

Guidance for Air Change Rate Measurements According to **ASTM E741 – (2006)**

Contents of ASTM - Set

- One 60 ml plastic syringe filled with tracer gas, SF₆ (sulphur hexafluoride) with yellow label and blue cap
- 18 empty plastic syringes with white labels and red caps
 - 1 syringe for outdoor sampling
 - max. 4 syringes for adjacent rooms
 - 4 syringes for spatial samples on START
 - 5 syringes for the ACR measurement
 - 4 syringes for spatial samples on END
- protocol form sheet

Instructions

Please review our instructions for conducting basic air exchange rate measurements which are valid for an ASTM conforming ACR measurement. The ASTM instructions only provide supplementary information.

What is different between Standard Air Change Rate (ACR) measurement and the ASTM ACR measurement

The ASTM standard requests to verify by test that some prerequisites to achieve a good result are met.

These are:

1. A tracer gas sample needs to be taken from the outside and adjacent rooms to make sure that the air which enters the zone does not contain tracer gas.
2. The uniformity of concentrations in a zone needs to be verified by spatial sampling in the zone at the beginning and at the end of the test.
3. The sampling sequence and thus the duration of the ACR test is defined to comply with a 10% uncertainty at the 95% confidence level in the determination of the ACR.

The ASTM protocol is more detailed and provides a detailed error analysis.

Instruction to perform an ASTM - ACR measurement:

1. Step - PREPARATION

Adjust the boundary conditions for your measurement in the building, e.g. close or open windows, doors, turn on/off fans, dampers etc. and document it on the protocol sheet.

2. Step – FILL OUT THE PROTOCOL SHEET

Write your name and address on the protocol sheet. Mark the type of building. Enter a zone description and an abbreviation to be documented on each white label syringe. When needed write other details of the measurement down.

3. Step – DETERMINE ZONE VOLUME

Measure or estimate the floor area and the zone volume; note it on the protocol sheet.

4. Step – FILLING OF SYRINGE WITH CORRECT AMOUNT OF TRACER GAS¹

See our instructions for conducting basic air exchange rate measurements

5. Step – PREPARE FOR SPATIAL AND MAIN SAMPLING

Spatial: Look for representative locations in your room (usually four are o.k.), where you want to take spatial samples to verify uniform mixing of the tracer gas. Make a drawing of the zone, note the locations for spatial sampling and the main sample location. Label each sample location in the zone and in the drawing unmistakably. Use SS1 for spatial sample at location_1, SS2 for location_2, etc.

Note: the spatial samples need to be really taken at the defined point in the room; do not walk for spatial sampling!

Main: Look for a representative main sample point, from which you take the decay samples. If you want to walk through the zone to automatically obtain an average spatial sample, please note as main location 'walking zone'.

6. Step – SAMPLE EXERCISE

See our instructions for conducting basic air exchange rate measurements

7. Step – DETERMINE SAMPLE INTERVAL

According to ASTM the Minimum Duration between the Initial and Final Samples is listed in Table 1.

Estimated Air Change Rate [1/h]	Minimum Duration of Test (analysis uncertainty 5%) [h]	Minimum Duration of Test (analysis uncertainty 3%) [h]	Minimum Duration of Test (analysis uncertainty 2 %) [h]
0,01	100	60	40
0,1	10	6	4
0,25	4	2,4	1,6
0,5	2	1,2	0,8
1	1	0,6	0,4
2	0,5	0,3	0,2
4	0,25	0,15	0,1

Table 1 Minimum Duration between the Initial and Final Samples acc. to ASTM

¹ Note: In some cases TRACERTECH already provides the injection syringe with the appropriate amount of tracer gas. In this case no further dilution is necessary

TRACERTECH usually provides SF₆ analysis with an uncertainty of <3%. On request we provide high accuracy analysis with an uncertainty of 2%.

8. Step – OUTDOOR AND ADJACENT ROOMS SAMPLING

Before injection take a sample from the outdoor air and from each adjacent room. Label the syringes with 'outdoor' and 'AR_1' for the first adjacent room, 'AR_2' for the second and so on. Note the sample time on the syringe and on the protocol sheet.

9. Step – EXERCISE THE INJECTION

Please see our instructions for conducting basic air exchange rate measurements.

10. Step – INJECTION

Please see our instructions for conducting basic air exchange rate measurements.

11. Step – SPATIAL START SAMPLING AND FIRST MAIN SAMPLE

After uniform mixing is achieved, take a spatial sample at all previously defined locations and take a sample at the main sample point (or walking sample). Denote the sample from the main location with 'M_1'. Note the sample time on the syringes and on the protocol.

12. Step – 2ND – 5TH SAMPLE

Take the 2. – 5. sample at the main sample point. Note the sample time on the syringes and on the protocol.

13. Step - SPATIAL END_1 SAMPLING

Directly after the 5. sample from the main location is drawn take again samples from the four spatial locations. Note the sample time on the syringes and on the protocol (marked with *END_1*).

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