

Subject
UNDERHOOD™ Clutch Diagnostics

System or Parts affected

- All UNDERHOOD compressors from VMAC.

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Overview

Belt driven VMAC compressors use an electromagnetic clutch to engage and disengage the compressor. +12V is supplied to the clutch through a white wire from the VMAC control box which is connected by a bullet connector to the black clutch wire. The clutch is grounded through the compressor to the chassis and to battery negative.

A clutch failure can present itself a few different ways:

- A slipping condition: Clutch will not be able to positively engage the compressor when energized. This condition will usually generate heat, noise, and sparks.
- Unresponsive: No response when the ON button is pressed. The compressor is not driven.
- Seized: The clutch is locked-on. The compressor is engaged full-time with or without voltage supplied to the clutch.
- Rattling or grinding noise: The bearing in the clutch has failed.

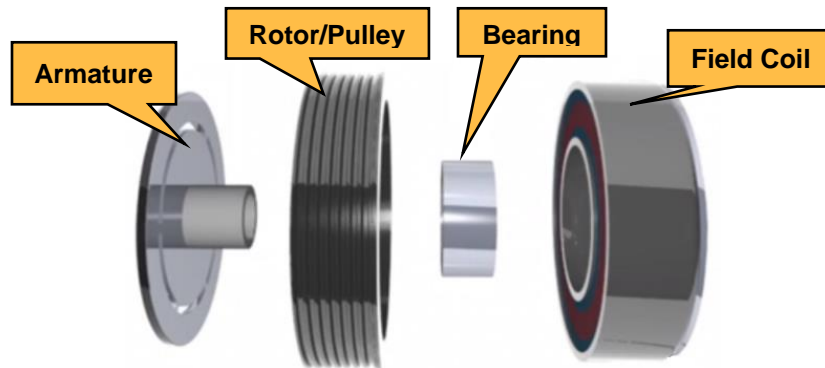


Figure 1

Document	Version	Department	Revision Details	Revised by	Tech	Engineering	Implemented
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UNDERHOOD 70 cfm and 150 cfm

Electrical issues

VMAC installation manuals indicate the appropriate method for all electrical connections related to the VMAC system.

As you work through the diagnostics that follow, confirm that all connections are made as per the installation manual's recommendation, and that the integrity of the connections is good.

Find the installation manual for your VMAC compressor system at [Manuals - VMAC \(vmacair.com\)](http://Manuals - VMAC (vmacair.com))

Confirm Power Supply to Clutch:

Sufficient and consistent voltage is required for proper clutch performance

- 1) With the engine off and the key in the run position, apply the vehicle's park brake and push the ON button on the VMAC control keypad. There should be an audible click at the VMAC clutch and the clutch should be engaged. Measure voltage at the clutch connector. This should be at least +12V DC
- 2) With the engine off, key in the run position, turn the Compressor Enable (On/Off) switch OFF. There should be no voltage measured at the clutch connector and the clutch should be disengaged.

If voltage is correct at the clutch, skip steps 2&3 and move on to the next section, Grounding Issues.

- 3) Measure voltage on the red key switched wire. This supplies power to the system and should be +12V DC. If voltage is low here, the battery, charging system, or a blown fuse may be at fault.
- 4) With power off, disconnect the white 4-pin interface connector. Check to make sure all the pins and sockets are all positively and equally affixed in the connectors. Confirm that there is no contamination, corrosion, or signs of arcing on them.

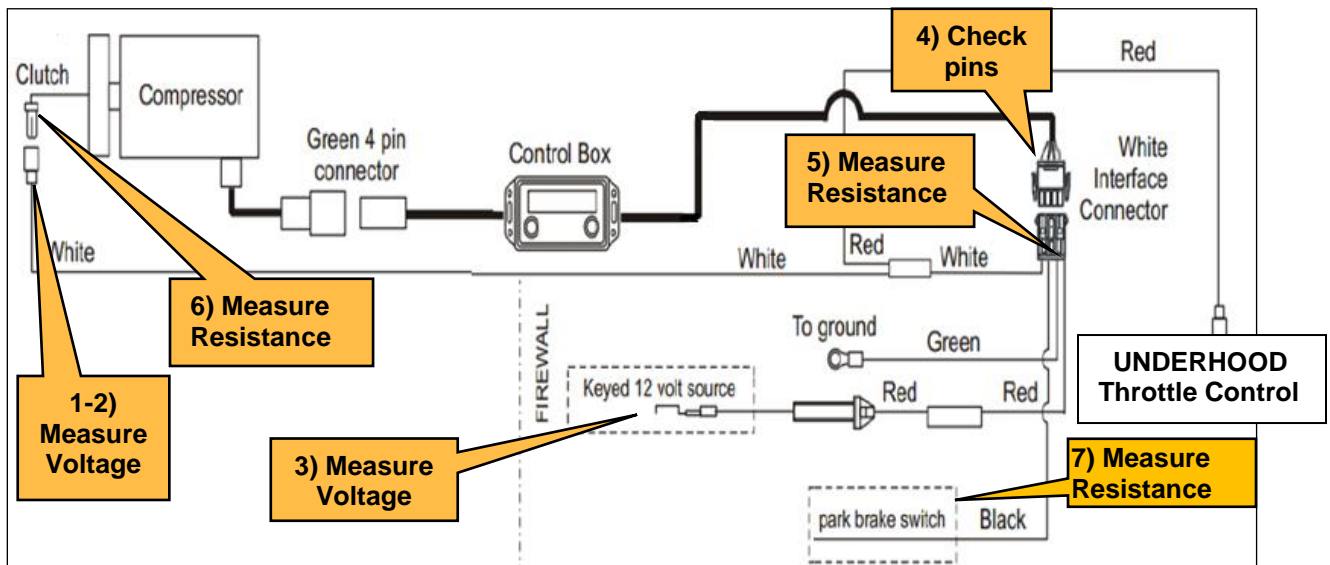


Figure 2

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i *Ensure that there are no additional demands on the vehicle's charging system that may draw system voltage below 12V while the compressor is engaged (e.g. power lift gate, winch, electric crane). Low voltage will cause the VMAC clutch to slip, damaging its armature.*

Isolate Grounding Issues:

Poor ground connections can reduce voltage to the system or cause intermittent power supply.

- 5) Measure the resistance from the green ground connection on the interface cable to the vehicle battery's negative terminal. This reading should be 1 ohm or less.
- 6) Check the clutch field coil resistance. Disconnect the bullet connector at the clutch. Using an ohm meter, measure the resistance between the clutch side of this wire and battery ground. This will measure the resistance of the coil as well as the grounding circuit. (Table 1)

VMAC Part Number*	Application	Ohms Resistance
P200044	UNDERHOOD 70	3.06 Ω +/- 10% @ 20°C / 68°F
P200035	UNDERHOOD 70	3.06 Ω +/- 10% @ 20°C / 68°F
P200039	UNDERHOOD 150	2.88 Ω +/- 10% @ 20°C / 68°F

* See The Illustrated Parts List to determine the correct part number for your specific product [Illustrated Parts List - VMAC \(vmacair.com\)](#)

Table 1

- 7) The control box will not allow the clutch to engage unless it sees that the park brake is engaged. With the park brake engaged measure resistance through the VMAC connection at the park brake switch to battery ground. This should be 1 ohm or less.

Mechanical Issues:

- 1) Inspect the conical sintered bronze muffler on the blowdown cap. Ensure it is not plugged or obstructed and will allow the compressor system to depressurize.
- 2) Ensure the compressor discharge hose is lower than the compressor. If the compressor discharge hose is higher than the compressor hydraulic lock can occur.

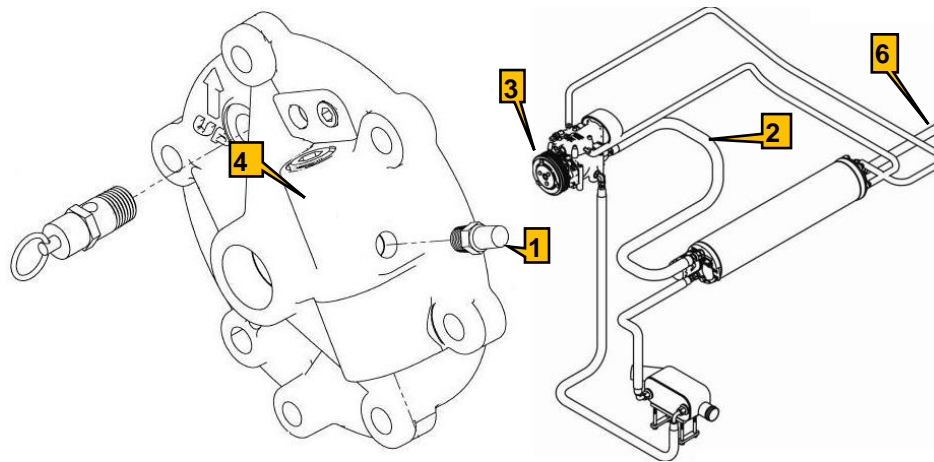


Figure 3

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- 3)
 - a. Compressor failure: Using a 13mm wrench to hand-turn the clutch center bolt, confirm the compressor turns smoothly with no hard spots or roughness.
 - b. Contamination of clutch: check for oil or fine particulate in the clutch that could create a clutch slippage condition. If compressor oil is contaminating the clutch a new oil seal or possibly a replacement front gear case may be required.
 - c. Seized clutch: If the clutch is engaged with no voltage supplied to the field coil, the armature plate may be stuck to the rotor by a process known as *galling*, or the clutch bearing may have locked up.
- 4) An internal fault in blowdown cap not allowing the system to depressurize at shut-down can cause the clutch to slip due to clutch engagement with excessive start-up load. For a detailed description of blowdown cap operation and troubleshooting, see [EXT-ALL-006](#)
- 5) Engaging the VMAC UNDERHOOD at a high engine RPM will cause clutch slippage. Normal clutch engagement occurs near the OEM engine idle rpm.
- 6) If an external receiver tank is installed inline between the VMAC Air Oil Separator Tank (AOST) and air tools, ensure there is a one way check valve installed in the discharge port of the blowdown cap. If no check valve is present between the VMAC UNDERHOOD system and a receiver tank, it will take longer for air pressure to blow down increasing the possibility that the system may be re-started under pressure and under load.

UNDERHOOD 30 cfm and 40 cfm

Electrical issues

VMAC installation manuals indicate the appropriate method for all electrical connections related to the VMAC system.

As you work through the diagnostics that follow, confirm that all connections are made as per the installation manual's recommendation, and that the integrity of the connections is good.

Find the installation manual for your VMAC compressor system at [Manuals - VMAC \(vmacair.com\)](http://Manuals-VMAC(vmacair.com))

- 1) Confirm Power Supply to clutch.
 - With the engine off, key in the run position, and no air pressure stored downstream of the WHASP, turn the Compressor Enable (On/Off) switch ON. There should be an audible click at the VMAC clutch and the clutch should be engaged. Measure voltage at the clutch connector. This should be at least +12V DC
- 2) With the engine off, key in the run position, and no air pressure stored downstream of the WHASP, turn the Compressor Enable (On/Off) switch OFF. There should be no voltage measured at the clutch connector and the clutch should be disengaged.
- 3) Check Field coil resistance. (Table 2)

VMAC Part Number*	Application	Ohms Resistance
P200057	UNDERHOOD 40	3.13 Ω +/- 10% @ 20°C / 68°F
P200048	UNDERHOOD 30 and 40	3.00 Ω +/- 10% @ 20°C / 68°F

* See The Illustrated Parts List to determine the correct part number for your specific product [Illustrated Parts List - VMAC \(vmacair.com\)](#)

Table 2

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Mechanical issues

- 1) Oil contamination can cause clutch slippage resulting in premature failure.
 - Check for leaking Scavenge fitting or line on or near the compressor.
 - If a compressor input shaft seal leak is discovered:
 - UNDERHOOD 30, compressor components are obsolete and unavailable see [V3000XX Compressor Replacement | VMAC Air](#)
 - UNDERHOOD™ 40 see [A700303_A700304_1901157.pdf \(vmacair.com\)](#)
- 2) Compressor starting under load can cause clutch slippage resulting in premature failure.
 - Check the conical sintered blowdown muffler located near the spin-on coalescing filter on the WHASP tank to confirm that it is clear and able to release system pressure freely.
 - Blowdown muffler is clear but the compressor is being restarted before blowdown is complete.
 - UNDERHOOD™ 30 see [A700248_1901069 \(vmacair.com\)](#)
 - UNDERHOOD™ 40 see [A700314_1901182.pdf \(vmacair.com\)](#)
- 3) Field coil coming loose, damage to circlip(s) and/or circlip grooves in front cover, field coil locating pin moved in front cover (or early model 30 without locating pin), damaging the wire to the field coil.
 - If UNDERHOOD 30, compressor components are obsolete and unavailable see [V3000XX Compressor Replacement | VMAC Air](#)
 - If UNDERHOOD 40 see [A700303_A700304_1901157.pdf \(vmacair.com\)](#)
- 4) Incorrect rotor to armature air gap.
 - See page 16 of the Clutch Replacement Kit installation manual for the measurement procedure [A700310_A700311_1901170.pdf \(vmacair.com\)](#)
 - Confirm air gap is equal all around the clutch. Variance in measurement can mean clutch warpage or bent shaft.

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