

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	1.09	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	60	70	80	-20	-40
Practical Avg.	0.87	1.20	1.70	2.40	3.20

Required Superheat Condenser Entering Air - Dry Bulb

Indoor Air - Wet Bulb	°F	55	60	65	70	75	80	85	90	95	100	105
	°F	55	60	65	70	75	80	85	90	95	100	105
50	9	7	6	6	6	6	6	6	6	6	6	6
52	12	10	8	8	8	8	8	8	8	8	8	8
54	14	12	10	9	8	8	8	8	8	8	8	8
56	17	15	13	10	9	8	8	8	8	8	8	8
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64	28	27	26	23	18	15	13	11	9	8	8	8
66	32	30	27	24	21	18	15	13	10	9	8	8
68	35	33	30	27	24	21	19	16	14	12	10	9
70	37	35	33	30	28	25	22	20	18	15	13	11
72	40	38	36	33	31	28	25	24	22	20	17	15
74	42	40	38	36	34	31	30	27	25	23	21	19
76	45	43	41	39	37	35	33	31	29	27	25	23

- (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

Charles Nehme



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HVAC/R Terminology: A Quick Reference Guide Richard Wirz, 2009-04-01 This one of a kind HVAC R technical reference guide incorporates all the HVAC R technical terms used in the industry today and is an indispensable resource for professionals dealing with electricity controls refrigeration cycle heating psychometrics boilers heat pumps heat transfer load calculations and more Covers the entire industry providing the most comprehensive collection of HVAC R terms available in one concise location For those just starting in and seasoned veterans of the HVAC R industry The 71 pages of appendices include common industry association abbreviations business computer and medical terminology area of circles color codes for resistors CFM tables decibel ratings hazardous time exposure of common noises duct sizing conversion charts and much much more

The HVAC Pro's Playbook: A Handy Guide to Systems and Solutions Charles Nehme, The world of HVAC is a complex ever evolving field critical to modern comfort safety and energy efficiency This HVAC Handy Cookbook is designed as a practical and accessible reference guide distilling decades of industry knowledge into a single easy to use resource Whether you are an experienced professional a student or a facility manager this book serves as a quick reference tool for the most commonly encountered HVAC components maintenance tasks calculations and problem solving scenarios The goal is to provide concise actionable information that helps you maintain optimal performance in any built environment

HVAC/R Terminology Richard Wirtz, 2006-01-01 **HVAC Formulas and Equations** Builder's Book Inc., 2007-04-16 *Data Center HVAC Quick Guide: Cooling & Energy Efficiency, Toolkit* Charles Nehme, In the high stakes world of data centers the saying uptime is everything rings true But what ensures that critical uptime It s not just the servers and software it s the often overlooked and energy hungry HVAC systems that keep them from overheating As a professional who has spent three decades consulting on complex building systems around the globe I ve seen firsthand how a well designed and efficiently managed cooling system is the backbone of a reliable data center This book is a practical no nonsense guide designed to demystify data center cooling It cuts through the academic theory to provide you with a hands on toolkit for success We ll cover everything from the fundamental principles of airflow and heat transfer to practical real world strategies like hot cold aisle containment free cooling and rapid troubleshooting My goal is to equip you with the knowledge to not only maintain a stable environment but to also significantly improve energy efficiency and reduce operational costs This guide is your shortcut to mastering the essentials and building a resilient sustainable and cost effective data center

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The Complete Guide to HVAC Troubleshooting: A Homeowners Manual Tim David, 2023-12-29

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HVAC Procedures and Forms Manual Herbert Wendes, 2002

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