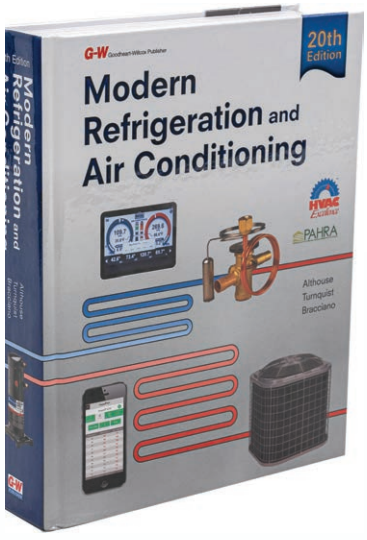

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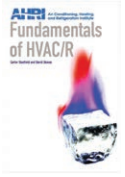
BOOKS

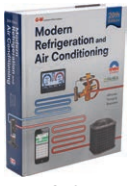


ISBN01322

FUNDAMENTALS OF HVAC/R

Created with a clear-cut vision of what trainees need, Fundamentals of HVAC/R provides comprehensive coverage of heating, ventilating, air conditioning, and refrigeration (HVACR) topics. This new reader-friendly book offers fundamental concepts, the most current trends, and practical applications in the field. With simple language skillfully presented concepts, carefully selected artwork, and the right amount of detail, this book is everything trainess need to know to install, service, and maintain HVACR systems.

Part No.	Description	Price
ISBN01322	Fundamentals of HVAC/R, ARI	$316.00



78701

MODERN REFRIGERATION AND AIR CONDITIONING

Provides an excellent blend of theory with job-qualifying skills, making it a leader in the refrigeration and air conditioning field! This compr - hensive text teaches fundamental principles and the service techniques needed to diagnose and remedy HVAC problems. This text contains all the most recent information and advances necessary to prepare the technician for today's world. This edition includes up-to-date material on EPA rules and regulations covering refrigerant recovery, recycling, and reclaiming.

By A.D. Althouse, C.H. Turnquist and A.F. Bracciano

- Identification of the various types of new refrigerants such as 134a and 123, and information on equipment needed for refrigerant recovery, recycling, and reclaiming
- Up-to-date methods of sizing, installing, and maintaining refrigeration and air conditioning systems
- Covers the operation of systems and their specific component
- Teaches proper procedures for using troubleshooting charts
- Emphasizes procedures that will help the service technician become more efficien

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RSGAC

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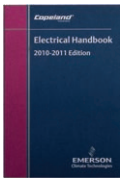
Pocket size service guide that includes: service procedures, problem solvings and reference charts for refrigeration cycle and compressors.

Part No.	Description	Price
RSGAC*	Residential A/C Service Guide	$6.00



6400

ELECTRIC AND START COMPONENTS REFERENCE

This large pocket size reference book lists the applicable starting components for all Copeland current model compressors and condensing units. Basic electrical applications are discussed along with typical wiring diagrams, model nomenclature, component specifications, fuse selection, motor protectors application and troubleshooting, and basic electrical troubleshooting. This is a must have reference.

COPELAND

Part No.	Description	Price
6400*	Copeland Electric and Start Component Reference	$24.00
6400SP*	Copeland Electric and Start Component Reference, Spanish	$24.00

ISBN02X

HVAC/R REFERENCE GUIDE

A pocket sized reference manual that every air conditioning and refrigeration technician MUST have. This book is a compilation of charts, graphs, formulas, and trouble shooting guidelines. It contains: Temp/Pressure/Enthalpy/ Entropy charts, Troubleshooting charts, English/Metric conversions, Gas laws/formulas, Insulation values, Wire capacity, Motor specifications, Electronics, Torque specifications, Pipe and tubing/copper/ aluminum/steel, Taps/dies/drill sizes, and much more.

Part No.	Description	Price
ISBN02X	HVAC/R Reference Guide	$21.90

ISBN038

PRINCIPLES OF AIR CONDITIONING

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ISBN038	Principles of Air Conditioning	$21.90

ISBN070

ELECTRICITY FOR HVAC/R

Electricity for HVAC&R - A Guide to Troubleshooting provides the technician with the information necessary to successfully diagnose electrical problems. Electricity for HVAC&R - A Guide to Troubleshooting is a practical view of what electricity is and how it works. It is more than just a textbook. Each subject is addressed by answering the most frequently asked questions about electricity.

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ISBN070	Electricity for HVAC/R	$21.90

*WARNING: This item may contain chemicals known to cause cancer and/or reproductive harm in the state of California. For more information go to www.P65Warnings.ca.gov

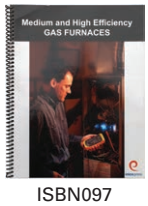
ISBN062

TROUBLESHOOTING AND SERVICING

Troubleshooting and Servicing Modern Air Conditioning and Refrigeration Systems gives service technicians all the information needed to accurately diagnose and solve various systems problems.

The book details a variety of topics and troubleshooting procedures, including the following: Refrigerant pressures, states, and conditions, Subcooling and superheat, Compression systems, Metering devices, System charge, Diagnosing air conditioning systems, Systematic troubleshooting, Alternative refrigerants, Refrigerant blends and oils, Leak detection - evacuation and clean up procedures, Ozone depletion and global warming. Discusses the changes affecting the refrigeration and air conditioning industries with an emphasis on the phaseout of CFC and HCFC refrigerants. Detailed sections on the most current leak detection and evacuation methods are included, as well as a section on alternative refrigerants and retrofit guidelines. The book also includes the most encountered refrigerant changeover guidelines.

Part No.	Description	Price
ISBN062	Troubleshooting and Servicing	$79.90

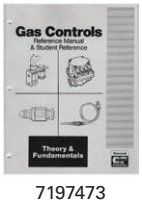


ISBN097

GAS FURNACES

This unique field guide di cusses each important aspect of the medium to high efficiency gas furnaces used i central heating applications, from the combustion process to the venting of the furnace itself. The author also provides detailed information on other related topics including: furnace construction, controls and components, ignition systems, sequences of operation, basic service procedures, and electric/electronic troubleshooting and repair. It also details the significant advances made in the furnace industr .

Part No.	Description	Price
ISBN097	Gas Furnaces	$59.90



7197473

GAS CONTROLS REFERENCE MANUAL

Basic information and technical data on gas heating controls: gas properties, combustion, pilot burner systems, warm air heating systems, hydronic heating appliances, power sources, safety shutoff circuit and combination gas valves. Extensive glossary and technical charts.

Honeywell

Part No.	Description	Price
7197473	Gas Controls Reference Manual	$11.00

771100

AUTOMATIC CONTROLS ENGINEERING MANUAL

This edition includes direct digital control and operator workstations, as well as other current control technology and strategies. The 500+ pages guide the reader through the fundamentals of control system theory, direct digital control, building management systems and a dozen other disciplines essential to proper environmental control in buildings. Microprocessor controls are shown in most of the control applications, rather than pneumatic, electric or electronic controls, to reflect the trends in today s industry. Also included is new in formation on indoor air quality and district heating. Often referred to as the Gray Manual, this technical resource has been a standard among engineering design professionals since it was first published in 1934

Honeywell

Part No.	Description	Price
771100	Engineering Manual of Automatic Control for Commercial Buildings	$51.22

7197932

CONTROLS SERVICE HANDBOOKS

- **Gas Controls Service Manual**: all of the technical data and service information needed to safely and efficiently check and repair gas burner controls systems. Includes combination gas controls manufactured in the last 30 years for furnace, boiler and other heating appliance manufacturers, as well as service replacement controls.
- **Gas Electronic Ignition Controls Service Manual**: principles of controlling gas heating equipment including intermittent pilot, direct spark ignition and hot surface ignition. Model numbers and specifications for obsolete as well as currently manufactured controls.
- **Oil Controls Service Manual**: control of oil burners is undergoing a major change as manufacturers are transitioning from electromechanical and electronic controls to microelectronic oil primary controls. This manual includes information on these controls and on older devices that have been used for years.
- **Commercial Controls Service Manual**: introduction and fundamentals of electric and electronic controls used on commercial packaged and other light commercial equipment. Includes: motors and actuators, linkages, dampers and valves, electromechanical controllers, electronic sensors, electromechanical economizers, electronic solid state economizers, reset systems and fan coil systems.
- **Air Conditioning and Electric Heat Controls Service Handbook**: components of the cooling control system: thermostat, contactor, pressure controllers, fan relays, fan centers and transformers. Glossary and troubleshooting guide.

Honeywell

Part No.	Description	Price
7197932	Service Handbook Library	$70.00

BOOKS

7197558

FLAME SAFEGUARD CONTROLS TEXTBOOK

The most comprehensive and popular Flame Safeguard textbook available in our industry. It's where the beginners begin and where the Old Pros return year after year and problem after problem. 362 pages. 2nd edition.

- Introduction to Flame Safeguard - Flame Safeguard functions and controls.
- Combustion - explanation of fuel types and flame characteristics
- Burners and Boilers - description of representative burners and boilers.
- Flame Rod Application - design and installation of flame rods and rectification systems
- Optical Detector Applications - description, operation, application and checkout of detectors; covering rectifying photocells, infrared, and ultraviolet detectors.
- Primary Controls - capabilities and operation of primary controls (RA890, R4795 and R7795) used on smaller burners
- Programming Controls - capabilities and operation of programming controls (R4140 and BC7000 Microcomputer Programmable Controls.
- Troubleshooting FSG Systems - outlines systematic procedures for isolating common Flame Safeguard problems.
- Service Equipment - description and operation of testers, simulators and meters.
- Auxiliary Equipment - description, operation, application and checkout of pressure and temperature controllers.
- Valves and Valve Trains - description and application of typical Flame Safeguard valves and valve trains.
- Sizing and Application of Large Gas Valves - principles and procedures for selecting gas valves (includes selection nomographs).
- Firing Rate Controls - covers methods for controlling firing rate, firing rate sequences, programmer switching, motors and valves
- Glossary - Flame Safeguard terminology.

Student notebook contains review questions to be used in conjunction with the textbook.

Honeywell

Part No.	Description	Price
7197558	Flame Safeguard Controls Textbook	$46.82
7197555	Student Notebook	$10.00


RJSTRJ

ESSI JOURNAL

A stand alone system for keeping track of refrigerant usage to comply with EPA rules. Technician journal has forms for recording refrigerant addi - tions and deletions by type and specifi equipment, purchases and disposal, appliance disposal and unintentional venting. Master Journal provides a company wide summary. The bonus pack includes one master journal, 4 technician journals and a copy of the EPA final rule summary. Use alone or as a data collection accessory for the Refrigerant Compliance Manager software package or Refrigerant Journal Software. From Environmental Support Solutions.

Part No.	Description	Price
RJSTRJ	ESSI Technician Journal	$19.50
RJSMRJ	ESSI Master Journal	$27.90
RJSBONUSPACK	ESSI Journal Kit	$73.90

SOFTWARE

QT3000-DVD

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Self Study Course: Mainstream Engineering Corporation is an EP A approved testing organization for the required EPA Refrigeration Technician Certification Exam. T o assure a better chance of passing this exam, Mainstream Engineering has devel - oped a self-study course the technician can use at home to gain a better understanding of what the EPA exam questions will involve. The individually boxed course includes a 236 page, full color, fully illustrated study manual, a concise study guide, a two-hour video DVD, a CD -Rom study guide which includes over 400 practice questions, and a one hour audio CD.

The EPA Test: When the technician is ready for testing, your local United Refrigeration branch is contacted and the test is taken there. The test must by proctored by an individual designated by Mainstream Engineering. This has been arranged by United Refrigeration and Mainstream. After the test is completed, United Refrigeration mails the test to Mainstream for grading. Once an exam is received at Mainstream, it is graded within 2 busi - ness days. Test results are mailed to the te chnician and po sted on-line at www .epatest.com the same day the exam is graded. The EPA certification card is mailed directly to the studen

- EPA approved test for Type I,II,III, and Universal
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6400CD

ELECTRICAL HANDBOOK CD

This reference covers in detail electrical service information on welded compressors, Copelametic®, Copeland Scroll®, and Copeland Screw® compressors. In addition, electrical service information is provided for Copeland brand Condensing Units. The booklet is designed to assist the service engineer to better understand the function of such items as motors, relays, starting capacitors, running capaci - tors and motor protectors. In addition to electrical information, a brief section dealing with diagnosing the causes of compressor failures has been added.

COPELAND™

Part No.	Description	Price
6400CD*	Electrical Handbook CD	$24.00

QL3334

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Features

- Shows hydronic heat for each room & totals on screen
- Displays both heating & cooling loads at the same time for each room and job totals
- All new updated default values and conditions, editable
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Part No.	Description	Price
QL3334	O'Brien Quickloads Pro Software	$534.00

ISBN178

R410A TRAINING CD

Provides field service personnel wit the necessary training and practical knowledge to safely perform service on systems containing R-410A and R-407C. It also includes information on: the R-22 phase-out, appropriate refrigerant and oil applications, service techniques, as well as safe handling of R-410A. This CD breaks down R-410A training into categories each with specific sub topics. All of the informatio needed to prepare for the R-410A Safety Certification is contained i this interactive CD-ROM

Part No.	Description	Price
ISBN178	R410A Safety CD	$59.90


MSDSFD

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Compilation of MSDS sheets for most of the products that we provide to our customers.

Part No.	Description	Price
MSDSFD	MSDS Flash Drive	$50.00

TRENTON REFRIGERATION DESIGN TOOLS

Trenton Refrigeration Design Tools is a suite of software applications created to help refrigeration professionals make accurate calculations, access product information, choose components and print technical drawings.

The software includes:

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- **PiCoil Fluid Cooler Designer:** Configure a single circuit Dry Fluid Cooler for free cooling or process cooling applications.
- **PiCoil Glycol Coil Designer:** Configure a single circuit Glycol Coil for use in walk-in coolers, refrigerated warehouses and docks.
- **Certified Print Generator** Generate one-off certified prints, approval drawings and specifications for all models in the equipment catalog.
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Bulletin 500-10-AWEF
December 2020

AWEF Factors for TEVS

Annual Walk-In Efficiency Factors for Systems Utilizing Sporlan Thermostatic Expansion Valves

Annual Walk-in Energy Factor (AWEF) is an energy standard by the Department of Energy (DOE) that measures electrical energy input versus its cooling capacity. All commercial refrigeration equipment manufacturers should comply with the AWEF rating specified by the DOE. Walk-in equipment of 3000 ft² or less must conform to this new requirement.

Most unit manufacturers are accomplishing the new standard by lowering the head pressure setting of the unit. This lower head pressure setting greatly impacts expansion valve sizing. This bulletin will help provide thermostatic expansion valve selections for AWEF applications. **This bulletin should not be used for applications outside of AWEF.**

Sporlan researched compressor efficiencies, distributor sizing, and valve sizing at the maximum summer condition and the minimum winter condition for these applications. The values presented in the following tables provide maximum and minimum BTU/hr load at the rated condition of the unit. Most times, this rating will be at 105°F condensing temperature and 96°F liquid temperature. Recommendations in this bulletin are in accordance with AHRI 1250.

This bulletin will help the contractor and wholesaler accurately size and select the proper thermostatic expansion valve for the application. For selection of an electric expansion valve, reference Bulletin 500-100-AWEF.

SELECTION PROCEDURE for AWEF UNITS

1. Select the chart with the system refrigerant
2. Determine saturated suction temperature (SST)
3. Determine thermostatic charge required
4. Select appropriate valve for unit's capacity

Example: Select a Type ER valve for R-407A. The rated unit capacity is published at 4500 BTU/hr and operates at a +25°F saturated suction temperature.

Using the R-407A table, the ERVE-1/2 has a capacity range of 3201 – 5400 BTU/hr at +25°F. The rated capacity of the unit falls between these values. This means the ½ ton valve is correct for the application. The valve will use a KT-43-VC thermostatic charge. This means that the valve required is an ERVE-1/2-C.

The values in the tables below are in BTU/Hr. To determine the appropriate expansion valve, select a valve range that the rated condition of the AWEF unit falls within for the desired evaporator temperature.

R-404A / R-507

Valve Type	Nominal Capacity	Recommended Thermostatic Charge															
		KT-43-SC/PC										KT-43-SZ or KT-43-SZP					
		Saturated Suction Temperature (SST) / Evaporator Temperature °F															
		30°F		25°F		20°F		10°F		0°F		-10°F		-20°F		-30°F	
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
BF SBF, EBF, BF **BQ** SBQ, EBQ, BQ	AAA	1000	1800	1000	2000	1000	2100	1000	2300	1000	2400	900	2200	800	2000	700	1900
	AA	1801	3700	2001	4100	2101	4300	2301	4700	2401	5000	2201	3900	2001	3600	1901	3400
	A	3701	8500	4101	9100	4301	9800	4701	10600	5001	11100	3901	9700	3601	8900	3401	8300
	B	8501	15300	9101	16500	9801	17500	10601	18000	11101	17900	9701	14000	8901	13000	8301	12200
	C	15301	23300	16501	25000	17501	26400	18001	27100	17901	27100	14001	21300	13001	19800	12201	18500

An EEV is recommended for applications above 30°F.

Valve Type	Nominal Capacity	Recommended Thermostatic Charge															
		KT-43-SC/PC										KT-43-SZ or KT-43-SZP					
		Saturated Suction Temperature (SST) / Evaporator Temperature °F															
		30°F		25°F		20°F		10°F		0°F		-10°F		-20°F		-30°F	
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
R ER, SR, R	1/6	1000	1800	1000	2000	1000	2100	1000	2300	1000	2400	900	2200	800	2000	700	1900
	1/4	1801	3200	2001	3500	2101	3700	2301	4000	2401	4200	2201	3500	2001	3200	1901	2900
	1/2	3201	5200	3501	5400	3701	5700	4001	6200	4201	6500	3501	5400	3201	5000	2901	4500
	1	5201	9400	5401	10200	5701	10800	6201	11800	6501	12400	5401	9600	5001	9000	4501	8500
	1-1/2	9401	12300	10201	13400	10801	14300	11801	15500	12401	16400	9601	12600	9001	11700	8501	11100
	2	12301	17200	13401	18700	14301	19900	15501	21400	16401	22600	12601	17600	11701	16600	11101	15700
	3	17201	22600	18701	24500	19901	25900	21401	28200	22601	30000	17601	23200	16601	21700	15701	20500
	4	22601	32200	24501	35000	25901	36900	28201	40400	30001	42600	23201	33000	21701	30900	20501	29100
	6	32201	43100	35001	46400	36901	49500	40401	54000	42601	56700	33001	43900	30901	41000	29101	38900

An EEV is recommended for applications above 30°F.

The values in the tables below are in BTU/Hr. To determine the appropriate expansion valve, select a valve range that the rated condition of the AWEF unit falls within for the desired evaporator temperature.

R-407A / R-407C / R-407F

Valve Type	Nominal Capacity	Recommended Thermostatic Charge															
		KT-43-VC										KT-43-VZ or KT-43-VZP40					
		Saturated Suction Temperature (SST) / Evaporator Temperature °F															
		30°F		25°F		20°F		10°F		0°F		-10°F		-20°F		-30°F	
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
BF SBF, EBF, BF **BQ** SBQ, EBQ, BQ	AAA	1400	3000	1400	3200	1400	3400	1400	3400	1300	3400	900	2100	800	2000	700	1800
	AA	3001	6300	3201	6700	3401	7100	3401	7200	3401	7100	2101	5300	2001	4900	1801	4300
	A	6301	13700	6701	14500	7101	15200	7201	15500	7101	15400	5301	9400	4901	9000	4301	7800
	B	13701	23800	14501	25200	15201	26500	15501	27000	15401	26800	9401	17400	9001	16400	7801	14300
	C	23801	44300	25201	46800	26501	49400	27001	50200	26801	50200	17401	31300	16401	29400	14301	25600

An EEV is recommended for applications above 30°F.

Valve Type	Nominal Capacity	Recommended Thermostatic Charge															
		KT-43-VC										KT-43-VZ or KT-43-VZP40					
		Saturated Suction Temperature (SST) / Evaporator Temperature °F															
		30°F		25°F		20°F		10°F		0°F		-10°F		-20°F		-30°F	
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
R ER, SR, R	1/3	1400	3000	1400	3200	1400	3400	1300	3400	1300	3400	900	2100	800	2000	700	1800
	1/2	3001	5100	3201	5400	3401	5700	3401	5800	3401	5800	2101	3600	2001	3400	1801	3000
	1	5101	8500	5401	9100	5701	9500	5801	9800	5801	9800	3601	6700	3401	6300	3001	5500
	1-1/2	8501	14900	9101	15900	9501	16500	9801	17100	9801	17100	6701	9400	6301	8900	5501	7800
	2	14901	19600	15901	20800	16501	21700	17101	22400	17101	22600	9401	15100	8901	14200	7801	12500
	3	19601	27300	20801	28900	21701	30400	22401	31300	22601	31300	15101	17700	14201	16800	12501	14600
	4	27301	35900	28901	37900	30401	39900	31301	41100	31301	41100	17701	26500	16801	24900	14601	21700
	5	35901	42600	37901	45100	39901	47400	41101	49000	41101	49100	26501	30700	24901	28800	21701	25100
	6	42601	51100	45101	54200	47401	57100	49001	58900	49101	59000	30701	34800	28801	32500	25101	28500
	8	51101	68100	54201	72500	57101	75700	58901	78200	59001	78700	34801	44900	32501	39600	28501	34500
	10	68101	89000	72501	94000	75701	98900	78201	101900	78701	102200	–	–	–	–	–	–
	12	89001	103100	94001	109300	98901	115300	101901	117900	102201	118900	–	–	–	–	–	–

An EEV is recommended for applications above 30°F.

CONTINUED ON NEXT PAGE

VIEW SPORLAN BALANCED PORT THERMOSTATIC EXPANSION VALVES PAGES 376-382

AWEF FACTORS FOR TEV (CONT'D.)

The values in the tables below are in BTU/Hr. To determine the appropriate expansion valve, select a valve range that the rated condition of the AWEF unit falls within for the desired evaporator temperature.

R-448A / R-449A

Valve Type	Nominal Capacity	Recommended Thermostatic Charge													
		KT-43-VC								KT-43-VZ or KT-43-VZP40					
		Saturated Suction Temperature (SST) / Evaporator Temperature °F													
		25°F		20°F		10°F		0°F		-10°F		-20°F		-30°F	
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
BF SBF, EBF, BF **BQ** SBQ, EBQ, BQ	AAA	1900	3100	1900	3500	1900	3200	1700	3200	1000	2200	900	2100	700	1800
	AA	3101	6900	3501	6800	3201	6800	3201	6800	2201	5400	2101	5000	1801	4400
	A	6901	15600	6801	15400	6801	15300	6801	14300	5401	9600	5001	9100	4401	8000
	B	15601	26400	15401	25800	15301	25100	14301	25100	9601	17700	9101	16800	8001	14700
	C	26401	42900	25801	45300	25101	46500	25101	46500	17701	31900	16801	30200	14701	26400

An EEV is recommended for applications above 25°F.

Valve Type	Nominal Capacity	Recommended Thermostatic Charge															
		KT-43-VC										KT-43-VZ or KT-43-VZP40					
		Saturated Suction Temperature (SST) / Evaporator Temperature °F															
		30°F		25°F		20°F		10°F		0°F		-10°F		-20°F		-30°F	
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
R ER, SR, R	1/3	1900	3500	1900	3500	1900	3500	1800	3300	1700	3200	1000	2200	900	2100	700	1800
	1/2	3501	4800	3501	4800	3501	5200	3301	5400	3201	5400	2201	3700	2101	3500	1801	3100
	3/4	4801	6300	4801	6800	5201	7100	5401	7400	5401	7400	3701	6000	3501	5600	3101	4400
	1	6301	9900	6801	9900	7101	9900	7401	9500	7401	9100	6001	6800	5601	6200	4401	5700
	1-1/2	9901	13500	9901	14400	9901	15200	9501	15900	9101	12000	6801	7400	6201	6600	5701	6700
	2	13501	15700	14401	19000	15201	20000	15901	20800	12001	14300	7401	9600	6601	9100	6701	8000
	2-1/2	15701	24600	19001	26300	20001	27700	20801	28900	14301	25100	9601	17700	9101	17100	8001	14700
	3-1/2	24601	34000	26301	34000	27701	36700	28901	38000	25101	38500	17701	27000	17101	25500	14701	22500
	5	34001	45900	34001	49400	36701	52000	38001	54300	38501	54800	27001	35500	25501	33400	22501	29400
	6	45901	61400	49401	66200	52001	69800	54301	72100	54801	72800	35501	45700	33401	40600	29401	35500

An EEV is recommended for applications above 30°F.

Bulletin 500-10-AWEF / 122020

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LINE SIZING

Line Sizing

The following Tables 7 and 8 indicate liquid lines and suction lines for all condensing units for R-404A, R-507, R-407A/C/F, R-448A and R-449A

When determining the refrigerant line length, be sure to add an allowance for fittings. See Table 5. Total equivalent length of refrigerant lines is the sum of the actual linear footage and the allowance for fittings.

Table 3. Weight of Refrigerants in Copper Lines During Operation (Pounds per 100 lineal feet of type "L" tubing)

Line Size O.D. (Inches)	Refrigerant	Liquid Line	Hot Gas Line	Suction Line at Suction Temperature				
				-40˚F	-20˚F	0˚F	+20˚F	+40˚F
3/8	R-407	3.8	0.25	0.02	0.03	0.04	0.06	0.09
	R-448A/R-449A	3.6	0.24	0.02	0.03	0.04	0.06	0.09
	R-507, R-404A	3.4	0.31	0.03	0.04	0.06	0.09	0.13
1/2	R-407	7.2	0.46	0.03	0.05	0.08	0.11	0.17
	R-448A/R-449A	6.7	0.44	0.03	0.05	0.07	0.11	0.16
	R-507, R-404A	6.4	0.58	0.04	0.07	0.13	0.16	0.24
5/8	R-407	11.5	0.74	0.05	0.08	0.12	0.18	0.26
	R-448A/R-449A	10.8	0.71	0.05	0.08	0.12	0.18	0.26
	R-507, R-404A	10.3	0.93	0.07	0.11	0.17	0.25	0.35
7/8	R-407	11.5	1.53	0.05	0.08	0.12	0.18	0.26
	R-448A/R-449A	22.5	1.48	0.10	0.16	0.25	0.37	0.54
	R-507, R-404A	21.2	1.92	0.15	0.23	0.37	0.51	0.72
1-1/8	R-407	23.8	2.60	0.10	0.16	0.25	0.37	0.54
	R-448A/R-449A	38.4	2.53	0.17	0.27	0.42	0.63	0.92
	R-507, R-404A	36.1	3.27	0.26	0.39	0.63	0.86	1.24
1-3/8	R-407	40.7	3.96	0.17	0.27	0.43	0.63	0.93
	R-448A/R-449A	58.4	3.85	0.25	0.41	0.64	0.96	1.40
	R-507, R-404A	55.0	4.98	0.40	0.58	0.95	1.32	1.87
1-5/8	R-407	61.8	5.61	0.26	0.41	0.65	1.96	1.43
	R-448A/R-449A	82.7	5.45	0.36	0.58	0.90	1.36	1.98
	R-507, R-404A	78.0	7.07	0.56	0.82	1.35	1.86	2.64
2-1/8	R-407	87.4	9.76	0.36	0.57	0.91	1.38	2.01
	R-448A/R-449A	143.8	9.48	0.62	1.01	1.57	2.36	3.44
	R-507, R-404A	134	12.25	0.98	1.43	2.35	3.23	4.58
2-5/8	R-407	152	15.05	0.63	1.00	1.60	2.38	3.49
	R-448A/R-449A	222	14.62	0.96	1.56	2.42	3.65	5.30
	R-507, R-404A	209	18.92	1.51	2.21	3.62	5.00	7.07
3-1/8	R-407	235	21.48	0.98	1.55	2.46	3.67	5.39
	R-448A/R-449A	317	20.86	1.37	2.22	3.45	5.20	7.57
	R-507, R-404A	298	27.05	2.16	3.15	5.17	7.14	9.95
3-5/8	R-407	345	29.05	1.40	2.23	3.50	5.23	8.27
	R-448A/R-449A	428	28.22	1.86	3.01	4.67	7.04	10.24
	R-507, R-404A	403	36.50	2.92	4.25	6.97	19.65	13.67
4-1/8	R-407	589	37.60	2.45	3.92	6.17	17.80	9.23
	R-448A/R-449A	554	36.53	2.40	3.89	6.05	9.11	13.25
	R-507, R-404A	526	47.57	3.80	5.55	9.09	12.58	17.80

Table 4. Pressure Loss of Liquid Refrigerants in Liquid Line Risers (Expressed in Pressure Drop, PSIG, and Subcooling Loss, ˚F)

Refrigerant	Liquid Line Rise in Feet																	
	10'		15'		20'		25'		30'		40'		50'		75'		100'	
	PSIG	˚F	PSIG	˚F	PSIG	˚F	PSIG	˚F	PSIG	˚F	PSIG	˚F	PSIG	˚F	PSIG	˚F	PSIG	˚F
R-407	4.3	1.4	6.4	2.0	8.5	2.7	10.6	3.4	12.8	4.1	17.0	5.4	21.3	6.8	31.9	10.1	42.5	13.5
R-448A, R-449A	4.3	1.1	6.5	1.7	8.7	2.3	10.9	2.8	13.0	3.4	17.4	4.5	21.7	5.6	32.6	8.3	43.5	10.9
R-507, R-404A	4.1	1.1	6.1	1.6	8.2	2.1	10.2	2.7	12.2	3.3	16.3	4.1	20.4	5.6	30.6	8.3	40.8	11.8

Based on 110˚F liquid temperature at bottom of riser.

Table 5. Equivalent Feet of Pipe Due to Valve and Fitting Friction

Copper Tube, O.D., Type "L"	1/2	5/8	7/8	1-1/8	1-3/8	1-5/8	2-1/8	2-5/8	3-1/8	3-5/8	4-1/8	5-1/8	6-1/8
Globe Valve (Open)	14	16	22	28	36	42	57	69	83	99	118	138	168
Angle Valve (Open)	7	9	12	15	18	21	28	34	42	49	57	70	83
90˚ Turn Through Tee	3	4	5	6	8	9	12	14	17	20	22	28	34
Tee (Straight Through) or Sweep Below	.75	1	1.5	2	2.5	3	3.5	4	5	6	7	9	11
90˚ Elbow or Reducing Tee (Straight Through)	1	2	2	3	4	4	5	7	8	10	12	14	16

LINE SIZING

Table 6. Recommended Remote Condenser Line Sizes

Net Evaporator Capacity	Total Equiv. Length	R-407A/C/F, R-448A & R-449A		R-507 & R-404A	
		Discharge Line (O.D.)	Liquid Line Cond. to Receiver (O.D.)	Discharge Line (O.D.)	Liquid Line Cond. to Receiver (O.D.)
3,000	50	3/8	3/8	3/8	3/8
	100	3/8	3/8	3/8	3/8
6,000	50	3/8	3/8	1/2	3/8
	100	1/2	3/8	1/2	3/8
9,000	50	1/2	3/8	1/2	3/8
	100	1/2	3/8	1/2	3/8
12,000	50	1/2	3/8	1/2	3/8
	100	5/8	3/8	5/8	1/2
18,000	50	5/8	3/8	5/8	1/2
	100	5/8	3/8	7/8	1/2
24,000	50	5/8	3/8	5/8	1/2
	100	7/8	1/2	7/8	5/8
36,000	50	7/8	1/2	7/8	5/8
	100	7/8	5/8	7/8	7/8
48,000	50	7/8	5/8	7/8	5/8
	100	7/8	7/8	1-1/8	7/8
60,000	50	7/8	5/8	7/8	7/8
	100	1-1/8	7/8	1-1/8	7/8
72,000	50	7/8	7/8	1-1/8	7/8
	100	1-1/8	7/8	1-1/8	1-1/8
90,000	50	1-1/8	7/8	1-1/8	7/8
	100	1-1/8	7/8	1-1/8	1-1/8
120,000	50	1-1/8	7/8	1-1/8	1-1/8
	100	1-3/8	1-1/8	1-3/8	1-3/8
180,000	50	1-3/8	1-1/8	1-3/8	1-3/8
	100	1-5/8	1-3/8	1-5/8	1-5/8
240,000	50	1-3/8	1-3/8	1-5/8	1-3/8
	100	1-5/8	1-3/8	2-1/8	1-5/8
300,000	50	1-5/8	1-3/8	1-5/8	1-5/8
	100	2-1/8	1-5/8	2-1/8	2-1/8
360,000	50	1-5/8	1-5/8	2-1/8	1-5/8
	100	2-1/8	2-1/8	2-1/8	2-1/8
480,000	50	2-1/8	1-5/8	2-1/8	2-1/8
	100	2-1/8	2-1/8	2-1/8	2-5/8
600,000	50	2-1/8	2-1/8	2-1/8	2-1/8
	100	2-5/8	2-5/8	2-5/8	2-5/8
720,000	50	2-1/8	2-1/8	2-1/8	2-5/8
	100	2-5/8	2-5/8	2-5/8	3-1/8
840,000	50	2-1/8	2-1/8	2-5/8	2-5/8
	100	2-5/8	2-5/8	2-5/8	3-1/8
960,000	50	2-5/8	2-5/8	2-5/8	2-5/8
	100	2-5/8	3-1/8	3-1/8	3-5/8
1,080,000	50	2-5/8	2-5/8	2-5/8	3-1/8
	100	3-1/8	3-1/8	3-1/8	3-5/8
1,200,000	50	2-5/8	2-5/8	2-5/8	3-1/8
	100	3-1/8	3-1/8	3-5/8	4-1/8
1,440,000	50	2-5/8	3-1/8	3-1/8	3-5/8
	100	3-1/8	3-5/8	3-5/8	4-1/8
1,680,000	50	3-1/8	3-1/8	3-1/8	3-5/8
	100	3-5/8	3-5/8	3-5/8	4-1/8

LINE SIZING

Table 7. Recommended Line Sizes for R-404A, R-507*

Capacity BTUH	Suction Line Size												Maximum Suction Line Riser Size						
	Suction Temperature												R-404A /507 Suction Temperature						
	+40˚F Equivalent Lengths				+20˚F Equivalent Lengths				+10˚F Equivalent Lengths										
	25'	50'	100'	150'	25'	50'	100'	150'	25'	50'	100'	150'	+40	+20	+10	-10	-20	-30	-40
1,000	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	1/2	1/2	1/2
3,000	3/8	3/8	1/2	1/2	3/8	3/8	1/2	1/2	3/8	1/2	1/2	5/8	3/8	3/8	1/2	1/2	1/2	1/2	1/2
4,000	3/8	1/2	1/2	1/2	3/8	1/2	1/2	5/8	1/2	1/2	5/8	5/8	3/8	1/2	1/2	1/2	5/8	5/8	5/8
6,000	1/2	1/2	1/2	5/8	1/2	1/2	5/8	7/8	1/2	1/2	5/8	7/8	1/2	1/2	1/2	1/2	5/8	5/8	7/8
9,000	1/2	5/8	5/8	5/8	5/8	5/8	7/8	7/8	5/8	5/8	7/8	7/8	1/2	5/8	5/8	7/8	7/8	7/8	7/8
12,000	1/2	5/8	7/8	7/8	5/8	7/8	7/8	7/8	5/8	7/8	7/8	7/8	1/2	7/8	7/8	7/8	7/8	1-1/8	1-1/8
15,000	5/8	5/8	7/8	7/8	5/8	7/8	7/8	7/8	7/8	7/8	7/8	1-1/8	5/8	7/8	7/8	7/8	7/8	1-1/8	1-1/8
18,000	5/8	7/8	7/8	7/8	7/8	7/8	7/8	1-1/8	7/8	7/8	1-1/8	1-1/8	5/8	7/8	7/8	1-1/8	1-1/8	1-1/8	1-1/8
24,000	5/8	7/8	7/8	7/8	7/8	7/8	1-1/8	1-1/8	7/8	1-1/8	1-1/8	1-1/8	5/8	1-1/8	1-1/8	1-1/8	1-1/8	1-3/8	1-3/8
30,000	7/8	7/8	7/8	1-1/8	7/8	7/8	1-1/8	1-1/8	7/8	1-1/8	1-1/8	1-3/8	7/8	1-1/8	1-1/8	1-1/8	1-1/8	1-3/8	1-3/8
36,000	7/8	7/8	1-1/8	1-1/8	7/8	1-1/8	1-1/8	1-3/8	1-1/8	1-1/8	1-3/8	1-3/8	7/8	1-1/8	1-1/8	1-1/8	1-1/8	1-3/8	1-3/8
42,000	7/8	7/8	1-1/8	1-1/8	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-1/8	1-3/8	1-3/8	7/8	1-3/8	1-3/8	1-3/8	1-3/8	1-5/8	1-5/8
48,000	7/8	1-1/8	1-1/8	1-1/8	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-1/8	1-3/8	1-5/8	7/8	1-3/8	1-3/8	1-3/8	1-3/8	1-5/8	1-5/8
54,000	7/8	1-1/8	1-1/8	1-3/8	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-3/8	1-3/8	1-5/8	1-1/8	1-3/8	1-3/8	1-3/8	1-3/8	1-5/8	1-5/8
60,000	7/8	1-1/8	1-1/8	1-3/8	1-1/8	1-1/8	1-3/8	1-5/8	1-1/8	1-3/8	1-5/8	1-5/8	1-1/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8
66,000	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-3/8	1-3/8	1-5/8	1-1/8	1-3/8	1-5/8	1-5/8	1-1/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8
72,000	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-3/8	1-5/8	1-5/8	1-1/8	1-3/8	1-5/8	1-5/8	1-1/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8
78,000	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-3/8	1-5/8	1-5/8	1-3/8	1-3/8	1-5/8	1-5/8	1-1/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8
84,000	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-3/8	1-5/8	1-5/8	1-3/8	1-3/8	1-5/8	2-1/8	1-3/8	1-5/8	1-5/8	1-5/8	1-5/8	2-1/8	1-5/8
90,000	1-1/8	1-3/8	1-3/8	1-5/8	1-3/8	1-3/8	1-5/8	2-1/8	1-3/8	1-5/8	1-5/8	2-1/8	1-3/8	1-5/8	1-5/8	1-5/8	2-1/8	2-1/8	2-1/8
120,000	1-1/8	1-3/8	1-5/8	1-5/8	1-3/8	1-5/8	2-1/8	2-1/8	1-3/8	1-5/8	2-1/8	2-1/8	1-5/8	2-1/8	2-1/8	2-1/8	2-1/8	2-1/8	2-1/8
150,000	1-3/8	1-3/8	1-5/8	2-1/8	1-5/8	1-5/8	2-1/8	2-1/8	1-5/8	2-1/8	2-1/8	2-1/8	1-5/8	2-1/8	2-1/8	2-1/8	2-1/8	2-1/8	2-5/8
180,000	1-3/8	1-5/8	2-1/8	2-1/8	1-5/8	2-1/8	2-1/8	2-1/8	1-5/8	2-1/8	2-1/8	2-5/8	1-5/8	2-1/8	2-1/8	2-5/8	2-5/8	2-5/8	2-5/8
210,000	1-3/8	1-5/8	2-1/8	2-1/8	1-5/8	2-1/8	2-1/8	2-5/8	2-1/8	2-1/8	2-5/8	2-5/8	2-1/8	2-5/8	2-5/8	2-5/8	2-5/8	2-5/8	3-1/8
240,000	1-5/8	1-5/8	2-1/8	2-1/8	1-5/8	2-1/8	2-1/8	2-5/8	2-1/8	2-1/8	2-5/8	2-5/8	2-1/8	2-5/8	2-5/8	2-5/8	2-5/8	3-1/8	3-1/8
300,000	1-5/8	2-1/8	2-1/8	2-5/8	2-1/8	2-1/8	2-5/8	2-5/8	2-1/8	2-5/8	2-5/8	3-1/8	2-1/8	2-5/8	2-5/8	2-5/8	2-5/8	3-5/8	3-5/8
360,000	2-1/8	2-1/8	2-5/8	2-5/8	2-1/8	2-1/8	2-5/8	3-1/8	2-1/8	2-5/8	2-5/8	3-1/8	2-5/8	2-5/8	3-1/8	3-5/8	3-5/8	3-5/8	4-1/8
480,000	2-1/8	2-1/8	2-5/8	2-5/8	2-1/8	2-5/8	3-1/8	3-1/8	2-5/8	2-5/8	2-5/8	3-5/8	2-5/8	3-1/8	3-5/8	3-5/8	3-5/8	3-5/8	4-1/8
600,000	2-1/8	2-5/8	2-5/8	3-1/8	2-5/8	2-5/8	3-1/8	3-5/8	2-5/8	2-5/8	3-1/8	3-5/8	3-1/8	3-5/8	3-5/8	3-5/8	3-5/8	4-1/8	4-1/8

* **NOTES:**

1. Sizes that are highlighted indicate maximum suction line sizes that should be used for risers. Riser size should not exceed horizontal size. Properly placed suction traps must also be used for adequate oil return. All sizes shown are for O.D. Type L copper tubing.
2. Suction line sizes selected at pressure drop equivalent to 2˚F. Reduce estimate of system capacity accordingly.
3. Recommended liquid line size may increase with reverse cycle hot gas systems.
4. If system load drops below 40% of design, consideration to installing double suction risers should be made.

LINE SIZING

Table 7a. Recommended Line Sizes for R-404A, R-507* (cont.)

Capacity BTUH	Suction Line Size																Liquid Line Size			
	Suction Temperature																Receiver to Expansion Valve Equivalent Lengths			
	-10 °F Equivalent Lengths				-20°F Equivalent Lengths				-30°F Equivalent Lengths				-40°F Equivalent Lengths							
	25'	50'	100'	150'	25'	50'	100'	150'	25'	50'	100'	150'	25'	50'	100'	150'	25'	50'	100'	150'
1,000	3/8	3/8	1/2	1/2	3/8	3/8	1/2	1/2	3/8	3/8	1/2	1/2	3/8	1/2	1/2	5/8	3/8	3/8	3/8	3/8
3,000	1/2	1/2	5/8	5/8	1/2	1/2	5/8	7/8	1/2	1/2	5/8	7/8	1/2	1/2	5/8	7/8	3/8	3/8	3/8	3/8
4,000	1/2	5/8	5/8	7/8	1/2	5/8	7/8	7/8	5/8	5/8	7/8	7/8	1/2	5/8	7/8	7/8	3/8	3/8	3/8	3/8
6,000	1/2	5/8	7/8	7/8	5/8	5/8	7/8	7/8	5/8	5/8	7/8	7/8	5/8	5/8	⅞	7/8	3/8	3/8	3/8	3/8
9,000	5/8	7/8	7/8	7/8	5/8	7/8	7/8	1-1/8	5/8	7/8	7/8	1-1/8	5/8	7/8	7/8	1-1/8	3/8	3/8	3/8	3/8
12,000	7/8	7/8	7/8	1-1/8	7/8	7/8	1-1/8	1-1/8	7/8	7/8	1-1/8	1-1/8	7/8	7/8	1-1/8	1-1/8	3/8	3/8	3/8	3/8
15,000	7/8	7/8	1-1/8	1-1/8	7/8	7/8	1-1/8	1-1/8	7/8	7/8	1-1/8	1-1/8	7/8	7/8	1-1/8	1-1/8	3/8	3/8	3/8	1/2
18,000	7/8	7/8	1-1/8	1-1/8	7/8	1-1/8	1-1/8	1-3/8	7/8	1-1/8	1-1/8	1-3/8	7/8	1-1/8	1-1/8	1-3/8	3/8	3/8	1/2	1/2
24,000	7/8	1-1/8	1-1/8	1-3/8	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-1/8	1-3/8	1-3/8	3/8	3/8	1/2	1/2
30,000	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-1/8	1-3/8	1-3/8	3/8	1/2	1/2	1/2
36,000	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-3/8	1-3/8	1-3/8	1-1/8	1-3/8	1-3/8	1-5/8	1/2	1/2	1/2	1/2
42,000	1-1/8	1-3/8	1-3/8	1-5/8	1-1/8	1-3/8	1-5/8	1-5/8	1-1/8	1-3/8	1-3/8	1-5/8	1-1/8	1-3/8	1-3/8	1-5/8	1/2	1/2	1/2	5/8
48,000	1-1/8	1-3/8	1-3/8	1-5/8	1-1/8	1-3/8	1-5/8	1-5/8	1-1/8	1-3/8	1-3/8	1-5/8	1-1/8	1-3/8	1-3/8	1-5/8	1/2	1/2	5/8	5/8
54,000	1-3/8	1-3/8	1-5/8	1-5/8	1-3/8	1-3/8	1-5/8	1-5/8	1-3/8	1-3/8	1-5/8	1-5/8	1-3/8	1-3/8	1-5/8	1-5/8	1/2	1/2	5/8	5/8
60,000	1-3/8	1-3/8	1-5/8	1-5/8	1-3/8	1-3/8	1-5/8	1-5/8	1-3/8	1-3/8	1-5/8	1-5/8	1-3/8	1-3/8	1-5/8	1-5/8	1/2	1/2	5/8	5/8
66,000	1-3/8	1-5/8	1-5/8	1-5/8	1-3/8	1-5/8	1-5/8	1-5/8	1-3/8	1-5/8	1-5/8	1-5/8	1-3/8	1-5/8	1-5/8	1-5/8	1/2	1/2	5/8	5/8
72,000	1-3/8	1-5/8	1-5/8	1-5/8	1-3/8	1-5/8	1-5/8	1-5/8	1-3/8	1-5/8	1-5/8	1-5/8	1-3/8	1-5/8	1-5/8	1-5/8	1/2	5/8	5/8	5/8
78,000	1-3/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8	2-1/8	1-5/8	1-5/8	1-5/8	2-1/8	1-5/8	1-5/8	1-5/8	2-1/8	5/8	5/8	5/8	5/8
84,000	1-3/8	1-5/8	1-5/8	2-1/8	1-5/8	1-5/8	2-1/8	2-1/8	1-5/8	1-5/8	2-1/8	2-1/8	1-5/8	1-5/8	2-1/8	2-1/8	5/8	5/8	5/8	7/8
90,000	1-5/8	1-5/8	2-1/8	2-1/8	1-5/8	1-5/8	2-1/8	2-1/8	1-5/8	2-1/8	2-1/8	2-1/8	1-5/8	1-5/8	2-1/8	2-1/8	5/8	5/8	7/8	7/8
120,000	1-5/8	2-1/8	2-1/8	2-5/8	1-5/8	2-1/8	2-1/8	2-5/8	1-5/8	2-1/8	2-1/8	2-5/8	1-5/8	2-1/8	2-1/8	2-5/8	5/8	5/8	7/8	7/8
150,000	2-1/8	2-1/8	2-5/8	2-5/8	2-1/8	2-1/8	2-5/8	2-5/8	2-1/8	2-1/8	2-5/8	2-5/8	2-1/8	2-1/8	2-5/8	2-5/8	5/8	7/8	7/8	7/8
180,000	2-1/8	2-1/8	2-5/8	2-5/8	2-1/8	2-1/8	2-5/8	2-5/8	2-1/8	2-1/8	2-5/8	2-5/8	2-1/8	2-1/8	2-5/8	2-5/8	7/8	7/8	7/8	1-1/8
210,000	2-1/8	2-1/8	2-5/8	3-1/8	2-1/8	2-5/8	2-5/8	3-1/8	2-1/8	2-5/8	2-5/8	3-1/8	2-1/8	2-5/8	2-5/8	3-1/8	7/8	7/8	1-1/8	1-1/8
240,000	2-1/8	2-5/8	2-5/8	3-1/8	2-1/8	2-5/8	2-5/8	3-1/8	2-5/8	2-5/8	3-1/8	3-1/8	2-5/8	2-5/8	3-1/8	3-1/8	7/8	7/8	1-1/8	1-1/8
300,000	2-5/8	2-5/8	3-1/8	3-1/8	2-5/8	2-5/8	3-1/8	3-5/8	2-5/8	2-5/8	3-1/8	3-5/8	2-5/8	2-5/8	3-5/8	3-5/8	7/8	1-1/8	1-1/8	1-3/8
360,000	2-5/8	2-5/8	3-1/8	3-5/8	2-5/8	2-5/8	3-5/8	3-5/8	2-5/8	3-1/8	3-5/8	3-5/8	2-5/8	3-1/8	3-5/8	4-1/8	1-1/8	1-1/8	1-3/8	1-3/8
480,000	2-5/8	3-1/8	3-5/8	3-5/8	2-5/8	3-1/8	3-5/8	3-5/8	3-1/8	3-5/8	4-1/8	4-1/8	3-1/8	3-5/8	4-1/8	4-1/8	1-1/8	1-1/8	1-3/8	1-5/8
600,000	3-1/8	3-1/8	3-5/8	4-1/8	3-1/8	3-1/8	3-5/8	3-5/8	3-1/8	3-5/8	4-1/8	4-1/8	3-1/8	3-5/8	4-1/8	4-1/8	1-1/8	1-3/8	1-5/8	1-5/8

*** NOTES:**

1. Sizes that are highlighted indicate maximum suction line sizes that should be used for risers. Riser size should not exceed horizontal size. Properly placed suction traps must also be used for adequate oil return. All sizes shown are for O.D. Type L copper tubing.
2. Suction line sizes selected at pressure drop equivalent to 2°F. Reduce estimate of system capacity accordingly.
3. Recommended liquid line size may increase with reverse cycle hot gas systems.
4. If system load drops below 40% of design, consideration to installing double suction risers should be made.

LINE SIZING

Table 8. Recommended Line Sizes for R-407*

Capacity BTUH	Suction Line Size												Maximum Suction Line Riser Size						
	Suction Temperature												R-407A/C/F Suction Temperature						
	+40˚F Equivalent Lengths				+20˚F Equivalent Lengths				+10˚F Equivalent Lengths										
	25'	50'	100'	150'	25'	50'	100'	150'	25'	50'	100'	150'	+40	+20	+10	-10	-20	-30	-40
1,000	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8
3,000	3/8	3/8	3/8	1/2	3/8	3/8	1/2	1/2	1/2	1/2	1/2	5/8	3/8	3/8	1/2	1/2	1/2	5/8	5/8
4,000	3/8	3/8	1/2	1/2	3/8	1/2	1/2	5/8	1/2	5/8	5/8	5/8	1/2	1/2	1/2	1/2	5/8	5/8	5/8
6,000	3/8	1/2	1/2	5/8	1/2	1/2	5/8	5/8	1/2	5/8	7/8	7/8	1/2	1/2	1/2	5/8	5/8	7/8	7/8
9,000	1/2	1/2	5/8	5/8	1/2	5/8	7/8	7/8	5/8	7/8	7/8	7/8	5/8	5/8	5/8	5/8	7/8	7/8	1-1/8
12,000	1/2	5/8	7/8	7/8	5/8	5/8	7/8	7/8	5/8	7/8	7/8	7/8	5/8	7/8	5/8	7/8	7/8	1-1/8	1-3/8
15,000	5/8	5/8	7/8	7/8	5/8	7/8	7/8	7/8	7/8	7/8	7/8	1-1/8	7/8	7/8	7/8	7/8	1-1/8	1-3/8	1-3/8
18,000	5/8	7/8	7/8	7/8	5/8	7/8	7/8	7/8	7/8	7/8	1-1/8	1-1/8	7/8	7/8	7/8	1-1/8	1-1/8	1-3/8	1-5/8
24,000	5/8	7/8	7/8	7/8	7/8	7/8	7/8	1-1/8	7/8	1-1/8	1-1/8	1-1/8	7/8	1-1/8	7/8	1-1/8	1-3/8	1-5/8	1-5/8
30,000	7/8	7/8	7/8	1-1/8	7/8	7/8	1-1/8	1-1/8	7/8	1-1/8	1-1/8	1-3/8	7/8	1-1/8	1-1/8	1-3/8	1-5/8	1-5/8	2-1/8
36,000	7/8	7/8	1-1/8	1-1/8	7/8	7/8	1-1/8	1-1/8	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-1/8	1-1/8	1-5/8	1-5/8	1-5/8	2-1/8
42,000	7/8	7/8	1-1/8	1-1/8	7/8	7/8	1-1/8	1-1/8	1-1/8	1-3/8	1-3/8	1-3/8	1-1/8	1-1/8	1-3/8	1-5/8	1-5/8	2-1/8	2-1/8
48,000	7/8	7/8	1-1/8	1-1/8	7/8	1-1/8	1-1/8	1-3/8	1-1/8	1-3/8	1-3/8	1-5/8	1-1/8	1-3/8	1-3/8	1-5/8	1-5/8	2-1/8	2-5/8
54,000	7/8	1-1/8	1-1/8	1-1/8	7/8	1-1/8	1-1/8	1-3/8	1-1/8	1-3/8	1-3/8	1-5/8	1-1/8	1-3/8	1-3/8	1-5/8	2-1/8	2-1/8	2-5/8
60,000	7/8	1-1/8	1-1/8	1-3/8	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-3/8	1-5/8	1-5/8	1-3/8	1-3/8	1-5/8	1-5/8	2-1/8	2-5/8	2-5/8
66,000	7/8	1-1/8	1-1/8	1-3/8	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-5/8	1-5/8	1-5/8	1-3/8	1-3/8	1-5/8	2-1/8	2-1/8	2-5/8	3-1/8
72,000	7/8	1-1/8	1-1/8	1-3/8	1-1/8	1-1/8	1-3/8	1-3/8	1-3/8	1-5/8	1-5/8	2-1/8	1-3/8	1-3/8	1-5/8	2-1/8	2-1/8	2-5/8	3-1/8
78,000	7/8	1-1/8	1-3/8	1-3/8	1-1/8	1-1/8	1-3/8	1-3/8	1-3/8	1-5/8	1-5/8	2-1/8	1-3/8	1-3/8	1-5/8	2-1/8	2-5/8	2-5/8	3-1/8
84,000	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-1/8	1-3/8	1-5/8	1-3/8	1-5/8	1-5/8	2-1/8	1-3/8	1-5/8	1-5/8	2-1/8	2-5/8	3-1/8	3-1/8
90,000	1-1/8	1-3/8	1-3/8	1-3/8	1-1/8	1-3/8	1-5/8	1-5/8	1-3/8	1-5/8	2-1/8	2-1/8	1-3/8	1-5/8	1-5/8	2-1/8	2-5/8	3-1/8	3-1/8
120,000	1-1/8	1-3/8	1-5/8	1-5/8	1-1/8	1-3/8	1-5/8	1-5/8	1-5/8	2-1/8	2-1/8	2-1/8	1-5/8	1-5/8	1-5/8	2-5/8	3-1/8	3-1/8	3-5/8
150,000	1-3/8	1-3/8	1-5/8	1-5/8	1-3/8	1-5/8	1-5/8	2-1/8	1-5/8	2-1/8	2-1/8	2-5/8	1-5/8	2-1/8	2-5/8	3-1/8	3-1/8	3-5/8	4-1/8
180,000	1-3/8	1-3/8	1-5/8	2-1/8	1-3/8	1-5/8	2-1/8	2-1/8	1-5/8	2-1/8	2-1/8	2-5/8	2-1/8	2-1/8	2-5/8	3-1/8	3-5/8	3-5/8	4-1/8
210,000	1-3/8	1-5/8	2-1/8	2-1/8	1-5/8	1-5/8	2-1/8	2-1/8	2-1/8	2-1/8	2-5/8	2-5/8	2-1/8	2-1/8	2-5/8	3-5/8	3-5/8	4-1/8	5-1/8
240,000	1-5/8	1-5/8	2-1/8	2-1/8	1-5/8	2-1/8	2-1/8	2-1/8	2-1/8	2-5/8	2-5/8	2-5/8	2-1/8	2-1/8	3-1/8	3-5/8	3-5/8	4-1/8	5-1/8
300,000	1-5/8	2-1/8	2-1/8	2-1/8	1-5/8	2-1/8	2-1/8	2-5/8	2-1/8	2-5/8	2-5/8	3-1/8	2-1/8	2-5/8	3-1/8	3-5/8	4-1/8	5-1/8	5-1/8
360,000	1-5/8	2-1/8	2-1/8	2-5/8	2-1/8	2-1/8	2-5/8	2-5/8	2-1/8	2-5/8	3-1/8	3-1/8	2-5/8	2-5/8	3-5/8	4-1/8	5-1/8	5-1/8	5-1/8
480,000	2-1/8	2-1/8	2-5/8	2-5/8	2-1/8	2-5/8	2-5/8	3-1/8	2-5/8	3-1/8	3-1/8	3-5/8	2-5/8	3-1/8	3-5/8	5-1/8	5-1/8	6-1/8	6-1/8
600,000	2-1/8	2-5/8	2-5/8	3-1/8	2-5/8	2-5/8	3-1/8	3-1/8	2-5/8	3-1/8	3-5/8	3-5/8	3-1/8	3-1/8	4-1/8	5-1/8	5-1/8	6-1/8	8-1/8

*** NOTES:**

1. Sizes that are highlighted indicate maximum suction line sizes that should be used for risers. Riser size should not exceed horizontal size. Properly placed suction traps must also be used for adequate oil return. All sizes shown are for O.D. Type L copper tubing.
2. Suction line sizes selected at pressure drop equivalent to 2˚F. Reduce estimate of system capacity accordingly.
3. Recommended liquid line size may increase with reverse cycle hot gas systems.
4. If system load drops below 40% of design, consideration to installing double suction risers should be made.

LINE SIZING

Table 8a. Recommended Line Sizes for R-407* (cont.)

Capacity BTUH	Suction Line Size																Liquid Line Size			
	Suction Temperature																Receiver to Expansion Valve Equivalent Lengths			
	-10˚F Equivalent Lengths				-20˚F Equivalent Lengths				-30˚F Equivalent Lengths				-40˚F Equivalent Lengths							
	25'	50'	100'	150'	25'	50'	100'	150'	25'	50'	100'	150'	25'	50'	100'	150'	25'	50'	100'	150'
1,000	3/8	3/8	1/2	1/2	3/8	1/2	1/2	1/2	3/8	1/2	1/2	5/8	3/8	5/8	5/8	5/8	3/8	3/8	3/8	3/8
3,000	1/2	1/2	5/8	5/8	1/2	5/8	7/8	7/8	5/8	5/8	7/8	7/8	5/8	5/8	7/8	7/8	3/8	3/8	3/8	3/8
4,000	1/2	5/8	7/8	7/8	5/8	7/8	7/8	7/8	5/8	7/8	7/8	7/8	5/8	7/8	7/8	1-1/8	3/8	3/8	3/8	3/8
6,000	5/8	5/8	7/8	7/8	5/8	5/8	7/8	1-1/8	7/8	7/8	1-1/8	1 1/8	7/8	7/8	1-1/8	1-1/8	3/8	3/8	3/8	3/8
9,000	5/8	7/8	7/8	1-1/8	7/8	7/8	1-1/8	1-1/8	7/8	1-1/8	1-1/8	1-3/8	1-1/8	1-1/8	1-3/8	1-3/8	3/8	3/8	3/8	3/8
12,000	7/8	7/8	1-1/8	1-1/8	7/8	1-1/8	1-1/8	1-3/8	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-1/8	1-3/8	1-5/8	3/8	3/8	3/8	3/8
15,000	7/8	1-1/8	1-1/8	1-1/8	7/8	1-1/8	1-3/8	1-3/8	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-3/8	1-5/8	1-5/8	3/8	3/8	3/8	3/8
18,000	7/8	1-1/8	1-1/8	1-3/8	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-3/8	1-3/8	1-5/8	1-1/8	1-3/8	1-5/8	1-5/8	3/8	3/8	3/8	1/2
24,000	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-3/8	1-3/8	1-5/8	1-3/8	1-3/8	1-5/8	1-5/8	1-3/8	1-5/8	2-1/8	2-1/8	3/8	3/8	1/2	1/2
30,000	1-1/8	1-1/8	1-3/8	1-5/8	1-1/8	1-3/8	1-5/8	1-5/8	1-3/8	1-5/8	1-5/8	2-1/8	1-3/8	1-5/8	2-1/8	2-1/8	3/8	1/2	1/2	1/2
36,000	1-1/8	1-3/8	1-3/8	1-5/8	1-3/8	1-3/8	1-5/8	2-1/8	1-3/8	1-5/8	2-1/8	2-1/8	1-5/8	2-1/8	2-1/8	2-1/8	3/8	1/2	1/2	5/8
42,000	1-3/8	1-3/8	1- 5/8	2-1/8	1-3/8	1-5/8	2-1/8	2-1/8	1-5/8	1-5/8	2-1/8	2-1/8	1-5/8	2-1/8	2-1/8	2-5/8	3/8	1/2	1/2	5/8
48,000	1-3/8	1-5/8	1-5/8	2-1/8	1-3/8	1-5/8	2-1/8	2-1/8	1-5/8	2-1/8	2-1/8	2-1/8	1-5/8	2-1/8	2-1/8	2-5/8	1/2	1/2	5/8	5/8
54,000	1-3/8	1-5/8	2-1/8	2-1/8	1-3/8	1- 5/8	2-1/8	2-1/8	1-5/8	2-1/8	2-1/8	2-5/8	2-1/8	2-1/8	2-5/8	2-5/8	1/2	1/2	5/8	5/8
60,000	1-3/8	1-5/8	2-1/8	2-1/8	1-5/8	2-1/8	2-1/8	2-1/8	1-5/8	2-1/8	2-1/8	2-5/8	2-1/8	2-1/8	2-5/8	2-5/8	1/2	1/2	5/8	5/8
66,000	1-3/8	1- 5/8	2-1/8	2-1/8	1-5/8	2-1/8	2-1/8	2-1/8	2-1/8	2-1/8	2-5/8	2-5/8	2-1/8	2-1/8	2-5/8	2-5/8	1/2	1/2	5/8	5/8
72,000	1- 5/8	1- 5/8	2-1/8	2-1/8	1-5/8	2-1/8	2-1/8	2-5/8	2-1/8	2-1/8	2-5/8	2-5/8	2-1/8	2-5/8	2-5/8	3-1/8	1/2	5/8	5/8	5/8
78,000	1- 5/8	2-1/8	2-1/8	2-1/8	1-5/8	2-1/8	2-1/8	2-5/8	2-1/8	2-1/8	2-5/8	2-5/8	2-1/8	2-5/8	2-5/8	3-1/8	1/2	5/8	5/8	7/8
84,000	1-5/8	2-1/8	2-1/8	2-1/8	1-5/8	2-1/8	2-1/8	2-5/8	2-1/8	2-1/8	2-5/8	2-5/8	2-1/8	2-5/8	2-5/8	3-1/8	1/2	5/8	5/8	7/8
90,000	1-5/8	2-1/8	2-1/8	2-5/8	2-1/8	2-1/8	2-5/8	2-5/8	2-1/8	2-1/8	2-5/8	2-5/8	2-1/8	2-5/8	3-1/8	3-1/8	1/2	5/8	7/8	7/8
120,000	2-1/8	2-1/8	2-5/8	2-5/8	2-1/8	2-1/8	2-5/8	3-1/8	2-1/8	2-5/8	3-1/8	3-1/8	2-5/8	2-5/8	3-1/8	3-5/8	5/8	5/8	7/8	7/8
150,000	2-1/8	2-1/8	2-5/8	2-5/8	2-5/8	2-5/8	3-1/8	3-1/8	2-5/8	2-5/8	3-1/8	3-5/8	2-5/8	3-1/8	3-5/8	3-5/8	5/8	7/8	7/8	7/8
180,000	2-1/8	2-5/8	2-5/8	3-1/8	2-5/8	2-5/8	3-1/8	3-1/8	2-5/8	3-1/8	3-1/8	3-5/8	2-5/8	3-1/8	3-5/8	4-1/8	7/8	7/8	7/8	1-1/8
210,000	2-1/8	2-5/8	3-1/8	3-1/8	2-5/8	2-5/8	3-1/8	3-5/8	2-5/8	3-1/8	3-5/8	3-5/8	3-1/8	3-5/8	4-1/8	4-1/8	7/8	7/8	7/8	1-1/8
240,000	2-5/8	2-5/8	3-1/8	3-1/8	2-5/8	3-1/8	3-5/8	3-5/8	2-5/8	3-1/8	3-5/8	4-1/8	3-1/8	3-5/8	4-1/8	5-1/8	7/8	7/8	1-1/8	1-1/8
300,000	2-5/8	3-1/8	3-1/8	3-5/8	2-5/8	3-1/8	3-5/8	4-1/8	3-1/8	3-5/8	4-1/8	4-1/8	3-5/8	3-5/8	5-1/8	5-1/8	7/8	7/8	1-1/8	1-1/8
360,000	2-5/8	3-1/8	3-5/8	3-5/8	3-1/8	3-5/8	4-1/8	4-1/8	3-1/8	3-5/8	4-1/8	5-1/8	3-5/8	4-1/8	5-1/8	5-1/8	7/8	1-1/8	1-1/8	1-1/8
480,000	3-1/8	3-5/8	4-1/8	4-1/8	3-1/8	3-5/8	4-1/8	5-1/8	3-5/8	4-1/8	5-1/8	5-1/8	4-1/8	5-1/8	5-1/8	6-1/8	7/8	1-1/8	1-3/8	1-3/8
600,000	3-1/8	3-5/8	4 -1/8	5-1/8	3-5/8	4-1/8	5-1/8	5-1/8	4-1/8	5-1/8	5-1/8	6-1/8	4-1/8	5-1/8	6-1/8	6-1/8	1-1/8	1-1/8	1-3/8	1-3/8

*** NOTES:**

1. Sizes that are highlighted indicate maximum suction line sizes that should be used for risers. Riser size should not exceed horizontal size. Properly placed suction traps must also be used for adequate oil return. All sizes shown are for O.D. Type L copper tubing.
2. Suction line sizes selected at pressure drop equivalent to 2˚F. Reduce estimate of system capacity accordingly.
3. Recommended liquid line size may increase with reverse cycle hot gas systems.
4. If system load drops below 40% of design, consideration to installing double suction risers should be made.

LINE SIZING

Table 9. Recommended Line Sizes for R-448A/R-449A*

Capacity BTUH	Suction Line Size												Maximum Suction Line Riser Size						
	Suction Temperature												R-448A/R-449A Suction Temperature						
	+40˚F Equivalent Lengths				+20˚F Equivalent Lengths				+10˚F Equivalent Lengths										
	25'	50'	100'	150'	25'	50'	100'	150'	25'	50'	100'	150'	+40	+20	+10	-10	-20	-30	-40
1,000	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	1/2	1/2
3,000	3/8	3/8	1/2	1/2	3/8	3/8	1/2	1/2	3/8	1/2	1/2	5/8	3/8	3/8	1/2	1/2	1/2	1/2	5/8
4,000	3/8	1/2	1/2	1/2	3/8	1/2	1/2	5/8	1/2	1/2	5/8	5/8	3/8	1/2	1/2	1/2	5/8	5/8	5/8
6,000	1/2	1/2	1/2	5/8	1/2	1/2	5/8	7/8	1/2	1/2	5/8	7/8	1/2	1/2	1/2	1/2	5/8	5/8	7/8
9,000	1/2	5/8	5/8	5/8	5/8	5/8	7/8	7/8	5/8	5/8	7/8	7/8	1/2	5/8	5/8	7/8	7/8	7/8	7/8
12,000	1/2	5/8	5/8	7/8	5/8	7/8	7/8	7/8	5/8	7/8	7/8	7/8	1/2	7/8	7/8	7/8	7/8	1-1/8	1-1/8
15,000	5/8	5/8	7/8	7/8	5/8	7/8	7/8	7/8	7/8	7/8	7/8	1-1/8	5/8	7/8	7/8	7/8	7/8	1-1/8	1-1/8
18,000	5/8	7/8	7/8	7/8	7/8	7/8	7/8	1-1/8	7/8	7/8	1-1/8	1-1/8	5/8	7/8	7/8	1-1/8	1-1/8	1-1/8	1-1/8
24,000	5/8	7/8	7/8	7/8	7/8	7/8	1-1/8	1-1/8	7/8	1-1/8	1-1/8	1-1/8	5/8	1-1/8	1-1/8	1-1/8	1-1/8	1-3/8	1-3/8
30,000	5/8	7/8	7/8	1-1/8	7/8	7/8	1-1/8	1-1/8	7/8	1-1/8	1-1/8	1-3/8	7/8	1-1/8	1-1/8	1-1/8	1-1/8	1-3/8	1-3/8
36,000	7/8	7/8	1-1/8	1-1/8	7/8	1-1/8	1-1/8	1-3/8	1-1/8	1-1/8	1-3/8	1-3/8	7/8	1-1/8	1-1/8	1-1/8	1-1/8	1-3/8	1-3/8
42,000	7/8	7/8	1-1/8	1-1/8	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-1/8	1-3/8	1-3/8	7/8	1-3/8	1-3/8	1-3/8	1-3/8	1-5/8	1-5/8
48,000	7/8	1-1/8	1-1/8	1-1/8	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-1/8	1-3/8	1-5/8	7/8	1-3/8	1-3/8	1-3/8	1-3/8	1-5/8	1-5/8
54,000	7/8	1-1/8	1-1/8	1-3/8	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-3/8	1-3/8	1-5/8	1-1/8	1-3/8	1-3/8	1-3/8	1-3/8	1-5/8	1-5/8
60,000	7/8	1-1/8	1-1/8	1-3/8	1-1/8	1-1/8	1-3/8	1-5/8	1-1/8	1-3/8	1-5/8	1-5/8	1-1/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8
66,000	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-3/8	1-3/8	1-5/8	1-1/8	1-3/8	1-5/8	1-5/8	1-1/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8
72,000	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-3/8	1-5/8	1-5/8	1-1/8	1-3/8	1-5/8	1-5/8	1-1/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8
78,000	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-3/8	1-5/8	1-5/8	1-3/8	1-3/8	1-5/8	1-5/8	1-3/8	1-5/8	1-5/8	1-5/8	1-5/8	2-1/8	2-1/8
84,000	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-3/8	1-5/8	1-5/8	1-3/8	1-3/8	1-5/8	2-1/8	1-3/8	1-5/8	1-5/8	1-5/8	1-5/8	2-1/8	2-1/8
90,000	1-1/8	1-3/8	1-3/8	1-5/8	1-3/8	1-3/8	1-5/8	2-1/8	1-3/8	1-5/8	1-5/8	2-1/8	1-3/8	1-5/8	1-5/8	1-5/8	2-1/8	2-1/8	2-1/8
120,000	1-1/8	1-3/8	1-5/8	1-5/8	1-3/8	1-5/8	2-1/8	2-1/8	1-3/8	1-5/8	2-1/8	2-1/8	1-5/8	2-1/8	2-1/8	2-1/8	2-1/8	2-5/8	2-5/8
150,000	1-3/8	1-3/8	1-5/8	2-1/8	1-5/8	1-5/8	2-1/8	2-1/8	1-5/8	2-1/8	2-1/8	2-1/8	1-5/8	2-1/8	2-1/8	2-1/8	2-1/8	2-5/8	2-5/8
180,000	1-3/8	1-5/8	2-1/8	2-1/8	1-5/8	2-1/8	2-1/8	2-1/8	1-5/8	2-1/8	2-1/8	2-5/8	1-5/8	2-1/8	2-1/8	2-5/8	2-5/8	2-5/8	2-5/8
210,000	1-3/8	1-5/8	2-1/8	2-1/8	1-5/8	2-1/8	2-1/8	2-5/8	2-1/8	2-1/8	2-5/8	2-5/8	2-1/8	2-5/8	2-5/8	2-5/8	2-5/8	3-1/8	3-1/8
240,000	1-5/8	1-5/8	2-1/8	2-1/8	1-5/8	2-1/8	2-1/8	2-5/8	2-1/8	2-1/8	2-5/8	2-5/8	2-1/8	2-5/8	2-5/8	2-5/8	2-5/8	3-1/8	3-1/8
300,000	1-5/8	2-1/8	2-1/8	2-5/8	2-1/8	2-1/8	2-5/8	2-5/8	2-1/8	2-5/8	2-5/8	3-1/8	2-5/8	2-5/8	2-5/8	2-5/8	2-5/8	3-1/8	3-1/8
360,000	2-1/8	2-1/8	2-5/8	2-5/8	2-1/8	2-1/8	2-5/8	3-1/8	2-1/8	2-5/8	2-5/8	3-1/8	2-5/8	2-5/8	3-1/8	3-1/8	3-1/8	3-5/8	3-5/8
480,000	2-1/8	2-1/8	2-5/8	2-5/8	2-1/8	2-5/8	3-1/8	3-1/8	2-5/8	2-5/8	2-5/8	3-5/8	3-1/8	3-1/8	3-5/8	3-5/8	3-5/8	4-1/8	4-1/8
600,000	2-1/8	2-5/8	2-5/8	3-1/8	2-5/8	2-5/8	3-1/8	3-5/8	2-5/8	2-5/8	3-1/8	3-5/8	3-1/8	3-5/8	3-5/8	3-5/8	3-5/8	4-1/8	4-1/8

*** NOTES:**

1. Sizes that are highlighted indicate maximum suction line sizes that should be used for risers. Riser size should not exceed horizontal size. Properly placed suction traps must also be used for adequate oil return. All sizes shown are for O.D. Type L copper tubing.
2. Suction line sizes selected at pressure drop equivalent to 2˚F. Reduce estimate of system capacity accordingly.
3. Recommended liquid line size may increase with reverse cycle hot gas systems.
4. If system load drops below 40% of design, consideration to installing double suction risers should be made.

LINE SIZING

Table 9a.Recommended Line Sizes for R-448A/R-449A* (cont.)

Capacity BTUH	Suction Line Size																Liquid Line Size			
	Suction Temperature																Receiver to Expansion Valve Equivalent Lengths			
	-10˚F Equivalent Lengths				-20˚F Equivalent Lengths				-30˚F Equivalent Lengths				-40˚F Equivalent Lengths							
	25'	50'	100'	150'	25'	50'	100'	150'	25'	50'	100'	150'	25'	50'	100'	150'	25'	50'	100'	150'
1,000	3/8	3/8	1/2	1/2	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	1/2	1/2	5/8	3/8	3/8	3/8	3/8
3,000	1/2	1/2	5/8	5/8	3/8	3/8	1/2	1/2	3/8	1/2	1/2	5/8	1/2	1/2	5/8	7/8	3/8	3/8	3/8	3/8
4,000	1/2	5/8	5/8	7/8	3/8	1/2	1/2	5/8	1/2	1/2	5/8	5/8	1/2	5/8	7/8	7/8	3/8	3/8	3/8	3/8
6,000	1/2	5/8	7/8	7/8	1/2	1/2	5/8	7/8	1/2	1/2	5/8	7/8	5/8	5/8	7/8	7/8	3/8	3/8	3/8	3/8
9,000	5/8	7/8	7/8	7/8	5/8	5/8	7/8	7/8	5/8	5/8	7/8	7/8	5/8	7/8	7/8	1-1/8	3/8	3/8	3/8	3/8
12,000	7/8	7/8	7/8	1-1/8	5/8	7/8	7/8	7/8	5/8	7/8	7/8	7/8	7/8	7/8	1-1/8	1-1/8	3/8	3/8	3/8	3/8
15,000	7/8	7/8	1-1/8	1-1/8	5/8	7/8	7/8	7/8	7/8	7/8	7/8	1-1/8	7/8	7/8	1-1/8	1-1/8	3/8	3/8	3/8	3/8
18,000	7/8	7/8	1-1/8	1-1/8	7/8	7/8	7/8	1-1/8	7/8	7/8	1-1/8	1-1/8	7/8	1-1/8	1-1/8	1-3/8	3/8	3/8	3/8	1/2
24,000	7/8	1-1/8	1-1/8	1-3/8	7/8	7/8	1-1/8	1-1/8	7/8	1-1/8	1-1/8	1-1/8	1-1/8	1-1/8	1-3/8	1-3/8	3/8	3/8	1/2	1/2
30,000	1-1/8	1-1/8	1-3/8	1-3/8	7/8	7/8	1-1/8	1-1/8	7/8	1-1/8	1-1/8	1-3/8	1-1/8	1-1/8	1-3/8	1-3/8	3/8	3/8	1/2	1/2
36,000	1-1/8	1-1/8	1-3/8	1-3/8	7/8	1-1/8	1-1/8	1-3/8	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-3/8	1-3/8	1-5/8	3/8	1/2	1/2	1/2
42,000	1-1/8	1-3/8	1-3/8	1-5/8	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-3/8	1-3/8	1-5/8	3/8	1/2	1/2	1/2
48,000	1-1/8	1-3/8	1-3/8	1-5/8	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-1/8	1-3/8	1-5/8	1-1/8	1-3/8	1-3/8	1-5/8	1/2	1/2	1/2	1/2
54,000	1-3/8	1-3/8	1-5/8	1-5/8	1-1/8	1-1/8	1-3/8	1-3/8	1-1/8	1-3/8	1-3/8	1-5/8	1-3/8	1-3/8	1-5/8	1-5/8	1/2	1/2	1/2	5/8
60,000	1-3/8	1-3/8	1-5/8	1-5/8	1-1/8	1-1/8	1-3/8	1-5/8	1-1/8	1-3/8	1-5/8	1-5/8	1-3/8	1-3/8	1-5/8	1-5/8	1/2	1/2	5/8	5/8
66,000	1-3/8	1-5/8	1-5/8	1-5/8	1-1/8	1-3/8	1-3/8	1-5/8	1-1/8	1-3/8	1-5/8	1-5/8	1-3/8	1-5/8	1-5/8	1-5/8	1/2	1/2	5/8	5/8
72,000	1-3/8	1-5/8	1-5/8	1-5/8	1-1/8	1-3/8	1-5/8	1-5/8	1-1/8	1-3/8	1-5/8	1-5/8	1-3/8	1-5/8	1-5/8	1-5/8	1/2	1/2	5/8	5/8
78,000	1-3/8	1-5/8	1-5/8	1-5/8	1-1/8	1-3/8	1-5/8	1-5/8	1-3/8	1-3/8	1-5/8	1-5/8	1-5/8	1-5/8	1-5/8	2-1/8	1/2	1/2	5/8	5/8
84,000	1-3/8	1-5/8	1-5/8	2-1/8	1-1/8	1-3/8	1-5/8	1-5/8	1-3/8	1-3/8	1-5/8	2-1/8	1-5/8	1-5/8	2-1/8	2-1/8	1/2	5/8	5/8	5/8
90,000	1-5/8	1-5/8	2-1/8	2-1/8	1-3/8	1-3/8	1-5/8	2-1/8	1-3/8	1-5/8	1 5/8	2-1/8	1-5/8	1-5/8	2-1/8	2-1/8	1/2	5/8	5/8	7/8
120,000	1-5/8	2-1/8	2-1/8	2-5/8	1-3/8	1-5/8	2-1/8	2-1/8	1-3/8	1-5/8	2-1/8	2-1/8	1-5/8	2-1/8	2-1/8	2-5/8	5/8	5/8	7/8	7/8
150,000	2-1/8	2-1/8	2-5/8	2-5/8	1-5/8	1-5/8	2-1/8	2-1/8	1-5/8	2-1/8	2-1/8	2-1/8	2-1/8	2-1/8	2-5/8	2-5/8	5/8	7/8	7/8	7/8
180,000	2-1/8	2-1/8	2-5/8	2-5/8	1-5/8	2-1/8	2-1/8	2-1/8	1-5/8	2-1/8	2-1/8	2-5/8	2-1/8	2-1/8	2-5/8	2-5/8	5/8	7/8	7/8	7/8
210,000	2-1/8	2-1/8	2-5/8	3-1/8	1-5/8	2-1/8	2-1/8	2-5/8	2-1/8	2-1/8	2-5/8	2-5/8	2-1/8	2-5/8	2-5/8	3-1/8	7/8	7/8	7/8	7/8
240,000	2-1/8	2-5/8	2-5/8	3-1/8	1-5/8	2-1/8	2-1/8	2-5/8	2-1/8	2-1/8	2-5/8	2-5/8	2-5/8	2-5/8	3-1/8	3-1/8	7/8	7/8	7/8	1-1/8
300,000	2-5/8	2-5/8	3-1/8	3-1/8	2-1/8	2-1/8	2-5/8	2-5/8	2-1/8	2-5/8	2-5/8	3-1/8	2-5/8	2-5/8	3-5/8	3-5/8	7/8	7/8	1-1/8	1-1/8
360,000	2-5/8	2-5/8	3-1/8	3-5/8	2-1/8	2-1/8	2-5/8	3-1/8	2-1/8	2-5/8	2-5/8	3-1/8	2-5/8	3-1/8	3-5/8	4-1/8	7/8	7/8	1-1/8	1-1/8
480,000	2-5/8	3-1/8	3-5/8	3-5/8	2-1/8	2-5/8	3-1/8	3-1/8	2-5/8	2-5/8	2-5/8	3-5/8	3-1/8	3-5/8	4-1/8	4-1/8	1-1/8	1-1/8	1-1/8	1-3/8
600,000	3-1/8	3-1/8	3-5/8	4-1/8	2-5/8	2-5/8	3-1/8	3-5/8	2-5/8	2-5/8	3-1/8	3-5/8	3-1/8	3-5/8	4-1/8	4-1/8	1-1/8	1-1/8	1-1/8	1-3/8

* **NOTES:**

1. Sizes that are highlighted indicate maximum suction line sizes that should be used for risers. Riser size should not exceed horizontal size. Properly placed suction traps must also be used for adequate oil return. All sizes shown are for O.D. Type L copper tubing.
2. Suction line sizes selected at pressure drop equivalent to 2˚F. Reduce estimate of system capacity accordingly.
3. Recommended liquid line size may increase with reverse cycle hot gas systems.
4. If system load drops below 40% of design, consideration to installing double suction risers should be made.

Unit Coolers

HEATCRAFT Worldwide Refrigeration

Table 3. Expansion Valve Selection 180# Head Pressure Valve

BTUH at about 10˚F T.D.	R-404A / R-507A -20˚F / -29˚C Evap.		R-404A / R-507A +25˚F / -4˚C Evap.		R-407A / R-407F -20˚F / -29˚C Evap.		R-407A / R-407F +25˚F / -4˚C Evap.		R-448A / R-449A -20˚F / -29˚C Evap.		R-448A / R-449A +25˚F / -4˚C Evap.	
	Sporlan	Alco	Sporlan	Alco	Sporlan	Alco	Sporlan	Alco	Sporlan	Alco	Sporlan	Alco
3,000-3,500	SQE-1 (1/4T)-SZP	HFESC-1/4-SZ	SQE-1 (1/4T)-SC	HFESC-1/4-SC	SQE-1 (3/4T)-NZP	HFESC-1-HZ	SQE-0 (1/3T)-NC	HFESC-1/2-HC	SQE-1 (1/4T)-DZP	HFESC-1/2-BZ	SQE-0 (1/6T)-DC	HFESC-1/2-BC
3,600-5,000	SQE-2 (1/2T)-SZP	HFESC-1/2-SZ	SQE-1 (1/4T)-SC	HFESC-1/4-SC	SQE-1 (3/4T)-NZP	HFESC-1-HZ	SQE-1 (3/4T)-NC	HFESC-1-HC	SQE-1 (1/4T)-DZP	HFESC-1-BZ	SQE-1 (1/4T)-DC	HFESC-1-BC
5,500-7000	SQE-3 (1T)-SZP	HFESC-1-SZ	SQE-2 (1/2T)-SC	HFESC-1/2-SC	SQE-2 (1T)-NZP	HFESC-1-1/2-HZ	SQE-1 (3/4T)-NC	HFESC-1-HC	SQE-2 (1/2T)-DZP	HFESC-1-BZ	SQE-1 (1/4T)-DC	HFESC-1-BC
7,500-8,000	SQE-3 (1T)-SZP	HFESC-1-SZ	SQE-3 (1T)-SC	HFESC-1-SC	SQE-3 (1-1/2T)-NZP	HFESC-1-1/2-HZ	SQE-1 (3/4T)-NC	HFESC-1-1/2-HC	SQE-2 (1/2T)-DZP	HFESC-1-BZ	SQE-2 (1/2T)-DC	HFESC-1-BC
8,500-10,000	SQE-4 (1-1/2T)-SZP	HFESC-1-1/2-SZ	SQE-3 (1T)-SC	HFESC-1-SC	SQE-3 (1-1/2T)-NZP	HFESC-2-HZ	SQE-2 (1T)-NC	HFESC-1-1/2-HC	SQE-3 (1T)-DZP	HFESC-1-1/2-BZ	SQE-2 (1/2T)-DC	HFESC-1-1/2-BC
10,500-11,000	SQE-4 (1-1/2T)-SZP	HFESC-1-1/2-SZ	SQE-4 (1-1/2T)-SC	HFESC–1-1/2-SC	SQE-4 (2-1/2T)-NZP	HFESC-2-HZ	SQE-3 (1-1/2T)-NC	HFESC-1-1/2-HC	SQE-3 (1T)-DZP	HFESC-1-1/2-BZ	SQE-2 (1/2T)-DC	HFESC-1-1/2-BC
11,500-13,000	SQE-4 (1-1/2T)-SZP	HFESC-1-1/2-SZ	SQE-4 (1-1/2T)-SC	HFESC–1-1/2-SC	SQE-4 (2-1/2T)-NZP	HFESC-2-1/2-HZ	SQE-3 (1-1/2T)-NC	HFESC-2-HC	SQE-4 (1-1/2T)-DZP	HFESC-2-BZ	SQE-3 (1T)-DC	HFESC-1-1/2-BC
13,500-15,000	SQE-4 (1-1/2T)-SZP	HFESC-1-1/2-SZ	SQE-4 (1-1/2T)-SC	HFESC–1-1/2-SC	SQE-4 (2-1/2T)-NZP	HFESC-2-1/2-HZ	SQE-3 (1-1/2T)-NC	HFESC-2-HC	SQE-4 (1-1/2T)-DZP	HFESC-2-BZ	SQE-3 (1T)-DC	HFESC-2-BC
15,500-17,000	SQE-5 (2T)-SZP	HFESC-2-SZ	SQE-4 (1-1/2T)-SC	HFESC–1-1/2-SC	SQE-4 (2-1/2T)-NZP	HFESC-3-HZ	SQE-4 (2-1/2T)-NC	HFESC-2-1/2-HC	SQE-4 (1-1/2T)-DZP	HFESC-2-1/2-BZ	SQE-4 (1-1/2T)-DC	HFESC-2-BC
17,500-20,000	SQE-5 (2T)-SZP	HFESC-2-SZ	SQE-5 (2T)-SC	HFESC-2-SC	SQE-4 (2-1/2T)-NZP	HFESC-3-HZ	SQE-4 (2-1/2T)-NC	HFESC-2-1/2-HC	SQE-4 (1-1/2T)-DZP	HFESC-2-1/2-BZ	SQE-4 (1-1/2T)-DC	HFESC-2-1/2-BC
20,500-24,000	SQE-6 (3T)-SZP	HFESC-3-1/2-SZ	SQE-6 (3T)-SC	HFESC-3-1/2-SC	SQE-5 (3-1/2T)-NZP	HFESC-5-1/2-HZ	SQE-4 (2-1/2T)-NC	HFESC-3-HC	SQE-5 (2T)-DZP	HFESC-3-1/2-BZ	SQE-4 (1-1/2T)-DC	HFESC-3-1/2-BC
24,500-28,000	SSE-4-ZP	HFESC-3-1/2-SZ	SQE-6 (3T)-SC	HFESC-3-1/2-SC	SQE-6 (5T)-NZP	HFESC-5-1/2-HZ	SQE-5 (3-1/2T)-NC	HFESC-3-HC	SQE-5 (2T)-DZP	HFESC-3-1/2-BZ	SQE-5 (2T)-DC	HFESC-3-1/2-BC
28,500-34,000	SSE-4-ZP	HFES-5-SZ	SSE-4-C	HFES-5-SC	SNE-5-ZP	HFESC-5-1/2-HZ	SQE-5 (3-1/2T)-NC	HFESC-5-1/2-HC	SQE-6 (3T)-DZP	HFES-6-BZ	SQE-5 (2T)-DC	HFESC-3-1/2-BC
34,500-40,000	SSE-6-ZP	HFES-7-SZ	SSE-6-C	HFES-7-SC	SNE-8-ZP	HFES-8-HZ	SQE-6 (5T)-NC	HFESC-5-1/2-HC	SDE-4-ZP	HFES-6-BZ	SQE-6 (3T)-DC	HFES-6-BC
40,500-50,000	SSE-7-ZP	HFES-7-SZ	SSE-6-C	HFES-7-SC	ONE-10-ZP	HFES-8-HZ	SQE-6 (5T)-NC	HFESC-5-1/2-HC	SDE-4-ZP	HFES-6-BZ	SDE-4-C	HFES-6-BC
50,500-60,000	SSE-7-ZP	HFES-7-SZ	SSE-7-C	HFES-7-SC	ONE-15-ZP	HFES-10-HZ	SNE-5-C	HFESC-5-1/2-HC	SDE-6-ZP	HFES-8-1/2-BZ	SDE-4-C	HFES-6-BC
60,500-70,000	OSE-12-ZP	TRAE-12-SZ	OSE-9-C	HFES-10-SC	ONE-15-ZP	HFES-15-HZ	SNE-8-C	HFES-8-HC	SDE-7-ZP	HFES-8-1/2-BZ	SDE-6-C	HFES-8-1/2-BC
70,500-80,000	OSE-12-ZP	TRAE-12-SZ	OSE-9-C	HFES-10-SC	ONE-15-ZP	HFES-15-HZ	SNE-8-C	HFES-10-HC	SDE-7-ZP	HFES-10-1/2-BZ	SDE-6-C	HFES-8-1/2-BC
80,500-90,000	OSE-12-ZP	TRAE-12-SZ	OSE-9-C	HFES-10-SC	ONE-20-ZP	HFES-15-HZ	ONE-10-C	HFES-15-HC	ODE-12-ZP	HFES-10-1/2-BZ	SDE-7-C	HFES-10-1/2-BC
90,500-100,000	OSE-12-ZP	TRAE-12-SZ	OSE-12-C	HFES-13-SC	ONE-20-ZP	TRAE-20-HZ	ONE-10-C	HFES-15-HC	ODE-17-ZP	HFES-16-BZ	SDE-7-C	HFES-10-1/2-BC
100,500-110,000	OSE-21-ZP	TRAE-20-SZ	OSE-12-C	HFES-13-SC	ONE-20-ZP	TRAE-20-HZ	ONE-15-C	TRAE-15-HC	ODE-17-ZP	HFES-16-BZ	ODE-12-C	HFES-16-BC
110,500-120,000	OSE-21-ZP	TRAE-20-SZ	OSE-12-C	HFES-13-SC	ONE-20-ZP	TRAE-20-HZ	ONE-15-C	TRAE-15-HC	ODE-17-ZP	HFES-16-BZ	ODE-12-C	HFES-16-BC
120,500-130,000	OSE-30-ZP	TRAE-30-SZ	OSE-12-C	HFES-13-SC	ONE-30-ZP	TRAE-30-HZ	ONE-15-C	TRAE-15-HC	ODE-17-ZP	HFES-16-BZ	ODE-12-C	HFES-16-BC
130,500-140,000	OSE-30-ZP	TRAE-30-SZ	OSE-21-C	TRAE-20-SC	ONE-30-ZP	TRAE-30-HZ	ONE-15-C	TRAE-15-HC	ODE-17-ZP	HFES-20-BZ	ODE-12-C	HFES-16-BC

NOTES:

1. Selections are optimized for systems using an air-cooled condensing unit.
2. For Medium temperature R507(A), valve power element will use a "P" code for refrigerant
3. Use R407A/R407F selections as a guide for R22/R407C applications, valve power element will use a "V" code for refrigerant (Sporlan)
4. An equivalent valve may be used in place of selection.

Table 4. Expansion Valve Selection 150# Head Pressure Valve

BTUH at about 10˚F T.D.	R-404A / R-507A -20˚F / -29˚C Evap.		R-404A / R-507A +25˚F / -4˚C Evap.		R-407A / R-407F -20˚F / -29˚C Evap.		R-407A / R-407F +25˚F / -4˚C Evap.		R-448A / R-449A -20˚F / -29˚C Evap.		R-448A / R-449A +25˚F / -4˚C Evap.	
	Sporlan	Alco	Sporlan	Alco	Sporlan	Alco	Sporlan	Alco	Sporlan	Alco	Sporlan	Alco
3,000-4,000	SBFSE-AA-ZP	HFESC-1/2-SZ	SBFSE-AA-C	HFESC-1/2-SC	SBFNE-AA-ZP	HFESC-1-HZ	SBFNE-AA-C	HFESC-1/2-HC	SBFDE-AA-ZP	HFESC-1/2-BZ	SBFDE-AA-C	HFESC-1/2-BC
4,100-5,000	SBFSE-AA-ZP	HFESC-1/2-SZ	SBFSE-A-C	HFESC-1-SC	SBFNE-AA-ZP	HFESC-1-HZ	SBFNE-AA-C	HFESC-1-HC	SBFDE-AA-ZP	HFESC-1-BZ	SBFDE-AA-C	HFESC-1-BC
5,500-7000	SBFSE-A-ZP	HFESC-1-SZ	SBFSE-A-C	HFESC-1-SC	SBFNE-A-ZP	HFESC-1-HZ	SBFNE-AA-C	HFESC-1-HC	SBFDE-AA-ZP	HFESC-1-BZ	SBFDE-AA-C	HFESC-1-BC
7,500-8,000	SBFSE-A-ZP	HFESC-1-SZ	SBFSE-A-C	HFESC-1-SC	SBFNE-A-ZP	HFESC-1-1/2-HZ	SBFNE-A-C	HFESC-1-1/2-HC	SBFDE-A-ZP	HFESC-1-1/2-BZ	SBFDE-A-C	HFESC-1-1/2-BC
8,500-10,000	SBFSE-A-ZP	HFESC-1-SZ	SBFSE-A-C	HFESC-1-SC	SBFNE-A-ZP	HFESC-1-1/2-HZ	SBFNE-A-C	HFESC-1-1/2-HC	SBFDE-A-ZP	HFESC-1-1/2-BZ	SBFDE-A-C	HFESC-1-1/2-BC
10,500-11,000	SBFSE-A-ZP	HFESC-1-SZ	SBFSE-B-C	HFESC-2-SC	SBFNE-A-ZP	HFESC-2-HZ	SBFNE-A-C	HFESC-2-HC	SBFDE-A-ZP	HFESC-2-BZ	SBFDE-A-C	HFESC-2-BC
11,500-13,000	SBFSE-B-ZP	HFESC-1-1/2-SZ	SBFSE-B-C	HFESC-2-SC	SBFNE-B-ZP	HFESC-2-HZ	SBFNE-A-C	HFESC-2-HC	SBFDE-A-ZP	HFESC-2-BZ	SBFDE-A-C	HFESC-2-BC
13,500-15,000	SBFSE-B-ZP	HFESC-1-1/2-SZ	SBFSE-B-C	HFESC-2-SC	SBFNE-B-ZP	HFESC-3-HZ	SBFNE-A-C	HFESC-2-1/2-HC	SBFDE-A-ZP	HFESC-2-1/2-BZ	SBFDE-A-C	HFESC-2-1/2-BC
15,500-17,000	SBFSE-C-ZP	HFESC-2-SZ	SBFSE-B-C	HFESC-2-SC	SBFNE-B-ZP	HFESC-3-HZ	SBFNE-B-C	HFESC-2-1/2-HC	SBFDE-B-ZP	HFESC-2-1/2-BZ	SBFDE-B-C	HFESC-2-1/2-BC
17,500-20,000	SBFSE-C-ZP	HFESC-2-SZ	SBFSE-C-C	HFESC-3-1/2-SC	SBFNE-B-ZP	HFESC-3-HZ	SBFNE-B-C	HFESC-3-HC	SBFDE-B-ZP	HFESC-3-1/2-BZ	SBFDE-B-C	HFESC-2-1/2-BC
20,500-24,000	SBFSE-C-ZP	HFESC-3-1/2-SZ	SBFSE-C-C	HFESC-3-1/2-SC	SBFNE-C-ZP	HFESC-5-1/2-HZ	SBFNE-B-C	HFESC-3-HC	SBFDE-C-ZP	HFESC-3-1/2-BZ	SBFDE-B-C	HFESC-3-1/2-BC
24,500-28,000	OSE-6-ZP	HFES-5-SZ	SBFSE-C-C	HFESC-3-1/2-SC	SBFNE-C-ZP	HFESC-5-1/2-HZ	SBFNE-B-C	HFESC-5-1/2-HC	SBFDE-C-ZP	HFES-6-BZ	SBFDE-B-C	HFES-6-BC
28,500-34,000	OSE-6-ZP	HFES-5-SZ	OSE-6-C	HFES-5-SC	SBFNE-C-ZP	HFESC-5-1/2-HZ	SBFNE-C-C	HFESC-5-1/2-HC	SBFDE-C-ZP	HFES-6-BZ	SBFDE-C-C	HFES-6-BC
34,500-40,000	OSE-6-ZP	HFES-7-SZ	OSE-6-C	HFES-7-SC	ONE-10-C	HFES-8-HZ	SBFNE-C-C	HFESC-5-1/2-HC	ODE-7-ZP	HFES-6-BZ	SBFDE-C-C	HFES-6-BC
40,500-50,000	OSE-9-ZP	HFES-10-SZ	OSE-6-C	HFES-7-SC	ONE-10-C	HFES-8-HZ	SBFNE-C-C	HFES-8-HC	ODE-7-ZP	HFES-8-1/2-BZ	ODE-7-C	HFES-6-BC
50,500-60,000	OSE-9-ZP	HFES-10-SZ	OSE-9-C	HFES-7-SC	ONE-15-ZP	HFES-10-HZ	ONE-10-C	HFES-8-HC	ODE-12-ZP	HFES-10-1/2-BZ	ODE-7-C	HFES-8-1/2-BC
60,500-70,000	OSE-12-ZP	TRAE-12-SZ	OSE-9-C	HFES-10-SC	ONE-15-ZP	HFES-10-HZ	ONE-10-C	HFES-10-HC	ODE-12-ZP	HFES-10-1/2-BZ	ODE-7-C	HFES-10-1/2-BC
70,500-80,000	OSE-12-ZP	TRAE-12-SZ	OSE-9-C	HFES-10-SC	ONE-15-ZP	HFES-15-HZ	ONE-10-C	HFES-10-HC	ODE-12-ZP	HFES-16-BZ	ODE-12-C	HFES-10-1/2-BC
80,500-90,000	OSE-12-ZP	TRAE-12-SZ	OSE-12-C	HFES-10-SC	ONE-20-ZP	HFES-15-HZ	ONE-10-C	HFES-15-HC	ODE-17-ZP	HFES-16-BZ	ODE-12-C	HFES-10-1/2-BC
90,500-100,000	OSE-21-ZP	TRAE-20-SZ	OSE-12-C	HFES-13-SC	ONE-20-ZP	TRAE-20-HZ	ONE-15-C	HFES-15-HC	ODE-17-ZP	HFES-16-BZ	ODE-12-C	HFES-16-BC
100,500-110,000	OSE-21-ZP	TRAE-20-SZ	OSE-12-C	HFES-13-SC	ONE-20-ZP	TRAE-20-HZ	ONE-15-C	HFES-15-HC	ODE-17-ZP	HFES-16-BZ	ODE-12-C	HFES-16-BC
110,500-120,000	OSE-30-ZP	TRAE-30-SZ	OSE-21-C	TRAE-20-SC	ONE-20-ZP	TRAE-20-HZ	ONE-15-C	TRAE-15-HC	ODE-17-ZP	HFES-20-BZ	ODE-12-C	HFES-20-BC
120,500-130,000	OSE-30-ZP	TRAE-30-SZ	OSE-21-C	TRAE-20-SC	ONE-30-ZP	TRAE-30-HZ	ONE-20-C	TRAE-20-HC	ODE-17-ZP	HFES-20-BZ	ODE-12-C	HFES-20-BC
130,500-140,000	OSE-30-ZP	TRAE-30-SZ	OSE-21-C	TRAE-20-SC	ONE-30-ZP	TRAE-30-HZ	ONE-20-C	TRAE-20-HC	ODE-28-ZP	–	ODE-17-C	–

NOTES:

1. Selections are optimized for systems using an air-cooled condensing unit.
2. For Medium temperature R507(A), valve power element will use a "P" code for refrigerant
3. Use R407A/R407F selections as a guide for R22/R407C applications, valve power element will use a "V" code for refrigerant (Sporlan)
4. An equivalent valve may be used in place of selection.

CONTINUED ON NEXT PAGE

EXPANSION VALVE SELECTION (CONT'D.)

Unit Coolers

HEATCRAFT Worldwide Refrigeration

Table 3. Expansion Valve Selection 180# Head Pressure Valve

BTUH at about 10°F T.D.	R-404A / R-507A -20°F / -29°C Evap.		R-404A / R-507A +25°F / -4°C Evap.		R-407A / R-407F -20°F / -29°C Evap.		R-407A / R-407F +25°F / -4°C Evap.		R-448A / R-449A -20°F / -29°C Evap.		R-448A / R-449A +25°F / -4°C Evap.	
	Sporlan	Alco	Sporlan	Alco	Sporlan	Alco	Sporlan	Alco	Sporlan	Alco	Sporlan	Alco
3,000-3,500	SQE-1 (1/4T)-SZP	HFESC-1/4-SZ	SQE-1 (1/4T)-SC	HFESC-1/4-SC	SQE-1 (3/4T)-NZP	HFESC-1-HZ	SQE-0 (1/3T)-NC	HFESC-1/2-HC	SQE-1 (1/4T)-DZP	HFESC-1/2-BZ	SQE-0 (1/6T)-DC	HFESC-1/2-BC
3,600-5,000	SQE-2 (1/2T)-SZP	HFESC-1/2-SZ	SQE-1 (1/4T)-SC	HFESC-1/4-SC	SQE-1 (3/4T)-NZP	HFESC-1-HZ	SQE-1 (3/4T)-NC	HFESC-1-HC	SQE-1 (1/4T)-DZP	HFESC-1-BZ	SQE-1 (1/4T)-DC	HFESC-1-BC
5,500-7000	SQE-3 (1T)-SZP	HFESC-1-SZ	SQE-2 (1/2T)-SC	HFESC-1/2-SC	SQE-2 (1T)-NZP	HFESC-1-1/2-HZ	SQE-1 (3/4T)-NC	HFESC-1-HC	SQE-2 (1/2T)-DZP	HFESC-1-BZ	SQE-1 (1/4T)-DC	HFESC-1-BC
7,500-8,000	SQE-3 (1T)-SZP	HFESC-1-SZ	SQE-3 (1T)-SC	HFESC-1-SC	SQE-3 (1-1/2T)-NZP	HFESC-1-1/2-HZ	SQE-1 (3/4T)-NC	HFESC-1-1/2-HC	SQE-2 (1/2T)-DZP	HFESC-1-BZ	SQE-2 (1/2T)-DC	HFESC-1-BC
8,500-10,000	SQE-4 (1-1/2T)-SZP	HFESC-1-1/2-SZ	SQE-3 (1T)-SC	HFESC-1-SC	SQE-3 (1-1/2T)-NZP	HFESC-2-HZ	SQE-2 (1T)-NC	HFESC-1-1/2-HC	SQE-3 (1T)-DZP	HFESC-1-1/2-BZ	SQE-2 (1/2T)-DC	HFESC-1-1/2-BC
10,500-11,000	SQE-4 (1-1/2T)-SZP	HFESC-1-1/2-SZ	SQE-4 (1-1/2T)-SC	HFESC–1-1/2-SC	SQE-4 (2-1/2T)-NZP	HFESC-2-HZ	SQE-3 (1-1/2T)-NC	HFESC-1-1/2-HC	SQE-3 (1T)-DZP	HFESC-1-1/2-BZ	SQE-2 (1/2T)-DC	HFESC-1-1/2-BC
11,500-13,000	SQE-4 (1-1/2T)-SZP	HFESC-1-1/2-SZ	SQE-4 (1-1/2T)-SC	HFESC–1-1/2-SC	SQE-4 (2-1/2T)-NZP	HFESC-2-1/2-HZ	SQE-3 (1-1/2T)-NC	HFESC-2-HC	SQE-4 (1-1/2T)-DZP	HFESC-2-BZ	SQE-3 (1T)-DC	HFESC-1-1/2-BC
13,500-15,000	SQE-4 (1-1/2T)-SZP	HFESC-1-1/2-SZ	SQE-4 (1-1/2T)-SC	HFESC–1-1/2-SC	SQE-4 (2-1/2T)-NZP	HFESC-2-1/2-HZ	SQE-3 (1-1/2T)-NC	HFESC-2-HC	SQE-4 (1-1/2T)-DZP	HFESC-2-BZ	SQE-3 (1T)-DC	HFESC-2-BC
15,500-17,000	SQE-5 (2T)-SZP	HFESC-2-SZ	SQE-4 (1-1/2T)-SC	HFESC–1-1/2-SC	SQE-4 (2-1/2T)-NZP	HFESC-3-HZ	SQE-4 (2-1/2T)-NC	HFESC-2-1/2-HC	SQE-4 (1-1/2T)-DZP	HFESC-2-1/2-BZ	SQE-4 (1-1/2T)-DC	HFESC-2-BC
17,500-20,000	SQE-5 (2T)-SZP	HFESC-2-SZ	SQE-5 (2T)-SC	HFESC-2-SC	SQE-4 (2-1/2T)-NZP	HFESC-3-HZ	SQE-4 (2-1/2T)-NC	HFESC-2-1/2-HC	SQE-4 (1-1/2T)-DZP	HFESC-2-1/2-BZ	SQE-4 (1-1/2T)-DC	HFESC-2-1/2-BC
20,500-24,000	SQE-6 (3T)-SZP	HFESC-3-1/2-SZ	SQE-6 (3T)-SC	HFESC-3-1/2-SC	SQE-5 (3-1/2T)-NZP	HFESC-5-1/2-HZ	SQE-4 (2-1/2T)-NC	HFESC-3-HC	SQE-5 (2T)-DZP	HFESC-3-1/2-BZ	SQE-4 (1-1/2T)-DC	HFESC-3-1/2-BC
24,500-28,000	SSE-4-ZP	HFESC-3-1/2-SZ	SQE-6 (3T)-SC	HFESC-3-1/2-SC	SQE-6 (5T)-NZP	HFESC-5-1/2-HZ	SQE-5 (3-1/2T)-NC	HFESC-3-HC	SQE-5 (2T)-DZP	HFESC-3-1/2-BZ	SQE-5 (2T)-DC	HFESC-3-1/2-BC
28,500-34,000	SSE-4-ZP	HFES-5-SZ	SSE-4-C	HFES-5-SC	SNE-5-ZP	HFESC-5-1/2-HZ	SQE-5 (3-1/2T)-NC	HFESC-5-1/2-HC	SQE-6 (3T)-DZP	HFES-6-BZ	SQE-5 (2T)-DC	HFESC-3-1/2-BC
34,500-40,000	SSE-6-ZP	HFES-7-SZ	SSE-6-C	HFES-7-SC	SNE-8-ZP	HFES-8-HZ	SQE-6 (5T)-NC	HFESC-5-1/2-HC	SDE-4-ZP	HFES-6-BZ	SQE-6 (3T)-DC	HFES-6-BC
40,500-50,000	SSE-7-ZP	HFES-7-SZ	SSE-6-C	HFES-7-SC	ONE-10-ZP	HFES-8-HZ	SQE-6 (5T)-NC	HFESC-5-1/2-HC	SDE-4-ZP	HFES-6-BZ	SDE-4-C	HFES-6-BC
50,500-60,000	SSE-7-ZP	HFES-7-SZ	SSE-7-C	HFES-7-SC	ONE-15-ZP	HFES-10-HZ	SNE-5-C	HFESC-5-1/2-HC	SDE-6-ZP	HFES-8-1/2-BZ	SDE-4-C	HFES-6-BC
60,500-70,000	OSE-12-ZP	TRAE-12-SZ	OSE-9-C	HFES-10-SC	ONE-15-ZP	HFES-15-HZ	SNE-8-C	HFES-8-HC	SDE-7-ZP	HFES-8-1/2-BZ	SDE-6-C	HFES-8-1/2-BC
70,500-80,000	OSE-12-ZP	TRAE-12-SZ	OSE-9-C	HFES-10-SC	ONE-15-ZP	HFES-15-HZ	SNE-8-C	HFES-10-HC	SDE-7-ZP	HFES-10-1/2-BZ	SDE-6-C	HFES-8-1/2-BC
80,500-90,000	OSE-12-ZP	TRAE-12-SZ	OSE-9-C	HFES-10-SC	ONE-20-ZP	HFES-15-HZ	ONE-10-C	HFES-15-HC	ODE-12-ZP	HFES-10-1/2-BZ	SDE-7-C	HFES-10-1/2-BC
90,500-100,000	OSE-12-ZP	TRAE-12-SZ	OSE-12-C	HFES-13-SC	ONE-20-ZP	TRAE-20-HZ	ONE-10-C	HFES-15-HC	ODE-17-ZP	HFES-16-BZ	SDE-7-C	HFES-10-1/2-BC
100,500-110,000	OSE-21-ZP	TRAE-20-SZ	OSE-12-C	HFES-13-SC	ONE-20-ZP	TRAE-20-HZ	ONE-15-C	TRAE-15-HC	ODE-17-ZP	HFES-16-BZ	ODE-12-C	HFES-16-BC
110,500-120,000	OSE-21-ZP	TRAE-20-SZ	OSE-12-C	HFES-13-SC	ONE-20-ZP	TRAE-20-HZ	ONE-15-C	TRAE-15-HC	ODE-17-ZP	HFES-16-BZ	ODE-12-C	HFES-16-BC
120,500-130,000	OSE-30-ZP	TRAE-30-SZ	OSE-12-C	HFES-13-SC	ONE-30-ZP	TRAE-30-HZ	ONE-15-C	TRAE-15-HC	ODE-17-ZP	HFES-16-BZ	ODE-12-C	HFES-16-BC
130,500-140,000	OSE-30-ZP	TRAE-30-SZ	OSE-21-C	TRAE-20-SC	ONE-30-ZP	TRAE-30-HZ	ONE-15-C	TRAE-15-HC	ODE-17-ZP	HFES-20-BZ	ODE-12-C	HFES-16-BC

NOTES:

1. Selections are optimized for systems using an air-cooled condensing unit.
2. For Medium temperature R507(A), valve power element will use a "P" code for refrigerant
3. Use R407A/R407F selections as a guide for R22/R407C applications, valve power element will use a "V" code for refrigerant (Sporlan)
4. An equivalent valve may be used in place of selection.

Table 4. Expansion Valve Selection 150# Head Pressure Valve

BTUH at about 10°F T.D.	R-404A / R-507A -20°F / -29°C Evap.		R-404A / R-507A +25°F / -4°C Evap.		R-407A / R-407F -20°F / -29°C Evap.		R-407A / R-407F +25°F / -4°C Evap.		R-448A / R-449A -20°F / -29°C Evap.		R-448A / R-449A +25°F / -4°C Evap.	
	Sporlan	Alco	Sporlan	Alco	Sporlan	Alco	Sporlan	Alco	Sporlan	Alco	Sporlan	Alco
3,000-4,000	SBFSE-AA-ZP	HFESC-1/2-SZ	SBFSE-AA-C	HFESC-1/2-SC	SBFNE-AA-ZP	HFESC-1-HZ	SBFNE-AA-C	HFESC-1/2-HC	SBFDE-AA-ZP	HFESC-1/2-BZ	SBFDE-AA-C	HFESC-1/2-BC
4,100-5,000	SBFSE-AA-ZP	HFESC-1/2-SZ	SBFSE-A-C	HFESC-1-SC	SBFNE-AA-ZP	HFESC-1-HZ	SBFNE-AA-C	HFESC-1-HC	SBFDE-AA-ZP	HFESC-1-BZ	SBFDE-AA-C	HFESC-1-BC
5,500-7000	SBFSE-A-ZP	HFESC-1-SZ	SBFSE-A-C	HFESC-1-SC	SBFNE-A-ZP	HFESC-1-HZ	SBFNE-AA-C	HFESC-1-HC	SBFDE-AA-ZP	HFESC-1-BZ	SBFDE-AA-C	HFESC-1-BC
7,500-8,000	SBFSE-A-ZP	HFESC-1-SZ	SBFSE-A-C	HFESC-1-SC	SBFNE-A-ZP	HFESC-1-1/2-HZ	SBFNE-A-C	HFESC-1-1/2-HC	SBFDE-A-ZP	HFESC-1-1/2-BZ	SBFDE-A-C	HFESC-1-1/2-BC
8,500-10,000	SBFSE-A-ZP	HFESC-1-SZ	SBFSE-A-C	HFESC-1-SC	SBFNE-A-ZP	HFESC-1-1/2-HZ	SBFNE-A-C	HFESC-1-1/2-HC	SBFDE-A-ZP	HFESC-1-1/2-BZ	SBFDE-A-C	HFESC-1-1/2-BC
10,500-11,000	SBFSE-A-ZP	HFESC-1-SZ	SBFSE-B-C	HFESC-2-SC	SBFNE-A-ZP	HFESC-2-HZ	SBFNE-A-C	HFESC-2-HC	SBFDE-A-ZP	HFESC-2-BZ	SBFDE-A-C	HFESC-2-BC
11,500-13,000	SBFSE-B-ZP	HFESC-1-1/2-SZ	SBFSE-B-C	HFESC-2-SC	SBFNE-B-ZP	HFESC-2-HZ	SBFNE-A-C	HFESC-2-HC	SBFDE-A-ZP	HFESC-2-BZ	SBFDE-A-C	HFESC-2-BC
13,500-15,000	SBFSE-B-ZP	HFESC-1-1/2-SZ	SBFSE-B-C	HFESC-2-SC	SBFNE-B-ZP	HFESC-3-HZ	SBFNE-A-C	HFESC-2-1/2-HC	SBFDE-A-ZP	HFESC-2-1/2-BZ	SBFDE-A-C	HFESC-2-1/2-BC
15,500-17,000	SBFSE-C-ZP	HFESC-2-SZ	SBFSE-B-C	HFESC-2-SC	SBFNE-B-ZP	HFESC-3-HZ	SBFNE-B-C	HFESC-2-1/2-HC	SBFDE-B-ZP	HFESC-2-1/2-BZ	SBFDE-B-C	HFESC-2-1/2-BC
17,500-20,000	SBFSE-C-ZP	HFESC-2-SZ	SBFSE-C-C	HFESC-3-1/2-SC	SBFNE-B-ZP	HFESC-3-HZ	SBFNE-B-C	HFESC-3-HC	SBFDE-B-ZP	HFESC-3-1/2-BZ	SBFDE-B-C	HFESC-2-1/2-BC
20,500-24,000	SBFSE-C-ZP	HFESC-3-1/2-SZ	SBFSE-C-C	HFESC-3-1/2-SC	SBFNE-C-ZP	HFESC-5-1/2-HZ	SBFNE-B-C	HFESC-3-HC	SBFDE-C-ZP	HFESC-3-1/2-BZ	SBFDE-B-C	HFESC-3-1/2-BC
24,500-28,000	OSE-6-ZP	HFES-5-SZ	SBFSE-C-C	HFESC-3-1/2-SC	SBFNE-C-ZP	HFESC-5-1/2-HZ	SBFNE-B-C	HFESC-5-1/2-HC	SBFDE-C-ZP	HFES-6-BZ	SBFDE-B-C	HFES-6-BC
28,500-34,000	OSE-6-ZP	HFES-5-SZ	OSE-6-C	HFES-5-SC	SBFNE-C-ZP	HFESC-5-1/2-HZ	SBFNE-C-C	HFESC-5-1/2-HC	SBFDE-C-ZP	HFES-6-BZ	SBFDE-C-C	HFES-6-BC
34,500-40,000	OSE-6-ZP	HFES-7-SZ	OSE-6-C	HFES-7-SC	ONE-10-C	HFES-8-HZ	SBFNE-C-C	HFESC-5-1/2-HC	ODE-7-ZP	HFES-6-BZ	SBFDE-C-C	HFES-6-BC
40,500-50,000	OSE-9-ZP	HFES-10-SZ	OSE-6-C	HFES-7-SC	ONE-10-C	HFES-8-HZ	SBFNE-C-C	HFES-8-HC	ODE-7-ZP	HFES-8-1/2-BZ	ODE-7-C	HFES-6-BC
50,500-60,000	OSE-9-ZP	HFES-10-SZ	OSE-9-C	HFES-7-SC	ONE-15-ZP	HFES-10-HZ	ONE-10-C	HFES-8-HC	ODE-12-ZP	HFES-10-1/2-BZ	ODE-7-C	HFES-8-1/2-BC
60,500-70,000	OSE-12-ZP	TRAE-12-SZ	OSE-9-C	HFES-10-SC	ONE-15-ZP	HFES-10-HZ	ONE-10-C	HFES-10-HC	ODE-12-ZP	HFES-10-1/2-BZ	ODE-7-C	HFES-10-1/2-BC
70,500-80,000	OSE-12-ZP	TRAE-12-SZ	OSE-9-C	HFES-10-SC	ONE-15-ZP	HFES-15-HZ	ONE-10-C	HFES-10-HC	ODE-12-ZP	HFES-16-BZ	ODE-12-C	HFES-10-1/2-BC
80,500-90,000	OSE-12-ZP	TRAE-12-SZ	OSE-12-C	HFES-10-SC	ONE-20-ZP	HFES-15-HZ	ONE-10-C	HFES-15-HC	ODE-17-ZP	HFES-16-BZ	ODE-12-C	HFES-10-1/2-BC
90,500-100,000	OSE-21-ZP	TRAE-20-SZ	OSE-12-C	HFES-13-SC	ONE-20-ZP	TRAE-20-HZ	ONE-15-C	HFES-15-HC	ODE-17-ZP	HFES-16-BZ	ODE-12-C	HFES-16-BC
100,500-110,000	OSE-21-ZP	TRAE-20-SZ	OSE-12-C	HFES-13-SC	ONE-20-ZP	TRAE-20-HZ	ONE-15-C	HFES-15-HC	ODE-17-ZP	HFES-16-BZ	ODE-12-C	HFES-16-BC
110,500-120,000	OSE-30-ZP	TRAE-30-SZ	OSE-21-C	TRAE-20-SC	ONE-20-ZP	TRAE-20-HZ	ONE-15-C	TRAE-15-HC	ODE-17-ZP	HFES-20-BZ	ODE-12-C	HFES-20-BC
120,500-130,000	OSE-30-ZP	TRAE-30-SZ	OSE-21-C	TRAE-20-SC	ONE-30-ZP	TRAE-30-HZ	ONE-20-C	TRAE-20-HC	ODE-17-ZP	HFES-20-BZ	ODE-12-C	HFES-20-BC
130,500-140,000	OSE-30-ZP	TRAE-30-SZ	OSE-21-C	TRAE-20-SC	ONE-30-ZP	TRAE-30-HZ	ONE-20-C	TRAE-20-HC	ODE-28-ZP	–	ODE-17-C	–

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3. Use R407A/R407F selections as a guide for R22/R407C applications, valve power element will use a "V" code for refrigerant (Sporlan)
4. An equivalent valve may be used in place of selection.

Fahrenheit-Celsius temperature conversion chart

The numbers in bold-face type in the center column refer to the temperature, either in Celsius of Fahrenheit, which is to be converted to the other scale. If converting Fahrenheit to Celsius the equivalent temperature will be found in the left column. If converting Celsius to Fahrenheit, the equivalent temperature will be found in the column on the right

Temperature			Temperature			Temperature			Temperature		
Celsius	C or F	Fahr	Celsius	C or F	Fahr	Celsius	C or F	Fahr	Celsius	C or F	Fahr
-40.0	**-40**	-40.0	-6.7	**+20**	+68.0	+26.7	**+80**	+176.0	+60.0	**+140**	+284.0
-39.4	**-39**	-38.2	-6.1	**+21**	+69.8	+27.2	**+81**	+177.8	+60.6	**+141**	+285.8
-38.9	**-38**	-36.4	-5.5	**+22**	+71.6	+27.8	**+82**	+179.6	+61.1	**+142**	+287.6
-38.3	**-37**	-34.6	-5.0	**+23**	+73.4	+28.3	**+83**	+181.4	+61.7	**+143**	+289.4
-37.8	**-36**	-32.8	-4.4	**+24**	+75.2	+28.9	**+84**	+183.2	+62.2	**+144**	+291.2
-37.2	**-35**	-31.0	-3.9	**+25**	+77.0	+29.4	**+85**	+185.0	+62.8	**+145**	+293.0
-36.7	**-34**	-29.2	-3.3	**+26**	+78.8	+30.0	**+86**	+186.8	+63.3	**+146**	+294.8
-36.1	**-33**	-27.4	-2.8	**+27**	+80.6	+30.6	**+87**	+188.6	+63.9	**+147**	+296.6
-35.6	**-32**	-25.6	-2.2	**+28**	+82.4	+31.1	**+88**	+190.4	+64.4	**+148**	+298.4
-35.0	**-31**	-23.8	-1.7	**+29**	+84.2	+31.7	**+89**	+192.2	+65.0	**+149**	+300.2
-34.4	**-30**	-22.0	-1.1	**+30**	+86.0	+32.2	**+90**	+194.0	+65.6	**+150**	+302.0
-33.9	**-29**	-20.2	-0.6	**+31**	+87.8	+32.8	**+91**	+195.8	+66.1	**+151**	+303.8
-33.3	**-28**	-18.4	.0	**+32**	+89.6	+33.3	**+92**	+197.6	+66.7	**+152**	+305.6
-32.8	**-27**	-16.6	+0.6	**+33**	+91.4	+33.9	**+93**	+199.4	+67.2	**+153**	+307.4
-32.2	**-26**	-14.8	+1.1	**+34**	+93.2	+34.4	**+94**	+201.2	+67.8	**+154**	+309.2
-31.7	**-25**	-13.0	+1.7	**+35**	+95.0	+35.0	**+95**	+203.0	+68.3	**+155**	+311.0
-31.1	**-24**	-11.2	+2.2	**+36**	+96.8	+35.6	**+96**	+204.8	+68.9	**+156**	+312.8
-30.6	**-23**	-9.4	+2.8	**+37**	+98.6	+36.1	**+97**	+206.6	+69.4	**+157**	+314.6
-30.0	**-22**	-7.6	+3.3	**+38**	+100.4	+36.7	**+98**	+208.4	+70.0	**+158**	+316.4
-29.4	**-21**	-5.8	+3.9	**+39**	+102.2	+37.2	**+99**	+210.2	+70.6	**+159**	+318.2
-28.9	**-20**	-4.0	+4.4	**+40**	+104.0	+37.8	**+100**	+212.0	+71.1	**+160**	+320.0
-28.3	**-19**	-2.2	+5.0	**+41**	+105.8	+38.3	**+101**	+213.8	+71.7	**+161**	+321.8
-27.8	**-18**	-0.4	+5.5	**+42**	+107.6	+38.9	**+102**	+215.6	+72.2	**+162**	+323.6
-27.2	**-17**	+1.4	+6.1	**+43**	+109.4	+39.4	**+103**	+217.4	+72.8	**+163**	+325.4
-26.7	**-16**	+3.2	+6.7	**+44**	+111.2	+40.0	**+104**	+219.2	+73.3	**+164**	+327.2
-26.1	**-15**	+5.0	+7.2	**+45**	+113.0	+40.6	**+105**	+221.0	+73.9	**+165**	+329.0
-25.6	**-14**	+6.8	+7.8	**+46**	+114.8	+41.1	**+106**	+222.8	+74.4	**+166**	+330.8
-25.0	**-13**	+8.6	+8.3	**+47**	+116.6	+41.7	**+107**	+224.6	+75.0	**+167**	+332.6
-24.4	**-12**	+10.4	+8.9	**+48**	+118.4	+42.2	**+108**	+226.4	+75.6	**+168**	+334.4
-23.9	**-11**	+12.2	+9.4	**+49**	+120.2	+42.8	**+109**	+228.2	+76.1	**+169**	+336.2
-23.3	**-10**	+14.0	+10.0	**+50**	+122.0	+43.3	**+110**	+230.0	+76.7	**+170**	+338.0
-22.8	**-9**	+15.8	+10.6	**+51**	+123.8	+43.9	**+111**	+231.8	+77.2	**+171**	+339.8
-22.2	**-8**	+17.6	+11.1	**+52**	+125.6	+44.4	**+112**	+233.6	+77.8	**+172**	+341.6
-21.7	**-7**	+19.4	+11.7	**+53**	+127.4	+45.0	**+113**	+235.4	+78.3	**+173**	+343.4
-21.1	**-6**	+21.2	+12.2	**+54**	+129.2	+45.6	**+114**	+237.2	+78.9	**+174**	+345.2
-20.6	**-5**	+23.0	+12.8	**+55**	+131.0	+46.1	**+115**	+239.0	+79.4	**+175**	+347.0
-20.0	**-4**	+24.8	+13.3	**+58**	+132.8	+46.7	**+116**	+240.8	+80.0	**+176**	+348.8
-19.4	**-3**	+26.6	+13.9	**+57**	+134.6	+47.2	**+117**	+242.6	+80.6	**+177**	+350.6
-18.9	**-2**	+28.4	+14.4	**+58**	+136.4	+47.8	**+118**	+244.4	+81.1	**+178**	+352.4
-18.3	**-1**	+30.2	+15.0	**+59**	+138.2	+48.3	**+119**	+246.2	+81.7	**+178**	+352.4
-17.8	**0**	+32.0	+15.6	**+60**	+140.0	+48.9	**+120**	+248.0	+82.2	**+180**	+356.0
-17.2	**+1**	+33.8	+16.1	**+61**	+141.8	+49.4	**+121**	+249.8	+82.8	**+181**	+357.8
-16.7	**+2**	+35.6	+16.7	**+62**	+143.6	+50.0	**+122**	+251.6	+83.3	**+182**	+359.6
-16.1	**+3**	+37.4	+17.2	**+63**	+145.4	+50.6	**+123**	+253.4	+83.9	**+183**	+361.4
-15.6	**+4**	+39.2	+17.8	**+64**	+147.2	+51.1	**+124**	+255.2	+84.4	**+184**	+363.2
-15.0	**+5**	+41.0	+18.3	**+65**	+149.0	+51.7	**+125**	+257.0	+85.0	**+185**	+365.0
-14.4	**+6**	+42.8	+18.9	**+66**	+150.8	+52.2	**+126**	+258.8	+85.6	**+186**	+366.8
-13.9	**+7**	+44.6	+19.4	**+67**	+152.6	+52.8	**+127**	+260.6	+86.1	**+187**	+368.6
-13.3	**+8**	+46.4	+20.0	**+68**	+154.4	+53.3	**+128**	+262.4	+86.7	**+188**	+370.4
-12.8	**+9**	+48.2	+20.6	**+69**	+156.2	+53.9	**+129**	+264.2	+87.2	**+189**	+372.2
-12.2	**+10**	+50.0	+21.1	**+70**	+158.0	+54.4	**+130**	+266.0	+87.8	**+190**	+374.0
-11.7	**+11**	+51.8	+21.7	**+71**	+159.8	+55.0	**+131**	+267.8	+88.3	**+191**	+375.8
-11.1	**+12**	+53.6	+22.2	**+72**	+161.6	+55.6	**+132**	+269.6	+88.9	**+192**	+377.6
-10.6	**+13**	+55.4	+22.8	**+73**	+163.4	+56.1	**+133**	+271.4	+89.4	**+193**	+379.4
-10.0	**+14**	+57.2	+23.3	**+74**	+165.2	+56.7	**+134**	+273.2	+90.0	**+194**	+381.2
-9.4	**+15**	+59.0	+23.9	**+75**	+167.0	+57.2	**+135**	+275.0	+90.6	**+195**	+383.0
-8.9	**+16**	+60.8	+24.4	**+76**	+168.8	+57.8	**+136**	+276.8	+91.1	**+196**	+384.8
-8.3	**+17**	+62.6	+25.0	**+77**	+170.6	+58.3	**+137**	+278.6	+91.7	**+197**	+386.6
-7.8	**+18**	+64.4	+25.6	**+78**	+172.4	+58.9	**+138**	+280.4	+92.2	**+198**	+388.4
-7.2	**+19**	+66.2	+26.1	**+79**	+174.2	+59.4	**+139**	+282.2	+92.8	**+199**	+390.2

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Conversion Factors (Constants)

Water

500 = 8.33 lbs/gal × 60 min. — (Converts GPM to lbs/hr)

Air

$4.5 = \frac{60 \text{ min.}}{13.35 \text{ cu ft/lb}}$ — (Converts CFM to lbs/hr)

1.08 = 4.5 × 0.241 BTU/lb/°F — (Lbs/hr × Sp. Ht. of Air)

$0.68 = \frac{4.5 \times 1054.3 \text{ BTU/lb}}{7000 \text{ gr/lb}}$ — (4.5 combined with heat of vaporization of water at 70°F and grains per pound of water)

Water Heating, Cooling & Heat Reclaim Coils, Water Chillers, Condensers, Etc.

$Q = 500 \times GPM \times \Delta T$ = BTU/hr

$\Delta T = \frac{Q}{500 \times GPM}$

For brines, Q = 500 × GPM × ΔT × (Sp. Ht. × Sp. Gr. of Brine) = BTU/hr

Air Coils

Q Sensible = 1.08×CFM×ΔT = BTU/hr
Q Latent = 0.68×CFM×ΔSH = BTU/hr
Q Total = 4.5×CFM×ΔH = BTU/hr

Lb/hr Condensate = $\frac{4.5 \times CFM \times \Delta SH \text{ Grains}}{7000 \text{ grains/lb}}$

SHR Sensible Heat Ratio = $\frac{Q \text{ Sensible}}{Q \text{ Total}}$

Heat Transmission

Q Total = U×A Surface×ΔT = BTU/hr

Product

Sensible Heat in BTU/hr = Lbs/hr × Sp. Ht. ×ΔT
Latent Heat in BTU/hr = Lbs/hr × Lt. Ht. in BTU/lb
Heat of Resp. in BTU/hr = Lbs ×Heat of Respiration in BTU/lb/hr

All conversion factors used in standard calculations must be corrected for other than standard properties

Properties of Water at 39.2°F

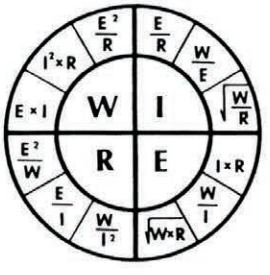
Density of water	= 62.4 lbs/cubic ft
Specific Heat of water	= 1 BTU/lb/°F
Latent Heat of Vaporization	= 970 BTU/lb at 212°F & 1 Atm. = 1054.3 BTU/lb at 70°F
Specific Heat of Ice	= 0.5 BTU/lb/°F
Latent Heat of Fusion	= 144 BTU/lb
1 Gallon of water	= 8.33 lbs
1 Pound of water	= 7000 Grains

Nomenclature

Q = Heat Flow in BTU/hr
T = Temperature in °F (ΔT = temp. diff.)
A = Area in sq. ft.
U = Coef. of Heat Transfer in BTU/hr/sq.ft./°F
H = Total heat of air at wet bulb temp. BTU/lb
ΔH = Enthalpy difference between entering & leaving air
SH = Specific humidity in grains of moisture/lb of dry air (ΔSH = Specific humidity difference for entering & leaving air)
CFM = Cu.ft./min.
GPM = Gal/min.

Table 37
Single Phase Loads

Ohm's Law for direct current



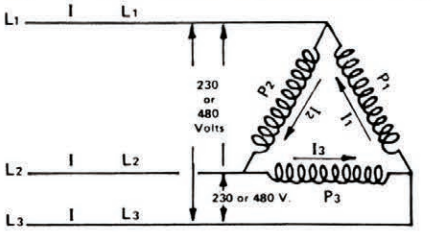
W = Watts
I = Current (Amperes)
E = Electromotive Force (Volts)
R = Resistance (Ohms)

To obtain any value in the center circle, for Direct or Alternating Current, perform the operation indicated in one segment of the adjacent outer circle.

3 Phase Delta Loads

3 Ø Balanced Loads = $P_1 + P_2 + P_3$

Total Line Current = Total Power (Balanced Load)



If the phases are unbalanced, each of the phases will differ from the others:

FORMULAE: $I_{L1} = \sqrt{I_2^2 + I_1^2 + (I_1 \times I_2)}$

$I_{L2} = \sqrt{I_2^2 + I_3^2 + (I_2 \times I_3)}$

$I_{L3} = \sqrt{I_3^2 + I_1^2 + (I_1 \times I_3)}$

English conversion Factors & Data

To Convert Measurements		
From	*To*	*Multiply By*
Cubic Feet	Cubic Inches	1728.
Cubic Inches	Cubic Feet	0.00058
Cubic Feet	Gallons	7.480
Gallons	Cubic Feet	0.1337
Cubic Inches	Gallons	0.00433
Gallons	Cubic Inches	231.
Barrels	Gallons	42.
Gallons	Barrels	0.0238
Imperial Gallons	U.S. Gallons	1.2009
U.S. Gallons	Imperial Gallons	0.8326
Feet	Inches	12.
Inches	Feet	0.0833
Square Feet	Square Inches	144.
Square Inches	Square Feet	0.00695
Short Tons	Pounds	2000.
Liters	U.S. Gallons	0.2642

To Convert Pressure (at 32° F)		
From	*To*	*Multiply By*
Inches of Water	Pounds per Square Inch	0.03612
Pounds per Sq. Inch	Inches of Water	27.686
Feet of Water	Pounds of Sq. Inch	0.4334
Pounds per Sq. Inch	Feet of Water	2.307
Inches of Mercury	Pounds per Sq. Inch	0.4912
Pounds per Sq. Inch	Inches of Mercury	2.036
Atmospheres	Pounds per Sq. Inch	14.696
Pounds per Sq. Inch	Atmospheres	0.06804

To Convert Power		
From	*To*	*Multiply By*
Horsepower	Metric Horsepower	1.014
Horsepower	Ft./Pounds per Minute	33000.
Horsepower	Kilowatts	0.746
Kilowatts	Horsepower	1.3404
British Thermal Units	Foot/Pounds	778.177
Foot/Pounds	British Thermal Units	0.001285
British Thermal Units	Horsepower Hours	0.0003927
Horsepower Hours	British Thermal Units	2544.1
British Thermal Units	Kilowatt Hours	0.0002928
Kilowatt Hours	British Thermal Units	3415.
Watt Hours	British Thermal Units	3.415

Volume-Weight Conversions	Wt. Lbs.
1 Cubic Foot of Water	62.4*
1 Cubic Inch of Water	0.0361*
1 Gallon of Water	8.33*
1 Cubic Foot of Air	.075†
1 Cubic Inch of Steel	0.284
1 Cubic Foot of Brick (Building)	112-120
1 Cubic Foot of Concrete	120-140
1 Cubic Foot of Earth	70-120

* at 32° F.
† at 70° F. — 29.92" Hg.

English to Metric conversion factors

To Convert Measurements		
From	*To*	*Multiply By*
Cubic Feet	Cubic Centimeters	28317.0
Cubic Inches	Cubic Centimeters	16.387
Cubic Feet	Liters	28.32
Gallons	Liters	3.7854
Cubic Inches	Liters	0.0164
Gallons	Cubic Centimeters	3785.4
Barrels	Cubic Meters	1.0551
Imperial Gallons	Cubic Meters	0.0045461
U.S. Gallons	Cubic Meters	0.0037854
Feet	Meters	0.3048
Inches	Meters	0.0254
Square Feet	Square Meters	0.0929
Square Inches	Square Centimeters	6.452
Ton (Short, 2000 Lb.)	Kilograms	907.2
Liter	Cubic Meters	0.001
Pounds	Kilograms	0.45359

To Convert Pressure (at 32° F)		
From	*To*	*Multiply By*
Inches of Water	Newton/Sq. Meter	249.082
Pounds per Sq. Inch	Newton/Sq. Meter	6894.8
Feet of Water	Newton/Sq. Meter	2988.98
Pounds per Sq. Inch	Kilograms/Sq. Cent.	0.07031
Inches of Mercury	Newton/Sq. Meter	3386.4
Pounds per Sq. Inch	Dyne/Sq. Cent.	68948.0
Atmospheres	Newton/Sq. Meter	101325.0
Pascal	Newton/Sq. Meter	1.0

To Convert Energy, Heat and Power		
From	*To*	*Multiply By*
Horsepower	Watt	745.7
British Thermal Units	Joule	1054.35
Foot-Pounds	Joule	1.3558
British Thermal Units	Calorie	252.0
British Thermal Units	Watt-Second	1054.35
Watt-Second	Joule	1.0
Calorie	Joule	4.184
Watt Hours	Joule	3600.0
Kilocalorie/Minute	Watt	69.73
Ton (Refrigeration)	Watt	3516.8
BTU/Hour	Watt	0.29288
BTU/In/Hr. Ft.² °F	Watt/Meter °K	0.14413
BTU/Hr. at 10°F TD	Kcal/Hr. at 6 °C. TD	0.252
BTU/Hr. at 15 °F. TD	Kcal/Hr. at 8 °C. TD	0.252

Volume-Weight Conversions	Wt. Kilograms
1 Cubic Foot of Water	28.3*
1 Cubic Inch of Water	0.0164*
1 Gallon of Water	3.788*
1 Cubic Foot of Air	0.034†
1 Cubic Inch of Steel	0.1288
1 Cubic Foot of Brick (Building)	51-54
1 Cubic Foot of Concrete	54-64
1 Cubic Foot of Earth	32-54

* at 32° F.
† at 70° F. — 29.92" Hg.

Tips for Quick Selection Guide

Walk-In Cooler Box Load Parameters

1. 95°F ambient air temperature surrounding box.
2. 4" Styrene (R = 16.7, K = .24) walls/ceiling, 6" concrete slab floor.
3. Average product load with 5 F pulldown in 24 hours.
4. BTUH load based on 16-18 hour compressor run time for 35 F box (timer recommended) + 20 hrs. for 30 F box.
5. See Table C for adjustment to box load for glass doors.
6. For 80 F ambient temp. surrounding box deduct 12%.
7. For 4" Urethane walls + ceiling, 6" concrete slab floor deduct 12%.
8. For 10' ceiling height add 10%.
9. For additional BTUH load for product cooling see Table A.

Walk-In Freezer Box Load Parameters

1. 95 F ambient air temperature surrounding box.
2. 4" Urethane (R = 25, K = .16) walls, ceiling + floor.
3. Average product load with 10 degree pulldown in 24 hours.
4. BTUH load based on 18 hour compressor run time.
5. See Table C for adjustment to box load for glass doors.
6. For 80 F ambient air temp. surrounding box deduct 12%.
7. For 20 hour compressor run time (light frost load) in lieu of 18 hour run time, deduct 11%.
8. For 10' ceiling height add 10%.
9. For additional BTUH load for product freezing, refer to Table D.

Table A
Product Cooling Loads for Walk-In Coolers
(24 hour pulldown/18 hour compressor operation) 24% safety factor added to loads to allow for service.

Product	*Specific Heat Above Freezing*	*10 Degree Pulldown BTUH Load for Indicated lbs of Product per 24 hours*					
		500	*1000*	*1500*	*2000*	*3000*	*5000*
Beef	.72	240	480	720	960	1440	2400
Pork	.53	177	353	530	706	1060	1767
Veal & Lamb	.76	253	506	760	1012	1520	2533
Poultry	.79	263	526	790	1053	1580	2633
Seafood	.80	267	533	800	1066	1600	2667
Vegetables	.92	307	613	920	1226	1840	3067
Bakery Food	.74	247	494	740	988	1480	2467
Beer	1.00	333	666	1000	1333	2000	3333

For product pulldown greater than 10 degrees, divide pulldown temperature by 10. Multiply this number by the BTUH shown on Table A, then add to box load.

Table B
Meat Cutting/Prep Room Load (BTUH/hr/sq.ft. of floor area)

Floor Sq. Ft.	*Approx. 65% R.H. Room Temperature*		
	55° F	*50° F*	
100	93	105	Room loads based on continuous operation and includes allowance for average number of personnel, processing equipment, etc., with glass panel in one wall and walls and ceilings insulated with 3" of styrene with box located in air conditioned area. Evaporator should be low outlet velocity type to avoid drafts and should be selected for continuous operation and not less than 30 F evap. temperature.
200	88	99	
300	85	95	
400	81	90	
500	78	87	
600	75	85	
700	72	81	
800	69	78	
900	67	75	
1000	65	73	
1200	62	69	

Table C
Glass Door Loads

Box Temperature	*BTU per Door*
+35	1060
+30	960
0	1730
-10	1730
-20	1730

*Adjusted for run time load. Multiply number of doors times door load above and add to box load.

Table D
Product Freezing Loads for Walk-In Freezers

Product	*Spec. Heat BTU/lb/Deg. F*		*Latent Heat BTU/lb*	*Freezer Temp. (F)*	*-10 F Freezer Temperature BTUH for Indicated lbs. Prod/Day*					
	32 -	*32 +*			*100*	*300*	*750*	*1000*	*1500*	*3000*
Beef	.72	.40	95	29	790	2370	5925	7900	11850	23700
Pork	.53	.32	60	28	523	1571	3926	5235	7853	15710
Veal & Lamb	.76	.45	100	28	841	2524	6311	8414	12621	25240
Poultry	.79	.42	106	27	878	2636	6590	8787	13181	26360
Seafood	.80	.43	110	28	906	2719	6797	9063	13595	27190
Vegetables	.92	.47	130	30	1053	3159	7898	10530	15795	31590
Bakery Foods	.74	.34	53	20	520	1560	3900	5200	7800	15600

Freezing loads based on product entering at 40 F maximum. For a specific pulldown time, the product load BTU/hr may be adjusted by multiplying the above loads by 24 and dividing by the specified pulldown time in hours. To adjust for 0 F freezer temperature, multiply the above loads by 0.97, and for -20 F freezer, multiply by 1.04.

Walk-In Selection Guide

		BTUH LOAD									
		+35 ROOM USAGE		+30 ROOM USAGE		0 ROOM USAGE		-10 ROOM USAGE		-20 ROOM USAGE	
DIMENSIONS	FLOOR SQ. FT.	AVG.	HVY.	AVG.	HVY.	AVG.	HVY.	AVG.	HVY.	AVG.	HVY.
6x6x8	36	4750	6389	4488	6037	4583	6505	4929	7041	5274	7577
6x8x8	48	5417	7274	5119	6974	5225	7407	5630	8028	6034	8648
6x10x8	60	6055	8100	5722	7655	5806	8213	6265	8911	6725	9609
8x8x8	64	6188	8291	5848	7835	5934	8410	6405	9127	6876	9844
8x10x8	80	6954	9269	6572	8759	6631	9363	7165	10169	7699	10974
8x12x8	96	7669	10174	7247	9614	7273	10234	7867	11123	8461	12011
8x14x8	112	8366	11045	7905	10437	7922	11092	8575	12059	9227	13026
8x16x8	128	9051	11888	8553	11234	8528	11890	9237	12933	9946	13976
8x18x8	144	9748	12732	9212	12032	9169	12732	9936	13852	10702	14972
8x20x8	160	10419	13548	9846	12803	9755	13490	10576	14682	11397	15874
8x22x8	176	11540	14807	10905	13992	10817	14715	11692	15977	12567	17239
8x24x8	192	12224	15622	11552	14763	11386	15439	12314	16769	13242	18099
8x26x8	208	12874	16398	12166	15496	11976	16176	12955	17573	13935	18970
8x28x8	224	13519	17163	12775	16219	12530	16873	13562	18336	14594	19799
8x30x8	240	14187	17947	13407	16960	13108	17587	14191	19115	15274	20642
8x32x8	256	14824	18694	14009	17666	13653	18264	14786	19855	15920	21446
10x10x8	100	7789	10339	7361	9770	7386	10401	7990	11304	8594	12208
10x12x8	120	8626	11385	8152	10759	8138	11405	8809	12401	9481	13397
10x14x8	140	9439	12384	8920	11703	8887	12405	9626	13493	10365	14581
10x16x8	160	10250	13379	9686	12643	9577	13311	10379	14484	11182	15658
10x18x8	180	11049	14349	10441	13560	10279	14216	11144	15472	12009	16728
10x20x8	200	11838	15299	11187	14458	10942	15070	11868	16405	12794	17741
10x24x8	240	13391	17180	12654	16207	12751	17231	13796	18721	14842	20211
10x28x8	280	14891	18922	14072	17881	14043	18844	15205	20482	16367	22120
12x12x8	144	10038	13021	9486	12305	8991	12553	9739	13655	10486	14756
12x14x8	168	10956	14155	10353	13376	10235	14052	11055	15251	11875	16450
12x16x8	192	11886	15284	11232	14443	11029	15082	11919	16375	12810	17667
12x18x8	216	12775	16359	12072	15459	11807	16080	12767	17464	13726	18847
12x20x8	240	13681	17440	12928	16481	12573	17052	13599	18524	14626	19995
12x22x8	264	14549	18474	13749	17458	13299	17974	14392	19541	15485	21088
14x14x8	196	11993	15423	11333	14575	11126	15216	12024	16521	12923	17826
14x16x8	224	13013	16656	12297	15740	11995	16338	12971	17745	13946	19152
14x20x8	280	15011	19042	14185	17795	13687	18487	14811	20088	15935	21688
14x24x8	336	16969	21347	16036	21073	15330	20539	16598	22324	17866	24110
16x16x8	256	14148	18019	13370	17028	12939	17550	13998	19067	15056	20583
16x20x8	320	16349	20631	15450	19496	14777	19873	15996	21598	17215	23323
16x24x8	374	18506	23157	17488	21883	16563	22093	17938	24017	19313	25941
18x18x8	324	16476	20782	15570	19639	14864	19989	16090	21724	17317	23460
18x20x8	360	18128	22644	17131	21398	16305	21678	17617	23523	18930	25369
18x24x8	432	20484	25389	19357	23993	18260	24090	19739	26149	21219	28208
20x20x8	400	19470	24145	18340	22817	17386	23019	18790	24982	20194	26945
20x24x8	480	21988	27132	20779	25640	19453	25566	21036	27755	22619	29945
20x28x8	560	24963	30480	23590	28804	21963	28514	23721	30922	25479	33330
20x32x8	640	27480	33340	25969	31506	23954	30909	25884	33529	27813	36149
20x36x8	720	29946	36127	28299	34140	25919	33251	28017	36077	30115	38903
20x40x8	800	32420	38904	30637	36764	27888	35575	30153	38603	32518	41631
24x40x8	960	38694	45735	36565	43878	34681	43023	37368	46538	39939	49937
28x40x8	1120	43183	50733	40808	48970	38123	47062	41095	50921	43950	54664
32x40x8	1280	48550	56318	45880	55056	42894	51900	46146	56580	49282	60656
36x40x8	1440	54344	62804	51355	61626	46254	56259	49872	60781	53194	65186
40x40x8	1600	58738	67611	55507	66608	49583	60073	53385	64916	57070	69642

✲Heavy usage is defined as two times the average air change. Average air changes determined by ASHRAE based on box size for 24 hour period.

HEATCRAFT™ Worldwide Refrigeration

VENTILATION CALCULATION METHODS

Airflow for general ventilation can be calculated by:

- Area Method
- Air Change Method
- Occupancy Method
- **Area Method**–Derives the ventilation rate from the area of the space (in square feet) to be ventilated multiplied by ventilation rate per square foot.

Example: For residential bathrooms up to 100 sq. ft. in area, HVI recommends an exhaust rate of 1 CFM per square foot. A bathroom is 6' x 10' or 60 sq. ft.
Multiply 1 cfm x 60 sq. ft. for a flow rate of 60 cfm.

- **Air Change Method**–Derives the ventilation rate from the volume of the space (in cubic feet) to be ventilated multiplied by the number of total air changes in one hour.

Example: For an auditorium the suggested air change rate is 4 to15 air changes per hour. An auditorium is 80' x 90' with
20' ceiling or 144,000 cu. ft. Use 10 air changes per hour.

$$CFM = \frac{144{,}000 \text{ cu. ft.} \times 10 \text{ AC p/ hr}}{60} \qquad CFM = 24{,}000$$

- **Occupancy Method**–Derives the ventilation rate from the number of people that will occupy the space at any given time.

Example: For an office, the recommended ventilation rate is 20 cfm per person. The occupancy of a general office is one person per 80 to 150 sq. ft. An office is 40' x 60' or 2,400 sq. ft.
Occupancy = 2,400 sq. ft./150 sq. ft. p/ person

CFM = 16 people x 20 cfm per person CFM = 320

Heat Removal Method

When the temperature of a space is higher than the ambient outdoor temperature general ventilation can be used to provide cooling. What is needed to calculate CFM is the amount of heat to be removed in BTU/hr, the desired indoor temperature and design outdoor dry bulb temperature.

Example: 200,000 BTU/hr to be removed, 70 degree desired indoor temperature and 90 outdoor dry bulb temperature.

CFM = 200,000 (BTU/hr)/(1.08 x 90 - 70) CFM = 9,260
(**Note**: rule of thumb outdoor/indoor temperature differential is 20 degrees)

Courtesy Floaire Inc.

APPLICATIONS

Listed below are ventilation rates for some common applications. Where more than one method is shown use the method that results in the higher airflow rate.

Application	Area Method	Air Change Method	Occupancy Method		Other
			cfm/person	sq ft/person	
General Ventilation	1 cfm				
Attic Ventilation	.7 cfm	10			
Auditoriums		4 to 15			
Banks		4 to 10	20	50 to 150	
Battery Charge Room	1.5 cfm	4			
Boiler Room		15 to 30			
Chemical Storage Area	1.5 cfm				
Class Room			15	0.05	
Computer Room		15 to 20	20	80 to 150	
Conference Room			20	0.05	
Corridors	.05 cfm				
Churches			20	5 to 20	
Elevators	1 cfm				
Electrical Room	2 cfm	10			5 cfm/KVA of transf.
Fire Station		4 to 10	20		100 to 500
Garage (Parking)	1.5 cfm	5 to 15			
Garage (Repair)		6 to 30			5000 cfm/car
Gymnasium		6 to 30			
Hospital (Patient Rooms)			25	0.01	
Kitchen Hood (Charbroiler)					300 cfm x linear. ft.
Kitchen Hood (Island Type)					150 cfm/ sq. ft.
Kitchen Hood (Wall Mounted)					100 cfm/ sq. ft.
Kitchen (General Ventilation)	1.5	12 to 15	15	50 to 150	
Libraries/Museums			20	30 to 100	
Locker Room		12 to 30			
Manufacturing (Light)		5 to 10			
Manufacturing (Heavy)		10 to 20			
Mechanical Room	2 cfm				
Mech. Room (Combustion Air)					8 cfm/ BHP
Mech. Room (Comb. Exhaust)					2 cfm/ BHP
Medical/Dental Office		8 to 12	20	50 to 150	
Municipal Buildings		4 to 10	20	50 to 150	
Police Station		4 to 10	20	100 to 500	
Retail Store	.3 cfm		15	15 to 75	
Supermarket			15	50 to 100	
Toilet Room (Public)					75 cfm p/ WC & urinal
Toilet Room (Residential)	1 cfm	8			
Warehouse Ventilation	1 cfm	6 to 15			
Welding Operation					2500 cfm p/welder