PART II – PRIMARY SYSTEMS INFORMATION

1. Operation

a. System Description

1. System Composition: The HVAC system consists of a complete installation of mechanical equipment to provide adequate heating, ventilation and air conditioning to the facility. All equipment is controlled through the DDC system. Individual descriptions of the HVAC systems are as follows:

a. The cooling system consists of air side and water side systems. The two airside distribution systems are variable air volume with terminal reheat (VAVTR). Each system consists of an air handling unit (AHU), supply and return air fans, terminal units, ductwork, and air devices. The waterside systems consist of an air cooled screw water chiller, two constant volume pumps piped in parallel, cooling coils mounted inside the air handling units, and connecting piping. The water chiller maintains a 7.2 degrees C. (45 degrees F.) leaving water temperature, which is piped to the cooling coils that absorb heat from the air and transfer it to the evaporator of the water chiller.
Outside air economizers in the air handling systems will cool the building whenever the ambient temperature falls below 12.7 degrees C. (55 degrees F.). The DDC system will de-energize the chilled water system whenever the outside air economizers are operating.

b. Air Distribution Systems: Two VAVTR air distribution systems are located in Room 2D05, and distribute conditioned air to terminal units throughout the facility, through insulated duct distribution systems located above the ceilings. Additional supply air ductwork connects the terminal units to air devices located in the conditioned spaces. Air is drawn from room air devices back to the return air fan of each AHU. The dampers inside the AHU control the air that is relieved to the outdoors or mixed with fresh outside air and recirculated back through the system. Fresh outside air is introduced into the system through a wall louver and is ducted to each AHU. The outside air duct has a minimum position damper with an airflow measuring station to calculate airflow. A second outside air damper controls airflow to the AHU for the economizer cycle. The economizer dampers modulate open whenever the outside air temperature is below 12.7 degrees C. (55 degrees F.). The supply and return fan speed is controlled by variable frequency drives, which vary the airflow through a static pressure controller located in the duct system and set to maintain a minimum of 250 Pa pressure. The return air fan speed tracks the supply fan speed in order to maintain a constant differential airflow equal to the outside air flow. AHU-1 & AHU-2 are provided with 30% pre-filters and 90% after-filters. These filters may require more maintenance supervision for the first few years because the current site

does not have a stand of grass and wind blown dirt debris may enter the air systems.

When the outside air temperature is above 12.7 degrees C. (55 degrees F.), the three way control valve on the piping of the AHU cooling coil will modulate open to maintain a constant discharge air temperature of 11.4 degrees C. Upon detection of combustion products in the airstream, the smoke detector will stop the fan and the smoke dampers in the supply and return ductwork will close.

Split system direct expansion units cool the communication rooms continuously, and the computer room only when the AHU's are shut down during unoccupied periods. The unit serving the computer room is provided with a built in Humidifier. This Humidifier may be shut down by building maintenance if found that it is not needed.

The terminal units each have a regulator, which is controlled by a space temperature sensor, and modulates from maximum to minimum airflow to maintain temperature setpoint in the space. On a further drop in space temperature, the control valve on the hot water reheat coil will modulate open and provide heat to the space. Building exhaust is draw from the spaces through air devices to in-line or roof mounted centrifugal exhaust fans which air interlocked with the AHU's.

b. The heating system consists of a natural gas fired copper tube boiler and two circulating pumps, piped in parallel to reheat coils mounted in terminal units described in "b" above. Both of the hot water pump shall operate during the heating season. The boiler hot water supply temperature is a maximum of 85 degrees C, but is reset through a controller down to a minimum of 48 degrees C, based on outside air temperature.

c. See schedules on the following sheets for equipment and equipment capacities.

AIR HANDLING UNIT SCHEDULE

MARK	TYPE	UNIT LOCATION ROOM No.	FAN							COOLING COIL						
			TOTAL AIR L/s MAX./MIN.	MINIMUM OUTSIDE AIR L/s	DESIGN EXT. S.P. IN. Pa	MIN. FAN MOTOR KW	POWER V	PH	Hz	TOTAL CAPACITY WATTS	ENT. AIR D.B. °C	ENT. AIR W.B. °C	LVG. AIR D.B. °C	LVG. AIR W.B. °C	ENT. WATER TEMP. °C	LVG. WATER TEMP. °C	CHILLED WATER L/s
AHU-1	1	2D-05	12385/8850	3255	900	30	480	3	60	330,909	25.2	18.4	10.8	10.3	7.2	12.8	14.25
AHU-2	1	2D-05	10675/6130	2385	625	30	480	3	60	219,282	24.5	17.2	11.3	10.8	7.2	12.8	9.44

BOILER SCHEDULE (HOT WATER)

MARK	INPUT KW	OUTPUT MIN. KW	WATER FLOW M^3/HR	ENT. WATER TEMP. °C	LVG WATER TEMP. °C	ELECTRICAL
B-1	405.0	324.0	21.0	68.9	82.2	120/1/60

DESIGN CONDITIONS

HEATING & COOLING	LOCATION	SUMMER	WINTER
1. ALL LOCATIONS EXCEPT OTHERWISE INDICATED	OUTSIDE	26.7 °C D.B. & 20.6 °C W.B.	6.1°C D.B.
	INSIDE	23.9 °C D.B. & 50% R.H.	20.0 °C D.B.
2. DENTAL TREATMENT RM'S 2C-06 & 2C-09	OUTSIDE	26.7 °C D.B. & 20.6 °C W.B.	6.1°C D.B.
	INSIDE	23.9 °C D.B. & 50% R.H.	20.0 °C D.B.
3. MECHANICAL ROOMS ELECTRICAL ROOMS	OUTSIDE	SAME AS NO. 1 ABOVE	6.1°C D.B.
	INSIDE	30.0 °C D.B.	–

AIR COOLED CHILLER SCHEDULE

MARK	LOCATION	DESCRIPTION	MIN. COOL. CAP. KW	WATER FLOW M^3/HR	AMBIENT TEMP. °C	LVG. WATER TEMP. °C.	ENT. WATER TEMP. °C.	ELECTRICAL CHAR.	MIN. STEPS OF CAP. UNLOADING
ACC-1	OUTSIDE	PACKAGED AIR COOLED CHILLER	523	85.28	32.2	7.2	12.8	480/3/60	100/75/50/25/0%

PUMP SCHEDULE

MARK	SERVICE	WT'R FLOW M^3/HR	MAX. R.P.M.	MIN. HEAD M	MIN. MOTOR SIZE KW	POWER VOLTS	PH.	CY.	IEC MOTOR STARTER K.W. RATING	TYPE	PIPING CIRCUIT SERVED	LOCATION	REMARKS
HWP-1	HWS & HWR	10.5	1750	21.4	2.0	480	3	60	4.0	1	HWS & HWR	2D-05	*
HWP-2	HWS & HWR	10.5	1750	21.4	2.0	480	3	60	4.0	1	HWS & HWR	2D-05	*
CWP-1	CWS & CWR	42.64	1750	21	5.9	480	3	60	7.5	1	CWS & CWR	1E-15	*
CWP-2	CWS & CWR	42.64	1750	21	5.9	480	3	60	7.5	1	CWS & CWR	1E-15	*

FAN SCHEDULE

UNIT NO.	LOCATION	TOTAL AIR L/s	INTERLOCK WITH	MAX. RPM	EXT. S.P. Pa	DESIGN MOTOR WATTS	POWER			DRIVE
							VOLT	PH	CYC	
RAF-1	2D-05	9130	AHU-1	1050	620	15000	480	3	60	BELT
RAF-2	2D-05	8290	AHU-2	950	520	11000	480	3	60	BELT
EF1-1	RF. BLOCK 1B	715	AHU-1	880	225	370	120	1	60	BELT
EF1-2	RF. BLOCK 2B	860	AHU-1	775	155	250	120	1	60	BELT
EF1-3	RF. BLOCK 1E	1360	AHU-1	925	225	750	480	3	60	BELT
EF1-4	RF. BLOCK 1E	70	AHU-1	1485	125	30	120	1	60	DIRECT
EF2-1	2D-05	810	AHU-2	750	215	550	208	3	60	BELT
EF2-2	2D-05	1130	AHU-2	615	250	750	480	3	60	BELT
EF2-3	2D-05	270	AHU-2	1650	325	370	120	1	60	BELT
EF-3	1E-15	450	THERMOSTAT	27.5	95	125	120	1	60	DIRECT
SF-4	1E-15A	50	THERMOSTAT	20.6	95	62	120	1	60	DIRECT
EF-5	1E-17	100	THERMOSTAT	20.6	95	62	120	1	60	DIRECT
EF-6	1E-20	100	THERMOSTAT	20.6	95	62	120	1	60	DIRECT
EF-7	1E-21	50	THERMOSTAT	20.6	95	62	120	1	60	DIRECT
SF-1	2D-05	3100	THERMOSTAT	45.5	125	750	480	3	60	DIRECT

A.C. UNIT SCHEDULE

MARK	LOCATION	TYPE	TOTAL L/s	O.A. L/s	APPROX. E.S.P. Pa	APPROX. FAN KW	D.X. COOLING COIL		ELECTRICAL
							TOTAL*	SENSIBLE*	
AC-1	1B-21	HORIZ. D.X. FAN COIL	300	0	50	.07	2500	2500	120/1/60
AC-2	1C-13	HORIZ. D.X. FAN COIL	300	0	50	.07	2500	2500	120/1/60
AC-3	2B-12	HORIZ. D.X. FAN COIL	300	0	50	.07	2500	2500	120/1/60
AC-4	2C-15	HORIZ. D.X. FAN COIL	300	0	50	.07	2500	2500	120/1/60
**AC-5	2D-04	HORIZ. D.X. FAN COIL	300	0	75	.07	3500	3500	208/1/60

AIR COOLED CONDENSING UNIT SCHEDULE

MARK	MATCHING A/C UNIT	*CAPACITY WATTS	OUTDOOR DESIGN TEMP. °C	ELEC. CHAR.	** EFFICIENCY
ACCU-1	AC-1	2500	35	208/1/60	10.0 SEER
ACCU-2	AC-2	2500	35	208/1/60	10.0 SEER
ACCU-3	AC-3	2500	35	208/1/60	10.0 SEER
ACCU-4	AC-4	2500	35	208/1/60	10.0 SEER
ACCU-5	AC-5	3500	35	208/1/60	10.0 SEER

AIR TERMINAL UNITS - V.A.V. - R.H. & C.V. - R.H. SCHEDULE

MARK	AHU	DESIGN L / sec	MIN SET PT. L / sec	TOTAL CAPACITY Watt	AIR TEMP. ENT. C	AIR TEMP. LVG. C	WATER TEMP. ENT. C	WATER TEMP. LVG. C	WATER FLOW M^3/Hr	T'STAT LOCATION RM #
A	1	100	60	1006.1	12.8	26.7	82.2	71.1	0.07	1A-01
B	1	255	85	1425.1	12.8	26.7	82.2	71.1	0.11	1A-02
C	1	90	40	670.8	12.8	26.7	82.2	76.6	0.11	1A-07
D	1	210	70	1173.7	12.8	26.7	82.2	71.1	0.09	1A-06
E		D E	L E	T E	D					
F	1	185	105	1760.4	12.8	26.7	82.2	71.1	0.14	1A-05
G1	1	265	85	2073.1	12.8	33.0	82.2	71.1	0.16	1AC2
G2	1	460	155	2683.5	12.8	27.1	82.2	71.1	0.20	1AC2
H	1	235	90	1509.0	12.8	26.7	82.2	71.1	0.11	1A-16
I	1	295	165	2766.5	12.8	26.7	82.2	71.1	0.20	1A-16
J	1	65	35	586.7	12.8	26.7	82.2	76.6	0.09	1A-10
K	1	165	165	2766.5	12.8	26.7	82.2	71.1	0.20	1AC3
L	1	380	360	6036.1	12.8	26.7	82.2	71.1	0.48	1AS1
M	1	125	85	1425.1	12.8	26.7	82.2	71.1	0.11	1C-01
N	1	210	210	3521.1	12.8	26.7	82.2	71.1	0.27	1D-05
O	1	225	205	3437.3	12.8	26.7	82.2	71.1	0.27	1D-02
P	1	300	150	2515.0	12.8	26.7	82.2	71.1	0.20	1DC1
Q	1	180	105	1760.4	12.8	26.7	82.2	71.1	0.14	1D-07
R	1	130	130	2179.8	12.8	26.7	82.2	71.1	0.16	1D-10
S	1	75	50	838.4	12.8	26.7	82.2	71.1	0.07	1C-10
T	1	150	85	1425.1	12.8	26.7	82.2	71.1	0.11	1C-09
U	1	220	105	1760.4	12.8	26.7	82.2	71.1	0.14	1C-05
V	1	100	55	922.3	12.8	26.7	82.2	71.1	0.07	1C-08
W	1	85	40	756.7	12.8	28.5	82.2	71.1	0.07	1C-19
X	1	235	110	1867.1	12.8	26.9	82.2	71.1	0.14	1C-14
Y	1	170	75	1257.5	12.8	26.7	82.2	71.1	0.09	1C-18
Z	1	80	40	670.8	12.8	26.7	82.2	76.6	0.11	1C-17
AA	1	85	45	754.6	12.8	26.7	82.2	71.1	0.07	1C-15
BB	1	160	75	1257.5	12.8	26.7	82.2	71.1	0.09	1C-18
CC	1	130	95	1592.8	12.8	26.7	82.2	71.1	0.11	1C-07
DD	1	225	100	1676.6	12.8	26.7	82.2	71.1	0.14	1D-16
EE	1	170	150	2515.0	12.8	26.7	82.2	71.1	0.20	1D-13
FF	1	355	320	5365.3	12.8	26.7	82.2	71.1	0.41	1DC1
GG	1	230	100	1676.6	12.8	26.7	82.2	71.1	0.14	1D-22
HH	1	135	80	1341.3	12.8	26.7	82.2	71.1	0.11	1D-21
II	1	185	105	1760.4	12.8	26.7	82.2	71.1	0.14	1D-16
JJ		D E	L E	T E	D					
KK	1	280	280	4694.8	12.8	26.7	82.2	71.1	0.36	1DC1
LL	1	125	65	1089.9	12.8	26.7	82.2	71.1	0.09	1D-27
MM	1	135	80	1341.3	12.8	26.7	82.2	71.1	0.11	1D-23
NN	1	90	70	1173.7	12.8	26.7	82.2	71.1	0.09	1E-14
OO	1	405	185	3101.7	12.8	26.7	82.2	71.1	0.25	1D-25
PP	1	130	130	2179.8	12.8	26.7	82.2	71.1	0.16	1E-33
QQ	1	410	205	3432.3	12.8	26.7	82.2	71.1	0.27	1E-16
RR	1	265	0	0.0	12.8	12.8	N/A	N/A	0.00	1E-19
SS		D E	L E	T E	D					
TT	1	170	140	2347.4	12.8	26.7	82.2	71.1	0.18	1E-23
UU	1	205	135	2263.6	12.8	26.7	82.2	71.1	0.18	1E-11
VV	1	75	40	670.8	12.8	26.7	82.2	76.6	0.11	1D-28
WW	1	110	65	1089.9	12.8	26.7	82.2	71.1	0.09	1D-31
XX	1	60	60	1006.1	12.8	26.7	82.2	71.1	0.07	1D-33
YY	1	165	100	1676.6	12.8	26.7	82.2	71.1	0.14	1D-34
ZZ		D E	L E	T E	D					
AAA	1	130	65	1089.9	12.8	26.7	82.2	71.1	0.09	1E-07
BBB	1	565	350	5868.5	12.8	26.7	82.2	71.1	0.45	1E-24
CCC	1	180	130	2179.8	12.8	26.7	82.2	71.1	0.16	1E-06
DDD	1	95	40	670.8	12.8	26.7	82.2	76.6	0.11	1E-26
EEE	1	160	100	1676.6	12.8	26.7	82.2	71.1	0.14	1E-05
FFF	1	330	135	2263.6	12.8	26.7	82.2	71.1	0.18	1E-29
GGG	1	155	70	1243.4	12.8	27.5	82.2	71.1	0.09	1E-25
HHH	1	300	150	2515.0	12.8	26.7	82.2	71.1	0.20	1DC1
III	1	55	55	922.3	12.8	26.7	82.2	71.1	0.07	1DC8
JJJ	1	105	105	1760.4	12.8	26.7	82.2	71.1	0.14	1D-38
KKK	1	95	50	838.4	12.8	26.7	82.2	71.1	0.07	1D-40
LLL	1	60	35	586.7	12.8	26.7	82.2	76.6	0.09	1D-35
MMM	1	230	85	1425.1	12.8	26.7	82.2	71.1	0.11	1AC2
NNN	1	540	0	0.0	12.8	12.8	N/A	N/A	0.00	1E-02
OOO	1	135	115	1928.0	12.8	26.7	82.2	71.1	0.16	1BC4
PPP	1	50	0	0.0	12.8	12.8	N/A	N/A	0.00	1B-23
QQQ	1	390	155	2598.8	12.8	26.7	82.2	71.1	0.20	1B-19
RRR	1	170	170	2850	12.8	26.7	82.2	71.1	0.23	1B-17
SSS	1	295	190	3185	12.8	26.7	82.2	71.1	0.25	1B-13
TTT	1	460	155	2598.8	12.8	26.7	82.2	71.1	0.20	1AC2
UUU	1	275	275	4611.0	12.8	26.7	82.2	71.1	0.36	1B-10
VVV	1	110	50	838.4	12.8	26.7	82.2	71.1	0.07	1B-06
WWW	1	115	115	1928.0	12.8	26.7	82.2	71.1	0.16	1BC2
XXX	1	730	730	12239.5	12.8	26.7	82.2	71.1	0.95	1B-04
YYY	1	200	155	2598.8	12.8	26.7	82.2	71.1	0.20	1B-01
ZZZ	1	260	85	1425.1	12.8	26.7	82.2	71.1	0.11	1AC2

AIR TERMINAL UNITS – V.A.V. – R.H. & C.V. – R.H. SCHEDULE

MARK	AHU	DESIGN L / sec	MIN SET PT. L / sec	TOTAL CAPACITY Watt	AIR TEMP. ENT. C	AIR TEMP. LVG. C	WATER TEMP. ENT. C	WATER TEMP. LVG. C	WATER FLOW M^3/Hr	T'STAT LOCATION RM #
A	2	270	85	1425.1	12.8	26.7	82.2	71.1	0.11	2A-01
B	2	210	125	2095.9	12.8	26.7	82.2	71.1	0.16	2A-14
C	2	75	35	586.7	12.8	26.7	82.2	76.6	0.09	2A-02
D	2	145	70	1173.7	12.8	26.7	82.2	71.1	0.09	2A-03
E	2	130	50	838.4	12.8	26.7	82.2	71.1	0.07	2A-04
F	2	160	70	1173.7	12.8	26.7	82.2	71.1	0.09	2A-05
G	2	365	300	5030.0	12.8	26.7	82.2	71.1	0.39	2A-12
H	2	160	70	1173.7	12.8	26.7	82.2	71.1	0.09	2A-06
I	2	160	70	1173.7	12.8	26.7	82.2	71.1	0.09	2A-07
J	2	295	240	4024.0	12.8	26.7	82.2	71.1	0.32	2A-11
K	2	160	70	1173.7	12.8	26.7	82.2	71.1	0.09	2A-08
L	2	210	100	2265.9	12.8	31.6	82.2	71.1	0.18	2AC1
M	2	160	70	1173.7	12.8	26.7	82.2	71.1	0.09	2A-09
N	2	285	255	4275.4	12.8	26.7	82.2	71.1	0.34	2C-01
O	2	170	70	1173.7	12.8	26.7	82.2	71.1	0.09	2C-02
P	2	215	90	1509.0	12.8	26.7	82.2	71.1	0.11	2C-03
Q	2	200	70	1174.0	12.8	26.7	82.2	71.1	0.09	2C-04
R	2	90	40	670.8	12.8	26.7	82.2	76.6	0.11	2C-22
S	2	200	70	1173.0	12.8	26.7	82.2	71.1	0.09	2C-06
T	2	205	205	3437.3	12.8	26.7	82.2	71.1	0.27	2C-08
U	2	200	70	1173.0	12.8	26.7	82.2	71.1	0.09	2C-09
V	2	140	95	1592.8	12.8	26.7	82.2	71.1	0.11	2C-19
W	2	215	215	3604.9	12.8	26.7	82.2	71.1	0.27	2C-10
X	2	260	260	4359.2	12.8	26.7	82.2	71.1	0.34	2C-12
Y	2	150	150	2515.0	12.8	26.7	82.2	71.1	0.20	2C-13
Z	2	220	220	3688.7	12.8	26.7	82.2	71.1	0.30	2C-16
AA	2	560	560	9389.3	12.8	26.7	82.2	71.1	0.73	2C-17
BB	2	200	105	1760.4	12.8	26.7	82.2	71.1	0.14	2C-14
CC	2	265	0	0.0	12.8	12.8	N/A	N/A	0.00	2C-18
DD	2	115	50	838.4	12.8	26.7	82.2	71.1	0.07	2B-21
EE	2	215	85	1425.1	12.8	26.7	82.2	71.1	0.11	2B-23
FF	2	70	40	670.8	12.8	26.7	82.2	76.6	0.11	2B-19
GG	2	145	145	2431.2	12.8	26.7	82.2	71.1	0.18	2B-25
HH	D	E	L E	T E	D					
II	2	225	85	1425.1	12.8	26.7	82.2	71.1	0.11	2B-18
JJ	2	240	175	2934.1	12.8	26.7	82.2	71.1	0.23	2B-15
KK	2	260	0	0.0	12.8	12.8	N/A	N/A	0.00	2B-13
LL	2	140	80	1341.3	12.8	26.7	82.2	71.1	0.11	2B-01
MM	2	160	95	1592.8	12.8	26.7	82.2	71.1	0.11	2B-03
NN	D	E	L E	T E	D					
OO	2	185	95	1592.8	12.8	26.7	82.2	71.1	0.11	2B-07
PP	2	70	35	586.7	12.8	26.7	82.2	76.6	0.09	2B-08
QQ	2	80	45	754.6	12.8	26.7	82.2	71.1	0.07	2B-10
RR	2	155	115	1928.0	12.8	26.7	82.2	71.1	0.16	2B-11
SS	2	45	45	754.6	12.8	26.7	82.2	71.1	0.07	2BC1
TT	2	155	85	1425.1	12.8	26.7	82.2	71.1	0.11	2D-03
UU	2	500	215	3604.9	12.8	26.7	82.2	71.1	0.27	2D-04A
VV	2	180	140	2347.4	12.8	26.7	82.2	71.1	0.18	2DC2
WW	2	200	70	1173.7	12.8	26.7	82.2	71.1	0.09	2D-21
XX	2	300	110	1844.2	12.8	26.7	82.2	71.1	0.14	2D-20
YY	D	E	L E	T E	D					
ZZ	2	330	140	2347.4	12.8	26.7	82.2	71.1	0.18	2D-17
AAA	2	105	40	670.8	12.8	26.7	82.2	76.6	0.11	2D-15
BBB	2	135	50	838.4	12.8	26.7	82.2	71.1	0.07	2D-16
CCC	D	E	L E	T E	D					
DDD	2	185	105	1760.4	12.8	26.7	82.2	71.1	0.14	2D-18
EEE	2	130	50	926.9	12.8	28.1	82.2	71.1	0.07	2D-11
FFF	2	125	55	922.3	12.8	26.7	82.2	71.1	0.07	2D-10
GGG	2	90	40	695.7	12.8	27.2	82.2	76.6	0.11	2D-09
HHH	2	65	35	586.7	12.8	26.7	82.2	76.6	0.09	2D-08
III	2	165	75	1257.5	12.8	26.7	82.2	71.1	0.09	2D-07
JJJ	2	180	105	1760.4	12.8	26.7	82.2	71.1	0.14	2D-18
KKK	D	E	L E	T E	D					
LLL	2	130	85	1425.1	12.8	26.7	82.2	71.1	0.11	2BC2