

Subject
Clutch Diagnostics and Replacement

## System or Parts affected

- All Compressors

## Index

<b>System or Parts affected</b> .....	<b>1</b>
<b>Index</b> .....	<b>1</b>
Resolution .....	1
Electrical Testing (Main source of failure): .....	1
Isolate Grounding Issues: .....	2
Isolate Power Source Issues: .....	2
<b>Blowdown Cap:</b> .....	<b>3</b>
Mechanical Issues: .....	3
<b>Replacement:</b> .....	<b>4</b>
Removing the clutch: .....	4
Installing New Clutch: .....	5
Checking the Repair: .....	5
Pictures: .....	6

## Resolution

### Electrical Testing (Main source of failure):

The majority of clutch failures are due to electrical issues. VMAC suggests that all electrical connections related to the VMAC install be soldered and shrink wrapped as opposed to butt connectors. The only exception to this is the bullet connection in the engine bay at the clutch.

VMAC compressors use an electromagnetic clutch. +12V is supplied to the clutch through a white wire from the VMAC control box (there is a connector near the clutch). The clutch is grounded through the compressor via the main bracket to the engine and chassis. The diagram below shows a typical Underhood electric control system. (Figure 1)

Document	Version	Department	Revision Details	Revised by	Tech	Engineering	Implemented
EXT-ALL-009	A	Tech	Document Release	SP 20 Jul 2015	DB 27 Jul 2015	N/A	27 Jul 2015

<b>Subject</b>
Clutch Diagnostics and Replacement

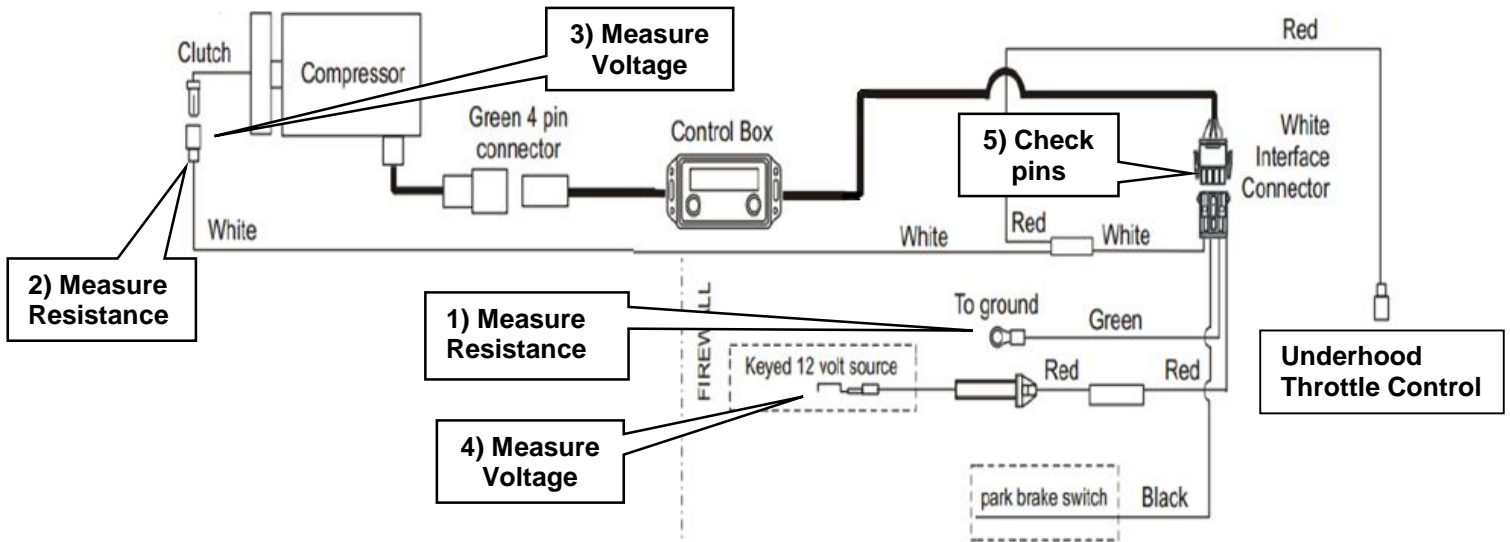


Figure 1

### Isolate Grounding Issues:

- 1) Measure the resistance from the GREEN ground connection on the interface cable to the vehicle battery's negative terminal. This reading should be less than 1 ohm.
- 2) Disconnect the electrical connector near the clutch. Using an ohm meter, measure the resistance between the clutch side of this wire and battery ground. This will measure the condition of the coil as well as the grounding circuit. This should read 2.3 – 2.5 ohms.

### Isolate Power Source Issues:

- 3) With the engine off, key in the run position and park brake applied, measure voltage at the clutch connector. This should be +12V DC
- 4) Measure voltage on the RED key switched +12V wire. This should be +12V DC.
- 5) With power off, disconnect the Interface Connector (white connector). Check to make sure all the pins and sockets are in the same position in the connectors, and that there is no dirt or signs of arcing on them.



Ensure that there are no other electrical loads which can drop the clutch voltage below 12V (e.g. power lift gates, winches, cranes or auxiliary lighting) this will cause the clutch to slip and damage the friction surfaces.

Document	Version	Department	Revision Details	Revised by	Tech	Engineering	Implemented
EXT-ALL-009	A	Tech	Document Release	SP 20 Jul 2015	DB 27 Jul 2015	N/A	27 Jul 2015

Subject
Clutch Diagnostics and Replacement

## Blowdown Cap:

Confirm that the Blowdown cap is functioning correctly to ensure that the compressor does not start under load and damage the clutch friction surfaces. The function of the blowdown cap is to depressurize the compressor system when you turn the compressor off. The blowdown cap takes 20 seconds to depressurize the compressor system.

The Blowdown cap is mounted to the rear of the Air Oil Separator Tank (mounted on the vehicle's frame). (Figure 2)

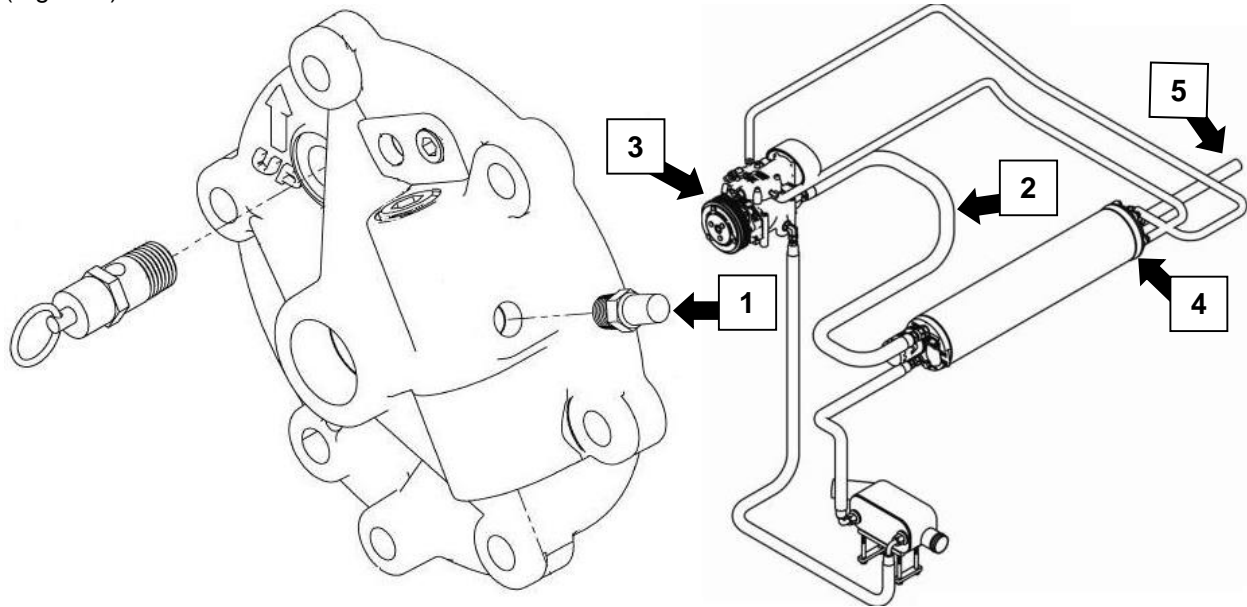


Figure 2

### Mechanical Issues:

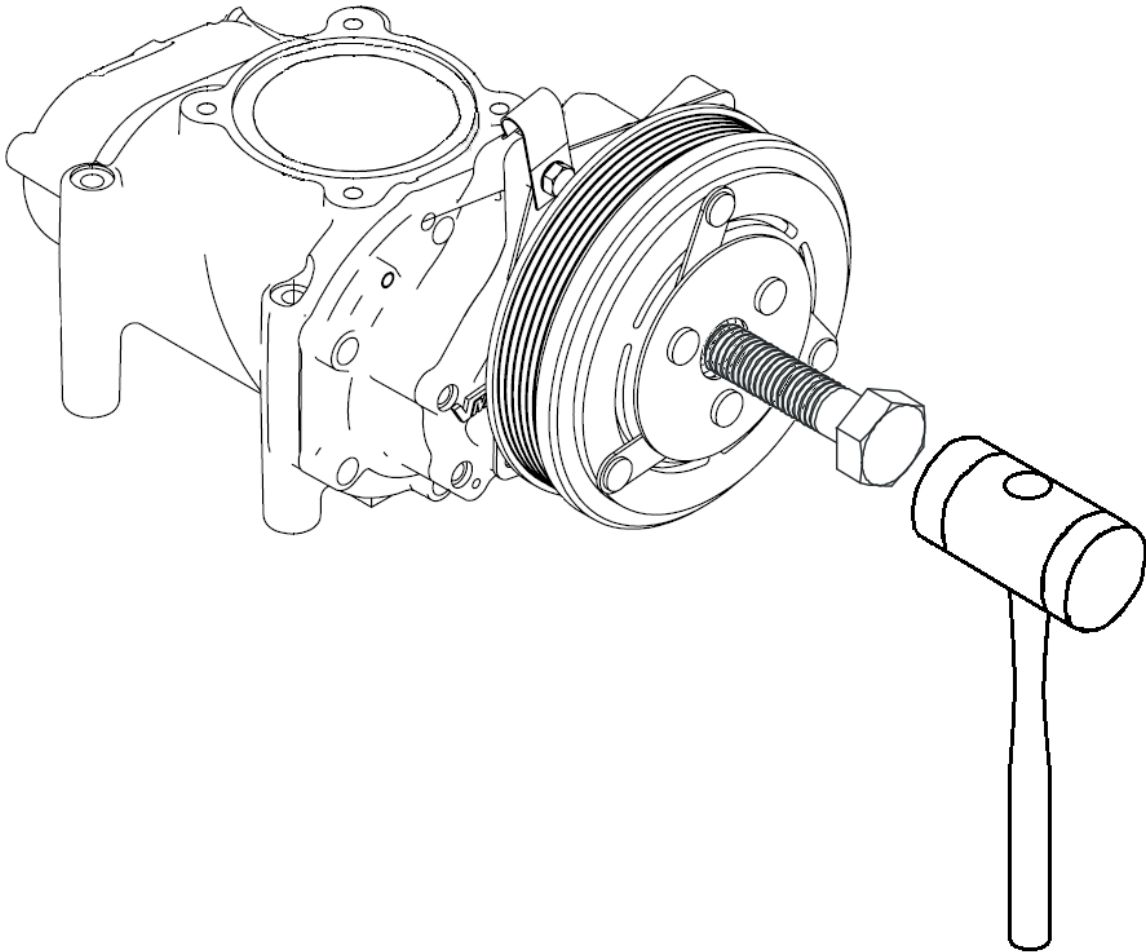
- 1) Inspect the conical muffler on the blowdown cap as this can get plugged or obstructed, not allowing the compressor to depressurize.
- 2) Ensure the compressor discharge hose is lower than the compressor. Hydraulic lock can occur if the compressor discharge hose is higher than the compressor.
- 3) Compressor failure: Using a 13mm wrench to turn the Clutch center bolt, confirm the clutch turns smoothly with no hard spots or roughness.
- 4) Internal fault in blowdown cap not allowing the system to depressurize
- 5) Do not engage the VMAC Underhood at a high engine RPM
- 6) If you have an external receiver tank, ensure there is a one way check valve between the receiver tank and the VMAC Air Oil Separator Tank. Ensure the Check Valve is installed with the arrow pointing downstream from the Air Oil Separator Tank.

Document	Version	Department	Revision Details	Revised by	Tech	Engineering	Implemented
EXT-ALL-009	A	Tech	Document Release	SP 20 Jul 2015	DB 27 Jul 2015	N/A	27 Jul 2015

Subject
Clutch Diagnostics and Replacement

## Replacement:

### Removing the clutch:



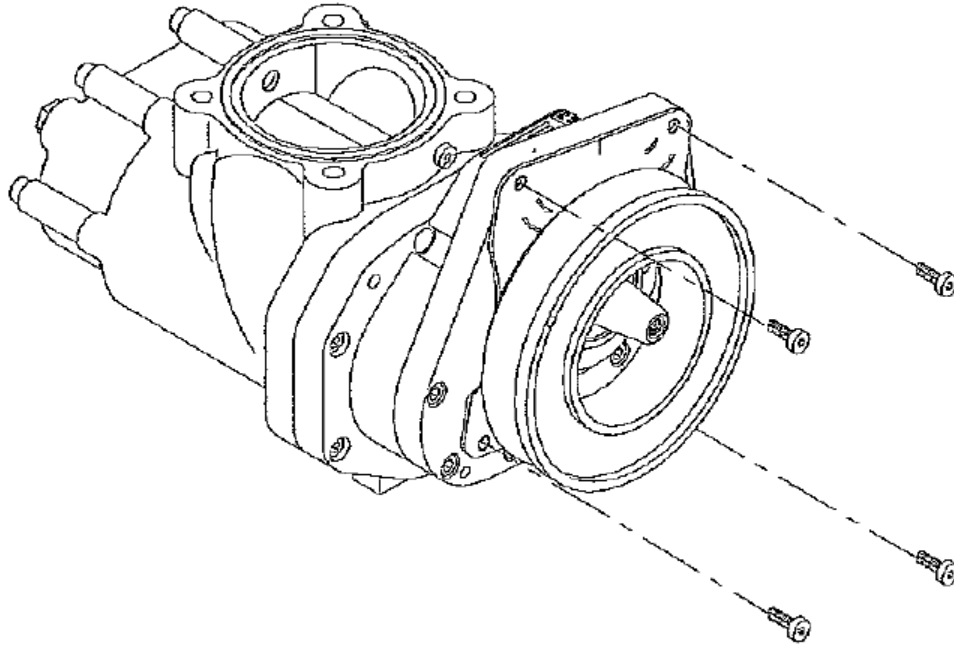
**Figure 3**

- 1) Depress the automatic belt tensioner and remove the drive belt.
- 2) Remove the 5/16" NF bolt and the thick washer from the center of the front face of the clutch. This fastener has right-hand threads.
- 3) Thread a 5/8" NC bolt firmly into the threads in the clutch hub.
- 4) Tap the head of the bolt with a hammer to dislodge the clutch from the shaft.
- 5) Remove the clutch hub and pulley assembly; retain the woodruff key for re-use later.
- 6) Disconnect the wire connector between the clutch and the wiring harness.
- 7) Remove the clutch stator.

Document	Version	Department	Revision Details	Revised by	Tech	Engineering	Implemented
EXT-ALL-009	A	Tech	Document Release	SP 20 Jul 2015	DB 27 Jul 2015	N/A	27 Jul 2015

Subject
Clutch Diagnostics and Replacement

## Installing New Clutch:



**Figure 4**

- 1) Clean the mounting surface on the front of the compressor.
- 2) Install the new clutch stator on the compressor.
- 3) Align the mounting holes, apply Loctite, and install the 4 bolts and serrated lock washers. Torque to 12 ft-lb.
- 4) Clean the compressor clutch hub.
- 5) Install the woodruff key into the compressor shaft.
- 6) Install the clutch hub over the compressor shaft. Make sure the clutch rotates free without rubbing on the stator.
- 7) Make sure the thick washer is on the 5/16" NF bolt. (Apply Loctite® 242 Blue if you are reusing the old bolt), thread the bolt in to retain the clutch hub. Torque to 18 ft-lb.
- 8) Connect the clutch stator wire to the harness connector.
- 9) Re-install the drive belt.

## Checking the Repair:

- 1) Place the standard transmission in neutral, or the automatic transmission in park, and apply the park brake.
- 2) Start the engine and allow the idle to stabilize.
- 3) Push the control box "ON" button.
- 4) Check to make sure that the compressor and the clutch are operating correctly.
- 5) Push the control box "OFF" button and shut down the vehicle engine.

Document	Version	Department	Revision Details	Revised by	Tech	Engineering	Implemented
EXT-ALL-009	A	Tech	Document Release	SP 20 Jul 2015	DB 27 Jul 2015	N/A	27 Jul 2015

Subject
Clutch Diagnostics and Replacement

**Pictures:**

- 1) Apply blue Loctite to screw holes at gear housing end. (Figure 5)



**Figure 5**

- 2) Insert woodruff key into shaft and tap with a hammer until seated. (Figure 6)  
**Note:** Support the shaft with a wooden block.



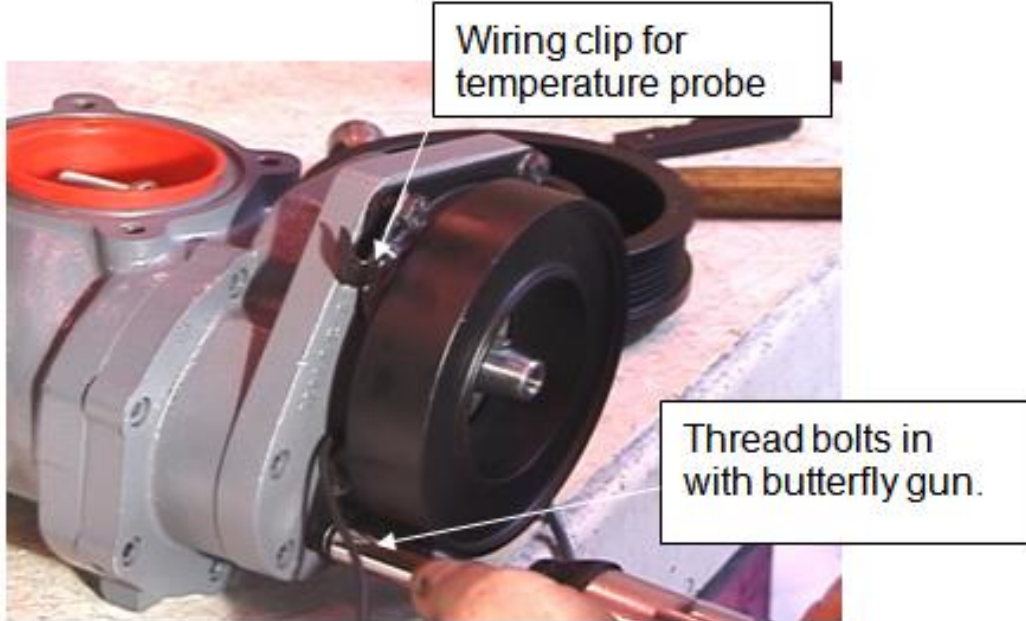
**Figure 6**

Document	Version	Department	Revision Details	Revised by	Tech	Engineering	Implemented
EXT-ALL-009	A	Tech	Document Release	SP 20 Jul 2015	DB 27 Jul 2015	N/A	27 Jul 2015

Subject
Clutch Diagnostics and Replacement

- 3) Bolt stator to front of assembly (The stator is the stationary housing in which the clutch will spin).
  - Mount wiring clip at upper left, by placing in front of stator and securing with bolt to stator.

**NOTE:** All bolts have blue Loctite pre-applied. (Figure 7)



**Figure 7**

- 4) Mount Clutch into stator. (Figure 8)



**Figure 8**

Document	Version	Department	Revision Details	Revised by	Tech	Engineering	Implemented
EXT-ALL-009	A	Tech	Document Release	SP 20 Jul 2015	DB 27 Jul 2015	N/A	27 Jul 2015

Subject
Clutch Diagnostics and Replacement

5) Check that Clutch spins freely. (Figure 9)



**Figure 9**

Document	Version	Department	Revision Details	Revised by	Tech	Engineering	Implemented
EXT-ALL-009	A	Tech	Document Release	SP 20 Jul 2015	DB 27 Jul 2015	N/A	27 Jul 2015