WEATHERMASTER®
48/50HJ004-014
HUMIDI-MIZER™ Adaptive Dehumidification System

Application Data

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INTRODUCTION

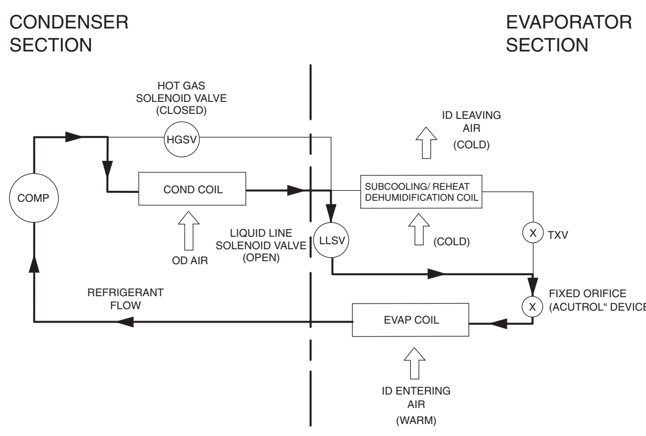
Packaged rooftop units are currently being implemented in many expanded applications that require the highest degree of indoor comfort and humidity control. This trend is a direct result of making rooftop packages more cost effective. To fully realize the potential energy-saving benefit of packaged rooftop units an expanded envelope of operation may be required. Maintaining indoor space humidity levels can be increasingly difficult depending on the time of year, location of the installation, and the ability of the equipment to provide reliable, flexible operation to meet indoor part load sensible and latent load requirements. Standard product enhancements cannot always meet these requirements, as the equipment must often inefficiently treat a higher proportion of outdoor air, or waste energy by trying to control humidity levels by overcooling a space.

Carrier's Humidi-MiZer adaptive dehumidification system is an all-inclusive factory-installed option that can be ordered with any Weathermaster 48/50HJ rooftop unit to meet the demand for providing a flexible and high performing solution to accommodate all of these design related issues. This system expands the envelope of operation of Carrier's Weathermaster 48/50HJ rooftop products to provide unprecedented flexibility to meet year round comfort conditions. The Humidi-MiZer adaptive dehumidification system has the industry's only dual dehumidification mode setting.

The Humidi-MiZer system includes two new modes of operation. The Weathermaster 48/50HJ rooftop coupled with the Humidi-MiZer system is capable of operating in the following modes:

1. Normal Design Cooling Mode

   Normal operation of the rooftop unit sequence to cycle up to two compressors (sizes 008-014) to maintain comfort conditions. See Fig. 1.



LEGEND

COND	— Condenser
EVAP	— Evaporator
HGSV	— Hot Gas Solenoid Valve
LLSV	— Liquid Line Solenoid Valve
OD AIR	— Outdoor Air
TXV	— Thermostatic Expansion Valve

Fig. 1 — Normal Design Cooling Mode

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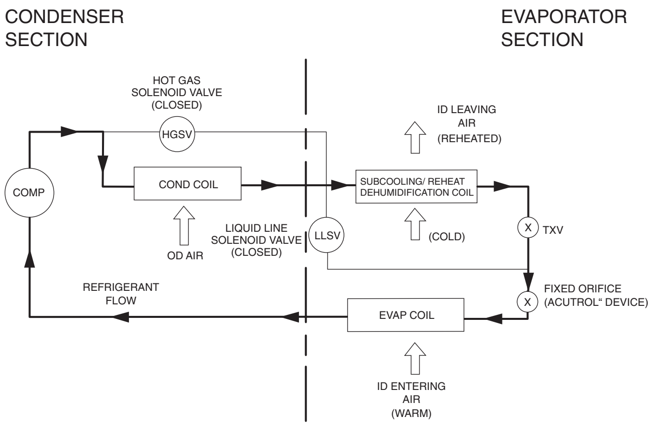
2. Subcooling Mode

This mode will operate to satisfy part load type conditions when the space requires combined sensible and a higher proportion of latent load control. See Fig. 2.



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COND — Condenser
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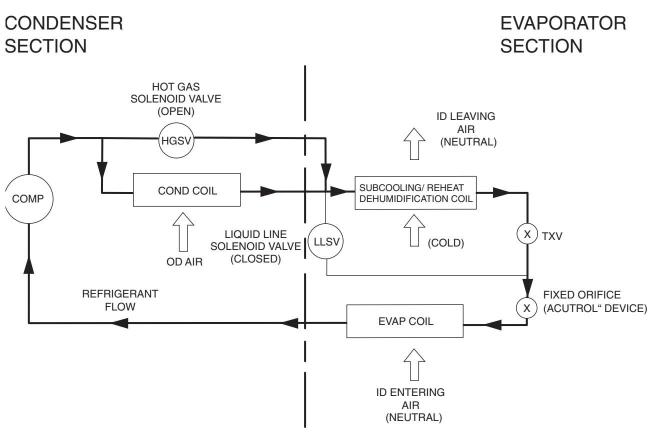
Fig. 2 — Subcooling Mode

3. Hot Gas Reheat Mode

When outdoor temperatures diminish and the need for latent capacity is required for sole humidity control, hot gas reheat mode will provide neutral air for maximum dehumidification operation. See Fig. 3.



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COND — Condenser
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Fig. 3 — Hot Gas Reheat Mode

FEATURES/BENEFITS

Combined together in one packaged rooftop unit, the Humidi-MiZer™ adaptive dehumidification system provides the greatest degree of operational flexibility and superior humidity control for consistently maintaining year round indoor comfort temperature and humidity levels. In summary, the Humidi-MiZer adaptive dehumidification system benefits include:

Maximum Flexibility — Using three operational modes, the system is better able to adapt to all peak and part load outdoor temperature and humidity conditions.

Consistent Comfort — System flexibility allows the rooftop unit to maintain both indoor temperature and humidity comfort conditions consistently year round.

Superior Humidity Control — When maximum humidity control is required in the space, Carrier's exclusive hot gas reheat design sequence provides neutral air and subsequent dehumidification of the space.

Cost Effectiveness — Available as a factory-installed option on the Weathermaster® 48/50HJ 3 to 12$^1/_2$-ton rooftop product line, the Humidi-MiZer adaptive dehumidification system provides a cost effective packaged alternative for meeting more latent load intensive applications. System installation costs are simplified and minimized by using Carrier's exclusive Thermidistat™ or a humidistat device with a thermostat for combined temperature and humidity sensing in the space.

HUMIDI-MIZER ADAPTIVE DEHUMIDIFICATION SYSTEM DESIGN CONSIDERATIONS

To fully understand the benefits of the Humidi-MiZer adaptive dehumidification system, it is necessary to outline some design challenges associated with maintaining appropriate humidity levels and indoor comfort conditions. Many factors can contribute to the need for increased levels of system flexibility and overall humidity control. In addition, maintaining indoor comfort conditions can be increasingly difficult depending on the type of equipment utilized. Design consideration for the selection of air conditioning equipment for maintaining humidity in all types of outdoor and indoor load conditions will depend on the flexibility of the system. Such a system would need to provide airflow volumes that will satisfy varying degrees of sensible and latent loads for both ventilation air and the space. This may be difficult for packaged unitary equipment due to the fixed amount of cfm/ton of capacity (a fixed sensible and latent capacity) that is representative of rooftop units. The Humidi-MiZer adaptive dehumidification option provides a cost effective, flexible solution for meeting more stringent conditioning (and specifically humidity) requirements using the Weathermaster 48/50HJ rooftop product line. The following are some challenges associated with the implications for dehumidification design:

1. Indoor Air Quality:

Humidity is one of the leading factors contributing to the growth and propagation of mold and mildew in a building. Mold and mildew can spread quickly and grow in carpets, ductwork, on and inside walls. Mold and mildew growth inside a space can lead to significant odors and subsequent illness. To maintain indoor humidity levels within an acceptable comfort level range, ANSI/ASHRAE (American National Standards Institute/American Society of Heating, Refrigeration, and Air Conditioning Engineers) Standard 62-2001, Ventilation for Acceptable Indoor Air Quality recommends that indoor relative humidity levels be maintained between 30% and 60% to minimize the growth of allergenic and pathogenic organisms. Maintaining the relative humidity within these limits requires the use of a system that will accommodate both peak and part load conditions. Reducing the potential for mold and mildew propagation on an annual basis will greatly minimize the chance for indoor air quality issues.

2. Occupant Comfort:

   One of the greatest challenges in the design of a particular HVAC (heating, ventilation and air conditioning) system is to maintain comfort conditions, especially indoor humidity, for all occupants year round. The challenge becomes increasingly difficult since occupants tend to have different comfort thresholds. ANSI/ASHRAE Standard 55-1992 provides a basis for the limits in which occupants feel comfortable in all seasonal extremes. This standard specifies the indoor conditions that would be acceptable for 80% or more of occupants within a space. This is depicted as the comfort zone as shown in Fig. 4.

3. Outdoor Climate Impact:

   Designing a HVAC system to appropriately handle variable sensible and latent loads year round requires consideration of the change in outdoor air conditions, location of the climate, and indoor latent conditions. Higher outdoor temperatures result in higher sensible wall, roof, and solar loads, as well as sensible ventilation load. However, as the outdoor dry bulb temperature diminishes, the outdoor wet bulb temperature may remain the same or be relatively higher. This is especially true on a mild, rainy day. As a result, latent loads (indoor loads from people and latent ventilation load), may remain constant or increase, while sensible loads decrease. Designing for only the peak coincident dry bulb conditions may not appropriately handle humidity during off-peak instances when humidity levels are still high, but the temperature has dropped. In these circumstances, the equipment needs to provide mostly latent capacity, which is difficult when applying packaged rooftops, since the sensible and latent capacities in cfm/ton are constant. Without system enhancements, it is not possible to provide only latent capacity without the system.

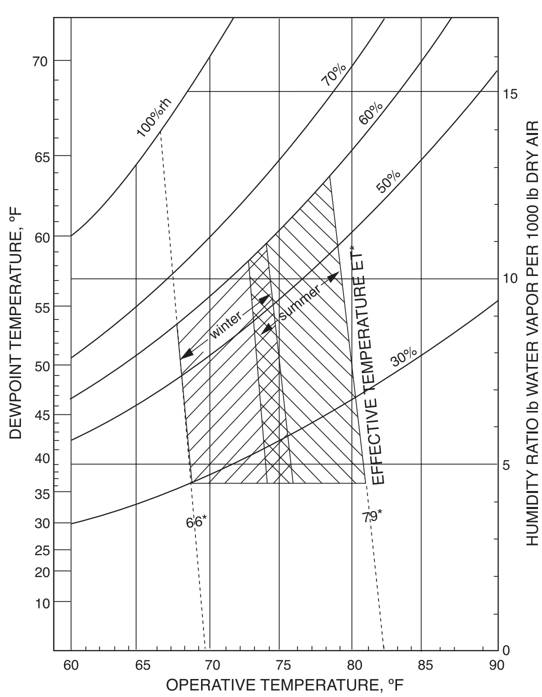


Fig. 4 — ASHRAE 55-1992 Comfort Zone Definition

4. Indoor Latent Loads:

   Another very important consideration in the application of appropriate dehumidification equipment is the variability and proportion of latent load in the space. When designing a system, the proportion of sensible to total load in the space is characterized by the sensible heat ratio (SHR). This ratio specifically outlines the sensible and latent heat removal characteristics for the space. For example, a higher SHR indicates a higher relative proportion of sensible load in the space and a lower SHR indicates higher relative proportion of latent load in the space. Since typical packaged rooftop equipment has a fixed cfm/ton sensible and latent capacity, the capability of the equipment to remove the relative proportions of sensible and latent heat from the space is constant. Providing a fixed sensible to total capacity may not always maintain comfort conditions in applications that have higher amounts of occupancy and associated internal latent load. This design challenge is further complicated by applications such as a school, where occupancy is highly variable (students entering and leaving a classroom). The sensible and latent heat removal required from the space thus varies and requires a system that can adapt. These applications require that the system maintain comfort zone conditions when the space requires conditioning to lower the temperature alone (higher SHR), lower the temperature and humidity levels (intermediate SHR), or lower the humidity level alone (lower SHR).

5. Operating Efficiency and Energy Use:

   When dehumidification alone (not cooling) in the space is required to reduce high humidity levels, occupants may attempt to lower the space thermostat set point. This action initiates the operation of the rooftop unit to cool the space. Since a rooftop without the Humidi-MiZer™ adaptive dehumidification option is not able to satisfy sole dehumidification requirements, the space is overcooled. The equipment cycles needlessly, wasting energy because the equipment without the Humidi-MiZer adaptive dehumidification option is unable to meet part load dehumidification conditions.

   The Humidi-MiZer adaptive dehumidification system employs a method for operating at part load to satisfy sole dehumidification requirements by providing neutral air to the space. Neutral air is returned to the rooftop unit (at room conditions), cooled and dehumidified (down to roughly 55 F), and reheated to near room temperature set point conditions (72 F to 75 F). Since the neutral supply air has the same temperature as the space, sensible heat from the space is not absorbed. In addition, since only the supply air was reheated, the moisture removal capability has not changed. Therefore, air is supplied to the room, absorbs moisture, and returns to the rooftop where the moisture is removed. Once the air in the rooftop is cooled and dehumidified, it is reheated again and the cycle continues until dehumidification requirements are met. This provides an energy efficient method for reheating the supply air since the energy source (hot refrigerant) is internal, not external, to the rooftop unit.

Reheating air to neutral conditions will provide the maximum amount of dehumidification. However, partial reheating of air will also be beneficial to satisfying intermediate space conditions. For example, when the space experiences higher humidity levels, and the temperature is not satisfied by the dehumidification process alone, partial reheat may be required to remove a lesser degree of sensible heat, and a higher proportion of latent heat. The rooftop would then repeat the process and the supply air would be reheated between 60 F to 65 F as opposed to the neutral conditioned air. Since the supply-air temperature is now lower than the space, sensible heat will be removed, but in a lower proportion than if the air was supplied at 55 F (which would be typical of normal rooftop operation without the Humidi-MiZer™ adaptive dehumidification system). Rooftop systems that include reheat operation, but without this intermediate step, would have to cycle between normal rooftop and reheat operation. Although this would be more effective than normal rooftop operation alone, the provision for an intermediate operation point enables the system to more closely match space part load conditions and further enhance both space comfort conditions and operational equipment efficiency.

The strategy to maintain sole humidity complies with the latest energy efficiency standards such as in ASHRAE (American Society of Heating, Refrigeration and Air Conditioning Engineers) 90.1. Typically, Standard 90.1 prevents the use of reheating by external energy sources (electric resistance) or simultaneous mixing of hot and cold airstreams (multizone units).

TYPICAL APPLICATIONS

Many applications can benefit from utilizing the Humidi-MiZer adaptive dehumidification system. The following exhibit conditions in which the Humidi-MiZer adaptive dehumidification system would be an ideal enhancement to the 48/50HJ rooftop unit. Applications that may exhibit some or all of the design challenges outlined previously include:

Schools — Due to variable student occupancy with constant changes in ventilation air change requirements in each classroom, the proportion of latent load will be high, and humidity may rise. High humidity levels can damage computer equipment or building structural materials. In addition, students entering and leaving classrooms result in a variation in latent load for each room, which requires maximum part load dehumidification control.

Restaurants and Fast Food Chains — Like schools, higher variable occupancy can result in humidity issues, along with kitchen areas of restaurants that have many humidity producing activities, such as dish washing and cooking.

Health Clubs — Shower areas and human perspiration can cause uncomfortable and higher humidity space conditions. In addition to human discomfort, these conditions can propagate the growth of mold and mildew.

Convenience Stores and Supermarkets — High humidity levels can cause inefficient operation of refrigeration and freezer systems.

Museums and Libraries — These applications require a tighter degree of tolerance to maintain part load conditions, since high humidity levels can cause substantial damage to priceless books and artifacts.

Humid Climates — In climates along the coast, when the temperature drops, the outdoor wet bulb may still remain the same or higher. This results in a need to provide more latent capacity to prevent humidity levels from increasing in the space.

NOTE: The system is designed to satisfy human comfort zone levels and is not designed for use in a space where precise humidity control is required, such as where pharmaceutical drying processes or chemical processes are conducted.

SYSTEM OVERVIEW

Modes of Operation — The design of the Humidi-MiZer adaptive dehumidification system allows for dual humidity control mode of operation of the rooftop unit, utilizing a common subcooling/reheat dehumidification coil located downstream of the standard evaporator coil. This unique and innovative design provides the capability for the rooftop unit to operate in both a subcooling mode and a hot gas reheat mode for maximum system flexibility. The dehumidification package is factory wired to operate whenever there is a dehumidification requirement. To control the normal rooftop and dehumidification modes of operation, either a Carrier Thermidistat™ device or thermostat and a wall-mounted humidity sensor may be added. The Carrier Thermidistat (see Fig. 5) or humidistat device (see Fig. 6) will only activate dehumidification operation when the occupied space humidity levels are undesirable. The Thermidistat or humidistat device humidity set point is typically set for 60% rh (relative humidity) or lower.

The unit will attempt to maintain the space humidity set point, and initiate subcooling mode when the space temperature and humidity are both above the temperature and humidity set points. The hot gas reheat mode will be initiated when just the humidity is above the humidity set point, without a demand for cooling.

Normal Design Cooling Operation — When the rooftop operates under the normal sequence of operation, the compressors will cycle to maintain indoor conditions. See Fig. 7.

The Humidi-MiZer adaptive dehumidification system includes a factory installed Motormaster® low ambient control to keep the head and suction pressure high, allowing normal design cooling mode operation down to 0° F.

Subcooling Mode — When subcooling mode is initiated, this will energize (close) the liquid line solenoid valve (LLSV) forcing the hot liquid refrigerant to enter into the subcooling/reheat dehumidification coil (see Fig. 8).

As the hot liquid refrigerant passes through the subcooling/reheat dehumidification coil, it is exposed to the cold supply airflow coming through the evaporator coil. The liquid is further subcooled to a temperature approaching the evaporator leaving-air temperature. The liquid then enters a thermostatic expansion valve (TXV) where the liquid drops to a lower pressure. The TXV does not have a pressure drop great enough to change the liquid to a 2-phase fluid, so the liquid then enters the Acutrol™ device at the evaporator coil.

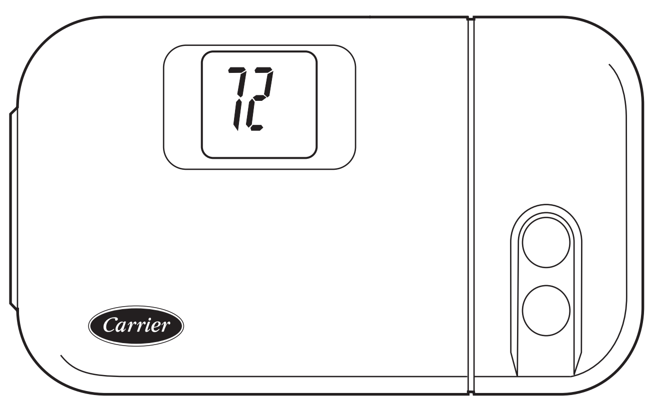


Fig. 5 — Carrier Thermidistat™ Device

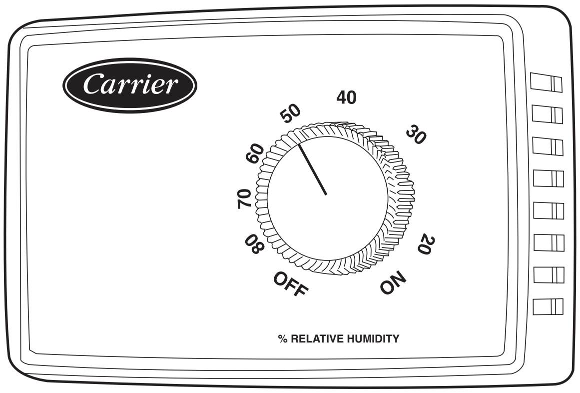


Fig. 6 — Carrier Humidistat Device

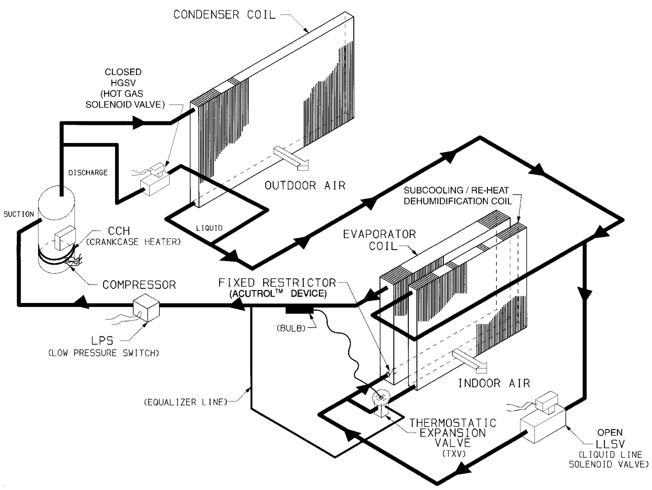


Fig. 7 — Normal Design Cooling Operation

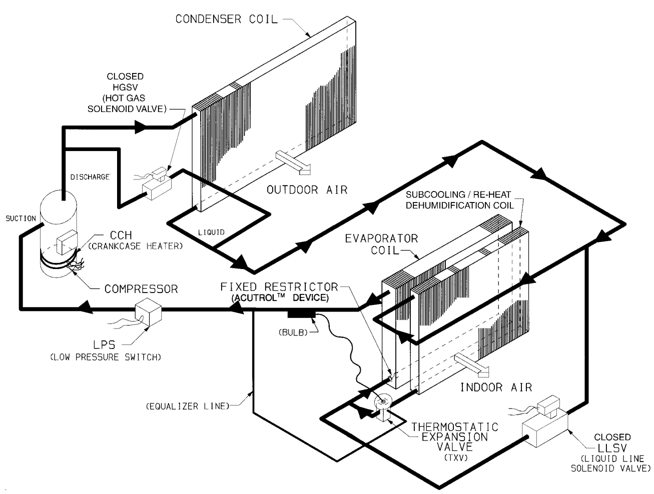


Fig. 8 — Subcooling Mode Operation

The liquid enters the evaporator coil at a temperature lower than in standard cooling operation. This lower temperature increases the latent capacity of the rooftop unit. The refrigerant passes through the evaporator and is turned into a vapor. The air passing over the evaporator coil will become colder than during normal operation. However, as this same air passes over the subcooling coil, it will be slightly warmed, partially reheating the air.

Subcooling mode operates only when the outside air temperature is warmer than 40 F. A factory-installed temperature switch located in the condenser section will lock out subcooling mode when the outside temperature is cooler than 40 F.

The scroll compressors are equipped with crankcase heaters to provide protection for the compressors due to the additional refrigerant charge required by the subcooling/reheat coil.

When in subcooling mode, there is a slight decrease in system total gross capacity (5% less), a lower gross sensible capacity (20% less), and a greatly increased latent capacity (up to 40% more).

Hot Gas Reheat Mode — When the humidity levels in the space require humidity control, a hot gas solenoid valve (specific to hot gas reheat mode only) will open to bypass a portion of hot gas refrigerant around the condenser coil (see Fig. 9).

This hot gas will mix with liquid refrigerant leaving the condenser coil and flow to the subcooling/reheat dehumidification coil. Now the conditioned air coming off the evaporator will be cooled and dehumidified, but will be warmed to neutral conditions (72 F to 75 F) by the subcooling/reheat dehumidification coil.

NOTE: The 48/50HJ008-014 rooftop units can operate one circuit in subcooling mode and one circuit in hot gas reheat mode or both circuits in hot gas reheat mode, or both in normal design cooling mode.

The net effect of the rooftop when in hot gas reheat mode is to provide nearly all latent capacity removal from the space when sensible loads diminish (when outdoor temperature conditions are moderate). When in hot gas reheat mode, the unit will operate to provide mostly latent capacity and extremely low sensible heat ratio capability.

Similar to the subcooling mode of operation, hot gas reheat mode operates only when the outside air temperature is warmer than 40 F. Below this temperature, a factory installed outside air temperature switch will lock out this mode of operation.

Rooftop System Performance — Rooftop performance for standard units, subcooling mode and hot gas reheat mode are illustrated in Tables 1-24. For hot gas reheat performance, the ambient outdoor air and return air temperature ranges are different from the ranges listed for normal design cooling rooftop operation. This is to provide appropriate performance data for those conditions when the rooftop unit would respond to provide all latent capacity removal from the space. All performance data are provided in terms of gross capacities.

Static pressure is also slightly affected by the addition of the subcooling/reheat dehumidification coil. See Fig. 10 for static pressure drop when using this option.

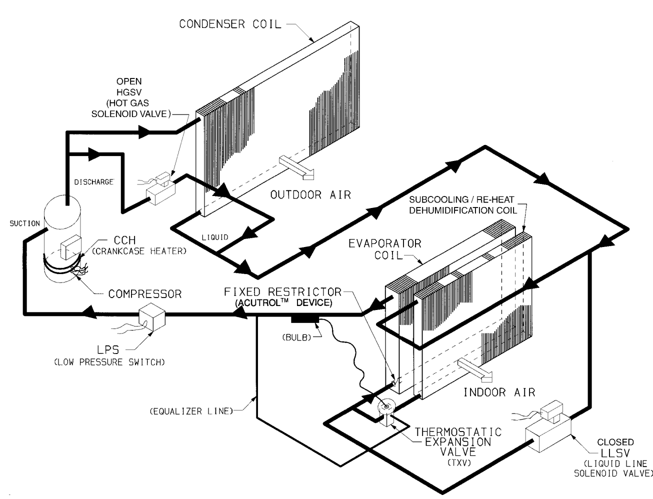


Fig. 9 — Hot Gas Reheat Mode Operation

Table 1 — 48/50HJ004 Cooling Capacities, Standard Units

TEMP (F) AIR ENT CONDENSER (Edb)		AIR ENTERING EVAPORATOR — Cfm/BF								
		900/0.14			1200/0.17			1500/0.20		
		Air Entering Evaporator — Ewb (F)								
		72	67	62	72	67	62	72	67	62
75	TC	41.9	38.7	35.7	43.5	40.8	37.7	44.8	41.8	39.0
	SHC	20.4	25.2	29.7	21.8	28.2	33.8	23.3	30.7	37.0
	kW	2.19	2.16	2.12	2.21	2.18	2.15	2.23	2.19	2.16
85	TC	40.7	37.5	34.5	42.1	39.3	36.4	43.5	40.4	37.6
	SHC	19.9	24.7	29.2	21.5	27.7	33.2	23.2	30.3	36.4
	kW	2.46	2.42	2.39	2.47	2.44	2.41	2.50	2.45	2.42
95	TC	39.3	36.1	33.1	40.8	37.8	34.9	42.0	38.9	36.1
	SHC	19.5	24.1	28.4	21.1	27.2	32.5	22.8	29.9	35.6
	kW	2.75	2.71	2.66	2.77	2.73	2.69	2.79	2.74	2.71
105	TC	37.7	34.6	31.7	39.3	36.2	33.4	40.1	37.2	34.7
	SHC	18.8	23.5	27.8	20.7	26.6	31.8	22.1	29.3	34.7
	kW	3.06	3.02	2.98	3.09	3.04	3.01	3.10	3.06	3.03
115	TC	36.0	33.0	29.7	37.4	34.5	31.5	38.1	35.5	33.2
	SHC	18.3	22.9	26.7	19.9	26.1	30.9	21.3	28.7	33.2
	kW	3.41	3.36	3.31	3.43	3.39	3.34	3.44	3.41	3.37
125	TC	34.2	31.3	27.8	35.6	32.7	29.4	36.3	33.6	31.9
	SHC	17.6	22.2	25.8	19.4	25.4	29.4	20.8	28.0	31.8
	kW	3.78	3.73	3.66	3.80	3.76	3.71	3.81	3.78	3.75

Table 2 — 48/50HJ004 Cooling Capacities, Subcooling Mode

TEMP (F) AIR ENT CONDENSER (Edb)		AIR ENTERING EVAPORATOR — Cfm/BF								
		900/0.14			1200/0.17			1500/0.20		
		Air Entering Evaporator — Ewb (F)								
		72	67	62	72	67	62	72	67	62
75	TC	41.3	37.3	34.3	43.5	39.2	35.9	45.5	41.6	38.2
	SHC	17.5	22.4	26.7	19.6	25.5	31.2	21.5	28.5	35.2
	kW	2.19	2.14	2.10	2.21	2.16	2.14	2.24	2.19	2.16
85	TC	38.6	34.4	31.6	41.3	37.5	33.3	43.5	38.6	35.5
	SHC	15.2	20.1	25.1	17.1	23.2	29.0	18.9	26.3	32.9
	kW	2.46	2.40	2.37	2.47	2.43	2.40	2.51	2.45	2.42
95	TC	35.9	31.4	28.8	39.2	35.9	30.6	41.3	35.7	32.9
	SHC	13.0	17.9	23.3	14.5	21.1	26.9	16.1	24.2	30.6
	kW	2.74	2.68	2.63	2.76	2.74	2.67	2.80	2.75	2.71
105	TC	33.8	29.7	27.4	36.3	32.2	28.7	38.1	32.8	30.4
	SHC	10.9	15.8	21.0	12.5	18.9	24.6	14.0	21.7	28.1
	kW	3.05	3.00	2.97	3.09	3.04	2.99	3.12	3.07	3.03
115	TC	31.8	28.0	25.5	33.2	28.7	26.5	34.9	30.0	27.9
	SHC	9.0	13.7	18.4	10.3	16.8	22.3	11.9	19.3	25.2
	kW	3.40	3.36	3.31	3.45	3.38	3.32	3.48	3.41	3.37
125	TC	28.7	26.3	23.4	29.7	25.5	22.9	31.3	27.1	25.5
	SHC	6.9	12.2	17.3	7.9	14.5	20.6	9.2	17.3	22.3
	kW	3.78	3.73	3.66	3.84	3.77	3.71	3.87	3.79	3.75

LEGEND AND NOTES FOR TABLES 1 AND 2.

(Shaded box) Standard Ratings — shaded values in Table 1: 95 F edb, 1200/0.17 cfm/BF, 67 F ewb (TC 37.8, SHC 27.2, kW 2.73).

LEGEND

BF — Bypass Factor
Edb — Entering Dry Bulb
Ewb — Entering Wet Bulb
kW — Compressor Motor Power Input
SHC — Sensible Heat Capacity (1000 Btuh) Gross
TC — Total Capacity (1000 Btuh) Gross

NOTES:

1. Direct interpolation is permissible. Do not extrapolate.
2. The following formulas may be used:

$$t_{ldb} = t_{edb} - \frac{\text{sensible capacity (Btuh)}}{1.10 \times \text{cfm}}$$

t_{lwb} = Wet-bulb temperature corresponding to enthalpy of air leaving evaporator coil (h_{lwb})

$$h_{lwb} = h_{ewb} - \frac{\text{total capacity (Btuh)}}{4.5 \times \text{cfm}}$$

Where: h_{ewb} = Enthalpy of air entering evaporator coil.

3. The SHC is based on 80 F edb temperature of air entering evaporator coil.
Below 80 F edb, subtract (corr factor x cfm) from SHC.
Above 80 F edb, add (corr factor x cfm) to SHC.
Correction Factor = 1.10 x (1 – BF) x (edb – 80).

Table 3 — 48/50HJ004 Cooling Capacities, Hot Gas Reheat Mode

TEMP (F) AIR ENT CONDENSER (Edb)		AIR ENTERING EVAPORATOR — Ewb (F)								
		75 Dry Bulb 62.5 Wet Bulb (50% Relative)			75 Dry Bulb 64 Wet Bulb (55% Relative)			75 Dry Bulb 65.3 Wet Bulb (60% Relative)		
		Air Entering Evaporator — Cfm								
		900	1200	1500	900	1200	1500	900	1200	1500
80	TC	12.83	15.84	18.20	13.24	16.31	18.73	13.58	16.72	19.18
	SHC	4.06	5.69	6.98	2.21	3.83	5.12	.59	2.20	3.50
	kW	2.12	2.12	2.12	2.13	2.13	2.13	2.14	2.14	2.14
75	**TC**	**13.61**	**16.44**	**18.67**	**14.03**	**16.93**	**19.20**	**14.39**	**17.34**	**19.67**
	SHC	**4.62**	**6.16**	**7.37**	**2.89**	**4.43**	**5.65**	**1.40**	**2.93**	**4.15**
	kW	**2.11**	**2.11**	**2.11**	**2.12**	**2.12**	**2.12**	**2.14**	**2.14**	**2.14**
70	TC	14.39	17.05	19.14	14.82	17.54	19.68	15.19	17.96	20.15
	SHC	5.17	6.62	7.77	3.58	5.03	6.18	2.20	3.65	4.80
	kW	2.10	2.10	2.10	2.12	2.12	2.12	2.13	2.13	2.13
60	TC	15.95	18.26	20.08	16.40	18.77	20.63	16.79	19.21	21.11
	SHC	6.27	7.55	8.56	4.95	6.23	7.24	3.81	5.09	6.10
	kW	2.09	2.09	2.09	2.11	2.11	2.11	2.12	2.12	2.12
50	TC	17.50	19.48	21.02	17.98	20.00	21.58	18.40	20.45	22.07
	SHC	7.37	8.47	9.35	6.32	7.43	8.30	5.42	6.52	7.39
	kW	2.07	2.07	2.07	2.10	2.10	2.10	2.12	2.12	2.12
40	TC	19.06	20.69	21.07	19.56	21.23	22.54	20.00	21.70	23.03
	SHC	8.47	9.40	10.13	7.71	8.63	9.36	7.02	7.95	8.69
	kW	2.06	2.06	2.06	2.08	2.08	2.08	2.11	2.11	2.11

Table 4 — 48/50HJ005 Cooling Capacities, Standard Units

TEMP (F) AIR ENT CONDENSER (Edb)		AIR ENTERING EVAPORATOR — Cfm/BF											
		1200/0.17			1450/0.19			1600/0.21			2000/0.24		
		Air Entering Evaporator — Ewb (F)											
		72	67	62	72	67	62	72	67	62	72	67	62
75	TC	54.0	50.7	44.2	55.9	52.2	47.7	56.4	52.8	49.1	58.1	54.5	50.6
	SHC	26.1	32.7	37.5	27.6	35.1	41.8	28.2	36.2	43.8	30.2	39.5	47.5
	kW	2.81	2.80	2.76	2.83	2.81	2.78	2.83	2.80	2.79	2.84	2.82	2.79
85	TC	52.2	48.9	41.9	54.1	50.4	45.9	54.5	51.0	47.2	55.3	52.3	48.7
	SHC	25.4	32.0	36.4	26.9	34.5	40.8	27.5	35.7	42.8	28.6	38.5	46.6
	kW	3.20	3.19	3.15	3.22	3.20	3.17	3.22	3.20	3.18	3.22	3.20	3.18
95	TC	50.7	46.9	39.5	51.9	48.4	43.5	52.5	48.9	45.2	53.9	50.1	46.7
	SHC	24.9	31.1	35.0	26.1	33.6	39.6	26.8	34.7	41.8	28.8	37.5	45.6
	kW	3.64	3.61	3.57	3.65	3.62	3.60	3.65	3.62	3.60	3.67	3.63	3.61
105	TC	48.8	44.5	36.7	49.8	46.2	40.7	50.2	46.7	42.1	51.5	48.2	44.7
	SHC	24.3	30.2	33.6	25.3	32.8	38.2	26.0	33.9	40.3	27.9	37.4	44.4
	kW	4.12	4.09	4.03	4.12	4.09	4.06	4.12	4.09	4.07	4.14	4.11	4.08
115	TC	46.5	41.1	34.3	47.7	43.3	37.0	48.0	44.4	38.5	48.9	45.7	42.0
	SHC	23.4	28.9	32.4	24.9	31.8	36.3	25.4	33.4	38.3	27.1	36.9	42.0
	kW	4.64	4.59	4.53	4.65	4.62	4.55	4.64	4.63	4.56	4.65	4.63	4.60
125	TC	43.8	37.5	32.4	45.1	39.0	33.8	45.3	40.1	35.4	46.3	42.6	38.8
	SHC	22.5	27.4	31.5	24.1	30.2	33.7	24.7	31.9	35.4	26.5	35.9	38.8
	kW	5.19	5.13	5.05	5.20	5.15	5.09	5.19	5.17	5.11	5.20	5.19	5.15

LEGEND AND NOTES FOR TABLES 3 AND 4.

[shaded box] Standard Ratings

LEGEND

BF — Bypass Factor
Edb — Entering Dry Bulb
Ewb — Entering Wet Bulb
kW — Compressor Motor Power Input
SHC — Sensible Heat Capacity (1000 Btuh) Gross
TC — Total Capacity (1000 Btuh) Gross

NOTES:

1. Direct interpolation is permissible. Do not extrapolate.
2. The following formulas may be used:

$$t_{ldb} = t_{edb} - \frac{\text{sensible capacity (Btuh)}}{1.10 \times \text{cfm}}$$

t_{lwb} = Wet-bulb temperature corresponding to enthalpy of air leaving evaporator coil (h_{lwb})

$$h_{lwb} = h_{ewb} - \frac{\text{total capacity (Btuh)}}{4.5 \times \text{cfm}}$$

Where: h_{ewb} = Enthalpy of air entering evaporator coil.

3. The SHC is based on 80 F edb temperature of air entering evaporator coil.
Below 80 F edb, subtract (corr factor x cfm) from SHC.
Above 80 F edb, add (corr factor x cfm) to SHC.
Correction Factor = 1.10 x (1 – BF) x (edb – 80).

Table 5 — 48/50HJ005 Cooling Capacities, Subcooling Mode

TEMP (F) AIR ENT CONDENSER (Edb)		AIR ENTERING EVAPORATOR — Cfm/BF											
		1200/0.17			1450/0.19			1600/0.21			2000/0.24		
		Air Entering Evaporator — Ewb (F)											
		72	67	62	72	67	62	72	67	62	72	67	62
75	TC	52.9	47.5	41.5	55.7	50.9	47.5	57.0	51.7	48.1	60.5	55.6	52.1
	SHC	22.7	28.4	33.4	26.1	34.1	38.9	25.9	33.7	41.6	29.4	39.1	47.5
	kW	2.87	2.86	2.82	2.89	2.87	2.84	2.89	2.86	2.85	2.90	2.88	2.85
85	TC	49.2	43.8	37.1	52.1	47.2	43.6	52.9	47.9	43.7	55.4	51.4	47.0
	SHC	19.8	25.5	30.4	22.2	29.5	35.8	22.4	31.1	38.7	24.2	36.0	44.3
	kW	3.26	3.25	3.21	3.28	3.26	3.23	3.28	3.26	3.24	3.28	3.26	3.24
95	TC	45.8	40.1	32.8	48.2	43.6	39.4	48.8	44.0	39.3	51.7	47.4	43.0
	SHC	17.2	22.5	27.3	18.4	24.8	32.6	19.0	28.1	35.9	20.7	33.0	41.0
	kW	3.71	3.68	3.64	3.72	3.69	3.67	3.72	3.69	3.67	3.74	3.70	3.68
105	TC	41.6	37.0	29.7	43.2	38.9	35.4	43.9	39.7	34.7	46.5	41.4	37.5
	SHC	13.5	19.5	23.9	14.7	21.7	29.2	15.0	23.7	30.6	16.4	27.8	35.1
	kW	4.20	4.17	4.11	4.20	4.17	4.14	4.20	4.17	4.15	4.22	4.19	4.16
115	TC	37.2	33.2	27.1	38.4	34.0	30.8	39.4	35.5	30.0	41.3	35.2	31.9
	SHC	9.9	16.4	20.7	11.3	18.5	25.6	11.2	19.7	25.4	12.4	22.4	28.6
	kW	4.73	4.68	4.62	4.74	4.71	4.64	4.73	4.72	4.65	4.74	4.72	4.69
125	TC	32.4	28.1	24.9	33.8	28.1	27.4	35.3	30.5	26.6	36.1	32.0	28.7
	SHC	7.2	12.9	18.3	8.4	14.5	21.9	16.8	21.1	21.2	9.5	18.3	24.1
	kW	5.29	5.23	5.15	5.30	5.25	5.19	5.29	5.27	5.21	5.30	5.29	5.25

Table 6 — 48/50HJ005 Cooling Capacities, Hot Gas Reheat Mode*

TEMP (F) AIR ENT CONDENSER (Edb)		AIR ENTERING EVAPORATOR — Ewb (F)								
		75 Dry Bulb 62.5 Wet Bulb (50% Relative)			75 Dry Bulb 64 Wet Bulb (55% Relative)			75 Dry Bulb 65.3 Wet Bulb (60% Relative)		
		Air Entering Evaporator — Cfm								
		1200	1450	1600	1200	1450	1600	1200	1450	1600
80	TC	12.13	14.30	15.43	14.98	17.20	18.36	17.44	19.71	20.90
	SHC	1.01	1.60	1.90	-0.18	0.41	0.72	-1.20	-0.61	-0.30
	kW	2.76	2.76	2.76	2.75	2.75	2.75	2.74	2.74	2.74
75	TC	**13.25**	**15.28**	**16.34**	**15.96**	**18.05**	**19.14**	**18.31**	**20.44**	**21.56**
	SHC	**1.60**	**2.14**	**2.43**	**0.50**	**1.05**	**1.34**	**-0.45**	**0.11**	**0.40**
	kW	**7.54**	**7.54**	**7.57**	**7.61**	**7.64**	**7.66**	**7.66**	**7.70**	**7.71**
70	TC	14.37	16.27	17.26	16.94	18.90	19.92	19.17	21.17	22.22
	SHC	2.18	2.69	2.96	1.17	1.69	1.96	0.30	0.82	1.10
	kW	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70
60	TC	16.60	18.24	19.10	18.91	20.60	21.48	20.91	22.64	23.54
	SHC	3.35	3.79	4.03	2.52	2.97	3.21	1.80	2.25	2.50
	kW	2.64	2.64	2.64	2.65	2.65	2.65	2.65	2.65	2.65
50	TC	18.83	20.22	20.94	20.87	22.30	23.04	22.65	24.10	24.86
	SHC	4.51	4.89	5.09	3.86	4.25	4.45	3.30	3.69	3.89
	kW	2.59	2.59	2.59	2.60	2.60	2.60	2.61	2.61	2.61
40	TC	21.06	22.19	22.78	22.84	24.00	24.61	24.38	25.57	26.19
	SHC	5.68	5.99	6.16	5.21	5.53	5.69	4.80	5.12	5.29
	kW	2.53	2.53	2.53	2.55	2.55	2.55	2.57	2.57	2.57

LEGEND AND NOTES FOR TABLES 5 AND 6.

LEGEND

BF — Bypass Factor
Edb — Entering Dry Bulb
Ewb — Entering Wet Bulb
kW — Compressor Motor Power Input
SHC — Sensible Heat Capacity (1000 Btuh) Gross
TC — Total Capacity (1000 Btuh) Gross

*Negative SHC value indicates that the air entering the coil is being heated.

NOTES:

1. Direct interpolation is permissible. Do not extrapolate.
2. The following formulas may be used:

$$t_{ldb} = t_{edb} - \frac{\text{sensible capacity (Btuh)}}{1.10 \times \text{cfm}}$$

t_{lwb} = Wet-bulb temperature corresponding to enthalpy of air leaving evaporator coil (h_{lwb})

$$h_{lwb} = h_{ewb} - \frac{\text{total capacity (Btuh)}}{4.5 \times \text{cfm}}$$

Where: h_{ewb} = Enthalpy of air entering evaporator coil.

3. The SHC is based on 80 F edb temperature of air entering evaporator coil.
Below 80 F edb, subtract (corr factor x cfm) from SHC.
Above 80 F edb, add (corr factor x cfm) to SHC.
Correction Factor = 1.10 x (1 – BF) x (edb – 80).

Table 7 — 48/50HJ006 Cooling Capacities, Standard Units

TEMP (F) AIR ENT CONDENSER (Edb)		AIR ENTERING EVAPORATOR — Cfm/BF											
		1500/0.08			1750/0.09			2000/0.11			2500/0.13		
		Air Entering Evaporator — Ewb (F)											
		72	67	62	72	67	62	72	67	62	72	67	62
75	TC	70.8	65.4	58.5	72.5	67.3	61.1	73.0	68.4	62.8	74.8	70.3	64.8
	SHC	34.1	42.7	49.9	35.7	45.5	54.2	36.8	48.0	57.8	39.6	53.0	63.4
	kW	3.53	3.49	3.44	3.55	3.50	3.46	3.55	3.51	3.47	3.57	3.54	3.48
85	TC	68.9	63.2	55.3	70.5	65.1	57.9	72.2	66.4	60.2	73.2	68.1	62.9
	SHC	33.5	41.8	48.4	35.0	44.8	52.8	37.0	47.6	56.8	39.3	52.5	62.4
	kW	3.98	3.94	3.87	4.00	3.96	3.90	4.03	3.97	3.92	4.04	3.99	3.94
95	TC	66.8	60.6	52.4	68.3	62.5	54.3	69.3	63.8	56.6	71.2	65.6	60.6
	SHC	32.8	40.7	47.0	34.5	43.8	51.1	36.0	46.7	55.0	39.1	51.8	60.5
	kW	4.48	4.43	4.35	4.50	4.45	4.37	4.51	4.46	4.40	4.55	4.48	4.44
105	TC	64.3	57.7	49.9	65.9	59.8	51.7	66.9	61.1	54.1	68.4	62.8	58.4
	SHC	32.0	39.6	45.8	33.7	42.8	49.7	35.3	45.7	53.5	38.4	51.0	58.4
	kW	5.03	4.96	4.87	5.05	4.99	4.90	5.06	5.00	4.93	5.08	5.02	4.98
115	TC	61.5	54.8	47.3	62.8	56.7	49.1	64.0	58.2	51.6	65.4	59.9	56.1
	SHC	31.0	38.4	44.5	32.5	41.6	48.2	34.4	44.6	51.6	37.4	50.0	56.1
	kW	5.61	5.55	5.46	5.62	5.58	5.49	5.65	5.60	5.52	5.67	5.61	5.57
125	TC	58.7	51.6	44.5	59.9	53.4	46.2	60.8	54.9	49.0	62.2	56.8	53.5
	SHC	30.0	37.2	43.1	31.7	40.4	46.2	33.3	43.4	48.9	36.4	48.9	53.4
	kW	6.27	6.19	6.09	6.28	6.21	6.13	6.29	6.24	6.17	6.31	6.27	6.22

Table 8 — 48/50HJ006 Cooling Capacities, Subcooling Mode

TEMP (F) AIR ENT CONDENSER (Edb)		AIR ENTERING EVAPORATOR — Cfm/BF											
		1500/0.08			1750/0.09			2000/0.11			2500/0.13		
		Air Entering Evaporator — Ewb (F)											
		72	67	62	72	67	62	72	67	62	72	67	62
75	TC	69.9	62.7	56.2	74.7	67.3	61.0	78.5	71.2	64.8	81.7	75.5	69.3
	SHC	29.0	36.9	43.9	31.7	40.5	51.2	34.5	44.2	55.4	37.8	52.0	62.8
	kW	3.61	3.55	3.51	3.64	3.58	3.49	3.65	3.60	3.51	3.62	3.58	3.51
85	TC	65.9	59.1	51.7	70.6	63.2	56.3	75.5	66.8	60.7	78.1	70.8	65.1
	SHC	25.3	34.0	41.9	27.5	37.6	48.0	30.7	41.6	52.0	33.8	47.4	58.0
	kW	4.05	3.97	3.91	4.07	4.01	3.92	4.11	4.00	3.95	4.08	4.02	3.96
95	TC	61.9	55.2	47.7	66.5	58.8	51.3	70.4	61.9	55.7	74.2	65.9	60.6
	SHC	21.6	31.1	40.0	23.5	34.5	44.6	26.0	38.6	47.9	30.0	42.8	52.6
	kW	4.53	4.43	4.35	4.55	4.47	4.37	4.56	4.42	4.41	4.58	4.49	4.44
105	TC	57.7	51.1	44.9	61.8	54.5	47.7	65.1	57.2	50.8	68.4	60.3	56.1
	SHC	18.1	27.8	35.7	20.0	31.2	40.1	22.1	34.3	43.5	26.1	38.9	48.5
	kW	5.05	4.93	4.84	5.09	4.97	4.88	5.11	4.96	4.92	5.11	5.03	4.98
115	TC	53.4	47.2	42.0	56.6	50.0	44.2	59.6	52.5	46.2	62.6	54.9	51.6
	SHC	14.7	24.6	31.5	16.5	27.8	35.7	18.2	30.0	39.0	22.1	34.9	44.3
	kW	5.60	5.49	5.40	5.64	5.52	5.45	5.69	5.55	5.48	5.69	5.61	5.57
125	TC	48.7	42.0	36.9	51.3	45.0	39.0	54.1	46.8	40.9	56.9	49.2	45.9
	SHC	10.9	19.6	28.0	12.5	22.2	31.5	13.5	24.0	34.0	16.5	28.0	38.8
	kW	6.26	6.12	6.02	6.28	6.18	6.09	6.33	6.18	6.13	6.33	6.27	6.22

LEGEND AND NOTES FOR TABLES 7 AND 8.

(Shaded box) Standard Ratings

LEGEND

BF — Bypass Factor
Edb — Entering Dry Bulb
Ewb — Entering Wet Bulb
kW — Compressor Motor Power Input
SHC — Sensible Heat Capacity (1000 Btuh) Gross
TC — Total Capacity (1000 Btuh) Gross

NOTES:

1. Direct interpolation is permissible. Do not extrapolate.
2. The following formulas may be used:

$$t_{ldb} = t_{edb} - \frac{\text{sensible capacity (Btuh)}}{1.10 \times \text{cfm}}$$

t_{lwb} = Wet-bulb temperature corresponding to enthalpy of air leaving evaporator coil (h_{lwb})

$$h_{lwb} = h_{ewb} - \frac{\text{total capacity (Btuh)}}{4.5 \times \text{cfm}}$$

Where: h_{ewb} = Enthalpy of air entering evaporator coil.

3. The SHC is based on 80 F edb temperature of air entering evaporator coil.
Below 80 F edb, subtract (corr factor x cfm) from SHC.
Above 80 F edb, add (corr factor x cfm) to SHC.
Correction Factor = 1.10 x (1 – BF) x (edb – 80).

Table 9 — 48/50HJ006 Cooling Capacities, Hot Gas Reheat Mode*

TEMP (F) AIR ENT CONDENSER (Edb)		AIR ENTERING EVAPORATOR — Ewb (F)								
		75 Dry Bulb 62.5 Wet Bulb (50% Relative)			75 Dry Bulb 64 Wet Bulb (55% Relative)			75 Dry Bulb 65.3 Wet Bulb (60% Relative)		
		Air Entering Evaporator — Cfm								
		1500	1750	2000	1500	1750	2000	1500	1750	2000
80	TC	17.67	19.23	20.59	17.51	19.09	20.48	17.37	18.98	20.39
	SHC	-0.39	0.07	0.46	-1.61	-1.15	-0.75	-2.67	-2.21	-1.80
	kW	3.45	3.45	3.45	3.48	3.48	3.48	3.50	3.50	3.50
75	**TC**	**18.55**	**20.03**	**21.32**	**18.45**	**19.95**	**21.27**	**18.36**	**19.89**	**21.23**
	SHC	**0.28**	**0.71**	**1.09**	**-0.85**	**-0.42**	**-0.04**	**-1.83**	**-1.39**	**-1.01**
	kW	**3.43**	**3.43**	**3.43**	**3.46**	**3.46**	**3.46**	**3.49**	**3.49**	**3.49**
70	TC	19.44	20.83	22.06	19.39	20.81	22.06	19.35	20.80	22.07
	SHC	0.95	1.36	1.71	-0.09	0.32	0.68	-0.99	-0.58	-0.22
	kW	3.42	3.42	3.42	3.45	3.45	3.45	3.48	3.48	3.48
60	TC	21.20	22.44	23.53	21.27	22.54	23.65	21.33	22.62	23.75
	SHC	2.30	2.65	2.95	1.44	1.80	2.11	0.70	1.06	1.37
	kW	3.38	3.38	3.38	3.42	3.42	3.42	3.46	3.46	3.46
50	TC	22.96	24.05	25.00	23.15	24.26	25.23	23.31	24.43	25.42
	SHC	3.64	3.94	4.20	2.97	3.27	3.53	2.39	2.69	2.96
	kW	3.35	3.35	3.35	3.40	3.40	3.40	3.43	3.43	3.43
40	TC	24.73	25.66	26.48	25.03	25.98	26.81	25.28	26.25	27.10
	SHC	4.99	5.23	5.45	4.50	4.75	4.96	4.07	4.32	4.54
	kW	3.32	3.32	3.32	3.37	3.37	3.37	3.41	3.41	3.41

Table 10 — 48/50HJ007 Cooling Capacities, Standard Units

TEMP (F) AIR ENT CONDENSER (Edb)		AIR ENTERING EVAPORATOR — Cfm/BF											
		1800/0.05			2100/0.06			2400/0.06			3000/0.08		
		Air Entering Evaporator — Ewb (F)											
		72	67	62	72	67	62	72	67	62	72	67	62
75	TC	86.7	80.7	74.4	88.8	82.7	76.6	90.5	84.4	78.2	92.6	86.3	81.0
	SHC	43.0	53.7	63.8	45.0	57.4	68.9	47.2	61.2	73.6	51.2	67.4	80.7
	kW	4.58	4.46	4.33	4.63	4.50	4.38	4.67	4.55	4.41	4.72	4.58	4.47
85	TC	84.1	78.2	72.0	86.4	80.3	74.1	88.2	81.7	75.7	90.2	84.0	78.8
	SHC	42.0	52.6	62.7	44.5	56.6	68.0	46.8	60.2	72.5	50.6	67.4	78.7
	kW	5.10	4.97	4.85	5.16	5.03	4.90	5.21	5.06	4.93	5.26	5.12	4.99
95	TC	81.3	75.3	69.2	83.4	77.3	71.3	85.1	78.9	72.9	87.2	80.6	76.2
	SHC	41.0	51.4	61.4	43.4	55.3	66.6	45.8	59.2	71.2	50.2	65.8	76.2
	kW	5.65	5.52	5.39	5.71	5.57	5.44	5.77	5.62	5.48	5.83	5.66	5.55
105	TC	77.9	72.0	66.1	80.0	73.8	68.0	81.6	75.3	69.6	83.4	77.1	73.2
	SHC	39.7	50.2	60.0	42.2	54.0	65.2	44.6	57.8	69.3	49.0	64.5	73.2
	kW	6.22	6.08	5.94	6.29	6.13	6.00	6.34	6.17	6.04	6.40	6.22	6.12
115	TC	74.7	68.4	61.8	75.9	70.0	64.1	77.6	71.3	66.5	78.7	73.0	70.1
	SHC	38.7	48.8	58.1	40.8	52.6	63.2	43.3	56.4	66.4	46.9	63.2	70.0
	kW	6.84	6.68	6.49	6.87	6.71	6.56	6.93	6.75	6.63	6.96	6.80	6.72
125	TC	70.3	63.6	57.2	71.8	65.5	59.1	72.9	66.8	61.9	74.0	68.6	66.4
	SHC	37.2	47.0	55.8	39.5	51.0	59.1	41.7	55.0	61.9	45.4	61.8	66.3
	kW	7.43	7.25	7.03	7.48	7.30	7.13	7.51	7.35	7.22	7.54	7.41	7.33

LEGEND AND NOTES FOR TABLES 9 AND 10.

[shaded box] Standard Ratings

LEGEND

BF — Bypass Factor
Edb — Entering Dry Bulb
Ewb — Entering Wet Bulb
kW — Compressor Motor Power Input
SHC — Sensible Heat Capacity (1000 Btuh) Gross
TC — Total Capacity (1000 Btuh) Gross

*Negative SHC value indicates that the air entering the coil is being heated.

NOTES:

1. Direct interpolation is permissible. Do not extrapolate.
2. The following formulas may be used:

$$t_{ldb} = t_{edb} - \frac{\text{sensible capacity (Btuh)}}{1.10 \times \text{cfm}}$$

t_{lwb} = Wet-bulb temperature corresponding to enthalpy of air leaving evaporator coil (h_{lwb})

$$h_{lwb} = h_{ewb} - \frac{\text{total capacity (Btuh)}}{4.5 \times \text{cfm}}$$

Where: h_{ewb} = Enthalpy of air entering evaporator coil.

3. The SHC is based on 80 F edb temperature of air entering evaporator coil.
Below 80 F edb, subtract (corr factor x cfm) from SHC.
Above 80 F edb, add (corr factor x cfm) to SHC.
Correction Factor = 1.10 x (1 – BF) x (edb – 80).

Table 11 — 48/50HJ007 Cooling Capacities, Subcooling Mode

TEMP (F) AIR ENT CONDENSER (Edb)		AIR ENTERING EVAPORATOR — Cfm/BF											
		1800/0.05			2100/0.06			2400/0.06			3000/0.08		
		Air Entering Evaporator — Ewb (F)											
		72	67	62	72	67	62	72	67	62	72	67	62
75	TC	82.6	75.6	68.5	84.9	78.0	70.9	85.9	79.5	73.5	89.1	82.7	77.0
	SHC	36.0	44.8	55.4	37.5	49.1	59.7	38.8	51.1	64.0	41.8	58.1	70.2
	kW	4.60	4.52	4.36	4.67	4.57	4.46	4.70	4.57	4.45	4.77	4.61	4.51
85	TC	78.2	71.6	64.5	80.9	73.4	65.8	82.0	74.4	67.9	85.8	78.2	72.3
	SHC	31.4	41.2	51.7	33.0	44.7	55.8	34.7	47.4	60.1	37.6	54.3	66.7
	kW	5.16	5.03	4.89	5.22	5.11	4.96	5.26	5.09	4.97	5.32	5.17	5.04
95	TC	73.8	67.4	60.2	76.3	68.3	60.5	77.5	69.3	62.3	82.0	72.8	67.5
	SHC	27.0	37.6	47.9	28.2	40.0	51.6	30.2	43.7	56.2	33.6	49.2	62.9
	kW	5.75	5.60	5.44	5.80	5.66	5.48	5.84	5.68	5.53	5.90	5.73	5.60
105	TC	68.4	62.6	55.9	71.4	64.3	56.2	72.1	64.6	58.3	75.7	67.0	62.4
	SHC	22.3	33.5	43.5	23.4	36.5	48.0	25.4	38.4	50.2	29.1	45.2	56.2
	kW	6.37	6.22	6.06	6.45	6.27	6.10	6.46	6.29	6.16	6.53	6.36	6.24
115	TC	63.4	57.8	50.7	66.0	60.1	51.5	66.4	59.6	54.5	68.8	60.8	57.5
	SHC	18.1	29.5	38.9	18.8	32.9	44.1	20.7	33.3	43.8	24.3	41.4	49.7
	kW	7.04	6.89	6.68	7.10	6.91	6.74	7.12	6.95	6.83	7.16	7.01	6.92
125	TC	55.5	49.6	45.8	58.4	52.4	46.1	57.6	52.1	49.5	59.2	52.8	53.1
	SHC	15.3	24.0	35.2	15.7	27.5	39.0	17.5	27.5	38.4	20.9	34.6	44.4
	kW	7.80	7.61	7.38	7.83	7.67	7.49	7.89	7.72	7.58	7.92	7.78	7.70

Table 12 — 48/50HJ007 Cooling Capacities, Hot Gas Reheat Mode*

TEMP (F) AIR ENT CONDENSER (Edb)		AIR ENTERING EVAPORATOR — Ewb (F)								
		75 Dry Bulb 62.5 Wet Bulb (50% Relative)			75 Dry Bulb 64 Wet Bulb (55% Relative)			75 Dry Bulb 65.3 Wet Bulb (60% Relative)		
		Air Entering Evaporator — Cfm								
		1800	2100	2400	1800	2100	2400	1800	2100	2400
80	TC	27.41	28.12	28.75	27.25	27.98	28.62	27.12	27.86	28.51
	SHC	5.74	7.61	9.25	1.68	3.52	5.14	-1.85	-0.03	1.58
	kW	4.40	4.39	4.39	4.44	4.44	4.44	4.49	4.49	4.49
75	TC	**27.98**	**28.66**	**29.24**	**27.89**	**28.58**	**29.18**	**27.81**	**28.52**	**29.13**
	SHC	**5.73**	**7.48**	**9.02**	**1.92**	**3.65**	**5.18**	**-1.38**	**0.34**	**1.85**
	kW	**4.45**	**4.45**	**4.45**	**4.50**	**4.50**	**4.50**	**4.55**	**4.55**	**4.55**
70	TC	28.55	29.19	29.74	28.53	29.18	29.74	28.51	29.17	29.74
	SHC	5.71	7.35	8.79	2.17	3.79	5.22	-0.91	0.70	2.12
	kW	4.51	4.51	4.51	4.57	4.57	4.57	4.62	4.62	4.62
60	TC	29.70	30.25	30.74	29.80	30.37	30.86	29.89	30.47	30.97
	SHC	5.67	7.09	8.34	2.65	4.06	5.29	0.04	1.43	2.65
	kW	4.62	4.62	4.62	4.69	4.69	4.69	4.75	4.75	4.75
50	TC	30.84	31.32	31.73	31.07	31.56	31.98	31.27	31.77	32.20
	SHC	5.63	6.83	7.89	3.14	4.33	5.37	0.98	2.15	3.19
	kW	4.74	4.74	4.74	4.82	4.82	4.82	4.89	4.89	4.89
40	TC	31.99	32.38	32.73	32.35	32.75	33.12	32.66	33.07	33.43
	SHC	5.60	6.57	7.43	3.63	4.59	5.44	1.92	2.88	3.72
	kW	4.86	4.86	4.86	4.95	4.95	4.95	5.02	5.02	5.02

LEGEND AND NOTES FOR TABLES 11 AND 12.

LEGEND

BF — Bypass Factor
Edb — Entering Dry Bulb
Ewb — Entering Wet Bulb
kW — Compressor Motor Power Input
SHC — Sensible Heat Capacity (1000 Btuh) Gross
TC — Total Capacity (1000 Btuh) Gross

*Negative SHC value indicates that the air entering the coil is being heated.

NOTES:
1. Direct interpolation is permissible. Do not extrapolate.
2. The following formulas may be used:

$$t_{ldb} = t_{edb} - \frac{\text{sensible capacity (Btuh)}}{1.10 \times \text{cfm}}$$

t_{lwb} = Wet-bulb temperature corresponding to enthalpy of air leaving evaporator coil (h_{lwb})

$$h_{lwb} = h_{ewb} - \frac{\text{total capacity (Btuh)}}{4.5 \times \text{cfm}}$$

Where: h_{ewb} = Enthalpy of air entering evaporator coil.
3. The SHC is based on 80 F edb temperature of air entering evaporator coil.
Below 80 F edb, subtract (corr factor x cfm) from SHC.
Above 80 F edb, add (corr factor x cfm) to SHC.
Correction Factor = 1.10 x (1 – BF) x (edb – 80).

Table 13 — 48/50HJ008 Cooling Capacities, Standard Units

TEMP (F) AIR ENT CONDENSER (Edb)		AIR ENTERING EVAPORATOR — Cfm/BF								
		2250/0.10			3000/0.11			3750/0.14		
		Air Entering Evaporator — Ewb (F)								
		72	67	62	72	67	62	72	67	62
75	TC	105.5	96.9	87.6	107.3	99.6	90.7	110.3	101.9	93.8
	SHC	50.6	63.6	75.7	53.3	69.2	83.7	58.0	76.6	92.2
	kW	5.15	5.07	5.04	5.16	5.11	5.06	5.20	5.13	5.07
85	TC	102.5	93.6	83.6	105.1	96.5	87.5	107.7	99.0	90.6
	SHC	49.7	62.4	73.9	52.8	68.4	82.2	57.3	75.9	90.0
	kW	5.86	5.79	5.73	5.89	5.82	5.77	5.93	5.86	5.78
95	TC	98.9	90.1	79.3	101.6	92.9	83.5	103.8	95.3	87.4
	SHC	48.5	61.2	71.9	51.9	67.2	80.2	56.2	74.9	87.3
	kW	6.65	6.58	6.49	6.69	6.61	6.53	6.72	6.64	6.57
105	TC	95.3	86.2	75.7	97.6	88.8	79.6	100.0	91.0	84.1
	SHC	47.3	59.6	70.2	50.7	65.9	78.0	55.3	73.6	84.1
	kW	7.51	7.44	7.31	7.55	7.48	7.36	7.59	7.50	7.41
115	TC	91.0	82.0	71.6	93.2	84.5	75.4	95.6	86.6	80.7
	SHC	45.9	58.0	68.1	49.3	64.2	75.3	54.2	72.1	80.7
	kW	8.43	8.33	8.20	8.46	8.37	8.27	8.52	8.42	8.34
125	TC	86.2	77.8	68.1	88.3	80.0	71.9	90.0	81.9	77.2
	SHC	44.1	56.4	66.3	47.5	62.6	71.8	52.1	70.1	77.2
	kW	9.38	9.29	9.14	9.43	9.34	9.24	9.47	9.38	9.32

→ Table 14 — 48/50HJ008 Cooling Capacities, Subcooling Mode

TEMP (F) AIR ENT CONDENSER (Edb)		AIR ENTERING EVAPORATOR — Cfm/BF								
		2250/0.10			3000/0.11			3750/0.14		
		Air Entering Evaporator — Ewb (F)								
		72	67	62	72	67	62	72	67	62
75	TC	98.4	91.1	81.1	103.7	97.9	91.8	105.8	101.3	94.1
	SHC	44.5	55.4	67.0	50.4	65.4	80.5	54.5	72.4	89.5
	kW	5.05	4.96	4.87	5.09	5.04	4.97	5.16	5.04	4.99
85	TC	94.2	85.8	76.9	100.3	92.4	85.2	103.5	96.8	89.0
	SHC	39.7	51.3	62.7	46.2	58.3	75.7	50.6	68.2	84.3
	kW	5.74	5.65	5.55	5.81	5.75	5.64	5.89	5.74	5.70
95	TC	89.9	80.5	72.6	96.9	86.8	78.6	101.1	92.2	83.8
	SHC	34.8	47.2	58.3	41.9	51.2	71.0	46.6	63.9	79.1
	kW	6.42	6.33	6.22	6.52	6.45	6.31	6.62	6.43	6.40
105	TC	84.6	75.3	68.0	91.6	81.3	73.4	94.5	86.3	78.4
	SHC	30.0	42.5	53.9	36.9	49.3	66.4	41.4	59.2	73.8
	kW	7.26	7.16	7.05	7.36	7.25	7.15	7.46	7.29	7.23
115	TC	79.2	70.1	63.3	86.2	75.8	68.1	87.9	80.3	72.9
	SHC	25.2	37.8	49.4	31.9	47.4	61.9	36.1	54.4	68.5
	kW	8.10	7.99	7.87	8.20	8.05	7.98	8.30	8.14	8.05
125	TC	72.8	64.5	57.2	78.0	69.8	62.3	81.6	73.2	69.2
	SHC	20.1	33.4	44.1	25.4	42.5	56.5	31.1	48.9	64.7
	kW	9.10	8.94	8.83	9.23	9.05	8.95	9.26	9.10	8.99

LEGEND AND NOTES FOR TABLES 13 AND 14.

[shaded box] Standard Ratings

LEGEND

BF — Bypass Factor
Edb — Entering Dry Bulb
Ewb — Entering Wet Bulb
kW — Compressor Motor Power Input
SHC — Sensible Heat Capacity (1000 Btuh) Gross
TC — Total Capacity (1000 Btuh) Gross

NOTES:

1. Direct interpolation is permissible. Do not extrapolate.
2. The following formulas may be used:

$$t_{ldb} = t_{edb} - \frac{\text{sensible capacity (Btuh)}}{1.10 \times \text{cfm}}$$

t_{lwb} = Wet-bulb temperature corresponding to enthalpy of air leaving evaporator coil (h_{lwb})

$$h_{lwb} = h_{ewb} - \frac{\text{total capacity (Btuh)}}{4.5 \times \text{cfm}}$$

Where: h_{ewb} = Enthalpy of air entering evaporator coil.

3. The SHC is based on 80 F edb temperature of air entering evaporator coil.
Below 80 F edb, subtract (corr factor x cfm) from SHC.
Above 80 F edb, add (corr factor x cfm) to SHC.
Correction Factor = 1.10 x (1 – BF) x (edb – 80).

Table 15 — 48/50HJ008 Cooling Capacities, Hot Gas Reheat Mode*

TEMP (F) AIR ENT CONDENSER (Edb)		AIR ENTERING EVAPORATOR — Ewb (F)								
		75 Dry Bulb 62.5 Wet Bulb (50% Relative)			75 Dry Bulb 64 Wet Bulb (55% Relative)			75 Dry Bulb 65.3 Wet Bulb (60% Relative)		
		Air Entering Evaporator — Cfm								
		2250	3000	3750	2250	3000	3750	2250	3000	3750
80	TC	37.74	40.54	42.68	38.48	41.35	43.55	39.12	42.05	44.29
	SHC	10.67	15.63	19.63	5.01	9.84	13.74	0.10	4.82	8.63
	kW	4.92	4.92	4.92	4.97	4.97	4.97	5.01	5.01	5.01
75	**TC**	**37.34**	**39.95**	**41.95**	**38.08**	**40.75**	**42.81**	**38.72**	**41.45**	**43.55**
	SHC	**9.83**	**14.48**	**18.24**	**4.52**	**9.05**	**12.70**	**-0.09**	**4.34**	**7.91**
	kW	**5.19**	**5.19**	**5.19**	**5.25**	**5.25**	**5.25**	**5.30**	**5.30**	**5.30**
70	TC	36.93	39.36	41.22	37.67	40.16	42.07	38.31	40.85	42.80
	SHC	8.99	13.33	16.84	4.02	8.26	11.67	-0.28	3.86	7.19
	kW	5.46	5.46	5.46	5.52	5.52	5.52	5.58	5.58	5.58
60	TC	36.13	38.18	39.75	36.87	38.97	40.58	37.51	39.66	41.31
	SHC	7.31	11.04	14.04	3.04	6.67	9.60	-0.66	2.89	5.75
	kW	5.99	5.99	5.99	6.08	6.08	6.08	6.15	6.15	6.15
50	TC	35.32	37.00	38.29	36.06	37.78	39.10	36.75	38.46	39.81
	SHC	5.63	8.74	11.25	2.06	5.09	7.53	-1.03	1.93	4.32
	kW	6.52	6.52	6.52	6.63	6.63	6.63	6.73	6.73	6.73
40	TC	34.52	35.82	36.82	35.26	36.60	37.62	35.90	37.27	38.32
	SHC	3.94	6.44	8.45	1.08	3.51	5.47	-1.41	0.97	2.88
	kW	7.05	7.05	7.05	7.18	7.18	7.18	7.30	7.30	7.30

Table 16 — 48/50HJ009 Cooling Capacities, Standard Units

TEMP (F) AIR ENT CONDENSER (Edb)		AIR ENTERING EVAPORATOR — Cfm/BF															
		2550/0.11				3000/0.12				3400/0.13				4250/0.17			
		Air Entering Evaporator — Ewb (F)															
		57	62	67	72	57	62	67	57	62	67	72	57	62	67	72	57
75	TC	94.6	101.0	110.0	119.2	100.4	104.4	113.4	121.8	104.2	106.8	115.8	123.4	109.8	111.0	119.0	125.8
	SHC	94.6	84.4	69.4	54.4	100.4	92.4	75.0	57.2	104.2	99.0	80.0	59.8	109.8	110.4	89.4	64.2
	kW	5.72	5.76	5.76	5.82	5.74	5.76	5.80	5.86	5.74	5.76	5.82	5.88	5.76	5.78	5.84	5.90
85	TC	91.0	97.4	106.8	115.8	97.4	101.0	110.0	119.6	101.2	103.0	112.0	121.6	108.0	108.0	116.0	123.4
	SHC	91.0	83.0	68.8	53.2	97.4	91.2	74.2	57.0	101.2	97.6	78.8	59.6	108.0	108.0	89.4	64.2
	kW	6.46	6.5	6.52	6.58	6.50	6.52	6.54	6.60	6.50	6.52	6.54	6.64	6.54	6.54	6.60	6.64
95	TC	85.2	91.4	103.0	112.8	93.4	96.6	106.2	116.0	98.2	99.2	108.4	117.8	104.6	104.6	111.6	121.2
	SHC	85.2	80.4	67.2	52.6	93.4	89.4	73.0	55.8	98.2	96.2	78.2	58.8	104.6	104.6	88.0	64.6
	kW	7.24	7.28	7.36	7.42	7.30	7.32	7.38	7.44	7.34	7.36	7.4	7.46	7.36	7.36	7.42	7.50
105	TC	80.0	82.2	98.6	108.6	87.0	87.8	101.6	111.8	93.4	93.6	103.8	114.0	101.0	100.8	106.8	116.6
	SHC	80.0	76.6	65.6	51.2	87.0	85.6	71.6	54.8	93.4	93.2	76.6	57.8	101.0	100.8	86.8	63.6
	kW	8.08	8.12	8.26	8.32	8.16	8.16	8.28	8.36	8.20	8.20	8.3	8.38	8.28	8.28	8.30	8.40
115	TC	73.6	74.6	89.4	103.4	81.0	81.2	95.2	106.4	86.2	86.2	98.4	108.4	96.4	96.4	101.6	111.8
	SHC	73.6	73.0	62.2	49.6	81.0	81.2	69.4	53.0	86.2	86.2	75.0	56.4	96.4	96.4	85.4	62.8
	kW	9.00	9.00	9.16	9.28	9.08	9.08	9.22	9.30	9.14	9.14	9.26	9.34	9.22	9.22	9.30	9.38
125	TC	68.6	68.6	80.2	98.2	74.4	74.4	84.0	101.0	79.2	79.2	86.8	102.8	88.0	88.0	93.8	105.6
	SHC	68.6	68.6	59.0	48.0	74.4	74.4	65.4	51.6	79.2	79.2	71.0	54.6	88.0	88.0	82.8	61.0
	kW	9.98	9.98	10.14	10.32	10.06	10.06	10.18	10.36	10.14	10.14	10.22	10.38	10.24	10.24	10.28	10.42

LEGEND AND NOTES FOR TABLES 15 AND 16.

[shaded box] Standard Ratings

LEGEND

BF — Bypass Factor
Edb — Entering Dry Bulb
Ewb — Entering Wet Bulb
kW — Compressor Motor Power Input
SHC — Sensible Heat Capacity (1000 Btuh) Gross
TC — Total Capacity (1000 Btuh) Gross

*Negative SHC value indicates that the air entering the coil is being heated.

NOTES:

1. Direct interpolation is permissible. Do not extrapolate.
2. The following formulas may be used:

$$t_{ldb} = t_{edb} - \frac{\text{sensible capacity (Btuh)}}{1.10 \times \text{cfm}}$$

t_{lwb} = Wet-bulb temperature corresponding to enthalpy of air leaving evaporator coil (h_{lwb})

$$h_{lwb} = h_{ewb} - \frac{\text{total capacity (Btuh)}}{4.5 \times \text{cfm}}$$

Where: h_{ewb} = Enthalpy of air entering evaporator coil.

3. The SHC is based on 80 F edb temperature of air entering evaporator coil.
Below 80 F edb, subtract (corr factor x cfm) from SHC.
Above 80 F edb, add (corr factor x cfm) to SHC.
Correction Factor = 1.10 x (1 – BF) x (edb – 80).

Table 17 — 48/50HJ009 Cooling Capacities, Subcooling Mode

TEMP (F) AIR ENT CONDENSER (Edb)		AIR ENTERING EVAPORATOR — Cfm/BF											
		2550/0.08			3000/0.09			3400/0.11			4250/0.13		
		Air Entering Evaporator — Ewb (F)											
		72	67	62	72	67	62	72	67	62	72	67	62
75	TC	114.1	104.1	97.8	116.3	108.5	103.4	117.6	111.9	108.0	122.2	118.9	111.4
	SHC	49.8	64.2	81.2	52.6	70.8	89.0	55.4	76.9	95.4	62.0	87.0	107.2
	kW	5.57	5.46	5.44	5.59	5.50	5.44	5.60	5.51	5.44	5.62	5.62	5.69
85	TC	107.3	98.4	92.6	111.0	101.8	98.0	113.0	104.2	102.0	117.1	111.4	106.1
	SHC	42.2	58.3	76.0	47.1	64.5	83.5	51.2	70.2	89.2	57.3	81.2	101.2
	kW	6.32	6.30	6.15	6.32	6.27	6.18	6.34	6.22	6.20	6.30	6.31	6.45
95	TC	101.9	92.4	86.8	105.3	95.5	92.8	107.4	97.7	96.5	112.1	103.7	100.3
	SHC	35.4	51.9	70.3	40.1	58.5	77.9	44.9	64.9	83.7	52.1	74.0	94.8
	kW	7.06	7.13	6.93	7.06	7.06	6.95	7.06	6.99	6.98	7.01	7.04	7.17
105	TC	94.5	85.4	77.0	97.6	88.3	82.4	99.9	90.6	88.0	104.1	96.1	94.0
	SHC	29.7	45.7	63.2	33.9	52.2	70.1	38.0	58.3	75.7	44.4	67.6	88.5
	kW	7.99	8.00	7.81	8.01	7.97	7.85	8.02	7.94	7.89	7.96	7.96	8.08
115	TC	86.4	75.0	68.3	89.3	80.2	74.1	91.4	83.2	78.4	96.5	88.4	87.1
	SHC	24.0	38.7	56.4	27.4	45.6	62.9	31.1	51.9	67.0	37.0	60.8	81.8
	kW	8.91	8.83	8.66	8.93	8.86	8.76	8.97	8.86	8.84	8.91	8.93	8.90
125	TC	78.6	65.5	60.2	81.3	68.9	64.7	83.3	71.6	68.2	88.5	78.8	78.9
	SHC	18.3	32.0	48.8	21.2	38.0	53.5	24.1	44.1	57.5	29.4	53.3	73.8
	kW	9.81	9.65	9.53	9.86	9.68	9.64	9.89	9.71	9.75	9.90	9.72	9.88

Table 18 — 48/50HJ009 Cooling Capacities, Hot Gas Reheat Mode

TEMP (F) AIR ENT CONDENSER (Edb)		AIR ENTERING EVAPORATOR — Ewb (F)											
		75 Dry Bulb 62.5 Wet Bulb (50% Relative)				75 Dry Bulb 64 Wet Bulb (55% Relative)				75 Dry Bulb 65.3 Wet Bulb (60% Relative)			
		Air Entering Evaporator — Cfm											
		2550	3000	3400	4250	2550	3000	3400	4250	2550	3000	3400	4250
80	TC	43.44	46.26	48.45	52.38	45.26	48.15	50.39	54.43	46.84	49.79	52.08	56.20
	SHC	12.34	16.78	20.29	26.74	5.79	10.15	13.60	19.93	0.11	4.40	7.80	14.03
	kW	6.31	6.31	6.31	6.31	6.05	6.05	6.05	6.05	5.83	5.83	5.83	5.83
75	**TC**	**44.33**	**47.00**	**49.06**	**52.78**	**46.12**	**48.85**	**50.97**	**54.78**	**47.67**	**50.46**	**52.63**	**56.52**
	SHC	**12.92**	**17.12**	**20.44**	**26.54**	**6.81**	**10.94**	**14.20**	**20.20**	**1.51**	**5.58**	**8.79**	**14.70**
	kW	**6.38**	**6.38**	**6.8**	**6.38**	**6.15**	**6.15**	**6.15**	**6.15**	**5.95**	**5.95**	**5.95**	**5.95**
70	TC	45.22	47.73	49.68	53.18	46.98	49.55	51.55	55.14	48.51	51.14	53.18	56.84
	SHC	13.50	17.47	20.59	26.34	7.83	11.73	14.81	20.46	2.92	6.76	9.79	15.36
	kW	6.46	6.46	6.46	6.46	6.25	6.25	6.25	6.25	6.07	6.07	6.07	6.07
60	TC	46.99	49.19	50.90	53.97	48.70	50.96	52.71	55.86	50.18	52.49	54.27	57.49
	SHC	14.67	18.15	20.90	25.95	9.88	13.31	16.01	20.99	5.73	9.11	11.78	16.68
	kW	6.60	6.60	6.60	6.60	6.45	6.45	6.45	6.45	6.32	6.32	6.32	6.32
50	TC	48.77	50.66	52.13	54.77	50.42	52.36	53.87	56.57	51.85	53.83	55.37	58.14
	SHC	15.83	18.83	21.20	25.56	11.93	14.89	17.22	21.51	8.55	11.47	13.77	18.01
	kW	6.74	6.74	6.74	6.74	6.64	6.64	6.64	6.64	6.56	6.56	6.56	6.56
40	TC	50.54	52.13	53.35	55.56	52.14	53.76	55.02	57.29	53.53	55.18	56.47	58.78
	SHC	17.00	19.52	21.51	25.16	13.98	16.47	18.43	22.04	11.36	13.82	15.76	19.33
	kW	6.88	6.88	6.88	6.88	6.84	6.84	6.84	6.84	6.81	6.81	6.81	6.81

LEGEND AND NOTES FOR TABLES 17 AND 18.

LEGEND

BF — Bypass Factor
Edb — Entering Dry Bulb
Ewb — Entering Wet Bulb
kW — Compressor Motor Power Input
SHC — Sensible Heat Capacity (1000 Btuh) Gross
TC — Total Capacity (1000 Btuh) Gross

NOTES:

1. Direct interpolation is permissible. Do not extrapolate.
2. The following formulas may be used:

$$t_{ldb} = t_{edb} - \frac{\text{sensible capacity (Btuh)}}{1.10 \times \text{cfm}}$$

t_{lwb} = Wet-bulb temperature corresponding to enthalpy of air leaving evaporator coil (h_{lwb})

$$h_{lwb} = h_{ewb} - \frac{\text{total capacity (Btuh)}}{4.5 \times \text{cfm}}$$

Where: h_{ewb} = Enthalpy of air entering evaporator coil.

3. The SHC is based on 80 F edb temperature of air entering evaporator coil.
Below 80 F edb, subtract (corr factor x cfm) from SHC.
Above 80 F edb, add (corr factor x cfm) to SHC.
Correction Factor = 1.10 x (1 – BF) x (edb – 80).

Table 19 — 48/50HJ012 Cooling Capacities, Standard Units

TEMP (F) AIR ENT CONDENSER (Edb)		AIR ENTERING EVAPORATOR — Cfm/BF											
		3000/0.03			3200/0.03			4000/0.04			5000/0.04		
		Air Entering Evaporator — Ewb (F)											
		72	67	62	72	67	62	72	67	62	72	67	62
75	TC	140.3	129.4	115.0	141.2	130.4	118.1	145.2	134.0	122.1	147.5	136.6	125.3
	SHC	65.6	82.2	97.4	66.7	84.4	101.5	71.3	93.1	113.5	77.9	103.7	124.7
	kW	7.35	7.21	7.12	7.37	7.23	7.13	7.46	7.31	7.17	7.51	7.37	7.22
85	TC	137.7	125.3	110.0	138.9	126.6	113.6	142.6	130.6	117.7	144.6	133.3	122.3
	SHC	65.0	81.2	95.2	66.3	83.6	99.7	71.0	92.8	112.0	76.9	103.1	122.2
	kW	8.29	8.13	8.02	8.32	8.16	8.03	8.40	8.24	8.09	8.45	8.31	8.16
95	TC	133.8	120.7	103.0	135.1	121.9	107.2	138.8	125.8	112.8	141.7	128.5	118.5
	SHC	63.9	79.6	92.2	65.2	82.0	97.0	70.6	91.5	109.7	76.9	102.5	118.4
	kW	9.33	9.16	8.98	9.35	9.18	9.00	9.44	9.27	9.07	9.51	9.33	9.19
105	TC	128.7	115.4	96.5	129.8	116.6	99.7	133.7	120.3	107.1	136.7	122.8	114.5
	SHC	62.3	77.6	89.4	63.6	80.2	93.5	69.4	89.6	106.8	76.0	100.6	114.3
	kW	10.46	10.28	10.00	10.47	10.30	10.07	10.57	10.38	10.21	10.66	10.43	10.31
115	TC	123.2	109.1	90.8	124.3	110.3	92.2	127.9	114.4	100.8	130.9	116.8	110.1
	SHC	60.4	75.1	86.6	61.9	77.8	90.0	67.6	87.6	100.7	74.6	98.7	109.9
	kW	11.66	11.47	11.20	11.68	11.51	11.25	11.77	11.60	11.41	11.89	11.66	11.58
125	TC	117.5	101.8	86.2	118.5	103.0	87.4	121.6	107.1	96.0	124.1	110.3	104.8
	SHC	58.5	72.5	84.5	60.0	75.0	87.3	65.8	85.1	96.0	72.5	96.9	104.8
	kW	12.99	12.77	12.50	13.02	12.81	12.55	13.10	12.92	12.74	13.19	13.01	12.91

Table 20 — 48/50HJ012 Cooling Capacities, Subcooling Mode

TEMP (F) AIR ENT CONDENSER (Edb)		AIR ENTERING EVAPORATOR — Cfm/BF											
		3000/0.03			3200/0.03			4000/0.04			5000/0.04		
		Air Entering Evaporator — Ewb (F)											
		72	67	62	72	67	62	72	67	62	72	67	62
75	TC	134.3	122.5	111.4	135.8	124.3	113.0	138.4	129.5	123.5	143.3	136.5	130.2
	SHC	60.0	76.1	93.7	61.3	79.1	97.4	68.0	89.5	109.4	75.2	100.9	123.3
	kW	7.03	6.84	6.72	7.01	6.89	6.77	7.10	6.92	6.77	7.15	7.03	6.88
85	TC	127.6	115.4	104.6	128.9	118.1	107.0	132.5	121.5	116.6	137.2	128.0	122.9
	SHC	51.5	68.8	87.2	53.9	72.0	91.2	61.0	82.7	102.4	68.6	93.6	115.9
	kW	7.96	7.86	7.59	7.94	7.78	7.51	8.02	7.84	7.69	8.02	7.94	7.79
95	TC	120.9	108.3	97.8	121.9	111.8	101.0	126.5	113.4	109.7	131.1	119.4	115.5
	SHC	43.0	61.5	80.6	46.5	64.8	84.9	53.9	75.9	95.4	62.0	86.2	108.4
	kW	8.88	8.87	8.46	8.86	8.66	8.26	8.94	8.76	8.60	8.89	8.85	8.69
105	TC	112.0	99.9	90.4	113.1	103.2	93.4	117.2	105.0	100.7	122.1	110.5	105.9
	SHC	36.1	54.1	73.8	38.8	57.8	78.9	45.6	68.2	86.8	53.0	78.3	99.7
	kW	10.0	10.0	9.6	10.0	9.8	9.5	10.1	9.9	9.8	10.1	10.0	9.9
115	TC	103.0	91.5	83.1	104.3	94.6	85.9	107.8	96.7	91.7	113.0	101.6	96.4
	SHC	29.2	46.7	66.9	31.2	50.7	72.9	37.3	60.6	78.3	44.0	70.3	90.9
	kW	11.2	11.1	10.8	11.2	11.0	10.7	11.3	11.1	11.0	11.3	11.2	11.1
125	TC	94.1	83.1	75.7	95.5	86.0	78.3	98.5	88.3	82.7	104.0	92.7	86.8
	SHC	22.3	39.3	60.1	23.5	43.7	66.8	29.0	52.9	69.7	35.0	62.4	82.2
	kW	12.35	12.15	11.94	12.38	12.13	11.92	12.48	12.27	12.25	12.53	12.30	12.28

LEGEND AND NOTES FOR TABLES 19 AND 20.

(shaded) Standard Ratings

LEGEND

BF — Bypass Factor
Edb — Entering Dry Bulb
Ewb — Entering Wet Bulb
kW — Compressor Motor Power Input
SHC — Sensible Heat Capacity (1000 Btuh) Gross
TC — Total Capacity (1000 Btuh) Gross

NOTES:

1. Direct interpolation is permissible. Do not extrapolate.
2. The following formulas may be used:

$$t_{ldb} = t_{edb} - \frac{\text{sensible capacity (Btuh)}}{1.10 \times \text{cfm}}$$

t_{lwb} = Wet-bulb temperature corresponding to enthalpy of air leaving evaporator coil (h_{lwb})

$$h_{lwb} = h_{ewb} - \frac{\text{total capacity (Btuh)}}{4.5 \times \text{cfm}}$$

Where: h_{ewb} = Enthalpy of air entering evaporator coil.

3. The SHC is based on 80 F edb temperature of air entering evaporator coil.
Below 80 F edb, subtract (corr factor x cfm) from SHC.
Above 80 F edb, add (corr factor x cfm) to SHC.
Correction Factor = 1.10 x (1 – BF) x (edb – 80).

Table 21 — 48/50HJ012 Cooling Capacities, Hot Gas Reheat Mode*

TEMP (F) AIR ENT CONDENSER (Edb)		AIR ENTERING EVAPORATOR — Ewb (F)											
		75 Dry Bulb 62.5 Wet Bulb (50% Relative)				75 Dry Bulb 64 Wet Bulb (55% Relative)				75 Dry Bulb 65.3 Wet Bulb (60% Relative)			
		Air Entering Evaporator — Cfm											
		3000	3200	4000	5000	3000	3200	4000	5000	3000	3200	4000	5000
80	TC	49.15	50.16	53.80	57.72	51.04	52.08	55.86	59.94	52.67	53.74	57.65	61.86
	SHC	9.58	12.02	20.74	29.89	2.88	5.29	13.88	22.89	-2.92	-0.55	7.93	16.83
	kW	7.39	7.38	7.38	7.37	7.45	7.45	7.44	7.43	7.50	7.50	7.49	7.49
75	TC	**49.60**	**50.61**	**54.30**	**58.28**	**51.45**	**52.50**	**56.33**	**60.45**	**53.05**	**54.14**	**58.09**	**62.34**
	SHC	**10.07**	**12.38**	**20.60**	**29.23**	**3.82**	**6.09**	**14.20**	**22.70**	**-1.60**	**0.64**	**8.65**	**17.05**
	kW	**7.56**	**7.56**	**7.55**	**7.55**	**7.63**	**7.63**	**7.62**	**7.62**	**7.69**	**7.69**	**7.69**	**7.68**
70	TC	50.04	51.07	54.81	58.83	51.86	52.92	56.80	60.96	53.43	54.53	58.52	62.82
	SHC	10.56	12.73	20.47	28.58	4.75	6.89	14.52	22.52	-0.28	1.83	9.36	17.26
	kW	7.73	7.73	7.72	7.72	7.81	7.81	7.81	7.80	7.89	7.88	7.88	7.87
60	TC	50.93	51.98	55.81	59.93	52.68	53.77	57.73	61.99	54.20	55.32	59.39	63.77
	SHC	11.54	13.44	20.19	27.28	6.62	8.49	15.16	22.15	2.36	4.21	10.79	17.70
	kW	8.07	8.07	8.07	8.06	8.18	8.18	8.17	8.17	8.27	8.27	8.26	8.26
50	TC	51.82	52.90	56.81	61.03	53.50	54.62	58.66	63.01	54.96	56.10	60.26	64.73
	SHC	12.53	14.14	19.92	25.98	8.50	10.09	15.80	21.78	5.00	6.58	12.22	18.14
	kW	8.42	8.42	8.41	8.41	8.54	8.54	8.54	8.54	8.66	8.65	8.65	8.65
40	TC	52.71	53.81	57.82	62.13	54.32	55.46	59.59	64.04	55.72	56.89	61.13	65.69
	SHC	13.51	14.85	19.64	24.67	10.37	11.70	16.43	21.41	7.64	8.96	13.65	18.58
	kW	8.76	8.76	8.76	8.75	8.91	8.91	8.91	8.90	9.04	9.04	9.04	9.03

Table 22 — 48/50HJ014 Cooling Capacities, Standard Units

TEMP (F) AIR ENT CONDENSER (Edb)		AIR ENTERING EVAPORATOR — Cfm/BF											
		3750/0.08			4300/0.09			5000/0.11			6250/0.13		
		Air Entering Evaporator — Ewb (F)											
		72	67	62	72	67	62	72	67	62	72	67	62
75	TC	167.1	154.3	142.0	169.8	157.7	144.8	173.5	160.6	148.4	176.5	164.5	153.3
	SHC	82.5	103.5	123.6	85.8	109.7	132.0	90.3	117.7	141.9	98.2	130.7	153.1
	kW	9.44	9.18	8.95	9.50	9.26	9.01	9.60	9.33	9.07	9.68	9.43	9.17
85	TC	162.3	149.3	135.6	165.1	152.5	139.5	168.8	155.3	143.5	172.1	159.2	149.3
	SHC	80.9	101.4	120.9	84.4	107.9	129.9	89.6	115.8	139.8	97.6	129.3	149.1
	kW	10.49	10.18	9.97	10.55	10.27	10.02	10.67	10.32	10.11	10.75	10.43	10.21
95	TC	156.5	143.7	126.3	159.6	146.8	131.3	162.3	149.8	136.5	166.5	153.2	144.5
	SHC	79.1	99.5	116.5	83.0	106.1	126.0	87.6	114.2	135.8	95.8	127.7	144.4
	kW	11.60	11.30	11.01	11.69	11.39	11.10	11.75	11.47	11.20	11.87	11.56	11.35
105	TC	150.0	136.2	115.7	153.0	139.3	120.9	155.6	142.5	138.5	158.8	145.9	138.8
	SHC	76.5	96.7	111.2	80.8	103.5	120.0	85.7	112.3	128.4	93.6	125.9	138.7
	kW	12.76	12.42	12.09	12.83	12.52	12.20	12.91	12.62	12.32	12.96	12.72	12.52
115	TC	141.8	122.2	104.4	144.3	126.1	110.8	147.7	129.4	118.9	150.7	135.2	130.1
	SHC	73.6	91.2	104.2	77.9	98.5	110.8	83.4	107.3	118.4	91.8	121.9	129.9
	kW	13.85	13.55	13.22	13.94	13.64	13.35	14.05	13.73	13.50	14.15	13.86	13.70
125	TC	132.5	108.6	93.9	134.8	111.4	100.7	137.6	114.4	106.6	140.3	122.9	120.1
	SHC	70.9	85.7	93.8	74.8	92.9	100.7	80.2	101.4	106.5	89.0	116.3	120.1
	kW	15.04	14.66	14.44	15.14	14.75	14.55	15.23	14.85	14.72	15.29	14.94	14.84

LEGEND AND NOTES FOR TABLES 21 AND 22.

[shaded box] Standard Ratings

LEGEND

BF — Bypass Factor
Edb — Entering Dry Bulb
Ewb — Entering Wet Bulb
kW — Compressor Motor Power Input
SHC — Sensible Heat Capacity (1000 Btuh) Gross
TC — Total Capacity (1000 Btuh) Gross

*Negative SHC value indicates that the air entering the coil is being heated.

NOTES:

1. Direct interpolation is permissible. Do not extrapolate.
2. The following formulas may be used:

$$t_{ldb} = t_{edb} - \frac{\text{sensible capacity (Btuh)}}{1.10 \times \text{cfm}}$$

t_{lwb} = Wet-bulb temperature corresponding to enthalpy of air leaving evaporator coil (h_{lwb})

$$h_{lwb} = h_{ewb} - \frac{\text{total capacity (Btuh)}}{4.5 \times \text{cfm}}$$

Where: h_{ewb} = Enthalpy of air entering evaporator coil.

3. The SHC is based on 80 F edb temperature of air entering evaporator coil.
Below 80 F edb, subtract (corr factor x cfm) from SHC.
Above 80 F edb, add (corr factor x cfm) to SHC.
Correction Factor = 1.10 x (1 – BF) x (edb – 80).

Table 23 — 48/50HJ014 Cooling Capacities, Subcooling Mode

TEMP (F) AIR ENT CONDENSER (Edb)		AIR ENTERING EVAPORATOR — Cfm/BF											
		3750/0.08			4300/0.09			5000/0.11			6250/0.13		
		Air Entering Evaporator — Ewb (F)											
		72	67	62	72	67	62	72	67	62	72	67	62
75	TC	156.3	144.2	132.3	160.0	148.4	136.2	162.8	150.6	138.2	169.0	157.5	145.6
	SHC	66.6	87.6	112.1	72.5	94.8	121.3	76.9	99.6	127.5	87.0	115.5	142.7
	kW	9.28	8.98	8.59	9.35	9.08	8.80	9.40	9.18	8.9	9.43	9.18	8.93
85	TC	147.6	136.2	123.7	150.7	140.1	127.2	154.1	140.8	127.9	161.1	148.0	135.4
	SHC	58.7	80.0	103.8	63.5	86.5	112.2	68.7	91.0	118.1	77.7	107.8	133.2
	kW	10.29	9.93	9.58	10.36	10.08	9.77	10.40	10.34	10.03	10.45	10.18	9.88
95	TC	138.9	128.2	115.1	141.4	131.8	118.3	145.3	131.0	117.6	153.1	138.4	125.1
	SHC	50.8	72.3	95.5	54.4	78.1	103.2	60.5	82.3	108.7	68.5	100.0	123.7
	kW	11.29	10.87	10.57	11.37	11.08	10.74	11.40	11.50	11.1	11.46	11.17	10.83
105	TC	129.1	117.8	105.8	131.7	121.0	108.7	134.8	119.9	107.7	140.9	126.9	115.9
	SHC	42.1	63.5	86.5	45.4	69.0	93.9	51.2	74.2	101.3	57.7	90.2	113.6
	kW	12.59	12.14	11.82	12.67	12.34	11.96	12.70	12.67	12.28	12.79	12.46	12.08
115	TC	119.2	107.3	96.4	122.1	110.2	99.0	124.2	108.8	97.8	128.7	115.3	106.7
	SHC	33.5	54.8	77.5	36.4	59.8	84.7	41.9	66.1	93.8	46.8	80.5	103.5
	kW	13.90	13.40	13.08	13.98	13.59	13.18	14.00	13.83	13.41	14.11	13.75	13.33
125	TC	109.4	96.9	87.1	112.4	99.4	89.3	113.7	97.7	87.8	116.5	103.8	97.5
	SHC	24.8	46.0	68.5	27.4	50.7	75.5	32.6	58.0	86.4	36.0	70.7	93.5
	kW	15.20	14.67	14.33	15.28	14.85	14.40	15.30	15.00	14.54	15.44	15.04	14.58

Table 24 — 48/50HJ014 Cooling Capacities, Hot Gas Reheat Mode*

TEMP (F) AIR ENT CONDENSER (Edb)		AIR ENTERING EVAPORATOR — Ewb (F)											
		75 Dry Bulb 62.5 Wet Bulb (50% Relative)				75 Dry Bulb 64 Wet Bulb (55% Relative)				75 Dry Bulb 65.3 Wet Bulb (60% Relative)			
		Air Entering Evaporator — Cfm											
		3750	4300	5000	6250	3750	4300	5000	6250	3750	4300	5000	6250
80	TC	43.54	45.21	47.05	49.78	45.46	47.16	49.05	51.85	47.11	48.86	50.78	53.64
	SHC	-4.36	0.76	6.50	15.20	-9.51	-4.35	1.45	10.22	-13.97	-8.77	-2.93	5.90
	kW	8.70	8.70	8.70	8.70	8.82	8.82	8.82	8.82	8.92	8.92	8.92	8.92
75	TC	**44.45**	**46.02**	**47.75**	**50.32**	**46.33**	**47.94**	**49.71**	**52.34**	**47.96**	**49.60**	**51.41**	**54.10**
	SHC	**-3.84**	**0.96**	**6.36**	**14.53**	**-8.66**	**-3.81**	**1.63**	**9.86**	**-12.84**	**-7.96**	**-2.48**	**5.82**
	kW	**8.90**	**8.90**	**8.90**	**8.90**	**9.03**	**9.03**	**9.03**	**9.03**	**9.14**	**9.14**	**9.14**	**9.14**
70	TC	45.36	46.82	48.45	50.86	47.20	48.71	50.37	52.84	48.80	50.34	52.04	54.55
	SHC	-3.32	1.17	6.21	13.85	-7.81	-3.28	1.80	9.50	-11.71	-7.14	-2.02	5.74
	kW	9.10	9.10	9.10	9.10	9.24	9.24	9.24	9.24	9.36	9.36	9.36	9.36
60	TC	47.17	48.44	49.84	51.93	48.95	50.25	51.69	53.83	50.49	51.82	53.29	55.47
	SHC	-2.28	1.59	5.93	12.50	-6.12	-2.22	2.16	8.79	-9.45	-5.52	-1.11	5.57
	kW	9.51	9.51	9.51	9.51	9.66	9.66	9.66	9.66	9.80	9.80	9.80	9.80
50	TC	48.98	50.05	51.24	53.00	50.70	51.80	53.01	54.82	52.18	53.31	54.55	56.39
	SHC	-1.24	2.00	5.64	11.15	-4.43	-1.15	2.52	8.07	-7.18	-3.89	-0.19	5.41
	kW	9.91	9.91	9.91	9.91	10.09	10.09	10.09	10.09	10.24	10.24	10.24	10.24
40	TC	50.79	51.67	52.64	54.07	52.44	53.34	54.33	55.80	53.87	54.79	55.80	57.30
	SHC	-0.20	2.41	5.35	9.80	-2.73	-.019	2.87	7.36	-4.92	-2.26	0.72	5.24
	kW	10.31	10.31	10.31	10.31	10.51	10.51	10.51	10.51	10.68	10.68	10.68	10.68

LEGEND AND NOTES FOR TABLES 23 AND 24.

LEGEND

BF — Bypass Factor
Edb — Entering Dry Bulb
Ewb — Entering Wet Bulb
kW — Compressor Motor Power Input
SHC — Sensible Heat Capacity (1000 Btuh) Gross
TC — Total Capacity (1000 Btuh) Gross

*Negative SHC value indicates that the air entering the coil is being heated.

NOTES:

1. Direct interpolation is permissible. Do not extrapolate.
2. The following formulas may be used:

$$t_{ldb} = t_{edb} - \frac{\text{sensible capacity (Btuh)}}{1.10 \times \text{cfm}}$$

t_{lwb} = Wet-bulb temperature corresponding to enthalpy of air leaving evaporator coil (h_{lwb})

$$h_{lwb} = h_{ewb} - \frac{\text{total capacity (Btuh)}}{4.5 \times \text{cfm}}$$

Where: h_{ewb} = Enthalpy of air entering evaporator coil.

3. The SHC is based on 80 F edb temperature of air entering evaporator coil.
Below 80 F edb, subtract (corr factor x cfm) from SHC.
Above 80 F edb, add (corr factor x cfm) to SHC.
Correction Factor = 1.10 x (1 – BF) x (edb – 80).

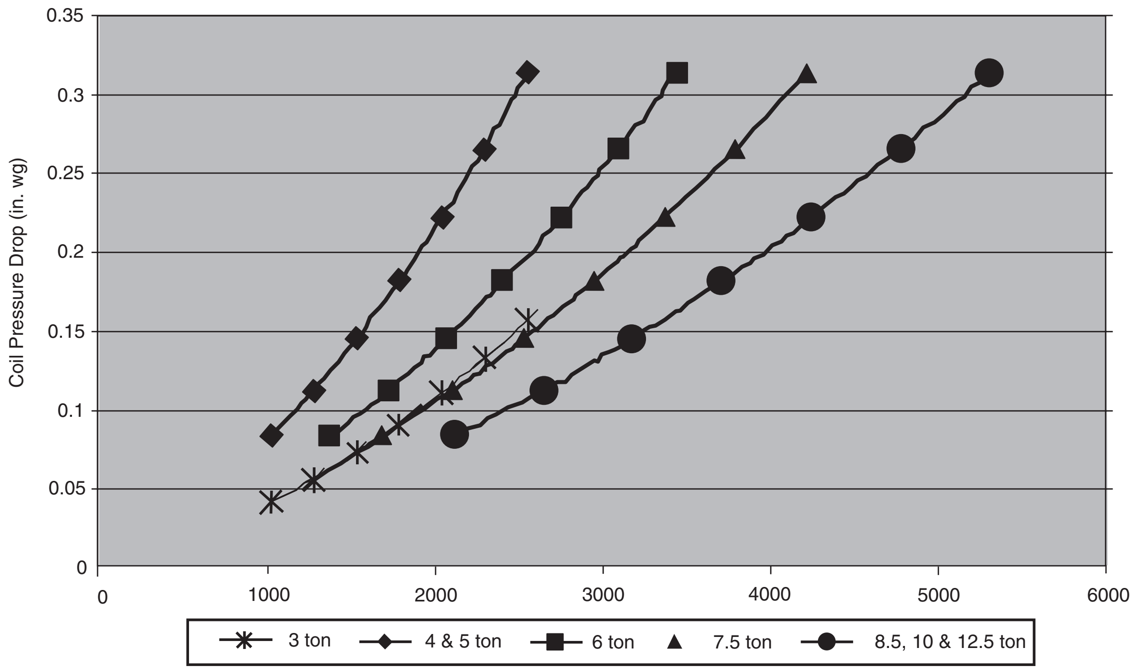


Fig. 10 — Humidi-MiZer™ Adaptive Dehumidification Coil Pressure Drop

SYSTEM SELECTION

Design Example — This section outlines a brief design example to illustrate the flexibility and dehumidification capacity of the Humidi-MiZer adaptive dehumidification system. The example directly reinforces and demonstrates the design challenges as previously outlined when designing to maintain changing space conditions to sustain comfort zone levels. In addition, the rooftop system response is outlined to represent the sequence of operation of a Weathermaster® 48/50HJ rooftop unit with the Humidi-MiZer adaptive dehumidification system and how this system would perform when the space humidity levels exceed the room set point.

Consider a school classroom in Houston, Texas with the following design characteristics:

- Total classroom area = 1,500 sq ft
- Total classroom volume = 15,000 cu ft

The design occupancy for this classroom is 30 students or roughly 10 people per 500 sq ft. Based on this occupancy, in accordance with ASHRAE (American Society of Heating, Refrigeration, and Air Conditioning Engineers) 62, the design ventilation rate would be 15 cfm/person or 450 cfm, total for this classroom.

To evaluate the full and part load rooftop performance, design requirements for the classroom will be evaluated at three conditions to assess annual full and part load operation to include:

1. Peak dry bulb (outdoor)
2. Peak dew point (outdoor)
3. Extremely high humidity (outdoor)

For each condition, the necessary rooftop performance will be calculated to evaluate the capacity requirements and associated required supply-air temperature from the unit to maintain space comfort conditions. The following formulas will be used:

OA Sensible Load = 1.08 x cfm_{oa} x (T_{oa} - T_{sp})

OA Latent Load = 0.7 x cfm_{oa} x (W_{oa} - W_{sp})

Where:

Cfm_{oa} = outdoor airflow in cu ft/min
T_{oa} = temperature of outdoor air in degrees of Fahrenheit
T_{sp} = temperature of space in degrees of Fahrenheit
W_{oa} = grains of water per pound of dry air of outdoor air
W_{sp} = grains of water per pound of dry air of space

NOTE: The W_{oa} and W_{sp} values of outdoor air can be obtained using the psychrometric chart.

Peak Dry Bulb — For Houston, the outdoor peak dry bulb (db) and coincident mean wet bulb (mwb) 1% conditions are 94 F db and 77 F (per the ASHRAE Fundamentals Handbook). The design room conditions are 75 F (space temperature) db and 62.5 F wet bulb (wb) (or roughly 50% relative humidity). At these conditions, the calculated indoor sensible (wall, roof, solar, windows, etc.) and latent (people) room loads for the classroom are **33,000 Btuh** and **6,150 Btuh**. The total room load is 33,000 + 6150 = **39,150 Btuh**.

For design purposes, there will be roughly 6.5 air changes per hour for the classroom. Therefore, the constant volume supply air from the rooftop unit would be (15,000 cu ft x 6.5)/60 = approximately 1,600 cfm. For this design supply airflow rate, the mixed air conditions entering the standard evaporator coil is 80.3 F db/66.7 F wb. See Table 25 for summary of peak db temperature conditions. In addition the calculated outdoor air loads are:

OA (sensible) = 1.08 x 450 x (94 – 75) = 9,276 Btuh

OA (latent) = 0.7 x 450 x (111 – 72) = 11,934 Btuh

The total capacity required of the rooftop unit including all sensible and latent room and outdoor loads is:

33,000 + 6,150 + 9,276 + 11,934 = 60,360 Btuh

Including total sensible capacity:

33,000 + 9276 = 42,776

Total latent capacity:

6,150 + 11,934 = 18,084

Select the 48/50HJ006 5-ton rooftop unit based on the total outdoor air and room load requirements.

Table 25 — Peak Dry Bulb, Temperature Summary

TEMPERATURE SUMMARY	DRY BULB	WET BULB
Outside-Air Temperature	94 F	77 F
Space Temperature	75 F	62.5 F
Entering-Air Temperature	80.3 F	66.7 F

Now that the desired supply air quantity is known, it is possible to estimate the required supply air temperature and performance for the rooftop unit to maintain the desired indoor conditions. At peak conditions, the SHR (the sensible to total heat rise in the room) and associated supply air temperature requirement is:

SHR (Peak Dry Bulb) = 33,000/39,150 = 0.84

33,000 Btuh = 1.08 x 1,600 cfm x (75 F – T)

Supply Air Temperature = 56 F

A supply-air temperature of 56 F is required for the sensible to total (SHR) heat ratio of 0.84 in the room. A supply-air temperature of 56 F is required to absorb the proportions of sensible and latent room load (per the SHR), so that space conditions are maintained at 75 F. Table 26 outlines a comparison of classroom requirements vs. actual rooftop performance to summarize the required classroom conditioning and the associated rooftop capacity under peak dry bulb conditions.

Table 26 — Peak Dry Bulb Operation Summary, Normal Design Cooling Mode

48/50HJ006	CLASSROOM REQUIREMENTS (Computer Simulation)	ROOFTOP PERFORMANCE (ECAT)
Total Capacity	60,360 Btuh	61,113 Btuh
Outdoor Sensible	9,276 Btuh	—
Outdoor Latent	11,934 Btuh	—
Sensible Capacity	—	42,930 Btuh
Latent Capacity	—	18,183 Btuh
Room Sensible	33,000 Btuh	33,718 Btuh
Room Latent	6,150 Btuh	6,249 Btuh
Supply Air	56 F	55.8 F
SHR	0.84	0.84

LEGEND

DB — Dry Bulb
ECAT — Carrier Electronic Catalog Program
SHR — Sensible Heat Ratio
WB — Wet Bulb

NOTES:
1. Data provided in terms of gross capacities.
2. Peak Dry Bulb Condition = 94 F DB/77 F WB.

Table 26 provides a breakdown of all the room load information and rooftop performance. To determine the available capacity that the rooftop unit has for room sensible and latent conditioning, the outdoor loads were subtracted from the total loads. For example, to evaluate the sensible capacity available for room conditioning, the outdoor sensible load of **9,276 Btuh** was subtracted from the total rooftop sensible capacity of **42,930 Btuh**. This yields a sensible capacity of **33,718 Btuh**, which closely matches the classroom sensible requirement of **33,000 Btuh**. The same calculation can be made to evaluate latent capacity requirements as shown in Table 26. Overall, under the peak dry bulb condition, the rooftop unit is sized appropriately to handle both the outdoor ventilation loads and room loads.

Peak Dew Point — Now that a unit has been selected for peak dry bulb conditions, evaluate the necessary and actual part load performance for the peak dew point condition in Houston. The peak dew point condition almost never coincides with the peak dry bulb condition. The coincident dry bulb at the peak wet bulb will usually be somewhat lower. This decreases room sensible loads, which are based on temperature difference dependent thermal conduction (through walls, roof, windows, etc.). Yet, despite potentially lower sensible room loads based on a lower dry bulb, the latent loads in the space will remain the same, since the classroom occupancy is designed for 30 people. Evaluating the performance at this point provides further verification that the selected unit will operate to meet comfort conditions in the space, based on different load conditions from peak dry bulb performance.

The ASHRAE Fundamental Handbook outlines peak dew point (dp) and coincident mean dry bulb (mdb) information. For Houston, the peak dew point 1% conditions are 77 F dp and 83 F mdb. Room design is still 75 F db and 50% relative humidity (rh). Mixed air conditions entering the rooftop standard evaporator coil are 77 F db and 66.7 F wb. At these outdoor conditions, the sensible load in the space drops to **25,000 Btuh** and the latent load remains the same at **6,150 Btuh**. The total room load is 25,000 + 6,150 = **31,150 Btuh**. See Table 27 for a peak dew point temperature summary.

The outdoor loads on the rooftop unit are now:

OA (sensible) = 1.08 x 450 x (83 – 75) = 3,888 Btuh

OA (latent) = 0.7 x 450 x (130 – 72) = 17,748 Btuh

Table 27 — Peak Dew Point, Temperature Summary

TEMPERATURE SUMMARY	DRY BULB	WET BULB
Outside-Air Temperature	83 F	77 F
Space Temperature	75 F	62.5 F
Entering-Air Temperature	77 F	66.7 F

The total capacity required of the rooftop unit including all sensible and latent room and outdoor loads is:

25,000 + 6,150 + 3,888 + 17,748 = 52,786 Btuh

Including total sensible capacity:

25,000 + 3,888 = 28,888 Btuh

Total latent capacity:

6,150 + 17,748 = 23,898 Btuh

Based on this information, evaluate the required rooftop performance. At the peak dew point conditions, the SHR and associated supply air temperature requirements are:

SHR (Peak Dew Point) = 25,000/31,150 = 0.80

25,000 Btuh = 1.08 x 1,600 cfm x (75 F – T)

Supply-Air Temperature = 60 F

Due to the change in outdoor conditions, the indoor proportion of sensible and latent heat removal has changed along with the associated supply air temperature. In order to satisfy lower sensible load and same latent load of the room, a supply-air temperature of 60 F is required.

At this part load condition, consider the performance of the 48/50HJ006 rooftop unit with the Humidi-MiZer™ adaptive dehumidification system to assess overall unit performance as was done for the dehumidification system. Table 28 provides a comparison for the peak dew point classroom requirements and the associated rooftop performance without the Humidi-MiZer adaptive dehumidification system.

Table 28 — Peak Dew Point Operation Summary, Rooftop Unit without the Humidi-MiZer™ Adaptive Dehumidification System

48/50HJ006	CLASSROOM REQUIREMENTS (Computer Simulation)	ROOFTOP PERFORMANCE (ECAT)
Total Capacity	52,786 Btuh	61,290 Btuh
Outdoor Sensible	3,888 Btuh	—
Outdoor Latent	17,748 Btuh	—
Sensible Capacity	—	38,040 Btuh
Latent Capacity	—	23,250 Btuh
Room Sensible	25,000 Btuh	**34,152 Btuh**
Room Latent	6,150 Btuh	5,502 Btuh
Supply Air	60 F	**55.3 F**
SHR	0.80	**0.86**

LEGEND

DB — Dry Bulb
ECAT — Carrier Electronic Catalog Program
SHR — Sensible Heat Ratio
WB — Wet Bulb

NOTES:
1. Data provided in terms of gross capacities.
2. Peak Dew Point Condition = 83 F DB/77 F WB.
3. Data in **bold** indicates unit is overcooling the space.

At the provided dew point conditions, discharge from the rooftop is 55 F, which is nearly the same as it was for peak dry bulb conditions (it is slightly lower since entering conditions to the evaporator are lower). However, based on this supply-air temperature, the rooftop unit may over-cool the space and/or cycle on and off to try to accommodate the lower sensible load requirement. The bold rooftop performance is demonstrated in Table 28 where the available capacity for sensible room loads is roughly 36% more than is required under this part load condition. The standard rooftop unit may then over-cool the temperature in the classroom by providing 55 F supply air due to a higher concentration of latent to sensible load.

In response to these conditions, a rooftop unit equipped with the Humidi-MiZer™ adaptive dehumidification system is the ideal solution to maintain the appropriate supply air temperature to satisfy the higher latent to sensible load ratio in the space at this part load condition. Under this condition, the rooftop would operate in subcooling mode to maintain space conditions. The performance from the rooftop in subcooling mode is outlined in Table 29 for peak dew point part load classroom requirements.

As shown in Table 29, the sensible capacity for the rooftop is slightly lower, and the supply-air temperature is 60 F. In subcooling mode the rooftop will be able to accommodate the change in sensible load and provide the appropriate supply-air temperature to maintain space conditions. Closely matching the sensible load to maintain indoor temperature conditions will allow the unit to properly maintain indoor humidity levels without occupants attempting to lower the thermostat set point, over-cooling the space, and wasting energy. The rooftop with the Humidi-MiZer system will respond to both the room thermostat and humidity-sensing device to attempt to maintain the space set points (75 F, 50% rh). In relation to the peak dew point condition, this means that both the room temperature and humidity may be above the set points, resulting in the unit to operate in subcooling mode. Therefore, with the subcooling mode initiated by the space temperature and humidity sensing device(s), the typical fixed envelope of operation for the rooftop adapts to maintain the space comfort.

Table 29 — Peak Dew Point Operation Summary, Rooftop Unit with the Humidi-MiZer Adaptive Dehumidification System in Subcooling Mode

48/50HJ006	CLASSROOM REQUIREMENTS (Computer Simulation)	SUBCOOLING ROOFTOP PERFORMANCE (ECAT)
Total Capacity	52,786 Btuh	56,750 Btuh
Outdoor Sensible	3,888 Btuh	—
Outdoor Latent	17,748 Btuh	—
Sensible Capacity	—	28,860 Btuh
Latent Capacity	—	27,890 Btuh
Room Sensible	25,000 Btuh	24,972 Btuh
Room Latent	6,150 Btuh	10,142 Btuh
Supply Air	60 F	60.6 F
SHR	0.80	0.71

LEGEND

DB — Dry Bulb
ECAT — Carrier Electronic Catalog Program
SHR — Sensible Heat Ratio
WB — Wet Bulb

NOTES:
1. Data provided in terms of gross capacities.
2. Outdoor Peak Dew Point Condition = 83 F DB/77 F WB.

Overall, the rooftop under peak dew point part load condition is able to adapt to the higher latent to sensible load ratio, which is not possible for a normal rooftop without the Humidi-MiZer adaptive dehumidification system. Rooftop units without the Humidi-MiZer system are not able to adapt, which leads to needless energy waste.

Extremely High Humidity — Even though peak dew point information is provided by ASHRAE, this may not be the worst-case condition for analyzing indoor humidity control. Such a condition may exist on a rainy day when the outdoor air temperature is somewhat moderate. Consider a rainy day in Houston with outdoor conditions of 72 F db and 70 F wb. These conditions typically require latent heat removal alone. For our example, the sensible load is reduced to **5,000 Btuh** and the room latent load again remains the same at **6,150 Btuh**. The mixed air condition entering the rooftop evaporator coil is now 74 F db and 64.4 F wb. See Table 30 for extremely high humidity temperature summaries. At these conditions the outdoor air loads are:

OA (sensible) = 1.08 x 450 x (72 – 75) = – 1458 (negative value indicates outdoor air is being heated)

OA (latent) = 0.7 x 450 x (108 – 72) = 11,016 Btuh

The total room load is **5,000 + 6150 = 11,150 Btuh**

The total capacity required of the rooftop unit including all sensible and latent room and outdoor loads is:

5,000 + 6,150 + (–1,458) + 11,016 = 20,708 Btuh

At this condition, the SHR and associated supply-air temperature requirement are:

SHR (High Humidity) = 5,000/11,150 = 0.45

5,000 Btuh = 1.08 x 1,600 cfm x (75 F – T)

Supply-Air Temperature = 72.1 F

Table 30 — Extremely High Humidity, Temperature Summary

TEMPERATURE SUMMARY	DRY BULB	WET BULB
Outside-Air Temperature	72 F	70 F
Space Temperature	75 F	62.5 F
Entering-Air Temperature	74 F	64.4 F

The supply-air temperature from the unit under normal operation and subcooling mode will be too low to accommodate this requirement. In this circumstance, the temperature in the space is potentially satisfied, however, sole humidity control may be required. As the humidity increases above the space humidity set point, this will initiate the hot gas reheat mode of operation for the rooftop unit equipped with the Humidi-MiZer adaptive dehumidification system. See Table 31 for hot gas reheat mode performance. For this type of part load condition, evaluate the latent load requirements and associated equipment performance to determine whether the unit can maintain the appropriate supply-air temperature and latent capacity to control humidity without affecting the indoor temperature.

Table 31 — Extremely High Humidity Operation Summary, Humid Day Performance, Rooftop Unit with the Humidi-MiZer Adaptive Dehumidification System in Hot Gas Reheat Mode

48/50HJ006	CLASSROOM REQUIREMENTS (Computer Simulation)	REHEAT ROOFTOP PERFORMANCE (ECAT)
Outdoor Latent	—	11,016 Btuh
Latent Capacity	—	19,610 Btuh
Room Latent	6,150 Btuh	8,594 Btuh
Supply Air	72.1 F	75.3 F
SHR	0.57	0.1

LEGEND

ECAT — Carrier Electronic Catalog Program
SHR — Sensible Heat Ratio

NOTES:
1. Data provided in terms of gross capacities.
2. Outdoor Extremely High Humidity = 72 F DB/70 F WB.

As shown in Table 31, the supply-air temperature is 75 F, providing neutral air to the space for latent heat removal. The unit will operate and has sufficient capability to provide humidity control in the space as required. Once the humidity in the space is satisfied, the unit will operate in subcooling or normal mode to maintain space conditions. In other words, to satisfy this part load condition, the rooftop unit without the Humidi-MiZer™ adaptive dehumidification system may not be able to properly dehumidify the space. However, with the hot gas reheat mode initiated, the rooftop unit with the Humidi-MiZer adaptive dehumidification system feature has substantial latent capacity potential for handling the need for sole humidity control in the space.

Overall, this design example fully illustrates the benefits of utilizing the Humidi-MiZer adaptive dehumidification system under all peak and part load conditions for maintaining comfort levels in the space. The rooftop unit performance is expanded depending on the mode of operation required for space conditioning, to provide maximum part load flexibility and dehumidification capacity when required. The benefit is better part load operation to provide more efficient energy utilization, and a better degree of space temperature and humidity control to keep occupants comfortable in the space year round. On Weathermaster® 48/50HJ units with two compressors (sizes 008-014) even further part load capabilities exist. Depending on the conditions required to maintain the space set points, one or both compressors could operate in subcooling mode, one compressor could operate in subcooling mode, while the other operates in hot gas reheat mode, or one or both compressors can operate in hot gas reheat mode.

Economizer Usage — Special consideration should be given when selecting an economizer changeover strategy for use with the Humidi-MiZer adaptive dehumidification system. Any economizer control strategy can be employed including:

- dry bulb
- differential dry bulb
- enthalpy
- differential enthalpy

However, based on the application involved and the humidity requirements for the space, it may be more desirable to utilize either enthalpy or differential enthalpy economizer changeover. Using either one of these two strategies minimizes the potential for an increase in space humidity, since enthalpy changeover reduces the possibility of bringing in more humid air for free cooling. Minimizing the introduction of more humid air for free cooling will further streamline rooftop operation, since humidity levels will not increase in the space. Since the goal of implementing the Humidi-MiZer adaptive dehumidification system is to maintain space conditions due to increasing proportions of humidity, utilizing a changeover strategy such as dry bulb may work against this design goal. Dry bulb economizer changeover utilizes outdoor air for free cooling without considering the moisture content of the outdoor air. If dry bulb changeover is utilized, a low enough changeover point should be selected to avoid bringing in moisture-laden outdoor air. Ultimately, the economizer strategy utilized is outlined in ASHRAE Standard 90.1, where the changeover strategy employed may be limited based on the climate where the rooftop is installed.

COBRA™ Energy Recovery Units — In the design example the rooftop unit was sufficient to condition the outdoor air and maintain space conditions. Carrier's COBRA energy recovery unit may be beneficial if the need to bring in higher amounts of outdoor air is required. This is a factory-installed energy recovery unit that can be provided with a Weathermaster® 48/50HJ rooftop unit with the Humidi-MiZer adaptive dehumidification system. Carrier's COBRA energy recovery unit pre-conditions ventilation air by recovering energy from the building exhaust air during both summer and winter operation. The energy recovery module (also designated by the Energy$Recycler™ 62AQ model nomenclature for field installation) incorporates an independent heat pump circuit to transfer energy between the outdoor air supply and return air streams. The outdoor air is then pre-conditioned and introduced to the rooftop unit. This pre-conditioned air decreases the load and associated size for the rooftop unit, allowing more flexibility to provide part load space conditioning, while bringing in higher quantities of outdoor air. Further equipment part load operation is realized since the heat pump energy recovery section can operate independently to provide an additional step of either cooling or heating capacity. To illustrate the additional flexibility and outdoor air conditioning possible with a COBRA unit utilized with the Humidi-MiZer adaptive dehumidification system, consider the following example:

A COBRA energy recovery unit would make it possible to:

- Select a smaller 4-ton 48/50HJ rooftop to operate with the same total airflow to satisfy the same conditions.
- Pre-condition the same or larger quantities of outdoor air depending on the application and climate.
- Provide an additional stage of capacity for both cooling and heating mode for enhanced part load performance.

In the previous example the following design changes would be made to accommodate more people. The occupancy would be increased from 30 to 35 people, increasing the required ventilation to 525 cfm (35 x 15 cfm/person).

A COBRA energy recovery unit is sized to accommodate and pre-treat the outdoor air to the rooftop unit. The COBRA unit brings in 600 cfm of outdoor air and pretreats it. Using the peak dry bulb information from the example (94 F db/ 77 wb F), the pre-treated outdoor air is mixed with the portion of the return air that is not used for energy recovery, resulting in a 75 F db/ 63 F wb mixed air condition entering the rooftop evaporator coil.

The outdoor and total equipment capacity requirements are as follows:

OA (sensible) = 1.08 x 570 x (94 – 75)= 10,882 Btuh

OA (latent) = 0.7 x 570 x (111 – 72) = 13,923 Btuh

Notice that these outdoor air loads are higher than was previously calculated in the example using 30 people. See Table 32 for Peak db with COBRA unit temperature summary. In addition, the indoor latent load will increase as follows:

35 x 205 Btuh/person = 7,175 Btuh

Table 32 — Peak Dry Bulb with COBRA Unit, Temperature Summary

TEMPERATURE SUMMARY	DRY BULB	WET BULB
Outside-Air Temperature	94 F	77 F
Space Temperature	75 F	62.5 F
Entering-Air Temperature	75 F	63 F

The total capacity required of the rooftop unit including all sensible and latent room and outdoor loads is:

33,000 + 7,175 + 10,882 + 13,923 = 64,980 Btuh.

Table 33 outlines the performance of the smaller (4 ton) 48/50HJ005 unit in combination with a COBRA energy recovery unit.

Overall, the combined unit capacities and supply-air temperature closely match the conditions for the room loads to maintain space conditions. In addition, the combined system was able to condition more outdoor air. Since the energy recovery unit consists of a heat pump that can operate as the first stage of heating or cooling, additional system flexibility is provided utilizing a smaller size rooftop unit.

Table 33 — Peak Dry Bulb Operation Summary, 48/50HJ005 with COBRA™ Energy Recovery Unit

48/50HJ005	CLASSROOM REQUIREMENTS (Computer Simulation)	COBRA UNIT PERFORMANCE (ECAT)
Total Capacity	64,980 Btuh	62,920 Btuh
Outdoor Sensible	10,882 Btuh	—
Outdoor Latent	13,923 Btuh	—
Sensible Capacity	—	40,380 Btuh
Latent Capacity	—	22,540 Btuh
Room Sensible	33,000 Btuh	29,498 Btuh
Room Latent	7,175 Btuh	8,617 Btuh
Supply Air	56 F	58.3 F
SHR	0.84	0.77

LEGEND

DB — Dry Bulb
ECAT — Carrier's Electronic Catalog Program
SHR — Sensible Heat Ratio
WB — Wet Bulb

NOTES:
1. Data provided in terms of gross capacities.
2. Outdoor Peak Dry Bulb Condition = 94 F DB/77 F WB.

This provides the operation of the unit at the peak dry bulb condition. The Humidi-MiZer™ adaptive dehumidification system could be provided with the COBRA energy recovery unit to help accommodate peak dew point and extremely high humid conditions and would yield similar performance to satisfy space conditions using subcooling mode and hot gas reheat mode, respectively.

Sequence of Operation — The response of the Humidi-MiZer adaptive dehumidification system to varying space conditions is extremely dynamic. The 48/50HJ rooftop unit equipped with the Humidi-MiZer system with or without a COBRA energy recovery unit will respond based on the temperature and humidity requirements as sensed in the space. Either a Carrier Thermidistat™ device (combined temperature and humidity sensing capability) or separate thermostat and humidistat can be used with the Humidi-MiZer system. The same is true for installations that include a COBRA energy recovery unit. In order to summarize the sequence of operation for 48/50HJ units with the Humidi-MiZer system, Tables 34A-35B outline the sequence of operation with and without COBRA energy recovery.

Cooling, Rooftop with Humidi-MiZer Adaptive Dehumidification System — When the humidity in the space is below or at the humidistat or Thermidistat device set point, the rooftop unit will operate under the normal sequence of operation. However, when the humidity is above the set point, either subcooling mode or hot gas reheat mode will be initiated depending on the temperature condition in the space.

For rooftop sizes 004 to 007 (single-compressor units), if the humidity in the space is above the sensor set point and there is no temperature demand, hot gas reheat mode will operate for the single circuit. When there is a demand to control both temperature and humidity in the space, subcooling mode will operate for the single circuit. The only exception is when the outdoor-air temperature is below the economizer set point. If this situation occurs, and there is a first stage demand for temperature (Y1 call from the thermostat), then the hot gas reheat mode will operate. If the opposite occurs (outdoor air above economizer set point) and there is a Y1 demand from the space, subcooling operation will operate.

For rooftop sizes 008 to 014 (two compressor units), if the humidity in the space is above the sensor set point and there is no temperature demand, hot gas reheat mode will operate for both circuits. When there is a demand to control both temperature and humidity in the space, subcooling mode will operate for one circuit and hot gas reheat for the second circuit. When there is a demand for both first stage and second stage cooling and the humidity level is above the set point, then both circuits will operate in subcooling mode. The only exception is when the outdoor air temperature is below the economizer set point. If this situation occurs, and there is a first stage demand for temperature (Y1 call from the thermostat), then the hot gas reheat mode will operate for both circuits. If the opposite situation occurs (outdoor air above economizer set point) and there is a Y1 demand from the space, subcooling operation will operate for one circuit and hot gas reheat for the other.

Heating, Rooftop with the Humidi-MiZer Adaptive Dehumidification System — If there is a thermostat call from the space for heating, all dehumidification (both subcooling mode and hot gas reheat mode) will not operate.

Cooling, Rooftop with Humidi-MiZer Adaptive Dehumidification System and COBRA Energy Recovery Unit — A COBRA unit consists of a factory-installed Energy$Recycler™ unit to a 48/50HJ Weathermaster® rooftop unit. The cooling changeover thermostat located on the Energy$Recycler hood determines when the Energy$Recycler unit switches into economizer mode. When the outdoor temperature is below the cooling set point the unit will be in economizer mode.

UNOCCUPIED MODE — In the unoccupied mode, fans are normally set for AUTO operation, causing the fans to cycle on only as needed for heating or cooling. If the Thermidistat device is set for AUTO fan, the rooftop unit fan will be off except when cooling or humidity control is required. The Energy$Recycler fans will be off except when unit is running in the economizer mode. If the Thermidistat device is set for ON fan, the Energy$Recycler and rooftop unit fans will run continuously. If the outdoor air is below the outdoor air thermostat set point, the compressors are locked off and the unit operates in economizer mode when cooling is required. If outdoor air is unsuitable due to humidity or quality, the Energy$Recycler unit is off and only the rooftop unit compressor runs when cooling is required. See Table 34A.

NOTE: The Energy$Recycler unit does not run and dampers are closed when the outdoor air is unsuitable for cooling and the mode is unoccupied.

If the outdoor air is suitable, first stage cooling is through the Energy$Recycler in economizer mode and all compressors are off. Second stage cooling adds the Energy$Recycler compressor and roof top unit compressor no. 1.

OCCUPIED MODE — In occupied mode, when the Energy$Recycler compressor runs in cooling mode, it is extracting heat from the incoming outdoor air and rejecting heat to the exhaust air. The Energy$Recycler and rooftop unit fans run continuously. On a first stage call, all compressors will be off if the outdoor air is suitable for free cooling. Otherwise, the Energy$Recycler compressor and rooftop unit compressor no. 1 will run whenever there is a first stage demand for cooling. On a second stage call, the Energy$Recycler compressor and rooftop unit compressor no. 1 and 2 will run whenever there is a demand for cooling. If there is a demand for humidity control but not cooling, only the Energy$Recycler compressor will run. If there is a field-installed CO_2 sensor and the levels are below that sensor set point, the unit will operate in the unoccupied mode sequence. (Energy$Recycler dampers close and rooftop unit operates only to maintain space conditions). See Table 35.

In addition to the COBRA unit operational sequence, when the unit has a subcooling/reheat dehumidification coil that coil will activate in subcooling mode whenever there is a demand for both indoor temperature and humidity control and at least one rooftop unit compressor is running. Hot gas reheat mode will operate whenever there is a demand to control humidity only with at least one compressor running.

Table 34A — Humidi-MiZer™ Adaptive Dehumidification System Sequence of Operation and System Response — Single Compressor Units (48/50HJ004-007)

THERMOSTAT INPUT			ECONOMIZER FUNCTION		48/50HJ UNIT OPERATION		
H	Y1	Y2	OAT. < Economizer Set Point	Economizer	Comp. 1	Subcooling Mode	Hot Gas Reheat Mode
Off	—	—	Normal Operation				
On	On	On	No	Off	On	Yes	No
On	On	Off	No	Off	On	Yes	No
On	On	On	Yes	On	On	Yes	No
On	On	Off	Yes	On	On	No	Yes
On	Off	Off	No	Off	On	No	Yes

LEGEND

OAT — Outdoor Air Temperature

Table 34B — Humidi-MiZer Adaptive Dehumidification System Sequence of Operation and System Response — Dual Compressor Units (48/50HJ008-014)

THERMOSTAT INPUT			ECONOMIZER FUNCTION		48/50HJ UNIT OPERATION					
					First Stage			Second Stage		
H	Y1	Y2	OAT. < Economizer Set Point	Economizer	Comp. 1	Subcooling Mode	Hot Gas Reheat Mode	Comp. 2	Subcooling Mode	Hot Gas Reheat Mode
Off			Unit Operates Under Normal Sequence of Operation							
On	On	On	No	Off	On	Yes	No	On	Yes	No
On	On	Off	No	Off	On	Yes	No	On	No	Yes
On	On	On	Yes	On	On	Yes	No	On	No	Yes
On	On	Off	Yes	On	On	No	Yes	On	No	Yes
On	Off	Off	No	Off	On	No	Yes	On	No	Yes

LEGEND

OAT — Outdoor Air Temperature

Table 35A — Humidi-MiZer Adaptive Dehumidification System Rooftop with COBRA™ Energy Recovery Unit Sequence of Operation — Unoccupied

UNOCCUPIED						
COOLING	**E$R Compressor**	**E$R Fans**	**RTU Compressor 1**	**RTU Compressor 2**	**RTU Fans**	**RTU Heat**
Indoor Temperature Above Y2						
Humidity Low & OAT Low	On	On (cyc.)	On without SC	Off	On (cyc.)	Off
Humidity Low & OAT High	Off	Off	On without SC	On without SC	On (cyc.)	Off
Humidity High & OAT Low	Off	Off	On with SC	On with SC	On (cyc.)	Off
Humidity High & OAT High	Off	Off	On with SC	On with SC	On (cyc.)	Off
Indoor Temperature Between Y1 & Y2						
Humidity Low & OAT Low	Off	On (cyc.)	Off	Off	On (cyc.)	Off
Humidity Low & OAT High	Off	Off	On without SC	Off	On (cyc.)	Off
Humidity High & OAT Low	Off	Off	On with SC	On with HGRH	On (cyc.)	Off
Humidity High & OAT High	Off	Off	On with SC	On with HGRH	On (cyc.)	Off
Indoor Temperature Below Y1						
Humidity Low	Off	Off	Off	Off	Off	Off
Humidity High	Off	Off	On with HGRH	On with HGRH	On (cyc.)	Off
NOTE: OAT < 55 F all compression off						
HEATING	**E$R Compressor**	**E$R Fans**	**RTU Compressor 1**	**RTU Compressor 2**	**RTU Fans**	**RTU Heat**
Indoor Temperature Above W1	Off	Off	Off	Off	Off	Off
Indoor Temperature Between W1 & W2	Off	Off	Off	Off	On (cyc.)	On, 50%
Indoor Temperature Below W2	Off	Off	Off	Off	On (cyc.)	On, 100%

LEGEND

E$R — Energy$Recycler™ Unit
HGRH — Hot Gas Reheat
OAT — Outdoor Air Temperature
RTU — Rooftop Unit
SC — Subcooling

Table 35B — Humidi-MiZer Adaptive Dehumidification System Rooftop with COBRA Energy Recovery Unit Sequence of Operation — Occupied

OCCUPIED						
COOLING	**E$R Compressor**	**E$R Fans**	**RTU Compressor 1**	**RTU Compressor 2**	**RTU Fans**	**RTU Heat**
Indoor Temperature Above Y2						
Humidity Low & OAT Low	On	On	On without SC	Off	On	Off
Humidity Low & OAT High	On	On	On without SC	On without SC	On	Off
Humidity High & OAT Low	On	On	On with SC	On with SC	On	Off
Humidity High & OAT High	On	On	On with SC	On with SC	On	Off
Indoor Temperature Between Y1 & Y2						
Humidity Low & OAT Low	Off	On	Off	Off	On	Off
Humidity Low & OAT High	On	On	On without SC	Off	On	Off
Humidity High & OAT Low	On	On	On with SC	On with HGRH	On	Off
Humidity High & OAT High	On	On	On with SC	On with HGRH	On	Off
Indoor Temperature Below Y1						
Humidity Low	Off	On	Off	Off	On	Off
Humidity High	On	On	On with HGRH	On with HGRH	On	Off
NOTE: OAT < 55 F all compression off						
HEATING	**E$R Compressor**	**E$R Fans**	**RTU Compressor 1**	**RTU Compressor 2**	**RTU Fans**	**RTU Heat**
Indoor Temperature Above W1	Off	On	Off	Off	On	Off
Indoor Temperature Between W1 & W2						
OAT >Set Pt (30 F)	On	On	Off	Off	On	Off
OAT <Set Pt (30 F)	On	On	Off	Off	On	On, 50%
Indoor Temperature Below W2						
OAT >Set Pt (30 F)	On	On	Off	Off	On	On, 50%
OAT <Set Pt (30 F)	On	On	Off	Off	On	On, 100%

LEGEND

E$R — Energy$Recycler Unit
HGRH — Hot Gas Reheat
OAT — Outdoor Air Temperature
RTU — Rooftop Unit
SC — Subcooling

Heating, Rooftop with Humidi-MiZer™ Adaptive Dehumidification System and COBRA™ Energy Recovery Unit — The heating changeover thermostat located on the Energy$Recycler™ hood determines the stage 1 to stage 2 switchover point in heating mode.

UNOCCUPIED MODE — In unoccupied mode, the Energy$Recycler unit is off and all compressors are locked off. First stage heat is roof top unit heat at 50%. Second stage heat is rooftop unit heat at 100%.

OCCUPIED MODE — In occupied mode, when the Energy$Recycler compressor runs in heat mode it extracts heat from the exhaust air and rejects heat to the incoming outdoor air, returning energy to the building that otherwise would be wasted. The Energy$Recycler and rooftop unit fans run continuously. Rooftop unit compressors are always off. On a first stage call, the Energy$Recycler compressor is on in heat mode. Rooftop unit heat is off if the outdoor air is above the set point. Rooftop unit heat is on at 50% if the outdoor air is below the set point. On a second stage call, the Energy$Recycler compressor is on in heat mode. Rooftop unit heat is on at 50% if the outdoor air is above the set point. Rooftop unit heat is on at 100% if the outdoor air is below the set point.

NOTE: If there is a thermostat call from the space for heating, all dehumidification (both subcooling mode and hot gas reheat mode) will not operate.

SYSTEM SPECIFICATIONS

1. The Humidi-MiZer dehumidification system shall be factory-installed in the Weathermaster® 48/50HJ004-014 rooftop units, and shall provide greater dehumidification of the occupied space by two modes of dehumidification operations beside its normal design cooling mode:
   A. Subcooling mode further subcools the hot liquid refrigerant leaving the condenser coil when both temperature and humidity in the space are not satisfied.
   B. Hot gas reheat mode shall mix a portion of the hot gas from the discharge of the compressor with the hot liquid refrigerant leaving the condenser coil to create a two-phase heat transfer in the system, resulting in a neutral leaving-air temperature when only humidity in the space is not satisfied.
2. The system shall consist of a subcooling/reheat dehumidification coil located downstream of the standard evaporator coil. This dehumidification coil is a two-row coil with the exception of the 004 unit, which has a one-row coil.
3. The system shall include belly band heater(s) for the scroll compressor(s).
4. The system shall include a low outdoor air temperature switch to lock out both subcooling and hot gas reheat mode when the outdoor-air temperature is below 40 F.
5. The system shall include a Motormaster® low ambient control to ensure the normal design cooling mode capable of down to 0° F low ambient operation.
6. The system shall include a low-pressure switch on the suction line to ensure low pressure start-up of hot gas reheat mode at lower outdoor temperature condition.
7. The system operation may be controlled by a field-installed, wall-mounted humidistat. The dehumidification circuit will then operate only when needed. Field connections for the humidistat are made in the low-voltage compartment of the unit control box. The sensor can be set for any level between 55% and 80% relative humidity.
8. The system shall include a Thermal Expansion Valve (TXV) to ensure a positive superheat condition and a balance of pressure drop.
9. For units with two compressors (sizes 008-014), depending on the conditions required to maintain the space set points, one or both compressors can operate in subcooling mode, one compressor could operate in subcooling mode while the other operates in hot gas reheat mode, or one or both compressors can operate in hot gas reheat mode.

CONTROL WIRING APPLICATIONS

No matter which controls or accessories are provided with Weathermaster 48/50HJ units with the Humidi-MiZer system, field control wiring is simple. This section outlines the necessary field control wiring diagrams for using the Humidi-MiZer system with standard units, PremierLink™ controls, and COBRA units.

Standard Unit — For units that have the standard controls and the Humidi-MiZer system, either a Carrier Thermidistat™ device or separate thermostat and humidistat can be utilized. When using a Thermidistat device a separate field-installed relay is required (part number HNb1KK324). In either case, when the Humidi-MiZer system is included, control wires are provided in the rooftop control box at the factory for connection of both devices. See Fig. 11 and 12.

PremierLink Units — For 48/50HJ units that are equipped with Carrier Premierlink DDC controls, a field-installed space temperature sensor is required for connection to PremierLink control. In addition, a space humidistat is required for connection to the rooftop unit as illustrated in Fig. 12 and 13.

COBRA™ Units — When a COBRA unit is provided with or without the Humidi-MiZer system, both a temperature and humidity-sensing device are required for the unit to function properly. It is recommended that a Carrier Thermidistat be used for COBRA units with the standard rooftop electro-mechanical controls. When a rooftop unit is provided with both COBRA unit and PremierLink DDC controls, both a temperature sensor is required for connection to PremierLink control and a separate humidistat is required for connection to the rooftop unit terminals. See Fig. 13 and 14 for the field wiring diagrams that employ COBRA with the standard controls and PremierLink controls.

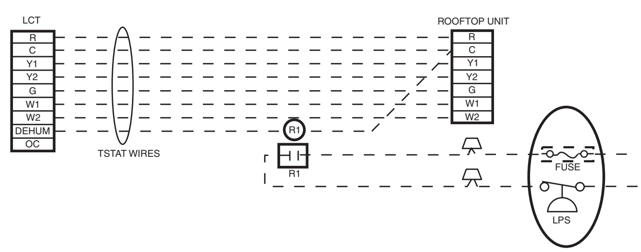


Fig. 11 — Carrier Thermidistat Field Control Wiring, Standard Controls

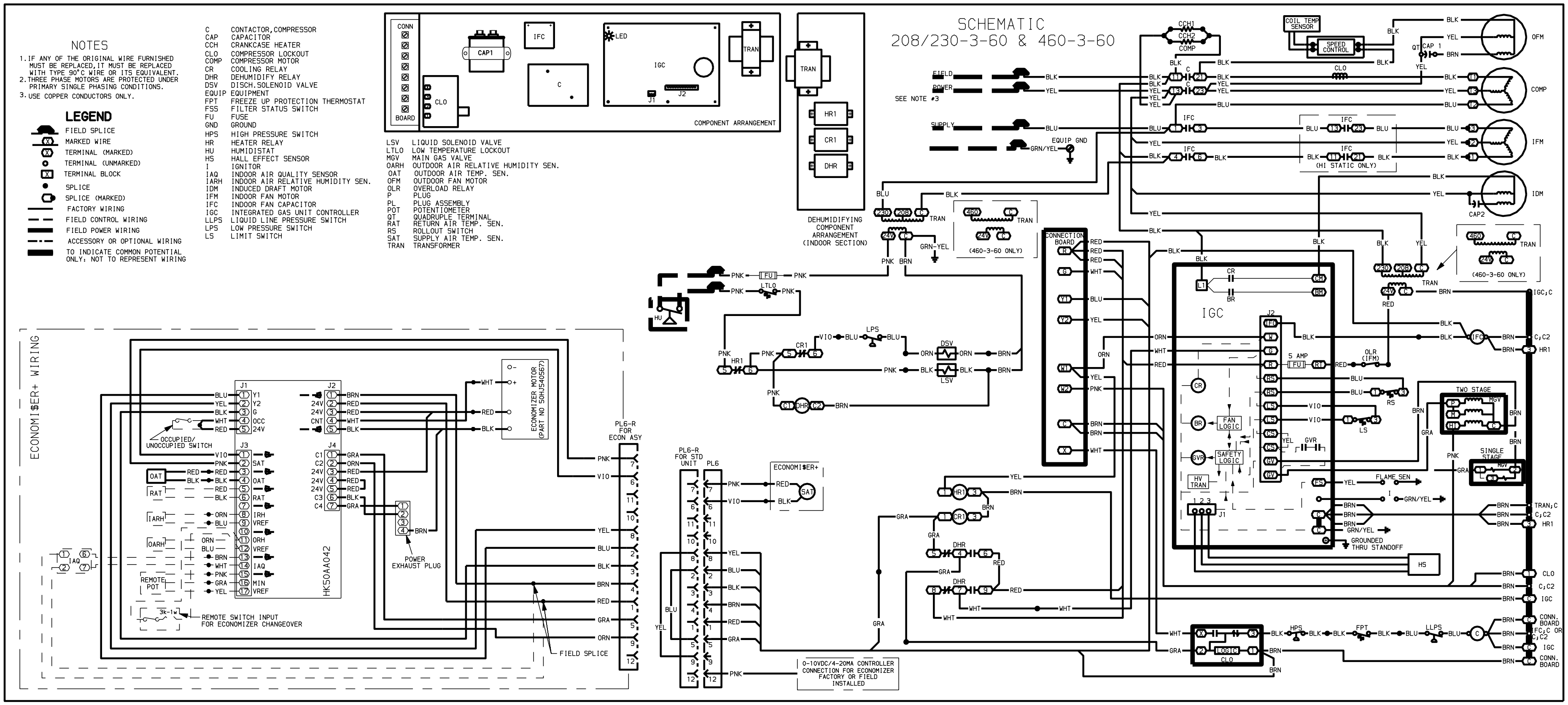
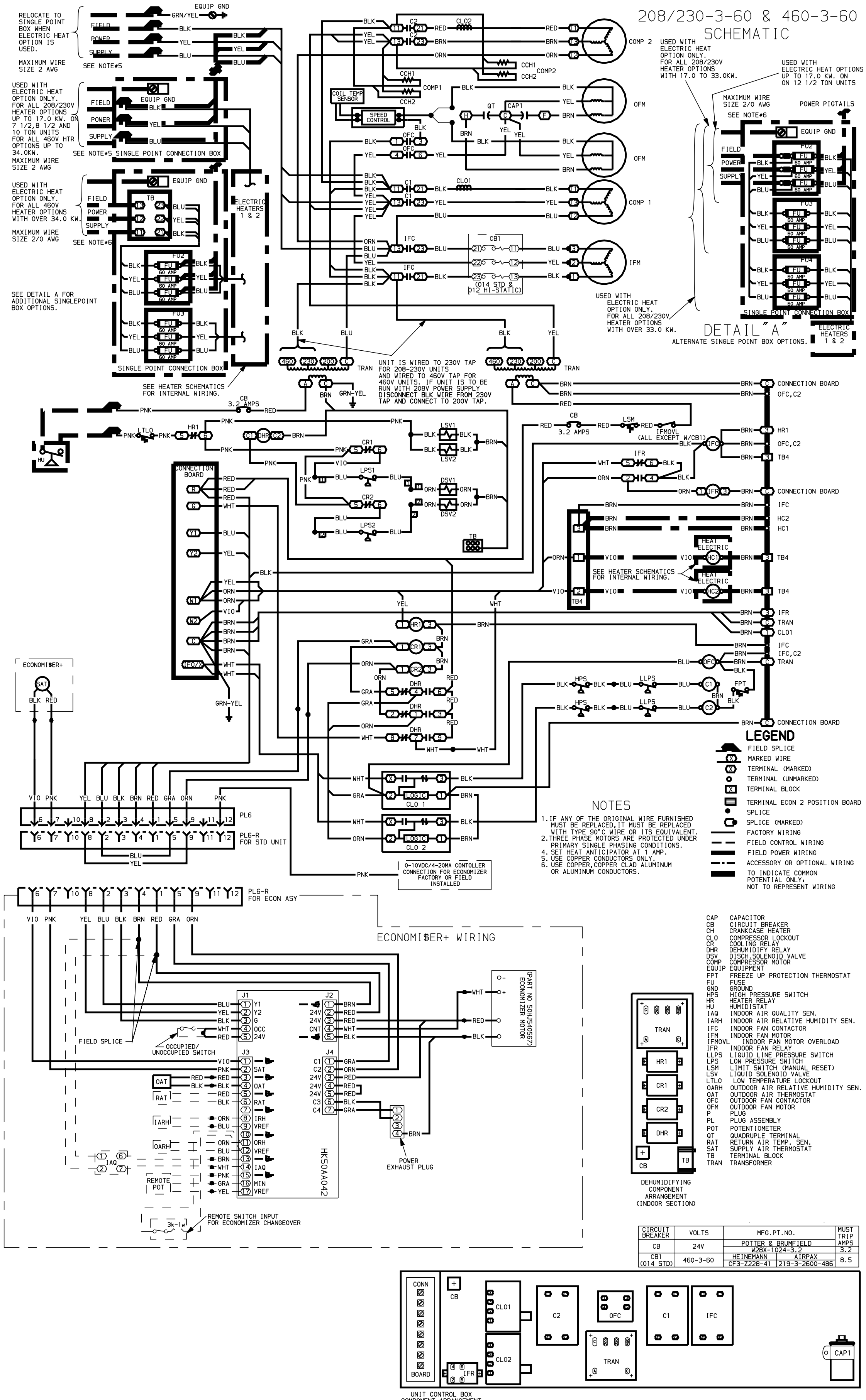


Fig. 12 — Typical Field Control Wiring 48/50HJ004-007 (Single-Compressor Units)



→ **Fig. 13 — Typical Field Control Wiring 48/50HJ008-014**

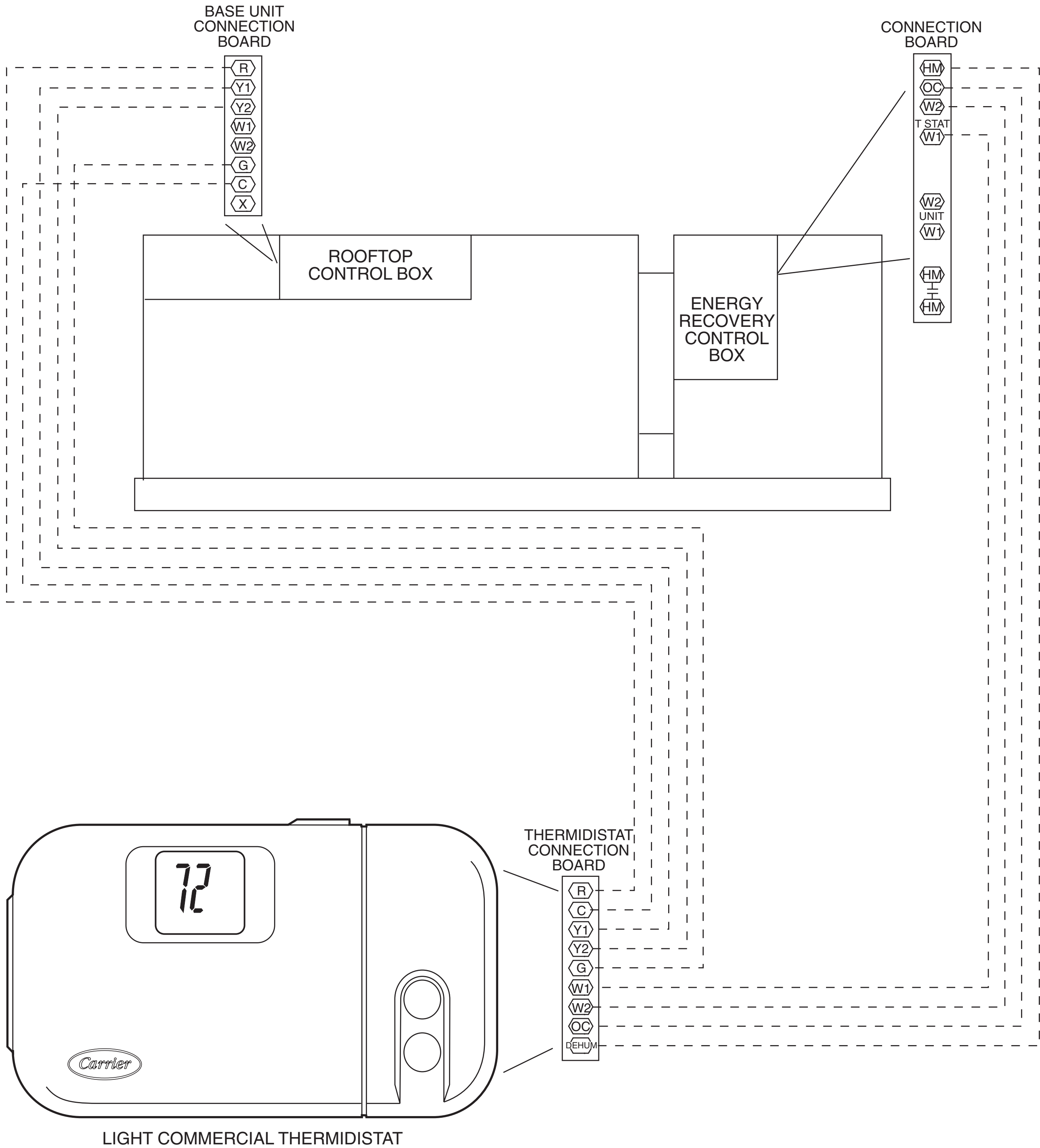


Fig. 14 — Carrier Thermidistat™ Field Control Wiring, COBRA™ Rooftop Unit and Standard Controls

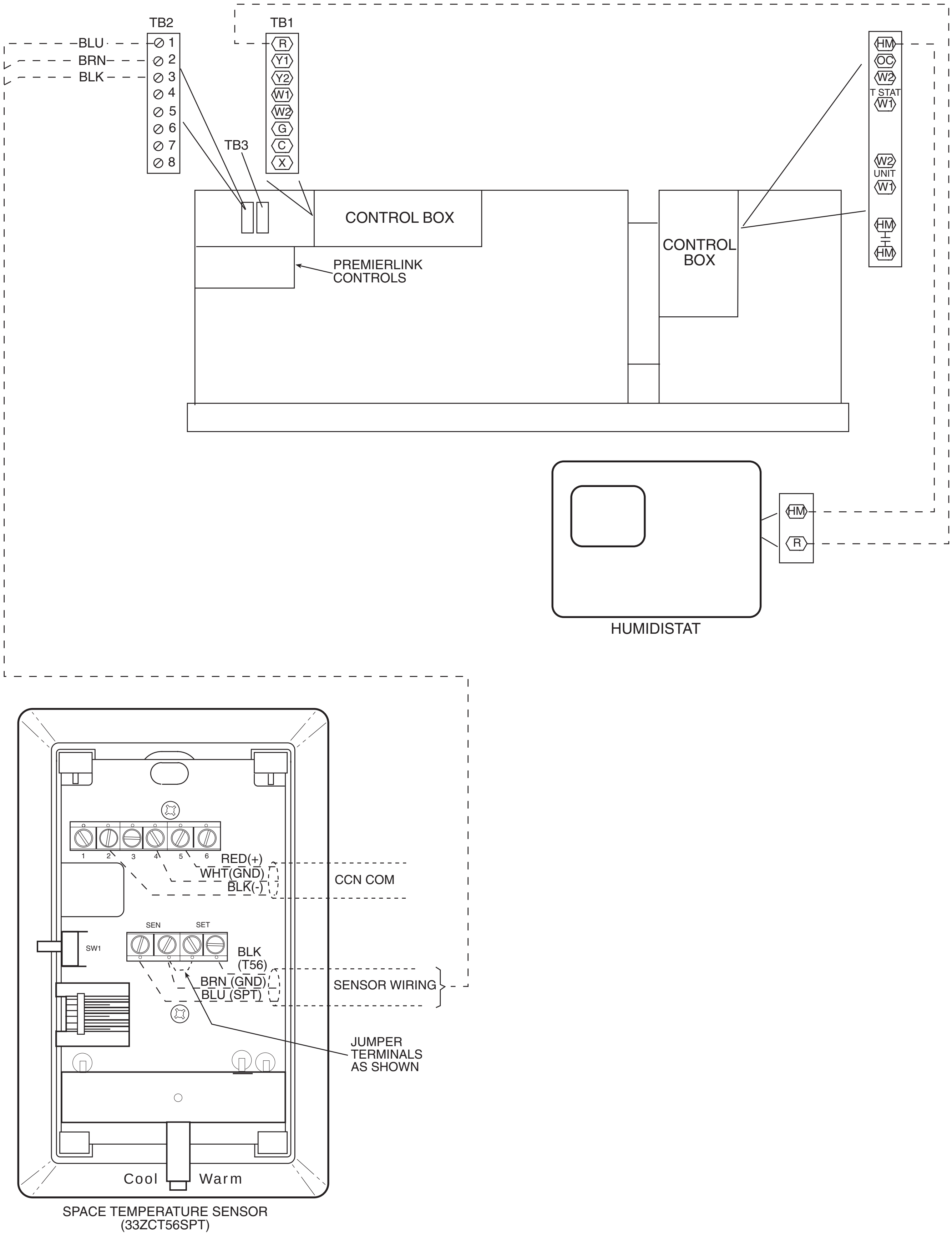


Fig. 15 — Carrier Humidistat Field Control Wiring, COBRA™ Rooftop Unit and Factory-Installed Controls

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