

Flexible Duct Pressure Losses Calculator Project

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Equations and inputs

1. Variables and user inputs

some of the variables are user inputs and the other are calculated

Variable Name	Equations	Description	Unit	Type
dh_inch	User input	Hydraulic diameter of the flexible duct	Inches	User input
e_rough	User input	The roughness of the duct with vary from 0.003-0.15 into 5 categories	Dimensionless	User input
a_duct	$A = \frac{\pi \left(\frac{Dh}{12}\right)^2}{4}$	The cross-sectional area of the flexible duct	Feet squared	To be calculated
q_airflow	$Q = V * A$	The airflow inside the duct V= v_duct (fpm) A= a_duct (ft ²)	CFM	User input
v_duct	$V = \frac{Q}{A}$	The velocity inside the duct Q= q_airflow (cfm) A= a_duct (ft ²)	FPM	To be calculated
re_number	$Re = 8.50 * dh * V$	Reynolds number Dh= dh_inch (inch) V = v_duct (fpm)	Dimensionless	To be calculated
f_factor	$f = \frac{0.25}{\left(\log\left(\frac{\epsilon}{3.7Dh} + \frac{5.74}{Re^{0.9}}\right)\right)^2}$	Friction factor Using Swamee-Jain formula Instead of modey cahry $\epsilon = e_{\text{rough}}$ Re= re_number Dh=dh_inches	Dimensionless	To be calculated
raw_air	$\rho_{air} = 0.075 \text{ lb/ft}^3$	Density of air at 1 atm	lb/ft ³	constant
l_length	User input	The total length of the flexible duct	ft	User input

Variable Name	Equations	Description	Unit	Type
bend_45degree	User input The equalvent length of the fittings are $45^\circ = 10 \text{ ft length}$	The fittings in the flexible duct and we convert them to equalvent length	degree	User input
bend_90degree	User input The equalvent length of the fittings are $90^\circ = 10 \text{ ft length}$	The fittings in the flexible duct and we convert them to equalvent length	degree	User input
bend_180degree	User input The equalvent length of the fittings are $180^\circ = 10 \text{ ft length}$	The fittings in the flexible duct and we convert them to equalvent length	degree	User input
eq_length	$L_{eq} = \sum \text{Bends}$	Equalvent length = sum of the fittings and bends	Ft	To be Calculated
p_lose	$P_f = \frac{(12 * f * (L_{total} + L_{eq}))}{D_h} * (\rho) * \left(\frac{V}{1097}\right)^2$	Pf= pressure lose F= f_factor L=l_length Leq=eq_length $\rho = raw_air$ Dh=dh_inches V=v_duct	In.w.g	To be Calculated
k_percentage	User input	K _c = flexible duct compression percentage 0% = fully stretched	Percentage %	User input
pdcf_pressure	$PDCF = 1 + 0.58 * K_c * e^{-0.126*D_h}$	PDCF= pressures drop correction factor Kc= k_percentage Dh= dh_inches	Dimensionless	To be calculated

Variable Name	Equations	Description	Unit	Type
sf_factor	10%	Safety factor	Percentage %	Constant
Total_pressure_drop	$\Delta P_{total} = P_f * PDCF * SF$	P _{total} = total pressure lose through flexible duct Pf= p_lose PDCF = pdcf_pressure SF=sf_factor	w.in.g	To be calculated