

DETERMINATION OF THE CHARACTERISTICS OF A DIFFUSER.

Task : MG (A)

Group :

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Lab Temperature and Pressure:
Initial Temperature (T_0) : 293,6 [K]
Initial atmospheric pressure (P_0) : 99810,00 [Pa].
Final Temperature (T_f) : 292,2 [K]
Final atmospheric pressure (P_f) : 99810,00 [Pa]

List of measuring Instruments :

No.	Instrument Name	Type	Serial Number.
1	6° diffuser.		
2.	30° diffuser.		
3.	Boda Carnot.		
4.	Calibrated Digital Manometer.	130	D13.
5.	Betz Manometer.		

Note : 15° diffuser is broken.

Manometer Calibration Data.

Betz [mmH ₂ O]	P _{dig} [Pa]	P _{Betz} [Pa]
10.2	100.9	100.04.
20.5	198.9	201.07.
24	232.3	235.40.
30	291.5	294.25
35	338.55	343.29.
39	376.12	382.52.
43	415.67	421.75

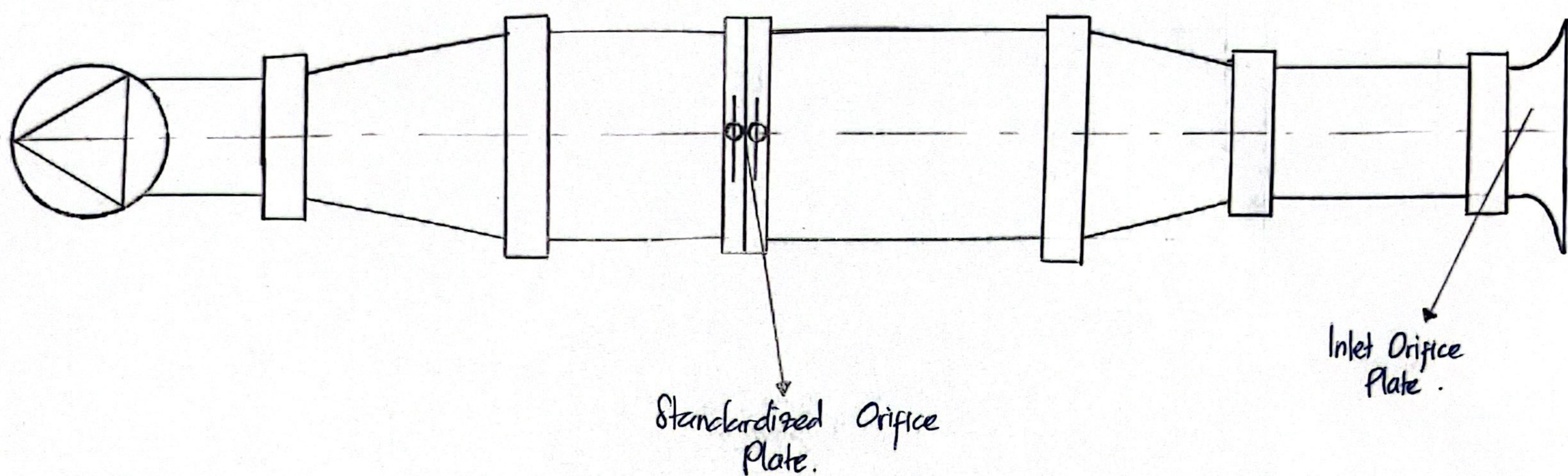
$$g = 9,808369 \text{ m/s}^2$$

Sign : Balice.

Inlet Orifice Calibration

Velocity	$\Delta P_{\text{inlet orifice plate}} \text{ [Pa]}$	$\Delta P_{\text{standardized orifice plate}} \text{ [Pa]}$
Minimum	169.65	467.53
Maximum	274.55	853.54
Middle	213.64	633.18

Drawing of Calibration Section.



Volume Flow Rates.

The volume flow rates during the measurement will be given by the Inlet orifice. The equation of the flow rate of the inlet orifice plate is the following:

$$q_v = k \cdot \frac{d_i^2 \pi}{4} \cdot \sqrt{\frac{2}{\rho_1} \Delta P_i}$$

Where :

k = flow factor [-]

d_i = Inner diameter of Inlet orifice plate [m].

ρ_1 = Density of air [kg/m^3]

ΔP_i = Pressure drop measured on the Inlet orifice plate.

The formula to calculate the flow rate of the standard orifice plate :

$$q_v = \frac{C}{\sqrt{1 - \beta^4}} \epsilon_1 \frac{d^2 \pi}{4} \sqrt{\frac{2}{\rho_1} \Delta P}$$

Where :

C = Flow coefficient.

β = Measured relation of the cross-section of the inner brim to the diameter of the pipe. (here $\beta = 0.6587$).

ϵ = Compressibility factor ($\epsilon=1$, since the change in the pressure of the fluid is small).

d = Hole diameter of the measurement brim (here $d = 38.8 \text{ mm}$)

ΔP = Pressure drop on fluid through orifice

sign : Balance

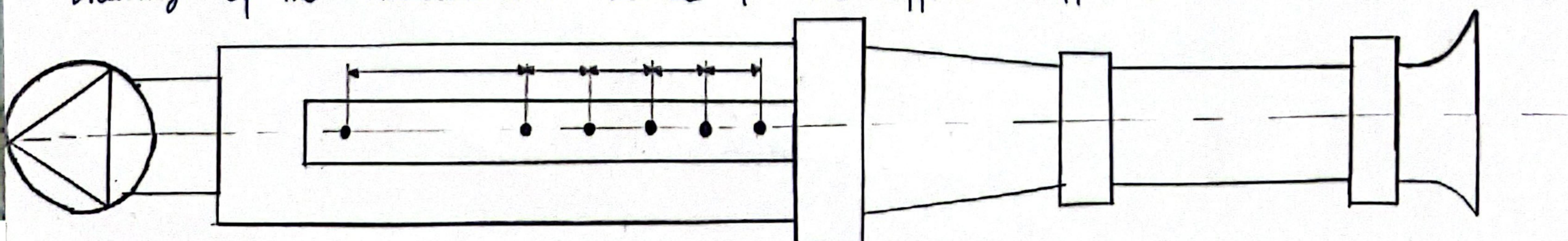
Diffuser Efficiency Measurement.

	Parameter	Borda Carnot Diffuser.	6° Diffuser	30° Diffuser.
1	Δ Diameter [mm]	110	260	80
	Δ Pressure [Pa]	-30.6	280	160.2
2	Δ Diameter [mm]	230	340	160
	Δ Pressure [pa]	29.23	287	222.73
3	Δ Diameter [mm]	350	400	240
	Δ Pressure [Pa]	80.34	294	245.64
4	Δ Diameter [mm]	410	460	300
	Δ Pressure [Pa]	105.24	298	250.9
5	Δ Diameter [mm]	470	520	360
	Δ Pressure [Pa]	110.5	295	260
6	Δ Diameter [mm]	530	580	420
	Δ Pressure [Pa]	103.97	289	242.8
7.	Δ Diameter [mm]	650	700	540
	Δ Pressure [Pa].	107.2.	284.	256.48.

Pressure Changes on the Inlet Orifice Plate from 3 different Diffusers.

Measurement Section.	Borda Carnot Diffuser [Pa]	6° Diffuser [Pa]	30° Diffuser. [Pa]
1	219.79	207.8	214.91
2	205.12.	206.4	212.91
3	202.56	207.9	216.77
4	201.9	205.7	215.9
5	209.96	205.2	216.6
6	201.7	204.2.	217.4
7.	204.2.	205.7.	215.4.

Drawing of the Measurement Device for the Diffuser Efficiency.




sign : Balcio

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downstream distance

Diagram of Pressure and (diameter Difference) Using Boda Carnot Diffuser.



Sign :

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