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BLANC

Protocol of aerodynamic tests

from 19.09.2024

DESCRIPTION OF THE AERODYNAMIC TEST INSTALLATION

The aerodynamic installation is designed according to the National standard GOST R EN 12238-2012 “Ventilation for buildings. Air terminal devices. Aerodynamic testing and rating for mixed flow application.”

The test installation consists of a variable speed fan, a measuring duct with a thermoanemometer and an air flow straightening chamber. The schematic diagram of the installation is shown in Figure 1.

The air flow straightening chamber has a cross-sectional area much larger than the cross-sectional areas of the diffuser slot and the air flow straightener. This ensures a uniform reduction in airflow velocity and equalization of the velocity profile over the entire cross-sectional area. In this case, the dynamic component of the pressure becomes negligible, which makes it possible to equate the total and static pressures and provide correct measurements of pressure drop.

Pressure drop is measured at a piezometer ring with four static pressure taps on each side of the air flow straightening chamber.

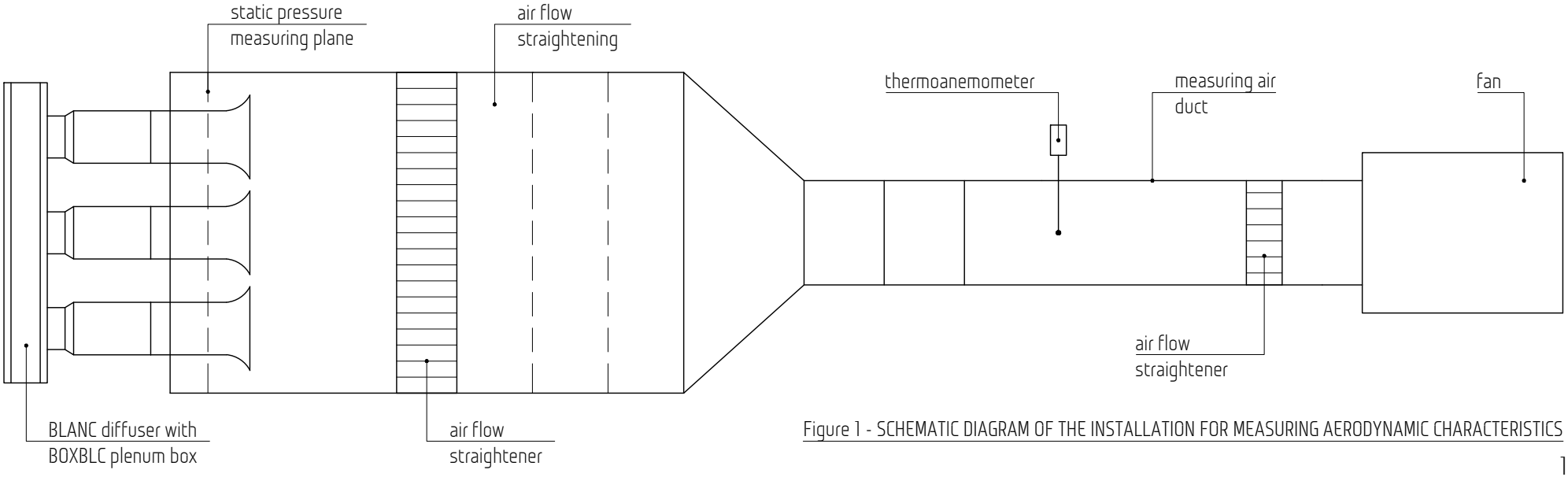


Figure 1 - SCHEMATIC DIAGRAM OF THE INSTALLATION FOR MEASURING AERODYNAMIC CHARACTERISTICS

AERODYNAMIC TESTING METHODICS

The test objects are diffuser specimens with a length of 1000 mm. The aerodynamic characteristics of diffusers with BOXBLC plenum boxes in different versions (STD, FRNT) may differ within ±10%.

Pressure drop is generally calculated according to the formula:

$$P_t = P_s + P_d$$

$$P_d = \frac{\rho}{2} \times \left(\frac{q_v}{A}\right)^2$$

Under the following condition, the static pressure, total pressure and pressure drop have equal values because the dynamic pressure component is negligibly small relative to the static pressure component:

$$\frac{q_v}{A} < \sqrt{\frac{P_s}{5 \times \rho}}$$

As a result, the total pressure formula takes the following form:

$$\Delta P_t = P_s$$

During the test, the installation is adjusted to a specified air flow rate. Once steady-state air flow rate is reached, the pressure drop and the air flow rate are measured. The measurements are then repeated for the other air flow rate values.

Measured parameters:

- q_v - air flow rate [m^3/h];
- ΔP_t - pressure drop [Pa];
- $T_{изм}$ - air temperature [°C];
- $\Phi_{отн}$ - relative humidity [%];
- $B_{изм}$ - atmospheric pressure [Pa].

The test results are processed using the least squares method. An average curve is plotted over the measured values of air flow rate and pressure drop.

Table 1 - MEASURING INSTRUMENTS

№	Measured parameter	Measuring instrument (QR code on FGIS "Arshin")	
1	Air flow velocity	Thermo-anemometer TTM-2-01 T	
2	Pressure drop	Differential pressure meter Testo 512 (0...2 GPa)	
3	Temperature, relative humidity, atmospheric pressure	Thermo-hygrometer ИВТМ-7 М 5-Д	

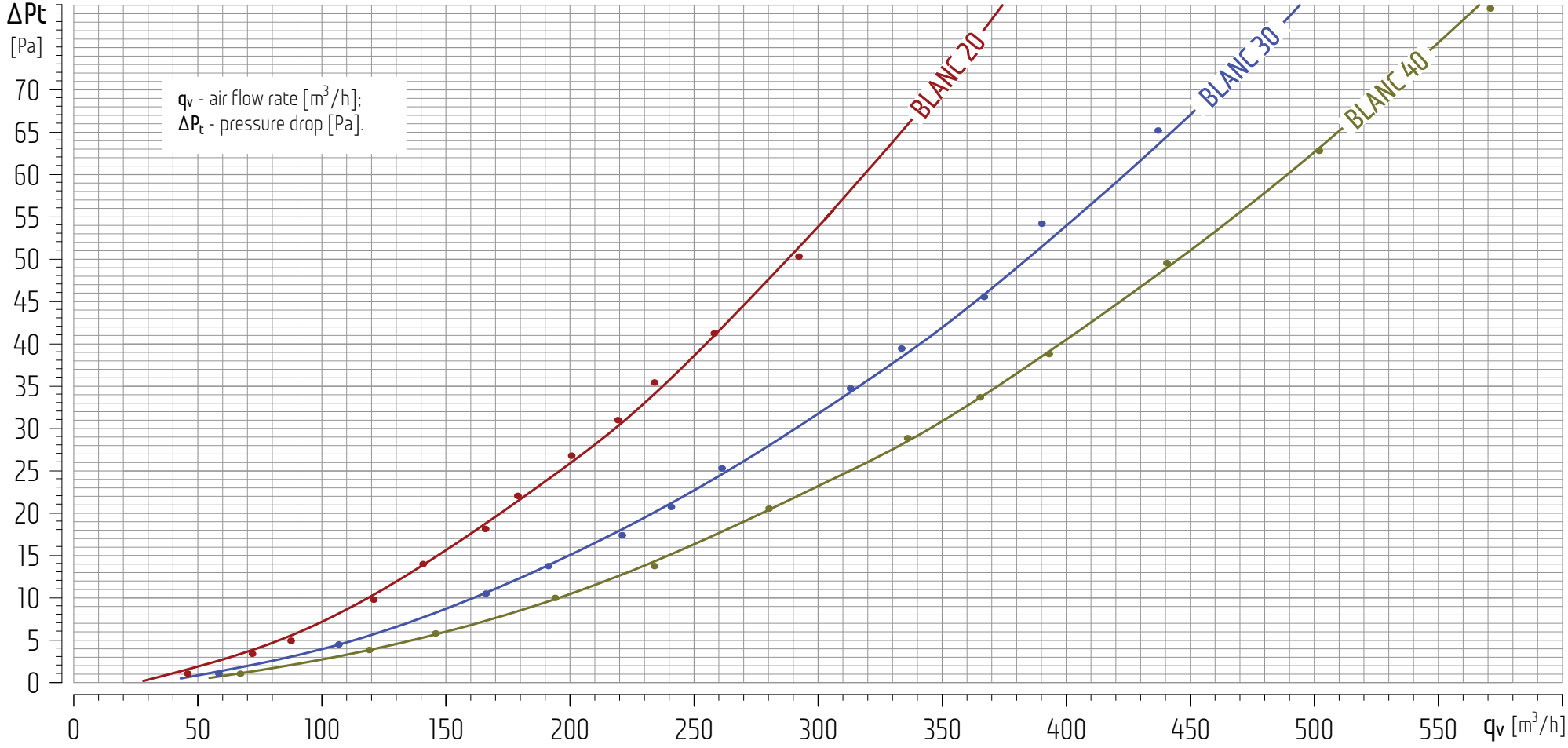
P_t - total pressure [Pa]; P_s - static pressure [Pa]; P_d - dynamic pressure [Pa]; **A** - cross-sectional area of the flow straightening chamber [m^2]; ρ - air density [kg/m^3].

AERODYNAMIC TEST RESULTS

Table 2 - AERODYNAMIC CHARACTERISTICS FOR BLANC 20, 30, 40 DIFFUSERS

	BLANC 20												BLANC 30												BLANC 40											
№	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
q_v [m^3/h]	46	72	88	121	141	166	179	201	219	234	258	292	59	107	166	191	221	241	261	313	334	367	390	437	67	119	146	194	234	280	336	365	393	441	502	571
ΔP_t [Pa]	1,1	3,4	5,0	9,8	14,0	18,2	22,1	26,8	31,0	35,5	41,3	50,3	1,1	4,5	10,5	13,8	17,4	20,8	25,3	34,8	39,5	45,6	54,2	65,2	1,1	3,9	5,8	10,0	13,8	20,6	28,9	33,7	38,8	49,6	62,8	79,6

Figure 3 - PRESSURE DROP VS. AIR FLOW RATE GRAPHIC

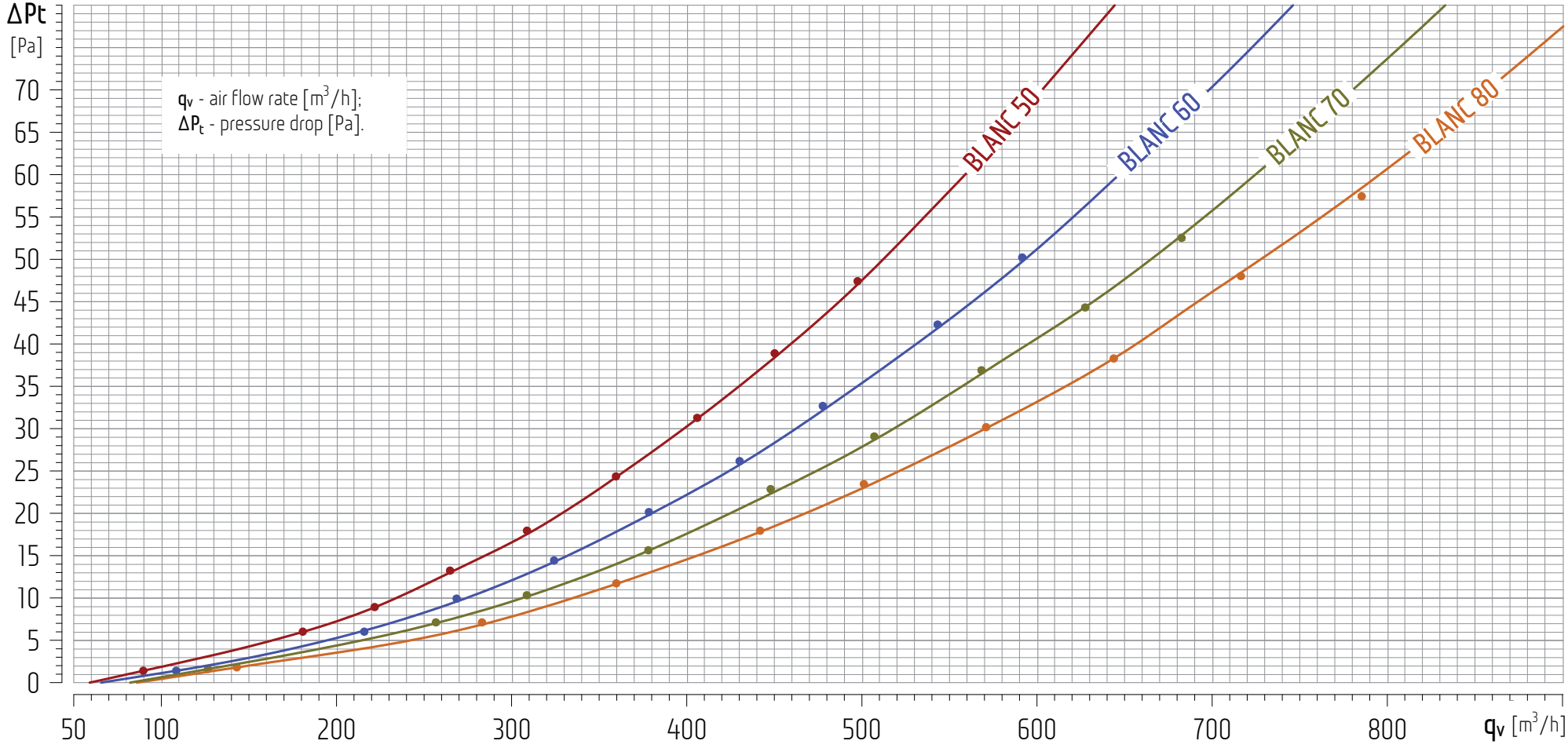


AERODYNAMIC TEST RESULTS

Table 3 - AERODYNAMIC CHARACTERISTICS FOR BLANC 50, 60, 70, 80 DIFFUSERS

	BLANC 50									BLANC 60									BLANC 70									BLANC 80								
№	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
q_v [m^3/h]	90	181	222	265	309	360	406	450	498	109	216	269	324	378	430	478	543	592	127	257	309	378	448	507	568	628	683	143	283	360	442	501	571	644	716	785
ΔP_t [Pa]	1,4	6,0	8,9	13,2	17,9	24,3	31,2	38,8	47,3	1,4	6,0	9,9	14,4	20,1	26,1	32,6	42,2	50,1	1,6	7,1	10,3	15,6	22,8	29,0	36,8	44,2	52,4	1,8	7,1	11,7	17,9	23,4	30,1	38,2	47,9	57,3

Figure 4 - PRESSURE DROP VS. AIR FLOW RATE GRAPHIC



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