ENERGY RECOVERY UNIT SCHEDULE

TAG	LOCATION	OA (CFM)	SA (CFM)	EA (CFM)	RA (CFM)	ELECTRIC PREHEAT	SUPPLY FAN						EXHAUST FAN						DIRECT EXPANSION COOLING						HOT GAS REHEAT COIL				GAS FURNANCE INPUT (5:1)	ENERGY RECOVERY WHEEL	OPERATING WEIGHT (LBS) - INCLUDING CURB	SUPPLY FILTERS	RETURN FILTER	ELECTRICAL REQUIREMENTS				MAKE / MODEL NO.	NOTES:
							FAN TYPE	T.S.P. (IN. WC)	E.S.P. (IN. WC)	RPM	HP	BHP	FAN TYPE	T.S.P. (IN. WC)	E.S.P. (IN. WC)	RPM	HP	BHP	TOTAL MBH	SENS MBH	FACE AREA SQ FT.	ROWS	EAT °F DB/WB	LAT °F DB/WB	APD IN-W.C.	CFM	EAT °F	LAT °F	MBH							V/PH	MCA	MAX FUSE	VFD(S)		
ERU-1	OUTDOOR	1890	1800	1890	1800	10 KW	PLENUM	2.77	1.25	2320	2.5	1.8	PLENUM	2.1	1	2156	2.5	1.5	68	52	6.6	4	76.3/63	50.3/49.6	0.13	1800	46.4	86.6	100	100 MBH	ERW-1	2400	MERV 8	MERV 8	460/3	26	30	N	TRANE HORIZON 0ABD07244	*

NOTES:
1. PROVIDE ERU WITH 2" INSULATED DOUBLE WALLED CONSTRUCTION, SOUND ATTENUATION PACKAGE, HINGED ACCESS DOORS, OUTDOOR AIR AND RETURN AIR FILTER SECTIONS, AND SERVICE LIGHTS.
2. PROVIDE WITH 36" HEIGHT ROOF CURB.
3. PROVIDE WITH OUTSIDE AIR HOOD SIZED AT 325 FPM

ENERGY RECOVERY WHEEL PERFORMANCE SCHEDULE

TAG	WINTER CONDITIONS										SUMMER CONDITIONS										NOTES:
	WHEEL ENTERING CONDITIONS				WHEEL LEAVING CONDITIONS				ENERGY RECOVERY @ WINTER DESIGN		EFFECTIVENESS @ WINTER DESIGN		WHEEL ENTERING CONDITIONS				WHEEL LEAVING CONDITIONS				ENERGY RECOVERY @ SUMMER DESIGN		EFFECTIVENESS @ SUMMER DESIGN		
	OUTSIDE AIR		RETURN AIR		SUPPLY AIR		EXHAUST AIR						OUTSIDE AIR		RETURN AIR		SUPPLY AIR		EXHAUST AIR						
	DB °F	WB °F	DB °F	WB °F	DB °F	WB °F	DB °F	WB °F	SENSIBLE MBH	LATENT MBH	SENSIBLE %	LATENT %	DB °F	WB °F	DB °F	WB °F	DB °F	WB °F	DB °F	WB °F	SENSIBLE MBH	LATENT MBH	SENSIBLE %	LATENT %	
ERW-1	-10	-11	70	53	46	38	15	15	113	18.4	69%	62%	87	71	72	58	77	63	82	67	21.2	28.7	69%	62%	*

NOTES:

HEAT PUMP SCHEDULE - WATER SOURCE

TAG	SERVES	CFM	MIN OA	ESP IN WC	COOLING CAPACITY						HEATING CAPACITY			ELECTRICAL DATA		TYPICAL UNIT MFG & MODEL NO.	NOTES:
					EDB °F	EWB °F	TOTAL MBH	EWT °F	GPM	WPD	EAT	EWT	TOTAL MBH	MCA	VOLTS/Ø		
HP-1109	TRAINING 1109	350	120	0.3	80	67	14	90	2.2	2.3	70	70	18.2	8.2	265/1	TRANE GEH	1,2
HP-2203	OFFICE 2203	250	50	0.3	80	67	8.6	90	1.4	1.8	70	70	18.2	4	265/1	TRANE GEH	1,2

NOTES:
1. PROVIDE WITH DELUXE SOUND ATTENUATION PACKAGE. PROVIDE FLEXIBLE ELASTOMER DUCT LINER IN FIRST 10 FEET OF SUPPLY AND RETURN DUCTWORK,
2. PROVIDE WITH HOSE KITS AND LIBERTY PUMP LCU-20S (OR APPROVED EQUAL) CONDENSATE REMOVAL PUMP WITH CHECK VALVE AND SAFETY SWITCH.
3.

SPLIT SYSTEM AIR CONDITIONER SCHEDULE

INDOOR SECTION TAG	OUTDOOR SECTION TAG	TYPE	SERVES	TOTAL CAPACITY BTUH	SEER	INDOOR SECTION			OUTDOOR SECTION			INDOOR SECTION MODEL NO.	OUTDOOR SECTION MODEL NO.	NOTES:
						CFM (DRY) HI-SPEED	FAN FLA	V/PH/HZ	FAN FLA	MCA	V/PH/HZ			
AC-1303	CU-1303	R-410A	IT 1303	12000	15.2	425	0.33	208/1/60	0.35	13	208/1/60	MITSUBISHI PKA-A12NHA6	MITSUBISHI PUY-A12NHA6	1,2
AC-1022	CU-1022	R-410A	IT 1022	24000	17	635	0.36	208/1/60	0.75	30	208/1/60	MITSUBISHI PKA-A24NHA6	MITSUBISHI PUY-A24NHA6	1,2
AC-2009	CU-2009	R-410A	IT 2009	12000	15.2	425	0.33	208/1/60	0.35	13	208/1/60	MITSUBISHI PKA-A12NHA6	MITSUBISHI PUY-A12NHA6	1,2
AC-2022	CU-2022	R-410A	IT 2022	12000	15.2	425	0.33	208/1/60	0.35	13	208/1/60	MITSUBISHI PKA-A12NHA6	MITSUBISHI PUY-A12NHA6	1,2

NOTES:
1. PROVIDE UNIT WITH SNOW STAND. MINI CONDENSATE PUMP (SAUERMANN SI-30 OR APPROVED EQUAL), MHK THERMOSTAT AND THREE POLE DISCONNECT.
2. PROVIDE OUTDOOR UNIT WITH ADVANCED WIND BAFFLE KIT FOR LOW AMBIENT APPLICATION.

FAN SCHEDULE

TAG	LOCATION	SERVICE	TYPE	ROOF OPENING	CFM	SP IN W.G.	DIAMETER IN.	RPM	ELECTRICAL DATA				TYPICAL UNIT MFG & MODEL NO.	NOTES:
									BHP / HP	VOLTS	PH	VFD (DIV, 26)		
EF-A	ROOF	GENERAL	CENTRIFUGAL	14.5x14.5	1000	1	25	1725	0.3 / .05	115	1	N	GREENHECK CUE-101-A	1

NOTES:
1. PROVIDE WITH AN ECM MOTOR WITH SPEED CONTROL, UNIT MOUNTED DISCONNECT SWITCH AND ROOF CURB.

REHEAT COIL SCHEDULE

TAG	LOCATION	AIR DATA				ELECTRICAL DATA			MFG SIZE HxL (IN.)	TYPICAL UNIT MFG & MODEL NO.	NOTES:
		CFM	TEMP °F ENT	TEMP °F LVG	MAX APD (IN WC)	kW	VOLTS	PHASE			
RHC-1504	OFFICE 1504	140	55	90	0.5	1.5	208	1	6"x10"	INDEECO QUZ	1
RHC-1505	MANAGER 1505	165	55	90	0.5	1.8	208	1	6"x10"	INDEECO QUZ	1

NOTES:
1. PROVIDE WITH SCR CONTROLS

FILTER SECTION SCHEDULE

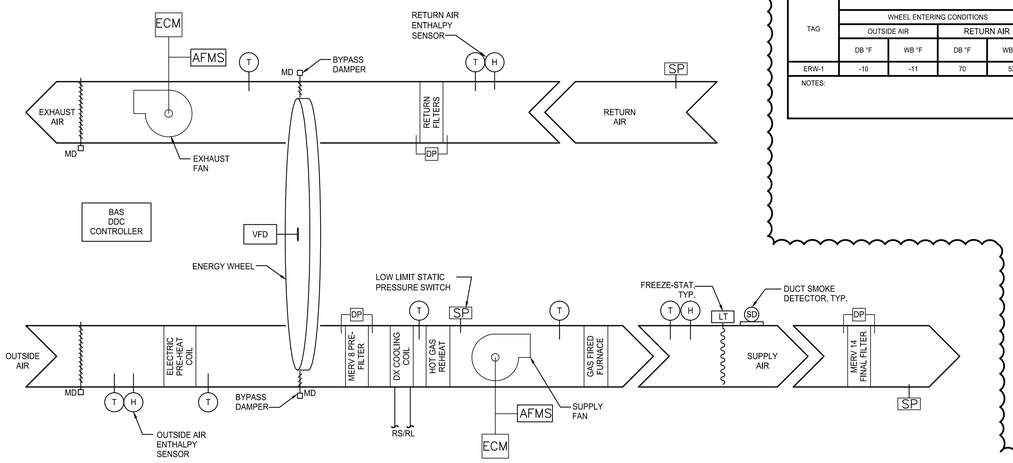
TAG	SERVICE	FACE VEL (FPM)	HOUSING SIZE (IN)			NO. FILTERS		ADP IN WC		EFFICIENCY PERCENTAGE	TYPICAL UNIT MFG & MODEL NO.	NOTES:
			H	L	D	H	L	INITIAL	FINAL			
F-1	UOM	450	27.3	23.4	25	1	1	0.26"	0.75"	MERV 14	CAMFIL FARR GLIDEPACK UNITRACK	1

NOTES:
1. PROVIDE CAMFIL FARR GASKETED DURAFIL ES FILTERS THAT ARE 24"X24"X11.6"

REGISTER, DIFFUSER & GRILL SCHEDULE

TAG	MAX CFM	NECK SIZE	TYPE	DP	MAX NC	TYPICAL UNIT MFG & MODEL NO.	NOTES
S-1	90	4"ø	LAY-IN	0.08	<20	PRICE SCD	1,2
S-2	160	6"ø	LAY-IN	0.09	<20	PRICE SCD	1,2
S-3	280	8"ø	LAY-IN	0.09	23	PRICE SCD	1,2
S-4	440	10"ø	LAY-IN	0,12	23	PRICE SCD	1,2
S-5	1000	20"x14"	DUCT MOUNTED	0,02	21	PRICE 620	3,4
E/R-1	125	8"X8"	LAY-IN	0.06	<20	PRICE 630	1,2
E/R-2	210	10"X10"	LAY-IN	0.09	<20	PRICE 630	1,2
E/R-3	325	12"X12"	LAY-IN	0.08	<20	PRICE 630	1,2
E/R-4	480	16"X16"	LAY-IN	0.06	<20	PRICE 630	1,2
E/R-5	625	18"X16"	LAY-IN	0.06	<20	PRICE 630	1,2
E/R-6	1000	20"X18"	LAY-IN	0.10	<20	PRICE 630	1,2
T-1	290	8"ø	LAY-IN	0.09	23	PRICE 630	1,2
T-2	580	18"X16"	WALL MOUNT	0.09	<20	PRICE 630	2,3

NOTES:
1. PROVIDE BORDER FOR LAY-IN CEILING INSTALLATION, 24x24 CEILING GRID,
2. PROVIDE BORDER FOR GYP. CONTRUCTION,
3. PROVIDE INTEGRAL OPPOSED BLADE DAMPER FOR BALANCING.



NOTE: CONTROLS CONTRACTOR SHALL REVIEW ERU SUBMITTAL TO DETERMINE CONTROLS COMPONENTS PROVIDED WITH ERUS.

CONTROLS SHALL CONSIST OF A PACKAGED CENTRAL CONTROLLER PROVIDED BY ERU MANUFACTURER. EXTEND EXISTING BUILDING DDC SYSTEM AS REQUIRED TO ALLOW FOR INTEGRATION WITH ERU MANUFACTURER'S CONTROLLER. SET POINT ADJUSTMENTS TO BE MADE THROUGH DDC SYSTEM.

SEQUENCE OF OPERATION IS DESIGNED TO ILLUSTRATE THE STAND ALONE CONTROLS BASIC FUNCTIONS ONLY. TEMPERATURE CONTROLS CONTRACTOR SHALL REVIEW DRAWINGS AND SUBMIT COMPLETE INSTALLATION DATA, INCLUDING MINOR DETAILS, TO PROVIDE PROPER OPERATION IN THEIR SUBMITTAL. WHERE AN ITEM DIFFERS FROM SPECIFICATIONS, CONTROLS CONTRACTOR SHALL SUBMIT MANUFACTURER'S RECOMMENDATIONS SUBJECT TO ENGINEERS' APPROVAL.

A. WITH THE H-O-A SWITCH IN THE "AUTO" POSITION THE ERU SHALL OPERATE BASED ON THE OWNER PROVIDED BUILDING OCCUPIED/UNOCCUPIED BUILDING SCHEDULE. THE UNIT CONTROLS SHALL BE PROVIDED, INSTALLED AND WIRED BY THE UNIT MANUFACTURER AND SHALL PROVIDE FROST CONTROL AND ECONOMIZER FUNCTIONS. OUTSIDE, RETURN, AND EXHAUST AIR DAMPER ACTUATORS SHALL BE PROVIDED BY THE CONTROLS CONTRACTOR.

B. ON A UNIT START SIGNAL FROM THE BAS, THE OUTSIDE AIR DAMPER/EXHAUST AIR DAMPER SHALL OPEN AND A DAMPER END SWITCH ON THE OUTSIDE AIR DAMPER SHALL ENERGIZE THE UNIT TO START BOTH BLOWERS.
   1. THE SUPPLY FAN SHALL MODULATE TO MAINTAIN CONSTANT AIR FLOW AS DETERMINED DURING TESTING, ADJUSTING AND BALANCING (TAB). SUPPLY AIRFLOW SHALL BE MONITORED USING THE FAN AIR FLOW MONITORING STATION.
   2. THE EXHAUST FAN SHALL MODULATE TO A CFM OFFSET AS DETERMINED DURING TAB TO MAINTAIN A POSITIVE PRESSURE RELATIONSHIP TO THE ADJACENT SPACE AS DETERMINED BY THE BAULIN TUBE DURING TESTING, ADJUSTING AND BALANCING. EXHAUST AIRFLOW SHALL BE MONITORED USING THE FAN AIR FLOW MONITORING STATION.

C. HEAT RECOVERY: THE TOTAL ENERGY WHEEL SHALL HAVE ITS OWN CONTROLLER, WHICH WILL PROVIDE TEMPERATURE AT A MINIMUM OF 62 DEGREES F. IF THE HEAT RECOVERY SYSTEM CANNOT MAINTAIN THE DISCHARGE TEMPERATURE, THEN THE GAS HEATER SHALL BE ENABLED TO MAINTAIN DISCHARGE AIR TEMPERATURE SETPOINT. DISCHARGE AIR TEMPERATURE CONTROL SHALL BE ACCOMPLISHED EITHER BY MODULATING A BYPASS DAMPER AROUND THE WHEEL OR BY MODULATING WHEEL SPEED VIA A VFD.
   C.A. DURING ENERGY WHEEL OPERATION, IF THE EXHAUST TEMPERATURE ACROSS THE ENERGY WHEEL DROPS BELOW 25 DEG F,THE OUTDOOR AIR BYPASS DAMPER WILL START TO SLOWLY MODULATE OPEN.
   C.B. IF AFTER THE BYPASS DAMPERS MODULATE TO 100 PERCENT OPEN AND THE EXHAUST TEMPERATURE ACROSS THE ENERGY WHEEL DROPS BELOW 15 DEG F (2 DEG F DEADBAND) FOR 5 MINUTES, THE UNIT CONTROLLER WILL COMMAND THE ENERGY WHEEL OFF.

D. FREE COOLING: THE FIRST STAGE OF COOLING SHALL BE ECONOMIZER FREE COOLING WHEN THE OUTSIDE AIR ENTHALPY IS LESS THAN 28 BTU/LB AND THE OUTSIDE AIR TEMPERATURE IS LESS THAN 65 DEG F. THE ENTHALPY WHEEL SHALL STOP DURING ECONOMIZER MODE TO PREVENT ANY TRANSFER OF HEAT AND/OR MOISTURE. IF THE OUTSIDE TEMPERATURE OR ENTHALPY IS GREATER THAN SETPOINT THE UNIT SHALL USE MECHANICAL COOLING. UNIT MANUFACTURER SHALL CONTROL THE OPERATION OF THE ENTHALPY WHEEL WITH FACTORY SUPPLIED CONTROLS.

E. MECHANICAL COOLING: THE DOAS SHALL MAINTAIN DISCHARGE AIR TEMPERATURE AIR DEWPOINT TEMPERATURE OF 55 DEG F, WITH A LEAVING AIR DRY BULB TEMPERATURE OF 62 DEG F.
   1. UPON A CALL FOR COOLING, SYSTEM CONTROL WILL SEND AN ENABLE SIGNAL TO THE CONDENSING UNIT. UPON RECEIVING THE ENABLE SIGNAL, THE CONDENSING SHALL ENABLE THE COMPRESSOR, AND THE SYSTEM SHALL MODULATE TO MAINTAIN DISCHARGE AIR TEMPERATURE.
   2. UPON A CALL FOR DEHUMIDIFICATION (RETURN AIR DEWPOINT ABOVE 55 DEG), THE DISCHARGE AIR TEMPERATURE OFF THE COOLING COIL SHALL BE RESET TO 55 DEG F DRY BULB (ADJ), AND THE HOT GAS REHEAT COIL SHALL MODULATE TO MAINTAIN DISCHARGE SET POINT. THE DISCHARGE AIR TEMPERATURE SHALL BE INCREMENTALLY REDUCED BY 1 DEG AT A TIME DELAY UNTIL THE RETURN AIR DEW POINT HITS SET POINT.

E. MECHANICAL HEATING : THE DOAS SHALL MAINTAIN DISCHARGE AIR TEMPERATURE AT 62 DEG F AT 50 °F (ADJ) AND BELOW AND 68 DEG °F AT 20 °F AND BELOW (ADJ) .
   1. WHEN THE SUPPLY AIR TEMP DROPS BELOW ITS SET POINT, THE GAS HEATER SHALL MODULATE TO MAINTAIN SET POINT.
   2. THE GAS HEATER SHALL BE DISABLED WITH OUTSIDE AIR TEMPERATURES ABOVE 50 °F (ADJ).
   3. THE ELECTRIC PRE-HEAT COIL WILL BE ENABLED ON AN OUTSIDE AIR TEMPERATURE BELOW 5 DEG F (ADJ).

F. DEFROST: THE UNIT SUPPLIED CONTROLS SHALL PROVIDE A SIGNAL TO THE BAS ALERTING A TRANSITION TO THE DEFROST MODE OF OPERATION. WHEN THIS SIGNAL IS PROVIDED THE GAS FURNACE SHALL MODULATE TO A MINIMUM OF 75% OPEN HEATING POSITION REGARDLESS OF THE DISCHARGE AIR TEMPERATURE SET POINT. THIS IS IN ANTICIPATION OF THE UNIT ENTERING THE DEFROST MODE OF OPERATION. ONCE THE UNIT HAS REACHED THE DEFROST MODE OF OPERATION (30 SECONDS FROM THE INITIAL SIGNAL) THE GAS FURNACE SHALL MODULATE AS REQUIRED TO MAINTAIN THE DISCHARGE AIR TEMPERATURE SET POINT. DEFROST OPERATION SHALL BE BY UNIT MANUFACTURER.

G. DUCT MOUNTED SMOKE DETECTORS (IONIZATION TYPE):
   1. ACTIVATION OF UNIT SUPPLY DUCT SMOKE DETECTOR SHALL SHUT DOWN THE SUPPLY AND EXHAUST FANS AND SEND AN ALARM SIGNAL TO THE CENTRAL WORKSTATION TO NOTIFY FACILITIES THAT THIS EVENT HAS TAKEN PLACE.
   2. SMOKE DETECTORS SHALL REQUIRE MANUAL RESET IN ORDER TO RESTART THE ASSOCIATED AHU.
   3. SMOKE DETECTOR SHALL BE LOCATED IN THE SUPPLY AIR DUCT (ONLY) AT THE ERU.

H. SAFETY DEVICES:
   1. DETECTION OF SMOKE AT THE SUPPLY DUCT SMOKE DETECTOR SHALL STOP THE UNIT BLOWERS, CLOSE THE OUTSIDE AIR AND EXHAUST AIR DAMPERS AND SIGNAL ALARM.

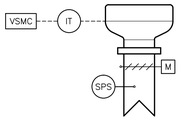
I. OTHER DEVICES:
   1. THE UNIT AIR FILTERS AND FINAL FILTER STATUS SHALL BE MEASURED AND SHOWN ON THE GRAPHICAL INTERFACE TO INDICATE THE STATIC PRESSURE AND PRESSURE DROP ACROSS THE FILTERS AND PROVIDE NOTIFYING CONDITIONS FOR FILTER CHANGE-OUT.

J. 2. FAN AND WHEEL STATUS SHALL BE DETERMINED BY A CURRENT SENSING DEVICE.

K. THE FOLLOWING MONITORING POINTS WILL BE AVAILABLE AT THE BMS USER WORKSTATION:
   1. OUTSIDE AIR TEMPERATURE
   2. OUTSIDE AIR HUMIDITY
   3. RETURN AIR TEMPERATURE
   4. RETURN AIR HUMIDITY
   5. SUPPLY FAN STATUS.
   6. EXHAUST FAN STATUS.
   7. SUPPLY FLOW.
   8. EXHAUST FLOW.
   9. WHEEL ROTATION DETECTOR.
   10. DISCHARGE AIR TEMPERATURE.
   11. SUPPLY FAN SPEED
   12. EXHAUST FAN SPEED
   13. RETURN FILTER DP ALARM
   11. PREFILTER DP ALARM.
   12. FINAL FILTER DP ALARM.
   13. WHEEL ROTATION FAILURE.
   14. OUTSIDE AIR DAMPER POSITION
   15. EXHAUST AIR DAMPER POSITION

SEQUENCE OF OPERATION - ENERGY RECOVERY UNIT F10
NOT TO SCALE

1. EXHAUST FAN SHALL BE CONTROLLED VIA DDC CONTROLLER (PROVIDED BY THE ATC CONTRACTOR). ALL SETPOINTS SHALL BE ADJUSTABLE, ALL ACTUATORS SHALL BE ELECTRONIC, FAN SHALL OPERATE AT CONSTANT SPEED.
2. MOTORIZED DAMPERS SHALL HAVE END SWITCHES TO PROVE DAMPER OPEN PRIOR TO THE FAN STARTING.
3. FANS SHALL BE STARTED AND STOPPED VIA THE SAME OCCUPANCY SCHEDULE AS THE ASSOCIATED AIR HANDLING SYSTEM.
4. COORDINATE OCCUPIED/UNOCCUPIED WITH OWNER.



FAN CONTROL
1. WHILE IN UNOCCUPIED MODE, THE EXHAUST FAN SHALL BE OFF WITH THE ASSOCIATED EXHAUST AIR DAMPER (EAD) CLOSED.
2. WHEN STARTED IN OCCUPIED MODE, THE EAD SHALL BE OPEN AND THE EXHAUST FAN SHALL START.

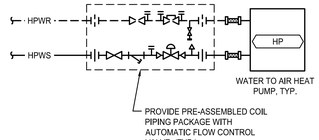
ALARMS
1. IF THE EXHAUST FAN FAILS, THE DDC CONTROLLER SHALL GIVE A DETAILED ALARM SIGNAL TO THE BAS.
2. FAN STATUS: CURRENT TRANSMITTER SHALL ALARM UPON FAN FAILURE.

SEQUENCE OF OPERATION - EXHAUST FANS C14
NOT TO SCALE

A. ELECTRIC REHEAT COILS

1. UPON A DROP IN SPACE TEMPERATURE BELOW THE SETPOINT, THE ZONE CONTROLLER SHALL ENABLE THE ASSOCIATED ELECTRIC REHEAT COIL. THE REHEAT COIL SHALL MODULATE TO MAINTAIN SPACE TEMPERATURE.

SEQUENCE OF OPERATION - ELECTRIC REHEAT COIL A14
NOT TO SCALE



A. WATER TO AIR HEAT PUMPS:
1. THE FACTORY MOUNTED HEAT PUMP CONTROLS SHALL PROVIDE ALL CONTROLS.
2. UNITS FANS OPERATE CONTINUOUSLY WHILE THE BUILDING IS IN OCCUPIED MODE. EXISTING UNIT CONTROLS TO BE MODIFIED ACCORDINGLY.
3. UPON A CALL FOR COOLING, THE REVERSING VALVE AND THE COMPRESSOR SHALL BE ENABLED TO MAINTAIN SPACE TEMPERATURE.
4. UPON A CALL FOR HEATING, THE REVERSING VALVE SHALL DISABLE AND THE COMPRESSOR SHALL BE ENABLED TO MAINTAIN SPACE TEMPERATURE.
5. DETECTION OF WATER BY THE OVERFLOW LEAK SENSOR SHALL DISABLE THE ASSOCIATED UNIT AND SEND AN ALARM TO THE BMS.

B. MONITORING POINT:
1. HEAT PUMP FAILURE ALARM
2. SPACE TEMPERATURE

HEAT PUMP PIPING SCHEMATIC AND SEQUENCE OF OPERATION A10
NOT TO SCALE

NOTE:

1. SEE SHEET M-001 FOR LEGEND AND ABBREVIATIONS.

REV	DESCRIPTION	DATE
1	ADDENDUM # 1	1-9-18
0	ISSUED FOR CONSTRUCTION	12-21-17

ISSUED FOR CONSTRUCTION
12-21-17
CURRENT ISSUE STATUS:

STATE OF MAINE
KERRY D. DINEEN
13301
LICENSED PROFESSIONAL ENGINEER
1-9-18

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MECHANICAL SCHEDULES AND SEQUENCE OF OPERATION

SHEET TITLE:

0 1/4" 1/2" 1" 2" 3"
SCALE: AS NOTED

PROJECT MANAGER:	RSC	PROJECT NO:	17123
A/E OF RECORD:	KDD		
JOB CAPTAIN:	SDL		
DRAWN BY:	CWF		
SMRT FILE:	M-601-17123	SHEET No.	M-601

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