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# Cyclone Separator sizing and Efficiency Calculator

USER MANUAL

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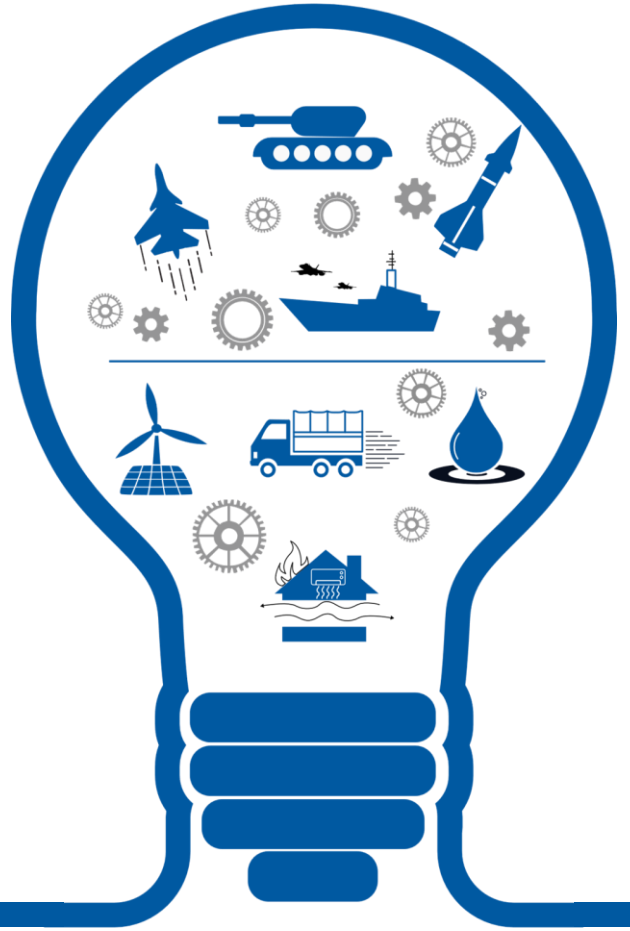

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# Introduction

- Cyclone separator sizing and efficiency Calculator is practical tool for the preliminary design of the separator.
- The User is required to input the designed flow rate, inlet velocity and gas density. To find the efficiency, user can provide dimension and material property inputs.
- Code takes input file and extracts data from it. Input data is used to solve the equations to obtain the dimensions and efficiencies of the separator.
- The results obtained are the standard dimensions according to five different models and the overall separation efficiency from input dimensions.

# APP Usage guide

INPUTS:

- Download Sample input file
- Edit it as per requirements
- Upload to input file to App webpage

EXECUTION:

- Run the App by hitting Run button
- App will perform the background calculations as described later in this manual

OUTPUT:

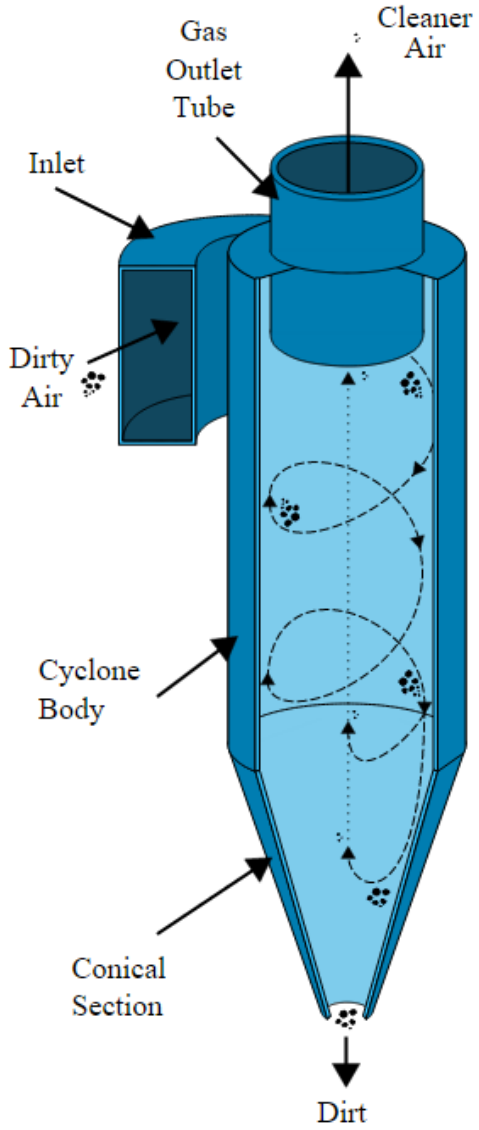
•After execution , output will be shown on the screen.

•To download output file, hit the Download Button

# Cyclone Separator

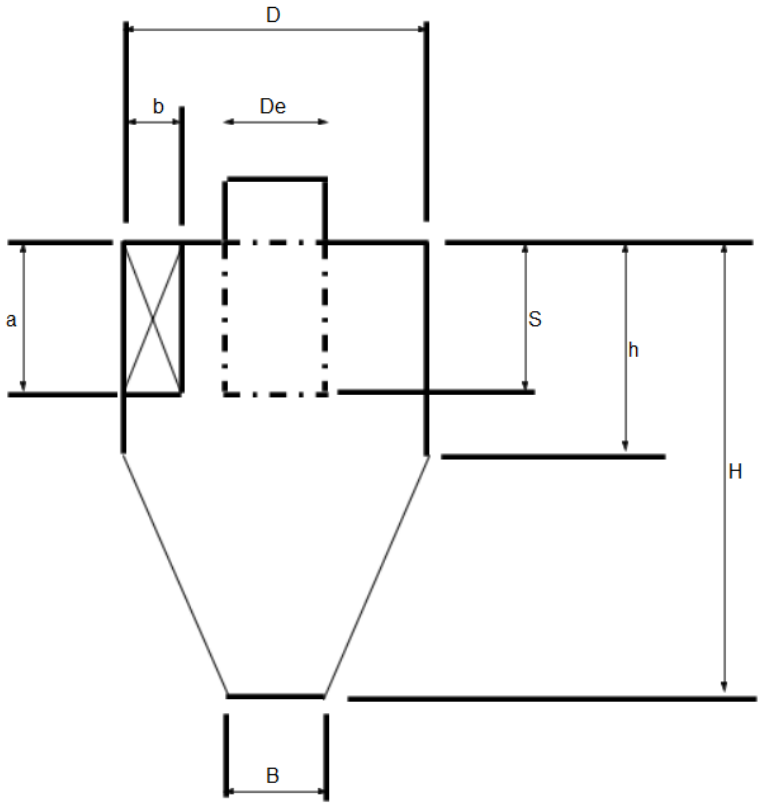
- A cyclone separator is an economical device for separating solid particles from contaminated gas streams, and has long been used in industrial applications such as power generations, gas turbines, chemical processes and so forth.

- A high speed air flow is established that follows a spiral pattern. Denser particles caught in the stream posses a high inertia and are forced to rotate at higher radii this causes them to strike the wall of the separator and leave the separator via a collection device.



# Cyclone Separator

- The dimensions shown in the following figure illustrates the dimensions that are output by the tool:



# Input file Information

Input file needs following data: SI unit system is used.

The tool uses various user input to calculate the dimensions and the overall separation efficiency of the cyclone separator using two distinct methods.

The first method is given by W.H Koch and W. Licht in a article titled “New design approach boosts cyclone efficiency” published in the Chemical engineering magazine in November 1977.

The second method is given by L.Enliang & W Yingmin in the American institute of chemical engineers journal of April 1989, volume 35 issue 4.

Both the methods use the same input parameters and the user can input the same values for both the methods or even use different values for both the methods.

# Input file Information

- Provide the following data for generating the cyclone dimensions:

  Flow rate

  Inlet velocity

  Gas density

- These three parameters are used to find the dimensions of the cyclone. These dimensions, along with a few material properties can be used to find the overall separation efficiency of the cyclone separator.
- If the user does not have designed dimensions and wishes to use the dimensions from one of the five models, run the tool once with dimensions set to zero and retrieve the dimensions, then use the retrieved dimensions as input and run the tool again.

# Input file Information

- Input the dimensions and material properties to find the overall efficiency, the required input dimensions are:

  Diameter

  Inlet height

  Inlet width

  Outlet length

  Outlet diameter

  Cylinder height

  Overall height, and

  Dust outlet diameter

# Input file Information

- The required input material properties are:

  Gas flow rate

  Density

  Viscosity

  Temperature

  Salt temperature factor

  Salt density factor, and

  Specific gravity.

# Input file Information

- The efficiency is calculated assuming that the size distribution of the particles are log normally distributed and hence, the user must input the log mean diameter of the particle and the log standard deviation. the user also has the choice of using regression.
- User can input either Y (yes) or N (no) to use regression or not. If the user chooses to use the regression tool, the calculation will be done without using the user defined log mean diameter and log standard deviation.

# Output file Information

The outputs of the tool are:

- The dimensions of the cyclone separator according to five standard design models, two high efficiency and three low efficiency, in a tabular format.
- The overall efficiency of the separator using the method specified by W.H Koch and W. Licht[1], and
- The overall efficiency of the separator using the method described by L.Enliang & W Yingmin[2]

# Sample Input file Information

- Initial input parameters for cyclone sizing.

  flow_rate = 447.9 $m^3/h$

  inlet_velocity = 22 m/s

  gas_density = 1.2470 $kg/m^3$

- Input dimensions for cyclone efficiency for both methods.

  diameter = 0.237851 m

  inlet_height = 0.118925 m

  inlet_width = 0.0475702 m

  outlet_length = 0.118925 m

  outlet_diameter = 0.118925 m

# Sample Input file Information

- Input dimensions for cyclone efficiency for both methods (continued.)

  cylinder_height = 0.356776 m

  overall_height = 0.951403 m

  dust_outlet_dia = 0.089194 m

- Input material properties for cyclone efficiency for both methods.

  gas_flow_rate = 2000 $m^3/h$

  density = 0.0740 $kg/m^3$

  viscosity = 0.010 cP

  temperature = 60 °C

# Sample Input file Information

- Input material properties for cyclone efficiency for both methods (continued)

  salt_temperature_factor = 1

  salt_density_factor = 1

  specific_gravity = 0.8

- Input  statistical data for both methods.

  regression = n

  log_mean_diameter = 12 μm

  log_standard_deviation = 3 μm

# Sample Output file Information

| Cyclone model/Dimensions | Stairmand High efficiency | Swift High efficiency | Laple low efficiency | Swift Low efficiency | Peterson-Whitby Low efficiency |
|---|---|---|---|---|---|
| Diameter (m) | 0.237851 | 0.247439 | 0.21274 | 0.21274 | 0.215992 |
| Inlet Height (m) | 0.118925 | 0.108873 | 0.10637 | 0.10637 | 0.125924 |
| Inlet width (m) | 0.0475702 | 0.0519622 | 0.053185 | 0.053185 | 0.0449264 |
| Outlet length (m) | 0.118925 | 0.12372 | 0.132963 | 0.127644 | 0.125924 |
| Outlet diameter (m) | 0.118925 | 0.0989757 | 0.10637 | 0.10637 | 0.107996 |
| Cylinder height (m) | 0.356776 | 0.346415 | 0.42548 | 0.372295 | 0.28727 |
| Overall height (m) | 0.951403 | 0.965013 | 0.850961 | 0.797776 | 0.684696 |
| Dust outlet dia (m) | 0.089194 | 0.0989757 | 0.053185 | 0.0850961 | 0.107996 |
| velocity head (m) | 5.138 | 4.87363 | 4.48712 | 4.69236 | 4.76836 |
| Pressure drop, no HV (m) | 15.8689 | 15.0523 | 13.8586 | 14.4925 | 14.7272 |
| Pressure drop, with HV (m) | 7.43853 | 7.05579 | 6.49622 | 6.79337 | 6.90339 |

The overall efficiency is 88.264

The overall efficiency is 93.9292

# References


1. W.H Koch and W. Licht, New design approach boosts cyclone efficiency. Chemical engineering, November 1977.

1. L.Enliang & W Yingmin, American institute of chemical engineers journal Volume 35 Issue 4, April 1989.

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# Thank You !


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