

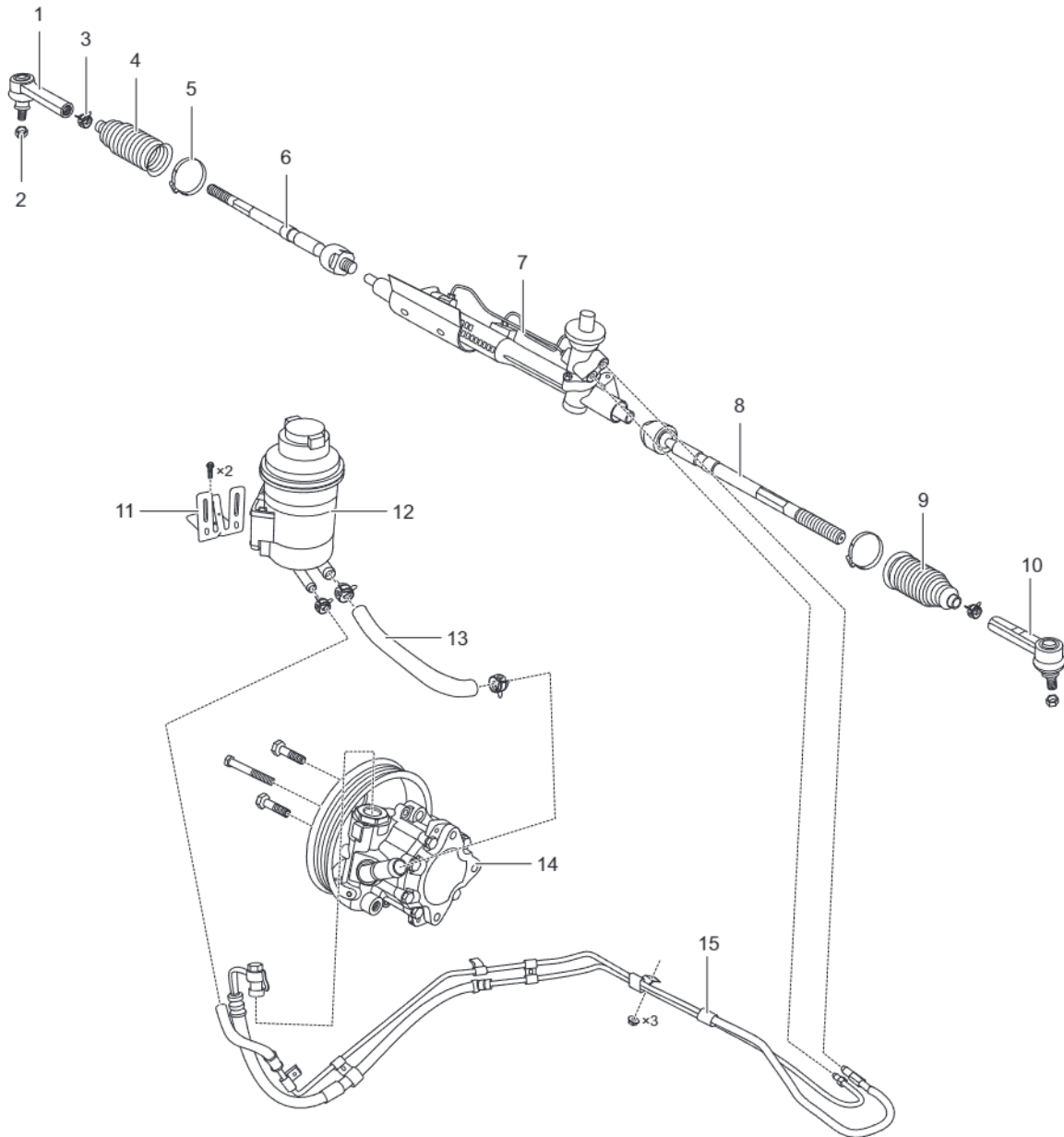
HYDRAULIC ASSIST STEERING

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GENERAL INFORMATION

Description

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RM16290010

1 - Right Steering Tie Rod Ball Pin	2 - Steering Tie Rod Ball Pin Locking Nut
3 - Elastic Clamp	4 - Right Steering Tie Rod Boot
5 - Clamping Ring	6 - Right Steering Tie Rod Assembly
7 - Steering Gear	8 - Left Steering Tie Rod Assembly
9 - Left Steering Tie Rod Boot	10 - Left Steering Tie Rod Ball Pin
11 - Steering Fluid Reservoir Bracket	12 - Steering Fluid Reservoir
13 - Fluid Suction Pipe	14 - Steering Pump
15 - High Pressure Fluid Pipe and Fluid Return Pipe	

Hydraulic assist steering system consists of power steering pump assembly, steering gear assembly, steering fluid pipe and steering fluid reservoir assembly and so on. This system can reduce steering force when driver operates steering wheel, thus improving operation convenience and driving safety.

Steering Gear Assembly

Steering gear assembly is rack & pinion type, which is characterized by simple and compact construction and high steering sensitivity. Piston rod is integrated with rack, and there is a boot at the connection between steering tie rod assembly and rack. Length of steering tie rod can be adjusted properly to match with the toe-in. Tie rod ball pin assembly and steering knuckle are connected and tightened by a locking nut.

Power Steering Pump Assembly

Power steering pump assembly is connected with steering gear assembly by high pressure fluid pipe, and connected with steering fluid reservoir assembly by fluid suction pipe. Never operate power steering pump assembly without fluid. Try to avoid turning steering wheel to the limit position for more than 5 seconds during operation.

Steering Fluid Pipe

Steering fluid pipe is used to deliver power steering fluid. Steering fluid pipes are divided into steel pipe, hose and hybrid type according to the length and operating features of each component. Ferrule connection is adopted between the steel pipe and hose of high pressure fluid pipe assembly and sealed reliably. Joint bolt and O-ring are used between steel pipe and component and tightened joint to guarantee sealing reliably. Hose and clamp are used between hose and component.

Steering Fluid Reservoir Assembly

Main functions of steering fluid reservoir assembly are to store fluid and supply it to steering pump and system.

Operation

Steering gear assembly converts the circular motion of steering wheel into linear motion of rack by engaging the rack and pinion inside. Power steering pump assembly delivers fluid into steering gear assembly to drive pistons move toward the direction made by driver. Piston transmits force to steering knuckle by steering tie rod assembly, thus reducing steering effort when driver turns steering wheel. If steering assist is ineffective, more steering effort is needed.

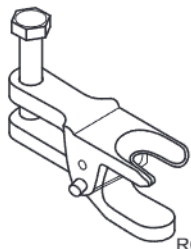
Specifications

Torque Specifications

Description	Torque (N·m)
Bracket Bolt 1 Between High Pressure Fluid Pipe and Fluid Return Pipe	10 ± 1
Clamping Bolt Between High Pressure Fluid Pipe and Steering Gear Assembly	30 ± 3
Clamping Bolt Between Fluid Return Pipe and Steering Gear Assembly	30 ± 3
Fluid Return Pipe Bracket Nut 1	7 ± 1
Fluid Return Pipe Bracket Nut 2	7 ± 1
High Pressure Fluid Pipe Joint Hollow Bolt	45 ± 3
Locking Nut Between Ball Pin Assembly and Steering Knuckle Assembly	35 ± 3
Coupling Bolt Between Front Sub Frame Assembly and Body	120 ± 10
Steering Tie Rod Adjustment Nut	$50 \sim 60$
Locking Nut of Through Bolt Between Rear Mounting Bracket and Rear Mounting Cushion Assembly	80 ± 5
Fixing Bolt Between Steering Gear Assembly and Front Sub Frame Welding Assembly	100 ± 10
Steering Pump Fixing Bolt	$20 + 5$

Tool

Special Tool

Ball Pin Separator	 RCH0000024
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DIAGNOSIS & TESTING

Problem Symptoms Table

HINT:

Use symptoms table below to help determine cause of problem. Check each suspected area in sequence. Repair or adjust faulty components, or replace as necessary.

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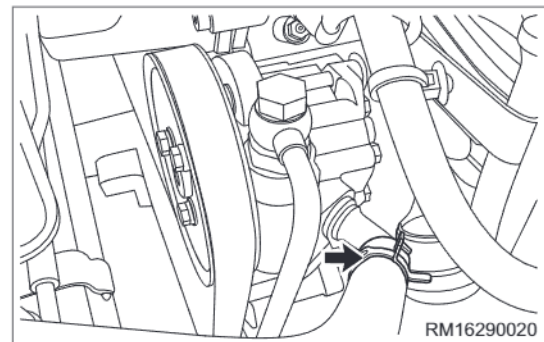
Symptom	Suspected Area	See page
Stuck or sticking in some position occurs when turning	Steering fluid (insufficient or dirty)	29-7
	Steering tie rod boot (damaged or worn)	29-19
	Steering tie rod assembly (rust)	29-19
	Steering gear assembly	29-21
	Power steering pump drive belt (loose)	07-24
Steering wheel is not centered or centered improperly	Tire (unevenly worn, deformed) or wheel (out of balance)	24-7
	Front wheel alignment (wrong)	23-49
	Ball pin assembly (worn or loose)	29-17
	Steering tie rod assembly (worn or loose)	29-19
	Intermediate shaft (twisted and deformed) or universal joint (worn, loose or insufficiently lubricated)	28-37
	Front sub frame welding assembly	22-17
	Steering knuckle assembly	22-9
	Steering gear assembly (incorrect clearance)	29-21
Steering shudders	Tire (unevenly worn, deformed) or wheel (out of balance)	24-7
	Front wheel alignment (wrong)	23-49
	Ball pin assembly (worn or loose)	29-17
	Brake disc and lining (deformed)	26-25
	Intermediate shaft (twisted and deformed) or universal joint (worn, loose or insufficiently lubricated)	28-37
	Front sub frame welding assembly	22-17
	Steering knuckle assembly	22-9
	Steering gear assembly (incorrect clearance)	29-21

Symptom	Suspected Area	See page
Steering wheel turns heavily or steering effort is uneven	Tire (improperly inflated)	24-7
	Front wheel alignment (wrong)	23-49
	Steering fluid (insufficient)	29-7
	Fluid pipe (leaked or blocked)	29-12
	Ball pin assembly (worn or loose)	29-17
	Steering tie rod assembly (worn or loose)	29-19
	Front suspension	23-12
	Power steering pump drive belt (loose or damaged)	07-24
	Power steering pump assembly	29-15
	Steering gear assembly (incorrect clearance)	29-21
Abnormal noises from steering system	Steering fluid (insufficient, air existing or dirty)	29-7
	Steering system fluid pressure fluctuates abnormally	-
	Ball pin assembly (worn or loose)	29-17
	Steering tie rod assembly (worn or loose)	29-19
	Steering gear assembly (incorrect clearance)	29-21
	Power steering pump assembly	29-15

Steering Fluid Replacement

Steering Fluid Draining

1. Set steering wheel to straight-ahead position.
2. Turn off all electrical equipment and the ignition switch.
3. Disconnect the negative battery cable.
4. Turn ignition switch to ACC.
5. Open the steering fluid reservoir cap.
6. Remove the engine lower protector assembly (See page 49-22).
7. Remove the fluid suction pipe clamp (arrow) on the power steering pump assembly.



8. Place a fluid container under the fluid suction pipe, and disconnect the fluid suction pipe joint to collect steering fluid flowing out of the fluid suction pipe and steering pump.

- Turn the steering wheel left and right to limit positions, and repeat the operation several times to drain steering fluid in steering system.

WARNING

- If steering fluid sprays on your skin, immediately wash it off with water.
- It is harmful to your skin, if contacting with power steering fluid for a long time.
- Steering wheel should not be in limit positions for more than 5 seconds.

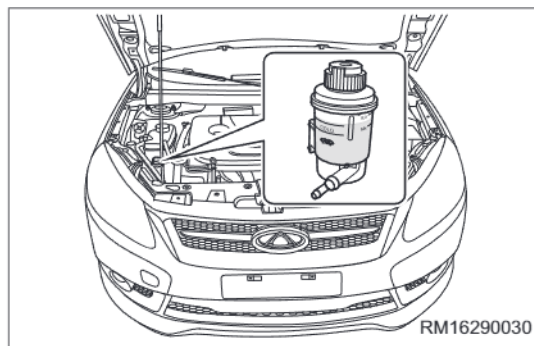
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ENVIRONMENTAL PROTECTION

- Wasted power steering fluid should be handled according to local environmental regulations.

Steering Fluid Adding

Proper steering fluid level is between "MAX" and "MIN" marks. It affects power steering system performance directly whether fluid level of the fluid reservoir is proper. If fluid level drops below "MIN" mark, it is necessary to add steering fluid.



CAUTION

- DO NOT apply foaming or expired steering to vehicle. Otherwise it may damage power steering pump assembly.

- Open steering fluid reservoir cap, and add steering fluid to reservoir until the level reaches "MAX" mark.
- Start engine and run it at idle to drive power steering pump assembly, thus filling the whole steering system with steering fluid.
- Observe fluid level of fluid reservoir while engine is running. If fluid level drops below "MIN" mark, add steering fluid to a proper level in time to prevent fluid level from dropping excessively and avoid air entering power steering pump assembly.
- If bubbles occur in steering fluid reservoir, perform bleeding procedures. Check that level is between "MAX" and "MIN" marks when there are no bubbles in fluid reservoir and fluid level does not change any longer.

WARNING

- If steering fluid sprays on your skin, immediately wash it off with water.
- It is harmful to your skin, if contacting with power steering fluid for a long time.

Bleeding Procedures

It is necessary to perform bleeding procedures when bubbles occur in steering fluid reservoir assembly and fluid has emulsified or there is excessive noise in power steering pump assembly.

Bleeding procedures are as follows:

1. Open steering fluid reservoir cap.
2. Raise vehicle with a lift (with front wheels off ground).
3. Start engine (idling) and turn steering wheel left and right to limit positions (do not stay at the limit positions more than 2 seconds). Repeat several times to completely bleed air in system from the reservoir. Observe fluid level of fluid reservoir during bleeding. If fluid level drops below "MIN" mark, add steering fluid to proper level in time.
4. After repeatedly turning steering wheel to limit positions several times, center the steering wheel, run engine at idle for 3 to 5 minutes and observe whether there are still bubbles in fluid reservoir. If there are still bubbles, perform above procedures again until no bubbles are bled. If there are still problems, perform steering system inspection.

ON-VEHICLE SERVICE

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⚠ WARNING

- Be sure to wear necessary safety equipment to prevent accidents when servicing.
- When removing and installing high temperature components and surrounding components, wait and operate until they drop to normal temperature to avoid being burned.
- Prevent skin and eyes from contacting with steering fluid.

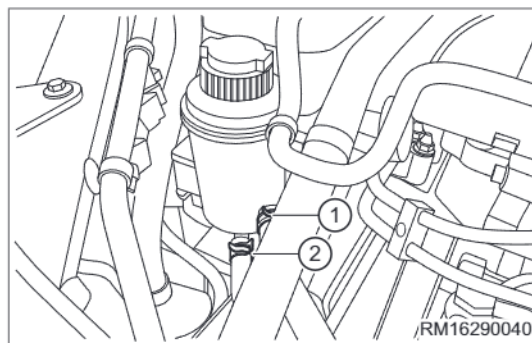
👁 CAUTION

- After disconnecting steering line, seal it immediately to prevent foreign matter from entering.
- Never run power steering pump assembly when steering fluid is insufficient.
- Steering wheel should not be in limit positions for more than 5 seconds.
- Never start engine with hose loosened or disconnected.
- Never allow hose to contact with high temperature exhaust pipe.

Steering Fluid Reservoir Assembly

Removal

1. Drain the steering fluid ([See page 29-7](#)).
2. Remove the steering fluid reservoir assembly.
 - a. Remove the fluid suction pipe clamp (1) on steering fluid reservoir, and disconnect the connection between fluid suction pipe assembly and steering fluid reservoir assembly.
 - b. Remove the fluid return pipe clamp (2) on steering fluid reservoir, and disconnect the connection between fluid return pipe assembly and steering fluid reservoir assembly.



👁 CAUTION

- Using a plug, clog disconnected pipe to prevent foreign matter from entering.

- c. Pull the steering fluid reservoir assembly upward to remove it from steering pump bracket.

Inspection

1. Check steering fluid reservoir assembly for breakage or deformation. Replace fluid reservoir if necessary.
2. Check if there is contamination in steering fluid reservoir assembly. Clean or replace if necessary.

Installation

Installation is in the reverse order of removal.

CAUTION

- Install fluid suction pipe clamp and fluid return pipe clamp in place.
- Never tap or hit the fluid reservoir.

Steering Fluid Pipe

Removal



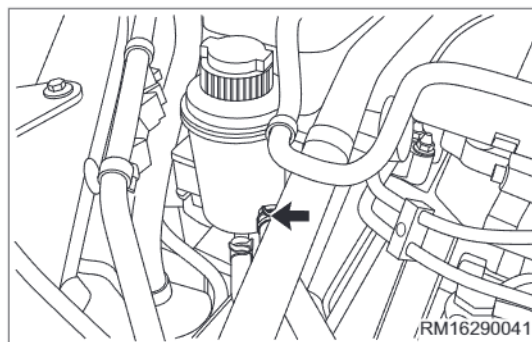
ENVIRONMENTAL PROTECTION

- Collect steering fluid residue in line with a container when disconnecting the line.

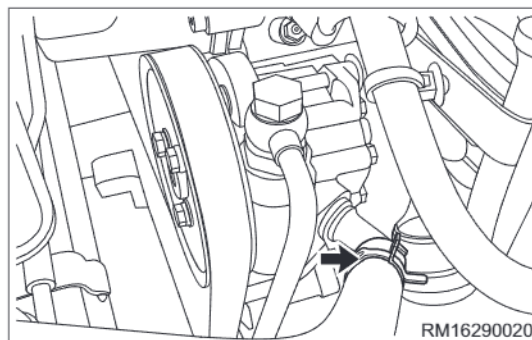
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1. Drain the steering fluid (See page 29-7).
2. Remove the front bumper (See page 49-8).
3. Remove the fluid suction pipe.

- a. Remove the fluid suction pipe clamp (arrow) on steering fluid reservoir, and disconnect the connection between fluid suction pipe and steering fluid reservoir assembly.



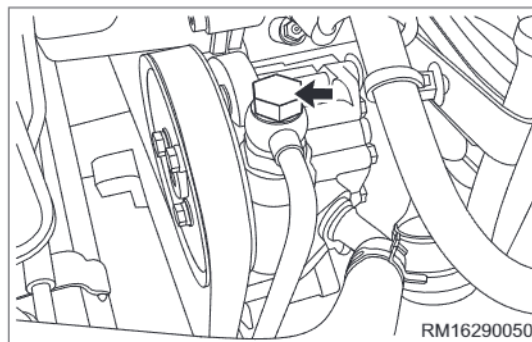
- b. Remove the fluid suction pipe clamp (arrow) on power steering pump assembly side, and disconnect the connection between fluid suction pipe and power steering pump assembly.



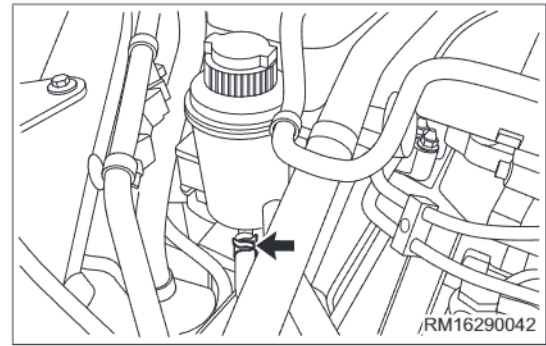
- c. Remove the fluid suction pipe.

4. Remove the high pressure fluid pipe and fluid return pipe.

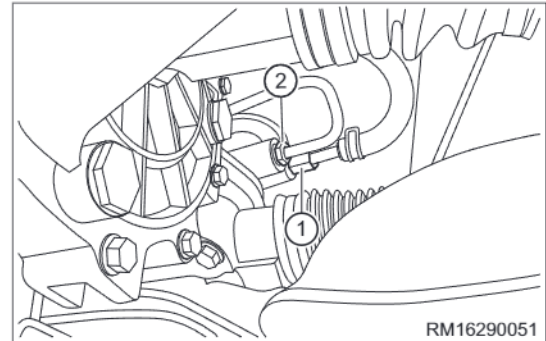
- a. Remove the high pressure fluid pipe joint hollow bolt (arrow) from power steering pump assembly. (Tightening torque: 45 ± 3 N·m)



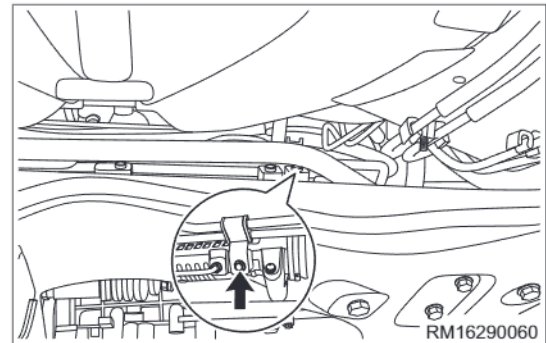
- b. Remove the fluid return pipe clamp (arrow) from steering fluid reservoir assembly.



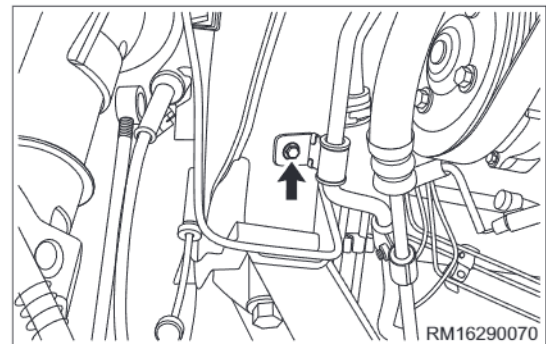
- c. Remove the high pressure fluid pipe clamping bolt (1) and fluid return pipe clamping bolt (2) from steering gear assembly.
(Tightening torque for high pressure fluid pipe clamping bolt: $30 \pm 3 \text{ N}\cdot\text{m}$)
(Tightening torque for fluid return pipe clamping bolt: $30 \pm 3 \text{ N}\cdot\text{m}$)



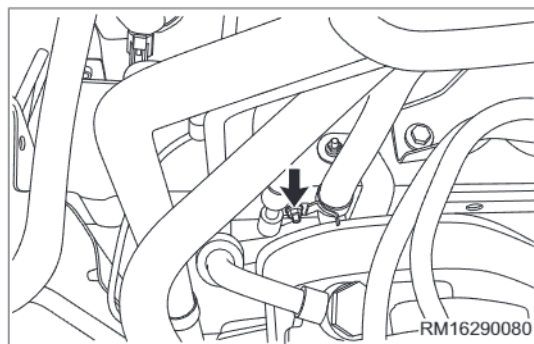
- d. Remove the bolt (arrow) from high pressure fluid pipe and fluid return pipe bracket.
(Tightening torque: $10 \pm 1 \text{ N}\cdot\text{m}$)



- e. Remove the fluid return pipe bracket nut 1 (arrow).
(Tightening torque: $7 \pm 1 \text{ N}\cdot\text{m}$)



- f. Remove the fluid return pipe bracket nut 2 (arrow).
(Tightening torque: 7 ± 1 N·m)



- g. Remove the high pressure fluid pipe and fluid return pipe.

Inspection

1. Check steering fluid pipe for cracks, wear or blockage. Replace steering fluid pipe assembly if necessary.
2. Check steering fluid pipe joint and O-ring for deformation or damage. Replace steering fluid pipe assembly if necessary.
3. Check if steering fluid pipe bracket is normal. Replace if necessary.

Installation

Installation is in the reverse order of removal.

CAUTION

- Never tap or squeeze steering fluid pipe.
- Tighten fixing nut and bolt to specified torques.

Power Steering Pump Assembly

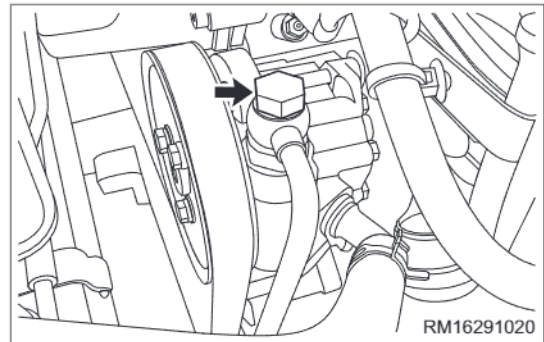
Removal



ENVIRONMENTAL PROTECTION

- Collect steering fluid flowing from line with a container when disconnecting the line.

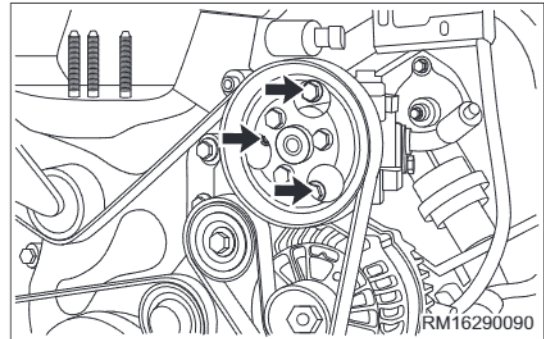
1. Drain the steering fluid (See page 29-7).
2. Remove the accessory drive belt (See page 07-21).
3. Remove the power steering pump assembly.
 - a. Remove the high pressure fluid pipe joint hollow bolt (arrow).
(Tightening torque: $45 \pm 3 \text{ N}\cdot\text{m}$)



CAUTION

- Using a plug, clog disconnected steering system line to prevent foreign matter from entering.

- b. Remove 3 fixing bolts (arrow) from power steering pump assembly, and then remove the power steering pump assembly.
(Tightening torque: $20 + 5 \text{ N}\cdot\text{m}$)



Inspection

1. Check power steering pump assembly for blockage or damage, and power steering pump bearing for looseness and abnormal noise. Replace power steering pump assembly if necessary.
2. Check if power steering pump pulley is normal. Replace if necessary.

Installation

Installation is in the reverse order of removal.

CAUTION

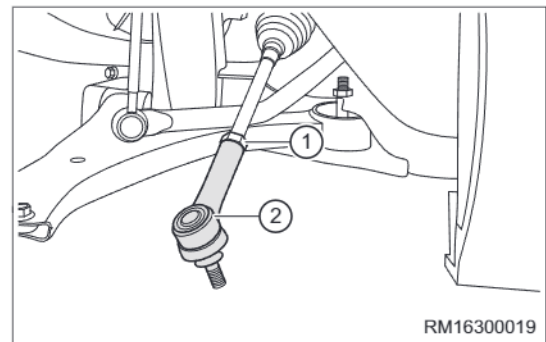
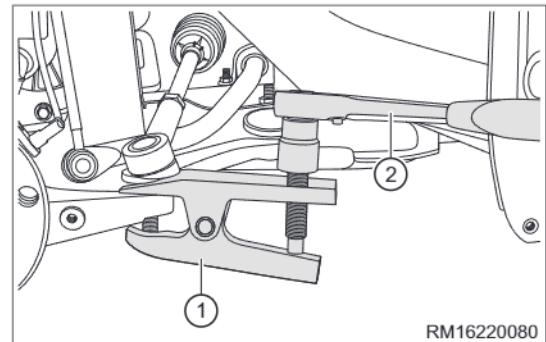
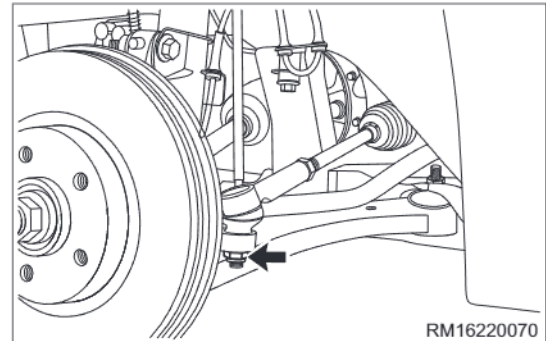
- Tighten fixing bolts to specified torque.
- DO NOT tap or hit power steering pump assembly.

Ball Pin Assembly

Removal

HINT:

- Use same procedures for right and left sides.
 - Procedures listed below are for left side.
1. Set steering wheel to straight-ahead position.
 2. Turn off all electrical equipment and the ignition switch.
 3. Disconnect the negative battery cable.
 4. Remove the front left wheel ([See page 24-9](#)).
 5. Remove the ball pin assembly.
 - a. Remove the locking nut (arrow) between left steering tie rod ball pin assembly and front left steering knuckle assembly.
(Tightening torque: $35 \pm 3 \text{ N}\cdot\text{m}$)
 - b. Install the ball pin separator (1), and tighten the ball pin separator bolt with a wrench (2) to separate the steering tie rod ball pin assembly from steering knuckle assembly.
 - c. Loosen the steering tie rod adjustment nut (1), and turn the ball pin assembly (2) counterclockwise to remove it.
(Tightening torque: $50 - 60 \text{ N}\cdot\text{m}$)



HINT:

When removing ball pin assembly, record revolutions during removal to make front wheel toe-in closer to setting value after installation.

Inspection

1. Check tie rod ball pin for looseness. Replace ball pin assembly if necessary.
2. Check tie rod ball pin bush rubber for damage. Replace ball pin assembly if necessary.



Installation

Installation is in the reverse order of removal.

CAUTION

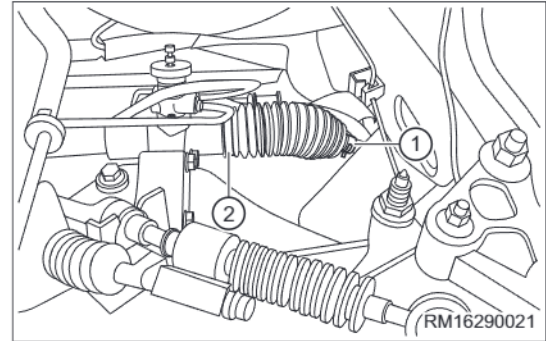
- After installing tie rod ball pin assembly, it is necessary to perform wheel alignment procedure ([See page 23-49](#)).

Steering Tie Rod Assembly

Removal

HINT:

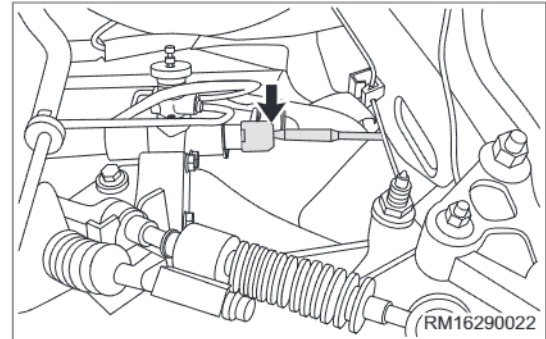
- Use same procedures for right and left sides.
 - Procedures listed below are for left side.
1. Turn off all electrical equipment and the ignition switch.
 2. Remove the battery (See page 16-7).
 3. Remove the air filter assembly (See page 10-12).
 4. Remove the battery tray (See page 16-9).
 5. Remove the front wheels (See page 24-9).
 6. Remove the tie rod ball pin assembly (See page 29-19).
 7. Remove the steering tie rod assembly.
 - a. Remove the steering tie rod boot elastic clamp (1).
 - b. Remove the steering tie rod boot clamping ring (2), and remove the steering tie rod boot.



CAUTION

- Operate carefully to prevent damaging the boot.
- It is necessary to replace with new clamping ring when reinstalling steering tie rod boot.

- c. Using a wrench, remove the tie rod assembly (arrow).



Inspection

1. Check steering tie rod boot for damage, and clamp for normality. Replace steering tie rod boot and clamp if necessary to prevent water and micro dust from entering and causing parts failure prematurely.
2. Check steering tie rod assembly for deformation or wear, and the ball for insufficient lubrication. Replace steering tie rod assembly or add grease if necessary.

Installation

Installation is in the reverse order of removal.

CAUTION

- It is necessary to apply thread seal gum to ball pin.
- It is necessary to fit steering tie rod ball face and rack face closely.

Steering Gear Assembly

WARNING

- Be sure to wear necessary safety equipment to prevent accidents when servicing.
- When removing and installing high temperature components and surrounding components, wait and operate them until they drop to normal temperature to avoid being burned.
- Prevent skin and eyes from contacting with steering fluid when removing steering system.

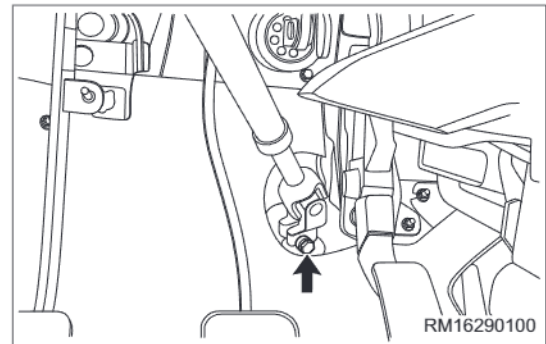
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CAUTION

- After disconnecting steering system line, seal it immediately to prevent foreign matter from entering.
- Never run power steering pump assembly when steering fluid is insufficient.
- Steering wheel should not be in limit positions for more than 5 seconds.
- Never start engine with hose loosened or disconnected.
- Never allow hose to contact with high temperature exhaust manifold or catalyst.

Removal

1. Set steering wheel to straight-ahead position.
2. Turn off all electrical equipment and the ignition switch.
3. Disconnect the negative battery cable.
4. Drain the steering fluid ([See page 29-7](#)).
5. Remove the front wheels ([See page 24-9](#)).
6. Remove the coupling bolt between steering column with intermediate shaft assembly and input shaft of steering gear.
(Tightening torque: $30 \pm 3 \text{ N}\cdot\text{m}$)

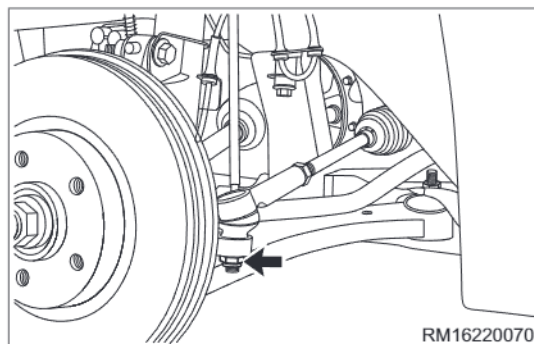


7. Separate the ball pin assembly and steering knuckle assembly.

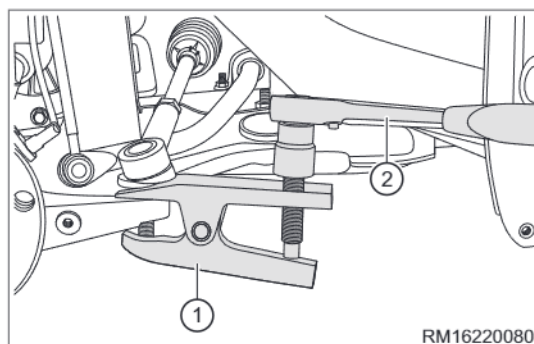
HINT:

- Use same procedures for right and left sides.
- Procedures listed below are for left side.

- a. Remove the locking nut (arrow) between left steering tie rod ball pin assembly and front left steering knuckle assembly.
(Tightening torque: $35 \pm 3 \text{ N}\cdot\text{m}$)

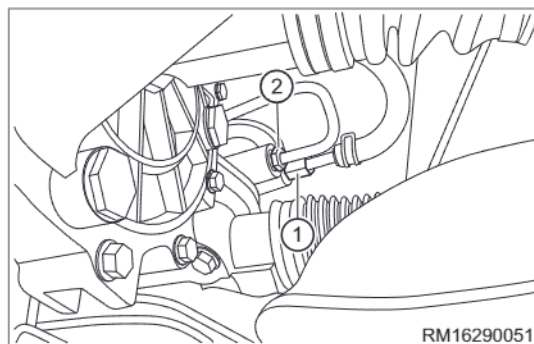


- b. Install the ball pin separator (1), and tighten the ball pin separator bolt with a wrench (2) to separate the steering tie rod ball pin assembly from the steering knuckle assembly.

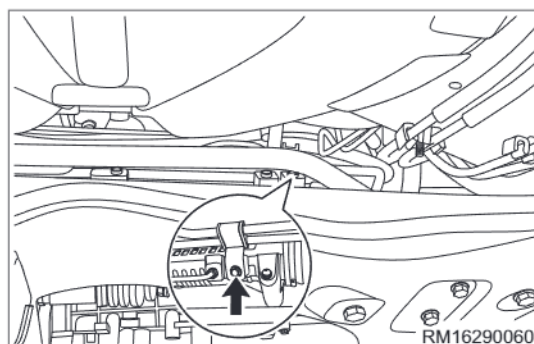


8. Use an engine equalizer to hang the engine.
9. Support the front sub frame welding assembly with a transmission carrier.
10. Remove the steering gear with tie rod assembly.

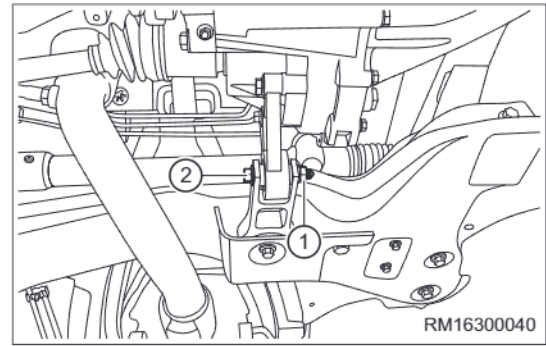
- a. Remove the high pressure fluid pipe clamping bolt (1) and fluid return pipe clamping bolt (2) on steering gear assembly. Disconnect the connection between fluid return pipe/high pressure pipe and steering gear assembly separately.
(Tightening torque for high pressure fluid pipe clamping bolt: $30 \pm 3 \text{ N}\cdot\text{m}$)
(Tightening torque for fluid return pipe clamping bolt: $30 \pm 3 \text{ N}\cdot\text{m}$)



- b. Remove the bolt (arrow) from high pressure fluid pipe and fluid return pipe bracket.
(Tightening torque: $10 \pm 1 \text{ N}\cdot\text{m}$)

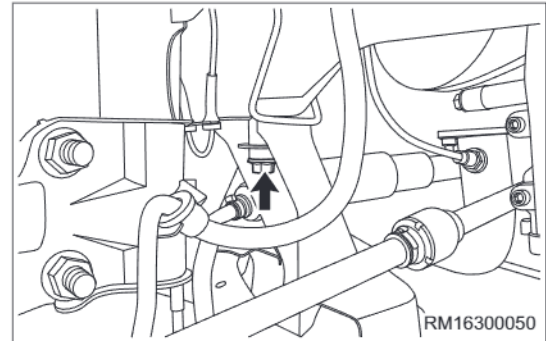


- c. Remove the locking nut (1) of through bolt between rear mounting bracket and rear mounting cushion assembly and remove the through bolt (2).
(Tightening torque: $80 \pm 5 \text{ N}\cdot\text{m}$)

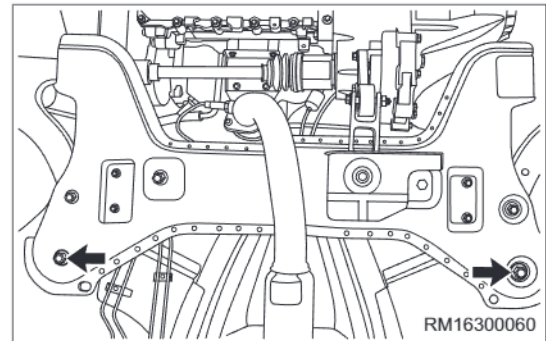


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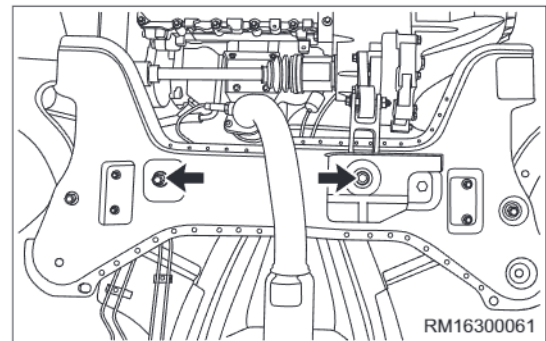
- d. Loosen the coupling nut (arrow) between the front right part of front sub frame welding assembly and the body. Use same procedure to loosen the nut on left side.
(Tightening torque: $120 \pm 10 \text{ N}\cdot\text{m}$)



- e. Loosen the coupling bolt between front sub frame welding assembly and body.
(Tightening torque: $120 \pm 10 \text{ N}\cdot\text{m}$)



- f. Remove 2 fixing bolts between steering gear assembly and front sub frame welding assembly.
(Tightening torque: $100 \pm 10 \text{ N}\cdot\text{m}$)



- g. Lower the front sub frame welding assembly (lower about 40 mm), and then remove the steering gear with tie rod assembly.

Inspection

1. Check steering gear assembly housing for damage or deformation, and the rack and pinion for sticking. Replace steering gear assembly if necessary.
2. Check if steering tie rod boot, clamp and clamping ring are normal. Replace if necessary to prevent water and micro dust from entering and causing parts failure prematurely.
3. Check steering tie rod assembly and ball pin assembly for serious wear. Replace steering tie rod assembly and ball pin assembly if necessary.

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Installation

Installation is in the reverse order of removal.

CAUTION

- After installing steering gear assembly, perform front wheel alignment procedure ([See page 23-49](#)).

