



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.

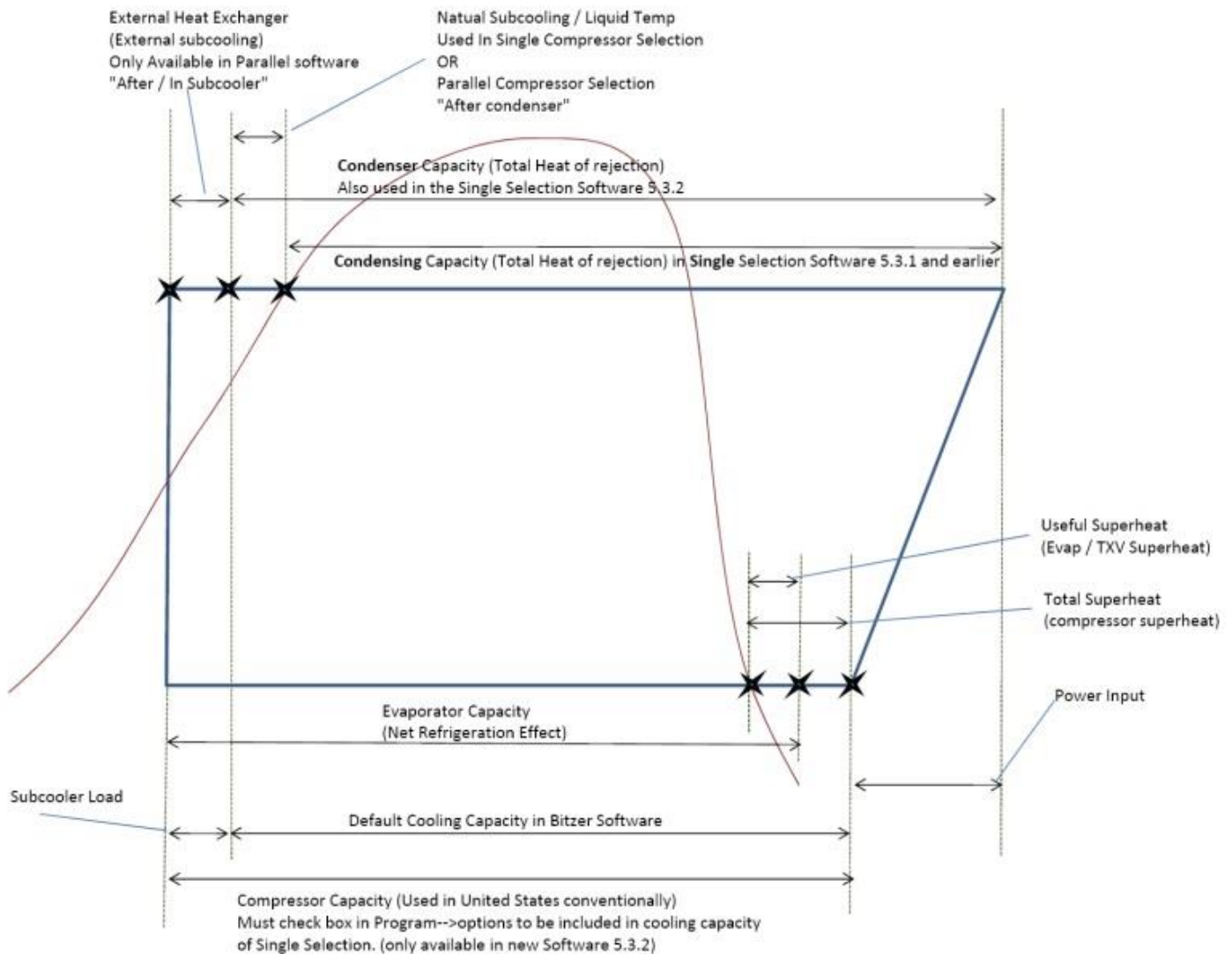
Other Industry Terms Not Found in the BITZER Software

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."

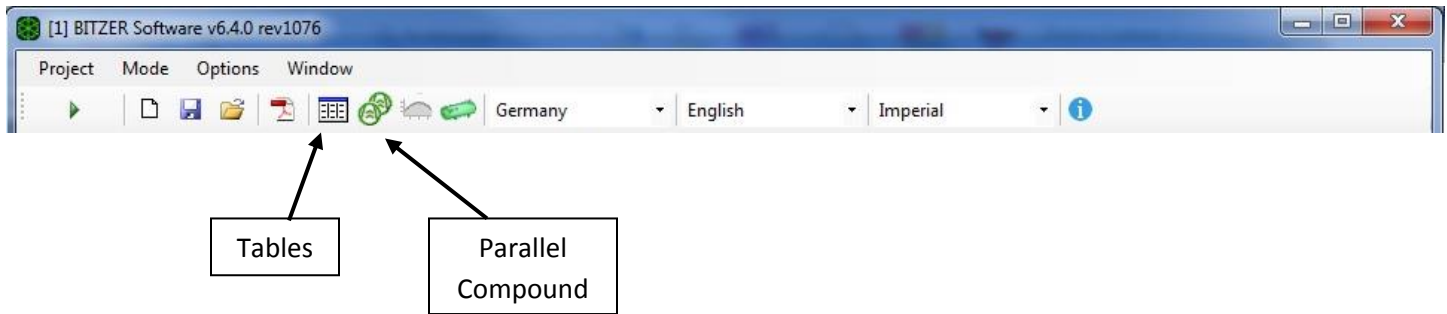
Capacity Terms as shown in a Pressure (P)-Enthalpy (H) diagram



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.



	86013	78356	71247	64646	58519
Qc [Btu/h]	86013	78356	71247	64646	58519
COP [-]	16.67	15.31	14.09	12.99	11.99
COP* [-]	16.23	14.91	13.72	12.65	11.68
m [lb/h]	1048	935	833	740	656
Op.	Standard	Standard	Standard	Standard	Standard
th [°F]	144.7	151.2	158.0	165.1	172.4
120 °F					
Q [Btu/h]	63504	56944	50921	45394	40328
Q* [Btu/h]	61634	55278	49438	44079	39165
P [kW]	4.92	4.75	4.58	4.39	4.19
I [A]	7.67	7.50	7.31	7.11	6.91
Qc [Btu/h]	80277	73159	66531	60360	54617
COP [-]	12.92	11.98	11.13	10.35	9.63
COP* [-]	12.54	11.63	10.81	10.05	9.35
m [lb/h]	1013	903	803	712	630
Op.	Standard	Standard	Standard	Standard	Standard
th [°F]	161.6	168.2	175.0	182.1	189.4

Legend

Q [Btu/h] Cooling capacity COP [-] COP/EER
 Q* [Btu/h] Cooling capacity * COP* [-] COP/EER *
 P [kW] Power input m [lb/h] Mass flow
 I [A] Current Op. Operating mode
 Qc [Btu/h] Condenser Capacity th [°F] Discharge gas temp. w/o cooling

*with 65°F suction gas temperature, 0°F liquid subcooling

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Polynom

$$y = c1 + c2*t0 + c3*tc + c4*t0^2 + c5*t0*tc + c6*tc^2 + c7*t0^3 + c8*tc*t0^2 + c9*t0*tc^2 + c10*tc^3$$

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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”.

The screenshot shows the BITZER Software interface for seasonal calculations. The configuration on the left includes:

- Series: CSH
- Refrigerant: R134a
- Reference temperature: Dew point temp.
- Calculation mode: **IPLV** (circled in red)
- Application type: Chiller, air cooled
- Compressor model: CSH6553-35Y

The central graph plots Qo [kBTu/h] against L [%]. The IPLV curve is shown as a blue line, and the EER curve is shown as a green line. The schematic diagram shows a refrigeration cycle with temperatures: 110.0°F (condenser), 105.0°F (evaporator), 144.8°F (superheat), 48.0°F (subcooling), and 38.0°F (suction).

The results table shows the following data:

		100%		75%		50%		25%				
Evaporating SST	38.0 °F	38.0 °F	38.0 °F	38.0 °F	38.0 °F	38.0 °F	38.0 °F	38.0 °F	38.0 °F			
Ambient temp.	95.0 °F	80.0 °F	65.0 °F	55.0 °F	95.0 °F	80.0 °F	65.0 °F	55.0 °F	95.0 °F			
	Qe	Pe	EER	Qe	Pe	EER	Qe	Pe	EER			
	kBTu/h	kW	Btu/h/W	kBTu/h	kW	Btu/h/W	kBTu/h	kW	Btu/h/W			
Total	328	24.7	13.31	246	13.70	18.18	164.2	7.58	21.6	82.1	3.18	23.8
CSH6553-35	328	24.7	13.31	246	13.70	18.18	164.2	7.58	21.6	82.1	3.18	23.8

The IPLV value is highlighted as **IPLV: 20.3** (circled in red).

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.

The image displays two screenshots of software interfaces for subcooling settings. The left screenshot is labeled "Parallel-Compound Section of Software" and shows the "Operating conditions" section with "Subcooling method" set to "External". The right screenshot is labeled "Single Compressor Section of Software" and shows the "Operating conditions" section with "Liq. subc. (in condenser)" set to 5. Arrows point from text boxes "Natural Subcooling" and "External Subcooling" to the respective settings in both screenshots.

Parameter	Value	Unit
Evaporating SST	20	°F
Condensing SDT	120	°F
Liq. subc. (in condenser)	5	°F
Suction gas temperature	65	°F
Useful superheat	100	%
Operating mode	Auto	
Capacity Control	100%	

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.

General Options

Options

Country: U.S.A.

Language: English

Dimensional units: IP

User mode: Standard

PDF Export

Head line 1: []

Head line 2: []

Head line 3: []

Calculate condensing capacity with heat transmission by natural convection

Compressor cooling capacity includes external subcooling.

Decimal char: Auto

Separator symbol for csv export: semicolon (;)

Update

Automatic check for new program version at start (recommended)

Note: Only anonymised information will be transferred to ensure update process and improve quality

Last check: 1/27/2014

Check online now

Save in global options

OK Cancel

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.

The screenshot displays the BITZER Software interface with the following configuration and data:

- Project:** [1] BITZER Software v6.4.0 rev1076
- Mode:** Refrigeration and Air con
- Refrigerant:** R404A
- Reference temperature:** Dew point temp.
- Series:** Standard
- Compressor type:** Single Compressor
- Compressor selection:**
 - Cooling capacity: 80
 - Compressor model: 4EES-6Y
 - Incl. former types:
- Operating point:**
 - Evaporating SST: 20 °F
 - Condensing SDT: 120 °F
- Operating conditions:**
 - Liq. subc. (in condenser): 5 °F
 - Suction gas temperature: 65 °F
 - Useful superheat: 100 %
- Power supply:**
 - Power frequency: 60Hz UL
 - Power voltage: 460V-Y (4SU)

Technical Data Table:

Result	Limits	Technical Data	Dimensions	Information	Documentation
Tentative Data. *with 65°F suction gas temperature, 0°F liquid subcooling					
Compressor		4EES-6Y-4SU			
Capacity steps		100%			
Cooling capacity		51.2 kBtu/h			
Cooling capacity *		49.0 kBtu/h			
Evaporator capacity		51.2 kBtu/h			
Power input		6.77 kW			
Current (460V)		9.82 A			
Voltage range		440-480V			
Condenser Capacity		74.3 kBtu/h			
COP/EER		7.56			
COP/EER *		7.24			
Mass flow		1030 lb/h			
Operating mode		Standard			
Discharge gas temp. w/o cooling		195.6 °F			

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. **This value should be used for motor sizing.** 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.

The screenshot displays the BITZER Software interface. On the left, the 'Compressor selection' panel shows the following settings:

- Mode: Refrigeration and Air con
- Refrigerant: R404A
- Reference temperature: Dew point temp.
- Compressor selection: 4H.2-K
- Operating point: Evaporating SST: 20 °F, Condensing SDT: 110 °F
- Operating conditions: Liq. subc. (in condenser): 15 °F, Suction gas temperature: 65 °F, Useful superheat: 100 %
- Capacity Control: 100%
- Drive: Motor speed: 1750 /min, Coupling (1:1)
- Compressor speed: Auto

The main window shows a refrigeration cycle diagram with the following temperatures: 110.0°F (condenser), 181.0°F (discharge gas), 65.0°F (suction gas), and 65.0°F (evaporator). The compressor is labeled '4H.2Y (100%)' and '20.0°F'.

The 'Result' tab is active, showing the following technical data:

Parameter	Value
Compressor	4H.2Y
Capacity steps	100%
Cooling capacity	197.5 kBtu/h
Cooling capacity *	177.3 kBtu/h
Evaporator capacity	197.5 kBtu/h
Shaft power	19.83 kW
Condenser Capacity	265 kBtu/h
COP/EER	9.96
COP/EER *	8.94
Mass flow	3423 lb/h
Operating mode	Coupling (1:1)
Compr. speed	1750 /min
Recommended driving motor	24.5 kW
Discharge gas temp. w/o cooling	181.0 °F