

Steering (11.00)

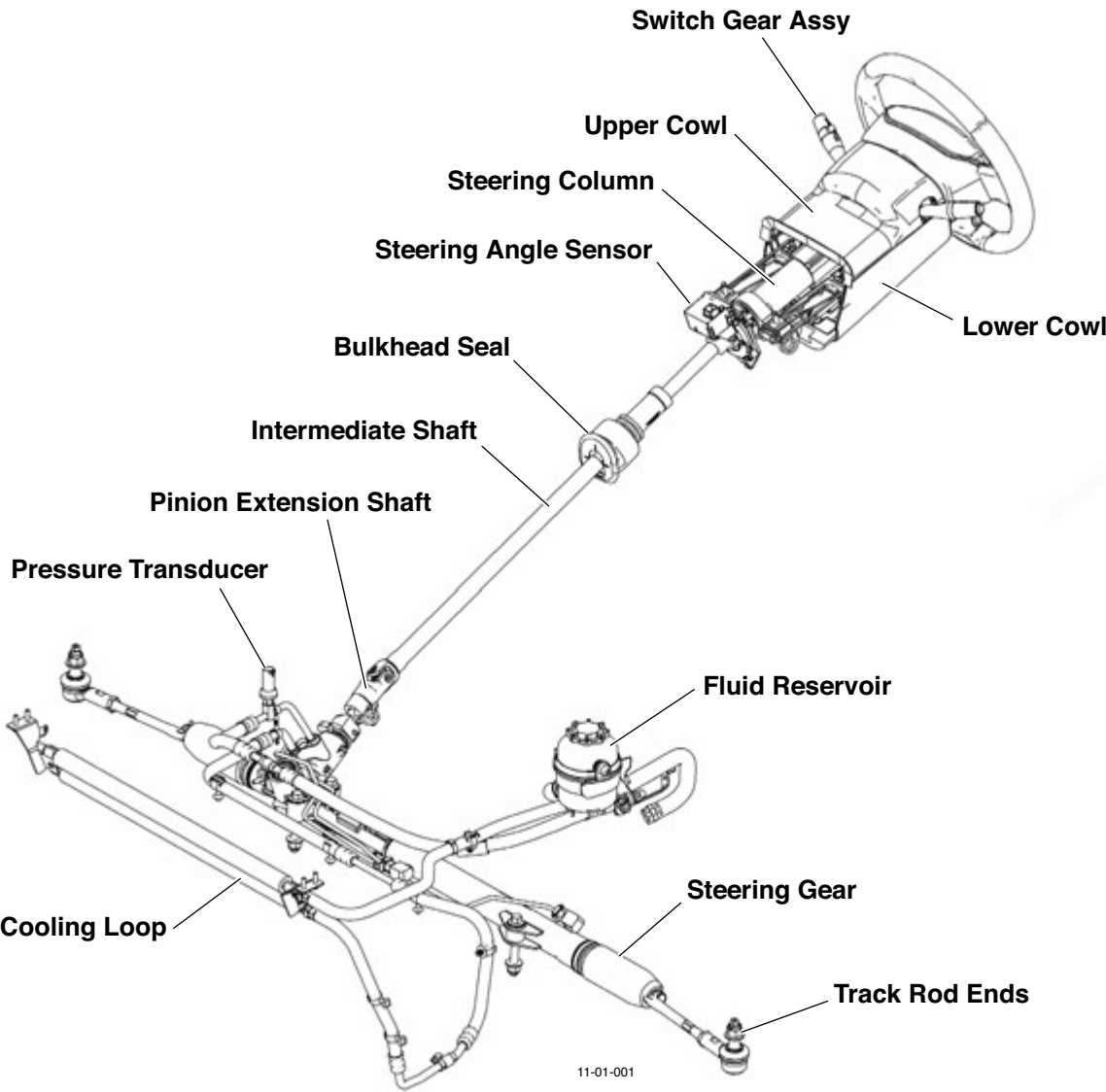
Contents

Steering Gear (11.01)	11-1-2
Diagnostics - Symptom Chart	1-2
Specifications	1-4
Maintenance	1-4
LH Track Rod End-Renew	1-4
RH Track Rod End-Renew	1-4
Power Steering (11.02)	11-2-1
Description	2-1
Specifications	2-1
Maintenance	2-2
System Bleeding	2-2
Power Steering Pump-Renew	2-2
Power Assisted Steering System-Bleed	2-2
Power Steering Rack-RHD-Renew	2-2
Power Steering Reservoir and Cap-Renew	2-2
Power Steering Pump to Rack Hose Assembly-Renew	2-2
Power Steering Rack to Cooler Hose-Renew	2-3
Power Steering Reservoir to Pump Hose Assembly - Renew	2-3
Power Steering Cooler to Reservoir Hose and Clip Assembly-Renew	2-3
Steering Column (11.04)	11-3-1
Description	3-1
Specifications	3-1
Maintenance	3-1
Upper Steering Column Assembly-Renew	3-1
Steering Column Switches (11.05)	11-4-1
Maintenance	4-1
Ignition Switch-Renew	4-1
Steering Column Stalk Assembly Switch-Renew	4-1
Cruise Control Switch-Renew	4-1
Steering Wheel (11.06)	11-5-1
Specifications	5-1
Maintenance	5-1
Steering Wheel-Renew	5-1



Steering (11.00)

Steering Gear (11.01)



Diagnostics - Symptom Chart

Symptom	Possible Cause	Action
Vehicle wanders from side to side on the road when driven straight ahead with the steering wheel held firmly.	Incorrect tyre size or pressure.	Check for correct tyre size. Adjust tyre pressures.
	Vehicle unevenly loaded or overloaded.	Adjust load.
	Loose or worn tie-rods or tie-rod ends.	New tie-rod end or steering gear.
	Steering gear bolts loose or damaged.	Tighten. New bolts.
	Loose or worn suspension ball joint(s).	New suspension ball joint assembly.
	Steering column universal joint pinch bolt loose.	Tighten pinch bolt.
	Incorrect toe adjustment.	Adjust as required.
	Loose or worn rear suspension.	Tighten if loose. New rear suspension components.
	Insufficient Castor.	Check front suspension geometry.

Symptom	Possible Cause	Action
Vehicle tends to pull to one side when driven on a level surface.	Incorrect tyre pressure.	Adjust tyre pressure.
	Incorrect tyre size.	New tyre as required.
	Different tyre or tread type.	
	Vehicle is unevenly or excessively loaded.	Adjust load evenly.
	Incorrect toe adjustment.	Adjust as required.
	Damaged front or rear suspension components.	New suspension components.
	Steering gear valve effort out of balance.	Shift transmission into neutral while driving at no more than 30 miles/hour (50 km/h) and turn the ignition to position I (engine 'Off'-coasting). a. If the vehicle does not pull to one side with the engine off, install a new steering gear. b. If the vehicle drifts with the engine off, 'cross switch' the front wheel assemblies. Test at low speed due to directional tyres. a. If the vehicle pulls to the opposite side, switch the wheels that were on the rear to the same side on the front. b. If the vehicle pull direction is not changed, check the front suspension components and toe adjustments.
	Check front and rear brakes for correct operation.	Adjust as required.
	Check for bent rear suspension components and for damaged coil springs in the front suspension.	New rear suspension components.
	Check the rear suspension for loose or worn suspension components.	Tighten. New components.
	Incorrect underbody alignment.	Check underbody alignment.
Feedback (whining or knocking noises in the steering gear) Condition where roughness is felt in the steering wheel by the driver when the vehicle is driven over rough surfaces.	Loose or worn tie-rods.	New steering gear.
	Steering gear bolts loose or damaged.	Tighten. New bolts.
	Loose suspension bushing, bolts or ball joints.	Tighten. New components.
	Damaged steering column. Loose Column bolts.	New steering column. Tighten bolts.
Power steering pump or reservoir leaks	Overfilled system.	Correct fluid level.
	Damaged fluid cap.	New fluid cap.
	Loose or damaged hose fittings.	Tighten. New hose.
	Leakage at power steering pump.	New power steering pump.
Poor returnability of the steering	Incorrect tyre pressure.	Check and adjust tyre pressure.
	Incorrect tyre size or type.	New tyre as required.
	Steering column universal joints binding.	New steering column.
	Steering column shaft floor seal may be torn and fouling I-shaft.	New floor seal as required.
	Binding or damaged tie-rods.	New steering gear.
	Damaged or worn front suspension components.	New front suspension components as required.
	Incorrect toe adjustment.	Adjust as required.



Symptom	Possible Cause	Action
Excessive steering efforts required to turn corners and during parking manoeuvres	Dirty fluid filter.	Clean/replace reservoir.
	Low power steering pump fluid.	Fill as required. Check for system leaks.
	Damaged accessory drive belt tensioner.	New accessory drive belt tensioner.
	Hose or oil cooler external leak.	New hose or oil cooler as required.
	Hose or cooler line restriction.	New hose as required.
	Fluid aeration.	Bleed system.
	Damaged pump.	Replace pump.
Fluid leakage	Overfilled system.	Correct fluid level.
	Component leak.	Locate suspect component and repair as required.
Accessory drive belt squeal	Check accessory drive belt for correct tension or glazing.	New accessory drive belt.
'Chirp' noise from steering pump	Loose or worn accessory drive belt.	New accessory drive belt.
Power steering pump noisy	Low fluid level.	Top up and check for system leaks.
	Power steering pump.	Check for leaks. Repair as required. New pump.
	Steering hoses fouling body structure.	Ensure hose is secured and routed correctly.
'Hiss' noise	Fluid flow through steering gear rotary valve - close to 'Full Lock'.	Normal noise.
'Whine' noise	Aerated fluid.	Bleed system.
Steering wheel vibration	Road wheels out of balance.	Check front end alignment.

Specifications

Torque Figures

Description	Nm.	lb/ft
Ball Joint (nut)	70	52
Track-Rod (lock nut)	70	52
Steering Rack to Subframe	115	85
Steering Rack Pipe Latch Plate	9-12	7-9
Intermediate Shaft Pinch Bolt	21-29	15.5-21.5

Maintenance

RH/LH Track Rod End-Renew

Repair Operation Time (ROT)		
Item		Code
Track Rod End	RH	11.02.AC
Track Rod End	LH	11.02.AB

Removal

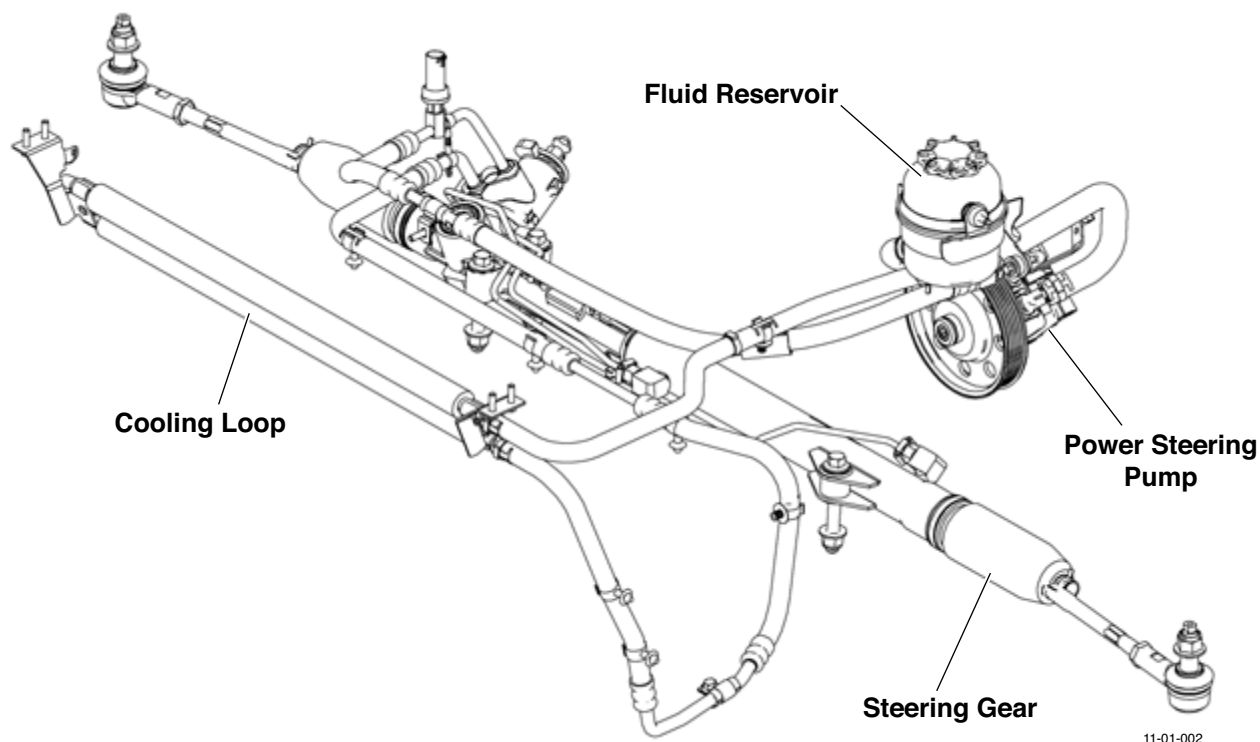
1. Raise vehicle on ramp.
2. Remove road wheel(s).
3. Loosen tie rod locknut.
4. Install tool (204 - 524) on front hub, install and tighten wheel nuts.
5. Lower vehicle to raise suspension sufficient to install ball joint removing tool (204 - 523).
6. Remove nut, track rod end to vertical link.
7. Using (204-523 Ball Joint Splitter), release track rod end from vertical link.

8. Remove tool (204 - 524) from front hub.
9. Count number of turns and remove track rod end from tie rod.

Installation

1. Clean track rod end taper and mating face on vertical link.
2. Install track rod end on tie rod the same amount of turns.
3. Install track rod end in vertical link.
4. Install road wheel(s).
5. Lower vehicle on ramp.
6. Carry out full vehicle geometry check/adjust.
7. Tighten tie rod ball joint locknut(s).

Steering (11.00)

Power Steering (11.02)**Description**

The power steering system comprises of a non-speed sensitive rack and pinion steering gear together with an engine driven vane pump, operating at a constant flow rate. The level of assistance is controlled via a rotary hydraulic valve, integral to the steering gear assembly.

Hoses / pipe are used to transmit hydraulic fluid throughout the steering system. The high-pressure line contains a pressure transducer, which sends an electronic signal to the engine management system. This ensures engine RPM is maintained when the steering system draws higher loads from the engine (i.e. during parking manoeuvres.) In order to regulate system temperatures, a wire-wound cooler is incorporated into the return line.

Specifications

Item	Data
Pump Pressure (max)	116 $\pm$ 4Bar
Turns lock-to-lock	3
Overall steering ratio	17:1
Turning Circle (Kerb To Kerb)	11.1m
Fluids	33270 Texaco Cold Climate Power Steering Fluid 14315G
Toe Settings	(Refer to 'Road Wheel Alignment (04.00)', page 4-1-2)

Maintenance

Power Assisted Steering System-Bleed

Repair Operation Time (ROT)	
Item	Code
Power Assisted Steering System-Bleed	11.01.AA

Removal

1. Top up PAS fluid.
2. Start engine and allow to idle for 20 secs.
3. Turn steering from lock to lock x3, stop engine.
4. Allow PAS fluid to settle for 5 minutes.
5. Top up PAS fluid.

Power Steering Rack-Renew

Repair Operation Time (ROT)	
Item	Code
Power Steering Rack-Renew	11.02.AA

Removal

1. Remove Front subframe (see Workshop Manual procedure 02.01.BA Subframe Assembly - Front - Remove for Access & Refit).
2. Remove PAS pipes from rack (bolt x1) (catch old oil).
3. Remove steering link (bolt x1 and move aside).
4. Remove steering rack.

Installation

1. Renew PAS pipe o-rings.
2. Install steering rack.
3. Install PAS pipes to rack.
4. Install steering link (bolt x1) (torque).
5. Install Front subframe (see Workshop Manual procedure 02.01.BA Subframe Assembly - Front - Remove for Access and Refit).
6. Bleed PAS system (see Workshop Manual procedure 11.01.AA Power Assisted Steering System - Bleed).

Power Steering Reservoir and Cap-Renew

Repair Operation Time (ROT)	
Item	Code
Power Steering Reservoir and Cap-Renew	11.02.BB

Removal

1. Remove reservoir cap.
2. Remove fluid from reservoir (syringe).
3. Disconnect pipes (x2) from reservoir.
4. Loosen clamp bolt and remove reservoir.

Installation

1. Install reservoir and tighten clamp.
2. Connect pipes (x2).
3. Top up PAS fluid.

4. Install reservoir cap.

Power Steering Pump to Rack Hose Assembly-Renew

Repair Operation Time (ROT)	
Item	Code
Power Steering Pump to Rack Hose Assembly-Renew	11.02.EA

Removal

1. Remove PAS fluid from reservoir (syringe).
2. Remove throttle body duct for access. (clips x3).
3. Remove top bolts (x2) from engine oil tank and loosen bottom bolts (x2) (allows tank to move to access pipe support fixings).
4. Remove bolts (x2) securing pipe to body.
5. Disconnect sensor multiplug.
6. Remove hose from pump union.
7. Remove pipes from steering rack (bolt x1).
8. Remove pipe from vehicle.

Installation

1. Renew o-rings on PAS pipes and pump pipe.
2. Install hose to vehicle.
3. Install bolts brackets to body.
4. Install PAS pipes to rack (bolt x1).
5. Connect sensor multiplug.
6. Install pipe to pump union.
7. Install bolts and tighten oil tank fixings (torque).
8. Install throttle body duct. (clips x3).
9. Bleed PAS system (see Workshop Manual procedure 11.01.AA Power Assisted Steering System - Bleed).

Power Steering Reservoir to Pump Hose Assembly-Renew

Repair Operation Time (ROT)	
Item	Code
Power Steering Reservoir to Pump Hose Assembly-Renew	11.02.EC

Removal

1. Remove PAS fluid from reservoir (syringe).
2. Remove hose from reservoir (clip x1).
3. Remove hose from support p-clip (bolt x1).
4. Remove hose from pump (clip x1).

Installation

1. Install hose to pump (clip x1) (align timing marks).
2. Install hose to support p-clip.
3. Install hose to reservoir (align timing marks).
4. Top up PAS fluid.

Power Steering Cooler to Reservoir Hose and Clip Assembly-Renew

Repair Operation Time (ROT)	
Item	Code
Power Steering Cooler to Reservoir Hose and Clip Assembly-Renew	11.02.ED

Removal

1. Remove radiator grille (see Workshop Manual procedure 01.08.AA Grille - Radiator - Renew).
2. Remove PAS fluid from reservoir (syringe).
3. Remove hose from cooler (clip x1).
4. Remove clamp bolt from reservoir bracket.
5. Move reservoir from bracket to access clip, remove clip and hose.
6. Remove hose from support clip and radiator side seal.

Installation

1. Install hose to support clip and radiator side seal.
2. Install hose and clip and reservoir to bracket.
3. Install hose to cooler (clips x1).
4. Install radiator grille (see Workshop Manual procedure 01.08.AA Grille - Radiator - Renew).
5. Top up PAS fluid.



Steering (11.00)

Steering Column (11.04)**Description**

The steering column has reach and tilt functions. These allow the driver to manually set the steering column position by using the reach / tilt lever, located on the underside of the steering column, regardless of the ignition switch position.

The steering intermediate shaft consists of two parts. The lower shaft is attached to both the steering gear and the upper shaft.

The steering column lock is secured to the upper casting of the steering column and consists of a locking pin. The steering column is locked and unlocked by inserting and removing the ignition key respectively.

Specifications

Torque Figures			
Description	Nm.	lb/ft	Nominal
Steering Column to cross car beam	21-27	15.5-19.9	24Nm
Upper column to I-shaft	21.2-28.8	15.6-21.2	25Nm
Vee yoke to pinion extension shaft	15.5-18.5	11.4-21.2	17Nm
Power coupling to pinion	21.2-28.8	15.6-21.2	25Nm

Maintenance**Upper Steering Column Assembly-Renew**

Repair Operation Time (ROT)	
Item	Code
Upper Steering Column Assembly-Renew	11.04.CB

Removal

1. Power driver's seat to its lowest and most rearward position.
2. Disconnect vehicle battery.
3. Release and remove driver's side lower instrument panel, clips (x7) and disconnect air temperature pipe.
4. Unlatch reach/rake lever and pull steering column forward.
5. Centralise steering, engage column lock and remove ignition key.
6. Remove steering wheel (see Workshop Manual procedure 11.06.AB Steering Wheel Renew).
7. Secure rotary coupling in position with masking tape.

8. Remove screws (x7) and remove steering column shrouds (see Fig. 1).

**Fig. 1**

9. Disconnect steering column switch multiplugs (x5).
10. Remove screw securing load spread plate to column and collect column shrouds mounting bracket.
11. Release clips (x2) from column switch harness to load spread plate.
12. Pull back steering column bulkhead gaiter.
13. Remove and discard pinch bolt from upper column to intermediate shaft.

**Fig. 2**

14. Remove Torx bolts (x4) from upper column mounting.
15. Release upper column from intermediate shaft.
16. Disconnect multiplug from steering sensor and remove steering column assembly.
17. Unclip steering column switches from column and remove switch gear.
18. Mark fitted position of rotary coupler and remove rotary coupler.
19. Remove gaiter from steering column.
20. Remove Torx screws (x3) from securing steering sensor to mounting bracket.
21. Remove sensor.



22. Remove Torx screws (x3) that secure steering sensor mounting bracket to column and remove bracket.

Installation

1. Position steering sensor mounting bracket, install and tighten Torx screws (x3).
2. Install steering sensor, install and tighten Torx screws (x3).
3. Install gaiter on steering column.
4. Install steering column switch gear and secure clips.
5. Install rotary coupler to marked position and secure with masking tape.
6. Position upper steering column assembly and connect to intermediate shaft.
7. Connect multiplug to steering sensor.
8. Position upper column to mounting bracket, install and torque tighten Torx bolts (x4).
9. Install and torque tighten column pinch bolt.
10. Connect multiplugs (x5).
11. Position load spread plate and secure harness clips (x2).
12. Install load spread plate and secure with screw.
13. Install upper steering column shrouds and install and tighten screws (x7).
14. Remove masking tape from rotary coupler.
15. Install steering wheel (see Workshop Manual procedure 11.06.AB Steering Wheel Renew).
16. Install air temperature pipe to lower instrument panel and install panel.
17. Connect vehicle battery.
18. Re-position driver's seat and reach/rake positions.

Steering (11.00)

Steering Column Switches (11.05)

Maintenance

Ignition Switch-Renew

Repair Operation Time (ROT)	
Item	Code
Ignition Switch-Renew	11.05.AB

Removal

1. Power driver's seat to its lowest and most rearward position.
2. Disconnect vehicle battery.
3. Release and remove driver's side lower instrument panel clips (x7) and disconnect air temperature pipe.
4. Unlatch reach/rake lever and pull steering column forward.
5. Centralise steering, engage column lock and remove ignition key.
6. Remove steering wheel (see Workshop Manual procedure 11.06.AB Steering Wheel Renew).
7. Remove screws (x7) then remove steering column shrouds (see Fig. 1).



Fig. 1

8. Remove screw securing load spread plate to column.
9. Retrieve column shrouds mounting bracket.
10. Release clips (x2) from column switch harness to load spread plate.
11. Unclip steering column switch from column (for access).
12. Unclip ignition switch from column.
13. Disconnect multiplug.

Installation

1. Connect multiplug.
2. Install ignition switch to column.
3. Install steering column switch.
4. Position load spread plate and secure harness clips (x2).
5. Install load spread plate and secure with screw.

6. Install upper steering column shrouds and tighten screws (x7).
7. Install steering wheel (see Workshop Manual procedure 11.06.AB Steering Wheel Renew).
8. Install air temperature pipe to lower instrument panel.
9. Install panel.
10. Connect vehicle battery.
11. Re-position driver's seat and reach/rake positions.

Steering Column Stalk Assembly Switch-Renew

Repair Operation Time (ROT)	
Item	Code
Steering Column Stalk Assembly Switch-Renew	11.06.BK

Removal

1. Power driver's seat to its lowest and most rearward position.
2. Disconnect vehicle battery.
3. Release and remove driver's side lower instrument panel clips (x7) and disconnect air temperature pipe.
4. Unlatch reach/rake lever and pull steering column forward.
5. Centralise steering, engage column lock and remove ignition key.
6. Remove steering wheel (see Workshop Manual procedure 11.06.AB Steering Wheel Renew).
7. Remove screws (x7) and remove steering column shrouds.
8. Remove screw securing load spread plate to column.
9. Retrieve column shrouds mounting bracket.
10. Release clips (x2) from column switch harness to load spread plate.
11. Disconnect multiplugs (x3) from steering column switches.
12. Unclip steering column switches from column and remove switch gear.

Installation

1. Install steering column switch gear and secure clips.
2. Connect multiplugs (x3).
3. Position load spread plate and secure harness clips (x2).
4. Install load spread plate and secure with screw.
5. Install upper steering column shrouds and tighten screws (x7).
6. Install steering wheel (see Workshop Manual procedure 11.06.AB Steering Wheel Renew).
7. Install air temperature pipe to lower instrument panel.
8. Install panel.
9. Connect vehicle battery.
10. Re-position driver's seat and reach/rake positions.



Cruise Control Switch-Renew

Repair Operation Time (ROT)	
Item	Code
Cruise Control Switch-Renew	11.06.BL

Removal

1. Remove Airbag module (see Workshop Manual procedure 11.06.BC Module - Drivers Airbag - Renew).
2. Remove cruise control switch.

Installation

1. Install cruise control switch.
2. Ensure switch harness is routed correctly.
3. Install Airbag module (see Workshop Manual procedure 11.06.BC Module - Drivers Airbag - Renew).

Steering (11.00)

Steering Wheel (11.06)

Specifications

Maintenance

Steering Wheel-Renew

Repair Operation Time (ROT)	
Item	Code
Steering Wheel-Renew	11.06.AB

Removal

1. Disconnect vehicle battery.
2. Remove driver's airbag module (see Workshop Manual Procedure 11.06.BC Module - Drivers Airbag - Renew).
3. Place steering wheel in straight ahead position.
4. Remove ignition key.
5. Remove steering wheel retaining Torx bolt (see Fig. 1).

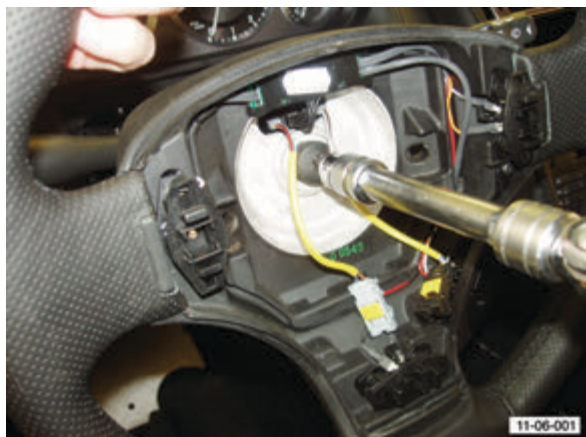


Fig. 1

6. Disconnect multiplug from cruise control.
7. Remove steering wheel.
8. Secure rotary coupler to steering column with tape.

Installation

1. Remove tape from rotary coupler.
2. Ensure steering is set in the straight ahead position.
3. Install steering wheel on column.
4. Install and tighten retaining Torx bolt (40 Nm).
5. Connect multiplug, cruise control.
6. Install driver's airbag module (see Workshop Manual procedure 11.06.BC Module - Drivers Airbag - Renew).
7. Connect vehicle battery.