Rectangular Duct WAF Calculation Spreadsheet Instructions

This spreadsheet can be used to calculate wall effect adjustment factors (WAFs) for rectangular ducts or stacks in accordance with *Conditional Test Method (CTM-041) - Determination of Volumetric Gas Flow in Rectangular Ducts or Stacks Tacking into Account Velocity Decay near the Stack or Duct Walls*. The *CTM-041* was designed to account for the overestimation bias inherent in EPA Method 1 due to the neglect of viscous shear effects at the stack or duct wall. For additional assistance, contact Steve Norfleet of RMB Consulting & Research, Inc. at (919) 791-3123.

Spreadsheet Setup

The complete the SETUP page of the spreadsheet prior to entering velocity measurement information on the DATA page. Changes to the SETUP page will dynamically change the measurement points listed on the DATA page.

First, enter the number of test ports and the number of traverse points per port as determined by Method 1. The number of Method 1 test ports should be the number required along a single wall excluding any additional ports on the opposite wall from which regular Method 1 traverse points may be made or any "extra ports" that may be used solely for near wall measurements under this method. The number of points per port is the total number of points specified under Method 1 (i.e., the total number of traverse points measured during each RATA run) divided by the number of ports. The spreadsheet can accommodate a matrix of up to 20 ports (including "extra ports") and 20 points per port.

Enter the duct or stack dimensions at the testing location (in feet). "Depth" is the interior distance from the test port wall to the opposite wall. "Width" is the interior length of test port wall from adjacent wall to adjacent wall at testing cross-section.

Select the general WAF approach. Enter "M" as the "WAF Calculation Approach" if you intend to use a full measurement-based approach, "L" if you use *CTM-041* Section 8.4.1 (logarithmic-assisted approach), or "D" if you use *CTM-041* Section 8.4.2 (unit-specific default approach). The logarithmic-assisted approach, which combines good accuracy and reduced measurements is recommended, but a unit-specific default approach can be used to determine a conservative WAF value without making any near wall measurements. Under the unit-specific default approach, the WAF is calculated simply based on the velocity data from a single RATA run.

If the full measurement-based approach is used, enter the number of near wall one-inch intervals that you intend to measure. The number of points should start with the 1" interval regardless of whether 1" is the first available point from any port. Up to 20 intervals may be selected. If more intervals are selected than needed, the spreadsheet will identify the proper number of intervals on the DATA page. You are not required to enter the number of intervals if the logarithmic-assisted approach or unit-specific default approach is employed.

Enter the number of any additional non-Method 1 ports where near wall measurements are made.

The ash layer provisions in the spreadsheet apply to procedures defined in the original test method developed by RMB that was included in the final EPRI report. Currently, EPA is disallowing these provisions. RMB is working with CAMD to resolve this issue. If the spreadsheet is being used on a

source where an ash layer exists, enter "N" and "0" in the Ash Correction Required? and Ash Depth fields, respectively.

For each test port, if a full-measurement or logarithmic-assisted approach is selected, enter the first available one-inch interval where measurements can be made and whether the port should be included in the WAF calculations (see *CTM-041* Section 8.1.2)

Finally, enter the order you would like the traverse points to be listed on DATA page (A = Ascending, D = Descending, G= Group by Type). Ascending and descending order the points accordingly with respect to distance from the test port wall. Group by type first lists the Method 1 points, then the one-inch intervals, and then any other required points.

Measurement Data

Complete the DATA page of the spreadsheet by entering the velocities measured at the points indicated. When the logarithmic-assisted approach is selected, the velocity of any traverse points less than 12 inches from the wall, with the exception of the 1" interval and any potential M1 point, will be calculated and, therefore, will not be listed. If the unit-specific default approach is used, one run of Method 1 (a.k.a. RATA) traverse point velocity data is all that is required.

When the full measurement-based approach is used, if measurements cannot be made at the first one-inch interval, enter the velocity measured at the first available point for the interval measurement(s) that cannot be made. If the logarithmic-assisted approach is selected, enter the first available interval in the field corresponding to "i-1."

Near wall measurements need no be made for Method 1 test ports that are not included to be included in the WAF calculations, although velocities are required for all Method 1 traverse points (i.e. regular flow RATA traverse points). For extra points, with the exception of the Method 1 traverse point closest to the wall, the other Method 1 points are not required and only the near wall points must be measured.

Calculations and Results

Calculations are performed on the WAF-1, WAF-2 and WAF-3 pages for each run, accordingly. The results for each run and the three run averages are presented in the RESULTS page.