ASTM D1250-04 for PC

Temperature and pressure volume correction factors for generalized crude oils, refined products, and lubricating oils.

Version 1.0

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Introduction

The density and therefore the volume of hydrocarbons is sensitive to temperature and pressure. Volume Correction Factors (VCFs) are used to correct observed volumes to equivalent volumes at a standard temperature and pressure. These standard, or base, conditions serve as a way to use volumetric measures equitably in general commerce. The calculations performed in this application conform to the calculations outlined in the API publication:
Manual of Petroleum Measurement Standards Chapter 11
Physical Properties Data SECTION 1 TEMPERATURE AND PRESSURE VOLUME CORRECTION FACTORS FOR GENERALIZED CRUDE OILS, REFINED PRODUCTS, AND LUBRICATING OILS
Measurement Coordination May 2004

That Standard establishes a procedure for crude oils, liquid refined products, and lubricating oils by which density measurements taken at any temperature and pressure can be corrected to an equivalent density at the base conditions. The Standard also provides a method for making a conversion to alternate base temperatures.

The procedure recognizes three distinct commodity groups: crude oil, refined products, and lubricating oils. A special application category is also provided which provides volume correction based on the input of an experimentally derived coefficient of thermal expansion.

Installation

Start the program "setup.exe" and follow the instructions on the screen.

ASTM D1250-04 VCF
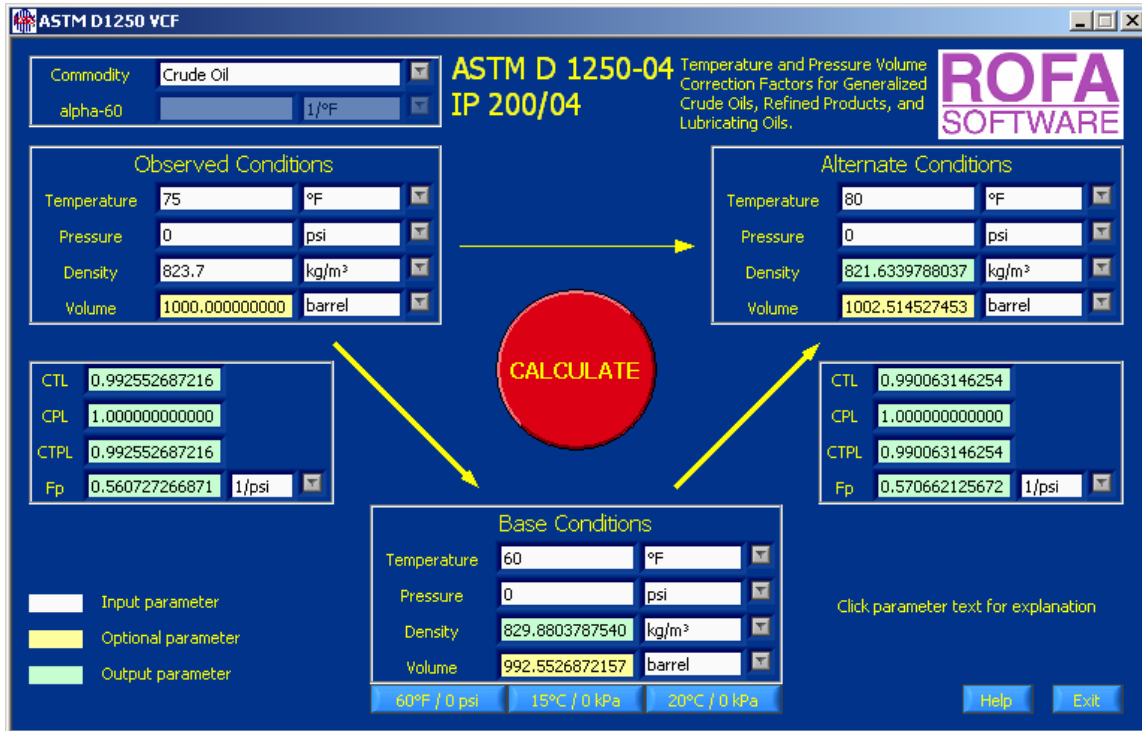
Select the commodity group first. It describes the classification of the liquid.
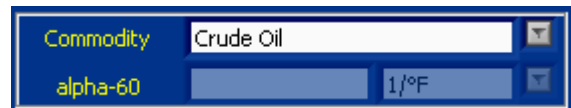

Crude Oil: A crude oil is considered to conform to the commodity group Generalized Crude Oils if its density falls in the range between approximately -10 to 100 °API.

Refined Products:A refined product is considered to conform to the commodity group of Generalized Refined Products if the fluid falls within one of the refined product groups: Gasoline, Jet Fuels, Fuel Oils

Lubricating Oils: A lubricating oil is considered to conform to the commodity group Generalized Lubricating Oils if it is a base stock derived from crude oil fractions by distillation or asphalt precipitation. For the purpose of this Standard, lubricating oils have initial boiling points greater than 700ºF (370ºC) and densities in the range between approximately -10 to 45 oAPI.

Special Applications (alpha-60 supplied): Liquids that are assigned the special applications category are generally relatively pure products or homogeneous mixtures with stable (unchanging) chemical composition that are derived from petroleum (or are petroleum-based with minor proportions of other constituents) and have been tested to establish a specific thermal expansion factor for the particular fluid.

Enter the observed temperature and pressure conditions and the measured density. The volume can be entered optionally.
The "observed" condition is the temperature and pressure at which the density of a liquid is actually or assumed to have been measured.
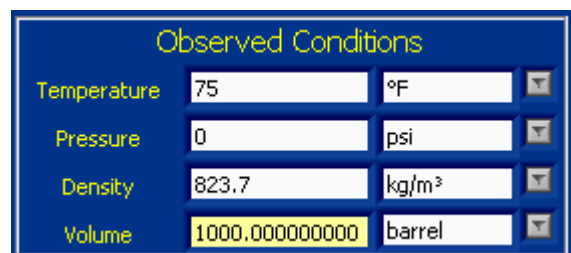
Calculations can then be performed to correct this observed density to any other temperature and pressure conditions. If the density has already been corrected to base conditions, you would enter the base temperature and pressure in the Observed Conditions fields. If the density has not already been corrected to base conditions, you enter the temperature and pressure at which the density was measured.

Enter the base temperature and pressure conditions.
The "standard" or "base" condition is a defined combination of temperature and pressure at which liquid volumes are expressed for purposes of custody transfer, stock accounting, etc. Accepted standard temperatures are 60°F, 15°C and 20°C.

Accepted standard pressures are zero gauge pressure (for non-volatile liquids at the standard temperature) or the liquid's vapour pressure at the standard temperature (for volatile liquids). You can use the buttons on the bottom for predefined values.

Enter the alternate temperature and pressure conditions.
The "alternate" conditions are any other temperature and pressure conditions to which the observed or standard density can be corrected.

The input of a volume is optional, but if you have already entered a observed volume, you must not enter an alternate volume.

After you have entered all inputs (white boxes), press the CALCULATE button.

The results are shown in the green boxes: CTL (Correction factor for the effect of Temperature on the Liquid), CPL (Correction factor for the effect of Pressure on the Liquid), CTPL (Correction factor for the effects of Temperature and Pressure on the Liquid, Volume Correction Factor VCF), Fp (Compressibility coefficient), base and alternate density and, if you have entered a observed or alternate volume, the base and alternate volumes.

ASTM D1250-04 Tables
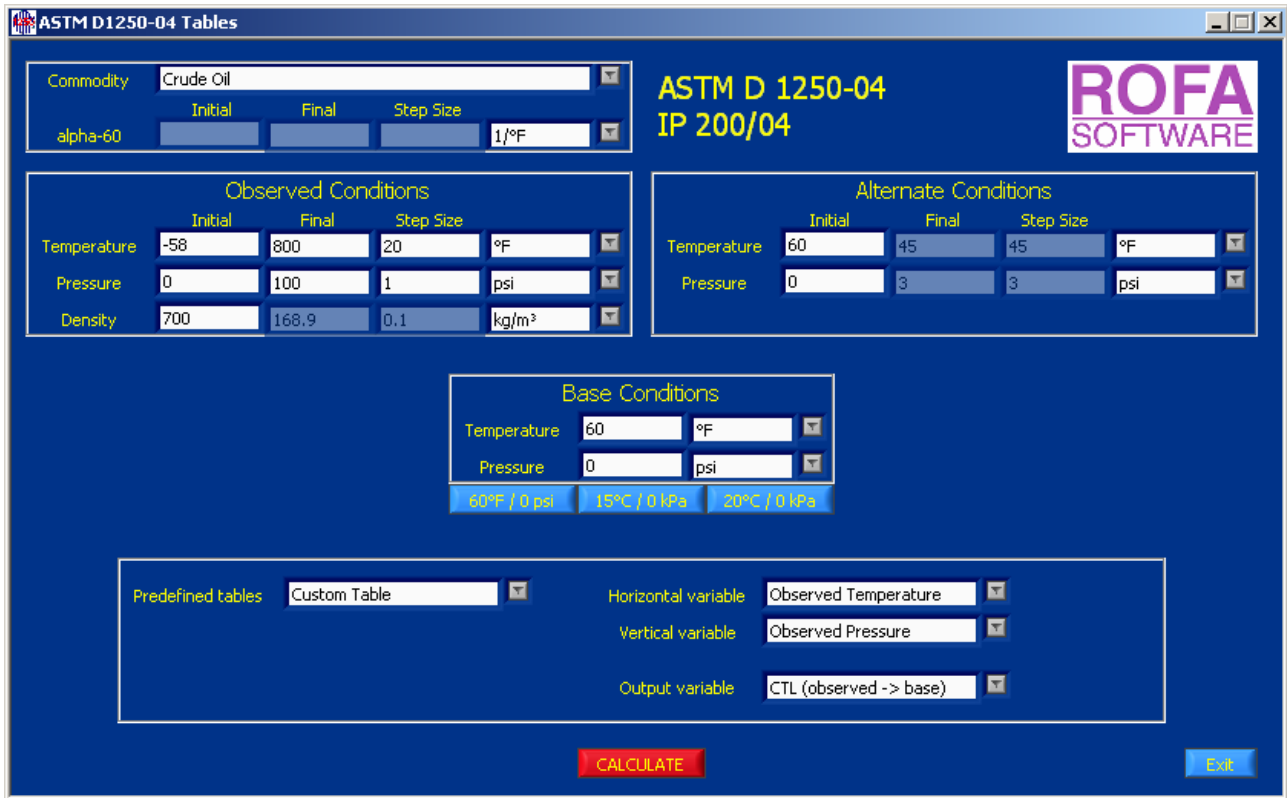
This software provides procedures for generating correction factors in tabular format that can be printed for convenience. The format of these tables is that of the historical Petroleum Measurement Tables.

Previous versions of this Standard had separate tables for the temperature and pressure corrections. These can still be created as specific cases of the general procedure. The equivalent of 1980 temperature correction tables can be generated by setting the pressure to the base value (one atmosphere). The equivalent of the pressure correction tables can be generated by printing the compressibility factor at the base pressure.

Select the commodity group first. (see previous section)

You may select from a number of predefined tables, which may be selected via the drop-down list labeled "Predefined tables". Once you select a table, the input parameters and base conditions will be set to the new values.
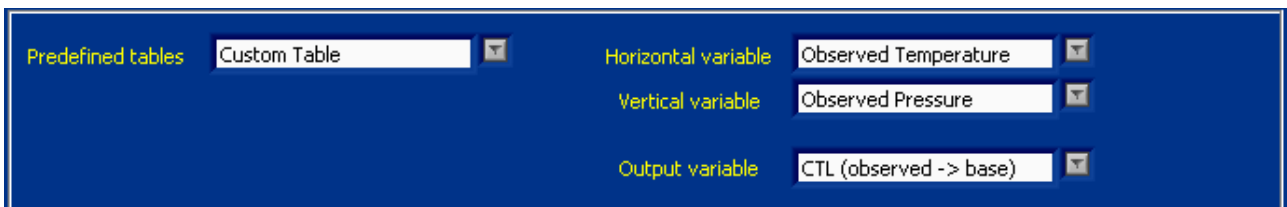

Selecting "Custom Table" lets you select the parameters you want to vary in the two drop-down lists labeled "Horizontal" and "Vertical", which denote the vertical and horizontal table parameters. The desired output parameter is selected via the drop-down lists labeled "Output variable".

For the "Horizontal" and "Vertical" variable you may select the initial and final value and the desired step size., the remaining input parameters are kept fixed at their respective initial values.

After pressing the CALCULATE button, the table will be calculated. Dependent on the input parameter, this can take a while, but you can abort the calculation anytime by pressing the ABORT button
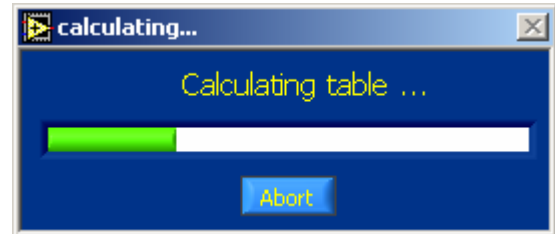
The tables can be viewed and saved in two different formats:

- ASCII Format
  This format is the same as the format of the historical Petroleum Measurement Tables of previous versions of the ASTM D1250 standard. It is most suitable for printing.
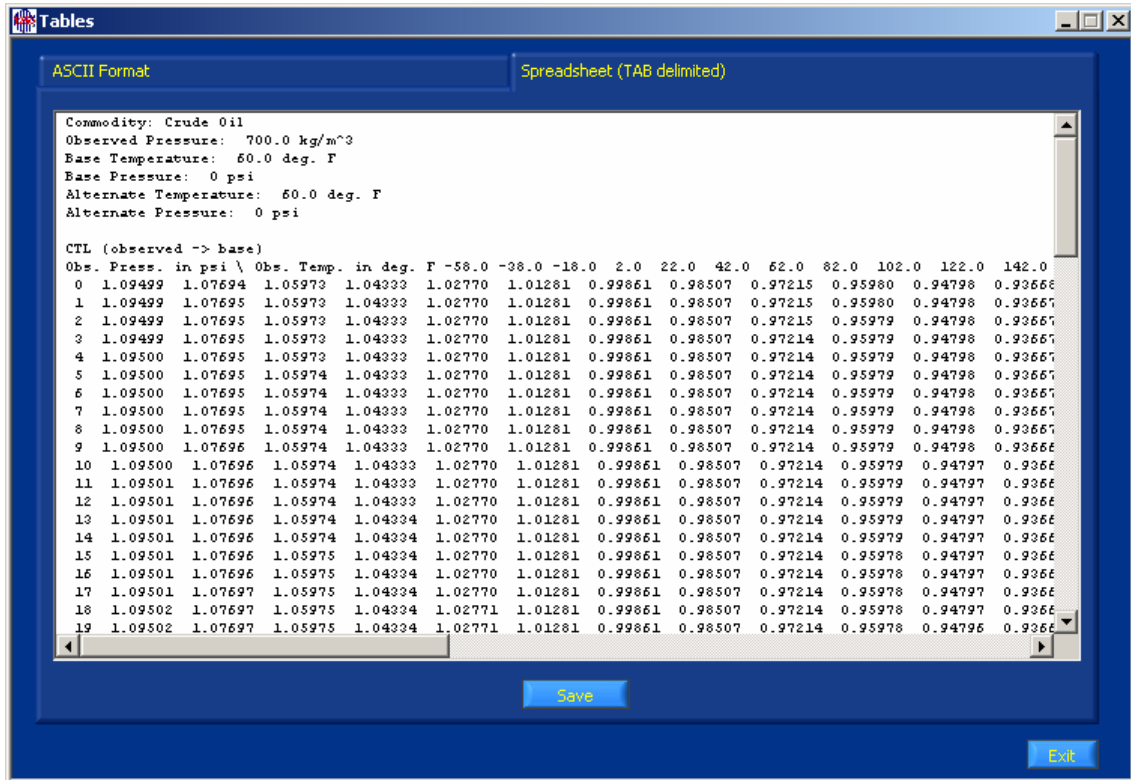
- Spreadsheet format (TAB delimited)
  The columns of the table are delimited by Tabulators and the rows by Carriage Return / Linefeed. This format is most suitable for spreadsheet programs like Microsoft EXCEL.

ASTM D1250-04 Regression
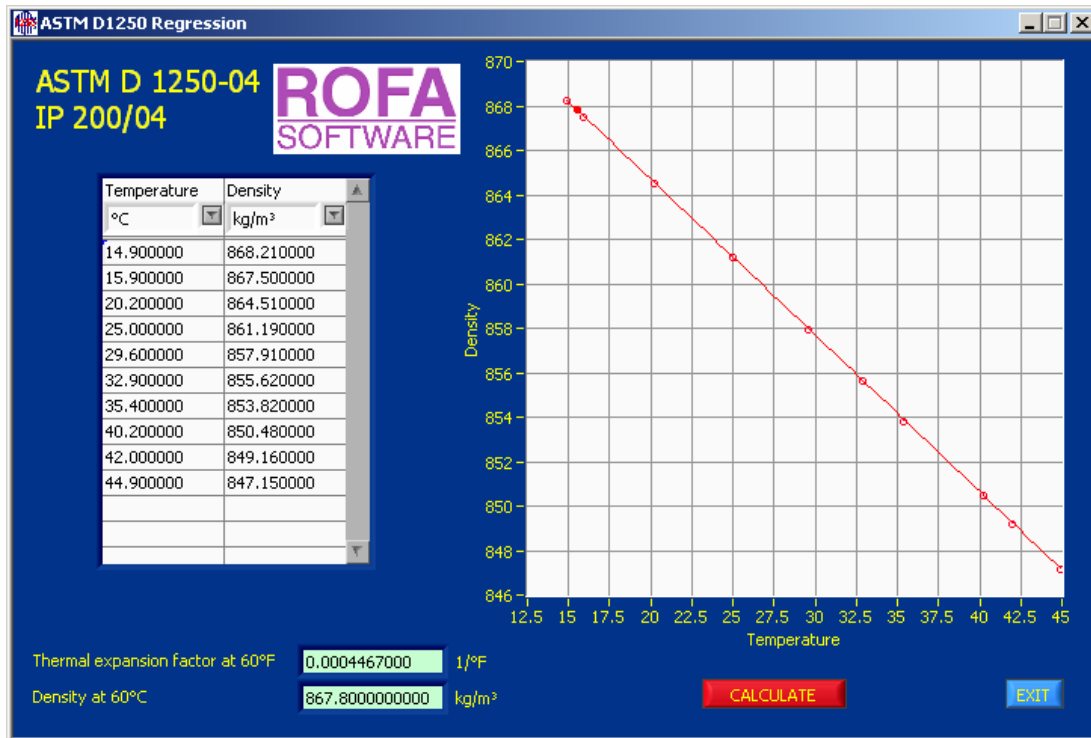
This software calculates the density at 60°F and the thermal expansion factor at 60°F from measured density values.
This software accepts measured density values and derives values of the density at 60°F and the thermal expansion factor at 60°F.The following are general guidelines for the data analysis:

- A minimum of 10 data points is needed to use this method.
- The data measurements should cover the temperature range over which the VCF values are to be used. The range should span 60°F even if a measurement is not made at this temperature.
- The density measurements should be made at such pressures that a pressure correction need not be applied (i.e., the CPL factor is 1 for all of the data points).

Enter the temperature / density data points into the table on the left side and press the CALCULATE button. The density at 60°F, the thermal expansion factor at 60°F and a graph of the data points will be shown.