| HYUNDAI<br>**Technical Service Bulletin** | GROUP<br>**HVAC** | NUMBER<br>**19-HA-001H** |
|---|---|---|
| | DATE<br>**APRIL, 2019** | MODEL(S)<br>**Multiple HEV, PHEV, and EV Models** |

**SUBJECT:** ELECTRIC COMPRESSOR INVERTER DIAGNOSTIC AND REPLACEMENT GUIDELINES

**Description:** This bulletin provides additional service diagnostic information and repair procedures related to electric A/C compressors equipped in hybrid electric vehicles, plug-in hybrid electric vehicles, and electric vehicles.

Refer to the applicable Shop Manual HVAC section of the vehicle, and then follow the procedures outlined in this bulletin whenever a vehicle with the following symptom(s) are being diagnosed:

- A/C does not get cold enough or A/C does not operate at all.
- A/C compressor operates with very high abnormal noise.
- Related Diagnostic Trouble Code (DTC) is present.

**⚠WARNING**

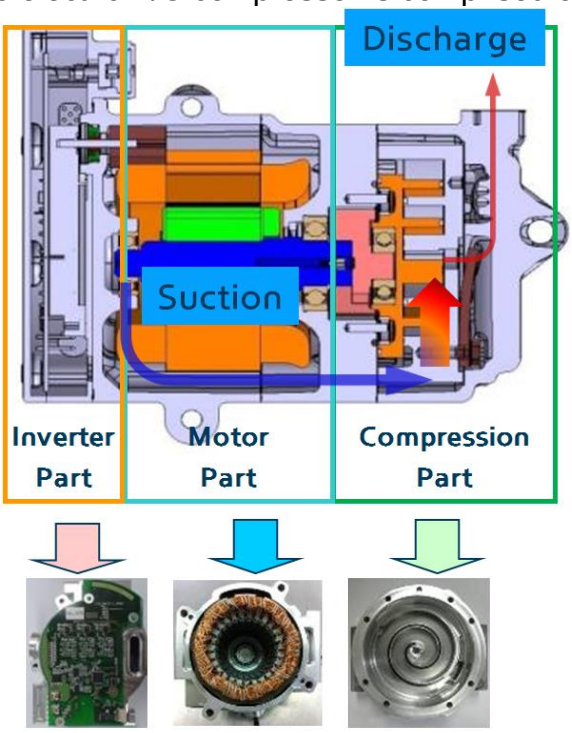
**Be sure to read and follow the sections listed below from the applicable Shop Manual before doing any work related with the high voltage system:**

- **General Safety Information and Caution**
- **High Voltage Shut-Off Procedures**

**Failure to follow the safety instructions may result in serious electrical injuries.**

**Component Overview:**

The electric A/C compressor is comprised of 3 segments with each part tasked to a specific function.




- **Inverter Part** – Converts direct current to 3-phase alternating current to control the compressor speed for supporting the required cooling or heating (if equipped with a heat pump system) demand.
  - Main Parts: PC Board, High voltage capacitor, Power switch
- **Motor Part** – The brushless DC motor converts the electric energy into mechanical motion.
  - Main Parts: Stator, Rotor, Insulator, Magnet
- **Compressor Part** – An orbital scroll rotated by the motor compresses the refrigerant against the fixed scroll.
  - Main Parts: Fixed/Orbital Scroll, Anti-rotating mechanism, Shaft/Bushing

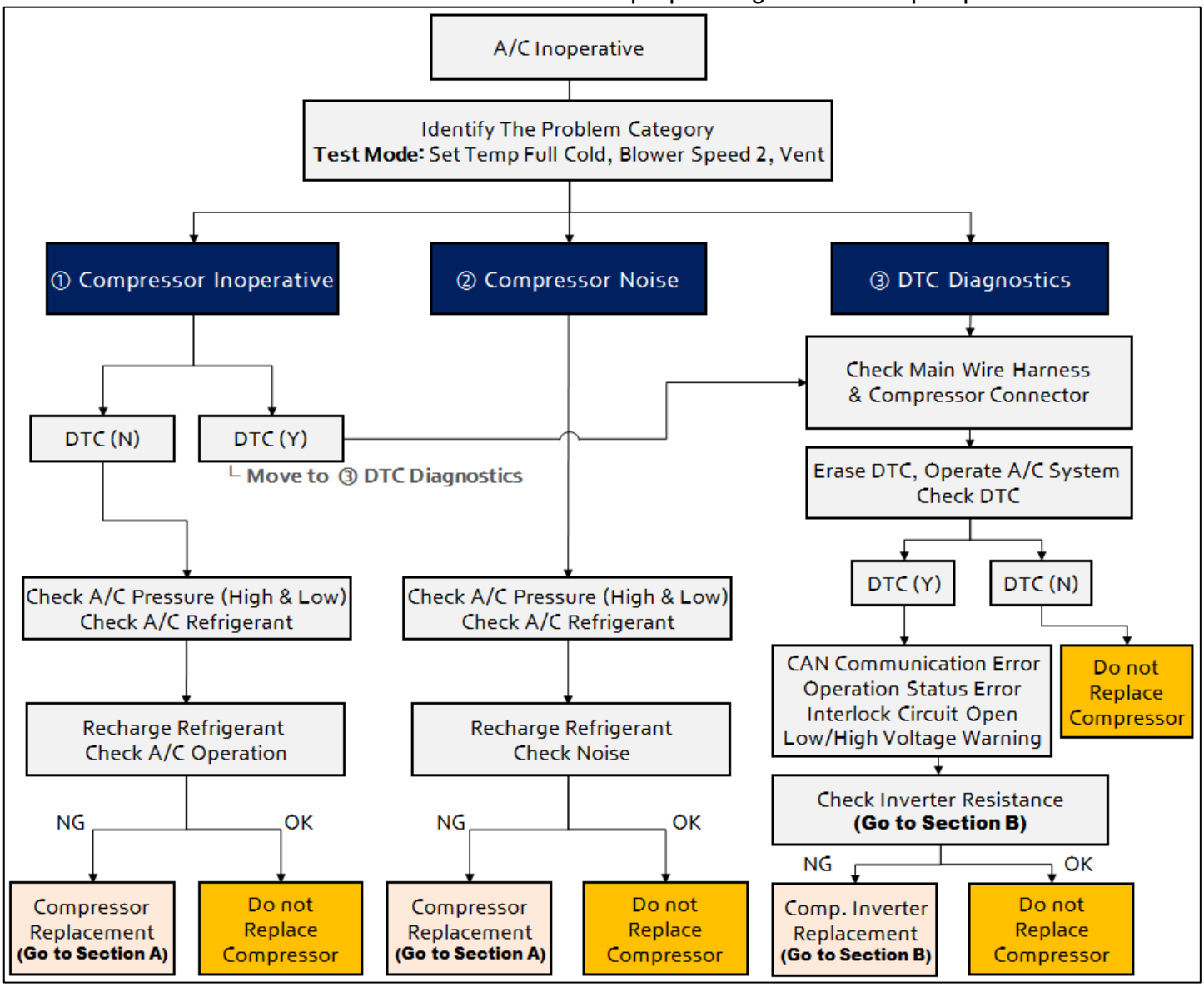
Circulate To: General Manager, Service Manager, Parts Manager, Warranty Manager, Service Advisors, Technicians, Body Shop Manager, Fleet Repair

## NOTICE

**If there's an issue with other parts of the high voltage system (such as the battery pack, BMS, power line, fuse, etc.), then it may affect the proper operation of the compressor.**

**Troubleshooting Flow Diagram:**

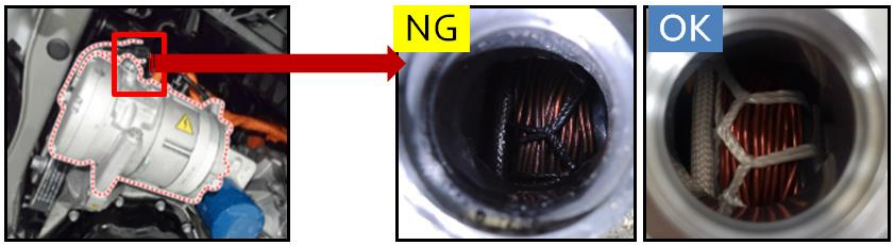
Follow the information shown below to determine the proper diagnosis and repair procedure.




## Service Procedure - Section A:

1. Remove the suction pipe fitting from compressor to gain access to the suction port.
2. Inspect the copper wire and white thread inside the suction port for **burnt colored contamination**.

| Inspection Results – Next Steps | |
|---|---|
| **Contamination:** Replace Compressor | **No Contamination:** Go to Section B if other issues exist. |



## Service Procedure - Section B:

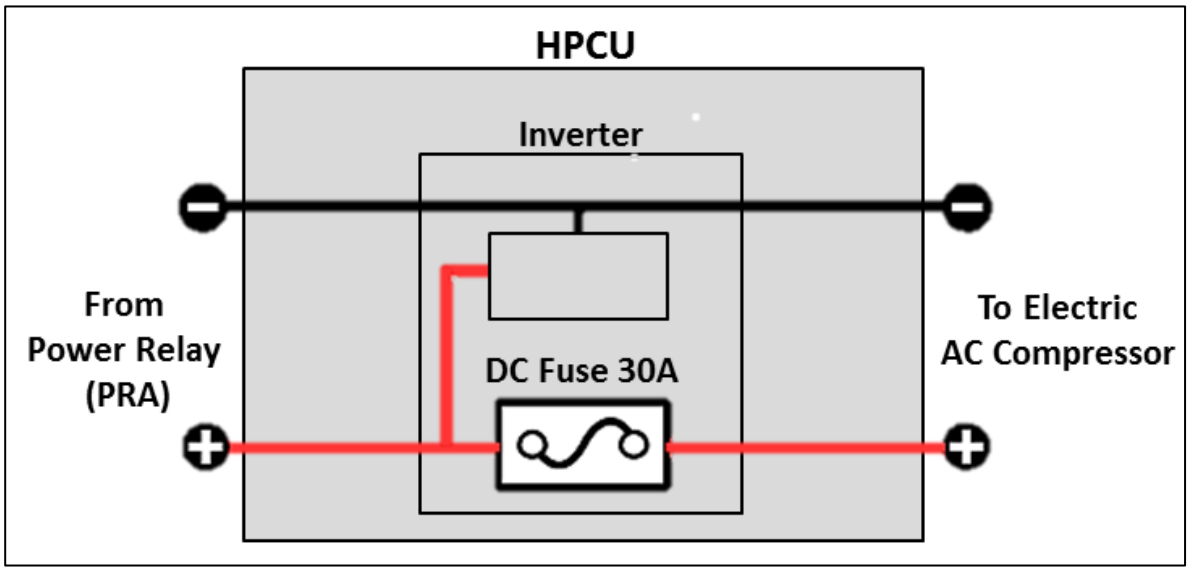
1. If there any BMS related codes unrelated to the A/C system, resolve the BMS related issues first and then retest the A/C system function again to determine if further diagnosis is necessary.

2. Inspect the 30A High Voltage DC Protection Fuse if any of the following symptoms are present and then retest the A/C system.

- Compressor will not operate (A/C is not cold).
- DTC set in DATC system (B1801 or B1695).

**NOTICE**

- **30A High Voltage DC Fuse is located in the HPCU.**
- **Shut off High Voltage before inspecting the DC Fuse.**

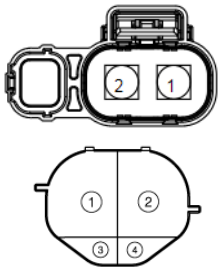



3. Inspect and diagnose the A/C system according to the DTC issues listed below.

| DTC Issue List | | Related DTC Category |
|---|---|---|
| 1 | **CAN Communication Error** | **B1695, B169588** |
| 2 | **Operation Status Error** | **B1696, B169688, B1807** |
| 3 | **Interlock Circuit Open** | **B2470, B247013** |
| 4 | Low Voltage Warning | **B1821, B182188, B1801** |
| 5 | High Voltage Warning | **B1822, B182288, B1802** |

- Refer to the following page for the inverter connector and harness pin resistance inspection procedures.

4. Check the resistance at the electric A/C compressor High and Low Voltage connectors.
   - **Operation Status Error** can be the result of internal inverter damage.
     - Check the High Voltage Connector resistance.
     - Replace the inverter if resistance is out of spec and then retest the A/C system.

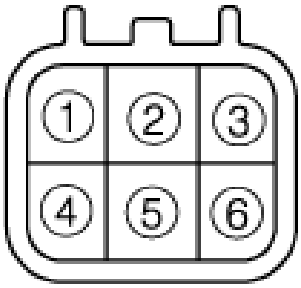
| **High Voltage Connector** - Resistance Value Checking | | |
|---|---|---|
| Inspect High Voltage input and ground resistance between terminals ① and ②.<br>➢ OK → Over 100Ω (Open)<br>➢ NG → Below 100Ω |  | (Connector Varies By Model)<br>① HV High Voltage IG<br>② HV High Voltage GRN<br>③ External Interlock (-)<br>④ External Interlock (+) |

   - **CAN Communication Error** can be the result of poor contact at the Low Voltage Connector.
     - Inspect the connector for (bent pin, poor contact, damage, etc.) and then inspect the Low Voltage Connector resistance.
     - Retest A/C operation after checking or replace the inverter if resistance is out of spec.

***NOTICE***

**Refer to the correct CAN High / CAN Low resistance specifications after confirming the Inverter Type by part number and VIN production date listed in the Parts Information table.**

   - **Interlock Circuit Open** can be the result of poor contact at the Low Voltage Connector.
     - Inspect the connector proper connection (complete insertion) and then inspect the Low Voltage Connector interlock resistance after connecting the High Voltage Connector.
     - Retest A/C operation after checking or replace the inverter if resistance is out of spec.

| **Low Voltage Connector** - Resistance Value Checking | | |
|---|---|---|
| Inspect CAN High/Low resistance between terminals ② and ⑤.<br>➢ OK → Approx. 120 Ω<br>➢ NG → Short (≒0 Ω) | | |
| ❖ Refer to Parts Information to verify Inverter Type.<br><br>Inspect CAN Low ground resistance between terminals ① (DVOM + probe) and ② (DVOM - probe).<br>Inspect CAN High ground resistance between terminals ① (DVOM + probe) and ⑤ (DVOM - probe).<br>➢ OK →13~14 KΩ **(Conventional Type)**<br>➢ OK →200~600 KΩ **(High Performance DSP Type)**<br>➢ NG → Short (≒0 Ω) **(Both Inverter Types)** |  | ① GND 12V<br>② CAN Low<br>③ Interlock (-)<br>④ IG 12V<br>⑤ CAN High<br>⑥ Interlock (+) |
| Inspect resistance at terminals ③ and ⑥ for interlock (-/+).<br>➢ OK → Below 1.0Ω<br>➢ NG → ∞MΩ<br>**NOTE:** *Connect the high voltage connector in order to measure the interlock resistance.* | | |

5. Once it is determined that the Inverter of the Electric A/C Compressor needs replacement, refer to the applicable Shop Manual for the specific Removal and Installation procedure.
   - Shop Manual > Heating, Ventilation and Air Conditioning > Air Conditioning System > Electric A/C Compressor > Repair procedures > Inverter

   **NOTE:** If the inverter removal and installation service information is not available for a specific model, refer to the service information for a similar model until the information becomes available.

## Parts Information:

- Part numbers may be subject to change. Newly created part numbers may be available.
- Refer to the latest Parts Catalog and filter by VIN for the applicable part numbers.

| Model Year / Model | Compressor | Inverter Kit | Inverter Type |
|---|---|---|---|
| 19MY- (FE) NEXO FC | 97701-M5000 | 977S5-M5000 | High Performance DSP |
| 15-17MY (LMFC) Tucson FC | 97701-4W000 | 97728-4W000 | Conventional |
| 19MY- (OS) KONA EV | 97701-K4000 | 97728-K4000 | High Performance DSP |
| 18MY- (AE) IONIQ PHEV | 97701-G2800 | 97728-G2800 | Conventional |
| 17MY- (AE) IONIQ HEV | 97701-G2000 | 97728-G2000 | Conventional |
| 17MY- (AE) IONIQ EV | 97701-G7000 | 97728-G7000 | Conventional |
| 16-19MY (LFE) Sonata PHEV | 97701-E6100<br>97701-E6110 | 97728-E6100 | Conventional |
| 16-19MY (LFE) Sonata HEV | 97701-E6000 | 97728-E6000 | Conventional (SOP-4/18/2018) |
| | | | High Performance DSP (4/19/2018-) |
| | 97701-E6010 | | High Performance DSP (3/15/2019-) |
| 11-15MY (YFE) Sonata HEV | 97701-4U000 | 97728-E7000 | Conventional |

**NOTES:**

- Replacement electric compressors include the inverter and are pre-filled with compressor oil.
  - Replace only if the motor or compressor portion is damaged/contaminated.
- Replacement inverters include the service kit containing the bolt(s), gasket, and thermal paste.
  - CAN High / CAN Low resistance specifications can differ depending on Inverter Type which can be determined by part number and VIN production date.
  - Replace the inverter whenever the pin testing results show an out of spec condition.

## Warranty Information:

| Model | OP Code | Operation | Op Time | Causal Part | Nature | Cause |
|---|---|---|---|---|---|---|
| Refer to Parts Information table for appropriate model | 97729R00 | Compressor Inverter | Refer to WEB LTS for the current LTS time | Refer to Parts Information table above for applicable P/N | I11 | ZZ3 |

**NOTE:** Normal warranty procedures apply.