

## ST-2

## Steering System

## General Information

General  
Specification

Items			Specification
Steering gear	Type		Rack & Pinion
	Rack stroke		142 mm / 144 mm
Motor pump unit	Type		Gear pump
	Relief pressure		108.3 ~ 116 bar
	Displacement		1.5 cc/rev
	Max. volume flow		7.8 LPM
Oil pump	Type		Vane
	Displacement		10.5 cc/rev
	Relief pressure		102(+3/-2)kgf/cm <sup>2</sup>
Steering angle	Inner	225/55 R17	41.59° ± 1°30'
		225/50 R18	42.70° ± 1°30'
	Outer	225/55 R17	34.07°
		225/50 R18	34.02°
Power steering oil	EPHS		Pentosin CHF 202
	NPS		PSF-4

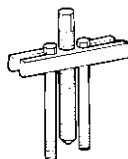
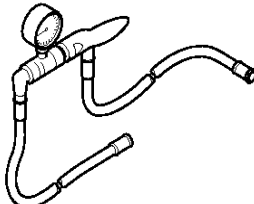
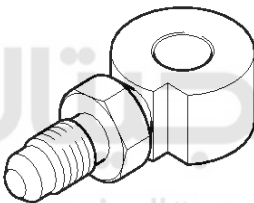
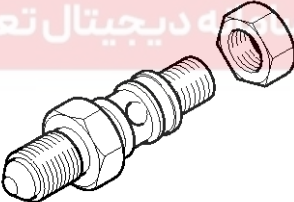
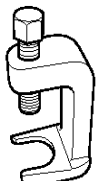
## Tightening Torques

Items	Tightening torque		
	N.m	kgf.m	lb-ft
Drive shaft nuts	200 ~ 280	20.0 ~ 28.0	145 ~ 203
Steering column assembly & universal joint	18 ~ 25	1.8 ~ 2.5	13 ~ 18
Universal joint to steering gear	18 ~ 25	1.8 ~ 2.5	13 ~ 18
Tie-rod end and knuckle	85 ~ 110	8.5 ~ 11.0	61 ~ 80
Power steering gear box and sub frame	80 ~ 100	8.0 ~ 10.0	58 ~ 72
Pressure tube wrench bolt and power steering motor pump unit	20 ~ 30	2.0 ~ 3.0	14 ~ 21
Power steering motor pump unit bracket and side body frame	45 ~ 60	4.5 ~ 6.0	33 ~ 43
Universal joint to dust cover	13 ~ 18	1.3 ~ 1.8	9 ~ 13
Steering column mounting bolt	13 ~ 18	1.3 ~ 1.8	9 ~ 13

# General Information

## ST-3

### Special Service Tools

Tool (Number and Name)	Illustration	Use
09561-11001 Steering wheel puller	 KPRE103G	Removal of steering wheel
09572-21000 Oil pressure gauge	 EPRF001F	Measurement of oil pressure (Use with 09572-22100, 09572-21200)
09572-22100 Oil pressure gauge adaptor	 EPRF001H	Measurement of oil pressure (Use with 09572-21000, 09572-21200)
09572-21200 Oil pressure gauge adaptor	 EPRF001G	Measurement of oil pressure (Use with 09572-22100, 09572-21200)
09568-2J100 Ball joint puller	 SBHSS8062D	Separation of tie-rod end ball joint

## ST-4

## Steering System

## Troubleshooting

Symptom	Probable cause	Remedy
Excessive play in steering	Loose yoke plug	Retighten
	Loose steering gear mounting bolts	Retighten
	Loose or worn tie rod end	Retighten or replace as necessary
Steering wheel operation is not smooth (Insufficient power assist)	V-belt slippage	Readjust
	Damaged V-belt	Replace
	Low fluid level	Replenish
	Air in the fluid	Bleed air
	Twisted or damaged hoses	Correct the routing or replace
	Insufficient oil pump pressure	Repair or replace the oil pump
	Sticky flow control valve	Replace
	Excessive internal oil pump leakage	Replace the damaged parts
	Excessive oil leaks from rack and pinion in gear box	Replace the damaged parts
	Distorted or damaged gear box or valve body seals	Replace
	Excessive turning resistance of tierod end	Replace
Steering wheel does not return properly	Yoke plug excessively tight	Adjust
	Tie rod and/or ball joint cannot turn smoothly	Replace
	Loose mounting of gear box mounting bracket	Retighten
	Worn steering shaft joint and/or	
	Worn steering shaft joint and/or body grommet	Correct or replace
	Distorted rack	Replace
	Damaged pinion bearing	Replace
	Twisted or damaged hoses	Reposition or replace
	Damaged oil pressure control valve	Replace
	Damaged oil pump input shaft bearing	Replace
Noise	<b>Hissing Noise in Steering Gear</b> There is some noise with all power steering systems. One of the most common is a hissing sound when the steering wheel is turned and the car is not moving. This noise will be most evident when turning the wheel while the brakes are being applied. There is no relationship between this noise and steering performance. Do not replace the valve unless the "hissing" noise becomes extreme. A replaced valve will also make a slight noise, and is not always a solution for the condition.	
Rattling or chucking noise in the rack and pinion	Interference with hoses from vehicle body	Reposition
	Loose gear box bracket	Retighten
	Loose tie rod end and/or ball joint	Retighten
	Worn tie rod and/or ball joint	Replace

## General Information

## ST-5

Symptom	Probable cause	Remedy
Noise in the oil pump	Low fluid level	Replenish
	Air in the fluid	Bleed air
	Loose pump mounting bolts	Retighten

# دیجیتال خودرو

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران



## ST-6

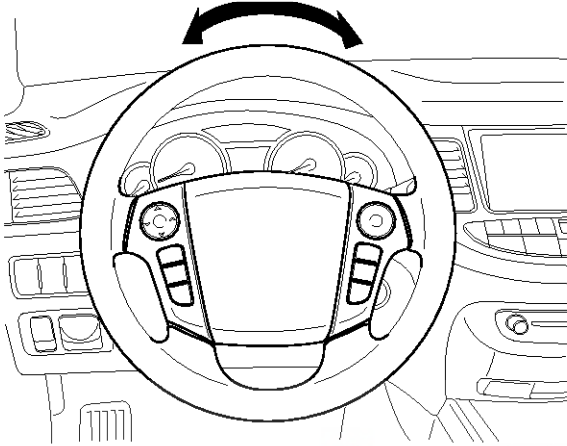
## Steering System

## EHPS

## Steering Wheel Play Inspection

1. Turn the steering wheel so that the front wheels can face straight ahead.
2. Measure the distance that the steering wheel can be turned without moving the front wheels.

**Standard value:** 0 ~ 30mm (1.18in.) or less



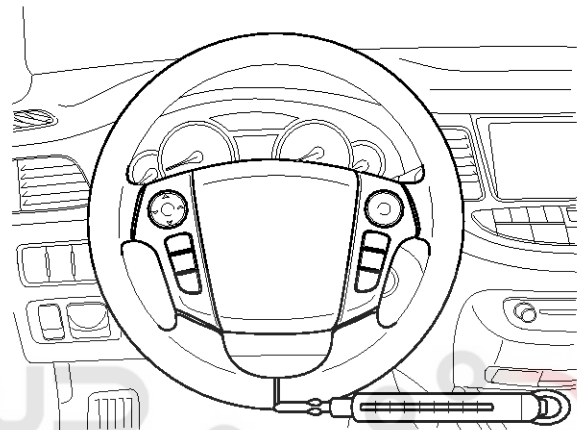
SBHST8032D

3. If the play exceeds standard value, inspect the steering column, shaft, and linkages.

## Checking Stationary Steering Effort

1. Position the vehicle on a level surface and place the steering wheel in the straight ahead position.
2. Start the engine and turn the steering wheel from lock to lock several times to warm up the power steering fluid.
3. Attach a spring scale to the steering wheel. With the engine speed 900 ~ 1100rpm, pull the scale and read it as soon as the tires begin to turn.

**Standard value :** 2.5kgf



SBHST8300D

4. If the measured value exceeds standard value, inspect the power steering gear box and pump.

## General Information

## ST-7

### Power Steering Fluid Replacement

#### ⚠ CAUTION

Always use genuine Pentosin CHF202. Using other type of power steering fluid or ATF can cause increased wear and poor steering in cold weather.

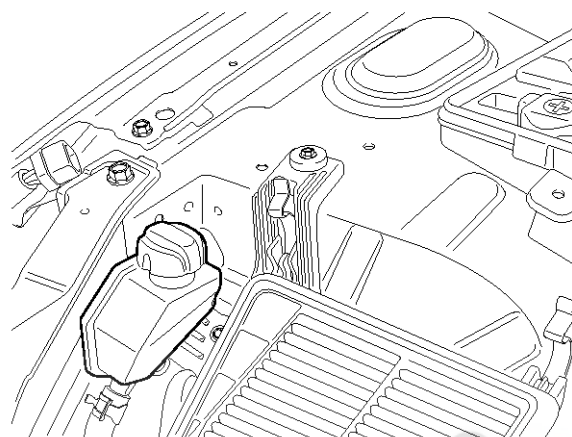
1. Raise the reservoir and then disconnect the return hose to drain the reservoir. Be careful not to spill the fluid on the body and parts. Wipe off any spilled fluid at once.
2. Connect a tube of suitable diameter to the disconnected return hose, and put the hose end in a suitable container.
3. Jack up the front wheels and turn the steering wheel from the lock to lock until fluid stops running out of the tube.
4. Reconnect the return hose to reservoir.
5. Fill the reservoir with the power steering fluid and then bleed the power steering system.

### Air bleeding

#### ⚠ CAUTION

Always use genuine Pentosin CHF202. Using other type of power steering fluid or ATF can cause increased wear and poor steering in cold weather.

1. Jack up the front wheels.
2. Fill the reservoir with the power steering fluid up to the level of 'COLD MAX' marked on the reservoir.



SBHST8034D

#### ⚠ CAUTION

Be careful not to start the engine. If starting the engine before performing the steps 3 through 4, it may cause an abnormal noise during power steering pump operation.

3. Turn the steering wheel from lock to lock 5 ~ 6 times for 15 ~ 20 seconds.
4. Crank the engine 1 ~ 2 times by turning the ignition key very quickly from the 'On' position to the 'Start' position, but do not start the engine.
5. Turn the steering wheel from lock to lock 5 ~ 6 times for 15 ~ 20 seconds.
6. Start the engine and keep turning the steering wheel from lock to lock until air bubbles stop appearing in the reservoir with the engine idle.
7. Check the color and level of the power steering fluid in the reservoir and then replenish the reservoir up to the 'COLD MAX' level as required.

#### 📌 NOTICE

If the fluid level moves up and down when turning the steering wheel, the fluid overflows out of the reservoir when turning off the engine or the fluid is a white color, it indicates that air bubbles have not been removed sufficiently from the power steering system. Therefore, repeat the steps 5 through 6 as required.

## ST-8

## Steering System

## Oil Pump Relief Pressure Test

1. Disconnect the pressure tube from the power steering pump and then install the special tools between the pump and the pressure tube as illustrated below.
2. Start the engine and turn the steering wheel several times so that the fluid temperature rises to approx. 50 ~ 60 C (122 F).
3. Set the engine speed to approx. 1000rpm.
4. Close the shut-off valve of the special tools and measure the fluid pressure.

**Relief pressure:** 108.3 ~ 116 BAR

**⚠ CAUTION**

**Do not keep the shut-off valve on the pressure gauge closed for longer than 10 seconds.**

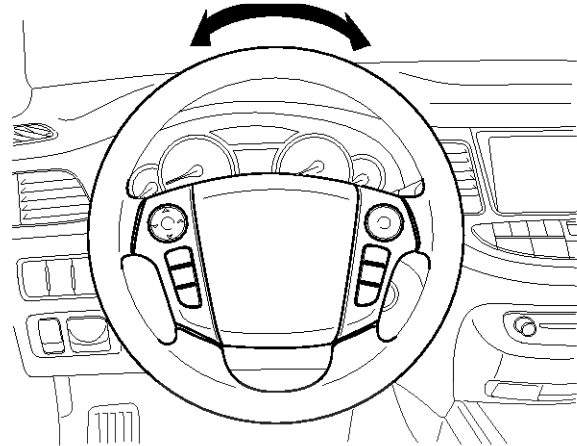
5. Remove the special tools, and then connect the pressure tube to the pump by tightening the eye bolt.
6. Bleed the power steering system.

## NPS

## Steering Wheel Play Inspection

1. Turn the steering wheel so that the front wheels can face straight ahead.
2. Measure the distance that the steering wheel can be turned without moving the front wheels.

**Standard value:** 30mm (1.18in.) or less



SBHST8032D

3. If the play exceeds standard value, inspect the steering column, shaft, and linkages.

دیجیتال خودرو  
شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران



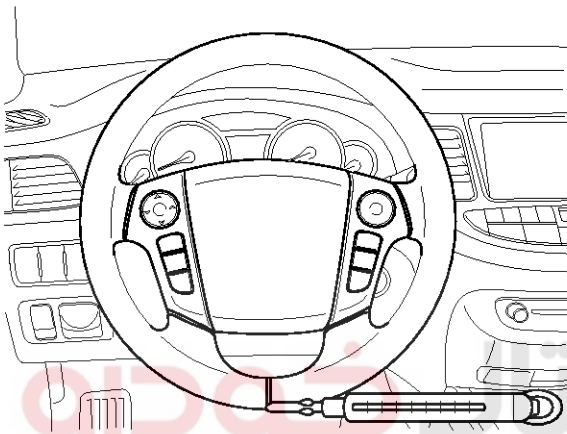
## General Information

## ST-9

### Checking Stationary Steering Effort

1. Position the vehicle on a level surface and place the steering wheel in the straight ahead position.
2. Start engine and turn the steering wheel from lock to lock several times to warm up the power steering fluid.
3. Attach a spring scale to the steering wheel. With the engine speed 900 ~ 1100rpm, pull the scale and read it as soon as the tires begin to turn.

**Standard value:** 3.0kgf or less



SBHST8300D

4. If the measured value exceeds standard value, inspect the power steering gear box and pump.

### Power Steering Fluid Replacement

#### ⚠CAUTION

**Always use genuine power steering fluid. Using other type of power steering fluid or ATF can cause increased wear and poor steering in cold weather.**

1. Raise the reservoir and then disconnect the return hose to drain the reservoir. Be careful not to spill the fluid on the body and parts. Wipe off any spilled fluid at once.
2. Connect a tube of suitable diameter to the disconnected return hose, and put the hose end in a suitable container.
3. Jack up the front wheels and turn the steering wheel from the lock to lock until fluid stops running out of the tube.
4. Reconnect the return hose to reservoir.
5. Fill the reservoir with the power steering fluid and then bleed the power steering system.



## ST-10

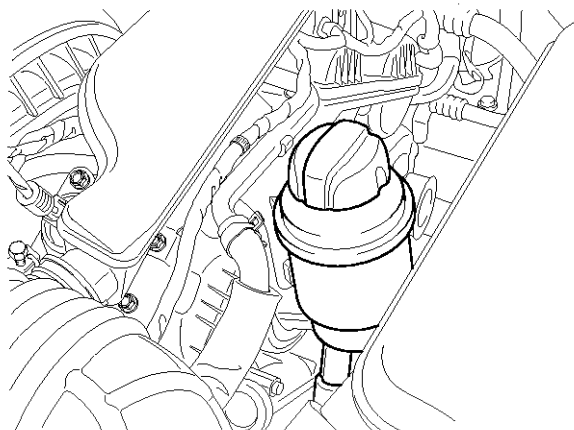
## Steering System

## Air bleeding

**⚠CAUTION**

Always use genuine power steering fluid. Using other type of power steering fluid or ATF can cause increased wear and poor steering in cold weather.

1. Fill the reservoir with the power steering fluid up to the level of 'COLD MAX' marked on the reservoir.



SBHST9301N

**ⓘNOTICE**

While conducting the following operations, keep replenishing the reservoir so that the fluid level is always between the 'COLD MAX' and the 'COLD MIN' marked on the reservoir.

2. Jack up the front wheels.
3. Crank the engine 1 ~ 2 times by turning the ignition key very quickly from the 'On' position to the 'Start' position, but do not start the engine.

**⚠CAUTION**

Be careful not to start the engine. Starting the engine before performing steps 3 through, may cause abnormal noise during power steering pump operation.

4. Turn the steering wheel from lock to lock 5 ~ 6 times for 15 ~ 20 seconds.
5. Start the engine and keep turning the steering wheel from lock to lock until air bubbles stop appearing in the reservoir with the engine idle.

6. Check the color and level of the power steering fluid in the reservoir and then replenish the reservoir up to the 'COLD MAX' level as required.

**ⓘNOTICE**

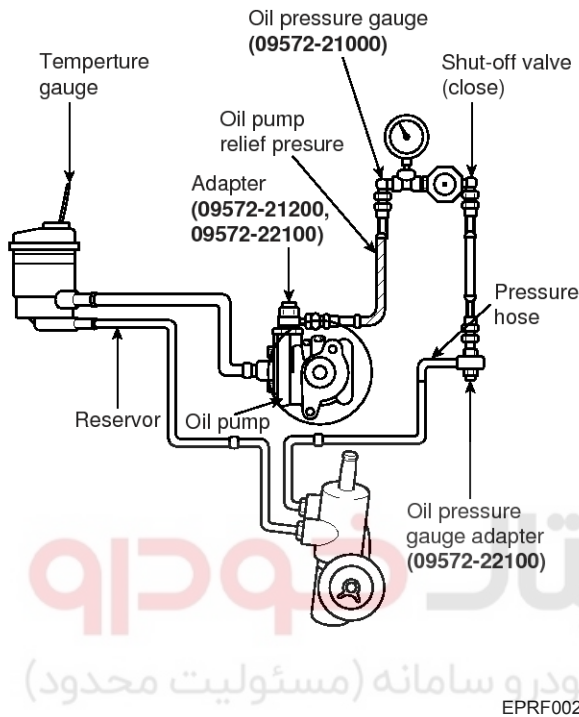
If the fluid level moves up and down when turning the steering wheel, the fluid overflows out of the reservoir when the turning off the engine or the fluid has white color, it indicates that air bubbles have not been removed sufficiently from the power steering system. Therefore, repeat the steps 5 through 6 as required.

## General Information

## ST-11

### Oil Pump Relief Pressure Test

1. Disconnect the pressure tube from the power steering pump and then install the special tools between the pump and the pressure tube as illustrated below.



2. Start the engine and turn the steering wheel several times so that the fluid temperature rises to approx. 50 ~ 60 C (122 F).
3. Set the engine speed to approx. 1000rpm.
4. Close the shut-off valve of the special tools and measure the fluid pressure.

#### Relief pressure:

102(+3/-2)kgf/cm<sup>2</sup> (1280 ~ 1351psi, 8.8 ~ 9.3Mpa)

#### ⚠ CAUTION

**Do not keep the shut-off valve on the pressure gauge closed for longer than 10 seconds.**

5. Remove the special tools, and then connect the pressure tube to the pump by tightening the eye bolt.
6. Bleed the power steering system.

# ST-12

## Steering System

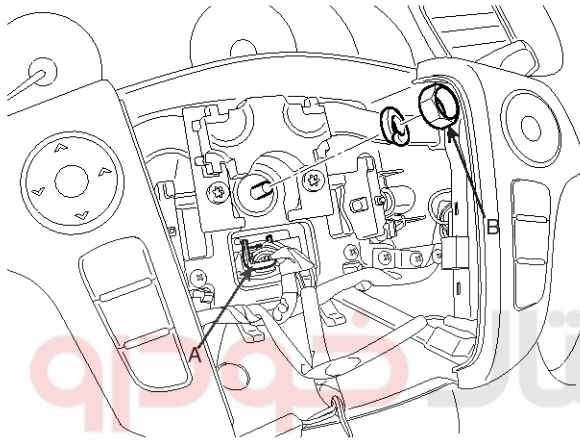
### Steering Column & Shaft

#### Replacement

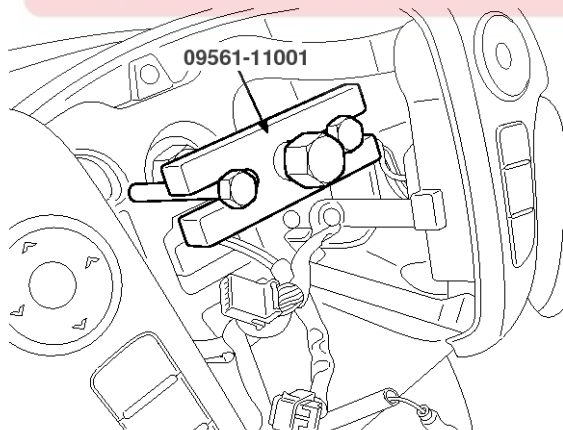
1. Disconnect the negative cable from the battery and wait for at least 30 seconds.
2. Turn the steering wheel so that the front wheels face straight ahead.
3. Remove the DAB module (or Horn pad). (Refer to RT group)

#### Tightening torque :

40 ~ 50N.m (4.0 ~ 5.0kgf.m, 29 ~ 36lb-ft)



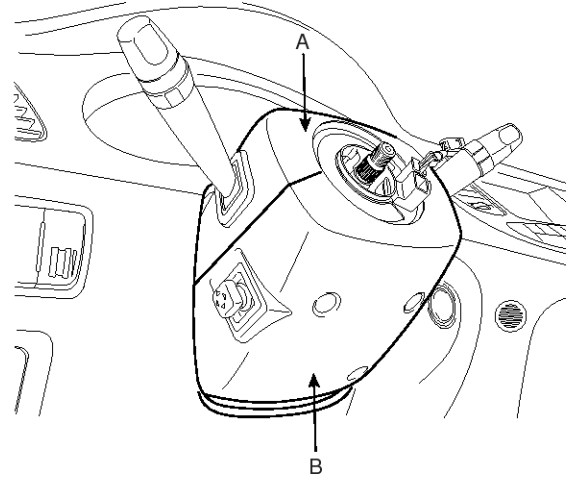
4. Remove the steering wheel from the steering column shaft using a SST (09561-11001).



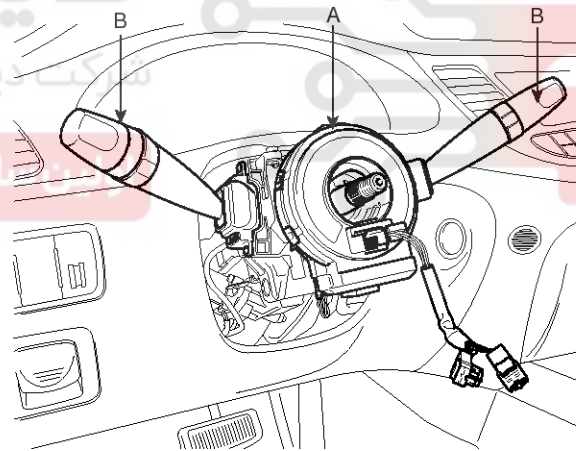
#### ⚠ CAUTION

Do not hammer on the steering wheel to remove it; it may damage the steering column.

5. Remove the steering column upper and lower shroud (A, B).



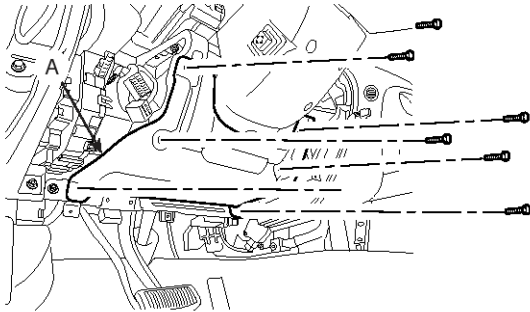
6. Remove the clock spring (A) and multifunction switch (B).



# Steering Column & Shaft

## ST-13

7. Remove the reinforce panel (A) by loosening the mounting bolts.

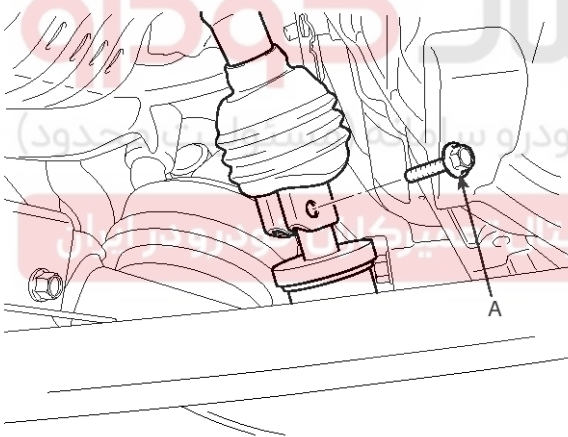


SBHST8302D

8. Loosen the bolt (A) and then disconnect the universal joint assembly with the steering column assembly.

### Tightening torque :

18 ~ 25N.m (1.8 ~ 2.8kgf.m, 13 ~ 18lb-ft)

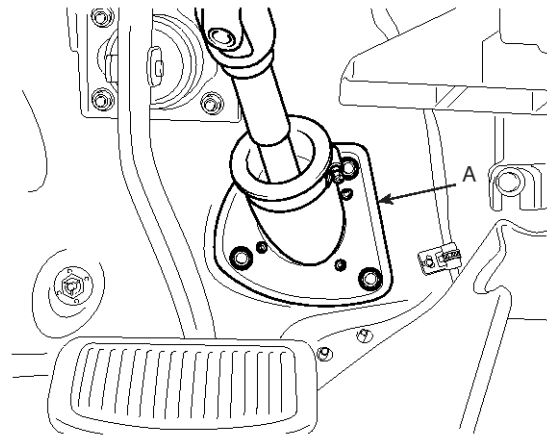


SBHST8006D

9. Remove the steering column dust cover (A) bolts.

### Tightening torque :

13 ~ 18N.m (1.3 ~ 1.8kgf.m, 9 ~ 13lb-ft)



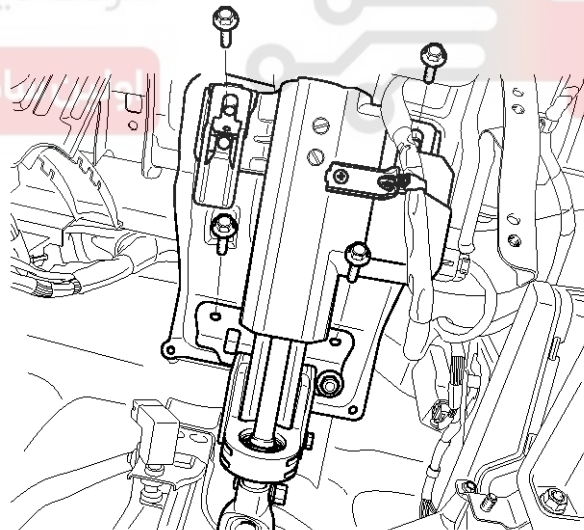
SBHST8007D

10. Disconnect all connectors connected to the steering column assembly.

11. Remove the steering column assembly by loosening the mounting bolts and nuts.

### Tightening torque :

13 ~ 18N.m (1.3 ~ 1.8kgf.m, 9 ~ 13lb-ft)



SBHST8008D

12. Installation is the reverse of removal.

## ST-14

## Steering System

## Electro Hydraulic Power Steering

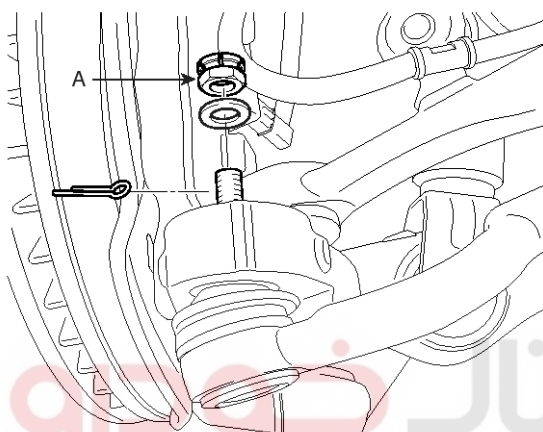
## Power Steering Gear Box

## Replacement

1. Drain the power steering fluid.
2. Remove both front wheels & tire.
3. Remove the split pin and castle nut (A).

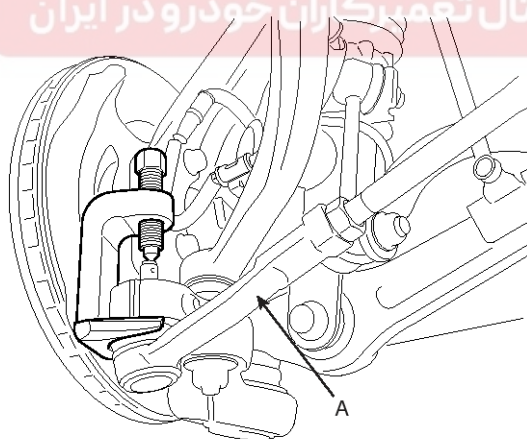
## Tightening torque :

85 ~ 110N.m (8.5 ~ 11.0kgf.m, 61 ~ 80lb-ft)



SBHST9302N

4. Disconnect the tie-rod end (A) with the knuckle using a SST (09568-2J100).

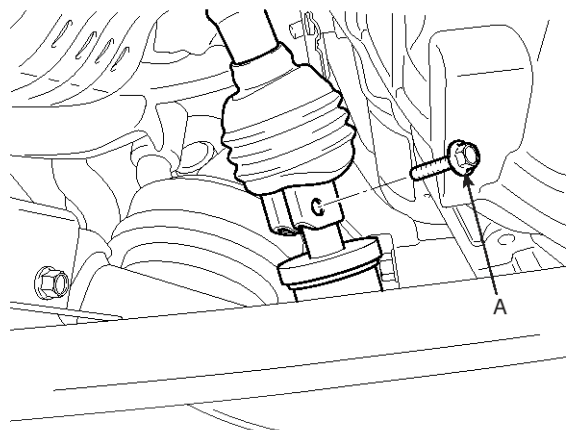


SBHSS8094D

5. Loosen the bolt (A).

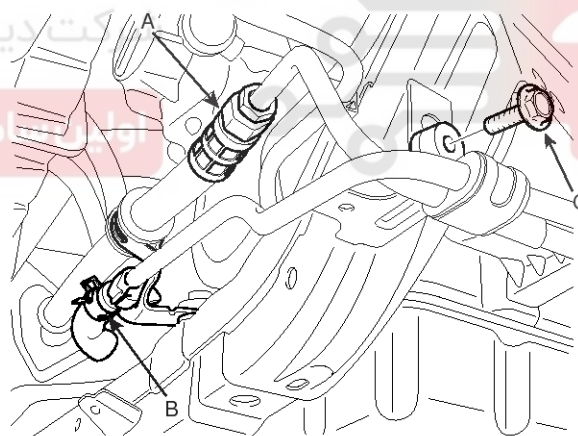
## Tightening torque :

18 ~ 25N.m (1.8 ~ 2.5kgf.m, 13 ~ 18lb-ft)



SBHST8006D

6. Loosen the tube bolts (C) and then disconnect the pressure (A) and return tube (B).



SBHST8033D



# Electro Hydraulic Power Steering

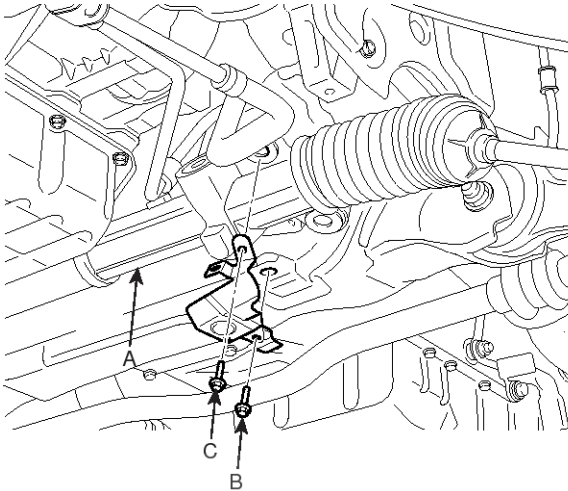
## ST-15

7. Remove the steering gear box (A) by loosening the bolts (B, C).

### Tightening torque

B : 20 ~ 30N.m (2.0 ~ 3.0kgf.m, 14 ~ 21lb-ft)

C : 80 ~ 100N.m (8.0 ~ 10.0kgf.m, 58 ~ 72lb-ft)

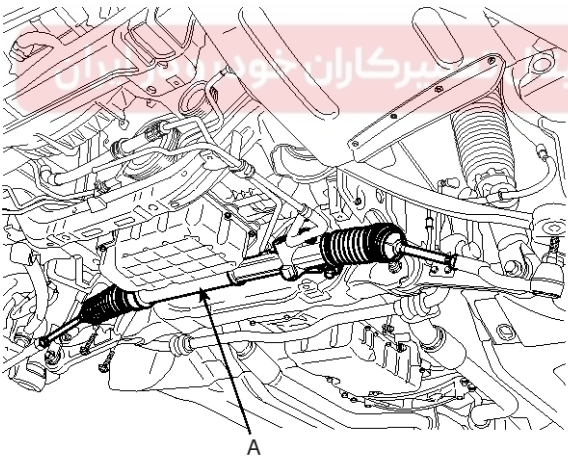


SBHST8011D

8. Loosen the bolts and then disconnect the steering gear box (A).

### Tightening torque :

80 ~ 100N.m (8.0 ~ 10.0kgf.m, 58 ~ 72lb-ft)

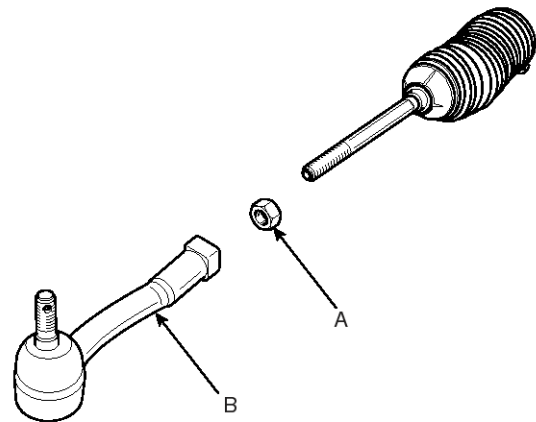


SBHST8012D

9. Installation is the reverse of the removal.

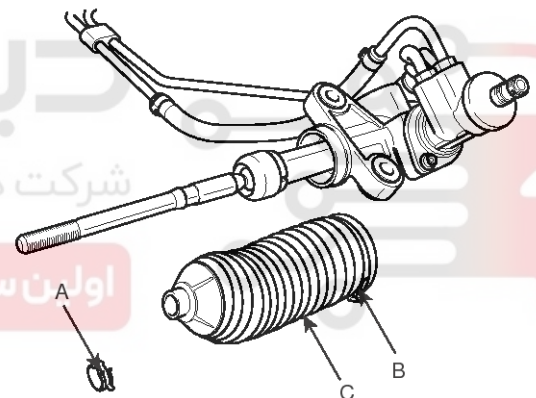
### Disassembly

1. Loosen the lock nut (A) and then unscrew the tie-rod end (B) and lock nut from the tie-rod.



SBHST8013D

2. Remove the clip (A) and band (B) and then pull the bellows (C) away from the end of the tie-rod.

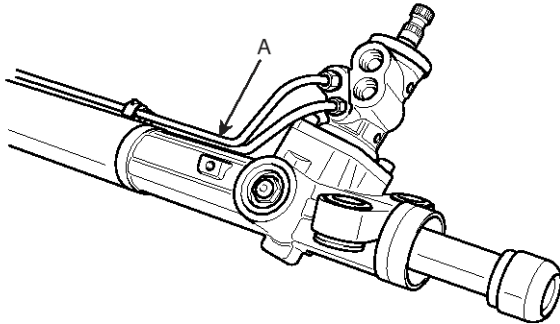


SBHST8014D

## ST-16

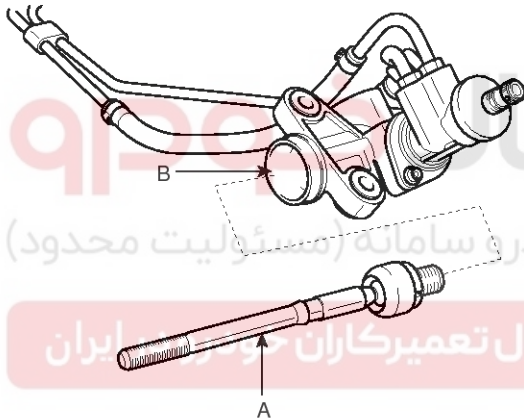
## Steering System

3. Remove the feed tubes (A) from the steering gear box.



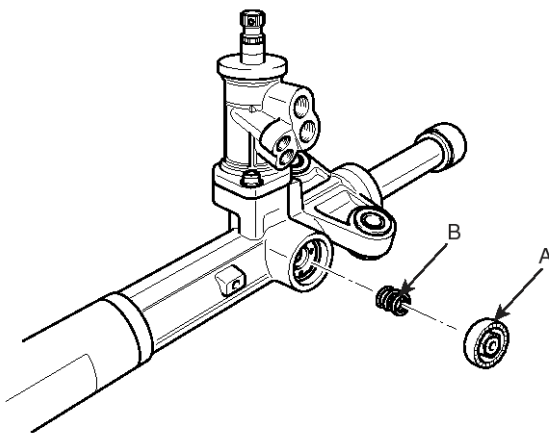
SBHST8015D

4. Unscrew the tie-rod (A) from the rack bar (B).



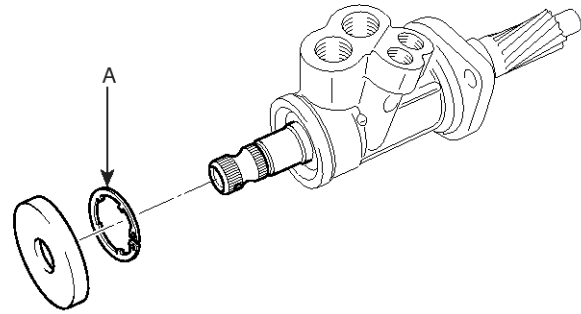
SBHST8306D

5. Remove the lock nut (A) and yoke plug and then pull out the yoke spring (B) and support yoke assembly.



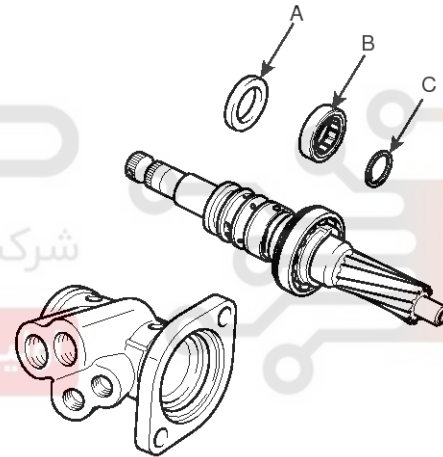
SBHST8017D

6. Remove the snap ring (A).



SBHST8018D

7. Remove the oil seal (A), bearing (B) and snap ring (C).



SBHST8019D

**⚠ CAUTION**

Do not allow dust, dirt, or foreign materials to contact the disassembled parts or inside of the valve assembly housing.

8. Unscrew the rack bush and pull the rack bar out of the rack housing.  
9. Reassembly is the reverse of the disassembly.

**Inspection**

1. Rack bar
  - Check the rack gear for damage.
  - Check the rack bar for bend and deformation.
2. Valve assembly
  - Check the valve assembly for wear, burr, and damage.

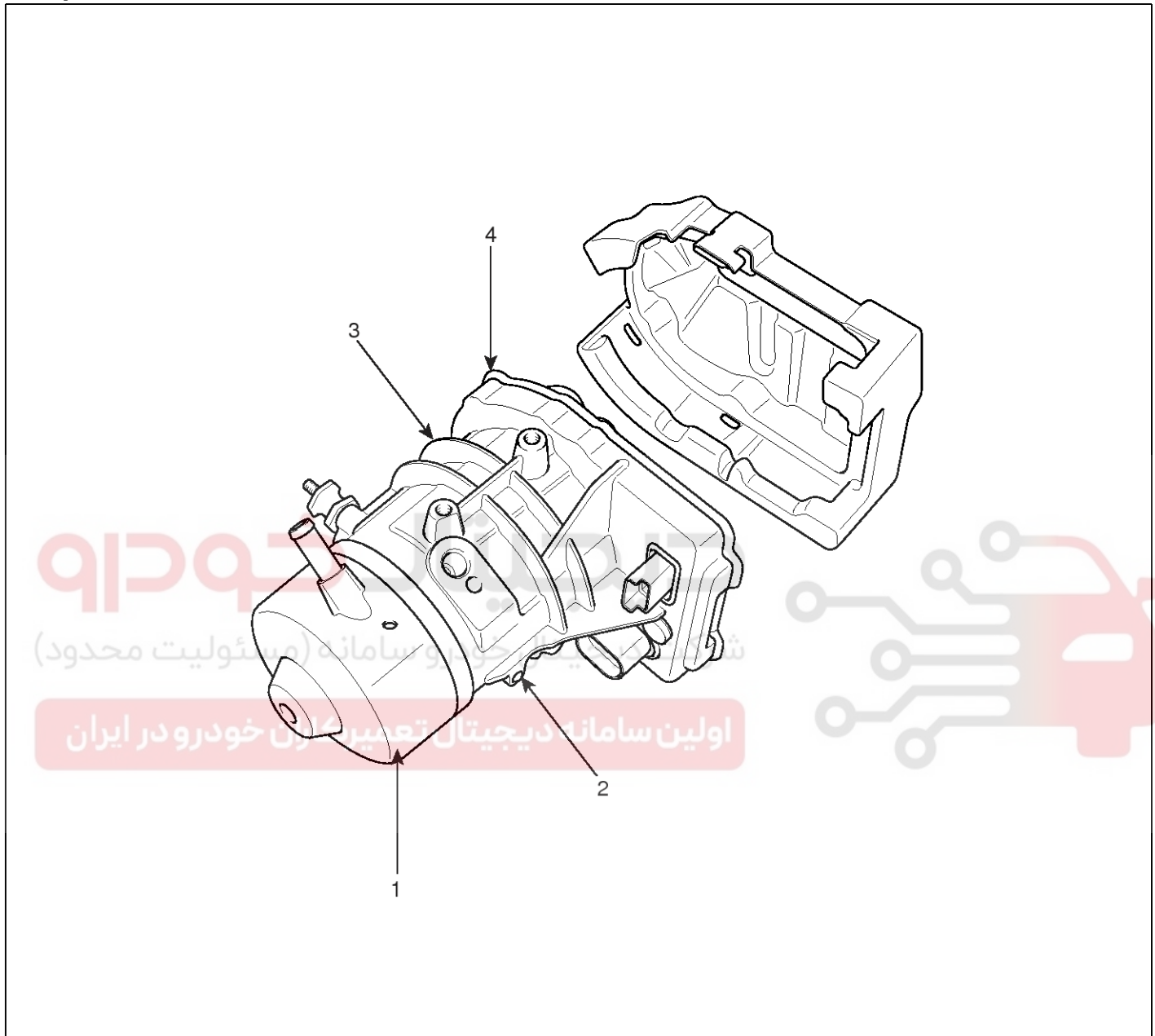


# Electro Hydraulic Power Steering

ST-17

## Power Steering Motor

### Components



SBHST9308N

- 1. Oil reservoir
- 2. Gear pump

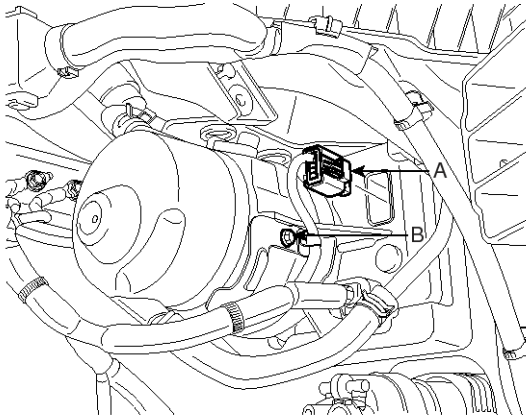
- 3. Motor
- 4. ECU

## ST-18

## Steering System

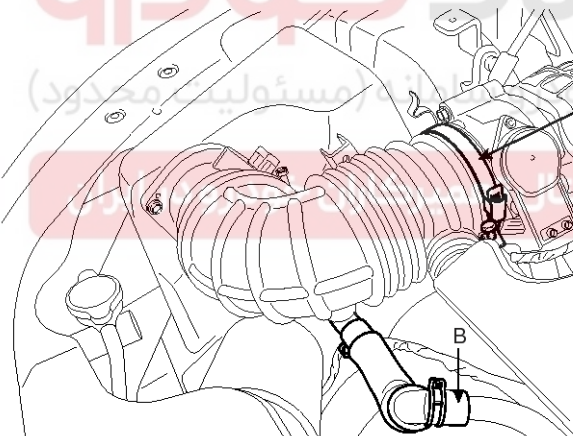
## Replacement

1. Remove the Front bumper. (Refer to BD group)
2. Remove the left head light. (Refer to BE group)
3. Disconnect the connector (A) and then loosen the bolts (B).



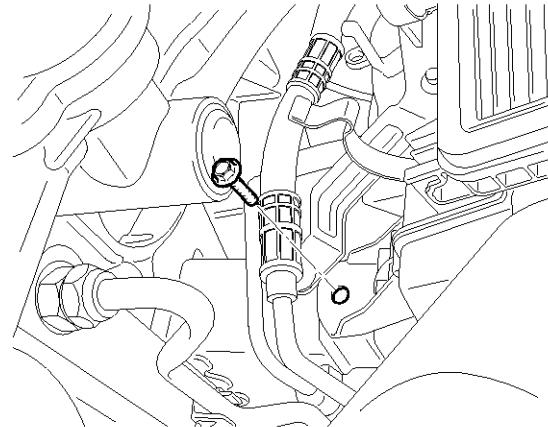
SBHST8024D

4. Remove the air cleaner by disconnecting the seal ring (A), hose (B).

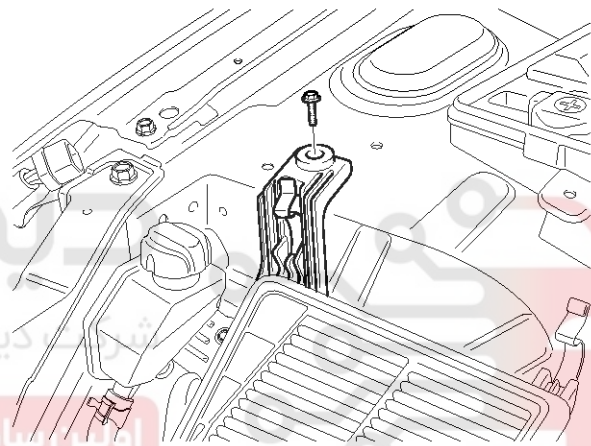


SBHST8021D

5. Loosen the bolts.

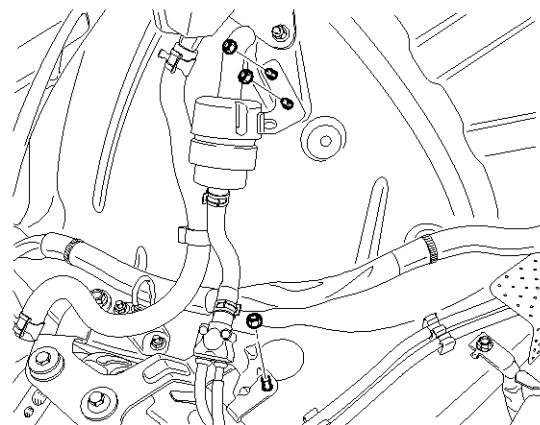


SBHST8022D



SBHST8023D

6. Remove the Y-connector bracket & air filter bracket by loosening the bolts.



SBHST8026D

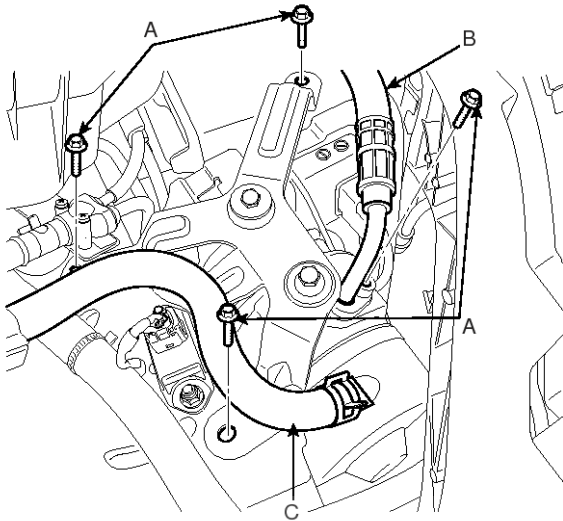
# Electro Hydraulic Power Steering

ST-19

7. Remove the mounting bolt (A), pressure hose (B), return hose (C).

**Tightening torque :**

45 ~ 60N.m (4.5 ~ 6.0kgf.m, 33 ~ 43lb-ft)



SBHST8027D

8. Installation is the reverse of the removal.



شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

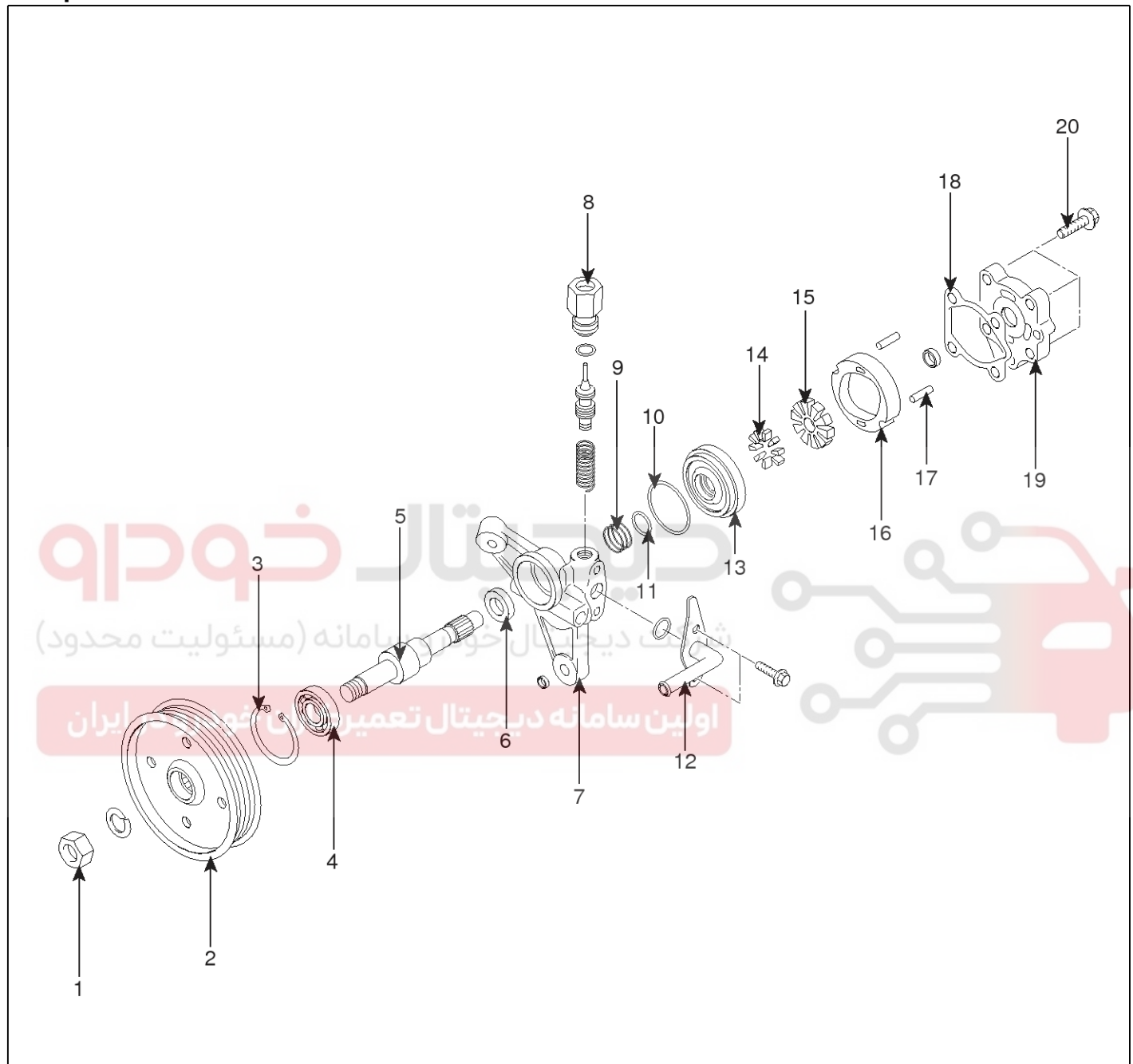
اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

## ST-20

## Steering System

## Power Steering Oil Pump

## Components



SBHST9300N

- |                  |                         |                             |
|------------------|-------------------------|-----------------------------|
| 1. Pulley nut    | 8. Connector            | 15. Rotor                   |
| 2. Pulley        | 9. Slide plate spring   | 16. Cam ring                |
| 3. Snap ring     | 10. O-ring (Outer)      | 17. Lock pin                |
| 4. Bearing       | 11. O-ring (Inner)      | 18. Gasket                  |
| 5. Driveshaft    | 12. Suction pipe        | 19. Oil pump cover assembly |
| 6. Oil seal      | 13. Oil pump side plate | 20. Mounting bolt           |
| 7. Front housing | 14. Vane                |                             |

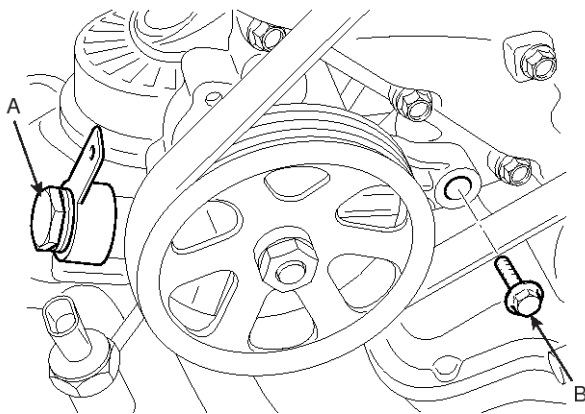
# Electro Hydraulic Power Steering

ST-21

## Normal Power Steering

### Replacement

1. Remove the drive belt.
2. Disconnect the pressure tube (A) and return hose (B) from the power steering pump.

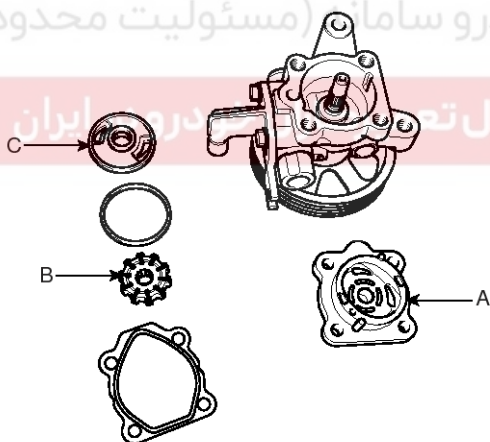


SBHST8028D

3. Installation is the reverse of the removal.

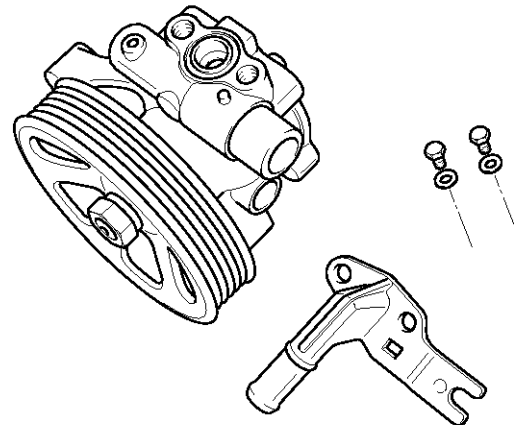
### Disassembly

1. Remove the pump cover (A) and rotor & vanes gasket (B), side plate (C).



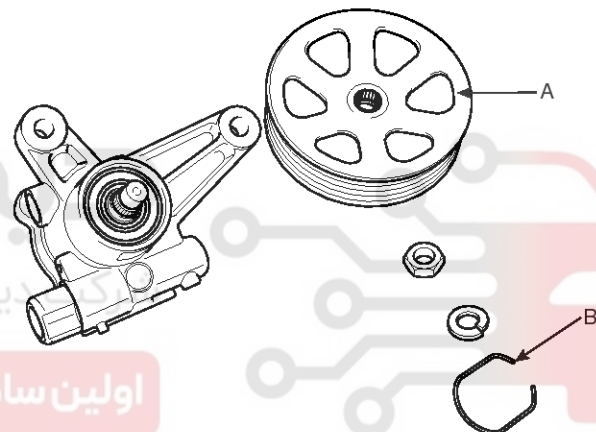
SBHST8031D

2. Remove the suction tube.



SBHST8030D

3. Remove the pump pulley & shaft (A), Oil seal (B).



SBHST8029D

4. Installation is the reverse of the removal.

### Inspection

1. Check that the flow control valve is not bent.
2. Check the grooves of the rotor and vanes for stratified abrasion.
3. Check the contact surface of the cam ring and vanes for stratified abrasion.
4. Check vanes for damage.
5. Check that there is no striped wear in the side plate or contacting part between the shaft and the pump cover surface.

## ST-22

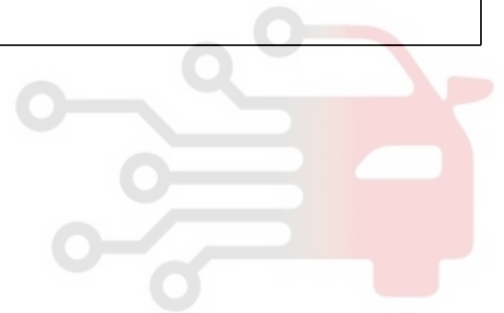
## Steering System

## Diagnostic Trouble Codes (DTC)

DTC	Trouble description
C1101	BatteryVoltage High
C1102	BatteryVoltage Low
C1260	Steering Angle Sensor Circuit-Signal
C1262	Temperature Sensor Failure
C1603	ECU Thermal Protection
C1604	ECU Hardware Error
C1611	CAN Time-out ECM
C1617	EMSInvalid Engine Speed
C1622	EMSInvalid Vehicle Speed
C1623	CAN Time-out Steering Angle Sensor
C2400	Motor Fault – Motor Not Running
C2413	Motor Current Fail (current over)
C2420	Motor Temperature Sensor high Input
C2421	Motor Temperature Sensor Low Input

دیجیتال خودرو  
شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

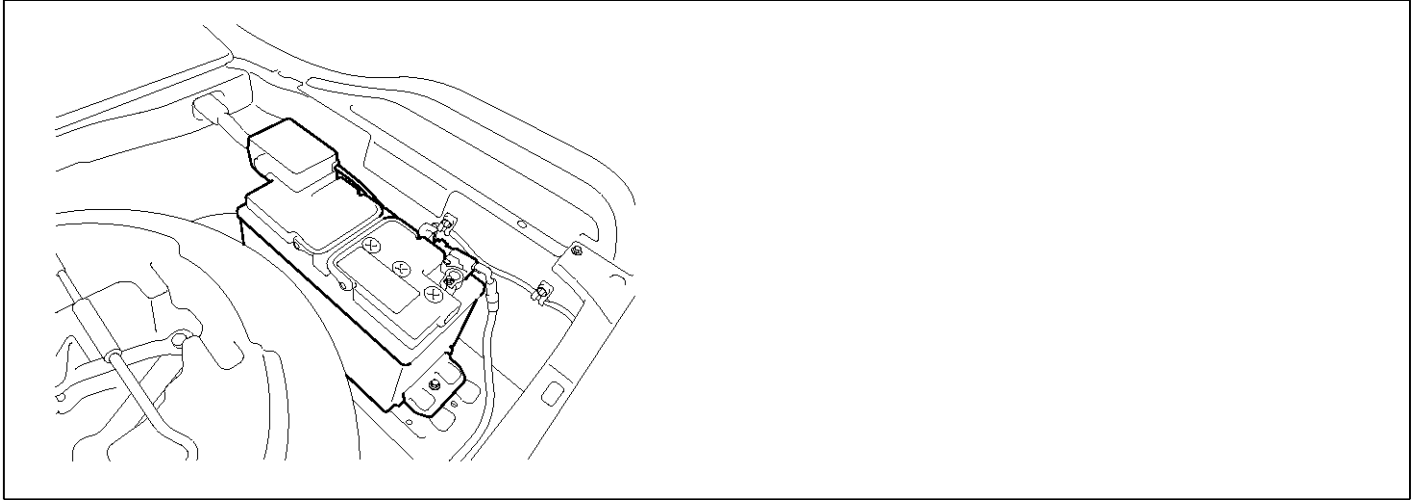


# Electro Hydraulic Power Steering

## ST-23

### C1101 Battery Voltage High

#### Component Location



SBHST8307D

#### General Description

EHPS (Electro Hydraulic Power Steering) is assistance steering ability system uses electrical motor that generate oil pressure not to use the Engine power.

The MPU(Motor Pump Unit) are input the Battery power, vehicle speed signal, steering angle speed signal and also oil pressure deliver to gear box.

MPU(Motor Pump Unit) perceive rapidly voltage changing so that If detected error in system voltage, MPU is not control the EHPS in order to prevent from damaging of MPU

#### DTC Description

The MPU set this code If faulty in alternater or faulty in circuit of battery power supply.

#### DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Voltage monitoring	<ul style="list-style-type: none"> <li>• Faulty in power circuit</li> <li>• Faulty in ground circuit</li> <li>• over charge</li> </ul>
Enable Conditions	• Engine " ON "	
Threshold Value	• when battery voltage is above 18V	
Detecting time	• 0.5sec.	
Fail Safe	• EHPS stop control	
Restoration conditions	• When Vign is lower than 17V for more than 100ms.	

#### Specification

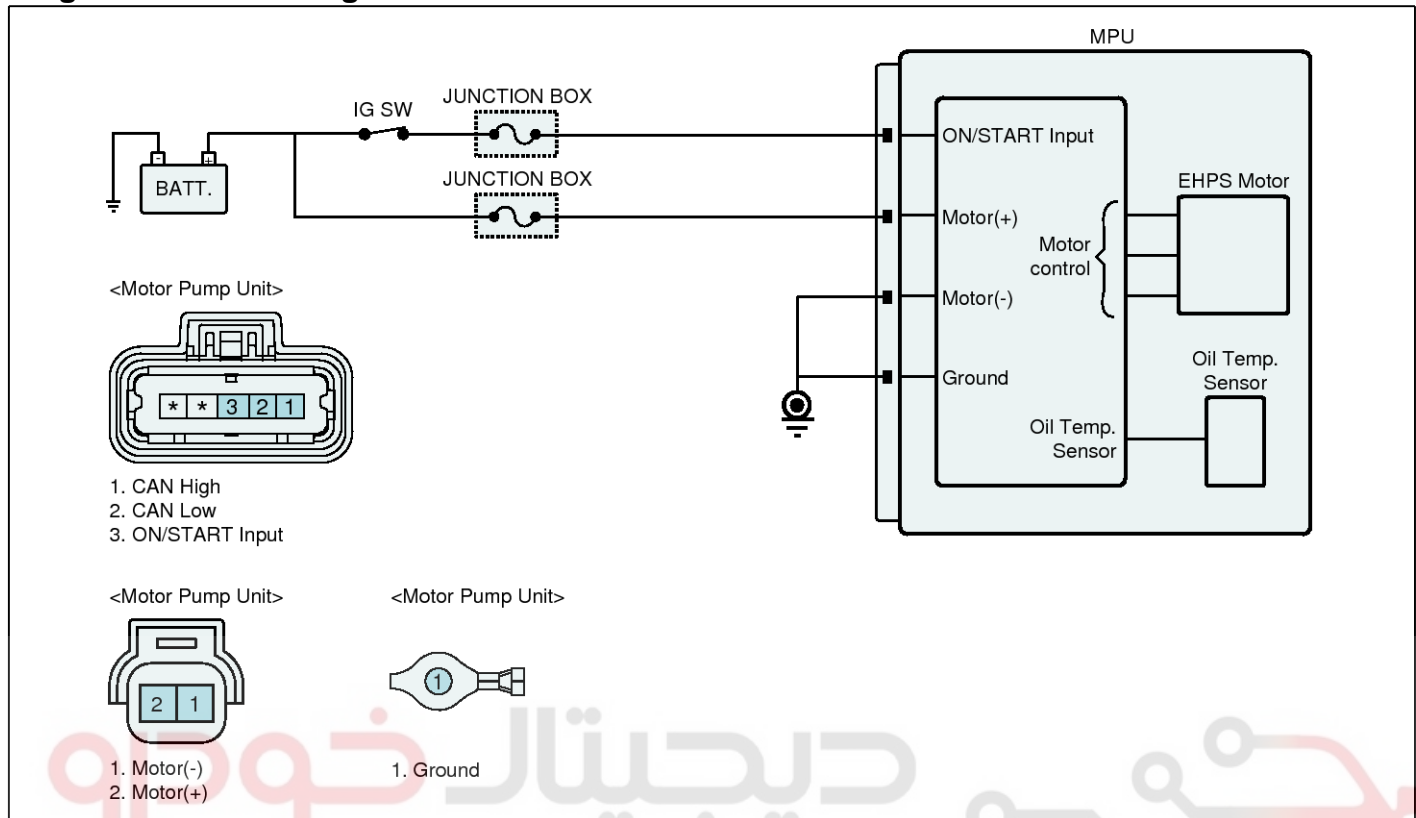
Bat. Voltage	IG Key ON	ENG. ON
	Approx. 11.8 [V]~12.5 [V]	Approx. 12.5 [V]~14.5 [V]



## ST-24

## Steering System

## Diagnostic Circuit Diagram



SBHST9501L

## Monitor Scantool Data

1. Connect scan tool to data link connector(DLC).
2. Engine "ON", Head light "ON", Defogger S/W "ON".
3. Monitor the "Supply voltage" parameter on the scan-tool.
4. Keep the 2500 Engine r.p.m with for 3 minutes and chect the "Supply voltage" parameter on the scan-tool.

**Specification : below 16 [V]**

Current Data		
Standard Display	Full List	Graph
Items List	Reset Min.Max.	Record
Stop	VSS	
Sensor Name	Value	Unit
<input type="checkbox"/> Engine Speed	569	RPM
<input type="checkbox"/> Vehicle Speed	0	MPH
<input type="checkbox"/> Filtered Vehicle Speed	0	MPH
<input type="checkbox"/> Steering Rate	0	'/s
<input type="checkbox"/> Filtered Steering Rate	0	'/s
<input type="checkbox"/> Drivestage Voltage	13.0	V
<input type="checkbox"/> Drivestage Temperature	50	'C
<input type="checkbox"/> Motor Speed	990	RPM
<input type="checkbox"/> Q-axis Motor Current	3.0	A

Fig.1

SBHST9601L

Fig.1) Engine "ON"

# Electro Hydraulic Power Steering

## ST-25

5. Is parameter displayed within specifications?

**YES** ▶ Fault is intermittent caused by poor contact in the sensor's and/or MPU's connector or was repaired and MPU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification Vehicle Repair" procedure.

**NO** ▶ Go to "Inspection/Repair" procedure

### Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES** ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure

**NO** ▶ Go to "Charging System Inspection" procedure.

### Charging System Inspection

1. Engine "ON"
2. Turn ON the all electrocity such as Head Lamp, defroster etc.
3. Measure voltage at battery at 2500 RPM.

**Specification** : below 16 [V]

4. Is the measured voltage within specifications ?

**YES** ▶ Go to "Power circuit Inspection" procedure.

**NO** ▶ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage from battery to alternator and also check the charging system.  
▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

### Power circuit Inspection

1. Ignition "OFF"
2. Disconnect ECU connector
3. Engine "ON"
4. Measure voltage between ON/START Power terminal of ECU harness connector and chassis ground.

5. Measure voltage between Motor(+) terminal of ECU harness connector and chassis ground.

**Specification** : below 16 [V]

6. Is the measured voltage within specifications ?

**YES** ▶ Go to "Ground circuit inspection" procedure

**NO** ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage for power circuit.  
▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

### Ground circuit inspection

1. Ignition "OFF"
2. Disconnect ECU connector
3. Measure resistance between ground terminal of ECU harness connector and chassis ground.

**Specification** : below 1Ω

4. Is the measured resistance within specification ?

**YES** ▶ Substitute with a known - good MPU and check for proper operation. If the problem is corrected, replace MPU and go to "Verification of Vehicle Repair" procedure.

**NO** ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage for ground circuit.  
▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verifying that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES** ▶ Go to the applicable troubleshooting procedure.

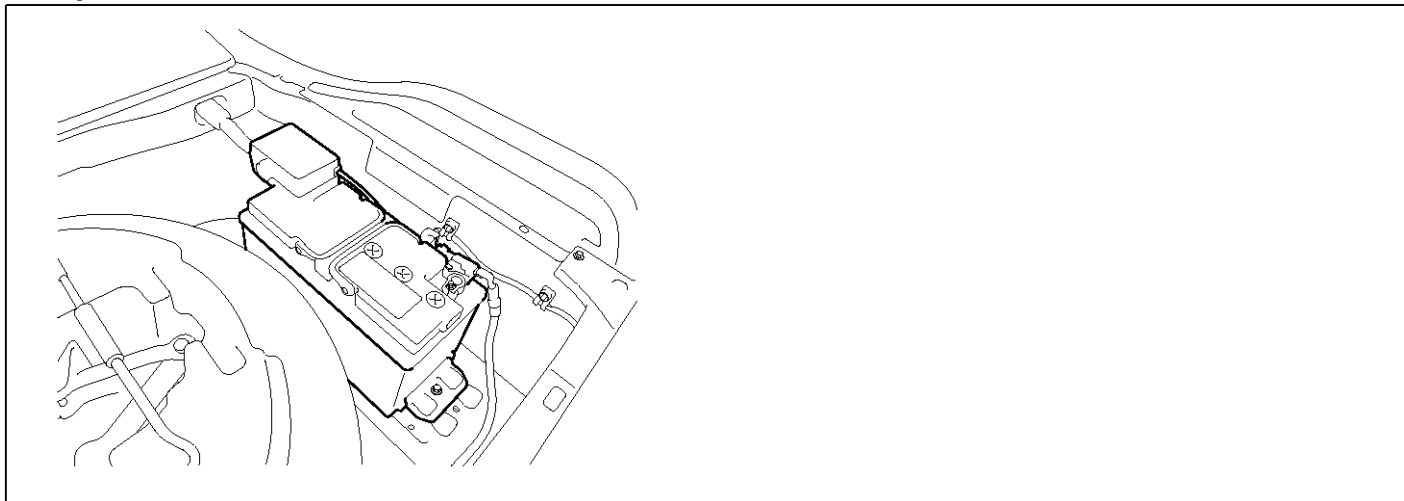
**NO** ▶ System is performing to specification at this time.

## ST-26

## Steering System

## C1102 Battery Voltage Low

## Component Location



SBHST8307D

## General Description

EHPS (Electro Hydraulic Power Steering) is assistance steering ability system uses electrical motor that generate oil pressure not to use the Engine power.

The MPU(Motor Pump Unit) are input the Battery power, vehicle speed signal, steering angle speed signal and also oil pressure deliver to gear box.

MPU(Motor Pump Unit) perceive rapidly voltage changing so that If detected error in system voltage, MPU is not control the EHPS in order to prevent from damaging of MPU.

## DTC Description

The MPU set this code If lower voltage detected than available value caused by faulty in alternater or faulty in circuit of battery power supply.

## DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Voltage monitoring	<ul style="list-style-type: none"> <li>• Open/short in power circuit.</li> <li>• Faulty ground circuit</li> <li>• Over discharge.</li> </ul>
Enable Conditions	• Engine " ON "	
Threshold Value	• Voltage < 9 [V]	
Detecting time	• 0.5sec.	
Fail Safe	• EHPS stop control	
Restoration conditions	• When Vign is higher than 9.5V for more than 100ms	

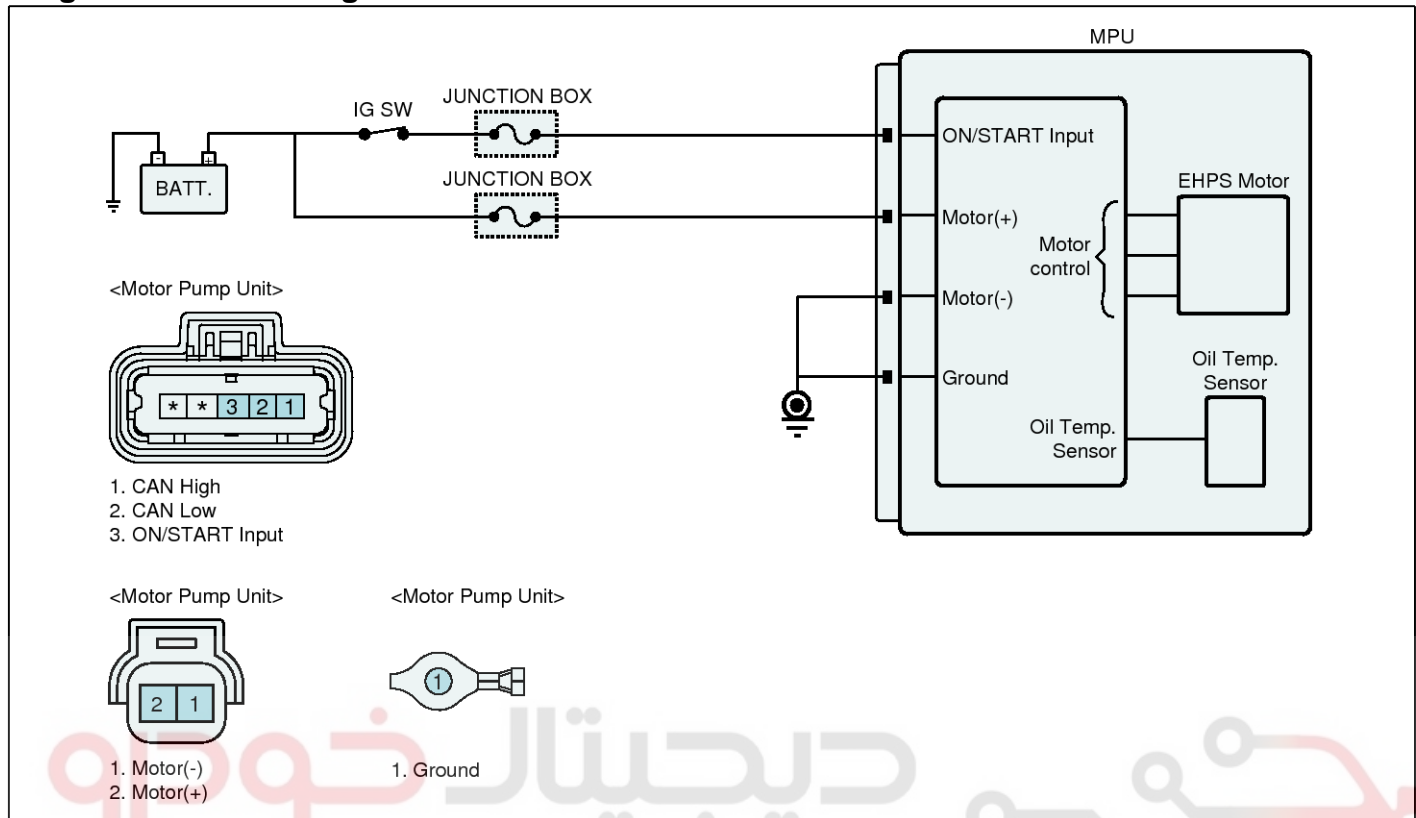
## Specification

Bat. Voltage	IG Key ON	ENG. ON
	Approx. 11.8 [V]~12.5 [V]	Approx. 12.5 [V]~14.5 [V]

# Electro Hydraulic Power Steering

ST-27

## Diagnostic Circuit Diagram



SBHST9501L

### Monitor Scantool Data

1. Connect scan tool to data link connector(DLC).
2. Engine "ON", Head light "ON", Defogger S/W "ON".
3. Monitor the "Supply voltage" parameter on the scan-tool.

4. Keep the 2500 Engine r.p.m with for 3 minutes and chect the "Supply voltage" parameter on the scan-tool.

**Specification :** over 10 [V]

Current Data		
Standard Display	Full List	Graph
Items List	Reset Min.Max.	Record
Stop	VSS	
Sensor Name	Value	Unit
<input type="checkbox"/> Engine Speed	569	RPM
<input type="checkbox"/> Vehicle Speed	0	MPH
<input type="checkbox"/> Filtered Vehicle Speed	0	MPH
<input type="checkbox"/> Steering Rate	0	'/s
<input type="checkbox"/> Filtered Steering Rate	0	'/s
<input type="checkbox"/> Drivestage Voltage	13.0	V
<input type="checkbox"/> Drivestage Temperature	50	'C
<input type="checkbox"/> Motor Speed	990	RPM
<input type="checkbox"/> Q-axis Motor Current	3.0	A

Fig.1

SBHST9601L

Fig.1) Engine "ON"

## ST-28

## Steering System

5. Is parameter displayed within specifications?

**YES** ▶ Fault is intermittent caused by poor contact in the sensor's and/or MPU's connector or was repaired and MPU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification Vehicle Repair" procedure.

**NO** ▶ Go to "Inspection/Repair" procedure

## Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES** ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure

**NO** ▶ Go to "Charging System Inspection" procedure.

## Charging System Inspection

1. Engine "ON"
2. Turn ON the all electrocity such as Head Lamp, defroster etc.
3. Measure voltage at battery at 2500 RPM.

**Specification** : below 16 [V]

4. Is the measured voltage within specifications ?

**YES** ▶ Go to "Power circuit Inspection" procedure.

**NO** ▶ Check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage from battery to alternator and also check the charging system.  
▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

## Power circuit Inspection

1. Ignition "OFF"
2. Disconnect ECU connector
3. Engine "ON"

4. Measure voltage between ON/START Power terminal of ECU harness connector and chassis ground.

5. Measure voltage between Motor(+) terminal of ECU harness connector and chassis ground.

**Specification** : below 16 [V]

6. Is the measured voltage within specifications ?

**YES** ▶ Go to "Ground circuit inspection" procedure

**NO** ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage for power circuit.  
▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

## Ground circuit inspection

1. Ignition "OFF"
2. Disconnect ECU connector
3. Measure resistance between ground terminal of ECU harness connector and chassis ground.

**Specification** : below 1Ω

4. Is the measured resistance within specification ?

**YES** ▶ Substitute with a known - good MPU and check for proper operation. If the problem is corrected, replace MPU and go to "Verification of Vehicle Repair" procedure.

**NO** ▶ Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage for ground circuit.  
▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

## Verification of Vehicle Repair

After a repair, it is essential to verifying that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES** ▶ Go to the applicable troubleshooting procedure.

**NO** ▶ System is performing to specification at this time.

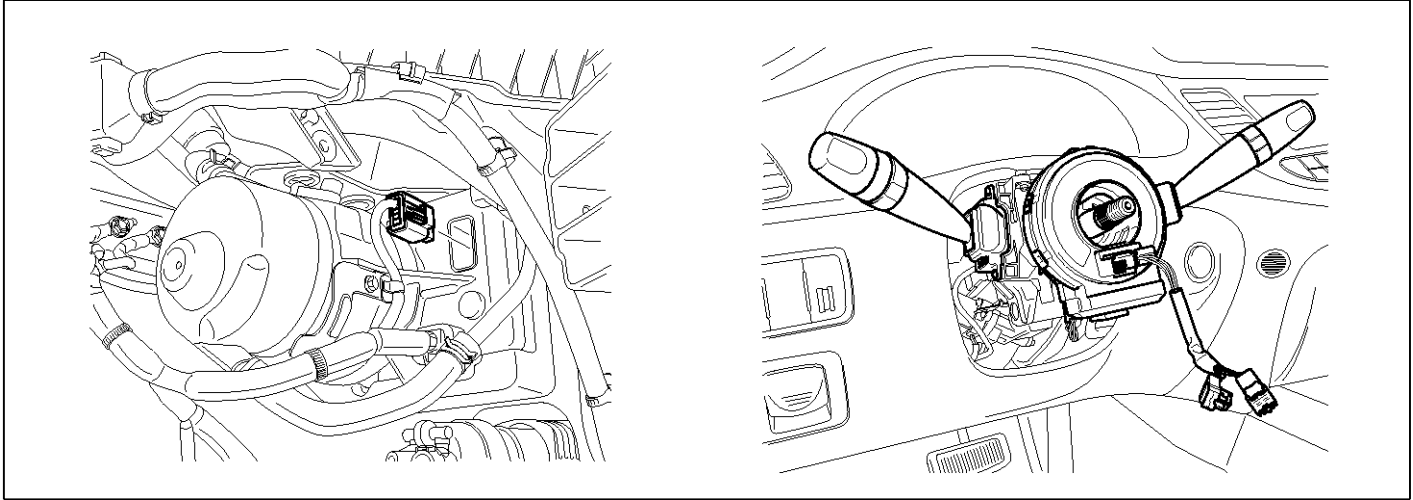


# Electro Hydraulic Power Steering

ST-29

## C1260 Steering Angle Sensor Circuit-Signal

### Component Location



SBHST9300L

### General Description

Steering angle sensor is installed under the clock spring. Steering angle sensor input to MPU uses CAN communication in order to measure for speed of steering wheel's operation and angel. Steering angle sensor is composed with main gear and sub gear1, sub gear2 to determine for rotation direction. According to rotation of steering wheel, If the main gear rotate, sub gear1 and sub gear2 be retated. Steering angle sensor calculate rotation angle use MR effect of magnetic that installed in sub gear and different gear ratio sub gear1 and sub gear2. MPU determine driver's intention in accordance with Steering angle sensor and also using as a input value for EHPS (Electro Hydraulic Power Steering) control.

### DTC Description

The MPU set this code If the input value of steering angle sensor is higher than maximum value or stuck with low status.

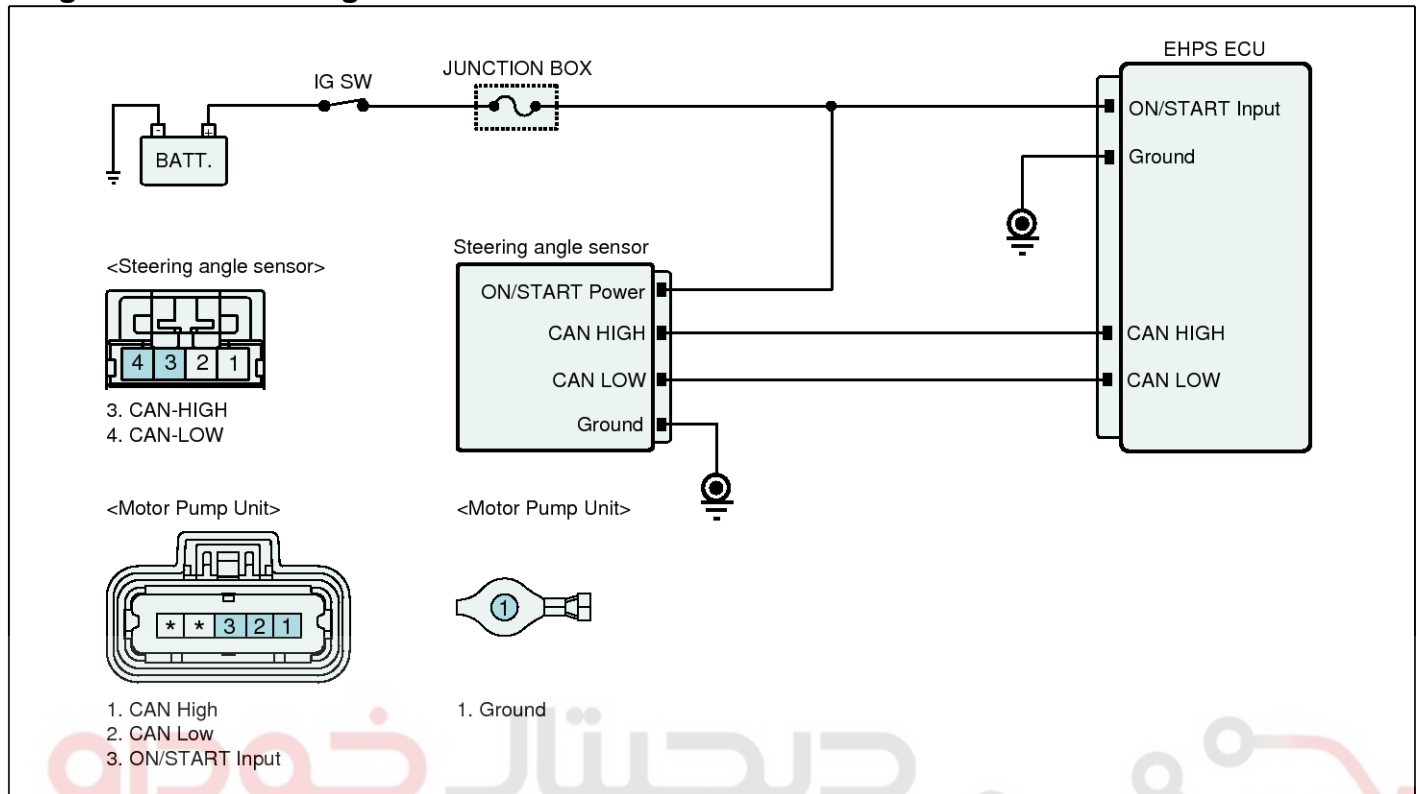
### DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	<ul style="list-style-type: none"> <li>Signal monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Faulty Steering angle sensor</li> <li>Faulty MPU</li> </ul>
Enable Conditions	<ul style="list-style-type: none"> <li>Engine " ON "</li> </ul>	
Threshold Value	<ul style="list-style-type: none"> <li>SAS Signal = 1020°/s or Steering Angle Sensor Frame (2B0h) &lt; 3 Bytes</li> </ul>	
Detecting time	<ul style="list-style-type: none"> <li>1sec.</li> </ul>	
Fail Safe	<ul style="list-style-type: none"> <li>Steering wheel operation heavily.</li> </ul>	
Restoration conditions	<ul style="list-style-type: none"> <li>Signal value &lt; 1020°/s or more than 10times input for normal value</li> </ul>	

## ST-30

## Steering System

## Diagnostic Circuit Diagram



## Monitor Scantool Data

1. Connect scan tool to data link connector(DLC).
2. Engine "ON".
3. Turn steering wheel to right and left .

4. Monitor the "Steering angle sensor" parameter on the scan-tool.

(Check the data of steering angle sensor with AFLS,VDC system and confirm output values related to CAN communication.)

**Specification :** output value is changed according to steering wheel operation.

Current Data		
Standard Display	Full List	Graph
Items List	Reset Min.Max.	Record
Run	VSS	
Sensor Name	Value	Unit
<input type="checkbox"/> Engine Speed	572	RPM
<input type="checkbox"/> Vehicle Speed	0	MPH
<input type="checkbox"/> Filtered Vehicle Speed	0	MPH
<input type="checkbox"/> Steering Rate	288	'/s
<input type="checkbox"/> Filtered Steering Rate	284	'/s
<input type="checkbox"/> Drivestage Voltage	13.0	V
<input type="checkbox"/> Drivestage Temperature	51	'C
<input type="checkbox"/> Motor Speed	4800	RPM
<input type="checkbox"/> Q-axis Motor Current	22.0	A

Fig.1

SBHST9602L



# Electro Hydraulic Power Steering

ST-31

Current Data		
Standard Display	Full List	Graph
Items List	Reset Min.Max.	Record
Stop	VSS	
Sensor Name	Value	Unit
<input type="checkbox"/> Vehicle Speed	0	MPH
<input type="checkbox"/> HLL position	0.10	mm
<input type="checkbox"/> DBL position	0.00	DEG
<input type="checkbox"/> Sensor angle rear	-5	mm
<input type="checkbox"/> Supply voltage	13.4	V
<input type="checkbox"/> Steering wheel angle	62	DEG
<input type="checkbox"/> Headlamp status	ON	-
<input type="checkbox"/> Engine Status	ON	-
<input type="checkbox"/> Main function activation status	All direction	-
<input type="checkbox"/> Sensor angle front	-7	mm
<input type="checkbox"/> AFLS activation swith/button status	ON	-

Fig.2

SBHST9603L

Fig.1) Engine "ON" -EHPS

Fig.2) Engine "ON" -(AFLS's current data)

5. Is parameter displayed within specifications?

**YES** ▶ Fault is intermittent caused by poor contact in the sensor's and/or MPU's connector or was repaired and MPU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification Vehicle Repair" procedure.

**NO** ▶ If the fault with related to CAN communication system(related to CAN communication system-ECS,AFLS,VDC )  
 ☞ "Repair CAN communication system and go to "Verification Vehicle Repair" procedure.  
 ▶ Faulty in steering angle sensor for ECS,AF-LS,VDC  
 ☞ Substitute with a known-good steering wheel sensor and check for proper operation. If the problem is corrected, replace steering wheel sensor and then go to "Verification of Vehicle Repair" procedure.  
 ▶ Faulty in steering wheel sensor signal only for EHPS  
 ☞ go to "Inspection/Repair" procedure.

## Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES** ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure

**NO** ▶ Go to "CAN communication circuit inspection" procedure.

## ST-32

## Steering System

**CAN communication circuit inspection (EHPS ECU ↔ Steering angle sensor)**

1. Ignition "OFF"
2. Disconnect Steering angle sensor connector and EHPS ECU connector
3. Measure the resistance between CAN-HIGH terminal of Steering angle sensor harness connector and CAN-HIGH terminal of EHPS ECU harness connector.
4. Measure the resistance between CAN-LOW terminal of Steering angle sensor harness connector and CAN-LOW terminal of EHPS ECU harness connector.

**Specification :** below 1Ω

5. Is the measured resistance within specification ?

**YES** ▶ Substitute with a known - good MPU and check for proper operation. If the problem is corrected, replace MPU and go to "Verification of Vehicle Repair" procedure.

**NO** ▶ Check for open/short in harness.  
▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

**Verification of Vehicle Repair**

After a repair, it is essential to verifying that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES** ▶ Go to the applicable troubleshooting procedure.

**NO** ▶ System is performing to specification at this time.

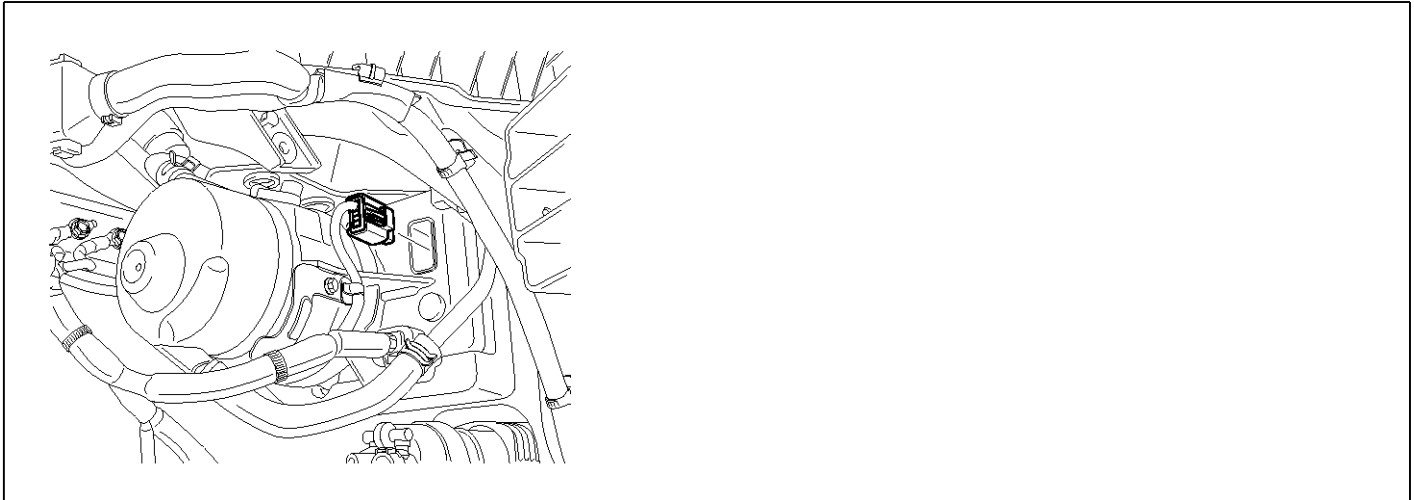


# Electro Hydraulic Power Steering

ST-33

## C1262 Temperature Sensor Failure

### Component Location



SBHST8308D

### General Description

EHPS (Electro Hydraulic Power Steering) is assistance steering ability system uses electrical motor that generate pressure not to use the Engine power.

Temperature sensor is installed is MPU(Motor Pump Unit) in order to measure oil temperature, This sensor uses a thermistor whose resistance changes according to the temperature changes.

MPU ECU perform limit current control to prevent from over-heating and motor speed control according to viscosity changes.

### DTC Description

The MPU set this code If the input value of temperature sensor is higher or lower than normal value.

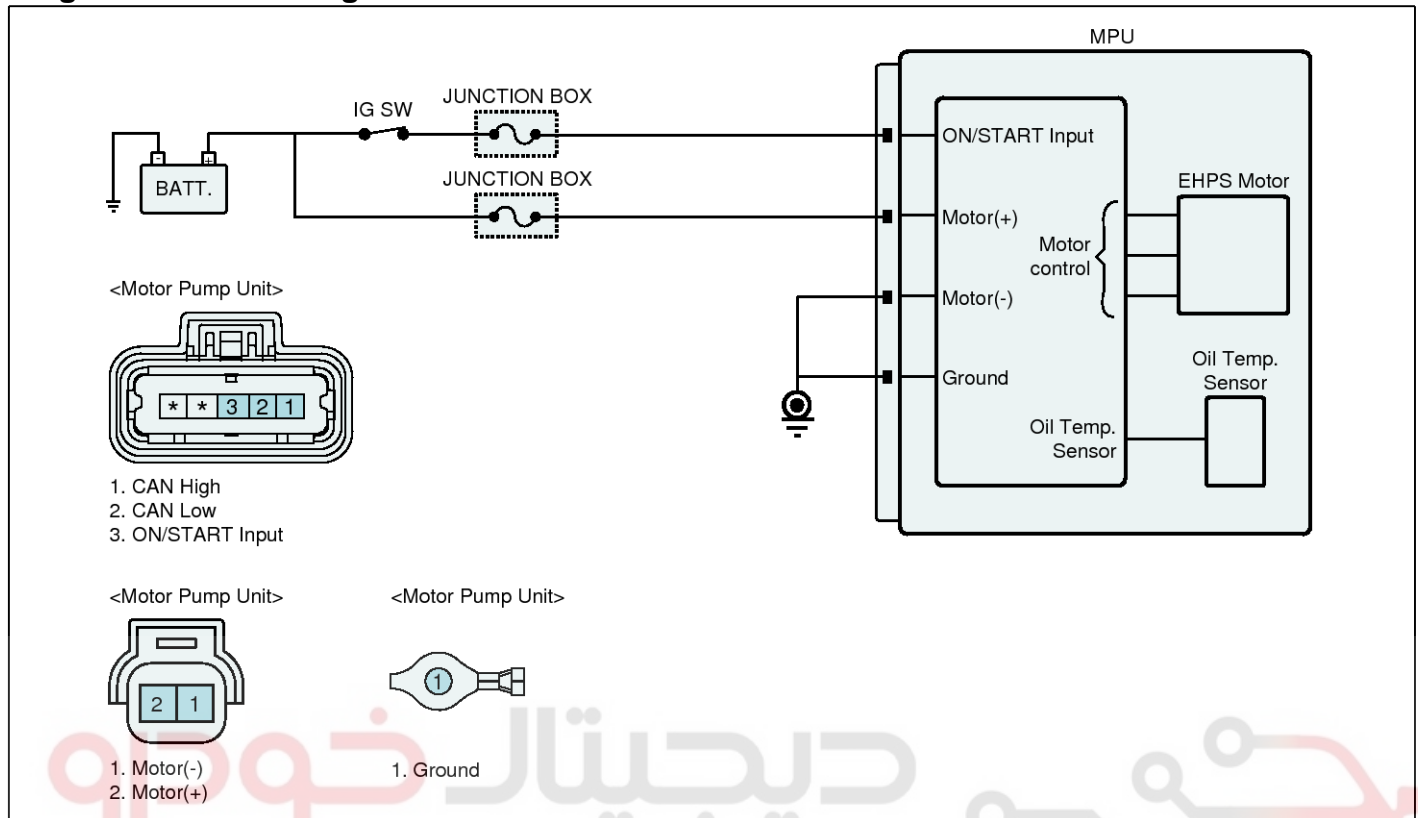
### DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal monitoring	• Faulty MPU
Enable Conditions	• Engine " ON "	
Threshold Value	• Signal > 150°C or Signal < -55°C	
Detecting time	• 1sec.	
Fail Safe	• EHPS stop control	
Restoration conditions	• -55°C ≤ signal value ≤ 150°C in condition that Keep the 1000ms	

## ST-34

## Steering System

## Diagnostic Circuit Diagram



SBHST9501L

## Monitor Scantool Data

1. Connect scan tool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "EPS temperature" parameter on the scan-tool.

Current Data		
Standard Display	Full List	Graph
Items List	Reset Min.Max.	Record
Run	VSS	
Sensor Name	Value	Unit
<input type="checkbox"/> Engine Speed	572	RPM
<input type="checkbox"/> Vehicle Speed	0	MPH
<input type="checkbox"/> Filtered Vehicle Speed	0	MPH
<input type="checkbox"/> Steering Rate	288	°/s
<input type="checkbox"/> Filtered Steering Rate	284	°/s
<input type="checkbox"/> Drivestage Voltage	13.0	V
<input type="checkbox"/> Drivestage Temperature	51	°C
<input type="checkbox"/> Motor Speed	4800	RPM
<input type="checkbox"/> Q-axis Motor Current	22.0	A

Fig.1

SBHST9604L

Fig.1) Engine "ON"

# Electro Hydraulic Power Steering

## ST-35

4. Is "EPS temperature" within normal range?

**YES** ► Fault is intermittent caused by poor contact in the sensor's and/or MPU's connector or was repaired and MPU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification Vehicle Repair" procedure.

**NO** ► Wait for cooling MPU-motor enough and then go to "Component inspection" procedure.

### Component inspection

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Clear the DTC
4. Ignition "OFF"
5. Engine "ON"
6. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and Read "DTC Status" parameter.
7. Is the DTC C1262 present?

**YES** ► Substitute with a known-good MPU and check for proper operation. If the problem is corrected, replace MPU and then go to "Verification of Vehicle Repair" procedure.

**NO** ► Faulty in temperature sensor or fault was repaired and MPU memory was not cleared. go to "Verification Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verifying that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES** ► Go to the applicable troubleshooting procedure.

**NO** ► System is performing to specification at this time.

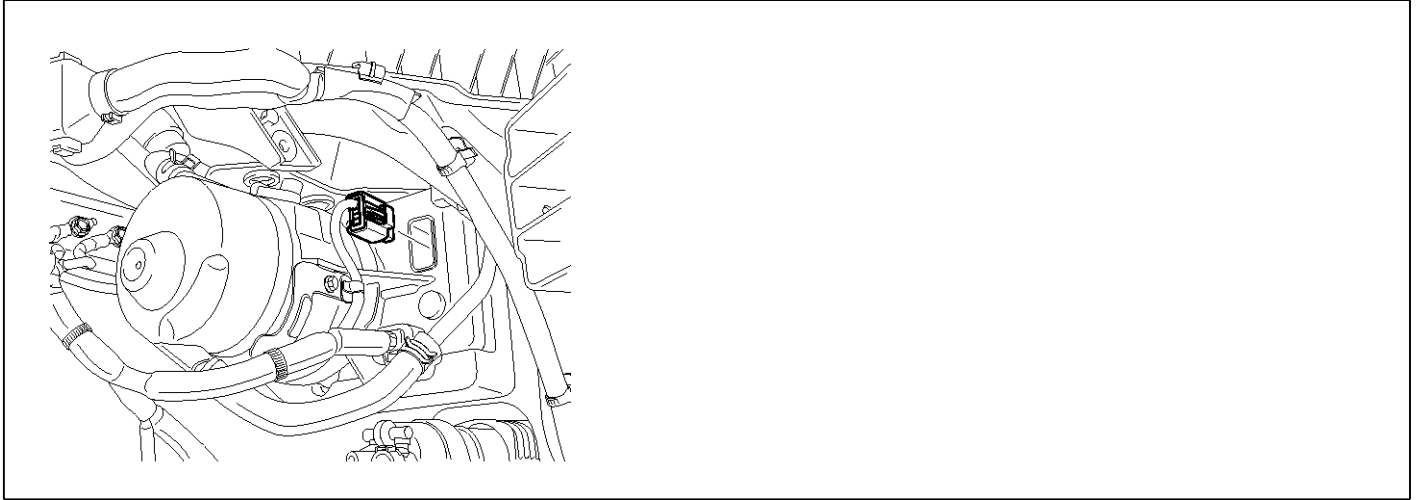


# ST-36

## Steering System

### C1603 ECU thermal protection

#### Component Location



SBHST8308D

#### General Description

EHPS (Electro Hydraulic Power Steering) is assistance steering ability system uses electrical motor that generate oil pressure not to use the Engine power.

Temperature sensor is installed is MPU(Motor Pump Unit) in order to measure oil temperature, This sensor uses a thermistor whose resistance changes according to the temperature changes.

MPU ECU perform limit current control to prevent from over-heating and motor speed control according to viscosity changes.

#### DTC Description

The MPU limit MPU-motor's current according to temperature sensor's signal. The MPU set this code if the current amount for MPU motor be limited.

(If C1101 or C1102 output same time with C1603, Check and repair C1101 or C1102 preferential. If C1262 output same time with C1603, Check and repair C1262 preferential.)

#### DTC Detecting Condition

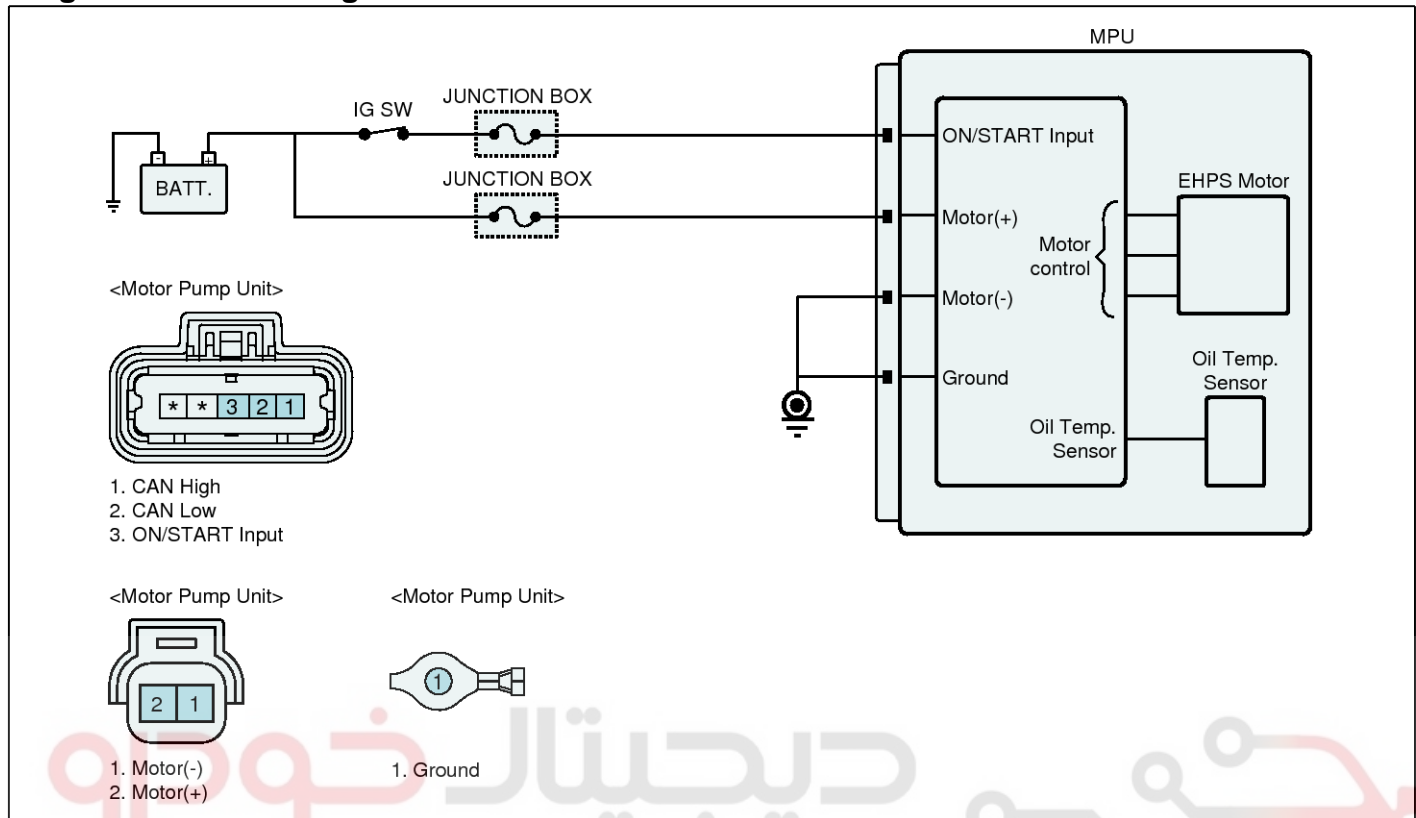
Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal monitoring	<ul style="list-style-type: none"> <li>Faulty in battery</li> <li>Contamination of Oil / Clog of Oil path</li> <li>Faulty MPU</li> </ul>
Enable Conditions	• Engine " ON "	
Threshold Value	• Current limited according to Mapping value.	
Detecting time	• 1sec.	
Fail Safe	• EHPS stop control	
Restoration conditions	• In case of not necessary current limit of motor according to temperature.	



# Electro Hydraulic Power Steering

ST-37

## Diagnostic Circuit Diagram



SBHST9501L

### Monitor Scantool Data

1. Connect scan tool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "Battery voltage, EPS temperature" parameter on the scan-tool.

Current Data		
Standard Display	Full List	Graph
Items List	Reset Min.Max.	Record
Run	VSS	
Sensor Name	Value	Unit
<input type="checkbox"/> Engine Speed	572	RPM
<input type="checkbox"/> Vehicle Speed	0	MPH
<input type="checkbox"/> Filtered Vehicle Speed	0	MPH
<input type="checkbox"/> Steering Rate	288	°/s
<input type="checkbox"/> Filtered Steering Rate	284	°/s
<input type="checkbox"/> Drivestage Voltage	13.0	V
<input type="checkbox"/> Drivestage Temperature	51	°C
<input type="checkbox"/> Motor Speed	4800	RPM
<input type="checkbox"/> Q-axis Motor Current	22.0	A

Fig.1

SBHST9605L

Fig.1) Engine "ON"



## ST-38

## Steering System

4. Are "Battery voltage and EPS temperature" within normal range?

**YES** ▶ Fault is intermittent caused by poor contact in the sensor's and/or MPU's connector or was repaired and MPU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification Vehicle Repair" procedure.

**NO** ▶ Wait for cooling MPU-motor enough and then go to "System check" procedure.

## System check

1. Check oil gauge.
2. Check clog of oil path.
3. Is there any problem?

**YES** ▶ Go to "Component inspection" procedure.

**NO** ▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

## Component inspection

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Clear the DTC
4. Ignition "OFF"
5. Engine "ON"
6. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and Read "DTC Status" parameter.
7. Is the DTC C1603 present?

**YES** ▶ Substitute with a known-good MPU and check for proper operation. If the problem is corrected, replace MPU and then go to "Verification of Vehicle Repair" procedure.

**NO** ▶ Faulty in temperature sensor or fault was repaired and MPU memory was not cleared. go to "Verification Vehicle Repair" procedure.

## Verification of Vehicle Repair

After a repair, it is essential to verifying that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES** ▶ Go to the applicable troubleshooting procedure.

**NO** ▶ System is performing to specification at this time.



# Electro Hydraulic Power Steering

ST-39

## C1604 ECU Hardware Error

### Component Location



SBHST8308D

### General Description

MPU(Motor Pump Unit) check the inner circuit of ECU in order to prevent from malfunction.

This test included Hard-ware check function for RAM, ROM, EEPROM, ALU, PLL.

### DTC Description

The MPU set this code If detected error in RAM or ROM.

### DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• ECU H/W monitoring	• Faulty MPU
Enable Conditions	• IG ON	
Threshold Value	• Faulty in ECU software	
Detecting time	• Immediately	
Fail Safe	• EHPS stop control	
Restoration conditions	• IG ON When next Initializing	

## ST-40

## Steering System

## Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES** ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure

**NO** ▶ Go to "Component inspection" procedure.

## Component inspection

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Clear the DTC
4. Ignition "OFF"
5. Engine "ON"
6. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and Read "DTC Status" parameter.
7. Is the DTC C1604 present?

**YES** ▶ Substitute with a known-good MPU and check for proper operation. If the problem is corrected, replace MPU and then go to "Verification of Vehicle Repair" procedure.

**NO** ▶ Fault was repaired and MPU memory was not cleared. go to "Verification Vehicle Repair" procedure.

## Verification of Vehicle Repair

After a repair, it is essential to verifying that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES** ▶ Go to the applicable troubleshooting procedure.

**NO** ▶ System is performing to specification at this time.

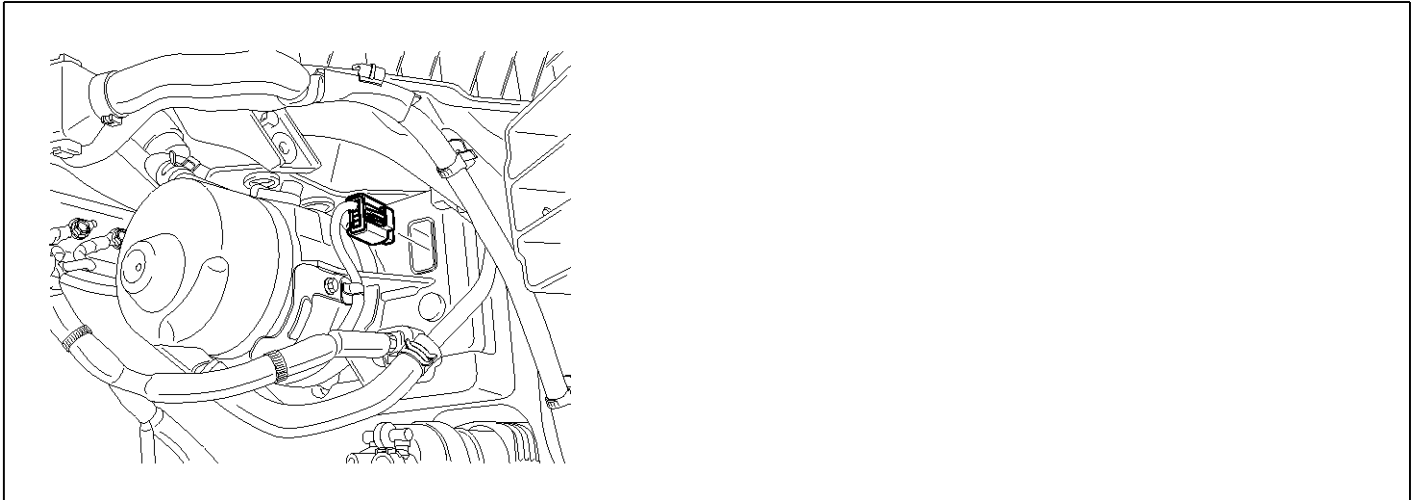


# Electro Hydraulic Power Steering

ST-41

## C1611 CAN Time-out ECM

### Component Location



SBHST8308D

### General Description

Several control units are applied to electronically controlled vehicles. These units perform each control with informations from various sensors. Thus, sharing signal information from sensors is needed, so CAN communication type whose communication speed is high and insensitive to electrical noise by spark generation is adopted to controlling power-train(engine, automatic transaxle, ABS, TCS, ECS)

As sharing signals of engine speed, vehicle speed, steering wheel position through CAN communication, MPU(Motor Pump Unit) control vehicle actively.

### DTC Description

The MPU set this code If EMS signal is not received properly.

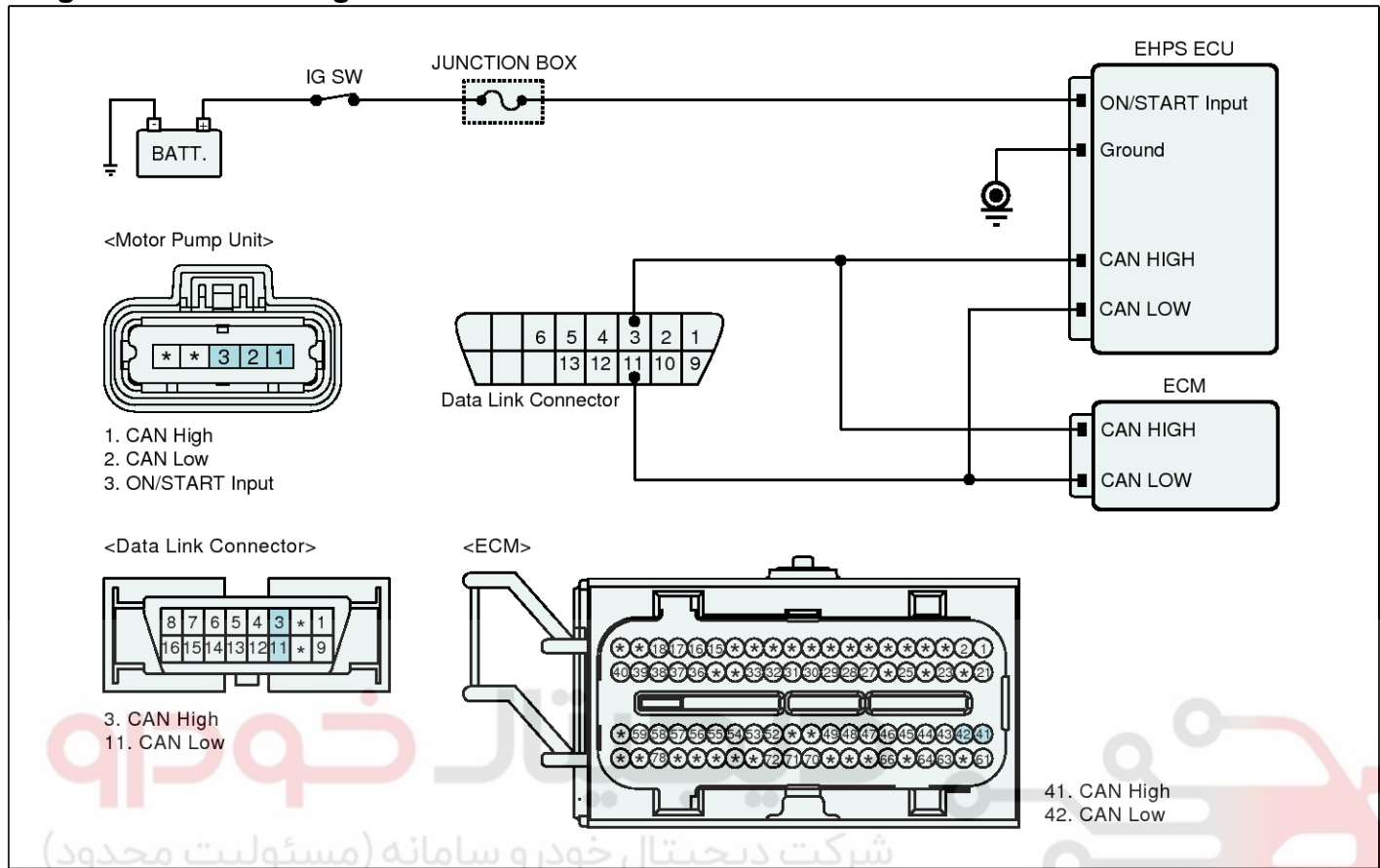
### DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal monitoring	<ul style="list-style-type: none"> <li>• CAN communication circuit Open/Short</li> <li>• Faulty ECM</li> <li>• Faulty MPU</li> </ul>
Enable Conditions	• IG ON	
Threshold Value	• CAN communication signal not output from Engine ECU	
Detecting time	• 1sec.	
Fail Safe	• Steering wheel operation heavily.	
Restoration conditions	• more than 10times input for normal value	

## ST-42

## Steering System

## Diagnostic Circuit Diagram



SBHST9503L

## Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine start and drive the vehicle on the road.

3. Monitor the "VSS and RPM" parameters on the scantool.

(Check the data of EHPS with TCU,ECM system and confirm output values related to CAN communication.)

Current Data		
Standard Display	Full List	Graph
Items List	Reset Min.Max.	Record
Run	VSS	
Sensor Name	Value	Unit
<input type="checkbox"/> Engine Speed	572	RPM
<input type="checkbox"/> Vehicle Speed	0	MPH
<input type="checkbox"/> Filtered Vehicle Speed	0	MPH
<input type="checkbox"/> Steering Rate	288	°/s
<input type="checkbox"/> Filtered Steering Rate	284	°/s
<input type="checkbox"/> Drivestage Voltage	13.0	V
<input type="checkbox"/> Drivestage Temperature	51	°C
<input type="checkbox"/> Motor Speed	4800	RPM
<input type="checkbox"/> Q-axis Motor Current	22.0	A

Fig.1

SBHST9606L

# Electro Hydraulic Power Steering

ST-43

Current Data			
Standard Display	Full List	Graph	Items List
Reset Min.Max.	Record	Stop	VSS
Sensor Name	Value	Unit	
<input checked="" type="checkbox"/> Vehicle Speed	0	MPH	
<input checked="" type="checkbox"/> Throttle Position1 Voltage	0.6	V	
<input checked="" type="checkbox"/> Throttle Position2 Voltage	4.4	V	
<input checked="" type="checkbox"/> Accelerator Pedal Position Sensor-1	0.0	V	
<input checked="" type="checkbox"/> Accelerator Pedal Position Sensor-2	0.0	V	
<input checked="" type="checkbox"/> Brake Pedal Switch	Off	-	
<input type="checkbox"/> Engine Speed	560	RPM	
<input type="checkbox"/> Battery Positive Voltage	13.3	V	

Fig.2

SBHST9607L

Fig.1) Engine "ON" -EHPS

Fig.2) Engine "ON" - (ECM's current data)

4. Is parameter displayed within specifications?

**YES** ► Fault is intermittent caused by poor contact in the sensor's and/or MPU's connector or was repaired and MPU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification Vehicle Repair" procedure.

**NO** ► If the fault with related to CAN communication system(related to CAN communication system-TCM,ECM )

☞ "Repair CAN communication system and go to "Verification Vehicle Repair" procedure.

► Faulty in vehicle speed and engine speed

☞ Substitute with a known-good ECM and check for proper operation. If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.

► Faulty in sensor signal only for EHPS

☞ go to "Verification of Vehicle Repair" procedure.

## Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

**YES** ► Repair as necessary and go to "Verification of Vehicle Repair" procedure

**NO** ► Go to "CAN communication circuit inspection" procedure.



## ST-44

## Steering System

**CAN communication circuit inspection (EHPS ECU ↔ ECM)**

1. Ignition "OFF"
2. Disconnect ECM connector and EHPS ECU connector
3. Measure the resistance between CAN-HIGH terminal of ECM harness connector and CAN-HIGH terminal of EHPS ECU harness connector.
4. Measure the resistance between CAN-LOW terminal of ECM harness connector and CAN-LOW terminal of EHPS ECU harness connector.

**Specification :** below 1Ω

5. Is the measured resistance within specification ?

**YES** ▶ Substitute with a known - good MPU and check for proper operation. If the problem is corrected, replace MPU and go to "Verification of Vehicle Repair" procedure.

**NO** ▶ Check for open/short in harness.  
▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

**Verification of Vehicle Repair**

After a repair, it is essential to verifying that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES** ▶ Go to the applicable troubleshooting procedure.

**NO** ▶ System is performing to specification at this time.



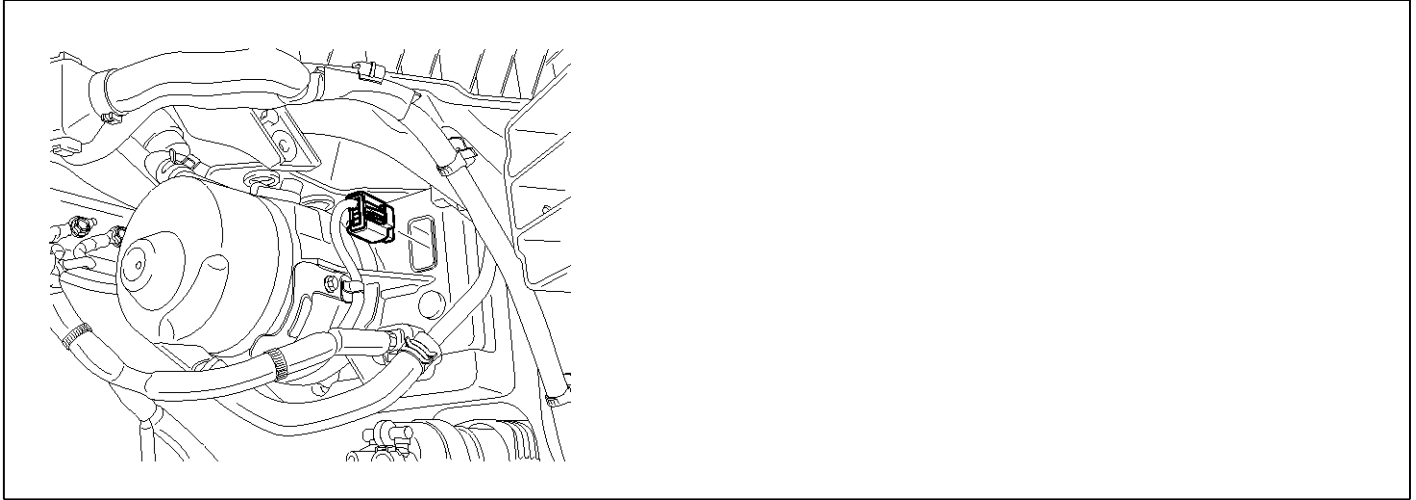
دیجیتال خودرو  
شرکت دیجیتال خودرو سامانه (مسئولیت محدود)  
اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

# Electro Hydraulic Power Steering

ST-45

## C1617 EMS Invalid Engine Speed

### Component Location



SBHST8308D

### General Description

Several control units are applied to electronically controlled vehicles. These units perform each control with informations from various sensors. Thus, sharing signal information from sensors is needed, so CAN communication type whose communication speed is high and insensitive to electrical noise by spark generation is adopted to controlling power-train(engine, automatic transaxle, ABS, TCS, ECS)

As sharing signals of engine speed, vehicle speed, steering wheel position through CAN communication, MPU(Motor Pump Unit) control vehicle actively.

### DTC Description

The MPU set this code If input signal is too low from EMS or input abnormal engine speed.

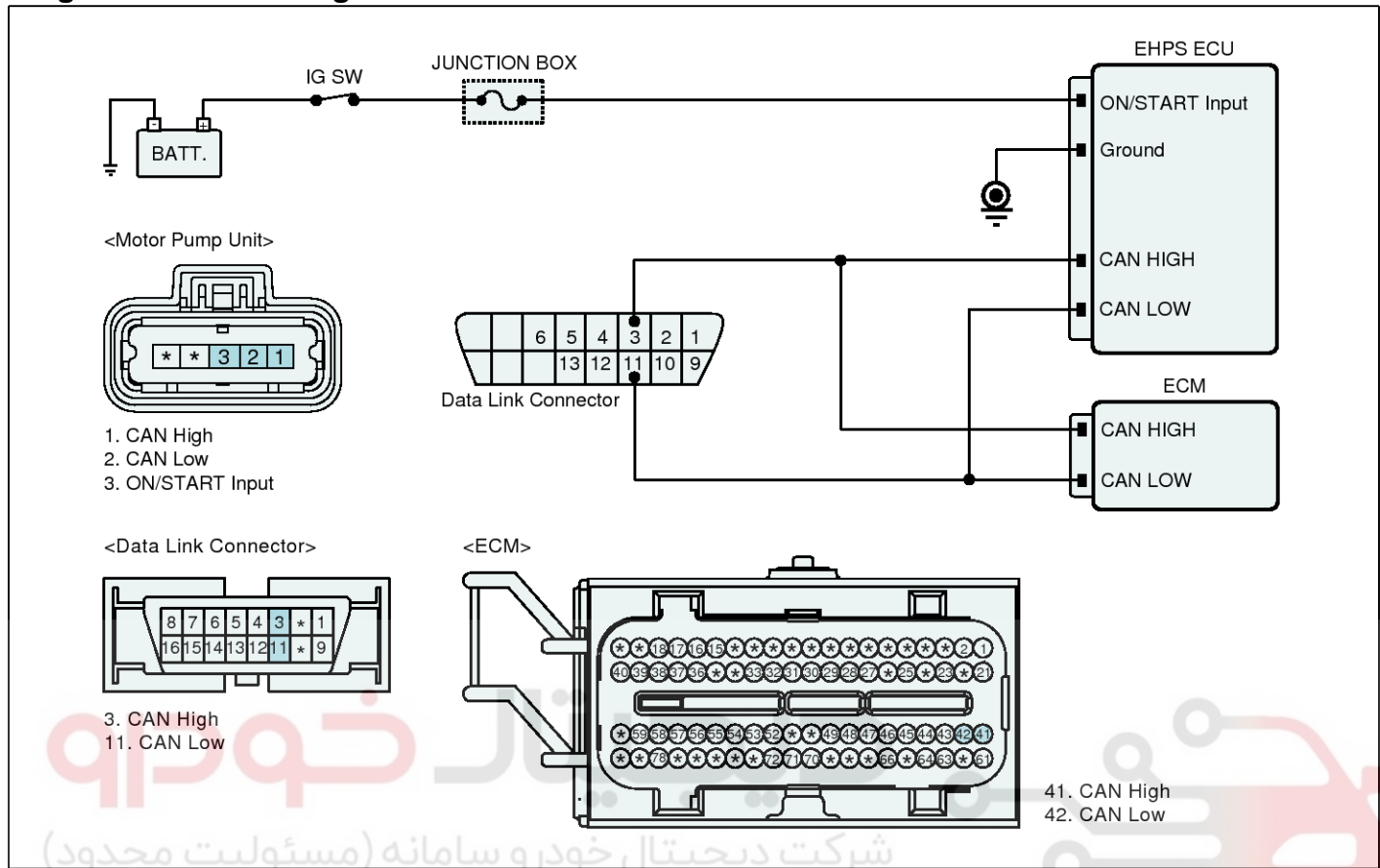
### DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal monitoring	<ul style="list-style-type: none"> <li>• CAN communication circuit Open/Short</li> <li>• Faulty ECM</li> <li>• Faulty MPU</li> </ul>
Enable Conditions	• IG ON	
Threshold Value	• input signal is too low from EMS or input abnormal engine speed	
Detecting time	• 1sec.	
Fail Safe	• Steering wheel operation heavily.	
Restoration conditions	• more than 10times input for normal value	

## ST-46

## Steering System

## Diagnostic Circuit Diagram



SBHST9503L

## Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).

2. ENG "ON"

3. Monitor the "RPM" parameters on the scantool.  
(EHPS and ECM's current data)

Current Data		
Standard Display	Full List	Graph
Items List	Reset Min.Max.	Record
Run	VSS	
Sensor Name	Value	Unit
<input type="checkbox"/> Engine Speed	572	RPM
<input type="checkbox"/> Vehicle Speed	0	MPH
<input type="checkbox"/> Filtered Vehicle Speed	0	MPH
<input type="checkbox"/> Steering Rate	288	°/s
<input type="checkbox"/> Filtered Steering Rate	284	°/s
<input type="checkbox"/> Drivestage Voltage	13.0	V
<input type="checkbox"/> Drivestage Temperature	51	°C
<input type="checkbox"/> Motor Speed	4800	RPM
<input type="checkbox"/> Q-axis Motor Current	22.0	A

Fig.1

SBHST9606L

# Electro Hydraulic Power Steering

ST-47

Current Data			
Standard Display	Full List	Graph	Items List
Reset Min.Max.	Record	Stop	VSS
Sensor Name	Value	Unit	
<input checked="" type="checkbox"/> Vehicle Speed	0	MPH	
<input checked="" type="checkbox"/> Throttle Position1 Voltage	0.6	V	
<input checked="" type="checkbox"/> Throttle Position2 Voltage	4.4	V	
<input checked="" type="checkbox"/> Accelerator Pedal Position Sensor-1	0.0	V	
<input checked="" type="checkbox"/> Accelerator Pedal Position Sensor-2	0.0	V	
<input checked="" type="checkbox"/> Brake Pedal Switch	Off	-	
<input type="checkbox"/> Engine Speed	560	RPM	
<input type="checkbox"/> Battery Positive Voltage	13.3	V	

Fig.2

SBHST9607L

Fig.1) Engine "ON" -EHPS

Fig.2) Engine "ON" - (ECM's current data)

4. Is parameter displayed within specifications?

**YES** ► Fault is intermittent caused by poor contact in the sensor's and/or MPU's connector or was repaired and MPU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification Vehicle Repair" procedure.

**NO** ► Faulty in engine speed(ECM)  
 ► Substitute with a known-good ECM and check for proper operation. If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.  
 ► Faulty in sensor signal only for EHPS  
 ► go to "Verification of Vehicle Repair" procedure.

## Terminal and Connector Inspection

- Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
- Has a problem been found?

**YES** ► Repair as necessary and go to "Verification of Vehicle Repair" procedure

**NO** ► Go to "CAN communication circuit inspection" procedure.

## CAN communication circuit inspection (EHPS ECU ↔ ECM)

- Ignition "OFF"
- Disconnect ECM connector and EHPS ECU connector
- Measure the resistance between CAN-HIGH terminal of ECM harness connector and CAN-HIGH terminal of EHPS ECU harness connector.
- Measure the resistance between CAN-LOW terminal of ECM harness connector and CAN-LOW terminal of EHPS ECU harness connector.

**Specification** : below 1Ω

5. Is the measured resistance within specification ?

**YES** ► Substitute with a known - good MPU and check for proper operation. If the problem is corrected, replace MPU and go to "Verification of Vehicle Repair" procedure.

**NO** ► Check for open/short in harness.  
 ► Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

## ST-48

## Steering System

### Verification of Vehicle Repair

After a repair, it is essential to verifying that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES** ► Go to the applicable troubleshooting procedure.

**NO** ► System is performing to specification at this time.

دیجیتال خودرو

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

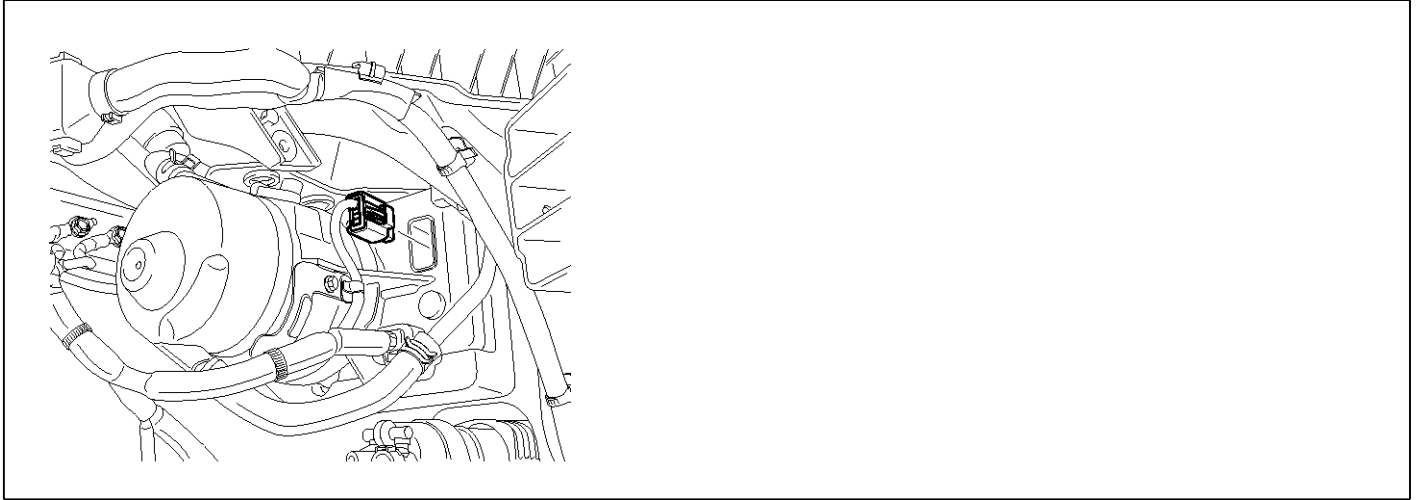


# Electro Hydraulic Power Steering

ST-49

## C1622 EMS invalid vehicle speed

### Component Location



SBHST8308D

### General Description

Several control units are applied to electronically controlled vehicles. These units perform each control with informations from various sensors. Thus, sharing signal information from sensors is needed, so CAN communication type whose communication speed is high and insensitive to electrical noise by spark generation is adopted to controlling power-train(engine, automatic transaxle, ABS, TCS, ECS)

As sharing signals of engine speed, vehicle speed, steering wheel position through CAN communication, MPU(Motor Pump Unit) control vehicle actively.

### DTC Description

The MPU set this code If input signal is too low from EMS or input abnormal vehicle speed.

### DTC Detecting Condition

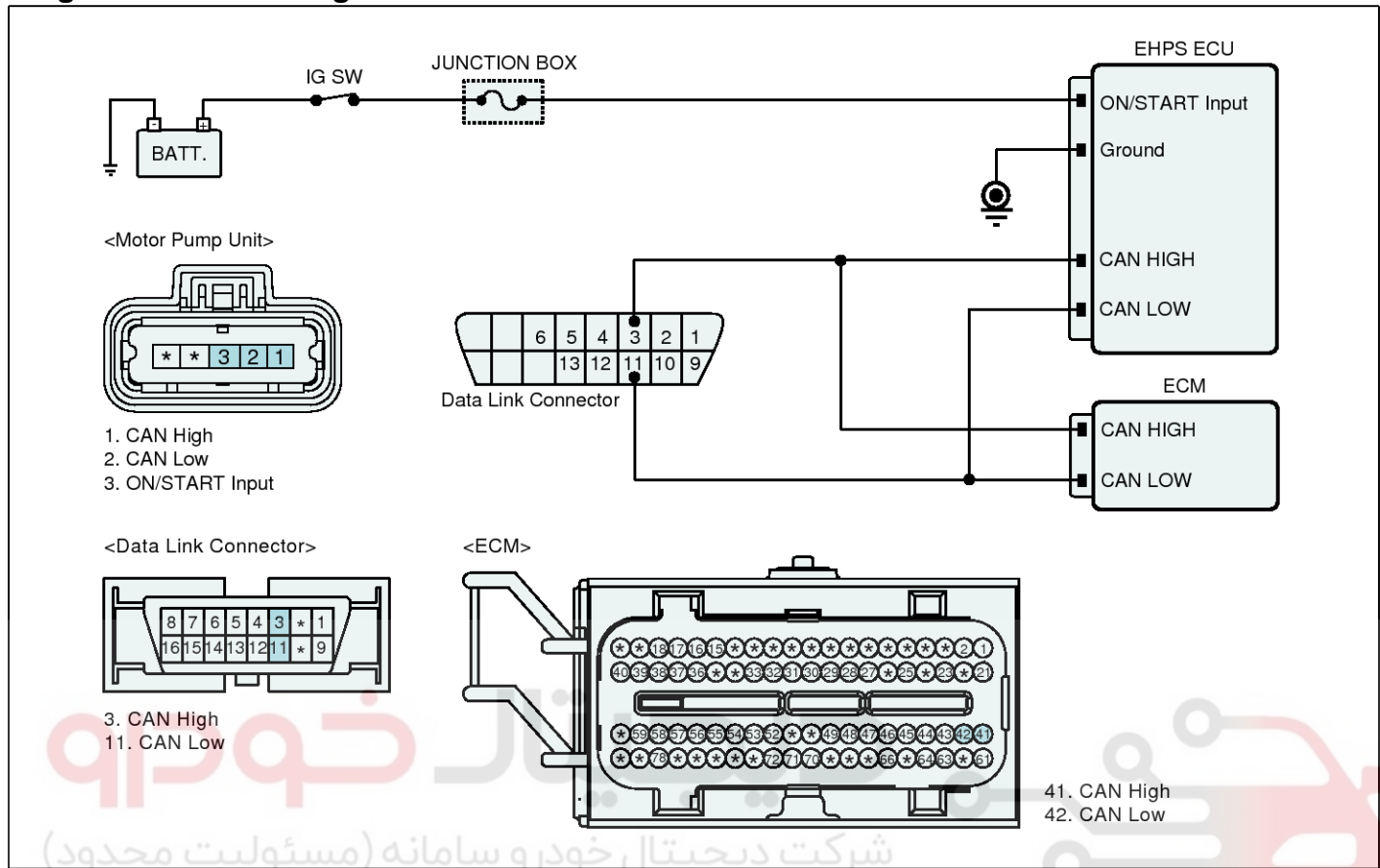
Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal monitoring	<ul style="list-style-type: none"> <li>• CAN communication circuit Open/Short</li> <li>• Faulty ECM</li> <li>• Faulty MPU</li> </ul>
Enable Conditions	• IG ON	
Threshold Value	• VSS = 255kph or input signal is too low from EMS	
Detecting time	• 1sec.	
Fail Safe	• Steering wheel operation heavily.	
Restoration conditions	• VSS < 255kph or more than 10times input for normal value	



## ST-50

## Steering System

## Diagnostic Circuit Diagram



## Monitor Scantool Data

1. Connect scantool to Data Link Connector(DLC).
2. Engine start and drive the vehicle on the road.

3. Monitor the "VSS and RPM" parameters on the scantool.

(Check the data of EHPS with ECM system and confirm output values related to CAN communication.)

Current Data		
Standard Display	Full List	Graph
Items List	Reset Min.Max.	Record
Run	VSS	
Sensor Name	Value	Unit
<input type="checkbox"/> Engine Speed	572	RPM
<input type="checkbox"/> Vehicle Speed	0	MPH
<input type="checkbox"/> Filtered Vehicle Speed	0	MPH
<input type="checkbox"/> Steering Rate	288	°/s
<input type="checkbox"/> Filtered Steering Rate	284	°/s
<input type="checkbox"/> Drivestage Voltage	13.0	V
<input type="checkbox"/> Drivestage Temperature	51	°C
<input type="checkbox"/> Motor Speed	4800	RPM
<input type="checkbox"/> Q-axis Motor Current	22.0	A

Fig.1

SBHST9606L

# Electro Hydraulic Power Steering

ST-51

Sensor Name	Value	Unit
<input checked="" type="checkbox"/> Vehicle Speed	0	MPH
<input checked="" type="checkbox"/> Throttle Position1 Voltage	0.6	V
<input checked="" type="checkbox"/> Throttle Position2 Voltage	4.4	V
<input checked="" type="checkbox"/> Accelerator Pedal Position Sensor-1	0.0	V
<input checked="" type="checkbox"/> Accelerator Pedal Position Sensor-2	0.0	V
<input checked="" type="checkbox"/> Brake Pedal Switch	Off	-
<input type="checkbox"/> Engine Speed	560	RPM
<input type="checkbox"/> Battery Positive Voltage	13.3	V

Fig.2

SBHST9608L

Fig.1) Engine "ON" -EHPS

Fig.2) Engine "ON" - (ECM's current data)

4. Is parameter displayed within specifications?

**YES** ► Fault is intermittent caused by poor contact in the sensor's and/or MPU's connector or was repaired and MPU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification Vehicle Repair" procedure.

**NO** ► Faulty in vehicle speed(ECM)  
 ► Substitute with a known-good ECM and check for proper operation. If the problem is corrected, replace ECM and then go to "Verification of Vehicle Repair" procedure.  
 ► Faulty in sensor signal only for EHPS  
 ► go to "Inspection/Repair" procedure.

## Terminal and Connector Inspection

- Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
- Has a problem been found?

**YES** ► Repair as necessary and go to "Verification of Vehicle Repair" procedure

**NO** ► Go to "CAN communication circuit inspection" procedure.

## CAN communication circuit inspection (EHPS ECU ↔ ECM)

- Ignition "OFF"
- Disconnect ECM connector and EHPS ECU connector
- Measure the resistance between CAN-HIGH terminal of ECM harness connector and CAN-HIGH terminal of EHPS ECU harness connector.
- Measure the resistance between CAN-LOW terminal of ECM harness connector and CAN-LOW terminal of EHPS ECU harness connector.

**Specification** : below 1Ω

5. Is the measured resistance within specification ?

**YES** ► Substitute with a known - good MPU and check for proper operation. If the problem is corrected, replace MPU and go to "Verification of Vehicle Repair" procedure.

**NO** ► Check for open/short in harness.  
 ► Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

## ST-52

## Steering System

### Verification of Vehicle Repair

After a repair, it is essential to verifying that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES** ► Go to the applicable troubleshooting procedure.

**NO** ► System is performing to specification at this time.

دیجیتال خودرو

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

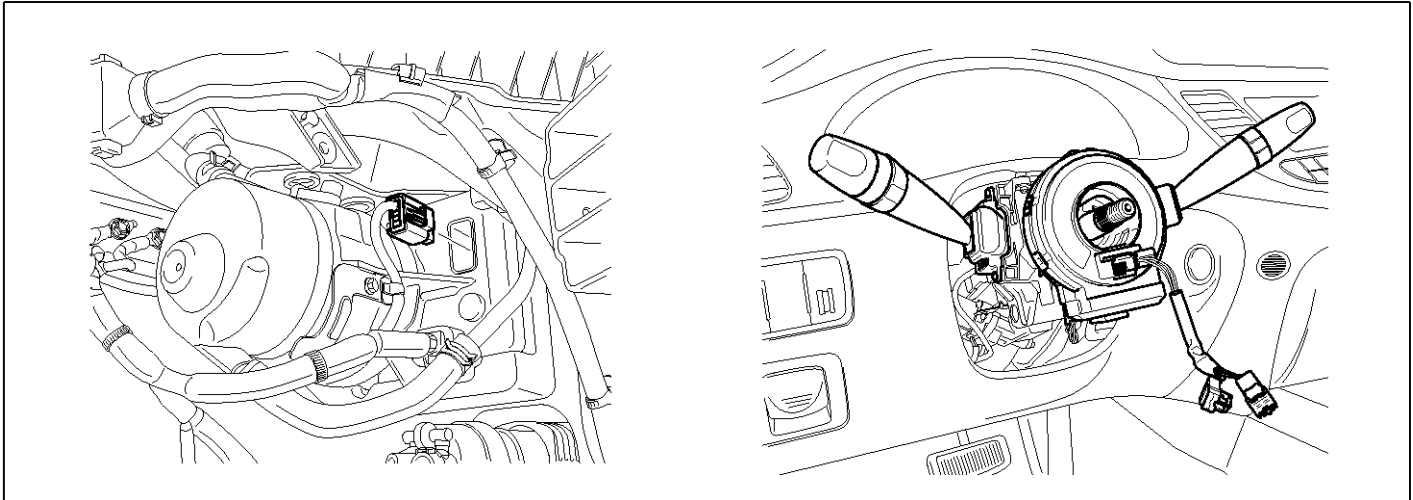


# Electro Hydraulic Power Steering

**ST-53**

## C1623 CAN Time-out Steering Angle Sensor

### Component Location



SBHST9300L

### General Description

Steering angle sensor is installed under the clock spring. Steering angle sensor input to MPU uses CAN communication in order to measure for speed of steering wheel's operation and angel. Steering angle sensor is composed with main gear and sub gear1, sub gear2 to determine for rotation direction. According to rotation of steering wheel, If the main gear rotate, sub gear1 and sub gear2 be retated. Steering angle sensor calculate rotation angle use MR effect of magnetic that installed in sub gear and different gear ratio sub gear1 and sub gear2. MPU determine driver's intention in accordance with Steering angle sensor and also using as a input value for EHPS (Electro Hydraulic Power Steering) control.

### DTC Description

The MPU set this code If the signal is not input from steering angle sensor.

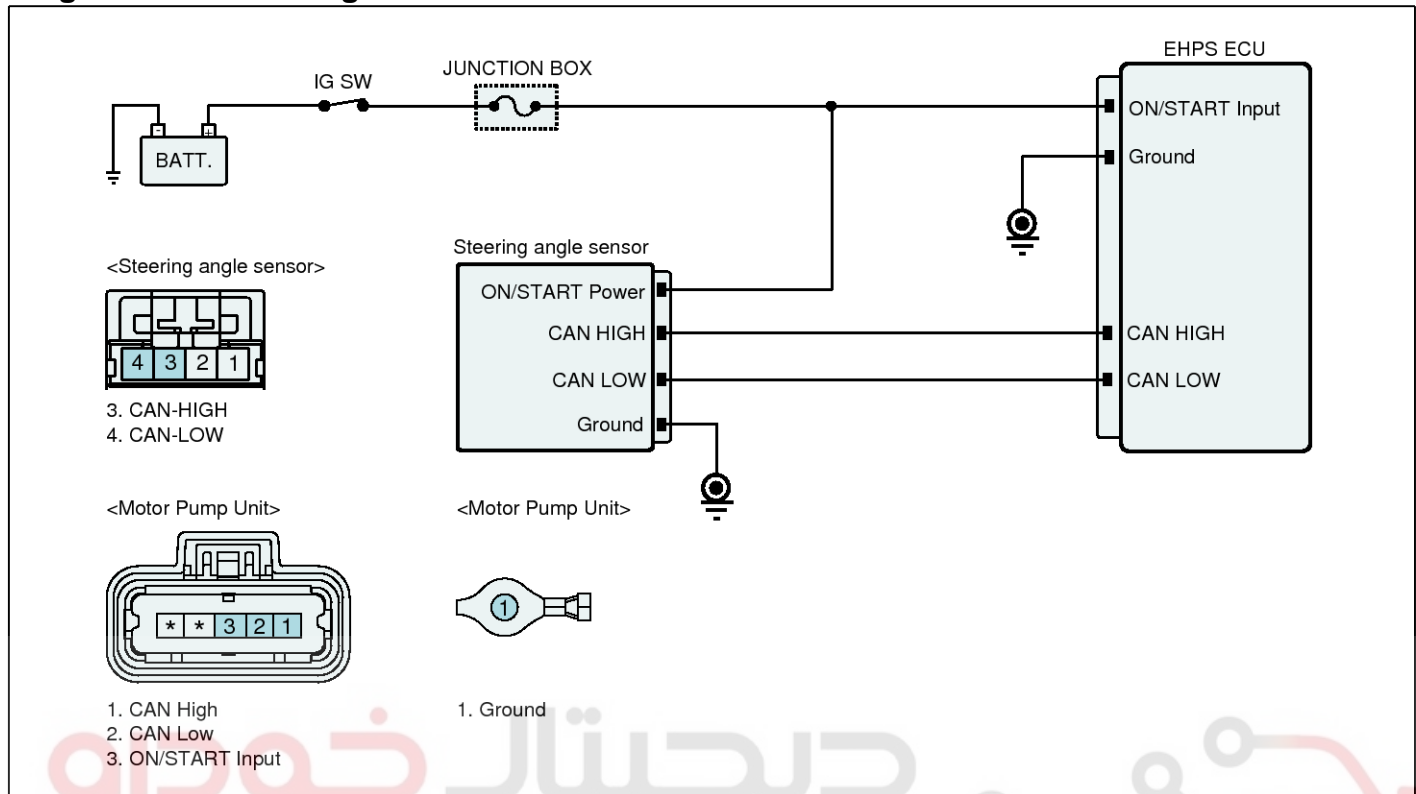
### DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal monitoring	<ul style="list-style-type: none"> <li>• CAN communication circuit Op-en/Short</li> <li>• Faulty Steering angle sensor</li> <li>• Faulty MPU</li> </ul>
Enable Conditions	• IG ON	
Threshold Value	• signal is not input from steering angle sensor	
Detecting time	• 1sec.	
Fail Safe	• Steering wheel operation heavily.	
Restoration conditions	• more than 10times input for normal value	

## ST-54

## Steering System

## Diagnostic Circuit Diagram



## Monitor Scantool Data

1. Connect scan tool to data link connector(DLC).
2. Engine "ON".
3. Turn steering wheel to right and left .

4. Monitor the "Steering angle sensor" parameter on the scan-tool.

(Check the data of steering angle sensor with AFLS, VDC system and confirm output values related to CAN communication.)

**Specification :** output value is changed according to steering wheel operation.

Current Data		
Standard Display	Full List	Graph
Items List	Reset Min.Max.	Record
Run	VSS	
Sensor Name	Value	Unit
<input type="checkbox"/> Engine Speed	572	RPM
<input type="checkbox"/> Vehicle Speed	0	MPH
<input type="checkbox"/> Filtered Vehicle Speed	0	MPH
<input type="checkbox"/> Steering Rate	288	'/s
<input type="checkbox"/> Filtered Steering Rate	284	'/s
<input type="checkbox"/> Drivestage Voltage	13.0	V
<input type="checkbox"/> Drivestage Temperature	51	'C
<input type="checkbox"/> Motor Speed	4800	RPM
<input type="checkbox"/> Q-axis Motor Current	22.0	A

Fig.1

SBHST9602L

# Electro Hydraulic Power Steering

ST-55

Current Data		
Standard Display	Full List	Graph
Items List	Reset Min.Max.	Record
Stop	VSS	
Sensor Name	Value	Unit
<input type="checkbox"/> Vehicle Speed	0	MPH
<input type="checkbox"/> HLL position	0.10	mm
<input type="checkbox"/> DBL position	0.00	DEG
<input type="checkbox"/> Sensor angle rear	-5	mm
<input type="checkbox"/> Supply voltage	13.4	V
<input type="checkbox"/> Steering wheel angle	62	DEG
<input type="checkbox"/> Headlamp status	ON	-
<input type="checkbox"/> Engine Status	ON	-
<input type="checkbox"/> Main function activation status	All direction	-
<input type="checkbox"/> Sensor angle front	-7	mm
<input type="checkbox"/> AFLS activation swith/button status	ON	-

Fig.2

SBHST9603L

Fig.1) Engine "ON" -EHPS

Fig.2) Engine "ON" -(AFLS's current data)

5. Is parameter displayed within specifications?

**YES** ▶ Fault is intermittent caused by poor contact in the sensor's and/or MPU's connector or was repaired and MPU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "Verification Vehicle Repair" procedure.

**NO** ▶ If the fault with related to CAN communication system(related to CAN communication system-ECS,AFLS,VDC )  
 ☞ "Repair CAN communication system and go to "Verification Vehicle Repair" procedure.  
 ▶ Faulty in steering angle sensor for ECS,AF-LS,VDC  
 ☞ Substitute with a known-good steering wheel sensor and check for proper operation. If the problem is corrected, replace steering wheel sensor and then go to "Verification of Vehicle Repair" procedure.  
 ▶ Faulty in steering wheel sensor signal only for EHPS  
 ☞ go to "Verification of Vehicle Repair" procedure.

## Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES** ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure

**NO** ▶ Go to "CAN communication circuit inspection" procedure.



## ST-56

## Steering System

**CAN communication circuit inspection (EHPS ECU ↔ Steering angle sensor)**

1. Ignition "OFF"
2. Disconnect Steering angle sensor connector and EHPS ECU connector
3. Measure the resistance between CAN-HIGH terminal of Steering angle sensor harness connector and CAN-HIGH terminal of EHPS ECU harness connector.
4. Measure the resistance between CAN-LOW terminal of Steering angle sensor harness connector and CAN-LOW terminal of EHPS ECU harness connector.

**Specification :** below 1Ω

5. Is the measured resistance within specification ?

**YES** ▶ Substitute with a known - good MPU and check for proper operation. If the problem is corrected, replace MPU and go to "Verification of Vehicle Repair" procedure.

**NO** ▶ Check for open/short in harness.  
▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

**Verification of Vehicle Repair**

After a repair, it is essential to verifying that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES** ▶ Go to the applicable troubleshooting procedure.

**NO** ▶ System is performing to specification at this time.



# Electro Hydraulic Power Steering

ST-57

## C2400 Motor Fault - Motor Not Running

### Component Location



SBHST8308D

### General Description

EHPS (Electro Hydraulic Power Steering) is assistance steering ability system uses electrical motor that generate oil pressure not to use the Engine power.

MPU(Motor Pump Unit) motor generate oil pressure and control steering force according to vehicle speed changes.

MPU ECU determine current amount in accordance with vehicle speed signal, steering angle sensor signal.

MPU motor control to current.

### DTC Description

The MPU set this code If the motor revolution speed below 100 rpm.

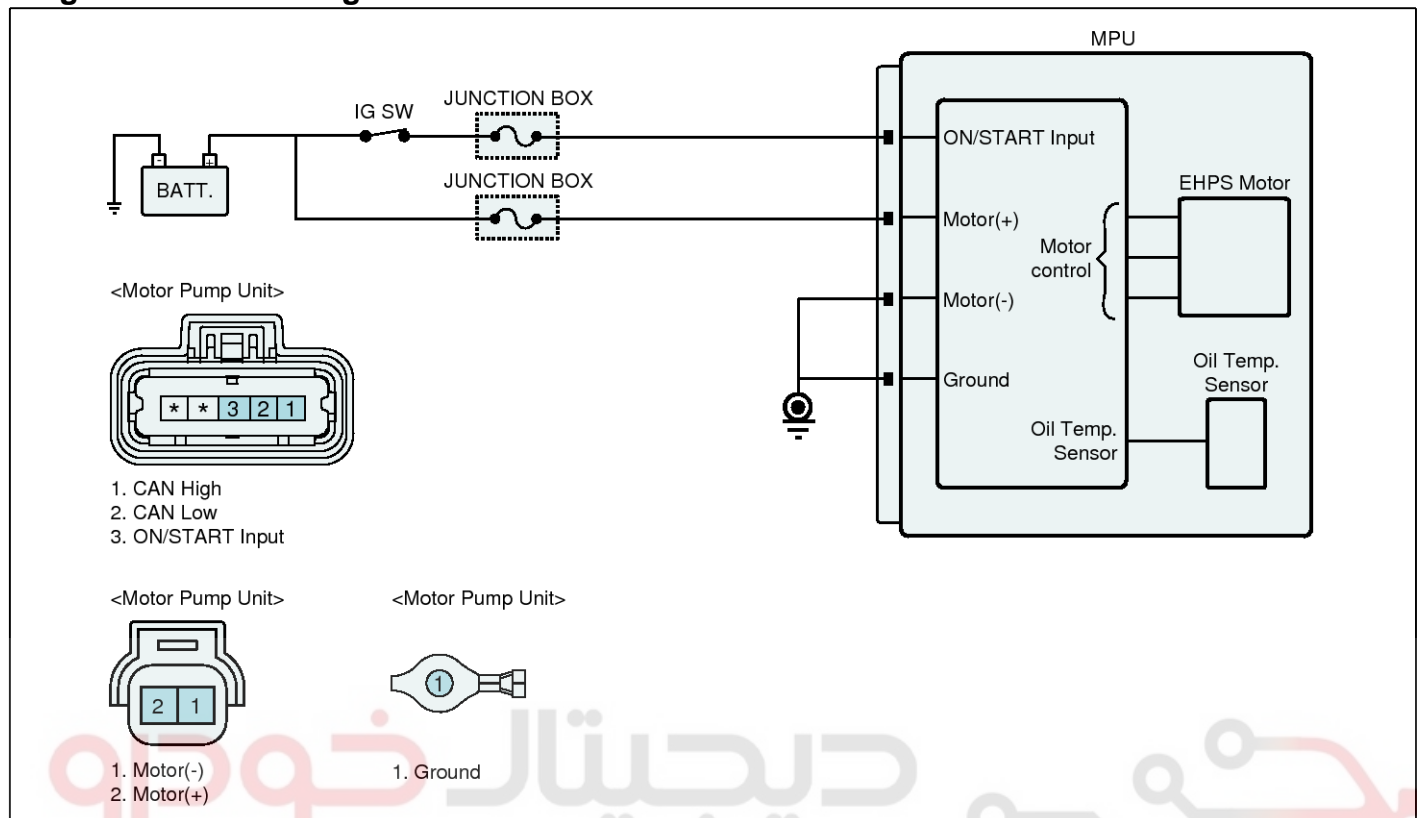
### DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Faulty motor	• Faulty MPU
Enable Conditions	• Engine " ON "	
Threshold Value	• motor revolution speed < 100rpm	
Detecting time	• 900ms	
Fail Safe	• EHPS stop control	
Restoration conditions	• IG OFF -> IG ON	

# ST-58

## Steering System

## Diagnostic Circuit Diagram



SBHST9501L

## Terminal and Connector Inspection

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

**YES** ► Repair as necessary and go to "Verification of Vehicle Repair" procedure

**NO** ▶ Go to "Component inspection" procedure.

## Component inspection

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Clear the DTC
4. Ignition "OFF"
5. Engine "ON"
6. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and Read "DTC Status" parameter.

7. Is the DTC C2400 present?

**YES** ▶ Substitute with a known-good MPU and check for proper operation. If the problem is corrected, replace MPU and then go to "Verification of Vehicle Repair" procedure.

**NO** ▶ Faulty in temperature sensor or fault was repaired and MPU memory was not cleared. go to "Verification Vehicle Repair" procedure.

## Verification of Vehicle Repair

After a repair, it is essential to verifying that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES** ▶ Go to the applicable troubleshooting procedure.

**NO** ▶ System is performing to specification at this time.

# Electro Hydraulic Power Steering

ST-59

## C2413 Motor current fail (current over)

### Component Location



SBHST8308D

### General Description

EHPS (Electro Hydraulic Power Steering) is assistance steering ability system uses electrical motor that generate oil pressure not to use the Engine power.

MPU(Motor Pump Unit) motor generate oil pressure and control steering force according to vehicle speed changes.

MPU ECU determine current amount in accordance with vehicle speed signal, steering angle sensor signal.

MPU motor control to current.

### DTC Description

The MPU set this code If input value is out of normal range.

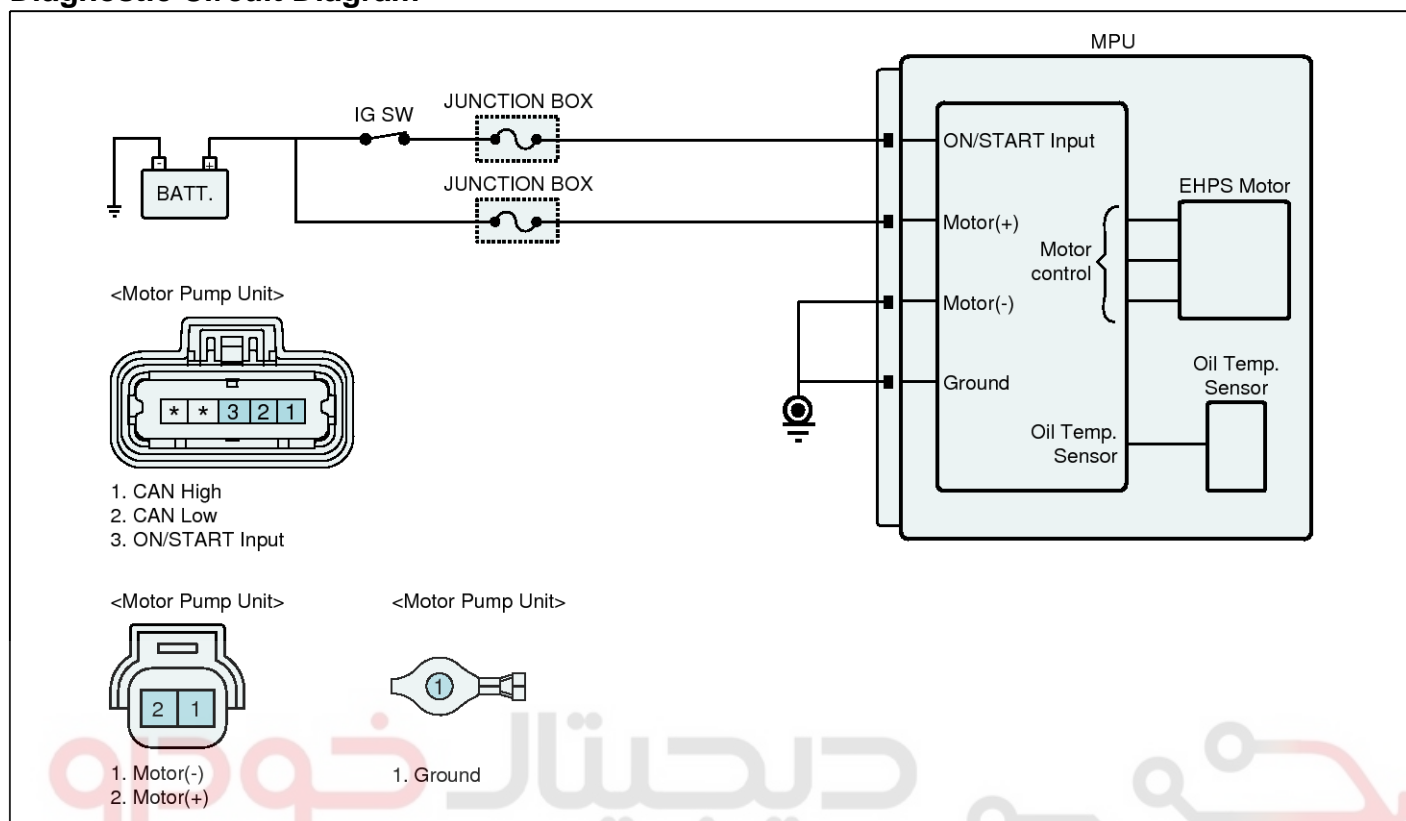
### DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	<ul style="list-style-type: none"> <li>Compare with calculated current value and measured current value</li> </ul>	<ul style="list-style-type: none"> <li>Faulty in power circuit</li> <li>Faulty in ground circuit</li> <li>over charge</li> </ul>
Enable Conditions	<ul style="list-style-type: none"> <li>Engine " ON "</li> </ul>	
Threshold Value	<ul style="list-style-type: none"> <li>current value &gt; 150A</li> </ul>	
Detecting time	<ul style="list-style-type: none"> <li>5ms</li> </ul>	
Fail Safe	<ul style="list-style-type: none"> <li>EHPS stop control</li> </ul>	
Restoration conditions	<ul style="list-style-type: none"> <li>IG OFF -&gt; IG ON</li> </ul>	

## ST-60

## Steering System

## Diagnostic Circuit Diagram



SBHST9501L

## Terminal and Connector Inspection

- Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
- Has a problem been found?

**YES** ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure

**NO** ▶ Go to "Component inspection" procedure.

## Component inspection

- Connect scantool to Data Link Connector(DLC).
- Engine "ON"
- Clear the DTC
- Ignition "OFF"
- Engine "ON"
- Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and Read "DTC Status" parameter.

- Is the DTC C2413 present?

**YES** ▶ Substitute with a known-good MPU and check for proper operation. If the problem is corrected, replace MPU and then go to "Verification of Vehicle Repair" procedure.

**NO** ▶ Faulty in temperature sensor or fault was repaired and MPU memory was not cleared. go to "Verification Vehicle Repair" procedure.

## Verification of Vehicle Repair

After a repair, it is essential to verifying that the fault has been corrected.

- Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
- Using scantool, Clear DTC.
- Operate the vehicle within DTC Enable conditions in General information.
- Are any DTCs present ?

**YES** ▶ Go to the applicable troubleshooting procedure.

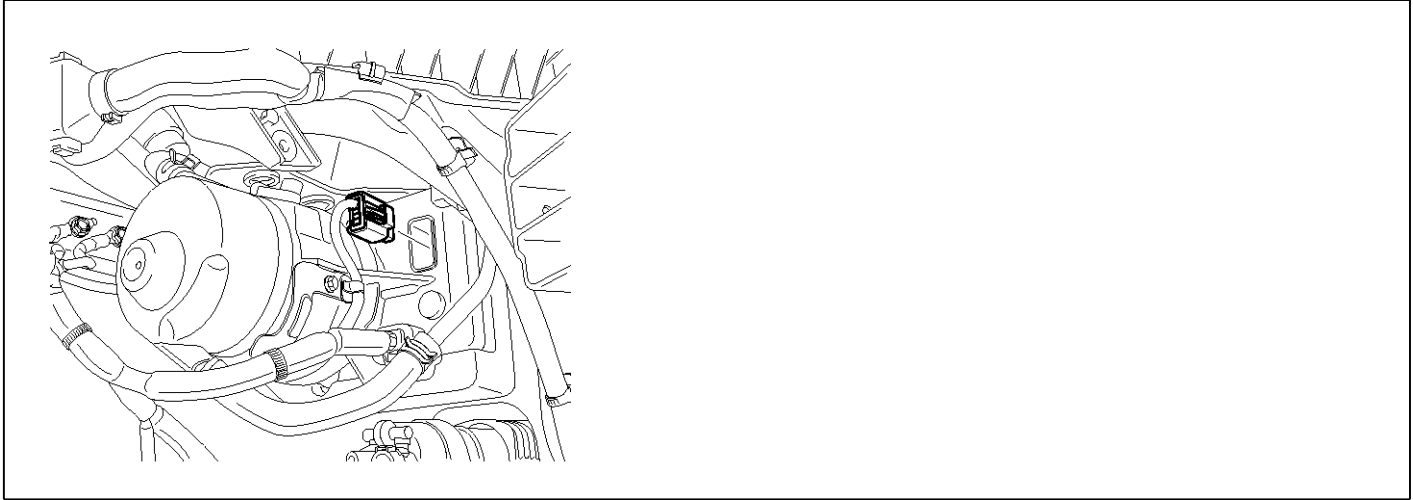
**NO** ▶ System is performing to specification at this time.

# Electro Hydraulic Power Steering

**ST-61**

## C2420 Motor temperature sensor high input

### Component Location



SBHST8308D

### General Description

EHPS (Electro Hydraulic Power Steering) is assistance steering ability system uses electrical motor that generate oil pressure not to use the Engine power.

Temperature sensor is installed is MPU(Motor Pump Unit) in order to measure oil temperature, This sensor uses a thermistor whose resistance changes according to the temperature changes.

MPU ECU perform limit current control to prevent from over-heating and motor speed control according to viscosity changes.

### DTC Description

This DTC code is set when supplied over current or input too high temperature to MPU ECU, in order to protect MPU ECU. The MPU not perform EHPS control.

### DTC Detecting Condition

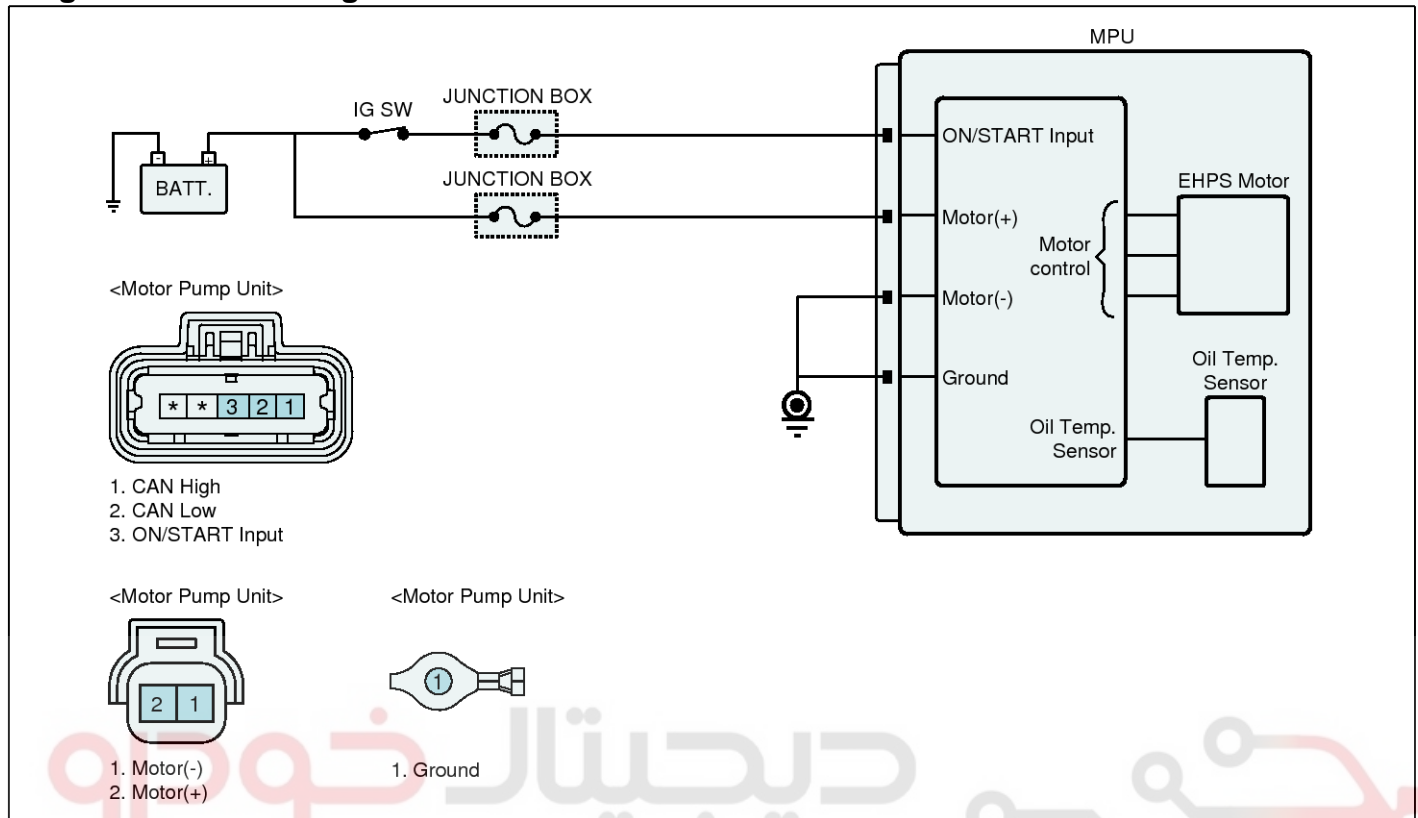
Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal monitoring	<ul style="list-style-type: none"> <li>Faulty in battery</li> <li>Contamination of Oil / Clog of Oil path</li> <li>Faulty MPU</li> </ul>
Enable Conditions	• Engine " ON "	
Threshold Value	• Temperature sensor > 125°C or Temperature to MPU ECU > 125°C	
Detecting time	• 1sec.	
Fail Safe	• EHPS stop control	
Restoration conditions	• IG OFF -> IG ON	



## ST-62

## Steering System

## Diagnostic Circuit Diagram



SBHST9501L

## Monitor Scantool Data

1. Connect scan tool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "EPS temperature" parameter on the scan-tool.

Current Data		
Standard Display	Full List	Graph
Items List	Reset Min.Max.	Record
Run	VSS	
Sensor Name	Value	Unit
<input type="checkbox"/> Engine Speed	572	RPM
<input type="checkbox"/> Vehicle Speed	0	MPH
<input type="checkbox"/> Filtered Vehicle Speed	0	MPH
<input type="checkbox"/> Steering Rate	288	°/s
<input type="checkbox"/> Filtered Steering Rate	284	°/s
<input type="checkbox"/> Drivestage Voltage	13.0	V
<input type="checkbox"/> Drivestage Temperature	51	°C
<input type="checkbox"/> Motor Speed	4800	RPM
<input type="checkbox"/> Q-axis Motor Current	22.0	A

Fig.1

SBHST9604L

Fig.1) Engine "ON"

# Electro Hydraulic Power Steering

## ST-63

4. Are "EPS temperature" within normal range?

**YES** ▶ Faulty in temperature sensor or fault was repaired and MPU memory was not cleared. go to "system check" procedure.

**NO** ▶ Wait for cooling MPU-motor enoughly and then go to "System check" procedure.

### System check

1. Check oil gauge.
2. Check clog of oil path.
3. Is there any problem?

**YES** ▶ Go to "Component inspection" procedure.

**NO** ▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

### Component inspection

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Clear the DTC
4. Ignition "OFF"
5. Engine "ON"
6. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and Read "DTC Status" parameter.
7. Is the DTC C2420 present?

**YES** ▶ Substitute with a known-good MPU and check for proper operation. If the problem is corrected, replace MPU and then go to "Verification of Vehicle Repair" procedure.

**NO** ▶ Faulty in temperature sensor or fault was repaired and MPU memory was not cleared. go to "Verification Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verifying that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES** ▶ Go to the applicable troubleshooting procedure.

**NO** ▶ System is performing to specification at this time.



## ST-64

## Steering System

## C2421 Motor Temperature Sensor Low Input

## Component Location



SBHST8308D

## General Description

EHPS (Electro Hydraulic Power Steering) is assistance steering ability system uses electrical motor that generate oil pressure not to use the Engine power.

Temperature sensor is installed is MPU(Motor Pump Unit) in order to measure oil temperature, This sensor uses a thermistor whose resistance changes according to the temperature changes.

MPU ECU perform limit current control to prevent from over-heating and motor speed control according to viscosity changes.

## DTC Description

The MPU set this code If input value from temperature sensor is too low and not control EHPS.

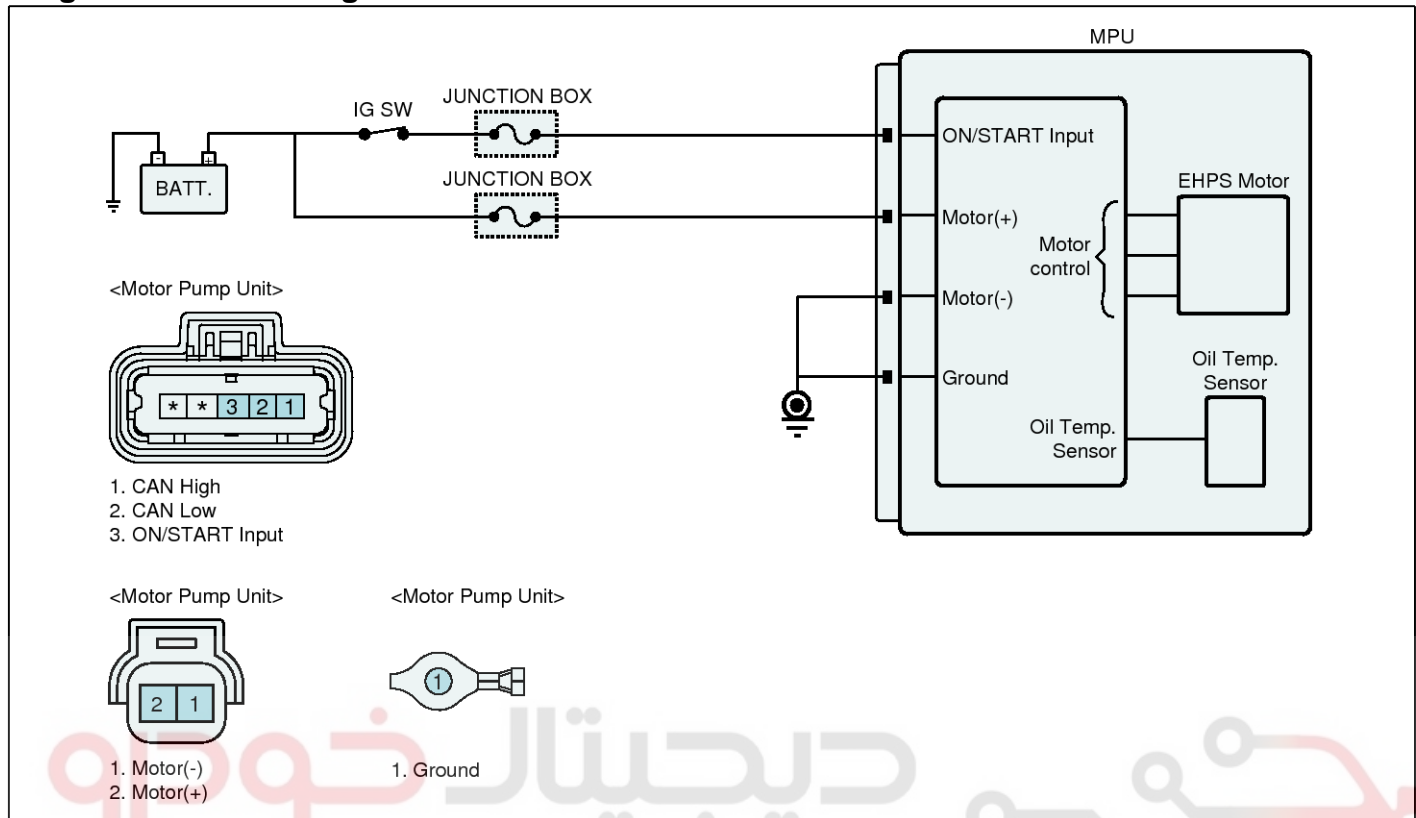
## DTC Detecting Condition

Item	Detecting Condition	Possible Cause
DTC Strategy	• Signal monitoring	<ul style="list-style-type: none"> <li>Faulty in battery</li> <li>Contamination of Oil / Clog of Oil path</li> <li>Faulty MPU</li> </ul>
Enable Conditions	• Engine " ON "	
Threshold Value	• Temperature sensor $\leq -40^{\circ}\text{C}$	
Detecting time	• 0.1sec.	
Fail Safe	• EHPS stop control	
Restoration conditions	• Temperature sensor $> -38^{\circ}\text{C}$	

# Electro Hydraulic Power Steering

ST-65

## Diagnostic Circuit Diagram



SBHST9501L

## Monitor Scantool Data

1. Connect scan tool to data link connector(DLC).
2. Engine "ON".
3. Monitor the "EPS temperature" parameter on the scan-tool.

Current Data		
Standard Display	Full List	Graph
Items List	Reset Min.Max.	Record
Run	VSS	
Sensor Name	Value	Unit
<input type="checkbox"/> Engine Speed	572	RPM
<input type="checkbox"/> Vehicle Speed	0	MPH
<input type="checkbox"/> Filtered Vehicle Speed	0	MPH
<input type="checkbox"/> Steering Rate	288	°/s
<input type="checkbox"/> Filtered Steering Rate	284	°/s
<input type="checkbox"/> Drivestage Voltage	13.0	V
<input type="checkbox"/> Drivestage Temperature	51	°C
<input type="checkbox"/> Motor Speed	4800	RPM
<input type="checkbox"/> Q-axis Motor Current	22.0	A

Fig.1

SBHST9604L

Fig.1) Engine "ON"

## ST-66

## Steering System

4. Are "EPS temperature" within normal range?

**YES** ▶ Faulty in temperature sensor or fault was repaired and MPU memory was not cleared. go to "system check" procedure.

**NO** ▶ Wait for cooling MPU-motor enoughly and then go to "System check" procedure.

### System check

1. Check oil gauge.
2. Check clog of oil path.
3. Is there any problem?

**YES** ▶ Go to "Component inspection" procedure.

**NO** ▶ Repair as necessary and go to "Verification of vehicle Repair" procedure.

### Component inspection

1. Connect scantool to Data Link Connector(DLC).
2. Engine "ON"
3. Clear the DTC
4. Ignition "OFF"
5. Engine "ON"
6. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode and Read "DTC Status" parameter.
7. Is the DTC C2421 present?

**YES** ▶ Substitute with a known-good MPU and check for proper operation. If the problem is corrected, replace MPU and then go to "Verification of Vehicle Repair" procedure.

**NO** ▶ Faulty in temperature sensor or fault was repaired and MPU memory was not cleared. go to "Verification Vehicle Repair" procedure.

### Verification of Vehicle Repair

After a repair, it is essential to verifying that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes(DTCs)" mode.
2. Using scantool, Clear DTC.
3. Operate the vehicle within DTC Enable conditions in General information.
4. Are any DTCs present ?

**YES** ▶ Go to the applicable troubleshooting procedure.

**NO** ▶ System is performing to specification at this time.

