Flare Sizing Ver1.0

KLM Technology Group

Practical Engineering Guidelines for Processing Plant Solutions

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KLM Technology Group

SOLUTIONS, STANDARDS AND SOFTWARE
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Introduction

Flares are primarily used in the hydrocarbon and petrochemical industries for burning of flammable gas released by pressure relief valves.

Flares are used extensively as a way to achieve safe and reliable vapor release during a plant upset or emergency situation.

Introduction

Safe design of a flare requires careful consideration of the thermal radiation and noise that also will affect the plant.

KLM Technology Group Flare Sizing program is a software for correctly sizing industrial flares, for estimating the atmospheric impact of industrial flares. The program allows to evaluate the thermal radiation and noise impact of existing or future flares at certain distances and height of flare stack.

Perform Calculations

- Calculate thermal radiation level at certain distances
- Calculate noise level at certain distances
- Supply fluid properties at flow conditions
- Supply transmissivity value based on relative humidity
- Supply emissivity value from flared gas
- Use English or SI engineering units in any mixture
- Use mass or volume flow units
- Import process data
- Print a calculation sheet using SAP Crystal Reports runtime engine application
- Save the data

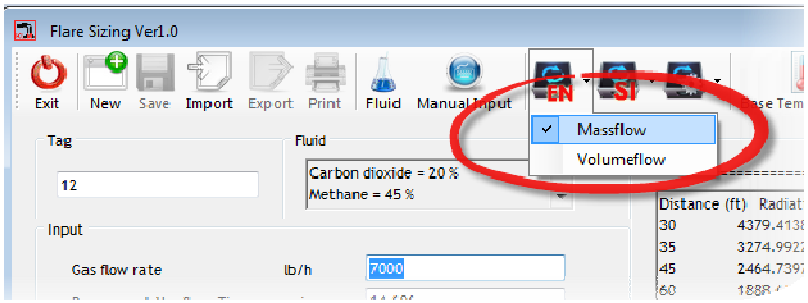
Features

- Engineering Units
- Base Conditions
- Fluid Properties
- Input Data
- Filing and Moving On

Engineering Units

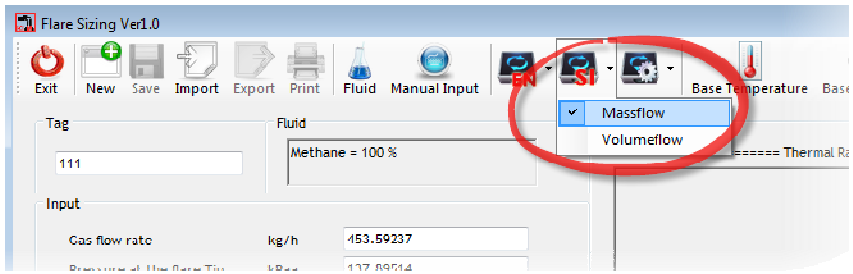
<u>English units</u> can change units in calculation, to be english units standard, it comprises :

- ✓ Massflow
- ✓ Volumetric flow



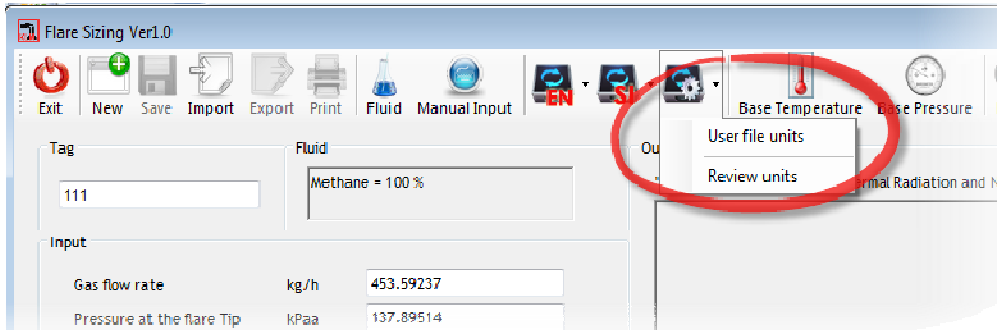
<u>SI units</u> can change units in calculation, to be SI (International System of units), it comprises :

- ✓ Massflow
- ✓ Volumetric flow



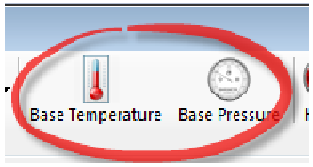
Engineering Units

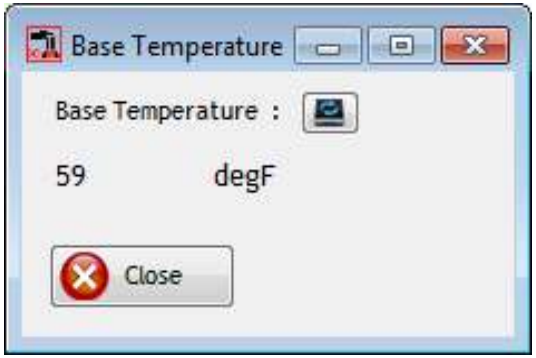
<u>User file units</u> can change units in calculation based on desired user (can be setup in **review units** menu)

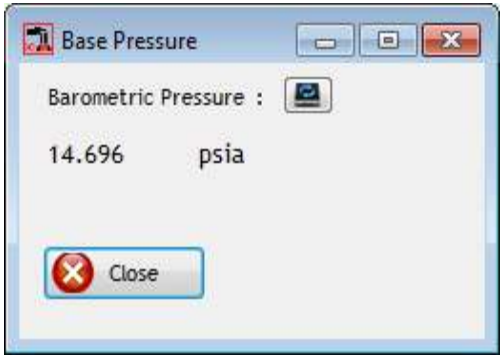


Base Condition

This program follows the ISO standard,
base pressure : 14.7 psia
base temperature : 59 degF

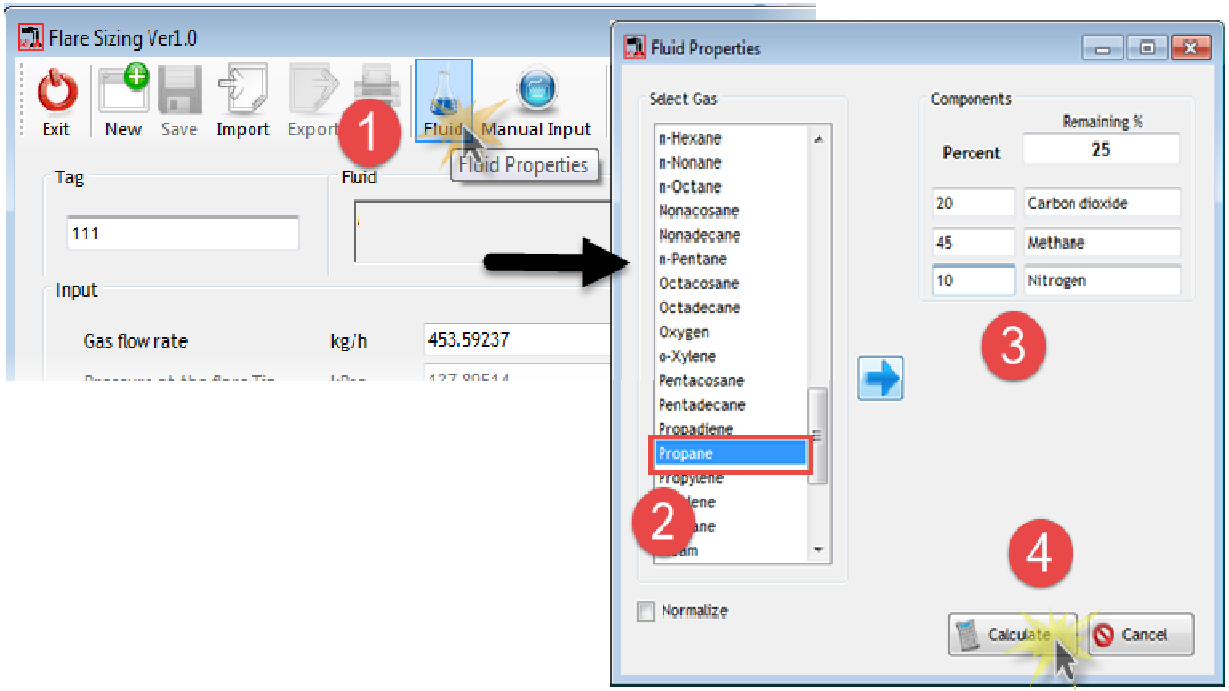




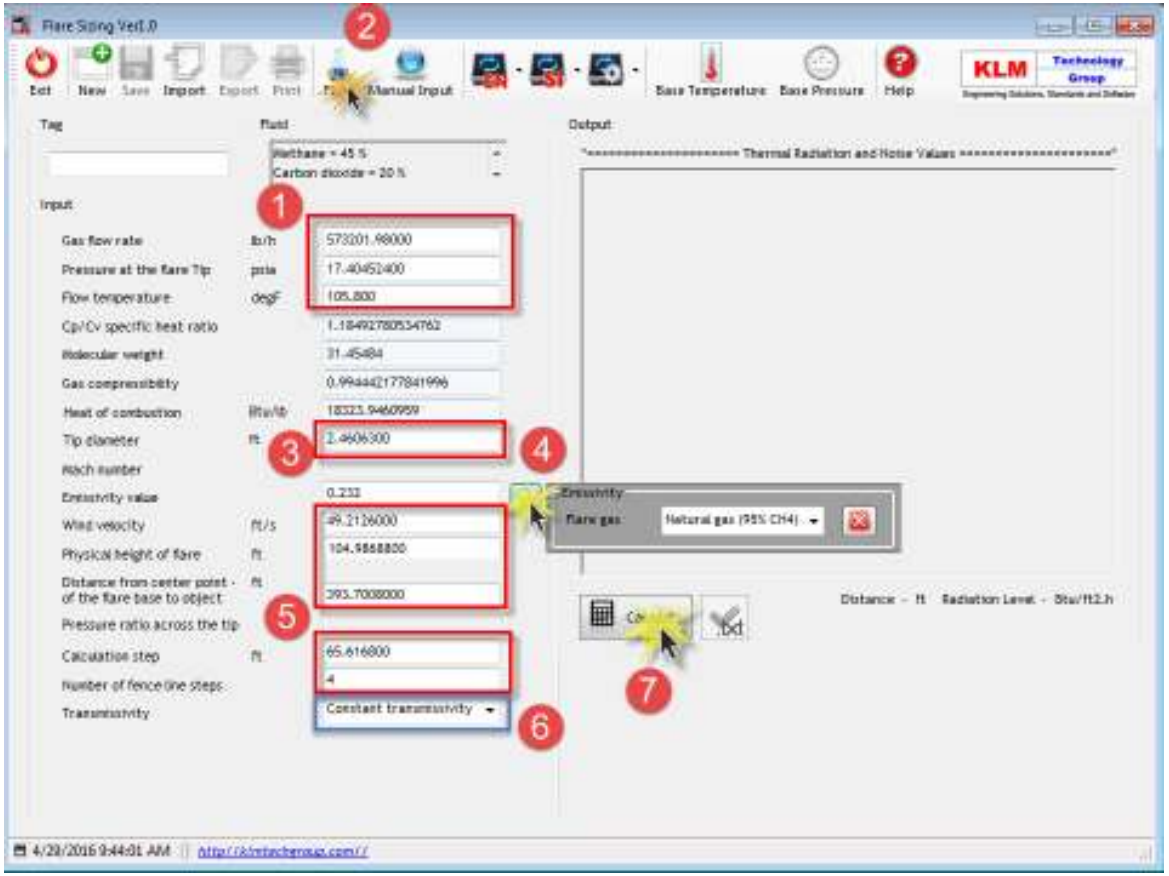


Fluid Properties

- Enabled when the pressure and temperature are entered
- Select the desired components
- In the component box, enter the percentage
- Continue until the remaining percentage equals zero
- Click calculate button in the component box and the program will calculate and enter the mixture values to the properties



Input Data



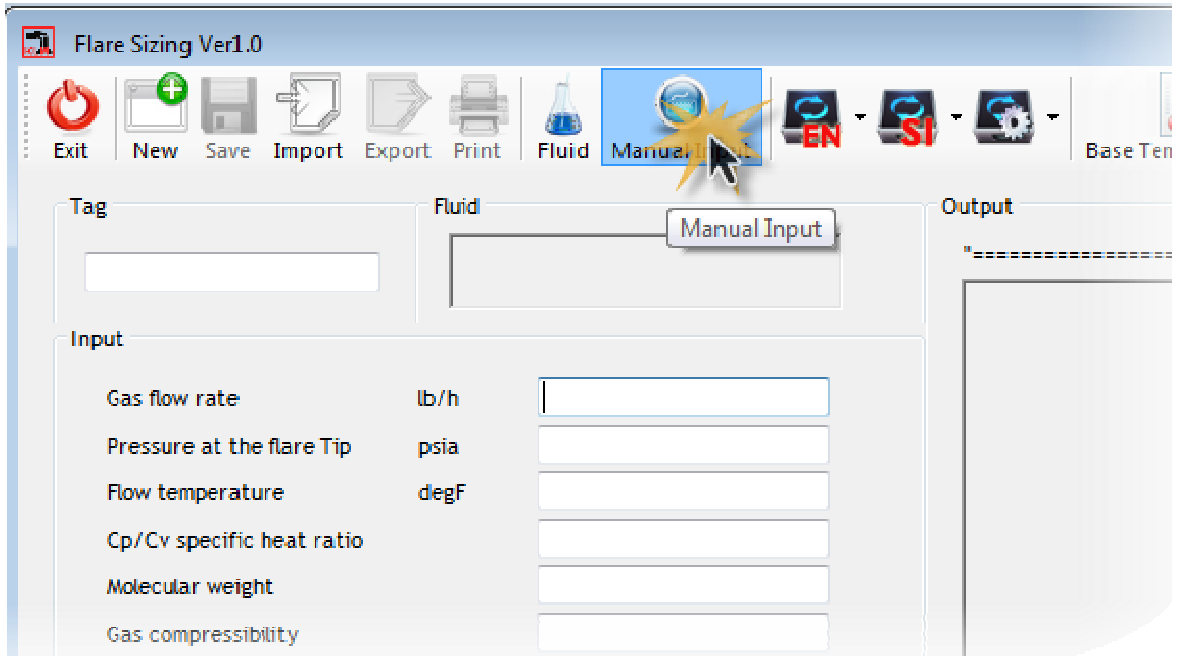
<u>Calculate</u> button

The calculate button will validate the input data.

- If not valid it will display the unsatisfactory data.
- If valid it will calculate the output data, display the results, enable button(save) and (export) , enable " output to TXT".

Manual Input

- Select **Manual Input data** Menu
- Enter desired data to input column
- Click calculate button
- Output will be displayed

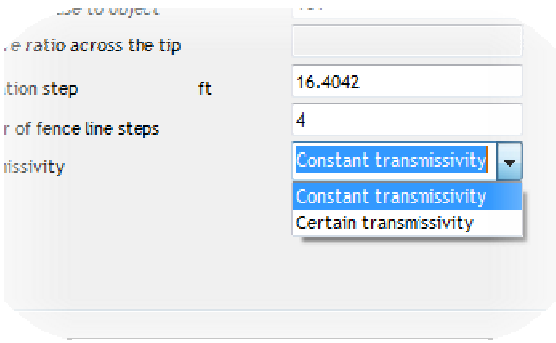


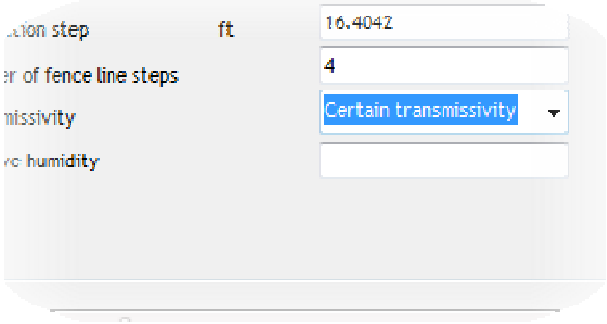
Emissivity Value

- The emissivity value can be looked up by click search emissivity value. Then,
  - ✓ Click button of emissivity value
  - ✓ Select the desired flare gas emissivity
  - ✓ Click button close
  - ✓ The emissivity value screen will be displayed

Transmissivity Selection

- Select the transmissivity, (There are two types that can be selected, namely the constant transmissivity and certain transmissivity)
- Select the constant transmissivity for transmissivity value 1
- Or select certain transmissivity and input the relative humidity





Filing and Moving On

- **Program menu –** It clears the calculation and returns to the main menu.
- **New** – It clears the screen for a new calculation.
- **Save -** It saves a new record if not previously saved or saves changes to an existing record to database. It is also used for saving temporary data, thus, the recorded data can be done printing calculation process.
- **Export data** – It saves input and output calculation record in *csv file.
- **Import data** – It opens *csv file record.
- **Print calculation** – It is enabled after calculation and save is made. It displays the screen to print a calculation.
- **Exit** – It leaves the program

Calculation Routines

- Calculate radiation level

$$K = \frac{\tau \cdot \varepsilon \cdot Q}{4\pi \cdot d^2}$$

- Calculate noise intensity at distance
  - Speed of sound in waste gas

$$C = 223 \times \sqrt{\frac{(k \times (T + 459.67))}{Mw}}$$

Calculation Routines

- Noise intensity parameter

  For Pr < 2.9

$$L = 13.3 + 88.1 \times \log_{10} P_r$$

  For Pr > 2.9

$$L = 51.9 + 5.06 \times \log_{10} P_r$$

- Noise level at distance from stack

$$L_p = \left[L + 10 \times \log_{10} \left(\frac{0.5 \times W \times C^2}{3600 \times 32} \right) \right] - 20 \times \log_{10} \left(R / 100 \right)$$

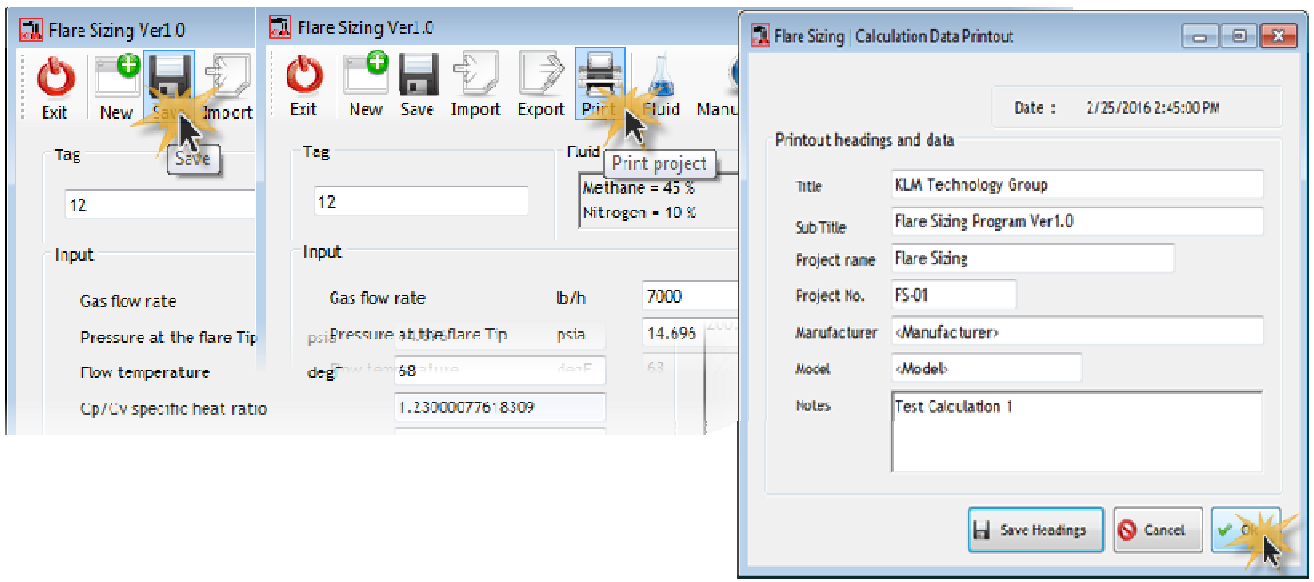
Calculation Routines

Nomenclature

1. C Speed of sound in waste gas, ft/s
2. d Diameter of stack, ft
3. Ɛ Emissivity value, dimensionless
4. k specific heat ratio, dimensionless
5. K Radiation level, Btu/h.ft^2
6. L Noise intensity parameter, dB
7. Lp Noise level , dB
8. Mw Molecular weight, lb/lbmol
9. Pr Pressure ratio across the safety valve, dimensionless
10. R Distance from center point of the base of the flare to object, ft
11. T Flow temperature, degF
12. W Gas flowrate, lb/hr

Calculation Printout

- This program will print the input and output calculation data and one associated comment. The comment is included in the data sheet for reference purposes.
- It also creates the default printout headings. The headings are printed at the top of all printouts.
- File → Save → Print Calculation



Calculation Printout, Cont'd

Save. Saves the headings

Cancel. Returns to the calculation form without printing

OK. View report calculation, then prints the headings and calculation using the Windows Print Manager.

KLM Technology Group
Engineering Solutions, Standards and Software

KLM Technology Group
Flare Sizing Program Ver1.0
Project No - FS-01 Flare Sizing
Date : 4/29/2016 2:05:22PM

Flare Sizing

Tag number : 123

Fluid : | Methane = 45 % | Carbon dioxide = 20 % | Propane = 35 % |

Input Data

Gas flow rate	573201.9800	lb/h
Pressure at the flare Tip	17.4045	psia
Flow temperature	105.8000	degF
Cp/cv specific heat ratio	1.1049	
Molecular weight	31.4548	
Gas compressibility	0.9944	
Heat of combustion	18323.9461	Btu/lb
Tip diameter	2.4606	ft
Mach number	0.3602	
Emissivity value	0.2320	

Wind velocity	49	ft/s
Phyisical height of flare	104.9869	ft
Distance from center point - of the flare base to object	393.7008	ft
Pressure ratio across - the tip	1.1843	
Calculation step	65.6168	ft
Number of fence line steps	4.0000	
Transmissivity	Constant transmissivity	
Relative humidity	0.0000	

Output Data

Distance (ft)	Radiation (Btu/ft2.h)	Noise Intensity (dB)
393.7008	1951.0076	72.0774
459.3176	1401.4258	70.7385
590.5512	1042.7857	69.5786
787.4016	800.7765	68.5556

Notes : Test Calculation 1

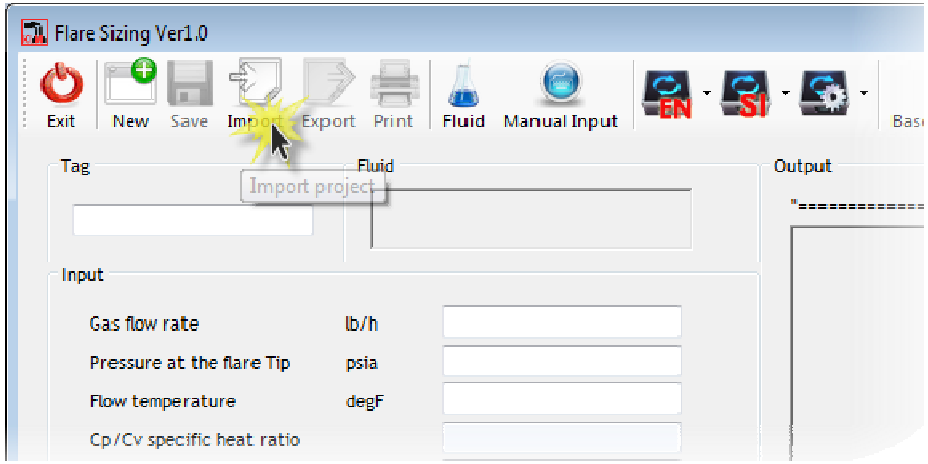
Page 1 of 1

Importing Data into a Calculation

To **Import** process data into a calculation :

Make a sequential file for each calculation. Files to have a filename(Suggest the tag number) with no extension (eg FS-12).

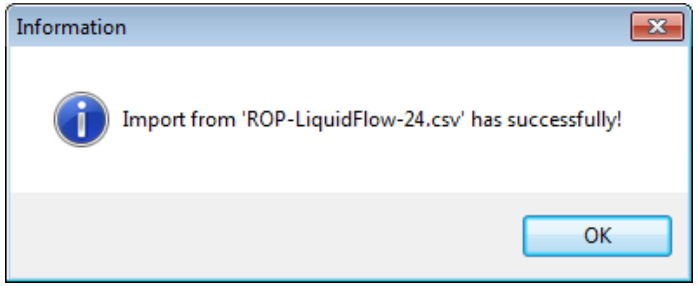
- Take the Import data menu option.



Importing Data into a Calculation, Cont'd

- Find the required file. (Using standard Windows procedures)
- Select the file and the data will be loaded.

- If the import is successful it will appear the following information
- Showing data import



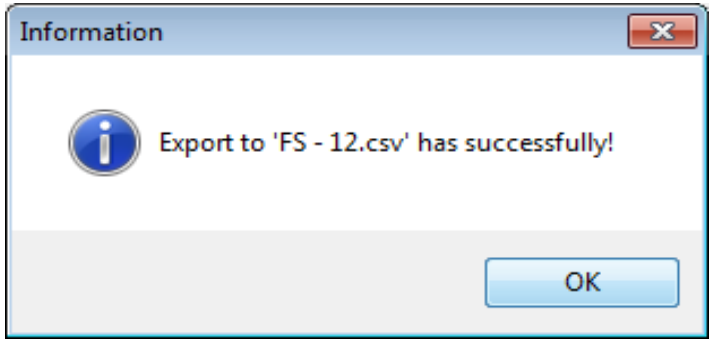
Export Data

- Click button Export

- Click button save on save file dialog, Files have a filename (Suggest the tag number)

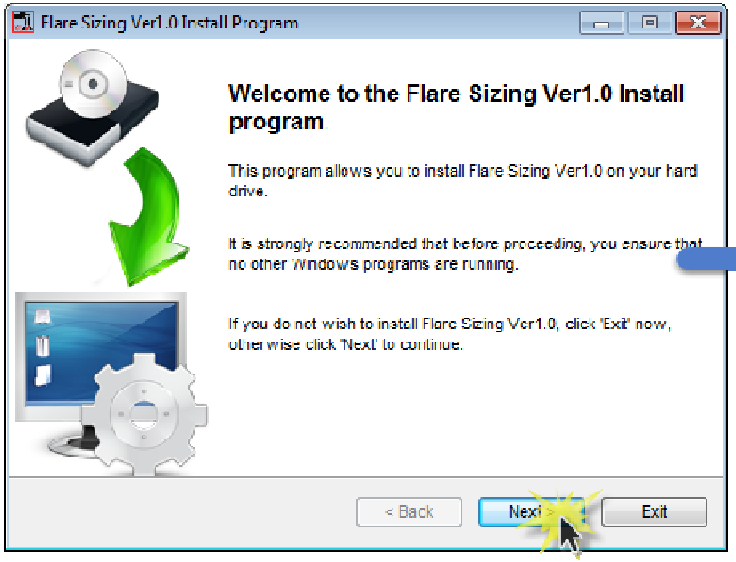
Export Data, Cont'd

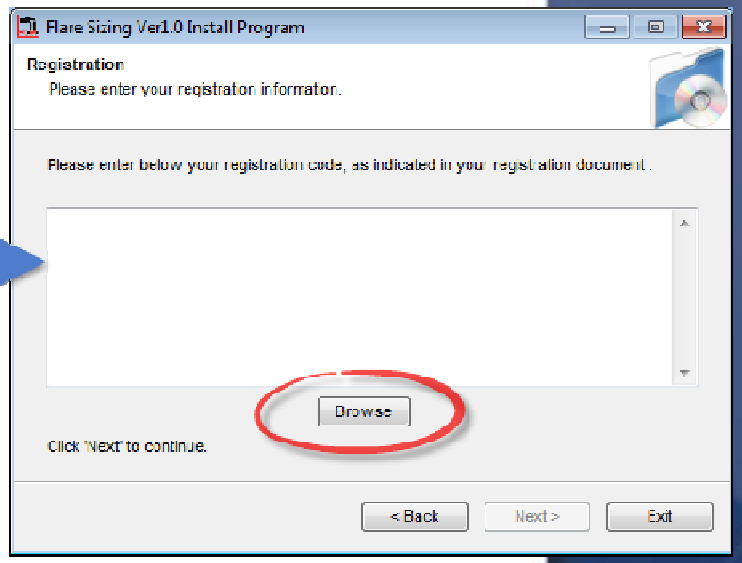
- If the import is successful it will appear the following information

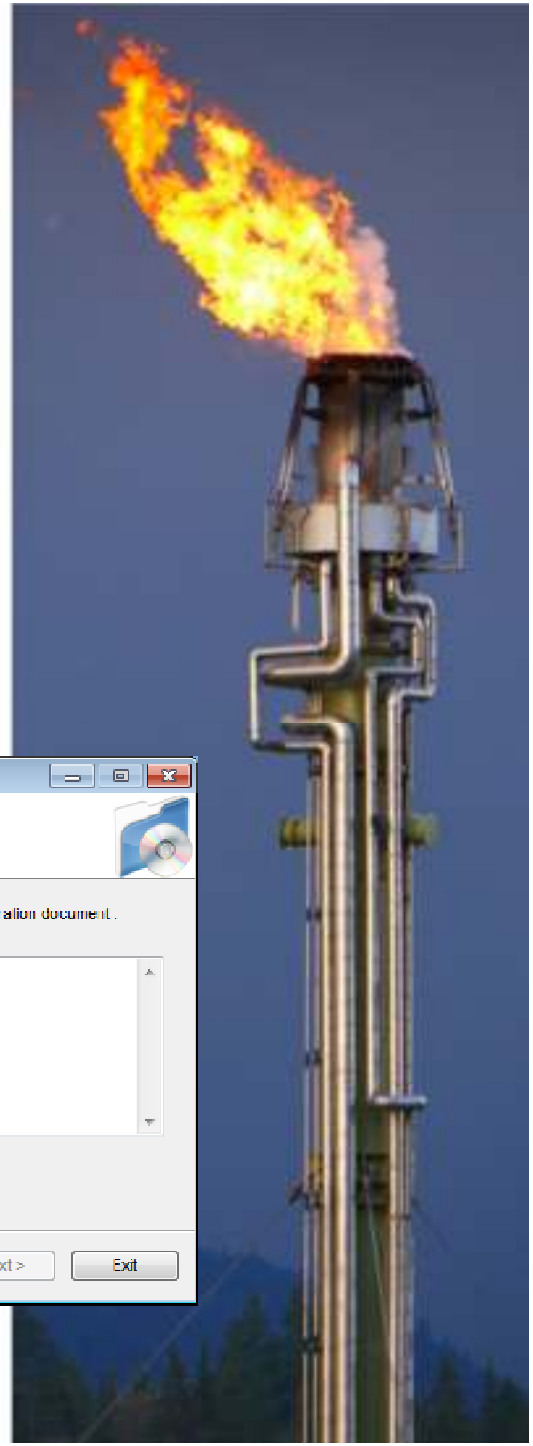


Installation

- Click Flare Sizing Ver1.0_Setup.exe → Click Next
- Enter your registration , click Next

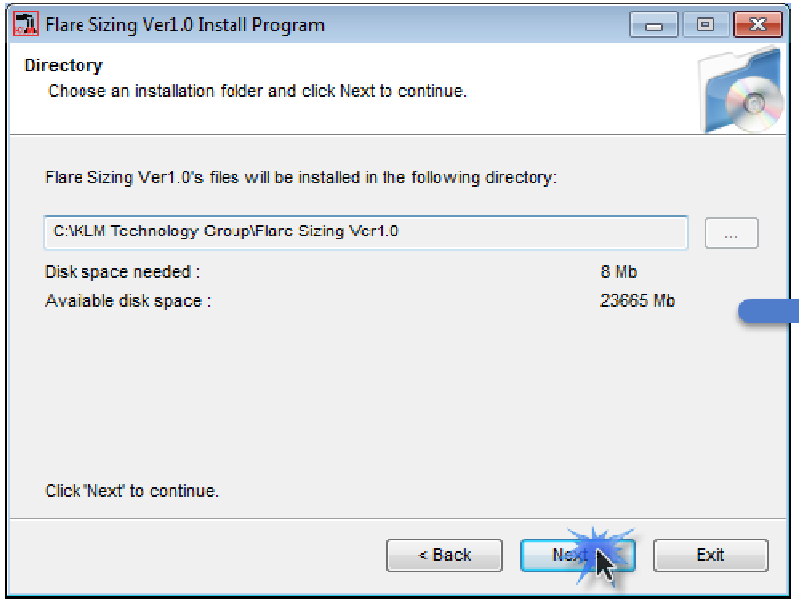


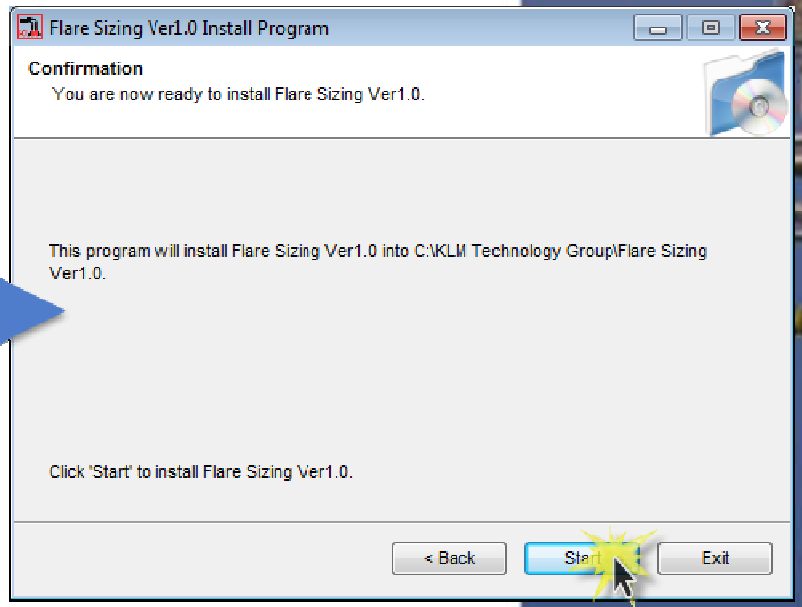


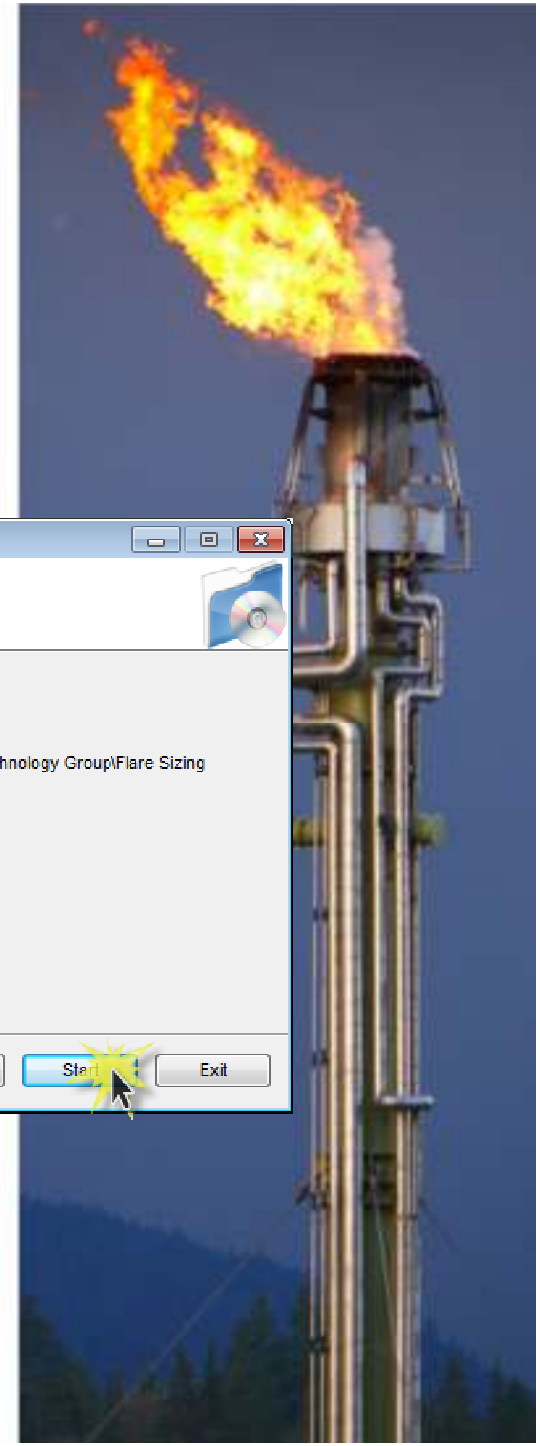


Installation Cont'd

- Click Next on Directory page

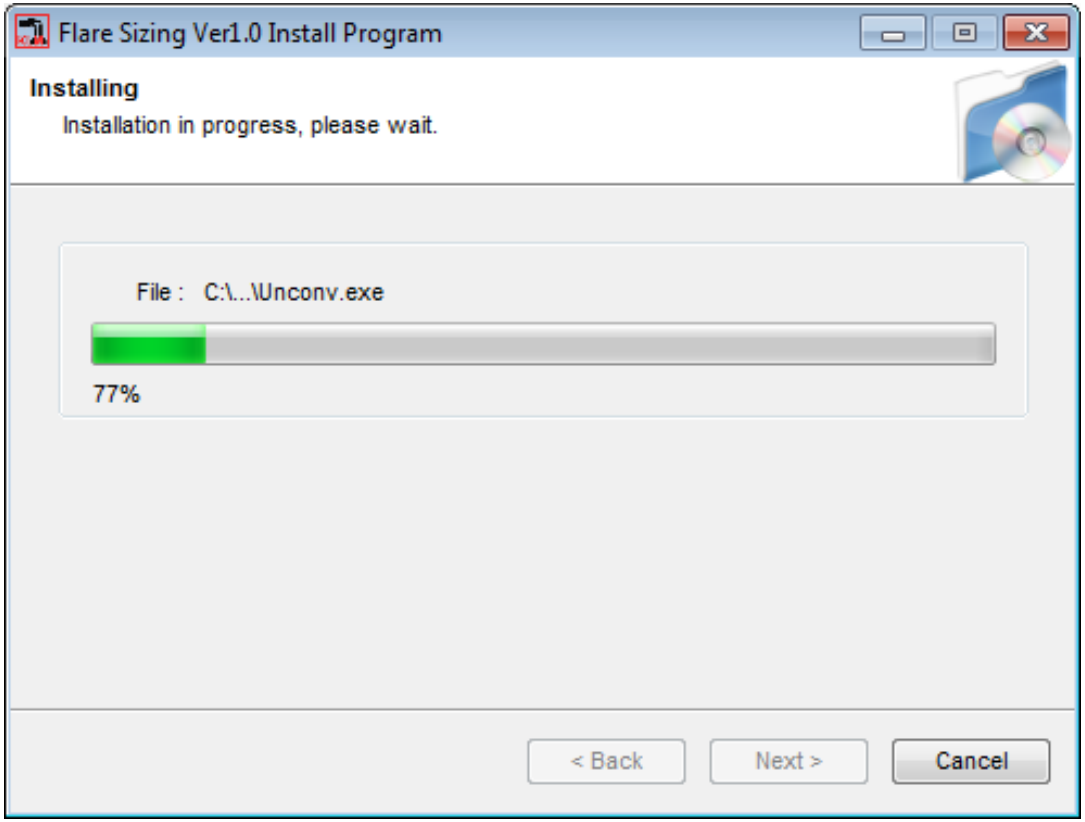






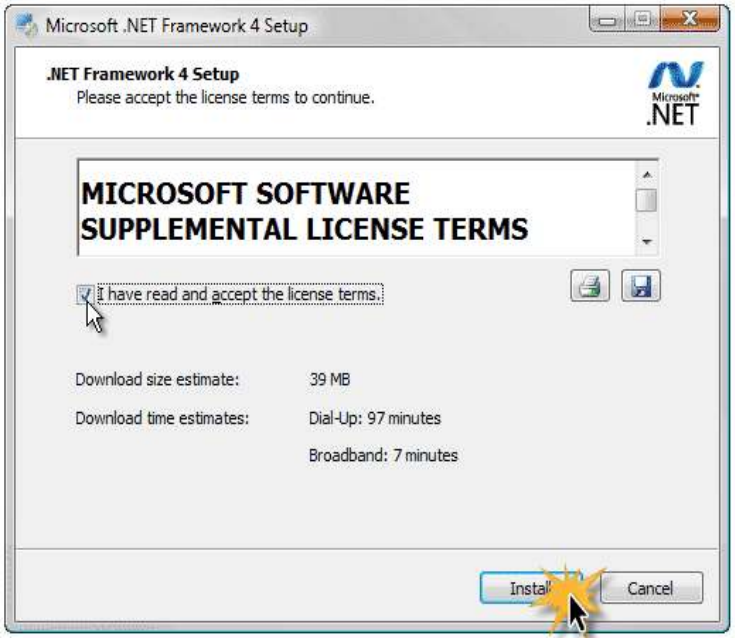
Installation Cont'd

- Install on Process

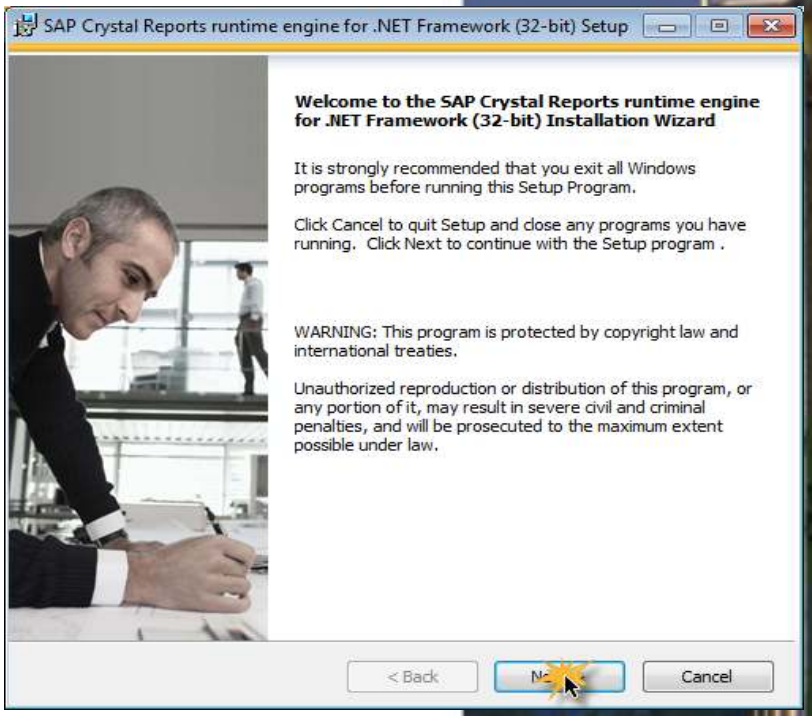


Installation, Cont'd

- Install .NET Framework 4 for requirement system(if NOT Exist on PC)

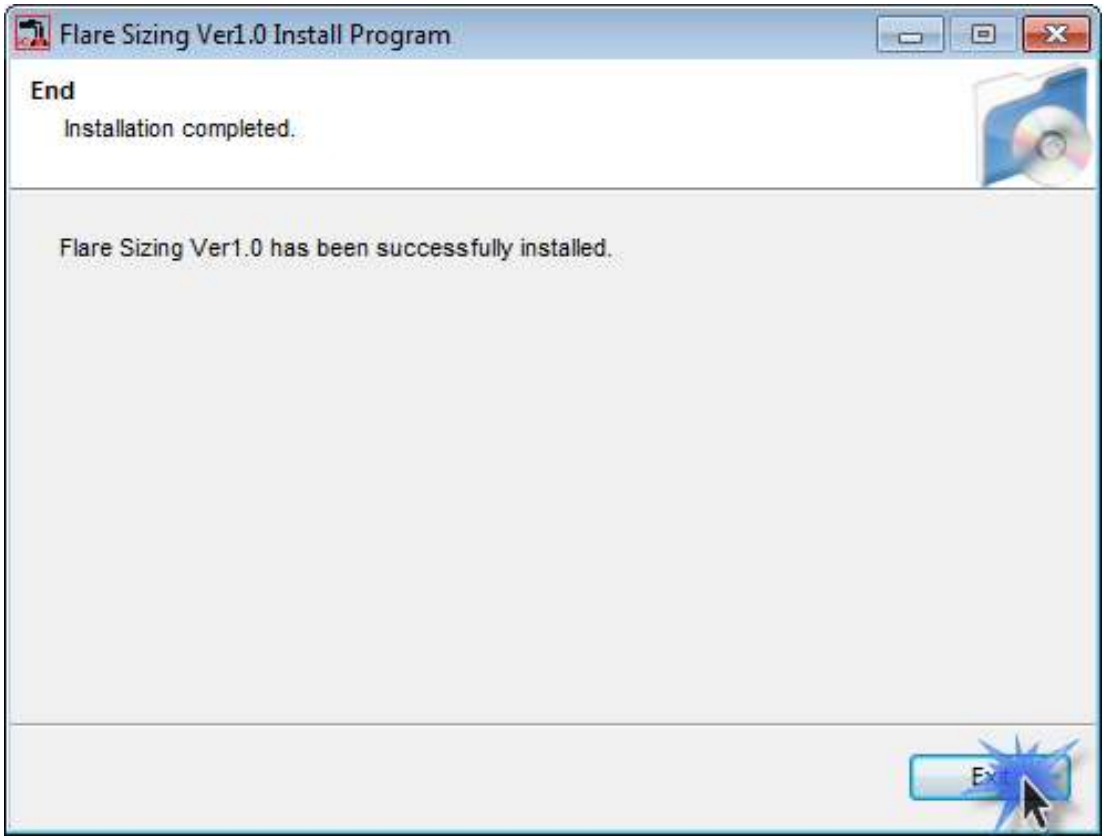


- Install Crystal Report for requirement system (if NOT exist on PC)



Installation Cont'd

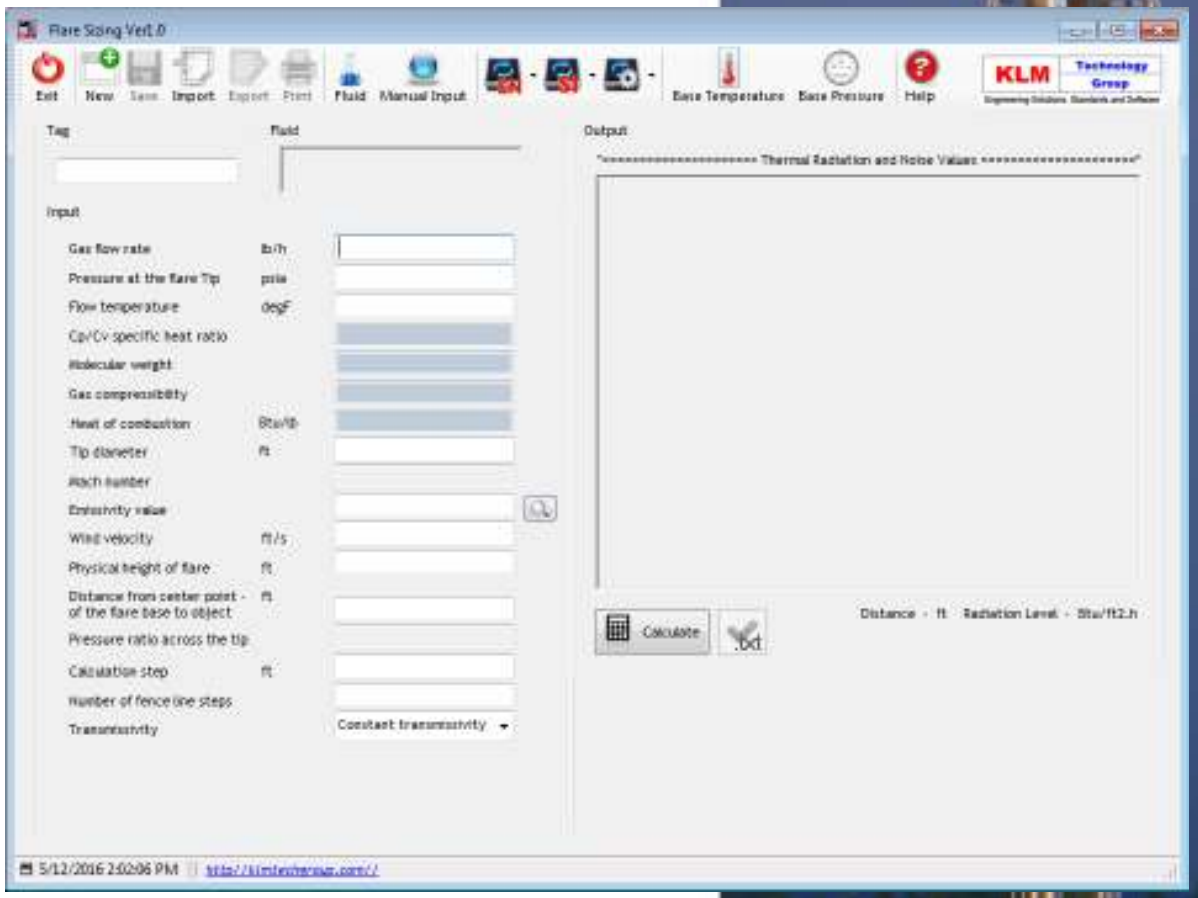
- If the installation is complete it will display a confirmation
- Click Exit



Installation, Cont'd

- Enter password application and click **OK**

- Applications will be open



Flare Sizing Program

Flare sizing program is specially designed to assist engineers for estimating the atmospheric impact of industrial flares.

KLM Technology Group Flare Sizing Program is very useful and recomended program to evaluate the thermal radiation and noise impact of existing or future flares at certain distances.

Flare Sizing Program, Cont'd

This is one of the best stand alone Flare Sizing program available.

1. Emmisivity value option based on selected flare gas
2. Multiple units of measure choices – SI and English
3. Multiple units of measure choices - mass or volume
4. Physical properties based on chosen temperature and pressure
5. The ability to evaluate thermal radiation and noise at certain distances
6. The ability to display the result in extension .txt

Purchasing Software

Flare Sizing Program Ver1.0

USD $ 299.95

For detailed information :

info@klmtechgroup.com

Thank You