# Bin Analysis Software / Input Field Descriptions

This document defines each of the input parameters shown in the Carlyle Solutions 'Bin Analyzer' input screen. The inputs allow the user to define the application requirements, selected compressors and the parameters for the energy analysis. The output of the 'Bin Analyzer' is a performance summary, including an estimate of annual energy consumption, for the operation of the defined refrigeration rack operated over the temperature range of the bin city selected.

**Project Name:** A data field for entering the relevant Job-Site information.

**Date:** A data field for entering the date. Input defaults to current date.

**Compressor Base Model Type**: User selects desired compressor type: 5F/H, 05T, 06CC, 06D/E.

**Refrigerant Type**: A user input, selectable from a 'Drop Down' list. The refrigerant type is typically specified by the Customer / End User.

**Design Saturated Suction Temperature (SST):** A data field for entering the design SST for the refrigeration system. This temperature is typically specified by the Customer / End User. For this software the maximum allowable temperature is + 30 degrees Fahrenheit. The minimum allowable temperature may be as low as – 60 degrees Fahrenheit depending on the compressor type. This software is designed for use in analyzing low and medium temperature refrigeration systems – not air conditioning systems.

**Design Saturated Discharge Temperature (DSDT):** A data field for entering the Design condensing temperature for the refrigeration system. This temperature is typically equal to the highest outdoor ambient temperature that the application site experiences plus some fixed condenser 'Delta T'. The Condenser 'Delta T' value is typically 10 degrees Fahrenheit for Low Temperature Applications and 15 degrees Fahrenheit for Medium Temperature Applications.

**Design Return Gas Temperature (RGT):** A data field for entering the design RGT for the refrigeration system. This temperature is generally selected as 25 degrees for Low Temperature applications and 40 degrees F for Medium Temperature applications but may be any temperature equal to or greater than the SST and less than or equal to 65F (65F is the default)

**Rack Controller SST 'DeadBand':** A user input, selectable from a 'Drop Down' list. This temperature is generally specified by the system designer and is used to define the temperature range that the controller will allow before changing the *compressor load profile*. The *compressor load profile* is defined as the number of compressors that are operating, at either a full load condition or a partial load condition (unloaded). A 'DeadBand' is desirable to prevent compressors from Short-Cycling. Short-Cycling of compressors leads to higher energy usage and premature compressor failure. Typical SST 'DeadBand' settings are 5 degrees for medium temperature applications and 10 degrees for low temperature applications.

**Comps. Equipped w/ Unl:** A user input, selectable from a 'Drop Down' list (YES/NO) indicating whether any of the compressors used in the analysis are equipped with Unloading Capacity Control. This feature may be added to as many as three compressors in the system and may be selected for the 06D/E and 5F/H type compressors.

**Web-Bulb Bin Hours (Evap. Cond.):** If this box is checked, the bin analysis will be based on the hourly distribution of outdoor wet-bulb temperature. This is applicable for systems that using evaporative condensing where the condensing temperature is driven by the wet-bulb temperature. The default (box not checked) is to use dry-bulb data for the analysis assuming an air cooled condenser.

**Bin City:** A user input, selectable from a 'Drop Down' list. This field allows the system designer to select the application location. There are 35 North American Cities and 25 Intercontinental Cities in the contained database. The Bin Hours data is presented in 5 degree Fahrenheit bins. Carlyle has additional Bin data for over 800 cities worldwide. There is also a 'Custom Bin Hours' routine that also allows the user to input custom bin hours for any city.

**Design Load:** A data field for entering the design refrigeration load for the application. The system designer typically specifies the required load. The final 'Required Load' value may be adjusted by the 'Additional Subcooling Load' input as described below.

**Condenser 'Delta T':** A user input, selectable from a 'Drop Down' list. The condenser 'Delta T' temperature is generally a function of the refrigerant condenser selected by the system designer. A typical condenser design is based on a 10 degrees Fahrenheit for Low Temperature applications and 15 degrees Fahrenheit for Medium Temperature applications, which are the defaults.

**Minimum Saturated Discharge Temperature:** A user input, selectable from a 'Drop Down' list. The minimum SDT temperature is 70 degrees Fahrenheit but may be selected as a higher value depending on the type of condenser selected.

**Adjust Evap. Load Based on O.D.Ambient T.:** A user input (YES/NO) indicating whether the evaporator load is to be adjusted by the outdoor ambient temperature. This feature allows the designer to select an automatic reduction of the required load. Selecting "Yes" reduces the 'Required Load' by 30%, linearly, between the design ambient temperature (the highest annual ambient temperature at the application site) and 20 degrees Fahrenheit outdoor ambient temperature. This load reduction is an understood and accepted principle in the refrigeration industry and allows the analysis to be more realistic and to have more accuracy. Selecting "No" maintains the required load at the constant value previously input in the 'Required Load' section. The final 'Adjusted Required Load' value may be further adjusted by the 'Additional Subcooling Load' input as described below.

**Oil Cooler In System:** A user input (YES/NO), which indicates whether the compressor is or is not operated with an oil cooler. This feature is applicable to the 05T and 06T Carlyle Screw compressors ONLY. The use of an Oil Cooler may be required for some applications. See the Application Guide for further information.

**Addl. Subcooling Load (From Diff. rack):** A data field for entering an 'Additional Subcooling Load', from another refrigeration rack (typically low temperature), that adds to the original 'Required Load' (or the 'Adjusted Required Load') mentioned earlier. This 'Additional Subcooling Load' automatically adjusts from 100% of the value entered down to 0% as the outdoor ambient changes from design ambient temperature (the highest annual ambient temperature at the application site) to 50 degrees Fahrenheit. This load reduction is known to occur in actual application and is generally linear.

**Application Temperature:** An informational field only. This field expresses the Application Temperature dictated by the Design Saturated Suction Temperature (SST) that was previously selected.

**Frequency:** A user input, selectable as either 50Hz or 60Hz (default) input power and is typically dictated by the application location.

**Voltage:** A user input, selectable from a 'Drop Down' list which is typically specified by the system designer based on the application location.

**Motor Speed (RPM):** A user input, selectable from a 'Drop Down' list. This feature applies to the 5F/H compressors only. The 5F/H compressors may be operated between 900 and 1750 RPM. These compressors typically reach their peak operating efficiencies between 900 – 1100 RPM.

**Motor Efficiency:** A user input, selectable from a 'Drop Down' list. This feature applies to the 5F/H and the 05T, open-drive compressors only. The analysis achieves greater accuracy for this type of compressor when the correct motor efficiency is chosen.

**Economizer / SubCooler:** A user input (YES/NO). An economizer is required for: 06T, 05T and 06CC compressors. A mechanical SubCooler may be selected for the 06D/E and 5F/H. Selecting "No" indicates the system will have natural SubCooling only.

**Liquid Temperature Entering TXV** or **Liquid SubCooling:** A user input, selectable from a 'Drop Down' list. This field title changes based on the input in the **Economizer / SubCooler** field. If 'Economizer' or 'SubCooler' is selected the field title will be **Liquid Temperature Entering TXV** (fixed temperature), if 'No' is selected the field title will be **Liquid SubCooling** (degrees of subcooling). The temperature values in these two lists are different and reflect typical values for the respective selection.

**Variable Speed on Comp #1:** A user input (YES/NO). This feature allows the user to select a Variable Speed Drive for compressor # 1 only. The analysis assumes compressor # 1 is the lead compressor and will keep this compressor active unless all other compressors are first cycled to "Off". The software adds a 3% energy penalty to the total power for compressor # 1 based on losses typically seen in variable speed drives. Energy savings (related to the use of variable speed drives) are the result of closely matching the compressor capacity to the required load and a tendency for the compressors to operate more efficiently at lower operating speeds (highest efficiencies are typically achieved between 900 – 1100 RPM for reciprocating compressors). For most applications, the largest compressor should be selected as being "Variable Speed Driven".

**Compressor # 1 (also # 2 & # 3):** A user input, selectable from a 'Drop Down' list. This list of available compressors is based on those compressors (of the type selected) that are applicable for the refrigerant type and the defined operating temperature (i.e. design SST value entered). Compressor # 1, Compressor # 2 and Compressor # 3 may be unloaded if the compressor type is 06D/E or 5F/H. Note that if a variable speed drive is selected (see above) it is assumed to operate with Compressor #1.

**Compressor # 4 (also # 5 & # 6):** A user input, selectable from a 'Drop Down' list. This list of available compressors is based on those compressors (of the type selected) that are applicable for the refrigerant type and the defined operating temperature (i.e. design SST value entered). The Bin Analyzer is capable of calculating annual energy usage for up to 6 compressors per system. Unloading cannot be included on more than 3 compressors (i.e. is not available as an option for Compressors 4 – 6).