Service Manual: STEERING SYSTEM

DESCRIPTION AND OPERATION > DESCRIPTION AND OPERATION > DESCRIPTION

This vehicle comes with Electric Power Steering (EPS) as standard equipment and it is the only steering system available. The power steering system consists of these major components:

- Rack and Pinion Steering Gear
- Power Steering Column with EPS assist
- Inner and Outer Tie Rod Ends

DESCRIPTION AND OPERATION > DESCRIPTION AND OPERATION > OPERATION

Turning of the steering wheel is converted into linear (side-to-side) travel through the meshing of the helical pinion teeth with the rack teeth within the steering gear. The lateral travel pushes and pulls the tie rods to change the direction of the vehicle's front wheels.

Power assist steering is provided by an electric motor connected to the steering column. The Electric Power Steering (EPS) system provides variable assist for steering maneuvers based on several inputs, including Vehicle Speed, Steering Angle Sensor (SAS), and Vehicle Voltage.

The EPS system communicates over the CAN C network. The steering angle sensor is internal to the EPS column and outputs the SAS position to other modules. The steering column is designed to be serviced only as a complete assembly if an internal component is found to be defective.

Manual steering control of the vehicle can be maintained if power steering assist is lost. However, under this condition, steering effort is significantly increased.

DIAGNOSIS AND TESTING > STEERING SYSTEM DIAGNOSIS CHARTS

NOTE:

There are three diagnosis charts following that cover NOISE, VIBRATION AND HARSHNESS (NVH) ISSUES, PERFORMANCE ISSUES, and FLUID ISSUES.

DIAGNOSIS AND TESTING > STEERING SYSTEM DIAGNOSIS CHARTS > PERFORMANCE ISSUES

CONDITION	POSSIBLE CAUSES	EVALUATION/CORRECTION
STEERING WHEEL IS OFF CENTER	1. Front toe is out of adjustment.	1. Perform wheel alignment Make sure to perform the Clear Steering Pull

		Compensation and Vehicle Trim procedures with the steering wheel lock still on the steering wheel. Refer to WHEEL ALIGNMENT, STANDARD PROCEDURE .
VEHICLE PULLS LEFT OR RIGHT	1. Steering wheel lock was taken off before the Clear Steering Pull Compensation procedure was performed during an alignment.	1. With the steering wheel straight ahead and locked in position, perform the Clear Steering Pull Compensation and Vehicle Trim procedures. Refer to STANDARD PROCEDURE .
	2. The Electric Power Steering (EPS) module has the incorrect center position.	2. With the steering wheel straight ahead and locked in position, perform the Clear Steering Pull Compensation and Vehicle Trim procedures Refer to STANDARD PROCEDURE .
	3. The center position of the column does not match the center position of the vehicle alignment.	3. Perform wheel alignment. Make sure to perform the Clear Steering Pull Compensation and Vehicle Trim procedures. Refer to WHEEL ALIGNMENT, STANDARD PROCEDURE and STANDARD PROCEDURE .
	4. Suspension components are bent and/or damaged.	4. Inspect suspension components for damage.
STEERING WHEEL OR COLUMN HAS FREE-PLAY/LASH /LOOSENESS (CLUNKING OR RATTLING)	1. Loose coupling pinch bolt at gear input shaft.	1. Check pinch bolt torque. Replace pinch bolt with thread locker patch and tighten to specifications.
	2. Steering gear loose on cradle/crossmember.	2. Inspect gear mounting bolts. Replace if necessary and tighten to specifications.
	3. Excessive free-play or noise from steering column bearings.	3. Replace steering column.
	4. Excessive intermediate (steering) shaft coupling U-joint free-play.	4. Rotate steering wheel back-and-forth while watching coupling. Observe for free-play.
	5. Loose or worn outer tie rod.	5. For evaluation and correction, refer to GEAR .
	6. Lack of lubrication in lower ball joint or ball joint is damaged.	6. Lubricate ball joint if equipped with a zerk fitting and check for function. If not equipped with a zerk fitting, test and replace ball joint/lower control arm as necessary.
	7. Excessive lash inside steering gear.	7. Disconnect intermediate shaft and turn steering gear input shaft. Observe for any movement without a corresponding tire

		movement. Replace steering gear as necessary.
STEERING WHEEL HAS FORE AND AFT LOOSENESS	1. Steering wheel retaining bolt loose.	1. Check steering wheel retaining bolt torque and tighten to specifications as necessary.
	2. Loose steering column to instrument panel fasteners.	2. Check steering column to instrument panel fastener torque and tighten to specifications as necessary.
STEERING WHEEL, DASH OR VEHICLE VIBRATES DURING STEERING MANEUVERS (ESPECIALLY AT LOW SPEED OR STANDSTILL)	1. Tire(s) not properly inflated.	1. Check and inflate tires to the specified pressure.
	2. Excessive engine vibration.	2. Ensure that the engine is tuned properly.
	3. Loose tie rod end jam nut.	3. Check torque and tighten the inner to outer tie rod jam nut to specifications.
	4. Grounded, damaged or loose engine mount.	4. Visually inspect for damaged or misaligned mounts. Check fastener torque. Replace or realign as necessary.
	5. Loose or worn outer tie rod.	5. For evaluation and correction, refer to GEAR .
	6. Steering gear noisy.	6. During a parking event at 0 mph, verify there is vibration only with steering. Steer in both directions and verify that the noise follows the steering input. Check TSBs for any known issues. Replace steering gear as necessary.
STEERING IS DIFFICULT IN BOTH DIRECTIONS	1. Steering column internal issue.	*CAUTION:* *Do not turn past two revolutions. Damage to the clockspring may occur. Always rotate steering column back to initial position. Steering column is equipped with an absolute position sensor that has a unique zero position.* 1. Disconnect the intermediate shaft and rotate steering column. If condition is still present, replace steering column. Refer to COLUMN, REMOVAL AND INSTALLATION .

STEERING CATCHES, SURGES OR STICKS IN CERTAIN POSITIONS OR IS DIFFICULT TO TURN	1. Tire(s) not properly inflated.	1. Check and inflate tires to the specified pressure.
	2. Lack of lubrication in lower ball joint or ball joint is damaged.	2. Lubricate ball joint if equipped with a zerk fitting and check for function. If not equipped with a zerk fitting, test and replace ball joint/lower control arm as necessary.
	3. Lack of lubrication in steering gear outer tie rod end(s).	3. For evaluation and correction, refer to GEAR .
	4. Excessive friction in intermediate shaft/coupler joint.	4. Disconnect intermediate shaft/coupler at steering gear and check joint for smooth operation in all directions.
	5. Excessive friction in steering column.	*CAUTION:* *Do not turn past two revolutions. Damage to the clockspring may occur. Always rotate steering column back to initial position. Steering column is equipped with an absolute position sensor that has a unique zero position.* 5. Disconnect intermediate shaft/coupler at steering gear. Turn steering wheel two revolutions in either direction from on center and check for smooth operation. Replace steering column as necessary.
	6. Worn or binding seat and bearing in front strut assembly.	6. Disconnect outer tie rod ends from knuckles, then turn tire and wheel assembly checking for smooth operation. Replace front strut assembly seat and bearing.
	7. Faulty steering gear.	7. With vehicle on hoist, tires unsupported and engine off, steer gear throughout travel and check for smooth operation. Replace steering gear (only after all previous components have been checked).
STEERING WHEEL DOES NOT RETURN TO CENTER POSITION	1. Tire(s) not properly inflated.	1. Check and inflate tires to the specified pressure.
	2. Improper front wheel alignment.	2. Check and adjust wheel alignment as necessary.

	3. Lack of lubrication in lower ball joint or ball joint is damaged.	3. Lubricate ball joint if equipped with a zerk fitting and check for function. If not equipped with a zerk fitting, test and replace ball joint/lower control arm as necessary.
	4. Excessive friction in intermediate shaft/coupler joint.	4. Disconnect intermediate shaft/coupler at steering gear and check joint for smooth operation in all directions. Replace steering column.
	5. Excessive friction in steering column.	5. Disconnect intermediate shaft/coupler at steering gear. Turn steering wheel two revolutions in either direction from on center and check for smooth operation. DO NOT turn past two revolutions. Damage to the clockspring may occur. Replace steering column as necessary.
	6. Worn or binding seat and bearing in front strut assembly.	6. Disconnect steering gear outer tie rod ends at knuckles, then turn tire and wheel assembly in and out checking for smooth operation. Replace seat and bearing as necessary.
	7. Excessive friction in steering gear.	7. With vehicle on hoist, tires unsupported and engine off, steer gear throughout travel and check for smooth operation. Replace steering gear (only after all previous components have been checked).
	8. EPS system issue.	8. If all previous steps did not fix the issue, the EPS must be replaced.
EXCESSIVE STEERING WHEEL KICKBACK FROM ROAD INPUTS	1. Steering gear loose on cradle/crossmember.	1. Inspect gear mounting bolts. Replace if necessary and tighten to specifications.
	2. Steering column, coupling or intermediate shaft worn or loose.	2. Rotate steering wheel back-and-forth while inspecting intermediate shaft going into steering gear. Look for excessive free-play. Retighten if loose bolt is found. Replace steering column, coupling. Refer to COLUMN, REMOVAL AND INSTALLATION .

DIAGNOSIS AND TESTING > STEERING SYSTEM DIAGNOSIS CHARTS > NOISE, VIBRATION AND HARSHNESS (NVH) ISSUES

CONDITION	POSSIBLE CAUSES	EVALUATION/CORRECTION
OBJECTIONABLE	1. Electric Power Steering (EPS)	1. Replace the steering column, which

ELECTRICAL BUZZING* OR STRONG VIBRATIONS WHILE TURNING STEERING WHEEL WHEN STATIONARY OR MOVING SLOWLY	System issue.	includes the EPS system. Refer to COLUMN, REMOVAL AND INSTALLATION .
NOISE FROM THE ELECTRIC POWER STEERING (EPS) SYSTEM WHILE VEHICLE IS MOVING	1. EPS column fasteners are loose. 2. Intermediate shaft is loose. 3. Tire pressure is incorrect.	1. Verify column fasteners are tightened to correct specifications. 2. Verify intermediate shaft pinch bolt is tightened to the correct specification. 3. Check and inflate tires to the specified pressure.
RATTLE OR EXCESSIVE CLUNK*	1. Steering gear loose on engine cradle/crossmember.	1. Check fastener torque and tighten to specifications. Replace as necessary. Check steering wheel center following repair.
	2. Loose strut assembly mounting fasteners at tower or knuckle.	2. Check fastener torque and tighten to specifications.
	3. Excessive play in outer tie rod.	3. For evaluation and correction, refer to GEAR .
	4. Engine cradle/crossmember mounting fasteners loose at frame or bushings worn.	4. Check fastener torque and tighten to specifications. Inspect bushings and repair as necessary.
	5. Wheel mounting (lug) bolts loose.	5. Inspect wheel mounting (Lug) bolts and repair as necessary. Tighten bolts to specifications.
	6. Stabilizer bar link joints worn (occurs with steering input only when moving, not stationary).	6. At park, jounce only one side of vehicle front to exercise stabilizer bar. Replace stabilizer bar link.
	7. Loose lower control arm mounting bolts at engine cradle, frame or crossmember (occurs with steering input only when moving, not stationary).	7. Check control arm mounting bolts and tighten to specified torque.
	8. Loose intermediate shaft or column.	8. Rotate intermediate (steering) shaft in relationship to gear, checking for free-play. Check column fasteners and tighten to specifications as necessary.
	9. Lower control arm pivot bushing worn (occurs with steering input only when moving, not stationary).	9. Inspect bushings for wear and replace lower control arm as necessary.
	10. Internal steering gear noise.	10. Drive vehicle on rough road, then steer rapidly back and forth when stopped. Replace steering gear as

		necessary.
	11. Loose inner tie rod.	11. For evaluation and correction, refer to GEAR .
	12. Damaged engine cradle/crossmember.	12. Inspect the cradle/crossmember for cracks or other damage. Replace as necessary.
POPPING NOISE	1. Loose steering gear mounting fasteners.	1. Check fasteners for proper torque and retighten as necessary.
	2. Loose outer tie rod mounting nut or jam nut.	2. Check fastener torque. Replace nuts as necessary and tighten to specifications.
	3. Loose intermediate (steering) shaft coupling at gear input shaft.	3. Make sure coupling is fully seated on gear input shaft. Retighten or re-seat as necessary.
	4. Worn tie rod (outer or inner).	4. For evaluation and correction, refer to GEAR .
	5. Worn axle half-shaft.	5. For evaluation and correction. Refer to DIAGNOSIS AND TESTING .
SQUEAKING OR RUBBING SOUND	1. Steering column shroud or shaft rubbing.	1. While turning the steering wheel, listen down column to locate. Check interference between moving components. Move or realign shrouds or shaft as necessary. Replace components if this does not correct problem.
	2. Clockspring inside steering column noisy.	2. Remove clockspring and reinstall steering wheel for testing. If noise is gone, replace clockspring.
	3. Boot/dash seal lubrication inadequate.	3. Remove boot seal and recheck for noise. Lubricate seal as necessary.
	4. Steering gear outer tie rod noisy.	4. While a helper turns the steering wheel, use an electronic listening tool to determine if noise is coming from either outer tie rod. Replace outer tie rods as necessary.
	5. Steering gear internally noisy.	5. Remove dash seal boot, then exercise the steering wheel. If noise is still present at gear, replace steering gear.
SCRUBBING OR KNOCKING SOUND	1. Incorrect tire or wheel size.	1. Replace incorrect size tire or wheel with original equipment size.
	2. Worn motor or transmission mount.	2. Drive vehicle, moving accelerator pedal rapidly up and down attempting to locate noise. Try in both forward and reverse. Replace mounts as necessary.

	3. Tires contacting wheel well.	3. Make sure wheel house is properly positioned. If not, reposition as necessary. If steering wheel is properly centered, check steering gear travel left to right by rotating the steering wheel to each stop. Steering wheel should rotate the same amount in both directions from center. If not, replace steering gear.
	4. Interference between moving steering components and other components.	4. Check for bent or misaligned components. Correct or replace as necessary.

NOTE:

** Slight noise is normal in the EPS system. There is only a problem if the noise is very intense or there are strong vibrations in the steering wheel that cannot be attributed to other steering components.*

NOTE:

*** A light clunk may be felt or heard during steering wheel reversal while vehicle is stationary. This results from internal steering gear rack movement at the bushings and in no way affects the performance of the steering system. This movement may be felt in the steering components during steering wheel reversal.*

SPECIAL TOOLS > SPECIAL TOOLS

Tool (EMEA)	Tool (NAFTA)	Name	Function
1871000700	C-4150A	Extractor	Steering rod from knuckle extractor

SPECIFICATIONS > TECHNICAL SPECIFICATIONS

	1.4 MultiAir Turbo	2.4 MultiAir	1.6 16V Multijet	2.0 16V Multijet
Type	Energy absorbing coupled steering column. Electric power steering rack.			
Turning radius (m)	11.07/10.76 (*)			

NOTE:

(*) Trailhawk versions

SPECIFICATIONS > TORQUE SPECIFICATIONS

STEERING SYSTEM TORQUE SPECIFICATIONS

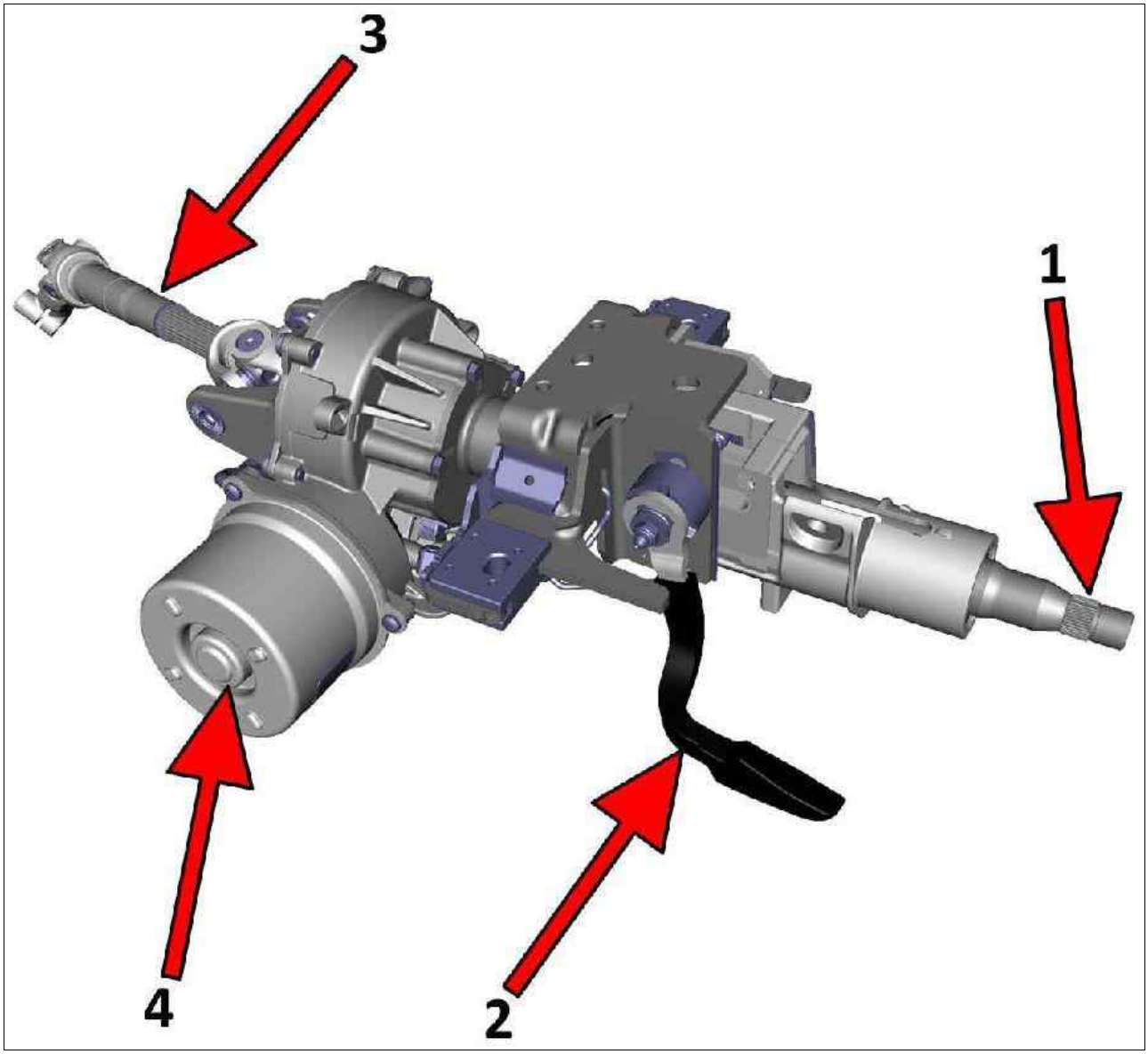
DESCRIPTION	N.m	Ft. Lbs.	In. Lbs.	NEW FASTENER*
Intermediate Shaft to Steering Gear Bolt	60	44	-	**X**
Outer Tie Rod End to Steering Knuckle Nut	40	30	-	**X**
Steering Column to Dash Frame Bolts	20	15	-	
Steering Column to Dash Frame Nuts	20	15	-	**X**
Steering Gear to Crossmember	110	81	-	
Steering Wheel to Column Nut	50	37	-	
Tie Rod Jam Nut	56	41	-	

*** NEW FASTENER:** Do not reuse these fasteners. If removed, a new fastener must be installed and tightened to specifications.

COLUMN > DESCRIPTION AND OPERATION > DESCRIPTION AND OPERATION

Electric Power Steering (EPS)

Fig 1: Steering Column, Locking/Unlocking Lever & Actuator



Courtesy of CHRYSLER GROUP, LLC

1. Steering column
2. Steering wheel adjustment locking/unlocking lever
3. Steering column
4. Power assistance actuator

The vehicle features Electric Power Steering (EPS) produced by TRW. Since the steering system is fully electric, all power assistance is provided by an electric motor system. The motor:

- Improves fuel economy as there is no power uptake from a power steering pump.
- Reduces steering system-generated noise, and allows optimal tuning of feedback to the driver.

The speed-sensitive, variable power assistance responds to sensors monitoring steering torque, steering wheel speed and angle, and vehicle speed. The steering system is fully integrated with the

electronic stability control system and helps compensate in situations where the wheels have different grip.

Operation

The EPS system is a power steering system designed to reduce the force necessary for maneuvering the vehicle at low speed, without rendering steering too light at higher speeds. EPS provides:

- A lighter and less complex system with fewer components.
- Less noise and improved driving comfort.
- Power assistance is relative to vehicle speed.

The EPS system operates according to the operating information received by the CAN, such as:

- Vehicle speed
- Engine speed
- Ignition status

The EPS assembly includes two built-in sensors that provide:

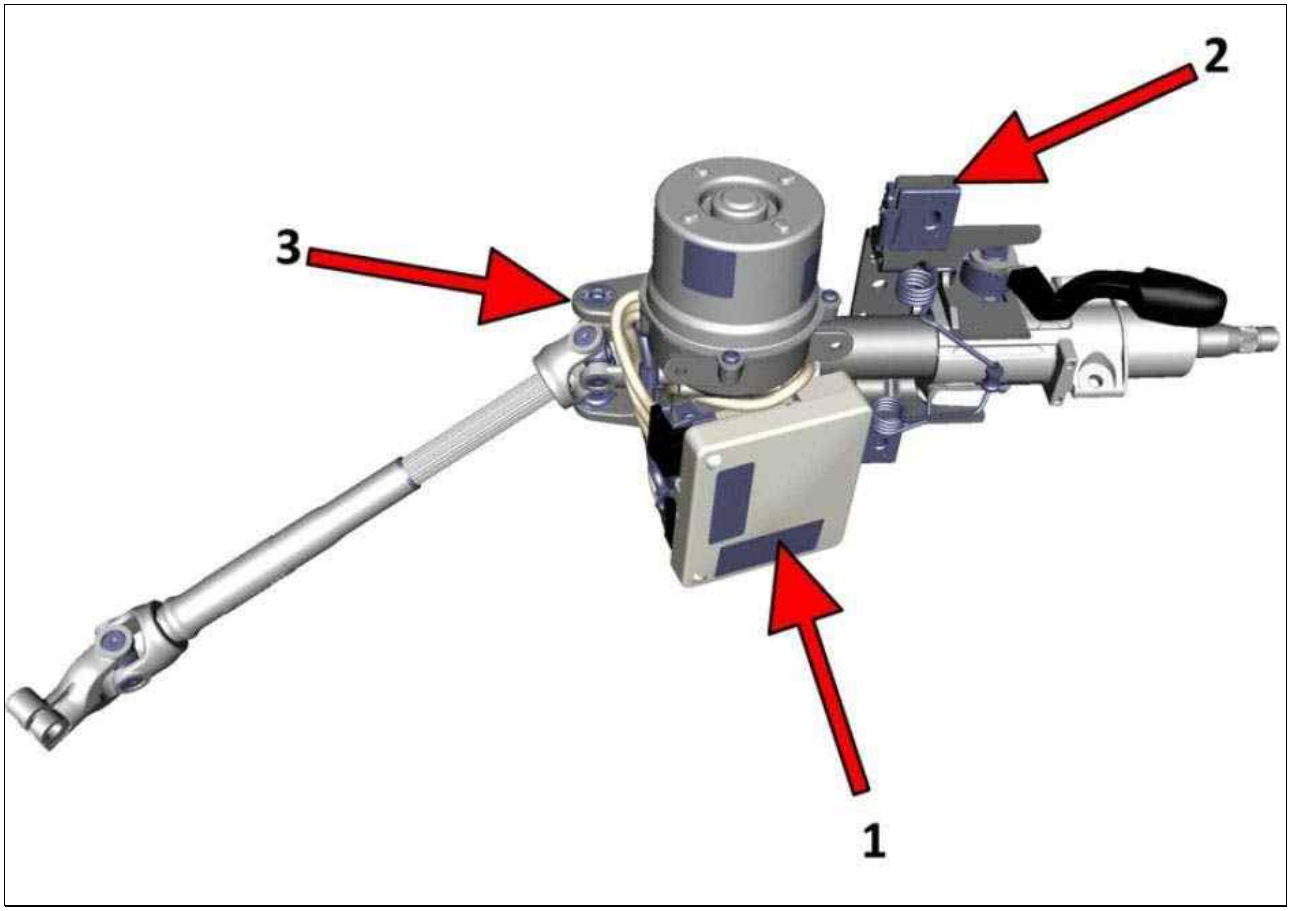
- Steering angle
- Steering wheel torque (driver input)

The system will turn off power assistance if the following criteria are met:

- Engine speed is less than 600 RPM
- Ignition is in the OFF position

This allows the system to continue providing assistance in the event of a stall, or a condition where ignition input is lost due to an electrical fault.

Fig 2: EPS Module & Mounts



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1. EPS module
2. Upper electric steering mounts
3. Lower electric steering mounts

COLUMN > REMOVAL AND INSTALLATION > REMOVAL AND INSTALLATION > REMOVAL

WARNING:

When an undeployed airbag module is to be removed from the vehicle, first disconnect the battery ground cable and isolate it. Allow the system capacitor to discharge for a minimum of two minutes before starting any removal.

NOTE:

Before proceeding, refer to WARNING .

NOTE:

In case of replacing steering column, connect the diagnostic tool to calibrate the "sensor".

NOTE:

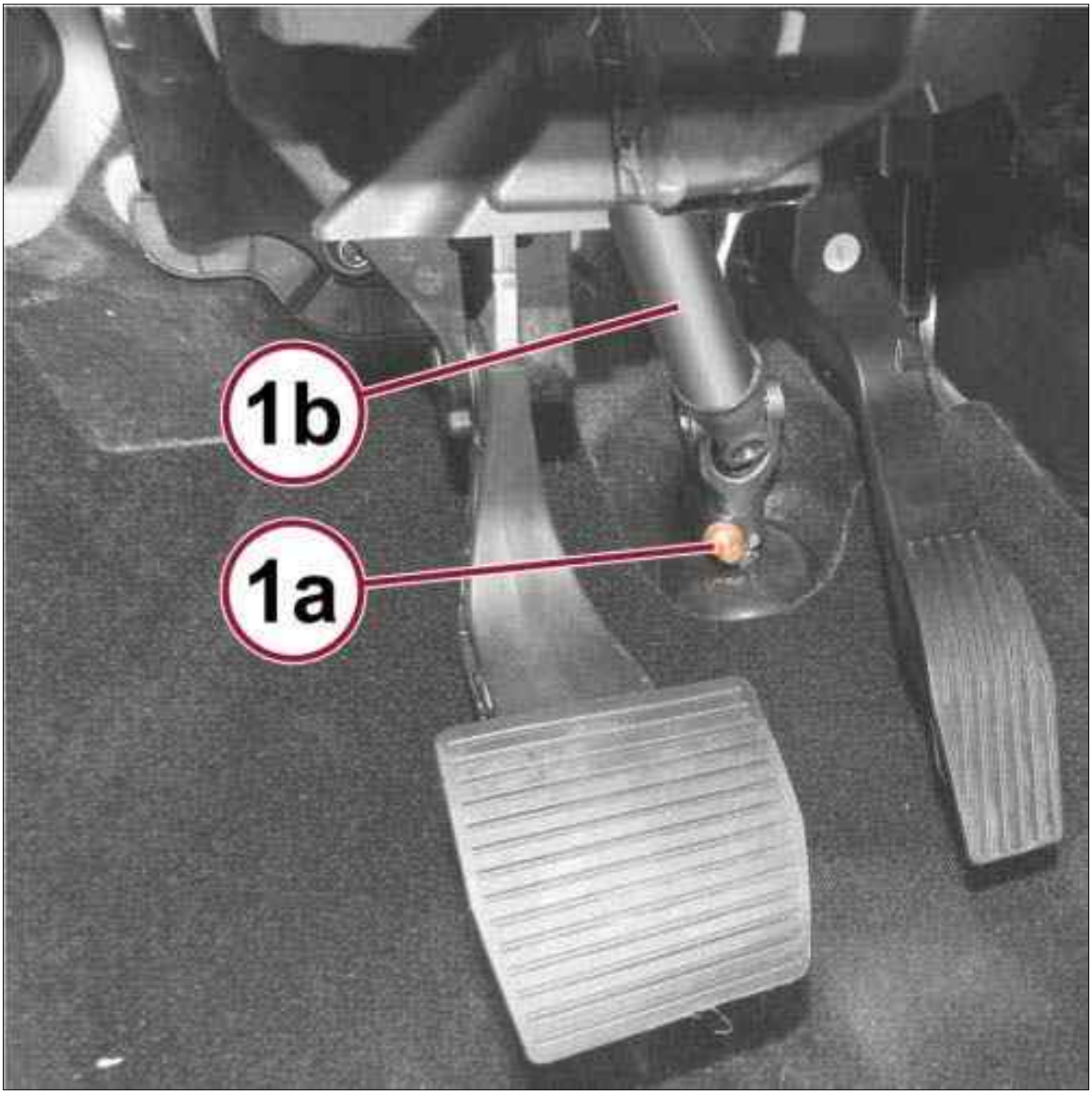
Position the front wheels straight, enter the first block steering to the right and remove the ignition key.

NOTE:

Keep closed the adjustment lever steering column during all phases of removal / installation.

1. Disconnect and isolate the negative battery cable.
2. Remove the steering wheel. Refer to WHEEL, STEERING, REMOVAL AND INSTALLATION .
3. Remove the clockspring. Refer to CLOCKSPRING, REMOVAL AND INSTALLATION .
4. Remove the sentry key antenna. Refer to ANTENNA, SENTRY KEY, REMOVAL AND INSTALLATION .
5. Remove the driver knee airbag. Refer to AIR BAG, KNEE BLOCKER, REMOVAL AND INSTALLATION .

Fig 1: Intermediate Shaft & Pinch Bolt



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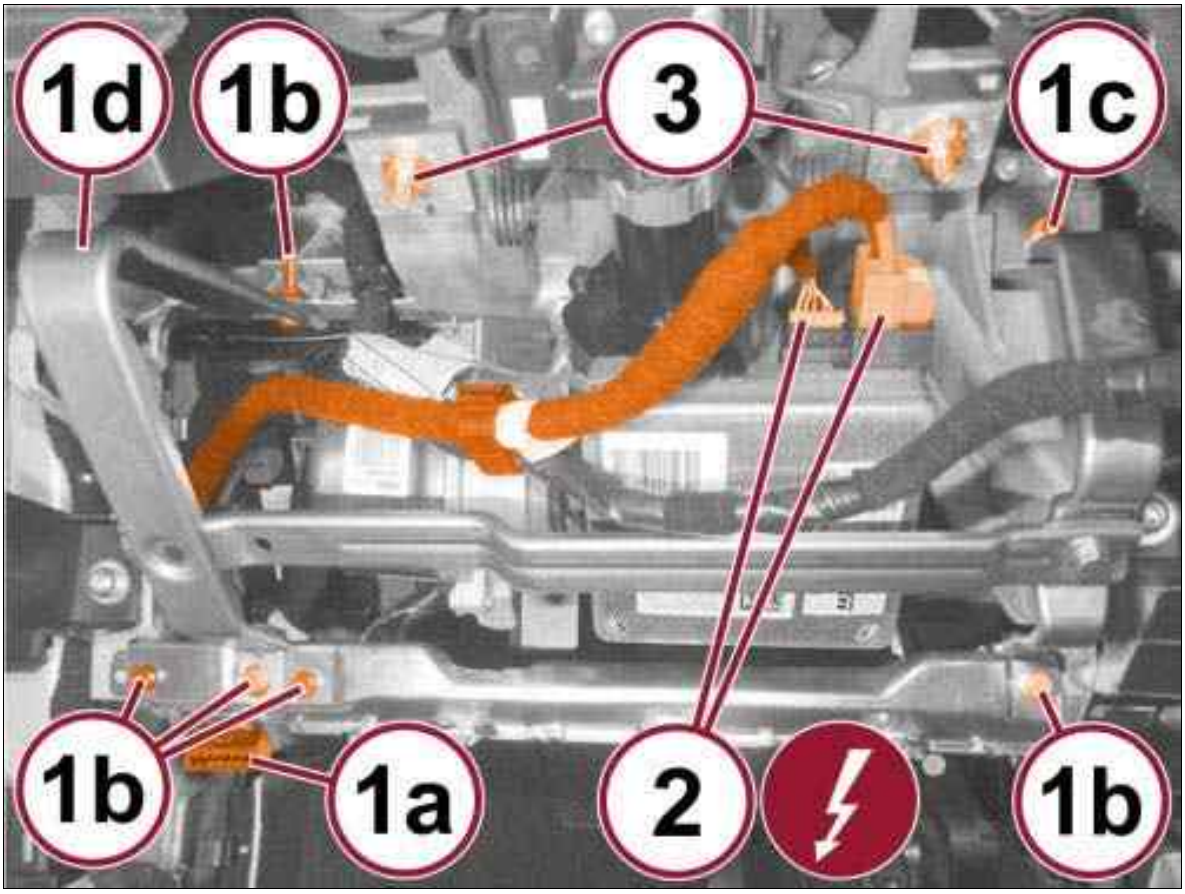
6. Remove the intermediate shaft pinch bolt (1a), and remove the intermediate shaft (1b) from the steering gear.

Fig 2: Steering Column Support Bolts, Data Link Connector, Nut, Screws & Connectors



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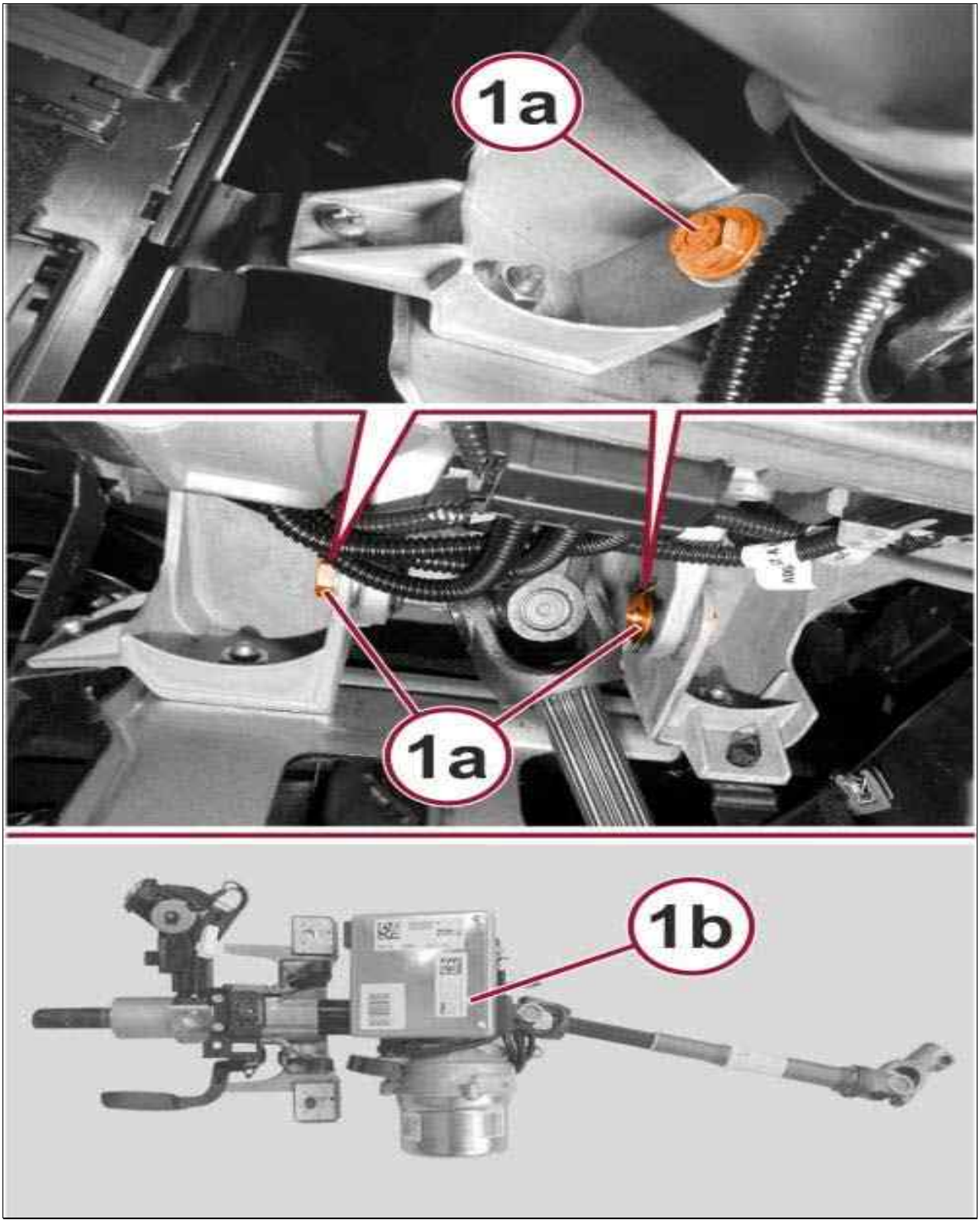
7. Remove the Data Link Connector (DLC) (1a) from the dash frame.
8. Remove the screws (1b), and the nut (1c) then remove the airbag support frame.
9. Remove the front two steering column support bolts (3).

Fig 3: Steering Column & Column To Dash Frame Bolts



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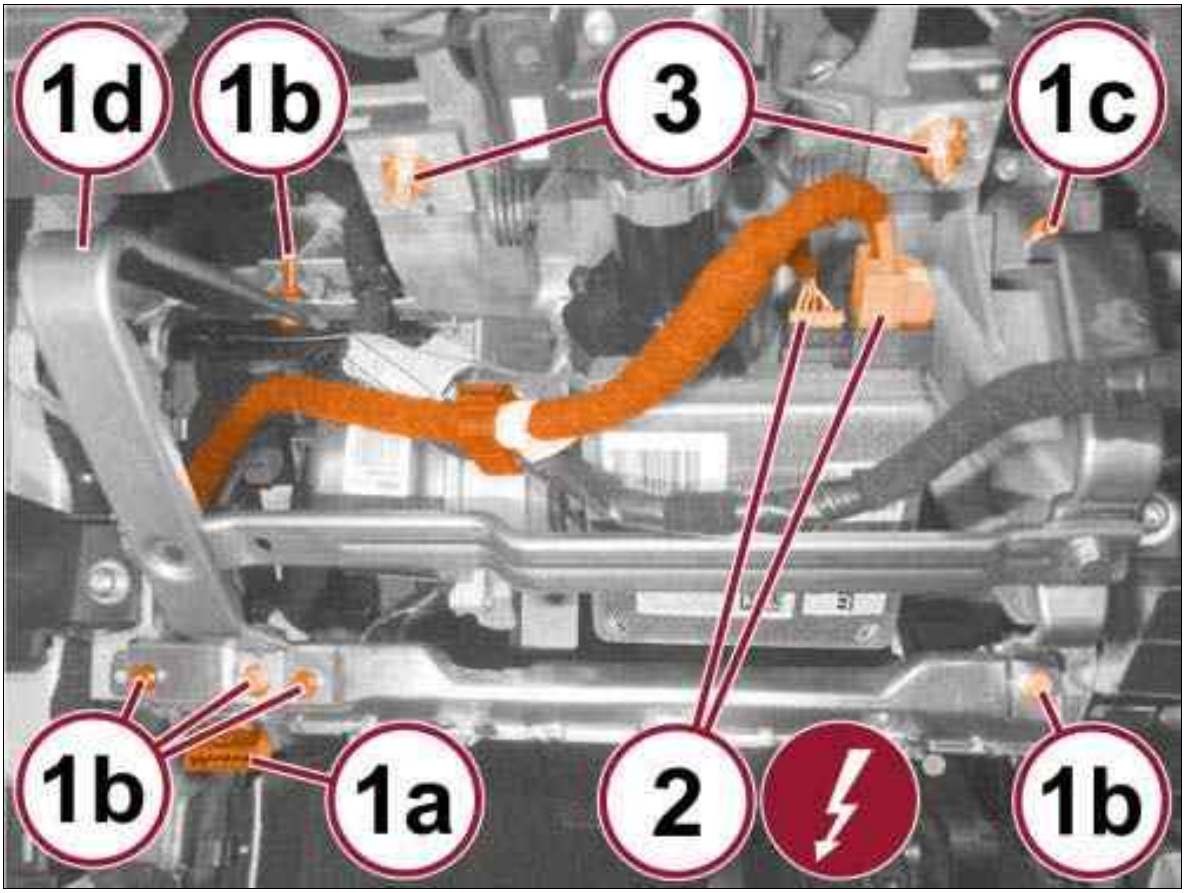
10. Remove the steering column to dash frame bolts (1a), and remove the steering column (1b).

COLUMN > REMOVAL AND INSTALLATION > REMOVAL AND INSTALLATION > INSTALLATION

1. Position the steering column in the vehicle. Install the four steering column to dash frame bolts, and tighten to the proper specification. Refer to SPECIFICATIONS .

   Fig 1: Steering Column Support Bolts, Data Link Connector, Nut, Screws & Connectors



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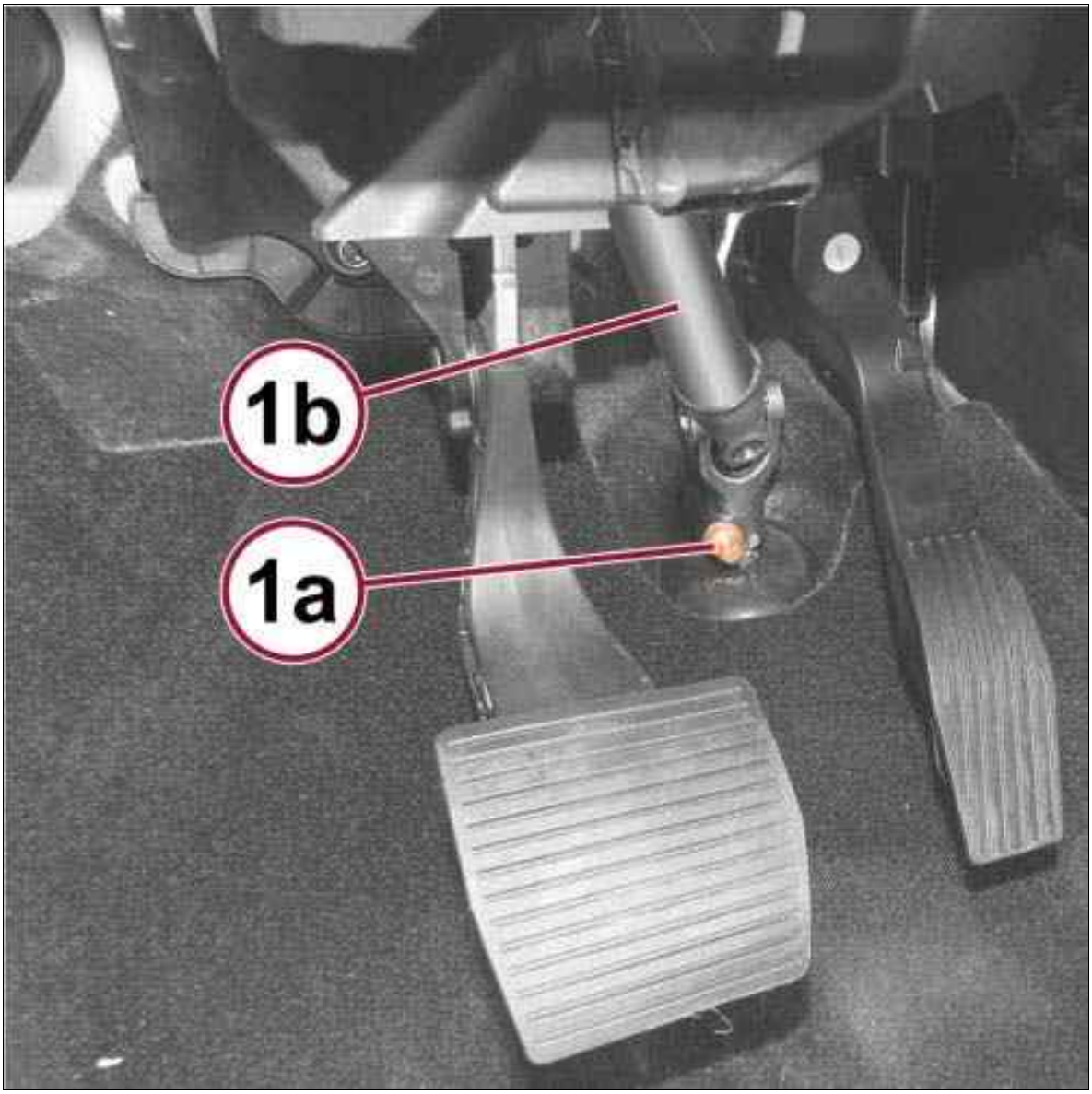
2. Install and tighten the screws (1b), and the nut (1c) for the airbag support frame.
3. Install the Data Link Connector (DLC) into the dash frame.

Fig 2: Intermediate Shaft & Pinch Bolt



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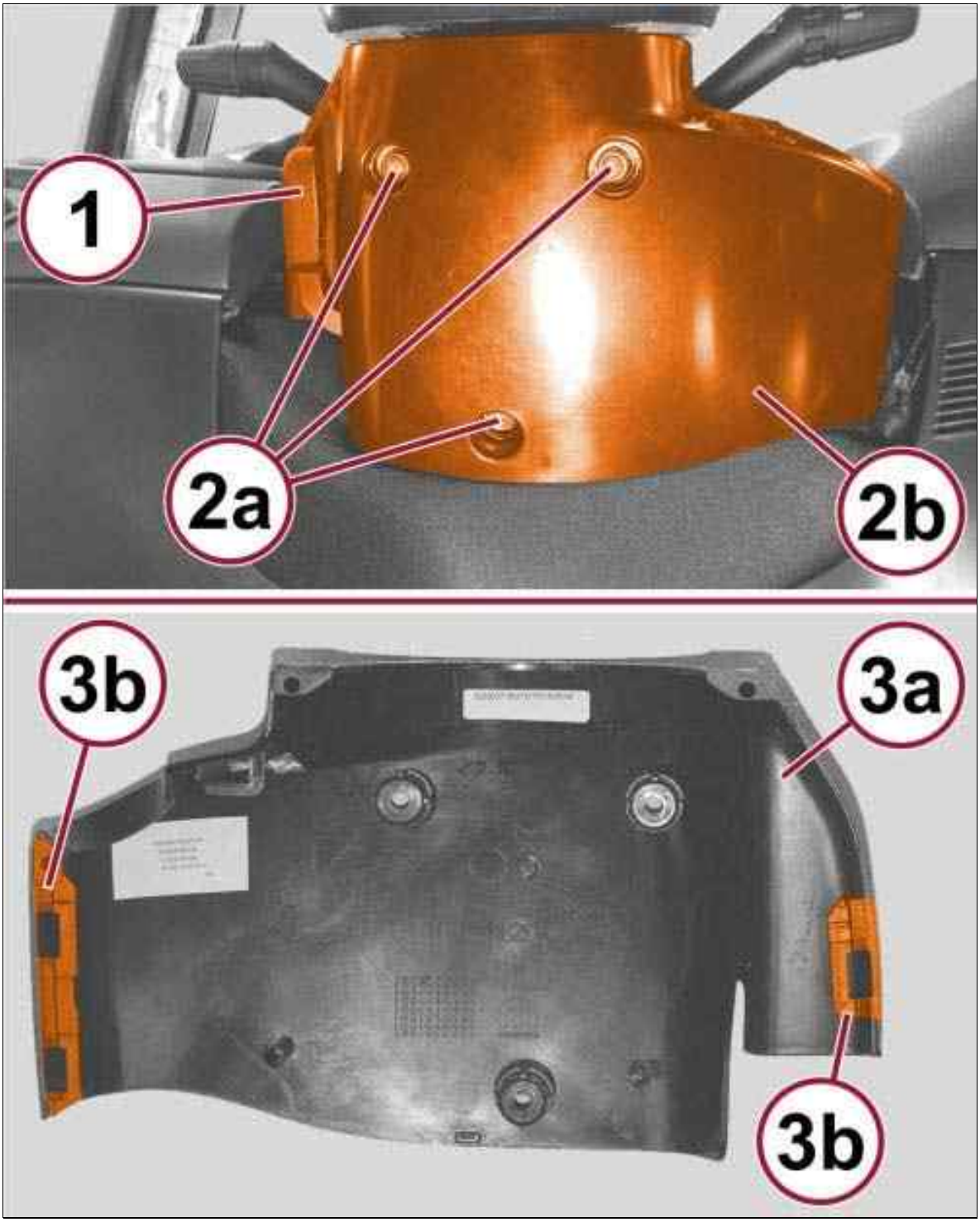
4. Install the intermediate shaft (1b) to the steering gear. Tighten the intermediate shaft pinch bolt (1a) to the proper specification. Refer to SPECIFICATIONS .
5. Install the driver knee airbag. Refer to AIR BAG, KNEE BLOCKER, REMOVAL AND INSTALLATION .
6. Install the sentry key antenna. Refer to ANTENNA, SENTRY KEY, REMOVAL AND INSTALLATION .
7. Install the clockspring. Refer to CLOCKSPRING, REMOVAL AND INSTALLATION .
8. Install the steering wheel. Refer to WHEEL, STEERING, REMOVAL AND INSTALLATION .
9. Connect the negative battery cable.

COLUMN > SHROUD, STEERING COLUMN > REMOVAL AND INSTALLATION > REMOVAL AND INSTALLATION > REMOVAL

1. Remove the instrument cluster bezel. Refer to BEZEL, INSTRUMENT CLUSTER, REMOVAL AND INSTALLATION .

   Fig 1: Bottom Cover, Tilt Lever, Screws & Retainers



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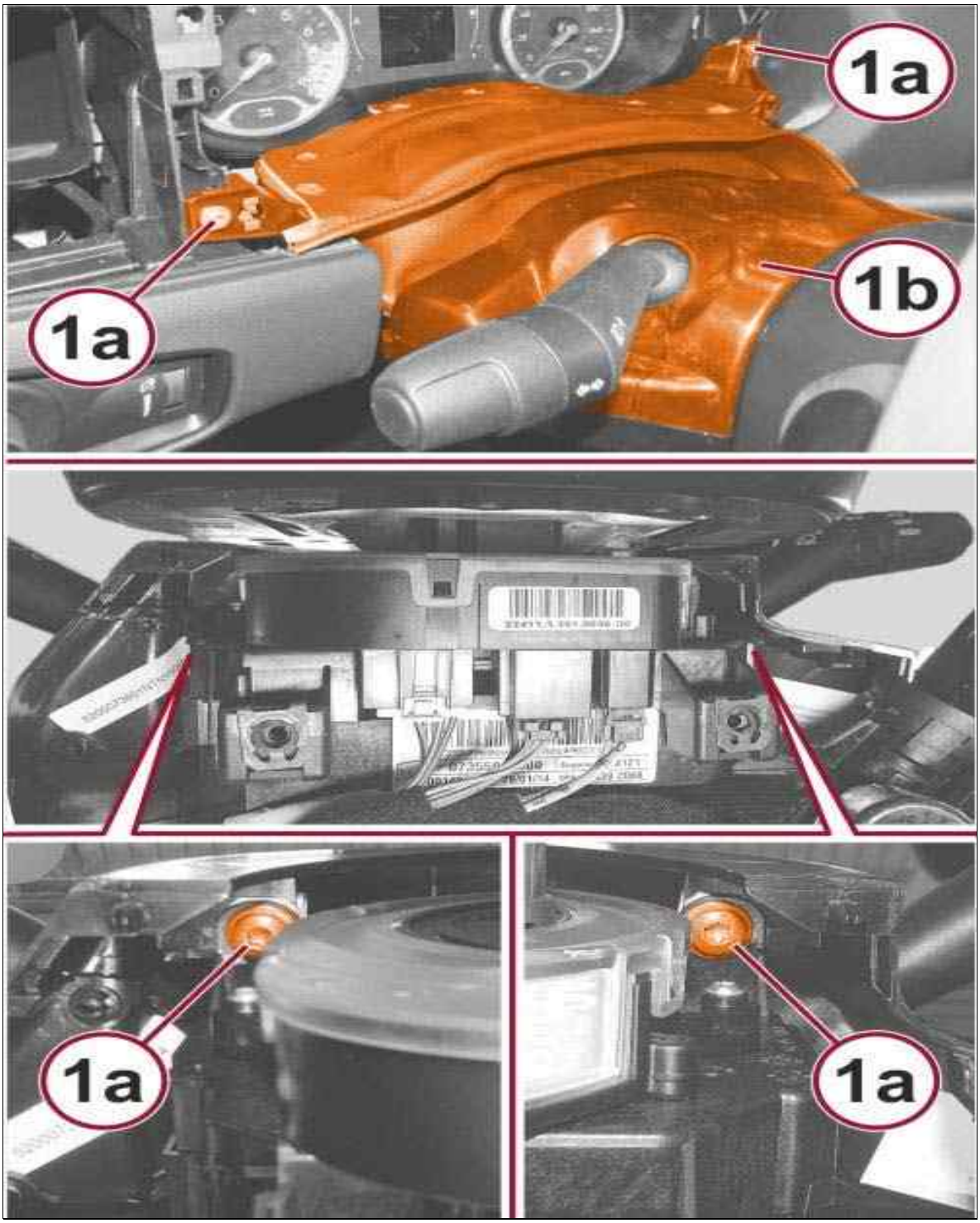
2. Lower the tilt lever (1).

3. Remove the screws (2a) securing the bottom cover (2b) to the steering column.
4. Remove the bottom cover (3a) by disengaging the inside retainers (3b).

Fig 2: Top Shroud & Screws



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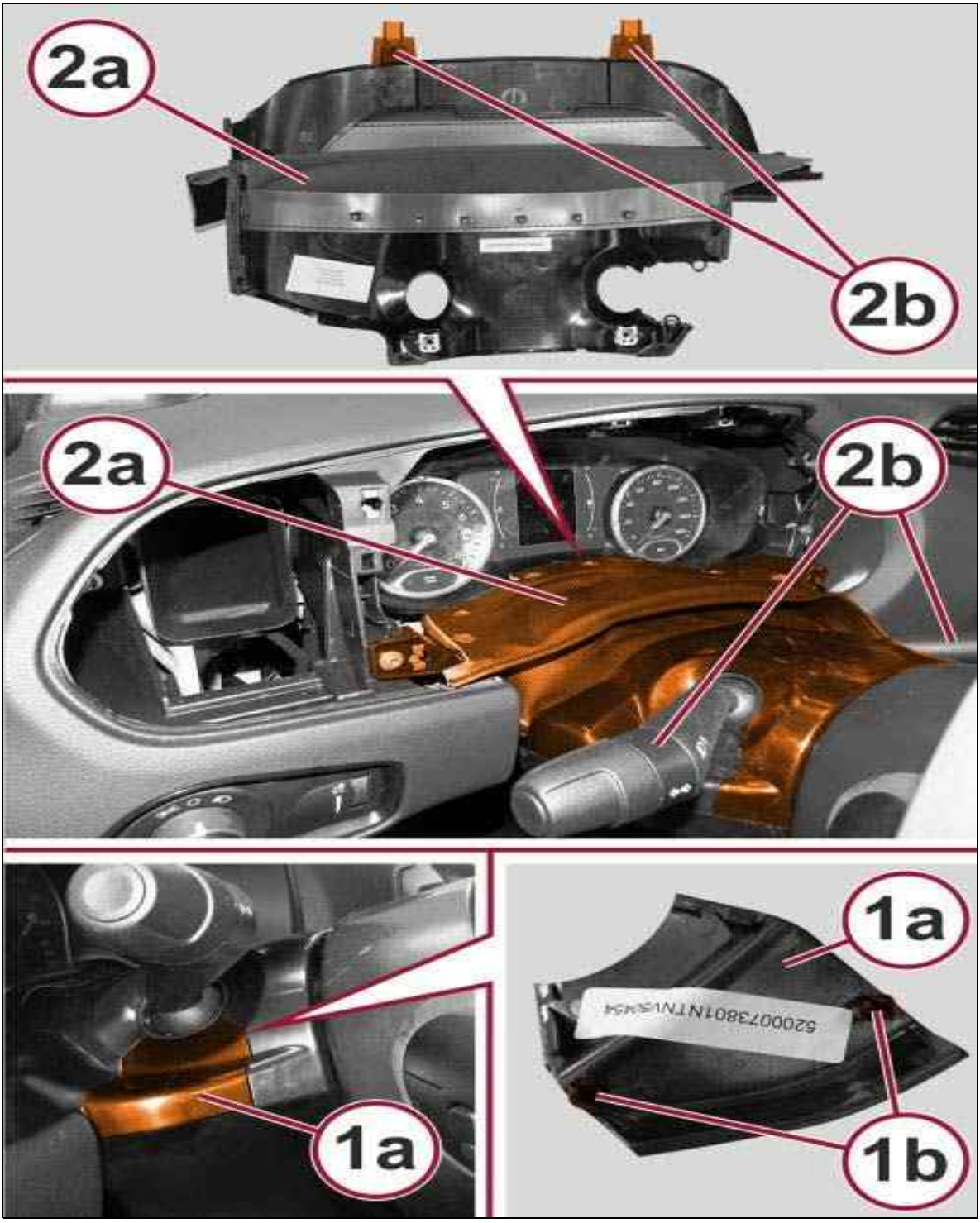
5. Remove the screws (1a) securing the top shroud (1b).

Fig 3: Top Shroud, Closeout Flange, Tabs & Clips



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6. Remove the small closeout flange (1a) by releasing the inside tabs (1b)
7. Remove the top shroud (2a) by releasing the inside clips (2b).

COLUMN > SHROUD, STEERING COLUMN > REMOVAL AND INSTALLATION >

REMOVAL AND INSTALLATION > INSTALLATION

1. Position the top steering column shroud by engaging the inside clips.
2. Tighten the screws that secure the top shroud to the steering column.
3. Install the small closeout flange by engaging the inside retainers.
4. Position the lower steering column shroud by engaging the inside clips.
5. Tighten the screws that secure the lower shroud to the steering column.
6. Install the instrument cluster bezel. Refer to BEZEL, INSTRUMENT CLUSTER, REMOVAL AND INSTALLATION .

COLUMN > WHEEL, STEERING > REMOVAL AND INSTALLATION > REMOVAL AND INSTALLATION > REMOVAL

WARNING:

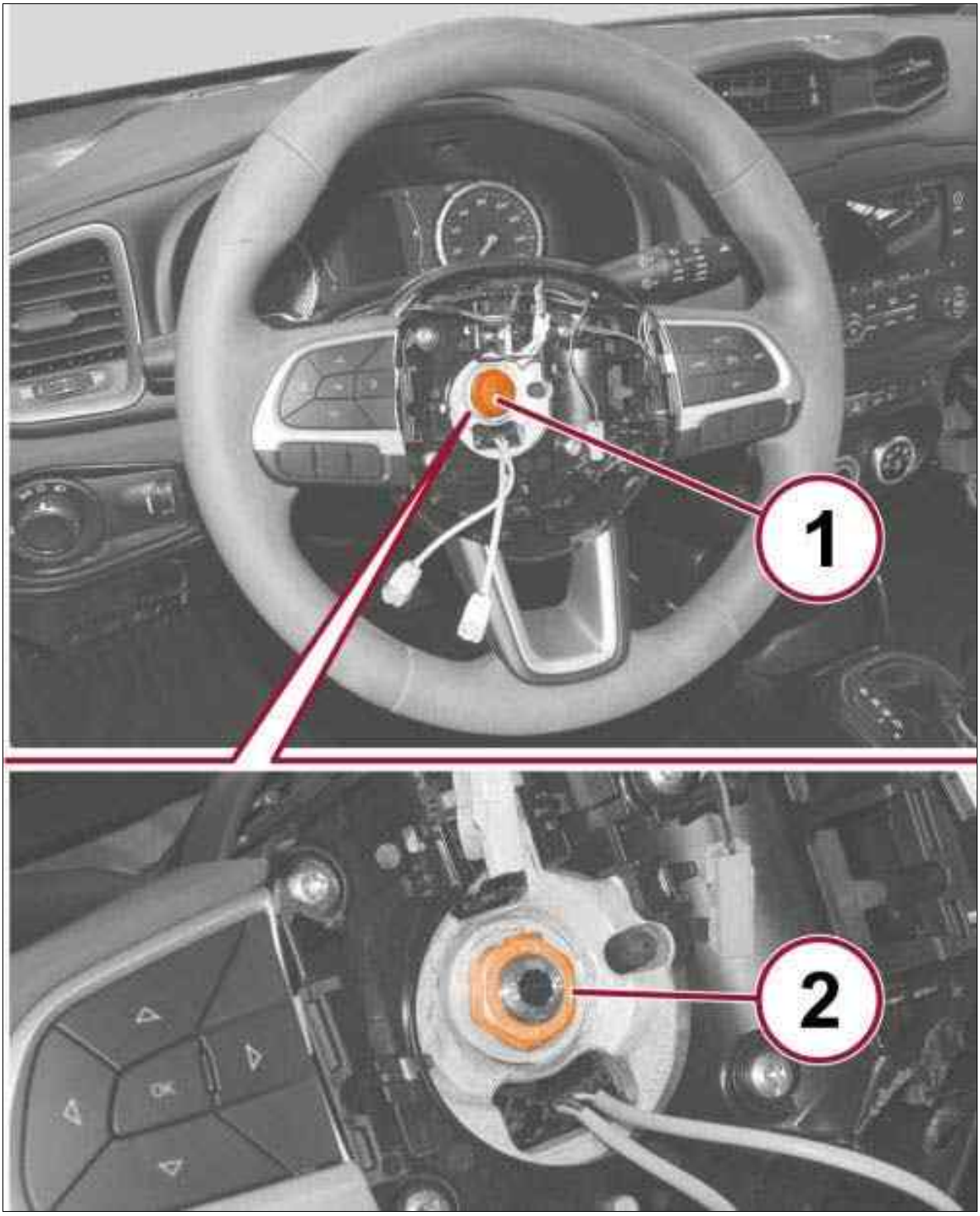
- *Do not place a non-deployed airbag face down on a hard surface. The airbag will propel into the air if accidentally deployed. Failure to follow this instruction may result in possible serious or fatal injury.*
- *Disconnect and isolate the battery negative (ground) cable before beginning steering wheel removal or installation. This will disable the airbag system. Failure to follow this instruction may result in accidental airbag deployment and possible serious or fatal injury.*
- *Allow the airbag system capacitor to discharge for two minutes before removing the steering wheel or any airbag system component. Failure to follow this instruction may result in accidental airbag deployment and possible serious or fatal injury.*

1. Disconnect and isolate the negative battery cable.
2. Remove drivers airbag. Refer to AIR BAG, DRIVER, REMOVAL AND INSTALLATION .

NOTE:

Straighten the front wheels, engage the first steering lock and remove the ignition key.

Fig 1: Steering Wheel Nut & Cover



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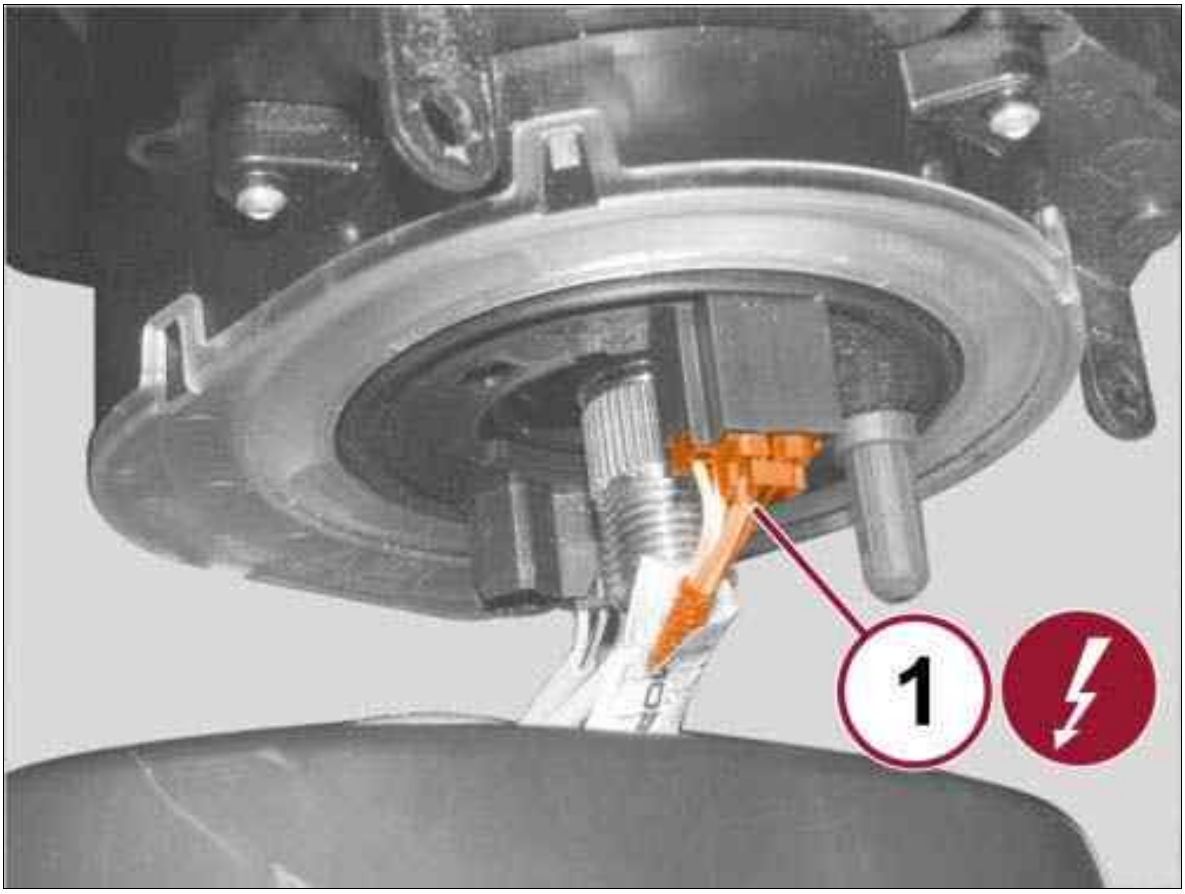
3. Remove the steering wheel nut cover (1).
4. Remove the steering wheel to column nut (2).

Fig 2: Steering Wheel Electrical Connector



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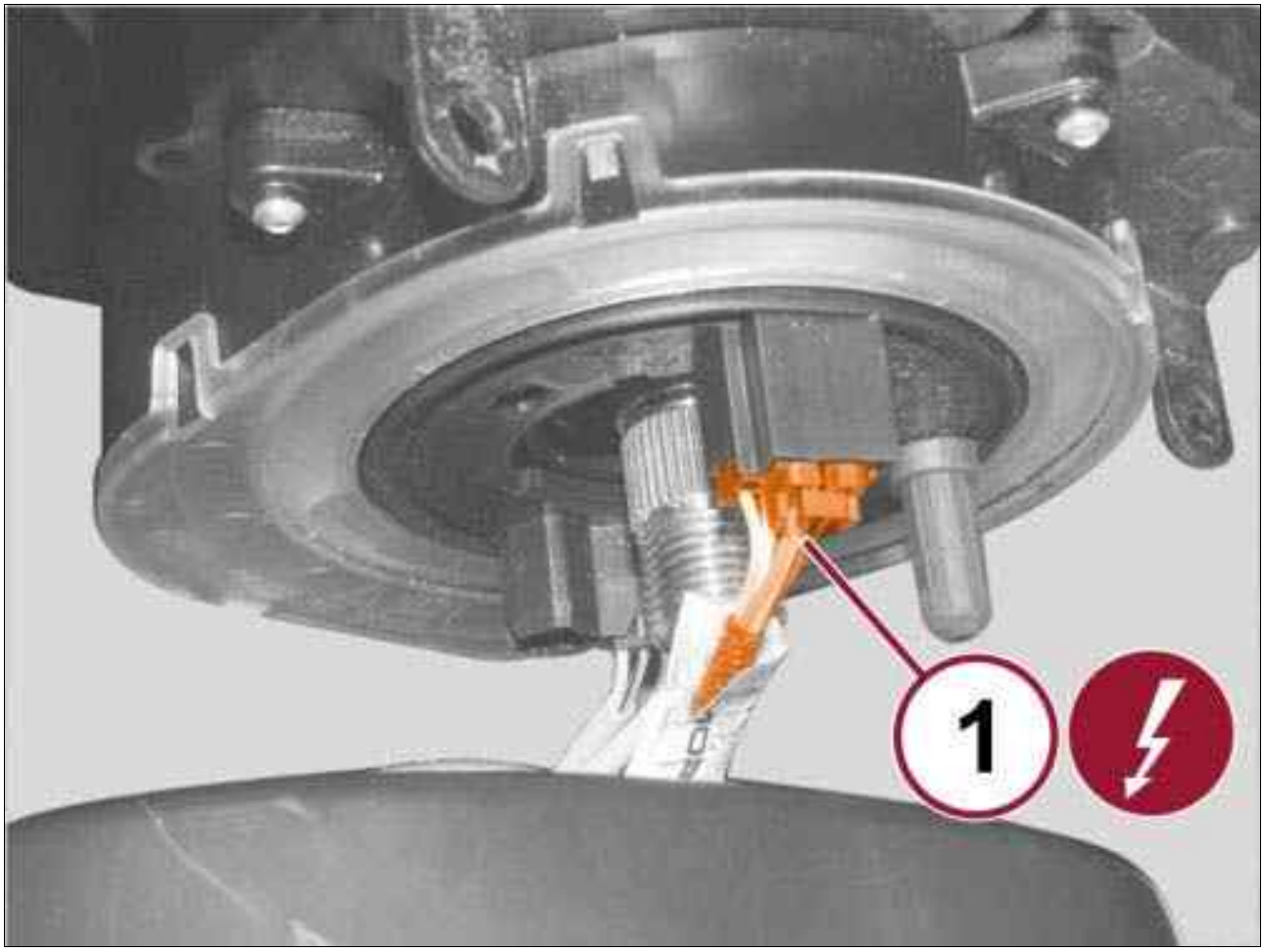
5. Partially remove the steering wheel and disconnect the steering wheel electrical connector (1).
6. Remove the steering wheel from the vehicle, transfer the switches if necessary.

COLUMN > WHEEL, STEERING > REMOVAL AND INSTALLATION > REMOVAL AND INSTALLATION > INSTALLATION

Fig 1: Steering Wheel Electrical Connector



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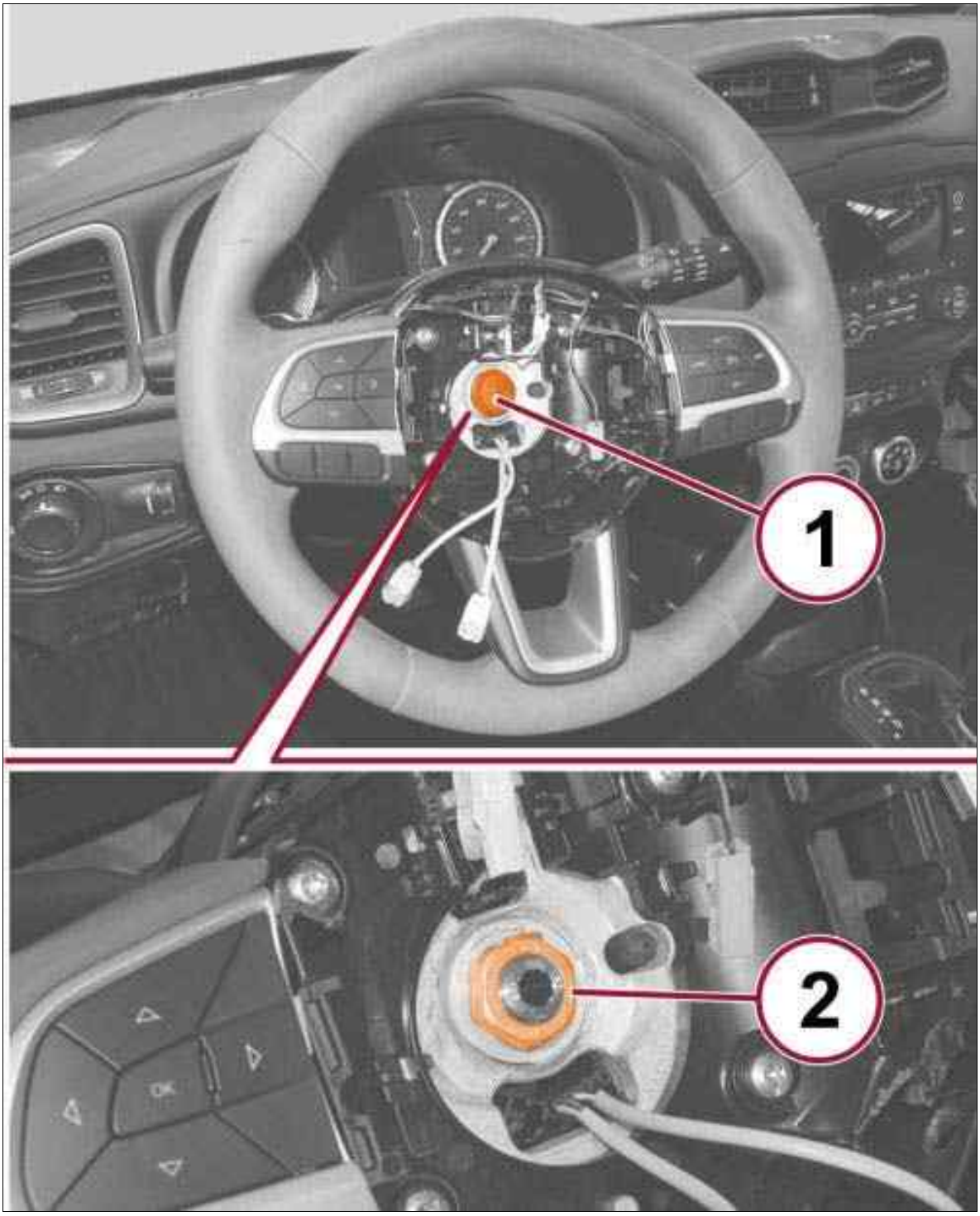
1. If removed, install the steering wheel switches.
2. Position the steering wheel on the shaft, aligning the references on the steering wheel and on the steering column.
3. Connect the steering wheel electrical connector (1).

Fig 2: Steering Wheel Nut & Cover



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4. Install the steering wheel nut (2), and tighten to the proper specification. Refer to SPECIFICATIONS .
5. Install the steering wheel nut cover (1).
6. Install drivers airbag. Refer to AIR BAG, DRIVER, REMOVAL AND INSTALLATION .
7. Connect the negative battery cable.

GEAR > REMOVAL AND INSTALLATION > REMOVAL AND INSTALLATION > REMOVAL

1. For the removal of the steering gear. Refer to CROSSMEMBER, FRONT SUSPENSION, REMOVAL AND INSTALLATION .

GEAR > REMOVAL AND INSTALLATION > REMOVAL AND INSTALLATION > INSTALLATION

1. For the installation of the steering gear. Refer to CROSSMEMBER, FRONT SUSPENSION, REMOVAL AND INSTALLATION .