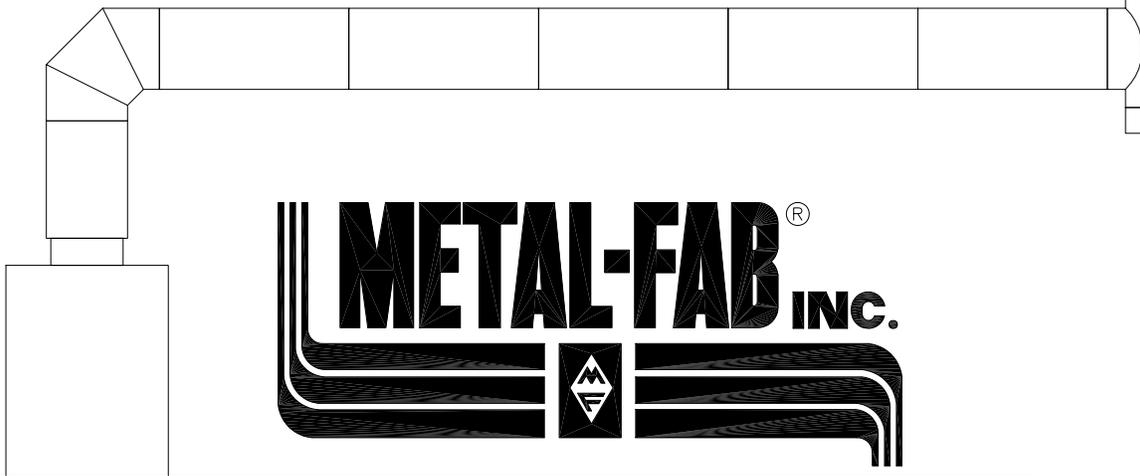
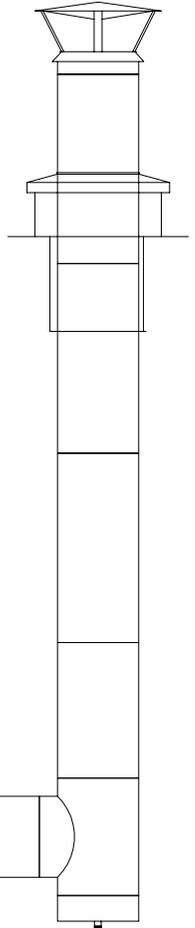


**METAL-FAB
ENGINE/TURBINE
EXHAUST SIZING PROGRAM
INSTRUCTION MANUAL**



Introduction/Overview

Metal-Fab Engine/Turbine Exhaust Sizing Program is software specifically designed to assist an engineer in the task of sizing an exhaust system, using Metal-Fab Pipe Products. This software is a combination of ASHRAE calculations and Metal-Fab Inc. specific details that will enable a user to size an exhaust system making best use of space and minimizing costs.

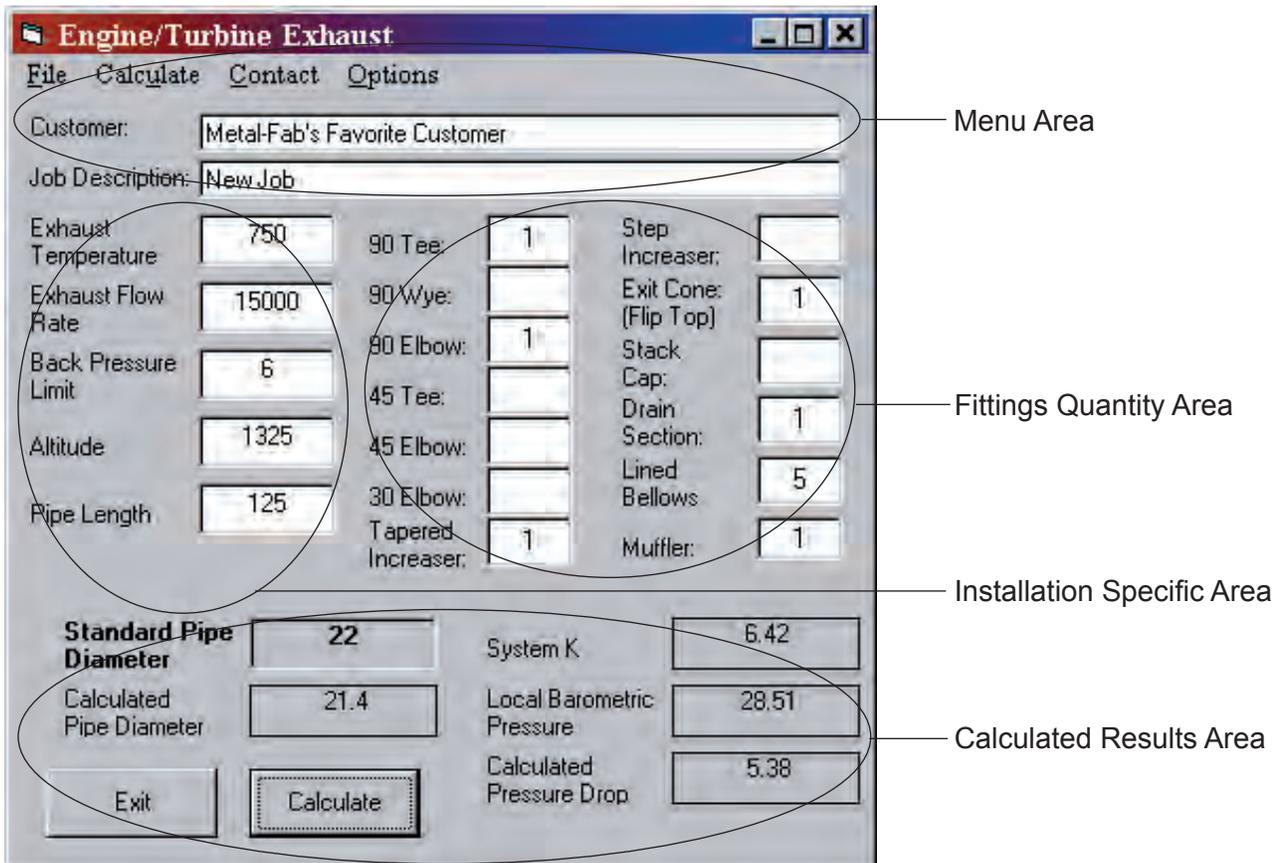
Quick Start:

1. Insert CD into CD drive, wait for Installation program to begin.
2. Install the CD onto your hard drive. It is strongly recommended that you accept the default file locations.
3. Start the Metal-Fab Inc. Exhaust Program from the Program Files menu.
4. Enter your data into the appropriate boxes.
5. Click on Calculate for pipe sizing.
6. You can save, print or even E-mail the resulting calculations by selecting from the File menu.

NOTE: If you E-mail the results as an attachment, the recipient must also have the sizing program.

Metal-Fab Inc. Exhaust Program Environment:

The Exhaust program environment can be broken down into a few distinct areas. The first area is the MENU AREA. This section contains options that can be accessed before/during/after the pipe sizing is initiated. The INSTALLATION SPECIFIC INFORMATION is a section of data that is input by the user and is required to calculate a pipe diameter. The FITTING QUANTITIES AREA is a section that details all the special fittings required for the installation. The CALCULATED RESULTS AREA displays the results of the information provided.



MENU AREA

The menu system allows users access to an assortment of information and options at anytime the program is in use. Below is a detail of the options available:

File

- Open.....Use to open previously saved sizing data.
- Save AsUse to save the current data to a size file for future retrieval.
- Print Form.....Used to print a copy of the form as shown on the screen.
- Print ReportUsed to print a text report of current sizing. Good for fax.
- Email.....Used to email the current sizing info. Requires email and Internet Connection.
- ExitQuits Program.

Calculate Causes program to calculate results from data entered.

Contact

- Address.....Brings up a form that stores the users contact information.

Options

- K-Factor.....Shows a list of K-Factors for each Metal-Fab Inc. Fitting.
- Clear AllClears all data from the input boxes.
- Altitude of Cities.....Gives a list of some U.S. Cities with an altitude greater than 1000ft.

INSTALLATION SPECIFIC INFORMATION

The Installation Specific Information Area contains information required to compute the pipe sizing and is specific to the particular job being sized. All input must be provided to complete the calculations. The following is an explanation of the data required:

Exhaust Temperature: Temperatures of gases to be vented.

Exhaust Flow Rate: (CFM) Cubic feet per minute of exhaust gases produced by engine/turbine at max rated rpm and load.

Back pressure limit: (Inches water column) Maximum allowable pressure at start of system. Usually specified at exhaust manifold by engine/turbine manufacturer. (Be sure to deduct pressure drop through muffler, provided by the muffler manufacturer.)

Altitude: Same as before.

Pipe length: (ft) Total vertical & horizontal distance that exhaust gases must travel to reach the termination

FITTING QUANTITIES AREA

This area is where specific fittings are identified. Each possible fitting has an input box associated with it where the quantity is entered. If a quantity of two 90 Tees are used then 2 should be entered into the appropriate box. If none of the fittings are used a quantity is not necessary. However 0 (zero) can be entered.

NOTE: Enter quantity of one in the appropriate box if the system has a muffler. This is an exit loss factor only. It does not account for the total flow loss through the muffler. (See definition of back pressure limit above).

CALCULATED RESULTS AREA

This section is an area that cannot be edited by the user. It displays the results of the calculations performed. Each item displays a different piece of information about the system specified. The following is a description of the results:

Standard Pipe Diameter: (Inches) This is the minimum standard size of pipe available from Metal-Fab Inc. that is required for the data provided. It is determined from the computed size.

Calculated Pipe Size: (Inches) This is the actual minimum size of pipe required for the data provided. It is determined through 2000 ASHRAE calculations for chimney venting. Refer to the 2000 ASHRAE Handbook – HVAC Systems and Equipment I-P Edition, or contact Metal-Fab for more information on the calculations used.

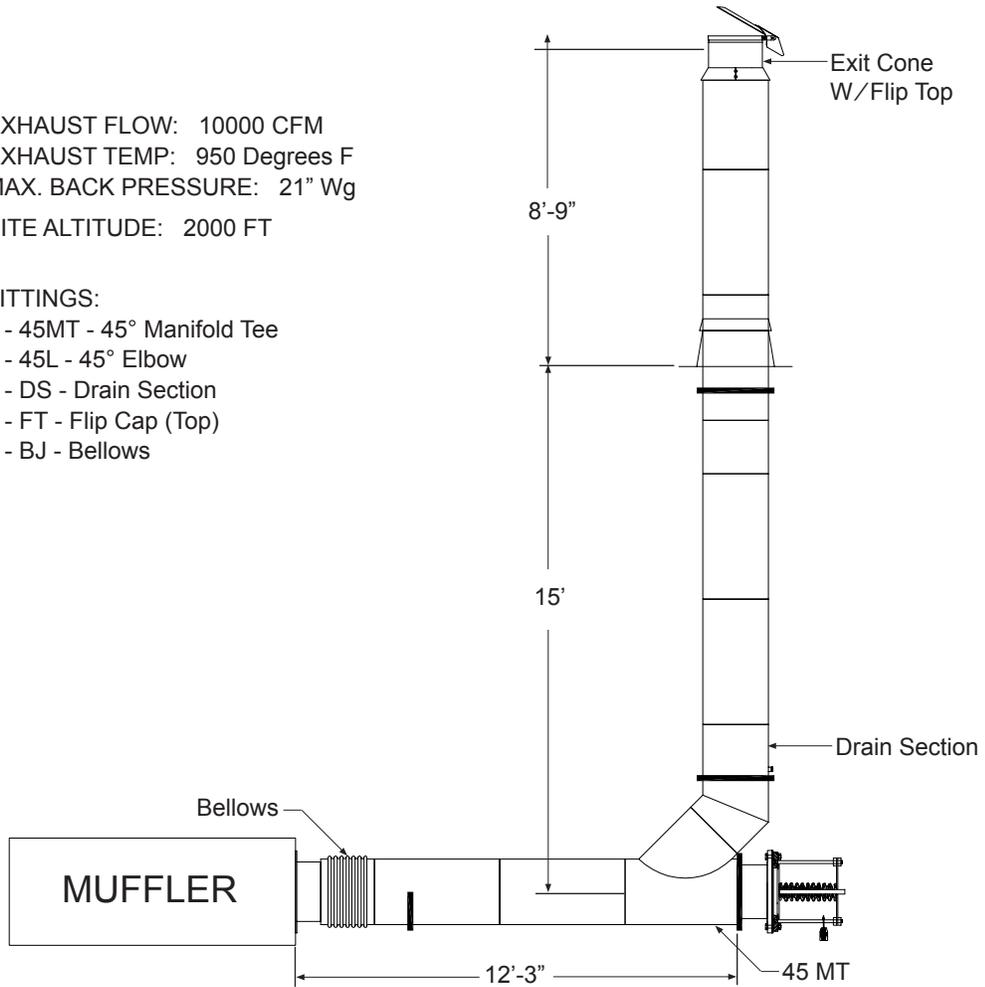
System K: Resistance coefficient for the entire chimney system including piping and fittings.

Local Barometric Pressure: Barometric pressure at installation site based on elevation.

Calculated Pressure Drop: Total of all losses in the vent system. Measured in inches of water column.

EXHAUST FLOW: 10000 CFM
 EXHAUST TEMP: 950 Degrees F
 MAX. BACK PRESSURE: 21" Wg
 SITE ALTITUDE: 2000 FT

- FITTINGS:
 1 - 45MT - 45° Manifold Tee
 1 - 45L - 45° Elbow
 1 - DS - Drain Section
 1 - FT - Flip Cap (Top)
 1 - BJ - Bellows



Engine/Turbine Exhaust

File Calculate Contact Options

Customer: Metal-Fab's Favorite Customer

Job Description: Example

Exhaust Temperature	950	90 Tee:		Step Increaser:	
Exhaust Flow Rate	10000	90 Wye:		Exit Cone: (Flip Top)	1
Back Pressure Limit	21	90 Elbow:		Stack Cap:	
Altitude	2000	45 Tee:	1	Drain Section:	1
Pipe Length	36	45 Elbow:	1	Lined Bellows:	1
		30 Elbow:		Muffler:	1
		Tapered Increaser:			

Standard Pipe Diameter	12	System K	3.73
Calculated Pipe Diameter	10.67	Local Barometric Pressure	27.82
Exit	Calculate	Calculated Pressure Drop	13.12

APPENDIX

TABLE 1
ALTITUDE CORRECTION

Altitude, ft.	Factor	B, in Hg
Sea Level	1.00	29.92
2,000	1.08	27.80
4,000	1.16	25.80
6,000	1.25	24.00
8,000	1.34	22.30
10,000	1.45	20.60

Multiply operating input by factor to obtain design input
 $m = ft * 0.3048$

TABLE 2
RESISTANCE LOSS COEFFICIENTS

Piping (Including Pipe, Expansion Joint, Variable Length, Single Wall Boiler Adapter, Flange Adapter, and Flip Top)	0.40L/D
90° Tee	1.25
45° Tee	0.40
30° Elbow	0.12
45° Elbow	0.15
90° Elbow	0.30
90° Wye	0.60
Exit Cone	1.25
Stack Cap	0.50
Drain Section	0.25
Lined Bellows	0.08
Nozzle Section	0.25
Duct Drain	0.25
Step Increaser	$\frac{[1 - (\frac{\text{small diameter}}{\text{large diameter}})^2]^2}{(\frac{\text{small diameter}}{\text{large diameter}})^4}$
Tapered Increaser	$\frac{.51[1 - (\frac{\text{small diameter}}{\text{large diameter}})^2]^2}{(\frac{\text{small diameter}}{\text{large diameter}})^4}$



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