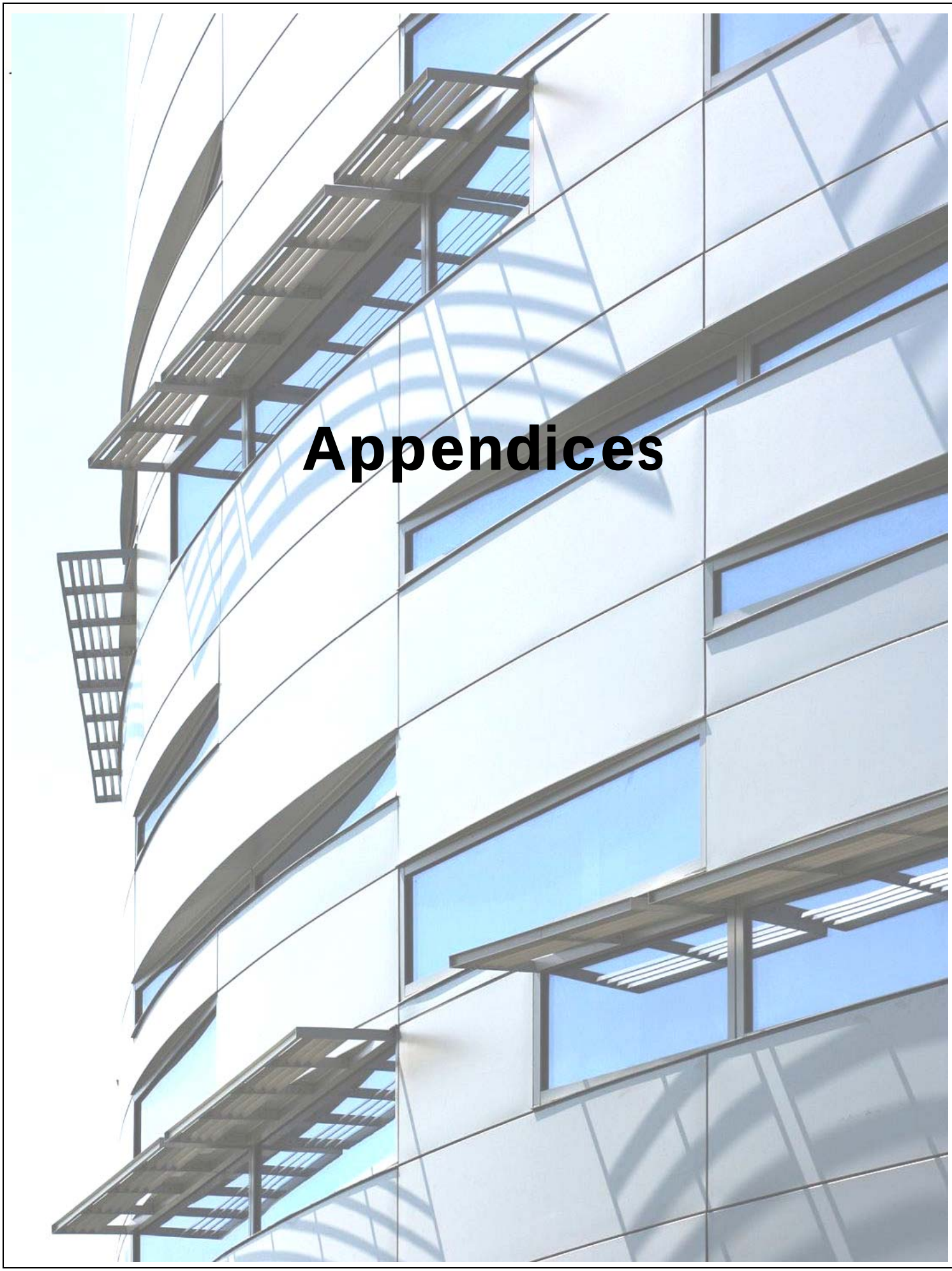
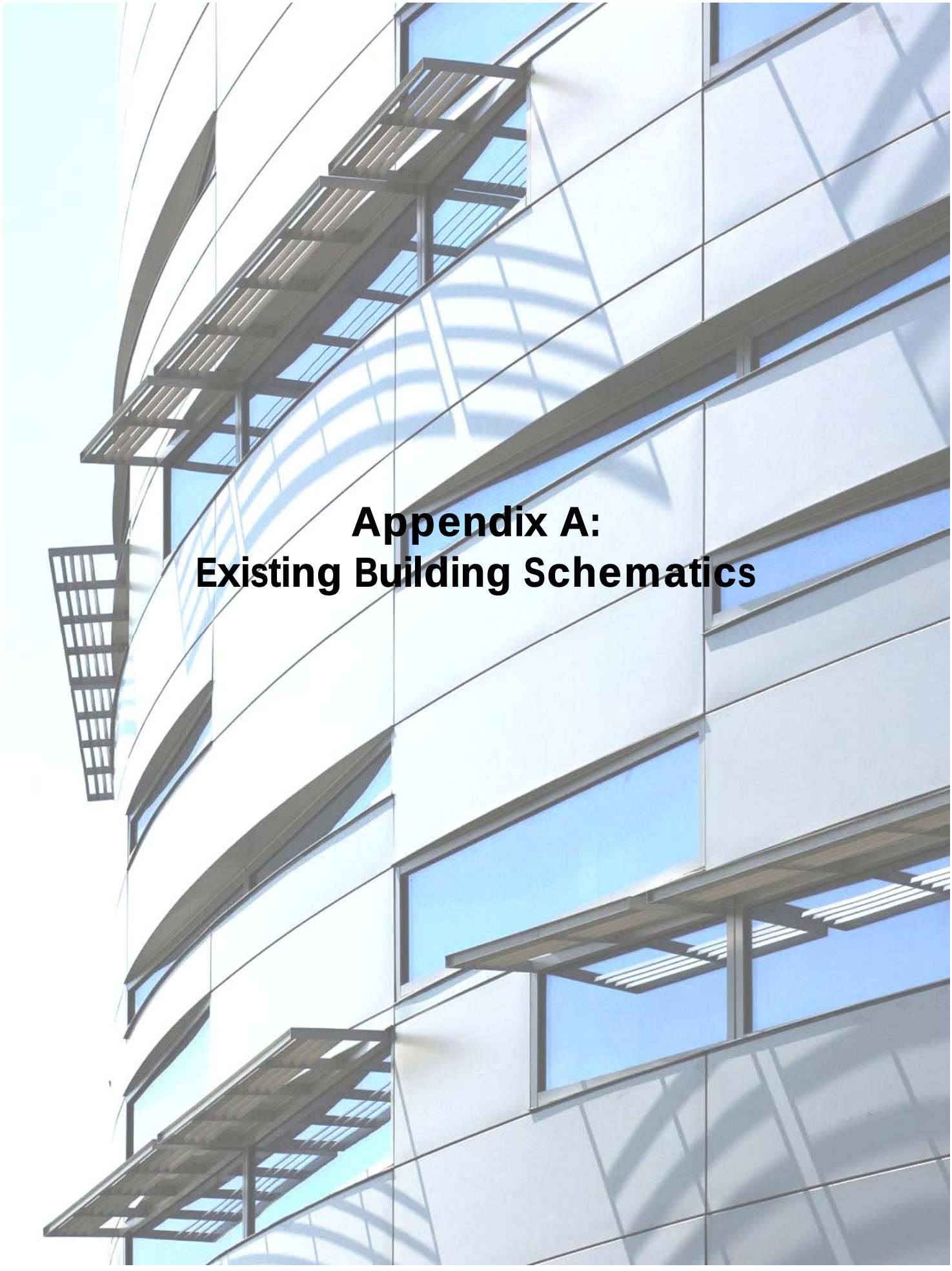
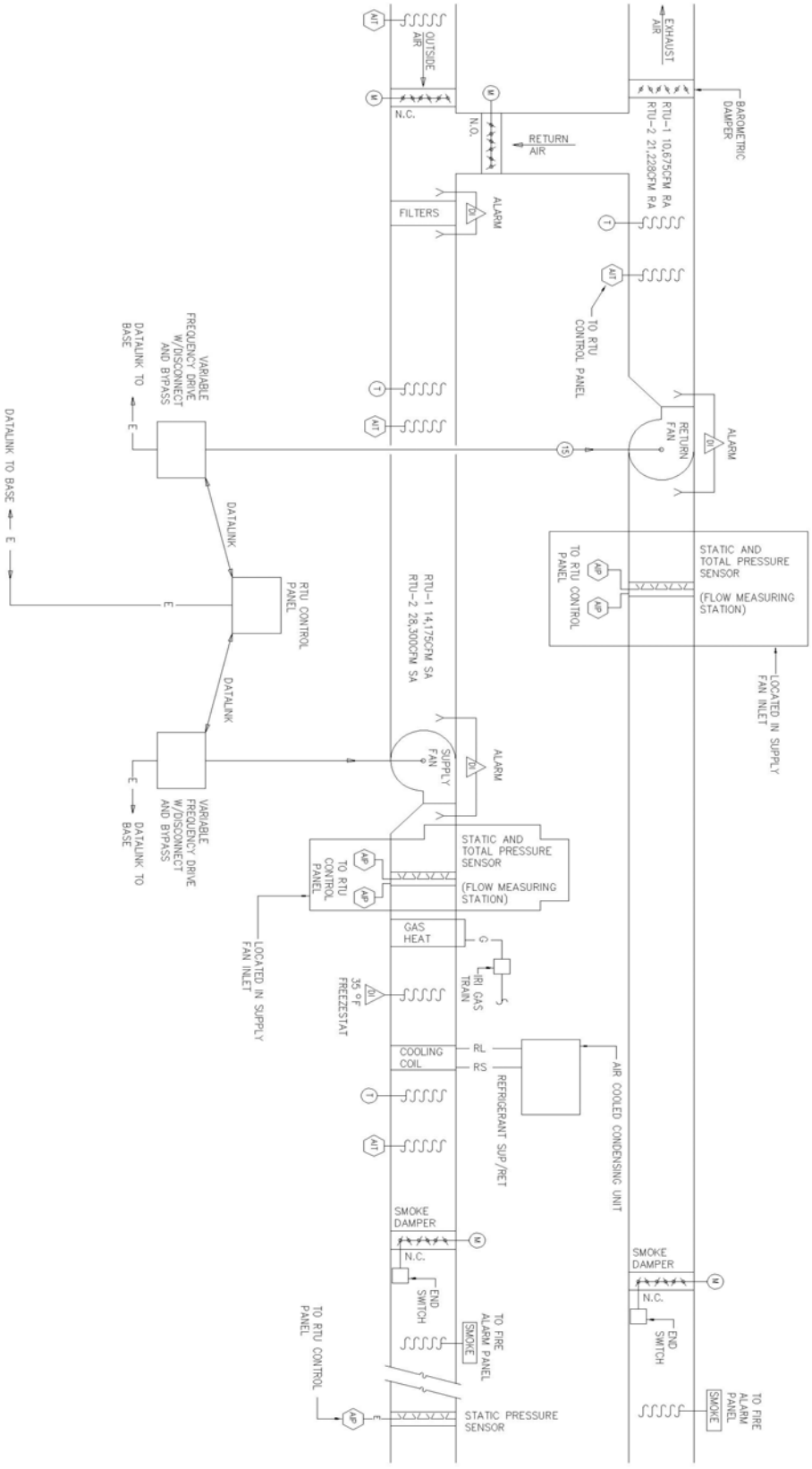


Appendices

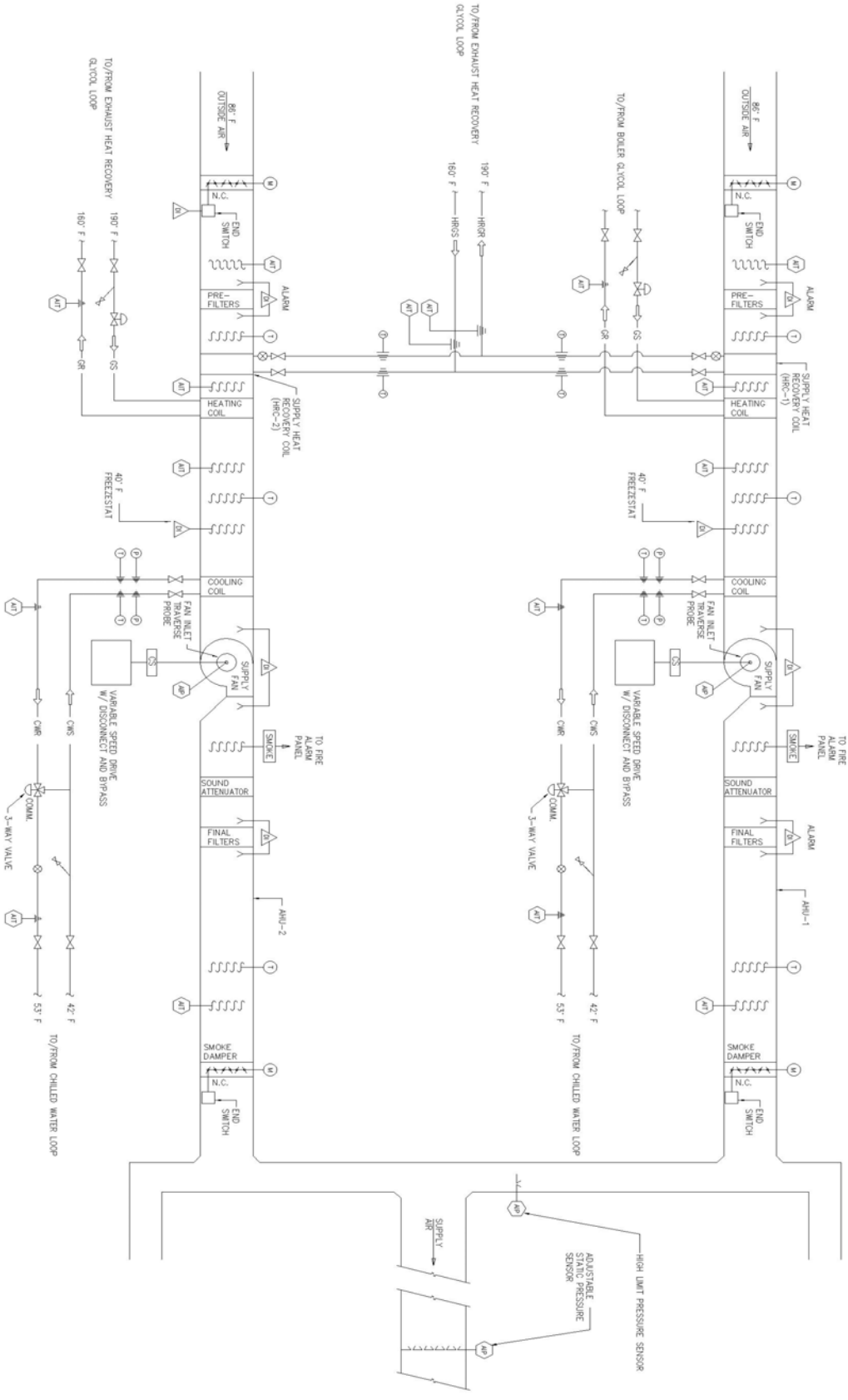


Appendix A:
Existing Building Schematics

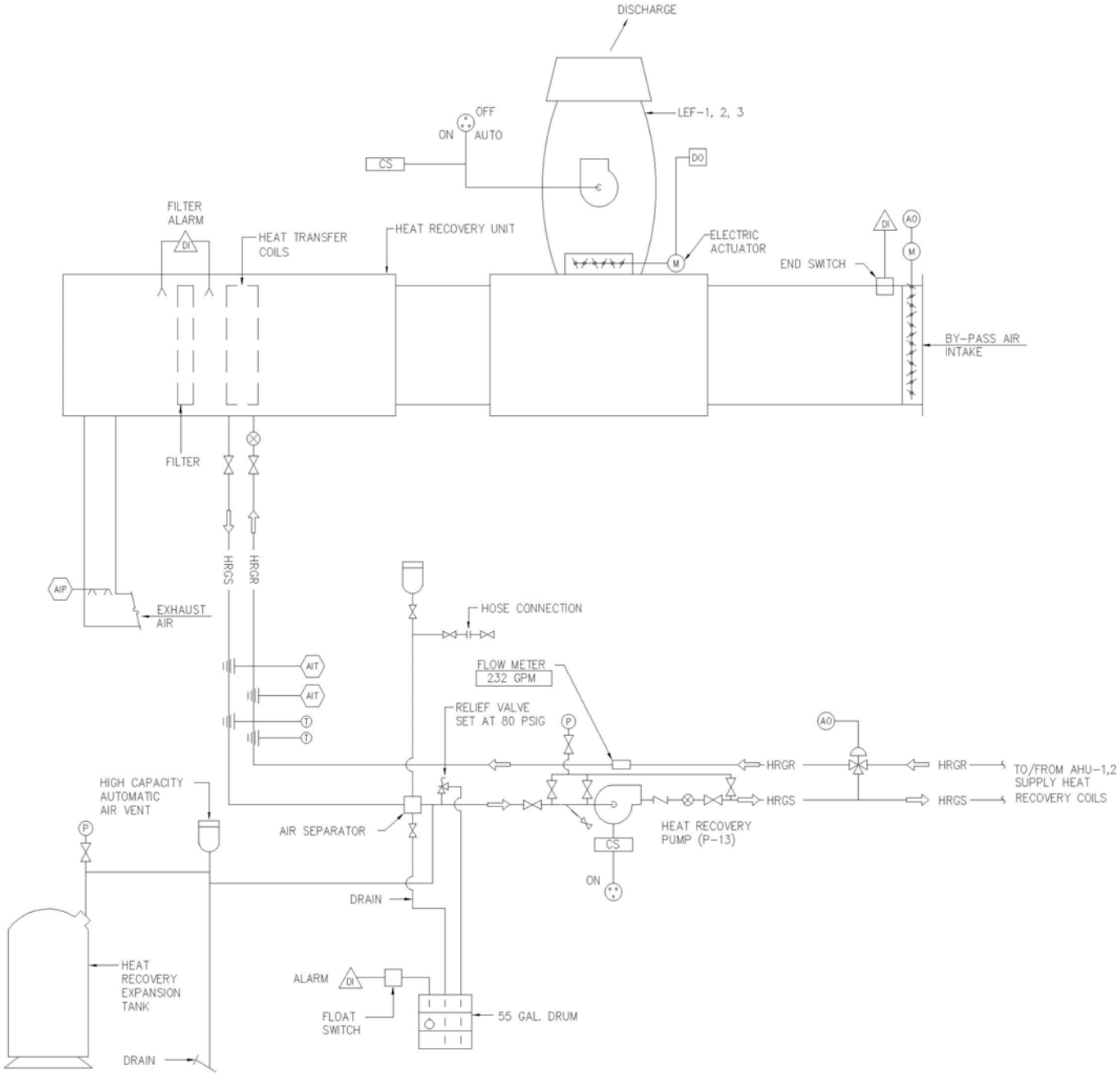
A.1 – Rooftop Units (RTU-1, RTU-2) Flow and Control Schematic



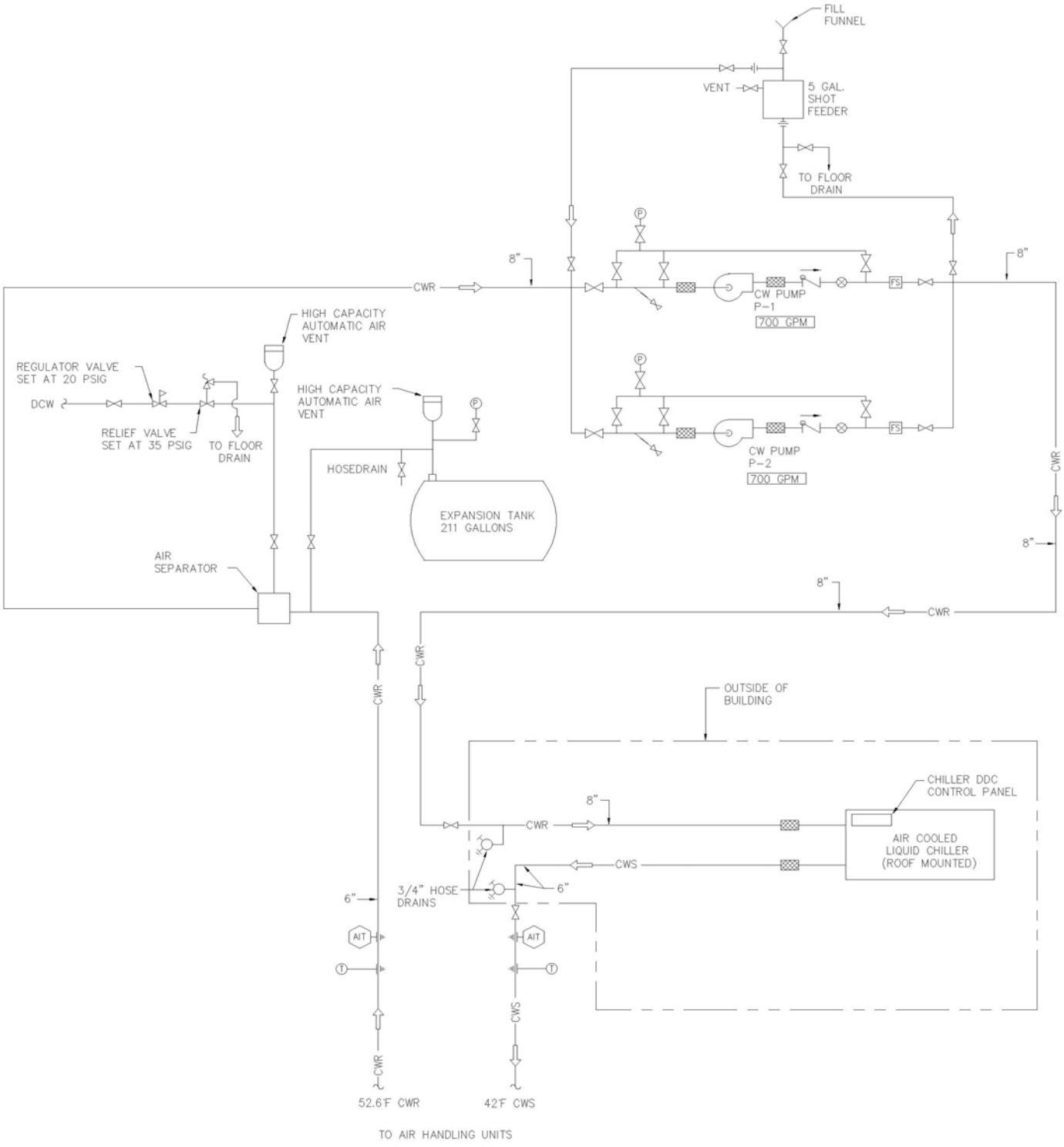
A.2 – Laboratory Air Handling Units (AHU-1,2) Flow and Control Schematic



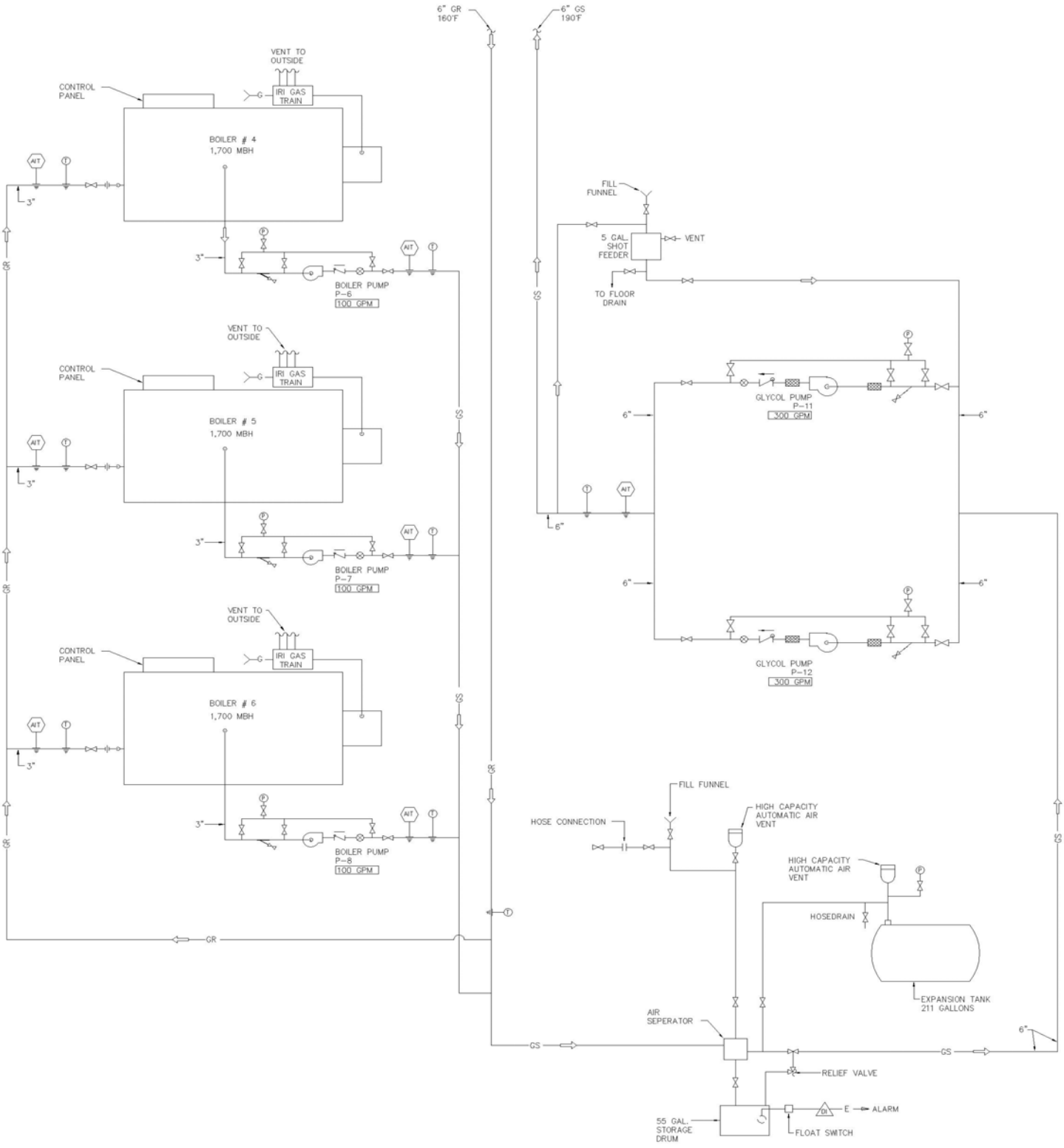
A.3 – Laboratory Heat Recovery System



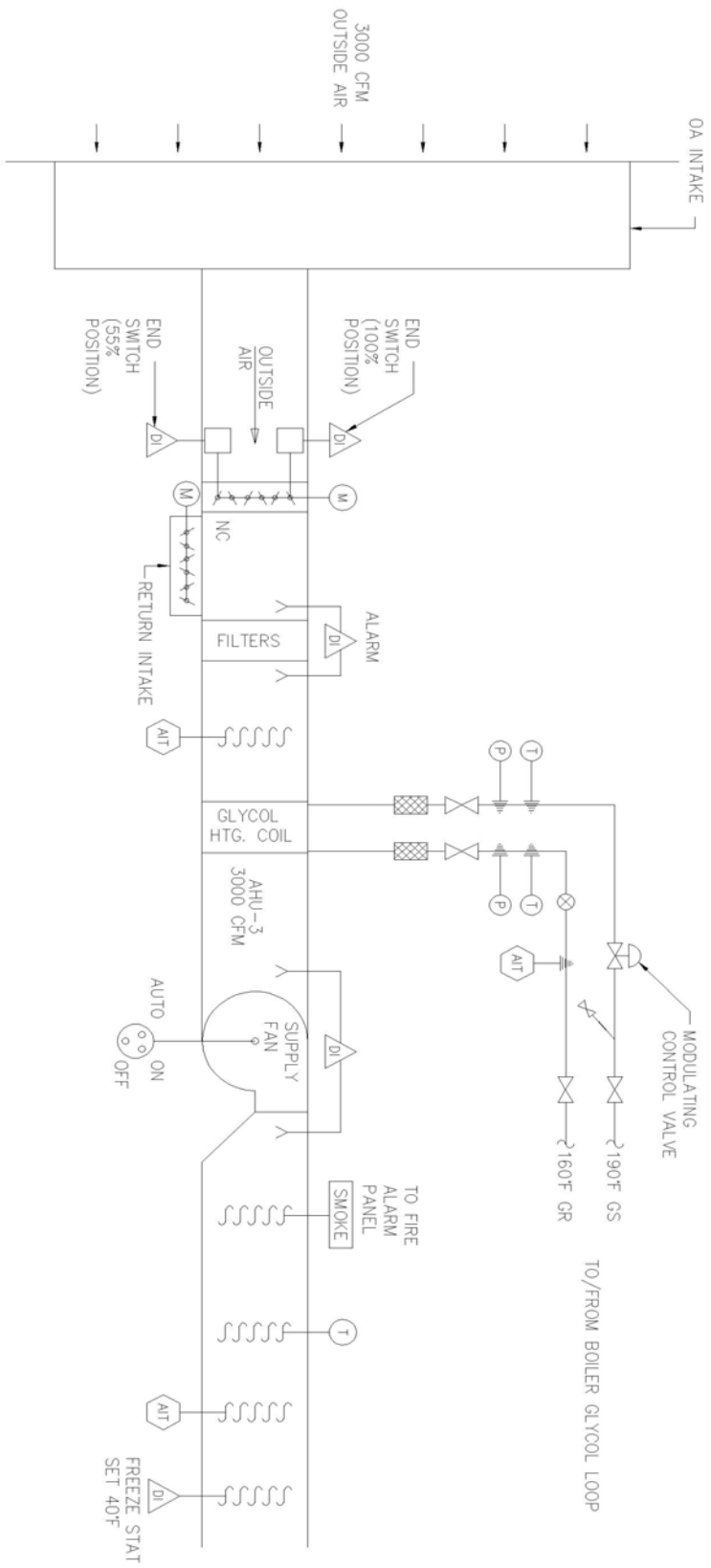
A.4 – Chilled Water System



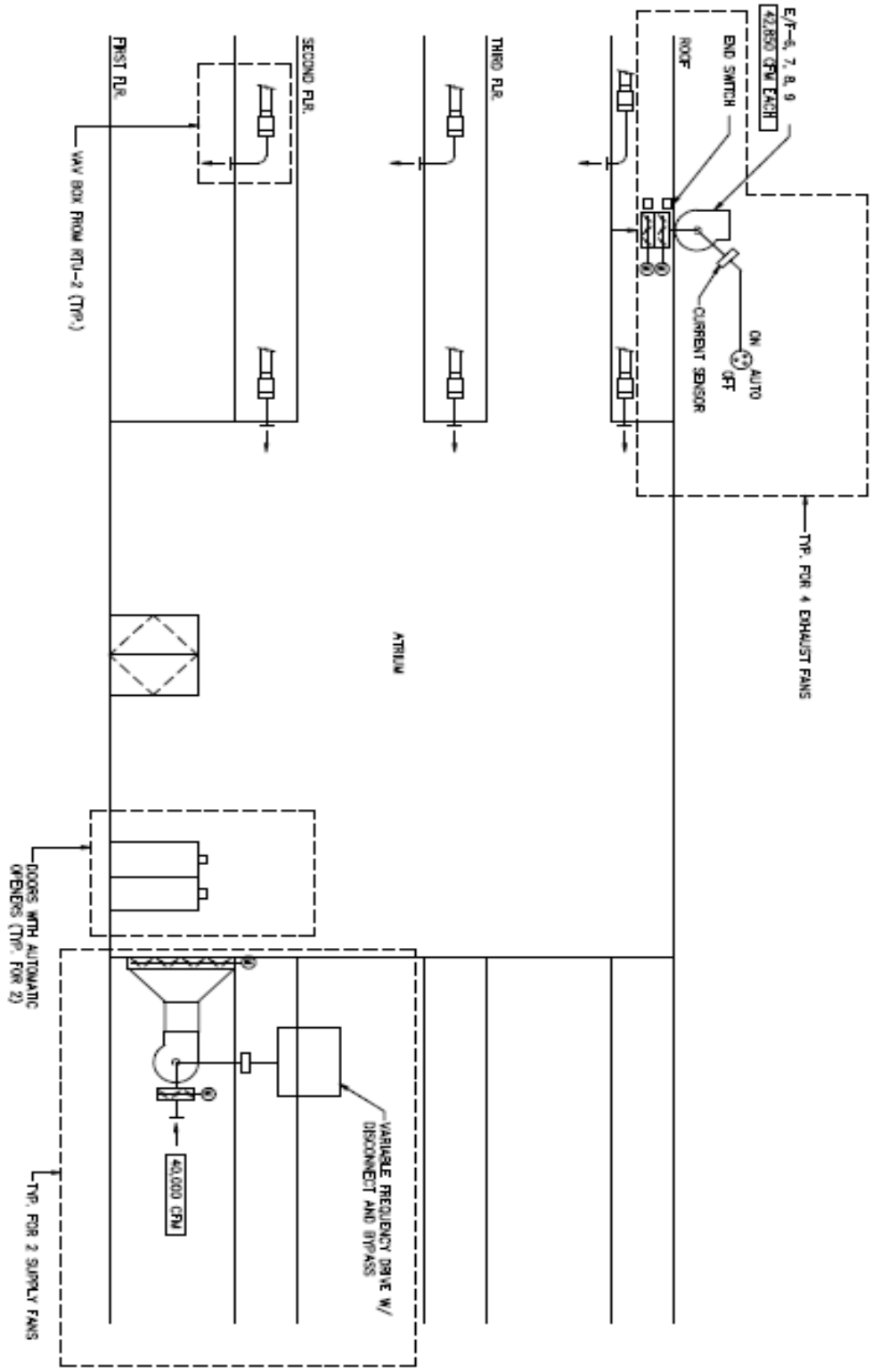
A.5 – Hot Water Boiler System



A.6 – Penthouse Air-Handling Unit



A.7 – Atrium Smoke Exhaust System



Appendix B:

ASHRAE Standard 92.1-2004
Lighting Power Densities by Space

B.1: Existing Lighting Power Densities by Space

Zone 1 - West Wing, Floors 1-3 Design											
Room Number	Room Name	Space Discription	Area (sq.ft)	Lamp	Wattage Per Lamp	Lamps per Fixture	Number of Fixtures	Watts	Power Density (W/SqFt)	Required PD (W/sqft)	Std 90.1 Compliant ?
103	Seminar Room	Lecture Room	830	PC1	26	2	5	260	0.31	2.4	No
			830	FF2	32	2	12	768	0.93		
			830	PB2	26	2	4	208	0.25		
			830	PB2D	26	2	24	1248	1.50		
104	Lecture Room	Lecture Room	550	PC1	32	3	3	288	0.52	2.4	No
			550	FF2	32	2	8	512	0.93		
			550	PB2	26	2	3	156	0.28		
			550	PB2D	26	2	16	832	1.51		
114	Shower/Locker	Restroom	120	PC1	26	2	3	156	1.30	1.2	No
115	Storage	Storage	290	FC1	32	3	4	384	1.32	1.2	No
116	Storage	Storage	490	FR4	32	2	9	576	1.18	0.8	No
117	Purchasing	Office	350	FD1	32	4	4	512	1.46	1.1	No
119	Building Facilities	Office	210	FD1	32	4	2	256	1.22	1.1	No
120	Receiving/Storage/Loading	Shipping/Receiving	310	FR4	32	2	4	256	0.83	0.8	No
144	Elevator Machine Room	Mechanical	110	FR4	32	2	2	128	1.16	1.4	Yes
147	Telecommunications	Electrical	225	FR4	32	2	4	256	1.14	1.4	Yes
148	Electrical Room	Electrical	680	FR4	32	2	9	576	0.85	1.4	Yes
150	Elevator Machine Room	Mechanical	130	FR4	32	2	1	64	0.49	1.4	Yes
151	Plumbing	Mechanical	380	FR4	32	2	6	384	1.01	1.4	Yes
152	Generator	Electrical	300	FR6	48	2	6	576	1.92	1.4	No
154	Fan Room	Mechanical	255	FR6	48	2	5	480	1.26	1.4	Yes
202	Lunch Room/Kitchen	Multi-Purpose	1250	PC1	26	2	37	1924	6.41	1.2	No
			1250	PK1	150	1	4	600	2.35		
			1250	FX1	25	1	3	75	0.06		
219	IT Office	Office Space	120	FN3	39	4	2	312	2.60	1.1	No
220	IT Office	Office Space	120	FN3	39	4	2	312	2.60	1.1	No
221	Computer/ Visual Room	Computer Lab	270	FN3	39	4	2	312	1.16	1.1	No
			270	PL2	50	1	2	100	0.37		
223	Conferemce Room	Conference Room	440	PC2	18	2	2	72	0.16	1.3	No
			440	PB2D	26	2	10	520	1.18		
224	Server Room	Computer Room	350	FH3	32	3	4	384	1.10	1.1	Yes
225	Mens Restroom	Restroom	210	PC1	26	2	5	260	1.24	0.9	No
			210	FW2	25	1	2	50	0.24		
226	Womens Restroom	Restroom	190	PC1	26	2	5	260	1.37	0.9	No
			190	FW2	25	1	2	50	0.26		
227	Corridor	Corridor	780	FN3	39	4	10	1560	2.00	0.5	No
229	Elevator Vestibule	Corridor	250	PC1	26	2	3	156	0.62	0.5	No
230	Telephone	Office Space	60	FR4	32	2	1	64	1.07	1.1	Yes
231	Electrical	Mechanical Room	140	FR4	32	2	3	192	1.37	1.4	Yes
262	Storage	Storage	60	FA1	32	2	1	64	1.07	0.8	No
	Corridor	Corridor	330	PC1	26	2	11	572	1.73	0.5	No
301	Library	Library	1200	PC1	26	2	30	1560	1.30	1.3	Yes
319	ACA Office	Office Space	120	FN3	39	4	2	312	2.60	1.1	No
320	ACA Office	Office Space	120	FN3	39	4	2	312	2.60	1.1	No
321	IT Office	Office Space	120	FN3	39	4	2	312	2.60	1.1	No
322	IT Office	Office Space	120	FN3	39	4	2	312	2.60	1.1	No
323	IT Office	Office Space	120	FN3	39	4	2	312	2.60	1.1	No
324	Conferemce Room	Conference Room	440	PC2	18	2	2	72	0.16	1.3	No
			440	PB2D	26	2	10	520	1.18		
325	IT Room	Office Space	350	FH3	32	3	4	384	1.10	1.1	Yes
326	Mens Restroom	Restroom	210	PC1	26	2	7	364	1.73	0.9	No
			210	FW2	25	1	2	50	0.24		
327	Womens Restroom	Restroom	190	PC1	26	2	8	416	2.19	0.9	No
			190	FW2	25	1	2	50	0.26		
328	Corridor	Corridor	780	FN3	39	4	10	1560	2.00	0.5	No
330	Elevator Vestibule	Corridor	250	PC1	26	2	3	156	0.62	0.5	No
331	Electrical	Mechanical Room	120	FR4	32	2	2	128	1.07	1.4	Yes
331	Telephone	Office Space	80	FR4	32	2	2	128	1.60	1.1	No
262	Storage	Storage	60	FA1	32	2	1	64	1.07	0.8	No
	Corridor	Corridor	330	PC1	26	2	11	572	1.73	0.5	No
100	Parking	Parking	7650	FR5	32	2	46	2944	0.38	0.2	No

Zone 2 - South Wing, Floors 1-3 Design											
Room Number	Room Name	Space Discription	Area (sq.ft)	Lamp	Wattage Per Lamp	Lamps per Fixture	Number of Fixtures	Watts	Power Density (W/SqFt)	Required PD (W/sqft)	Std 90.1 Compliant ?
AT	Atrium	Atrium	4800	PF3	42	1	25	1050	0.22	0.6	No
			4800	PF2	32	1	25	800	0.17		
			4800	PC1	26	2	6	312	0.07		
			4800	PG1	350	1	9	3150	0.66		
			4800	PY2	100	1	14	1400	0.29		
			4800	PY3	70	1	14	980	0.20		
			4800	PP1	32	2	9	576	0.12		
121	Open Office	Office Space	1115	FK1	32	2	15	960	0.86	1.1	No
			1115	PF3	42	1	7	294	0.26		
			1115	PC2	18	2	7	252	0.23		
122	Personnel Manager	Office Space	105	FN3	39	4	2	312	2.97	1.1	No
123	Accounting	Office Space	110	FN3	39	4	2	312	2.84	1.1	No
124	Accounting	Office Space	110	FN3	39	4	2	312	2.84	1.1	No
125	Development	Office Space	110	FN3	39	4	2	312	2.84	1.1	No
126	Development	Office Space	110	FN3	39	4	2	312	2.84	1.1	No
127	Conference	Conference	190	FQ1	150	2	4	1200	6.32	1.3	No
			190	PC1D	26	2	3	156	0.82		
128	Development	Office Space	200	PL2	50	1	2	100	0.5	1.1	No
			200	FN3	39	4	1	156	0.78		
			200	FN4	54	4	1	216	1.08		
129	Board Member	Office Space	200	PL2	50	1	2	100	0.5	1.1	No
			200	FN3	39	4	1	156	0.78		
			200	FN4	54	4	1	216	1.08		
130	CFO	Office Space	200	PL2	50	1	2	100	0.5	1.1	No
			200	FN3	39	4	1	156	0.78		
			200	FN4	54	4	1	216	1.08		
131	Vice President	Office Space	200	PL2	50	1	2	100	0.5	1.1	No
			200	FN3	39	4	1	156	0.78		
			200	FN4	54	4	1	216	1.08		
132	President	Office Space	200	PL2	50	1	2	100	0.5	1.1	No
			200	FN3	39	4	1	156	0.78		
			200	FN4	54	4	1	216	1.08		
133	Executive Director	Office Space	200	PL2	50	1	2	100	0.5	1.1	No
			200	FN3	39	4	1	156	0.78		
			200	FN4	54	4	1	216	1.08		
134	Board Room	Conference Roor	775	PC3	18	2	1	36	0.05	1.3	No
			775	PW2D	26	2	9	468	0.60		
			775	PC1D	26	2	8	416	0.54		
			775	FQ1	150	2	5	1500	1.94		
135	Mens Restroom	Restroom	230	PC1	26	2	7	364	1.58	0.9	No
			230	FW2	25	1	2	50	0.22		
136	Womens Restroom	Restroom	220	PC1	26	2	8	416	1.89	0.9	No
			220	FW2	25	1	2	50	0.23		
137	Corridor/Kitchenette	Corridor	460	PC1	26	2	34	1768	3.84	0.5	No
			460	FX1	25	1	2	50	0.11		
139	Workroom Storage	Storage	300	FD1	32	4	3	384	1.28	0.8	No
140	Graphics	Office Space	340	FH3	32	3	7	672	1.98	1.1	No
145	Telephone Room	Electrical Room	90	FR4	32	2	1	64	0.71	1.5	Yes
146	Electrical Closet	Electrical Room	30	FR4	32	2	1	64	2.13	1.5	No
143	Reception	Office Space	530	FK1	32	2	5	320	0.60	1.1	No
			530	PB2	26	2	4	208	0.39		
			530	FR2	32	2	2	128	0.24		
			530	PF3	42	1	2	84	0.16		
204	Open Office	Office Space	2325	FK1	32	2	37	2368	1.02	1.1	No
			2325	PF3	42	1	17	714	0.31		
			2325	PC2	18	2	17	612	0.26		

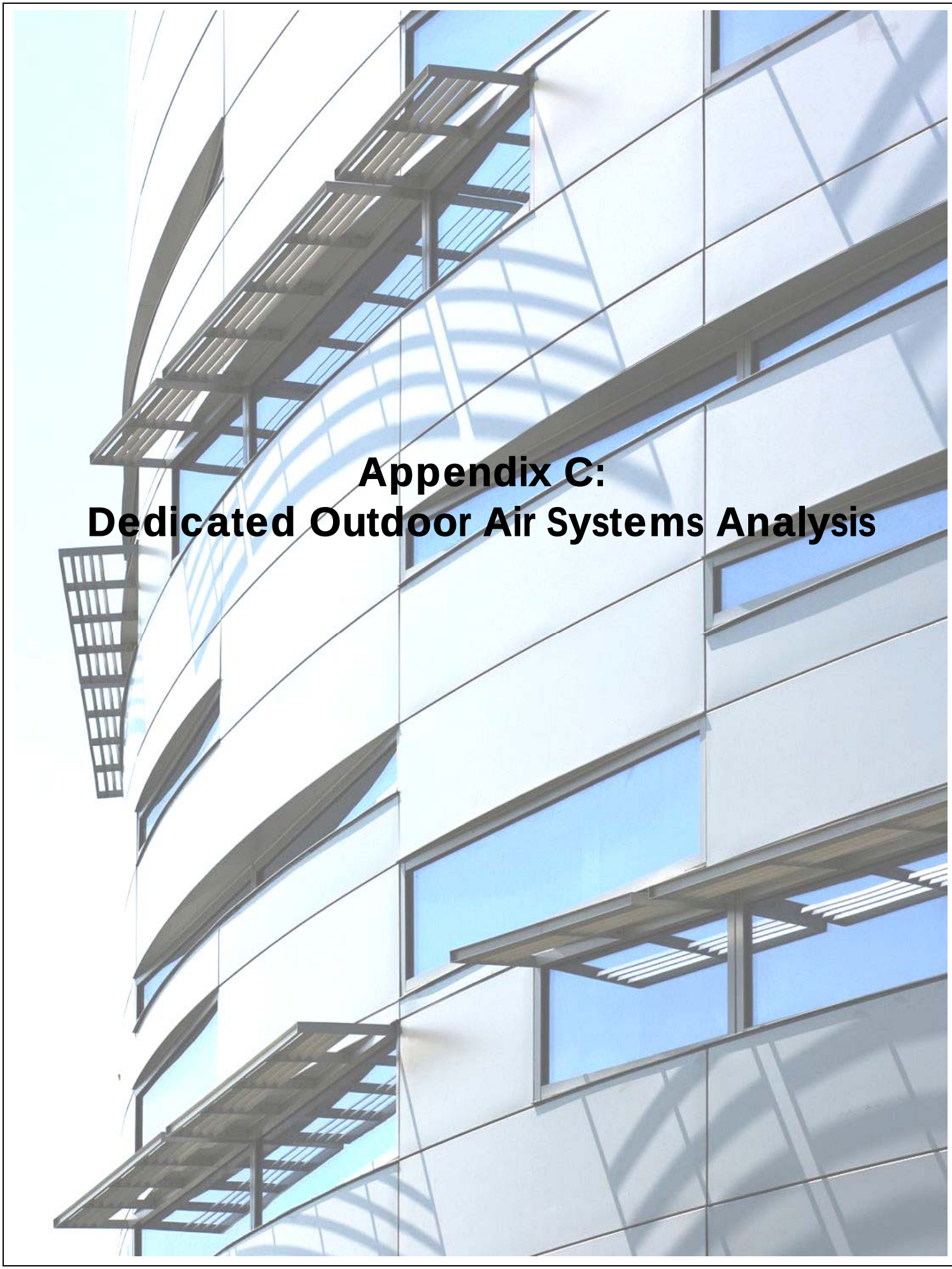
Zone 2 - South Wing, Floors 1-3 Design											
Room Number	Room Name	Space Discription	Area (sq.ft)	Lamp	Wattage Per Lamp	Lamps per Fixture	Number of Fixtures	Watts	Power Density (W/SqFt)	Required PD (W/sqft)	Std 90.1 Compliant ?
205	PI Office	Office Space	120	FN3	39	4	2	312	2.60	1.1	No
206	PI Office	Office Space	120	FN3	39	4	2	312	2.60	1.1	No
207	PI Office	Office Space	120	FN3	39	4	2	312	2.60	1.1	No
208	PI Office	Office Space	120	FN3	39	4	2	312	2.60	1.1	No
209	PI Office	Office Space	120	FN3	39	4	2	312	2.60	1.1	No
210	PI Office	Office Space	120	FN3	39	4	2	312	2.60	1.1	No
211	PI Office	Office Space	120	FN3	39	4	2	312	2.60	1.1	No
212	PI Office	Office Space	120	FN3	39	4	2	312	2.60	1.1	No
213	PI Office	Office Space	120	FN3	39	4	2	312	2.60	1.1	No
214	PI Office	Office Space	120	FN3	39	4	2	312	2.60	1.1	No
215	PI Office	Office Space	120	FN3	39	4	2	312	2.60	1.1	No
216	PI Office	Office Space	120	FN3	39	4	2	312	2.60	1.1	No
217	PI Office	Office Space	120	FN3	39	4	2	312	2.60	1.1	No
218	PI Office	Office Space	120	FN3	39	4	2	312	2.60	1.1	No
302	Open Office	Office Space	2325	FK1	32	2	37	2368	1.02	1.1	No
			2325	PF3	42	1	17	714	0.31		
			2325	PC2	18	2	17	612	0.26		
305	PI Office	Office Space	120	FN3	39	4	2	312	2.60	1.1	No
306	PI Office	Office Space	120	FN3	39	4	2	312	2.60	1.1	No
307	PI Office	Office Space	120	FN3	39	4	2	312	2.60	1.1	No
308	PI Office	Office Space	120	FN3	39	4	2	312	2.60	1.1	No
309	PI Office	Office Space	120	FN3	39	4	2	312	2.60	1.1	No
310	PI Office	Office Space	120	FN3	39	4	2	312	2.60	1.1	No
311	PI Office	Office Space	120	FN3	39	4	2	312	2.60	1.1	No
312	PI Office	Office Space	120	FN3	39	4	2	312	2.60	1.1	No
313	PI Office	Office Space	120	FN3	39	4	2	312	2.60	1.1	No
314	PI Office	Office Space	120	FN3	39	4	2	312	2.60	1.1	No
315	PI Office	Office Space	120	FN3	39	4	2	312	2.60	1.1	No
316	PI Office	Office Space	120	FN3	39	4	2	312	2.60	1.1	No
317	PI Office	Office Space	120	FN3	39	4	2	312	2.60	1.1	No
318	PI Office	Office Space	120	FN3	39	4	2	312	2.60	1.1	No

B.2- Redesign Lighting Power Densities by Space

Zone 1 - West Wing, Floors 1-3 Redesign											
Room Number	Room Name	Space Discription	Area (sq.ft)	Lamp	Wattage Per Lamp	Lamps per Fixture	Number of Fixtures	Watts	Power Density (W/SqFt)	Required PD (W/sqft)	Std 90.1 Compliant ?
103	Seminar Room	Lecture Room	830	PC1	26	2	0	0	0.00	2.75	Yes
			830	FF2	32	2	12	768	0.93		
			830	PB2	26	2	4	208	0.25		
			830	PB2D	26	2	24	1248	1.50		
104	Lecture Room	Lecture Room	550	PC1	26	2	0	0	0.00	2.75	Yes
			550	FF2	32	2	8	512	0.93		
			550	PB2	26	2	3	156	0.28		
			550	PB2D	26	2	16	832	1.51		
114	Shower/Locker	Restroom	120	PC1	26	2	3	156	1.30	1.2	No
115	Storage	Storage	290	FC1	32	3	4	384	1.32	1.2	No
116	Storage	Storage	490	FR4	32	2	9	576	1.18	1.2	Yes
117	Purchasing	Office	350	FD1	32	4	4	512	1.46	1.1	No
119	Building Facilities	Office	210	FD1	32	4	2	256	1.22	1.1	No
120	Receiving/Storage/Loading	Shipping/Receiving	310	FR4	32	2	4	256	0.83	1	Yes
144	Elevator Machine Room	Mechanical	110	FR4	32	2	2	128	1.16	1.4	Yes
147	Telecommunications	Electrical	225	FR4	32	2	4	256	1.14	1.4	Yes
148	Electrical Room	Electrical	680	FR4	32	2	9	576	0.85	1.4	Yes
150	Elevator Machine Room	Mechanical	130	FR4	32	2	1	64	0.49	1.4	Yes
151	Plumbing	Mechanical	380	FR4	32	2	6	384	1.01	1.4	Yes
152	Generator	Electrical	300	FR6	48	2	6	576	1.92	1.4	No
154	Fan Room	Mechanical	255	FR6	48	2	5	480	1.26	1.4	Yes
202	Lunch Room/Kitchen	Multi-Purpose	1250	PC1	26	2	37	1924	6.41	2.2	No
			1250	PK1	150	1	4	600	2.35		
			1250	FX1	25	1	3	75	0.06		
219	IT Office	Office Space	120	FN3	28	2	2	112	0.93	1.1	Yes
220	IT Office	Office Space	120	FN3	28	2	2	112	0.93	1.1	Yes
221	Computer/ Visual Room	Computer Lab	270	FN3	39	4	2	312	1.16	2.1	Yes
			270	PL2	50	1	2	100	0.37		
223	Conferemce Room	Conference Room	440	PC2	18	2	2	72	0.16	2.3	Yes
			440	PB2D	26	2	10	520	1.18		
224	Server Room	Computer Room	350	FH3	32	3	4	384	1.10	1.1	Yes
225	Mens Restroom	Restroom	210	PC1	26	2	5	260	1.24	1.9	Yes
			210	FW2	25	1	2	50	0.24		
226	Womens Restroom	Restroom	190	PC1	26	2	5	260	1.37	1.9	Yes
			190	FW2	25	1	2	50	0.26		
227	Corridor	Corridor	780	FN3	39	4	10	1560	2.00	1	No
229	Elevator Vestibule	Corridor	250	PC1	26	2	3	156	0.62	1	Yes
230	Telephone	Office Space	60	FR4	32	2	1	64	1.07	1.1	Yes
231	Electrical	Mechanical Room	140	FR4	32	2	3	192	1.37	1.4	Yes
262	Storage	Storage	60	FA1	32	2	1	64	1.07	1.2	Yes
	Corridor	Corridor	330	PC1	26	2	11	572	1.73	1	No
301	Library	Library	1200	PC1	26	2	30	1560	1.30	1.3	Yes
319	ACA Office	Office Space	120	FN3	28	4	2	224	1.87	1.1	No
320	ACA Office	Office Space	120	FN3	28	2	2	112	0.93	1.1	Yes
321	IT Office	Office Space	120	FN3	28	2	2	112	0.93	1.1	Yes
322	IT Office	Office Space	120	FN3	28	2	2	112	0.93	1.1	Yes
323	IT Office	Office Space	120	FN3	28	2	2	112	0.93	1.1	Yes
324	Conferemce Room	Conference Room	440	PC2	18	2	2	72	0.16	2.3	Yes
			440	PB2D	26	2	10	520	1.18		
325	IT Room	Office Space	350	FH3	32	3	4	384	1.10	1.1	Yes
326	Mens Restroom	Restroom	220	PC1	26	2	7	364	1.65	1.9	Yes
			220	FW2	25	1	2	50	0.23		
327	Womens Restroom	Restroom	220	PC1	26	2	8	416	1.89	1.9	No
			220	FW2	25	1	2	50	0.23		
328	Corridor	Corridor	780	FN3	39	4	10	1560	2.00	0.5	No
330	Elevator Vestibule	Corridor	250	PC1	26	2	3	156	0.62	0.5	No
331	Electrical	Mechanical Room	120	FR4	32	2	2	128	1.07	1.4	Yes
331	Telephone	Office Space	80	FR4	32	2	2	128	1.60	1.1	No
262	Storage	Storage	60	FA1	32	2	1	64	1.07	1.2	Yes
	Corridor	Corridor	330	PC1	26	2	11	572	1.73	1	No
100	Parking	Parking	7650	FR5	32	2	46	2944	0.38	0.4	Yes

Zone 2 - South Wing, Floors 1-3 Redesign											
Room Number	Room Name	Space Discription	Area (sq.ft)	Lamp	Wattage Per Lamp	Lamps per Fixture	Number of Fixtures	Watts	Power Density (W/SqFt)	Required PD (W/sqft)	Std 90.1 Compliant ?
AT	Atrium	Atrium	4800	PF3	42	1	25	1050	0.22	1.6	Yes
			4800	PF2	32	1	25	800	0.17		
			4800	PC1	26	2	6	312	0.07		
			4800	PG1	250	1	9	2250	0.47		
			4800	PY2	100	1	14	1400	0.29		
			4800	PY3	70	1	14	980	0.20		
			4800	PP1	32	2	9	576	0.12		
121	Open Office	Office Space	1115	FK1	32	2	15	960	0.86	2.1	Yes
			1115	PF3	42	1	7	294	0.26		
			1115	PC2	18	2	7	252	0.23		
122	Personnel Manager	Office Space	105	FN3	28	2	2	112	1.07	1.1	Yes
123	Accounting	Office Space	110	FN3	28	2	2	112	1.02	1.1	Yes
124	Accounting	Office Space	110	FN3	28	2	2	112	1.02	1.1	Yes
125	Development	Office Space	110	FN3	28	2	2	112	1.02	1.1	Yes
126	Development	Office Space	110	FN3	28	2	2	112	1.02	1.1	Yes
127	Conference	Conference	190	FQ1	150	2	4	1200	6.32	1.3	No
			190	PC1D	26	2	3	156	0.82		
128	Development	Office Space	200	PL2	50	1	2	100	0.5	2.1	Yes
			200	FN3	39	2	1	78	0.39		
			200	FN4	54	2	1	108	0.54		
129	Board Member	Office Space	200	PL2	50	1	2	100	0.5	2.1	Yes
			200	FN3	39	2	1	78	0.39		
			200	FN4	54	2	1	108	0.54		
130	CFO	Office Space	200	PL2	50	1	2	100	0.5	2.1	Yes
			200	FN3	39	2	1	78	0.39		
			200	FN4	54	2	1	108	0.54		
131	Vice President	Office Space	200	PL2	50	1	2	100	0.5	2.1	Yes
			200	FN3	39	2	1	78	0.39		
			200	FN4	54	2	1	108	0.54		
132	President	Office Space	200	PL2	50	1	2	100	0.5	2.1	No
			200	FN3	39	4	1	156	0.78		
			200	FN4	54	4	1	216	1.08		
133	Executive Director	Office Space	200	PL2	50	1	2	100	0.5	2.1	Yes
			200	FN3	39	2	1	78	0.39		
			200	FN4	54	2	1	108	0.54		
134	Board Room	Conference Room	775	PC3	18	2	1	36	0.05	2.1	No
			775	PW2D	26	2	9	468	0.60		
			775	PC1D	26	2	8	416	0.54		
			775	FQ1	150	2	5	1500	1.94		
135	Mens Restroom	Restroom	240	PC1	26	2	7	364	1.52	1.9	Yes
			240	FW2	25	1	2	50	0.21		
136	Womens Restroom	Restroom	240	PC1	26	2	7	364	1.52	1.9	Yes
			240	FW2	25	1	2	50	0.21		
137	Corridor/Kitchenette	Corridor	460	PC1	26	2	34	1768	3.84	1.5	No
			460	FX1	25	1	2	50	0.11		
139	Workroom Storage	Storage	320	FD1	32	4	3	384	1.20	1.2	Yes
140	Graphics	Office Space	340	FH3	32	3	7	672	1.98	1.1	No
145	Telephone Room	Electrical Room	90	FR4	32	2	1	64	0.71	1	Yes
146	Electrical Closet	Electrical Room	30	FR4	32	2	1	64	2.13	0.5	No
143	Reception	Office Space	530	FK1	32	2	5	320	0.60	2.1	Yes
			530	PB2	26	2	4	208	0.39		
			530	FR2	32	2	2	128	0.24		
			530	PF3	42	1	2	84	0.16		
204	Open Office	Office Space	2325	FK1	32	2	37	2368	1.02	2.1	Yes
			2325	PF3	42	1	17	714	0.31		
			2325	PC2	18	2	17	612	0.26		

Zone 2 - South Wing, Floors 1-3 Redesign											
Room Number	Room Name	Space Discription	Area (sq.ft)	Lamp	Wattage Per Lamp	Lamps per Fixture	Number of Fixtures	Watts	Power Density (W/SqFt)	Required PD (W/sqft)	Std 90.1 Compliant ?
205	PI Office	Office Space	120	FN3	28	2	2	112	0.93	1.1	Yes
206	PI Office	Office Space	120	FN3	28	2	2	112	0.93	1.1	Yes
207	PI Office	Office Space	120	FN3	28	2	2	112	0.93	1.1	Yes
208	PI Office	Office Space	120	FN3	28	2	2	112	0.93	1.1	Yes
209	PI Office	Office Space	120	FN3	28	2	2	112	0.93	1.1	Yes
210	PI Office	Office Space	120	FN3	28	2	2	112	0.93	1.1	Yes
211	PI Office	Office Space	120	FN3	28	2	2	112	0.93	1.1	Yes
212	PI Office	Office Space	120	FN3	28	2	2	112	0.93	1.1	Yes
213	PI Office	Office Space	120	FN3	28	2	2	112	0.93	1.1	Yes
214	PI Office	Office Space	120	FN3	28	2	2	112	0.93	1.1	Yes
215	PI Office	Office Space	120	FN3	28	2	2	112	0.93	1.1	Yes
216	PI Office	Office Space	120	FN3	28	2	2	112	0.93	1.1	Yes
217	PI Office	Office Space	120	FN3	28	2	2	112	0.93	1.1	Yes
218	PI Office	Office Space	120	FN3	28	2	2	112	0.93	1.1	Yes
302	Open Office	Office Space	2325	FK1	32	2	37	2368	1.02	2.1	Yes
			2325	PF3	42	1	17	714	0.31		
			2325	PC2	18	2	17	612	0.26		
305	PI Office	Office Space	120	FN3	28	2	2	112	0.93	1.1	Yes
306	PI Office	Office Space	120	FN3	28	2	2	112	0.93	1.1	Yes
307	PI Office	Office Space	120	FN3	28	2	2	112	0.93	1.1	Yes
308	PI Office	Office Space	120	FN3	28	2	2	112	0.93	1.1	Yes
309	PI Office	Office Space	120	FN3	28	2	2	112	0.93	1.1	Yes
310	PI Office	Office Space	120	FN3	28	2	2	112	0.93	1.1	Yes
311	PI Office	Office Space	120	FN3	28	2	2	112	0.93	1.1	Yes
312	PI Office	Office Space	120	FN3	28	2	2	112	0.93	1.1	Yes
313	PI Office	Office Space	120	FN3	28	2	2	112	0.93	1.1	Yes
314	PI Office	Office Space	120	FN3	28	2	2	112	0.93	1.1	Yes
315	PI Office	Office Space	120	FN3	28	2	2	112	0.93	1.1	Yes
316	PI Office	Office Space	120	FN3	28	2	2	112	0.93	1.1	Yes
317	PI Office	Office Space	120	FN3	28	2	2	112	0.93	1.1	Yes
318	PI Office	Office Space	120	FN3	28	2	2	112	0.93	1.1	Yes



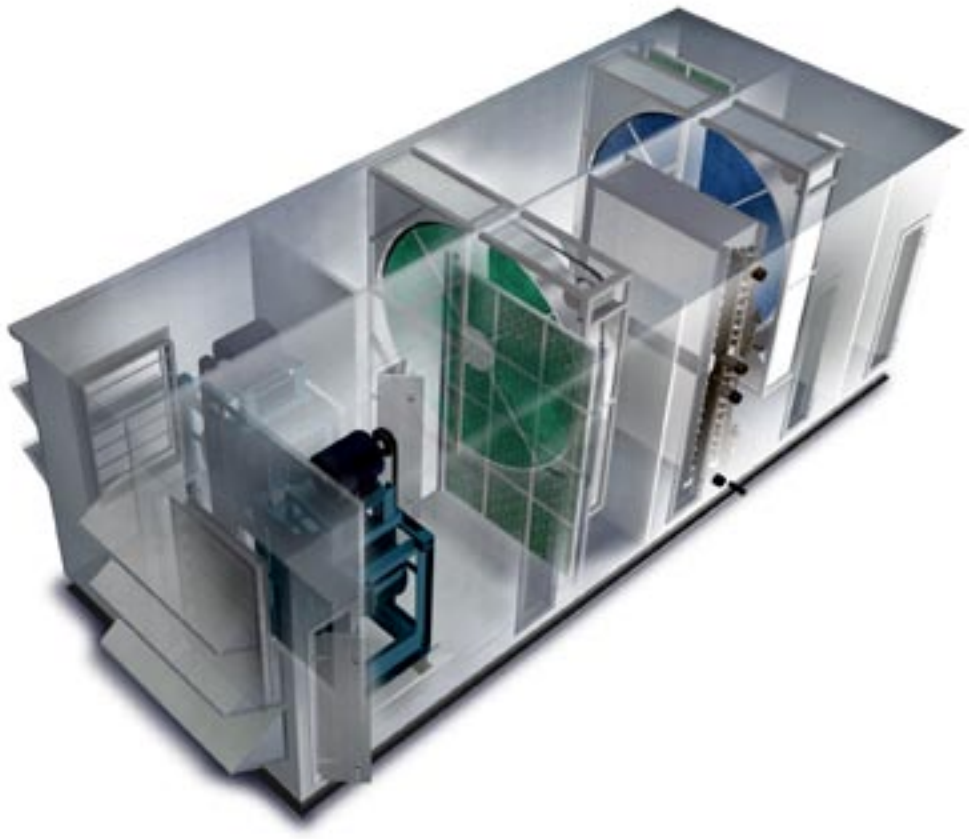
Appendix C:
Dedicated Outdoor Air Systems Analysis

SEMCO® INCORPORATED

Desiccant Wheel Products

EP Series

Packaged Energy Recovery Systems



Technical Guide

Table of Contents

Designs For Energy Efficiency And Indoor Air Quality

Energy efficient design and indoor air quality are the two challenges facing mechanical engineers today in the field of Heating, Ventilating and Air Conditioning (HVAC). To minimize the loss of energy, building envelopes have been made more energy efficient. This also reduces the cost associated with cooling or heating the building. By tightening the building envelopes, we reduce the amount of outside air entering the building. However, that outside air is needed to remove the air contaminants generated indoors. Flushing these pollutants from the indoors to the outdoors has been the most effective way of reducing the indoor air contaminant to acceptable levels. This ventilation concept is formalized in ASHRAE Standard 62.

What does this mean for an "average" building? First, it will have forms of mechanical ventilation to supply controlled amounts of outside air into the building. To balance the building pressure, a similar amount of air has to be exhausted from the building. This is a waste of energy for the sake of air quality. Imagine a building owner/operator sitting next to the exhaust air discharge and throwing dollar bills into the air stream. The exhaust air stream represents a revenue loss. Meanwhile, the building owner/operator is paying for the ventilation air to be cooled or heated.

Can this waste be stopped? Yes, it can! And that is exactly what total energy recovery will do. The heating or cooling energy contained in the exhaust air stream can be recovered and used to precondition the outdoor air being brought into the building.

Energy recovery systems are easy to apply if you separate the ventilation system from the air-conditioning system. This solution offers several advantages: easy to design, allows use of existing conventional equipment with no modifications and simple to control.

In addition, total energy recovery systems can be directly connected to individual or multiple air-conditioning units to provide a controlled minimum amount of fresh air at all times. This allows the conventional equipment to behave as if it were using re-circulated air year-round.

" ...The air-conditioning system doesn't know if it's summer or winter," stated a building operator. In other words, a building on the humid, muggy Gulf Coast would have the same fresh air intake as a building in Southern California.

Using This Manual

This design manual presents the SEMCO EP and EPD Series of packaged energy recovery systems, which are designed around the EXCLU-SIEVE® total energy (TE) and sensible only (TS) recovery wheels. These systems are designed to provide efficient, large amounts of outdoor air to all types of facilities. They can be applied as precon-ditioners to traditional HVAC equipment or as integrated systems that provide total space conditioning and precise humidity control. This manual explains the benefits provided by the technology, provides a detailed selection procedure and reviews specific guidelines to assure an effective system design. This material should be studied carefully before beginning the design process.

SEMCO also offers a computerized energy savings analysis and energy wheel selection program for frequent users, which simplifies this design process and cost justification.

For additional design support or to answer any technical questions, a list of the SEMCO representatives nearest you is located at SEMCO's website at www.semcoinc.com. You can also call SEMCO Incorporated toll-free at 888-4SEMCOINC.

The SEMCO System

The SEMCO packaged energy recovery system offers the ultimate performance in the transfer of total energy (both latent and sensible). Pre-engineered and factory assembled, the SEMCO system also provides the air handling capability for the building's exhaust and supply air. The system can be selected to precondition outdoor air going to other conventional air handling systems or as an integrated system that provides total space conditioning with the additional heating and cooling options available.

The heart of this system is a technologically advanced EXCLU-SIEVE desiccant wheel. In addition to providing superior performance, the wheel's 3Å molecular sieve-desiccant coating is selective in what it adsorbs from an exhaust air stream. The desiccant rejects airborne contaminants while it transfers water vapor, thus providing total energy transfer from the exhaust to the supply air stream. Selectivity allows EXCLU-SIEVE to be used in critical applications, including recovery from contaminated airstreams. In the past, energy recovery was avoided or limited to sensible-only energy exchange in applications like these.

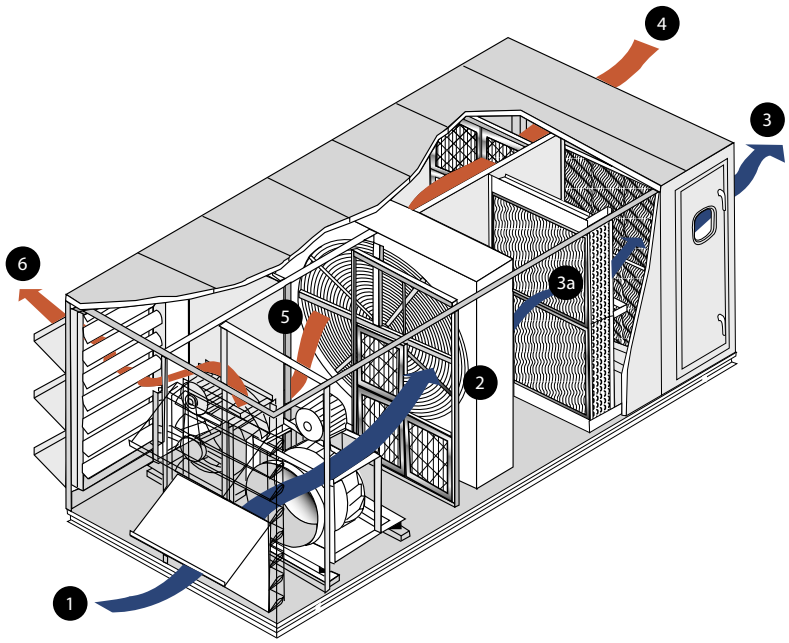
The EXCLU-SIEVE wheel uses a fluted media with an aluminum backbone, which is coated with a fast-acting, adsorbent desiccant surface. As the transfer media slowly rotates between the outdoor and exhaust airstreams, the warmer air surrenders its sensible energy to the aluminum. This energy is then shifted to the cooler air stream during the second half of the revolution.

Just as the temperature is captured and released, so is the moisture. EXCLU-SIEVE's 3Å molecular sieve-desiccant coating has an enormous internal surface area and strong attraction to water vapor. Since the opposing airstreams have different temperatures and moisture contents, the vapor pressure will also be different. This pressure difference is the driving force in the transferring of latent energy.

By using the desiccant coating, EXCLU-SIEVE recovers the moisture from the exhaust air stream to the supply air stream without the airborne pollutants exchanging. This very important and unique feature has been well documented through independent laboratory and field-testing. (A copy of the Georgia Tech Research Institute study is available free of charge.)

Six steps to fresh, cool air during the cooling season:

Step 1
Hot, humid outside air is drawn in.
Step 2
Fresh air is blown in through the slowly rotating EXCLU-SIEVE wheel. The desiccant-coated fluted media captures heat and moisture.
Step 3a
The air can be further cooled or heated to space neutral conditions.
Step 3
The cooled and dehumidified air enters the HVAC system or is delivered directly to the occupied space.
Step 4
Cool, dry return air that is exhausted from the building enters the Total Energy Recovery System.
Step 5
As return air passes through the EXCLU-SIEVE wheel, it removes the heat and humidity captured by the wheel from the fresh air stream.
Step 6
Warm, humidified exhaust air is blown out.



The Product Line

SEMCO Packaged Energy Recovery Systems are available in nine cabinet sizes ranging in airflow capacity from 2,000 scfm to 40,000 scfm. The standard and optional features that are available with this system are discussed below. Equipment summaries are provided on pages 45 and 46. Individual equipment information, as well as, their configurations, complete with typical flow schematics, is presented on pages 6 and 7.

Standard Features

1 The EXCLU-SIEVE® Total Energy Wheel

- Certified total energy recovery performance (sensible and latent) up to 90 percent efficient.
- Patented 3Å molecular sieve-desiccant coating to avoid desiccant cross-contamination.
- Wheel faces are coated to ensure long lasting corrosion protection.
- Sensible-only wheel is polymer coated to avoid oxidation and future transferring of moisture.
- All aluminum, structural spoke system eliminates mechanical fatigue and allows media replacement for wheels greater than size TE3-9.
- Non-wearing labyrinth seals.

2 SEMCO Panel System

- Double-wall panel construction (2 inches thick with 18-gauge outer skin) eliminates exposed insulation and the associated risk of bacterial growth.
- Double-wall removable panels provided for large internal components.
- Gasketed double-wall access doors for all compartments.
- Secondary roof of continuous standing-seam panels standard on units designed for outdoor installation.
- Welded cabinet floor with integrated drain pan.

3 Supply and Exhaust Air Fans

- AMCA rated fans sized for quiet and efficient operation, backward curve(up to 16 inches diameter) and airfoil (18 inches diameter and greater).
- Mounted, balanced, tested and internally isolated for vibration.
- Motors are NEMA frame, high-efficiency with a 1.15 service factor.

4 Filter Sections

- Filters that are 30 percent efficient are provided for the outdoor air and return airstreams.

5 Hoods and Dampers

- Low-leakage motorized fresh air damper and gravity exhaust air damper.
- Outdoor units are provided with an intak and exhaust hood with bird screen.

6 Electrical Package with Single Point Connection

- All motors wired to starters, disconnects and a main start/stop control center.
- Start/stop panel has hand/off/auto positions.
- Control center integrates limit switches on damper motors.
- 208, 240 or 480 volt single-point connections are available.

Optional Features

7 Increased Filter Efficiency

- Sixty-five, 85 or 95 percent cartridge filters can be provided in addition to the standard 30 percent filters.

8 Reheat Options

- Hot water coil.
- Steam coil, non-freeze type.
- Electric coil, wiring and controls for the electric heater to a separate electrical connection point.

9 Cooling Options

- Chilled water or direct expansion coil.

10 Variable Speed Wheel Control Package

- Digital reading of temperatures.
- Proportional heating control.
- Automatic summer/winter changeover.

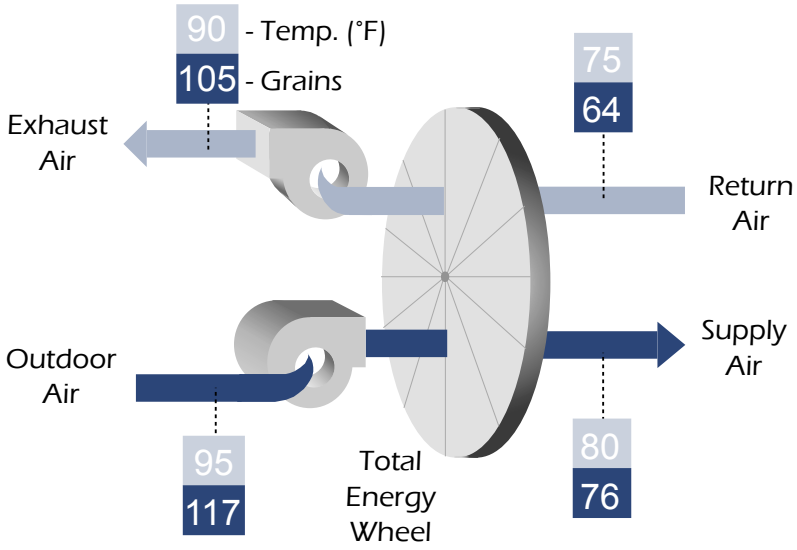
Key Benefits

- Standard, catalogued energy wheel products and wheel systems.
- Independently certified wheel performance in accordance with ASHRAE Standard 84-91 and ARI Standard 1060 with regard to:
  - — latent heat transfer efficiency;
  - — sensible heat transfer efficiency; and,
  - — pressure loss across wheel.
- Equal latent and sensible heat transfer.
- Highest performing wheel on the market.
- Independently certified cross-contamination of less than 0.04 percent.
- Field adjustable purge section.
- Wheel media independently certified to pass NFPA 90A requirements for flame spread and smoke generation based upon ASTM E84 fire test method.
- Reliable operation.
- Minimal maintenance.
- Many successful installations.
- Extended 3 and 5-year service contract available for wheel.
- Highest engineering expertise in the industry.

Available Equipment Configurations

EP

In addition to the SEMCO EXCLU-SIEVE energy recovery wheel, this dual-wall system contains backward curved supply and exhaust fans, outdoor air and return air filtration and an optional, full-electrical package with a single-point electrical connection. All EP family products are designed for either indoor or outdoor mounting.

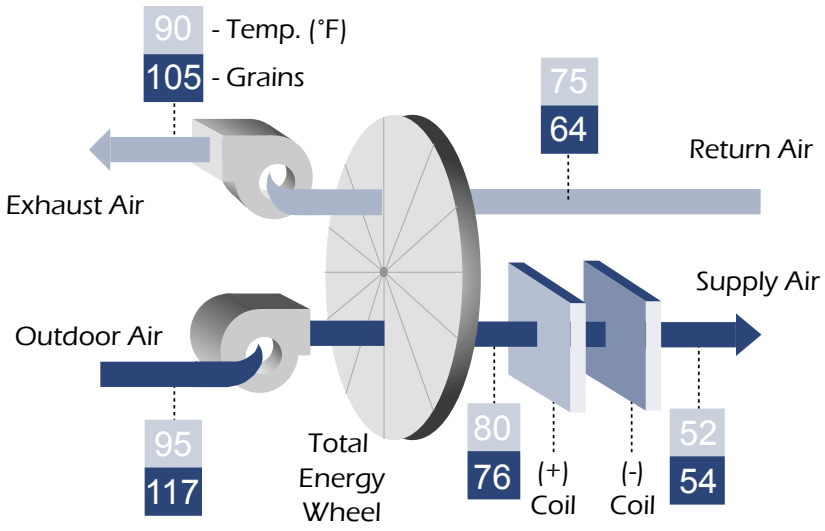


EP Product

• Suitable for new construction and can be retrofitted to most existing facilities.
• Precools and dehumidifies outdoor air during the cooling season.
• Preheats and pre-humidifies the outdoor air during the heating season.
• Supplies preconditioned outdoor air to conventional HVAC systems, allowing them to effectively increase outdoor air percentages.
• Preconditioned outdoor air can be introduced to the return air plenum serving a central HVAC system.
• It can also be supplied directly to the conditioned space since the system's recovery efficiency ranges between 74 and 85% (in balanced flow operation).

EPH, EPC, EPHC

These products build on the EP product mentioned above. However, unlike the EP, they integrate full heating and cooling options. The cooling options include either chilled water or DX cooling coils, with options regarding the number of fins per inch and the number of row options. The heating options include either hot water, steam or electric coils.



EPH, EPC, EPHC Products

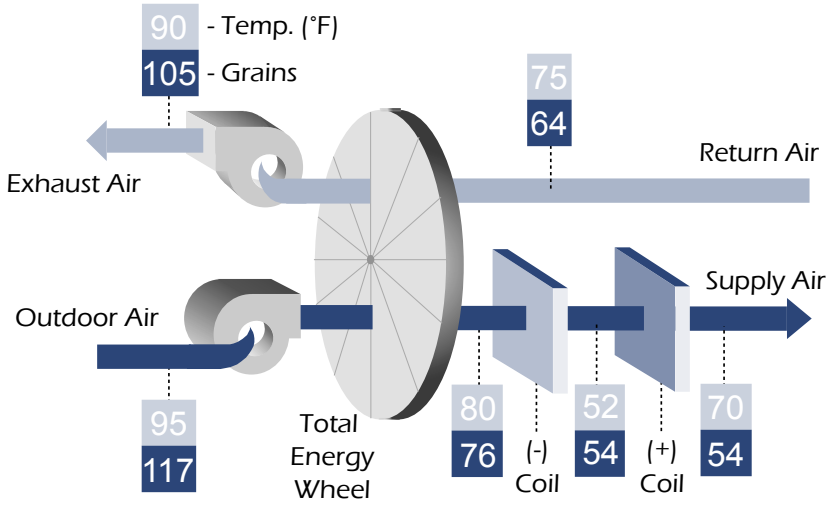
These products are applied to installations where there is a need for 100 percent outdoor air. The SEMCO system is the primary source for temperature and/or humidity control. This includes hospitals, manufacturing areas, laboratories and casinos. These products are also used to precondition buildings where the outdoor air goes directly to the space, but requires additional post heating or cooling to supplement what is being provided by the energy recovery wheel.

EPCH

EPCH Product

Applications for this product include buildings that need high percentages of outdoor air for a humidity controlled environment, where the SEMCO system is the primary source. This product may be the sole source for temperature and humidity control. It also handles primarily latent loads by over-drying the outdoor air with the cooling coil and then reheating to a temperature that is comfortable to the occupants.

This product builds on the basic EP product, but integrates full cooling and reheating. The cooling options include either chilled water or direct expansion (DX) cooling coils, with options regarding the number of fins per inch and the number of row options. The heating options include either hot water, steam or electric coils.

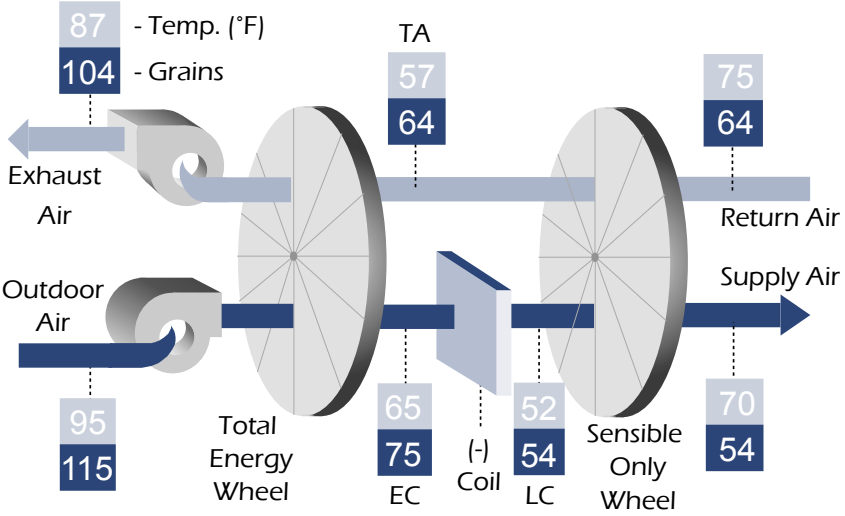


EPD

EPD Product

The applications for this product include buildings that need high percentages of outdoor air for a humidity controlled environment where the SEMCO system provides 45-55 grains of water/pound of dry air and a neutral temperature of 65-70 degrees to the space. This approach allows conventional HVAC systems to operate most efficiently by cycling on and off, while using all recirculated air and handling only sensible loads. Good applications for the EPD systems include classrooms, hotels, dormitories, casinos and laboratories. This approach to ventilation of humidity control is very energy efficient since the EPD system can generate up to 10 tons of latent cooling for every 3 tons input with no cost of reheating.

This product builds on the EP product but integrates full cooling for humidity control and a sensible energy wheel to provide free reheat. This dual-wall system contains an EXCLU-SIEVE energy recovery wheel, a sensible energy wheel, backward curved, supply and exhaust fans, outdoor air and return air filtration, cooling coil, limited capacity reheat coil and an optional full-electrical package including a single-point electrical connection. The cooling options include either chilled water or DX cooling coils, with options regarding the number of fins per inch and the number of row options. The heating options include either hot water, steam or electric coils.



EP Detailed Selection Procedure

1 Select unit size from Table 1 based on the larger supply air (SA) or return air (RA) cfm required. Then select the smallest unit which meets the required task, since it will provide the most cost-effective selection.

ex. *If 7000 cfm SA at 1-inch external static pressure and 6000 cfm RA at .5-inch external static pressure is required, then select size 9 based on 7000 cfm.*

2 Select unit configuration(EP, EPH, EPC, EPCH or EPHC) based on project requirements (see page 6 and 7 for guidance).

ex. *Select EPHC if a year-round controlled SA condition is desired.*

3 Use Table 4 (page 24) to determine the internal static pressures (ISP) for both the SA and RA sides of the unit.

ex. *In an indoor unit, the ISP for the SA side of the EPCH-9 at 7000 cfm is 2.54 inches. The ISP for the RA side of the EP-9 at 6000 cfm is 1.81 inches.*

SA @ 7000 cfm

OA opening	*.11 in.wg.*
SA opening	*.11 in.wg.*
Damper	*.11 in.wg.*
OA filter	*.42 in.wg.*
Wheel	*.82 in.wg.*
CHW coil	*.61 in.wg.*
HW Coil	*.10 in.wg.*
Casing	*.30 in.wg.*
ISP	*2.58 in.wg.*

RA @ 6000 cfm

EA opening	*.15 in.wg.*
RA opening	*.15 in.wg.*
Damper	*.08 in.wg.*
RA filter	*.49 in.wg.*
Wheel	*.67 in.wg.*
Casing	*.30 in.wg.*
ISP	*1.84 in.wg.*

4 Determine fan total static pressure (TSP) by adding the ISP to the required external static pressure.

ex. *SA side TSP is 2.58" + 1" = 3.58"*
RA side TSP is 1.84" + .5" = 2.34"

5 Use Table 4 again to determine purge/seal air volume to be added to each designed airflow to determine total fan airflow.

ex. *EP-9 purge/seal volume is 906 cfm.*

Total SA fan flow = 7906 cfm
Total RA fan flow = 6906 cfm

Table 1. System Capacities and Base Effectiveness

Model	Capacity	%Base Effective- ness
EP-3	Low 2,000 Mid 2,500 High 3,000	78 75 74
EP-5	Low 3,000 Mid 4,000 High 4,500	81 77 76
EP-9	Low 4,500 Mid 6,000 High 8,000	82 78 75
EP-13	Low 6,000 Mid 8,000 High 10,000	84 80 77
EP-18	Low 8,000 Mid 10,000 High 15,000	85 82 76
EP-24	Low 11,000 Mid 14,000 High 18,000	84 81 77
EP-28	Low 15,000 Mid 18,000 High 23,000	82 79 76
EP-35	Low 18,000 Mid 22,000 High 27,000	83 80 77
EP-43	Low 26,000 Mid 30,000 High 40,000	80 78 75

Example 1

Condition	Temp. Dry Bulb	Temp. Wet Bulb	Abs. Humidity gr/lb
Summer OA	95°	78°	117
Summer RA	75°	61.9°	63
Summer SA	81°	62.7°	79
Winter OA	0°	-1°	4
Winter RA	70°	51.4°	27
Winter SA	49°	39.2°	20

Table 2. Supply Air Efficiency Chart

Airstream Flow Ratio	Base Effectiveness in %					
	75	77	79	81	83	85
0.70	81	83	86	88	90	92
0.80	79	81	83	85	87	90
0.90	77	79	81	83	85	87
1.00	75	77	79	81	83	85
1.10	69	71	73	75	77	78
1.25	63	65	67	69	71	72
1.40	57	58	60	61	63	64

Notes:
For SA efficiency use SA cfm/RA cfm.
For RA efficiency use RA cfm/SA cfm.

6 Determine motor horsepower based on the unit's basic fan size, total fan airflow and TSP from the fan data table on pages 26-29. The minimum motor horsepower is the fan brake horsepower plus 10 percent to allow for drive loss and safety factors. An optional extended range fan (shown as size X or XX) is offered for most model sizes. This fan offers horsepower savings depending on exact performance required. However, an increase in unit size is possible.

ex. *Using a size 9 fan, the SA fan brake horsepower is 6.9 based on 7900 cfm at 3.58 in.wg. static pressure. This would require a minimum 10 hp motor. The RA fan brake horsepower is 4.0 based on 6900 cfm at 2.34 in.wg. static pressure. This would require a minimum of 5.0 hp motor.*

7 Find the base wheel effectiveness percentage from Table 1 based on the model selected and the smaller SA or RA cfm.

ex. *Base effectiveness for EP-9 based on 6000 cfm is 78 percent.*

8 Determine SA efficiency from Table 2 and their cfm ratio.

ex. *SA efficiency would be approximately 70 percent interpolating from Table 2 for a base wheel effectiveness of 78 percent and a SA/RA ratio of 7000 cfm/6000 cfm = 1.17.*

9 Determine summer and winter SA conditions, based on design temperatures and SA efficiency by using Equation 1 from Figure 1. (See page 6 for EP configuration.)

Figure 1:

Equation 1:
$X_{SA} = X_{OA} - E_{SA}(X_{OA} - X_{RA})$

Equation 2:
$X_{EA} = X_{RA} + E_{SA}(X_{OA} - X_{RA})$

X = dry bulb temperature (°F) or moisture content (gr/lb) or enthalpy (BTU/lb).

ex. *The following design condition example and a 70 percent SA efficiency are determined below:*

Equation 1 for summer dry bulb:
$SA_{(DB\ TEMP)} = 95° - .70\ (95°-75°) = 81°F$

Equation 1 for summer humidity:
$SA_{(GRAINS)} = 117\ gr - .70\ (117gr - 63\ gr) = 79\ gr$

10 Estimate unit SA conditions using the cooling coil table (page 30) and the heating coil tables (page 33).

11 Determine the need for variable speed option on the wheel.

ex. *If the 7000 cfm EP unit supplies preconditioned outdoor air directly to an air-conditioned space, the unit's full capacity will be required in the cooling season. On cool days, the unit may have the capacity to provide SA conditions above the desired setpoint design, such as 65°F, with a desired 55°F SA setpoint. To provide better control of the unit's SA conditions, the variable speed option should be selected. This option can also be used to provide frost protection for the wheel. (See also the SEMCO Energy Recovery Wheel Technical Guide for a complete discussion of wheel performance and controls.)*

12 Select unit voltage and determine power requirements from the Electrical Data Table on page 37.

ex. *For the EPCH-9, use a 10-hp SA fan, a 7.5-hp RA fan, a variable speed wheel and 240 volt/3 phase/60-cycle power.*

From Electrical Data Table:

Full Load Ampacity	
10-hp SA fan	*28.0 amps*
5-hp RA fan	*15.2 amps*
Wheel VFD	*3.9 amps*
Control power	*0.8 amps*
Total FLA's	**47.9 amps**

Minimum Circuit Ampacity	
FLA from above	*47.9 amps*
25% of largest motor	*7.0 amps*
Total MCA	**54.9 amps**

Maximum Overcurrent Protection(MOCP)	
FLA from above	*47.9 amps*
125% of largest motor	*35.0 amps*
MOCP*	**82.9 amps**

**Select the next smaller sized time delay fuse, per instructions in UL 1995.*

Table 3. System Capacities and Base Effectiveness

Model	Capacity		Effectiveness in %
EPD-3	Low	2,000	78
	Mid	2,250	76
	High	2,500	75
EPD-5	Low	3,000	81
	Mid	3,500	79
	High	4,000	77
EPD-9	Low	4,500	82
	Mid	6,000	78
	High	7,300	76
EPD-13	Low	6,000	84
	Mid	7,500	81
	High	8,800	79
EPD-18	Low	8,000	85
	Mid	10,000	82
	High	14,000	77
EPD-24	Low	11,000	84
	Mid	13,000	82
	High	15,000	80
EPD-28	Low	15,000	82
	Mid	18,500	80
	High	21,000	78
EPD-34	Low	18,000	83
	Mid	21,000	80
	High	24,000	79
EPD-43	Low	26,000	80
	Mid	30,000	78
	High	37,000	76

EPD Detailed Selection Procedure

1 Select unit size from Table 3 based on larger SA or RA cfm required. Then select the smallest unit which meets the required task, since this will provide the most cost-effective selection.

ex. *If 7000 cfm of SA at 1-inch external static pressure and 6000 cfm RA at .5-inch external static pressure is required, then select EP-9 based on 7000 cfm.*

2 Select EPD unit configuration based on project requirements of high latent load and to provide year-round temperature of SA conditions. (See page 7 for EPD configuration.)

3 Use Table 5 (page 25) to determine the ISP for both the SA and RA sides of the unit.

ex. *In an indoor unit, the ISP pressure for the SA side of EPD-9 at 7000 cfm is 3.46 inches. The ISP for the RA side of EPD-9 at 6000 cfm is 2.73 inches.*

SA @ 7000cfm

OA opening	*.04 in.wg.*
SA opening	*.04 in.wg.*
Damper	*.13 in.wg.*
OA Filter	*.55 in.wg.*
E Wheel	*.96 in.wg.*
CHW Coil	*.78 in.wg.*
HW Coil	*.13 in.wg.*
S Wheel	*.82 in.wg.*
Casing	*.30 in.wg.*
ISP	**3.75 in.wg.**

RA @ 6000cfm

EA opening	*.20 in.wg.*
RA opening	*.20 in.wg.*
Damper	*.10 in.wg.*
RA Filter	*.49 in.wg.*
E Wheel	*.80 in.wg.*
S Wheel	*.67 in.wg.*
Casing	*.30 in.wg.*
ISP	**2.76 in.wg.**

4 Determine fan TSP by adding the ISP to the required external static pressure.

ex. *SA side TSP is 3.75" + 1" = 4.75"*
RA side TSP is 2.76" + .5" = 3.26"

5 Use Table 5 again to determine purge/seal air volume to be added to each designed airflow to determine total fan airflow.

ex. *EPD-9 sensible wheel purge/seal volume is 906 cfm and the enthalpy wheel purge/seal volume is 1119 cfm.*

Total SA fan flow = 9025 cfm
Total RA fan flow = 8025 cfm

6 Determine motor horsepower based on the unit's basic fan size, total fan airflow and TSP from the fan performance tables (pages 26-29). The minimum motor horsepower is the fan brake horsepower listed in the chart plus 10 percent to allow for drive loss and safety factors. An optional extended range fan (shown as size X or XX) is offered for most model sizes. This fan offers horsepower savings depending on the exact performance required. However, an increase in unit size is possible.

ex. *Using a size 9 fan, the SA fan brake horsepower is 10.2 based on 9025 cfm at 4.75-inches static pressure. This would require a minimum 15 hp motor. The RA fan brake horsepower is 6.4 based on 8025 cfm at 3.26-inches static pressure. This would require a minimum 7.5 hp motor.*

7 Find the base wheel effectiveness from Table 3 (page 11) based on the model selected and using the smaller of the SA or RA cfm.

ex. *The base wheel effectiveness for EPD-9 based on 6000 cfm is 78 percent.*

8 Determine SA and RA efficiency from Table 3 and their cfm ratio.

ex. *SA efficiency would be approximately 70 percent interpolating from Table 4 for a base wheel effectiveness of 78 percent and a SA/RA ratio of 7000 cfm/6000 cfm =1.17. The RA efficiency would be approximately 81 percent using 6000 cfm/7000 cfm.*

9 Determine summer and winter SA conditions, based on design temperature and SA and RA efficiencies using equations 3 to 5 from Figure 2. (See page 7 for EPD configuration.)

Figure 2:

Equation 3: Enthalpy Wheel
$X_{EC} = X_{OA} - E_{SA} (X_{OA} - X_{TA})$

Equation 4A: Sensible Wheel (SA Side)
$T_{SA} = T_{LC} - E_{SA} (T_{LC} - T_{RA})$

Equation 4B: Sensible Wheel (SA Side)
$W_{SA}[gr/lb] = W_{LC}[gr/lb]$

Equation 5A: Sensible Wheel (RA Side)
$T_{TA} = T_{RA} - E_{SA} (T_{LC} - T_{RA})$

Equation 5B: Sensible Wheel (RA Side)
$W_{TA}[gr/lb] = W_{RA}[gr/lb]$

EC = entering coil condition

LC = leaving coil condition

TA = sensible wheel leaving EA condition

T = dry bulb temperature (°F)

W= humidity (gr/lb)
X = dry bulb temperature (°F) or, moisture content (gr/lb) or, enthaply (Btu/lb)

ex. *By using Equation 4A with the design conditions shown in Example 2 and a 70 percent SA efficiency, the following leaving coil condition (LC) is determined.*

Equation 4A for summer DB:
$SA_{(DB\ TEMP)} = 53°F - .70(53°F - 75°F) = 68.4°F$

Equation 4B for Summer Humidity:
$SA_{(GRAINS)} = LC_{(GRAINS)} = 56\ gr$

The summer coil entering conditions can be calculated by using the remaining equations and working backwards through the exhaust air (EA) side of the unit. This will allow verification that the coil has adequate capacity to achieve the assumed LC condition.

When the temperature drops below 25°F, the sensible wheel and cooling coil will shut off to prevent frosting. In this mode, Equation 3 will yield the SA conditions for the unit.

Example 2

Condition	TDB	TWB	rh%	Grains
Summer OA	95.0°	78.0°	47	117
Summer RA	75.0°	62.3°	63	63
Summer LC	53.0°	52.1°	94	56
Summer TA	57.2°	55.5°	90	63
Summer EC	68.5°	63.2°	75	79
Summer SA	68.4°	58.0°	54	56
Winter OA	0.0°	-1.0°	70	4
Winter RA	70.0°	51.4°	25	27
Winter SA	49.0°	39.2°	38	20

10 Determine the need for variable speed option on the sensible wheel.

ex. *If the EPD system is the only source for space-conditioning, a sensor located in the supply airstream can be used to vary the speed of the sensible wheel in order to control the SA temperature leaving the system.*

In the cooling mode, the EPD's LC temperature is set to control the desired humidity level. However, by reducing the speed of the sensible wheel, the amount of reheat is altered. This allows the system to provide more or less sensible cooling. (Note: If the variable speed control option is used, the reduced sensible wheel efficiency must be taken into account when determining the tonnage for the EPD system.)

In the heating mode, the sensible wheel speed is controlled to provide the desired SA condition. In rare cases, the supplemental heating is required if the two wheels in series are inefficient and cannot satisfy the load of the conditioned space. When the air temperature outside falls below 25°F, the sensible wheel is turned off to avoid condensation.

11 Select unit voltage and determine power requirements from the Electrical Data table on page 37.

ex. *For the EPD-9, use a 15-hp SA fan, a 10-hp RA fan, 2 constant speed wheels and 240 volt/3 phase/60-cycle power:*

From Electrical Data Table:

Full Load Ampacity	
15-hp SA fan	*42.0 amps*
7.5-hp RA fan	*22.0 amps*
Wheels	*4.4 amps*
Control power	*0.8 amps*
Total FLA's	**69.2 amps**

Minimum Circuit Ampacity	
FLA from above	*69.2 amps*
25% of largest motor	*10.5 amps*
Total MCA	**79.7 amps**

Maximum Overcurrent Protection(MOCP)	
FLA from above	*69.2 amps*
125% of largest motor	*52.5 amps*
MOCP*	**121.7 amps**

**Select the next smaller sized time delay fuse, per instructions in UL 1995.*

Basic cooling coil performance is given in the Cooling Coil Tables on pages 30-32. The amount of dehumidification capacity is related to the LC air temperature. To calculate the amount of cooling capacity required, use the following equations:

Equation 6:
$BTU/H = 4.5 \times cfm \ (EC_{ENTHALPY} - LC_{ENTHALPY})$

Equation 7A:
$BTU/H_{SENSIBLE} = 1.08 \times cfm \ (EC_{DB\ TEMP} - LC_{DB\ TEMP})$

Equation 7B:
$BTU/H_{LATENT} = .68 \times cfm \ (EC_{GRAINS} - LC_{GRAINS})$

ex. *For the 7000 cfm EPD unit, calculate the cooling capacity with and without the EPD unit at the outside air condition of 95°F DB and 78°F WB and with a 53°F DB and 52°F WB leaving coil condition. Use a psychrometric chart to obtain either the enthalpies or the humidity in grains at each condition:*

For the cooling capacity without the EPD unit, use equation 6:

BTU/H = 4.5 x 7000 x (41.3 - 21.4) = 626,850 BTU/H or 626,850/12,000 = 52.2 tons of cooling

Example 2 (Continued)

Condition	Dry Bulb	Wet Bulb	Humidity	Enthalpy
OA	95.0°	78.0°	117gr	41.3
EC	68.5°	63.2°	79gr	28.8
LC	53.0°	52.1°	56gr	21.4

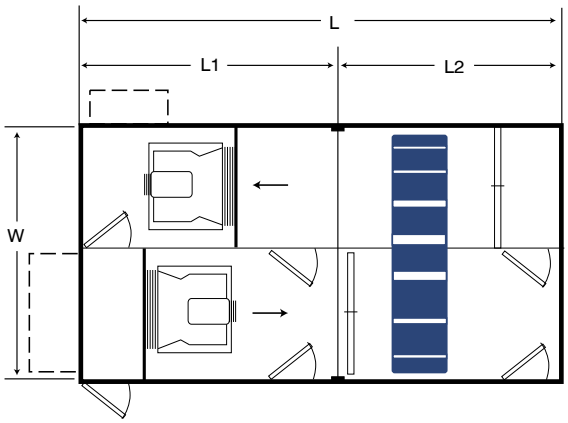
Use equations 7A and 7B for the cooling capacity with the EPD unit:

$BTU/H_{SENSIBLE} = 1.08 \times 7000 \times (68.5 - 53) = 117{,}180\ BTU/H$

$BTU/H_{LATENT} = .68 \times 7000 \times (79 - 56) = 109{,}480\ BTU/H$

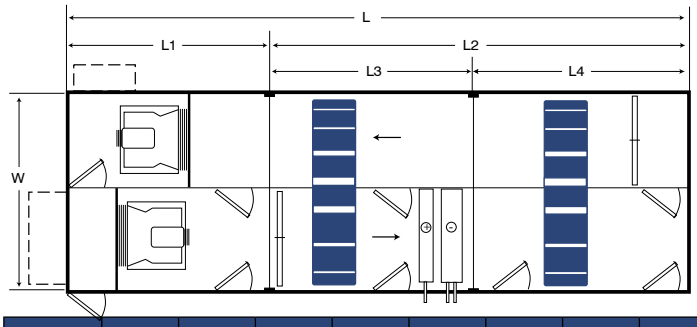
$BTU/H = 117{,}180 + 109{,}480 = 226{,}660\ BTU/H$ *or* $226{,}660/12{,}000 = 18.9$ *tons of cooling*

Unit Weights and Dimensions



EP

	W	L	L1	L2	H	Weight Mod#1	Weight Mod#2	
Model	(in.)	(in.)	(in.)	(in.)	(in.)	(lbs)	(lbs)	Notes
EP-3	86	163	-	-	48	4,950	-	5
EP-5	86	167	-	-	60	5,750	-	5
EP-9	98	171	-	-	72	7,350	-	2,4
EP-13	98	182	-	-	86	9,400	-	2,4
EP-18	122	190	-	-	98	12,150	-	2,4
EP-24	122	204	-	-	110	14,250	-	2,4
EP-28	146	215	119	96	122	10,100	7,750	2,4
EP-35	146	231	129	102	134	11,700	8,650	2,4
EP-43	182	245	137	108	146	15,100	10,500	3



EPD

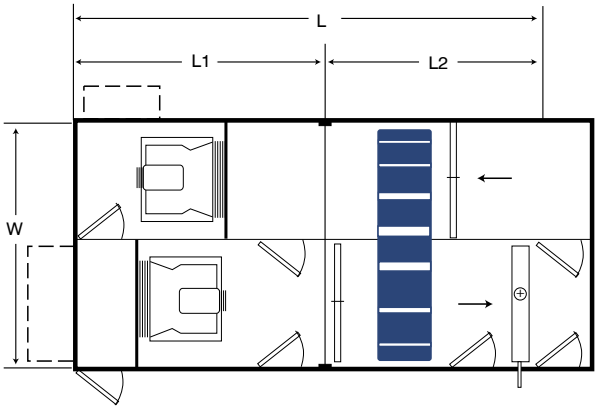
Model	W	L	L1	L2	L3	L4	H	Weight Mod#1	Weight Mod#2	Weight Mod#3	Weight Mod#4	Notes
	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(lbs)	(lbs)	(lbs)	(lbs)	
EPD-3	86	263	-	-	-	-	48	7,100	-	-	-	1,5
EPD-5	86	267	-	-	-	-	60	8,300	-	-	-	1,5
EPD-9	98	271	-	-	-	-	72	10,450	-	-	-	1,4
EPD-13	98	295	-	-	-	-	86	13,700	-	-	-	1,4
EPD-18	122	308	108	200	-	-	98	7,150	10,000	-	-	1,4
EPD-24	122	321	115	206	-	-	110	8,450	11,450	-	-	1,4
EPD-28	146	334	119	-	113	102	122	10,100	-	7,800	7,750	1,4
EPD-35	146	350	129	-	113	108	134	11,700	-	8,500	8,650	1,4
EPD-43	182	364	137	-	113	113	146	15,100	-	10,150	10,500	1

FOR ALL EP MODELS

Notes:

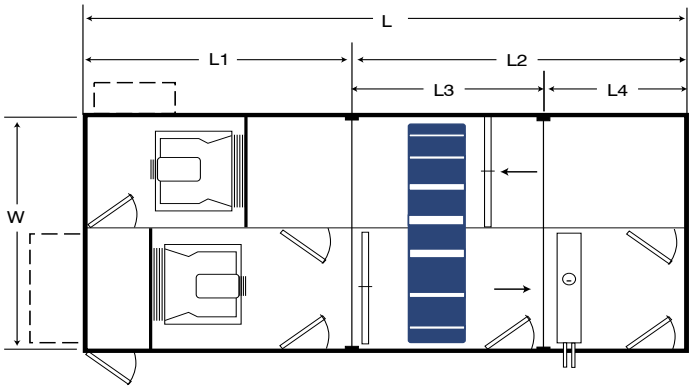
1. Electric heating coil will add 12” to unit length.
2. 12” wider EA side available for increased capacity.
3. 24” wider EA side available for increased capacity.
4. Add 12” to width for X and XX size EA fan.
5. Add 18” to unit length for X and XX size SA or EA fan.
6. Right handed units shown. For left hand unit, mirror down centerline.

EPH

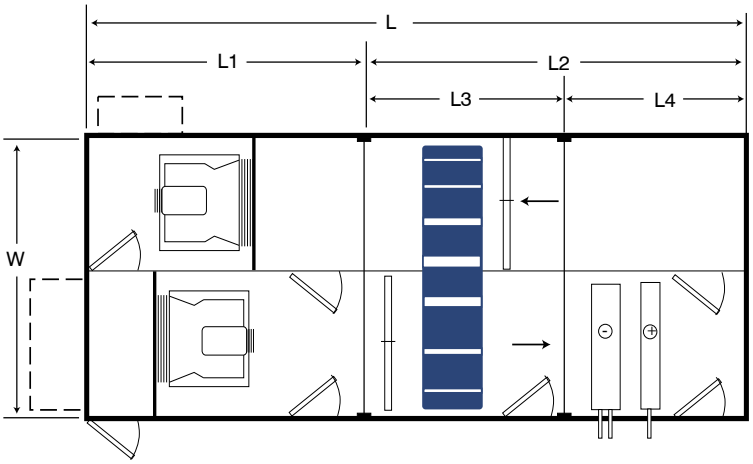


Model	W	L	L1	L2	H	Weight Mod#1	Weight Mod#2	Notes
	(in.)	(in.)	(in.)	(in.)	(in.)	(lbs)	(lbs)	
EPH-3	86	182	-	-	48	5,300	-	1,5
EPH-5	86	186	-	-	60	6,150	-	1,5
EPH-9	98	190	-	-	72	7,850	-	1,4
EPH-13	98	208	-	-	86	10,150	-	1,4
EPH-18	122	216	-	-	98	13,000	-	1,4
EPH-24	122	230	-	-	110	15,200	-	1,4
EPH-28	146	241	119	121	122	10,100	8,750	1,4
EPH-35	146	256	129	127	134	11,700	9,750	1,4
EPH-43	182	270	137	133	146	15,100	11,850	1

EPC

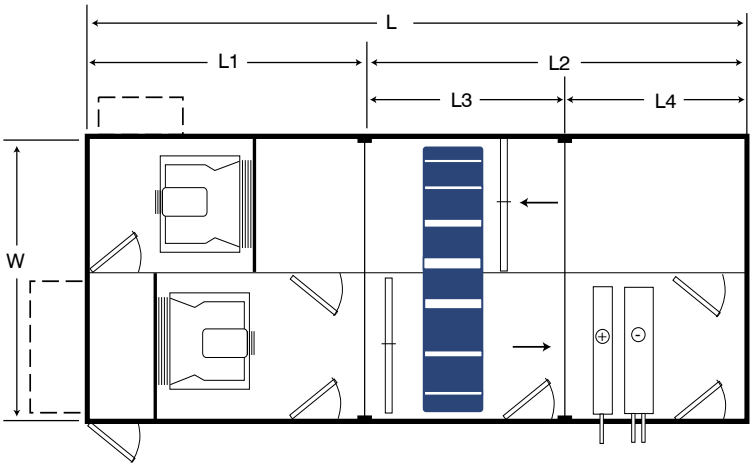


Model	W	L	L1	L2	L3	L4	H	Weight Mod#1	Weight Mod#2	Weight Mod#3	Weight Mod#4	Notes
	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(lbs)	(lbs)	(lbs)	(lbs)	
EPC-3	86	198	-	-	-	-	48	5,650	-	-	-	5
EPC-5	86	202	-	-	-	-	60	6,600	-	-	-	5
EPC-9	98	206	-	-	-	-	72	8,350	-	-	-	4
EPC-13	98	224	-	-	-	-	86	10,800	-	-	-	4
EPC-18	122	232	-	-	-	-	98	13,900	-	-	-	4
EPC-24	122	250	115	135	-	-	110	8,450	7,700	-	-	4
EPC-28	146	256	119	137	-	-	122	10,100	9,950	-	-	4
EPC-35	146	272	129	143	-	-	134	11,700	11,050	-	-	4
EPC-43	182	291	137	-	74	80	146	15,100	-	6,750	7,350	1



EPCH

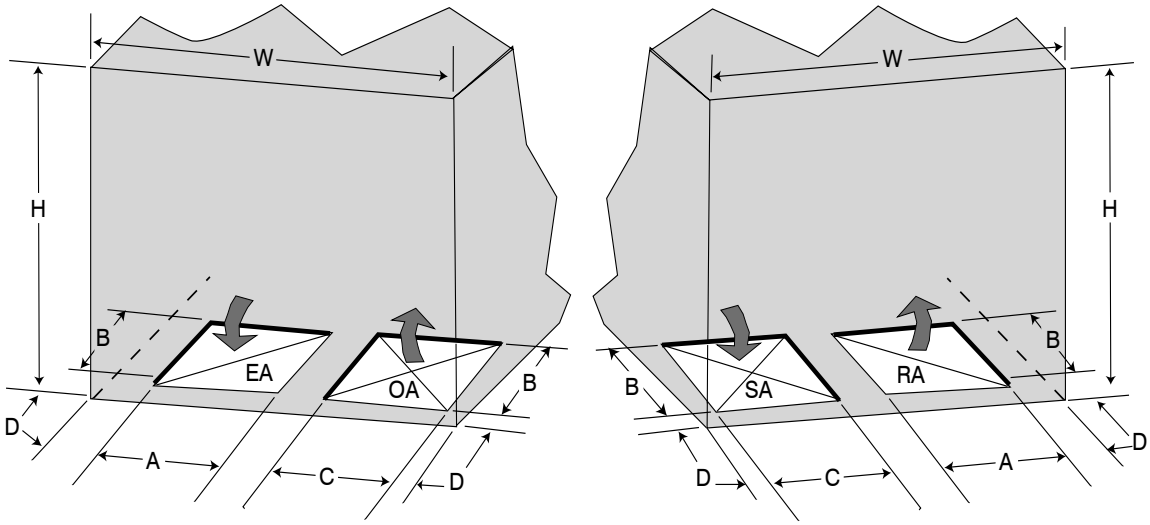
Model	W	L	L1	L2	L3	L4	H	Weight Mod#1	Weight Mod#2	Weight Mod#3	Weight Mod#4	Notes
	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(lbs)	(lbs)	(lbs)	(lbs)	
EPCH-3	86	210	-	-	-	-	48	5,850	-	-	-	1,5
EPCH-5	86	214	-	-	-	-	60	6,850	-	-	-	1,5
EPCH-9	98	218	-	-	-	-	72	8,700	-	-	-	1,4
EPCH-13	98	236	-	-	-	-	86	11,200	-	-	-	1,4
EPCH-18	122	243	-	-	-	-	98	14,400	-	-	-	1,4
EPCH-24	122	262	115	147	-	-	110	8,450	8,200	-	-	1,4
EPCH-28	146	273	119	-	74	80	122	10,100	-	5,400	5,600	1,4
EPCH-35	146	289	129	-	74	86	134	11,700	-	5,900	6,200	1,4
EPCH-43	182	303	137	-	74	92	146	15,100	-	6,750	8,150	1



EPHC

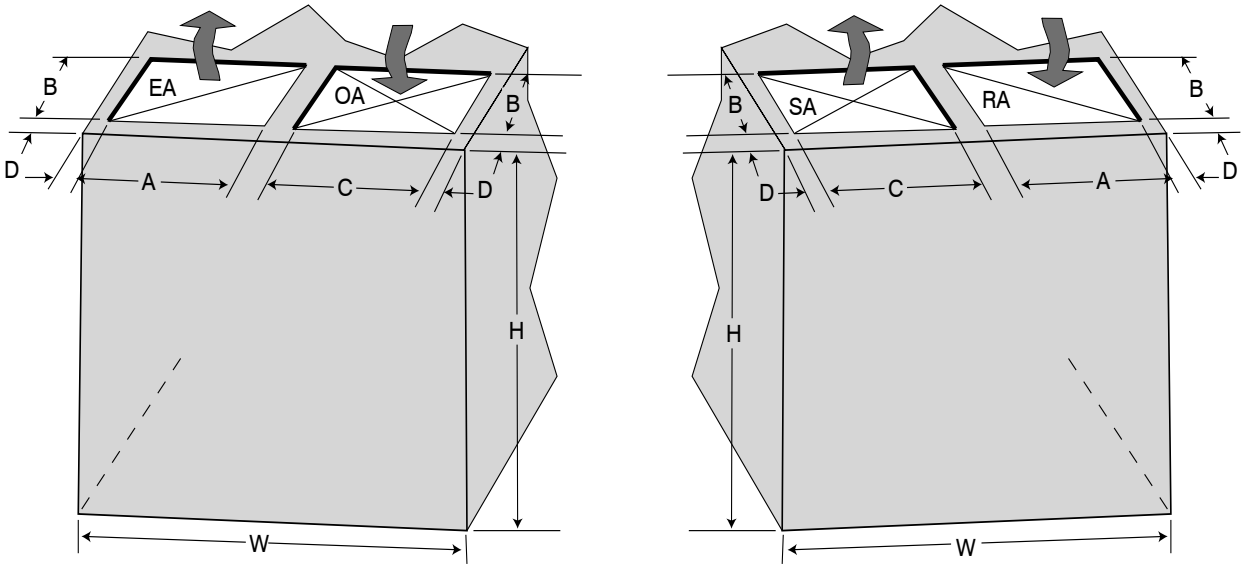
Model	W	L	L1	L2	L3	L4	H	Weight Mod#1	Weight Mod#2	Weight Mod#3	Weight Mod#4	Notes
	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(lbs)	(lbs)	(lbs)	(lbs)	
EPHC-3	86	210	-	-	-	-	48	5,850	-	-	-	1,5
EPHC-5	86	214	-	-	-	-	60	6,850	-	-	-	1,5
EPHC-9	98	218	-	-	-	-	72	8,700	-	-	-	1,4
EPHC-13	98	236	-	-	-	-	86	11,200	-	-	-	1,4
EPHC-18	122	243	-	-	-	-	98	14,400	-	-	-	1,4
EPHC-24	122	262	115	147	-	-	110	8,450	8,200	-	-	1,4
EPHC-28	146	273	119	-	74	80	122	10,100	-	5,400	5,600	1,4
EPHC-35	146	289	129	-	74	86	134	11,700	-	5,900	6,200	1,4
EPHC-43	182	303	137	-	74	92	146	15,100	-	6,750	8,150	1

Standard Roof & Floor Openings



Standard Floor Openings

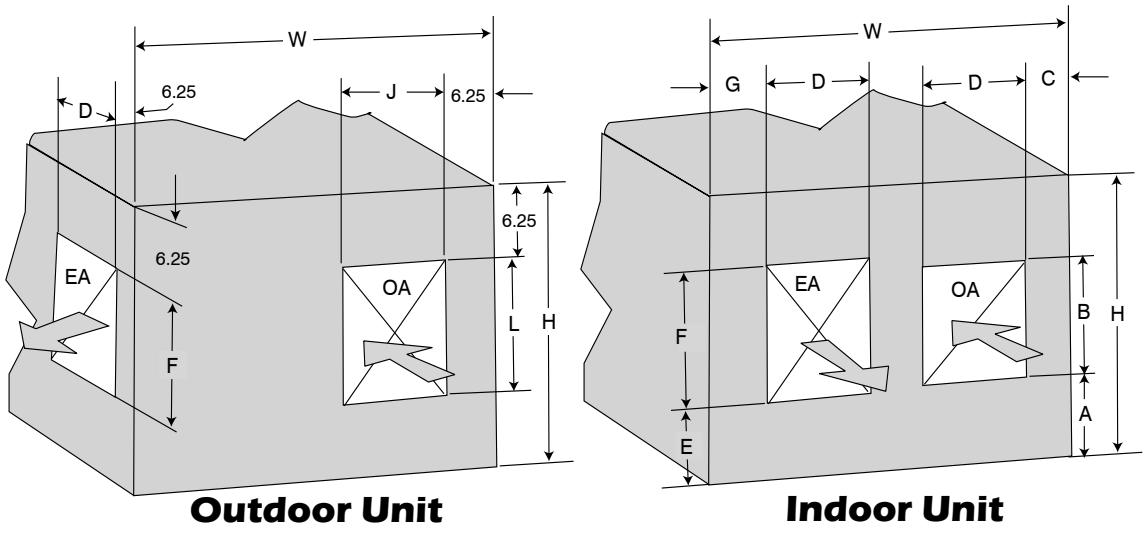
SIZE	H	W	A	B	C	D
3	48.25	86.25	24	20	24	6.25
5	60.25	86.25	24	20	34	6.25
9	72.25	98.25	34	20	46	6.25
13	86.25	98.25	34	26	46	6.25
18	98.25	122.25	46	26	58	6.25
24	110.25	122.25	46	32	58	6.25
28	122.25	146.25	58	32	70	6.25
35	134.25	146.25	58	37	70	6.25
43	146.25	182.25	70	44	94	6.25



Standard Roof Openings

Notes:
1. All dimensions are in inches.
2. Height includes structural steel base.
3. Roof openings only available on interior units.

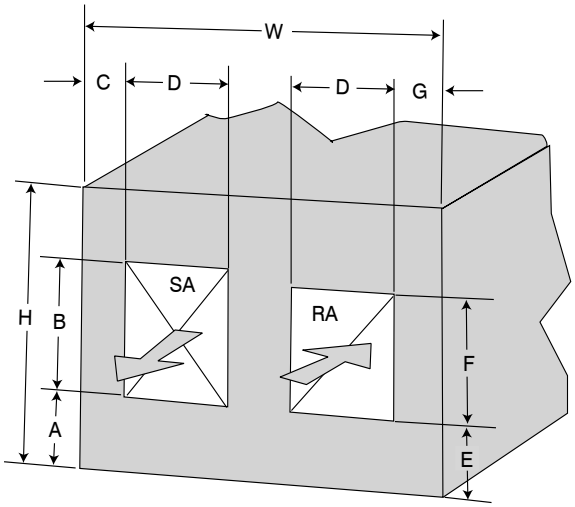
Standard End Wall and Side Wall Openings



Standard OA/EA Openings

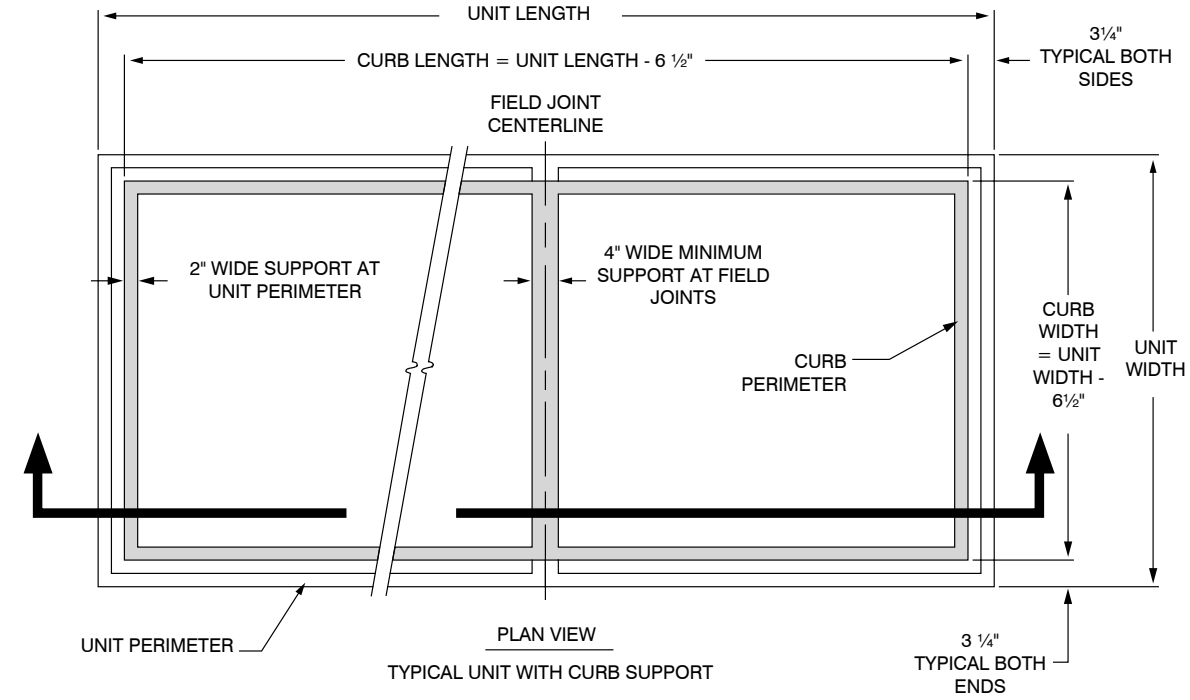
Size	H	W	A	B	C	D	E	F	G	J	L
3	48.25	86.25	14.25	24	12.25	20	14.25	24	12.25	24	24
5	60.25	86.25	15.25	34	14.25	20	20.25	24	14.25	24	42
9	72.25	98.25	15.25	46	20.25	20	21.25	34	14.25	36	48
13	86.25	98.25	23.25	46	17.25	26	29.25	34	11.25	36	60
18	98.25	122.25	23.25	58	23.25	26	29.25	46	17.25	48	72
24	110.25	122.25	29.25	58	20.25	32	35.25	46	14.25	48	72
28	122.25	146.25	29.25	70	26.25	32	35.25	58	20.25	54	96
35	134.25	146.25	35.25	70	22.75	37	41.25	58	16.75	60	96
43	146.25	182.25	29.25	94	32.25	44	41.25	70	20.25	84	96

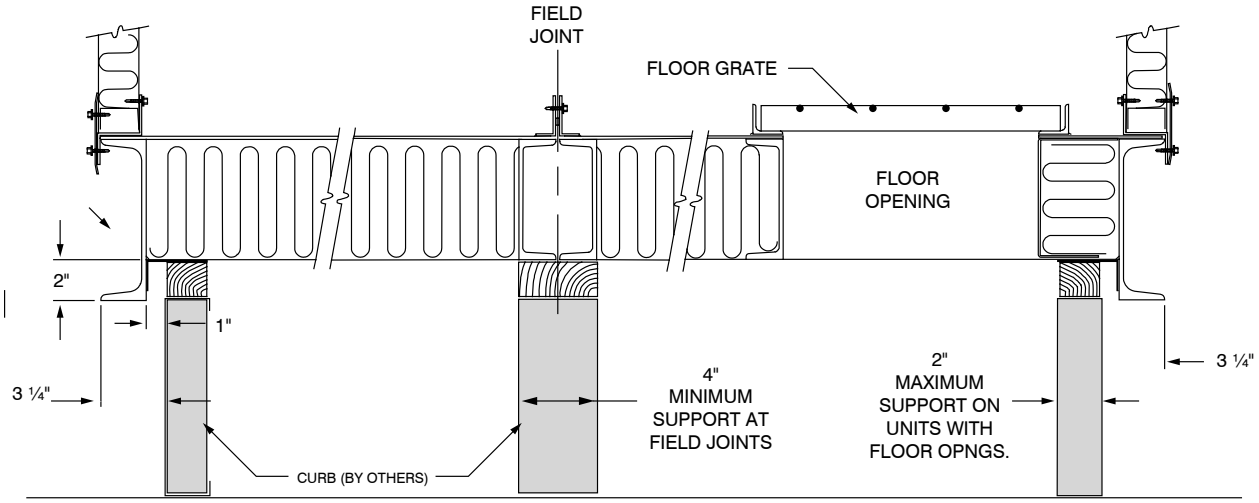
Notes:
1. All dimensions are in inches.
2. Height includes structural steel base.



Standard SA/RA Openings

Mounting Details, Curb Support





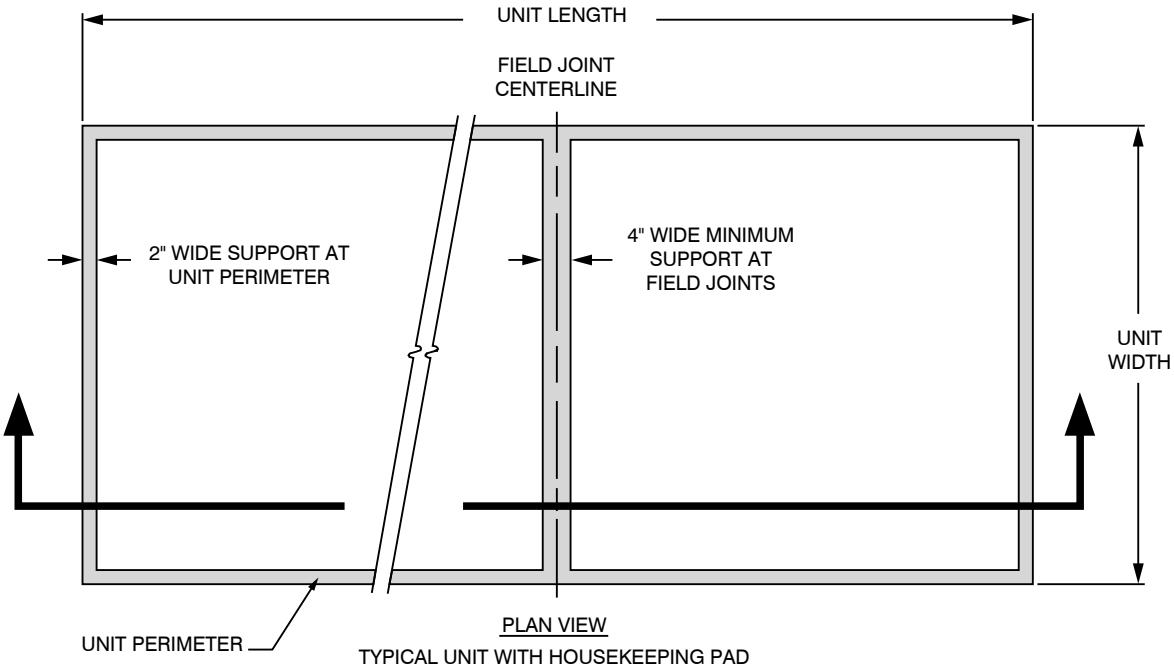
SECTION

SELF FLASHING UNIT BASE
SHOWING CURB SUPPORT REQUIREMENTS

NOTES

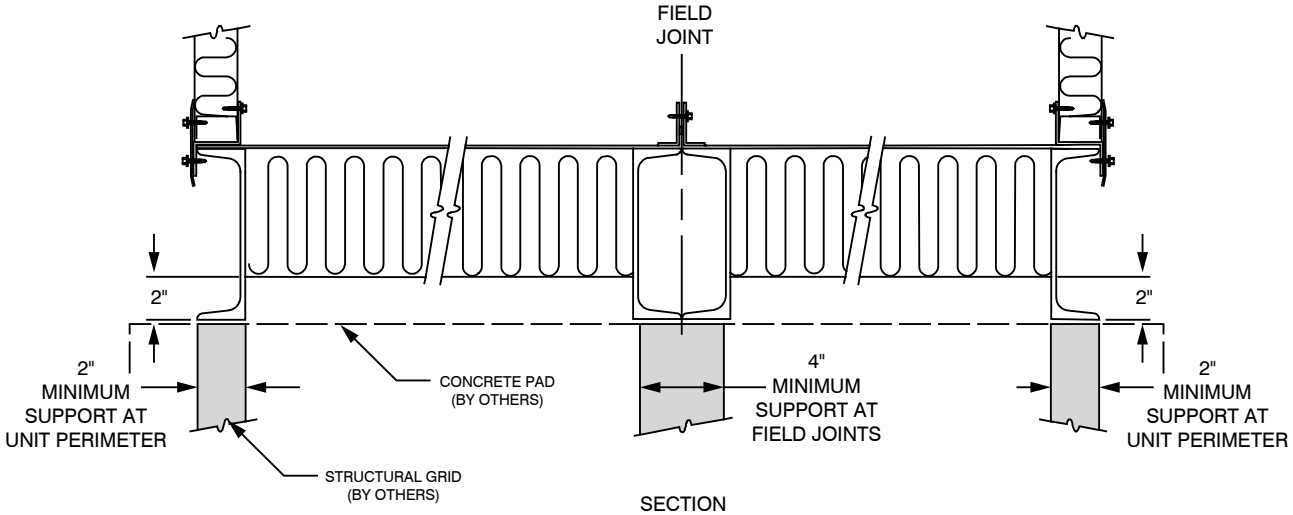
1. ROOF CURB SHOULD BE SIZED TO ALLOW UNIT TO HANG OVER CURB.
2. CURB SIZE:
   WIDTH = UNIT WIDTH - 6.5"
   LENGTH = UNIT LENGTH -6.5"
3. UNIT SUPPORT IS REQUIRED AROUND THE ENTIRE PERIMETER AND ALONG BOTH SIDES OF ANY FIELD JOINTS.
4. WHEN UNITS REQUIRE FIELD JOINTS, SUPPORT SHOULD BE LEVEL TO 1/16" BETWEEN FIELD JOINTS.

Mounting Details, Grid or Pad Support



PLAN VIEW

TYPICAL UNIT WITH HOUSEKEEPING PAD OR STRUCTURAL GRID SUPPORT



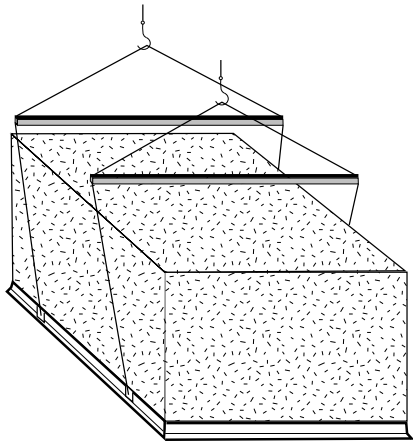
SECTION

UNIT BASE WHEN MOUNTING ON PAD OR STRUCTURAL GRID

NOTES

1. UNIT SUPPORT IS REQUIRED AROUND THE ENTIRE PERIMETER AND ALONG BOTH SIDES OF ANY FIELD JOINTS.

2. WHEN UNITS REQUIRE FIELD JOINTS, SUPPORT SHOULD BE LEVEL TO 1/16" BETWEEN FIELD JOINTS.



Lifting and Rigging

The units are designed to be lifted from lifting eyes attached to the unit base structure. Spreader bars must be used to hoist sections to avoid damaging the enclosure. The unit must not be lifted with a forklift.

Field Joints

Units may be split into multiple shipping modules, if size or weight dictates. These units will include factory matched field joints for reassembly at the site. All fasteners, gaskets and caulk are included with the unit.

Coil Piping

Hot water coils and chilled water coils have supply and return connections extended through the casing wall to the unit exterior. Drain and vent connections are not extended.

DX refrigerant coils have liquid lines extended to the unit exterior. Suction line connections are inside the unit.

Steam coils have supply and condensate connection extended through the casing wall to the unit exterior. The condensate connection for the lower steam coil is approximately at floor level. Accommodations for the drip leg will need to be made to the exterior of the unit.

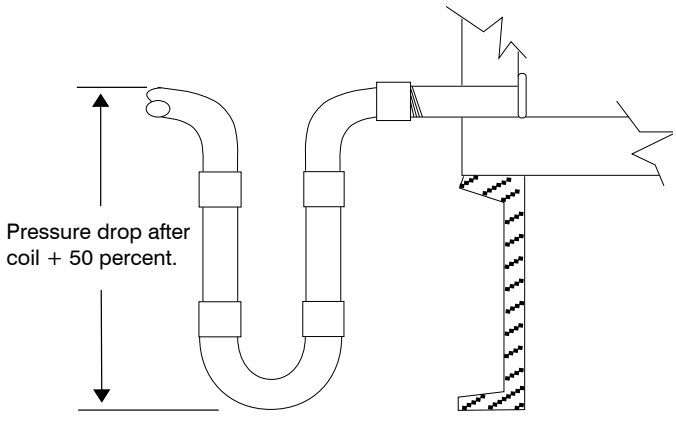
Cooling Coil Condensate Connections

The centerline of the connections is 8.75 inches above the bottom of the base steel. The connections are 1.5 inches MPT.

The plenum containing the condensate pan will be subject to a positive pressure drop on the downstream side of the cooling coil, including the external losses.

The height of water in the trap should be about 50 percent greater than the downstream air pressure drop to prevent air from being blown through the trap.

The unit must be mounted at a sufficient height above the floor or roof to permit installation of the required height P-trap.



Component Pressure Drop Tables

Table 4: Single Wheel Unit Pressure Drops

Size	EP-3			EP-5			EP-9			EP-13			EP-18	
CFM	2000	2500	3000	3000	4000	4500	4500	6000	8000	6000	8000	10000	8000	10000
Enth. wheel purge	513	543	513	695	695	695	906	906	906	1168	1168	1168	1440	1440
Fan cfm	2513	3013	3513	3695	4695	5195	5406	6906	8906	7168	9168	11168	9440	11440
OA opening (w/hood)	0.02	0.04	0.05	0.02	0.03	0.03	0.01	0.02	0.03	0.01	0.02	0.30	0.01	0.01
EA opening (w/hood)	0.04	0.05	0.07	0.08	0.12	0.15	0.07	0.12	0.20	0.08	0.12	0.18	0.07	0.11
RA or EA opening	0.10	0.14	0.19	0.09	0.15	0.19	0.09	0.15	0.24	0.09	0.15	0.22	0.09	0.13
SA or OA opening	0.06	0.10	0.14	0.06	0.11	0.14	0.05	0.08	0.14	0.05	0.08	0.13	0.04	0.06
Damper	0.07	0.10	0.14	0.05	0.08	0.09	0.05	0.08	0.13	0.06	0.09	0.14	0.04	0.07
OA filter	0.26	0.38	0.51	0.25	0.41	0.50	0.19	0.32	0.53	0.24	0.39	0.58	0.19	0.28
RA filter	0.17	0.26	0.37	0.17	0.30	0.37	0.27	0.49	0.87	0.30	0.52	0.82	0.22	0.34
Enth. wheel	0.69	0.92	1.18	0.52	0.74	0.86	0.48	0.67	0.97	0.42	0.57	0.75	0.47	0.51
Cooling coil	0.26	0.40	0.58	0.31	0.56	0.70	0.25	0.44	0.79	0.30	0.53	0.82	0.23	0.36
Heating coil	0.04	0.07	0.09	0.05	0.09	0.11	0.04	0.07	0.13	0.05	0.09	0.13	0.04	0.06
Casing losses	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Int. static pressure														
Ext. static pressure														
Total static pressure														

Size	EP-18	EP-24			EP-28			EP-35			EP-43		
CFM	15000	11000	14000	18000	15000	18500	23000	18000	22500	27000	26000	30000	40000
Enth. wheel purge	1440	1735	1735	1735	1961	1961	1961	2297	2297	2297	2662	2662	2662
Fan cfm	16440	12735	15735	19735	16961	20461	24961	20297	24797	29297	28662	32662	42662
OA opening (w/hood)	0.03	0.20	0.02	0.04	0.01	0.02	0.03	02	0.02	0.03	0.02	0.02	0.04
EA opening (w/hood)	0.22	0.09	0.14	0.21	0.10	0.15	0.22	0.11	0.16	0.23	0.11	0.14	0.23
RA or EA opening	0.26	0.16	0.24	0.38	0.11	0.17	0.25	0.11	0.17	0.24	0.12	0.15	0.26
SA or OA opening	0.14	0.05	0.08	0.13	0.06	0.09	0.15	0.06	0.10	0.14	0.06	0.08	0.14
Damper	0.14	0.06	0.09	0.13	0.07	0.10	0.14	0.06	0.10	0.13	0.09	0.11	0.19
OA filter	0.59	0.27	0.41	0.65	0.26	0.38	0.57	0.30	0.45	0.63	0.28	0.37	0.62
RA filter	0.76	0.31	0.50	0.84	0.30	0.45	0.69	0.34	0.54	0.77	0.41	0.55	0.98
Enth. wheel	0.83	0.42	0.55	0.74	0.49	0.62	0.81	0.47	0.60	0.75	0.56	0.67	0.98
Cooling coil	0.80	0.32	0.53	0.87	0.33	0.51	0.78	0.38	0.60	0.86	0.35	0.47	0.83
Heating coil	0.13	0.05	0.09	0.14	0.05	0.08	0.13	0.06	0.10	0.14	0.06	0.08	0.13
Casing losses	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Int. static pressure													
Ext. static pressure													
Total static pressure													

Notes:

1. Filter pressure drops based on 2 inches thick, 30% efficient Class II filters.
2. Cooling coil pressure drops based on 6 row, 10 fins per inch single-circuited coil.
3. Heating coil pressure drops based on 1 row, 6 fins per inch.
4. Purge volumes based on 4 inches P_{OA}-P_{RA} for wheel.
5. Casing losses include fan inlet losses.

Table 5: Dual Wheel Unit Pressure Drops

Size	EPD-3			EPD-5			EPD-9			EPD-13			EPD-18	
CFM	2000	2250	2500	3000	4000	4500	4500	6000	8000	6000	8000	10000	8000	10000
Sens. wheel purge	513	513	513	695	695	695	906	906	906	1168	1168	1168	1440	1440
Enth. wheel purge	663	663	663	877	877	877	1119	1119	1119	1415	1415	1415	1718	1718
Fan cfm	3176	3676	4176	4572	5572	6072	6525	8025	10025	8583	10583	12583	11158	13158
OA opening (w/hood)	0.04	0.05	0.07	0.03	0.04	0.05	0.02	0.03	0.04	0.02	0.03	0.04	0.01	0.02
EA opening (w/hood)	0.06	0.07	0.10	0.12	0.17	0.21	0.11	0.16	0.25	0.11	0.17	0.23	0.03	0.04
RA or EA opening	0.16	0.21	0.27	0.14	0.22	0.26	0.13	0.20	0.31	0.13	0.19	0.27	0.12	0.17
SA or OA opening	0.06	0.10	0.14	0.06	0.11	0.14	0.05	0.08	0.14	0.05	0.08	0.13	0.04	0.06
Damper	0.11	0.15	0.19	0.07	0.11	0.13	0.07	0.10	0.16	0.08	0.12	0.17	0.06	0.09
OA filter	0.42	0.56	0.72	0.39	0.57	0.68	0.28	0.43	0.67	0.34	0.52	0.73	0.27	0.38
RA filter	0.17	0.26	0.37	0.17	0.30	0.37	0.27	0.49	0.87	0.30	0.52	0.82	0.22	0.34
Enth. wheel	0.93	1.19	1.46	0.67	0.91	1.05	0.59	0.80	1.13	0.50	0.67	0.86	0.48	0.59
Sens. wheel	0.69	0.92	1.18	0.52	0.74	0.86	0.48	0.67	0.97	0.42	0.57	0.75	0.41	0.51
Cooling coil	0.41	0.59	0.80	0.47	0.77	0.94	0.36	0.59	0.98	0.42	0.69	1.03	0.32	0.47
Heating coil	0.07	0.10	0.13	0.08	0.13	0.15	0.06	0.110	0.16	0.07	0.11	0.17	0.05	0.08
Casing losses	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Int. static pressure														
Ext. static pressure														
Total static pressure														

Size	EPD-18	EPD-24			EPD-28			EPD-35			EPD-43		
CFM	15000	11000	14000	18000	15000	18500	23000	18000	22500	27000	26000	30000	40000
Sens. wheel purge	1440	1735	1735	1735	1961	1961	1961	2297	2297	2297	2662	2662	2662
Enth. wheel purge	1718	2044	2044	2044	2291	2291	2291	2657	2657	2657	3052	3052	3052
Fan cfm	18158	14779	17779	21779	19252	22752	27252	22954	27454	31954	31714	35714	45714
OA opening (w/hood)	0.04	0.02	0.03	0.04	0.02	0.02	0.04	0.02	0.03	0.04	0.02	0.03	0.04
EA opening (w/hood)	0.07	0.12	0.17	0.26	0.13	0.18	0.26	0.14	0.20	0.27	0.13	0.16	0.27
RA or EA opening	0.32	0.21	0.31	0.46	0.15	0.21	0.30	0.15	0.21	0.28	0.14	0.18	0.30
SA or OA opening	0.14	0.05	0.08	0.13	0.06	0.09	0.50	0.06	0.10	0.14	0.06	0.08	0.14
Damper	0.17	0.08	0.11	0.16	0.08	0.12	0.17	0.08	0.12	0.16	0.10	0.13	0.22
OA filter	0.71	0.36	0.52	0.79	0.34	0.47	0.68	0.39	0.56	0.75	0.34	0.44	0.74
RA filter	0.76	0.31	0.51	0.84	0.30	0.45	0.69	0.34	0.54	0.77	0.41	0.55	0.98
Enth. wheel	0.94	0.49	0.63	0.83	0.56	0.70	0.91	0.53	0.68	0.84	0.63	0.74	1.07
Sens. wheel	0.83	0.42	0.55	0.74	0.49	0.62	0.81	0.47	0.60	0.75	0.56	0.67	0.98
Cooling coil	0.97	0.43	0.66	1.04	0.43	0.62	0.92	0.49	0.73	1.01	0.42	0.55	0.94
Heating coil	0.16	0.07	0.11	0.17	0.07	0.10	0.15	0.08	0.12	0.17	0.07	0.09	0.15
Casing losses	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Int. static pressure													
Ext. static pressure													
Total static pressure													

Notes:

1. Filter pressure drops based on 2 inches thick, 30% efficient Class II filter.
2. Cooling coil pressure drops based on 6 row, 10 fins per inch single-circuited coil.
3. Heating coil pressure drops based on 1 row, 6 fins per inch.
4. Purge volumes based on 4 inches P_{OA}-P_{RA} for enthalpy wheel and 7 inches for sensible wheel.
5. Casing losses include fan inlet losses.

Fan Data

Max motor size assumes the motor is mounted on top of the fan. A larger motor may be provided by mounting the motor and the fan on a common base. This will add length to the unit.

SIZE 3

Maximum 5 hp Motor

STATIC PRESSURE IN INCHES OF WATER																				
	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
1200	1464	.32																		
1400	1563	.38	1933	.74																
1600	1670	.45	2025	.86	2323	1.28														
1800	1786	.52	2120	.97	2406	1.44	2667	1.92												
2200	2029	.71	2327	1.21	2594	1.78	2835	2.36	3051	2.93	3265	3.53								
2600	2285	.96	2558	1.53	2799	2.14	3025	2.81	3235	3.50	3427	4.17	3608	4.48	3789	5.54				
3000	2548	1.27	2801	1.90	3024	2.57	3231	3.29	3428	4.05	3615	4.85	3792	5.65						
3400	2818	1.65	3052	2.36	3262	3.09	3455	3.86	3637	4.67	3813	5.53								
3800	3092	2.10	3311	2.90	3508	3.70	3691	4.53	3862	5.40										
4200	3370	2.65	3576	3.53	3761	4.40														
4600	3650	3.28	3844	4.25																
5000																				

Class I = Max. 3006 RPM Class II = Max. 3909 RPM

EPF150

SIZE 5

Maximum 10 hp Motor

STATIC PRESSURE IN INCHES OF WATER																				
	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
2500	1101	.59	1420	1.20																
2800	1157	.68	1449	1.32	1721	2.06														
3100	1217	.77	1487	1.45	1742	2.22														
3400	1281	.88	1534	1.60	1772	2.40	1998	3.29												
4000	1416	1.14	1644	1.94	1852	2.81	2054	3.76	2249	4.78	2436	5.88								
4600	1551	1.43	1767	2.34	1956	3.29	2135	4.31	2312	5.39	2484	6.53	2650	7.74	2811	9.02				
5200	1689	1.78	1899	2.81	2073	3.85	2238	4.94	2396	6.09	2553	7.30	2707	8.56	2858	9.88	**3004**	**11.27**	**3147**	**12.71**
5800	1833	2.20	2034	3.35	2200	4.48	2353	5.66	2500	6.89	2642	8.17	2783	9.51	2922	10.88	**3059**	**12.30**	**3194**	**13.79**
7000	2135	3.28	2306	4.61	2468	6.00	2607	7.37	2735	8.75	2861	10.20	**2983**	**11.68**	**3102**	**13.21**	**3219**	**14.77**	**3335**	**16.38**
8200	2448	4.74	2592	6.22	2739	7.83	2876	9.46	**2998**	**11.07**	**3110**	**12.67**	**3219**	**14.30**	**3327**	**16.00**	**3432**	**17.72**	**3535**	**19.48**
9400			2892	8.28	**3019**	**10.04**	**3147**	**11.90**	**3268**	**13.78**	**3378**	**15.63**	**3479**	**17.45**	**3277**	**19.31**	**3672**	**21.18**	**3766**	**23.10**
10600			**3201**	**10.84**	**3312**	**12.76**	**3426**	**14.78**	**3539**	**16.88**	**3648**	**19.00**	**3749**	**21.10**						

Class I = Max. 2302 RPM Class II = Max. 2930 RPM Class III = Max. 3767 RPM

EPF182

SIZE 5X

Maximum 10 hp Motor

STATIC PRESSURE IN INCHES OF WATER																				
	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
3000	1004	.71	1295	1.44																
3400	1061	.82	1326	1.60	1572	2.50														
3800	1123	.96	1366	1.78	1595	2.71	1810	3.76												
4200	1189	1.11	1415	1.98	1627	2.96	1829	4.03	2021	5.21										
4600	1257	1.27	1470	2.20	1667	3.23	1858	4.34	2040	5.55	2214	6.85								
5400	1394	1.66	1592	2.72	1767	3.84	1934	5.06	2098	6.34	2258	7.70	2411	9.14	2560	10.67				
6200	1533	2.11	1725	3.34	1885	4.58	2036	5.88	2181	7.26	2325	8.71	2467	10.22	2604	11.79	**2738**	**13.45**	**2869**	**15.17**
7000	1679	2.67	1862	4.05	2013	5.42	2152	6.84	2286	8.32	2415	9.86	2543	11.47	2670	13.13	**2794**	**14.83**	**2917**	**16.62**
7800	1831	3.34	1999	4.85	2148	6.39	2278	7.93	2402	9.51	2523	11.17	2639	12.86	**2754**	**14.61**	**2869**	**16.43**	**2982**	**18.28**
9400	2144	5.09	2282	6.81	2422	8.68	2548	10.54	2659	12.37	**2765**	**14.23**	**2868**	**16.14**	**2970**	**18.12**	3068	20.12	**3164**	**22.15**
11000			2583	9.40	**2703**	**11.48**	**2822**	**13.67**	**2933**	**15.86**	**3033**	**18.02**	**3126**	**20.15**	**3216**	**22.32**	3305	24.55	3393	26.82
12600			**2895**	**12.71**	**2998**	**15.00**	**3102**	**17.40**	**3207**	**19.91**	**3307**	**22.44**	**3399**	**24.93**						

Class I = Max. 2101 RPM Class II = Max. 2674 RPM Class III = Max. 3438 RPM

EPF200

Legend:

Class I = First white section

Class II = Blue shaded section

Class III = White section after blue section

Underlined figures indicate Maximum Static Efficiency

SIZE 9, 5XX

Maximum 20 hp Motor

STATIC PRESSURE IN INCHES OF WATER																				
	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
3500	868	.79	1130	1.61																
4000	912	.92	1156	1.82																
4500	962	1.06	1191	2.03	1393	3.09														
5000	1016	1.22	1231	2.26	1422	3.40	1600	4.61												
6000	1133	1.60	1324	2.79	1498	4.07	1657	5.43	1809	6.86	1954	8.31								
7000	1256	2.07	1429	3.40	1587	4.83	1735	6.33	1874	7.91	2006	9.53	2135	11.22	2259	12.90				
8000	1383	2.64	1544	4.13	1688	5.70	1825	7.34	1955	9.06	2078	10.83	2196	12.65	2311	14.54	**2424**	**16.47**	**2533**	**18.38**
9000	1514	3.33	1665	4.98	1798	6.69	1924	8.48	2046	10.34	2162	12.25	2274	14.23	2381	16.25	**2485**	**18.31**	**2587**	**20.43**
10000	1647	4.14	1788	5.95	1915	7.83	2032	9.76	2145	11.76	2254	13.81	2360	15.93	**2463**	**18.11**	**2562**	**20.33**	**2657**	**22.56**
12000	1917	6.20	2046	8.37	2159	10.55	2266	12.81	2365	15.09	**2461**	**17.43**	**2555**	**19.83**	**2648**	**22.30**	**2737**	**24.78**	**2825**	**27.32**
14000	2192	8.92	2310	11.46	**2415**	**14.00**	**2511**	**16.54**	**2604**	**19.16**	**2692**	**21.82**	**2776**	**24.50**	**2858**	**27.23**	**2939**	**30.02**	**3019**	**32.85**
16000			**2579**	**15.34**	**2677**	**18.24**	**2767**	**21.14**	**2852**	**24.06**	**2934**	**27.02**	**3013**	**30.03**	**3088**	**33.04**				

Class I = Max. 1888 RPM Class II = Max. 2403 RPM Class III = Max. 3090 RPM

EPF222

SIZE 13, 9X

Maximum 20 hp Motor

STATIC PRESSURE IN INCHES OF WATER																				
	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
4400	804	.99																		
5000	849	1.15	1057	2.20																
5600	898	1.34	1094	2.49	1270	3.71														
6200	950	1.55	1135	2.79	1299	4.10														
7400	1058	2.05	1227	3.45	1376	4.98	1515	6.55	1647	8.15										
8600	1171	2.64	1328	4.26	1466	5.94	1593	7.73	1714	9.55	1828	11.35	1942	13.28						
9800	1289	3.36	1436	5.22	1564	7.05	1683	9.00	1794	11.04	1902	13.12	2004	15.16	2104	17.25	**2204**	**19.45**		
11000	1409	4.22	1546	6.30	1668	8.36	1780	10.45	1885	12.64	1985	14.93	2081	17.23	2175	19.55	**2266**	**21.87**	**2355**	**24.21**
12200	1533	5.27	1660	7.52	1776	9.83	1882	12.11	1981	14.43	2077	16.88	2167	19.37	**2255**	**21.93**	**2342**	**24.53**	**2426**	**27.10**
14600	1787	7.94	1896	10.51	2001	13.28	2098	16.05	**2189**	**18.77**	**2275**	**21.49**	**2358**	**24.28**	**2439**	**27.18**	**2516**	**30.11**	**2592**	**33.15**
17000			2142	14.43	**2234**	**17.50**	**2324**	**20.74**	**2408**	**23.96**	**2489**	**27.18**	**2565**	**30.32**	**2639**	**33.49**	**2711**	**36.72**	**2781**	**40.01**
19400			**2394**	**19.40**	**2477**	**22.81**	**2557**	**26.35**	**2636**	**30.05**	**2711**	**33.74**	**2783**	**37.40**						

Class I = Max. 1715 RPM Class II = Max. 2183 RPM Class III = Max. 2806 RPM

EPF245

SIZE 13X, 9XX

Maximum 30 hp Motor

STATIC PRESSURE IN INCHES OF WATER																				
	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
5000	716	1.13	943	2.37																
5800	756	1.33	961	2.65																
6600	803	1.56	991	2.98	1163	4.59														
7400	854	1.82	1028	3.34	1187	5.04	1338	6.91												
8200	909	2.12	1070	3.76	1219	5.55	1358	7.48	1495	9.60										
9000	966	2.47	1115	4.20	1256	6.10	1388	8.14	1514	10.31	1638	12.63								
10600	1082	3.28	1217	5.24	1341	7.35	1460	9.58	1574	11.95	1683	14.41	1789	16.99	1895	19.72	**1999**	**22.55**		
12200	1203	4.30	1328	6.50	1439	8.83	1547	11.29	1651	13.85	1751	16.51	1848	19.27	1942	22.12	**2034**	**25.07**	**2126**	**28.16**
13800	1326	5.54	1443	7.99	1547	10.56	1643	13.21	1738	15.99	1831	18.87	1921	21.83	**2009**	**24.90**	**2094**	**28.03**	**2177**	**31.24**
17000	1576	8.74	1682	11.81	1774	14.83	1861	17.98	1941	21.17	**2019**	**24.47**	**2096**	**27.86**	**2173**	**31.36**	**2248**	**34.90**	**2321**	**38.49**
20200	1831	13.12	1928	16.84	**2013**	**20.45**	**2090**	**24.01**	**2165**	**27.72**	**2235**	**31.46**	**2303**	**35.31**	**2368**	**39.18**	**2433**	**43.15**	**2499**	**47.26**
23400			**2178**	**23.25**	**2258**	**27.52**	**2330**	**31.67**	**2397**	**35.79**	**2462**	**40.00**	**2526**	**44.34**						

Class I = Max. 1556 RPM Class II = Max. 1981 RPM Class I = Max. 2546 RPM

EPF270

Legend:
Class I = First white section
Class II = Blue shaded section
Class III = White section after blue section
Underlined figures indicate Maximum Static Efficiency

SIZE 18, 13XX

Maximum 50 hp Motor

STATIC PRESSURE IN INCHES OF WATER																				
	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
6000	639	1.33																		
7000	675	1.56	860	3.20																
8000	717	1.84	888	3.58	1041	5.56														
9000	761	2.14	921	3.99	1064	6.11	1198	8.40												
10000	809	2.50	959	4.48	1094	6.69	1219	9.13	1339	11.70										
11000	858	2.89	1000	5.02	1128	7.33	1246	9.87	1358	12.57	14.67	15.41								
13000	960	3.89	1090	6.26	1205	8.83	1313	11.55	1415	14.48	1512	17.58	1607	20.83	1699	24.14	**1790**	**27.60**		
15000	1066	5.15	1186	7.73	1292	10.60	1391	13.58	1485	16.69	1575	19.97	1662	23.45	1746	27.07	**1828**	**30.78**	**1909**	**34.60**
17000	1174	6.66	1287	9.53	1386	12.63	1477	15.90	1565	19.30	1649	22.80	1730	26.44	**1808**	**30.22**	**1884**	**34.16**	**1958**	**38.22**
21000	1399	10.60	1496	14.27	1585	17.77	1667	21.52	1744	25.50	**1817**	**29.55**	**1889**	**33.72**	**1959**	**37.98**	**2026**	**42.26**	**2092**	**46.69**
25000	1629	15.97	1714	20.50	**1794**	**24.77**	**1869**	**28.93**	**1940**	**33.30**	**2007**	**37.89**	**2071**	**42.62**	**2133**	**47.44**	**2194**	**52.36**	**2254**	**57.33**
29000			**1938**	**28.38**	**2010**	**33.57**	**2078**	**38.45**	**2143**	**43.24**	**2206**	**48.20**	**2266**	**53.37**						

Class I = Max. 1401 RPM Class II = Max. 1783 RPM Class III = Max. 2291 RPM

EPF300

SIZE 24, 18X

Maximum 50 hp Motor

STATIC PRESSURE IN INCHES OF WATER																				
	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
7000	574	1.56																		
8000	600	1.77	774	3.70																
9000	630	2.03	792	4.06	939	6.39														
11000	696	2.63	841	4.89	969	7.44	1091	10.26												
13000	769	3.38	899	5.89	1017	8.66	1126	11.71	1230	14.96	1330	18.33								
15000	845	4.31	965	7.09	1073	10.09	1174	13.32	1269	16.80	1360	20.46	1449	24.27	1536	28.22				
17000	923	5.47	1036	8.46	1136	11.77	1230	15.23	1319	18.88	1403	22.73	1485	26.82	1565	31.06	**1643**	**35.38**	**1720**	**39.84**
19000	1003	6.83	1110	10.07	1204	13.65	1291	17.37	1375	21.27	1455	25.33	1532	29.61	1606	34.05	**1678**	**38.63**	**1749**	**43.35**
23000	1169	10.25	1264	14.18	1350	18.17	1428	22.46	1502	26.94	1573	31.47	**1642**	**36.15**	**1709**	**40.97**	**1774**	**45.93**	**1838**	**51.13**
27000	1340	14.75	1424	19.53	1502	24.01	1575	28.71	**1643**	**33.71**	**1707**	**38.84**	**1769**	**44.08**	**1831**	**49.51**	**1890**	**54.92**	**1948**	**60.46**
31000	1514	20.52	1589	26.12	**1661**	**31.48**	**1728**	**36.61**	**1792**	**41.97**	**1852**	**47.59**	**1909**	**53.36**	**1965**	**59.34**	**2019**	**65.36**	**2073**	**71.52**
35000			**1758**	**34.14**	**1823**	**40.36**	**1886**	**46.32**	**1945**	**52.09**	**2002**	**58.05**	**2057**	**64.35**						

Class I = Max. 1273 RPM Class II = Max. 1620 RPM Class III = Max. 2083 RPM

EPF330

SIZE 28, 24X, 18XX

Maximum 50 hp Motor

STATIC PRESSURE IN INCHES OF WATER																				
	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
8000	496	1.73																		
9200	518	2.00																		
10400	541	2.28	689	4.55																
11600	568	2.60	707	5.04																
14000	628	3.34	751	6.11	862	9.11	968	12.42												
16400	693	4.25	803	7.35	906	10.73	999	14.21	1089	17.97										
18800	762	5.37	862	8.78	954	12.45	1043	16.36	1126	20.42	1203	24.51	1282	29.02						
23600	906	8.32	992	12.37	1070	16.67	1145	21.24	1218	25.98	1289	30.90	1357	35.95	1421	41.00	**1483**	**46.15**	**1544**	**51.45**
28400	1053	12.27	1131	17.14	1201	22.10	1266	27.23	1329	32.63	1390	38.13	1451	43.85	**1511**	**49.74**	**1569**	**55.72**	**1625**	**61.76**
33200	1204	17.52	1275	23.22	1339	28.93	1398	34.70	1455	40.71	**1509**	**46.84**	**1562**	**53.14**	**1615**	**59.66**	**1667**	**66.25**	**1719**	**73.06**
38000	1357	24.22	1423	30.84	**1482**	**37.35**	**1536**	**43.81**	**1588**	**50.43**	**1638**	**57.19**	**1687**	**64.19**	**1734**	**71.26**	**1780**	**78.45**	**1826**	**85.81**
42800			**1572**	**40.05**	**1627**	**47.40**	**1678**	**54.70**	**1726**	**61.99**	**1773**	**69.48**	**1818**	**77.02**	**1862**	**84.75**				

Class I = Max. 1151 RPM Class II = Max. 1465 RPM Class I = Max. 1884 RPM

EPF365

Legend:

Class I = First white section

Class II = Blue shaded section

Class III = White section after blue section

Underlined figures indicate Maximum Static Efficiency

SIZE 35, 28X, 24XX

Maximum 50 hp Motor

STATIC PRESSURE IN INCHES OF WATER																				
	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
10000	454	2.18																		
11500	474	2.50																		
13000	497	2.87	628	5.66																
16000	549	3.71	667	6.98	770	10.45														
19000	609	4.78	712	8.42	808	12.38	895	16.52	981	21.07										
22000	672	6.09	765	10.13	852	14.51	934	19.13	1010	23.89	1083	28.87								
25000	738	7.70	824	12.15	901	16.85	978	21.97	1050	27.21	1118	32.59	1182	38.01	1247	43.87	1314	50.25		
28000	805	9.59	885	14.45	957	19.60	1026	25.03	1094	30.75	1159	36.61	1221	42.62	1279	48.57	**1337**	**54.86**	**1394**	**61.32**
34000	943	14.45	1014	20.26	1078	26.20	1138	32.43	1195	38.84	1251	45.45	1307	52.33	**1362**	**59.43**	**1415**	**66.61**	**1466**	**73.87**
40000	1083	20.84	1148	27.73	1206	34.58	1260	41.56	1312	48.83	**1361**	**56.20**	**1410**	**63.90**	**1458**	**71.71**	**1506**	**79.75**	**1553**	**87.90**
46000	1226	29.16	1285	37.08	**1339**	**44.99**	**1388**	**52.80**	**1436**	**60.90**	**1481**	**69.04**	**1525**	**77.44**	**1568**	**86.05**	**1610**	**94.77**	**1652**	**103.72**
52000			**1425**	**48.66**	**1475**	**57.61**	**1521**	**66.45**	**1564**	**75.24**	**1607**	**84.39**	**1648**	**93.58**	**1688**	**103.00**				

Class I = Max. 1044 RPM Class II = Max. 1329 RPM Class III = Max. 1708 RPM

EPF402

SIZE 43, 35X, 28XX

Maximum 50 hp Motor (up to 75 hp motor on C-III fan)

STATIC PRESSURE IN INCHES OF WATER																				
	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
12000	408	2.60																		
13800	426	3.00																		
15600	446	3.44	566	6.82																
17400	468	3.91	581	7.54																
21000	518	5.03	618	9.17	709	13.67	794	18.53												
24600	572	6.41	661	11.02	745	16.07	822	21.35	894	26.84										
28200	629	8.11	710	13.18	786	18.73	859	24.63	926	30.63	989	36.75	1053	43.45						
35400	748	12.57	819	18.69	883	25.16	943	31.90	1003	39.04	1061	46.42	1116	53.90	1168	61.40	**1219**	**69.16**	**1269**	**77.13**
42600	871	18.66	934	25.91	991	33.33	1044	41.01	1095	49.03	1145	57.30	1195	65.91	**1244**	**74.74**	**1291**	**83.61**	**1337**	**92.71**
49800	996	26.65	1054	35.22	1105	43.65	1154	52.40	1200	61.32	**1244**	**70.47**	**1287**	**79.88**	**1330**	**89.59**	1373	99.58	1415	109.67
57000	1122	36.80	1176	46.74	**1224**	**56.49**	**1268**	**66.17**	**1310**	**76.00**	**1352**	**86.34**	**1391**	**96.62**	**1429**	**107.13**	1467	117.99	1505	129.14
64200			**1300**	**60.84**	**1345**	**71.91**	**1386**	**82.76**	**1425**	**93.66**	**1463**	**104.8**	**1500**	**116.15**	**1536**	**127.73**				

Class I = Max. 944 RPM Class II = Max. 1202 RPM Class III = Max. 1545 RPM

EPF445

SIZE 43X, 35XX

Maximum 50 hp Motor

STATIC PRESSURE IN INCHES OF WATER																				
	1" SP		2" SP		3" SP		4" SP		5" SP		6" SP		7" SP		8" SP		9" SP		10" SP	
CFM	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
16000	381	3.47																		
18000	397	3.93	510	7.95																
20000	414	4.42	520	8.67																
24000	454	5.59	550	10.46	634	15.65														
28000	499	7.05	583	12.37	663	18.29	734	24.33	805	31.07										
32000	545	8.75	622	14.63	695	21.09	763	27.86	825	34.71	887	42.18								
36000	593	10.79	665	17.24	730	24.10	794	31.48	855	39.21	910	46.79	965	54.94	1020	63.59				
44000	693	16.04	756	23.59	813	31.53	867	39.90	920	48.64	972	57.75	1022	67.09	1069	76.42	**1114**	**85.81**	**1159**	**95.68**
52000	795	22.92	853	31.88	904	40.86	952	50.22	998	59.97	1043	70.02	1088	80.46	**1132**	**91.14**	**1175**	**102.05**	**1217**	**113.23**
60000	899	31.77	952	42.11	999	52.33	1043	62.77	1086	73.74	**1126**	**84.77**	**1165**	**96.07**	**1204**	**107.73**	1243	119.72	1282	132.10
68000	1005	42.97	1054	54.77	**1098**	**66.40**	**1138**	**77.89**	**1177**	**89.76**	**1215**	**102.02**	**1251**	**114.41**	**1286**	**127.04**	1321	140.08	1355	153.12
76000			**1156**	**69.75**	**1198**	**82.94**	**1236**	**95.83**	**1272**	**108.78**	**1307**	**122.01**	**1341**	**135.50**	**1374**	**149.26**				

Class I = Max. 857 RPM Class II = Max. 1091 RPM Class I = Max. 1403 RPM

EPF490

Legend:
Class I = First white section
Class II = Blue shaded section
Class III = White section after blue section
Underlined figures indicate Maximum Static Efficiency

Coil Data Tables

Standard EPC, EPCH, EPHC Chilled Water Coils

Model	Capacity (cfm)	Finned Height	Finned Width	Face Velocity (fpm)	Standard Chilled Water Coils				
					Model	Water Pressure Drop, ft.	GPM	Leaving Air Temp. °F db/wb	Connection Size MPT
EP-3	Low 2000 Med 2500 High 3000	33 in	30 in	291 364 436	5WQ1006B	9.3 13.4 18.8	17 21 26	51.6 / 51.3 52.4 / 52 53.1 / 52.6	1.5 “
EP-5	Low 3000 Med 4000 High 4500	45 in	30 in	320 427 480	5WQ1006B	10.8 17.7 21.5	26 34 38	51.9 / 51.6 52.9 / 52.5 53.5 / 52.9	2 “
EP-9	Low 4500 Med 6000 High 8000	54 in	42 in	286 381 508	5WH1006B	3.8 6.5 10.9	38 51 68	52.1 / 51.8 52.9 / 52.6 54.1 / 53.5	1.5 “
EP-13	Low 6000 Med 8000 High 10000	66 in	42 in	312 416 519	5WH1006B	5 8.3 12.4	51 68 85	52.3 / 52 53.3 / 52.8 54.2 / 53.5	1.5 “
EP-18	Low 8000 Med 10000 High 15000	78 in	54 in	274 342 513	5WH1006B	6 8.9 18.2	68 85 128	51.4 / 51.2 52.2 / 51.8 53.8 / 53.1	2 “
EP-24	Low 11000 Med 14000 High 18000	90 in	54 in	326 415 533	5WH1006B	8.5 13 20.3	94 119 153	52 / 51.7 52.9 / 52.5 53.9 / 53.3	2 “
EP-28	Low 15000 Med 18500 High 23000	99 in	66 in	331 408 507	5WL1006B	4.9 7.1 10.5	128 158 196	52.4 / 52.1 53.1 / 52.7 53.9 / 53.3	2.5 “
EP-35	Low 18000 Med 22500 High 27000	111 in	66 in	354 442 531	5WL1006B	5.5 8.2 11.6	153 191 232	52.6 / 52.3 53.5 / 53 54.2 / 53.5	2.5 “
EP-43	Low 26000 Med 30000 High 40000	123 in	90 in	338 390 520	5WS1006B	5.9 7.7 13	221 256 341	52.5 / 52.1 53 / 52.6 54.1 / 53.4	2.5 “

Design basis: Entering air temperature: 73°Fdb/66°F wb; entering water temperature: 45°F; water temperature rise: 11°±2°F.

Standard EPC, EPCH, EPHC DX Coils

Model	Capacity (cfm)	Finned Height	Finned Width	Face Velocity (fpm)	Standard Chilled Water Coils			
					Model	Leaving Air Temp. °F db / wb	Suction Line Connection Size MPT	Liquid Line Connection Size MPT
EP-3	Low 2000 Med 2500 High 3000	33 in	30 in	291 364 436	5EN1006B	53.2 / 53.2 54.4 / 54.3 55.2 / 55	(1) 1-5/8 (1) 1-5/8 (1) 1-5/8	(1) 1-3/8 (1) 1-3/8 (1) 1-3/8
EP-5	Low 3000 Med 4000 High 4500	45 in	30 in	320 427 480	5EN1006B	53.6 / 53.5 55.2 / 54.9 55.6 / 55.3	(1) 1-5/8 (1) 1-5/8 (1) 1-5/8	(1) 1-3/8 (1) 1-3/8 (1) 1-3/8
EP-9	Low 4500 Med 6000 High 8000	54 in	42 in	286 381 508	5EN1006B	51.7 / 51.7 53.4 / 53.2 54.8 / 54.6	(2) 1-5/8 (2) 1-5/8 (2) 1-5/8	(2) 1-1/8 (2) 1-1/8 (2) 1-1/8
EP-13	Low 6000 Med 8000 High 10000	66 in	42 in	312 416 519	5EN1006B	52.2 / 52.2 53.5 / 53.5 54.8 / 54.6	(2) 1-5/8 (2) 1-5/8 (2) 1-5/8	(2) 1-3/8 (2) 1-3/8 (2) 1-3/8
EP-18	Low 8000 Med 10000 High 15000	78 in	54 in	274 342 513	5EN1006B	51.1 / 51.1 52.1 / 52.1 54.6 / 54.2	(2) 2-1/8 (2) 2-1/8 (2) 2-1/8	(2) 1-3/8 (2) 1-3/8 (2) 1-3/8
EP-24	Low 11000 Med 14000 High 18000	90 in	54 in	326 415 533	5EN1006B	51.7 / 51.7 53.1 / 53.1 54.7 / 54.6	(2) 2-1/8 (2) 2-1/8 (2) 2-1/8	(2) 1-3/8 (2) 1-3/8 (2) 1-3/8
EP-28	Low 15000 Med 18500 High 23000	99 in	66 in	331 408 507	5EN1006B	52.1 / 51.8 53.1 / 53.1 54.7 / 54.2	(3) 2-1/8 (3) 2-1/8 (3) 2-1/8	(3) 1-3/8 (3) 1-3/8 (3) 1-3/8
EP-35	Low 18000 Med 22500 High 27000	111 in	66 in	354 442 531	5EN1006B	52.3 / 52.2 53.9 / 53.5 54.9 / 54.6	(3) 2-1/8 (3) 2-1/8 (3) 2-1/8	(3) 1-3/8 (3) 1-3/8 (3) 1-3/8
EP-43	Low 26000 Med 30000 High 40000	123 in	90 in	338 390 520	5EN1006B	52 / 51.8 52.7 / 52.5 54.4 / 54.2	(3) 2-5/8 (3) 2-5/8 (3) 2-5/8	(3) 1-5/8 (3) 1-5/8 (3) 1-5/8

Design basis standard: Entering air temperature: 73°Fdb/66°Fwb; entering water temperature: 45°F; water temperature rise: 11°±2°F. DX coil suction temp.: 45°F; refrigerant: R-22.

Increased Capacity EPC, EPCH, EPHC Chilled Water Coils

Model	Capacity (cfm)	Finned Height	Finned Width	Face Velocity (fpm)	Standard Chilled Water Coils				
					Model	Water Pressure Drop, ft.	GPM	Leaving Air Temp. °F db/wb	Connection Size MPT
EP-3	Low 2000 Med 2500 High 3000	33 in	30 in	291 364 436	5WH0808B	9.1 13.7 18.8	35 44 52	51.9 / 51.8 53.1 / 52.9 54.3 / 53.9	1.5 “
EP-5	Low 3000 Med 4000 High 4500	45 in	30 in	320 427 480	5WH1008B	9.6 16 19.7	52 70 78	50.8 / 50.7 52.3 / 52.2 53 / 52.8	2 “
EP-9	Low 4500 Med 6000 High 8000	54 in	42 in	286 381 508	5WL1008B	6.1 10.2 17	78 105 139	50.4 / 50.3 51.7 / 51.6 53.4 / 53.2	2 “
EP-13	Low 6000 Med 8000 High 10000	66 in	42 in	312 416 519	5WL1008B	7 11.7 17.4	105 139 174	50.8 / 50.7 52.2 / 52.1 53.5 / 53.3	2.5 “
EP-18	Low 8000 Med 10000 High 15000	78 in	54 in	274 342 513	5WS1008B	5.4 8.1 16.9	139 174 261	50.4 / 50.3 51.4 / 51.3 53.6 / 53.4	2.5 “
EP-24	Low 11000 Med 14000 High 18000	90 in	54 in	326 415 533	5WS1008B	6.9 10.7 16.9	192 244 314	51.2 / 51.1 52.4 / 52.2 53.8 / 53.6	3 “
EP-28	Low 15000 Med 18500 High 23000	99 in	66 in	331 408 507	5WM1008B	5.3 7.8 11.7	261 322 401	51.8 / 51.7 52.9 / 52.7 54.1 / 53.9	2.5 “
EP-35	Low 18000 Med 22500 High 27000	111 in	66 in	354 442 531	5WM1008B	6.6 10 14.1	313 392 470	52.2 / 52.1 53.4 / 53.2 54.4 / 54.1	2.5 “
EP-43	Low 26000 Med 30000 High 40000	123 in	90 in	338 390 520	5WT1006B	6.4 8.5 14.8	453 523 697	56.9 / 56.5 57.7 / 57.3 59.4 / 58.7	3 “

Design basis: Entering air temperature: 95°Fdb/78°Fwb; entering water temperature: 45°F; water temperature rise: 11°±2°F.

Increased Capacity EPC, EPCH, EPHC DX Coils

Model	Capacity (cfm)	Finned Height	Finned Width	Face Velocity (fpm)	Standard Chilled Water Coils			
					Model	Leaving Air Temp. °F db / wb	Suction Line Connection Size MPT	Liquid Line Connection Size MPT
EP-3	Low 2000 Med 2500 High 3000	33 in	30 in	291 364 436	5EN1008B	51.5 / 51.5 52.2 / 52.2 54.3 / 54.3	(1) 1-5/8 (1) 2-1/8 (1) 2-1/8	(1) 1-3/8 (1) 1-3/8 (1) 1-3/8
EP-5	Low 3000 Med 4000 High 4500	45 in	30 in	320 427 480	5EN1008B	52.1 / 52.1 54.2 / 54.2 55 / 55	(1) 2-1/8 (1) 2-1/8 (1) 2-5/8	(1) 1-3/8 (1) 1-3/8 (1) 1-3/8
EP-9	Low 4500 Med 6000 High 8000	54 in	42 in	286 381 508	5EN1008B	51.3 / 51.3 53.4 / 53.4 56.3 / 56.3	(2) 2-1/8 (2) 2-1/8 (2) 2-1/8	(2) 1-3/8 (2) 1-3/8 (2) 1-3/8
EP-13	Low 6000 Med 8000 High 10000	66 in	42 in	312 416 519	5EN1008B	52.1 / 52.1 54.3 / 54.3 56.5 / 56.5	(2) 2-1/8 (2) 2-1/8 (2) 2-5/8	(2) 1-3/8 (2) 1-3/8 (2) 1-3/8
EP-18	Low 8000 Med 10000 High 15000	78 in	54 in	274 342 513	5EN1008B	51.6 / 51.6 52.9 / 52.9 55.8 / 55.8	(2) 2-1/8 (2) 2-5/8 (2) 2-5/8	(2) 1-5/8 (2) 1-5/8 (2) 1-5/8
EP-24	Low 11000 Med 14000 High 18000	90 in	54 in	326 415 533	5EN1008B	52.3 / 52.3 54.1 / 54.1 56.1 / 56	(2) 2-5/8 (2) 2-5/8 (2) 2-1/8	(2) 1-5/8 (2) 1-5/8 (2) 1-5/8
EP-28	Low 15000 Med 18500 High 23000	99 in	66 in	331 408 507	5EN1008B	52.1 / 52.1 53.5 / 53.5 55.4 / 55.4	(3) 2-5/8 (3) 2-5/8 (3) 2-5/8	(3) 1-5/8 (3) 1-5/8 (3) 1-5/8
EP-35	Low 18000 Med 22500 High 27000	111 in	66 in	354 442 531	5EN1008B	52.5 / 52.5 54.2 / 54.2 55.8 / 55.8	(3) 2-5/8 (3) 2-5/8 (3) 2-5/8	(3) 1-5/8 (3) 1-5/8 (3) 1-5/8
EP-43	Low 26000 Med 30000 High 40000	123 in	90 in	338 390 520	5EN1008B	52.6 / 52.6 53.7 / 53.7 56.5 / 56.5	* (3) 2-5/8 (3) 2-5/8	(3) 1-5/8 (3) 1-5/8 (3) 1-5/8

Design basis: Entering air temperature: 95°Fdb/78°Fwb; entering water temperature: 45°F; water temperature rise: 11°±2°F. DX coil suction temperature: 45°F; refrigerant: R-22. *(2) 2-5/8 & (1) 2-1/8

Standard EPD Chilled Water Coils

Model	Capacity (cfm)	Finned Height	Finned Width	Face Velocity (fpm)	Standard Chilled Water Coils				
					Model	Water Pressure Drop, ft.	GPM	Leaving Air Temp. °F db/wb	Connection Size MPT
EPD-3	Low 2,513 Med 2,763 High 3,013	33 in	30 in	366 402 438	5WQ1006B	10.9 12.8 14.9	19 21 22	52.9 / 52.7 53.2 / 52.9 53.5 / 53.2	1.5 ”
EPD-5	Low 3,695 Med 4,695 High 5,195	45 in	30 in	394 501 554	5WQ1006B	13.9 16.4 19.5	30 33 36	52.8 / 52.6 54.2 / 54.0 54.5 / 54.2	2 ”
EPD-9	Low 5,406 Med 6,906 High 8,906	54 in	42 in	343 438 565	5WH1006B	5.5 8.5 11.5	46 59 70	53.5 / 52.3 53.3 / 53.0 54.5 / 54.2	1.5 ”
EPD-13	Low 7,168 Med 9,168 High 11,168	66 in	42 in	372 476 580	5WH1006B	5.1 8.0 13.8	52 66 88	53.5 / 53.3 54.3 / 54.0 54.6 / 54.3	1.5 ”
EPD-18	Low 9,440 Med 11,440 High 16,440	78 in	54 in	323 391 562	5WH1006B	7.0 9.8 18.5	74 90 129	52.3 / 52.1 52.9 / 52.7 54.1 / 53.8	2 ”
EPD-24	Low 12,735 Med 15,735 High 19,735	90 in	54 in	377 466 585	5WH1006B	11.1 16.2 17.9	109 134 143	52.4 / 52.2 53.1 / 52.8 54.6 / 54.2	2 ”
EPD-28	Low 16,961 Med 20,461 High 24,961	99 in	66 in	374 451 550	5WH1006B	10.6 14.8 18.3	103 125 141	52.0 / 51.4 52.5 / 51.8 53.4 / 52.5	1.5 ”
EPD-35	Low 20,297 Med 24,797 High 29,297	111 in	66 in	399 487 576	5WL1006B	6.5 9.3 10.7	170 206 224	52.9 / 52.7 53.6 / 53.3 54.5 / 54.2	2.5 ”
EPD-43	Low 28,662 Med 32,662 High 42,662	123 in	90 in	373 425 555	5WL1006B	10.8 16.0 19.0	230 287 317	52.6 / 52.4 52.6 / 52.4 54.3 / 53.9	2.5 ”

Design basis: Entering air temperature: 73°Fdb/66°Fwb; entering water temperature: 45°F; water temperature rise: 11°±2°F.
Note 1: CFM capacity includes typical values for sensible wheel purge volume.

Standard EPD DX Coils

Model	Capacity (cfm)	Finned Height	Finned Width	Face Velocity (fpm)	Standard Chilled Water Coils			
					Model	Leaving Air Temp. °F db / wb	Suction Line Connection Size MPT	Liquid Line Connection Size MPT
EPD-3	Low 2,513 Med 2,763 High 3,013	33 in	30 in	366 402 438	5EN1006B	54.5 / 54.4 54.9 / 54.9 55.3 / 55.2	(1) 1-5/8 (1) 1-5/8 (1) 1-5/8	(1) 1-3/8 (1) 1-3/8 (1) 1-3/8
EPD-5	Low 3,695 Med 4,695 High 5,195	45 in	30 in	394 501 554	5EN1006B	54.9 / 54.8 55.9 / 55.8 56.4 / 56.2	(1) 1-5/8 (1) 1-5/8 (1) 1-5/8	(1) 1-3/8 (1) 1-3/8 (1) 1-3/8
EPD-9	Low 5,406 Med 6,906 High 8,906	54 in	42 in	343 438 565	5EN1006B	52.7 / 52.7 53.9 / 53.8 55.2 / 55.0	(2) 1-5/8 (2) 1-5/8 (2) 1-5/8	(2) 1-1/8 (2) 1-1/8 (2) 1-1/8
EPD-13	Low 7,168 Med 9,168 High 11,168	66 in	42 in	372 476 580	5EN1006B	53.1 / 53.1 54.5 / 54.2 55.4 / 55.2	(2) 1-5/8 (2) 1-5/8 (2) 1-5/8	(2) 1-3/8 (2) 1-3/8 (2) 1-3/8
EPD-18	Low 9,440 Med 11,440 High 16,440	78 in	54 in	323 391 562	5EN1006B	51.8 / 51.8 52.8 / 52.8 54.8 / 54.7	(2) 2-1/8 (2) 2-1/8 (2) 2-1/8	(2) 1-3/8 (2) 1-3/8 (2) 1-3/8
EPD-24	Low 12,735 Med 15,735 High 19,735	90 in	54 in	377 466 585	5EN1006B	52.6 / 52.6 53.8 / 53.7 55.1 / 54.9	(2) 2-1/8 (2) 2-1/8 (2) 2-1/8	(2) 1-3/8 (2) 1-3/8 (2) 1-3/8
EPD-28	Low 16,961 Med 20,461 High 24,961	99 in	66 in	374 451 550	5EN1006B	52.6 / 52.6 53.7 / 53.6 54.9 / 54.7	(3) 2-1/8 (3) 2-1/8 (3) 2-1/8	(3) 1-3/8 (3) 1-3/8 (3) 1-3/8
EPD-35	Low 20,297 Med 24,797 High 29,297	111 in	66 in	399 487 576	5EN1006B	52.9 / 52.9 54.1 / 54.0 55.2 / 55.0	(3) 2-1/8 (3) 2-1/8 (3) 2-1/8	(3) 1-3/8 (3) 1-3/8 (3) 1-3/8
EPD-43	Low 28,662 Med 32,662 High 42,662	123 in	90 in	373 425 555	5EN1006B	52.4 / 52.4 53.2 / 53.1 54.7 / 54.6	(3) 2-5/8 (3) 2-5/8 (3) 2-5/8	(3) 1-5/8 (3) 1-5/8 (3) 1-5/8

Design Basis: Entering air temperature: 73°Fdb/66°Fwb; DX coil suction temperature: 45°F; refrigerant: R-22.
Note 1: CFM capacity includes typical values for sensible wheel purge volume.

Standard EPH, EPCH, EPHC Hot Water Coils

Model	Capacity (cfm)	Finned Height	Finned Width	Face Velocity (fpm)	Standard Chilled Water Coils				
					Model	Water Pressure Drop, ft.	GPM	Leaving Air Temp. °F db/wb	Connection Size MPT
EP-3	Low 2000 Med 2250 High 2500	33 in	30 in	291 327 364	5MH0601B	0.2 0.2 0.3	8 9 10	66.7 65.3 64	1.5 ”
EP-5	Low 3000 Med 4000 High 4500	45 in	30 in	320 427 480	5MH0601B	0.1 0.2 0.3	12 16 17	65.6 62.1 60	2 ”
EP-9	Low 4500 Med 6000 High 8000	54 in	42 in	286 381 508	5MH0601B	0.3 0.5 0.9	17 23 31	68.4 65 61	1.5 ”
EP-13	Low 6000 Med 8000 High 10000	66 in	42 in	312 416 519	5MH0601B	0.4 0.7 1.1	23 31 39	67.4 64 61	1.5 ”
EP-18	Low 8000 Med 10000 High 15000	78 in	54 in	274 342 513	5MH0601B	0.6 1 2.2	31 39 58	70.1 67 61.5	1.5 ”
EP-24	Low 11000 Med 14000 High 18000	90 in	54 in	326 415 533	5MH0601B	0.5 0.8 1.3	43 54 70	68 64.2 61	2 ”
EP-28	Low 15000 Med 18500 High 23000	99 in	66 in	331 408 507	5MH0601B	1.3 1.9 2.9	58 72 89	68 65.4 32.1	1.5 ”
EP-35	Low 18000 Med 22500 High 27000	111 in	66 in	354 442 531	5MH0601B	1.6 2.5 3.6	70 87 105	67.1 63.9 61.5	1.5 ”
EP-43	Low 26000 Med 30000 High 40000	123 in	90 in	338 390 520	5MH0601B	3.1 4.1 7.3	101 116 155	68.4 66.3 62.3	1.5 ”

Design Basis: Entering air temperature: 30°Fwb; entering water temperature: 180°F; leaving water temperature: 160±3°F.

Increased Capacity EPH, EPCH, EPHC Hot Water Coils

Model	Capacity (cfm)	Finned Height	Finned Width	Face Velocity (fpm)	Standard Chilled Water Coils				
					Model	Water Pressure Drop, ft.	GPM	Leaving Air Temp. °F db/wb	Connection Size MPT
EP-3	Low 2000 Med 2250 High 2500	33 in	30 in	291 327 364	5MH0702B	0.7 0.9 1.2	14 16 18	76.6 73.6 71	1.5 ”
EP-5	Low 3000 Med 4000 High 4500	45 in	30 in	320 427 480	5MH0702B	0.6 1 1.3	22 29 32	74.3 67.1 64	2 ”
EP-9	Low 4500 Med 6000 High 8000	54 in	42 in	286 381 508	5MH0702B	1.3 2.3 4.1	32 43 58	78.7 71.1 64	1.5 ”
EP-13	Low 6000 Med 8000 High 10000	66 in	42 in	312 416 519	5MH0702B	1.8 3.2 4.9	43 58 72	76.4 69 63.1	1.5 ”
EP-18	Low 8000 Med 10000 High 15000	78 in	54 in	274 342 513	5MH0702B	1.6 2.4 5.2	58 72 108	81 74.8 64.1	2 ”
EP-24	Low 11000 Med 14000 High 18000	90 in	54 in	326 415 533	5MH0702B	2.4 3.8 6	79 101 130	76.1 69.6 63	2 ”
EP-28	Low 15000 Med 18500 High 23000	99 in	66 in	331 408 507	5MH0702B	5.5 8.3 12.7	108 134 166	76.3 70.6 64.8	1.5 ”
EP-35	Low 18000 Med 22500 High 27000	111 in	66 in	354 442 531	5MH0702B	5.8 8.9 12.7	130 162 195	74.5 68.4 64	2 ”
EP-43	Low 26000 Med 30000 High 40000	123 in	90 in	338 390 520	5MS0802B	2.6 3.5 6.2	188 216 289	80.6 76.6 68.7	2.5 ”

Design Basis: Entering air temperature: 0°F; entering water temperature: 180°F; leaving water temperature: 160±3°F.

Standard EPD Hot Water Coils

Model	Capacity (cfm)	Finned Height	Finned Width	Face Velocity (fpm)	Standard Chilled Water Coils				
					Model	Water Pressure Drop, ft.	GPM	Leaving Air Temp. °F db	Connection Size MPT
EPD-3	Low 2,513 Med 2,763 High 3,013	33 in	30 in	366 402 438	5MQ0601B	0.39 0.57 0.57	8 10 10	62.3 61.9 60.5	1.5 “
EPD-5	Low 3,695 Med 4,695 High 5,195	45 in	30 in	394 501 554	5MQ0601B	0.52 0.87 0.97	12 16 17	61.6 59.0 57.9	1.5 “
EPD-9	Low 5,406 Med 6,906 High 8,906	54 in	42 in	343 438 565	5MH0601B	0.34 0.58 0.99	17 23 31	62.2 59.8 57.3	1.5 “
EPD-13	Low 7,168 Med 9,168 High 11,168	66 in	42 in	372 476 580	5MH0601B	0.67 0.90 1.00	28 33 35	62.4 59.3 56.6	1.5 “
EPD-18	Low 9,440 Med 11,440 High 16,440	78 in	54 in	323 391 562	5MH0601B	0.87 1.06 2.18	35 39 58	65.1 61.9 58.0	1.5 “
EPD-24	Low 12,735 Med 15,735 High 19,735	90 in	54 in	377 466 585	5MH0601B	0.61 0.92 1.28	43 54 65	62.2 59.9 57.3	2 “
EPD-28	Low 16,961 Med 20,461 High 24,961	99 in	66 in	374 451 550	5MH0601B	1.31 1.93 2.83	58 72 89	62.9 60.7 58.6	1.5 “
EPD-35	Low 20,297 Med 24,797 High 29,297	111 in	66 in	399 487 576	5MH0601B	2.24 2.62 2.78	83 90 93	62.9 60.2 60.3	1.5 “
EPD-43	Low 28,662 Med 32,662 High 42,662	123 in	90 in	373 425 555	5MH0601B	3.55 3.99 4.94	113 120 135	64.0 62.2 58.5	1.5 “

Design Basis: Entering air temperature: 0°F; entering water temperature: 180°F; leaving water temperature: 160±3°F.
Note 1: CFM capacity includes typical values for sensible wheel purge volume.

Increased Capacity EPD Hot Water Coils

Model	Capacity (cfm)	Finned Height	Finned Width	Face Velocity (fpm)	Standard Chilled Water Coils				
					Model	Water Pressure Drop, ft.	GPM	Leaving Air Temp. °F db	Connection Size MPT
EPD-3	Low 2,513 Med 2,763 High 3,013	33 in	30 in	366 402 438	5MH0702B	1.43 1.70 1.99	20 22 24	74.1 72.0 70.1	1.5 “
EPD-5	Low 3,695 Med 4,695 High 5,195	45 in	30 in	394 501 554	5MH0702B	1.87 2.48 2.74	30 35 37	72.6 66.7 64.3	2 “
EPD-9	Low 5,406 Med 6,906 High 8,906	54 in	42 in	343 438 565	5MH0702B	2.54 3.50 4.73	46 55 65	77.4 71.4 65.2	1.5 “
EPD-13	Low 7,168 Med 9,168 High 11,168	66 in	42 in	372 476 580	5MH0702B	3.12 4.24 5.39	59 70 80	75.3 69.2 64.5	1.5 “
EPD-18	Low 9,440 Med 11,440 High 16,440	78 in	54 in	323 391 562	5MH0702B	4.67 6.38 8.86	84 100 120	79.9 75.3 66.1	2 “
EPD-24	Low 12,735 Med 15,735 High 19,735	90 in	54 in	377 466 585	5MH0702B	6.38 8.03 9.85	110 125 140	76.1 70.7 65.0	2 “
EPD-28	Low 16,961 Med 20,461 High 24,961	99 in	66 in	374 451 550	5MH0702B	8.06 10.24 13.27	140 160 185	76.5 71.9 67.1	1.5 “
EPD-35	Low 20,297 Med 24,797 High 29,297	111 in	66 in	399 487 576	5MH0702B	10.51 12.21 14.97	173 188 210	75.4 70.1 66.1	1.5 “
EPD-43	Low 28,662 Med 32,662 High 42,662	123 in	90 in	373 425 555	5MS0702B	2.65 3.27 4.69	240 270 330	75.4 72.4 66.0	2.5 “

Design Basis: Entering air temperature: 0°F; entering water temperature: 180°F; leaving water temperature: 160±3°F.
Note 1: CFM capacity includes typical values for sensible wheel purge volume.

Standard EPH, EPCH, EPHC Electric Coils

Model	Capacity (cfm)	Electric Heater kW	Nominal Temp Rise at Rated Capacity	FLA @ 208 Volts 3Ø / 60 hz	FLA @ 240 Volts 3Ø / 60 hz	FLA @ 480 Volts 3Ø / 60 hz
EPH-3	Low 2000 Med 2250 High 3000	10	15.8 14.0 12.6	27.8	24.1	12.0
EPH-5	Low 3000 Med 4000 High 4500	15	15.8 11.9 10.5	41.6	36.1	18.0
EPH-9	Low 4500 Med 6000 High 8000	20	14.0 10.5 7.9	55.5	48.1	24.1
EPH-13	Low 6000 Med 8000 High 10000	25	13.2 9.9 7.9	69.4	60.1	30.1
EPH-18	Low 8000 Med 10000 High 15000	35	13.8 11.1 7.4	97.2	84.2	42.1
EPH-24	Low 11000 Med 14000 High 18000	45	12.9 10.2 7.9	124.9	108.3	54.1
EPH-28	Low 15000 Med 18500 High 23000	60	12.6 10.2 8.2	-	-	72.2
EPH-35	Low 18000 Med 22500 High 27000	75	13.2 10.5 8.8	-	-	90.2
EPH-43	Low 26000 Med 30000 High 40000	100	12.2 10.5 7.9	-	-	120.3

Increased Capacity EPH, EPCH, EPHC Electric Coils

Model	Capacity (cfm)	Electric Heater kW	Nominal Temp Rise at Rated Capacity	FLA @ 208 Volts 3Ø / 60 hz	FLA @ 240 Volts 3Ø / 60 hz	FLA @ 480 Volts 3Ø / 60 hz
EPH-3	Low 2000 Med 2250 High 3000	30	47.4 42.1 37.9	83.3	72.2	36.1
EPH-5	Low 3000 Med 4000 High 4500	45	47.4 35.6 31.6	124.9	108.3	54.1
EPH-9	Low 4500 Med 6000 High 8000	60	42.1 31.6 23.7	166.5	144.3	72.2
EPH-13	Low 6000 Med 8000 High 10000	75	39.5 29.6 23.7	208.2	180.4	90.2
EPH-18	Low 8000 Med 10000 High 15000	105	41.5 33.2 22.1	291.5	252.6	126.3
EPH-24	Low 11000 Med 14000 High 18000	135	38.8 30.5 23.7	374.7	324.8	162.4
EPH-28	Low 15000 Med 18500 High 23000	180	37.9 30.7 24.7	-	-	216.5
EPH-35	Low 18000 Med 22500 High 27000	225	39.5 31.6 26.3	-	-	270.6
EPH-43	Low 26000 Med 30000 High 40000	300	36.5 31.6 23.7	-	-	360.8

Note 1: Electric heating coils require a separate power connection.
Note 2: To determine Minimum Ampacity use 125% of the listed full load amps.
Note 3: Fuse Recommendation: Use 125% of the listed full load amps and select the next larger size Dual-Element Time-Delay Fuses.
Note 4: $kw = \frac{cfm \times \triangle T}{360}$

Standard EPD Electric Coils

Model	Capacity (cfm)	Electric Heater kW	Nominal Temp Rise at Rated Capacity	FLA @ 208 Volts 3Ø / 60 hz	FLA @ 240 Volts 3Ø / 60 hz	FLA @ 480 Volts 3Ø / 60 hz
EPD-3	Low 2,513 Med 2,763 High 3,013	10	15.8 14.0 12.6	27.8	24.1	12.0
EPD-5	Low 3,695 Med 4,695 High 5,195	15	15.8 11.9 10.5	41.6	36.1	18.0
EPD-9	Low 5,406 Med 6,906 High 8,906	20	14.0 10.5 7.9	55.5	48.1	24.1
EPD-13	Low 7,168 Med 9,168 High 11,168	25	13.2 9.9 7.9	69.4	60.1	30.1
EPD-18	Low 9,440 Med 11,440 High 16,440	35	13.8 11.1 7.4	97.2	84.2	42.1
EPD-24	Low 12,735 Med 15,735 High 19,735	45	12.9 10.2 7.9	124.9	108.3	54.1
EPD-28	Low 16,961 Med 20,461 High 24,961	60	12.6 10.2 8.2	-	-	72.2
EPD-35	Low 20,297 Med 24,797 High 29,297	75	13.2 10.5 8.8	-	-	90.2
EPD-43	Low 28,662 Med 32,662 High 42,662	100	12.2 10.5 7.9	-	-	120.3

Increased Capacity EPD Electric Coils

Model	Capacity (cfm)	Electric Heater kW	Nominal Temp Rise at Rated Capacity	FLA @ 208 Volts 3Ø / 60 hz	FLA @ 240 Volts 3Ø / 60 hz	FLA @ 480 Volts 3Ø / 60 hz
EPD-3	Low 2,513 Med 2,763 High 3,013	30	37.7 34.3 31.5	83.3	72.2	36.1
EPD-5	Low 3,695 Med 4,695 High 5,195	45	38.5 30.3 27.4	124.9	108.3	54.1
EPD-9	Low 5,406 Med 6,906 High 8,906	60	35.1 27.5 21.3	166.5	144.3	72.2
EPD-13	Low 7,168 Med 9,168 High 11,168	75	33.1 25.9 21.2	208.2	180.4	90.2
EPD-18	Low 9,440 Med 11,440 High 16,440	105	35.1 29.0 20.2	291.5	252.6	126.3
EPD-24	Low 12,735 Med 15,735 High 19,735	135	33.5 27.1 21.6	374.7	324.8	162.4
EPD-28	Low 16,967 Med 20,461 High 24,961	180	33.5 27.8 22.8	-	-	216.5
EPD-35	Low 20,297 Med 24,797 High 29,297	225	35.0 28.7 24.3	-	-	270.6
EPD-43	Low 28,662 Med 32,662 High 42,662	300	33.1 29.0 22.2	-	-	360.8

Note 1: Electric heating coils require a separate power connection.
Note 2: To determine Minimum Ampacity use 125% of the listed full load amps.
Note 3: Fuse Recommendation: Use 125% of the listed full load amps and select the next larger size Dual-Element Time-Delay Fuses.
Note 4: CFM capacity includes typical values for sensible wheel purge volume.
Note 5: $kw = \frac{cfm \times \triangle T}{360}$

HP	3 Phase Full Load Amps			Minimum Efficiency Std. Motors	Minimum Efficiency High Eff. Motors
	208V	240V	480V		
1/6	0.6	0.6	0.3	-	-
1/4	1.0	1.0	0.5	-	-
1/2	2.4	2.2	1.1	-	-
3/4	3.5	3.2	1.6	73	-
1	4.6	4.2	2.1	76.6	82.5
1-1/2	6.6	6.0	3.0	80	84
2	7.5	6.8	3.4	79.9	84
3	10.6	9.6	4.8	83.1	86.5
5	16.7	15.2	7.6	83.4	87.5
7-1/2	24.2	22	11	86.6	88.5
10	30.8	28	14	88.2	89.5
15	46.2	42	21	89.3	90.2
20	59.4	54	27	90.4	91
25	74.8	68	34	90.5	92.4
30	88.0	80	40	89.3	93
40	114	104	52	90	93
50	-	130	65	91.2	94.1
60	-	-	77	92	93.6
75	-	-	96	92.4	94.1
100	-	-	124	92.5	94.1
HP	3Ø Variable Frequency Drive (VFD)			Yaskawa Model #	
1/2	3.9	3.9	-	CIMR-V7AM20P4	
1/2	-	-	1.6	CIMR-V7AM40P2	
1	6.4	6.4	-	CIMR-V7AM20P7	
1	-	-	4.7	CIMR-V7AM40P7	
	Control Power Transformer (CPT)				
150 VA	0.7	0.6	0.4		
500 VA	2.4	2.0	1.0		
3 KVA	14.4	13.0	6.25		

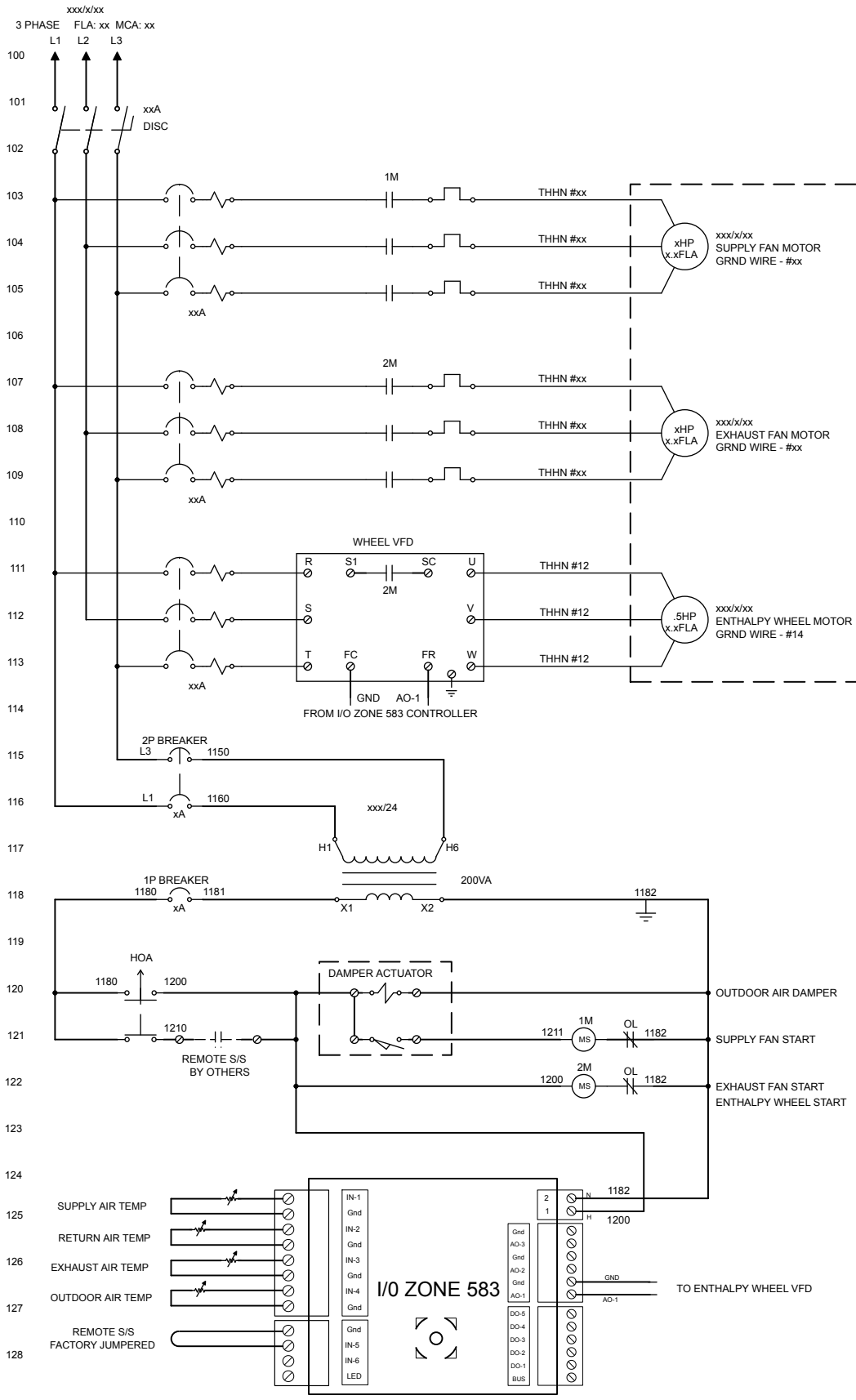
Note 1: To determine Minimum Circuit Ampacity, add the FLA's for each fan motor, the FLA of the constant speed wheel motor or the Variable Frequency Drive. Then add the CPT amps and 25 percent of the largest motor FLA.

Note 2: Maximum Overcurrent Protection(MOCP) is 125% of largest motor plus FLA, per instructions in UL 1995.

Note 3: Use a 3KVA transformer for units with 120 volt lights. Usa a 500 VA transformer if controls are included, otherwise use 180 VA transformer.

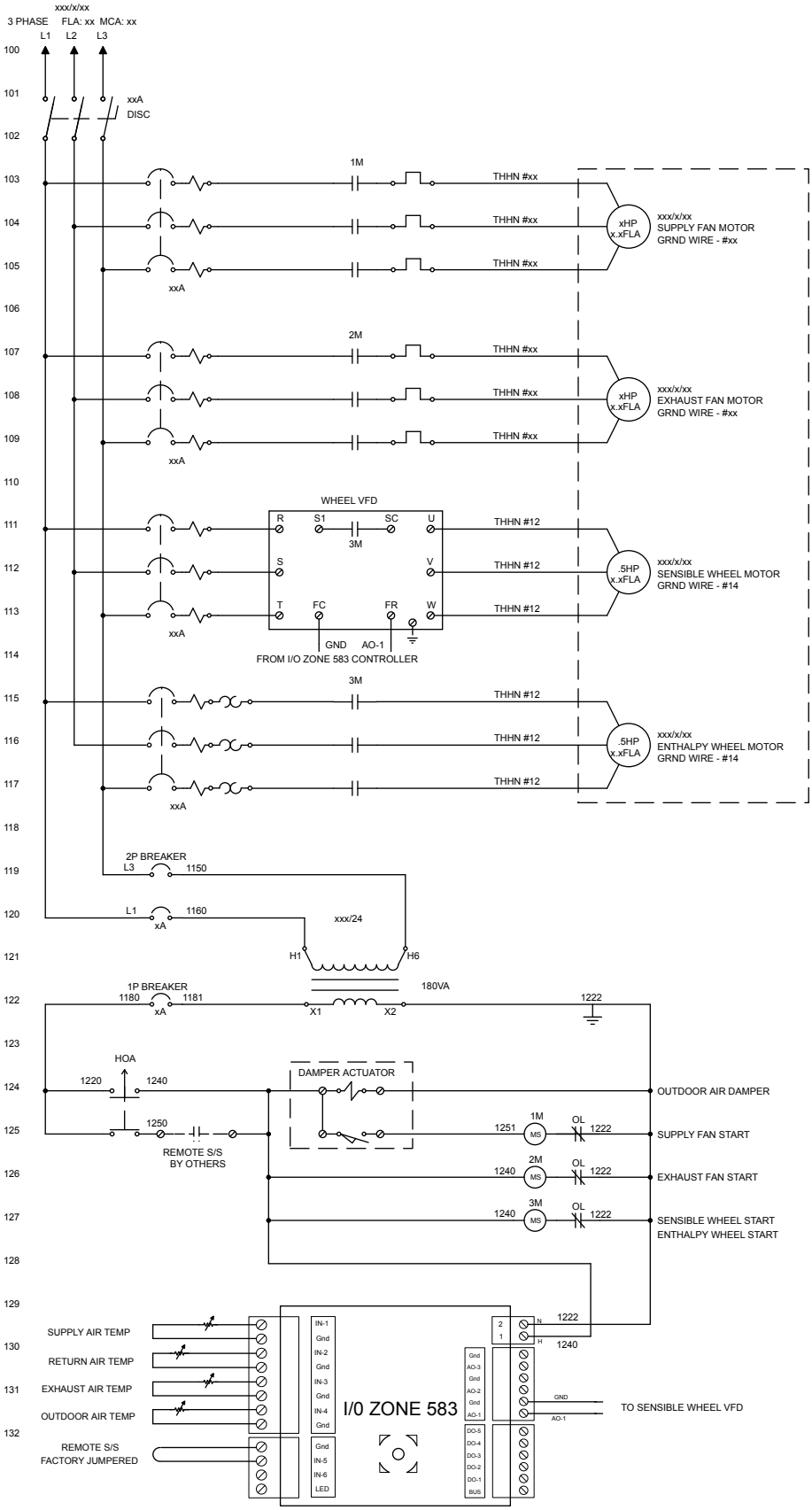
Single Wheel Electrical Schematic

Typical EP Series Unit with Variable Speed Wheel



Dual Wheel Electrical Schematic

Typical EPD Series Unit with Variable Speed Wheel



Sample Specifications

Energy recovery units shall be SEMCO standard 'EP' series with components as follows:

A. Casing - Wall and roof panels shall consist of 2 inch thick dual wall 18 gauge galvanized solid exterior skins and 22 gauge galvanized steel solid interior skins enclosing 2 inch thick 3 pcf mineral wool insulation. The housing shall be supported by a painted structural steel base. The base includes a solid welded floor with mineral wool insulation. The bottom face of the insulation shall be protected with a 22 gauge galvanized steel cover. The base shall be self-flashing when set on a properly sized curb. Floor openings shall have perimeter lips turned up into unit and be covered by a protective grate. Lifting lugs shall be welded to the structural base.

Access - Access shall be provided through large hinged, tightly sealed doors or removable access panels. Access doors shall be constructed of the same materials as the unit casing. Each door shall be provided with two cam type handles and two heavy duty hinges to achieve maximum sealing. Handles shall be internal and external for opening from the inside or outside of the unit. All doors shall open against the air pressure. Removable panels shall be provided for heating and cooling coils.

Outdoor Installation - Units shall have a factory-installed, 22 gauge galvanized steel standing seam sheet metal roof. All roof field joints shall have U-clips. The U-clips shall be shipped with the unit for field installation. Outdoor air intake and exhaust air discharge openings shall have galvanized steel sheet metal hoods with openings covered with bird screen. Hoods may ship loose for field installation depending on shipping width restrictions.

B. Fans - Fans shall be centrifugal plenum type. Fans shall incorporate a wheel, heavy gauge reinforced steel inlet plate with removable spun inlet cone, structural steel frame, and shaft and bearings in the AMCA Arrangement 3 configuration to form a heavy duty integral unit. All fan wheels shall be tapered spun wheel cones or shrouds providing stable flow and high rigidity. The wheels shall be non-overloading type. The blades shall be securely welded, die-formed backward curved (16" and smaller) or airfoil (18" and larger) type. Fan wheels shall be statically and dynamically balanced. Fan shafts shall be sized for first critical speed of at least 1.43 times the maximum speed for the class. Fan wheel bearings shall be heavy duty, grease lubricated, anti-friction ball or roller, self-aligning, pillow block type and selected for minimum average bearing life (AFBMA L-50) in excess of 200,000 hours at the maximum class RPM. Fan ratings shall be based on tests made in accordance with AMCA Standard 210 and shall bear the AMCA Seal.

Motors, Drives and Guards - Fan motors shall be standard NEMA frame, high efficiency, with 1.15 service factor and open drip-proof enclosures. Belt drives shall be designed for a minimum 1.4 service factor. Drives shall be fixed pitch. Rotating fan and drive parts shall be enclosed by protective guards.

Fan Vibration Isolation - Fans assemblies shall have adjustable motor bases, motors and V-belt drives mounted with the assembly mounted on 1-inch deflection spring isolators with flexible connections between fan and fan wall.

C. Enthalpy Recovery Wheel - The rotor media shall be made of aluminum, which is coated to prohibit corrosion. All media surfaces shall be coated with a non-migrating solid adsorbent layer prior to being formed into the honeycomb media structure to ensure that all surfaces are coated and that adequate latent capacity is provided. The media shall have a flame spread of less than 25 and a smoke developed of less than 50 when rated in accordance with ASTM E87. In addition to the desiccant coating that is applied to the surfaces of the aluminum substrate, the two faces of the total energy recovery wheel shall be covered and sealed with a two part polymer heavy duty coating specifically chosen for chemical resistance.

The desiccant shall be inorganic and specifically developed for the selective adsorption of water vapor. The desiccant shall utilize a 3A molecular sieve certified by the manufacturer to have an internal pore diameter distribution which limits adsorption to materials not larger than the critical diameter of a water molecule (2.8 angstroms).

Submit certification by a qualified independent organization - documenting equal sensible and latent recovery efficiencies conducted in accordance with ASHRAE 84-78P and the results presented in accordance with ARI 1060 standards.

An independent wheel test from a credible test laboratory shall document that the desiccant material utilized does not transfer pollutants typically encountered in the indoor air environment. The cross-contamination and performance certification reports shall be provided upon written request for engineering review.

Sensible Recovery Wheel (For EPD only)- The rotor media shall be made of aluminum, which is coated to prohibit corrosion. The media shall have a flame spread of less than 25 and a smoke developed of less than 50 when rated in accordance with ASTM E-87.

Media Cleaning - The media shall be cleanable with low-pressure steam (less than 5 PSI), hot water or light detergent, without degrading the latent recovery. Dry particles up to 800 microns shall pass freely through the media.

Purge Sector - The unit shall be provided with a factory set, field adjustable purge sector designed to limit cross-contamination to less than .04 percent of that of the exhaust air stream concentration when operated under appropriate conditions.
Rotor Seals - The rotor shall be supplied with labyrinth seals only, which at no time shall make contact with any rotating surface of the exchanger rotor face. These multi-pass seals shall utilize four labyrinth stages for optimum performance.

Rotor Support System - The rotor media shall be provided in segmented fashion to allow for field erection or replacement of one section at a time without requiring side access. The media shall be rigidly held in place

by a structural spoke system made of extruded aluminum.

Rotor Housing - The rotor housing shall be a structural framework which limits the deflection of the rotor due to air pressure loss to less than 1/32 inch. The housing is made of galvanized steel to prevent corrosion. The rotor is supported by two pillow block bearings which can be maintained or replaced without the removal of the rotor from its casing or the media from its spoke system.

Temperature Control Panel - Variable speed control shall be accomplished by the use of an A/C inverter. The inverter shall include all digital programming with a manual speed adjustment on the front of the inverter. The drive system shall allow for a turndown ratio of 80:1 (20 rpm to 1/4 rpm). The control system shall include four linearized thermistor sensors as follows:
(1) Proportional temperature controller mounted in the supply air stream;
(2) Differential summer/winter changeover sensors mounted in the outdoor and return air streams;
(3) Frost prevention sensor located in the exhaust air stream; and, (4) Digital readout of the temperature readings recorded by these sensors and control set points is displayed by the control panel.

Digital Performance Display Module - Digital read out confirming the effectiveness of the energy wheel via temperature readings recorded by these sensors and control set points shall be displayed by the control panel.

D. Chilled Water, DX and Hot Water Coils - Primary surface shall be round seamless 5/8 inch O.D. by .020 inch thick copper tube on 1.5 inch centers, staggered in the direction of airflow. All joints shall be brazed.

Secondary surface shall consist of .006 (.0075 for heating coils) inch rippled aluminum plate fins for higher capacity and structural strength. Fins shall have full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Bare copper tube shall not be visible between fins and the fins shall have no openings punched in them to prevent the accumulation of lint and dirt. Tubes shall be mechanically expanded into the fins to provide a continuous primary to secondary compression bond over the entire finned length for maximum heat transfer rates.

Casings shall be constructed of continuous galvanized steel. Coil side plates shall be of reinforced flange type.

Coils shall have equal pressure drop through all circuits. Coils shall be circuited for counter flow heat transfer to provide the maximum heat transfer rates.

Headers on coils shall be seamless copper tubing. The headers shall have intruded tube holes to provide a large brazing surface for maximum strength and inherent flexibility. Supply and return connections on water coils shall be steel with male pipe threads. DX coils shall have copper sweat connections.

The complete coil core shall be tested with 315 psig air pressure under

warm water and be suitable for operation at 250 psig working pressures.

Individual tube tests and core tests before installation of headers shall not be considered satisfactory. Water cooling coils shall be circuited for drainability. Use of internal restrictive devices to obtain turbulent flow shall not be acceptable. Vents and drains shall be furnished on all water coils. Coils shall be rated in accordance with ARI.

Coils shall be mounted in galvanized holding racks. Water coil supply and return connections shall be extended to the unit exterior. Water coil drain and vent connections are accessible from the interior of the unit and are not extended. Cooling coils shall be mounted in an insulated pitched 304 stainless steel condensate pan.

Optional Electric Heating Coil - Where scheduled, heater shall be the finned tubular or open coil electric resistance type. Heater shall include, door interlocking non-fused disconnect switch, magnetic de-energizing contactors, control circuit transformer, pressure type air flow interlock switch and manual and auto reset thermal cutout over current protection. The electric heater shall require a separate power feeder connection in addition to the power connection to the main unit electrical panel.

E. Pre-Filters (Return & Outside Air) - Filters shall be Farr type 30/30 or approved equal. Air filters shall be 2" thick, pleated, disposable type. Each filter shall consist of a non-woven cotton and synthetic fabric media, media support grid and enclosing frame. Filter media shall be a cotton and synthetic blend with at least 15 pleats per linear foot. A welded wire grid, spot-welded on one-inch centers and treated for corrosion resistance is bonded to the downstream side of the media to maintain the radial pleat and prevent media oscillation. The filter media shall have a Minimum Efficiency Reporting Value of MERV 7 when evaluated under guidelines of ASHRAE Standard 52.2-1999 and an average dust spot efficiency of 25-30% when evaluated under ASHRAE Standard 52.1-1992. The filter shall be listed by Underwriters' Laboratories as Class 2. A bank of galvanized universal holding frames shall be arranged for upstream access. Provisions shall be made on the downstream side of the frames to prevent filter blowout from moisture or overloading.

Optional Secondary High Efficiency Filters (65%, 85%, 95%) - Mounted in the same filter bank with the Pre-filters shall be 12" deep high performance filters, which shall be high lofted supported media disposable type. The media blanket shall be formed into uniform tapered radial pleats and bonded to a welded wire media support grid, which is spot-welded on one-inch centers, and treated for corrosion resistance. Media support contour stabilizers shall be mechanically fastened to diagonal support members of the same construction to create a rigid and durable filter enclosure. There shall be a minimum of four contour stabilizers on the air entering side and six on the air exiting side. The media shall have a Minimum Efficiency Reporting Value of MERV 14 when evaluated under guidelines of ASHRAE Standard 52.2-1999 and an average dust spot efficiency of either 60-65%, 80-85%, or 90-95% when evaluated under ASHRAE Standard 52.1-1992. The filter is listed by Underwriters' Laboratories as Class 2.

F. Outdoor Air Dampers - Dampers shall have galvanized steel frames and blades, with blade and jamb seals for low leakage performance. Dampers shall have two-position electric actuators with an integral limit switch. The limit switch shall be wired through the supply fan coil.

G. Exhaust Air Dampers - Dampers shall be gravity operated back draft type. Dampers shall have aluminum frames and blades, with blade seals for low leakage performance.

H. Electrical - Unit shall require a 480, 240 or 208 volt (as scheduled), 3 phase, 60 cycle power connection at the main electrical panel. The electrical panel shall be NEMA 3R rated and mounted on the unit exterior as shown on the General Arrangement drawings. The electric panel shall consist of a non-fused disconnect, fused IEC full voltage starters for each fan and constant speed wheel, control power transformer and HOA switch for the unit. Electrical panels shall bear an ETL label.

All wiring 120 volt and higher and wire size #8 and smaller shall be run in MC cable. All wire size #6 and larger shall be run in EMT. Fan motors requiring wire run in EMT shall have a 2' length of seal tight at the motor junction box. Low voltage wiring shall use plenum cable, installed external to the conduit. Starter coils shall be 24 volt AC for contactors rated 75 amps or less and 120-volt AC for contactors rated greater than 75 amps.

Optional Lights & GFI Receptacle - Vapor tight lights shall be provided in access compartments as shown on the General Arrangement drawing. Lights shall be wired to a single switch on the unit exterior. A GFI receptacle shall be mounted next to the light switch. A separate 120-volt power connection shall be required at the GFI receptacle to provide power for the lights and receptacle.

I. Warranty - The unit manufacturer shall warrant to the Buyer, for a period of eighteen months from the date of shipment, that goods delivered to the Buyer should in all respects be free from defects in material and workmanship when used in a proper and normal manner. In the event of equipment failure, prompt notification during the Warranty Period must first be made by the Buyer, in addition to there being confirmation to the unit manufacturer's satisfaction that the goods have been stored, installed, operated and maintained properly and in accordance with standard industry practice. If such confirmation is granted and it is established that the equipment failed to be free from defects within the eighteen months of shipment, the unit manufacturer shall correct the nonconformity at the unit manufacturer's option of either: (1) repairing any defective part or parts, or (2) making available at the unit manufacturer's plant a repaired or replacement part.

Model Size	3	5	9	13	18	24	28	35	43
Width	86.25	86.25	98.25	98.25	122.25	122.25	146.25	146.25	182.25
Height	48.25	60.25	72.25	86.25	98.25	110.25	122.25	134.25	146.25
Supply Air CFM Range [1]	2,000-3,000	3,000-4,500	4,500-8,000	6,000-10,000	8,000-15,000	11,000-18,000	15,000-23,000	18,000-27,000	26,000-40,000
Return Air CFM Range [1]									
Fan size (standard)	EPF 150	EPF 182	EPF 222	EPF 245	EPF 300	EPF 330	EPF 365	EPF 402	EPF 445
Fan size (option X)	-	EPF 200	EPF 245	EPF 270	EPF 330	EPF 365	EPF 402	EPF 445	EPF 490
Fan size (option XX)	-	EPF 222	EPF 270	EPF 300	EPF 365	EPF 402	EPF 445	EPF 490	-
Purge volume (single wheel) [3]	513	695	906	1168	1440	1735	1961	2297	2662
Heat/cool coil total fin height	33 in	45 in	54 in	66 in	78 in	90 in	99 in	111 in	123 in
Heat/cool coil total fin length	30 in	30 in	42 in	42 in	54 in	54 in	66 in	66 in	90 in
Number of stacked coils (height)	(1) 33 in	(1) 45 in	(2) 27 in	(2) 33 in	(2) 39 n	(2) 45 in	(3) 33 in	(2) 36 in	(2) 42 in
	-	-	-	-	-	-	-	(1) 39 in	(1) 39 in
Supply filter	(1) 24x24	(2) 24x24	(4) 24 x 24	(6) 24x24	(3) 20x24	(12) 20x24	(12) 24x24	(15) 24x24	(20) 24x24
	(2) 12x24	(2) 12x24	(2) 12 x 24	-	(9) 20x20	-	(3) 12x24	-	(4) 12x24
Return filter	(1) 24x24	(2) 24x24	(2) 24x24	(3) 24x24	(6) 24x24	(8) 24x24	(6) 20x24	(15) 20x24	(15) 24x24
	(2) 12x24	(2) 12x24	(3) 12x24	(3) 12x24	(2) 12x24	-	(9) 20x20	-	(3) 12x24
Door size (inches)	13x31	13x43	13x55	18x66	18x66	18x66	18x66	18x66	18x66

Notes:
1. Maximum airflow limitations vary. Consult SEMCO before laying out unit with velocities greater than 525 fpm on 2" filters, 525 fpm on cooling coils, and 1100 fpm on wheels.
2. For optional wide RA side, RA side components will be the same as the SA side components.
3. Single wheel purge volume based on 4" P_{OA}-P_{RA}.

EPD Equipment Summary

Model Size	3	5	9	13	18	24	28	35	43
Width	86.25	86.25	98.25	98.25	122.25	122.25	146.25	146.25	182.25
Height	48.25	60.25	72.25	86.25	98.25	110.25	122.25	134.25	146.25
Supply Air CFM Range [1]	2,000-3,000	3,000-4,500	4,500-8,000	6,000-10,000	8,000-15,000	11,000-18,000	15,000-23,000	18,000-27,000	26,000-40,000
Return Air CFM Range [1]									
Fan size (standard)	EPF 150	EPF 182	EPF 222	EPF 245	EPF 300	EPF 330	EPF 365	EPF 402	EPF 445
Fan size (option X)	-	EPF 200	EPF 245	EPF 270	EPF 330	EPF 365	EPF 402	EPF 445	EPF 490
Fan size (option XX)	-	EPF 222	EPF 270	EPF 300	EPF 365	EPF 402	EPF 445	EPF 490	-
Purge volume (dual wheel) [3]	1176	1572	2025	2583	3158	3779	4252	4954	5714
Heat/cool coil total fin height	33 in	45 in	54 in	66 in	78 in	90 in	99 in	111 in	123 in
Heat/cool coil total fin length	30 in	30 in	42 in	42 in	54 in	54 in	66 in	66 in	90 in
Number of stacked coils (height)	(1) 33 in	(1) 45 in	(2) 27 in	(2) 33 in	(2) 39 n	(2) 45 in	(3) 33 in	(2) 36 in	(2) 42 in
	-	-	-	-	-	-	-	(1) 39 in	(1) 39 in
Supply filter	(1) 24x24	(2) 24x24	(4) 24x24	(6) 24x24	(3) 20x24	(12) 20x24	(12) 24x24	(15) 24x24	(20) 24x24
	(2) 12x24	(2) 12x24	(2) 12x24	-	(9) 20x20	-	(3) 12x24	-	(4) 12x24
Return filter	(1) 24x24	(2) 24x24	(2) 24x24	(3) 24x24	(6) 24x24	(8) 24x24	(6) 20x24	(15) 20x24	(15) 24x24
	(2) 12x24	(2) 12x24	(3) 12x24	(3) 12x24	(2) 12x24	-	(9) 20x20	-	(3) 12x24
RA evaporative cooler area	5	7.5	10	12.5	21	24.5	33.8	38.3	52.3
SA evaporative cooler area	5	7.5	14	17.5	27	31.5	41.3	46.8	71.3
Door size (inches)	13x31	13x43	13x55	18x66	18x66	18x66	18x66	18x66	18x66

Notes:
1. Maximum airflow limitations vary. Consult SEMCO before laying out unit with velocities greater than 525 fpm on 2" filters, 525 fpm on cooling coils, and 1100 fpm on wheels.
2. For optional wide RA side, RA side components will be the same as the SA side components.
3. Dual wheel purge volume based on 7" P_{OA}-P_{RA} on Enthalpy wheel, 4" P_{OA}-P_{RA} on Sensible wheel.

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CPA

Passive Chilled Beam

- Modular convector for mounting flush or below ceiling plane
- Quiet operation
- No moving parts
- Long maintenance interval and low cost
- Individual/multiple beam control
- Suitable for offices, conference rooms, retail, hotels and healthcare environments
- Can be delivered with 2- or 3-port valve
- Standard height 130 mm with optional coil configuration output
- Customized perforation and multi-service solutions on request

Accessories & product options

- Pipe connection in the end (WD=S)
- Pipe connection at the top (WD=U)
- Factory-fitted 2- or 3-port valve
- Flexible connection pipes

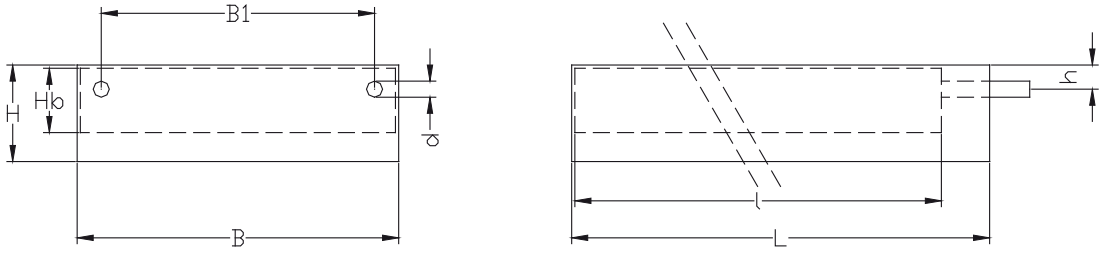
Material and finishing

CPA has side flanges made from extruded aluminum profiles. The modular perforated screen (holes 10 mm / 50% free area) is produced in pre-painted sheet metal, RAL 9010. The outer mounted end cap is produced in ABS-material, RAL 9010. The coil is made from Ø15 mm copper pipes bonded to aluminum fins. Internal distance between fins is 8 mm.

PART	MATERIAL	FINISHING	NOTE
Side flanges	Extruded aluminium	White RAL 9010	Pre-painted
Perforated screen	Sheet metal	White RAL 9010	Pre-painted Hole 10 mm / 50% free area
End cap	ABS-material	White RAL 9010	
Coiling fins	Aluminium		Distance between fins: 8 mm
Cooling pipes	Copper		Diameter 15 mm

DIMENSIONS

B	H	Hb	h	d	B1	l	L
315	130	75	40	15	225	1000 – 4000	l + 200
465	130	75	40	15	375	1000 – 4000	l + 200
615	130	75	40	15	525	1000 – 4000	l + 200
315	130	100	30	15	225	1000 – 4000	l + 200
465	130	100	30	15	375	1000 – 4000	l + 200
615	130	100	30	15	525	1000 – 4000	l + 200



Cooling capacity

Cooling capacities (Pw) [W] are presented for water flow rate qmw= 0.08 kg/s.

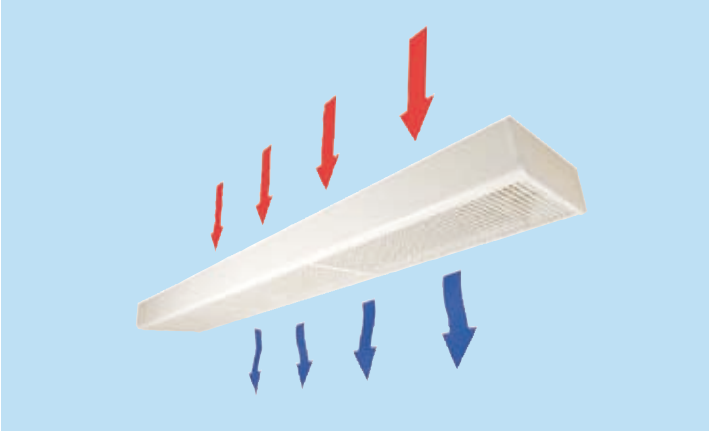
	Pw(W/m) ΔT (°C) 6	7	8	8,5	9	9,5	10	11
CPA-130/075-315	86	107	131	144	157	170	183	212
CPA-130/075-465	136	170	207	228	248	269	290	335
CPA-130/075-615	180	226	276	294	312	349	386	446
CPA-130/100-315	102	126	153	167	181	196	209	242
CPA-130/100-465	168	208	252	276	300	323	345	400
CPA-130/100-615	214	266	322	352	382	411	440	510

ΔT = temperature difference Tr-(Tw1+Tw2)/2, °C

Correction factor for alternative flow rate

qmv (kg/s)	kc
0.015	0.79
0.02	0.83
0.025	0.86
0.03	0.88
0.035	0.91
0.04	0.92
0.045	0.94
0.05	0.96
0.055	0.97
0.06	0.98
0.08	1.0

Cooling capacity according to EN 14518.

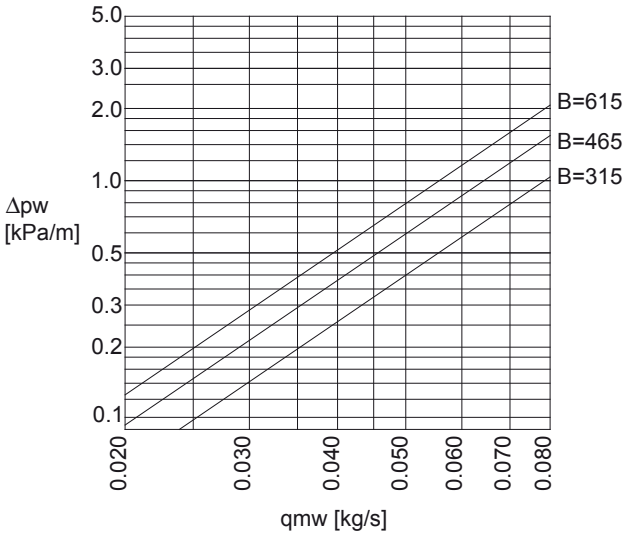


Function

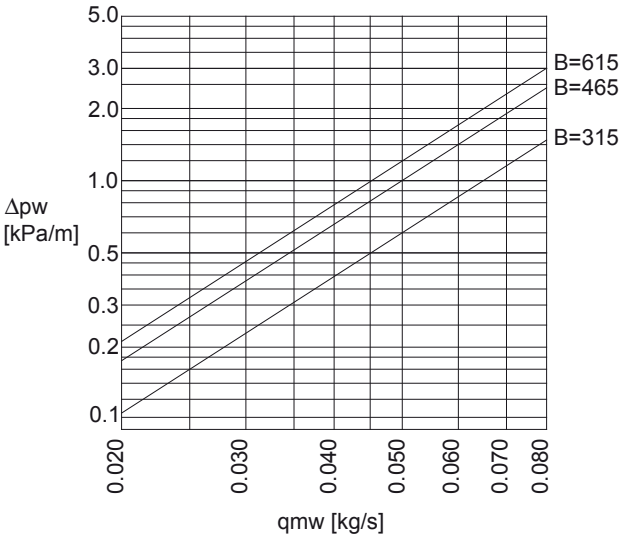
The beam operates by natural convection, removing the heat load from the room and replacing it with a cooling airflow. The convective airflow (output) increases or decreases in proportion with the heat load within the occupied zone, securing an optimal thermal comfort. Varying sensible cooling output requirements are met by regulating the flow of chilled water through the beam heat exchanger. This is controlled by a combination of room thermostat and 2 or 3-port valve. Operating at elevated chilled water temperatures (to avoid latent cooling), the opportunities for "free-cooling" are significant.

Pressure drop of water flow

CPA-130/75



CPA-130/100



ΔT	temperature difference Tr- (Tw1+Tw2) /2, °C
Tr	room temperature, °C
Tw1	water flow temperature, °C
Tw2	return water temperature, °C
P'w	cooling capacity per unit length, W/m
qmw	water mass flow rate, kg/s
kc	correction factor for water flow rate
Δpw	pressure drop of water flow per unit length, kPa

$$q_{mv} = \frac{P'w \times L}{C_v \times \Delta T} = kg/s$$

Water loops - slings

When the pressure drop is high, you need to have 2 parallel water loops (= 2 slings) in the coil. A coil with 2 slings has a connection pipe Ø22mm. Recommended operation pressure for 1 sling, max 15 kPa.

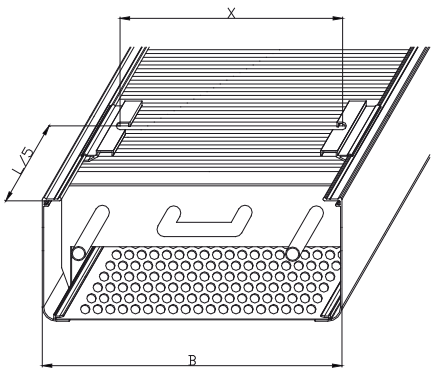
	L	Δt=7,5°C	Δt=8,0°C	Δt=8,5°C	Δt=9,0°C	Δt=9,5°C
CPA-130/075-315-L	1200	1	1	1	1	1
	1800	1	1	1	1	1
	2400	1	1	1	1	1
	3000	1	1	1	1	1
	3600	1	1	1	1	1
	4200	1	1	1	1	1
CPA-130/075-465-L	1200	1	1	1	1	1
	1800	1	1	1	1	1
	2400	1	1	1	1	1
	3000	1	1	1	1	1
	3600	1	1	1	1	1
	4200	1	1	1	1	1
CPA-130/075-615-L	1200	1	1	1	1	1
	1800	1	1	1	1	1
	2400	1	1	1	1	1
	3000	1	1	1	1	1
	3600	1	1	1	1	1
	4200	1	1	1	2	2
CPA-130/100-315-L	1200	1	1	1	1	1
	1800	1	1	1	1	1
	2400	1	1	1	1	1
	3000	1	1	1	1	1
	3600	1	1	1	1	1
	4200	1	1	1	1	1
CPA-130/100-465-L	1200	1	1	1	1	1
	1800	1	1	1	1	1
	2400	1	1	1	1	1
	3000	1	1	1	1	1
	3600	1	1	1	1	1
	4200	1	1	1	2	2
CPA-130/100-615-L	1200	1	1	1	1	1
	1800	1	1	1	1	1
	2400	1	1	1	1	1
	3000	1	1	1	1	1
	3600	1	2	2	2	2
	4200	2	2	2	2	2

Installation

The chilled beam CPA is installed fully exposed below a ceiling or suspended ceiling.
In order to ensure effective convection, the beam should be mounted at a minimum distance from the ceiling (H1) equal to 0.25 x the width of the beam, when installed away from wall surfaces, or 0.5 x beam width when installed close to partition walls.

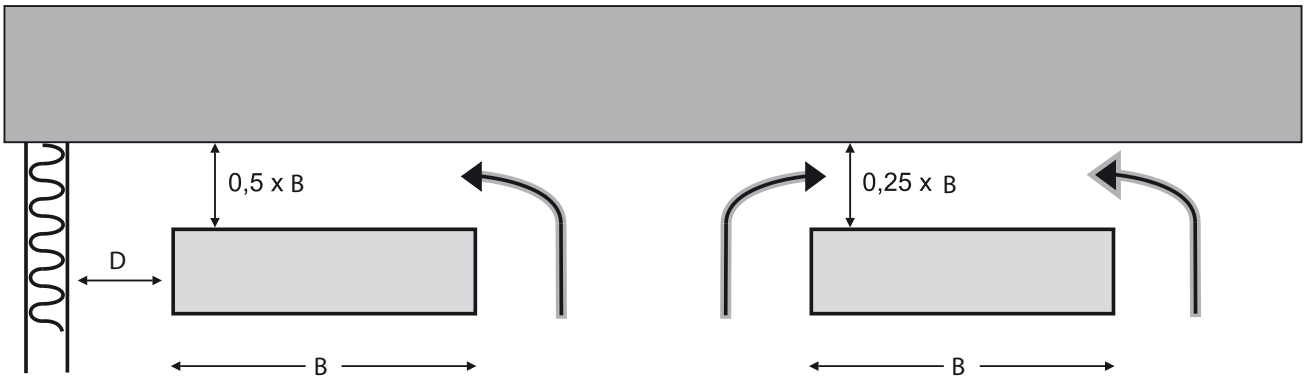
Each chilled beam is fixed to the ceiling with expansion anchors and threaded drop rods (not included in the delivery). Four assembly brackets are fixed one fifth of the unit length (L/5) away from the end of the beam.
The exact positions of the brackets are adjusted according to the rod position.

The chilled beam position can be easily adjusted both horizontally and vertically. Assembly brackets are supplied as standard in the package.



B	X
315	223
465	373
615	523

Distance from the ceiling



D = distance wall; up to 1,5 x W

Commissioning

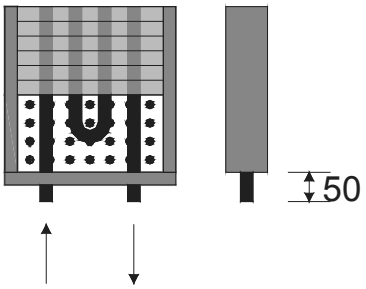
Commissioning of the chilled beam system is carried out following standard practice:

- Fill up and flush the main pipelines
- Fill up and vent the beam circuits
- Adjust the flow water temperature set point
- Adjust water flow rates with the balancing valves in all main pipelines to the correct value

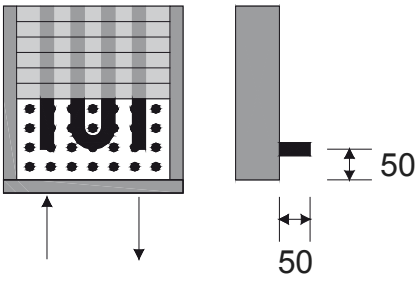
Adjust water flows in all chilled beams to the correct value

Pipe connections

Pipe connection in the end



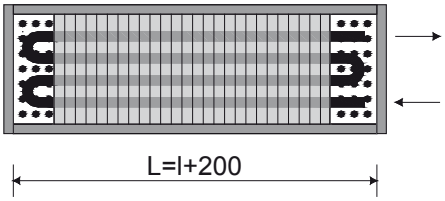
Pipe connection at the top



Coil length with or without factory-fitted control valves

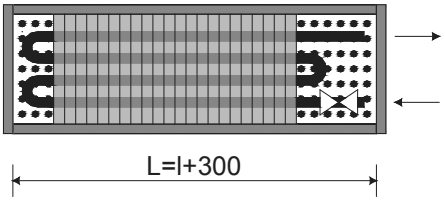
Standard length

Without valve

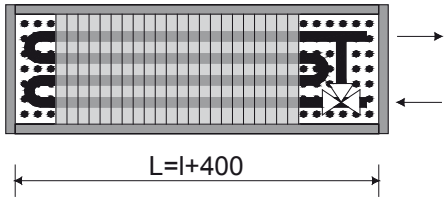


Optional

With 2-port valve



With 3-port valve



Servicing

The CPA chilled beam requires little maintenance. It may be necessary to clean the cooling coils every three to five years, depending on room conditions and air quality. The casing may be cleaned with a damp cloth. The cooling coil can be cleaned using a vacuum cleaner.

Specification

Output/capacity:	80 – 500 W/m
Standard length:	1200, 1800, 2400, 3000, 3600 and 4200 mm
Width:	315, 465 and 615 mm
Casing height:	130 mm
Coil height:	75 and 100 mm

The heat exchanger shall be constructed from aluminium fins and copper pipes with a nominal outside diameter of 15 mm.
The maximum chilled water pipe work operating pressure is 1.0 MPa. All joints shall be fully soldered and factory pressure tested.

Product code

CPA-H/CH-W-L-NW

H = Casing height
130

CH = Coil height
075,100

W = Width
315,465,615

L = Length
1200, 1800, 2400, 3000, 3600, 4200

NW = Number of water loops
CH=075 and W=315: 1
CH=100 and W=315: 1
CH=075 and W=465: 1
CH=100 and W=465: 1,2
CH=075 and W=615: 1,2
CH=100 and W=615: 1,2

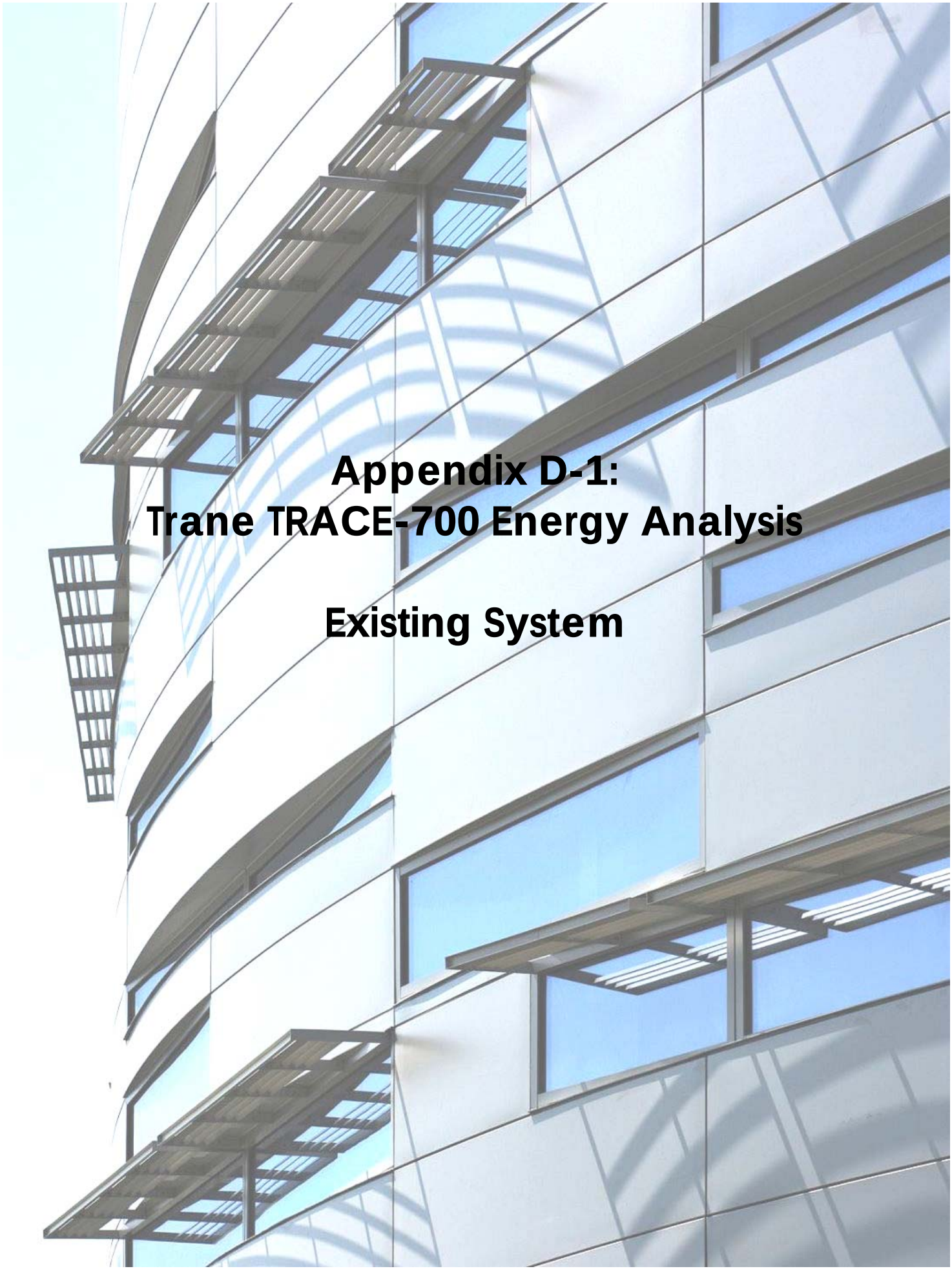
Specifics and accessories

WD = Location of pipe connections
S Front end
U On top

AC = Accessories
N=Not assigned
FT=Flexible connection pipes

Code example

CPA-130-100-315-1200-1, WD=S, AC=N



Appendix D-1:
Trane TRACE-700 Energy Analysis

Existing System

MONTHLY ENERGY CONSUMPTION

By ae

Alternative: 1

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------- Monthly Energy Consumption -------												
Electric													
On-Pk Cons. (kWh)	65,914	59,530	71,361	63,038	91,864	102,071	100,008	117,155	93,190	72,097	65,621	61,844	963,693
Off-Pk Cons. (kWh)	89,312	80,518	81,230	86,290	97,715	101,119	126,975	115,390	113,186	86,776	83,263	90,590	1,152,365
On-Pk Demand (kW)	216	218	220	251	433	490	534	542	488	287	240	222	542
Off-Pk Demand (kW)	212	212	214	219	307	371	403	415	385	235	218	215	415
Gas													
On-Pk Cons. (therms)	2,691	2,028	1,861	672	232	183	101	168	245	754	1,044	1,372	11,352
Off-Pk Cons. (therms)	4,497	3,649	2,834	1,539	587	530	454	509	597	1,210	1,865	2,547	20,815
On-Pk Demand (therms/hr)	12	10	9	4	2	2	2	2	2	3	5	7	12
Off-Pk Demand (therms/hr)	12	12	9	6	3	3	2	2	2	4	6	7	12

Building Energy Consumption =	177,555	Btu/(ft2-year)
Source Energy Consumption =	426,155	Btu/(ft2-year)
Floor Area =	58,792	ft2

MONTHLY UTILITY COSTS

By ae

Alternative: 1

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
					------- Monthly Utility Costs -------								
Electric													
On-Pk Cons. ($)	1,384	1,250	1,499	1,324	1,929	2,143	2,100	2,460	1,957	1,514	1,378	1,299	20,238
On-Pk Demand ($)	2,096	2,116	2,140	2,434	4,157	4,696	5,117	5,189	4,682	2,775	2,327	2,159	39,888
Total ($):	3,480	3,366	3,638	3,758	6,086	6,840	7,218	7,650	6,639	4,289	3,705	3,458	60,125
Gas													
On-Pk Cons. ($)	3,002	2,267	2,082	763	275	220	130	204	289	854	1,176	1,540	12,803
Water													
On-Pk Cons. ($)	186	186	186	186	186	186	186	186	186	186	186	186	2,238
Monthly Total ($):	6,669	5,819	5,907	4,707	6,548	7,246	7,534	8,040	7,115	5,330	5,068	5,184	75,166

EQUIPMENT ENERGY CONSUMPTION

By ae

Equipment - Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------- Monthly Consumption -------												
Lights													
Electric (kWh)	65,369.7	59,043.6	65,369.6	63,261.0	65,369.7	63,261.0	65,369.7	65,369.6	63,261.0	65,369.7	63,261.0	65,369.7	769,675.1
Peak (kW)	87.9	87.9	87.9	87.9	87.9	87.9	87.9	87.9	87.9	87.9	87.9	87.9	87.9
MISC LD													
Electric (kWh)	29,099.7	26,283.6	29,099.7	28,161.0	29,099.7	28,161.0	29,099.7	29,099.7	28,161.0	29,099.7	28,161.0	29,099.7	342,625.3
Peak (kW)	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1
AHU-1,2													
Eq4205 - FC rooftop w/IV & econ (Main Clg Fan)													
Electric (kWh)	17,492.2	15,799.5	17,492.2	16,928.0	20,271.9	19,293.2	21,747.0	20,447.6	19,124.3	17,492.2	16,928.0	17,492.3	220,508.4
Peak (kW)	23.5	23.5	23.5	23.9	40.2	56.3	60.3	58.5	51.3	27.7	23.5	23.5	60.3
Eq4223 - FC Centrifugal var freq drv (System Exhaust Fan)													
Electric (kWh)	9,268.4	8,324.7	8,701.4	8,276.6	10,233.2	12,125.9	12,872.8	12,289.3	9,360.0	8,617.8	8,362.8	8,612.5	117,045.5
Peak (kW)	13.1	13.1	13.1	13.4	24.3	35.7	38.6	37.3	32.1	15.9	13.1	13.1	38.6
Cpl 1: Cooling plant - 001													
McQuay Air Cooled Screw Chiller (Cooling Equipment)													
Electric (kWh)	0.0	0.0	51.3	1,382.4	28,417.3	38,492.0	54,696.6	60,775.2	49,767.1	4,814.9	912.5	239.4	239,548.5
Peak (kW)	2.0	2.1	3.4	30.1	147.3	185.0	210.6	230.4	201.7	62.0	20.9	5.8	230.4
Eq5221 - Condenser fan													
Electric (kWh)	0.0	0.0	41.0	606.3	4,071.4	5,222.7	7,024.7	7,788.4	6,541.9	1,339.8	479.6	175.2	33,290.9
Peak (kW)	1.1	1.1	1.4	4.6	17.1	21.2	23.4	25.7	23.0	8.1	3.8	1.9	25.7
Eq5302 - Cntl panel & interlocks (Misc Accessory Equipment)													
Electric (kWh)	0.0	0.0	6.2	51.0	74.4	72.0	74.4	74.4	72.0	74.4	48.0	24.8	571.6
Peak (kW)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Hpl 1: Heating plant - 002													
Boiler - 001 (Heating Equipment)													
Gas (therms)	7,187.4	5,676.3	4,694.8	2,210.4	819.5	712.2	555.8	677.1	841.4	1,964.3	2,909.2	3,918.8	32,167.0
Peak (therms/Hr)	12.4	11.8	8.9	5.7	2.8	2.8	2.3	2.5	2.5	3.8	6.0	7.3	12.4

EQUIPMENT ENERGY CONSUMPTION

By ae

Equipment - Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------- Monthly Consumption -------												
Hpl 1: Heating plant - 002													
Eq5020 - Heating water circ pump (Misc Accessory Equipment)													
Electric (kWh)	1,109.6	1,002.2	1,109.6	1,073.8	739.7	644.3	601.0	647.3	760.6	1,109.6	1,073.8	1,109.6	10,981.2
Peak (kW)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Eq5240 - Boiler forced draft fan (Misc Accessory Equipment)													
Electric (kWh)	1,488.0	1,344.0	1,488.0	1,440.0	992.0	864.0	806.0	868.0	1,020.0	1,488.0	1,440.0	1,488.0	14,726.0
Peak (kW)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Eq5307 - Boiler cntl panel & inter (Misc Accessory Equipment)													
Electric (kWh)	372.0	336.0	372.0	360.0	248.0	216.0	201.5	217.0	255.0	372.0	360.0	372.0	3,681.5
Peak (kW)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Eq5032 - VV Cond Wtr Pump (12 F Delta T) (Misc Accessory Equipment)													
Electric (kWh)	248.0	198.7	169.4	84.9	30.7	26.6	21.3	26.1	32.1	76.8	109.6	144.2	1,168.1
Peak (kW)	0.4	0.4	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.3	0.4
RTU-1													
Eq4223 - FC Centrifugal var freq drv (Main Clg Fan)													
Electric (kWh)	2,145.7	1,989.1	2,377.0	2,597.2	3,272.3	3,206.1	3,484.9	3,325.7	3,106.3	2,728.4	2,417.9	2,385.9	33,036.4
Peak (kW)	3.2	4.1	4.6	6.0	12.6	13.0	13.4	12.6	10.5	5.2	4.4	4.0	13.4
Eq4223 - FC Centrifugal var freq drv (Main Return Fan)													
Electric (kWh)	2,323.2	2,141.6	2,438.4	2,611.5	3,278.1	3,843.9	3,934.7	3,833.8	3,047.8	2,757.2	2,458.0	2,424.6	35,092.7
Peak (kW)	3.6	4.6	5.1	6.6	13.3	13.7	14.2	13.4	11.3	5.8	4.9	4.5	14.2
Eq4223 - FC Centrifugal var freq drv (System Exhaust Fan)													
Electric (kWh)	4,897.4	4,423.5	4,524.0	4,264.6	4,427.5	4,738.8	4,767.1	4,865.8	4,092.1	4,422.7	4,362.3	4,469.8	54,255.4
Peak (kW)	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6
RTU-2													
Eq4223 - FC Centrifugal var freq drv (Main Clg Fan)													
Electric (kWh)	6,518.0	5,888.7	6,525.2	6,322.6	6,559.1	6,346.0	6,573.8	6,571.0	6,360.2	6,544.0	6,322.2	6,527.6	77,058.3
Peak (kW)	8.9	8.9	8.9	8.9	18.8	20.5	23.9	20.8	14.6	9.0	9.0	9.0	23.9

EQUIPMENT ENERGY CONSUMPTION

By ae

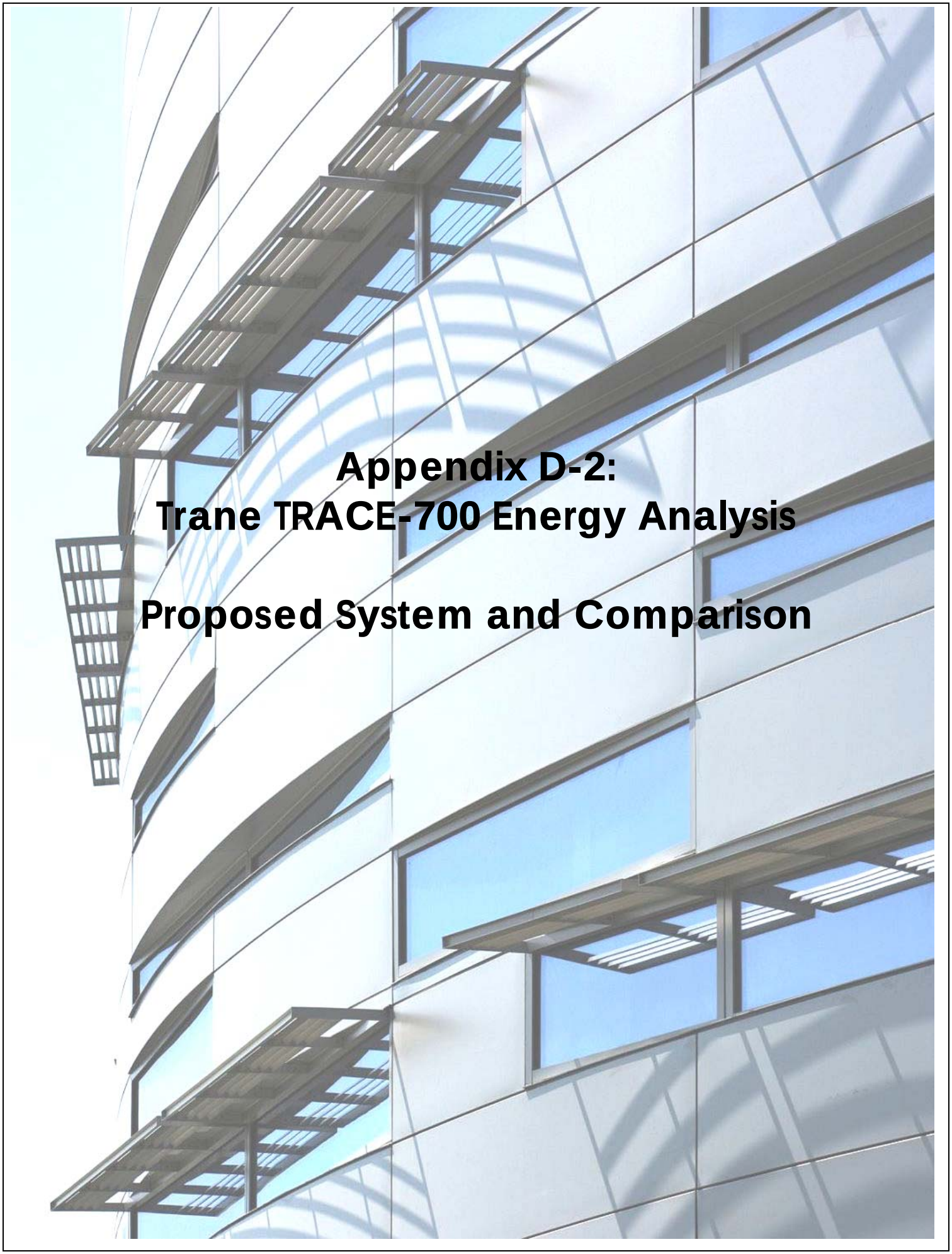
Equipment - Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------- Monthly Consumption -------												
RTU-2													
Eq4223 - FC Centrifugal var freq drv (Main Return Fan)													
Electric (kWh)	7,294.5	6,538.6	6,686.4	6,322.9	6,603.1	8,613.0	8,049.8	8,336.8	6,188.8	6,616.4	6,413.1	6,591.7	84,255.0
Peak (kW)	10.7	10.7	10.7	10.7	21.4	23.1	26.7	23.5	16.9	10.8	10.8	10.7	26.7
Eq2003 - FC Centrifugal vav/inlet vn (System Exhaust Fan)													
Electric (kWh)	7,600.0	6,733.6	6,139.9	5,584.8	5,891.0	8,063.7	7,657.4	8,009.6	5,225.4	5,950.2	5,774.5	5,907.3	78,537.3
Peak (kW)	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1

ENERGY CONSUMPTION SUMMARY

By ae

	Elect Cons. (kWh)	Gas Cons. (therms)	Percent of Total Energy	Total Source Energy* (kBtu/yr)
Primary heating				
Primary heating	19,575.6	32,167.0	31.5 %	35,864.6
Primary cooling				
Cooling Compressor	239,548.5		7.8 %	24,529.8
Tower/Cond Fans	33,290.9		1.1 %	3,409.0
Condenser Pump			0.0 %	0.0
Other CLG Accessories	571.6		0.0 %	58.5
Cooling Subtotal....	273,411.0		8.9 %	27,997.4
Auxiliary				
Supply Fans	699,789.0		22.9 %	71,658.6
Circ Pumps	10,981.2		0.4 %	1,124.5
Base Utilities			0.0 %	0.0
Aux Subtotal....	710,770.2		23.2 %	72,783.0
Lighting				
Lighting	769,675.1		25.2 %	78,814.9
Receptacle				
Receptacles	342,625.3		11.2 %	35,084.9
Heating plant load				
Base Utilities			0.0 %	0.0
Cogeneration				
Cogeneration			0.0 %	0.0
Totals				
Totals**	2,116,057.0	32,167.0	100.0 %	250,544.8

* Note: Resource Utilization factors are included in the Total Source Energy value.
** Note: This report can display a maximum of 6 utilities. If additional utilities are used, they will be included in the total.



Appendix D-2:
Trane TRACE-700 Energy Analysis

Proposed System and Comparison

ENERGY CONSUMPTION SUMMARY

By ae

	Elect Cons. (kWh)	Gas Cons. (therms)	Percent of Total Energy	Total Source Energy* (kBtu/yr)
Primary heating				
Primary heating	19,440.2	28,891.9	35.7 %	32,403.2
Primary cooling				
Cooling Compressor	154,997.6		6.4 %	15,871.8
Tower/Cond Fans	20,988.4		0.9 %	2,149.2
Condenser Pump			0.0 %	0.0
Other CLG Accessories	554.5		0.0 %	56.8
Cooling Subtotal....	176,540.6		7.3 %	18,077.8
Auxiliary				
Supply Fans	253,438.9		10.4 %	25,952.2
Circ Pumps	19,388.9		0.8 %	1,985.4
Base Utilities	474.5		0.0 %	48.6
Aux Subtotal....	273,302.3		11.3 %	27,986.2
Lighting				
Lighting	769,675.1		31.7 %	78,814.9
Receptacle				
Receptacles	342,625.3		14.1 %	35,084.9
Heating plant load				
Base Utilities			0.0 %	0.0
Cogeneration				
Cogeneration			0.0 %	0.0
Totals				
Totals**	1,581,583.4	28,891.9	100.0 %	192,367.0

* Note: Resource Utilization factors are included in the Total Source Energy value.
** Note: This report can display a maximum of 6 utilities. If additional utilities are used, they will be included in the total.

MONTHLY ENERGY CONSUMPTION

By ae

Alternative: 2

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------- Monthly Energy Consumption -------												
Electric													
On-Pk Cons. (kWh)	63,036	56,991	68,842	45,461	60,174	67,140	63,496	74,529	59,749	50,096	47,113	47,642	704,270
Off-Pk Cons. (kWh)	85,629	77,246	78,830	63,072	67,372	71,410	86,535	78,564	76,032	60,962	61,453	70,207	877,314
On-Pk Demand (kW)	204	207	207	201	222	276	287	292	236	187	162	164	292
Off-Pk Demand (kW)	202	202	204	205	194	216	226	226	208	161	161	161	226
Gas													
On-Pk Cons. (therms)	2,578	1,911	1,843	195	75	430	550	949	631	65	545	1,164	10,935
Off-Pk Cons. (therms)	4,557	3,699	2,940	874	40	160	477	655	451	472	1,344	2,287	17,957
On-Pk Demand (therms/hr)	12	11	10	3	2	3	4	4	4	1	5	7	12
Off-Pk Demand (therms/hr)	13	12	10	5	1	2	3	3	3	3	6	7	13

Building Energy Consumption =	140,957	Btu/(ft2-year)
Source Energy Consumption =	327,199	Btu/(ft2-year)
Floor Area =	58,792	ft2

EQUIPMENT ENERGY CONSUMPTION

By ae

Equipment - Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------- Monthly Consumption -------												
Lights													
Electric (kWh)	65,369.7	59,043.6	65,369.6	63,261.0	65,369.7	63,261.0	65,369.7	65,369.6	63,261.0	65,369.7	63,261.0	65,369.7	769,675.1
Peak (kW)	87.9	87.9	87.9	87.9	87.9	87.9	87.9	87.9	87.9	87.9	87.9	87.9	87.9
MISC LD													
Electric (kWh)	29,099.7	26,283.6	29,099.7	28,161.0	29,099.7	28,161.0	29,099.7	29,099.7	28,161.0	29,099.7	28,161.0	29,099.7	342,625.3
Peak (kW)	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1
Bsu 1: Parking lot lights													
Electric (kWh)	40.3	36.4	40.3	39.0	40.3	39.0	40.3	40.3	39.0	40.3	39.0	40.3	474.5
Peak (kW)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Cpl 1: Cooling plant - 001													
McQuay Air Cooled Screw Chiller (Cooling Equipment)													
Electric (kWh)	0.0	0.0	7.8	418.1	19,163.7	29,364.6	36,129.4	37,892.0	27,703.0	3,866.0	375.1	77.9	154,997.7
Peak (kW)	0.0	0.3	0.3	9.1	66.0	110.0	119.2	122.8	77.6	36.4	13.7	2.0	122.8
Eq5221 - Condenser fan													
Electric (kWh)	0.0	0.0	8.1	217.2	2,620.3	3,828.6	4,659.4	4,910.2	3,619.0	851.2	212.1	62.4	20,988.4
Peak (kW)	0.0	0.3	0.3	1.8	7.6	12.5	13.2	13.7	8.9	4.8	2.2	0.8	13.7
Eq5003 - Var vol chill water pump (Misc Accessory Equipment)													
Electric (kWh)	0.0	0.0	5.3	130.5	1,064.6	1,563.4	1,981.9	2,123.8	1,469.9	427.9	128.8	39.6	8,935.6
Peak (kW)	0.0	0.2	0.2	0.8	3.2	8.4	9.4	10.3	4.2	1.9	1.0	0.4	10.3
Eq5302 - Cntl panel & interlocks (Misc Accessory Equipment)													
Electric (kWh)	0.0	0.0	3.1	45.0	74.4	72.0	74.4	74.4	72.0	74.4	46.2	18.6	554.5
Peak (kW)	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
DOAS LAB													
Eq4205 - FC rooftop w/IV & econ (Main Clg Fan)													
Electric (kWh)	31,087.0	28,078.5	31,087.0	7,626.6	3,186.0	3,074.8	3,162.0	3,166.7	3,067.8	4,284.2	7,617.5	12,292.7	137,730.7
Peak (kW)	41.8	41.8	41.8	41.8	10.6	4.4	4.4	4.4	4.4	7.3	16.0	16.9	41.8

EQUIPMENT ENERGY CONSUMPTION

By ae

Equipment - Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------- Monthly Consumption -------												
DOAS LAB													
Eq4223 - FC Centrifugal var freq drv (System Exhaust Fan)													
Electric (kWh)	18,450.6	16,522.0	16,742.5	3,274.3	1,311.6	1,651.9	1,554.5	1,604.6	1,230.1	1,748.1	3,354.6	5,669.8	73,114.6
Peak (kW)	26.8	26.8	26.8	26.8	5.5	2.9	2.6	2.8	2.1	3.4	7.7	8.9	26.8
Hpl 1: Heating plant - 002													
Boiler - 001 (Heating Equipment)													
Gas (therms)	7,134.4	5,610.4	4,782.5	1,069.4	115.1	590.3	1,027.1	1,604.4	1,081.9	537.0	1,889.0	3,450.5	28,891.9
Peak (therms/Hr)	12.8	12.3	9.8	4.9	2.4	3.3	3.6	4.2	4.0	2.8	5.7	6.8	12.8
Eq5020 - Heating water circ pump (Misc Accessory Equipment)													
Electric (kWh)	1,109.6	1,002.2	1,109.6	715.9	250.6	644.3	832.2	1,109.6	894.8	601.0	1,073.8	1,109.6	10,453.3
Peak (kW)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Eq5240 - Boiler forced draft fan (Misc Accessory Equipment)													
Electric (kWh)	1,488.0	1,344.0	1,488.0	960.0	336.0	864.0	1,116.0	1,488.0	1,200.0	806.0	1,440.0	1,488.0	14,018.0
Peak (kW)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Eq5307 - Boiler cntl panel & inter (Misc Accessory Equipment)													
Electric (kWh)	372.0	336.0	372.0	240.0	84.0	216.0	279.0	372.0	300.0	201.5	360.0	372.0	3,504.5
Peak (kW)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Eq5032 - VV Cond Wtr Pump (12 F Delta T) (Misc Accessory Equipment)													
Electric (kWh)	441.3	353.5	312.8	77.2	5.3	44.6	73.4	119.7	77.2	39.2	136.5	237.2	1,917.7
Peak (kW)	0.8	0.7	0.6	0.3	0.2	0.2	0.3	0.3	0.3	0.2	0.4	0.5	0.8
Office DOAS System													
Eq4223 - FC Centrifugal var freq drv (Main Clg Fan)													
Electric (kWh)	303.8	310.7	519.8	869.0	1,376.3	1,369.4	1,448.9	1,419.2	1,326.5	915.7	593.2	513.2	10,965.6
Peak (kW)	0.9	1.5	1.7	1.9	2.1	2.1	2.1	2.1	2.1	2.0	1.9	1.7	2.1
Eq4223 - FC Centrifugal var freq drv (Main Return Fan)													
Electric (kWh)	357.6	368.3	593.9	956.4	1,461.5	1,543.6	1,587.0	1,573.4	1,398.2	1,018.9	672.7	582.2	12,113.7
Peak (kW)	1.0	1.7	2.0	2.1	2.2	2.4	2.3	2.3	2.2	2.2	2.1	2.0	2.4

EQUIPMENT ENERGY CONSUMPTION

By ae

Equipment - Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------- Monthly Consumption -------												
Office DOAS System													
Eq2003 - FC Centrifugal vav/inlet vn (System Exhaust Fan)													
Electric (kWh)	546.0	558.3	911.8	1,542.2	2,102.2	2,852.1	2,623.6	2,730.3	1,962.3	1,714.3	1,094.4	876.7	19,514.2
Peak (kW)	2.0	3.4	3.4	3.4	3.4	5.4	4.7	5.0	3.4	3.4	3.4	3.4	5.4

MONTHLY UTILITY COSTS

By ae

Alternative: 2

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
					------- Monthly Utility Costs -------								
Electric													
On-Pk Cons. ($)	1,324	1,197	1,446	955	1,264	1,410	1,333	1,565	1,255	1,052	989	1,000	14,790
On-Pk Demand ($)	1,982	2,015	2,011	1,959	2,156	2,670	2,772	2,822	2,289	1,826	1,590	1,608	25,700
Total ($):	3,306	3,211	3,456	2,914	3,420	4,080	4,105	4,387	3,544	2,878	2,579	2,608	40,490
Gas													
On-Pk Cons. ($)	2,877	2,138	2,062	234	101	494	628	1,071	717	90	622	1,309	12,341
Water													
On-Pk Cons. ($)	186	186	186	186	186	186	186	186	186	186	186	186	2,238
Monthly Total ($):	6,369	5,536	5,705	3,335	3,707	4,761	4,919	5,644	4,448	3,155	3,387	4,104	55,069

TRACE® 700 Economic Summary

By ae

Project Information

Weather file	Buffalo, New York	Alternative 1 -	-
Project Name	Hauptman-Woodward Medical Research	Alternative 2 -	-
Location	Buffalo, NY		
Building Owner			
User	Justin Schultz		
Company	The Pennsylvania State University		
Comments	Senior Thesis Tech Report 2		

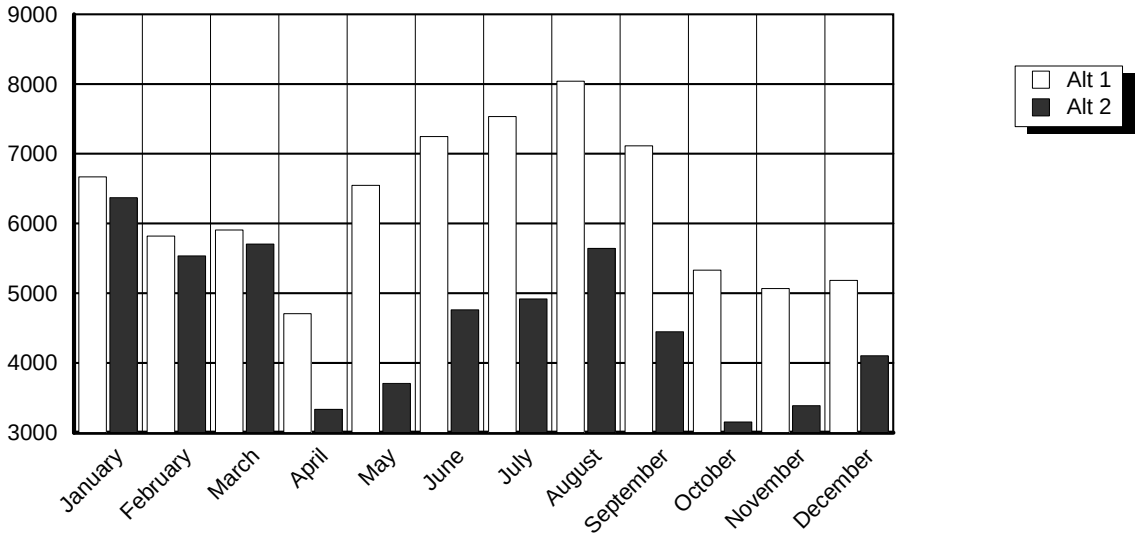
Economic Summary

Alternative Number	Installed Cost	First Year Util.Cost	Final Year Util. Cost	First Year Maint. Cost	Final Year Maint. Cost	Life Cycle Cost
1	822520.00	75166.36	75166.36	0.00	0.00	1462453.60
2	574345.00	55068.53	139155.42	0.00	0.00	1241339.68

Economic Comparison of the Alternatives

Alt. - Alt.	First Cost Difference	Simple Payback	Net Present Value	Life Cycle Payback	Internal Rate of Return
1 - 2	248175.00	Does not pay back	-221113.93	Does not pay back	1.2 %

Monthly Utility Costs



Equipment Energy Consumption by Alternative

	Elect Cons. (kWh)	Gas Cons. (therms)	Percent of Total Energy	Total Source Energy* (kBtu/yr)
Alternative: 1 -				
Primary heating	19,575.6	32,167.0	31.5%	35,864.6
Cooling Compressor	239,548.5		7.8%	24,529.8
Tower/Cond Fans	33,290.9		1.1%	3,409.0
Other CLG Accessories	571.6		0.0%	58.5
Supply Fans	699,789.0		22.9%	71,658.6
Circ Pumps	10,981.2		0.4%	1,124.5
Lighting	769,675.1		25.2%	78,814.9
Totals	**2,116,057.0**	**32,167.0**	**100.0%**	**250,544.8**
Alternative: 2 -				
Primary heating	19,440.2	28,891.9	35.7%	32,403.2
Cooling Compressor	154,997.6		6.4%	15,871.8
Tower/Cond Fans	20,988.4		0.9%	2,149.2
Other CLG Accessories	554.5		0.0%	56.8
Supply Fans	253,438.9		10.4%	25,952.2
Circ Pumps	19,388.9		0.8%	1,985.4
Base Utilities	474.5		0.0%	48.6
Lighting	769,675.1		31.7%	78,814.9
Totals	**1,581,583.4**	**28,891.9**	**100.0%**	**192,367.0**

* *Note: Resource Utilization factors are included in the Total Source Energy value.*

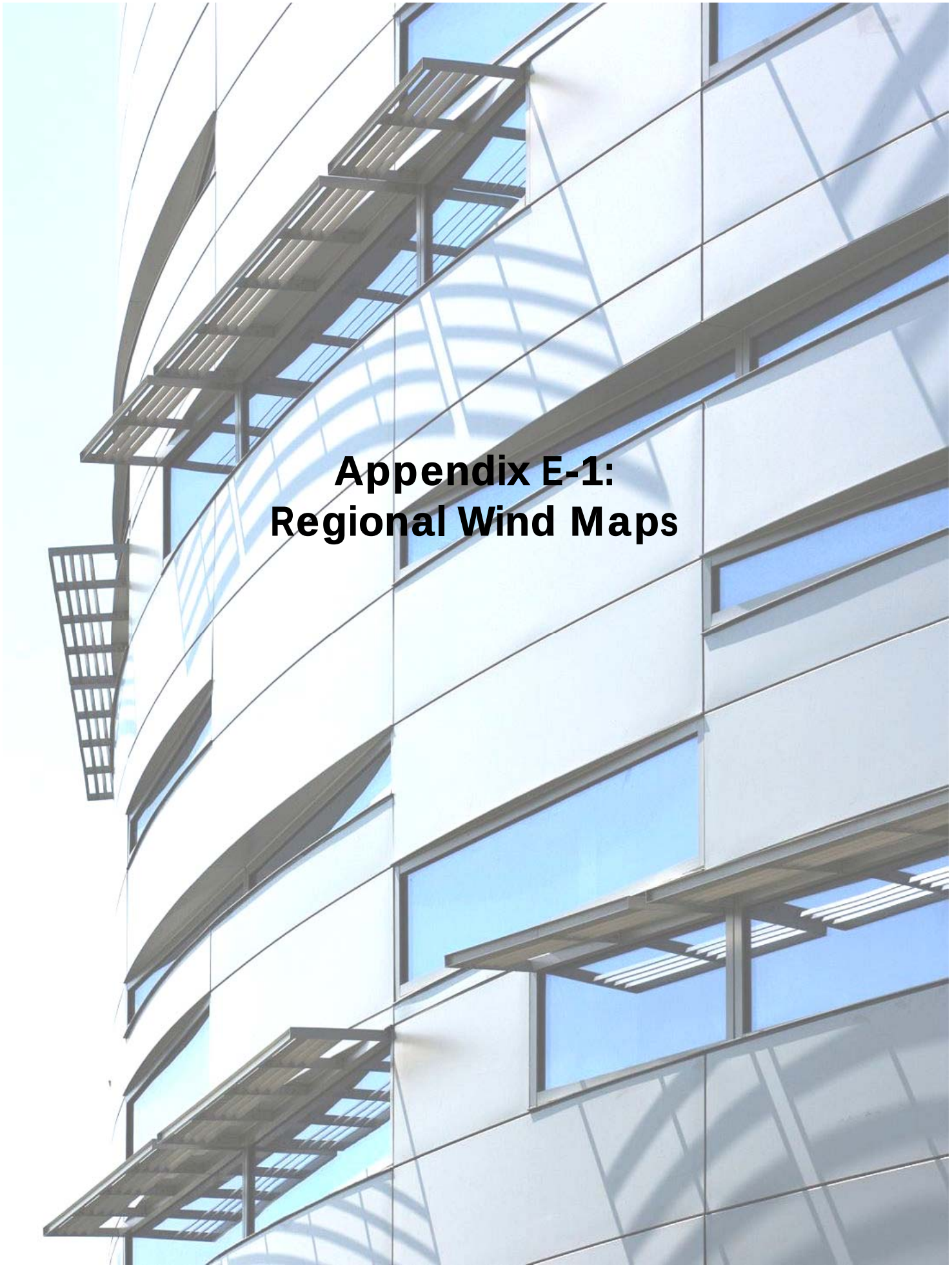
ALTERNATIVE COMPARISON

By ae

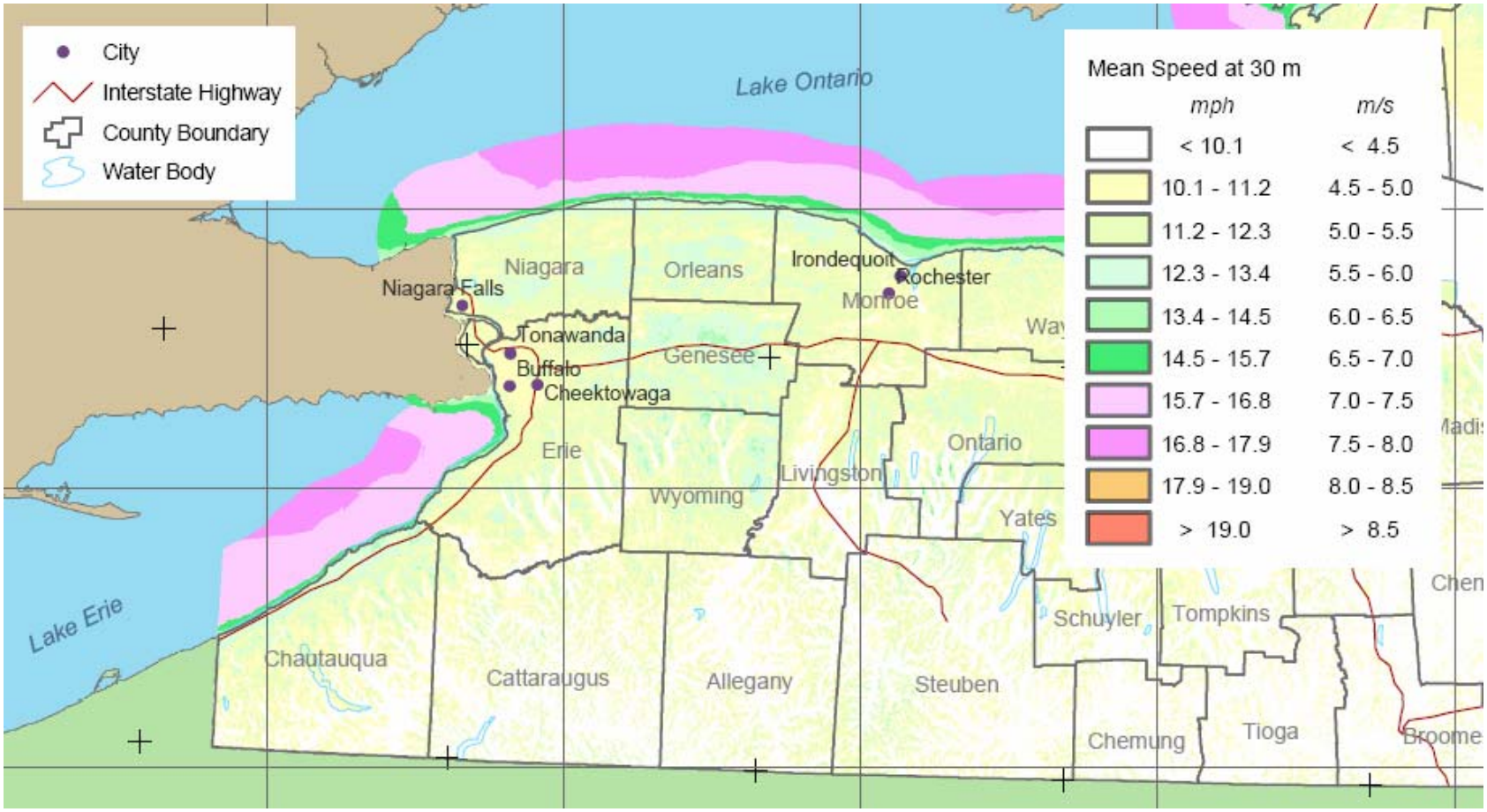
Alternative 1 vs Alternative 2 Comparison

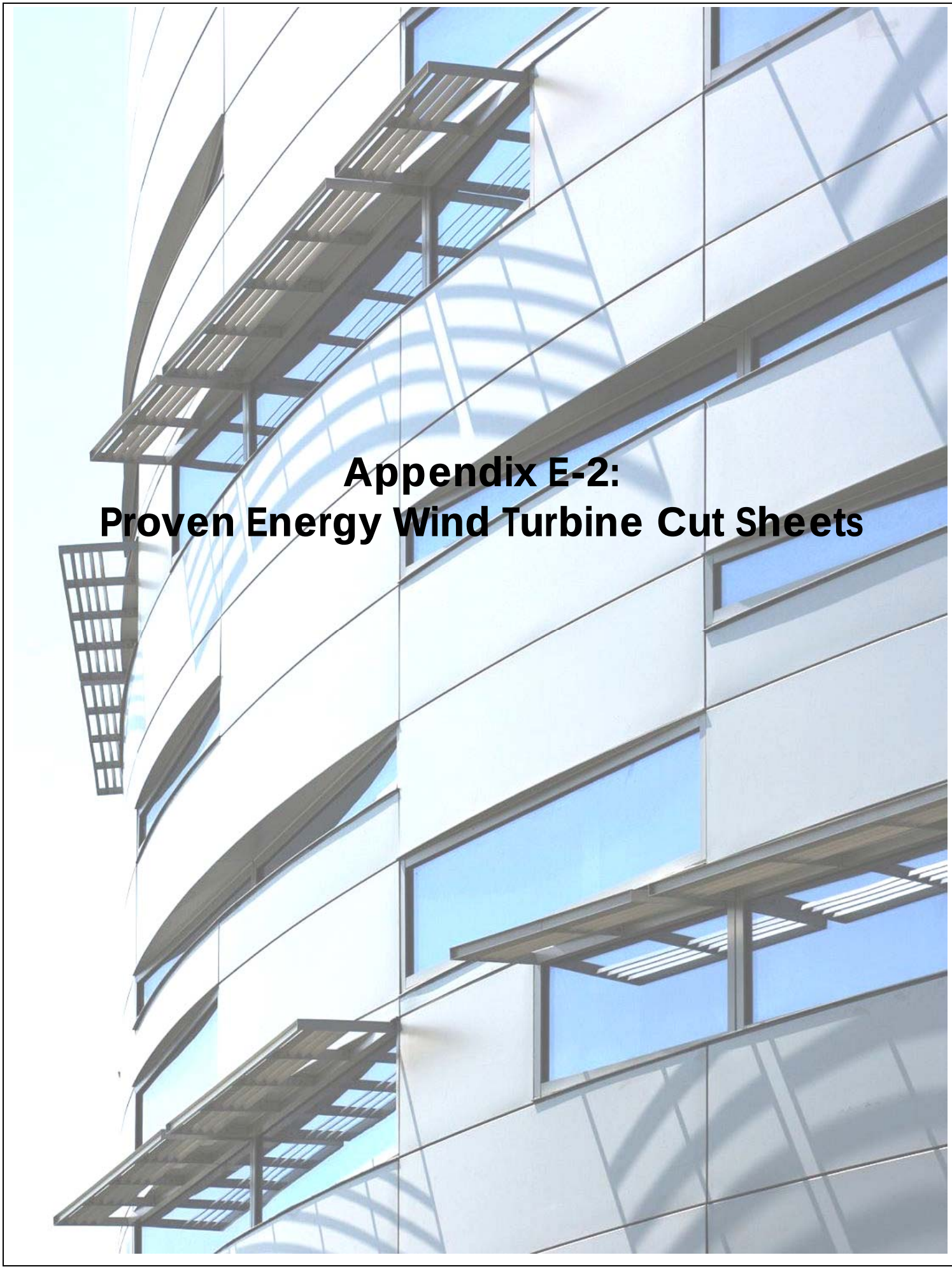
First Cost Difference	248175.00
Down Payment Difference	248175.00
Net Present Value of Incremental Cash Flows	-221113.93
Life Cycle Cost Difference	-221113.93
Revenue Penalty Difference	0.00
Simple Payback on Investment	Does not pay back
Life Cycle Payback on Investment	Does not pay back
Internal Rate of Return	1.2 %
Cost of capital (%)	10.0

Year	Cash Flow Difference	Cumulative Cash Flow Difference	Present Value of Flow Difference	Net Present Value
0	-248175.00	-248175.00	-248175.00	-248175.00
1	-20097.83	-268272.83	-18270.75	-266445.75
2	-17344.40	-285617.23	-14334.22	-280779.97
3	-14453.30	-300070.53	-10858.98	-291638.95
4	-11417.65	-311488.19	-7798.41	-299437.36
5	-8230.22	-319718.40	-5110.32	-304547.68
6	-4883.41	-324601.81	-2756.56	-307304.24
7	-1369.26	-325971.07	-702.65	-308006.88
8	2320.59	-323650.48	1082.57	-306924.31
9	6194.94	-317455.54	2627.26	-304297.05
10	10263.00	-307192.54	3956.83	-300340.22
11	14534.47	-292658.07	5094.24	-295245.97
12	19019.51	-273638.56	6060.20	-289185.77
13	23728.81	-249909.75	6873.39	-282312.38
14	28673.56	-221236.19	7550.65	-274761.74
15	33865.56	-187370.63	8107.15	-266654.59
16	39317.16	-148053.47	8556.56	-258098.03
17	45041.33	-103012.14	8911.19	-249186.84
18	51051.71	-51960.42	9182.10	-240004.74
19	57362.62	5402.19	9379.25	-230625.49
20	63989.07	69391.26	9511.57	-221113.93



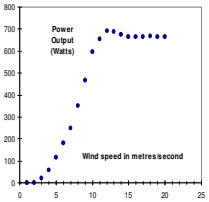
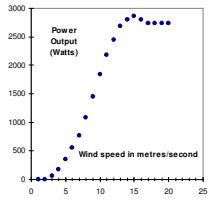
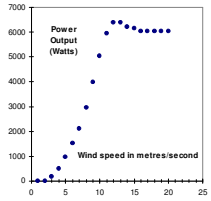
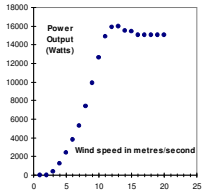
Appendix E-1:
Regional Wind Maps


City
Interstate Highway
County Boundary
Water Body
Lake Ontario
Lake Erie
Niagara
Orleans
Irondequoit
Rochester
Monroe
Niagara Falls
Tonawanda
Buffalo
Cheektowaga
Genesee
Erie
Wyoming
Livingston
Ontario
Yates
Schuyler
Tompkins
Chautauqua
Cattaraugus
Allegany
Steuben
Chemung
Tioga
Broome
Mean Speed at 30 m
mph
m/s
< 10.1
< 4.5
10.1 - 11.2
4.5 - 5.0
11.2 - 12.3
5.0 - 5.5
12.3 - 13.4
5.5 - 6.0
13.4 - 14.5
6.0 - 6.5
14.5 - 15.7
6.5 - 7.0
15.7 - 16.8
7.0 - 7.5
16.8 - 17.9
7.5 - 8.0
17.9 - 19.0
8.0 - 8.5
> 19.0
> 8.5



Appendix E-2:
Proven Energy Wind Turbine Cut Sheets

Proven Wind Turbines - Technical Specification Sheet

Rotor Speed Control Above 12m/s or 25mph) blades twist to limit power in response to high rpm ***Low Speed Equals Durability***				
Marine Build Quality All machines ***galvanised*** steel, ***stainless*** steel & ***plastic*** components				

WT MODEL	**WT600 (0.6kW)**	**WT2500 (2.5kW)**	**WT6000 (6kW)**	**WT15000 (15kW)**
Cut In (m/s)[1]	2.5			
Cut Out m/s)	None!			
Survival m/s)	65			
Rated (m/s)	12			
Rotor Type	Downwind, Self Regulating			
No. of Blades	3			
Blade Material	Polypropylene	Polypropylene	Wood/Epoxy	Glass Polypropylene
Rotor Diameter(m)	2.55	3.5	5.5	9
Generator Type	Brushless, Direct Drive, Permanent Magnet			
Battery charging	12 **,** 24 ***or*** 48V DC	24 ***or*** 48V DC	48V DC	48V DC
Grid connect with *Windy Boy Inverter*	230Vac 50Hz ***or*** 240 Vac 60Hz	230Vac 50Hz ***or*** 240 Vac 60Hz	230Vac 50Hz ***or*** 240 Vac 60Hz	230Vac 50Hz ***or*** 240 Vac 60Hz
Direct Heating	n/a	120Vac ***or*** 240Vac	120Vac ***or*** 240Vac	120Vac ***or*** 240Vac
Rated RPM	500	300	200	140
Annual Output[2]	900-1,500 kWh	2,500 – 5,000 kWh	6,000 – 12,000 kWh	15,000 – 30,000 kWh
Head Weight (kg)	70	190	500	1100
Mast Type	Tilt-up, tapered, self-supporting, no guy wires (Taller guyed towers also available on request)			
Hub Height (m)	5.5 ***or*** 12	6.5 ***or*** 11	9 ***or*** 15	15
WT Found (m)	1x1x1 ***or*** 1.6x1.6x1	1.6x1.6x1 ***or*** 2.5x2.5x1	2.5x2.5x1 ***or*** 3x3x1.2	3.7x3.7x1.2
Winch Found (m)	0.65x0.65x0.65	0.65x0.65x0.65 ***or*** 1x1x1	1x1x1 ***or*** 1.5x1.5x1	1.5x1.5x1.2
Tower Weight (kg)	120 ***or*** 350	241 ***or*** 445	360 ***or*** 656	1200
Mechanical Brake	No	Yes	Yes	Yes
Noise[3] **@ 5m/s**	35 dBA	40 dBA	45 dBA	48 dBA
Noise @ 20m/)	55 dBA	60 dBA	65 dBA	65 dBA
Rotor Thrust (kN)	2.5	5	10	26
Sample of UK commercial customers	British Telecom / Scottish Youth Hostel Association / British Rail / Irish Lighthouse Authority UK Lighthouse Authority / T-mobile /Orange / Saudi Aramco / Shell / B&Q / BP / Sainsbury's			

[1] 1 metre/second = 2.24 miles per hour=3.6kph.

[2] Based on an ideal site and average wind speed of 5m/s - please refere to our website at www.provenenergy.com for further information

[3] All readings taken with an ATP SL-25 dBA meter at the base of the tower at a height of 1.5m.

* A car passing 20m away @ approx 40 mph is 70-80dBA

PROVEN ENERGY LTD, WARDHEAD PARK, STEWARTON, AYRSHIRE, KA3 5LH
TEL: ++44 (0) 1560 485 570 FAX: ++44 (0) 1560 485 580 EMAIL: info@provenenergy.com

SECTION 3	PROVEN WT6000 (6000 Watt) WIND TURBINES, CONTROLLERS & TOWERS	*US List Price **
	6kW WIND TURBINES & CONTROLLERS - FOR BATTERY CHARGING	
WT6000/ 048	6kW wind turbine/generator (48V output)	**$18,160.00**
ECM6001/ 048	6kW 48V DC battery charging controller. Includes 2 DC and 3 AC divert load connections, Volt/Ammeters plus 8 system status indicators. 600mmHx400Wx260D Suitable for use with a DC system or DC/AC using an inverter. **Includes PAT100 MCCB**	**$2,840.00**
ECM6002/ 048	6kW 48V DC battery charging controller... Includes 3 AC divert load connections, Volt/Ammeters plus 8 system status indicators. 600mmHx400Wx260D Suitable for an AC system using a large inverter. **Includes PAT100 MCCB** *(Additional connections for PV input to battery charging controllers on request)*	**$2,570.00**
	6kW WIND TURBINES & CONTROLLERS - FOR DIRECT HEATING	
WT6000/ 120	6kW wind turbine/generator (120V output)	**$18,160.00**
WT6000/ 240	6kW wind turbine/generator (240V output)	**$18,160.00**
ECM6003/ 120	6kW 120V heating controller. Volt and Ammeters 500mmHx300Wx260D	**$2,010.00**
ECM6003/ 240	6kW 240V heating controller. Volt and Ammeters 500mmHx300Wx260D	**$1,870.00**
	6kW WIND TURBINES & CONTROLLERS - FOR GRID CONNECT	
WT6000/ 300	6kW wind turbine/generator (300V output)	**$18,160.00**
ECM6004/ 300	Isolation and rectification controller for WT6000/300 for use with grid connect inverter. Suitable for int/ext. mount 300mmHx300Wx200D	**$850.00**
ECM6004ME/ 300	Isolation and rectification controller for WT6000/300 for use with grid connect inverter. Suitable for internal or external mount. **With V,I meters** for performance monitoring. 300mmHx300Wx200D See Section 5 for SMA Windy Boy 6000U Grid Intertie Inverter price, WT6000/300 requires one WB 6000U for grid connect	**$1,090.00**
	6kW TOWERS	
TM900/ 6000	Tilt-up self supporting wind turbine mast (9m) including foundation kit and plans & gin pole	**$6,860.00**
TM1500/ 6000	Tilt-up self supporting wind turbine mast (15m) including foundation kit and plans & gin pole	**$8,650.00**
TM160/ 6000	Wind turbine mount for use with own mast (ungalvanised on request)	**$490.00**
TWT532/ 6000	Tirfor winch with 20 meters wire rope + strap (suitable for WT6000 on 9m tower)	**$1,780.00**
TWT532/ 6001	Tirfor winch with 30 meters wire rope + strap (suitable for WT6000 on 15m tower) (Taller free standing or guyed towers also available upon request)	**$1,890.00**

SECTION 5	INVERTERS - GRID CONNECTED	*US List Price **
WB 1800U	SMA Windy Boy 1800U, 1.8 kilowatt Grid Intertie Inverter, with LCD display, UL 1741 listed	**$2,180.00**
WB2500U	SMA Windy Boy 2500U, 2.5 kilowatt Grid Intertie Inverter, with LCD display, UL 1741 listed	**$2,430.00**
WB6000U	SMA Windy Boy 6000U, 6.0 kilowatt Grid Intertie Inverter, with LCD display, UL 1741 listed	**$4,715.00**
SECTION 6	**ACCESSORIES & WARRANTIES**	
	ACCESSORIES FOR BATTERY CHARGING SYSTEMS	
RES1000/ 024	1kW 24V Resistive heating element for use with ECM2501 & ECM6001	**$200.00**
RES1000/ 048	1kW 48V Resistive heating element for use with ECM2501 & ECM6001	**$200.00**
HBX2500/ 024/ 048	Custom stainless steel heater box containing 2 RES1000 24V or 48V heating elements. Ideal for use as DC divert load with ECM2501 or ECM6001	**$700.00**
	EXTENDED WARRANTY	
WAR03/600	Additional 3-years warranty on top of 2-years Manufacturers warranty to allow total 5-years cover for WT600	**$400.00**
WAR03/2500	Additional 3-years warranty on top of 2-years Manufacturers warranty to allow total 5-years cover for WT2500	**$675.00**
WAR03/6000	Additional 3-years warranty on top of 2-years Manufacturers warranty to allow total 5-years cover for WT6000	**$1,475.00**
WAR03/15000	Additional 3-years warranty on top of 2-years Manufacturers warranty to allow total 5-years cover for WT15000	**$2,900.00**
SECTION 7	**EXPORT PACKING & CASES**	
	WIND TURBINE PACKING & CASES	
BOX601	Sturdy export packing & case for 1 WT600 wind turbine and controller 1.4m x 1.4m x 0.5m approx 110kg, weight varies	**$360.00**
BOX2501	Sturdy export packing & case for 1 WT2500 wind turbine and controller 1.8m x 1.9m x 0.6m approx 300kg, weight varies	**$530.00**
BOX6001	Sturdy export packing & case for 1 WT6000 wind turbine and controller 2.4m x 2.2m x 1.2m approx 550kg, weight varies INCLUDES BLADES	**$760.00**
BOX15001	Sturdy export packing & case for 1 WT15000 wind turbine and controller 3.5 m x 1.6m x 1.5m approx 1200kg, weight varies. Note BLADE CRATE IS SEPARATE	**$940.00**
BOX15002	Sturdy export packing & case for 1 set of WT15000 wind turbine blades 5 m x .69m x .5m approx 130kg	**$510.00**
	TOWER PACKING	
TEP-01	Export tower packing for 1-section towers	**$230.00**
TEP-02	Export tower packing for 2-section towers	**$470.00**
TEP-03	Export tower packing for 3-section towers	**$700.00**