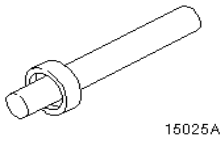
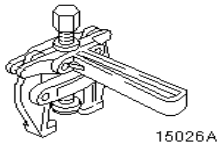
Transmission Assembly - Dismantle and Reassemble (Transmission Removed) (16 118 8)

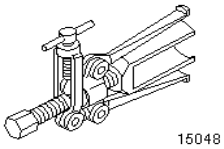
Special Tools



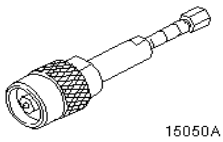
15-025 A Installer, differential bearing



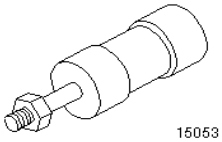
15-026 A Remover, differential bearing



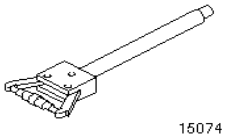
15-048 Remover, output shaft outer bearing ring



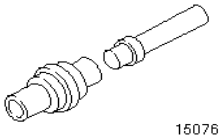
15-050 A Remover, main tool



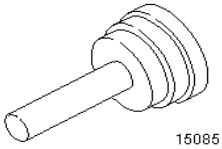
15-053 Slide hammer



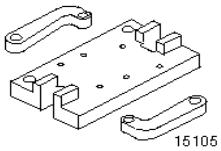
15-074 Remover, differential bearing cone



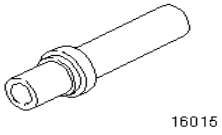
15-076 Installer, drive shaft oil seal



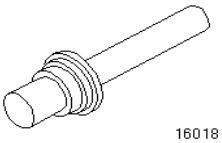
15-085 Installer, differential bearing cone



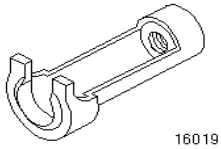
15-105 Mounting plate, transmission



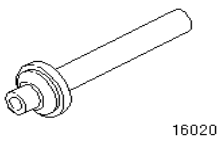
16-015 Installer



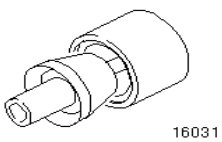
16-018 Installer, drive shaft oil seal



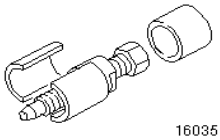
16-019 Remover/installer, selector shaft oil seal



16-020 Installer, bearing cups

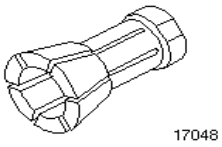


16-031 Installer, circlip

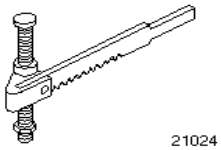


16-035 Remover, fifth gear wheel

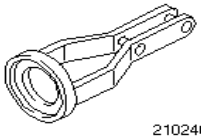
16-086 Extractor, clutch release shaft bush



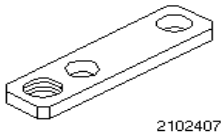
17-048 Collet for 15-050 A



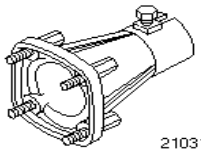
21-024 Valve spring compressor



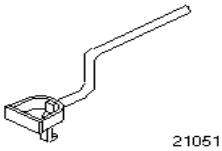
21-024-02 Adapter for 21-024



21-024-07 Adapter for 21-024



21-031 B Mounting plate, transmission



21-051 Remover, oil seal

Proprietary Tools

Description	
Magnetic fixture	
Dial gauge	
Hot air fan	

Workshop Equipment

Description	
Press	
Assembly stand	

Materials

Description	Ford Specification
High temperature grease	ESD-M1C220-A
Transmission fluid	WSD-M2C200-C
Universal sealer (Hylomar)	ESEE-M4G1008-A
Freezing spray	
Liquid gasket - transmission housing	WSK-M2G348-A5
Liquid gasket - transmission housing	WSE-M4G323-A4

Measuring and Adjusting Shims

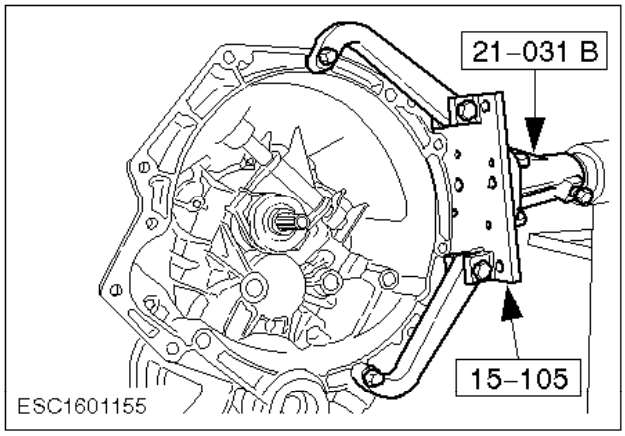
Description	Shim thickness
Measuring shim	3.8 mm
Shim availability (from - to)	0,1 - 1,1 (increasing in increments of 0,1 mm)

Dismantle 09-70">

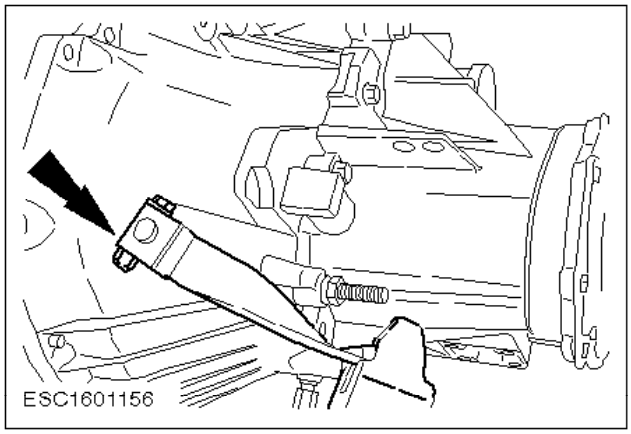
1. General note.

   - A transmission may be fitted with a multifunction switch.

   CAUTION:
   Double synchroniser parts must be treated carefully.
   - Whenever items are clamped in a vice, soft jaws must be used.
   - Do not re-use snap rings, circlips or self-locking nuts.

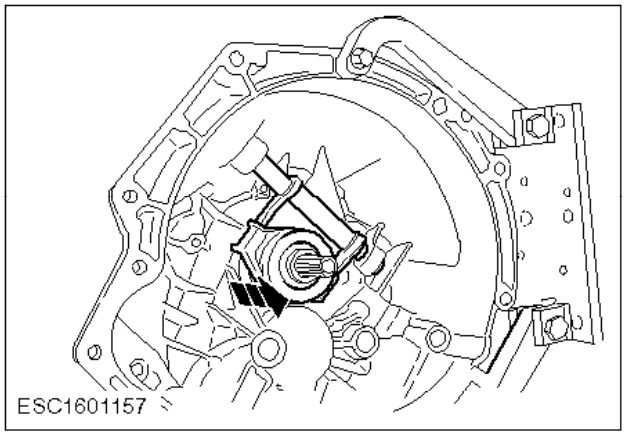


2. Fit the transmission to the assembly stand.



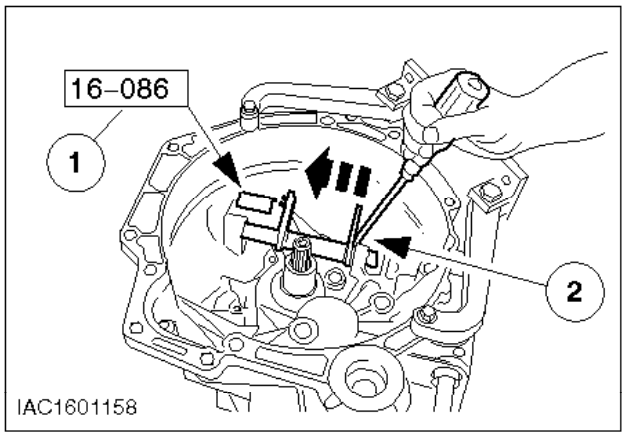
3. Detach the clutch release lever.

   Take off the rubber gaiter.



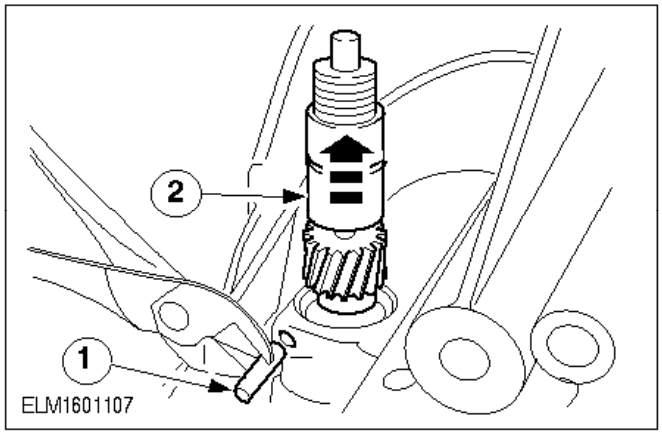
4. Remove the release bearing.

   Pull the release bearing forward and unhook it.



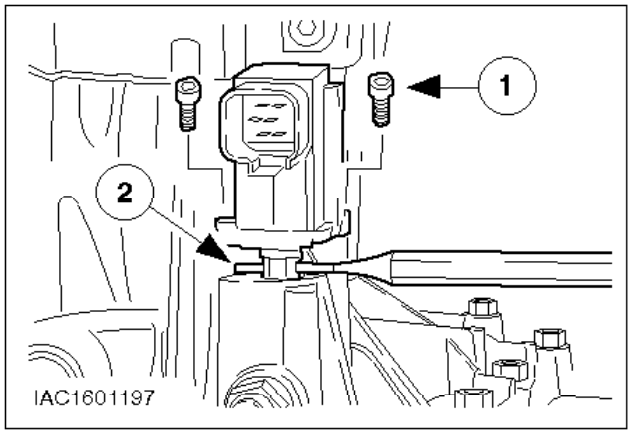
5. Remove the release shaft.

CAUTION:
Turn the release shaft outwards until it touches the housing.
1 Fit the Special Tool.
2 Push the release shaft up and take out the bearing bush.
Remove the release shaft.



6. Detach the speedometer drive pinion.

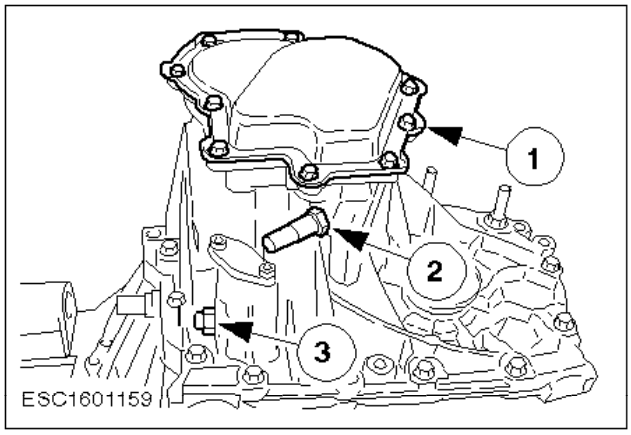
   1 Pull out the roll pin.
   2 Pull out the drive pinion.



WARNING:
FOLLOW THE STEPS EXACTLY, OTHERWISE THE MULTIFUNCTION SWITCH WILL BE DESTROYED.

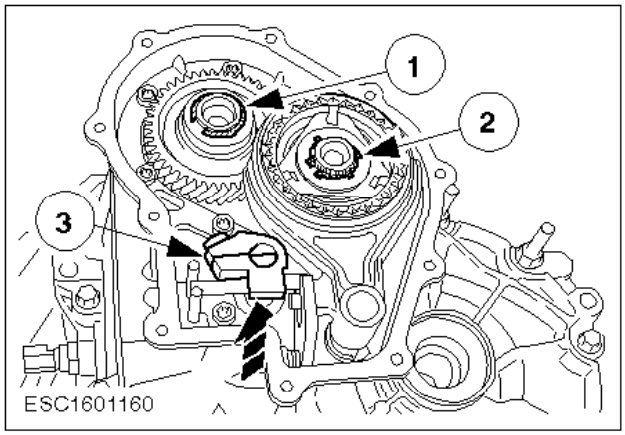
7. Remove the multi-function switch.

Select fourth gear (from neutral, push the selector shaft in as far as it will go).
1 Remove the bolts and lift the multifunction switch.
2 Insert a pin punch (ø 4mm) into the assembly hole.
Shift the transmission into third gear and remove the multifunction switch.



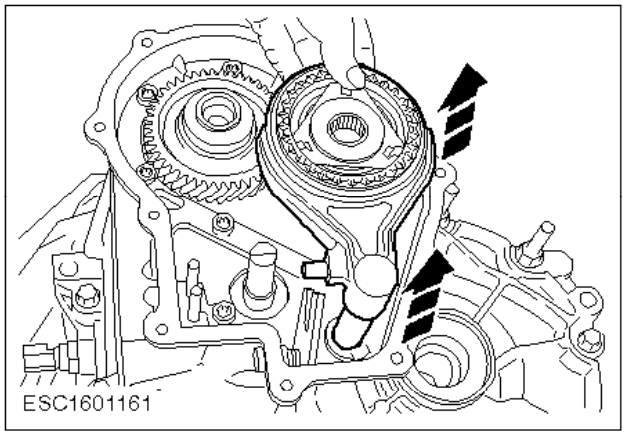
8. Remove the end cover and the detent mechanisms.

1 End cover
2 Fifth gear detent mechanism
3 Auxiliary selector shaft detent mechanism



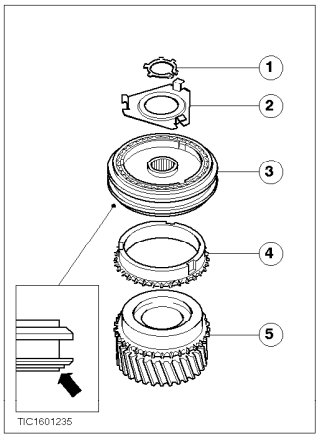
9. Remove the circlips and the selector finger.

1 Circlip for fifth gear wheel.
2 Circlip for fifth gear synchroniser.
3 Slacken the bolt and remove the selector finger.



10. Remove the fifth gear synchroniser and gear wheel, together with the selector fork.

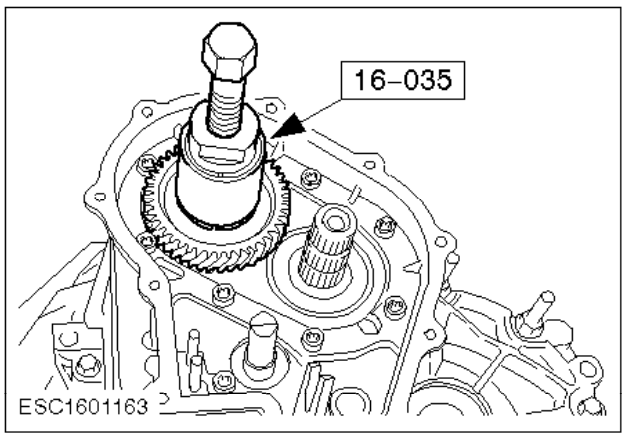
Detach the synchroniser complete with the selector fork from the output shaft.



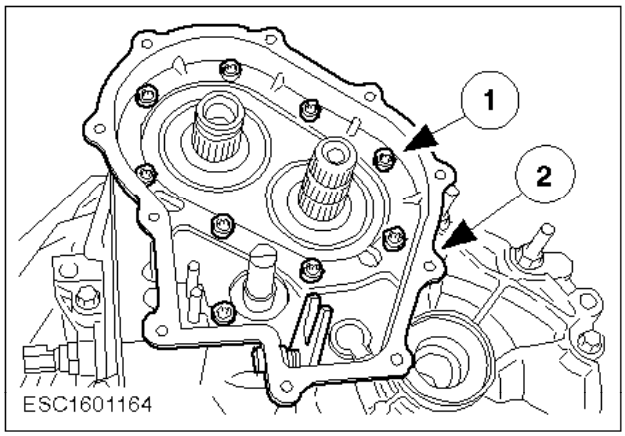
Note:
Before dismantling, mark the installation position of the gear synchroniser.

11. Dismantle the fifth gear synchroniser.

1 Circlip
2 Retaining plate
3 Gear synchroniser
4 Synchroniser ring
5 Fifth gear wheel



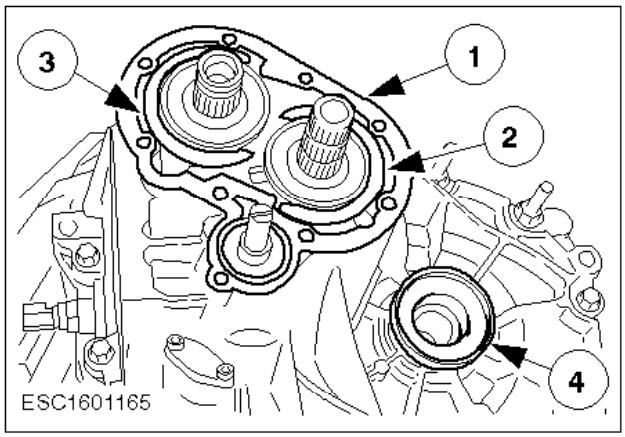
12. Pull off the fifth gear wheel.



CAUTION:
Do not hit the sealing surface.

13. Detach the fifth gear housing.

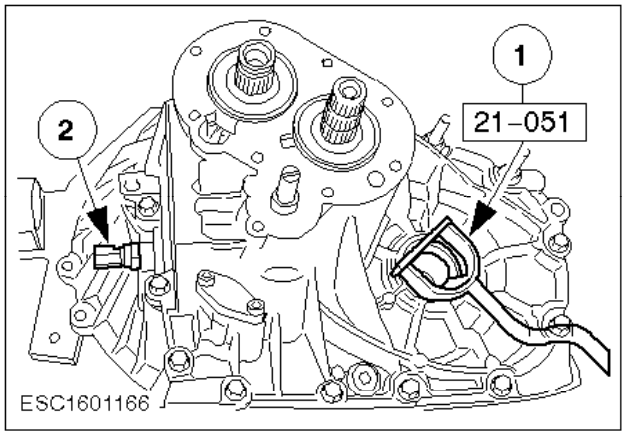
1 Remove the bolts and carefully detach the fifth gear housing by tapping it lightly.
2 Loosen the housing gasket and remove it.



CAUTION:
Do not hit the sealing surface.

14. Remove the gasket, detach the circlips.

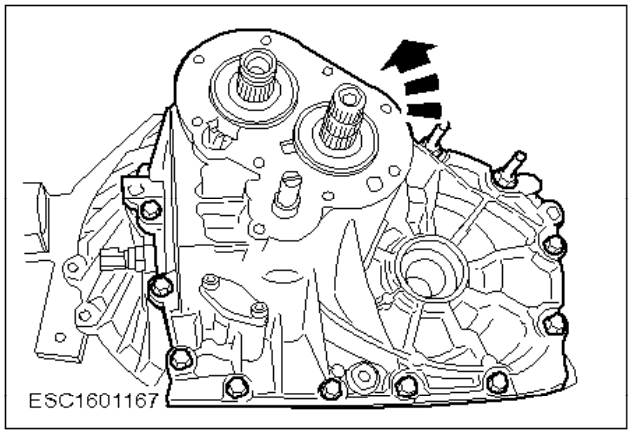
1 Gasket
2 Output shaft circlip.
3 Input shaft circlip.
4 Withdraw the assembly plug.



15. Remove the oil seals.

1 Prise the oil seals out with the Special Tool.
2 The reversing light switch only needs to be removed for sealing purposes.

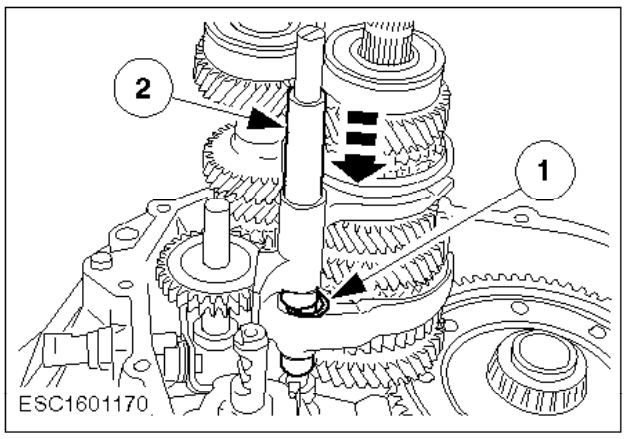
CAUTION:
On transmissions without liquid gasket, do not damage the gasket.



Note:
To lift it off, turn the transmission housing slightly (transmission breather hose catches on the input shaft).

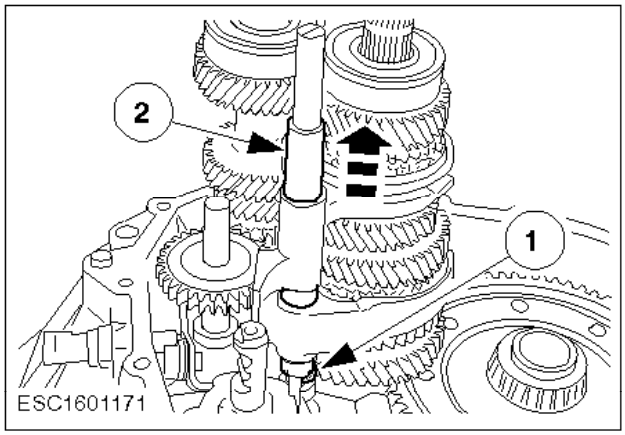
16. Separate the transmission housing halves

Remove the bolts and carefully separate the transmission housing by tapping it lightly.



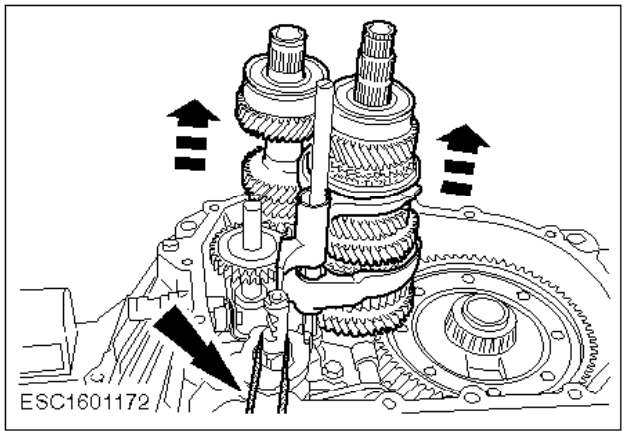
17. Remove the upper circlip of the selector shaft guide sleeve.

1 Remove the upper circlip.
2 Slide the guide sleeve downwards.



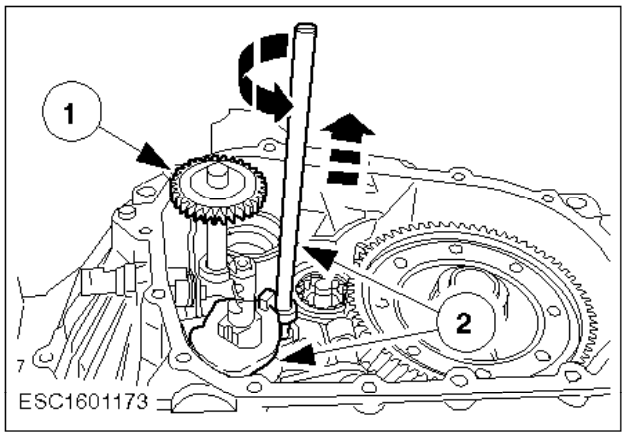
18. Remove the selector shaft guide sleeve.

1 Remove the guide sleeve lower circlip.
2 Withdraw the sleeve.



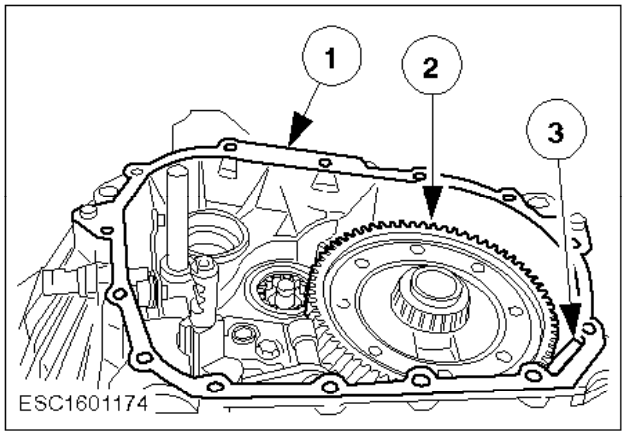
Note:
Attach a rubber band to the auxiliary selector shaft as an aid to assembly.

19. Lift out the input and output shafts together with the selector forks.



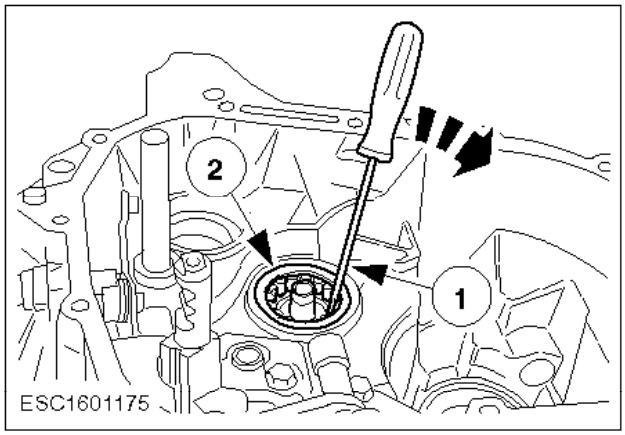
20. Remove the reverse gear idler and selector shaft with the locking plate.

1 Remove the reverse gear idler.
2 Remove the selector shaft together with the locking plate.



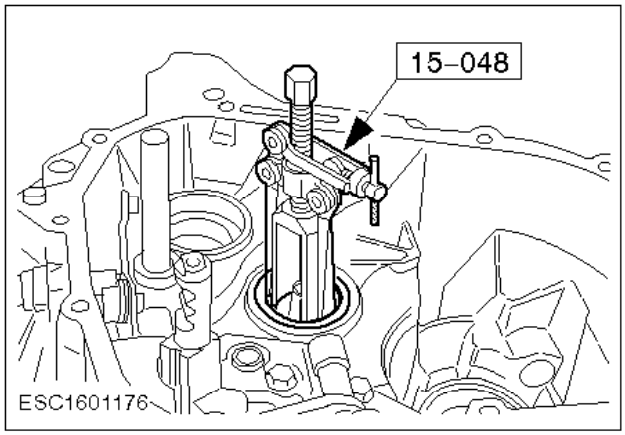
21. Remove the gasket, differential and permanent magnet.

    1 Gasket (on transmissions without liquid gasket).
    2 Lift out the complete differential assembly.
    3 Permanent magnet



22. Remove the output shaft taper roller bearing.

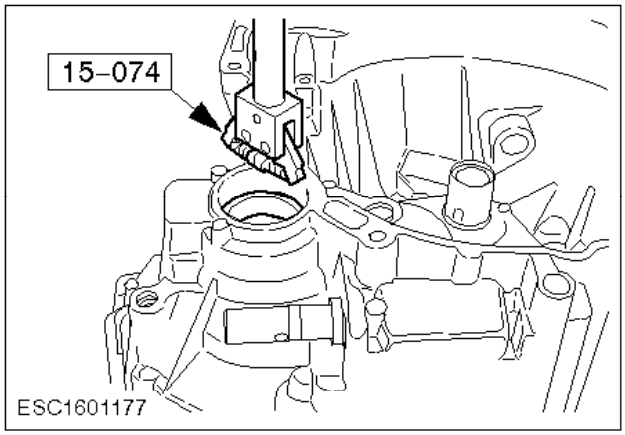
    1 Press the rollers out of the bearing cage.
    2 Remove the bearing cage.



CAUTION:
Only use the Special Tool in the position shown, otherwise the blanking plug is pressed out of the transmission.

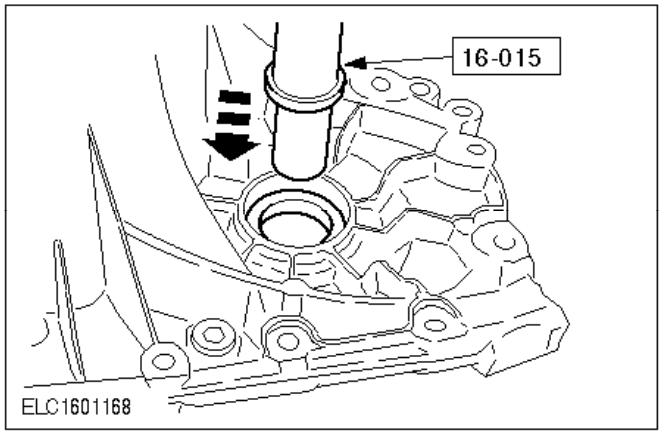
23. Withdraw the output shaft bearing ring.

    - Remove the oil slinger.



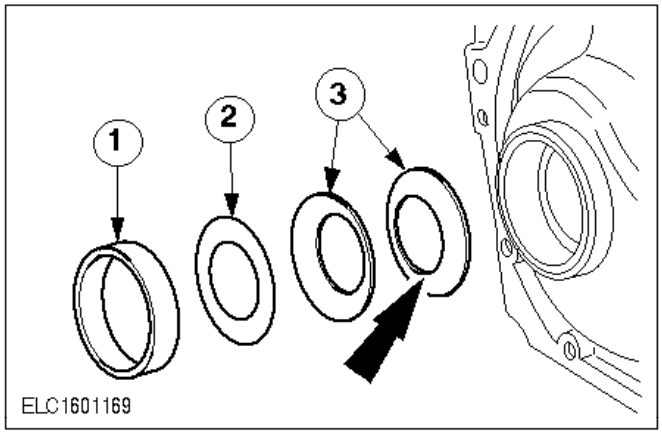
Note:
Locate the Special Tool in the transmission recesses.

24. Take off the differential bearing ring.



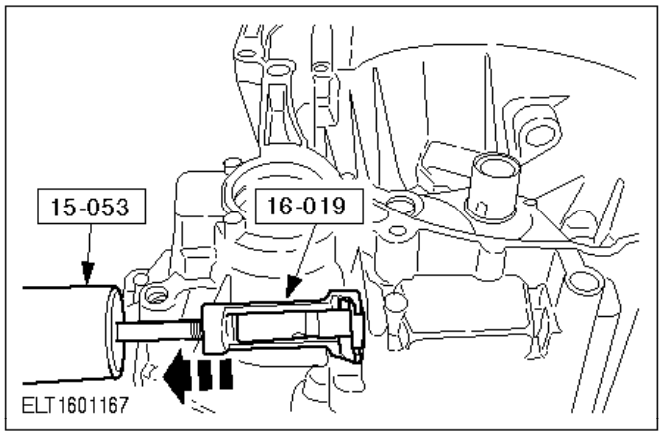
Note:
See Step 26 for the position of the shim pack.

25. Remove the outer bearing ring.



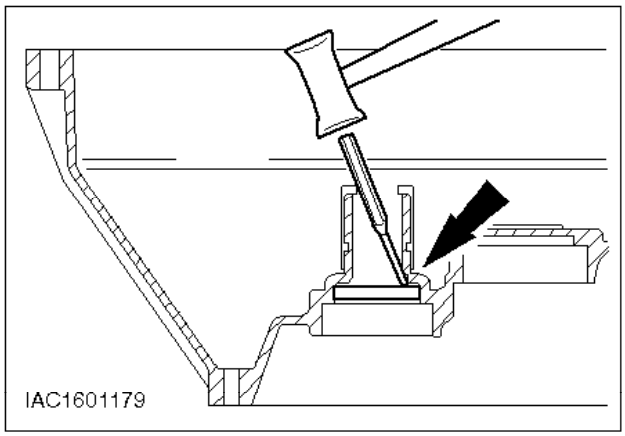
26. Order of installation of differential shim pack.

1 Outer bearing ring.
2 Adjusting shim.
3 The spring (Belleville) washers are fitted with the inside diameters facing one another.



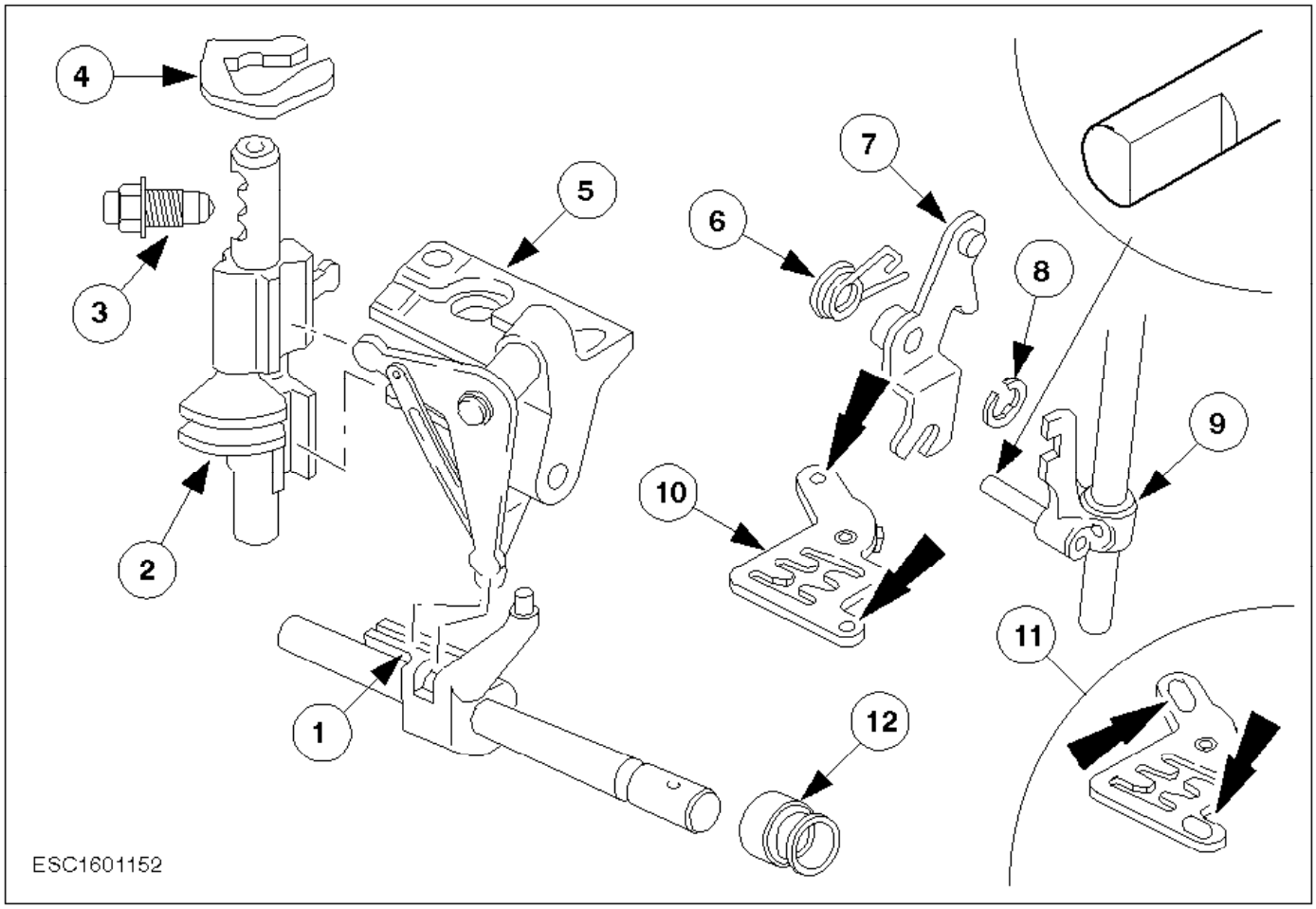
27. Remove the selector shaft oil seal.

    Pull off the gaiter.



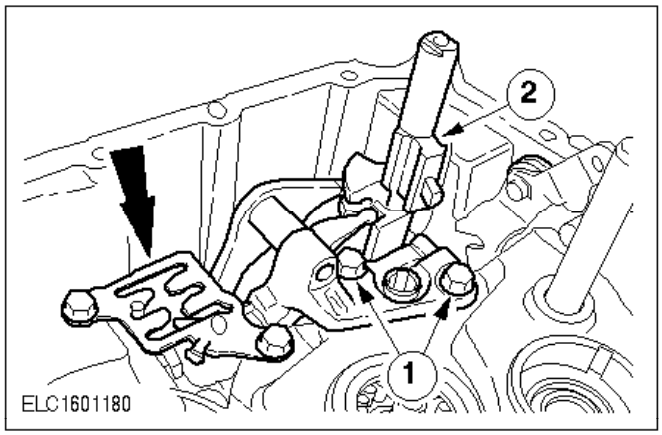
Note:
Put the pin punch in the cut-out and drive out the seal.

28. Remove the driveshaft oil seal.



Layout of internal gearshift mechanism

Item	Description
1	Main selector shaft with selector block
2	Auxiliary selector shaft
3	Auxiliary selector shaft detent mechanism
4	Shift locking plate
5	Mounting block with relay levers
6	Return spring (reverse gear shift lever)
7	Shift lever (reverse gear)
8	Circlip
9	Selector finger - reverse gear idler
10	Selector shaft (fifth/reverse gear)
11	Selector gate (service type)
12	Selector gate (production type)
13	Selector shaft oil seal



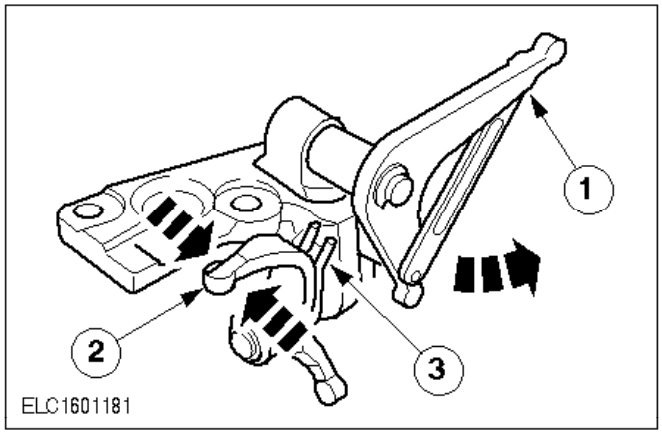
Remove internal gearshift mechanism

Note:
Only release the selector gate if there is damage.

CAUTION:
The selector gate is adjusted in production. If the gate is released, it must be replaced with the service gate.

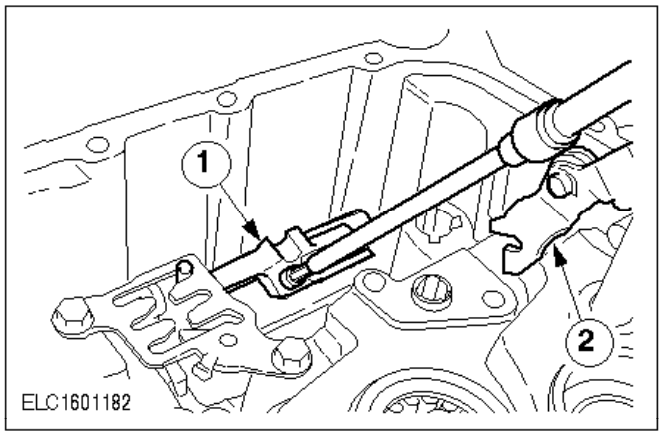
29. Remove the auxiliary selector shaft.

1 Unscrew the bolts of the relay lever retaining plate.
2 Remove the auxiliary selector shaft together with the relay levers.



30. Check the relay levers and the detent mechanism.

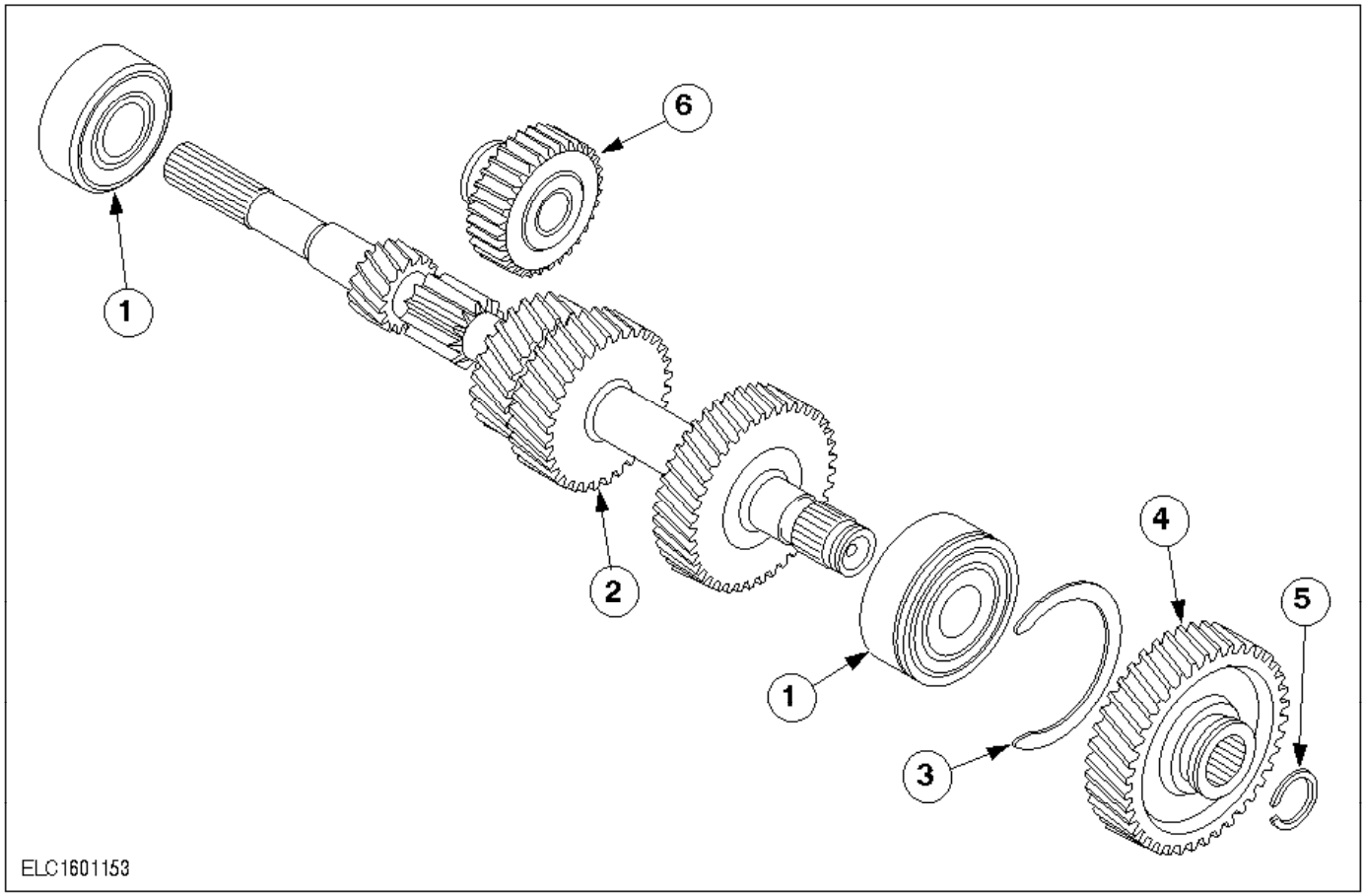
Check for ease of movement and correct resetting in the "neutral" position.
1 Relay lever (shift)
2 Relay lever (pre-select)
3 Return spring (gearshift mechanism in neutral)



Note:
Check for ease of movement and correct resetting to the ”neutral" position.

31. Remove the selector shaft and the reverse gear shift lever.

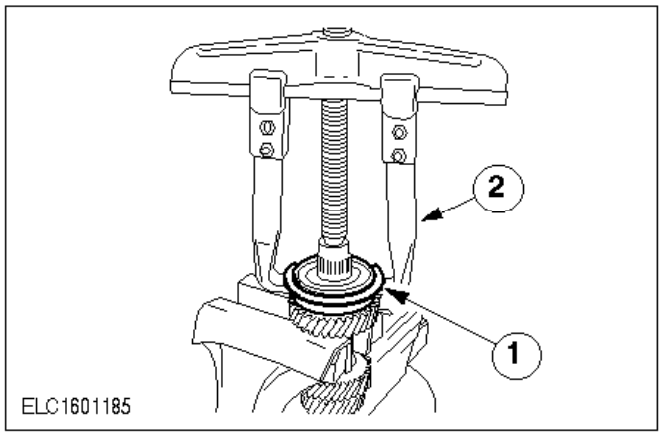
1 Detach the selector block from the selector shaft (remove the bolt).
Withdraw the selector shaft and remove the selector block.
2 Detach the circlip and remove the shift lever and spring.



Layout of the input shaft

Item	Description
1	Ball bearing (closed on both sides)
2	Input shaft
3	Circlip
4	Fifth gear driving gear

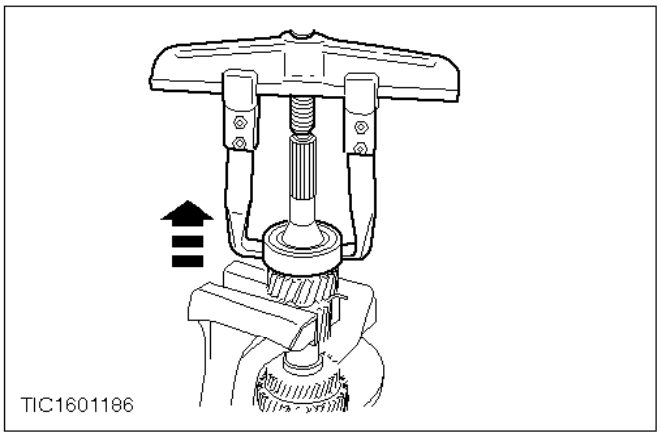
5	Circlip
6	Reverse gear idler



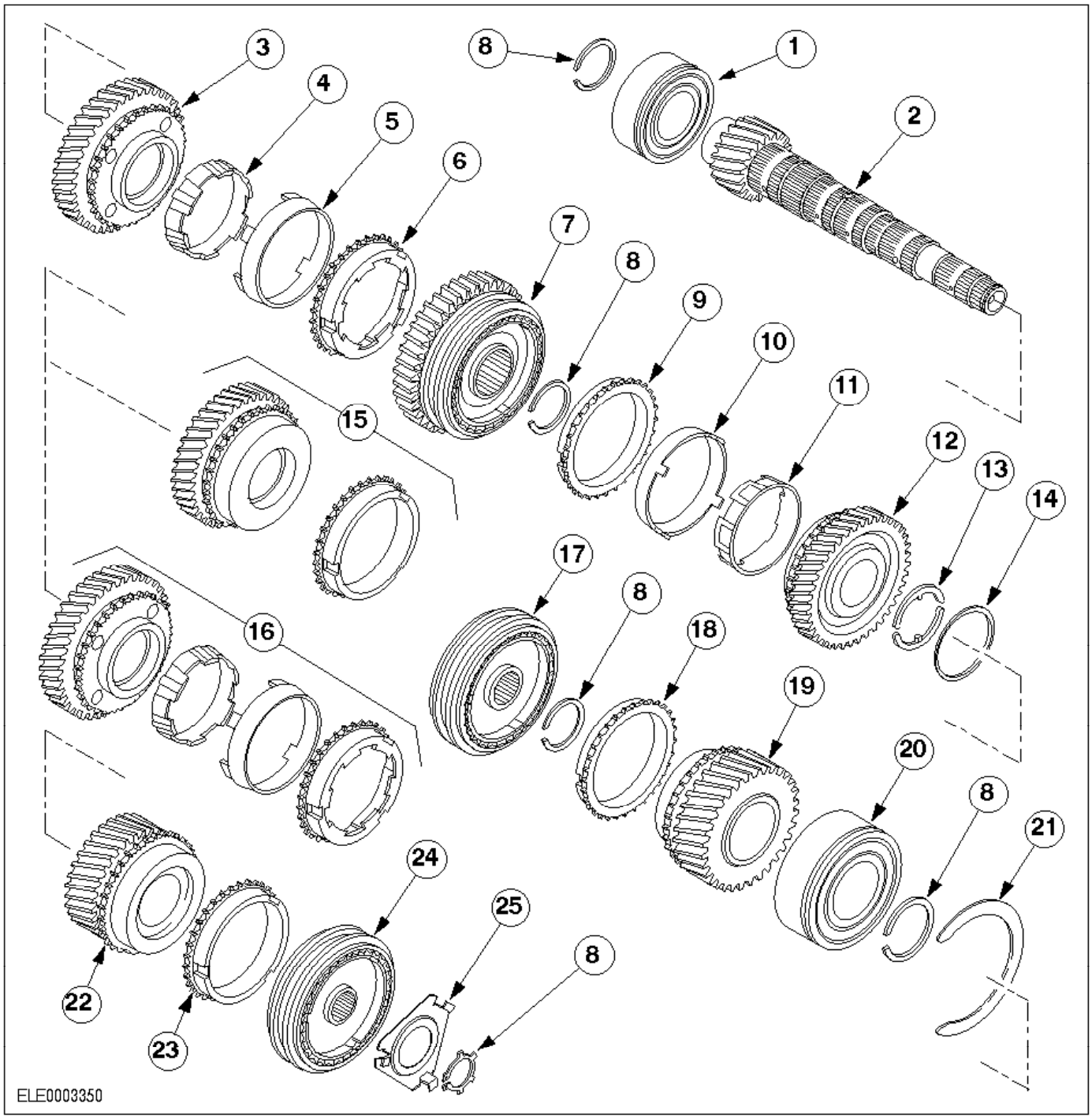
Dismantle input shaft

32. Pull off the ball bearing at the transmission end.

    1 Fit the circlip.
    2 Locate the puller under the circlip and pull off the bearing.



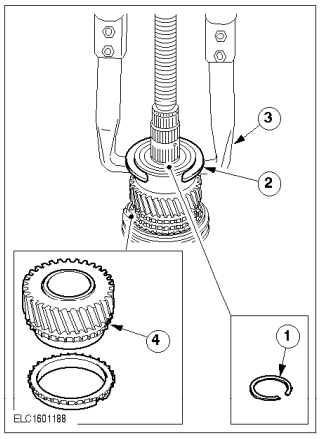
33. Pull off the ball bearing at the clutch end.



Layout of output shaft

Item	Description
1	Parallel roller bearing
2	Output shaft
3	1st gear wheel
4	Inner synchroniser ring
5	Synchroniser cone
6	Outer synchroniser ring
7	1st/2nd gear synchroniser with reverse gear wheel
8	Circlip

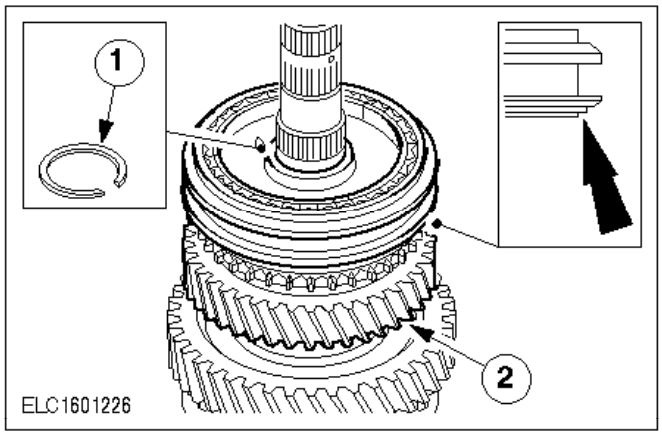
9	Outer synchroniser ring
10	Synchroniser cone
11	Inner synchroniser ring
12	2nd gear wheel
13	Half rings
14	Circlip
15	3rd gear wheel with single synchroniser
16	3rd gear wheel with double synchroniser
17	3rd/4th gear synchroniser
18	4th gear synchroniser ring
19	4th gear wheel
20	Ball bearing (closed on both sides)
21	Circlip
22	Fifth gear wheel
23	5th gear synchroniser ring
24	5th gear synchroniser
25	Retaining plate



Dismantle output shaft

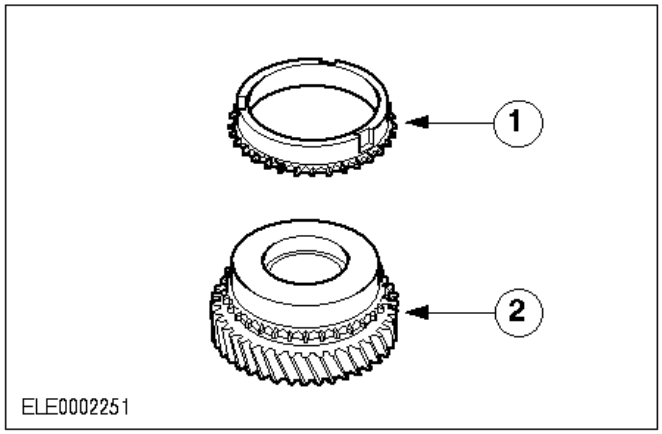
34. Detach the ball bearing and the 4th gear wheel

1 Detach the small circlip.
2 Fit the circlip.
3 Pull off the ball bearing with a conventional puller.
4 Remove the 4th gear wheel together with the synchroniser ring.



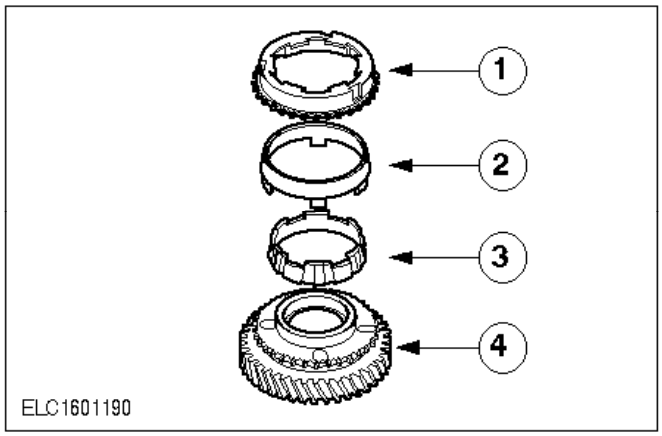
35. Detach the third/fourth gear synchroniser.

    1 Detach the circlip.
    2 Remove the gear synchroniser complete with the third gear wheel.



36. Remove the 3rd gear synchroniser ring

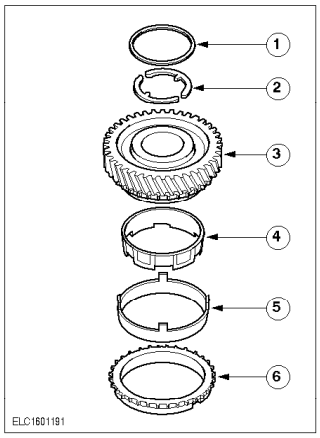
    1 Synchroniser ring
    2 3rd gear wheel



Note:
Double synchroniser is shown, will be used if servicing work is carried out.

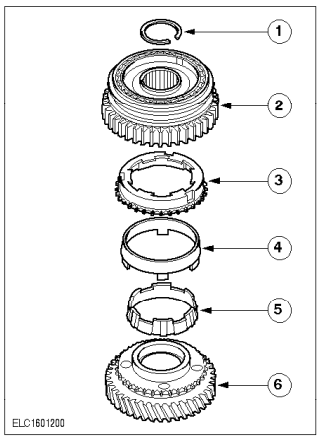
37. Dismantle the third gear synchroniser.

    1 Outer synchroniser ring
    2 Synchroniser cone
    3 Inner synchroniser ring
    4 Gear wheel



38. Detach the second gear wheel with the synchroniser.

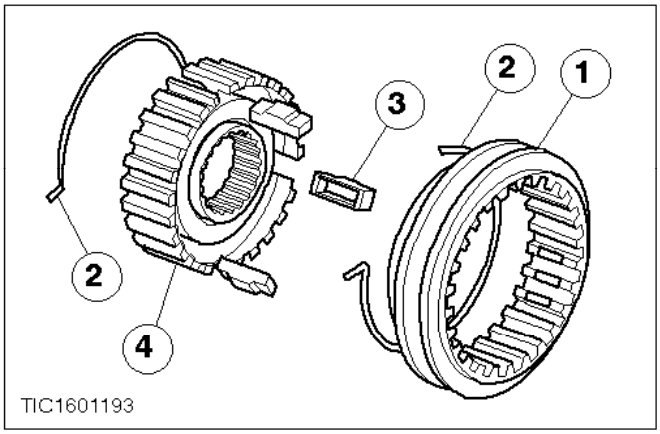
1 Retaining ring
2 Half rings
3 Gear wheel
4 Inner synchroniser ring
5 Synchroniser cone
6 Outer synchroniser ring



39. Detach the first gear wheel with the synchroniser.

1 Detach the circlip.

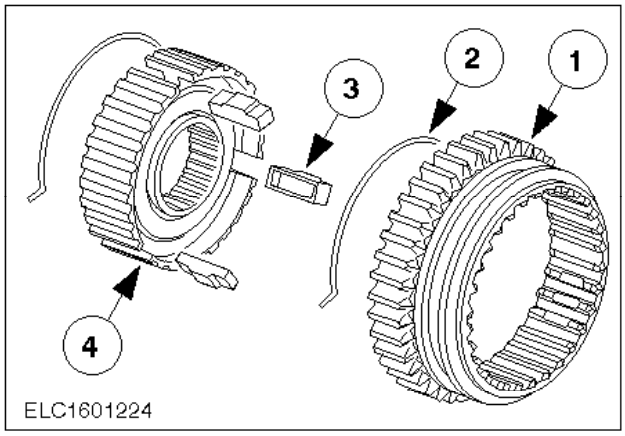
Note:
Remove the synchroniser, together with the gear wheel.
2 1st/2nd gear synchroniser with reverse gear wheel.
3 Outer synchroniser ring
4 Synchroniser cone
5 Inner synchroniser ring
6 Gear wheel



CAUTION:
Mark the selector ring position before dismantling the assembly.

40. Dismantle the gear synchroniser.

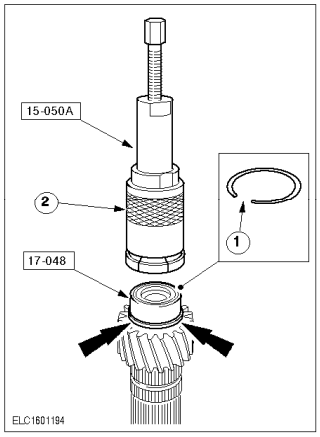
1 Selector ring
2 Synchroniser spring
3 Blocker bar
4 Gear synchroniser hub



CAUTION:
Mark the selector ring position before dismantling the assembly.

41. Dismantle the gear synchroniser.

1 Selector ring
2 Synchroniser spring
3 Blocker bar
4 Gear synchroniser hub



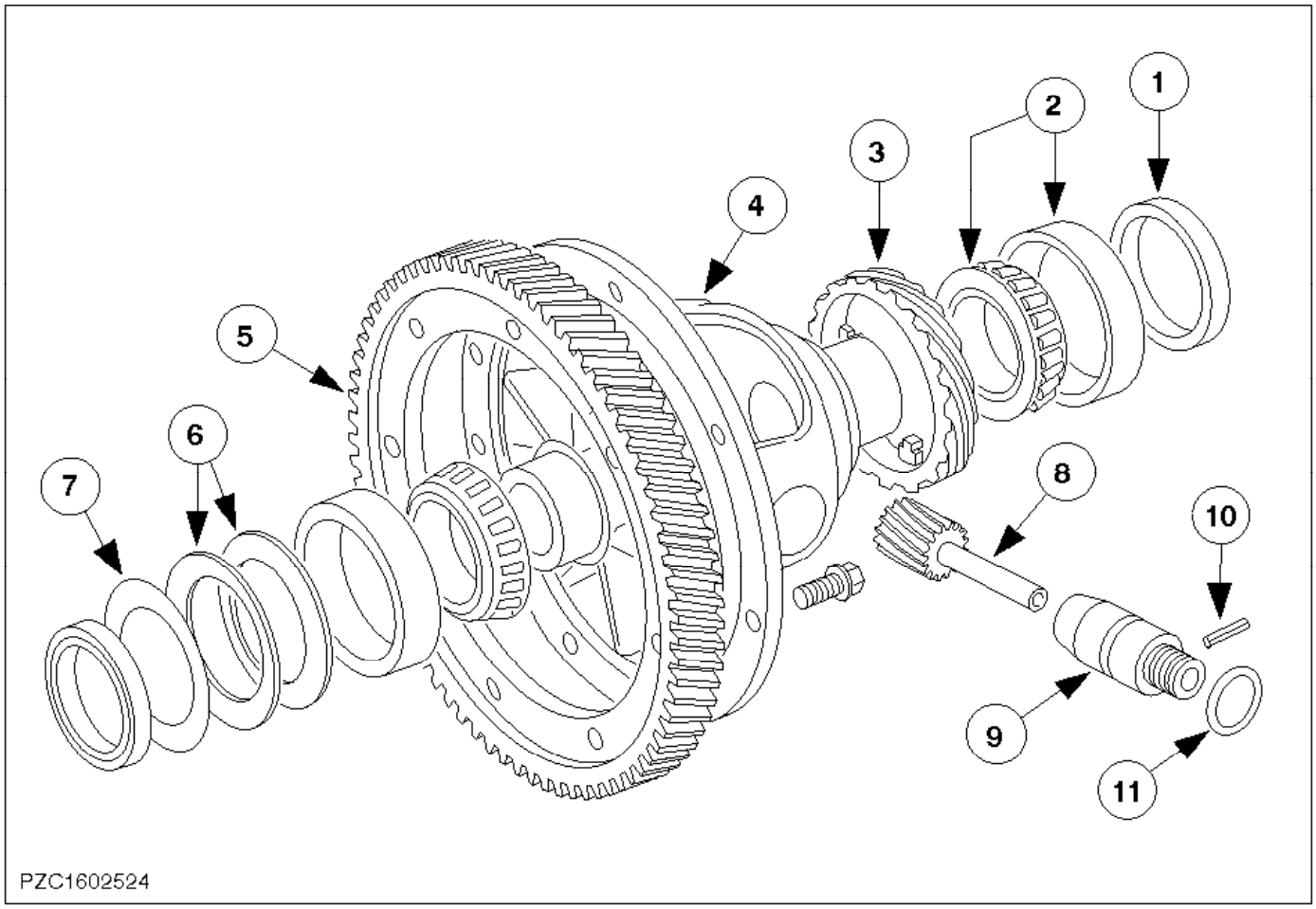
42. Pull off the output shaft bearing ring.

1 Detach the circlip.

Note:
Insert the extractor thrust pad into the oil slinger hole. Position the claws underneath the outer bearing ring.

2 Pull off the inner bearing ring.

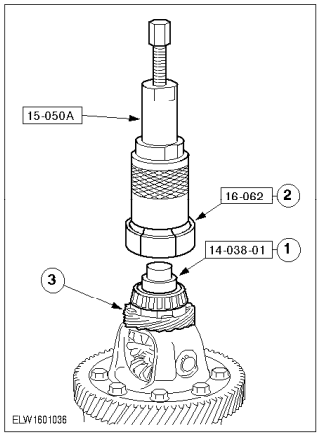
- Position the claws underneath the bearing cone.



Layout - Differential

Item	Description
1	Radial oil seal
2	Taper roller bearing

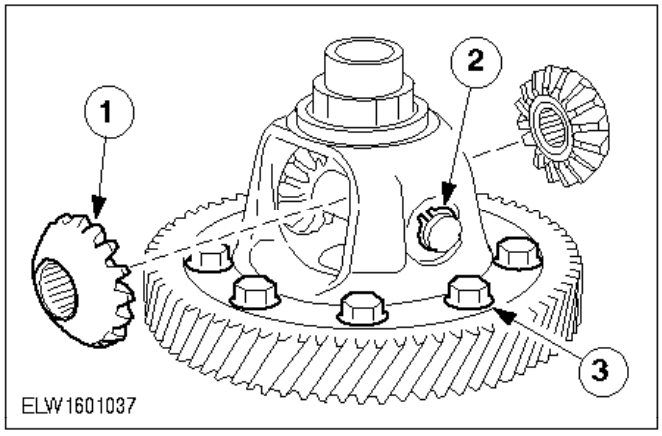
3	Speedometer drive worm gear
4	Differential case
5	Crown wheel
6	Belleville washers (two)
7	Adjusting shim
8	Speedometer drive pinion
9	Drive pinion bearing
10	Roll pin
11	O-ring



Dismantle the differential

43. Dismantle the differential.

1 Insert the thrust element.
2 Pull off both taper roller bearings.
3 Remove speedometer drive gear.

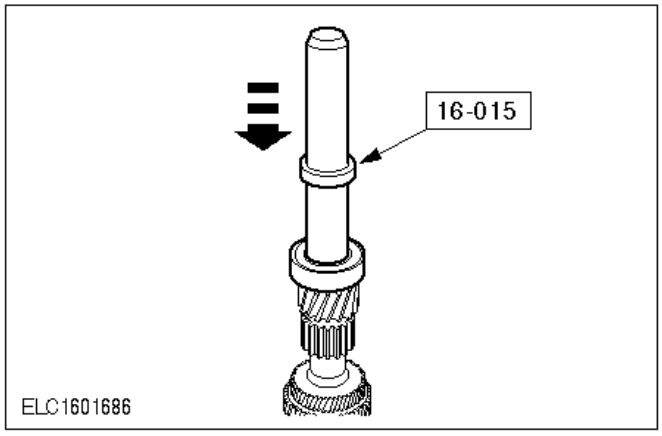


44. Remove the differential pinions.

1 Turn the pinion gears 905 in the differential cage and remove them.
2 Remove the retaining ring and drive out the shaft.
Remove the pinions and the plastic thrust washers.
3 Remove the bolts and push the crown wheel down evenly off the differential.

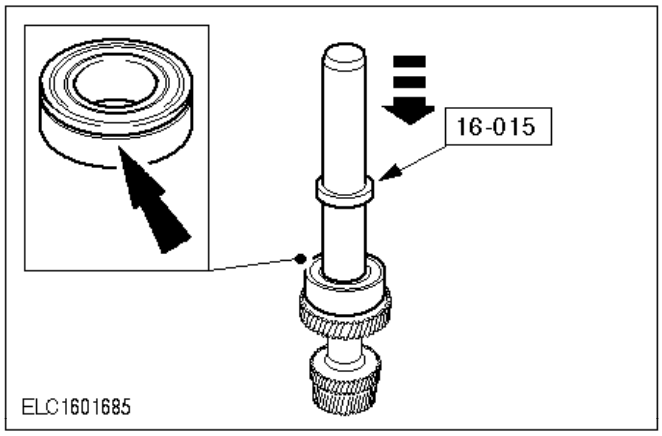
Assemble

45. Carefully check and clean all the parts and coat all the running parts with transmission fluid (WSD-M2C200-C) before assembly.



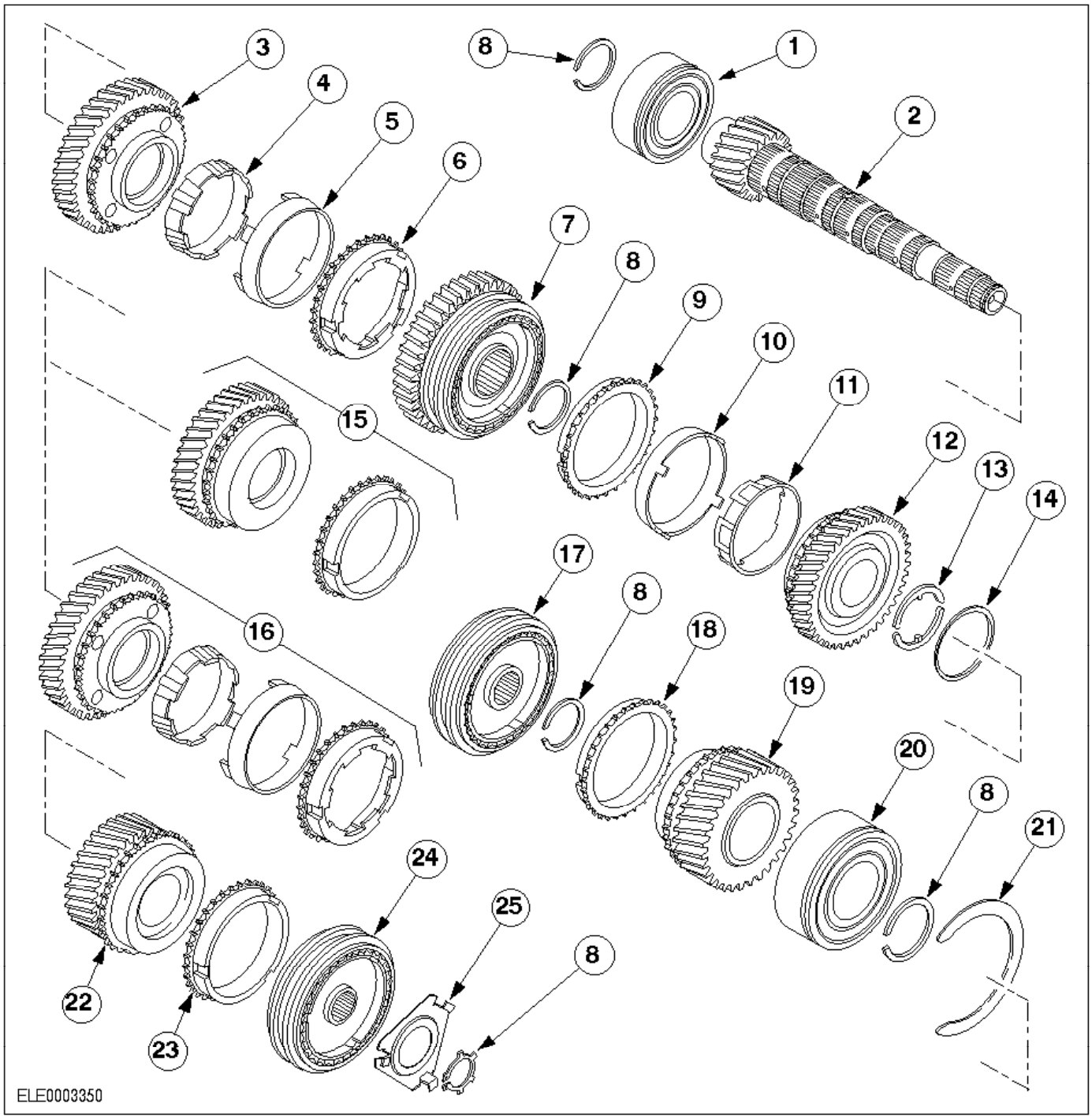
Assemble input shaft

46. Press on the ball bearing at the clutch end.



Note:
Fit the ball bearing with the annular groove facing outwards.

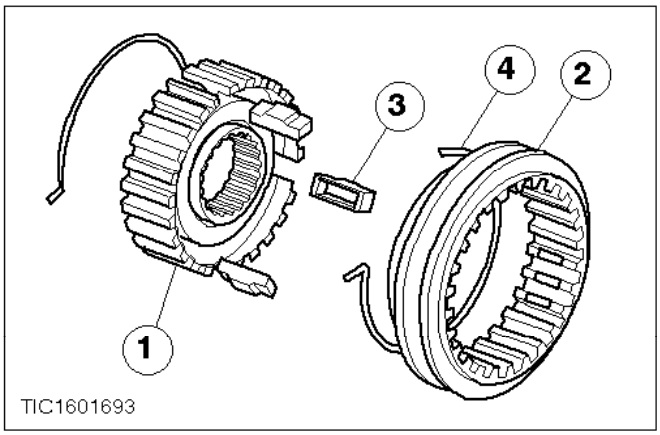
47. Press on the ball bearing at the transmission end.



Layout of output shaft

Item	Description
1	Parallel roller bearing
2	Output shaft
3	1st gear wheel
4	Inner synchroniser ring
5	Synchroniser cone
6	Outer synchroniser ring
7	1st/2nd gear synchroniser with reverse gear wheel
8	Circlip

9	Outer synchroniser ring
10	Synchroniser cone
11	Inner synchroniser ring
12	2nd gear wheel
13	Half rings
14	Circlip
15	3rd gear wheel with single synchroniser
16	3rd gear wheel with double synchroniser
17	3rd/4th gear synchroniser
18	4th gear synchroniser ring
19	4th gear wheel
20	Ball bearing (closed on both sides)
21	Circlip
22	Fifth gear wheel
23	5th gear synchroniser ring
24	5th gear synchroniser
25	Retaining plate

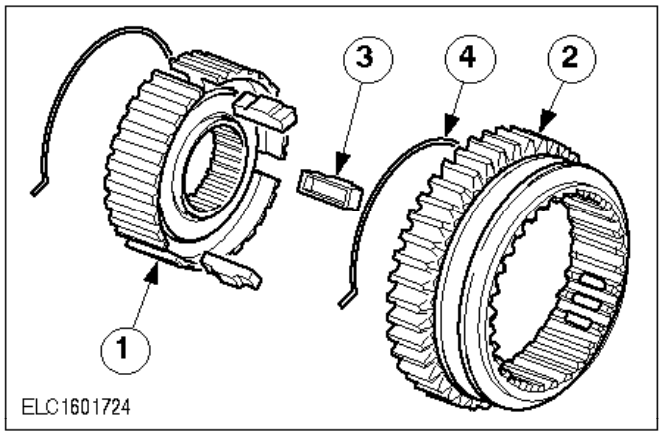


Assemble output shaft

48. Assemble the gear synchroniser.

    1 Gear synchroniser hub

    Note:
    Mark the installation position.
    2 Place the selector ring on the gear synchroniser.
    3 Put in the blocker bars.
    4 Put in the synchroniser springs.

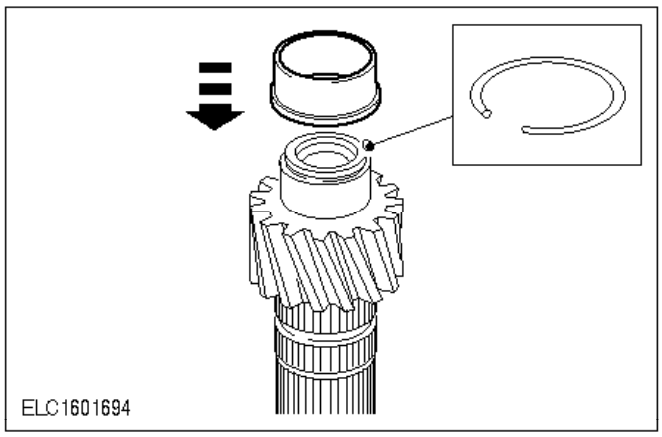


49. Assembly the gear synchroniser.

1 Gear synchroniser hub

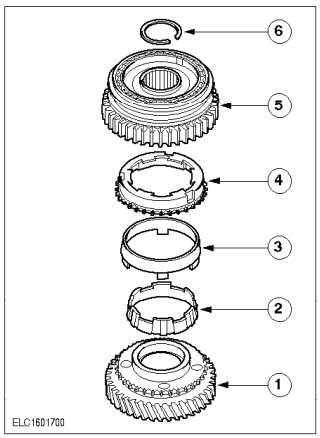
Note:
Mark the installation position.

2 Place the selector ring on the gear synchroniser.
3 Put in the blocker bars.
4 Put in the synchroniser spring.



50. Fit the output shaft bearing ring.

- Heat the bearing ring to approximately 80_C and fit it.
- Fit the circlip.



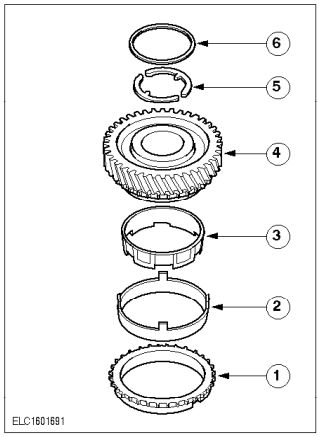
CAUTION:
Double synchroniser parts must be treated carefully. Place the double synchronisers in an

oil bath (WSD-M2C200-C) before fitting them.

Note:
Installation position of the circlip.

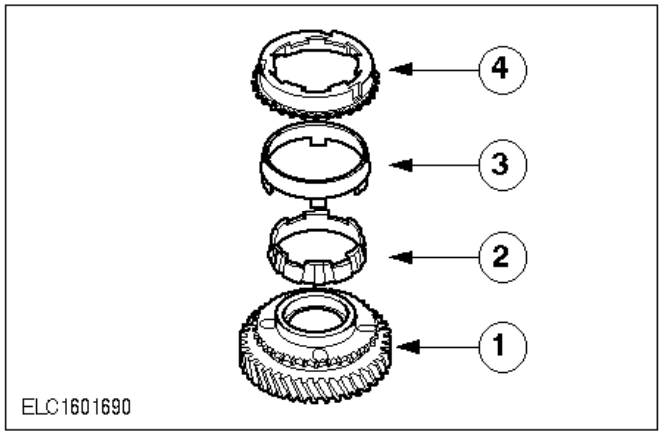
51. Fit the first gear wheel, together with the synchroniser, on the output shaft.

1 Gear wheel
2 Inner synchroniser ring
3 Synchroniser cone
4 Outer synchroniser ring
5 1st/2nd gear synchroniser with reverse gear wheel.
6 Circlip



52. Fit the second gear wheel, together with the synchroniser, on the output shaft.

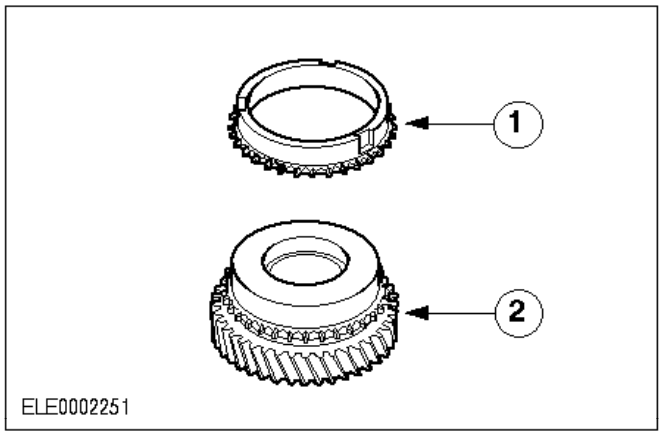
1 Outer synchroniser ring
2 Synchroniser cone
3 Inner synchroniser ring
4 Gear wheel
5 Half ring circlips
6 Closed retaining ring



Note:
Double synchroniser is shown, will be used if servicing work is carried out.

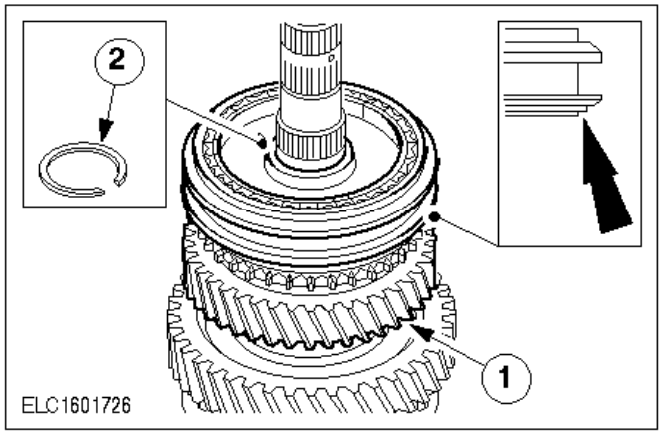
53. Assemble the third gear synchroniser.

1 Gear wheel
2 Inner synchroniser ring
3 Synchroniser cone
4 Outer synchroniser ring



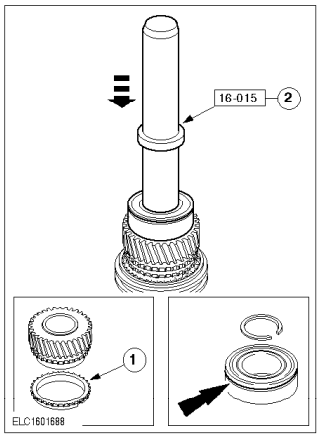
54. Place on the third gear synchroniser ring.

    1 Synchroniser ring
    2 3rd gear wheel



55. Fit the third gear synchroniser.

    Note:
    Selector ring with the annular groove facing downwards and the small collar of the hub facing upwards.
    1 Fit the complete gear synchroniser together with the third gear wheel.
    2 Fit the circlip.

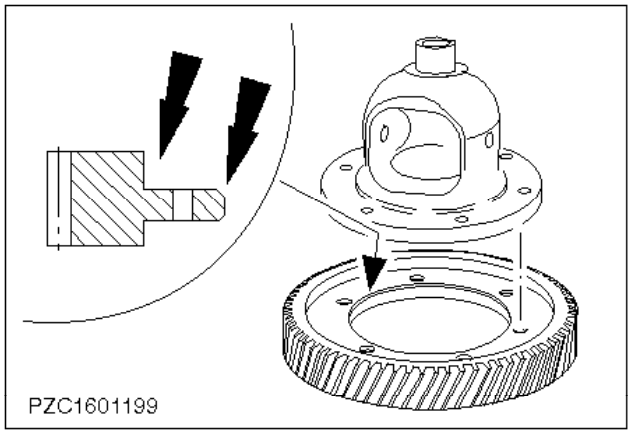


56. Fit the fourth gear wheel and the ball bearing.

    1 Fit the synchroniser ring with the fourth gear wheel.

    Note:

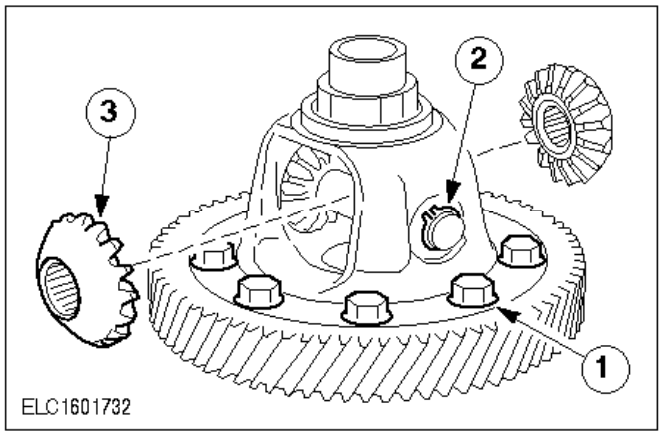
Fit with the annular groove facing upwards.
2 Press on the bearing.
Fit the circlip.



Assemble differential

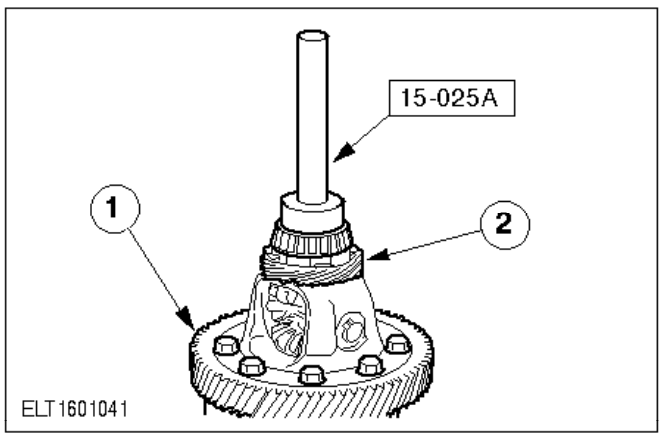
Note:
The crown wheel is asymmetrical. Fit the crown wheel with the larger shoulder and chamfer facing the differential cage.

57. Place on the differential case.



58. Install the differential pinion wheels.

1 Pull the crown wheel evenly home using the old bolts.
Place the plastic thrust washers and both pinions in their installation positions.
2 Drive in the shaft and secure it in position.
3 Insert the pinions and turn them 905 in the differential case.



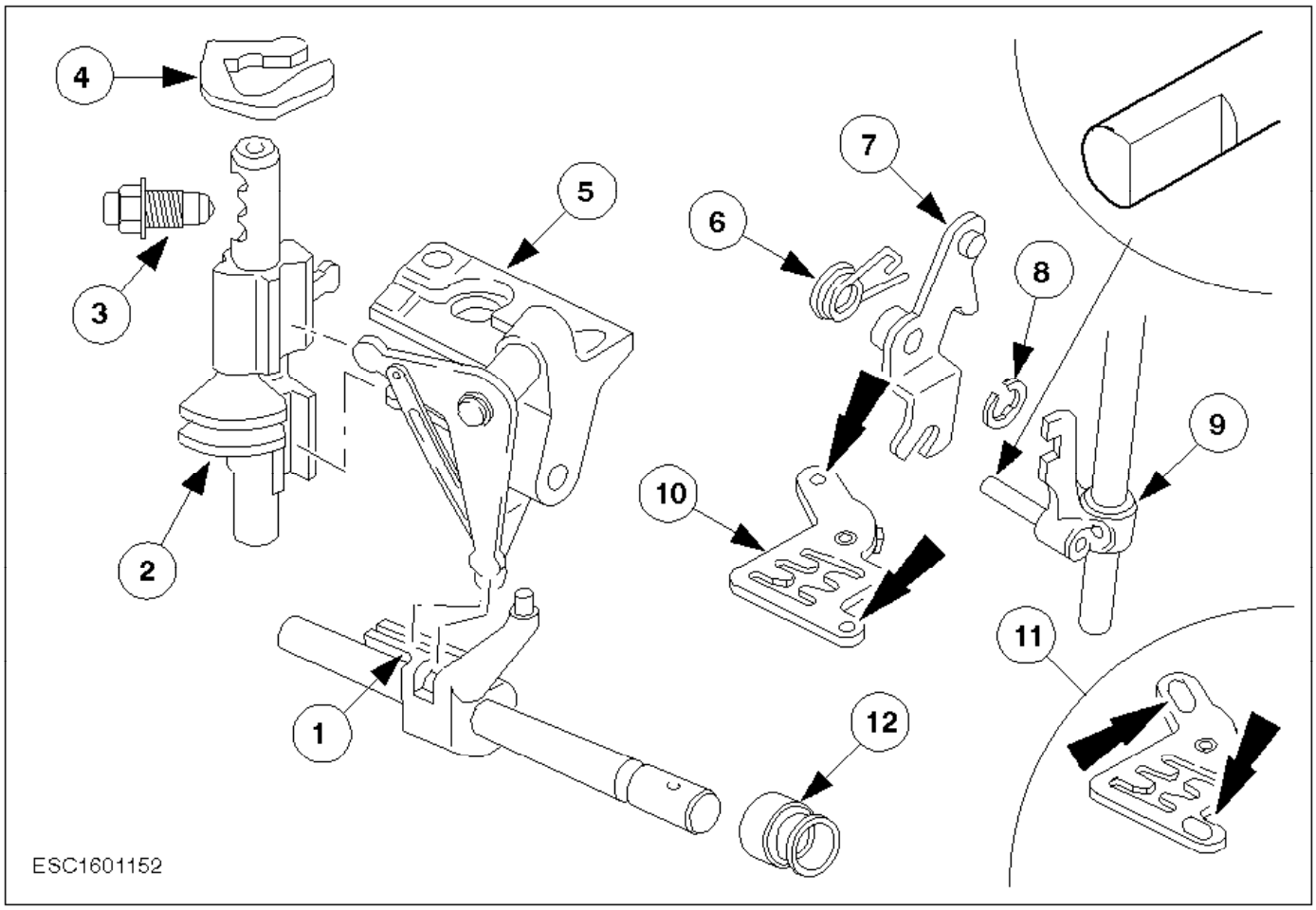
59. Fit the taper roller bearing and tighten the crown wheel.

CAUTION:
Different tightening torque for the crown wheel. Crown wheel with eight bolts - 85 Nm, crown wheel with six bolts - 115 Nm.

1 Tighten the crown wheel with new bolts (eight bolts).
2 Locate the worm wheel in the recesses.

Note:
Do not support the assembly on the lower taper roller bearing.

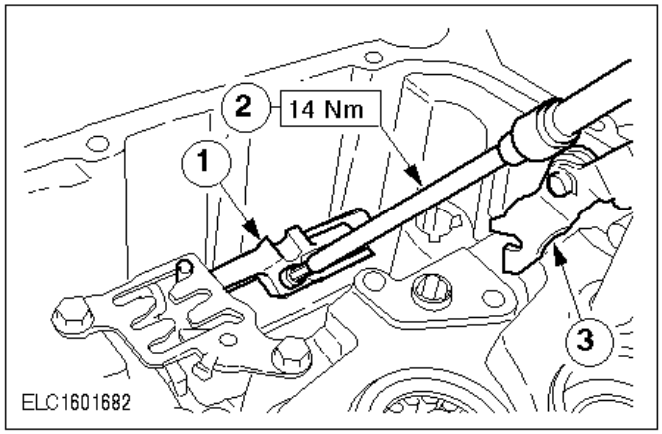
3 Drive on the two taper roller bearings.



Layout of internal gearshift mechanism

Item	Description
1	Main selector shaft with selector block
2	Auxiliary selector shaft
3	Auxiliary selector shaft detent mechanism
4	Shift locking plate
5	Mounting bracket with relay levers
6	Return spring (reverse gear shift lever)
7	Shift lever (reverse gear)

8	Circlip
9	Selector shaft (fifth/reverse gear)
10	Selector gate (service type)
11	Selector gate (production type)
12	Selector shaft oil seal

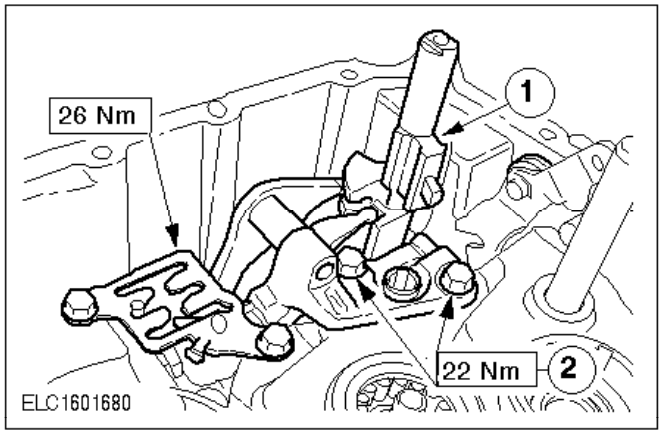


Install internal gearshift mechanism

60. Install the selector shaft and the reverse gear shift lever.

    1 Fit the selector block.
    Insert the selector shaft.

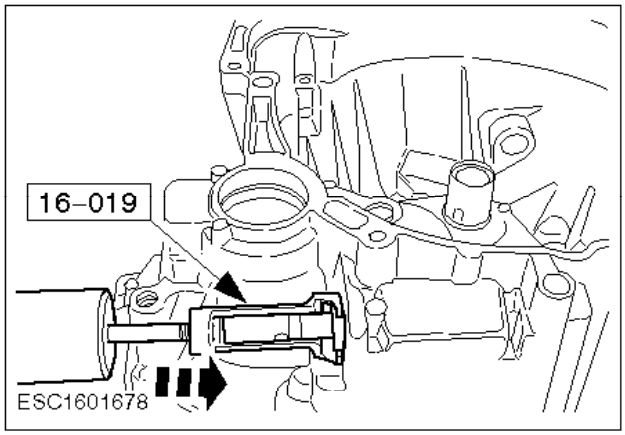
    Note:
    Smear the bolt with thread-locking compound before fitting it.
    2 Coat bolt with universal sealer (Hylomar) and screw in.
    3 Install the shift lever and spring and fit the circlip.



CAUTION:
The gate is adjusted in production. If the gate is undone or moved, it must be replaced with a service gate.

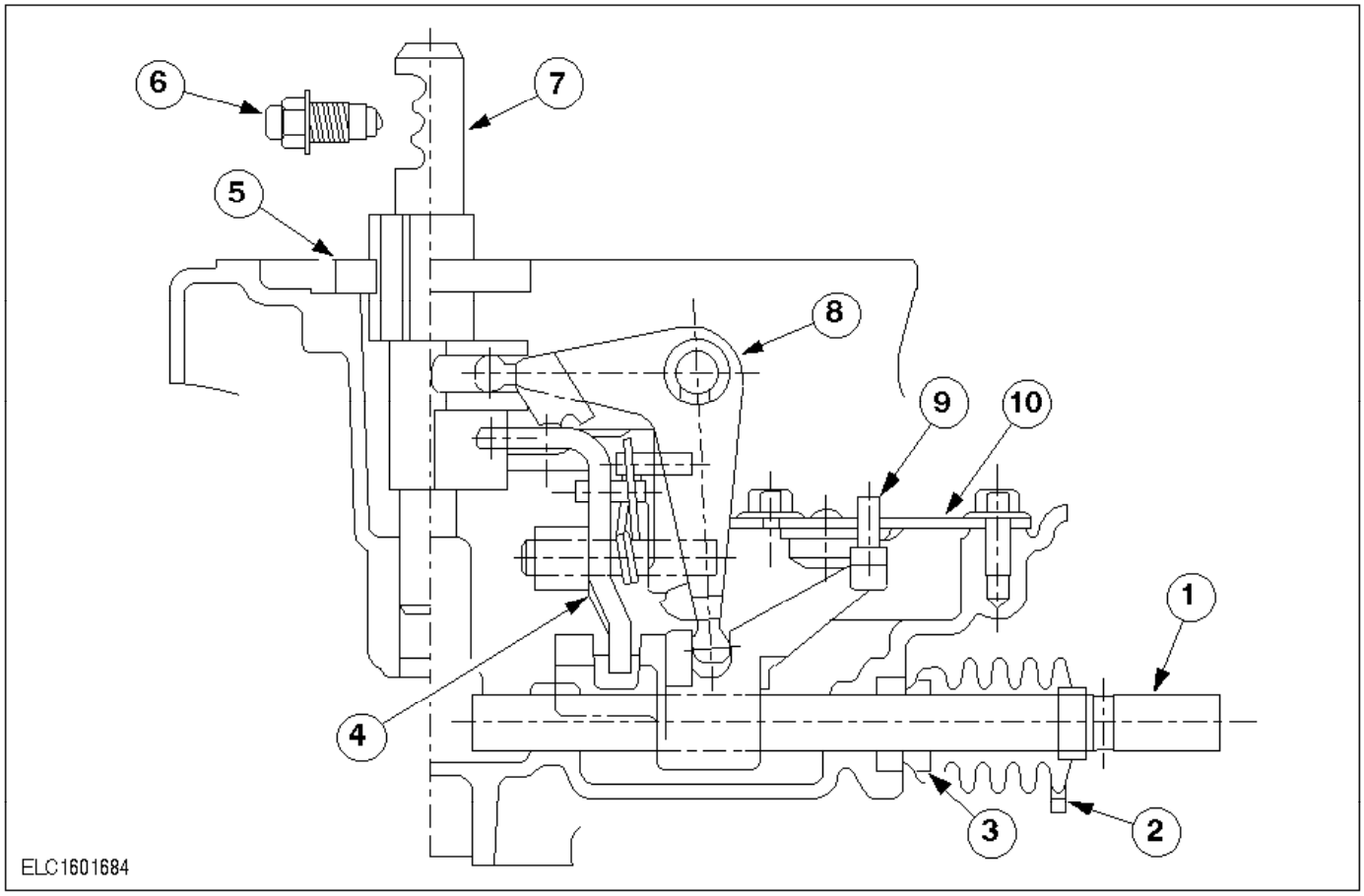
61. Install the auxiliary selector shaft.

    1 Insert the auxiliary selector shaft together with the relay levers.
    2 Tighten the bolts of the relay lever retaining plate.



62. Fit the selector shaft oil seal.

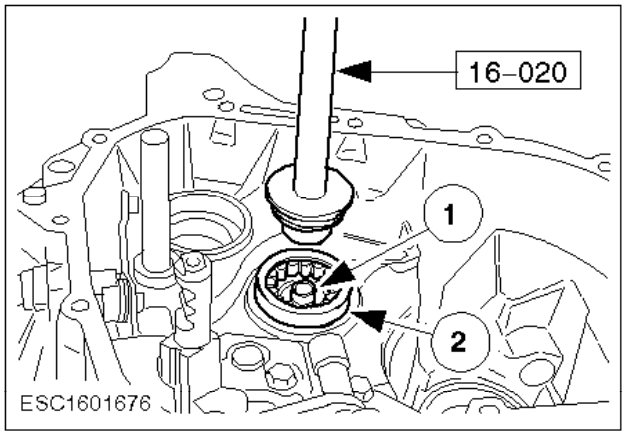
    Fit the gaiter.



Internal gearshift mechanism in position

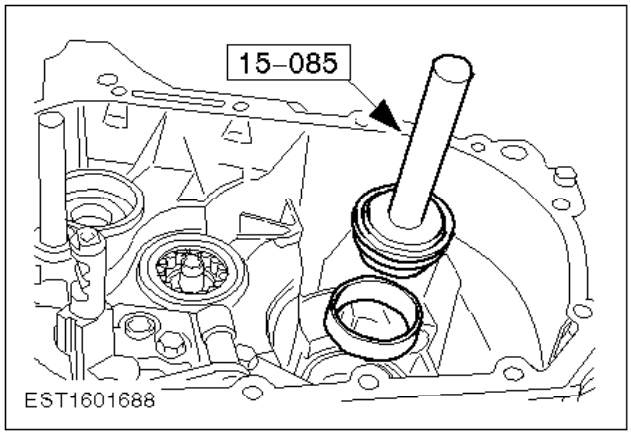
Item	Description
1	Selector shaft
2	Gaiter (vent pointing downwards)
3	Selector shaft oil seal
4	Relay lever (shift)
5	Shift locking plate
6	Detent mechanism

7	Auxiliary selector shaft
8	Relay lever (shift)
9	Selector block
10	Selector gate (adjusted in production)

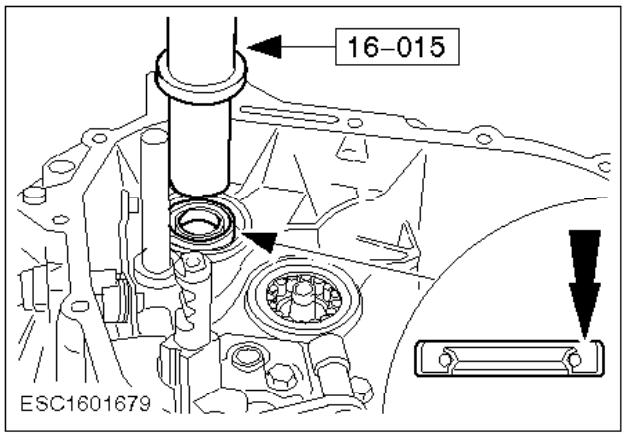


63. Fit the output shaft roller bearing

1 Fit the oil slinger.
2 Drive in the roller bearing as far as the stop.

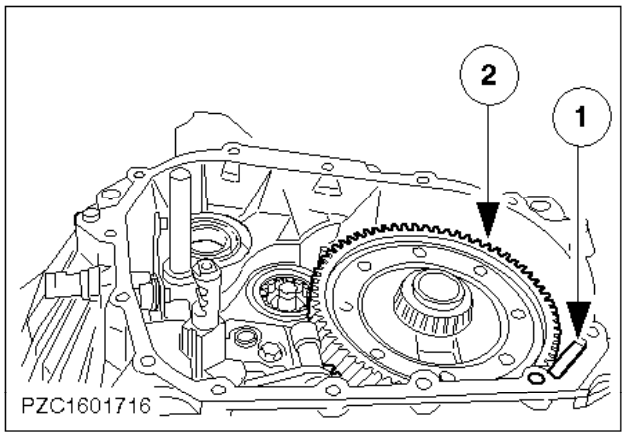


64. Drive in the differential bearing ring.



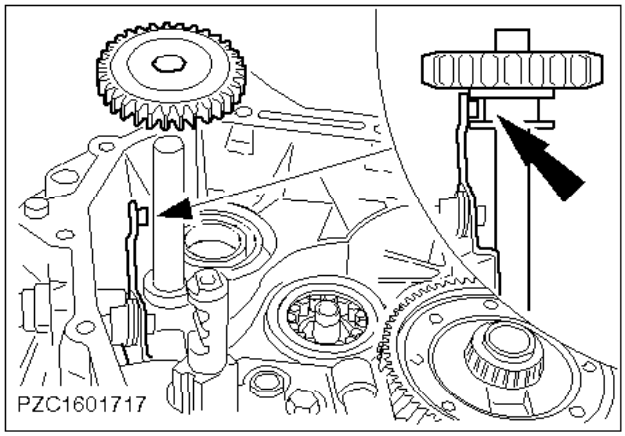
Note:
Install the oil seal with the open side facing upwards.

65. Install the input shaft oil seal.



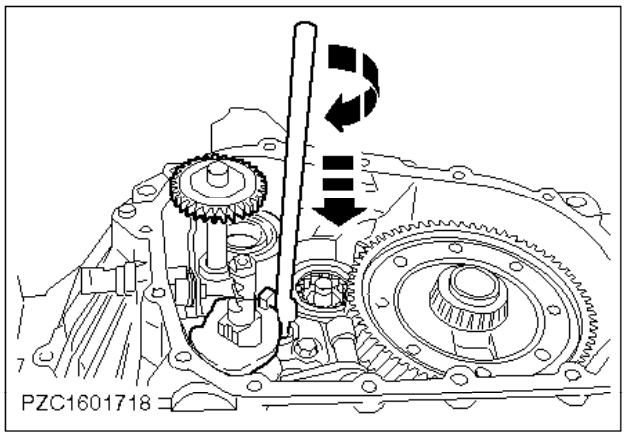
66. Fit the differential and the permanent magnet.

1 Permanent magnet
2 Differential

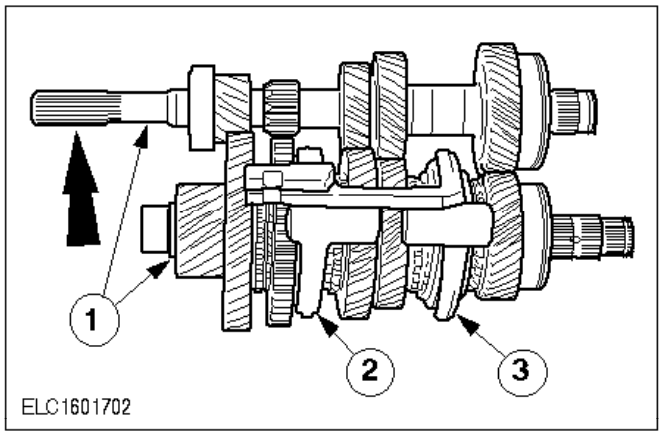


Note:
Position.

67. Fit the reverse gear idler.

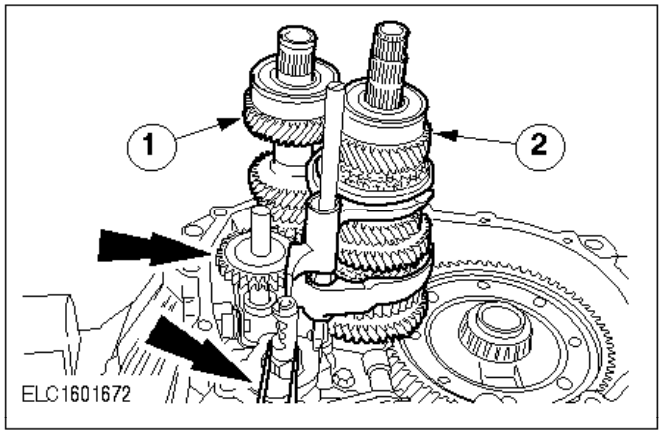


68. Fit the selector shaft with the locking plate.



69. Prepare the input and output shafts for installation.

1 Bring the input shaft and output shaft into mesh with one another.
2 Fit the first/second gear selector fork.
3 Fit the third/fourth gear selector fork.



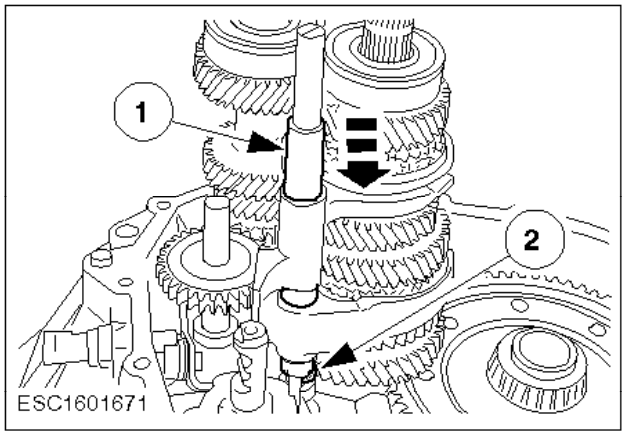
70. Install the input and output shafts.

- Attach a rubber band to the auxiliary selector shaft as an aid to assembly.

1 Insert the input shaft approximately 50 mm and swivel it slightly to one side.
2 Insert the output shaft until it is level with the input shaft and bring the gear teeth into mesh again.

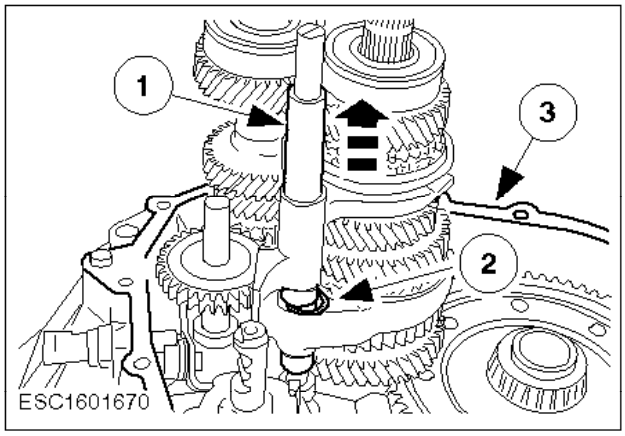
Note:
Position of reverse gear idler.

- Bring the shafts into position together.



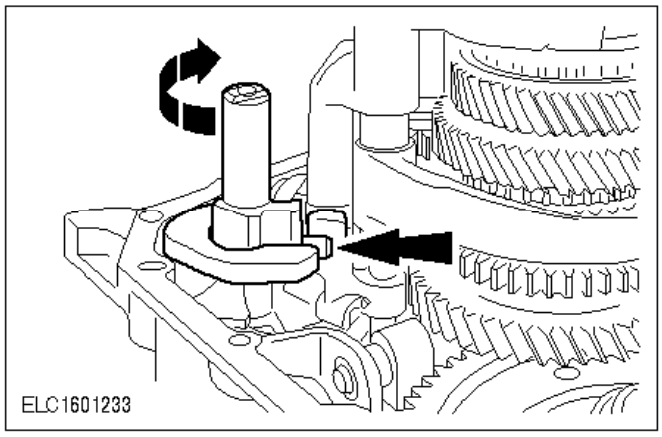
71. Fit the selector shaft guide sleeve.

1 Slide in the guide sleeve.
2 Fit the lower circlip.



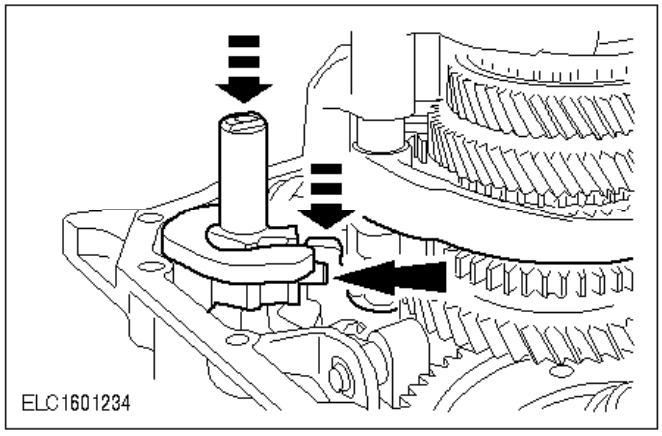
72. Fit the upper circlip of the selector shaft guide sleeve.

1 Raise the guide sleeve.
2 Fit the circlip.
3 Fit the housing gasket or carefully clean the sealing surface.



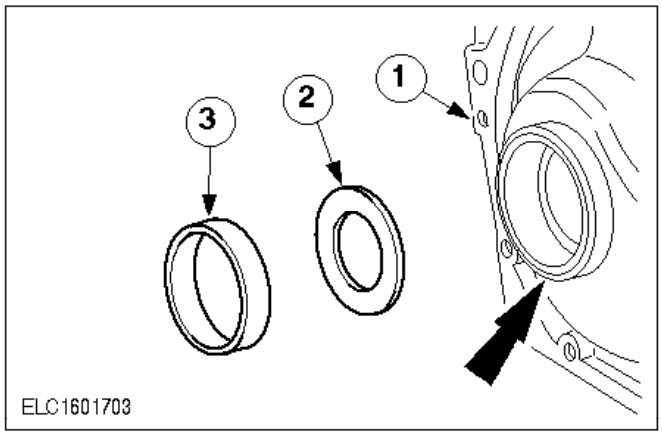
73. Engage fifth gear using the internal shift mechanism.

Turn the auxiliary selection shaft clockwise until the shift path for reverse/fifth gear is reached.



74. Engage fifth gear using the internal shift mechanism (continued).

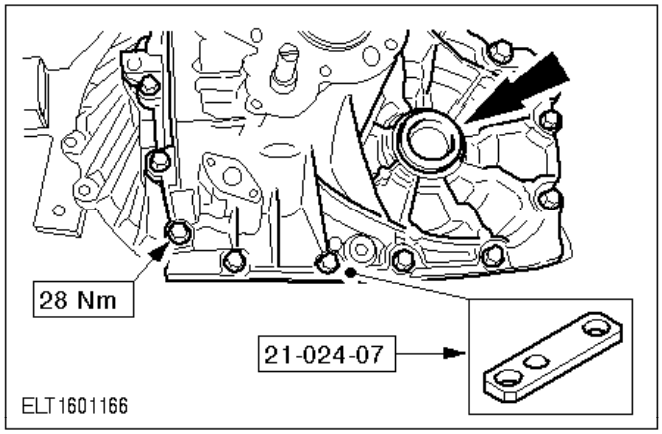
Press the auxiliary shaft and shift rod down together.



Measure the differential shim

75. Install the measuring shim and the bearing ring.

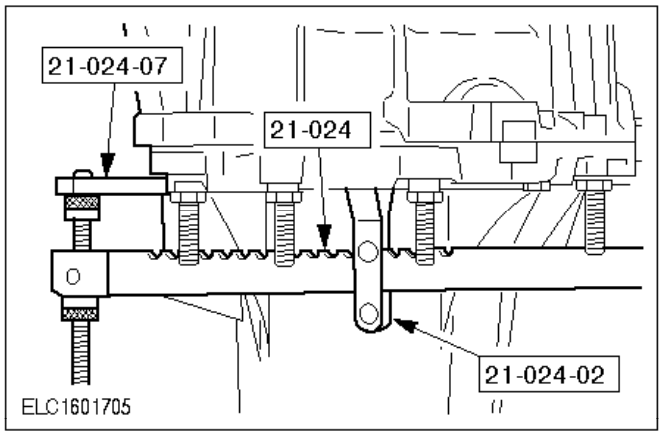
    1 Transmission housing
    2 Measuring shim (3,8 mm thick)
    3 Bearing ring
    Prevent the bearing ring from dropping out by staking the housing edge.



CAUTION:
On transmissions without liquid gaskets, the housing gasket must be installed for the following measuring procedure.

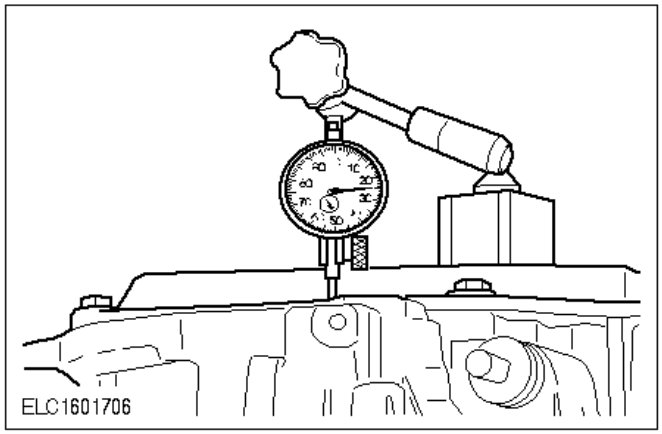
76. Fit the transmission housing.

    Note:
    Fit the Special Tool and the longer bolt. Fit the auxiliary plug.
    - Tighten all the housing bolts.
    - Turn the transmission through 180 degrees.



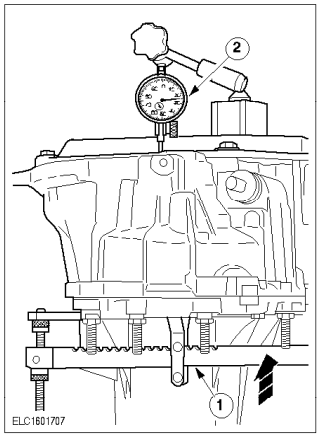
77. Fit the Special Tools.

    Remove the assembly plug.



78. Prepare the differential for measuring.

- Rotate the differential at least 10 revolutions to settle the bearings.
- Set up the dial indicator gauge and set it to zero.



79. Measure the differential end float.

    1 Lift the differential.
    2 Read off the measurement.

    Note:
    Carry out the previous steps three times and calculate the average measurement.

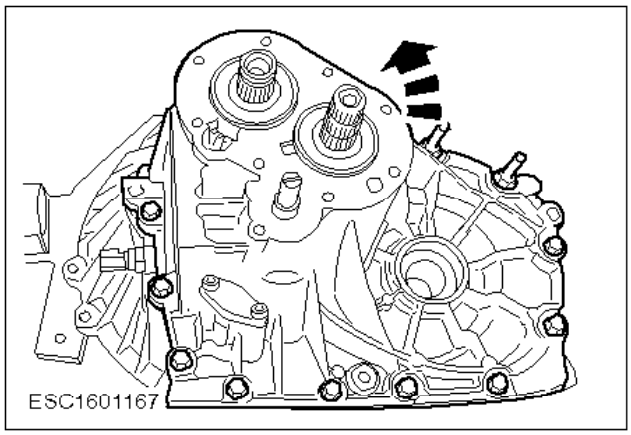
- Example:
- First measurement 0,73 mm
- Second measurement 0,76 mm

- Third measurement 0,72 mm

Note:
The shim thickness should be rounded down up to 0,05 mm and rounded up from 0,06 mm.
- The shims are available in thicknesses from 0,1 mm - 1,1 mm in increments of 0,1 mm.
- Continue with the next step.

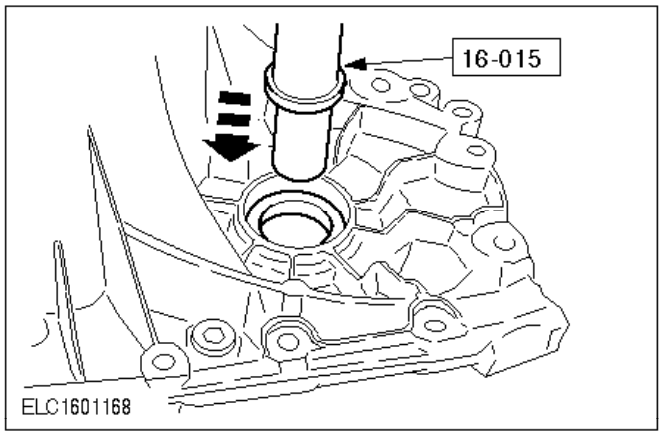
80. Calculate the adjusting shim to be fitted.

- 0,74 mm = calculated average value
- + 3,80 mm for measuring shim
- + 0,14 mm for bearing preload
- 4,86 mm = subtotal
- - 4,42 mm = thickness of spring washers
- 0,56 mm = calculated shim thickness
- Thickness of shim to be fitted: 0,30 mm

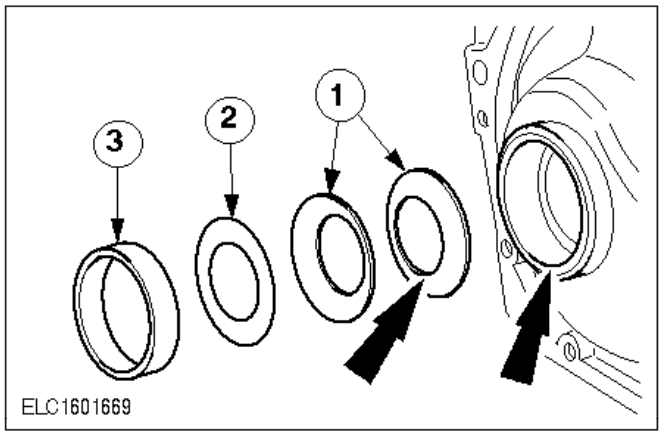


81. Detach the transmission housing again.

- Insert the upper assembly plug.
- Turn the transmission through 180º.
- Detach the dial gauge and valve spring compressor.

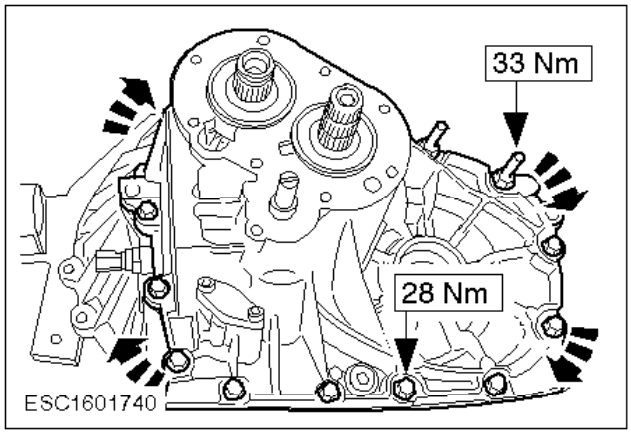


82. Remove the bearing ring with the measuring shim.



83. Fit the spring (Belleville) washers, required shim and outer bearing ring.

Note:
The spring (Belleville) washers are fitted with the inside diameters facing one another.
1 Spring (Belleville) washers
2 Required shim
3 Outer bearing ring
Prevent the bearing ring from falling out by staking the housing edge.

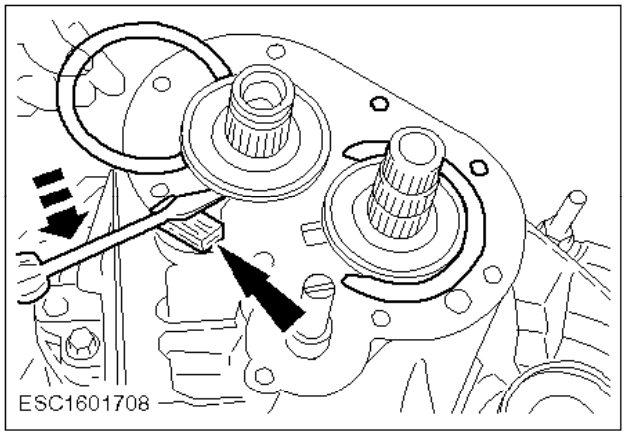


Note:
Position of housing gasket.

Note:
Use the specified liquid gasket (WSK-M2G348-A5) on transmissions that have a black end cover.

Note:
Tighten the studs to 33 Nm.

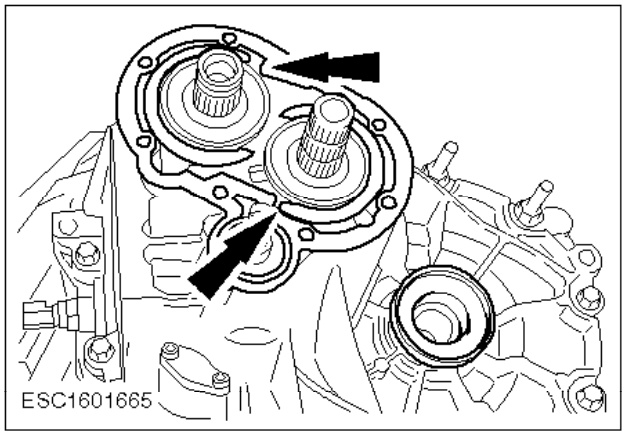
84. Fit the transmission housing and tighten evenly.



Note:
Insert the circlips so that they lie in the recesses of the gasket (see the following step).

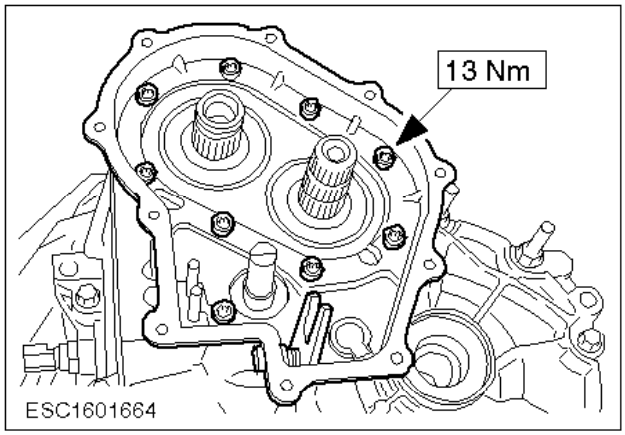
Note:
Use a support.

85. Fit the circlips of the input shaft and output shaft.

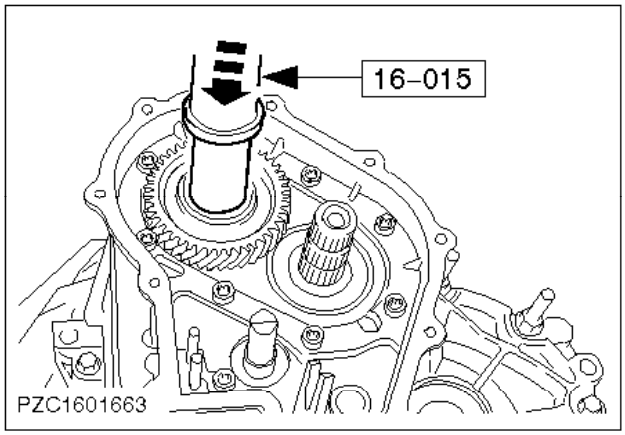


86. Fit the gasket.

Fit the auxiliary plug.



87. Fit the fifth gear housing.



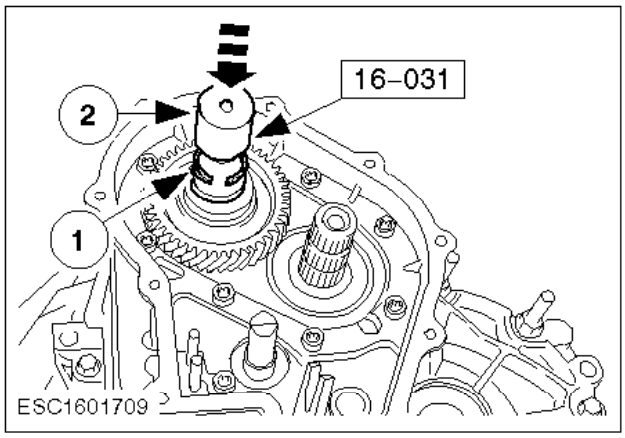
CAUTION:

Detach the transmission from the assembly stand and carry out the following operation on the press.

88. Support the input shaft clutch splines on the press.

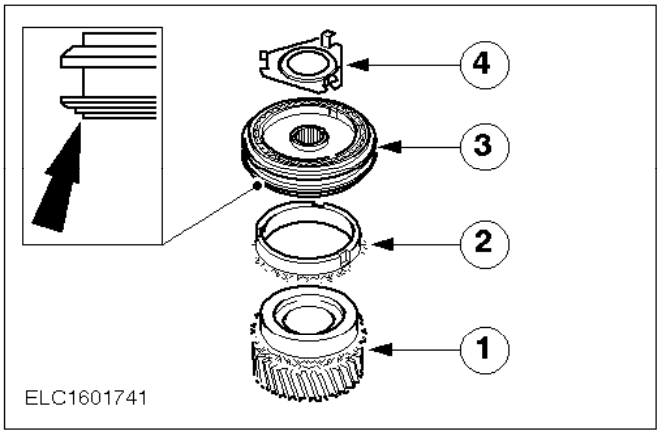
Note:
The transmission housing must not rest on the press table.

89. Press the fifth gear driving gear onto the input shaft.



90. Fit the circlip of the fifth gear wheel.

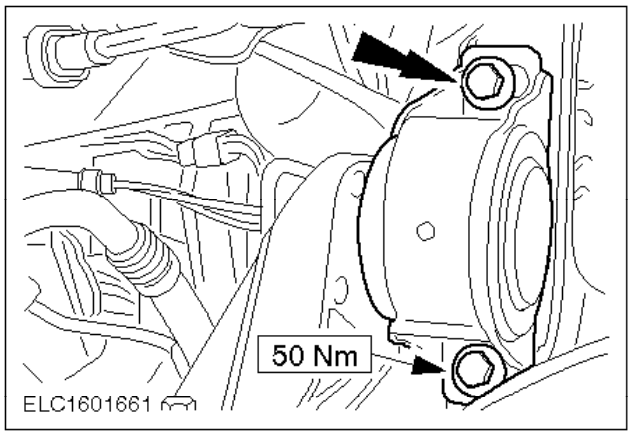
1 Fit the circlip on the Special Tool.
2 Fit the Special Tool and drive on the circlip.



91. Layout and installation sequence of the fifth gear wheel

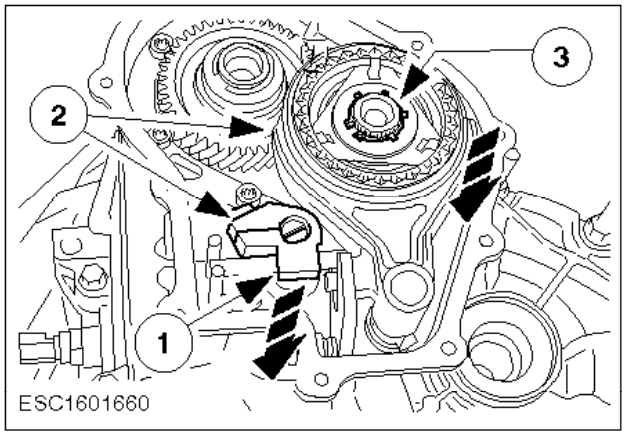
Note:
Installation position of gear synchroniser.

1 5th gear wheel
2 Synchroniser ring
3 Gear synchroniser
4 Retaining plate



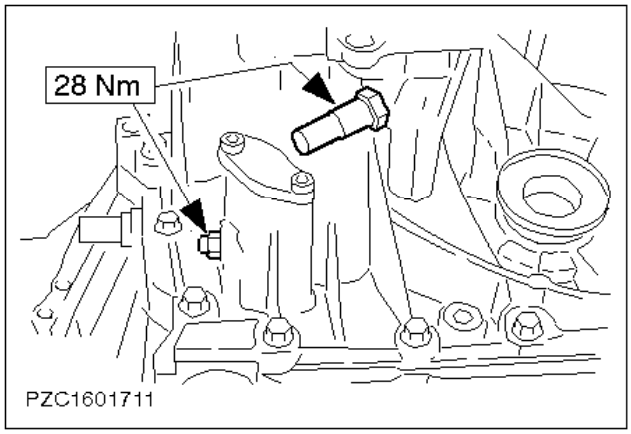
92. Install the fifth gear synchroniser together with the selector fork.

1 Swivel the lever upwards.
2 Slide the synchroniser down until the fork reaches the lever.



93. Fit the selector finger.

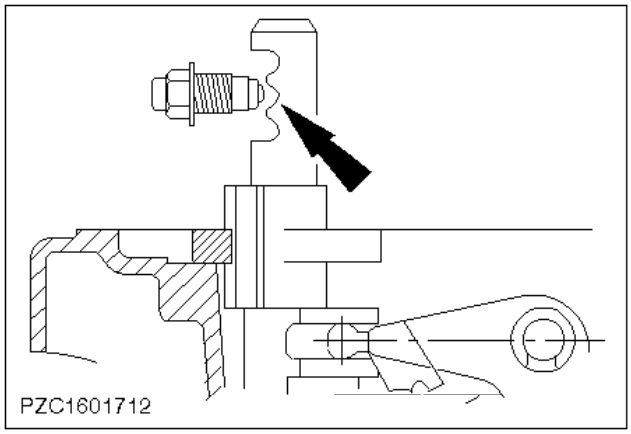
1 Insert the selector finger.
2 Bring the selector finger and synchroniser into position together.
3 Fit the circlip.



CAUTION:
For fitting position, see following step.

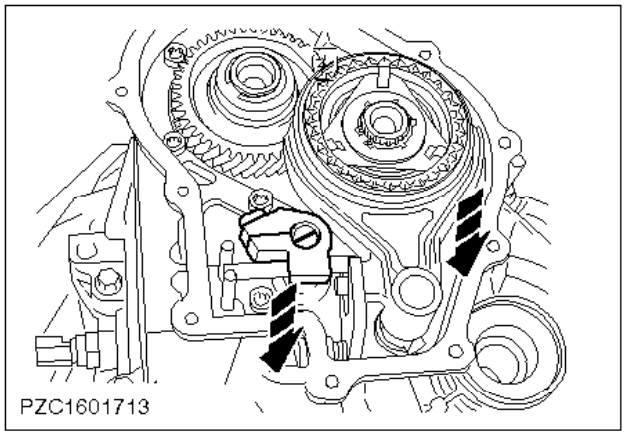
94. Fit the detent mechanisms.

- Put the transmission into neutral.
- Coat the thread with sealer (ESEE-M4G1008-A).



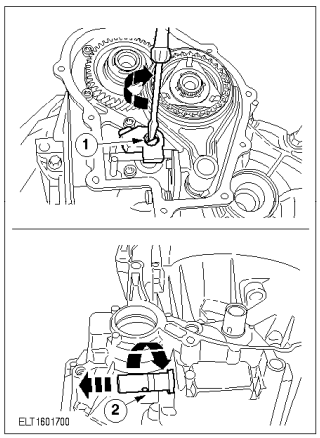
Note:
Only fit in the neutral position.

95. Fitting position of auxiliary selector shaft detent mechanism.



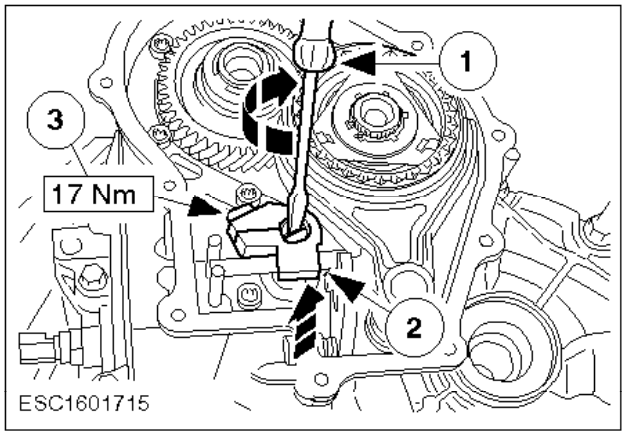
96. Engage fifth gear.

Press the selector fork and selector finger down together.



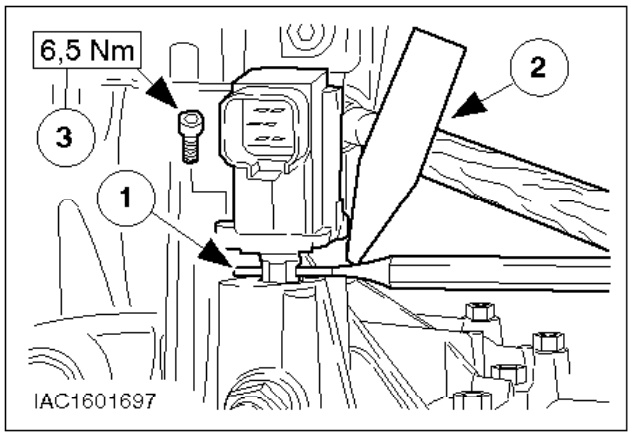
97. Engage fifth gear (continued).

1 Turn the fifth gear selector shaft clockwise as far as the stop.
2 Turn the main selector shaft clockwise as far as the stop and pull it out.



98. Adjust the selector finger.

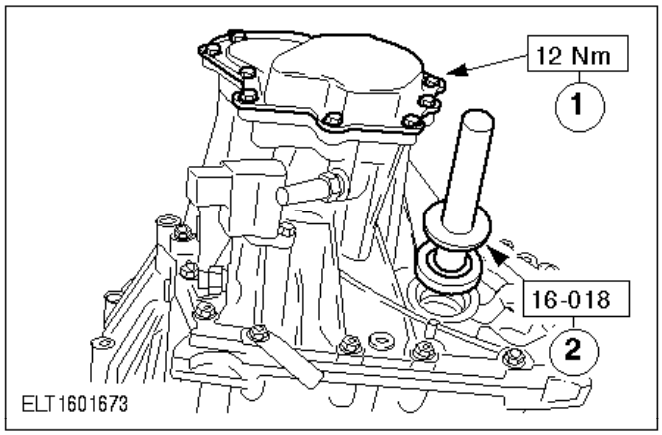
1 Turn the main selector shaft clockwise and press it down.
2 Lift to remove any selector finger end float.
3 Tighten the clamp bolt in this position.



CAUTION:
Follow the steps exactly, otherwise the multifunction switch will be destroyed.

99. Install the multifunction switch.

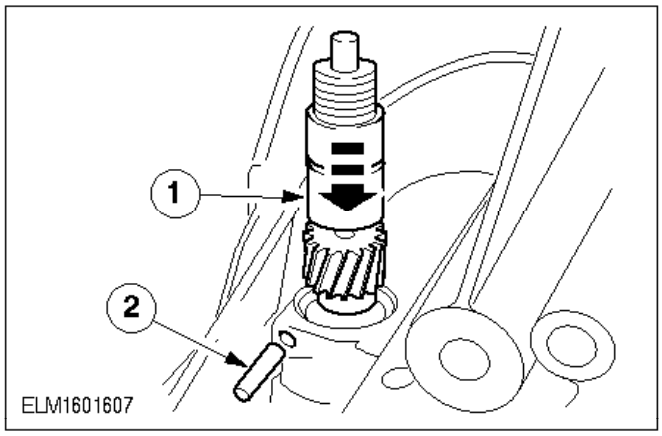
Select fourth gear (from neutral, push the selector shaft in as far as it will go).
1 Insert the pin punch (ø 4mm) into the assembly hole and position the switch.
2 Carefully tap the pin punch to drive the multifunction switch into position on the auxiliary selector shaft until it engages.
3 Tighten the multi-function switch.



Note:
Use the specified liquid gasket (WSE-M4G323-A4) on transmissions with a black end cover.

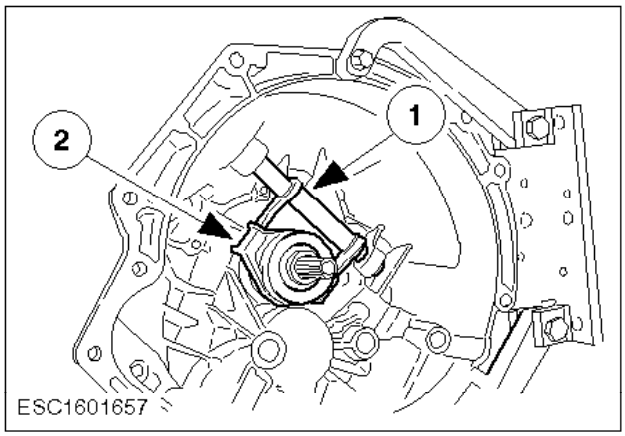
100. Fit the end cover and the oil seal.

1 Fit the end cover with the gasket.
2 Drive the driveshaft oil seals in until they are felt to be home.
Fit the auxiliary plug.



101. Install the speedometer drive.

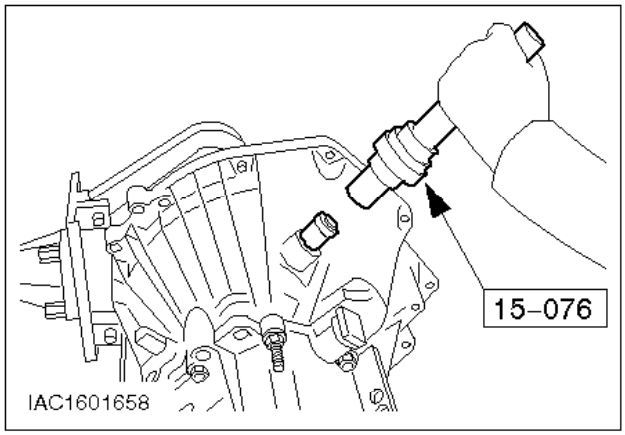
1 Put the speedometer drive in place with the sleeve.
2 Drive in the notched pin using a hammer.



102. Fit the thrust bearing.

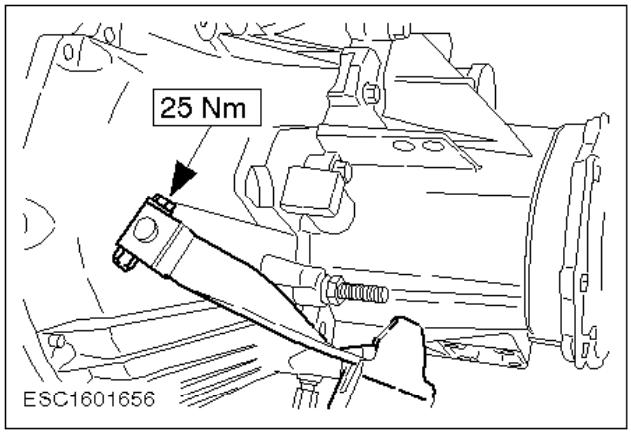
Lightly coat the steel bush and input shaft clutch splines with high temperature grease (ESDM-1C220-A).
1 Install the release shaft.

2 Hook the thrust bearing in place and move it into the correct position ready for assembly.



103. Drive the release shaft bearing bush into position.

Fit the gaiter.



104. Install the clutch release lever.
105. Detach the transmission from the assembly stand.