

## QR515MHF TRANSMISSION

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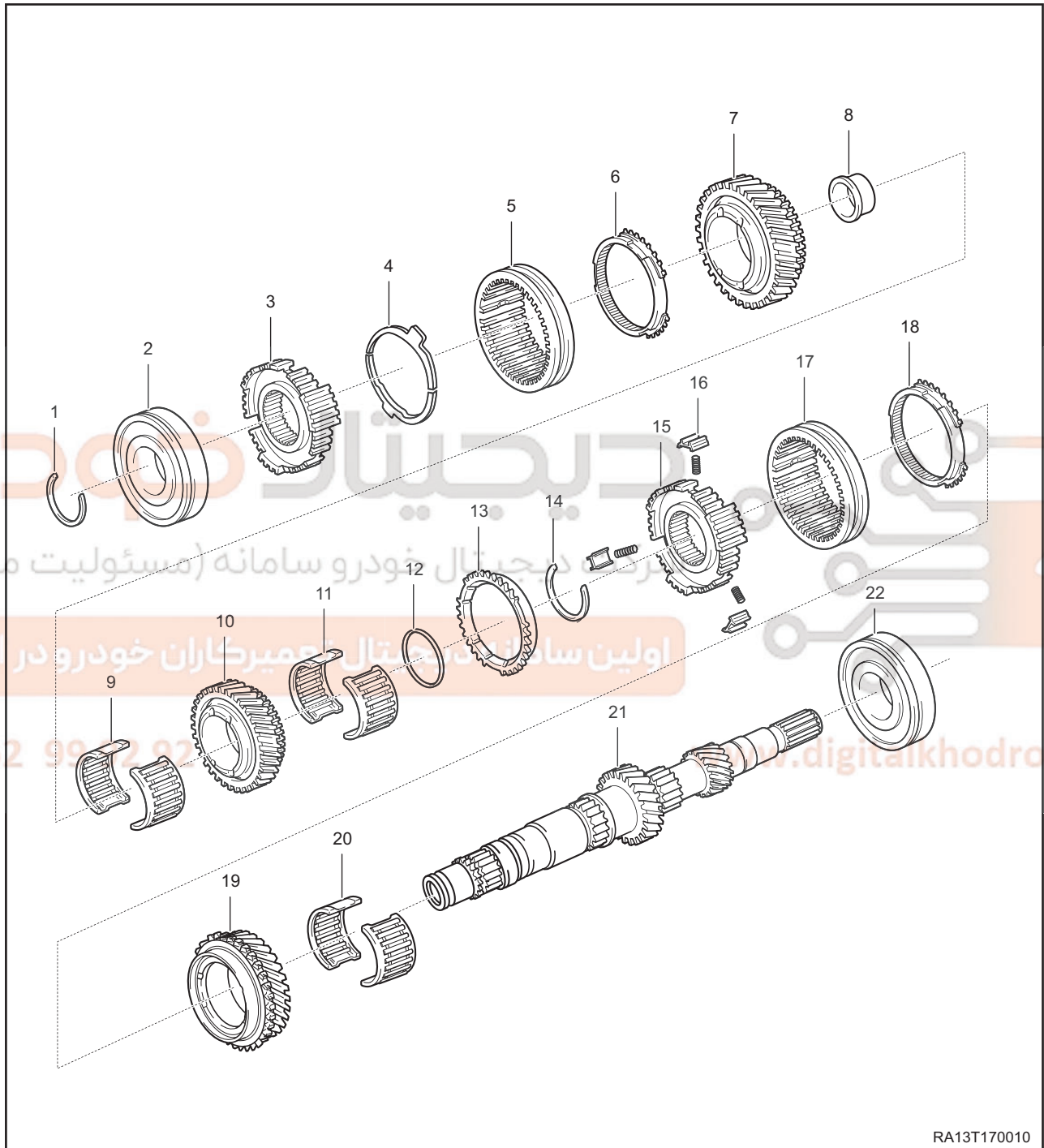
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# GENERAL INFORMATION

## Description

### Input Shaft



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1 - Input Shaft Rear Snap Ring	2 - Input Shaft Rear Bearing
3 - 5th Synchronizer Gear Hub	4 - 5th Synchronizer Meshing Plate
5 - 5th Synchronizer Gear Hub Outer Race	6 - 5th Synchronizer Ring
7 - 5th Drive Gear	8 - 5th Gear Shaft Bushing
9 - 5th Needle Roller Bearing	10 - 4th Drive Gear
11 - 4th Needle Roller Bearing	12 - 4th Gear Gasket
13 - 4th Synchronizer Ring	14 - Snap Ring
15 - 3rd-4th Synchronizer Gear Hub	16 - 3rd-4th Synchronizer Meshing Key and Spring
17 - 3rd-4th Synchronizer Outer Race	18 - 3rd Synchronizer Ring
19 - 3rd Drive Gear	20 - 3rd Needle Roller Bearing
21 - Input Shaft	22 - Input Shaft Front Bearing

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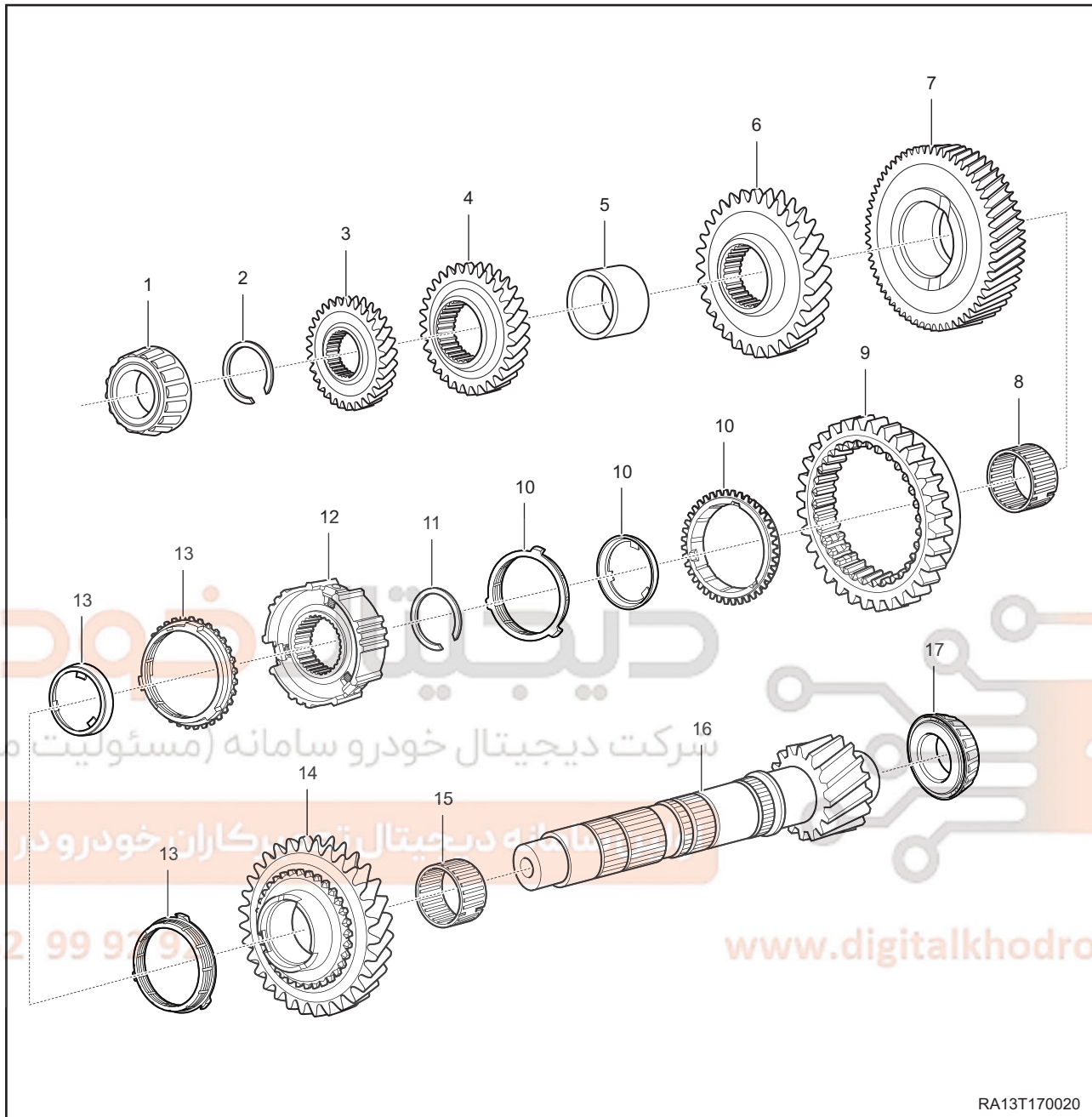


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Output Shaft

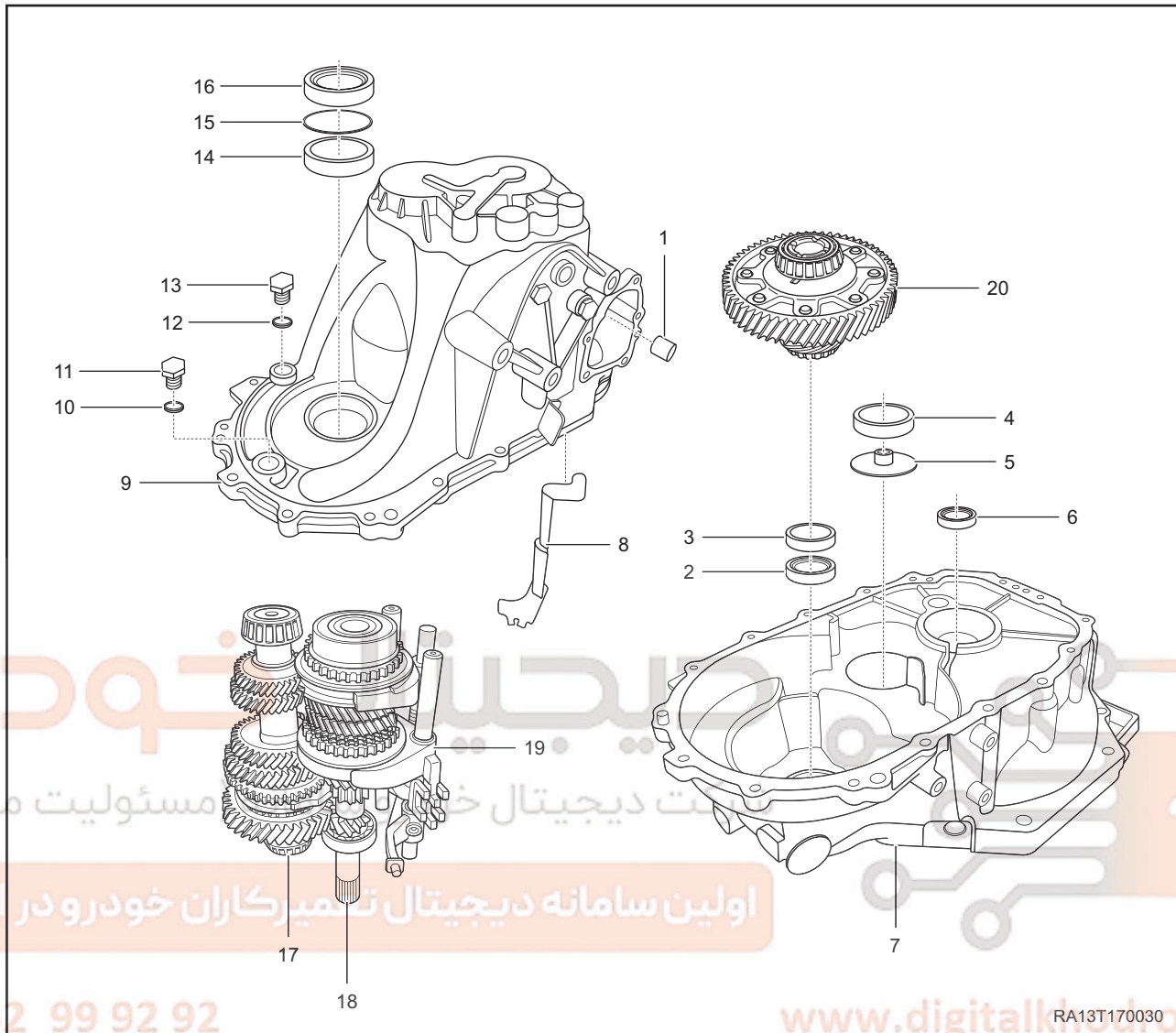


RA13T170020

1 - Output Shaft Rear Bearing	2 - Snap Ring
3 - 5th Driven Gear	4 - 4th Driven Gear
5 - Gear Shaft Bushing	6 - 3rd Driven Gear
7 - 2nd Driven Gear	8 - 2nd Needle Roller Bearing
9 - 1st-2nd Synchronizer Outer Race	10 - Synchronizer Ring Set
11 - Snap Ring	12 - 1st-2nd Synchronizer Gear Hub
13 - Synchronizer Ring Set	14 - 1st Driven Gear
15 - 1st Needle Roller Bearing	16 - Output Shaft
17 - Output Shaft Front Bearing	

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Transmission and Clutch Cases



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1 - Linear Bearing	2 - Differential Oil Seal
3 - Bearing Outer Race	4 - Bearing Outer Race
5 - Oil Deflector	6 - Input Shaft Oil Seal
7 - Clutch Case	8 - Oil Guide
9 - Transmission Case	10 - Washer
11 - Transmission Retaining Plug	12 - Washer
13 - Drain Plug	14 - Bearing Outer Race
15 - Adjusting Washer	16 - Differential Oil Seal
17 - Output Shaft Assembly	18 - Input Shaft Assembly
19 - Shift Fork Assembly	20 - Differential Assembly

## Operation

This transmission has five forward gears and one reverse gear, which is achieved by three sets of synchronizers and two shafts (input shaft and output shaft). All forward gears use conventional engagement, and reverse gear uses a sliding idler gear device. 1st-2nd synchronizer is installed on output shaft and 3rd-4th and 5th synchronizers are installed on input shaft. Transmission will engage with its corresponding gear hub separately when it is shifted to each different gear position, thus realizing the power transmission. Drive gear of final drive, which is on output shaft, rotates driven gear of final drive and differential assembly, thus propeller shaft is driven to turn wheels.

## Specifications

### Torque Specifications

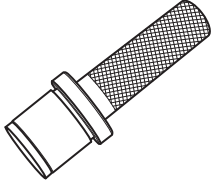
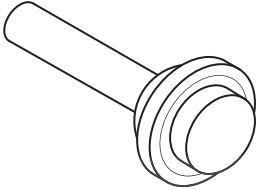

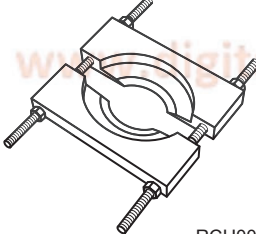
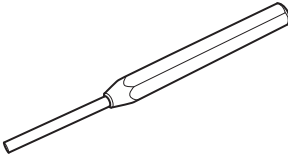
Description	Torque (N·m)
Coupling Bolt Between Clutch Case and Transmission Case	25 ± 2
Reverse Idler Gear Shaft Locating Bolt	40 ± 4
Coupling Bolt Between Gear Shift Mechanism and Transmission Case	25 ± 2
Gear Shift Mechanism Locating Bolt	35 ± 5.25
Back-up Light Switch Assembly	20 ± 2
Gear Locking Bolt	35 ± 5.25
Gear Shift Control Mechanism Fixing Bolt	23 ± 2
Drain/Retaining Plug	40 ± 6
Gear Shift Arm Bracket Bolt	25 ± 2
Reverse Gear Lock Mechanism Fixing Bolt	18 ± 2
Reverse Gear Fork Fixing Bolt	25 ± 2
Transmission Lower Coupling Bolt	50 ± 5
Transmission Upper Coupling Bolt	60 ± 5
Engine Side Coupling Bolt	60 ± 5
Reverse Gear Lock Mechanism Fixing Bolt	18 ± 2

### QR515MHF Transmission Gear Ratio

Type	QR515MHF
1st	3.545
2nd	2.050
3rd	1.346
4th	0.969
5th	0.725
Reverse	3.364
Final Drive Ratio	4.500

**Tools**

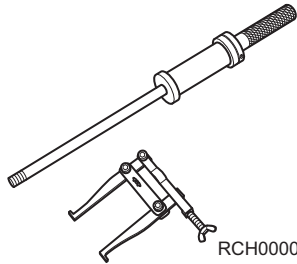
**Special Tools**

<p>Input Shaft Oil Seal Installer</p>	 <p>RCH0000008</p>
<p>Differential Oil Seal Installer</p>	 <p>RCH0000009</p>
<p>Installer Joint</p>	 <p>RCH0000010</p>
<p>Bearing Remover</p>	 <p>RCH0000011</p>
<p>Punch</p>	 <p>RCH0000015</p>

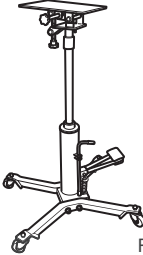
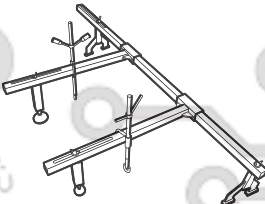
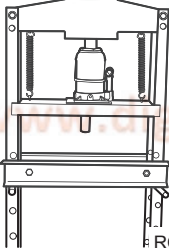
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<p>Puller</p>	 <p>RCH0000059</p>
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General Tools

<p>Transmission Carrier</p>	 <p>RCH0000005</p>
<p>Engine Equalizer</p>	 <p>RCH0000026</p>
<p>Hydraulic Press</p>	 <p>RCH0000012</p>

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## DIAGNOSIS & TESTING

### Problem Symptoms Table

Symptom	Possible Cause	See page
Noise	Oil level (too low)	17-13
	Oil grade (incorrect)	17-12
	Gear (worn or damaged)	17-41
	Bearing (worn or damaged)	17-41
	Gear thrust position and clearance (improper)	-
Oil leakage	Drain plug	17-13
	Drain plug washer	17-13
	Differential Oil Seal	17-15
	Joint surface subjected to impact and not trimmed in time	-
Hard shifting or impossible to shift	Oil level (too low)	17-13
	Shift cable (stuck or damaged)	-
	Clutch disengagement (incomplete)	-
	Gear (worn or damaged)	17-41
	Synchronizer ring (worn or damaged)	17-41
	Shift key spring (worn or damaged)	17-39
Jumps out of gear	Detent ball spring	-
	Shift fork (worn)	17-39
	Gear (worn or damaged)	17-41
	Bearing (worn or damaged)	17-41
Bearing is damaged irregularly	Lubricant (with metal impurities)	-
	Insufficient lubrication or lubricant not as specified	-
	Bearing (irregular)	-
Release fork makes a "click" sound when clutch pedal is depressed	Insufficient lubrication at joint surface between release fork and hydraulic sub cylinder or ball pin seat	-
No shift	Shift drive train (loose)	-
	Driver rocker arm (loose)	-



**CAUTION**

- To guarantee the service quality of transmission, perform operations carefully and keep each component clean.
- Select appropriate or special tools.
- Transmission can achieve a good operation condition only when strictly performing service according to technical requirements of assembly or adjustment.

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## 17 - QR515MHF TRANSMISSION

**On-vehicle Inspection****Transmission Oil****Check the transmission oil level.**

1. Raise vehicle with a lift.

**⚠ WARNING**

- Be sure to wear necessary safety equipment to prevent accidents.
- Check if safety lock of lift is locked when repairing or inspecting the lifted vehicle.

2. Remove transmission filler plug and washer.
3. Check that oil level is at the opening of retaining plug.

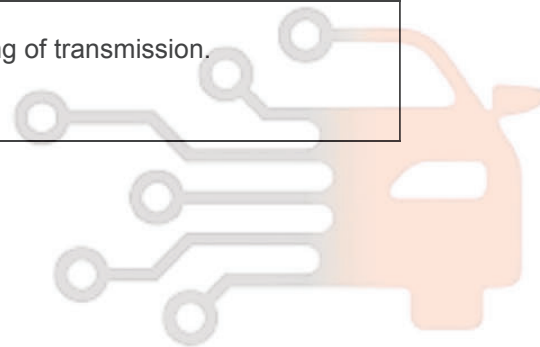
Transmission Oil Type	Viscosity	Standard Capacity
API GL	75W-90	2.3 L ± 0.1 L

**👁 CAUTION**

- An excessively large or small amount of oil may affect proper functioning of transmission.
- After filling oil, run vehicle and then check oil level.

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## ON-VEHICLE SERVICE

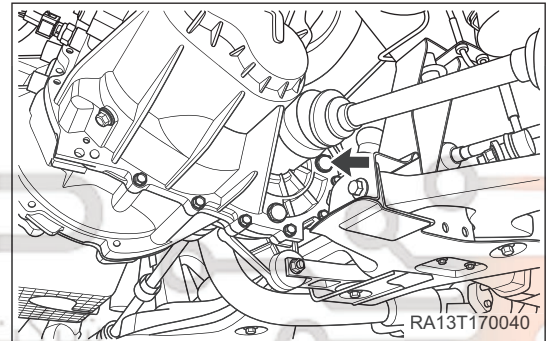
### Transmission Oil Replacement

#### CAUTION

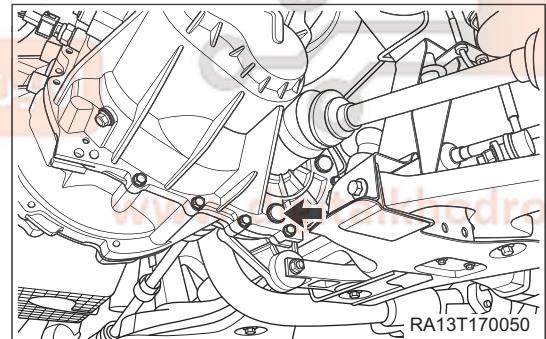
- Replace transmission oil only when engine stops and transmission cools down.
- Before installation, replace drain/retaining plug washer with a new one.

#### Draining

1. Turn off all electrical equipment and the ignition switch.
2. Raise the vehicle to a proper height.
3. Place a recovering container under transmission drain hole.
4. Using a wrench, loosen transmission oil filler plug (arrow).



5. Using a wrench, remove transmission drain plug (arrow). Replace drain plug washer and tighten drain plug after draining transmission oil.  
(Tightening torque:  $40 \pm 3 \text{ N}\cdot\text{m}$ )



#### ENVIRONMENTAL PROTECTION

- Drained transmission oil should be collected with a recovering container.

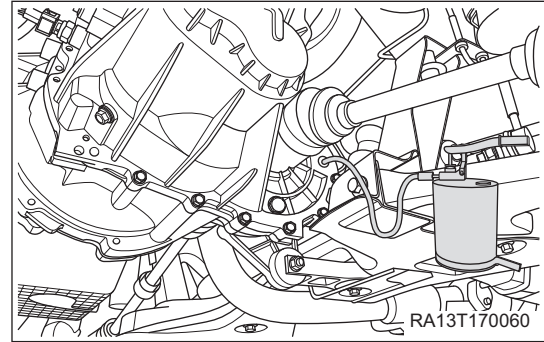
6. Fill transmission oil.
  - a. Make sure that transmission drain plug has been tightened in place.
  - b. Using a filling tool, fill transmission oil into transmission filler until it overflows.
  - c. Replace filler plug washer and tighten filler plug after filling.  
(Tightening torque:  $40 \pm 3 \text{ N}\cdot\text{m}$ )

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 CAUTION

- Only use transmission oil approved by Chery Automobile Co., Ltd.

7. Make sure that transmission drain plug has been tightened in place.
8. Using a filling tool, fill transmission oil into transmission filler until it overflows.



9. Replace filler plug washer and tighten filler plug after filling.  
(Tightening torque:  $40 \pm 3$  N·m)

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## Differential Oil Seal

### Removal

Use same procedures for right and left sides.

Procedures listed below are for left side.

1. Raise vehicle with a lift.

#### WARNING

- Be sure to wear necessary safety equipment to prevent accidents.
- Check if safety lock of lift is locked when repairing or inspecting the lifted vehicle.

2. Drain transmission oil.
  - a. Remove retaining plug and washer.
  - b. Remove drain plug and washer to drain transmission oil.

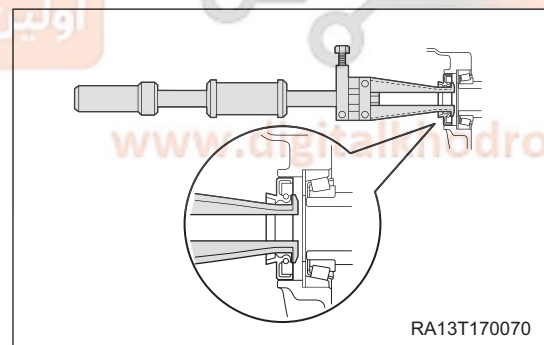
#### ENVIRONMENTAL PROTECTION

- Drained transmission oil should be collected with a recovering container.

- c. Install a new washer and drain plug.

(Tightening torque:  $40 \pm 6$  N·m)

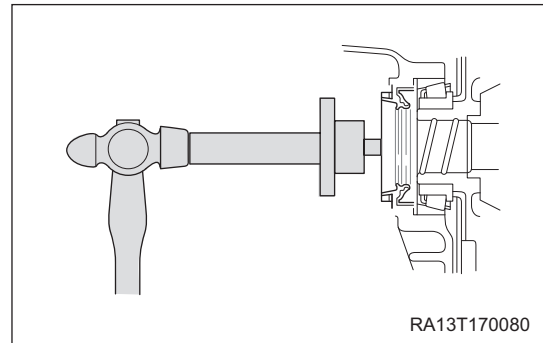
3. Remove the front left wheel (See page 24-7).
4. Remove the left drive shaft (See page 20-5).
5. Pull out oil seal with a puller.



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**Installation**

1. Apply an appropriate amount of transmission oil to lip of new oil seal.
2. Using a special tool and a hammer, tap in oil seal.

**CAUTION**

- DO NOT damage oil seal during installation.

3. Fill transmission oil.
4. Other procedures are in the reverse order of removal.

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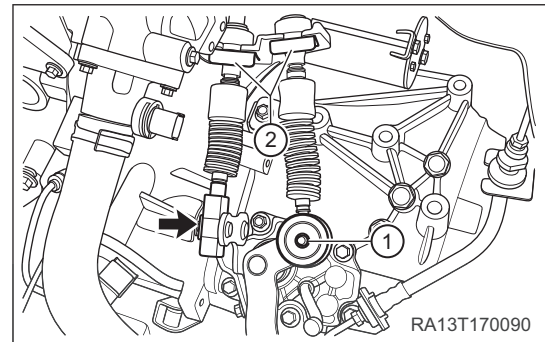
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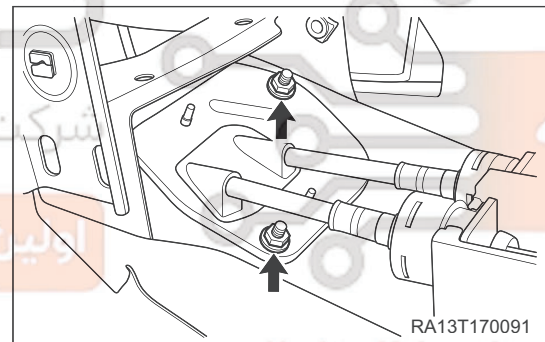
## Gear Select and Shift Cable

### Removal

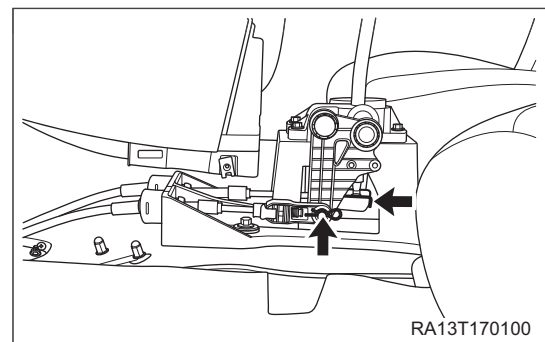
1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the battery (See page 16-7).
4. Remove the battery tray (See page 16-9).
5. Remove the air filter assembly (See page 10-10).
6. Disconnect gear select and shift cable from transmission.
  - a. Remove cotter pins (1) connecting gear select and shift cable with transmission gear shift mechanism.
  - b. Remove the flexible shaft clamps (2).



7. Remove the auxiliary fascia console (See page 46-8).
8. Remove fixing bolts (arrow) between gear select and shift cable and body.

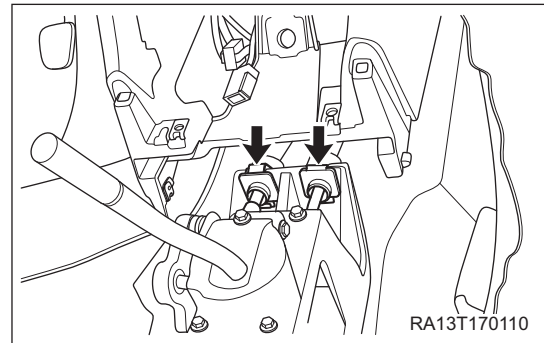


9. Disconnect gear select and shift cable from gear shift control mechanism.
  - a. Remove cotter pins (arrow) connecting gear select and shift cable with gear shift control mechanism.



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- b. Remove flexible shaft clamps (arrow) connecting gear select and shift cable with gear shift control mechanism.



10. Remove the gear select and shift cable.

### Installation

Installation is in the reverse order of removal.

**CAUTION**

- DO NOT install gear select and shift cable in reverse position during installation.

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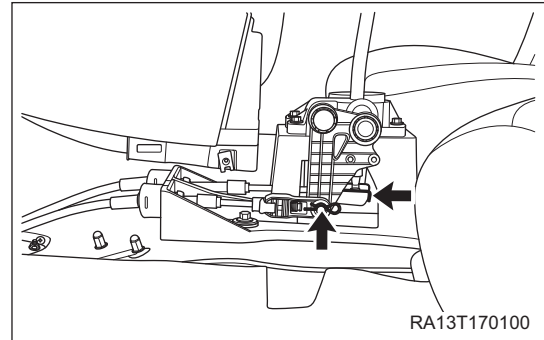
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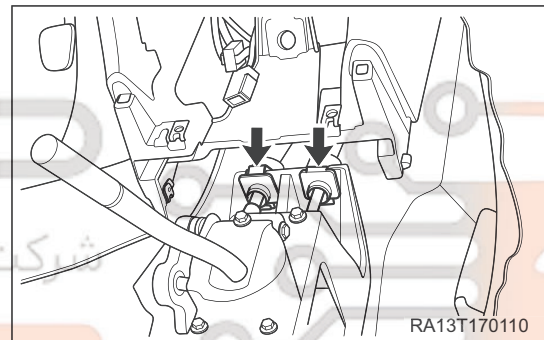
## Gear Shift Control Mechanism

### Removal

1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the auxiliary fascia console (See page 46-8).
4. Remove the gear shift control mechanism.
  - a. Remove cotter pins (arrow) connecting gear select and shift cable with gear shift control mechanism.

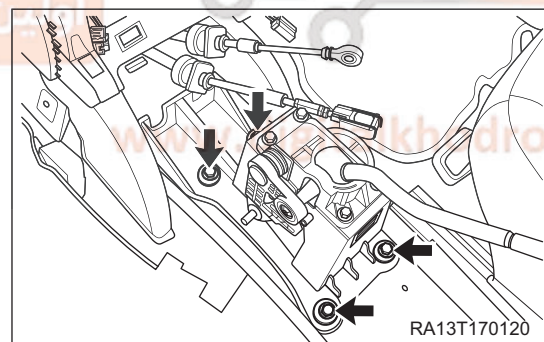


- b. Remove flexible shaft clamps (arrow) connecting gear select and shift cable with gear shift control mechanism.



- c. Remove 4 fixing bolts (arrow) from gear shift control mechanism, and remove gear shift control mechanism.

(Tightening torque:  $23 \pm 2$  N·m)



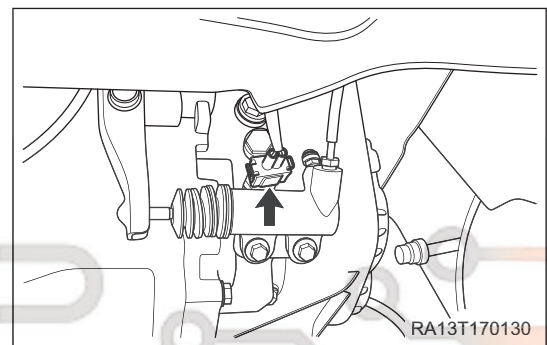
### Installation

Installation is in the reverse order of removal.

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**Transmission Assembly****Removal**

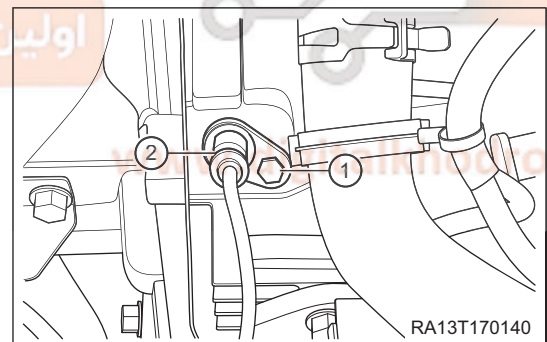
1. Turn off all electrical equipment and the ignition switch.
2. Disconnect the negative battery cable.
3. Remove the battery (See page 16-7).
4. Remove the battery tray (See page 16-9).
5. Remove the air filter assembly (See page 10-10).
6. Drain transmission oil (See page 17-13).
7. Remove the front wheels (See page 24-7).
8. Remove the drive shaft (See page 20-5).
9. Loosen the front exhaust pipe (See page 11-10).
10. Disconnect the back-up light switch connector (1).



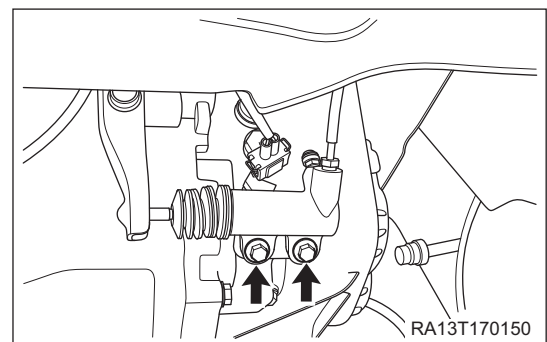
11. Remove flexible shaft clamps and cotter pins connecting gear select and shift cable with gear shift mechanism (See page 17-17).

12. Remove the crankshaft position sensor.

- a. Remove fixing bolt (1) from crankshaft position sensor and remove crankshaft position sensor (2).

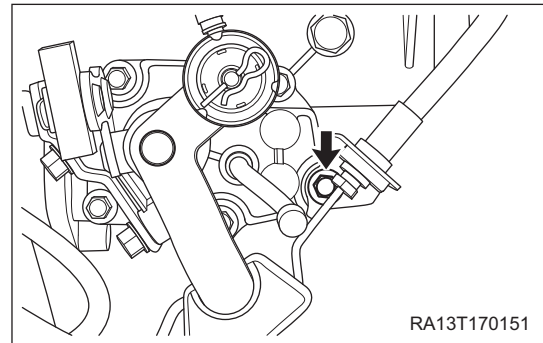


13. Remove 2 fixing bolts from clutch release cylinder, so that clutch release cylinder is separated from transmission.



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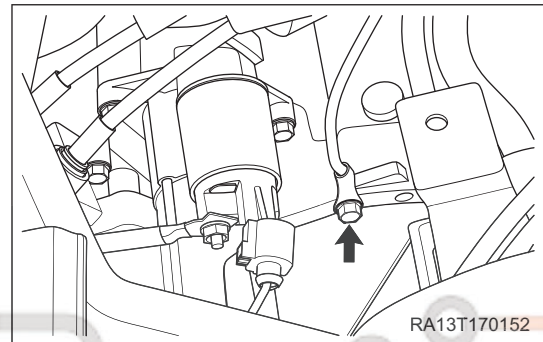
14. Remove 1 fixing bolt between clutch release cylinder hose and transmission case, so that clutch release cylinder hose is separated from transmission.



15. Use an engine equalizer to hang the engine.

16. Remove the left mounting (See page 07-53).

17. Remove the transmission negative ground wire harness.



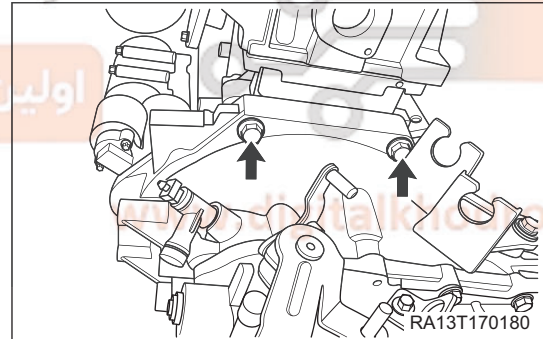
18. Remove the starter (See page 15-9).

19. Remove the front mounting (See page 07-54).

20. Remove the transmission.

a. Remove the transmission upper coupling bolts (arrow).

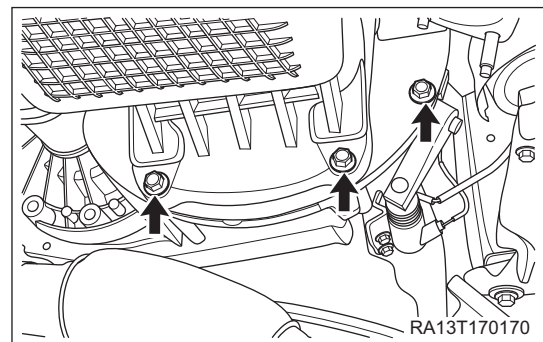
(Tightening torque:  $60 \pm 5$  N·m)



b. Raise vehicle and support transmission assembly with a transmission carrier.

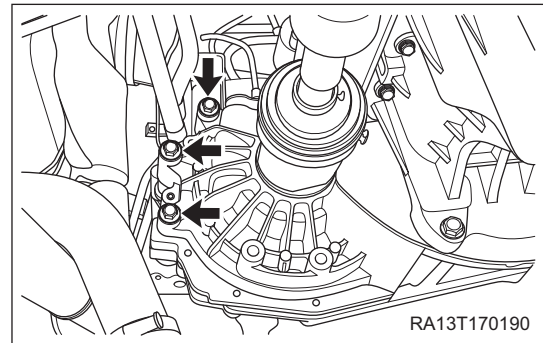
c. Remove transmission lower coupling bolts (arrow) and baffle plate.

(Tightening torque:  $50 \pm 5$  N·m)



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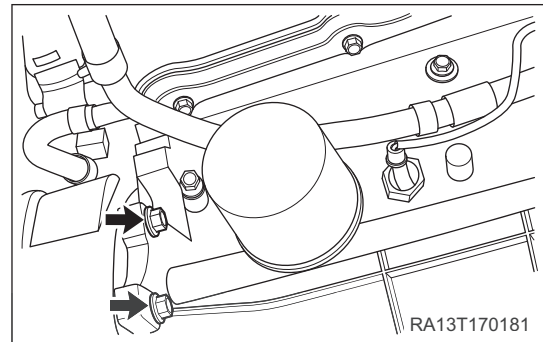
- d. Remove coupling bolts (arrow) between engine rear mounting and transmission side.



- e. Remove coupling bolt (arrow) between engine and rear side of transmission.

- f. Remove engine rear mounting, and pull transmission to separate it and engine.

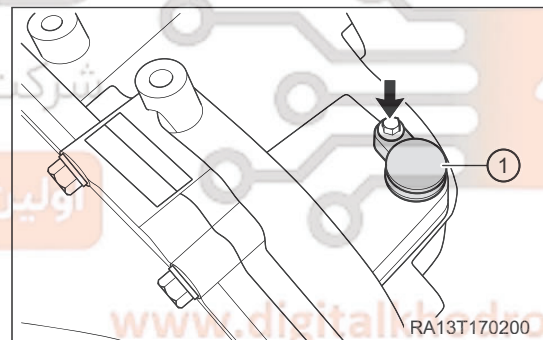
(Tightening torque:  $60 \pm 5$  N·m)



## Disassembly

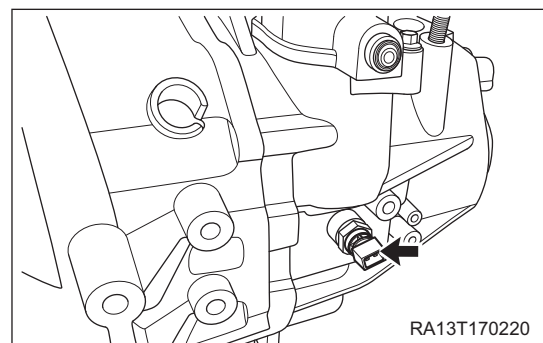
1. Remove the vehicle speed sensor cover.

- a. Remove vehicle speed sensor cover fixing bolt (arrow) and vehicle speed sensor cover (1).



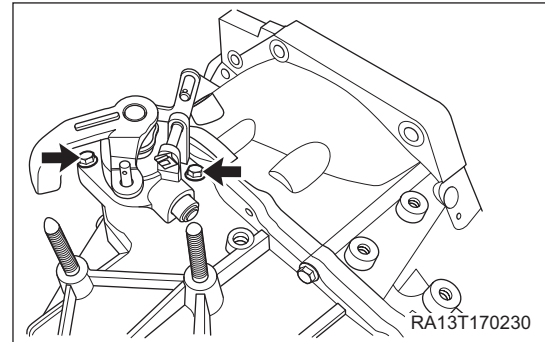
2. Remove the back-up light switch.

- a. Remove back-up light switch (arrow) from transmission.



## 17 - QR515MHF TRANSMISSION

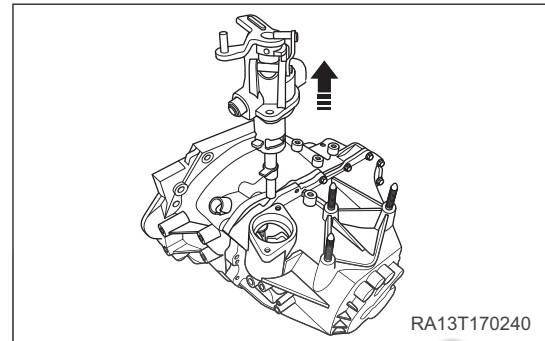
3. Remove the gear shift mechanism.
  - a. Remove the gear shift mechanism fixing bolts (arrow).



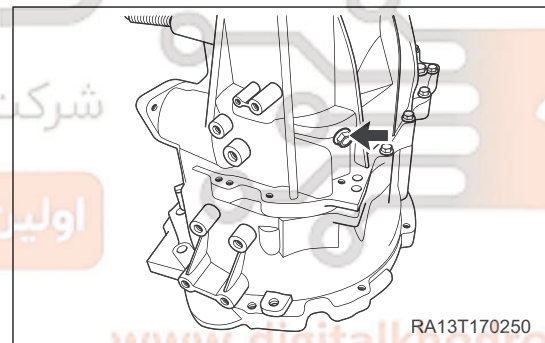
- b. Remove the gear shift mechanism.

**HINT:**

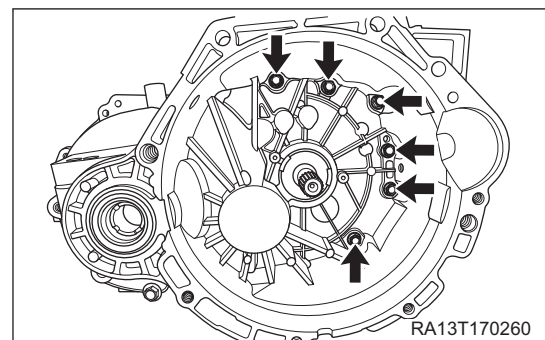
Tap the protrusion of gear shift mechanism with a rubber hammer if it is difficult to remove.



4. Remove the reverse idler gear shaft locating bolt.
  - a. Remove reverse idler gear shaft locating bolt (arrow) from transmission assembly.



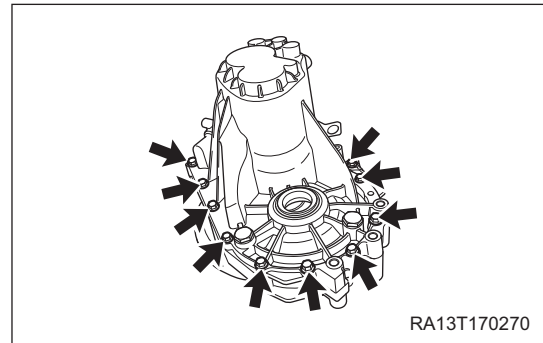
5. Remove the transmission case.
  - a. Remove clutch case fixing bolts (arrow) from transmission assembly.





## 17 - QR515MHF TRANSMISSION

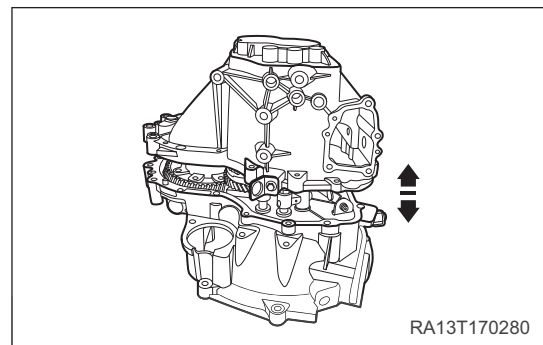
- b. Remove transmission case fixing bolts (arrow) from transmission assembly.



- c. Separate transmission case and clutch case, and remove transmission case.

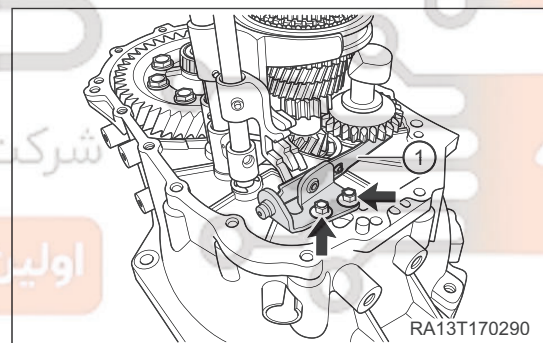
**HINT:**

Tap the protrusion of transmission case with a rubber hammer or equivalent for easy removal, as it may be difficult to remove because of seal gum.



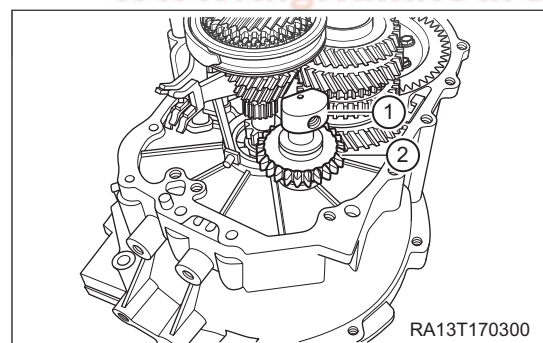
6. Remove the reverse gear fork.

- a. Remove reverse gear fork fixing bolts (arrow), and remove reverse gear fork (1).

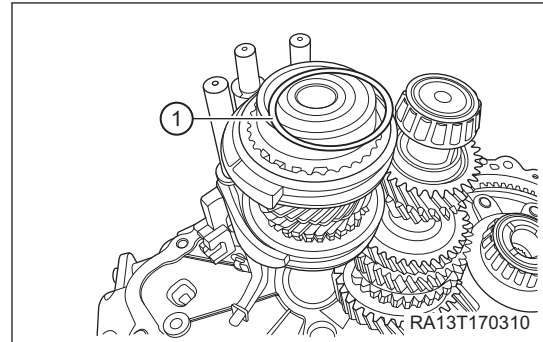


7. Remove reverse gear shaft and reverse gear.

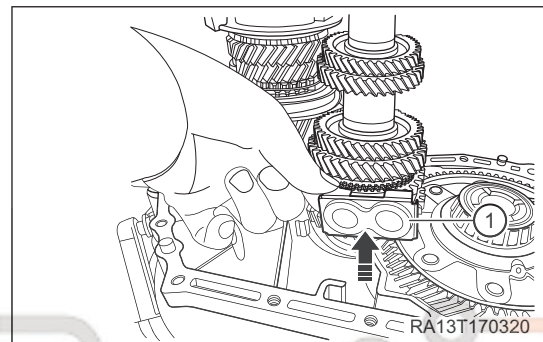
- a. Remove reverse gear shaft (1) and reverse gear (2) together from clutch case.



8. Remove the input shaft rear washer.
- a. Remove input shaft rear washer (1) from input shaft.



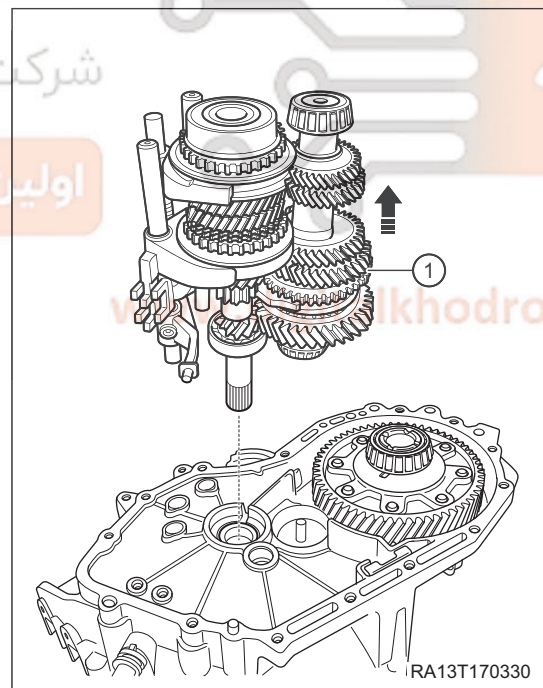
9. Remove the magnet.
- a. Remove magnet (1) from clutch case.



10. Remove input shaft, output shaft and fork mechanism.
- a. Remove input shaft, output shaft and fork mechanism (1) together from clutch case.

**HINT:**

Gently jiggle them during removal.

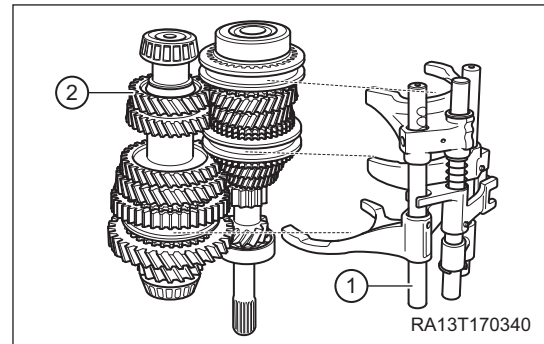
**CAUTION**

- Prevent input shaft spline from damaging input shaft front oil seal during removal.
- Prevent interference between output shaft bearing cage and differential big ring gear to avoid damaging the bearing cage during removal.

## 17 - QR515MHF TRANSMISSION

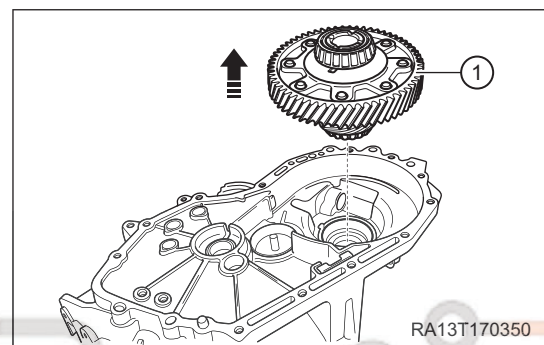
11. Remove the shift fork assembly.

- a. Separate shift fork assembly (2) from input shaft and output shaft (1).



12. Remove the differential assembly.

- a. Remove differential assembly (1) from clutch case.



## Assembly

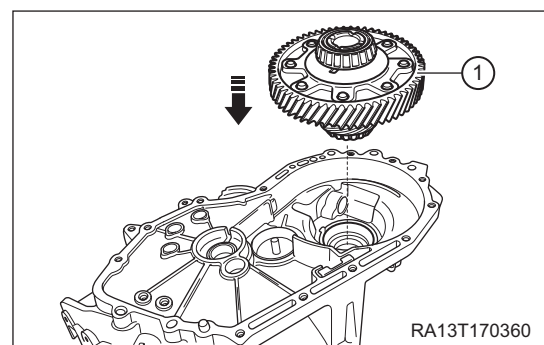
### CAUTION

- Before assembling components, wash them clean.
- Remove seal gum residues from cases.
- Make sure that joint surface of cases is free of oil, and uniformly apply seal gum.
- Make sure joint surface of case and shift assembly is free of oil, and uniformly apply seal gum.
- Tighten bolts to specified torques.

17

1. Install the differential assembly.

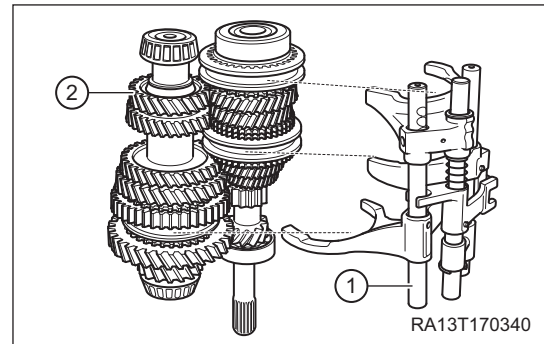
- a. Apply transmission oil to each sliding part of differential, and install differential (1) to clutch case in direction of arrow.



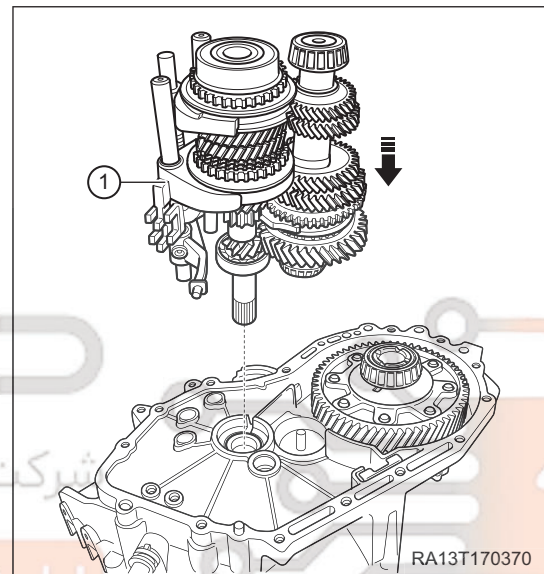


## 17 - QR515MHF TRANSMISSION

2. Install the shift fork assembly.
  - a. Install shift fork assembly (1) to input shaft and output shaft (2).



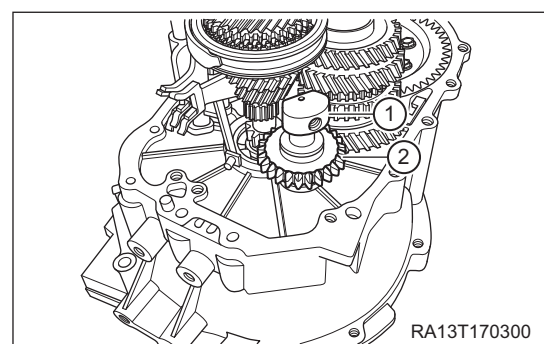
3. Install input shaft, output shaft and fork mechanism.
  - a. Apply transmission oil to each sliding part of input shaft and output shaft, and install input shaft, output shaft and fork mechanism together into clutch case in direction of arrow.



 CAUTION

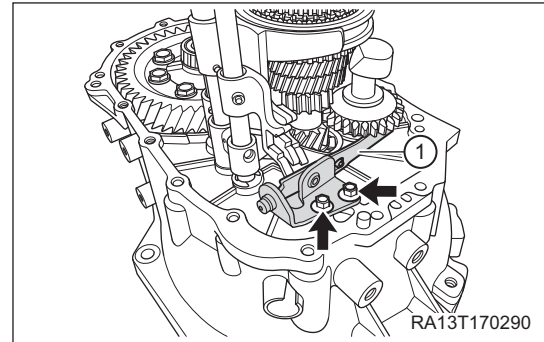
- Prevent input shaft spline from damaging input shaft front oil seal during installation.

4. Install reverse idler gear and reverse gear.
  - a. Apply transmission oil to contact part between reverse gear and reverse gear shaft, and install reverse idler gear (1) and reverse gear (2) together into clutch case.

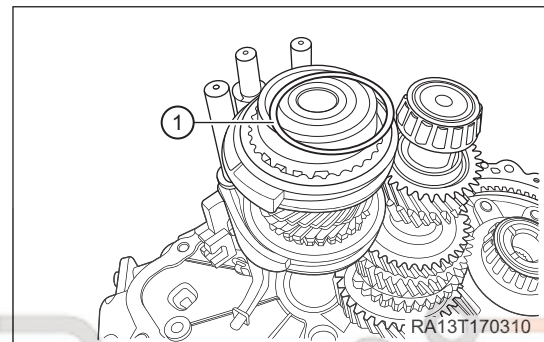



## 17 - QR515MHF TRANSMISSION

5. Install the reverse gear fork.
  - a. Install reverse gear fork (1) to clutch case, and tighten reverse gear fork fixing bolts (arrow).  
(Tightening torque:  $25 \pm 2$  N·m)



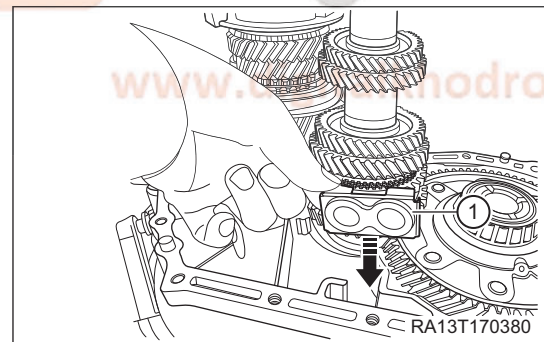
6. Install the input shaft rear washer.
  - a. Apply an appropriate amount of transmission oil to input shaft rear washer, and put input shaft rear washer (1) onto input shaft rear bearing.



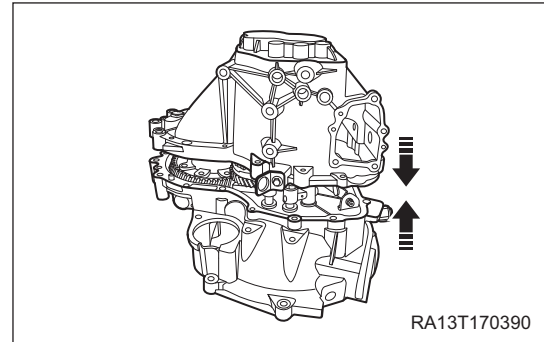
 CAUTION

- Evenly put the input shaft rear washer onto input shaft rear bearing with washer edge not out of input shaft rear bearing.

7. Install the magnet.
  - a. Install magnet (1) to clutch case in direction of arrow.



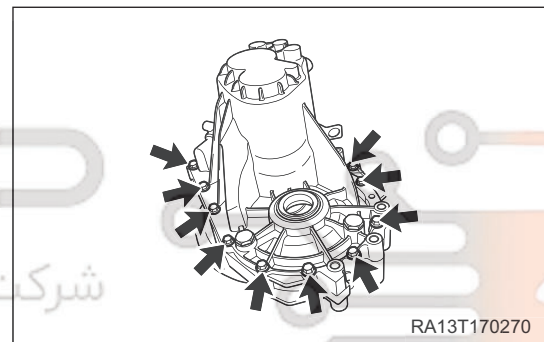
8. Install the transmission case.
  - a. Install transmission case to clutch case.



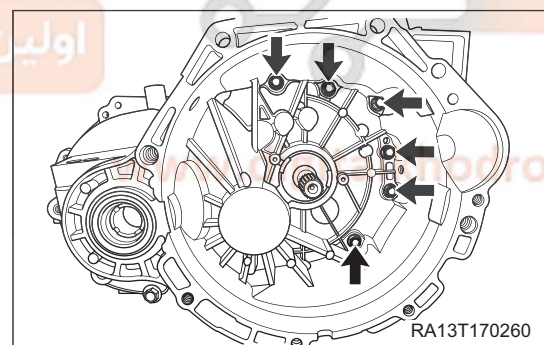
**CAUTION**

- Install transmission case to clutch case.
- Make sure that joint surface of cases is free of oil, and uniformly apply seal gum.

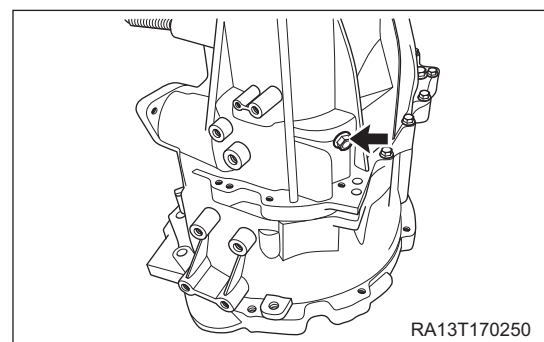
- b. Install and tighten transmission case fixing bolts.  
(Tightening torque:  $25 \pm 2$  N·m)



- c. Install and tighten clutch case fixing bolts.  
(Tightening torque:  $25 \pm 2$  N·m)



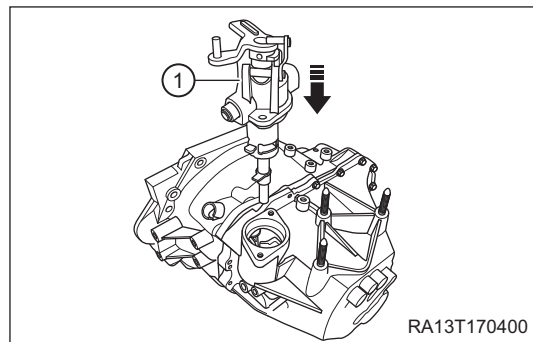
9. Install the reverse idler gear shaft locating bolt.
  - a. Install reverse idler gear shaft locating bolt (arrow) to transmission case.  
(Tightening torque:  $40 \pm 4$  N·m)



## 17 - QR515MHF TRANSMISSION

10. Install the back-up light switch.

- a. Install gear shift mechanism (1) to transmission case.

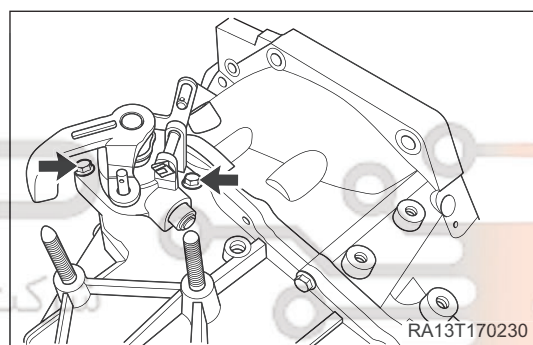


**CAUTION**

- Clean engagement portion between gear shift mechanism and transmission case, and apply seal gum evenly.

- b. Install coupling bolts between gear shift mechanism and transmission case.

(Tightening torque:  $25 \pm 2$  N·m)



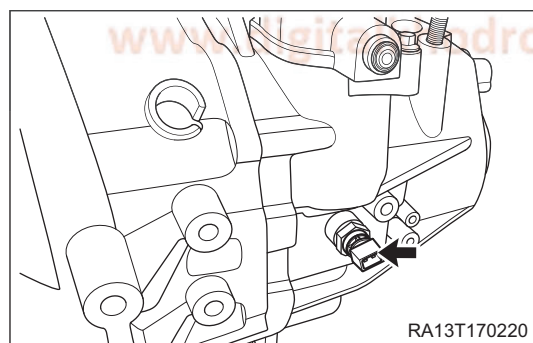
11. Install the gear shift mechanism.

**HINT:**

Apply thread adhesive to threads before installation.

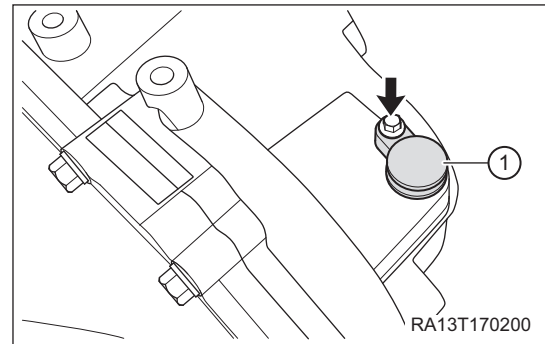
- a. Install back-up light switch (arrow) to transmission.

(Tightening torque:  $20 \pm 2$  N·m)



12. Install the vehicle speed sensor cover.

- a. Install vehicle speed sensor cover (1) and its fixing bolt (arrow).



# دیجیتال خودرو

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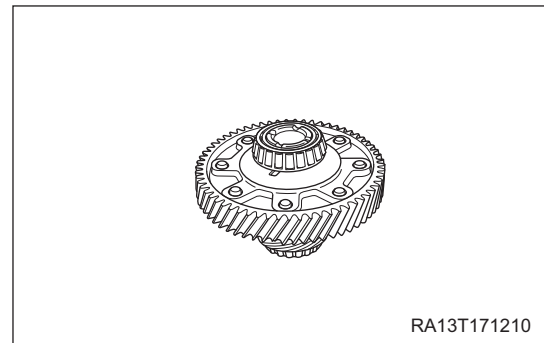
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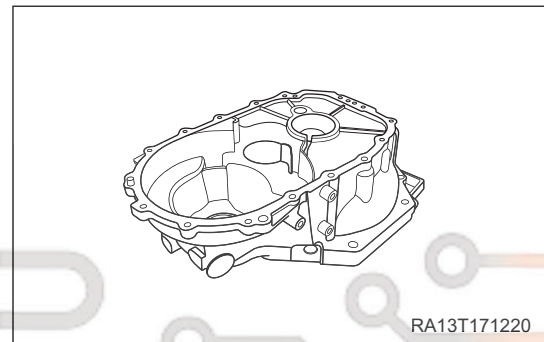
## 17 - QR515MHF TRANSMISSION

**Adjustment****Rear Bearing Adjusting Washer Selection****Differential Rear Bearing Adjusting Washer Selection**

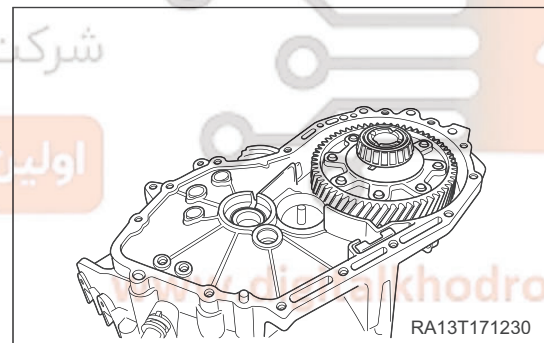
1. Take out the assembled differential assembly.



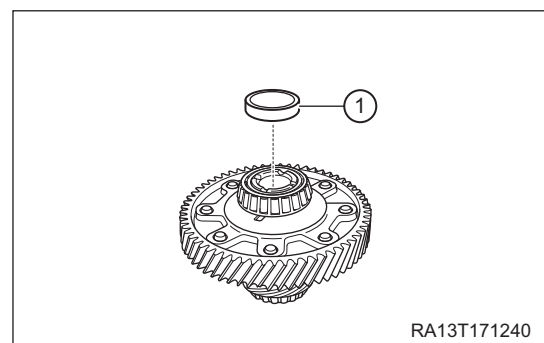
2. Take out the assembled clutch case assembly.



3. Assemble differential assembly to clutch case assembly.



4. Take out the differential rear bearing outer race (1).

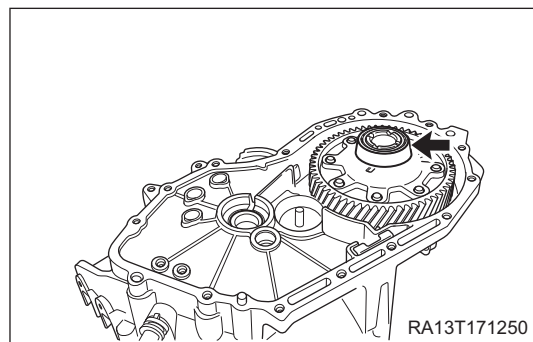
**CAUTION**

- It is recommended that differential rear bearing outer race and differential front bearing outer race should be from the same manufacture.

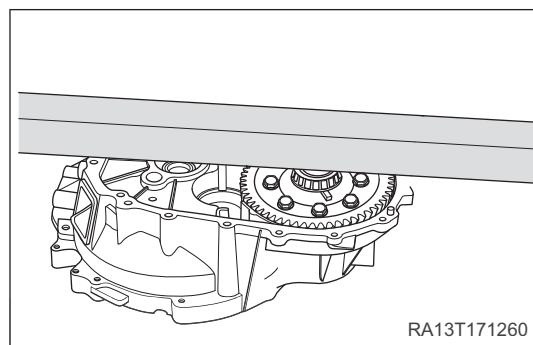


## 17 - QR515MHF TRANSMISSION

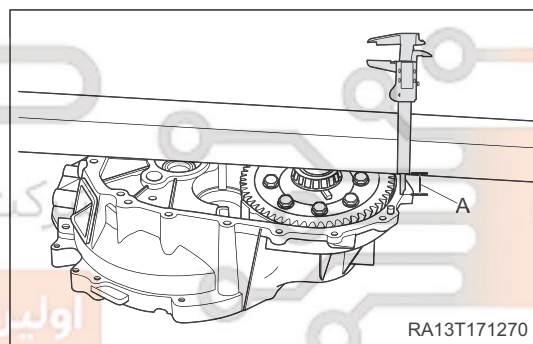
5. Install differential rear bearing outer race onto differential rear bearing (arrow).



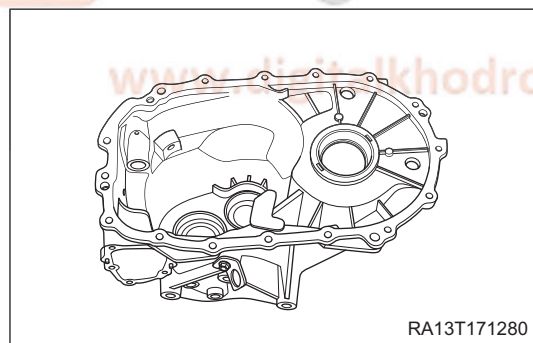
6. Place a measuring tool onto differential rear bearing outer race.



7. Using a depth gauge, measure distance A from rear end surface of differential rear bearing outer race to joint surface of clutch case (and transmission case).

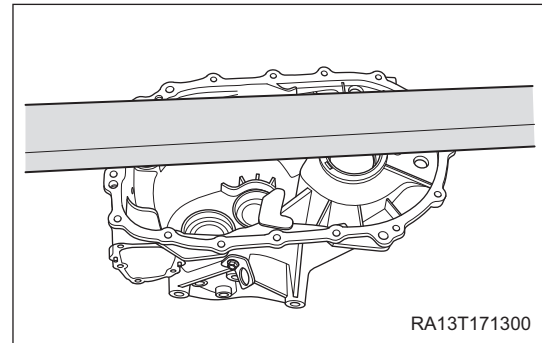


8. Place transmission case to be assembled onto workbench.



## 17 - QR515MHF TRANSMISSION

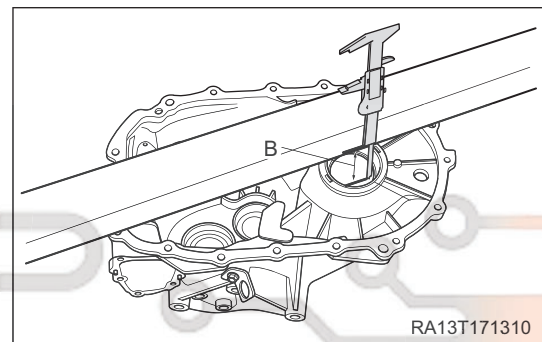
9. Place a measuring tool onto joint surface of transmission case (and clutch case).



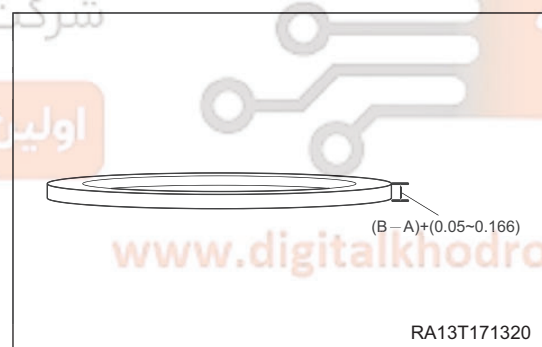
 CAUTION

- DO NOT hit joint surface of transmission case (and clutch case).

10. Using a depth gauge, measure distance B from locating end surface of differential rear bearing hole to joint surface of transmission case (and clutch case).

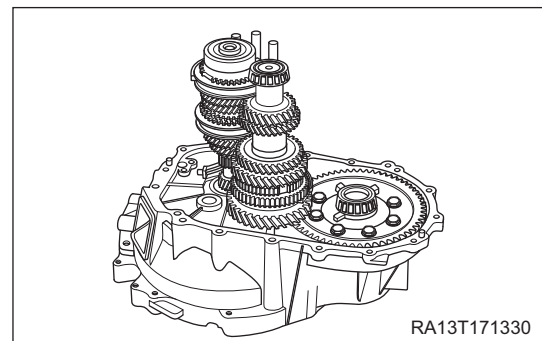


11. Thickness of differential rear bearing adjusting washer should be  $(B - A) + (0.05 \sim 0.166)$  mm. Select thickness of differential rear bearing adjusting washer according to calculated measurement value. Select adjusting washer type according to thickness.



### Input Shaft Rear Bearing Adjusting Washer Selection

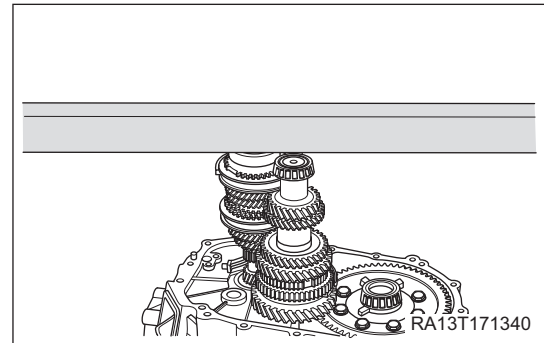
1. Take out assembled input shaft assembly and output shaft assembly.



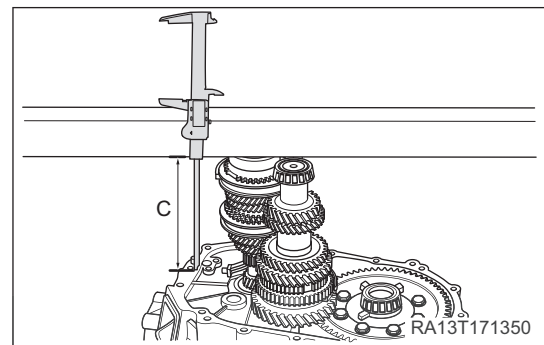


## 17 - QR515MHF TRANSMISSION

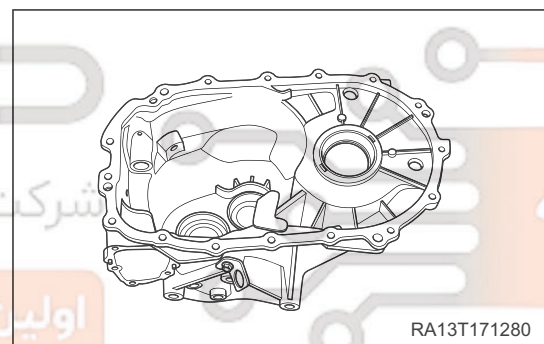
2. Place a measuring tool onto end surface of input shaft rear bearing outer race.



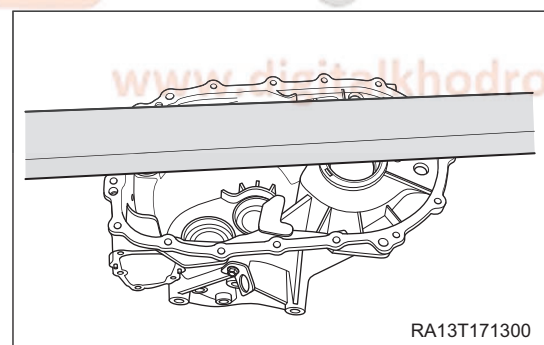
3. Using a depth gauge, measure distance C from rear end surface of input shaft rear bearing outer race to rear end surface of clutch.



4. Place transmission case to be assembled onto workbench.



5. Place a measuring tool onto joint surface of transmission case (and clutch case).

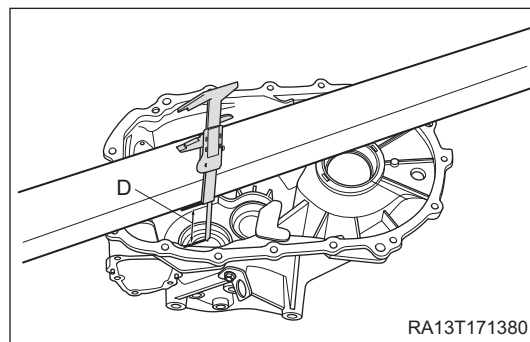


**CAUTION**

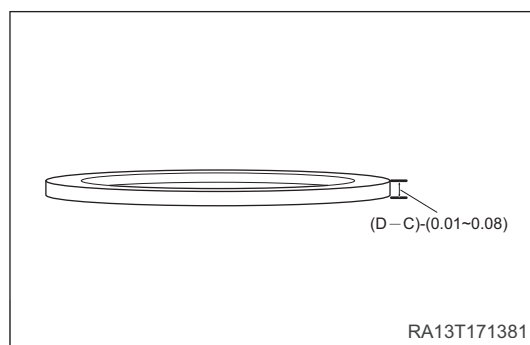
- DO NOT hit joint surface of transmission case (and clutch case). Be sure to measure with parallelism of 0.03 or less between input shaft rear bearing surface and joint surface of transmission case (and clutch case).

## 17 - QR515MHF TRANSMISSION

6. Using a depth gauge, measure distance D from locating end surface of transmission case input shaft rear bearing hole and front end surface of transmission case.

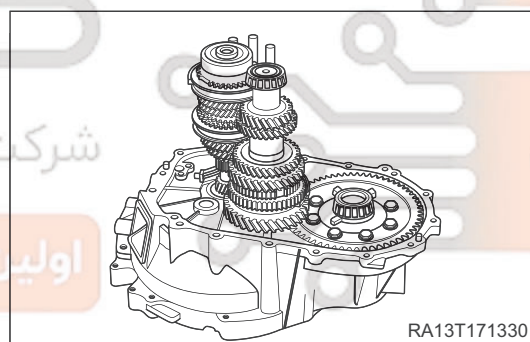


7. Thickness of input shaft rear bearing adjusting washer should be  $(D - C) - (0.01 \sim 0.08)$  mm. Select thickness of input shaft rear bearing adjusting washer based on calculated measurement value. Select adjusting washer type according to thickness.

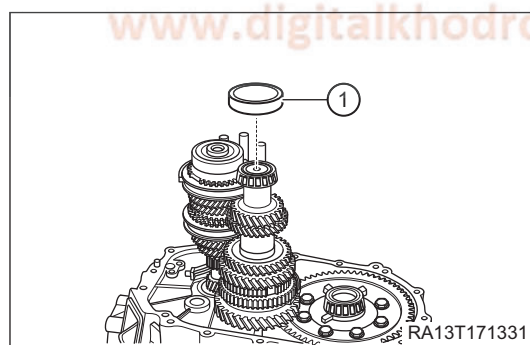


## Output Shaft Rear Bearing Adjusting Washer Selection

1. Take out assembled input shaft assembly and output shaft assembly.



2. Install output shaft rear bearing outer race (1) to output shaft rear bearing.

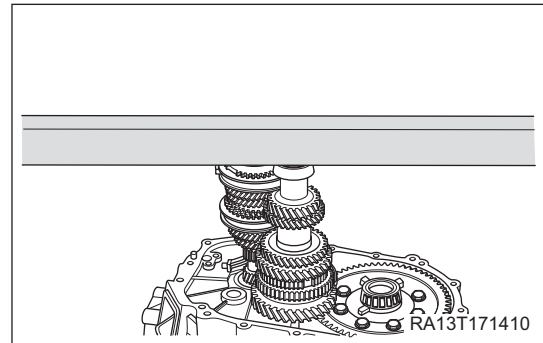


## CAUTION

- It is recommended that output shaft rear bearing outer race and output shaft front bearing outer race should be from the same manufacture.

## 17 - QR515MHF TRANSMISSION

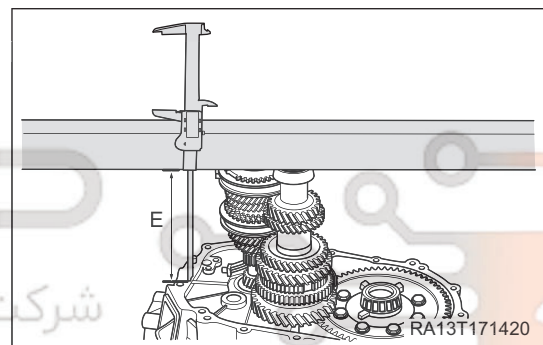
3. Place a measuring tool onto end surface of output shaft rear bearing outer race.



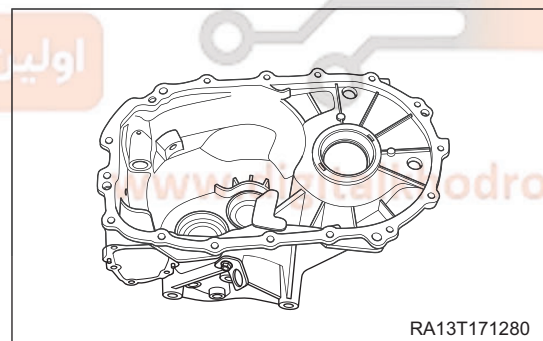
**CAUTION**

- DO NOT hit joint surface of transmission case (and clutch case). Be sure to measure with parallelism of 0.03 or less between output shaft rear bearing surface and joint surface of transmission case (and clutch case).

4. Using a depth gauge, measure distance E from rear end surface of output shaft rear bearing outer race to rear end surface of clutch.

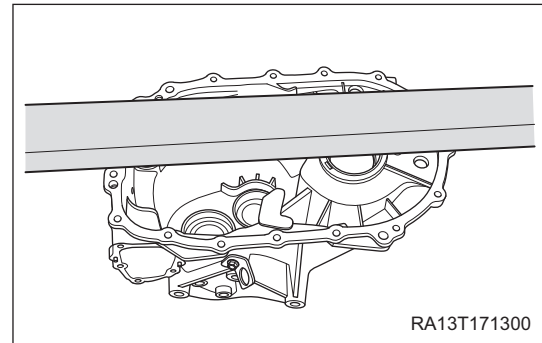


5. Place transmission case to be assembled onto workbench.



## 17 - QR515MHF TRANSMISSION

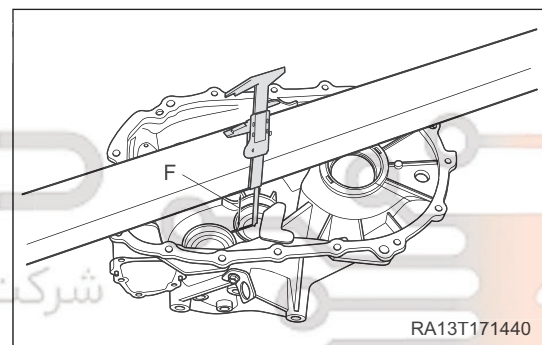
6. Place a measuring tool onto joint surface of transmission case (and clutch case).



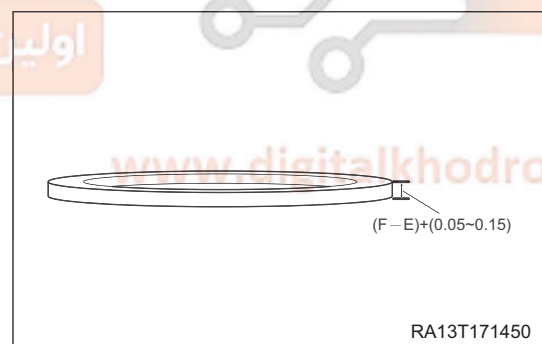
**CAUTION**

- DO NOT hit joint surface of transmission case (and clutch case). Be sure to measure with parallelism of 0.03 or less between input shaft rear bearing surface and joint surface of transmission case (and clutch case).

7. Using a depth gauge, measure distance F from locating end surface of transmission case output shaft rear bearing hole and front end surface of transmission case.



8. Thickness of output shaft rear bearing adjusting washer should be  $(F - E) + (0.05 \sim 0.15)$  mm. Select thickness of output shaft rear bearing adjusting washer based on calculated measurement value. Select adjusting washer type according to thickness.



### Installation

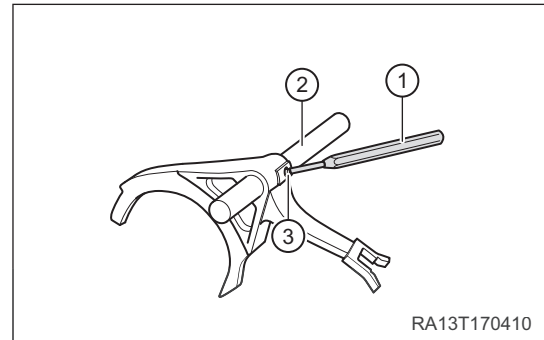
Installation is in the reverse order of removal.

**CAUTION**

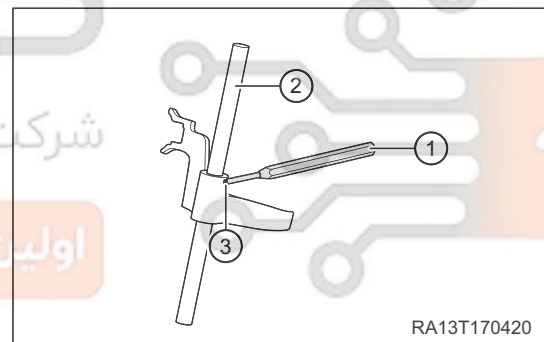
- After installation, add transmission oil and check transmission oil level.

**Shift Fork****Disassembly**

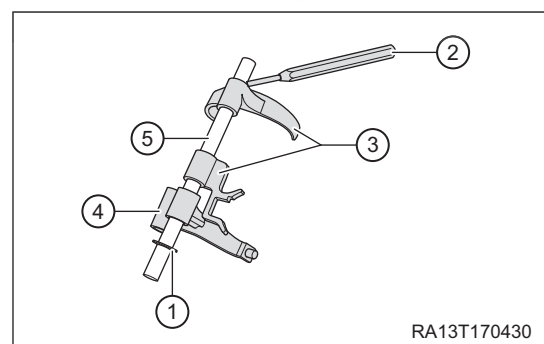
1. Remove the 1st gear shift fork.
  - a. Using a punch (1), tap out dowel pin (3) from 1st-2nd gear shift shaft (2).



2. Remove the 3rd-4th gear shift fork.
  - a. Using a punch (1), tap out dowel pin (3) from 3rd-4th gear shift shaft (2).



3. Remove the 5th and reverse gear shift fork.
  - a. Remove snap ring (1) and 5th and reverse gear shift fork (4).
  - b. Using a punch (2), tap out dowel pin (3) from shift shaft (5).

**Inspection**

1. Check shift shaft for excessive wear or damage. Replace if damaged.
2. Check shift fork for excessive wear or damage. Replace if damaged.

**Assembly**

Assembly is in the reverse order of disassembly.

 CAUTION

- When installing dowel pins, if there is excessive wear or damage, replace with new ones.

دیجیتال خودرو

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17

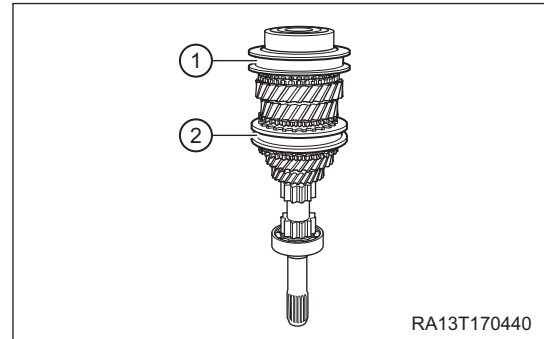
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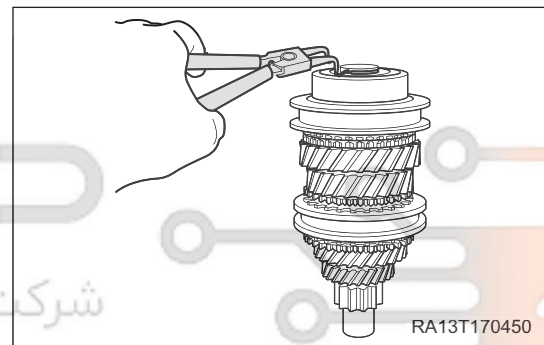
## Input Shaft

### Disassembly

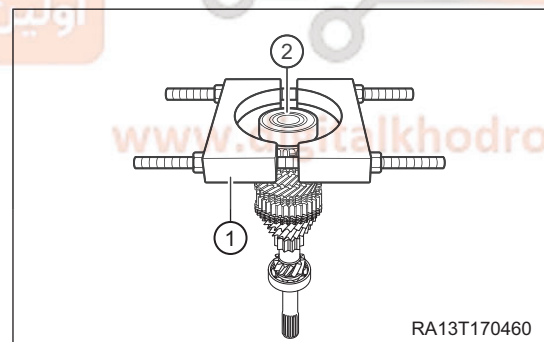
1. Remove the input shaft (See page 17-20).
2. Remove 5th synchronizer outer race and 3rd-4th synchronizer outer race.
  - a. Remove 5th synchronizer outer race (1) and 3rd-4th synchronizer outer race (2) from input shaft.



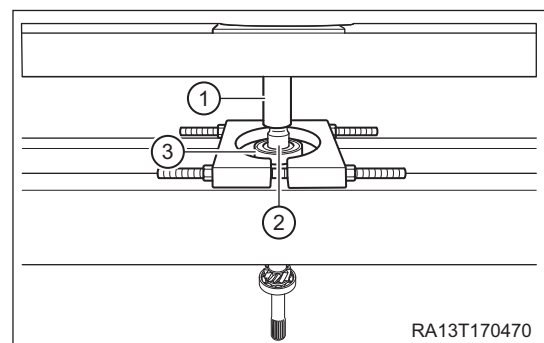
3. Remove the rear snap ring.
  - a. Using snap spring calipers, remove rear snap ring.



4. Remove the input shaft rear bearing.
  - a. Using a special tool (1), secure input shaft rear bearing (2).

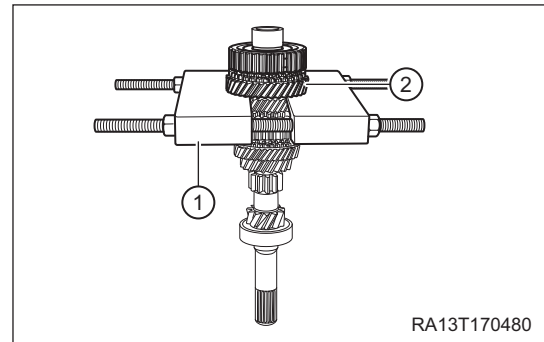


- b. Using a hydraulic press (1), press out input shaft (2) and remove input shaft rear bearing (3).

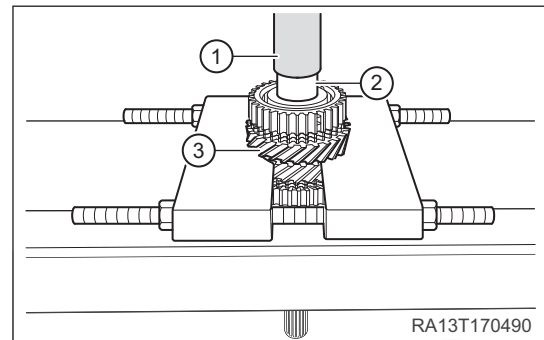


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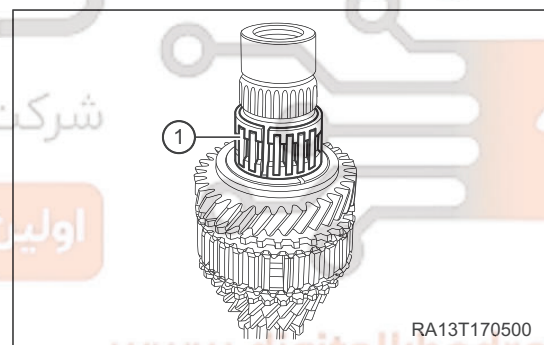
5. Remove 5th drive gear and 5th synchronizer gear hub.  
a. Using a special tool (1), secure 5th drive gear (2).



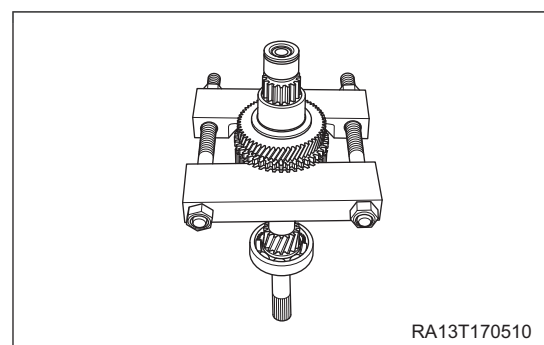
- b. Using a hydraulic press (1), press out input shaft (2), and remove 5th drive gear and 5th synchronizer gear hub (3).



6. Remove the 5th needle roller bearing.  
a. Remove 5th needle roller bearing (1) from input shaft.

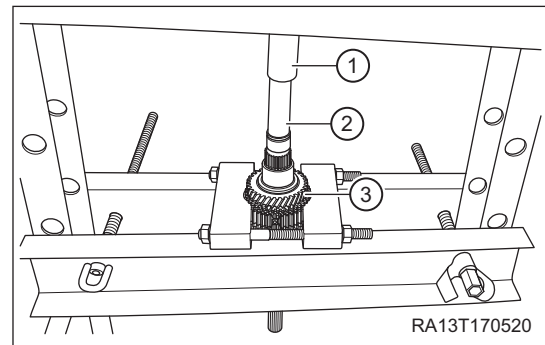


- 17 7. Remove 5th drive gear needle roller bearing bushing and 4th drive gear.  
a. Install a special tool.



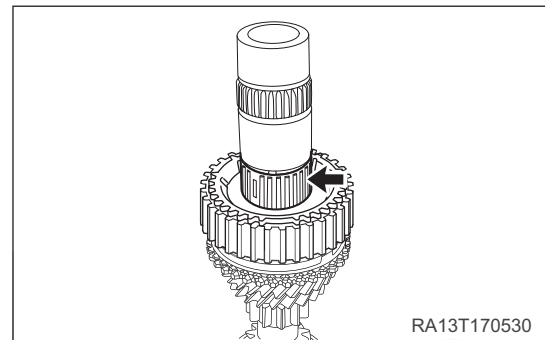
## 17 - QR515MHF TRANSMISSION

- b. Using a hydraulic press (1), press out input shaft (2), and remove 5th drive gear needle roller bearing bushing and 4th drive gear (3).



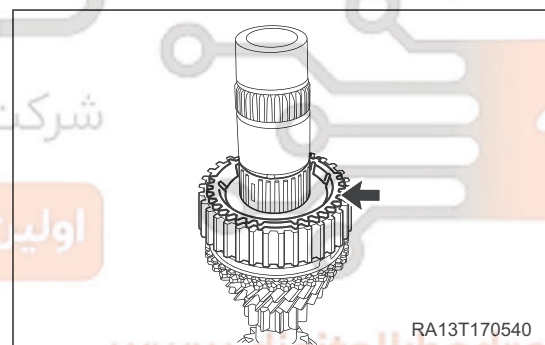
8. Remove the 4th needle roller bearing.

- a. Remove 4th needle roller bearing (arrow) from input shaft.

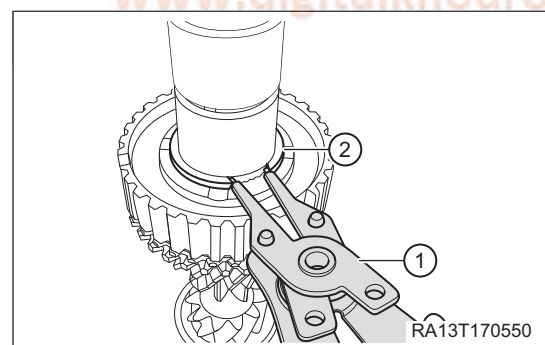


9. Remove 3rd drive gear and 3rd-4th synchronizer gear hub.

- a. Remove synchronizer ring (arrow) from 3rd-4th synchronizer gear hub.

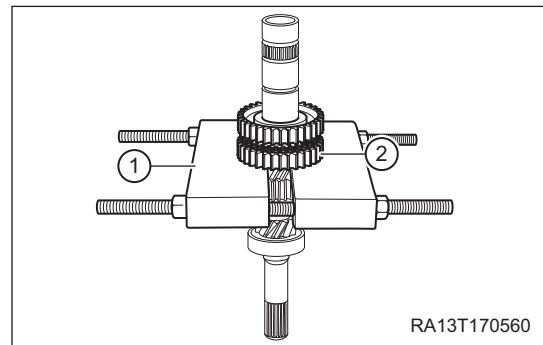


- b. Using snap spring calipers (1), remove snap ring (2).

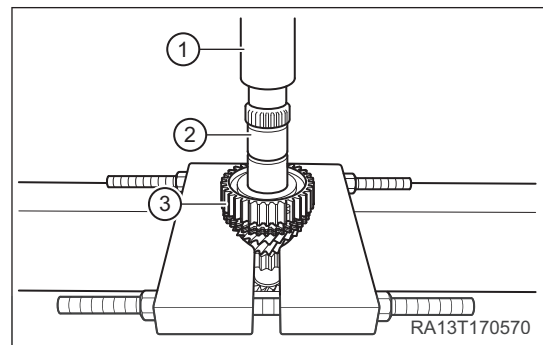


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c. Using a special tool (1), secure 3rd drive gear (2).

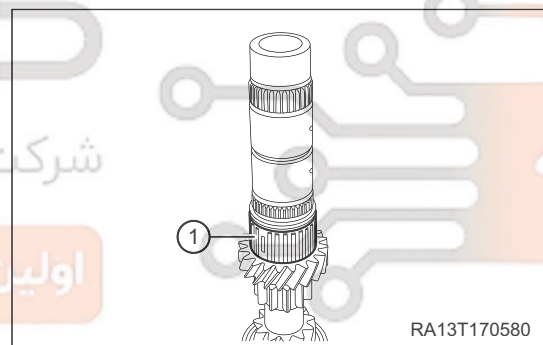


d. Using a hydraulic press (1), press out input shaft (2), and remove 3rd drive gear and 3rd-4th synchronizer gear hub (3).



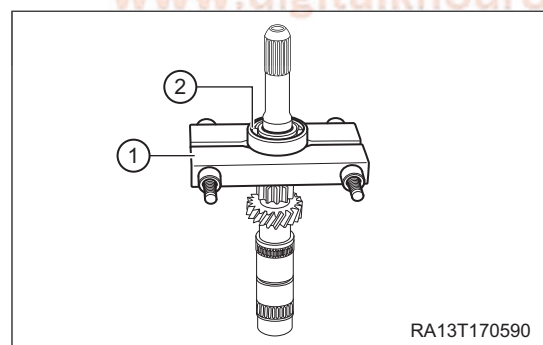
10. Remove the 3rd needle roller bearing.

a. Remove 3rd needle roller bearing (1) from input shaft.



11. Remove the input shaft front bearing.

a. Using a special tool (1), secure input shaft front bearing (2).

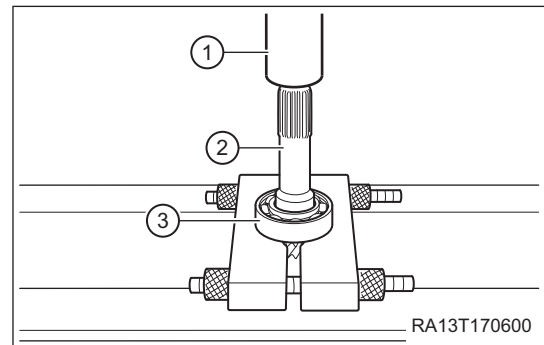


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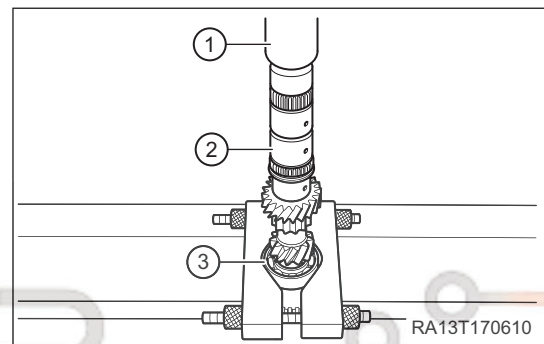
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- b. Using a hydraulic press (1), press out input shaft (2), and remove input shaft front bearing (3).



**Assembly**

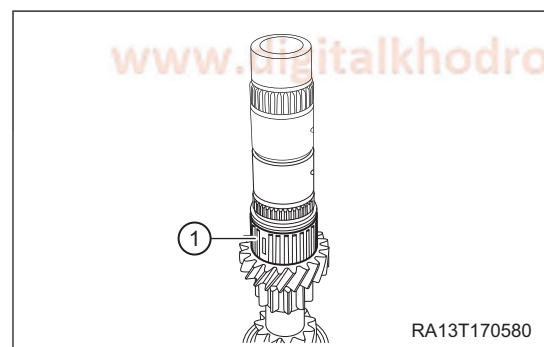
- 1. Install the input shaft front bearing.
  - a. Using a hydraulic press (1), press input shaft (2) into input shaft front bearing (3).



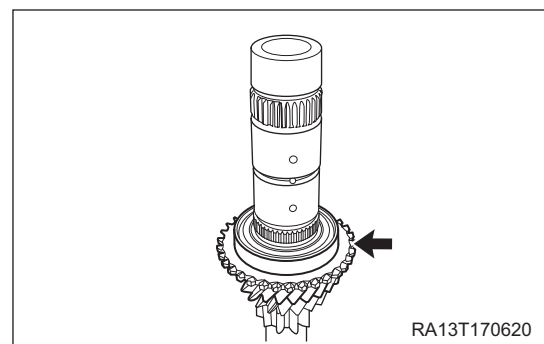
**CAUTION**

- When pressing in input shaft front bearing, make sure that pressure is applied to bearing inner race as the bearing may be damaged due to uneven force.

- 2. Install the 3rd needle roller bearing.
  - a. Apply transmission oil to 3rd needle roller bearing (1), and install it to input shaft.

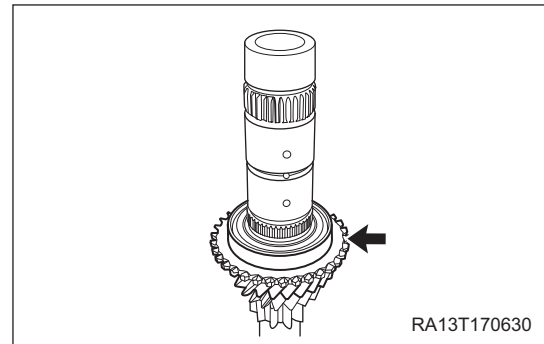


- 3. Install the 3rd drive gear.
  - a. Apply transmission oil to 3rd drive gear, and install it to input shaft.

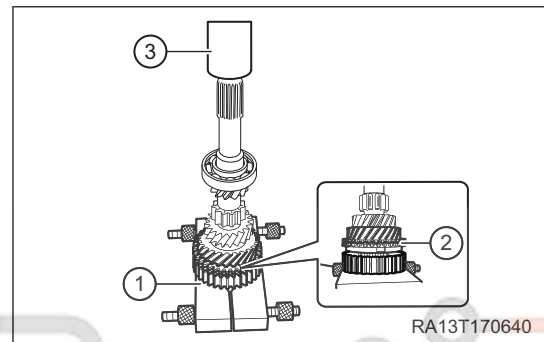


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4. Install the 3rd synchronizer ring.
- a. Apply transmission oil to 3rd synchronizer ring, and install it to input shaft.



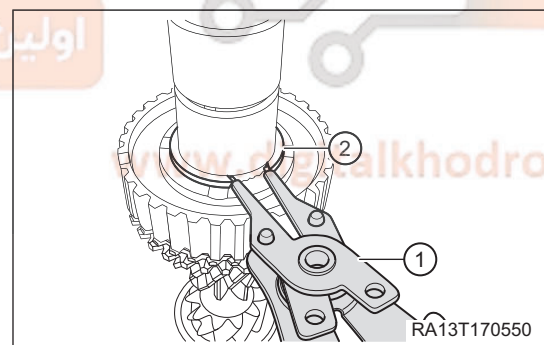
5. Install the 3rd-4th synchronizer gear hub.
- a. Using a hydraulic press (3), press 3rd-4th synchronizer gear hub (1) into input shaft.



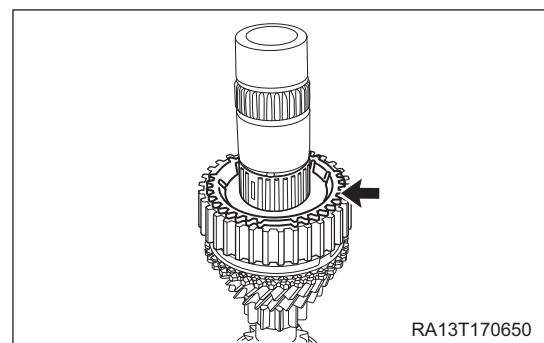
**CAUTION**

- When pressing in synchronizer gear hub, prevent 3rd drive gear (2) from disengaging.

- b. Using snap spring calipers (1), remove snap ring (2).



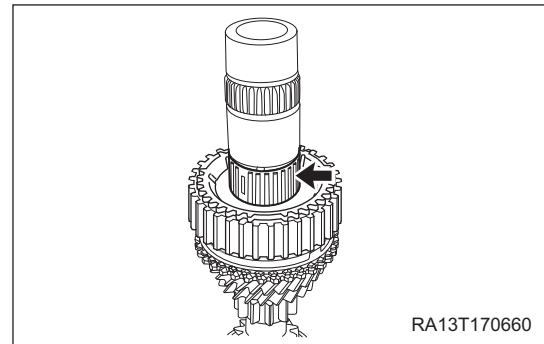
6. Install the 4th synchronizer ring.
- a. Apply transmission oil to 4th synchronizer ring, and install it to input shaft.



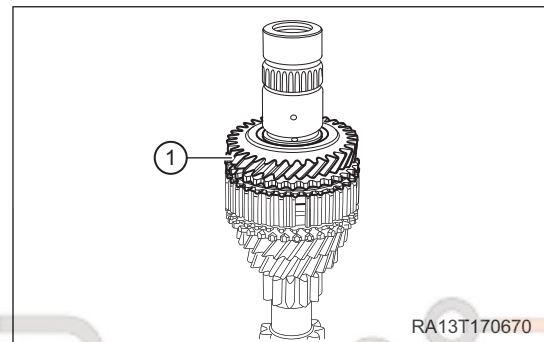


## 17 - QR515MHF TRANSMISSION

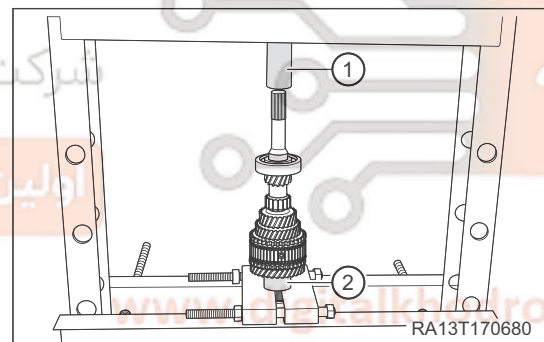
7. Install the 4th gear needle roller bearing.
- a. Apply transmission oil to 4th gear needle roller bearing, and install it to input shaft.



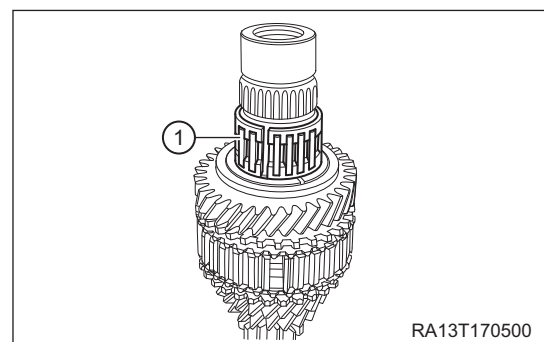
8. Install the 4th drive gear.
- a. Apply transmission oil to 4th drive gear, and install it to input shaft.



9. Install the 5th drive gear needle roller bearing bushing.
- a. Using a hydraulic press (1), press 5th drive gear needle roller bearing bushing (2) into input shaft.



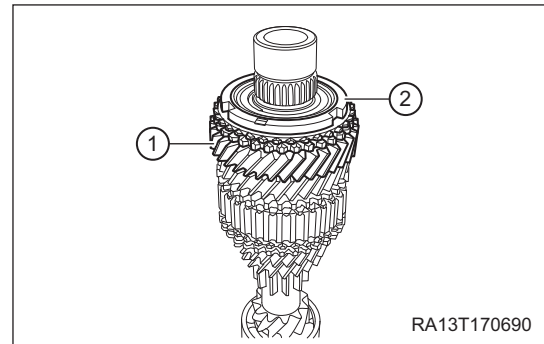
10. Install the 5th gear needle roller bearing.
- a. Apply transmission oil to 5th gear needle roller bearing (1), and install it to input shaft.



## 17 - QR515MHF TRANSMISSION

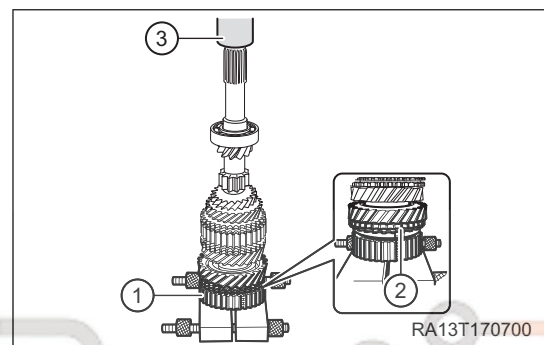
11. Install 5th drive gear and 5th synchronizer ring.

- a. Apply transmission oil to 5th drive gear (1) and 5th synchronizer ring (2), and install them to input shaft.



12. Install the 5th synchronizer gear hub.

- a. Using a hydraulic press (3), press 5th synchronizer gear (2) and 5th synchronizer gear hub (1) together into input shaft.

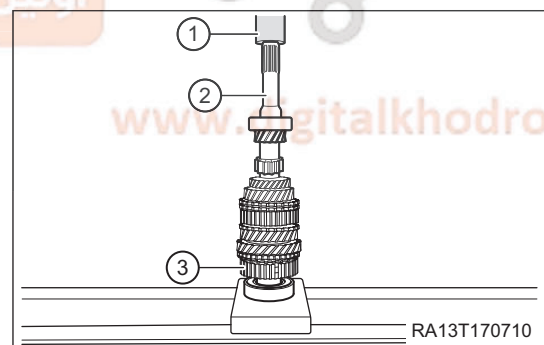


**CAUTION**

- When pressing in synchronizer gear hub, prevent 5th drive gear (2) from disengaging.

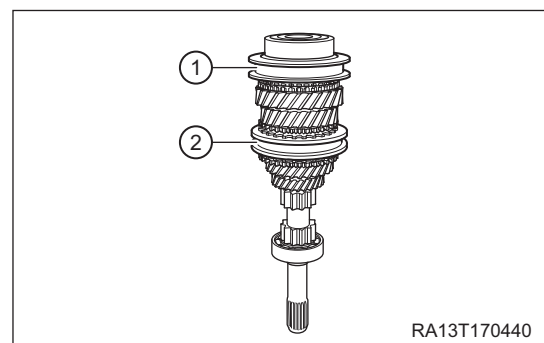
13. Install the input shaft rear bearing.

- a. Using a hydraulic press (1), press input shaft (2) into input shaft rear bearing (3).



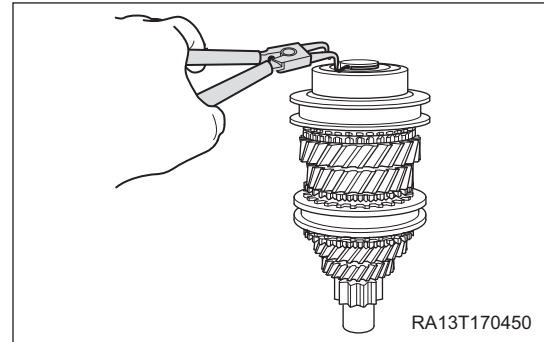
14. Install 5th synchronizer outer race and 3rd-4th synchronizer outer race.

- a. Apply transmission oil to 5th synchronizer outer race and 3rd-4th synchronizer outer race, and install them to input shaft.



15. Install the input shaft rear bearing snap ring.

- a. Using snap spring calipers, install the rear bearing snap ring.



### CAUTION

- Check gears on input shaft for smooth rotation after installation.
- Check engagement of gears on input shaft for looseness or sticking.

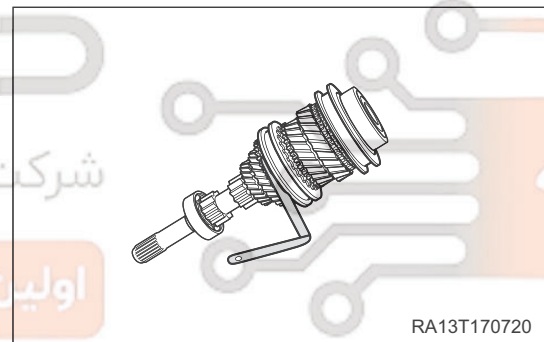
### Inspection

Check gears on input shaft for smooth rotation after installation.

1. Using a feeler gauge, measure clearance between 3rd drive gear and synchronizer ring.

Standard value: 1.35 mm

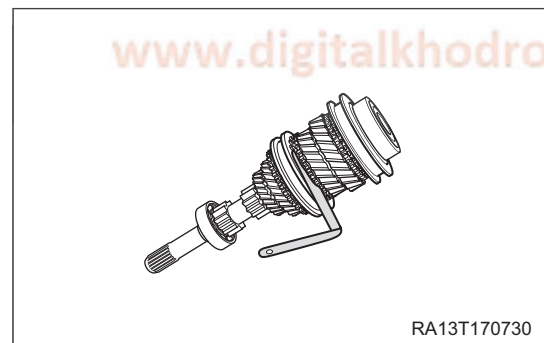
Limit value: 1.100 - 1.600 mm



2. Using a feeler gauge, measure clearance between 4th drive gear and synchronizer ring.

Standard value: 1.35 mm

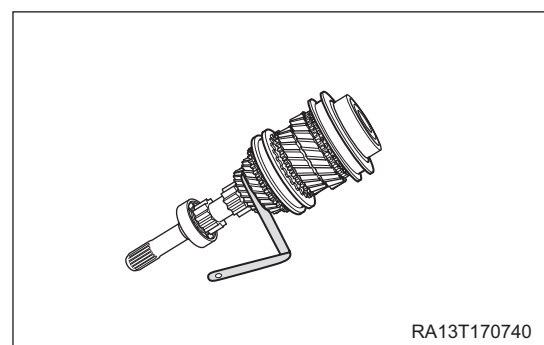
Standard value: 1.35 mm



3. Using a feeler gauge, measure clearance between 2nd drive gear and 3rd drive gear.

Standard value: 0.65 mm

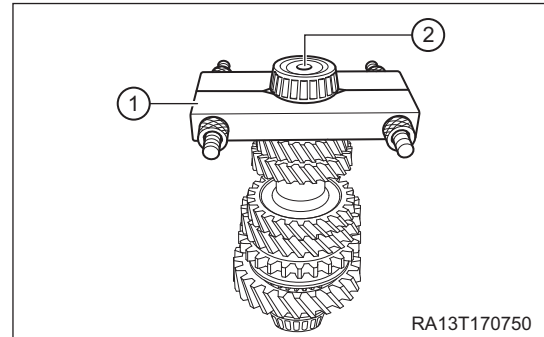
Limit value: 0.45 - 0.85 mm



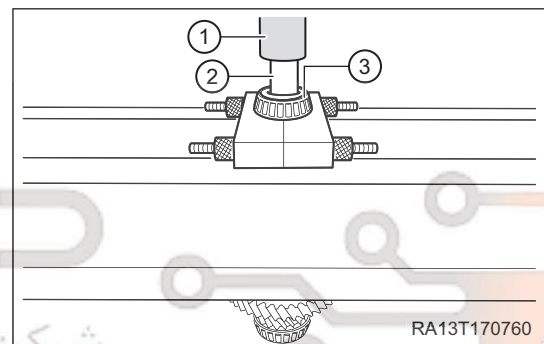
## Output Shaft

### Disassembly

1. Remove the output shaft (See page 17-20).
2. Remove the output shaft rear bearing.
  - a. Using a special tool (1), secure output shaft rear bearing (2).

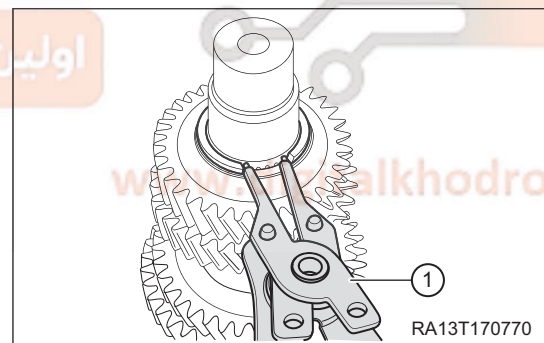


- b. Using a hydraulic press (1), press out output shaft (2) and remove output shaft rear bearing (3).

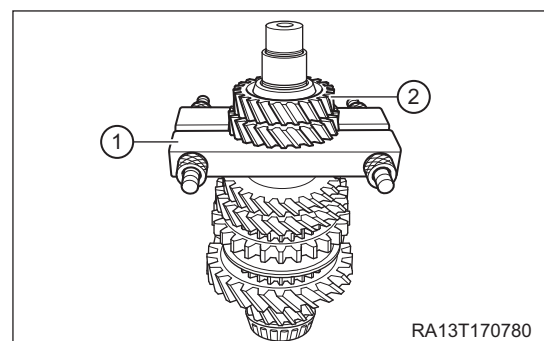


3. Remove 4th and 5th driven gears.

- a. Using snap spring calipers (1), remove snap ring (2).

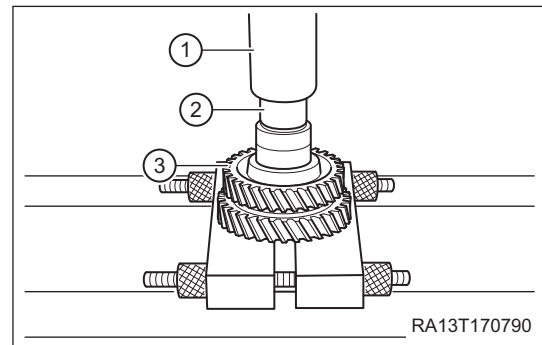


- b. Using a special tool (1), secure 4th and 5th driven gear set (2).



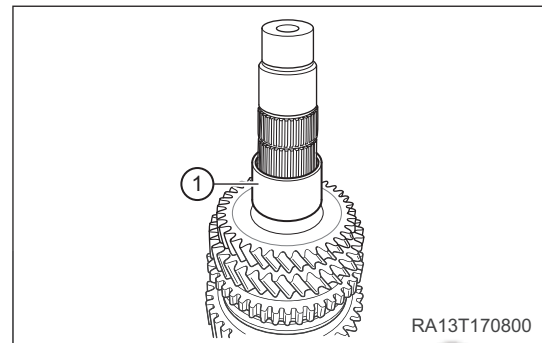
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- c. Using a hydraulic press (1), press out output shaft (2) and remove 4th and 5th driven gears (3).



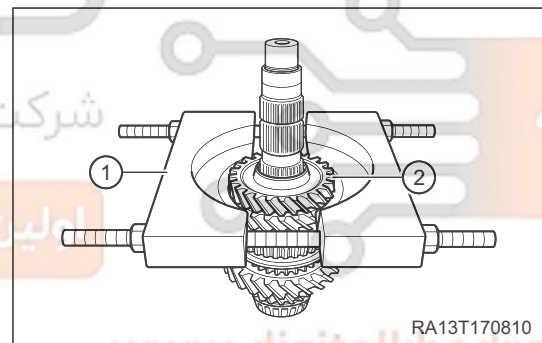
4. Remove the gear shaft bushing.

- a. Remove gear shaft bushing (1) from output shaft.

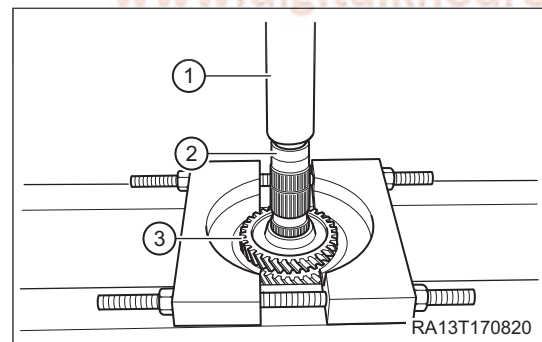


5. Remove 2nd and 3rd driven gears.

- a. Using a special tool (1), secure 2nd driven gear (2).

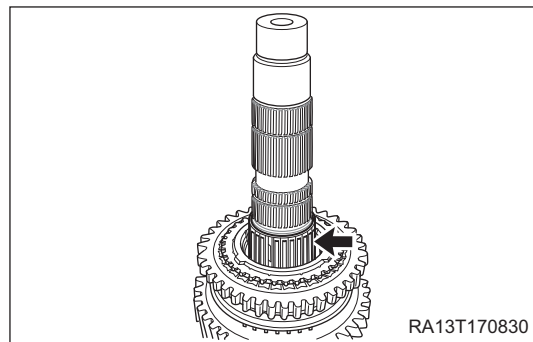


- b. Using a hydraulic press (1), press out output shaft (2) and remove 2nd and 3rd driven gears (3).

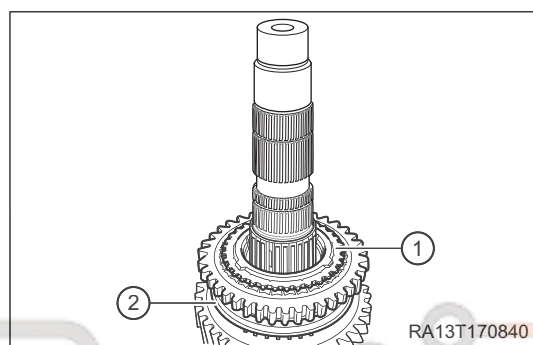


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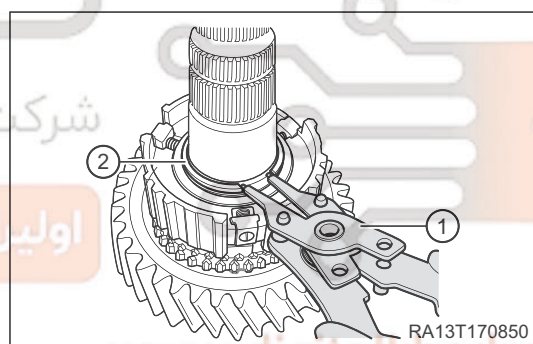
6. Remove the 2nd needle roller bearing.
- Remove 2nd needle roller bearing (1) from output shaft.



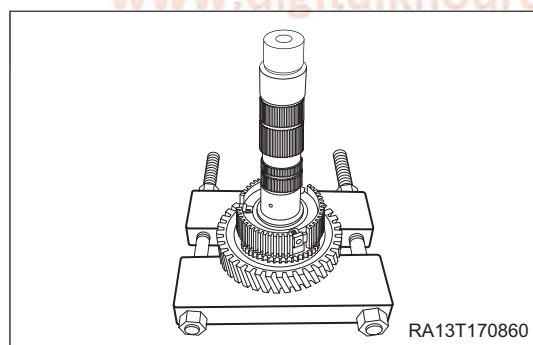
7. Remove 1st driven gear and 1st-2nd synchronizer gear hub.
- Remove the 1st-2nd synchronizer ring set (1).
  - Remove the 1st-2nd synchronizer outer race (2).



- Using snap spring calipers (1), remove snap ring (2).



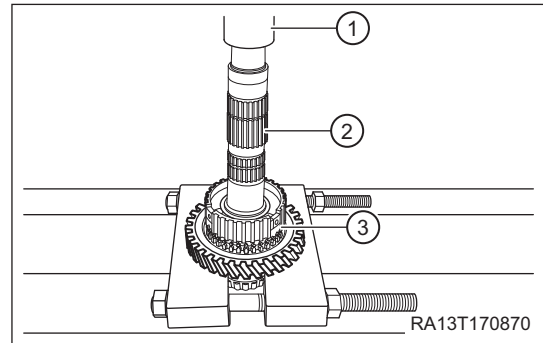
- Secure a special tool to 1st driven gear.



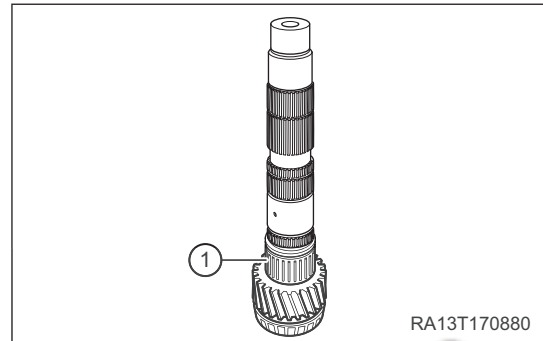


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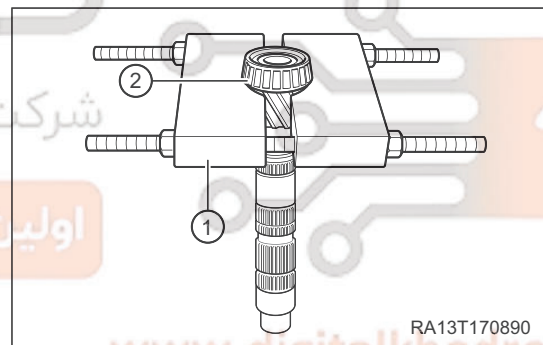
- e. Using a hydraulic press (1), press out output shaft (2), and remove 1st driven gear and 1st-2nd synchronizer (3).



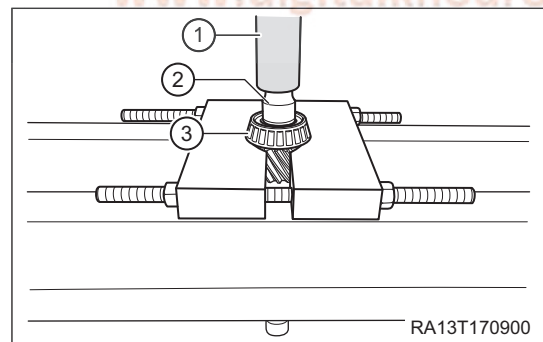
- 8. Remove the 1st needle roller bearing.
  - a. Remove the 1st needle roller bearing (1).



- 9. Remove the output shaft front bearing.
  - a. Using a special tool (1), secure output shaft front bearing (2).



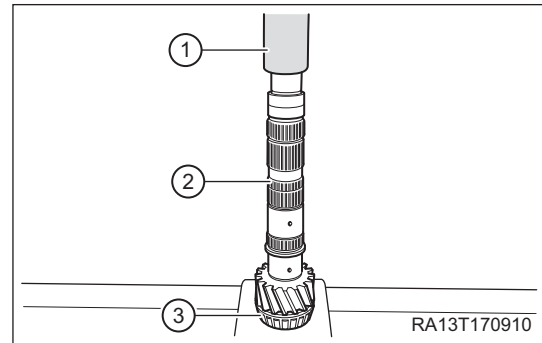
- b. Using a hydraulic press (1), press out output shaft (2) and remove front bearing (3).



## 17 - QR515MHF TRANSMISSION

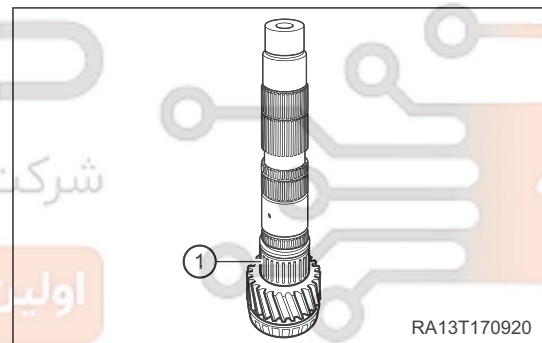
**Assembly**

1. Install the output shaft front bearing.
  - a. Using a hydraulic press (1), press output shaft front bearing (3) into output shaft (2).

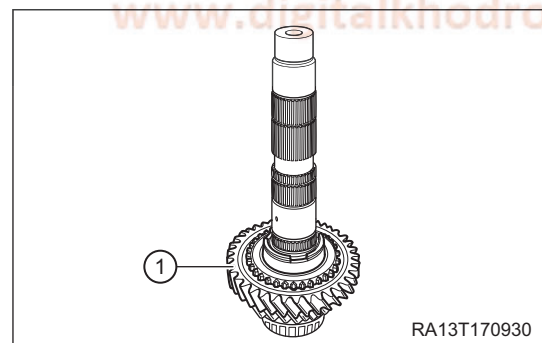
**CAUTION**

- When pressing in bearing, make sure that pressure is applied to bearing inner race as the bearing may be damaged due to uneven force.

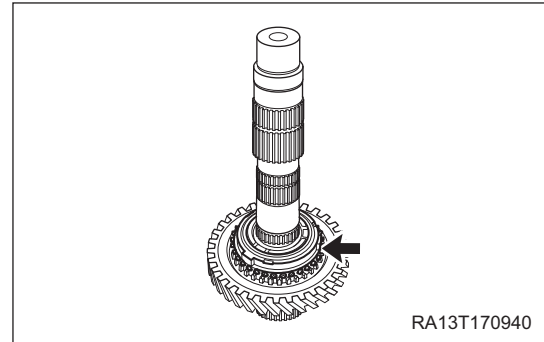
2. Install the 1st needle roller bearing.
  - a. Apply transmission oil to 1st needle roller bearing (1), and install it to output shaft.



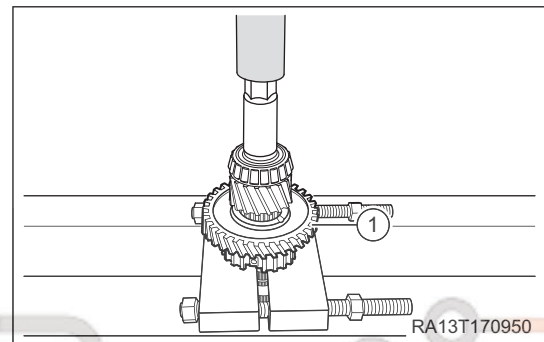
3. Install the 1st driven gear.
  - a. Apply transmission oil to 1st driven gear (1), and install it to output shaft.



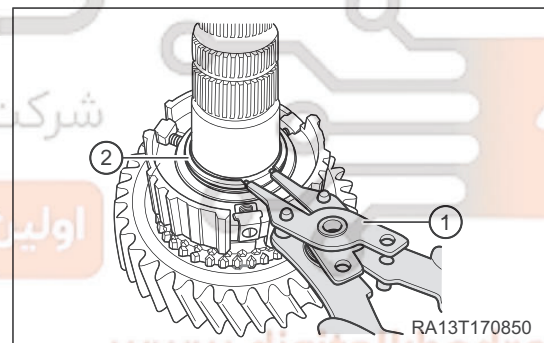
4. Install the 1st synchronizer ring set.
  - a. Apply transmission oil to 1st synchronizer ring set (1), and install it to output shaft.



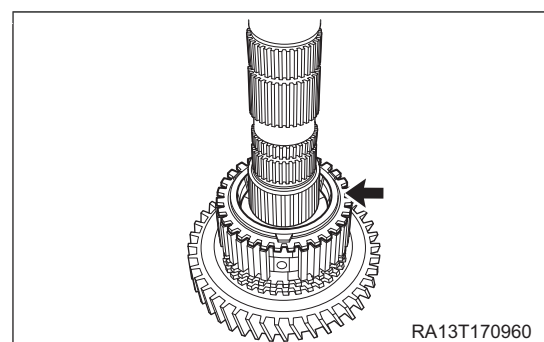
5. Install 1st-2nd synchronizer gear hub and 1st driven gear.
  - a. Place 1st-2nd synchronizer gear hub (1) in place, and then press 1st-2nd synchronizer gear hub (1) into output shaft with a hydraulic press.



- b. Using snap spring calipers (1), install snap ring (2).

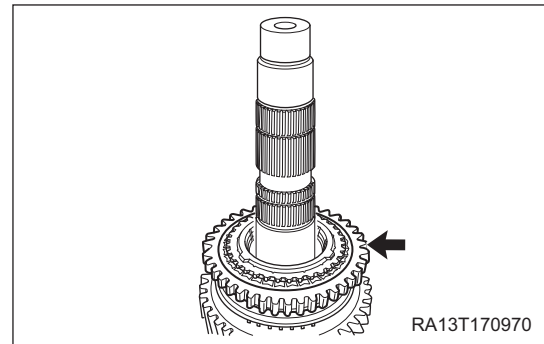


6. Install the synchronizer ring set.
  - a. Apply transmission oil to synchronizer ring set, and install it to output shaft.

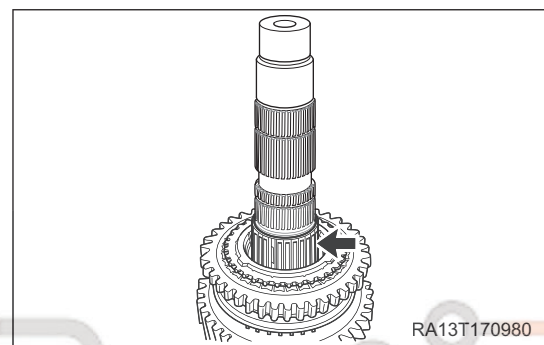


## 17 - QR515MHF TRANSMISSION

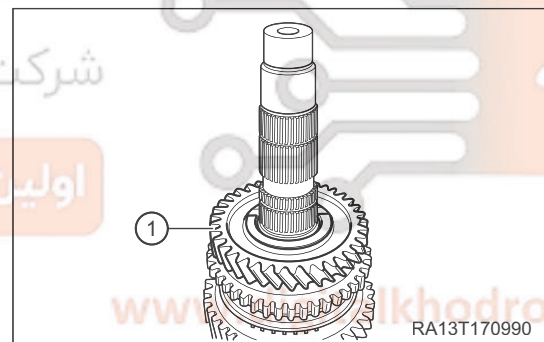
7. Install the synchronizer outer race.
- a. Apply transmission oil to synchronizer outer race, and install it to output shaft.



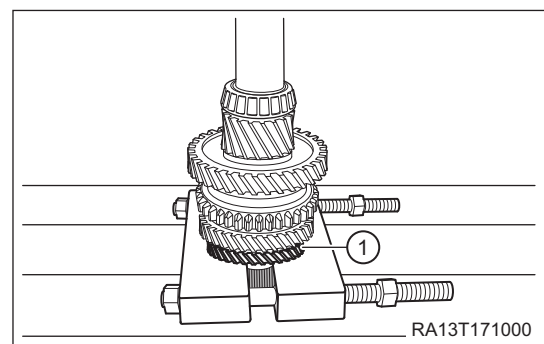
8. Install the 2nd needle roller bearing.
- a. Apply transmission oil to 2nd needle roller bearing, and install it to output shaft.



9. Install the 2nd driven gear.
- a. Apply transmission oil to 2nd driven gear (1), and install it to output shaft.



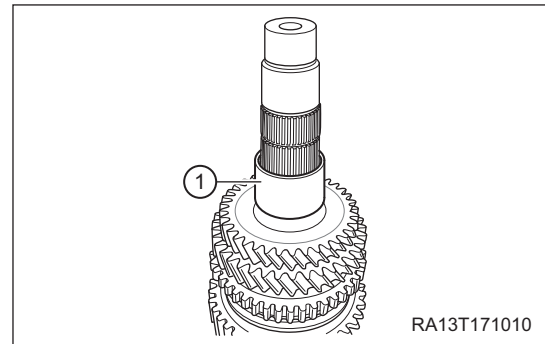
10. Install the 3rd driven gear.
- a. Using a hydraulic press, press 3rd driven gear (1) into output shaft.



## 17 - QR515MHF TRANSMISSION

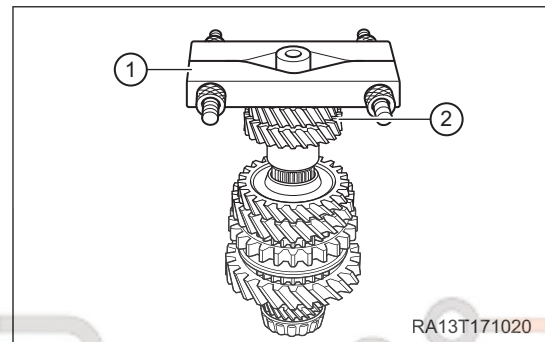
11. Install the gear shaft bushing.

- a. Apply transmission oil to gear shaft bushing (1), and install it to output shaft.

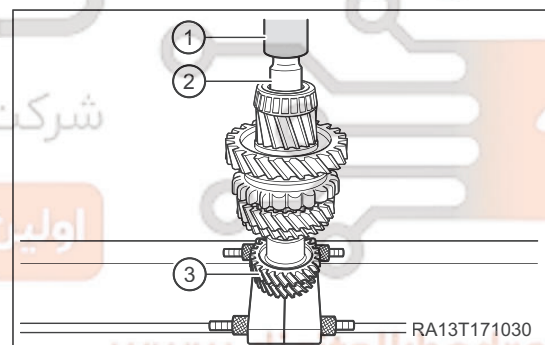


12. Install 4th and 5th driven gears.

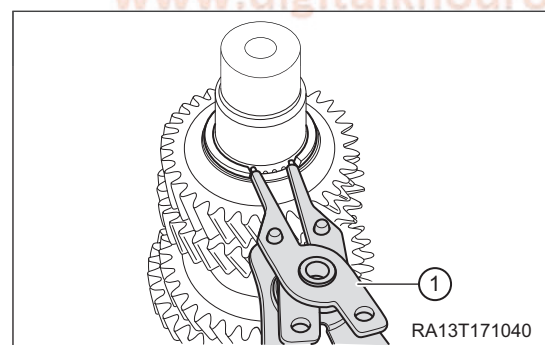
- a. Using a special tool (1), secure 4th and 5th driven gears (2).



- b. Using a hydraulic press (1), press 4th and 5th driven gears (3) into output shaft (2).



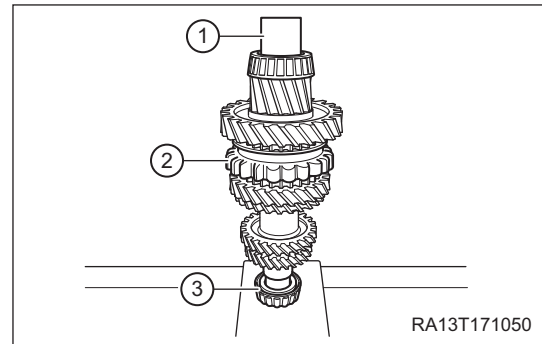
- c. Using snap spring calipers (1), install snap ring.



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13. Install the output shaft rear bearing.

- a. Using a hydraulic press (1), press output shaft rear bearing (3) into output shaft (2).



 CAUTION

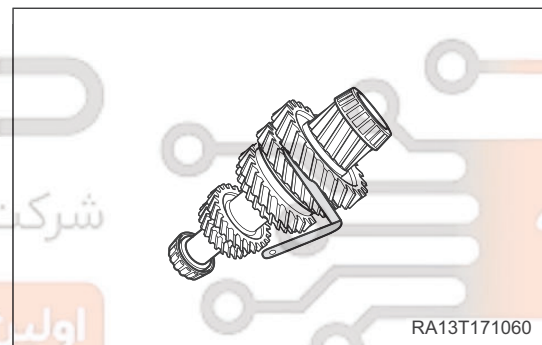
- Check gears on the output shaft for smooth rotation after installation.
- Check engagement of gears on the output shaft for looseness or sticking.

### Inspection

1. Using a feeler gauge, measure clearance between 1st driven gear and synchronizer ring.

Standard value: 1.54 mm

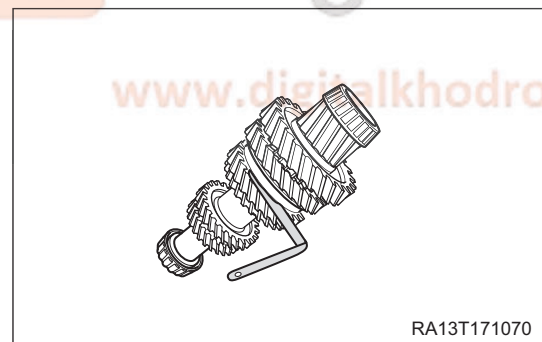
Limit value: 1.240 - 1.840 mm



2. Using a feeler gauge, measure clearance between 2nd driven gear and synchronizer ring.

Standard value: 1.54 mm

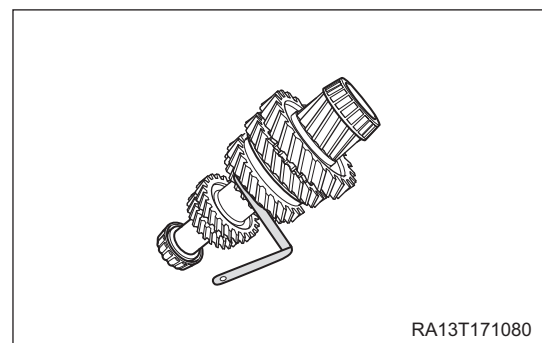
Limit value: 1.240 - 1.840 mm



3. Using a feeler gauge, measure clearance between 2nd driven gear and 3rd driven gear.

Standard value: 1.2 mm

Limit value: 0.72 - 1.68 mm

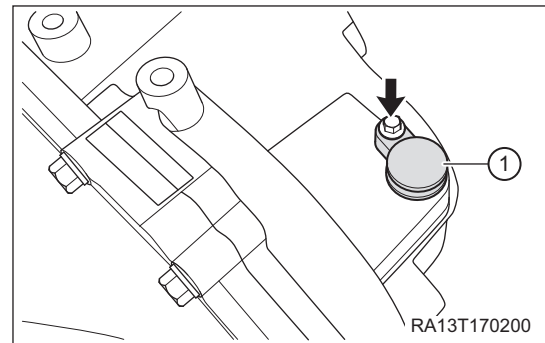




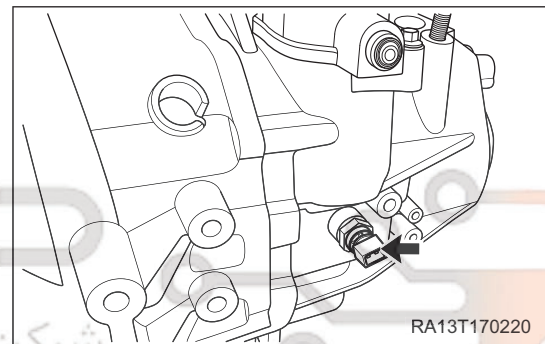
## Transmission External Accessory

### Removal

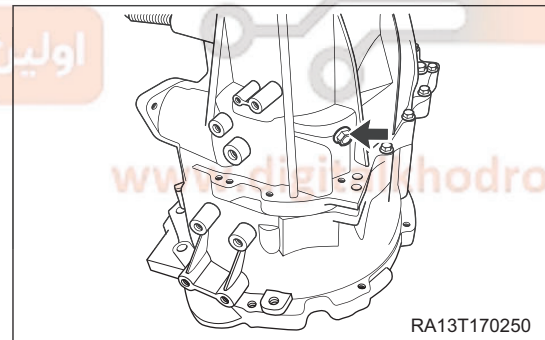
1. Remove the vehicle speed sensor cover.
  - a. Remove vehicle speed sensor cover fixing bolt (arrow) and vehicle speed sensor cover (1) from transmission assembly.



2. Remove the back-up light switch.
  - a. Remove back-up light switch (arrow) from transmission.



3. Remove the reverse idler gear shaft locating bolt.
  - a. Remove reverse idler gear shaft locating bolt (arrow) from transmission assembly.



### Installation

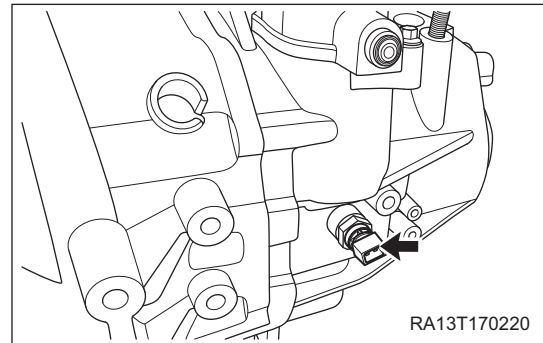
1. Remove the back-up light switch.

**HINT:**

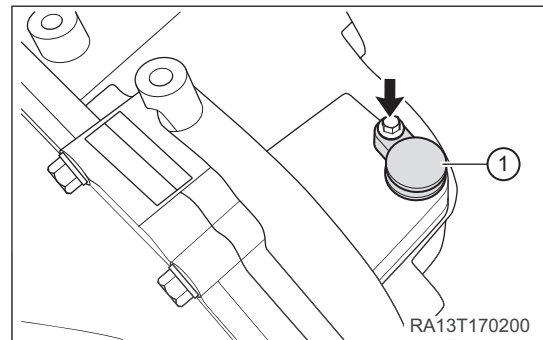
Apply thread adhesive to threads before installation.

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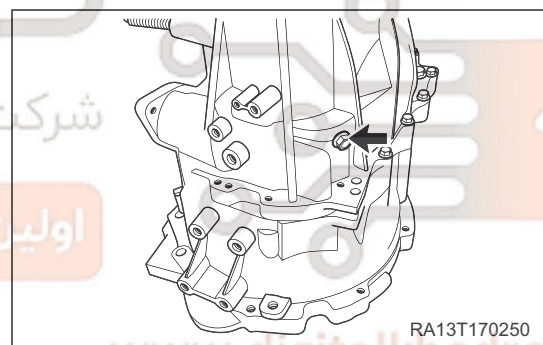
- a. Remove back-up light switch (arrow) from transmission.  
(Tightening torque:  $20 \pm 2$  N·m)



2. Install the vehicle speed sensor cover.
  - a. Install vehicle speed sensor cover (1) and its fixing bolt (arrow).



3. Install the reverse idler gear shaft locating bolt.
  - a. Install reverse idler gear shaft locating bolt (arrow) to transmission case.  
(Tightening torque:  $40 \pm 4$  N·m)



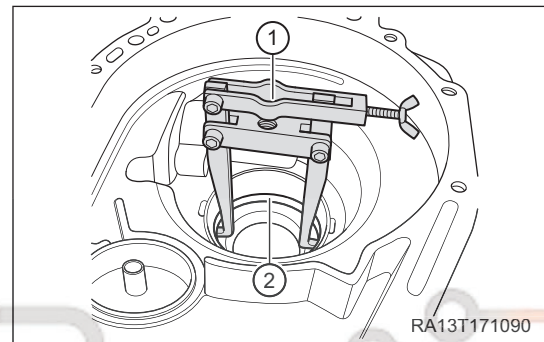
## Transmission Case

### Disassembly

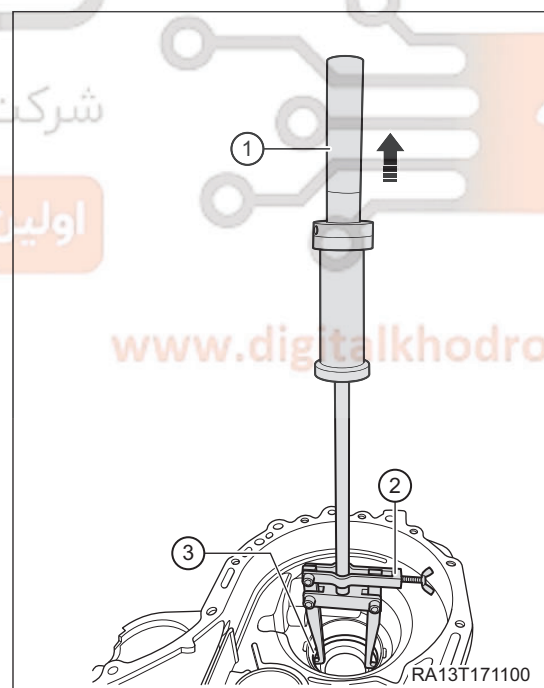
#### CAUTION

- Use same removal procedures for differential bearing outer races and oil seals of transmission case and clutch case.
- Replace the oil seals if removed, as they are not reusable.

1. Remove the differential bearing outer race.
  - a. Secure bearing outer race puller joint (1) to bearing outer race (2).

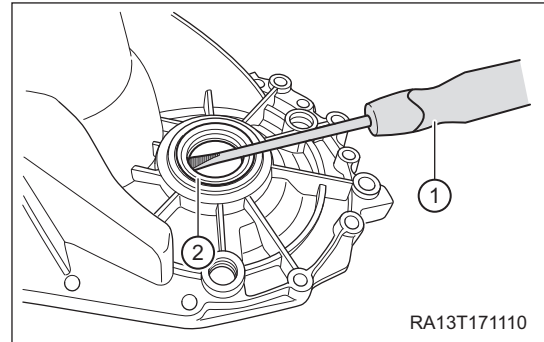


- b. Install puller (1) to bearing outer race remover (2), and pull out bearing outer race (3) with a puller.

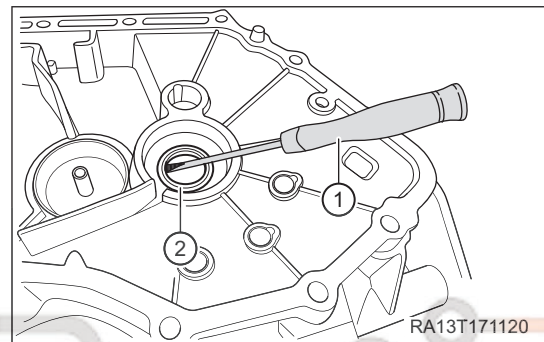


## 17 - QR515MHF TRANSMISSION

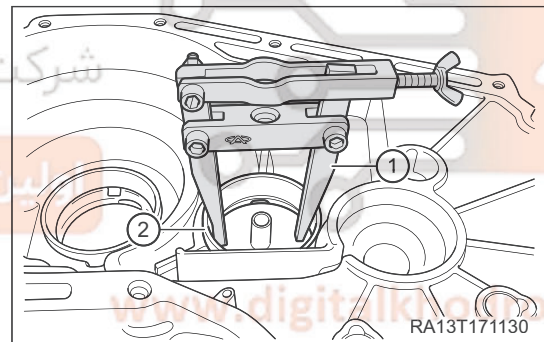
2. Remove the drive shaft oil seal.
  - a. Using a flat tip screwdriver (1), pry out drive shaft oil seal (2).



3. Remove the input shaft oil seal.
  - a. Using a flat tip screwdriver (1), pry out input shaft oil seal (2).

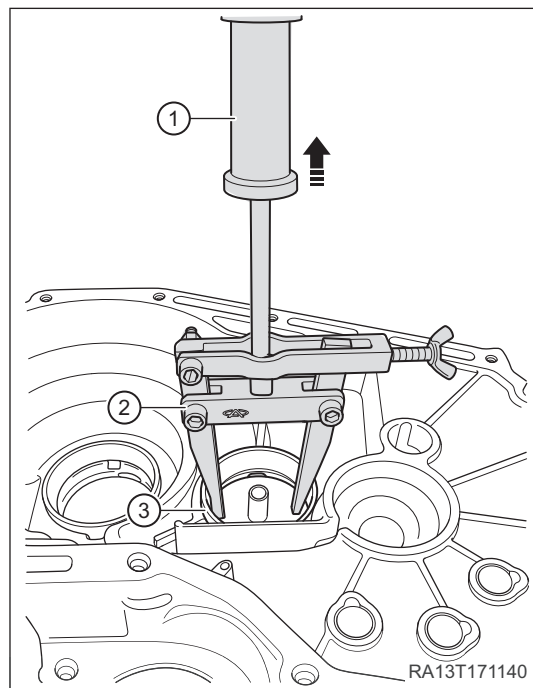


4. Remove the output shaft bearing outer race.
  - a. Secure output shaft end bearing outer race puller joint (1) to output shaft bearing outer race (2).

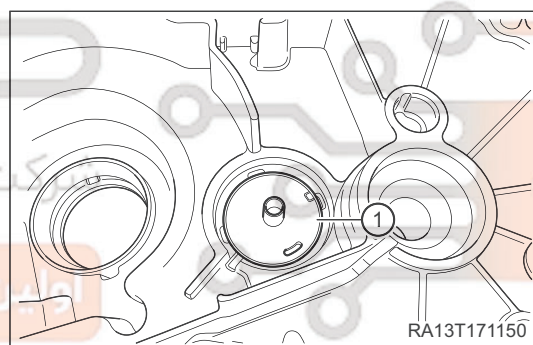


## 17 - QR515MHF TRANSMISSION

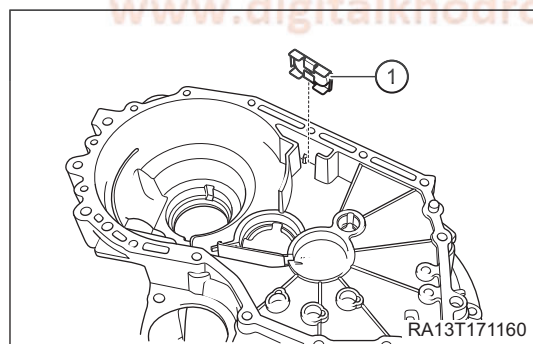
- b. Install puller (1) to bearing outer race remover (2).
- c. Using a puller, pull out output shaft bearing outer race (3).



5. Remove the oil deflector.
  - a. Remove oil deflector (1) from clutch case.

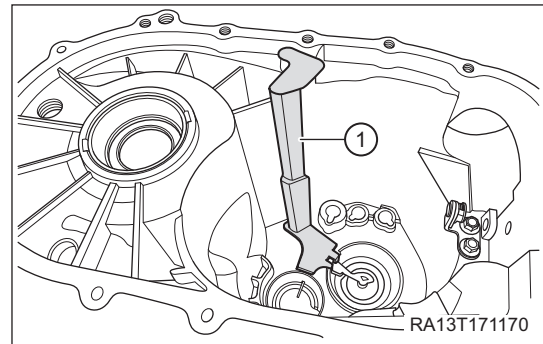


6. Remove the magnet.
  - a. Remove magnet (1) from clutch case.

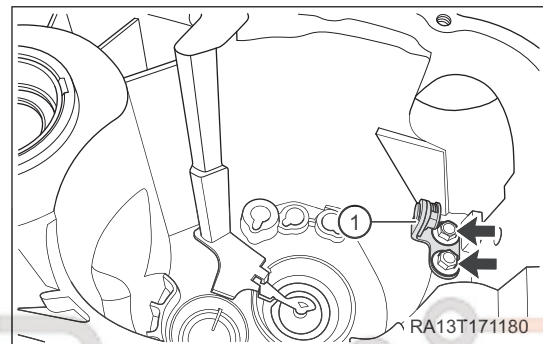


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7. Remove the oil guide.
  - a. Remove oil guide (1) from transmission case.



8. Remove the reverse gear lock mechanism.
  - a. Remove reverse gear lock mechanism fixing bolts (arrow) and reverse gear lock mechanism (1).

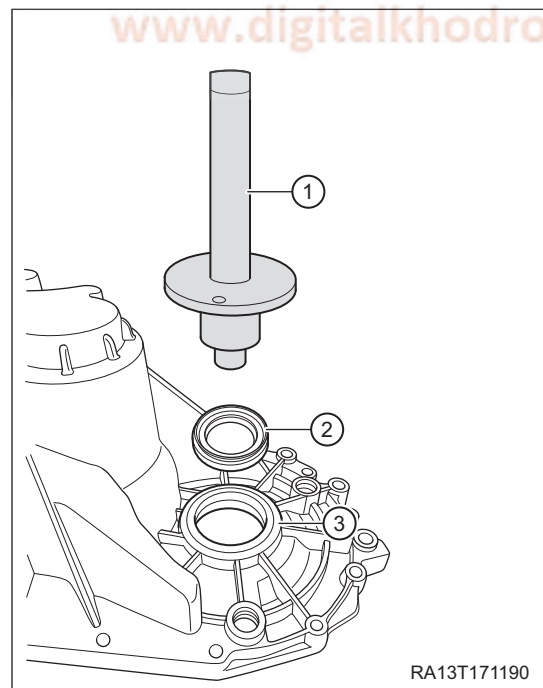
**Assembly**

1. Install the drive shaft oil seal.

**CAUTION**

- Apply a proper amount of transmission oil to the lip when installing the oil seal.

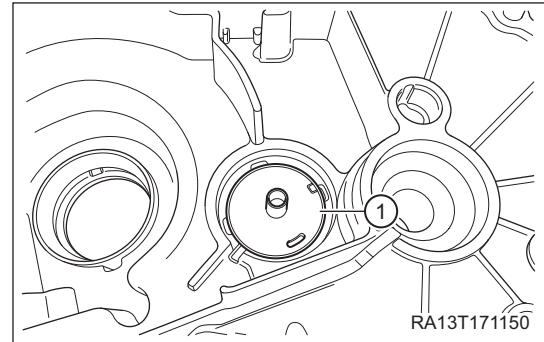
- a. Using a drive shaft oil seal installer (1), install drive shaft oil seal (2) to transmission case (3).



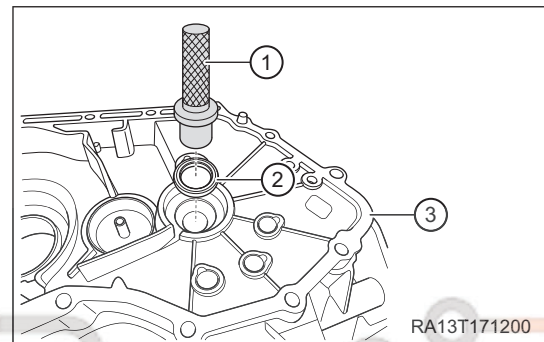


## 17 - QR515MHF TRANSMISSION

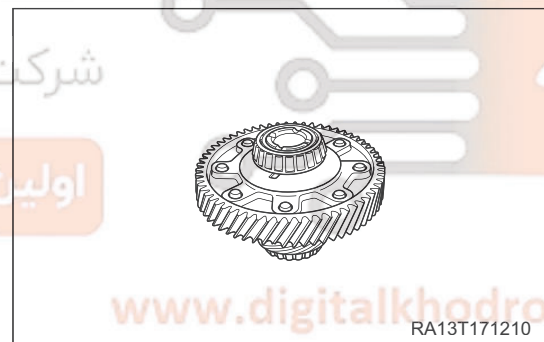
2. Install the oil deflector.
  - a. Install oil deflector (1) to clutch case.



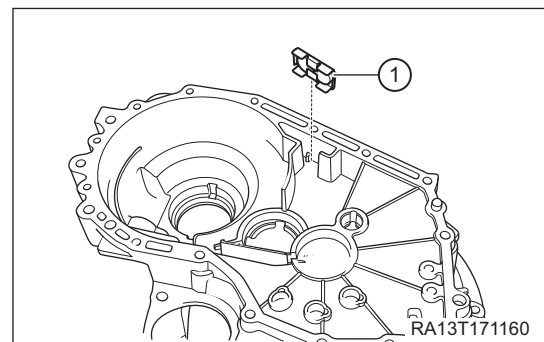
3. Install the input shaft oil seal.
  - a. Using an input shaft oil seal installer (1), install input shaft oil seal (2) to clutch case (3).



4. Install the differential bearing outer race.
  - a. Install an installer joint (1) to bearing outer race (2), and install bearing outer race (2) to case (3) with a rubber hammer (4).

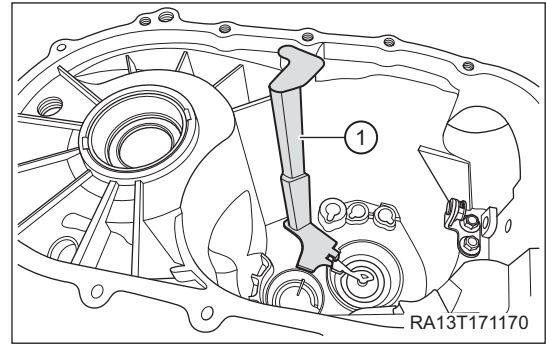


5. Install the magnet.
  - a. Install magnet (1) to clutch case.

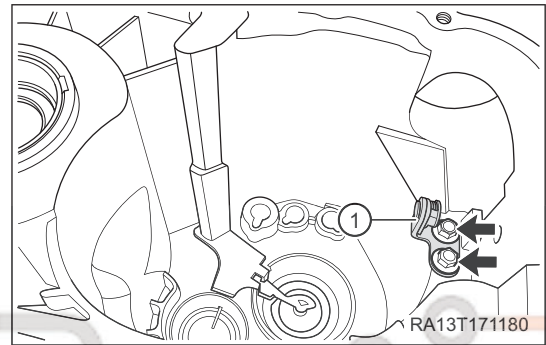


## 17 - QR515MHF TRANSMISSION

6. Install the oil guide.
  - a. Install oil guide (1) to transmission case.



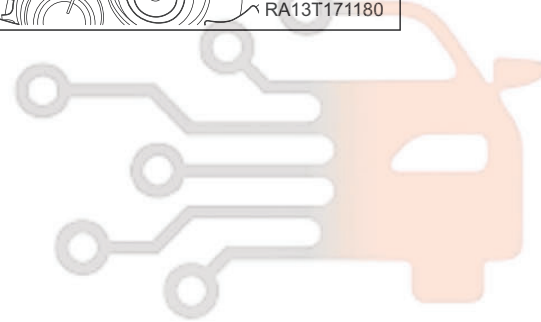
7. Remove the reverse gear lock mechanism.
  - a. Remove reverse gear lock mechanism fixing bolts (arrow) and reverse gear lock mechanism (1).  
(Tightening torque:  $18 \pm 2$  N·m)



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