CIRCUL-AIRE

THERMOPAK

PLATE-TYPE HEAT EXCHANGER ENERGY RECOVERY SYSTEMS

RANGE 750-15,000 CFM

INDOOR AIR QUALITY USING AIR-TO-AIR ENERGY RECOVERY

- HVAC ENERGY RECOVERY
- AIR PURIFICATION TO MEET STANDARDS ON VENTILATION FOR ACCEPTABLE INDOOR AIR QUALITY
- ODOR AND CONTAMINANT FILTRATION

THERMOPAK ENERGY RECOVERY SYSTEMS

INTRODUCTION

The Thermopak Air-to-Air Energy Recovery System is a self-contained air handling unit fully manufactured by Circul-Aire. The unit is designed to enhance energy efficiency while providing indoor air quality via gas phase filtration.

ASHRAE's* Standard on *''Ventilation for Acceptable Indoor Air Quality''* has required designers to re-assess ventilation design techniques. Circul-Aire's Thermopak unit was designed with these concerns in mind. Moreover, with the integration of gas phase filtration media, the Thermopak Energy Recovery unit can provide clean air at a low operational cost, by benefiting from recirculation when possible, instead of costly outdoor air dilution techniques.

DESIGN FEATURES

PASSIVE ENERGY RECOVERY

Unlike other types of air-to-air heat exchangers, the plate-type does not require any external power to function. This advantage translates into lower installation costs, and extremely low operating life-cycle costs. The thermal energy saved can be directly applied to the initial cost of the Thermopak unit, and can thus be justified financially by a relatively short payback period.

NO CROSS CONTAMINATION

Due to indoor air quality concerns, Circul-Aire has designed a structural plate assembly that eliminates the possibility of cross-contamination between the exhaust and supply air streams. This design permits high pressure differentials to exist without risk of infiltration.

BIDIRECTIONAL HEAT TRANSFER

The Thermopak can be used for both heating and/or cooling applications. While Circul-Aire plate-type heat exchangers can achieve an exceptionally high thermal efficiency, it is common practice to design plate exchangers in the 60-70% supply effectiveness range. As a result, a higher seasonal efficiency can be achieved when combined with various frost control strategies.

ODOR CONTROL/CONTAMINANT REMOVAL

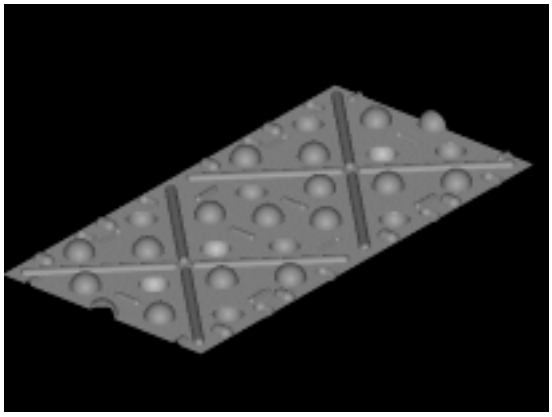
The Thermopak Energy Recovery System can incorporate chemical media designed to remove contaminants such as volatile organic compounds, malodorous gases, or toxins from the supply or exhaust air streams. The air purification section is typically designed to be 99.9% efficient in the removal of gases ensuring no bypass of contaminants.

TRAVERSING DEFROST

Circul-Aire's Thermopak unit has been designed to maximize energy efficiency in winter by utilizing a traversing defrost system. This system provides protection to the heat exchanger from frost formation while ensuring maximum energy transfer during the entire heating season.

*ASHRAE: AMERICAN SOCIETY OF HEATING, REFRIGERATING and AIR-CONDITIONING ENGINEERS

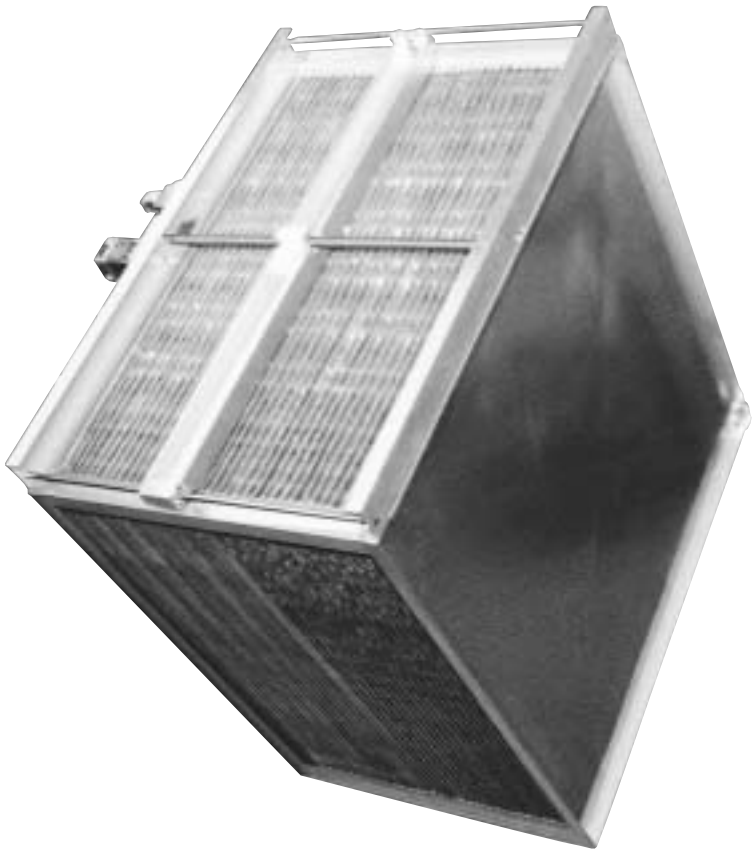
INDOOR AIR QUALITY AT MINIMAL COST



CIRCUL-AIRE's Plate Configuration Designed to Achieve Maximum Energy Recovery Without Excessive Pressure Drop

The Thermopak Plate-Type Air Handling System has been designed to incorporate the most advanced energy recovery techniques utilized in the HVAC industry. The embossed plate pattern, material of construction and assembly technique have all been developed to guarantee superior indoor air quality without adding to the operational cost of a ventilation system.

Plate-Type Heat Exchanger c/w Traversing Defrost System



UNIT IDENTIFICATION

TMP - 1000P - X TD R

Type of Unit (TMP, TMPi)

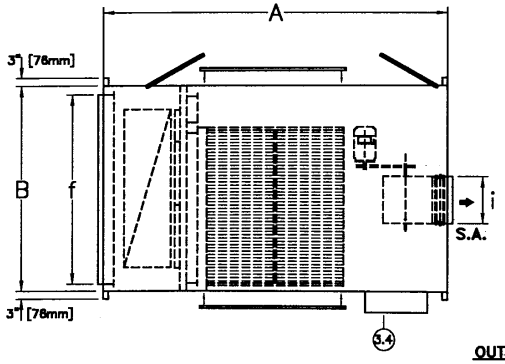
Nominal CFM (1000 to 13500)

X: No heating or cooling component
Y: Heating component only
Y1: Electric
Y2: Hot water coil
Y3: Steam coil
Y4: Indirect gas fired
Y5: Direct gas fired
Z: Heating and cooling component
Z1: Electric and chilled water coil (CWC)
Z2: Hot water coil and CWC
Z3: Steam coil and CWC
Z4: Indirect gas fired and CWC
Z5: Direct gas fired and CWC
Z6: Electric and DX coil
Z7: Hot water coil and DX
Z8: Steam coil and DX
Z9: Indirect gas fired and DX
Z10: Direct gas fired and DX

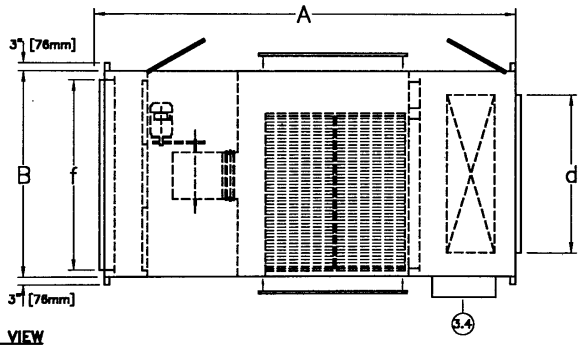
Recirculation

TD = Traversing Defrost
FB = Face and Bypass

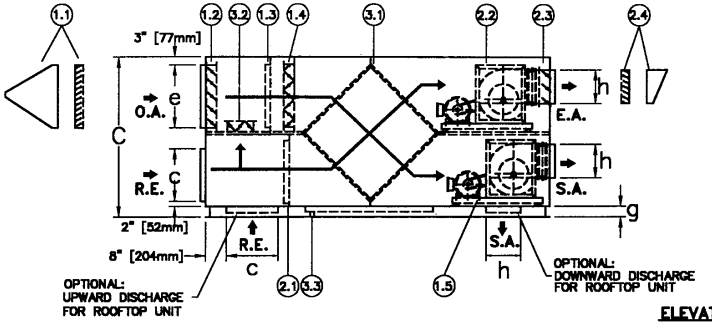
TMP

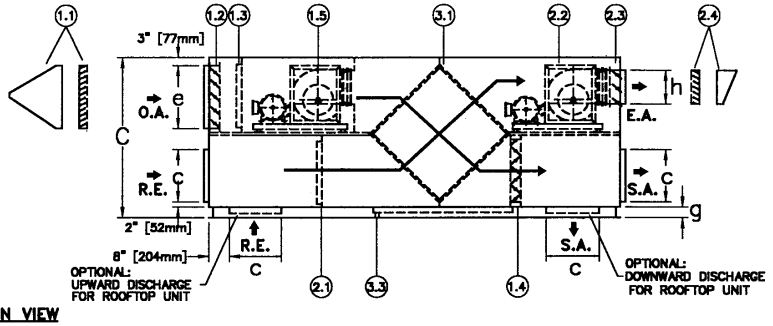


TMPi

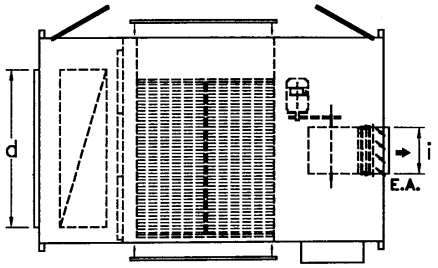


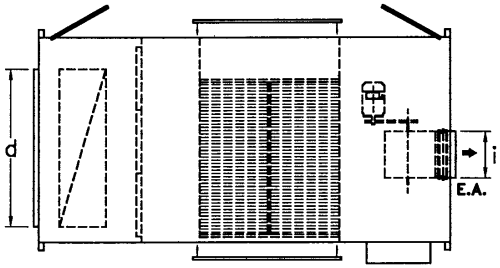
OUTSIDE AIR/SUPPLY AIR PLAN VIEW





ELEVATION VIEW





RETURN AIR/EXHAUST AIR PLAN VIEW

COMPONENT IDENTIFICATION

SUPPLY SIDE:
1.1 OPTIONAL: OUTSIDE AIR INTAKE HOOD C/W BIRD SCREEN OR LOUVER
1.2 MOTORIZED OUTSIDE AIR INTAKE DAMPERS (INSULATED)
1.3 30% EFFICIENT PREFILTERS
1.4 OPTIONAL: FACE AND BYPASS DAMPERS
1.5 FORWARD CURVE CENTRIFUGAL BLOWER AND MOTOR

EXHAUST SIDE:
2.1 30% EFFICIENT PREFILTERS
2.2 FORWARD CURVE CENTRIFUGAL BLOWER AND MOTOR
2.3 OPTIONAL: MOTORIZED EXHAUST AIR DISCHARGE DAMPERS (INSULATED) OR BACKDRAFT DAMPERS (INSULATED)
2.4 OPTIONAL: EXHAUST AIR DISCHARGE HOOD C/W BIRD SCREEN OR LOUVERS

GENERAL COMPONENTS:
3.1 PLATE TYPE HEAT EXCHANGER
3.2 RECIRCULATION DAMPER
3.3 CONDENSATION DRAIN PIPE C/W DRAIN PAN
3.4 UNIT MOUNTED CONTROL PANEL
OPTIONAL: REMOTE CONTROL PANEL

DIMENSIONS

Table 1

MODEL	OVERALL DIMENSIONS inches (millimeters)				WEIGHT lb. (kg)		DETAILED DIMENSIONS inches (millimeters)		
	A		B	C					
	LENGTH		WIDTH	HEIGHT					
	TMP	TMPi			TMP	TMPi	c x d	e x f	g
1000	118 (2997)	130 (3303)	58 (1473)	24 (610)	750 (340)	840 (381)	14 x 20 (356 x 508)	16 x 23 (368 x 584)	2 (52)
1500	118 (2997)	130 (3303)	58 (1473)	30 (760)	860 (390)	1010 (458)	14 x 20 (356 x 508)	22 x 23 (559 x 584)	2 (52)
2000	128 (3251)	146 (3708)	58 (1473)	39 (910)	1150 (521)	1260 (572)	20 x 20 (508 x 508)	28 x 23 (711 x 584)	3 (76)
2500	128 (3251)	146 (3708)	58 (1473)	45 (1143)	1290 (585)	1490 (676)	26 x 20 (660 x 508)	34 x 23 (864 x 584)	3 (76)
3000	128 (3251)	146 (3708)	58 (1473)	53 (1346)	1360 (617)	1520 (689)	32 x 20 (813 x 508)	40 x 23 (1016 x 584)	3 (76)
3500	128 (3251)	146 (3708)	58 (1473)	59 (1499)	1470 (667)	1620 (735)	38 x 20 (965 x 508)	46 x 23 (1168 x 584)	3 (76)
4000	132 (3353)	156 (3962)	64 (1626)	61 (1549)	1870 (848)	2040 (925)	20 x 48 (508 x 1220)	24 x 48 (610 x 1220)	4 (102)
5000	132 (3353)	156 (3962)	76 (1930)	61 (1549)	2050 (930)	2240 (1016)	20 x 60 (508 x 1524)	24 x 60 (610 x 1524)	4 (102)
6000	132 (3353)	156 (3962)	88 (2235)	61 (1549)	2490 (1130)	2750 (1247)	20 x 72 (508 x 1829)	24 x 72 (610 x 1829)	4 (102)
7500	132 (3353)	156 (3962)	102 (2642)	61 (1549)	2862 (1298)	3122 (1416)	20 x 84 (508 x 2134)	24 x 84 (610 x 2134)	4 (102)
9000	162 (4115)	182 (4623)	88 (2235)	87 (2210)	4170 (1891)	4390 (1991)	24 x 78 (610 x 1981)	36 x 78 (914 x 1981)	6 (152)
10500	162 (4115)	182 (4623)	102 (2642)	87 (2210)	4510 (2046)	4750 (2155)	24 x 90 (610 x 2286)	36 x 90 (914 x 2286)	6 (152)
12000	162 (4115)	182 (4623)	114 (2845)	87 (2210)	4980 (2259)	5240 (2377)	24 x 102 (610 x 2591)	36 x 102 (914 x 2591)	6 (152)
13500	162 (4115)	182 (4623)	128 (3251)	87 (2210)	5290 (2400)	5680 (2576)	24 x 114 (610 x 2896)	36 x 114 (914 x 2896)	6 (152)

**** Notes:***

1. Length (dimension A) adders for heating and cooling coils are as follows:
   - add 12'' for hot water coil, electric heater;
   - add 16'' for chilled water or DX coil;
   - consult factory if chemical media section is desired.

2. Weight of units are based on single wall construction. Units up to TMP-7500 (or TMPi-7500) are constructed of 18 gauge satin coated steel. Larger units are constructed of 16 gauge satin coated steel. Construction of units depends upon client requirements.

3. Dimensions h x i are dependant upon blower size, please refer to approval drawings.

TOTAL STATIC PRESSURE / FAN MOTOR HP

Table 2

MODEL	CFM RANGE	0.75" W.C. ESP						1.25" W.C. ESP					
		X		Y		Z		X		Y		Z	
		ΔPT	HP	ΔPT	HP	ΔPT	HP	ΔPT	HP	ΔPT	HP	ΔPT	HP
1000	750	1.75	.50	1.91	.75	2.42	.75	2.25	.75	2.41	.75	2.93	1.0
	1000	1.95	.75	2.11	1.0	2.62	1.0	2.45	1.0	2.61	1.0	3.13	1.5
	1250	2.15	1.0	2.31	1.5	2.83	1.5	2.65	1.5	2.81	1.5	3.33	1.5
1500	1250	1.75	1.0	1.91	1.0	2.43	1.5	2.25	1.5	2.41	1.5	2.93	1.5
	1500	1.90	1.5	2.06	1.5	2.58	2.0	2.40	1.5	2.56	2.0	3.08	2.0
	1750	2.00	2.0	2.16	2.0	2.68	2.0	2.50	2.0	2.66	3.0	3.18	3.0
2000	1750	1.80	1.5	1.96	1.5	2.48	1.5	2.30	1.5	2.46	1.5	2.98	2.0
	2000	1.85	1.5	2.01	2.0	2.53	2.0	2.35	2.0	2.51	2.0	3.03	2.0
	2250	1.95	2.0	2.11	2.0	2.63	3.0	2.45	3.0	2.61	3.0	3.13	3.0
2500	2250	1.80	1.5	1.96	1.5	2.48	2.0	2.30	1.5	2.46	2.0	2.98	2.0
	2500	1.85	2.0	2.01	2.0	2.53	3.0	2.35	2.0	2.51	3.0	3.03	3.0
	2750	1.90	3.0	2.06	3.0	2.58	3.0	2.40	3.0	2.56	3.0	3.08	3.0
3000	2750	1.80	2.0	1.96	3.0	2.48	3.0	2.30	3.0	2.46	3.0	2.98	3.0
	3000	1.85	3.0	2.01	3.0	2.53	3.0	2.35	3.0	2.51	3.0	3.03	3.0
	3250	1.90	3.0	2.06	3.0	2.58	5.0	2.40	3.0	2.56	5.0	3.08	5.0
3500	3250	1.90	3.0	2.06	3.0	2.58	5.0	2.40	3.0	2.56	5.0	3.08	5.0
	3500	1.95	3.0	2.11	5.0	2.63	5.0	2.45	5.0	2.61	5.0	3.13	5.0
	3750	2.00	5.0	2.16	5.0	2.68	5.0	2.50	5.0	2.66	5.0	3.18	5.0
4000	3750	1.80	5.0	1.96	5.0	2.48	5.0	2.30	5.0	2.46	5.0	2.98	5.0
	4000	1.85	5.0	2.01	5.0	2.53	5.0	2.35	5.0	2.51	5.0	3.03	5.0
	4500	1.90	5.0	2.06	7.5	2.58	7.5	2.40	7.5	2.56	7.5	3.08	7.5
5000	4500	1.80	5.0	1.96	5.0	2.48	5.0	2.30	5.0	2.46	5.0	2.98	5.0
	5000	1.85	5.0	2.01	5.0	2.53	5.0	2.35	5.0	2.51	5.0	3.03	5.0
	5500	1.90	5.0	2.06	5.0	2.58	7.5	2.40	7.5	2.56	7.5	3.08	7.5
6000	5500	1.80	5.0	1.96	5.0	2.48	5.0	2.30	5.0	2.46	5.0	2.98	7.5
	6000	1.85	5.0	2.01	5.0	2.53	7.5	2.35	7.5	2.51	7.5	3.03	7.5
	6750	1.90	7.5	2.06	7.5	2.58	7.5	2.40	7.5	2.56	7.5	3.08	7.5
7500	6750	1.75	7.5	1.91	7.5	2.43	7.5	2.25	7.5	2.41	7.5	2.93	7.5
	7500	1.88	7.5	2.04	7.5	2.56	7.5	2.38	7.5	2.54	7.5	3.06	10.0
	8250	1.95	7.5	2.11	10.0	2.63	10.0	2.45	10.0	2.61	7.5	3.13	15
9000	8250	1.90	7.5	2.06	7.5	2.58	7.5	2.40	7.5	2.56	7.5	3.08	10.0
	9000	2.00	7.5	2.16	7.5	2.68	10.0	2.50	7.5	2.66	10.0	3.18	10.0
	9750	2.05	10.0	2.23	10.0	2.73	10.0	2.55	10.0	2.71	10.0	3.23	15.0
10500	9750	2.05	7.5	2.23	7.5	2.73	10.0	2.55	10.0	2.71	10.0	3.23	10.0
	10500	2.07	10.0	2.25	10.0	2.75	15.0	2.57	10.0	2.73	15.0	3.25	15.0
	11250	2.2	15.0	2.38	15.0	2.88	15.0	2.70	15.0	2.86	15.0	3.38	15.0
12000	11250	1.85	10.0	2.01	10.0	2.53	15.0	2.35	10.0	2.51	15.0	3.03	15.0
	12000	1.90	10.0	2.06	10.0	2.58	15.0	2.40	15.0	2.50	15.0	3.08	15.0
	12750	1.95	10.0	2.11	15.0	2.63	15.0	2.45	15.0	2.65	15.0	3.13	15.0
13500	12750	1.85	10.0	2.01	10.0	2.53	15.0	2.35	15.0	2.51	15.0	3.03	15.0
	13500	1.90	15.0	2.06	15.0	2.58	15.0	2.40	15.0	2.56	15.0	3.08	20.0
	15000	2.00	15.0	2.11	15.0	2.68	20.0	2.68	20.0	2.66	20.0	3.18	20.0

Legend:

X: A unit containing no heating or cooling component in supply airstream or exhaust side pressure drop.

Y: A unit containing a heating component in the supply air side such as a hot water coil, steam vapour, electric heating or an indirect gas fired furnace. Average ΔP across heating component is taken as 0.16" W.C. Consult factory for required HP when a direct fired gas furnace is utilized.

Z: A unit containing a heating and cooling component. The cooling component is either a chilled water coil or a direct expansion evaporator coil. The average pressure drop is based on a coil that provides sensible cooling only. The combined pressure drop for a heating and cooling coil is taken as 0.68" W.C. If a cooling coil that provides dehumidification is utilized, then consult the factory for the required HP.

THERMAL PERFORMANCE

Table 3

MODEL	CFM RANGE	WINTER BTU/hr (kW)			SUMMER BTU/hr (TON)		
		HEATING REQ'D W/O ENERGY RECOVERY	ENERGY RECOVERED	HEATING REQ'D USING HEAT EXCHANGER	COOLING REQ'D W/O ENERGY RECOVERY	ENERGY RECOVERED	COOLING REQ'D USING HEAT EXCHANGER
1000	750	64,800 (19.0)	45,684 (13.4)	19,116 (5.6)	18,630 (1.55)	8,565 (0.71)	10,065 (0.84)
	1000	86,400 (25.3)	59,184 (17.3)	27,216 (8.0)	24,840 (2.07)	11,124 (0.93)	13,716 (1.14)
	1250	108,000 (31.6)	73,440 (21.5)	34,560 (10.1)	31,050 (2.59)	13,770 (1.15)	17,280 (1.44)
1500	1250	108,000 (31.6)	76,140 (22.3)	31,860 (9.33)	31,050 (2.59)	14,276 (1.19)	16,774 (1.40)
	1500	129,600 (38.0)	89,424 (26.2)	40,176 (11.8)	37,260 (3.11)	16,767 (1.40)	20,493 (1.71)
	1750	151,200 (44.3)	103,570 (30.3)	47,630 (14.0)	43,470 (3.62)	19,419 (1.62)	24,051 (2.0)
2000	1750	151,200 (44.3)	105,840 (31.0)	45,360 (13.3)	43,470 (3.62)	19,845 (1.65)	23,625 (1.97)
	2000	172,800 (50.6)	120,096 (35.2)	52,704 (15.4)	49,680 (4.14)	22,518 (1.88)	27,162 (2.26)
	2250	194,400 (57.0)	133,164 (39.0)	61,236 (17.9)	55,890 (4.66)	24,968 (2.08)	30,922 (2.58)
2500	2250	194,400 (57.0)	136,080 (39.9)	58,320 (17.1)	55,890 (4.66)	25,515 (2.13)	30,375 (2.53)
	2500	216,000 (63.3)	150,120 (44.0)	65,880 (19.3)	62,100 (5.18)	28,147 (2.35)	33,953 (2.83)
	2750	237,600 (69.6)	149,040 (43.7)	88,560 (25.9)	68,310 (5.69)	30,740 (2.56)	37,570 (3.13)
3000	2750	237,600 (69.6)	166,320 (48.7)	71,280 (20.9)	68,310 (5.69)	31,185 (2.60)	37,125 (3.09)
	3000	259,200 (75.9)	180,144 (52.8)	79,056 (23.2)	74,520 (6.21)	33,777 (2.81)	40,743 (3.39)
	3250	280,800 (82.3)	193,752 (56.8)	87,048 (25.5)	80,730 (6.73)	36,328 (3,03)	44,402 (3.70)
3500	3250	280,800 (82.3)	193,752 (56.8)	87,048 (25.5)	80,730 (6.73)	36,318 (3.03)	44,412 (3.70)
	3500	302,400 (88.6)	207,144 (60.7)	95,256 (27.9)	86,940 (7.25)	38,839 (3.24)	48,101 (4.0)
	3750	324,400 (94.9)	221,940 (65.0)	102,060 (29.9)	93,150 (7.76)	41,613 (3.47)	51,537 (4.29)
4000	3750	324,400 (94.9)	226,800 (66.5)	97,200 (28.5)	93,150 (7.76)	42,525 (3.54)	50,625 (4.22)
	4000	345,600 (101.3)	240,192 (70.4)	105,408 (30.9)	99,360 (8.28)	45,036 (3.75)	54,324 (4.53)
	4500	388,800 (113.9)	268,272 (78.6)	120,528 (35.3)	111,780 (9.32)	50,300 (4.19)	61,480 (5.12)

Note:

1. Thermal performance (Tables 3 & 4) were derived using:
   Winter: T1 (O.A.) = -10ºF, T3 (R.A.) = 70ºF
   Summer: T1 (O.A.) = 95/75 (DB/WB) ºF, T3 (R.A.) = 72/59 (DB/WB) ºF
2. Heat recovery efficiencies range between 68% to 71%.
3. The winter heat recovery values in the table are based on dry air. If moist air conditions are present in return air, a frost prevention or defrost mechanism must be used. In this case, consult the factory for revised calculation of heat recovery.
4. Data is subject to change without notice.

THERMAL PERFORMANCE

Table 4

MODEL	CFM RANGE	WINTER BTU/hr (kW)			SUMMER BTU/hr (TON)		
		HEATING REQ'D W/O ENERGY RECOVERY	ENERGY RECOVERED	HEATING REQ'D USING HEAT EXCHANGER	COOLING REQ'D W/O ENERGY RECOVERY	ENERGY RECOVERED	COOLING REQ'D USING HEAT EXCHANGER
5000	4500	388,800 (113.9)	272,160 (79.7)	116,640 (34.2)	111,780 (9.32)	51,030 (4.25)	60,750 (5.06)
	5000	432,000 (126.6)	300,240 (88.0)	131,760 (38.6)	124,200 (10.35)	56,295 (4.69)	67,905 (56.6)
	5500	475,000 (139.2)	327,888 (96.1)	143,312 (42.0)	136,620 (11.39)	61,479 (5.12)	75,141 (6.26)
6000	5500	475,200 (139.2)	332,640 (97.5)	142,560 (41.8)	136,620 (11.39)	62,370 (5.20)	74,250 (6.19)
	6000	518,400 (151.9)	360,288 (105.6)	158,112 (46.3)	149,040 (12.4)	67,554 (5.63)	81,486 (6.79)
	6750	583,200 (170.9)	402,408 (117.9)	180,792 (53.0)	167,670 (13.97)	75,515 (6.29)	92,155 (7.68)
7500	6750	583,200 (170.9)	408,240 (119.6)	174,960 (51.3)	167,670 (13.97)	76,545 (6.38)	91,125 (7.59)
	7500	648,000 (190.0)	447,930 (131.2)	200,070 (58.6)	186,300 (15.53)	84,078 (7.01)	102,222 (8.52)
	8250	712,800 (208.8)	491,832 (144.1)	220,968 (64.7)	204,930 (17.10)	92,218 (7.68)	112,712 (9.39)
9000	8250	712,800 (208.8)	507,513 (148.7)	205,287 (60.1)	204,930 (17.10)	95,158 (7.93)	109,772 (9.15)
	9000	777,600 (227.8)	552,096 (161.8)	225,504 (66.1)	223,560 (18.63)	103,518 (8.63)	120,042 (10.00)
	9750	842,400 (246.8)	591,364 (173.3)	251,036 (73.6)	242,190 (20.18)	110,880 (9.24)	131,310 (10.94)
10500	9750	842,400 (246.8)	599,789 (175.6)	242,611 (71.1)	242,190 (20.18)	112,460 (9.37)	129,730 (10.81)
	10500	907,200 (265.8)	644,112 (203.4)	263,088 (77.1)	260,820 (21.74)	120,771 (10.06)	140,049 (11.67)
	11250	972,000 (284.8)	612,344 (179.4)	359,656 (105.4)	279,450 (23.29)	127,939 (106.61)	151,511 (126.26)
12000	11250	972,000 (284.8)	692,060 (202.8)	279,940 (82.0)	279,450 (23.29)	129,760 (10.81)	149,690 (12.47)
	12000	1,036,800 (303.8)	736,128 (215.7)	300,672 (88.1)	298,080 (24.84)	138,020 (11.50)	160,060 (13.33)
	12750	1,101,600 (322.8)	776,628 (227.5)	324,972 (95.2)	316,710 (26.39)	145,617 (12.13)	171,093 (14.26)
13500	12750	1,101,600 (322.8)	764,339 (223.9)	337,261 (98.8)	316,710 (26.39)	147,063 (12.26)	169,647 (14.14)
	13500	1,166,400 (341.8)	828,144 (242.6)	338,256 (99.1)	335,340 (27.95)	155,277 (12.94)	180,063 (15.00)
	15000	1,296,000 (379.7)	909,792 (266.6)	386,208 (113.2)	372,600 (27.30)	170,586 (14.22)	202,014 (16.83)

Note:

1. Thermal performance (Tables 3 & 4) were derived using:
   Winter: T1 (O.A.) = -10ºF, T3 (R.A.) = 70ºF
   Summer: T1 (O.A.) = 95/75 (DB/WB) ºF, T3 (R.A.) = 72/59 (DB/WB) ºF
2. Heat recovery efficiencies range between 68% to 71%.
3. The winter heat recovery values in the table are based on dry air. If moist air conditions are present in return air, a frost prevention or defrost mechanism must be used. In this case, consult the factory for revised calculation of heat recovery.
4. Data is subject to change without notice.

GENERAL SPECIFICATIONS

1.0 GENERAL

1.1 Supply and install a CIRCUL-AIRE model Thermopak energy recovery system (TMP Series).

1.2 The unit manufacturer shall have been engaged in the design and fabrication of heat recovery systems for no less than the last ten years. Strict adherence to sizes and capacities shall be maintained. Any deviation from the specifications must be approved by the engineer's office no less than ten days prior to the project bid date. No consideration of alternates will be given after this time.

1.3 All components shall comply with, but not limited to, the following standards:

ASHRAE:	Standard for filters.
AMCA:	Standard for fans.
ASTM:	Standard for testing methods.
ASW:	Standard for welding.
CSA/ETL:	Standard for electrical systems.
ANSI:	Standard for sound.
OSHA:	Standard for safety.
ARI:	Standard for air handler design.

1.4 The Thermopak Energy Recovery System (TMP) supplied by Circul-Aire shall be capable of delivering the specified volumes of air at external static pressures required.

1.5 The TMP heat recovery system and heat exchanger core shall be fabricated and supplied by the same manufacturer.

1.6 The heat recovery system shall be designed to provide a heat recovery efficiency of _____ %.

2.0 UNIT CASING

2.1 The TMP system shall be constructed of zinc coated steel. The structure shall be designed to provide a fully self supporting frame.

2.2 Exterior panels shall be minimum 20 gauge zinc coated steel. All casing sections subject to heat loss or condensation shall be internally covered by a one inch thick fibre glass insulation with neoprene backing.

2.3 All floor-to-wall and wall-to-wall interfaces shall be carefully sealed with silicone to provide high static pressure leakage prevention. All bolts penetrating the external skin shall be (cadmium plated or stainless steel) and shall have individual rubber neoprene closed cell water tight gasket (roof top models).

2.4 1.5" diameter drains shall be supplied for removal of condensate and/or water from wash cycle.

2.5 All access doors shall be constructed of a minimum 20 gauge zinc coated steel. Doors shall be of double wall construction. All doors shall be flush to unit casing and gasketed to provide a positive air/acoustic seal around sill, jamb and head. Inner panels shall be recessed, allowing the exterior panel to provide knife edge seal.

2.6 Access doors shall be hinged and bolted to assure a complete positive leakage allowing access to all components.

2.7 Access shall be provided on both sides for units unless otherwise specified.

2.8 The TMP floor system shall be constructed of a minimum of 16 gauge zinc coated steel and shall be supported by a steel U-channel.

2.9 Lifting lugs shall be integrated with the steel structural channel base to allow the unit to be lifted evenly without deflection.

2.10 External surfaces shall be coated with one part corrosion resistant aliphatic polyurethane finish, followed by one finishing coat. Standard system paint color shall be grey.

3.0 PLATE-TYPE HEAT EXCHANGER

3.1 Unit shall include a stationary air-to-air heat exchanger with efficiency scheduled on the plans and must be manufactured by the heat recovery unit manufacturer.

3.2 Heat transfer media shall be 1100 series aluminum, 0.008" thick plates, die formed with vertical and diagonal ribs to increase heat transfer efficiency and to add column strength to the media.

3.3 The plates also shall have die formed dimples to provide positive separation and support each plate to the adjacent plate.

3.4 The heat exchanger module housing shall be constructed of 0.08" aluminum.

3.5 The heat exchanger plates shall be mechanically crimped together and the seams coated with GE RTV 109 Silicone and encapsulated in "V" sealing strips. The combination double sealing with silicone is to assure positive isolation of the supply air stream from the exhaust air stream.

3.6 The heat exchanger shall be designed to withstand pressure differentials between air streams of 10" WC. and to withstand air temperatures of up to 400˚F.

4.0 FAN SECTION

4.1 The supply air fan shall provide _____ CFM at _____ inches W.C. of external static pressure. The exhaust air fan shall provide _____ CFM at _____ inches W.C. of external static pressure. Depending on CFM and static pressure, the following fans can be used:

4.1.A *Backward Inclined (Plug Blower) Arrangement*
Fan wheel design shall be of a non-overloading type backward curved double surface airfoil section. The wheels shall be of welded construction and the wheel and shaft assembly shall be dynamically balanced to ANSI Standard S219-1989, Quality Grade G6.3. Wheel and cone shall be coated steel (aluminum, stainless steel).

4.1.B *Centrifugal Fans*
The supply and exhaust fans shall be centrifugal type, forward curved, having double width, double inlet Class I or Class II fans and permanently greased ball bearings. They shall be dynamically balanced to ANSI S219-1989, Quality Grade G6.3.

4.2 The fan and motor shall be mounted on a structural steel base of sufficient strength to resist with minimum deflection all loads resulting from normal operation of the fan. Vibration spring mounts or rubber and shear isolators shall be selected with a maximum transmissibility of 25%.

4.3 Each fan shall be complete with a matched set of V-belt sheaves rated at a safety factor of 1.3 times the driving motor nameplate horsepower.

5.0 HEATING

5.1.A *Electric Heater (Open-Wire Type, Fin Tubular or Tubular) (Optional)*
Coil is factory installed, prewired and tested prior to shipment with the desired output capacity. The heating coils are of the open nickel-chromium wire type providing instantaneous heat transfer. All controls are selected for automatic operation and are prewired and interlocked to the heat recovery system. All stages of the coil are arranged to prevent stratification when operating at less than full capacity and individually fused over 48 amps. An air pressure switch and a high limit thermostat protect the coil from excessive temperatures. The electric coil is located in the supply air section downstream of the heat exchanger. All components are C.S.A. and E.T.L. listed (to supply supplemental heat during recovery mode or primary heat during recirculation mode). Fin tubular or tubular type coil is used for applications serving humid and/or corrosive environments. (For sizing of coils and options available, consult factory).

5.1.B *Hot Water Coil or Steam Coil (Optional)*
The TMP unit shall be provided with a heating coil to supply supplemental heating when the system is in recovery mode or supply primary heating when system is in recirculation mode. The coil shall be fabricated of copper tubes with aluminum fins. (For sizing of coils and options available, consult factory).

5.1.C *Indirect Gas-Fired Heater (Optional)*
The system incorporates an indirect gas-fired duct heater CGA and AGA certification. The system is designed to operate with natural gas supply 5-14" W.C. or a propane gas supply 8-14" W.C. Burner operation is achieved with a spark ignited safety pilot system with electronic flame supervision. Two stage control maintains desired space temperature (to supply supplemental heat recovery or primary heat during recirculation mode. For sizing consult factory).

6.0 COOLING

6.1.A *Chilled Water Coil or Direct Expansion Coil (Optional)*
The TMP unit shall be provided with a cooling coil to supply supplemental cooling when the system is in recovery mode. On large units where two coils are used, an intermediate drain pan between coils shall be provided. The coil shall be fabricated of copper tubes with aluminum fins. (For sizing of coils and options available, consult factory).

6.1.B *Indirect Evaporative Cooling (Optional)*
Either outside air or building air is directed through one side of the heat exchanger which has water spray nozzles injecting a very fine water mist into the air stream. The water mist is carried by the air stream throughout the passageways and is deposited on the heat exchanger surfaces. The air moving over the surfaces causes evaporation to occur at the air/water interface until, at the exit of the heat exchanger, the air becomes almost saturated and can no longer accept additional moisture. As the water on the surface evaporates, the water layer and the surface approach wet bulb temperature. When the opposite air stream, at a higher temperature, is present in counterflow on the other side of the exchanger, this air stream has its temperature lowered to near the wet bulb temperature of the air stream that has the water spray. Therefore cool dry air is supplied to the space. For sizing and thermodynamic performance, consult factory

GENERAL SPECIFICATIONS

7.0 FILTRATION

The contaminant removal filter section shall be designed to provide a high degree of sealing integrity. All particulate filter banks shall be designed for side access servicing via full opening hinged doors. From the air entering side, the unit shall include:

7.1 *Prefilters*

Roughing prefilters shall be 2" deep in direction of air flow having a rated average efficiency of 36.5% by ASHRAE Standard 52-76 test method using atmospheric dust. Filters shall be UL Class 2 as per Standard 900.

7.2 *Intermediate Filters (Optional)*

Intermediate filters shall be 12" deep in direction of air flow having an average efficiency 60% to 90% by ASHRAE Standard 52-76 test method using atmospheric dust. Filters shall be UL Class 2 as per Standard 900.

7.3 *High-Efficiency Filters (Optional)*

HEPA filters, D.O.P. 95% to 99.99% (consult factory).

7.4 *Gas Phase Filtration (Optional)*

Odor and gas phase filtration shall be achieved by a Circul-Aire factory fabricated gas phase air purification system. The filter section, as well as the chemical media shall be manufactured by the same supplier. The air purification system shall be 99.9% efficient in the removal of gases ensuring no bypass of gaseous contaminants. The manufacturer shall also have the in-house capability of analyzing the chemical media in the system to determine the degree of saturation. This shall be a service provided at no additional charge for the life of the system. Formal reports shall be issued directly to the client to aid in maintenance scheduling. For selection of chemical media and sizing, consult factory.

8.0 DAMPERS AND ACTUATORS

8.1 *Outside Air Motorized Damper*

Minimum leakage opposed blade aluminum dampers shall be constructed of a minimum 12 gauge extruded aluminum. All dampers shall be fabricated and installed to ensure less than 0.6% leakage at 10" w.g. Fan motors are interlocked with damper motor limit switch to open dampers on unit start-up and spring return close on unit shut down.

8.2 *Modulating Face and Bypass Dampers*

Opposed blade minimum leakage face and bypass dampers shall be operated by 24 V modulating motor with proportioning duct-stat.

8.3 *Exhaust Air Gravity Backdraft Damper*

Minimum leakage parallel blade aluminum dampers shall be constructed of a minimum 12 gauge extruded aluminum. All dampers shall be fabricated and installed to ensure less than 0.8% leakage at 4" w.g. Damper shall prevent air flow through unit when system is off. An exhaust air mortorized damper can be provided as an option.

8.4 *Recirculation Air Damper*

Minimum leakage opposed blade aluminum dampers shall be constructed of a minimum 12 gauge extruded aluminum. All dampers shall be fabricated and installed to ensure less than 0.6% leakage at 10" w.g. The damper linkage mechanism shall include 2 position electric interlock to shut down exhaust fan, motorized exhaust and outside air dampers. Recirculation damper shall provide 100% outside air potential with heat recovery, or 100% recirculation air, or a percentage of each.

9.0 TRAVERSING DEFROST

9.1 A factory installed reversible type traversing defrost system with the drive screw and traversing plate located in the clean air stream and the drive motor located outside of the air stream shall be provided.

9.2 Guide rods are provided above and below the screw drive to provide support for the traversing plate and prevent vibration of the system.

9.3 The traversing plate and support channels are constructed of extruded aluminum.

9.4 A defrost thermostat shall activate the defrost system by a drop in exhaust leaving air temperature below 35 degrees F.

9.5 The traversing plate will travel at approximately three inches per minute once the drive motor has been activated.

9.6 When the traversing plate mechanically activates the micro-switch located at either end of the heat exchanger, the drive motor reverses direction allowing continuous traversing across heat exchanger core.

APPLICATIONS

- **Apartment buildings**
- **Restaurant exhaust systems**
- **Hospitals**
- **Sport complexes**
- **Laboratories**
- **Hotels**
- **Educational institutions**
- **Indoor pools**
- **Theatres**
- **Auditoriums**
- **Museums**
- **Commercial office spaces**

MULTI-MIX MEDIA & TECH-CHEK SERVICE

Circul-Aire's MULTI-MIX® is a proven filter media which provides continuous purification of corrosive, odorous and toxic contaminants in industrial and commercial environments. MULTI-MIX® media combines the adsorption properties of activated carbon with the oxidation properties of chemically impregnated alumina. For more information on MULTI-MIX® media, refer to our brochures on this product.

Media analysis through our TECK-CHEK Program ensures maximum efficiency of our products. A complete computerized report establishes a media replacement schedule for each unit. Circul-Aire's in-house laboratory can also provide additional performance tests for specific air contaminants.

For more information on a specific application, please contact a local representative or CIRCUL-AIRE.

CIRCUL-AIRE

3999 Cote Vertu
Montreal, Quebec
Canada H4R 1R2
Tel.: (514) 336-3330
Fax: (514) 337-3336

USA & CANADA
1-800-800-1868

WEB SITE
http://www.circul-aire.com

Printed in Canada
THPL 0179