

9.3 Engine Pre-Test Measurements and Inspections-Measure and inspect the engine components prior to each test. Information on component reusability and assembly is found, herein, and in the P/N 1Y540 Service Manual¹⁰. Part numbers for replacement parts are also given in this manual.

9.3.1 Crankshaft Angles-Record the crankshaft angles at the specified exhaust and intake cam lift before each test and show a full lift profile before each reference test. See 1Y540 Service Manual.

9.3.2 Cylinder Head and Specification for Valves-Use a new or reconditioned head for each test. Ensure that measurements after reconditioning are within specification requirements as shown in [Fig. A5.1](#). Also measure valve head projection and ensure that it meets specification requirements. Record the measurement. Conduct non-reference tests using cylinder head/jug assemblies that, during their laboratory histories, had been subjected to at least one complete and acceptable calibration test.

9.3.2.1 Valve Guide Bushings-The valve guide bushings have threaded bores and are machined to close fit tolerances to the valve stem. See [A5.2](#) for the reconditioning method. Use a short arbor and a long stone for valve guide honing, the final valve guide sizing operation.

9.3.2.2 Fuel Nozzle-Remove the fuel nozzle from the cylinder head before commencing reconditioning. Use either Service Kit P/N 6V7020 (see [Annex A18](#)) to pull the nozzle or a suitable adapter that is threaded on the nozzle head. Replace the P/N 9L9098 seal and P/N 2W6163 (see [Annex A18](#)) fiber washer as needed. Inspect the nozzle tip for carbon build-up and deformed surfaces. Replace questionable nozzles. Check the valve opening pressure (V.O.P.) before each test using any commercially available nozzle testing tool or a P/N 5P4150 (see [Annex A18](#)) nozzle tester group. A V.O.P. equal to or greater than 10.34 MPa is satisfactory. Remove the P/N 2W1230 screw (see [Annex A18](#)) only during this check. See the Caterpillar Service Manual for additional information. Fuel injection housing bolts may be standardized to the hex head type of Grade 8 quality.

9.3.3 Piston and Rings-Use a new piston (P/N 1Y0727) and new rings (P/N 1Y0728) for each test, and record measurements before and after each test (see [Annex A18](#) for all P/Ns). The measurements before the test ensure that good parts are evaluated and are compared to measurements after the test to determine the amount of wear. **Record piston and ring identification codes in accordance with 1K/1N Parts Identification Document available on the TMC website.**

9.3.3.1 Before the test clean all three rings using pentane and a lint-free cotton cloth.

9.3.3.2 Measure the ring side clearances and ring end gaps of all three rings in accordance with the procedure in [Fig. A5.2](#). For Keystone ring side clearance measurements, confine the ring in a dedicated slotted liner (see [Fig. A5.2](#)) or a ring gage 137.16 mm in size (see [Fig. A5.2](#)). Obtain the average side clearances with four feeler gages of equal width and thickness increments of 0.01 mm at 90° spacing around the piston. Similarly, measure the rectangular side clearance.

9.3.3.3 Measure minimum side clearance in accordance with directions in ASTM Deposit Rating Manual 20. Measurement may also be made using taper gages.

9.3.4 Cylinder Liner-Use a 1Y3998 liner for 1K and 1N testing. No surface finish measurement is required for 1Y3998 liners. Remove the protective grease with mineral spirits, then clean the liner bore with a hot water/detergent solution (see [7.5](#)) and rinse with hot water. **Record liner identification codes in accordance with 1K/1N Parts Identification Document available on the TMC website.**

9.3.4.1 Measure the surface finish and record the results on the Liner Measurements form of the test report. Oil the liner bore with Exxon-Mobil EF-411 oil.

9.3.4.2 Assemble the cylinder liner, block and head, torquing the stud nuts as shown in [Fig. A5.5](#).

9.3.4.3 Measure the liner with a dial bore gage to ensure that the out-of-round and taper conditions are within specified tolerances measured at five intervals as shown in [Fig. A5.3](#) and [Fig. A5.5](#).

9.3.4.4 Torquing increases the cylinder liner outside diameter at the o-flange necessitating machining of the 1Y544 cylinder block. Machine the block inside diameter as shown in [Fig. A5.6](#).