



Transfeu WP2 Subtask 2.1.2 Development of small-scale test method for fire effluents

Step 5 : Development of calibration method

Smoke chamber test – Smoke density calibration procedure

Smoke density measurement calibration with certified standard glass filters

According to DoW

► Step 5: Development of calibration method

Partners: LSFIRE, LNE, RATP, VTT, SP, CUR

The optimum calibration procedures will be carried out in parallel by LSFIRE, LNE, RATP, VTT, SP and CUR. These procedures will be established by checking of thermal attack and by measurements of gases, with particular attention to the quantitative measure for the expected kind of gases.

10. Forward

The procedure for smoke density calibration should be in accordance with the paragraph 9.4 of the ISO DIS 5659-2 Standard (2004).

The principle of this calibration is to measure the transmittance all along the ranges of the smoke chamber apparatus, using a batch of 6 calibrated attenuation filters (see annex1_v2.pdf doc – the wavelength to use is 590 nm). Pôlynomes will be established between the certified smoke density and those measured on the filters, to correct systematic error of the device. These polynomes are to be applied later and systematically on real tests data.

11. Set up of apparatus

- a. Clean the apparatus of any residues left from previous tests and flush the chamber (with the door shut and the exhaust and inlet vents open) with air for 2 min. Clean the optical windows, and switch on the beam at least 30 min before to continue this procedure.
- b. Set the 0 and 100% transmittance for the beam.

12. Calibration

- a. Place the filters the one after the other on lower lens of optical system in the order described on table 1. For most values of optical densities, it is necessary to add several filters together. For each density, note the transmittance value measured by the smoke chamber apparatus.
- b. Introduce transmittance values obtained in the Excel sheet attached (Smoke density calibration sheet _ glass filters.xls) with this procedure (green column). Transmittance are converted into smoke density values D_s . For each sensibility range of the smoke chamber, a polynome ($y = Ax + B$) is calculated between smoke density measurements obtained and nominal density of corresponding calibration filter(s).

Calibrated filters				
Filters to use	Corresponding DO	Range of the NBS apparatus (Transmission,%)	Certified Transmittance (600 nm)	DS - theoretical
0.1	0.1	100	79.99%	12.8
0.3	0.3		47.91%	42.2
0.5	0.5		31.06%	67.0
1 + 0.1	1.1	10	6.71%	154.8
1 + 0.3	1.3		4.02%	184.2
1 + 0.5	1.5		2.61%	209.1
2 + 0.1	2.1	1	0.60%	293.7
2 + 0.3	2.3		0.36%	323.1
2 + 0.5	2.5		0.23%	347.9
3 + 0.1	3.1	0.1	0.054%	431.8
3 + 0.3	3.3		0.032%	461.1
3 + 0.5	3.5		0.021%	486.0
3 + 1 + 0.1	4.1		0.00450%	573.8
3 + 1 + 0.3	4.3		0.00269%	603.2
3 + 1 + 0.5	4.5		0.00175%	628.0

Table 1

13. Use of calibration results on test data

After a test on real samples, each smoke density measurement obtained must be corrected using polynomes determined during calibration process.

For example, if the smoke density value D_s to correct fall in the range 1%, the polynome obtained for this range must be used to compensate systematic error of the smoke measurement.

$$y = a \cdot x + b$$

where:

"y" is the value of D_s corrected

"a" is the coefficient "a" determined by the table of "Smoke density calibration sheet _ glass filters.xls" excel file

"x" is value of D_s read from your system (uncorrected)

"b" is the coefficient "b" determined by the table of "Smoke density calibration sheet _ glass filters.xls" excel file

Each D_s data uncorrected shall be corrected using the above polynome with different coefficients determined at different D_s range which the data is included: (from 0 to 132; 132 to 264; 264 to 396; 396 to full range scale).

14. Report

Report the measurements obtained on the calibrated filters in the excel sheet (green column) provided with this procedure.

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