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STEERING SYSTEM - GENERAL INFORMATION

STEERING SYSTEM (G2400944)

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PRINCIPLES OF OPERATION

For a detailed description of the power steering system and operation, refer to the relevant description and operation section of the workshop manual

INSPECTION AND VERIFICATION

 CAUTION:

Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

 NOTES:

- If a control module or a component is at fault or may be at fault and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual, or determine if any prior approval program is in operation, prior to the installation of a new module/component.
- When performing voltage or resistance tests, always use a digital multimeter that has the resolution ability to view 3 decimal places. For example, on the 2 volts range can measure 1mV or 2 K Ohm range can measure 1 Ohm. When testing resistance always take the resistance of the digital multimeter leads into account.
- Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.
- When diagnosing steering faults if issues are found to be due to interfacing system issues. For example, anti-lock brake system, park aid, suspension, battery / charging system, etc. Make sure warranty is claimed against the interfacing system where the problem is identified not steering gear.

1. Verify the customer concern

- If a road test is necessary make sure the vehicle is safe to do so

- 1.** Using guidance from the symptom chart, and the symptoms defined in the electrical service diagnostic tool

2. Visually inspect for obvious signs of mechanical or electrical damage**Summary**

Accident/Water Damage

**WARNING:**

The following issues are not covered under Warranty. Retailer/Authorized repairers should not claim these issues.

■ Accident damage

- Bent Steering Gear
- Bent Tie Rod
- Damage PSCM housing and Power Motor

■ Water damage

- Rusty gears
- Water ingress

Visual Inspection

MECHANICAL	ELECTRICAL
■ Check the tires for correct pressure, size, wear and tread pattern ■ Check for wheel rim and tire damage ■ Check road wheel security ■ Check for vehicle or suspension damage ■ Check steering ball joints and suspension components for abnormally high friction	■ Fuses ■ Wiring harnesses and connectors ■ Power steering control module ■ Steering angle sensor module

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the cause is not visually evident, verify the symptom with the customer and refer to the approved retailer /authorized repairer diagnostic tool. Alternatively check symptoms against symptom chart below and check Diagnostic Trouble Code(s) (DTC)s as appropriate and refer to the DTC index
5. Check JLR claims submission system for open campaigns. Refer to the corresponding bulletins and SSMS which may be valid for the specific customer complaint and complete the recommendations as required.

SYMPTOM CHART

SYMPTOM	POSSIBLE CAUSES	ACTION
No communication with power steering control module		■ Refer to the electrical circuit diagrams and check the power steering control module power and ground circuits for open circuit, high resistance

SYMPTOM	POSSIBLE CAUSES	ACTION
	- Power steering control module power or ground circuit open circuit, high resistance - High speed Controller Area Network (CAN) bus (chassis) circuit short circuit to ground, short circuit to power, open circuit, high resistance	Using the Jaguar Land Rover approved diagnostic equipment, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus (chassis) circuit for short circuit to ground, short circuit to power, open circuit, high resistance
Permanently heavy /notchy steering with the engine running, even after cycling the ignition	- Abnormally high friction in steering ball joints or suspension components - Abnormally high friction in steering or suspension components due to poor subframe mounting foot alignment or as a result of impact damage - Abnormally high friction in steering gear due to water ingress - Fouling/abnormally high friction within steering column components - Power steering system fault - Vehicle speed signal fault	 NOTES: - Do not damage the gaiter on steering gear removal. Failure to follow this instruction may result in warranty becoming invalid for steering gear assembly. - If the steering column is disconnected from the steering gear, do not allow the steering wheel to rotate, as this will damage the steering angle sensor module. - If the customer has reported notchy steering, turn the steering gear slowly across lock (with the ignition off) and check for any tight or high friction points in the steering travel - Disconnect the steering gear from the suspension. Check the suspension system for freedom of movement or abnormally high friction - Check the steering and suspension system for correct installation and for signs of impact damage. For additional information on the suspension system refer to section 204-00 Diagnosis and Testing. For steering gear damage inspection see below table - Remove the steering gear boots and check for evidence of water inside the steering gear boots. If evidence of water ingress is present, replace the steering gear - Disconnect the steering column from the steering gear. Check the steering column and universal joints for freedom of movement or abnormally high friction. For additional information on the steering column refer to section 211-04 Removal and Installation - Using the Jaguar Land Rover approved diagnostic equipment, check the power steering control module for related DTCs and refer to the relevant DTC index - Using the Jaguar Land Rover approved diagnostic equipment, check the anti-lock brake system control module for related DTCs and refer to the relevant DTC index
Steering catch-up (heavy at fast steering wheel rates)	- Power steering control module power or ground circuit open circuit, high resistance - Battery/charging system fault - Abnormally high friction in steering ball joints or suspension components	 NOTES: - The system is designed to give a heavier but stable steering feel when a low/high voltage or high temperature is detected. It is recommended to reduce harsh inputs to the steering in these scenarios, for example recently after start-up, extreme cold climate or high electrical system utilization/load. Depending on the level of reduction this could be accompanied by an alert. - If the steering column is disconnected from the steering gear, do not allow the steering wheel to rotate, as this will damage the steering angle sensor module.

SYMPTOM	POSSIBLE CAUSES	ACTION
	- Abnormally high friction in steering or suspension components due to poor subframe mounting foot alignment or as a result of impact damage - Abnormally high friction in steering gear due to water ingress - Power steering system fault	- Refer to the electrical circuit diagrams and check the power steering control module power and ground circuits for open circuit, high resistance - Refer to the relevant section of the workshop manual and test the battery and charging system - Disconnect the steering gear from the suspension. Check the suspension system for freedom of movement or abnormally high friction. For additional information on the suspension system refer to section 204-00 Diagnosis and Testing - Check the steering and suspension system for correct installation and for signs of impact damage. For additional information on the suspension system refer to section 204-00 Diagnosis and Testing - Check the steering gear for freedom of movement or abnormally high friction. Remove the steering gear boots and check for evidence of water inside the steering gear boots. If evidence of water ingress is present, replace the steering gear - Using the Jaguar Land Rover approved diagnostic equipment, check the power steering control module for related DTCs and refer to the relevant DTC index
Permanent loss of steering assistance with engine running, even after cycling ignition	- Power steering control module power or ground circuit open circuit, high resistance - Battery/charging system fault - High speed CAN bus (chassis) circuit short circuit to ground, short circuit to power, open circuit, high resistance - Power steering system fault	- Refer to the electrical circuit diagrams and check the power steering control module power and ground circuits for open circuit, high resistance - Refer to the relevant section of the workshop manual and test the battery and charging system - Using the Jaguar Land Rover approved diagnostic equipment, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus (chassis) circuit for short circuit to ground, short circuit to power, open circuit, high resistance - Using the Jaguar Land Rover approved diagnostic equipment, check the power steering control module for related DTCs and refer to the relevant DTC index
Intermittent reduction /loss of steering assistance (recovers during drive cycle or after ignition cycle)	- Power steering control module power or ground circuit open circuit, high resistance - Battery/charging system fault - Power steering control module internal temperature above threshold - Power steering system fault	 NOTE: The system is designed to give a heavier but stable steering feel when a low/high voltage or high temperature is detected. It is recommended to reduce harsh inputs to the steering in these scenarios, for example recently after start-up, extreme cold climate or high electrical system utilization/load. Depending on the level of reduction this could be accompanied by an alert. - Refer to the electrical circuit diagrams and check the power steering control module power and ground circuits for open circuit, high resistance - Refer to the relevant section of the workshop manual and test the battery and charging system - Check for heat shield damage or mud packing around steering gear and power steering control module. Allow the power steering control module to cool. Consider the environmental temperature - Using the Jaguar Land Rover approved diagnostic equipment, check the power steering control module for related DTCs and refer to the relevant DTC index

SYMPTOM	POSSIBLE CAUSES	ACTION
Excessive free play at steering wheel (when no assistance and very light torque is applied to the steering wheel)	- Steering wheel fixing loose - Steering column fixing(s) loose - Steering gear fixing(s) loose - Steering linkage toe adjust locknut(s) loose - Steering linkage outer ball joint to knuckle fixing(s) loose - Steering column pinch bolt loose - Steering column universal joint(s) excessively worn - Steering gear excessively worn	 NOTES: - Check for play in steering gear. Do not attempt to adjust the steering gear. Failure to follow this instruction will result in warranty becoming invalid. Refer to any relevant special service messages for checking procedures. - If the steering column is disconnected from the steering gear, do not allow the steering wheel to rotate, as this will damage the steering angle sensor module. - Check the steering wheel fixing torque - Check the steering column fixings torques - Check the steering gear fixings torques - Check the steering linkage toe adjust locknut(s) torques - Check the steering linkage outer ball joint to knuckle fixing(s) torques - Check the steering column pinch bolt torque - Check the steering column universal joints for excessive free play - Check the steering gear for freedom of movement or abnormally high friction. Remove the steering gear boots and check for evidence of water inside the steering gear boots. If evidence of water ingress is present, replace the steering gear
Vehicle pull to one side without brake applied	- Damage to wheel, tires, suspension or steering components - Suspension or steering system components are loose - Wheel and tire assemblies are non-factory specification - Uneven/irregular tire wear - Brake binding - Steering angle sensor fault - Abnormally high friction or excessive wear in the steering or suspension components - Wheel alignment is incorrect	 NOTE: If the steering column is disconnected from the steering gear, do not allow the steering wheel to rotate, as this will damage the steering angle sensor module. GO to Pinpoint Test A.
Steering wheel misalignment	- Damage to wheel, tires, suspension or steering components - Suspension or steering system components are loose	 NOTE: If the steering column is disconnected from the steering gear, do not allow the steering wheel to rotate, as this will damage the steering angle sensor module. GO to Pinpoint Test A.

SYMPTOM	POSSIBLE CAUSES	ACTION
	- Wheel and tire assemblies are non-factory specification - Uneven/irregular tire wear - Brake binding - Steering angle sensor fault - Abnormally high friction or excessive wear in the steering or suspension components - Wheel alignment is incorrect	
Vehicle drift	- Damage to wheel, tires, suspension or steering components - Suspension or steering system components are loose - Wheel and tire assemblies are non-factory specification - Uneven/irregular tire wear - Brake binding - Steering angle sensor fault - Abnormally high friction or excessive wear in the steering or suspension components - Wheel alignment is incorrect	 NOTE: If the steering column is disconnected from the steering gear, do not allow the steering wheel to rotate, as this will damage the steering angle sensor module. GO to Pinpoint Test A.
Poor feel, steering light, not connected, requires constant correction	- Wheel/tire size incorrect - Uneven/irregular tire wear - Damaged or worn front /rear suspension components - Steering angle sensor fault - Abnormally high friction in steering ball joints or suspension components	 NOTE: If the steering column is disconnected from the steering gear, do not allow the steering wheel to rotate, as this will damage the steering angle sensor module. - Check that the wheels and tires comply with the manufacturer's specification for the vehicle - Check the tires for uneven or irregular wear - Check the front and rear suspension for damage or wear - Using the Jaguar Land Rover approved diagnostic equipment, check the steering angle sensor module for related DTCs and refer to the relevant DTC index

SYMPTOM	POSSIBLE CAUSES	ACTION
	- Excessive wear or abnormally high friction in steering gear due to water ingress - Wheel alignment incorrect - Power steering system fault	- Check the steering gear for freedom of movement or abnormally high friction. Remove the steering gear boots and check for evidence of water inside the steering gear boots. If evidence of water ingress is present, replace the steering gear - Check the suspension system for freedom of movement or abnormally high friction. Disconnect the steering column from the steering gear. Check the steering column and universal joints for freedom. Check the steering gear for freedom of movement - Check and adjust wheel alignment as necessary - Using the Jaguar Land Rover approved diagnostic equipment, check the power steering control module for related DTCs and refer to the relevant DTC index
Steering assistance no longer changes when terrain mode changed	- Terrain response system fault - Body system fault - Car configuration file mismatch with vehicle specification	 NOTE: After updating the car configuration file, set the ignition to on and wait 30 seconds before clearing the DTCs. - Using the Jaguar Land Rover approved diagnostic equipment, check the terrain response switchpack for related DTCs and refer to the relevant DTC index - Using the Jaguar Land Rover approved diagnostic equipment, check the central junction box for related DTCs and refer to the relevant DTC index - Using the Jaguar Land Rover approved diagnostic equipment, check and update the car configuration file as necessary. Clear the DTCs and retest
Park assist function is not working	- Tire pressure(s) incorrect - Wheel/tire size incorrect - Damaged or worn front /rear suspension components - Wheel alignment incorrect - Fouling/abnormally high friction within steering wheel /steering column components - Parking aid system fault - Body system fault - Power steering system fault - Steering angle sensor fault - Anti-lock brake system fault - Transmission system fault	 NOTES: - After updating the car configuration file, set the ignition to on and wait 30 seconds before clearing the DTCs. - If the steering column is disconnected from the steering gear, do not allow the steering wheel to rotate, as this will damage the steering angle sensor module. - Check and adjust the tire pressures as necessary - Check that the wheels and tires comply with the manufacturer's specification for the vehicle - Check the front and rear suspension for damage or wear - Check and adjust wheel alignment as necessary - Disconnect the steering column from the steering gear. Check the steering wheel/steering column and universal joints for freedom of movement or abnormally high friction - Using the Jaguar Land Rover approved diagnostic equipment, check the parking assist control module for related DTCs and refer to the relevant DTC index - Using the Jaguar Land Rover approved diagnostic equipment, check the central junction box for related DTCs and refer to the relevant DTC index - Using the Jaguar Land Rover approved diagnostic equipment, check the power steering control module for related DTCs and refer to the relevant DTC index

SYMPTOM	POSSIBLE CAUSES	ACTION
	Car configuration file mismatch with vehicle specification	- Using the Jaguar Land Rover approved diagnostic equipment, check the steering angle sensor module for related DTCs and refer to the relevant DTC index - Using the Jaguar Land Rover approved diagnostic equipment, check the anti-lock brake system control module for related DTCs and refer to the relevant DTC index - Using the Jaguar Land Rover approved diagnostic equipment, check the transmission control module for related DTCs and refer to the relevant DTC index - Using the Jaguar Land Rover approved diagnostic equipment, check and update the car configuration file as necessary. Clear the DTCs and retest
Shimmy through steering wheel without brake applied	- Tire damage - Uneven/irregular tire wear - Wheel imbalance - Driveshaft out of balance (normally accompanied by more severe body shake and less steering wheel feedback compared to a shimmy) - Damaged or worn front /rear suspension components	 NOTE: Shimmy: Defined as a lower frequency feedback/oscillation through the steering, which changes with vehicle speed. A good example of this is when the wheels are out of balance at around 65-85 kph - Check the tires for damage - Check the tires for flatspots and uneven or irregular wear - Check the wheels for imbalance - Check the driveshafts - Check the front and rear suspension for damage or wear
Harsh, high frequency vibration through steering wheel	- Tire pressure(s) incorrect - Wheel/tire size incorrect - Power steering system fault	- Check and adjust the tire pressures as necessary - Check that the wheels and tires comply with the manufacturer's specification for the vehicle - Using the Jaguar Land Rover approved diagnostic equipment, check the power steering control module for related DTCs and refer to the relevant DTC index
Vehicle turns hard into end lock / lock stops	- Steering angle sensor fault - New steering components installed and calibration routine not performed - Uneven toe setting (tire contact with suspension or body components)	- Using the Jaguar Land Rover approved diagnostic equipment, check the steering angle sensor module for related DTCs and refer to the relevant DTC index - Using the Jaguar Land Rover approved diagnostic equipment, perform routine - Power Steering Soft Lock End Stops Reset Routine - Check and adjust wheel alignment as necessary
Knocking through steering wheel when pulling away and/or braking with no warning light	- Steering gear fixing(s) loose - Steering column pinch bolt loose	 NOTES: In the case steering gear bolts are loose, often a creaking is heard when steering near the lock stops position.

SYMPTOM	POSSIBLE CAUSES	ACTION
	- Excessive wear in steering system - Steering wheel /steering column components fixings loose - Damaged or worn front /rear suspension components	- If the steering column is disconnected from the steering gear, do not allow the steering wheel to rotate, as this will damage the steering angle sensor module. - Check the steering gear fixings torques - Check the steering column pinch bolt torque - Check steering column components for excessive wear and rectify as necessary - Check the steering wheel/steering column fixings torques - Check the front and rear suspension for damage or wear
Scraping from inside of vehicle when turning the steering wheel	- Steering column fouling components - Clockspring mechanism fouling - Uneven toe setting (tire contact with suspension or body components)	- Check the steering column for fouling on cowls, carpets, or harnesses - Check the clockspring mechanism for security - Check and adjust wheel alignment as necessary
Excessive noise (refer to further applicable special service message information) with no warning light, instability, graunch	- Tire pressure(s) incorrect - Wheel/tire size incorrect - Damaged or worn front /rear suspension components - Foul condition - Water ingress to the steering gear - Clockspring internal failure	 NOTE: If the steering column is disconnected from the steering gear, do not allow the steering wheel to rotate, as this will damage the steering angle sensor module. - Check and adjust the tire pressures as necessary - Check that the wheels and tires comply with the manufacturer's specification for the vehicle - Check the front and rear suspension for damage or wear - Check for a foul condition between the steering column and the body. Check for a foul condition between the steering gear and the body - Check the steering gear for freedom of movement or abnormally high friction. Remove the steering gear boots and check for evidence of water inside the steering gear boots. If evidence of water ingress is present, replace the steering gear - Install a new clockspring
Excessive noise (refer to further applicable special service message information) with amber warning light, instability, graunch	- Tire pressure(s) incorrect - Wheel/tire size incorrect - Damaged or worn front /rear suspension components - Foul condition - Water ingress to the steering gear	 NOTE: If the steering column is disconnected from the steering gear, do not allow the steering wheel to rotate, as this will damage the steering angle sensor module. - Check and adjust the tire pressures as necessary - Check that the wheels and tires comply with the manufacturer's specification for the vehicle - Check the front and rear suspension for damage or wear

SYMPTOM	POSSIBLE CAUSES	ACTION
	■ Clockspring internal failure ■ Transmission system fault ■ Power steering control module is not configured correctly ■ Abnormally high friction in steering or suspension components due to poor subframe mounting foot alignment or as a result of impact damage	■ Check for a foul condition between the steering column and the body. Check for a foul condition between the steering gear and the body ■ Check the steering gear for freedom of movement or abnormally high friction. Remove the steering gear boots and check for evidence of water inside the steering gear boots. If evidence of water ingress is present, replace the steering gear ■ Install a new clockspring ■ Using the Jaguar Land Rover approved diagnostic equipment, check the transmission control module for related DTCs and refer to the relevant DTC index ■ Using the Jaguar Land Rover approved diagnostic equipment, re-configure the power steering control module with the latest level software ■ Check the steering and suspension system for correct installation and for signs of impact damage
Excessive noise (refer to further applicable special service message information), zipper, whoop, rattle	■ Foul condition ■ Power steering control module power or ground circuit open circuit, high resistance ■ Battery/charging system fault ■ Steering gear wear excessive ■ Abnormally high friction in steering or suspension components due to poor subframe mounting foot alignment or as a result of impact damage ■ Uneven toe setting (tire contact with suspension or body components)	■ Check for a foul condition between the steering column and the body. Check for a foul condition between the steering gear and the body ■ Refer to the electrical circuit diagrams and check the power steering control module power and ground circuits for open circuit, high resistance ■ Refer to the relevant section of the workshop manual and test the battery and charging system ■ Install a new steering gear ■ Check the steering and suspension system for correct installation and for signs of impact damage ■ Check and adjust wheel alignment as necessary

ELECTRIC POWER STEERING GEAR INSPECTION - WITH HEAVY/NOTCHY STEERING GEAR



NOTE:

Some variation in the illustrations may occur, but the essential information is always correct.

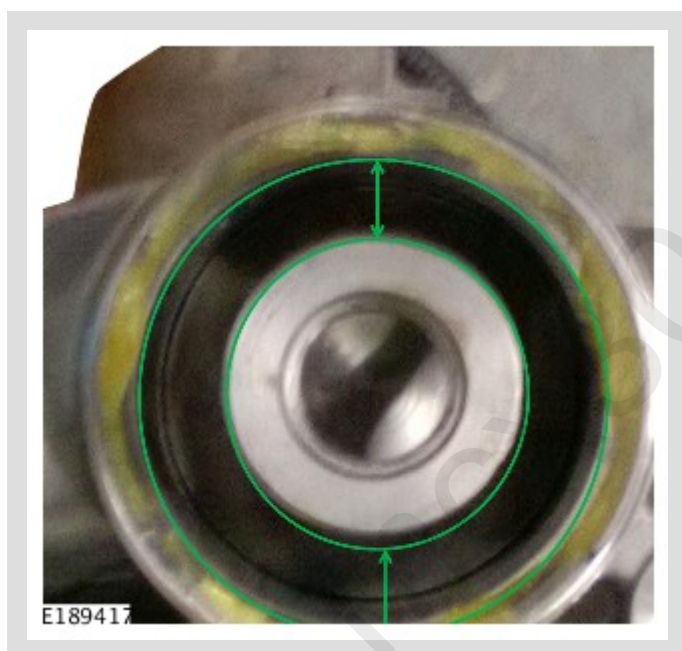
Electric Power Steering Gear Damage Assessment Checklist

1. Log Vehicle Identification Number (VIN)

2. Confirm noise, is it repeatable on the vehicle?
3. Has vehicle previously had accident damage repairs?
4. Are there any signs of impact damage to the wheels/tires?
5. Is the steering free to turn lock to lock on a wheel free ramp?
6. Is front steering alignment correct?
7. Does the noise occur on all surfaces?
8. Does the noise occur in all temperatures?

ELECTRIC POWER STEERING GEAR ACCIDENT DAMAGE CHECK

The example below shows a good steering gear in central position.



Bent Steering Gear

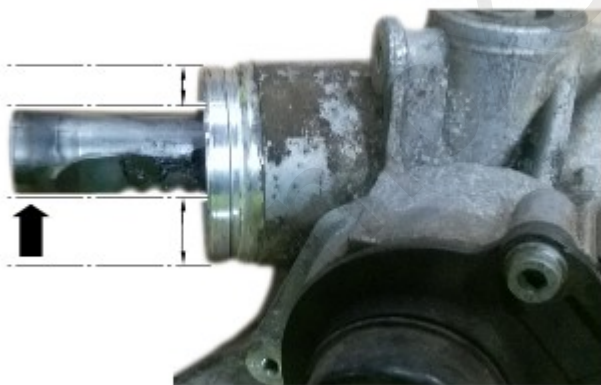
Below are some examples of damage that would not be accepted under the terms of the Jaguar Land Rover warranty agreement. Please note: these are examples only and do not represent all warrantable/non warrantable customer concerns.

Check the differences between the distances at point A and B. Check if the rack is central and not rubbing on the end stop damper.



The rack clearly shows that it is not centralized meaning it is a bent steering gear issue.

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The rack is not centralized to the gear housing meaning it is a bent steering gear issue.

Sign of Recent Repair

Check if the tie rod ends were recently changed. Visually inspect if the conditions of the boot are the same (dirty or clean).

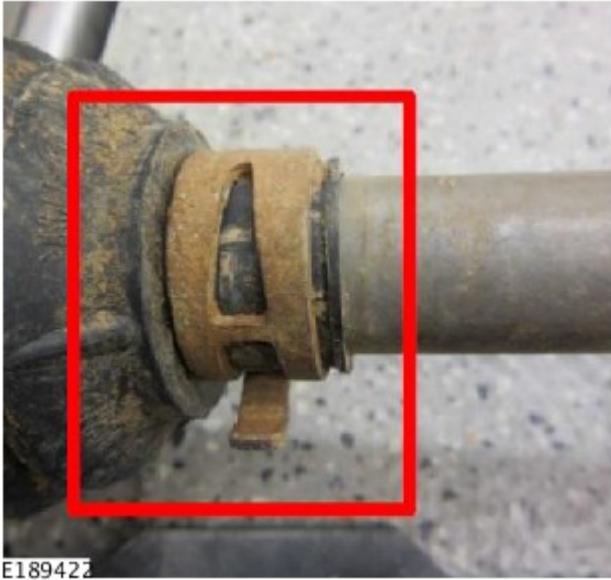


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See the difference between the boots highlighted in yellow and in red. This will tell you if a tie rod has been replaced before in which case you can assume accident damage.

Water/Debris Damage

Check if boot clips are in position and they were not recently disturbed or moved. Check if clips are the correct type.





Check for damages and pin holes on the boots.



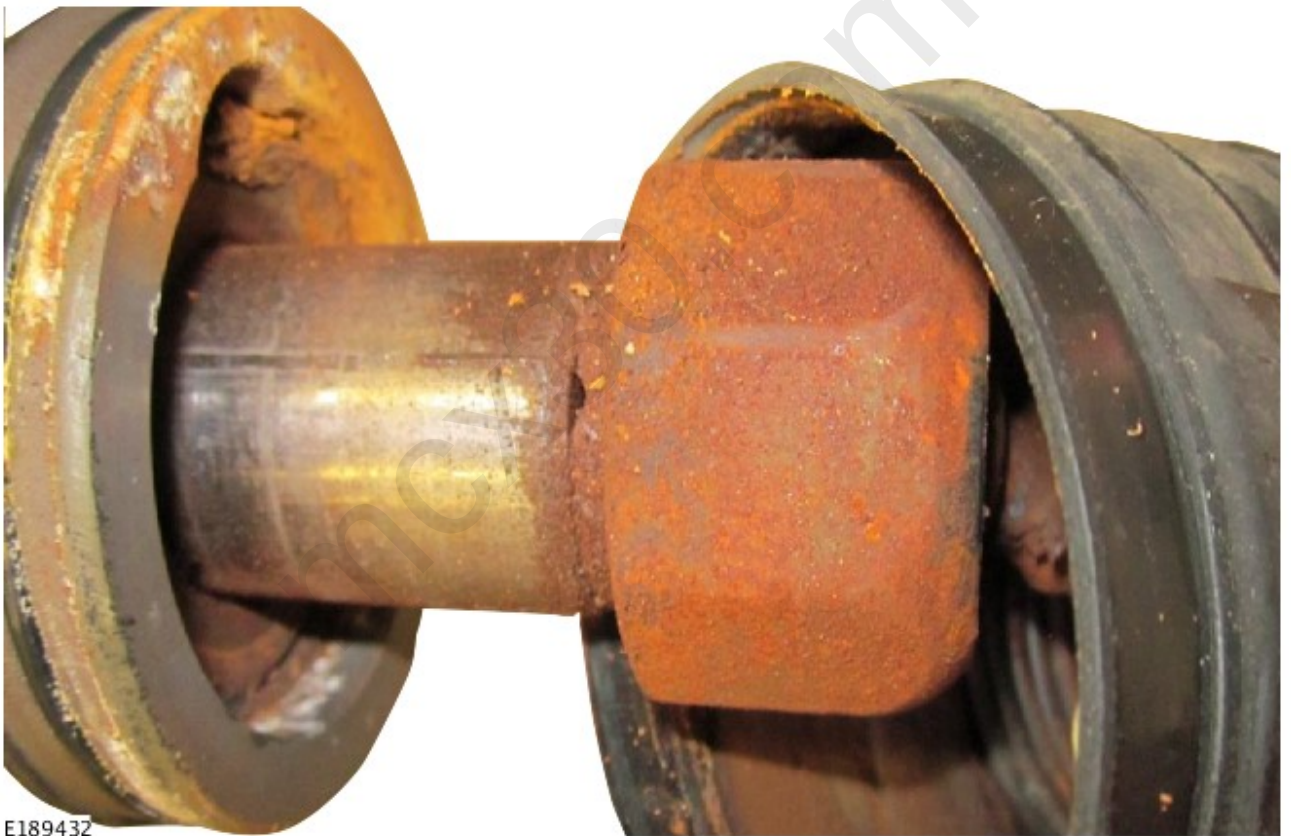
Check for split boots. Check for repair marks on tie rods.



Is there evidence of water/debris into steering gear.



E189431



E189432

Check for Rust, condensation, and water deposits.



E189433



E189434



ECU Damages

Check for cracks on PSCM housing.

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Check for scratches and damages on PSCM connectors and the steering gear.



E189438



E189439

Damage to Connector, Seals or Wiring

Is there evidence of damage to connector clips.

Check for removed/damaged connectors.



Check for Harness damage between ECU and Torque sensor.



Impact Damage to Motor/Gear Housing

Check for evidence of impact on the motor/gear housing.



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Check the alignment of the bolt between the housing and the motor and external damages on the motor housing that can alter belt tension.



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Damage of Seat Material

Is there evidence of damage to seat material?



Damage to Tie Rod

Is there evidence of tie rod bending?

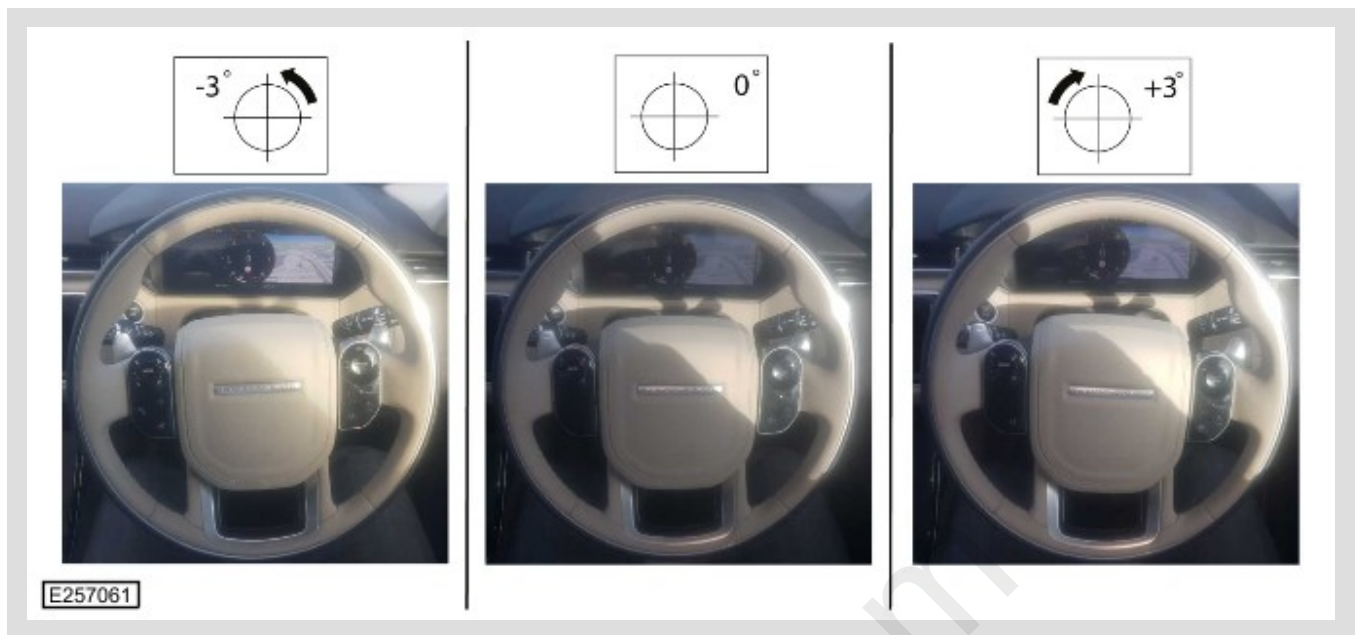


If there is heavy steering and bent tie rod there is a clear indication that the vehicle was subjected to heavy impacts.

Damage to Ball Joint

Is there evidence of damage to ball joints?

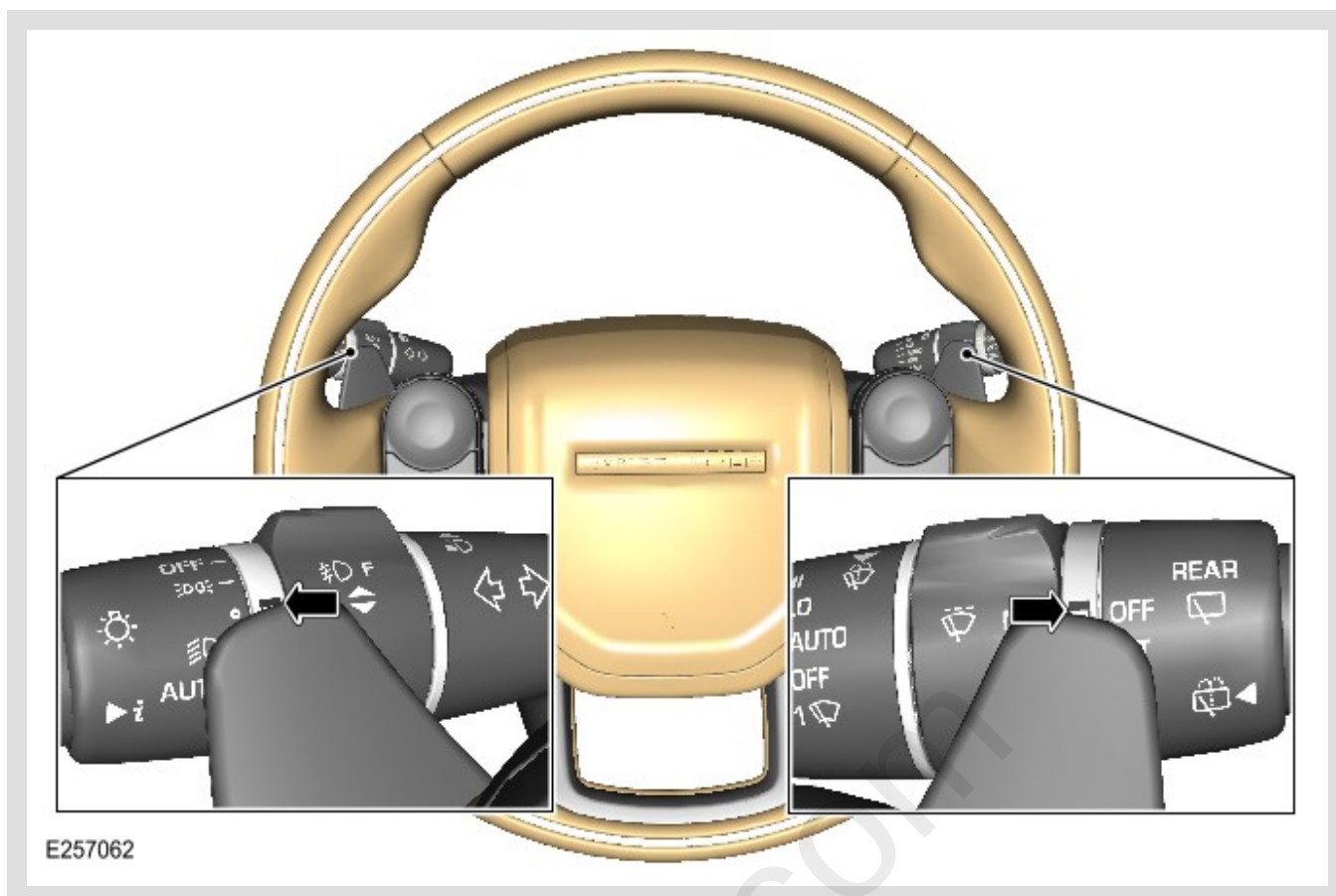




Vehicles with steering wheel angles within ± 3 degrees to the horizontal as shown in illustration E257061 should not be adjusted as they meet Jaguar Land Rover specifications.

 NOTE:

Dependent on specification the relationship between the steering wheel control switches / paddle shifts / steering wheel upper spoke profile and the column wiper / indicator stalks should be used for this assessment.



Road Test - Route Design and Consistency

Steering and wheel alignment is dependant on a consistent and repeatable methodology; this is equally important when road testing the vehicle. The same test route must be used every time a road test is completed, using a consistent method for determining if an actual problem exists.

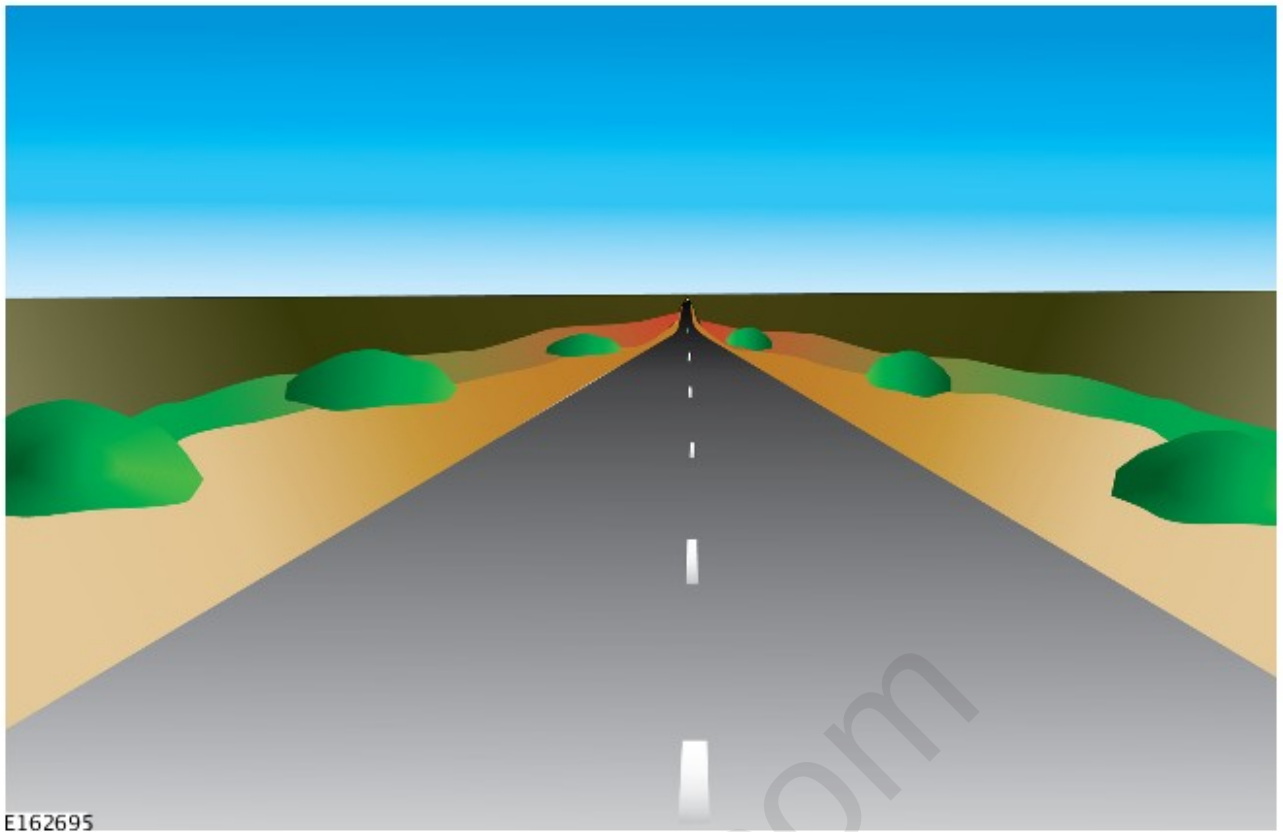
NOTE:

When a suitable route has been designed, make sure anyone that is likely to be road testing for steering /wheel alignment issues is aware of the approved test route.

Suitable Roads for Test Route

When road testing for a potential steering and wheel alignment issues, use the same road every time. A suitable test route should have the following features:

- Roads with little or no camber for the length of the test section.
- Roads which are straight and allow upwards of 40mph (64km/h) speeds.
- Roads which are flat and level.
- Roads with smooth surfaces.
- Roads which are free from excessive traffic.

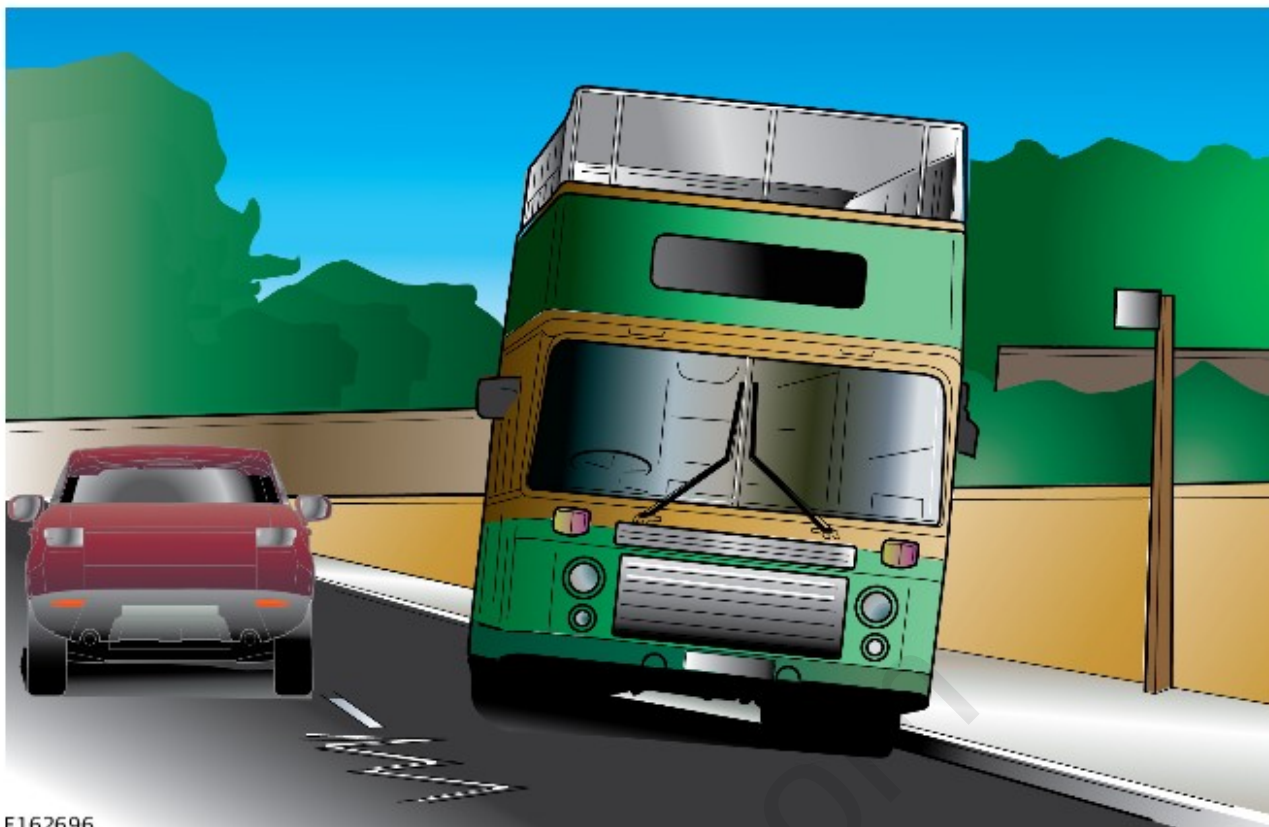


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Unsuitable Roads for Test Route

Avoid roads with the following features:

- Heavily cambered roads.
- Roads with bends or deviations.
- Roads with inclines or declines.
- Roads with poor surfaces.
- Roads which are crowded.



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PINPOINT TEST

NOTE:

Pinpoint Test A will guide the retailer through correctly diagnosing and rectifying steering wheel misalignment, vehicle pulling and vehicle drifting, when driving in a straight line without the brake applied. The pinpoint test should be completed until the customer symptom is rectified.

PINPOINT TEST A : STEERING WHEEL MISALIGNED / VEHICLE PULL / DRIFT

A1: VISUAL INSPECTION OF THE TIRES

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	NOTE: There is no warranty claim if the wheels and tires are non-factory specification 1 Visually inspect the tires for any obvious issues with damage, tire tread depth and tire pressure
	Were there any issues found with the vehicles tires? Yes Rectify the issue that was found before continuing to Pinpoint Test A2 No GO to A2.

A2: DYNAMIC ASSESSMENT WITH THE CUSTOMER	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	1 A dynamic assessment must be completed on a similar road type to the road surface the customer was driving on when the customer symptom occurred. The assessment should be done with the customer in the vehicle if possible.
	2 Avoid heavily cambered roads, roads with bends or deviations, roads with steep inclines/declines, roads with poor surfaces, roads which are crowded and with heavy traffic
	3 When testing for symptoms on the ideal road surface, maintain the same speed and stay in the same gear. Use the Cruise Control feature if it is equipped to the vehicle
	4 Make sure that the customer symptom is not a result of the Lane Keep Assist feature (if the feature is equipped to the vehicle)
	Is the issue due to the Lane Keep Assist feature? Yes Advise the customer that no error states or fault exists with their vehicle and educate the customer on the features of their vehicle No Were you able to recreate the customer's symptom? Yes GO to A3. No Where unable to recreate the issue, please be aware that vehicles will naturally follow the camber of the road. Heavily cambered roads will naturally induce a drift/pull towards the edge of the road. At this point the customer should be advised that no error states or fault exists with their vehicle and offer the customer an accompanied drive if this wasn't done initially
A3: STATIC CHECKS	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	 NOTES: ■ If any required changes are found through static assessment, follow relevant Service Repair Operations to rectify found issues ■ Static assessment does not include wheel alignment 1 Static checks include ■ Check the tire tread depth ■ Check the tire pressures ■ Visual check for damage to the suspension components ■ Visual check for damage to the wheels and the tires ■ Check the brake system for brake binding ■ Check the steering system for high friction ■ Using the Jaguar Land Rover approved diagnostic equipment, check the Steering Angle Sensor Module (SASM) for DTC's
	2 Required tools: ■ Tire pressure gauge ■ Tire depth gauge

A3: STATIC CHECKS	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	■ Jaguar Land Rover approved diagnostic equipment
	Based on the static checks of the vehicle, is there any evidence of damage to wheels, tires, suspension or steering components? Yes Stop the bulletin and rectify the damage No Do the tire tread depth indicators show evidence of excessive tire wear? Yes Replace the tires (refer to Warranty Compliance and Procedures). Verify through driving assessment if the issue has been rectified. No Are any of the tire pressures low? Yes Inflate the tires as per the specification. Verify through driving assessment if the issue has been rectified No Is there any evidence of brake binding on one wheel? Yes Go to the Brake System diagnosis and testing pinpoint tests to rectify the problem No Were any Steering Angle Sensor Module (SASM) related DTC's present? Yes Refer to the relevant DTC index and rectify as applicable No Is there any evidence of heavy or notchy steering? Yes Go to Steering System diagnosis and testing symptom chart No GO to A4.
A4: THE WHEEL ALIGNMENT PROCESS	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	 NOTES: ■ Make sure that the air suspension is locked into tight tolerance (if the vehicle is equipped with air suspension⁹). Follow the instructions from TOPIx to enable this function ■ The wheel alignment process must be completed using the Jaguar Land Rover approved wheel alignment equipment. The equipment must be calibrated ■ The runout compensation must be completed as part of the process ■ The operators must be trained to use wheel alignment equipment 1 Complete the wheel alignment process followed by a further driving assessment
	Did this rectify the problem? Yes No further action No GO to A5.

A5: TIRE SWAP FRONT AXLE SIDE TO SIDE	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	 NOTE: If the tires are directional DO NOT swap the assemblies side to side on one axle Tire swap is applicable where steering wheel misalignment and/or steering pull is still evident after the wheel alignment process 1 Road test the vehicle to allow the power steering control module pull drift compensation to re-learn the new steering alignment set up
	2 If the vehicle is still experiencing issues after the wheel alignment process, the front axle wheel and tire assemblies should be swapped side to side
	Did this rectify the problem? Yes No further action required No GO to A6.
A6: TIRE SWAP REAR AXLE SIDE TO SIDE	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	 NOTES: - If the tires are directional DO NOT swap the assemblies side to side on one axle - Tire swap is applicable where steering wheel misalignment and/or steering pull is still evident after the wheel alignment process 1 If the vehicle is still experiencing issues after the wheel alignment process, the rear axle wheel and tire assemblies should be swapped side to side
	Did this rectify the problem? Yes No further action required No GO to A7.
A7: TIRE SWAP REAR AXLE TO FRONT AXLE	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	 NOTES: - If the tires are differential. For example, wider at the back. DO NOT swap tires front to back - Tire swap is applicable where steering wheel misalignment and/or steering pull is still evident after the wheel alignment process 1 If the vehicle is still experiencing issues after the wheel alignment process, the rear axle wheel and tire assemblies should be swapped side with the front axle tires
	Did this rectify the problem? Yes No further action required No GO to A8.

A8: TIRE SWAP FRONT AXLE SIDE TO SIDE	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	 NOTE: If the tires are directional DO NOT swap the assemblies side to side on one axle Tire swap is applicable where steering wheel misalignment and/or steering pull is still evident after the wheel alignment process 1 If the vehicle is still experiencing issues after the wheel alignment process, the front axle wheel and tire assemblies should be swapped side to side
	Did this rectify the problem? Yes No further action required No GO to A9.
A9: TIRE SWAP REAR AXLE SIDE TO SIDE	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
	 NOTES: - If the tires are directional DO NOT swap the assemblies side to side on one axle - Tire swap is applicable where steering wheel misalignment and/or steering pull is still evident after the wheel alignment process 1 If the vehicle is still experiencing issues after the wheel alignment process, the rear axle wheel and tire assemblies should be swapped side to side
	Did this rectify the problem? Yes No further action required No If the tire swap did not rectify the issue, contact Technical Assistance function of the GCM (Global Concern Management).

DTC INDEX

For a list of Diagnostic Trouble Code(s) that could be set on this vehicle, please refer to Section 100-00. REFER to: [Diagnostic Trouble Code Index - DTC: Steering Angle Sensor Module \(SASM\)](#) (100-00 General Information, Description and Operation). and REFER to: [Diagnostic Trouble Code Index - DTC: Power Steering Control Module \(PSCM\)](#) (100-00 General Information, Description and Operation).