



Technical Note

For Engines Produced in Accordance with ASTM F2239

Title: **Differential Pressure Compression Check**

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1.0 MAINTENANCE SCHEDULE

Regularly scheduled maintenance for the cylinders consists of compression checks and cylinder removal and replacement, and valve check.

1. Perform compression checks at 100 hours of engine operation and annual inspection intervals. A compression check is also recommended any time loss of power, increasing oil consumption, hard starting, or other evidence of unexplained abnormal operation is encountered.
2. Record the results in the engine maintenance logs to determine progressive wear trends.

2.0 DIFFERENTIAL COMPRESSION TEST EQUIPMENT SPECIFICATIONS

Differential compression testers acceptable for use with the TITAN[®] engines incorporate a 0.250 in. long restrictor orifice with a 0.040 inch ID orifice and 60° entrance angle.

1. Regularly clean and check the differential compression equipment for accuracy.

Note: Ensure all gages are accurately calibrated within the gage manufacturer's calibration specifications.

2. Check equipment for accuracy with the shutoff valve closed and regulated pressure at 80 psi. The cylinder pressure gage must indicate 80 ± 2 psi while maintaining the regulated pressure at 80 psi for at least 5 seconds.
3. The apparatus in seen in Figure 1 is an example of a typical differential compression measuring device that must be employed for this procedure.

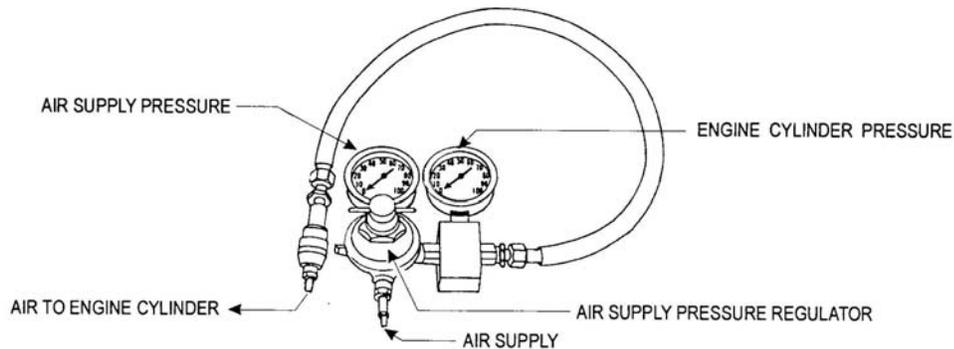


Figure 1: Typical Differential Compression – Measuring Device

3.0 RECOMMENDATIONS FOR PERFORMING THE DIFFERENTIAL COMPRESSION CHECK

Note: The following recommendations outline the principles involved and are intended to supplement the equipment manufacturer’s instructions. Read and follow the equipment manufacturer’s instructions for the correct operation of specific testing equipment.



Warning

Take all necessary precautions against accidental firing or rotation of the engine.

1. Run the engine to normal cylinder head and oil temperatures immediately preceding the compression check.
2. Ensure the magneto switches are operating correctly before shutdown following the airframe manufacturer’s operating instructions.
3. Shut down the engine by closing the throttle and placing the mixture control in “Idle Cut-Off”. Be sure the magnetos are properly grounded.
4. Perform the compression test as soon as possible after engine shutdown to provide uniform lubrication of the cylinder walls and rings.
5. Verify that the magneto switches and fuel supply switches are all in the “OFF” position.
6. Verify the security of “P” lead connections.
7. Ensure that the throttle is in the closed position and that the mixture control is in the “IDLE-CUT-OFF” position.



8. Set aircraft breaks and chock wheels.
9. Disconnect all spark plug leads.



Caution

Leads and spark plugs are very hot. Take precautions to avoid burns.

10. Remove the most accessible spark plug from each cylinder.
11. Verify that the air valve on the test equipment is in the closed position.
12. Connect the compression tester to a clean source of compressed air at approximately 100 to 120 psi.
13. Adjust the regulator of the compression tester to obtain 80 psi on the regulated pressure gage. The cylinder pressure gage must also read 80 ± 2 psi for at least 5 seconds.



Warning

Severe bodily injury or death may result if struck by a rotating propeller. Always remain clear of the propeller's blade arc. Ensure the security of the propeller blade before applying compressed air to the combustion chamber. Use heavy gloves or rags to protect the hands while holding the propeller blade. Before attaching the compression tester, check the air supply regulator to be sure that air pressure to the engine cylinder is not in excess of 80 psi air pressure or the cylinder can cause the propeller to turn.

14. Rotate the propeller in the direction of rotation until the piston is coming up on its compression stroke.
15. Install an adapter in the spark plug bushing.
16. Verify that the compression tester's air valve is in the "OFF" position and connect the compression tester's quick disconnect adapter to the spark plug cylinder adapter.
17. Secure the propeller and slowly open the air valve and pressurize the cylinder with 15 to 20 psi. To assure that the piston rings are seated, one person should move the propeller back and forth slightly with a rocking motion while air pressure is introduced.
18. Rotate the propeller against this pressure until the piston reaches Top Dead Center (TDC). A sudden decrease in the force required to move the propeller indicates TDC.



Rotating the propeller past TDC will tend to rotate the propeller in the direction of rotation.

Note: Back up at least one-half engine revolution and start over if the piston is rotated past TDC. This backing up is necessary to eliminate the effect of backlash in the valve operating mechanism and to keep piston rings seated on the lower ring lands.

19. Secure the propeller blade and continue to open the air valve completely.



Warning

The combustion chamber will contain sufficient air pressure to rotate forcefully the propeller if it is not exactly on TDC. Always remain clear of the propellers blade arc. Severe bodily injury or death may result if struck by a rotating propeller.

20. Check the regulated pressure and adjust to 80 psi as necessary.

21. Observe the pressure indicated on the cylinder pressure gage. The difference between this pressure and the pressure indicated on the regulator pressure gage is the amount of leakage through the cylinder. The maximum allowable leakage is 25% of the 80 psi regulated pressure or a reading of 60/80.

(a) A pressure reading of 70 psi or greater is satisfactory.

(b) A pressure reading of 61 psi to 69 psi indicates possible wear and subsequent compression checks should be made at 100-hour intervals to monitor wear

Note: Make log book entry to insure that compression check is made at the next 100-hour interval.

(c) If the pressure reading is 60 psi or lower, or if the monitored pressure decreases at a rapid rate, a defective cylinder is indicated and removal or overhaul should be considered.

(d) Low pressure in a single cylinder is indicative of air passing by the piston or by the valve.

(e) Air discharged from the exhaust system indicates leakage at the intake valve.

(f) Air discharged from the exhaust system indicates leakage at the exhaust valve.

22. Pressure readings for all cylinders should be nearly equal. A difference of 5 psi is satisfactory. A difference of 6 to 15 psi indicates a need for further investigation.



Note: If the pressure difference does not exceed 15 psi, it may not be necessary to remove the cylinder. A valve can reseat itself and regain acceptable compression. Unless the psi differential exceeds 15 or unless there are indications of other conditions, recheck the compression within the next 10 hours of operation.

23. If low compression results are obtained on a cylinder, rotate the engine through several revolutions with the starter or restart and operate the engine at least 3 minutes. This will allow the rings to seal with oil. Recheck the compression on the affected cylinder.
24. If low compression still results on a cylinder, listen for airflow at the exhaust or intake ports. Airflow at either location indicates a poor seal at the valve face to valve seat. This may be corrected by “staking” the valves.
 - (a) Rotate the propeller so the piston will not be at TDC to prevent the valve from striking the top of the piston during the “staking” operation.

**Caution**

Staking at TDC will result in damage to the piston and / or valve.

- (b) Remove the rocker box cover and place a fiber drift on the rocker arm directly over the valve stem.
 - (c) Tap the drift several times with a 1 to 2 lb. hammer to dislodge any foreign material between the valve face and seat.
 - (d) Rotate the engine several revolutions to reseat the valves in the normal manner.
 - (e) Recheck compression.
25. If low compression still results, check spark plug port seals with a soap solution to determine if the Heli-coil insert requires replacement.
 26. Check cylinder head and barrel with a soap solution for cracks, Cylinders with cracks must be replaced.
 27. Inspect the spark plugs removed from cylinders with low compression.
 28. Visually inspect for evidence of cylinder malfunction.
 29. Perform a boroscopic inspection of the combustion chamber and top of the piston for evidence of damage.



30. If indicated by testing or inspection, repair and/or replace cylinder components in accordance with the applicable overhaul manual procedures.
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