

Steam Properties Help Contents

Steam Properties is a shareware developed by Taftan Data. It calculates the properties of water and steam by using a set of equations accepted by the members of the Sixth International Conference on the Properties of Steam. The sets of equations are also known as "IFC Formulation for Industrial Use". The calculated results can be transferred between this program and any other spreadsheet or calculation program. For transferring data:

- 1) Select the data.
- 2) **Ctrl+Insert** or **Shift+Delete** to **Cut** from Steam Properties.
- 3) **Shift+Insert** to **paste** into the other program.

Registered users will receive a DLL version of Steam Properties which can be integrated into all major spreadsheets. Important topics are:

Brief
Description

Thermodynamics
Online Help?

Error
Messages!

Brief description

Steam Properties calculates some properties of steam (or water) over a wide range of temperature and pressure. It may be used for analyzing a number of energy conversion components. Many of these components such as steam turbine and heat exchangers are briefly described in the Thermodynamics Online Help.

Steam Properties finds a solution to a problem by knowing two parameters. Input fields are as following:

The screenshot shows the 'Steam/Water Properties' software window. It features a list of input fields on the left, each with a 'Clear' button to its right. Red callout boxes on the right point to these fields with red dashed lines. The fields and their values are: P (30.0 bar), T (233.84 C), x (1.00), h (2802.30 kJ/kg), s (6.18 kJ/kg.K), and v (0.067 m3/kg). Below the input fields are two rows of control buttons: the first row contains 'Report', 'OK' (with a green checkmark), 'Cancel' (with a red X), and 'Help' (with a blue question mark); the second row contains 'About', 'Units', 'Reset', and 'Clear All'.

Parameter	Value	Unit
P	30.0	bar
T	233.84	C
x	1.00	
h	2802.30	kJ/kg
s	6.18	kJ/kg.K
v	0.067	m ³ /kg

Callouts (from top to bottom):

- Absolute pressure
- Temperature
- Dryness fraction
- Specific enthalpy
- Specific entropy
- Specific volume

Definition of Shareware

Shareware distribution gives users a chance to try software before buying it. If you try a Shareware program and continue using it, you are expected to register. Individual programs differ on details -- some request registration while others require it, some specify a maximum trial period. With registration, you get anything from the simple right to continue using the software to an updated program with printed manual.

Copyright laws apply to both Shareware and commercial software, and the copyright holder retains all rights, with a few specific exceptions as stated below. Shareware authors are accomplished programmers, just like commercial authors, and the programs are of comparable quality. (In both cases, there are good programs and bad ones!) The main difference is in the method of distribution. The author specifically grants the right to copy and distribute the software, either to all and sundry or to a specific group. For example, some authors require written permission before a commercial disk vendor may copy their Shareware.

Shareware is a distribution method, not a type of software. You should find software that suits your needs and pocketbook, whether it's commercial or Shareware. The Shareware system makes fitting your needs easier, because you can try before you buy. And because the overhead is low, prices are low also. Shareware has the ultimate money-back guarantee -- if you don't use the product, you don't pay for it.

Benefits of Registering

By registration of your copy of **Steam Properties** you will be sent:

- a complete registered copy of the most recent version of the **Steam Properties**
- a **DLL version** of Steam Properties which can be integrated into your spreadsheet. This kind of integration is supported by all major spreadsheets. The setup program enables the user to choose the units for the input and output of the DLL version.
- the latest version of the Thermodynamics Online Help

In addition your name will be added to our mailing list and you will be informed about other software. These software products are mainly related to properties of chemicals and applied thermodynamics. Other benefits of registering are:

- Unlimited support by mail or email.
- One free major update
- Update and upgrade notices
- Discount on upgrades

Please remember that your registration helps to support the shareware concept and promote the development of PC programs at reasonable prices.

Related topic:



Taftan Data is a member of Association of Shareware Professionals (ASP).

How to Register

For registration, please read file (readme) accompanied with the program. If there is any problem, contact us at:

Steam Properties Registration
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DISCLAIMER - AGREEMENT

Users of **Steam Properties** must accept this disclaimer of warranty: **Steam Properties** is supplied as is. The author disclaims all warranties, expressed or implied, including, without limitation, the warranties of merchantability and of fitness for any purpose. The author assumes no liability for damages, direct or consequential, which may result from the use of **Steam Properties**.

Steam Properties is a **shareware program** and is provided at no charge to the user for evaluation. Feel free to share it with your friends, but please do not give it away altered or as part of another system. The essence of "user-supported" software is to provide personal computer users with quality software without high prices, and yet to provide incentive for programmers to continue to develop new products. If you find this program useful and find that you are using **Steam Properties** and continue to use **Steam Properties** after a reasonable trial period, you must make a registration payment of \$60.00 US to **Taftan Data**. The \$60.00 US registration fee will license one copy for use on any one computer at any one time. You must treat this software just like a book. An example is that this software may be used by any number of people and may be freely moved from one computer location to another, so long as there is no possibility of it being used at one location while it's being used at another. Just as a book cannot be read by two different persons at the same time.

Commercial users of **Steam Properties** must register and pay for their copies of **Steam Properties** within 30 days of first use or their license is withdrawn. Site-License arrangements may be made by contacting **Taftan Data**.

Anyone distributing **Steam Properties** for any kind of remuneration must first contact **Taftan Data** at the address below for authorization. This authorization will be automatically granted to distributors recognized by the (ASP) as adhering to its guidelines for shareware distributors, and such distributors may begin offering **Steam Properties** immediately (However **Taftan Data** must still be advised so that the distributor can be kept up-to-date with the latest version of **Steam Properties**).

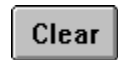
You are encouraged to pass a copy of **Steam Properties** along to your friends for evaluation. Please encourage them to register their copy if they find that they can use it. All registered users will receive a copy of the latest version of the **Steam Properties** system.

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ASP Ombudsman

Steam Properties is produced by **Taftan Data**, a member of the Association of Shareware Professionals (ASP). ASP wants to make sure that the shareware principle works for you. If you are unable to resolve a shareware-related problem with an ASP member by contacting the member directly, ASP may be able to help. The ASP Ombudsman can help you resolve a dispute or problem with an ASP member, but does not provide technical support for members' products. Please write to the ASP Ombudsman at 545 Grover Road, Muskegon, MI USA 49442-9427, Fax 616-788-2765, or send a CompuServe message via CompuServe Mail to ASP Ombudsman 70007,3536.

Push Button Commands



Clears a data field. This button command changes the state of data to unknown. Please remember when you try to edit a data field and later change your mind, push this button, otherwise the program tries to check this data field when you press OK!



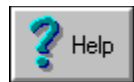
This push button creates a pure text file named "**STEAM.TXT**" and then starts "**MS notepad.exe**" which is a text editor. You can cut and paste the text into your favorite editor. If you want to keep the text as it is you should rename "**STEAM.TXT**" otherwise the next use of this push button will overwrite it. This push button performs all steps described under OK push button.



Using this push button in the main window activates the **Steam Properties**. First the input parameters are controlled for correct format. If the format is OK, then the unit used to specify the input is controlled. You are not restricted to input the values by default units. The default units are there just to simplify your job. They are also used for specifying the output values. The next step is to check if the input values are in the acceptable range. If every thing is ok and there are enough inputs, **Steam Properties** will find unknown parameters.



Exiting the program. This works exactly the same way **Alt+F4** does.



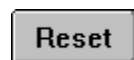
Starts this help file.



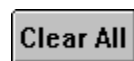
Copyright notice and address of **Taftan Data**.



Default values for the unit conversion.



Clears all the fields which are filled by the program.



Clears all data fields.

Parameters

The following parameters may be used both as input to or output from the **Steam Properties**:

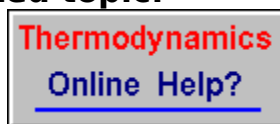
- Absolute Pressure, **P**
- Temperature, **T**
- Specific Enthalpy, **h**
- Specific Entropy, **s**
- Specific Volume, **v**
- Dryness Fraction, **x**

Steam properties solves only those cases which are marked by green rectangles in the table below.

	P	T	h	s	v	x
P	Green	Green	Red	Red	Red	Red
T	Green	Yellow	Red	Red	Red	Green
h	Green	Red	Yellow	Red	Red	Red
s	Green	Red	Red	Yellow	Red	Red
v	Green	Red	Red	Red	Yellow	Red
x	Green	Green	Red	Red	Red	Yellow

It can be seen that if pressure, **P**, and one other parameter is known, then there is a solution to the problem. There is also a solution to the problem if temperature, **T**, and dryness fraction are known. These cases cover all practical types of energy conversion problems in applied thermodynamics. If the temperature, **T**, and pressure **P** belong to a point within the wet steam region, the program will not find other properties just by knowing **T** and **P**. The reason is that **T** and **P** are not two independent properties for the steam in this region. In this case there is a need to one other parameter, e.g. dryness fraction **x**. If there are more input parameters than needed, then the program tests if the inputs are compatible. The program also tests if inputs are within the acceptable ranges.

Related topic:



Some Words About Shareware and Registration

- [Definition of Shareware](#)
- [Benefits of Registering](#)
- [DISCLAIMER - AGREEMENT](#)
- [ASP Ombudsman](#)
- [How to Register](#)

Input Format

The input consists of a number and a suitable unit. At least one space is necessary to separate the number from the unit. If the format is not correct, a message will be sent i.e. **Incorrect format!**. This message will be followed by another message which specifies in which input field the error encountered e.g. **The value in the pressure [P] field is not acceptable!**. You should also use a correct unit for the input which is supported by the program. If the unit is not correct, the first message will be e.g. **For entropy use one the following units: kJ/kg,K J/kg,K erg/g,K Btu/lb,F or Btu/lbm,F.** which will be completed by another message which specifies where this error occurred. It should be noted that the dryness fraction of the steam is dimensionless and does not require any unit. If you specify any unit in the input field, the error message will be **Dimensionless values do not need units!**.

The program supports both ordinary real number notation and scientific notation. All these examples are correct as an input in the pressure field:

100.0 bar
100 bar
1.0e2 bar
1E+2 bar

Input Range

The **IFC formulation for industrial use** of properties of water and steam is valid within a restricted range. The acceptable range for pressure is:

$$0.01 \text{ bar} < P < 1000 \text{ bar}$$

and for temperature is :

$$0 \text{ C} < T < 800 \text{ C}$$

The other input parameters are also restricted. The restriction is not as straight forward as the limitations for pressure and temperature. The program will send error messages if any parameter falls outside the acceptable range.

Error Messages

The error messages are as following:

Error 1001: The input value in the pressure [P] field is outside the acceptable range for pressure specified in IFC formulation for Industrial use!
 $0.01 \text{ bar} < P < 1000 \text{ bar}$

Error 1002: The input value in the temperature [T] field is outside the acceptable range for temperature specified in IFC formulation for Industrial use!
 $0 \text{ C} < T < 800 \text{ C}$

Error 1003: Dryness fraction [x] should be within the following limits:
 $0.0 = x \leq 1.0$

Error 1004: If the dryness fraction in field [x] is known, pressure in field [P] may not be more than 221.2 bar (pressure at critical point) i.e.
 $P < 221.2 \text{ bar}$

Error 1005: If the dryness fraction in field [x] is known, temperature in field [T] may not be more than 374.15 C (temperature at critical point) i.e.
 $T < 374.15 \text{ C}$

Error 1006: There are too many inputs than necessary. The data in specific enthalpy field [h] does not match with other inputs!

Error 1007: There are too many inputs than necessary. The data in specific entropy field [s] does not match with other inputs!

Error 1008: There are too many inputs than necessary. The data in specific volume field [v] does not match with other inputs!

Error 1009: There are too many inputs than necessary. The data in dryness fraction field [x] does not match with other inputs!

Error 1010: There are too many inputs than necessary. The data in temperature field [T] does not match with other inputs!

Error 1011: There are too many inputs than necessary. The data in pressure field [P] does not match with other inputs!

Error 1012: It is impossible to find a point with the specified pressure [P] and specific entropy [s]!

Error 1013: It is impossible to find a point with the specified pressure [P]

and specific volume [v]!

Error 1014: It is impossible to find a point with the specified pressure [P] and specific enthalpy [h]!

Error 1015: Inputs are not enough to determine the state of the steam or water. Pressure and temperature are too close to wet steam data.

The DLL version of Steam Properties

DLL stands for **D**ynamic **L**ink **L**ibrary which is a standard for executable code. This kind of code can be used by other programs if they follow the standard. The DLL version of Steam Properties can be used by Pascal, C/C++ and all major spreadsheet and Data Base programs. The user manual of your spreadsheet or Data Base program describes if you can use DLLs and how you **register** functions and **call** them. The DLL version of Steam Properties supports 23 functions. Inputs and output of these functions are defined as **double** according to IEEE standard. If the inputs are out of range, the function will return a large negative number. The returned value is the index for the error message; e.g. if the input for pressure is 0.001 bar then all functions will return -1001. The functions headers are as following:

Library Steam;

Type PDouble=^Double;

Function STMPT(P:Double):PDouble;Export;
Pressure -> Saturation Temperature

Function STMTQ(T:Double):PDouble;Export;
Temperature -> Saturation Pressure

Function STMTQH(T,Q:Double):PDouble;Export;
Temperature and Dryness fraction -> Enthalpy

Function STMTQS(T,Q:Double):PDouble;Export;
Temperature and Dryness fraction -> Entropy

Function STMTQV(T,Q:Double):PDouble;Export;
Temperature and Dryness fraction -> Specific Volume

Function STMPQH(P,Q:Double):PDouble;Export;
Pressure and Dryness fraction -> Enthalpy

Function STMPQS(P,Q:Double):PDouble;Export;
Pressure and Dryness fraction -> Entropy

Function STMPQV(P,Q:Double):PDouble;Export;
Pressure and Dryness fraction -> Specific volume

Function STMPTH(P,T:Double):PDouble;Export;
Pressure and Temperature -> Enthalpy

Function STMPTS(P,T:Double):PDouble;Export;

Pressure and Temperature -> Entropy

Function STMPVT(P,T:Double):PDouble;Export;
Pressure and Temperature -> Specific volume

Function STMPHT(P,H:Double):PDouble;Export;
Pressure and Enthalpy -> Temperature

Function STMPHS(P,H:Double):PDouble;Export;
Pressure and Enthalpy -> Entropy

Function STMPHV(P,H:Double):PDouble;Export;
Pressure and Enthalpy -> Specific volume

Function STMPHQ(P,H:Double):PDouble;Export;
Pressure and Enthalpy -> Dryness fraction

Function STMPST(P,S:Double):PDouble;Export;
Pressure and Entropy -> Temperature

Function STMPSH(P,S:Double):PDouble;Export;
Pressure and Entropy -> Enthalpy

Function STMPSV(P,S:Double):PDouble;Export;
Pressure and Entropy -> Specific volume

Function STMPSQ(P,S:Double):PDouble;Export;
Pressure and Entropy -> Dryness fraction

Function STMPVT(P,V:Double):PDouble;Export;
Pressure and Specific volume -> Temperature

Function STMPVH(P,V:Double):PDouble;Export;
Pressure and Specific volume -> Enthalpy

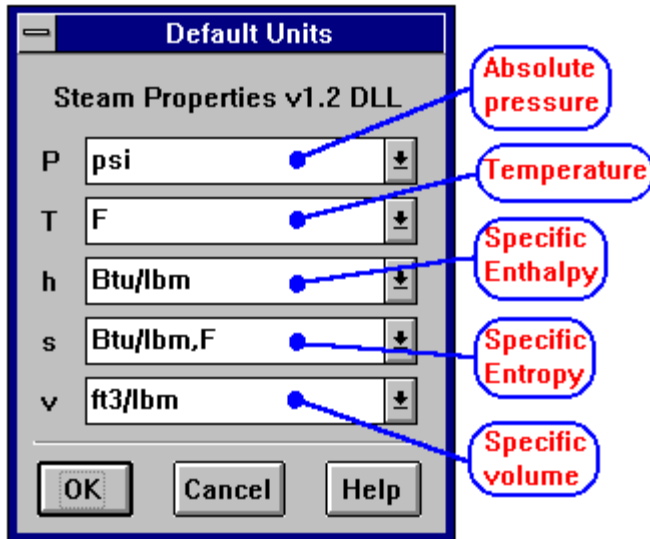
Function STMPVS(P,V:Double):PDouble;Export;
Pressure and Specific volume -> Entropy

Function STMPVQ(P,V:Double):PDouble;Export;
Pressure and Specific volume -> Dryness fraction

DLL Setup

DLL Version of **Steam Properties** is offered as a bonus to the registered users of Steam Properties v1.2. The functions inside the DLL can be reached by many spreadsheet and database programs.

User can select the suitable units for inputs and outputs of the program. This is done by running **dllsetup.exe**.





Taftan Data is a member of the Association of Shareware Professional (ASP).

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<http://www.asp-shareware.org/>

