STEAMDOSS

What is STEAMDOSS?

STEAMDOSS is a windows based software application.” Total system solutions" is the focus and underlying concept for the development of this software.

This software is aimed at fulfilling the needs of design, installation, operation and plant engineers and energy engineers in steam generation and user facility systems. This is designed as "one stop shop software solution" for steam systems.

Salient features:

- Contains 12 independent design programs in design module
- Contains 28 engineering components and one general component in the engineering tool box in simulation module
- Contains 2 independent programs for steam system users common for both modules
- Designed to work in a wide variety of system of units namely , US units, SI and metric and mixed units
- User can build a partial system to evaluate in simulation module. This is done with ends connected to a hypothetical component called source and sink in heat and simulation module
- Reports can be generated for design and heat and power simulation modules which can be printed, or exported to excel, word or as a PDF document
- User can graphically build a process flow diagram ,calculate and or print models
- Templates are provided in the software and additional models can also be downloaded from website
- Both design module and heat and power simulation modules are provided with rich graphics and diagrams for ease of use.
- User friendly software architecture and high flexibility in modeling, data entry and results display.

Uses:

This software can be used

- as a design tool for steam systems to solve many of the design problems

- to model and analyze the steam systems using the heat and power simulation module.
- to estimate the energy savings for different options and also use the financial software program to estimate payback

Key benefits:

- This software effectively aids in design and simulation of steam generation and user facility systems thus saving time and dollars.
- It aids in problem solving where on site solutions are needed fast.
- User can model basic and proposed modifications using heat and power simulation module and calculate the fuel, power and water consumptions .User can then compare alternative performances and also calculate energy savings and evaluate payback. The software aids in faster energy audit and preparation of reports.
- It helps perform "sensitivity analysis" and evaluate various design and problem solving options
- User can prepare process flow diagram with ease
- It can be used as a tool for preparation of proposals
- The software can be used as a training tool where needed

Design module

The design programs can be accessed by clicking the left side menu bar in the design module screen .The graphic flash screen indicates the fit of the program in the steam system and a short description below.

Program details:

1. Estimate boiler capacity: This program provides calculations for the user to decide the capacity of the boiler plant based on the plant operating data .User has option to input data in excel format . It provides calculated results on boiler capacity, load profile and fuel cost.

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2. Combustion: This program provides combustion calculations for the boiler. Calculates fuel consumption, excess air, efficiency, flue gas analysis for a given set of fuel, air and steam conditions. Sankey diagram and facility to calculate the stack diameter are provided in this design program .ABMA charts are used for radiation losses

3. Economizer calculations: This design program calculates the in and out stack temperatures, increase in feed water temperature and efficiency gain due to

installing an economizer in the boiler. The input given for calculations are type of boiler, it's rated efficiency and firing rate, steam and blow down conditions. Also this program recommends when condensing economizer is required.

4. Estimate blow down: This program provides calculations to estimate percent of blow down or percent of makeup in boiler plant system when condensate percent is known or unknown. The calculations are based on TDS or conductivity measurements as input data.

5. Fuel properties: This program calculates the HHV and LHV values for the natural gas, fuel oils and coal fuels for user defined compositions. User needs to provide gravimetric or volumetric analysis of elements for calculation. This program also gives typical composition and values for these fuels.

6. Condensate load estimation: This program calculates heat loss and estimates condensate load when steam traps are installed in steam pipe lines. .The input data consists of pipe data, insulation type and steam trap orifice diameter and steam trap safety factor.

7. Pump sizing : This program calculates the pump design flow, efficiency, power, NPSH required and also specific speed of the pump. It also estimates the performance curves and resistance curves and recommends the motor size. The efficiency data is based on generic centrifugal pumps data based on specific speed calculated. This program also provides operating cost for the pump. Input condition consists of fluid parameters and operating scenarios and pipe data.

8. Estimate pressure drop: This program estimates piping pressure drop and head loss for water and saturated steam .This program is provided with piping, valves and fittings data base. It also provides calculations on power and shear for piping

9. Orifice sizing: This program calculates orifice size, flow or pressure drop depending on the input data for water and saturated steam.

10. Estimate insulation thickness: This program estimates typical insulation thickness for variety of insulation materials for a given pipe size and ambient conditions. It also calculates heat loss for given user defined values

11. Heat exchanger: This program estimates in or out temperatures or mass flow for cross flow heat exchangers steam water calculations. Calculations based on heat and mass balance. Primarily intended for blow down recovery heat exchanger calculations

12. Estimate payback and cash flow: This program calculates simple payback, discounted payback, present worth and profitability factor and provides cash flow scenario for one time investment where revenues are greater than investment and expenses are less than revenue. This program is intended for energy savings calculations

Common Programs:

These are independent programs that can be accessed directly.
1. Steam table: This program gives steam and water properties. Table developed based on ASME steam table for industrial use. Provides graphical Temperature – entropy diagram for ease of locating the property point

2. Unit Converter: This program gives conversion values with a provision invert the conversion for all US metric and SI units commonly needed.

Heat and Power simulation module:

This module is designed to simulate a steam system model. User can construct process flow diagram using engineering tool box components provided in the module and run the calculations, view and evaluate results, save or print them.

There are two stages when simulation module is run. They are design mode and results mode.

Design mode:

In design mode, user is provided with an engineering tool box which contains small icons of the components to build models. User can drag and place it in module screen, resize and change attributes as needed, connect them logically as is done in drawing a steam system process flow diagram. When the user places the components on the screen, the user interface property pop up forms ask for the data required for calculations. These properties again appear on the module screen in properties box in module screen .This enables user to access the input properties of the component at any time and change them direct on screen. User can connect the nodes between components drawing lines and providing properties of pipe lines to build a system. Grid points are provided for ease of drawing and building the models. All the User Interface forms are supported by data base properties or linked to design programs where needed.

Results mode:

User runs the calculations for the model built and validation and calculation status are displayed as they progress. Results are displayed in results window in place of engineering tool box in results mode.

User can analyze the results of each connecting point called node and component by viewing the properties box and results window at the same time. This enables user to perform sensitivity analysis or "what if" scenarios by changing the input properties in property box on screen. Results of individual node can also be tracked in addition to viewing the entire component results at the same time. This enables user to analyze the effect of one component input properties on another node of a different component.

Grid points provided in the design mode can be turned off in the results mode. User has also option to close the engineering tool box, property boxes and view the results of individual nodes or connecting point .User has also option to resize the property window and results window to view the full size of model built.

Components and calculations:

The engineering tool box contains the following components:

Engineering Components:

1. Boilers: This component can model a fire tube or water tube boiler. User needs to provide data for nodes connecting the fuel, air and feed water and provide boiler operating conditions. The component will display results on Boiler rating , combustion efficiency , thermal efficiency, steam load, fuel consumptions, air flow , excess air , factor of evaporation and heat of absorption in addition to pressure, temperature and enthalpy at each of the nodes connecting a the Boiler component .
2. Economizer: This component can be connected to the boiler stack node. Data required are feed water inlet properties and pressure drops .Results give the economizer efficiency. User can model a boiler scenario with and without economizer and compare performances.
3. Airpreheater: This component can be connected to the boiler stack node. Data required are air source properties. Results give the airpreheater efficiency. User can model a boiler scenario with and without airpreheater and compare performances.
4. Deaerator: This component can connect make up water and condensate return lines or sources having data. It calculates flow and process parameters to feed pump and estimates heating steam required.
5. Surge tank : It can be modeled as a storage tank in feed water lines
6. Pumps : This is a centrifugal pump component ;when modeled, it calculates suction and discharge side process parameters and estimates NPSH required .Separate icons and calculations are provided for feed pumps, transfer pumps and cooling water pumps
7. Flash tank: This component calculates flash percent and vent steam and condensate drain process parameters. This component is provided for blow down recovery system modeling.

8. Turbine: This models single and extraction steam turbines. Results are shaft power, efficiency, specific steam consumption and heat rate. Fixed power option is provided when turbine is modeled separately.
9. Condenser: This provides heat balance calculations when turbine is connected to condenser and cooling water nodes are connected. It provides results on heat load, cooling water temperature rise and Terminal Temperature Difference.
10. Cooling Tower: This component gives results on heat rejected, evaporation rates, estimated drift, cycles of concentration, make up flow, approach, cooling tower estimated, efficiency, blow down, CW temperature drop. The data required are TDS values, cooling water drained, cooling load and pressure drop. This component can be modeled connecting to a source and sink or to condenser through pump.
11. Blow down: This component works like flash tank when connected to blow down drain node of boiler component.
12. Heat exchanger: This component models cross flow and contact heat exchangers. Calculations provided are based on heat balance.
13. PRDS Valves: Pressure reducing and Desuperheating valves (PRDS) will calculate water injection flow when connected to saturated steam upstream and when downstream pressure is defined.
14. Control valves: Calculates the mass flow when downstream pressure and valve coefficient data are given. It works for water and saturated steam.
15. General valves: Ball valve, globe valve, gate valve, pressure reducing valves, butterfly valves are used for drawing the process flow diagrams and valve pressure drop value can be an input for calculation.
16. Branch –Tee. This component is used for dividing the flow or addition of fluid flow. Pressures need to be balanced at ends when branches are connected .designed for steam and water as fluids.

Hypothetical components:

These are hypothetical components specifically designed with engineering data built in. It is used to start a model or end a model. This enables user to model and evaluate a single component or a partial system model

1. Source: This provides hypothetical source input data for, liquid, steam, fuel, air, two phase fluids.
2. Sink : This component used as a terminator for the system modeled.
3. Loss: This component is used to input losses data in steam systems. Losses can be due to steam leak, steam trap or user defined. User can also estimate the losses with design programs provided.

Common Component:

1. Notes: This is provided for the user to write title, labels or notes in the diagrams built

Support for STEAMDOSS:

Numerous information and downloads are available for this software at www.anasolconsulting.com

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