



Test Monitoring Center

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1M-PC Information Letter No. 03-1

Sequence No. 9

November 21, 2003

ASTM consensus has not yet been obtained on this information letter. An appropriate ASTM ballot will be issued in order to achieve such consensus.

TO: Single Cylinder Diesel Mailing List

SUBJECT: Report Package Revision and Removal of Report Package from Test Method
Editorial Changes

The Single Cylinder Surveillance Panel has approved several changes to Test Method D 6618 (1M-PC). The changes below are effective immediately.

The report forms and data dictionary (Annexes A2 and A3) are being removed from the test method. Instead, the test method will refer the reader to the TMC website for the most recent report package.

Several editorial changes are also being made. The updated sections of the test method are attached.

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Attachment

c: ftp://ftp.astmtmc.cmu.edu/docs/diesel/scote/procedure_and_ils/1mpc/il03-01.pdf

Distribution: Email

(Revises Test Method D 6618-00)

- Section 7.1 *Fuel*—The specified test fuel is: Haltermann Products 0.4 % Sulfur Diesel Test Fuel.^{13,19} All fuel shall meet the fuel specifications as shown in Annex A4 and shall be referenced through the ASTM TMC. Approximately 1137 L (300 gal) are required for each test. Include the fuel analysis for the last batch used for the test in the final report. The fuel supplier provides the analysis. If more than one batch is used, note this in the comments section of the Unscheduled Downtime & Maintenance Summary form of the test report with the appropriate percentages of run time.
- Section 7.4.1 *Solvent*—Use mineral spirits meeting the requirements of Specification D 235, Type II, Class C anywhere mineral spirits are called for.
- Section 7.4.2 *Dispersant Engine Cleaner*—Use Dispersant Engine Cleaner^{13,21} (order by this name) in solution with mineral spirits where called for in the engine flush procedure.
- Section 9.10.2 *For First Stage Flushing with mineral spirits*^{13, 23}:
- Section 9.10.2.3 Remove breather assembly 1Y2592 (top portion of side cover assembly) and clean separately by soaking in mineral spirits. Air-dry.
- Section 9.10.2.5 Place the flushing pump inlet line in a clean supply tank (sample location illustrated in Fig. A1.13) containing 7.6 L (2 gal) of mineral spirits. Open the crankcase drain, start the flushing pump, and run this flush material through the engine into a drain pan one time. Do not recirculate.
- Section 9.10.3 *For Second Stage Flushing and Recirculating with Cleaning Mixture*—Mix 1.9 L (1/2 gal) of dispersant engine cleaner (see Footnote 19) with 5.7 L (1 1/2 gal) of mineral spirits to obtain 7.6 L (2 gal) of flushing solution. Add this mixture to the crankcase.
- Section 9.10.4 *Using mineral spirits* —Repeat 9.10.2.4 through 9.10.2.6 until the mineral spirits discharge is clean. (Three to four flushes with mineral spirits are usually sufficient to remove all traces of the flushing solution from the engine.) Drain the mineral spirits from the crankcase, governor housing, oil filter, and oil cooler.
- Section 9.10.5.3 Connect the flushing pump outlet to the engine oil cooler drain location. Start the flushing pump, and force any mineral spirits in the system out the crankcase drain. After the mineral spirits have been forced out of the system, connect the inlet line of the flushing pump to the crankcase drain. Install the dummy piston (reference service manual SENR2074^{13,16}) and the assembled cylinder liner and block assembly or the alignment fixture specified in Fig. A1.19. Re-install the oil filler spout and pipe plug in the modified governor housing cover (see Fig. A1.15).

- Section 9.11.1 Spray with mineral spirits and dry with compressed air. (Warning—High concentration of vapors should be avoided. Use vented hood, face shield, gloves (same precautions as for gasoline).)
- Section 9.12.1.5 Thoroughly clean the reamed valve guide bushing with mineral spirits or hot water, detergent, and stiff brush.
- Section 9.14.1 *Initial Cylinder Liner Measurements*—Assemble the cylinder head, block, and liner with specified stud nut torque. Measure the 1Y3590 liner in both transverse and longitudinal directions relative to the crankshaft to ensure that the out-of-round and taper conditions are within specified tolerances. Take measurements from underneath at 25 mm (1 in.) intervals for 23 cm (9 in.), starting 25 mm (1 in.) from the top of the liner. Determine the out-of-round condition for each 25 mm (1 in.) interval: It shall not exceed 0.038 mm (0.0015 in.). The taper measurement compares the diameters from 25 mm (1 in.) to 23 cm (9 in.) for both transverse and longitudinal positions; the maximum difference shall not exceed 0.051 mm (0.0020 in.). Measure liner surface finish. Record all measurements on the Liner Measurements form of the test report.
- Section 9.14.2 *Post Test Wear Measurements for Liner Step Wear*—At the end of the test, determine the liner wear step in both transverse and longitudinal directions by using a surface profile measurement. Remove deposits on the liner above the piston ring travel. Take transverse and longitudinal measurements at the wear step location approximately 20 to 25 mm (0.75 to 1 in.) from the top of the liner at four locations. Record the measurements as liner wear on the Liner Measurements form of the test report .
- Section 9.14.3 *Ring End Gap*—Determine wear on the rings by measuring the gap width before and after the test with the ring confined in a 13.02 cm (5.125 in.) inside diameter ring gage. Remove all deposits from the end of the rings after the deposit inspection and before the final ring gap measurements. Record the difference between these two measurements as ring gap increase or wear on the Ring Measurements form of the test report.
- Section 9.14.4.1 Before and after the test, measure the piston ring side clearance of all rings. Make the after-test measurements before the rings are removed from the piston and with the accumulated deposits in place. Record all measurements on the Ring Measurements form of the test report. Measure side clearances as follows:
- (1) Insert thickness (feeler) gage underneath the piston ring.
 - (2) Slide gage around the piston while holding ring in gently at the point of measurement to determine the minimum and maximum clearance to the nearest 0.013 mm (0.0005 in.)
 - (3) Use of gage requires firm but smooth horizontal pull. If gage movement is not firm or requires undue stress to move it, adjust the thickness up or down as required.
 - (4) Repeat 9.14.4.1 (1), (2), and (3), being careful not to force ring or gage against any deposit build up.

Section 9.14.4.2 Calculate ring side clearance loss from:

$$\text{Max}_{\text{before}} - \text{Max}_{\text{after}} \quad \text{or} \quad \text{Min}_{\text{before}} - \text{Min}_{\text{after}} \quad (1)$$

Whichever is greater. Report zero in cases where loss of side clearance is less than zero.

Section 9.14.4.3 Side clearance specification for new parts is: (1) Top ring, 0.185 mm maximum (0.0073 in.) to 0.114 mm minimum (0.0045 in.) (2) Two intermediate rings, 0.122 mm maximum (0.0048 in.) to 0.076 mm minimum (0.0030 in.) (3) Oil ring, 0.076 mm maximum (0.0030 in.) to 0.038 mm minimum (0.0015 in.)

Section 10.1 *Engine Break-in*—Weigh in 4.8 ± 0.11 kg (10.6 ± 0.25 lb) of oil. For non-reference tests, take a 240 mL (8 oz) sample of the oil for use in the 40°C initial viscosity measurement reported on the Operational Summary form of the test report. Perform break-in per Table 6. When the cooldown is complete and the engine is still hot, drain the crankcase, governor housing, oil cooler, and lubricating oil filter housing for 30 min. Use the drain cocks provided.

Section 10.5.2.4 Document instances of missing or bad test data in the comments section of the Unscheduled Downtime & Maintenance Summary form of the test report. If a test has greater than 4-h data acquisition on any controlled parameter, the test is operationally invalid. Note any alternate method of data acquisition in the comment section of the Unscheduled Downtime & Maintenance Summary form of the test report.

Section 10.9.1 For all occurrences, report the test hours and length of time down on the Unscheduled Downtime & Maintenance Summary. If the cool-down procedure is not used, identify the shutdown as an emergency shutdown. In the event of an emergency shutdown, maintain a 2-h off-test condition for engine cooling before restarting. Maximum total allowable downtime for the duration of the test is 125 h. Minimize the total downtime of the test. To protect deposits, rotate the engine to top dead center of the compression stroke during shutdowns.

Section 10.11 *Brake Specific Oil Consumption (BSOC) Calculation*—Calculate the BSOC for the test as follows:

$$\frac{(\text{sum of adds}) - (\text{sum of drains})}{120 \times \text{average engine power}}$$

BSOC greater than 1.216 g/kW-h (0.002 lb/bhp-h) will invalidate the test. Plot each 12-h oil consumption point and include as the Oil Consumption Plot form of the test report.

Section 11.2 *Inspection*—Inspect the piston and liner, and photograph the piston at the end of the test. Make a complete written description of the inspection. Remove all rings from the piston before it is photographed. Determine and record cylinder liner and piston ring wear. Inspect the piston, rings, and liner in accordance with the report forms shown in CRC Manual #20^{13,26} with the following exceptions:

Section 12.5.3 *Special Circumstances*—A laboratory not running a 1M-PC test for twelve months from the start of the last test is considered a new laboratory. Under special circumstances (that is, extended downtime due to industry-wide parts shortage or fuel outages) the TMC may extend the lapsed time requirement. Annotate non-reference tests conducted during an extended time allowance in the comments section of the Unscheduled Downtime & Maintenance Summary form of the test report.

Section 12.6.1 A calibration test on a reference oil assigned by the TMC is required after no more than 14 test starts or after six months from the start date of the last acceptable calibration test (whichever comes first). The 1M-PC calibration run is not counted as one of the 14 test starts; however, *all* other test starts are counted. The TMC is permitted to move up or extend reference tests to enhance reference test program design and test severity monitoring. If a reference test calibration period is extended beyond the normal duration, note this fact in the comments section of the Unscheduled Downtime & Maintenance Summary form of the test report for all subsequent non-reference tests. Also attach written confirmation from the TMC to the report.

Section 12.11.3.1 *Severity Adjustment Calculation Example:*

Applicable Test Targets: Mean = 40.8; Standard Deviation = 15.9; TGF = 55 Z1=0.897
Standard Test Result: Y2 = (TGF - Mean)/STD = 0.893
Alarm Limit: 0.653
EWMA: Z2 = 0.2Y2 + 0.8Z1 = 0.896 (4)

Since 0.896 > 0.653, an SA shall be applied: SA = -1 * EWMA* STD (in the above example, SA = -14).

For TGF, the SA is rounded to a whole percent; for WTD, it is rounded to one decimal place. Enter this number in the appropriate Lab Severity Adjustment box and add it to the Unadjusted Lab Rating on the Test Report Summary form of the test report. An SA will remain in effect until the next calibration test. At that time, calculate a new EWMA and SA.

Section 12.12.1 *Report Forms*— For reference oil tests, the standardized report forms and data dictionary for reporting test results and for summarizing the operational data are required. All report forms making up the 1M-PC final report are available at the TMC website (<http://www.astmtmc.cmu.edu>). For calibration tests, attach the control chart summary page sent to the lab from the TMC to the test report. An example of this and other forms are shown in Fig. X2.1 of Appendix X2 and Fig. X3.1 of Appendix X3.

Section 12.12.2 *Deviation Percent and Offset Percent Calculation*— Offset percent measures how close any given test parameter is run to the target mean. Deviation percent indicates excursions made by any given parameter outside the minimum or maximum limit. Calculate them as follows:

Section 12.12.2.5 Include an explanation for any data used in the calculation of the percentages that are edited. List the data before they are edited, the new value, and the explanation for the change in comments section of the Unscheduled Downtime & Maintenance Summary form of the test report.

Section 12.12.2.6 Record these values on the Operational Summary – Offset And Deviation form of the test report.

Section 12.12.3 *Electronic Data Communication and Data Dictionary*— Use the data dictionary and report forms available at the TMC website (<http://www.astmtmc.cmu.edu>) for any electronic transmission of data to the TMC. The data dictionary lists all variable names given to all fields as well as the important information about those fields.

Section 12.13 *Reporting Reference Results*—Transmit the calibration test results by fax or electronic data transmission to the ASTM TMC immediately after completion of test analysis. Send this data within seven days of EOT or the test will be considered invalid. Though referee ratings are required for all operationally valid tests reported to TMC, statistical validity of the test is computed using the ratings produced by the test lab; referee ratings are used only to reveal rating errors. Report referee results to the TMC on the Referee Rating form of the test report within ten working days of the test completion. The TMC will review all calibration test results to determine test acceptability. If the test is judged acceptable, the reference oil code along with the industry average for the reference oil will be disclosed by the TMC. In the event the reference oil test is not acceptable an explanation of the problem relating to the failure is to be provided by the test laboratory. If the problem is not obvious, recheck all test-related equipment. If no explanation of the problem is presented it will be assumed that the problem is laboratory-related and another reference oil will be assigned. For all reference oil tests, send one copy of the test report to Caterpillar Inc.^{13,29} and one to ASTM TMC² within 30 days of test completion, or the test will be considered invalid.

Annex A2 Download report forms and data dictionary from the ASTM Test Monitoring Center (TMC) Web Page at: <http://www.astmtmc.cmu.edu/>. TMC can also provide hardcopies on request.

Report Form Table of Contents

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Note 1 – If the test will be submitted to the registration organization as a candidate oil, then use the same forms used for reporting reference test results and add the ACC Conformance Statement, Form 18.