

# ASTM D1250-04 for PC

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

Version 1.0

**ASTM D1250 VCF**

Commodity: Crude Oil  
alpha-60: 1/°F

**ASTM D 1250-04 IP 200/04** Temperature and Pressure Volume Correction Factors for Generalized Crude Oils, Refined Products, and Lubricating Oils.

**Observed Conditions**  
Temperature: 75 °F  
Pressure: 0 psi  
Density: 823.7 kg/m³  
Volume: 1000.0000000000 barrel

**Alternate Conditions**  
Temperature: 60 °F  
Pressure: 0 psi  
Density: 821.6339788037 kg/m³  
Volume: 1002.514527453 barrel

**Base Conditions**  
Temperature: 60 °F  
Pressure: 0 psi  
Density: 829.8803787540 kg/m³  
Volume: 992.5526872157 barrel

CTL: 0.99252687216  
CPL: 1.00000000000  
CTPL: 0.99252687216  
Fp: 0.56072726871 1/psi

CTL: 0.990063146254  
CPL: 1.00000000000  
CTPL: 0.990063146254  
Fp: 0.570662125672 1/psi

Legend:  
Input parameter (white)  
Optional parameter (yellow)  
Output parameter (green)

Click parameter text for explanation

60°F / 0 psi    15°C / 0 MPa    20°C / 0 MPa

**ASTM D1250-04 Tables**

Commodity: Crude Oil  
alpha-60: Initial Final Step Size 1/°F

**Observed Conditions**  
Temperature: -58 Initial 800 Final 20 Step Size °F  
Pressure: 0 Initial 100 Final 1 Step Size psi  
Density: 700 Initial 168.9 Final 0.1 Step Size kg/m³

**Base Conditions**  
Temperature: 60 °F  
Pressure: 0 psi

60°F / 0 psi    15°C / 0 MPa    20°C / 0 MPa

Predefined tables: Custom Table  
Horizontal variable: Observed Temperature  
Vertical variable: Observed Pressure  
Output variable: CTL (observed -> base)

Thermal expansion factor at 60°F: 0.0004467000 1/°F  
Density at 60°C: 867.8000000000 kg/m³

Graph: Density vs. Temperature (12.5 to 45 °C)

15.900000	867.500000
20.200000	864.510000
25.000000	861.190000
29.600000	857.910000
32.900000	855.620000
35.400000	853.820000
40.200000	850.480000
42.000000	849.160000
44.900000	847.150000

ROFA Laboratory & Process Analyzers  
Mag. Matthias Fiedler  
Hauptstrasse 145  
A-3420 Kritzensdorf  
AUSTRIA  
Email: [office@rofa.at](mailto:office@rofa.at)

## 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

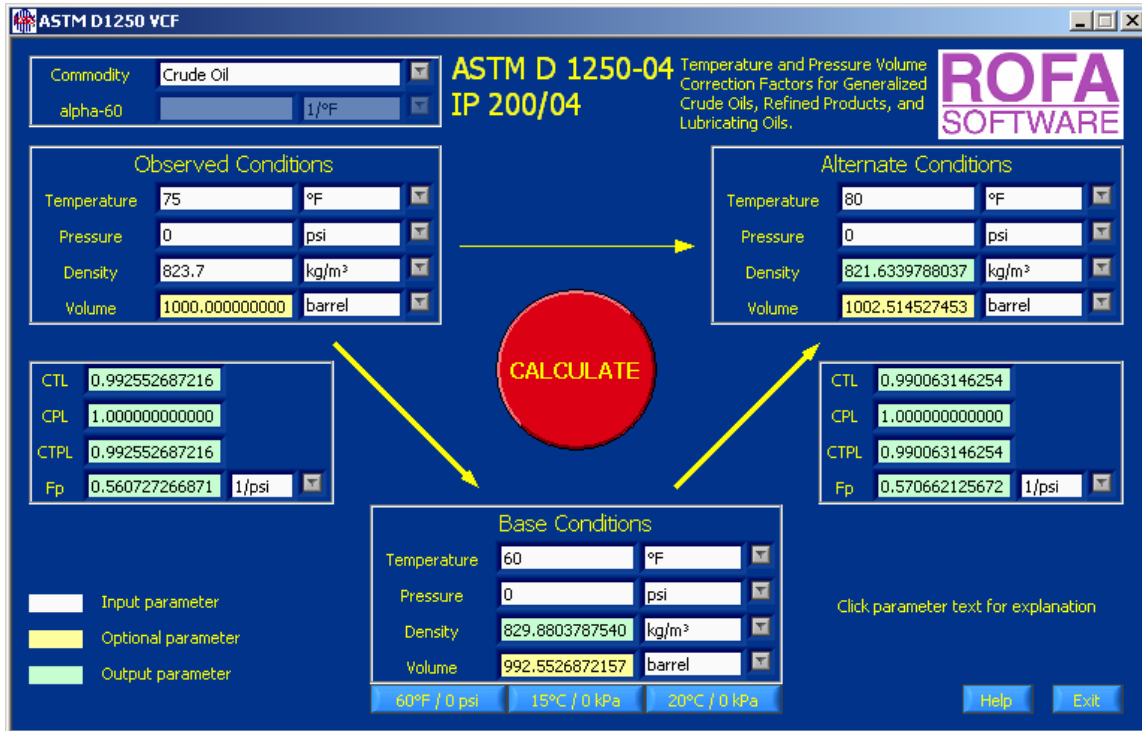
That Standard establishes a procedure for crude oils, liquid refined products, and lubricating oils by which density measurements taken at any temperature and pressure can be corrected to an equivalent density at the base conditions. The Standard also provides a method for making a conversion to alternate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

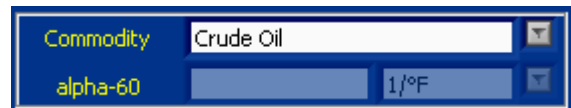
## Installation

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.

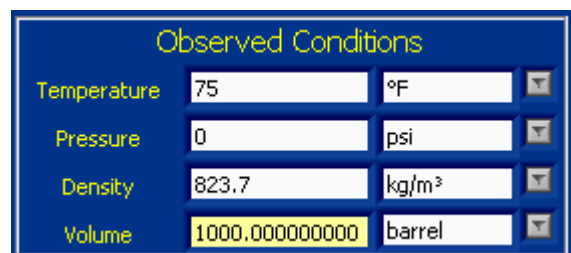
**Refined Products:** A refined product is considered to conform to the commodity group of Generalized Refined Products if the fluid falls within one of the refined product groups: Gasoline, Jet Fuels, Fuel Oils

**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 700°F (370°C) 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.

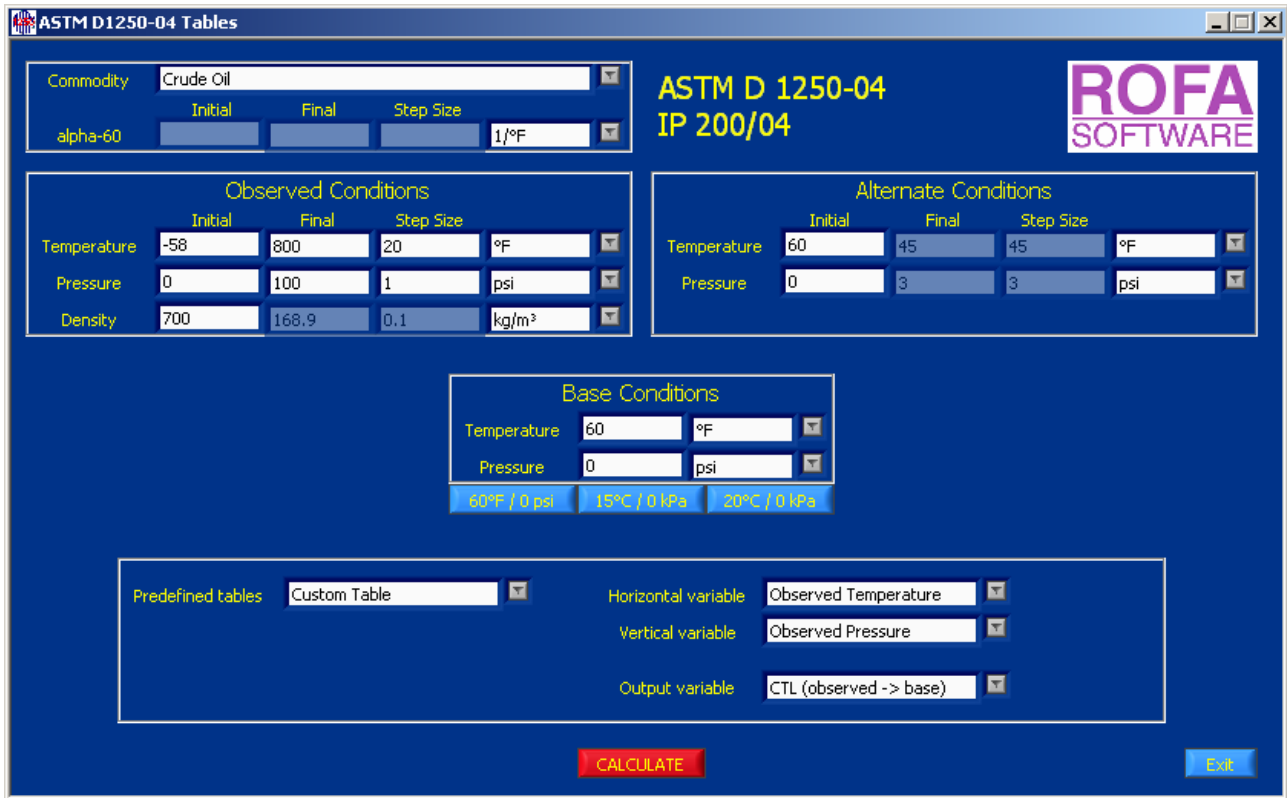
The “alternate” conditions are any other temperature and pressure conditions to which the observed or standard density can be corrected.

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



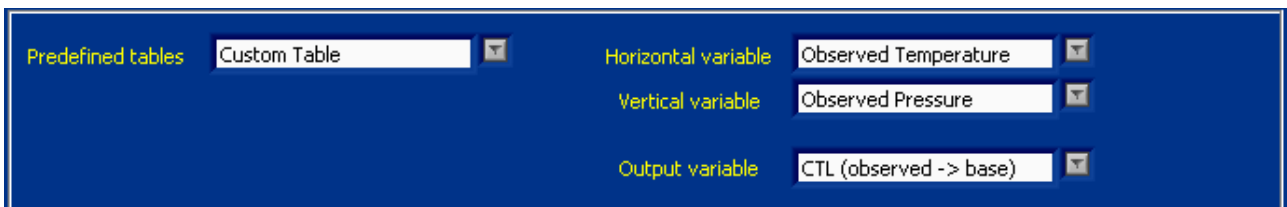
This software provides procedures for generating correction factors in tabular format that can be printed for convenience. The format of these tables is that of the historical Petroleum Measurement Tables.

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.

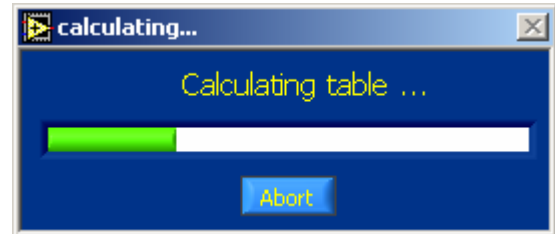


Selecting "Custom Table" lets you select the parameters you want to vary in the two drop-down lists labeled "Horizontal" and "Vertical", which denote the vertical and horizontal table parameters. The desired output parameter is selected via the drop-down lists labeled "Output variable".

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.

Observed Conditions				
	Initial	Final	Step Size	
Temperature	-58	800	2	°F
Pressure	0	100	1	psi
Density	700	168.9	0.1	kg/m³

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.

Tables

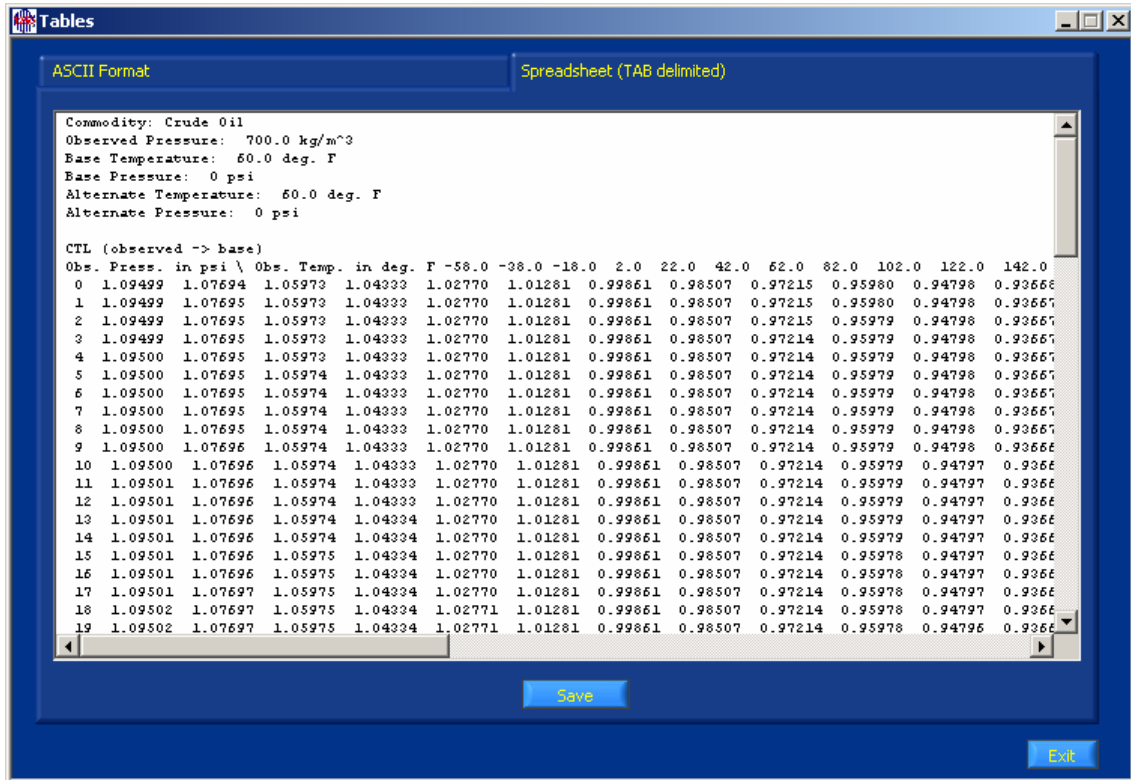
ASCII Format      Spreadsheet (TAB delimited)

Commodity: Crude Oil  
 Observed Pressure: 700.0 kg/m<sup>3</sup>  
 Base Temperature: 60.0 deg. F  
 Base Pressure: 0 psi  
 Alternate Temperature: 60.0 deg. F  
 Alternate Pressure: 0 psi

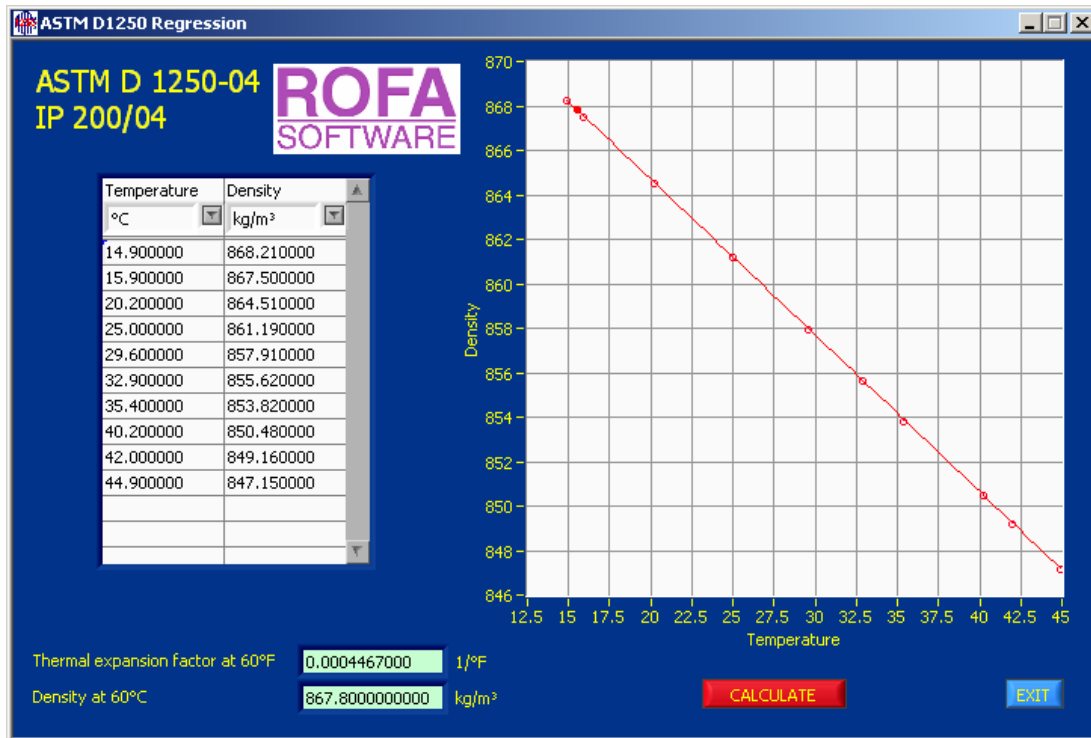
psi	-58.0	-38.0	-18.0	2.0	22.0	42.0	62.0	psi
CTL (observed -> base)								
0	1.09499	1.07694	1.05973	1.04333	1.02770	1.01281	0.99861	0
1	1.09499	1.07695	1.05973	1.04333	1.02770	1.01281	0.99861	1
2	1.09499	1.07695	1.05973	1.04333	1.02770	1.01281	0.99861	2
3	1.09499	1.07695	1.05973	1.04333	1.02770	1.01281	0.99861	3
4	1.09500	1.07695	1.05973	1.04333	1.02770	1.01281	0.99861	4
5	1.09500	1.07695	1.05974	1.04333	1.02770	1.01281	0.99861	5
6	1.09500	1.07695	1.05974	1.04333	1.02770	1.01281	0.99861	6
7	1.09500	1.07695	1.05974	1.04333	1.02770	1.01281	0.99861	7
8	1.09500	1.07695	1.05974	1.04333	1.02770	1.01281	0.99861	8
9	1.09500	1.07696	1.05974	1.04333	1.02770	1.01281	0.99861	9
10	1.09500	1.07696	1.05974	1.04333	1.02770	1.01281	0.99861	10
11	1.09501	1.07696	1.05974	1.04333	1.02770	1.01281	0.99861	11
12	1.09501	1.07696	1.05974	1.04333	1.02770	1.01281	0.99861	12
13	1.09501	1.07696	1.05974	1.04334	1.02770	1.01281	0.99861	13
14	1.09501	1.07696	1.05974	1.04334	1.02770	1.01281	0.99861	14
15	1.09501	1.07696	1.05975	1.04334	1.02770	1.01281	0.99861	15

Save      Exit

- 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.