

VOLVO

for life



Course Code: 0819

2004 Model Year Product, Featuring the R-Range

TECHNICAL UPDATE 1



IMPORTANT SAFETY NOTICE

WARNING: Before performing service, diagnosis or troubleshooting procedures on a vehicle equipped with safety devices containing pyro-technical igniters, i.e., airbags, seatbelt tensioners, side impact curtains, etc., **you must be aware of certain precautions, and follow special procedures to help ensure your safety.** Refer to applicable SAFETY SYSTEM service information for these procedures and precautions.

NOTE: The information contained in this manual is intended for technical training purposes **ONLY**. Always refer to appropriate Volvo service information & wiring diagram manuals when performing fault tracing or service procedures.

Following proper service and repair procedures is essential for the safe, reliable operation of motor vehicles, as well as for the personal safety of the individual doing the work. This manual provides general directions for accomplishing service and repair work with tested, effective techniques.

Numerous variations in procedures, techniques, tools and parts for servicing vehicles, as well as the skill of individual doing the work cannot possibly be anticipated or provided for. Accordingly, anyone who departs from instructions provided in this manual must first establish that they compromise neither their own personal safety nor the vehicle integrity by their choice of methods, tools or parts.

As you read through the procedures, you will come across NOTES, CAUTIONS, and WARNINGS. Each one is there for a specific purpose. NOTES give you added information that can help you to complete a particular procedure. CAUTIONS are given to help prevent you from making an error that could damage the vehicle. WARNINGS remind you to be especially careful in areas where carelessness can cause personal injury. The following list contains some general WARNINGS that you should follow whenever you work on a vehicle.

- Always wear safety glasses for eye protection.
- Use safety stands whenever a procedure requires you to be under the vehicle.
- Turn the ignition switch OFF unless otherwise required by the procedure.
- Set the parking brake when working on the vehicle. If you have an automatic transmission, set it in PARK unless instructed otherwise for a specific service operation. If you have a manual transmission it should be in NEUTRAL unless instructed otherwise for a specific service operation.
- Operate the engine only in a well-ventilated area to avoid the danger from carbon monoxide.
- Keep yourself and your clothing away from moving parts when the engine is running, especially the cooling fan and belts.
- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.
- Do not smoke while working on the vehicle.
- To avoid injury, always remove rings, watches, loose hanging jewelry, and loose clothing before beginning to work on a vehicle. Tie long hair securely behind your head.
- Keep hands and other objects clear of the radiator fan blades. Electric cooling fans can start to operate at any time even with the ignition turned OFF.

Date:

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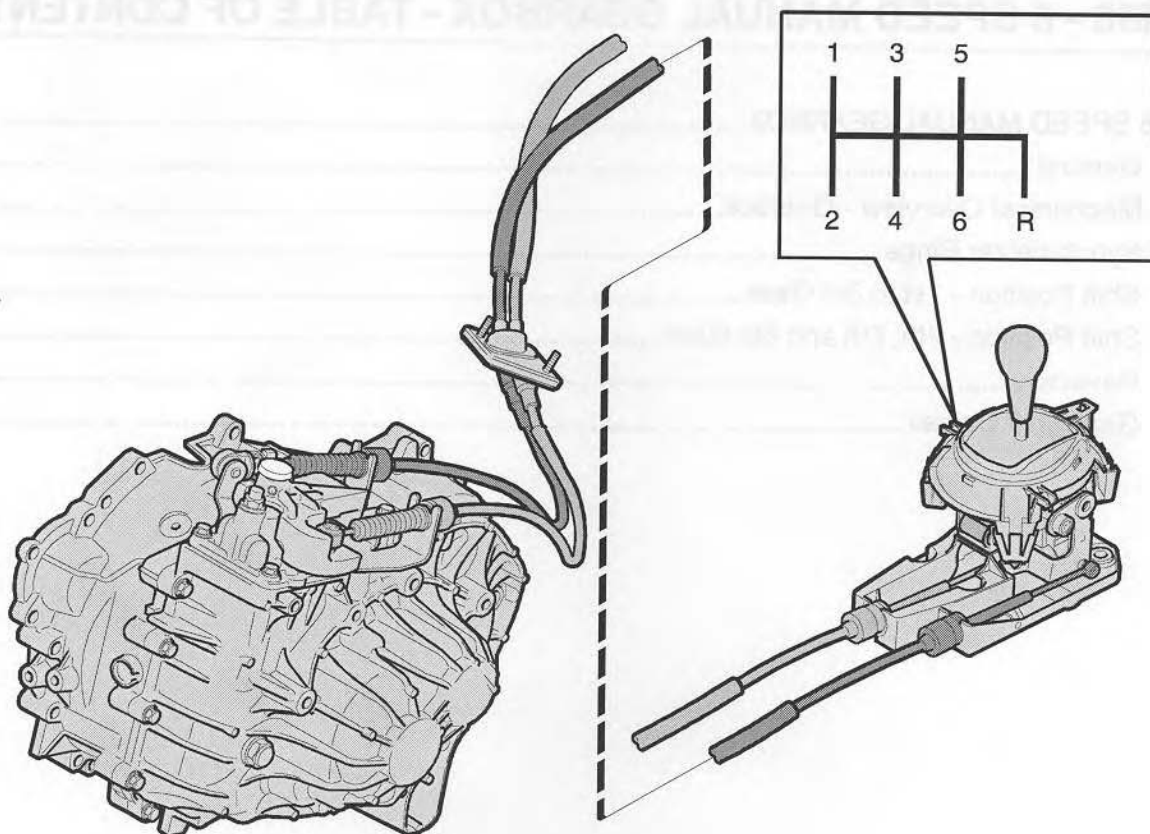
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This book is available in electronic format

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M66 – 6 SPEED MANUAL GEARBOX

GENERAL

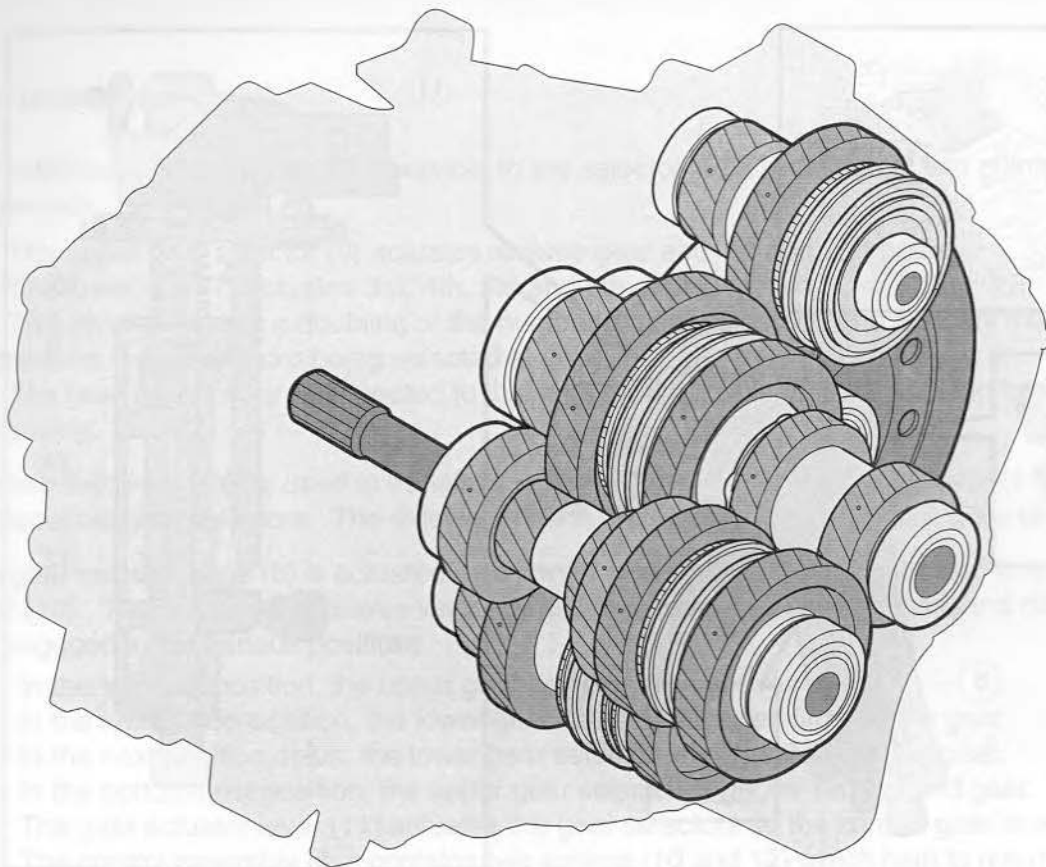
- All gears (including reverse) are synchronized.
- Includes four shafts: one input shaft and three countershafts.
- The oil is synthetic, and normally does not need to be replaced.

Gear Shift Carrier, Cables

- The outer cable casings are attached to the gearshift carrier with snap-on couplings.
- The ends of the cable are attached to the gearshift carrier and gearbox with ball seats.
- The selector cable is adjustable.
 - The adjustment is located on the mounting to the lever, on the gearbox.

Ratios for the Respective Gears – S60R/V70R

1st gear	3.38:1
2nd gear	2.05:1
3rd gear	1.43:1
4th gear	1.08:1
5th gear	0.86:1
6th gear	0.70:1
Reverse	0.77:1
Final drive	3.77
Reverse final drive	4.61



Shafts and Drive

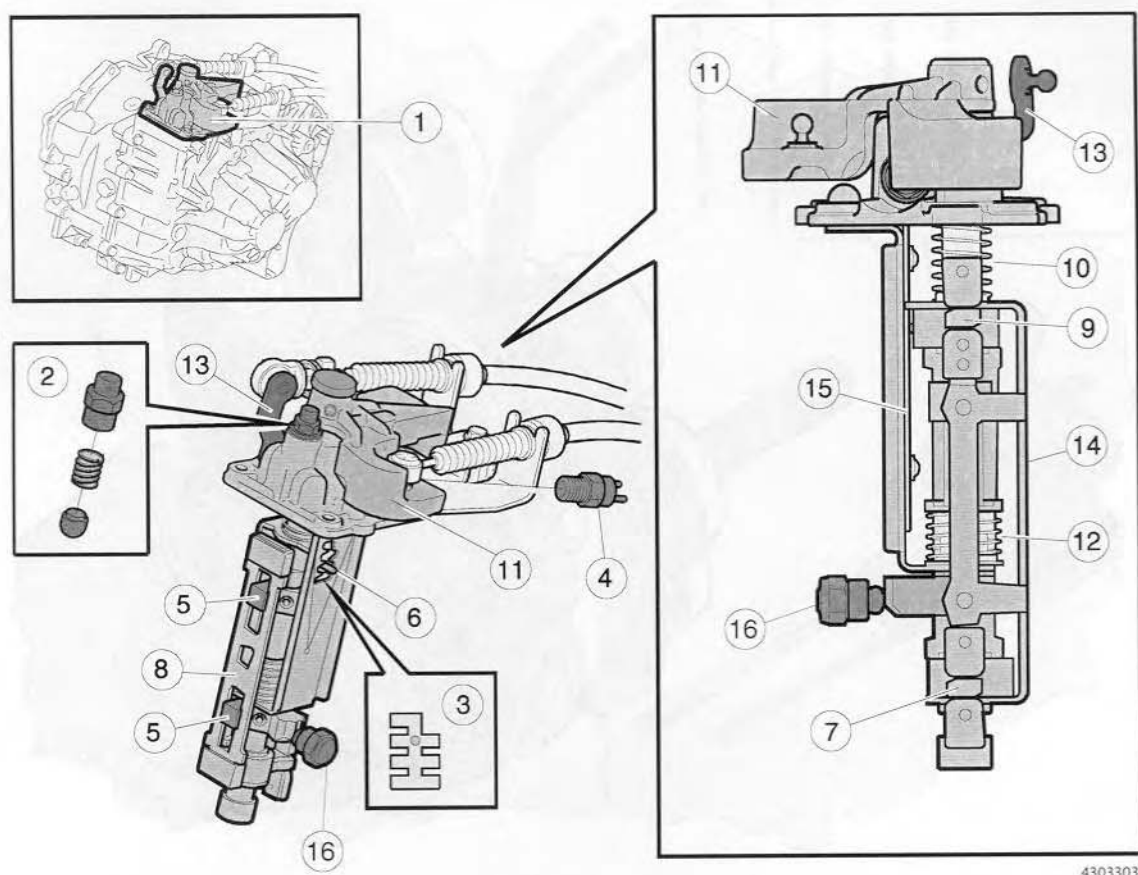
The gears are located on four shafts: one input shaft, two secondary shafts and one reverse shaft.

The clutch gears are welded directly onto the drive cogs, which allows the shaft length to be reduced.

The inner rings are located on the shaft inside the trailing wheels and extend longitudinally a short way outside of each respective trailing wheel.

When the shaft components are pulled together, the inner rings resist so the driven gears can rotate freely. The components are pulled together on the input shaft and by a screw located on the shaft extension.

The components on the upper countershaft are pre-loaded.



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MECHANICAL OVERVIEW – CONTROL ASSEMBLY

COMPONENTS and LOCATION

1	Complete control assembly	9	Upper gear selector
2	Detent, 5th-6th gear	10	Spring
3	Gear selector gate	11	Gate actuator lever
4	Reverse light switch	12	Spring
5	Follower	13	Selector lever
6	Gate pin	14	Locking plate
7	Lower gear selector	15	Carrier plate
8	Gear selector plate	16	Detent for gear position

The gearshift is combined into a complete control assembly (1), apart from the detent for gear position (16) that is threaded into the gearbox housing.

The assembly is held in place by four bolts and is easy to remove.

Two pins in the control housing and a needle bearing in the bottom of the control assembly locate it in position in the gearbox housing.

The reverse light switch (4) is located in the control housing and actuated by the selector shaft.

- The reverse switch is connected directly to the CEM, then sends the signal via CAN to the REM which switches on the reverse lights.

General Information

- The transfer from the control assembly to the selector forks is divided at two points in the gearbox.
 - The upper gear selector (9) actuates reverse gear and 1st and 2nd gears.
 - The lower one (7) actuates 3rd, 4th, 5th and 6th gears.
 - This division means a doubling of the number of gear selectors, and a safety mechanism prevents two gears from being selected at once.
 - The gear selectors are connected to the selector forks which are mounted in bearings in the housing.
- The two followers (5) are used to transfer the torque from the gate actuator lever (11) to the axially displaceable gear selectors. The followers ride in a race in the gear selector plate (8).
- The gear selector plate (8) is actuated by a carrier plate (15) which is connected to the selector lever (13). The carrier plate moves vertically between four possible positions, and different gears are engaged in the various positions.
 - In the topmost position, the upper gear selector engages reverse.
 - In the next-to-top position, the lower gear selector engages 5th and 6th gear.
 - In the next position down, the lower gear selector engages 3rd and 4th gear.
 - In the bottommost position, the upper gear selector engages 1st and 2nd gear.
 - The gate actuator lever (11) actuates the gear selectors so the correct gear is selected.
 - The control assembly also contains two springs (10 and 12) which help to return the gear shift to its neutral position.
- The parts in the control assembly are mounted in bearings in different ways.
 - The selector movement is mounted in two needle roller bearings and two ball bearings.
 - The gate actuator movement is mounted in double needle roller bearings.

NOTE: The mechanical control assembly is not serviceable and can only be replaced as a complete unit.

SYNCHRONIZER RINGS

The new synchronizer ring design:

- Made from pressed sheet metal instead of brass.

Advantages:

The same thermal expansion as interference parts. This means that space required for clearance for thermal expansion can be eliminated. Sheet metal is stronger than brass. These two elements mean that the synchro takes up less space in the box.

- Reduced clutch gear module.

Advantage:

The angle through which the driven gears and synchro have to be turned when the gear selected is smaller. This makes shifting lighter and more positive.

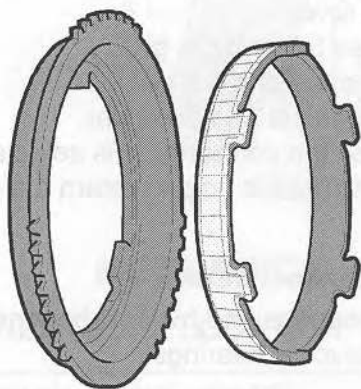
- No cones on the driven gears for single and double synchronizer ring.

Advantage:

Less manufacturing cost since cone machining is not necessary.

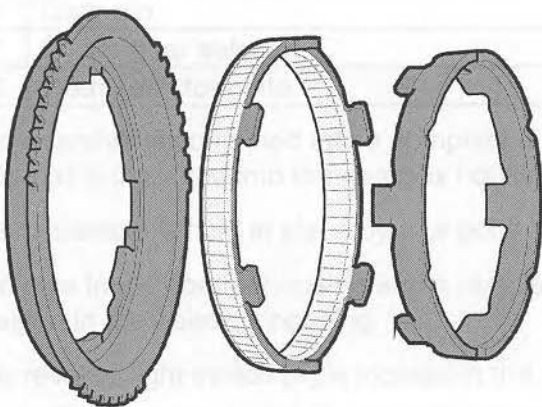
The synchronizer ring is structured according to a modular system.

For example, you could upgrade from a single synchronizer ring to a double synchronizer ring by simply changing the synchronizer ring kit.



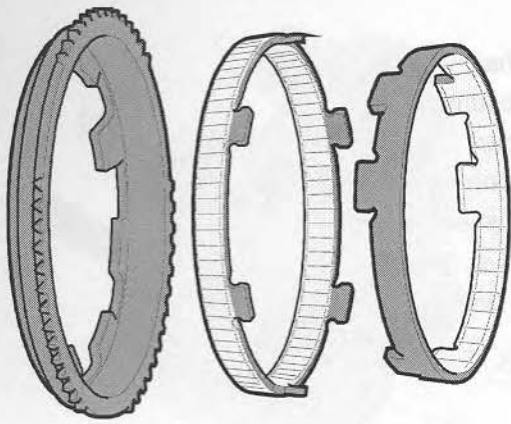
Synchronizer Ring

- Reverse
- 4th gear
- 5th gear
- 6th gear



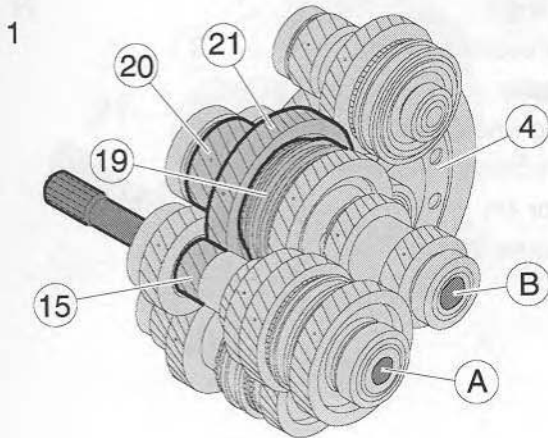
Double Synchronizer Ring

- 3rd gear

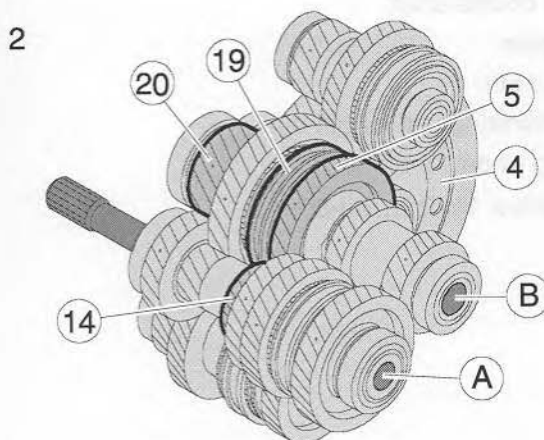
**Triple Synchronizer Ring**

- 1st gear
- 2nd gear

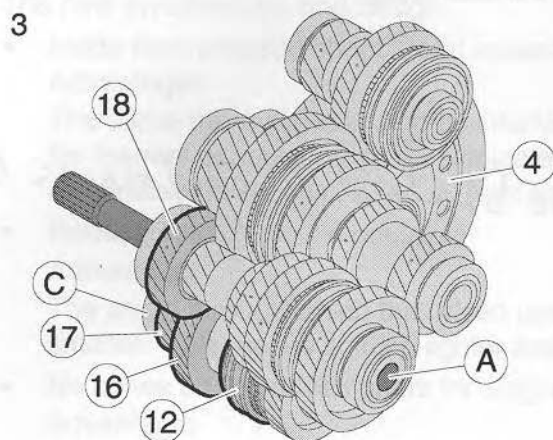
Stamped Sheet Metal w/ Brass Coat

SHIFT POSITION – 1st to 3rd GEAR**1st Gear**

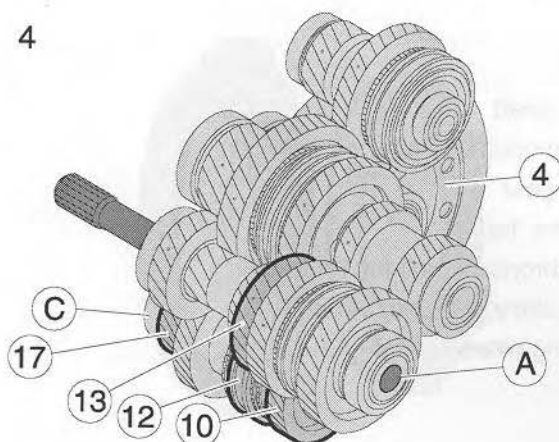
- A Input shaft
- B Upper countershaft
- 4 Ring gear
- 15 Cog for 1st
- 19 Synchronizing unit for 1st-2nd
- 20 Final drive, 1st-2nd, 5th-6th
- 21 Trailing wheel for 1st

**2nd Gear**

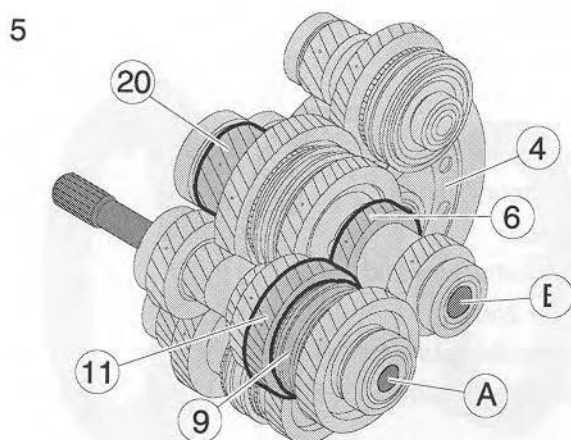
- A Input shaft
- B Upper countershaft
- 4 Ring gear
- 5 Trailing wheel for 2nd
- 14 Cog for 2nd
- 19 Synchronizing unit for 1st-2nd
- 20 Final drive, 1st-2nd, 5th-6th

**3rd Gear**

- A Input shaft
- C Lower countershaft
- 4 Ring gear
- 12 Synchronizing unit for 3rd-4th
- 16 Trailing wheel for 3rd
- 17 Final drive, 3rd-4th
- 18 Cog for 3rd

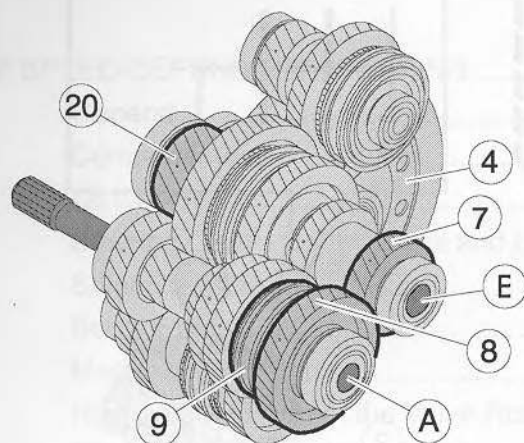
SHIFT POSITION – 4th, 5th and 6th GEAR**4th Gear**

- A Input shaft
- B Lower countershaft
- 4 Ring gear
- 10 Trailing wheel for 4th
- 12 Synchronizing unit for 3rd-4th
- 13 Cog for 4th
- 17 Final drive, 3rd-4th

**5th Gear**

- A Input shaft
- B Upper countershaft
- 4 Ring gear
- 6 Cog for 5th
- 9 Synchronizing unit for 5th-6th
- 11 Trailing wheel for 5th
- 20 Final drive, 1st-2nd, 5th-6th

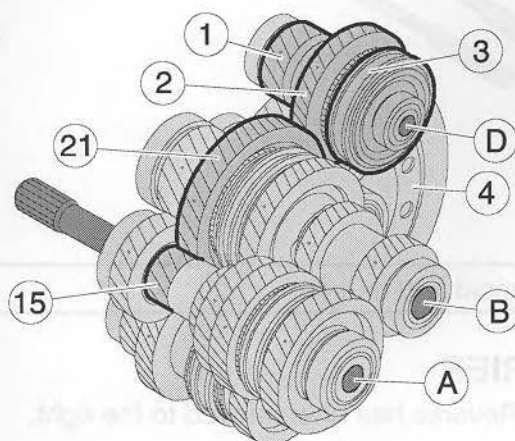
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**6th Gear**

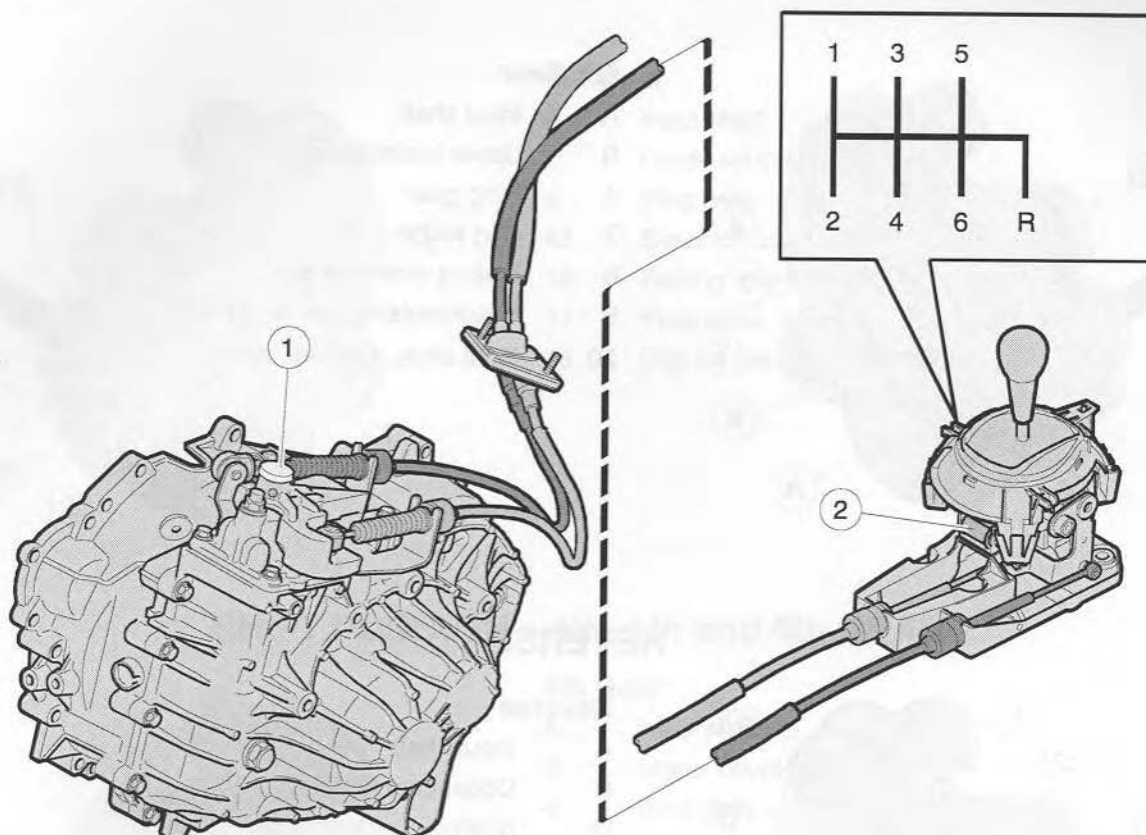
- A Input shaft
- B Upper countershaft
- 4 Ring gear
- 7 Cog for 6th
- 8 Trailing wheel for 6th
- 9 Synchronizing unit for 5th-6th
- 20 Final drive, 1st-2nd, 5th-6th

REVERSE

R

**Reverse**

- A Input shaft
- B Upper countershaft
- D Shaft for reverse gear
- 1 Final drive
- 2 Trailing wheel for reverse
- 3 Synchronizing unit
- 4 Ring gear
- 15 Cog for 1st
- 21 Trailing wheel for 1st



1 Locking of adjustable selector cable

2 Solenoid and damper

GEAR SHIFT CARRIER

The gear shift carrier for the M66 has a new shifting pattern. Reverse has been moved to the right. Neutral is between 3rd and 4th.

There is a solenoid (2) on the gear shift carrier which works as an electronic reverse lock.

- If the speed of the car is beyond 25 km/h (15 mph), the solenoid activates to prevent selection of reverse.

- If the speed drops below 15 km/h (9 mph), the solenoid is released and reverse can be selected.

Above the solenoid is an electronic damper which gives the solenoid a soft movement and provides insulation against unnecessary noise. This solenoid can be replaced and is available as a spare part. The activation and release of the solenoid is controlled via the CEM.

- The control between the solenoid and the CEM is transferred via serial communication.

The gearshift carrier has a return spring on the selector lever.

- There are two return springs in total (one in the control assembly and one in the gearshift carrier).

Cables

The outer cable casings are mounted in the gearshift carrier and gearbox with snap on couplings. The ends of the cable are attached to the gearshift carrier and gearbox with ball seats.

The selector cable is longitudinally adjustable.

- The adjustment is located on the mounting to the lever on the gearbox.

- The spring in the gear shift carrier pulls the cable into the correct position, and the cable is then locked in position manually using the lock. When locked, the gearshift and components in the gearbox must be in neutral (between 3rd and 4th).

GLOSSARY

ABS	Anti-lock Braking System	KIR	Key Integrated Remote
A/C	Air Conditioning	LDC	Load Dependable Control
ACS	Active Chassis Setting	LED	Light Emitting Diode
AUX	AUXiliary	LEV	Low Emission Vehicle
AWD	All Wheel Drive	LSM	Light Switch Module
AYC	Active Yaw Control	MHz	MegaHertz
BCM	Brake Control Module	MLS	Multi Layer Sealing
BGC	Brake Grip Control	MMS	Mass Movement Sensor
BRC	Bump and Rebound Control	MOST	Media Oriented Systems Transport
CAN	Controller Area Network	PDM	Passenger Door Module
CCC	Close Coupled Catalyst	PEM	Pump Electronic Module
CCM	Climate Control Module	Prog-mode	Programming mode
CEM	Central Electronic Module	PRV	Pressure Regulation Valve
CM	Control Module	PVV	Pressure Ventilation Valve
CVVT	Continuously Variable Valve Timing	PWM	Pulse Width Modulated
DBC	Dynamic Body Control	RSC	Roll Stability Control
DCC	Dynamic Cornering Control	REM	Rear Electronic Module
DDM	Driver Door Module	SAS	Steering Angle Sensor
DEM	Differential Electronic Module	SBL	Secondary BootLoader
DIM	Driver Information Module	SC	Stability Control
DLC	Dive and Lift Control	SCM	Siren Control Module
DSTC	Dynamic Stability and Traction Control	SRS	Supplementary Restraint System
DTC	Diagnostic Trouble Code	SULEV	Super Ultra Low Emission Vehicle
DVD	Digital Versatile/Video Disc	SUM	SUspension Module
EBA	Emergency Brake Assistance	TCM	Transmission Control Module
ECM	Engine Control Module	TCV	Turbo Control Valve
FOUR-C	Continuously Controlled Chassis Concept	TRACS	TRACtion Control System
FWD	Front Wheel Drive	UEM	Upper Electronic Module
GDL	Gas Discharge Lightning	VADIS	Volvo Aftersales Diagnostics & Information System
IR	Infra Red	WHC	Wheel Hop Control
ISM	Inclination Sensor Module		



VOLVO

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Service Training and Development Department

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