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Service Note

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HOW TO CALCULATE MOLY CONVERTER EFFICIENCIES

I. PURPOSE:

To provide instructions on how to calculate the efficiency of a Moly converter when using a GPT method of testing converters, by using the US EPA method, where the actual concentration of ozone is not a factor in the accuracy of the calculation of the converter efficiency. This procedure is based on the Code of Federal Regulations, Title 40, Chapter I, subchapter C, Part 50, Appendix F.

II. TOOLS:

a. API M700, M700E, or M700EU calibrator with O3 Gen option (or equivalent)

III. PARTS:

NONE

IV. PROCEDURE:

1. For the sake of numbers to input into this note, we have chosen 450 PPB NO gas as our reference point, you don't have to pick these values, they are just an example. There is also an assumption that the analyzer has a good calibration done @ 450 PPB NO span gas. If this is not the case, then once you are done with the leak check on the analyzer, input your 450 PPB NO span gas & calibrate the analyzer.

NOTE: For the GPT to be performed correctly there must be a minimum of 10% MORE NO than O3 produced. For example, if the Ozone produced is 400 PPB then the NO used must be 440 or more. Typically 450 PPB NO is made & 400 PPB of Ozone is produced.

2. Leak check machine to ensure that there are no leaks in the analyzer.
3. If you have input a CE factor into the instrument firmware (this would be in the CAL-CONC-CONV-SET menu) other than 100%, change this back to 100% for the duration of this test.
4. The first gas check is to test to see how much the converter is eating NO gas or out gassing NO gas. Bypass the converter in the machine, by placing a short piece of tubing in place of the converter. Perform a straight dilution with NO gas & air as a diluent gas. Input this 450 PPB NO gas into the analyzer, allow the machine to stabilize, & write down the NOx value on your data sheet on line 3.

5. Remove the converter bypass & install the converter back into the NOx sample stream, such that the NO sample goes through the converter again & allow the machine to stabilize. Write down your NOx value on your data sheet on line 4.
6. Subtract line 3 from line 4 & write that number down on line 5. The spec on the data sheet is the value that we use here in house, and your spec might be a bit higher. We have found that on NEW Moly converters this spec is a good one that predicts a good performing Moly converter, but in an older converter might eat a bit more NO, & this would be acceptable. If it is a constant value, or changes little over time, this is not a problem the machine will calibrate this out.
7. The next step depends on what type of calibrator you have. For the M700 generate 450 PPB of NO, and 0 PPB of O3. For the M700E or M700EU generate GPTZ with 450 PPB of NO and 400 PPB of O3. After allowing time to stabilize, record the NOX value on line 6, and the NO value on line 9. This is to allow for the extra flow from the ozone generator to be taken into account for when determining the change in the total concentration of gas takes place.
8. The next step is to perform your GPTPS. Generate 450 PPB of NO gas & input 400 PPB of O3. Allow instrument to run for 30 minutes or until the green sample light on the front display stops flashing. No values are taken during this step as it is an internal conditioning step for the O3 generator necessary for setting the proper drive voltage for the remainder of the test.
9. The next step is to perform your GPT. Generate the same 450 PPB NO gas & input 400 PPB of O3 (or generate 450 PPB NO & 400 PPB NO2, if that's what your calibrator says). Allow the machine to stabilize for 30 minutes & then write down the NOx value on line 7 & the NO value on line 10.
10. Subtract line 7 from line 6 & put that onto line 8
11. Subtract line 10 from line 9 & put that onto line 11
12. Put the number from line 8 into the letter A on line 12 & put the number from line 11 into the letter B on line 12.
13. Divide A by B & multiply it by 100 & put it into letter C on line 12.
14. Put the number in letter C onto the C on line 13 & subtract that value from 100 & put it into letter D on line 13. This is the converter efficiency.
15. This value should be >96%. For CEMS applications, a CE of <96% might be acceptable, depending on application & the guideline set up by the regulatory agency. In any application, check with your regulatory agency to see what the minimum CE factor is before replacing the converter.

MOLY TEST DATA SHEET

Line #	TEST		RESULT
2	**LEAK-CHECK** (WHEN HOT)		YES / NO
3	NO_X RESPONSE (MOLY BYPASSED)		__________
4	NO_X RESPONSE (MOLY IN-LINE)		__________
5	**OUT-GASSING / EATING** (NO – NO_X)		__________ (>-5 PPB, <5 PPB)
6	(NOx_{ORIG})	(NO_X mode, O_3 off)	__________ PPB
7	(NOx_{REM})	(NO_X mode, O_3 on)	__________ PPB
8	**NO_X LOSS** (9A - 10B)		__________ (***A***) (<4% of $NOx_{ORIG;}$ ex: for 450PPB 4% is 18PPB)
9	(NO_{ORIG})	(NO mode, O_3 off)	__________ PPB
10	(NO_{REM})	(NO mode, O_3 on)	__________ PPB
11	**NO_2** (9B - 10A)		__________ (***B***) (>300PPB)

12 Efficiency LOSS [(***A*** / ***B***) x 100] = [(____***A***____ / ____***B***____) x 100] = ____***C***____%

13 Total Conv Eff [100% – ***C***] = 100% - ____***C***_____ = _____***D***_____ % (≥ 96%)