AIR COOLED CONDENSING UNITS

MODEL HAR-5

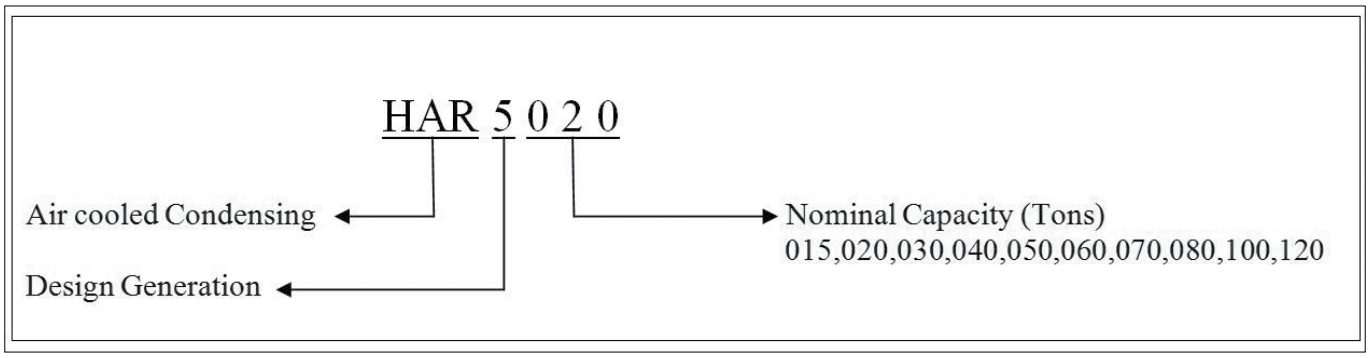
English / Metric Measure

Table of Contents

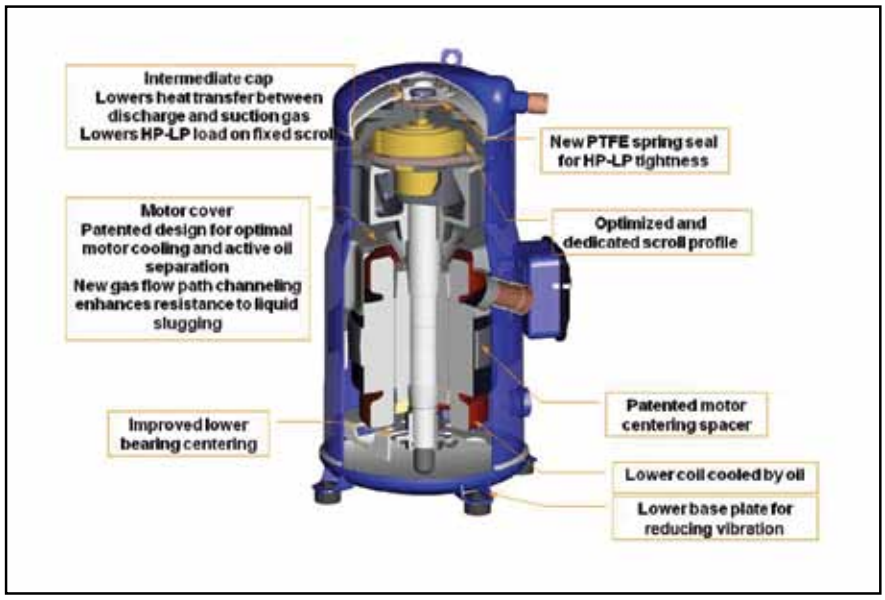
Introduction

TAHVIEH 15 to 120 Ton Air Cooled Scroll Condensing Units are the perfect refrigeration components for all air conditioning applications that use DX central station air handling. They are designed for outdoor (Roof or Ground level) installation. Each unit includes two separated refrigerant circuit with multiple hermetic scroll compressors and a weather resistant microprocessor central center, all mounted on a formed steel base

Nomenclature



Features and Benefits



Fewer parts than an equal capacity reciprocating compressor means significant reliability and efficiency benefits. The single orbiting scroll eliminates the need for pistons, connecting rods, wrist pins and valves. Fewer parts lead to increased reliability. Fewer moving parts, less rotating mass and less internal friction means greater efficiency than reciprocating compressors. TAHVIEH uses Performer scroll compressor, the compression is performed by two scroll elements located in the upper part of the compressor above the motor (see adjacent figure). Suction gas enters the compressor at the suction connection. The gas then flows around the motor and enters at the bottom side through the openings as shown. Oil droplets separate from suction gas and fall into the oil sump. All of the suction gas passes through the electrical motor, thus ensuring motor cooling in all applications. After exciting the electrical motor, the gas enters the scroll elements where compression takes place. A check valve is located directly above the fixed scroll discharge port; this feature prevents the compressor from running backwards once the power has been switched off. Ultimately, the discharge gas leaves the compressor at the discharge connection.

Versatility

HAR Fifth generation series condensing units feature up to 6 compressors and 2 refrigerant circuits, and can be matched with a wide variety of air-handling units. All condensing units' circuits can be supply a single air handler or 2 separate air handlers. Unit is designed for proper operation in ambient temperature of 85°F to 125°F. Reaching this proposal, the unit should have the Max. EER.

Fulfilling the customer's request, the unit is designing in a way to work with HCFC (R22) and HFC (R134a, R407C) gases.

For all above mentioned refrigerants, unit capacities are shown in performance data section.

Durable Construction

All HAR units have weatherized cabinets constructed of heavy-duty galvanized steel prepainted with air-dry paint finish (exceeds 500 hour salt spray test in accordance with ASTM B117).

High Efficiency Full Load Operation

Utilizing the new scroll compressor technology, the HAR condensing units have high full load efficiency. All components are selected for optimum performance including the large condenser coil areas and low noise condenser fan. Full load EERs range up to 12.5 at ARI Standard Conditions (45°F saturated suction temperature, 95°F ambient temperature, sea level).

Excellent Part Load Performance

By using either two, four or six compressors on each condensing unit, unloading characteristics and part load performance are outstanding. The IPLV part load values for our scroll units range up to 15.9 EER. Integrated part load value (IPLV) is a part load performance indicator as outlined in ARI Standard 365-94. The IPLV rating compares the performance of different condensing units under identical conditions. When the IPLV is listed in EER (Energy Efficiency Ratio), a higher EER will indicate that the chiller's overall performance is better.

Compact Design with Small Footprint

Again, Tahvieh HAR series condensing units have the reputation for a compact design and small footprint. A small footprint saves the installation costs by minimizing the size of the concrete mounting pas or reduces the amount of structural steel if the unit is mounted on the roof.

Quiet Operation — "Neighborhood friendly"

The HAR condensing units are designed with quiet scroll compressors. Fans are selected for good performance and lower sound levels. The attention to details with sound mind is critical in the design. Paying attention to small issues such as refrigerant piping, supports for piping, securing of component to the structure are all important to making a quiet product.

Option and Accessories

Unit Option

* Hot gas by-pass- permits continuous, stable operation at capacities below the minimum step of compressor unloading to as low as 5% capacity (depending on both the unit and operating conditions) by introducing an artificial load. Hot gas by-pass is installed on only refrigerant system on two circuited units.
* Copper fin condenser coil- The unit constructed with condenser coil which have copper fins (This is not recommended for units in areas where they may be exposed to acid rain).
* Post- Coated condenser coil- The unit is built with air-dry Aluminum Impregnated Polyurethane -coated condenser coils. This is another choice for seashore and other corrosive applications. The coating material (FIN GUARD) is a green VOC FREE (ECO) with high corrosion resistance level:
  - ASTM G85 + 3 000 hours industrial environment
  - ASTM B117 + 10 000 hours marine environment
  - Kesternich test 80 cycles sulfuric environment (fuel combustion)
* Blue Fin Condenser Coils –The air cooled condenser coils are constructed of blue epoxy- coated aluminum fins. This can provide corrosion resistance comparable to copper fin coils in typical seashore location. Either these or the phenolic-coated coils (above), are recommended for units being installed at the seashore or where salt spray may hit the unit.

* Sound Attenuation- one or both of the following sound attenuation options are recommended for residential or other similar sound sensitive location:
* Compressor Acoustic sound Blanket- each compressor is individually enclosed by an acoustic sound blanket . The sound blankets are made with one layer of acoustical absorbent textile fiber of 9.5 mm (3/8") thickness.
* Low Sound Fans-Lower RPM,8-pole fan motors are used with steeper-pitch fans.(Factory-mounted)
* Vibration Isolator-Level adjusting, spring type or seismic deflection or neoprene pad isolator for mounting under unit base rails.(Field Mounted)
* Oil Separators Kit- for installation of large piping erection, Tahvieh recommended to use oil separator. This will ensure minor oil amount immigration from compressor during unit operation.

Control Option

* Low Ambient Control- Standard units will operate for ###°F(### °C). This accessory includes all necessary components to permit chiller operation to 0 °F (-18°C). This option includes the Discharge Pressure Transducer/Read out Capability option. (Factory mounted)
* Discharge Pressure Transducers and Readout Capability- The addition of pressure transducer allows models to sense and display discharge pressure. For proper head pressure control in applications below 25 °F (-4 °C) where wind gusts may exceed 5mph (8 Km/h), it is recommended that optional condenser louvered enclosure panels also included. (Factor mounted)

Application consideration

Certain application constraints should be considered when sizing, selecting and installing air-cooled condensing units. Unit reliability is dependent upon these considerations. Where your application varies from the guidelines presented, it should be reviewed with the sales engineer.

Unit sizing

Unit capacities are listed in the performance data section on pages ### to ###. Intentionally over sizing a unit to assure adequate capacity is not recommended. Erratic system operation and excessive compressor cycling are often a direct result of an oversized condensing unit. In addition, an oversized unit is usually more expensive to purchase, install and operate. If over sizing is desired, consider using two units.

Unit Placement

A base or foundation is not required if the selected unit location is level and strong enough to support the unit's operating weight (as listed on page ###)

Location and Sound Emission

The most effective from of isolation is to locate the unit away from any sound sensitive area. Structurally transmitted sound can be reduced by using spring or rubber isolators. The isolators are effective in reducing the low frequency sound generated by compressors and, therefore, are recommended for sound sensitive installations. An acoustical engineer should always be consulted on critical applications.

For maximum isolation effect, the refrigeration lines and electrical conduit should also be isolated. Use flexible electrical conduit. Since the environment in which a sound source is located affects sound pressure, unit placement must be carefully evaluated.

Servicing

Adequate clearance for compressor servicing should be provided. Recommended minimum space envelopes for servicing are located in the dimensional data section of this catalog and can serve as guidelines for providing adequate clearance. The minimum space envelopes also allow for control panel door swing and routine maintenance requirements.

Unit Location

Unobstructed flow of condenser air is essential for maintaining condensing unit capacity and operating efficiency. When determining unit placement, careful consideration must be given to assure proper air flow across the condenser heat transfer surface. Failure to heed these considerations will result in warm air recirculation and coil air flow starvation.

Warm air recirculation occurs when discharge air from the condenser fans is recycled back at the condenser coil inlet. Coil starvation occurs when free air flow to the condenser is restricted.

Both warm air recirculation and coil starvation cause reductions in unit efficiency and capacity. In addition, in more server cases, nuisance unit shutdowns will result from excessive head pressures. Accurate esti-

mates of the degree of efficiency and capacity reduction are not possible due to the unpredictable effect of varying winds. When hot gas bypass is used, reduced head pressure increases the minimum ambient condition for proper operation. In addition, wind tends to further reduce head pressure. Therefore, it is advisable to protect the air-cooled condensing unit from continuous direct winds exceeding 10 miles per hour.

Debris, trash, supplies, etc., should not be allowed to accumulate in the vicinity of the air-cooled condensing unit. Supply air movement may draw debris between coil fins and cause coil starvation. Special consideration should be given to units operating in low ambient temperatures. Condenser coils and fan discharge must be kept free of snow and other obstructions to permit adequate air flow for satisfactory unit operation.

Effect of Altitude on Capacity

Condensing unit capacities given in the performance data tables on pages ### to ### are at sea level. At elevations substantially above sea level, the decreased air density will decrease condenser capacity and, therefore, unit capacity and efficiency. The adjustment factors in table ### can be applied directly to the catalog performance data to determine the unit's adjusted performance.

Altitude	Capacity	Power
See Level	1.000	1.000
2000 ft (610m)	0.984	1.012
4000 ft (1220m)	0.965	1.023
6000 ft (1830m)	0.946	1.034

Table-1 Adjustment factor for altitude effect

Ambient Considerations

Start-up and operation at lower ambient requires sufficient head pressure be maintained for proper expansion valve operation. At higher ambient, excessive head pressure may result. Standard operating conditions are 50°F to 125°F. With a low ambient fan speed control, operation down to 0°F is possible. Minimum ambient temperatures are based on still conditions (winds not exceeding five mph). Greater wind velocities will result in increased minimum operating ambient. Unit with hot gas bypass have a minimum operating ambient temperature of 10°F. For proper operation outside these recommendations, contact Tahvieh sales office.

Refrigerant Piping

Special consideration must always be given to oil return. Minimum suction gas velocities must always be maintained for proper oil return.

When sizing refrigerant pipe for split system air conditioning, consideration must be given to the: (1) Suction line pressure drop due to friction, (2) Liquid line pressure drop due to friction, (3) Suction line velocity for oil return, and (4) Liquid line pressure drop due to vertical rise. Refer to DESIGN PARAMETERS for friction losses for both the suction and liquid lines for the condensing unit.

On a system where the evaporator blower is located below the condensing unit, the suction line must be sized for both pressure drop and oil return.

When the condensing unit is located below the evaporator blower, the liquid line must be designed for pressure drop due to friction loss and vertical rise. If the pressure drop due to vertical rise and friction loss exceeds 30 psig (2.1 barg), some refrigerant will flash before it reaches the thermal expansion valve.

All horizontal suction lines should be pitched at least 1/4inch (6 mm) per foot in the direction of the refrigerant flow to aid the return of oil to the compressor. All suction lines with a vertical rise exceeding 3feet (1 m) should have a 'P' trap at the bottom and the top to facilitate oil return. Suction lines with a vertical rise exceeding 25 feet (7.6 m) should be trapped every 15 feet (4.6 m) to provide drain points for the oil when the circuit is deactivated. When the circuit is reactivated, oil will return to the compressor more quickly and in smaller slugs.

For more details, refer to ASHRAE Refrigeration Handbook, System Practices for Halocarbon Refrigerants.

Design Advantages

General

The HAR new generation models are shipped complete from factory ready for installation.

The unit is pressure tested, evacuated and given with nitrogen pre charged. After assembly, an additional refrigerant value due to calculated line (Suction & Liquid) and evaporator should be added to given value in ####.

The unit structure is heavy-gauge, steel channel base. This channel is coated with dry-air paint, which subjected to ASTM B117 300 hour, salt spray testing, yield a minimum ASTM 1654 rating "6". Units are designed NFPA 70(National Fire code), ASHRAE /ANSI 15 safety code for mechanical refrigeration. All units are produced at an ISO 9000-registered facility.

Compressors

Danfoss Performer Scroll tandem compressors are used. These rugged hermetic compressors are constructed with an integral cast iron frame, cast iron scrolls, three Teflon impregnated bearings, and three oil filtration devices for each compressor.

Using Danfoss's performer scroll tandem compressors provides two, four steps of capacity modulation depending on model size. One compressor can run alone, depending on the load of the system, resulting in excellent part-load efficiency. Each refrigerant circuit has specially designed oil and gas equalization lines to control oil migration. The design also offers radial and axial compliance (no tip seals), a large internal volume for liquid handling, a removable suction screen, and a rotary dirt trap and oil screen. In addition, the compressor is self-compensating for wear, handles liquid and debris, and inherently yields the highest efficiency for its class.

This well protected compressor includes a solid-state motor protection module, 4 individual motor-winding sensors, a patented internal discharge temperature probe, and a patented shutdown feature that prevents reverse rotation. An intenal discharge check valve helps prevent shutdown noise

Condenser Coils

Aluminum plate fins are mechanically bonded on seamless 3/8-inch OD copper tubes in a staggered configuration for maximum heat transfer efficiency. Copper plate fins are another coil option which is proper for moderate coastal ambient condition . This will improve cooling capacity of the units too. Condenser coils are factory leak tested at 470 psig (33.0 Kg/cm^2) air pressure underwater and vacuum dehydrated. Over 10°F of liquid sub cooling may be obtained, depending upon the difference between condensing temperature and the outside ambient temperature. Sub cooling adds to the efficiency of the system and assures liquid refrigerant at the expansion valve even though vertical lifts or long runs of piping may be necessary.

Selection Procedure

The rating shown on pages #### through #### are based on unit operation in a well designed and properly piped system.

Selection rules

1. Capabilities are based on Refrigerant 22, 407C & 134a.
2. Ratings may interpolate, but must not be extrapolated.
3. Ratings shown are at saturated suction temperatures corresponding to pressures at the compressor. In actual practice, suction line pressure drop has the effect of reducing compressor capacity, forcing the compressor to operate at a lower suction pressure to maintain the desired evaporator temperature.

For normal air conditioning application, size the suction line for a pressure drop of 0.2 bar (3 Psi), corresponding to 1.1°C (2°F), for R-22 refrigerant. Thus, the evaporator temperature will be approximately 1.1°C (2°F) higher than the compressor suction temperature. Line loss must be taken into consideration when selecting the evaporator.

How to select

The air-cooled condensing unit may be selected from the Ratings on pages #### through ####, if the ambient air temperature at the condenser and the saturated suction temperature at the compressor are known. The ambient air temperature is a known design parameter, but the suction temperature at the compres-

sor, in many cases, are known only within certain allowable limits. The actual compressor operating suction temperature and the overall performance of the system will be depending directly upon the choice of the evaporator. For system selection, the HAR condensing unit is usually selected first, then the line loss 1.1°C(2°F)added to the condensing unit saturated suction temperature to determine the saturated evaporating temperature. This temperature is then used for the selection of the evaporator, whether it is a DX coil or shell and tube heat exchanger.

After the system balance point has been determined, the compressor KW input may be interpoted rating tables.

Sample selection

The TEQSEL selection software program provides the ability to generate performance output for pre-selected TAHVIEH-AHU evaporator coils with HAR5 condensing units. To select a condensing unit and evaporator coil not available in the TEQSEL program, the example below can be used to cross-plot an evaporator coil with known performance with HAR5 condensing unit.

From the TAHVIEH TEQSEL –AHU computer selection program:

AHU selected size and model: SH -24

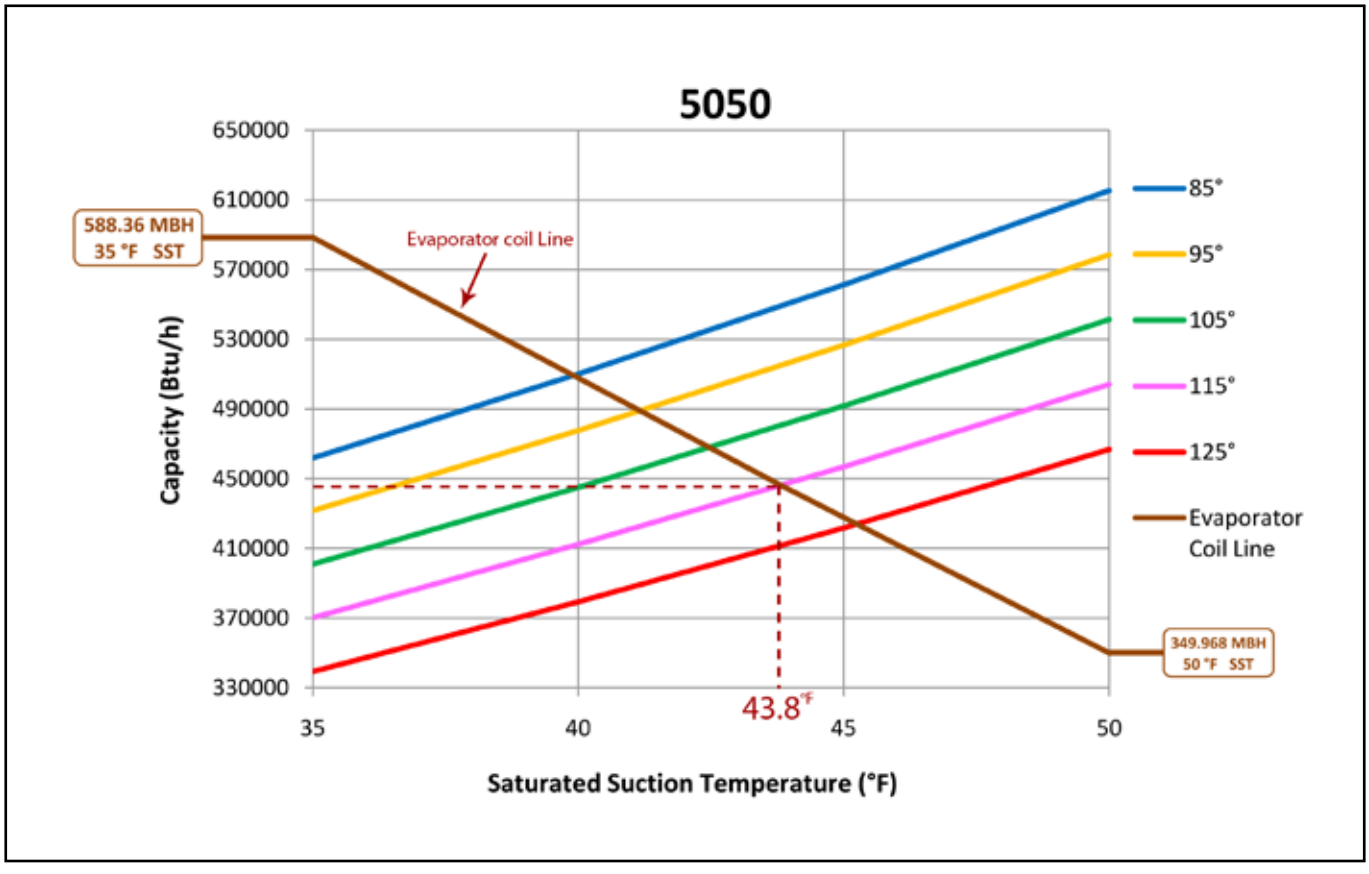
DX Evap. coil: 34.5”(H) x 100” (L)/4ROW/14 FPI/ Aluminum fin

Entering coil condition =82/69 of DB/WB and 115°F ambient -11300 cfm @ sea level

Coil performance @35°F SST-588.36 MBh total with R22 refrigerant

Coil performance @50°F SST-349.97 MBh total with R22 refrigerant

Balance point at 115°F ambient: 446 MBh @ 43.8°F



By plotting the two coil performances outputs across HAR5050 net capacity curve at their respective total MBh at the defined saturated suction temperature and ignoring line losses, we can see that the condenser /evaporator coil condition at 115°F ambient, provides 446 MBh net capacity at 43.8°F.

General Data

Model	HAR5015			HAR5020			HAR5030		
Unit Type	R22	R407C	R134a	R22	R407C	R134a	R22	R407C	R134a
General									
Nominal Capacity (a) tons	14.3	12.2	10.1	18.4	15.9	13.4	27.9	23.8	20.2
Kcal/h x 1000	43.3	36.9	30.5	55.7	48.1	40.4	84.3	71.9	61.4
Total Compressor (a) Kw	11.9	13.9	7.7	16	18.6	10.4	26	28.7	17.1
Unit EER (a)	12.1	9.1	12.0	12.1	9.2	12.5	11.8	9.2	11.6
Total Pressure Noise Lvl. db(A) @ 10m Around Unit	46.8	49.1	50.4	50.8	52.6	53.2	50.9	52.7	52.4
Compressor									
Quantity	2			2			4		
hp. (Circuit#1)+(Circuit#2)	(8.3) + (8.3)			(10) + (10)			(8.3+ 8.3) + (8.3 + 8.3)		
Oil Charge Per Circuit lit	3.25			3.25			6.5		
Capacity Reduction % Full Circuit	0-50-100			0-50-100			0-25-50-75-100		
Condenser									
Number Of Fans	2			2			2		
Fan Speed rpm	900								
Fan Diameter in	31.5								
mm	800								
Fan Motor (Each) Kw	1.12	1.12	1.21	1.12	1.12	1.21	1.21	1.21	1.93
Total Air Flow cfm	18400	18400	20000	18700	18700	20400	22320	22320	25260
m^3/h	31260	31260	33980	31770	31770	34660	37920	37920	42920
Total Cond. Storage Capacity (b) lbs	66	20	92	77	73	103	102	97	139
Kg	30	29	42	35	33	47	46	44	63
Total Face Area sq.ft.	36.2			41.3			56.0		
sq.m	3.4			3.8			5.2		
Number of Rows	3								
Fin Spacing FPI	12								
mm	2.3								
Refrigerant Data									
Operating Charge lbs	22	20	18	24	22	20	31	29	24
Per unit (c) & (d) Kg	10	9	8	11	10	9	14	13	11
ODF Liquid (Each circuit) in	5/8			5/8			5/8		
ODF Suction (Each circuit) in	1⅛			1⅜			1⅜		

LEGEND:

(a) Nominal cooling capacity & compressor total power input @ 95 °F (35 °C) outdoor and 45 °F (7.2 °C) Saturated Suction Temperature.

(b) Condenser storage capacity is given at condition of 95 °F (35 °C) outdoor temperature, and 95% full.

(c) Operating charge is approximate for condensing unit only, and does not include charge for low ide or interconnecting lines.

(d) Condensing units are shipped with a nitrogen holding charge only.

General Data

Model	HAR5040			HAR5050			HAR5060		
Unit Type	R22	R407C	R134a	R22	R407C	R134a	R22	R407C	R134a
General									
Nominal Capacity (a) tons	36.5	32.4	26.3	44.6	38.0	32.1	56.5	48.0	39.9
Kcal/h x 1000	110.3	97.9	79.7	134.9	115.0	97.1	170.8	145.2	120.7
Total Compressor (a) Kw	35.2	36.6	23.0	39.6	45.3	26.1	52.3	56.6	32.6
Unit EER (a)	10.7	9.2	11.0	12.0	9.1	11.4	11.3	9.2	12.5
Total Pressure Noise Lvl. db(A) @ 10m Around Unit	54.5	56.1	56.0	57.9	57.9	57.8	58.8	59.7	59.6
Compressor									
Quantity	4			4			4		
hp. (Circuit#1)+(Circuit#2)	(10 + 10) + (10 + 10)			(12.3 + 12.3) + (12.3 + 12.3)			(15.4 + 15.4) + (15.4 + 15.4)		
Oil Charge Per Circuit lit	6.5			7.2			12.4		
Capacity Reduction % Full Circuit	0-25-50-75-100			0-25-50-75-100			0-25-50-75-100		
Condenser									
Number Of Fans	3			4			4		
Fan Speed rpm	900								
Fan Diameter in	31.5								
mm	800								
Fan Motor (Each) Kw	1.93	1.93	1.93	1.21	1.21	1.93	1.93	1.93	1.93
Total Air Flow cfm	31200	31200	37500	43380	43380	47600	51700	51700	50000
m^3/h	53000	53000	63710	73700	73700	80870	87780	87780	84950
Total Cond. Storage Capacity (b) lbs	142	137	196	155	148	211	189	181	262
Kg	65	62	89	70	67	96	86	82	119
Total Face Area sq.ft.	77.5			84.7			103.3		
sq.m	7.2			7.9			9.6		
Number of Rows	3								
Fin Spacing FPI	12								
mm	2.3								
Refrigerant Data									
Operating Charge lbs	50	40	36	54	50	48	66	60	52
Per unit (c) & (d) Kg	23	18	16	25	23	22	30	27	24
ODF Liquid (Each circuit) in	3/4			7/8			7/8		
ODF Suction (Each circuit) in	1⅝			2⅛			2⅛		

LEGEND:

(a) Nominal cooling capacity & compressor total power input @ 95 °F (35 °C) outdoor and 45 °F (7.2 °C) Saturated Suction Temperature.

(b) Condenser storage capacity is given at condition of 95 °F (35 °C) outdoor temperature, and 95% full.

(c) Operating charge is approximate for condensing unit only, and does not include charge for low side or nterconnecting lines.

(d) Condensing units are shipped with a nitrogen holding charge only.

General Data

Model	HAR5070			HAR5080			HAR5100		
Unit Type	R22	R407C	R134a	R22	R407C	R134a	R22	R407C	R134a
General									
Nominal Capacity (a) tons	65	56.1	46.1	74.2	63.9	52	83.7	73.3	59.6
Kcal/h x 1000	196.4	169.5	139.4	224.4	193.2	157.2	253.1	221.5	180.1
Total Compressor (a) Kw	59.5	65	36.9	70.2	76.6	43.2	79.7	86.3	50.6
Unit EER (a)	11.7	9.3	11.4	11.5	9.1	11.4	11.4	9.3	11.2
Total Pressure Noise Lvl. db(A) @ 10m Around Unit	59.9	61.1	61.1	60.7	62.1	62.0	60.8	62.4	62.3
Compressor									
Quantity	4			4			4		
hp. (Circuit#1)+(Circuit#2)	(20 + 15.4) + (20 + 15.4)			(20 + 20) + (20 + 20)			(25 + 20) + (25 + 20)		
Oil Charge Per Circuit lit	14.2			16			16		
Capacity Reduction % Full Circuit	0-21-50-71-79-100			0-25-50-75-100			0-22-50-78-100		
Condenser									
Number Of Fans	6			6			7		
Fan Speed rpm	900								
Fan Diameter in	31.5								
mm	800								
Fan Motor (Each) Kw	1.21	1.21	1.93	1.21	1.21	1.93	1.21	1.21	1.93
Total Air Flow cfm	62600	62600	69260	63360	63360	69600	73100	73100	81200
m^3/h	106350	106350	117670	107650	107650	118250	124200	124200	138000
Total Cond. Storage Capacity (b) lbs	207	196	282	218	207	294	244	231	334
Kg	94	89	128	99	94	134	111	105	152
Total Face Area sq.ft.	113.7			118.7			134.7		
sq.m	10.6			11.0			12.5		
Number of Rows	3								
Fin Spacing FPI	12								
mm	2.3								
Refrigerant Data									
Operating Charge lbs	74	62	56	82	64	62	100	68	68
Per unit (c) & (d) Kg	33	28	26	37	29	31	45	31	31
ODF Liquid (Each circuit) in	7/8			7/8			1⅛		
ODF Suction (Each circuit) in	2⅛			2⅛			2⅝		

LEGEND:

(a) Nominal cooling capacity & compressor total power input @ 95 °F (35 °C) outdoor and 45 °F (7.2 °C) Saturated Suction Temperature.

(b) Condenser storage capacity is given at condition of 95 °F (35 °C) outdoor temperature, and 95% full.

(c) Operating charge is approximate for condensing unit only, and does not include charge for low side or interconnecting lines.

(d) Condensing units are shipped with a nitrogen holding charge only.

General Data

Model	HAR5120		
Unit Type	R22	R407C	R134a
General			
Nominal Capacity (a) tons	111.4	97.2	78.8
Kcal/h x 1000	336.7	293.8	238.1
Total Compressor (a) Kw	115.2	118.4	71.1
Unit EER (a)	10.7	9.1	10.9
Total Pressure Noise Lvl. db(A) @ 10m Around Unit	62.4	63.8	63.8
Compressor			
Quantity	6		
hp. (Circuit#1)+(Circuit#2)	20 + 20 + 20) + (20 + 20 + 20)		
Oil Charge Per Circuit lit	24		
Capacity Reduction % Full Circuit	0-17-33-50-67-83-100		
Condenser			
Number Of Fans	8		
Fan Speed rpm	900		
Fan Diameter in	31.5		
mm	800		
Fan Motor (Each) Kw	1.21	1.21	1.93
Total Air Flow cfm	86400	86400	93200
m^3/h	146800	146800	158350
Total Cond. Storage lbs	298	282	405
Capacity (b) Kg	135	128	184
Total Face Area sq.ft.	163.3		
sq.m	15.2		
Number of Rows	3		
Fin Spacing FPI	12		
mm	2.3		
Refrigerant Data			
Operating Charge lbs	126	62	56
Per unit (c) & (d) Kg	57	28	26
ODF Liquid (Each circuit) in	1⅛		
ODF Suction (Each circuit) in	2⅝		

LEGEND:

(a) Nominal cooling capacity & compressor total power input @ 95 °F (35 °C) outdoor and 45°F (7.2°C) Saturated Suction Temperature.

(b) Condenser storage capacity is given at condition of 95 °F (35 °C) outdoor temperature, and 95% full.

(c)Operating charge is approximate for condensing unit only, and does not include charge for low side or interconnecting lines.

(d) Condensing units are shipped with a nitrogen holding charge only.

Capacities /R22

English Measure

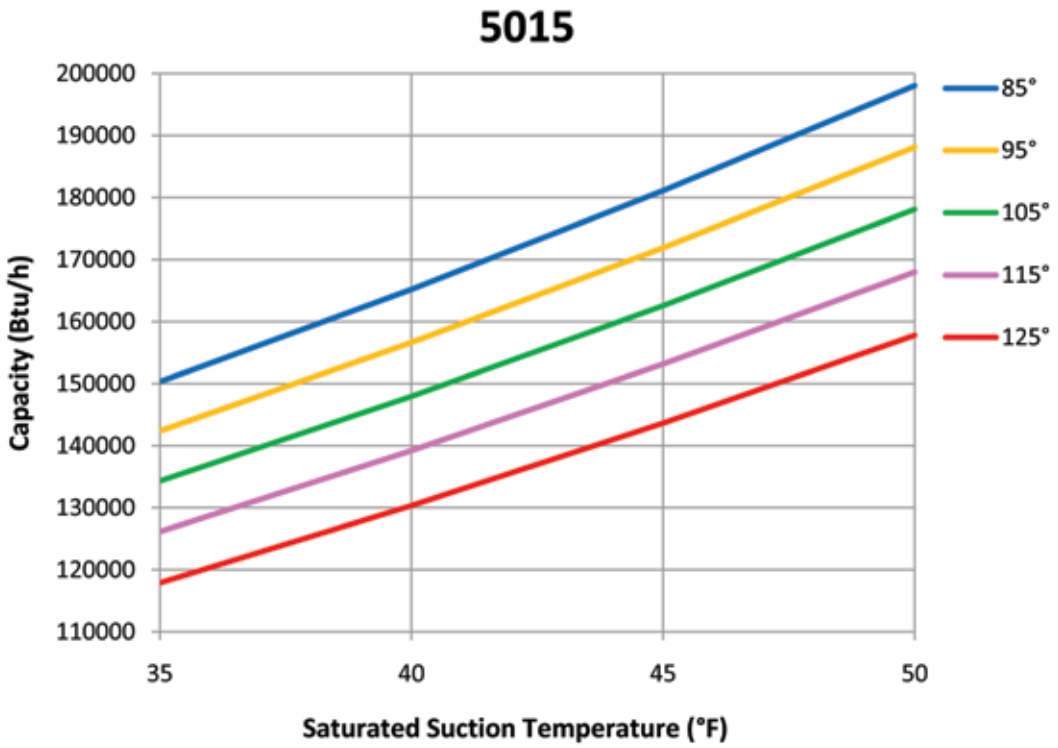
Unit Size	Sat. Suct. Temp. (°F)	Ambient Temperature (°F)																	
		85		90		95		100		105		110		115		120		125	
	(°F)	Ton	Kw*	Ton	Kw*	Ton	Kw*	Ton	Kw*	Ton	Kw*	Ton	Kw*	Ton	Kw*	Ton	Kw*	Ton	Kw*
15	35	12.5	10.0	12.2	10.4	11.9	10.8	11.5	11.3	11.2	11.8	10.9	12.4	10.5	13.0	10.2	13.6	9.8	14.4
	40	13.8	10.7	13.4	11.1	13.1	11.6	12.7	12.1	12.3	12.7	12.0	13.2	11.6	13.9	11.2	14.5	10.9	15.3
	45	15.1	11.0	14.7	11.5	14.3	11.9	13.9	12.5	13.5	13.0	13.2	13.6	12.8	14.2	12.4	14.8	12.0	15.5
	50	16.5	12.4	16.1	12.8	15.7	13.4	15.3	13.8	14.8	14.4	14.4	14.8	14.0	15.4	13.6	16.0	13.1	16.8
20	35	16.1	13.2	15.7	13.6	15.3	14.2	14.8	14.7	14.4	15.4	14.0	16.1	13.5	16.9	13.1	17.7	12.6	18.7
	40	17.7	14.9	17.3	15.5	16.8	16.2	16.3	16.9	15.9	17.7	15.4	18.6	14.9	19.5	14.4	20.5	14.0	21.5
	45	19.4	14.8	18.9	15.4	18.4	16.0	17.9	16.7	17.4	17.4	16.9	18.2	16.4	19.0	15.9	19.8	15.3	20.7
	50	21.2	15.1	20.7	15.7	20.1	16.3	19.6	17.0	19.1	17.7	18.5	18.4	18.0	19.2	17.4	19.9	16.9	20.8
30	35	24.1	22.1	23.4	23.0	22.7	24.1	22.1	25.2	21.4	26.4	20.7	27.7	20.1	29.1	19.4	30.8	18.7	32.6
	40	26.4	23.0	25.7	24.0	25.0	25.0	24.2	26.1	23.5	27.2	22.8	28.5	22.1	29.8	21.3	31.3	20.6	33.0
	45	28.8	23.9	28.1	24.9	27.3	26.0	26.5	27.1	25.8	28.2	25.0	29.4	24.2	30.7	23.4	32.1	22.6	33.6
	50	31.4	24.9	30.6	26.0	29.8	27.1	29.0	28.1	28.1	29.3	27.3	30.5	26.5	31.7	25.6	33.1	24.8	34.5
40	35	31.3	28.5	30.4	29.8	29.6	31.1	28.7	32.4	27.9	34.0	27.0	35.6	26.1	37.4	25.3	39.5	24.4	41.7
	40	34.4	29.5	33.5	30.8	32.6	32.1	31.7	33.5	30.7	34.9	29.8	36.5	28.9	38.1	27.9	40.0	27.0	42.1
	45	37.7	30.7	36.7	32.0	35.7	33.3	34.8	34.6	33.8	36.1	32.8	37.6	31.8	39.1	30.8	40.9	29.7	42.8
	50	41.2	31.9	40.2	33.3	39.1	34.6	38.0	35.9	37.0	37.3	35.9	38.8	34.8	40.4	33.7	42.0	32.6	43.8
50	35	38.5	34.0	37.2	35.3	36.0	36.6	34.7	37.9	33.4	39.4	32.1	40.9	30.9	42.6	29.6	44.4	28.3	46.4
	40	42.5	35.6	41.1	36.9	39.8	38.2	38.4	39.6	37.1	41.0	35.7	42.5	34.4	44.1	33.0	45.8	31.6	47.7
	45	46.8	37.2	45.3	38.6	43.9	40.0	42.4	41.4	41.0	42.8	39.5	44.3	38.1	45.9	36.6	47.5	35.1	49.3
	50	51.3	38.9	49.7	40.4	48.2	41.8	46.7	43.3	45.1	44.8	43.6	46.3	42.0	47.8	40.4	49.4	38.9	51.1
60	35	48.7	43.3	47.4	45.3	46.1	47.3	44.7	49.5	43.4	51.9	42.0	54.4	40.7	57.2	39.3	60.4	37.9	63.8
	40	53.4	45.1	52.0	47.1	50.6	49.1	49.1	51.2	47.7	53.5	46.3	55.9	44.8	58.6	43.3	61.5	41.8	64.7
	45	58.5	46.8	56.9	48.8	55.4	51.2	53.9	53.2	52.3	55.2	50.7	57.6	49.2	60.4	47.6	62.8	46.0	66.0
	50	63.8	48.8	62.1	50.8	60.5	53.2	58.8	55.2	57.2	57.6	55.5	60.0	53.8	62.4	52.1	64.8	50.4	67.9
70	35	56.0	49.3	54.5	51.5	53.0	53.8	51.4	56.3	49.9	59.0	48.4	61.8	46.8	65.0	45.2	68.5	43.6	72.4
	40	61.4	51.3	59.8	53.5	58.2	55.8	56.5	58.3	54.9	60.8	53.2	63.6	51.5	66.5	49.9	69.8	48.2	73.4
	45	67.2	53.3	65.5	55.6	63.7	58.0	62.0	60.4	60.2	63.0	58.4	65.6	56.6	68.5	54.8	71.5	53.0	74.9
	50	73.4	55.4	71.5	57.8	69.6	60.3	67.7	62.8	65.8	65.3	63.9	68.0	62.0	70.7	60.0	73.7	58.1	76.8
80	35	63.8	57.5	62.1	60.0	60.3	62.7	58.6	65.5	56.8	68.6	55.0	71.9	53.2	75.6	51.4	79.7	49.6	84.3
	40	70.0	59.8	68.1	62.4	66.2	65.1	64.3	67.9	62.4	70.8	60.5	74.0	58.6	77.5	56.7	81.3	54.7	85.5
	45	76.6	62.3	74.6	65.0	72.5	67.7	70.5	70.5	68.4	73.4	66.4	76.5	64.3	79.8	62.2	83.3	60.2	87.2
	50	83.5	64.9	81.3	67.7	79.2	70.4	77.0	73.3	74.8	76.2	72.6	79.3	70.4	82.5	68.1	85.9	65.9	89.5
100	35	72.2	65.5	70.2	68.4	68.2	71.4	66.2	74.7	64.2	78.2	62.2	82.0	60.1	86.3	58.1	91.0	56.0	96.3
	40	79.1	68.1	77.0	71.0	74.9	74.1	72.7	77.3	70.5	80.7	68.4	84.4	66.2	88.3	64.0	92.7	61.8	97.5
	45	86.6	71.0	84.3	74.0	82.0	77.0	79.6	80.2	77.3	83.6	75.0	87.1	72.6	90.9	70.3	95.0	67.9	99.4
	50	94.4	73.9	91.9	77.0	89.5	80.2	87.0	83.4	84.5	86.7	82.0	90.2	79.5	93.9	76.9	97.8	74.4	102.0
120	35	94.2	87.7	91.6	91.6	88.9	95.8	86.3	100.2	83.7	104.9	81.0	110.1	78.4	115.9	75.7	122.3	73.0	129.3
	40	103.2	91.4	100.4	95.3	97.6	99.4	94.8	103.7	91.9	108.3	89.1	113.3	86.2	118.6	83.4	124.5	80.5	131.0
	45	112.7	95.3	109.7	99.4	106.7	103.4	103.7	107.7	100.7	112.2	97.6	116.9	94.6	122.1	91.5	127.6	88.4	133.7
	50	122.9	99.4	119.6	103.5	116.4	107.8	113.2	112.1	109.9	116.5	106.7	121.1	103.4	126.1	100.1	131.3	96.8	137.0

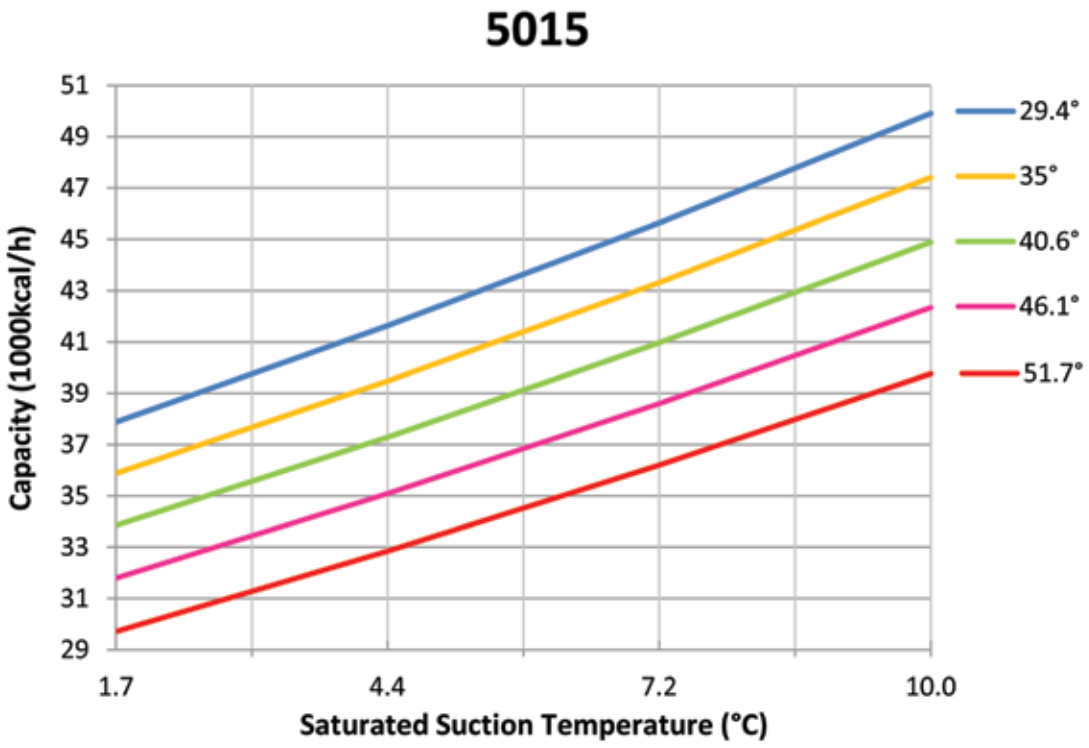
Capacities /R22

Metric Measure

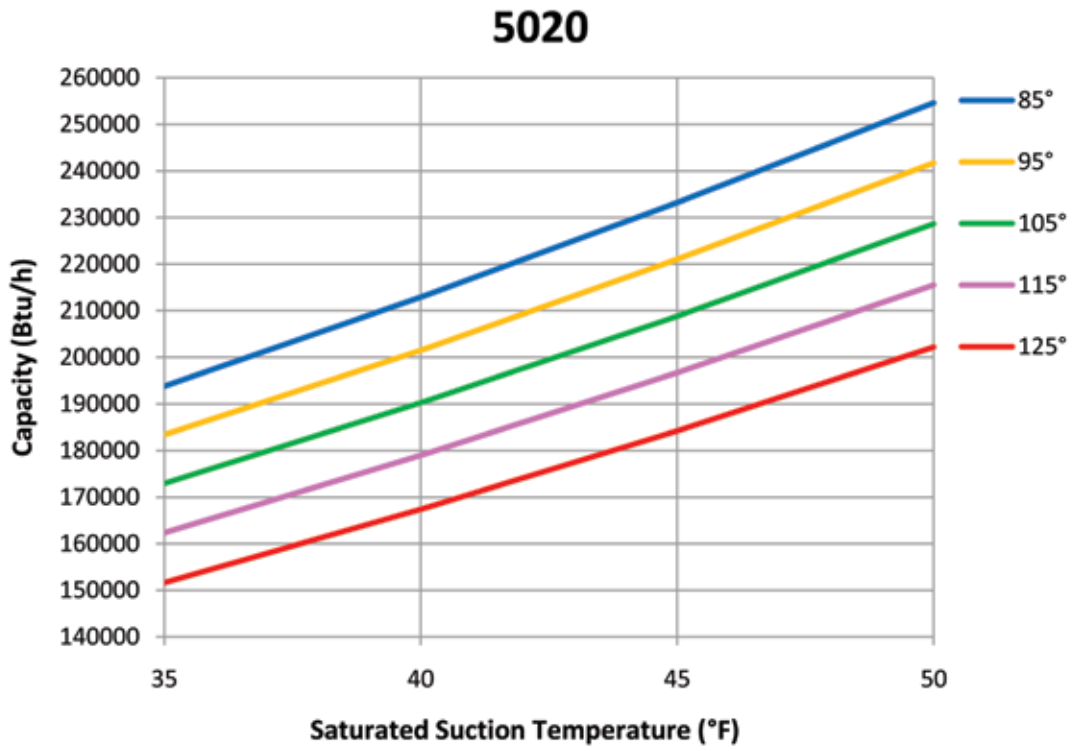
Unit Size	Sat. Suct. Temp. (°C)	Ambient Temperature (°C)																	
		29.4		32.2		35		37.8		40.6		43.3		46.1		48.9		51.7	
	(°C)	1000 kcal/h	Kw*	1000 kcal/h	Kw*	1000 kcal/h	Kw*	1000 kcal/h	Kw*	1000 kcal/h	Kw*	1000 kcal/h	Kw*	1000 kcal/h	Kw*	1000 kcal/h	Kw*	1000 kcal/h	Kw*
15	1.7	37.9	10.0	36.9	10.4	35.9	10.8	34.9	11.3	33.8	11.8	32.8	12.4	31.8	13.0	30.8	13.6	29.7	14.4
	4.4	41.6	10.7	40.5	11.1	39.5	11.6	38.4	12.1	37.3	12.7	36.2	13.2	35.1	13.9	34.0	14.5	32.8	15.3
	7.2	45.6	11.0	44.5	11.5	43.3	11.9	42.1	12.5	41.0	13.0	39.8	13.6	38.6	14.2	37.4	14.8	36.2	15.5
	10.0	49.9	12.4	48.7	12.8	47.4	13.4	46.1	13.8	44.9	14.4	43.6	14.8	42.3	15.4	41.1	16.0	39.8	16.8
20	1.7	48.8	13.2	47.5	13.6	46.2	14.2	44.9	14.7	43.6	15.4	42.2	16.1	40.9	16.9	39.6	17.7	38.2	18.7
	4.4	53.7	14.9	52.2	15.5	50.8	16.2	49.4	16.9	47.9	17.7	46.5	18.6	45.1	19.5	43.6	20.5	42.2	21.5
	7.2	58.8	14.8	57.2	15.4	55.7	16.0	54.2	16.7	52.6	17.4	51.1	18.2	49.6	19.0	48.0	19.8	46.4	20.7
	10.0	64.2	15.1	62.5	15.7	60.9	16.3	59.3	17.0	57.6	17.7	56.0	18.4	54.3	19.2	52.6	19.9	51.0	20.8
30	1.7	72.8	22.1	70.8	23.0	68.8	24.1	66.8	25.2	64.7	26.4	62.7	27.7	60.7	29.1	58.6	30.8	56.6	32.6
	4.4	79.8	23.0	77.6	24.0	75.5	25.0	73.3	26.1	71.1	27.2	69.0	28.5	66.8	29.8	64.6	31.3	62.3	33.0
	7.2	87.2	23.9	84.9	24.9	82.6	26.0	80.3	27.1	77.9	28.2	75.6	29.4	73.2	30.7	70.9	32.1	68.5	33.6
	10.0	95.1	24.9	92.6	26.0	90.1	27.1	87.6	28.1	85.1	29.3	82.6	30.5	80.1	31.7	77.5	33.1	75.0	34.5
40	1.7	94.6	28.5	92.0	29.8	89.4	31.1	86.9	32.4	84.3	34.0	81.6	35.6	79.0	37.4	76.4	39.5	73.7	41.7
	4.4	104.0	29.5	101.3	30.8	98.5	32.1	95.7	33.5	92.9	34.9	90.1	36.5	87.3	38.1	84.4	40.0	81.6	42.1
	7.2	114.0	30.7	111.1	32.0	108.1	33.3	105.1	34.6	102.1	36.1	99.1	37.6	96.1	39.1	93.0	40.9	89.9	42.8
	10.0	124.6	31.9	121.4	33.3	118.2	34.6	115.0	35.9	111.8	37.3	108.6	38.8	105.3	40.4	102.0	42.0	98.7	43.8
50	1.7	116.4	34.0	112.6	35.3	108.8	36.6	104.9	37.9	101.1	39.4	97.2	40.9	93.3	42.6	89.4	44.4	85.5	46.4
	4.4	128.5	35.6	124.4	36.9	120.3	38.2	116.2	39.6	112.1	41.0	108.0	42.5	103.9	44.1	99.7	45.8	95.6	47.7
	7.2	141.4	37.2	137.1	38.6	132.7	40.0	128.3	41.4	123.9	42.8	119.5	44.3	115.1	45.9	110.7	47.5	106.3	49.3
	10.0	155.1	38.9	150.4	40.4	145.8	41.8	141.1	43.3	136.4	44.8	131.7	46.3	127.0	47.8	122.3	49.4	117.6	51.1
60	1.7	147.3	43.3	143.3	45.3	139.3	47.3	135.3	49.5	131.2	51.9	127.1	54.4	123.0	57.2	118.9	60.4	114.7	63.8
	4.4	161.6	45.1	157.3	47.1	153.0	49.1	148.6	51.2	144.3	53.5	139.9	55.9	135.5	58.6	131.0	61.5	126.5	64.7
	7.2	176.8	46.8	172.2	48.8	167.5	51.2	162.9	53.2	158.2	55.2	153.4	57.6	148.7	60.4	143.9	62.8	139.0	66.0
	10.0	193.0	48.8	187.8	50.8	183.0	53.2	177.9	55.2	173.0	57.6	167.9	60.0	162.7	62.4	157.6	64.8	152.4	67.9
70	1.7	169.4	49.3	164.8	51.5	160.2	53.8	155.5	56.3	150.9	59.0	146.2	61.8	141.5	65.0	136.8	68.5	132.0	72.4
	4.4	185.8	51.3	180.9	53.5	175.9	55.8	171.0	58.3	166.0	60.8	160.9	63.6	155.9	66.5	150.8	69.8	145.7	73.4
	7.2	203.4	53.3	198.1	55.6	192.7	58.0	187.4	60.4	182.0	63.0	176.6	65.6	171.2	68.5	165.7	71.5	160.2	74.9
	10.0	222.0	55.4	216.3	57.8	210.5	60.3	204.8	62.8	199.0	65.3	193.2	68.0	187.4	70.7	181.5	73.7	175.6	76.8
80	1.7	193.1	57.5	187.8	60.0	182.5	62.7	177.1	65.5	171.8	68.6	166.4	71.9	161.0	75.6	155.6	79.7	150.1	84.3
	4.4	211.7	59.8	206.0	62.4	200.3	65.1	194.6	67.9	188.8	70.8	183.0	74.0	177.2	77.5	171.4	81.3	165.5	85.5
	7.2	231.6	62.3	225.4	65.0	219.3	67.7	213.2	70.5	207.0	73.4	200.8	76.5	194.5	79.8	188.2	83.3	181.9	87.2
	10.0	252.6	64.9	246.0	67.7	239.4	70.4	232.8	73.3	226.2	76.2	219.5	79.3	212.8	82.5	206.0	85.9	199.3	89.5
100	1.7	218.3	65.5	212.2	68.4	206.2	71.4	200.1	74.7	194.1	78.2	187.9	82.0	181.8	86.3	175.6	91.0	169.4	96.3
	4.4	239.3	68.1	232.9	71.0	226.4	74.1	219.9	77.3	213.3	80.7	206.8	84.4	200.2	88.3	193.5	92.7	186.8	97.5
	7.2	261.7	71.0	254.8	74.0	247.8	77.0	240.8	80.2	233.8	83.6	226.8	87.1	219.7	90.9	212.5	95.0	205.4	99.4
	10.0	285.5	73.9	278.0	77.0	270.5	80.2	263.0	83.4	255.5	86.7	247.9	90.2	240.3	93.9	232.7	97.8	225.0	102.0
120	1.7	284.7	87.7	276.9	91.6	269.0	95.8	261.0	100.2	253.1	104.9	245.1	110.1	237.1	115.9	229.0	122.3	220.9	129.3
	4.4	311.9	91.4	303.5	95.3	295.1	99.4	286.6	103.7	278.0	108.3	269.4	113.3	260.8	118.6	252.1	124.5	243.4	131.0
	7.2	340.9	95.3	331.8	99.4	322.8	103.4	313.6	107.7	304.4	112.2	295.3	116.9	286.0	122.1	276.7	127.6	267.3	133.7
	10.0	371.5	99.4	361.8	103.5	352.0	107.8	342.2	112.1	332.4	116.5	322.5	121.1	312.6	126.1	302.6	131.3	292.6	137.0

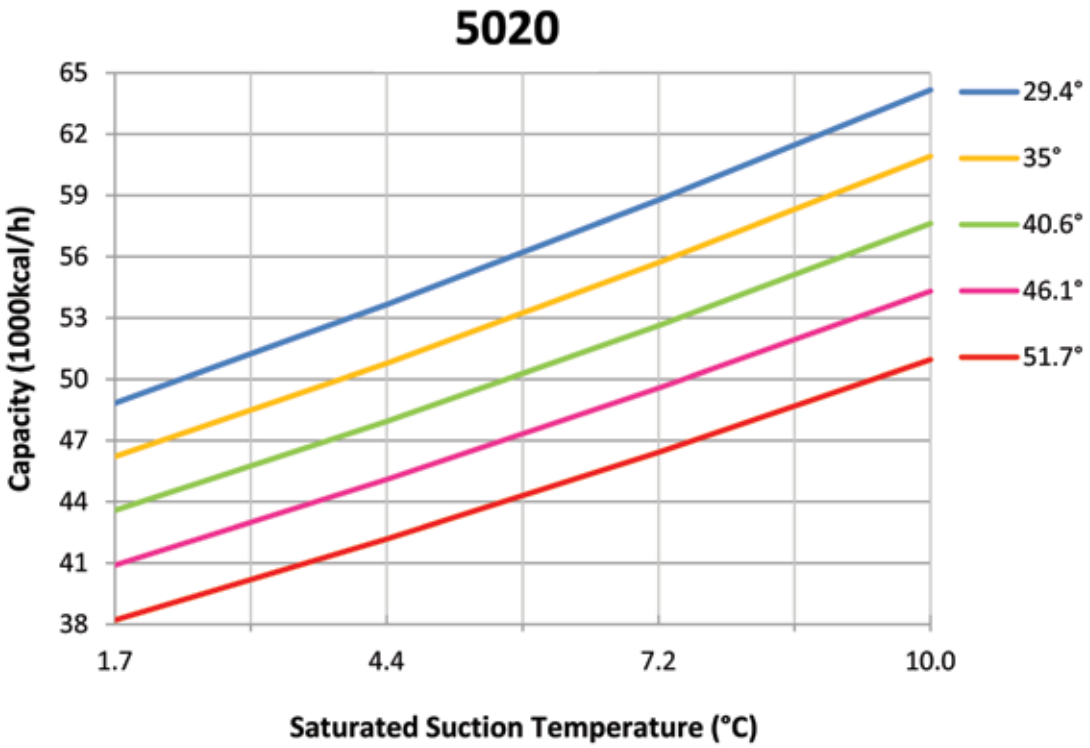
Capacities chart /R22





Capacities chart /R22





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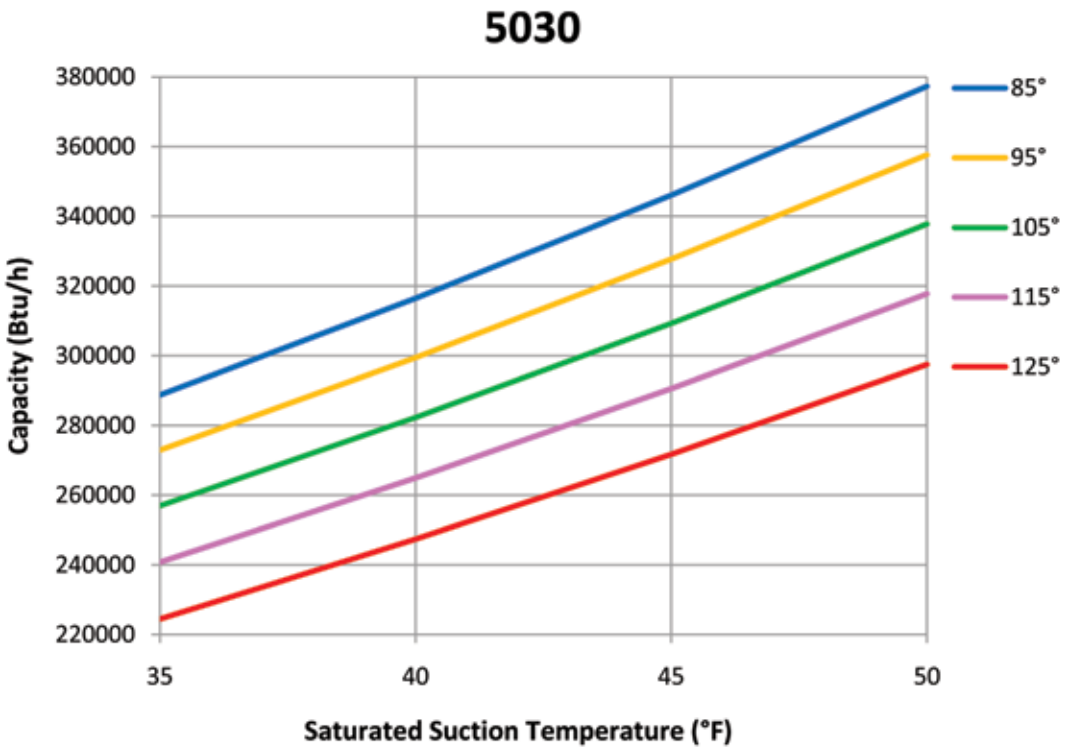

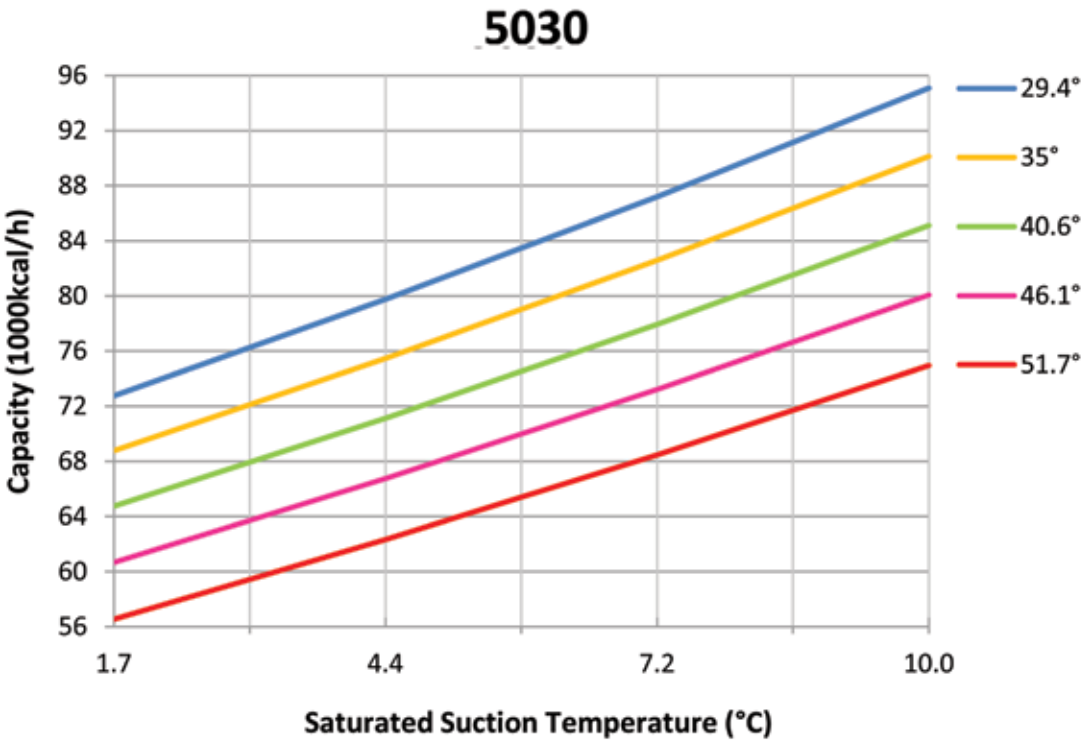

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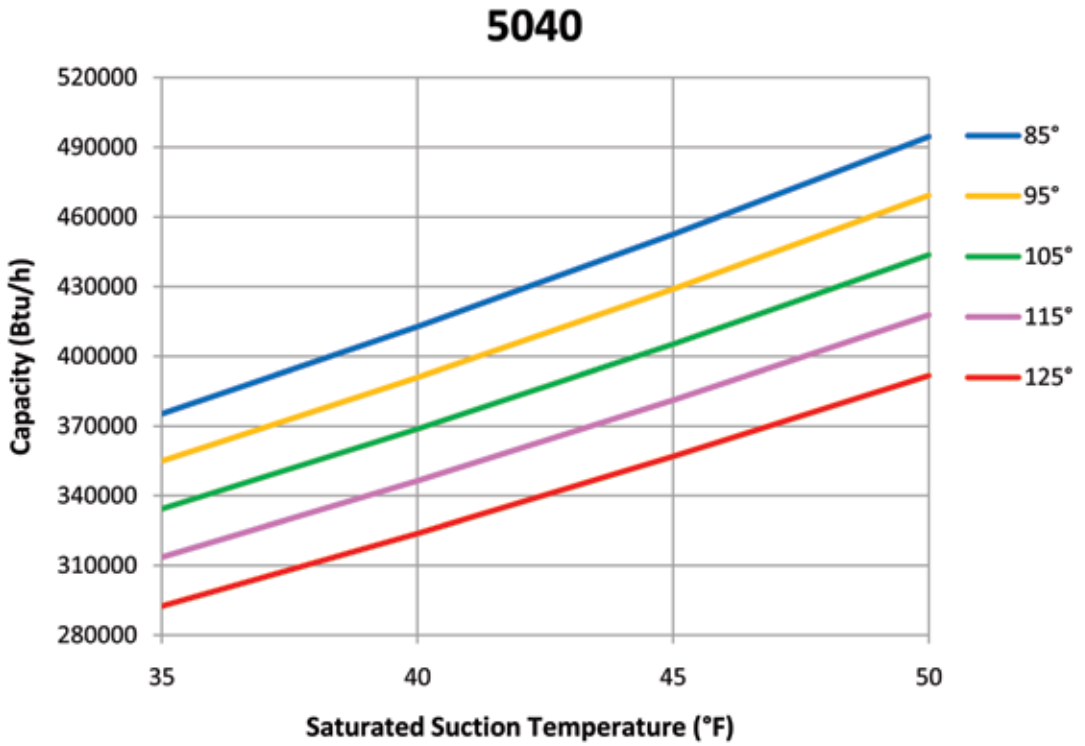

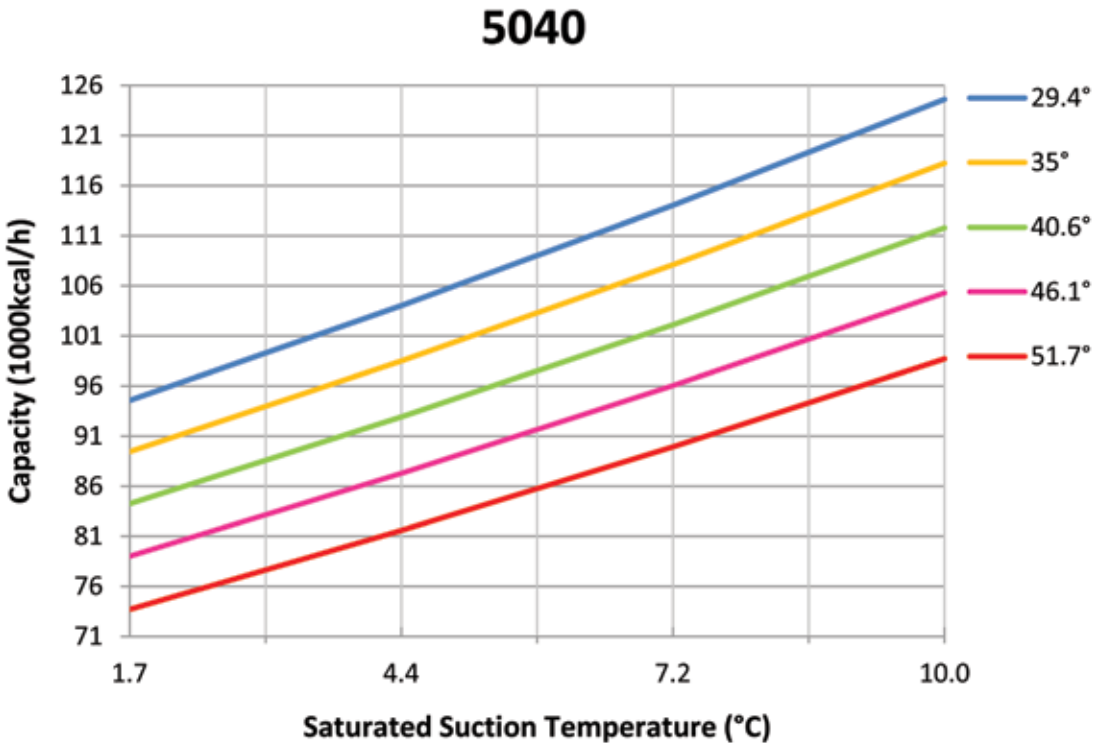

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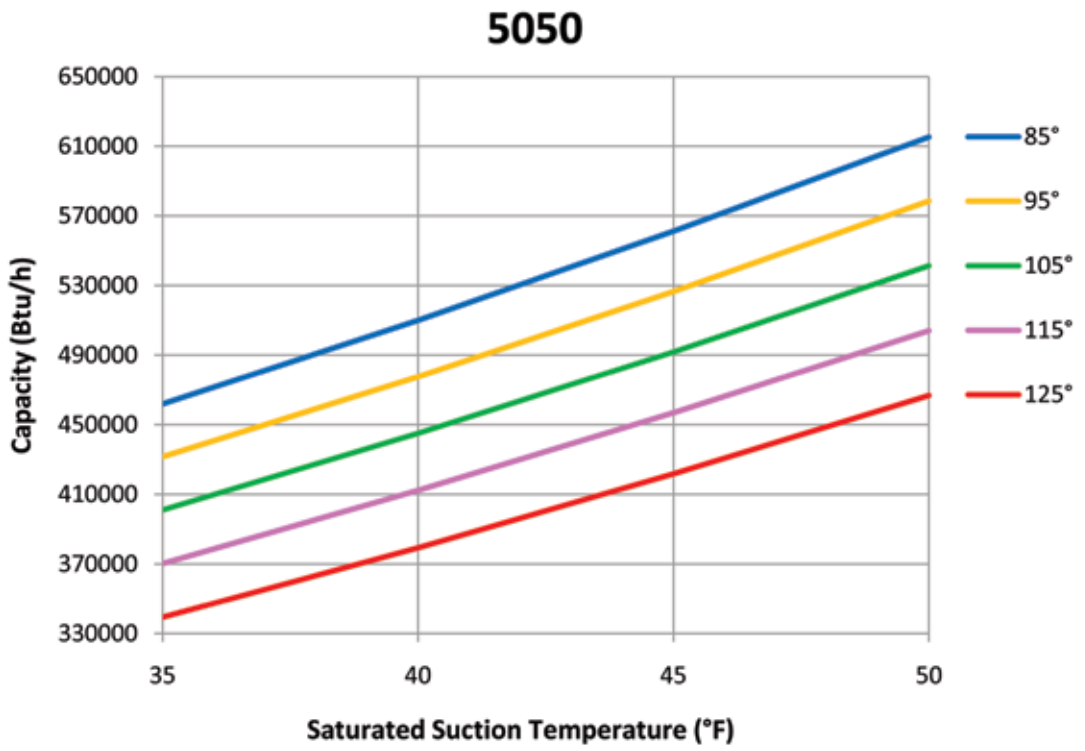

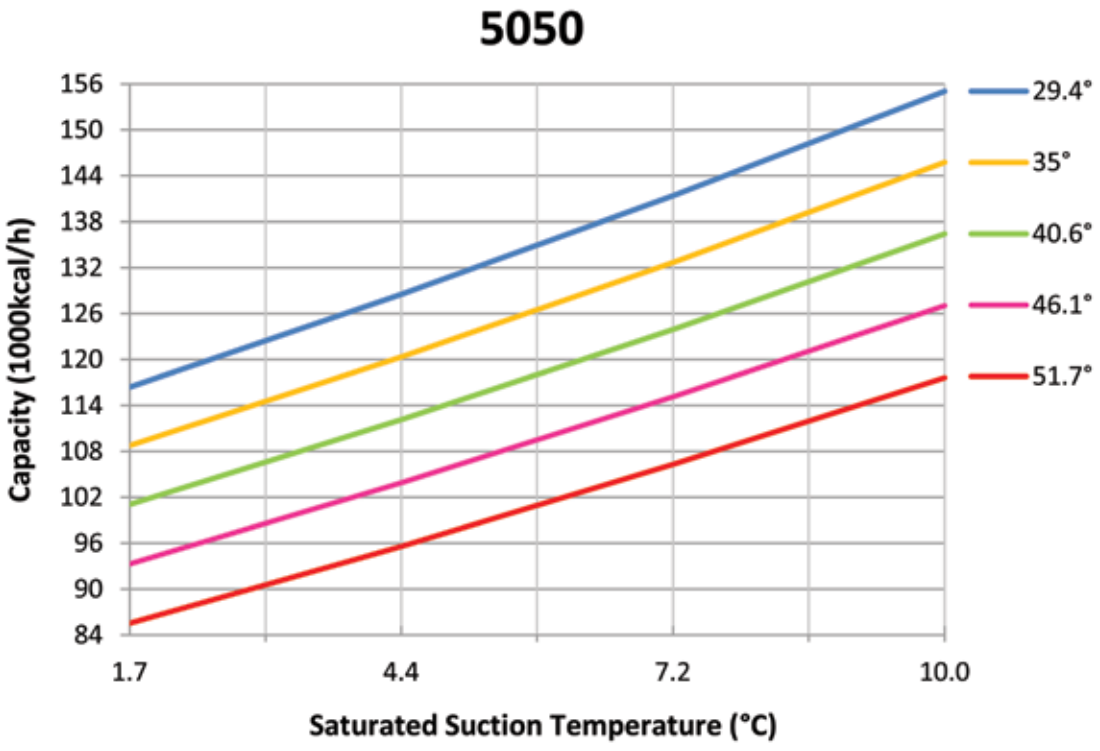

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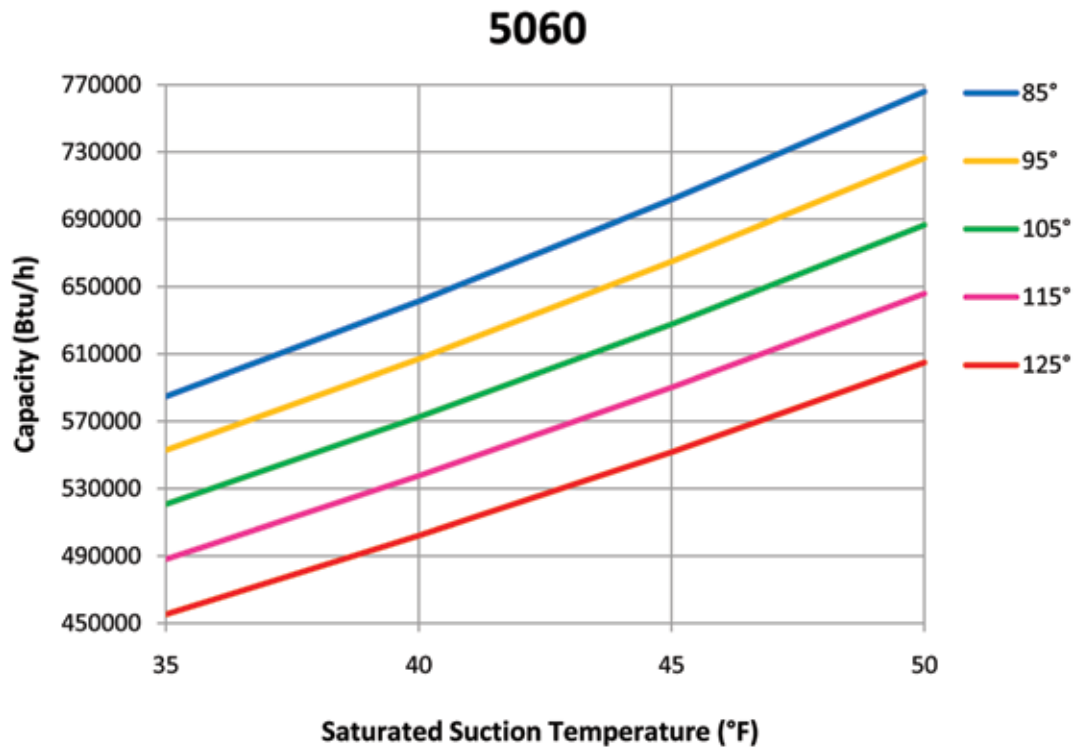
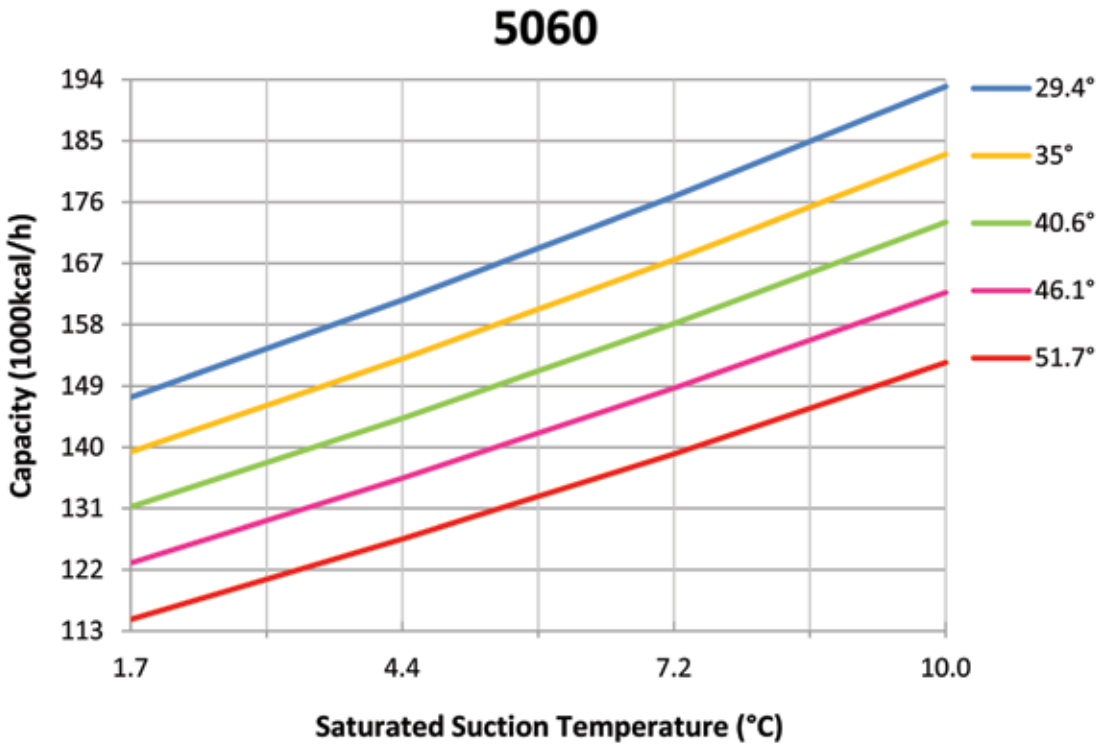
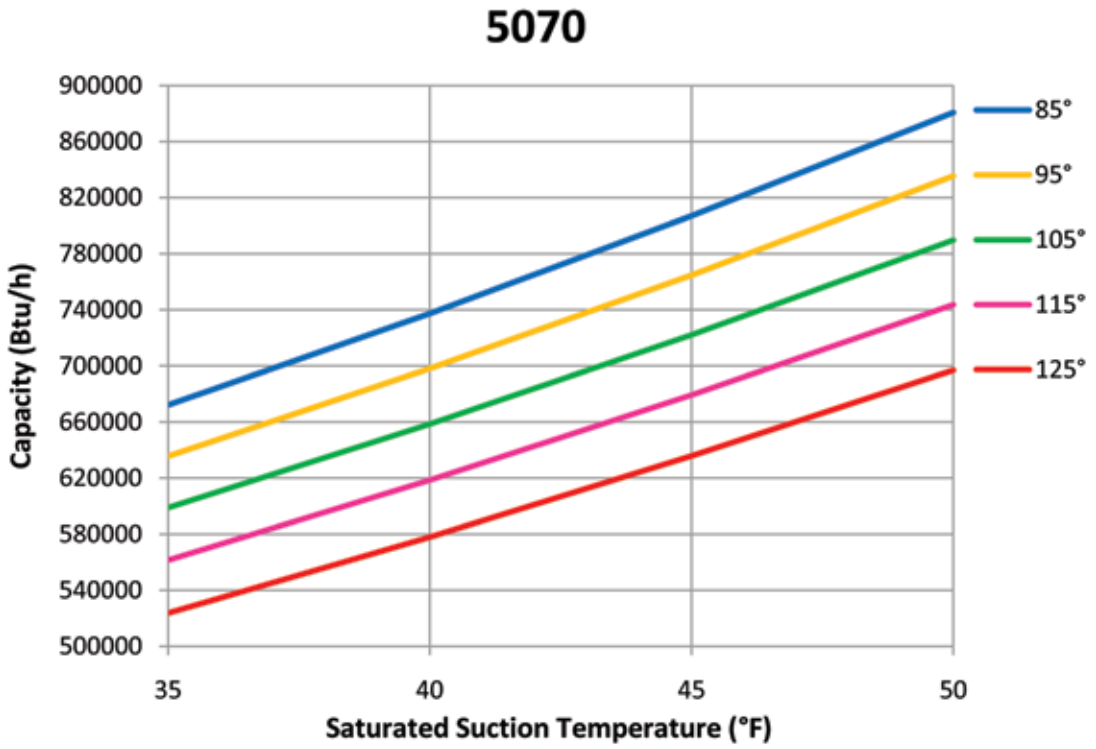
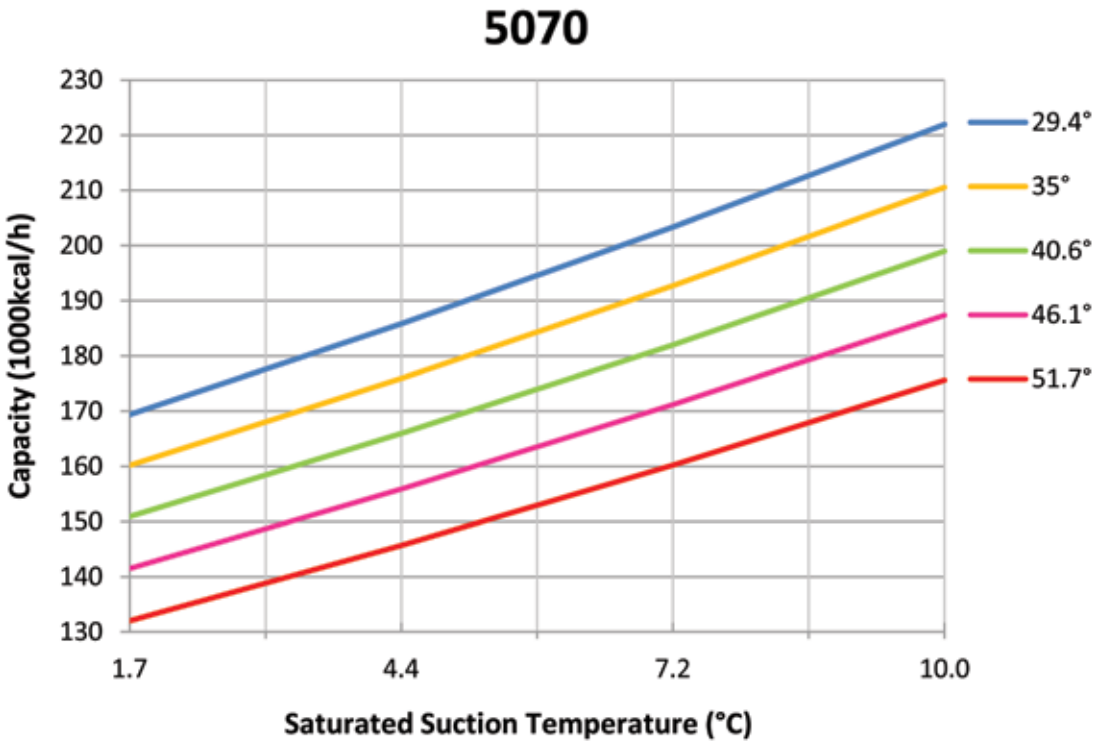


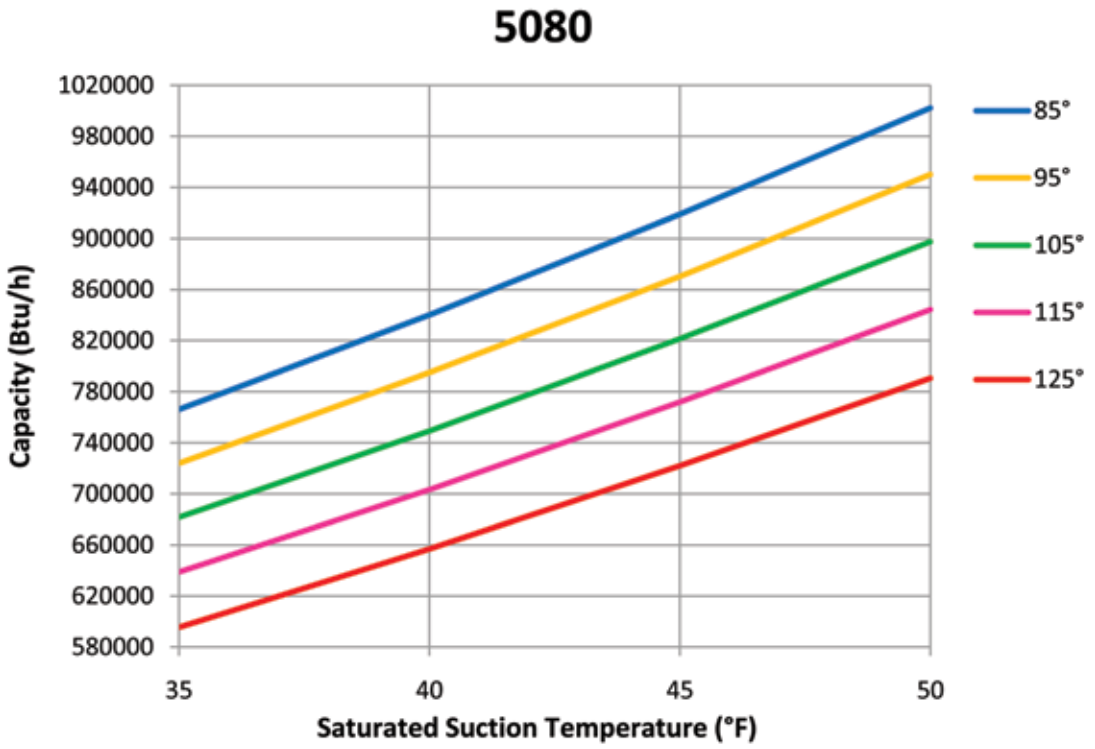


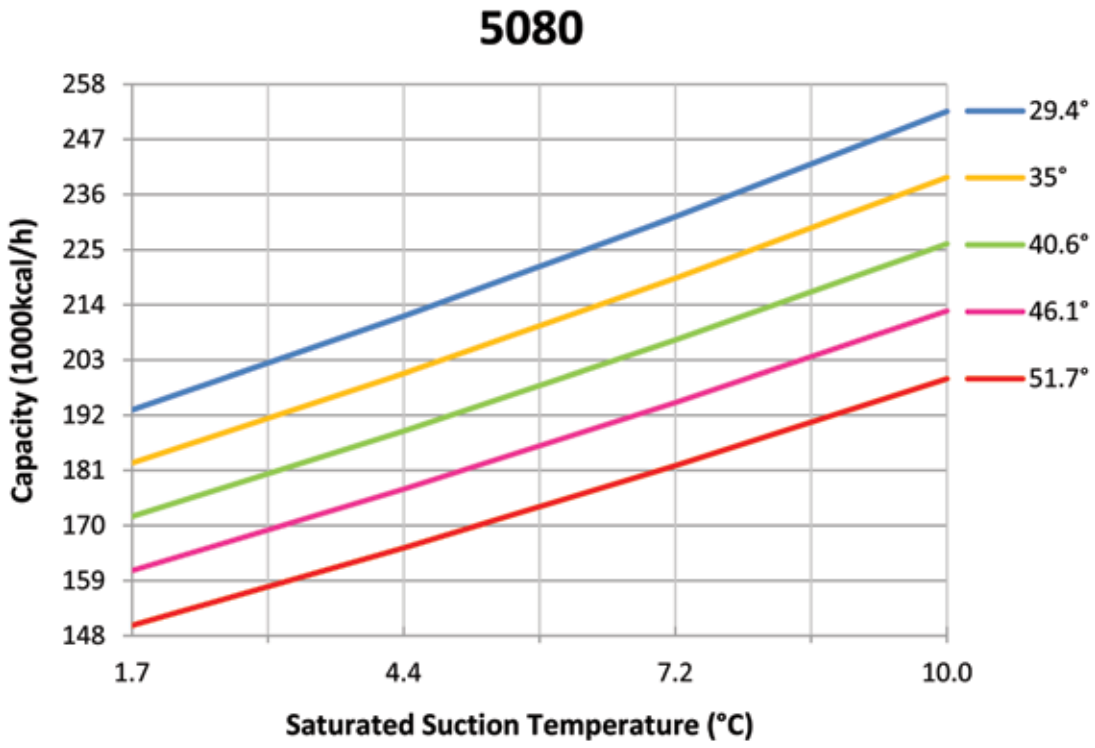
Capacities chart /R22



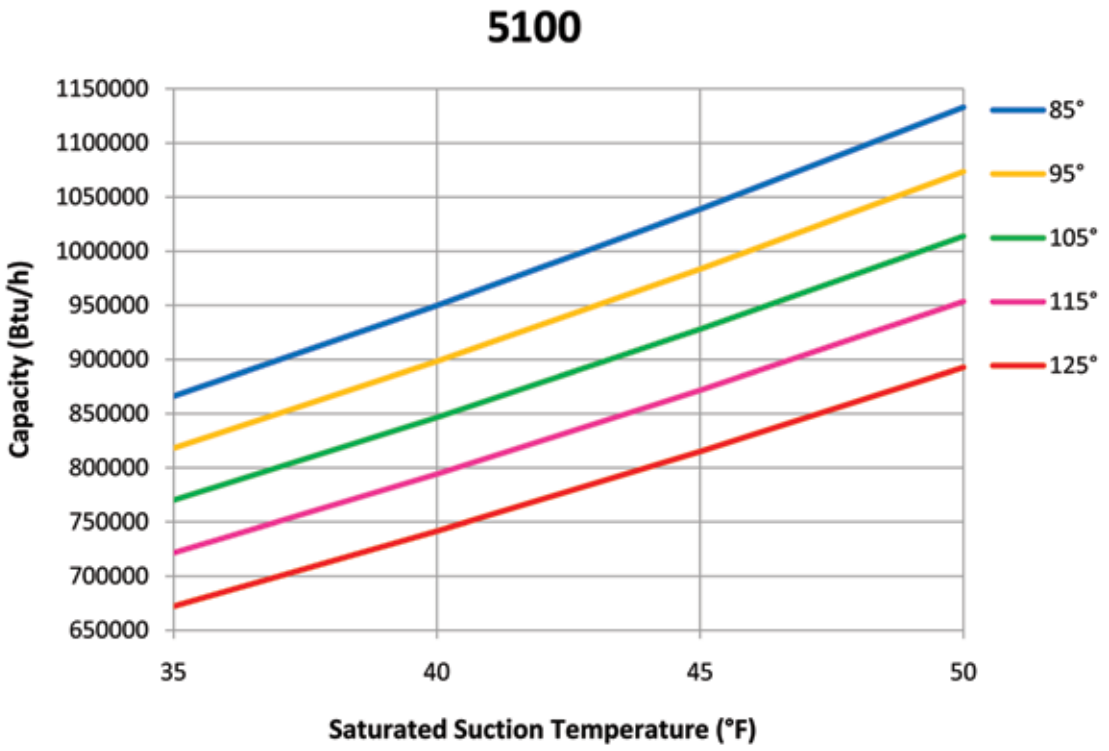


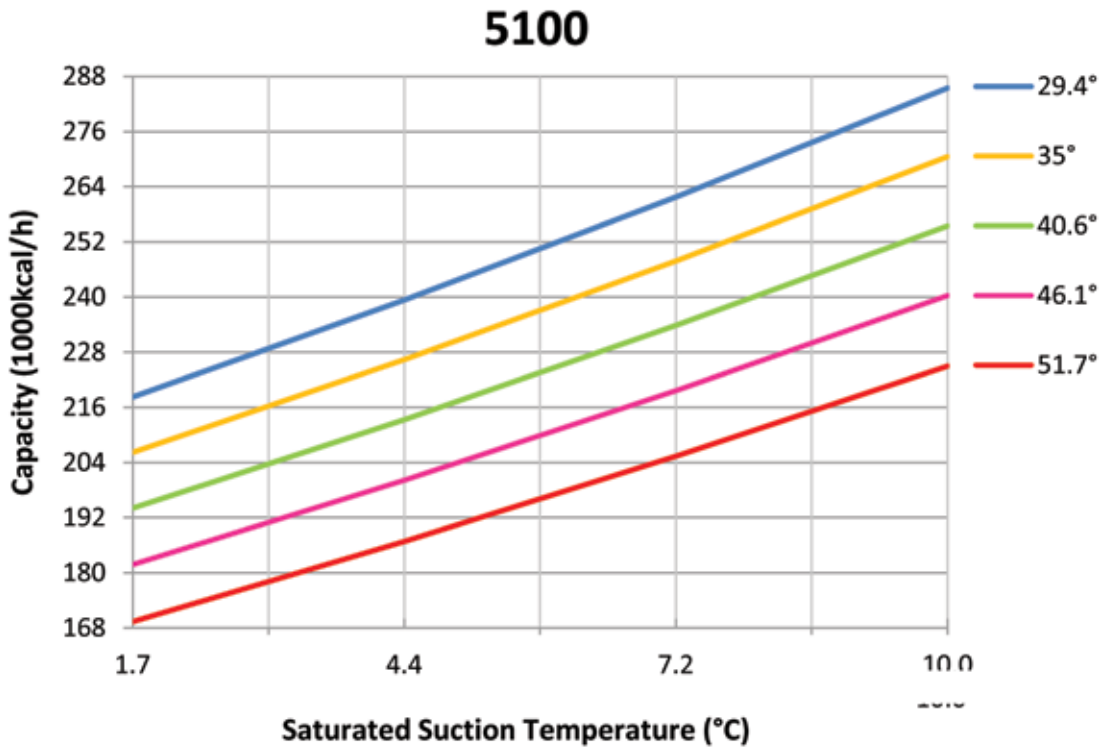
Capacities chart /R22



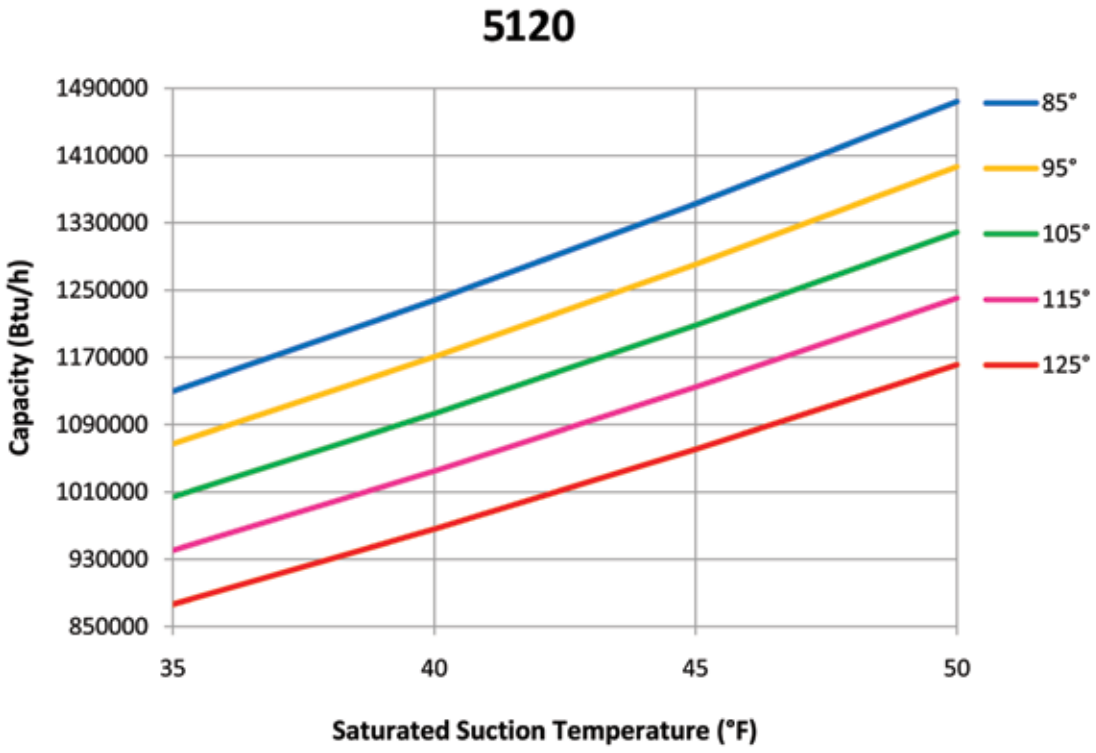


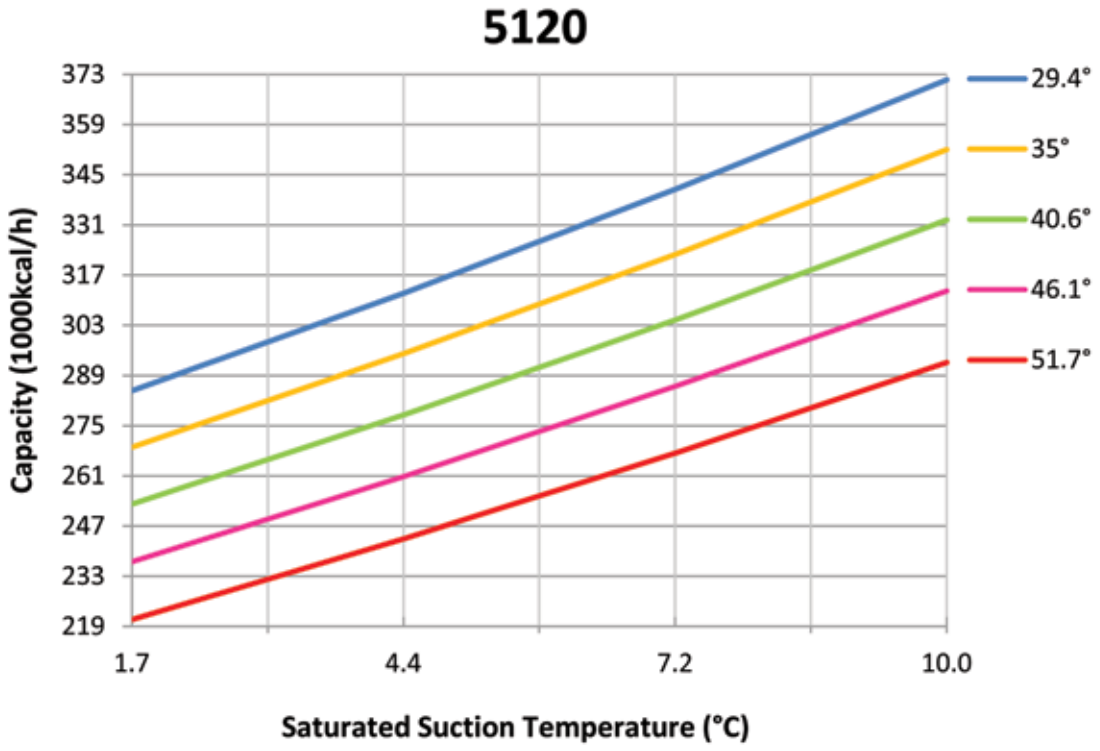
Capacities chart /R22





Capacities chart /R22





Capacities /R134a

English Measure

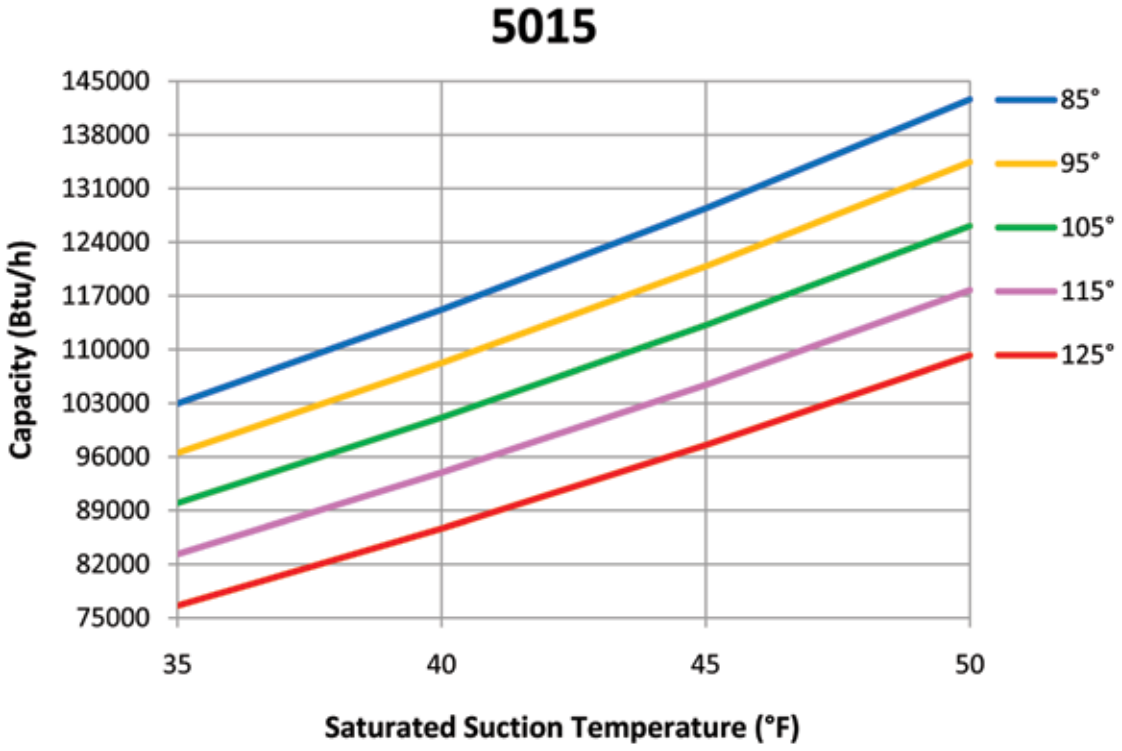
Unit Size	Sat. Suct. Temp. (°F)	Ambient Temperature (°F)																	
		85		90		95		100		105		110		115		120		125	
	(°F)	Ton	Kw*	Ton	Kw*	Ton	Kw*	Ton	Kw*	Ton	Kw*	Ton	Kw*	Ton	Kw*	Ton	Kw*	Ton	Kw*
15	35	8.6	6.5	8.3	6.8	8.0	7.2	7.8	7.6	7.5	8.0	7.2	8.5	6.9	9.0	6.7	9.6	6.4	10.3
	40	9.6	6.7	9.3	7.0	9.0	7.4	8.7	7.8	8.4	8.2	8.1	8.6	7.8	9.1	7.5	9.6	7.2	10.2
	45	10.7	6.9	10.4	7.3	10.1	7.7	9.8	8.0	9.4	8.4	9.1	8.8	8.8	9.3	8.5	9.8	8.1	10.3
	50	11.9	7.2	11.5	7.6	11.2	7.9	10.9	8.3	10.5	8.7	10.2	9.1	9.8	9.5	9.5	10.0	9.1	10.5
20	35	11.3	8.8	10.9	9.2	10.6	9.7	10.2	10.2	9.9	10.8	9.5	11.4	9.1	12.1	8.8	12.9	8.4	13.8
	40	12.6	9.1	12.2	9.6	11.8	10.0	11.5	10.5	11.1	11.0	10.7	11.6	10.3	12.3	9.9	13.0	9.5	13.8
	45	14.0	9.5	13.6	9.9	13.2	10.4	12.8	10.9	12.3	11.4	11.9	12.0	11.5	12.6	11.1	13.2	10.6	14.0
	50	15.6	9.8	15.1	10.3	14.6	10.8	14.2	11.3	13.7	11.8	13.3	12.4	12.8	12.9	12.3	13.5	11.9	14.2
30	35	17.2	13.7	16.6	14.4	16.1	15.2	15.5	16.0	15.0	16.8	14.4	17.8	13.9	18.9	13.3	20.2	12.8	21.7
	40	19.1	14.3	18.5	15.0	18.0	15.7	17.4	16.5	16.8	17.3	16.2	18.2	15.6	19.2	15.0	20.4	14.4	21.7
	45	21.2	14.9	20.6	15.6	20.0	16.4	19.3	17.1	18.7	17.9	18.0	18.8	17.4	19.7	16.7	20.8	16.1	21.9
	50	23.5	15.6	22.8	16.3	22.1	17.0	21.4	17.8	20.7	18.6	20.0	19.4	19.3	20.3	18.6	21.3	17.9	22.4
40	35	22.3	18.0	21.6	18.9	20.9	19.9	20.2	20.9	19.5	22.0	18.8	23.3	18.0	24.8	17.3	26.4	16.6	28.3
	40	24.9	18.8	24.1	19.7	23.3	20.6	22.6	21.6	21.8	22.7	21.0	23.8	20.2	25.2	19.4	26.6	18.7	28.3
	45	27.6	19.6	26.8	20.5	26.0	21.4	25.1	22.4	24.3	23.4	23.4	24.6	22.6	25.8	21.7	27.1	20.9	28.6
	50	30.6	20.5	29.7	21.4	28.8	22.4	27.9	23.3	27.0	24.3	26.1	25.4	25.1	26.6	24.2	27.8	23.3	29.2
50	35	27.2	21.7	26.4	22.8	25.5	24.0	24.7	25.3	23.8	26.7	22.9	28.2	22.0	30.0	21.2	32.1	20.3	34.4
	40	30.4	22.6	29.5	23.7	28.5	24.8	27.6	26.1	26.7	27.4	25.7	28.8	24.8	30.5	23.8	32.3	22.8	34.3
	45	33.8	23.5	32.8	24.6	31.8	25.8	30.8	27.0	29.7	28.3	28.7	29.7	27.7	31.2	26.6	32.8	25.6	34.7
	50	37.5	24.4	36.4	25.6	35.3	26.8	34.2	28.1	33.1	29.3	31.9	30.7	30.8	32.1	29.7	33.6	28.6	35.3
60	35	33.8	26.4	32.8	27.7	31.7	29.1	30.6	30.6	29.5	32.3	28.5	34.2	27.4	36.3	26.3	38.7	25.2	41.5
	40	37.7	27.4	36.5	28.8	35.4	30.2	34.2	31.6	33.0	33.2	31.9	35.0	30.7	36.9	29.5	39.1	28.3	41.5
	45	41.9	28.6	40.6	29.9	39.3	31.4	38.1	32.8	36.8	34.4	35.5	36.0	34.3	37.9	33.0	39.8	31.7	42.1
	50	46.3	29.8	45.0	31.2	43.6	32.6	42.2	34.1	40.9	35.7	39.5	37.3	38.1	39.0	36.7	40.9	35.3	43.0
70	35	39.2	30.7	38.0	32.2	36.7	33.8	35.5	35.6	34.2	37.5	33.0	39.7	31.7	42.1	30.4	44.9	29.1	48.1
	40	43.7	32.0	42.4	33.5	41.0	35.1	39.7	36.7	38.3	38.6	37.0	40.6	35.6	42.8	34.2	45.3	32.8	48.1
	45	48.6	33.3	47.2	34.9	45.7	36.5	44.2	38.1	42.8	39.9	41.3	41.8	39.8	43.8	38.3	46.1	36.8	48.7
	50	53.9	34.7	52.3	36.3	50.7	37.9	49.1	39.7	47.5	41.4	45.9	43.2	44.3	45.2	42.7	47.3	41.1	49.7
80	35	43.2	36.4	41.8	38.2	40.4	40.2	39.0	42.4	37.5	44.9	36.1	47.6	34.7	50.7	33.3	54.2	31.8	58.3
	40	48.2	37.8	46.7	39.6	45.1	41.6	43.6	43.7	42.1	45.9	40.5	48.4	39.0	51.2	37.5	54.3	35.9	57.9
	45	53.5	39.3	51.9	41.2	50.3	43.1	48.6	45.2	47.0	47.3	45.3	49.7	43.6	52.3	42.0	55.1	40.3	58.3
	50	59.3	41.0	57.6	42.9	55.8	44.9	54.0	46.9	52.2	49.0	50.4	51.3	48.6	53.7	46.8	56.4	45.0	59.3
100	35	50.1	41.5	48.5	43.6	46.9	45.7	45.3	48.1	43.6	50.8	42.0	53.8	40.4	57.1	38.7	61.0	37.1	65.5
	40	55.8	43.3	54.1	45.3	52.4	47.5	50.6	49.8	48.8	52.2	47.1	55.0	45.3	58.0	43.5	61.5	41.7	65.4
	45	62.1	45.2	60.2	47.3	58.3	49.4	56.4	51.6	54.5	54.0	52.6	56.6	50.6	59.4	48.7	62.6	46.8	66.1
	50	68.8	47.2	66.7	49.4	64.7	51.5	62.6	53.7	60.5	56.1	58.5	58.6	56.4	61.3	54.3	64.2	52.2	67.4
120	35	66.6	55.3	64.5	58.0	62.3	61.0	60.2	64.2	58.0	67.7	55.9	71.7	53.7	76.2	51.6	81.3	49.4	87.3
	40	74.2	57.7	71.9	60.4	69.6	63.3	67.3	66.4	64.9	69.7	62.6	73.4	60.2	77.4	57.9	82.0	55.5	87.3
	45	82.4	60.3	79.9	63.1	77.4	65.9	74.8	68.9	72.3	72.1	69.8	75.6	67.2	79.4	64.7	83.6	62.1	88.3
	50	91.1	63.1	88.4	65.9	85.7	68.8	83.0	71.8	80.3	74.9	77.5	78.3	74.8	81.9	72.0	85.8	69.2	90.2

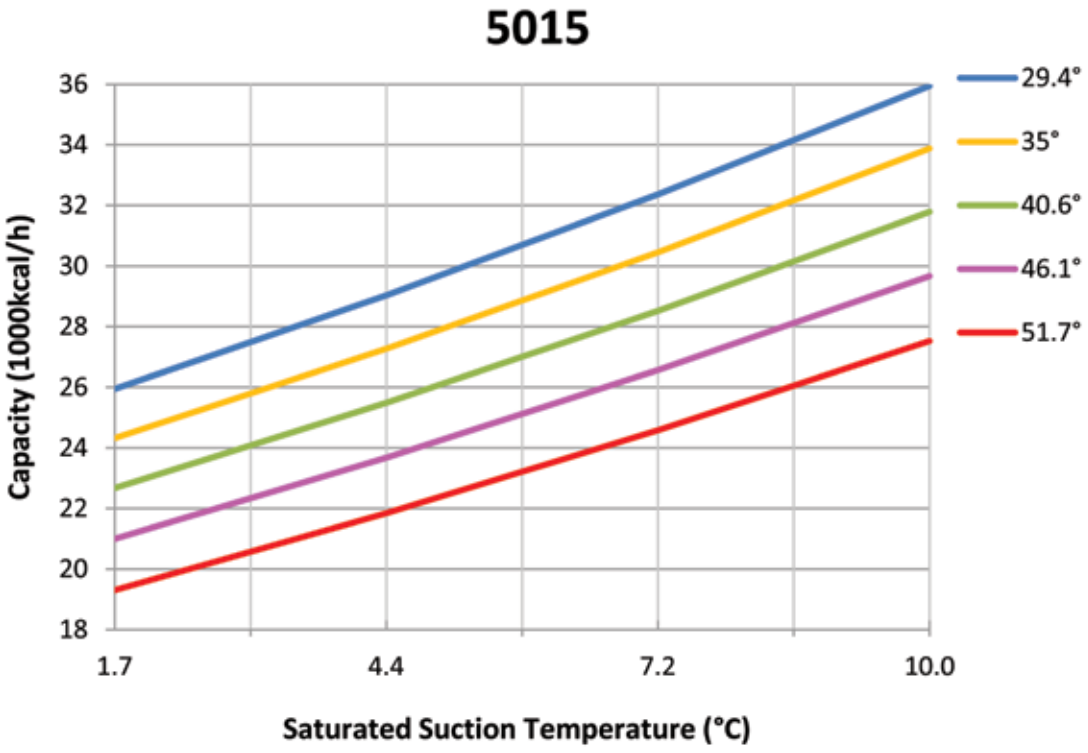
Capacities /R134a

Metric Measure

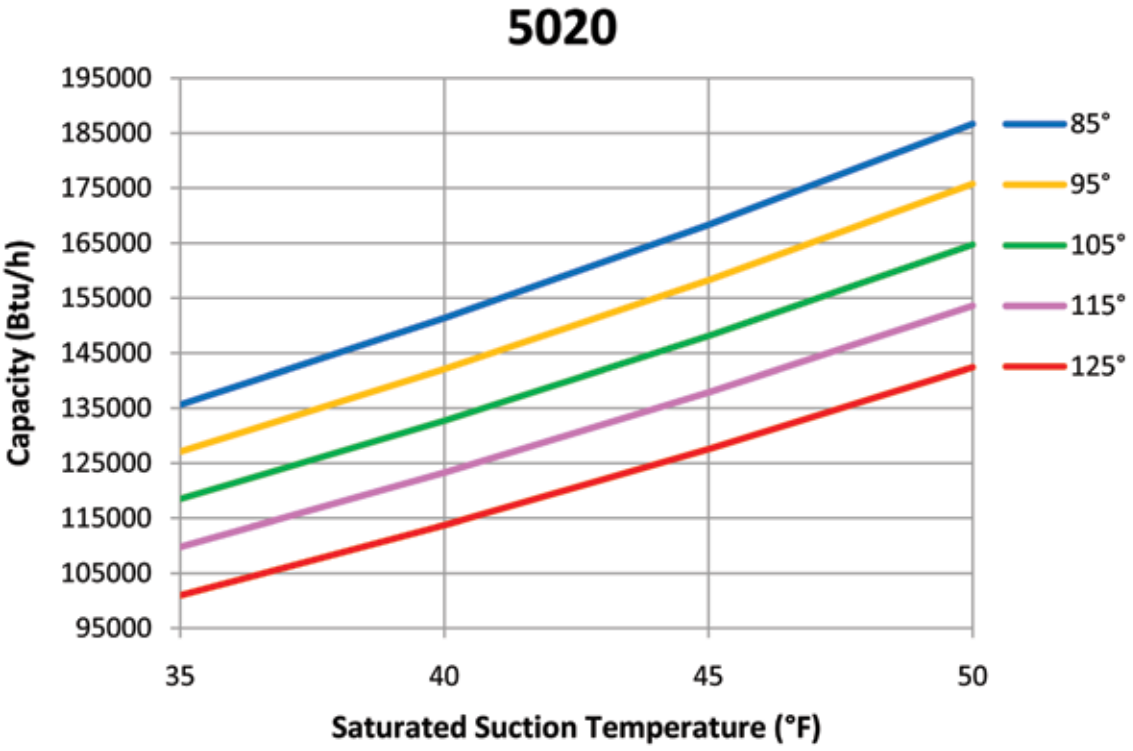
Unit Size	Sat. Suct. Temp. (°C)	Ambient Temperature (°C)																	
		29.4		32.2		35		37.8		40.6		43.3		46.1		48.9		51.7	
	(°C)	1000 kcal/h	Kw*	1000 kcal/h	Kw*	1000 kcal/h	Kw*	1000 kcal/h	Kw*	1000 kcal/h	Kw*	1000 kcal/h	Kw*	1000 kcal/h	Kw*	1000 kcal/h	Kw*	1000 kcal/h	Kw*
15	1.7	25.9	6.5	25.1	6.8	24.3	7.2	23.5	7.6	22.7	8.0	21.8	8.5	21.0	9.0	20.2	9.6	19.3	10.3
	4.4	29.0	6.7	28.2	7.0	27.3	7.4	26.4	7.8	25.5	8.2	24.6	8.6	23.7	9.1	22.8	9.6	21.8	10.2
	7.2	32.4	6.9	31.4	7.3	30.5	7.7	29.5	8.0	28.5	8.4	27.5	8.8	26.6	9.3	25.6	9.8	24.6	10.3
	10.0	35.9	7.2	34.9	7.6	33.9	7.9	32.8	8.3	31.8	8.7	30.7	9.1	29.7	9.5	28.6	10.0	27.5	10.5
20	1.7	34.2	8.8	33.1	9.2	32.0	9.7	30.9	10.2	29.9	10.8	28.8	11.4	27.7	12.1	26.6	12.9	25.4	13.8
	4.4	38.1	9.1	37.0	9.6	35.8	10.0	34.6	10.5	33.4	11.0	32.3	11.6	31.1	12.3	29.9	13.0	28.7	13.8
	7.2	42.4	9.5	41.2	9.9	39.9	10.4	38.6	10.9	37.3	11.4	36.0	12.0	34.7	12.6	33.4	13.2	32.1	14.0
	10.0	47.0	9.8	45.7	10.3	44.3	10.8	42.9	11.3	41.5	11.8	40.1	12.4	38.7	12.9	37.3	13.5	35.9	14.2
30	1.7	51.9	13.7	50.3	14.4	48.6	15.2	47.0	16.0	45.3	16.8	43.7	17.8	42.0	18.9	40.3	20.2	38.6	21.7
	4.4	57.8	14.3	56.1	15.0	54.3	15.7	52.5	16.5	50.7	17.3	48.9	18.2	47.1	19.2	45.3	20.4	43.5	21.7
	7.2	64.2	14.9	62.3	15.6	60.4	16.4	58.4	17.1	56.5	17.9	54.5	18.8	52.6	19.7	50.6	20.8	48.6	21.9
	10.0	71.1	15.6	69.0	16.3	66.9	17.0	64.8	17.8	62.7	18.6	60.6	19.4	58.5	20.3	56.3	21.3	54.2	22.4
40	1.7	67.5	18.0	65.3	18.9	63.2	19.9	61.0	20.9	58.9	22.0	56.7	23.3	54.6	24.8	52.4	26.4	50.2	28.3
	4.4	75.2	18.8	72.9	19.7	70.6	20.6	68.2	21.6	65.9	22.7	63.5	23.8	61.2	25.2	58.8	26.6	56.4	28.3
	7.2	83.6	19.6	81.1	20.5	78.5	21.4	76.0	22.4	73.5	23.4	70.9	24.6	68.3	25.8	65.8	27.1	63.2	28.6
	10.0	92.6	20.5	89.8	21.4	87.1	22.4	84.4	23.3	81.6	24.3	78.8	25.4	76.0	26.6	73.3	27.8	70.5	29.2
50	1.7	82.4	21.7	79.8	22.8	77.2	24.0	74.6	25.3	72.0	26.7	69.3	28.2	66.7	30.0	64.0	32.1	61.3	34.4
	4.4	91.9	22.6	89.1	23.7	86.3	24.8	83.4	26.1	80.6	27.4	77.7	28.8	74.9	30.5	72.0	32.3	69.1	34.3
	7.2	102.2	23.5	99.1	24.6	96.1	25.8	93.0	27.0	89.9	28.3	86.8	29.7	83.7	31.2	80.6	32.8	77.4	34.7
	10.0	113.3	24.4	110.0	25.6	106.6	26.8	103.3	28.1	99.9	29.3	96.6	30.7	93.2	32.1	89.8	33.6	86.4	35.3
60	1.7	102.3	26.4	99.1	27.7	95.8	29.1	92.6	30.6	89.3	32.3	86.1	34.2	82.8	36.3	79.5	38.7	76.2	41.5
	4.4	114.0	27.4	110.5	28.8	107.0	30.2	103.5	31.6	99.9	33.2	96.4	35.0	92.8	36.9	89.2	39.1	85.6	41.5
	7.2	126.6	28.6	122.8	29.9	119.0	31.4	115.2	32.8	111.3	34.4	107.5	36.0	103.6	37.9	99.7	39.8	95.8	42.1
	10.0	140.1	29.8	136.0	31.2	131.9	32.6	127.7	34.1	123.6	35.7	119.4	37.3	115.2	39.0	111.0	40.9	106.8	43.0
70	1.7	118.5	30.7	114.8	32.2	111.0	33.8	107.3	35.6	103.5	37.5	99.7	39.7	95.8	42.1	92.0	44.9	88.1	48.1
	4.4	132.2	32.0	128.2	33.5	124.1	35.1	120.0	36.7	115.9	38.6	111.8	40.6	107.6	42.8	103.5	45.3	99.3	48.1
	7.2	147.1	33.3	142.7	34.9	138.2	36.5	133.8	38.1	129.3	39.9	124.9	41.8	120.4	43.8	115.9	46.1	111.3	48.7
	10.0	163.0	34.7	158.2	36.3	153.4	37.9	148.6	39.7	143.8	41.4	138.9	43.2	134.1	45.2	129.2	47.3	124.3	49.7
80	1.7	130.5	36.4	126.3	38.2	122.1	40.2	117.8	42.4	113.5	44.9	109.2	47.6	104.9	50.7	100.6	54.2	96.3	58.3
	4.4	145.6	37.8	141.1	39.6	136.5	41.6	131.9	43.7	127.3	45.9	122.6	48.4	117.9	51.2	113.3	54.3	108.6	57.9
	7.2	161.9	39.3	157.0	41.2	152.0	43.1	147.0	45.2	142.0	47.3	137.0	49.7	131.9	52.3	126.9	55.1	121.8	58.3
	10.0	179.4	41.0	174.1	42.9	168.7	44.9	163.3	46.9	157.9	49.0	152.4	51.3	147.0	53.7	141.5	56.4	136.0	59.3
100	1.7	151.4	41.5	146.6	43.6	141.7	45.7	136.8	48.1	131.9	50.8	127.0	53.8	122.1	57.1	117.1	61.0	112.1	65.5
	4.4	168.9	43.3	163.6	45.3	158.3	47.5	153.0	49.8	147.7	52.2	142.4	55.0	137.0	58.0	131.6	61.5	126.2	65.4
	7.2	187.7	45.2	182.0	47.3	176.3	49.4	170.5	51.6	164.7	54.0	158.9	56.6	153.1	59.4	147.3	62.6	141.4	66.1
	10.0	207.9	47.2	201.7	49.4	195.5	51.5	189.3	53.7	183.0	56.1	176.8	58.6	170.4	61.3	164.1	64.2	157.7	67.4
120	1.7	201.4	55.3	195.0	58.0	188.5	61.0	182.0	64.2	175.5	67.7	169.0	71.7	162.5	76.2	155.9	81.3	149.3	87.3
	4.4	224.4	57.7	217.4	60.4	210.4	63.3	203.4	66.4	196.3	69.7	189.2	73.4	182.1	77.4	175.0	82.0	167.9	87.3
	7.2	249.1	60.3	241.5	63.1	233.9	65.9	226.3	68.9	218.7	72.1	211.0	75.6	203.3	79.4	195.6	83.6	187.8	88.3
	10.0	275.6	63.1	267.4	65.9	259.2	68.8	251.0	71.8	242.7	74.9	234.4	78.3	226.1	81.9	217.7	85.8	209.3	90.2

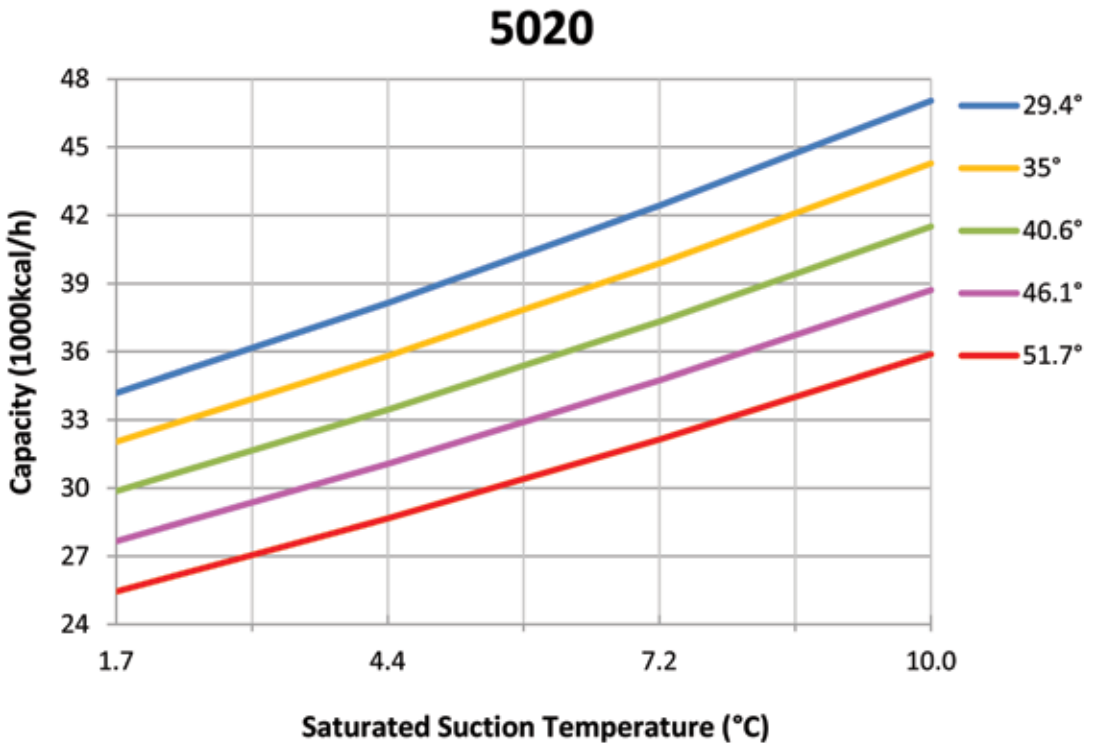
Capacities chart /R134a



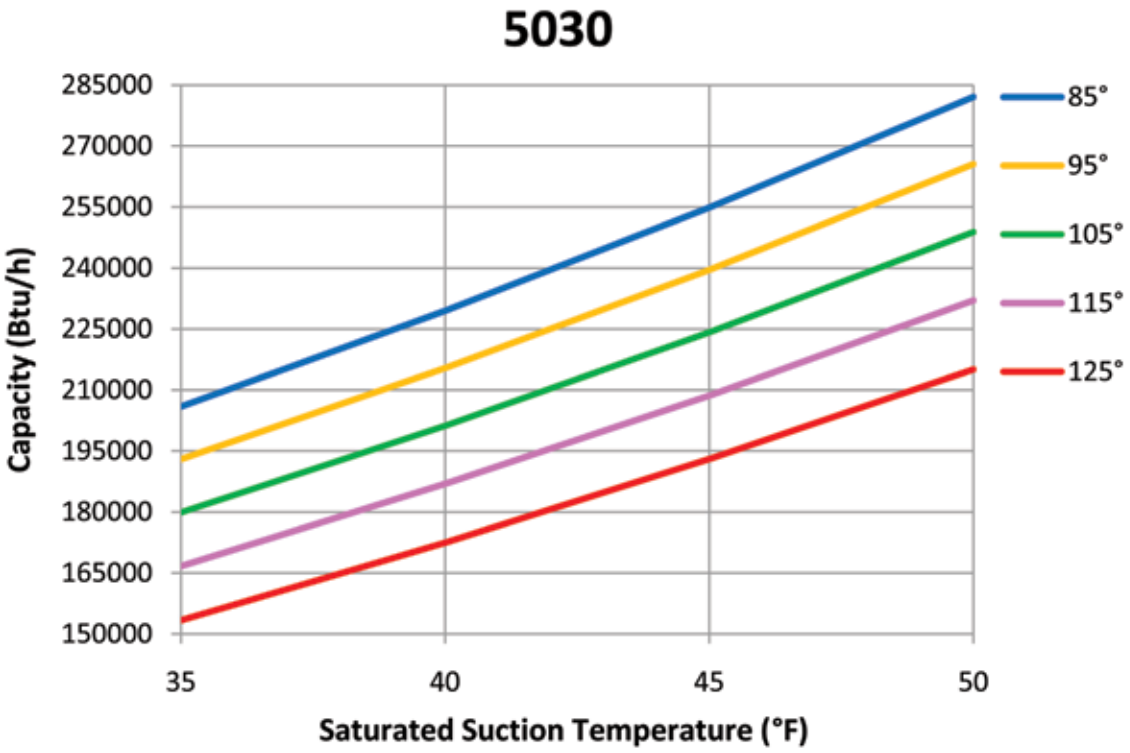


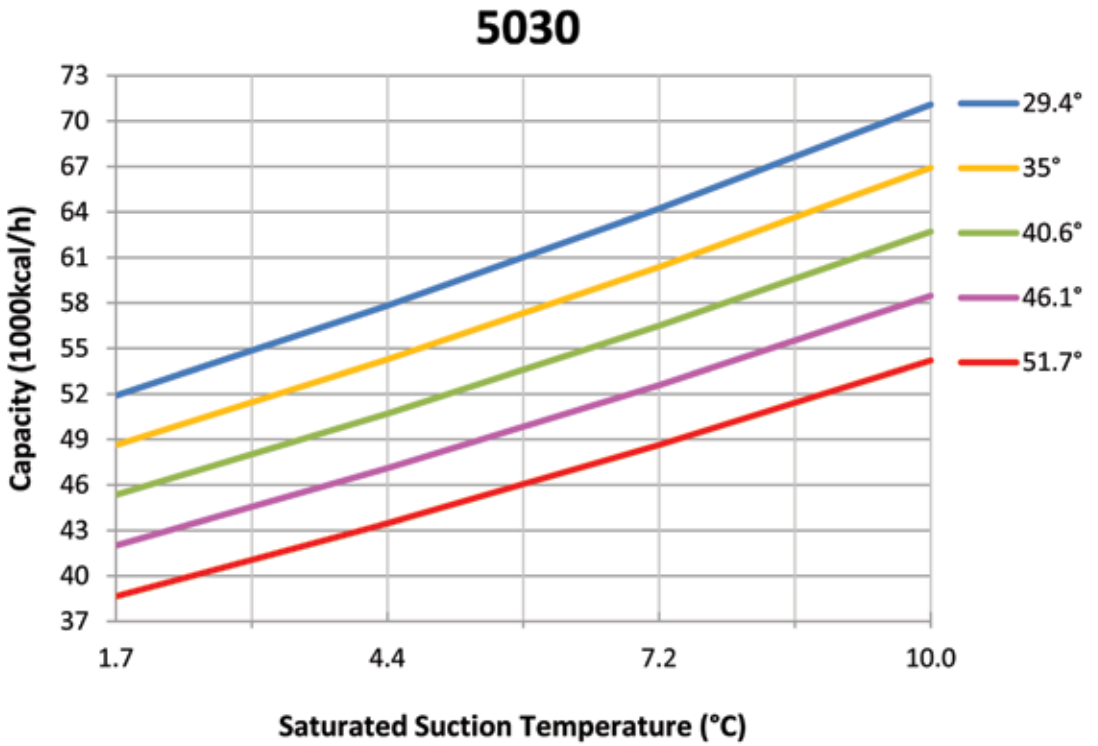
Capacities chart /R134a



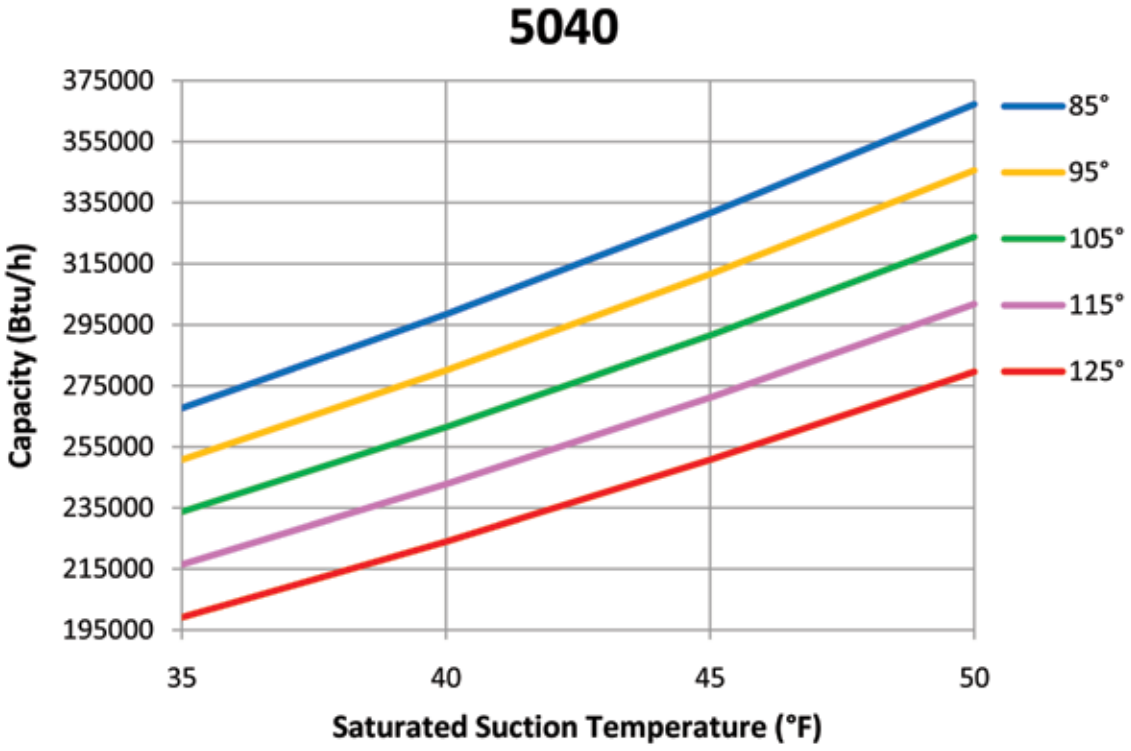


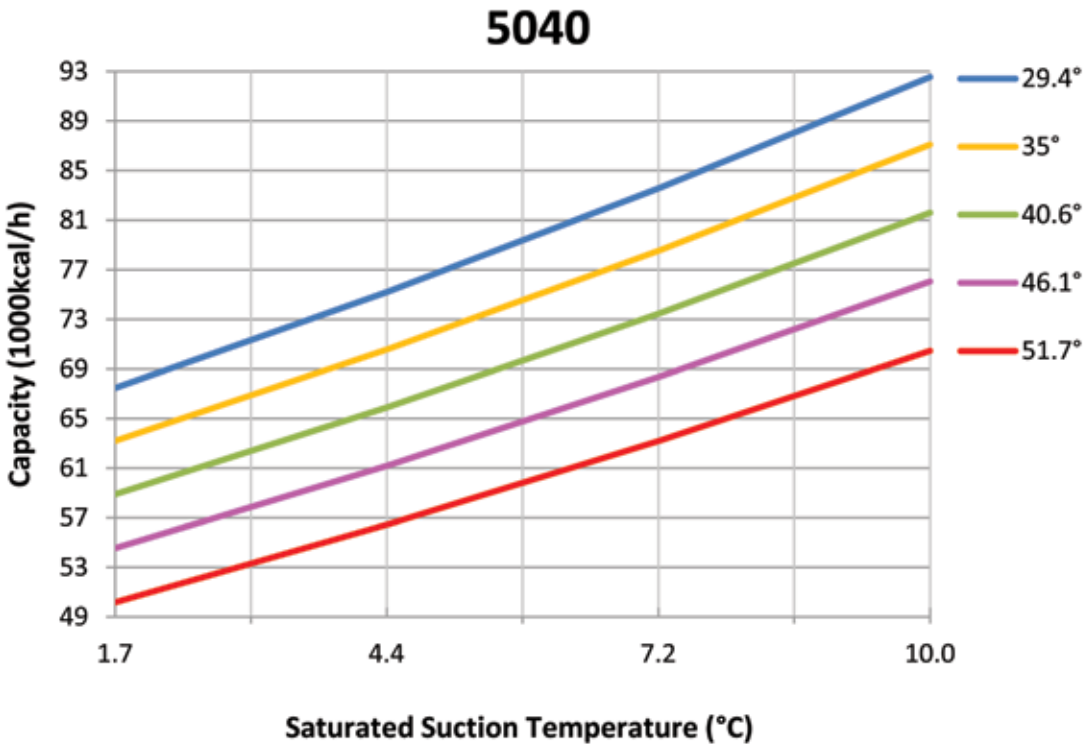
Capacities chart /R134a



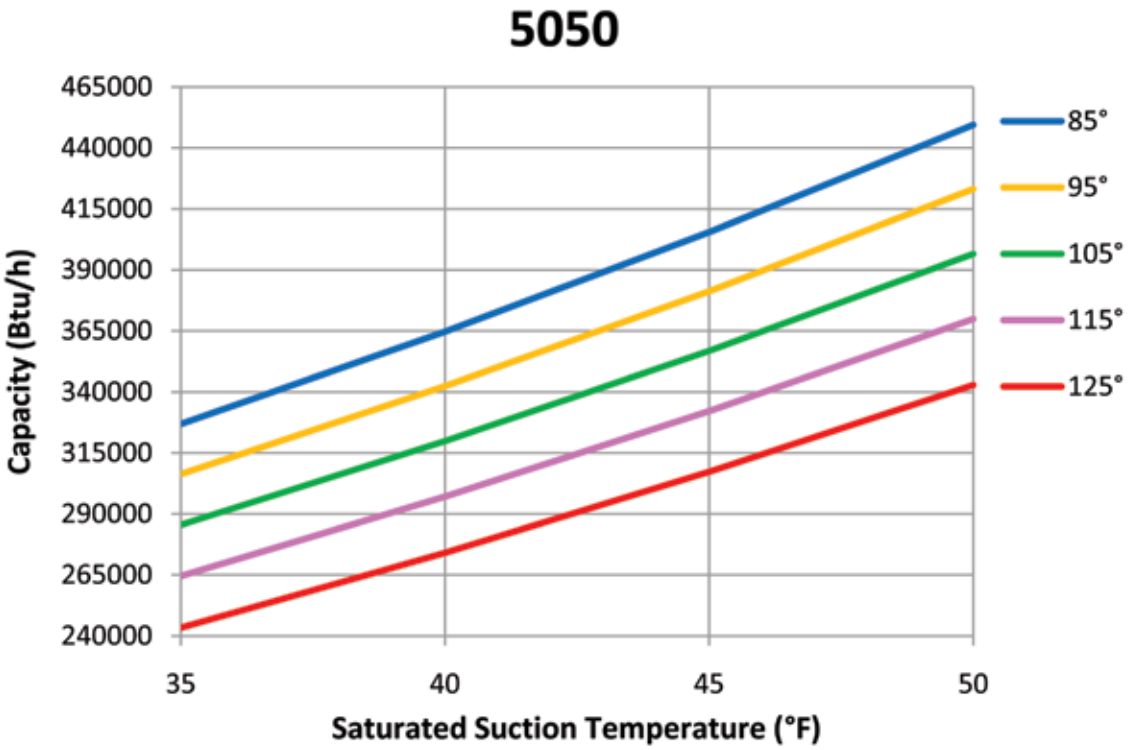


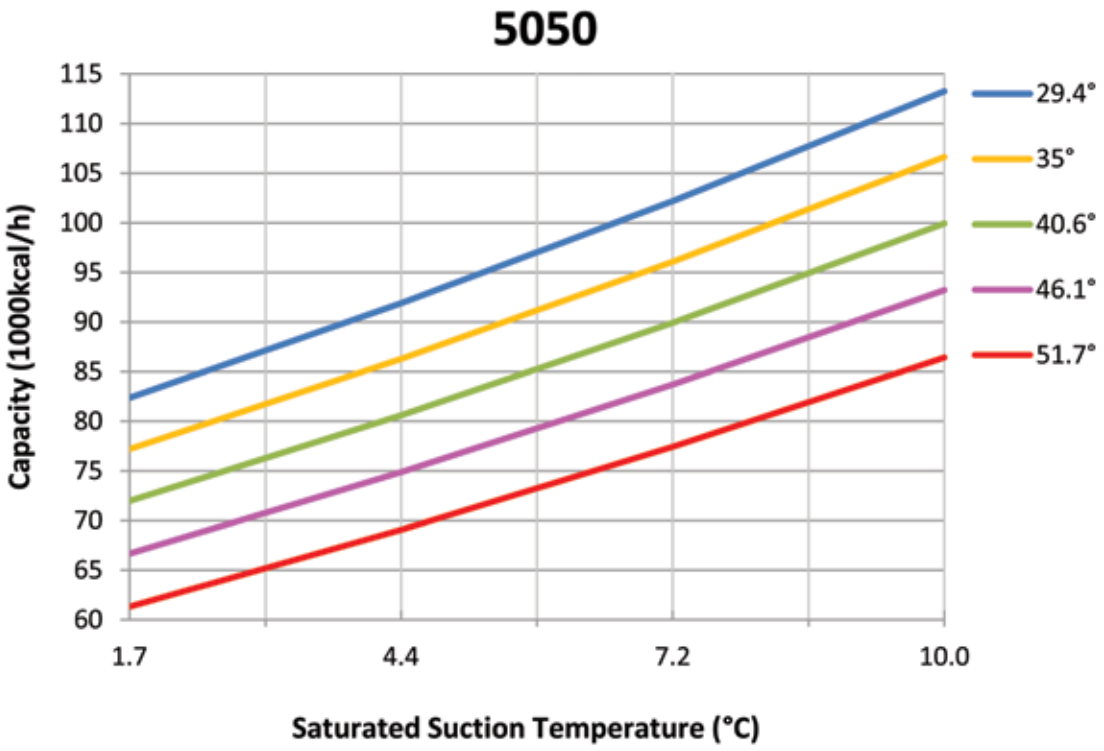
Capacities chart /R134a



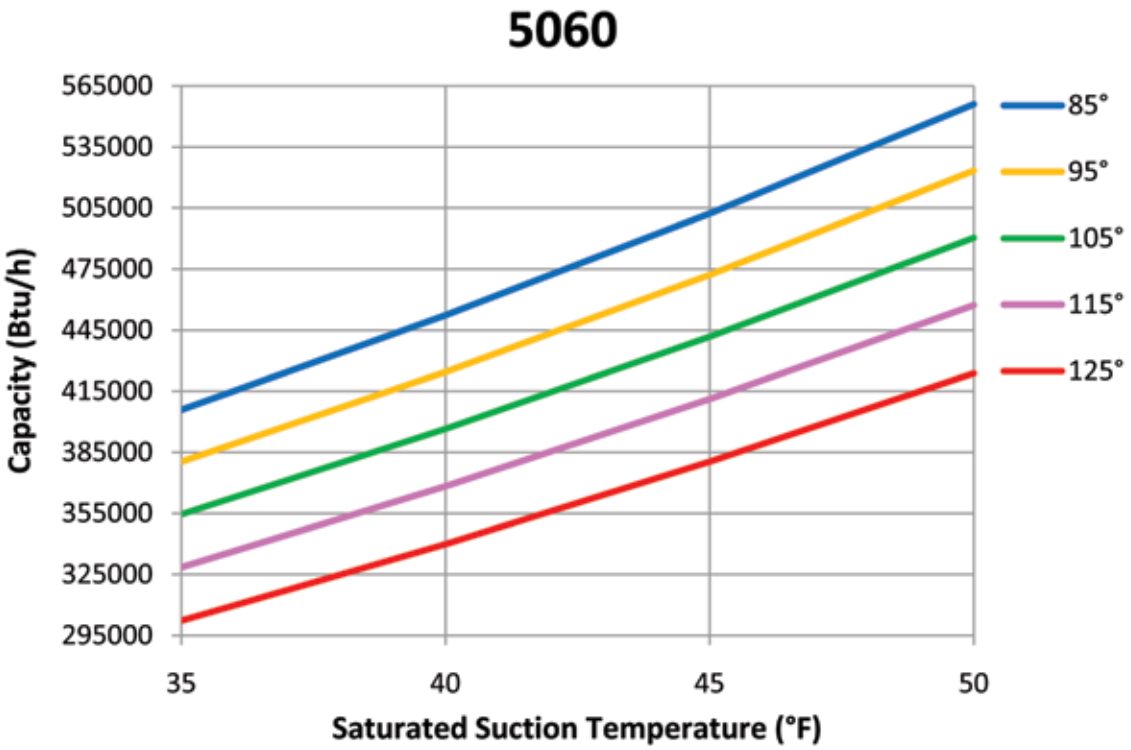


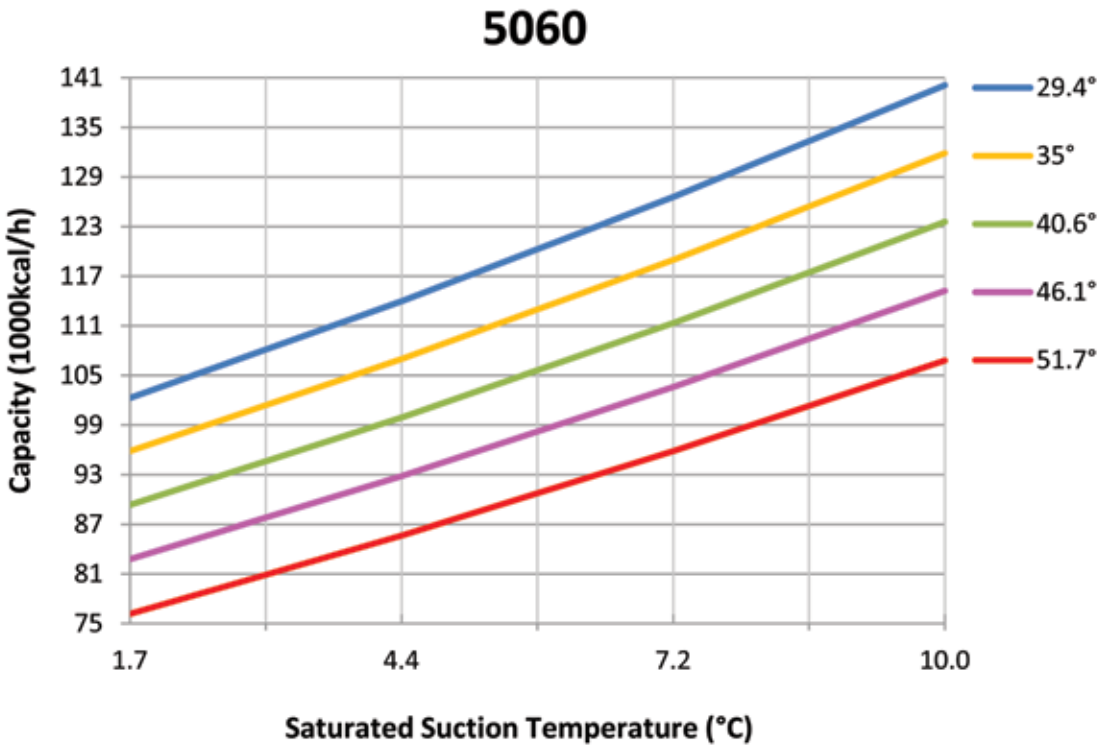
Capacities chart /R134a



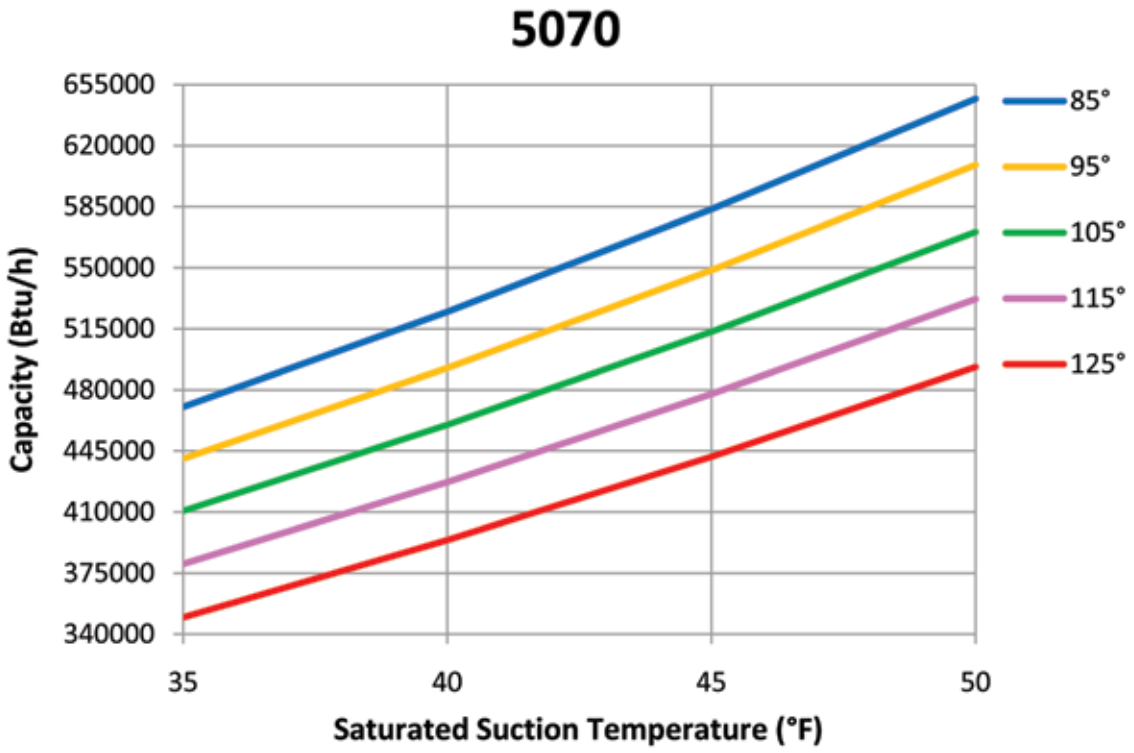


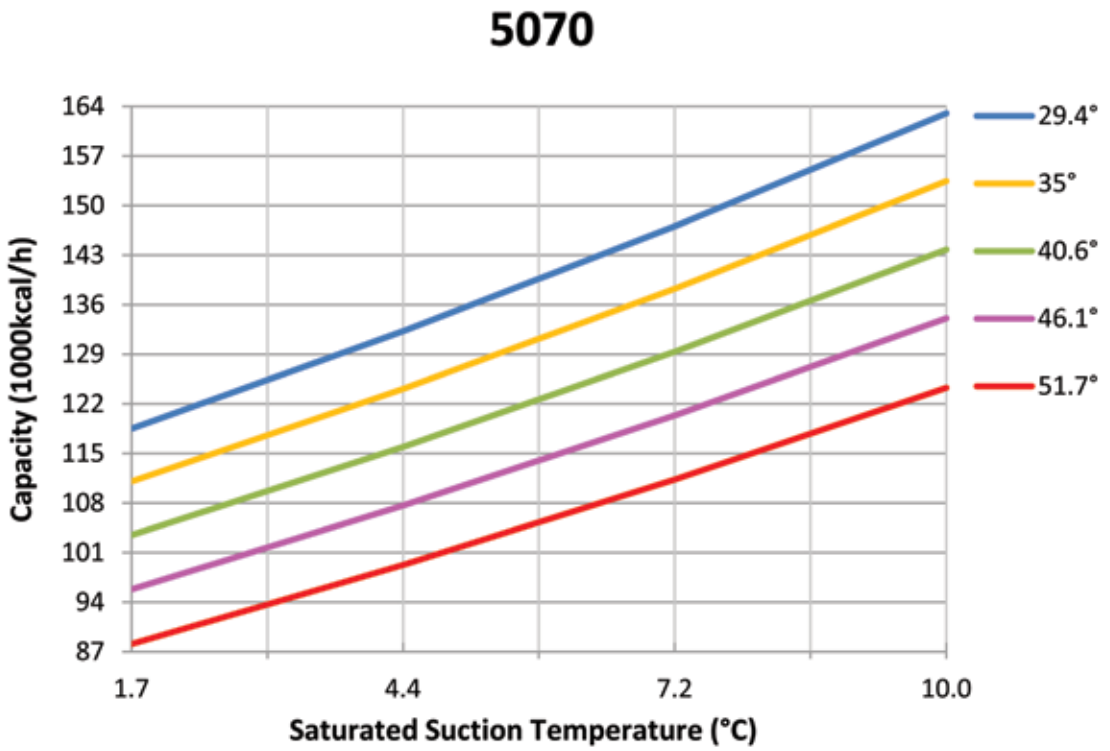
Capacities chart /R134a



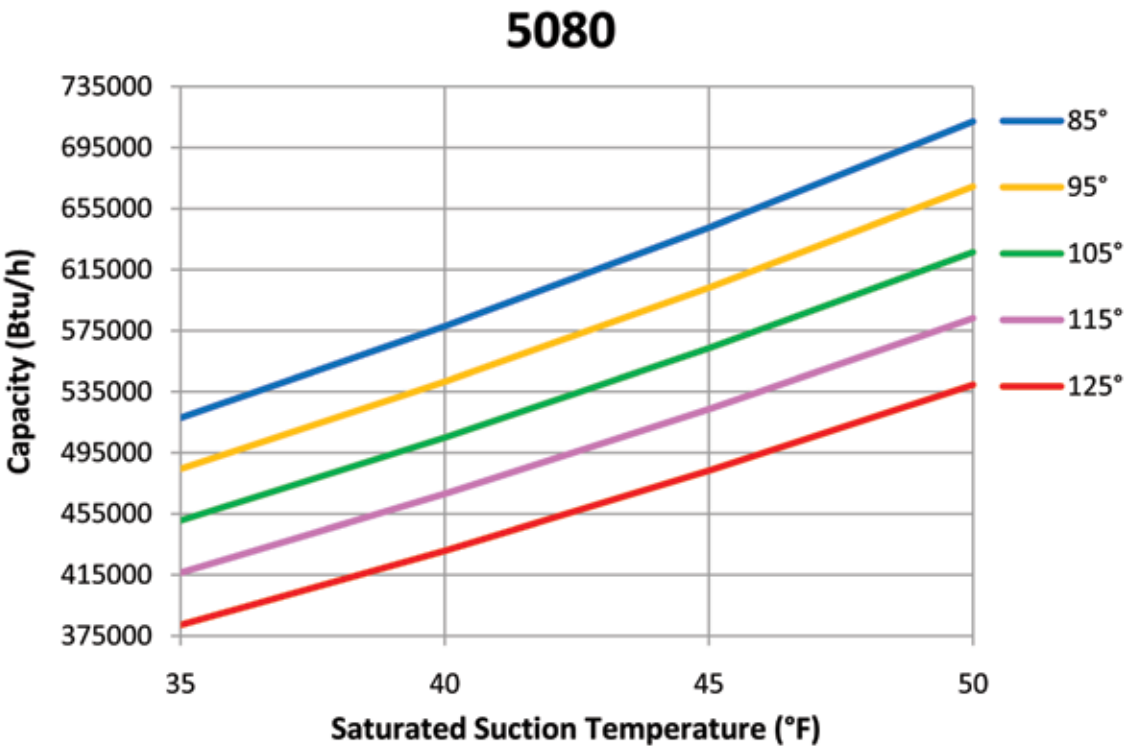


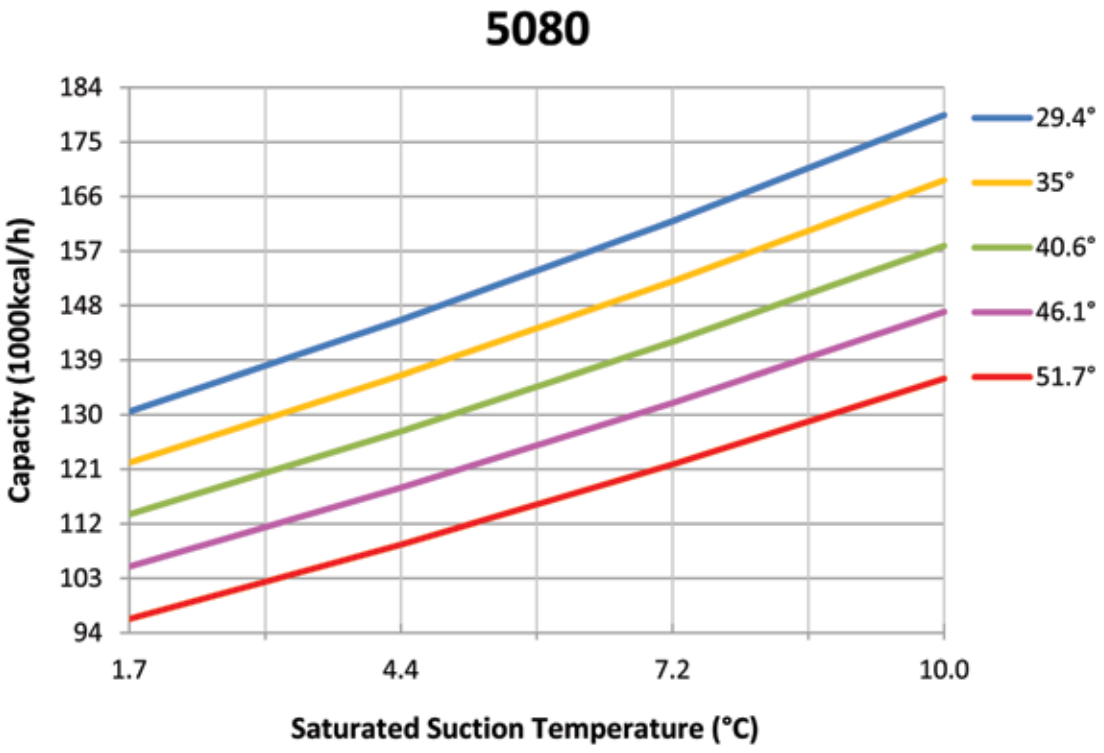
Capacities chart /R134a



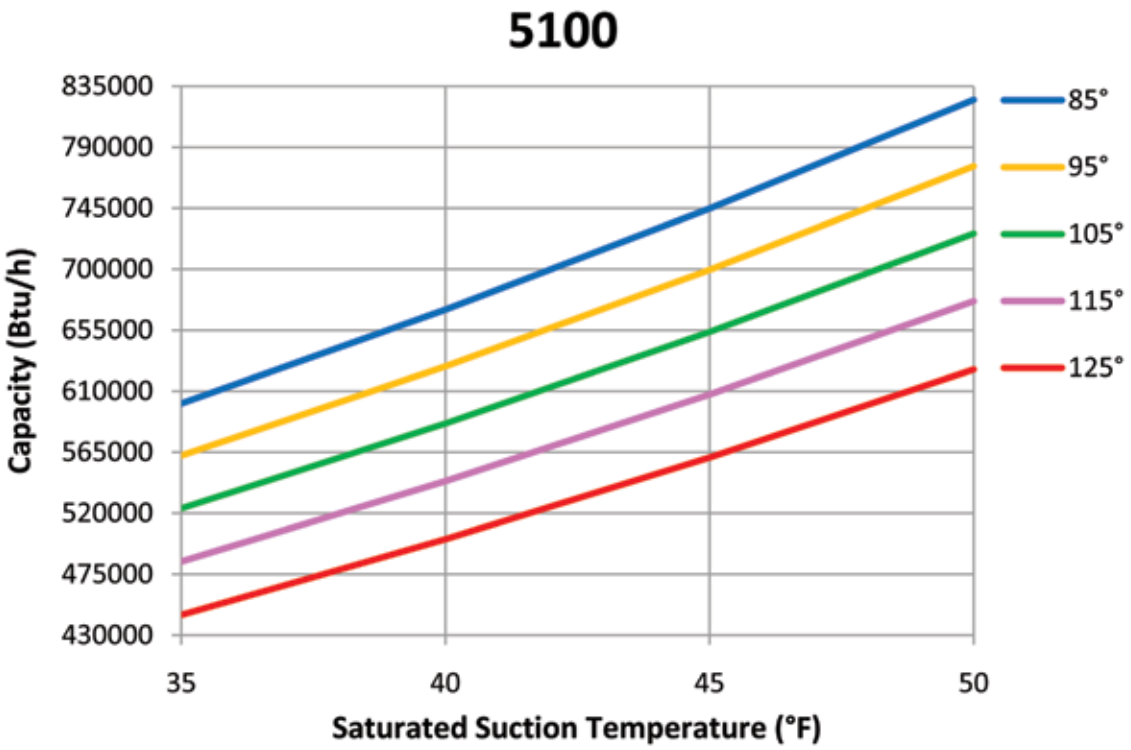


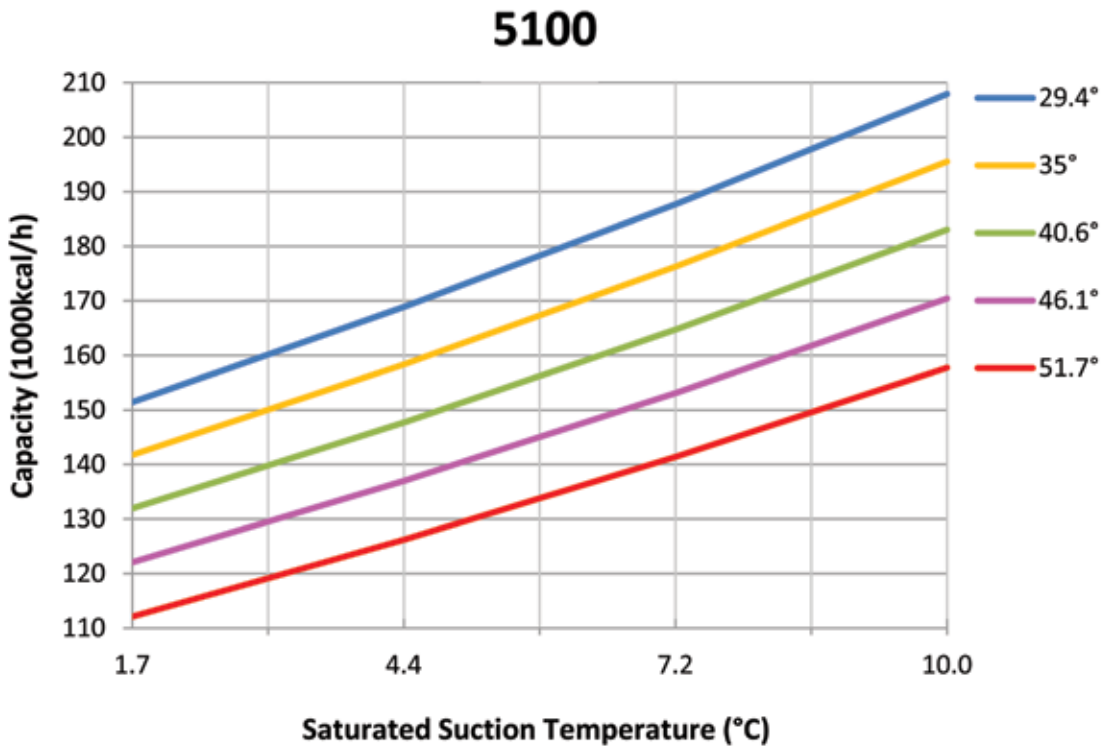
Capacities chart /R134a



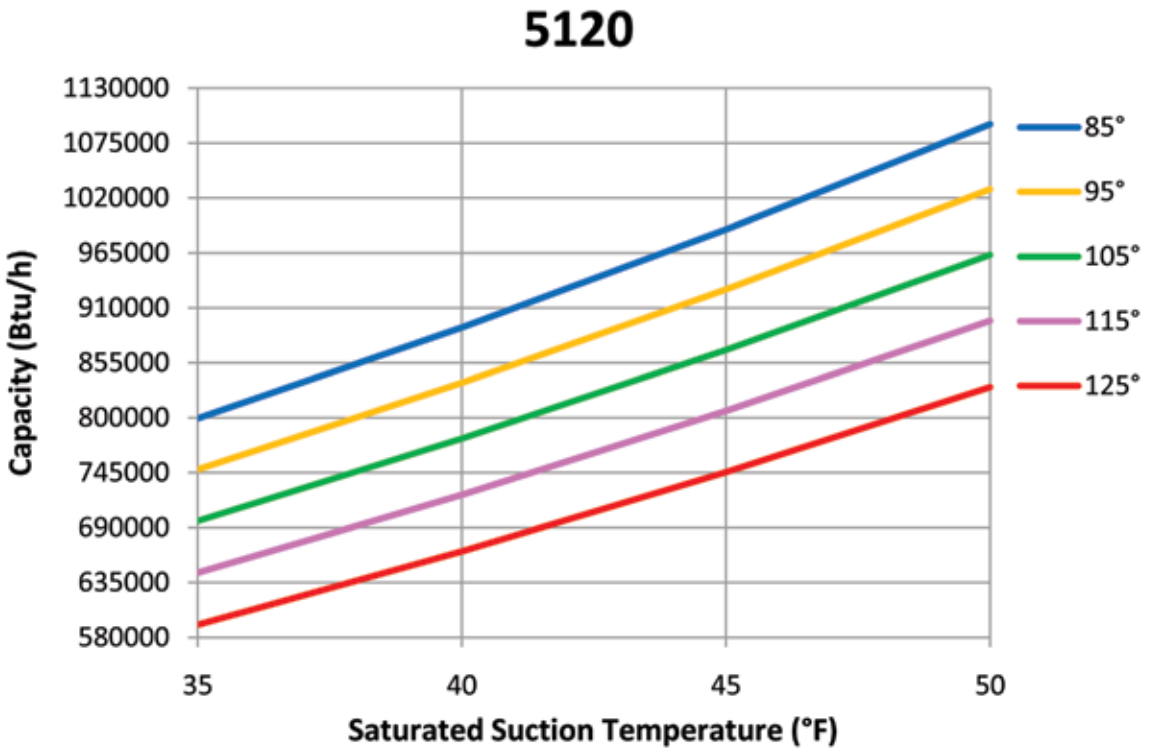


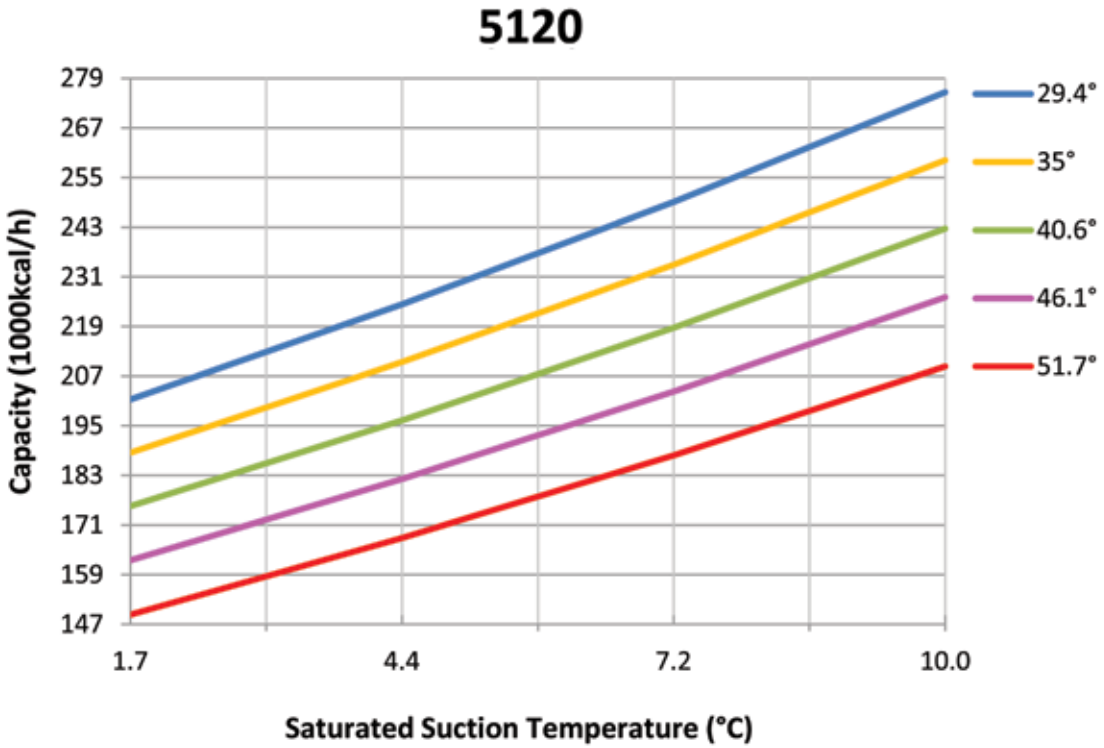
Capacities chart /R134a





Capacities chart /R134a





Capacities /R407C

English Measure

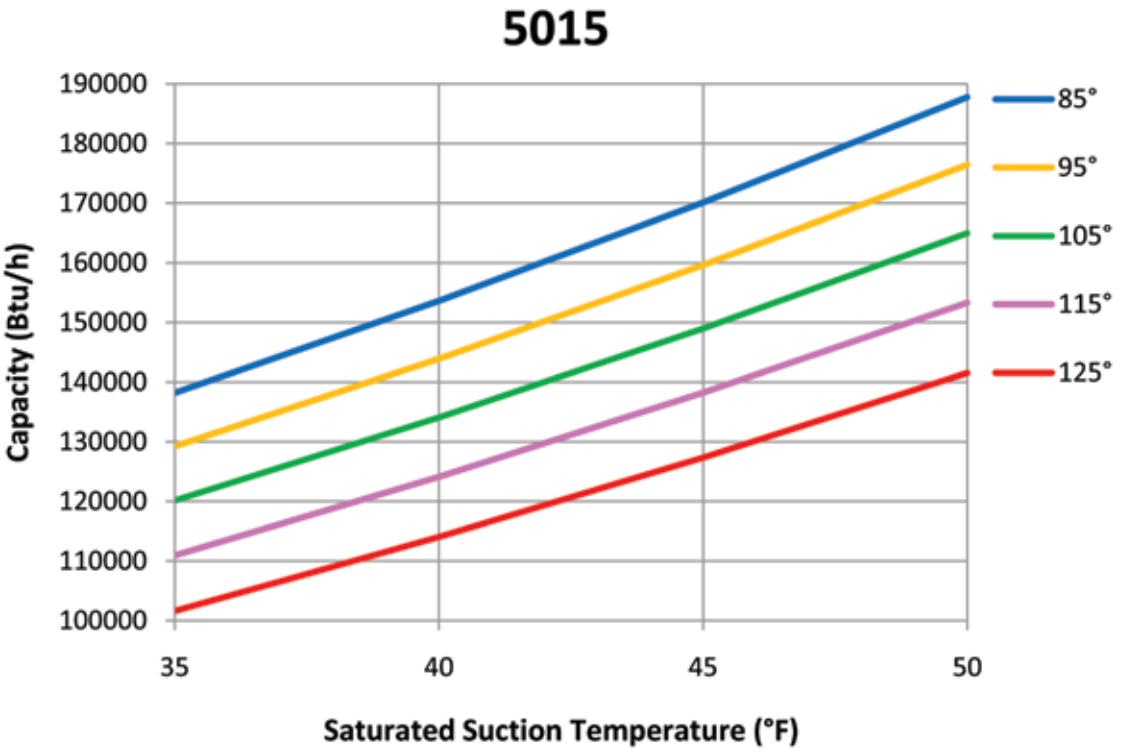
Unit Size	Sat. Suct. Temp. (°F)	Ambient Temperature (°F)																	
		85		90		95		100		105		110		115		120		125	
	(°F)	Ton	Kw*	Ton	Kw*	Ton	Kw*	Ton	Kw*	Ton	Kw*	Ton	Kw*	Ton	Kw*	Ton	Kw*	Ton	Kw*
15	35	11.5	10.6	11.1	11.1	10.8	11.7	10.4	12.3	10.0	12.9	14.1	18.7	13.5	19.8	13.0	20.9	12.4	22.2
	40	12.8	11.0	12.4	11.5	12.0	12.0	11.6	12.6	11.2	13.2	15.6	19.2	15.0	20.2	14.4	21.2	13.8	22.4
	45	14.2	11.4	13.7	11.9	13.3	12.4	12.9	13.0	12.4	13.6	17.2	19.8	16.6	20.7	16.0	21.7	15.3	22.7
	50	15.7	11.8	15.2	12.3	14.7	12.9	14.2	13.4	13.7	14.0	18.5	29.1	17.8	31.0	17.0	33.1	16.3	35.5
20	35	15.1	14.2	14.6	14.9	14.1	15.7	13.6	16.5	13.1	17.4	20.6	29.6	19.8	31.3	19.0	33.2	18.1	35.3
	40	16.7	14.8	16.2	15.5	15.7	16.2	15.1	16.9	14.6	17.8	22.8	30.4	21.9	31.9	21.0	33.6	20.2	35.5
	45	18.5	15.4	17.9	16.1	17.4	16.8	16.8	17.5	16.2	18.3	25.2	31.3	24.2	32.8	23.3	34.3	22.3	36.1
	50	20.4	16.0	19.8	16.7	19.1	17.4	18.5	18.2	17.9	18.9	24.4	38.6	23.4	41.0	22.4	43.8	21.4	47.0
30	35	22.2	22.4	21.5	23.5	20.7	24.7	20.0	26.0	19.3	27.5	27.3	38.9	26.3	41.1	25.2	43.5	24.1	46.3
	40	24.6	23.3	23.8	24.4	23.0	25.5	22.2	26.8	21.4	28.1	30.4	39.7	29.3	41.7	28.1	43.8	26.9	46.3
	45	27.1	24.4	26.3	25.4	25.4	26.5	24.6	27.7	23.7	29.0	33.7	40.8	32.4	42.6	31.2	44.6	29.9	46.8
	50	29.8	25.5	28.9	26.5	28.0	27.6	27.0	28.8	26.1	30.0	30.0	45.2	28.8	48.0	27.6	51.3	26.4	54.9
40	35	29.3	29.7	28.3	31.2	27.4	32.8	26.4	34.5	25.4	36.4	33.4	45.9	32.1	48.5	30.8	51.4	29.5	54.6
	40	32.6	30.8	31.5	32.1	30.5	33.6	29.4	35.2	28.4	37.0	37.1	47.0	35.7	49.4	34.3	52.0	32.8	54.9
	45	36.1	32.0	35.0	33.3	33.8	34.7	32.7	36.2	31.6	37.9	41.0	48.4	39.4	50.6	37.9	53.0	36.4	55.7
	50	39.8	33.3	38.6	34.6	37.4	36.0	36.2	37.5	34.9	39.0	37.5	57.1	36.0	60.7	34.5	64.8	32.9	69.5
50	35	35.9	34.8	34.7	36.5	33.6	38.4	32.4	40.4	31.2	42.7	41.7	58.1	40.1	61.3	38.4	65.0	36.8	69.1
	40	39.8	36.2	38.5	37.8	37.3	39.6	36.0	41.5	34.7	43.6	46.2	59.5	44.5	62.5	42.7	65.8	40.9	69.5
	45	44.0	37.7	42.6	39.3	41.2	41.0	39.9	42.9	38.5	44.9	51.1	61.4	49.2	64.2	47.2	67.2	45.3	70.6
	50	48.4	39.3	46.9	40.9	45.5	42.6	44.0	44.4	42.5	46.4	43.6	65.8	41.8	69.9	40.1	74.5	38.3	79.8
60	35	44.9	44.0	43.4	46.2	41.9	48.5	40.5	51.1	39.0	53.9	48.5	66.9	46.7	70.6	44.8	74.7	42.8	79.4
	40	49.7	45.8	48.2	47.9	46.6	50.1	45.0	52.5	43.3	55.2	53.8	68.5	51.8	71.9	49.7	75.7	47.7	79.9
	45	54.9	47.7	53.2	49.8	51.5	52.0	49.7	54.3	48.0	56.8	59.4	70.6	57.2	73.8	55.0	77.3	52.8	81.2
	50	60.4	49.8	58.6	51.9	56.7	54.0	54.8	56.3	53.0	58.7	50.0	77.2	48.0	82.1	45.9	87.6	43.9	93.8
70	35	52.2	50.8	50.5	53.2	48.8	55.9	47.0	58.8	45.3	62.1	55.6	78.6	53.4	83.0	51.2	87.9	49.0	93.4
	40	57.8	52.8	56.0	55.2	54.1	57.7	52.3	60.5	50.4	63.5	61.5	80.7	59.2	84.7	56.8	89.1	54.4	94.1
	45	63.8	55.0	61.9	57.4	59.9	59.9	57.9	62.5	55.8	65.4	67.9	83.2	65.4	87.0	62.8	91.1	60.2	95.6
	50	70.3	57.4	68.1	59.8	66.0	62.3	63.8	64.9	61.6	67.7	56.1	89.0	53.8	94.6	51.5	101.0	49.2	108.3
80	35	59.9	59.6	57.9	62.5	55.9	65.7	54.0	69.1	52.0	73.0	62.4	90.5	60.0	95.5	57.5	101.2	55.0	107.6
	40	66.3	62.1	64.2	64.9	62.0	67.9	59.9	71.2	57.7	74.7	69.2	92.7	66.5	97.3	63.8	102.5	61.1	108.2
	45	73.1	64.8	70.8	67.6	68.5	70.5	66.2	73.6	63.9	77.0	76.4	95.4	73.5	99.8	70.6	104.6	67.6	109.8
	50	80.4	67.8	77.9	70.6	75.4	73.4	72.9	76.4	70.4	79.7	74.7	121.6	71.7	129.3	68.6	138.1	65.6	148.1
100	35	67.4	68.5	65.2	71.8	62.9	75.5	60.7	79.5	58.4	84.0	83.0	123.6	79.7	130.6	76.4	138.5	73.1	147.3
	40	74.7	71.3	72.3	74.5	69.8	77.9	67.4	81.7	64.9	85.9	91.8	126.6	88.3	133.1	84.7	140.2	81.2	148.1
	45	82.4	74.4	79.8	77.5	77.2	80.9	74.5	84.5	71.9	88.4	101.2	130.5	97.4	136.5	93.5	143.1	89.7	150.4
	50	90.6	77.7	87.8	80.9	84.9	84.2	82.1	87.7	79.2	91.4	58.5	58.6	56.4	61.3	54.3	64.2	52.2	67.4
120	35	89.7	93.3	86.7	97.9	83.8	103.0	80.8	108.5	77.7	114.7	55.9	71.7	53.7	76.2	51.6	81.3	49.4	87.3
	40	99.2	97.3	96.0	101.6	92.8	106.4	89.5	111.6	86.3	117.3	62.6	73.4	60.2	77.4	57.9	82.0	55.5	87.3
	45	109.3	101.5	105.8	105.9	102.4	110.5	98.9	115.4	95.4	120.8	69.8	75.6	67.2	79.4	64.7	83.6	62.1	88.3
	50	120.0	106.2	116.3	110.5	112.5	115.0	108.8	119.9	105.0	125.0	77.5	78.3	74.8	81.9	72.0	85.8	69.2	90.2

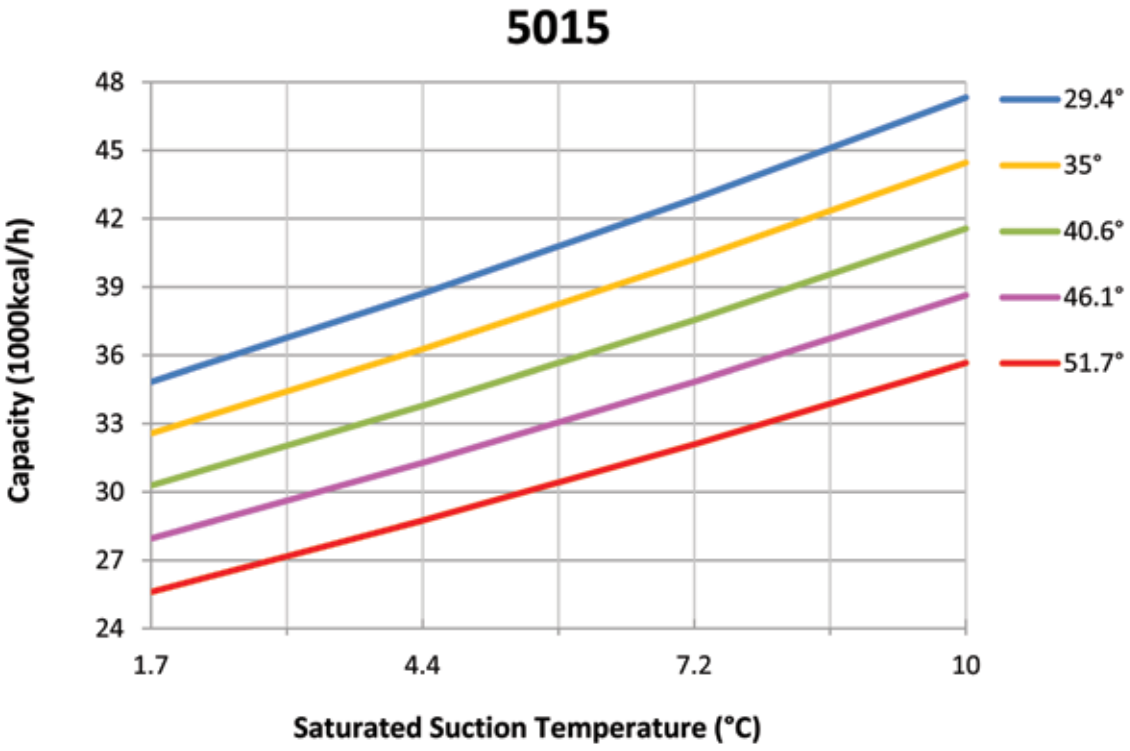
Capacities /R407C

Metric Measure

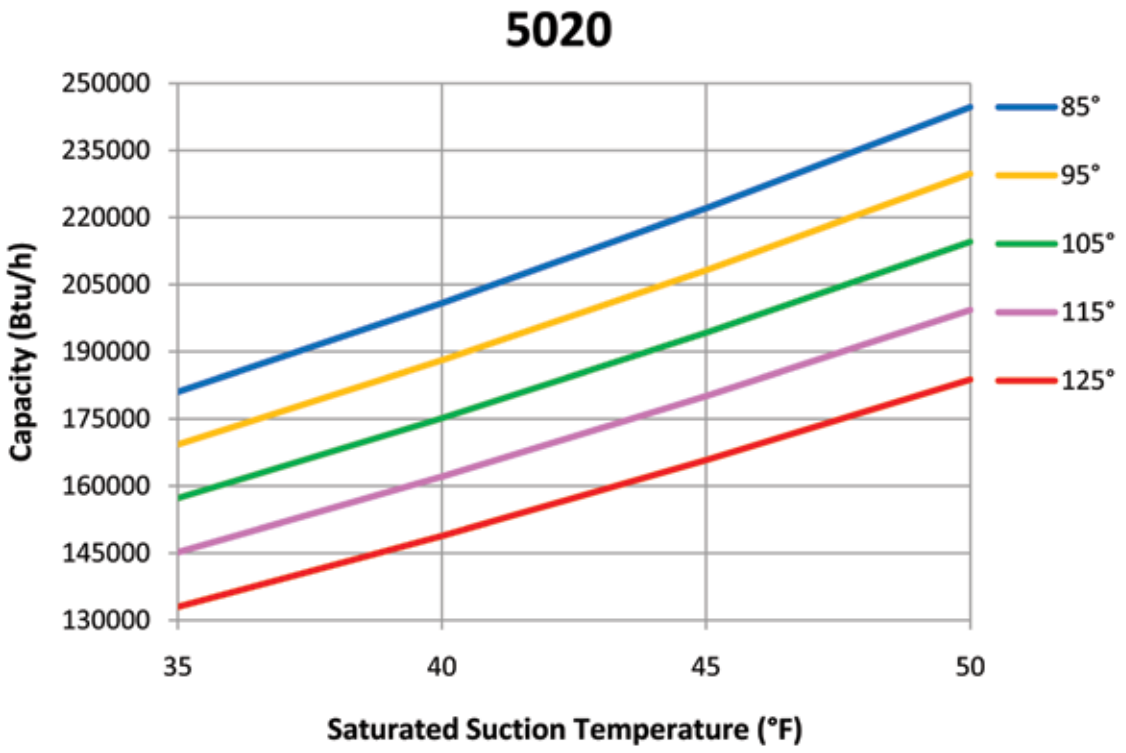
Unit Size	Sat. Suct. Temp. (°C)	Ambient Temperature (°C)																	
		29.4		32.2		35		37.8		40.6		43.3		46.1		48.9		51.7	
	(°C)	1000 kcal/h	Kw*	1000 kcal/h	Kw*	1000 kcal/h	Kw*	1000 kcal/h	Kw*	1000 kcal/h	Kw*	1000 kcal/h	Kw*	1000 kcal/h	Kw*	1000 kcal/h	Kw*	1000 kcal/h	Kw*
15	1.7	34.8	10.6	33.7	11.1	32.6	11.7	31.4	12.3	30.3	12.9	29.1	13.7	28.0	14.5	26.8	15.5	25.6	16.6
	4.4	38.7	11.0	37.5	11.5	36.3	12.0	35.0	12.6	33.8	13.2	32.5	13.9	31.3	14.7	30.0	15.5	28.7	16.5
	7.2	42.9	11.4	41.6	11.9	40.2	12.4	38.9	13.0	37.5	13.6	36.2	14.2	34.8	14.9	33.5	15.7	32.1	16.6
	10.0	47.3	11.8	45.9	12.3	44.5	12.9	43.0	13.4	41.6	14.0	40.1	14.6	38.6	15.3	37.2	16.0	35.7	16.8
20	1.7	45.6	14.2	44.1	14.9	42.7	15.7	41.2	16.5	39.6	17.4	38.1	18.4	36.6	19.6	35.1	20.8	33.5	22.3
	4.4	50.6	14.8	49.0	15.5	47.4	16.2	45.8	16.9	44.1	17.8	42.5	18.7	40.8	19.8	39.2	20.9	37.5	22.2
	7.2	56.0	15.4	54.2	16.1	52.5	16.8	50.7	17.5	49.0	18.3	47.2	19.2	45.4	20.2	43.6	21.2	41.8	22.4
	10.0	61.7	16.0	59.8	16.7	57.9	17.4	56.0	18.2	54.1	18.9	52.2	19.8	50.2	20.7	48.3	21.7	46.3	22.7
30	1.7	67.2	22.4	65.0	23.5	62.7	24.7	60.5	26.0	58.3	27.5	56.0	29.1	53.7	31.0	51.5	33.1	49.2	35.5
	4.4	74.4	23.3	72.0	24.4	69.6	25.5	67.2	26.8	64.7	28.1	62.3	29.6	59.8	31.3	57.4	33.2	54.9	35.3
	7.2	82.1	24.4	79.5	25.4	76.9	26.5	74.3	27.7	71.6	29.0	69.0	30.4	66.3	31.9	63.7	33.6	61.0	35.5
	10.0	90.2	25.5	87.4	26.5	84.6	27.6	81.8	28.8	79.0	30.0	76.1	31.3	73.2	32.8	70.3	34.3	67.4	36.1
40	1.7	88.6	29.7	85.6	31.2	82.7	32.8	79.8	34.5	76.8	36.4	73.8	38.6	70.9	41.0	67.9	43.8	64.8	47.0
	4.4	98.5	30.8	95.4	32.1	92.2	33.6	89.0	35.2	85.8	37.0	82.6	38.9	79.4	41.1	76.1	43.5	72.9	46.3
	7.2	109.2	32.0	105.8	33.3	102.4	34.7	98.9	36.2	95.5	37.9	92.0	39.7	88.5	41.7	85.0	43.8	81.4	46.3
	10.0	120.5	33.3	116.8	34.6	113.1	36.0	109.4	37.5	105.7	39.0	101.9	40.8	98.1	42.6	94.3	44.6	90.5	46.8
50	1.7	108.6	34.8	105.1	36.5	101.5	38.4	97.9	40.4	94.4	42.7	90.7	45.2	87.1	48.0	83.5	51.3	79.8	54.9
	4.4	120.4	36.2	116.6	37.8	112.7	39.6	108.9	41.5	105.0	43.6	101.1	45.9	97.2	48.5	93.2	51.4	89.2	54.6
	7.2	133.0	37.7	128.9	39.3	124.7	41.0	120.5	42.9	116.3	44.9	112.1	47.0	107.9	49.4	103.6	52.0	99.3	54.9
	10.0	146.4	39.3	142.0	40.9	137.5	42.6	133.0	44.4	128.4	46.4	123.9	48.4	119.3	50.6	114.7	53.0	110.0	55.7
60	1.7	135.8	44.0	131.3	46.2	126.9	48.5	122.4	51.1	117.9	53.9	113.3	57.1	108.8	60.7	104.2	64.8	99.6	69.5
	4.4	150.4	45.8	145.6	47.9	140.8	50.1	135.9	52.5	131.1	55.2	126.2	58.1	121.2	61.3	116.3	65.0	111.3	69.1
	7.2	166.1	47.7	160.9	49.8	155.7	52.0	150.4	54.3	145.1	56.8	139.8	59.5	134.5	62.5	129.1	65.8	123.7	69.5
	10.0	182.8	49.8	177.1	51.9	171.5	54.0	165.8	56.3	160.1	58.7	154.4	61.4	148.6	64.2	142.8	67.2	137.0	70.6
70	1.7	157.7	50.8	152.6	53.2	147.4	55.9	142.3	58.8	137.1	62.1	131.8	65.8	126.5	69.9	121.2	74.5	115.9	79.8
	4.4	174.8	52.8	169.3	55.2	163.7	57.7	158.1	60.5	152.4	63.5	146.8	66.9	141.1	70.6	135.3	74.7	129.5	79.4
	7.2	193.1	55.0	187.0	57.4	181.0	59.9	174.9	62.5	168.9	65.4	162.7	68.5	156.6	71.9	150.4	75.7	144.1	79.9
	10.0	212.5	57.4	206.0	59.8	199.5	62.3	192.9	64.9	186.3	67.7	179.7	70.6	173.1	73.8	166.4	77.3	159.6	81.2
80	1.7	181.1	59.6	175.1	62.5	169.1	65.7	163.2	69.1	157.1	73.0	151.1	77.2	145.0	82.1	138.9	87.6	132.7	93.8
	4.4	200.5	62.1	194.0	64.9	187.6	67.9	181.1	71.2	174.6	74.7	168.0	78.6	161.5	83.0	154.9	87.9	148.2	93.4
	7.2	221.1	64.8	214.2	67.6	207.2	70.5	200.2	73.6	193.2	77.0	186.1	80.7	179.0	84.7	171.8	89.1	164.7	94.1
	10.0	243.2	67.8	235.6	70.6	228.1	73.4	220.5	76.4	212.9	79.7	205.3	83.2	197.6	87.0	189.9	91.1	182.1	95.6
100	1.7	203.9	68.5	197.2	71.8	190.3	75.5	183.5	79.5	176.6	84.0	169.7	89.0	162.8	94.6	155.8	101.0	148.8	108.3
	4.4	225.8	71.3	218.5	74.5	211.1	77.9	203.7	81.7	196.3	85.9	188.8	90.5	181.3	95.5	173.8	101.2	166.3	107.6
	7.2	249.2	74.4	241.3	77.5	233.3	80.9	225.3	84.5	217.3	88.4	209.2	92.7	201.1	97.3	193.0	102.5	184.8	108.2
	10.0	274.1	77.7	265.5	80.9	256.9	84.2	248.3	87.7	239.6	91.4	230.9	95.4	222.2	99.8	213.4	104.6	204.5	109.8
120	1.7	271.3	93.3	262.3	97.9	253.3	103.0	244.2	108.5	235.1	114.7	226.0	121.6	216.8	129.3	207.6	138.1	198.4	148.1
	4.4	300.0	97.3	290.3	101.6	280.5	106.4	270.7	111.6	260.9	117.3	251.0	123.6	241.1	130.6	231.1	138.5	221.2	147.3
	7.2	330.6	101.5	320.1	105.9	309.5	110.5	298.9	115.4	288.3	120.8	277.7	126.6	267.0	133.1	256.2	140.2	245.4	148.1
	10.0	363.0	106.2	351.7	110.5	340.3	115.0	328.9	119.9	317.5	125.0	305.9	130.5	294.4	136.5	282.8	143.1	271.2	150.4

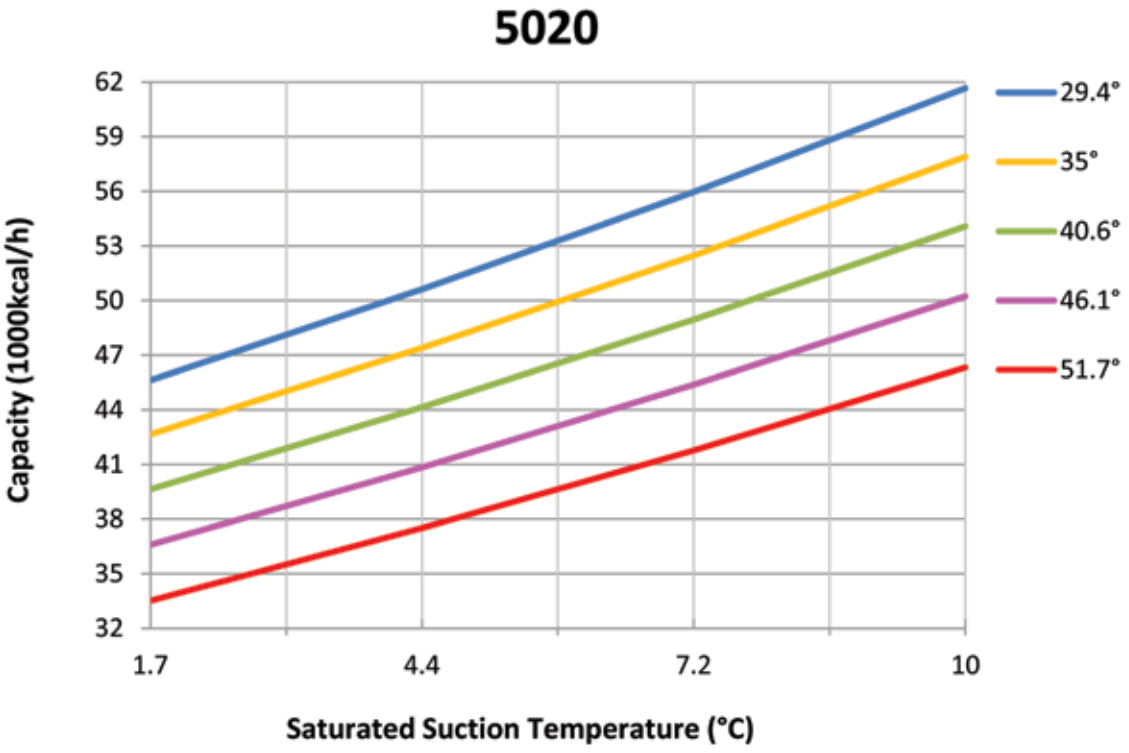
Capacities chart /R407C





Capacities chart /R407C





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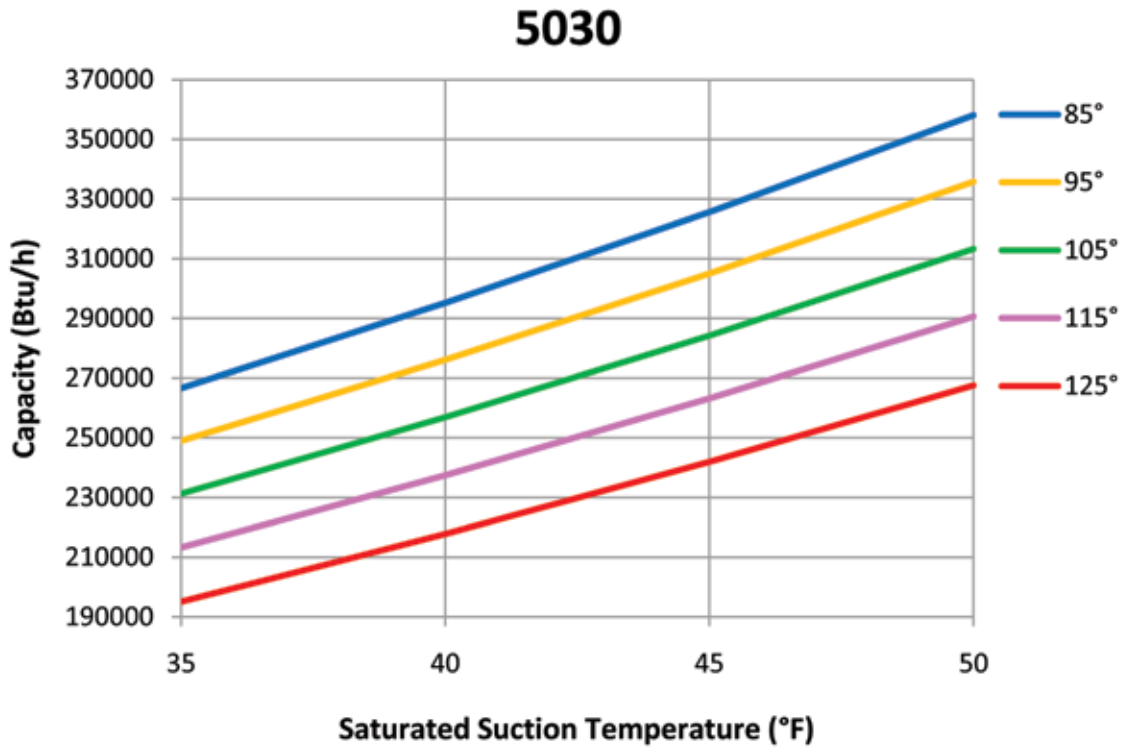

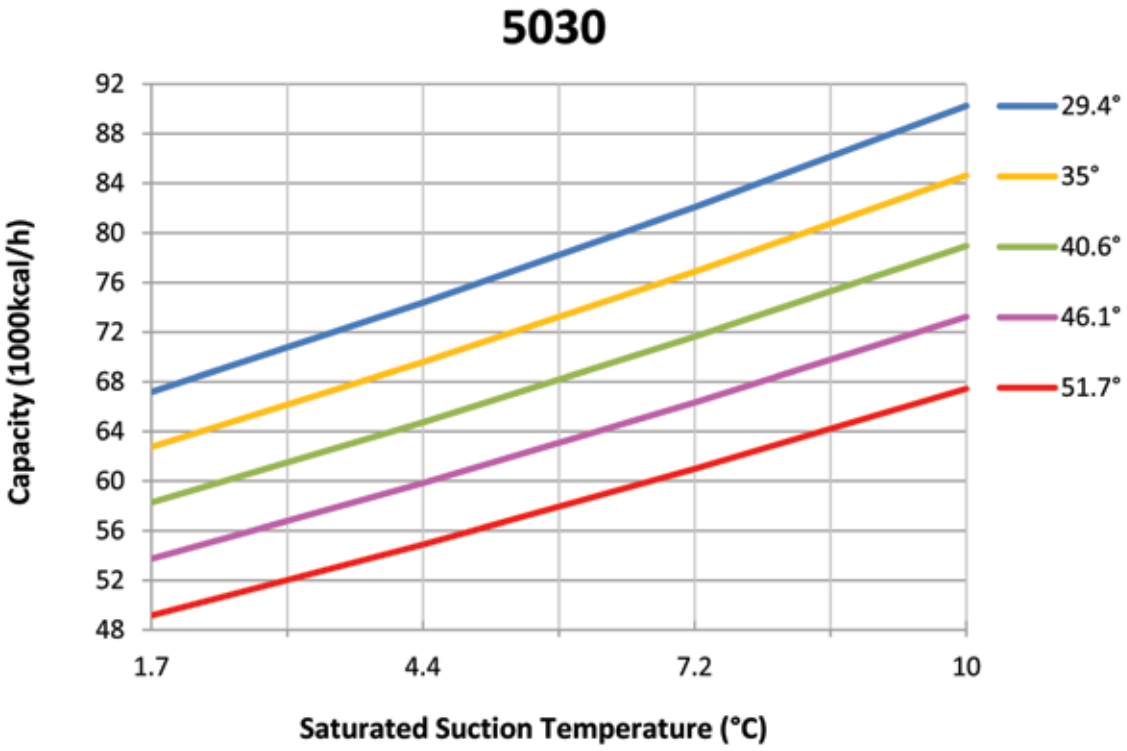

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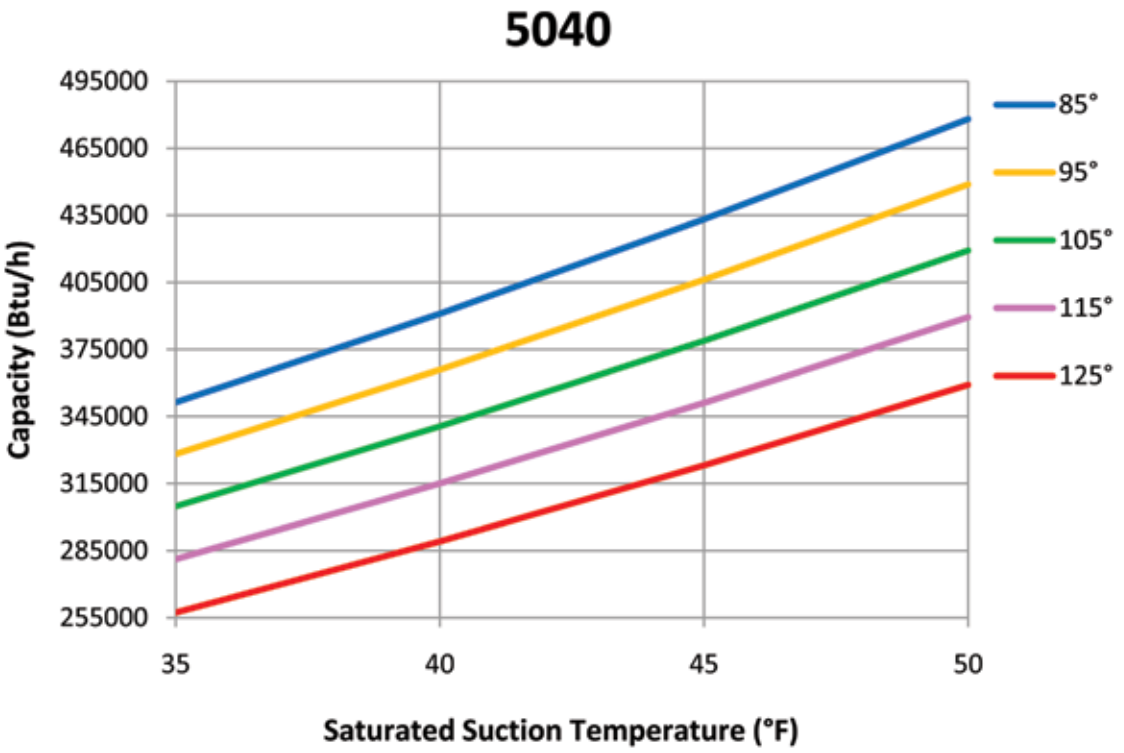

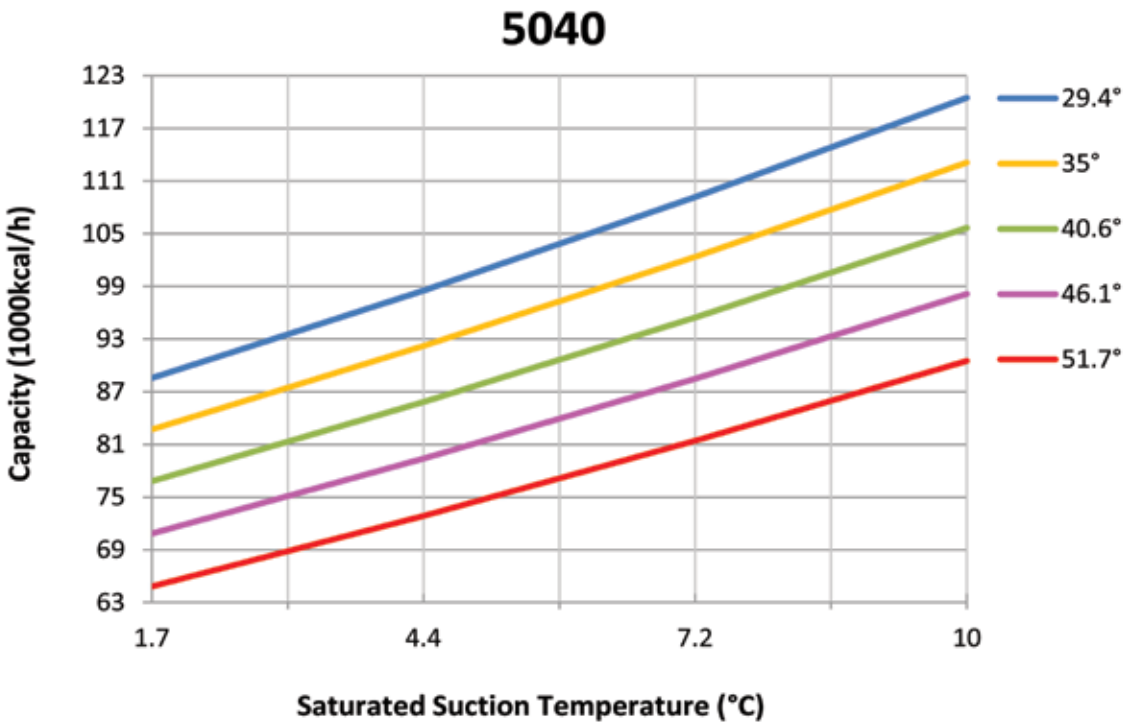

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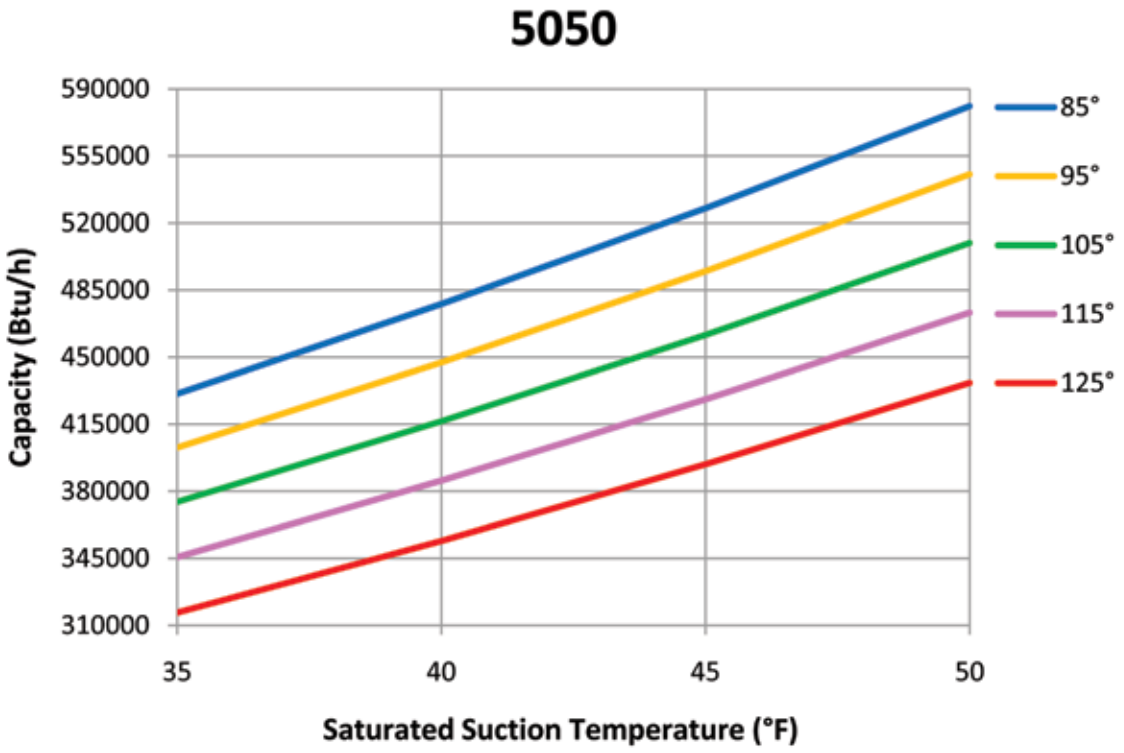
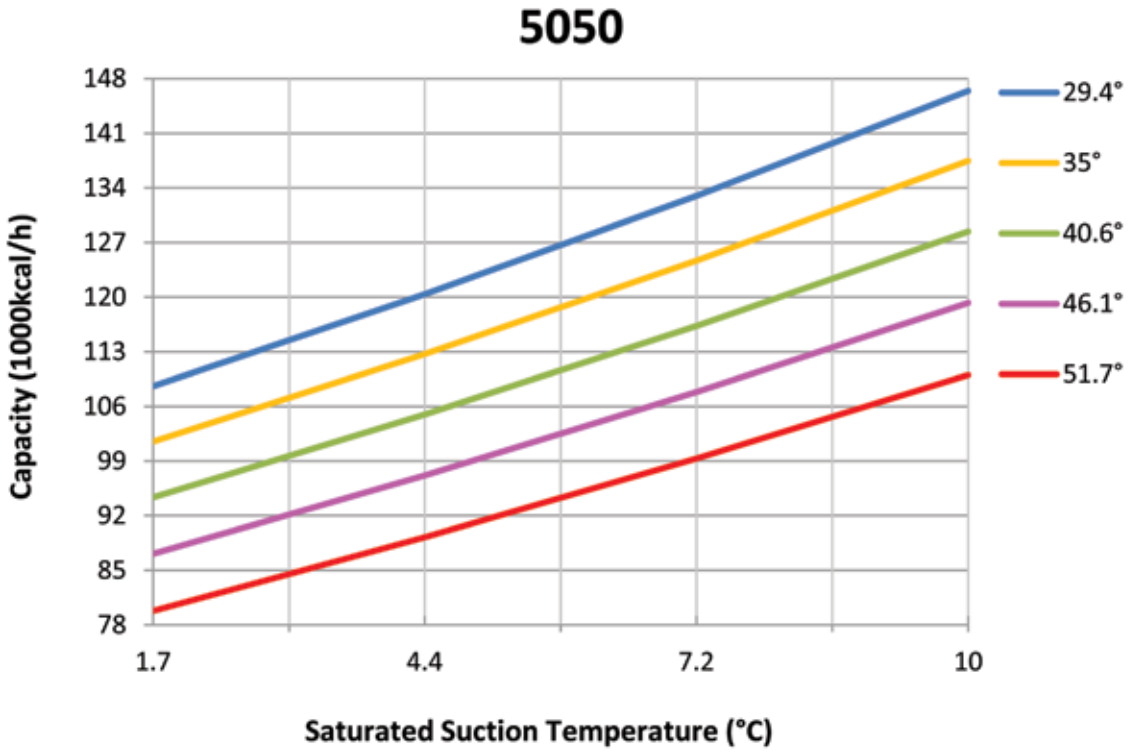
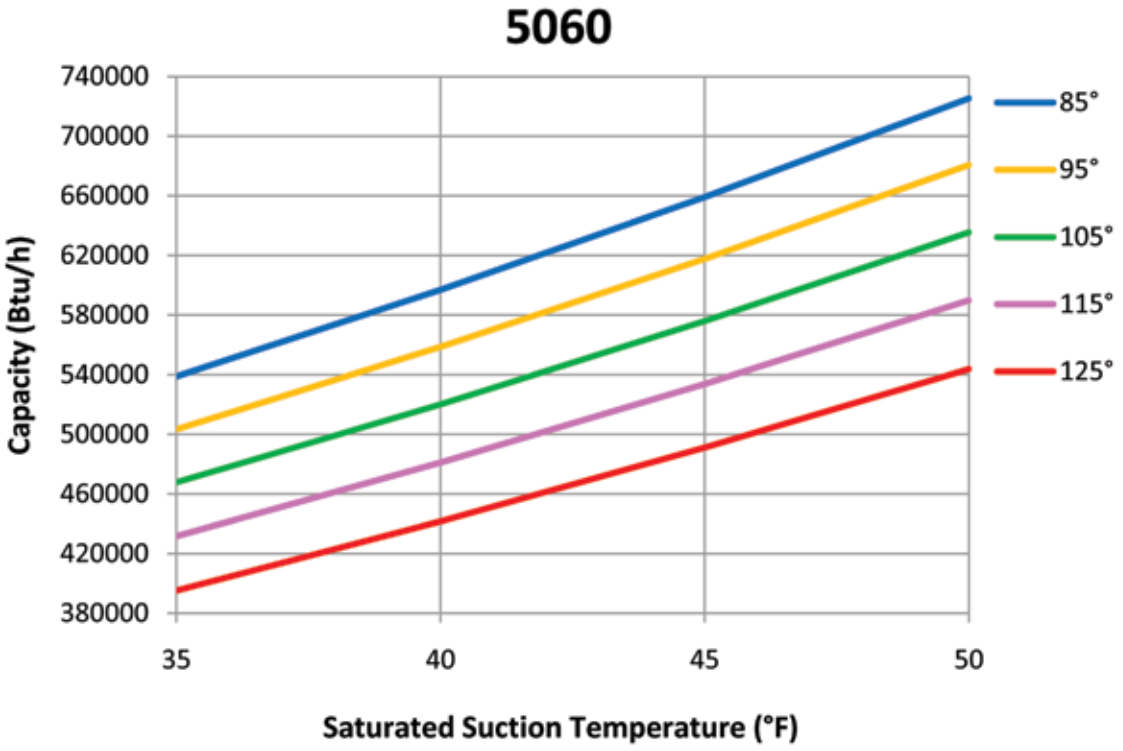
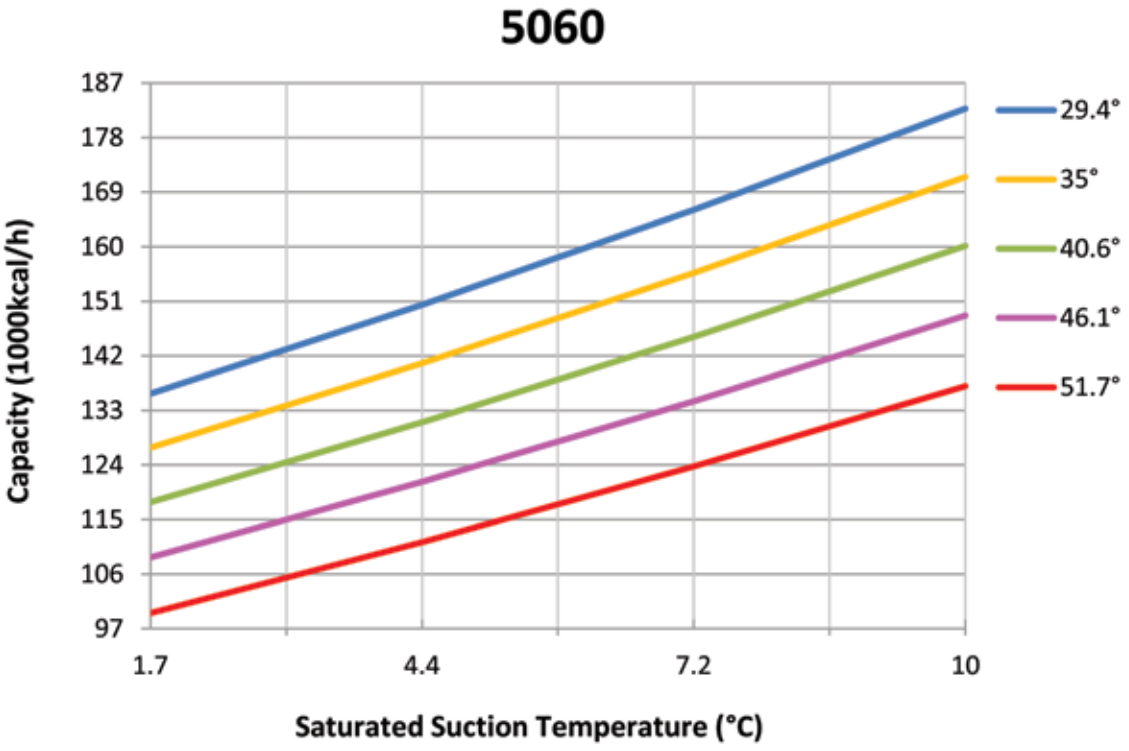


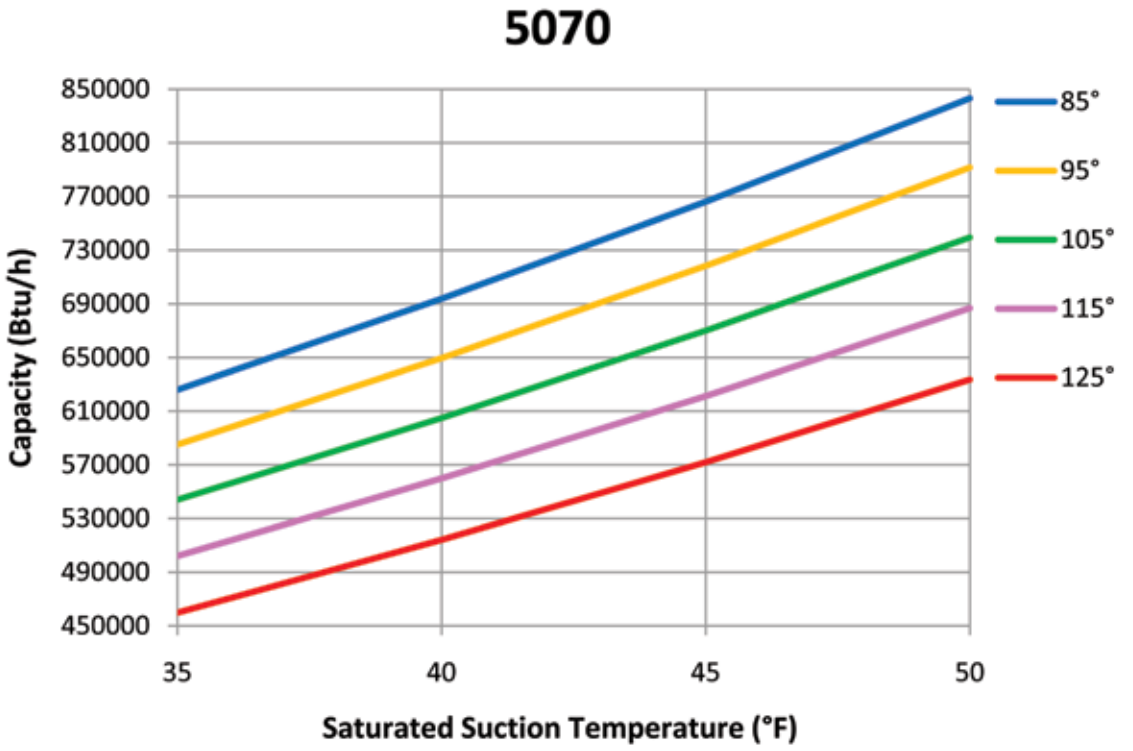


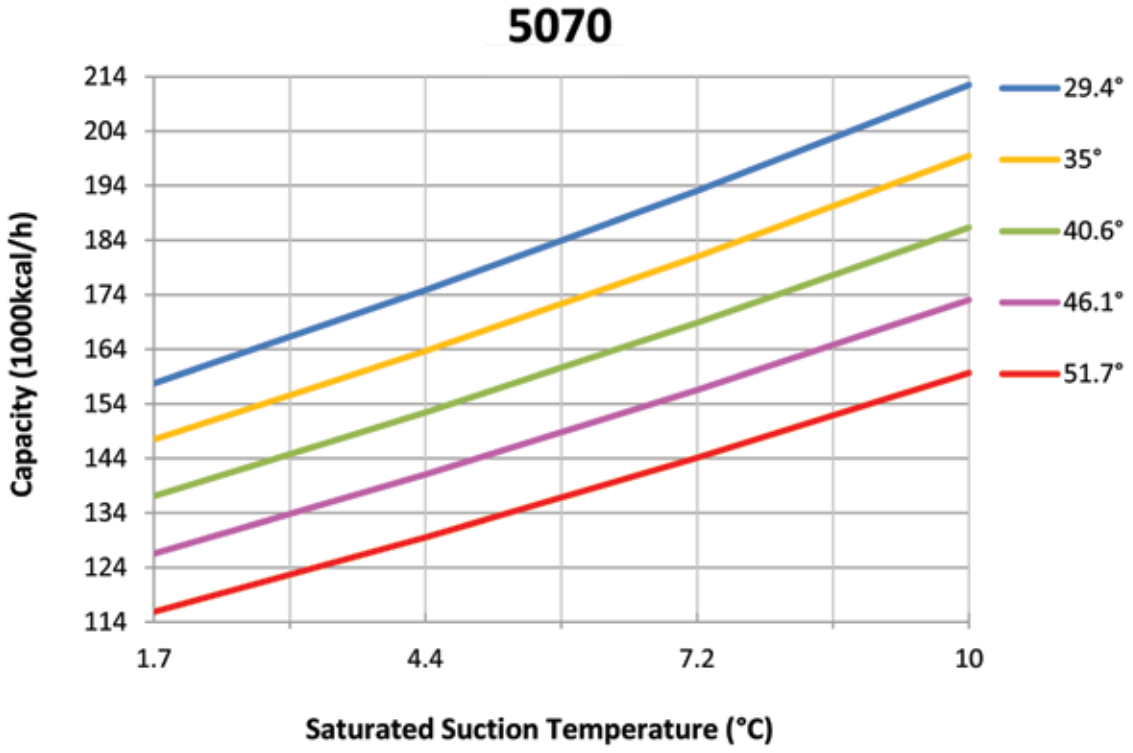
Capacities chart /R407C





Capacities chart /R407C





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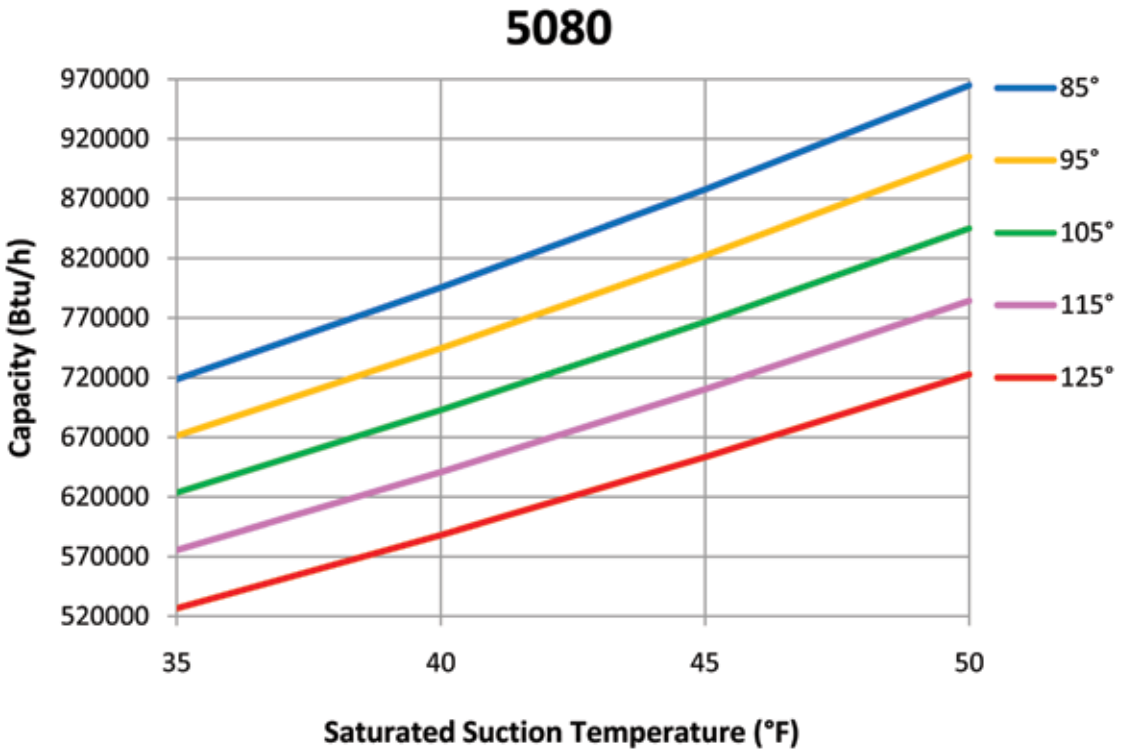
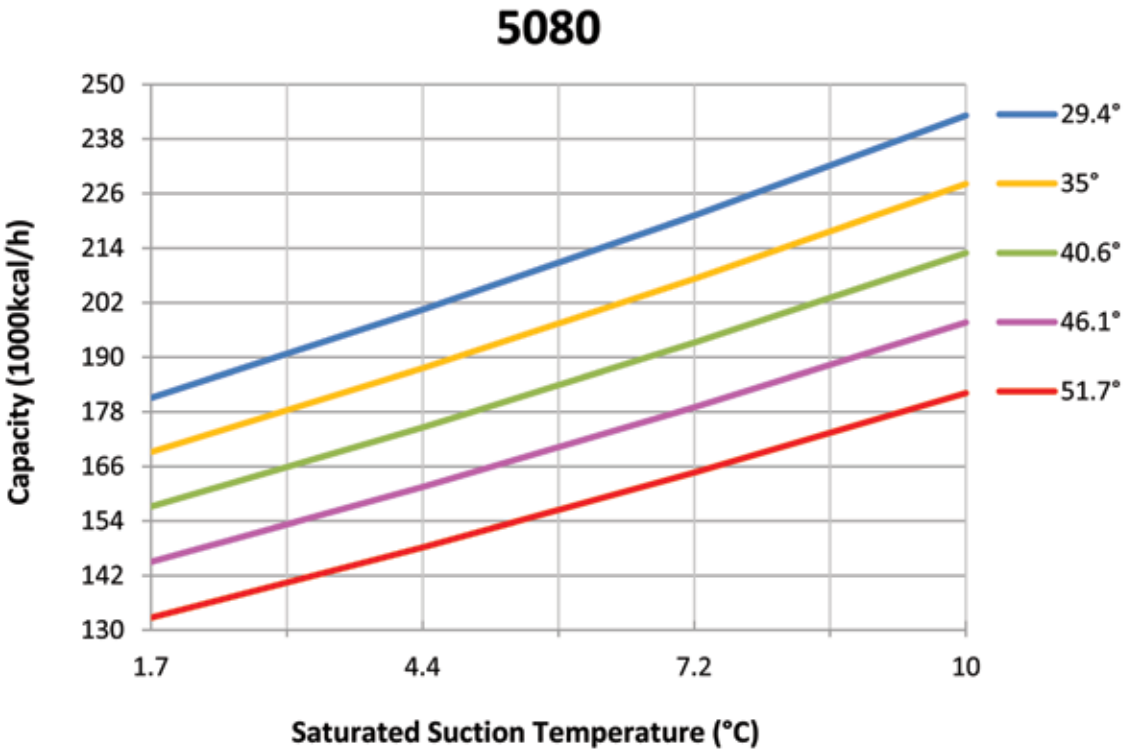
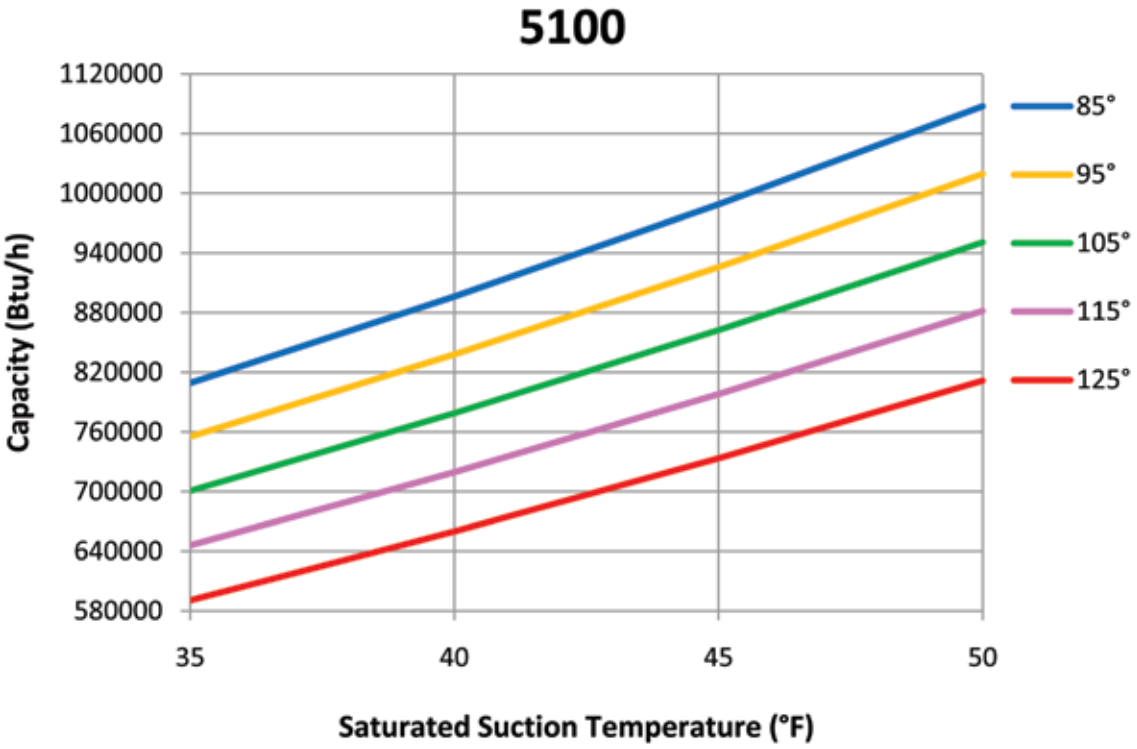
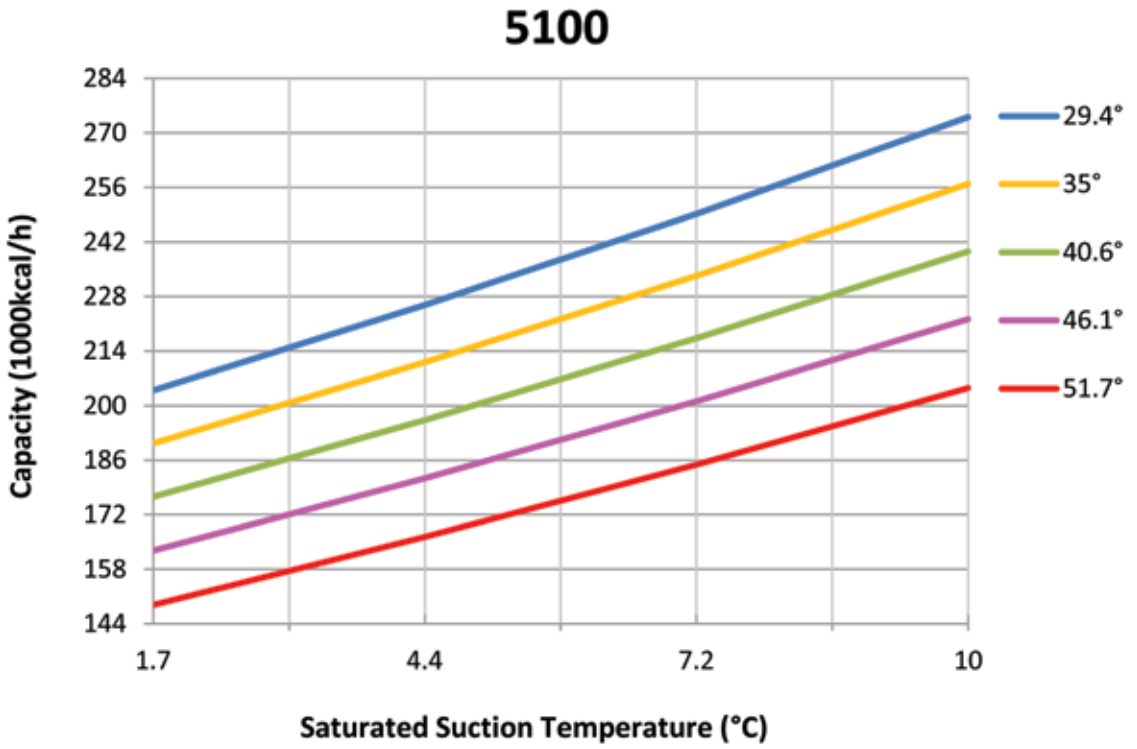




Capacities chart /R407C





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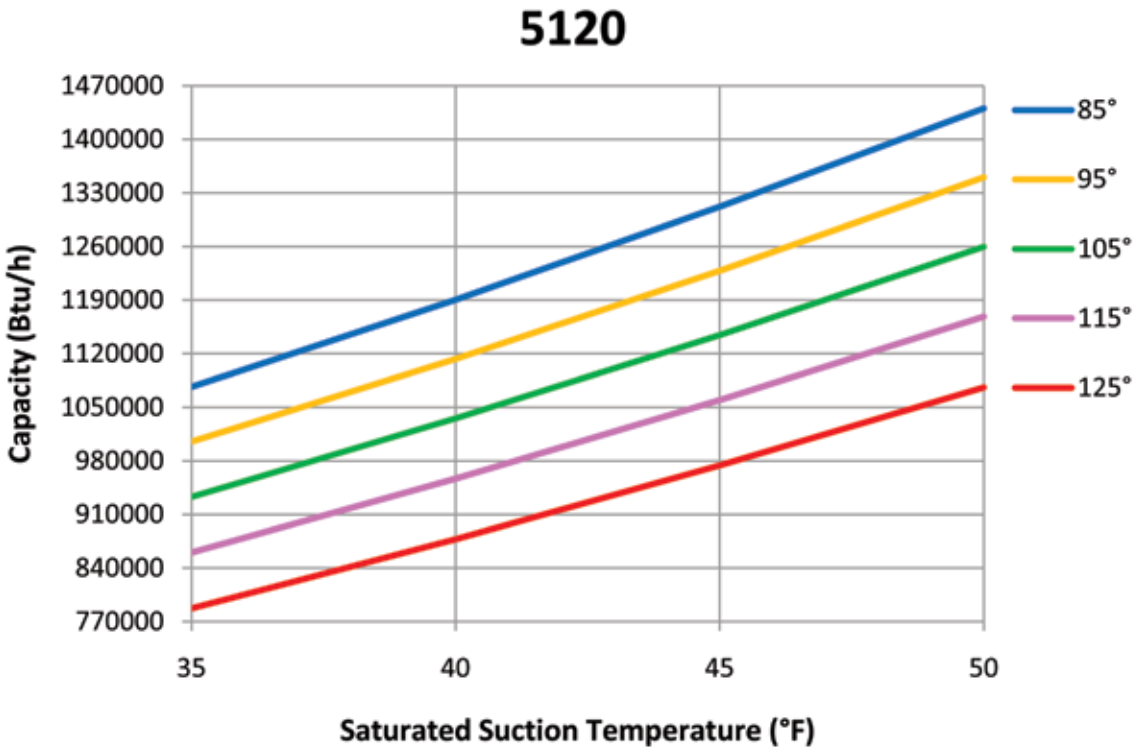
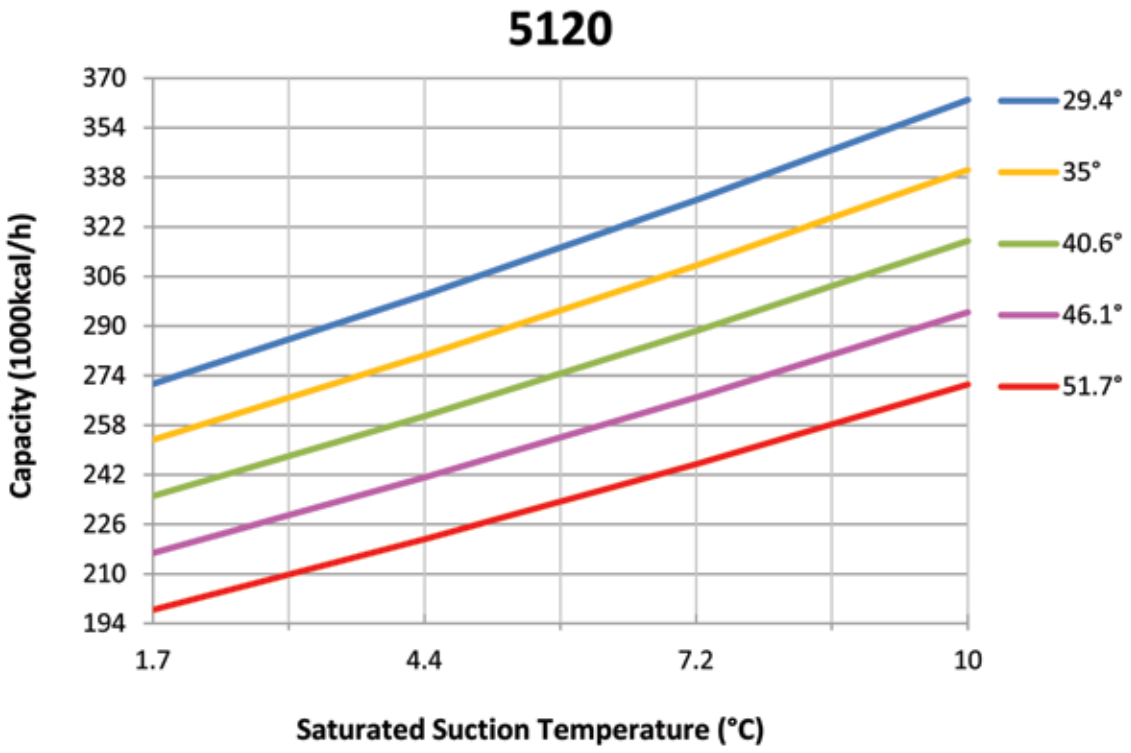




Part Load Data /R22

"Unit Size"	% Load	" Capacity (BTUh)"	kW	EER	IPLV
5015	50	101397	7.6	13.3	14.0
	100	202794	13.0	15.6	
5020	50	130462	9.5	13.8	14.3
	100	260924	16.7	15.6	
5030	25	102769	8.0	12.8	13.6
	50	193500	14.8	13.1	
	75	296269	19.9	14.9	
	100	387000	26.8	14.4	
5040	25	131803	12.8	10.3	12.1
	50	253511	21.3	11.9	
	75	385314	28.1	13.7	
	100	507022	36.6	13.9	
5050	25	158373	15.2	10.5	12.7
	50	316747	24.5	12.9	
	75	475120	33.9	14.0	
	100	633494	43.2	14.7	
5060	25	196282	19.7	10.0	12.3
	50	392563	31.3	12.5	
	75	588845	43.0	13.7	
	100	785127	54.6	14.4	
5070	21	208951	18.4	11.4	13.2
	50	451506	35.2	12.8	
	71	660457	44.9	14.7	
	79	718914	48.3	14.9	
	100	903012	61.7	14.6	
5080	25	257023	24.3	10.6	12.7
	50	514046	39.8	12.9	
	75	771069	55.3	13.9	
	100	1028092	70.9	14.5	
5100	22	275678	23.3	11.8	13.2
	50	581029	45.6	12.7	
	78	921271	62.7	14.7	
	100	1162058	81.0	14.3	
5120	17	275764	24.3	11.3	13.3
	33	527820	40.4	13.1	
	50	756184	59.3	12.8	
	67	1031948	71.9	14.4	
	83	1284005	88.0	14.6	
	100	1512369	106.9	14.1	

Part Load Data /R134a

"Unit Size"	% Load	" Capacity (BTUh)"	kW	EER	IPLV
5015	50	73328	6.3	11.6	12.7
	100	146657	9.7	15.1	
5020	50	96011	7.6	12.7	13.6
	100	192022	12.3	15.6	
5030	25	75366	7.3	10.3	12.9
	50	145121	11.4	12.7	
	75	220487	14.7	15.0	
	100	290242	18.9	15.4	
5040	25	98199	10.3	9.5	12.2
	50	188940	15.8	12.0	
	75	287139	20.0	14.4	
	100	377881	25.6	14.8	
5050	25	115595	13.8	8.4	11.6
	50	231190	19.6	11.8	
	75	346785	25.5	13.6	
	100	462380	31.3	14.8	
5060	25	143001	15.1	9.5	12.7
	50	286003	22.2	12.9	
	75	429004	29.3	14.6	
	100	572005	36.4	15.7	
5070	21	149435	18.4	8.1	11.8
	50	332768	28.5	11.7	
	71	482202	35.0	13.8	
	79	526158	37.0	14.2	
	100	665535	45.1	14.8	
5080	25	183268	21.8	8.4	11.5
	50	366536	31.5	11.6	
	75	549804	41.3	13.3	
	100	733071	51.0	14.4	
5100	22	196616	22.8	8.6	11.7
	50	424611	36.6	11.6	
	78	668593	47.9	14.0	
	100	849223	59.2	14.4	
5120	17	197974	24.6	8.0	12.4
	33	387376	34.6	11.2	
	50	562940	46.1	12.2	
	67	760915	54.8	13.9	
	83	950316	64.7	14.7	
	100	1125880	76.3	14.8	

Part Load Data /R407C

"Unit Size"	% Load	" Capacity (BTUh)"	kW	EER	IPLV
5015	50	96677	7.9	12.2	12.8
	100	193353	13.6	14.2	
5020	50	126005	10.0	12.6	13.1
	100	252009	17.7	14.3	
5030	25	98516	8.3	11.9	12.7
	50	184500	15.1	12.2	
	75	283016	20.6	13.8	
	100	369000	27.4	13.5	
5040	25	128284	13.3	9.6	11.4
	50	246251	22.0	11.2	
	75	374536	29.3	12.8	
	100	492503	38.0	13.0	
5050	25	149633	15.2	9.8	12.0
	50	299265	24.6	12.2	
	75	448898	34.0	13.2	
	100	598531	43.5	13.8	
5060	25	186817	19.9	9.4	11.5
	50	373635	31.9	11.7	
	75	560452	43.8	12.8	
	100	747270	55.8	13.4	
5070	21	201101	19.3	10.4	12.3
	50	434236	36.2	12.0	
	71	635337	46.9	13.6	
	79	692545	50.4	13.7	
	100	868472	63.8	13.6	
5080	25	248576	25.0	9.9	11.9
	50	497151	41.2	12.1	
	75	745727	57.5	13.0	
	100	994302	73.8	13.5	
5100	22	267531	24.6	10.9	12.2
	50	560449	47.5	11.8	
	78	891080	66.1	13.5	
	100	1120897	84.8	13.2	
5120	17	272641	25.9	10.5	12.3
	33	521438	42.9	12.2	
	50	742396	62.7	11.8	
	67	1015036	77.0	13.2	
	83	1263834	94.0	13.4	
	100	1484792	113.7	13.1	

Sound Data

HAR Unit Model V	Octave Band at Center Frequency							Overall A-Weighted
	63	125	250	500	1000	2000	4000	
5015	67.9	59.8	63.1	70.8	72.2	70.5	65.3	76.9
5020	70.0	67.9	70.8	76.0	75.7	75.7	68.9	80.4
5030	73.5	69.9	71.0	74.2	76.0	73.9	69.5	80.5
5040	72.8	71.8	73.8	78.7	78.4	78.5	71.8	83.9
5050	77.0	71.1	72.6	80.5	81.0	79.4	76.5	85.6
5060	74.8	73.5	76.7	83.0	81.8	82.1	79.0	87.5
5070	76.9	74.2	77.2	85.3	83.4	82.1	80.1	88.9
5080	78.2	74.8	77.6	86.8	84.6	82.1	81.0	89.9
5100	75.3	60.9	73.4	87.8	84.5	81.5	80.3	90.2
5120	79.0	62.8	73.1	88.4	86.0	83.5	82.6	91.6

Quiet Operation

Sound levels can be as important as unit cost and efficiency, and must be addressed before the start of any development program. Efforts by Tahvieh Design Engineers to design units that are sensitive to the sound requirements of the market, combined with inherently quiet scroll compressors, have paid off.

Background Information

Sound is a vibration in an elastic medium and is essentially a pressure and particle displacement phenomena.

A vibrating body produces compression waves, and as the waves are emitted from the vibrating body, molecules are ultimately compressed. These values are transmitted through gas, liquid, solid-anything which is elastic or viscous. The sound data provided in this section is presented with both sound pressure and sound power levels. Sound power is the total sound energy radiated by a source per unit of time integrated over the surface through which the sound is radiated. Sound power is a calculated quantity and cannot be measured directly like sound pressure. Sound power is not dependent on the surrounding environment or distance from the source, as is sound pressure. Sound pressure varies with the distance from the source and is dependent on its surroundings. For example, a brick wall located 10 feet from a unit will affect the sound pressure measurements differently than a brick wall at 20 feet. Sound pressure is measured in decibels (dB), which is a dimensionless ratio (on a logarithmic scale) between measured sound pressure and a reference sound pressure level.

Sound Pressure Levels - Full Load

All sound pressure tables give the overall "A" weighted sound pressure levels which are considered typical of what can be measured in a free field with a hand held sound meter, in the absence of any nearby reflective surfaces. The sound pressure levels are measured at 30 feet (10 meters) from the side of the unit at 100% unit load and ARI conditions. 95°F (35°C) ambient air temperatureand 45°F suction temperature.

Sound Power Levels

Acoustical consultants can require sound power octave band data to perform a detailed acoustical analysis. The tables present sound power levels per ARI Standard 370, "Sound Rating of Large Outdoor Refrigerating and Air Conditioning Equipment". These standards were developed to establish uniform methods of determining the sound power radiated by large outdoor and indoor equipment. The aforementioned methods are based on providing sound power levels by octave band and the overall 'A' weighted value. Measurements are taken over a prescribed area around the unit and the data is mathematically calculated to give the sound power, dB. Sound power can be thought of as basic sound level emanating from the unit without consideration of distance or obstructions.

Sound Reduction due to Distance from the Unit

The distance between a source of sound and the location of the sound measurement plays an important role in minimizing sound problems. The equation below can be used to calculate the sound pressure level at any distance if the sound power is known. Results for typical distances are tabulated in Table 2. Another way of determining the effect of distance is to work from sound pressure only. "Q", the directionality factor, is a dimensionless number that compensates for the type of sound reflection from the source. For example, a unit sitting on a flat roof or ground with no other reflective surfaces or attenuation due to grass, snow, etc. ,between source and receiver: Q=2.

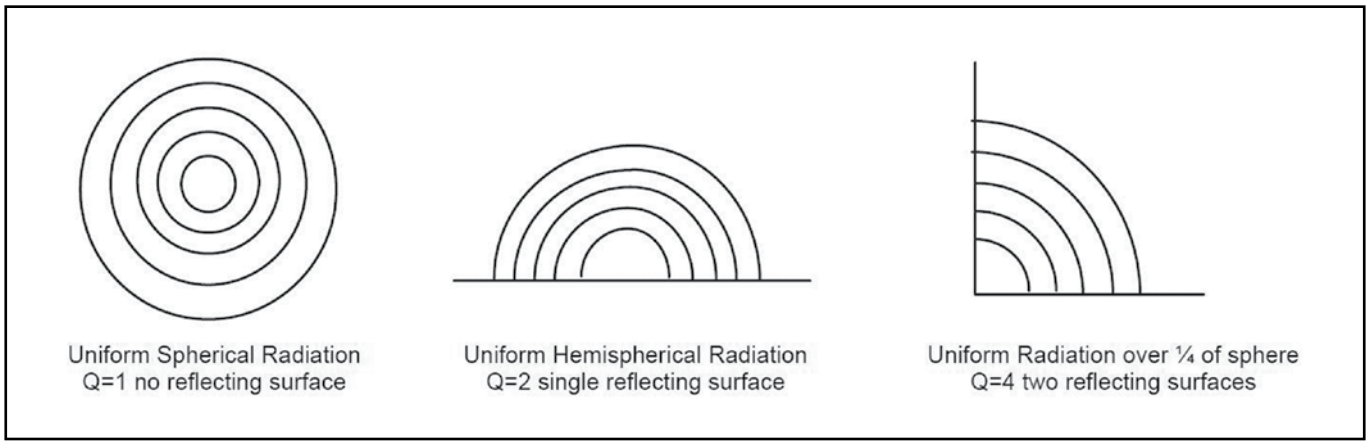


Figure 1, "Q" Definition, Plan View, Unit Located in Center

Sound pressure can be calculated at any distance from the unit if the sound power is known.

Lp=Lw-(20 log r) + (10 log Q) - .5

Lp = sound pressure — r = distance from unit in feet

Lw = sound power — Q = directionality factor

With Q=1, Unit suspended in space (theoretical condition), the equation simplifies to:

Lp = Lw – (20)(log r) –0.5

With Q=2, for a unit sitting on a flat roof or ground with no adjacent vertical wall as a reflective surface, the equation simplifies to:

Lp = Lw – (20)(log r) + 2.5

With Q=4 for a unit sitting on a flat roof or ground with one adjacent vertical wall as a reflective surface, the equation simplifies to:

Lp = Lw – (20)(log r) + 5.5

The equations are reduced to table form in Table 2 for various distances and the two most usual cases of "Q" type of location.

Distance from Sound Source, ft (m)	dB Reduction from Sound Power at the Source to Sound Pressure at Referenced Distance	
	Q=2	Q=4
30 (9)	27.1	24.0
50 (15)	31.6	28.5
75 (23)	35.1	32.0
100 (30)	37.6	34.5
150 (46)	41.1	38.0
200 (61)	43.6	40.5
300 (91)	47.6	44.0

Table 1, dB Conversion of Sound Power to Pressure for Distance

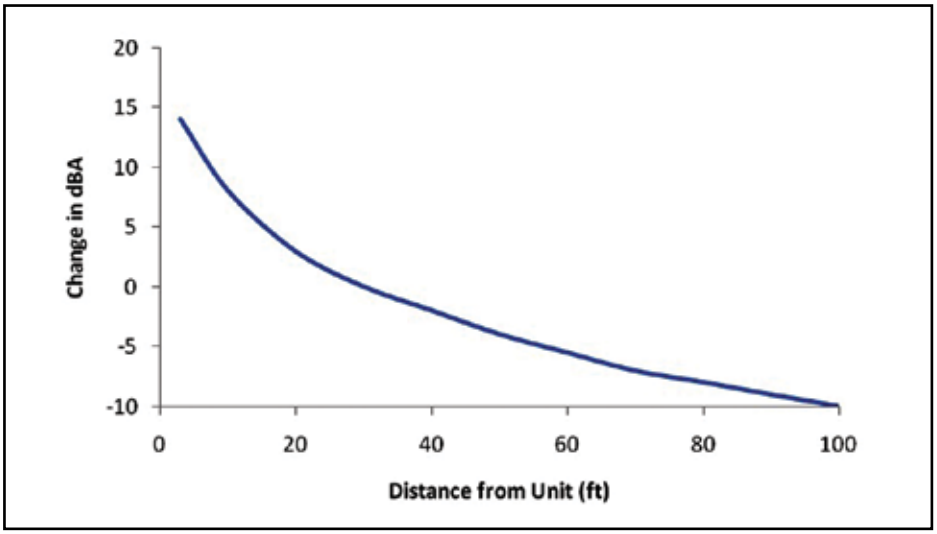


Figure 2, Sound Pressure Attenuation Due to Distance from Unit

Sound Pressure Reduction - Low Ambient Conditions

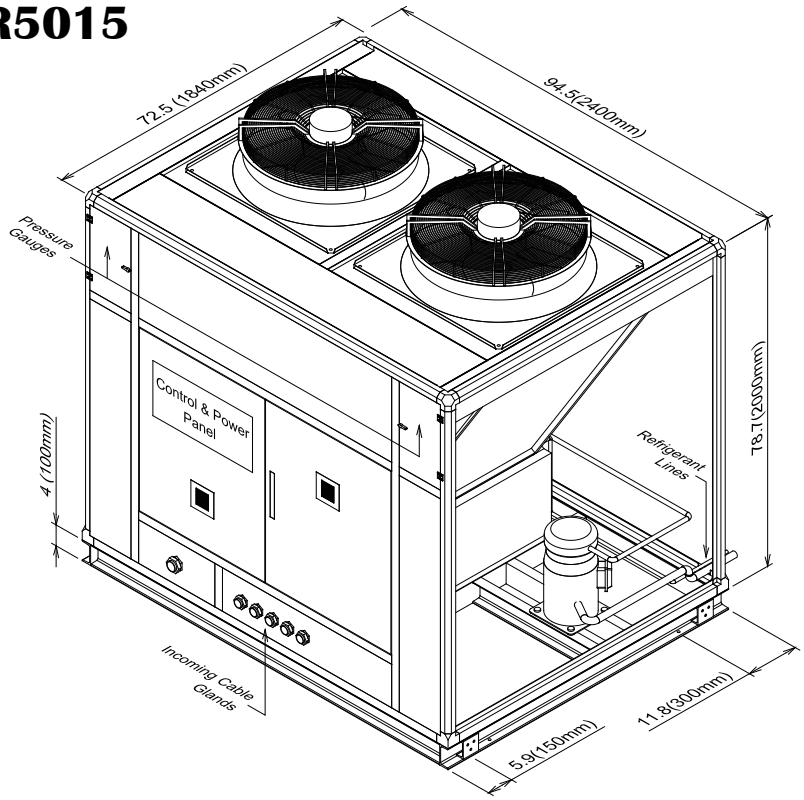
Unit operation at a lower ambient temperature than 95°F (35°C) will also result in lower sound pressure levels. The sound pressure level will decrease 1 dBA for ambient temperatures between 85°F and 94°F (29.4°C and 34.4°C), 2 dBA for ambient temperatures between 75°F and 84°F (23.9°C and 28.9°C), and 3 dBA for ambient temperatures between 65°F and 74°F (18.3°C and 23.3°C).

Electrical Data

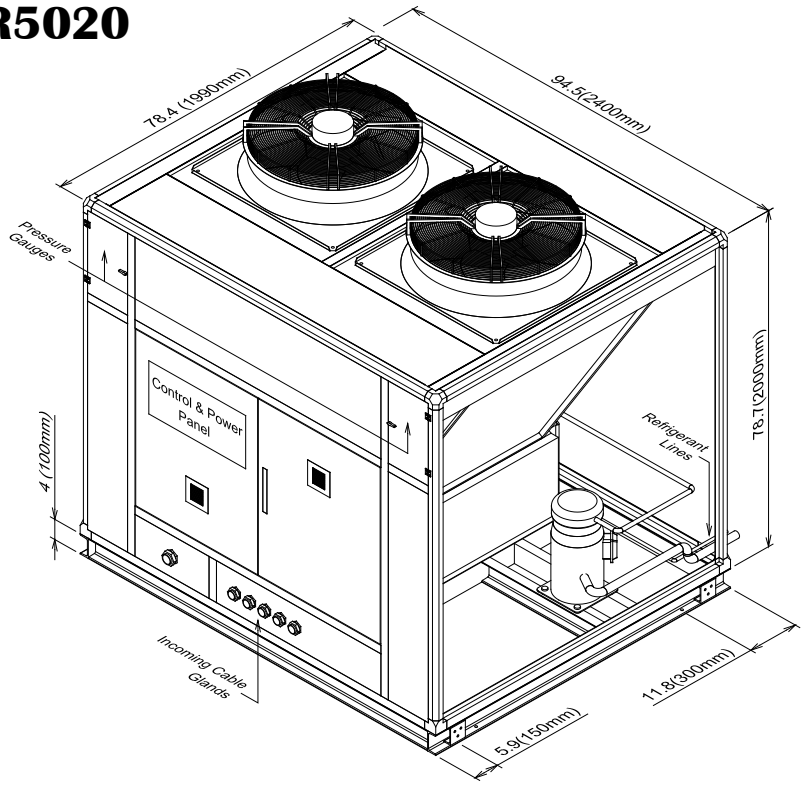
Unit Size	No. Compres.	No. Fans	Voltage-Ph-Hz	Rated Load Amp.(A) (Each)		Total Unit Current (A)	Maximum Continues Current(A) (Each)		Total Maximum Current (A)	Main Circuit Breaker Size/ Fuse (A)
				COMP	FAN		COMP	FAN		MCCB
HAR5015	2	2	400-3-50	13.6	2.45	32.1	19	2.45	42.9	63
HAR5020	2	2	400-3-50	20.7	2.45	46.3	29	2.45	62.9	100
HAR5030	4	2	400-3-50	13.6	3.2	60.8	19	3.2	82.4	125
HAR5040	4	3	400-3-50	20.7	4.3	95.7	29	4.3	128.9	160
HAR5050	4	4	400-3-50	22.9	3.2	104.4	32	3.2	140.8	200
HAR5060	4	4	400-3-50	24	4.3	113.2	34	4.3	153.2	200
HAR5070	2 (tandem)	6	400-3-50	59.7	3.2	138.6	84	3.2	187.2	250
HAR5080	4	6	400-3-50	35.7	3.2	162	50	3.2	219.2	300
HAR5100	2 (tandem)	7	400-3-50	85	3.2	192.4	119	3.2	260.4	350
HAR5120	6	8	400-3-50	35.7	3.2	239.8	50	3.2	325.6	400

Dimension and Weight

HAR5015

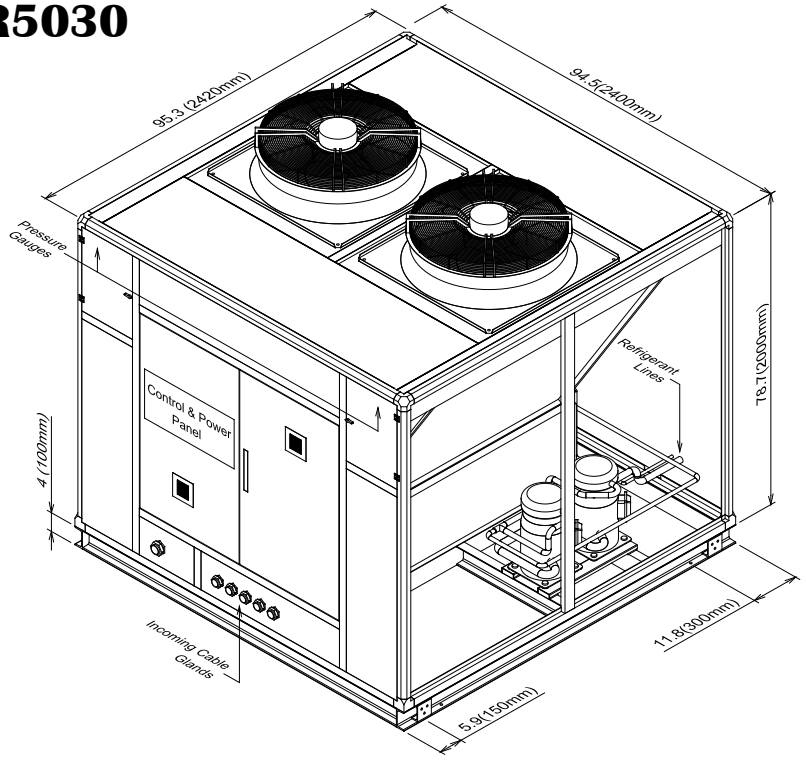


HAR5020

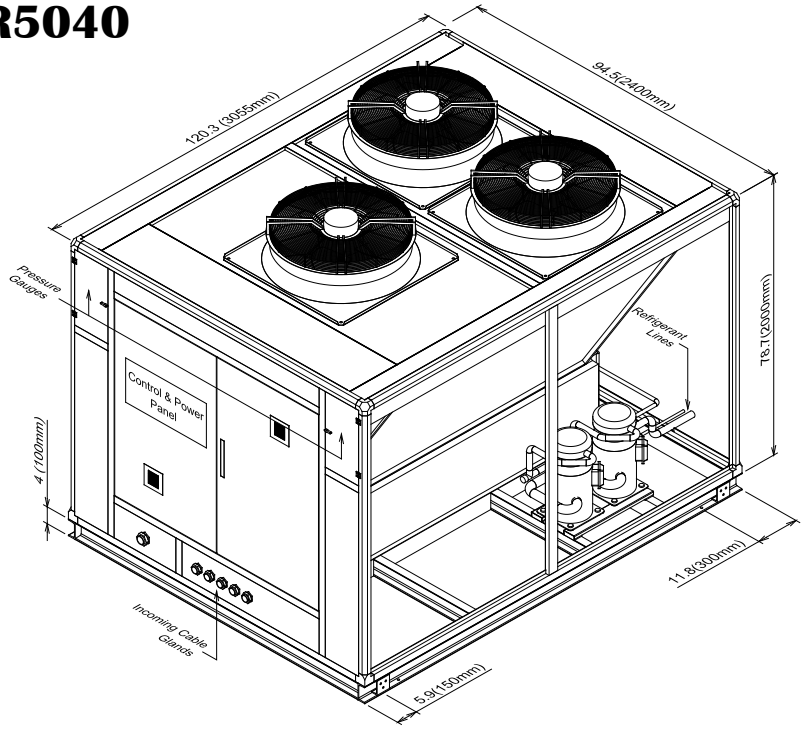


Dimension and Weight

HAR5030

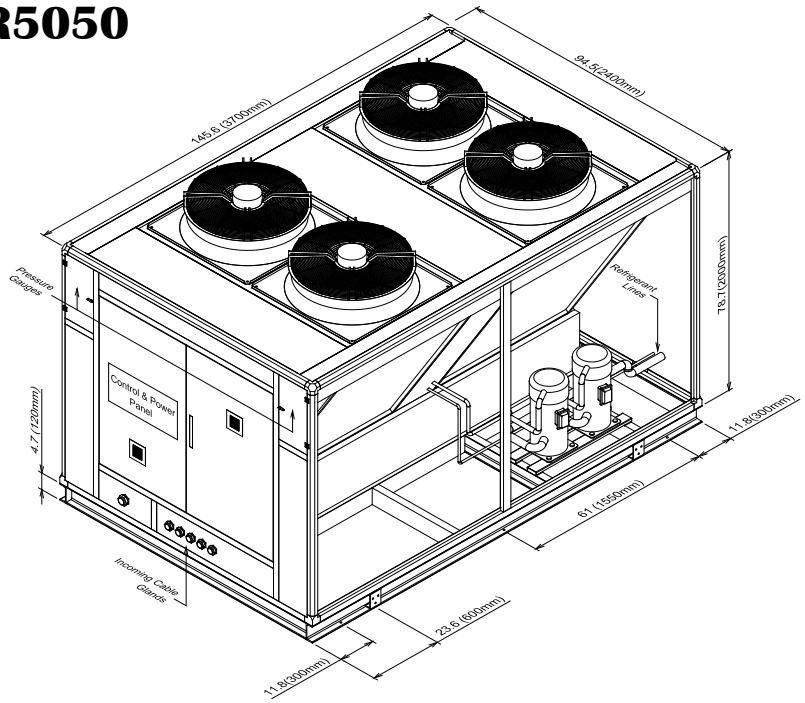


HAR5040



Dimension and Weight

HAR5050



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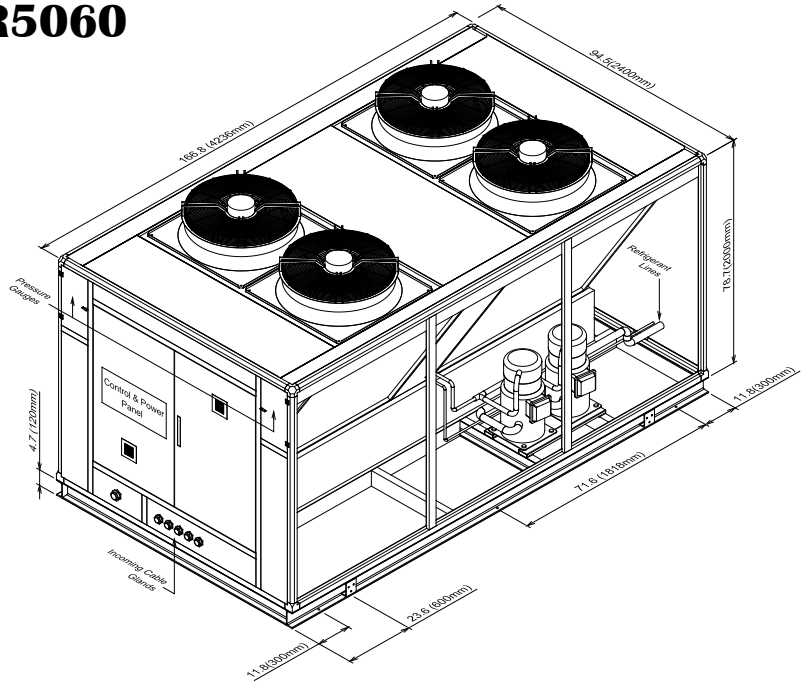
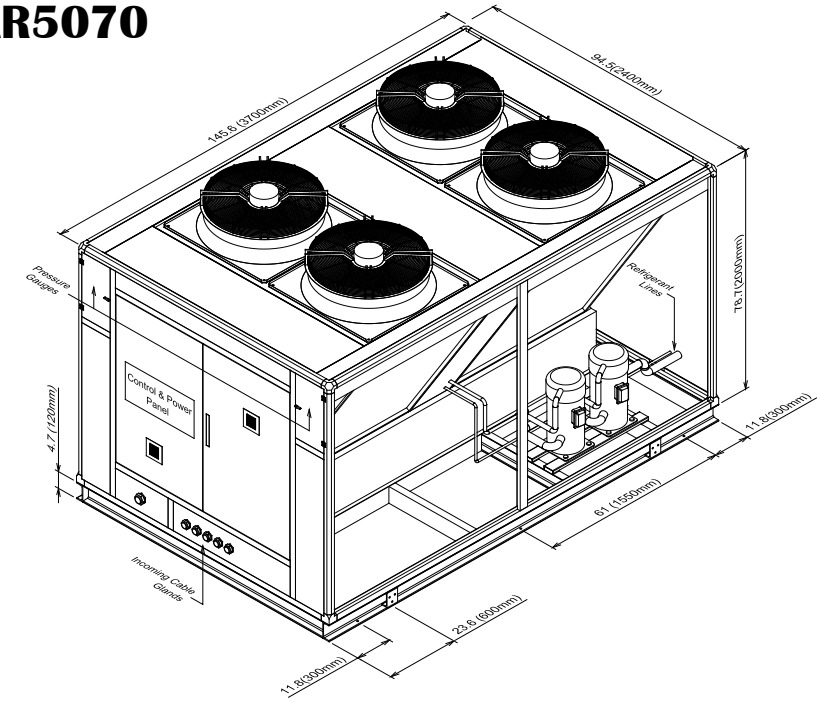
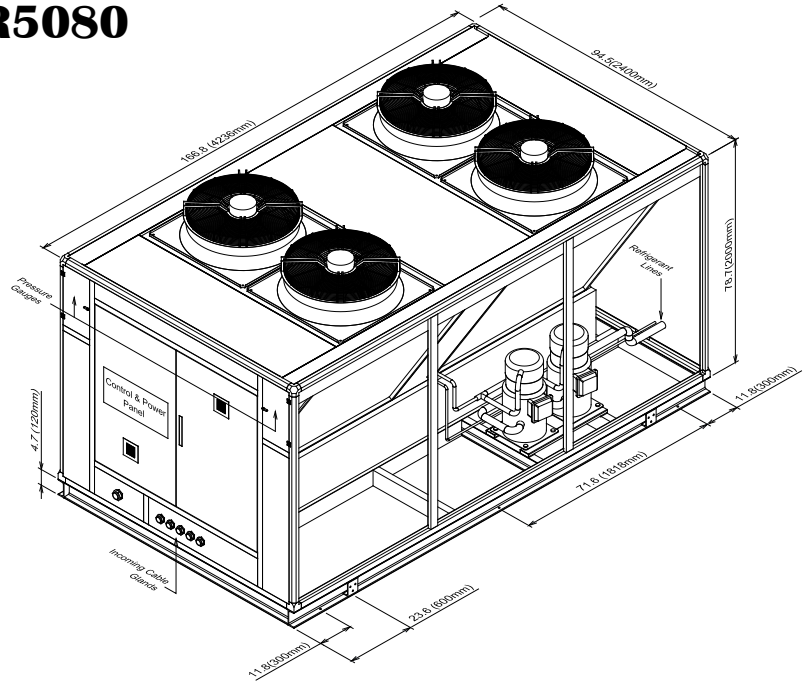


HAR5070



HAR5080



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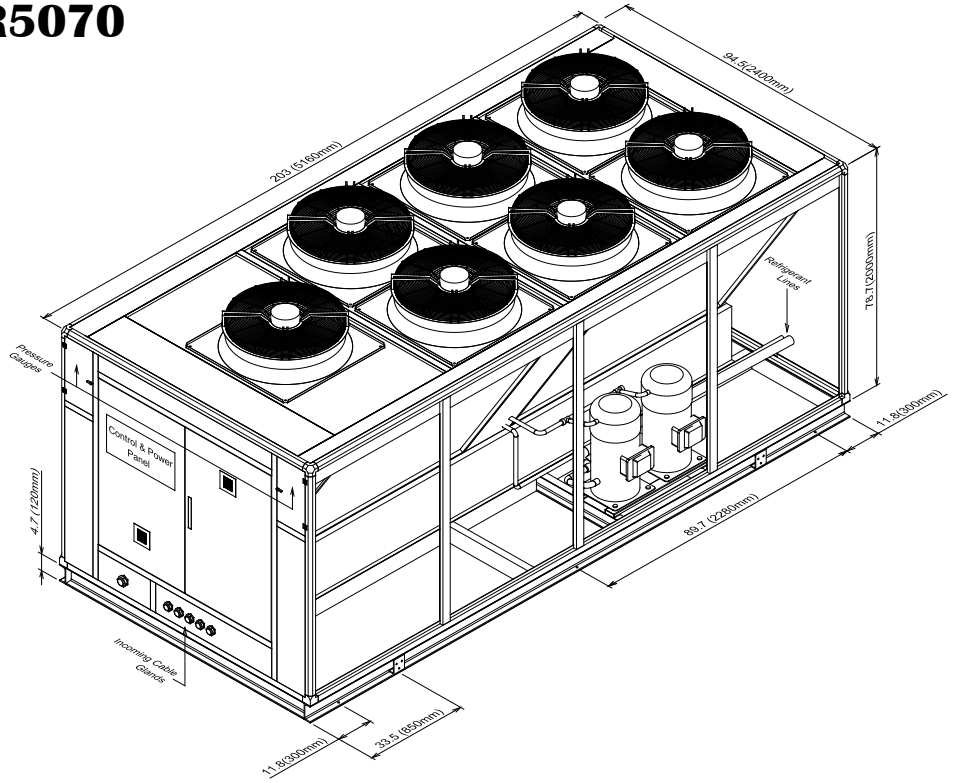

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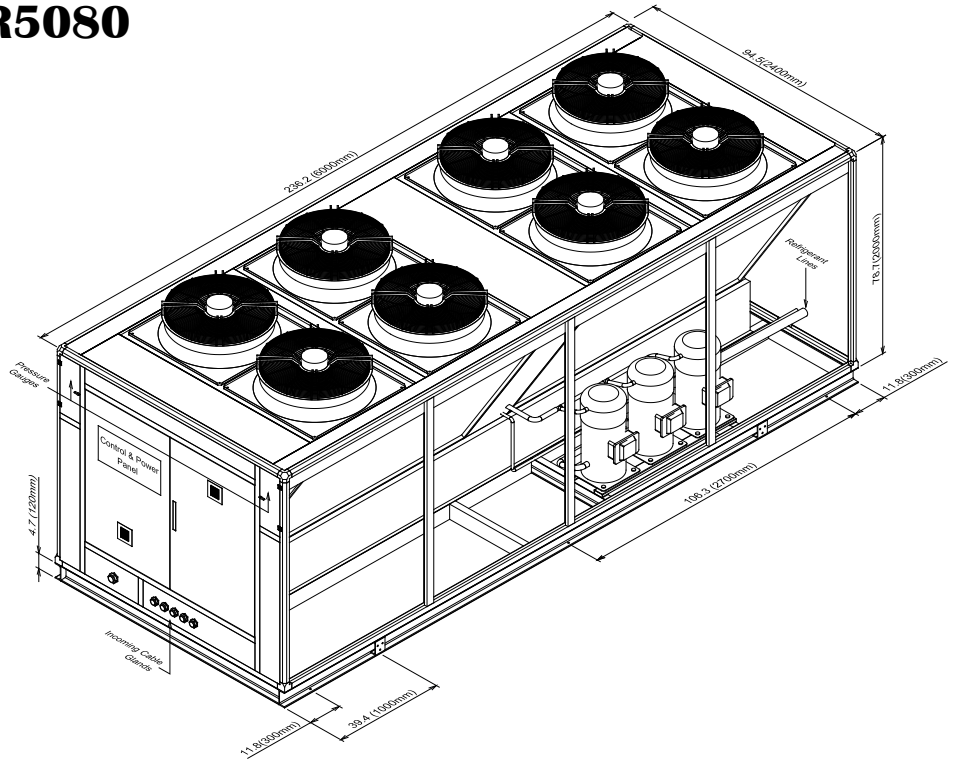
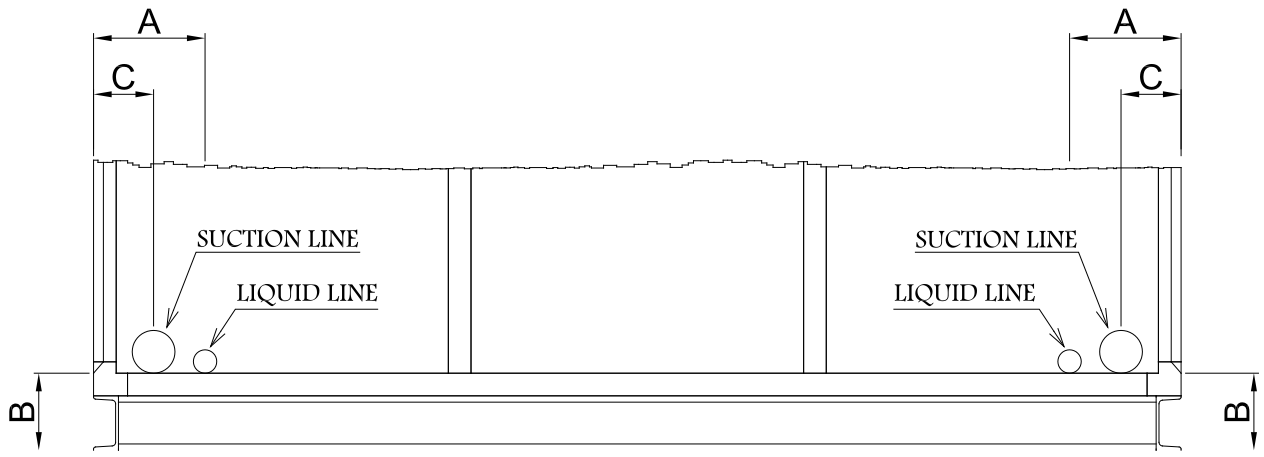


Dimensions and Weight

Model	HAR5015	HAR5020	HAR5030	HAR5040	HAR5050	HAR5060	HAR5070	HAR5080	HAR5100	HAR5120
Weight, kg	1200	1300	1400	1600	2200	2300	2700	2800	3000	3300

Connection Orientation



Unit Size	Dimensions, mm (in)		
	A	B	C
5015	180 (7.0)	150(5.9)	120(4.7)
5020	180 (7.0)	150(5.9)	120(4.7)
5030	180 (7.0)	150(5.9)	150(5.9)
5040	200 (7.9)	150(5.9)	150(5.9)
5050	200 (7.9)	195(7.7)	150(5.9)
5060	210 (8.3)	195(7.7)	160(6.3)
5070	210 (8.3)	195(7.7)	160(6.3)
5080	215 (8.5)	195(7.7)	160(6.3)
5100	225 (8.9)	195(7.7)	170(6.7)
5120	225 (8.9)	195(7.7)	170(6.7)

Unit Size	Dimensions, mm (in)		
	A	B	C
5015	110 (4.3)	210 (8.3)	280 (11.0)
5020	110 (4.3)	210 (8.3)	300 (11.8)
5030	110 (4.3)	210 (8.3)	300 (11.8)
5040	110 (4.3)	210 (8.3)	335 (13.2)
5050	135 (5.3)	210 (8.3)	335 (13.2)
5060	135 (5.3)	210 (8.3)	340 (13.4)
5070	135 (5.3)	210 (8.3)	315 (12.4)
5080	135 (5.3)	210 (8.3)	315 (12.4)

Unit Placement

HAR units are for outdoor applications and can be mounted either on a roof or at ground level.

For roof mounted applications, install the unit on a steel channel or I-beam frame to support the unit above the roof. For ground level applications, install the unit on a substantial base that will not settle. A one-piece concrete slab with footings extended below the frost line is recommended. Be sure the foundation is level within 1/2”(13mm) over its length and width. The foundation must be strong enough to support the weights listed in the Physical Data Tables beginning on page 46.

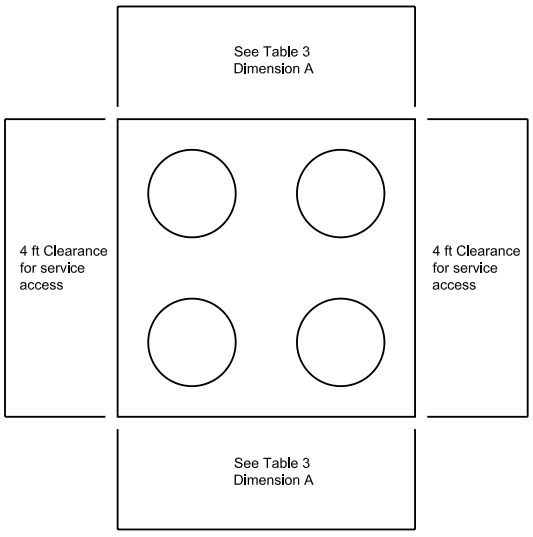


Figure 3, Clearances

Table 3, Recommended Minimum ClearancesT

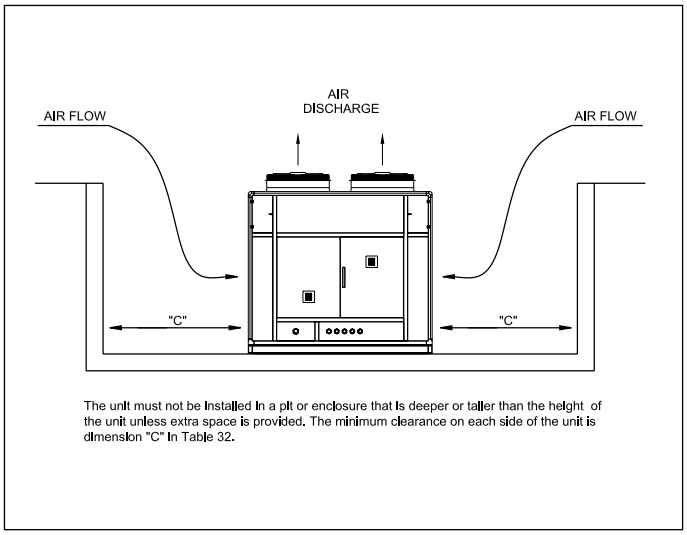
Coil Side (A)	B	C
6	12	8

Note: Dimensions in ft.

Clearances

Do not block the flow of air to and from the condenser coil. Restricting airflow or allowing air recirculation will result in a decrease in unit performance and efficiency because the unit

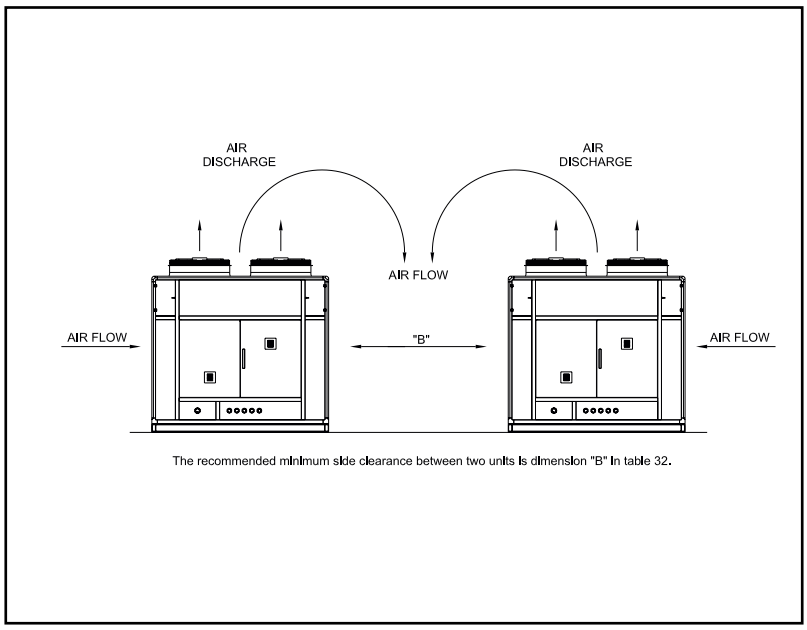
discharge pressure is increased. There must be no obstruction above the unit that would deflect discharge air downward where it could be recirculated back to the inlet of the condenser coil. The condenser fans are propeller type and will not operate with ductwork. Install the unit with enough side clearance for air entrance to the coil and for servicing. Provide service access to the evaporator, compressors, electrical control panel and piping components. Do not allow debris to accumulate near the unit where it could be drawn into the condenser coil. Keep condenser coils and fan discharge free of snow or other obstructions to permit adequate airflow for proper operation.



Restricted Air Flow

Hail and Wind Guards

If hail and wind guards are used, care must be taken when considering air flow clearances. The guards add 20 inches to the width of each side of the unit and essentially increase the total unit width by that amount. Wall spacing in the following discussions must be taken from the outside of the guards, i.e. 20 inches from the side of the unit.



General

The clearances required for design-life operation of HAR air-cooled condensing units are

described in the previous section. occasionally, these clearances cannot be maintained due to site restrictions such as units being too close together or a fence or wall restricting airflow, or both. Fortunately, the Tahvieh HAR condensing units have several features that can mitigate the penalties attributable to restricted airflow.

• The condenser section is “V” shaped, as shown below. This allows inlet air for these

coils to come in from one side.

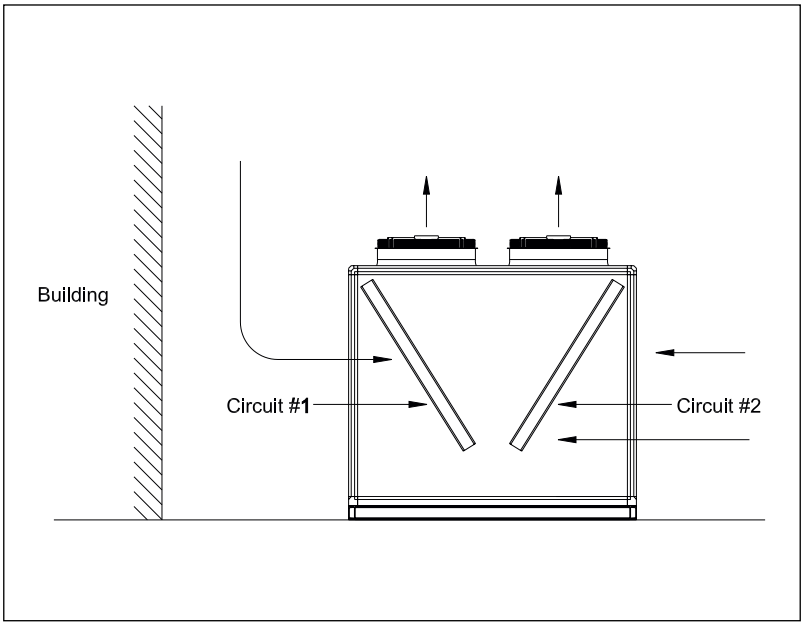
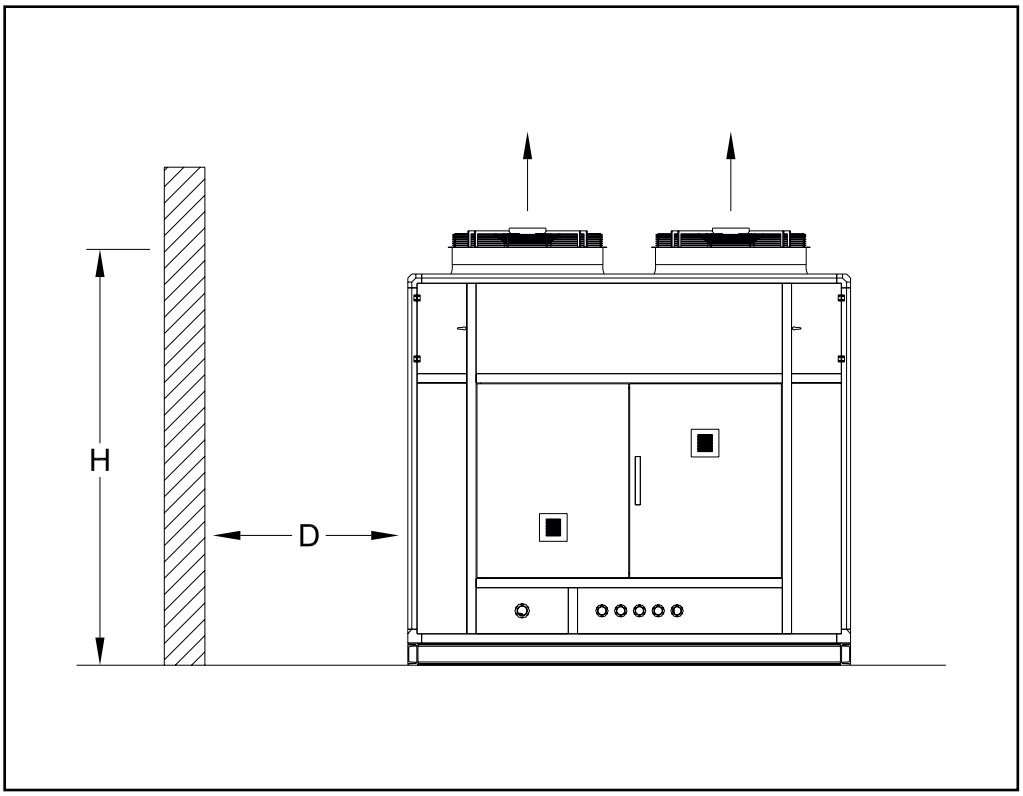


Figure 4, Coil and Fan Arrangement

Figure 5, Coil and Fan Arrangement



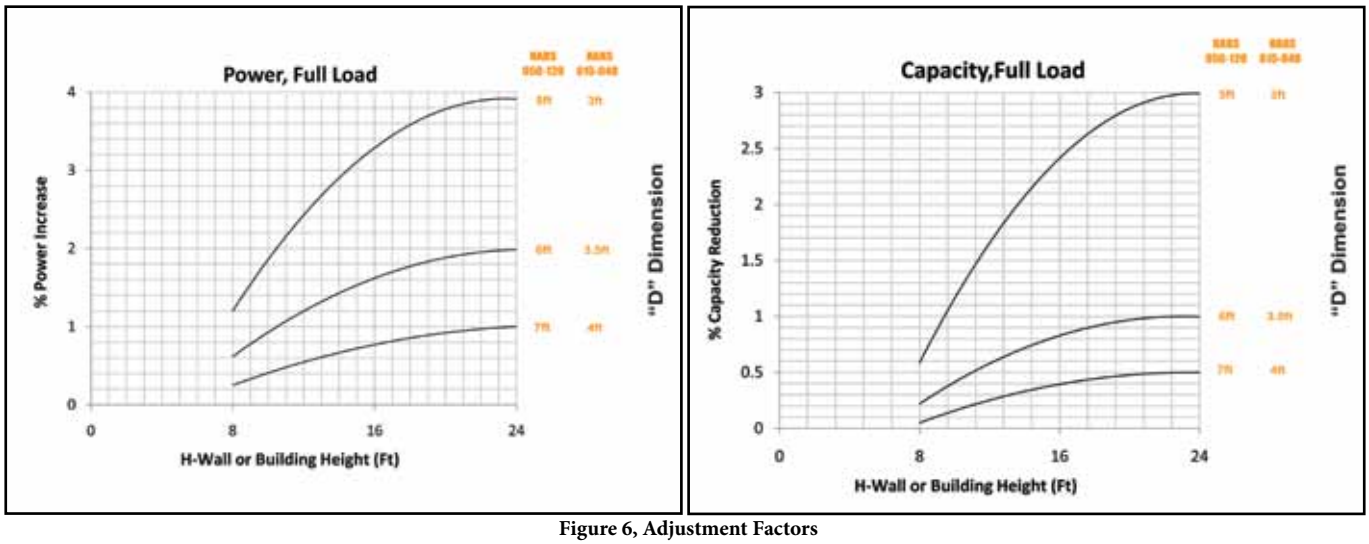


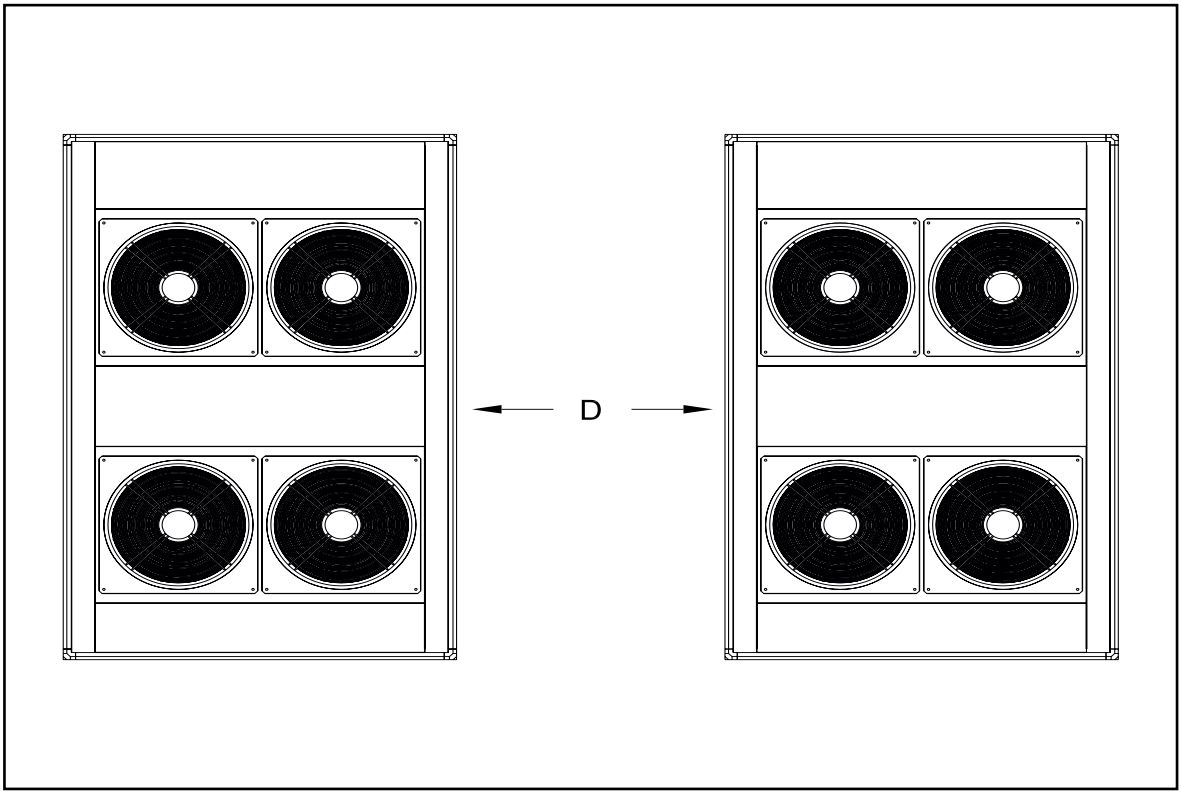
Figure 6, Adjustment Factors

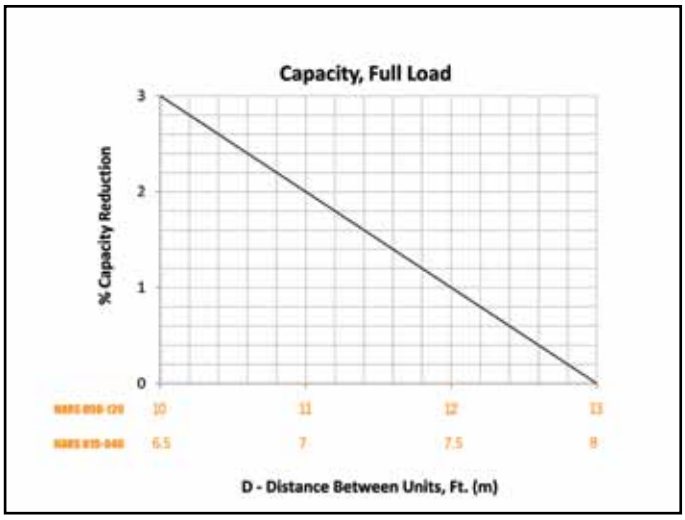
Case 1, Building or Wall on One Side of One Unit

The existence of a screening wall or the wall of a building in close proximity to an air cooled unit is common in both rooftop and ground level applications. Hot air recirculation on the coils adjoining the wall will increase compressor discharge pressure, decreasing capacity and increasing power consumption. Only the compressor(s) connected to these coils will be affected. Circuits opposite the wall are unaffected.

When close to a wall, it is desirable to place the units on the North or East side of them. It is also desirable to have prevailing winds blowing parallel to the unit's long axis. The worst case is to have wind blowing hot discharge air into the wall.

Figure 7, Two Units Side by Side





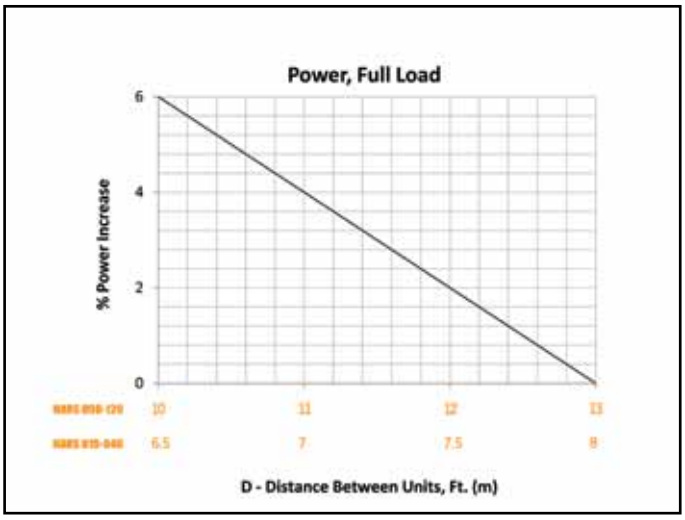


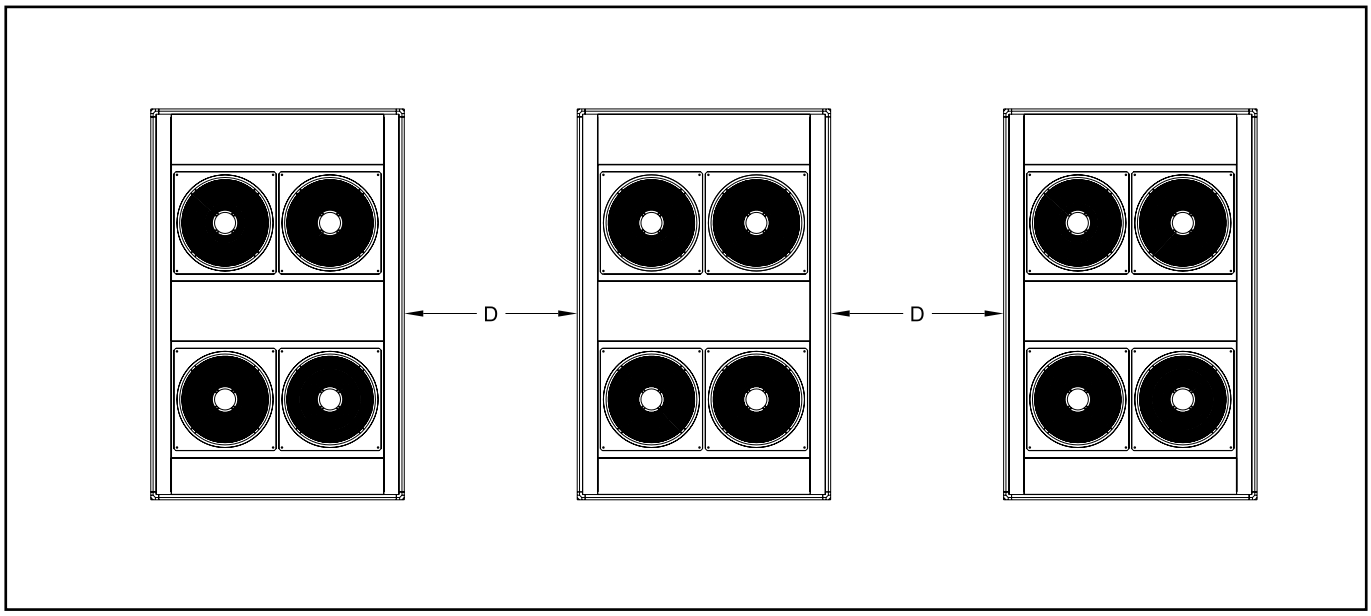
Figure 8, Adjustment Factors

Case 2, Two Units Side By Side

Two or more units sited side by side are common. If spaced closer than 12 feet (3.7 meters) or 8 feet (2.5meters) depending on size, it is necessary to adjust the performance of each unit; circuits adjoining each other are affected. NOTE: This case applies only to two units side by side. See Case 3 for three or more parallel units. If one of the two units also has awall adjoining it, see Case 1. Add the two adjustment factors together and apply to the unit located between the wall and the other unit.

Mounting units end to end will not necessitate adjusting performance. Depending on theactual arrangement, sufficient space must be left between the units for access to the control panel door opening and/or evaporator tube removal. See “Clearance” section of this guide for requirements for specific units.

Figure 9, Three or More Units



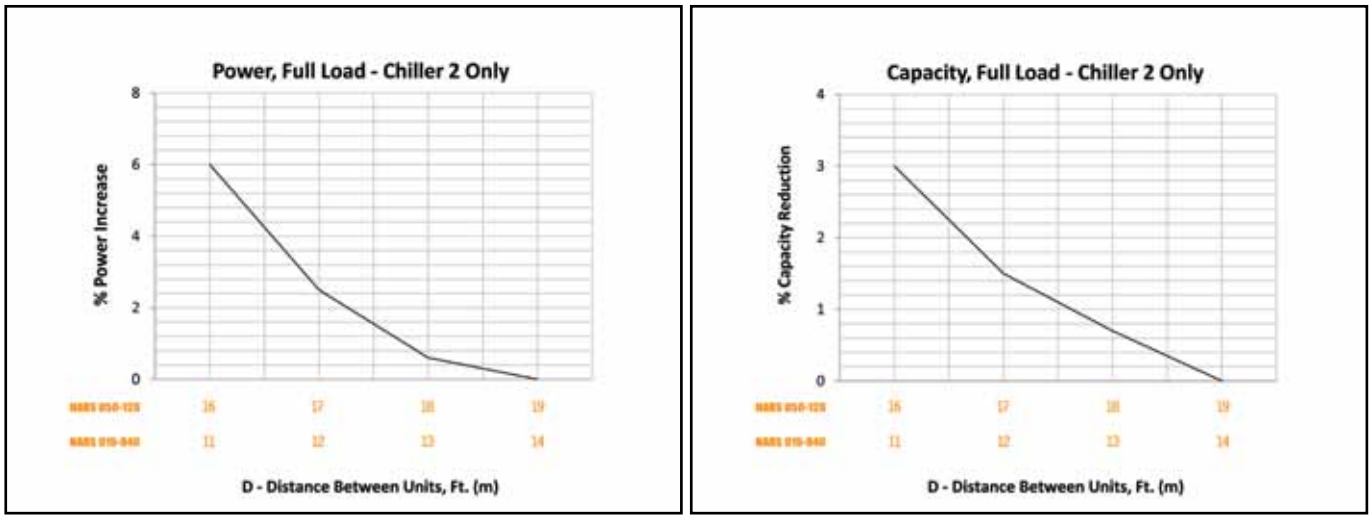


Figure 10, Adjustment Factors

Case 3, Three or More Units Side By Side

When three or more units are side by side, the outside units (1 and 3 in this case) are influenced by the middle unit only on their inside circuits. Their adjustment factors will bethe same as Case 2. All inside units (only number 2 in this case) are influenced on bothsides and must be adjusted by the factors shown below.

Figure 8, Adjustment Factor