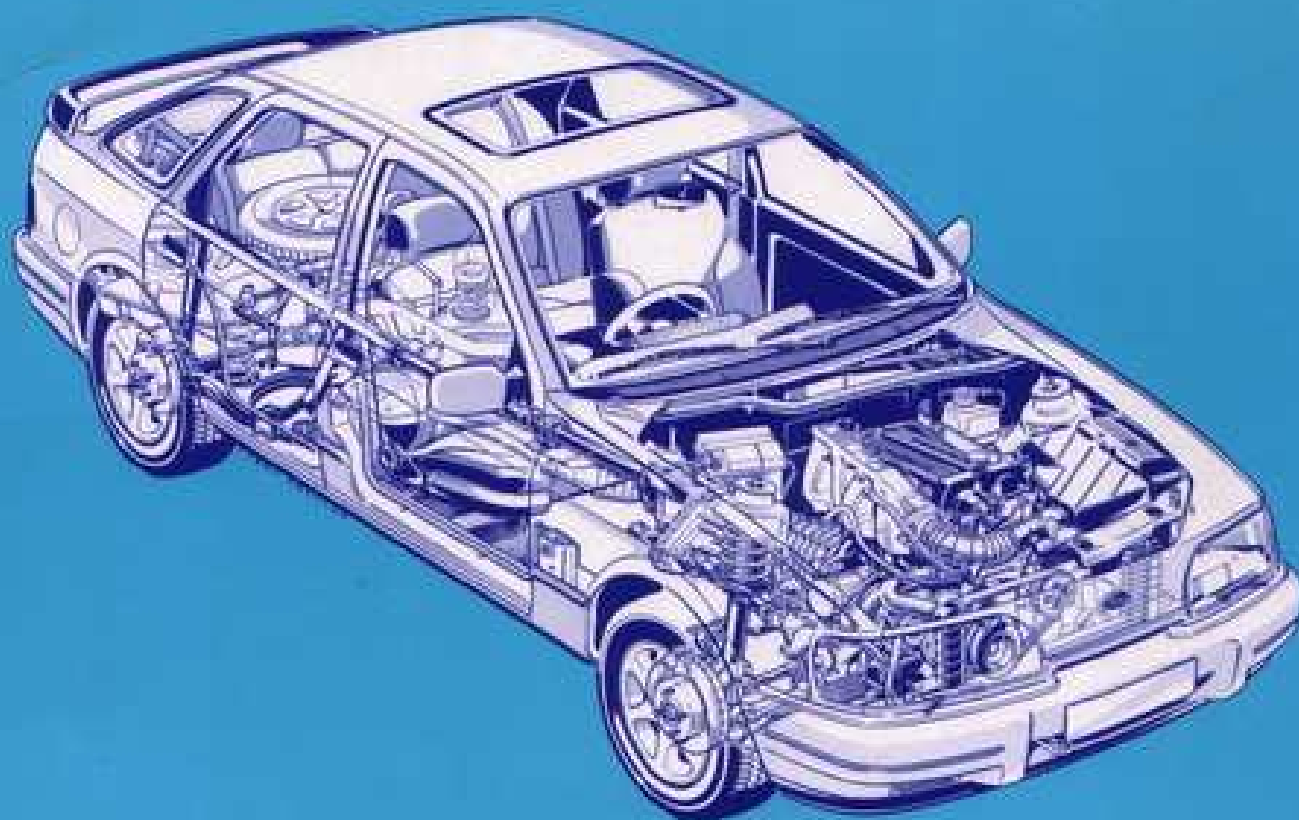




SIERRA DOHC 4x4



Technicians Product Training






The Sierra DOHC 4x4 is essentially based on the rear-wheel drive Sierra DOHC and the Sierra XR4x4.

The aim of this Technicians Product Training brochure is to inform you, the service technician, of all modifications and innovations incorporated in the Sierra DOHC 4x4.

Note: In this brochure only those changes and innovation are listed which have been carried out on the Sierra DOHC rear axle drive and the Sierra XR4x4. All assemblies or parts not listed have been carried over from the model's indication.

The colours used in coloured illustrations indicating the scope of modification have the following significance:

-  New - New component for Sierra DOHC 4x4
-  Modified - Modified component of another vehicle
-  Unchanged - Component adopted unchanged from another vehicle

Please remember that our "Technicians Product Training" brochures are designed for introductory training only.

Repair and adjustment operations should always be carried out according to instructions and specifications in the workshop literature which is regularly updated.



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Literature Summary



Technicians Product Training:
CG 7308, 2,0 l DOHC engine

Wiring diagram Sierra

Service Microfiche

- Sierra
- Sierra 4x4
- Sierra XR4x4

Vehicle System Test Manual

Parts Microfiche

- Sierra
- Sierra 4x4
- Sierra XR4x4
- Engine
- Transmission



Vehicle Data

15/04-version

83 US version

Weight (kg)

Unladen weight

Permissible total weight

Permissible axle load - front

- rear

Saloon

Estate

1725

1800

850

850

925

1025

ENGINE

Output (DIN)

92 KW (125 HP)

88 KW (120 HP)

Acceleration 0 - 100 km/h (s)

0 - 60 mph

Saloon

10,4

10,7

Estate

10,8

11,1

Maximum Speed (km/h)

Saloon

191 (117 mph)

186 (113 mph)

Estate

188 (115 mph)

183 (112 mph)

Fuel consumption (l/100 km)

Town traffic

9,2

10,3

90 km/h (56 mph)

6,0

6,4

120 km/h (74 mph)

7,8

8,3

Component Summary

Engine	2.0 l DOHC engine with EFI injection system (Electronically controlled Fuel Injection). Emission Regulation 83 US (three-way catalytic converter and evaporative emission control system) and 15/04 systems are available
Front suspension	Independent suspension by McPherson spring strut
Steering	Power assisted steering system
Drive	4x4 drive concept with MT 75 manual transmission, transfer case with viscous coupling, front drive shaft, front differential, two side shafts, rear drive shaft, rear differential with viscous coupling, two side shafts
Rear suspension	Independent suspension utilising twin semi-trailing arms
Wheels/Tyres	Alloy wheels 5 1/2 J x 14 H2 E 41 Tyres 195/60 R14-H
Brakes	Anti-lock brake system (ABS) with disc brakes all round

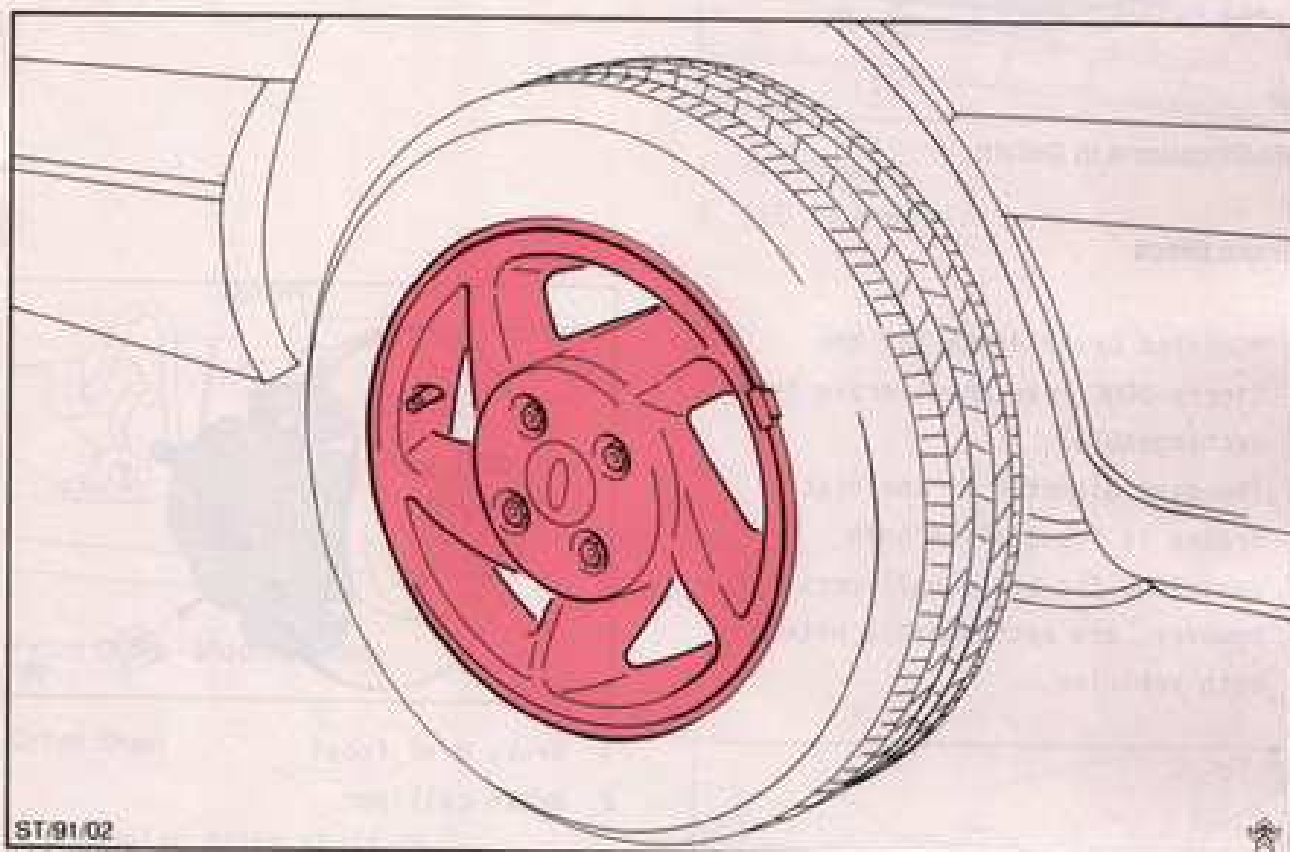
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Wheels/Tyres - Modifications

Alloy Wheels

New alloy wheels 5 1/2 J x 14 H2 E 41 with tyres 195/60 R14-H.



Alloy wheels

Vehicle towing

- o The vehicle may be towed provided that all four wheels are in normal contact with the road.
- o If this is not possible the vehicle may only be moved by transporter.

Braking System - Modifications

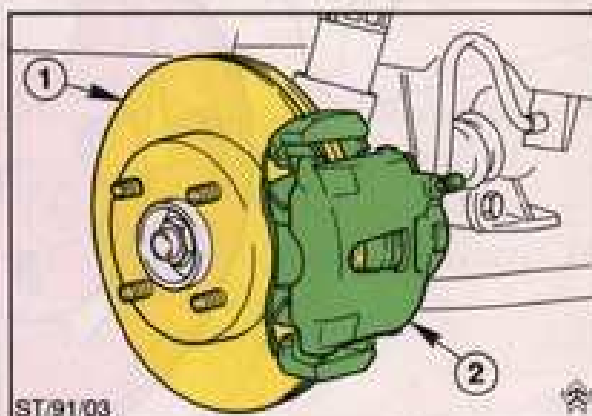
Summary:

- o Brake discs
- o ABS module

Modifications in Detail:

Brake Discs

- o Modified brake discs for the Sierra DOHC rear wheel drive (not exchangeable).
The disc diameter of the disc brakes is identical in both vehicles. The brake callipers however, are exchangeable between both vehicles.



- 1 Brake disc, front
- 2 Brake calliper

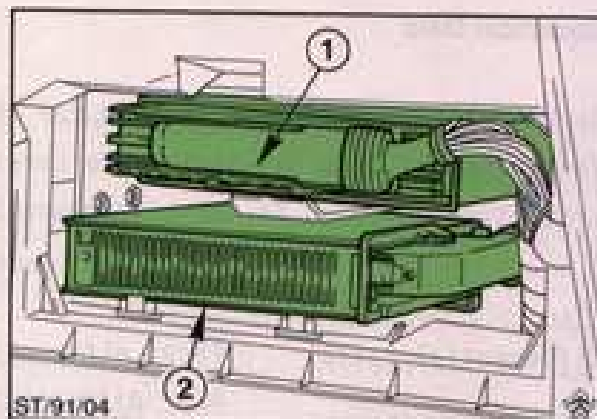
Check Brakes (on brake roller dynamometer)

Note: It is possible to check the brakes by conventional means on a roller dynamometer provided that:

- o The brakes must not be tested for longer than 60 seconds per axle and at a roller speed of (max.) 5 km/h (3 mph). To avoid damage to the viscous coupling.

ABS Module

- o The ABS module is now behind the glove compartment. This simplifies the cable routing.

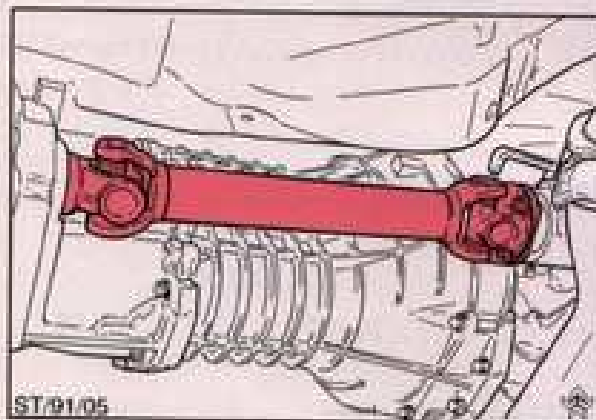


- 1 ABS module
- 2 EEC IV module

Front Drive - Modifications

Drive Shaft

- o A tubular drive shaft to the front differential gives greater torsional rigidity.



Drive shaft to front differential



Technical Data

Technical data which has changed for the Sierra DOHC 4X4.

The technical data not listed are carried over from the existing Service Literature as shown in the Literature Summary page 3.

Differential ratios	Front differential	3.92 : 1
	Rear differential	3.92 : 1

Tyre pressure (bar) with tyres cold

Note: Sweden only

Type	Tyre size	Unladen		Laden	
		front	rear	front	rear
Estate	195/60 R14-H	1.8	1.8	2.0	2.5

Unladen weight

	Saloon		Estate	
	15/04	83 US	15/04	83 US
CL	1155	1165	1195	1205
CLX	1160	1170	1200	1210
Ghia	1230	1240	1270	1280
XR	1195	1205	-	-



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General

The Sierra DOHC 4x4 is equipped with an MT-75 5-speed manual transmission and transfer assembly. Apart from a few modifications, the 4x4 drive concept was adopted from the Sierra XR4x4. The system operates permanently in 4-wheel drive and utilises viscous couplings in the transfer case and rear differential.

The following components have been modified for the Sierra DOHC 4x4:

- o Transmission ratios
- o Transmission bell housing
- o Breather for double lip rotary shaft seal
- o Drive shaft

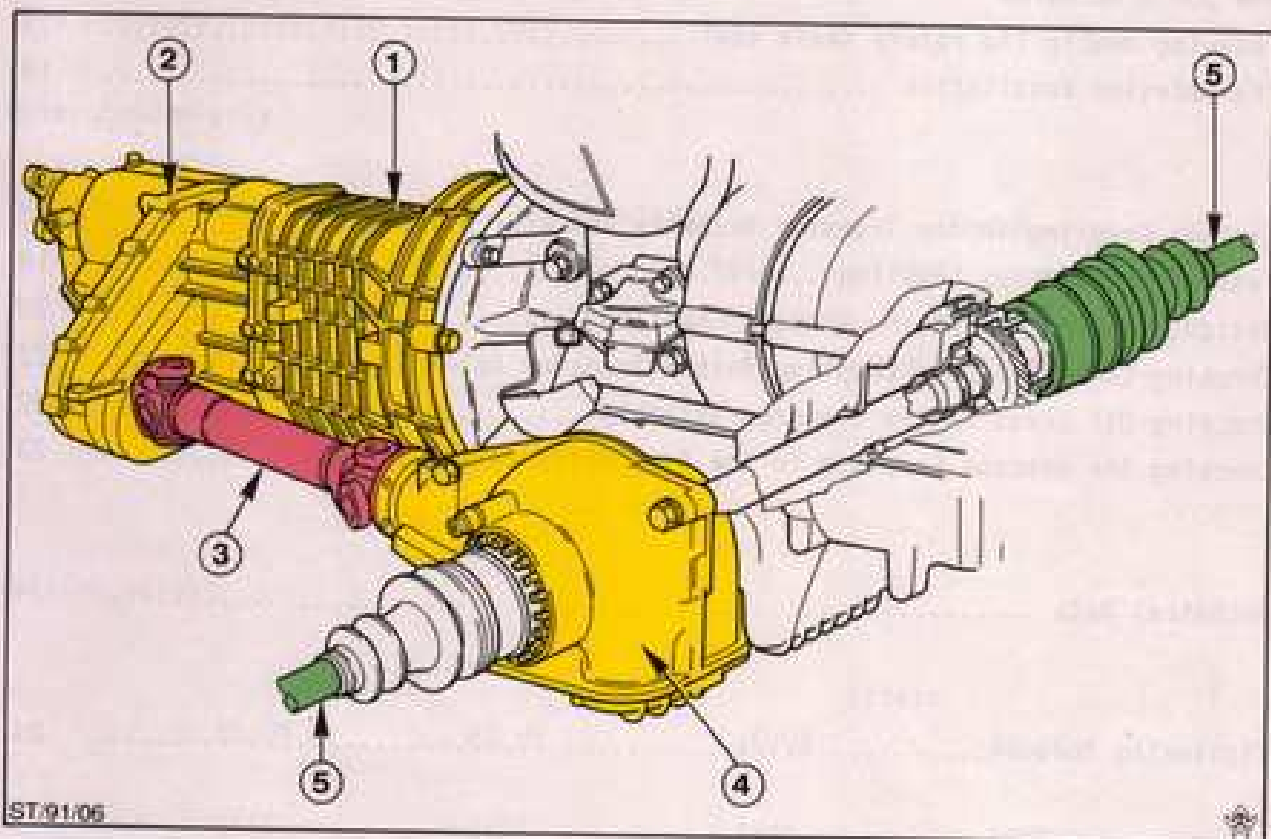


Illustration of the front wheel drive of the Sierra DOHC 4x4

- | | |
|-----------------------|----------------------|
| 1 Transmission | 4 Front differential |
| 2 Transfer assembly | 5 Front drive shafts |
| 3 Tubular drive shaft | |

■ New

■ Modified

■ Unchanged

Transmission/Transfer Assembly - Modifications

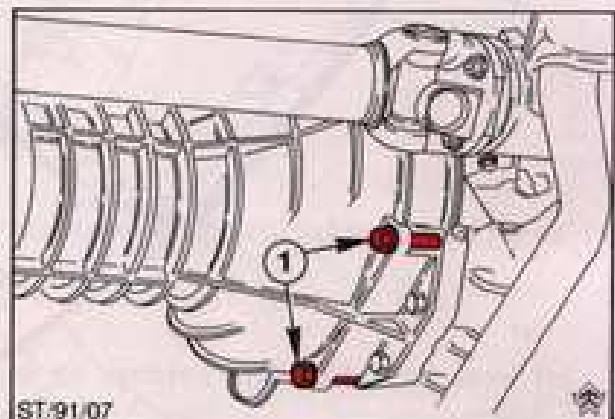
Summary:

- o Transmission bell housing
- o Bearing bracket for drive sprocket
- o Clutch cable assembly
- o Breather for double lip rotary shaft seal

Modifications In Detail:

Transmission Bell Housing

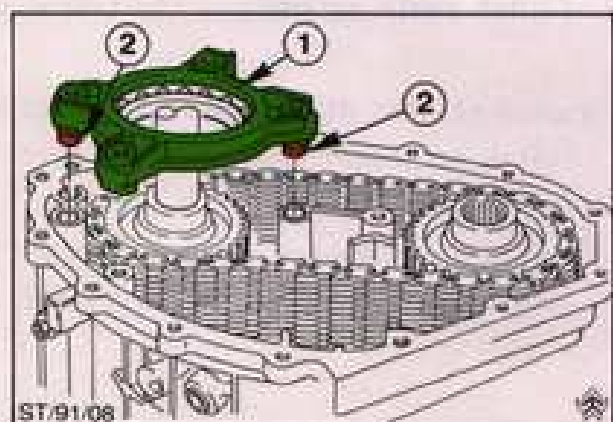
- o The transmission bell housing has been adapted to the DOHC engine. For space reasons, it was necessary to extend two securing bolts holding the transmission bell housing.



1 Securing bolts for transmission

Bearing Bracket

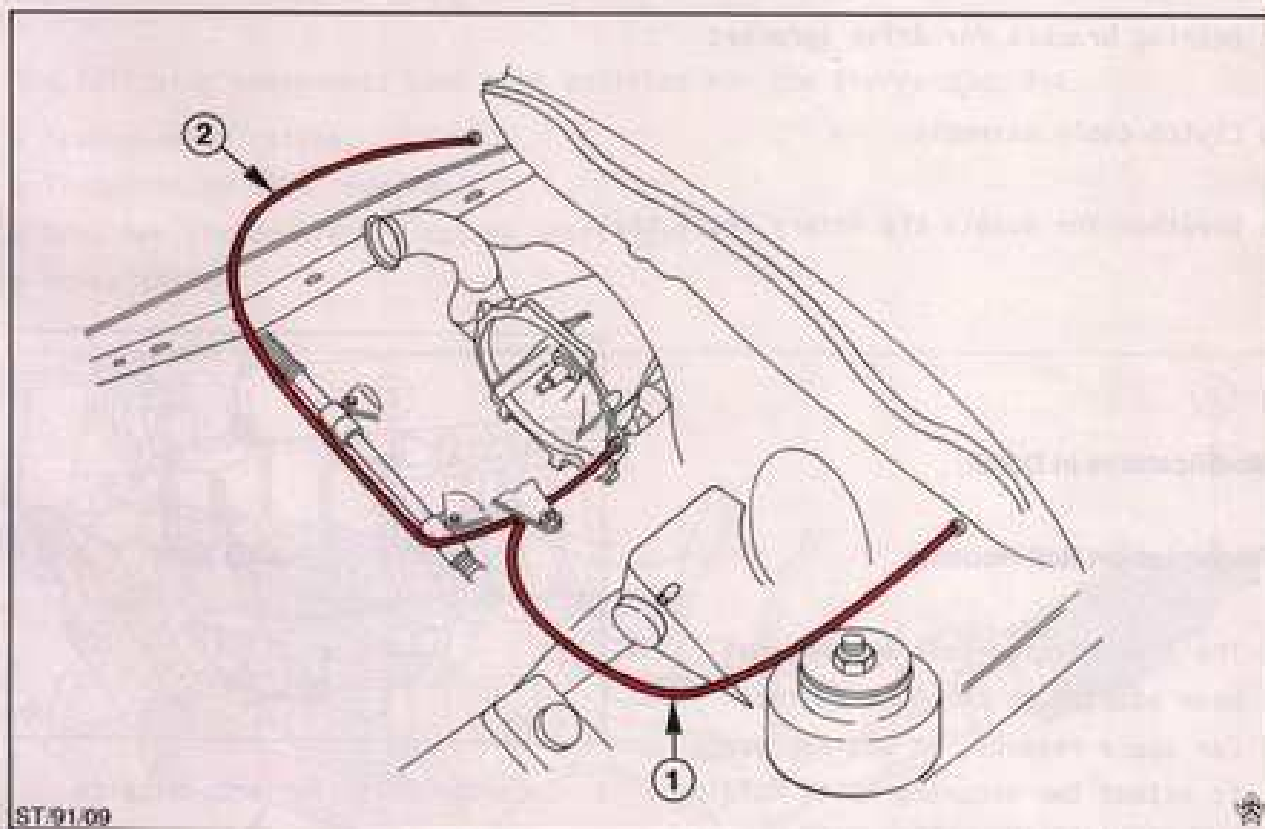
- o To give increased support, a new bearing bracket has been installed in the transfer assembly with centering sleeves for the drive sprocket.



1 Bearing bracket
2 Centering sleeve

Clutch Cable Assembly

- o The clutch cable assembly is different for left-hand drive and right-hand drive variants.

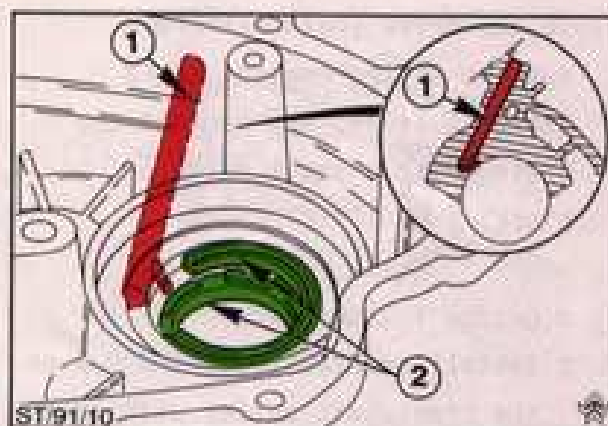


ST/01/09

- 1 Clutch cable assembly - left-hand drive
- 2 Clutch cable assembly - right-hand drive

Breather

- o A double rotary shaft seal is installed between the manual transmission and transfer assembly. A breather prevents pressurization of the double lip rotary shaft seal. In addition, oil can be seen to emerge from this drilling on the left-hand side of the transmission in the event of the double lip rotary shaft seal leaking.



- 1 Breather drilling
- 2 Double lip rotary shaft seal

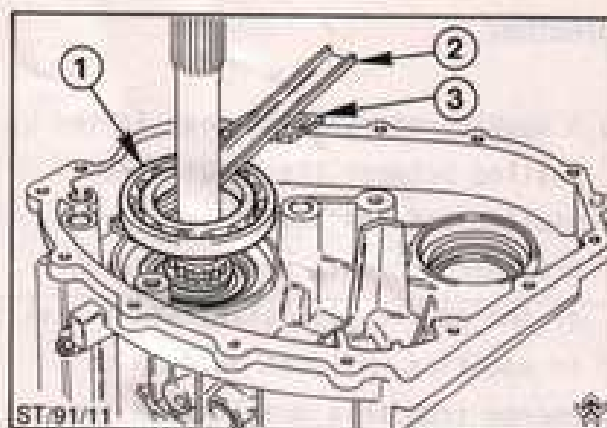
Renewing double lip rotary shaft seal (new job procedure)

Note: o Disassembly and assembly of the transmission (MT-75/4x4) is described in the service microfiche job procedure 16118 8.

- o The double lip rotary shaft seal can be removed and installed when installed in the vehicle or on an assembly bench.
- o The drive flange of the rear drive shaft is not removed (job numbers 5, 6, 7, 14).
- o Important:
 - warm up cover around lower drive sprocket bearing with hot air before removing and installing housing cover. Bearing must remain on drive sprocket after cover is removed.
 - also warm up housing around bearing with hot air before removing and installing upper drive sprocket. Bearing should be removed together with drive sprocket.

1. Disassemble transmission (however, only up to job number 15, job numbers 1 - 4 are not applicable when the repair is performed with the transmission installed in the vehicle) see service microfiche.

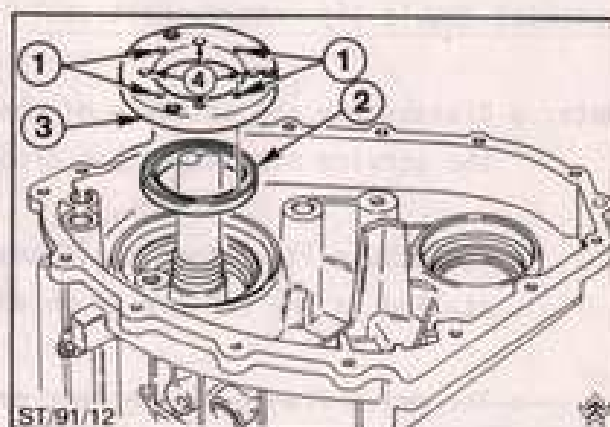
2. If the drive shaft ball race remains in the housing, use a suitable lever, and protect the casing with a small hardwood block.
3.
 - o Engage fourth gear.
 - o Install special tool 15-030 A on the crankshaft pulley with spacers.
 - o Unscrew nut of the transmission main shaft with special tool 16-051.



1 Ball race 3 Hardwood block
2 Lever

4. Fit extractor 16-055 for the double lip rotary shaft seal in the transmission housing in order to drill the holes and hold in position with the nut of the transmission main shaft.

5.
 - o With a 2.5 mm twist drill, drill through the first rotary shaft seal and spot-drill the second rotary shaft seal.
 - o Unscrew nut of transmission main shaft and now turn special tool 16-055 through 90° (see ill.).



1 Holes for spot-drilling
2 Double lip rotary shaft seal
3 Extractor
4 Holes for extractor

Note: Coat drill with grease to trap swarf.

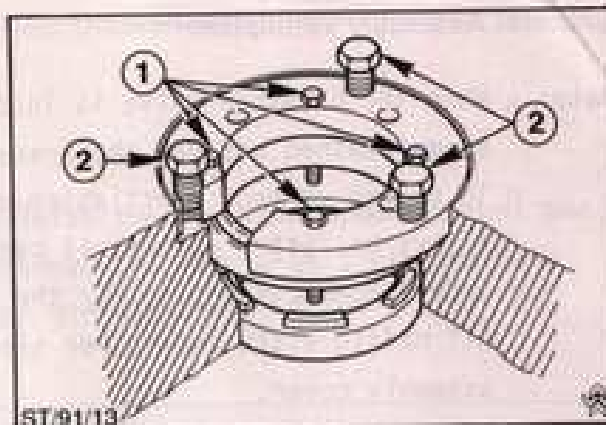
Note: The rotary shaft seal is shown removed for better illustration.

6. o The holes of the extractor and rotary shaft seal must be aligned in agreement.
- o Secure the rotary shaft seal to the extractor by means of four self-tapping screws.
- o Screw in three M6 screws (cross-wise in several operations) and remove rotary shaft seal.

Note: Before removing the second rotary shaft seal, remove any remaining metal chips with a magnet.

- o With the aid of a pointed drift (21-151), punch through the spot-drilled points on the second rotary shaft seal.
- o Remove rotary shaft seal in the same way as the first seal.

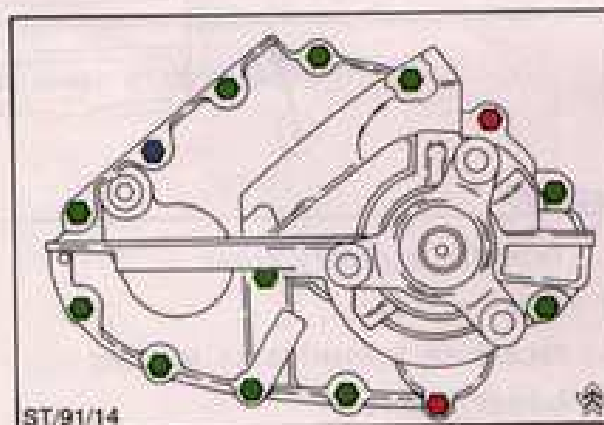
7. For installation, refer to service microfiche.



- 1 Supplied self-tapping screws
2 M6 screws

Note: Arrangement of the bolts on the transfer assembly:

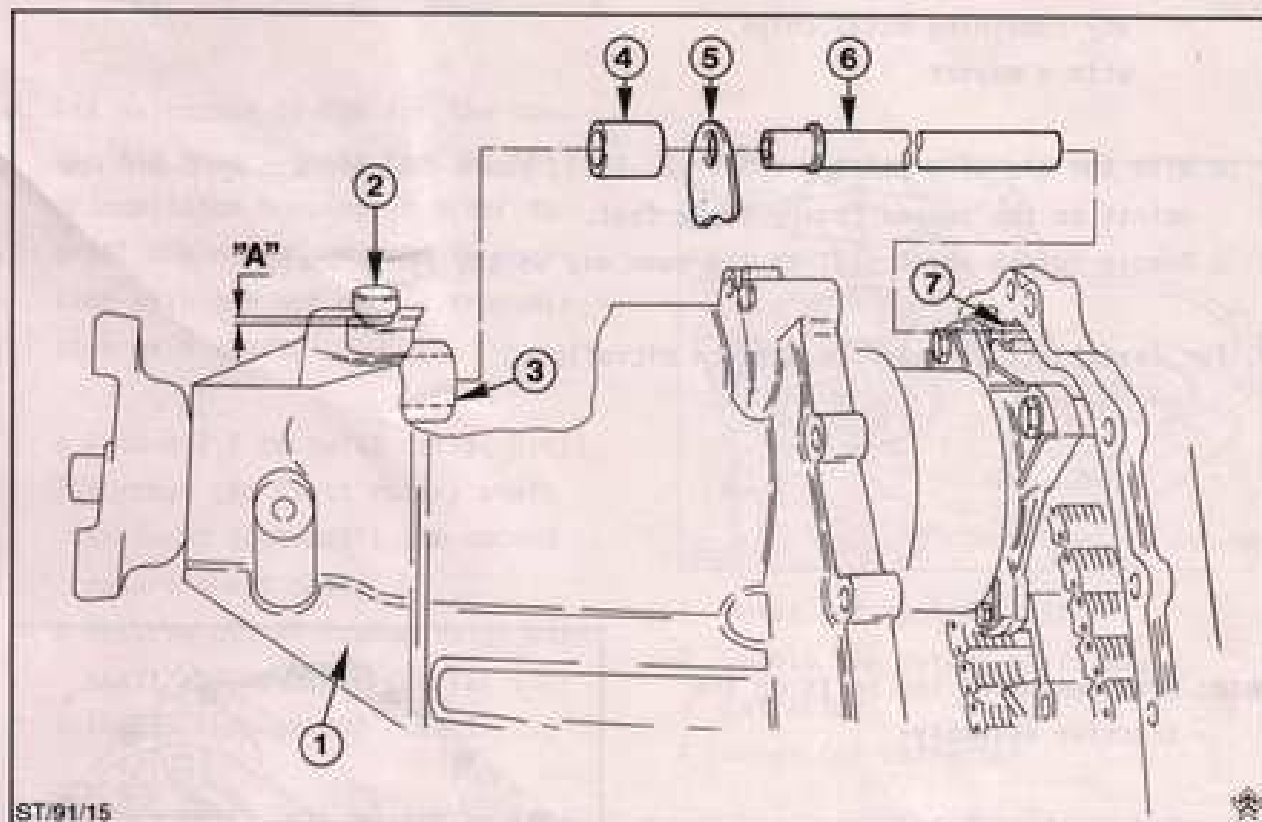
- Red - Long bolts
Green - Short bolts
Blue - Stud bolts for ground strap



Transfer assembly

Transfer Assembly Ventilation

- Note:**
- o When the breather valve is installed, a clearance "A" of 2 to 3 mm must be maintained between the transmission housing and breather cap.
 - o To ensure correct ventilation of the transmission, the breather cap must always be fitted so that it can move freely on the stem.
 - o Insert connection pipe for the transmission ventilation together with oil baffle plate and rubber sleeve in the recess in the transfer assembly cover.
 - o When attaching the transfer assembly cover to the transmission, insert the transfer assembly ventilation connection pipe correctly in the recess in the transmission.



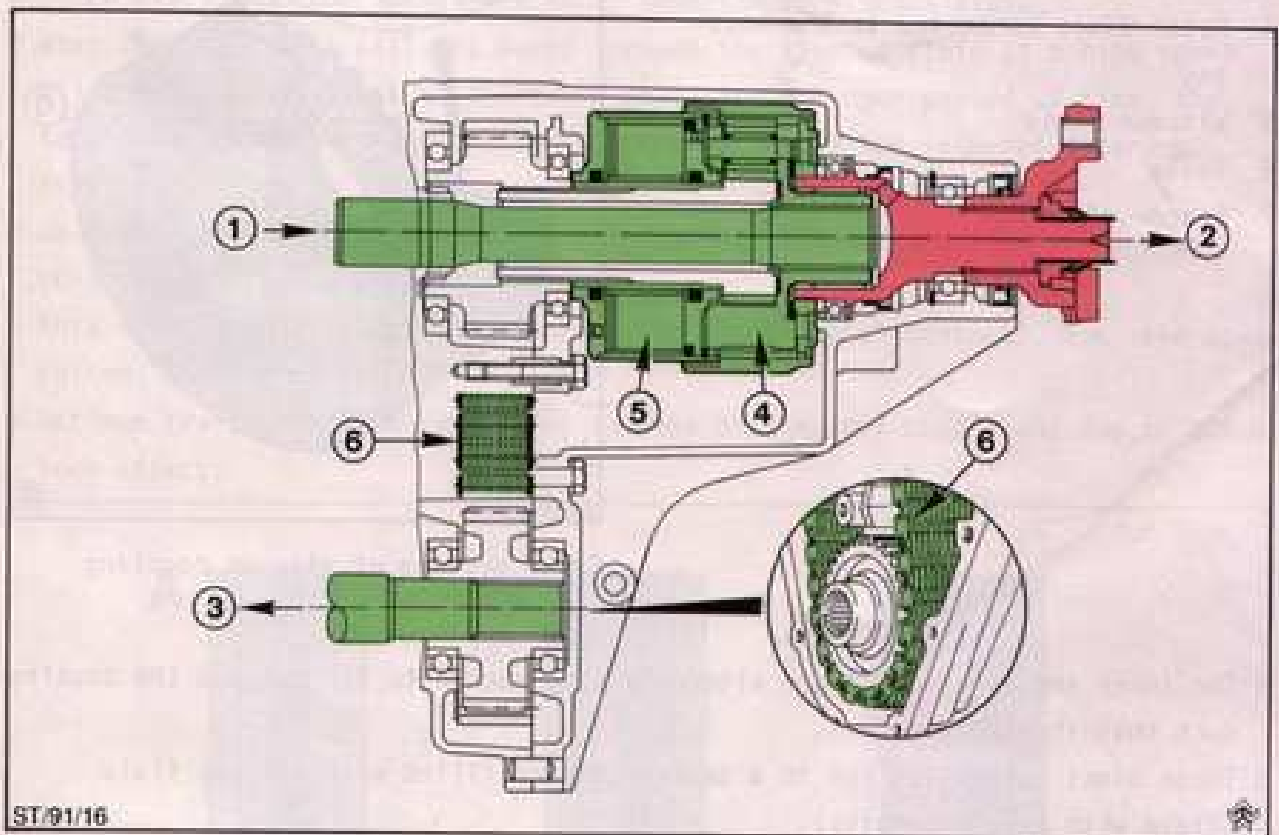
- 1 Transfer assembly cover
- 2 Breather cap
- 3 Recess in transmission housing
- 4 Rubber sleeve

- 5 Oil baffle plate
- 6 Connection pipe
- 7 Recess in transmission

Viscous Coupling in the Transfer Assembly and Rear Differential

Task of the Viscous Coupling

The task of the viscous couplings is to maximize the traction between front and rear wheels (in the transfer case), also between the rear wheels (in the rear differential), by means of controlled torque distribution.



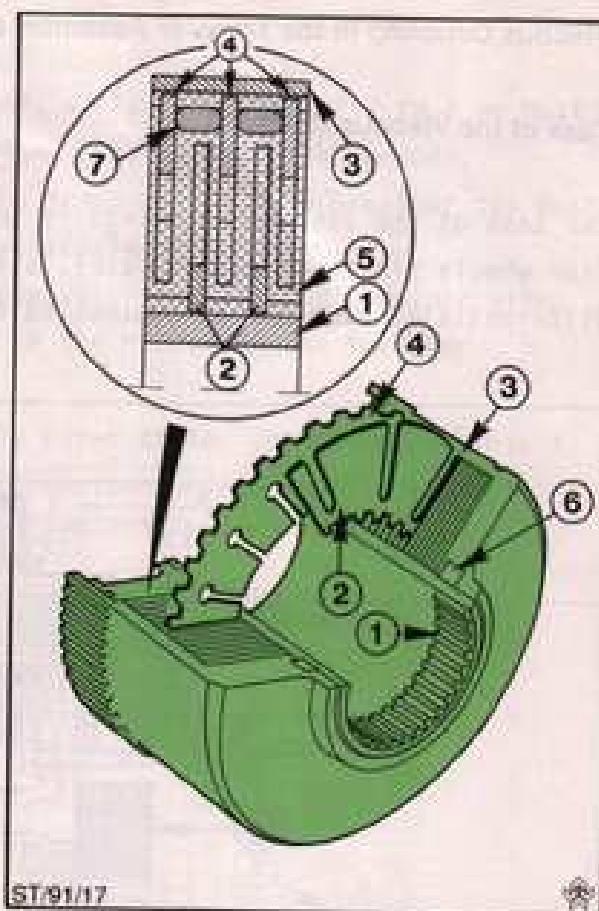
Schematic diagram of transfer assembly with power distribution

- 1 Power transmission main shaft - 100 %
- 2 Power rear axle - 66 %
- 3 Power front axle - 34 %
- 4 Planetary gear differential
- 5 Viscous coupling
- 6 Drive chain

Design and Function of the Viscous Coupling

The viscous coupling consists of the following components:

- 1 Hub
- 2 Inner discs connected to the hub
- 3 Housing
- 4 Outer discs connected to the housing
- 5 Viscous fluid
- 6 Seals
- 7 Spacer rings



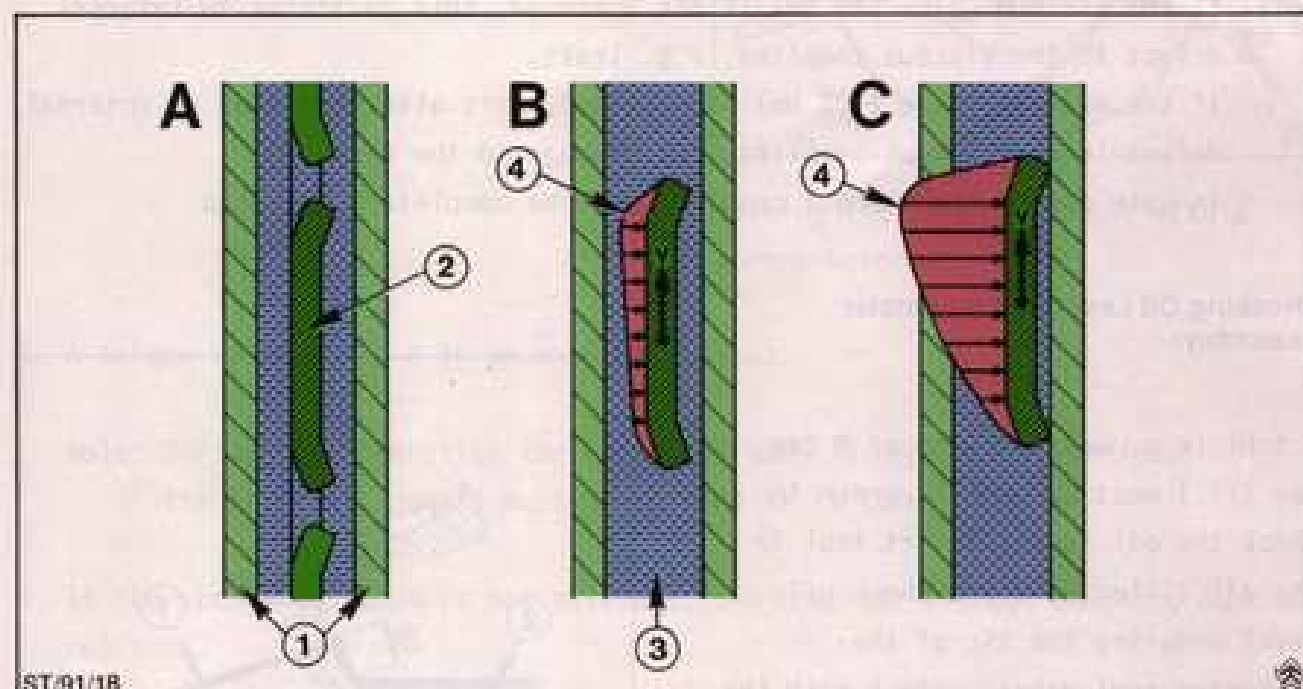
Cross section of viscous coupling

- o The inner and outer discs are alternately connected to the hub and the housing such that they cannot turn.
- o These discs assemblies run in a sealed chamber filled with viscous fluid (fluid with high viscosity).
- o The inner and outer discs make no contact with each other.
- o If a difference in speed occurs between the housing (outer discs) and the hub (inner discs), for instance, because one wheel or one axle slips, the force is transmitted from the outer to the inner discs by the shearing the viscous fluid.
- o Similar to a jar of honey (housing cage) through which a teaspoon is drawn (inner discs): When the spoon is moved slowly, the jar remains still, when it is moved faster the glass is also drawn with it.
- o The viscous coupling operates in a similar manner. The greater the speed difference between the front and rear axle or right-hand and left-hand wheel, the greater is the "drawing effect" by the viscous fluid.

During general vehicle operation, the viscous coupling operate in so-called viscous mode in accordance with the principle of fluid friction without metal contact of the discs. Under extreme conditions, a transition takes place from viscous mode to the so-called "hump". The hump effect refers to an increase in the rate of transmitted torque caused by mechanical contact of the inner and outer discs.

Function (see schematic diagram):

- o (ill. A). The inner discs with profiled slot edges move freely between two stationary outer discs.
- o Outer discs and inner discs are fully immersed in viscous fluid.
- o When the inner disc (ill. B) moves through the viscous fluid at a high speed difference with respect to the outer discs for a longer period of time, the temperature and therefore pressure increases due to the internal shearing friction.
- o As a result of a further increase in pressure (ill. C) the inner disc makes contact with the outer disc.
- o This results in frictional contact of the discs (metal contact), i.e. the so-called "hump" effect.
- o Optimum traction is achieved under extreme driving off conditions due to 100 % lock effect.



1 Stationary outer discs

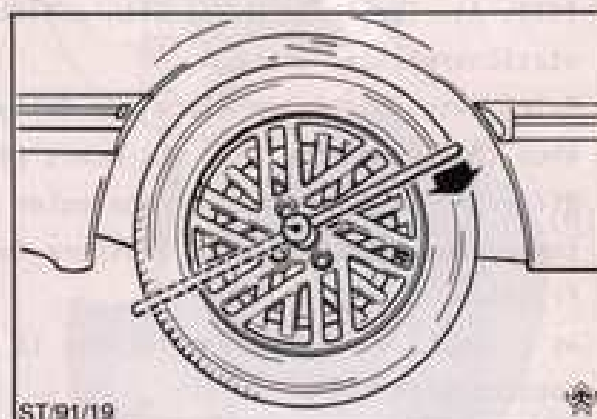
2 Moving inner discs

3 Viscous fluid

4 Pressure differences distribution

Checking Centre Viscous Coupling in the Transfer Assembly

1. Apply hand brake and place shift lever in neutral position.
2. Jack up vehicle at the front on one side (the three other wheels must have ground contact) and remove hub cap.
3. Fit torque wrench on axle shaft nut and turn the wheel with the torque wrench by approx. 1/2 turn within 1 second.
4. A torque of 70 ± 30 Nm must be achieved.



Turning the wheel with a torque wrench

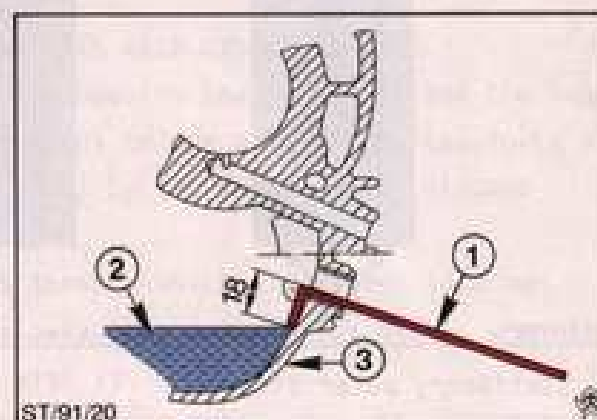
Note: If the minimum value (40 Nm) is not achieved, this indicates an internal defect in the viscous coupling, e.g. leaks.

If the maximum value (100 Nm) is exceeded, this also indicates an internal defect in the viscous coupling, e.g. damage to the discs.

In both cases, the viscous coupling must be completely replaced.

Checking Oil Level in the Transfer Assembly:

A tool (e.g. welding wire of $\varnothing 2$ mm, see ill.) must be made in order to check the oil level. Insert tool in the oil filler hole and check oil level ensuring the tip of the measuring tool makes contact with the housing. When the oil level in the transmission is correct, the tip of the measuring tool will be coated with oil.

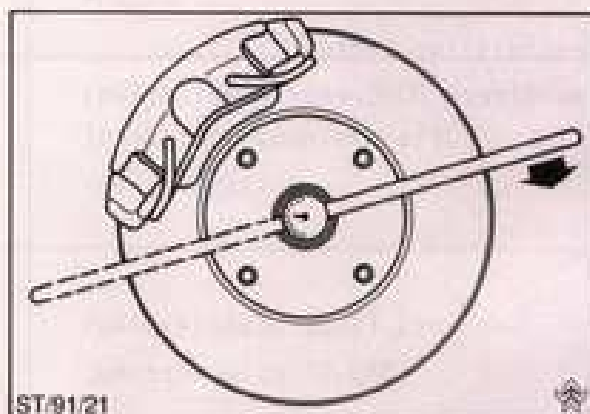


- | | |
|--------------------|-----------|
| 1 Measuring tool | 3 Housing |
| 2 Transmission oil | |

Checking the Viscous Coupling in the Rear Differential

Note: The rear wheel must be removed for applying the torque wrench to the axle shaft nut.

1. Slacken off wheel nuts of one rear wheel.
2. Release handbrake.
3. Jack up rear of vehicle and remove wheel (front wheels must make ground contact).
4. Fit torque wrench on the axle shaft nut and turn the axle shaft nut with the torque wrench approx. 1/2 turn within 1 second.



Turning the axle shaft nut with a torque wrench

5. A torque value of 70 ± 30 Nm must be reached.

Note: During this operation the rear hups turn in opposite directions. The rear drive shaft must be secured if it turns also.

6. If the specified value is not obtained, the complete viscous coupling must be replaced.



Technical Data

Oil filling capacity - Transmission 1.20 l

Transfer Assembly 0.50 l

Oil grade - Transmission Ford specification

ESD-M2C186-A

Transfer Assembly SQM2C9010B

ESPM2C166H

optionally SQM2C9010A

Transmission ratios 1st. gear 3.89

(as Sierra DOHC rear-wheel drive) 2nd. gear 2.08

3rd. gear 1.34

4th. gear 1.00


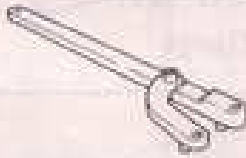





5th. gear 0.82

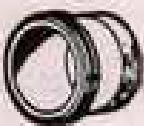




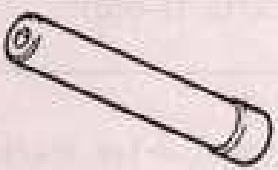



Reverse 3.51




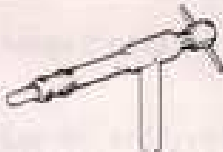



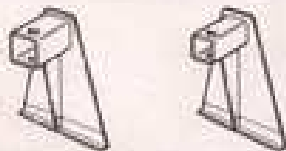
Tightening Torque - Modification

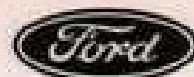
Clutch release bearing guide sleeve 250 - 270 Nm

Special Tools

Special Tools	Number	Description
	14-028	Installer, oil seal front axle drive
	15-030A	Universal flange holding wrench
	15-036	Installer, countershaft roller bearing
	15-050	Puller (basic tool) (in conjunction with 16-050)
	15-073	Socket wrench, drive shaft
	16-040	Socket wrench, guide sleeve
	16-041	Remover/Installer, transmission front housing

	16-041-01	Adapter for removing front transmission housing (in conjunction with 16-041)
	16-041-02	Adapter plate for removal of transmission main shaft
	16-043A	Installer, oil seal in output flange
	16-044	Installer, oil seal input shaft
	16-050	Collet, inner race of roller bearing in countershaft (in conjunction with 15-050)
	16-051	Socket wrench, nut on transmission main shaft
	16-052	Mounting fixture (in conjunction with 21-023)
	16-053	Installer, transmission main shaft
	16-054	Installer, double lip oil seal

	16-055	Remover, double lip oil seal
	21-023	Universal shaft to attach the transmission to the assembly bench (in conjunction with 16-045)
	21-036A	Remover, selector rail ball sleeve (used with spindle 21-037A)
	21-037B	Remover, selector rail ball sleeve (only use the spindle)
	21-044A	Installer, selector rail ball sleeve
	21-051	Remover, oil seal output flange
	21-140	Engine support bar or MS 53 C with MS 53 C2
	21-140-01	Adaptors for engine support bar

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Remove and Install Engine with Transmission - Modifications

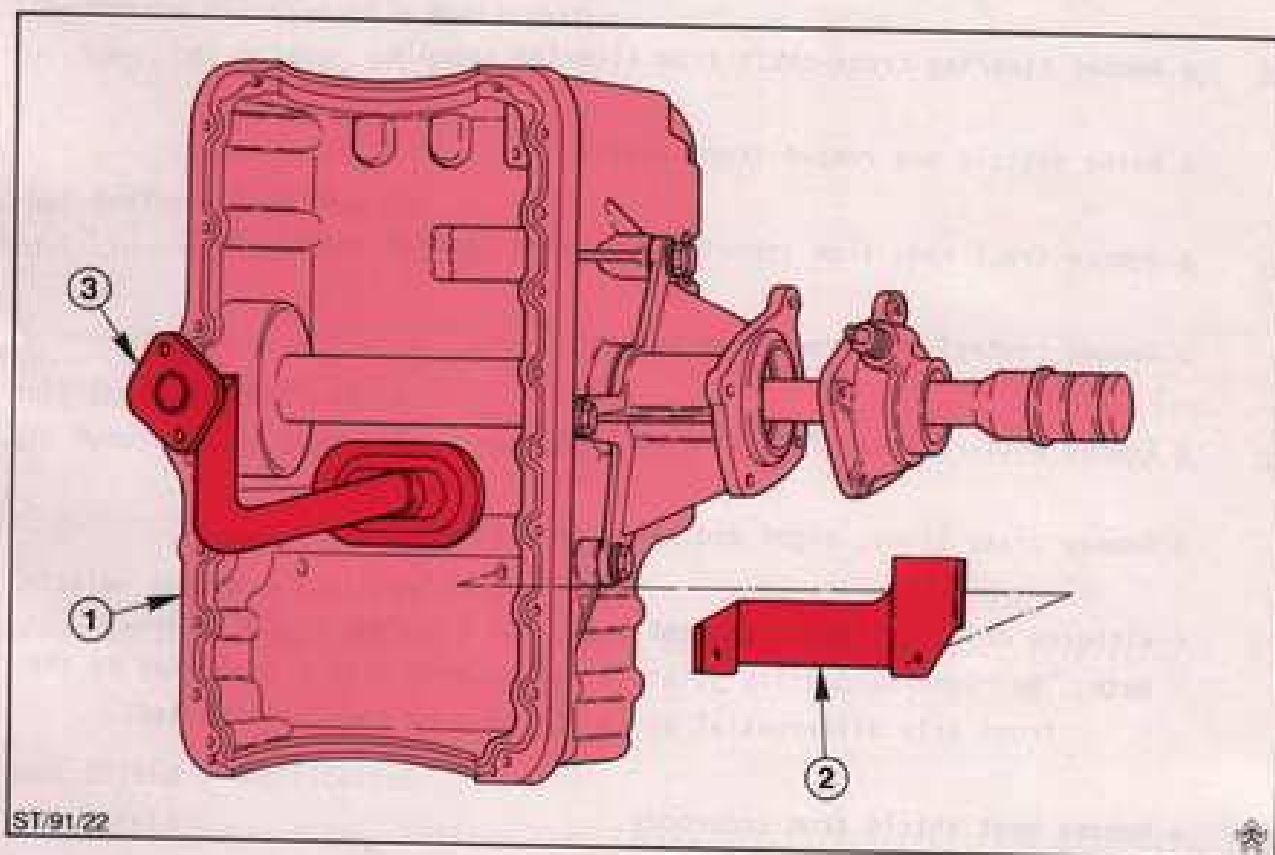
Note: The DOHC engine must be removed and installed from below with the transmission. To do this, it is necessary additionally to perform the working steps listed in the following.

- o Remove steering cross-shaft from steering spindle.
- o Raise vehicle and remove front wheels.
- o Remove track rods from steering arm using special tool 13-006.
- o Remove control arm from pivot bearing.
- o Remove anti-roll bar from side members.
- o Remove brake lines, right and left, from holder.
- o Withdraw drive joints, right and left, and tie down at the sides.
Note: The right-hand drive joint is not secured with a snap ring in the front axle differential as is the case on the Cosworth 4x4.
- o Remove heat shield from underbody.
- o Support engine mount and remove from side member and take out with steering, control arm, anti-roll bar.

Lubrication Oil Circuit - Modifications

Oil Sump, Oil Baffle and Oil Pickup

- o New oil sump, oil baffle and oil pickup. Caused by the routing-through-sump of the left hand drive shaft.

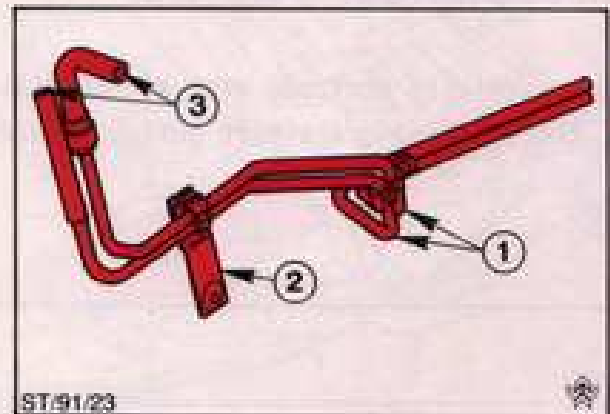


- 1 Oil sump
- 2 Oil baffle
- 3 Oil pickup

Fuel System - Modifications

Fuel Lines

- o To accommodate the front-wheel drive, the routing of the lines as well as brackets and connections have been redesigned.

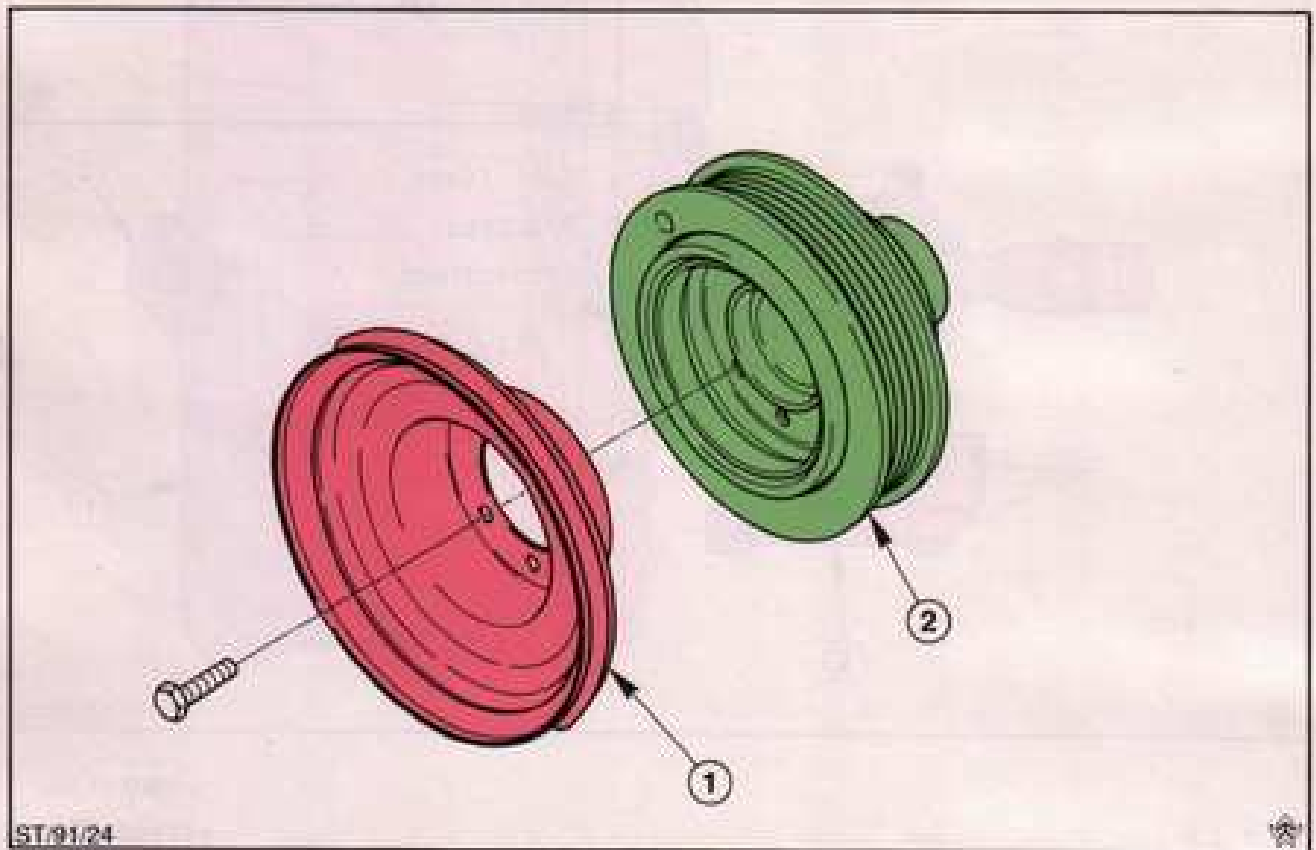


- 1 Fuel lines
- 2 Brackets
- 3 Connections

Belt Drive - Modification

Air Conditioning Compressor Drive

- o In vehicles equipped with air conditioning, an additional pulley is bolted to the existing crankshaft pulley in order to drive the compressor.

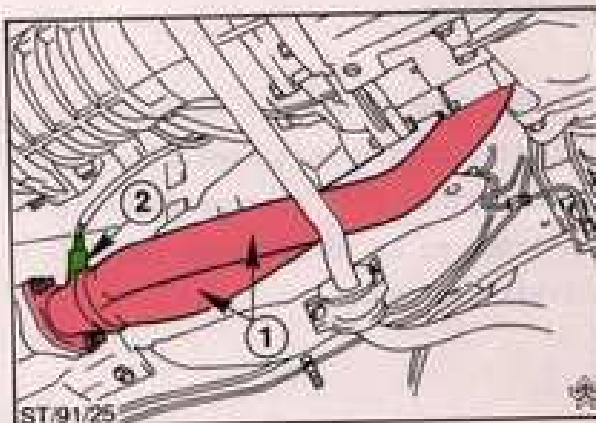


- 1 Additional pulley (for driving the compressor)
- 2 Existing crankshaft pulley

Emission System - Modifications

Front Section of Exhaust Pipe and Lambda Sensor

- o New front section of exhaust pipe.
The lambda sensor is located at the end of the front section of the exhaust pipe.

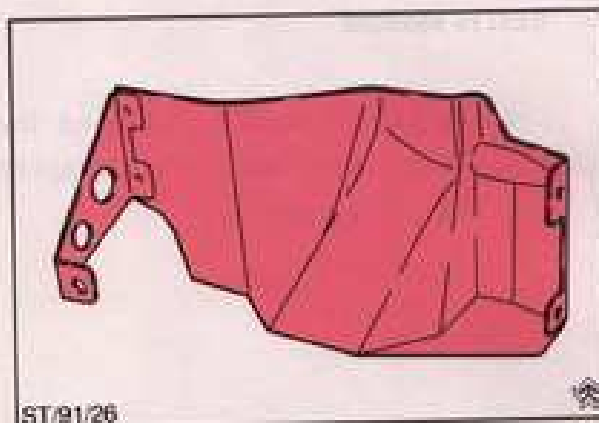


- 1 Front section of exhaust pipe
- 2 Lambda sensor

Heat Shield - Modification

Heat Shield

- o New heat shield for ABS unit, left-hand side of engine compartment.

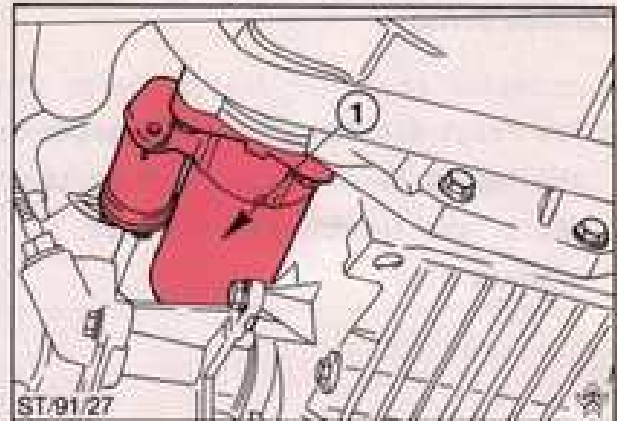


Heat shield

Starting System - Modification

Starter Motor

- o A new type of starter motor is mounted on the left hand side of the engine. This starter motor is shorter so as to fit into the available space.

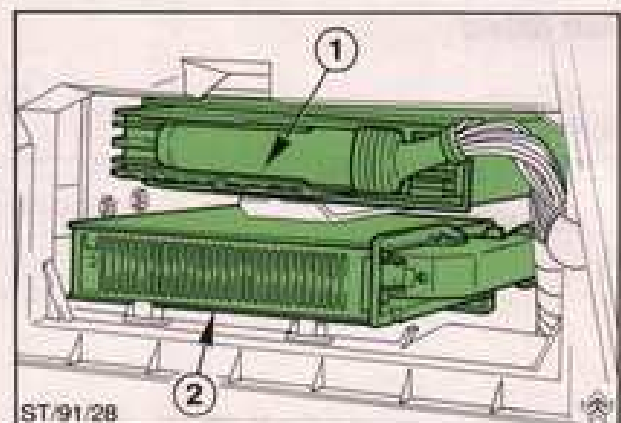


1 Starter motor

Engine Management - Modification

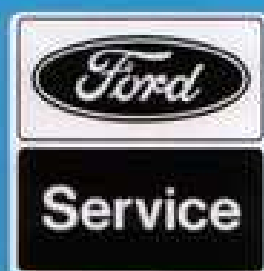
EEC IV Module

- o The EEC IV module is behind the glove compartment. This simplifies the cable routing.



1 ABS module

2 EEC IV module



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