



United States  
US Environmental Protection Agency  
Office of Air and Radiation, Office of Transportation and Air Quality

## Manufacturer Production Line Testing Report for Locomotive Engines

Version Number: 4.3.1 Last Revision: August 2018

### Manufacturer Data Submission Template -- INSTRUCTIONS

#### I. About

This template allows locomotive engine manufacturers to submit production line testing (PLT) data in a simple, consistent format. Based on the information entered by the submitter, the template performs the required calculation of the final test result and displays the current status of the test.

It is intended that a copy of this template be created for each engine family for which the reporting of PLT results is required. The engine family name should be included in the submission file name. These data must be submitted on a quarterly basis. It is intended that one copy of a template be maintained per engine family, per year. For instance, the file submitted for the second quarter will contain all test results previously submitted for the first quarter with the results from the second quarter added on. The template provides a field to indicate the associated quarter at the engine test level.

The template is organized into several worksheets, including a "Summary" worksheet that includes both preliminary information as entered by the manufacturer and overall compliance information based on the actual PLT data entered in subsequent worksheets (i.e., "Test Engine #1" through "Test Engine #5"). There are two additional worksheets to allow for the submittal of invalid test results and any other relevant notes that the manufacturer would like to submit with the test results. In all of the worksheets, only values in cells that are white may be modified - the shaded cells contain either labels or calculated values.

Before entering data in this template, international users should ensure that the settings for number handling are consistent with the template. Number handling settings that currently specify the use of a comma for the decimal separator and a period for the thousands separator must be temporarily modified to avoid errors within the automatic calculations. To modify the number handling settings, the users with Excel 2003 should go to the "Tools" menu and select "Options." In the window that appears, the "International" tab should be selected. At the top of this tab there will be a section at the top entitled "Number handling"; the check mark in the "Use system separators" box found within this section should be removed. At this point, a period should be inserted for the decimal separator and a comma should be inserted for the thousands separator. Users with Excel 2007 can get to the appropriate screen by clicking on the Microsoft Office Button, clicking on "Excel Options", and then going to the "Advanced" tab.

Please note that if a given engine family has results for both the Line-Haul and the Switch cycles, two separate Excel files must be filled out and submitted.

#### II. Entering General Information

Before entering data into the Test Engine worksheets, some information on the manufacturer and the engine family name being tested should be entered into the worksheet labeled "Summary." The top portion of this worksheet includes spaces to enter general information about the PLT test. These fields include:

- Manufacturer contact information (manufacturer name, contact, email, and phone);
- Engine Family identifier;
- Projected annual production volume;
- Indication whether the test results are for the Line-Haul or Switch cycle;
- Indication whether the engines being tested are freshly manufactured or remanufactured;
- Date of start of MY production;
- Date of end of MY production; and
- Engine Fuel Type: Diesel, Gaseous Fuel, Alcohol, or Other. Once this selection has been made, and a tier has been selected (see following paragraph) a note will appear indicating which type of hydrocarbon emission (NMHC, NMHCE, THCE, or THC) should be entered as part of the HC test results.

There is also a field for selecting the applicable tier. If tier 4 is selected, then another field will appear asking the user if combined HC+NO<sub>x</sub> results and a combined HC+NO<sub>x</sub> standard/FEL are being used. If "Y" is specified, then the "NO<sub>x</sub>" headings will be replaced with "HC+NO<sub>x</sub>" headings throughout the template, the "HC" columns will be removed from the summary table, and the HC data entry cells will be shaded out for all of the test engine worksheets in order to indicate that no data should be entered in these.

In addition to these fields, there is a field at the top right of the "Summary" worksheet where the current quarter can be specified. Based on the quarter chosen, a set of fields will appear where actual quarter-by-quarter production values should be entered. At the bottom right are fields for entering comments and the test location.

The top portion of this worksheet will automatically calculate and display the total engine sample size, the minimum required sample size, and the sample size status. The total engine sample size is calculated based on the number of test engines for which test data have been entered. This calculation does not include any additional engines tested as a part of the follow-up that is required when an engine fails a test (see 40 CFR 92.507). The required minimum sample size is calculated based on the amount entered in the Total Production field, and will be the lesser of 5 engines or the rounded amount of 1% of Total Production. The sample size status can be either "OPEN," "OK," or "Too Small" and is calculated based on the following criteria:

- If test data have not yet been entered, or if the projected production volume has not been specified, the sample size status is displayed as "OPEN."
- If the total engine sample size is greater than or equal to the minimum required sample size, the sample size status is displayed as "OK."
- If the total engine sample size is less than the minimum required sample size, the sample size status is displayed as "Too Small."

Note that the lower portion of this worksheet (described in Section IV, "Compliance Summary") contains the overall PLT results for the engine family and will be populated based on the results entered in the Test Engine worksheets.

### III. Entering PLT Engine Test Results

Each PLT result is comprised of one or more tests of individual engines within the engine family being tested. Following the "Summary" worksheet, there are five worksheets labeled "Test Engine #1" through "Test Engine #5." Within one or more of these five worksheets, the engine-specific test data can be entered. The required sample size for each engine family is the lesser of 5 engines or the rounded amount of 1% of Total Production.

For each individual engine tested, a separate worksheet should be used (Note: the same worksheet should be used for test results from the two follow-up engines that must be tested if an engine fails). The "Test Engine #1" worksheet has a field (in cell N10) where the Deterioration Factor Type must be specified as either additive or multiplicative. Once this is specified, it will automatically be displayed in the "Det Factor Type" fields for all parameters in all 5 test engine worksheets. The "Test Engine #2" through "Test Engine #5" worksheets have fields where running changes can be entered for NOx (cell R16) and PM (cell V16). These fields become available for use when the value for "Running Change?" (cell R15 for NOx and cell V15 for PM) is set to "Y".

The fields that are included in all 5 test engine worksheets are:

- NOx Standard or FEL (required);
- NOx Units (required);
- NOx Deterioration Factor (required);
- NOx Deterioration Factor Type (populated based on Deterioration Factor Type entry in "Test Engine #1" worksheet);
- NOx Green Engine Factor (only fill in if applicable);
- PM Standard or FEL (required);
- PM Units (required);
- PM Deterioration Factor (required);
- PM Deterioration Factor Type (populated based on Deterioration Factor Type entry in "Test Engine #1" worksheet); and
- PM Green Engine Factor (only fill in if applicable).
- CO Standard or FEL (required);
- CO Units (required);
- CO Deterioration Factor (required);
- CO Deterioration Factor Type (populated based on Deterioration Factor Type entry in "Test Engine #1" worksheet);
- CO Green Engine Factor (only fill in if applicable);
- HC Standard or FEL (required);
- HC Units (required);
- HC Deterioration Factor (required);
- HC Deterioration Factor Type (populated based on Deterioration Factor Type entry in "Test Engine #1" worksheet); and
- HC Green Engine Factor (only fill in if applicable on the individual test engine worksheets).

The Standards/FELs, Units, and Deterioration Factors should only be entered in the worksheet labeled "Test Engine #1"; once this is done the values will automatically populate the corresponding cells in the "Test Engine #2" through "Test Engine #5" worksheets. If a running change for NOx or PM is specified on a given test engine worksheet, then this value will be used in the compliance calculations for that engine and for all subsequent engines. In addition, the subsequent test engine worksheets will display the running change in the appropriate "Standard/FEL" cell. Please note that if a running change has been mistakenly entered and the user does not wish for it to be used in the template, it is not enough to set the value of "Running Change?" to "N"; the actual numeric value must be deleted.

The actual test results should be entered starting in row 21 with specific engine tests entered in the order in which they occur. The worksheet allows multiple test results ("initial results") to be entered for an individual engine. The "Final Result" cells are only populated for a given row when "Y" is selected in the "Calc Final Result?" field. For example, if an individual engine has been subjected to three separate tests, the initial results for each parameter would be entered on three consecutive rows, with "Y" indicated in the corresponding "Calc Final Result?" field on the third row. In cases where an engine only has a single test result, the parameter-specific data would be entered in the initial result fields and "Y" would be entered in the "Calc Final Result?" field on that same row.

If an engine fails a test, follow-up tests should be performed on two additional engines and the results from these tests should be entered within the same worksheet, on consecutive rows directly following the results associated with the failed engine. Once again, it is possible to enter multiple initial results for each engine, as previously described. For both the initial engine and any follow-up engines it is very important that test data be entered starting on the first row and that rows should not be skipped as results are entered.

The following data fields are available for each engine test:

- Calc Final Result (required);

- Test Number (required - this should be numeric and sequential);
- Test Date (required);
- Test Time (required);
- Test Quarter (required);
- Engine ID (required);
- Engine Make;
- Test Engine Configuration (required);

- Build Date (required);
- Green Engine Factor Applied? (required);
- Green Engine Factor Determination Method? (enter if "Green Engine Factor Applied" is "Y");
- Service Hours or Miles Accumulation (required; enter N/A if Green Engine Factor is used);
- Service Hours Location (required; enter N/A if Green Engine Factor is used);
- Service Accumulation Procedure (required; enter N/A if Green Engine Factor is used);
- NOx Initial Result (required);
- Rounded NOx Initial Result (automatic calculation);
- NOx Final Result (automatic calculation; averages rounded initial results and then rounds);
- NOx Final Deteriorated Result (automatic calculation; applies NOx Deterioration Factor to NOx final result and then rounds);
- PM Initial Result (required);
- Rounded PM Initial Result (automatic calculation);
- PM Final Result (automatic calculation; averages rounded initial results, and then rounds);
- PM Final Deteriorated Result (automatic calculation; applies PM Deterioration Factor to PM final result and then rounds);
- CO Initial Result (required);
- Rounded CO Initial Result (automatic calculation);
- CO Final Result (automatic calculation; averages rounded initial results, and then rounds);
- CO Final Deteriorated Result (automatic calculation; applies CO Deterioration Factor to CO final result and then rounds);
- HC Initial Result (required);
- Rounded HC Initial Result (automatic calculation);
- HC Final Result (automatic calculation; averages rounded initial results, and then rounds);
- HC Final Deteriorated Result (automatic calculation; applies HC Deterioration Factor to HC final result and then rounds);
- Reason for Failed Test;
- Remedy;
- Repairs; and
- Test Comments.

The parameter specific final results within each Test Engine worksheet will be displayed above the corresponding final result column. Once all the tests for a worksheet have been entered, "Y" should be selected for the "Engine Testing Completed Cell" (cell N11). Entering data for all the required fields described above will ensure that the calculated values are included in the final compliance calculations (see Section IV).

Note that the five Test Engine worksheets should only include valid test results. If there are any invalid test results, these should be entered in the "Invalid Tests" worksheet. Any additional notes or information relevant to the PLT information for the engine family should be included in the "Notes" worksheet.

#### **IV. Compliance Summary**

The lower portion of the "Summary" worksheet (below the general information entered previously, as described in Section II) includes the summary compliance information for the engine family's PLT tests as entered in the Test Engine worksheets. This section provides a determination of the current status of the PLT results for the entire engine family. The test results will indicate one of the following three status options: FAIL, PASS, or OPEN. This status will be indicated both for each Test Engine as well as for the entire engine family below the engine-specific results.

status will be indicated both for each Test Engine as well as for the entire engine family based on the engine-specific results.

- **FAIL:** The engine-specific PLT test as indicated in each Test Engine worksheet will be in a failing status if the Average NOx Final Result, the Average PM Final Result, the Average CO Final Result, or the Average HC Final Result exceeds the Standard or FEL to which the engine family is certified. This final result used in the "Summary" worksheet includes an average of each final test result within the Test Engine worksheet (including as a single result, the average of any failed initial test and the two required follow-up tests). The overall PLT results for the entire engine family will be in a failing status if any one of the Test Engine results shows a failed status for NOx or PM.
- **PASS:** The engine-specific PLT test as indicated in each Test Engine worksheet will be in a passing status if the Average NOx Final Result, the Average PM Final Result, the Average CO Final Result, or the Average HC Final Result is at or below the Standard or FEL to which the engine family is certified. This final result used in the "Summary" worksheet includes an average of each final test result within the Test Engine worksheet (including as a single result, the average of any failed initial test and the two required follow-up tests). The overall PLT results for the entire engine family will be in a passing status if all of the Test Engine results show a passing status for NOx and PM.
- **OPEN:** The PLT test will remain in an open status if it has not yet reached a fail or pass status. This would apply in cases where there is insufficient data or information to determine whether the engine family is in compliance with the standard or FEL (based on the PLT results). For example, if the sample size requirement has not been met, the test will remain in an open status.

## V. Troubleshooting

If odd or unexpected results are displayed in the "Summary" worksheet, the following items can be checked:

- Has a projected production volume been specified on the "Summary" worksheet?
- Is "Y" indicated for the "Engine Testing Completed?" field for each completed "Test Engine" tab?
- Are all engine tests entered sequentially without skipping rows?
- Has the "Calc Final Result" cell been set to "Y" for rows in which a final result is to be calculated?
- Are there any data that have been inadvertently omitted within any of the required data fields? The PLT results will not be displayed unless there is an entry in all required fields.

### Paperwork Reduction Act Notice

The public reporting and recordkeeping burden for this collection of information is estimated to average 17 hours per response for manufacturers and 8 hours per response for remanufacturers. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed Form 5900-135 to this address.

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**Engine Family Data**

Submission Date

Manufacturer:   
 PLT Test Contact:   
 Email Address:   
 Phone #:   
 Cycle:   
 Manufacture Type:   
 Engine Fuel Type:   
 Applicable Tier:

Engine Family:   
 Projected Annual Production:   
 Total Engine Sample Size:   
 Minimum Required Engine Sample Size:   
 Production Period From:  To:   
 Sample Size Status:

Current Quarter:

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**Notes:**  
 Follow-ups to failed tests are not included in the "Total Engine Sample Size."  
 Please select the applicable tier.

**Compliance Summary**

	NOx			PM			CO			HC		
	Final Result	Standard/FEL	Compliance Status	Final Result	Standard/FEL	Compliance Status	Final Result	Standard	Compliance Status	Final Result	Standard	Compliance Status
Test Engine #1												
Test Engine #2												
Test Engine #3												
Test Engine #4												
Test Engine #5												

COMPLIANCE STATUS:

Comments:

Test Location and Description



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**Basic Information: Test Engine #1**

Manufacturer: \_\_\_\_\_  
 PLT Test Contact: \_\_\_\_\_  
 Email Address: \_\_\_\_\_  
 Phone #: \_\_\_\_\_  
 Test Location & description: \_\_\_\_\_

Engine Family: \_\_\_\_\_  
 Total Production: \_\_\_\_\_  
 Date of Start of Model Year Production: \_\_\_\_\_  
 Date of End of Model Year Production: \_\_\_\_\_  
 Deterioration Factor Type: \_\_\_\_\_  
 Engine #1 Testing Completed? \_\_\_\_\_

Current NOx Result: \_\_\_\_\_

Current PM Result: \_\_\_\_\_

Current CO Result: \_\_\_\_\_

Current HC Result: \_\_\_\_\_

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Comments: \_\_\_\_\_

NOx Standard or FEL Units: \_\_\_\_\_  
 NOx Det Factor: \_\_\_\_\_  
 Det Factor Type: \_\_\_\_\_  
 NOx Green Engine Factor: \_\_\_\_\_

PM Standard or FEL Units: \_\_\_\_\_  
 PM Det Factor: \_\_\_\_\_  
 Det Factor Type: \_\_\_\_\_  
 PM Green Engine Factor: \_\_\_\_\_

CO Standard Units: \_\_\_\_\_  
 CO Det Factor: \_\_\_\_\_  
 Det Factor Type: \_\_\_\_\_  
 CO Green Engine Factor: \_\_\_\_\_

HC Standard Units: \_\_\_\_\_  
 HC Det Factor: \_\_\_\_\_  
 Det Factor Type: \_\_\_\_\_  
 HC Green Engine Factor: \_\_\_\_\_

**PLT Engine Test Results: Test Engine #1**

Calc Final Result?	Test Number	Test Date	Test Time	Test Qtr	Engine ID	Engine Make	Engine Configuration	Build Date	Green Engine Factor Applied?	Green Engine Factor Determination Method	Service Hours (or miles) Accumulation	Service Hours Location	Service Acc. Procedure	NOx Initial Result	Rounded NOx Initial Result	NOx Final Result	Det. NOx Final Result	PM Initial Result	Rounded PM Initial Result	PM Final Result	Det. PM Final Result	CO Initial Result	Rounded CO Initial Result	CO Final Result	Det. CO Final Result	HC Initial Result	Rounded HC Initial Result	HC Final Result	Det. HC Final Result	Reason for Failed Test (if applicable)	Remedy	Repairs	Comments
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**Basic Information: Test Engine #3**

Manufacturer: \_\_\_\_\_  
 PLT Test Contact: \_\_\_\_\_  
 Email Address: \_\_\_\_\_  
 Phone #: \_\_\_\_\_  
 Test Location & description: \_\_\_\_\_

Engine Family: \_\_\_\_\_  
 Total Production: \_\_\_\_\_  
 Date of Start of Model Year Production: \_\_\_\_\_  
 Date of End of Model Year Production: \_\_\_\_\_  
 Engine #3 Testing Completed?

Current NOx Result \_\_\_\_\_

Current PM Result \_\_\_\_\_

Current CO Result \_\_\_\_\_

Current HC Result \_\_\_\_\_

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Comments: \_\_\_\_\_

Running Change?   
 NOx Standard or FEL Units \_\_\_\_\_  
 NOx Det Factor \_\_\_\_\_  
 Det Factor Type \_\_\_\_\_  
 NOx Green Engine Factor \_\_\_\_\_

Running Change?   
 PM Standard or FEL Units \_\_\_\_\_  
 PM Det Factor \_\_\_\_\_  
 Det Factor Type \_\_\_\_\_  
 PM Green Engine Factor \_\_\_\_\_

CO Standard Units \_\_\_\_\_  
 CO Det Factor \_\_\_\_\_  
 Det Factor Type \_\_\_\_\_  
 CO Green Engine Factor \_\_\_\_\_

HC Standard Units \_\_\_\_\_  
 HC Det Factor \_\_\_\_\_  
 Det Factor Type \_\_\_\_\_  
 HC Green Engine Factor \_\_\_\_\_

**PLT Engine Test Results: Test Engine #3**

Calc Final Result?	Test Number	Test Date	Test Time	Test Qtr	Engine ID	Engine Make	Engine Configuration	Build Date	Green Engine Factor Applied?	Green Engine Factor Determination Method	Service Hours (or miles) Accumulation	Service Hours Location	Service Acc. Procedure	NOx Initial Result	Rounded NOx Initial Result	NOx Final Result	Det. NOx Final Result	PM Initial Result	Rounded PM Initial Result	PM Final Result	Det. PM Final Result	CO Initial Result	Rounded CO Initial Result	CO Final Result	Det. CO Final Result	HC Initial Result	Rounded HC Initial Result	HC Final Result	Det. HC Final Result	Reason for Failed Test (if applicable)	Remedy	Repairs	Comments
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### Manufacturer Notes

Please provide any additional notes here.

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