

## Evaporator Condenser Ratings

An evaporator condenser rated at a condensing temperature of 100°F and a wet bulb temperature of 70°F will have rating factors under other conditions as follows:

Condenser Temp. °F	Entering Air Wet Bulb Temp. °F					
	55°	60°	65°	70°	75°	78°
90	0.98	0.88	0.75	0.58	0.32	0.43
95	1.00	1.00	0.91	0.80	0.67	0.59
100	1.02	1.02	1.11	1.00	0.87	0.79
105	1.05	1.05	1.16	1.05	1.00	1.00
110	1.10	1.02	1.15	1.10	1.10	1.12
115	1.08	1.05	1.15	1.15	1.24	1.47
120	1.20	1.13	1.00	1.00	1.00	1.15

## Compressor Capacity vs Refrigerant

Refrigerant Temp. °F	Heat Rejection Ratio (40)	Capacity % Based on:			
		50°F	40°F	30°F	20°F
50	1.16	100			
40	1.18	95	100		
30	1.21	85	85	100	
20	1.25	75	67		100
10	1.30	65	54	30	
0	1.45	35	45	64	100
-10	1.53	28	34	50	78
-20	1.64	23	26	38	61
-30	1.77	15	18	27	42
-40	1.92	10	12	18	28

††† For sealed compressors.

The capacity of a typical compressor is reduced as the evaporating temperature is reduced because of increased specific volume (cu ft/lb) of the refrigerant and lower compressor volumetric efficiency. The average 1 hp compressor will have a capacity of nearly 12,000-btu/hr per ton, at 40°F refrigerant temperature, 100°F condensing temperature. A 10° rise/fall in condensing temperature will reduce/increase capacity about 6%.

## Proper System Charging

### Subcooling Charging Method - TXV (Expansion Valve)

Subcooling is defined as: The temperature of a liquid refrigerant when it is cooled below its condensing temperature. Subcooling takes place in the condenser and is determined by subtracting the liquid line temperature (as read on a thermometer strapped on the liquid line) from the saturation temperature (gauge temperature - the temperature that corresponds to the pressure read on the high side of the gauge).

- (1) Locate the unit required subcooling from the name plate or product literature. (Typically 8-12°F).
- (2) Measure liquid line temperature - convert to pressure.
- (3) Subtract the required subcooling (1) from the converted temperature (2). This is the required liquid line temperature.
- (4) Measure the liquid line temperature. If the measured temperature does not equal the required liquid line temperature:
  - Add refrigerant to lower the temperature.
  - Remove refrigerant to raise the temperature.
  - Allow a tolerance of +/- 3°F.

### Superheat Charging Chart - Cooling - Non TXV (Expansion Valve)

Superheat is defined as: The temperature of vapor refrigerant above its saturation point (evaporation) temperature. Superheat occurs in the evaporator and is determined by subtracting the saturation temperature (the temperature that corresponds to the pressure read on the low-side gauge) from the suction line temperature (as read on a thermometer strapped on the suction line).

## Cooling Tower Ratings

Temperatures °F			
Hot Water	Cold Water	Wet Bulb	Capacity Factor
90	60	70	0.85
92	62	70	1.00
95	65	70	1.24
98	68	72	0.74
92	62	72	0.88
95	65	72	1.12
98	68	74	1.00
95	65	76	0.88
98	68	78	0.75
98	68	80	0.62

Hot water - Cold Water = Range

Cold Water - Hot Water = Approach

The Capacity factor is a multiplier by which the capacity at any common assumed condition may be found if the rating at some other point is known. Factors are based on heat rejection ratio of 1.25 (15,000 btu/hr per ton) and gpm/ton flow rate.

Example: at 95-85-80, the capacity is 0.62/0.85 or 0.73 that of the rating of 90-80-70.

Capacity is reduced as the flow rate per ton is increased. If the refrigerant temperature is below 40°F, the heat rejection will be greater than 15,000 btu/hr per ton. Evaporation will cause increasing deposits of solids and fouling of the condenser tubes unless water is bled off. A bleed of 1% of the circulation rate will result in concentrations of twice the original solids (two concentrations), and 0.5% bleed will result in three concentrations.

## Horsepower Per Ton

At 100°F condensing temperature vapor enters the compressor at 65°F

Refrig. Temp. °F	40	20	0	-20	-40
Practical Avg.	0.87	1.20	1.70	2.40	3.20

		Required Superheat Condenser Entering Air - Dry Bulb											
		°F	55	60	65	70	75	80	85	90	95	100	105
Indoor Air - Wet Bulb	50	9	7	6	6	6	6	6	6	6	6	6	6
	52	12	10	8	6	6	6	6	6	6	6	6	6
	54	14	12	10	7	6	6	6	6	6	6	6	6
	56	17	15	12	10	6	6	6	6	6	6	6	6
	58	19	18	15	13	9	6	6	6	6	6	6	6
	60	22	20	18	16	12	8	6	6	6	6	6	6
	62	25	24	23	19	15	12	8	5	6	6	6	6
	64	29	27	24	23	18	15	13	9	6	6	6	6
	66	32	30	27	24	21	18	15	13	10	8	5	6
	68	35	33	30	27	24	21	19	16	14	12	9	6
	70	37	35	33	30	28	25	22	20	18	15	13	10
	72	40	38	36	33	31	28	26	24	22	20	17	14
	74	42	40	38	36	34	31	30	27	25	23	21	18
	76	45	43	41	39	37	35	33	31	29	27	25	22

- (1) Measure the outdoor air (dry bulb) temperature, and indoor wet bulb temperature.
- (2) Find the required superheat from the chart.
- (3) Measure the suction line pressure - convert pressure to temperature.
- (4) Add the required superheat (2) to the converted temperature (3). This is the required suction line temperature.
- (5) Measure the suction line temperature. If the suction line temperature does not equal the required suction line temperature (4):
  - Add refrigerant to lower the suction line temperature.
  - Remove refrigerant to raise the suction line temperature.
  - Allow a tolerance of +/- 3°F.

# Hvac Quick Reference Guide

**L Reisser**



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### Table of Contents **Hvac Quick Reference Guide**

1. Understanding the eBook **Hvac Quick Reference Guide**
  - The Rise of Digital Reading **Hvac Quick Reference Guide**
  - Advantages of eBooks Over Traditional Books
2. Identifying **Hvac Quick Reference Guide**
  - Exploring Different Genres
  - Considering Fiction vs. Non-Fiction
  - Determining Your Reading Goals
3. Choosing the Right eBook Platform
  - Popular eBook Platforms
  - Features to Look for in an **Hvac Quick Reference Guide**
  - User-Friendly Interface
4. Exploring eBook Recommendations from **Hvac Quick Reference Guide**
  - Personalized Recommendations
  - **Hvac Quick Reference Guide** User Reviews and Ratings
  - **Hvac Quick Reference Guide** and Bestseller Lists

- 
5. Accessing Hvac Quick Reference Guide Free and Paid eBooks
    - Hvac Quick Reference Guide Public Domain eBooks
    - Hvac Quick Reference Guide eBook Subscription Services
    - Hvac Quick Reference Guide Budget-Friendly Options
  6. Navigating Hvac Quick Reference Guide eBook Formats
    - ePub, PDF, MOBI, and More
    - Hvac Quick Reference Guide Compatibility with Devices
    - Hvac Quick Reference Guide Enhanced eBook Features
  7. Enhancing Your Reading Experience
    - Adjustable Fonts and Text Sizes of Hvac Quick Reference Guide
    - Highlighting and Note-Taking Hvac Quick Reference Guide
    - Interactive Elements Hvac Quick Reference Guide
  8. Staying Engaged with Hvac Quick Reference Guide
    - Joining Online Reading Communities
    - Participating in Virtual Book Clubs
    - Following Authors and Publishers Hvac Quick Reference Guide
  9. Balancing eBooks and Physical Books Hvac Quick Reference Guide
    - Benefits of a Digital Library
    - Creating a Diverse Reading Collection Hvac Quick Reference Guide
  10. Overcoming Reading Challenges
    - Dealing with Digital Eye Strain
    - Minimizing Distractions
    - Managing Screen Time
  11. Cultivating a Reading Routine Hvac Quick Reference Guide
    - Setting Reading Goals Hvac Quick Reference Guide
    - Carving Out Dedicated Reading Time
  12. Sourcing Reliable Information of Hvac Quick Reference Guide
    - Fact-Checking eBook Content of Hvac Quick Reference Guide
    - Distinguishing Credible Sources
  13. Promoting Lifelong Learning

- Utilizing eBooks for Skill Development
- Exploring Educational eBooks

#### 14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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