KeepRite® REFRIGERATION

KVC Direct Drive Air-Cooled Condenser

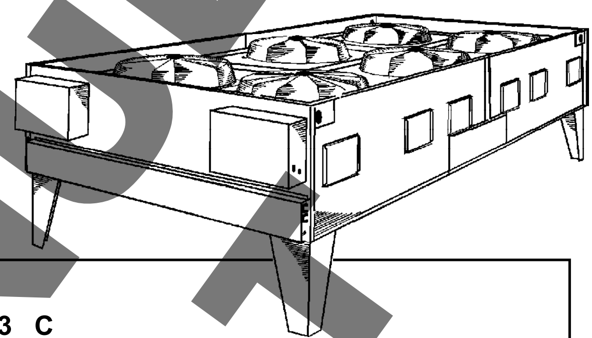
One to Twelve Fan Motors

PRODUCT DATA & INSTALLATION

Bulletin K50-KVC-PDI-10

1068831

We are on the Internet
www.keepriterefrigeration.com



NOMENCLATURE

KVC 2 A 26 206 A - T3 C

Model
KVC = KeepRite Vertical air flow Condenser
KHC = KeepRite Horizontal air flow Condenser

Tubing
1 = 3/8 OD smooth   2 = 1/2 OD smooth

Motor & Fan Type
A = 30” fan with 850 RPM motor (Standard)
B = 30” fan with 550 RPM motor
C = 30” fan with 1140 RPM motor

Fan Configuration
First number = number of fans wide
Second number = number of fans in length
26 = 2 fans wide x 6 fans length (total 12 fans)
11 = 1 fan wide x 1 fan length (total 1 fan)

Generation
C = Latest series (A, B older series)

Electrical Code
S2 = 208-230/1/60   S6 = 200-220/1/50
T3 = 208-230/3/60   T7 = 200-220/3/50
T4 = 460/3/60   T9 = 380-400/3/50
T5 = 575/3/60

Fin Material & Spacing
A = Aluminum 12 FPI (Standard), B = 10, C = 8
D = Gold Coat Alum 12 FPI, E = 10, F = 8
G = Copper 12 FPI, H = 10, J = 8
K = Heresite Coat Alum 12 FPI, L = 10, M = 8

Nominal Capacity (Tons - THR)
Rated at 25ºF (14 ºC) TD, 30” Fan / 850 RPM Motor, 12” FPI, smooth tubing, 0° Subcooling, Sea Level, 60 Hz

CONTENTS PAGE

- **THERMOSPAN™** coil design feature eliminates tube failure on tube sheets.
- **Standard 850 RPM** quiet low speed dual voltage (230/460) fan motors with male electrical plug, moisture slinger, and rainshield for complete weather protection.
- **Optional 550 ultra low and 1140 RPM high speed** motors available.
- **Rugged heavy-gauge** galvanized steel rail motor mounts/support.
- **All fan sections individually baffled** with full height partitions, and clean-out panels.
- **Complete selection** of electrical fan cycling and speed control options.
- **Heavy-gauge** galvanized steel cabinet construction assembled with zinc plated huck bolts supported on heavy-duty legs.

CAPACITY DATA - 850 RPM MODELS - R22

KVC MODEL NUMBER	Fan Rows	TOTAL HEAT OF REJECTION CAPACITY (MBH) TEMPERATURE DIFFERENCE (TD) 12 FPI 1°F (0.56°C)	12 FPI 10°F (5.56°C)	12 FPI 15°F (8.3°C)	12 FPI 20°F (11.1°C)	12 FPI 30°F (16.7°C)	10 FPI 1°F (0.56°C)	8 FPI 1°F (0.56°C)	Maximum No. of Feeds	MBH @ 1° F TD Per Feed (12 FPI)
Single Row Models										
007	1 x 1	3.165	31.7	47.5	63.3	95.0	2.912	2.595	7	0.45
009	1 x 1	4.135	41.4	62.0	82.7	124	3.846	3.515	8	0.52
010	1 x 1	4.655	46.6	69.8	93.1	140	4.329	3.957	9	0.52
011	1 x 1	5.365	53.7	80.5	107	161	5.097	4.721	12	0.45
012	1 x 1	5.875	58.8	88.1	118	176	5.581	5.170	12	0.49
013	1 x 1	6.465	64.7	97.0	129	194	6.336	5.948	15	0.43
017	1 x 2	8.265	82.7	124	165	248	7.686	7.025	14	0.59
019	1 x 2	9.265	92.7	139	185	278	8.616	7.875	18	0.51
022	1 x 2	10.74	107	161	215	322	10.20	9.447	24	0.45
024	1 x 2	11.77	118	176	235	353	11.18	10.35	24	0.49
027	1 x 2	12.94	129	194	259	388	12.68	11.90	30	0.43
029	1 x 3	13.97	140	209	279	419	12.90	11.87	27	0.52
034	1 x 3	16.07	161	241	321	482	15.26	14.14	36	0.45
037	1 x 3	17.64	176	265	353	529	16.75	15.52	36	0.49
041	1 x 3	19.40	194	291	388	582	19.01	17.85	45	0.43
043	1 x 3	20.64	206	310	413	619	19.61	18.17	36	0.57
048	1 x 3	23.01	230	345	460	690	22.55	21.17	45	0.51
056	1 x 4	26.34	263	395	527	790	24.50	22.39	22	1.20
063	1 x 4	30.29	303	454	606	909	28.77	26.65	30	1.01
068	1 x 4	32.55	326	488	651	977	31.90	29.95	37	0.88
079	1 x 5	37.95	379	569	759	1138	36.05	33.39	30	1.26
085	1 x 5	40.70	407	610	814	1221	39.88	37.44	37	1.10
095	1 x 6	45.54	455	683	911	1366	43.26	40.07	30	1.52
103	1 x 6	48.84	488	733	977	1465	47.85	44.93	37	1.32
Double Row Models										
039	2 x 2	18.60	186	279	372	558	17.30	15.81	36	0.52
045	2 x 2	21.47	215	322	429	644	20.39	18.89	48	0.45
049	2 x 2	23.50	235	353	470	705	22.33	20.68	48	0.49
054	2 x 2	25.84	258	388	517	775	25.32	23.77	60	0.43
058	2 x 3	27.90	279	419	558	837	25.95	23.72	54	0.52
067	2 x 3	32.17	322	482	643	965	30.56	28.31	72	0.45
073	2 x 3	35.24	352	529	705	1057	33.47	31.01	72	0.49
081	2 x 3	38.77	388	581	775	1163	37.99	35.66	90	0.43
086	2 x 3	41.29	413	619	826	1239	39.22	36.33	72	0.57
096	2 x 3	46.02	460	690	920	1381	45.10	42.34	90	0.51
112	2 x 4	53.89	539	808	1078	1617	50.11	45.80	45	1.20
126	2 x 4	60.57	606	909	1211	1817	57.54	53.30	60	1.01
137	2 x 4	65.99	660	990	1320	1980	64.67	60.71	75	0.88
158	2 x 5	75.90	759	1138	1518	2277	72.10	66.79	60	1.26
172	2 x 5	82.50	825	1237	1650	2475	80.85	75.90	75	1.10
190	2 x 6	91.08	911	1366	1822	2732	86.52	80.15	60	1.52
206	2 x 6	98.99	990	1485	1980	2970	97.01	91.07	75	1.32

Correction Factors for Other refrigerants - Use R22 Values Multiplied By

R134a	R12	R507	R404A	R407A	R407B	R502	R407C
0.94	0.95	0.97	0.97	0.97	0.97	0.98	1.00

NOTES:

(1) Above capacity data based on 0°F subcooling and at sea level.

(2) TD = Condensing temperature - ambient temperature

(3) Standard fin spacing is 12 FPI except models 056 and 112 (13 FPI).

(4) For High Altitude applications apply the following correction factors: 0.94 for 2000 feet, 0.88 for 4000 feet and 0.81 for 6000 feet.

(5) For 50Hz capacity multiply by 0.92.

CAPACITY DATA - 850 RPM MODELS - R404A

KVC MODEL NUMBER	Fan Rows	TOTAL HEAT OF REJECTION CAPACITY (MBH)							Maximum No. of Feeds	MBH @ 1° F TD Per Feed (12 FPI)
		TEMPERATURE DIFFERENCE (TD)								
		12 FPI					10 FPI	8 FPI		
		1°F (0.56°C)	10°F (5.56°C)	15°F (8.3°C)	20°F (11.1°C)	30°F (16.7°C)	1°F (0.56°C)	1°F (0.56°C)		
Single Row Models										
007	1 x 1	3.070	30.7	46.1	61.4	92.1	2.825	2.517	7	0.44
009	1 x 1	4.011	40.1	60.2	80.2	120	3.731	3.410	8	0.50
010	1 x 1	4.515	45.2	67.7	90.3	135	4.199	3.838	9	0.50
011	1 x 1	5.204	52.0	78.1	104	156	4.944	4.579	12	0.43
012	1 x 1	5.699	57.0	85.5	114	171	5.414	5.015	12	0.47
013	1 x 1	6.271	62.7	94.1	125	188	6.146	5.770	15	0.42
017	1 x 2	8.017	80.2	120	160	241	7.455	6.814	14	0.57
019	1 x 2	8.987	89.9	135	180	270	8.358	7.639	18	0.50
022	1 x 2	10.41	104	156	208	312	9.892	9.164	24	0.43
024	1 x 2	11.41	114	171	228	342	10.84	10.04	24	0.48
027	1 x 2	12.55	125	188	251	376	12.30	11.54	30	0.42
029	1 x 3	13.55	135	203	271	406	12.51	11.51	27	0.50
034	1 x 3	15.58	156	234	312	467	14.80	13.71	36	0.43
037	1 x 3	17.11	171	257	342	513	16.25	15.05	36	0.48
041	1 x 3	18.82	188	282	376	565	18.44	17.31	45	0.42
043	1 x 3	20.02	200	300	400	601	19.02	17.62	36	0.56
048	1 x 3	22.32	223	335	446	670	21.87	20.53	45	0.50
056	1 x 4	25.55	256	383	511	767	23.77	21.72	22	1.16
063	1 x 4	29.38	294	441	588	881	27.91	25.85	30	0.98
068	1 x 4	31.58	316	474	632	947	30.94	29.05	37	0.85
079	1 x 5	36.81	368	552	736	1104	34.97	32.39	30	1.23
085	1 x 5	39.48	395	592	790	1184	38.69	36.32	37	1.07
095	1 x 6	44.17	442	663	883	1325	41.96	38.87	30	1.47
103	1 x 6	47.37	474	711	947	1421	46.41	43.58	37	1.28
Double Row Models										
039	2 x 2	18.04	180	271	361	541	16.78	15.34	36	0.50
045	2 x 2	20.82	208	312	416	625	19.78	18.32	48	0.43
049	2 x 2	22.80	228	342	456	684	21.66	20.06	48	0.47
054	2 x 2	25.06	251	376	501	752	24.56	23.05	60	0.42
058	2 x 3	27.06	271	406	541	812	25.17	23.00	54	0.50
067	2 x 3	31.20	312	468	624	936	29.64	27.46	72	0.43
073	2 x 3	34.18	342	513	684	1025	32.47	30.08	72	0.47
081	2 x 3	37.60	376	564	752	1128	36.85	34.59	90	0.42
086	2 x 3	40.05	400	601	801	1201	38.04	35.24	72	0.56
096	2 x 3	44.64	446	670	893	1339	43.75	41.07	90	0.50
112	2 x 4	52.27	523	784	1045	1568	48.61	44.43	45	1.16
126	2 x 4	58.75	588	881	1175	1763	55.82	51.70	60	0.98
137	2 x 4	64.01	640	960	1280	1920	62.73	58.88	75	0.85
158	2 x 5	73.62	736	1104	1472	2209	69.94	64.78	60	1.23
172	2 x 5	80.02	800	1200	1600	2401	78.42	73.62	75	1.07
190	2 x 6	88.34	883	1325	1767	2650	83.93	77.74	60	1.47
206	2 x 6	96.02	960	1440	1920	2881	94.10	88.34	75	1.28

To calculate capacities with other refrigerants, multiply the R22 capacity by the appropriate correction factor. Refer to the table accompanying each of the R22 tables.

NOTES:

(1) Above capacity data based on 0°F subcooling and at sea level.

(2) TD = Condensing temperature - ambient temperature

(3) Standard fin spacing is 12 FPI except models 056 and 112 (13 FPI).

(4) For High Altitude applications apply the following correction factors: 0.94 for 2000 feet, 0.88 for 4000 feet and 0.81 for 6000 feet.

(5) For 50Hz capacity multiply by 0.92.

GENERAL SPECIFICATIONS - 850 RPM MODELS

KVC MODEL NUMBER	Total No. of Feeds	R22 Refrigerant Charge (1)				Air Flow Rate (4)		Sound Level (5)	Piping Connections		Condenser Weight (6)	
		Normal (2)		90% FULL (3)					Inlet	Outlet		
		lbs	kg	lbs	kg	CFM	m³/h	dBA	Qty - OD	Qty - OD	lbs	kg
Single Row Models												
1A11**007**	7	1.7	0.8	11.0	5.2	7150	12200	63.5	1 - 1 1/8	1 - 7/8	360	163
1A11**009**	8	2.2	1.0	17.0	7.5	6280	10700	63.5	1 - 1 3/8	1 - 7/8	375	170
1A11**010**	9	2.8	1.3	21.0	9.5	7150	12200	63.5	1 - 1 3/8	1 - 7/8	420	191
1A11**011**	12	3.9	1.8	27.0	12.0	6880	11700	63.5	1 - 1 3/8	1 - 1 1/8	440	200
1A11**012**	12	4.3	2.0	31.0	14.0	7200	12200	63.5	1 - 1 3/8	1 - 1 1/8	480	218
1A11**013**	15	5.2	2.4	39.0	18.0	6930	11800	63.5	1 - 1 5/8	1 - 1 1/8	505	229
1A12**017**	14	4.1	1.9	31.0	14.0	12500	21300	66.5	1 - 1 5/8	1 - 1 1/8	565	256
1A12**019**	18	6.1	2.8	44.0	20.0	14300	24300	66.5	1 - 2 1/8	1 - 1 3/8	630	286
1A12**022**	24	7.4	3.4	55.0	25.0	13700	23300	66.5	1 - 2 1/8	1 - 1 3/8	675	306
1A12**024**	24	8.3	3.8	62.0	28.0	14400	24500	66.5	1 - 2 1/8	1 - 1 3/8	740	336
1A12**027**	30	10.0	4.5	75.0	34.0	13900	23600	66.5	1 - 2 1/8	1 - 1 3/8	790	358
1A13**029**	27	9.0	4.1	61.0	28.0	21400	36400	67.7	1 - 2 1/8	1 - 1 5/8	840	381
1A13**034**	36	10.0	4.5	78.0	35.0	20600	35000	67.7	1 - 2 1/8	1 - 1 5/8	905	410
1A13**037**	36	12.0	5.4	94.0	42.0	21600	36700	67.7	1 - 2 5/8	1 - 1 5/8	1000	454
1A13**041**	45	14.0	6.4	113	51.0	20800	35400	67.7	1 - 2 5/8	1 - 1 5/8	1070	485
1A13**043**	36	17.5	7.9	128	57.8	26500	45100	67.7	1 - 2 5/8	1 - 1 5/8	1055	479
1A13**048**	45	20.5	9.3	152	68.9	25800	43800	67.7	1 - 2 5/8	1 - 1 5/8	1150	522
2A14**056**	22	25.9	11.8	183	83.2	35900	61000	69	1 - 2 5/8	1 - 2 1/8	1600	726
2A14**063**	30	32.5	14.7	239	108	35300	59900	69	1 - 2 5/8	1 - 2 1/8	1650	748
2A14**068**	37	38.0	17.2	286	130	34300	58300	69	1 - 2 5/8	1 - 2 1/8	1750	794
2A15**079**	30	38.5	17.5	290	131	44100	74900	70.3	1 - 2 5/8	1 - 2 1/8	2063	936
2A15**085**	37	48.8	22.2	356	161	42900	72900	70.3	1 - 2 5/8	1 - 2 5/8	2188	992
2A16**095**	30	53.5	24.3	365	165	52900	89900	71	1 - 3 1/8	1 - 3 1/8	2475	1123
2A16**103**	37	61.2	27.7	436	198	51500	87500	71	1 - 3 1/8	1 - 3 1/8	2625	1191
Double Row Models												
1A22**039**	36	16.0	7.3	104	47.0	28600	48600	69.5	2 - 2 1/8	2 - 1 3/8	1060	481
1A22**045**	48	19.0	8.6	126	57.0	27500	46800	69.5	2 - 2 1/8	2 - 1 3/8	1145	519
1A22**049**	48	21.0	9.5	141	64.0	28800	49000	69.5	2 - 2 1/8	2 - 1 3/8	1255	569
1A22**054**	60	23.0	10.0	167	76.0	27700	47100	69.5	2 - 2 1/8	2 - 1 3/8	1350	612
1A23**058**	54	22.0	10.0	141	64.0	42800	72800	71	2 - 2 1/8	2 - 1 5/8	1420	644
1A23**067**	72	26.0	12.0	174	79.0	41200	70000	71	2 - 2 1/8	2 - 1 5/8	1550	703
1A23**073**	72	30.0	14.0	212	96.0	43200	73400	71	2 - 2 5/8	2 - 1 5/8	1710	776
1A23**081**	90	35.0	16.0	251	114	41600	70700	71	2 - 2 5/8	2 - 1 5/8	1865	846
1A23**086**	72	35.0	16.0	255	116	53000	90100	71	2 - 2 5/8	2 - 1 5/8	2110	957
1A23**096**	90	41.0	19.0	304	138	51500	87600	71	2 - 2 5/8	2 - 1 5/8	2300	1043
2A24**112**	45	53.0	24.0	375	170	71800	122100	72.5	2 - 2 5/8	2 - 2 1/8	3200	1451
2A24**126**	60	65.0	30.0	477	217	70500	119900	72.5	2 - 2 5/8	2 - 2 1/8	3300	1497
2A24**137**	75	77.0	35.0	579	263	68600	116600	72.5	2 - 2 5/8	2 - 2 1/8	3500	1588
2A25**158**	60	77.0	35.0	579	263	88100	149800	73.3	2 - 2 5/8	2 - 2 1/8	4125	1871
2A25**172**	75	99.0	45.0	721	327	85800	145800	73.3	2 - 2 5/8	2 - 2 5/8	4375	1984
2A26**190**	60	107.0	49.0	729	331	106000	179800	74	2 - 3 1/8	2 - 3 1/8	4950	2245
2A26**206**	75	124.0	56.0	883	401	102900	174900	74	2 - 3 1/8	2 - 3 1/8	5250	2381

(1) For R407A, R507 use R22 Charge x 0.87. For R407-C use R22 Charge x 0.97.
For R134a and R502 use R22 Charge. For R12 use R22 Charge X 1.1.

(2) Normal Charge is the refrigerant charge for warm ambient or summer operation. For low ambient or winter charge with flooded head pressure control and fan cycling see Page 33 and Page 34.

(3) 90% FULL is the liquid refrigerant weight at 90% of internal volume and is for reference ONLY.

(4) For 50Hz Fan Data use 60Hz CFM (m³/h) X 0.83.

(5) Sound Pressure Level at ten meter distance.

(6) Less weight of refrigerant charge.

ELECTRICAL DATA - 850 RPM MODELS 60Hz

NO. OF FANS	208-230/1/60*			208-230/3/60			460/3/60			575/3/60		
	TOTAL FLA	MCA	MOP	TOTAL FLA	MCA	MOP	TOTAL FLA	MCA	MOP	TOTAL FLA	MCA	MOP
1	3.4	4.3	15	5.9	7.4	15	2.9	3.6	15	2.3	2.9	15
2	6.8	7.7	15	11.8	13.3	20	5.8	6.5	15	4.6	5.2	15
3	10.2	11.1	15	17.7	19.2	25	8.7	9.4	15	6.9	7.5	15
4	13.6	14.5	20	23.6	25.1	30	11.6	12.3	15	9.2	9.8	15
5	N/A	N/A	N/A	29.5	35.1	40	14.5	15.2	20	11.5	12.1	15
6	20.4	21.3	30	35.4	36.9	45	17.4	18.1	25	13.8	14.4	20
8	NA	NA	NA	47.2	48.7	60	23.2	23.9	30	18.4	19.0	25
10	NA	NA	NA	59	60.5	70	29	29.7	40	23	23.6	30
12	NA	NA	NA	70.8	72.3	80	34.8	35.5	45	27.6	28.2	40

M.C.A. = Minimum Circuit Ampacity (AMPS)
M.O.P. = Maximum Overcurrent Protection (AMPS)

* Not available on 4 and 5 fan single row models and 6 fan models 183" and longer.

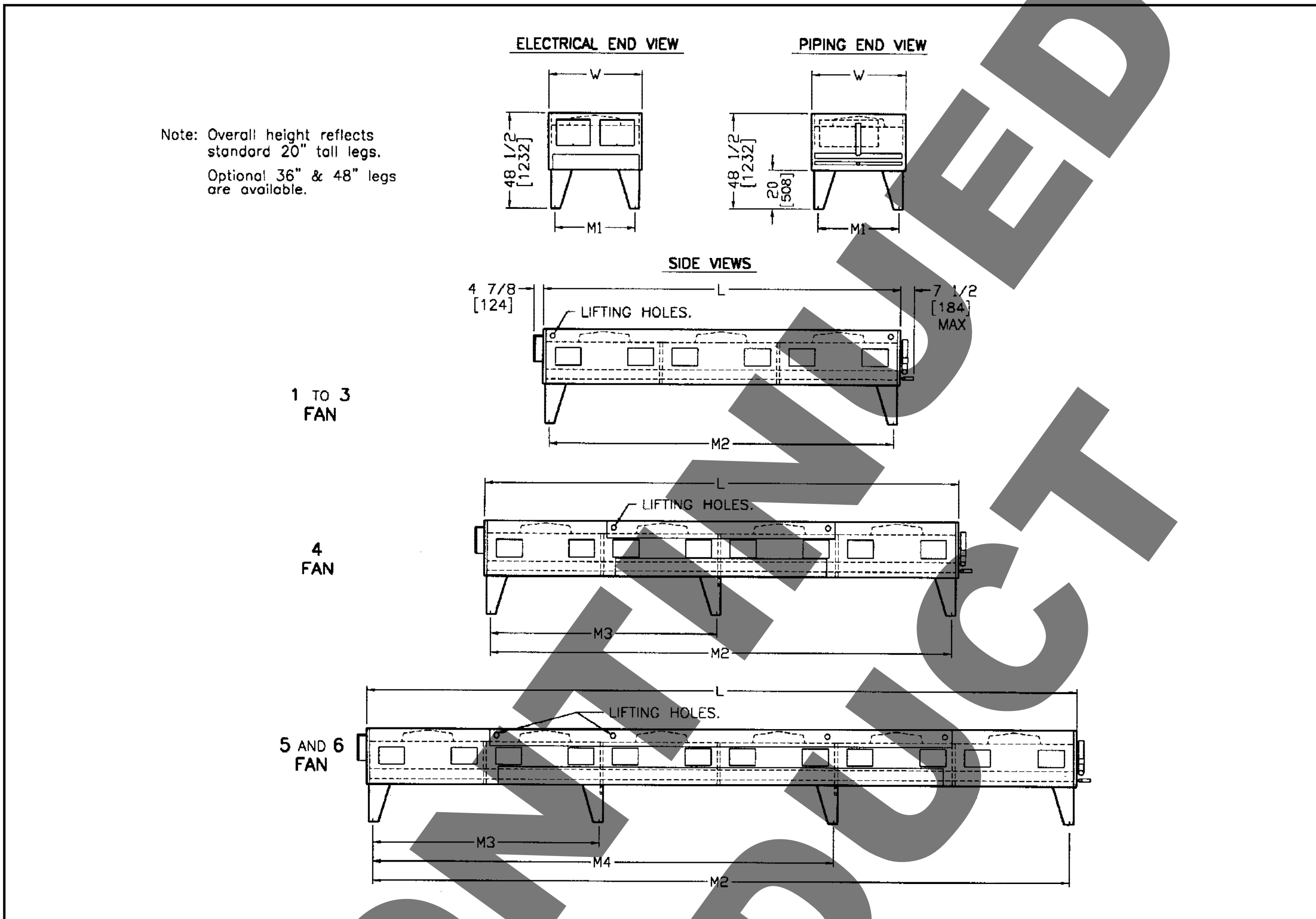
ELECTRICAL DATA - 850 (700) RPM MODELS 50Hz

NO. OF FANS	200-220/1/50*			200-220/3/50*			380-400/3/50		
	TOTAL FLA	MCA	MOP	TOTAL FLA	MCA	MOP	TOTAL FLA	MCA	MOP
1	3.6	4.5	15	6.5	8.1	15	2.7	3.4	15
2	7.2	8.1	15	13	14.6	20	5.4	6.1	15
3	10.8	11.7	15	19.5	21.1	25	8.1	8.8	15
4	14.4	15.3	20	26	27.6	40	10.8	11.5	15
5	N/A	N/A	N/A	32.5	34.1	40	13.5	15.1	20
6	21.6	22.5	30	39	40.6	45	16.2	16.9	20
8	NA	NA	NA	52	53.6	60	21.6	22.3	30
10	NA	NA	NA	65	66.6	80	27	27.7	40
12	NA	NA	NA	78	79.6	90	32.4	33.1	45

M.C.A. = Minimum Circuit Ampacity (AMPS)
M.O.P. = Maximum Overcurrent Protection (AMPS)

* Not available on 4 and 5 fan single row models and 6 fan models 183" and longer.

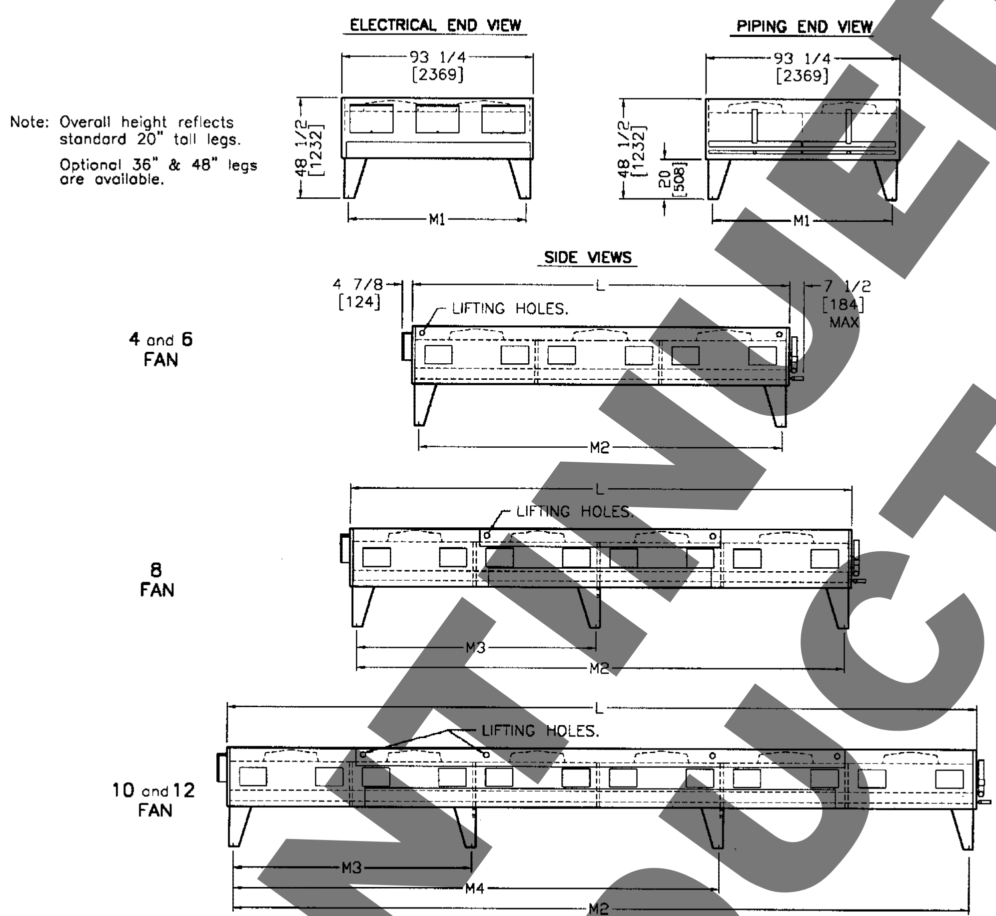
DIMENSIONAL DATA - SINGLE ROW KVC MODELS



DIMENSIONS - Inches (mm)

SINGLE ROW MODEL	WIDTH W	LENGTH L	MOUNTING LEG CENTRES			
			M1	M2	M3	M4
11 **007**	38 1/8 (968)	43 (1092)	31 1/8 (791)	36 (914)	-	-
11 **009**	38 1/8 (968)	43 (1092)	31 1/8 (791)	36 (914)	-	-
11 **010**	48 1/8 (1222)	43 (1092)	41 1/8 (1045)	36 (914)	-	-
11 **011**	48 1/8 (1222)	43 (1092)	41 1/8 (1045)	36 (914)	-	-
11 **012**	48 1/8 (1222)	50 (127)	41 1/8 (1045)	43 (1092)	-	-
11 **013**	48 1/8 (1222)	50 (127)	41 1/8 (1045)	43 (1092)	-	-
12 **017**	38 1/8 (968)	83 1/8 (2111)	31 1/8 (791)	76 1/8 (1934)	-	-
12 **019**	48 1/8 (1222)	83 1/8 (2111)	41 1/8 (1045)	76 1/8 (1934)	-	-
12 **022**	48 1/8 (1222)	83 1/8 (2111)	41 1/8 (1045)	76 1/8 (1934)	-	-
12 **024**	48 1/8 (1222)	97 1/8 (2467)	41 1/8 (1045)	90 1/8 (2289)	-	-
12 **027**	48 1/8 (1222)	97 1/8 (2467)	41 1/8 (1045)	90 1/8 (2289)	-	-
13 **029**	48 1/8 (1222)	123 1/4 (3131)	41 1/8 (1045)	116 1/4 (2953)	-	-
13 **034**	48 1/8 (1222)	123 1/4 (3131)	41 1/8 (1045)	116 1/4 (2953)	-	-
13 **037**	48 1/8 (1222)	144 1/4 (3664)	41 1/8 (1045)	137 1/4 (3486)	-	-
13 **041**	48 1/8 (1222)	144 1/4 (3664)	41 1/8 (1045)	137 1/4 (3486)	-	-
13 **043**	48 1/8 (1222)	183 (4648)	41 1/8 (1045)	176 1/4 (4477)	-	-
13 **048**	48 1/8 (1222)	183 (4648)	41 1/8 (1045)	176 1/4 (4477)	-	-
14 **056**	48 1/8 (1222)	243 (6172)	41 1/8 (1045)	236 5/16 (6002)	116 3/16 (2951)	-
14 **063**	48 1/8 (1222)	243 (6172)	41 1/8 (1045)	236 5/16 (6002)	116 3/16 (2951)	-
14 **068**	48 1/8 (1222)	243 (6172)	41 1/8 (1045)	236 5/16 (6002)	116 3/16 (2951)	-
15 **079**	48 1/8 (1222)	303 (7696)	41 1/8 (1045)	296 5/16 (7526)	116 3/16 (2951)	176 3/16 (4475)
15 **085**	48 1/8 (1222)	303 (7696)	41 1/8 (1045)	296 5/16 (7526)	116 3/16 (2951)	176 3/16 (4475)
16 **095**	48 1/8 (1222)	363 (9220)	41 1/8 (1045)	356 5/16 (9050)	116 3/16 (2951)	236 3/16 (5999)
16 **103**	48 1/8 (1222)	363 (9220)	41 1/8 (1045)	356 5/16 (9050)	116 3/16 (2951)	236 3/16 (5999)

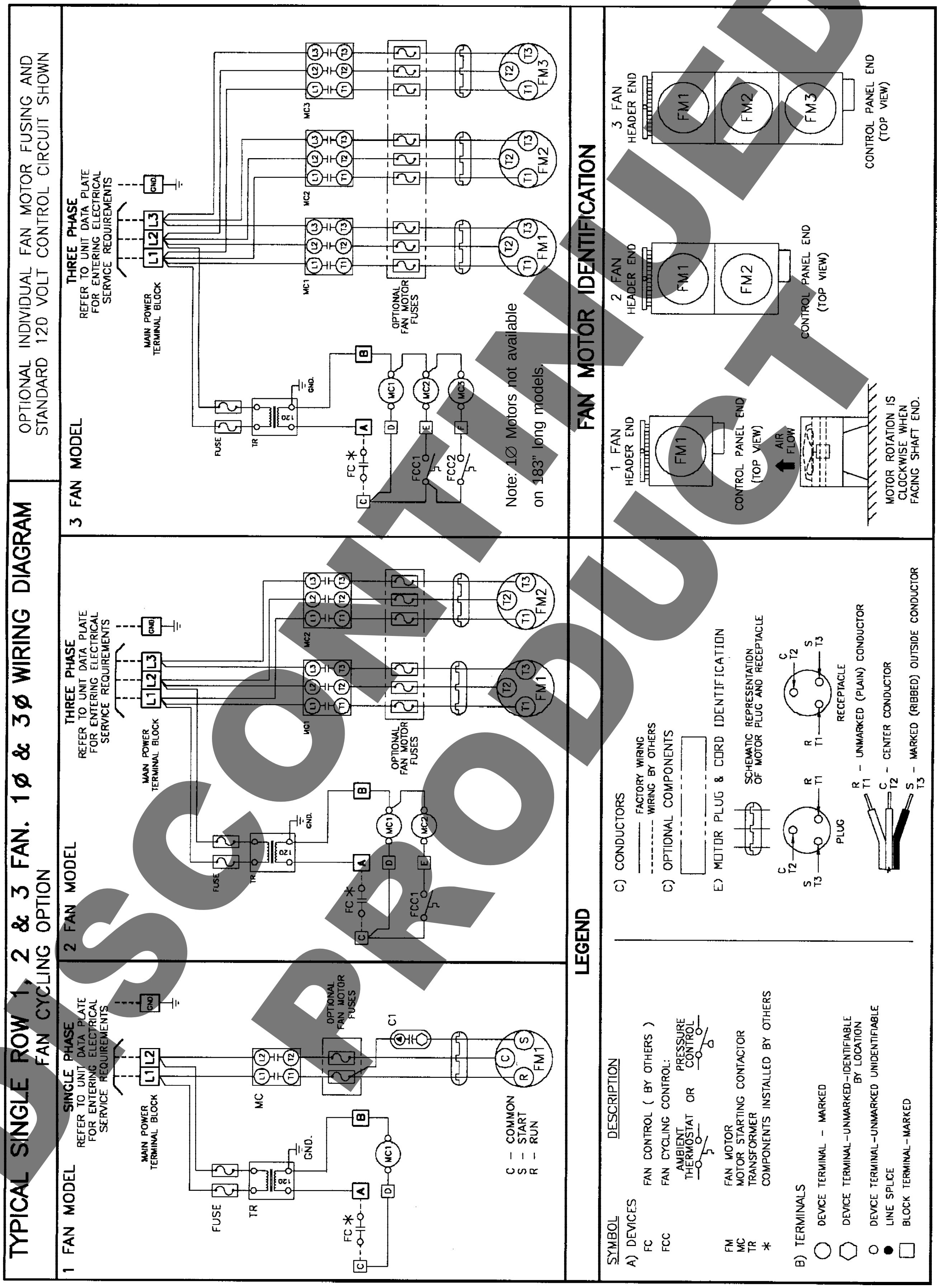
DIMENSIONAL DATA - DOUBLE ROW KVC MODELS



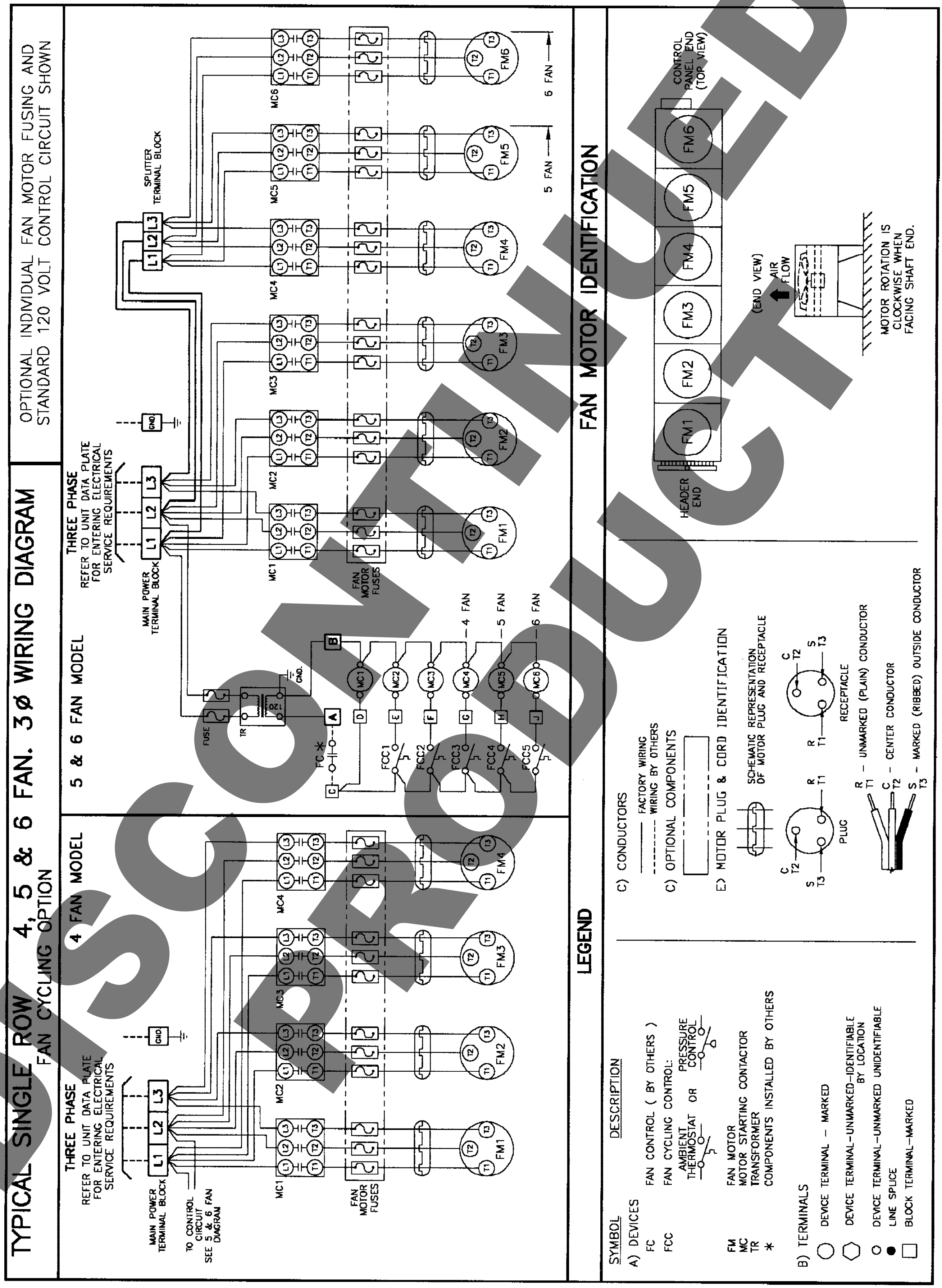
DIMENSIONS - Inches (mm)

DOUBLE ROW MODEL	LENGTH L	MOUNTING LEG CENTRES			
		M1	M2	M3	M4
22 **039**	83 1/8 (2111)	86 1/8 (2188)	76 1/8 (1934)	-	-
22 **045**	83 1/8 (2111)	86 1/8 (2188)	76 1/8 (1934)	-	-
22 **049**	97 1/8 (2467)	86 1/8 (2188)	90 1/8 (2289)	-	-
22 **054**	97 1/8 (2467)	86 1/8 (2188)	90 1/8 (2289)	-	-
23 **058**	123 1/4 (3131)	86 1/8 (2188)	116 1/4 (2953)	-	-
23 **067**	123 1/4 (3131)	86 1/8 (2188)	116 1/4 (2953)	-	-
23 **073**	144 1/4 (3664)	86 1/8 (2188)	137 1/4 (3486)	-	-
23 **081**	144 1/4 (3664)	86 1/8 (2188)	137 1/4 (3486)	-	-
23 **086**	183 (4648)	86 7/16 (2196)	176 1/4 (4477)	-	-
23 **096**	183 (4648)	86 7/16 (2196)	176 1/4 (4477)	-	-
24 **112**	243 (6172)	86 7/16 (2196)	236 5/16 (6002)	116 3/16 (2951)	-
24 **126**	243 (6172)	86 7/16 (2196)	236 5/16 (6002)	116 3/16 (2951)	-
24 **137**	243 (6172)	86 7/16 (2196)	236 5/16 (6002)	116 3/16 (2951)	-
25 **158**	303 (7696)	86 7/16 (2196)	296 5/16 (7526)	116 3/16 (2951)	176 3/16 (4475)
25 **172**	303 (7696)	86 7/16 (2196)	296 5/16 (7526)	116 3/16 (2951)	176 3/16 (4475)
26 **190**	363 (9220)	86 7/16 (2196)	356 5/16 (9050)	116 3/16 (2951)	236 3/16 (5999)
26 **206**	363 (9220)	86 7/16 (2196)	356 5/16 (9050)	116 3/16 (2951)	236 3/16 (5999)

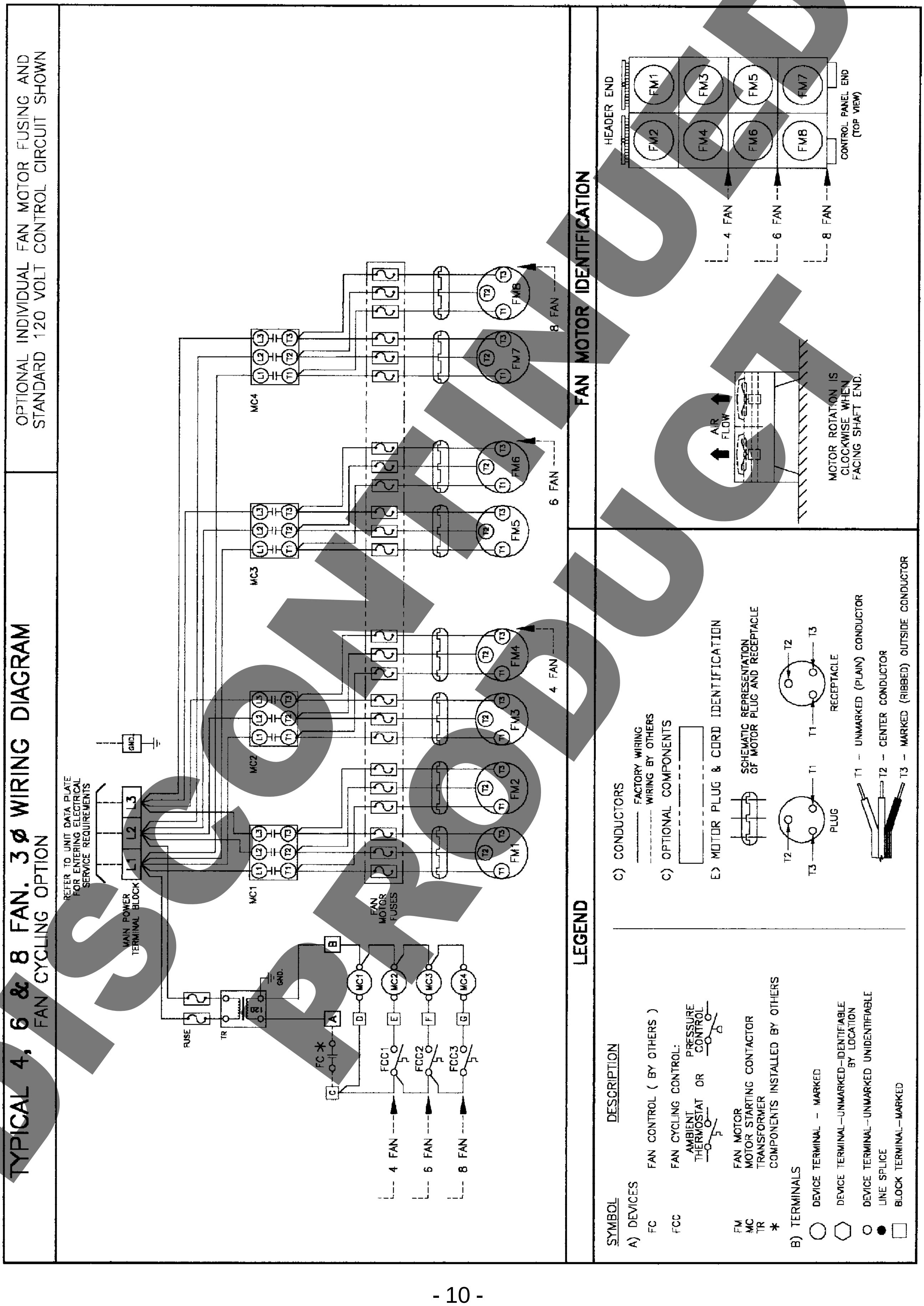
WIRING DIAGRAMS
(SINGLE ROW MODELS)



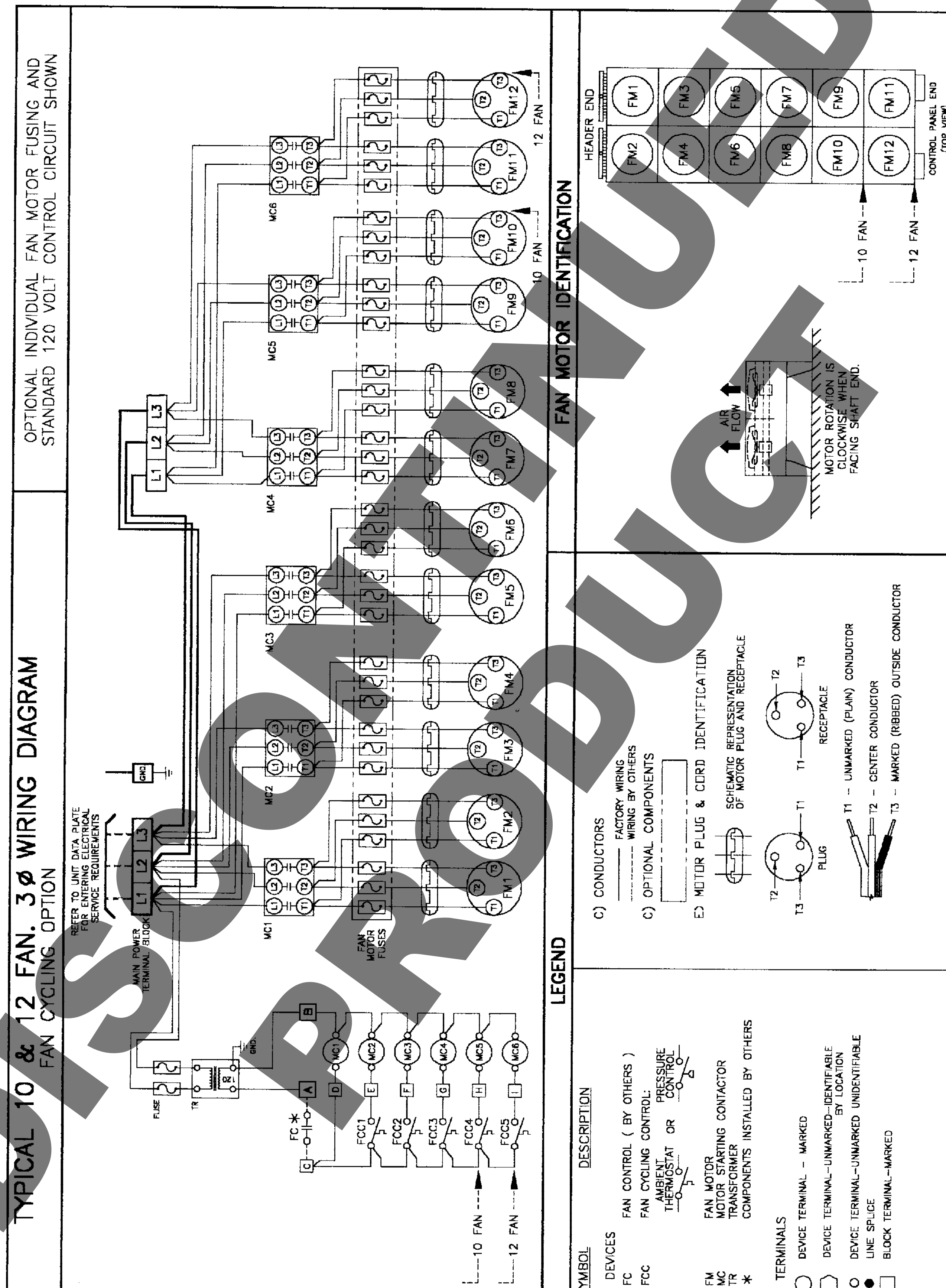
WIRING DIAGRAMS
(SINGLE ROW MODELS)



WIRING DIAGRAMS
(DOUBLE ROW MODELS)



WIRING DIAGRAMS
(DOUBLE ROW MODELS)



CAPACITY DATA - 550 RPM MODELS - R22

KVC MODEL NUMBER	Fan Rows	TOTAL HEAT OF REJECTION CAPACITY (MBH) TEMPERATURE DIFFERENCE (TD) 12 FPI 1°F (0.56°C)	12 FPI 10°F (5.56°C)	12 FPI 15°F (8.3°C)	12 FPI 20°F (11.1°C)	12 FPI 30°F (16.7°C)	10 FPI 1°F (0.56°C)	8 FPI 1°F (0.56°C)	Maximum No. of Feeds	MBH @ 1° F TD Per Feed (12 FPI)
Single Row Models										
007	1 x 1	2.540	25.4	38.1	50.8	76.2	2.324	2.059	4	0.63
009	1 x 1	3.162	31.6	47.4	63.2	94.8	3.011	2.760	8	0.40
010	1 x 1	3.523	35.2	52.8	70.5	106	3.312	3.014	9	0.39
011	1 x 1	3.949	39.5	59.2	79.0	118	3.822	3.568	8	0.49
012	1 x 1	4.298	43.0	64.5	86.0	129	4.104	3.835	8	0.54
013	1 x 1	4.580	45.8	68.7	91.6	137	4.503	4.288	10	0.46
017	1 x 2	6.316	63.2	94.7	126	189	6.015	5.514	14	0.45
019	1 x 2	7.008	70.1	105	140	210	6.589	5.997	18	0.39
022	1 x 2	7.898	79.0	118	158	237	7.644	7.136	18	0.44
024	1 x 2	8.603	86.0	129	172	258	8.215	7.677	18	0.48
027	1 x 2	9.159	91.6	137	183	275	9.006	8.575	18	0.51
029	1 x 3	10.56	106	158	211	317	9.930	9.037	18	0.59
034	1 x 3	11.82	118	177	236	355	11.44	10.68	24	0.49
037	1 x 3	12.89	129	193	258	387	12.31	11.51	24	0.54
041	1 x 3	13.73	137	206	275	412	13.50	12.86	30	0.46
043	1 x 3	15.24	152	229	305	457	14.17	13.32	36	0.42
048	1 x 3	16.20	162	243	324	486	15.59	14.92	45	0.36
056	1 x 4	20.23	202	303	405	607	19.02	17.32	15	1.35
063	1 x 4	22.53	225	338	451	676	21.52	20.10	20	1.13
068	1 x 4	23.66	237	355	473	710	23.26	22.15	25	0.95
079	1 x 5	28.24	282	424	565	847	26.97	25.19	30	0.94
085	1 x 5	29.18	292	438	592	887	28.69	27.32	37	0.79
095	1 x 6	33.88	339	508	678	1017	32.36	30.23	30	1.13
103	1 x 6	35.02	350	525	710	1065	34.42	32.78	37	0.95
Double Row Models										
039	2 x 2	14.06	141	211	281	422	13.22	12.03	27	0.52
045	2 x 2	15.79	158	237	316	474	15.28	14.27	36	0.44
049	2 x 2	17.18	172	258	344	515	16.40	15.33	36	0.48
054	2 x 2	18.29	183	274	366	549	17.98	17.12	45	0.41
058	2 x 3	21.09	211	316	422	633	19.83	18.05	36	0.59
067	2 x 3	23.66	237	355	473	710	22.90	21.37	48	0.49
073	2 x 3	25.76	258	386	515	773	24.60	22.99	48	0.54
081	2 x 3	27.44	274	412	549	823	26.98	25.69	60	0.46
086	2 x 3	30.48	305	457	610	914	28.34	26.63	72	0.42
096	2 x 3	32.39	324	486	648	972	31.18	29.85	90	0.36
112	2 x 4	40.46	405	607	809	1214	38.03	34.63	30	1.35
126	2 x 4	45.07	451	676	901	1352	43.04	40.20	40	1.13
137	2 x 4	47.32	473	710	946	1420	46.52	44.29	50	0.95
158	2 x 5	56.47	565	847	1129	1694	53.93	50.38	60	0.94
172	2 x 5	59.16	592	887	1183	1775	58.15	55.37	75	0.79
190	2 x 6	67.77	678	1017	1355	2033	64.72	60.45	60	1.13
206	2 x 6	70.98	710	1065	1420	2129	69.78	66.44	75	0.95

Correction Factors for Other refrigerants - Use R22 Values Multiplied By

R134a	R12	R507	R404A	R407A	R407B	R502	R407C
0.94	0.95	0.97	0.97	0.97	0.97	0.98	1.00

NOTES:

(1) Above capacity data based on 0°F subcooling and at sea level.
(2) TD = Condensing temperature - ambient temperature
(3) Standard fin spacing is 12 FPI except models 056 and 112 (13 FPI).
(4) For High Altitude applications apply the following correction factors: 0.94 for 2000 feet, 0.88 for 4000 feet and 0.81 for 6000 feet.
(5) For 50Hz capacity multiply by 0.92.

CAPACITY DATA - 550 RPM MODELS - R404A

KVC MODEL NUMBER	Fan Rows	TOTAL HEAT OF REJECTION CAPACITY (MBH) TEMPERATURE DIFFERENCE (TD)							Maximum No. of Feeds	MBH @ 1° F TD Per Feed (12 FPI)
		12 FPI					10 FPI	8 FPI		
		1°F (0.56°C)	10°F (5.56°C)	15°F (8.3°C)	20°F (11.1°C)	30°F (16.7°C)	1°F (0.56°C)	1°F (0.56°C)		
Single Row Models										
007	1 x 1	2.464	24.6	37.0	49.3	73.9	2.254	1.998	4	0.62
009	1 x 1	3.067	30.7	46.0	61.3	92.0	2.921	2.677	8	0.38
010	1 x 1	3.417	34.2	51.3	68.3	103	3.213	2.924	9	0.38
011	1 x 1	3.830	38.3	57.5	76.6	115	3.707	3.461	8	0.48
012	1 x 1	4.169	41.7	62.5	83.4	125	3.981	3.720	8	0.52
013	1 x 1	4.442	44.4	66.6	88.8	133	4.368	4.159	10	0.44
017	1 x 2	6.126	61.3	91.9	123	184	5.834	5.348	14	0.44
019	1 x 2	6.798	68.0	102	136	204	6.391	5.817	18	0.38
022	1 x 2	7.661	76.6	115	153	230	7.415	6.922	18	0.43
024	1 x 2	8.345	83.5	125	167	250	7.969	7.447	18	0.46
027	1 x 2	8.885	88.8	133	178	267	8.736	8.318	18	0.49
029	1 x 3	10.24	102	154	205	307	9.632	8.766	18	0.57
034	1 x 3	11.46	115	172	229	344	11.09	10.36	24	0.48
037	1 x 3	12.51	125	188	250	375	11.94	11.16	24	0.52
041	1 x 3	13.32	133	200	266	400	13.10	12.47	30	0.44
043	1 x 3	14.78	148	222	296	443	13.75	12.92	36	0.41
048	1 x 3	15.71	157	236	314	471	15.12	14.48	45	0.35
056	1 x 4	19.19	192	288	392	589	18.44	16.80	15	1.28
063	1 x 4	21.86	219	328	437	656	20.87	19.50	20	1.09
068	1 x 4	22.64	226	340	459	689	22.56	21.48	25	0.91
079	1 x 5	27.39	274	411	548	822	26.16	24.43	30	0.91
085	1 x 5	28.31	283	425	574	861	27.82	26.50	37	0.77
095	1 x 6	32.87	329	493	657	986	31.39	29.32	30	1.10
103	1 x 6	33.97	340	510	689	1033	33.39	31.80	37	0.92
Double Row Models										
039	2 x 2	13.64	136	205	273	409	12.82	11.67	27	0.51
045	2 x 2	15.31	153	230	306	459	14.82	13.84	36	0.43
049	2 x 2	16.66	167	250	333	500	15.91	14.87	36	0.46
054	2 x 2	17.74	177	266	355	532	17.44	16.61	45	0.39
058	2 x 3	20.46	205	307	409	614	19.24	17.51	36	0.57
067	2 x 3	22.95	229	344	459	688	22.21	20.73	48	0.48
073	2 x 3	24.99	250	375	500	750	23.86	22.30	48	0.52
081	2 x 3	26.62	266	399	532	799	26.17	24.92	60	0.44
086	2 x 3	29.57	296	443	591	887	27.49	25.83	72	0.41
096	2 x 3	31.42	314	471	628	943	30.24	28.95	90	0.35
112	2 x 4	39.24	392	589	785	1177	36.89	33.59	30	1.31
126	2 x 4	43.72	437	656	874	1311	41.75	38.99	40	1.09
137	2 x 4	45.90	459	689	918	1377	45.12	42.96	50	0.92
158	2 x 5	54.78	548	822	1096	1643	52.32	48.86	60	0.91
172	2 x 5	57.38	574	861	1148	1722	56.41	53.71	75	0.77
190	2 x 6	65.74	657	986	1315	1972	62.78	58.64	60	1.10
206	2 x 6	68.85	689	1033	1377	2066	67.68	64.45	75	0.92

To calculate capacities with other refrigerants, multiply the R22 capacity by the appropriate correction factor. Refer to the table accompanying each of the R22 tables.

NOTES:

(1) Above capacity data based on 0°F subcooling and at sea level.

(2) TD = Condensing temperature - ambient temperature

(3) Standard fin spacing is 12 FPI except models 056 and 112 (13 FPI).

(4) For High Altitude applications apply the following correction factors: 0.94 for 2000 feet, 0.88 for 4000 feet and 0.81 for 6000 feet.

(5) For 50Hz capacity multiply by 0.92.

GENERAL SPECIFICATIONS - 550 RPM MODELS - R22

KVC MODEL NUMBER	Total No. of Feeds	R22 Refrigerant Charge [1]				Air Flow Rate[4]		Piping Connections		Condenser Weight [5]	
		Normal [2]		90% FULL [3]				Inlet	Outlet		
		lbs	kg	lbs	kg	CFM	m^3/h	Qty - OD	Qty - OD	lbs	kg
Single Row Models											
1B11**007**	4	1.7	0.8	11.0	5.2	4630	7900	1 - 1 1/8	1 - 7/8	360	163
1B11**009**	8	2.2	1.0	17.0	7.5	4060	6900	1 - 1 3/8	1 - 7/8	375	170
1B11**010**	9	2.8	1.3	21.0	9.5	4630	7900	1 - 1 3/8	1 - 7/8	420	191
1B11**011**	8	3.9	1.8	27.0	12.0	4450	7600	1 - 1 3/8	1 - 1 1/8	440	200
1B11**012**	8	4.3	2.0	31.0	14.0	4660	7900	1 - 1 3/8	1 - 1 1/8	480	218
1B11**013**	10	5.2	2.4	39.0	18.0	4480	7600	1 - 1 5/8	1 - 1 1/8	505	229
1B12**017**	14	4.1	1.9	31.0	14.0	8100	13800	1 - 1 5/8	1 - 1 1/8	565	256
1B12**019**	18	6.1	2.8	44.0	20.0	9300	15700	1 - 2 1/8	1 - 1 3/8	630	286
1B12**022**	18	7.4	3.4	55.0	25.0	8900	15100	1 - 2 1/8	1 - 1 3/8	675	306
1B12**024**	18	8.3	3.8	62.0	28.0	9300	15800	1 - 2 1/8	1 - 1 3/8	740	336
1B12**027**	18	10.0	4.5	75.0	34.0	9000	15300	1 - 2 1/8	1 - 1 3/8	790	358
1B13**029**	18	9.0	4.1	61.0	28.0	13800	23500	1 - 2 1/8	1 - 1 5/8	840	381
1B13**034**	24	10.0	4.5	78.0	35.0	13300	22700	1 - 2 1/8	1 - 1 5/8	905	410
1B13**037**	24	12.0	5.4	94.0	42.0	14000	23800	1 - 2 5/8	1 - 1 5/8	1000	454
1B13**041**	30	14.0	6.4	113	51.0	13500	22900	1 - 2 5/8	1 - 1 5/8	1070	485
1B13**043**	36	17.5	7.9	128	57.8	17100	29200	1 - 2 5/8	1 - 1 5/8	1055	479
1B13**048**	45	20.5	9.3	152	68.9	16700	28300	1 - 2 5/8	1 - 1 5/8	1150	522
2B14**056**	15	25.9	11.8	183	83.2	23200	39500	1 - 2 5/8	1 - 2 1/8	1600	726
2B14**063**	20	32.5	14.7	239	108	22800	38800	1 - 2 5/8	1 - 2 1/8	1650	748
2B14**068**	25	38.0	17.2	286	130	22200	37700	1 - 2 5/8	1 - 2 1/8	1750	794
2B15**079**	30	38.5	17.5	290	131	28500	48500	1 - 2 5/8	1 - 2 1/8	2063	936
2B15**085**	37	48.8	22.2	356	161	27700	47200	1 - 2 5/8	1 - 2 5/8	2188	992
2B16**095**	30	53.5	24.3	365	165	34200	58200	1 - 3 1/8	1 - 3 1/8	2475	1123
2B16**103**	37	61.2	27.7	436	198	33300	56600	1 - 3 1/8	1 - 3 1/8	2625	1191
Double Row Models											
1B22**039**	27	16.0	7.3	104	47.0	18500	31500	2 - 2 1/8	2 - 1 3/8	1060	481
1B22**045**	36	19.0	8.6	126	57.0	17800	30300	2 - 2 1/8	2 - 1 3/8	1145	519
1B22**049**	36	21.0	9.5	141	64.0	18600	31700	2 - 2 1/8	2 - 1 3/8	1255	569
1B22**054**	45	23.0	10.0	167	76.0	17900	30500	2 - 2 1/8	2 - 1 3/8	1350	612
1B23**058**	36	22.0	10.0	141	64.0	27700	47100	2 - 2 1/8	2 - 1 5/8	1420	644
1B23**067**	48	26.0	12.0	174	79.0	26700	45300	2 - 2 1/8	2 - 1 5/8	1550	703
1B23**073**	48	30.0	14.0	212	96.0	28000	47500	2 - 2 5/8	2 - 1 5/8	1710	776
1B23**081**	60	35.0	16.0	251	114	26900	45800	2 - 2 5/8	2 - 1 5/8	1865	846
1B23**086**	72	35.0	16.0	255	116	34300	58300	2 - 2 5/8	2 - 1 5/8	2110	957
1B23**096**	90	41.0	19.0	304	138	33300	56700	2 - 2 5/8	2 - 1 5/8	2300	1043
2B24**112**	30	53.0	24.0	375	170	46500	79000	2 - 2 5/8	2 - 2 1/8	3200	1451
2B24**126**	40	65.0	30.0	477	217	45600	77600	2 - 2 5/8	2 - 2 1/8	3300	1497
2B24**137**	50	77.0	35.0	579	263	44400	75500	2 - 2 5/8	2 - 2 1/8	3500	1588
2B25**158**	60	77.0	35.0	579	263	57000	96900	2 - 2 5/8	2 - 2 1/8	4125	1871
2B25**172**	75	99.0	45.0	721	327	55500	94300	2 - 2 5/8	2 - 2 5/8	4375	1984
2B26**190**	60	107.0	49.0	729	331	68400	116300	2 - 3 1/8	2 - 3 1/8	4950	2245
2B26**206**	75	124.0	56.0	883	401	66600	113200	2 - 3 1/8	2 - 3 1/8	5250	2381

NOTES:

(1) For R407A, R507 use R22 Charge x 0.87. For R407-C use R22 Charge x 0.97. For R134a and R502 use R22 Charge. For R12 use R22 Charge x 1.1.

(2) Normal Charge is the refrigerant charge for warm ambient or summer operation. For low ambient or winter charge with flooded head pressure control and fan cycling see Page 33 and Page 34.

(3) 90% FULL is the liquid refrigerant weight at 90% of internal volume and is for reference ONLY.

(4) For 50Hz Fan data use 60Hz CFM (m^3/h) x 0.83.capacity multiply by 0.92.

(5) Less weight pf refrigerant charge.

ELECTRICAL DATA - 550 RPM MODELS 60Hz

NO. OF FANS	208-230/3/60			460/3/60			575/3/60		
	TOTAL FLA	MCA	MOP	TOTAL FLA	MCA	MOP	TOTAL FLA	MCA	MOP
1	2.8	3.5	15	1.3	1.6	15	1.1	1.4	15
2	5.6	6.3	15	2.6	2.9	15	2.2	2.5	15
3	8.4	9.1	15	3.9	4.2	15	3.3	3.6	15
4	11.2	11.9	15	5.2	5.5	15	4.4	4.7	15
5	14.0	16	20	6.5	6.8	15	5.5	5.8	15
6	16.8	21	25	7.8	8.1	15	6.6	6.9	15
8	22.4	26	30	10.4	10.7	15	8.8	9.1	15
10	28.0	31	35	13	16	20	11	11.3	15
12	33.6	41	45	15.6	15.9	20	13.2	16	20

M.C.A. = Minimum Circuit Ampacity (AMPS)
M.O.P. = Maximum Overcurrent Protection (AMPS)

ELECTRICAL DATA - 550 (450) RPM MODELS 50Hz

NO. OF FANS	200-220/3/50			380-400/3/50		
	TOTAL FLA	MCA	MOP	TOTAL FLA	MCA	MOP
1	2.2	2.7	15	1	1.2	15
2	4.4	4.9	15	2	2.2	15
3	6.5	7.1	15	2.9	3.2	15
4	8.7	9.3	15	3.9	4.2	15
5	10.9	11.4	15	4.9	5.1	15
6	13.1	16	20	5.9	6.1	15
8	17.4	21	25	7.8	8.1	15
10	17.4	21	25	7.8	8.1	15
12	26.2	31	35	11.8	12	15

M.C.A. = Minimum Circuit Ampacity (AMPS)
M.O.P. = Maximum Overcurrent Protection (AMPS)

CAPACITY DATA - 1140 RPM MODELS - R22

KVC MODEL NUMBER	Fan Rows	TOTAL HEAT OF REJECTION CAPACITY (MBH) TEMPERATURE DIFFERENCE (TD) 12 FPI 1°F (0.56°C)	12 FPI 10°F (5.56°C)	12 FPI 15°F (8.3°C)	12 FPI 20°F (11.1°C)	12 FPI 30°F (16.7°C)	10 FPI 1°F (0.56°C)	8 FPI 1°F (0.56°C)	Maximum No. of Feeds	MBH @ 1° F TD Per Feed (12 FPI)
Single Row Models										
007	1 x 1	3.627	36.3	54.4	72.5	109	3.303	2.911	7	0.52
009	1 x 1	4.989	49.9	74.8	100	150	4.677	4.220	8	0.62
010	1 x 1	5.516	55.2	82.7	110	165	5.094	4.572	9	0.61
011	1 x 1	6.446	64.5	96.7	129	193	6.118	5.589	12	0.54
012	1 x 1	7.157	71.6	107	143	215	6.710	6.114	12	0.60
013	1 x 1	7.985	79.9	120	160	240	7.678	7.095	15	0.53
017	1 x 2	9.971	100	150	199	299	9.348	8.434	14	0.71
019	1 x 2	10.98	110	165	220	329	10.14	9.100	18	0.61
022	1 x 2	12.90	129	194	258	387	12.25	11.19	24	0.54
024	1 x 2	14.34	143	215	287	430	13.44	12.25	24	0.60
027	1 x 2	15.98	160	240	320	479	15.37	14.20	30	0.53
029	1 x 3	16.55	166	248	331	497	15.29	13.72	27	0.61
034	1 x 3	19.31	193	290	386	579	18.33	16.74	36	0.54
037	1 x 3	21.49	215	322	430	645	20.15	18.36	36	0.60
041	1 x 3	23.96	240	359	479	719	23.04	21.29	45	0.53
043	1 x 3	25.40	254	381	508	762	24.03	21.94	36	0.71
048	1 x 3	28.48	285	427	570	854	27.14	25.19	45	0.63
056	1 x 4	31.01	310	465	620	930	28.64	25.71	22	1.41
063	1 x 4	36.76	368	551	735	1103	34.77	31.76	30	1.23
068	1 x 4	40.34	403	605	807	1210	38.44	35.67	37	1.09
079	1 x 5	46.06	461	691	921	1382	43.57	39.79	30	1.54
085	1 x 5	50.43	504	756	1009	1513	48.06	44.59	37	1.36
095	1 x 6	55.27	553	829	1105	1658	52.29	47.75	30	1.84
103	1 x 6	60.51	605	908	1210	1815	57.66	53.51	37	1.64
Double Row Models										
039	2 x 2	22.04	220	331	441	661	20.35	18.27	36	0.61
045	2 x 2	25.79	258	387	516	774	24.48	22.37	48	0.54
049	2 x 2	28.63	286	429	573	859	26.84	24.45	48	0.60
054	2 x 2	31.92	319	479	638	957	30.69	28.36	60	0.53
058	2 x 3	33.06	331	496	661	992	30.53	27.40	54	0.61
067	2 x 3	38.65	386	580	773	1159	36.69	33.52	72	0.54
073	2 x 3	42.93	429	644	859	1288	40.25	36.67	72	0.60
081	2 x 3	47.89	479	718	958	1437	46.05	42.55	90	0.53
086	2 x 3	50.80	508	762	1016	1524	48.06	43.89	72	0.71
096	2 x 3	56.97	570	854	1139	1709	54.29	50.38	90	0.63
112	2 x 4	63.44	634	952	1269	1903	58.58	52.58	45	1.41
126	2 x 4	73.52	735	1103	1470	2205	69.55	63.51	60	1.23
137	2 x 4	81.76	818	1226	1635	2453	77.92	72.30	75	1.09
158	2 x 5	92.12	921	1382	1842	2764	87.15	79.59	60	1.54
172	2 x 5	102.2	1022	1533	2044	3067	97.41	90.39	75	1.36
190	2 x 6	110.5	1105	1658	2211	3316	104.6	95.50	60	1.84
206	2 x 6	122.7	1227	1840	2453	3680	116.9	108.5	75	1.64

Correction Factors for Other refrigerants - Use R22 Values Multiplied By

R134a	R12	R507	R404A	R407A	R407B	R502	R407C
0.94	0.95	0.97	0.97	0.97	0.97	0.98	1.00

NOTES:

(1) Above capacity data based on 0°F subcooling and at sea level.

(2) TD = Condensing temperature - ambient temperature

(3) Standard fin spacing is 12 FPI except models 056 and 112 (13 FPI).

(4) For High Altitude applications apply the following correction factors: 0.94 for 2000 feet, 0.88 for 4000 feet and 0.81 for 6000 feet.

(5) For 50Hz capacity multiply by 0.92.

CAPACITY DATA - 1140 RPM MODELS - R404A

KVC MODEL NUMBER	Fan Rows	TOTAL HEAT OF REJECTION CAPACITY (MBH)							Maximum No. of Feeds	MBH @ 1° F TD Per Feed (12 FPI)
		TEMPERATURE DIFFERENCE (TD)								
		12 FPI					10 FPI	8 FPI		
		1°F (0.56°C)	10°F (5.56°C)	15°F (8.3°C)	20°F (11.1°C)	30°F (16.7°C)	1°F (0.56°C)	1°F (0.56°C)		
Single Row Models										
007	1 x 1	3.518	35.2	52.8	70.4	106	3.204	2.824	7	0.50
009	1 x 1	4.839	48.4	72.6	96.8	145	4.537	4.093	8	0.60
010	1 x 1	5.351	53.5	80.3	107	161	4.941	4.435	9	0.59
011	1 x 1	6.252	62.5	93.8	125	188	5.935	5.422	12	0.52
012	1 x 1	6.943	69.4	104	139	208	6.509	5.930	12	0.58
013	1 x 1	7.746	77.5	116	155	232	7.448	6.882	15	0.52
017	1 x 2	9.672	96.7	145	193	290	9.068	8.181	14	0.69
019	1 x 2	10.65	106	160	213	319	9.834	8.827	18	0.59
022	1 x 2	12.52	125	188	250	375	11.88	10.85	24	0.52
024	1 x 2	13.91	139	209	278	417	13.04	11.88	24	0.58
027	1 x 2	15.50	155	233	310	465	14.91	13.77	30	0.52
029	1 x 3	16.06	161	241	321	482	14.83	13.31	27	0.59
034	1 x 3	18.73	187	281	375	562	17.78	16.24	36	0.52
037	1 x 3	20.85	208	313	417	625	19.54	17.81	36	0.58
041	1 x 3	23.24	232	349	465	697	22.35	20.65	45	0.52
043	1 x 3	24.64	246	370	493	739	23.31	21.29	36	0.68
048	1 x 3	27.63	276	414	553	829	26.33	24.43	45	0.61
056	1 x 4	30.08	301	451	602	903	27.78	24.93	22	1.37
063	1 x 4	35.65	357	535	713	1070	33.73	30.80	30	1.19
068	1 x 4	39.13	391	587	783	1174	37.29	34.60	37	1.06
079	1 x 5	44.68	447	670	894	1340	42.27	38.60	30	1.49
085	1 x 5	48.92	489	734	978	1467	46.61	43.26	37	1.32
095	1 x 6	53.61	536	804	1072	1608	50.72	46.32	30	1.79
103	1 x 6	58.69	587	880	1174	1761	55.93	51.90	37	1.59
Double Row Models										
039	2 x 2	21.38	214	321	428	641	19.74	17.72	36	0.59
045	2 x 2	25.02	250	375	500	751	23.75	21.70	48	0.52
049	2 x 2	27.77	278	417	555	833	26.03	23.72	48	0.58
054	2 x 2	30.96	310	464	619	929	29.77	27.51	60	0.52
058	2 x 3	32.07	321	481	641	962	29.61	26.58	54	0.59
067	2 x 3	37.49	375	562	750	1125	35.59	32.51	72	0.52
073	2 x 3	41.64	416	625	833	1249	39.04	35.57	72	0.58
081	2 x 3	46.45	465	697	929	1394	44.66	41.27	90	0.52
086	2 x 3	49.28	493	739	986	1478	46.62	42.57	72	0.68
096	2 x 3	55.26	553	829	1105	1658	52.66	48.86	90	0.61
112	2 x 4	61.53	615	923	1231	1846	56.82	51.00	45	1.37
126	2 x 4	71.31	713	1070	1426	2139	67.46	61.61	60	1.19
137	2 x 4	79.31	793	1190	1586	2379	75.58	70.14	75	1.06
158	2 x 5	89.36	894	1340	1787	2681	84.53	77.20	60	1.49
172	2 x 5	99.15	992	1487	1983	2975	94.49	87.68	75	1.32
190	2 x 6	107.2	1072	1608	2145	3217	101.4	92.64	60	1.79
206	2 x 6	119.0	1190	1785	N/A	N/A	113.4	105.2	75	1.59

To calculate capacities with other refrigerants, multiply the R22 capacity by the appropriate correction factor. Refer to the table accompanying each of the R22 tables.

NOTES:

(1) Above capacity data based on 0°F subcooling and at sea level.
(2) TD = Condensing temperature - ambient temperature
(3) Standard fin spacing is 12 FPI except models 056 and 112 (13 FPI).
(4) For High Altitude applications apply the following correction factors: 0.94 for 2000 feet, 0.88 for 4000 feet and 0.81 for 6000 feet.
(5) For 50Hz capacity multiply by 0.92.

GENERAL SPECIFICATIONS - 1140 RPM MODELS

KVC / KHC MODEL NUMBER	Total No. of Feeds	R22 Refrigerant Charge (1)				Air Flow Rate(4)		Piping Connections		Condenser Weight (5)	
		Normal(2)		90% FULL (3)				Inlet	Outlet		
		lbs	kg	lbs	kg	CFM	m³/h	Qty - OD	Qty - OD	lbs	kg
Single Row Models											
1C11**007**	7	1.7	0.8	11.0	5.2	9590	16300	1 - 1 1/8	1 - 7/8	360	163
1C11**009**	8	2.2	1.0	17.0	7.5	8420	14300	1 - 1 3/8	1 - 7/8	375	170
1C11**010**	9	2.8	1.3	21.0	9.5	9590	16300	1 - 1 3/8	1 - 7/8	420	191
1C11**011**	12	3.9	1.8	27.0	12.0	9230	15700	1 - 1 3/8	1 - 1 1/8	440	200
1C11**012**	12	4.3	2.0	31.0	14.0	9660	16400	1 - 1 3/8	1 - 1 1/8	480	218
1C11**013**	15	5.2	2.4	39.0	18.0	9290	15800	1 - 1 5/8	1 - 1 1/8	505	229
1C12**017**	14	4.1	1.9	31.0	14.0	16800	28500	1 - 1 5/8	1 - 1 1/8	565	256
1C12**019**	18	6.1	2.8	44.0	20.0	19200	32600	1 - 2 1/8	1 - 1 3/8	630	286
1C12**022**	24	7.4	3.4	55.0	25.0	18400	31200	1 - 2 1/8	1 - 1 3/8	675	306
1C12**024**	24	8.3	3.8	62.0	28.0	19300	32800	1 - 2 1/8	1 - 1 3/8	740	336
1C12**027**	30	10.0	4.5	75.0	34.0	18600	31700	1 - 2 1/8	1 - 1 3/8	790	358
1C13**029**	27	9.0	4.1	61.0	28.0	28700	48800	1 - 2 1/8	1 - 1 5/8	840	381
1C13**034**	36	10.0	4.5	78.0	35.0	27600	47000	1 - 2 1/8	1 - 1 5/8	905	410
1C13**037**	36	12.0	5.4	94.0	42.0	29000	49200	1 - 2 5/8	1 - 1 5/8	1000	454
1C13**041**	45	14.0	6.4	113	51.0	27900	47400	1 - 2 5/8	1 - 1 5/8	1070	485
1C13**043**	36	17.5	7.9	128	57.8	35500	60400	1 - 2 5/8	1 - 1 5/8	1055	479
1C13**048**	45	20.5	9.3	152	68.9	34500	58700	1 - 2 5/8	1 - 1 5/8	1150	522
2C14**056**	22	25.9	11.8	183	83.2	48100	81900	1 - 2 5/8	1 - 2 1/8	1600	726
2C14**063**	30	32.5	14.7	239	108	47300	80400	1 - 2 5/8	1 - 2 1/8	1650	748
2C14**068**	37	38.0	17.2	286	130	46000	78200	1 - 2 5/8	1 - 2 1/8	1750	794
2C15**079**	30	38.5	17.5	290	131	59100	100500	1 - 2 5/8	1 - 2 1/8	2063	936
2C15**085**	37	48.8	22.2	356	161	57500	97800	1 - 2 5/8	1 - 2 5/8	2188	992
2C16**095**	30	53.5	24.3	365	165	70900	120600	1 - 3 1/8	1 - 3 1/8	2475	1123
2C16**103**	37	61.2	27.7	436	198	69000	117300	1 - 3 1/8	1 - 3 1/8	2625	1191
Double Row Models											
1C22**039**	36	16.0	7.3	104	47.0	38400	65200	2 - 2 1/8	2 - 1 3/8	1060	481
1C22**045**	48	19.0	8.6	126	57.0	36900	62700	2 - 2 1/8	2 - 1 3/8	1145	519
1C22**049**	48	21.0	9.5	141	64.0	38600	65700	2 - 2 1/8	2 - 1 3/8	1255	569
1C22**054**	60	23.0	10.0	167	76.0	37200	63200	2 - 2 1/8	2 - 1 3/8	1350	612
1C23**058**	54	22.0	10.0	141	64.0	57400	97600	2 - 2 1/8	2 - 1 5/8	1420	644
1C23**067**	72	26.0	12.0	174	79.0	55300	93900	2 - 2 1/8	2 - 1 5/8	1550	703
1C23**073**	72	30.0	14.0	212	96.0	57900	98500	2 - 2 5/8	2 - 1 5/8	1710	776
1C23**081**	90	35.0	16.0	251	114	55800	94800	2 - 2 5/8	2 - 1 5/8	1865	846
1C23**086**	72	35.0	16.0	255	116	71100	120800	2 - 2 5/8	2 - 1 5/8	2110	957
1C23**096**	90	41.0	19.0	304	138	69100	117400	2 - 2 5/8	2 - 1 5/8	2300	1043
2C24**112**	45	53.0	24.0	375	170	96300	163700	2 - 2 5/8	2 - 2 1/8	3200	1451
2C24**126**	60	65.0	30.0	477	217	94600	160700	2 - 2 5/8	2 - 2 1/8	3300	1497
2C24**137**	75	77.0	35.0	579	263	92000	156400	2 - 2 5/8	2 - 2 1/8	3500	1588
2C25**158**	60	77.0	35.0	579	263	118200	200900	2 - 2 5/8	2 - 2 1/8	4125	1871
2C25**172**	75	99.0	45.0	721	327	115000	195500	2 - 2 5/8	2 - 2 5/8	4375	1984
2C26**190**	60	107.0	49.0	729	331	141800	241100	2 - 3 1/8	2 - 3 1/8	4950	2245
2C26**206**	75	124.0	56.0	883	401	138000	234600	2 - 3 1/8	2 - 3 1/8	5250	2381

NOTES:

(1) For R407A, R507 use R22 Charge x 0.87. For R407-C use R22 Charge x 0.97. For R134a and R502 use R22 Charge. For R12 use R22 Charge x 1.1.

(2) Normal Charge is the refrigerant charge for warm ambient or summer operation. For low ambient or winter charge with flooded head pressure control and fan cycling see Page 33 and Page 34.

(3) 90% FULL is the liquid refrigerant weight at 90% of internal volume and is for reference ONLY.

(4) For 50Hz Fan data use 60Hz CFM (m³/h) x 0.83.capacity multiply by 0.92.

(5) Less weight pf refrigerant charge.

ELECTRICAL DATA - 1140 RPM MODELS 60Hz

NO. OF FANS	208-230/3/60			460/3/60			575/3/60		
	TOTAL FLA	MCA	MOP	TOTAL FLA	MCA	MOP	TOTAL FLA	MCA	MOP
1	6.6	8.3	15	3.1	3.9	15	2.5	3.1	15
2	13.2	14.9	20	6.2	7	15	5	5.6	15
3	19.8	21.5	25	9.3	10.1	15	7.5	8.1	15
4	26.4	31	35	12.4	13.2	15	10	10.6	15
5	33	34.7	40	15.5	16.3	20	12.5	13.1	15
6	39.6	46	50	18.6	21	25	15	15.6	20
8	52.8	61	70	24.8	25.6	30	20	20.6	25
10	66	71	80	31	36	40	25	25.6	30
12	79.2	91	100	37.2	41	45	30	36	40

M.C.A. = Minimum Circuit Ampacity (AMPS)
M.O.P. = Maximum Overcurrent Protection (AMPS)

ELECTRICAL DATA - 1140 (950) RPM MODELS 50Hz

NO. OF FANS	200-220/3/50			380-400/3/50		
	TOTAL FLA	MCA	MOP	TOTAL FLA	MCA	MOP
1	5.9	7.4	15	2.7	3.4	15
2	11.8	13.3	15	5.4	6	15
3	17.7	19.1	25	8.0	8.7	15
4	23.6	25	30	10.7	11.4	15
5	29.5	36	40	13.4	16	20
6	35.3	41	45	16.1	16.8	20
8	47.1	51	60	21.4	26	30
10	58.9	71	80	26.8	31	35
12	70.7	81	90	32.2	36	40

M.C.A. = Minimum Circuit Ampacity (AMPS)
M.O.P. = Maximum Overcurrent Protection (AMPS)

CONDENSER THEORY

The purpose of a refrigeration system is to absorb heat from an area where it is not wanted and reject this heat to an area where it is unobjectionable. By referring to the diagram below, it can be seen that only a few components are required to perform this task.

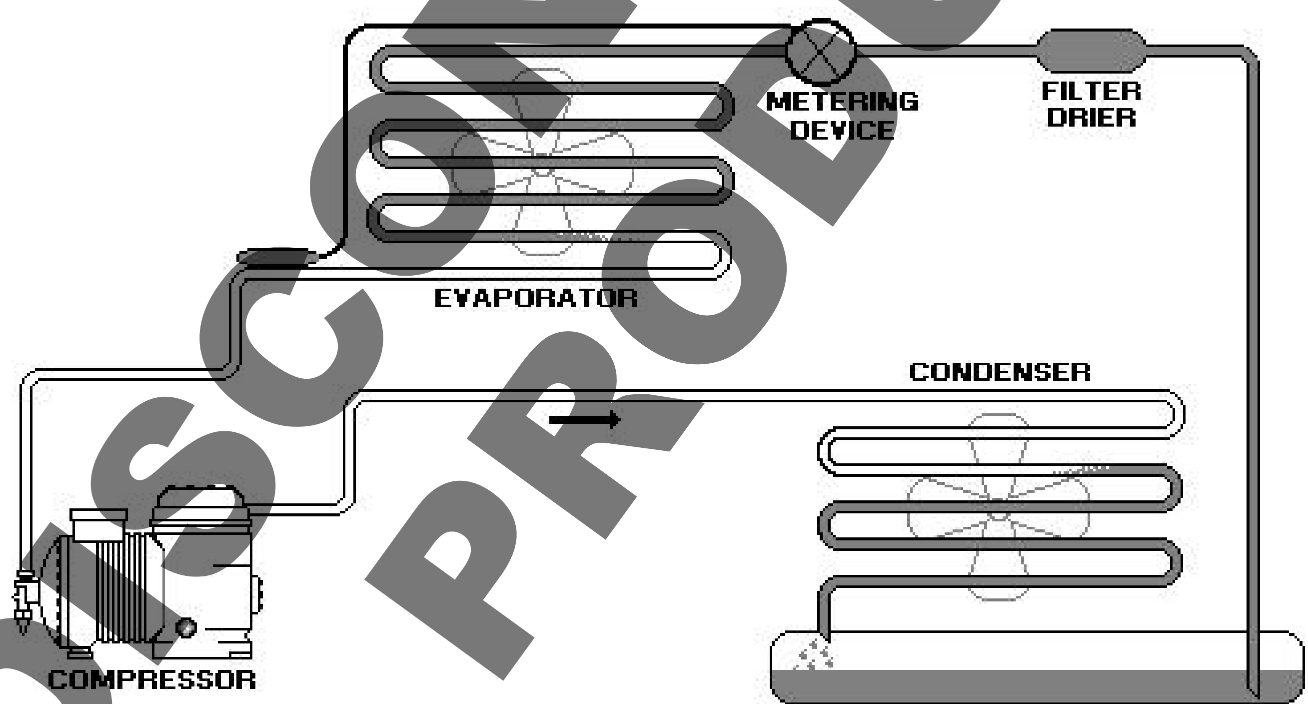
High pressure/high temperature vapor leaves the compressor and is forced into the condenser via the discharge line. The condenser first desuperheats the vapor down to its saturation point. This saturation point can be expressed as the condensing temperature of the refrigerant and varies with condenser size, load and ambient temperature.

Now the condenser must remove the latent heat of condensation from the refrigerant so that it may fully condense. After the refrigerant has fully condensed, it will be subcooled to some extent.

The liquid leaving the condenser is still at a high pressure but at a much lower temperature and drains into the receiver. As the liquid level in the receiver increases, the vapor is allowed to vent back up to the condenser via the condensate line.

Because the dip tube almost reaches the bottom of the receiver, only liquid will enter the liquid line. This liquid now passes through the metering device where its pressure is reduced to the evaporating pressure. The temperature will drop with pressure since the refrigerant will always attempt to meet its saturation point during a change of state.

The condensing temperature decreases as the ambient temperature drops and/or as the condenser surface increases.



THE BASIC REFRIGERATION CYCLE

GLOSSARY OF TERMS

Balance point - after a system stabilizes, the heat added to the refrigerant during the refrigeration cycle will equal the heat rejected at the condenser. The balance point usually refers to the actual TD that the system is operating at. The balance point could refer to a low side balance or a high side balance. For example, a system operating with a 120 ^{o}F condensing temperature in a 90 ^{o}F ambient will have a condenser balance point of 30 ^{o}F TD.

Circuit - a circuit can be considered a group of feeds. A condenser may be sized to handle several refrigeration systems at one time. Each system is considered one circuit and the number of feeds required for each circuit depends on the THR for that particular system. Each circuit has its own inlet and outlet header. The number of circuits on a condenser can not exceed the total number of feeds available.

Compression Ratio - Compression ratio equals the discharge pressure in pounds per square inch absolute (psia) divided by the suction pressure in psia. The compression ratio in a compressor increases as suction pressure decreases and as discharge pressure increases. (at sea-level, psia is equal to psig plus 14.7).

Compressor Capacity - can be defined as the actual refrigerating capacity available at the evaporator and suction line after considering the overall system balance point. Compressor capacity is mainly affected by the evaporating and condensing temperatures of the system.

Condensate Line - (also called “Drain Leg”) is a term that describes the refrigerant line between the condenser and the receiver.
The condensate line should drop vertically and is typically larger than the liquid line. This is to promote free draining of the refrigerant from the condenser to the receiver.

Condenser Temperature Difference (TD) - is the difference between the condensing temperature of the refrigerant and the temperature of the air entering the condenser.

.

Condensing Temperature (CT) - is the temperature where the refrigerant vapor condenses back to a liquid. This temperature varies with condenser size. Condensing temperature should be kept as low as possible to maintain higher refrigerating capacity and system efficiency

Desuperheat - refers to the lowering of refrigerant superheat. Hot vapor entering a condenser must first be desuperheated before any condensing of the refrigerant can take place.

Evaporating Temperature - the temperature at which heat is absorbed in the evaporator, at this temperature, the refrigerant changes from a liquid to a vapor. This evaporating temperature is dependent on pressure and must be lower than the surrounding temperature for heat transfer to take place.

Feed - a single path for refrigerant flow inside a condenser. This path begins at the inlet header and terminates at the condenser’s outlet header. These feeds can be grouped together to accommodate one or more circuits.

Heat of Compression - heat is added to the refrigerant as it is compressed. Evidence of this can be observed on the pressure-enthalpy diagram for the refrigerant being used. The amount of this heat is dependent on the refrigerant type and compression ratio.

Additional heat from friction also increases the heat of compression. All of this heat along with the heat absorbed in the evaporator, suction line and any motor heat must be rejected by the condenser.

Latent Heat of Vaporization (also Latent Heat of Condensation) - refers to the heat required to fully vaporize or condense a refrigerant. This latent heat varies with temperature and pressure. Latent heat is often referred to as *hidden heat* since adding heat to a saturated liquid or removing heat from a saturated vapor will result in a *change of state and heat content* but not a change in temperature.

Liquid Line - is the piping between the receiver and the metering device. On systems without a receiver, the liquid line runs between the condenser and the metering device.

GLOSSARY OF TERMS

Open Drive - This term is given to a compressor where its driving motor is separate from the compressor. In this type of compressor, motor heat is not transferred to the refrigerant.

Refrigerating Effect - the total amount of heat absorbed by the evaporator. This heat includes both *latent heat* and *superheat.* This value is usually expressed in BTU/Hour, (BTUH), or 1000 BTU/Hour (MBH)

Saturation - occurs whenever the refrigerant exists in both a vapor and liquid state, example: a cylinder of refrigerant is in a saturated condition or state of equilibrium. Any heat removed from a saturated vapor will result in condensation. Conversely, any heat added to a saturated liquid will result in evaporation of the refrigerant. Temperature pressure charts for the various refrigerants indicate saturation values. For a single component refrigerant, each temperature value can only have one pressure when the refrigerant is either a saturated vapor or saturated liquid.
A single component refrigerant can not change state until it approaches its saturation temperature or pressure. For refrigerant blends, the pressure-temperature relationship is more complex. Simply stated, Dew point temperature (saturation point in evaporator-low side) and Bubble point temperature (saturation point in condenser-high side) are used to define their saturated condition.

Subcool - to reduce a refrigerant's temperature below its saturation point or bubble point. Subcooling of the refrigerant is necessary in order to maintain a solid column of liquid at the inlet to the metering device. Subcooling can take place naturally (in the condenser) or it can be accomplished by a suction liquid heat exchanger or a mechanical sub-cooler (separate refrigeration system).

Superheat - to heat a refrigerant above its saturation point or dew point. The "amount of superheat" is the *difference* between the actual refrigerant temperature and its saturation temperature. This value is usually expressed in degrees Fahrenheit or degrees Celsius.

Total Heat of Rejection (THR) is the heat absorbed at the evaporator plus the heat picked up in the suction line plus the heat added to the refrigerant in the compressor. Condensers are sized according to the required THR. Compressor capacity and the heat of compression are usually enough to determine the THR.

CONDENSER SELECTION

During a condenser selection process, the application engineer should choose a condenser which is large enough to reject all of the heat added to the refrigerant during the refrigerating cycle. When the condenser is sized to equal the total heat of rejection (THR) at design conditions, enough heat will be rejected to maintain the required condensing temperature. This will ensure that sufficient refrigeration capacity will be maintained at the evaporator during the warm summer period when it is needed the most.

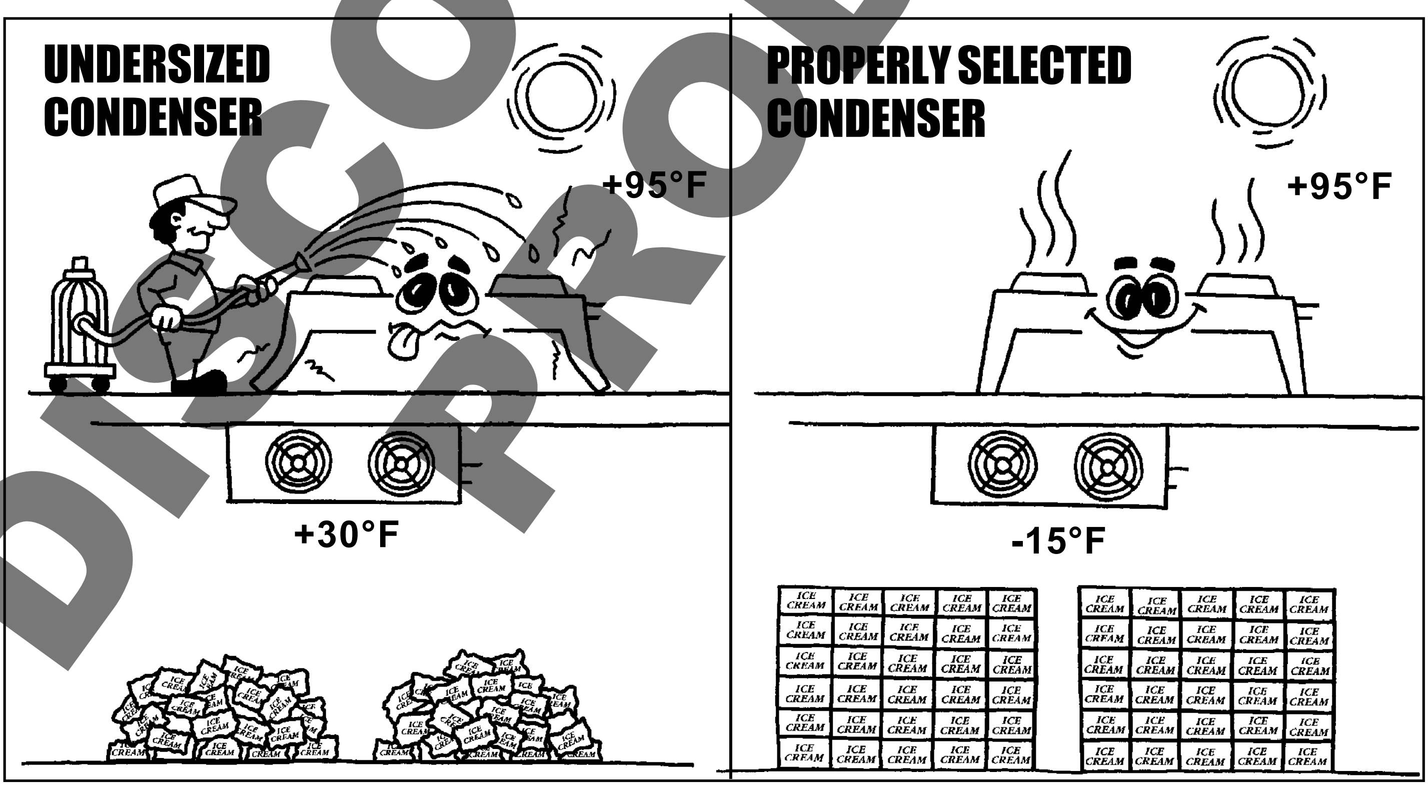
If a condenser is undersized, the condensing temperature (CT) will be driven upwards. This naturally occurs as the system seeks its new balance point. As the CT increases, the operating temperature difference (TD) °F the condenser also increases. Even though the capacity of the condenser increases with the higher TD, the refrigerating capacity of the compressor will decrease due to the higher condensing temperature.
An undersized condenser may perform satisfactorily when ambient temperatures are below design, but the overall system capacity will not be high enough during the warmer periods.

Oversizing a condenser increases project costs and can also lead to undesirable operating conditions.

Low ambient control devices such as pressure regulators and fan cycling switches operate to maintain a sufficient pressure in the condenser during low ambient periods.
On systems utilizing a receiver and flooding type of head pressure control, more refrigerant will be required to flood the condenser in order to achieve the desired condensing pressure.

Consider an air conditioning system with an oversized condenser which is only used during the summer time and does not have any type of head pressure control. This particular system may experience problems due to a lack of subcooling. Since the condenser was oversized the amount of natural subcooling available is less. *The maximum amount of natural subcooling possible is the difference between the condensing temperature and the ambient temperature.* If this amount of subcooling is not enough to offset the pressure losses in the liquid line, then flashing is certain to occur.

Flashing produces vapor at the metering device which was designed to meter 100% liquid. One cure for this is to apply head pressure control devices to the system that will increase the head pressure and ensure adequate liquid subcooling.



CONDENSER SELECTION

PRELIMINARY DATA REQUIREMENTS

There are several factors that influence the size of an air cooled condenser. Before a condenser can be properly selected, this information must be obtained. It may be convenient for you to refer to the calculation worksheets (P. 26 and 27) as you read through the following information.

1. <u>What are the Desired Evaporating and Condensing Temperatures?</u>

The evaporating temperature is needed to determine the THR (total heat of rejection) of the condenser. As the evaporating temperature is lowered, the heat of compression increases due to the higher compression ratio. This affects THR.

The required condensing temperature (CT) must be known before the temperature difference can be determined. This is necessary since condenser capacity varies with temperature difference. The required compressor capacity will determine the maximum CT since the compressor can only provide this capacity at certain operating conditions. You could also refer to Table 1 for CT recommendations. The heat of compression varies with compression ratio. Both evaporating and condensing temperatures affect the compression ratio.
Often customers may request a specified TD value (i.e 10, 15 etc.). The condensing temperature is then established as being the sum of this TD value and the design ambient temperature. (i.e 10 + 95 = 105 ^{o}F)

2. <u>Compressor Capacity</u>

Determine the capacity of the compressor at the desired evaporating and condensing conditions. Remember, *tons refrigeration* does not necessarily equal *horsepower.* As the evaporating temperature decreases and/or the condensing temperature increases, *tons refrigeration* per horsepower decreases. One ton refrigeration equals 12000 Btuh.

3.<u>Condenser Ambient Design Temperature</u>

This will be the maximum design temperature of the air entering the condenser. It is typical to add about 5 ^{o}F to the maximum outdoor design temperature in some instances to compensate for radiation from a dark surface such as a black roof.

4. <u>Type of Compressor</u>

It is necessary to identify the type of compressor to be utilized in the application so that accurate heat of rejection information may be obtained. For example, open-drive compressors can be belt driven or direct coupled to the motor. Electrical energy from the motor is converted to heat energy which is not transferred to the refrigerant as in a refrigerant cooled compressor.
In a hermetic refrigerant cooled compressor, the cool suction vapor picks up heat as it travels through the warm motor windings. The condenser must be sized to reject this heat along with any other heat absorbed by the refrigerant. It can be observed in Table 2 that hermetic refrigerant cooled compressors have higher heat of rejection factors.

5. <u>Heat of Compression</u>

As the refrigerant is compressed in the compressor, its heat content increases due to the physical and thermodynamic properties of the refrigerant. Additional heat from friction between moving parts in the compressor also increases the heat content of the refrigerant. The amount of heat added to the refrigerant is dependent on the refrigerant type, the compression ratio and the type of compressor.

Accurate THR or heat of compression factors may be available from the compressor manufacturer. Always attempt to access this information prior to using other methods. If this information is not available, refer to the heat of rejection factors in Table 2.

However, in situations where your application exceeds the limits of this table, such as in compound compression and cascade systems, one of the following calculations may be performed.

For OPEN DRIVE COMPRESSORS:
Total heat of Rejection = Compressor Capacity (Btuh) + (2545 x BHP)
(BHP - Brake Horsepower of the motor)

For SUCTION COOLED COMPRESSORS:
Total heat Rejection = Compressor Capacity (Btuh) + (3413 x KW)
(KW may be obtained from the power input curve for that compressor)

6. <u>What is the Refrigerant Type?</u>

A condenser's capacity can vary by 8 to 10% due to differences in physical and thermodynamic properties. Refer to the correct refrigerant capacity table or use factor as indicated. (see P. 2)

7. <u>Altitude</u>

The volume of a given mass of air increases as it rises above sea level. As its volume increases, its density decreases. As the air becomes less dense, its heat capacity decreases. Therefore, more air volume would have to be forced through the condenser at 6,000 feet *above* sea level than *at* sea level.

Since condenser capacities are based on operation at sea level, an altitude correction factor must be applied to the total heat of rejection. Basically, the load on the condenser will be increased to a point which will compen sate for the higher altitude.

CONDENSER SELECTION

8. Are you Replacing a Water Cooled Condenser with a Remote Air Cooled Condenser?

If this is the case, it should be remembered that the compressor will operate at a higher discharge pressure after converting to air cooled. To help minimize the resulting loss in capacity, the condenser should be sized generously. In other words, you may consider keeping the balance point of the condenser as low as possible.

9. Is this an application for multiple circuits?

If you wish to utilize the condenser for multiple circuits, then all of the above data must be obtained for EACH circuit. After obtaining this information, proceed to the MULTIPLE CIRCUIT WORKSHEET (P. 27) (for single circuit applications refer to the SINGLE CIRCUIT WORKSHEET (P. 26)).

TABLE 1 - CONDENSING TEMPERATURE GUIDELINES

Evaporating Temperature	Condensing Temperature Guidelines (at 85° to 105° Ambient Temperature)					TD*
	85 °F	90 °F	95 °F	100 °F	105 °F	
Low Temp Systems (-40 °F to +9 °F Evap Temps)	95-100 °F	100-105 °F	105-110 °F	110-115 °F	115-120 °F	10-15
Medium Temp Systems (+10 °F to +34 °F Evap Temps)	100-105 °F	105-110 °F	110-115 °F	115-120 °F	120-125 °F	15-20
High Temp Systems (+35 °F to +50 °F Evap Temps)	105-110 °F	110-115 °F	115-120 °F	120-125 °F	125-130 °F	20-25
Air Conditioning Systems (+40 °F to +50 °F Evap Temps)	110-115 °F	115-120 °F	120-125 °F	125-130 °F	130-135 °F	25-30

* TD - Condenser TD guideline

TABLE 2 - HEAT OF REJECTION FACTORS

EVAPORATOR TEMPERATURE		CONDENSING TEMPERATURE															
		90°F (32°C)		100°F (38°C)		105°F (41°C)		110°(43°C)		115°F (46°C)		120°F (49°C)		130°F (55°C)		140°F (60°C)	
°F	°C	OPEN	HERM	OPEN	HERM	OPEN	HERM	OPEN	HERM	OPEN	HERM	OPEN	HERM	OPEN	HERM	OPEN	HERM
-40	-40	*	**1.66**	*	**1.73**	*	**1.76**	*	**1.80**	*	**1.90**	*	**2.00**	*	*	*	*
-30	-34	1.37	**1.57**	1.42	**1.62**	1.44	**1.65**	1.47	**1.68**	*	**1.74**	*	**1.80**	*	*	*	*
-20	-29	1.33	**1.49**	1.37	**1.53**	1.39	**1.55**	1.42	**1.58**	1.44	**1.61**	1.47	**1.65**	*	*	*	*
-10	-23	1.28	**1.42**	1.32	**1.46**	1.34	**1.48**	1.37	**1.50**	1.39	**1.53**	1.42	**1.57**	1.47	**1.64**	*	*
0	-18	1,24	**1.36**	1.28	**1.40**	1.30	**1.42**	1.32	**1.44**	1.34	**1.47**	1.37	**1.50**	1.41	**1.56**	1.47	**1.62**
10	-12	1.21	**1.31**	1.24	**1.34**	1.26	**1.36**	1.28	**1.38**	1.30	**1.40**	1.32	**1.43**	1.36	**1.49**	1.42	**1.55**
20	-7	1.17	**1.26**	1.20	**1.29**	1.22	**1.31**	1.24	**1.33**	1.26	**1.35**	1.28	**1.37**	1.32	**1.43**	1.37	**1.49**
30	-1	1.14	**1.22**	1.17	**1.25**	1.18	**1.26**	1.20	**1.28**	1.22	**1.30**	1.24	**1.32**	1.27	**1.37**	1.32	**1.42**
40	4	1.12	**1.18**	1.15	**1.21**	1.16	**1.23**	1.17	**1.24**	1.18	**1.25**	1.20	**1.27**	1.23	**1.31**	1.28	**1.35**
50	10	1,09	**1.14**	1.12	**1.17**	1.13	**1.19**	1.14	**1.20**	1.16	**1.22**	1.17	**1.23**	1.20	**1.26**	1.24	**1.29**

OPEN - Direct Drive or Belt Drive open compressors
HERM - Hermetic or semi-Hermetic, Refrigerant (suction) cooled motor compressors.

SINGLE CIRCUIT WORKSHEET
(REFER TO P. 24 FOR GUIDELINES, SEE SAMPLE SELECTION ON P. 28)

JOB REF: ____________

1. SYSTEM DATA REQUIREMENTS

EVAP TEMP = ________ ºF   COND TEMP= ________ ºF

COMPR. CAPACITY= ____________ Btuh / 1000 = ________ MBH

COND. DESIGN AMBIENT TEMP= ____________ (AT)ºF   TD= ______ (Cond. Temp. - Ambient Temp)

COMPRESSOR TYPE= ☐ OPEN ☐ HERMETIC (Refrigerant cooled)

REFRIGERANT= R ________ REF. FACTOR= ________ (see P. 2)

ALTITUDE= ☐ AT SEA LEVEL or ________ FEET ALT. FACTOR= ____________
(See P.2)

2. THR (Total Heat of Rejection) CALCULATION

COMPR. CAPACITY (MBH) X HR f X ALT f X REF f =THR (MBH)

____________ X ____________ X ____________ X ____________ = ____________

Where HR f =Heat of rejection factor (see Table 2, P. 25)
ALT f = Altitude/elevation factor (Sea level=1, or above factor)
REF f = Refrigerant Correction factor (R22 = 1)
Alternate refrigerant based on factors from P. 2
R12 = 1/.95 = 1.05, R134a = 1/.94 = 1.06,
R502 = 1/.98 = 1.02, R404A/R507/R407A/B = 1/.97 = 1.03
THR = Total Heat of Rejection (MBH, factored in R22) to be rejected by condenser

3. CONDENSER MODEL SELECTION

Refer to the R22 CAPACITY section (P. 2) and select a condenser at the TD (required above) that will closely match the above calculated THR value. (NOTE: use the R22 capacity Table. The above calculation has already been adjusted for alternate types).

COND. MODEL # ____________ For the model selected record the THR PER 1ºF TD value = ________ (B) (see P. 2)

4. ACTUAL CONDENSING TEMP CALCULATION

THR (from sec. 2) / value (B) = ATD (actual Temperature Difference)

____________ / ____________ = ____________

To find the Actual Condensing Temp. (ACT) just add the Actual Temperature Difference (ATD) to the design Ambient Temperature (AT).

ATD + AT = ACT

________ + ________ = ________ ºF

NOTE: The Actual Condensing Temp. MUST EQUAL or BE LESS THAN the condensing temp recorded in section 1 above. This ensures the compressor capacity is maintained when operating the condenser at the designed ambient temperature.

For further assistance please contact your local KEEPRITE sales representative.

WORKSHEETS - MULTIPLE CIRCUITS

MULTIPLE CIRCUIT WORKSHEET

(REFER TO P. 24 FOR GUIDELINES & SEE SAMPLE SELECTION ON P. 29)

1. SYSTEM DATA REQUIREMENTS **JOB REF:** ____________

CONDENSER DESIGN AMBIENT TEMP = ________ (AT) ºF

ALTITUDE = ☐ SEA LEVEL or ________ FEET FACTOR = ________ (See P. 2)

CIRCUIT INFORMATION

	CIRC # 1	CIRC # 2	CIRC # 3	CIRC # 4
OPEN	☐	☐	☐	☐
HERMETIC	☐	☐	☐	☐
EVAP. TEMP ºF =	____	____	____	____
CONDENSING TEMP =	____	____	____	____
COMPR CAP. (MBH) =	____	____	____	____
REFRIGERANT =	____	____	____	____
TD = (Cond Temp - Amb.)	____	____	____	____

2. THR (Total Heat of Rejection) CALCULATION

	COMPR CAPACITY (MBH)	X	HRf	X	ALTf	X	REFf	= THR (MBH)	/ TD	= CL
CIRC # 1	____	X	____	X	____	X	____	= ____	/ ____	= ____
CIRC # 2	____	X	____	X	____	X	____	= ____	/ ____	= ____
CIRC # 3	____	X	____	X	____	X	____	= ____	/ ____	= ____
CIRC # 4	____	X	____	X	____	X	____	= ____	/ ____	= ____

TOTAL THR Capacity (MBH / 1 ºF TD) = ____

Where HR f =Heat of rejection factor (see Table 2, P. 25)
ALT f = Altitude/elevation factor (Sea level=1, see P. 2 for Higher)
REF f = Refrigerant Correction factor (R22 = 1)
R12 = 1/.95 = 1.05, R134a = 1/.94 = 1.06,
R502 = 1/.98 = 1.02, R404A / R507 / R407A/B = 1/.97 = 1.03
Alternate refrigerant based on factors from P. 2
THR = Total Heat of Rejection (MBH) to be rejected by condenser (R22 capacity)
TD = Condensing Temp - Ambient Temperature
CL = Circuit loading per 1ºF TD

3. CONDENSER SELECTION

Refer to the R22 CAPACITY selection (P.2) and select a condenser at the 1ºF TD that will closely match the above Total THR Capacity (MBH/ 1ºF TD).

COND. MODEL # ________ For the model selected, refer to P. 2 and enter...
Max no. of Feeds = ________ (A)
MBH @ 1ºF TD per feed = ________ (B)

calculate the number of feeds required for each circuit.

	CL (MBH / 1º F TD) /	(B) value	= NF number of feeds required (round off to nearest whole #)
CIRC # 1	____ /	____	= ____
CIRC # 2	____ /	____	= ____
CIRC # 3	____ /	____	= ____
CIRC # 4	____ /	____	= ____

Total number of feeds required NF = ________
(must not exceed value (A))
If number of feeds required exceeds number of feeds available then select the next larger size condenser model that can handle the number and repeat above process.

4. ACTUAL CONDENSING TEMP (per circuit) CALCULATION

First calculate the ATD (Actual TD) as follows:

	{ THR (from sec. 2) /	NF value}	/ value (B)	= ATD (Actual Temperature Difference)
CIRC # 1	{ ____ /	____ }	/ ____	= ____
CIRC # 2	{ ____ /	____ }	/ ____	= ____
CIRC # 3	{ ____ /	____ }	/ ____	= ____
CIRC # 4	{ ____ /	____ }	/ ____	= ____

To find the Actual Condensing Temperature (ACT) just add the Actual Temperature Difference (ATD) to the design ambient (AT)

	ATD	+ AT	= ACT
CIRC # 1	____	+ ____	= ____ ºF
CIRC # 2	____	+ ____	= ____ ºF
CIRC # 3	____	+ ____	= ____ ºF
CIRC # 4	____	+ ____	= ____ ºF

NOTE: The Actual Condensing Temp. MUST EQUAL or BE LESS THAN the condensing temp recorded in section 1 above. This ensures the compressor capacity is maintained when operating the condenser at the design ambient tr,emperature. For further assistance please contact your local KEEPRITE sales representative.

WORKSHEETS - SAMPLE SELECTION #1

Preliminary Data Given:

1. Evaporating temp = -20 °F
2. Condensing temp = 105 °F
3. Compressor capacity = 300,000 Btuh
4. Design ambient = 90 °F

Use WORKSHEET - SINGLE CIRCUIT (P 26) to complete selection of condenser

JOB REF: TC 1500

1. SYSTEM DATA REQUIREMENTS

EVAP TEMP = -20 °F COND TEMP= 105 °F

COMPR. CAPACITY= 300,000 Btuh / 1000 = 300 MBH

COND. DESIGN AMBIENT TEMP= 90 (AT) °F TD= 15 (Cond. Temp. - Ambient Temp)

COMPRESSOR TYPE= ☐ OPEN ☑ HERMETIC (Refrigerant cooled)

REFRIGERANT= R 22 REF. FACTOR= 1 (see P. 2)

ALTITUDE = ☑ AT SEA LEVEL or ________ FEET ALT. FACTOR= 1 (See P.2)

2. THR (Total Heat of Rejection) CALCULATION

COMPR. CAPACITY (MBH) X	HR f	X	ALT f	X	REF f	=	THR (MBH)
300	1.55	X	1	X	1	=	465

3. CONDENSER MODEL SELECTION

COND. MODEL # KVC1A23067 For the model selected record the THR PER 1°F TD value = 32.165 (B) (see P. 2)

4. ACTUAL CONDENSING TEMP CALCULATION

THR (from sec. 2)	/	value (B)	=	ATD (actual Temperature Difference)
465	/	32.165	=	14.5 °F

To find the Actual Condensing Temp. (ACT) just add the Actual Temperature Difference (ATD) to the design Ambient Temperature (AT).

ATD	+	AT	=	ACT
14.5	+	90	=	104.5 °F

Above selection using condenser model KVC1A23067 ensures condensing temperature will be at 105 °F or below during design ambient conditions. See SAMPLE SELECTION # 2 for multiple circuit selections.

WORKSHEETS - SAMPLE SELECTION # 2

Preliminary Data Given:
1. Location at Reno, Nevada, 95 °F design ambient and 4,000 feet elevation.
2. Multiple circuits required with evaporating temperatures, condensing temperatures, compressor capacities and refrigerant types as listed below.

Use WORKSHEET-MULTIPLE CIRCUITS (P. 27) to complete selection of condenser.

1. SYSTEM DATA REQUIREMENTS JOB REF: TC2000

CONDENSER DESIGN AMBIENT TEMP = 95 (AT) °F

ALTITUDE = ☐ SEA LEVEL or 4,000 FEET FACTOR = 1.14

(See P. 2)

CIRCUIT INFORMATION

	CIRC # 1	CIRC # 2	CIRC # 3	CIRC # 4
OPEN	☐	☐	☐	☐
HERMETIC	☑	☑	☑	☑
EVAP. TEMP °F =	+20	+10	-10	-20
CONDENSING TEMP =	110	110	105	105
COMPR CAP. (MBH) =	13	25	4.6	31.5
REFRIGERANT =	22	22	404A	404A
TD = (Cond Temp - Amb.)	15	15	10	10

2. THR (Total Heat of Rejection) CALCULATION

	COMPR CAPACITY (MBH)	X HRf	X ALTf	X REFf	= THR (MBH)	/ TD	= CL
CIRC # 1	13	1.33	1.14	1	19.71	15	1.314
CIRC # 2	25	1.38	1.14	1	39.33	15	2.622
CIRC # 3	4.6	1.48	1.14	1.03	7.99	10	.799
CIRC # 4	31.5	1.55	1.14	1.03	57.33	10	5.733

TOTAL THR Capacity (MBH / 1 °F TD) = 10.468

3. CONDENSER SELECTION

Refer to the R22 CAPACITY selection (P. 2) and select a condenser at the 1°F TD that will closely match the above Total THR Capacity (MBH/ 1°F TD).

COND. MODEL # KVC1A12022

For the model selected, refer to P. 2 and enter...

Max no. of Feeds = 24 (A)

MBH @ 1°F TD per feed = .447 (B)

calculate the number of feeds required for each circuit.

	CL (MBH / 1° F TD)	/ (B) value	= NF number of feeds required (round off to nearest whole #)
CIRC # 1	1.314	.447	(2.93) 3
CIRC # 2	2.622	.447	(5.86) 6
CIRC # 3	.799	.447	(1.78) 2
CIRC # 4	5.733	.447	(12.82) 13

Total number of feeds required NF = 24

(must not exceed value (A))

If number of feeds required exceeds number of feeds available then select the next larger size condenser model that can handle the number and repeat above process.

4. ACTUAL CONDENSING TEMP (per circuit) CALCULATION

First calculate the ATD (Actual TD) as follows: {THR (from sec. 2) / NF value} / value (B) = ATD (Actual Temperature Difference)

	THR	/ NF	/ value (B)	= ATD
CIRC # 1	19.71	3	.447	14.7
CIRC # 2	39.33	6	.447	14.7
CIRC # 3	7.99	2	.447	8.9
CIRC # 4	57.33	13	.447	9.9

To find the Actual Condensing Temperature (ACT) just add the Actual Temperature Difference (ATD) to the design ambient (AT)

	ATD	+ AT	= ACT
CIRC # 1	14.7	95	109.7 °F
CIRC # 2	14.7	95	109.7 °F
CIRC # 3	8.9	95	103.9 °F
CIRC # 4	9.9	95	104.9 °F

LOW AMBIENT OPERATION

GENERAL

When a remote air cooled condenser is installed outdoors, it will be subjected to varying temperatures. Within many areas, winter to summer annual temperatures swings can be as high as 120 °F or so, this will have a major impact on the performance of the condenser. As the ambient temperature drops, the condenser capacity increases due to the wider temperature difference between ambient and condensing. As this happens, the condensing temperature also drops as the system finds a new balance point. Although the overall system capacity will be higher at lower condensing temperatures, other problems can occur. The capacity of an expansion valve is affected by both the liquid temperature entering the valve and the pressure drop across it. As the condensing temperature decreases, the pressure drop across the metering device also decreases. A lower pressure drop decreases the capacity of the valve. Although lower liquid temperatures increase the capacity of the metering device, the increase is not large enough to offset the loss due to the lower pressure drop.
The following three sections cover the various options used to control condensing temperatures.

(i) Fan Cycling

Cycling of the condenser fans helps control the condensing temperature. With this approach to solving low ambient problems, fans are taken off-line either one at a time, or in pairs. It is not recommended that multiple fan condensers cycle more than two fans per step. The reason for this is that the pressure in the condenser will increase drastically as several fans are taken off-line at the same time. This will result in erratic operation of the refrigeration system and applies additional stress to the condenser tubes. It is preferable to control the condensing temperature as smoothly as possible. Fans should be cycled independently on a condenser where the fans are all in a single row. On two row condensers, the fans should be cycled in pairs.

Ambient temperature sensing controls can be set to bring on certain fans when the outdoor temperature reaches a predetermined setpoint. Pressure sensing controls are set to bring on certain fans when the condensing pressure reaches the setpoint on the control. Temperature or pressure setpoints and differentials should be set in such a way as to prevent short cycling of the fans. Constant short cycling will produce a volatile condensing pressure while decreasing the life of the fan motors.

For recommended fan cycling switch settings, refer to Table 4. Differential settings on fan cycling temperature controls should be about 5 °F (2.8 °C). On fan cycling pressure controls, a differential of approximately 35 psig is recommended.
On supermarket applications (using 6-12 Fan models) condenser fans may be cycled individually (not in pairs) and therefore lower differential settings may apply and will depend on the specific application.

Fans closest to the inlet header should be permitted to run whenever the compressor is running. If these initial fans are wired through a cycling control, the life of the condenser may be shortened due to the additional stress placed on the tubes and headers. Table 3 shows the fan cycling options available for all condenser models.

(ii) Variable Motor Speed Control

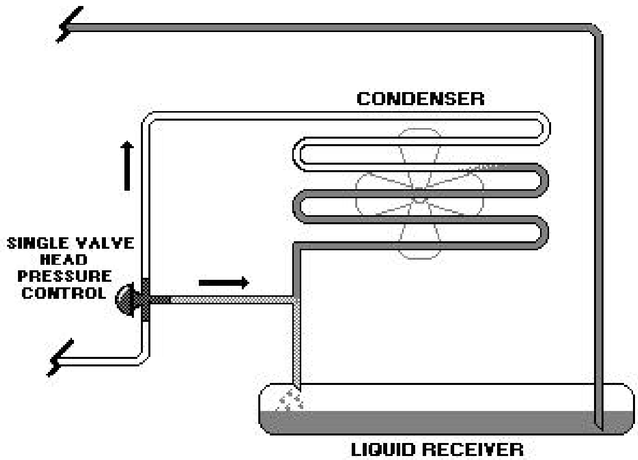
If additional head pressure control is required beyond the last step of fan cycling variable fan motor speed may be used. Variable motor speed is optional on all condenser models. A varying motor speed may be accomplished using a modulating temperature or modulating pressure control. A variable speed controller can be an electronic or solid state device which varies the voltage going to the motor depending on the temperature or pressure of the medium being sensed.

(iii) Refrigerant Regulating Controls

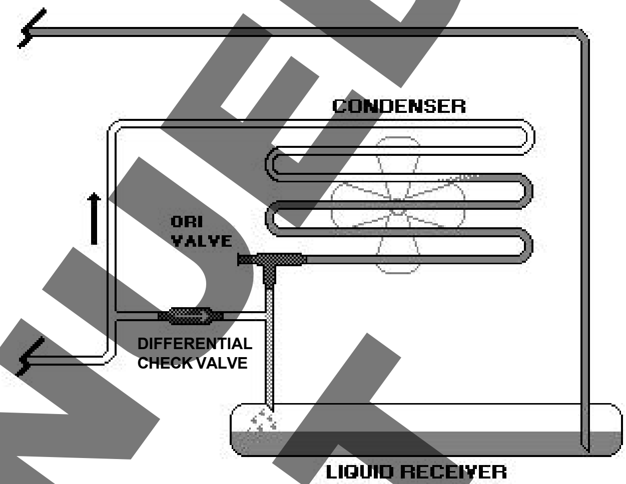
Pressure regulating controls are available from a number of valve manufacturers. The purpose of such a control is to regulate the refrigerant flow in such a way as to maintain a pre-selected condensing pressure. In lower ambient temperatures, these valves throttle to maintain the desired pressure and in doing so, flood the condenser with liquid refrigerant.
The larger the condenser surface is, the higher its capacity will be. When a condenser is flooded, its useful condensing surface is reduced. This is because the refrigerant occupies the space which would otherwise be used for condensing.

Some control/check valve combinations will regulate refrigerant flow depending on the pressure at the inlet of the condenser.These are often referred to as *inlet regulators.* As the valve closes, hot gas bypasses the condenser through a differential check valve to increase the pressure at the receiver.

LOW AMBIENT OPERATION



SINGLE VALVE CONDENSER PRESSURE CONTROL
(Regulates inlet pressure or outlet pressure depending on valve design)



ORI / ORD CONDENSER PRESSURE CONTROL

This will flood the condenser until the condensing pressure increases to a point which will again open the valve. Other valves regulate the refrigerant at the outlet of the condenser to provide a similar effect. These are commonly referred to as *outlet regulators.* There are also combination inlet/outlet regulators with a differential check valve or other type of condenser bypass arrangement incorporated within the valve.

Controls which regulate the flow of refrigerant based on condenser inlet pressure are typically used in conjuction with a check valve having a minimum opening differential across the condenser. Outlet regulators typically require a check valve with a fixed pressure differential setting of between 20 and 35 psi. The differential is needed to compensate for pressure drop through the condenser during flooding and associated discharge piping.

Systems equipped with a condenser flooding arrangement should always use a receiver having sufficient liquid holding capacity. Additional liquid required for flooding is only required during the winter low ambients and must be stored somewhere in the system at the higher ambients. Failure to use an adequately sized receiver will result in liquid back-up in the condenser during the warmer summer months. This will cause the system to develop very high pressures in the high side resulting in a high pressure safety control trip.

Determining Additional Flooded Refrigerant Charge

Additional charge will vary with the condenser design TD and the coldest expected ambient temperature. Condensers designed for low TD applications (low temperature evaporators) and operating in colder ambients will require more additional charge than those designed for higher TD applications (high temperature evaporators) and warmer ambients.
Refer to Table 5 to determine the required added refrigerant charge at the selected TD and ambient temperatures.
These charges are based on condensers using Fan Cycling options with their last fan (Single Row Fan Models) running or last pair of fans running (Double Row Fan models).

WARNING: Do not over charge when charging by a sightglass. Liquid lines feeding the TXV at the evaporator must have a solid column of liquid (no bubbles) however bubbles at the sightglass (located adjacient to the receiver) may be normal due to the result of a higher pressure drop at that point. Bubbles could also appear in the glass whenever the regulating valves start to flood the condenser.
Always record the number of drums or the weight of refrigerant that has been added or removed in the system. Overcharged systems may result in compressor failure as well as other serious mechanical damage to the system components.

LOW AMBIENT OPERATION

TABLE 3 - FAN CYCLING CONTROL SCHEDULE

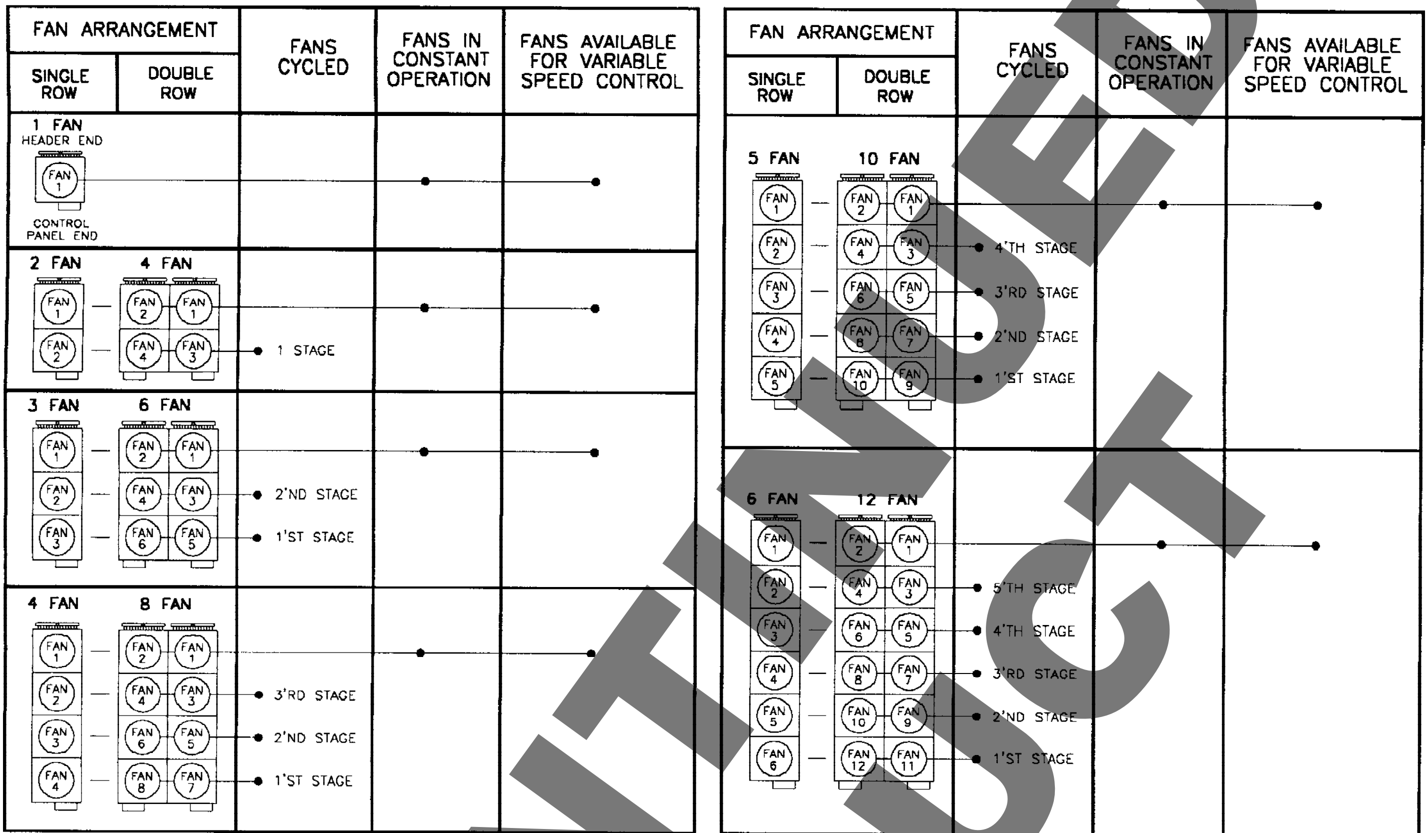


TABLE 4 - AMBIENT FAN CYCLING THERMOSTAT SETTINGS

Number of Fans on Condenser		Design T.D. °F (°C)	Thermostat Setting * °F (°C)				
Single Row Models	Double Row Models		1st Stage	2nd Stage	3rd Stage	4th Stage	5th Stage
2	**4**	30 (16.7) 25 (13.9) 20 (11.1) 15 (8.3) 10 (5.6)	60 (15.6) 65 (18.3) 70 (21.1) 75 (23.9) 80 (26.7)				
3	**6**	30 (16.7) 25 (13.9) 20 (11.1) 15 (8.3) 10 (5.6)	60 (15.6) 65 (18.3) 70 (21.1) 75 (23.9) 80 (26.7)	40 (4.4) 55 (12.8) 60 (15.6) 65 (18.3) 75 (23.9)			
4	**8**	30 (16.7) 25 (13.9) 20 (11.1) 15 (8.3) 10 (5.6)	60 (15.6) 65 (18.3) 70 (21.1) 75 (23.9) 80 (26.7)	50 (10.0) 55 (12.8) 65 (18.3) 70 (21.1) 75 (23.9)	30 (-1.1) 40 (4.4) 50 (10.0) 60 (15.6) 70 (21.1)		
5	**10**	30 (16.7) 25 (13.9) 20 (11.1) 15 (8.3) 10 (5.6)	60 (15.6) 65 (18.3) 70 (21.1) 75 (23.9) 80 (26.7)	55 (12.8) 60 (15.6) 65 (18.3) 70 (21.1) 75 (23.9)	45 (7.2) 50 (10.0) 60 (15.6) 65 (18.3) 70 (21.1)	30 (-1.1) 35 (1.7) 40 (4.4) 55 (12.8) 65 (18.3)	
6	**12**	30 (16.7) 25 (13.9) 20 (11.1) 15 (8.3) 10 (5.6)	55 (12.8) 65 (18.3) 70 (21.1) 75 (23.9) 80 (26.7)	50 (10.0) 60 (15.6) 65 (18.3) 70 (21.1) 75 (23.9)	40 (4.4) 55 (12.8) 60 (15.6) 65 (18.3) 70 (21.1)	30 (-1.1) 45 (7.2) 50 (10.0) 60 (15.6) 65 (18.3)	25 (-3.9) 35 (1.7) 40 (4.4) 50 (10.0) 60 (15.6)

* NOTE: These are typical settings. Further adjustments may be necessary to suit actual field conditions.

LOW AMBIENT OPERATION

TO DETERMINE WINTER CHARGE, ADD THE SUM OF THE NORMAL CHARGE AND ADDITIONAL WINTER CHARGE

TABLE 5
R22 WINTER OPERATION CHARGE - Lbs • Deg °F
Flooded Condensers with Fan Cycling

MODEL	TOTAL No OF FEEDS	NORMAL CHARGE Lbs	ADDITIONAL CHARGE FOR WINTER OPERATION (LBS)																			
			Design TD = 10 (Deg F)					Design TD = 15 (Deg F)					Design TD = 20 (Deg F)					Design TD = 25 (Deg F)				
			Ambient (Deg F)					Ambient (Deg F)					Ambient (Deg F)					Ambient (Deg F)				
			40	20	0	-20	-40	40	20	0	-20	-40	40	20	0	-20	-40	40	20	0	-20	-40
1A 11 **007**	7	1.7	3.5	3.8	4.0	4.1	4.2	3.0	3.5	3.7	3.9	4.0	2.5	3.1	3.5	3.7	3.8	2.0	2.8	3.2	3.4	3.6
1A 11 **009**	8	2.2	5.2	5.7	5.9	6.1	6.2	4.5	5.2	5.5	5.7	5.9	3.7	4.6	5.1	5.4	5.6	3.0	4.1	4.7	5.1	5.4
1A 11 **010**	9	2.8	6.7	7.3	7.6	7.8	7.9	5.8	6.6	7.1	7.4	7.6	4.8	6.0	6.6	7.0	7.2	3.8	5.3	6.1	6.6	6.9
1A 11 **011**	12	3.9	8.9	9.7	10	10	11	7.6	8.8	9.4	9.8	10	6.4	7.9	8.8	9.3	9.6	5.1	7.0	8.1	8.7	9.2
1A 11 **012**	12	4.3	10	11	12	12	12	8.9	10	11	11	12	7.4	9.3	10	11	11	6.0	8.3	9.5	10	11
1A 11 **013**	15	5.2	13	14	15	15	15	11	13	14	14	15	9.3	12	13	14	14	7.4	10	12	13	13
1A 12 **017**	14	4.1	10	12	13	14	15	6.4	9.3	11	12	13	4.0	7.5	9.4	11	12	0	5.1	7.6	9.2	10
1A 12 **019**	18	6.1	15	18	20	21	23	9.4	14	16	18	20	6.0	11	14	16	17	0	7.6	11	14	15
1A 12 **022**	24	7.4	17	21	24	26	27	11	17	20	22	23	7.0	13	17	19	21	0	9.2	14	14	18
1A 12 **024**	24	8.3	20	24	27	29	30	13	19	22	24	26	9.0	15	19	21	23	0	10	15	18	21
1A 12 **027**	30	10	23	28	31	34	36	15	22	26	29	31	12	18	22	25	28	0	12	18	22	24
1A 13 **029**	27	8.6	19	24	27	30	31	11	18	22	25	27	0	11	17	20	23	0	2.6	12	17	20
1A 13 **034**	36	10	23	29	33	36	38	13	22	27	30	33	0	13	20	25	28	0	3.2	15	20	24
1A 13 **037**	36	12	27	34	39	42	45	15	26	32	35	38	0	15	24	29	33	0	3.8	18	24	28
1A 13 **041**	45	14	32	40	46	50	53	18	31	37	42	45	0	18	28	34	38	0	4.4	21	28	33
1A 13 **043**	36	18	39	49	56	61	64	22	37	46	51	55	0	22	35	42	47	0	6	25	35	41
1A 13 **048**	45	21	45	57	65	70	75	26	43	53	59	64	0	26	40	49	55	0	6	29	40	47
2A 14 **056**	22	26	51	69	80	88	94	3	46	62	71	79	0	14	43	57	66	0	0	19	42	53
2A 14 **063**	30	33	64	87	100	110	117	4	58	77	89	98	0	18	54	71	82	0	0	24	52	67
2A 14 **068**	37	38	74	101	116	127	136	5	67	89	104	114	0	20	63	82	95	0	0	27	60	77
2A 15 **079**	30	39	64	97	114	127	136	0	48	81	99	111	0	0	48	75	91	0	0	12	55	75
2A 15 **085**	37	49	80	122	145	160	172	0	60	102	125	140	0	0	60	95	115	0	0	15	70	95
2A 16 **095**	30	54	66	126	154	172	186	0	66	113	137	154	0	0	29	88	116	0	0	0	54	92
2A 16 **103**	37	61	76	145	177	197	213	0	76	129	157	177	0	0	33	101	133	0	0	0	62	105
1A 22 **039**	36	16	38	47	53	57	60	25	37	43	48	52	15	30	37	42	46	0	20	30	36	41
1A 22 **045**	48	19	44	54	61	65	69	29	42	50	55	60	18	34	43	49	53	0	23	35	42	47
1A 22 **049**	48	21	48	59	66	72	76	32	46	55	61	65	19	37	47	53	58	0	25	38	45	51
1A 22 **054**	60	23	55	68	76	82	87	36	53	62	69	75	22	43	53	61	66	0	29	43	52	58
1A 23 **058**	54	22	49	62	70	76	81	28	47	57	64	70	0	28	43	53	59	0	6.8	32	43	51
1A 23 **067**	72	26	57	72	82	89	95	32	55	67	75	81	0	32	51	62	69	0	8.0	37	51	60
1A 23 **073**	72	30	66	84	96	104	111	38	64	78	88	95	0	38	59	72	81	0	9.3	43	59	70
1A 23 **081**	90	35	76	97	110	119	127	43	73	89	100	109	0	43	68	82	92	0	11	50	68	80
1A 23 **086**	72	35	77	98	111	121	128	44	74	91	102	110	0	44	69	83	94	0	11	50	69	81
1A 23 **096**	90	41	89	114	129	140	149	51	86	105	118	128	0	51	80	97	109	0	12	58	80	94
2A 24 **112**	45	53	104	142	164	180	192	6.4	94	126	146	161	0	29	88	116	135	0	0	38	85	109
2A 24 **126**	60	65	127	173	200	219	234	7.8	115	154	178	196	0	35	108	142	164	0	0	47	103	133
2A 24 **137**	75	77	149	204	235	258	275	9.2	135	181	210	231	0	41	127	167	193	0	0	55	121	157
2A 25 **158**	60	77	127	193	228	253	271	0	95	161	197	221	0	0	95	149	181	0	0	23	109	149
2A 25 **172**	75	99	163	248	294	325	348	0	122	207	253	284	0	0	122	192	233	0	0	30	141	192
2A 26 **190**	60	107	132	252	308	344	371	0	132	225	274	308	0	0	57	176	232	0	0	0	108	183
2A 26 **206**	75	124	154	293	358	400	432	0	154	261	318	358	0	0	66	205	270	0	0	0	126	213

Note: For R134a and R502 use R22 charge
For R404A and R507 use R22 charge x 0.87
For R407C use R22 charge x 0.97
For R12 use R22 charge x 1.10
For 90% full volume charge see P. 4

LOW AMBIENT OPERATION

TO DETERMINE WINTER CHARGE, ADD THE SUM OF THE NORMAL CHARGE AND ADDITIONAL WINTER CHARGE

TABLE 5A
R22 WINTER OPERATION CHARGE - Kg • Deg °C
Flooded Condensers with Fan Cycling

MODEL	TOTAL No OF FEEDS	NORMAL CHARGE Kg	ADDITIONAL CHARGE FOR WINTER OPERATION (Kg)																			
			Design TD = 5.6 (Deg C)					Design TD = 8.3 (Deg C)					Design TD = 11.1 (Deg C)					Design TD = 13.9 (Deg C)				
			Ambient (Deg C)					Ambient (Deg C)					Ambient (Deg C)					Ambient (Deg C)				
			4.4	-6.7	-17.8	-28.9	-40.0	4.4	-6.7	-17.8	-28.9	-40.0	4.4	-6.7	-17.8	-28.9	-40.0	4.4	-6.7	-17.8	-28.9	-40.0
1A 11 **007**	7	0.8	1.6	1.7	1.8	1.9	1.9	1.4	1.6	1.7	1.8	1.8	1.1	1.4	1.6	1.7	1.7	0.9	1.3	1.4	1.6	1.6
1A 11 **009**	8	1.0	2.4	2.6	2.7	2.8	2.8	2.0	2.3	2.5	2.6	2.7	1.7	2.1	2.3	2.5	2.6	1.4	1.9	2.1	2.3	2.4
1A 11 **010**	9	1.3	3.0	3.3	3.5	3.5	3.6	2.6	3.0	3.2	3.4	3.4	2.2	2.7	3.0	3.2	3.3	1.7	2.4	2.8	3.0	3.1
1A 11 **011**	12	1.8	4.0	4.4	4.6	4.7	4.8	3.5	4.0	4.3	4.5	4.6	2.9	3.6	4.0	4.2	4.4	2.3	3.2	3.7	4.0	4.2
1A 11 **012**	12	1.9	4.7	5.1	5.4	5.5	5.6	4.1	4.7	5.0	5.2	5.4	3.4	4.2	4.7	4.9	5.1	2.7	3.7	4.3	4.6	4.9
1A 11 **013**	15	2.4	5.9	6.4	6.7	6.9	7.0	5.1	5.8	6.3	6.5	6.7	4.2	5.3	5.8	6.2	6.4	3.4	4.7	5.4	5.8	6.1
1A 12 **017**	14	1.9	4.4	5.4	6.1	6.6	6.9	2.9	4.2	5.0	5.5	6.0	1.8	3.4	4.3	4.9	5.3	0	2.3	3.5	4.2	4.7
1A 12 **019**	18	2.8	6.6	8.0	9.0	9.7	10	4.3	6.3	7.4	8.2	8.9	2.7	5.1	6.3	7.2	7.9	0	3.5	5.1	6.2	6.9
1A 12 **022**	24	3.4	7.9	9.7	11	12	12	5.1	7.5	8.9	9.9	11	3.2	6.1	7.6	8.7	9.5	0	4.2	6.2	7.4	8.4
1A 12 **024**	24	3.8	8.9	11	12	13	14	5.8	8.4	10	11	12	4.1	6.8	8.5	9.7	11	0	4.7	6.9	8.3	9.3
1A 12 **027**	30	4.4	10	13	14	15	16	6.8	9.9	12	13	14	5.3	8.0	10	11	13	0	5.5	8.1	9.8	11
1A 13 **029**	27	3.9	8.5	11	12	13	14	4.9	8.2	10	11	12	0	4.9	7.6	9.2	10	0	1.2	5.6	7.6	9.0
1A 13 **034**	36	4.8	10	13	15	16	17	5.9	10	12	14	15	0	5.9	9.3	11	13	0	1.5	6.8	9.3	11
1A 13 **037**	36	5.6	12	15	18	19	20	6.9	12	14	16	17	0	6.9	11	13	15	0	1.7	8.0	11	13
1A 13 **041**	45	6.6	14	18	21	23	24	8.2	14	17	19	21	0	8.2	13	16	17	0	2.0	9.4	13	15
1A 13 **043**	36	8.0	18	22	25	28	29	10	17	21	23	25	0	10	16	19	21	0	2.5	11	16	18
1A 13 **048**	45	9.0	20	26	29	32	34	12	20	24	27	29	0	12	18	22	25	0	2.7	13	18	21
2A 14 **056**	22	11.8	23	32	36	40	43	1.4	21	28	32	36	0	6.4	20	26	30	0	0	8.4	19	24
2A 14 **063**	30	14.8	29	39	46	50	53	1.8	26	35	41	45	0	8.0	25	32	37	0	0	11	23	30
2A 14 **068**	37	17.3	33	46	53	58	62	2.1	30	41	47	52	0	9.2	29	37	43	0	0	12	27	35
2A 15 **079**	30	17.5	29	44	52	58	62	0	22	37	45	50	0	0	22	34	41	0	0	5.2	25	34
2A 15 **085**	37	22.2	37	56	66	73	78	0	27	46	57	64	0	0	27	43	52	0	0	6.7	32	43
2A 16 **095**	30	24.3	30	57	70	78	84	0	30	51	62	70	0	0	13	40	53	0	0	0	25	42
2A 16 **103**	37	27.8	35	66	80	90	97	0	35	59	71	80	0	0	15	46	61	0	0	0	28	48
1A 22 **039**	36	7.4	17	21	24	26	27	11	17	20	22	24	6.8	13	17	19	21	0	9.2	14	16	18
1A 22 **045**	48	8.5	20	25	28	30	31	13	19	23	25	27	8.2	15	19	22	24	0	11	16	19	21
1A 22 **049**	48	9.3	22	27	30	32	34	14	21	25	27	30	8.6	17	21	24	26	0	12	17	21	23
1A 22 **054**	60	11	25	31	34	37	39	16	24	28	31	34	10	19	24	28	30	0	13	20	24	27
1A 23 **058**	54	10	22	28	32	35	37	13	21	26	29	32	0	13	20	24	27	0	3.1	14	20	23
1A 23 **067**	72	12	26	33	37	41	43	15	25	30	34	37	0	15	23	28	31	0	3.6	17	23	27
1A 23 **073**	72	14	30	38	44	47	50	17	29	35	40	43	0	17	27	33	37	0	4.2	20	27	32
1A 23 **081**	90	16	34	44	50	54	58	20	33	41	46	49	0	20	31	37	42	0	4.8	23	31	36
1A 23 **086**	72	16	35	44	50	55	58	20	34	41	46	50	0	20	31	38	43	0	4.9	23	31	37
1A 23 **096**	90	19	40	52	59	64	68	23	39	48	54	58	0	23	36	44	49	0	5.7	26	36	43
2A 24 **112**	45	24	47	64	75	82	87	2.9	43	57	66	73	0	13	40	53	61	0	0	17	38	50
2A 24 **126**	60	30	58	78	91	99	106	3.5	52	70	81	89	0	16	49	64	74	0	0	21	47	60
2A 24 **137**	75	35	68	92	107	117	125	4.2	61	82	95	105	0	19	58	76	88	0	0	25	55	71
2A 25 **158**	60	35	58	88	104	115	123	0	43	73	89	100	0	0	43	68	82	0	0	11	50	68
2A 25 **172**	75	45	74	113	133	147	158	0	55	94	115	129	0	0	55	87	106	0	0	14	64	87
2A 26 **190**	60	48	60	114	140	156	169	0	60	102	124	140	0	0	26	80	105	0	0	0	49	83
2A 26 **206**	75	56	70	133	162	182	196	0	70	119	145	162	0	0	30	93	123	0	0	0	57	97

Note: For R134a and R502 use R22 charge
For R404A and R507 use R22 charge x 0.87
For R407C use R22 charge x 0.97
For R12 use R22 charge x 1.10
For 90% full volume charge see P. 4

INSTALLATION

INSPECTION

A thorough inspection of the equipment, including all component parts and accessories, should be made immediately upon delivery. Any damage caused in transit, or missing parts, should be reported to the carrier at once. The consignee is responsible for making any claim for losses or damage. Electrical characteristics should also be checked at this time to ensure that they are correct.

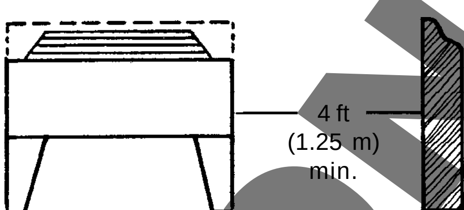
LOCATION

Before handling and placing the unit into position a review of the most suitable location must be made. This condenser is designed for outdoor installation.
A number of factors must be taken into consideration when selecting a location. Most important is the provision fo a supply of ambient air to the condenser, and removal of heated air from the condenser area.
Higher condensing temperatures, decreased performance, and the possibility of equipment failure may result from inadequate air supply.
Other considerations include:

1. Customer requests
2. Loading capacity of the roof or floor.
3. Distance to suitable electrical supply.
4. Accessibility for maintenance.
5. Local building codes.
6. Adjacent buildings relative to noise levels.

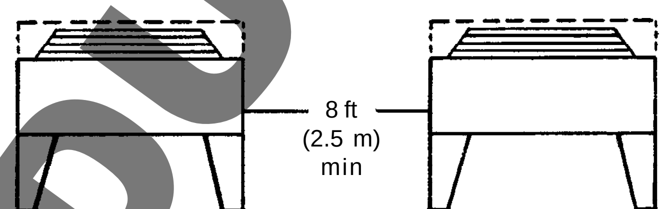
WALLS OR OBSTRUCTIONS

All sides of the unit must be a minimum of 4 feet (1.25 m) away from any wall or obstruction. Overhead obstructions are not permitted. If enclosed by three walls, the condenser must be installed as indicated for units in a pit.



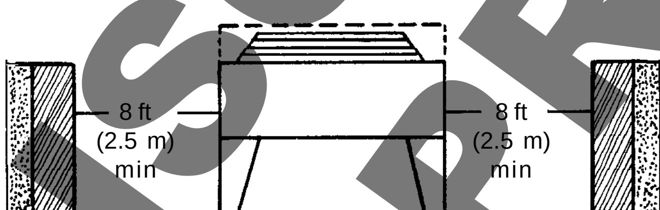
MULTIPLE UNITS

A minimum of 8 feet (2.5 m) is required between multiple units placed side by side. If placed end to end, the minimum distance between units is 4 feet (1.25 m).



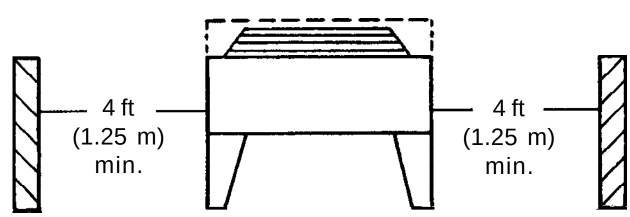
UNITS IN PITS

The top of the condenser <u>must be level</u> with, or <u>above</u> the top of the pit. In addition, a minimum of 8 feet (2.5 m) is required between the unit and the pit walls.



LOUVERS/FENCES

Louvers/fences must have a minimum of 80% free area and 4 feet (1.25 m) minimum clearance between the unit and louvers/fence. Height of louver/fence <u>must not exceed</u> top of unit.

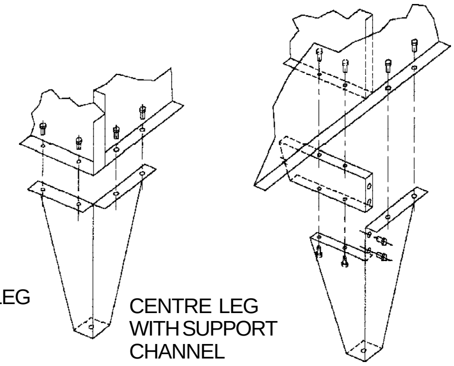


PLACEMENT

Once a suitable location is selected ensure all the remote mounting parts (legs and hardware) are available. Refer to Fig.1 (P. 36) and the dimensional data on pages 6 and 7 for the leg mounting locations. On 8, 10 and 12 fan models a 90” (2.3 m) channel is also included for maximum support. Single row 4, 5 and 6 fan models use a 45” (1.15m) channel.

LEG INSTALLATION INSTRUCTIONS

Fig. 1

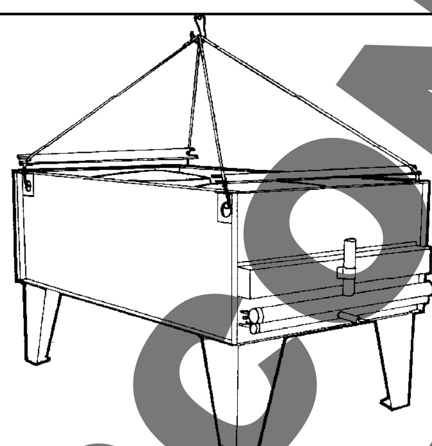


1) Assemble R.H. center leg L.H. center leg and 90" (or 45" on single row) channel as shown.
Remove 2 bolts from bottom flange of unit side panels that match the hole pattern on the top flanges of both legs. Attach center leg and channel assembly using hardware provided at divider panel locations required for applicable model as shown in dimensional data.
Replace bolts that were removed from side panels to secure leg assembly to bottom flanges of side panels.

2) Assemble four corner legs to bottom flanges on unit side panels and end panels using hardware provided, at matching mounting hole patterns. All corner legs are the same.

Air cooled condensers are large, heavy mechanical equipment and must be handled as such. A fully qualified and properly equipped crew with necessary rigging should be engaged to set the condenser into position.
Lifting brackets or holes have been provided at the corners for attaching lifting slings. Spreader bars must be used when lifting so that the lifting force must be applied vertically. See Fig. 2. **Under no circumstances should the coil headers or return bends be used in lifting or moving the condenser.**

Fig. 2



Ensure the unit is placed in a level position (to ensure proper drainage of liquid refrigerant and oil). The legs should be securely anchored to the building structure, sleeper or concrete pad. The weight of the condenser is not enough to hold in place during a strong wind, **the legs must be anchored.**

REFRIGERANT PIPING

All refrigeration piping must be installed by a qualified refrigeration mechanic. The importance of correct refrigerant pipe sizing and layout cannot be over-emphasized. Failure to observe proper refrigerant piping practices can result in equipment failure which may not be covered under warranty.
All air cooled condensers are supplied complete with headers and refrigerant connections sized for connecting to standard refrigeration tubing.These connections may not be the same as the actual line sizes required for the field installation. Refer to a recognized source (ASHRAE charts, manufacturer's engineering manuals etc.) for line sizing.

DISCHARGE LINES

The proper design of discharge lines involves following objective:
(1) to minimize refrigerant pressure drop, since high pressure losses increase the required compressor horsepower per ton of refrigeration.

Discharge lines must be pitched away from the compressor to ensure proper drainage of oil being carried in the line.
A discharge check-valve at the bottom of a vertical riser will prevent oil (and liquid refrigerant) from draining back to the compressor during the off-cycle. When the vertical lift exceeds 30 feet (9 m), insert close-coupled traps in the riser at 30 feet (9 m) intervals.

An alternate method of handling the oil problem would be the addition of an oil separator see Figure 4 (b).

A reverse trap should be installed at the top of all vertical risers. The top of the reverse trap should be the highest point in the discharge line and should have an access valve installed to allow the reclaimation of non-condensible gas from the system.

Pulsation of the hot gas in the discharge line is an inherent characteristic of systems utilizing reciprocating compressors. The discharge line must be rigidly supported along its entire length to prevent transmission of vibration and movement of the line.

CONDENSATE LINES

The condensate line must be designed to allow free drainage of refrigerant from the condenser coil to the receiver. Refer to Fig. 5 for typical condensate line piping when utilizing head pressure regulating valves.

Fig. 3 - 6

KVC TYPICAL SYSTEM PIPING

Figure 3 - Single Circuit

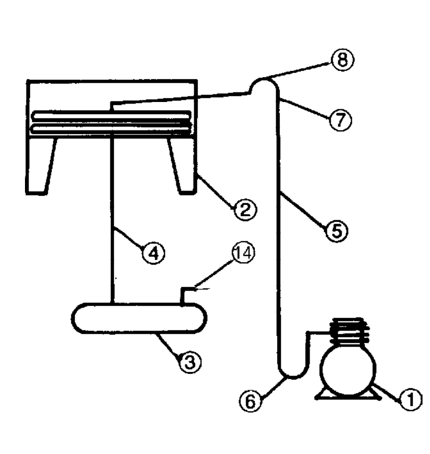


Figure 4(a) - Single circuit with double discharge riser (may be required with capacity control)

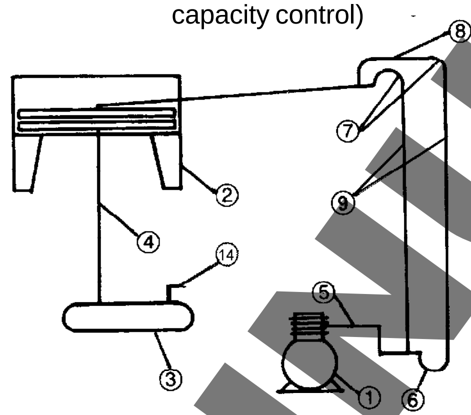


Figure 4(b) - Single circuit with Oil Separator (may be required with capacity control)

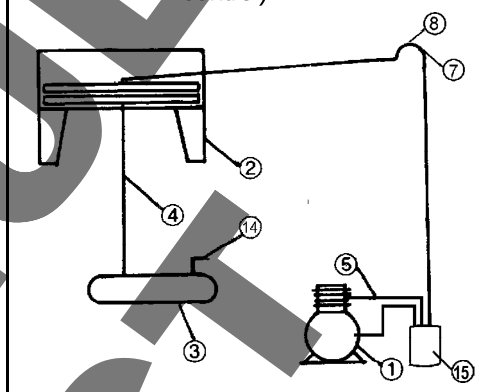


Figure 5 - Single circuit regulator valve head pressure control

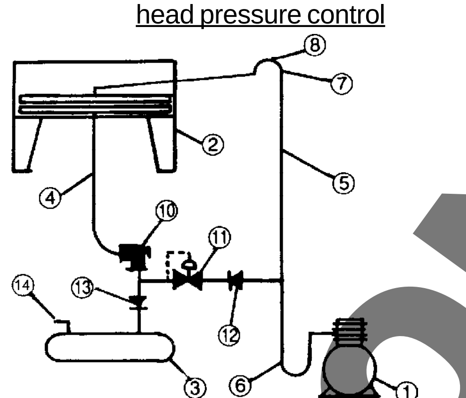
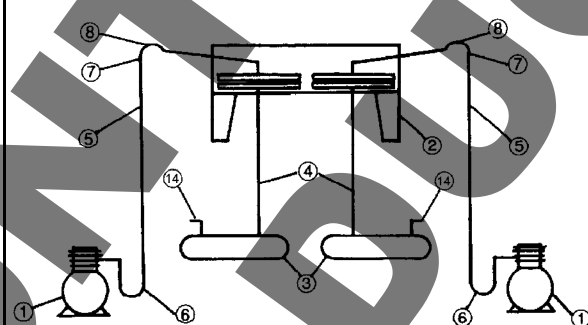


Figure 6 - Multiple circuits



LEGEND
1 - Compressor
2 - Air Cooled Condenser
3 - Receiver
4 - Condensate Line
5 - Discharge Line
6 - Trap-minimum 18" (157 mm)
7 - Reverse Trap-minimum 6" (152 mm)
8 - Access Schrader Valve
9 - Double Discharge Riser
10 - Head Pressure Regulator (open on rise of inlet)
11 - Receiver Pressure Regulator Valve (opens on rise of differential)
12 - Check Valve "A"
13 - Check Valve "B"
14 - Receiver Relief Valve
15 - Oil Separator

ELECTRICAL WIRING

All wiring and connections to the air cooled condenser must be made in accordance with the National Electrical Code and all local codes and regulations. Any wiring diagrams shown are basic and do not necessarily include electrical components which must be field supplied. (see pages 8-11 for typical wiring diagrams). Refer to the Electrical Specifications table on pages 5, 15 and 19 for voltage availability and entering service requirements.

SYSTEM START-UP CHECKS

1. Check the electrical characteristics of all components to be sure they agree with the power supply.
2. Check tightness of all fans and motor mounts.
3. Check tightness of all electrical connections.
4. Upon start-up, check fans for correct rotation. Air is drawn through the condenser coil. To change rotation on 3 phase units reverse any two (2) fan motor leads.
5. All system piping must be thoroughly leak checked before a refrigerant charge is introduced.

MAINTENANCE

A semi annual inspection should be carried out by a qualified refrigeration service mechanic. The main power supply must be disconnected.

1. Check electrical components. Tighten any loose connections.
2. Check control capillary tubes and lines for signs of wear due to excessive vibration or rubbing on metal parts. Secure if necessary.
3. Check tightness of all fans and motor mounts. Remove any deposits which could effect fan balance. Note: Fan motors are permanently lubricated and require only visual inspection.
4. Clean the condenser coil using a soft brush or by flushing with cool water or coil cleansers available through NRP (National Refrigeration Products Inc.)
5. Update service log information (back page of service manual)

SERVICE PARTS LIST

PART DESCRIPTION	MODELS	PART NUMBER
FAN MOTORS-60 Hz		
850 RPM Models		
208/230-1-60	850 RPM (3/4 HP)	1048725-001
208/230-3-60	850 RPM (1 HP)	1048726-001
460-3-60	850 RPM (1 HP)	1048727-001
575-3-60	850 RPM (1 HP)	1048728-001
208/230/460 -3-60	850 RPM (1 HP)	1062967-001
550 RPM Models		
208/230/460 -3-60	550 RPM (1/2 HP)	1068176-001
575-3-60	550 RPM (1/2 HP)	1068177-001
1140 RPM Models		
208/230/460 -3-60	1140 RPM (2 HP)	1067454-001
575-3-60	1140 RPM (2 HP)	1068175-001
FAN MOTORS-50 Hz		
850 RPM Models		
200/220-1-50	700 RPM (3/4 HP)	1048725-001
200/220-3-50	700 RPM (1 HP)	1048726-001
380-3-50	700 RPM (1 HP)	1048727-001
200/220/380 -3-50	700 RPM (1 HP)	1062967-001
550 RPM Models		
200/220/380 -3-50	450 RPM (1/2 HP)	1068176-001
1140 RPM Models		
200/220/380 -3-50	950 RPM (2 HP)	1067454-001
MOTOR MOUNT RAIL (2 REQ'D)	35" WIDE FAN SECTION 45" WIDE FAN SECTION	1046500 1046502
MOTOR RAIN SHIELD*	ALL	1043295
MOTOR RAIN SLINGER*	ALL	106098
FAN BLADES 30" 22º 4 BLADE 30" 28º 4 BLADE	 UP TO 144" LONG MODELS 183" LONG AND OVER MODELS	 1048739 1048738
FAN GUARD - 35" DIA.	ALL	1048603
MOUNTING LEGS 20" CORNER LEG 20" LEFT HAND CENTRE LEG 20" RIGHT HAND CENTRE LEG 90" SUPPORT RAIL - DOUBLE ROW 45" SUPPORT RAIL - SINGLE ROW	 ALL 144" LONG AND OVER MODELS 144" LONG AND OVER MODELS 144" LONG AND OVER MODELS 144" LONG AND OVER MODELS	 106025 107024-001 107024-002 107025 1065906

* Fan motor service kit part number with - 001 suffix includes a rain shield and slinger.

NOTES

SERVICE PARTS LIST

Service Parts List
Label
To Be Attached
HERE

PROJECT INFORMATION

System	
Model Number	Date of Start-Up
Serial Number	Service Contractor
Refrigerant	Phone
Electrical Supply	Fax

KeepRite® REFRIGERATION

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