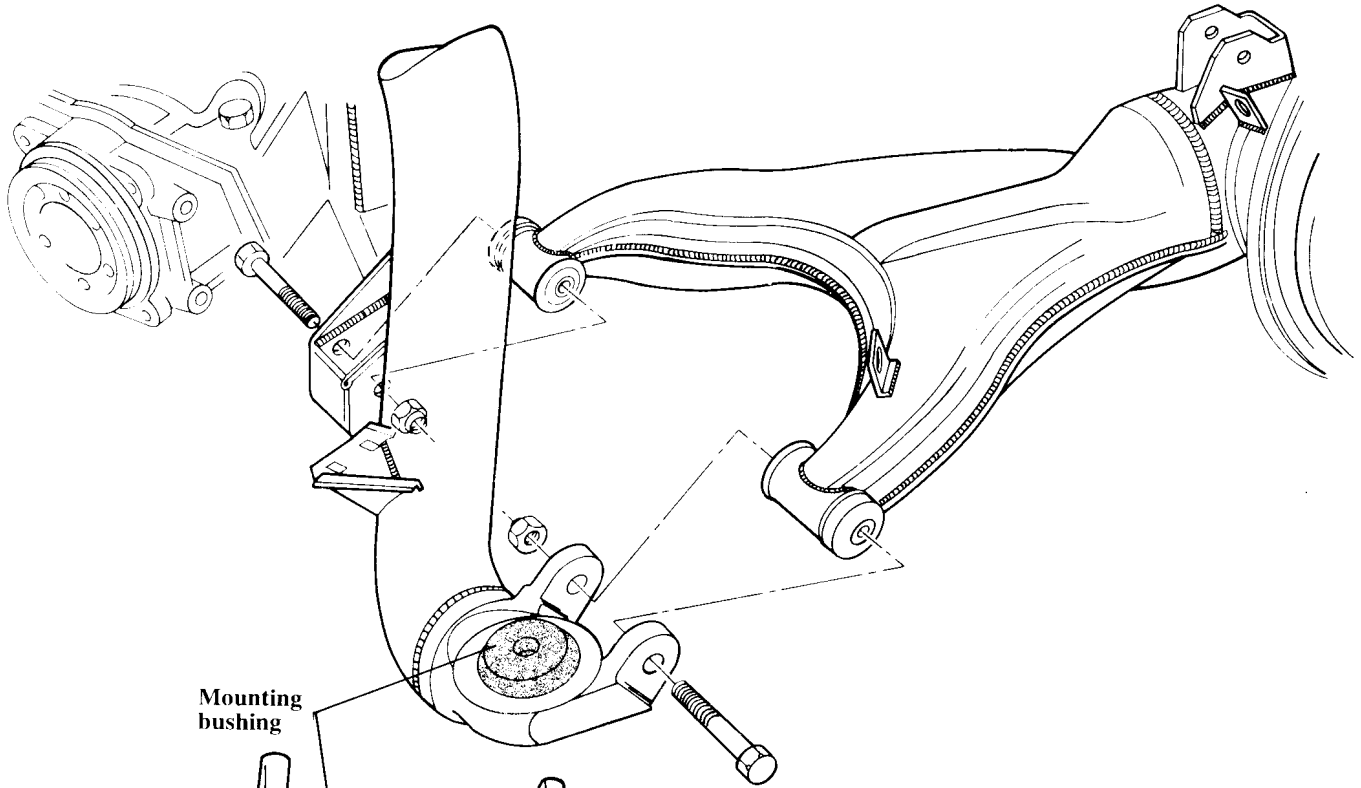
When removing the axle carrier, the mounting brackets need **not** be removed from the body. The axle carrier should be unbolted at the bonded rubber bushings. This will maintain rear wheel alignment after reassembly.



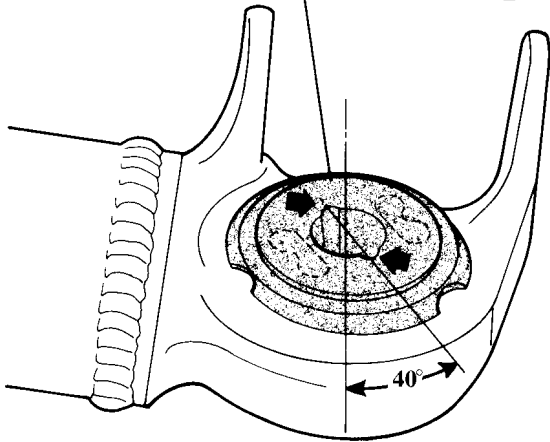
The rear axle differential is bolted to the rear axle carrier. If the rear axle carrier has to be removed, the rear axle differential will have to be removed with it, and separated afterwards. During removal of the rear axle carrier, the control arms can remain attached to the struts.



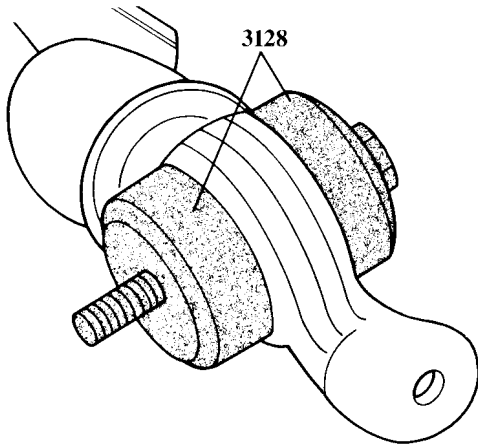
# Rear Suspension



Mounting bushing



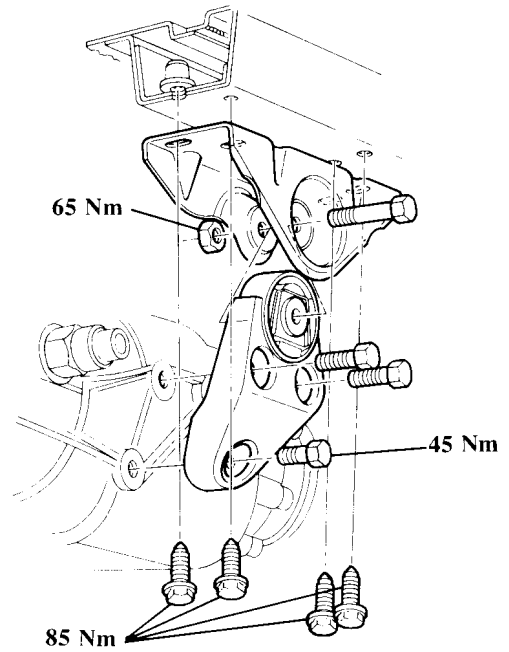
For proper operation of the rear axle, it is imperative that the bushings be positioned properly during assembly of the bushings. The two centering grooves (arrows) must point outward 40° as seen from the longitudinal centerline of the vehicle.



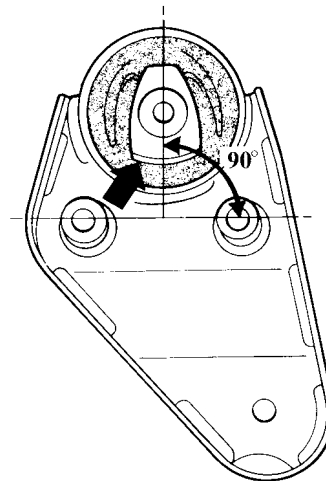
When replacing the bushings, special tool 3128 is used to pull each half of the bushing in separately.

# Rear Suspension

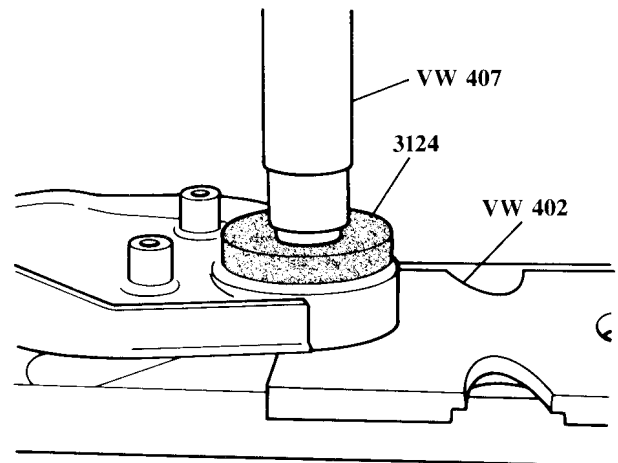
The track correcting feature of the rear axle relies on a central pivot point for the suspension. There is a single rubber bushing at the rear of the differential to provide this function.



During replacement of this bushing, the wider side of the metal center piece (arrow) must be at right angles ( $90^\circ$ ) to the two threaded sleeves so that the track correcting action of the rear axle is not adversely affected.

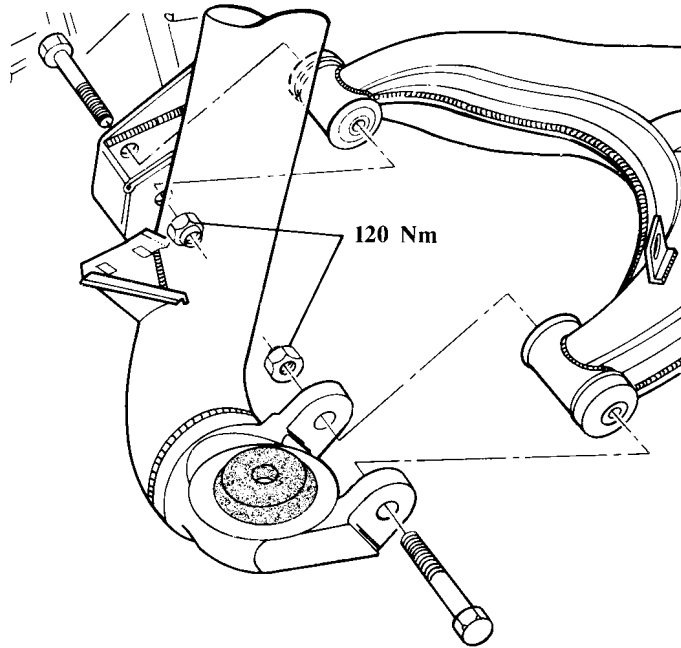


In the event that replacement of this bushing is required, special tool 3124 has been developed. It is used to press the bushing out and in.

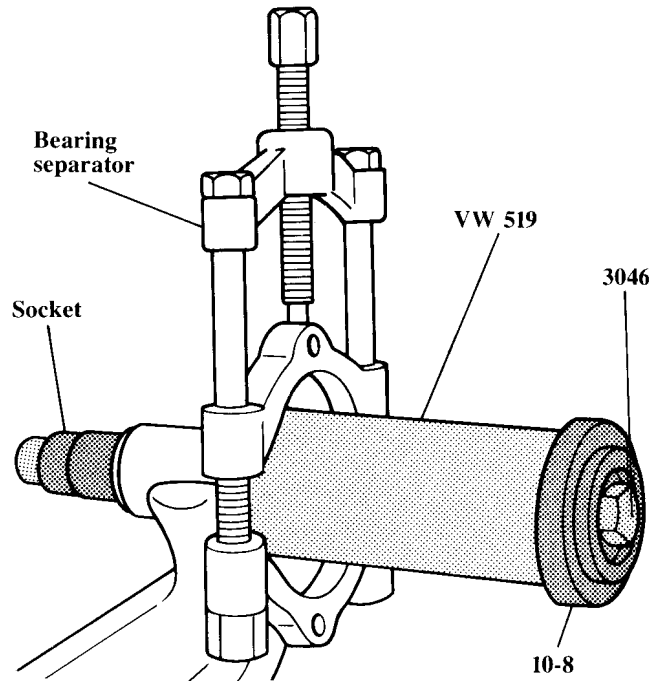


# Rear Suspension

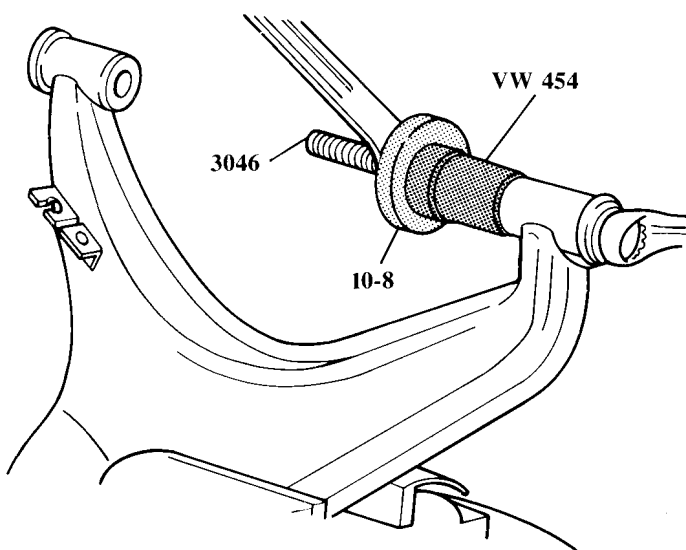
The rear suspension control arms are all new and are attached to the rear axle carrier with bonded rubber bushings.



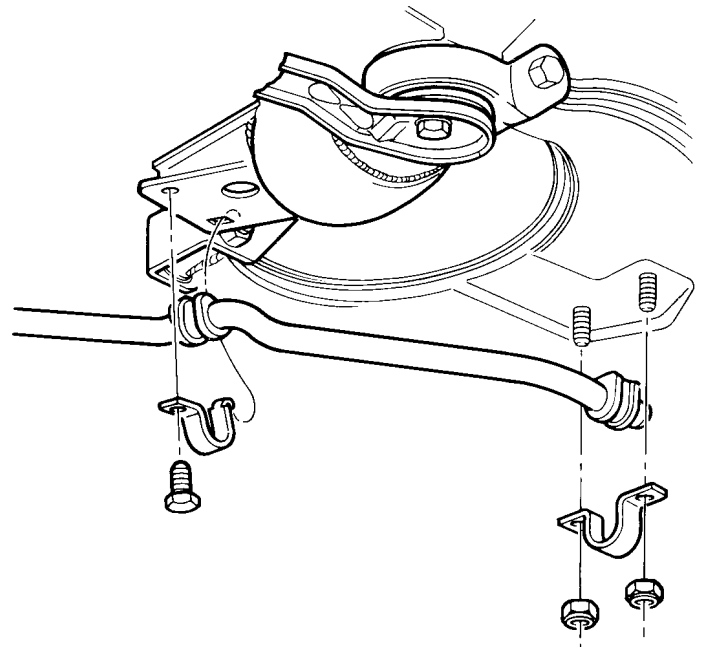
If the bushings need to be replaced, they can be removed using the bearing separator as shown.



They should be reinstalled by pulling them into position.



The stabilizer bar is mounted to the rear axle carrier with two bonded rubber bushings, and to the control arms with one bushing on each arm.



# Wheel and Tire Specifications

## Wheel Alignment Specifications

Front		Rear	
Total toe	+10' ± 10'	Total toe	+20' ± 25'
Camber	-40' ± 30'	Maximum toe difference left to right	20'
Maximum camber difference left to right	30'	Camber (non-adjustable)	-30' ± 30'
Caster	+1° 25' ± 30'	Maximum camber difference left to right	30'
Max difference left to right	30'		

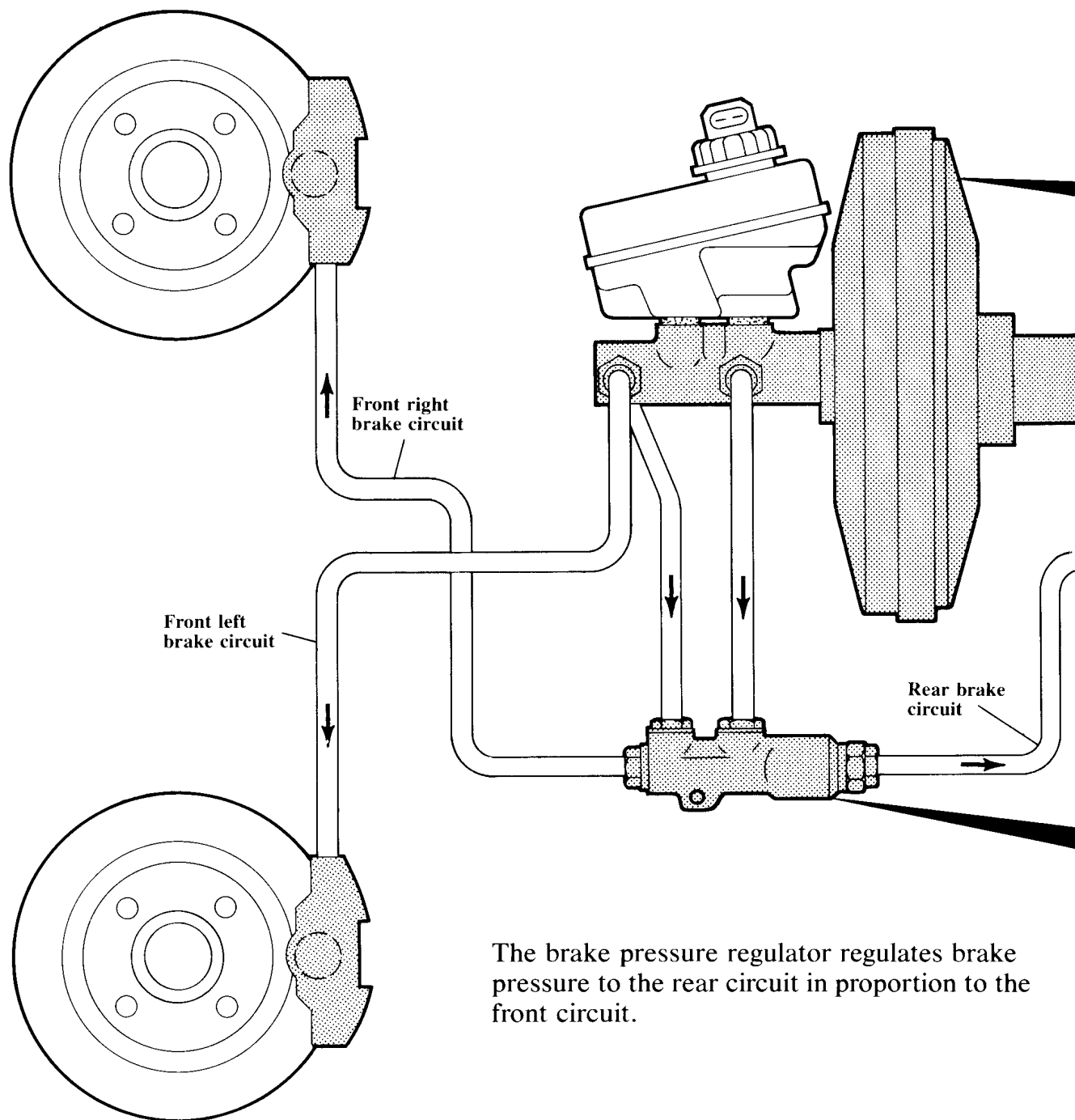
## Tire and Wheel Specifications

	Tire size	Wheel size	Offset
	195/60 HR 14 85 H	6 J x 14	38
Space saver spare	T105/70 R 14	3½ J x 14	45

Inflation pressure	Front	Rear
Half load	2.1 bar (32 PSI)	2.1 bar (32 PSI)
Full load	2.1 bar (32 PSI)	2.8 bar (42 PSI)

# Brakes

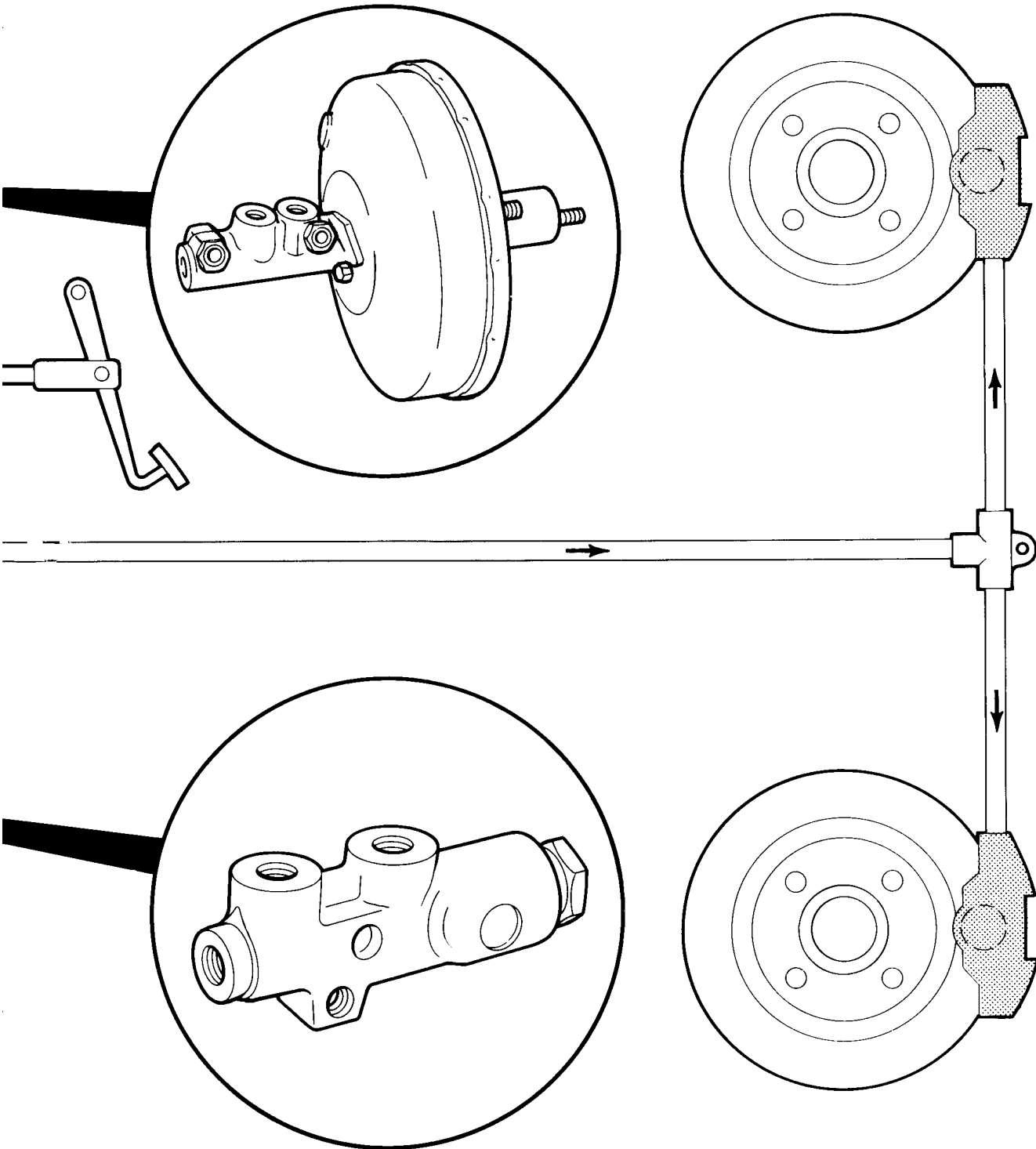
The Quantum Syncro is equipped with a dual circuit brake system which is divided into a front axle circuit and a rear axle circuit.



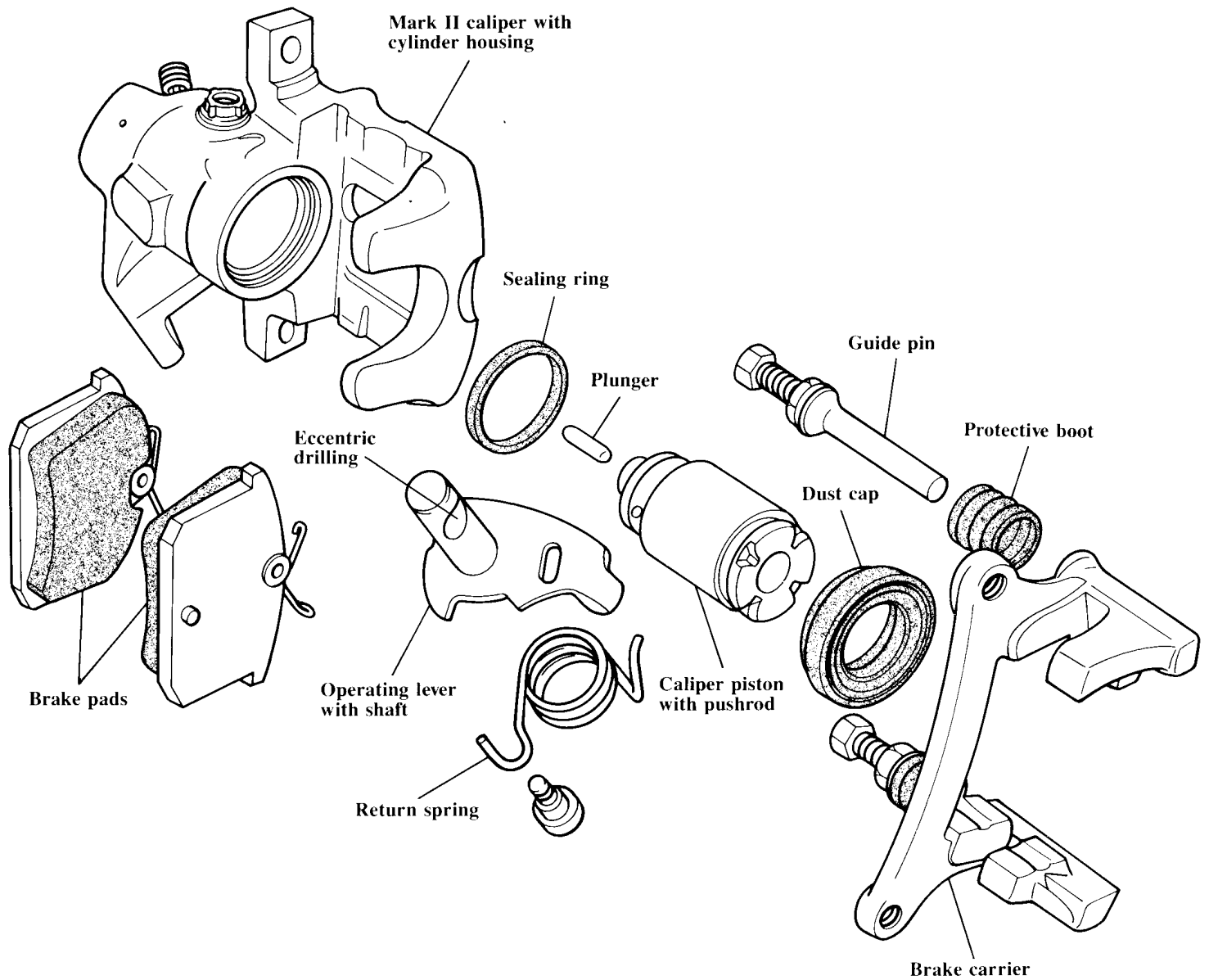
The brake pressure regulator regulates brake pressure to the rear circuit in proportion to the front circuit.

A 10" diameter power brake booster with integrated master cylinder is lighter and more

compact and produces a high degree of power assist.



# Handbrake



The rear Mark II disc brake caliper incorporates a self-adjusting handbrake mechanism directly into the caliper piston. The operating lever is actuated by the handbrake cable and applies the

brake by means of an eccentric drilling in the operating lever shaft.

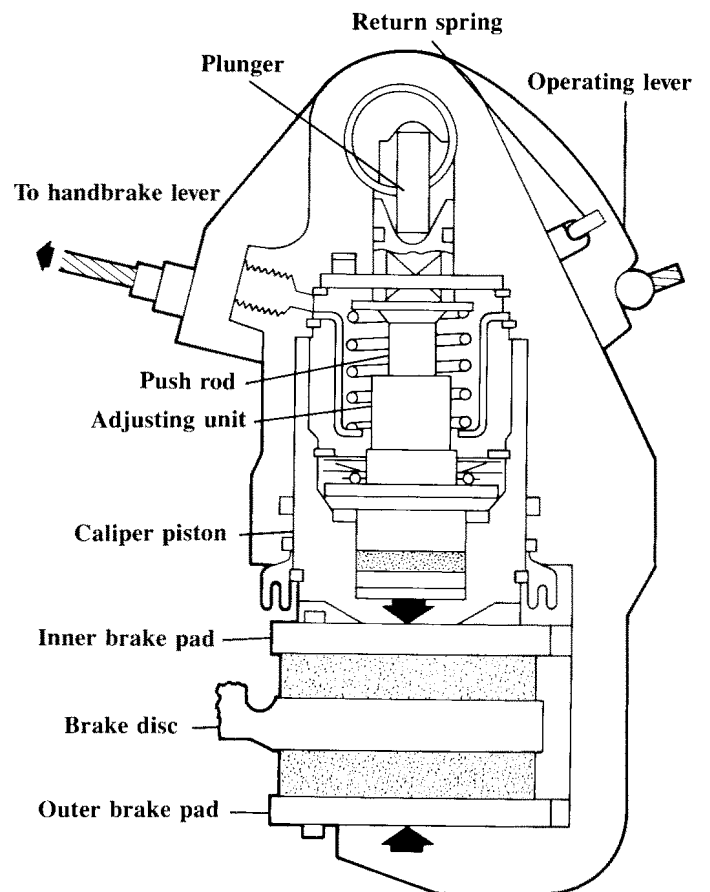
The brake pads on all four wheels of the Syncro are made of asbestos free material.



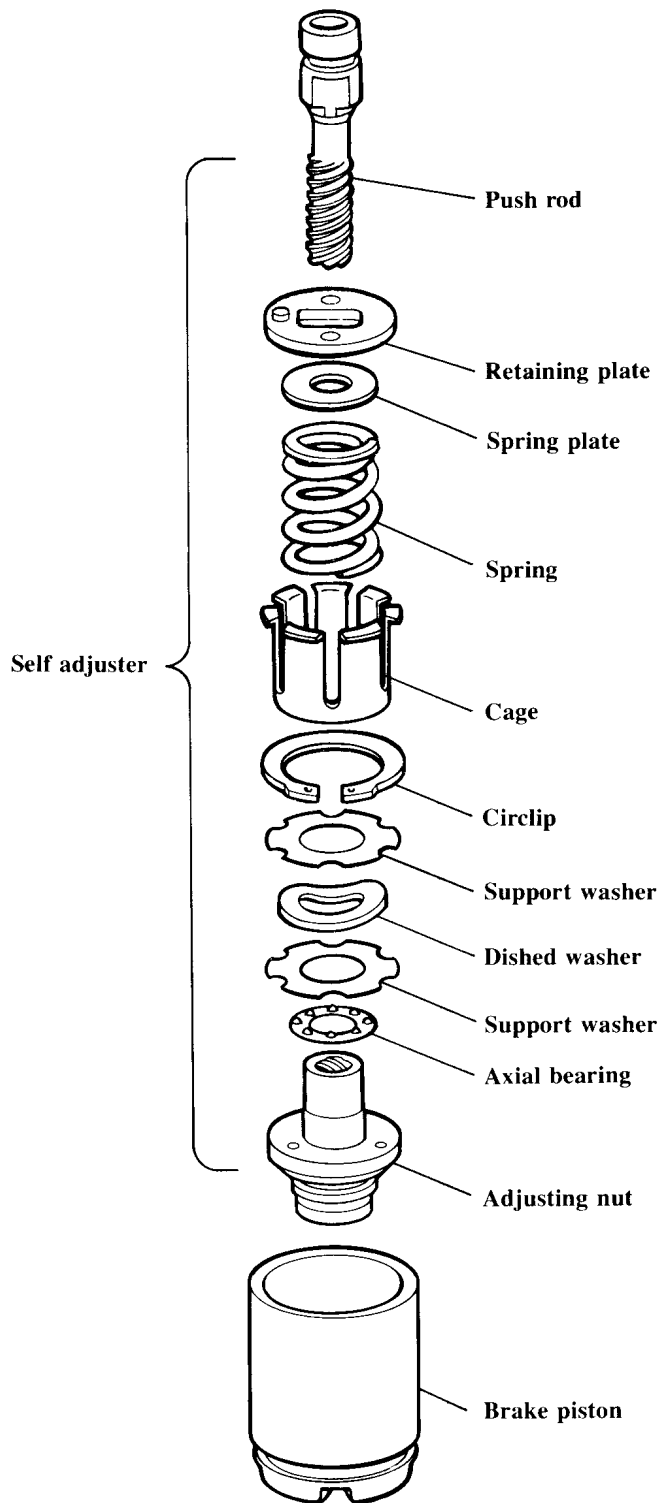
# Handbrake Operation

When the handbrake lever is pulled, the operating lever moves and pushes the plunger against the pushrod. The pushrod forces the caliper piston into contact with the inner brake pad.

When the pad contacts the brake disc, the plunger pushes against the pad housing and draws the outer brake pad into contact with the other side of the brake disc.



# Self-Adjusting Handbrake



The self-adjusting mechanism for the handbrake compensates for the change in pad to disc clearance that occurs as the pads wear. Adjustment occurs every time the brakes are applied.

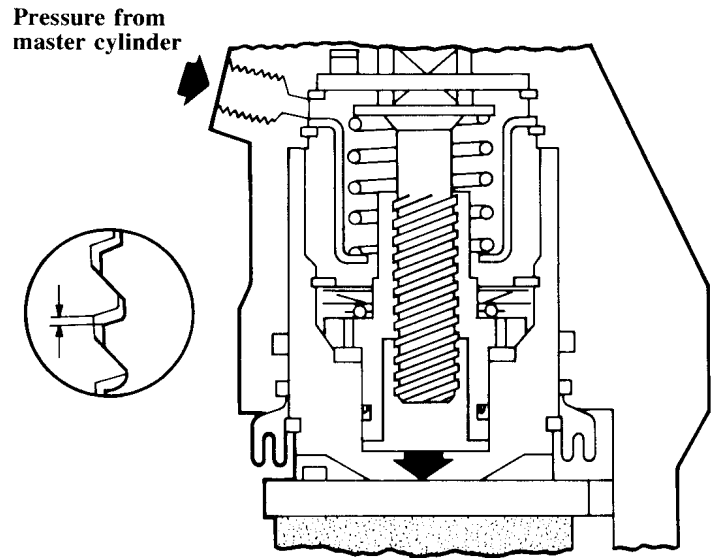
All the components of the self-adjusting mechanism are incorporated in the caliper housing.

When the caliper piston moves, the adjusting nut is momentarily released from its conical seat on the inside of the piston. As it lifts, it is rotated by the thread on the push rod. The push rod itself is kept from rotating by the retaining plate.

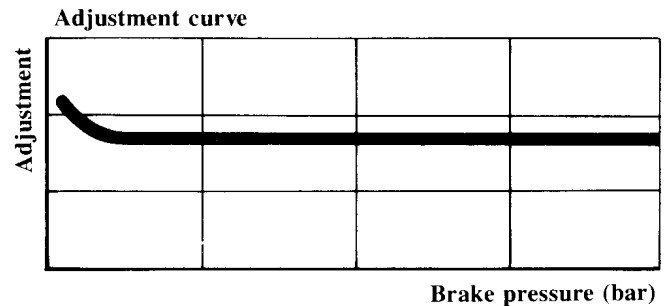
# Self-Adjusting Handbrake

When pressure from the master cylinder moves the caliper piston and brake pad into contact with the brake disc, the adjuster nut is carried along due to spring pressure on the axial bearing. Once the distance between the pad and the disc has been taken up, the adjusting nut is released from its conical seat.

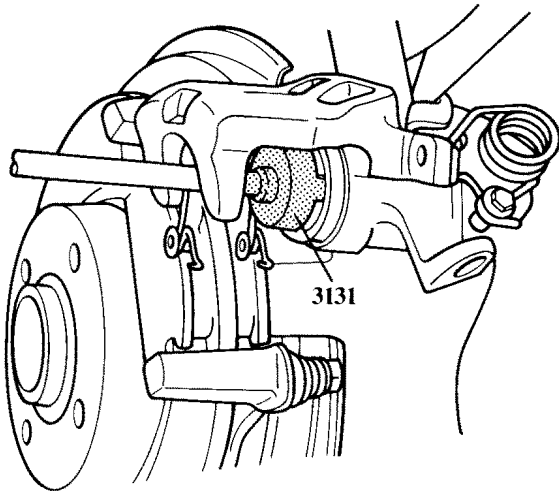
If enough brake pad wear has occurred so that the adjuster threads contact the threads on the push rod, as shown, the adjuster is rotated by the steep angle of the threads on the pushrod. This process keeps the handbrake in constant adjustment.



As hydraulic pressure increases, the force exerted on the adjusting nut surface area increases and the adjusting nut is forced back onto the conical seat and can no longer rotate. The push rod now moves down together with the adjusting nut.

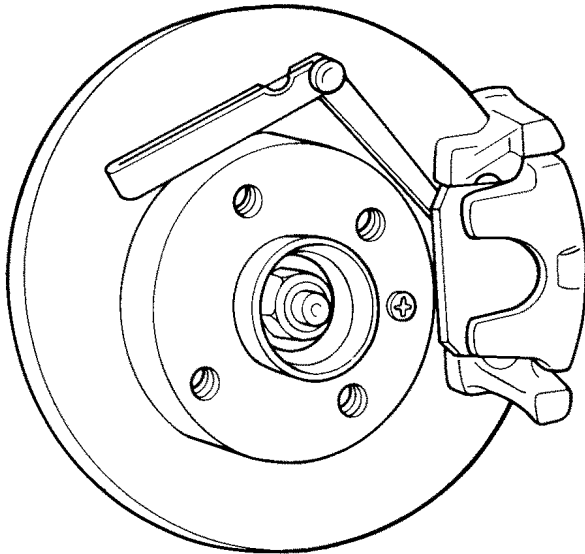


# Basic Handbrake Adjustment

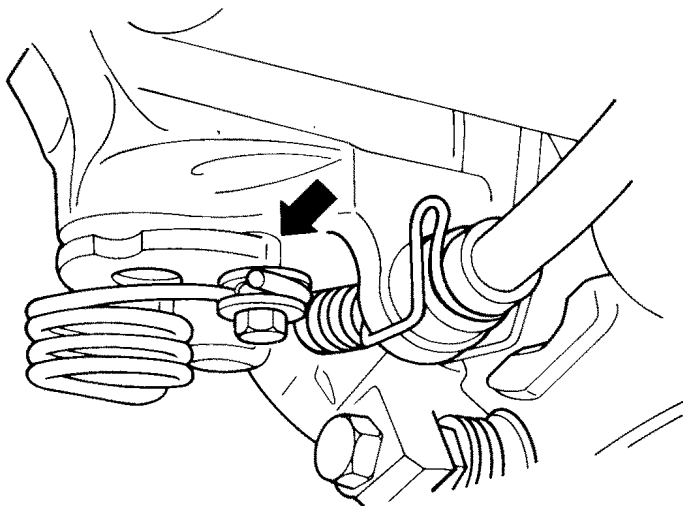


The minimum allowable thickness of the brake pads is 7mm. When new rear pads are installed, the basic setting of the self-adjusting mechanism will have to be readjusted.

With the handbrake cable removed, the caliper piston can be threaded into the caliper with tool 3131.



Once new pads are installed, a clearance of 1 mm must exist between the brake pad and the brake disc. This is so that a gap of 0.4mm is maintained at the adjuster nut inside the caliper piston to provide correct self-adjuster operation.

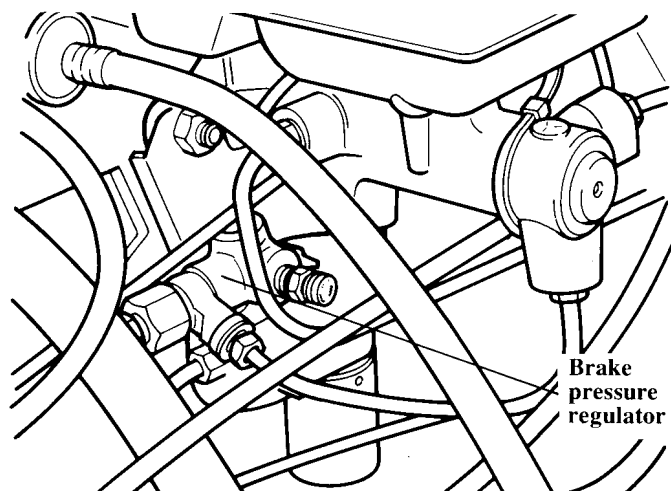


When the handbrake cable is reinstalled it should be tightened until the adjustment lever is lifted off its stop, no more than 1mm (arrow).

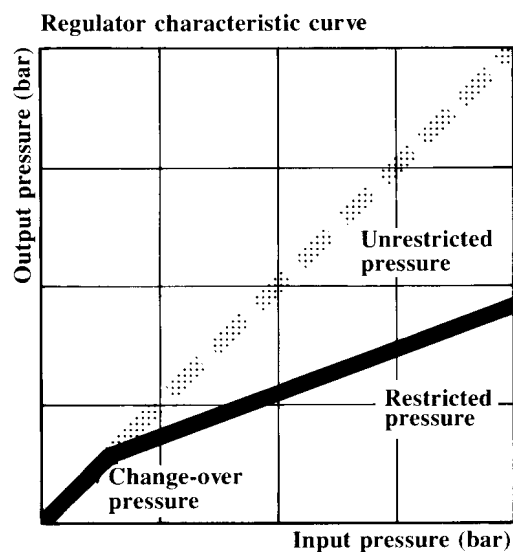
The adjustment of the cables should be checked whenever the handbrake cables, brake calipers, brake pads and brake discs are renewed.

# Brake Pressure Regulator

The brake pressure regulator is located below the power brake booster. It reduces brake pressure to the rear circuit to prevent the rear brakes from locking.



This chart shows the regulation of brake pressure to the rear brakes. The regulator is preset and is not adjustable.

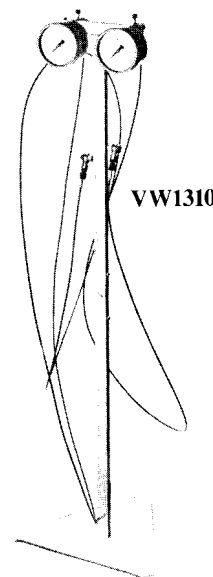


To test the operation of the pressure regulator:

- Lift vehicle and connect gauge VW 1310 to left front and left rear brake calipers.
- Apply pressure to brake pedal and compare pressure readings to this chart.

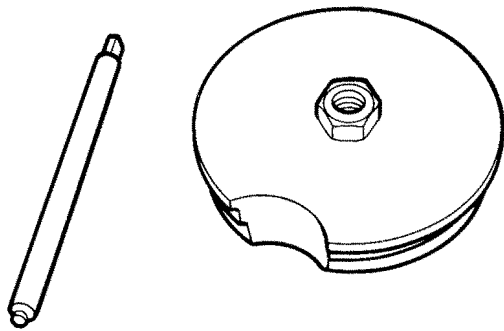
Front axle	50 bar
Rear axle	35-39 bar
Front axle	100 bar
Rear axle	58-62 bar

- If out of specifications, replace pressure regulator and retest.



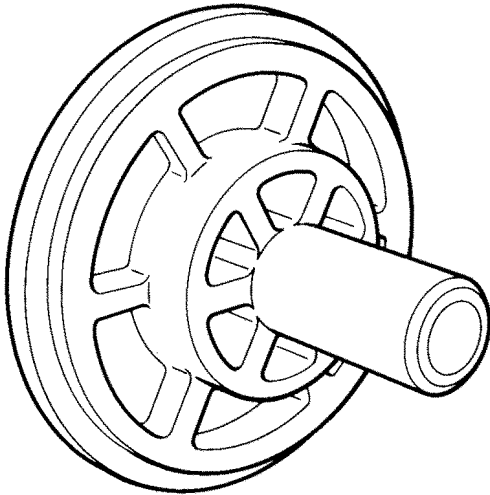
# Special Tools

---



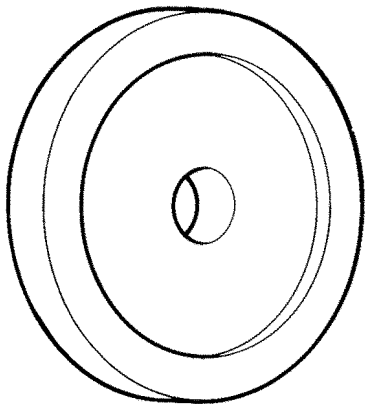
3066

Threaded sleeve and driver for installing rear differential axle flange oil seal. Only the threaded sleeve is needed and is used with 3066/1.



3066/1

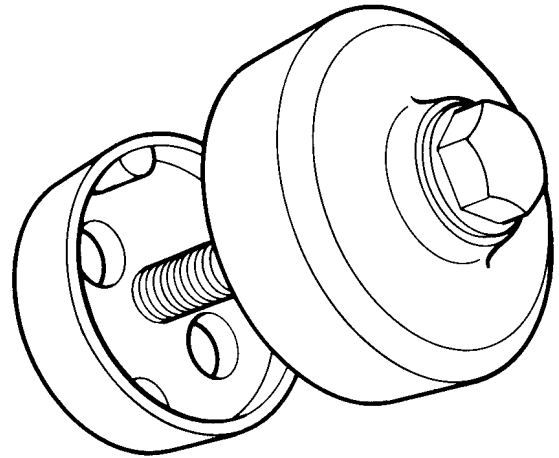
Thrust pad used in conjunction with 3066 to install rear differential axle flange oil seal.



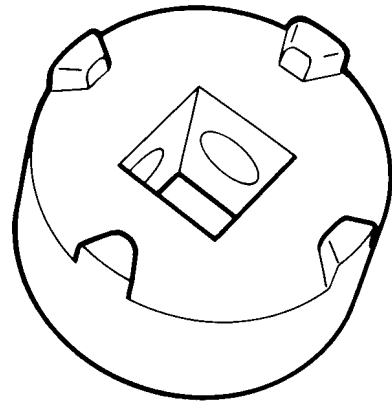
3124

Thrust pad for removing and installing the bonded rubber bushing for the rear differential final drive mount.

3128  
Puller for installing the two piece bonded  
rubber bushing in the rear axle control arm.



3131  
Socket for adjusting the rear brake caliper  
piston.



3139  
Fixture for removing, installing and adjusting  
the driveshaft.

