



# **MaxxForce<sup>®</sup> DT, 9 and 10 Turbocharger Repair**

**Study Guide  
TMT-121003**

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# Introduction

Welcome to the MaxxForce® DT, MaxxForce 9, and MaxxForce 10 Turbocharger Repair Program. The goal of this program is to train technicians in the repair of the Variable Geometry Turbocharger.

The procedures discussed in this program apply to the 2007 through 2009 model-year MaxxForce DT, 9, and 10 Diesel Engines within the serial number range 3,000,000 through 3,299,999.

## Objectives

**After completion of this course you should be able to identify the following procedures:**

- **Turbine housing installation**
- **Compressor housing cleaning**
- **and Turbo pre-lubrication**

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# Supplemental Diagnostic Procedures

## Module 1

### Overview

The diagnostic procedures covered in this program can be used to supplement Performance Diagnostics when a MaxxForce DT, 9, or 10 Engine with a variable geometry turbocharger has certain symptoms, test results, or Diagnostic Trouble Codes.

The symptoms are: low power, poor throttle response, boosts issues, exhaust back pressure issues, and smoke.

The test results that indicate a need for turbo service are a failed key-on engine-running Standard Test with exhaust back pressure codes, or a failed key-on engine-running Air Management Test with exhaust back pressure codes.

The applicable DTC's are: 2174 through 2177, and 3345 through 3348.

The following procedures will expose the turbine wheel. Do not allow any object to make contact with the turbine wheel. If the turbine wheel is damaged, a new turbocharger must be installed or engine damage will occur.



### CAUTION

**To prevent engine damage, do not damage the turbine wheel. If the turbine wheel is damaged, a new turbocharger must be installed.**

The turbocharger assembly consists of the following components: the turbine housing, heat shield, center section, compressor cover, actuator, actuator linkage, turbine band clamp, and the compressor band clamp.

## NOTE

**The order of the diagnostic steps for the MaxxForce DT, 9, and 10 engines is unique to these engines; they are different than those for 2004 through 2006 DT466 and 570 engines.**

**Always perform these diagnostics in the proper order.**

## Turbo Pre Cycle Test

The first step in this diagnostic procedure is to perform the Turbocharger Pre-Cycle Test.

Observe the turbo actuator linkage while cycling the key-switch On. The linkage should complete a full sweep at Key-On without partial or erratic movement. Complete this step five times.

If the turbo passes this test, the turbocharger is operating properly and no further turbocharger diagnostic action is required. If the turbo does not pass this test, perform the linkage movement test.

## Linkage Movement Test

Start the linkage movement test by turning the ignition switch to OFF and wait 15 seconds for the ECM to power off.

Now push the linkage by hand to the opposite end of travel and release it.



The linkage should move smoothly with spring resistance, then return to its original position. The linkage does not need to bounce when it returns to the stop to pass this test.

***“The linkage does not need to bounce when it returns to the stop to pass this test.”***

If the turbo passes the linkage test, perform the Circuit Diagnostic Test.

If the linkage is stuck, drags, or does not return to its starting position, perform the mechanical diagnostics.

## **Circuit Diagnostics Test**

Complete the circuit diagnostics per the appropriate Diagnostic Repair Manual on ISIS. Then verify the repair by repeating the supplemental diagnostic procedures.

## **Mechanical Diagnostics**

### **Overview**

There are two types of actuators used on this turbo; serviceable and non-serviceable. Each style requires unique diagnostic steps.

***“Each style of actuator requires unique diagnostic steps.”***

The non-serviceable actuator has the linkage ball joint secured with an e-clip. Do not attempt to remove this type of actuator from the turbo.

However, on the serviceable type, the actuator and linkage can be removed as a set by removing the 4mm Allen head screw at the turbo housing end of the linkage.

### **Serviceable Actuators**

With the turbo still on the engine, remove the 4mm Allen-head screw and disconnect the link from the pivot shaft.

***“Push the linkage by hand to the opposite end of travel and release it.”***

Push the linkage by hand to the opposite end of travel and release it.

Then, attempt to rotate the pivot shaft in the turbine housing.

At this point in the diagnostic steps, either the linkage and actuator, or the pivot shaft will have rough movement.

If the linkage arm is stuck or dragging, but the pivot arm moves freely, replace the actuator and linkage.

However, if the arm moves smoothly with spring resistance, but the pivot shaft is stuck or resists movement, replace the turbine housing.

### **Non-Serviceable Actuators**

On turbo's with non-serviceable actuators, the center section and compressor assembly must be removed

from the turbine housing to diagnose the mechanical condition.

To start, remove the turbocharger from the engine using instructions on removal from the appropriate Engine Service Manual on ISIS.

After removal, set the turbocharger assembly on a clean workbench with the turbine side down.

Next, remove the turbine housing heat shield.

Make a paint mark on the center housing, the v-band clamp, and the actuator flange to mark the orientation of these components.

Now remove the V-band clamp.

Tap the turbine housing with a rubber mallet to unseat it from the center section. Then remove the compressor assembly from the turbine housing.

Move the center section to a safe position on a work bench and install a protective cap over the turbine wheel.

With the two sections of the turbocharger separated you can now determine which section has failed.

***“Tap the turbine housing with a rubber mallet to unseat it from the center section.”***

To do this, push the actuator linkage by hand to the opposite end of travel and release it.

If the linkage is stuck, drags, or does not return to its starting position, the problem is in the pivot shaft, linkage, or actuator. In this case the entire turbo assembly must be replaced.

If the linkage moves smoothly with spring resistance and returns to its original position, the problem is in the turbine housing. The remanufactured turbine housing kit must be installed to correct this problem.

This concludes Supplemental Diagnostic Procedures.

## NOTES

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# Installing the Remanufactured Turbine Housing

## Module 2

Let's identify the internal components before we install the remanufactured turbine housing.

The turbine housing contains the vane lever, Torx® screw, and the dowel pin hole.

The unison ring components are the unison ring, the main pivot block, and on the other side, the small pivot blocks.

Place the remanufactured turbine housing on a bench and center the vane levers.

The Unison ring will only fit in the housing one way. To install the ring, line up the main pivot block with the Torx® screw opposite the exhaust flange.

Then, install the unison ring using a small screwdriver or pick to line up the vane levers with the small pivot blocks. The ring will drop in place when all the small pivot blocks are lined up with the vane levers.



### CAUTION

**To prevent engine damage, the unison ring must not be rotated too far clockwise during assembly. Over rotation in a clockwise direction will cause the unison ring to detach from the vanes.**

Test the movement of the vane levers and the unison ring to make sure they move freely. Do not over rotate.

Position the main pivot block perpendicular to the edge of turbine housing. This positions the block to line up with the fork in the actuator flange.

Then secure the lever to the actuator mounting boss with a tie strap. This points the open slot of the fork to the outer edge of the housing.



## CAUTION

**To prevent turbocharger damage, do not damage the dowel pin in the center housing/actuator flange. If dowel pin is damaged, a new turbocharger must be installed.**

If the dowel pin in the actuator flange is damaged, a new turbocharger must be installed.

Carefully install the center housing onto the turbine housing by lowering the center housing straight down while engaging the pivot fork with the pivot block.

Align the paint mark on the center housing flange with the bolt boss on the new turbine housing.

Rotate the housing as necessary to align the dowel pin properly with the dowel pin hole and then make sure the actuator flange is seated tightly and evenly on the turbine housing.

Stop here and check the actuator for proper movement. If the unison ring is



not connected to the vanes, discovering it now will save time.

Install the V-band clamp in the correct location and orientation.

Tighten the clamp nut to the proper torque.

Remove the tie strap holding the lever. Position the turbocharger as it is when mounted on the engine. Push the actuator linkage to the opposite end of travel and release it. The linkage should move smoothly with spring-like action and return to the original position.

***“The linkage should move smoothly with spring-like action and return to the original position.”***

Spin the compressor wheel to confirm the turbine wheel does not rub against the housing.

Install the turbocharger heat shield and torque the screws to the proper torque.

This concludes Installing the Remanufactured Turbine Housing.

[illegible]

# Compressor Cover Cleaning

## Module 3

Set the turbo on a clean work surface with the compressor housing facing upward.

Use a paint stick to mark the compressor cover location, and then remove the compressor V-band clamp.

The following procedures will expose the aluminum compressor wheel. Do not allow any object to make contact with the compressor wheel. If the compressor wheel is damaged, a new turbocharger must be installed or engine damage will occur.

Remove the compressor cover squarely so the compressor wheel does not contact the cover. If the wheel contacts the housing, the blades may be damaged. Do not use a damaged turbocharger due to the possibility of failure.

Now remove the cover and discard the compressor cover o-ring.

Clean the compressor cover with a good solvent base cleaner, then rinse with water and dry with compressed air.



### CAUTION

**To prevent engine damage, do not damage the compressor wheel. If the compressor wheel is damaged, a new turbocharger must be installed.**



### CAUTION

**Do not scrape oil from the aluminum compressor housing with a hard tool, due to the risk of gouging and damage of the housing. If scraping is needed to remove caked oil deposits, use a wood tool to loosen and remove the deposits.**



## CAUTION

**If the diffuser comes out during these procedures, reinstall it. Do not damage the seal behind the diffuser. If the seal is damaged, or it becomes damaged during the cleaning procedure, the entire turbo must be replaced.**

Some turbochargers use a compressor cover diffuser. The diffuser does not need to be removed for cleaning.

Clean the iron face of the bearing housing with a good solvent base cleaner. A razor blade can be used to scrape the coked oil from the face, but use care to ensure that the compressor wheel and the face are not damaged. After all the oil has been removed, clean the remaining residue with water and dry thoroughly before installation.

Lightly grease the new compressor o-ring and install it.

Install the cover squarely using the same tapping method as the one used during removal to ensure that the compressor cover is properly seated to the flange. Make sure the paint marks line up.

Install the new V-band clamp on the turbocharger using a tightening and tapping method on the clamp. This assures that the clamp is seated before it is torqued. Tighten the clamp to the proper torque given in the work instructions.

Remove the turbo supply connector from the oil filter module. Clean the screen in the connector. Then,

reinstall it with a new o-ring from the turbocharger mounting kit.

Clean the associated air intake system components, following the steps in the service manual on ISIS.

This concludes Compressor Cleaning.

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# Turbocharger Pre-lubrication

## Module 4

The turbo must be pre-lubed before installation on the engine.

Pre-lube the turbocharger by adding oil to the supply port while rotating the turbine shaft. Continue to add oil until it runs out of the drain port.

Install the turbocharger on the engine using components in the kit. For the installation procedures, see the turbocharger section of the appropriate Engine Service Manual on ISIS.

***“Pre-lube the turbocharger by adding oil to the supply port while rotating the turbine shaft.”***

[illegible]



## **Conclusion**

This concludes the MaxxForce DT, 9, and 10 turbocharger repair program. You can now take the post test.

Thanks for your participation.

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