Technical Bulletin (TB-0037)

BITZER Software Guide

Version 4, January 2015

DEFINITION OF TERMS

Terms Found in the BITZER Software

Condenser Capacity: The power needed to reject heat from the refrigerant after being compressed to fully condense and achieve specified amount of subcooling at the exit of the condenser. Reference "Total Heat of Rejection" for comparison.

Condensing Capacity: The power needed to reject heat from the refrigerant after being compressed to fully condense the refrigerant. Reference "Total Heat of Rejection" for comparison.

Cooling Capacity (Q_{oh}): The potential energy transfer rate of the compressor that utilizes the suction gas temperature and the naturally subcooled liquid temp. In the Parallel-compound section of the software, externally subcooled liquid temp can be included in this capacity by checking the box located in Program → Options. Compressor cooling capacity includes external subcooling.

Evaporator Capacity (Q_o): The energy transfer rate taking place inside the evaporator using the final liquid temp before entering the expansion device and the useful superheat. This term is the same as "Net Refrigeration Effect."

Natural Subcooling: The difference in temperature of the liquid refrigerant from the outlet of the condenser to the saturated condensing temp.

Suction Gas Superheat: Temperature at the inlet of the compressor minus the saturated suction temp.

Suction Gas Temperature (t_{oh}): Temperature at the inlet of the compressor.

Useful Superheat: Superheat taking place inside of the evaporator (corresponds to the expansion device superheat.) 100% useful superheat indicates that the suction gas superheat and the useful superheat are identical.

With Economizer / with Subcooler: When these terms are used in either a two stage or screw section of the software, they indicate a liquid line subcooler that utilizes its own expanded liquid which is fed back to the compressor at an interstage pressure.

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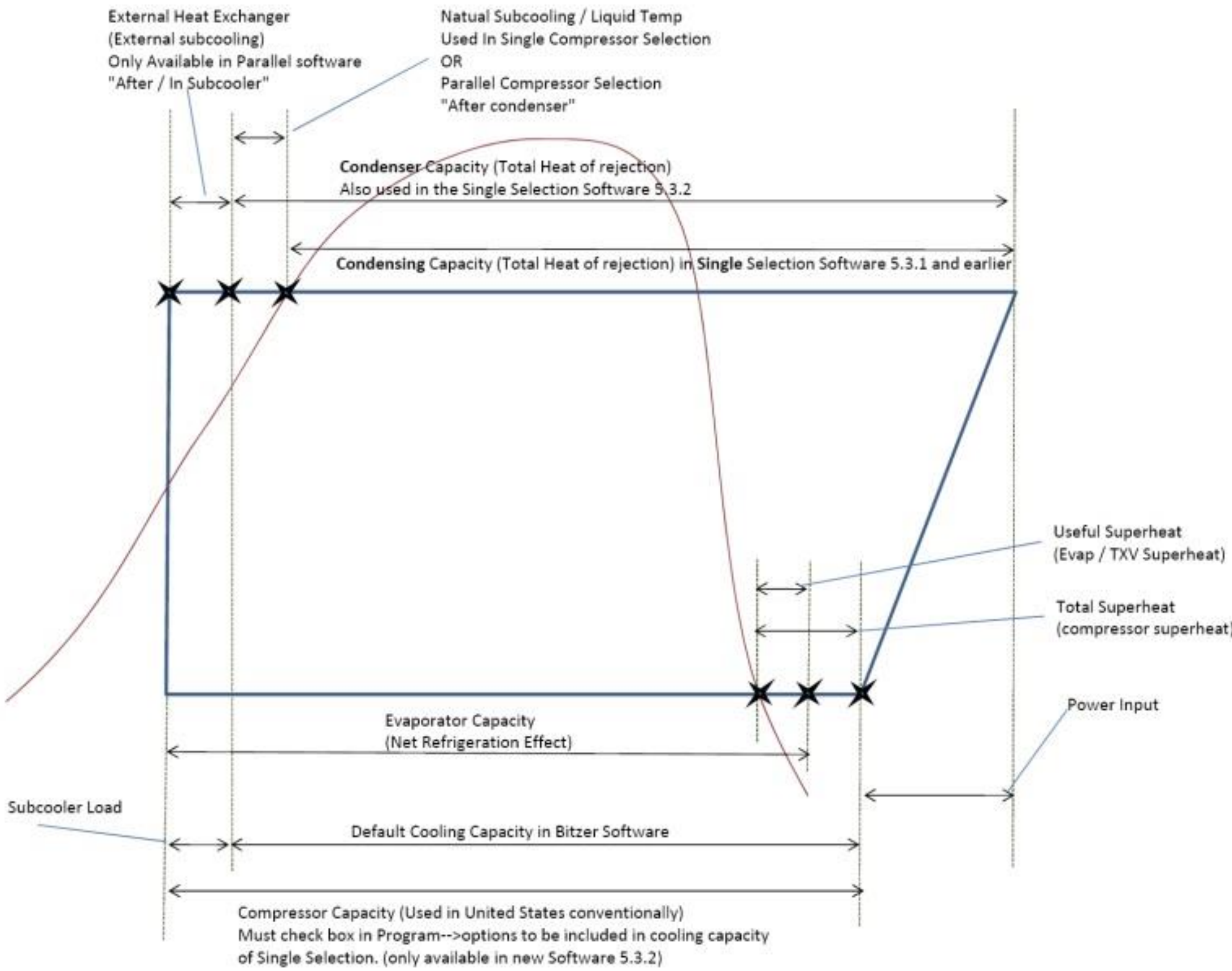
Other Industry Terms Not Found in the BITZER Software

Compressor Capacity: The potential energy transfer rate of the compressor that utilizes the return gas temp and the final liquid temp before entering the expansion device.

Total Heat of Rejection: The power needed to reject heat from the refrigerant after being compressed to fully condense the refrigerant. This term can indicate subcooling depending on how it is used.

Net Refrigeration Effect: The energy transfer rate taking place inside the evaporator using the final liquid temp before entering the expansion device and the useful superheat. This term is the same as "Evaporator Capacity."

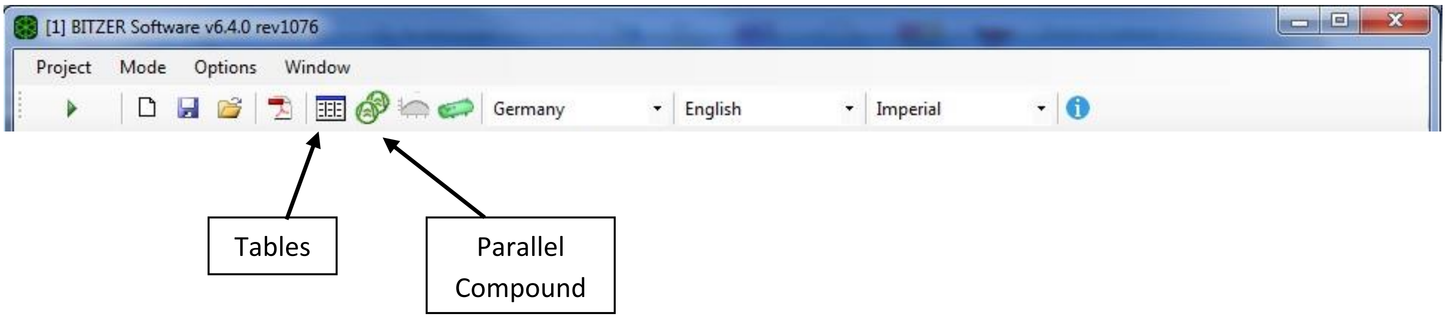
Capacity Terms as shown in a Pressure (P)-Enthalpy (H) diagram

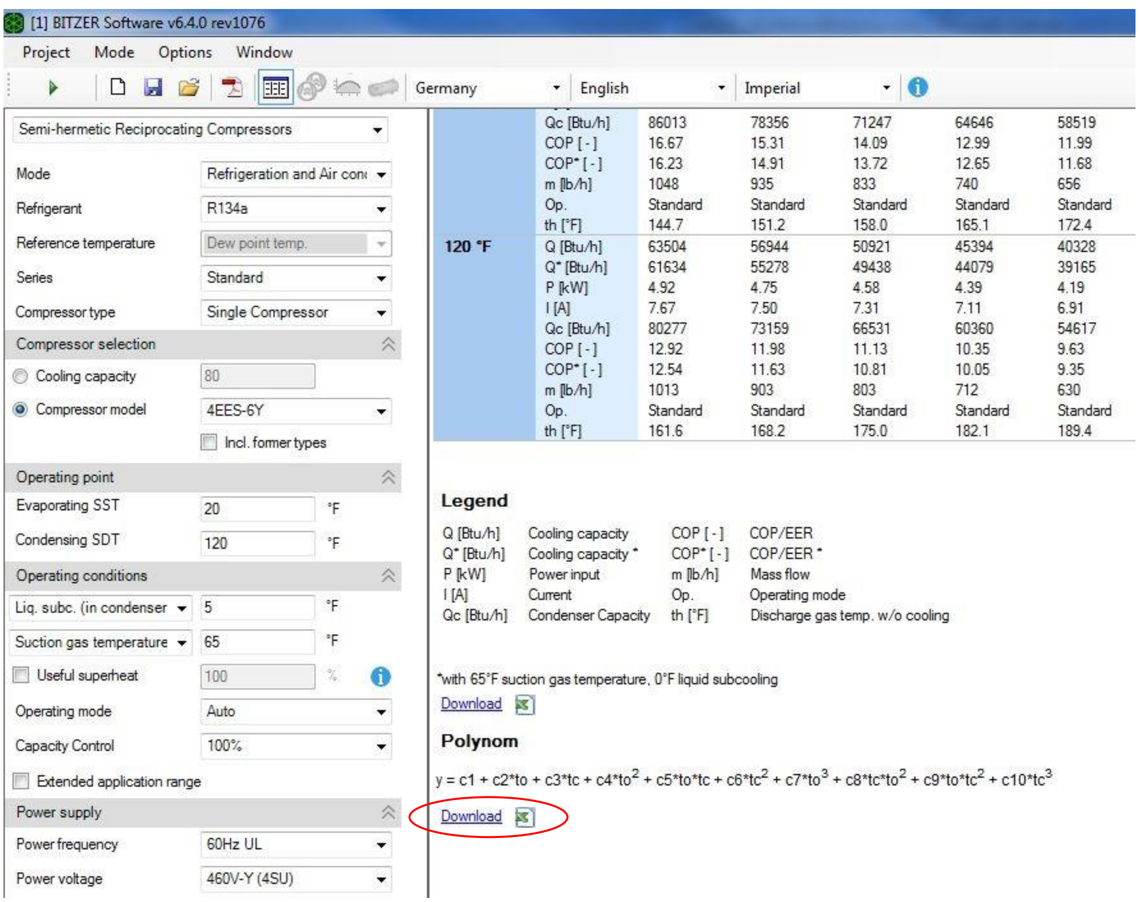


USING THE BITZER SOFTWARE

Navigation

The upper section of the software window can be used to navigate to various pages in the BITZER software. One commonly used section is “Tables”, wherein a performance table can be generated for a selected compressor and compressor coefficients can be saved to a .csv file.



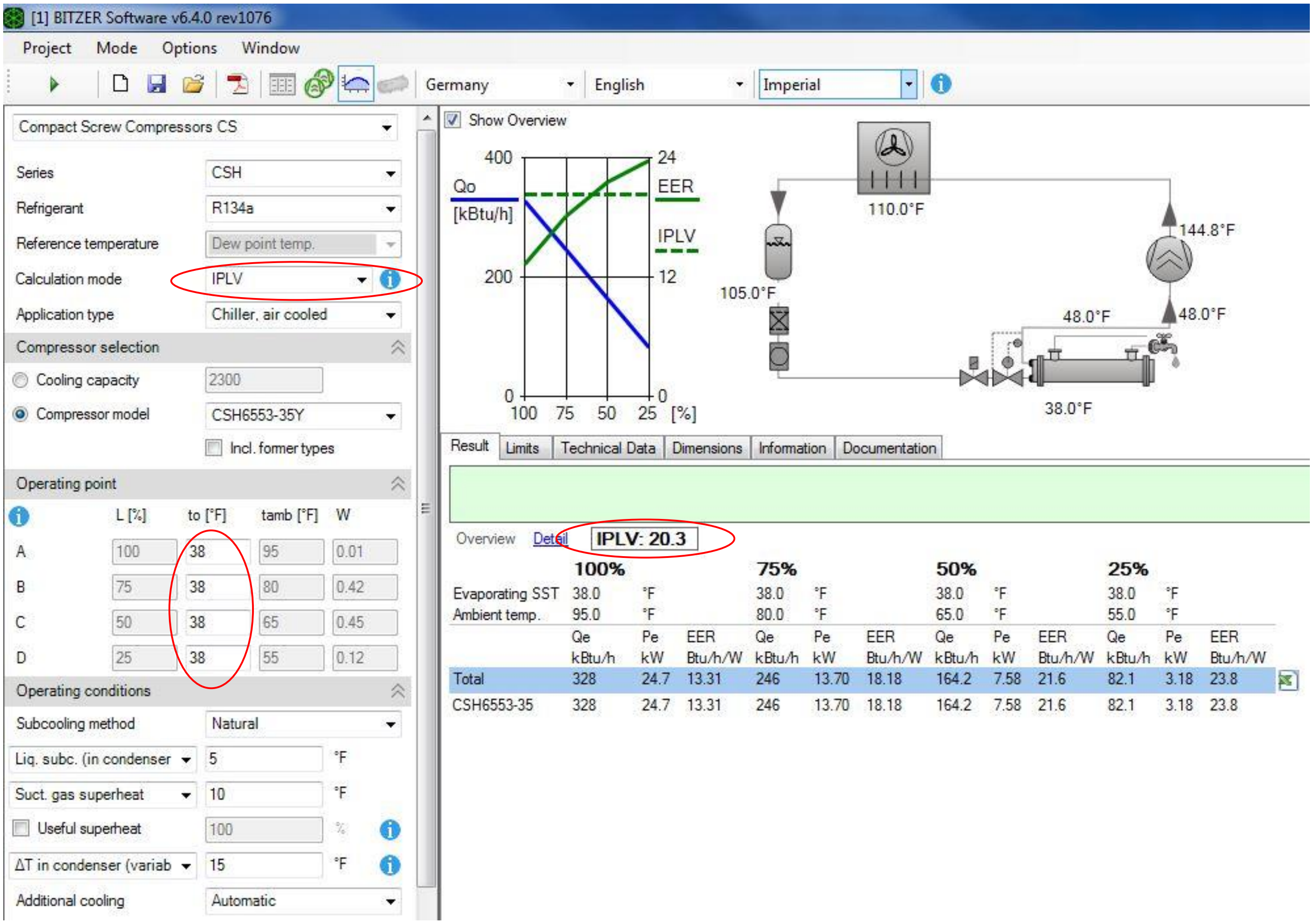


The “Parallel Compound” page allows for calculations and selection of semi hermetic screw and piston compressors, and scrolls in parallel or compound.

The BITZER software also allows for seasonal calculations and accessory selection, icons for which may also be found in the upper area or the software window. All of these pages may also be accessed via the “Mode” menu in the application.

Seasonal Calculations

IPLV calculations can be made for CS Series screw compressors and scroll compressors from the “Seasonal Calculation” page by selecting IPLV as the calculation mode. A compressor model, application, and operating point information must be specified as well. A successful calculation will display an IPLV value along with capacity and power information at applicable part load conditions. An ESEER calculation may also be done from this page if units are specified as “SI”.



Former Types and Octagon Varispeed

Please note that Varispeed compressors currently cannot be selected with “U.S.A” as the country. In order to select a Varispeed compressor, select a valid refrigerant under the “Semi-hermetic Reciprocating Compressors” page and change the series drop down from “Standard” to “OCTAGON VARISPEED”.

Semi-hermetic reciprocating compressor model numbers show the current New Ecoline compressors default. In order to view data from the previous .2 series of compressors with North American nomenclature (e.g. 4C1480SL), “U.S.A” must be selected as the country.

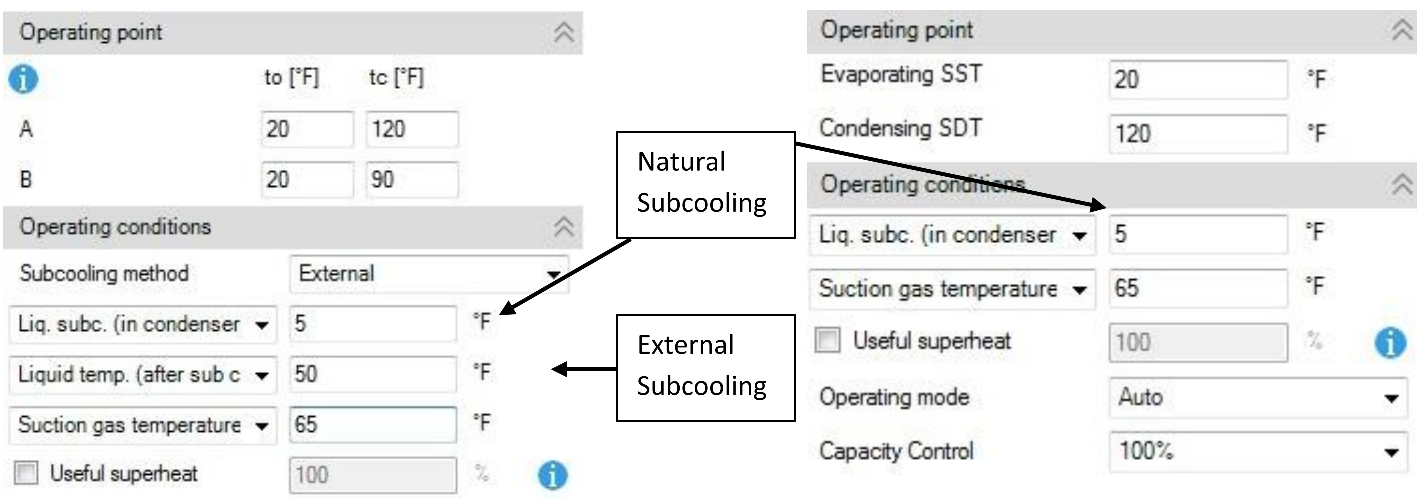
Subcooling

Subcooling the liquid refrigerant will increase the capacity of a system whether this is achieved with a condenser, ambient cooling, an Economizer or using an external heat exchanger after the condenser.

An internal heat exchanger (subcooling using the suction gas) does not increase capacity unless it is compared to the same system that would have gained additional heat on the suction return line back to the compressor. Ambient cooling is free subcooling occurring by using the ambient air to subcool the liquid and is rarely considered in compressor software. The Economizer is only applicable to compressors that have a port for injecting into the interstage.

This leaves two primary methods of subcooling to increase capacity (excluding the Economizer for now): “natural” subcooling that takes place in the condenser or “external” that uses a heat exchanger associated with another system. Natural subcooling is assumed to take place in the condenser and would require a larger condenser. External subcooling absorbs heat from the system and takes it to another system to be rejected and does not require a larger condenser.

In the parallel-compound section of the software, these two inputs are distinguishable, utilizing “Liquid subcooling (in condenser)” or “Liquid temperature (after condenser)” will increase cooling capacity, evaporator capacity and condenser capacity. Utilizing “Liquid subcooling (in subcooler)” or a “Liquid temperature (after subcooler)” will increase evaporator capacity and only increase cooling capacity if the appropriate box is checked under Program → Options. It will not increase the condenser capacity.



Parallel-Compound Section of Software

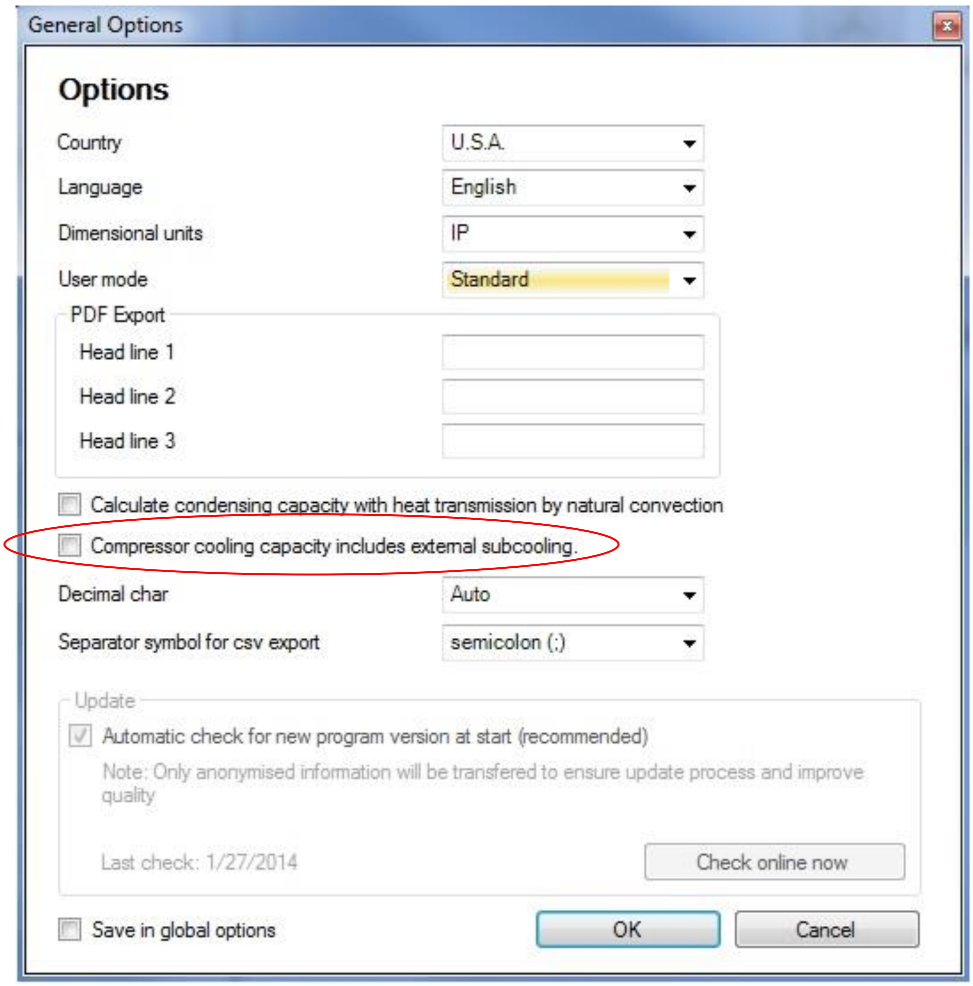
Single Compressor Section of Software

In the single selection section of the software, subcooling is considered natural. Utilizing the “Liquid subcooling” or “Liquid temperature” will increase cooling capacity, evaporator capacity and condenser capacity.

In the Two-stage or Screw sections of the software, subcooling using an economizer is also possible. Because this utilizes liquid refrigerant expanded to an interstage pressure that is fed back into the compressor, this will not only increase the cooling capacity and the evaporator capacity, but also the condenser capacity.

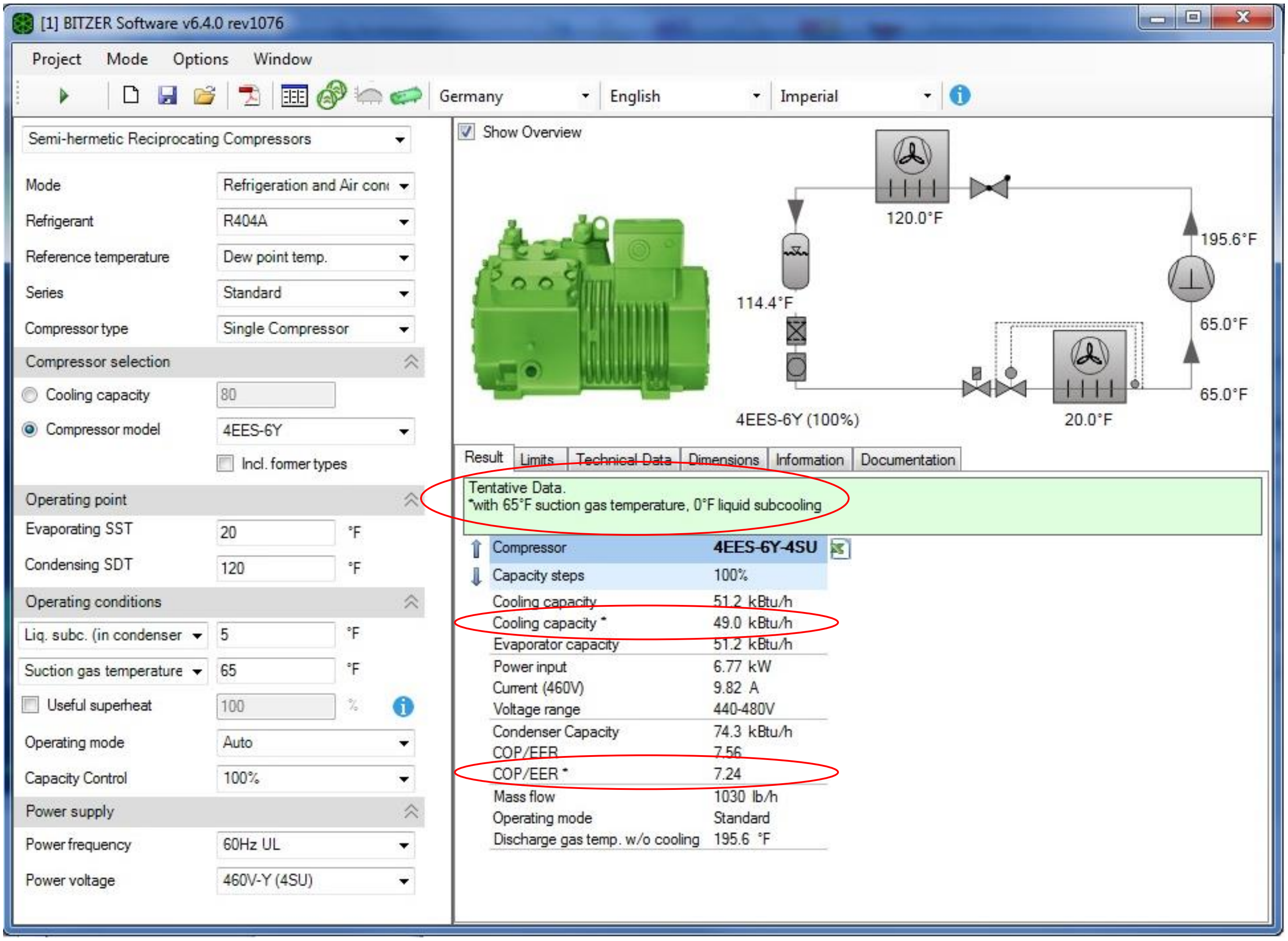
Cooling Capacity with External Subcooling

Cooling capacity can include external subcooling. By checking the appropriate box found in the Program → Options screen, the cooling capacity can increase with external subcooling in addition to the evaporator capacity.



Asterisk Capacities

In the software, there are two terms that will appear with an asterisk: “Cooling capacity*” and “COP/EER*”. These values are for comparison to the conditions that were inputted and are usually a standard condition or rating (e.g. AHRI 540). The standard condition or rating that is used can be found in the green upper box.



Shaft Power versus Recommended Driving Motor for Open Drive Compressor

For Open Drive compressors, BITZER software provides two power outputs: *Shaft power* and *Recommended driving motor*.

The *Shaft power* is the motor power required to operate the compressor at the specified conditions. **<u>This value should be used for motor sizing.</u>** Please consider the motor service factor and operating conditions when incorporating safety factor into the sizing of the motor.

The *Recommended driving motor* is a suggested motor size that is calculated using a built-in safety factor and IEC motor size and does not apply to NEMA motor sizes. If using NEMA motors, please ignore this value as it is not valid.