

TEST FACILITY FOR VAV MEASUREMENTS
(Laboratory of the Dept. Fluid Mechanics BME)

- 1) Test facility: horizontal axis flow, tubing upstream & downstream of the fan.
- 2) Fan with continuous motor *rpm* regulation potentiometer.
- 3) Flow rate q_V [m³/s] measurement with orifice plate at the fan inlet side, collector line tubing to digital differential pressure meter is applied, that measures the differential pressure of the orifice meter to the still ambient pressure ($\Delta p_{\text{orifice}} = p_{\text{orifice}} - p_{\text{amb}}$). The diameter of the orifice plates varies for the different DN VAVs.
- 4) Differential pressure of the orifice plate measured by digital manometer, type EMB-001, +/- 1500Pa, whole range linear characteristics, $\delta\Delta p$: +/- 2Pa, the digital manometer is calibrated to standard Betz-type manometer.
- 5) Fan outlet side:
 - a. downstream of the fan internal guide vanes (honeycomb) are upstream of the contractor. The diameter of the circular outlet cross-section of the contractor element varies for the different DN VAVs, and is identical to the tested VAV's and its tubing's DN.
 - b. for developed flow conditions long upstream tubing lengths (L_u) are used, also minimum 4xDN downstream length (L_d) are used for all tested VAVs, see table for data:

DN	TUBING UPSTREAM OF VAV		TUBING DOWNSTREAM OF VAV	
	length in [m]	length in [? x DN]	length in [m]	length in [? x DN]
80	2	25,0	1	13
100	2	20,0	1	10
125	2	16,0	1	8
160	2	12,5	1	6
200	3	15,0	1	5
250	3	12,0	1	4
315	4	12,7	1,5	5
400	4	10,0	2,5	6

- c. Differential pressure ($\Delta p_{\text{VAV}} = p_{\text{upstream}} - p_{\text{amb}}$) of the VAV is measured by same type digital manometer (type EMB-001), the manometer is calibrated to standard Betz-type manometer. Collector line tubing to digital differential pressure meter is applied.
- d. Downstream tubing of the VAV is open to the still ambient pressure p_{amb} .

How to perform the q_V vs. Δp_{VAV} characteristic curve measurements?

- at a given flow rate setting of the VAV (=indicator arrow is fixed to a given m³/h)
- the fan motor is regulated via potentiometer from its minimum (0%) *rpm* to the maximum (100%) *rpm* setting by 10% steps. First upward with increasing *rpm* setting from 0 to 100% *rpm* upward direction, and then downward from 100% to 0% *rpm* setting, mostly by 10% *rpm* steps.
- After each new *rpm* setting a few minutes wait must be included to allow stabilisation of the fan *rpm*, fan flow rate, valve axis, plastic bag up/download (blowup/blowout) process. It means that approx. 4-10 minutes (!) time period waiting after each *rpm* setting is needed to allow this stabilization.
- The differential pressure of the orifice meter ($\Delta p_{\text{orifice}}$) and also Δp_{VAV} of the VAV are read only after this time period. It is a very time consuming process but allows for reliable measurement of the VAV characteristic curve. It simulates also the built-in VAV operation, when it is used as set to a given m³/h setting and left alone.

The sketch and photo of the test facility in the Laboratory of Dept Fluid Mechanics, BME is shown on the next page, in Fig.1.

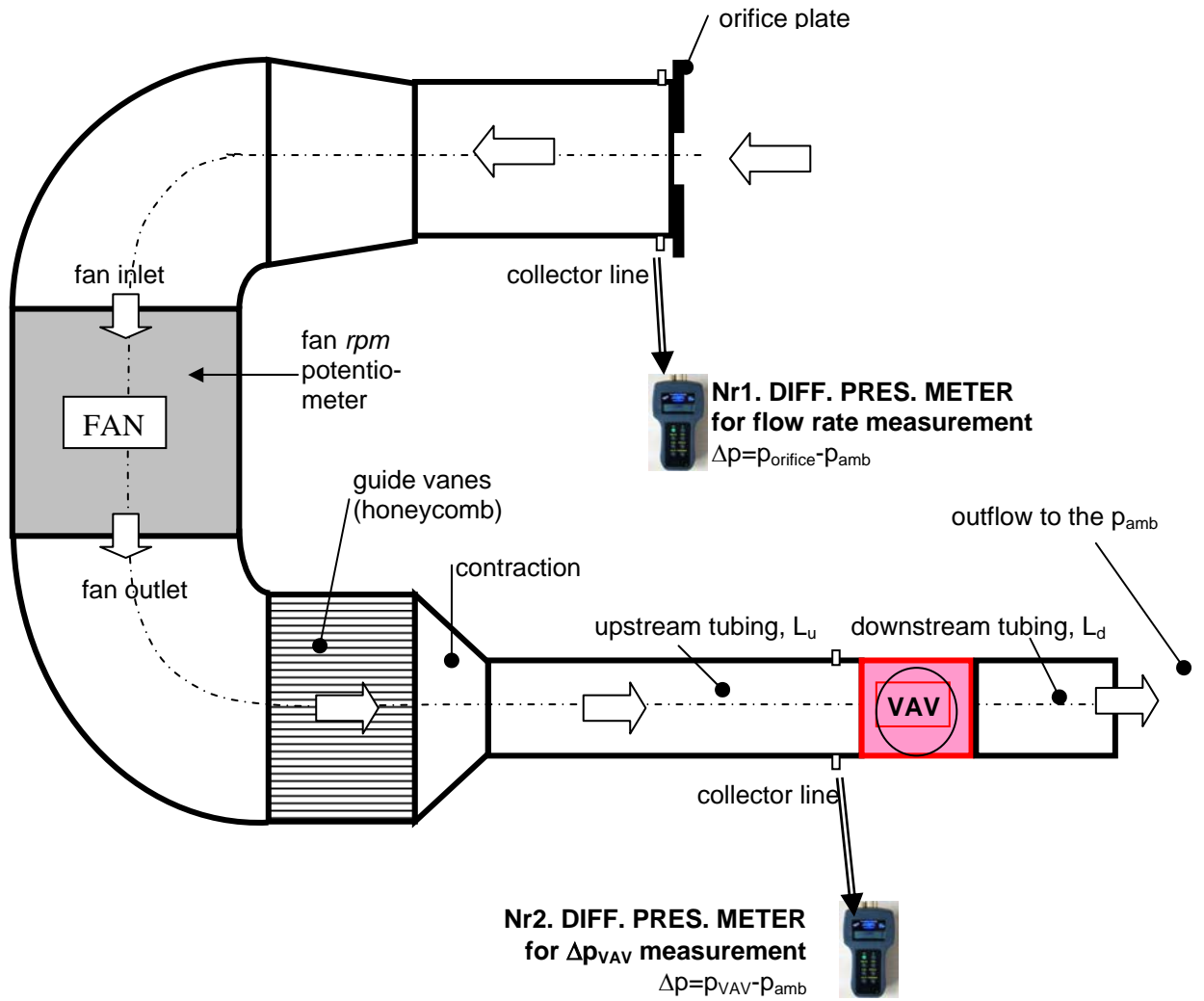


Fig.1. Sketch and photo of the test facility at the Laboratory of Dept Fluid Mechanics, BME

Budapest, 29-01-2010.

Best regards:

J.M. Suda, PhD, Dept. Fluid Mechanics BME