The following changes in the bid documents are effective immediately. This addendum will form part of the contract documents.

Part 1 MECHANICAL

1.1 Specifications

.1 Refer to **Schedules – Chiller Schedule**:

.1 **Revise** chiller schedule to match attached schedule;

.2 Refer to **Schedules – Air Handling Unit Schedule**:

.1 **Revise** AHU schedule to match attached schedule;

.3 Refer to **Schedules – Boiler Schedule**:

.1 **Revise** boiler B-3 schedule to use Gas fuel only, as indicated in attached schedule;

.4 Refer to **Schedules – Fan Coil Schedule**:

.1 **Delete** item **FCU-02** in its entirety;
.2 **Delete** item **FCU-03** in its entirety;
.3 **Delete** item **CD-02** in its entirety;
.4 **Delete** item **CD-03** in its entirety;

.5 Refer to **Schedules – Humidifier Schedule**:

.1 **Revise** humidifier schedule to indicate drainage to utilize flash tank to lower drain water temperature;

.6 Refer to **Schedules – Pump Schedules**:

.1 **Add** item **P-08** to read as shown on the attached schedule;

.7 Refer to **Specification 23 75 00 – Air Handling Units – Custom Indoor**:

.1 **Remove** pages 8 to 16. Specification has been attached;

.8 Refer to **Specification 25 90 01 – EMCS: Site Requirements, Applications and Systems Sequence of Operation**:

.1 **Add** item 2.1.6.6;
.2 **Remove** item 2.1.8.10.3;

.3 **Add** item 2.1.8.10.5;
.4 **Revise** item 2.1.8.11.2;
.5 **Revise** item 2.1.8.12 in its entirety;
.6 **Add** item 2.4.1.3.3;
.7 **Add** item 2.4.3.7;
.8 **Revise** item 2.4.4;
.9 **Revise** item 2.5.1;
.10 **Revise** item 2.6.1.3;
.11 Sequence has been issued in it's entirety;

1.2 Drawings

.1 Refer to **Drawing M-001 – Mechanical Legend and Drawing List**:

.1 **Delete** drawing M-A502 as shown on the attached drawing;

.2 Refer to **Drawing M-A502 – Main Building IT Room HVAC Ductwork**:

.1 **Delete** drawing M-A502 in its entirety;

.3 Refer to **Drawing MA-405 – Main Building Mechanical Room HVAC Piping**:

.1 **Replace** pump P-08 with a new pump P-08;
.2 **Add** note 12 to exiting pump P-08 on detail#1;
.3 **Add** note 7 to new pump P-08 on detail#2;
.4 **Add** note 9 to new pump P-08 to read as follows:

.1 New pump shall be provided with new housekeeping pad provided by the contractor. Refer to detail 7 on M-802 for further pump details.

.4 Refer to **Drawing M-803 – General Mechanical Details #3**:

.1 **Revise** dimensions on detail 1 as indicated in attached drawing;

END OF ADDENDUM No. 01

HVAC UPGRADES TO MAIN BUILDING
PARRY SOUND CANADIAN COAST GUARD BASE
28 WAUBEEK STREET, PARRY SOUND, ONTARIO
PROJECT NUMBER: R.064667.004

VENTILATION LEGEND

- SUPPLY AIR DUCT
- RETURN OR EXHAUST AIR DUCT
- 105 cfm 2-250Ø — DENOTES - SUPPLY 105 cfm THRU TYPE 'A' DIFFUSER c/w 250 NECK
- 105 cfm 1-450x250 — DENOTES - SUPPLY 105 cfm THRU 450x250 TYPE 'B' GRILLE
- 105 cfm 1-450x250 — **DENOTES - RETURN OR EXHAUST 105** cfm THRU 450x250 TYPE 'C' GRILLE
- SQUARE S/A DIFFUSER
- ROUND S/A DIFFUSER
- PERIMETER BOOT
- **AIR SUPPLY BOOT OVER LIGHT FIXTURE**
- V.A.V. BOX C/W ATTENUATOR
- V.A.V. BOX C/W ATTENUATOR & REHEAT COIL
- ACOUSTIC DUCT LINING
- DUCT SILENCER
- TURNING VANES
- FLEXIBLE DUCT
- UC — DOOR UNDERCUT
- AC — ACCESS DOOR
- TAKE-OFF WITH VOLUME DAMPER
- FC — FLEXIBLE CONNECTION
- F or S — FIRE OR SMOKE DAMPER
- VD — VOLUME DAMPER
- BD — BACKDRAFT DAMPER
- MD — MOTORIZED DAMPER
- SD — SPLITTER DAMPER

GENERAL NOTES

A / 150x400	A	-	DENOTES VAV UNIT TYPE REFER TO SPECIFICATION
	150	-	DENOTES AIR QUANTITY - IN CFM. MINIMUM
	450	-	DENOTES AIR QUANTITY - IN CFM. MAXIMUM
CV-A / 1.0	CV	-	DENOTES CONVECTOR HEATING UNIT
	A	-	DENOTES UNIT TYPE - REFER TO SPECIFICATION
	1.0	-	DENOTES HEATING CAPACITY - IN MBH.
FF / 1	FF	-	DENOTES FORCE FLOW HEATER
	1	-	DENOTES FORCE FLOW HEATER NUMBER
UH / 1	UH	-	DENOTES UNIT HEATER
	1	-	DENOTES UNIT HEATER NUMBER
RH / 1	RH	-	DENOTES REHEAT COIL
	1	-	DENOTES REHEAT COIL NUMBER
HWT / 1	HWT	-	DENOTES HOT WATER TANK
	1	-	DENOTES HOT WATER TANK NUMBER
B / 1	B	-	DENOTES BOILER
	1	-	DENOTES BOILER NUMBER
ET / 1	ET	-	DENOTES EXPANSION TANK
	1	-	DENOTES EXPANSION TANK NUMBER
P / 1	P	-	DENOTES PUMP
	1	-	DENOTES PUMP NUMBER
CD / 1	CD	-	DENOTES CONDENSER
	1	-	DENOTES CONDENSER NUMBER
EF / 1	EF	-	DENOTES EXHAUST FAN
	1	-	DENOTES EXHAUST FAN NUMBER
SF / 1	SF	-	DENOTES SUPPLY AIR FAN
	1	-	DENOTES SUPPLY AIR FAN NUMBER
AH / 1	AH	-	DENOTES AIR HANDLING UNIT
	1	-	DENOTES AIR HANDLING UNIT NUMBER
FCU / 1	FCU	-	DENOTES FAN COIL UNIT
	1	-	DENOTES FAN COIL UNIT NUMBER
H / 1	H	-	DENOTES EXISTING UNIT HEATER
	1	-	DENOTES EXISTING UNIT HEATER NUMBER
ME / 1	ME	-	DENOTES EXISTING MECHANICAL EQUIPMENT
	1	-	DENOTES EXISTING MECHANICAL EQUIPMENT NUMBER
CH / 1	SL	-	DENOTES CHILLER
	1	-	DENOTES CHILLER NUMBER

HEATING & COOLING LEGEND

- EXPANSION COMPENSATOR
- FLOAT & THERMOSTATIC TRAP
- FLEXIBLE CONNECTION
- T — THERMOSTAT/TEMPERATURE SENSOR
- H — HUMIDISTAT/HUMIDITY SENSOR
- C — WALL MOUNTED SPEED CONTROLLER
- A.A.V. — AUTOMATIC AIR VENT
- M.V. — MANUAL VENT
- F.V. — FLOAT VENT
- GLS — GLYCOL SUPPLY LINE
- GLR — GLYCOL RETURN LINE
- RS — REFRIDGERANT SUCTION
- RL — REFRIDGERANT LIQUID
- RHG — REFRIDGERANT HOT GAS LINE
- HWS — HOT WATER SUPPLY LINE
- HWR — HOT WATER RETURN LINE
- CHWS — CHILLED WATER SUPPLY LINE
- CHWR — CHILLED WATER RETURN LINE

LINEWORK DESIGNATION

- NEW WORK (PIPING AND DUCTWORK)
- EXIST. WORK TO REMAIN
- EXIST. DUCTWORK TO BE REMOVED
- EXISTING PIPING TO BE REMOVED
- EXIST. SPRINKLER HEAD TO REMAIN
- EXIST. SPRINKLER HEAD TO BE REMOVED

VALVES & SPECIALTIES LEGEND

- SHUT OFF VALVE
- GLOBE VALVE
- BALL VALVE
- SUPERVISED VALVE
- **AUTOMATIC BALANCING VALVE**
- CONTROL VALVE
- SOLENOID VALVE
- PRESSURE REDUCING VALVE
- PRESSURE RELIEF VALVE
- **PRESSURE & TEMPERATURE RELIEF VALVE**
- MIXING OR DIVERTER VALVE (3-WAY)
- BUTTERFLY VALVE
- PLUG VALVE (GAS)
- CHECK VALVE
- BASKET STRAINER
- 'Y' STRAINER
- BWV — BACK WATER VALVE
- BFPA — BACK FLOW PREVENTER ASSEMBLY
- FS — FLOW SWITCH
- PS — PRESSURE SWITCH
- UNION
- PET COCK
- THERMOMETER
- PG — PRESSURE GAUGE
- UH — UNIT HEATER
- WALL FIN CONVECTOR
- UNINSULATED PIPE (IN SECTION)
- INSULATED PIPE (IN SECTION)

MECHANICAL DRAWING LIST

MA-SERIES — MAIN BUILDING		M-SERIES — GENERAL	
M-A001	KEY PLAN - SHOP WING - MAIN BUILDING (MA)	M-001	MECHANICAL LEGEND AND DRAWING LIST
M-A002	KEY PLAN - ADMINISTRATION - MAIN BUILDING (MA)	M-701	HOT WATER HEATING SCHEMATIC - NEW
M-A402	HVAC DUCTWORK ADMINISTRATIVE - MAIN BUILDING (MA)	M-701D	HOT WATER HEATING SCHEMATIC - DEMOLITION
M-A403	HVAC DUCTWORK - FAN ROOM - MAIN BUILDING (MA)	M-801	MECHANICAL DETAILS #1
M-A404	HVAC DUCTWORK - MECHANICAL ROOM - MAIN BUILDING (MA)	M-802	MECHANICAL DETAILS #2
M-A405	HVAC PIPING - MECHANICAL ROOM - MAIN BUILDING (MA)	M-803	MECHANICAL DETAILS #3
M-A451	HVAC PIPING - BOILER ROOM - MAIN BUILDING (MA)		
M-A452	HVAC PIPING - ROOF PLAN - MAIN BUILDING (MA)		
M-A501	HVAC DUCTWORK - GENERAL STORES - MAIN BUILDING (MA)		
M-A503	HVAC DUCTWORK - BOILER ROOM - MAIN BUILDING (MA)		

1

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CONSULTING ENGINEERS
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2255 Sheppard Avenue. E., Suite E 331
North York, On M2J 4Y1
(416)497.3111 fax (416)497.7210

revision		date
07		
06	ISSUED FOR TENDER 2016-01-26	2016.01.26
05	ISSUED FOR TENDER	2015.12.11
04	ISSUED FOR CLASS A COST ESTIMATE	2015.11.06
03	FINAL CONTRACT DOCUMENT FOR CLASS A	2014.12.15
02	ISSUED FOR 66% PROGRESS REVIEW R1	2014.08.29
01	ISSUED FOR 66% PROGRESS REVIEW	2014.06.14

Do not scale drawings.
Verify all dimensions and conditions on site and immediately notify the Departmental Representative of all discrepancies.

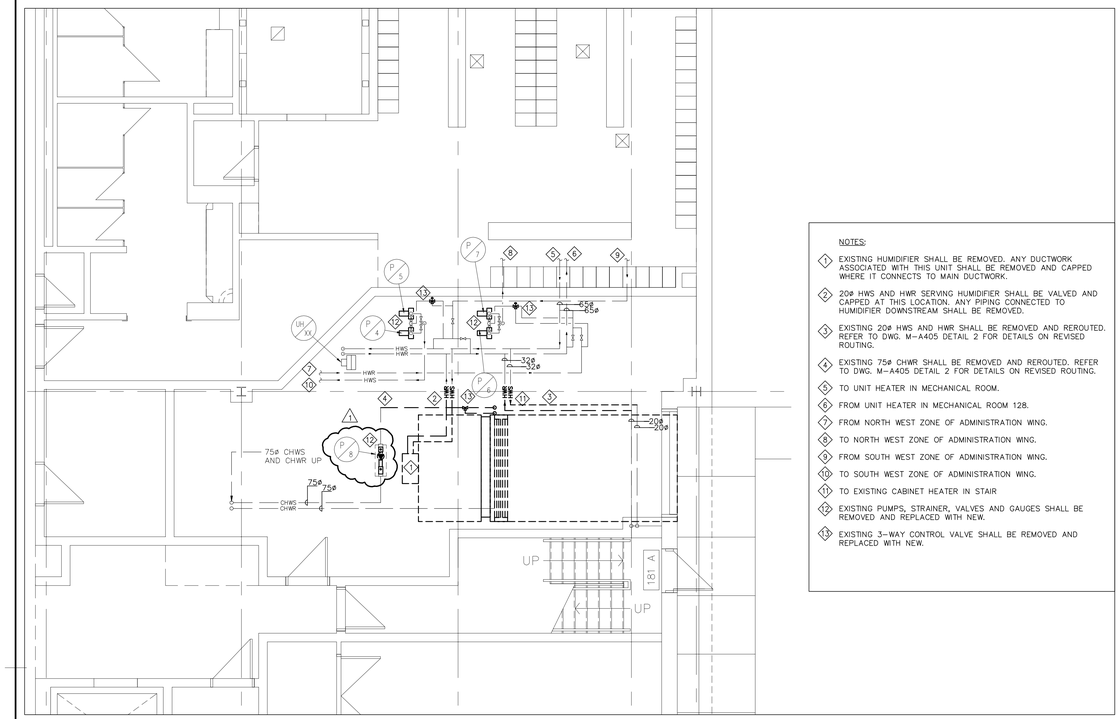
A — Detail No. No. du détail
B — drawing no. – where detail required dessin no. – où détail exigé
C — drawing no. – where detailed dessin no. – où détaillé

project title / titre du projet
PARRY SOUND ONTARIO
28 WAUBEEK STREET
P2A 1B9
CANANDIAN COAST GUARD BASE
HVAC UPGRADE TO MAIN BUILDING

drawing title / titre du dessin
MECHANICAL LEGEND AND DRAWING LIST

drawn by / dessine par: LP
designed by / conc par: LP
approved by / approuve par: AC
bid / offre
project manager / administrateur de projets: J.LEON
project date / date du projet: 2016-01-26
project no. / no. du projet: R.064667.004
drawing no. / dessine no.: M-001

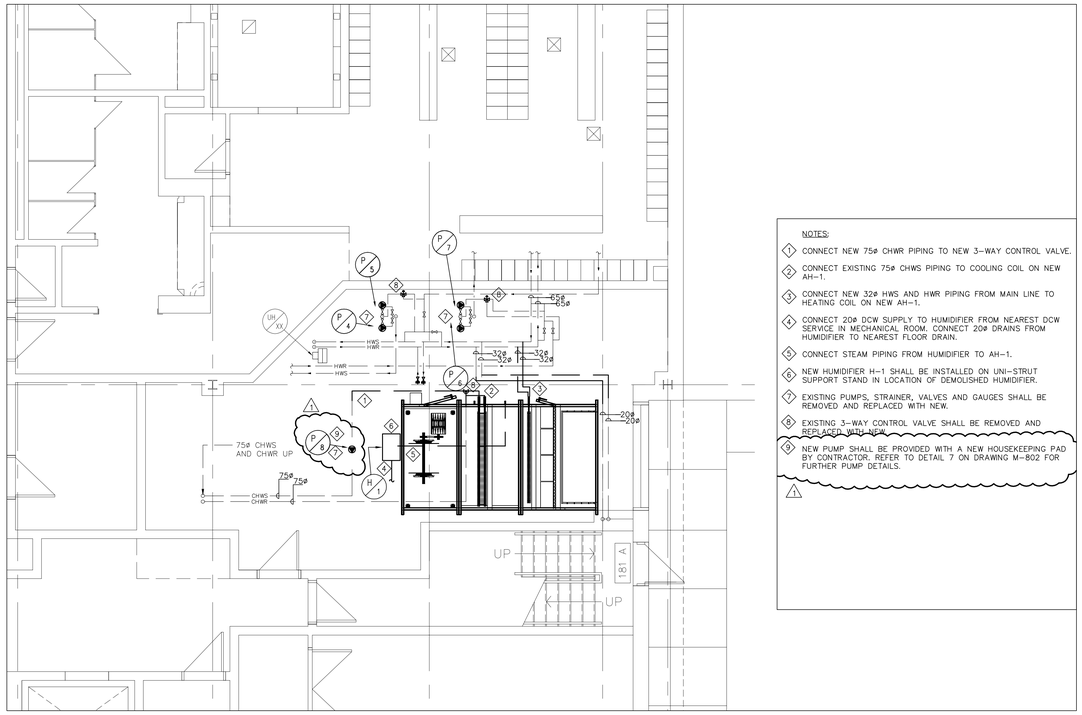
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 millimetres



NOTES:

1. EXISTING HUMIDIFIER SHALL BE REMOVED. ANY DUCTWORK ASSOCIATED WITH THIS UNIT SHALL BE REMOVED AND CAPPED WHERE IT CONNECTS TO MAIN DUCTWORK.
2. 20ø HWS AND HWR SERVING HUMIDIFIER SHALL BE VALVED AND CAPPED AT THIS LOCATION. ANY PIPING CONNECTED TO HUMIDIFIER DOWNSTREAM SHALL BE REMOVED.
3. EXISTING 20ø HWS AND HWR SHALL BE REMOVED AND REROUTED. REFER TO DWG. M-A405 DETAIL 2 FOR DETAILS ON REVISED ROUTING.
4. EXISTING 75ø CHWR SHALL BE REMOVED AND REROUTED. REFER TO DWG. M-A405 DETAIL 2 FOR DETAILS ON REVISED ROUTING.
5. TO UNIT HEATER IN MECHANICAL ROOM.
6. FROM UNIT HEATER IN MECHANICAL ROOM 128.
7. FROM NORTH WEST ZONE OF ADMINISTRATION WING.
8. TO NORTH WEST ZONE OF ADMINISTRATION WING.
9. FROM SOUTH WEST ZONE OF ADMINISTRATION WING.
10. TO SOUTH WEST ZONE OF ADMINISTRATION WING.
11. TO EXISTING CABINET HEATER IN STAIR
12. EXISTING PUMPS, STRAINER, VALVES AND GAUGES SHALL BE REMOVED AND REPLACED WITH NEW.
13. EXISTING 3-WAY CONTROL VALVE SHALL BE REMOVED AND REPLACED WITH NEW.

1 GROUND FLOOR MECHANICAL ROOM DEMOLITION
M-A405 1:50



NOTES:

1. CONNECT NEW 75ø CHWR PIPING TO NEW 3-WAY CONTROL VALVE.
2. CONNECT EXISTING 75ø CHWS PIPING TO COOLING COIL ON NEW AH-1.
3. CONNECT NEW 32ø HWS AND HWR PIPING FROM MAIN LINE TO HEATING COIL ON NEW AH-1.
4. CONNECT 20ø DCW SUPPLY TO HUMIDIFIER FROM NEAREST DCW SERVICE IN MECHANICAL ROOM. CONNECT 20ø DRAINS FROM HUMIDIFIER TO NEAREST FLOOR DRAIN.
5. CONNECT STEAM PIPING FROM HUMIDIFIER TO AH-1.
6. NEW HUMIDIFIER H-1 SHALL BE INSTALLED ON UNI-STRUT SUPPORT STAND IN LOCATION OF DEMOLISHED HUMIDIFIER.
7. EXISTING PUMPS, STRAINER, VALVES AND GAUGES SHALL BE REMOVED AND REPLACED WITH NEW.
8. EXISTING 3-WAY CONTROL VALVE SHALL BE REMOVED AND REPLACED WITH NEW.
9. NEW PUMP SHALL BE PROVIDED WITH A NEW HOUSEKEEPING PAD BY CONTRACTOR. REFER TO DETAIL 7 ON DRAWING M-802 FOR FURTHER PUMP DETAILS.

1

2 GROUND FLOOR MECHANICAL ROOM NEW
M-A405 1:50

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04	ISSUED FOR CLASS A COST ESTIMATE	2015.11.06
03	FINAL CONTRACT DOCUMENT FOR CLASS A	2014.12.15
02	ISSUED FOR 66% PROGRESS REVIEW R1	2014.08.29
01	ISSUED FOR 66% PROGRESS REVIEW	2014.06.14

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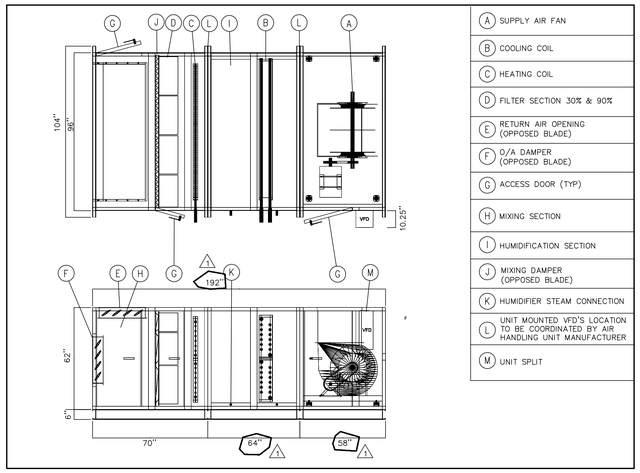
project title / titre du projet
PARRY SOUND ONTARIO
28 WAUBEEK STREET
P2A 1B9
CANANDIAN COAST GUARD BASE
HVAC UPGRADE TO MAIN BUILDING

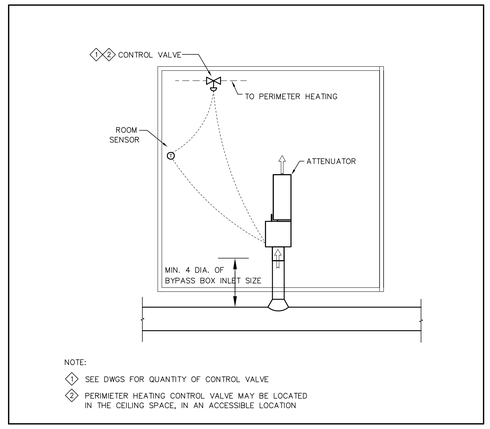
drawing title / titre du dessin
MAIN BUILDING
MECHANICAL ROOM
HVAC PIPING

drawn by / dessine par: LP
designed by / conc par: LP
approved by / approuve par: AC
bid / offre
project manager / administrateur de projets: J.LEON
project date / date du projet: 2016-01-26
project no. / no. du projet: R.064667.004
drawing no. / dessine no.: **M-A405**

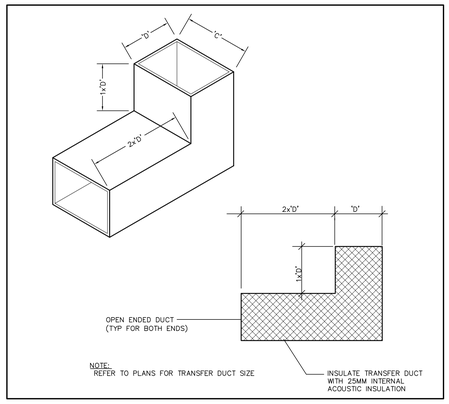


A	SUPPLY AIR FAN
B	COOLING COIL
C	HEATING COIL
D	FILTER SECTION 30% & 90%
E	RETURN AIR OPENING (OPPOSED BLADE)
F	O/A DAMPER (OPPOSED BLADE)
G	ACCESS DOOR (TYP)
H	MIXING SECTION
I	HUMIDIFICATION SECTION
J	MIXING DAMPER (OPPOSED BLADE)
K	HUMIDIFIER STEAM CONNECTION
L	UNIT MOUNTED VFD'S LOCATION TO BE COORDINATED BY AIR HANDLING UNIT MANUFACTURER
M	UNIT SPLIT

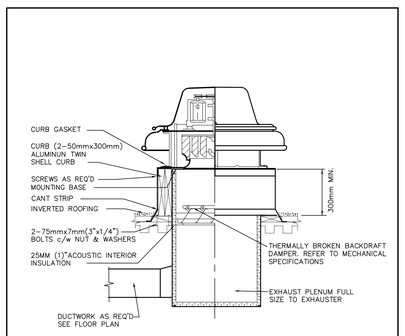
1 DETAIL OF AHU-1
M-803 N.T.S.



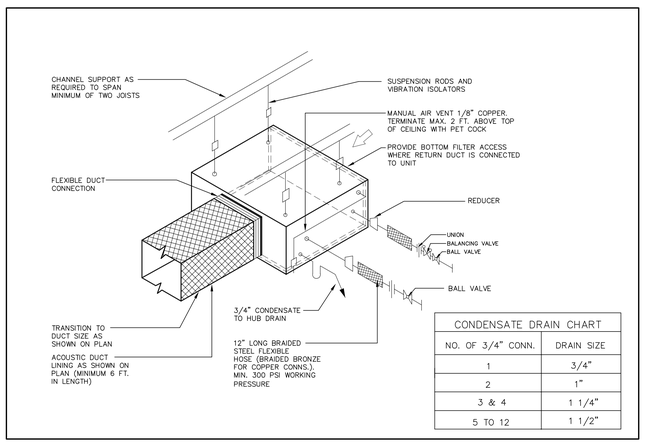
2 VAV TERMINAL UNIT WITH RE-HEAT COIL DETAIL & PERIMETER HEATING
M-803 N.T.S.



3 TYPICAL TRANSFER DUCT DETAIL
M-803 N.T.S.



4 ROOF EXHAUSTER DETAIL
M-803 N.T.S.



CONDENSATE DRAIN CHART	
NO. OF 3/4" CONN.	DRAIN SIZE
1	3/4"
2	1"
3 & 4	1 1/4"
5 TO 12	1 1/2"

5 FAN COIL INSTALLATION DETAIL
M-803 N.T.S.

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PARRY SOUND ONTARIO
28 WAUBEEK STREET
P2A 1B9
CANANDIAN COAST GUARD BASE HVAC UPGRADE TO MAIN BUILDING

drawing title / titre du dessin
GENERAL
MECHANICAL DETAILS#3

drawn by / dessine par LP
designed by / conc par LP
approved by / approuve par AC
bid / offre
project manager / administrateur de projets J.LEON
project date / date du projet 2016-01-26
project no. / no. du projet R.064667.004
drawing no. / dessine no. M-803

AIR HANDLING UNIT SCHEDULE
Parry Sound CCG Base
HVAC Upgrades to Main Building

Tag No: **AH-1**
Date: 1/29/2015
CEL Project No.: 13403
Revision No.:

Tag No.	Unit Location	Name	Marine Lights	Min. Outdoor Air Flow [CFM]	Weight [kg]	Manufacturer	Model No.	Remarks
AH-1	Main Building		Yes	2,500		Daikin	CAH031GDAM	

FAN SCHEDULE

Tag No.	CFM	ESP [in.wg]	Fan RPM	Motor								Size	Manufacturer	Model No.	Remarks
				V	Ph	HP	BHP	Type	Starter	MCA	Power Type				
F-1	15,000	1.75	1887	575	3	25	20.1	ODP	VFD		Normal	20	Daikin		

FAN SOUND POWER LEVEL SCHEDULE

Sound Power Level RE: 10^{-12} Watts

Tag No.	Inlet									Discharge								
	1	2	3	4	5	6	7	8	Average	1	2	3	4	5	6	7	8	Average
F-1	86	91	81	81	72	62	50	37		86	91	81	81	72	62	50	37	

HYDRONIC COIL SCHEDULE

Tag No.	Air PD [in.wg]	Face Velocity [FPM]	Entering Air Temperature		Leaving Air Temperature		Fluid	GPM	ΔP [FT]	EWT [°F]	LWT [°F]	Size [inch]		Fins Per Inch	Rows	Remarks
			DB [°F]	WB [°F]	DB [°F]	WB [°F]						Width	Height			
CCI-1	1.15	542	77.5	65	54.1	53.7	Glycol 40%	107	16.8	45	55	83	24	6	12	Total = 505 MBH Sensible = 383 MBH

AIR HANDLING UNIT SCHEDULE Tag No: **AH-1**

Parry Sound CCG Base

HCI-1	0.12	563	43		68.8		Water	36	3.5	180	160			9	1	Total = 180 MBH

HUMIDIFICATION UNIT SCHEDULE

Tag No.	Steam Capacity [Lbs/hr]	Remarks
HUI-1	**102**	

Remarks:

1. New unit to be attached to existing ductwork and piping
2. Unit shall be provided with marine lights in all sections
3. return fan is separate from unit and location in the third floor fan room. Refer to return fan schedule for further details
4. Variable speed drives shall be provided for S/A fan. Fan motor shall be premium efficiency motor.
5. Unit shall be installed on 6" concrete pad
6. Minimum outdoor airflow is 2500 cfm
7. humidifier grid shall be capable of supplying 102 lbs/hr. Refer to humidifier specifications.schedule for further details.
8. Cooling coil shall be based on 40% propylene glycol.

Crossey Engineering Ltd.

HYDRONIC BOILER SCHEDULE
Parry Sound CCG Base
HVAC Upgrades to Main Building

Date: 2015/11/06
CEL Project No. 13403
Revision No.: 0

Tag No.	Fuel	Input MBH	Output MBH	EWT (C)	LWT (C)	V/Ph	Manufacturer	Model No.	Boiler dBa High Fire	Comments
B-01	GAS	1112	1078	43.3	60	120/1	VIESSMANN	CM2-311		
B-02	GAS	1112	1078	43.3	60	120/1	VIESSMANN	CM2-311		
B-03	GAS	934	794	76.6	93.3	120/1	VIESSMANN	VD2A-230		

Remarks:

1. Provide double acting barometric draft regulator located within 5-7 ft from the breaching outlet located at the back of the boiler.
2. Provide one 120/1 power connection for the boiler controls and one 208/3 power connection for the fan motor.
3. Boilers B-01 and B-02 shall be capable of resetting the water temperature that will be operating outside of condensing mode up to a temperature of 93.3C.

Crossey Engineering Ltd.

AIR COOLED CHILLER SCHEDULE
Parry Sound CCG Base
HVAC Upgrades to Main Building

Date:2016/09/30
CEL Project No.:13403
Revision No.: 1

Tag No.	CH-01
Design Capacity Tons	43.1
Power Input KW	43.8
Kw/ton Design Duty	43.8/43.1
Kw/ton 75% Design Duty	
Kw/ton 50% Design Duty	
APLV	
Refrigerant Charge LBS	42
Refrigerant type	R410A
Evaporator	
EWT ^{o}F	55
LWT ^{o}F	45
USGpm	113
Pressure Drop FT	22.7
Number of Passes	
Fouling Factor (°F.ft².h/Btu)	0.00010
Condenser	
EWT ^{o}F	
LWT ^{o}F	
USGpm	
Pressure Drop FT	
Number of Passes	
Fouling Factor	
V/ph	575/3
Manufacturer	Daikin
Model No.	AGZ045E
Max Motor Lra	14 A
MCA	74.6A
Operating Weight Lbs	2964
Overall Sound Power	89 dBA

Remarks:

1. Air cooled chiller. Condenser specs as follows:
   40% Propylene Glycol
   Ambient Air temperature: 90 ^{o}F
   Fan Diameter: 30 in
   Fan motor horsepower: 1.5 hp
   Fan speed: 1140 RPM
   Low Ambient control to 32 ^{o}F
   Unit Airflow: 40400 CFM

Crossey Engineering Ltd.

FAN COIL UNIT SCHEDULE
Parry Sound CCG Base
HVAC Upgrades to Main Building

Revision No.: 0

Tag No.	Location Served	Air		Motor			Starter	Type	Manufacturer	Model No.	Remarks
		CFM	ESP (in)	V/ph	BHP	HP					
FCU-01	CENTRAL STORES	1500	1.00	575/3	1.15	2		TopHorizontal-CCW rotation-Chilled Water Cooled	Daikin	LAH003A	DX Fan Coil Unit

FAN COIL UNIT PERFORMANCE DATA

Tag No.	Location Served	Air	Chilled Water Cooling (20% PG)						DX Cooling					
		CFM	EAT db/wb °F	LAT db/wb °F	EWT	LWT	GPM	MBH TC/SC	EAT db/wb °F	LAT db/wb °F	Coil Rows	Coil FPI	SST/SCT °F	MBH TC/SC
CD-01	CENTRAL STORES	1500	-	-	-	-	-	-	76.5/65.5	59.4/58.3	4	12	53	33.9/28.1

Remarks:

1. MS – Magnetic Starter
2. Unit shall be on Normal Power.
3. Condensing Unit CD-1 shall be paired with DX fan coil unit FC-1:

a. Refplus model OCZ-035-1H1-8D
b. 95 deg.F design ambient
c. 575V/3 phase
d. MCA = 8.05A
e. R-410A refrigerant
f. Provide low ambient kit, unit will be operational in the winter.
g. 3.8 tons
h. Approximate weight of 650 lbs

4. Fan Coil unit FC-1 shall have an electric heating Coil with the following performance:
   a. Heater Size: 9.0 KW
   b. Total Capacity: 30726 Btu/hr
   c. EAT: 63F
   d. LAT: 82F
   e. MROPDA: 15
5. Mechanical contractor shall be responsible for hiring a refrigeration contractor to size and route the refrigerant lines from the fan coil units to the roof mounted condensing units.

Crossey Engineering Ltd.

PUMP SCHEDULE
Parry Sound CCG Base
HVAC Upgrades to Main Building

Date: 2015/11/06
CEL Project No. 13403
Revision No.: 0

Tag No.	Service	Location	GPM	Head Ft.	Motor				Manufacturer	Model No.	Remarks
					V/Ph	BHP	HP	Rpm			
P-01		BOILER RM.	130	70	575/3	4.01	7.5	1200	Armstrong	4380	3X3X13
P-02		BOILER RM.	130	70	575/3	4.01	7.5	1200	Armstrong	4380	3X3X13
P-04		MECHANICAL RM.	26.2	43	575/3	0.7	1.5	1800	Armstrong	1060-1.5D	
P-05		MECHANICAL RM.	26.2	43	575/3	0.7	1.5	1800	Armstrong	1060-1.5D	
P-06		MECHANICAL RM.	22.3	36	575/3	0.26	0.75	1800	Armstrong	H-H64	
P-07		MECHANICAL RM.	22.3	36	575/3	0.26	0.75	1800	Armstrong	H-H64	
P-08		MECHANICAL RM.	113	50	575/3	1.94	3	3600	Bell & Gosset	E-90	

Remarks:

1. All pumps that are over 20 HP shall be provided with thermistor.
2. Refer to Section 15010 of the specification
3. Pumps P-01 and P-02 shall be provided with Variable Frequency Drives.

Crossey Engineering Ltd.

HUMIDIFIER SCHEDULE
Parry Sound CCG Base
HVAC Upgrades to Main Building

Date: 2015/11/06
CEL Project No. 13403
Revision No.: 0

Tag No.	Face Size HxW In x In	CFM	S/A Temp °F	Load Lbs/hr	Steam PSI	Absorption Distance	Space Conditions		Manufacturer	Model No.
							Temp °F	Hum. %		
H-1	18.6x24.2	15,000	55	86.1	-	11”	75	30	Dri-Steem	VM-34

Remarks:

1) Minimum water conductivity of 2 grains/gallon
2) To be installed in location of existing humidifier.
3) Electrical Info:
    a. 600V/3 Phase
    b. 32.7 Amps
4) Humidifier drain to utilize flash tank to lower water temperature entering the drain.

Crossey Engineering Ltd.

PART 1 - GENERAL

1.1 GENERAL

.1 units shall be completely factory assembled piped, wired, tested and shipped in one piece to the job site. Refer to schedules for unit performance.

.2 Air handling units shall be ETL-Canada safety listed to conform to UL Standard 1995 and CAN/CSA Standard C22.2 No. 236. Air handling unit water heating & cooling coils shall be certified in accordance with the forced circulation air cooling and air heating coils certification program, which is based on ARI Standard 410.

1.2 CASING

.1 Fabricate unit with 16 gauge nominal channel posts and panels secured with mechanical fasteners. All panels and access doors shall be sealed with bulb-type gasket.

.2 Panels and access doors shall be constructed as a 2-inch (50-mm) nominal thick, thermal broke double wall assembly, with 3 lb. per cu ft. density density neoprene coated fiberglass glass fiber insulation. The outer casing shall be constructed of 16 gauge G90 galvanized steel.

.3 The inner liner shall be constructed of 22 gauge G90 galvanized steel. Panel deflection shall not exceed L/240 at 125% of design static pressure, minimum +/- 8". Deflection shall be measured at the midpoint of the panel height.

.4 Access doors shall be flush mounted to the cabinetry and secured with heavy-duty stainless steel hinges. The door latch handle assembly shall be provided with a full-size grip handle and roller pall for smooth operation. The assembly shall be gasketed and sealed to prevent thermal bridging. All access doors shall open against pressure. Provide inspection window for each access door.

.5 Construct drain pans from stainless steel with cross break and pitch to drain connection. Provide drain pans under fan section, cooling coil section and humidifier sections.

1.2 CASING (Cont'd)

.6 Provide unit with a factory installed 6 inch high full perimeter channel base rail.

1.3 FILTERS

.1 Provide filter box section with filter guides, hinged and latching access doors on one sides, for side loading of filters. Filter section shall house prefilters and final filters per requirements in section 23 41 00.

.2 Filter media shall be UL 900 listed, Class I or Class II.

1.4 FILTERS

.1 Unit shall be provided with a draw-through filter section.

.2 Provide angle arrangement filters with 2 inch deep (pleated panel filter) (disposable panel filters). Filters shall be accessible from both sides of the unit.

1.5 FANS AND MOTORS

.1 Fans shall be belt driven, double inlet, forward curved or backward airfoil as indicated in the specification or on the equipment schedules.

.2 All fans shall be tested in accordance with AMCA Standard 210-70 Test Code for Air Moving Devices. Fans to carry AMCA authorized seal.

.3 Fan housing shall be constructed of steel, continuously welded. All housings are equipped with spun intake cones designed for smooth air flow. The housing shall be adequately braced with structural steel for rigidity.

.4 Fan shafts are to be solid, ground and polished, carbon steel, machined to close tolerances, keyed to the fan wheel and designed with its maximum operating speed not to exceed 75% of its first critical speed. Coat the shaft with rust inhibitor after machining. Hollow shafts will not be acceptable.

1.5 FANS AND MOTORS (Cont'd)

.5 Fan bearings shall be self aligning pillow block type with split tapered adapter locking sleeves, pre-lubricated with grease, heavy duty ball type, selected for an average life of 200,000 hours at design operating conditions. Bearings are to be mounted on the structural frame of the fan.

.6 Drive sheaves are to be machined cast iron minimum two groove. An adjustable motor sheave is provided on 7-1/2 HP and less. Sheave selection and belt lengths are to be in accordance with the drive manufacturer and shall be rated for a capacity greater than 125% (150%) of the motor HP. For motors greater than 7 HP provide one drive change for air balancing.

.7 Provide extended lubrication lines to permit lubrication for offside bearings from the access door side of the air handling unit.

.8 Motors shall be high efficiency ODP type in accordance with section 23 05 13 for requirements.

.9 Standard of Acceptance: Twin City, Barry Blower, Chicago, New York Blower.

1.6 VIBRATION ISOLATION

.1 Fan and motor are to be mounted on an all welded, structural steel base, prime coated, internally isolated with springs to provide vibration isolation from the building structure. The fan outlet shall be separated from the unit casing with a factory installed flexible fabric connection. The motor shall be mounted on a slide rail base with dual adjustments for belt tensioning.

.2 Vibration isolators shall be open type with sound deadening pads and leveling bolts. Isolators shall be sized in accordance with the manufacturers recommendations. Removable shipping restraints are provided to protect the fan, motor and base during shipment.

1.7 VARIABLE FREQUENCY DRIVES

.1 Refer to Section 23 05 14.

.2 Where units are indicated to be provided with variable speed drives in item 1.5.6 above, the variable speed drives shall be factory mounted on the air handling units. A power connection point shall be provided for each variable speed drive for connection by Electrical Contractor. The wiring from the variable speed drive to the motor shall be factory wired by the unit manufacturer in accordance with Electrical Contractor wiring methods.

1.8 FILTER GAUGE

.1 Provide magnehelic gauges accurate to +/- 2 percent of full range for each filter bank.

.2 Sensing probes and shut off valves shall be provided for each gauge.

1.9 DAMPERS

.1 Refer to Section 23 33 15 for damper requirements.

1.10 COILS

.1 Coils shall be fully enclosed within casing and mounted on primed and painted angle iron racks manufactured to allow coils to slide out individually.

.2 Removable coil access panels shall be provided to remove coils through casing wall. Coils shall be individually removable towards the access side as shown on the drawings.

.3 Drain pans shall be continuously welded galvanized steel. Intermediate drain pans shall be interconnected with 25 mm (1") drain lines.

.4 Coils shall be designed for glycol and chilled water service.

.5 Water coils shall be certified in accordance with ARI Standard 410-81.

.6 Coils shall be hydrostatically tested at 400 Psig, (2758 KPa) and shall be suitable for working pressures and temperatures up to 200 Psig (1379 Kpa) and 220oF (104 C).

1.10 COILS (Cont'd)

.7 Pipe connections shall be on the same end , and shall be threaded.

.8 Air handling unit manufacturer to extend coil connections, coil drain, and vent connections through the casing wall and properly grommet and seal to ensure leakage specification is met.

.9 Provide access to coils from connection side of unit for service and cleaning. Enclose coil headers and return bends fully within unit casing. Fabricate coil connections, vents and drains to extend beyond unit casing. Coils shall be removable through side panels without removal and disassembly of entire section.

.10 Coil performance shall be as per schedule. Coil performance data shall be certified in accordance with ARI Standard 410 where applicable.

.11 Water and glycol coils shall be circuited drainable with a vent connection at the high point and a drain connection at the low point. Coil headers shall be copper with steel male pipe connections.

.12 Electrical requirements:
.1 All unit power wiring shall enter unit cabinet at factory predrilled locations.
.2 Provide marine lights in accordance with item 2.2.16 where indicated in the components list.

1.11 HUMIDIFIERS

.1 Provide a complete humidification system as per schedules and schematics and as indicated on the drawings.

.2 Direct Steam Injection Humidifiers

.3 The humidification steam shall be generated by a DriSteem electric steam generator (or equivalent noted below) and shall be directly into air handling unit for humidification.

.4 The humidification grid within the air handling unit shall be DriSteem Rapid Sorb (or equivalent noted below) with the following specifications:

1.11 HUMIDIFIERS (Cont'd)

.4 (Cont'd)

.1 Supply high-efficiency dispersion tubes insulated with plenum approved insulating material for in duct installation. The insulation material shall meet the criteria mandated by UL 723, NFPA 255 and ASTM E48 standards.

.2 Each dispersion tube shall be fitted with two rows of high temperature tubelets inserted into the tube wall, centered on the diametric line, and spaced 1 ½" (40mm) apart. These tubelets shall be made of thermal resin material designed for high temperature steam temperatures. The two rows of tubelets in each dispersion tube shall discharge steam in diametrically opposite directions.

.3 Each tubelet shall contain a steam orifice sized for its required steam capacity.

.4 Each humidifier panel assembly of tubes and headers shall be contained with a stainless steel casing to facilitate the stacking of and/or the end to end mounting of multiple humidifier panels in the air handling unit.

.5 All tubes and headers shall be 304 stainless steel and joints shall be Heli arc welded.

.6 High Limit Duct Humidistat: Compatible high limit duct humidistat shall be shipped loose for field installation. Humidistat shall sense humidity level with the duct and provide over-humidification protection.

.7 Air Flow Proving Switch: diaphragm operated, air flow proving switch shall be provided for field installation. Switch shall have an adjustable control point range of 1.27 mm to 305 mm W.C. and be rated for 1/4 H.P. at 125 VAC.

1.12 EXECUTION

.1 Install units in accordance with manufacturers' instructions and as indicated.

.2 Air handling unit may required in sections in order to fit through the louver opening. Mechanical Contractor shall be required to coordinate with the Air Handling unit Manufacturer the required section sizes to fit through this louver opening.

.3 All air handling units shall be installed on 6" (150 mm) concrete housekeeping pads.

1.12 EXECUTION (Cont'd)

.4 All air handling units shall be installed on 6" (150 mm) concrete housekeeping pads.

.5 If equipment is stored before use, the field contactor must provide adequate protection to ensure that the unit interior and unit exterior are undamaged. This protection shall remain on the unit until such time as unit start up is performed. The contractor must rotate the fan assemblies on a periodic basis as recommended by the fan manufacturer.

.6 Rig and set the unit in place. Ensure that spreader bars are used and the unit is protected from lifting cables. All lifting lugs must be used during the rigging process.

.7 Entire unit shall be leveled.

.8 Each drain connection shall be provided with a properly sized P trap. Provide union to allow for trap removal.

.9 Remove all internal hold downs and shipping fasteners, and install any parts which were shipped loose. Level spring isolators.

.10 Check and realign all access doors and dampers as required to ensure smooth operation through the entire range of travel.

.11 Upon start up, fan motor is to be checked for rotation and amperage draw for each phase. Amperage readings are to be marked on the manufacturers start up form and returned to the manufacturer.

.12 All belt drives are to be readjusted for tension and alignment. Refer to the manufacturers O & M manual for detailed servicing requirements.

.13 Check all fan bearings and sheave set screws to ensure tightness. Refer to manufacturers O & M manual for detailed servicing requirements.

PART 1 - GENERAL

1.1 RELATED INSTRUCTIONS

.1 This section of the specification shall be read in conjunction with and shall be governed by the requirements outlined in Section 23 05 00 of the specification.

.2 To be read in conjunction with Section 25 05 01 of the specification.

.3 Comply with the General Requirements of Electrical Divisons.

1.2 SHOP DRAWINGS AND SAMPLES

.1 Submit shop drawings in accordance with Section 01 33 00.

.2 Submittals shall include:
.1 A minimum six (6) copies of shop drawings shall be submitted and shall consist of a complete list of equipment and materials, including manufacturer's descriptive and technical literature, catalogue cuts, and installation instructions. Shop drawings shall also contain complete wiring, routing, schematic diagrams, tag number of devices, software descriptions, calculations, and any other details required to demonstrate that the system will function properly. Drawings shall show proposed layout and installation of all equipment and the relationship to other parts of the work.

PART 2 - AIR HANDLING UNIT SEQUENCE OF OPERATION

2.1 AIR HANDLING UNIT NO. 1

.1 General
.1 The unit serves the Administration Office Area.
.2 The air handling unit consists of a supply fan (F-1) and a loose return fan (F-2).
.3 The unit will operate as a variable volume unit.
.4 While the subsequence mentions imperial units

of measurement, all BAS points will only display metric units.

.2 Initial Temperature and Humidity Setpoints

Device	Method	Equipment	Action
Low Limit Thermostat	**Hard Wired to Variable Frequency** Drives by Controls **Contractor**	**AH-SF-F1** **RF-RF-F2**	**Off** **Off**
Fire Alarm	**Hard Wired to** Variable Frequency Drives by Electrical Contractor.	**AH-SF-F1** RF-RF-F2	**Off** Off
High Supply Air Temperatur e	**Software Shutdown**	**AH-SF-F1** **RF-RF-F2**	**Off** **Off**
High Return Air Temperature	**Software Shutdown**	**AH-SF-F1** **RF-RF-F2**	**Off**

.3 Initial Temperature and Humidity Setpoints

	Temperature	Humidity (% RH)
Heating	**22 C (71.6 F)**	**30% RH**
Cooling	**24 C (75.2 F)**	**55% RH (Design** condition, Unit does not have a dehumidification sequence.

.4 System Start Up

.1 System start up shall be by the Operator at the Operator workstation or by time of day scheduling. The schedule for the unit shall be established prior to system start up.

.5 System Shut Down

.1 System shut down shall be by the Operator or time of day schedule.

.6 Equipment Start Up

.1 If any of the variable frequency drives are in their Local control position, indicate this on the system graphic.

.2 If any of the shut down alarms are still active, the BAS shall not be allowed to start up the equipment.

.3 On system start up command start the return fan at minimum speed. Confirm that the fan is running at the variable frequency drive. If the fan is not running within 30 seconds commence an auto shutdown and alarm at the BAS.

.4 Once the return fan is running, send a start up command to the supply fan at minimum speed. Confirm that the fan is running at the variable frequency drive. If the fan is not running within 30 seconds commence auto shutdown and alarm at the BAS.

.5 Wait for the supply fan and return fan to both be running at minimum speed. Once they are at minimum speed enable the temperature and humidity controls.

.6 Modulate O/A damper, mixed air damper, and E/A damper to maintain minimum outside air volume.

.7 Enable the air flow stations.

.8 Ramp up the speed of the variable frequency drive to bring the supply air static pressure to setpoint. Monitor the supply air volume at the flow station. The return fan shall track the supply fan utilizing the return air flow station.

.9 If the air flows are not within 10% of setpoint within 5 minutes alarm at the BAS.

.10 Enable pressure and air flow alarms. If the static pressure in the supply air ductwork is in excess of 2" WC, alarm at the BAS. If the static pressure in the supply air ductwork is in excess of 3" WC alarm at the BAS and shut down the system.

.11 20 minutes after the air handling unit is running enable the space temperature setpoint and space humidity setpoint alarms.

.7 Equipment Shut Down

.1 Equipment shut down shall be by the operator at the Operator Workstation or time-of-day scheduling.

.2 Close the cooling valve.

.3 Modulate the heating coil control valve to maintain 18C (65 F) in the mixed air plenum when outdoor air temperatures are below 2C.

.4 Shut down the return fan.

.5 Shut down the supply fan.

.6 Close the exhaust air damper and the outside air damper and open the mixed air damper.

.8 Alarm Shut Down

.1 In alarm shut down shut down the return fan.

.2 Shut down the supply fan.

.3 Close all heating and cooling valves.

.4 Close the exhaust air damper and the outside air damper and open the mixed air damper.
.5 Show the unit as Alarm Shut Down on the graphic display.
.6 Alarms that cause an alarm shut down are as follows:

.1 Fire alarm.
.2 Low Limit Thermostat.
.3 High supply air temperature. (66.5°C (152°F).
.4 High return air temperature. (66.5°C (152°F).
.5 Supply fan failure.
.6 High supply air static pressure. (Above 3" wc.)
.7 Failure of the return fan.
.8 Low limit supply air temperature alarm (Less than 45 °F (7.2 °C)).

.7 The following alarms shall not cause fan shutdown.
.1 Room temperature alarms.
.2 Any duct mounted temperature or relative humidity alarm up until it reaches its high limit or limit setpoint.
.8 Occupied Mode
.1 In the occupied mode the minimum setting for the outside air damper shall be set to maintain a minimum outside air flow rate 2500 cfm.
.9 Unoccupied Mode
.1 In the unoccupied mode the unit shall be off and the space temperature shall be reset to 18 C (65 F). The perimeter electric baseboard heaters shall be utilized to maintain the space at this temperature. If any of the space temperature sensors indicates a temperature below 15.6 °C (60 °F) the unit shall be restarted in full recirculation mode and shall raise the space temperature to setpoint.
.2 Once the space reaches setpoint the unit shall shut off. If the space temperature sensor/sensors indicate a temperature above 27 °C (80 °F) the unit shall be restarted in full recirculation mode and shall lower the space temperature to setpoint. Once the space reaches setpoint the unit shall shut off.
.10 Air Volume Control
.1 The supply air, return and outside air volumes provided by this system are to be measured by air flow stations.
.2 Control the supply air static pressure 2/3 downstream in the supply duct initially at 250 Pa (1.0 in w.g.) setpoint subject to a high limit fan discharge static pressure setpoint of 500

Pa (2 in w.g.) by adjusting the setting of the variable frequency drive.
.3 If a static pressure of 500 Pa (2 in w.g.) is reached within the supply air duct alarm at the BAS. If a static pressure of 750 Pa (3 in w.g.) is reached automatically stop the supply fan and alarm at the BAS. Unit shall be restarted by manual restart.
.4 Control the differential air quantity between the supply and return air by air flow measurement, to a setpoint established by the difference between fan volumes at design flow by adjusting the setting of the variable frequency drives.
.4 The R/A shall be 90% (adjustable) of the S/A volume.

.11 Minimum Outside Air

.1 The minimum outside air for the unit shall be set at 2500cfm.
.2 The outside air damper, mixed air damper, and E/A shall modulate as required to maintain the outside air flow rate based on the air flow station.
.3 When the unit is in free cooling mode the exhaust air damper shall modulate in conjunction with the outside air and return air dampers to provide free cooling.

.12 Humidity Control

.1 Humidity control shall consist of a direct injection steam humidifier.
.2 Humidity levels shall be controlled by sending a modulating signal to the controller on the humidifier as required to maintain the return air relative humidity at setpoint.
.3 Humidity control shall only be available when the outside air temperature is 18.2deg. C (65F) and below.

.13 Setpoint

.1 The low limit setpoint shall be set for 30% RH (operator adjustable).

.14 Low Limit Setpoint Output

.1 When the relative humidity level is below the low limit setpoint modulate the control valve at the direct injection humidifier to maintain the exhaust air relative humidity at setpoint.
.2 If the supply air relative humidity is

above 95% limit the humidifier control valve position to maintain this setpoint.
.3 If the air flow station is indicating that there is no supply air flow the humidifier steam control valve shall be locked in the 100% closed position.
.4 If the return air relative humidity is more than 5% below setpoint for a period of 20 minutes alarm at the BAS.

.15 Temperature Control
.1 Temperature control shall be provided by a chilled water cooling coil, heating coil and free cooling dampers and hot water convectors.
.2 The supply air temperature shall be controlled between 53° F (11.7° C) and 65° F (18.3°C).
.3 The supply air temperature shall be reset based on outside air temperature utilizing the following:

Outside Air Temperature		**Hot Water Supply Temperature**	
28 C (-18F)		18.3C (65F)	
12.8C (50F)		13.3C (55F)	
	Free Cooling		
15.5C (66F)		37.8C (55F)	3
32.2C (90F)		37.8C (55F)	

.4 Note the BAS will provide a 2°C (3.5°F) deadband on the disabling of free cooling.
.5 If the supply air temperature is more than 11 F (5.5° C) above or below setpoint for a period of 10 minutes alarm at the BAS.
.6 If the supply air temperature drops below 45° F (7.2 °C) alarm at the BAS and initiate an automatic shut-down.

.16 Chilled Water Cooling

.1 When the supply air temperature is above the supply air temperature setpoint the chilled water cooling coil control valve shall be modulated as required to maintain setpoint.
.2 The chilled water control valve shall be allowed to be manually overridden by the operator at the BAS.
.3 The chilled water control valve shall be allowed to be manually overridden by the operator at the BAS.

.17 Heating

.1 When the supply air temperature is below the supply air temperature setpoint the heating coil control valve shall be modulated as required to maintain setpoint.

.2 The maximum supply air temperature setpoint shall be 65° F (18.3° C).

.3 The heating control valve shall be allowed to be manually overridden by the operator at the BAS.

.18 Filters

.1 The pressure differential alarm across the following filters shall be monitored at the BAS using a differential pressure switch.

.1 Merv 7 (30%).

.2 Merv 14 (95%) outside air intake filter.

.2 The pressure differential alarm shall be displayed on the system graphic.

.3 An alarm shall be initiated if the filter differential exceeds the following setpoints:

.1 Merv 7 - 1" (250 Pa).

.2 Merv 14 - 1.5" (375 Pa).

.19 Trends

.1 The BAS will continuously trend the following data:

.1 Supply air temperature.

.2 Return air temperature.

.3 Mixed air temperature.

.4 Status of Supply Fan and Return Fan.

.5 Return air relative humidity.

.6 Supply air static pressure.

.7 Filter differential pressure switch status.

.8 Outside, Supply and Return air flow.

.9 System Graphics

.1 The system graphic will show the following:

.2 All of the above.

.3 Status of the unit (Running, Off, Auto Shutdown).

.4 Supply and Return air relative humidity.

.5 Supply air temperature setpoint, humidity setpoint and mode of operation of the unit.

.6 Status of low limit thermostat.

.7 Operating Condition for cooling coil control

valves, heating control valves and humidity control valve.

.10 Provide the monitoring and control points as listed on the point schedule.

2.2 AIR FLOW STATIONS

.1 9 Flow stations shall be provided in accordance with the following table:

AH Unit	Supply Air	Return Air	Outside Air	Exhaust Air
AHU-1 Administration Offices	Yes	Yes	Yes	--

2.3 VARIABLE VOLUME PUMPING

.1 This shall apply to the following systems:
.1 Hot water heating pumps.

.2 Provide the following:
.1 Differential pressure sensors.
.1 Differential pressure sensor to be located towards the end of the piping system a minimum of 3/4 of the way down the system.
.2 There shall be one differential pressure sensor for each system installed in the locations shown on the schematic for each system.
.3 Each of the differential pressure sensors in the system will provide a 4-20 mA signal to the BAS to indicate process variable condition.

.2 Provide temperature sensors in the supply and return lines of the variable volume pumping system. Refer to the schematic for the number of sensors required. Sensors must be a matching pair and shall be calibrated on site utilizing an ice bath to confirm that they are a matching pair.

.3 Provide an inline flow meter in the supply line of each boiler. Provide a minimum of 4 diameter straight run upstream of the meter.

.3 System Graphics shall display the following:
.1 Each differential pressure sensor operating point.
.2 Current differential pressure setpoint.
.3 Pump on/off.
.4 Operating speed of each pump.
.5 System flow.

.4 BAS shall utilize the flow meter and the temperature sensors to calculate the total amount of btu/hr the system is utilizing.

.5 Trends

.1 Current Trends

.1 Actual System Differential Pressure (Each Sensor).

.2 System Differential Pressure setpoint.

.3 Supply Flow.

.4 Supply Temperature.

.5 Return Temperature.

.2 Historical Trends complete with time and date.

.1 Peak Daily Load (Btu/hr).

.2 Peak Daily Flow (gpm).

.3 Total Daily Load (Btu).

.4 Total Daily Flow (gpm).

.5 Total Load for (Identify Month@ (Btu).

.6 Total Flow for (Identify Month@ gpm).

.7 The operator shall be able to display the last 12 months of data at the computer terminal.

.6 Provide the following in the event of equipment failure:

.1 If the variable frequency drive(s), pump(s), flow meter or differential pressure sensor(s) fail initiate an alarm at the BAS.

.2 In the event of a system differential pressure failure, due to a pump failure, variable frequency drive failure or overload fault, the BAS shall automatically initiate a timed sequence of event to start the remaining pump set(s) in the variable speed mode. A message on the display shall indicate the fault, pump/motor or VFD. Subsequent failures shall initiate a timed sequence of events to the variable speed mode as available.

.3 In the event of the failure of a zone sensor/transmitter, its process variable signal shall be removed from the scan/compare program. Alternative zone sensor/transmitters, if available, shall remain in the scan/compare program for control.

.4 In the event of failure to receive all zone process variable signals the variable frequency drives shall continue to operate at their last known position and a critical alarm shall be initiated at the BAS.

.5 If a pump is supposed to be running and the VFD indicates that it has failed start the next pump in sequence and alarm at the BAS.

2.4 HOT WATER HEATING PLANT

.1 General

.1 The system serves the following systems:

.1 Administration area heating system.

.2 Perimeter convector

.3 Unit heaters.

.4 Force Flow Heaters.
.5 Reheat Coils.

.2 The system is a variable volume pumping system.
.3 The Boiler system consists of the following:
.1 Two Hot Water heating pumps each sized for 100% of the heating load. The system is a variable volume pumping system and the pumps are on emergency power.
.2 Three hot water heating boilers. B-3 is a backup boiler. Each boiler is on emergency power.
.4 Open/Close boiler control valves to be hardwired interlocked to the boiler control panel such that the burner can be enabled only when the valve if fully open. If the valve is not in the fully open position the burner shall be disabled.

.2 Alternation of Equipment
.5 Pumps P1 and P2 will be alternated to equalize run times.
.6 Under normal operating conditions the building should be satisfied utilizing only one boiler. Boiler B-1 and B-2 will alternate to equalize run times.
.7 Pumps/Boilers will be designated lead and standby.
.8 Alternations will occur every Wednesday morning at 7:45 am.
.9 If no pumps/boilers are running the system will alternate the equipment designations.
.10 If a pump/boiler is running the system shall start the new pump and confirm operation before shutting down the pump that is scheduled to be turned off.

.2 Scheduling
.1 When the outside air temperature drops below 15.6 C (60° F) for a period of 20 minutes the hot water heating system shall be activated.
.2 If the outside air temperature rises above 18.3 C (65° F) for a period of 20 minutes the hot water heating system shall be deactivated.
.3 Provide an outside air temperature sensor.

.3 System Start-Up
.1 On system activation the boiler system shall be activated.
.2 Open the open/close control valve at the inlet to the lead boiler and confirm the valve position. Activate the lead boiler.
.3 If the boiler goes into alarm initiate a critical alarm at the BAS and start the lag boiler.
.4 Send a signal to start the lead pump at minimum speed and confirm the pump is running at the variable frequency drive.
.5 If the pump fails to start automatically start

the lag pump and alarm at the BAS. If the lag pump fails to start initiate a critical alarm at the BAS.

.6 If one boiler is unable to maintain the hot water system at setpoint send a signal to activate the lag boiler. Send a signal to start the lag pump and confirm the pump is running at the variable frequency drive. Initiate a general alarm at the BAS indicating that a second boiler is required to meet the heating load.

.7 If the lag boiler fails to start, start boiler B-3 and reset the discharge water temperature as noted below.

.4 Temperature Control

.1 The system shall send a signal to the boiler control panel to maintain the hot water supply temperature at setpoint based on the following reset schedule:

Outside Air Temperature	**Hot Water Supply Temperature**
-28 C (-18 F)	82.2 C (180 F)
15.6 C (60 F)	43.3 C (110 F)

.2 In the event boiler B-3 is activated, reset supply water temperature to 180F.

.5 Pump Operation

.1 The BAS shall analyze the current differential pressure operating point for the differential pressure sensor against the differential pressure setpoint.

.2 When all set points are satisfied by the process variable, the pump speed shall remain constant at the optimum energy consumption level. If the input from the flow sensor indicates that the operating pumps are approaching the end of curve point, the controller shall automatically stage on lag pumps as required to bring all pumps back to an acceptable operating point.

.3 The system has been designed to have one pump active and one pump standby. On rare occasions it may be necessary to run both pumps.

.4 If the setpoint cannot be satisfied by the designated lead pump, the BAS shall initiate a timed sequence of events to stage a lag pump.

.5 The lag pump will accelerate resulting in the lead pump(s) decelerating until they equalize speed.

.6 Further change in process variable will cause the pumps to change speed together.

.7 When the set point criteria can be safely satisfied with fewer pumps, the BAS shall initiate a timed de stage sequence and continue variable speed operation.

.8 When only one pump is operating the minimum speed of the pump motor as commanded by the variable frequency drive shall be 40%. Monitor the flow in the system and modulate the control valve in the bypass line as

required to ensure that the pump does not dead head.

.6 Differential Pressure Control

.1 The initial differential pressure setpoint shall be 7 psi (operator adjustable).

.2 If the pump is running at minimum speed and the pressure is above setpoint modulate open the differential control valve to maintain the system pressure at setpoint.

.7 Alarms

.1 HVAC Critical

.1 Pumps are commanded on and status is not received (10 minute delay).

.2 Low pressure alarm from system static pressure sensor.

.3 Two boilers are required and one boiler or pump has failed.

.4 Initiate a critical alarm if one of the boiler control panels indicates that it has gone into alarm.

.2 HVAC General

.1 The system is running and the supply water temperature drops more than 20° F below setpoint (10 minute delay).

.2 The system is running and the supply water temperature rises above 200° F (93° C) (10 minute delay).

.3 Pump failure if only one boiler is required to meet the load.

.4 Boiler failure if only one boiler is required to meet the load.

.5 The system is running and the differential pressure is +/- 3 psi from setpoint.

.3 HVAC Maintenance

.1 Pump status is on and the pumps are commanded off (10 minute delay).

.2 The system is put into manual mode of operation.

.8 Monitoring

.1 Hot water heating supply and return temperatures.

.2 Pump Status

.3 Boiler status.

.4 Boiler firing rate.

.5 Boiler alarm.

.9 Trends

.1 All Hot Water Heating supply and return temperatures.

.2 Differential pressure actual value and setpoint.

.3 % speed of the variable frequency drives.

.4 Flow

.5 Boiler status and percent fire.

2.5 ADMINISTRATION AREA SECONDARY HOT WATER HEATING SYSTEM

.1 General

.1 The system serves:
- .1 Perimeter radiation
- .2 Force flow heaters.

.2 The Secondary hot water heating system consists of the following:
- .1 A north-west administration zone (Pump P6 and P7) and a south-west administration zone (Pump P4 and P5).
- .2 Each zone consists of a 3-way control valve and two hot water heating circulator pumps each sized for 100% of the heating load. The existing pneumatic 3-way control valves have been replaced with new DDC 3-way control valves.
- .3 The system is a constant volume pumping system and the pumps are on emergency power.

.2 Alternation of Equipment

.1 Pumps P6 and P7 will be alternated to equalize run times.

.2 Pumps P4 and P5 will be alternated to equalize run times.

.3 Pumps will be designated lead and standby.

.4 Alternations will occur every Wednesday morning at 7:45 am.

.5 If no pumps are running the system will alternate the equipment designations.

.6 If a pump/ is running the system shall start the new pump and confirm operation before shutting down the pump that is scheduled to be turned off.

.3 Scheduling

.1 When the outside air temperature drops below 15.6 C (60° F) for a period of 20 minutes the hot water heating system shall be activated.

.2 If the outside air temperature rises above 18.3 C (65° F) for a period of 20 minutes the hot water heating system shall be deactivated.

.3 Provide an outside air temperature sensor.

.4 System Start-Up

.1 Send a signal to start the lead pump and confirm the pump is running.

.2 If the pump fails to start automatically start the lag pump and alarm at the BAS. If the lag pump fails to start initiate a critical alarm at the BAS.

.5 Temperature Control

.1 The system shall send a signal to the 3-way control valve to maintain the return water temperature 30deg.F below the current boiler supply water temperature:

.6 Alarms
.1 HVAC Critical
.1 Pumps are commanded on and status is not received (10 minute delay).
.2 HVAC General
.1 The system is running and the supply water temperature drops more than 20° F below setpoint (10 minute delay).
.2 The system is running and the supply water temperature rises above 200° F (93° C) (10 minute delay).
.3 Pump failure.
.3 HVAC Maintenance
.1 Pump status is on and the pumps are commanded off (10 minute delay).
.2 The system is put into manual mode of operation.

.7 Monitoring
.1 Hot water heating supply and return temperatures.
.2 Pump Status.
.3 3-way control valve.
.4 3-way control valve.
.5 Pump alarm.

.8 Trends
.1 All Hot Water Heating supply and return temperatures.

2.6 CONTROL OF CHILLED WATER SYSTEM

.1 General

.1 The chilled water system provides chilled water to the air handling unit in the main building.
.2 All equipment is powered on normal power.
.3 The system consists of one pump P-8 and one air cooled chiller CH-1.

.2 Safeties
.1 All safeties listed in this section will override all operational control sequences unless explicitly stated not to.
.2 If a pump failure occurs the BAS will disable the pump and alarm at the BAS. Once a failure has occurred, the equipment will be disabled from the system until its failure status is reset to normal. Pump failure will be cleared once run status is received on the pump.
.3 Each pump can be manually taken out of service by the operator. When this is done, the BAS will remove the equipment from service until the operator returns it back to normal service. The operator may choose to do this when performing maintenance on a selected piece

of equipment.

.3 Communication

.1 The BMS shall communicate with the chillers utilizing BACNET.

.2 The following points shall be displayed/utilized at the BMS.

.1 Inputs.

.1 Chiller enable/disable command.

.2 Chilled water setpoint.

.3 Current limit setpoint.

.2 Outputs.

.1 Run modes (starting, running, shutting down).

.2 State (Alarm, run enabled, local control, limited).

.3 Active chilled water setpoint.

.4 Active current limit setpoint.

.5 Evaporator leaving water temperature.

.6 Unit Power Consumption (KW).

.7 Evaporator entering water temperature.

.8 Condenser entering water temperature (Heat Reclaim only).

.9 Condenser leaving water temperature. (Heat Reclaim Only).

.3 Alarm description.

.1 Compressor starts.

.2 Compressor run time.

.4 System Start-up

.1 The chilled water system is a constant volume pumping system. Chilled water pump is designated as Pump P8.

.2 On command to strt on outside air temperature or operator command the BAS shall start the chilled water pump.

.3 On confirmation of pump status the BAS shall start the air cooled chiller CH-1. If the chiller does not start, alarm at the BAS.

.5 System Shut Down

.1 The system shall shut down on Operator command or when the outside air temperature drops below 10 C (50 F) for a period of 10 minutes.

.2 When the system shuts off the pumps shall shut off.

.6 Monitoring

.1 Chilled water supply and return temperatures as indicated on the schematic.

.7 Alarms

.1 HVAC Critical

.1 Pump is commanded on and status is not received (10 minute delay).
.2 Chiller failure alarm is received.
.3 Chilled water supply temperature is in excess of 15.6 C (60 F).

.2 HVAC General
.1 The system is running and the supply water temperature is +/- 2°C (3.6°F) from setpoint (10 minute delay).
.2 A low pressure alarm is received from the expansion tank.
.3 The system differential pressure is above 220 kPa (15 psi).

.3 HVAC Maintenance
.1 Pump status is on and the pump is commanded off (10 minute delay).

.8 Trends
.1 Chilled water supply and return temperatures.

.9 System Graphics
.1 The system graphic will show the following:
.1 Chilled water supply and return temperature setpoint.
.2 Actual chilled water supply and return temperatures.
.3 Pump Status
.4 Chiller Status.

2.7 FAN COILS

.1 The fan coils shall be capable of being enabled/disabled at the BAS. They are intended to run24 hours per day. .2 The following fan coils have been provided.

Fan Coil#	**Room Served**	**Control Sequence**
FC-1	Central Stores	Temperature Control
FC-2	LAN Room	Monitor Status
FC-3	LAN Room	Monitor

.3 Monitor the status of the fan with a current switch. Alarm at the BAS on fan failure.

.4 Fan Coils Controlled Based on Temperature Control (FC-1)
.1 Provide a temperature sensor with each room served by the unit.
.2 Space temperature shall be set at 26.7C (75F)
.3 The D/X cooling shall be staged on/off as required to maintain the space temperature at setpoint.

.5 Alarms (Events)
.1 HVAC General

.1 The space temperature rises more than 5C (9F) above the cooling setpoint (10 minute delay).
.2 Supply air temperature drops below 4.4C (40F).

.6 Trends
.1 Space Temperatures
.2 Fan Status

.7 System Graphics
.1 The system graphic will show the following
.1 All of the above
.2 Cooling setpoint

2.8 SUPPLY FAN TEMPERATURE CONTROL

.1 For the following fans provide controls as follows:

Supply Fan	Serves	Operation
SF-24	Boiler Room	Temperature

.2 Temperature Operation
.1 When the space temperature reaches 75o F the supply fan shall be activated.
.2 The space temperature sensor operating through a digital controller shall maintain space temperature at 75o F by modulating the outside air, relief and return air dampers as required to maintain temperature setpoint.
.3 Monitor status with a current switch. On fan failure alarm at the EMCS.
.4 When the outside air temperature rises above 80 o F the supply fan shall be deactivated.

.3 Alarms (Events)
.1 HVAC General
.1 Alarm on fan failure.

.4 System Graphics
.1 The system graphic will show the fan status and the mode of operation for the system.
.2 For supply that are modulating based on temperature the supply fan status, space temperature and damper position shall be displayed.

2.9 ADJUSTMENTS SERVICE & WARRANTY

.1 Adjust and set thermostats, temperature sensors, humidity sensors, damper operators, relays and other components to proper settings to give required performance. Cooperate with other sections during

testing and balancing of each mechanical system to ensure each total system operates to approval.

.2 Temperature control system shown and specified herein shall be warranted free from defects in materials and workmanship and shall be serviced without charge (except for damage from lack of maintenance of other causes) for one year after date of start of lien period. If, within this period, any equipment herein described is proved to be defective in workmanship or materials, it shall be replaced or repaired without charge.

2.10 SUBMITTALS

.1 Submit shop drawings for review prior to installation and in accordance with Section 01 33 00.