GENERAL MECHANICAL SYMBOLS

- REVISION NUMBER - SHOWN ON PLANS
- POINT WHERE NEW CONNECTS TO EXISTING
- NUMBER OF DETAIL ON SHEET / NUMBER OF SHEET WHERE DETAIL APPEARS
- KEYNOTE
- CONTINUATION SYMBOL
- Room / 1 — ROOM NAME AND NUMBER
- ITEM TO BE DEMOLISHED
- AREA NOT IN CONTRACT

HVAC SYMBOLS

- 16"x8" — SQUARE DUCT SIZE TAG (WIDTH x HEIGHT)
- 16"/8" — OVAL DUCT SIZE TAG (WIDTH / HEIGHT)
- 16"Ø — ROUND DUCT SIZE TAG (DIAMETER)
- (E) — EXISTING DUCT TAG
- DUCT BEING DEMOLISHED
- S/A — SUPPLY AIR
- S-O/A — SUPPLY AIR (100% OUTSIDE AIR)
- O/A — OUTSIDE AIR
- R/A — RETURN AIR
- T/A — TRANSFER AIR
- E/A — EXHAUST AIR
- L/A — RELIEF AIR
- GE/A — GREASE EXHAUST AIR
- SE/A — SMOKE EXHAUST AIR
- FLUE — EXHAUST GAS FLUE
- C/A — COMBUSTION AIR
- DROP — RECTANGULAR SUPPLY/OUTSIDE AIR DUCT RISE
- DROP — ROUND SUPPLY/OUTSIDE AIR DUCT RISE
- DROP — RECTANGULAR RETURN/TRANSFER AIR DUCT RISE
- DROP — ROUND RETURN/TRANSFER AIR DUCT RISE
- DROP — RECTANGULAR EXHAUST/RELIEF AIR DUCT RISE
- DROP — ROUND EXHAUST/RELIEF AIR DUCT RISE
- SUPPLY OUTLET — RETURN/EXHAUST INLET
- SECTORIZING BAFFLE OR BLANKOFF PANEL
- S2 / 0 — TYPE (SEE SCHEDULE) / GRILLES, REGISTERS, AND DIFFUSERS TAG
- CFM
- LINEAR DIFFUSER
- S6 / 0 — TYPE (SEE SCHEDULE) / LINEAR DIFFUSER TAG
- CFM
- MECHANICAL EQUIPMENT
- VAV-XX — MECHANICAL EQUIPMENT TAG
- EXISTING MECHANICAL EQUIPMENT
- (X)VAV-XX — EXISTING MECHANICAL EQUIPMENT TAG (TYPICAL FOR ALL EXISTING TAGS)
- MECHANICAL EQUIPMENT FOR REFERENCE
- VAV-XX — MECHANICAL EQUIPMENT TAG (REFER TO OTHER DISCIPLINE FOR ADDITIONAL INFORMATION)
- CO2 — CARBON DIOXIDE SENSOR
- D — DUCT SMOKE DETECTOR
- H — HUMIDITY SENSOR
- E — E-STOP
- T — TEMPERATURE SENSOR
- FIRE DAMPER (F)
- SMOKE DAMPER (S)
- MOTORIZED DAMPER (M)
- MANUAL BALANCING DAMPER (B)
- BACKDRAFT DAMPER (D)
- COMBINATION FIRE/SMOKE DAMPER (C)

PIPING SYMBOLS

- PIPE SIZE TAG (DIAMETER)
- ABOVE GROUND PIPING
- 1/8" / 12" SLOPE — PIPE SLOPE TAG
- BELOW GROUND PIPING
- INVERT: -10' - 1" — PIPE INVERT ELEVATION TAG
- EXISTING PIPE TAG
- PIPING BEING DEMOLISHED
- CD — CONDENSATE DRAINAGE
- PG — PROPANE GAS
- PIPE DROP
- PIPE RISE
- PIPE TEE
- CAP
- 4" / 4" / 2" — PLUG
- REDUCING 45 DEGREE TEE
- 45 DEGREE TEE
- DOMESTIC WATER METER
- FLOW MEASURING AND BALANCING DEVICE
- BALL VALVE
- CHECK VALVE
- THREE WAY VALVE
- MOTORIZED CONTROL VALVE
- THREE WAY MOTORIZED CONTROL VALVE
- PRESSURE REDUCING VALVE
- SOLENOID VALVE
- BUTTERFLY VALVE

EQUIPMENT ABBREVIATIONS

AC	AIR CONDITIONING UNIT	FP	FIRE PUMP
ACC	AIR COOLED CONDENSER	GI	GREASE INTERCEPTOR
ACCU	AIR COOLING CONDENSING UNIT	GRV	GRAVITY ROOF VENTILATOR
AFMS	AIR FLOW MEASURING STATION	H	HUMIDIFIER
AHU	AIR HANDLING UNIT	HWP	HEATING WATER PUMP
AS	AIR SEPARATOR	HX	HEAT EXCHANGER
B	BOILER	HPU	HEAT PUMP UNIT
CF	CABINET FAN	HRU	HEAT RECOVERY UNIT
CF	CHEMICAL FEEDER	ILC	INLINE CENTRIFUGAL
CFP	CHEMICAL FEEDER PUMP	PF	PROPELLER FAN
CH	CHILLER	PV	POWER VENTILATOR
CRU	CONDENSATE RETURN UNIT	PWF	POWER WALL FAN
CT	COOLING TOWER	RE	RETURN/EXHAUST FAN
CUH	CABINET UNIT HEATER	RTU	ROOFTOP UNIT
CWP	CONDENSER WATER PUMP	SA	SHOCK ABSORBER
CHWP	CHILLED WATER PUMP	SAT	SOUND ATTENUATOR
DAH	DUCTLESS AIR HANDLER	SEP	SEWAGE EJECTOR PUMP
DHP	DUCTLESS HEAT PUMP	SF	SUPPLY FAN
DCP	DOMESTIC WATER CIRCULATING PUMP	SP	SUMP PUMP
EUH	ELECTRIC UNIT HEATER	UH	UNIT HEATER
EDC	ELECTRIC DUCT COIL	US	UTILITY SET
ET	EXPANSION TANK	UV	UNIT VENTILATOR
EWH	ELECTRIC WATER HEATER	VAV	VARIABLE AIR VOLUME
FCU	FAN COIL UNIT	WH	WATER HEATER

ABBREVIATIONS

&	AND	ID	INDIRECT
Ø	ROUND	IN	INCH
A	AIR	INL	INLET
AB	ABOVE BASE	INSUL	INSULATION
ABV	ABOVE	INT	INTERIOR
AC	AIR CONDITIONING	INV	INVERT
ACOUS	ACOUSTICAL	INWG	INCHES WATER GAUGE
AD	AREA DRAIN	JST SPC	JOIST SPACE
ADD	ADDENDUM	JT	JOINT
ADDL	ADDITIONAL	LAB	LABORATORY
AFF	ABOVE FINISHED FLOOR	LB	POUND
AFUE	ANNUAL FUEL UTILIZATION EFFICIENCY	LB/HR	POUNDS PER HOUR
AG	ABOVE GROUND	LAT	LEAVING AIR TEMPERATURE
ALT	ALTERNATE	LF	LINEAL FOOT
ALUM	ALUMINUM	LOC	LOCATION
AP	ACCESS PANEL	LP	LOW PRESSURE
APPROX	APPROXIMATE	LPG	LIQUEFIED PETROLEUM GAS
ARCH	ARCHITECT/ARCHITECTURAL	LR	LIQUID REFRIGERANT
AV	ACID RESISTANT VENT	LS	LAWN SPRINKLER
AW	ACID RESISTANT WASTE	L	LOUVER
AUTO	AUTOMATIC	LWT	LEAVING WATER TEMPERATURE
BFF	BELOW FINISHED FLOOR	MA	MIXED AIR
BLDG	BUILDING	MAN	MANUAL
BLW	BELOW	MATL	MATERIAL
BM	BEAM	MAV	MANUAL AIR VENT
BO	BY OTHER	MAX	MAXIMUM
BOT	BOTTOM	MBD	MOTORIZED BYPASS DAMPER
BSMT	BASEMENT	MBH	ONE THOUSAND BTU PER HOUR
BTU	BRITISH THERMAL UNITS	MCF	ONE THOUSAND CUBIC FEET
BTUH	BRITISH THERMAL UNITS PER HOUR	MCW	MAKE-UP COLD WATER
BTWN	BETWEEN	MD	MOTORIZED DAMPER
CAP	CAPACITY	MECH	MECHANICAL
CB	CATCH BASIN	MFR	MANUFACTURER
CCW	COUNTER CLOCKWISE	MH	MANHOLE
CFCV	CONSTANT FLOW CONTROL VALVE	MIN	MINIMUM
CFM	CUBIC FEET PER MINUTE	MISC	MISCELLANEOUS
CHW	CIRCULATING HOT WATER	MTR	MOTOR
CI	CAST IRON	MU/A	MAKE-UP/AIR
CLG	CEILING	N	NECK
CLG	COOLING	NC	NOISE CRITERIA
CO	CLEAN OUT	NC	NORMALLY CLOSED
COL	COLUMN	NIC	NOT IN CONTRACT
COMB	COMBINATION	NO	NUMBER
CONC	CONCRETE	NO	NORMALLY OPEN
COND	CONDENSATE	NOM	NOMINAL
CONF	CONFERENCE	NTS	NOT TO SCALE
CONN	CONNECT	O	OXYGEN
CONST	CONSTRUCTION	O/A	OUTSIDE AIR
CONT	CONTINUE/CONTINUATION	OC	ON CENTER
CONTR	CONTRACT/CONTRACTOR	OF	OVERFLOW
COORD	COORDINATE	OPNG	OPENING
CTR	CENTER	ORD	OVERFLOW ROOF DRAIN
CUFT	CUBIC FEET	PD	PRESSURE DROP
CV	CHECK VALVE	PIV	POST INDICATOR VALVE
CW	COLD WATER	PLBG	PLUMBING
CW	CLOCKWISE	PR	PAIR
D	DEGREE	PREL	PRELIMINARY
DB	DRY BULB	PRESS	PRESSURE
DET	DETAIL	PRIM	PRIMARY
DIA	DIAMETER	PRV	PRESSURE REDUCING VALVE
DIAG	DIAGONAL	PSI	POUNDS PER SQUARE INCH
DISCH	DISCHARGE	PSIG	POUNDS PER SQUARE INCH GAUGE
DIV	DIVISION	PW	POTABLE WATER
DI	DEIONIZED WATER	PWR	POWER
DMPR	DAMPER	R	DUCT RISER
DN	DOWN	R/A	RETURN AIR
DWG	DRAWING	RCP	RADIANT CEILING PANEL
DW	DISTILLED WATER	RD	ROOF DRAIN
EA	EACH	REC	RECESSED
EAT	ENTERING AIR TEMPERATURE	RED	REDUCER
EL	ELBOW	REFR	REFRIGERATION
ELEC	ELECTRICAL	RH	RELATIVE HUMIDITY
ELEV	ELEVATION	REQD	REQUIRED
EP	EXPLOSION PROOF	REV	REVERSE
EQ	EQUAL	RL/A	RELIEF AIR
EQUIP	EQUIPMENT	RM	ROOM
EWC	ELECTRIC WATER COOLER	RPM	REVOLUTIONS PER MINUTE
EWT	ENTERING WATER TEMPERATURE	RW	RAIN WATER
EA	EXHAUST AIR	SF	SQUARE FOOT
EAH	EXHAUST HOOD	S/A	SUPPLY AIR
EXIST	EXISTING	SAN	SANITARY
EXP	EXPANSION	SCHED	SCHEDULE
EXPJT	EXPANSION JOINT	SECT	SECTION
EXT	EXTERIOR	SF	SQUARE FOOT
F	DEGREES FAHRENHEIT	SD	SMOKE DAMPER
FCO	FLOOR CLEAN OUT	SHT	SHEET
FD	FLOOR DRAIN	SIM	SIMILAR
FD	FIRE DAMPER	SLV	SLEEVE
FDV	FIRE DEPARTMENT VALVE	SM	SURFACE MOUNT
FHC	FIRE HOSE CABINET	SP	STANDPIPE
FL	FLOOR	SP	STATIC PRESSURE
FLEX	FLEXIBLE	SPEC	SPECIFICATION
FLG	FLANGE	SPS	STATIC PRESSURE STATION
FO	FUEL OIL	SQ	SQUARE
FOV	FUEL OIL VENT	SR	SUCTION REFRIGERANT
FOR	FUEL OIL RETURN	SSD	SOIL SUBDRAIN
FOS	FUEL OIL SUPPLY	SS	STAINLESS STEEL
FPM	FEET PER MINUTE	STD	STANDARD
FRP	FIBERGLASS REINFORCED PIPE	STM	STEAM
FS	FULL SIZE	STRUCT	STRUCTURAL
FS	FLOOR SINK	SUCT	SUCTION
FT	FOOT/FEET	SUSP	SUSPENDED
FTG	FOOTING	T	THERMOSTAT
FTR	FIN TUBE RADIATION	TCP	TEMPERATURE CONTROL PANEL
FUT	FUTURE	TD	TEMPERATURE DROP
GA	GAGE/GAUGE	TDR	TRENCH DRAIN
GAL	GALLON	TEFC	TOTALLY ENCLOSED FAN COOLED
GALV	GALVANIZED	TEMP	TEMPERATURE
GC	GENERAL CONTRACTOR	TYP	TYPICAL
GEN	GENERATOR	UFD	UNDER FLOOR DUCT
GENL	GENERAL	UG	UNDERGROUND
GPH	GALLONS PER MINUTE	VAC	VACUUM
GR	GRADE	V	VENT
GW	GREASE WASTE	VAV	VARIABLE AIR VOLUME
HB	HOSE BIB	VEL	VELOCITY
HD	HEAD	VENT	VENTILATION
HORZ	HORIZONTAL	VERT	VERTICAL
HP	HORSE POWER	VOL	VOLUME
HP	HIGH PRESSURE	VTR	VENT THROUGH ROOF
HTG	HEATING	W	WASTE
HTR	HEATER	WB	WET BULB
HW	HOT WATER	WCO	WALL CLEAN OUT
HYD	HYDRANT	WH	WALL HYDRANT

PHASING REQUIREMENTS

REFER TO ARCHITECTURAL DRAWING SET FOR CONSTRUCTION PHASING REQUIREMENTS. COORDINATE WORK CLOSELY WITH GENERAL CONTRACTOR AND ALL OTHER TRADES.

ALTERNATES COORDINATION NOTE

REFER TO SPECIFICATION SECTION 012300 "ALTERNATES" AND ARCHITECTURAL DRAWINGS FOR THE LOCATION, EXTENT, AND DESCRIPTION OF ALL ALTERNATE SCOPE ITEMS. MECHANICAL, ELECTRICAL, AND PLUMBING SYSTEMS SERVING THESE AREAS SHALL BE MODIFIED ACCORDINGLY BASED ON ACCEPTED ALTERNATES. COORDINATE WITH ALL DISCIPLINES AND INCLUDE PROVISIONS FOR AFFECTED SYSTEMS AS REQUIRED.

FLOOR PLAN LEGEND

- EXISTING BUILDING
- RENOVATED AREA
- UPFIT BY OTHERS
- 1-HR RATED WALL
- 2-HR RATED WALL
- 3-HR RATED WALL

MECHANICAL SUMMARY (RENOVATION & EXPANSION, PHASE 1 ONLY)

MECHANICAL SYSTEMS, SERVICE SYSTEMS AND EQUIPMENT

CLIMATE ZONE	3A - WARM/HUMID
WINTER DRY BULB:	23 °F
SUMMER DRY BULB	93 °F
INTERIOR DESIGN CONDITIONS	
WINTER DRY BULB	70 °F
SUMMER DRY BULB	75 °F
RELATIVE HUMIDITY	60°RH*
	*DESIGN- NOT CONTROLLED
BUILDING HEATING LOAD:	791.6 MBH
BUILDING COOLING LOAD:	2,030.7 MBH
MECHANICAL SPACING CONDITIONING SYSTEM	
UNITARY	
DESCRIPTION OF UNIT:	SEE SCHEDULES
HEATING EFFICIENCY:	SEE SCHEDULES
COOLING EFFICIENCY:	SEE SCHEDULES
SIZE CATEGORY OF UNIT:	SEE SCHEDULES
BOILER	
SIZE CATEGORY, IF OVERSIZED STATE REASON:	N/A
CHILLER	
SIZE CATEGORY, IF OVERSIZED STATE REASON:	N/A
LIST EQUIPMENT EFFICIENCIES:	SEE SCHEDULES

MECHANICAL SUMMARY (NEW GENERATOR BUILDING ONLY)

MECHANICAL SYSTEMS, SERVICE SYSTEMS AND EQUIPMENT

CLIMATE ZONE	3A - WARM/HUMID
WINTER DRY BULB:	23 °F
SUMMER DRY BULB	93 °F
INTERIOR DESIGN CONDITIONS	
WINTER DRY BULB	70 °F
SUMMER DRY BULB	75 °F
RELATIVE HUMIDITY	60°RH*
	*DESIGN- NOT CONTROLLED
BUILDING HEATING LOAD:	32.3 MBH
BUILDING COOLING LOAD:	43.4 MBH
MECHANICAL SPACING CONDITIONING SYSTEM	
UNITARY	
DESCRIPTION OF UNIT:	SEE SCHEDULES
HEATING EFFICIENCY:	SEE SCHEDULES
COOLING EFFICIENCY:	SEE SCHEDULES
SIZE CATEGORY OF UNIT:	SEE SCHEDULES
BOILER	
SIZE CATEGORY, IF OVERSIZED STATE REASON:	N/A
CHILLER	
SIZE CATEGORY, IF OVERSIZED STATE REASON:	N/A
LIST EQUIPMENT EFFICIENCIES:	SEE SCHEDULES

MECHANICAL SUMMARY (NEW PUMP BUILDINGS ONLY)

MECHANICAL SYSTEMS, SERVICE SYSTEMS AND EQUIPMENT

CLIMATE ZONE	3A - WARM/HUMID
WINTER DRY BULB:	23 °F
SUMMER DRY BULB	93 °F
INTERIOR DESIGN CONDITIONS	
WINTER DRY BULB	70 °F
SUMMER DRY BULB	75 °F
RELATIVE HUMIDITY	60°RH*
	*DESIGN- NOT CONTROLLED
BUILDING HEATING LOAD:	36.8 MBH
BUILDING COOLING LOAD:	44.6 MBH
MECHANICAL SPACING CONDITIONING SYSTEM	
UNITARY	
DESCRIPTION OF UNIT:	SEE SCHEDULES
HEATING EFFICIENCY:	SEE SCHEDULES
COOLING EFFICIENCY:	SEE SCHEDULES
SIZE CATEGORY OF UNIT:	SEE SCHEDULES
BOILER	
SIZE CATEGORY, IF OVERSIZED STATE REASON:	N/A
CHILLER	
SIZE CATEGORY, IF OVERSIZED STATE REASON:	N/A
LIST EQUIPMENT EFFICIENCIES:	SEE SCHEDULES

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SZOSTAK DESIGN

FORT FISHER AQUARIUM RENOVATION & EXPANSION: PHASE 1

SCO #17-18042-02A
CODE: 42014-4G02
ITEM: 41414-4Y4A

900 LOGGERHEAD RD,
KURE BEACH, NC 28449

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NOTE: IF THIS DRAWING IS NOT 30" X 42", IT IS A REDUCED PRINT. REFER TO GRAPHIC SCALE.

NOT FOR CONSTRUCTION

SEAL 23551 — ENGINEER — DAVID M. HAHN

NOT FOR CONSTRUCTION

NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

MECHANICAL ABBREVIATIONS, LEGEND, & SUMMARY

M-0.1

GENERAL NOTES

1. HATCHED AREAS ON DRAWINGS INDICATE EXTENT OF DEMOLITION. DEMOLITION LIMITS SHALL BE CLEARLY IDENTIFIED AND VERIFIED IN FIELD PRIOR TO WORK.

2. REFER TO HYDRONIC RISER DIAGRAMS FOR DETAILED DEMOLITION SCOPE. REMOVE PIPING, CONNECTIONS, AND TERMINATIONS AS INDICATED. COORDINATE WITH DEMOLITION OF ASSOCIATED EQUIPMENT.

3. SINGLE-LINE DUCTWORK INDICATES GENERAL ROUTING OF EXISTING SYSTEMS. FIELD-VERIFY CONDITIONS PRIOR TO DEMOLITION OR RECONNECTION.

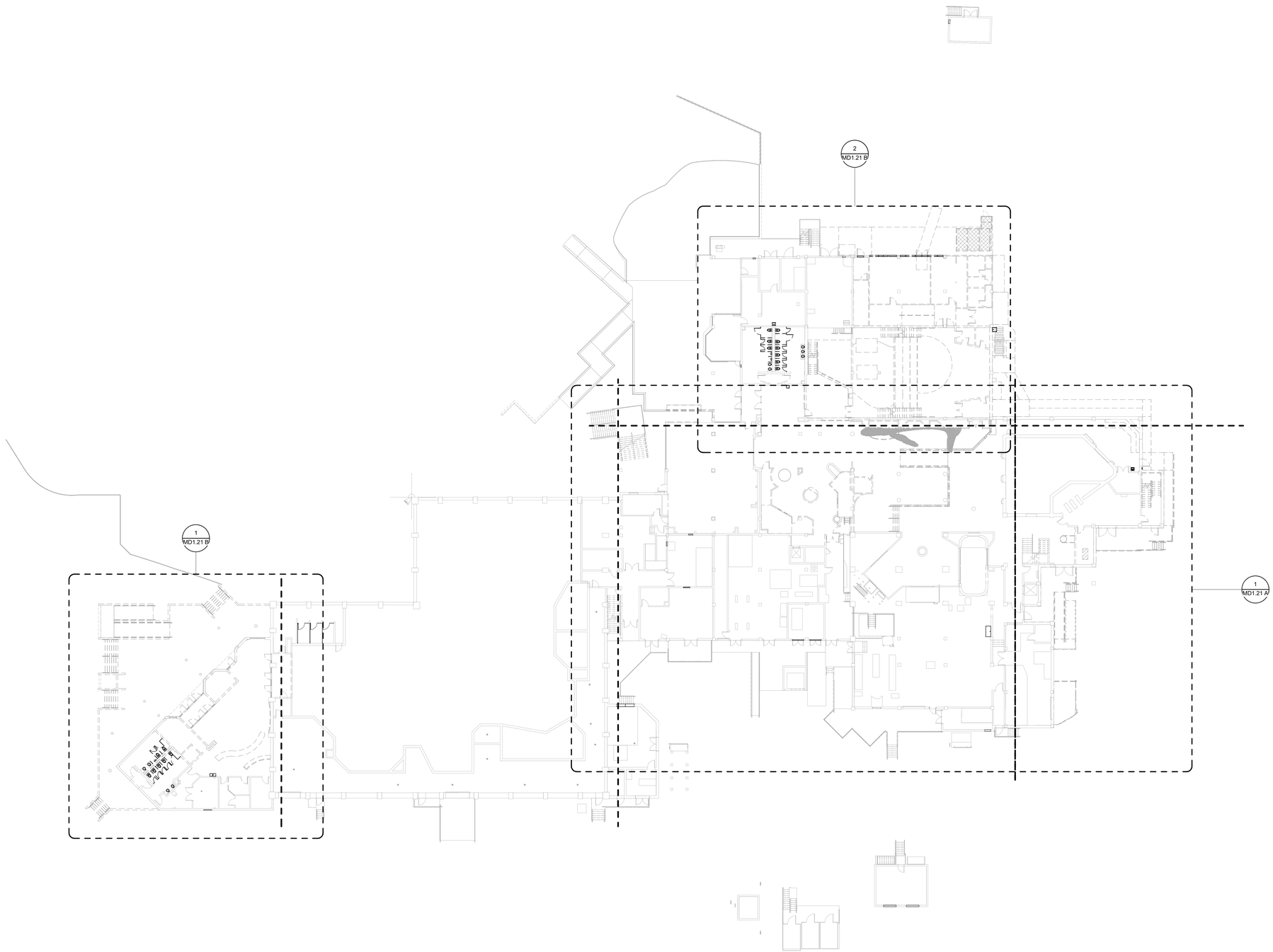
4. REMOVE ALL ASSOCIATED HANGERS, SUPPORTS, INSULATION, SEALANTS, PIPING SPECIALTIES, CONTROLS, AND ACCESSORIES WITH DEMOLISHED HVAC EQUIPMENT, DUCTWORK, OR PIPING AS REQUIRED FOR COMPLETE REMOVAL. DO NOT REMOVE ITEMS REQUIRED FOR ACTIVE OR REUSED SYSTEMS. CONTRACTOR SHALL FIELD-VERIFY AND CONFIRM REUSE PRIOR TO REMOVAL. PATCH AND SEAL ALL PENETRATIONS IN FLOORS, WALLS, OR ROOF TO MATCH ADJACENT CONSTRUCTION.

5. WHERE PARTIAL DEMOLITION OCCURS, PREPARE SYSTEMS FOR RECONNECTION TO NEW WORK. CAP OR TEMPORARILY SUPPORT AS REQUIRED.

6. COORDINATE WITH OTHER TRADES FOR SAFE REMOVAL OF PIPING, DUCTWORK, AND EQUIPMENT.

7. PROTECT REMAINING ACTIVE SYSTEMS DURING DEMOLITION.

8. ALL EXTERIOR AND INTERIOR PENETRATIONS AFFECTED BY DEMOLITION SHALL HAVE EXISTING FLASHING, SEALANT, AND CAULKING REMOVED, SURFACES CLEANED, AND OPENINGS PREPARED FOR NEW WORK. COORDINATE WITH ARCHITECTURAL FINISHES FOR PATCHING AND REPAIR AS REQUIRED.



20' 10' 20'
SCALE : 1" = 20'-0"

OVERALL 1ST FLOOR - DEMO - HVAC
SCALE : 1" = 20'-0"

1

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SEAL 23551
NORTH CAROLINA PROFESSIONAL ENGINEER
DAVID M. HAHN

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NO.	DATE	DESCRIPTION
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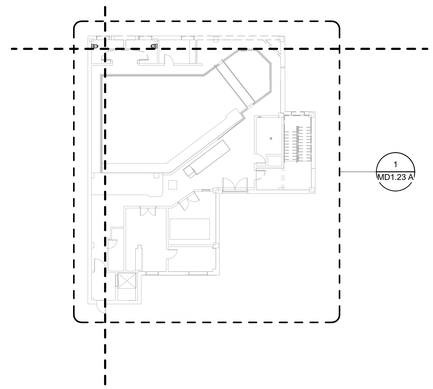
FIRST FLOOR DEMO PLAN

MD1.11



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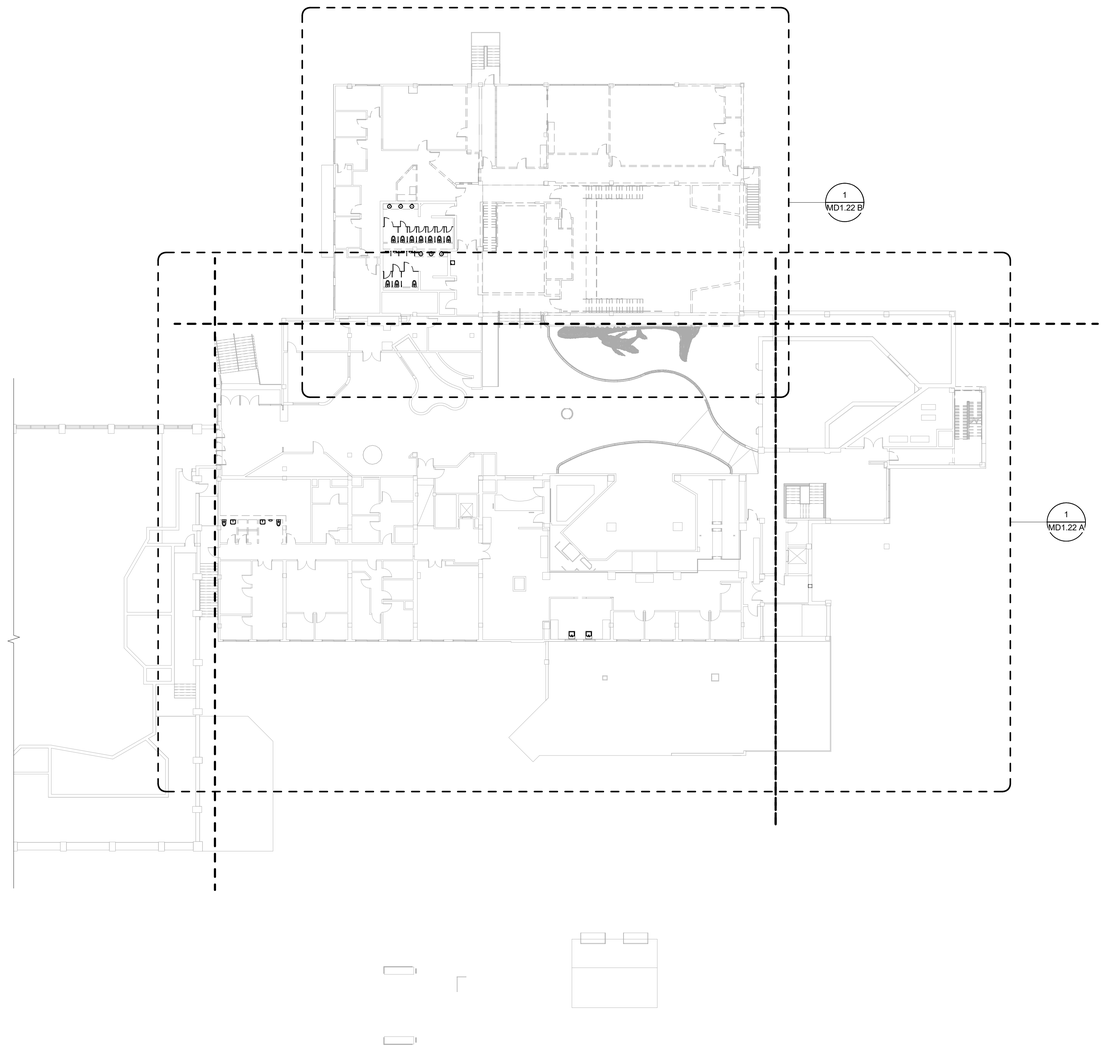
4. REMOVE ALL ASSOCIATED HANGERS, SUPPORTS, INSULATION, SEALANTS, PIPING SPECIALTIES, CONTROLS, AND ACCESSORIES WITH DEMOLISHED HVAC EQUIPMENT, DUCTWORK, OR PIPING AS REQUIRED FOR COMPLETE REMOVAL. DO NOT REMOVE ITEMS REQUIRED FOR ACTIVE OR REUSED SYSTEMS. CONTRACTOR SHALL FIELD-VERIFY AND CONFIRM REUSE PRIOR TO REMOVAL. PATCH AND SEAL ALL PENETRATIONS IN FLOORS, WALLS, OR ROOF TO MATCH ADJACENT CONSTRUCTION.
5. WHERE PARTIAL DEMOLITION OCCURS, PREPARE SYSTEMS FOR RECONNECTION TO NEW WORK. CAP OR TEMPORARILY SUPPORT AS REQUIRED.
6. COORDINATE WITH OTHER TRADES FOR SAFE REMOVAL OF PIPING, DUCTWORK, AND EQUIPMENT.
7. PROTECT REMAINING ACTIVE SYSTEMS DURING DEMOLITION.
8. ALL EXTERIOR AND INTERIOR PENETRATIONS AFFECTED BY DEMOLITION SHALL HAVE EXISTING FLASHING, SEALANT, AND CAULKING REMOVED, SURFACES CLEANED, AND OPENINGS PREPARED FOR NEW WORK. COORDINATE WITH ARCHITECTURAL FINISHES FOR PATCHING AND REPAIR AS REQUIRED.

20' 10' 20'
SCALE : 1" = 20'-0"

OVERALL 3RD FLOOR - DEMO - HVAC
SCALE : 1" = 20'-0"

2



20' 10' 20'
SCALE : 1" = 20'-0"

OVERALL 2ND FLOOR - DEMO - HVAC
SCALE : 1" = 20'-0"

1

SZOSTAK DESIGN

FORT FISHER AQUARIUM RENOVATION & EXPANSION: PHASE 1

SCO #17-18042-02A
CODE: 42014-4G02
ITEM: 41414-4Y4A

900 LOGGERHEAD RD,
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NOT FOR CONSTRUCTION

SEAL 23551 ENGINEER DAVID M. HAHN

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NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

SECOND AND THIRD FLOOR DEMO PLAN

MD1.12

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DEMOLITION KEYED NOTES

1	REMOVE EXISTING WALL CAP AND PREPARE OPENING FOR INSTALLATION OF NEW LIKE-SIZED WALL CAP.
2	DEMO 48"x24"x6" RELIEF LOUVER. PATCH AND INFILL WALL OPENING TO MATCH ADJACENT CONSTRUCTION. COORDINATE MATERIALS AND FINISHES WITH ARCHITECTURAL.
3	REMOVE 48"x30"x6" OUTSIDE AIR INTAKE LOUVER AND PREPARE OPENING FOR NEW LIKE-SIZED LOUVER.
4	DEMO INLINE SUSPENDED 1.5 HP FAN. REMOVE ASSOCIATED SUPPORTS AND CONNECTIONS.
5	REMOVE ROOF-MOUNTED 1/6 HP FAN. PREPARE EXISTING ROOF OPENING FOR INSTALLATION OF NEW FAN. COORDINATE WITH ROOFING/ARCHITECTURAL FOR FLASHING AND SEALING.
6	(ALTERNATE #2 ONLY) DEMOLISH EXISTING MECHANICAL SYSTEM (X)AHU-7 INCLUDING ALL DUCTWORK, PIPING, CONTROLS, SUPPORTS, AND RELATED COMPONENTS. REMOVE IN THEIR ENTIRETY UNLESS NOTED TO REMAIN. CONFIRM AGAINST NEW WORK PLANS PRIOR TO DEMOLITION. COORDINATE WITH OTHER TRADES, PHASING, AND SAFETY REQUIREMENTS.

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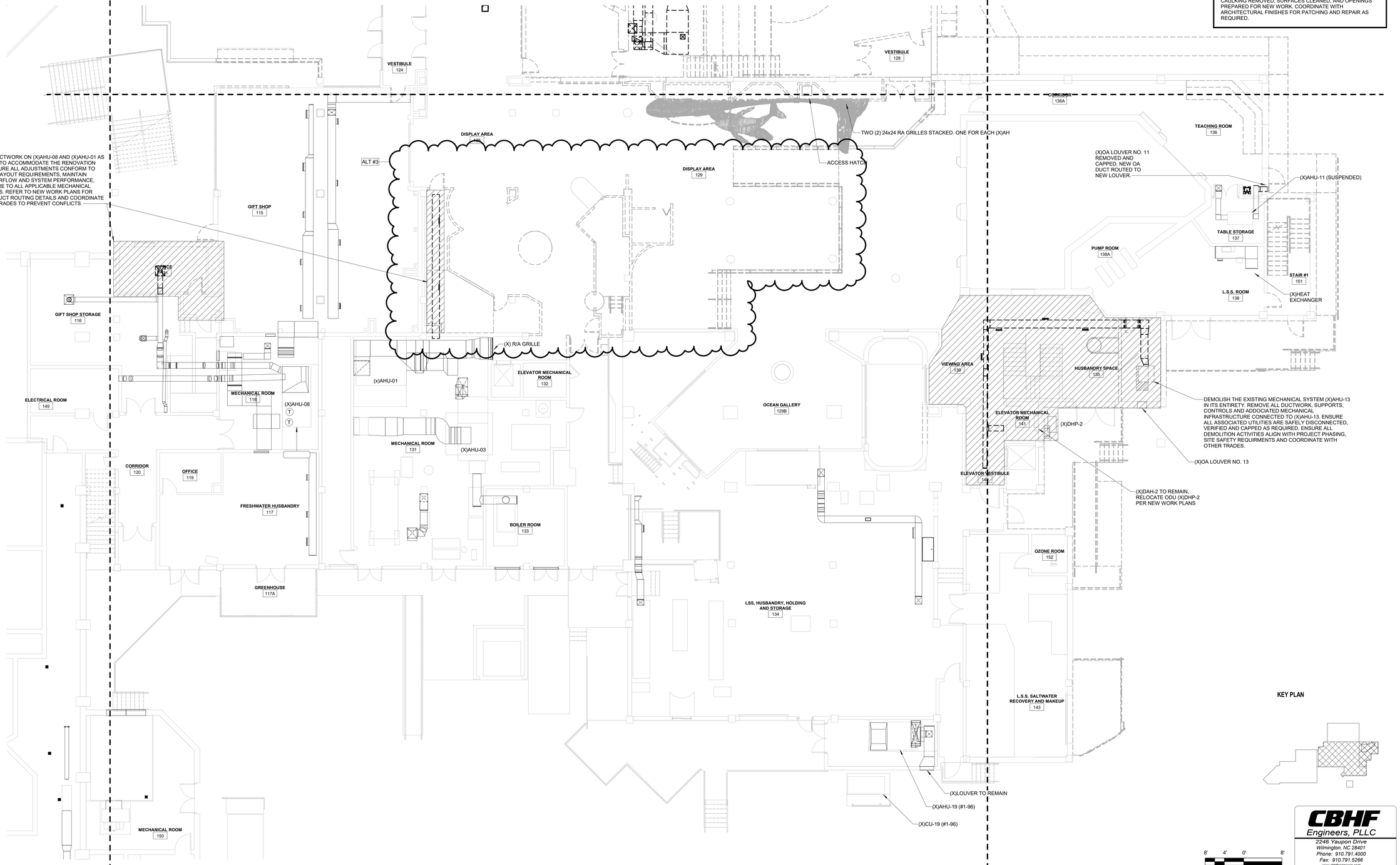

KEY PLAN

8' 4' 0' 8'

SCALE : 1/8" = 1'-0"

1ST FLOOR - DEMO - CAPE FEAR - HVAC

SCALE : 1/8" = 1'-0"

1

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FORT FISHER AQUARIUM RENOVATION & EXPANSION: PHASE 1

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NOT FOR CONSTRUCTION

REGISTERED PROFESSIONAL ENGINEER SEAL 23551 DAVID M. HAHN

NOT FOR CONSTRUCTION

NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

FIRST FLOOR DEMO PLAN - CAPE FEAR

MD1.21 A

DEMOLITION KEYED NOTES

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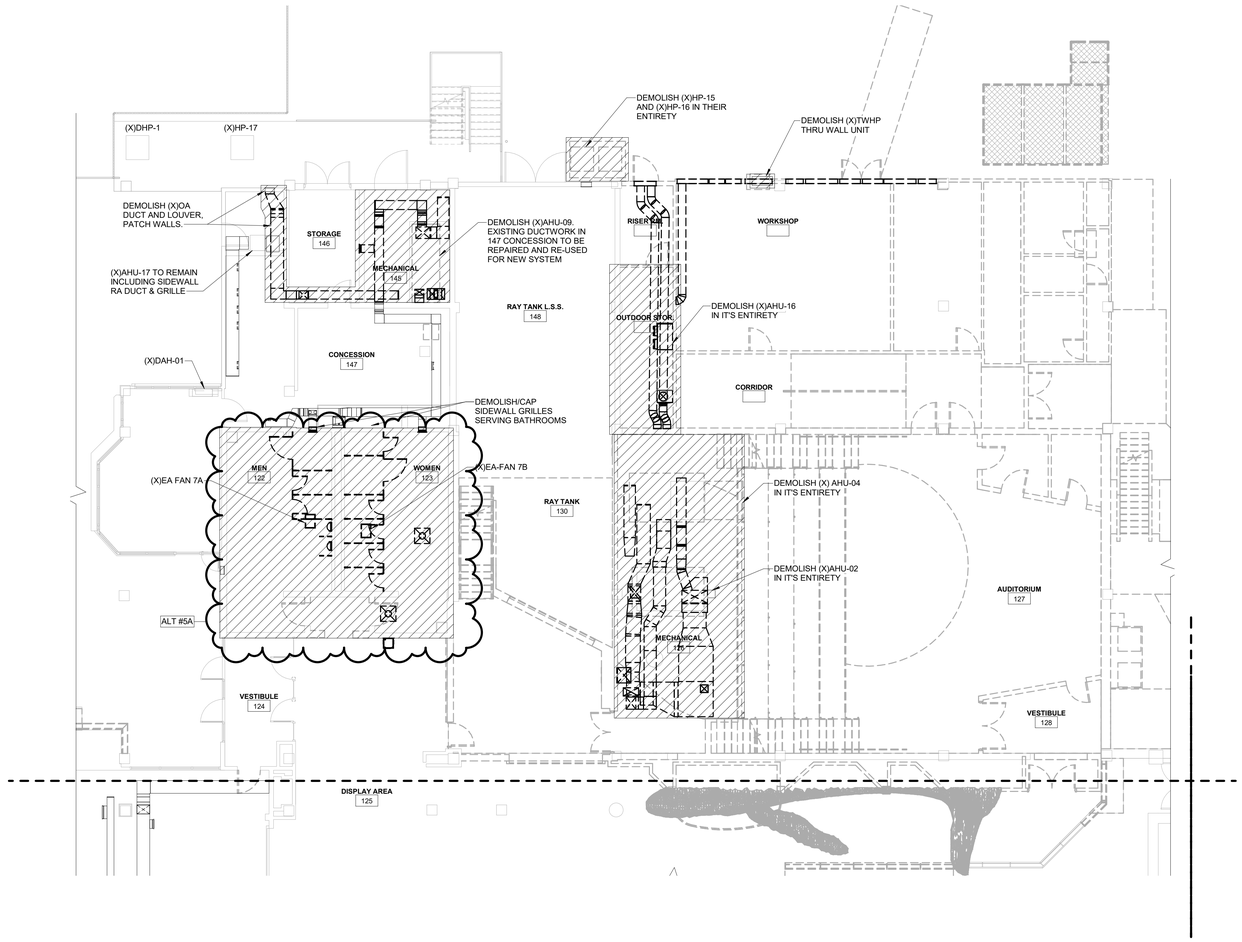
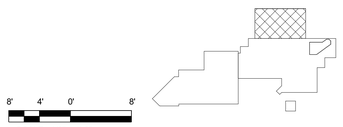


KEY PLAN



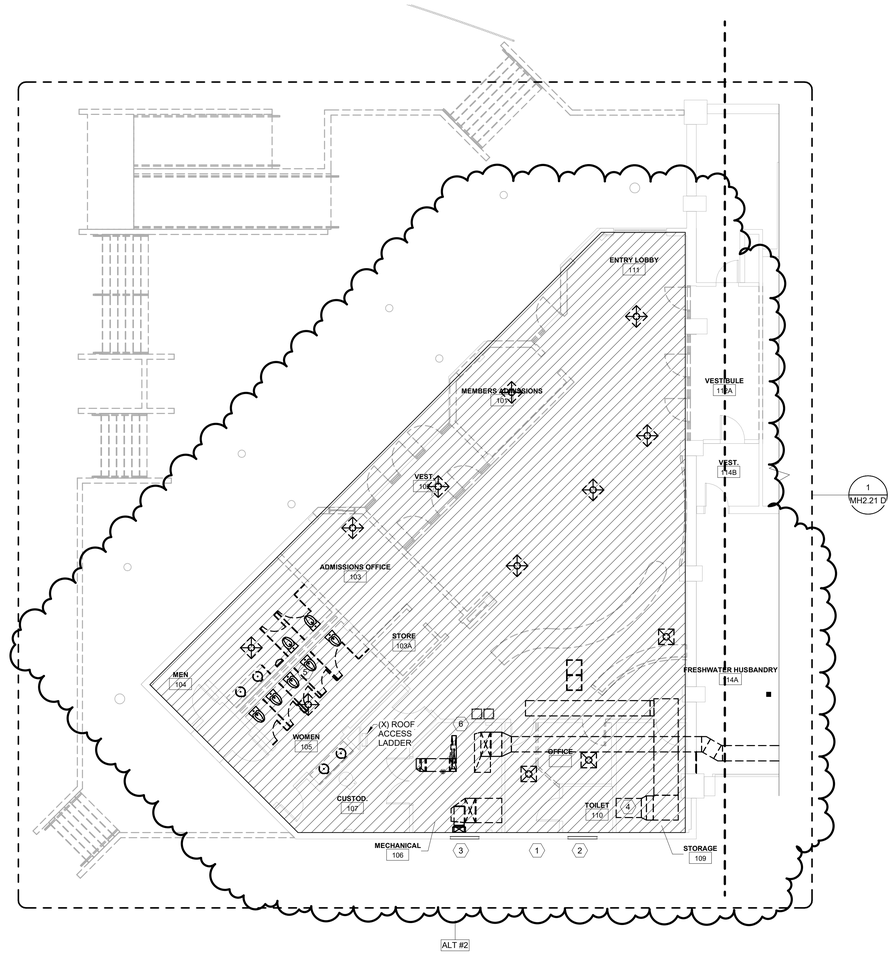
8' 4' 0' 8'

SCALE : 1/8" = 1'-0"

1ST FLOOR - DEMO - TOUCH AND SHARK TANK - HVAC

SCALE : 1/8" = 1'-0"

2



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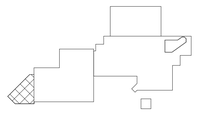

8' 4' 0' 8'

SCALE : 1/8" = 1'-0"

1ST FLOOR - DEMO - MAIN ENTRY - HVAC

SCALE : 1/8" = 1'-0"

1

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SCO #17-18042-02A
CODE: 42014-4G02
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SEAL 23551 — ENGINEER — DAVID M. HAHN

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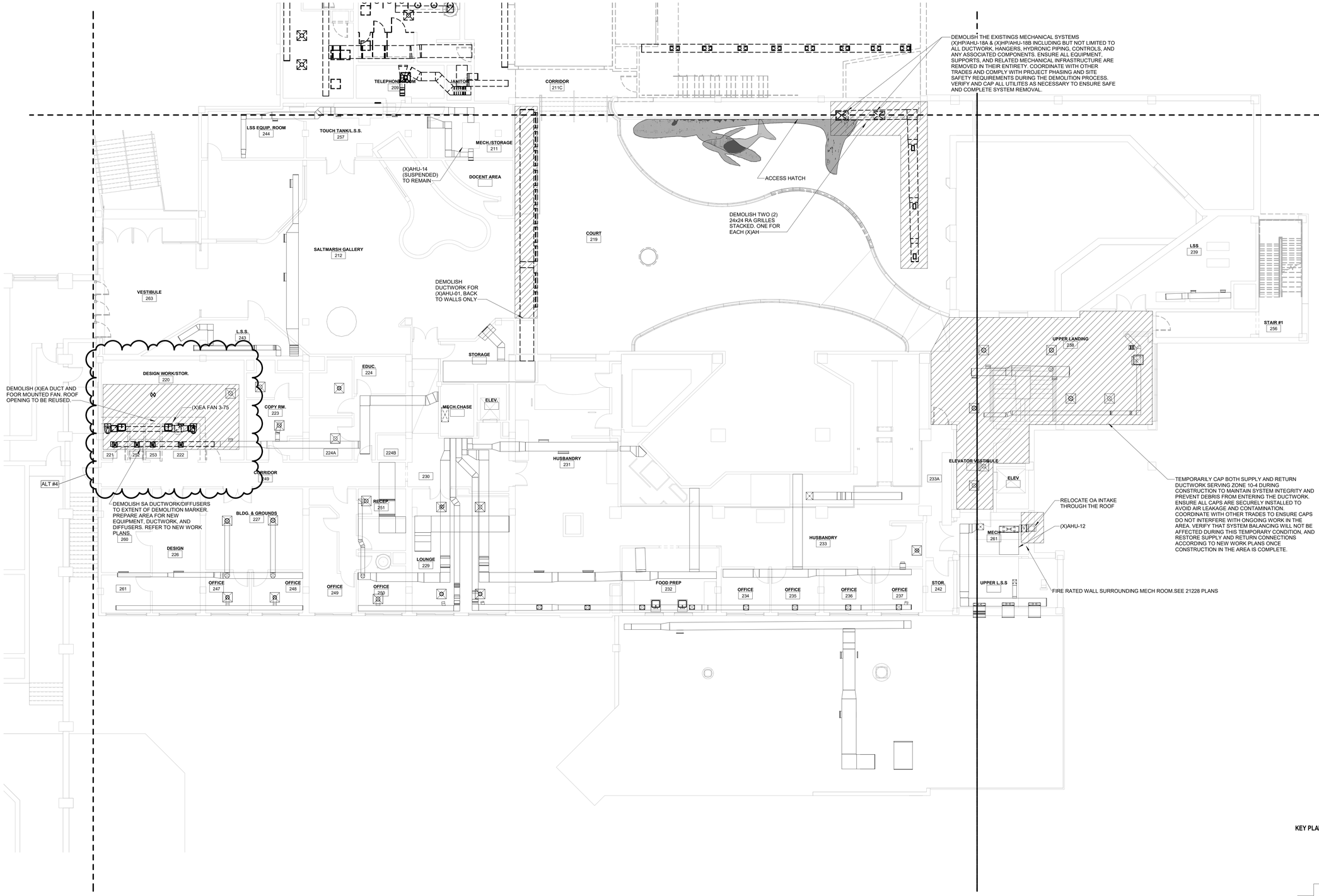
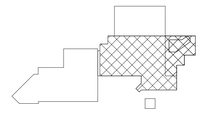
NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

FIRST FLOOR DEMO PLAN - MAIN ENTRY & TOUCH TANK

MD1.21 B



KEY PLAN



8' 4' 0' 8'

SCALE : 1/8" = 1'-0"

2ND FLOOR - DEMO - CAPE FEAR - HVAC

SCALE : 1/8" = 1'-0"

1

SZOSTAK DESIGN

FORT FISHER AQUARIUM RENOVATION & EXPANSION: PHASE 1

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SEAL 23561 ENGINEER DAVID M. HAHN

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SECOND FLOOR DEMO PLAN - CAPE FEAR

MD1.22 A

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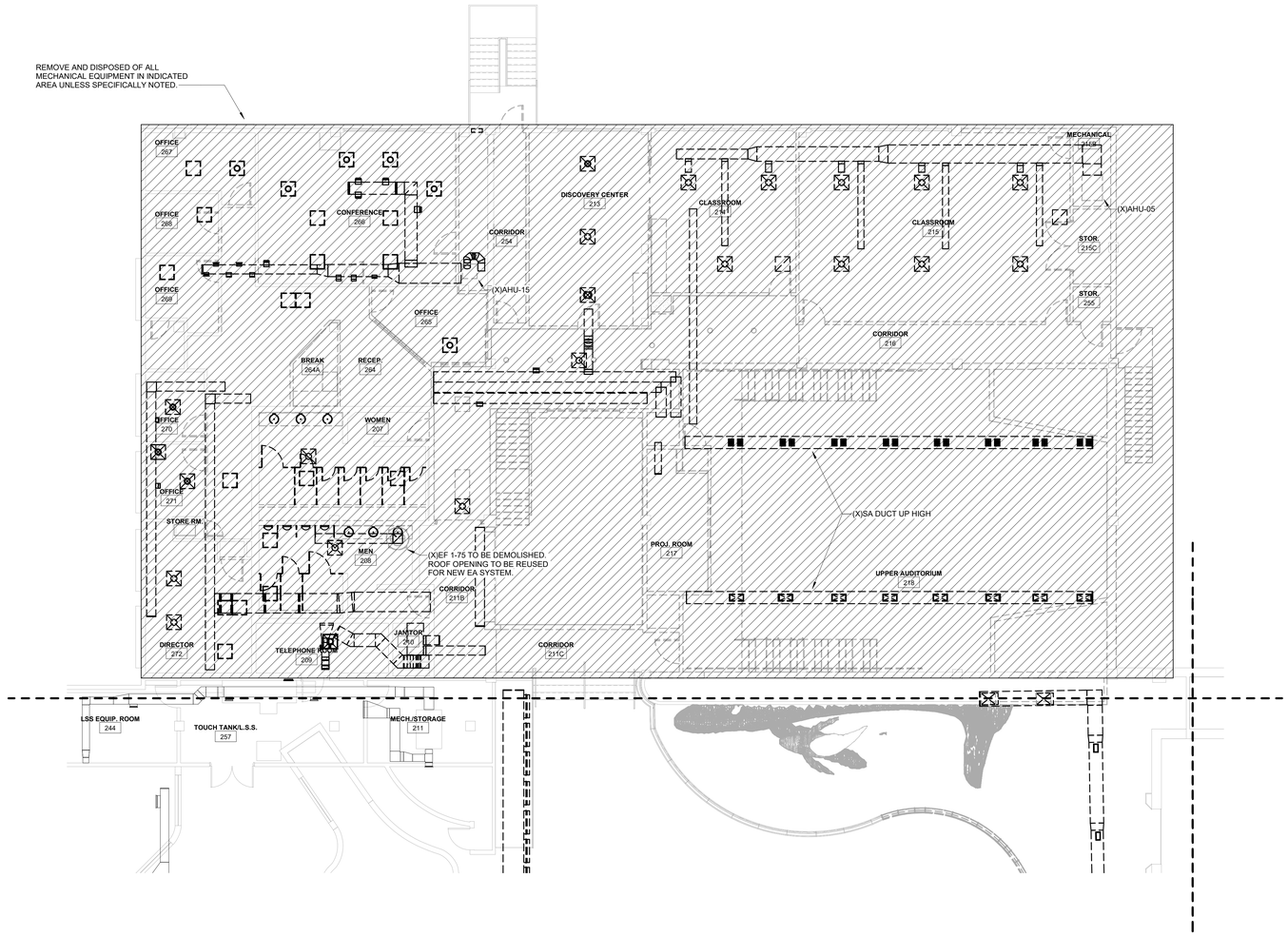
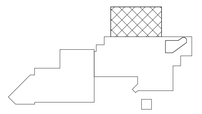


KEY PLAN



SCALE : 1/8" = 1'-0"

2ND FLOOR - DEMO - TOUCH AND SHARK TANK - HVAC

SCALE : 1/8" = 1'-0"

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SZOSTAK DESIGN

FORT FISHER AQUARIUM RENOVATION & EXPANSION: PHASE 1

SCO #17-18042-02A
CODE: 42014-4G02
ITEM: 41414-4Y4A

900 LOGGERHEAD RD,
KURE BEACH, NC 28449

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NOT FOR CONSTRUCTION

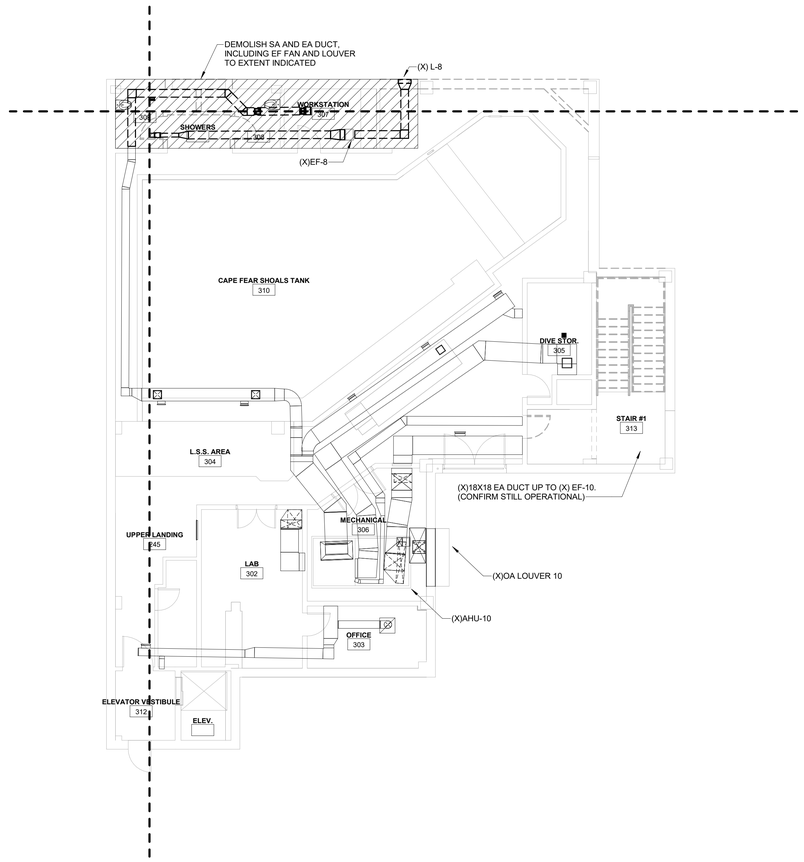
SEAL 23551 ENGINEER DAVID M. HAHN

NOT FOR CONSTRUCTION

NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

SECOND FLOOR DEMO PLAN - TOUCH TANK

MD1.22 B



8' 4' 0' 8'

SCALE : 1/8" = 1'-0"

3RD FLOOR - DEMO - CAPE FEAR - HVAC

SCALE : 1/8" = 1'-0"

1

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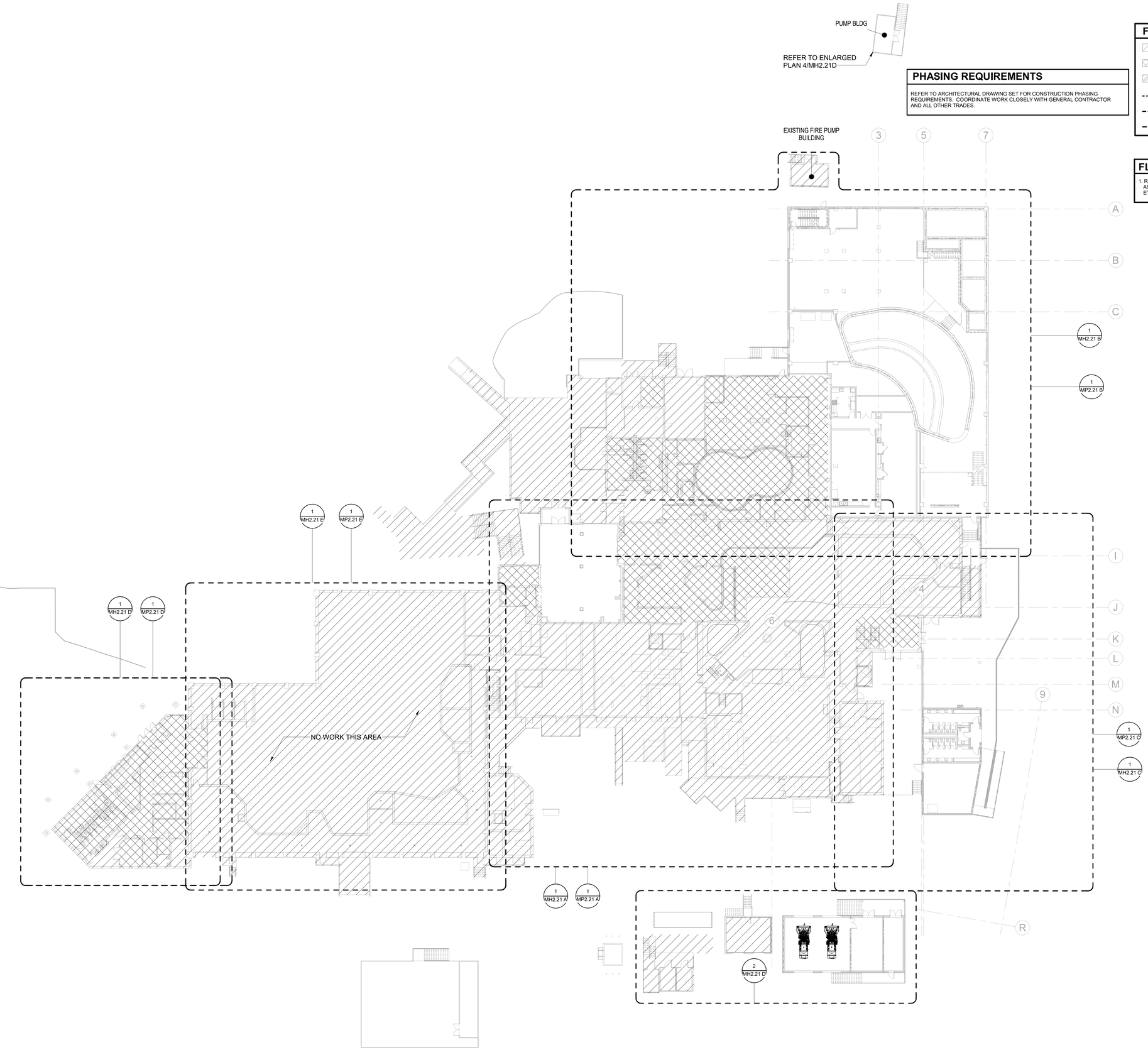
THIRD FLOOR DEMO PLAN - CAPE FEAR

MD1.23 A



PHASING REQUIREMENTS

REFER TO ARCHITECTURAL DRAWING SET FOR CONSTRUCTION PHASING REQUIREMENTS. COORDINATE WORK CLOSELY WITH GENERAL CONTRACTOR AND ALL OTHER TRADES.

FLOOR PLAN LEGEND

- EXISTING BUILDING
- RENOVATED AREA
- UPFIT BY OTHERS
- 1-HR RATED WALL
- 2-HR RATED WALL
- 3-HR RATED WALL

FLOOR PLAN SHEET NOTES

1. REFER TO ARCHITECTURAL DRAWINGS FOR RATED ASSEMBLY UL NUMBERS (WALLS, FLOOR / CEILINGS, ETC..

SCALE : 1" = 20'-0"

OVERALL 1ST FLOOR PLAN - HVAC

SCALE : 1" = 20'-0"

1

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NOT FOR CONSTRUCTION

SEAL 23551 — REGISTERED PROFESSIONAL ENGINEER — DAVID M. HAHN

NOT FOR CONSTRUCTION

NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

FIRST FLOOR PLAN - HVAC

MH2.11

PHASING REQUIREMENTS

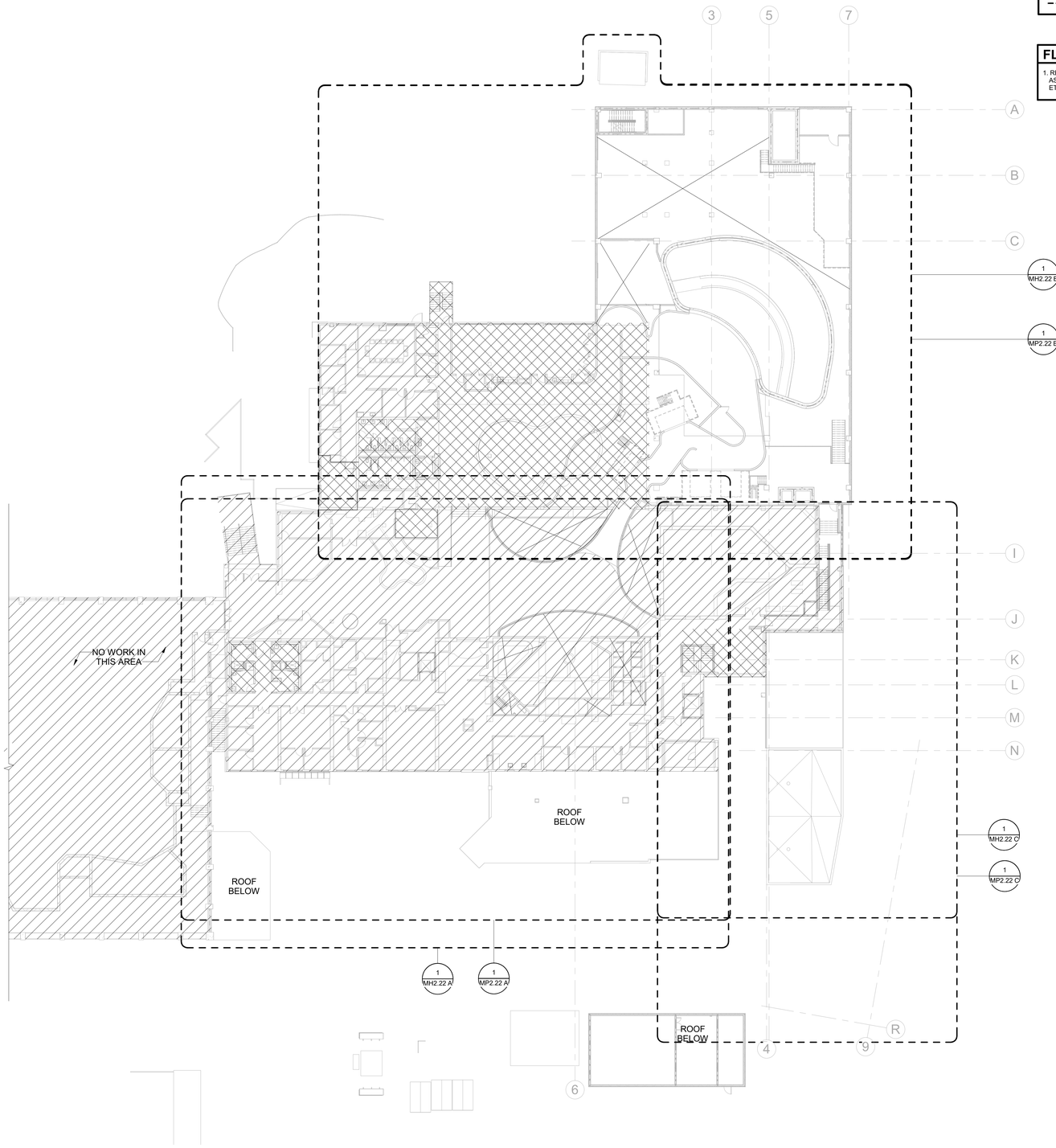
REFER TO ARCHITECTURAL DRAWING SET FOR CONSTRUCTION PHASING REQUIREMENTS. COORDINATE WORK CLOSELY WITH GENERAL CONTRACTOR AND ALL OTHER TRADES.

FLOOR PLAN LEGEND

- EXISTING BUILDING
- RENOVATED AREA
- UPFIT BY OTHERS
- 1-HR RATED WALL
- 2-HR RATED WALL
- 3-HR RATED WALL

FLOOR PLAN SHEET NOTES

1. REFER TO ARCHITECTURAL DRAWINGS FOR RATED ASSEMBLY UL NUMBERS (WALLS, FLOOR / CEILINGS, ETC..



SCALE : 1" = 20'-0"

OVERALL 2ND FLOOR PLAN - HVAC

SCALE : 1" = 20'-0"

1

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SEAL 23551 ENGINEER DAVID M. HAHN

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NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

SECOND FLOOR PLAN - HVAC

MH2.12

PHASING REQUIREMENTS

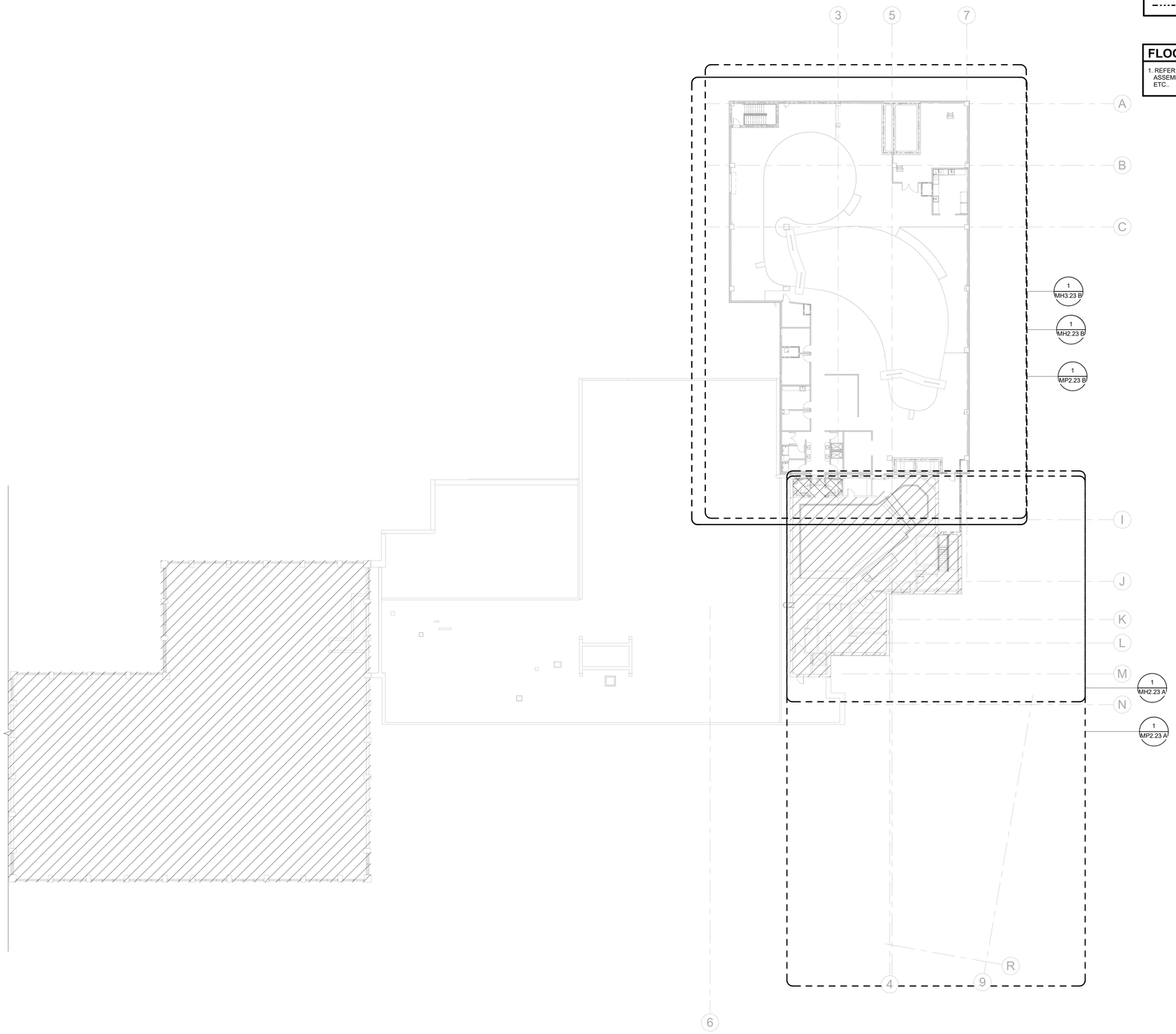
REFER TO ARCHITECTURAL DRAWING SET FOR CONSTRUCTION PHASING REQUIREMENTS. COORDINATE WORK CLOSELY WITH GENERAL CONTRACTOR AND ALL OTHER TRADES.

FLOOR PLAN LEGEND

- EXISTING BUILDING
- RENOVATED AREA
- UPFIT BY OTHERS
- 1-HR RATED WALL
- 2-HR RATED WALL
- 3-HR RATED WALL

FLOOR PLAN SHEET NOTES

1. REFER TO ARCHITECTURAL DRAWINGS FOR RATED ASSEMBLY UL NUMBERS (WALLS, FLOOR / CEILINGS, ETC..



20' 10' 20'

SCALE : 1" = 20'-0"

OVERALL 3RD FLOOR PLAN - HVAC

SCALE : 1" = 20'-0"

1

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SEAL 23551
REGISTERED PROFESSIONAL ENGINEER
DAVID M. HAHN

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NO.	DATE	DESCRIPTION
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THIRD FLOOR PLAN - HVAC

MH2.13

PHASING REQUIREMENTS

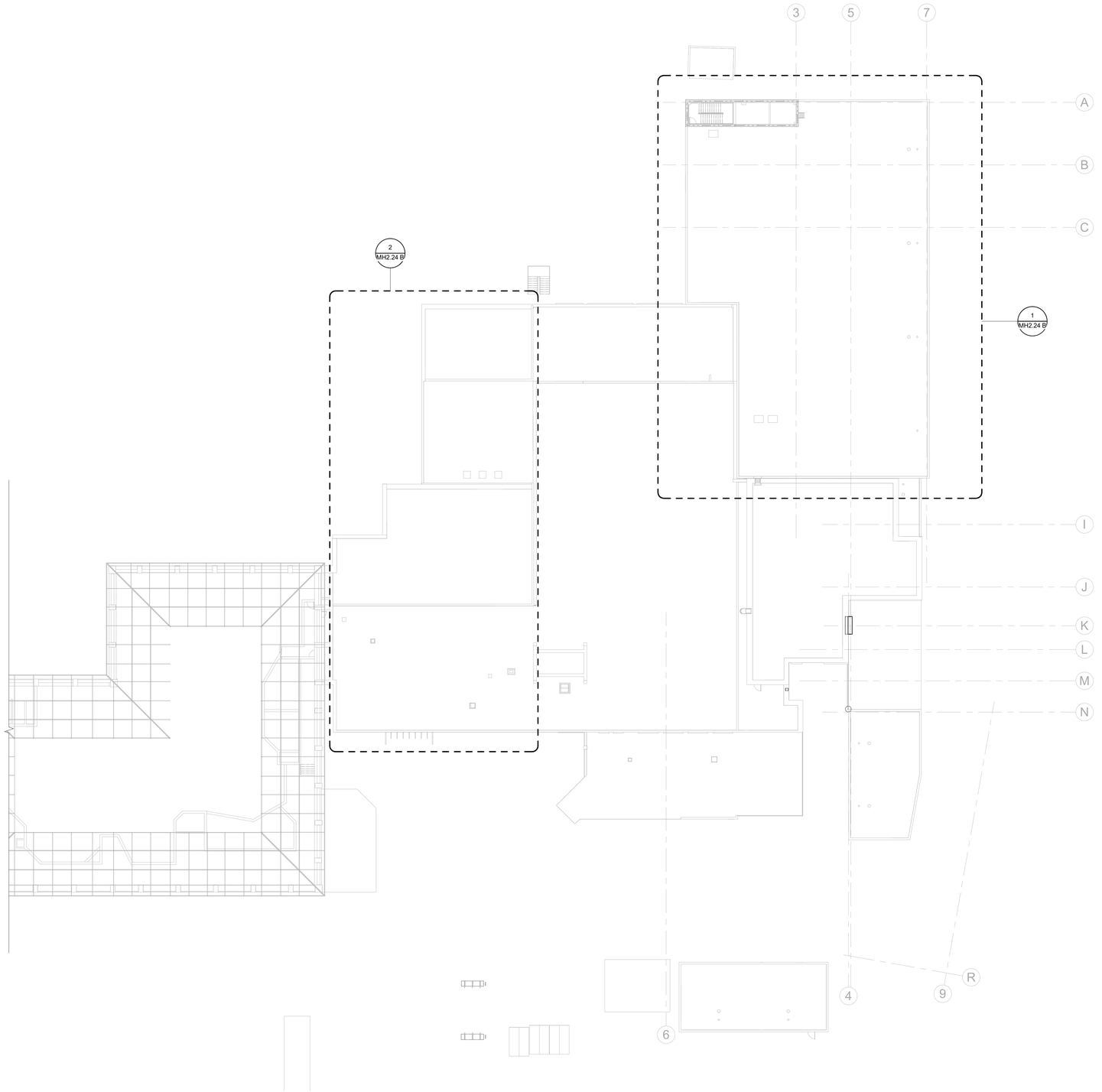
REFER TO ARCHITECTURAL DRAWING SET FOR CONSTRUCTION PHASING REQUIREMENTS. COORDINATE WORK CLOSELY WITH GENERAL CONTRACTOR AND ALL OTHER TRADES.

FLOOR PLAN LEGEND

- EXISTING BUILDING
- RENOVATED AREA
- UPFIT BY OTHERS
- 1-HR RATED WALL
- 2-HR RATED WALL
- 3-HR RATED WALL

ROOF PLAN SHEET NOTES

1. REFER TO ARCHITECTURAL DRAWINGS FOR RATED ASSEMBLY UL NUMBERS (WALLS, FLOOR / CEILINGS, ETC..
2. REFER TO STRUCTURAL DRAWINGS FOR EQUIPMENT ROOF MOUNTING CONDITIONS.
3. ALL ROOF PENETRATIONS SHALL CONFORM TO ROOF MANUFACTURER'S APPROVED METHODS.
4. MAINTAIN MINIMUM 10 FOOT SEPARATION BETWEEN EXHAUST AND ANY OUTSIDE AIR INTAKES.



20' 10' 20'

SCALE : 1" = 20'-0"

OVERALL ROOF PLAN - HVAC

SCALE : 1" = 20'-0"

1

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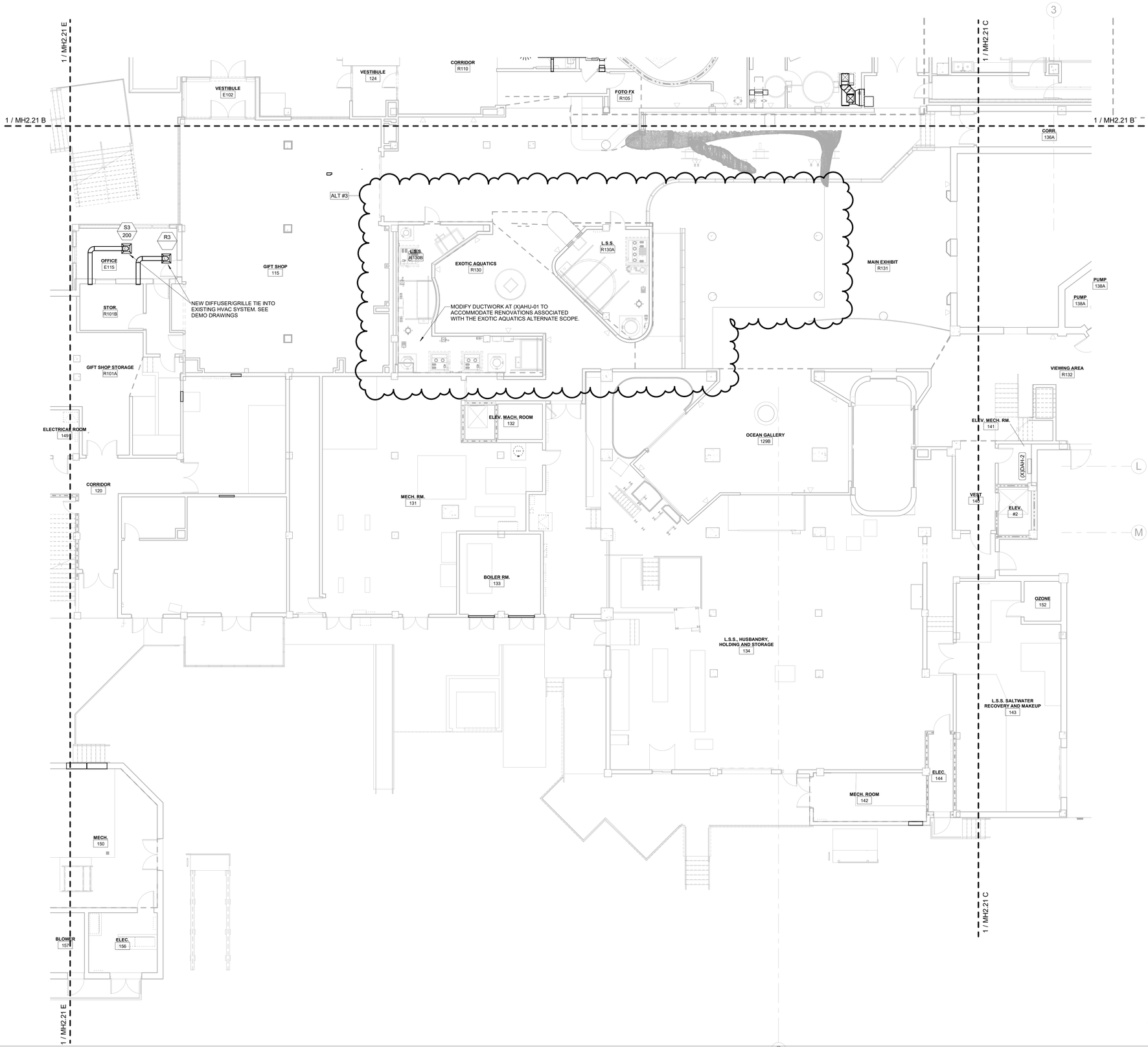
ROOF PLAN - HVAC

MH2.14



FLOOR PLAN LEGEND

- EXISTING BUILDING
- RENOVATED AREA
- UPFIT BY OTHERS
- 1-HR RATED WALL
- 2-HR RATED WALL
- 3-HR RATED WALL

FLOOR PLAN SHEET NOTES

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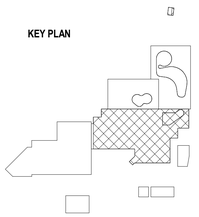
9. PROVIDE ACCESS DOORS FOR ALL DAMPERS, CONTROLS, AND EQUIPMENT REQUIRING SERVICE.
10. PROVIDE MARINE-GRADE OR CORROSION-RESISTANT MATERIALS IN AREAS SUBJECT TO SALT SPRAY OR HIGH HUMIDITY. SEE SPECIFICATIONS.

KEY PLAN



8' 4' 0' 8'

SCALE : 1/8" = 1'-0"

1ST FLOOR - CAPE FEAR SHOALS - RAMP - HVAC

SCALE : 1/8" = 1'-0"

1

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Fax: 910.791.5266
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SZOSTAK DESIGN

FORT FISHER AQUARIUM RENOVATION & EXPANSION: PHASE 1

SCO #17-18042-02A
CODE: 42014-4G02
ITEM: 41414-4Y4A

900 LOGGERHEAD RD,
KURE BEACH, NC 28449

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NOT FOR CONSTRUCTION

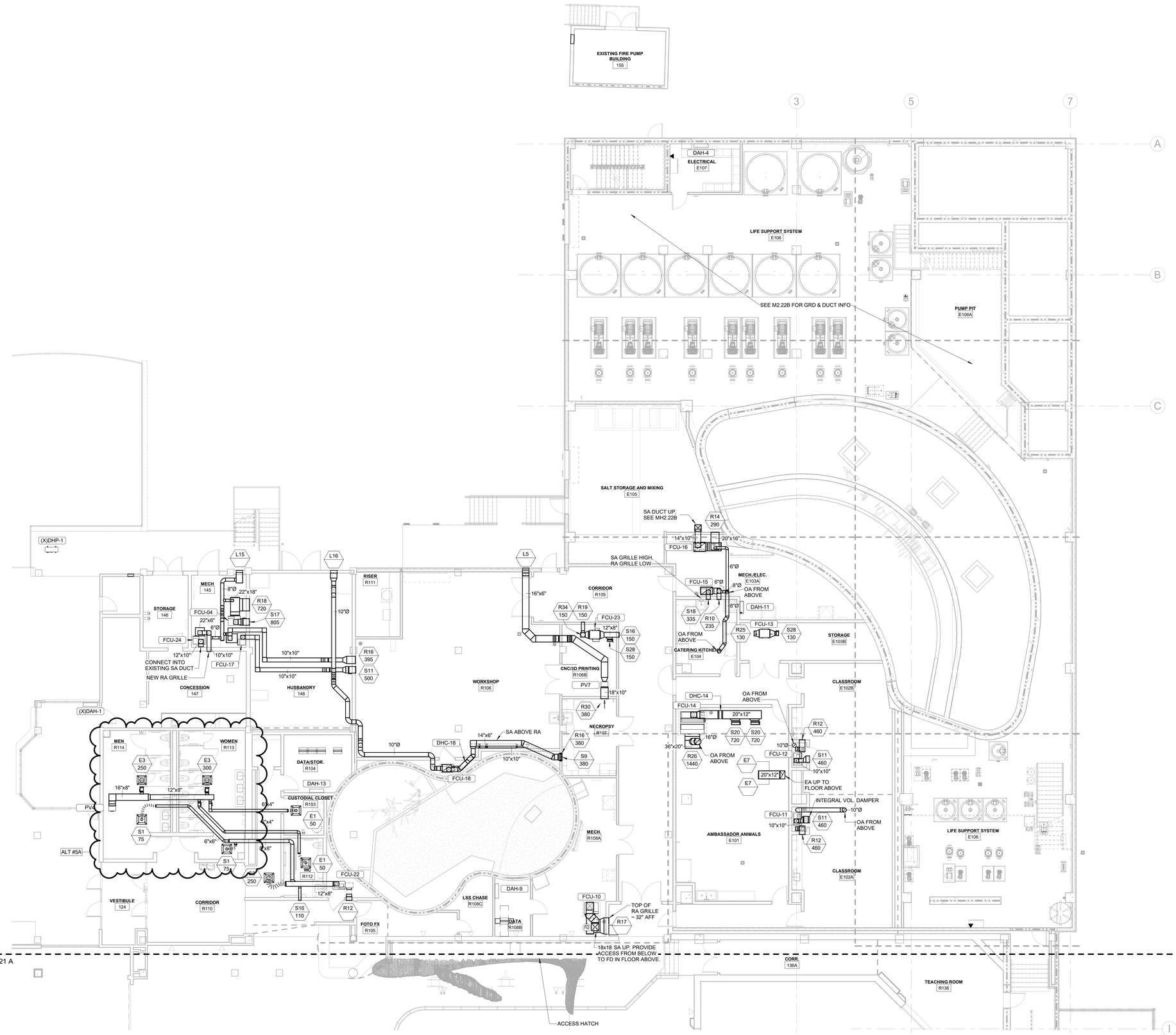
SEAL 23551 ENGINEER DAVID M. HAHN

NOT FOR CONSTRUCTION

NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

FIRST FLOOR PLAN - CAPE FEAR SHOALS - HVAC

MH2.21 A



FLOOR PLAN LEGEND

- EXISTING BUILDING
- RENOVATED AREA
- UPFIT BY OTHERS
- 1-HR RATED WALL
- 2-HR RATED WALL
- 3-HR RATED WALL

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SEAL 25506 — ENGINEER — DAVID RA MINNETTI

NOT FOR CONSTRUCTION

NO.	DATE	DESCRIPTION
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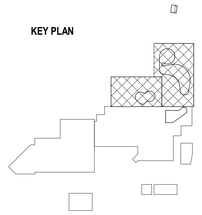
FIRST FLOOR PLAN - TOUCH AND SHARK TANK - HVAC

MH2.21 B

KEY PLAN



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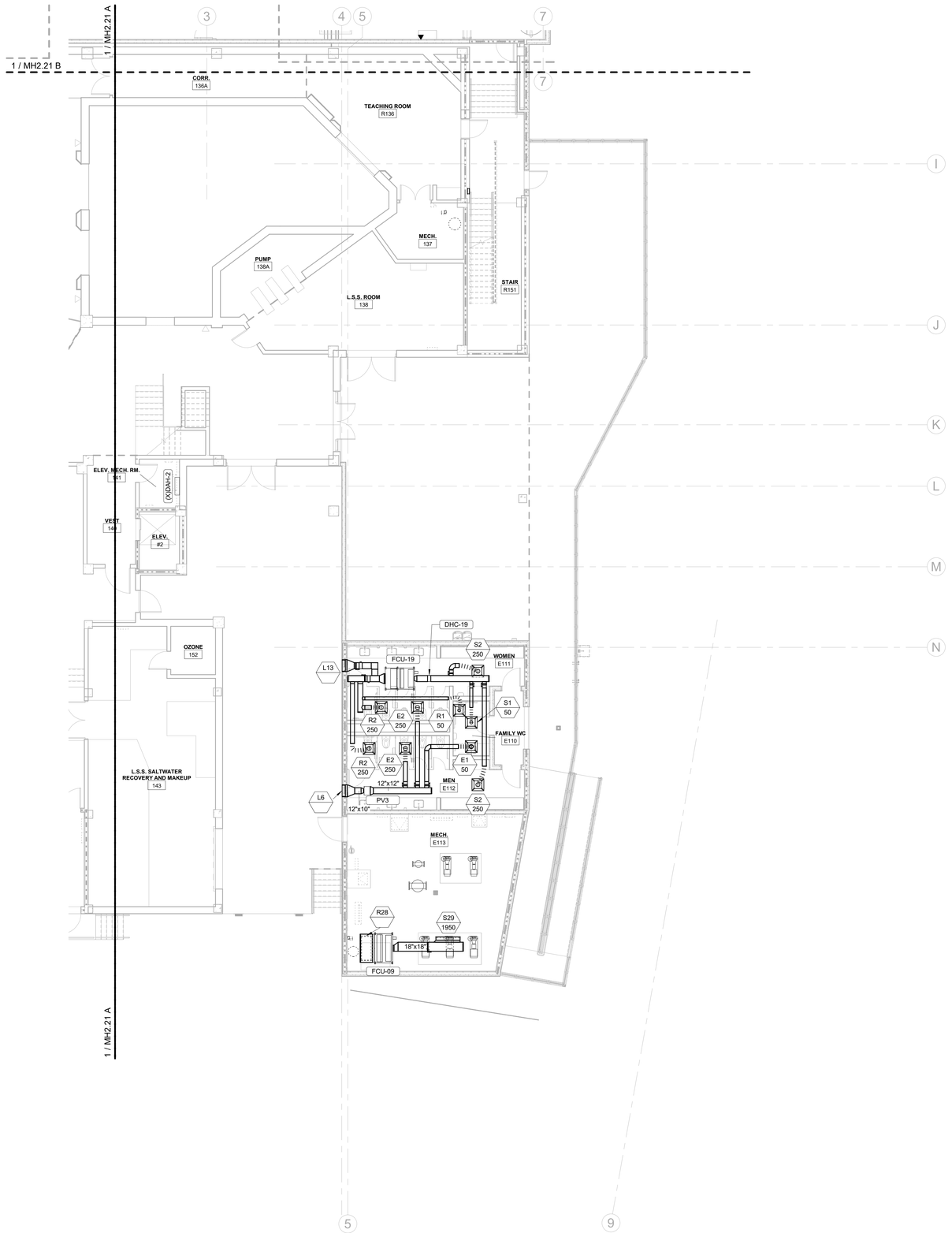
8' 4' 0' 8'
SCALE : 1/8" = 1'-0"

1ST FLOOR PLAN - TOUCH & SHARK TANK - HVAC
SCALE : 1/8" = 1'-0"



FLOOR PLAN LEGEND

- EXISTING BUILDING
- RENOVATED AREA
- UPFIT BY OTHERS
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- 3-HR RATED WALL

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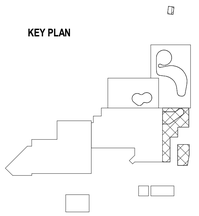

8' 4' 0' 8'

SCALE : 1/8" = 1'-0"

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1ST FLOOR PLAN - SOUTHEAST WING - HVAC

SCALE : 1/8" = 1'-0"

1

SZOSTAK DESIGN

FORT FISHER AQUARIUM RENOVATION & EXPANSION: PHASE 1

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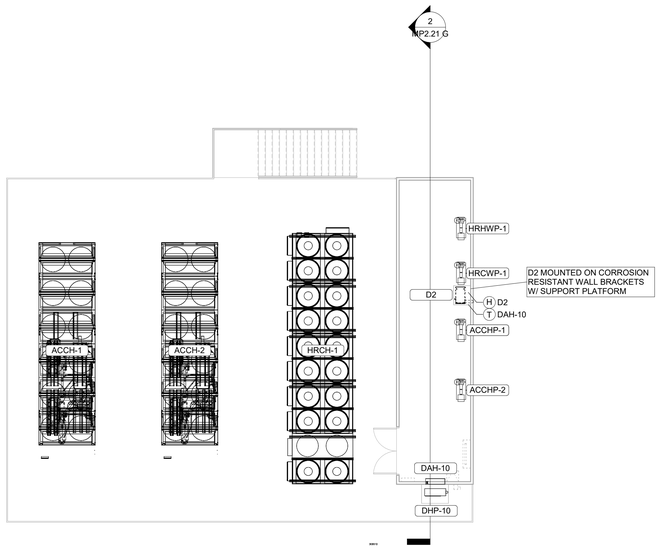
SEAL 23551 DAVID M. HAHN ENGINEER

NOT FOR CONSTRUCTION

NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

FIRST FLOOR PLAN - SOUTHEAST WING - HVAC

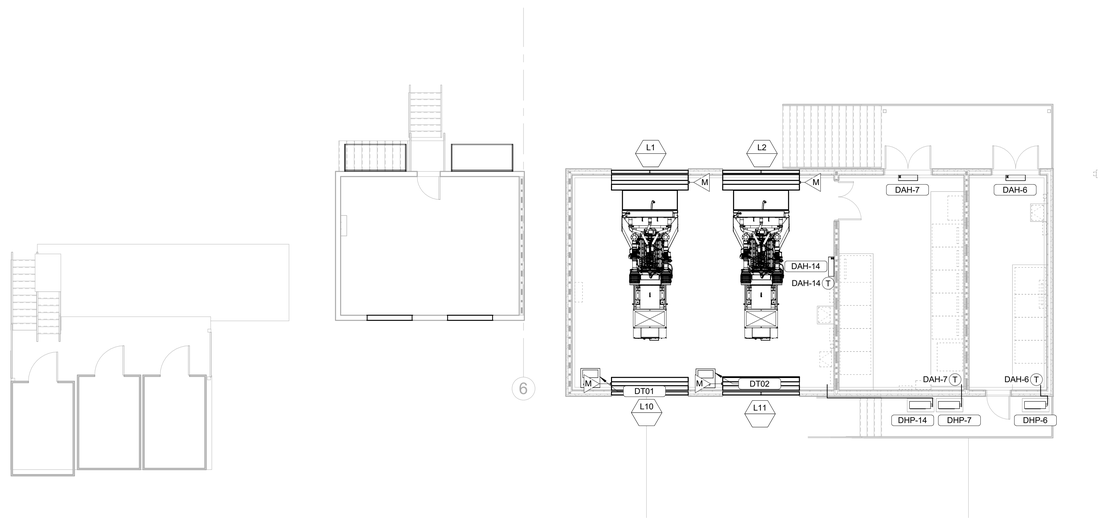
MH2.21 C



CHILLER PLATFORM HVAC PLAN

SCALE : 1/8" = 1'-0"

3



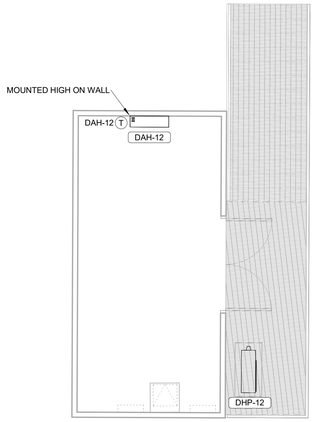
8' 4' 0' 8'

SCALE : 1/8" = 1'-0"

1ST FLOOR PLAN - GENERATOR BUILDING -HVAC

SCALE : 1/8" = 1'-0"

2



DOMESTIC WATER BOOSTER PUMP BUILDING - HVAC

SCALE : 1/4" = 1'-0"

4

FLOOR PLAN LEGEND

- EXISTING BUILDING
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- UPFIT BY OTHERS
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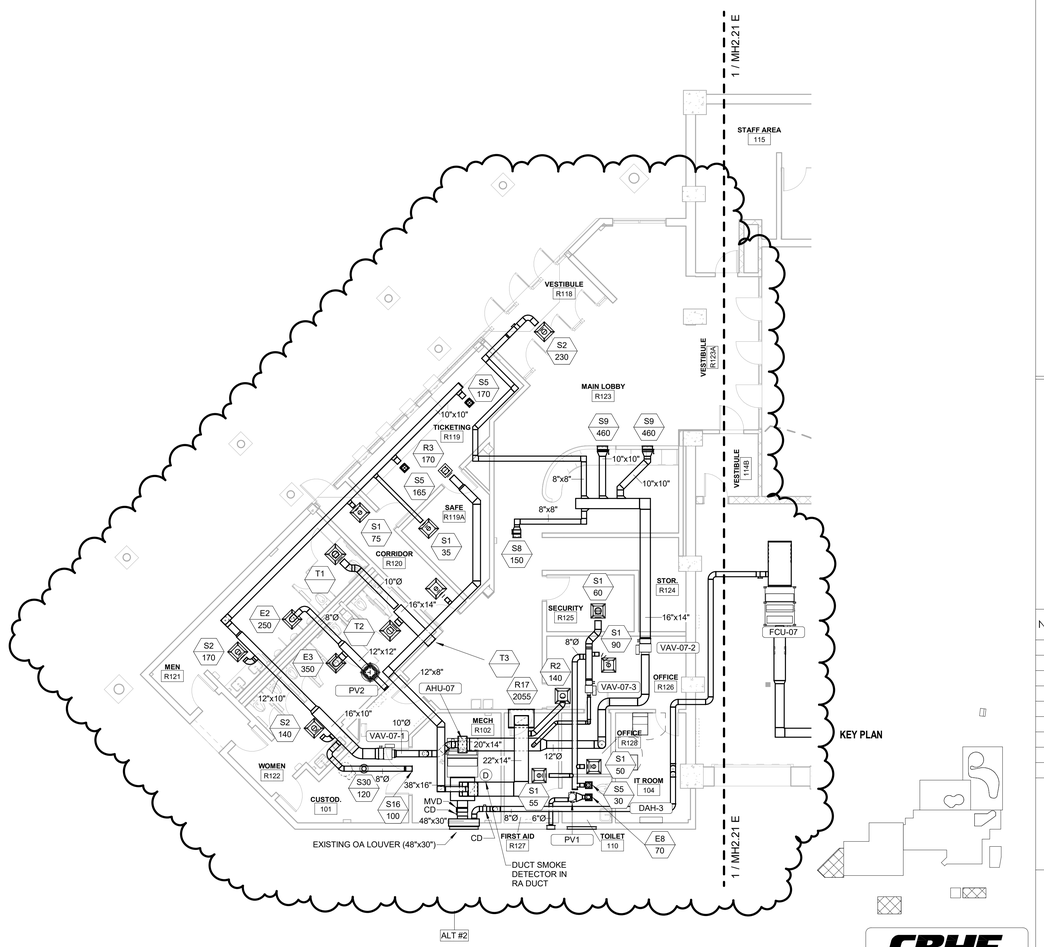

ALT #2

8' 4' 0' 8'

SCALE : 1/8" = 1'-0"

1ST FLOOR PLAN - MAIN ENTRY - HVAC

SCALE : 1/8" = 1'-0"

1

SZOSTAK DESIGN

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SEAL 23551
ENGINEER
DAVID M. HAHN

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FIRST FLOOR PLAN - MAIN ENTRY & MECH BLDNG - HVAC

MH2.21 D

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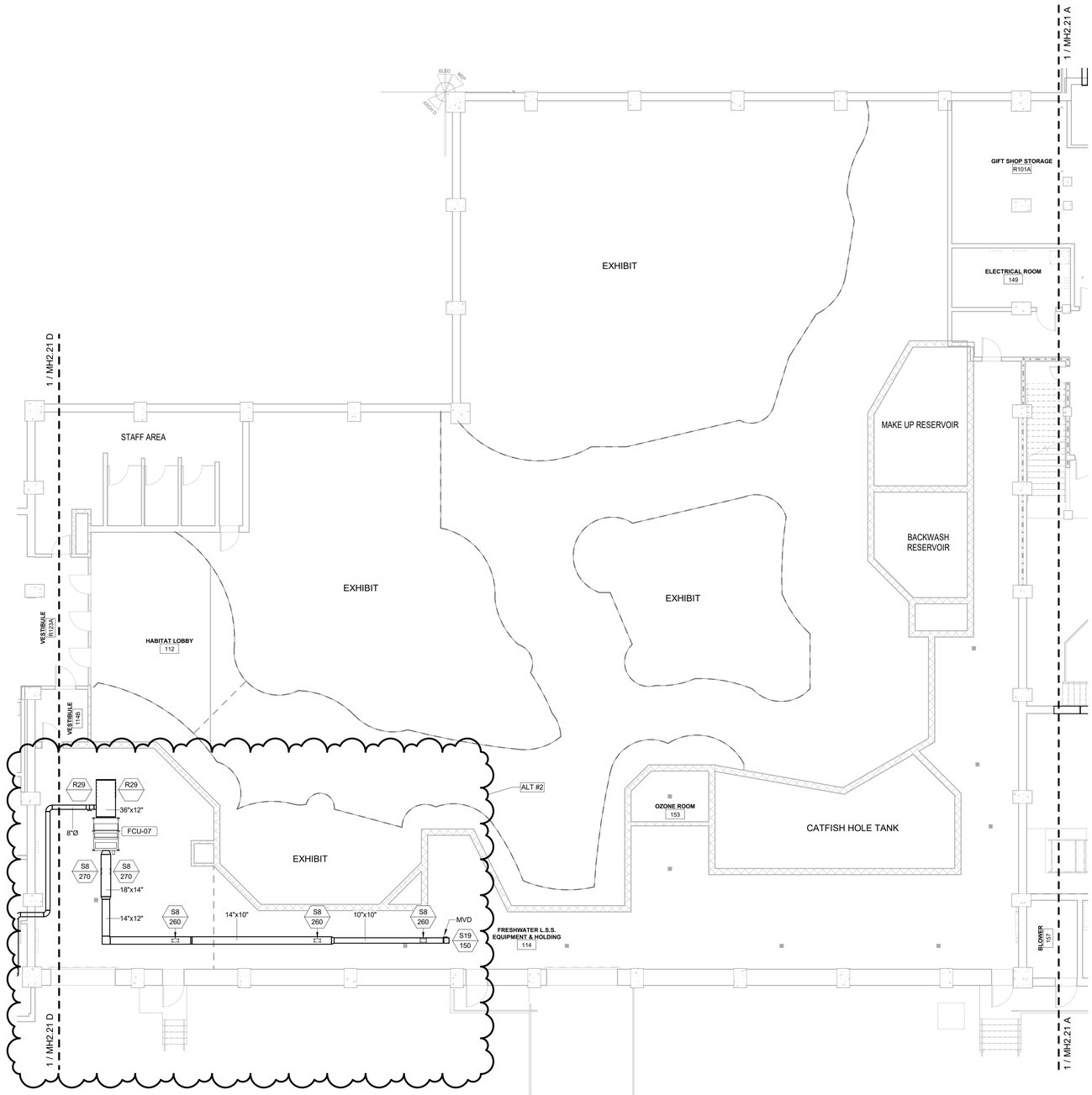

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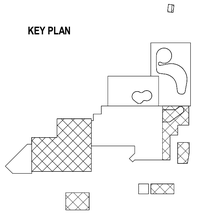
KEY PLAN



8' 4' 0' 8'

SCALE : 1/8" = 1'-0"

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Fax: 910.791.5266
www.cbhfengineers.com

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1ST FLOOR PLAN - FRESHWATER HABITAT - HVAC

SCALE : 1/8" = 1'-0"

1

SZOSTAK DESIGN

FORT FISHER AQUARIUM RENOVATION & EXPANSION: PHASE 1

SCO #17-18042-02A
CODE: 42014-4G02
ITEM: 41414-4Y4A

900 LOGGERHEAD RD,
KURE BEACH, NC 28449

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FAX: 919.960.7967
WWW.SZOSTAKDESIGN.COM
LICENSE # 51679

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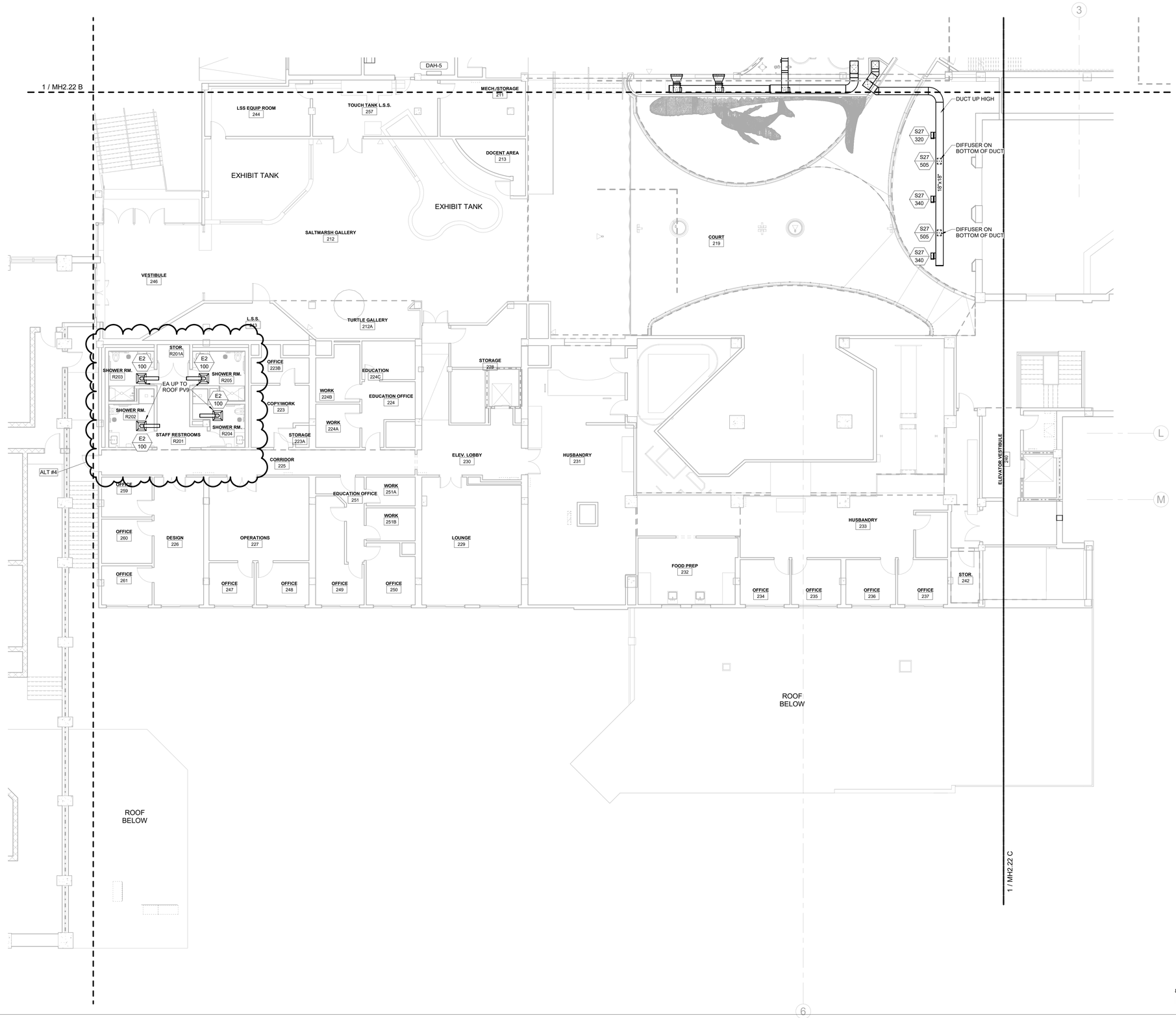
REGISTERED PROFESSIONAL ENGINEER SEAL 23551 DAVID M. HAHN

NOT FOR CONSTRUCTION

NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

FIRST FLOOR PLAN - FRESHWATER HABITAT - HVAC

MH2.21 E



FLOOR PLAN LEGEND

- EXISTING BUILDING
- RENOVATED AREA
- UPFIT BY OTHERS
- 1-HR RATED WALL
- 2-HR RATED WALL
- 3-HR RATED WALL

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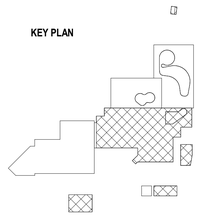

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2ND FLOOR PLAN - CAPE FEAR SHOALS - HVAC

SCALE : 1/8" = 1'-0"

1

SZOSTAK DESIGN

FORT FISHER AQUARIUM RENOVATION & EXPANSION: PHASE 1

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LICENSE # C-1073

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NOT FOR CONSTRUCTION

SEAL 23551 ENGINEER DAVID M. HAHN

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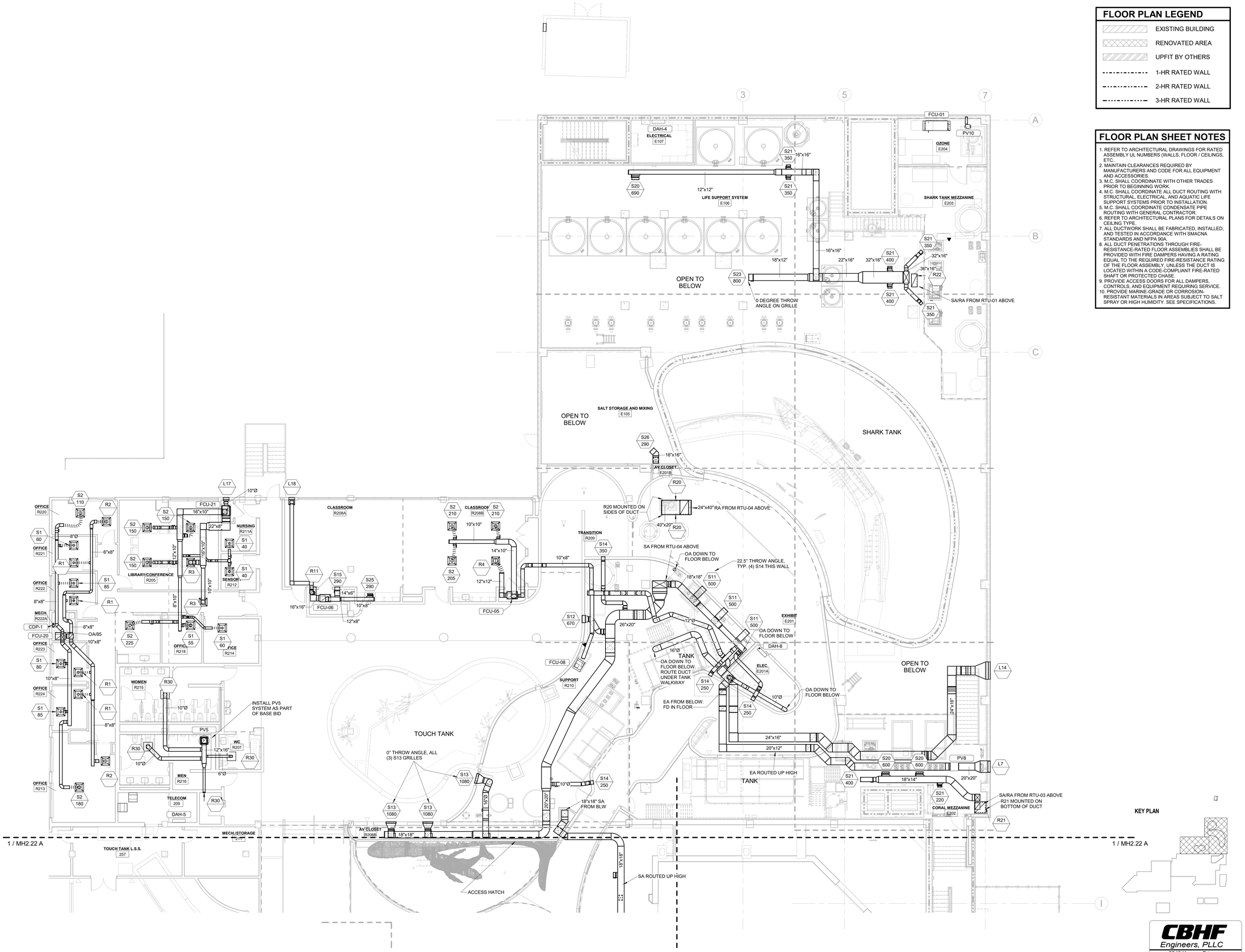
SECOND FLOOR PLAN - CAPE FEAR SHOALS - HVAC

MH2.22 A



FLOOR PLAN LEGEND

- EXISTING BUILDING
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- UPFIT BY OTHERS
- 1-HR RATED WALL
- 2-HR RATED WALL
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SCALE : 1/8" = 1'-0"

2ND FLOOR PLAN - TOUCH & SHARK TANK - HVAC

SCALE : 1/8" = 1'-0"

1

SZOSTAK DESIGN

FORT FISHER AQUARIUM RENOVATION & EXPANSION: PHASE 1

SCO #17-18042-02A
CODE: 42014-4G02
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WWW.TUNSTALLENGINEERS.COM
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FAX: 919.419.1669
WWW.SURFACE678.COM
LICENSE # C-098

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PALACIO COLLABORATIVE
COST ESTIMATOR
4819 EMPEROR BOULEVARD SUITE 400
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NOT FOR CONSTRUCTION
PROFESSIONAL ENGINEER SEAL 23551 DAVID M. HAHN

NOT FOR CONSTRUCTION

NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

SECOND FLOOR PLAN - TOUCH AND SHARK TANK - HVAC

MH2.22 B

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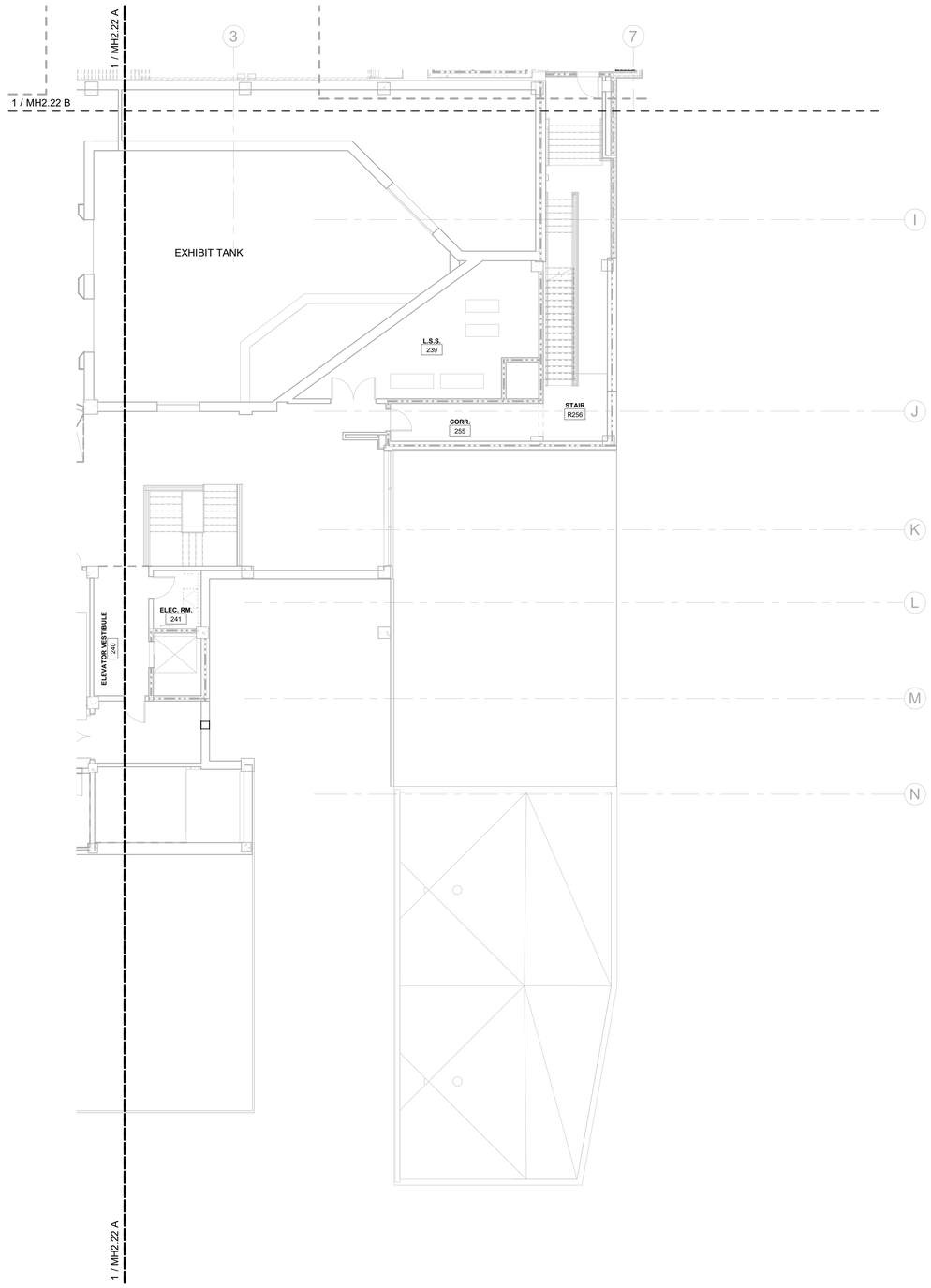

FLOOR PLAN LEGEND

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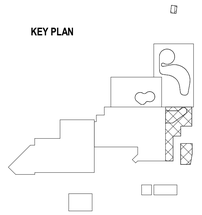

8' 4' 0' 8'

SCALE : 1/8" = 1'-0"

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2ND FLOOR PLAN - SOUTHEAST WING - HVAC

SCALE : 1/8" = 1'-0"

1

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SEAL 23581 ENGINEER DAVID M. HAHN

NOT FOR CONSTRUCTION

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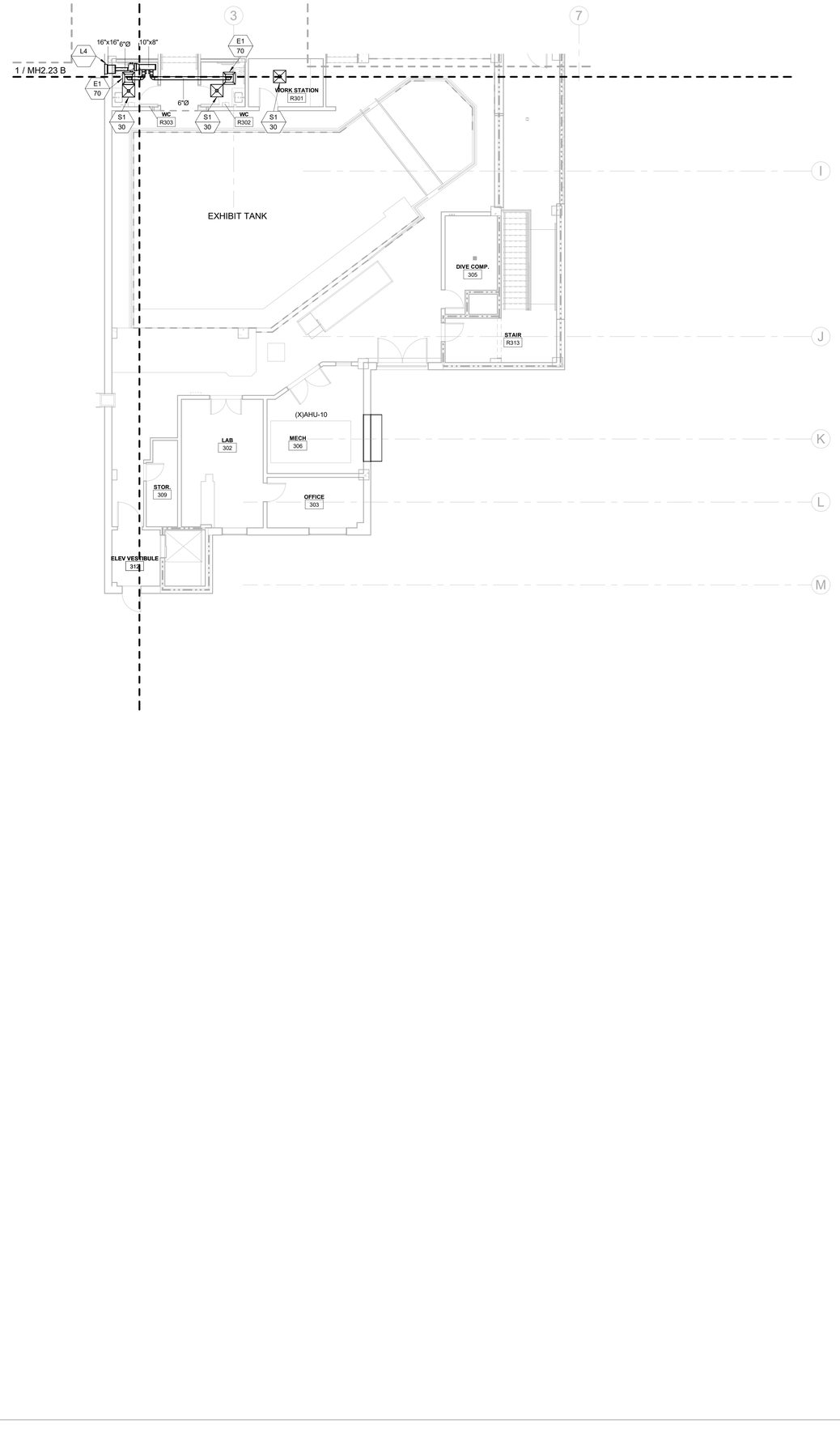
SECOND FLOOR PLAN - SOUTHEAST WING - HVAC

MH2.22 C



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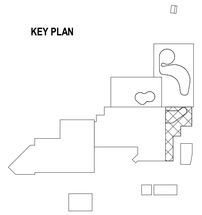

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3RD FLOOR PLAN - SOUTHEAST WING - HVAC

SCALE : 1/8" = 1'-0"

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SZOSTAK DESIGN

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CODE: 42014-4G02
ITEM: 41414-4Y4A

900 LOGGERHEAD RD,
KURE BEACH, NC 28449

NORTH CAROLINA DEPT. OF NATURAL & CULTURAL RESOURCES

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LICENSE # 51679

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SURFACE 678, PA
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CHEATHAM & ASSOCIATES, PA
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NOT FOR CONSTRUCTION

NORTH CAROLINA SEAL 23551 ENGINEER DAVID M. HAHN

NOT FOR CONSTRUCTION

NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

THIRD FLOOR PLAN - SOUTHEAST WING - HVAC

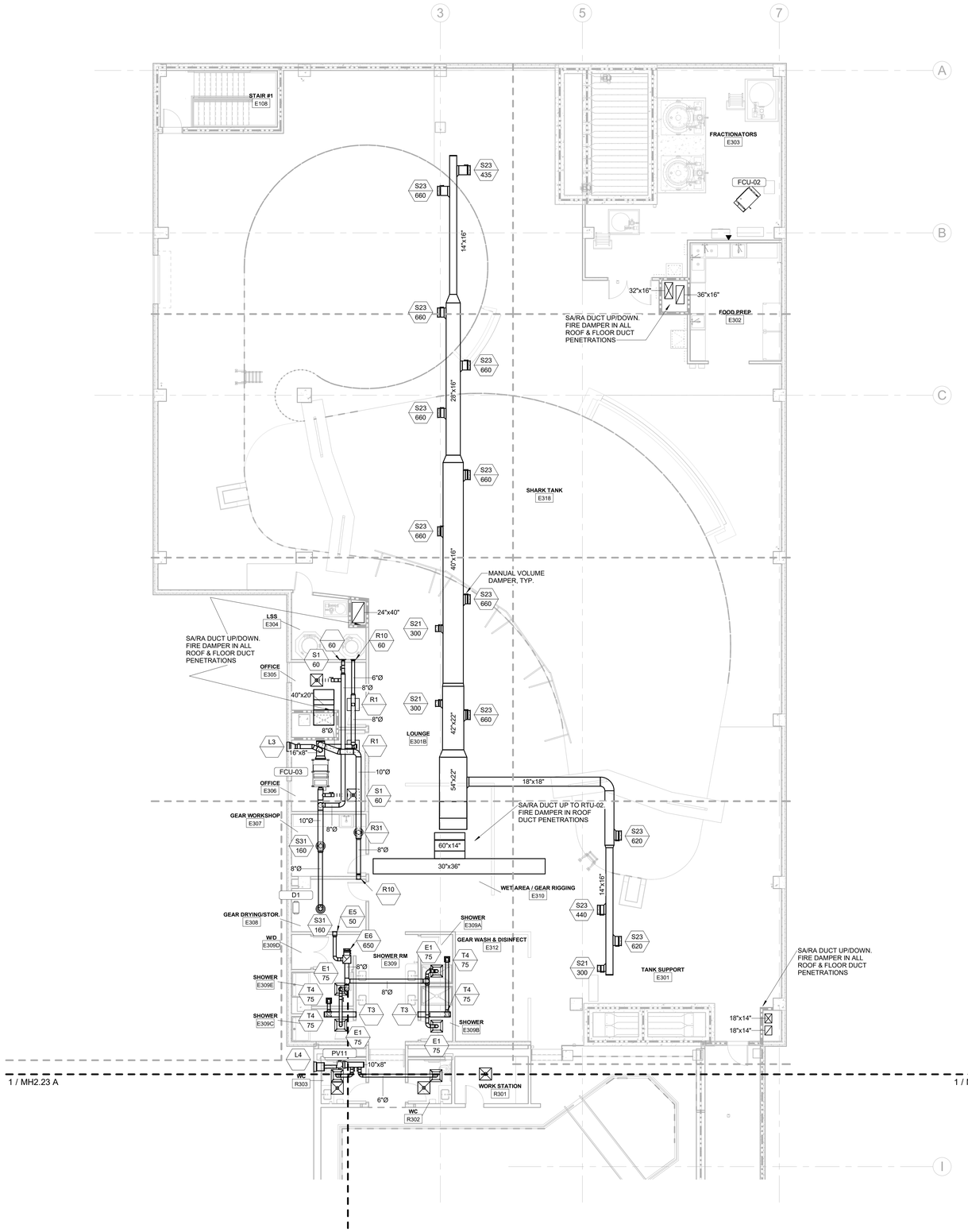
MH2.23 A

FLOOR PLAN LEGEND

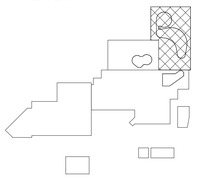
- EXISTING BUILDING
- RENOVATED AREA
- UPFIT BY OTHERS
- 1-HR RATED WALL
- 2-HR RATED WALL
- 3-HR RATED WALL

FLOOR PLAN SHEET NOTES

1. REFER TO ARCHITECTURAL DRAWINGS FOR RATED ASSEMBLY UL NUMBERS (WALLS, FLOOR / CEILINGS, ETC..
2. MAINTAIN CLEARANCES REQUIRED BY MANUFACTURERS AND CODE FOR ALL EQUIPMENT AND ACCESSORIES.
3. M.C. SHALL COORDINATE WITH OTHER TRADES PRIOR TO BEGINNING WORK.
4. M.C. SHALL COORDINATE ALL DUCT ROUTING WITH STRUCTURAL, ELECTRICAL, AND AQUATIC LIFE SUPPORT SYSTEMS PRIOR TO INSTALLATION.
5. M.C. SHALL COORDINATE CONDENSATE PIPE ROUTING WITH GENERAL CONTRACTOR.
6. REFER TO ARCHITECTURAL PLANS FOR DETAILS ON CEILING TYPE.
7. ALL DUCTWORK SHALL BE FABRICATED, INSTALLED, AND TESTED IN ACCORDANCE WITH SMACNA STANDARDS AND NFPA 90A.
8. ALL DUCT PENETRATIONS THROUGH FIRE-RESISTANCE-RATED FLOOR ASSEMBLIES SHALL BE PROVIDED WITH FIRE DAMPERS HAVING A RATING EQUAL TO THE REQUIRED FIRE-RESISTANCE RATING OF THE FLOOR ASSEMBLY, UNLESS THE DUCT IS LOCATED WITHIN A CODE-COMPLIANT FIRE-RATED SHAFT OR PROTECTED CHASE.
9. PROVIDE ACCESS DOORS FOR ALL DAMPERS, CONTROLS, AND EQUIPMENT REQUIRING SERVICE.
10. PROVIDE MARINE-GRADE OR CORROSION-RESISTANT MATERIALS IN AREAS SUBJECT TO SALT SPRAY OR HIGH HUMIDITY. SEE SPECIFICATIONS.



KEY PLAN



8' 4' 0' 8'

SCALE : 1/8" = 1'-0"

3RD FLOOR PLAN - SHARK TANK

SCALE : 1/8" = 1'-0"

1

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SZOSTAK DESIGN

FORT FISHER AQUARIUM RENOVATION & EXPANSION: PHASE 1

SCO #17-18042-02A
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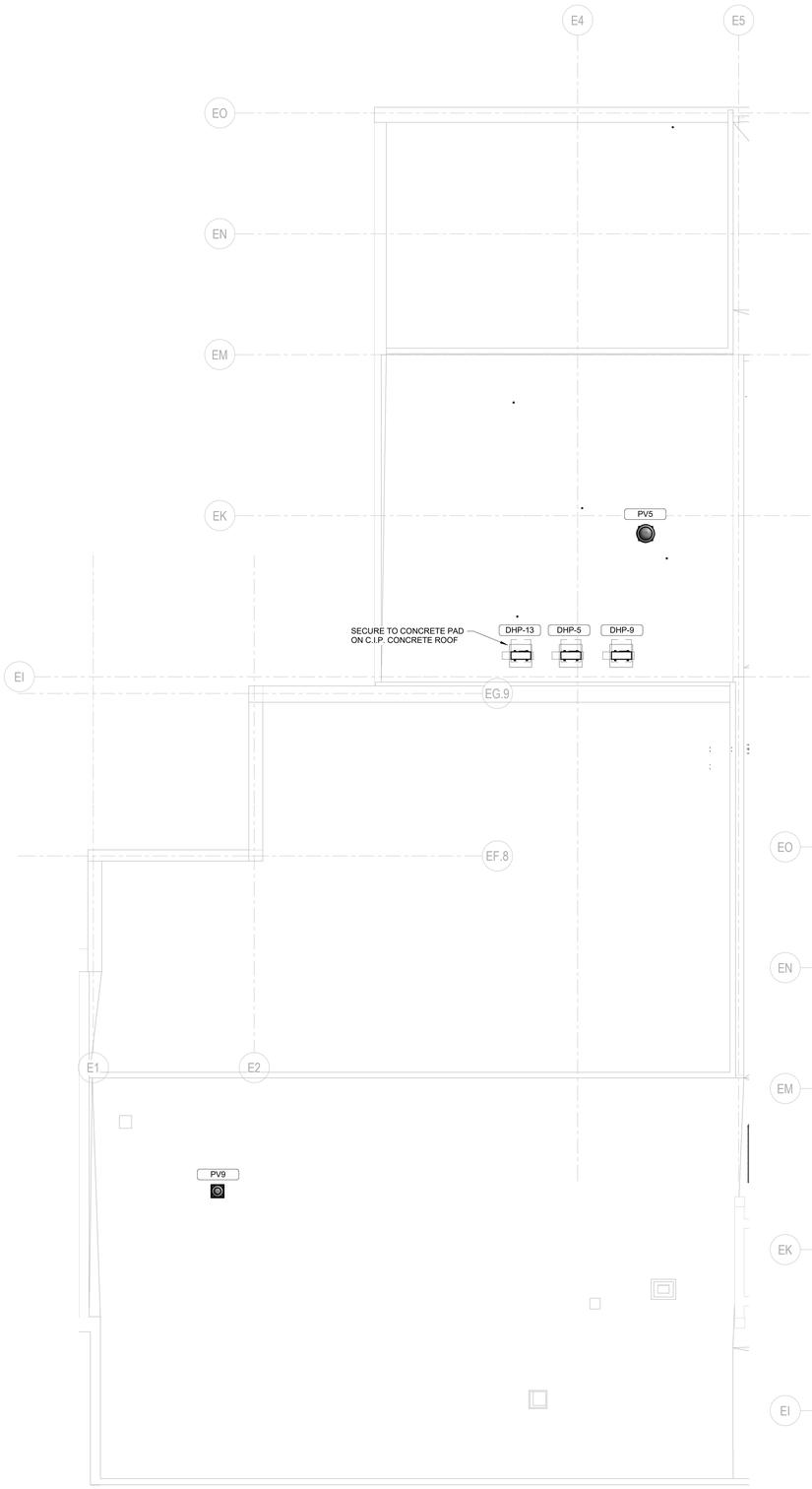
SEAL 23551 ENGINEER DAVID M. HAHN

NOT FOR CONSTRUCTION

NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

THIRD FLOOR PLAN - SHARK TANK - HVAC

MH2.23 B

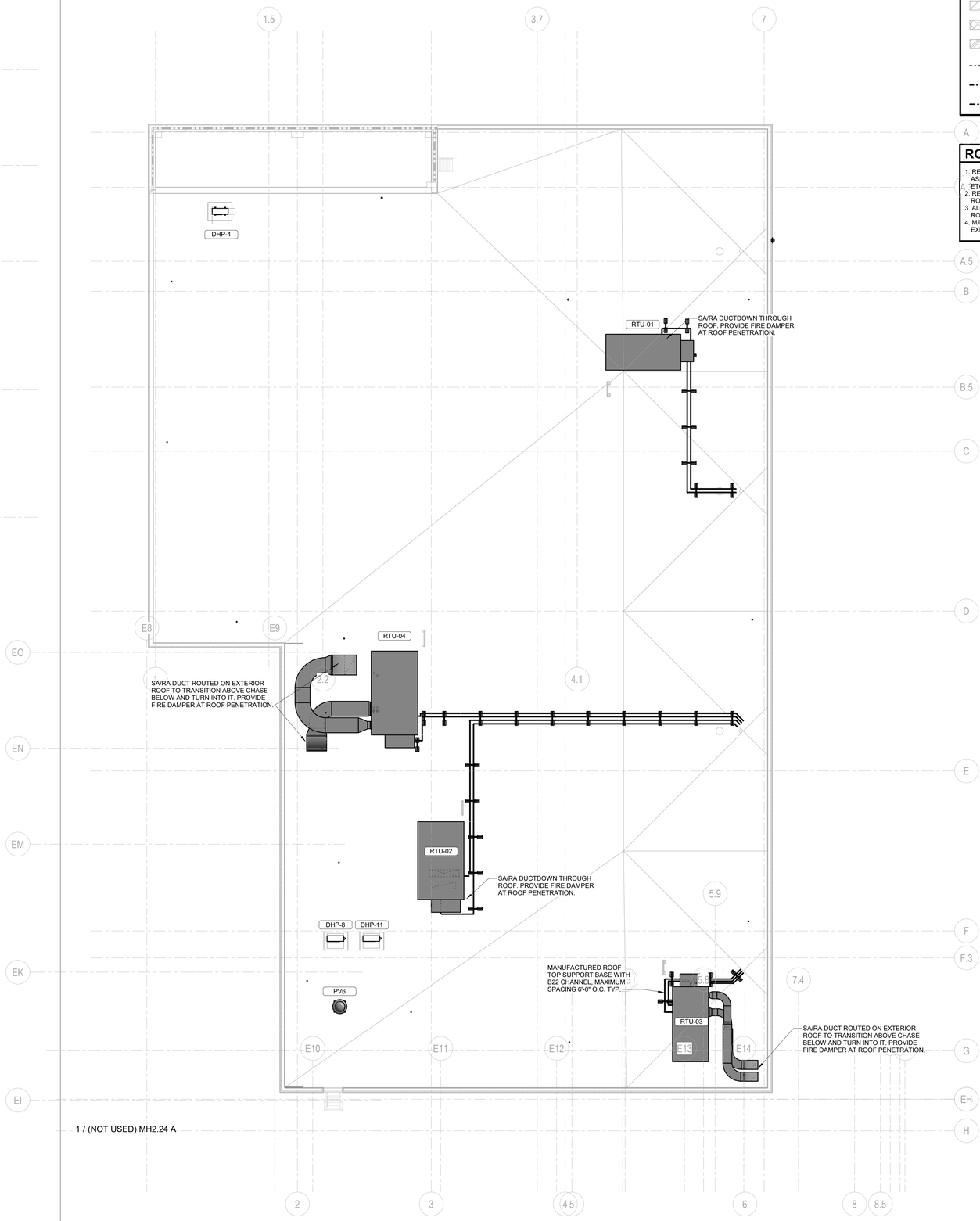


SCALE : 1/8" = 1'-0"

ROOF PLAN - TOUCH & SHARK TANK - HVAC

SCALE : 1/8" = 1'-0"

2



1 / (NOT USED) MH2.24 A

SCALE : 1/8" = 1'-0"

ROOF PLAN - SHARK TANK - HVAC

SCALE : 1/8" = 1'-0"

1

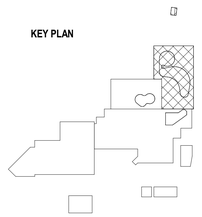
FLOOR PLAN LEGEND

- EXISTING BUILDING
- RENOVATED AREA
- UPFIT BY OTHERS
- 1-HR RATED WALL
- 2-HR RATED WALL
- 3-HR RATED WALL

ROOF PLAN SHEET NOTES

1. REFER TO ARCHITECTURAL DRAWINGS FOR RATED ASSEMBLY UL NUMBERS (WALLS, FLOOR / CEILINGS, ETC..
2. REFER TO STRUCTURAL DRAWINGS FOR EQUIPMENT ROOF MOUNTING CONDITIONS.
3. ALL ROOF PENETRATIONS SHALL CONFORM TO ROOF MANUFACTURER'S APPROVED METHODS.
4. MAINTAIN MINIMUM 10 FOOT SEPARATION BETWEEN EXHAUST AND ANY OUTSIDE AIR INTAKES.

KEY PLAN



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SZOSTAK DESIGN

FORT FISHER AQUARIUM RENOVATION & EXPANSION: PHASE 1

SCO #17-18042-02A
CODE: 42014-4G02
ITEM: 41414-4Y4A

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SEAL 23561 ENGINEER DAVID M. HAHN

NOT FOR CONSTRUCTION

NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

ROOF PLANS - TOUCH & SHARK TANK - HVAC

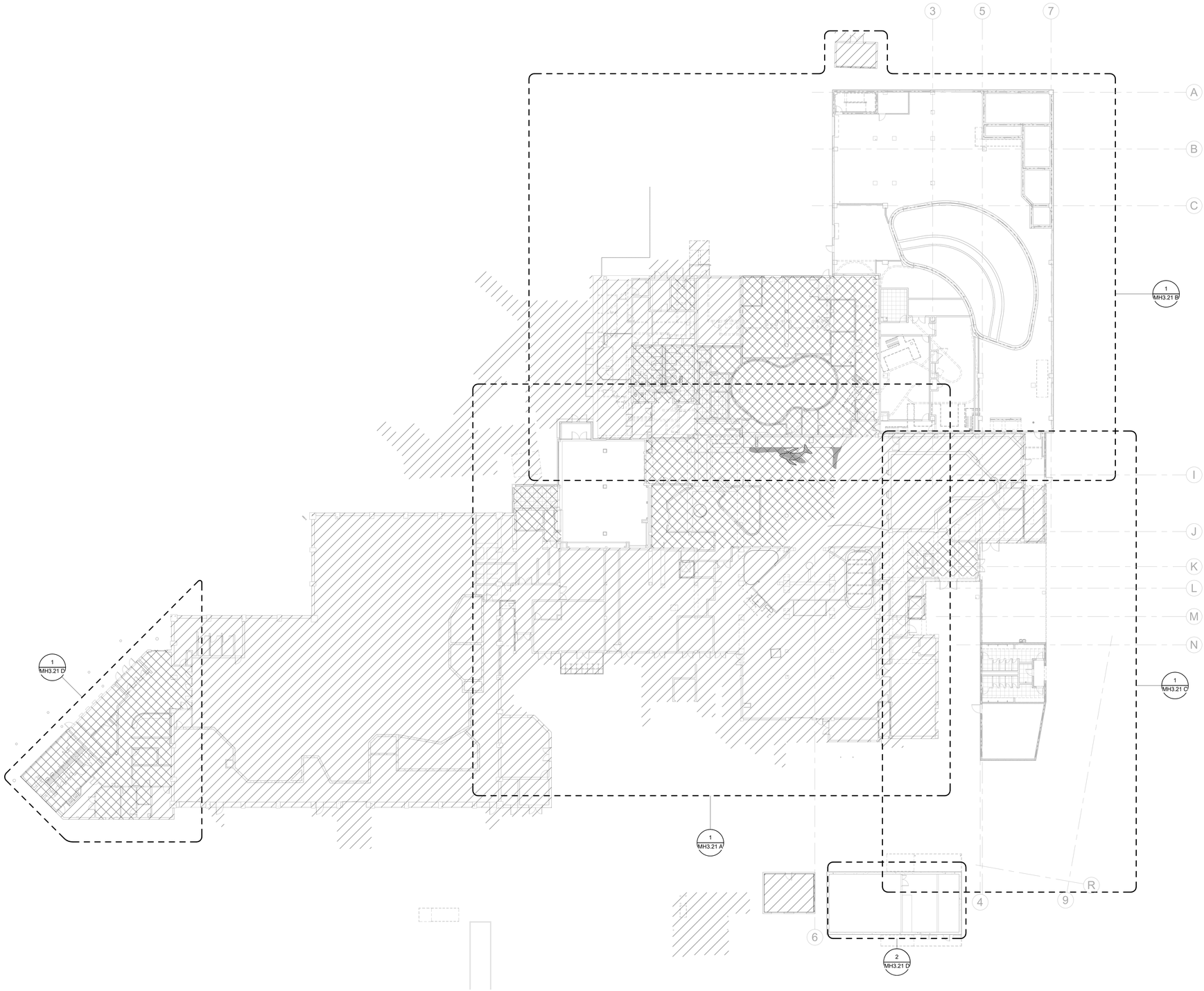
MH2.24 B

PHASING REQUIREMENTS

REFER TO ARCHITECTURAL DRAWING SET FOR CONSTRUCTION PHASING REQUIREMENTS. COORDINATE WORK CLOSELY WITH GENERAL CONTRACTOR AND ALL OTHER TRADES.

FLOOR PLAN LEGEND

- EXISTING BUILDING
- RENOVATED AREA
- UPFIT BY OTHERS
- 1-HR RATED WALL
- 2-HR RATED WALL
- 3-HR RATED WALL



20' 10' 20'

SCALE : 1" = 20'-0"

OVERALL 1ST FLOOR RCP - HVAC

SCALE : 1" = 20'-0"

1

SZOSTAK DESIGN

FORT FISHER AQUARIUM RENOVATION & EXPANSION: PHASE 1

SCO #17-18042-02A
CODE: 42014-4G02
ITEM: 41414-4Y4A

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NORTH CAROLINA ENGINEER SEAL 23551 DAVID M. HAHN

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NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

FIRST FLOOR - RCP - HVAC

MH3.11

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PHASING REQUIREMENTS

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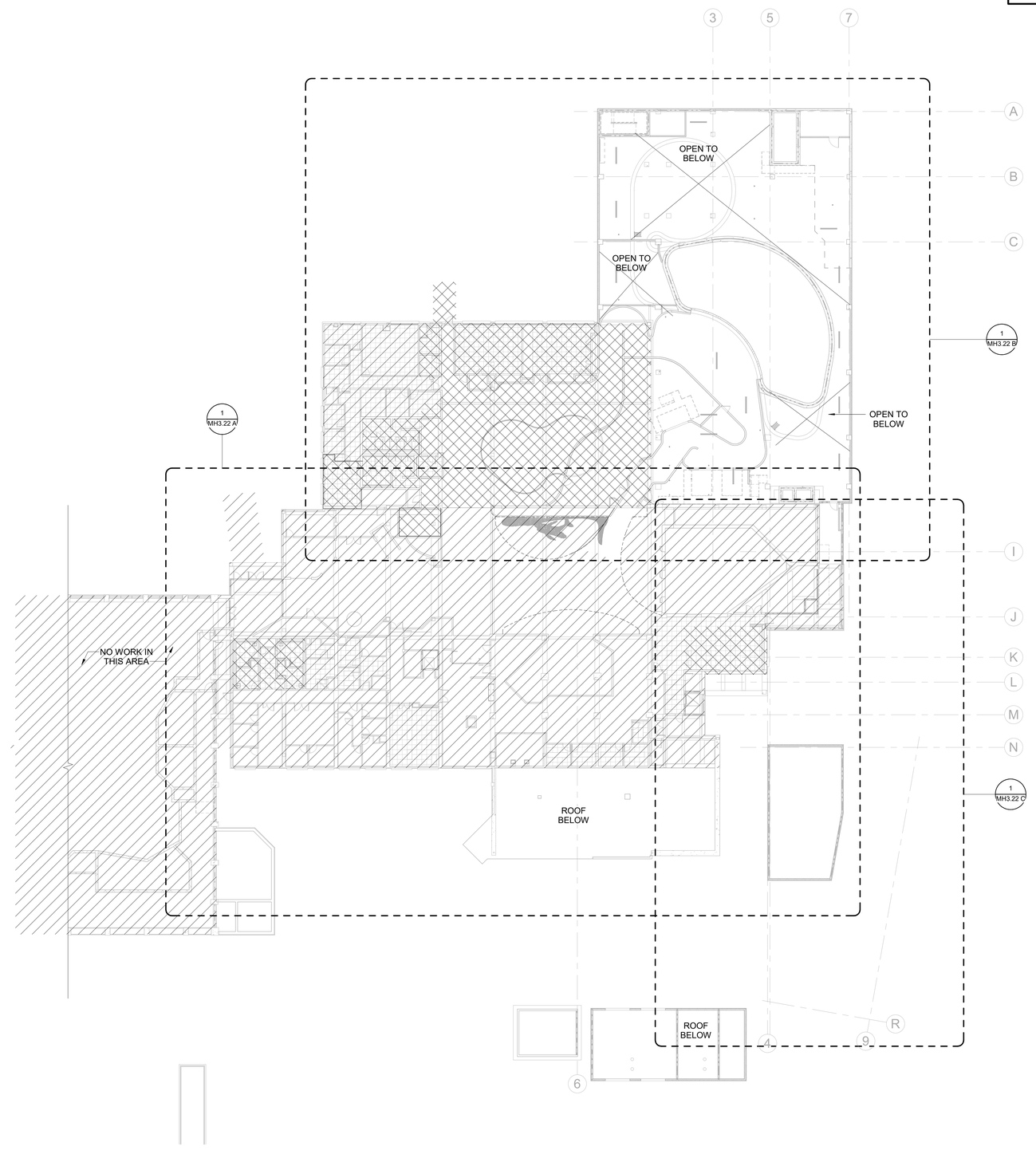
FLOOR PLAN LEGEND

- EXISTING BUILDING
- RENOVATED AREA
- UPFIT BY OTHERS
- 1-HR RATED WALL
- 2-HR RATED WALL
- 3-HR RATED WALL



20' 10' 20'

SCALE : 1" = 20'-0"

OVERALL 2ND FLOOR RCP - HVAC

SCALE : 1" = 20'-0"

1

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NORTH CAROLINA SEAL 23551 ENGINEER DAVID M. HAHN

NOT FOR CONSTRUCTION

NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

SECOND FLOOR - RCP - HVAC

MH3.12

PHASING REQUIREMENTS

REFER TO ARCHITECTURAL DRAWING SET FOR CONSTRUCTION PHASING REQUIREMENTS. COORDINATE WORK CLOSELY WITH GENERAL CONTRACTOR AND ALL OTHER TRADES.

FLOOR PLAN LEGEND

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- UPFIT BY OTHERS
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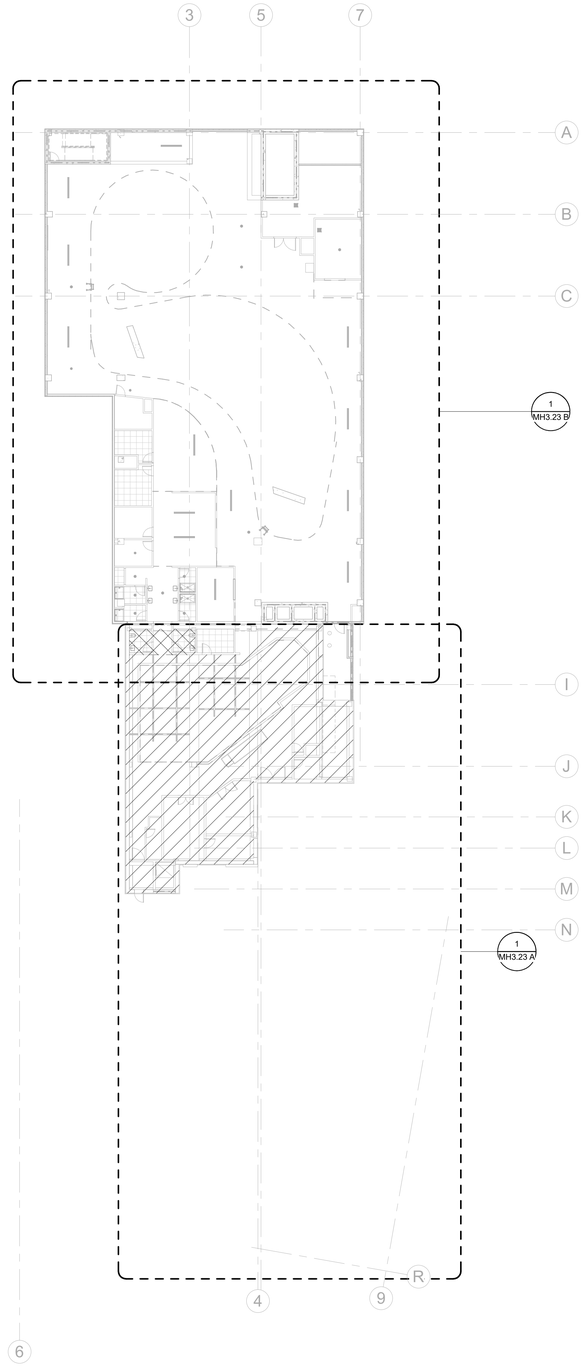
- 3-HR RATED WALL



20' 10' 20'

SCALE : 1" = 20'-0"

OVERALL 3RD FLOOR - RCP - HVAC

SCALE : 1" = 20'-0"

1

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NORTH CAROLINA REGISTERED PROFESSIONAL ENGINEER SEAL 23551 DAVID M. HAHN

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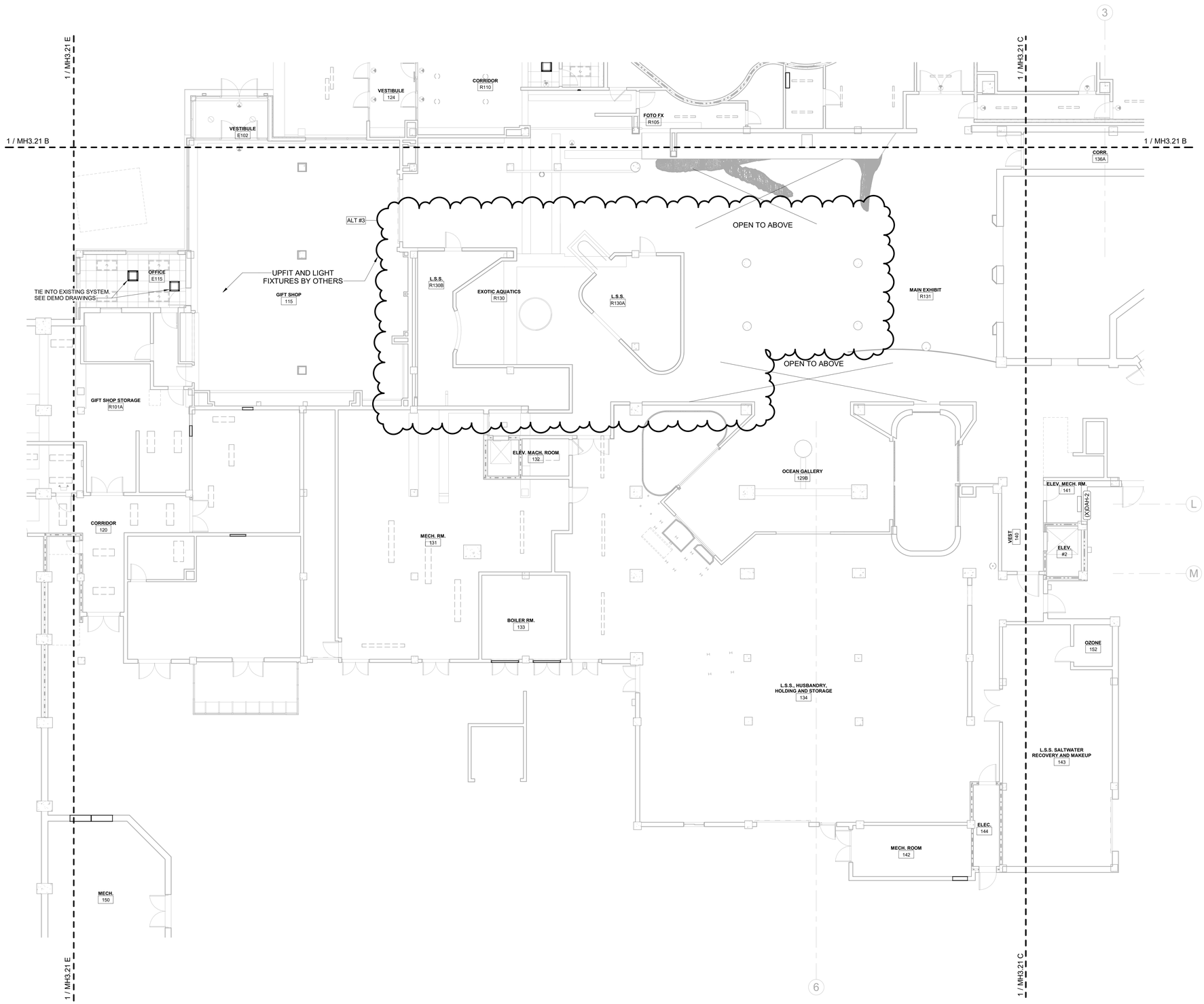
NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

THIRD FLOOR - RCP - HVAC

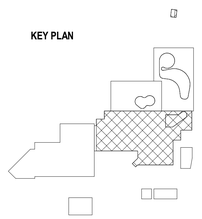
MH3.13



RCP LEGEND

ACT 2	2' x 2' ACOUSTIC CEILING TILES
EXP	EXPOSED STRUCTURE
ASI	ACOUSTIC SPRAY INSULATION
GWB	GYPSUM BOARD
EIFS	EIFS SOFFIT
	EXISTING CEILING, NO CHANGES
	UPFIT BY OTHERS

KEY PLAN



8' 4' 0' 8'

SCALE : 1/8" = 1'-0"

1ST FLOOR RCP - CAPE FEAR SHOALS - HVAC

SCALE : 1/8" = 1'-0"

1

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SZOSTAK DESIGN

FORT FISHER AQUARIUM RENOVATION & EXPANSION: PHASE 1

SCO #17-18042-02A
CODE: 42014-4G02
ITEM: 41414-4Y4A

900 LOGGERHEAD RD,
KURE BEACH, NC 28449

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SEAL 23551 — DAVID M. HAHN — ENGINEER

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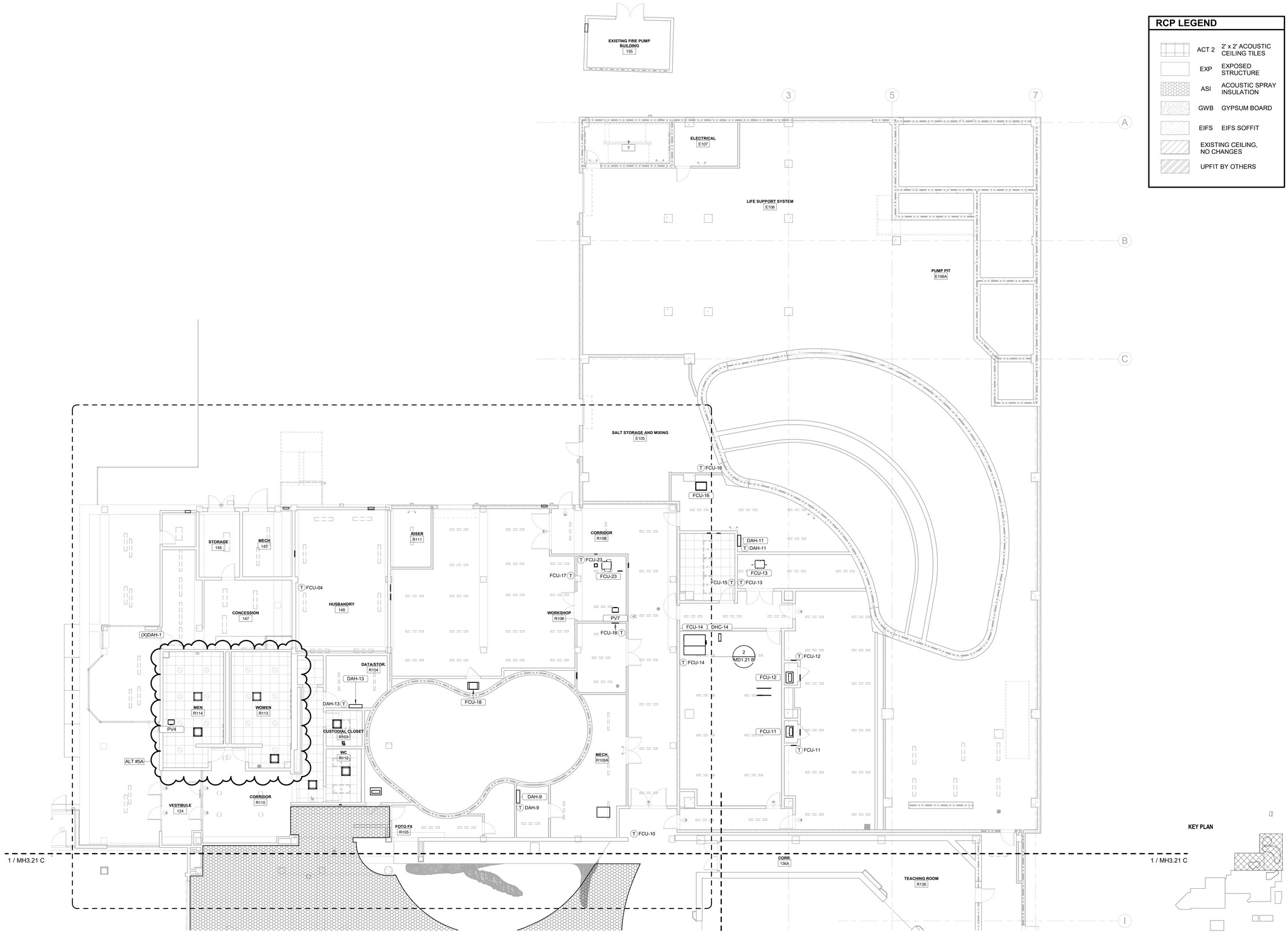
NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

FIRST FLOOR - RCP - CAPE FEAR SHOALS - HVAC

MH3.21 A



RCP LEGEND

ACT 2	2' x 2' ACOUSTIC CEILING TILES
EXP	EXPOSED STRUCTURE
ASI	ACOUSTIC SPRAY INSULATION
GWB	GYPSUM BOARD
EIFS	EIFS SOFFIT
	EXISTING CEILING, NO CHANGES
	UPFIT BY OTHERS

KEY PLAN

8' 4' 0' 8'

SCALE : 1/8" = 1'-0"

1ST FLOOR RCP - TOUCH AND SHARK TANK - HVAC

SCALE : 1/8" = 1'-0"

1

SZOSTAK DESIGN

FORT FISHER AQUARIUM RENOVATION & EXPANSION: PHASE 1

SCO #17-18042-02A
CODE: 42014-4G02
ITEM: 41414-4Y4A

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NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

FIRST FLOOR -RCP- TOUCH & SHARK TANK - HVAC

MH3.21 B

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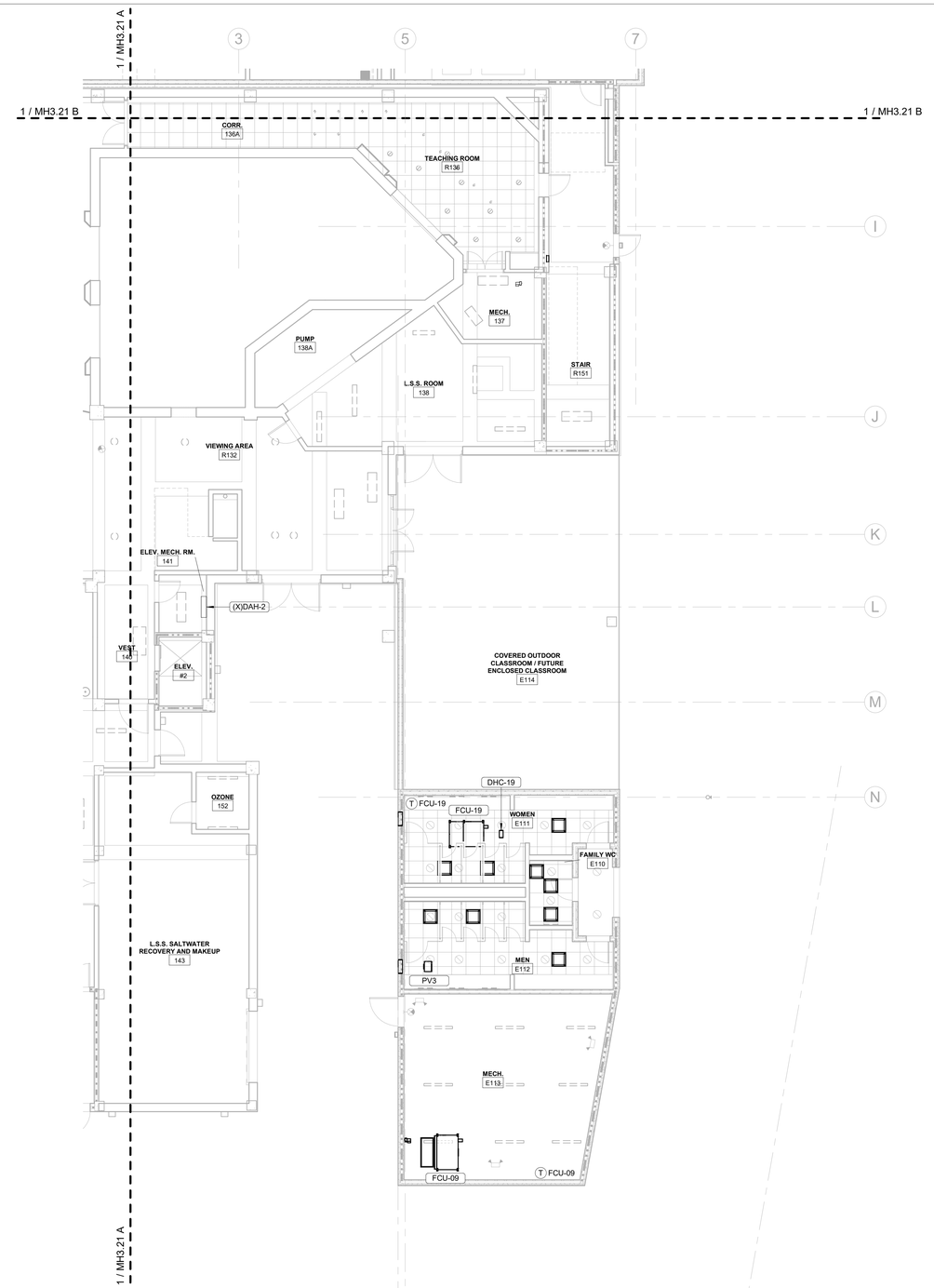
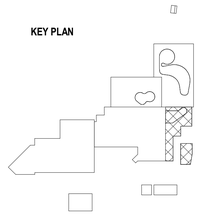


RCP LEGEND

ACT 2	2' x 2' ACOUSTIC CEILING TILES
EXP	EXPOSED STRUCTURE
ASI	ACOUSTIC SPRAY INSULATION
GWB	GYPSUM BOARD
EIFS	EIFS SOFFIT
	EXISTING CEILING, NO CHANGES
	UPFIT BY OTHERS

KEY PLAN



8' 4' 0' 8'

SCALE : 1/8" = 1'-0"

1ST FLOOR RCP - SOUTHEAST WING - HVAC

SCALE : 1/8" = 1'-0"

1

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SZOSTAK DESIGN

FORT FISHER AQUARIUM RENOVATION & EXPANSION: PHASE 1

SCO #17-18042-02A
CODE: 42014-4G02
ITEM: 41414-4Y4A

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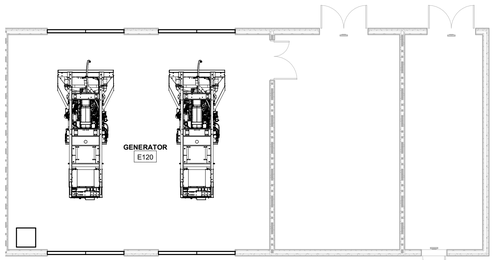
NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

FIRST FLOOR -RCP- SOUTHEAST WING - HVAC

MH3.21 C



8' 4' 0' 8'

SCALE : 1/8" = 1'-0"

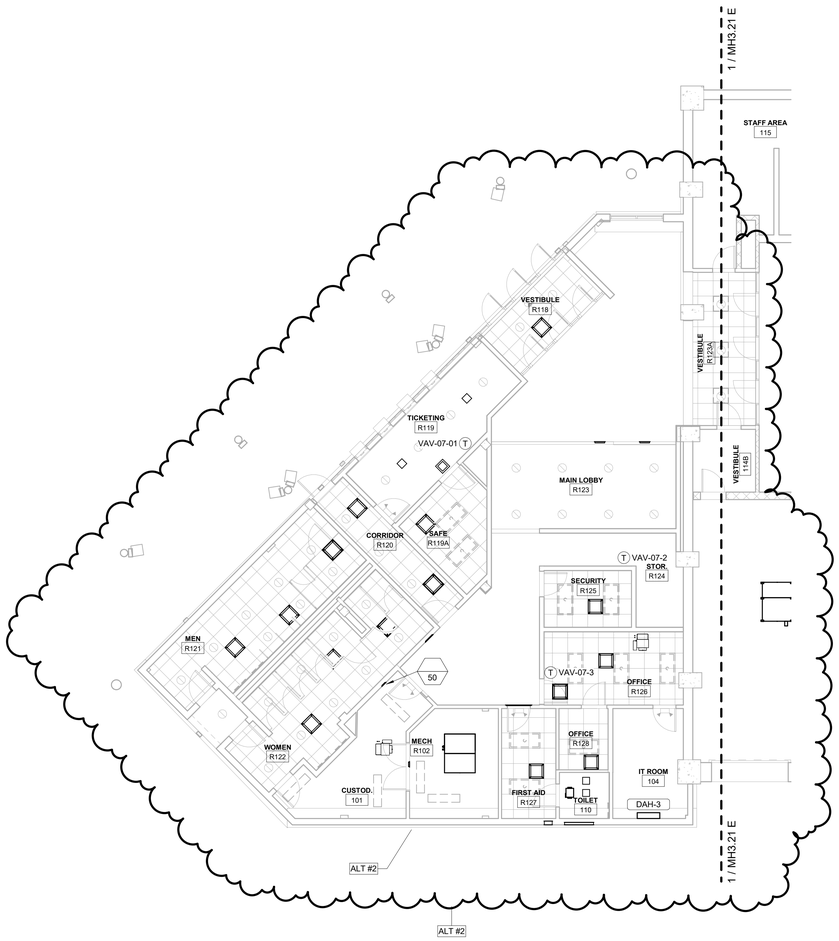
1ST FLOOR RCP - MECHANICAL BUILDING - HVAC

SCALE : 1/8" = 1'-0"

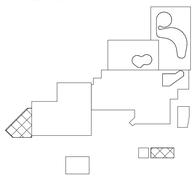
2

RCP LEGEND

	ACT 2	2' x 2' ACOUSTIC CEILING TILES
	EXP	EXPOSED STRUCTURE
	ASI	ACOUSTIC SPRAY INSULATION
	GWB	GYPSUM BOARD
	EIFS	EIFS SOFFIT
		EXISTING CEILING, NO CHANGES
		UPFIT BY OTHERS



KEY PLAN



8' 4' 0' 8'

SCALE : 1/8" = 1'-0"

1ST FLOOR RCP - MAIN ENTRY - HVAC

SCALE : 1/8" = 1'-0"

1

SZOSTAK DESIGN

FORT FISHER AQUARIUM RENOVATION & EXPANSION: PHASE 1

SCO #17-18042-02A
CODE: 42014-4G02
ITEM: 41414-4Y4A

900 LOGGERHEAD RD,
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SEAL 23551 — DAVID M. HAHN — ENGINEER — NORTH CAROLINA

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NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

FIRST FLOOR -RCP- MAIN ENTRY & MECH BLDNG - HVAC

MH3.21 D

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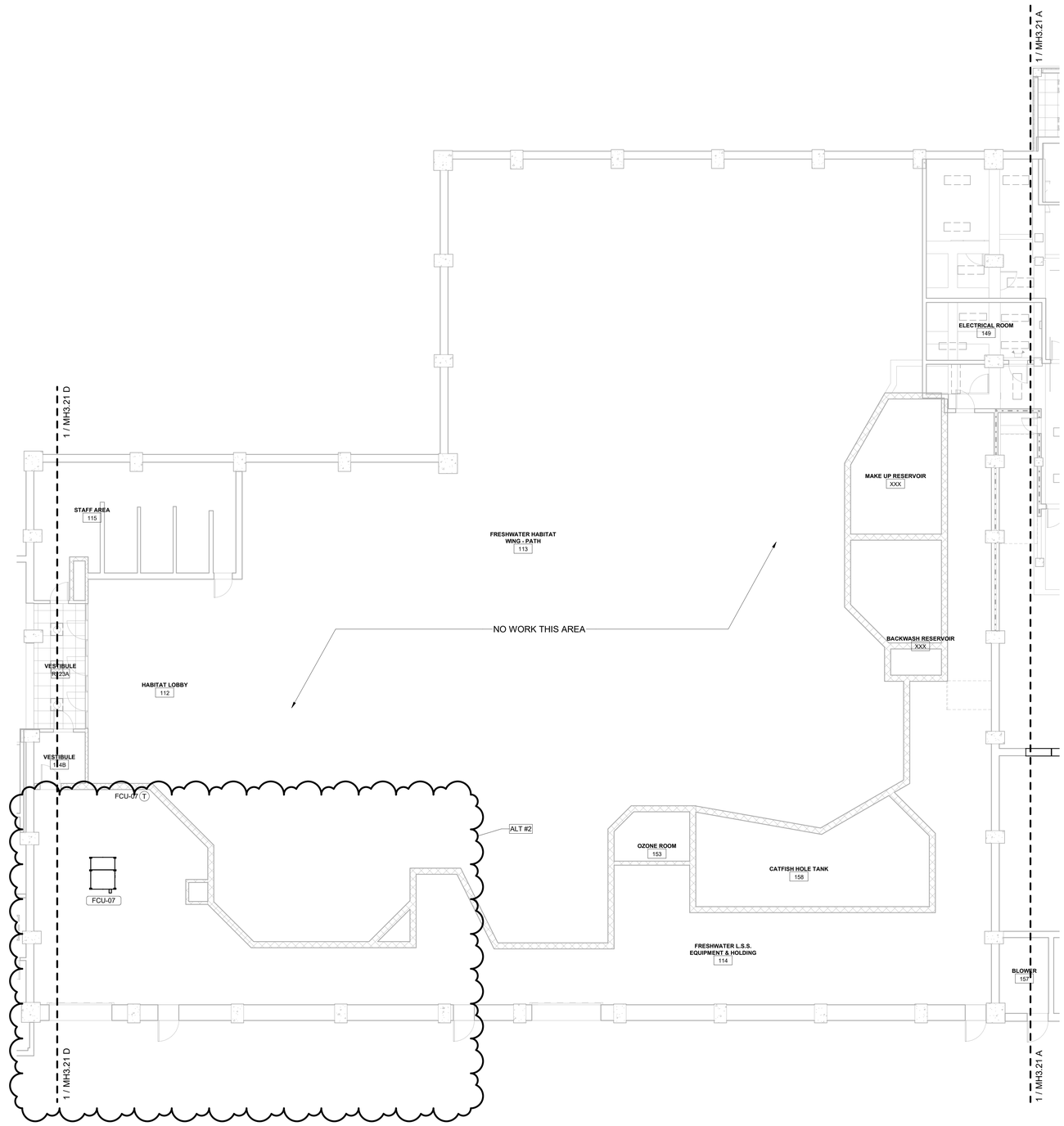

RCP LEGEND

ACT 2	2' x 2' ACOUSTIC CEILING TILES
EXP	EXPOSED STRUCTURE
ASI	ACOUSTIC SPRAY INSULATION
GWB	GYPSUM BOARD
EIFS	EIFS SOFFIT
	EXISTING CEILING, NO CHANGES
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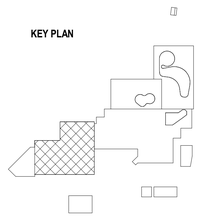
KEY PLAN



SCALE : 1/8" = 1'-0"

1ST FLOOR RCP - FRESHWATER HABITAT - HVAC

SCALE : 1/8" = 1'-0"

1

SZOSTAK DESIGN

FORT FISHER AQUARIUM RENOVATION & EXPANSION: PHASE 1

SCO #17-18042-02A
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FIRST FLOOR -RCP- FRESHWATER HABITAT - HVAC

MH3.21 E

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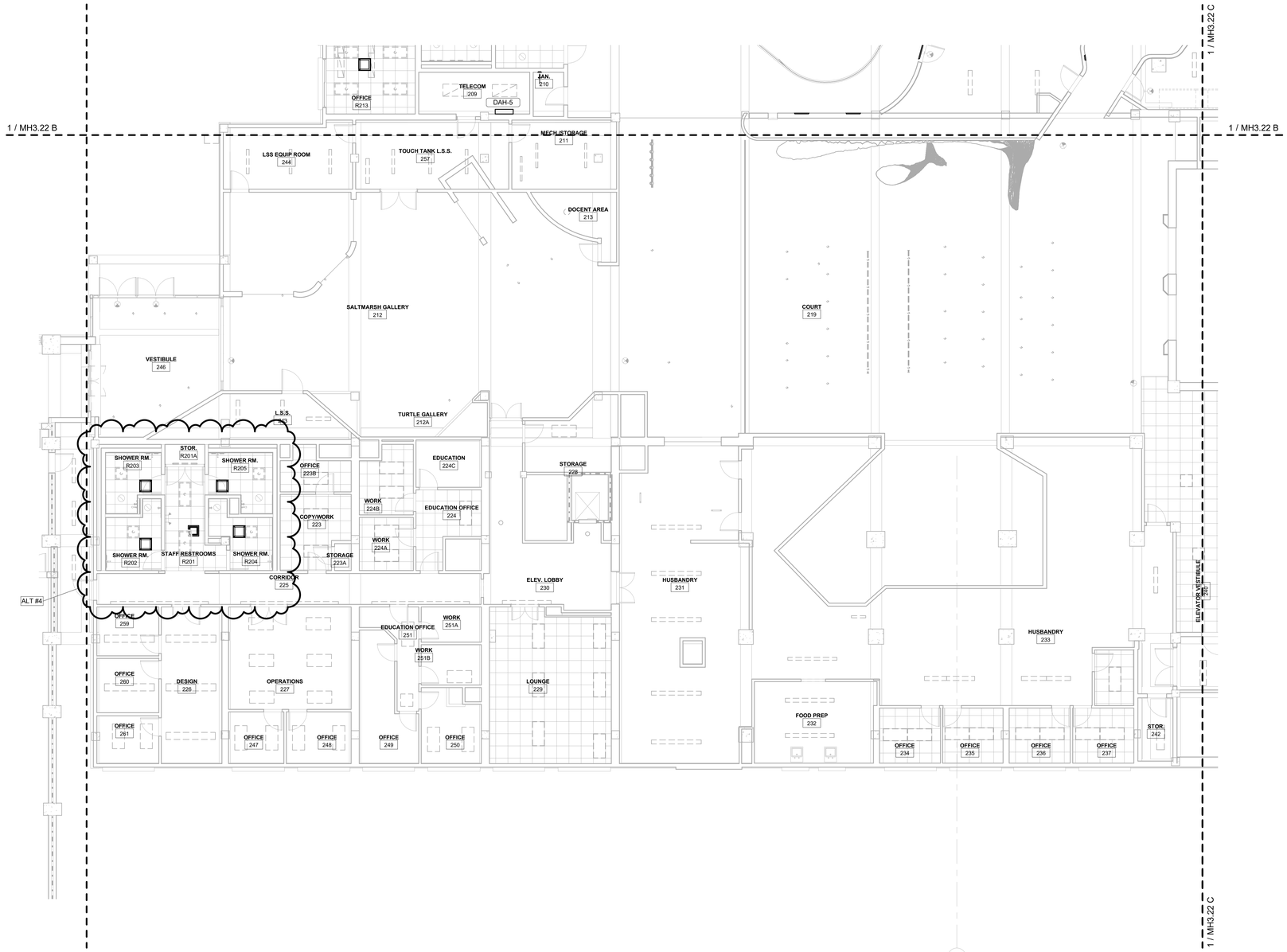
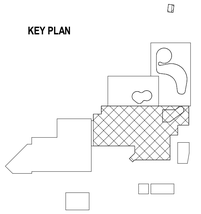


6

RCP LEGEND

ACT 2	2' x 2' ACOUSTIC CEILING TILES
EXP	EXPOSED STRUCTURE
ASI	ACOUSTIC SPRAY INSULATION
GWB	GYPSUM BOARD
EIFS	EIFS SOFFIT
	EXISTING CEILING, NO CHANGES
	UPFIT BY OTHERS



8' 4' 0' 8'

SCALE : 1/8" = 1'-0"

2ND FLOOR RCP - CAPE FEAR SHOALS HVAC

SCALE : 1/8" = 1'-0"

1

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FORT FISHER AQUARIUM RENOVATION & EXPANSION: PHASE 1

SCO #17-18042-02A
CODE: 42014-4G02
ITEM: 41414-4Y4A

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REGISTERED SEAL 23551 ENGINEER DAVID M. HAHN

NOT FOR CONSTRUCTION

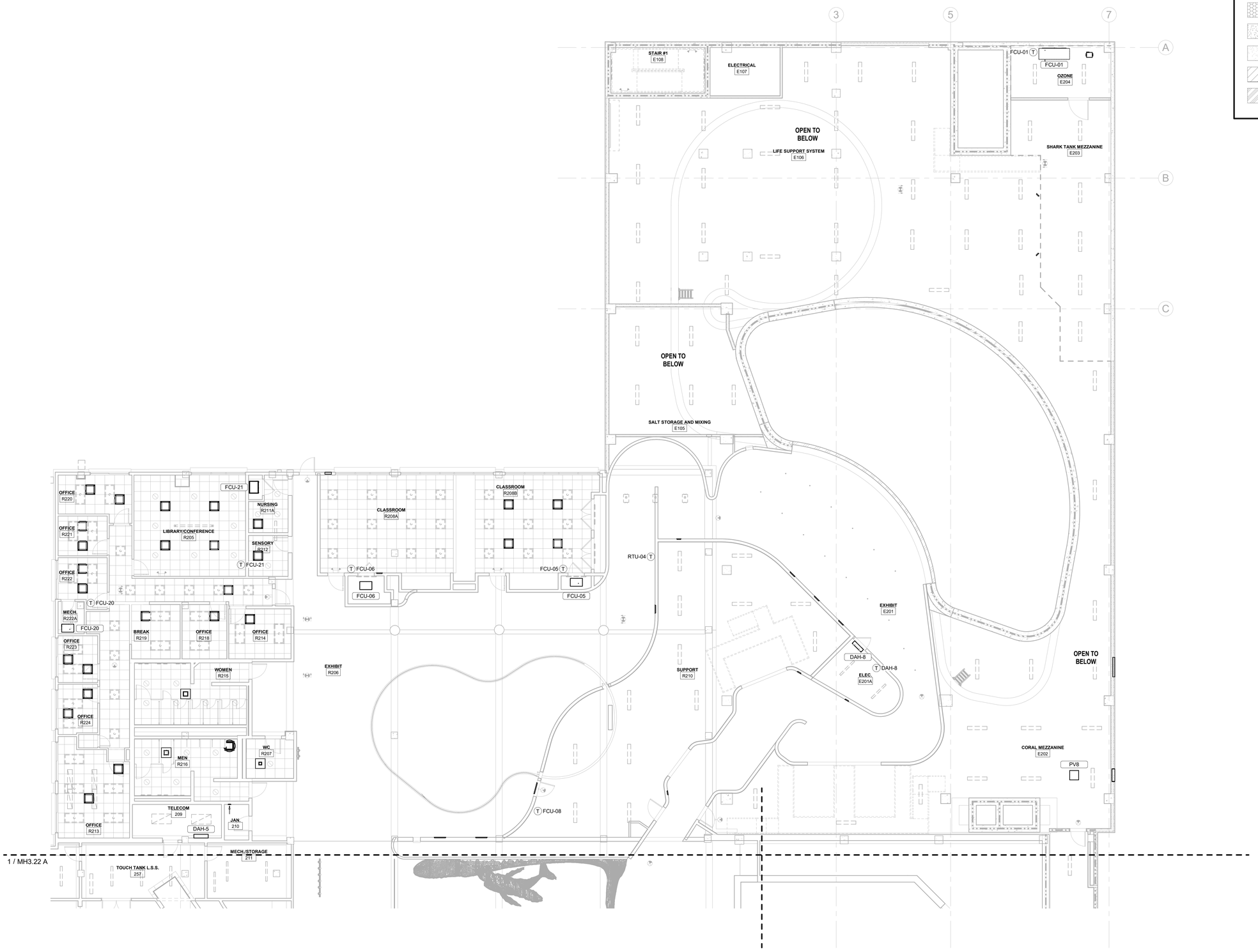
NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

SECOND FLOOR - RCP - CAPE FEAR SHOALS - HVAC

MH3.22 A

RCP LEGEND

ACT 2	2' x 2' ACOUSTIC CEILING TILES
EXP	EXPOSED STRUCTURE
ASI	ACOUSTIC SPRAY INSULATION
GWB	GYPSUM BOARD
EIFS	EIFS SOFFIT
	EXISTING CEILING, NO CHANGES
	UPFIT BY OTHERS



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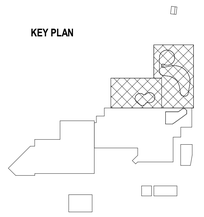

8' 4' 0' 8'

SCALE : 1/8" = 1'-0"

2ND FLOOR RCP - TOUCH AND SHARK TANK - HVAC

SCALE : 1/8" = 1'-0"

1

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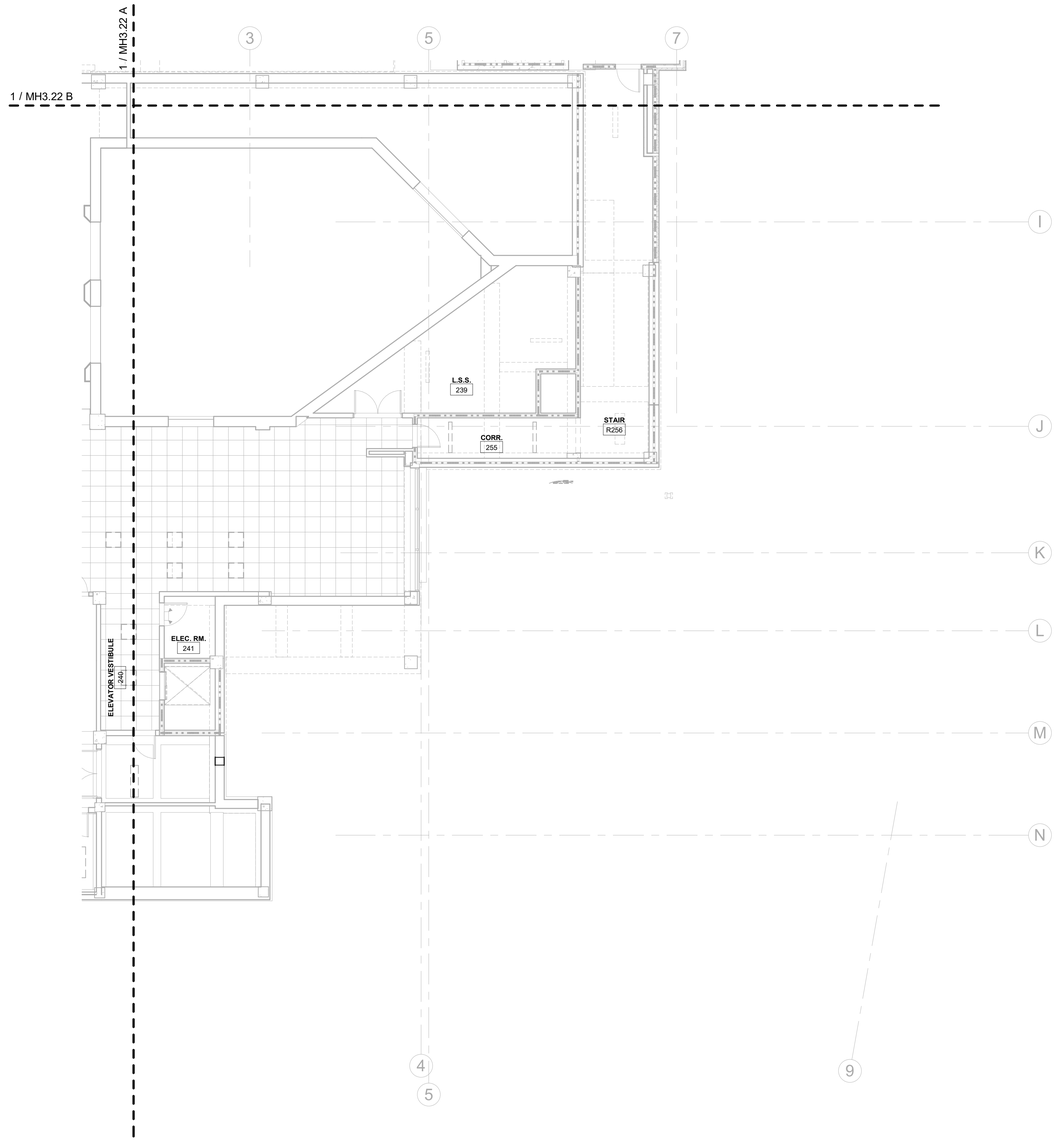
SECOND FLOOR - RCP - TOUCH AND SHARK TANK - HVAC

MH3.22 B



RCP LEGEND

ACT 2	2' x 2' ACOUSTIC CEILING TILES
EXP	EXPOSED STRUCTURE
ASI	ACOUSTIC SPRAY INSULATION
GWB	GYPSUM BOARD
EIFS	EIFS SOFFIT
	EXISTING CEILING, NO CHANGES
	UPFIT BY OTHERS

SZOSTAK DESIGN

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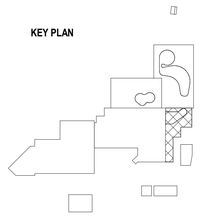
NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

KEY PLAN



SECOND FLOOR - RCP - SOUTHEAST WING - HVAC

MH3.22 C

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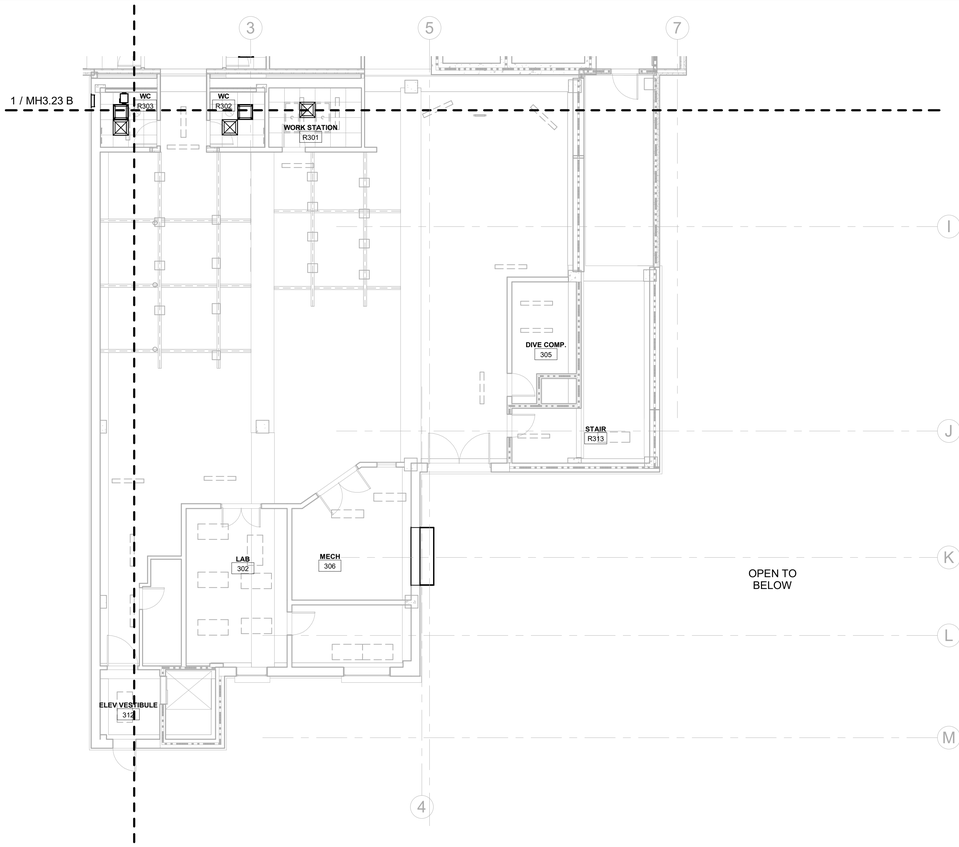
2ND FLOOR RCP - SOUTHEAST WING - HVAC

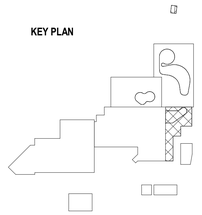
SCALE : 1/8" = 1'-0"



RCP LEGEND

	ACT 2	2' x 2' ACOUSTIC CEILING TILES
	EXP	EXPOSED STRUCTURE
	ASI	ACOUSTIC SPRAY INSULATION
	GWB	GYPSUM BOARD
	EIFS	EIFS SOFFIT
		EXISTING CEILING, NO CHANGES
		UPFIT BY OTHERS

KEY PLAN



8' 4' 0' 8'

SCALE : 1/8" = 1'-0"

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3RD FLOOR RCP - SOUTHEAST WING - HVAC

SCALE : 1/8" = 1'-0"

1

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SCO #17-18042-02A
CODE: 42014-4G02
ITEM: 41414-4Y4A

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SEAL 23551 ENGINEER DAVID M. HAHN

NOT FOR CONSTRUCTION

NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

THIRD FLOOR - RCP - SOUTHEAST WING - HVAC

MH3.23 A

RCP LEGEND

ACT 2	2' x 2' ACOUSTIC CEILING TILES
EXP	EXPOSED STRUCTURE
ASI	ACOUSTIC SPRAY INSULATION
GWB	GYPSUM BOARD
EIFS	EIFS SOFFIT
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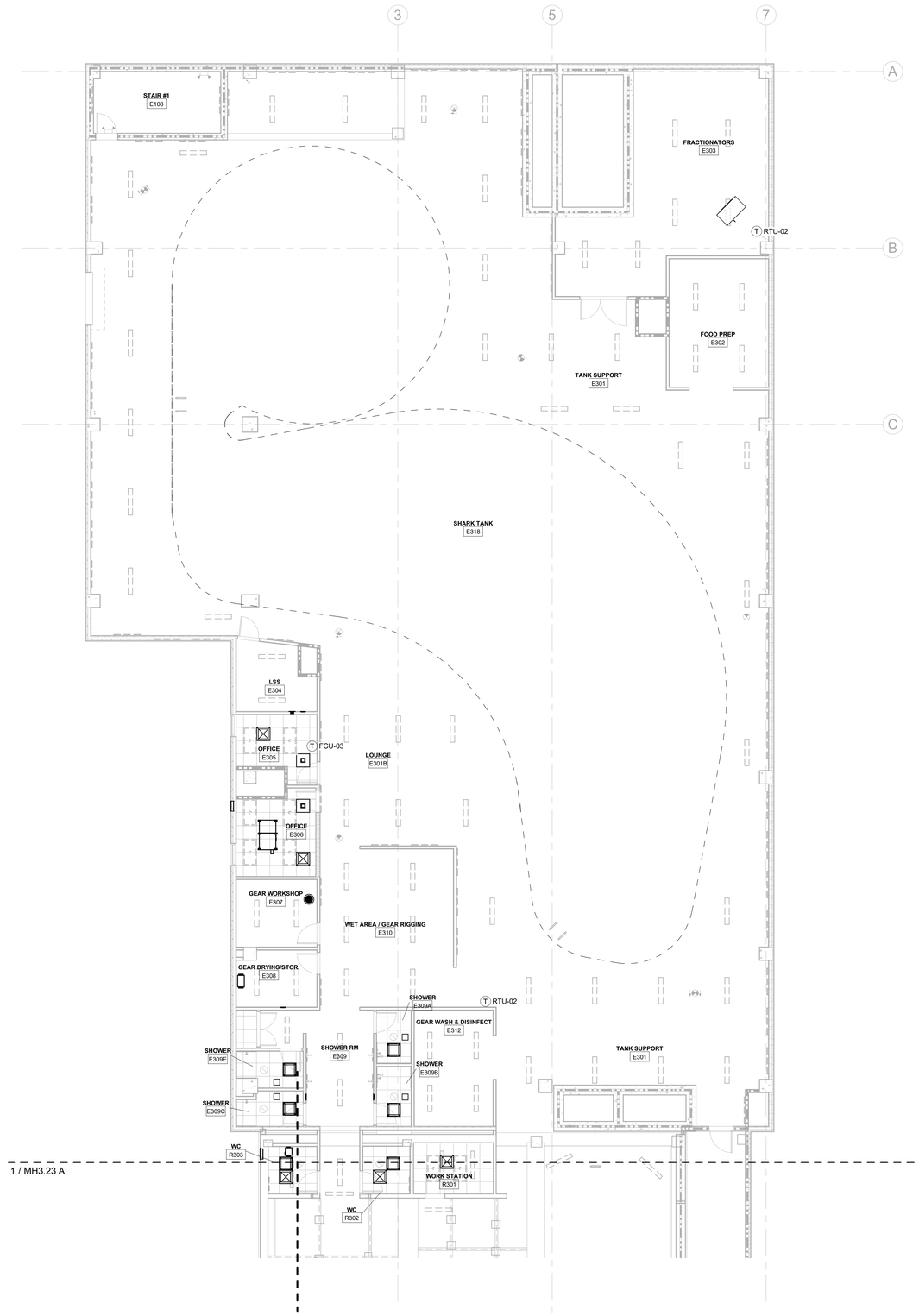
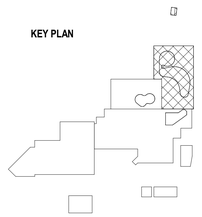


KEY PLAN



8' 4' 0' 8'

SCALE : 1/8" = 1'-0"

3RD FLOOR - RCP - SHARK TANK - HVAC

SCALE : 1/8" = 1'-0"

1

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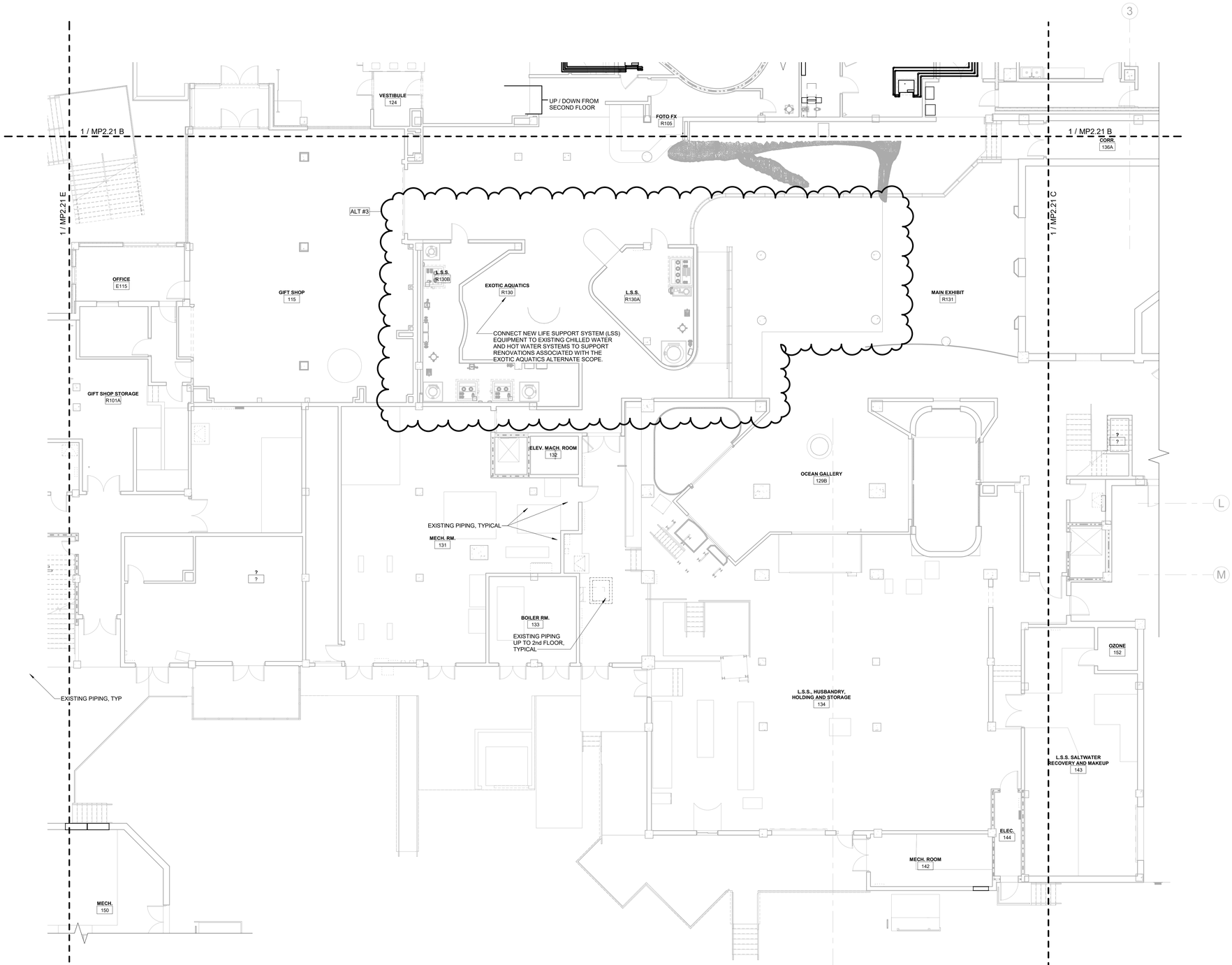
NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

THIRD FLOOR - RCP - SHARK TANK - HVAC

MH3.23 B

FLOOR PLAN LEGEND

- EXISTING BUILDING
- RENOVATED AREA
- UPFIT BY OTHERS
- 1-HR RATED WALL
- 2-HR RATED WALL
- 3-HR RATED WALL



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NO.	DATE	DESCRIPTION
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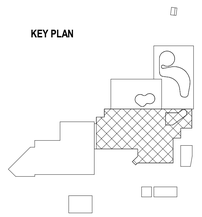
KEY PLAN



FIRST FLOOR PLAN - CAPE FEAR SHOALS - HYDRONICS

MP2.21 A

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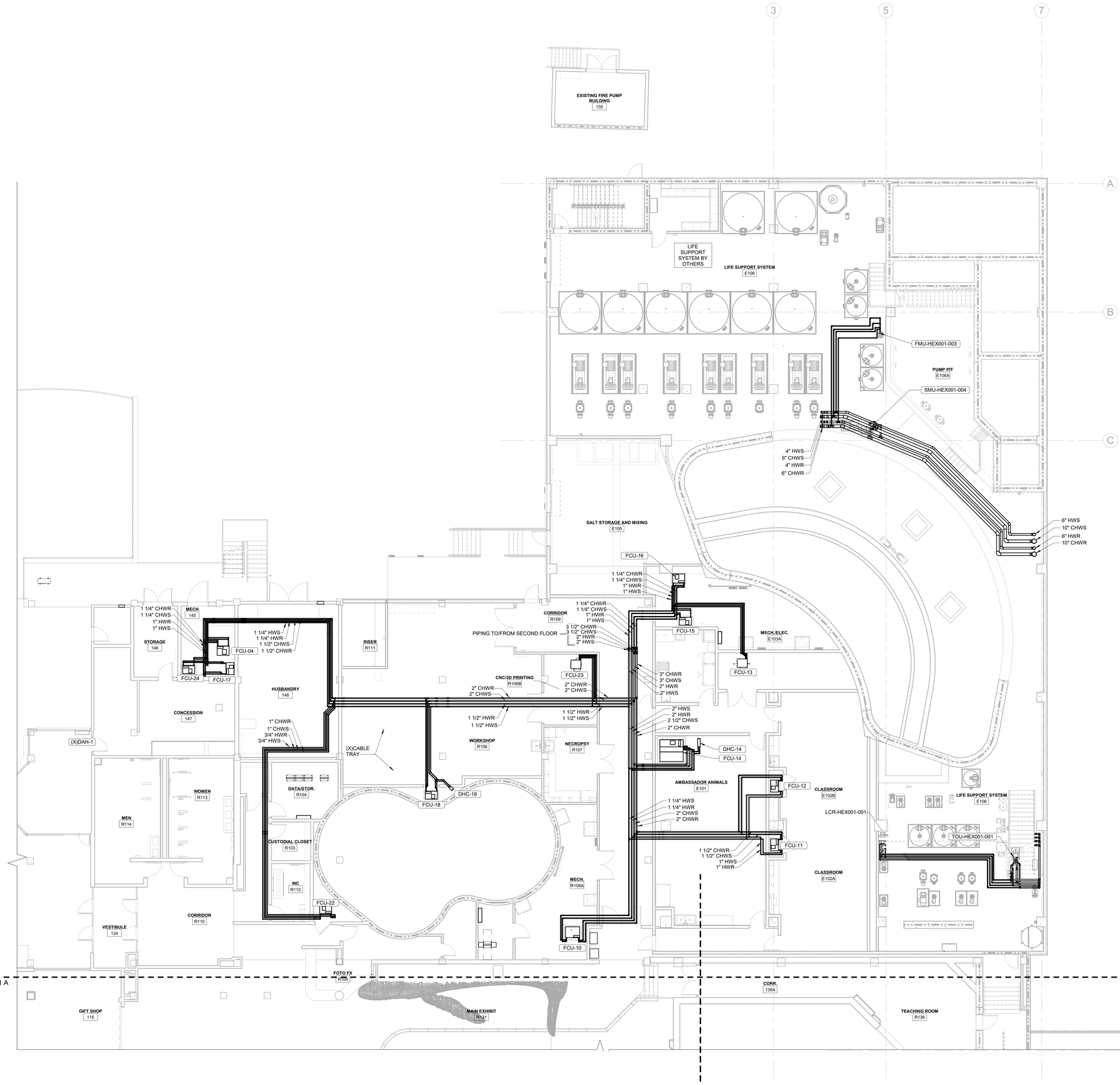
8' 4' 0' 8'
SCALE : 1/8" = 1'-0"

6

1ST FLOOR - CAPE FEAR SHOALS - RAMP - HYDRONICS
SCALE : 1/8" = 1'-0"

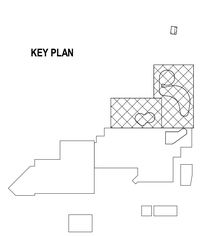
1



FLOOR PLAN LEGEND

- EXISTING BUILDING
- RENOVATED AREA
- UPFIT BY OTHERS
- 1-HR RATED WALL
- 2-HR RATED WALL
- 3-HR RATED WALL

KEY PLAN



8' 4' 0' 8'

SCALE : 1/8" = 1'-0"

1ST FLOOR PLAN - TOUCH & SHARK TANK - HYDRONICS

SCALE : 1/8" = 1'-0"

1

SZOSTAK DESIGN

FORT FISHER AQUARIUM RENOVATION & EXPANSION: PHASE 1

SCO #17-18042-02A
CODE: 42014-4G02
ITEM: 41414-4Y4A

900 LOGGERHEAD RD,
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SEAL 23551 ENGINEER DAVID M. HAHN

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NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

FIRST FLOOR PLAN - TOUCH AND SHARK TANK - HYDRONICS

MP2.21 B

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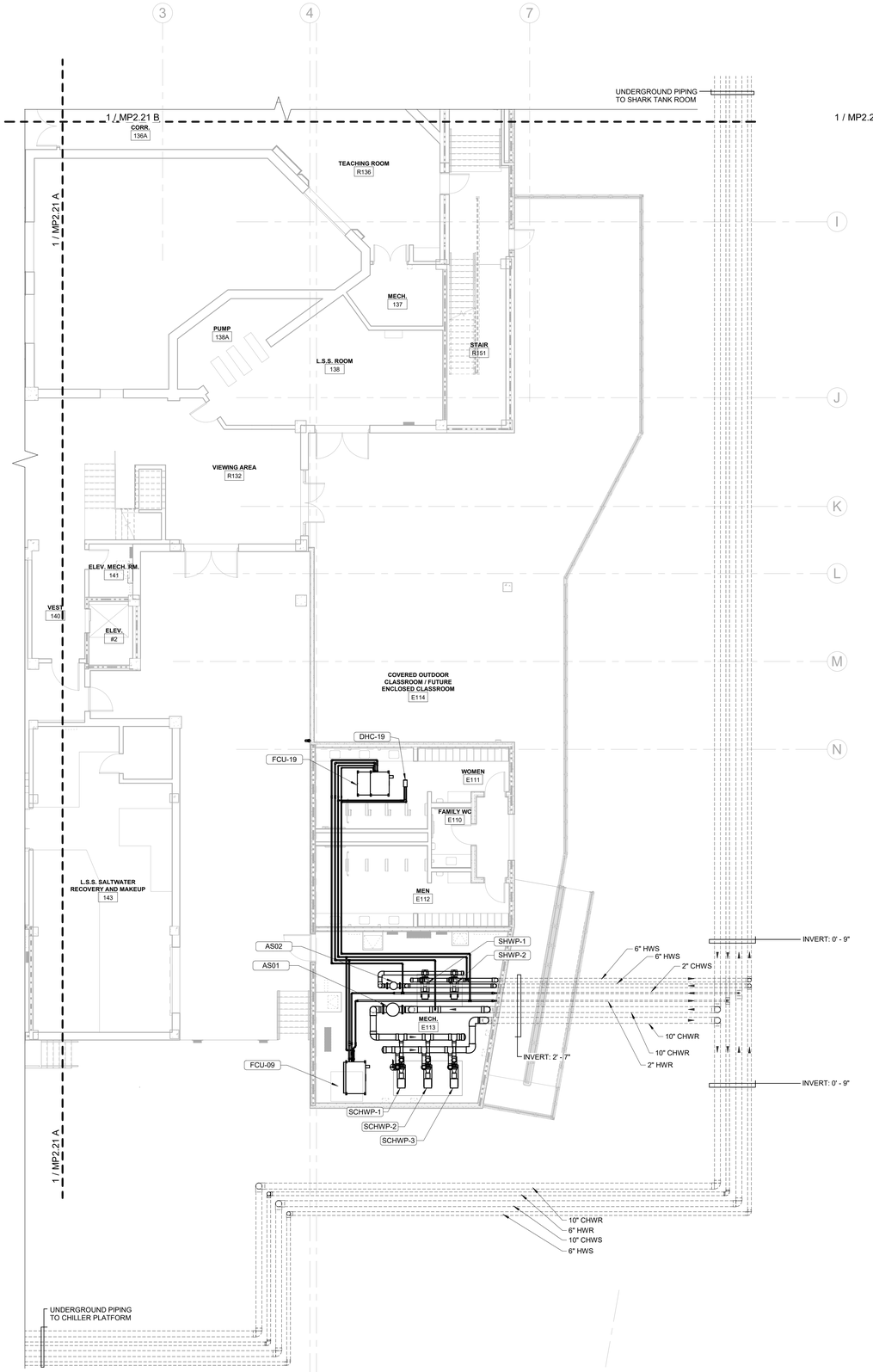

FLOOR PLAN LEGEND

- EXISTING BUILDING
- RENOVATED AREA
- UPFIT BY OTHERS
- 1-HR RATED WALL
- 2-HR RATED WALL
- 3-HR RATED WALL

SZOSTAK DESIGN

FORT FISHER AQUARIUM RENOVATION & EXPANSION: PHASE 1

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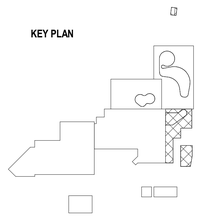

FIRST FLOOR PLAN - SOUTHEAST WING - HYDRONICS

MP2.21 C

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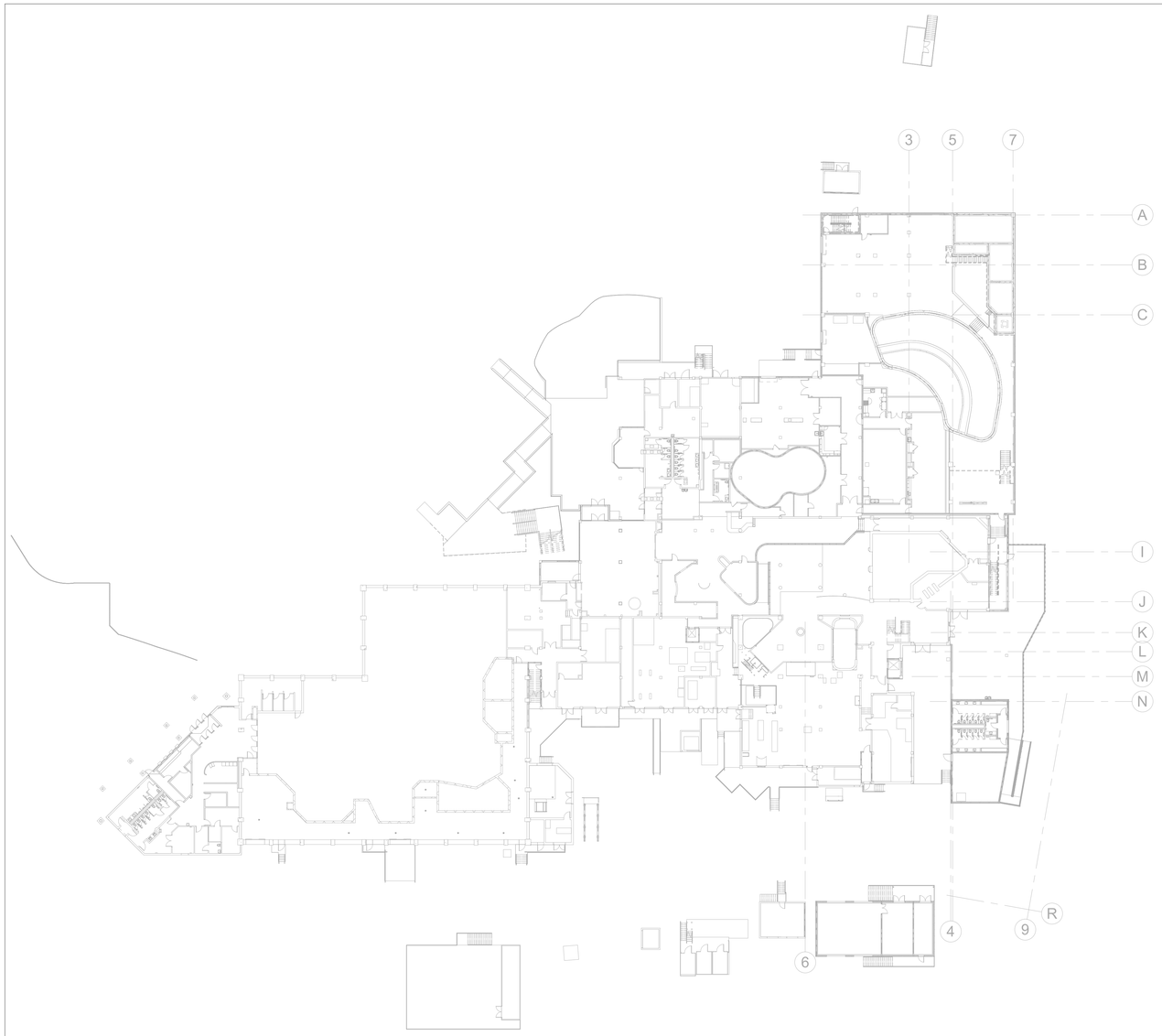
8' 4' 0' 8'
SCALE : 1/8" = 1'-0"

1ST FLOOR PLAN - SOUTHEAST WING - HYDRONICS
SCALE : 1/8" = 1'-0"

1



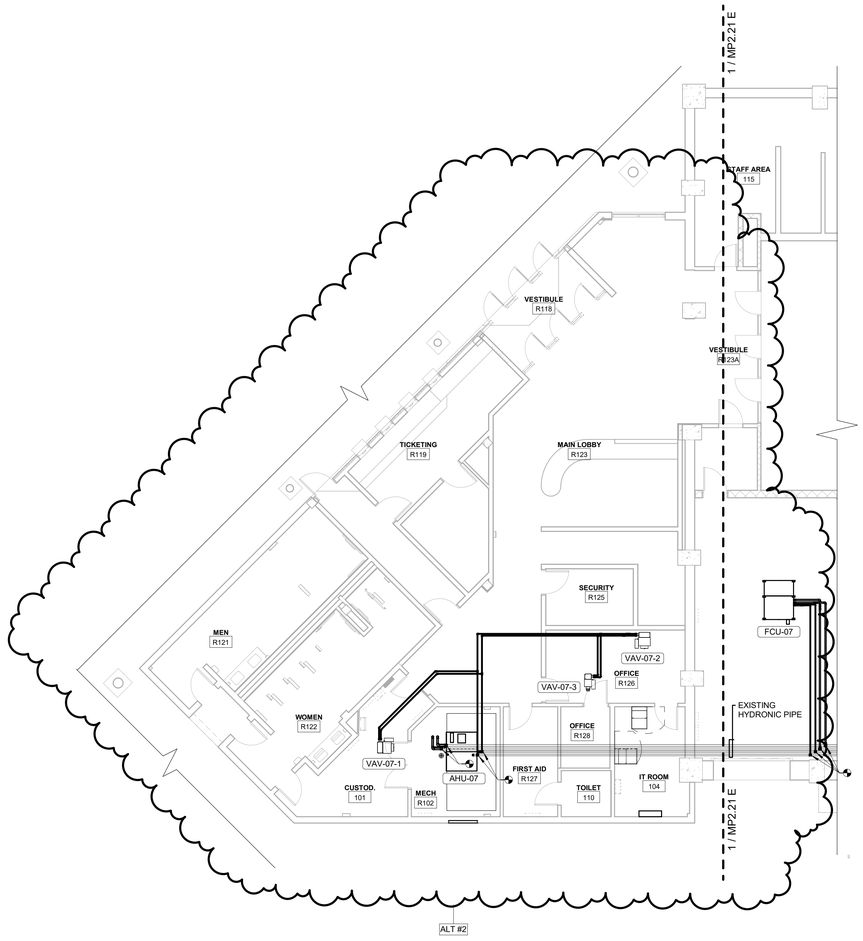
MECHANICAL SITE PLAN

SCALE : 1" = 30'-0"

30' 15' 30'

SCALE : 1" = 30'-0"

3



FUEL OIL SYSTEM GENERAL NARRATIVE – FOR BIDDING PURPOSES

FURNISH AND INSTALL A COMPLETE FUEL OIL STORAGE AND TRANSFER SYSTEM TO SERVE TWO NEW GENERATORS AND AN EXISTING FUEL-OIL-FIRED BOILER. WORK SHALL INCLUDE ALL FUEL OIL PIPING, PUMPS, CONTROLS, TANKS, VALVES, AND ACCESSORIES REQUIRED FOR A FULLY OPERATIONAL SYSTEM. SYSTEM COMPONENTS ARE SPECIFIED ELSEWHERE IN THESE DOCUMENTS; ROUTING AND COORDINATION SHALL BE DETERMINED IN THE FIELD AND COORDINATED WITH OTHER TRADES.

THE SYSTEM SHALL INCLUDE A NEW ABOVEGROUND FUEL OIL STORAGE TANK (AST) INSTALLED AT GRADE AND LOCATED IN A FLOOD ZONE. THE TANK SHALL BE EQUIPPED WITH A SUBMERSIBLE TURBINE PUMP SYSTEM AND TANK MONITORING SYSTEM AS SPECIFIED. PROVIDE FLOOD-RESISTANT INSTALLATION PER LOCAL CODE.

PROVIDE DUPLEX SUBMERSIBLE TURBINE PUMPS WITH LEAD/LAG OPERATION AND AUTOMATIC ROTATION CAPABILITIES. PUMPS SHALL BE CONTROLLED BY A DUPLEX CONTROLLER WITH FLOW SWITCH MONITORING, ALARM REPORTING, AND MODBUS INTEGRATION FOR REMOTE STATUS. CONTROLLER SHALL BE SPCP1.2 OR EQUAL.

FUEL OIL SHALL BE DELIVERED FROM THE AST TO TWO NEW GENERATOR DAY TANKS LOCATED IN A NEW GENERATOR BUILDING. DAY TANKS WILL BE PROVIDED BY DIVISION 26 WITH RETURN PUMPS TO MAINTAIN PROPER LEVELS AND CIRCULATE FUEL TO PREVENT STRATIFICATION OR COOLING. SYSTEM SHALL ALLOW FOR SIMULTANEOUS OPERATION OF BOTH GENERATORS. INCLUDE ALL REQUIRED LEVEL SENSORS, OVERFILL ALARMS, VENTS, AND EMERGENCY SHUTDOWNS.

IN ADDITION, MAINTAIN OPERATION OF AN EXISTING FUEL OIL-FIRED BOILER SERVED BY A SEPARATE EXISTING DAY TANK AND SUPPLY PUMP LOCATED INSIDE THE EXISTING GENERATOR BUILDING. PROVIDE NEW FUEL OIL SUPPLY AND RETURN PIPING BETWEEN THE NEW AST AND THE EXISTING DAY TANK. FIELD-VERIFY CONNECTION DETAILS.

FUEL SYSTEM MONITORING SHALL BE VIA TMS3000 TANK MONITORING SYSTEM OR APPROVED EQUIVALENT. SYSTEM SHALL MONITOR TANK INVENTORY, HIGH/LOW LEVELS, WATER PRESENCE, AND LEAK CONDITIONS. PROVIDE PROBES AND SENSORS FOR PRIMARY AND SECONDARY CONTAINMENT IN COMPLIANCE WITH EPA REQUIREMENTS.

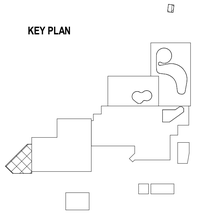
CONTRACTOR SHALL COORDINATE ALL PENETRATIONS THROUGH FLOOD-RATED ENCLOSURES AND ENSURE ALL WORK IS IN COMPLIANCE WITH APPLICABLE CODE REQUIREMENTS FOR FLOOD ZONE INSTALLATION, INCLUDING SUPPORTS, VENTING, AND EQUIPMENT MOUNTING HEIGHTS.

ALL POWER, CONTROL, AND ALARM WIRING SHALL BE PROVIDED UNDER THIS CONTRACT. FINAL WIRING TERMINATIONS SHALL BE COORDINATED WITH THE ELECTRICAL CONTRACTOR.

FLOOR PLAN LEGEND

- EXISTING BUILDING
- RENOVATED AREA
- UPFIT BY OTHERS
- 1-HR RATED WALL
- 2-HR RATED WALL
- 3-HR RATED WALL

KEY PLAN



8' 4' 0' 8'

SCALE : 1/8" = 1'-0"

1ST FLOOR PLAN - MAIN ENTRY - HYDRONICS

SCALE : 1/8" = 1'-0"

1

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FORT FISHER AQUARIUM RENOVATION & EXPANSION: PHASE 1

SCO #17-18042-02A
CODE: 42014-4G02
ITEM: 41414-4Y4A

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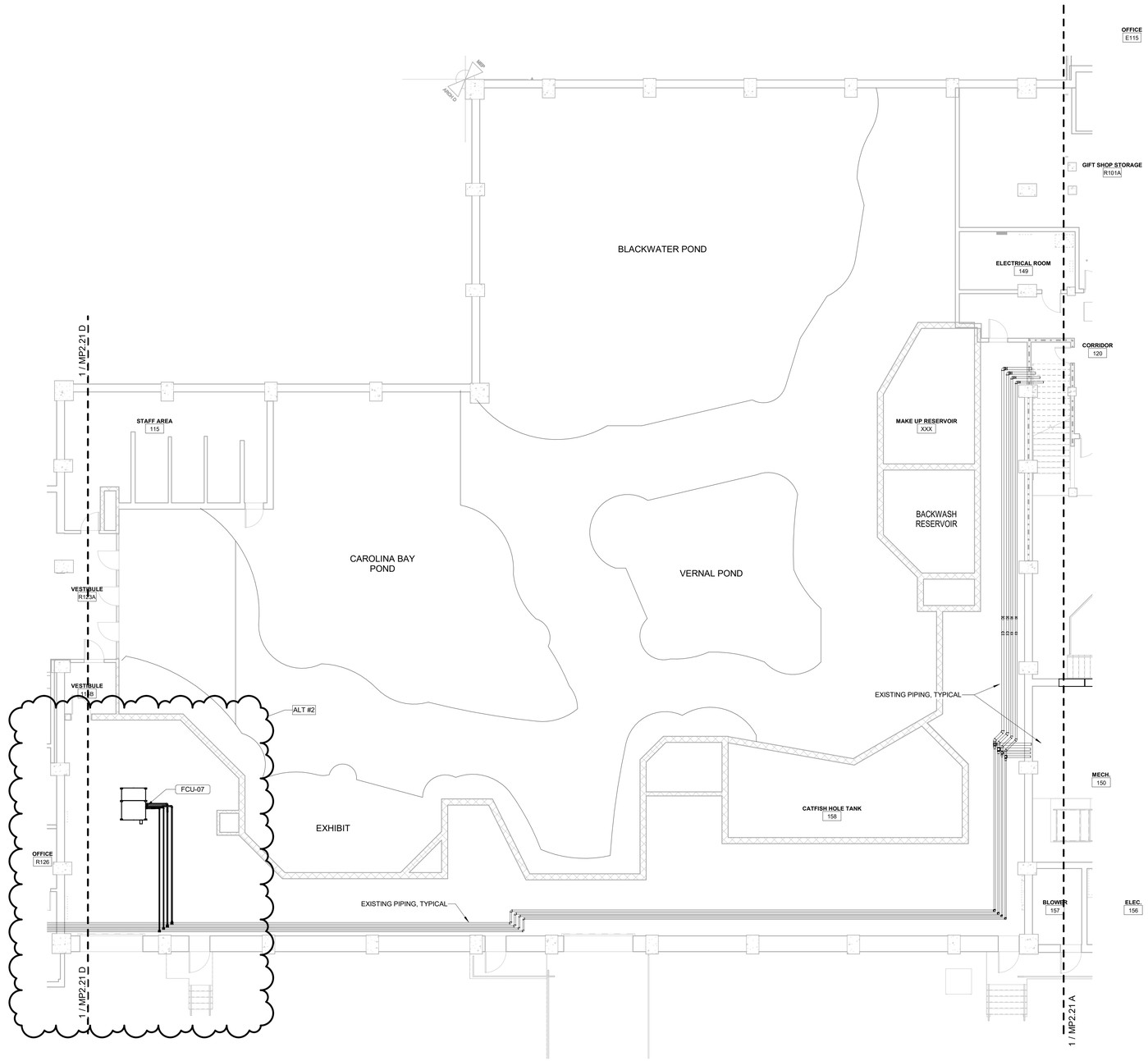
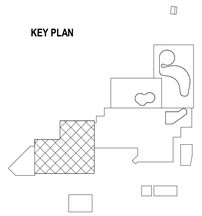
NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

FIRST FLOOR PLAN - MAIN ENTRY, MECH SITE PLAN AND FUEL OIL SYSTEM NARRATIVE - HYDRONICS

MP2.21 D



KEY PLAN



8' 4' 0' 8'

SCALE : 1/8" = 1'-0"

1ST FLOOR PLAN - FRESHWATER HABITAT - HYDRONICS

SCALE : 1/8" = 1'-0"

1

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SEAL 23551 DAVID M. HAHN ENGINEER

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FIRST FLOOR PLAN - FRESHWATER HABITAT - HYDRONICS

MP2.21 E

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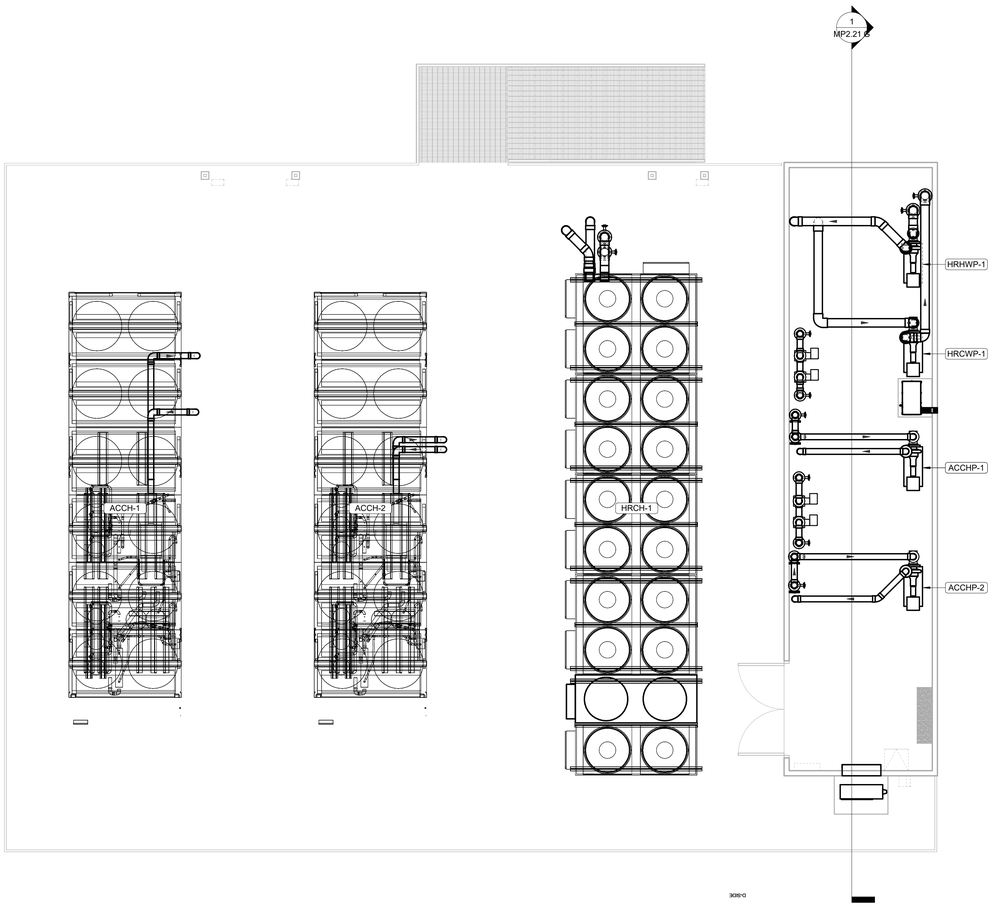
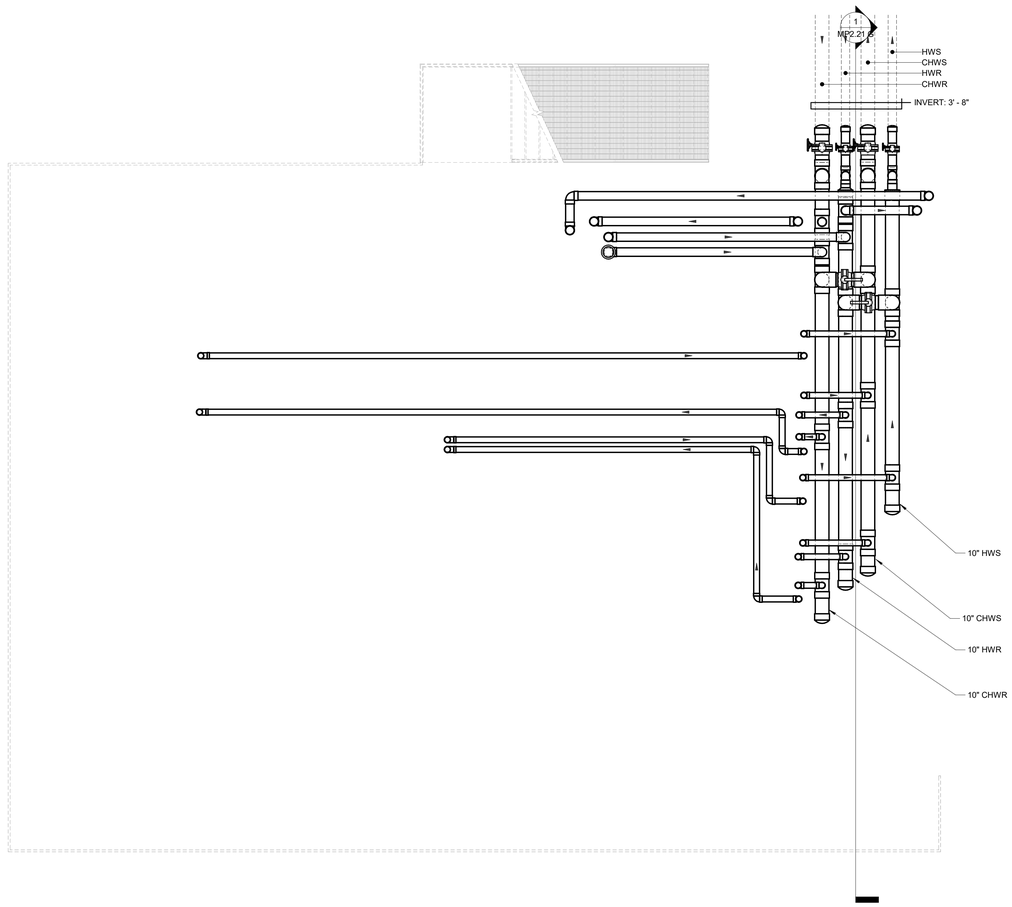


CHILLER ABOVE PLATFORM HYDRONIC PIPING PLAN

SCALE : 1/4" = 1'-0"

3

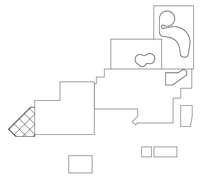


CHILLER BELOW PLATFORM HYDRONIC PIPING PLAN

SCALE : 1/4" = 1'-0"

2

KEY PLAN



4' 2' 0' 4'

SCALE : 1/4" = 1'-0"

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SZOSTAK DESIGN

FORT FISHER AQUARIUM RENOVATION & EXPANSION: PHASE 1

SCO #17-18042-02A
CODE: 42014-4G02
ITEM: 41414-4Y4A

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KURE BEACH, NC 28449

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SEAL 23551 DAVID M. HAHN ENGINEER

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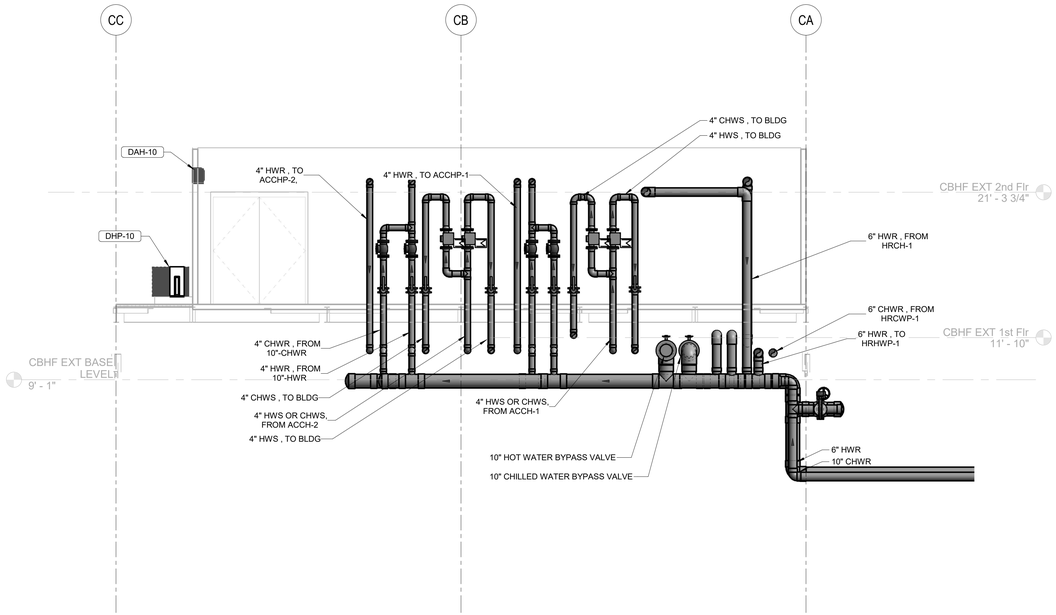
NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

CHILLER PLATFORM - HYDRONICS

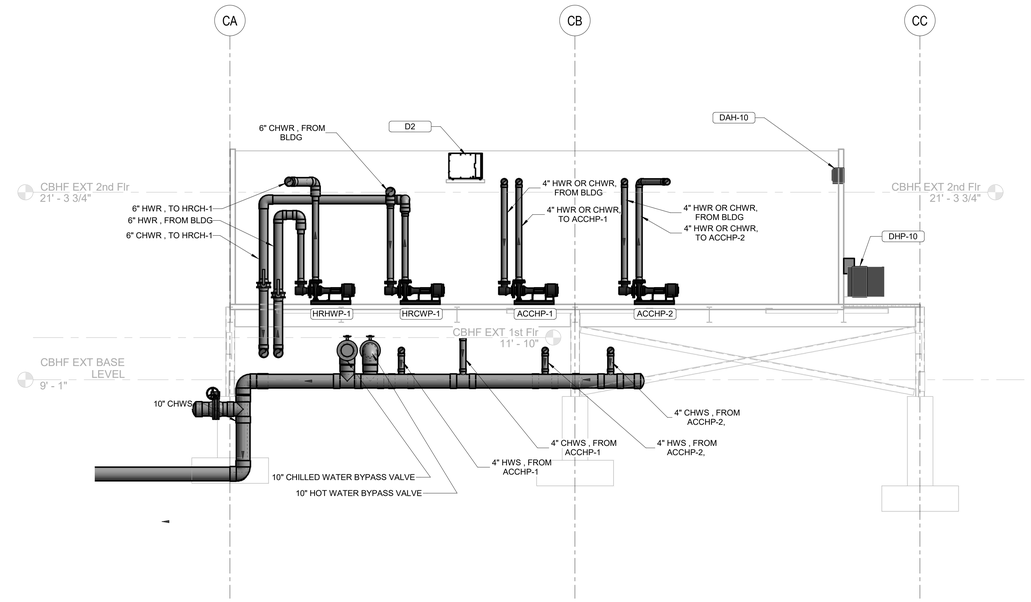
MP2.21 F



CHILLER PLATFORM SECTION - LOOKING WEST

SCALE : 1/4" = 1'-0"

2



CHILLER PLATFORM SECTION - LOOKING EAST

SCALE : 1/4" = 1'-0"

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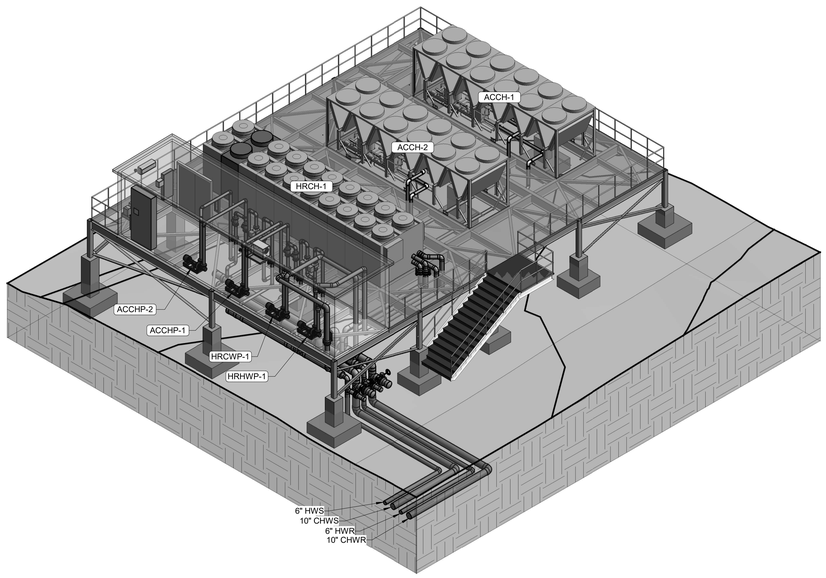
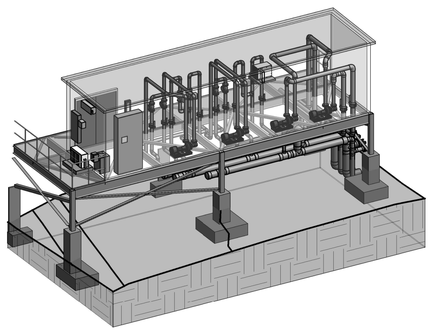


CHILLER PLATFORM 3D - LOOKING SOUTH-WEST

SCALE :

3



CHILLER PLATFORM 3D - LOOKING NORTH-WEST

SCALE :

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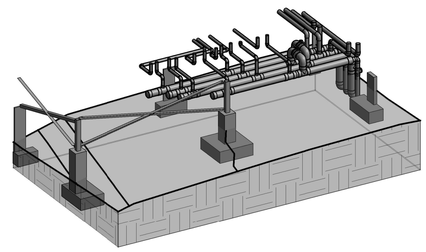

CHILLER PLATFORM BELOW FRAMES - LOOKING NORTH-WEST

SCALE :

5

4' 2' 0' 4'

SCALE : 1/4" = 1'-0"

FLOOR PLAN LEGEND

- EXISTING BUILDING
- RENOVATED AREA
- UPFIT BY OTHERS
- 1-HR RATED WALL
- 2-HR RATED WALL
- 3-HR RATED WALL

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CHILLER PLATFORM - HYDRONICS SECTIONS AND 3D VIEWS

MP2.21 G

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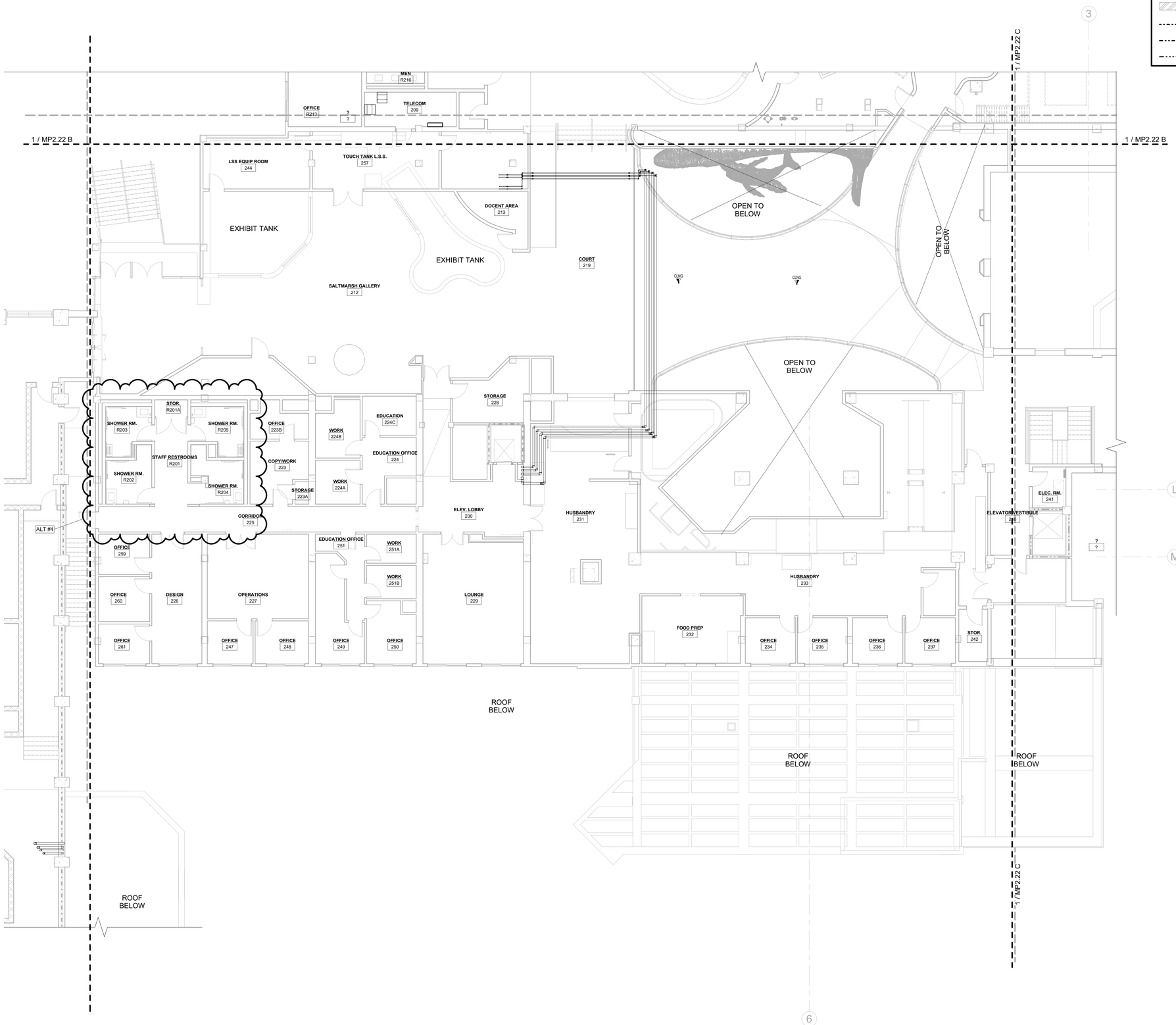
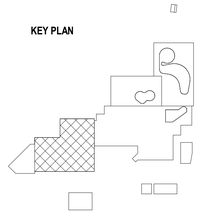
- 3-HR RATED WALL



KEY PLAN



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2ND FLOOR PLAN - CAPE FEAR - HYDRONICS

SCALE : 1/8" = 1'-0"

1

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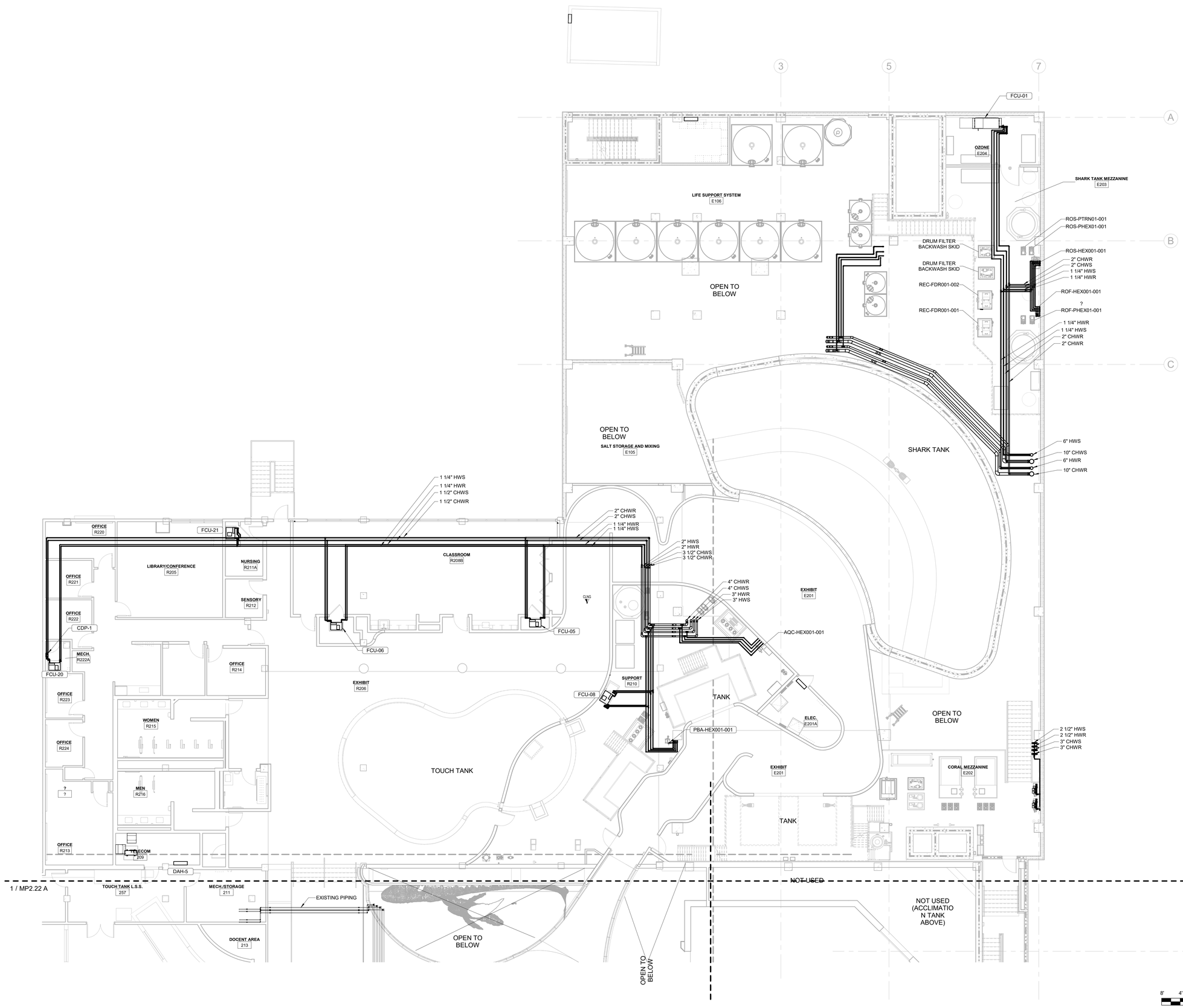
SECOND FLOOR PLAN - CAPE FEAR SHOALS - HYDRONICS

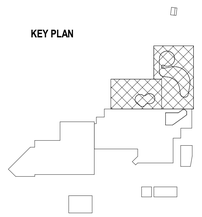
MP2.22 A

FLOOR PLAN LEGEND

- EXISTING BUILDING
- RENOVATED AREA
- UPFIT BY OTHERS
- 1-HR RATED WALL
- 2-HR RATED WALL
- 3-HR RATED WALL



KEY PLAN



8' 4' 0' 8'

SCALE : 1/8" = 1'-0"

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2ND FLOOR PLAN - TOUCH & SHARK TANK - HYDRONICS

SCALE : 1/8" = 1'-0"

1

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FORT FISHER AQUARIUM RENOVATION & EXPANSION: PHASE 1

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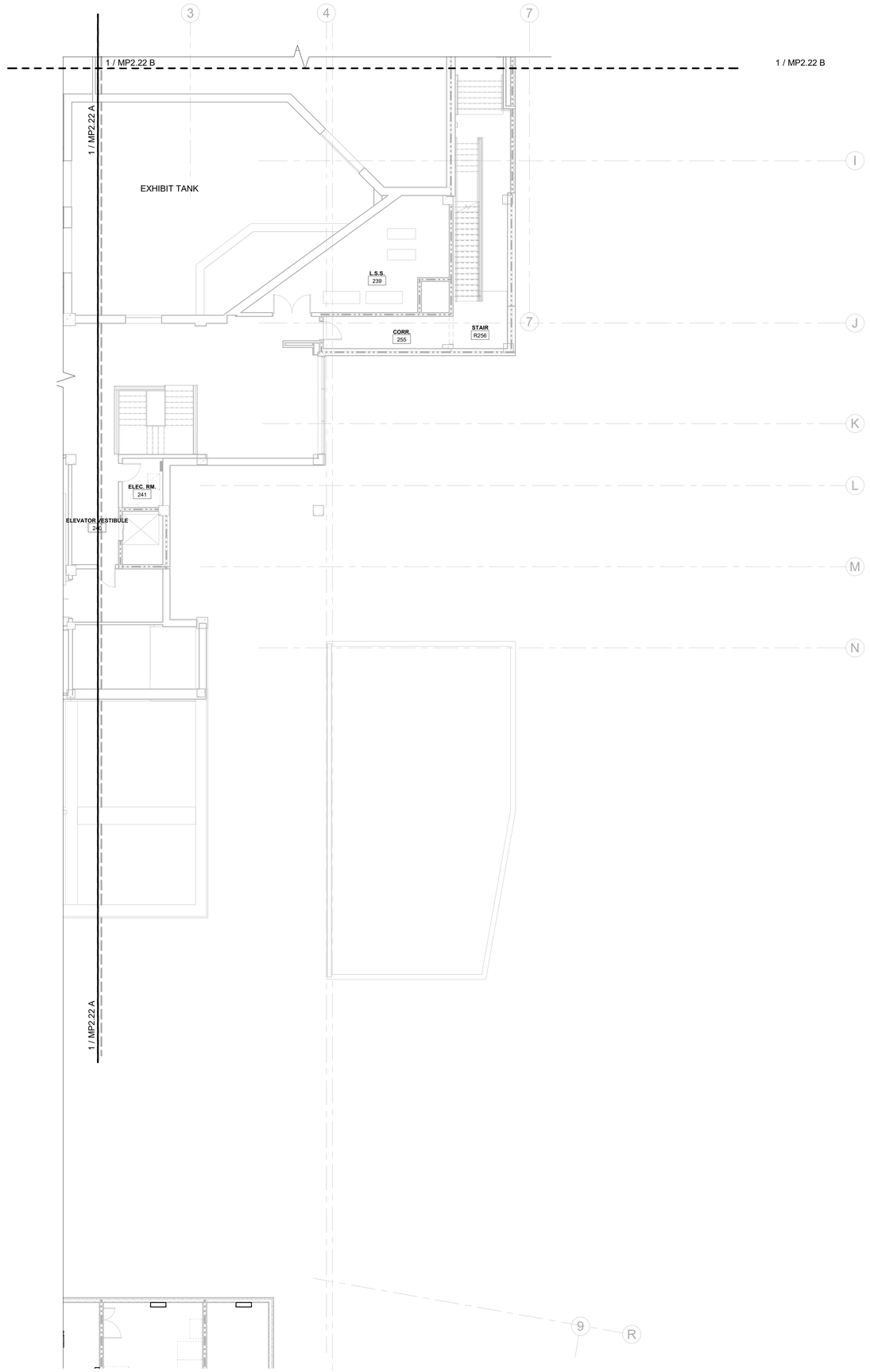
SECOND FLOOR PLAN - TOUCH AND SHARK TANK - HYDRONICS

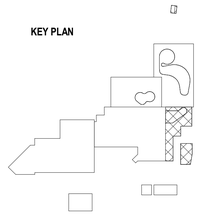
MP2.22 B



FLOOR PLAN LEGEND

- EXISTING BUILDING
- RENOVATED AREA
- UPFIT BY OTHERS
- 1-HR RATED WALL
- 2-HR RATED WALL
- 3-HR RATED WALL

KEY PLAN



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SCALE : 1/8" = 1'-0"

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2ND FLOOR PLAN - SOUTHEAST WING - HYDRONICS

SCALE : 1/8" = 1'-0"

1

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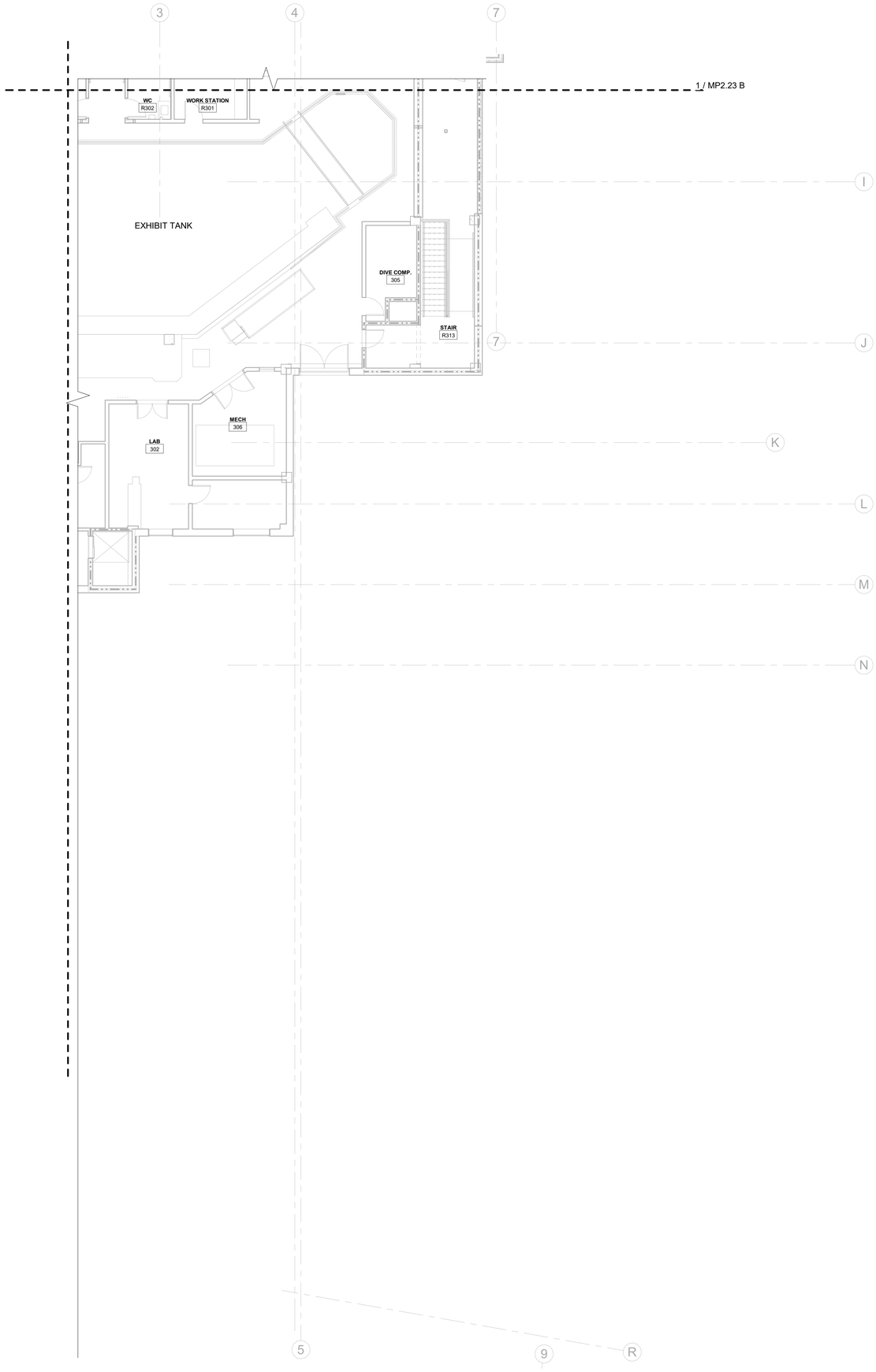
SECOND FLOOR PLAN - SOUTHEAST WING - HYDRONICS

MP2.22 C



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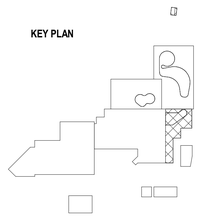
KEY PLAN



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3RD FLOOR PLAN - SOUTHEAST WING - HYDRONICS

SCALE : 1/8" = 1'-0"

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FAX: 919.419.1669
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NOT FOR CONSTRUCTION

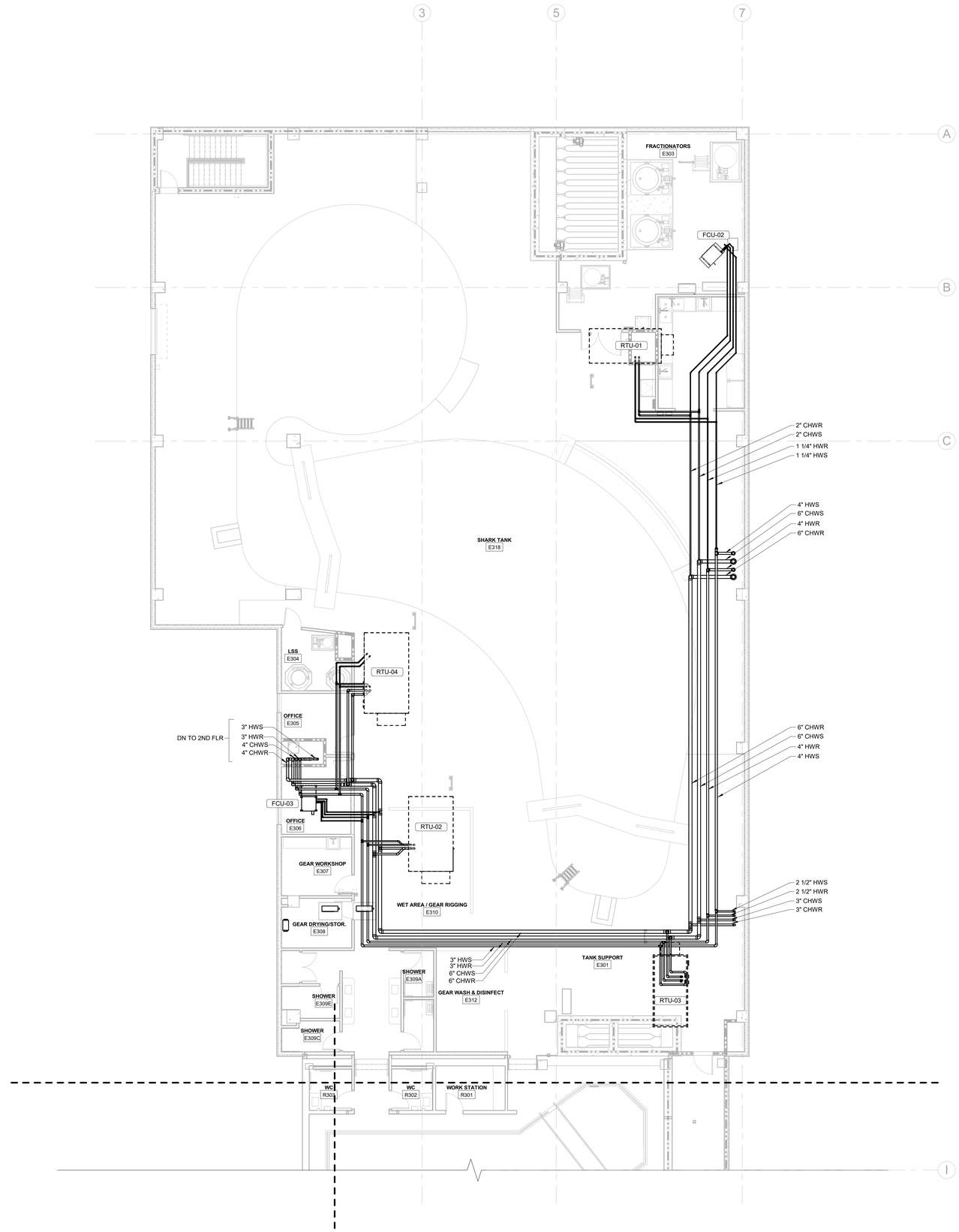
SEAL 23551
NORTH CAROLINA PROFESSIONAL ENGINEER
DAVID M. HAHN

NOT FOR CONSTRUCTION

NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

THIRD FLOOR PLAN - SOUTHEAST WING - HYDRONICS

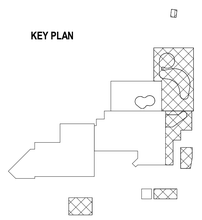
MP2.23 A



FLOOR PLAN LEGEND

- EXISTING BUILDING
- RENOVATED AREA
- UPFIT BY OTHERS
- 1-HR RATED WALL
- 2-HR RATED WALL
- 3-HR RATED WALL

KEY PLAN



8' 4' 0' 8'

SCALE : 1/8" = 1'-0"

3RD FLOOR PLAN - SHARK TANK - HYDRONICS

SCALE : 1/8" = 1'-0"

1

SZOSTAK DESIGN

FORT FISHER AQUARIUM RENOVATION & EXPANSION: PHASE 1

SCO #17-18042-02A
CODE: 42014-4G02
ITEM: 41414-4Y4A

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SEAL 23551 — NORTH CAROLINA — ENGINEER — DAVID M. HAHN

NOT FOR CONSTRUCTION

NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

THIRD FLOOR PLAN - SHARK TANK - HYDRONICS

MP2.23 B

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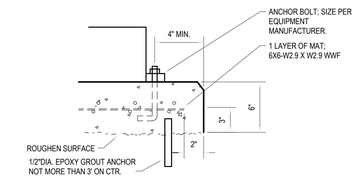
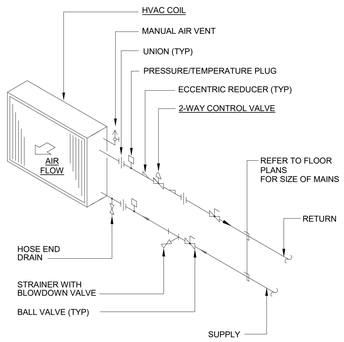
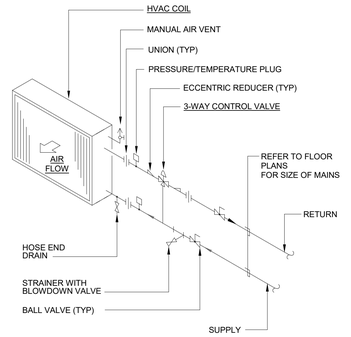
NOTE:
1. MESH SHALL BE FURNISHED IN SHEETS.
2. ALL PAD EDGES SHALL BE CHAMFERED.
3. CONCRETE COMPRESSIVE STRENGTH SHALL BE 3,000 PSI AT 28 DAYS
4. ONLY ANCHOR EQUIPMENT WITH MANUFACTURER SUPPLIED ANCHOR MOUNTS







DUCTLESS SPLIT SYSTEM DETAIL
SCALE : NO SCALE

1

EQUIPMENT HOUSEKEEPING PAD DETAIL
SCALE : NO SCALE

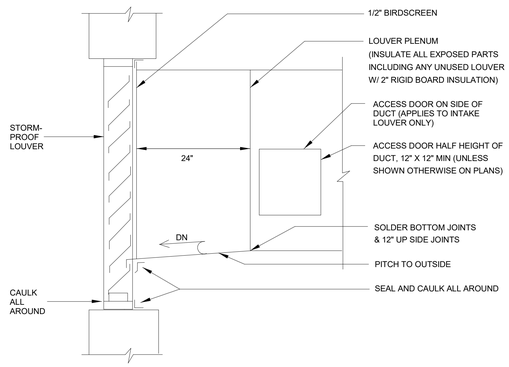
2

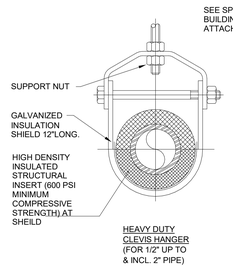
HVAC COIL (2-WAY VALVE) DETAIL
SCALE : NO SCALE

3

HVAC COIL (3-WAY VALVE) DETAIL
SCALE : NO SCALE

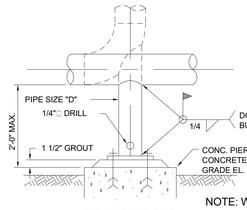
4





LOAD SCHEDULE		
PIPE SIZE	MAXIMUM SPACING	ROD SIZE
1/2" - 2"	8'	1/2"∅
2 1/2"	10'	5/8"∅
3"	10'	5/8"∅
4"	14'	5/8"∅
5"	14'	5/8"∅

NOTES:
1. THIS DETAIL SHALL BE USED AS A GUIDE. ALL HANGERS SHALL MEET THE REQUIREMENTS OF THE SPECIFICATIONS.
2. PIPE 6" AND LARGER SHALL HAVE ROLLER SUPPORTED WITH DUAL RODS.
3. FOR CHW SERVICE OVER 3" REPLACE SADDLE WITH 12" LONG 14 GA SHIELD WITH RIGID INSULATION BETWEEN PIPE AND SHIELD.
4. WHERE TRAPEZE HANGERS ARE USED FOR HEATING HOT WATER PROVIDE ROLLERS.



ELEVATION

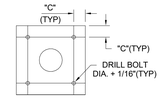


PLATE "A"

NOTE: WHEN SETTING ON STEEL, DELETE ANCHOR BOLTS AND WELD BASE PLATE TO STEEL WITH 1/4" FILLET ALL AROUND.

PIPE SIZE	STANCHION SIZE "D"	PLATE "A"	DIM "C"	ANCHOR BOLT SIZE
2"	1 1/2" SCH. 40	6"x1/2"x6"	1"	1/2"
3"-4"	2" SCH. 40	6"x5/8"x6"	1"	1/2"
6"-8"	3" SCH. 40	10"x3/4"x10"	1"	5/8"
10"-14"	4" SCH. 40	10"x3/4"x10"	1"	5/8"
16"-20"	6" SCH. 40	12"x1"x12"	1"	3/4"

LOUVER PLENUM DETAIL
SCALE : NO SCALE

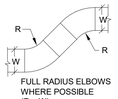
5

PIPE HANGER SUPPORT DETAIL
SCALE : NO SCALE

6

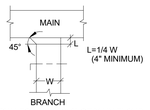
PIPE SUPPORT DETAIL
SCALE : NO SCALE

7



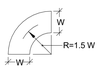
FULL RADIUS ELBOWS WHERE POSSIBLE (R = W)

DUCT OFFSETS

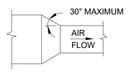


(BRANCH FLOW LESS THAN 25% OF MAIN FLOW)

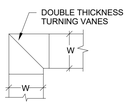
BRANCH TAKE-OFFS



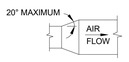
RADIUS ELBOW



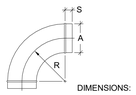
CONVERGING FLOW



RECTANGULAR ELBOW

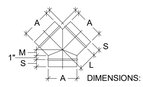


DIVERGING FLOW



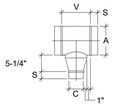
DIMENSIONS:
CR = 1.5A
S = 2"-L

DIE-STAMPED 45° AND 90°



DIMENSIONS:
S = 2"
L = A/2+1"
M = .207A

Y-BRANCH 90°

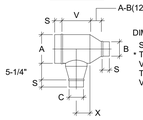


DIMENSIONS:
S = 2"
TC = ONE TAP
V = C+4"
* TC2 = TWO TAPS
V = C+D+8"

CONICAL TEE

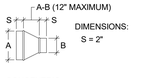
DIMENSIONS:
S = 2"
V = 2A UNLESS SPECIFIED
Z = SPECIFY OFFSET

OFFSET



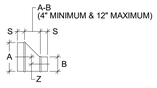
DIMENSIONS:
S = 2"
* TCR = ONE TAP
V = C+4"
TC2R = TWO TAPS
V = C+D+8"

REDUCING CONICAL TEE



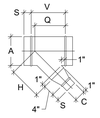
DIMENSIONS:
S = 2"

CONCENTRIC



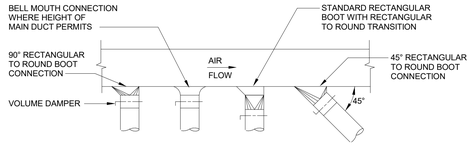
ECCENTRIC

REDUCERS

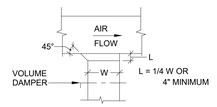


DIMENSIONS:
S = 2"
LC = ONE TAP
V = 1.414C+4.83
* LC2 = TWO TAPS
V = 1.414(C+D)+8.66
Q = A/2+.707C+2.414
H = .707A+.5C+2"

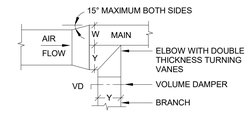
CONICAL LATERAL



ALTERNATE RECTANGULAR TO ROUND DUCT BRANCH CONNECTIONS
(BRANCH FLOW LESS THEN 25% OF MAIN FLOW)



STANDARD RECTANGULAR DUCT BRANCH TAKE-OFF
(BRANCH FLOW LESS THAN 25% OF MAIN FLOW)



STANDARD RECTANGULAR BRANCH TAKE-OFF
(BRANCH FLOW GREATER THAN 25% OF MAIN FLOW)

RECTANGULAR DUCT FITTING DETAILS
SCALE : NO SCALE

8

ROUND DUCT FITTING DETAILS
SCALE : NO SCALE

9

ROUND/RECT. DUCT TAKE-OFF FITTING DETAILS
SCALE : NO SCALE

10

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NORTH CAROLINA SEAL 23551 ENGINEER DAVID M. HAHN

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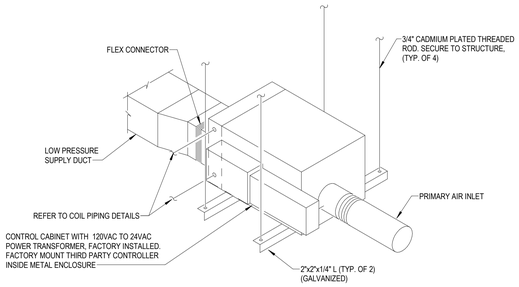
1	9-8-25	BID SET

MECHANICAL DETAILS

M-5.1

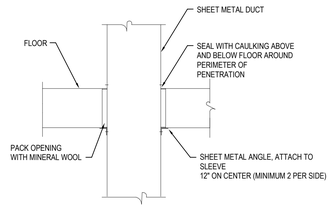


NOTE:
MAINTAIN MANUFACTURER'S RECOMMENDED CLEARANCE AND VERIFY INSTALLATION INSTRUCTIONS FOR HANGING SO THAT ALL NECESSARY ACCESS PANELS ARE NOT OBSTRUCTED.

TYPICAL SINGLE DUCT TERMINAL WITH HOT WATER COIL

SCALE : NO SCALE

1

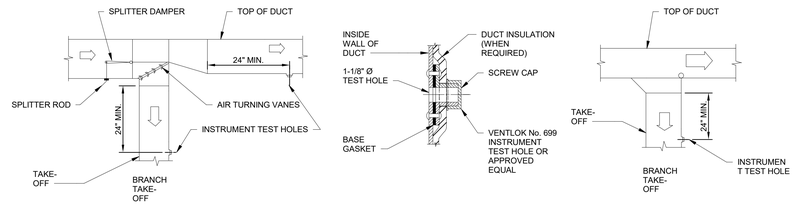


NOTE: EXTERNALLY WRAPPED DUCT INSTALLED SIMILARLY. BLANKET INSULATION SHALL BE INSTALLED OVER ANGLES AND SEALED TO FLOOR BARRIER.

TYPICAL DUCT THROUGH NON-RATED WALL

SCALE : NO SCALE

2



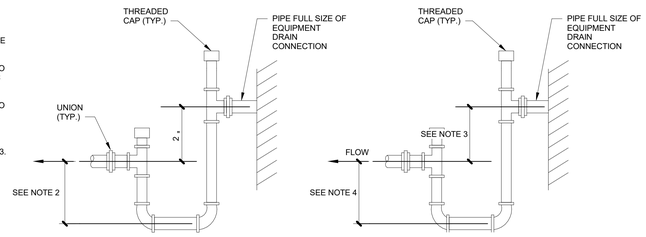
TYPICAL LOW PRESSURE DUCT DETAILS

SCALE : NO SCALE

3

NOTES:

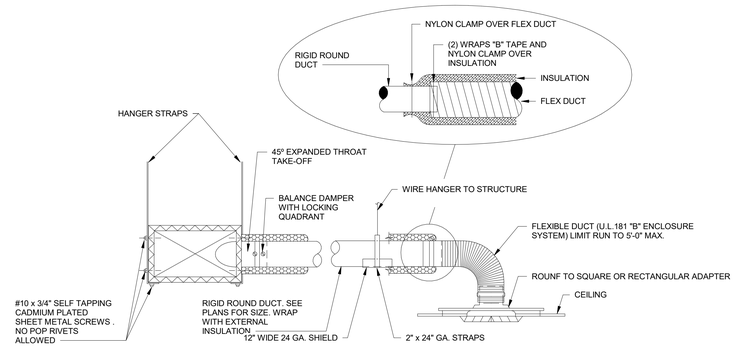
1. LOCATE TRAPS SO AS TO BE ACCESSIBLE FOR CLEANING.
2. HEIGHT SHALL BE EQUAL TO UNIT MAXIMUM TOTAL STATIC PRESSURE PLUS 1/2".
3. HEIGHT SHALL BE EQUAL TO UNIT MAXIMUM NEGATIVE STATIC PRESSURE PLUS 1".
4. HEIGHT SHALL BE 1/2" OF HEIGHT INSTALLED ON NOTE 3.
5. PIPE TO NEAREST DRAIN.
6. TRAP SHALL NOT BLOCK ACCESS TO EQUIPMENT.
7. PROVIDE UNIONS AT INLET AND OUTLET OF TRAP.



TYPICAL EQUIPMENT CONDENSATE DRAIN DETAIL

SCALE : NO SCALE

4



TYPICAL DIFFUSER CONNECTION DETAIL

SCALE : NO SCALE

5

CBHF
Engineers, PLLC
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Wilmington, NC 28401
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www.cbhfengineers.com

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SZOSTAK DESIGN

FORT FISHER AQUARIUM RENOVATION & EXPANSION: PHASE 1

SCO #17-18042-02A
CODE: 42014-4G02
ITEM: 41414-4Y4A

900 LOGGERHEAD RD,
KURE BEACH, NC 28449

NORTH CAROLINA DEPT. OF NATURAL & CULTURAL RESOURCES

SZOSTAK DESIGN, INC.
ARCHITECT
310 1/2 WEST FRANKLIN STREET
CHAPEL HILL, NORTH CAROLINA 27516
TEL#: 919.929.5244
FAX: 919.960.7967
WWW.SZOSTAKDESIGN.COM
LICENSE # 5167F

TJP ENGINEERING, INC.
LIFE SUPPORT SYSTEMS ENGINEER
56880 VENTURE LANE SUITE 205H
BEND, OR 97707
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WWW.TJPENGINEERING.COM
LICENSE # C-5505

ROTO GROUP, LLC.
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7001 DISCOVERY BOULEVARD
DUBLIN, OHIO 43017
TEL#: 617.760.8690
WWW.ROTO.COM

BENNETT & PLESS
STRUCTURAL ENGINEER
5430 WADE PARK BOULEVARD SUITE 400
RALEIGH, NC 27607
TEL#: 919.832.5587
WWW.BENNETT-PLESS.COM
LICENSE # F-1105

CBHF ENGINEERS, PLLC
MEP ENGINEER
2246 YAUPON DRIVE
WILMINGTON, NC 28401
TEL#: 910.791.4000
FAX: 910.791.5266
WWW.CBHFENGINEERS.COM
LICENSE # P-0506

LIGHTSWITCH
LIGHTING DESIGNER
10265 INDIANA COURT
RANCHO CUCAMONGA, CA 91730
TEL#: 909.360.2900
WWW.LIGHTSWITCH.NET

TUNSTALL CONSULTING ENGINEERS PLLC
CIVIL ENGINEER
2602 IRON GATE DRIVE SUITE 102
WILMINGTON, NC 28412
TEL#: 910.343.9653
FAX: 910.343.9604
WWW.MTEHGINEERS.COM
LICENSE # P-3152

SURFACE 678, PA
LANDSCAPE ARCHITECT
215 MORRIS STREET SUITE 150
DURHAM, NC 27701
TEL#: 919.419.1177
FAX: 919.419.1669
WWW.SURFACE678.COM
LICENSE # C-098

CHEATHAM & ASSOCIATES, PA
FIRE PROTECTION ENGINEER
3412 ENTERPRISE DRIVE
WILMINGTON, NC 28405
TEL#: 910.452.4210
WWW.CHEATHAMFA.COM
LICENSE # C-1075

PALACIO COLLABORATIVE
COST ESTIMATOR
4819 EMPEROR BOULEVARD SUITE 400
DURHAM, NC 27703
TEL#: 919.605.8952
WWW.PALACIOCOLLABORATIVE.COM

NOTE: IF THIS DRAWING IS NOT 30" X 42", IT IS A REDUCED PRINT. REFER TO GRAPHIC SCALE.

NOT FOR CONSTRUCTION

SEAL 23551 ENGINEER DAVID M. HAHN

NOT FOR CONSTRUCTION

NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

MECHANICAL DETAILS

M-5.2

AIR COOLED HEAT PUMP CHILLER SCHEDULE

DRAWING CODE	BOD MFR.	BOD MODEL	ALTERNATE APPROVED MFR	NOMINAL CAPACITY (TONS)	PERFOMANCE - COOLING MODE											PERFOMANCE - HEATING MODE											REFRIGERANT			COMPRESSOR		EVAPORATOR				CONDENSER		SOUND AT FULL LOAD	ELECTRICAL							PHYSICAL DIMS. (IN.)			WEIGHT (LBS)	NOTES	ACCESS
					CAPACITY (TONS)	MIN EER	MIN IPLV (BTU/W-h)	MAX POWER INPUT (KW)	AMBIENT TEMP (°F db)	EWT (°F)	LWT (°F)	DESIGN FLOW (GPM)	HX HEAD LOSS (FT H20)	STRAINER HEAD LOSS (FT H20)	VPF MIN FLOW (GPM)	CAPACITY (MBH)	MIN COP (kW/kW)	MAX POWER INPUT (KW)	AMBIENT TEMP (°F db/wb)	EWT (°F)	LWT (°F)	DESIGN FLOW (GPM)	HX HEAD LOSS (FT H20)	STRAINER HEAD LOSS (FT H20)	TYPE	CIRCUIT SQTY	CHARGE PER CKT (LBS)	TYPE	QTY	FLUID	TYPE	FOULING FACTOR	PIPE SIZE (IN.)	EAT (°F)	NUMBER OF FANS	POWER LEVEL (dBA)	PRESS. LEVEL (dBA)	VOLTAGE (V/PH/HZ)	MCA (A)	MOCP (A)	COMP. (KW)	FANS (KW)	COMP. RLA CKT. 1A/B/C (EA.)	COMP. RLA CKT. 2A/B/C (EA.)	L	W	H			
ACCH-1	TRANE	ACXA230	JETSON, CLIMACOOL	230	200.10	10.28	17.76	233.5	95.0	54.00	44.00	478.6	12.80	2.07	301.90	1,769	2.17	238.7	21.0 / 20.0	107.50	120.00	285.9	3.09	0.40	R-454B	2	189.0	SCREW	2	WATER	BRAZED PLATE	0.00010	4	95.0	12	99	68	460/3/60	466.0	500	224.0	14.3	69.0	69.0	338	88	98	13,311	1 - 6	A - L
ACCH-2	TRANE	ACXA230	JETSON, CLIMACOOL	230	200.10	10.28	17.76	233.5	95.0	54.00	44.00	478.6	12.80	2.07	301.90	1,769	2.17	238.7	21.0 / 20.0	107.50	120.00	285.9	3.09	0.40	R-454B	2	189.0	SCREW	2	WATER	BRAZED PLATE	0.00010	4	95.0	12	99	68	460/3/60	466.0	500	224.0	14.3	69.0	69.0	338	88	98	13,311	1 - 6	A - L

NOTES:
1 REFER TO SPECIFICATIONS FOR FURTHER INFORMATION.
2 CHILLER TO BE PROVIDED WITH EVAPORATOR FREEZE PROTECTION WIRE/TERMINATED BY MECHANICAL CONTRACTOR. FREEZE PROTECTION SHALL BE POWERED BY A DEDICATED 20A 120V CIRCUIT PROVIDED/INSTALLED BY ELECTRICAL CONTRACTOR.
3 WEIGHT LISTED IS OPERATING WEIGHT.
4 MANUFACTURER PROVIDED 10-YEAR PARTS, LABOR AND REFRIGERANT WARRANTY.
5 PROVIDE NEXT-GEN REFRIGERANT.
6 CONDENSER FIN: COATED COPPER ROUND TUBE, ALUMINUM PLATE FIN

ACCES... A COILS TO BE COATED FOR EXPOSURE TO ASTM B117-90 10,000 HOUR SALT SPRAY RESISTANCE TEST WITH NO DEGRADATION
B BACNET MS/TP CONTROL INTERFACE
C ARCHITECTURAL LOUVERED PANELS COMPLETELY COVERING CONDENSING COIL AND SERVICE AREA BENEATH THE CONDENSER
D MOLDED ELASTOMERIC ISOLATORS
E FACTORY INSTALLED WATER STRAINER
F FACTORY INSTALLED FLOW SWITCH
G AMBIENT CONTROL FOR OPERATION FROM 0 TO 125 DEG F
H CONCRETE MOUNTING PAD
I FACTORY STARTUP
J FACTORY INSTALLED MINIMUM 1-1/4 INCH INSULATION, ALL COLDED SURFACES
K PHASE VOLTAGE MONITOR
L CONVENIENCE OUTLET: 115V / 60HZ / 20A

DIFFUSERS, REGISTERS AND GRILLES SCHEDULE

DRAWING CODE	BOD MFR	BOD MODEL	ALTERNATE APPROVED MFRS	TYPE	SERVICE	NECK SIZE (IN.)	BRANCH CONN. SIZE (IN.)	MODULE SIZE (IN.)	MATERIAL	FINISH	MOUNTING	NOTES	ACCESS
S1	PRICE	ASPD	GREENHECK, TITUS	SQUARE CEILING DIFFUSER	SUPPLY	6%%C		24 X 24	ALUMINUM	WHITE	T-BAR	1,2	A
S2	PRICE	ASPD	GREENHECK, TITUS	SQUARE CEILING DIFFUSER	SUPPLY	8%%C		24 X 24	ALUMINUM	WHITE	T-BAR	1,2	A
S3	PRICE	ASPD	GREENHECK, TITUS	SQUARE CEILING DIFFUSER	SUPPLY	10%%C		24 X 24	ALUMINUM	WHITE	T-BAR	1,2	A
S5	PRICE	620	GREENHECK, TITUS	SQUARE CEILING DIFFUSER	SUPPLY	6%%C		12 X 12	ALUMINUM	WHITE	CEILING...	1,2	A
S8	PRICE	620	GREENHECK, TITUS	DBL DEFLECTTION	SUPPLY	12 X 6		14 X 8	ALUMINUM	MATCH	WALL SURFACE	1,2,3	A
S9	PRICE	620	GREENHECK, TITUS	DBL DEFLECTTION	SUPPLY	16 x 10		18 x 12	ALUMINUM	MATCH	WALL SURFACE	1,2,3	B
S10	PRICE	620	GREENHECK, TITUS	DBL DEFLECTTION	SUPPLY	12 X 6		14 X 8	ALUMINUM	MATCH	WALL SURFACE	1,2,3	B
S11	PRICE	620	GREENHECK, TITUS	DBL DEFLECTTION	SUPPLY	16 x 10		18 x 12	ALUMINUM	MATCH	WALL SURFACE	1,2,3	A
S12	PRICE	620	GREENHECK, TITUS	DBL DEFLECTTION	SUPPLY	20 X 10		22 X 12	ALUMINUM	MATCH	WALL SURFACE	1,2,3	A
S13	PRICE	620	GREENHECK, TITUS	DBL DEFLECTTION	SUPPLY	28 X 12		30 X 14	ALUMINUM	MATCH	WALL SURFACE	1,2,3	A
S14	PRICE	620	GREENHECK, TITUS	DBL DEFLECTTION	SUPPLY	12 X 8		14 x 10	ALUMINUM	MATCH	WALL SURFACE	1,2,3	A
S15	PRICE	620	GREENHECK, TITUS	DBL DEFLECTTION	SUPPLY	14 X 6		16 X 8	ALUMINUM	MATCH	WALL SURFACE	1,2,3	A
S16	PRICE	620	GREENHECK, TITUS	DBL DEFLECTTION	SUPPLY	8 X 8		10 X 10	ALUMINUM	MATCH	WALL SURFACE	1,2,3	A
S17	PRICE	620	GREENHECK, TITUS	DBL DEFLECTTION	SUPPLY	16 X 16		18 X 18	ALUMINUM	MATCH	WALL SURFACE	1,2,3	A
S18	PRICE	620	GREENHECK, TITUS	DBL DEFLECTTION	SUPPLY	10 X 10		12 X 12	ALUMINUM	MATCH	WALL SURFACE	1,2,3	A
S19	PRICE	620	GREENHECK, TITUS	DBL DEFLECTTION	SUPPLY	6 X 6		8 X 8	ALUMINUM	MATCH	DUCT SURFACE	1,2	A
S20	PRICE	620	GREENHECK, TITUS	DBL DEFLECTTION	SUPPLY	20 X 10			ALUMINUM	MATCH	DUCT SURFACE	1,2	A
S21	PRICE	620	GREENHECK, TITUS	DBL DEFLECTTION	SUPPLY	12 X 8			ALUMINUM	MATCH	DUCT SURFACE	1,2	A
S23	PRICE	620	GREENHECK, TITUS	DBL DEFLECTTION	SUPPLY	18 X 12			ALUMINUM	MATCH	DUCT SURFACE	1,2	A
S25	PRICE	620	GREENHECK, TITUS	DBL DEFLECTTION	SUPPLY	16 X 6		16 X 8	ALUMINUM	MATCH	DUCT SURFACE	1,2	A
S26	PRICE	620	GREENHECK, TITUS	DBL DEFLECTTION	SUPPLY	16 X 16		18 X 18	ALUMINUM	MATCH	DUCT SURFACE	1,2	A
S27	PRICE	620	GREENHECK, TITUS	DBL DEFLECTTION	SUPPLY	14 X 10		16 X 12	ALUMINUM	MATCH	DUCT SURFACE	1,2	A
S28	PRICE	620	GREENHECK, TITUS	DBL DEFLECTTION	SUPPLY	10 X 4		12 X 6	ALUMINUM	MATCH	DUCT SURFACE	1,2	A
S29	PRICE	620	GREENHECK, TITUS	DBL DEFLECTTION	SUPPLY	48 X 12		50 X 14	ALUMINUM	MATCH	DUCT SURFACE	1,2	A
S30	PRICE	ARCD	GREENHECK, TITUS	ROUND CONE DIFFUSER	SUPPLY	6%%C			ALUMINUM	MATCH	DUCT SURFACE	1,2	A
S31	PRICE	ARCD	GREENHECK, TITUS	ROUND CONE DIFFUSER	SUPPLY	8%%C			ALUMINUM	MATCH	DUCT SURFACE	1,2	A
T1	PRICE	630	GREENHECK, TITUS	FIXED FACE GRILLE	TRANSFER	22 X 22	8%%C	24 X 24	ALUMINUM	WHITE	T-BAR	1,2,3	-
T2	PRICE	630	GREENHECK, TITUS	FIXED FACE GRILLE	TRANSFER	22 X 22	10%%C	24 X 24	ALUMINUM	WHITE	T-BAR	1,2,3	-
T3	PRICE	630	GREENHECK, TITUS	FIXED FACE GRILLE	RETURN	10 X 10		12 X 12	ALUMINUM	MATCH	WALL SURFACE	1,2,3	-
T4	PRICE	630	GREENHECK, TITUS	FIXED FACE GRILLE	TRANSFER	10 X 10	6%%C	12 X 12	ALUMINUM	WHITE	T-BAR	1,2,3	-
R1	PRICE	630	GREENHECK, TITUS	FIXED FACE GRILLE	RETURN	22 X 22	6%%C	24 X 24	ALUMINUM	WHITE	T-BAR	1,2,3	-
R2	PRICE	630	GREENHECK, TITUS	FIXED FACE GRILLE	RETURN	22 X 22	8%%C	24 X 24	ALUMINUM	WHITE	T-BAR	1,2,3	-
R3	PRICE	630	GREENHECK, TITUS	FIXED FACE GRILLE	RETURN	22 X 22	10%%C	24 X 24	ALUMINUM	WHITE	T-BAR	1,2,3	-
R4	PRICE	630	GREENHECK, TITUS	FIXED FACE GRILLE	RETURN	22 X 22	12%%C	24 X 24	ALUMINUM	WHITE	T-BAR	1,2,3	-
R10	PRICE	630	GREENHECK, TITUS	FIXED FACE GRILLE	RETURN	10 X 10		12 X 12	ALUMINUM	MATCH	WALL SURFACE	1,2,3	-
R11	PRICE	630	GREENHECK, TITUS	FIXED FACE GRILLE	RETURN	16 X 16		18 X 18	ALUMINUM	MATCH	WALL SURFACE	1,2,3	-
R12	PRICE	630	GREENHECK, TITUS	FIXED FACE GRILLE	RETURN	14 X 14		16 X 16	ALUMINUM	MATCH	WALL SURFACE	1,2,3	-
R14	PRICE	630	GREENHECK, TITUS	FIXED FACE GRILLE	RETURN	20 X 16		22 X 18	ALUMINUM	MATCH	WALL SURFACE	1,2,3	-
R16	PRICE	630	GREENHECK, TITUS	FIXED FACE GRILLE	RETURN	18 X 10		20 X 12	ALUMINUM	MATCH	WALL SURFACE	1,2,3	-
R17	PRICE	630	GREENHECK, TITUS	FIXED FACE GRILLE	RETURN	40 x 24		40 x 26	ALUMINUM	MATCH	WALL SURFACE	1,2,3	-
R18	PRICE	630	GREENHECK, TITUS	FIXED FACE GRILLE	RETURN	30 X 14		32 X 16	ALUMINUM	MATCH	WALL SURFACE	1,2,3	-
R19	PRICE	630	GREENHECK, TITUS	FIXED FACE GRILLE	RETURN	8 X 8		10 X 10	ALUMINUM	MATCH	WALL SURFACE	1,2,3	-
R20	PRICE	630	GREENHECK, TITUS	FIXED FACE GRILLE	RETURN	72 x 16			ALUMINUM	MATCH	DUCT SURFACE	1,2	-
R21	PRICE	630	GREENHECK, TITUS	FIXED FACE GRILLE	RETURN	28 X 28			ALUMINUM	MATCH	DUCT SURFACE	1,2	-
R22	PRICE	630	GREENHECK, TITUS	FIXED FACE GRILLE	RETURN	72 X 24			ALUMINUM	MATCH	DUCT SURFACE	1,2	-
R25	PRICE	630	GREENHECK, TITUS	FIXED FACE GRILLE	RETURN	12 X 6			ALUMINUM	MATCH	DUCT SURFACE	1,2	-
R26	PRICE	630	GREENHECK, TITUS	FIXED FACE GRILLE	RETURN	36 X 20			ALUMINUM	MATCH	DUCT SURFACE	1,2	-
R28	PRICE	630	GREENHECK, TITUS	FIXED FACE GRILLE	RETURN	48 X 20			ALUMINUM	MATCH	DUCT SURFACE	1,2	-
R29	PRICE	630	GREENHECK, TITUS	FIXED FACE GRILLE	RETURN	28 X 12		30 X 14	ALUMINUM	MATCH	DUCT SURFACE	1,2	-
R30	PRICE	ARCD	GREENHECK, TITUS	ROUND CONE DIFFUSER	RETURN	6%%C			ALUMINUM	MATCH	DUCT SURFACE	1,2	-
R31	PRICE	ARCD	GREENHECK, TITUS	ROUND CONE DIFFUSER	RETURN	8%%C			ALUMINUM	MATCH	DUCT SURFACE	1,2	-
R34	PRICE	630	GREENHECK, TITUS	FIXED FACE GRILLE	RETURN	8 X 8		10 X 10	ALUMINUM	MATCH	DUCT SURFACE	1,2	-
E1	PRICE	630	GREENHECK, TITUS	FIXED FACE GRILLE	EXHAUST	22 X 22	6%%C	24 X 24	ALUMINUM	WHITE	T-BAR	1,2,3	A
E2	PRICE	630	GREENHECK, TITUS	FIXED FACE GRILLE	EXHAUST	22 X 22	8%%C	24 X 24	ALUMINUM	WHITE	T-BAR	1,2,3	A
E3	PRICE	630	GREENHECK, TITUS	FIXED FACE GRILLE	EXHAUST	22 X 22	10%%C	24 X 24	ALUMINUM	WHITE	T-BAR	1,2,3	A
E5	PRICE	630	GREENHECK, TITUS	FIXED FACE GRILLE	EXHAUST	8 X 8		10 X 10	ALUMINUM	MATCH	WALL SURFACE	1,2,3	A
E6	PRICE	630	GREENHECK, TITUS	FIXED FACE GRILLE	EXHAUST	24 X 12		26 X 14	ALUMINUM	MATCH	DUCT SURFACE	1,2	A
E7	PRICE	630	GREENHECK, TITUS	FIXED FACE GRILLE	EXHAUST	38 X 10		40 X 12	ALUMINUM	MATCH	DUCT SURFACE	1,2	A
E8	PRICE	630	GREENHECK, TITUS	FIXED FACE GRILLE	EXHAUST	10 X 10	6%%C	12 X 12	ALUMINUM	WHITE	CEILING...	1,2,3	A

NOTES:
1 REFER TO SPECIFICATIONS FOR FURTHER INFORMATION.
2 DUCT BRANCH CONNECTION SIZE TO BE EQUAL TO THE NECK SIZE OF DIFFUSER UNLESS NOTED OTHERWISE ON PLANS.
3 PAINT ALL VISIBLE DUCTWORK THROUGH GRILLES AND REGISTERS FLAT BLACK.

ACCESS: A MANUAL VOLUME DAMPER
B INTEGRAL VOLUME DAMPER

AIR COOLED MODULAR CHILLER WITH HEAT RECOVERY SCHEDULE

DRAWING CODE	UNIT LOCATION	BOD MFR	MODEL	ALTERNATE APPROVED MFRS	QTY OF ASSEMB.	NUMBER OF MODULES IN ASSEMB.	COOLING ONLY CAPACITY		SIMULTANEOUS HEATING AND COOLING CAPACITY		MAX POWER INPUT (KW)	COOLING ONLY MIN EER	SIMULTANEOUS EER / COP	MIN UNLOADING (TONS)	REFRIG. (PER...		COMPR. (PER...		ELECTRICAL PER POWER SUPPLY					WEIGHT OPERATING (LBS)	NOTES	ACCESS
							COOLING (TONS)	COOLING...	HEATING (MBH)						TYPE	CKTS QTY	TYPE	QTY	NUM. POWER SUPPLIES	MODULES PER POWER SUPPLIES	VOLTAGE (V/PH/HZ)	MCA (A)	MOCP (A)			
HRCH-1	MECH PLANT	TRANE	5xTPACVMV0500D4-MM-HR	JETSON, CLIMACOOL	1	5	235.9	222.7	3220		242.50	10.548	11.33 / 4.22	21.3	R-545B	2	SCROLL	2	1	5	460/3/60	460	500	25,000	1 - 10	-

NOTES:
1 REFER TO SPECIFICATIONS FOR FURTHER INFORMATION.
2 SIMULTANEOUS HEATING AND COOLING UNITS
3 PROVIDE NEXT-GEN REFRIGERANT.
4 FINNED CONDENSER COILS WITH COPPER TUBING.
5 VARIABLE SPEED FANS
6 DUAL REFRIGERATION CIRCUITS ON EACH CHILLER MODULE.
7 SCROLL COMPRESSOR ON EACH REFRIGERATION CIRCUIT EACH WITH SERVICE VALVES, CRANKCASE HEATER, SOLID STATE OVERLOAD PROTECTION AND IN-LINE CIRCUIT BREAKER
8 MANUAL ISOLATION VALVES ON EVAPORATOR AND CONDENSER BRANCH LINES TO PERMIT SERVICE ISOLATION OF THE FLOW SWITCH, STRAINER AND EVAPORATOR.
9 VALVES AND CONTROLS FOR HEAT RECOVERY OPERATION.
10 PHASE MONITOR ON THE POWER SUPPLY TO PROTECT AGAINST LOW VOLTAGE, PHASE UNBALANCE, PHASE LOSS, AND PHASE REVERSAL CONDITIONS.

ACCESS: A N/A

MINI-SPLIT SYSTEM SCHEDULE

DRAWING CODE (IDU / ODU)	INDOOR UNIT LOCATION	BOD MFR	BOD MODEL (IDU / ODU)	ALTERNATE APPROVED MFRS	INDOOR UNIT CONFIGURATION	SYSTEM TYPE	ARI COOLING 80/67/95		ARI HEATING 70/47		MIN SEER 2	MIN HSPF 2	INDOOR UNIT				OUTDOOR UNIT				LSS EMERG. POWER?	REF. PIPING		NOTES	ACCESS
							TOTAL (MBH)	MIN (MBH)	TOTAL (MBH)				FAN	ELECTRICAL		WEIGHT (LBS)	ELECTRICAL			WEIGHT (LBS)		MAX LENGTH (FT.)	MAX HEIGHT DIFF. (FT.)		
													SA MIN-MAX (CFM)	VOLTAGE (V/PH/HZ)	MCA (A)		VOLTAGE (V/PH/HZ)	MCA (A)	MOCP (A)						
DAH-3 / DHP-3	(104) IT ROOM	TRANE	TPKA0A0241KA80A / TRUYA0241HA70NA	DAIKIN, LG	WALL MOUNTED	AIR CONDITIONER	24.0	10.0	-		21.3	-	635 - 775	208/1/60	1.0	46	208/1/60	19.0	26	151	NO	225	100	1 - 7	A - C
DAH-4 / DHP-4	(E103B) ELECTRICAL	TRANE	TPKA0A0121LA10A / TRUYA0121KA70N	DAIKIN, LG	WALL MOUNTED	AIR CONDITIONER	12.0	4.4	-		21.3	-	265 - 385	208/1/60	1.0	28	208/1/60	11.0	28	92	NO	165	100	1 - 6	A - C
DAH-5 / DHP-5	(209) TELECOM	TRANE	TPKA0A0121LA10A / TRUYA0121KA70N	DAIKIN, LG	WALL MOUNTED	AIR CONDITIONER	12.0	4.4	-		21.3	-	265 - 385	208/1/60	1.0	28	208/1/60	11.0	28	92	NO	165	100	1 - 6	A - C
DAH-6 / DHP-6	GENERATOR BLDG	TRANE	TPKA0A0241KA80A / TRUZA0241HA70NA	DAIKIN, LG	WALL MOUNTED	HEAT PUMP	24.0	10.0	26.0	21.3	9.3	635 - 775	208/1/60	1.0	46	208/1/60	19.0	26	153	YES	165	100	1 - 6	A - C
DAH-7 / DHP-7	GENERATOR BLDG	TRANE	TPKA0A0241KA80A / TRUZA0241HA70NA	DAIKIN, LG	WALL MOUNTED	HEAT PUMP	24.0	10.0	26.0	21.3	9.3	635 - 775	208/1/60	1.0	46	208/1/60	19.0	26	153	YES	165	100	1 - 6	A - C
DAH-8 / DHP-8	(E201A) ELECTRICAL	TRANE	TPKA0A0241KA80A / TRUYA0241HA70NA	DAIKIN, LG	WALL MOUNTED	AIR CONDITIONER	24.0	10.0	-		21.3	-	635 - 775	208/1/60	1.0	46	208/1/60	19.0	26	151	NO	165	100	1 - 6	A - C
DAH-9 / DHP-9	(R108B) DATA	TRANE	TPKA0A0121LA10A / TRUYA0121KA70N	DAIKIN, LG	WALL MOUNTED	AIR CONDITIONER	12.0	4.4	-		21.3	-	265 - 385	208/1/60	1.0	28	208/1/60	11.0	28	92	YES	165	100	1 - 6	A - C
DAH-10 / DHP-10	CHILLER PUMP BLDG	TRANE	TPKA0A0241KA80A / TRUYA0241HA70NA	DAIKIN, LG	WALL MOUNTED	HEAT PUMP	24.0	10.0	26.0	21.3	9.3	635 - 775	208/1/60	1.0	46	208/1/60	19.0	26	153	YES	165	100	1 - 6	A - C
DAH-11 / DHP-11	(E103A) MECH./ELEC.	TRANE	TPKA0A0241KA80A / TRUYA0241HA70NA	DAIKIN, LG	WALL MOUNTED	AIR CONDITIONER	24.0	10.0	-		21.3	-	635 - 775	208/1/60	1.0	46	208/1/60	19.0	26	151	NO	165	100	1 - 6	A - C
DAH-12 / DHP-12	DOM. BOOSTER PUMP BLDG	TRANE	TPKA0A0241KA80A / TRUYA0241HA70NA	DAIKIN, LG	WALL MOUNTED	HEAT PUMP	24.0	10.0	26.0	21.3	9.3	635 - 775	208/1/60	1.0	46	208/1/60	19.0	26	153	YES	165	100	1 - 6	A - C
DAH-13 / DHP-13	(R104) DATA/STOR.	TRANE	TPKA0A0121LA10A / TRUYA0121KA70N	DAIKIN, LG	WALL MOUNTED	AIR CONDITIONER	12.0	4.4	-		21.3	-	265 - 385	208/1/60	1.0	28	208/1/60	11.0	28	92	NO	165	100	1 - 6	A - C
DAH-14 / DHP-14	GENERATOR BLDG	TRANE	TPKA0A0241KA80A / TRUZA0241HA70NA	DAIKIN, LG	WALL MOUNTED	HEAT PUMP	24.0	10.0	26.0	21.3	9.3	635 - 775	208/1/60	1.0	46	208/1/60	19.0	26	153	YES	165	100	1 - 6, 8	A - C

NOTES: 1 REFER TO SPECIFICATION... REFER...
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NOTES:
1 REFER TO SPECIFICATIONS FOR FURTHER INFORMATION.
2 ELECTRICAL CONTRACTOR TO PROVIDE CONDUIT AND CONDUCTOR FROM OUTDOOR UNIT TO INDOOR UNIT.
3 MOUNT INDOOR UNIT AT MAX ALLOWED HEIGHT WHILE MAINTAINING MANUFACTURERS RECOMMENDED CLEARANCES.
4 INSTALL BASE FOUNDATION BOLTS FOR HIGH WIND PROTECTION.
5 LOW AMBIENT COOLING
6 CONTROLS BY DDC CONTRACTOR
7 INCLUDED IN ALTERNATE #2 ONLY
8 DUCTLESS SYSTEM TO SHUT DOWN UPON GENERATOR START-UP, COINCIDING WITH THE OPENING OF GENERATOR INTAKE LOUVERS

ACCESS: A MANUFACTURER'S STANDARD COATING PROTECTION ON OUTDOOR UNIT.
B PROVIDE CONDENSATE PUMP AND RESERVOIR OR EQUAL WITH CAPACITY OF 1.6 GAL/HR AT 33 FT OF HEAD. INTERLOCK TO SHUTDOWN UNIT.
C WIRED WALL-MOUNTED REMOTE CONTROLLER

POWER VENTILATOR SCHEDULE

DRAWING CODE	UNIT LOCATION	BOD MFR	BOD MODEL	ALTERNATE APPROVED MFRS	FAN TYPE	SERVICE	DRIVE TYPE	SPEED CONTROL	FAN DIAM. (IN)	DAMPER	MOTOR ENCLOSURE	CAPACITIES				ELECTRICAL				SONES	WEIGHT (LBS.)	NOTES	ACCESS
												AIRFLOW (CFM)	ESP (IN. WG.)	FAN RPM	MOTOR RPM	MOTOR TYPE	MOTOR SIZE (HP)	V/PH/HZ	MOCP (A)				
PV1	MAIN ENTRY - R129	COOK	GNVF-100	GREENHECK, TWIN CITY	CENTRIFUGAL INLINE CABINET	EXHAUST	DIRECT	EC	7.63	BACKDRAFT	-	70	0.35	846	1,000	ECM	0.13	120/1/60	15	2	17	1,2,5	A,B,C,D,E,F
PV2	MAIN ENTRY (ROOF)	COOK	120 ACED OR91	GREENHECK, TWIN CITY	DOWNBLAST CENTRIFUGAL EXHAUST	EXHAUST	DIRECT	EC	12.00	BACKDRAFT	OPEN	650	0.60	1,334	1,725	ECM	0.25	120/1/60	15	10	80	1,2,4,5	E,G,H,I,J,K,L,M,N,O
PV3	SE WING	COOK	GNVF-700	GREENHECK, TWIN CITY	CENTRIFUGAL INLINE CABINET	EXHAUST	DIRECT	EC	6.31	BACKDRAFT	-	550	0.60	1,515	1,778	ECM	0.33	120/1/60	15	5	38	1,2	A,B,D,E,P
PV4	CONCESSIONS	COOK	GNVF-700	GREENHECK, TWIN CITY	CENTRIFUGAL INLINE CABINET	EXHAUST	DIRECT	EC	6.31	BACKDRAFT	-	650	0.75	1,724	1,778	ECM	0.33	120/1/60	15	6	38	1,2	A,B,D,E,P
PV5	TOUCH 2ND FLR	COOK	120 ACED	GREENHECK, TWIN CITY	DOWNBLAST CENTRIFUGAL EXHAUST	EXHAUST	DIRECT	EC	12.00	BACKDRAFT	OPEN	1,000	0.60	1,309	1,725	ECM	0.25	120/1/60	15	9	79	1,2,4	E,G,H,I,J,L,M,N,O
PV6	3RD FLR SHARK (ROOF)	COOK	120 ACED	GREENHECK, TWIN CITY	DOWNBLAST CENTRIFUGAL EXHAUST	EXHAUST	DIRECT	EC	12.00	BACKDRAFT	OPEN	1,000	0.60	1,309	1,725	ECM	0.25	120/1/60	15	9	79	1,2	E,G,H,I,J,L,M,N,O
PV7	NECROPSY	COOK	GNVF-700	GREENHECK, TWIN CITY	CENTRIFUGAL INLINE CABINET	EXHAUST	DIRECT	EC	6.31	BACKDRAFT	-	380	0.75	1,519	1,778	ECM	0.33	120/1/60	15	4	39	1,3	A,B,D,E,P
PV8	CORAL MEZZ (AMB.AN)	COOK	135 SQIN-D GALV	GREENHECK, TWIN CITY	SQUARE CENTRIFUGAL INLINE BLOWER	EXHAUST	DIRECT	EC	13.50	BACKDRAFT	OPEN	1,440	0.75	1,390	1,725	ECM	0.50	120/1/60	15	9	124	1,3	E,G,H,M,N,R
PV9	CF STAFF 2ND FLR (ROOF)	COOK	100 ACEH	GREENHECK, TWIN CITY	DOWNBLAST CENTRIFUGAL EXHAUST	EXHAUST	DIRECT	EC	10.00	BACKDRAFT	OPEN	400	0.60	1,515	1,725	ECM	0.25	120/1/60	15	8	67	1,2,4,6	E,G,H,I,J,M,N,Q
PV10	OZONE	COOK	GNVF-180	GREENHECK, TWIN CITY	CENTRIFUGAL INLINE CABINET	EXHAUST	DIRECT	EC	7.63	BACKDRAFT	-	250	0.35	1,572	1,675	ECM	0.13	120/1/60	15	7	17	1,2,5	A,B,D,E,F,S
PV11	3RD FLOOR CFS REST.	COOK	GNVF-180	GREENHECK, TWIN CITY	CENTRIFUGAL INLINE CABINET	EXHAUST	DIRECT	EC	7.63	BACKDRAFT	-	100	0.35	1,058	1,675	ECM	0.13	120/1/60	15	3	17	1,2	-

NOTES:
1 REFER TO SPECIFICATIONS FOR FURTHER INFORMATION.
2 UNIT TO RUN ON SCHEDULE. REFER TO CONTROL SEQUENCE FOR ADDITIONAL INFORMATION.
3 UNIT TO RUN ON WALL SWITCH AND INTERLOCK WITH ASSOCIATED AHU. REFER TO CONTROL SEQUENCE FOR ADDITIONAL INFORMATION.
4 REPLACES EXISTING FAN IN SAME LOCATION; SAME VOLTAGE IS USED, VERIFY SIZE DIFFERENCES AND ADJUST CONNECTIONS AS NEEDED.
5 ALTERNATE #2 ONLY.
6 ALTERNATE #4 ONLY.
7

ACCESS:
A COATING: NO COAT - GALVANIZED STEEL
B SERVICE SWITCH: PLUG DISCONNECT
C SPEED CONTROL: FAN MOUNTED CONTROLLER (GEMINI)
D ISOLATOR: GEMINI ISOLATOR KIT
E UL 705 - POWER VENTILATOR
F INTEGRAL BACKDRAFT DAMPER
G SPEED CONTROL: FAN MOUNTED CONTROLLER
H SERVICE SWITCH: NEMA 1, LOOSE
I BIRD SCREEN - ALUMINUM
J HURRICANE RATED CURB / ADAPTER CURB
K ORIFICE PLATE 91
L STAINLESS STEEL HARDWARE
M DAMPER: MOTORIZED BACKDRAFT DAMPER
N COATING: LORENIZED
O CURB: RCG 18
P SPEED CONTROL: TYPE M1 INTERNAL CONTROL
Q CURB: RCG 16
R ISOLATOR: SC-35 SET(4)
S SPEED CONTROL: TYPE P1 INTERNAL CONTROL

DUCT MOUNTED HEATING COIL

DRAWING CODE	SERVING UNIT	BOD MFR	MODEL	ALTERNATE APPROVED MFRS	PERFORMANCE						CONSTRUCTION							UNIT DIMENSIONS					OPERATING WEIGHT (LBS.)	NOTES	ACCESS
					CAPACITY (MBH)	SUPPLY AIR (CFM)	EAT (°F)	LAT (°F)	AIR PD (FT. H20)	FACE VEL. (FPM)	SYSTEM TYPE	ROWS	TUBE MATERIAL	TUBE WALL THICKNESS (IN.)	FIN SPACING (FINS/FT)	FIN MATERIAL	FIN TYPE	COIL FACE AREA (SF)	NOM. COIL HEIGHT (IN.)	FINNED LENGTH (IN.)	LENGTH (IN.

ROOFTOP UNIT SCHEDULE

DRAWING CODE	UNIT LOCATION	BOD MFR	BOD MODEL	ALTERNATE APPROVED MFRS (SEE NOTE 10)	SYSTEM TYPE	AIRFLOW CONDITIONS SA	SA ESP (IN. WG.)	MAX OA	MIN OA	RA	SUPPLY FAN QTY	TYPE	AIRFLOW	TOTAL ESP (IN. WG.)	RPM	HP	BHP	MOTOR HEAT	TOTAL ESP (IN.WG.)	CHILLED WATER COIL AIRFLOW MAX	EAT (db)	EAT (wb)	LAT (db)	LAT (wb)	SENS CAP (MBH)	TOTAL CAP (MBH)	EWT	LWT	FLOW (GPM)	TOTAL CAP (TON)	WPD (FT. H20)	PIPE CONN. (IN)	PREHEAT AND/OR REHEAT COIL COIL POSITION (SEE NOTE 9)	AIRFLOW	EAT	LAT	EWT	LWT	FLOW (GPM)	TOTAL CAP (MBH)	WPD (FT. H20)	PIPE CONN. (IN)	FILTERS PRE FILTERS SA & EA	FINAL FILTERS SA	ELECTRICAL POWER SUPPLY (V/PH/HZ)	UNIT FLA (A)	MCA (A)	MOCP (A)	LSS EMERG. BACKUP	EST. WEIGHT (LBS)	OCCUP. CONTROL METHOD	NOTES	ACCESS
RTU-01	N.E. SHARK ROOF	ANNEXAIR	AHU-E-03-C-H	TRANE, PETRA, CAHS	4-PIPE CAV	3,690	1.5	610	-	3,080	2	PLUG	1,845	4.91	2,734	4.14	3.76	5.26	4.91	3,690	79.0	64.6	53.0	52.2	106	135	44	54	27.0	11.3	20.0	1.5	REHEAT	3,690	50.0	75.0	120	100	10.0	102.0	10.0	1	2" MERV 10	4" MERV 15	460/3/60	16.0	18.0	25	YES	2,800	24 HR	1 - 8, 10	A - F
RTU-02	CENTER SHARK ROOF	ANNEXAIR	AHU-E-07-C-H	TRANE, PETRA, CAHS	4-PIPE CAV	8,295	1.5	1,025	185	7,270	3	PLUG	2,765	4.91	2,338	4.88	4.44	4.27	4.91	8,295	78.6	67.2	52.7	51.8	237	387	44	54	77.0	32.3	20.0	2	REHEAT	8,295	50.0	75.0	120	100	23.0	229.0	10.0	1.25	2" MERV 10	4" MERV 15	460/3/60	25.0	27.0	35	YES	4,500	24 HR	1 - 8, 10	A - F
RTU-03	S.E. SHARK ROOF	ANNEXAIR	AHU-E-02-C-H	TRANE, PETRA, CAHS	4-PIPE CAV	1,820	1.5	540	220	1,280	2	PLUG	910	4.91	2,735	2.19	1.99	6.06	4.91	1,820	81.6	69.0	53.0	52.5	58	94	44	54	19.0	7.9	20.0	1.25	REHEAT	1,820	50.0	75.0	120	100	5.0	51.0	10.0	3/4	2" MERV 10	4" MERV 15	460/3/60	9.0	10.0	15	YES	2,500	24 HR	1 - 8, 10	A - F
RTU-04	S.W. SHARK ROOF	ANNEXAIR	AHU-E-07-H-C-H	TRANE, PETRA, CAHS	4-PIPE VAV	6,510	1.5	2,230	2,300	4,280	2	PLUG	3,255	5.13	2,323	7.74	7.04	5.69	5.13	6,510	80.9	69.9	51.1	50.5	214	390	44	54	78.0	32.5	20.0	2	PRE / REHEAT	2230 / 6510	23.0 / 50.0	50.0 / 75.0	120	100	7.0 / 18.0	67.0 / 180.0	10.0 /10.0	.75 / 1.25	2" MERV 10	4" MERV 15	460/3/60	22.0	25.0	35	NO	4,600	DCV	1 - 10	A - F

NOTES:
1 REFER TO SPECIFICATIONS FOR FURTHER INFORMATION.
2 AIRFLOW IN CFM; TEMPERATURES IN °F
3 COIL, DRAIN AND MOTOR SIDE ACCESS TO BE FIELD CONFIRMED PRIOR TO SUBMITTING FOR APPROVAL.
4 MAX COIL FACE VELOCITY SHALL NOT EXCEED SCHEDULED VALUES.
5 ALL CONTROLS SENSORS, ACTUATORS AND WIRING PROVIDED AND INSTALLED BY DDC CONTRACTOR.
6 REFER TO PLANS AND SECTION FOR UNIT ARRANGEMENTS.
7 FAN SHALL BE DIRECT DRIVE PLENUM TYPE (VFD FACTORY INSTALLED), ONE SPEED CONTROLLER PER FAN. SEE EQUIPMENT SCHEDULE FOR SIZES AND QUANTITIES.
8 N+1 FAN REDUNDANCY WITH BACKDRAFT DAMPERS.
9 CONSTRUCTION TYPE: BIOCOMPOSITE
10 ALTERNATE # - ALTERNATE ROOFTOP UNIT CONSTRUCTION: AS AN ALTERNATE TO THE BIOCOMPOSITE RTU, MANUFACTURERS MAY PROVIDE AN ALUMINUM CONSTRUCTION UNIT THAT MEETS SPECIFIED CORROSION RESISTANT REQUIREMENTS; FOR THE SAKE OF THE PRICING PACKAGE SUBMITTAL HERE ARE SOME REQUIREMENTS
(10.1) MINIMUM MARINE GRADE ALUMINUM OR EQUIVALENT FOR ALL EXTERIOR PANELS AND STRUCTURAL COMPONENTS
(10.2) FACTORY APPLIED ELECTRO-DEPOSITION OR PHENOLIC COATING ON ALL COOLING AND HEATING COILS
(10.3) 316 STAINLESS STEEL OR NON-CORROSIVE COATED FASTENERS THROUGHOUT
(10.4) EXTERIOR COATINGS MUST BE HIGH-PERFORMANCE EPOXY OR POLYURETHANE BASED WITH A MINIMUM OF 5,000 HOUR SALT SPRAY RATING (ASTM B117), IF A HIGHER RATED COATING IS AVAILABLE, INCLUDE THE ASSOCIATED COST INCREASE AS A SEPERATE LINE ITEM IN THE SUBMITTAL.
(10.5) 2" DOUBLE WALL CONSTRUCTION. R13 MINIMUM

ACCESS:
A COOLING COIL SECTIONS SHALL BE PROVIDED WITH AN INSULATED, DOUBLE WALL, 316 STAINLESS STEEL DRAIN PAN WITH POSITVE DRAINAGE MEETING INDOOR AIR QUALITY (IAQ) IN ACCORDANCE WITH ASHRAE 62.1.
B COPPER COIL, ALUMINUM FIN, STAINLESS STEEL COIL CASING.
C PROVIDE FILTERS AS SPECIFIED, THREE SETS OF EACH TYPE. PROVIDE ONE SET IN UNIT, PROVIDE ONE SET FOR INSTALLATION AFTER SYSTEM IS BALANCED AND BUILDING IS CLEANED, AND ONE SET FOR TURN OVER TO OWNER.
D PROVIDE RETURN AIR AND OUTDOOR AIR DAMPERS. ALL DAMPERS INTERNAL TO AHUS SHALL BE ALL ALUMINUM CONSTRUCTION, ALL DAMPERS EXTERNAL TO THE UNIT MUST BE ALUMINUM OR SEACOAST-RATED, MOTORIZED AND INTEGRATED WITH UNIT CONTROLS.
E HINGED ACCESS DOORS, MOTOR SIDE ONLY.
F PROVIDE MARINE LIGHTS AND GFI RECEPTACLE FACTORY-POWER BY UNIT TRANSFORMER.

INDOOR AIR HANDLER SCHEDULE

DRAWING CODE	AREA SERVED	BOD MFR	MODEL	ALTERNATE APPROVED MFRS	CONFIGURATION	COOLING COIL TOTAL CAP (MBH)	SENSIBLE CAP (MBH)	EAT (°F db)	EAT (°F wb)	LAT (°F db)	LAT (°F wb)	EWT (°F)	LWT (°F)	FLOW (GPM)	COIL PD (FT. H2O)	PREHEAT / REHEAT COIL COIL POS. PH	COIL POS. RH	CAP (MBH)	FAN SECTION EAT (°F)	LAT (°F)	EWT (°F)	LWT (°F)	FLOW (GPM)	COIL PD (FT. H2O)	SUPPLY AIR (CFM)	OUTSIDE AIR (CFM)	ESP (IN.H20)	MOTOR QTY	MOTOR (W)	MOTOR (HP)	VOLTAGE (V/PH/HZ)	MCA (A)	MOCP (A)	UNIT DIMENSIONS LENGT H (IN.)	WIDTH (IN.)	HEIGHT (IN.)	OPERATING WEIGHT (LBS.)	LSS EMERGENCY POWER	FILTER	NOTES	ACCESS
FCU-01	E204 - OZONE	TRANE	FCDB120	DAIKIN, IEC	4-PIPE, HORIZ. CAB.	35.0	26.8	76.9	64.1	53.4	52.7	44.0	55.6	6.0	11.4	-	RH	14.8	60.4	73.4	120.0	100.2	1.5	1.0	1,050	210	0.00	1	277	-	120/1/60	6.1	15	83.0	26.0	10.0	218	YES	1" MERV 13	1 - 9	-
FCU-02	E303 - FRACTIONATORS	TRANE	FCDB060	DAIKIN, IEC	4-PIPE, HORIZ. CAB.	11.5	11.5	74.8	45.8	53.8	34.9	44.0	55.4	2.0	2.1	-	RH	5.6	69.5	79.8	120.0	105.0	0.8	0.2	505	-	0.00	1	110	-	120/1/60	3.9	15	58.0	26.0	10.0	155	YES	1" MERV 13	1 - 9	-
FCU-03	E306 - OFFICES	TRANE	BCHE024	DAIKIN, IEC	4-PIPE, HORIZ.	29.2	16.2	81.5	69.8	52.1	50.9	44.0	54.0	6.0	6.4	-	RH	24.2	50.8	95.6	120.0	101.3	2.5	3.2	500	200	0.50	1	-	.5	120/1/60	9.3	15	53.7	39.0	17.0	226	NO	2" MERV 13	1 - 8,10	-
FCU-04	148 - HUSBANDRY	TRANE	BCVE036	DAIKIN, IEC	4-PIPE, VERT./FRONT RET	34.9	21.9	76.6	65.6	51.8	50.9	44.0	53.6	7.5	4.5	-	RH	31.1	55.0	90.7	120.0	102.8	3.5	0.6	805	85	0.50	1	-	.5	120/1/60	9.3	15	23.0	29.8	49.9	244	YES	2" MERV 13	1 - 8,10	-
FCU-05	R208B - CLASSROOM	TRANE	BCVE024	DAIKIN, IEC	4-PIPE, VERT.	41.6	21.6	84.7	72.7	53.5	52.2	44.0	54.1	8.5	11.0	-	RH	26.9	44.3	84.0	120.0	99.5	2.5	0.5	625	340	0.50	1	-	.5	120/1/60	9.3	15	19.5	29.8	45.9	204	NO	2" MERV 13	1 - 8,10	-
FCU-06	R208A - CLASSROOM	TRANE	BCVE024	DAIKIN, IEC	4-PIPE, VERT.	40.0	20.6	85.1	73.1	53.1	51.9	44.0	54.3	8.0	9.9	-	RH	26.3	42.9	84.7	120.0	99.9	2.5	0.5	580	330	0.50	1	-	.5	120/1/60	9.3	15	19.5	29.8	45.9	204	NO	2" MERV 13	1 - 8,10	-
FCU-07	114A - FW HUSBANDRY	TRANE	BCHE054	DAIKIN, IEC	4-PIPE, HORIZ.	43.2	37.6	76.3	62.3	53.0	52.0	44.0	54.7	8.5	2.1	-	RH	32.7	55.0	75.5	120.0	102.6	3.5	0.6	1,470	125	0.50	1	-	1	120/1/60	16.6	25	59.9	46.0	18.0	337	YES	2" MERV 13	1 - 8,10,12	-
FCU-08	R210 - SUPPORT	TRANE	BCVE036	DAIKIN, IEC	4-PIPE, VERT.	51.9	29.4	80.9	69.5	52.9	52.0	44.0	54.1	10.5	8.2	-	RH	33.0	56.8	88.9	120.0	102.0	3.5	0.6	950	260	0.50	1	-	.5	120/1/60	9.3	15	23.0	29.8	49.9	244	YES	2" MERV 13	1 - 8,10	-
FCU-09	E113 - MECH.	TRANE	BCHE072	DAIKIN, IEC	4-PIPE, HORIZ.	56.8	56.8	76.7	46.8	50.4	33.0	44.0	54.5	11.5	4.2	-	RH	45.6	55.0	76.0	120.0	101.3	4.5	1.0	1,900	-	0.50	1	-	1.5	460/60/3	4.1	15	59.9	58.0	18.0	424	YES	2" MERV 13	1 - 8,10	-
FCU-10	R131 - CFS EXHIBIT	TRANE	BCVE060	DAIKIN, IEC	4-PIPE, VERT./FRONT RET	63.8	45.0	74.3	63.3	52.7	51.7	44.0	54.3	13.0	7.9	-	RH	67.6	54.0	86.9	120.0	100.2	6.5	1.3	1,900	-	0.75	1	-	1.5	460/60/3	4.1	15	27.5	34.8	58.6	372	NO	2" MERV 13	1 - 8,10	-
FCU-11	E102A - CLASSROOM	TRANE	BCVE024	DAIKIN, IEC	4-PIPE, VERT.	33.0	16.7	84.6	73.1	51.9	50.8	44.0	54.4	6.5	6.8	-	RH	21.5	43.0	86.1	120.0	99.3	2.0	0.4	460	265	0.50	1	-	.5	120/1/60	9.3	15	19.5	29.8	45.9	204	NO	2" MERV 13	1 - 8,10	-
FCU-12	E102B - CLASSROOM	TRANE	BCVE024	DAIKIN, IEC	4-PIPE, VERT.	33.0	16.6	84.4	73.1	51.9	50.8	44.0	54.4	6.5	6.8	-	RH	21.5	43.0	86.1	120.0	99.3	2.0	0.4	460	265	0.50	1	-	.5	120/1/60	9.3	15	19.5	29.8	45.9	204	NO	2" MERV 13	1 - 8,10	-
FCU-13	E103B - STORAGE	TRANE	FCCB020	DAIKIN, IEC	4-PIPE, HORIZ. CONC.	3.8	3.2	74.9	62.2	52.5	51.9	44.0	54.0	0.8	1.3	-	RH	3.1	57.0	79.2	120.0	111.6	0.8	0.1	130	-	0.25	1	42	-	120/1/60	2.8	15	32.7	25.0	10.0	81	NO	1" MERV 13	1 - 8,10	-
FCU-14	E101 - AMB. ANIMALS	TRANE	BCVE072	DAIKIN, IEC	4-PIPE, VERT.	138.2	63.4	91.5	78.9	52.1	51.2	44.0	55.9	23.5	15.2	PH	-		23.0		120.0				1,440	1,440	1.00	1	-	1	460/60/3	3.1	15	54.6	58.0	53.8	500	YES	2" MERV 13	1,2,3,5,6,7,8,10,11	-
FCU-15	E104 - CATERING...	TRANE	BCVE024	DAIKIN, IEC	4-PIPE, VERT.	19.7	11.5	82.1	69.2	50.9	49.9	44.0	54.1	4.0	2.9	-	RH	10.3	50.8	79.2	120.0	100.4	1.0	0.3	335	100	0.50	1	-	.5	120/1/60	9.3	15	19.5	29.8	45.9	200	NO	2" MERV 13	1 - 8,10	-
FCU-16	E105 - SALT STORAGE	TRANE	BCVE036	DAIKIN, IEC	4-PIPE, VERT.	30.6	20.0	75.7	64.7	51.7	50.7	44.0	53.7	6.5	3.5	-	RH	30.0	55.0	91.7	120.0	103.4	3.5	0.6	755	55	0.50	1	-	.5	120/1/60	9.3	15	23.0	29.8	49.9	244	NO	2" MERV 13	1 - 8,10	-
FCU-17	R106 - WORKSHOP	TRANE	BCVE024	DAIKIN, IEC	4-PIPE, VERT.	22.3	14.4	78.6	66.3	52.5	51.3	44.0	54.3	4.5	3.6	-	RH	19.2	50.3	95.1	120.0	105.3	2.5	0.5	500	105	0.50	1	-	.5	120/1/60	9.3	15	19.5	29.8	45.9	204	NO	2" MERV 13	1 - 8,10	-
FCU-18	R107 - NECROPSPY	TRANE	BCVE024	DAIKIN, IEC	4-PIPE, VERT.	38.1	17.9	93.0	79.0	50.9	49.8	44.0	54.3	7.5	8.8	PH	-		23.0		120.0				380	380	0.50	1	-	.5	120/1/60	9.3	15	19.5	29.8	45.9	200	NO	2" MERV 13	1,2,3,5,6,7,8,10,11	-
FCU-19	E112 - MEN	TRANE	BCHE036	DAIKIN, IEC	4-PIPE, HORIZ.	57.2	26.9	93.0	79.0	49.2	48.2	44.0	54.5	11.0	9.9	PH	-		23.0		120.0				550	550	0.80	1	-	.5	120/1/60	9.3	15	56.7	42.0	17.0	292	NO	2" MERV 13	1,2,3,5,6,7,8,10,11	-
FCU-20	R213 - TOUCH TANK...	TRANE	BCVE024	DAIKIN, IEC	4-PIPE, VERT.	22.3	15.7	77.0	64.5	53.3	51.9	44.0	54.4	4.5	3.6	-	RH	21.2	55.0	87.4	120.0	100.0	2.0	0.4	605	85	0.50	1	-	.5	120/1/60	9.3	15	19.5	29.8	45.9	204	NO	2" MERV 13	1 - 8,10	B
FCU-21	R205 - LIBRARY / CONF...	TRANE	BCVE036	DAIKIN, IEC	4-PIPE, VERT.	44.5	25.6	79.3	68.3	52.6	51.6	44.0	54.2	9.0	6.3	-	RH	30.9	54.4	87.2	120.0	100.2	3.0	0.4	870	280	0.50	1	-	.5	120/1/60	9.3	15	23.0	29.8	49.9	244	NO	2" MERV 13	1 - 8,10	-
FCU-22	R110 - CORRIDOR	TRANE	BCVE024	DAIKIN, IEC	4-PIPE, VERT.	22.9	14.5	79.0	66.7	52.6	51.4	44.0	54.5	4.5	3.6	-	RH	12.5	55.0	78.0	120.0	101.5	1.3	0.4	500	120	0.50	1	-	.5	120/1/60	9.3	15	19.5	29.8	45.9	200	NO	2" MERV 13		-
FCU-23	R106B - CNC/3D...	TRANE	FCCB030	DAIKIN, IEC	4-PIPE, HORIZ. CONC.	7.6	7.0	74.9	61.6	53.4	52.6	44.0	54.1	1.5	4.3	-	RH	3.9	65.0	77.0	120.0	112.2	1.0	0.2	300	-	0.25	1	113	-	120/1/60	2.8	15	32.7	25.0	10.0	81	NO	1" MERV 13		
FCU-24	147 - CONCESSION	TRANE	BCVE024	DAIKIN, IEC	4-PIPE, VERT.	25.2	16.1	77.8	66.2	53.4	52.2	44.0	54.6	5.0	4.3	-	RH	20.8	61.2	93.3	120.0	104.3	2.5	0.5	600	105	0.50	1	-	0.5	120/1/60	9.3	15	19.5	29.8	45.9	204	NO	2" MERV 13		
AHU-07	R123 - MAIN LOBBY	TRANE	BCVE090	DAIKIN, IEC	4P, HORIZ. MULT. VAV	131.5	74.0	80.4	69.3	53.5	52.4	44.0	54.1	27.0	7.7	-	-								2,490	855	1.50	1	-	3.0	460/60/3	6.9	15	60.8	48.0	66.7	574	NO	2" MERV 13		A

NOTES:
1 REFER TO SPECIFICATIONS FOR FURTHER INFORMATION.
2 PROVIDE FACTORY INSTALLED DISCONNECT SWITCH.
3 PROVIDE ECM FAN MOTOR.
4 PROVIDE HEATING COIL IN REHEAT POSITION.
5 PROVIDE STAINLESS STEEL DRAIN PAN WITH WATER-LEVEL DETECTION DEVICE CONFORMING TO UL 508 IN ACCORDANCE WITH NCMC DECTION 307.2.3.
6 CONTROL VALVE SUPPLIED BY CONTROLS CONTRACTOR.
7 DOUBLE WALL PANELS
8 CABINET AND COILS FIELD COATED
9 PROVIDE 1" MERV 13 FILTER WHERE RETURN GRILLE NOT PROVIDED WITH FILTER GRILLE.
10 PROVIDE 2" MERV 13 FILTER WHERE RETURN GRILLE NOT PROVIDED WITH FILTER GRILLE.
11 UNIT INCLUDES AN INTERNAL PREHEAT COIL AND A DUCT-MOUNTED REHEAT COIL.
12 INCLUDED IN ALTERNATE ONLY

ACCESS:
A DUCT SMOKE DETECTOR INSTALLED IN RETURN AIR DUCT.
B 120V CONDENSATE PUMP

SINGLE DUCT VAV TERMINAL BOX SCHEDULE

DRAWING CODE	BOD MFR	BOD MODEL	ALTERNATE APPROVED MFRS	PRIMARY AIRFLOW COOLING MAX (CFM)	COOLING MIN (CFM)	HEATING (CFM)	INLET DIA. (IN)	AIR PRESSURE DROP (IN H2O)	COOLING INLET VELOCITY (FPM)	HEATING COIL CAPACITY (MBH)	ROWS	EAT (°F)	LAT (°F)	EWT (°F)	FLOW (GPM)	WPD (FT H2O)	RUNOUT SIZE (SUP/RET) (IN)	NOISE CRITERIA DISCH (NC)	RAD (NC)	WEIGHT OPERATING (LBS.)	UNIT SERVED FROM	NOTES	ACCESS
VAV-07-1	TRANE	VCWF12	PRICE, IEC	960	750	750	12	0.33	1,222	29.0	3 ROW	55.0	90.6	120.0	3.0	0.66	7/8 / 7/8	34.0	23.0	58	AHU-7	1 - 7	A - D
VAV-07-2	TRANE	VCWF12	PRICE, IEC	1,300	635	635	12	0.53	1,655	25.2	3 ROW	55.0	91.5	120.0	2.5	0.48	7/8 / 7/8	35.0	24.0	58	AHU-7	1 - 7	A - D
VAV-07-3	TRANE	VCWF06	PRICE, IEC	285	160	160	6	0.33	1,452	6.6	3 ROW	55.0	92.9	120.0	0.5	0.28	7/8 / 7/8	31.0	21.0	30	AHU-7	1 - 7	A - D

NOTES:
1 REFER TO SPECIFICATIONS FOR FURTHER INFORMATION.
2 COIL CONNECTION AND CONTROL ENCLOSURE SHALL BE ON SAME SIDE OF THE UNIT.
3 REFER TO PIPING DIAGRAMS FOR CONTROL VALVE TYPE (2-WAY VS 3-WAY)
4 CONTROLS BY DDC CONTRACTOR.
5 A MINIMUM OF 2 DUCT DIAMETERS OF STRAIGHT-RUN DUCTWORK PRIOR TO INLET CONNECTION.
6 A MINIMUM OF 3 DUCT DIAMETERS OF STRAIGHT DUCT FROM THE DISCHARGE OF THE UNITS PRIOR TO ANY TAKE-OFFS OR TRANSITIONS.
7 INCLUDED IN ALTERNATE #2 ONLY

ACCESS:
A NON-FUSED DISCONNECT SWITCH, FACTORY INSTALLED BY VAV MANUFACTURER
B FACTORY-WIRED AND TAGGED HOT-WATER VALVE AND PIPING PACKAGE.
C CONTRACTOR SHALL PROVIDE 120 VAC TO 24 VAC TRANSFORMER TO POWER UNITS ALONG WITH WIRING FROM TRANSFORMER TO UNITS. REFER TO ELECTRICAL DRAWINGS FOR CIRCUIT LOCATION.
D 1" FOIL FACED INSULATION

LOUVER SCHEDULE

DRAWING CODE	BOD MFR	BOD MODEL	ALTERNATE APPROVED MFRS	TYPE	FRAME	DESCRIPTION	MATERIAL	LOUVER DEPTH (IN.)	SIZE (W x H) (IN.)	SERVICE	AIRFLOW (CFM)	PERFORMANCE RATINGS FREE AREA (SF)	FREE AREA VEL (FPM)	S.P. LOSS (IN. H20)	WATER PEN...	LOCATION	CONNECTED UNIT/S	NOTES	ACCESS
L1	RUSKIN	EME5625MDE	GREENHECK, VENT PRODUCTS	FIXED	STANDARD	VERTICAL, WIND-DRIVEN-RAIN-RESISTANT	ALUMINUM	5	120 X 120	EXHAU...	50,570	60.02	843	0.14	0.00	GEN, BLDG	GENERATOR 1	1	C
L2	RUSKIN	EME5625MDE	GREENHECK, VENT PRODUCTS	FIXED	STANDARD	VERTICAL, WIND-DRIVEN-RAIN-RESISTANT	ALUMINUM	5	120 X 120	EXHAU...	50,570	60.02	843	0.14	0.00	GEN, BLDG	GENERATOR 2	1	C
L3	RUSKIN	EME5625MDE	GREENHECK, VENT PRODUCTS	FIXED	STANDARD	VERTICAL, WIND-DRIVEN-RAIN-RESISTANT	ALUMINUM	5	16 X 16	EXHAU...	200				0.00	E306 - OFFICE	FCU-03	1,2,3,4,5	A
L4	RUSKIN	EME5625MDE	GREENHECK, VENT PRODUCTS	FIXED	STANDARD	VERTICAL, WIND-DRIVEN-RAIN-RESISTANT	ALUMINUM	5	16 X 16	EXHAU...	140				0.00		PV11	1,2,3,4,5	A
L5	RUSKIN	EME5625MDE	GREENHECK, VENT PRODUCTS	FIXED	STANDARD	VERTICAL, WIND-DRIVEN-RAIN-RESISTANT	ALUMINUM	5	16 X 16	EXHAU...	380	0.63	605	0.07	0.00	R106 WORKSHOP	PV7	1,2,3,4,5	A
L6	RUSKIN	EME5625MDE	GREENHECK, VENT PRODUCTS	FIXED	STANDARD	VERTICAL, WIND-DRIVEN-RAIN-RESISTANT	ALUMINUM	5	24 X 16	EXHAU...	550				0.00	E112 - MEN	PV3	1,2,3,4,5	A
L7	RUSKIN	EME5625MDE	GREENHECK, VENT PRODUCTS	FIXED	STANDARD	VERTICAL, WIND-DRIVEN-RAIN-RESISTANT	ALUMINUM	6	32 X 32	EXHAU...	1,440			0.06	0.00	E202 - CORAL MEZZ.	PV8	1,2,3,4,5	A
L10	RUSKIN	EME5625MDE	GREENHECK, VENT PRODUCTS	FIXED	STANDARD	VERTICAL, WIND-DRIVEN-RAIN-RESISTANT	ALUMINUM	5	120 X 120	INTAKE	54,740	60.02	912	0.17	0.00	GEN, BLDG	GENERATOR 1	1	C
L11	RUSKIN	EME5625MDE	GREENHECK, VENT PRODUCTS	FIXED	STANDARD	VERTICAL, WIND-DRIVEN-RAIN-RESISTANT	ALUMINUM	5	120 X 120	INTAKE	54,740	60.02	912	0.17	0.00	GEN, BLDG	GENERATOR 2	1	C
L13	RUSKIN	EME5625MDE	GREENHECK, VENT PRODUCTS	FIXED	STANDARD	VERTICAL, WIND-DRIVEN-RAIN-RESISTANT	ALUMINUM	5	24 X 16	INTAKE	550			0.05	0.00	E112 - MEN	FCU-19	1,2,3,4,5	A
L14	RUSKIN	EME5625MDE	GREENHECK, VENT PRODUCTS	FIXED	STANDARD	VERTICAL, WIND-DRIVEN-RAIN-RESISTANT	ALUMINUM	5	48 X 32	INTAKE	2,725	5.53	492	0.05	0.00	E202 - CORAL MEZZ.	FCU-05/08/11/12/14/15/16	1,2,3,4,5	A
L15	RUSKIN	EME5625MDE	GREENHECK, VENT PRODUCTS	FIXED	STANDARD	VERTICAL, WIND-DRIVEN-RAIN-RESISTANT	ALUMINUM	5	16 X 16	INTAKE	295	0.63	470	0.04	0.00	145 - MECH	FCU-04/17/24	1,2,3,4,5	A
L16	RUSKIN	EME5625MDE	GREENHECK, VENT PRODUCTS	FIXED	STANDARD	VERTICAL, WIND-DRIVEN-RAIN-RESISTANT	ALUMINUM	5	16 X 16	INTAKE	380	0.63	605	0.07	0.00	R106 - WORKSHOP	FCU-18	1,2,3,4,5	A
L17	RUSKIN	EME5625MDE	GREENHECK, VENT PRODUCTS	FIXED	STANDARD	VERTICAL, WIND-DRIVEN-RAIN-RESISTANT	ALUMINUM	5	16 X 16	INTAKE	280	0.63	470	0.06	0.00	R211A - NURSING	FCU-21	1,2,3,4,5	A
L18	RUSKIN	EME5625MDE	GREENHECK, VENT PRODUCTS	FIXED	STANDARD	VERTICAL, WIND-DRIVEN-RAIN-RESISTANT	ALUMINUM	5	16 X 16	INTAKE	330	0.63	470	0.07	0.00	R208A CLASSROOM	FCU-06	1,2,3,4,5	A

NOTES:
1 REFER TO SPECIFICATIONS FOR FURTHER INFORMATION.
2 AMCA 540 LISTED (IMPACT RESISTANCE)
3 AMCA 550 LISTED (WATER PENETRATION)
4 SEACOAST RATED FINISH AS SELECTED BY ARCHITECT FROM MANUFACTURER'S FULL RANGE OF COLOR AND GLOSS.
5 INTERLOCK WITH ASSOCIATED POWER VENTILATOR OR AHU/FCU

ACCESS:
A BIRD SCREENING (MATERIAL TO MATCH LOUVER MATERIAL)
B LOW-LEAK FAST ACTING GENSET CONTROL DAMPERS, 8 SECOND CYCLE, RUSKIN MODEL # CD50GS
C LOW-LEAK COASTAL ENVIRONMENT DAMPERS, RUSKIN MODEL #CD50CE

PACKAGED DEHUMIDIFIER SCHEDULE

DRAWING CODE	BOD MFR	BOD MODEL	ALTERNATE APPROVED MFRS	DEHUMID. CAPACITY @ 80°F/60%RH (PINTS/DAY)	INDOOR SECTION FAN SA (CFM)	OA (CFM)	ESP (IN H2O)	ELECTRICAL VOLTAGE (V/PH/HZ)	MCA (A)	MOCP (A)	WEIGHT (LBS)	NOTES	ACCESS
D1	SANTA-FE	COMPACT 70	APRILAIRE, QUEST	70.0	150	-	0.00	120/1/60	3.7	15	55	1,2,3,4,5	A
D2	SANTA-FE	OASIS 105	APRILAIRE, QUEST	100.0	320		0.00	120/1/60	5.6	15	81	1,2,3,4,6	A

NOTES:
1 REFER TO SPECIFICATIONS FOR FURTHER INFORMATION.
2 9' CORD PLUGS INTO DEDICATED DUPLEX OUTLET.
3 WALL MOUNT OR SUSPEND

Sequence of Operation: CHILLER HEATER SYSTEM

System General Description:

The chiller-heater plant control system shall monitor and control the system's air to water heat pump(s), pump(s), control valves, and any other equipment as shown on the chiller-heater plant flow diagram, in the chiller-heater plant points list and as detailed in the sequence of operation listed below.

The chiller-heater plant system consists of Air to Water Heat Pumps (AWHPs) with its piping configuration arranged as a primary-secondary dual-feed modular system supplying chilled water and hot water to the facility.

The manifolded water distribution pumps are configured as lead / lag control.

Chiller-Heater System Enable/Disable:

The chiller-heater plant shall be enabled/disabled by the chiller-heater plant controller as requested by the Building Automation System (BAS) operator interface panel or the BAS time of day schedule. The chiller-heater plant control system shall start and stop the water pumps and AWHPs based upon system cooling and heating loads.

When the chiller-heater plant is enabled and there is a call for cooling or heating as determined by the BAS, the system shall send an enable signal to the lead AWHP. Upon receiving the enable signal the AWHP shall send a water pump request signal to the control system to enable the water pumping sequence.

When the chiller-heater plant is enabled, the system shall respond to an AWHP water pump request from any system AWHP. The system shall then open the isolation valves associated to each operation mode, once valve fully open status is proven then it shall start the primary pumps associated to each AWHP. Units shall run after confirming evaporator water flow, differential-to-start and all required internal processes and delay timers. As additional AWHPs make water pump requests, open the associated water isolation valves and enable the associated water pump to start.

Secondary pumps shall be enabled if any primary pump is running or the BAS point to enable the water system to be turned on.

The chiller-heater plant is disabled based on the heating and cooling load requirements. When the plant is disabled, the dedicated water pumps shall be commanded off and the chiller-heater isolation valves shall be closed.

Chiller-Heater Isolation Valves Control:

The AWHP isolation valves shall be controlled and arranged to prevent complete chiller fluid pressure isolation of a chiller-heater from the rest of the system. Supply side isolation valves shall operate as two position Open/Close valves according to the AWHP's mode of operation. Return isolation valves shall operate as a three-position Open/Close/Standby control device, depending on the AWHP's mode of operation. Valves shall operate as follows:

If the chiller-heater plant is enabled, and the AWHP are enabled to run in any mode, the supply and return isolation valves shall be open for that mode of operation and closed for the non-operation mode. If the AWHP is not running, supply side cooling and heating valves shall be closed. Cooling return isolation valve shall be closed, while heating return isolation valve shall be at the standby position of 20% open (adj.) to prevent complete fluid isolation in the AWHP.

If the plant is disabled, all isolation valves shall be closed.

Chiller-Heater Primary Water Pump Commands:

When the chiller-heater system is enabled, the BAS controller shall start the corresponding heat pump primary water pump through a contact closure of the pumps VFD run-enable contacts.

The BAS controller shall detect water pump run status by a VFD current switch.

Chiller-Heater Primary Water Pump Failure:

If the pump start/stop relay is enabled and the current switch status is off for more than 30 seconds (adj.), the BAS controller shall annunciate a water pump failure alarm to the BAS and start the next pump in the lead/standby sequence when multiple dedicated primary pumps are provided.

Once the problem has been corrected, the operator shall be able to clear the alarm failure from a BAS operator interface or by manually overriding the pump on momentarily. This shall re-enable the pump lead/standby sequence when multiple dedicated primary pumps are provided.

Chiller-Heater Primary Water Pump Speed:

The Chiller-Heater primary water system is designed to run at a constant flow rate. The design flow rate setpoints could be different based on the mode of operation of each unit (Heating or Cooling). The BAS controller shall load a pre-determined pump speed setpoint according to water plant design and mode of operation. Mode of operation flow rates and pump speeds shall be determined and confirmed by the project engineer or commissioning agent during system startup.

Secondary Chilled Water Distribution Pump Commands:

When the chiller-heater plant system is enabled and there is a call for cooling as determined by the BAS, the BAS controller shall start a secondary chilled water pump through a contact closure of the pumps VFD run-enable contacts.

The BAS controller shall detect secondary chilled water pump run status by a VFD current switch.

The secondary chilled water pump(s) lead/lag sequence shall be rotated on a weekly schedule. The rotation sequence shall be based on calculated run time with the pump having the least run time designated as lead, the pump with the next lowest run time will be the second in the sequence (or lag pump) and so on. From the BAS operator interface, an operator shall be able to manually change the lead/lag sequence or request any pump to be unavailable which would remove it from the rotation sequence.

If the chilled water system differential pressure falls 0.5 psid (adj.) below setpoint and the lead pump is at 100% (adj.) for more than 5 minutes (adj.), the next pump in the sequence shall start. If the pump speed control output is below 65% (adj.) for more than 5 minutes (adj.), the last operating pump in the sequence shall be disabled.

Secondary Chilled Water Distribution Pump Failure:

If the lead start/stop relay is enabled and the current switch status is off for more than 30 seconds (adj.), the system shall annunciate a secondary chilled water pump failure alarm to the BAS and start the next pump in the sequence. Once the problem has been corrected, the operator shall be able to clear the alarm failure from the BAS operator interface or by manually overriding the pump on. This shall re-enable the lead/lag sequence.

Secondary Chilled Water Pump Speed Pressure Control:

The BAS controller shall monitor the chilled water system differential pressure sensor. When the pump variable speed drive is enabled, the BAS controller shall control the analog speed signal that is sent to the variable speed drives of operating pumps to initially maintain a water system differential pressure setpoint of 15.0 psid (adj.).

Secondary Hot Water Distribution Pump Commands:

When the chiller-heater plant is enabled and there is a call for heating as determined by the BAS, the BAS controller shall start a secondary hot water pump through a contact closure of the pumps VFD run-enable contacts.

The BAS controller shall detect secondary hot water pump run status by a VFD current switch.

The secondary hot water pump(s) lead/lag sequence shall be rotated on a weekly schedule. The rotation sequence shall be based on calculated run time with the pump having the least run time designated as lead, the pump with the next lowest run time will be the second in the sequence (or lag pump) and so on. From the BAS operator interface, an operator shall be able to manually change the lead/lag sequence or request any pump to be unavailable which would remove it from the rotation sequence.

If the hot water system differential pressure falls 0.5 psid (adj.) below setpoint and the lead pump is at 100% (adj.) for more than 5 minutes (adj.), the next pump in the sequence shall start. If the pump speed control output is below 65% (adj.) for more than 5 minutes (adj.), the last operating pump in the sequence shall be disabled.

Secondary Hot Water Distribution Pump Failure:

If the lead start/stop relay is enabled and the run status is not present for more than 30 seconds (adj.), the system shall annunciate a secondary hot water pump failure alarm to the BAS and start the next pump in the sequence. Once the problem has been corrected, the operator shall be able to clear the alarm failure from the BAS operator interface or by manually overriding the pump on. This shall re-enable the lead/lag sequence.

Secondary Hot Water Pump Speed Pump Pressure Control:

The BAS controller shall monitor the hot water system differential pressure sensor. When the pump variable speed drive is enabled, the BAS controller shall control the analog speed signal that is sent to the variable speed drives of operating pumps to initially maintain a water system differential pressure setpoint of 15.0 psid (adj.).

Secondary Chilled Water and Hot Water Pump Pressure Setpoint Optimization:

The BAS shall continually monitor the position of all chilled and hot water valves in the water system.

At water system startup, the water system pressure setpoint shall be set 100% of the maximum pressure setpoint.

The setpoint control shall be based on ASHRAE Guideline 36 "Trim and Respond Logic". At a frequency of once every 10 minutes (adj), the control system shall calculate requests for cooling or heating based on the criteria shown below:

- The unit has been in a determined mode of operation for more than 15 minutes (adj.)

- Every valve serving non-critical areas that are open more than 95% represents 1 request (adj.) and 0 request when the valve closes to less than 70%.

- Valve serving critical loads can send 2 requests (adj.) if it is open more than 95% and send 1 request if the valve is between 80% and 95% and send a 0 request when the valve closes to less than 65%.

The BAS shall default to ignoring the first 2 requests (adj). (Note: At startup set Ignore value to at least 40% of the number of AHUs served).

When (Requests > Ignores) the system shall respond by adjusting the chilled water pump differential pressure setpoint upward by ((Requests — Ignores) * (3) psi) (adj), but no larger than 10 psi (adj). When requests are equal to, or less than ignores, the setpoint shall be reset downward by 2 psi (adj).

Tempering Valve Operation:

When in heating mode, the BAS controller shall modulate the tempering valve open to maintain the AWHP entering water temperature higher than the low limit setpoint of 70.0 deg F. (adj.).

When in cooling mode, the BAS controller shall modulate the tempering valve open to maintain the AWHP entering water temperature lower than the high limit setpoint of 68.0 deg F. (adj.).

Chiller-Heater Plant Cooling Mode:

COOLING ADDITION SEQUENCE:

Upon a cooling request, if the system does not already have a unit running in cooling mode (i.e., it is an initial start in that mode for the day) the BAS controller shall monitor the AWHP leaving water temperature for a period of 5 minutes (adj.) prior to enabling the AWHP. If the AWHP leaving temperature is below 68.0 deg. F (adj.), the BAS controller shall enable the AWHP in cooling mode. If the AWHP leaving temperature is above 68.0 deg. F (adj.), the BAS shall modulate the tempering valve to a pre-defined start position (adj.) before enabling the AWHP to run in cooling mode. Tempering valve pre-defined position shall be linearly determined from 0% to 100% open when the entering water temperature rises from 68.0 deg. F (adj.) to 80.0 deg. F (adj.) v

When the AWHP unit is commanded to run in cooling mode, isolation valves associated to this mode of operation shall modulate open over a stroke time of 240 seconds (adj.). When AWHP cooling mode isolation valves are in the fully open position, the AWHP water pump shall be started and operate continuously per its sequence. Once the water flow is proven in the AWHP by its control panel, the AWHP shall begin producing 50.0 deg.F (adj.) water.

Once the lead AWHP is enabled, the add sequence of additional AWHP units shall be disabled for a period of 30 minutes (adj.). Additional AWHP are added if the system leaving water temperature is higher than the chilled water setpoint (adj.) plus a dead band of 2.5 deg. F (adj.) for more than 15 minutes (adj.) consecutively.

If there are units running in cooling mode and this is an add, the BAS shall demand limit the running unit to 80.0% (adj.)

COOLING SUBTRACTION SEQUENCE:

The BAS shall calculate the capacity of the running units and then compares it to the capacity after the next unit was to be subtracted. If the estimated plant capacity after subtraction is less than a subtract plant capacity setpoint (adj.) a subtract request is generated. Subtract plant capacity setpoint should be consistent with the current heating load and a safety factor (adj.).

The unit Isolation valve should close over a 90 second (adj.) period to limit flow transients and the potential for water hammer in the system.

In cooling mode, the shutdown process shall include a pump off delay (adj.) for primary pump(s) to maintain water flow after de-energizing the compressor.

AWHP unit shall remain enabled or disabled for minimum of 30 minutes (adj.) to avoid short cycling.

Chiller-Heater Plant Heating Mode:

HEATING ADDITION SEQUENCE:

Upon a heating request, if the system does not already have a unit running in heating mode (i.e., it is an initial start in that mode for the day) the BAS controller shall monitor the AWHP leaving water temperature for a period of 5 minutes (adj.) prior to enabling the AWHP. If the AWHP leaving temperature is above 65.0 deg. F (adj.), the BAS controller shall enable the AWHP in heating mode. If the AWHP leaving temperature is below 65.0 deg. F (adj.), the BAS shall modulate the tempering valve to a pre-defined start position (adj.) before enabling the AWHP to run in heating mode. Tempering valve pre-defined position shall be linearly determined from 0% to 100% open when the entering water temperature falls from 70.0 deg. F (adj.) to 55.0 deg. F (adj.)

When the AWHP unit is commanded to run in heating mode, isolation valves associated to this mode of operation shall modulate open over a stroke time of 240 seconds (adj.). When AWHP heating mode isolation valves are in the fully open position, the AWHP water pump shall be started and operate continuously per its sequence. Once the water flow is proven in the AWHP by its control panel, the AWHP shall begin producing 110.0 deg.F (adj.) water.

Once the lead AWHP is enabled, the add sequence of additional AWHP units shall be disabled for a period of 30 minutes (adj.). Additional AHWP shall be added if the hot water distribution system supply temperature falls 2.5 deg. F (adj.) below the hot water setpoint for a period of 15 minutes (adj.) consecutively.

If there are units running in heating mode and this is an add, the BAS shall send a "Unload Before Starting Command" to the running units.

HEATING SUBTRACTION SEQUENCE:

The BAS shall calculate the capacity of the running units and then compares it to the capacity after the next unit was to be subtracted. If the estimated plant capacity after subtraction is less than a subtract plant capacity setpoint (adj.) a subtract request is generated. Subtract plant capacity setpoint should be consistent with the current heating load and a safety factor (adj.). The unit supply heating Isolation valve should close over a 90 seconds (adj.) period to limit flow transients and the potential for water hammer in the system. Return heating isolation valve should modulate to its standby position of 20% (adj.) AWHP unit shall remain enabled or disabled for minimum of 30 minutes (adj.) to avoid cycling.

Hot Water Setpoint Reset:

The hot water supply temperature setpoint shall be linearly reset from 80.0 deg. F (adj.) to 140.0 deg. F (adj.) as the outside air temperature falls from 60.0 deg. F (adj.) to the AWHP lowest ambient operating temperature.

Simultaneous Heating and Cooling Modes:

Simultaneous heating and cooling requests can be generated during mild outside air temperatures. Mild outside temperature is limited by a cooling lockout setpoint (adj.) and heating lockout setpoint (adj.). AWHP units perform at high efficiency in the mild temperature range. Dominant and non-dominant modes of operation shall be identified by the BAS depending on the current cooling and heating load requests by monitoring all room space temperature readings and identifying the deviation from the desired setpoints.

Units shall run and rotate accordingly to the units staging sequence of operation.

If provided, the dedicated heat recovery unit (DHRU) shall run by its sequence to satisfy the non-dominant mode of operation. If the non-dominant mode is not fully satisfied by the DHRU, the BAS shall run the remaining AWHP for that mode of operation.

If a demand for additional heating occurs when all units are already operating, a cooling unit shall transition to heating to ensure the heating load is met.

AWHP units shall remain enabled or disabled for minimum of 30 minutes (adj.) to avoid short cycling.

Defrost Mode:

Defrost cycle shall be initiated periodically by the unit when the outdoor temperature is below 47.0 deg. F., to melt the unacceptable accumulation of ice on the refrigerant tubes. This results in heating interruption with sourcing of heat from the hydronic system during the defrost cycle.

BAS shall monitor the status of the chiller-heater's defrost mode signal. When the signal is detected then the chiller-heater unit is in defrost mode.

During a defrost mode, the BAS controller shall suspend all heating and cooling unit staging, and high/low temperature alarms for a period of the defrost cycle plus 15 minutes (adj.).

The heat pump tempering valve shall modulate fully closed, avoiding chilled water to mix back into the unit entering water stream.

Air to Water Heat Pump Units Staging:

The AWHP units shall operate in a lead/lag sequence, so that the last AWHP unit enabled is the first to be disabled. The water plant shall add and subtract AWHP units according to its sequence of operation.

When having unequal sized AWHP units, the swing unit (1/3 to 2/3 the size of the other units in the plant) shall run to satisfy the non-dominant mode of operation in simultaneous heating-cooling scenarios and shall run as a swing unit for cooling or heating only mode of operation.

The AWHP rotation sequence, and dedicated chillers rotation sequence shall be programmed to rotate at one of the following strategies. The specific rotation strategy preferred by the building operator will need to be communicated to the controls vendor for implementation prior system startup and commissioning.

NEVER: Units are not rotating, and the same sequence is always being used. (Operator manually rotates)

DAY OF WEEK: Units rotate on a user-specified day and time once per week.

FIXED NUMBER OF DAYS: Units rotate after a number of specific days elapsed.

RUN HOURS: Units rotate to attempt to even out the amount of time each unit runs.

ROTATION INPUT: Units rotate when a specific reference commands them to rotate.

From the optional BAS controller human-interface panel or a BAS workstation, an operator will be able to perform the following: 1) manually change the lead/lag sequence; 2) request any AWHP, or dedicated chiller if provided, to be unavailable which would remove it from the rotation sequence.

System Transition Alarm Suppression:

To avoid nuisance alarms when the system is transitioning between modes, temperature alarms shall be suspended for a period of 15 minutes (adj.) after a defrost cycle is started or an AWHP is transitioning its mode of operation. When an AWHP is commanded to run in heating mode, and the circuit starts after being idle for more than 30 mins, the temperature alarms for that unit shall be suspended for 10 minutes (adj.).

Dedicated Heat Recovery Unit (DHRU):

Dedicated heat recovery unit and DHRU pumps shall run during an adjustable period to pull down/up the system temperature at system start up prior to starting any AWHP or chiller in the water plant.

During normal system operation, if running in cooling mode and there is a call for heating, or if running in heating mode and there is a call for cooling, the BAS controller shall energize both DHRU circulation pumps, after confirming water flow through the hot water and cold water flow switches the BAS shall enable the DHRU, to meet the non-dominant heating or cooling call with recovered energy. If the non-dominant call is reversed, then the DHRU unit shall be disabled, and the DHRU circulation pumps shall be de-energized. If after a period of time (adj.) the non-dominant call is not satisfied the BAS shall enable the non-running AWHP to operate in the non-dominant mode.

Mode of Operation Transitions:

Heating mode:
Upon a heating call the water plant shall operate the Chiller-Heater to satisfy the heating load.
The system shall collect heat during scheduled heat collecting hours, if the ice level is higher than the ice level setpoint (adj.) plus a deadband. The system shall also collect heat when the building is in heating mode, the system is in heating dominant operation, and the ice level in the tanks is above 90.0%. The system will collect until the ice level is below 70%. This is to avoid running out of water and losing heating capacity when in heating operation. When the outdoor air temperature is below the full winter temperature setpoint of 20 deg F (adj.), the plant shall collect heat if the ice level is above 70%, with a 10% deadband. The heat collection method shall be selected based on the outside air temperature, so if the outside air temperature is higher than the AWHP minimum operational limit, the system shall use the AWHP in heating mode. Otherwise, the system shall use trickle-heater as the collection method. If during Chiller-Heater heating and heat collection mode the ice level rises above 95.0% (adj.), a low-capacity heating critical alarm shall be annunciated in the BAS. The system will terminate heat collection when the criteria for collecting heat are no longer met. If the ice level has not met the setpoint by the end of scheduled heat collection period, the system will generate an alarm at the BAS.

Simultaneous Heating/Cooling:
When operating in a single mode of operation and the BAS receives a call to operate in the opposite mode, the system controller shall command the plant to run and satisfy both the heating and cooling loads as indicated in the cooling only and heating only sequence of operation.
The TES shall be used as much as possible to satisfy the building load, maximizing TES heat recovery. When using TES energy to heat and cool (i.e. Chiller-Heaters and TES cooling), the system shall determine the dominant mode and operate the TES control valve and chilled water control valve as indicated in the simultaneous heating and cooling sequence.

Air-Side Economizer Enable/Disable:

PLEASE INSERT THE TES ICE LEVEL, SETPOINT, AND DEADBANDS GRAPHIC HERE.

AWHP Defrost:

During defrost, the AWHP tempering valve and trickle-heater shall operate to maintain a minimum allowed entering fluid temperature to the AWHP.

When the defrost starts, the AWHP tempering valve shall modulate open to recirculate water in the AWHP loop to temper the AWHP return water. If the AWHP tempering valve is fully open, and the AWHP return water temperature continues to fall, the control system shall command and stage the trickle-heater to maintain the minimum allowed AWHP entering water temperature.

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FORT FISHER AQUARIUM RENOVATION & EXPANSION: PHASE 1

SCO #17-18042-02A
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SEAL 23551 ENGINEER DAVID M. HAHN

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NO.	DATE	DESCRIPTION
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MECHANICAL CONTROLS

M-7.1

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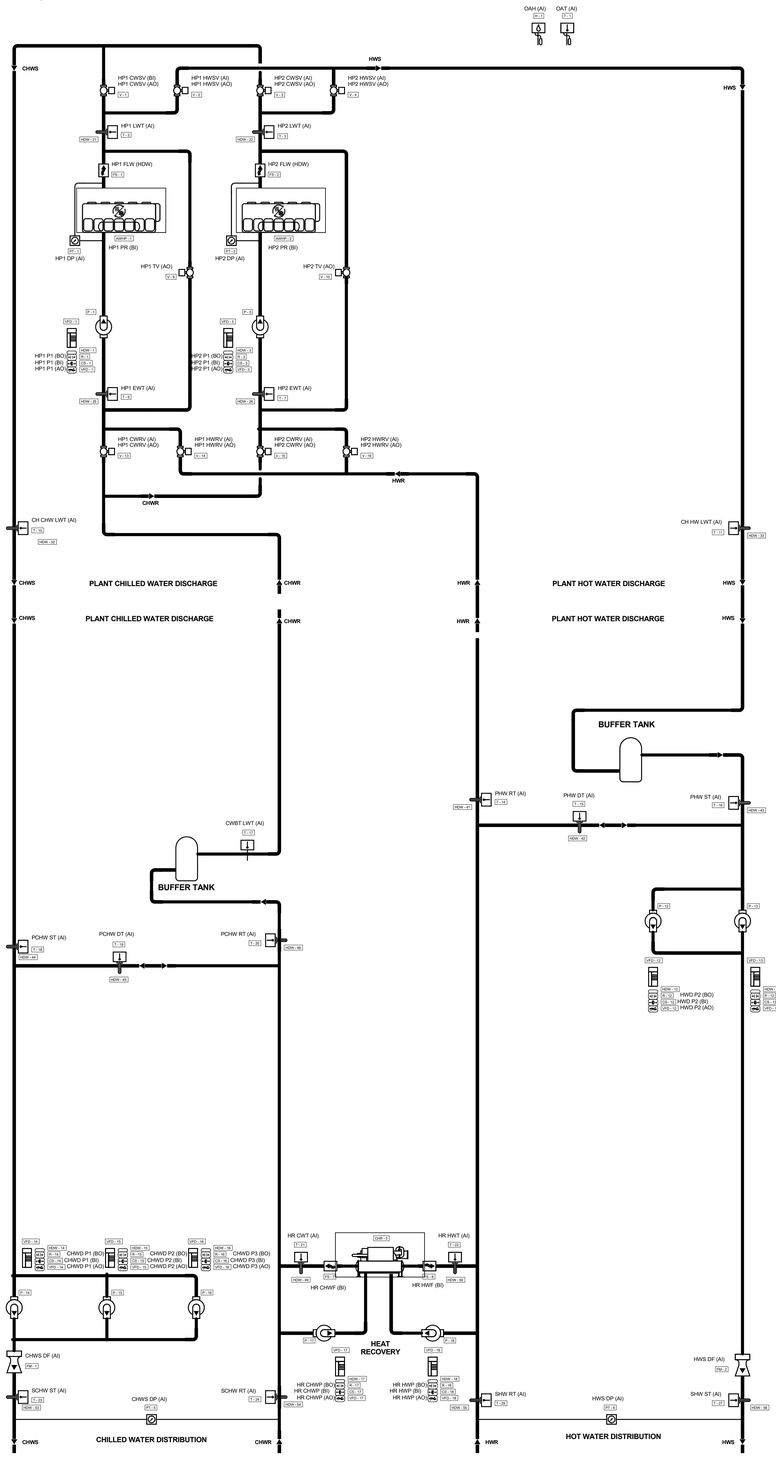
CHILLER HEATER SYSTEM SEQUENCE OF OPERATIONS

SCALE : 1/8" = 1'-0"

Flow Diagram: CHILLER HEATER SYSTEM



Points List - CHILLER HEATER SYSTEM

System Point Description	GRAPHIC	ANALOG HARDWARE INPUT (AI)	BINARY HARDWARE INPUT (BI)	ANALOG HARDWARE OUTPUT...	BINARY HARDWARE OUTPUT...	SOFTWARE POINT (SFT)	HARDWARE INTERLOCK (HDW)	WIRELESS (WLS)	NETWORK (NET)	HIGH ANALOG LIMIT	LOW ANALOG LIMIT	BINARY	LATCH DIAGNOSTIC	SENSOR FAIL	COMMUNICATION FAIL
		POINTS								ALARMS					
CHILLED WATER BUFFER TANK LEAVING WATER TEMPERATURE...		X	X							X	X				
CHILLED WATER DISTRIBUTION SUPPLY DIFFERENTIAL PRESSURE...		X	X							X	X				
CHILLED WATER DISTRIBUTION SUPPLY FLOW...		X	X											X	
CHILLED WATER DISTRIBUTION PUMP 1 SPEED...		X			X										
CHILLED WATER DISTRIBUTION PUMP 1 START STO...		X				X									
CHILLED WATER DISTRIBUTION PUMP 1 STATUS...		X		X											
CHILLED WATER DISTRIBUTION PUMP 2 SPEED...		X			X										
CHILLED WATER DISTRIBUTION PUMP 2 START STO...		X				X									
CHILLED WATER DISTRIBUTION PUMP 2 STATUS...		X		X											
CHILLED WATER DISTRIBUTION PUMP 3 SPEED...		X			X										
CHILLED WATER DISTRIBUTION PUMP 3 START STO...		X				X									
CHILLED WATER DISTRIBUTION PUMP 3 STATUS...		X		X											
CHILLER 3 CHILLED WATER PUMP REQUEST FROM COOLING ONLY CHILLER...		X		X											
CHILLER 3 CHILLED WATER PUMP SPEED...		X			X										
CHILLER 3 CHILLED WATER PUMP START/STOP...		X				X									
CHILLER 3 CHILLED WATER PUMP STATUS...		X		X											
CHILLER 3 CHILLED WATER SUPPLY ISO VALVE OPEN STATUS...		X		X											
CHILLER 3 CHILLED WATER SUPPLY ISO VALVE...		X			X										
CHILLER 3 LEAVING WATER TEMPERATURE...		X	X							X	X				
CHILLER 3 WATER FLOW STATUS...		X		X											
CHILLER 4 CHILLED WATER PUMP REQUEST FROM COOLING ONLY CHILLER...		X		X											
CHILLER 4 CHILLED WATER PUMP SPEED...					X										
CHILLER 4 CHILLED WATER PUMP START/STOP...		X				X									
CHILLER 4 CHILLED WATER PUMP STATUS...		X		X											
CHILLER 4 CHILLED WATER SUPPLY ISO VALVE OPEN STATUS...		X		X											
CHILLER 4 CHILLED WATER SUPPLY ISO VALVE...		X				X									
CHILLER 4 LEAVING WATER TEMPERATURE...		X	X							X	X				
CHILLER 4 WATER FLOW STATUS...		X		X											
CHILLER HEATER CHILLED WATER LEAVING WATER TEMPERATURE...		X	X							X	X				
CHILLER HEATER HOT WATER LEAVING WATER TEMPERATURE...		X	X							X	X				
HEAT PUMP 1 CHILLED WATER RETURN ISO VALVE OPEN STATUS...		X	X												
HEAT PUMP 1 CHILLED WATER RETURN ISO VALVE OUTPUT...					X										
HEAT PUMP 1 CHILLED WATER SUPPLY ISO VALVE OPEN STATUS...		X		X											
HEAT PUMP 1 CHILLED WATER SUPPLY ISO VALVE OUTPUT...					X										
HEAT PUMP 1 ENTERING WATER TEMPERATURE...			X							X	X				
HEAT PUMP 1 HOT WATER RETURN ISO VALVE OPEN STATUS...		X	X												
HEAT PUMP 1 HOT WATER RETURN ISO VALVE...					X										
HEAT PUMP 1 HOT WATER SUPPLY ISO VALVE OPEN STATUS...		X	X												
HEAT PUMP 1 HOT WATER SUPPLY ISO VALVE...					X										
HEAT PUMP 1 LEAVING WATER TEMPERATURE...			X							X	X				
HEAT PUMP 1 SUPPLY WATER DIFFERENTIAL...		X	X											X	
HEAT PUMP 1 TEMPERING BYPASS VALVE OUTPUT...		X			X										
HEAT PUMP 1 WATER FLOW STATUS...		X					X								
HEAT PUMP 1 WATER PUMP 1 SPEED...					X										
HEAT PUMP 1 WATER PUMP 1 START STOP...						X									
HEAT PUMP 1 WATER PUMP 1 STATUS...		X		X											
HEAT PUMP 1 WATER PUMP REQUEST FROM HEAT PUMP CHILLER...				X											
HEAT PUMP 2 CHILLED WATER RETURN ISO VALVE OPEN STATUS...		X	X												
HEAT PUMP 2 CHILLED WATER RETURN ISO VALVE OUTPUT...					X										
HEAT PUMP 2 CHILLED WATER SUPPLY ISO VALVE OPEN STATUS...		X	X												
HEAT PUMP 2 CHILLED WATER SUPPLY ISO VALVE OUTPUT...					X										
HEAT PUMP 2 ENTERING WATER TEMPERATURE...		X	X							X	X				
HEAT PUMP 2 HOT WATER RETURN ISO VALVE OPEN STATUS...		X	X												
HEAT PUMP 2 HOT WATER RETURN ISO VALVE...					X										
HEAT PUMP 2 HOT WATER SUPPLY ISO VALVE OPEN STATUS...		X	X												
HEAT PUMP 2 HOT WATER SUPPLY ISO VALVE...					X										
HEAT PUMP 2 LEAVING WATER TEMPERATURE...		X	X							X	X				
HEAT PUMP 2 SUPPLY WATER DIFFERENTIAL...		X	X											X	
HEAT PUMP 2 TEMPERING BYPASS VALVE OUTPUT...		X			X										
HEAT PUMP 2 WATER FLOW STATUS...		X					X								
HEAT PUMP 2 WATER PUMP 1 SPEED...		X			X										
HEAT PUMP 2 WATER PUMP 1 START STOP...		X				X									
HEAT PUMP 2 WATER PUMP 1 STATUS...				X											
HEAT PUMP 2 WATER PUMP REQUEST FROM HEAT PUMP CHILLER...				X											
HEAT RECOVERY CHILLED WATER FLOW STATUS...		X		X											
HEAT RECOVERY CHILLED WATER LEAVING WATER TEMPERATURE...		X	X							X	X				
HEAT RECOVERY CHILLED WATER PUMP SPEED...					X										
HEAT RECOVERY CHILLED WATER PUMP START ST...		X				X									
HEAT RECOVERY CHILLED WATER PUMP STATUS...				X											
HEAT RECOVERY HOT WATER FLOW STATUS...				X											
HEAT RECOVERY HOT WATER LEAVING WATER TEMPERATURE...		X	X							X	X				

Points List - CHILLER HEATER SYSTEM

System Point Description	GRAPHIC	ANALOG HARDWARE INPUT (AI)	BINARY HARDWARE INPUT (BI)	ANALOG HARDWARE OUTPUT...	BINARY HARDWARE OUTPUT...	SOFTWARE POINT (SFT)	HARDWARE INTERLOCK (HDW)	WIRELESS (WLS)	NETWORK (NET)	HIGH ANALOG LIMIT	LOW ANALOG LIMIT	BINARY	LATCH DIAGNOSTIC	SENSOR FAIL	COMMUNICATION FAIL
		POINTS								ALARMS					
HEAT RECOVERY HOT WATER PUMP SPEED...				X											
HEAT RECOVERY HOT WATER PUMP START STOP...		X			X										
HEAT RECOVERY HOT WATER PUMP STATUS...			X												
HOT WATER DISTRIBUTION PUMP 1 SPEED OUTPUT...		X		X											
HOT WATER DISTRIBUTION PUMP 1 START STOP...		X			X										
HOT WATER DISTRIBUTION PUMP 1 STATUS...		X		X											
HOT WATER DISTRIBUTION PUMP 2 SPEED OUTPUT...		X		X											
HOT WATER DISTRIBUTION PUMP 2 START STOP...		X			X										
HOT WATER DISTRIBUTION PUMP 2 STATUS...		X		X											
HOT WATER DISTRIBUTION SUPPLY DIFFERENTIAL PRESSURE...		X	X											X	
HOT WATER DISTRIBUTION SUPPLY FLOW...		X	X											X	
OUTDOOR AIR RELATIVE HUMIDITY LOCAL...		X	X											X	
OUTDOOR AIR TEMPERATURE LOCAL...		X	X											X	
PRIMARY CHILLED WATER DECOUPLER WATER TEMPERATURE...		X	X							X	X				
PRIMARY CHILLED WATER RETURN TEMPERATURE...		X	X							X	X				
PRIMARY CHILLED WATER SUPPLY TEMPERATURE...		X	X							X	X				
PRIMARY HOT WATER DECOUPLER WATER TEMPERATURE...		X	X							X	X				
PRIMARY HOT WATER RETURN TEMPERATURE...		X	X							X	X				
PRIMARY HOT WATER SUPPLY TEMPERATURE...		X	X							X	X				
SECONDARY CHILLED WATER RETURN...		X	X							X	X				
SECONDARY CHILLED WATER SUPPLY TEMPERATU...		X	X							X	X				
SECONDARY HOT WATER RETURN TEMPERATURE...		X	X							X	X				
SECONDARY HOT WATER SUPPLY TEMPERATURE...		X	X							X	X				
BAS COMMUNICATION STATE...						X									
CHILLED WATER DISTRIBUTION PUMP 1 FAILURE...		X				X						X			
CHILLED WATER DISTRIBUTION PUMP 2 FAILURE...		X				X						X			
CHILLED WATER DISTRIBUTION PUMP 3 FAILURE...		X				X						X			
CHILLED WATER SUPPLY DIFFERENTIAL PRESSURE SETPOINT...		X				X									
CHILLED WATER SUPPLY TEMPERATURE SETPOINT...		X				X									
CHILLER HEATER PLANT SYSTEM ENABLE...						X									
HEAT PUMP 1 WATER PUMP 1 FAILURE...		X				X						X			
HEAT PUMP 2 WATER PUMP 1 FAILURE...		X				X						X			
HEAT PUMP ISOLATION VALVE OPEN/CLOSE INTERVAL TIME...						X									
HEAT RECOVERY CHILLED WATER PUMP FAILURE...		X				X						X			
HEAT RECOVERY HOT WATER PUMP FAILURE...		X				X						X			
HOT WATER DISTRIBUTION PUMP 1 FAILURE...		X				X						X			
HOT WATER DISTRIBUTION PUMP 2 FAILURE...		X				X						X			
HOT WATER SUPPLY TEMPERATURE SETPOINT...		X				X									
HOT WATER SUPPLY TEMPERATURE OUTSIDE AIR LOW LIMIT RESET...		X				X									
HOT WATER SUPPLY TEMPERATURE OUTSIDE AIR HIGH LIMIT RESET...		X				X									
HOT WATER SUPPLY TEMPERATURE WATER HIGH LIMIT RESET...		X				X									
HOT WATER SUPPLY TEMPERATURE WATER LOW LIMIT RESET...		X				X									

Points List - HEAT PUMP AIR-TO-WATER

System Point Description	GRAPHIC	ANALOG HARDWARE INPUT (AI)	BINARY HARDWARE INPUT (BI)	ANALOG HARDWARE OUTPUT...	BINARY HARDWARE OUTPUT...	SOFTWARE POINT (SFT)	HARDWARE INTERLOCK (HDW)	WIRELESS (WLS)	NETWORK (NET)	HIGH ANALOG LIMIT	LOW ANALOG LIMIT	BINARY	LATCH DIAGNOSTIC	SENSOR FAIL	COMMUNICATION FAIL
		POINTS								ALARMS					
PUMP START REQUEST TO SYSTEM...					X										
CHILLED WATER SETPOINT...						X									
COMPRESSOR RUN TIME (PER COMPRESSOR)...						X									
COMPRESSOR STATUS (PER COMPRESSOR)...						X									
CONDENSER REFRIGERANT PRESSURE (PER...						X									
EVAPORATOR ENTERING WATER TEMPERATURE...						X									
EVAPORATOR LEAVING WATER TEMPERATURE...						X									
EVAPORATOR REFRIGERANT PRESSURE (PER...						X									
HEAD PRESSURE CONTROL OUTPUT...						X									
HEAT PUMP AUTO/STOP COMMAND...						X									
HEAT PUMP OPERATING MODE...						X									
HOT WATER SETPOINT...						X									

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SEAL 23551 ENGINEER DAVID M. HAHN

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NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

MECHANICAL CONTROLS

M-7.2

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CHILLER HEATER SYSTEM CONTROLS

SCALE : 1/8" = 1'-0"

Sequence of Operation: RTU04

Building Automation System Interface:

The Building Automation System (BAS) shall send the controller Occupied Bypass, Morning Warm-up/Pre-Cool, Occupied/Unoccupied and Heat/Cool modes. If a BAS is not present, or communication is lost with the BAS the controller shall operate using default modes and setpoints.

Occupied:

During occupied periods, the supply fan shall run continuously and the mixed air dampers shall open to maintain minimum ventilation requirements.

In the cooling mode The chilled water valve shall modulate to control the discharge air setpoint.

In the heating mode the hot water valve shall modulate to control the discharge air setpoint.

If the discharge air temperature sensor fails, the chilled water valve should close, the heating valve should close, the outdoor air should close, and an alarm should annunciate at the BAS

Unoccupied:

During the unoccupied periods, the supply fan shall be disabled, the outside air damper shall close, the mechanical cooling shall be disabled, the mechanical heating shall be disabled, to conserve energy.

Optimal Stop:

Outside air damper shall remain enabled to provide minimum ventilation.

Morning Warm-Up Mode:

The outside air damper shall remain closed.

Pre-Cool Mode:

During optimal start, if the space temperature is above the occupied cooling setpoint, pre-cool mode shall be activated. When pre-cool is initiated the unit shall enable the fan and cooling. The outside air damper shall remain closed. When the space temperature reaches occupied cooling setpoint (adj.), the unit shall transition to the occupied mode.

Occupied Humidity Control:

If the space relative humidity is greater than 50% (adj.), the chilled water valve shall modulate to maintain space relative humidity setpoint of 50% (adj.) and the reheat valve shall modulate to maintain the discharge air temperature setpoint. Mode shall terminate when the space relative humidity falls below the relative humidity setpoint of 50% (adj.) minus 3% (adj.). If the space relative humidity sensor fails the dehumidification sequence shall be terminated and an alarm shall annunciate at the BAS.

Demand Control Ventilation:

Using a return CO2 input (local sensor or network communicated value), the controller shall monitor and compare the measured return CO2 to the return CO2 concentration setpoint (adj.). When the measured return CO2 concentration reaches the setpoint (adj.), the outside air damper shall modulate open incrementally until the return air CO2 level is satisfied or the outside air damper reaches the full open position. If the measured CO2 concentration falls, the outside air damper shall modulate toward minimum outdoor air position setpoint. If the mixed air temperature drops below the mixed air low limit setpoint the CO2 sensor input is overridden and the outside air damper will be modulated closed to maintain the mixed air temperature low limit setpoint. When the mixed air temperature rises above the mixed air low limit setpoint, CO2 operation is restored.

Discharge Air Temperature Control:

Also, the BAS shall override this reset function whenever outdoor dew point is higher than 60.0 deg. F (adj.) or indoor humidity (measured at the source of control) is higher than 60% RH (adj.). If the discharge air temperature drops below the minimum limit, a low temperature alarm shall annunciate, and the unit shall shut down. If the discharge air temperature rises above the maximum limit, a high temperature alarm shall annunciate.

Supply Fan:

The supply fan shall be off in the unoccupied mode. The supply fan shall be on if the control is heating or cooling in the unoccupied mode. When the controller is in the occupied mode, the supply fan shall operate continuously. The supply fan should be modulated to maintain a constant air flow setpoint. The supply fan should be modulated to maintain a constant speed. The speed will be determined by the test and balance contractor.

If the supply fan fails to prove status for 30 seconds (adj.), the fan shall be commanded off, the outside air damper shall close, cooling shall be disabled, all heating shall be disabled, and an alarm shall annunciate at the BAS. A manual reset shall be required to restart the fan.

Preheat Control:

When the fan is off, if the outdoor air temperature is below 40.0 deg. F (adj.) or the outside air temperature sensor is failed, the preheat valve shall modulate to maintain a mixed air temperature of 45.0 deg. F (adj.). If the outdoor air temperature is above 40.0 deg. F (adj.) and the outdoor air temperature sensor is not failed the preheat valve shall be closed. If the mixed air temperature sensor fails the preheat valve shall be 10% open.

When the fan is on, the preheat shall control to maintain a leaving preheat temperature of 45.0 deg. F (adj.). If the preheat temperature sensor fails and the mixed air temperature is below 45.0 deg. F (adj.) the preheat valve shall be 10% open. If the preheat temperature sensor fails and the mixed air temperature is above 50.0 deg. F (adj.) the preheat valve shall be commanded closed. An alarm shall annunciate at the BAS if the leaving preheat temperature sensor, the mixed air temperature sensor or the outside air temperature sensor are failed.

Mixed Air Low Limit:

The initial damper opening rate shall be limited to 2% per minute (adj.) until the damper has reached its minimum ventilation position. The outside air damper shall modulate to a position less than the minimum damper position if the mixed air temperature drops below 50.0 deg. F (adj.). If the mixed air temperature sensor fails an alarm shall annunciate at the BAS and the outside air damper shall return to the minimum position.

Freeze Protection:

A hardwired, low limit temperature switch shall be electrically interlocked with the motor starter. If the low limit temperature switch is tripped 38.0 deg. F (adj.), the fan shall be commanded off and the outside air damper shall close. All valves shall be commanded open to 100% open (adjust per climate). An alarm shall annunciate at the BAS and manual reset of the low limit temperature switch shall be required to restart the fan.

Condensate Overflow Monitoring:

If the condensate level reaches the trip point, a condensate overflow diagnostic shall annunciate at the BAS. To prevent the condensate drain pan from overflowing and causing water damage to the building the fan shall be disabled and the chilled water valve shall close.

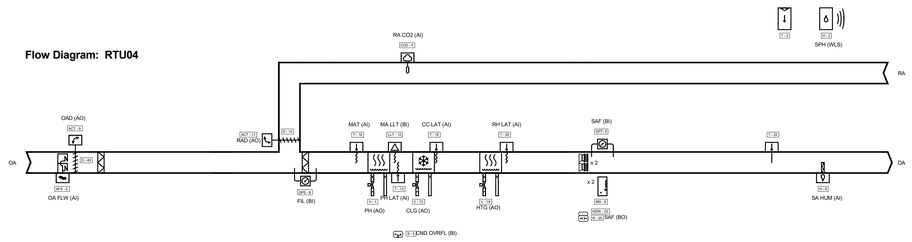
Filter Status:

A differential pressure switch shall monitor the differential pressure across the filter(s) when the fan is running. If the switch closes during normal operation a dirty filter alarm shall annunciate at the BAS.

Points List - RTU04

System Point Description	POINTS										ALARMS					
	GRAPHIC	ANALOG HARDWARE INPUT (AI)	BINARY HARDWARE INPUT (BI)	ANALOG HARDWARE OUTPUT...	BINARY HARDWARE OUTPUT...	SOFTWARE POINT (SFT)	HARDWARE INTERLOCK (HDW)	WIRELESS (WLS)	NETWORK (NET)	HIGH ANALOG LIMIT	LOW ANALOG LIMIT	BINARY	LATCH DIAGNOSTIC	SENSOR FAIL	COMMUNICATION FAIL
AIR CLEANING ACCESS DOOR INTERLOCK...							X								
AIR CLEANING ACCESS DOOR INTERLOCK...							X								
CHANGEOVER COIL LEAVING AIR TEMPERATURE...	X	X								X	X			X	
COIL LEAVING AIR LOW TEMP CUTOUT ALARM...			X										X		
COMPRESSOR 1 COMMAND...	X				X										
COMPRESSOR 2 COMMAND...	X				X										
COMPRESSOR 3 COMMAND...	X				X										
COMPRESSOR 4 COMMAND...	X				X										
CONDENSATE OVERFLOW DETECTION LOCAL...	X		X									X	X		
COOLING COIL LEAVING TEMPERATURE...	X	X								X	X			X	
COOLING OUTPUT COMMAND...	X			X											
FILTER STATUS...	X		X									X			
HEATING OUTPUT COMMAND...	X			X											
MIXED AIR DAMPER COMMAND...	X			X											
MIXED AIR LOW TEMPERATURE CUTOUT ALARM...			X										X		
MIXED AIR TEMPERATURE LOCAL...	X	X								X				X	
OUTDOOR AIR DAMPER COMMAND...	X			X											
OUTDOOR AIR FLOW...	X	X													
OUTDOOR AIR RELATIVE HUMIDITY LOCAL...	X	X													
OUTDOOR AIR TEMPERATURE LOCAL...	X	X													
PREHEAT LEAVING COIL TEMPERATURE LOCAL...	X	X												X	
PREHEAT OUTPUT COMMAND...	X			X											
REHEAT LEAVING COIL TEMPERATURE LOCAL...	X	X								X	X			X	
REHEAT OUTPUT COMMAND...	X			X											
RETURN AIR CO2 LOCAL...	X	X								X					
RETURN AIR DAMPER COMMAND...	X			X											
RETURN AIR HUMIDITY LOCAL...	X	X								X					
RETURN AIR TEMPERATURE LOCAL...	X	X													
SPACE HUMIDITY LOCAL...	X						X							X	
SPACE TEMPERATURE LOCAL...	X						X			X	X			X	
SPACE TEMPERATURE SETPOINT LOCAL...	X						X								
SUPPLY AIR HUMIDITY LOCAL...	X	X								X	X			X	
SUPPLY FAN START STOP COMMAND...	X				X										
SUPPLY FAN STATUS...	X		X												
SUPPLY FAN 2 SPEED COMMAND...	X			X											
SUPPLY FAN 2 START STOP COMMAND...	X				X										
SUPPLY FAN 2 STATUS...	X		X												
BAS COMMUNICATION STATE...						X									X
MAINTENANCE REQUIRED...						X									
MIXED AIR TEMPERATURE LOW LIMIT SETPOINT...						X									
OCCUPIED COOLING SETPOINT...	X					X									
OCCUPIED HEATING SETPOINT...	X					X									
SUPPLY FAN FAILURE...	X					X									
UNOCCUPIED COOLING SETPOINT...	X					X									
UNOCCUPIED HEATING SETPOINT...	X					X									

Flow Diagram: RTU04



Sequence of Operation: RTU01, 02, 03 [QTY: 3]

Building Automation System Interface:

The Building Automation System (BAS) shall send the controller Occupied Bypass, Morning Warm-up/Pre-Cool, Occupied/Unoccupied and Heat/Cool modes. If a BAS is not present, or communication is lost with the BAS the controller shall operate using default modes and setpoints.

Occupied:

During occupied periods, the supply fan shall run continuously and the mixed air dampers shall open to maintain minimum ventilation requirements.

In the cooling mode The chilled water valve shall modulate to control the discharge air setpoint.

In the heating mode the hot water valve shall modulate to control the discharge air setpoint.

If the discharge air temperature sensor fails, the chilled water valve should close, the heating valve should close, the outdoor air should close, and an alarm should annunciate at the BAS

Unoccupied:

During the unoccupied periods, the supply fan shall be disabled, the outside air damper shall close, the mechanical cooling shall be disabled, the mechanical heating shall be disabled, to conserve energy.

Optimal Stop:

Outside air damper shall remain enabled to provide minimum ventilation.

Morning Warm-Up Mode:

The outside air damper shall remain closed.

Pre-Cool Mode:

During optimal start, if the space temperature is above the occupied cooling setpoint, pre-cool mode shall be activated. When pre-cool is initiated the unit shall enable the fan and cooling. The outside air damper shall remain closed. When the space temperature reaches occupied cooling setpoint (adj.), the unit shall transition to the occupied mode.

Occupied Humidity Control:

If the space relative humidity is greater than 50% (adj.), the chilled water valve shall modulate to maintain space relative humidity setpoint of 50% (adj.) and the reheat valve shall modulate to maintain the discharge air temperature setpoint. Mode shall terminate when the space relative humidity falls below the relative humidity setpoint of 50% (adj.) minus 3% (adj.). If the space relative humidity sensor fails the dehumidification sequence shall be terminated and an alarm shall annunciate at the BAS.

Discharge Air Temperature Control:

Also, the BAS shall override this reset function whenever outdoor dew point is higher than 60.0 deg. F (adj.) or indoor humidity (measured at the source of control) is higher than 60% RH (adj.). If the discharge air temperature drops below the minimum limit, a low temperature alarm shall annunciate, and the unit shall shut down. If the discharge air temperature rises above the maximum limit, a high temperature alarm shall annunciate.

Supply Fan:

The supply fan shall be off in the unoccupied mode. The supply fan shall be on if the control is heating or cooling in the unoccupied mode. When the controller is in the occupied mode, the supply fan shall operate continuously. The supply fan should be modulated to maintain a constant air flow setpoint. The supply fan should be modulated to maintain a constant speed. The speed will be determined by the test and balance contractor.

If the supply fan fails to prove status for 30 seconds (adj.), the fan shall be commanded off, the outside air damper shall close, cooling shall be disabled, all heating shall be disabled, and an alarm shall annunciate at the BAS. A manual reset shall be required to restart the fan.

Mixed Air Low Limit:

The initial damper opening rate shall be limited to 2% per minute (adj.) until the damper has reached its minimum ventilation position. The outside air damper shall modulate to a position less than the minimum damper position if the mixed air temperature drops below 50.0 deg. F (adj.). If the mixed air temperature sensor fails an alarm shall annunciate at the BAS and the outside air damper shall return to the minimum position.

Freeze Protection:

A hardwired, low limit temperature switch shall be electrically interlocked with the motor starter. If the low limit temperature switch is tripped 38.0 deg. F (adj.), the fan shall be commanded off and the outside air damper shall close. All valves shall be commanded open to 100% open (adjust per climate). An alarm shall annunciate at the BAS and manual reset of the low limit temperature switch shall be required to restart the fan.

Condensate Overflow Monitoring:

If the condensate level reaches the trip point, a condensate overflow diagnostic shall annunciate at the BAS. To prevent the condensate drain pan from overflowing and causing water damage to the building the fan shall be disabled and the chilled water valve shall close.

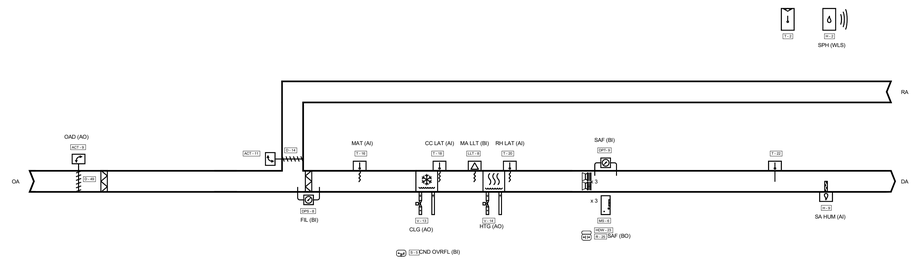
Filter Status:

A differential pressure switch shall monitor the differential pressure across the filter(s) when the fan is running. If the switch closes during normal operation a dirty filter alarm shall annunciate at the BAS.

Points List - RTU01, 02, 03 [QTY: 3]

System Point Description	POINTS									ALARMS					
	GRAPHIC	ANALOG HARDWARE INPUT (AI)	BINARY HARDWARE INPUT (BI)	ANALOG HARDWARE OUTPUT...	BINARY HARDWARE OUTPUT...	SOFTWARE POINT (SFT)	HARDWARE INTERLOCK (HDW)	WIRELESS (WLS)	NETWORK (NET)	HIGH ANALOG LIMIT	LOW ANALOG LIMIT	BINARY	LATCH DIAGNOSTIC	SENSOR FAIL	COMMUNICATION FAIL
AIR CLEANING ACCESS DOOR INTERLOCK...							X								
AIR CLEANING ACCESS DOOR INTERLOCK...							X								
CHANGEOVER COIL LEAVING AIR TEMPERATURE...	X	X								X	X			X	
COIL LEAVING AIR LOW TEMP CUTOUT ALARM...			X										X		
COMPRESSOR 1 COMMAND...	X				X										
COMPRESSOR 2 COMMAND...	X				X										
COMPRESSOR 3 COMMAND...	X				X										
COMPRESSOR 4 COMMAND...	X				X										
CONDENSATE OVERFLOW DETECTION LOCAL...	X		X									X	X		
COOLING COIL LEAVING TEMPERATURE...	X	X								X	X			X	
COOLING OUTPUT COMMAND...	X			X											
FILTER STATUS...	X		X									X			
HEATING OUTPUT COMMAND...	X			X											
MIXED AIR LOW TEMPERATURE CUTOUT ALARM...			X										X		
MIXED AIR TEMPERATURE LOCAL...	X	X								X				X	
OUTDOOR AIR DAMPER COMMAND...	X			X											
OUTDOOR AIR RELATIVE HUMIDITY LOCAL...	X	X													
OUTDOOR AIR TEMPERATURE LOCAL...	X	X													
REHEAT LEAVING COIL TEMPERATURE LOCAL...	X	X								X	X			X	
REHEAT OUTPUT COMMAND...	X			X											
RETURN AIR HUMIDITY LOCAL...	X	X								X					
RETURN AIR TEMPERATURE LOCAL...	X	X													
SPACE HUMIDITY LOCAL...	X						X							X	
SPACE TEMPERATURE LOCAL...	X						X			X	X			X	
SPACE TEMPERATURE SETPOINT LOCAL...	X						X								
SUPPLY AIR HUMIDITY LOCAL...	X	X								X	X			X	
SUPPLY FAN START STOP COMMAND...	X				X										
SUPPLY FAN STATUS...	X		X												
SUPPLY FAN 2 SPEED COMMAND...	X			X											
SUPPLY FAN 2 START STOP COMMAND...	X				X										
SUPPLY FAN 2 STATUS...	X		X												
SUPPLY FAN 3 SPEED COMMAND...	X			X											
SUPPLY FAN 3 START STOP COMMAND...	X				X										
SUPPLY FAN 3 STATUS...	X		X												
BAS COMMUNICATION STATE...						X									X
MAINTENANCE REQUIRED...						X						X			
MIXED AIR TEMPERATURE LOW LIMIT SETPOINT...						X									
OCCUPIED COOLING SETPOINT...	X					X									
OCCUPIED HEATING SETPOINT...	X					X									
SUPPLY FAN FAILURE...	X					X						X			
UNOCCUPIED COOLING SETPOINT...	X					X									
UNOCCUPIED HEATING SETPOINT...	X					X									

Flow Diagram: RTU01, 02, 03 [QTY: 3]



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FORT FISHER AQUARIUM RENOVATION & EXPANSION: PHASE 1

SCO #17-18042-02A
CODE: 42014-4G02
ITEM: 41414-4Y4A

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REGISTERED ARCHITECT SEAL 23551 ENGINEER DAVID M. HAHN

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NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

MECHANICAL CONTROLS

M-7.3

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Sequence of Operation: VAV07-1, 2, 3 [QTY: 3]

Building Automation System Interface:

The Building Automation System (BAS) shall send the controller Occupied, and Unoccupied commands. The BAS may also send a Heat/Cool mode, priority shutdown commands, space temperature and/or space temperature setpoint. If communication is lost with the BAS, the controller shall operate using its local setpoints.

Occupied:

The occupancy mode will be communicated or hardwired to the controller via a binary input. When the unit is in the occupied mode the VAV will maintain the space temperature at the active occupied heating or cooling setpoint. Applicable ventilation and airflow setpoints will be enforced. The occupied mode will be the default mode of the VAV. Applicable ventilation and airflow setpoints will be enforced. The occupied mode will be the default mode of the VAV.

Occupied Standby:

The occupancy mode will be communicated or hardwired to the controller via a binary input, even though the BAS has scheduled the space as occupied. In the occupied standby mode, the active cooling and heating setpoints shall be relaxed (see cooling and heating mode) and both the ventilation airflow and minimum airflow setpoints shall be lowered (see VAV schedule).

Occupied Bypass:

Mode used to temporarily place the unit into the occupied operation. Tenants shall be able to override the unoccupied mode from the space sensor. The override shall last for a maximum of 4 hours (adj.). The tenants shall be able to cancel the override from the space sensor at any time. During the override the unit shall operate in occupied mode.

Heat/Cool Mode:

The Heat/Cool mode shall be set by a communicated value or automatically by the VAV. In standalone or auto mode the VAV shall compare the primary air temperature with the configured auto changeover setpoint to determine if the air is "hot" or "cold". Heating mode implies the primary air temperature is hot. Cooling mode implies the primary air temperature is cold.

Cooling Mode:

When the unit is in cooling mode, the VAV controller shall maintain the space temperature at the active cooling setpoint by modulating the airflow between the active cooling minimum airflow setpoint to the maximum cooling airflow setpoint. The VAV shall use the measured space temperature and the active cooling setpoint to determine the requested cooling capacity of the unit. The outputs will be controlled based on the unit configuration and the requested cooling capacity.

Based on the VAV controller occupancy mode, the active cooling setpoint will be one of the following:

Setpoint	Default Value
Occupied Cooling Setpoint	74.0 deg. F
Unoccupied Cooling Setpoint	85.0 deg. F
Occupied Standby Cooling Setpoint	78.0 deg. F
Occupied Min Cooling Airflow Setpoint	See VAV Schedule
Occupied Max Cooling Airflow Setpoint	See VAV Schedule

Heat/Cool Setpoint:

The space temperature setpoint shall be determined either by a local (e.g., thumbwheel) setpoint, the VAV default setpoint or a communicated value. The VAV shall use the locally stored default setpoints when neither a local setpoint nor communicated setpoint is present. If both a local setpoint and communicated setpoint exist, the VAV shall use the communicated value.

Reheat Control Mode:

Reheat will only be allowed when the supply air temperature is 5.0 deg. F below the configured reheat enable setpoint of 70.0 deg. F (adj.). The reheat will be enabled when the space temperature drops below the active heating setpoint and the minimum airflow requirements are met. During reheat the VAV will operate at its minimum heating airflow setpoint and energize the heat as follows:

Setpoint	Default Value
Occupied Heating Setpoint	71.0 deg. F
Unoccupied Heating Setpoint	60.0 deg. F
Occupied Standby Heating Setpoint	67.0 deg. F
Occupied Min Heating Airflow Setpoint	See VAV Schedule
Occupied Max Heating Airflow Setpoint	See VAV Schedule

Reheat will only be allowed when the supply air temperature is 5.0 deg. F below the configured reheat enable setpoint of 70.0 deg. F (adj.). Reheat Control:
In heat mode, reheat will be enabled when:

- Primary air temperature is 5.0 deg. F below the configured reheat enable setpoint of 70.0 deg. F (adj.).
- Space temperature drops below the active heating setpoint and the minimum airflow requirements are met.
- Supply air temperature is below the configured reheat enable setpoint.

When reheat enabled, the VAV will operate at its minimum heating airflow setpoint and control the heat as follows:

Modulating Hot Water Reheat:

If the space temperature is below the heating setpoint the hot water reheat valve will modulate as required to maintain space temperature at the active heating setpoint while the VAV operates at its minimum heating airflow setpoint. If the discharge air temperature reaches the design heating discharge air temperature setpoint (adj.), the VAV will modulate airflow between the minimum heating airflow setpoint and the maximum heating airflow setpoint as required to maintain space temperature at the active heating setpoint, while the hot water reheat valve modulates to maintain discharge air temperature at the design heating discharge air temperature setpoint. If the airflow reaches the maximum heating airflow setpoint, the VAV will modulate the hot water reheat valve as required to maintain space temperature at the active heating setpoint, while the VAV operates at its maximum heating airflow setpoint.

Heating Mode:
When the unit is in heating mode, the VAV controller will maintain the space temperature at the active heating setpoint by modulating the VAV damper (between the active heating minimum and maximum airflow setpoints). Based on the VAV controller occupancy mode, the active heating setpoint will be one of the following:

Setpoint	Default Value
Occupied Heating Setpoint	71.0 deg. F
Unoccupied Heating Setpoint	60.0 deg. F
Occupied Standby Heating Setpoint	67.0 deg. F
Occupied Min Heating Airflow Setpoint	See VAV Schedule
Occupied Max Heating Airflow Setpoint	See VAV Schedule

Local Reheat Control:

Reheat will only be allowed when the primary air temperature is 5.0 deg. F below the configured reheat enable setpoint of 70.0 deg. F (adj.). The reheat shall be enabled when the space temperature drops below the active heating setpoint and the minimum airflow requirements are met. During reheat the VAV shall operate at its minimum heating airflow setpoint and energize the heat as follows:

Proportional Hot Water Reheat:

If the space temperature is below the heating setpoint the hot water reheat valve shall control as required to maintain the active heating setpoint.

Demand Control Ventilation:

When the unit is in unoccupied mode, the ventilation airflow setpoint will be zero. When the unit is in occupied mode, the ventilation airflow setpoint shall equal the design outdoor airflow (see VAV schedule).

The current ventilation airflow setpoint shall be communicated to the BAS for control of the system outdoor-air intake.

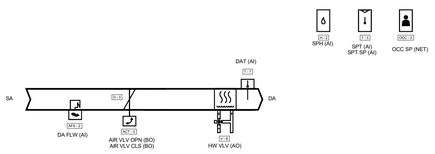
Space Sensor Failure:

If there is a fault with the operation of the zone sensor an alarm shall be annunciated at the BAS. Space sensor failure shall cause the VAV to drive the damper to minimum air flow if the VAV is in the occupied mode, or drive it closed if the VAV is in the unoccupied mode.

Space Humidity Monitoring:

The VAV Box will monitor the space humidity.

Flow Diagram: VAV07-1, 2, 3 [QTY: 3]



Points List - VAV07-1, 2, 3 [QTY: 3]

System Point Description	POINTS										ALARMS					
	GRAPHIC	ANALOG HARDWARE INPUT (AI)	BINARY HARDWARE INPUT (BI)	ANALOG HARDWARE OUTPUT (AO)	BINARY HARDWARE OUTPUT (BO)	SOFTWARE POINT (SFT)	HARDWARE INTERLOCK (HDW)	WIRELESS (WLS)	NETWORK (NET)	HIGH ANALOG LIMIT	LOW ANALOG LIMIT	BINARY	LATCH DIAGNOSTIC	SENSOR FAIL	COMMUNICATION FAIL
AIR VALVE DRIVE OPEN COMMAND...	X				X										
AIR VALVE DRIVE CLOSE COMMAND...	X				X										
DISCHARGE AIR TEMPERATURE...	X	X								X	X			X	
LOCAL HEAT VALVE COMMAND...	X			X											
SPACE HUMIDITY LOCAL...	X	X								X					
SPACE OCCUPANCY INPUT...	X		X												
SPACE TEMPERATURE LOCAL...	X	X													
SPACE TEMPERATURE SETPOINT LOCAL...	X	X													
SUPPLY AIRFLOW...	X	X								X	X				
BAS COMMUNICATION STATE...						X									X
DESIGN HEAT DISCHARGE AIR TEMP SETPOINT...						X									
MAXIMUM COOLING AIRFLOW SETPOINT...						X									
MINIMUM COOLING AIRFLOW SETPOINT...						X									
MAXIMUM HEATING AIRFLOW SETPOINT...						X									
MINIMUM HEATING AIRFLOW SETPOINT...						X									
OCCUPIED BYPASS TIMER...	X					X									
OCCUPIED COOLING SETPOINT...	X					X									
OCCUPIED HEATING SETPOINT...	X					X									
UNOCCUPIED COOLING SETPOINT...	X					X									
SPACE OCCUPANCY (COMMUNICATED)...	X								X						
UNOCCUPIED HEATING SETPOINT...	X					X									

VAV TERMINAL UNITS CONTROLS

SCALE : 1/8" = 1'-0"

2

Sequence of Operation: AHU07

Building Automation System Interface:

The Building Automation System (BAS) shall send the controller Occupied Bypass, Pre-Cool, Occupied/Unoccupied and Heat/Cool modes. The BAS shall also send the discharge air temperature setpoint and the duct static pressure setpoint. If a BAS is not present, or communication is lost with the BAS the controller shall operate using default modes and setpoints.

Occupied:

During occupied periods, the supply fan shall run continuously and the mixed air dampers shall open to maintain minimum ventilation requirements.

In the cooling mode The chilled water valve shall modulate to control the discharge air setpoint.

to control the discharge air setpoint.

If the discharge air temperature sensor fails, the cooling will fallback to control to the active space temperature setpoint and an alarm shall be annunciated at the BAS

If the discharge air temperature sensor fails, and the space temperature sensor fails, the chilled water valve should close, the outdoor air should close, and an alarm should annunciate at the BAS

Unoccupied:

During the unoccupied periods, the supply fan shall be disabled, the outside air damper shall close, the mechanical cooling shall be disabled, to conserve energy.

Optimal Start:

The BAS shall monitor the scheduled occupied time, occupied space setpoints and space temperature to calculate when the optimal start occurs.

Optimal Stop:

The BAS shall monitor the scheduled unoccupied time, occupied setpoints and space temperature to calculate when the optimal stop occurs. When the optimal stop mode is active the unit controller shall switch to the unoccupied mode. Outside air damper shall remain enabled to provide minimum ventilation.

Occupied Bypass:

The BAS shall monitor the status of the ON and CANCEL buttons of the space temperature sensor. When an occupied bypass request is received from a space sensor, the unit shall transition from its current occupancy mode to occupied bypass mode and the unit shall maintain the space temperature to the occupied setpoints (adj.).

Heat/Cool Mode:

When the space temperature rises above the occupied cooling setpoint the mode shall transition to cooling. When the space temperature falls below the occupied heating setpoint the mode shall transition to heating. When the space temperature is below the occupied cooling setpoint and above the occupied heating setpoint the mode shall remain in its last state. If the space temperature sensor fails the mode shall remain in its last state and an alarm shall annunciate at the BAS. If the local and communicated setpoints fail the controller shall disable the supply fan and an alarm shall annunciate at the BAS.

Morning Warm-Up Mode:

During optimal start, if the average space temperature is below the occupied heating setpoint a morning warm-up mode shall be activated. The outside air damper shall remain closed. When the space temperature reaches the occupied heating setpoint (adj.), the unit shall transition to the occupied mode.

Daytime Warm-Up Control:

During Occupied periods, when the space temperature is below the Daytime Warm-up Initiate setpoint, a daytime warm-up sequence shall be activated. The outside air damper shall modulate to maintain minimum ventilation requirements, and the heating shall enable to maintain the discharge air temperature heating setpoint. Daytime Warm-up shall terminate when the average space temperature reaches the Occupied heating setpoint.

Pre-Cool Mode:

During optimal start, if the average space temperature is above the occupied cooling setpoint, pre-cool mode shall be activated. When pre-cool is initiated the unit shall enable the fan and cooling. The outside air damper shall remain closed. When the space temperature reaches occupied cooling setpoint (adj.), the unit shall transition to the occupied mode.

Discharge Air Temperature Control:

The discharge air temperature setpoint shall be reset to the optimal setpoint communicated by the BAS. The Space Temperature BAS and the Space Temperature Setpoint BAS shall be communicated to the unit controller by the BAS. The discharge air temperature setpoint shall be reset based upon the deviation of the Space Temperature BAS from the Space Temperature Setpoint BAS. If the discharge air temperature drops below the minimum limit, a low temperature alarm shall annunciate, and the unit shall shut down.

Supply Fan:

The supply fan shall be off in the unoccupied mode. The supply fan shall be on if the control is heating or cooling in the unoccupied mode. When the controller is in the occupied mode, the supply fan shall operate continuously. The supply fan speed shall be modulated to maintain the duct static pressure setpoint. The supply fan should be modulated to maintain a constant air flow setpoint. The supply fan should be modulated to maintain a constant speed. The speed will be determined by the test and balance contractor. The duct static pressure setpoint shall be sent by the BAS and is reset between the minimum and maximum static pressure limits to maintain the critical zone VAV air damper in a position between 65% and 75% open.

If the supply fan fails to prove status for 30 seconds (adj.), the fan shall be commanded off, the outside air damper shall close, cooling shall be disabled, and an alarm shall annunciate at the BAS. A manual reset shall be required to restart the fan.

A hardwired, high static pressure cut-off switch shall be electrically interlocked with the variable speed drive. If the high static pressure cut-off switch is tripped the fan shall be commanded off, cooling should be disabled, and an alarm shall annunciate at the BAS. A manual reset of the high static pressure cut-off switch shall be required to restart the fan.

Mixed Air Low Limit:

The initial damper opening rate shall be limited to 2% per minute (adj.) until the damper has reached its minimum ventilation position. The outside air damper shall modulate to a position less than the minimum damper position if the mixed air temperature drops below 50.0 deg. F (adj.). If the mixed air temperature sensor fails an alarm shall annunciate at the BAS and the outside air damper shall return to the minimum position.

Freeze Protection:

A hardwired, low limit temperature switch shall be electrically interlocked with the variable speed drive. If the low limit temperature switch is tripped 38.0 deg. F (adj.), the fan shall be commanded off and the outside air damper shall close. All valves shall be commanded open to 100% open (adjust per climate). An alarm shall annunciate at the BAS and manual reset of the low limit temperature switch shall be required to restart the fan.

Condensate Overflow Monitoring:

If the condensate level reaches the trip point, a condensate overflow diagnostic shall annunciate at the BAS. To prevent the condensate drain pan from overflowing and causing water damage to the building the fan shall be disabled and the chilled water valve shall close.

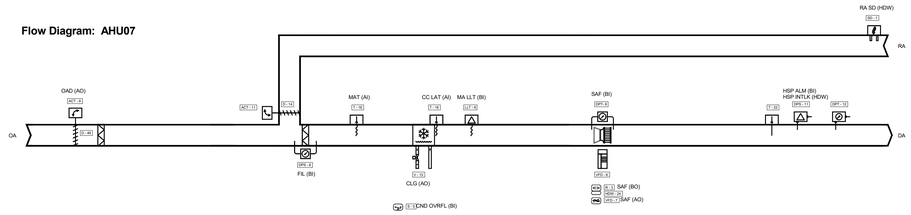
Filter Status:

A differential pressure switch shall monitor the differential pressure across the filter(s) when the fan is running. If the switch closes during normal operation a dirty filter alarm shall annunciate at the BAS.

Smoke Detector Shutdown:

The unit shall shut down in response to a signal from the smoke detector indicating the presence of smoke. The smoke detector shall be interlocked to the unit through the dry contacts of the smoke detector. A manual reset of the smoke detector shall be required to restart the unit.

Flow Diagram: AHU07



Points List - AHU07

System Point Description	POINTS										ALARMS					
	GRAPHIC	ANALOG HARDWARE INPUT (AI)	BINARY HARDWARE INPUT (BI)	ANALOG HARDWARE OUTPUT (AO)	BINARY HARDWARE OUTPUT (BO)	SOFTWARE POINT (SFT)	HARDWARE INTERLOCK (HDW)	WIRELESS (WLS)	NETWORK (NET)	HIGH ANALOG LIMIT	LOW ANALOG LIMIT	BINARY	LATCH DIAGNOSTIC	SENSOR FAIL	COMMUNICATION FAIL
AIR CLEANING ACCESS DOOR INTERLOCK...						X									
AIR CLEANING ACCESS DOOR INTERLOCK...						X									
CHANGEOVER COIL LEAVING AIR TEMPERATURE...	X	X								X	X			X	
COIL LEAVING AIR LOW TEMP CUTOUT ALARM...			X										X		
COMPRESSOR 1 COMMAND...	X				X										
COMPRESSOR 2 COMMAND...	X				X										
COMPRESSOR 3 COMMAND...	X				X										
COMPRESSOR 4 COMMAND...	X				X										
CONDENSATE OVERFLOW DETECTION LOCAL...	X		X									X	X		
COOLING COIL LEAVING TEMPERATURE...	X	X								X	X			X	
COOLING OUTPUT COMMAND...	X			X											
FILTER STATUS...	X		X									X			
HIGH STATIC ALARM...	X		X									X	X		
HIGH STATIC ALARM INTERLOCK...							X								
MIXED AIR LOW TEMPERATURE CUTOUT ALARM...			X										X		
MIXED AIR TEMPERATURE LOCAL...	X	X								X				X	
OUTDOOR AIR DAMPER COMMAND...	X			X											
RETURN AIR TEMPERATURE LOCAL...	X	X													
RETURN SMOKE DETECTOR INPUT...							X								
SUPPLY FAN SPEED COMMAND...	X			X											
SUPPLY FAN START STOP COMMAND...	X				X										
SUPPLY FAN STATUS...	X		X												
BAS COMMUNICATION STATE...						X									X
DISCHARGE AIR COOLING SETPOINT...						X									
DISCHARGE AIR HEATING SETPOINT...						X									
MAINTENANCE REQUIRED...						X						X			
MIXED AIR TEMPERATURE LOW LIMIT SETPOINT...						X									
OCCUPIED COOLING SETPOINT...	X					X									
SUPPLY FAN FAILURE...	X					X						X			
UNOCCUPIED COOLING SETPOINT...	X					X									

AHU07 CONTROLS

SCALE : 1/8" = 1'-0"

1

SZOSTAK DESIGN

FORT FISHER AQUARIUM RENOVATION & EXPANSION: PHASE 1

SCO #17-18042-02A
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ITEM: 41414-4Y4A

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NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

MECHANICAL CONTROLS

M-7.4

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Sequence of Operation: FCU03, 15, 17, 20, 21 [QTY: 5]

Building Automation System Interface:

The Building Automation System (BAS) shall send the controller Occupied Bypass, Morning Warm-up/Pre-Cool, Occupied/Unoccupied and Heat/Cool modes. If a BAS is not present, or communication is lost with the BAS the controller shall operate using default modes and setpoints

Occupied:

During occupied periods, the supply fan shall run continuously and the outdoor air damper shall open to maintain minimum ventilation requirements. The chilled water valve and the hot water valve shall control to maintain the active space temperature setpoint.

Unoccupied:

When the space temperature is above the unoccupied cooling setpoint of 85.0 deg. F (adj.) the supply fan shall start and the DX cooling shall be enabled. When the space temperature falls below the unoccupied cooling setpoint of 85.0 deg. F minus the unoccupied differential 4.0 deg. F (adj.) the supply fan shall stop and the DX cooling shall be disabled. Test for bug reporting

Optimal Start:

The BAS shall monitor the scheduled occupied time, occupied space setpoints and space temperature to calculate when the optimal start occurs.

Morning Warm-Up Mode

During optimal start, if the space temperature is below the occupied heating setpoint a morning warm-up mode shall be activated. When morning warm-up is initiated the unit shall enable the heating and supply fan. The outside air damper shall remain closed. When the space temperature reaches the occupied heating setpoint (adj.), the unit shall transition to the occupied mode.

Pre-Cool Mode:

During optimal start, if the space temperature is above the occupied cooling setpoint, pre-cool mode shall be activated. When pre-cool is initiated the unit shall enable the fan and cooling. The outside air damper shall remain closed. When the space temperature reaches occupied cooling setpoint (adj.), the unit shall transition to the occupied mode.

Optimal Stop:

The BAS shall monitor the scheduled unoccupied time, occupied setpoints and space temperature to calculate when the optimal stop occurs. When the optimal stop mode is active the unit controller shall maintain the space temperature to the space temperature offset setpoint. Outside air damper shall remain enabled to provide minimum ventilation.

Occupied Bypass:

The BAS shall monitor the status of the ON and CANCEL buttons of the space temperature sensor. When an occupied bypass request is received from a space sensor, the unit shall transition from its current occupancy mode to occupied bypass mode and the unit shall maintain the space temperature to the occupied setpoints (adj.).

Space Temperature Control:

Cascade zone control shall be used in the occupied, occupied bypass, and occupied standby modes. It maintains zone temperature by controlling the discharge air temperature to control the zone temperature while minimizing the fan speed. The space temperature shall be maintained between the occupied cooling setpoint of 74.0 deg. F (adj.) and the occupied heating setpoint of 71.0 deg. F (adj.). The unit shall transition to the cooling mode when the space temperature rises one degree above the occupied cooling setpoint of 74.0 deg. F (adj.). The unit shall transition to the heating mode when the space temperature drops one degree below the occupied heating setpoint of 71.0 deg. F (adj.).

Occupied Humidity Control:

Dehumidification mode shall terminate when the space relative humidity falls below the relative humidity setpoint minus the relative humidity offset. If the space relative humidity sensor fails the dehumidification sequence shall be terminated and an alarm shall annunciate at the BAS.

Supply Fan Operation:

The supply fan shall cycle on demand during the unoccupied mode. When the controller transitions to the occupied mode, the supply fan shall start at high speed before transitioning to continuous operation at the selected speed. The supply fan status shall be monitored by a differential pressure switch. If the supply fan fails the fan shall be commanded off and an alarm shall annunciate at the BAS. A manual reset shall be required to restart the fan.

Condensate Overflow Monitoring:

If the condensate level reaches the trip point, a condensate overflow diagnostic shall annunciate at the BAS. To prevent the condensate drain pan from overflowing and causing water damage to the building the fan shall be disabled and the chilled water valve shall close.

Freeze Protection:

A hardwired, low limit temperature switch shall be electrically interlocked with the safety circuit. If the low limit temperature switch is tripped 38.0 deg. F (adj.), the supply fan shall be commanded off, water valves shall open to 100%, outside air damper shall close, and an alarm shall annunciate at the BAS.

The controller shall automatically attempt to restart the unit after 30 minutes. If the unit restarts successfully with no low temperature condition, the diagnostic is cleared. If a second low temperature condition occurs within a 24 hour period the unit shall be locked out until manually reset.

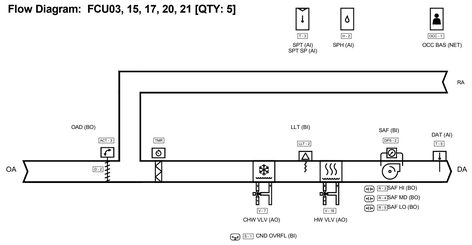
Filter Timer:

The fan-run time (hrs) shall be compared to the filter maintenance timer setpoint. Once the setpoint is reached a filter timer alarm diagnostic shall annunciate at the BAS. When the diagnostic is cleared, the filter-maintenance timer is reset to zero, and the timer begins accumulating fan-run time again.

Points List - FCU03, 15, 17, 20, 21 [QTY: 5]

System Point Description	POINTS										ALARMS					
	GRAPHIC	ANALOG HARDWARE INPUT (AI)	BINARY HARDWARE INPUT (BI)	ANALOG HARDWARE OUTPUT...	BINARY HARDWARE OUTPUT...	SOFTWARE POINT (SFT)	HARDWARE INTERLOCK (HDW)	WIRELESS (WLS)	NETWORK (NET)	HIGH ANALOG LIMIT	LOW ANALOG LIMIT	BINARY	LATCH DIAGNOSTIC	SENSOR FAIL	COMMUNICATION FAIL
CHILLED WATER VALVE...	X			X											
CONDENSATE OVERFLOW DETECTION LOCAL...	X		X									X	X		
DISCHARGE AIR TEMPERATURE...	X	X								X	X			X	
HOT WATER VALVE...	X			X											
LOW LIMIT CUTOUT...	X		X									X	X		
OUTDOOR AIR DAMPER...	X				X										
SPACE HUMIDITY SENSOR LOCAL...	X	X								X				X	
SPACE TEMPERATURE LOCAL...	X	X								X	X			X	
SPACE TEMPERATURE SETPOINT LOCAL...	X	X													
SUPPLY FAN STATUS LOCAL...	X		X												
SUPPLY FAN OUTPUT HIGH...	X				X										
SUPPLY FAN OUTPUT MEDIUM...	X				X										
SUPPLY FAN OUTPUT LOW...	X				X										
BAS COMMUNICATION STATE...						X									X
FILTER TIMER HOURS...						X						X	X		
MAINTENANCE REQUIRED...						X						X			
SPACE DEHUMIDIFICATION SETPOINT...						X									
SPACE TEMPERATURE SETPOINT ACTIVE...	X					X									
OCCUPIED BYPASS TIMER...						X									
OCCUPIED COOLING SETPOINT...	X					X									
OCCUPIED HEATING SETPOINT...	X					X									
UNOCCUPIED COOLING SETPOINT...	X					X									
OCCUPANCY BAS...	X								X						
UNOCCUPIED HEATING SETPOINT...	X					X									

Flow Diagram: FCU03, 15, 17, 20, 21 [QTY: 5]



Sequence of Operation: FCU01, 02 [QTY: 2]

Building Automation System Interface:

The Building Automation System (BAS) shall send the controller Occupied Bypass, Morning Warm-up/Pre-Cool, Occupied/Unoccupied and Heat/Cool modes. If a BAS is not present, or communication is lost with the BAS the controller shall operate using default modes and setpoints

Occupied:

During occupied periods, the supply fan shall run continuously and the outdoor air damper shall open to maintain minimum ventilation requirements. The chilled water valve and the hot water valve shall control to maintain the active space temperature setpoint.

Unoccupied:

When the space temperature is below the unoccupied heating setpoint of 60.0 deg. F (adj.) the supply fan shall start, the outside air damper shall remain closed and the hot water valve shall open. When the space temperature rises above the unoccupied heating setpoint of 60.0 deg. F (adj.) plus the unoccupied differential of 4.0 deg. F (adj.) the supply fan shall stop and the hot water valve shall close. When the space temperature is above the unoccupied cooling setpoint of 85.0 deg. F (adj.) the supply fan shall start, the outside air damper shall remain closed and the chilled water valve shall open. When the space temperature falls below the unoccupied cooling setpoint of 85.0 deg. F (adj.) minus the Unoccupied differential of 4.0 deg. F (adj.) the supply fan shall stop, the chilled water valve shall close and the outside air damper shall remain closed.

Optimal Start:

The BAS shall monitor the scheduled occupied time, occupied space setpoints and space temperature to calculate when the optimal start occurs.

Morning Warm-Up Mode

During optimal start, if the space temperature is below the occupied heating setpoint a morning warm-up mode shall be activated. When morning warm-up is initiated the unit shall enable the heating and supply fan. The outside air damper shall remain closed. When the space temperature reaches the occupied heating setpoint (adj.), the unit shall transition to the occupied mode.

Pre-Cool Mode:

During optimal start, if the space temperature is above the occupied cooling setpoint, pre-cool mode shall be activated. When pre-cool is initiated the unit shall enable the fan and cooling. The outside air damper shall remain closed. When the space temperature reaches occupied cooling setpoint (adj.), the unit shall transition to the occupied mode.

Optimal Stop:

The BAS shall monitor the scheduled unoccupied time, occupied setpoints and space temperature to calculate when the optimal stop occurs. When the optimal stop mode is active the unit controller shall maintain the space temperature to the space temperature offset setpoint. Outside air damper shall remain enabled to provide minimum ventilation.

Occupied Bypass:

The BAS shall monitor the status of the ON and CANCEL buttons of the space temperature sensor. When an occupied bypass request is received from a space sensor, the unit shall transition from its current occupancy mode to occupied bypass mode and the unit shall maintain the space temperature to the occupied setpoints (adj.).

Space Temperature Control:

Cascade zone control shall be used in the occupied, occupied bypass, and occupied standby modes. It maintains zone temperature by controlling the discharge air temperature to control the zone temperature while minimizing the fan speed. The space temperature shall be maintained between the occupied cooling setpoint of 74.0 deg. F (adj.) and the occupied heating setpoint of 71.0 deg. F (adj.). The unit shall transition to the cooling mode when the space temperature rises one degree above the occupied cooling setpoint of 74.0 deg. F (adj.). The unit shall transition to the heating mode when the space temperature drops one degree below the occupied heating setpoint of 71.0 deg. F (adj.).

Occupied Humidity Control:

If the space relative humidity is greater than the humidity setpoint, the chilled water valve shall modulate to maintain space relative humidity and the hot water valve shall modulate to maintain the space temperature cooling setpoint. Dehumidification mode shall terminate when the space relative humidity falls below the relative humidity setpoint minus the relative humidity offset. If the space relative humidity sensor fails the dehumidification sequence shall be terminated and an alarm shall annunciate at the BAS.

Supply Fan Operation:

The supply fan shall cycle on demand during the unoccupied mode. When the controller transitions to the occupied mode, the supply fan shall start and run continuously. The supply fan status shall be monitored by a differential pressure switch. If the supply fan fails the fan shall be commanded off and an alarm shall annunciate at the BAS. A manual reset shall be required to restart the fan.

Condensate Overflow Monitoring:

If the condensate level reaches the trip point, a condensate overflow diagnostic shall annunciate at the BAS. To prevent the condensate drain pan from overflowing and causing water damage to the building the fan shall be disabled and the chilled water valve shall close.

Freeze Protection:

A hardwired, low limit temperature switch shall be electrically interlocked with the safety circuit. If the low limit temperature switch is tripped 38.0 deg. F (adj.), the supply fan shall be commanded off, water valves shall open to 100%, outside air damper shall close, and an alarm shall annunciate at the BAS.

The controller shall automatically attempt to restart the unit after 30 minutes. If the unit restarts successfully with no low temperature condition, the diagnostic is cleared. If a second low temperature condition occurs within a 24 hour period the unit shall be locked out until manually reset.

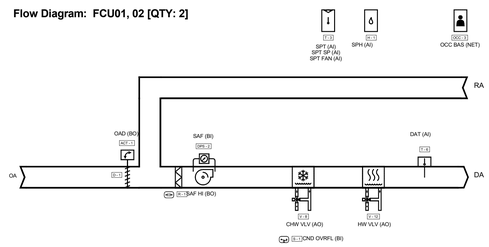
Filter Timer:

The fan-run time (hrs) shall be compared to the filter maintenance timer setpoint. Once the setpoint is reached a filter timer alarm diagnostic shall annunciate at the BAS. When the diagnostic is cleared, the filter-maintenance timer is reset to zero, and the timer begins accumulating fan-run time again.

Points List - FCU01, 02 [QTY: 2]

System Point Description	POINTS									ALARMS					
	GRAPHIC	ANALOG HARDWARE INPUT (AI)	BINARY HARDWARE INPUT (BI)	ANALOG HARDWARE OUTPUT...	BINARY HARDWARE OUTPUT...	SOFTWARE POINT (SFT)	HARDWARE INTERLOCK (HDW)	WIRELESS (WLS)	NETWORK (NET)	HIGH ANALOG LIMIT	LOW ANALOG LIMIT	BINARY	LATCH DIAGNOSTIC	SENSOR FAIL	COMMUNICATION FAIL
CHILLED WATER VALVE...	X			X											
CONDENSATE OVERFLOW DETECTION LOCAL...	X		X									X	X		
DISCHARGE AIR TEMPERATURE...	X	X								X	X			X	
HOT WATER VALVE...	X			X											
LOW LIMIT CUTOUT...	X		X									X	X		
OUTDOOR AIR DAMPER...	X				X										
SPACE HUMIDITY SENSOR LOCAL...	X	X								X				X	
SPACE TEMPERATURE LOCAL...	X	X								X	X			X	
SPACE TEMPERATURE SETPOINT LOCAL...	X	X													
SUPPLY FAN STATUS LOCAL...	X		X												
SUPPLY FAN OUTPUT HIGH...	X				X										
BAS COMMUNICATION STATE...						X									X
FILTER TIMER HOURS...						X						X	X		
MAINTENANCE REQUIRED...						X						X			
OCCUPANCY BAS...	X								X						
OCCUPIED BYPASS TIMER...						X									
OCCUPIED COOLING SETPOINT...	X					X									
OCCUPIED HEATING SETPOINT...	X					X									
SPACE DEHUMIDIFICATION SETPOINT...						X									
SPACE TEMPERATURE SETPOINT ACTIVE...	X					X									
UNOCCUPIED COOLING SETPOINT...	X					X									
UNOCCUPIED HEATING SETPOINT...	X					X									
SPACE FAN SETPOINT...		X													

Flow Diagram: FCU01, 02 [QTY: 2]



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FORT FISHER AQUARIUM RENOVATION & EXPANSION: PHASE 1

SCO #17-18042-02A
CODE: 42014-4G02
ITEM: 41414-4Y4A

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NOT FOR CONSTRUCTION
REGISTERED PROFESSIONAL ENGINEER
SEAL 23551
DAVID M. HAHN

NOT FOR CONSTRUCTION

NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

MECHANICAL CONTROLS

M-7.5

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Sequence of Operation: FCU05, 06, 11, 12 [QTY: 4]

Building Automation System Interface:

The Building Automation System (BAS) shall send the controller Occupied Bypass, Morning Warm-up/Pre-Cool, Occupied/Unoccupied and Heat/Cool modes. If a BAS is not present, or communication is lost with the BAS the controller shall operate using default modes and setpoints

Occupied:

During occupied periods, the supply fan shall run continuously and the outdoor air damper shall open to maintain minimum ventilation requirements. The chilled water valve and the hot water valve shall control to maintain the active space temperature setpoint.

Unoccupied:

When the space temperature is above the unoccupied cooling setpoint of 85.0 deg. F (adj.) the supply fan shall start and the DX cooling shall be enabled. When the space temperature falls below the unoccupied cooling setpoint of 85.0 deg. F minus the unoccupied differential 4.0 deg. F (adj.) the supply fan shall stop and the DX cooling shall be disabled. Test for bug reporting

Optimal Start:

The BAS shall monitor the scheduled occupied time, occupied space setpoints and space temperature to calculate when the optimal start occurs.

Morning Warm-Up Mode

During optimal start, if the space temperature is below the occupied heating setpoint a morning warm-up mode shall be activated. When morning warm-up is initiated the unit shall enable the heating and supply fan. The outside air damper shall remain closed. When the space temperature reaches the occupied heating setpoint (adj.), the unit shall transition to the occupied mode.

Pre-Cool Mode:

During optimal start, if the space temperature is above the occupied cooling setpoint, pre-cool mode shall be activated. When pre-cool is initiated the unit shall enable the fan and cooling. The outside air damper shall remain closed. When the space temperature reaches occupied cooling setpoint (adj.), the unit shall transition to the occupied mode.

Optimal Stop:

The BAS shall monitor the scheduled unoccupied time, occupied setpoints and space temperature to calculate when the optimal stop occurs. When the optimal stop mode is active the unit controller shall maintain the space temperature to the space temperature offset setpoint. Outside air damper shall remain enabled to provide minimum ventilation.

Occupied Bypass:

The BAS shall monitor the status of the ON and CANCEL buttons of the space temperature sensor. When an occupied bypass request is received from a space sensor, the unit shall transition from its current occupancy mode to occupied bypass mode and the unit shall maintain the space temperature to the occupied setpoints (adj.).

Space Temperature Control:

Cascade zone control shall be used in the occupied, occupied bypass, and occupied standby modes. It maintains zone temperature by controlling the discharge air temperature to control the zone temperature while minimizing the fan speed. The space temperature shall be maintained between the occupied cooling setpoint of 74.0 deg. F (adj.) and the occupied heating setpoint of 71.0 deg. F (adj.). The unit shall transition to the cooling mode when the space temperature rises one degree above the occupied cooling setpoint of 74.0 deg. F (adj.). The unit shall transition to the heating mode when the space temperature drops one degree below the occupied heating setpoint of 71.0 deg. F (adj.).

Occupied Humidity Control:

Dehumidification mode shall terminate when the space relative humidity falls below the relative humidity setpoint minus the relative humidity offset. If the space relative humidity sensor fails the dehumidification sequence shall be terminated and an alarm shall annunciate at the BAS.

Supply Fan Operation:

The supply fan shall cycle on demand during the unoccupied mode. When the controller transitions to the occupied mode, the supply fan shall start at high speed before transitioning to continuous operation at the selected speed. The supply fan status shall be monitored by a differential pressure switch. If the supply fan fails the fan shall be commanded off and an alarm shall annunciate at the BAS. A manual reset shall be required to restart the fan.

Condensate Overflow Monitoring:

If the condensate level reaches the trip point, a condensate overflow diagnostic shall annunciate at the BAS. To prevent the condensate drain pan from overflowing and causing water damage to the building the fan shall be disabled and the chilled water valve shall close.

Freeze Protection:

A hardwired, low limit temperature switch shall be electrically interlocked with the safety circuit. If the low limit temperature switch is tripped 38.0 deg. F (adj.), the supply fan shall be commanded off, water valves shall open to 100%, outside air damper shall close, and an alarm shall annunciate at the BAS.

The controller shall automatically attempt to restart the unit after 30 minutes. If the unit restarts successfully with no low temperature condition, the diagnostic is cleared. If a second low temperature condition occurs within a 24 hour period the unit shall be locked out until manually reset.

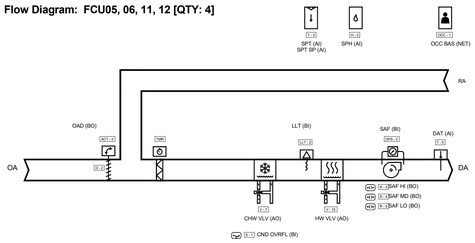
Filter Timer:

The fan-run time (hrs) shall be compared to the filter maintenance timer setpoint. Once the setpoint is reached a filter timer alarm diagnostic shall annunciate at the BAS. When the diagnostic is cleared, the filter-maintenance timer is reset to zero, and the timer begins accumulating fan-run time again.

Points List - FCU05, 06, 11, 12 [QTY: 4]

System Point Description	POINTS										ALARMS					
	GRAPHIC	ANALOG HARDWARE INPUT (AI)	BINARY HARDWARE INPUT (BI)	ANALOG HARDWARE OUTPUT....	BINARY HARDWARE OUTPUT...	SOFTWARE POINT (SFT)	HARDWARE INTERLOCK (HDW)	WIRELESS (WLS)	NETWORK (NET)	HIGH ANALOG LIMIT	LOW ANALOG LIMIT	BINARY	LATCH DIAGNOSTIC	SENSOR FAIL	COMMUNICATION FAIL
CHILLED WATER VALVE...	X			X											
CONDENSATE OVERFLOW DETECTION LOCAL...	X		X									X	X		
DISCHARGE AIR TEMPERATURE...	X	X								X	X			X	
HOT WATER VALVE...	X			X											
LOW LIMIT CUTOUT...	X		X									X	X		
OUTDOOR AIR DAMPER...	X				X										
SPACE HUMIDITY SENSOR LOCAL...	X	X								X				X	
SPACE TEMPERATURE LOCAL...	X	X								X	X			X	
SPACE TEMPERATURE SETPOINT LOCAL...	X	X													
SUPPLY FAN STATUS LOCAL...	X		X												
SUPPLY FAN OUTPUT HIGH...	X				X										
SUPPLY FAN OUTPUT MEDIUM...	X				X										
SUPPLY FAN OUTPUT LOW...	X				X										
BAS COMMUNICATION STATE...						X									X
FILTER TIMER HOURS...						X						X	X		
MAINTENANCE REQUIRED...						X						X			
SPACE DEHUMIDIFICATION SETPOINT...						X									
SPACE TEMPERATURE SETPOINT ACTIVE...	X					X									
OCCUPIED BYPASS TIMER...						X									
OCCUPIED COOLING SETPOINT...	X					X									
OCCUPIED HEATING SETPOINT...	X					X									
UNOCCUPIED COOLING SETPOINT...	X					X									
OCCUPANCY BAS...	X								X						
UNOCCUPIED HEATING SETPOINT...	X					X									

Flow Diagram: FCU05, 06, 11, 12 [QTY: 4]



Sequence of Operation: FCU04, 07, 08, 16 [QTY: 4]

Building Automation System Interface:

The Building Automation System (BAS) shall send the controller Occupied Bypass, Morning Warm-up/Pre-Cool, Occupied/Unoccupied and Heat/Cool modes. If a BAS is not present, or communication is lost with the BAS the controller shall operate using default modes and setpoints

Occupied:

During occupied periods, the supply fan shall run continuously and the outdoor air damper shall open to maintain minimum ventilation requirements. The chilled water valve and the hot water valve shall control to maintain the active space temperature setpoint.

Unoccupied:

When the space temperature is above the unoccupied cooling setpoint of 85.0 deg. F (adj.) the supply fan shall start and the DX cooling shall be enabled. When the space temperature falls below the unoccupied cooling setpoint of 85.0 deg. F minus the unoccupied differential 4.0 deg. F (adj.) the supply fan shall stop and the DX cooling shall be disabled. Test for bug reporting

Optimal Start:

The BAS shall monitor the scheduled occupied time, occupied space setpoints and space temperature to calculate when the optimal start occurs.

Morning Warm-Up Mode

During optimal start, if the space temperature is below the occupied heating setpoint a morning warm-up mode shall be activated. When morning warm-up is initiated the unit shall enable the heating and supply fan. The outside air damper shall remain closed. When the space temperature reaches the occupied heating setpoint (adj.), the unit shall transition to the occupied mode.

Pre-Cool Mode:

During optimal start, if the space temperature is above the occupied cooling setpoint, pre-cool mode shall be activated. When pre-cool is initiated the unit shall enable the fan and cooling. The outside air damper shall remain closed. When the space temperature reaches occupied cooling setpoint (adj.), the unit shall transition to the occupied mode.

Optimal Stop:

The BAS shall monitor the scheduled unoccupied time, occupied setpoints and space temperature to calculate when the optimal stop occurs. When the optimal stop mode is active the unit controller shall maintain the space temperature to the space temperature offset setpoint. Outside air damper shall remain enabled to provide minimum ventilation.

Occupied Bypass:

The BAS shall monitor the status of the ON and CANCEL buttons of the space temperature sensor. When an occupied bypass request is received from a space sensor, the unit shall transition from its current occupancy mode to occupied bypass mode and the unit shall maintain the space temperature to the occupied setpoints (adj.).

Space Temperature Control:

Cascade zone control shall be used in the occupied, occupied bypass, and occupied standby modes. It maintains zone temperature by controlling the discharge air temperature to control the zone temperature while minimizing the fan speed. The space temperature shall be maintained between the occupied cooling setpoint of 74.0 deg. F (adj.) and the occupied heating setpoint of 71.0 deg. F (adj.). The unit shall transition to the cooling mode when the space temperature rises one degree above the occupied cooling setpoint of 74.0 deg. F (adj.). The unit shall transition to the heating mode when the space temperature drops one degree below the occupied heating setpoint of 71.0 deg. F (adj.).

Occupied Humidity Control:

Dehumidification mode shall terminate when the space relative humidity falls below the relative humidity setpoint minus the relative humidity offset. If the space relative humidity sensor fails the dehumidification sequence shall be terminated and an alarm shall annunciate at the BAS.

Supply Fan Operation:

The supply fan shall cycle on demand during the unoccupied mode. When the controller transitions to the occupied mode, the supply fan shall start at high speed before transitioning to continuous operation at the selected speed. The supply fan status shall be monitored by a differential pressure switch. If the supply fan fails the fan shall be commanded off and an alarm shall annunciate at the BAS. A manual reset shall be required to restart the fan.

Condensate Overflow Monitoring:

If the condensate level reaches the trip point, a condensate overflow diagnostic shall annunciate at the BAS. To prevent the condensate drain pan from overflowing and causing water damage to the building the fan shall be disabled and the chilled water valve shall close.

Freeze Protection:

A hardwired, low limit temperature switch shall be electrically interlocked with the safety circuit. If the low limit temperature switch is tripped 38.0 deg. F (adj.), the supply fan shall be commanded off, water valves shall open to 100%, outside air damper shall close, and an alarm shall annunciate at the BAS.

The controller shall automatically attempt to restart the unit after 30 minutes. If the unit restarts successfully with no low temperature condition, the diagnostic is cleared. If a second low temperature condition occurs within a 24 hour period the unit shall be locked out until manually reset.

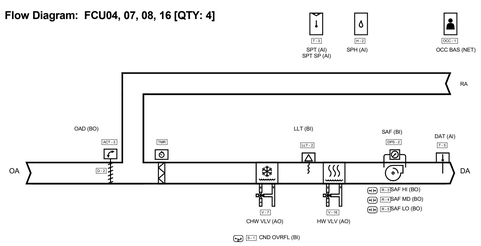
Filter Timer:

The fan-run time (hrs) shall be compared to the filter maintenance timer setpoint. Once the setpoint is reached a filter timer alarm diagnostic shall annunciate at the BAS. When the diagnostic is cleared, the filter-maintenance timer is reset to zero, and the timer begins accumulating fan-run time again.

Points List - FCU04, 07, 08, 16 [QTY: 4]

System Point Description	POINTS										ALARMS					
	GRAPHIC	ANALOG HARDWARE INPUT (AI)	BINARY HARDWARE INPUT (BI)	ANALOG HARDWARE OUTPUT....	BINARY HARDWARE OUTPUT...	SOFTWARE POINT (SFT)	HARDWARE INTERLOCK (HDW)	WIRELESS (WLS)	NETWORK (NET)	HIGH ANALOG LIMIT	LOW ANALOG LIMIT	BINARY	LATCH DIAGNOSTIC	SENSOR FAIL	COMMUNICATION FAIL
CHILLED WATER VALVE...	X			X											
CONDENSATE OVERFLOW DETECTION LOCAL...	X		X									X	X		
DISCHARGE AIR TEMPERATURE...	X	X								X	X			X	
HOT WATER VALVE...	X			X											
LOW LIMIT CUTOUT...	X		X									X	X		
OUTDOOR AIR DAMPER...	X				X										
SPACE HUMIDITY SENSOR LOCAL...	X	X								X				X	
SPACE TEMPERATURE LOCAL...	X	X								X	X			X	
SPACE TEMPERATURE SETPOINT LOCAL...	X	X													
SUPPLY FAN STATUS LOCAL...	X		X												
SUPPLY FAN OUTPUT HIGH...	X				X										
SUPPLY FAN OUTPUT MEDIUM...	X				X										
SUPPLY FAN OUTPUT LOW...	X				X										
BAS COMMUNICATION STATE...						X									X
FILTER TIMER HOURS...						X						X	X		
MAINTENANCE REQUIRED...						X						X			
SPACE DEHUMIDIFICATION SETPOINT...						X									
SPACE TEMPERATURE SETPOINT ACTIVE...	X					X									
OCCUPIED BYPASS TIMER...						X									
OCCUPIED COOLING SETPOINT...	X					X									
OCCUPIED HEATING SETPOINT...	X					X									
UNOCCUPIED COOLING SETPOINT...	X					X									
OCCUPANCY BAS...	X								X						
UNOCCUPIED HEATING SETPOINT...	X					X									

Flow Diagram: FCU04, 07, 08, 16 [QTY: 4]



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FORT FISHER AQUARIUM RENOVATION & EXPANSION: PHASE 1

SCO #17-18042-02A
CODE: 42014-4G02
ITEM: 41414-4Y4A

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REGISTERED ENGINEER
SEAL 23551
DAVID M. HAHN

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NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

MECHANICAL CONTROLS

M-7.6

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Sequence of Operation: FCU10

Building Automation System Interface:

The Building Automation System (BAS) shall send the controller Occupied Bypass, Morning Warm-up/Pre-Cool, Occupied/Unoccupied and Heat/Cool modes. If a BAS is not present, or communication is lost with the BAS the controller shall operate using default modes and setpoints

Occupied:

During occupied periods, the supply fan shall run continuously and the outdoor air damper shall open to maintain minimum ventilation requirements. The chilled water valve and the hot water valve shall control to maintain the active space temperature setpoint.

Unoccupied:

When the space temperature is above the unoccupied cooling setpoint of 85.0 deg. F (adj.) the supply fan shall start and the DX cooling shall be enabled. When the space temperature falls below the unoccupied cooling setpoint of 85.0 deg. F minus the unoccupied differential 4.0 deg. F (adj.) the supply fan shall stop and the DX cooling shall be disabled. Test for bug reporting

Optimal Start:

The BAS shall monitor the scheduled occupied time, occupied space setpoints and space temperature to calculate when the optimal start occurs.

Morning Warm-Up Mode

During optimal start, if the space temperature is below the occupied heating setpoint a morning warm-up mode shall be activated. When morning warm-up is initiated the unit shall enable the heating and supply fan. The outside air damper shall remain closed. When the space temperature reaches the occupied heating setpoint (adj.), the unit shall transition to the occupied mode.

Pre-Cool Mode:

During optimal start, if the space temperature is above the occupied cooling setpoint, pre-cool mode shall be activated. When pre-cool is initiated the unit shall enable the fan and cooling. The outside air damper shall remain closed. When the space temperature are reaches occupied cooling setpoint (adj.), the unit shall transition to the occupied mode.

Optimal Stop:

The BAS shall monitor the scheduled unoccupied time, occupied setpoints and space temperature to calculate when the optimal stop occurs. When the optimal stop mode is active the unit controller shall maintain the space temperature to the space temperature offset setpoint. Outside air damper shall remain enabled to provide minimum ventilation.

Occupied Bypass:

The BAS shall monitor the status of the ON and CANCEL buttons of the space temperature sensor. When an occupied bypass request is received from a space sensor, the unit shall transition from its current occupancy mode to occupied bypass mode and the unit shall maintain the space temperature to the occupied setpoints (adj.).

Space Temperature Control:

Cascade zone control shall be used in the occupied, occupied bypass, and occupied standby modes. It maintains zone temperature by controlling the discharge air temperature to control the zone temperature while minimizing the fan speed. The space temperature shall be maintained between the occupied cooling setpoint of 74.0 deg. F (adj.) and the occupied heating setpoint of 71.0 deg. F (adj.). The unit shall transition to the cooling mode when the space temperature rises one degree above the occupied cooling setpoint of 74.0 deg. F (adj.). The unit shall transition to the heating mode when the space temperature drops one degree below the occupied heating setpoint of 71.0 deg. F (adj.).

Occupied Humidity Control:

Dehumidification mode shall terminate when the space relative humidity falls below the relative humidity setpoint minus the relative humidity offset. If the space relative humidity sensor fails the dehumidification sequence shall be terminated and an alarm shall annunciate at the BAS.

Supply Fan Operation:

The supply fan shall cycle on demand during the unoccupied mode. When the controller transitions to the occupied mode, the supply fan shall start at high speed before transitioning to continuous operation at the selected speed. The supply fan status shall be monitored by a differential pressure switch. If the supply fan fails the fan shall be commanded off and an alarm shall annunciate at the BAS. A manual reset shall be required to restart the fan.

Condensate Overflow Monitoring:

If the condensate level reaches the trip point, a condensate overflow diagnostic shall annunciate at the BAS. To prevent the condensate drain pan from overflowing and causing water damage to the building the fan shall be disabled and the chilled water valve shall close.

Freeze Protection:

A hardwired, low limit temperature switch shall be electrically interlocked with the safety circuit. If the low limit temperature switch is tripped 38.0 deg. F (adj.), the supply fan shall be commanded off, water valves shall open to 100%, outside air damper shall close, and an alarm shall annunciate at the BAS.

The controller shall automatically attempt to restart the unit after 30 minutes. If the unit restarts successfully with no low temperature condition, the diagnostic is cleared. If a second low temperature condition occurs within a 24 hour period the unit shall be locked out until manually reset.

Smoke Detector Shutdown:

The unit shall shut down in response to a signal from the smoke detector indicating the presence of smoke. The smoke detector shall be interlocked to the unit through the dry contacts of the smoke detector. A manual reset of the smoke detector shall be required to restart the unit.

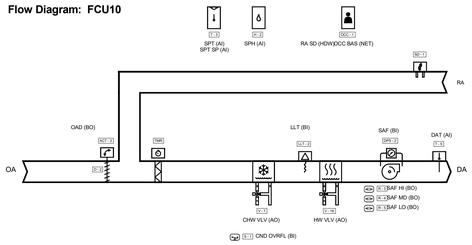
Filter Timer:

The fan-run time (hrs) shall be compared to the filter maintenance timer setpoint. Once the setpoint is reached a filter timer alarm diagnostic shall annunciate at the BAS. When the diagnostic is cleared, the filter-maintenance timer is reset to zero, and the timer begins accumulating fan-run time again.

Points List - FCU10

System Point Description	POINTS											ALARMS				
	GRAPHIC	ANALOG HARDWARE INPUT (AI)	BINARY HARDWARE INPUT (BI)	ANALOG HARDWARE OUTPUT...	BINARY HARDWARE OUTPUT...	SOFTWARE POINT (SFT)	HARDWARE INTERLOCK (HDW)	WIRELESS (WLS)	NETWORK (NET)	HIGH ANALOG LIMIT	LOW ANALOG LIMIT	BINARY	LATCH DIAGNOSTIC	SENSOR FAIL	COMMUNICATION FAIL
CHILLED WATER VALVE...	X			X											
CONDENSATE OVERFLOW DETECTION LOCAL...	X		X									X	X		
DISCHARGE AIR TEMPERATURE...	X	X								X	X			X	
HOT WATER VALVE...	X			X											
LOW LIMIT CUTOUT...	X		X									X	X		
OUTDOOR AIR DAMPER...	X				X										
RETURN AIR SMOKE DETECTOR...							X								
SPACE HUMIDITY SENSOR LOCAL...	X	X								X				X	
SPACE TEMPERATURE LOCAL...	X	X								X	X			X	
SPACE TEMPERATURE SETPOINT LOCAL...	X	X													
SUPPLY FAN STATUS LOCAL...	X		X												
SUPPLY FAN OUTPUT HIGH...	X				X										
SUPPLY FAN OUTPUT MEDIUM...	X				X										
SUPPLY FAN OUTPUT LOW...	X				X										
BAS COMMUNICATION STATE...						X									X
FILTER TIMER HOURS...						X						X	X		
MAINTENANCE REQUIRED...						X						X			
SPACE DEHUMIDIFICATION SETPOINT...						X									
SPACE TEMPERATURE SETPOINT ACTIVE...	X					X									
OCCUPIED BYPASS TIMER...						X									
OCCUPIED COOLING SETPOINT...	X					X									
OCCUPIED HEATING SETPOINT...	X					X									
UNOCCUPIED COOLING SETPOINT...	X					X									
OCCUPANCY BAS...	X								X						
UNOCCUPIED HEATING SETPOINT...	X					X									

Flow Diagram: FCU10



FCU10 CONTROLS

SCALE : 1/8" = 1'-0"

2

Sequence of Operation: FCU09

Building Automation System Interface:

The Building Automation System (BAS) shall send the controller Occupied Bypass, Morning Warm-up/Pre-Cool, Occupied/Unoccupied and Heat/Cool modes. If a BAS is not present, or communication is lost with the BAS the controller shall operate using default modes and setpoints

Occupied:

During occupied periods, the supply fan shall run continuously. The chilled water valve and the hot water valve shall control to maintain the active space temperature setpoint.

Unoccupied:

When the space temperature is below the unoccupied heating setpoint of 60.0 deg. F (adj.) and hot water is detected, the supply fan shall start and the Heat/Cool water valve shall open. If hot water is not available, the electric heat shall be energized. When the space temperature rises above the unoccupied heating setpoint of 60.0 deg. F (adj.) plus the unoccupied differential of 2.0 deg. F (adj.) the supply fan shall stop and the Heat/Cool water valve shall close. When the space temperature is above the unoccupied cooling setpoint of 85.0 deg. F (adj.) the supply fan shall start and the chilled water valve shall open. When the space temperature falls below the unoccupied cooling setpoint of 85.0 deg. F (adj.) minus the unoccupied differential of 4.0 deg. F (adj.) the supply fan shall stop and the chilled water valve shall close. Test for bug reporting

Optimal Start:

The BAS shall monitor the scheduled occupied time, occupied space setpoints and space temperature to calculate when the optimal start occurs.

Morning Warm-Up Mode

During optimal start, if the space temperature is below the occupied heating setpoint a morning warm-up mode shall be activated. When morning warm-up is initiated the unit shall enable the heating and supply fan. When the space temperature reaches the occupied heating setpoint (adj.), the unit shall transition to the occupied mode.

Pre-Cool Mode:

During optimal start, if the space temperature is above the occupied cooling setpoint, pre-cool mode shall be activated. When pre-cool is initiated the unit shall enable the fan and cooling. When the space temperature reaches occupied cooling setpoint (adj.), the unit shall transition to the occupied mode.

Optimal Stop:

The BAS shall monitor the scheduled unoccupied time, occupied setpoints and space temperature to calculate when the optimal stop occurs. When the optimal stop mode is active the unit controller shall maintain the space temperature to the space temperature offset setpoint.

Occupied Bypass:

The BAS shall monitor the status of the ON and CANCEL buttons of the space temperature sensor. When an occupied bypass request is received from a space sensor, the unit shall transition from its current occupancy mode to occupied bypass mode and the unit shall maintain the space temperature to the occupied setpoints (adj.).

Space Temperature Control:

Cascade zone control shall be used in the occupied, occupied bypass, and occupied standby modes. It maintains zone temperature by controlling the discharge air temperature to control the zone temperature while minimizing the fan speed. The space temperature shall be maintained between the occupied cooling setpoint of 74.0 deg. F (adj.) and the occupied heating setpoint of 71.0 deg. F (adj.). The unit shall transition to the cooling mode when the space temperature rises one degree above the occupied cooling setpoint of 74.0 deg. F (adj.). The unit shall transition to the heating mode when the space temperature drops one degree below the occupied heating setpoint of 71.0 deg. F (adj.).

Occupied Humidity Control:

Dehumidification mode shall terminate when the space relative humidity falls below the relative humidity setpoint minus the relative humidity offset. If the space relative humidity sensor fails the dehumidification sequence shall be terminated and an alarm shall annunciate at the BAS.

Supply Fan Operation:

The supply fan shall cycle on demand during the unoccupied mode. When the controller transitions to the occupied mode, the supply fan shall start at high speed before transitioning to continuous operation at the selected speed. The supply fan status shall be monitored by a differential pressure switch. If the supply fan fails the fan shall be commanded off and an alarm shall annunciate at the BAS. A manual reset shall be required to restart the fan.

Condensate Overflow Monitoring:

If the condensate level reaches the trip point, a condensate overflow diagnostic shall annunciate at the BAS. To prevent the condensate drain pan from overflowing and causing water damage to the building the fan shall be disabled and the chilled water valve shall close.

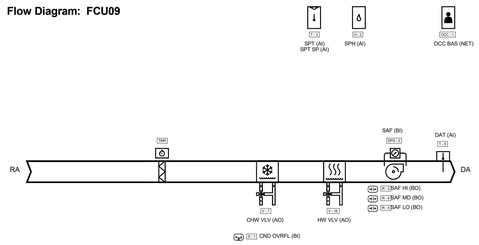
Filter Timer:

The fan-run time (hrs) shall be compared to the filter maintenance timer setpoint. Once the setpoint is reached a filter timer alarm diagnostic shall annunciate at the BAS. When the diagnostic is cleared, the filter-maintenance timer is reset to zero, and the timer begins accumulating fan-run time again.

Points List - FCU09

System Point Description	POINTS									ALARMS					
	GRAPHIC	ANALOG HARDWARE INPUT (AI)	BINARY HARDWARE INPUT (BI)	ANALOG HARDWARE OUTPUT...	BINARY HARDWARE OUTPUT...	SOFTWARE POINT (SFT)	HARDWARE INTERLOCK (HDW)	WIRELESS (WLS)	NETWORK (NET)	HIGH ANALOG LIMIT	LOW ANALOG LIMIT	BINARY	LATCH DIAGNOSTIC	SENSOR FAIL	COMMUNICATION FAIL
CHILLED WATER VALVE...	X			X											
CONDENSATE OVERFLOW DETECTION LOCAL...	X		X								X	X			
DISCHARGE AIR TEMPERATURE...	X	X								X	X			X	
HOT WATER VALVE...	X			X											
SPACE HUMIDITY SENSOR LOCAL...	X	X								X				X	
SPACE TEMPERATURE LOCAL...	X	X								X	X			X	
SPACE TEMPERATURE SETPOINT LOCAL...	X	X													
SUPPLY FAN STATUS LOCAL...	X		X												
SUPPLY FAN OUTPUT HIGH...	X				X										
SUPPLY FAN OUTPUT MEDIUM...	X				X										
SUPPLY FAN OUTPUT LOW...	X				X										
BAS COMMUNICATION STATE...						X									X
FILTER TIMER HOURS...						X						X	X		
MAINTENANCE REQUIRED...						X						X			
SPACE DEHUMIDIFICATION SETPOINT...						X									
SPACE TEMPERATURE SETPOINT ACTIVE...	X					X									
OCCUPIED BYPASS TIMER...						X									
OCCUPIED COOLING SETPOINT...	X					X									
OCCUPIED HEATING SETPOINT...	X					X									
UNOCCUPIED COOLING SETPOINT...	X					X									
OCCUPANCY BAS...	X								X						
UNOCCUPIED HEATING SETPOINT...	X					X									

Flow Diagram: FCU09



FCU09 CONTROLS

SCALE : 1/8" = 1'-0"

1

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FORT FISHER AQUARIUM RENOVATION & EXPANSION: PHASE 1

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CODE: 42014-4G02
ITEM: 41414-4Y4A

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NOT FOR CONSTRUCTION

REGISTERED PROFESSIONAL ENGINEER
SEAL 23551
DAVID M. HAHN

NOT FOR CONSTRUCTION

NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

MECHANICAL CONTROLS

M-7.7

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Sequence of Operation: FCU14, 18 [QTY: 2]

Building Automation System Interface:

The Building Automation System (BAS) shall send the controller Occupied Bypass, Morning Warm-up/Pre-Cool, Occupied/Unoccupied and Heat/Cool modes. If a BAS is not present, or communication is lost with the BAS the controller shall operate using default modes and setpoints

Occupied:

During occupied periods, the supply fan shall run continuously and the outdoor air damper shall open to maintain minimum ventilation requirements. The chilled water valve and the hot water valve shall control to maintain the active space temperature setpoint.

Unoccupied:

When the space temperature is above the unoccupied cooling setpoint of 85.0 deg. F (adj.) the supply fan shall start and the DX cooling shall be enabled. When the space temperature falls below the unoccupied cooling setpoint of 85.0 deg. F minus the unoccupied differential 4.0 deg. F (adj.) the supply fan shall stop and the DX cooling shall be disabled. Test for bug reporting

Optimal Start:

The BAS shall monitor the scheduled occupied time, occupied space setpoints and space temperature to calculate when the optimal start occurs.

Morning Warm-Up Mode

During optimal start, if the space temperature is below the occupied heating setpoint a morning warm-up mode shall be activated. When morning warm-up is initiated the unit shall enable the heating and supply fan. The outside air damper shall remain closed. When the space temperature reaches the occupied heating setpoint (adj.), the unit shall transition to the occupied mode.

Pre-Cool Mode:

During optimal start, if the space temperature is above the occupied cooling setpoint, pre-cool mode shall be activated. When pre-cool is initiated the unit shall enable the fan and cooling. The outside air damper shall remain closed. When the space temperature reaches occupied cooling setpoint (adj.), the unit shall transition to the occupied mode.

Optimal Stop:

The BAS shall monitor the scheduled unoccupied time, occupied setpoints and space temperature to calculate when the optimal stop occurs. When the optimal stop mode is active the unit controller shall maintain the space temperature to the space temperature offset setpoint. Outside air damper shall remain enabled to provide minimum ventilation.

Occupied Bypass:

The BAS shall monitor the status of the ON and CANCEL buttons of the space temperature sensor. When an occupied bypass request is received from a space sensor, the unit shall transition from its current occupancy mode to occupied bypass mode and the unit shall maintain the space temperature to the occupied setpoints (adj.).

Space Temperature Control:

Cascade zone control shall be used in the occupied, occupied bypass, and occupied standby modes. It maintains zone temperature by controlling the discharge air temperature to control the zone temperature while minimizing the fan speed. The space temperature shall be maintained between the occupied cooling setpoint of 74.0 deg. F (adj.) and the occupied heating setpoint of 71.0 deg. F (adj.). The unit shall transition to the cooling mode when the space temperature rises one degree above the occupied cooling setpoint of 74.0 deg. F (adj.). The unit shall transition to the heating mode when the space temperature drops one degree below the occupied heating setpoint of 71.0 deg. F (adj.).

Occupied Humidity Control:

Dehumidification mode shall terminate when the space relative humidity falls below the relative humidity setpoint minus the relative humidity offset. If the space relative humidity sensor fails the dehumidification sequence shall be terminated and an alarm shall annunciate at the BAS.

Supply Fan Operation:

The supply fan shall cycle on demand during the unoccupied mode. When the controller transitions to the occupied mode, the supply fan shall start at high speed before transitioning to continuous operation at the selected speed. The supply fan status shall be monitored by a differential pressure switch. If the supply fan fails the fan shall be commanded off and an alarm shall annunciate at the BAS. A manual reset shall be required to restart the fan.

Condensate Overflow Monitoring:

If the condensate level reaches the trip point, a condensate overflow diagnostic shall annunciate at the BAS. To prevent the condensate drain pan from overflowing and causing water damage to the building the fan shall be disabled and the chilled water valve shall close.

Freeze Protection:

A hardwired, low limit temperature switch shall be electrically interlocked with the safety circuit. If the low limit temperature switch is tripped 38.0 deg. F (adj.), the supply fan shall be commanded off, water valves shall open to 100%, outside air damper shall close, and an alarm shall annunciate at the BAS.

The controller shall automatically attempt to restart the unit after 30 minutes. If the unit restarts successfully with no low temperature condition, the diagnostic is cleared. If a second low temperature condition occurs within a 24 hour period the unit shall be locked out until manually reset.

Filter Timer:

The fan-run time (hrs) shall be compared to the filter maintenance timer setpoint. Once the setpoint is reached a filter timer alarm diagnostic shall annunciate at the BAS. When the diagnostic is cleared, the filter-maintenance timer is reset to zero, and the timer begins accumulating fan-run time again.

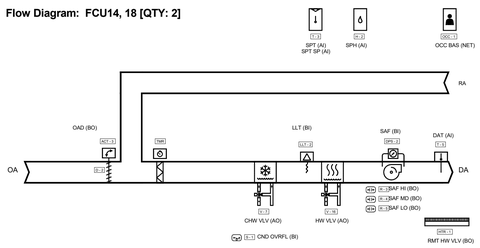
Remote Heating Source

When the space temperature falls 2.0 deg. F (adj) below the space temperature setpoint, then open the hot water valve for the remote heater to help maintain space temperature. If the outside air temperature falls below 55.0 deg. F (adj) then enable the remote heat to slow radiant heat loss around the perimeter of the building.

Points List - FCU14, 18 [QTY: 2]

System Point Description	POINTS										ALARMS					
	GRAPHIC	ANALOG HARDWARE INPUT (AI)	BINARY HARDWARE INPUT (BI)	ANALOG HARDWARE OUTPUT...	BINARY HARDWARE OUTPUT...	SOFTWARE POINT (SFT)	HARDWARE INTERLOCK (HDW)	WIRELESS (WLS)	NETWORK (NET)	HIGH ANALOG LIMIT	LOW ANALOG LIMIT	BINARY	LATCH DIAGNOSTIC	SENSOR FAIL	COMMUNICATION FAIL
CHILLED WATER VALVE...	X			X											
CONDENSATE OVERFLOW DETECTION LOCAL...	X		X									X	X		
DISCHARGE AIR TEMPERATURE...	X	X								X	X			X	
HOT WATER VALVE...	X			X											
LOW LIMIT CUTOUT...	X		X									X	X		
OUTDOOR AIR DAMPER...	X				X										
REMOTE HOT WATER VALVE...	X				X										
SPACE HUMIDITY SENSOR LOCAL...	X	X								X				X	
SPACE TEMPERATURE LOCAL...	X	X								X	X			X	
SPACE TEMPERATURE SETPOINT LOCAL...	X	X													
SUPPLY FAN STATUS LOCAL...	X		X												
SUPPLY FAN OUTPUT HIGH...	X				X										
SUPPLY FAN OUTPUT MEDIUM...	X				X										
SUPPLY FAN OUTPUT LOW...	X				X										
BAS COMMUNICATION STATE...						X									X
FILTER TIMER HOURS...						X						X	X		
MAINTENANCE REQUIRED...						X						X			
SPACE DEHUMIDIFICATION SETPOINT...						X									
SPACE TEMPERATURE SETPOINT ACTIVE...	X					X									
OCCUPIED BYPASS TIMER...						X									
OCCUPIED COOLING SETPOINT...	X					X									
OCCUPIED HEATING SETPOINT...	X					X									
UNOCCUPIED COOLING SETPOINT...	X					X									
OCCUPANCY BAS...	X								X						
UNOCCUPIED HEATING SETPOINT...	X					X									

Flow Diagram: FCU14, 18 [QTY: 2]



Sequence of Operation: FCU13

Building Automation System Interface:

The Building Automation System (BAS) shall send the controller Occupied Bypass, Morning Warm-up/Pre-Cool, Occupied/Unoccupied and Heat/Cool modes. If a BAS is not present, or communication is lost with the BAS the controller shall operate using default modes and setpoints

Occupied:

During occupied periods, the supply fan shall run continuously. The chilled water valve and the hot water valve shall control to maintain the active space temperature setpoint.

Unoccupied:

When the space temperature is below the unoccupied heating setpoint of 60.0 deg. F (adj.) the supply fan shall start and the hot water valve shall open. When the space temperature rises above the unoccupied heating setpoint of 60.0 deg. F (adj.) plus the unoccupied differential of 4.0 deg. F (adj.) the supply fan shall stop and the hot water valve shall close. When the space temperature is above the unoccupied cooling setpoint of 85.0 deg. F (adj.) the supply fan shall start and the chilled water valve shall open. When the space temperature falls below the unoccupied cooling setpoint of 85.0 deg. F (adj.) minus the unoccupied differential of 4.0 deg. F (adj.) the supply fan shall stop and the chilled water valve shall close.

Optimal Start:

The BAS shall monitor the scheduled occupied time, occupied space setpoints and space temperature to calculate when the optimal start occurs.

Morning Warm-Up Mode

During optimal start, if the space temperature is below the occupied heating setpoint a morning warm-up mode shall be activated. When morning warm-up is initiated the unit shall enable the heating and supply fan. When the space temperature reaches the occupied heating setpoint (adj.), the unit shall transition to the occupied mode.

Pre-Cool Mode:

During optimal start, if the space temperature is above the occupied cooling setpoint, pre-cool mode shall be activated. When pre-cool is initiated the unit shall enable the fan and cooling. When the space temperature reaches occupied cooling setpoint (adj.), the unit shall transition to the occupied mode.

Optimal Stop:

The BAS shall monitor the scheduled unoccupied time, occupied setpoints and space temperature to calculate when the optimal stop occurs. When the optimal stop mode is active the unit controller shall maintain the space temperature to the space temperature offset setpoint.

Occupied Bypass:

The BAS shall monitor the status of the ON and CANCEL buttons of the space temperature sensor. When an occupied bypass request is received from a space sensor, the unit shall transition from its current occupancy mode to occupied bypass mode and the unit shall maintain the space temperature to the occupied setpoints (adj.).

Space Temperature Control:

Cascade zone control shall be used in the occupied, occupied bypass, and occupied standby modes. It maintains zone temperature by controlling the discharge air temperature to control the zone temperature while minimizing the fan speed. The space temperature shall be maintained between the occupied cooling setpoint of 74.0 deg. F (adj.) and the occupied heating setpoint of 71.0 deg. F (adj.). The unit shall transition to the cooling mode when the space temperature rises one degree above the occupied cooling setpoint of 74.0 deg. F (adj.). The unit shall transition to the heating mode when the space temperature drops one degree below the occupied heating setpoint of 71.0 deg. F (adj.).

Occupied Humidity Control:

If the space relative humidity is greater than the humidity setpoint, the chilled water valve shall modulate to maintain space relative humidity and the hot water valve shall modulate to maintain the space temperature cooling setpoint. Dehumidification mode shall terminate when the space relative humidity falls below the relative humidity setpoint minus the relative humidity offset. If the space relative humidity sensor fails the dehumidification sequence shall be terminated and an alarm shall annunciate at the BAS.

Supply Fan Operation:

The supply fan shall cycle on demand during the unoccupied mode. When the controller transitions to the occupied mode, the supply fan shall start and run continuously. The supply fan status shall be monitored by a differential pressure switch. If the supply fan fails the fan shall be commanded off and an alarm shall annunciate at the BAS. A manual reset shall be required to restart the fan.

Condensate Overflow Monitoring:

If the condensate level reaches the trip point, a condensate overflow diagnostic shall annunciate at the BAS. To prevent the condensate drain pan from overflowing and causing water damage to the building the fan shall be disabled and the chilled water valve shall close.

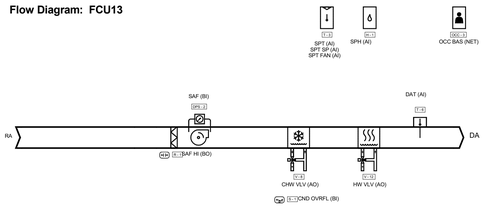
Filter Timer:

The fan-run time (hrs) shall be compared to the filter maintenance timer setpoint. Once the setpoint is reached a filter timer alarm diagnostic shall annunciate at the BAS. When the diagnostic is cleared, the filter-maintenance timer is reset to zero, and the timer begins accumulating fan-run time again.

Points List - FCU13

System Point Description	POINTS									ALARMS					
	GRAPHIC	ANALOG HARDWARE INPUT (AI)	BINARY HARDWARE INPUT (BI)	ANALOG HARDWARE OUTPUT...	BINARY HARDWARE OUTPUT...	SOFTWARE POINT (SFT)	HARDWARE INTERLOCK (HDW)	WIRELESS (WLS)	NETWORK (NET)	HIGH ANALOG LIMIT	LOW ANALOG LIMIT	BINARY	LATCH DIAGNOSTIC	SENSOR FAIL	COMMUNICATION FAIL
CHILLED WATER VALVE...	X			X											
CONDENSATE OVERFLOW DETECTION LOCAL...	X		X										X	X	
DISCHARGE AIR TEMPERATURE...	X	X								X	X			X	
HOT WATER VALVE...	X			X											
SPACE HUMIDITY SENSOR LOCAL...	X	X								X				X	
SPACE TEMPERATURE LOCAL...	X	X								X	X			X	
SPACE TEMPERATURE SETPOINT LOCAL...	X	X													
SUPPLY FAN STATUS LOCAL...	X		X												
SUPPLY FAN OUTPUT HIGH...	X				X										
BAS COMMUNICATION STATE...						X									X
FILTER TIMER HOURS...						X							X	X	
MAINTENANCE REQUIRED...						X							X		
OCCUPANCY BAS...	X								X						
OCCUPIED BYPASS TIMER...						X									
OCCUPIED COOLING SETPOINT...	X					X									
OCCUPIED HEATING SETPOINT...	X					X									
SPACE DEHUMIDIFICATION SETPOINT...						X									
SPACE TEMPERATURE SETPOINT ACTIVE...	X					X									
UNOCCUPIED COOLING SETPOINT...	X					X									
UNOCCUPIED HEATING SETPOINT...	X					X									
SPACE FAN SETPOINT...		X													

Flow Diagram: FCU13



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NORTH CAROLINA SEAL 23551 ENGINEER DAVID M. HAHN

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NO.	DATE	DESCRIPTION
1	9-8-25	BID SET

MECHANICAL CONTROLS

M-7.8

Sequence of Operation: PV10

Building Automation System Interface:

The Building Automation System (BAS) shall send the controller an Occupied or Unoccupied command. If a BAS is not present, or communication is lost with the BAS, the controller shall operate in the Occupied mode.

Occupied:

During occupied periods, the exhaust fan shall run continuously.

Unoccupied:

During unoccupied periods the exhaust fan shall be disabled.

Operation:

The damper end switch shall prove fully open prior to fan start. When the exhaust fan is disabled, the exhaust air damper shall close.

the normally open exhaust air damper shall open.

Fan Status:

The fan status shall be monitored by a current sensing switch. If the fan is signaled to start, and status is not proven within 20 seconds (adj.), an alarm shall annunciate at the BAS.

Points List - PV10

System Point Description	POINTS										ALARMS					
	GRAPHIC	ANALOG HARDWARE INPUT (AI)	BINARY HARDWARE INPUT (BI)	ANALOG HARDWARE OUTPUT...	BINARY HARDWARE OUTPUT...	SOFTWARE POINT (SFT)	HARDWARE INTERLOCK (HDW)	WIRELESS (WLS)	NETWORK (NET)	HIGH ANALOG LIMIT	LOW ANALOG LIMIT	BINARY	LATCH DIAGNOSTIC	SENSOR FAIL	COMMUNICATION FAIL
EXHAUST AIR DAMPER COMMAND...					X										
EXHAUST AIR DAMPER POSITION STAT...	X		X												
EXHAUST FAN SPEED COMMAND...				X											
EXHAUST FAN STATUS...	X		X												
EXHAUST FAN START STOP COMMAND...	X				X										
BAS COMMUNICATION STATE...						X									

Flow Diagram: PV10

PV10 CONTROLS

SCALE : 1/8" = 1'-0"

4

Sequence of Operation: PV02, 05, 06, 09 [QTY: 4]

Building Automation System Interface:

The Building Automation System (BAS) shall send the controller an Occupied or Unoccupied command. If a BAS is not present, or communication is lost with the BAS, the controller shall operate in the Occupied mode.

Occupied:

During occupied periods, the exhaust fan shall run continuously.

Unoccupied:

During unoccupied periods the exhaust fan shall be disabled.

Operation:

The damper end switch shall prove fully open prior to fan start. When the exhaust fan is disabled, the exhaust air damper shall close.

the normally open exhaust air damper shall open.

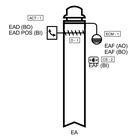
Fan Status:

The fan status shall be monitored by a current sensing switch. If the fan is signaled to start, and status is not proven within 20 seconds (adj.), an alarm shall annunciate at the BAS.

Points List - PV02, 05, 06, 09 [QTY: 4]

System Point Description	POINTS										ALARMS					
	GRAPHIC	ANALOG HARDWARE INPUT (AI)	BINARY HARDWARE INPUT (BI)	ANALOG HARDWARE OUTPUT...	BINARY HARDWARE OUTPUT...	SOFTWARE POINT (SFT)	HARDWARE INTERLOCK (HDW)	WIRELESS (WLS)	NETWORK (NET)	HIGH ANALOG LIMIT	LOW ANALOG LIMIT	BINARY	LATCH DIAGNOSTIC	SENSOR FAIL	COMMUNICATION FAIL
EXHAUST AIR DAMPER COMMAND...					X										
EXHAUST AIR DAMPER POSITION STAT...	X		X												
EXHAUST FAN SPEED COMMAND...				X											
EXHAUST FAN STATUS...	X		X												
EXHAUST FAN START STOP COMMAND...	X				X										
BAS COMMUNICATION STATE...						X									

Flow Diagram: PV02, 05, 06, 09 [QTY: 4]



PV02, 05, 06, 09 CONTROLS

SCALE : 1/8" = 1'-0"

3

Sequence of Operation: PV01, 03, 04 [QTY: 3]

Building Automation System Interface:

The Building Automation System (BAS) shall send the controller an Occupied or Unoccupied command. If a BAS is not present, or communication is lost with the BAS, the controller shall operate in the Occupied mode.

Occupied:

During occupied periods, the exhaust fan shall run continuously.

Unoccupied:

During unoccupied periods the exhaust fan shall be disabled.

Operation:

The damper end switch shall prove fully open prior to fan start. When the exhaust fan is disabled, the exhaust air damper shall close.

the normally open exhaust air damper shall open.

Fan Status:

The fan status shall be monitored by a current sensing switch. If the fan is signaled to start, and status is not proven within 20 seconds (adj.), an alarm shall annunciate at the BAS.

Points List - PV01, 03, 04 [QTY: 3]

System Point Description	POINTS										ALARMS					
	GRAPHIC	ANALOG HARDWARE INPUT (AI)	BINARY HARDWARE INPUT (BI)	ANALOG HARDWARE OUTPUT...	BINARY HARDWARE OUTPUT...	SOFTWARE POINT (SFT)	HARDWARE INTERLOCK (HDW)	WIRELESS (WLS)	NETWORK (NET)	HIGH ANALOG LIMIT	LOW ANALOG LIMIT	BINARY	LATCH DIAGNOSTIC	SENSOR FAIL	COMMUNICATION FAIL
EXHAUST AIR DAMPER COMMAND...					X										
EXHAUST AIR DAMPER POSITION STAT...	X		X												
EXHAUST FAN SPEED COMMAND...				X											
EXHAUST FAN STATUS...	X		X												
EXHAUST FAN START STOP COMMAND...	X				X										
BAS COMMUNICATION STATE...						X									

Flow Diagram: PV01, 03, 04 [QTY: 3]

PV01, 03, 04 CONTROLS

SCALE : 1/8" = 1'-0"

2

Sequence of Operation: FCU19

Building Automation System Interface:

The Building Automation System (BAS) shall send the controller Occupied Bypass, Morning Warm-up/Pre-Cool, Occupied/Unoccupied and Heat/Cool modes. If a BAS is not present, or communication is lost with the BAS the controller shall operate using default modes and setpoints

Occupied:

During occupied periods, the supply fan shall run continuously and the outdoor air damper shall open to maintain minimum ventilation requirements. The chilled water valve and the hot water valve shall control to maintain the active space temperature setpoint.

Unoccupied:

When the space temperature is above the unoccupied cooling setpoint of 85.0 deg. F (adj.) the supply fan shall start and the DX cooling shall be enabled. When the space temperature falls below the unoccupied cooling setpoint of 85.0 deg. F minus the unoccupied differential 4.0 deg. F (adj.) the supply fan shall stop and the DX cooling shall be disabled. Test for bug reporting

Optimal Start:

The BAS shall monitor the scheduled occupied time, occupied space setpoints and space temperature to calculate when the optimal start occurs.

Morning Warm-Up Mode

During optimal start, if the space temperature is below the occupied heating setpoint a morning warm-up mode shall be activated. When morning warm-up is initiated the unit shall enable the heating and supply fan. The outside air damper shall remain closed. When the space temperature reaches the occupied heating setpoint (adj.), the unit shall transition to the occupied mode.

Pre-Cool Mode:

During optimal start, if the space temperature is above the occupied cooling setpoint, pre-cool mode shall be activated. When pre-cool is initiated the unit shall enable the fan and cooling. The outside air damper shall remain closed. When the space temperature reaches occupied cooling setpoint (adj.), the unit shall transition to the occupied mode.

Optimal Stop:

The BAS shall monitor the scheduled unoccupied time, occupied setpoints and space temperature to calculate when the optimal stop occurs. When the optimal stop mode is active the unit controller shall maintain the space temperature to the space temperature offset setpoint. Outside air damper shall remain enabled to provide minimum ventilation.

Occupied Bypass:

The BAS shall monitor the status of the ON and CANCEL buttons of the space temperature sensor. When an occupied bypass request is received from a space sensor, the unit shall transition from its current occupancy mode to occupied bypass mode and the unit shall maintain the space temperature to the occupied setpoints (adj.).

Space Temperature Control:

Cascade zone control shall be used in the occupied, occupied bypass, and occupied standby modes. It maintains zone temperature by controlling the discharge air temperature to control the zone temperature while minimizing the fan speed. The space temperature shall be maintained between the occupied cooling setpoint of 74.0 deg. F (adj.) and the occupied heating setpoint of 71.0 deg. F (adj.). The unit shall transition to the cooling mode when the space temperature rises one degree above the occupied cooling setpoint of 74.0 deg. F (adj.). The unit shall transition to the heating mode when the space temperature drops one degree below the occupied heating setpoint of 71.0 deg. F (adj.).

Occupied Humidity Control:

Dehumidification mode shall terminate when the space relative humidity falls below the relative humidity setpoint minus the relative humidity offset. If the space relative humidity sensor fails the dehumidification sequence shall be terminated and an alarm shall annunciate at the BAS.

Supply Fan Operation:

The supply fan shall cycle on demand during the unoccupied mode. When the controller transitions to the occupied mode, the supply fan shall start at high speed before transitioning to continuous operation at the selected speed. The supply fan status shall be monitored by a differential pressure switch. If the supply fan fails the fan shall be commanded off and an alarm shall annunciate at the BAS. A manual reset shall be required to restart the fan.

Condensate Overflow Monitoring:

If the condensate level reaches the trip point, a condensate overflow diagnostic shall annunciate at the BAS. To prevent the condensate drain pan from overflowing and causing water damage to the building the fan shall be disabled and the chilled water valve shall close.

Freeze Protection:

A hardwired, low limit temperature switch shall be electrically interlocked with the safety circuit. If the low limit temperature switch is tripped 38.0 deg. F (adj.), the supply fan shall be commanded off, water valves shall open to 100%, outside air damper shall close, and an alarm shall annunciate at the BAS.

The controller shall automatically attempt to restart the unit after 30 minutes. If the unit restarts successfully with no low temperature condition, the diagnostic is cleared. If a second low temperature condition occurs within a 24 hour period the unit shall be locked out until manually reset.

Filter Timer:

The fan-run time (hrs) shall be compared to the filter maintenance timer setpoint. Once the setpoint is reached a filter timer alarm diagnostic shall annunciate at the BAS. When the diagnostic is cleared, the filter-maintenance timer is reset to zero, and the timer begins accumulating fan-run time again.

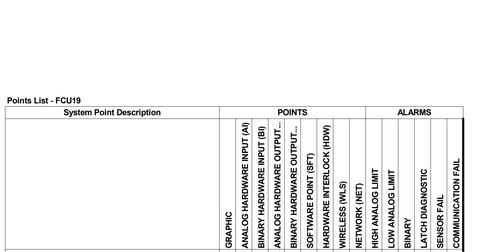
Remote Heating Source

When the space temperature falls 2.0 deg. F (adj) below the space temperature setpoint, then open the hot water valve for the remote heater to help maintain space temperature. If the outside air temperature falls below 55.0 deg. F (adj) then enable the remote heat to slow radiant heat loss around the perimeter of the building.

Points List - FCU19

System Point Description	POINTS										ALARMS					
	GRAPHIC	ANALOG HARDWARE INPUT (AI)	BINARY HARDWARE INPUT (BI)	ANALOG HARDWARE OUTPUT...	BINARY HARDWARE OUTPUT...	SOFTWARE POINT (SFT)	HARDWARE INTERLOCK (HDW)	WIRELESS (WLS)	NETWORK (NET)	HIGH ANALOG LIMIT	LOW ANALOG LIMIT	BINARY	LATCH DIAGNOSTIC	SENSOR FAIL	COMMUNICATION FAIL
CHILLED WATER VALVE...	X			X											
CONDENSATE OVERFLOW DETECTION LOCAL...	X		X									X	X		
DISCHARGE AIR TEMPERATURE...	X	X								X	X			X	
HOT WATER VALVE...	X			X											
LOW LIMIT CUTOUT...	X		X									X	X		
OUTDOOR AIR DAMPER...	X				X										
REMOTE HOT WATER VALVE...	X				X										
SPACE HUMIDITY SENSOR LOCAL...	X	X								X				X	
SPACE TEMPERATURE LOCAL...	X	X								X	X			X	
SPACE TEMPERATURE SETPOINT LOCAL...	X	X													
SUPPLY FAN STATUS LOCAL...	X		X												
SUPPLY FAN OUTPUT HIGH...	X				X										
SUPPLY FAN OUTPUT MEDIUM...	X				X										
SUPPLY FAN OUTPUT LOW...	X				X										
BAS COMMUNICATION STATE...						X									X
FILTER TIMER HOURS...						X							X	X	
MAINTENANCE REQUIRED...						X							X		
SPACE DEHUMIDIFICATION SETPOINT...						X									
SPACE TEMPERATURE SETPOINT ACTIVE...	X					X									
OCCUPIED BYPASS TIMER...						X									
OCCUPIED COOLING SETPOINT...	X					X									
OCCUPIED HEATING SETPOINT...	X					X									
UNOCCUPIED COOLING SETPOINT...	X					X									
OCCUPANCY BAS...	X								X						
UNOCCUPIED HEATING SETPOINT...	X					X									

Flow Diagram: FCU19



FCU19 CONTROLS

SCALE : 1/8" = 1'-0"

1

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SCO #17-18042-02A
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ITEM: 41414-4Y4A

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MECHANICAL CONTROLS

M-7.9

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HEAT EXCHANGER SEQUENCE OF OPERATIONS

SEQUENCE OF OPERATIONS (MONITORING-ONLY)

THE BAS WILL MONITOR THE OPERATING CONDITIONS OF THE HEAT EXCHANGER SYSTEM TO:
- •TRACK ENERGY USAGE
- •LOG THERMAL PERFORMANCE
- •RAISE ALARMS IF CONDITIONS DEVIATE FROM ACCEPTABLE RANGES

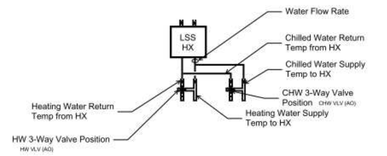
COOLING MODE (INITIATED BY LSS)
- •WHEN THE CHILLED WATER 3-WAY VALVE OPENS (BY LSS CONTROL), BAS:
  - oMONITORS CHW SUPPLY/RETURN TEMPERATURES
  - oMONITORS CHW FLOW RATE
  - oCALCULATES COOLING ENERGY (BTU/KW) VIA ΔT × FLOW
  - oMONITORS VALVE POSITION (READ-ONLY)

HEATING MODE (INITIATED BY LSS)
- •WHEN THE HEATING WATER 3-WAY VALVE OPENS (BY LSS CONTROL), BAS:
  - oMONITORS HW SUPPLY/RETURN TEMPERATURES
  - oMONITORS HW FLOW RATE
  - oCALCULATES HEATING ENERGY DELIVERED
  - oMONITORS VALVE POSITION (READ-ONLY)

ALARMS & MONITORING FUNCTIONS
BAS GENERATES ALARMS INDEPENDENTLY OF VALVE CONTROL:
- •NO FLOW ON CHW/HW SIDE WHILE VALVE INDICATES OPEN POSITION
- •UNEXPECTED ΔT (I.E., FLOW WITH NO SIGNIFICANT HEAT TRANSFER)
- •ENERGY USE TRENDS FOR DIAGNOSTIC/TRENDING

Description	Point Type	Units
Chilled Water Supply Temp to HX	Analog Input	°C / °F
Chilled Water Return Temp from HX	Analog Input	°C / °F
Chilled Water Flow Rate	Analog Input	GPM / LPM
CHW 3-Way Valve Position	Analog Input	%
CHW Side Energy Usage	Calculated / AI	kW
Heating Water Supply Temp to HX	Analog Input	°C / °F
Heating Water Return Temp from HX	Analog Input	°C / °F
Heating Water Flow Rate	Analog Input	GPM / LPM
HW 3-Way Valve Position	Analog Input	%
HW Side Energy Usage	Calculated / AI	kW

Symbols
WT (AI) Temp
DF (AI) Flow



DOMESTIC WATER PRESSURE BOOSTER PUMP POINTS LIST

Point Name / Type / Units / Notes			
Booster System Power Status	Binary (On/Off)		System main power status
Booster System General Fault	Binary (Fault/OK)		Any system-wide fault
System Pressure	Analog	PSI	Outlet pressure from booster system
Suction Pressure	Analog	PSI	Inlet pressure to booster system
Discharge Pressure	Analog	PSI	Pressure at discharge header
High Temp Shutdown Alarm	Binary Alarm		Triggered at overtemp
Low System Pressure Alarm	Binary Alarm		Below system pressure threshold
Low Suction Pressure Alarm	Binary Alarm		Suction drops below threshold
Low Suction Pressure Shutdown	Binary Alarm		Interlocks system shutdown
High Discharge Pressure Alarm	Binary Alarm		Above max threshold
Low Discharge Pressure Alarm	Binary Alarm		Below expected range
Pump VFD Fault – Pump 1	Binary Alarm		Specific to each pump
Pump VFD Fault – Pump 2	Binary Alarm		
Pump VFD Fault – Pump 3	Binary Alarm		
Pump Failure Detected – Pump 1	Binary Alarm		Pump unable to operate
Pump Failure Detected – Pump 2	Binary Alarm		
Pump Failure Detected – Pump 3	Binary Alarm		
VFD Running Status – Pump 1	Binary (Run/Stop)		Indicates VFD operation
VFD Running Status – Pump 2	Binary (Run/Stop)		
VFD Running Status – Pump 3	Binary (Run/Stop)		
Pump Elapsed Run Time – Pump 1	Analog	Hours	Runtime meter
Pump Elapsed Run Time – Pump 2	Analog	Hours	
Pump Elapsed Run Time – Pump 3	Analog	Hours	-

DOMESTIC BOOSTER PUMP CONTROLS
SCALE : 1/8" = 1'-0"

2

HX CONTROLS
SCALE : 1/8" = 1'-0"

1

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SCO #17-18042-02A
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MECHANICAL CONTROLS

M-7.10

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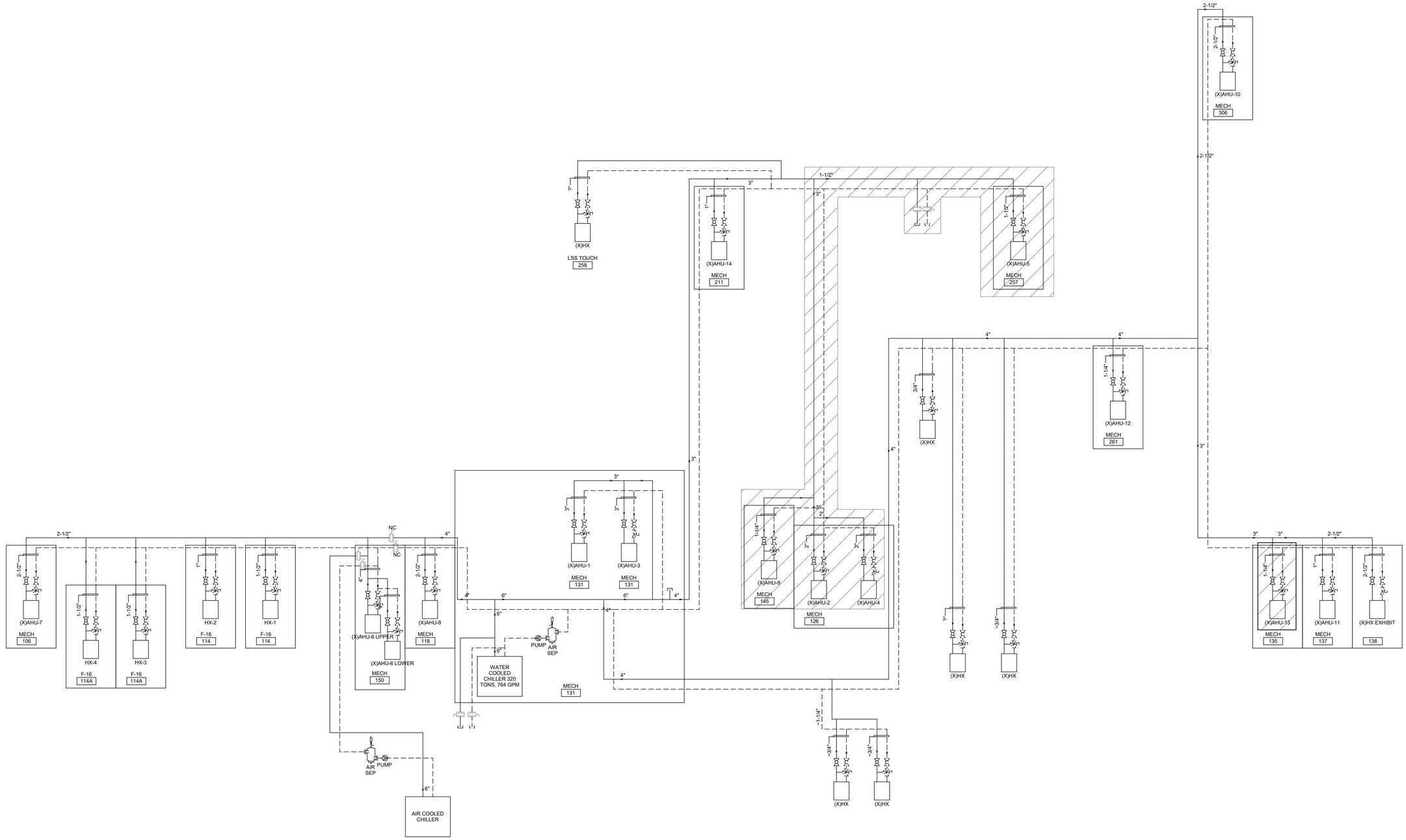

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MECHANICAL CHILLED WATER PIPING FLOW DIAGRAM DEMO

M-8.1

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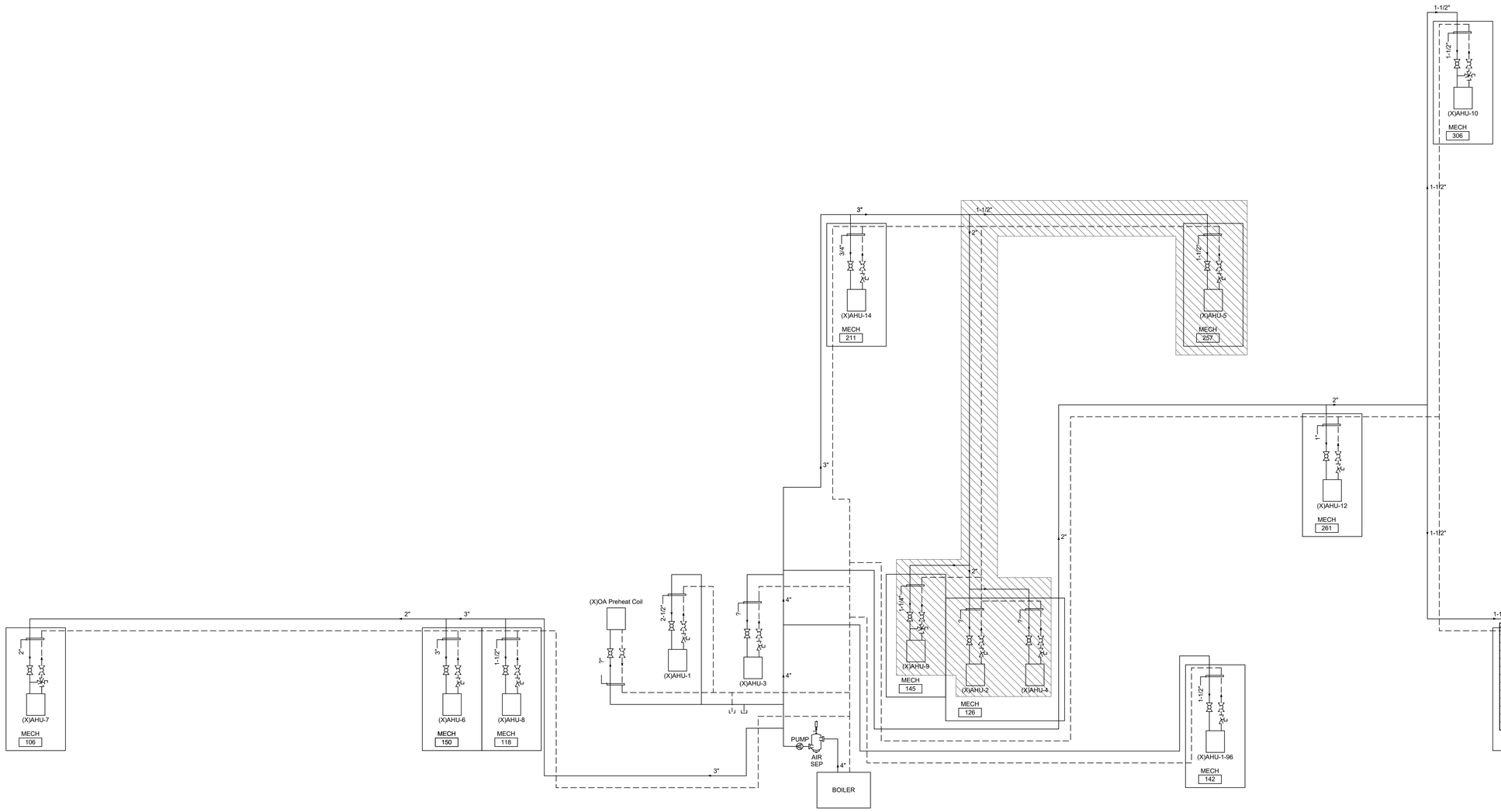
CHILLED WATER PIPING FLOW DIAGRAM DEMO
SCALE : NO SCALE



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MECHANICAL HEATING
HOT WATER PIPING FLOW
DIAGRAM DEMO

M-8.2

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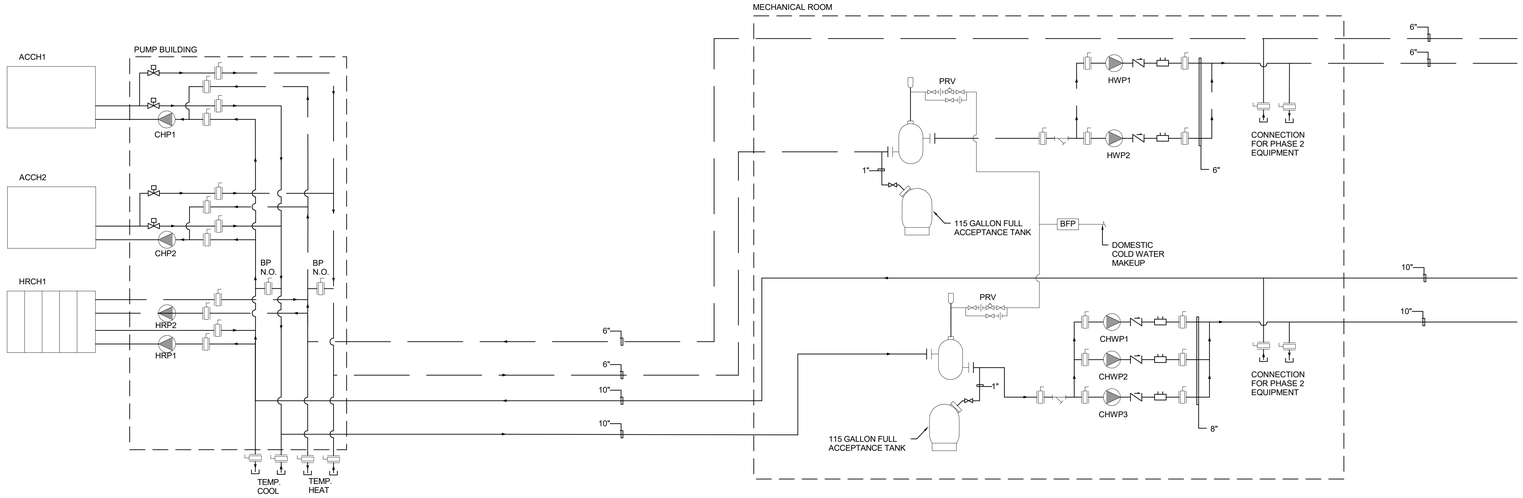
HEATING HOT WATER PIPING FLOW DIAGRAM DEMO

SCALE : NO SCALE



HYDRONIC PIPING DIAGRAM

SCALE : 12" = 1'-0"

1

SZOSTAK DESIGN

FORT FISHER
AQUARIUM
RENOVATION
& EXPANSION:
PHASE 1

SCO #17-18042-02A
CODE: 42014-4G02
ITEM: 41414-4Y4A

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MECHANICAL CHILLED AND HOT WATER PIPING FLOW DIAGRAM

M-8.3

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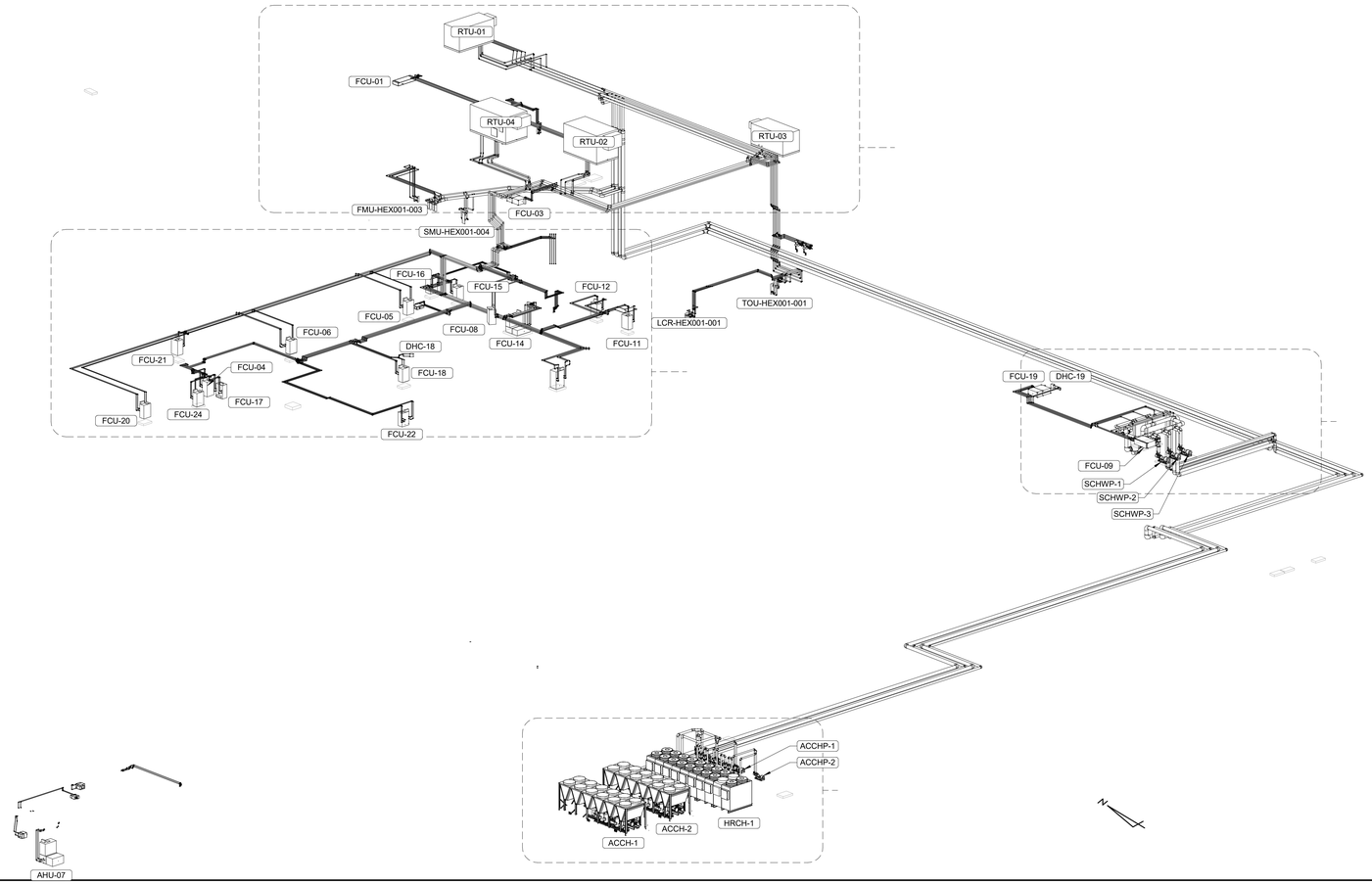
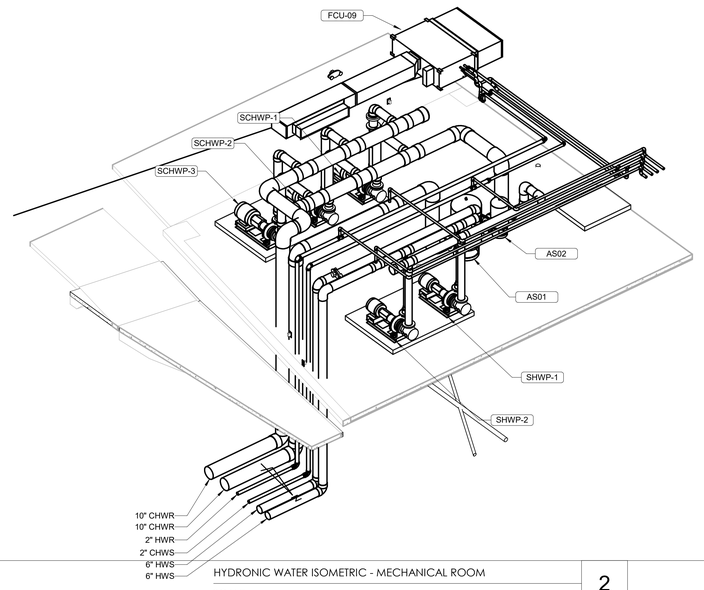


HYDRONIC WATER ISOMETRIC

SCALE :

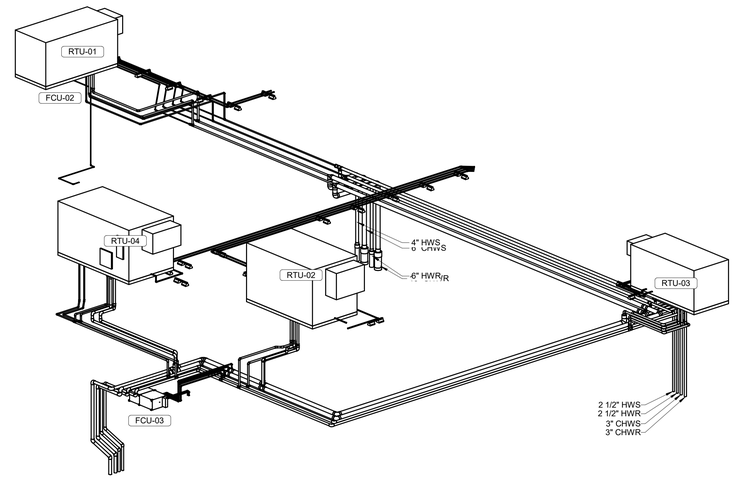
1



HYDRONIC WATER ISOMETRIC - MECHANICAL ROOM

SCALE :

2



HYDRONIC WATER ISOMETRIC - SHARK - THIRD FLR AND ROOF

SCALE :

3

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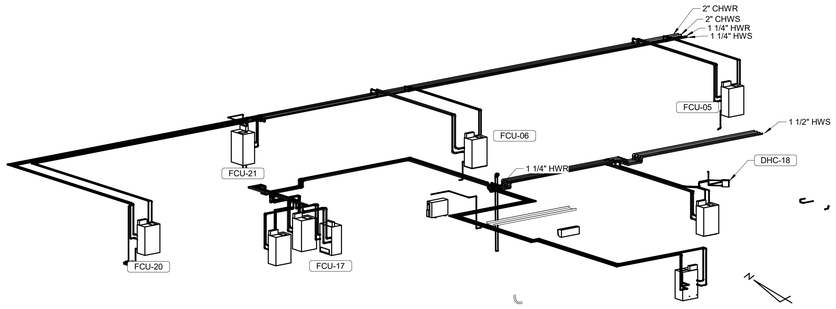
MECHANICAL ISOMETRICS

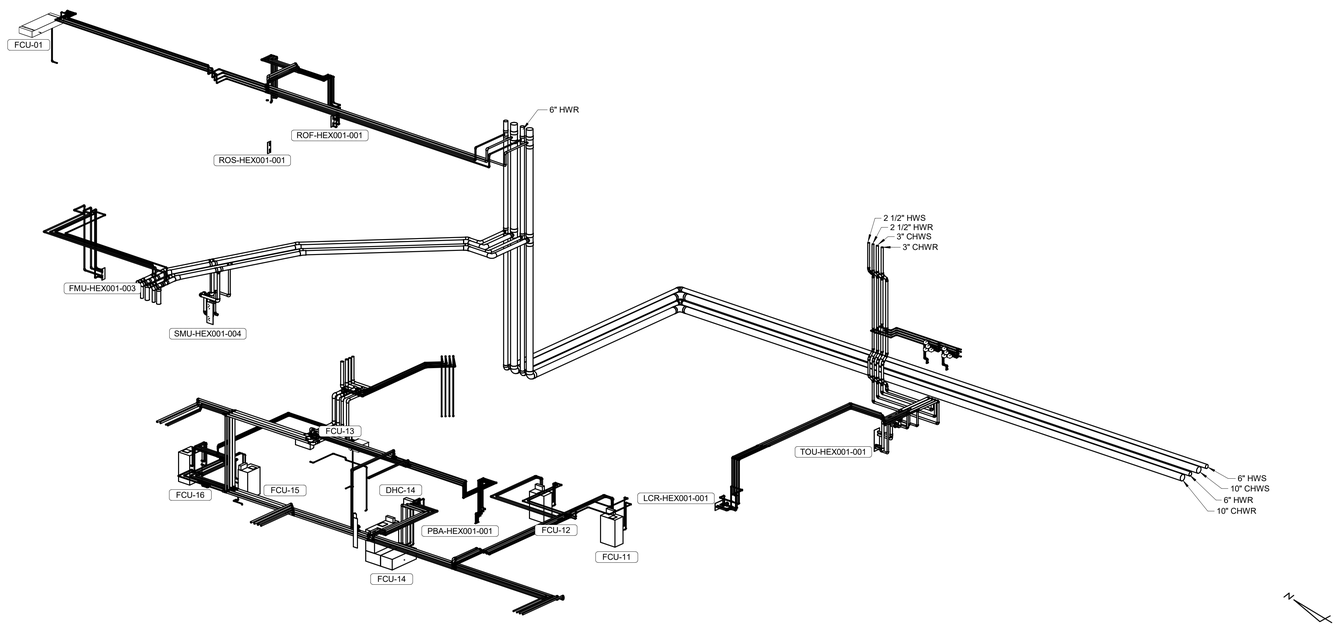
M-8.4



HYDRONIC WATER ISOMETRIC - TOUCH - FIRST AND SECOND FLOOR

SCALE :

2



HYDRONIC WATER ISOMETRIC - SHARK - FIRST AND SECOND FLOOR

SCALE :

1

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M-8.5