**93-24-03 - Service Information, HV Component Measurement Process**

**Release date:** 5/1/2024

## Condition

| Applicable Vehicles | | | | | |
|---|---|---|---|---|---|
| **Model(s)** | **Year** | **Eng. Code** | **Trans. Code** | **VIN Range From** | **VIN Range To** |
| ID.4 | 2021 – 2024 | All | All | All | All |

| Revision Table | | | |
|---|---|---|---|
| **Instance Number** | **Published Date** | **Version Number** | **Reason For Update** |
| 2073520/1 | 05/01/24 | 93-24-03 | Original publication. |

Process and reference information for Volkswagen technicians who have already completed high voltage expert (HVE) training and applicable prerequisite training courses:

- Reporting process for review of measurement results to receive repair direction.
- Performing GFF based high-voltage (HV) component measurements.

**CAUTION**

**Until further notice, the GFF test plan described herein is to be used only for the collection of the measurements to be uploaded to GFF Paperless for evaluation, with repair direction given through a TAC case. Replacement of parts solely on the basis of repair direction given in the GFF test plan will be considered invalid and not eligible for warranty reimbursement.**

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## Technical Background

Any one of the following diagnostic trouble codes (DTCs) present in the Battery Regulation Control Module ***-J840-*** (diagnostic address 008C) can indicate the Fuse for High-Voltage Battery Interruption ***-S415-*** (pyrofuse) has been triggered.

When the pyrofuse in the HV battery has been triggered **without** any apparent crash-related cause, electrical measurements of all HV components in the vehicle are required, to identify any potential component or wiring faults which must be repaired **before** replacement of the J840, SX7, and SX8.

These measurements are only to be performed in conjunction with an open TAC case.

The first scan after a vehicle is received with this condition will contain the most information.

- P1CAC00: Hybrid/High-Voltage System blasting fuse triggered – Symptom 42572
- P1CA700: Igniter for hybrid/high-voltage system fuse – Symptom 42503
- P1CA800: Igniter for hybrid/high-voltage system fuse electrical error – Symptom 42571

Additionally in model year 2021-2022 vehicles (model code E21*):

- U10BA00: Local data bus no communication – Symptom 42129

Note, this procedure may also be directed in certain cases for further diagnosis of an isolation fault without a blown pyrofuse, in conjunction with an open TAC case.

## Production Solution

Not applicable.

## Service

**DANGER**

**There is a risk of fatal injury due to high voltage. Electrocution by direct contact or electric arc can cause severe bodily injury or fatal injury.**

**CAUTION**

**Until further notice, the GFF test plan described herein is to be used only for the collection of the measurements to be uploaded to GFF Paperless for evaluation, with repair direction given through a TAC case. Replacement of parts solely on the basis of repair direction given in the GFF test plan will be considered invalid and not eligible for warranty reimbursement.**

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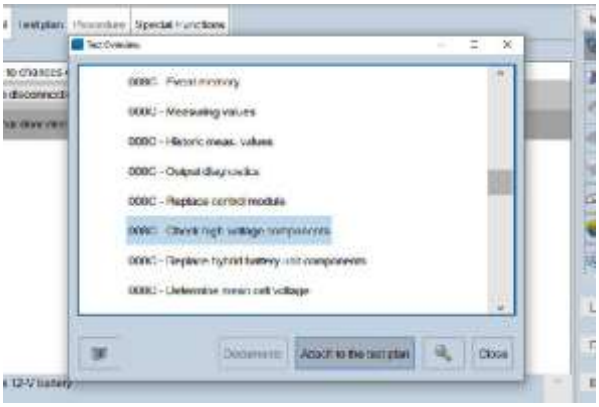
**Overview of steps:**

1. Validate that the blown pyrofuse is not directly related to a crash event.
2. Read out all DTC memory and all measured value blocks (MVBs) from address 008C.
3. Send the diagnostic log to GFF Paperless.
4. Open a technical support ticket with Volkswagen Group TAC.
5. Case dispatched from TAC to Quality Technical Manager (QTM) with notification to Product Support.
6. Receive direction from QTM to either proceed with this bulletin or wait for on-site QTM visit.
7. De-energize the HV system using ODIS and GFF-based “manual” de-energization if required.
8. Perform the GFF test plan “008C – Check High Voltage Components.”
9. Review the reference information below for hints and tips when performing the measurements.
10. Repeat measurements for validation of single components that are suspicious or questionable.
11. After measurements are fully completed, send the log to GFF Paperless.
12. Notify the QTM that measurements are ready for review and document the status in the TAC case.
13. Completed measurements will be reviewed between the QTM and Product Support.
14. Direction for repair or steps for further measurements will be provided as necessary.

**Measurement procedure hints and tips:**

The “step by step” instructions are provided within the GFF test plan. Similar measurements are performed for each of the HV components. The reference information and examples below are not intended as a substitute for the steps and content within the GFF test plan, but rather to help the technician to better understand the procedures that will be performed when working through the GFF-based HV component measurements, in order to avoid errors or inconclusive results.

| **Reference Information – Locating the GFF test plan** | |
|---|---|
|  <br>Fig. 1 | • Locate the GFF test plan “008C – Check high-voltage components” (Fig. 1). |

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**Reference Information – De-energization and preparation**

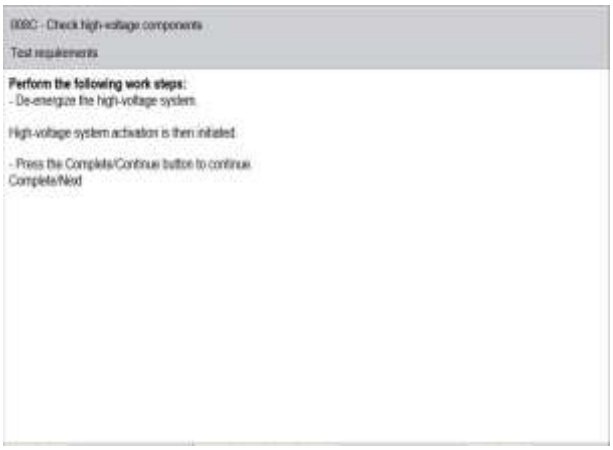


Fig. 2

- De-energize the vehicle using the ODIS tester to prepare for HV component measurements (Fig. 2).
- In cases with a blown fuse, welded contacts are also possible, and therefore “manual” de-energization using the VAS 6558A and associated HV measurement adapters is required.

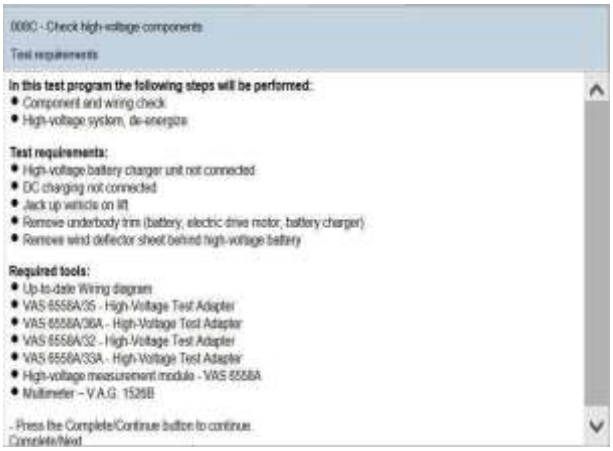


Fig. 3

- After de-energization, observe the required conditions and obtain the tools as shown (Fig. 3).
- The VAS 6558A is used for all electrical measurements except capacitance.
- The VAG 1526B multimeter is not distributed within North America. Instead, the Fluke 83-V or equivalent with a suitable capacitance measurement range and resolution may be used (i.e., maximum capacitance 9,999 µF, accuracy ±(1% + 2), maximum resolution 0.01 nF).

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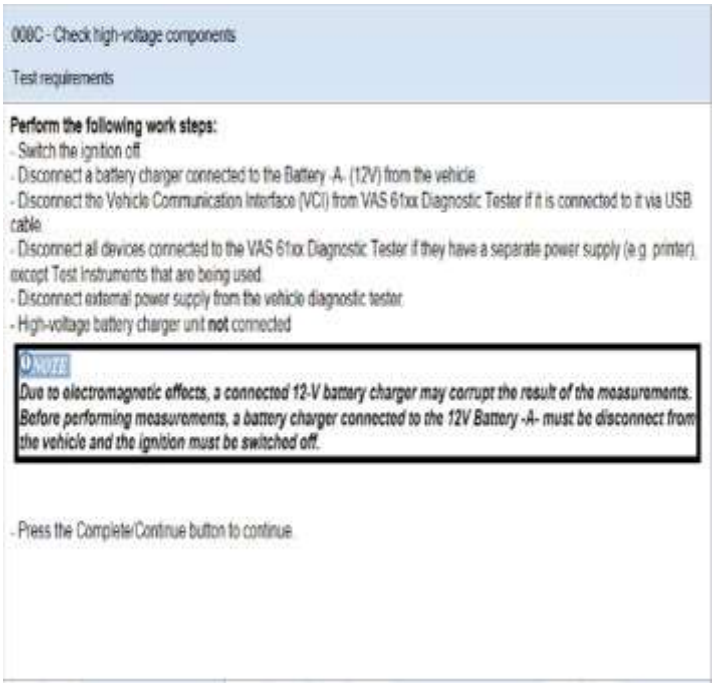


Fig. 4

- Read and follow all preparatory steps leading up to the HV component measurements (Fig. 4).
- Erroneous measurements can be caused by a failure to remove electrical devices from the vehicle as described.
- It is not necessary to have a connection between the vehicle and the ODIS tester after starting this test plan if the steps are performed correctly and without cancelling or stopping the test plan.

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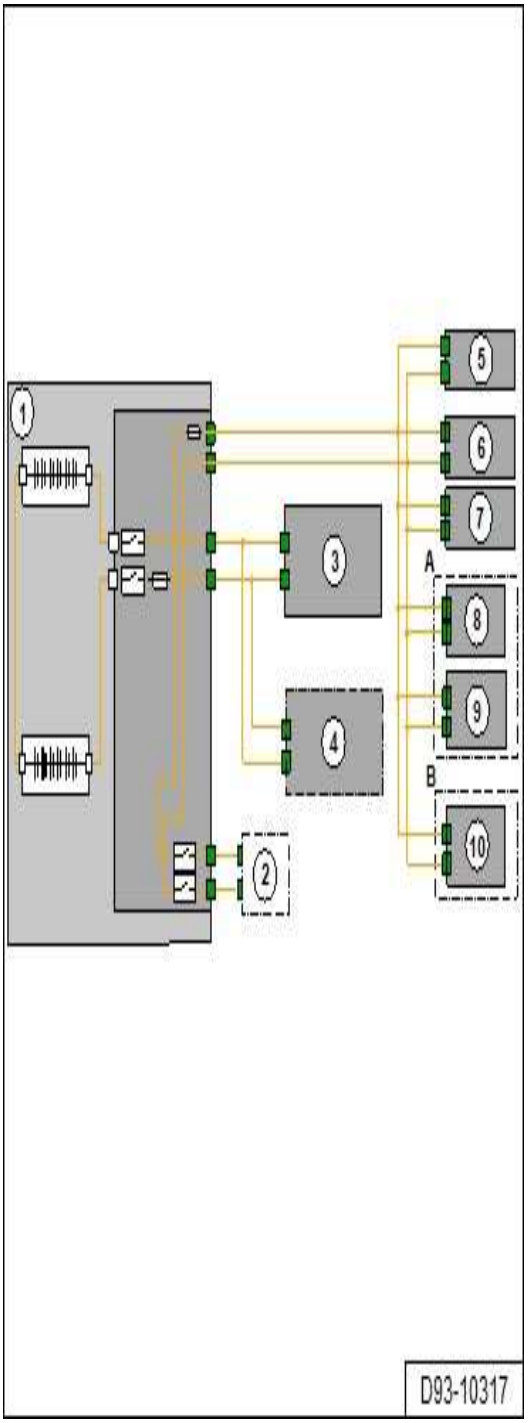


Fig. 5

- Overview diagram of HV system as given in GFF test plan (Fig. 5):
- Position 1: AX2 - High-Voltage Battery 1
- Position 2: UX4 - High-Voltage Battery Charging Socket 1
- Position 3: JX1 - Electric Drive Power and Control Electronics
- Position 4: - optional - JX4 - Electric Drive Power and Control Electronics 2
- Position 5: Z132 - Heating Element (PTC) 3 – Water Heater (Battery Coolant Heating)
- Position 6: VX81 - A/C Compressor
- Position 7: ZX17 - High-Voltage Heater (PTC) / Z115 - High-Voltage Heater (PTC) – Air Heater (Passenger Compartment Heating)
- Variant A:
- Position 8: A19 - Voltage Converter
- Position 9: AX4 - High-Voltage Battery Charger 1
- Variant B:
- Position 10: AX4 - High-Voltage Battery Charger 1 (OCDC)

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**Reference Information – Removal of connectors (high voltage and low voltage)**


Fig. 6

- During the HV component measurements, nearly all of the HV connectors will be unplugged.
- Observe this general precaution and visually inspect each of the connections (Fig. 6).


Fig. 7

- Disconnect all of the HV connectors from the HV battery, but do not remove the potential equalization cable from the battery (Fig. 7).

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| | |
|---|---|
|  <br>Fig. 8 | • In vehicles having the HV connector “version 2” shown (Fig. 8) take care to only lift the lock tab slightly to allow it to be pulled over the ramp piece.<br>• The tab may be lifted up by gently prying it through the square hole, or by gently pushing it using a very small flat blade screwdriver through the center of the connector while observing the lift on the tab using an inspection mirror and/or feeling for movement.<br>• The red connector lock will break if it is lifted too far or forced.<br>• See also repair manual > “High voltage connectors, disconnecting” |
|  <br>Fig. 9 | • Example of the “onboard supply connector” disconnected from the -AX2- High-Voltage Battery 1 (Fig. 9).<br>• To avoid erroneous measurements, this connector must be unplugged before performing the HV component measurements. |

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| | |
|---|---|
|  <br>Fig. 10 | • Example of the vehicle electric system connector disconnected from the -AX4- High-Voltage Battery Charger 1 (Fig. 10).<br>• To avoid erroneous measurements, this connector must be unplugged before performing the HV component measurements. |
|  <br>Fig. 11 | • Example of the vehicle electric system connector disconnected from the Three-Phase Current Drive - VX54- at the -JX1- Electric Drive Power and Control Electronics (Fig. 11).<br>• To avoid erroneous measurements, this connector must be unplugged before performing the HV component measurements. |
|  <br>Fig. 12 | • Example of the vehicle electric system connector disconnected from the Three-Phase Current Drive 2 - VX97 at the -JX4- Electric Drive Power and Control Electronics 2, if equipped (Fig. 12).<br>• To avoid erroneous measurements, this connector must be unplugged before performing the HV component measurements. |

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**Reference Information – HV adapters and text descriptions**


Fig. 13

- Unless the adapters were just used for “manual” de-energization and already checked, it is important to complete the check of the HV adapters before performing the HV component measurements (Fig. 13).
- This procedure is essential to ensure that the HV adapters are in good condition prior to using them.

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Fig. 14

- Perform the VAS 6558A resistance measurement calibration routine whenever prompted to do so during the GFF test plan (Fig. 14).
- The pointed tips from the VAS 6558A kit are not used with the HV measurement adapters, but are needed for performing the calibration. Install the pointed tips when prompted to “merge” the red and black probes.
- Take care to press the button on the red probe only as instructed.


Fig. 15

- For the first run-through, the “overall system” check should be performed (Fig. 15).
- The “individual HV component” check is used to repeat the measurements for validation purposes on a single component that is suspicious or questionable after running through the complete measurements of all components.
- At individual components on the auxiliary circuit, the measurements may be repeated directly at the component using the appropriate HV measurement adapter VAS 6558A/36A or VAS 6558A/37 as needed, depending on the connector type.


Fig. 16

- Take care to observe small changes in the text.
- In the example shown, the first test will be a series of measurements at the DC charging connection **of** the HV battery (e.g., with VAS 6558A/35 adapter plugged into the HV battery DC connection (Fig. 16).

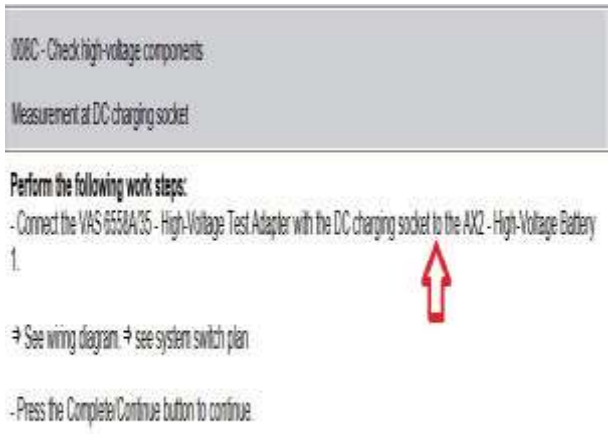


Fig. 17

- Later the measurement is done at the DC charging connection **to** the HV battery (e.g., with VAS 6558A/35 disconnected from the HV battery and connected only to the HV connector leading up to the charging socket (Fig. 17).

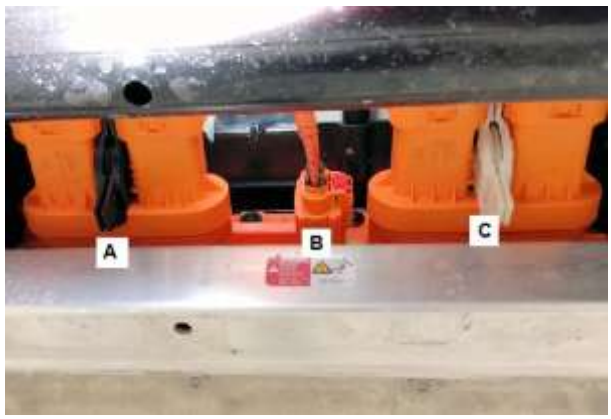


Fig. 18

- Designation of battery HV connections used in the GFF test plan:
  a. TNS connection **of** the AX2 - High-Voltage Battery 1
  b. AUX connection **of** the AX2 - High-Voltage Battery 1.
  c. DC charging socket **of** the AX2 - High-Voltage Battery 1.

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**Reference information – Connection of HV measurement adapters to vehicle**

Fig. 19

Fig. 20

- Example of HV adapter connections at HV battery (Fig. 19):
  a. VAS 6558A/35 connected to TNS (traction connector) of the HV battery.
  b. VAS 6558A/36A connected to AUX (auxiliary connector) of the HV battery.
- Example of black lead of VAS 6558A clipped to chassis ground point at HV battery (Fig. 20).
- Note that measurements of all auxiliary components are generally taken through the auxiliary harness. After a measurement is taken with all of the components on the auxiliary harness still connected, all of the components are disconnected, and then reconnected one at a time.

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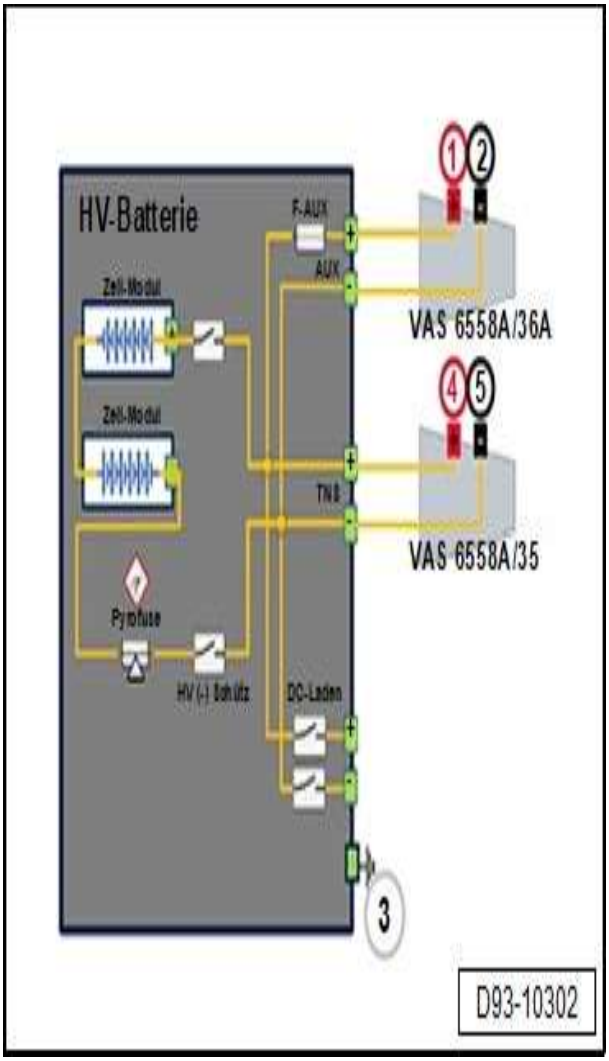


Fig. 21

- Example diagrams of HV adapter connections and designations of connectors at HV battery as provided through functional description attachments within the GFF test plan.
- At auxiliary AUX and traction network TNS connectors (Fig. 21)
- At DC charging connector (Fig. 22)

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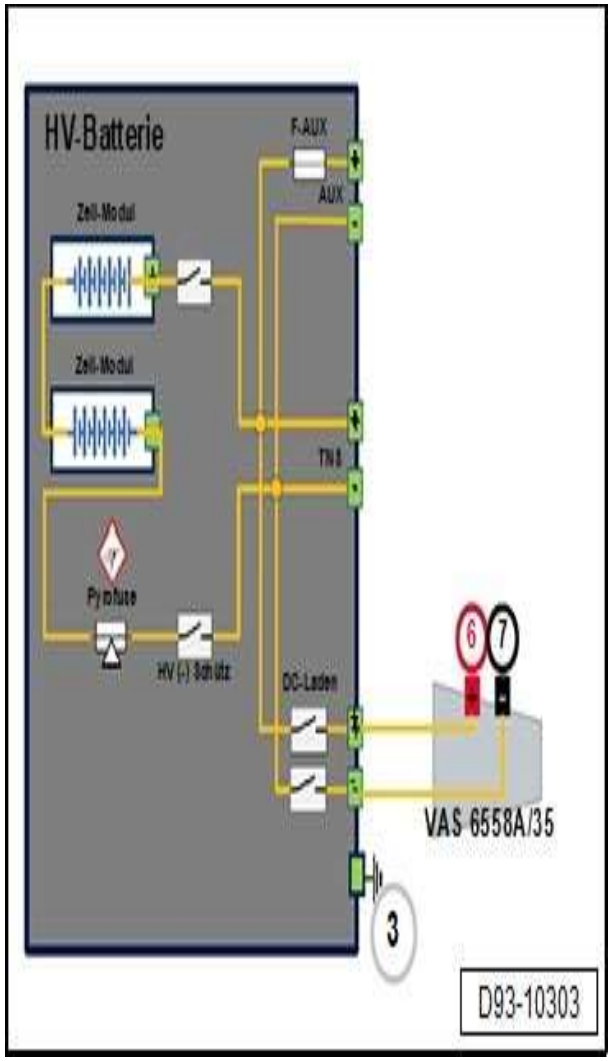


Fig. 22

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Fig. 23

- Example of VAS 6558A/35 adapter connected with the DC charging socket **to** the -AX2- High-Voltage Battery 1 (Fig. 23) and associated diagram (Fig. 24).
- Note that the HV adapters are **never** connected inline between two components in this measurement procedure!

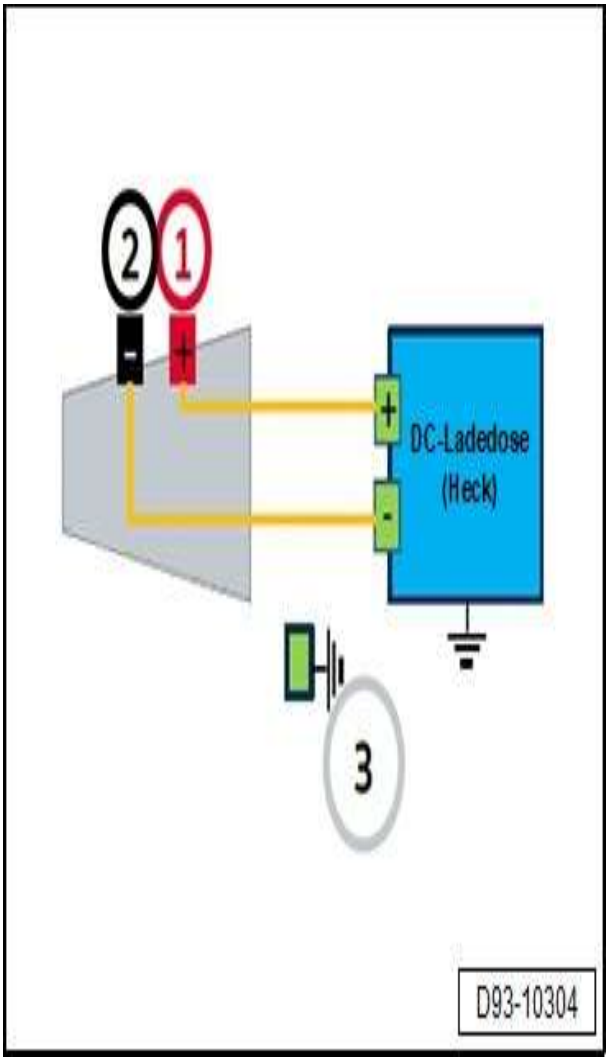


Fig. 24

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Fig. 25

- Example of VAS 6558A/35 adapter connected with the -JX1- Electric Drive Power and Control Electronics (Fig. 25).
- Note that the measurements of the rear electric drive -JX1- are taken through the HV harness, because it is not possible to disconnect the HV connector from the -JX1- however, in vehicles equipped with all wheel drive, it is necessary to then remove the HV connector from the JX4 - Electric Drive Power and Control Electronics 2 before taking measurements of the -JX1- (Fig. 26).
- Under no circumstances should the HV measurements be taken with front (-JX4-) and rear (-JX1-) connected to the HV harness at the same time. Such measurements would be inconclusive and must be repeated.
- Measurements at the -JX4- are similar to the -JX1-, with the exception that the VAS 6558A/35 adapter is connected directly into the HV connector of the -JX4- rather than through the HV harness.

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Fig. 26

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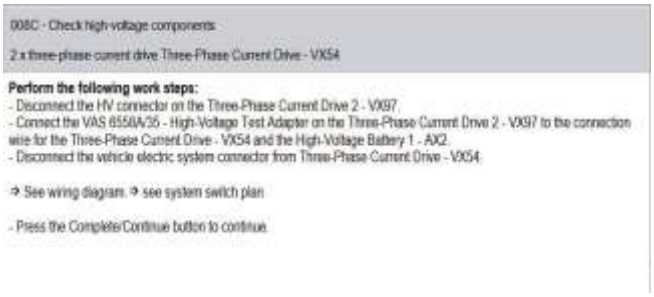


Fig. 27

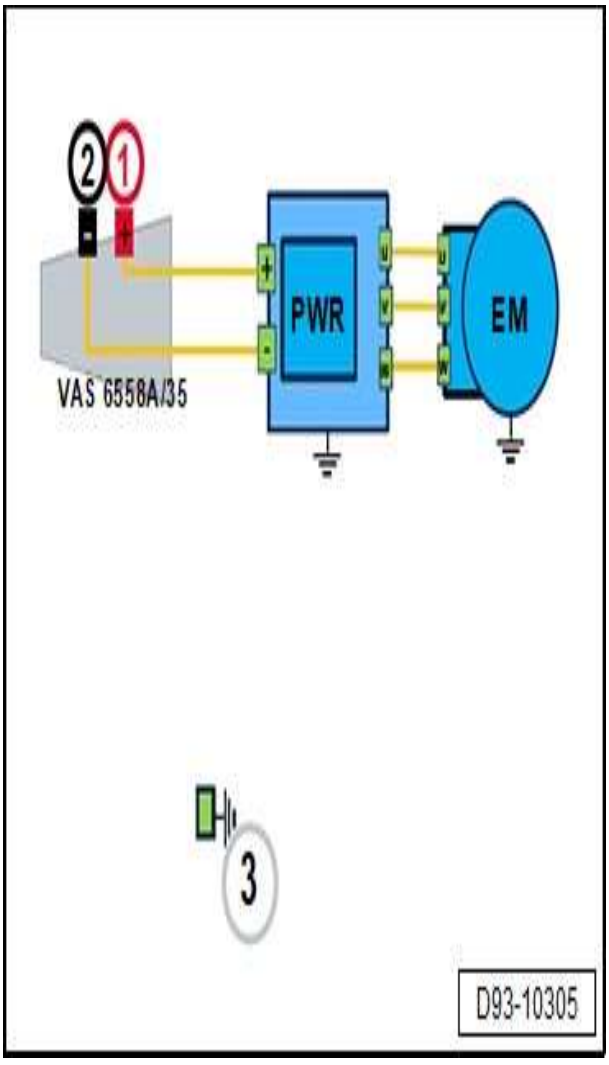


Fig. 28

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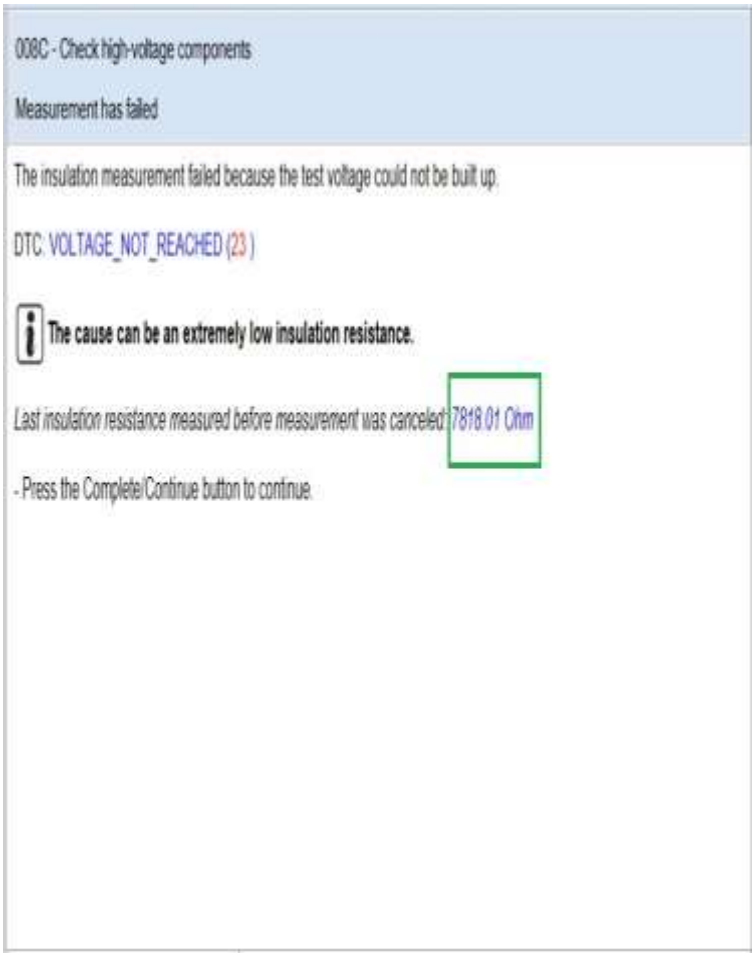


Fig. 29

- When taking the insulation resistance measurements at certain HV components with 250 Volts between HV+ and HV- the normal value may be low enough to cause what appears to be an incorrect result.
- The insulation resistance test is being used in this way to check the HV component against a good reference value and is not being used to measure insulation resistance against the vehicle chassis.
- In the example shown (Fig. 29) the value 7818.01 Ohm is within the normal range for the -JX1- power electronics.
- If the measurement is repeated the value may increase, but repeat measurements are not necessary in this case (Fig. 30 and 31).


Fig. 30

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Fig. 31

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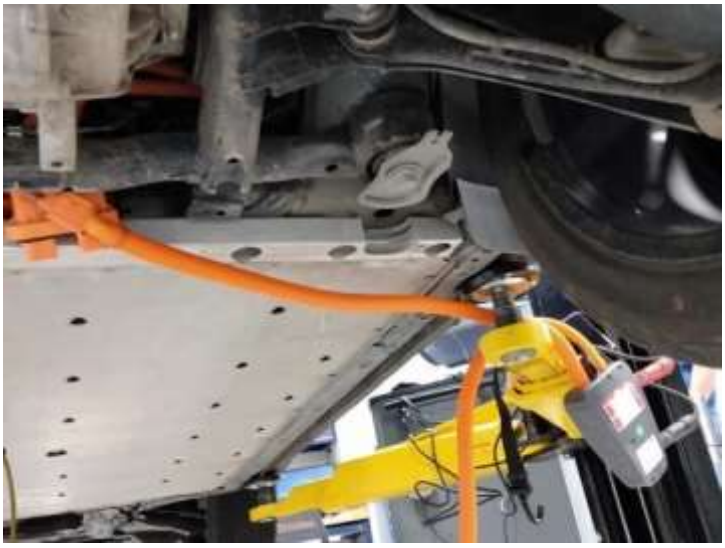

Fig. 32

Fig. 33

- Example showing connection of the HV adapter VAS 6558A/36A to the HV auxiliary harness (Fig. 32 and 33).
- The measurement of all components on the HV auxiliary harness is taken through the harness first with all components connected, then with the harness only (all components disconnected), and lastly with each component individually (reconnected one at a time).

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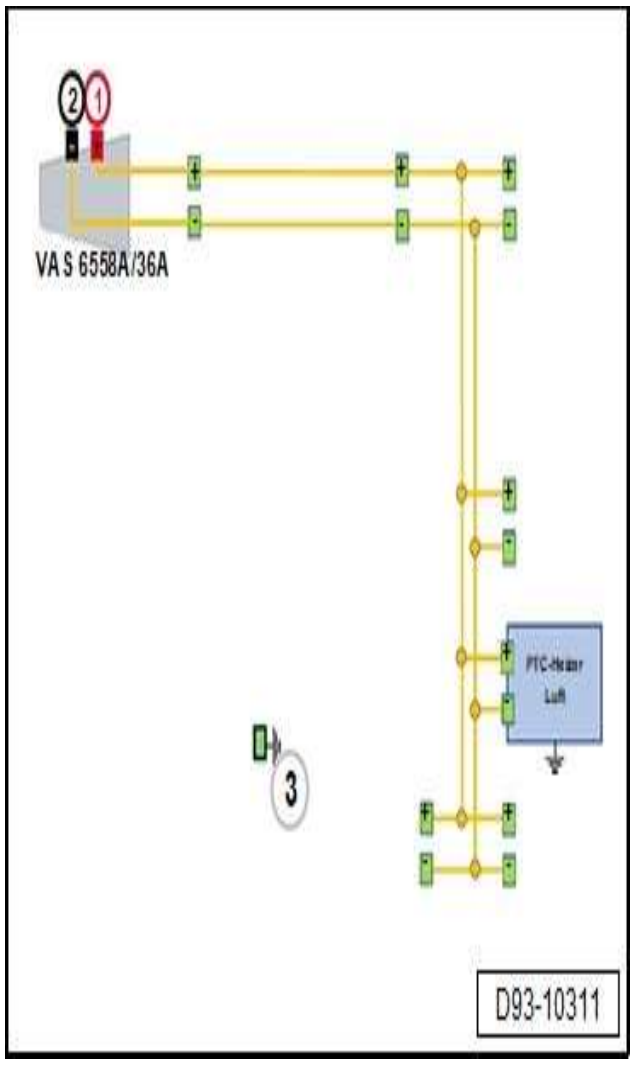


Fig. 34

- Example diagrams, showing how single HV components are normally measured one at a time, through the auxiliary harness. Diagrams are shown for two components only, all other components on the auxiliary harness are checked similarly (Fig. 34 and 35)

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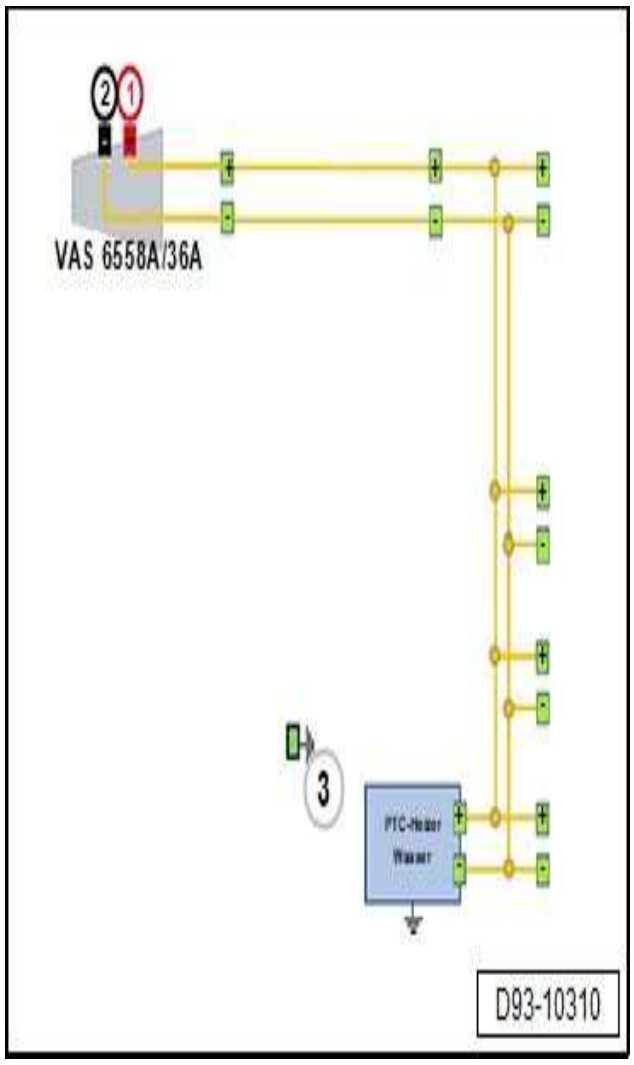


Fig. 35

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| | |
|---|---|
|  Fig. 36 | • To remove the HV connector at the -VX81- A/C Compressor, first remove the harness retainer clip (circled) from the bracket (Fig. 36). |
|  Fig. 37 | • In vehicles equipped with four-wheel drive, a long right angle pick tool with a solid handle is useful for accessing the HV connector (circled) of the -A19 - Voltage Converter (Fig. 37).<br>• When removing the HV connector, care must be taken to avoid making contact between the B+ post of the -A19 - Voltage Converter and chassis ground. The B+ post is connected to the 12V battery positive terminal through the main fuse block SA. |

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Fig. 38

- After completing the entire set of measurements for all components in the HV system, perform a repeat measurement of any individual component that was suspicious or questionable.
- For components on the HV auxiliary harness, a direct measurement at the component is achieved using the appropriate HV measurement adapter VAS 6558A/36A or VAS 6558A/37 as needed to match the connector type on the component being measured.
- In the example shown (Fig. 38) the VAS 6558A/37 is being used to perform the measurement directly at the -Z132- Heating Element (PTC) 3 – Water Heater (Battery Coolant Heating).

**Reference information – Capacitance measurements**

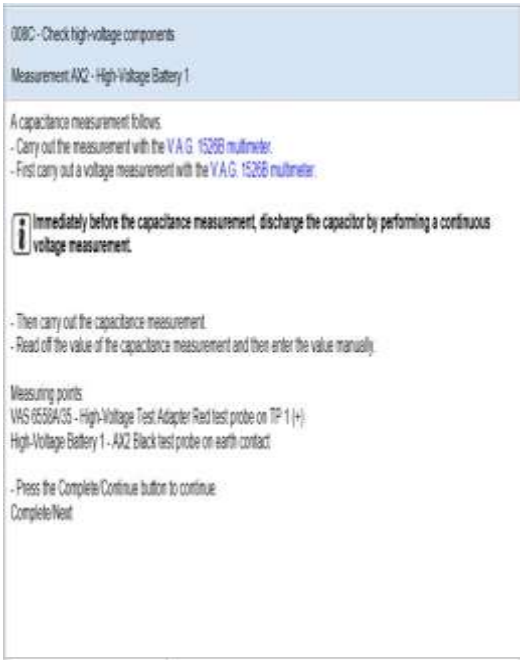


Fig. 39

- The VAS 6558A cannot measure capacitance, therefore a separate multimeter must be used.
- The VAG 1526B multimeter is not distributed within North America. Instead, the Fluke 83-V or equivalent with a suitable capacitance measurement range and resolution may be used (i.e., maximum capacitance 9,999 µF, accuracy ±(1% + 2), maximum resolution 0.01 nF).
- Before taking a capacitance measurement, it is necessary to discharge any energy stored in the capacitor being measured (Fig. 39).
- To discharge the capacitor, perform a continuous voltage measurement until 0.1V or less is displayed.

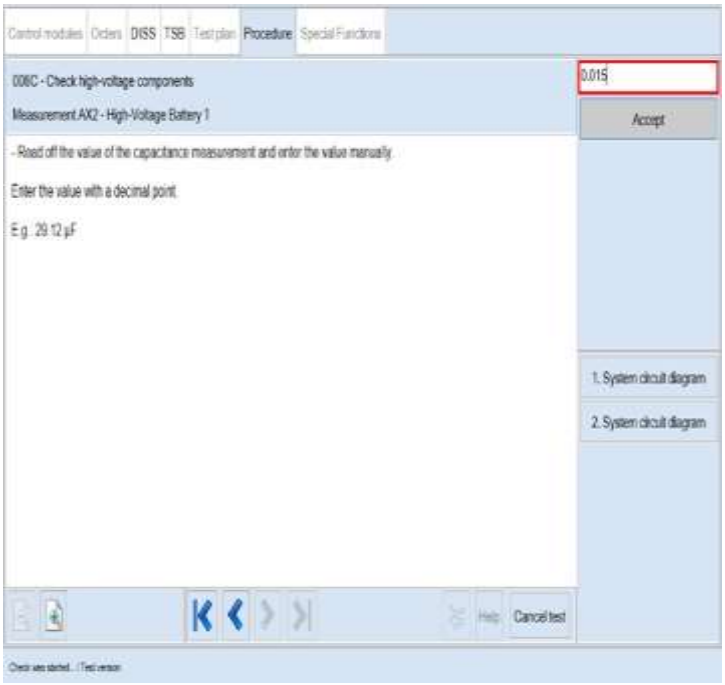


Fig. 40

- The acceptable unit of data entry for all capacitance measurements is µF and any measurements given in nF must be converted accordingly (Fig. 40)
- 1,000 nF = 1 µF
- 1 nF = 0.001 µF


Fig. 41

- Pay attention to whether the capacitance measurement on the multimeter display is given as µF or nF, which will vary according to auto-ranging behavior (Fig. 41)
- For the example given:
  a. Display: 990 nF – Input: 0.990 µF (conversion from nF to µF)
  b. Display: 625 µF – Input: 625 µF (conversion not required)
-

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**Reference information – Diode test mode measurements**


Fig. 42

- The diode test mode of the VAS 6558A is used to test the individual components (Fig. 42).
- The response of the forward voltage drop varies, according to circuits contained in the components.

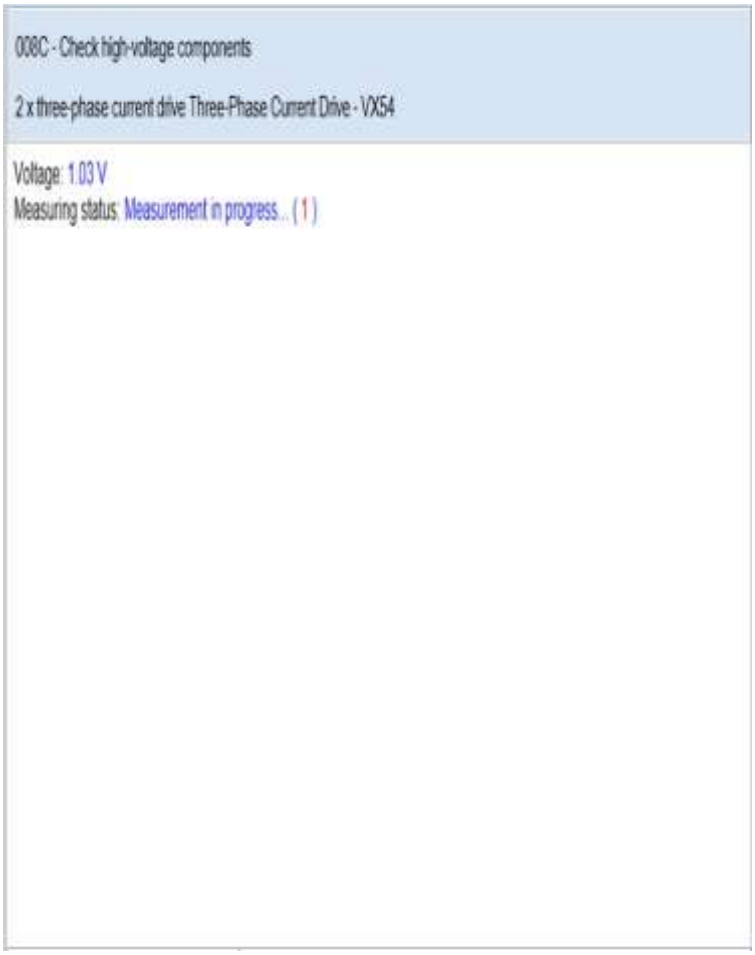


Fig. 43

- Before doing the diode test, a voltage measurement is taken until any voltage present in the capacitors of the component is dissipated (Fig. 43).


Fig. 44

- The measurement using the diode test mode will be conducted when the button is pressed, after the voltage measurement is completed (Fig. 44).


Fig. 45

- For the example given at -JX1- power electronics in the reverse direction, the voltage 4.43 V indicates the result is OK and open circuit in the blocking direction (Fig. 45).

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Fig. 46

- For the example given at -JX1- power electronics in the forward direction, the voltage drop 0.46V is acceptable for the particular component under test (Fig. 46).
- The response of the forward voltage drop varies, according to circuits contained in the components.

**Typical Values of Plausible Measurements:**

The values given in the table below are for reference only and are not specifications. These values are not to be used for “good vs. bad” determinations and are representative of typical values in vehicles without faults across a range of years and hardware versions.

If an individual measurement is suspicious, then it should be repeated. If the same measurement type is abnormal across several components, then the equipment should be checked, and the GFF test plan reviewed carefully, to be certain that the HV adapters and probes are being used correctly.

| | | | | |
|---|---|---|---|---|
| AX2 - High-Voltage Battery 1<br>TNS and AUX connections | Voltage at TNS | + to - | 0 | V |
| | Voltage at AUX | + to - | 0 | V |
| | Resistance between TNS and AUX | + to + | 0.01 – 0.10 | Ω |
| | Resistance between TNS and AUX | - to - | 0.01 – 0.10 | Ω |
| | ISO@250V | + to - | >500 | MΩ |
| | ISO@500V | + to Chassis | >500 | MΩ |
| | ISO@500V | - to Chassis | >500 | MΩ |
| | Y-Capacitance | + to Chassis | 9<br>0.009 | nF<br>µF |
| | Y-Capacitance | - to Chassis | 10<br>0.010 | nF<br>µF |
| AX2 - High-Voltage Battery 1<br>DC charging connection | Voltage | + to - | 0 | V |
| | ISO@250V | + to - | 11.5 | MΩ |
| | ISO@500V | + to Chassis | >500 | MΩ |
| | ISO@500V | - to Chassis | >500 | MΩ |

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|---|---|---|---|---|
| | Y-Capacitance | + to Chassis | 4<br>0.004 | nF<br>µF |
| | Y-Capacitance | - to Chassis | 6<br>0.006 | nF<br>µF |
| UX4 - High-Voltage Battery Charging Socket 1 | Voltage | + to - | 0 | V |
| | ISO@250V | + to - | >500 | MΩ |
| | ISO@500V | + to Chassis | >500 | MΩ |
| | ISO@500V | - to Chassis | >500 | MΩ |
| | Y-Capacitance | + to Chassis | 0<br>0 | nF<br>µF |
| | Y-Capacitance | - to Chassis | 0<br>0 | nF<br>µF |
| JX1 - Electric Drive Power and Control Electronics | Voltage | + to - | 0 | V |
| | ISO@250V | + to - | 0.007 – 0.015 | MΩ |
| | Diode mode | + to - | OL | V |
| | Diode mode | - to + | 0.41 – 0.47 | V |
| | ISO@500V | + to Chassis | 3.2 – 4.0 | MΩ |
| | ISO@500V | - to Chassis | 3.2 – 4.0 | MΩ |
| | Y-Capacitance | + to Chassis | 700 – 800<br>0.700 – 0.800 | nF<br>µF |

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|---|---|---|---|---|
| | Y-Capacitance | - to Chassis | 700 – 800<br>0.700 – 0.800 | nF<br>µF |
| | Capacitance | + to - | 620 – 720 | µF |
| JX4 - Electric Drive Power and Control Electronics 2 | Voltage | + to - | 0 | V |
| | ISO@250V | + to - | 0.007 – 0.015 | MΩ |
| | Diode mode | + to - | OL | V |
| | Diode mode | - to + | 0.41 – 0.67 | V |
| | ISO@500V | + to Chassis | 3.2 – 4.2 | MΩ |
| | ISO@500V | - to Chassis | 3.2 – 4.2 | MΩ |
| | Y-Capacitance | + to Chassis | 550 – 1000<br>0.55 – 1.0 | nF<br>µF |
| | Y-Capacitance | - to Chassis | 550 – 1000<br>0.55 – 1.0 | nF<br>µF |
| | Capacitance | + to - | 350 – 500 | µF |
| Auxiliary Harness – with <u>all</u> components connected | Voltage | + to - | 0 | V |
| | ISO@250V | + to - | 0 – 0.015 | MΩ |
| | ISO@500V | + to Chassis | 150 – 500 | MΩ |

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|---|---|---|---|---|
| | ISO@500V | - to Chassis | 150 – 500 | MΩ |
| | Y-Capacitance | + to Chassis | 240 – 260<br>0.240 – 0.260 | nF<br>µF |
| | Y-Capacitance | - to Chassis | 240 – 260<br>0.240 – 0.260 | nF<br>µF |
| Auxiliary Harness – with no components connected | Voltage | + to - | 0 | V |
| | ISO@250V | + to - | >500 | MΩ |
| | ISO@500V | + to Chassis | >500 | MΩ |
| | ISO@500V | - to Chassis | >500 | MΩ |
| | Y-Capacitance | + to Chassis | 0<br>0 | nF<br>µF |
| | Y-Capacitance | - to Chassis | 0<br>0 | nF<br>µF |
| AX4 - High-Voltage Battery Charger 1 | Voltage | + to - | 0 | V |
| | ISO@250V | + to - | 0.110 – 0.190 | MΩ |
| | Diode mode | + to - | OL | V |
| | Diode mode | - to + | 0.74 – 0.77 | V |
| | ISO@500V | + to Chassis | >500 | MΩ |
| | ISO@500V | - to Chassis | >500 | MΩ |

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|---|---|---|---|---|
| | Y-Capacitance | + to Chassis | 75 – 80<br>0.075 – 0.080 | nF<br>µF |
| | Y-Capacitance | - to Chassis | 75 – 80<br>0.075 – 0.808 | nF<br>µF |
| | Capacitance | + to - | 24 – 28 | µF |
| VX81 - A/C Compressor | Voltage | + to - | 0 | V |
| | ISO@250V | + to - | 0.008 – 0.020 | MΩ |
| | Diode mode | + to - | OL | V |
| | Diode mode | - to + | 0.74 – 0.77 | V |
| | ISO@500V | + to Chassis | >500 | MΩ |
| | ISO@500V | - to Chassis | >500 | MΩ |
| | Y-Capacitance | + to Chassis | 45 – 65<br>0.045 – 0.065 | nF<br>µF |
| | Y-Capacitance | - to Chassis | 45 – 65<br>0.045 – 0.065 | nF<br>µF |
| | Capacitance | + to - | 24 – 26 | µF |
| Z132 - Heating Element (PTC) 3 – Water Heater (Battery Coolant Heating) | Voltage | + to - | 0 | V |
| | ISO@250V | + to - | 0.300 – 0.600 | MΩ |
| | Diode mode | + to - | OL | V |

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|---|---|---|---|---|
| | Diode mode | - to + | 0.80 – 1.20 | V |
| | ISO@500V | + to Chassis | 150 – 500 | MΩ |
| | ISO@500V | - to Chassis | 150 – 500 | MΩ |
| | Y-Capacitance | + to Chassis | 19 – 24<br>0.019 – 0.024 | nF<br>µF |
| | Y-Capacitance | - to Chassis | 19 – 24<br>0.019 – 0.024 | nF<br>µF |
| | Capacitance | + to - | 24 – 26 | µF |
| ZX17 - High-Voltage Heater (PTC) / Z115 - High-Voltage Heater (PTC) – Air Heater (Passenger Compartment Heating) | Voltage | + to - | 0 | V |
| | ISO@250V | + to - | 0.4 – 0.45 | MΩ |
| | Diode mode | + to - | OL | V |
| | Diode mode | - to + | 0.77 – 0.89 | V |
| | ISO@500V | + to Chassis | >500 | MΩ |
| | ISO@500V | - to Chassis | >500 | MΩ |
| | Y-Capacitance | + to Chassis | 0 – 1<br>0 – 0.001 | nF<br>µF |
| | Y-Capacitance | - to Chassis | 0 – 1<br>0 – 0.001 | nF<br>µF |

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|---|---|---|---|---|
| | Capacitance | + to - | 0.200 – 1.0 | µF |
| A19 - Voltage Converter | Voltage | + to - | 0 | V |
| | ISO@250V | + to - | 0.5 – 0.55 | MΩ |
| | Diode mode | + to - | OL | V |
| | Diode mode | - to + | 0.36 – 0.74 | V |
| | ISO@500V | + to Chassis | >500 | MΩ |
| | ISO@500V | - to Chassis | >500 | MΩ |
| | Y-Capacitance | + to Chassis | 0 – 1<br>0 – 0.001 | nF<br>µF |
| | Y-Capacitance | - to Chassis | 0 – 1<br>0 – 0.001 | nF<br>µF |
| | Capacitance | + to - | 4.9 – 5.3 | µF |

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## Warranty

Information only.

**NOTICE**

**This technical bulletin describes a detailed GFF-based diagnostic procedure for electrical measurements of all HV components in the vehicle, of which many outcomes are possible. Following evaluation through a TAC case, one or more components may be identified for replacement. The labor time for the measurements performed according to the GFF-based procedure is automatically logged and documented on the GFF diagnostic log. To determine if this procedure and any subsequent repairs are covered under warranty, refer to the Warranty Policies and Procedures Manual.**

## Required Parts and Tools

No Special Parts required.

| Tool Description | Tool No*: |
|---|---|
| VAS Battery Tester/Charger | VAS 5908 |
| VAS Diagnostic Tool | VAS 6150/X & VAS 6160/X with ODIS Service with current online updates |
| Test Adapter - Hybrid Module | VAS 6558A |
| High Voltage Test Adapter | VAS6558A/35 |
| High Voltage Test Adapter | VAS6558A/32 |
| High Voltage Test Adapter | VAS6558A/36A |
| High Voltage Test Adapter | VAS6558A/33A |
| High Voltage Test Adapter | VAS6558A/37 |
| Fluke 83-V Multimeter or equivalent | FLUKE835 |

* Call Volkswagen Tools and Equipment Program, Snap-On® Business Solutions (SBS at 1-800-892-9650 for product.

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## Additional Information

All part and service references provided in this Technical Bulletin are subject to change and/or removal. Always check with your Parts Dept. and Repair Manuals for the latest information.