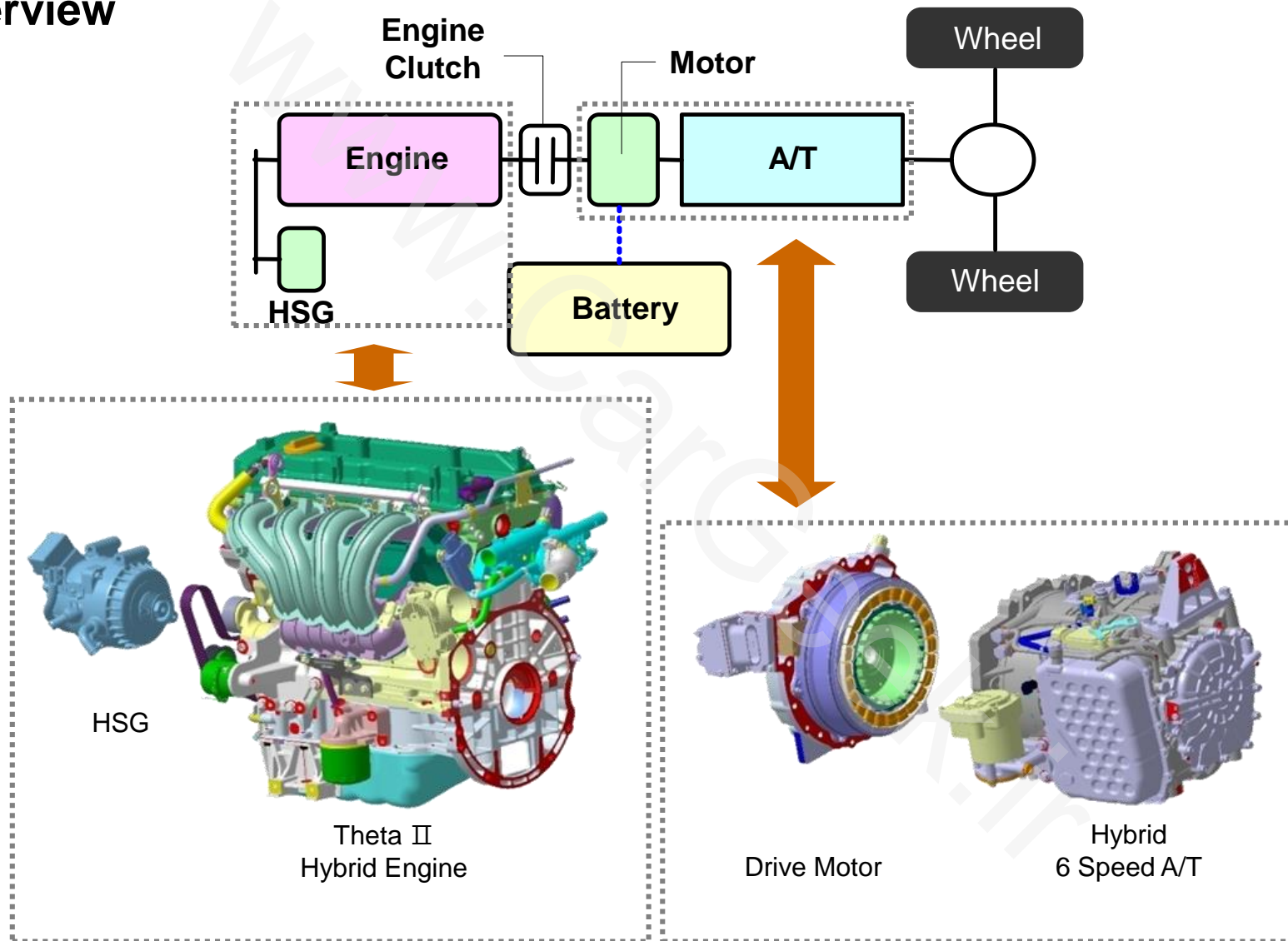


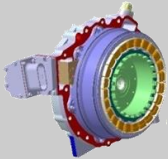

SONATA HEV Motor



Overview

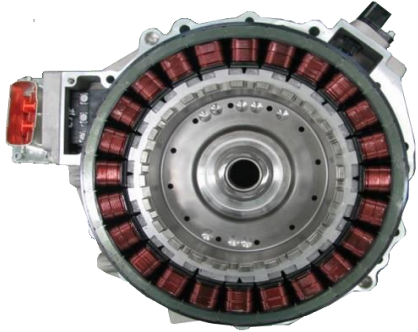
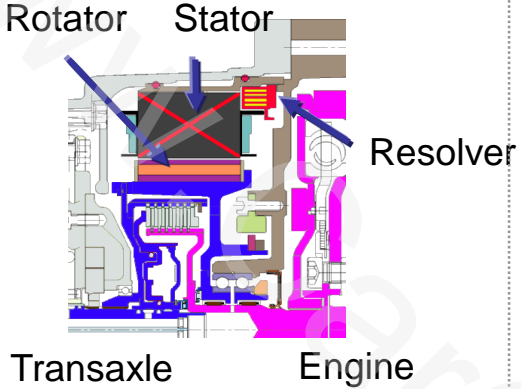


Specifications

Item					
		Drive Motor		HSG	
Number of Mag. Polarity/Core		16 / 24 Slots		6 / 36 Slots	
Output Spec.	Output	Max	30kW@1.4k~6krpm (5s)	8.5kW@1.87k~12krpm (5s)	
		Continuous	10kW@1.54k~4krpm (40min)	6.4kW@4.25k~12krpm (40min)	
	Max RPM		6300rpm	15750rpm	
	Max Torque		205Nm(@245A)	43.2Nm(@125A)	
	Max Output		95% ↑	95% ↑	
Category	Core (Stator)		Split Core/0.35t/Sheet Type	Unibody Core/0.35t/Sheet Type	
	Permanent Magnet		High Energy Rare-earth Type	High Energy Rare-earth Type	
	Position Sensor		Resolver	Resolver	
	High Voltage Connector		100A Connector Type	40A Connector Type	
	Sensor Connector		8P Integrated Type (position and temperature sensors)	10P Integrated Type (position and temperature sensors)	

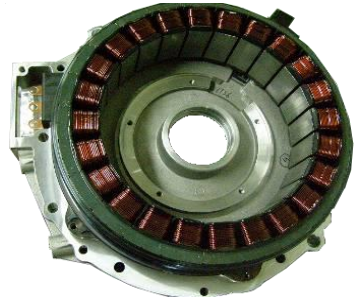
Composition of Drive Motor

Drive Motor Ass'y


Stator Ass'y

- matching engine/transaxle
- motor cooling function (oil cooling type)
- power cable connection
- terminal




ROTOR Ass'y


generate/deliver power
PM (16 polarities)




rotor core
(16 polarities, IPM)



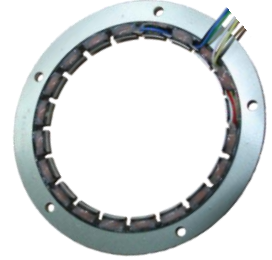
PM (ND series)



high voltage terminal
(connector type)



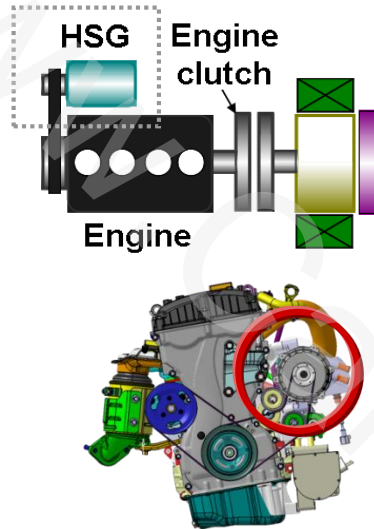
stator
(concentrated winding)



resolver
(position sensor)
- detects magnet position

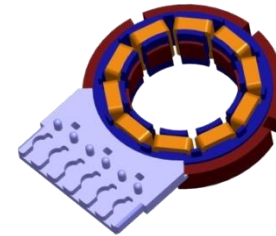
HSG Configuration

HSG Ass'y



Stator Ass'y

- Emergency power generation
- HSG cooling
- Power cable terminal



Resolver



Stator

Rotor Ass'y

- Engine start
- PM
- Rotating magnetic field



bearing



pulley



bearing

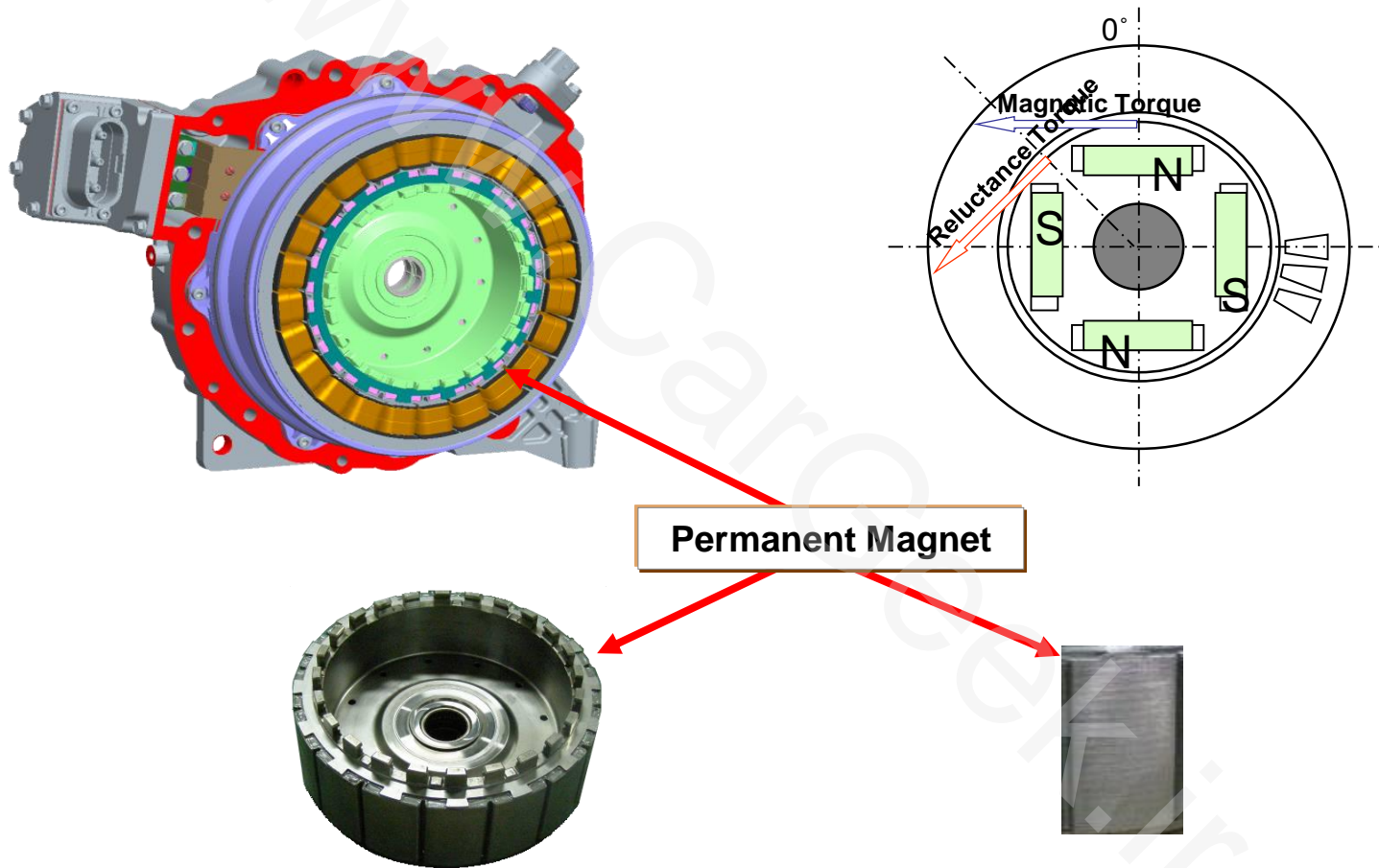


rotor



Housing

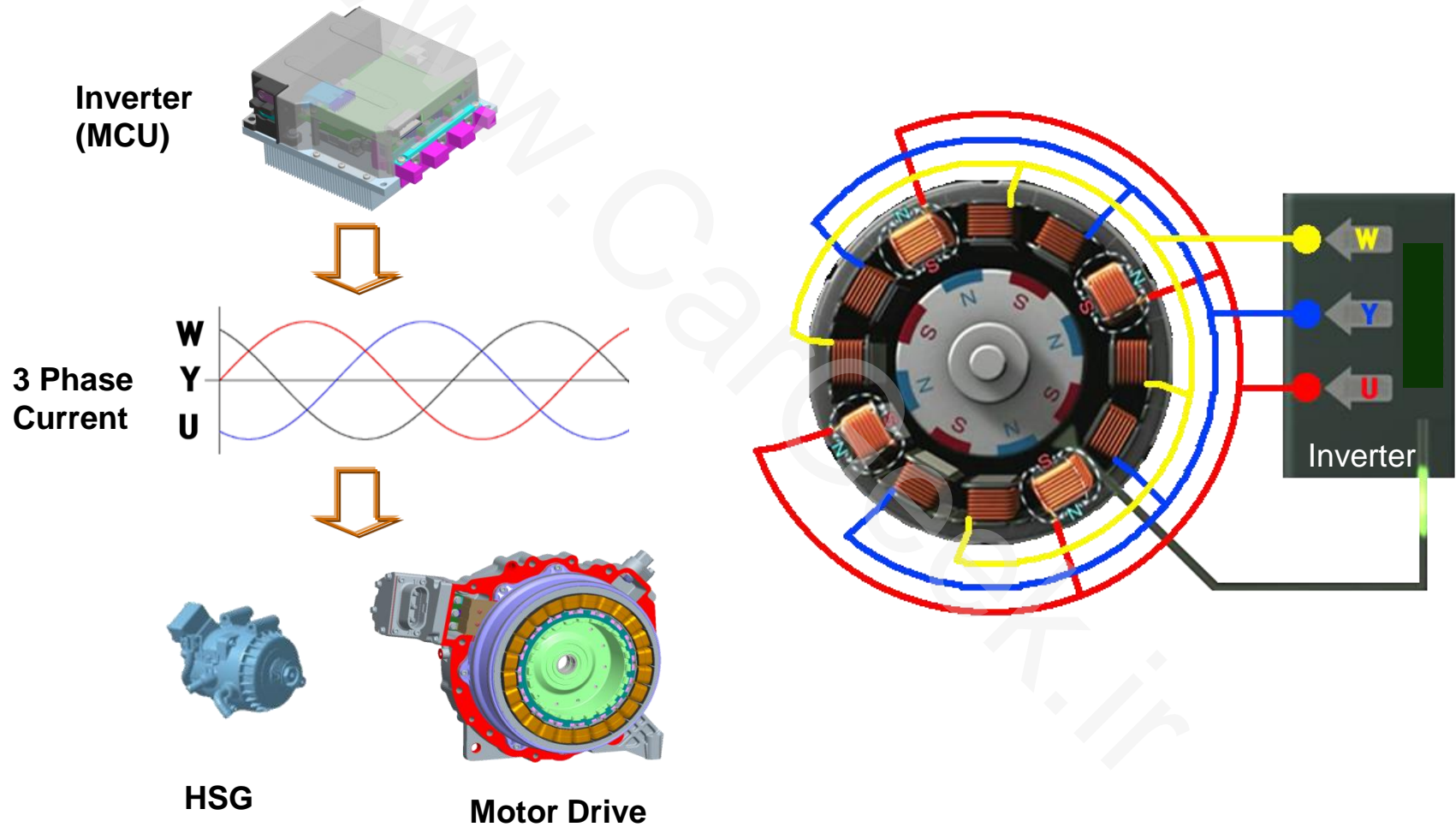
Motor Operating Principle



※PMSM : Permanent Magnet Synchronous Motor

HEV Motor

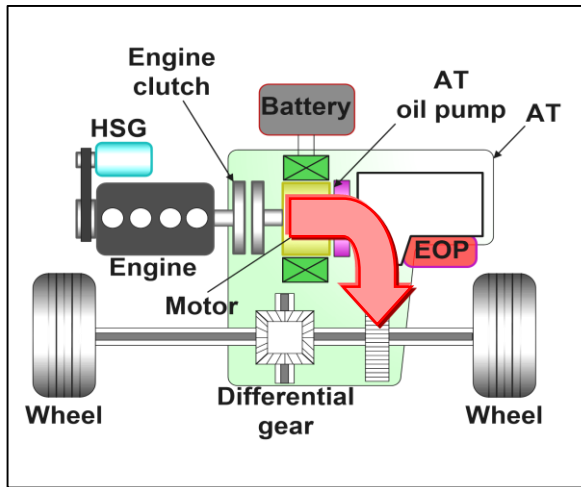
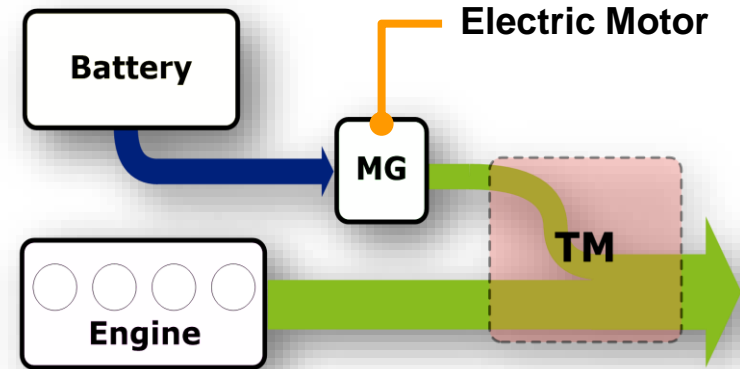
Motor Operating Principle



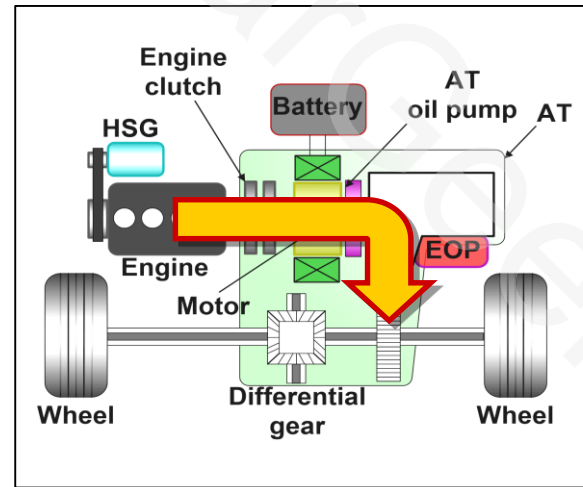
Role of the Drive Motor

Power Source for HEV

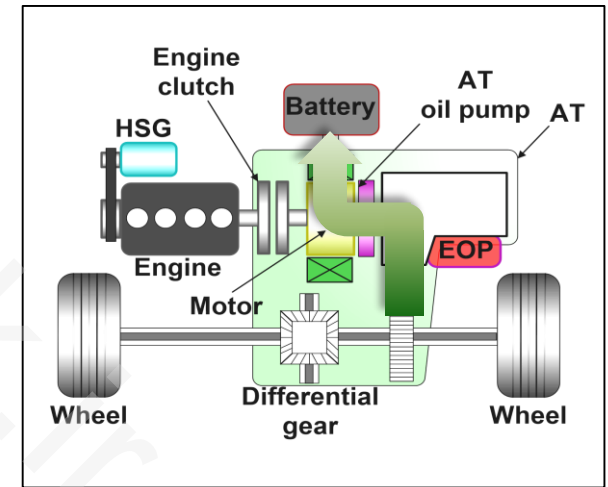
- Starting and low-speed/cruising: motor power only
- Acceleration: supplement engine power
- Deceleration and braking: store electric energy



➤ Elec. Mode: electric motor only



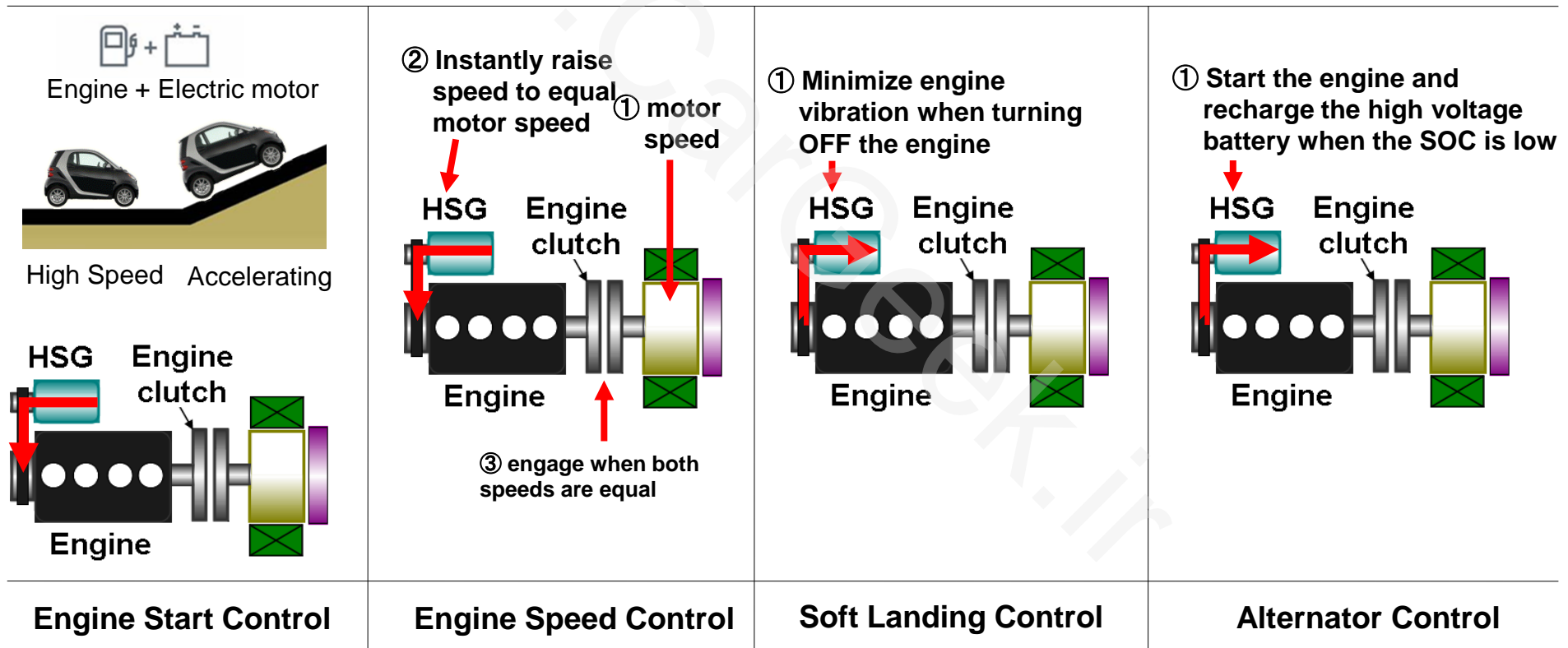
➤ Hybrid Mode: engine + motor



➤ Regenerative Brake mode: stores electric energy

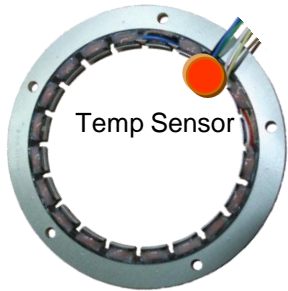
Role of HSG

- **Engine Start Control:** Starts the engine when HEV mode is engaged.
- **Engine Speed Control:** Raises the engine RPM to equal the motor speed when the engine clutch is activated.
- **Soft Landing Control:** Minimizes engine vibration when the engine is turned off.
- **Alternator:** Starts the engine when the SOC is low and charges the high voltage battery.

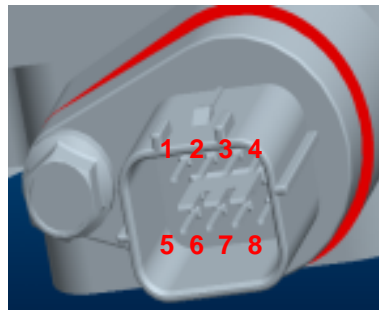
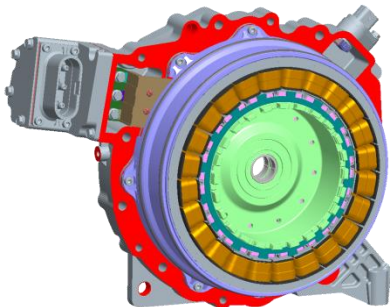


Temperature Sensor's Role

Drive Motor



PIN NO	PIN ASSIGN
1	REZ +
2	REZ S1
3	REZ S2
4	TEMP
5	REZ —
6	REZ S3
7	REZ S4
8	TEMP GND

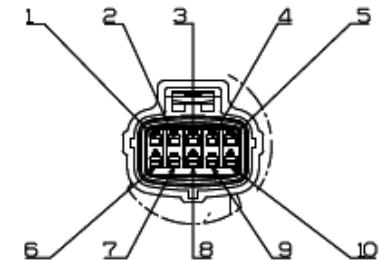
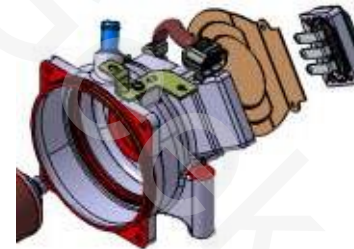


Temp. sensor	Pin 4-8	126.8 kΩ±5%	@20°C
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HSG



PIN NO	PIN ASSIGN
1	REZ +
2	REZ S1
3	REZ S2
4	TEMP
5	SHIELD
6	REZ —
7	REZ S3
8	REZ S4
9	TEMP GND
10	SHIELD

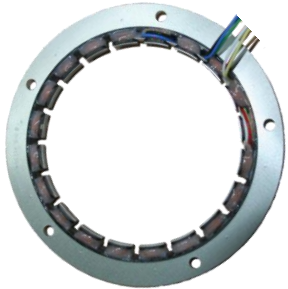


Temp.sensor	Pin 4~9	143~71 kΩ
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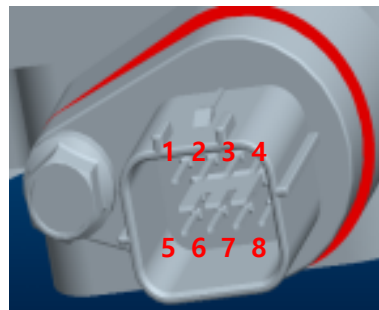
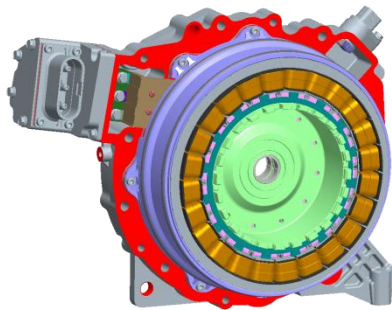
Resolver's (Position Sensor) Role

Drive Motor

Position sensor
(Resolver)



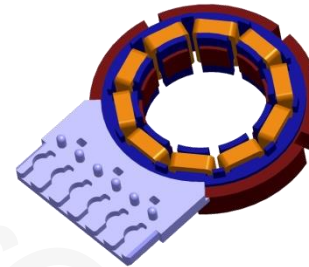
PIN NO	PIN ASSIGN
1	REZ +
2	REZ S1
3	REZ S2
4	TEMP
5	REZ —
6	REZ S3
7	REZ S4
8	TEMP GND



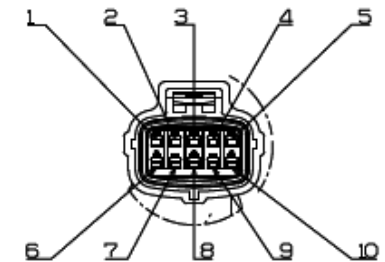
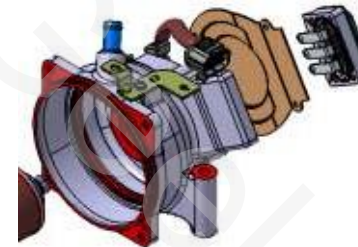
Position Sensor (resolver)	Pin 1-5	11.7 $\Omega \pm 10\%$	@20~30°C
	Pin 2-6	32 $\Omega \pm 10\%$	
	Pin 3-7	27 $\Omega \pm 10\%$	

HSG

Position sensor
(Resolver)

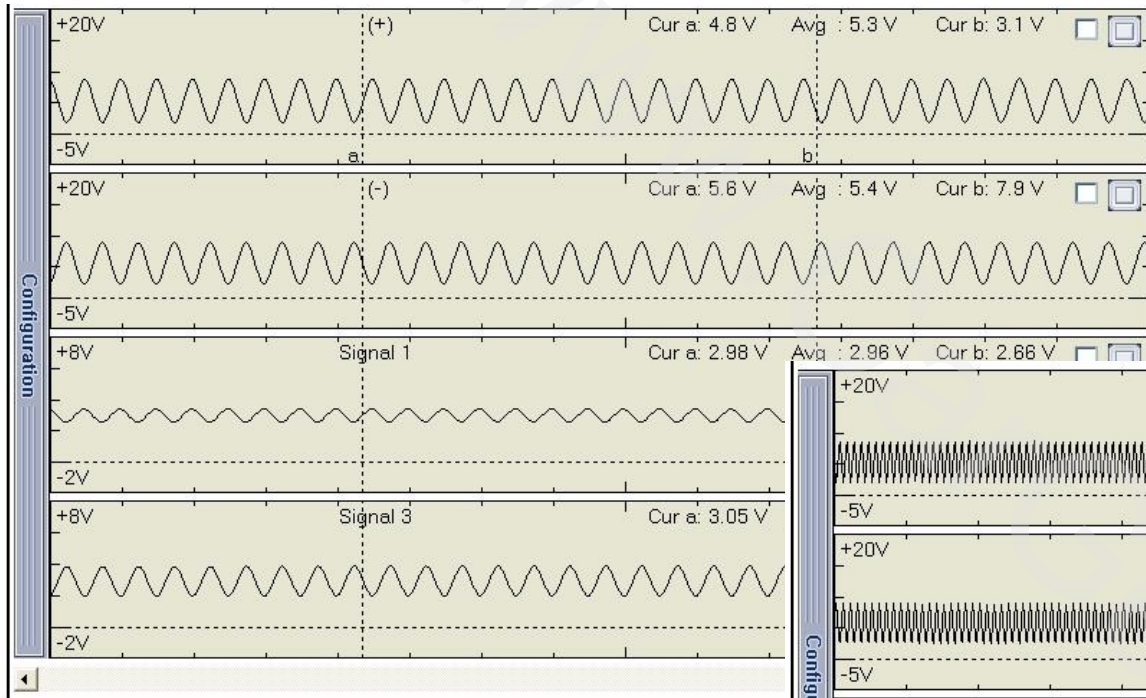


PIN NO	PIN ASSIGN
1	REZ +
2	REZ S1
3	REZ S2
4	TEMP
5	SHIELD
6	REZ —
7	REZ S3
8	REZ S4
9	TEMP GND
10	SHIELD



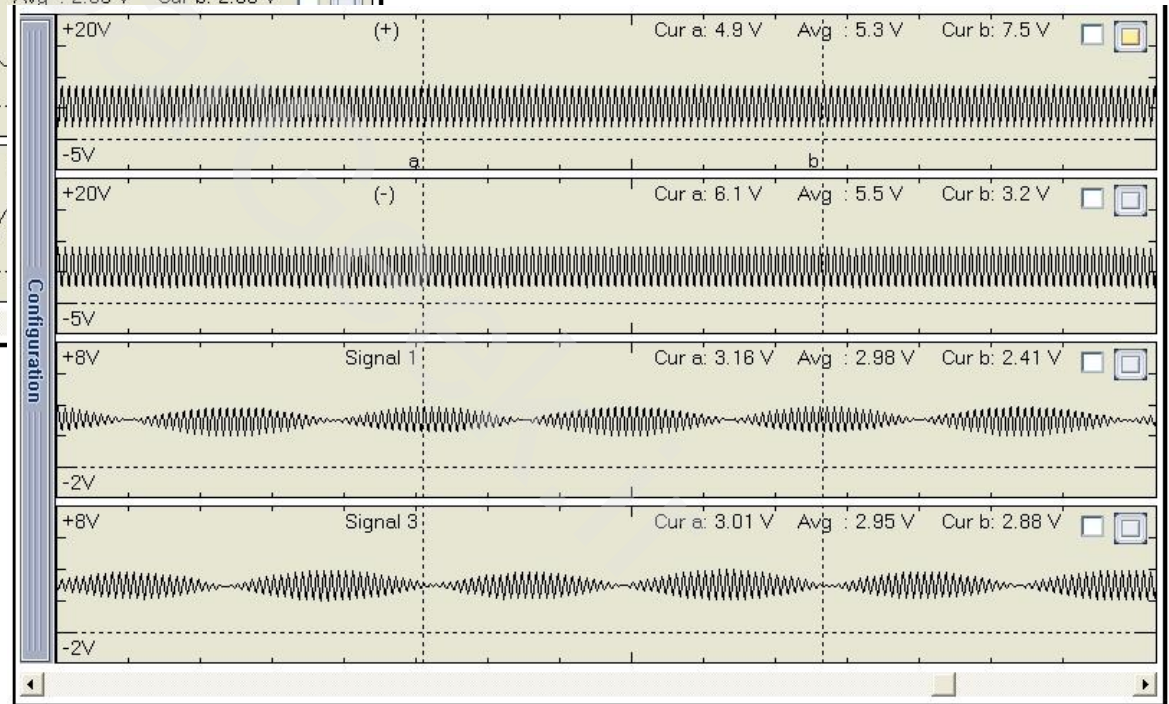
Position Sensor (resolver)	Pin 1~6	14.2~17.4 Ω	@20~30°C
	Pin 2~7	26.1~32 Ω	
	Pin 3~8	26.1~32 Ω	

Resolver's (Position Sensor) Waveform



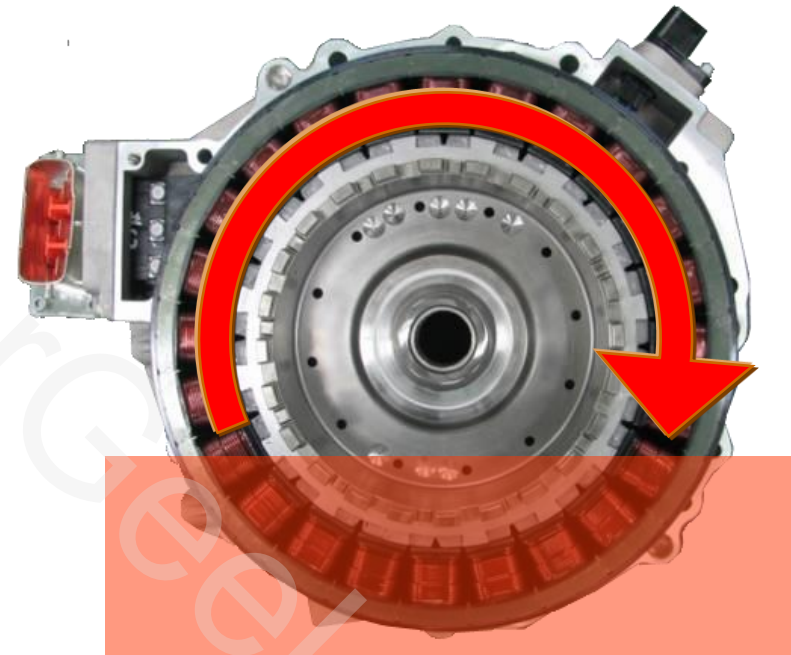
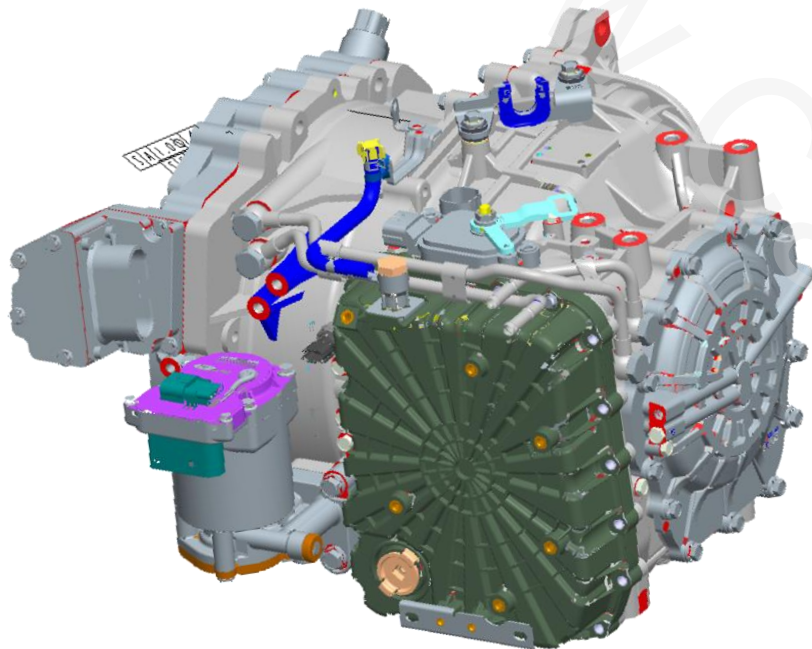
↑ IG ON

↓ HSG ON



Motor Cooling

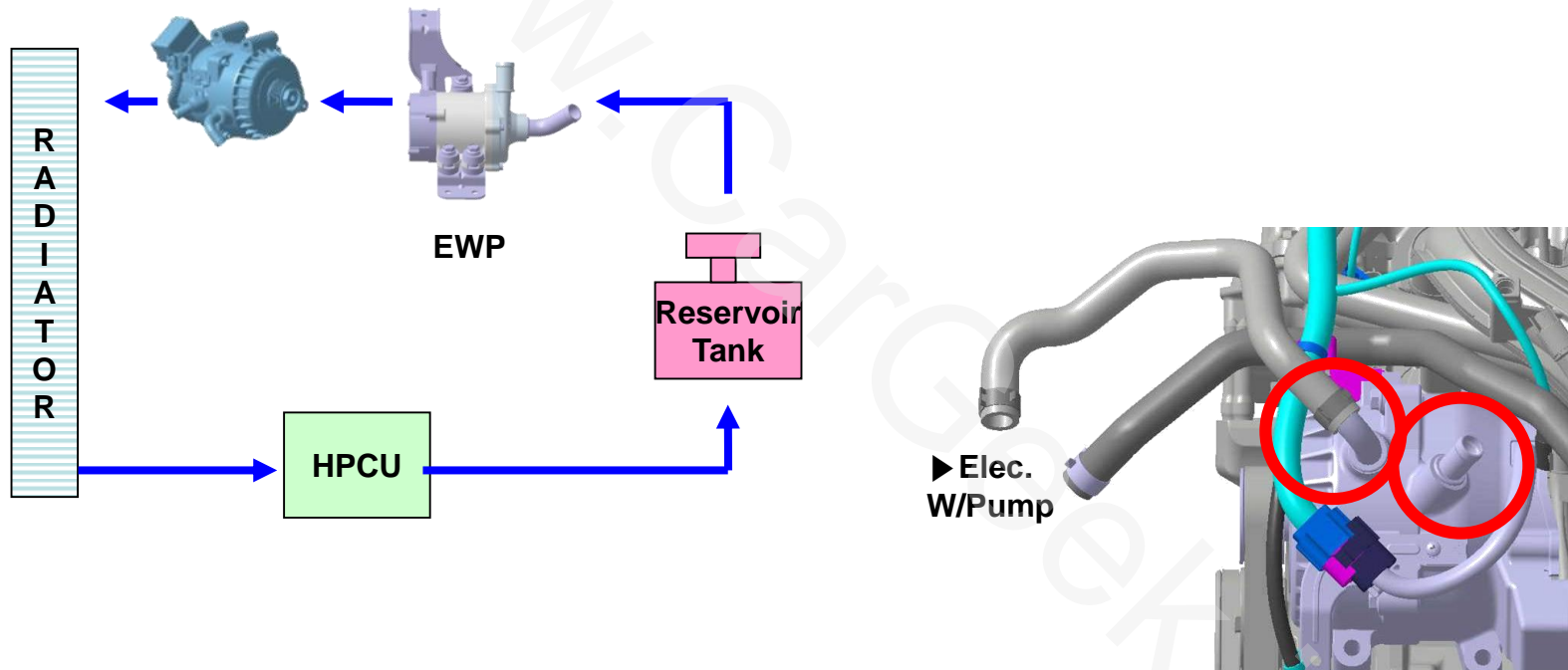
ATF Oil Cooling Type



ATF is filled in the lower section of the motor up to the oil level

HSG Cooling

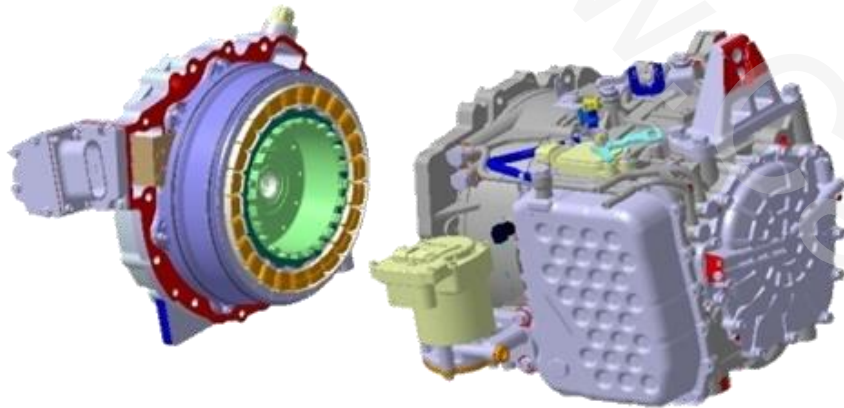
Cooling System Configuration



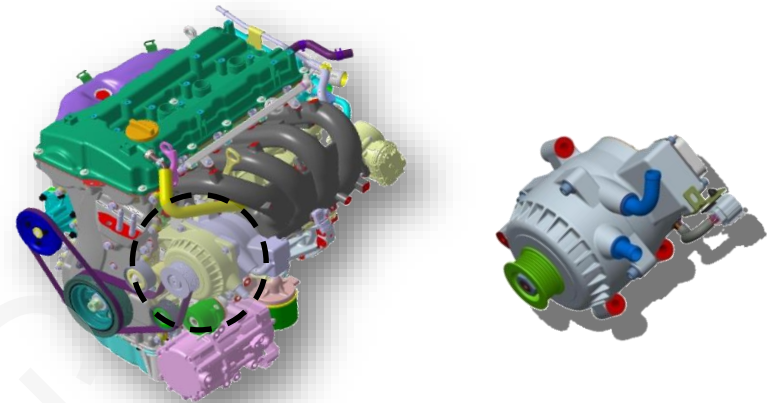
HSG is cooled via water cooling of EWP System

Precautions when replacing motor

Drive Motor



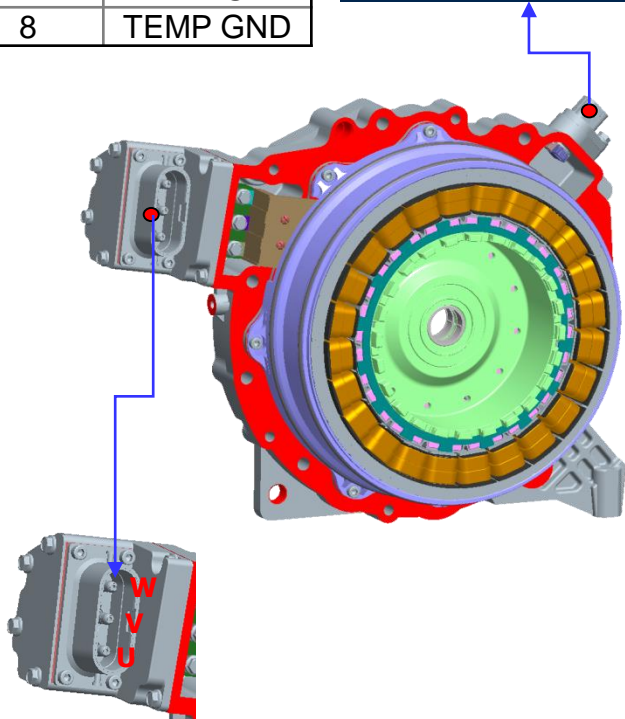
HSG



When the IPM is removed, it may affect your mobile phone, credit cards, or other magnetic devices. Therefore, when conducting motor maintenance, make sure you remove mobile phone and credit cards from your possession before you start the task

Inspecting Drive Motor

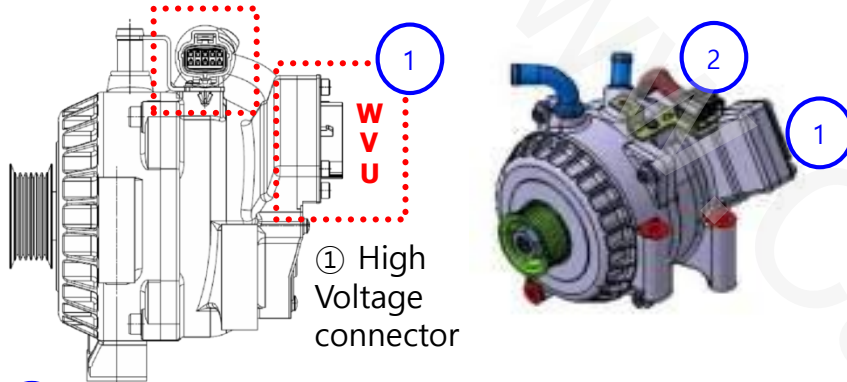
PIN NO	PIN ASSIGN
1	REZ +
2	REZ S1
3	REZ S2
4	TEMP
5	REZ -
6	REZ S3
7	REZ S4
8	TEMP GND



Test item	Test part		spec	note	
Resistance	Power (Line-Line)	U-V	Average $\pm 5\%$ m Ω	@10Arms @20~30°C	
		V-W			
		W-U			
	Temp. sensor	Pin 4-8	126.8 k $\Omega \pm 5\%$	@20°C	
		Position Sensor (resolver)	Pin 1-5	11.7 $\Omega \pm 10\%$	@20~30°C
			Pin 2-6	32 $\Omega \pm 10\%$	
	Pin 3-7	27 $\Omega \pm 10\%$			
Insulation	Cover (ground)	U, V, W	10 M $\Omega \uparrow$	@DC500V, 1min	
			5 mA \downarrow	@AC1500V, 1min	
		Resolver	10 M $\Omega \uparrow$	@DC500V, 1min	
		Temp. sensor	10 M $\Omega \uparrow$		

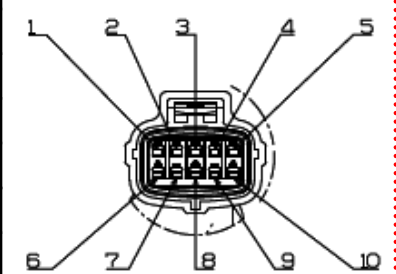
Inspecting HSG

② Sensor connector



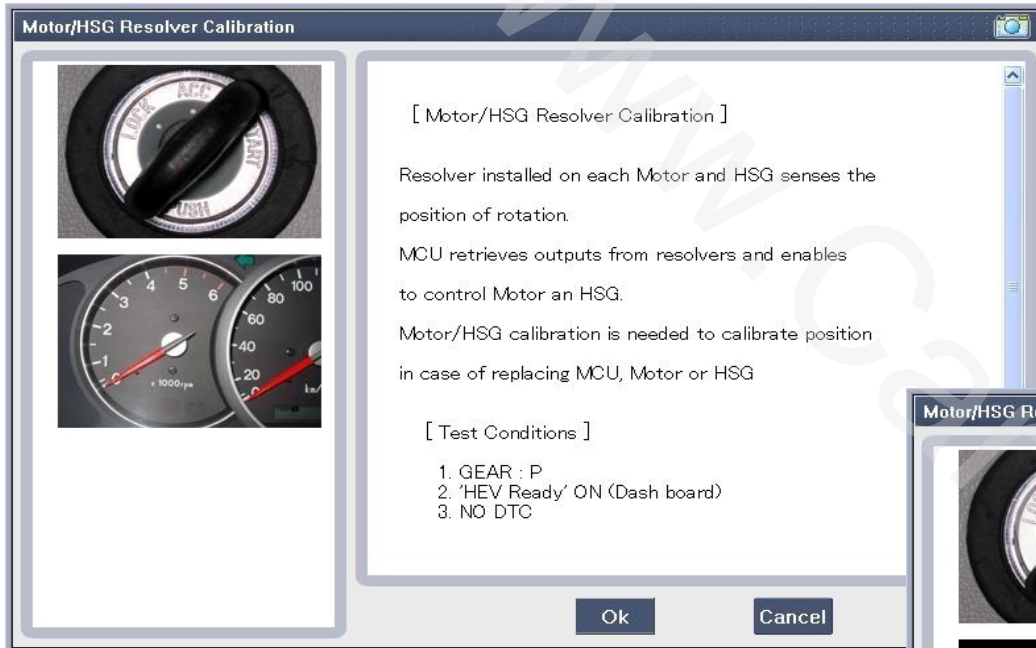
① High Voltage connector

PIN NO	PIN ASSIGN
1	REZ +
2	REZ S1
3	REZ S2
4	TEMP
5	SHIELD
6	REZ -
7	REZ S3
8	REZ S4
9	TEMP GND
10	SHIELD



Test item	Test part		spec	note
Power (Line-Line)	U-V	95~106 mΩ		@10Arms @20~30°C
	V-W			
	W-U			
Resistance	Temp. sensor	Pin 4~9	143~71 kΩ	@20~30°C
		U-V-W	1 MΩ↑	
	Position Sensor (resolver)	Pin 1~6	14.2~17.4 Ω	@20~30°C
Pin 2~7		26.1~32 Ω		
Pin 3~8		26.1~32 Ω		
Insulation	Housing /Cover (ground)	U-V-W	10 MΩ↑	@DC500V,1min
			5 mA↓	@AC1500V,1min
	Resolver	1 MΩ↑	@20~30°C	
Temp.sensor	1 MΩ↑			

Resolver Calibration



➤ **Conduct Calibration after replacing;**

- Drive Motor
- HSG
- MCU

