

Getting Started with PhazeComp

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A manual for PhazeComp has not yet been completed. Until its availability, the best and easiest way to learn the effective use of PhazeComp is to take advantage of the following resources, in this recommended order:

- **MMPz Manual** — MMPz was a precursor to PhazeComp. Its features were far fewer than PhazeComp's, but its manual does cover the common input conventions and many of the basic PhazeComp commands.
- **PhazeComp Keywords** — This Microsoft Excel spreadsheet lists and briefly describes all available PhazeComp commands, subcommands, option keywords and aliases, along with proper syntax for each. This spreadsheet should be kept handy when studying the examples.
- **Examples** — The “PhazeComp Examples” folder contains a collection of practical example files and projects that illustrate nearly every feature of PhazeComp. In particular, the included “Characterization Case Study” folder contains a 7-step project that demonstrates how one can use PhazeComp to build an actual, multi-sample, equation-of-state fluid characterization from start to finish.
- **Zick Technologies** — Simple help is free for the asking. Time-consuming help is also available, although it may require a consulting fee.

What's New in PhazeComp 2

Compared with the previous release (version 1.8.1), PhazeComp 2 includes a multitude of new features, the most important of which are:

- **Plotting.** In conjunction with the open-source software, *gnuplot*, PhazeComp will plot (in PDF format) any experimental quantity against any other, comparing calculated results with experimental data. PhazeComp will also plot phase envelopes (more details below), characterization properties, gamma distributions, and black oil properties. Most of the examples now include plotting.
- **Reporting.** In conjunction with the open-source software, *LaTeX*, PhazeComp will automate the building of a report in PDF format. PhazeComp will generate any number of user-directed tables and figures and lay them out automatically with numbering, captioning, cross-referencing, and hyperlinking. Users will only need to add their own text and rerun LaTeX to produce, within seconds, a professional quality, finished report. Most of the examples now include LaTeX commands. Output will include a “Report” folder. Execute the enclosed “make_report.bat” (Windows) or “make_report.command” (Mac) file to generate and display a Report.pdf file.

- **Phase Envelopes.** PhazeComp can now generate P-T (pressure versus temperature), P-X (pressure versus molar composition), and P-W (pressure versus mass composition) diagrams. PhazeComp will identify bubble points, dew points, critical points, phase inversions, and incipient phase transitions, along with physical properties at each saturation point. It will cover the entire range from ultra-high vacuum to ultra-high pressure. If plotting is enabled, it will generate any number of user-directed plots, with axes on normal scales, log scales, or inverse temperature scales. Many of the examples now include phase envelopes.
- **Black Oil Tables.** The generation of black oil tables has been enhanced. PhazeComp's standard black oil table (.bot) output file can now include the standard black oil properties, R_s (solution gas-oil ratio), B_o (oil formation volume factor), $1/B_o$, R_v (oil-gas volatility ratio, also known as r_s), B_g (gas formation volume factor), and $1/B_g$. PhazeComp will also calculate the surface oil and gas densities that will optimize the prediction of reservoir oil and gas densities. PhazeComp can also be directed to output the black oil tables to separate files in Eclipse 100 format or in Sensor format. Finally, plots can be generated for all the saturated black oil properties, along with reservoir densities and viscosities.
- **Viscosity Estimates.** The drawback to the industry standard Lohrenz-Bray-Clark (LBC) viscosity correlation is that it is not very predictive for components with a molecular weight greater than about 90. The workaround is to adjust the components' ZcVis parameters (critical z-factors for viscosities) to match viscosity data, but that has never been easy to do in a systematic way. However, PhazeComp now includes a proprietary method for estimating the temperature-dependent, atmospheric liquid viscosities for each component that would be a liquid at a specified temperature and atmospheric pressure. It will then automatically calculate the value of ZcVis necessary to reproduce that viscosity. This results in LBC viscosity predictions for reservoir fluids at reservoir conditions that are usually much more accurate (often within 10% of measured values), even before any subsequent tuning. Many of the examples now include this feature.
- **MW/SG vs MW Correlation.** Experience has shown that distillation cuts from multiple samples of related fluids from a reservoir or field will display a linear relationship between MW/SG and MW. That's not surprising, because the molecular weight divided by the specific gravity is essentially the molar volume of a cut, and if the reservoir fluids are made up of similar building blocks, the molar volume should be linear in MW. Therefore, PhazeComp has introduced a new correlation between SG and MW (to augment the previous Søreide and Jacoby correlations). If activated, it will calculate SG versus MW from a linear relationship between MW/SG and MW. By default, the linear model will closely reproduce the Katz-Firoozabadi SG vs MW correlation, but the two parameters of the linear model can be adjusted to match available data. Many of the examples now include this feature.
- **Gamma Fitting.** In addition to fitting (or modeling) MWs, component mole fractions, or component mass fractions, a Gamma distribution can now be fit to the logarithms of the component mole or mass fractions. This can improve the fitting of the tail end of a distribution, where the mole or mass fractions become very small (if they are still deemed significant and reliable). Gamma distributions can now also be plotted, comparing the input

molar or mass distribution with the model distribution. Several of the examples now include these new Gamma features.

Learning Curve

With some basic understanding of input conventions and command syntax, most users have actually found PhazeComp to be fairly easy to learn by example, even with its extraordinarily rich set of features not found in any other phase behavior software. The included example files are pretty self-explanatory, and they can serve as excellent templates for the creation of one's own input files. The less obvious details and nuances of each feature will eventually be documented in a PhazeComp Manual, but even before then, PhazeComp should still prove to be extremely useful and usable.