



EXHAUST SYSTEM
(COSWORTH 4x4 Variants only) 25B

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TECHNICAL DATA

EXHAUST SYSTEM (COSWORTH 4x4)

Tightening Torques

									<u>Nm</u>	<u>lbf.ft</u>
Front exhaust pipe at turbocharger (M10 hardware)	..	..	..	..	..	..	..	..	35 to 47	26 to 35
All flange joints	..	..	..	..	..	..	..	..	35 to 40	26 to 30
All clamps	..	..	..	..	..	..	..	..	38 to 45	28 to 33

Sealants

Exhaust jointing compound SPM 4G 9100-A

GENERAL DESCRIPTION

The exhaust system fitted to the Sierra RS Cosworth 4x4 is designed to safely, quietly and efficiently conduct exhaust gases away from the engine at all engine speeds without adversely affecting fuel consumption.

The exhaust system comprises a manifold, downpipe/pre-catalytic converter (83US variants only), front mufflers (15.04 variants only) or front catalytic converters (83US variants only), centre mufflers and a rear muffler assembly. The rear muffler assembly is made from an aluminised material which helps to increase the service life of the system. In addition, the internals and end plates of the rear muffler assembly are of stainless steel to provide increased protection against the corrosive products of combustion held in the exhaust gas condensate.

Vehicles meeting the 15.04 emission level are fitted with two-piece exhaust systems for production and three-piece for service.

Vehicles meeting the 83US emission level are fitted with three-piece exhaust systems for production and four piece for service.

Each system is secured at the front by the manifold flange and supported in the middle and at the rear by rubber insulators.

Service Exhaust Systems

These comprise a downpipe, front muffler, centre muffler assemblies and rear muffler assembly. Refer to frame five for service/product exhaust system installation.

NOTE: The front/centre mufflers of the production system cannot be replaced without fitting a new rear muffler too.

Downpipe/Pre-catalytic converter

The downpipe assembly fitted to 83US variants incorporates a catalytic converter which starts off the conversion process before being completed by the two catalytic converters positioned in the exhaust system prior to the centre muffler assemblies.

Front Muffler Assemblies (15.04 variants only)

The front muffler assemblies smooth the exhaust gas pulses which reduces the exhaust pressure/noise at an early stage.

Centre Muffler Assemblies

The centre mufflers reduce exhaust gas noise by the use of sound absorbing materials.

Rear Muffler Assembly

The rear muffler further reduces exhaust gas noise by the use of sound absorbing materials.

The Catalytic Converter (83US variants only)

The catalysts fitted to the Sierra RS Cosworth 4x4, where a stricter emission level has to be met, resemble a small muffler assembly. The vehicle underbody around the catalyst has been protected by heat shields, because of the high temperatures at which the catalyst operates.

The catalyst is designed to convert exhaust gases to levels which comply with territorial legislation.

The Three-Way Catalyst (TWC) converts three emissions: HC, CO and NO_x.

HC	=	Hydrocarbons (unburnt fuel)		CO ₂	=	Carbon Dioxide
			CONVERT			
CO	=	Carbon Monoxide	TO	N ₂	=	Nitrogen
NO _x	=	Oxides of Nitrogen (TWCs only)		H ₂ O	=	Water

Internally there are two components, these being the Support Mat and the Coated Substrate (catalyst), both are explained below:

The Support Mat

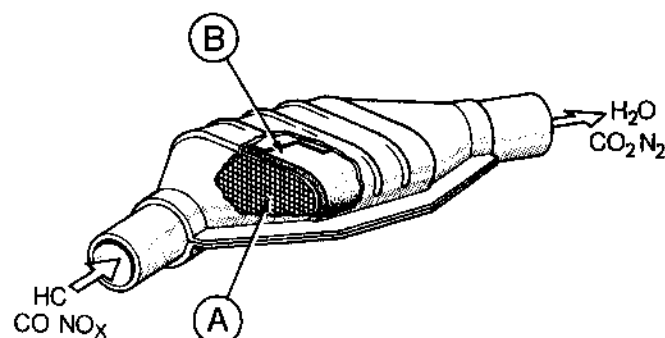
This is used to mount the catalyst in the converter assembly. The support mat is made of a high temperature ceramic fibre (alumina silicate) containing vermiculite.

Vermiculite causes the support mat to expand as the temperature of the catalyst increases, thus maintaining adequate holding force on the catalyst under all operating conditions.

The Coated Substrate

The coated substrate consists of a substrate which is covered by a washcoat impregnated with precious metals; these are explained below:

- **The substrate:** This is the components on which the catalytic materials are supported. Its honeycomb structure provides a high geometric surface area for the exhaust gases to pass over. Ceramic substrates are of a porous material which gives good washcoat adhesion.
- **Washcoat:** This is an alumina-based material which is applied to the substrate to provide a high surface area for optimum precious metal dispersion. The complex structure of the washcoat effectively increases the surface area of the substrate, this feature being necessary to achieve a high degree of catalytic activity. Precious metals are the active catalytic components and are dispersed onto the washcoat as precious metals used in automotive catalysts are platinum, palladium and rhodium.



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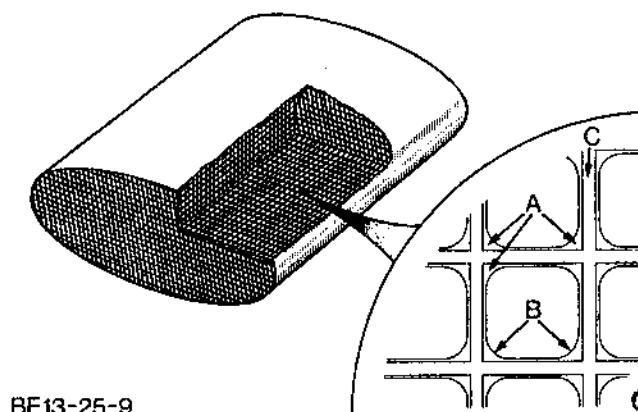
Fig.1. Catalytic converter assembly.

A - Catalyst B - Support Mat

Catalyst Operation

The catalyst, in order to function, requires to reach a minimum operating temperature. Once this temperature has been attained the catalyst starts to react and rapidly approaches peak conversion efficiency, generating its own heat. Below 320°C conversion of exhaust gases is negligible.

In order for catalysts to convert efficiently it is essential that the air/fuel ratio is correctly controlled. This is particularly true for the TWCs which will only work within a narrow band. To operate within this band, closed-loop fuelling is employed to achieve the more stringent emission standards.



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Fig.2. Catalyst substrate.

- A - Washcoat
- B - Precious metal deposits
- C - Substrate

Catalyst Deactivation due to poisoning

Lead (Pb) in fuel can cause severe deactivation at levels above 5mg per litre of fuel. It is therefore essential that catalyst-equipped vehicles always operate on unleaded fuel.

Zinc (Zn) and Phosphorous (P) present in some engine oils, can cause deactivation when oil consumption levels are high.

Sulphur (S) in fuel can also cause deactivation but the effect of sulphur is felt most if it is released from the catalyst as Hydrogen Sulphide (H_2S).

Hydrogen Sulphide Emissions (H_2S). Some catalyst-equipped vehicles may give off hydrogen sulphide. This has an unpleasant odour similar to rotten eggs. Under normal operating conditions, sulphur released from the fuel during combustion becomes stored on the washcoat. During rich operation this stored sulphur combines with hydrogen in the exhaust and is released as hydrogen sulphide. It is this storage/release phenomenon that causes the hydrogen sulphide to be emitted at levels detectable by smell. Normally this situation will improve as the catalyst 'ages'; renewing the catalytic converter will only serve to promote the phenomenon. To minimise hydrogen sulphide emissions it is essential that the idle CO is within specification (preferably at the lower end of the emission range). It is therefore important that the engine management system is functioning correctly.

NOTE: Changing the fuel source or manufacturer may also help in reducing this phenomenon.

The Catalytic Converter (cont'd)

Thermal Deactivation and Catalyst Melt

Thermal deactivation of the catalyst occurs throughout the life of the exhaust, but is most severe over the first 6,500 km (4000 miles). Catalysts are intended to operate at temperatures up to 850°C, under these conditions normal deactivation takes place.

Advanced thermal ageing occurs when temperatures exceed 850°C, the ageing process accelerates rapidly at temperatures above 1000°C.

If temperatures exceeding 1400°C are achieved, the catalyst substrate will melt down. Catalyst melts are normally accompanied by loss of power due to excessive exhaust gas back pressure.

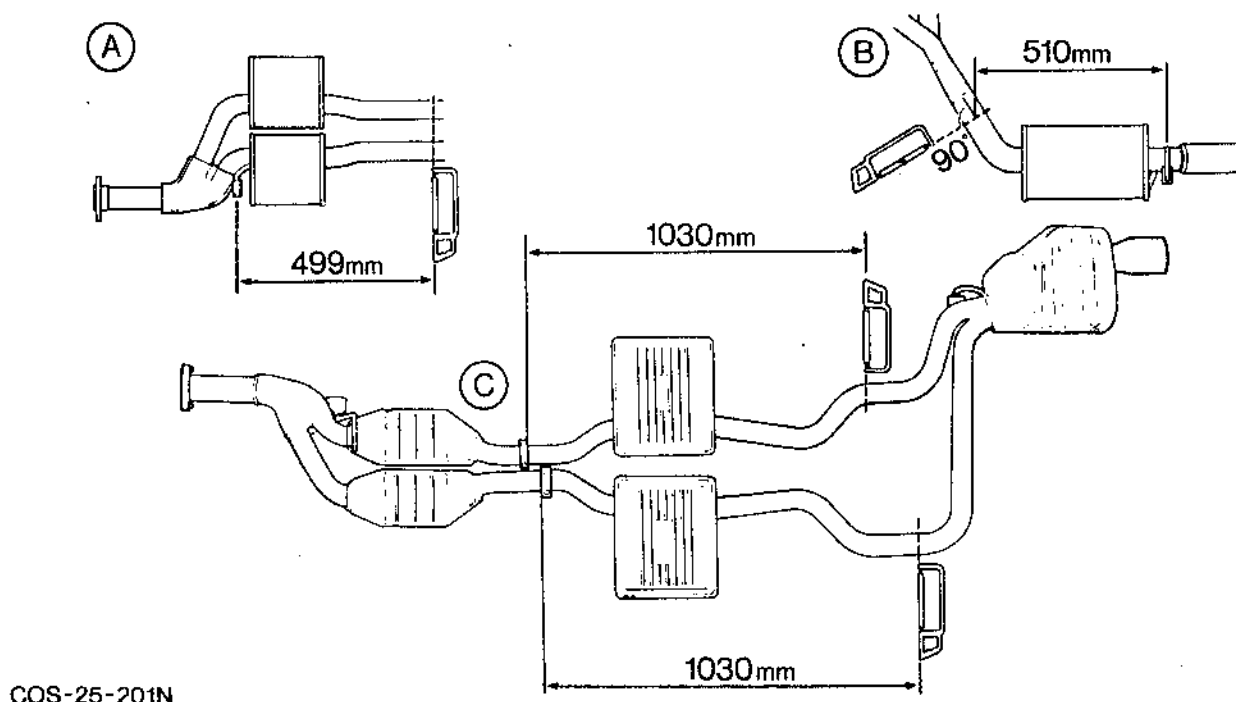
High substrate temperatures are caused by malfunction of the ignition or fuel systems, or by driver abuse (such as switching 'off' ignition when the vehicle is still in motion). These causal factors allow unburnt fuel to enter the catalyst, which ignites, producing localised high temperatures within the catalyst.

Catalysts are fairly tolerant of low engine speed misfire. Misfire at high engine speed may result in an almost instantaneous melt. IT IS IMPORTANT THAT THE CAUSE OF THE MISFIRE IS IDENTIFIED AND RECTIFIED IF SUBSEQUENT MELTS ARE TO BE PREVENTED.

Service-Fit Exhaust System

It is not possible to replace a centre section of the production exhaust system on its own. Should it be necessary to replace this section, a new centre and rear muffler assembly must be fitted.

To replace a rear tail pipe and muffler assembly, cut the production exhaust pipe at the point shown in Fig.3.

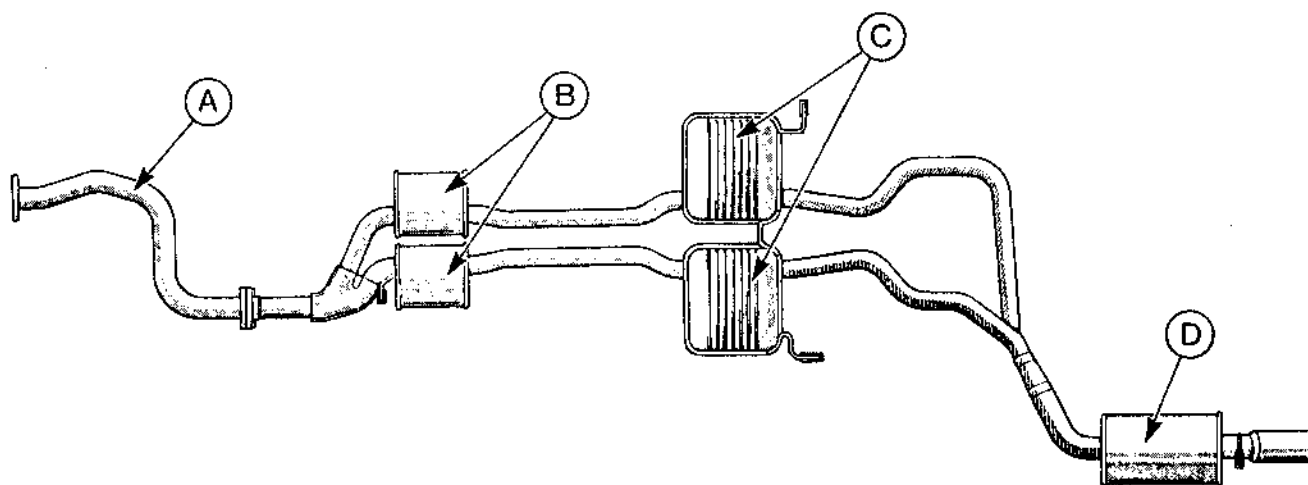


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Fig.3. Cut line of production exhaust system.

- A - Cut dimension for Sierra front muffler assemblies
- B - Cut dimension for Sierra rear muffler assembly
- C - Cut dimension for Escort rear muffler assembly

Exhaust Systems Removed from Vehicle

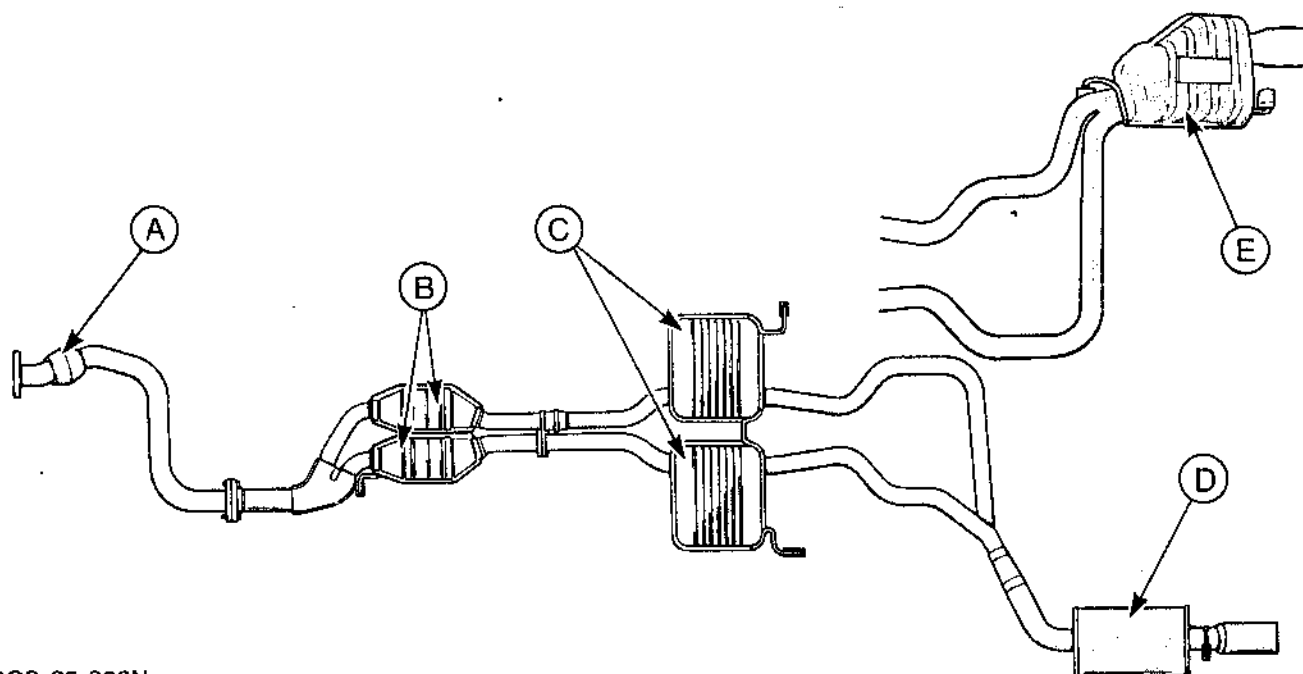


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TI

Fig.4. Exhaust system removed (15.04 emission level).

- | | |
|------------------------------|-------------------------------|
| A - Downpipe | C - Centre muffler assemblies |
| B - Front muffler assemblies | D - Rear muffler assembly |



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Fig.5. Exhaust system removed (83US emission level).

- | | |
|--------------------------------------|------------------------------------|
| A - Downpipe/Pre-catalytic converter | B - Catalytic converter assemblies |
| C - Centre muffler assemblies | D - Sierra Rear muffler assembly |
| E - Escort rear muffler assembly | |

25 204 0 EXHAUST SYSTEM - REPLACE

SPECIAL TOOLS REQUIRED: NONE

NOTE: This operation does not include the front down pipe from turbo to flange joint.

To Remove

1. Disconnect battery earth cable. Raise vehicle on a ramp.
2. Remove plastic sump guard, refer to Fig.1.
3. Disconnect front pipe to exhaust system flange joints, refer to Fig.2.
4. Support exhaust system, unhook rubber insulators from front and rear muffler assembly and carefully remove exhaust system.

CAUTION: Care should be taken not to damage catalyst assembly. Excessive force may damage the internal ceramic substrates.

To Install

5. Inspect rubber insulators for cracks, splits or damage, replace as necessary.

NOTE: Variants fitted with a catalytic converter use special exhaust insulators made from high temperature resistant natural rubber. Use only correct insulators as detailed in the vehicle parts microfiche.

6. Clean front exhaust pipe flanges.
7. Fit rubber insulators to exhaust system brackets, lift exhaust system into position, secure rubber insulators to body brackets.
8. Reconnect exhaust system to front pipe flanges, torque joints to specification.
9. Reconnect battery. Start engine and check exhaust system for leaks. Lower vehicle to ground.

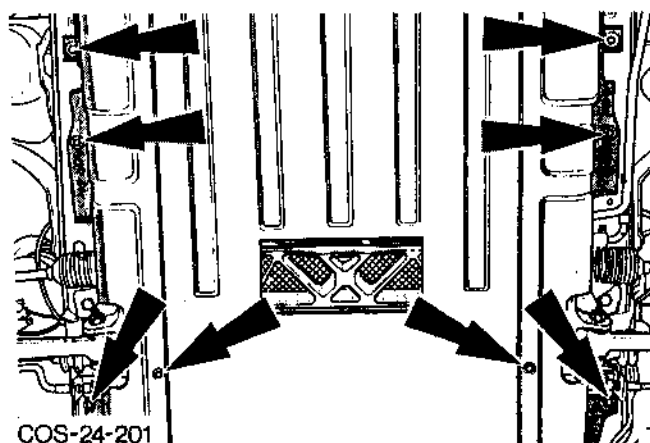


Fig.1. Sump guard securing bolts (Sierra shown).

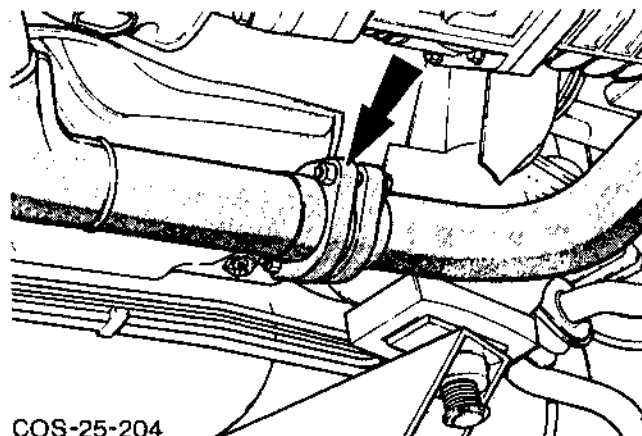


Fig.2. Front pipe flange connection.

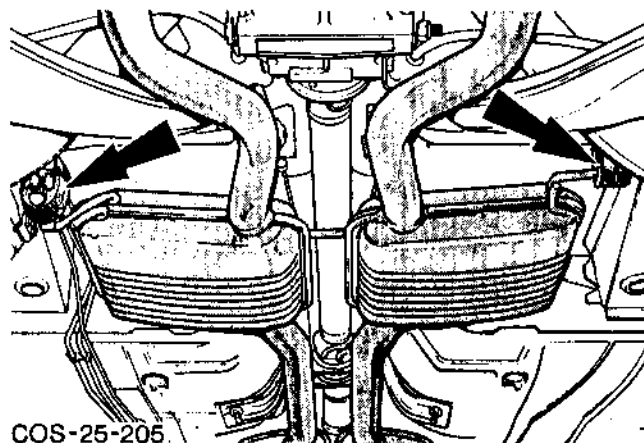
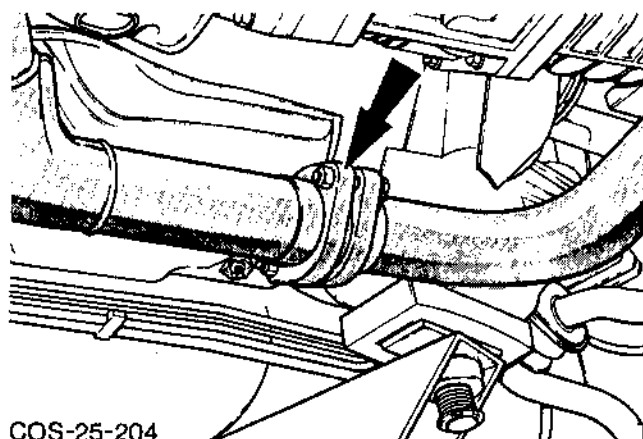


Fig.3. Centre muffler assembly rubber insulators.

25 223 0 MUFFLER FRONT - REPLACE

SPECIAL TOOLS REQUIRED: NONE

Service jointing sleeves are not available for the SIERRA RS COSWORTH. The front muffler of the production mounted exhaust system can only be replaced together with the two centre mufflers. This operation assumes that the centre exhaust section has already been replaced.

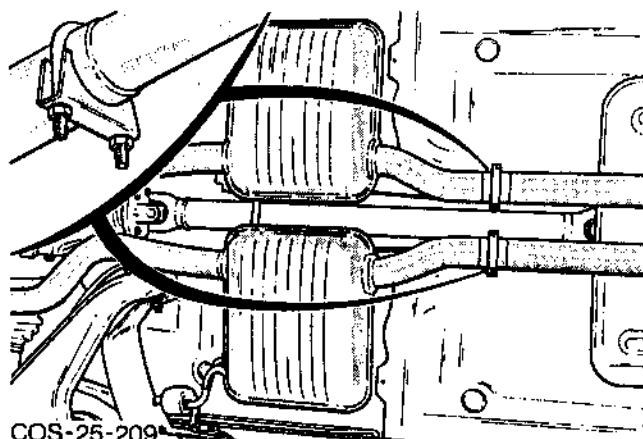


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Fig.1. Front flange connections.

To Remove

1. Disconnect battery earth cable. Raise vehicle on a ramp. Support front exhaust pipe.
2. Disconnect flanges between front exhaust pipe and front muffler, refer to Fig.1, and the clamps between front and centre mufflers, refer to Fig.2. Remove muffler assembly.



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Fig.2. Clamps between front muffler and centre mufflers.

To Install

3. Clean connector and apply sealant (refer to Technical Data) to front muffler joint.
4. Fit front muffler. Loosely secure the front pipe flange clamp connections to muffler assembly.
5. Check that the exhaust system is in the correct installation position and tighten flange clamp and front pipe connections to the specified torque.
6. Reconnect battery, start engine and check exhaust system for leaks. Lower vehicle to the ground.

25 243 0 MUFFLER REAR - REPLACE

SPECIAL TOOLS REQUIRED: NONE

To Remove

1. Disconnect battery earth cable.
2. Raise vehicle on a ramp. Remove rear muffler clamp, refer to Fig.1.
3. Unhook rubber insulator and remove rear muffler assembly.

NOTE: Inspect rubber insulators for cracks and splits before unhooking rear muffler, this can be achieved by applying light downward pressure on the rear muffler and observing rubber insulator.

To Install

4. Clean joint and apply sealant (refer to Technical Data).
5. Position exhaust system onto centre pipe assembly. Fit insulator to rear muffler and hook insulator onto body bracket.
6. Align rear muffler assembly and tighten clamp to correct torque, (refer to Technical Data).
7. Reconnect battery earth cable.
8. Start engine and check exhaust system for leaks. Lower vehicle to the ground.

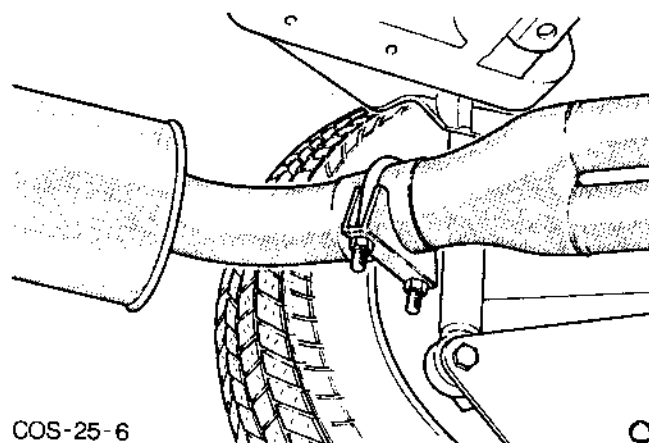


Fig.1. Rear muffler clamp (Sierra shown).

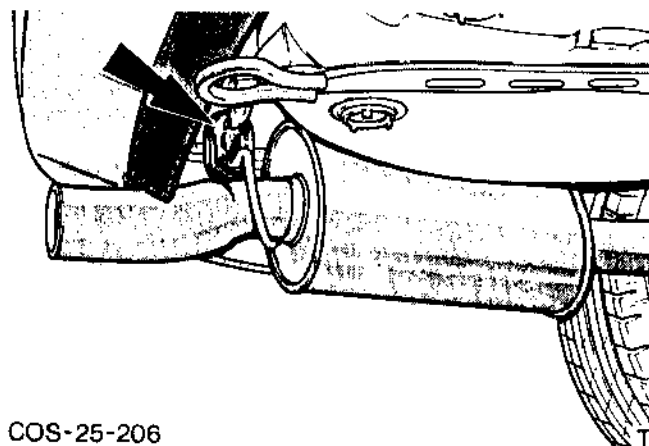


Fig.2. Rubber insulator, rear muffler (Sierra shown).

25 250 0 CATALYST - REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED: NONE

CAUTION: NEVER USE JOINTING COMPOUND FORWARD OF THE CATALYTIC CONVERTER.

To Remove

1. Disconnect battery earth cable.
2. Raise vehicle on a ramp.
3. Remove front flange bolts securing catalyst to exhaust downpipe, Fig.1, and separate joint.
4. Remove rear flange bolts securing catalyst to exhaust pipe, refer to Fig.2.
5. Unhook exhaust system from rear insulators.
6. Unhook catalyst from front exhaust rubber insulator.

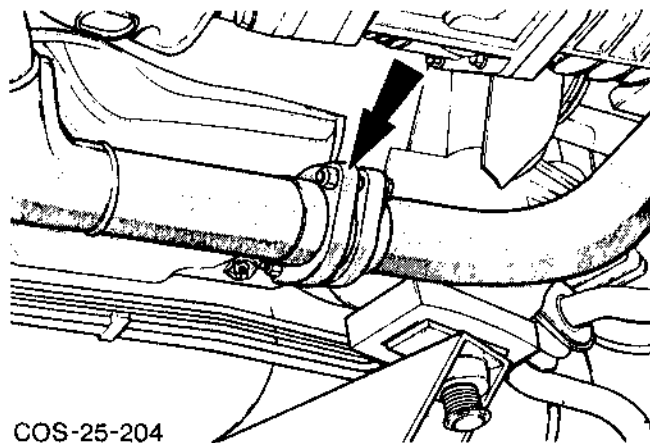
NOTE: Inspect insulators for cracks and splits before unhooking system. This can be achieved by applying light downward movement on exhaust system whilst observing insulator condition.

7. Separate catalyst from exhaust system. Care should be taken not to damage catalyst assembly. Excessive force may damage the internal ceramic substrates.

To Install

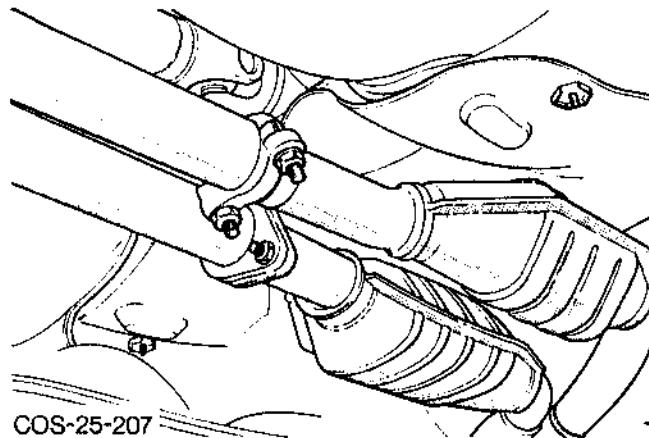
8. Clean all mating joints.

NOTE: Catalyst systems use special exhaust insulators, made from high temperature-resistant, natural rubber. Use only correct insulators as detailed in vehicle parts microfiche.



COS-25-204

Fig.1. Remove front flange securing bolts.



COS-25-207

Fig.2. Remove rear flange securing bolts.



25 250 0

EXHAUST SYSTEM
(COSWORTH 4x4)

9. Locate catalyst to rear exhaust pipe, apply exhaust jointing compound to pipe connections. Tighten 'U' clamp nuts to specification, (see Technical Data).
10. Refit exhaust system to rubber insulators.
11. Align and secure catalyst to exhaust downpipe, fitting new sealing ring. Tighten bolts to specification, (see Technical Data).
12. Lower vehicle and reconnect battery earth cable.
13. Start engine and check system for leaks. Ensure spring-loaded flexible joint has some free movement by applying light downward pressure to exhaust system.

25 263 0 EXHAUST PIPE - FRONT - RIGHT -
REPLACE

SPECIAL TOOLS REQUIRED: NONE

NOTE: When M10 studs are fitted, the tab washers are deleted and self-locking nuts are used which should be replaced after removal.

To Remove

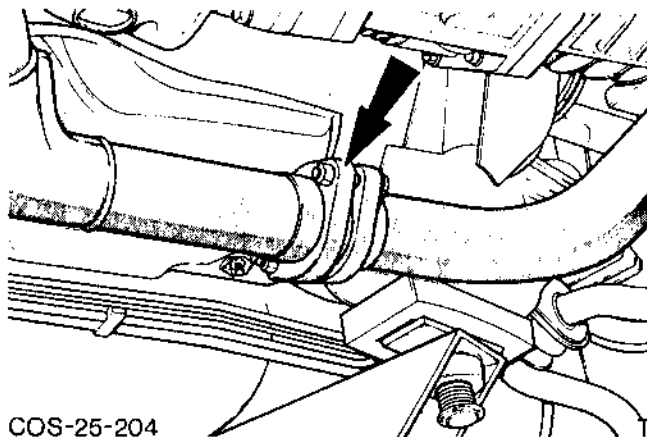
1. Disconnect battery earth cable.
2. Raise vehicle and disconnect front pipe to exhaust system flanges.
3. Bend back lock tabs and remove the three nuts securing front pipes to turbocharger. Remove front pipe from vehicle.

NOTE: Care should be taken when removing these nuts as high temperatures may cause the nuts to seize to the studs.

4. Clean turbocharger flange with wire brush, ensure dirt does not enter turbocharger during this cleaning operation.

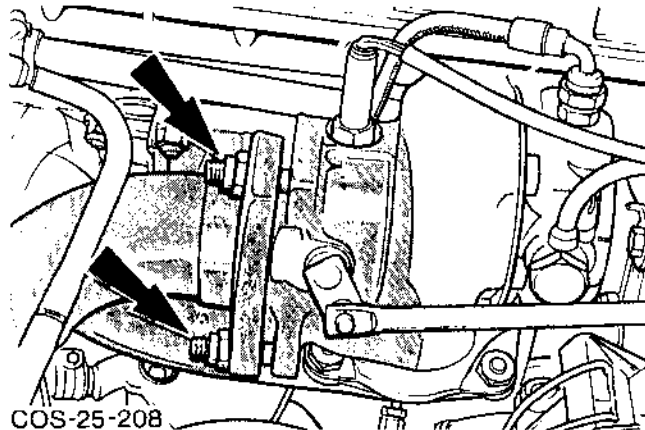
To Install

5. Locate front pipe in position, loosely securing turbocharger flange and front pipe exhaust system flanges.
6. Ensure front pipe is free from strain, secure front pipe flange to turbocharger using new nuts and lock tabs. Tighten nuts to correct torque, (see Technical Data) and bend over lock tabs.
7. Secure front pipe to exhaust system flanges, fully tighten joints to specified torque, (see Technical Data).
8. Reconnect battery, start engine and check system for exhaust leaks. Lower vehicle to ground.
9. Remove fender covers and close hood.



COS-25-204

Fig.1. Disconnect front pipe to exhaust system flanges.



COS-25-208

Fig.2. Turbo charger to front pipe securing nuts. (Two of three illustrated)

