Countries:	RUSSIA, AUSTRALIA, CANADA, UNITED STATES, MEXICO, PUERTO RICO, KOREA, NEW ZEALAND	**Document ID:**	IK0900094
Availability:	ISIS	**Revision:**	5
Major System:	COOLING	**Created:**	11/27/2013
Current Language:	English	**Last Modified:**	6/27/2014
Other Languages:	NONE	**Author:**	Kevin Kochanek
Viewed:	1071		

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Title: Horton VMaster Ultra (Stratis) Viscous Fan Hub Diagnostics and Troubleshooting Guide

Applies To: ProStars, LoneStars, WorkStar, TranStar, IBB

CHANGE LOG

Dealers: Please refer to the change log text box below for recent changes to this article:

6/19/2014 - Initial Article Release: IK0900075 was combined with this article.
6/24/2014- Updated Article title
6/24/2014- Remove information about Anti Rotation Bracket, it is cover with the Harness Re-Route Procedure
6/24/2014- Updated Part number for Horton ILD 800922R91
6/27/2014 - Added information from PL3000024: Recall Serial Numbers of Horton Fan Drive and reformatted entire article.

CONTENT MENU

DESCRIPTION

This article is a Troubleshooting Guide for the Horton VMaster Ultra (Stratis) Viscous Fan Drive.

Engine feature code: 12THX

General Fan Operation (All Engines):

Horton VMaster is a variable speed drive. It does not function like an on/off drive. Even when the drive is off the fan will spin between 50-300 rpm.
When drive is commanded off by ECU, fan speed should be 50 to 300 rpm. When drive is commanded on by ECU, fan speed should be approximately 125% of the engine speed. *For Example:* At 2100 engine rpm x 1.25 fan drive ratio, the fully engaged fan speed should be approximately between 2490 and 2600 rpm

The default state of the fan is ON. The ECM or EIM uses a pulse width modulated (PWM) signal to turn the fan OFF. This is described in more detail in the information provided for each engine platform.

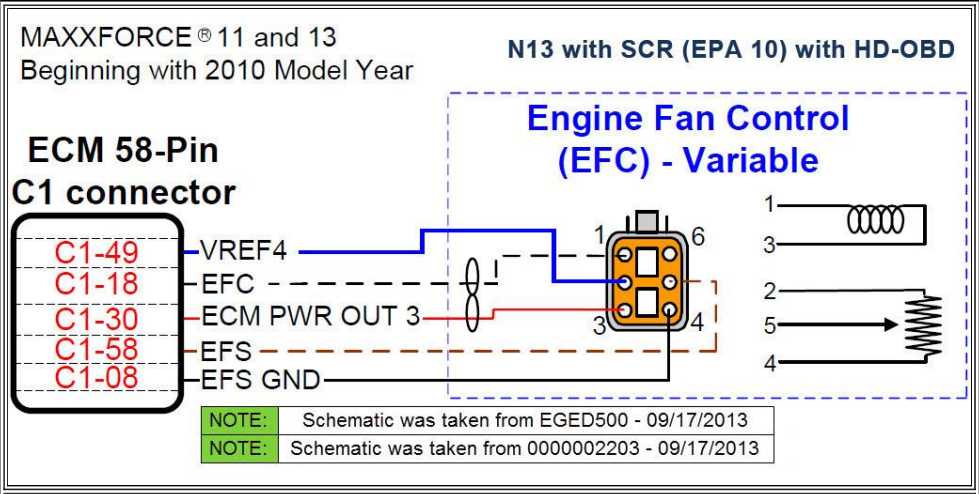
After first start of the day (A/C in off position) time for fan to disengage; at high idle (2100 engine rpm), disengagement may take up to 2 minutes after disengagement command, depending on the ambient temperature and at low idle (600 engine rpm), disengagement occurs approximately 25 to 30 minutes after disengagement command.

Warm truck (A/C in OFF position), time for fan to disengage; at high idle (2100 engine rpm), disengagement occurs approximately 20 seconds after disengagement command and at low idle (600 engine rpm), disengagement occurs approximately 25 to 30 minutes after disengagement command.

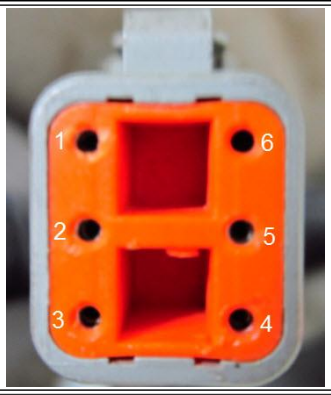
CAUTION :
This fan clutch has left hand threads.

The default state of the fan is ON. Ground is required to turn the fan OFF (r*efer to the two figures below*).

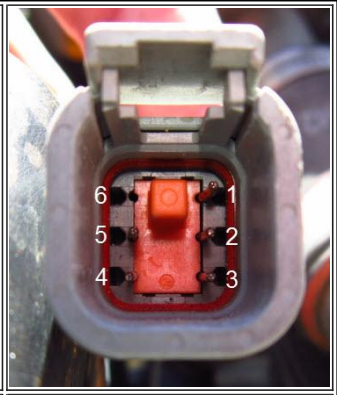
- ECM C1-18 controls the fan by supplying a Ground PWM signal
- ECM C1-58 is feedback for the fan speed



Wiring Diagram of 2010 Fan



Chassis Connector 6420
Front side



Fan Hub Assembly Connector

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N13 and EPA10 MaxxForce 11/13

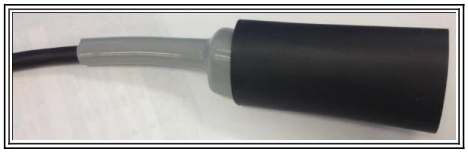
INSPECTION STEPS

Visual Inspection for fan drive and wiring:

NOTE: The visual inspection steps are the same for EPA07 MaxxForce 11/13.

1. Check for rubbing on wire:

- If rubbing is present and inside wires are visible, but no copper is visible apply heat shrink over the harness.
- If copper can be seen, check to see if it is only one single wire, or multiple wires.
  - If it is one wire, place electrical tape over the wire.
  - Using 4:1 heat shrink will allow the heat shrink tubing to pass over the connector as shown. P/N: ZBJE849565 or equivalent

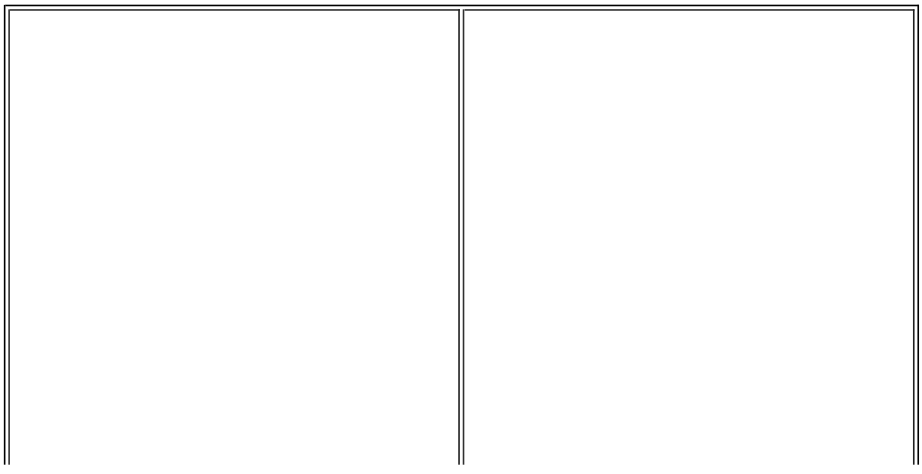


  - If multiple wires are showing copper, remove and replace the fan hub assembly.
- Reroute the wiring harness at outlined in the "Harness Re-Route Procedure" in this iKNow article.

2. Check to see if ARB is touching the target wheel. Refer to *Figure 1* and *Figure 2*.
   - If it is touching, reposition ARB to clear the target wheel as shown in *Figure 1*.

3. Check to see if the target wheel is loose, moves, or spins freely.
   - If it is loose, moves, or spins freely replace the fan hub assembly.
   - An improperly positioned ARB or loose target wheel can cause the damage in *Figure 4*.

4. Pull / Push fan ON - refer to *Figure 5*.
   - Rotating the fan by hand, the hub should provide a smooth and consistent resistance.
   - If it rotates freely approximately 1" or more before resistance is felt, replace the fan hub assembly.
   - If you have any questions on this process, call Horton customer service for assistance at: 1-800-621-1320



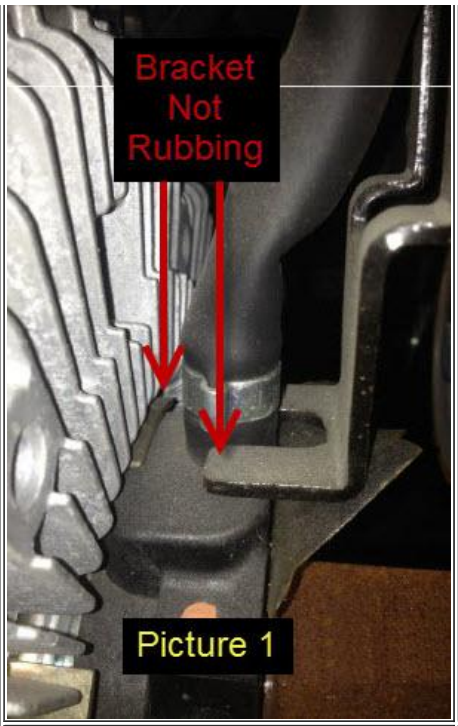


Figure 1

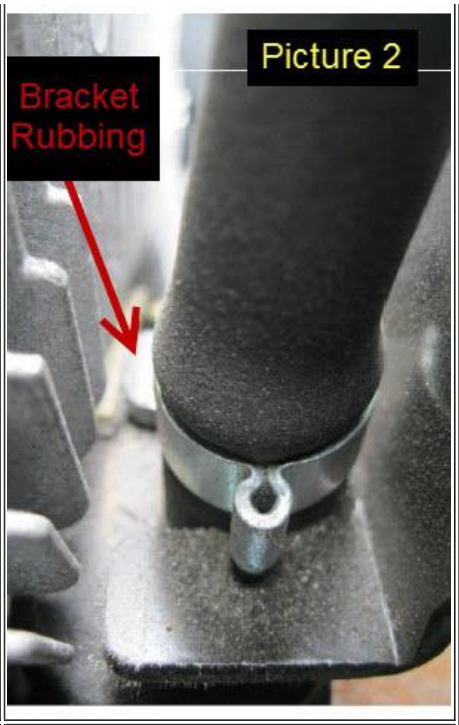


Figure 2

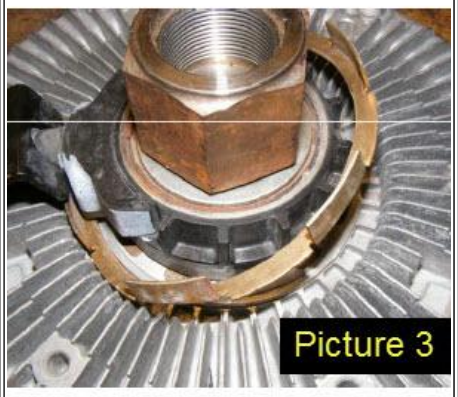


Figure 3

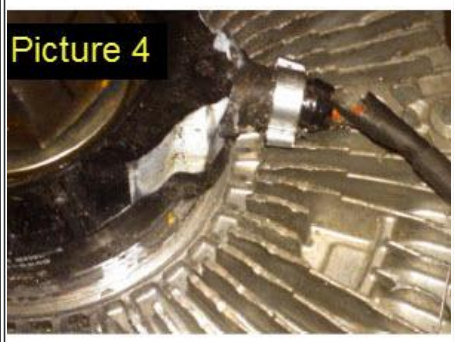


Figure 4

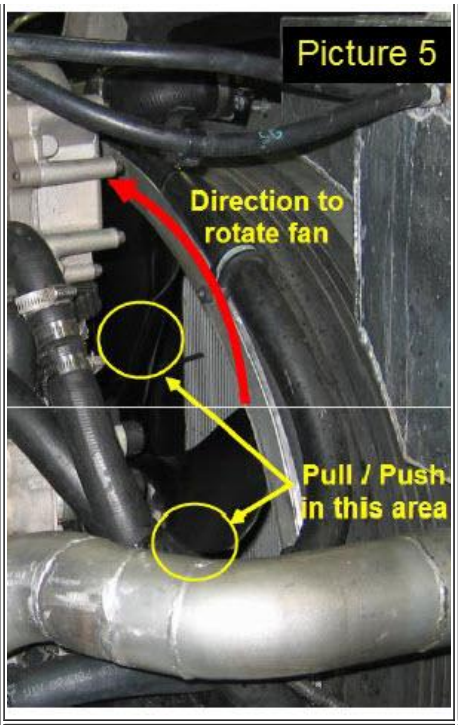


Figure 5

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Electrical Inspection of Control:

1. Ensure the truck is turned off and the key is removed from the ignition.

2. Unplug the fan hub from the chassis connector.

3. Using a digital multimeter, measure the resistance between pins on the fan hub Deutsch connector.
   - Terminal 1 to Terminal 2 (1-2) Spec (>1MΩ)
     - If it fails this test, use In Line Device (ILD) shown in photo. This failure is usually associated with a 3512 code.
   - Terminal 1 to Terminal 3 (1-3) Spec (6Ω to 16Ω)
   - Terminal 2 to Terminal 5 (2-5) Spec (2.5KΩ to 4KΩ)
     - If it fails this test, replace the fan hub assembly.
   - Double check any resistance that are out of spec to ensure an accurate reading

SPN	FMI	DESCRIPTION	REPAIR PROCEDURE
647	3	EFC Short to PWR	Check coil resistance.
	4	EFC Short to GND	Spec: 6Q to 16Q
	5	EFC Open Load/Circuit	Replace fan hub assembly if out of spec. EPA10 only.
1639	3	EFS Unrealistically HIGH	Do not replace the fan hub assembly.
	4	EFS Unrealistically LOW	
	8	EFS Frequency Signal Error	Update ECM calibration to 3.5.4 or later.
3512	14	VREF4 Voltage Deviation ECM Terminals: C1-37, C1-43 C1-49, C2-08, E1-58, E1-91	Install Horton ILD (In Line Device) P/N 800922R91 Replace fan hub assembly if both codes 3512 and 647 are present. EPA 10 only.

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Engine Fan Test:

NOTE: The 'Engine Fan Test' is not available for the EPA07 Engine.

1. Manually apply 12 volts to Pin 3 and Ground to Pin 1, checking fan operation. It should be disengaged. Some surging may be normal depending on the temperature of the fan hub.

2. Bring engine to operating temperature. 175°F-180°F.

3. Connect with ServiceMaxx and perform "Engine Fan Test" (*Figure 6*).

4. The entire test (5 test points) must be recorded and submitted with the warranty claim (*Figure 7*).

5. If the visual, electrical and functional tests all check OK, the fan hub is not the cause of the customer complaint. **Do NOT** replace the fan hub.

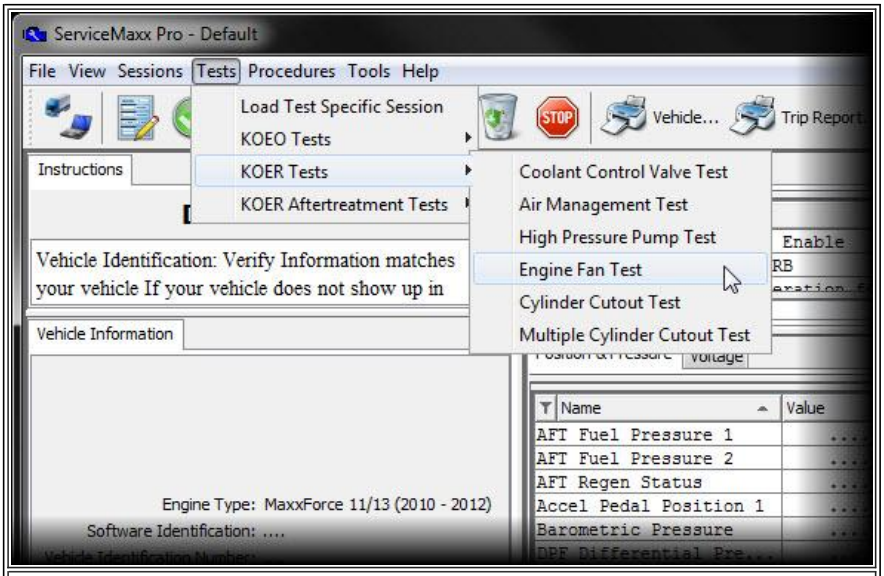

Figure 6

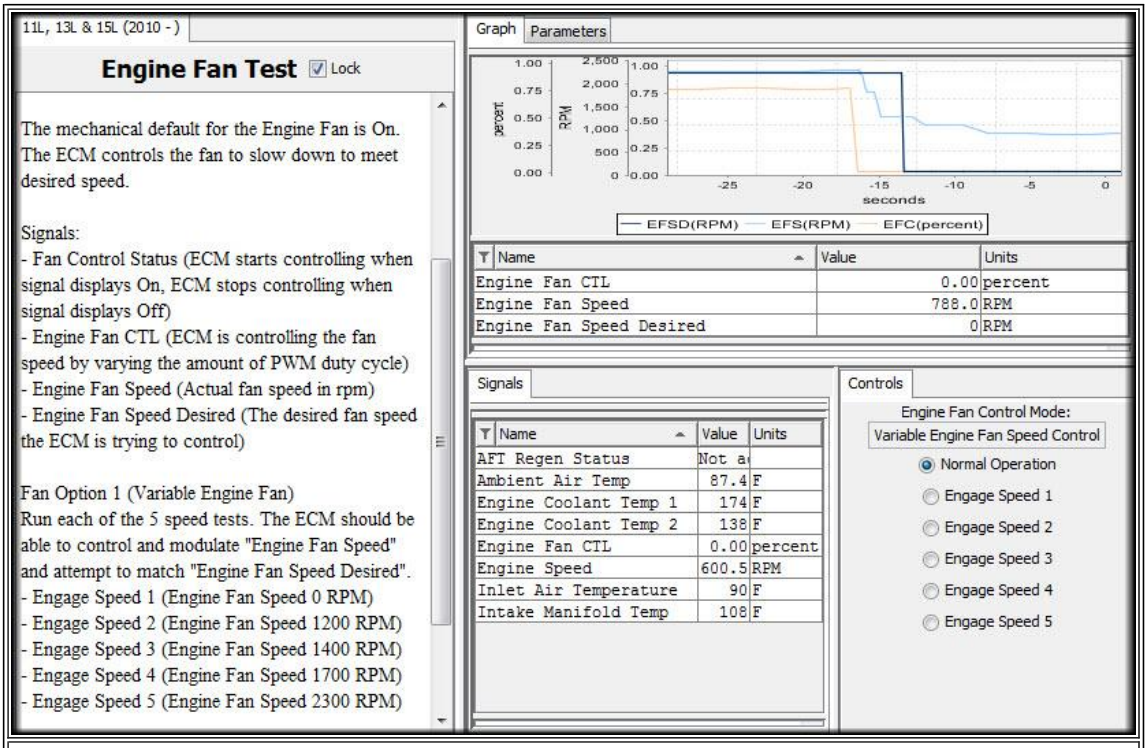

Figure 7

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Engine Fan Test Results:

1. You will need to monitor the entire fan test while it is running to determine if the fan has passed or failed.

2. The fan needs to operate within the limits at each test point. The fan should engage and remain engaged during the entire engagement request.

3. The actual fan speed should be approx ± 250 RPM of desired. Some viscous properties of the fan hub may vary the results. See examples below (*Figure's 8, 9 & 10*).

4. Notice in the chart below (*Figure's 8, 9 & 10*), when the engine ramps with 0 RPM desired fan speed, the fan does pick up some speed. This is normal due to the viscous properties of the fan hub.

4. Also as Item 3 points out (*Figure's 8, 9 & 10*), the engine speed and desired fan speed nearly match. If the fan is requested on 100%, the fan may actually engage at 125% of engine speed as shown.

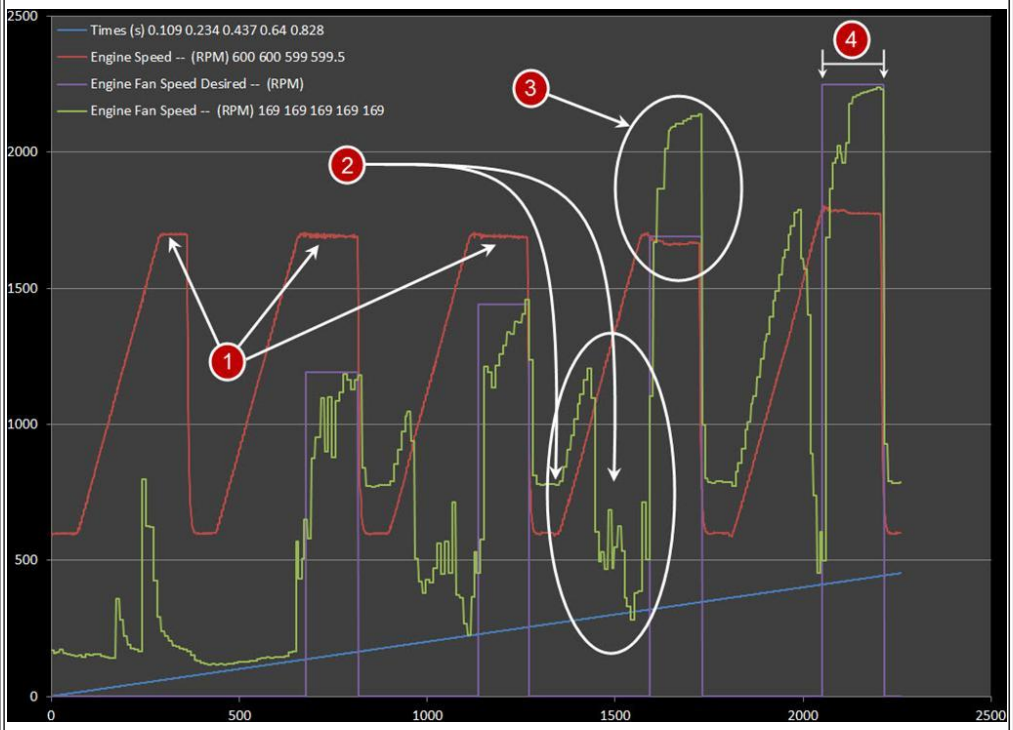

Figure 8 - Properly Working Fan Hub Assembly

- The engine ramps to the same speed for each section of the test.

- When the ECM is no longer requesting a set fan speed, the fan disengages. However, as the engine ramps to start the next section of the test, the fan speed increases. This is normal due to the viscous characteristics of the fan hub. As the fan hub stabilizes you see the fan speed then continues to decrease.

- This section of the test shows the fan speed higher than the desired fan speed. This is due to engine speed and desired speed being very similar values. The fan is then commanded ON, and the fan speed is 125% of desired. This is normal.

- This is showing the duration of the fan on command. Notice in each section the fan does not match up and perfectly align. This is due to the PWM (Pulse Width Modulated) signal that is being sent to the fan hub.
  - You can review your fan test in ServiceMaxx to see a chart view of the signals shown in this chart.
  - If you have any questions of the results, attach your fan test snapshot to your case file for review.

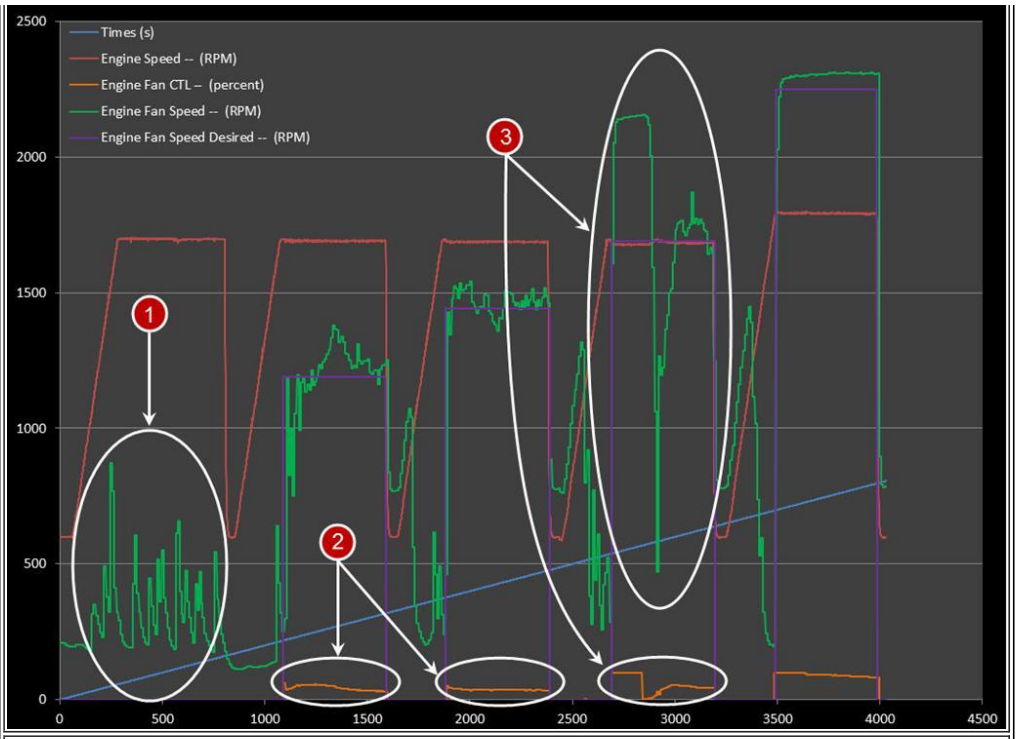

Figure 9 - Properly Working Fan Hub Assembly (Example 2)

- Again, notice the fan speed varies when the engine ramps for the first time and desired fan speed is zero. This is normal due to the viscous properties of the fan hub, and is normal operation.

- The Fan Control % has been added to this chart.

- As stated in the chart above, due to the engine speed and desired fan speed being very similar values, the ECM commands the fan on at 98.04%. However, in this test the ECM tries to change the fan speed by changing the fan control percent. The fan control percent drops near zero to attempt to achieve this. While this is a different reaction for this portion of the test then the chart above, it is still normal operation.
  - You can review your fan test in ServiceMaxx to see a chart view of the signals shown in this chart.
  - If you have any questions of the results, attach your fan test snapshot to your case file for review.

Figure 10 - Failed Fan Hub Assembly

- Engine ramps to the same speed for each section of the test.

- When the ECM is no longer requesting a set fan speed, the fan disengages. However, in this example, the viscous portion of the fan is not responding, allowing the fan speed to drop off rapidly.

- Notice the fan speed is always engaging to over 2000 RPM. The fan is turning on fully. This is not normal operation for the fan test.

- This is showing when the fan is commanded off, the fan hub speed increases with engine speed. Fan speed never drops back off, as shown in the working fan example above.
  - Note: This is one example of a failed fan. Not every fan hub will fail this way.
  - You can review your fan test in ServiceMaxx to see a chart view of the signals shown in this chart.

5. The "Test Completed, Successful" (*Figure 11*) window at the conclusion of the test does not indicate the fan has passed. It only indicates the test has been completed successfully. You will need to determine if the fan has passed or failed.

Figure 11

EPA07 MaxxForce 11 / 13

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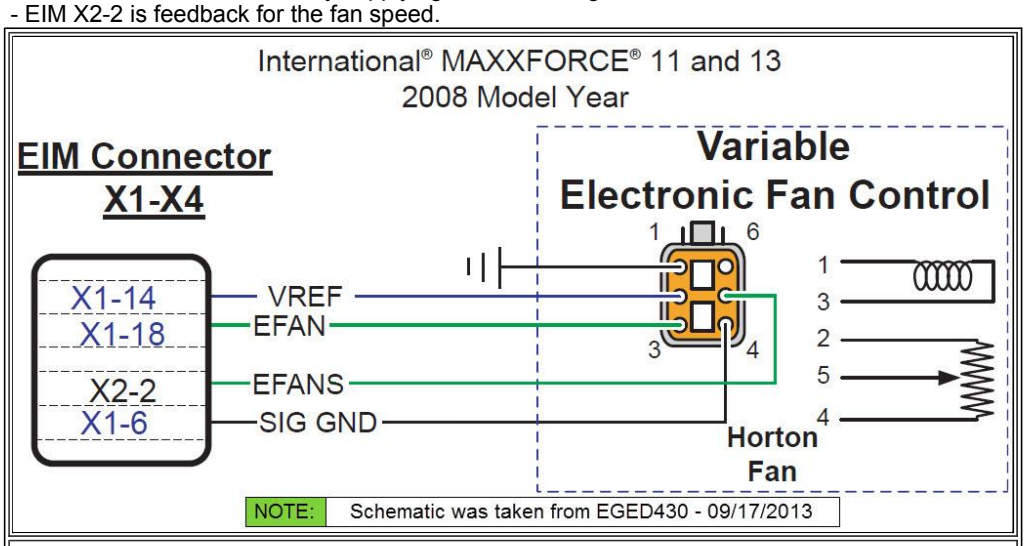
GENERAL DESCRIPTION

This fan hub is controlled by the EIM using a Pulse Width Modulated (PWM) control. 100% duty cycle indicates the fan is off. The lower the duty cycle the faster the fan operates.

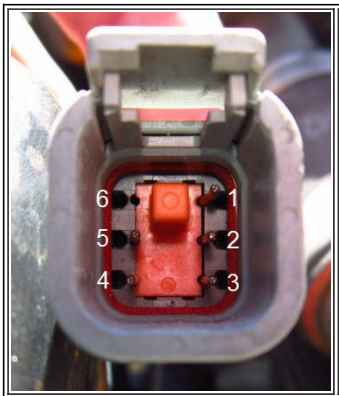
- Desired Fan Speed and Actual Fan Speed may not always match due to the fan speed to engine ratio and normal viscous delays.\
- The fan hub may seem to surge or operate erratically. This may be normal operation.
- The fan may be commanded on for a data link message from other modules, such as A/C demand or Transmission temperature.
- Any engine temperature sensor input to the ECM can cause the EIM to turn the fan on.

The default state of the fan is ON. B+ is needed to turn the fan OFF.

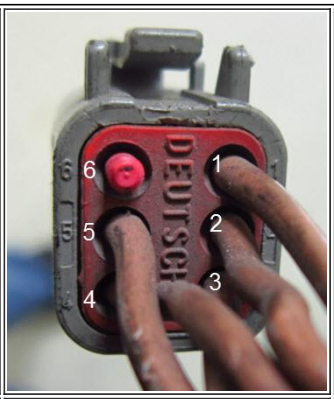
- EIM X1-18 controls the fan by supplying a B+ PWM signal.
- EIM X2-2 is feedback for the fan speed.



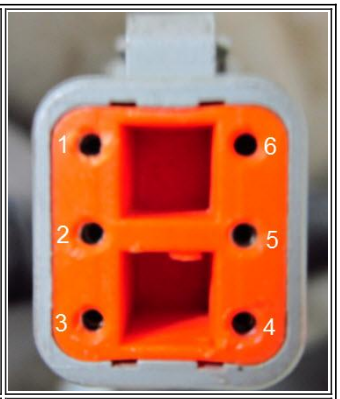
Wiring Diagram of 2007 Fan



Fan Hub Assembly Connector



EPA07 Chassis Connector 6420 Backside



EPA07 Chassis Connector 6420 Front side

INSPECTION STEPS

1. Perform the visual inspection on the harness (as shown in the EPA2010 Engine inspection above).
   - Proceed to Step 2 (below) after completing the Visual Inspection.

NOTE: The 'Engine Fan Test' is not available for the EPA07 Engine.

2. Measure resistance from Terminal 1 to Terminal 3 (1-3) Spec (6Ω to 16Ω).

3. Manually apply 12 volts to Pin 3 and Ground to Pin 1; checking fan operation. It should be disengaged. Some surging may be normal depending on the temperature of the fan hub.

4. Open a Programming session in ServiceMaxx (*Figure 12*) and view the Engine Fan tab (*Figure 13*) to monitor signals.

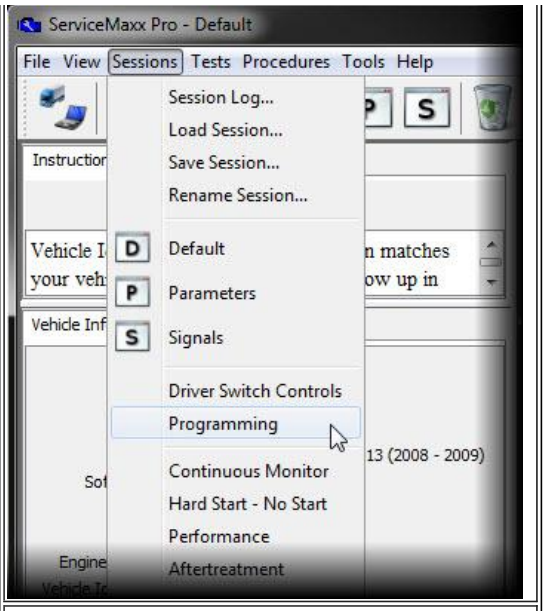


Figure 12

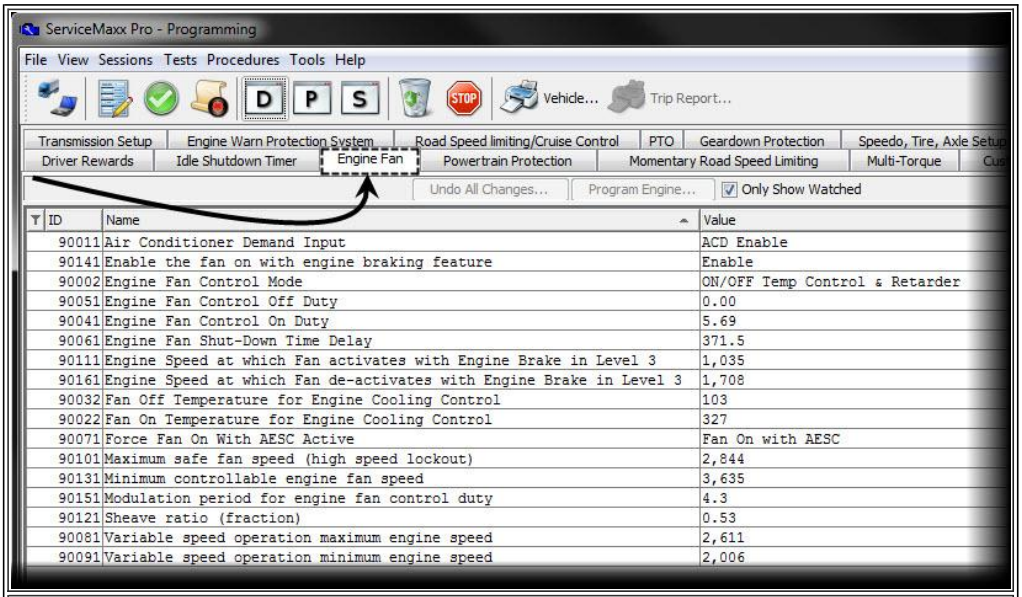


Figure 13

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Harness Re-Route Procedure:N13 and EPA10 MaxxForce 11/13

DESCRIPTION

The following Harness Re-Route Procedure is only for the N13 and 2010EPA MaxxForce 11/13.

Wiring on the Horton Stratis Fan Hub has shown to be rubbing, causing DTC codes. Re-routing of the wiring harness before a failure will prevent future failures. Re-routing after a failure will prevent multiple failures.

SYMPTOMS

The fan clutch harness can rub on the fan wiring harness bracket and cause intermittent fault codes. Some of the symptoms can include:

- Low Power
- Erratic Fan Engagement
- No Fan Engagement
- Vref 4 DTC

This repair will require rerouting the harness, inspecting the harness for abrasions, and repairing the harness if required.

SERVICE PARTS INFORMATION

Part Number	Description	Quantity
3014391C1	Strap, Tie (Cap)	1
1821643C1 or equivalent	Bolt, Flange, M6 x 25 MM	1
3667668C1 or equivalent	Strap, Lock Cable	1
3544378C1 or equivalent	Nut, Hex M6 (Prevailing Torque)	1

NOTE: The Assembly Plants installed a **NEW** lower clip in production on the following dates and will **NOT** require modifications:

• SAP (Springfield Assembly Plant)	02/28/2013
• GAP (Garland Assembly Plant)	02/28/2013
• EAP (Escobedo Assembly Plant)	03/06/2013

SERVICE PROCEDURE

WARNING: Park vehicle on hard flat surface, turn the engine off, set the parking brake, and block the wheels to prevent the vehicle from moving in both directions. Failure to do so may result in property damage, personal injury, and / or death.

WARNING: If the vehicle must be raised, do not work under the vehicle supported only by jacks. Jacks can slip or fall over, potentially resulting in property damage, personal injury, and / or death.

WARNING: Always wear safe eye protection when performing vehicle maintenance. Failure to do so may result in personal injury and / or death.

WARNING: Keep flames or sparks away from vehicle and do not smoke while servicing the vehicle's batteries. Batteries expel explosive gases. Failure to do so may result in property damage, personal injury, and / or death.

WARNING: Remove the ground cable from the negative terminal of the battery box before disconnecting any electrical components. Always connect the ground cable last. Failure to do so may result in property damage, personal injury, and / or death.

1. Park the truck on a flat surface inside the shop.
2. Shift transmission to park or neutral, set parking brake and install wheel chocks.
3. Unlatch and open hood.
4. Disconnect negative battery cable.

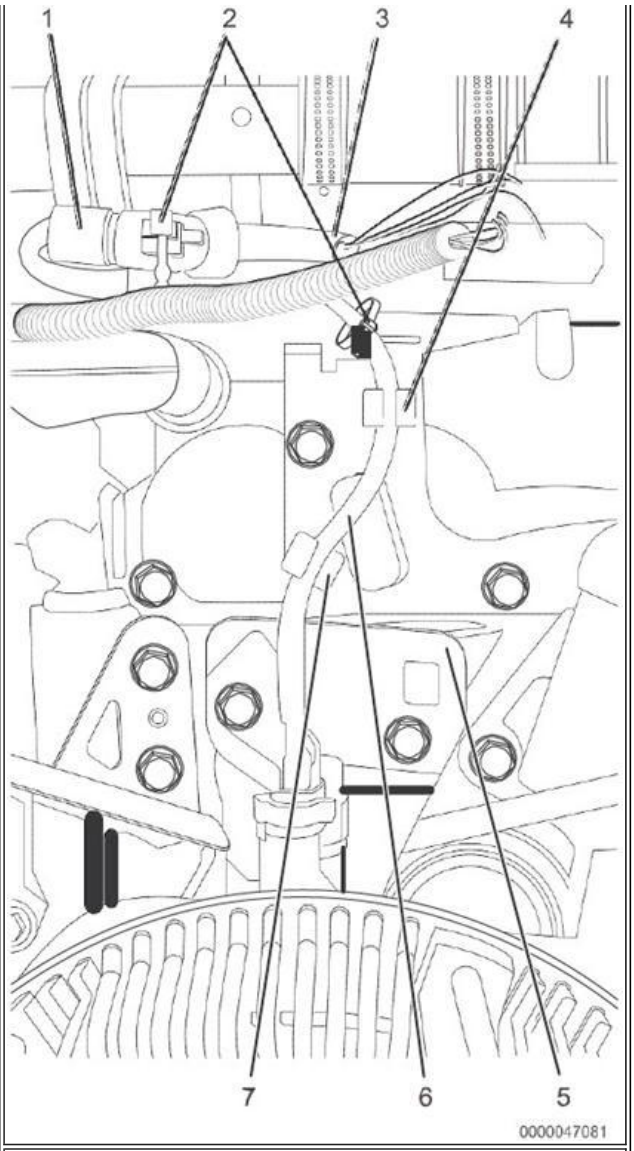

Figure 14 - Fan Clutch Harness
1. Fan clutch harness connector
2. Tie Strap (2)
3. Engine harness
4. Push pin (upper)
5. Fan clutch harness bracket
6. Fan clutch harness
7. Push pin (lower)

5. Remove two tie straps (*Figure 14, Item 2*) securing fan clutch harness (*Figure 14, Item 6*) to engine harness (*Figure 14, Item 3*) and fan clutch harness bracket (*Figure 14, Item 5*). Discard tie straps.

6. Remove harness from upper and lower push pins (*Figure 14, Items 4 and 7*).
   a. If secured with two push pins, discard lower push pin (*Figure 14, Item 7*)

7. Inspect fan clutch harness (*Figure 14, Item 6a*) for signs of wear from contact with sharp or hard surfaces of harness bracket (*Figure 14, Item 5*).
   a. If no damage is observed, proceed to Step 16.
   b. If insulation chafing is observed or if copper is exposed or damaged, proceed to Step 8.

8. Disconnect harness connector (*Figure 14, Item 1*).

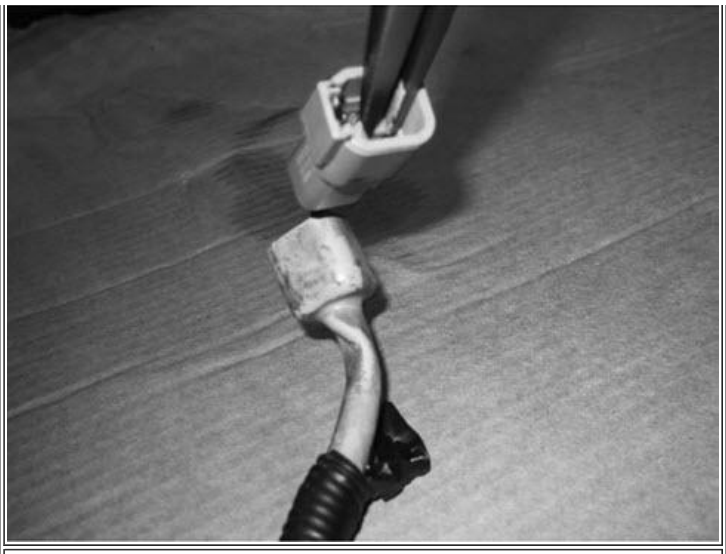

Figure 15 - Primary Lock

9. Using needle nose pliers, remove primary lock from fan clutch harness connector (*Figure 15*).

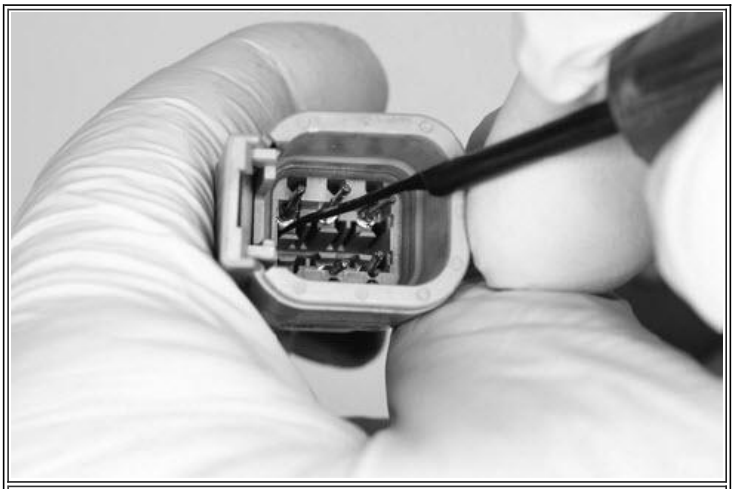

Figure 16 - Terminal Lock

NOTE:

To aid installation, label all wires before terminal removal.

10. Using pick tool or small flathead screwdriver, remove terminal wires by depressing each terminal lock while pulling corresponding wire out through rear of connector (*Figure 16*).

11. If damage to copper wiring in fan clutch harness was observed in Step 6b, repair the fan clutch harness. Follow the procedure in article: IK0800269 - Proper Wire Repair; before proceeding to Step 12.

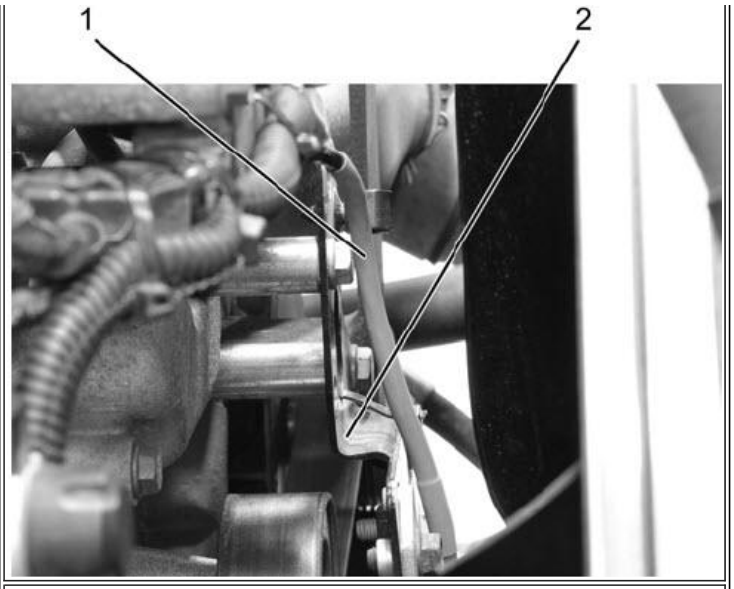

Figure 17 - Fan Clutch Harness with Heat Shrink
1. Fan clutch harness with heat shrink installed
2. Fan clutch harness bracket

NOTE:

When adding heat shrink, ensure the heat shrink does not force the harness to any pre-existing form.

12. Install self-sealing dual wall heat shrink on damaged or repaired area of harness (*Figure 17, Item 1*).

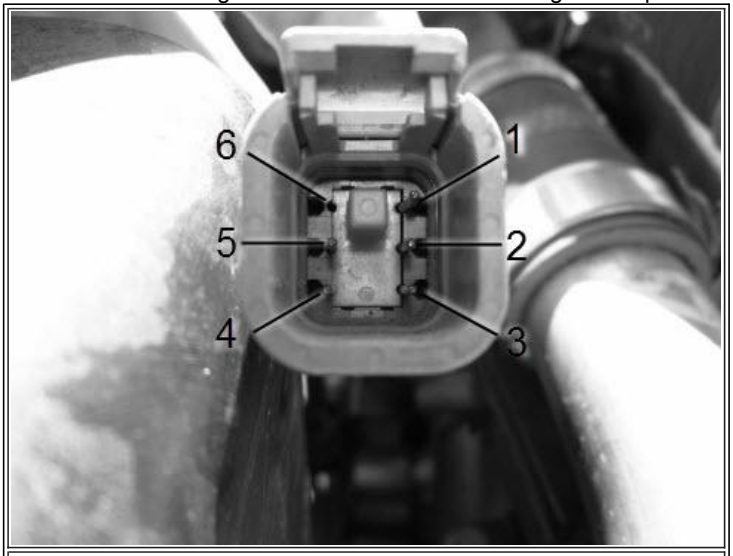

Figure 18 - Pin Location Map (Front View)
1. Brown Wire
2. Red Wire
3. Grey Wire
4. Blue Wire
5. Green Wire
6. Empty

13. Install wires into terminals in fan clutch harness connector following pin location map (*Figure 18*).

NOTE:

If wires are installed incorrectly, fan clutch may run continuously.

14. Verify wires are correctly installed and locked in place by performing pull test, then install primary lock.

15. Connect fan clutch harness connector to engine harness connector.

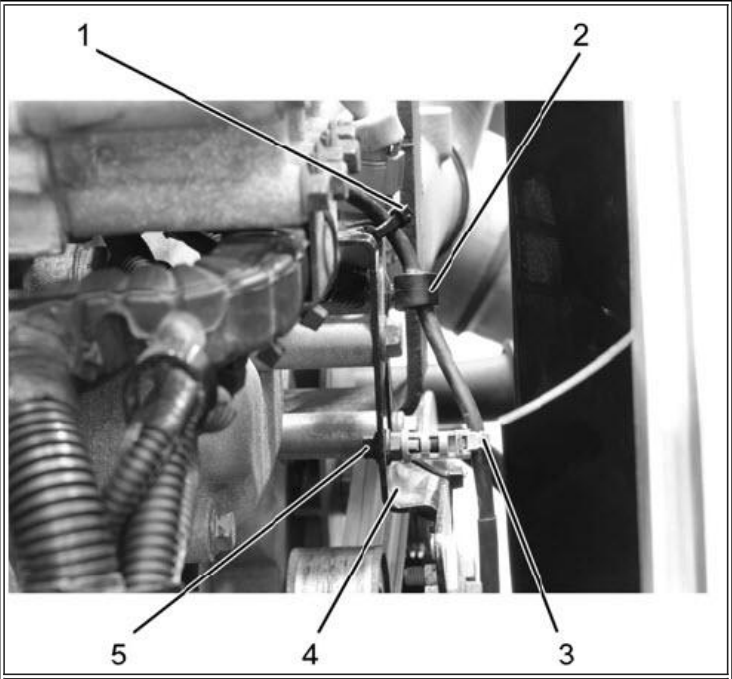

Figure 19 - Fan Clutch Harness Re-route
1. Tie strap
2. Push pin (upper)
3. Stud cap tie strap
4. Fan clutch harness bracket
5. M6 x 25 mm bolt and nut

16. Install M6 x 25 mm bolt (*Figure 19, Item 5*) into fan clutch harness bracket (*Figure 19, Item 4*), then install M6 prevailing torque nut to bolt and tighten nut to 80 lb-in (9 N•m).

17. Loosely secure fan clutch harness with stud cap tie strap (*Figure 19, Item 3*) before securing stud cap tie strap to bolt (*Figure 19, Item 5*). Tighten tie strap when cap is secured to bolt.

18. Remove slack from fan clutch harness, and install harness in upper push pin (*Figure 19, Item 2*). Verify proper clearance between fan clutch harness and fan clutch harness bracket.

NOTE:

When securing harness to bracket with tie strap, verify the harness does not contact any sharp edges.

19. Secure fan clutch harness to fan clutch harness bracket with tie strap (Figure 6, Item 1) above upper push pin location (Figure 6, Item 2).

20. Connect negative battery cable.

21. Start engine to verify proper operation and no fault codes present.

22. Close and latch hood.

23. Remove wheel chocks.

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Fan Engages Prematurely

DESCRIPTION

NOTE: The following steps for 'Fan Engages Prematurely' is only for the N13 and 2010EPA MaxxForce 11/13.

Engine fan engages before the programmed fan on temperature. If the fan is engaging from a temperature sensor, the engagement will be very consistent. Intermittent or erratic fan operation will most likely be caused by a wiring issue. Keep in mind if a temperature sensor has a wiring issue, it could read excessively high intermittently and cause erratic fan operation.

DIAGNOSTIC STEPS

1. Verify the air conditioning is not requesting the fan on.

2. Monitor the temperatures of all engine temperature sensors. The fan will engage if an engine temperature sensor is reading excessively high.

3. Monitor ECT2, if the engine cooling system is working properly, ECT2 should be approximately 20°F cooler than ECT1 under full engine load. The engine fan will engage for ECT2 at 194°F, and an EGR over temperature fault will be set when ECT2 reaches 204°F

4. If the fan is engaging from high temps on ECT2, further diagnostics on the Coolant Control Valve (CCV) and Low Temperature Radiator (LTR) will be needed. Refer to the appropriate engine diagnostic manual.

5. If further assistance is needed in troubleshooting the issue, follow IK0800374 and get a Helios capture with the engine running and the complaint present. Attach the Helios capture to your case file. This capture can be reviewed to see why the ECM is turning the fan on.

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Part Recall Information

PART RECALL INFORMATION

NOTE: The following information for the Part Recall is only for the N13 and 2010EPA MaxxForce 11/13.

ATTN: U.S. and Canadian Dealers

Recall Serial Numbers of Horton Fan Drive: PN HOR9906017

There is a recall for the all serial numbers less than or equal to 94200 of PN HOR9906017- Horton Fan Drive.

Do not use these serial number parts to service trucks. All inventory of for these serial numbers are defective and should be returned to the PDCs per the instructions below.

Serial Number of PN HOR9906017	Status
Less than or equal to 94200	Recalled- Please return part
94201 and greater	Good parts

Return Instructions:

All current inventory at the PDCs is good inventory. Please return any of the defective parts per instructions below and order new from PDCs as required.
Return Instructions:

1. Serial numbers less than or equal to 94200 of part number HOR9906017 that you have in stock should be returned to your home PDC.
   - PDC Shipping Addresses

2. Please complete the attached Return Materials Authorization (RMA) form and secure the form with your return shipment. The form must be filled out completely in order for the recall to be processed properly.
   - Send this return by itself; please do not combine it with any other type of return or any other parts coming back to the PDC.
   - You will be reimbursed for 100% of the Dnet price once the recalled product(s) are processed at the PDC.
   - The freight for these return shipments will be paid by Navistar. In order to set up your collect shipment, please contact our team at Menlo Logistics. You may contact Menlo at:
   - 1-800-323-4338 Option 4
   - Menlonavistarparts@menloworldwide.com
   - Please reference Horton Fan Drive Part Number HOR9906017 return during the call or on the subject line of the email.

The requested due date for return was January 31st 2014. If you have not yet returned affected inventory, please do so as soon as possible

For any further questions, please contact the Customer Support Center at 1-800-336-4500.

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