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2018.0 RANGE ROVER (LG), 205-00

DRIVELINE SYSTEM - GENERAL INFORMATION

# DRIVELINE SYSTEM (G1851647)

## DIAGNOSIS AND TESTING

### PRINCIPLE OF OPERATION

For a detailed description of the driveline system and operation, refer to the relevant description and operation section in the workshop manual. REFER to: [Specifications](#) (205-01 Driveshaft, Specifications) / [Rear Drive Axle and Differential](#) (205-02 Rear Drive Axle/Differential, Description and Operation) / [Front Drive Axle and Differential](#) (205-03 Front Drive Axle/Differential, Description and Operation) / [Specifications](#) (205-04 Front Drive Halfshafts, Specifications) / [Specifications](#) (205-05 Rear Drive Halfshafts, Specifications).

### 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

#### NOTE:

Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests

1. Verify the customer concern
  - If a road test is necessary make sure the vehicle is safe to do so
2. Visually inspect for obvious signs of mechanical damage

#### Visual Inspection

MECHANICAL

ELECTRICAL

| MECHANICAL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | ELECTRICAL                                                                                                                                                                                                                                                                                                                      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>■ Wheel rim and tire damage or runout</li> <li>■ Check all the driveshafts and halfshafts for damage including dents, cracks and excessive runout</li> <li>■ Check all the constant velocity joint gaiters for splits, damage and security</li> <li>■ Check all the driveshafts and halfshafts for correct alignment</li> <li>■ Check the driveshaft mounting bolts security</li> <li>■ Check all the driveshaft and halfshaft joints for excessive movement</li> <li>■ Check the rear driveshaft centre support bearing for security, damage and excessive wear</li> <li>■ Check the front and rear differential mounting bolts and bushes for wear, damage and security</li> <li>■ Check the front and rear differentials for oil leaks</li> </ul> | <ul style="list-style-type: none"> <li>■ Power supply</li> <li>■ Fuses/relays</li> <li>■ Damaged, loose or corroded connector(s)</li> <li>■ Damage to wiring loom/incorrect location, stretched or taught</li> <li>■ Rear differential control module</li> <li>■ Controller area network circuits</li> <li>■ Sensors</li> </ul> |

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 and refer to the symptom chart, alternatively check for Diagnostic Trouble Code(s) (DTC)s and refer to the DTC index

## DIAGNOSTICS FOR DRIVELINE NOISE AND VIBRATION



### NOTE:

If vibration is felt through the steering wheel, then the diagnostics detailed below are not applicable. Vibration felt through the steering should be investigated and rectified separately.

In the case of noise and/or vibration from the driveline system, follow the remedial steps set out below:

**1. Check for Metallic Debris Within The Differential Units:** Remove the differential (front and rear) drain plugs REFER to: Differential Draining and Filling (205-02 Rear Drive Axle/Differential, General Procedures) / Differential Draining and Filling (205-03 Front Drive Axle/Differential, General Procedures). and check for evidence of metallic debris. While it is normal to see smooth graphite or fine grained deposits (see left and centre illustrations below), if there is evidence of sharp spikes or shards of metallic debris on the drain plug (see right illustration below), then this indicates an internal failure of the differential unit. Inspect the condition of the differential oil REFER to: Driveline Oil Color Charts (205-00, Diagnosis and Testing). If there is evidence of sharp spikes or shards of metallic debris on the drain plug, then replace the drain plug as found and replace the differential unit as required. If there is no evidence of metallic debris on the drain plug, discard the old plug, fit a new drain plug and proceed to the next step.



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2. Double flush the oil in the transfer case and rear differential. Using the Jaguar Land Rover approved diagnostic equipment, check and update the transfer case control module software and rear differential control module software to the latest level and recalibrate the rear clutch

1. Drain and refill the rear differential. REFER to: Differential Draining and Filling (205-02 Rear Drive Axle /Differential, General Procedures)
2. Drain and refill the transfer case. REFER to: Transfer Case Draining And Filling (308-07c Transfer Case - Vehicles With: Twin Speed Transfer Case)
3. Perform a drive cycle to allow oil to circulate around the rear differential and transfer case
4. Repeat the drain and refill of the rear differential. REFER to: Differential Draining and Filling (205-02 Rear Drive Axle/Differential, General Procedures)
5. Repeat the drain and refill of the transfer case. REFER to: Transfer Case Draining And Filling (308-07c Transfer Case - Vehicles With: Twin Speed Transfer Case)
6. Using the Jaguar Land Rover approved diagnostic equipment, update Rear Differential Control Module (RDCM) and Transfer Case Control Module (TCCM) to the latest level software/calibration

7.



**NOTE:**

Additional datalogger information on clutch life can be read using the Jaguar Land Rover approved diagnostic equipment: With the engine running select - ECU Diagnostics/Rear Differential Control Module [RDCM] / Live data / "Operational Zero Position (OPZ) [D903]" - Include the value reported by the datalogger signal with the warranty return.

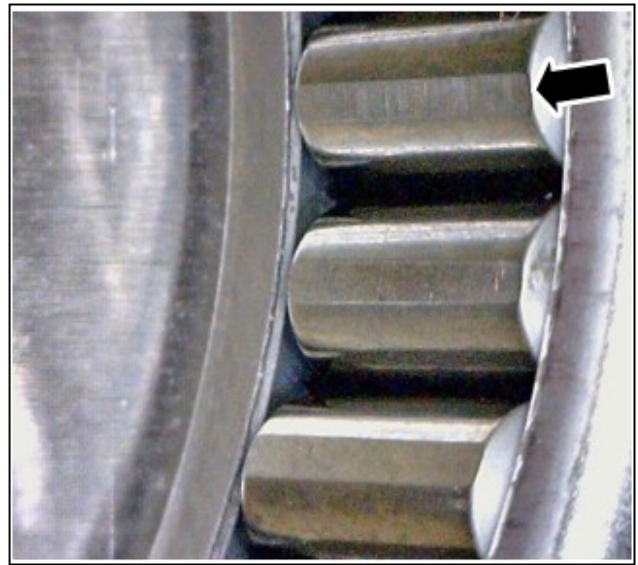
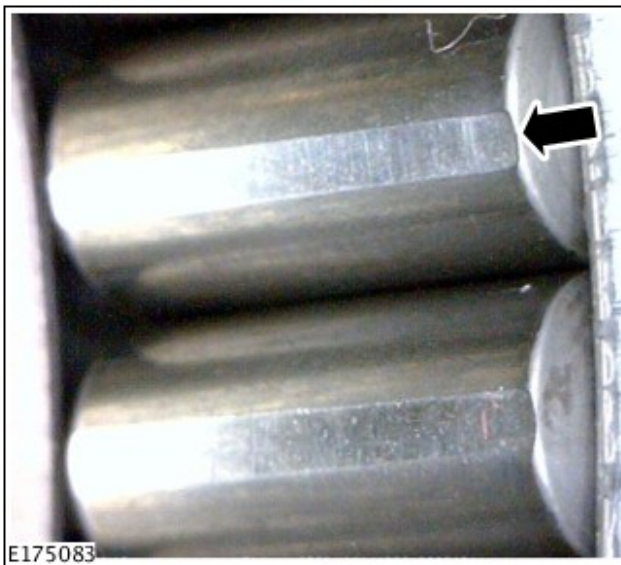
Calibrate the RDCM by performing routine - On Demand Self Test within pathfinder

8. Calibrate the TCCM by performing routine - Automatic Clutch Calibration Application
9. Perform a further drive cycle to confirm the customer issue is resolved

3. In the case of either noise and/or vibration, loosen off all differential and associated driveshaft fixings. Resettle the differential units and then re-tighten the fixings in a diagonal pattern for both differential units and the

associated driveshafts. When all the fixings are secured to the correct torque, road test the vehicle and check for any indications of driveline noise or vibration. If noise and/or vibration is still evident, proceed to the next step.

4. Note the position of the front driveshaft prior to removal. Remove the driveshaft. When removed, check the axle tube needle roller bearings for signs of damage. If the needle roller bearings are damaged, as indicated by a flattening of the surface of the roller bearings (see illustration below), then both the driveshaft and axle tube should be replaced. If the needle roller bearings are undamaged, the driveshaft should be rotated by 180 degrees (relative to its original installation) and re-fitted. Road test the vehicle and check for any indications of driveline noise or vibration. If noise and/or vibration is still evident, proceed to the next step.



5. Install a stiffener bracket and associated fixings to the front differential unit/axle tube assembly (note: this component is a production part fitted as standard to L494 14MY vehicles with V8 5.0L S/C PETROL engines). Road test the vehicle and check for any indications of driveline noise or vibration. If noise and/or vibration is still evident, proceed to the next step.

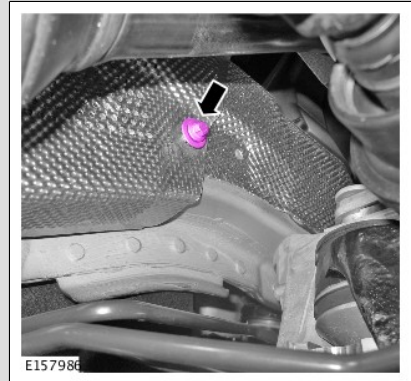
 **NOTE:**

The diagnostic procedures below are ONLY relevant to the following Vehicle Identification Number (VIN)-ranges: L405 VIN EA171765 or earlier/L494 VIN EA371202 or earlier.

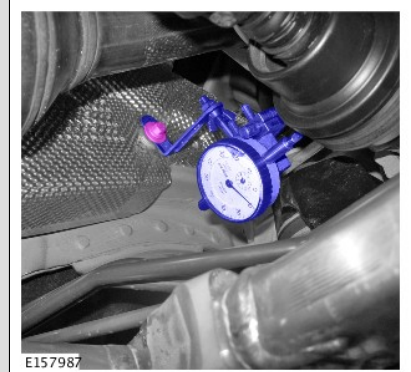
**6. Instructions For Front Driveshaft:**

1. Remove the engine undershield (see TOPIx Workshop Manual section 501-02)

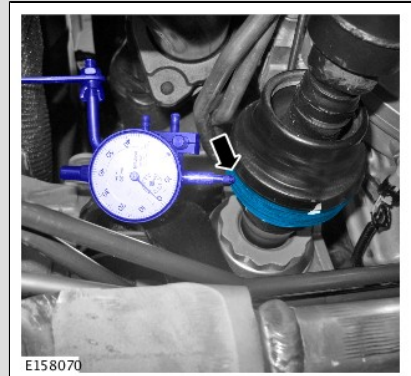
2. Remove heat shield retaining bolt



3. Install the mounting bracket and dial test indicator (DTI)



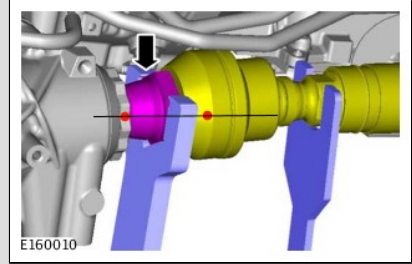
4. Position dial gauge pointer so that it is touching the surface of the inner driveshaft coupling



5. Hold one of the front wheels in position and rotate the other to measure the total indicator reading (TIR) of the joint head. Record the TIR value

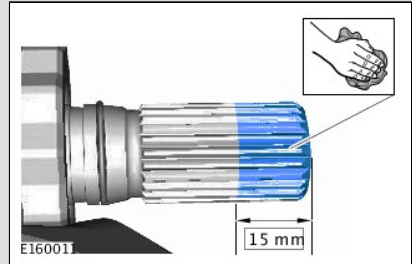


6. Mark the driveshaft joint head relative to the axle for installation purposes

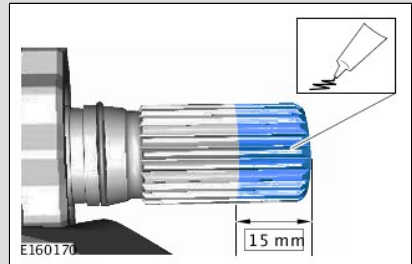


7. Remove the front driveshaft (see TOPIx, workshop Manual, section 205-01)

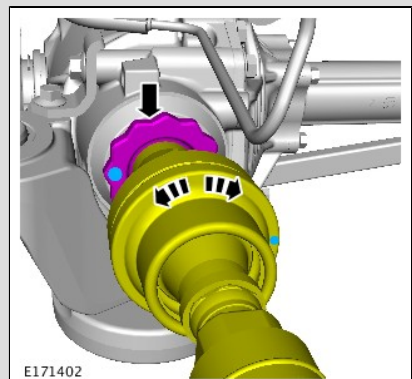
8. Clean 15mm of spline at the end of the axle pinion



9. Apply 648 Loctite to a length of 15mm at the end of the axle pinion



10. Install the driveshaft with the ID marks 180 degrees opposed. Tighten driveshaft nut by hand



**NOTE:**

The joint may require adjustment by tapping it lightly with a copper hammer to centralise and to bring TIR within specification

11. Repeat Step 5 until TIR is as close to zero as possible (must be less than 0.15mm TIR)

12. Leave for 45 minutes for allow Loctite to cure

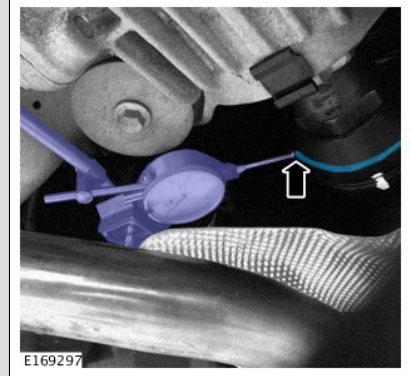
13. Tighten driveshaft nut following procedure shown in workshop manual, (see TOPlx Workshop Manual, section 205-01)

14. Remove DTI gauge

15. Install the engine undershield (see TOPlx Workshop Manual section 501-02)

## 7. Instructions For Rear Driveshaft:

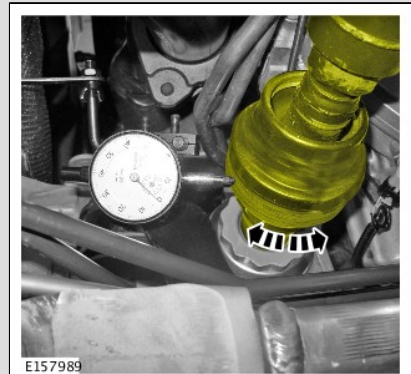
1. Install a suitable mounting bracket and dial test indicator (DTI)



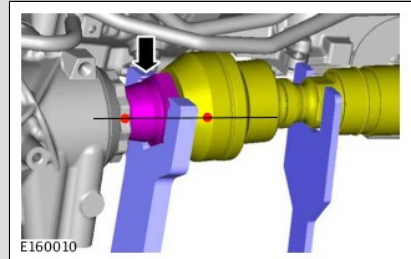
### NOTE:

Front differential is shown, the rear differential is similar

2. Hold one of the rear wheels in position and rotate the other to measure the TIR of the joint head. Record the TIR value

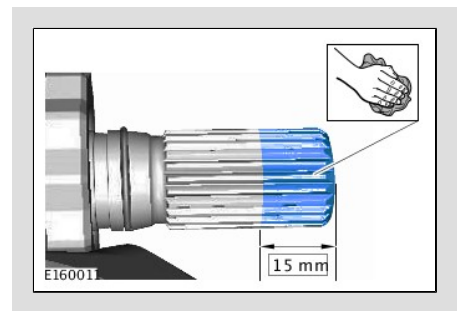


3. Mark the driveshaft joint head relative to the axle for installation purposes

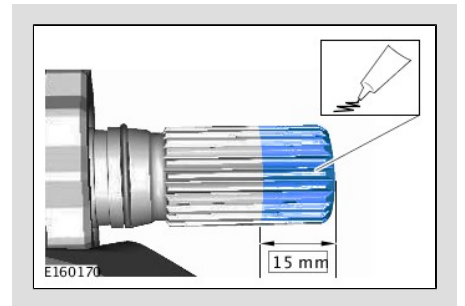


4. Remove the rear driveshaft (see TOPlx, workshop Manual, section 205-01)

5. Clean 15mm of spline at the end of the axle pinion



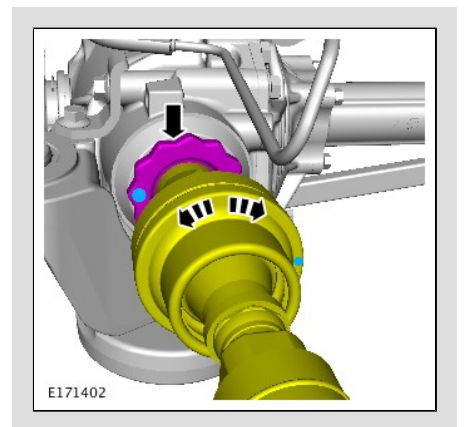
6. Apply 648 Loctite to a length of 15mm at the end of the axle pinion



**NOTE:**

Front differential is shown, the rear differential is similar

7. Install the driveshaft with the ID marks 180 degrees opposed. Tighten driveshaft nut by hand



**NOTE:**

The joint may require adjustment by tapping it lightly with a copper hammer to centralise and to bring TIR within specification

8. Repeat Step 2 until TIR is as close to zero as possible (must be less than 0.15mm TIR)

9. Leave for 45 minutes for allow Loctite to cure

10. Tighten driveshaft nut following procedure shown in workshop manual, (see TOPlx Workshop Manual, section 205-01)

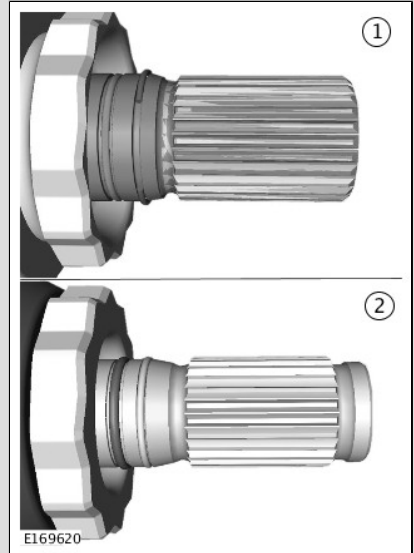
11. Remove DTI gauge

15. Retest vehicle, if vibration is resolved release the vehicle, if vibration is still evident move to step 16

**NOTE:**

Some vehicles will already be equipped with the modified differential from vehicle manufacture

16. The front differential pinions are identified as follows; (1) Old type, (2) Modified type. If the pinion is the modified type (2) then the differential does not need replacing, replace only the driveshaft. If the pinion is the old type (1) replace the differential and driveshaft as per step 17

**NOTE:**

Loctite is not required on latest level parts

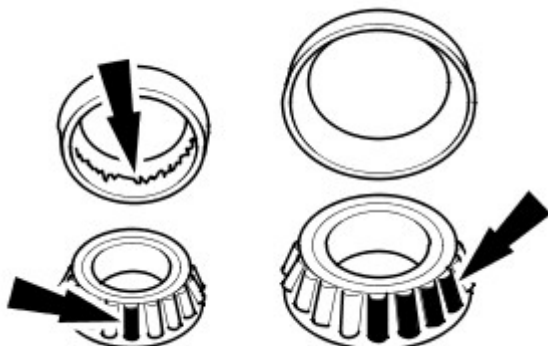
17. If vibration is still present after the Loctite procedure has been completed, then replace the front differential and the front driveshaft with the latest production parts to reduce eccentricity at coupling (see TOPIX Workshop Manual, section 205-03)

**IDENTIFY THE CONDITION****GEAR HOWL AND WHINE**

Howling or whining of the ring gear and pinion is due to an incorrect gear pattern, gear damage or incorrect bearing preload

**BEARING WHINE**

Bearing whine is a high-pitched sound similar to a whistle. It is usually caused by worn/damaged pinion bearings, which are operating at driveshaft speed. Bearing noise occurs at all driving speeds. This distinguishes it from gear whine which is speed dependent



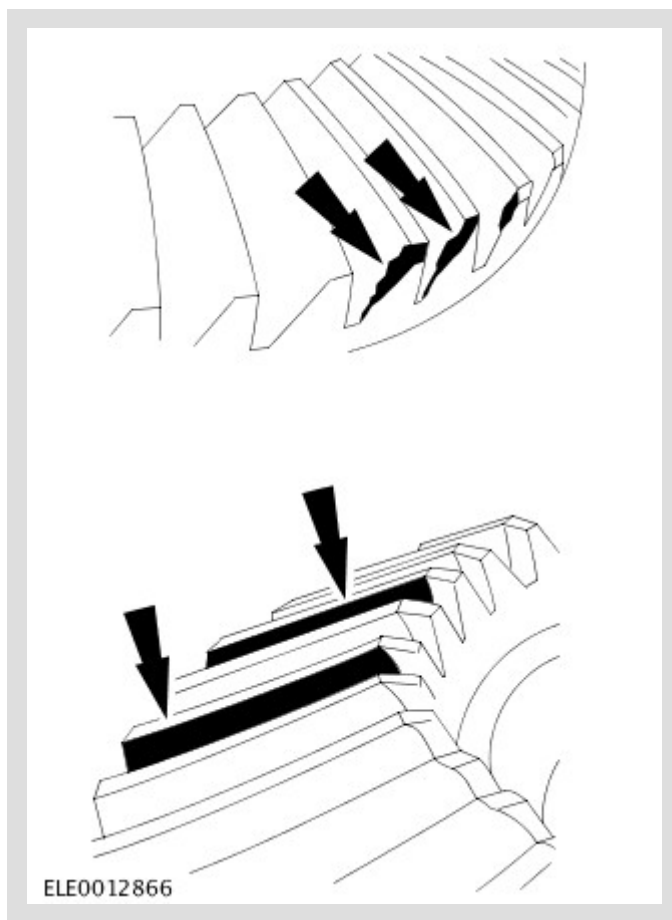
As noted, pinion bearings make a high-pitched, whistling noise, usually at all speeds. If however there is only one pinion bearing that is worn/damaged, the noise may vary in different driving phases

A wheel bearing noise can be mistaken for a pinion bearing noise

### **CHUCKLE**

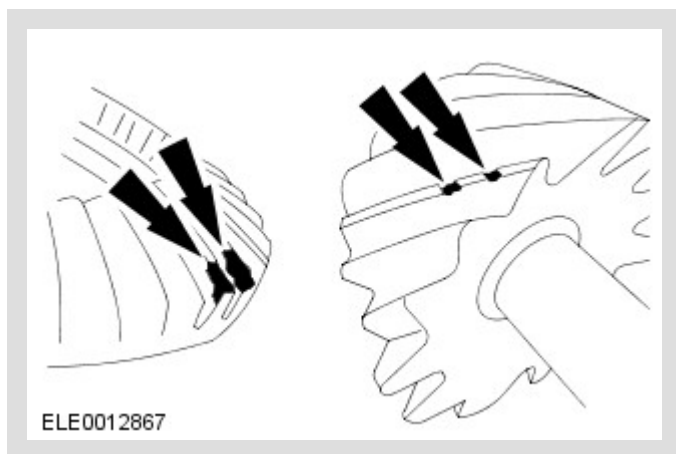
Chuckle that occurs on the coast driving phase is usually caused by excessive clearance between the differential gear hub and the differential case bore

Damage to a gear tooth on the coast side can cause a noise identical to a chuckle. A very small tooth nick or ridge on the edge of a tooth can cause the noise

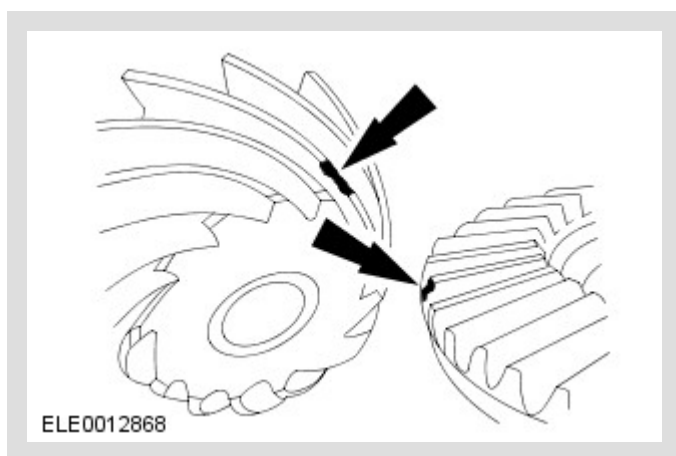


### **KNOCK**

Knock, which can occur on all driving phases, has several causes including damaged teeth or gearset



A gear tooth damaged on the drive side is a common cause of the knock



## CLUNK

Clunk is a metallic noise heard when the automatic transmission is engaged in REVERSE or DRIVE. The noise may also occur when the throttle is applied or released. Clunk is caused by transmission calibration, backlash in the driveline or loose suspension components and is felt or heard in the vicinity of the rear drive axle

## BEARING RUMBLE

Bearing rumble sounds like marbles being tumbled. This condition is usually caused by a worn/damaged wheel bearing. The lower pitch is because the wheel bearing turns at only about one-third of the driveshaft speed. Wheel bearing noise also may be high-pitched, similar to gear noise, but will be evident in all four driving modes

## SYMPTOM CHART

| SYMPTOM                                                 | POSSIBLE CAUSES                                                                                          | ACTION                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Vibration through the vehicle body at a specified speed | <ul style="list-style-type: none"> <li>■ Road wheel imbalance</li> <li>■ Driveshaft imbalance</li> </ul> | <ul style="list-style-type: none"> <li>■ Road test the vehicle. If the vibration is only at a specified speed, balance the road wheels. Test for normal operation. Disconnect the rear driveshaft. Check constant velocity and universal joints for smooth and full movement. Disconnect the front driveshaft. Check constant velocity joints for smooth and full movement. If any joints are faulty, replace the driveshaft. Test for normal operation</li> </ul> |

| SYMPTOM                                                                                  | POSSIBLE CAUSES                                                                                                                                                                | ACTION                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Vibration through the vehicle body at all speeds                                         | <ul style="list-style-type: none"> <li>■ Misalignment of the rear driveshaft</li> <li>■ Bent or misaligned stub axle</li> </ul>                                                | <ul style="list-style-type: none"> <li>■ Road test the vehicle. Check the rear driveshaft for correct alignment through the centre support bearing. Rectify as necessary. Test for normal operation. Check for a damaged or bent stub axle. Rectify as necessary</li> </ul>                                                                                                                                                                          |
| Rumbling noise from the rear of the vehicle varying at different vehicle speed and load  | <ul style="list-style-type: none"> <li>■ Rear differential bearings worn</li> <li>■ Rear wheel bearings worn</li> <li>■ Rear driveshaft centre support bearing worn</li> </ul> | <ul style="list-style-type: none"> <li>■ Using a suitable listening device (for example stethoscope) listen to the rear differential pinion bearings and output bearings, the rear wheel bearings and the rear driveshaft centre bearing. Rectify as necessary. Test for normal operation</li> <li>■ Using the manufacturer approved diagnostic system run application Noise, vibration and harshness diagnostic test - Rear differential</li> </ul> |
| Rumbling noise from the front of the vehicle varying at different vehicle speed and load | <ul style="list-style-type: none"> <li>■ Front differential bearings worn</li> <li>■ Front wheel bearings worn</li> </ul>                                                      | <ul style="list-style-type: none"> <li>■ Using a suitable listening device (for example stethoscope) listen to the front differential pinion bearings and output bearings and the front wheel bearings. Rectify as necessary. Test for normal operation</li> <li>■ Using the manufacturer approved diagnostic system run application Noise, vibration and harshness diagnostic test - Front differential</li> </ul>                                  |
| Whining noise from the rear of the vehicle during acceleration and overrun conditions    | <ul style="list-style-type: none"> <li>■ Rear differential gears worn or damaged</li> </ul>                                                                                    | <ul style="list-style-type: none"> <li>■ Check and top up the rear differential oil level if necessary. Using a suitable listening device (for example stethoscope) listen to the rear differential. Replace the rear differential unit if there is excessive gear noise</li> <li>■ Using the manufacturer approved diagnostic system run application Noise, vibration and harshness diagnostic test - Rear differential</li> </ul>                  |
| Whining noise from the front of the vehicle during acceleration and overrun conditions   | <ul style="list-style-type: none"> <li>■ Front differential gears worn or damaged</li> </ul>                                                                                   | <ul style="list-style-type: none"> <li>■ Check and top up the front differential oil level if necessary. Using a suitable listening device (for example stethoscope) listen to the front differential. Replace the front differential unit if there is excessive gear noise</li> <li>■ Using the manufacturer approved diagnostic system run application Noise, vibration and harshness diagnostic test - Front differential</li> </ul>              |

| SYMPTOM                                                                                               | POSSIBLE CAUSES                                                                                                                                                                                                                                                                 | ACTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Knocking, clicking or clunking noise from rear of vehicle during acceleration and overrun conditions  | <ul style="list-style-type: none"> <li>■ Rear driveshaft joint fixings insecure</li> <li>■ Rear driveshaft joints worn or damaged</li> <li>■ Rear halfshaft joints or splined shaft worn or damaged</li> <li>■ Rear differential internal components worn or damaged</li> </ul> | <ul style="list-style-type: none"> <li>■ Disconnect the rear driveshaft. Check joint mounting bolt holes for elongation. Check the joints. Disconnect the rear halfshafts. Check the shaft splines for wear or damage. Check the constant velocity joints. Rectify as necessary. With the rear driveshaft and halfshafts disconnected, check the rear differential for tight spots or excessive play. Rectify as necessary</li> <li>■ Using the manufacturer approved diagnostic system run application Noise, vibration and harshness diagnostic test - Rear differential</li> </ul>                                                                                                                                                                                                                                                                                                                     |
| Knocking, clicking or clunking noise from front of vehicle during acceleration and overrun conditions | <ul style="list-style-type: none"> <li>■ Front driveshaft constant velocity joints worn or damaged</li> <li>■ Front halfshaft joints or splined shaft worn or damaged</li> <li>■ Front differential internal components worn or damaged</li> </ul>                              | <ul style="list-style-type: none"> <li>■ Disconnect the front driveshaft. Check joint mounting bolt holes for elongation. Check the joints. Disconnect the front halfshafts. Check the shaft splines for wear or damage. Check the constant velocity joints. Rectify as necessary. With the front driveshaft and halfshafts disconnected check the front differential for tight spots or excessive play. Rectify as necessary</li> <li>■ Using the manufacturer approved diagnostic system run application Noise, vibration and harshness diagnostic test - Front differential</li> </ul>                                                                                                                                                                                                                                                                                                                 |
| No drive to wheels                                                                                    | <ul style="list-style-type: none"> <li>■ Left/right halfshaft disconnected from differential (drive unit)</li> </ul>                                                                                                                                                            | <ul style="list-style-type: none"> <li>■ Confirm if each halfshaft is correctly located in the drive unit. If a halfshaft is disconnected, inspect the splines for damage</li> <li>■ If no damage, plunge inboard Constant Velocity joint (CV) to make sure an easy movement. When re-fitting halfshaft, always use a new circlip and make sure that shaft is securely located in the drive unit. Pull joint to make sure complete engagement</li> <li>■ If halfshaft spline is damaged and circlip is present install a new halfshaft</li> <li>■ If halfshaft is sheared off after the circlip groove end, remove the complete circlip and end of halfshaft from the drive unit bore without damaging the seal, install a new halfshaft</li> <li>■ If the circlip and end of halfshaft can not be removed, install a new drive unit and a new halfshaft</li> <li>■ Re-calibrate transfer case</li> </ul> |

| SYMPTOM            | POSSIBLE CAUSES                                                                            | ACTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------|--------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No drive to wheels | <ul style="list-style-type: none"> <li>Front/rear differential failure</li> </ul>          | <ul style="list-style-type: none"> <li>Put vehicle on ramp with free wheels</li> <li>With vehicle in park, hold one wheel and turn the opposite wheel. If the wheel turns there is a failure in the drive unit</li> <li>Install new differential, install a new circlip on the halfshaft and make sure circlip fitted in the groove. Pull joint to make sure complete engagement in the drive unit</li> <li>Re-calibrate transfer case</li> <li>Using the manufacturer approved diagnostic system run application Noise, vibration and harshness diagnostic test - Front differential</li> <li>Using the manufacturer approved diagnostic system run application Noise, vibration and harshness diagnostic test - Rear differential</li> </ul> |
| No drive to wheels | <ul style="list-style-type: none"> <li>Front/rear left /right halfshaft failure</li> </ul> | <ul style="list-style-type: none"> <li>If halfshaft is broken, install a new halfshaft</li> <li>Re-calibrate transfer case</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

## DTC INDEX

For a list of diagnostic trouble codes that could be set on this vehicle, please refer to Section 100-00. REFER to: [Diagnostic Trouble Code Index - DTC: Rear Differential Control Module \(RDCM\)](#) (100-00 General Information, Description and Operation).