

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											
Indoor Air - Wet Bulb	°F	55	60	65	70	75	80	85	90	95	100	105	110
	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	21	19	15	12	8	5	6	6	6	6
	64	29	27	24	21	18	15	12	9	6	6	6	6
	66	32	30	27	24	21	18	15	12	10	8	5	6
	68	35	33	30	27	24	21	19	16	14	12	9	6
	70	37	35	32	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	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

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HVAC Formulas and Equations Builder's Book Inc., 2007-04-16 **The Complete Guide to HVAC Troubleshooting: A Homeowners Manual** Tim David, 2023-12-29 The Complete Guide to HVAC Troubleshooting is a definitive resource for homeowners and aspiring technicians alike offering in depth insights and practical advice on diagnosing and resolving a wide range of heating ventilation and air conditioning issues This book serves as an indispensable tool for anyone looking to understand maintain and repair their HVAC systems efficiently and effectively Structured to cater to both beginners and those with more technical experience the guide begins by introducing the fundamentals of HVAC systems It outlines the core components how they operate and the common types of HVAC systems found in homes and buildings This foundational knowledge sets the stage for more complex topics ensuring all readers are up to speed Central to the book is a comprehensive troubleshooting section detailing step by step methods to diagnose common and not so common problems From strange noises and inconsistent temperatures to complete system failures the guide provides clear concise instructions to identify issues and implement solutions It covers a range of scenarios including quick fixes that can be handled without professional help and more complex problems requiring expert intervention The guide goes beyond simple fixes delving into the nitty gritty of HVAC maintenance performance optimization and longevity It discusses preventive measures routine maintenance schedules and the signs that indicate a need for repair or replacement Additionally the book offers valuable tips on selecting the right tools safety precautions and understanding when to call in a professional With The Complete Guide to HVAC Troubleshooting readers

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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

Quick Reference to Building & MEP Codes: Compliance Made Simple, Toolkit Charles Nehme, Navigating the complex world of building and MEP Mechanical Electrical and Plumbing codes can be daunting For professionals and students alike the sheer volume of information across various codes such as the International Building Code IBC International Mechanical Code IMC and National Electrical Code NEC can feel overwhelming The process of ensuring a project is compliant can be time consuming and prone to costly errors This book Quick Reference to Building MEP Codes Compliance Made Simple Toolkit was created to be your essential guide and on the go resource It is designed to cut through the jargon and provide clear concise summaries of the most critical codes and standards We ve organized the information into practical chapters complete with easy to read tables flowcharts checklists and decision guides Our goal is not to replace the official code books but to serve as a fast track tool that helps you quickly find the information you need understand common pitfalls and confidently ensure your projects meet compliance Whether you re in the office on site or in the classroom this toolkit is meant to simplify the complex and help you achieve compliance with confidence

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technical management providing procedures for achieving thorough systematic and accurate problem solving troubleshooting and decision making in building systems management and contracting **Audel HVAC Pocket Reference** James E. Brumbaugh, 2005-08-19 Answers when you need them When you need to check specs confirm measurements or make a quick metric conversion on the job find the answers quickly and easily right in your pocket Your one stop reference for Conversion tables electrical formulas pipe thread standards and motor ampere ratings Fuel cost comparisons Offset calculations and valve details Gas and oil burner specifications Pipe performance data Weather and design factors affecting heating cooling calculations Troubleshooting guidelines MEP Load Calculation Quick Reference & toolkit Charles Nehme, In the complex and ever evolving world of building design the accurate calculation of mechanical electrical and plumbing MEP loads is not merely a technical step it s the foundation of a successful project Whether ensuring a building is comfortable and energy efficient or guaranteeing its systems can handle peak demand precise load calculations are paramount This book MEP Load Calculation Quick Reference it s a field guide designed to be your go to reference for tackling real world challenges in MEP design **HVAC Procedures & Forms Manual, Second Edition** Wendes, 2020-12-22 Developed over the course of many years of on the job projects involving HVAC energy auditing testing balancing and cost estimating and refined through feedback from thousands of engineers and technicians who have used them the forms contained in this manual are concise comprehensive and optimally organized for easy reference Complete sets of forms are provided for all aspects of testing and balancing energy auditing indoor quality diagnosis and load calculations The first edition entitled HVAC Energy Audit Balancing Forms Manual compiled these time saving forms for the first time in a single reference This enhanced second edition adds a new chapter on technical management providing procedures for achieving thorough systematic and accurate problem solving troubleshooting and decision making in building systems management and contracting **HVAC Repair Secrets** Tim David, 2023-11-01 HVAC Repair Secrets will examine practical aspects such as routine maintenance diagnosing problems effectively managing thermostats and various repair techniques By the end of this book you will possess the confidence and expertise to become a proficient HVAC enthusiast ensuring your system stays in top shape Cost Estimating for the Handyman Business Bill O'Donnell, 2015-09-27 The Cost Estimating for the Handyman Business manual by RemodelMAX contains 128 pages of material costs and manhours for over 3000 items for small jobs **Comprehensive Guide to HVAC Cleaning Equipment and Techniques** Charles Nehme, The cleanliness and efficiency of HVAC systems are critical to maintaining a healthy indoor environment and ensuring the optimal performance of heating ventilation and air conditioning units Despite the growing awareness of indoor air quality IAQ and energy efficiency HVAC cleaning often remains an overlooked aspect of building maintenance Over time dust debris mold and other contaminants accumulate in HVAC systems reducing their efficiency and circulating pollutants that can impact occupant health Proper cleaning of HVAC systems not only improves air quality but also extends the life of the

equipment and reduces energy consumption This book Comprehensive Guide to HVAC Cleaning Equipment and Techniques is designed to be a practical and thorough resource for HVAC professionals building maintenance staff and anyone involved in the upkeep of air handling systems Whether you re an experienced technician or a beginner seeking to understand the basics this guide provides a step by step roadmap to the cleaning process covering everything from essential tools and equipment to advanced cleaning techniques As HVAC systems vary greatly in complexity size and use from small residential systems to large commercial and industrial setups the challenges of cleaning them require different approaches and specialized equipment This book delves into the various types of equipment available from simple brushes and vacuums to more advanced tools like robotic cleaners and negative air machines Safety is a key priority throughout with guidance on personal protective equipment PPE and workplace safety practices included in every step With the fast pace of technological advancements the HVAC industry continues to evolve and so do the cleaning techniques and tools we use Robotics artificial intelligence and eco friendly cleaning technologies are already making their mark and this book touches on these emerging trends as well Throughout the chapters you ll find practical tips industry standards and case studies to give you insights into real world scenarios Whether you are tackling the ducts of a small home or a large industrial complex this guide equips you with the knowledge and tools to approach each job confidently and efficiently It is my hope that this book not only serves as a technical reference but also helps to elevate the standards of HVAC cleaning ensuring that all who work in this field contribute to healthier more sustainable indoor environments

Patty's Industrial Hygiene, Volume 4 Barbara Cohrssen, 2021-03-25 Since the first edition in 1948 Patty s Industrial Hygiene and Toxicology has become a flagship publication for Wiley During its nearly seven decades in print it has become a standard reference for the fields of occupational health and toxicology The volumes on industrial hygiene are cornerstone reference works for not only industrial hygienists but also chemists engineers toxicologists lawyers and occupational safety personnel Volume 4 covers environmental and health and safety program management with a number of new chapters on sustainability construction health and safety health and safety of new energies and working with cannabis

Index of USACERL Publications, October 1984 - September 1992, 1992 *Contractor's Index to the 1997 Uniform Building Code, Vol. 1* Jack M. Hageman, 1998 A common sense index to help you quickly find what you need in Volume 1 of the UBC Topics are listed under names you use in construction Guaranteed to help you save time looking for what you need in the Code

Federal Buildings Supplemental Survey 1993, 1995 The Energy Information Administration EIA of the US Department of Energy DOE is mandated by Congress to be the agency that collects analyzes and disseminates impartial comprehensive data about energy including the volume consumed its customers and the purposes for which it is used The Federal Buildings Supplemental Survey FBSS was conducted by EIA in conjunction with DOE s Office of Federal Energy Management Programs OFEMP to gain a better understanding of how Federal buildings use energy This report presents the data from 881 completed telephone

interviews with Federal buildings in three Federal regions These buildings were systematically selected using OFEMP s specifications therefore these data do not statistically represent all Federal buildings in the country The purpose of the FBSS was threefold 1 to understand the characteristics of Federal buildings and their energy use 2 to provide a baseline in these three Federal regions to measure future energy use in Federal buildings as required in EPACT and 3 to compare building characteristics and energy use with the data collected in the CBECS

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