Russell

Multicon

Air Cooled Condenser

Catalog 400.10
April 1996

3/4 thru 216
Nominal tons
Vertical and
Horizontal

General

Russell's Multicon condensers are designed to provide the optimum in heat transfer efficiency and are constructed for years of reliable performance. Available in 85 sizes, the Multicon condensers range in capacity from 3/4 to 216 nominal tons. Only the highest grades of commercially available aluminum, copper and galvanized steel go into the manufacturing of each Multicon air cooled condenser. After assembly every unit is closely inspected before it is securely crated to ensure trouble free installation and operation.

VAC MODEL — 5 to 19 nominal tons

- Available in 10 sizes
- Direct drive
- Vertical discharge
- Optional horizontal discharge
- Galvanized steel casing

RAC MODEL — 3/4 to 3 nominal tons

- Available in 5 sizes
- Direct drive
- Vertical or horizontal discharge
- Galvanized steel casing

VAC MODEL — 22 to 216 nominal tons

- Available in 35 sizes
- Direct drive **1140 RPM motors**
- Vertical discharge
- Optional horizontal discharge
- Galvanized steel casing

VEQ MODEL — 21 to 189 nominal tons

- Available in 35 sizes
- Direct drive **850 RPM motors**
- Vertical discharge
- Optional horizontal discharge
- Galvanized steel casing

Features

COILS

- Coil fins are manufactured from die formed corrugated aluminum. The tubes are seamless 1/2" OD copper, arranged in a staggered pattern and mechanically expanded into the fins and tube sheets for optimum heat transfer efficiency.
- Headers are produced from heavy wall copper tubing, and are brazed to the coil using a high temperature brazing process.
- All coils are leak tested in an illuminated test tank at a pressure of 380 psig.

FAN / MOTOR

- All fans are sized for maximum energy efficiency, minimum noise, and are individually balanced to minimized vibration.
- All models have die stamped aluminum blades riveted to a galvanized steel spider assembly.
- Fan guards are fabricated from heavy gauge steel rod and epoxy coated.
- On multiple fan units, all fans are baffled to prevent short-circuiting of air during fan cycling.
- All VAC and VEQ motor assemblies are supported in all-welded, heavy gauge wire support structures. The wire structures are zinc-chromate coated for corrosion protection.
- All motors have built in thermal protection.
- Motors are available in the following voltages:
  RAC - 115/230/1/60, shaded pole
  VAC 5 thru 19 - 208/230/1/60, psc. Optional 460/1/60, 230/3/60 or 460/3/60.
  VAC 22 thru 216, VEQ 21 thru 189 - 208/230/460/3/60, open drip-proof

OPTIONS

- ***Fan cycling control*** — available with contactors and either ambient or head pressure sensors. Fan cycling, on double width VAC & VEQ motors can be supplied with individual contactors.
- ***Flooded condenser control*** — available using three-way modulating valves controlled by discharge pressure. Valves are shipped mounted.
- ***Motor fusing*** — available on all models. Motors can be fused individually or in pairs on double width units (not U.L. listed).
- ***Sub-cooling section*** — available as an integral part of the condenser.
- ***Fins*** — available in four options; aluminum, copper, polyester coated aluminum, and baked phenolic coated aluminum.
- ***Multiple system circuiting*** — available on RAC, VAC and VEQ models. (See page 6 for details.)
- **Variable speed fan control** — can be supplied on VAC models 5 thru 19.
- ***Hinged venturi panel(s)*** — can be provided on all VAC and VEQ models to allow for easy coil cleaning of the coil fins and quick access to the fan and motor assembly.
- ***Horizontal air discharge*** — available upon request. Contact Russell for details.
- ***Built-in power disconnect switch*** — available on all VAC and VEQ models.

Selections

For the proper selection of an air cooled condenser it is necessary to know the total heat rejection of the condenser. The Total Heat Rejection (THR) is equivalent to the sum of the Net Refrigerating Effect (NRE) plus the heat of compression added by the compressor. The amount of heat added to the refrigerant will depend on the style of compressor, open or suction cooled, and the operating conditions of the system.

Whenever the THR values are available from the compressor manufacturer they should be used in selecting a condenser.

For those cases in which the THR data is unavailable it can be quickly estimated using the following equation and the appropriate factor from Tables 1 or 2.

Eq. (1) THR = Compressor Capacity x Heat Rejection Factor

In those cases where the refrigeration system is of a multiple or cascade style, the following equations should be used to estimate the total heat rejection.

Open Compressor

Eq. (2) THR = Compressor Capacity + (2545 x BHP)

Suction Cooled Compressor

Eq. (3) THR = Compressor Capacity + (3413 x KW)

Altitude at which a condenser is to operate will also affect its capacity. In order to correctly select a condenser at a specific altitude, use the following equation and the appropriate correction factor from Table 3.

Eq. (4) $THR_{Corr.} = THR_{Design} \times$ Altitude Correction Factor

Selection Example

Given:

Altitude ..... 5000 ft.
Ambient Temperature ..... 90°F
Evaporator Temperature ..... 20°F
Maximum Condensing Temperature ..... 110°F
Refrigerant R-22
Compressor Capacity (NRE) ..... 225,000 BTUH
Compressor Type ..... Suction Cooled
Assume compressor THR is not available

Calculate:

1. Total Heat Rejection
2. Design temperature difference
3. Russell condenser size
4. Actual system TD
5. Actual condensing temperature

Solution:

1. Calculate the system THR from Table 2, a suction cooled compressor, at 110°F condensing temperature and 20°F evaporator temperature, will have a heat rejection factor of 1.33.
   THR = Compressor Capacity x Heat Rejection Factor
   THR = 299,250 BTUH
   $THR_{Corrected\ Altitude}$ = THR x Altitude Corr. Factor
   $THR_{Corrected\ Altitude}$ = 336,656 BTUH
2. Design TD = Condensing Temp. - Ambient Temp.
   Design TD = 20°F
3. Select condenser size:
   From Table 5 on page 6 locate the R-22 section of the table. Then, using the TD of 20°F calculated in Step 2, go to the appropriate column and select a condenser whose THR equals or exceeds that of which we calculated in Step 1, 336,656, BTUH.
   A model VAC-35 with a THR of 357,100 BTUH will meet the required conditions.
4. Eq.(5) $\text{Actual TD} = \dfrac{\text{Design TD x Design THR}}{\text{Actual Condenser Capacity at Design TD}}$
   Actual TD = 18.9°F
5. Eq.(6) Actual Condensing Temp. = Actual TD + Ambient Temp.
   Actual Condensing Temp. = 108.9°F

HEAT REJECTION FACTORS

TABLE 1 - OPEN COMPRESSOR

EVAP. TEMP.	CONDENSING TEMPERATURE							
	90°	100°	105°	110°	115°	120°	125°	130°
-40°	1.45	1.48	1.52	1.56	1.58	1.61		
-35°	1.42	1.45	1.47	1.51	1.54	1.57		
-30°	1.39	1.41	1.44	1.47	1.50	1.53		
-25°	1.37	1.39	1.41	1.44	1.46	1.49	1.52	
-20°	1.34	1.37	1.39	1.41	1.43	1.45	1.48	1.51
-15°	1.31	1.34	1.37	1.38	1.40	1.42	1.45	1.47
-10°	1.28	1.31	1.33	1.37	1.38	1.40	1.42	1.45
0°	1.24	1.28	1.29	1.32	1.33	1.35	1.38	1.41
10°	1.21	1.24	1.26	1.28	1.30	1.31	1.34	1.36
20°	1.18	1.21	1.23	1.24	1.26	1.28	1.30	1.32
30°	1.15	1.18	1.20	1.21	1.23	1.24	1.26	1.28
40°	1.13	1.15	1.17	1.18	1.19	1.20	1.22	1.24
50°	1.11	1.13	1.14	1.15	1.16	1.17	1.18	1.20

TABLE 2 - SUCTION COOLED COMPRESSOR

EVAP. TEMP.	CONDENSING TEMPERATURE							
	90°	100°	105°	110°	115°	120°	125°	130°
-40°	1.67	1.71	1.75	1.79	1.84	1.90		
-35°	1.63	1.67	1.70	1.73	1.78	1.83		
-30°	1.58	1.62	1.65	1.68	1.72	1.77		
-25°	1.54	1.58	1.60	1.64	1.67	1.71	1.76	
-20°	1.49	1.53	1.56	1.58	1.63	1.66	1.70	1.75
-15°	1.46	1.50	1.52	1.54	1.58	1.62	1.65	1.69
-10°	1.42	1.46	1.48	1.50	1.53	1.57	1.62	1.64
0°	1.36	1.40	1.42	1.44	1.47	1.50	1.54	1.56
10°	1.31	1.34	1.36	1.38	1.40	1.43	1.47	1.49
20°	1.26	1.29	1.31	1.33	1.35	1.37	1.40	1.43
30°	1.22	1.25	1.26	1.28	1.30	1.32	1.35	1.37
40°	1.18	1.21	1.22	1.24	1.25	1.27	1.30	1.32
50°	1.14	1.17	1.18	1.20	1.21	1.23	1.25	1.27

Multi-circuiting

Russell's "Multicon" condensers have the inherent capability of allowing multiple refrigeration systems to be connected to a single condenser. Multi-circuiting is available on all RAC, VAC and VEQ model condensers.

Each system on the condenser will be properly circuited to ensure even distribution of refrigerant throughout the circuits. Hot gas inlet and liquid outlet connections will be supplied for each system and will be properly identified for easy hookup on site.

Please note that all system numbers must be in numerical sequence when ordering a multi-circuited condenser, as the connection on the condenser will be installed in numerical sequence. The number 1 circuit will be located at the left hand side of the header when facing the header end of the unit, with all other circuits following the sequence to the right.

An example is provided to assist you in the selection of a multi-circuited condenser. Our application engineering department is also available to make the selection for your specific requirements. For copies of the multi-circuiting worksheets contact your local Russell representative and request form MC-4.

EXAMPLE

Given:

Number of refrigerant systems.
Compressor type - Suction cooled
Altitude - 5000 feet
Ambient - 95°F

See Table 4 for Refr. Type, Evap. Temp., Condensing Temp. and Compressor Capacity for each system.

Calculation:

1. As the THR is not given, select for each system the heat rejection factor for the appropriate style of compressor from Table 1 or 2, and enter the factors in column F. Note: If the compressor's THR is available enter it in column E and enter 1.0 in column F.
2. From Table 3, select the altitude correction factor for 5000 feet elevation and enter it in column G.
3. Calculate the design TD using the following equation 7, and enter the design TD in column H.

   Eq. (7) TD design = Cond. Temp. - Design ambient.
4. Calculate the corrected THR at 1°F by multiplying columns E, F and G, then divide the total by column H. Enter the result in column I.
5. Calculate the total required THR by adding the values in column I and entering the result at the bottom of the column.

   Example: THR = 22685 BTUH
6. Using R-22 and the THR from the bottom of column I, select a model from the 1°F TD column of Table 5.

   Example: A Model VAC-55 with a THR of 25.4 using R-22 will provide the required THR.
7. From Table 11 select the capacity per circuit for the model selected in step 6 and enter it in column J.
8. Calculate the number of circuits required by dividing column I by column J. Enter the result in column K.
9. In column K assign the number of circuits required for each system. If the fractional part of the circuits in column K is less than 10% of the whole number, then drop the fraction and enter the whole number in column L.
   When the fraction is greater than 10% of the whole number, then round it off to the next whole number and enter it in column K.
10. Total column L and enter it at the bottom of the column. If the total number of circuits exceeds the maximum number of circuits available, for the condenser model selected (see Table 10), then it may be necessary to allow a higher condensing temperature for one or two of the systems.. If this is not acceptable it will be necessary to select a larger condenser and recalculate the circuits by repeating steps 6 through 10.
11. Calculate the actual TD for each circuit using equation 8.

    Eq. (8) TD Actual = TD $\frac{\text{Design x No. of Circ. Req'd.}}{\text{No. of Circ. assigned}}$

TABLE 3 - ALTITUDE CORRECTION FACTOR (FT)

Altitude	Sea Level	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
Factor	1.0	1.029	1.052	1.076	1.101	1.125	1.151	1.177	1.204	1.231	1.260

TABLE 4

(A)	(B)	(C)	(D)	(E)	X	(F)	X	(G)	÷	(H)	=	(I)	÷	(J)	=	(K)	(L)	(M)
SYST. NO.	REFR. TYPE	EVAP. TEMP.	COND. TEMP.	COMP. CAP. BTUH NRE	X	COMP. HEAT REJ. FACT. (Table 1 or 2)	X	ALTITUDE CORR. FACTOR (Table 3)	÷	DESIGN T.D.	=	CORRECTED THR BTUH/1°T.D.	÷	CAP. PER CIRCUIT BTUH/1°T.D. (Table 11)	=	NO. CIRC. REQ'D	NO. CIRC. REQ'D	ACTUAL T.D.
1	22	20	115	15000	X	1.35	X	1.125	÷	20	=	1139	÷	968	=	1.2	2	12.0
2	22	10	110	26000	X	1.38	X	1.125	÷	15	=	2691	÷	968	=	2.8	3	14.0
3	22	50	125	240000	X	1.25	X	1.125	÷	30	=	11250	÷	1017	=	11.1	11	30.3
4	502	-10	110	34000	X	1.50	X	1.125	÷	15	=	3825	÷	999	=	3.8	4	14.3
5	502	-25	105	21000	X	1.60	X	1.125	÷	10	=	3780	÷	999	=	3.8	4	9.5
TOTAL												22685					24	

Capacities

TABLE 5 - CONDENSER CAPACITIES (MBH)

MODEL NUMBER	R-404A REFRIGERANT* T.D. 10°	20°	30°	R-22 REFRIGERANT T.D. 10°	20°	30°
"RAC" MODELS						
RAC 3/4	4.3	8.7	13.0	4.4	8.8	13.2
RAC 1	5.6	11.1	16.7	5.7	11.3	17.0
RAC 1-1/2	8.0	16.1	24.1	8.2	16.4	24.6
RAC 2	10.3	20.6	31.0	10.5	21.0	31.5
RAC 3	15.1	30.1	45.2	15.3	30.7	46.0
"VAC" SINGLE FAN WIDTH MODELS						
VAC 5	26.6	53.3	79.9	27.1	54.2	81.3
VAC 6	29.2	58.4	87.6	29.7	59.5	89.2
VAC 7	36.4	72.9	109.3	37.1	74.2	111.2
VAC 8	43.4	86.9	130.3	44.2	88.4	132.7
VAC 9	46.7	93.5	140.2	47.6	95.2	142.7
VAC 11	56.0	112.1	168.1	57.0	114.1	171.1
VAC 13	73.7	147.4	221.1	75.0	150.0	225.0
VAC 15	77.6	155.2	232.8	79.0	158.0	237.0
VAC 17	91.3	182.7	274.0	93.0	185.9	278.9
VAC 19	96.3	192.6	288.9	98.0	196.0	294.0
VAC 22	115.6	231.2	346.8	117.6	235.3	352.9
VAC 25	123.8	247.7	371.5	126.0	252.1	378.1
VAC 29	134.2	268.3	402.5	136.6	273.1	409.7
VAC 31	149.6	299.3	448.9	152.3	304.6	456.9
VAC 35	175.4	350.9	526.3	178.6	357.1	535.7
VAC 42	201.2	402.5	603.7	204.8	409.7	614.5
VAC 48	225.0	450.0	674.9	229.0	458.0	687.0
VAC 55	249.7	499.5	749.2	254.2	508.4	762.6
VAC 58	268.3	536.6	805.0	273.1	546.2	819.3
VAC 62	299.3	598.6	897.8	304.6	609.2	913.8
VAC 67	332.3	664.6	996.9	338.2	676.5	1014.7
VAC 72	350.9	701.8	1052.6	357.1	714.3	1071.4
VAC 79	374.4	748.8	1123.2	380.7	761.3	1142.0
VAC 84	415.6	1039.0	1246.7	422.5	845.0	1267.5
VAC 90	438.9	877.8	1316.8	446.3	892.5	1338.8
VAC 96	449.1	898.2	1347.3	456.8	913.6	1370.4
VAC 101	498.5	997.1	1495.6	507.0	1014.0	1521.0
VAC 108	526.7	1053.5	1580.2	535.6	1071.2	1606.8
"VAC" DOUBLE FAN WIDTH MODELS						
VAC 59	268.3	536.6	805.0	273.1	546.2	819.3
VAC 63	299.3	598.6	897.8	304.6	609.2	913.8
VAC 68	332.3	664.6	996.9	338.2	676.5	1014.7
VAC 73	350.9	701.8	1052.6	357.1	714.3	1071.4
VAC 83	402.5	805.0	1207.4	409.7	819.3	1229.0
VAC 95	459.2	918.5	1377.7	467.4	934.9	1402.3
VAC 102	498.5	996.9	1495.4	507.3	1014.7	1522.0
VAC 116	536.6	1073.3	1609.9	546.2	1092.4	1638.6
VAC 127	598.6	1197.1	1795.7	609.2	1218.5	1827.7
VAC 134	664.6	1329.2	1993.8	676.5	1352.9	2029.4
VAC 144	701.8	1403.5	2105.3	714.3	1428.5	2142.8
VAC 158	748.8	1497.6	2246.4	761.3	1522.6	2283.9
VAC 168	831.1	1662.9	2493.3	845.0	1690.0	2535.0
VAC 180	877.8	1755.7	2633.5	892.5	1785.0	2677.5
VAC 190	898.3	1796.5	2694.9	913.6	1827.2	2740.8
VAC 202	997.1	1994.2	2991.3	1014.0	2028.0	3042.0
VAC 216	1053.5	2107.0	3160.5	1071.2	2142.4	3213.6

* Also R-507, R-502.

MODEL NUMBER	R-404A REFRIGERANT T.D. 10°	20°	30°	R-22 REFRIGERANT T.D. 10°	20°	30°
"VEQ" SINGLE FAN WIDTH MODELS						
VEQ-21	101.0	202.1	303.1	102.9	205.8	308.7
VEQ-23	108.3	216.5	324.8	110.2	220.5	330.7
VEQ-24	117.4	234.7	352.1	119.5	239.0	358.5
VEQ-27	130.8	261.7	392.5	133.2	266.5	399.7
VEQ-32	153.4	306.9	400.3	156.3	312.5	468.8
VEQ-36	176.0	351.9	527.9	179.2	358.4	537.5
VEQ-40	196.7	393.5	590.2	200.3	400.7	601.0
VEQ-45	218.4	436.8	655.2	222.4	444.8	667.2
VEQ-49	234.6	469.3	703.9	238.9	477.9	716.8
VEQ-54	261.7	523.4	785.1	266.5	533.0	799.5
VEQ-60	290.6	581.1	871.7	295.9	591.8	887.7
VEQ-64	306.8	613.6	920.4	312.4	624.8	937.3
VEQ-69	327.1	654.2	981.2	333.1	666.1	999.2
VEQ-75	363.0	726.0	1089.0	369.6	739.3	1108.9
VEQ-80	383.4	766.9	1150.3	390.5	780.9	1171.4
VEQ-81	392.5	784.9	1177.4	399.7	799.3	1199.0
VEQ-89	435.6	871.2	1306.8	443.6	887.1	1330.7
VEQ-94	460.2	920.3	1380.5	468.6	937.2	1405.8
"VEQ" DOUBLE FAN WIDTH MODELS						
VEQ-50	234.6	469.3	703.9	238.9	477.9	716.8
VEQ-56	261.7	529.4	785.1	266.5	533.0	799.5
VEQ-61	290.6	581.1	871.7	295.9	591.8	887.7
VEQ-65	306.8	613.6	920.4	312.4	624.8	937.3
VEQ-74	352.0	704.0	1056.0	358.4	716.9	1075.3
VEQ-82	401.6	803.1	1204.7	408.9	817.8	1226.8
VEQ-91	435.8	871.7	1307.5	443.8	887.7	1331.5
VEQ-97	469.3	935.5	1407.8	477.9	955.7	1433.6
VEQ-107	523.4	1046.8	1570.2	533.0	1066.0	1599.0
VEQ-119	581.2	1162.4	1743.6	591.9	1183.7	1775.6
VEQ-126	613.7	1227.4	1841.1	624.9	1249.9	1874.8
VEQ-135	654.1	1308.1	1962.2	666.1	1332.1	1998.2
VEQ-149	726.0	1452.0	2177.9	739.3	1478.6	2217.8
VEQ-157	766.8	1533.6	2300.4	780.8	1561.7	2342.5
VEQ-161	784.9	1569.8	2354.7	799.3	1598.6	2397.9
VEQ-179	871.2	1742.3	2613.5	887.1	1774.3	2661.4
VEQ-189	920.3	1840.6	2760.9	937.2	1874.4	2811.5

All capacities are in MBH. (MBH x 1000 = BtuH)

For R-12, 134a ratings, multiply R-22 ratings by .95.

For R-502, R-507 ratings, use R-404A data.

NOTE:

Standard circuiting of condensers are based on the following conditions:

25° T.D. for R-22
20° T.D. for R-12 & R-134a
15° T.D. for R-502 & R-404A

If T.D. used to select a given condenser is different from above conditions, those conditions must be given at time of order. This will allow for checking of the internal coil circuiting to optimize refrigerant pressure drop and performance for the specific application.

Low Ambient Head Pressure Controls

LOW AMBIENT HEAD PRESSURE CONTROLS

A decrease in ambient air temperature results in a capacity increase in the air cooled condenser. This capacity increase is directly proportional to the temperature difference (TD) between the condensing temperature and the temperature of the ambient air entering the condenser. Since most refrigerating and air conditioning systems are designed for summer operation, it follows that when the same system operates under low ambients resulting from seasonal changes there occurs an increase in the condenser capacity, with a consequent reduction in the system head pressure. If the head pressure drops below the point where the expansion valve can properly feed the evaporator, inefficient system operation will result.

To maintain adequate head pressure in the condenser under low ambient conditions, Russell offers two basic control methods: (1) fan cycling on multiple fan units; (2) flooding the condenser with liquid refrigerant.

FAN CYCLING HEAD PRESSURE CONTROL

The fan cycling head pressure control option is available on all multiple fan condenser models. This option offers satisfactory head pressure control to minimum ambients as low as 18°F on some models. See table 6 for specific details on minimum ambients and field thermostat settings.

The control package consists of factory wired weathertight control box. Each fan is individually sectioned off to prevent air bypass. All control options are UL listed and consist of the following:

- **Ambient control** consists of 1 to 5 thermostats. On VAC and VEQ models the sensing bulbs are mounted in a specially designed sensing well that uses the condenser fan to move the ambient air over the sensing bulb of the thermostats. All fans, except for the first fan(s) closest to the header, will cycle.
- **Pressure control** consists of pressure stats which cycle the fans in response to the head pressure.
- **Ambient and pressure control** consists of 1 to 5 thermostats which cycle all but the closest fan(s) to the header end, which are cycled by pressure stats.
- **Control voltage** is 208-230V as standard. Optional 115V or 24V control voltages are available upon request.
- **Additional motor protection** can be supplied via fuses or circuit breakers. On all double fan width units, motors are protected in pairs, but optional individual motor protection is also available.

TABLE 6

DESIGN TD	MINIMUM OUTSIDE AIR TEMPERTURE AT PERCENT COMPRESSOR CAPACITY SHOWN																			
	1 x 2 & 2 x 2 FAN UNITS				1 x 3 & 2 x 3 FAN UNITS				1 x 4 & 2 x 4 FAN UNITS				1 x 5 & 2 x 5 FAN UNITS				1 x 6 & 2 x 6 FAN UNITS			
	100	75	50	25	100	75	50	25	100	75	50	25	100	75	50	25	100	75	50	25
30	35	39	42	56	15	24	32	51	-2	11	24	47	-17	0	16	43	-30	-10	10	40
25	45	46	47	58	27	33	38	54	13	22	31	51	1	13	25	48	-10	5	20	45
20	54	53	52	61	40	42	45	57	28	33	39	54	19	26	34	52	10	20	30	50
15	63	60	56	63	52	51	51	60	44	45	47	58	36	40	43	57	30	35	40	55
10	72	66	61	65	62	61	57	64	59	57	54	62	54	53	52	61	50	50	50	60

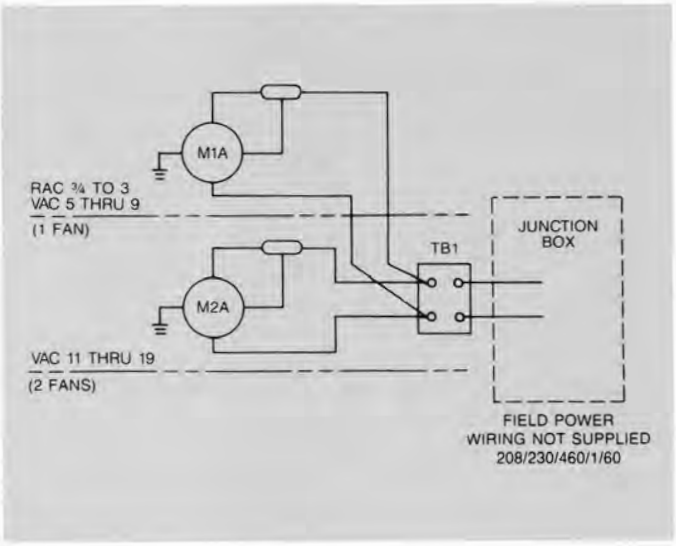

FIGURE 1: VAC 5 THRU 19 single phase wiring without fan cycling control.

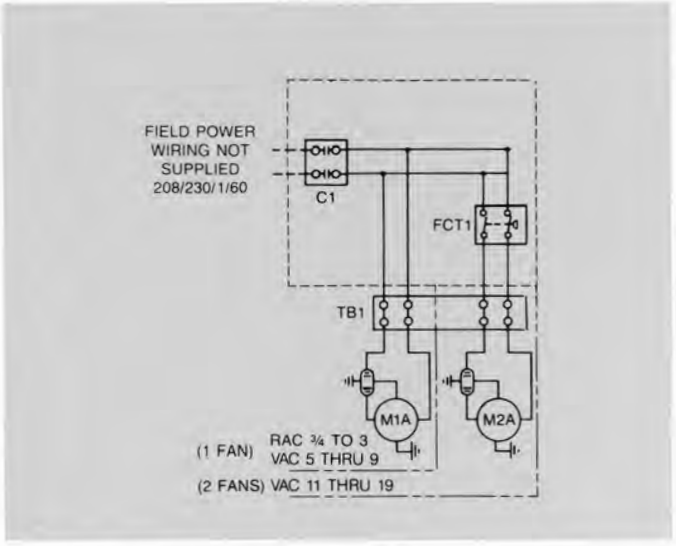

FIGURE 2: VAC 5 THRU 19 single phase wiring with fan cycling control.

Wiring Diagram continues

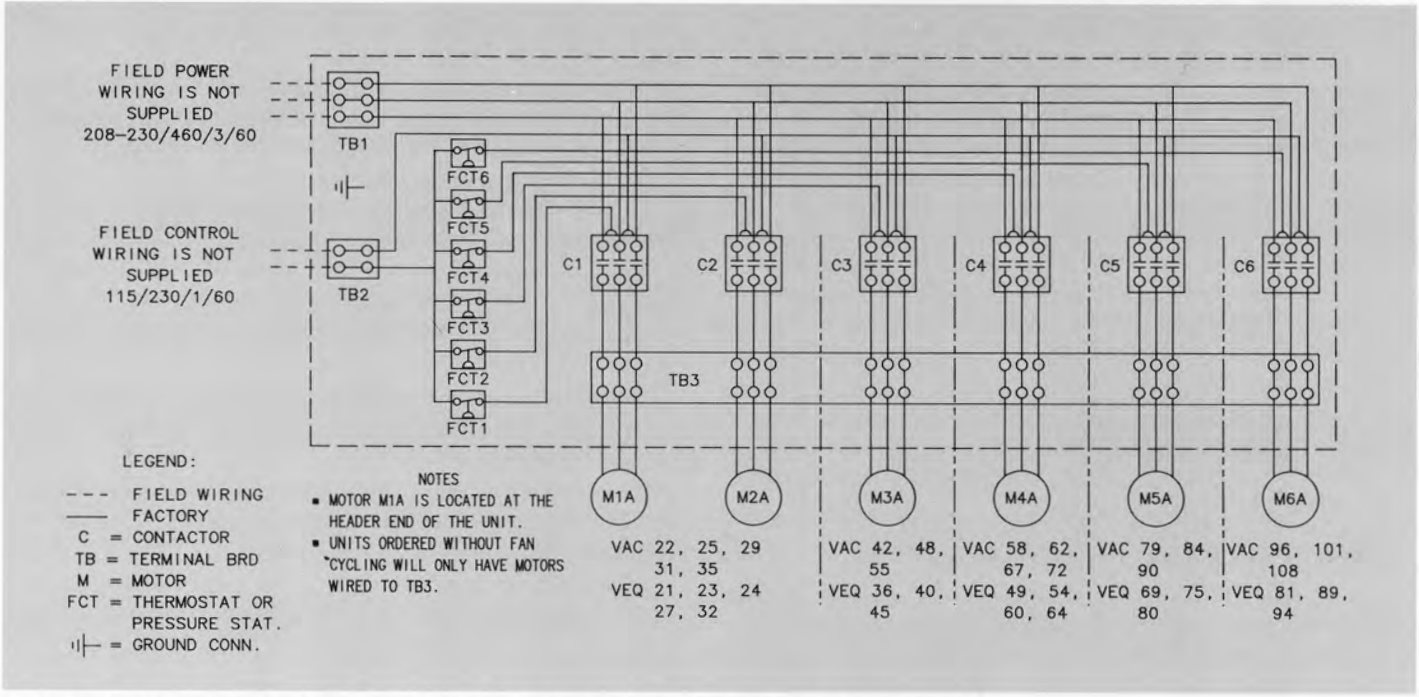

FIGURE 3: VAC and VEQ 3 phase wiring diagram for single row fan models with fan control.

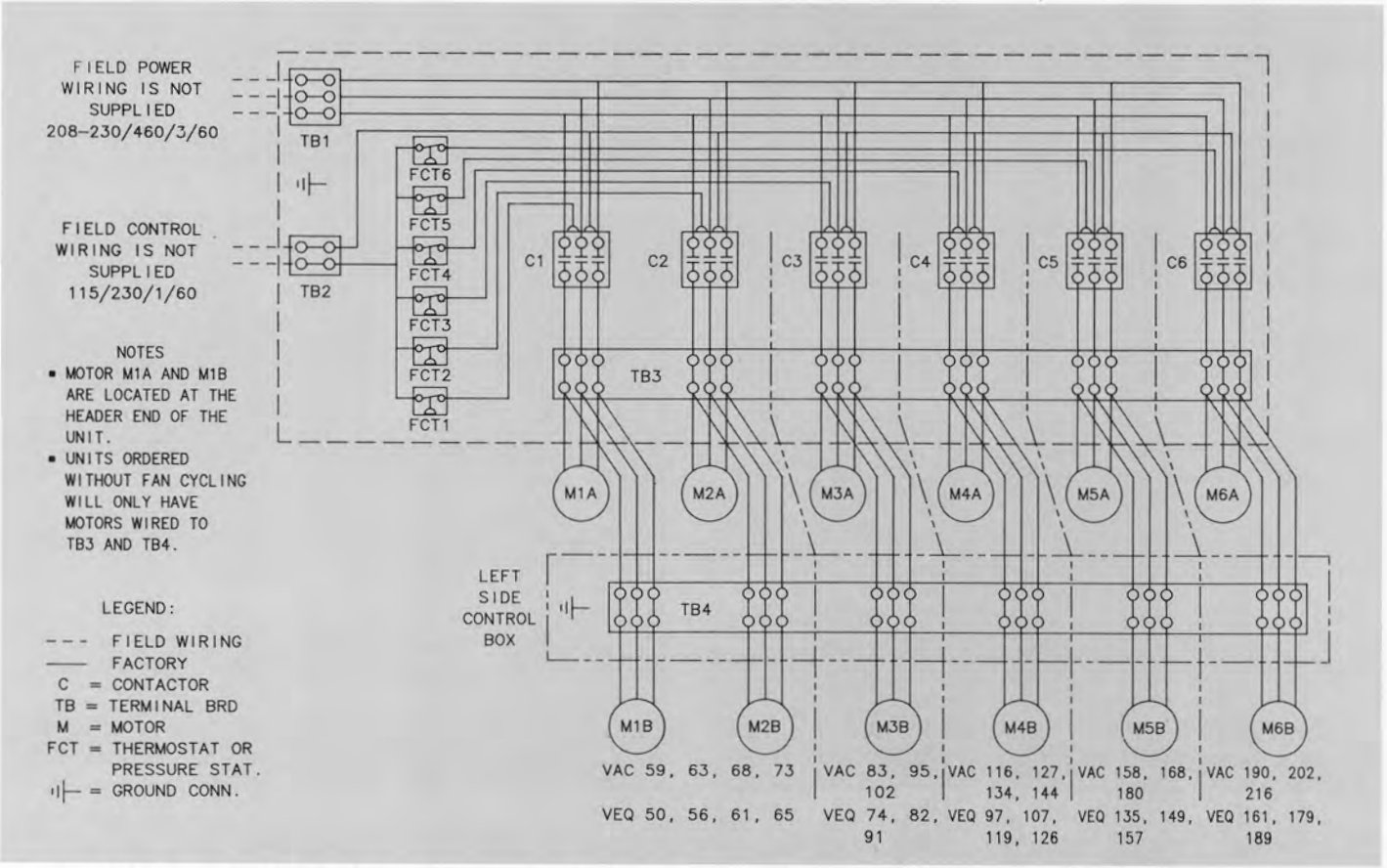

FIGURE 4: VAC and VEQ 3 phase wiring diagram for double row fan models with fan control.

Flooded-type Head Pressure Controls

The Russell condenser-flooding type of low ambient head pressure control consists of a combination of modulating pressure sensitive valve(s) mounted to the liquid and hot gas headers. (See Figures 5 and 6).

How the Valves Work

Under the normal summer ambient design conditions the liquid side of the valve remains fully open and the hot-gas side fully closed, thus offering no interference with the design operation of the system. Under conditions of reduced loads and/or cold ambient temperatures, the liquid side valve remains closed on start-up, causing the condenser to flood, thus reducing the effective condenser surface area. Flooding continues until the condenser pressure reaches the pressure of the valve setting. The gas side valve, meanwhile is open, allowing a portion of the hot discharge gas to flow directly into the receiver, maintaining in the receiver the high side pressure required for proper valve operation and prevention of compressor short-cycling. Once the desired pressure is reached in the condenser, the valve(s) modulate to maintain adequate high-side pressure regardless of outside ambient temperature conditions.

Valve Selection

Because different refrigerants have varying pressure-temperature characteristics and require different flow rates to produce given refrigeration tonnages, the valve ratings are based on net refrigerating tons at the evaporator. The psig settings are based on the type of refrigerant to be used in the system.

Select valves from Table 7. **Do not undersize.**

TABLE 7

FLOODED CONTROL VALVE SELECTIONS

MODEL	MAXIMUM CAPACITY TON (NRE) (1)			QUANTITY OF	CONNECTION SIZE (2)	
	134a	R-22	R-404A	VALVES	HOT-GAS	LIQUID
A	15	21	12	1	7/8" ODS	5/8" ODS
B	30	42	24	2	1-3/8" ODS	7/8" ODS
C	45	63	36	3	1-5/8" ODS	1-1/8" ODS
D	60	84	42	4	2-1/8" ODS	1-3/8" ODS
E	75	105	60	4	2-5/8" ODS	1-3/8" ODS
F	90	126	72	6	2-5/8" ODS	1-5/8" ODS
G	105	147	84	7	2-5/8" ODS	1-5/8" ODS
H	120	168	96	8	2-5/8" ODS	1-5/8" ODS
I	135	189	108	9	2-5/8" ODS	1-5/8" ODS
J	150	210	120	10	2-5/8" ODS	1-5/8" ODS

TABLE 8

VALVE SETTING (PSIG)

REFRIGERANT	LIQUID SIDE	HOT GAS SIDE (3)
134a	100	20
R-22	180	20
R-404A	180	20

Note: (1) Valve Capacity is based on net refrigeration effect at the evaporator.
(2) See Figure 6 for pipe arrangement of multiple valve systems.
(3) Pressure difference between discharge line and receiver.
(4) When ordering a flooding control package, specify refrigeration type by adding the refrigerant code to the valve model number. R-22 = 2, 134a = 1, R-502 = 2 (Example: C-2).

Valve Installation

Figure 5 shows a typical installation of the condenser flooding low ambient control valve. Due to the tight seating arrangement of the valve, an auxiliary check valve in the liquid drain line to prevent refrigerant migration from the warm receiver to the cold condenser is not required under normal circumstances. Migration can occur only if the receiver pressure increases above the valve setting — where the receiver is located in an ambient of 90°F. or higher and the condenser in a lower ambient.

When condenser flooding valves are used, careful selection of the receiver is most important. Receiver pump-down capacity must equal or exceed the total refrigerant charge required in the system, including flooded condenser (see Page 10). Under all low ambient conditions, receivers should be located indoors in a warm area or, if outdoors, insulated and heated to a thermostatically controlled 60° to 65° temperature. Such heater(s) should be wired in parallel with the compressor crankcase heater, so it functions only during compressor off-cycle.

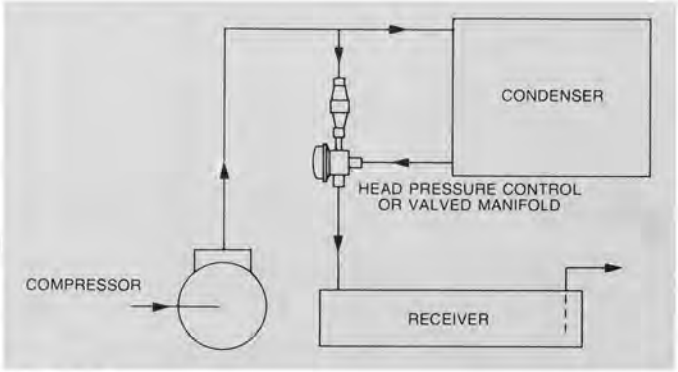

FIGURE 5

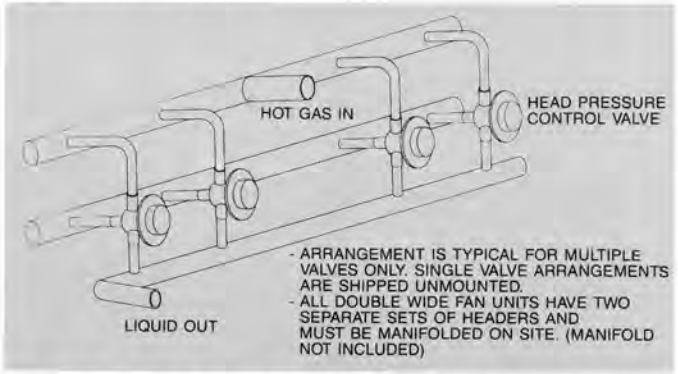

FIGURE 6: 4 valve arrangement shown. Valve quantity may vary from 2 to 10.

Refrigerant Charge

REFRIGERANT CHARGE

The summer design refrigerant charge necessary for effective system operation is the sum of operating charge for the evaporator, refrigerant piping (suction, liquid and discharge lines), condenser and receiver. The pump-down capacity of the receiver should be somewhat greater (10% to 15%) than the total refrigerant charge required. When using the Russell low ambient control system, additional refrigerant, over and above the summer design system charge, must be added to the system to allow for condenser flooding. The amount of this added charge is determined by the ambient in which the condenser will operate. Table 9 lists the total unit charge for all Russell single systems.

For calculating the refrigerant charge for each compressor system or condenser follow the example below:

Given:
VAC-55 (3 fans long)
Design TD: 20°F
Flooded control, no fan cycling
R-22
Minimum design ambient: 40°F

Solution:

1. Select the total charge from Table 9 for a VAC-55 condenser, using R-22 refrigerant.
2. Select the appropriate correction factor from Table 10 for the ambient temperature range at time of charging.
3. Use Equation (9) to calculate the total unit charge for the condenser.

Eq. 9:
System Cond. Chg. = total unit charge x correction factor
System Cond. Chg. = 36.4 x 3.0
System Cond. Chg. = 109.2 lbs.

For multiple system condensers use the same procedure above, except in step 1 use the charge per circuit value from Table 9 instead of the total unit charge and multiply by the number of circuits for each system.

For refrigerant line sizing see Pages 26-29 of Russell's refrigeration engineering manual.

TABLE 9
REFRIGERANT WEIGHTS, TOTAL AND PER CIRCUIT (LBS)

MODEL	MAX CIR QTY	R-404A CHARGE PER CIRCUIT	R-404A TOTAL UNIT CHARGE	R-22 CHARGE PER CIRCUIT	R-22 TOTAL UNIT CHARGE
"RAC" MODELS					
RAC 3/4	12	0.11	1.4	0.11	1.4
RAC 1	12	0.21	2.5	0.21	2.5
RAC 1-1/2	12	0.18	2.2	0.18	2.2
RAC 2	12	0.27	3.3	0.27	3.3
RAC 3	12	0.37	4.4	0.37	4.4
"VAC" SINGLE FAN WIDTH MODELS					
VAC 5	30	0.11	3.5	0.11	3.3
VAC 6	30	0.11	3.5	0.11	3.3
VAC 7	22	0.28	6.1	0.23	6.0
VAC 8	30	0.23	7.0	0.22	6.6
VAC 9	30	0.23	7.0	0.22	6.6
VAC 11	30	0.22	6.6	0.21	6.2
VAC 13	22	0.45	9.8	0.43	9.4
VAC 15	22	0.45	9.8	0.43	9.4
VAC 17	30	0.44	13.1	0.42	12.5
VAC 19	25	0.65	16.3	0.63	15.7
VAC 22, VEQ 21	22	0.68	15.0	0.67	14.7
VAC 25, VEQ 23	22	0.68	15.0	0.67	14.7
VAC 29, VEQ 24	22	0.68	15.0	0.67	14.7
VAC 31, VEQ 27	30	0.67	20.2	0.66	19.7
VAC 35, VEQ 32	25	1.00	24.8	0.98	24.6
VAC 42, VEQ 36	22	1.01	22.1	0.99	21.9
VAC 48, VEQ 40	30	0.98	29.5	0.97	29.1
VAC 55, VEQ 45	25	1.47	36.7	1.46	36.4
VAC 58, VEQ 49	22	1.34	29.4	1.32	29.0
VAC 62, VEQ 54	30	1.31	39.4	1.29	38.6
VAC 67, VEQ 60	25	1.96	48.9	1.93	48.3
VAC 72, VEQ 64	25	1.96	48.9	1.93	48.3
VAC 79, VEQ 69	30	1.63	48.9	1.60	48.1
VAC 84, VEQ 75	25	2.44	61.1	2.40	60.1
VAC 90, VEQ 80	25	2.44	61.1	2.40	60.1
VAC 96, VEQ 81	30	1.96	58.6	1.93	57.7
VAC 101, VEQ 89	25	2.93	73.2	2.88	72.1
VAC 108, VEQ 94	25	2.93	73.2	2.88	72.1

MODEL	MAX CIR QTY	R-404A CHARGE PER CIRCUIT	R-404A TOTAL UNIT CHARGE	R-22 CHARGE PER CIRCUIT	R-22 TOTAL UNIT CHARGE
"VAC" DOUBLE FAN WIDTH MODELS					
VAC 59, VEQ 50	44	0.67	29.8	0.67	29.5
VAC 63, VEQ 56	60	0.67	39.7	0.66	39.3
VAC 68, VEQ 61	50	1.00	49.4	0.98	49.1
VAC 73, VEQ 65	50	1.00	49.4	0.98	49.1
VAC 83, VEQ 74	44	1.00	44.3	0.99	43.7
VAC 95, VEQ 82	60	1.00	58.9	0.97	58.3
VAC 102, VEQ 91	50	1.47	73.6	1.46	72.8
VAC 116, VEQ 97	44	1.34	58.9	1.32	57.9
VAC 127, VEQ 107	60	1.31	78.7	1.29	77.2
VAC 134, VEQ 119	50	1.97	98.3	1.93	96.5
VAC 144, VEQ 126	50	1.97	98.3	1.93	96.5
VAC 158, VEQ 135	60	1.64	98.1	1.60	96.2
VAC 168, VEQ 149	50	2.46	122.8	2.40	120.2
VAC 180, VEQ 157	50	2.46	122.8	2.40	120.2
VAC 190, VEQ 161	60	1.95	117.7	1.93	115.4
VAC 202, VEQ 179	50	2.94	147.1	2.88	144.2
VAC 216, VEQ 189	50	2.94	147.1	2.88	144.2

For R-12 circuit or total charge multiply the R-22 values by 1.109.
For R-502 circuit or total charge use R-404A data.

Refrigerant Charge

TABLE 10 - REFRIGERANT CHARGE CORRECTION FACTOR WITH FLOODED-TYPE HEAD PRESSURE CONTROL

UNIT LENGTH*	DESIGN TD	MINIMUM DESIGN AMBIENT TEMPERATURE 60°	50°	40°	30°	20°	10°	0°	-10°	-20°
	WITHOUT FAN CYCLING									
ALL SIZES	30°	1.07	1.88	2.36	2.68	2.92	3.09	3.22	3.33	3.43
	25°	1.61	2.28	2.68	2.95	3.15	3.29	3.40	3.49	3.56
	20°	2.15	2.68	3.00	3.22	3.36	3.49	3.57	3.65	3.70
	15°	2.68	3.09	3.33	3.49	3.59	3.70	3.75	3.81	3.85
	10°	3.22	3.49	3.65	3.75	3.83	3.88	3.93	3.97	4.00
	WITH FAN CYCLING									
TWO FAN CELLS LONG	30°	1.03	1.05	1.07	1.60	1.99	2.28	2.50	2.68	2.83
	25°	1.05	1.07	1.60	2.06	2.37	2.60	2.80	2.95	3.09
	20°	1.05	1.60	2.15	2.50	2.76	2.95	3.11	3.22	3.32
	15°	1.60	2.28	2.68	2.95	3.15	3.29	3.41	3.49	3.62
	10°	2.50	2.95	3.22	3.41	3.53	3.60	6.69	3.75	3.81
THREE FAN CELLS LONG	30°	1.01	1.01	1.03	1.05	1.07	1.37	1.77	2.03	2.24
	25°	1.01	1.03	1.05	1.15	1.59	1.92	2.19	2.40	2.58
	20°	1.04	1.06	1.27	1.77	2.04	2.40	2.62	2.78	2.92
	15°	1.06	1.37	2.03	2.40	2.68	2.88	305.	3.17	3.28
	10°	1.78	2.40	2.78	3.05	3.22	2.34	3.46	3.53	3.61
FOUR FAN CELLS LONG	30°	1.01	1.01	1.01	1.02	1.04	1.06	1.23	1.54	1.79
	25°	1.01	1.01	1.03	1.05	1.07	1.43	1.74	2.01	2.21
	20°	1.02	1.04	1.07	1.23	1.67	2.01	2.33	2.46	2.62
	15°	1.05	1.07	1.54	2.01	2.33	2.58	2.75	2.92	3.05
	10°	1.23	2.01	2.46	2.75	2.98	3.15	3.27	3.37	3.45
FIVE FAN CELLS LONG	30°	1.00	1.00	1.00	1.00	1.00	1.01	1.01	1.06	1.36
	25°	1.00	1.00	1.00	1.00	1.00	1.01	1.04	1.63	1.85
	20°	1.00	1.00	1.00	1.01	1.20	1.63	2.07	2.19	2.36
	15°	1.01	1.01	1.12	1.63	2.03	2.32	2.52	2.72	2.87
	10°	1.01	1.65	2.13	2.46	2.72	2.92	3.10	3.23	3.33
SIX FAN CELLS LONG	30°	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.09
	25°	1.00	1.00	1.00	1.00	1.00	1.00	1.08	1.25	1.51
	20°	1.00	1.00	1.00	1.00	1.08	1.21	1.79	1.94	2.10
	15°	1.00	1.00	1.00	1.18	1.71	2.04	2.26	2.52	2.74
	10°	1.00	1.35	1.83	2.19	2.37	2.69	2.94	3.11	3.23

TABLE 11

CAPACITY PER CIRCUIT AT 1° F TD

MODEL	R-404A BTUH/ CIRCUIT	R-22 BTUH/ CIRCUIT
"RAC" MODELS		
RAC 3/4	36	37
RAC 1	47	47
RAC 1-1/2	67	68
RAC 2	86	88
RAC 3	126	128
"VAC" SINGLE FAN WIDTH MODELS		
VAC 5	89	90
VAC 6	97	99
VAC 7	165	169
VAC 8	145	147
VAC 9	156	159
VAC 11	187	190
VAC 13	335	341
VAC 15	353	359
VAC 17	304	310
VAC 19	385	392
VAC 22	526	535
VAC 25	563	573
VAC 29	610	621
VAC 31	499	508
VAC 35	702	714
VAC 42	915	931
VAC 48	750	763
VAC 55	999	1017
VAC 58	1220	1241
VAC 62	998	1015
VAC 67	1329	1353
VAC 72	1404	1429
VAC 79	1248	1269
VAC 84	1663	1690
VAC 90	1750	1785
VAC 96	1498	1523
VAC 101	1995	2028
VAC 108	2107	2142

For R-12 ratings, multiply R-22 ratings by .95.
For R-502 ratings, use R-404A data.

CAPACITY PER CIRCUIT AT 1° F TD

MODEL	R-404A BTUH/ CIRCUIT	R-22 BTUH/ CIRCUIT
"VAC" DOUBLE FAN WIDTH MODELS		
VAC 59	610	621
VAC 63	499	508
VAC 68	665	676
VAC 73	702	714
VAC 83	915	931
VAC 95	765	779
VAC 102	997	1015
VAC 116	1220	1241
VAC 127	997	1015
VAC 134	1329	1353
VAC 144	1404	1429
VAC 158	1248	1269
VAC 168	1662	1690
VAC 180	1756	1785
VAC 190	1497	1523
VAC 202	1994	2028
VAC 216	2107	2142

CAPACITY PER CIRCUIT AT 1° F TD

MODEL	R-404A BTUH/ CIRCUIT	R-22 BTUH/ CIRCUIT
"VEQ" SINGLE FAN WIDTH MODELS		
VEQ-21	459	468
VEQ-23	492	501
VEQ-24	537	543
VEQ-27	436	444
VEQ-32	614	625
VEQ-36	786	814
VEQ-40	656	668
VEQ-45	873	890
VEQ-49	1067	1086
VEQ-54	873	888
VEQ-60	1163	1184
VEQ-64	1227	1250
VEQ-69	1090	1110
VEQ-75	1452	1479
VEQ-80	1534	1562
VEQ-81	1309	1332
VEQ-89	1743	1774
VEQ-94	1841	1874
"VEQ" DOUBLE FAN WIDTH MODELS		
VEQ-50	533	543
VEQ-56	437	444
VEQ-61	581	592
VEQ-65	614	625
VEQ-74	800	815
VEQ-82	669	682
VEQ-91	872	888
VEQ-97	1067	1086
VEQ-107	872	888
VEQ-119	1162	1184
VEQ-126	1228	1250
VEQ-135	1090	1110
VEQ-149	1452	1479
VEQ-157	1534	1562
VEQ-161	1308	1332
VEQ-179	1743	1774
VEQ-189	1841	1874

Physical Data

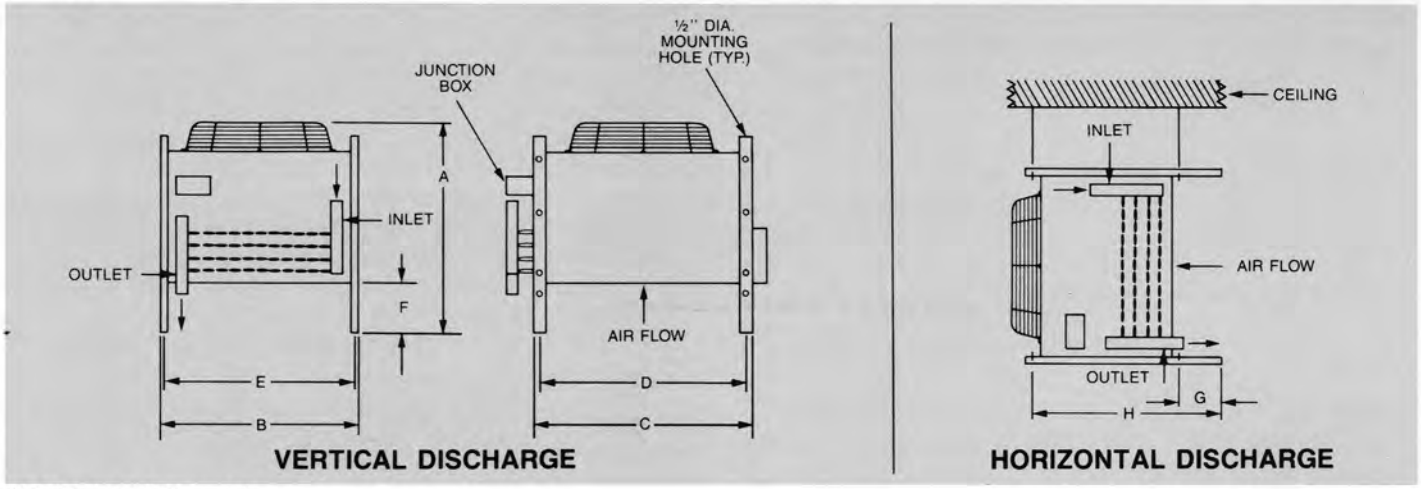

FIGURE 7: RAC models

TABLE 12

MODEL	DIMENSIONS (IN.)								CONNECTION SIZE O.D.						FAN DATA			APPROX NET WEIGHT
									R-134a		R-22		R-404A		QTY	DIAM.	TOTAL CFM	
	A	B	C	D	E	F	G	H	IN	OUT	IN	OUT	IN	OUT				
RAC-3/4	21	20-1/4	21	19-1/8	19-1/2	6	4-3/4	14-3/4	5/8	5/8	5/8	5/8	5/8	5/8	1	16	1440	60
RAC-1	21	20-1/4	21	19-1/8	19-1/2	6	4-3/4	14-3/4	5/8	5/8	5/8	5/8	5/8	5/8	1	16	2300	65
RAC-11/2	22	26-1/4	25	23-1/8	25-1/2	6	4-3/4	14-3/4	5/8	5/8	5/8	5/8	5/8	5/8	1	20	2600	90
RAC-2	22	26-1/4	25	23-1/8	25-1/2	6	4-3/4	14-3/4	5/8	5/8	5/8	5/8	5/8	5/8	1	20	2500	110
RAC-3	22	26-1/4	25	23-1/8	25-1/2	6	4-3/4	14-3/4	7/8	7/8	7/8	7/8	7/8	7/8	1	20	2400	145

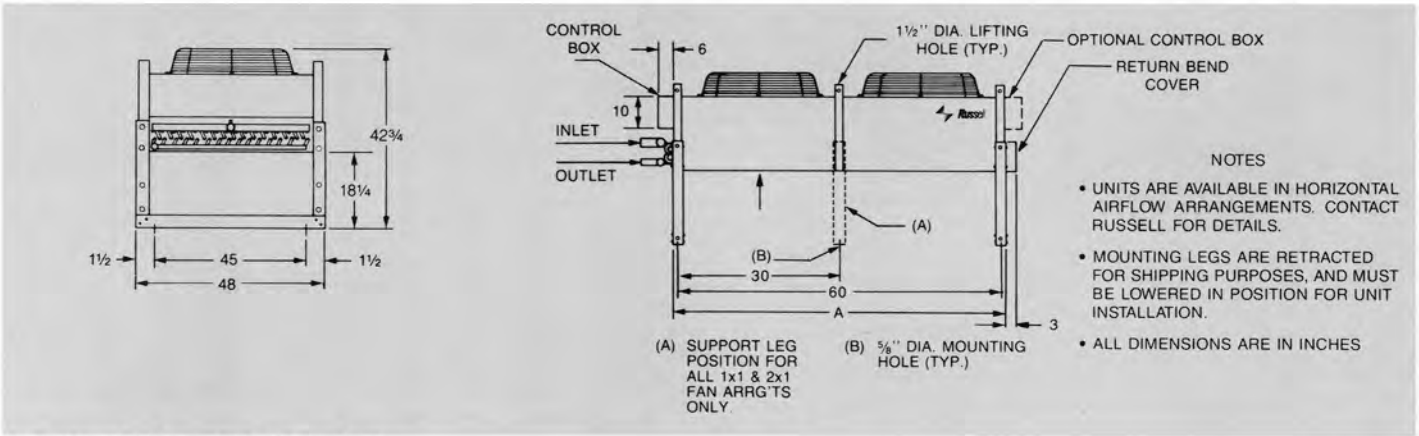

FIGURE 8: VAC 5 THRU 19 models

TABLE 13 SINGLE WIDTH

MODEL	DIMENSION (IN)	(1) CONNECTION SIZE OD (IN)		FAN DATA			APPROX NET WEIGHT (LBS)
	A	IN	OUT	QTY	DIAM.	TOTAL CFM	
VAC 5	32-1/4	1-1/8	1-1/8	1	24	5200	220
VAC 6	32-1/4	1-3/8	1-3/8	1	24	5100	245
VAC 7	32-1/4	1-3/8	1-3/8	1	24	5000	270
VAC 8	32-1/4	1-3/8	1-3/8	1	24	4900	295
VAC 9	32-1/4	1-5/8	1-1/8	1	24	4800	305

TABLE 14 DOUBLE WIDTH

MODEL	DIMENSION (IN)	(1) CONNECTION SIZE OD (IN)		FAN DATA			APPROX NET WEIGHT (LBS)
	A	IN	OUT	QTY	DIAM.	TOTAL CFM	
VAC 11	62-1/4	1-5/8	1-1/8	2	24	10400	340
VAC 13	62-1/4	1-5/8	1-1/8	2	24	10200	355
VAC 15	62-1/4	1-5/8	1-1/8	2	24	10000	370
VAC 17	62-1/4	1-5/8	1-1/8	2	24	9800	400
VAC 19	62-1/4	2-1/8	1-3/8	2	24	9600	420

NOTE: (1) Actual connection sizes may depend on refrigerant type and load. Contact factory for specifications.

Physical Data

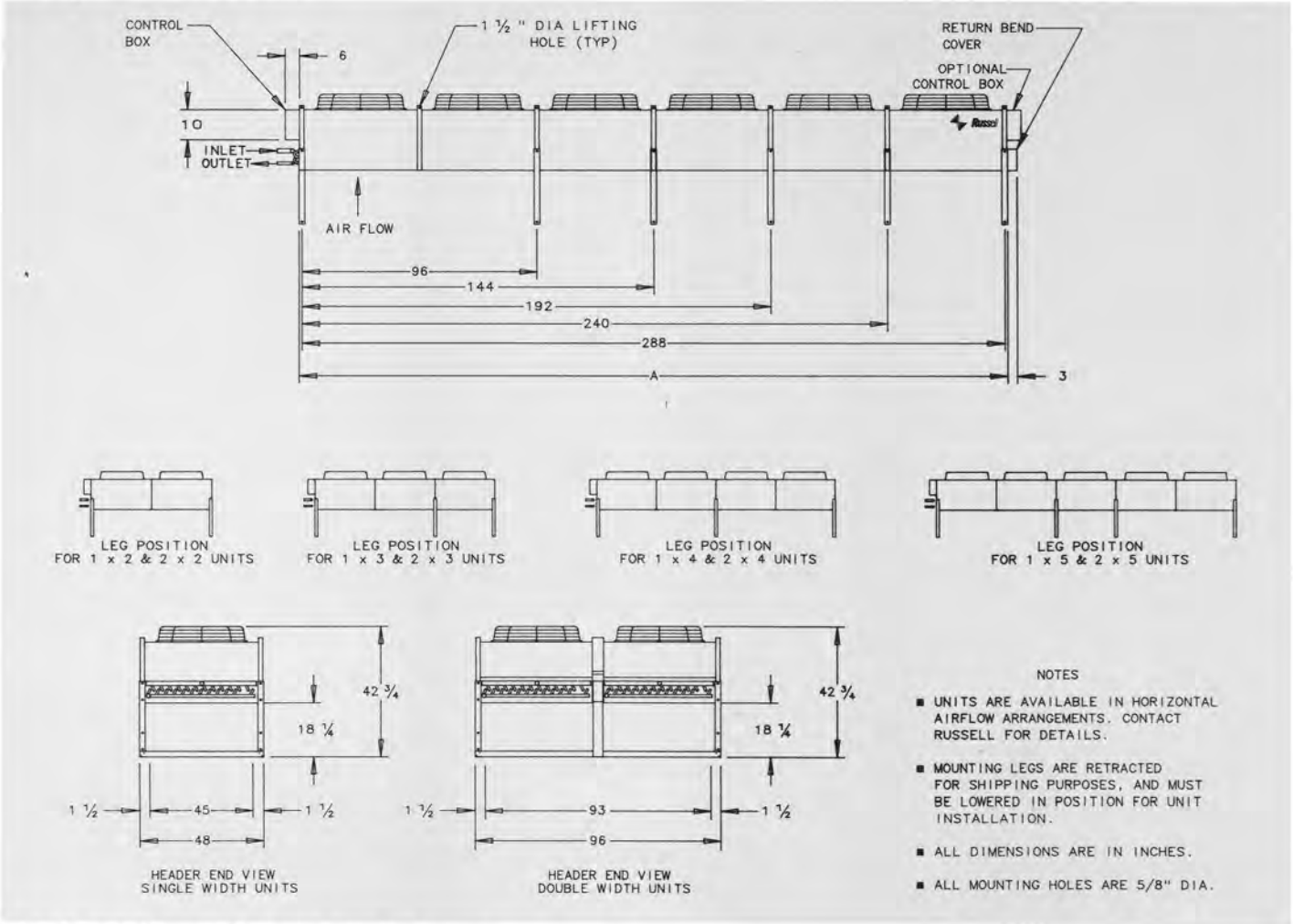

FIGURE 9: VAC and VEQ double width fan models

TABLE 15 SINGLE WIDTH

MODEL	DIMEN-SION (IN)	(1) CONNECTION SIZE OD (IN)		FAN DATA			APPROX NET WEIGHT (LBS)
	A	IN	OUT	QTY	DIAM.	TOTAL CFM	
VAC 22	98-1/4	1-5/8	1-1/8	2	30	22000	465
VAC 25	98-1/4	1-5/8	1-1/8	2	30	21500	495
VAC 29	98-1/4	1-5/8	1-1/8	2	30	21000	520
VAC 31	98-1/4	1-5/8	1-1/8	2	30	20500	550
VAC 35	98-1/4	2-1/8	1-1/8	2	30	20000	600
VAC 42	146-1/4	2-1/8	1-1/8	3	30	32000	800
VAC 48	146-1/4	2-1/8	1-1/8	3	30	31500	900
VAC 55	146-1/4	2-1/8	1-3/8	3	30	31000	1000
VAC 58	194-1/4	2-1/8	1-3/8	4	30	42000	1050
VAC 62	194-1/4	2-1/8	1-3/8	4	30	41000	1100
VAC 67	194-1/4	2-5/8	1-3/8	4	30	40500	1150
VAC 72	194-1/4	2-5/8	1-3/8	4	30	40000	1200
VAC 79	242-1/4	2-5/8	1-3/8	5	30	51250	1370
VAC 84	242-1/4	2-5/8	1-3/8	5	30	50625	1430
VAC 90	242-1/4	2-5/8	1-3/8	5	30	50000	1490
VAC 96	290-1/4	2-5/8	1-3/8	6	30	61500	1690
VAC 101	290-1/4	2-5/8	1-3/8	6	30	60750	1750
VAC 108	290-1/4	2-5/8	1-3/8	6	30	60000	1830

TABLE 16 DOUBLE WIDTH

MODEL	DIMEN-SIONS (IN)	(1) CONNECTION SIZE OD (IN)		FAN DATA			APPROX NET WEIGHT (LBS)
	A	IN	OUT	QTY	DIAM.	TOTAL CFM	
VAC 59	98-1/4	(2)1-5/8	(2)1-1/8	4	30	42000	1080
VAC 63	98-1/4	(2)1-5/8	(2)1-1/8	4	30	41000	1140
VAC 68	98-1/4	(2)1-5/8	(2)1-1/8	4	30	40500	1190
VAC 73	98-1/4	(2)2-1/8	(2)1-1/8	4	30	40000	1240
VAC 83	146-1/4	(2)2-1/8	(2)1-1/8	6	30	64000	1640
VAC 95	146-1/4	(2)2-1/8	(2)1-1/8	6	30	63000	1840
VAC 102	146-1/4	(2)2-1/8	(2)1-3/8	6	30	62000	2050
VAC 116	194-1/4	(2)2-1/8	(2)1-3/8	8	30	84000	2150
VAC 127	194-1/4	(2)2-1/8	(2)1-3/8	8	30	82000	2250
VAC 134	194-1/4	(2)2-5/8	(2)1-3/8	8	30	81000	2350
VAC 144	194-1/4	(2)2-5/8	(2)1-3/8	8	30	80000	2460
VAC 158	242-1/4	(2)2-5/8	(2)1-3/8	10	30	102500	2800
VAC 168	242-1/4	(2)2-5/8	(2)1-3/8	10	30	101250	2950
VAC 180	242-1/4	(2)2-5/8	(2)1-3/8	10	30	100000	3075
VAC 190	290-1/4	(2)2-5/8	(2)1-3/8	12	30	123000	3400
VAC 202	290-1/4	(2)2-5/8	(2)1-3/8	12	30	121500	3620
VAC 216	290-1/4	(2)2-5/8	(2)1-3/8	12	30	120000	3750

Physical Data

TABLE 17 SINGLE WIDTH

MODEL	DIMENSIONS (IN)	CONNECTION SIZE OD (IN)		FAN DATA			APPROX NET
	A	IN	OUT	QTY	DIAM	TOTAL CFM	WEIGHT (LBS)
VEQ 21	98-1/4	1-5/8	1-1/8	2	30	16400	465
VEQ 23	98-1/4	1-5/8	1-1/8	2	30	16000	495
VEQ 24	98-1/4	1-5/8	1-1/8	2	30	15700	520
VEQ 27	98-1/4	1-5/8	1-1/8	2	30	15300	550
VEQ 32	98-1/4	2-1/8	1-1/8	2	30	14900	600
VEQ 36	146-1/4	2-1/8	1-1/8	3	30	23900	800
VEQ 40	146-1/4	2-1/8	1-1/8	3	30	23500	900
VEQ 45	146-1/4	2-1/8	1-3/8	3	30	23100	1000
VEQ 49	194-1/4	2-1/8	1-3/8	4	30	31300	1050
VEQ 54	194-1/4	2-1/8	1-3/8	4	30	30600	1100
VEQ 60	194-1/4	2-5/8	1-3/8	4	30	30200	1150
VEQ 64	194-1/4	2-5/8	1-3/8	4	30	29800	1200
VEQ 69	242-1/4	2-5/8	1-3/8	5	30	38200	1370
VEQ 75	242-1/4	2-5/8	1-3/8	5	30	37800	1430
VEQ 80	242-1/4	2-5/8	1-3/8	5	30	37300	1490
VEQ 81	290-1/4	2-5/8	1-3/8	6	30	45900	1690
VEQ 89	290-1/4	2-5/8	1-3/8	6	30	45300	1750
VEQ 94	290-1/4	2-5/8	1-3/8	6	30	44800	1830

TABLE 18 DOUBLE WIDTH

MODEL	DIMENSIONS (IN)	(1) CONNECTION SIZE OD (IN)		FAN DATA			APPROX NET
	A	IN	OUT	QTY	DIAM.	TOTAL CFM	WEIGHT (LBS)
VEQ 50	98-1/4	(2) 1-5/8	(2) 1-1/8	4	30	31300	1080
VEQ 56	98-1/4	(2) 1-5/8	(2) 1-1/8	4	30	30600	1140
VEQ 61	98-1/4	(2) 1-5/8	(2) 1-1/8	4	30	30200	1190
VEQ 65	98-1/4	(2) 2-1/8	(2) 1-1/8	4	30	29800	1240
VEQ 74	146-1/4	(2) 2-1/8	(2) 1-1/8	6	30	47700	1640
VEQ 82	146-1/4	(2) 2-1/8	(2) 1-1/8	6	30	47000	1840
VEQ 91	146-1/4	(2) 2-1/8	(2) 1-3/8	6	30	46200	2050
VEQ 97	194-1/4	(2) 2-1/8	(2) 1-3/8	8	30	62600	2150
VEQ 107	194-1/4	(2) 2-1/8	(2) 1-3/8	8	30	61100	2250
VEQ 119	194-1/4	(2) 2-5/8	(2) 1-3/8	8	30	60400	2350
VEQ 126	194-1/4	(2) 2-5/8	(2) 1-1/8	8	30	59700	2460
VEQ 135	242-1/4	(2) 2-5/8	(2) 1-3/8	10	30	76400	2800
VEQ 149	242-1/4	(2) 2-5/8	(2) 1-3/8	10	30	75600	2950
VEQ 157	242-1/4	(2) 2-5/8	(2) 1-3/8	10	30	74600	3075
VEQ 161	290-1/4	(2) 2-5/8	(2) 1-3/8	12	30	91800	3400
VEQ 179	290-1/4	(2) 2-5/8	(2) 1-3/8	12	30	90600	3620
VEQ 189	290-1/4	(2) 2-5/8	(2) 1-3/8	12	30	89600	3750

Electrical Data

TABLE 19

MODEL	MOTOR QTY	MOTOR HP	MOTOR RPM	TOTAL MOTOR AMPS				
				SINGLE PHASE			THREE PHASE (1)	
				115V	208/230V	460V	208/230V	460V
				MODEL RAC				
RAC 3/4	1	1/6	1050	5.9	2.9	--	--	--
RAC 1	1	1/6	1050	5.9	2.9	--	--	--
RAC 1-1/2	1	1/6	1050	5.9	2.9	--	--	--
RAC 2	1	1/6	1050	5.9	2.9	--	--	--
RAC 3	1	1/6	1050	5.9	2.9	--	--	--
VAC 5	1	3/4	1075	--	4.2	2.1	4.0	2.0
VAC 6	1	3/4	1075	--	4.2	2.1	4.0	2.0
VAC 7	1	3/4	1075	--	4.2	2.1	4.0	2.0
VAC 8	1	3/4	1075	--	4.2	2.1	4.0	2.0
VAC 9	1	3/4	1075	--	4.2	2.1	4.0	2.0
VAC 11	2	3/4	1075	--	8.4	4.2	8.0	4.0
VAC 13	2	3/4	1075	--	8.4	4.2	8.0	4.0
VAC 15	2	3/4	1075	--	8.4	4.2	8.0	4.0
VAC 17	2	3/4	1075	--	8.4	4.2	8.0	4.0
VAC 19	2	3/4	1075	--	8.4	4.2	8.0	4.0

NOTES: Shaded areas indicate standard wiring arrangement. (1) All VAC 5 thru 19 models in this column have optional inherent 3 phase motors.

Electrical Data (Con't)

TABLE 20

MODEL	MOTOR QTY	MOTOR HP	MOTOR RPM	TOTAL MOTOR AMPS THREE PHASE 208/230V	TOTAL MOTOR AMPS THREE PHASE 460V
VAC 22	2	1-1/2	1140	12.8	6.4
VAC 25	2	1-1/2	1140	12.8	6.4
VAC 29	2	1-1/2	1140	12.8	6.4
VAC 31	2	1-1/2	1140	12.8	6.4
VAC 35	2	1-1/2	1140	12.8	6.4
VAC 42	3	1-1/2	1140	19.2	9.6
VAC 48	3	1-1/2	1140	19.2	9.6
VAC 55	3	1-1/2	1140	19.2	9.6
VAC 58	4	1-1/2	1140	25.6	12.8
VAC 62	4	1-1/2	1140	25.6	12.8
VAC 67	4	1-1/2	1140	25.6	12.8
VAC 72	4	1-1/2	1140	25.6	12.8
VAC 79	5	1-1/2	1140	32.0	16.0
VAC 84	5	1-1/2	1140	32.0	16.0
VAC 90	5	1-1/2	1140	32.0	16.0
VAC 96	6	1-1/2	1140	38.4	19.2
VAC 101	6	1-1/2	1140	38.4	19.2
VAC 108	6	1-1/2	1140	38.4	19.2
DOUBLE WIDTH FAN UNITS					
VAC 59	4	1-1/2	1140	25.6	12.8
VAC 63	4	1-1/2	1140	25.6	12.8
VAC 68	4	1-1/2	1140	25.6	12.8
VAC 73	4	1-1/2	1140	25.6	12.8
VAC 83	6	1-1/2	1140	38.4	19.2
VAC 95	6	1-1/2	1140	38.4	19.2
VAC 102	6	1-1/2	1140	38.4	19.2
VAC 116	8	1-1/2	1140	51.2	25.6
VAC 127	8	1-1/2	1140	51.2	25.6
VAC 134	8	1-1/2	1140	51.2	25.6
VAC 144	8	1-1/2	1140	51.2	25.6
VAC 158	10	1-1/2	1140	64.0	32.0
VAC 168	10	1-1/2	1140	64.0	32.0
VAC 180	10	1-1/2	1140	64.0	32.0
VAC 190	12	1-1/2	1140	76.8	38.4
VAC 202	12	1-1/2	1140	76.8	38.4
VAC 216	12	1-1/2	1140	76.8	38.4

TABLE 21

MODEL	MOTOR QTY	MOTOR HP	MOTOR RPM	TOTAL MOTOR AMPS THREE PHASE 208/230V	TOTAL MOTOR AMPS THREE PHASE 460V
VEQ 21	2	1	850	10.6	5.3
VEQ 23	2	1	850	10.6	5.3
VEQ 24	2	1	850	10.6	5.3
VEQ 27	2	1	850	10.6	5.3
VEQ 32	2	1	850	10.6	5.3
VEQ 36	3	1	850	15.9	8.0
VEQ 40	3	1	850	15.9	8.0
VEQ 45	3	1	850	15.9	8.0
VEQ 49	4	1	850	21.2	10.6
VEQ 54	4	1	850	21.2	10.6
VEQ 60	4	1	850	21.2	10.6
VEQ 64	4	1	850	21.2	10.6
VEQ 69	5	1	850	26.5	13.3
VEQ 75	5	1	850	26.5	13.3
VEQ 80	5	1	850	26.5	13.3
VEQ 81	6	1	850	31.8	15.9
VEQ 89	6	1	850	31.8	15.9
VEQ 94	6	1	850	31.8	15.9
DOUBLE WIDTH FAN UNITS					
VEQ 50	4	1	850	21.2	10.6
VEQ 56	4	1	850	21.2	10.6
VEQ 61	4	1	850	21.2	10.6
VEQ 65	4	1	850	21.2	10.6
VEQ 74	6	1	850	31.8	15.9
VEQ 82	6	1	850	31.8	15.9
VEQ 91	6	1	850	31.8	15.9
VEQ 97	8	1	850	42.4	21.2
VEQ 107	8	1	850	42.4	21.2
VEQ 119	8	1	850	42.4	21.2
VEQ 126	8	1	850	42.4	21.2
VEQ 135	10	1	850	53.0	26.5
VEQ 149	10	1	850	53.0	26.5
VEQ 157	10	1	850	53.0	26.5
VEQ 161	12	1	850	63.6	31.8
VEQ 179	12	1	850	63.6	31.8
VEQ 189	12	1	850	63.6	31.8

Engineering Specifications

GENERAL
Furnish and install as specified and as shown on plans, Russell type(s) (RAC, VAC, VEQ) air cooled condensers, arranged for (horizontal) (vertical) airflow. Condensers shall perform in accordance with (following schedule) (schedule on plan).

Each condenser shall consist of casing, condenser coil, direct driven propeller fan(s) driven by independent fan motor(s), approved fan guard and mounting legs. All fan motors shall be factory wired to a common electrical control box.

Condensers shall be UL listed and each unit shall bear the UL seal.

CONDENSER COIL
All condenser coils up to 3 nominal tons shall be 3/8" O.D. seamless copper tubing. All condenser coils larger than 3 nominal tons shall be fabricated of 1/2" O.D. seamless copper tubing. The tubes shall be mechanically expanded into full fin collars for permanent fin-tube contact. Fins shall be (aluminum) (copper) with die formed corrugations for optimum heat transfer capability. For additional corrosion protection the aluminum fins shall have a (polyester) (baked phenolic) coating.

Headers shall be seamless heavy wall copper tubing. No header shall be longer than 45" and no more than 2 headers can be manifolded together in the field.

Coils shall be leak tested at 380 psig in an illuminated water test tank.

HOUSING
The casing of all RAC, VAC and VEQ models shall be constructed from heavy gauge galvanized steel, designed to provide maximum casing rigidity as well as high corrosion protection. Tube sheets shall be mill finish aluminum and shall be designed in such a fashion to eliminate refrigerant tube leaks at the tube sheets.

FANS
All fan blades shall be constructed of aluminum, riveted onto a galvanized steel spider.

Fans shall be designed for low tip speed and minimal noise.

All fans shall be statically balanced and factory run prior to shipping to ensure quiet, trouble-free operation.

All multiple fan condensers shall be supplied with full width baffles to prevent air bypass.

MOTORS
All motors shall be equipped with inherent overload protection rated for group installation.

Motors for RAC models shall be shaded pole type with sleeve bearings.

Motors for VAC models 5 thru 19 shall be open drip-proof, permanent split capacitor type with permanently lubricated ball bearings.

Motors for VAC 22 thru 216 and VEQ models shall be open drip-proof 230/460/3/60 with permanently lubricated ball bearings. Motor shafts shall be keyed to the fan hub.

Motors shall be mounted in a zinc-chromate coated heavy steel rod support frame.

All units shall be factory wired into a junction box with all leads marked.