Chilmark School

HVAC Engineering Services

December 6, 2019

The Up Island Regional School Committee & the Town of Chilmark are seeking proposals from qualified engineers to provide the services necessary to accomplish the following:

I. Current Needs

A. <u>School needs a reliable, efficient, & effective heating system for the 11,000 sq foot, 13 room building housing Preschool – 5th Grade with 55 k-5 and 16 pre-k students.</u>

1. The school is considering a Cold Climate Heat Pump HVAC system to replace or augment the existing systems to improve comfort in the building and achieve Green Community status.

2. The school thinks it would like to complete upgrades to the existing oil fired boiler system, if it is retained in any manner.

3. The school is concerned that the attic spaces may need to receive additional insulation.

4. The school desires an upgraded control system that is controllable in the classrooms, through a main control, and remotely.

5. The School would like to ensure that the fire suppression system (sprinkler heads) has not been compromised by recent or future changes to the HVAC system.

6. The school expects to need an appropriately sized back-up power generator if Cold Climate Heat Pumps are installed.

7. Recently installed ERV units in classrooms are considered noisy and circulate cool air during the winter. The School would like to explore a solution to these complaints, possibly moving the ERVs to the attic spaces or re-purposing the original air handling units in the attic spaces.

II. Engineer would provide a comprehensive approach to responsive needs listed above

1. a) The engineer will assess the existing HVAC system.

   b) The engineer will review the potential solutions to the current HVAC concerns.

   c) The engineer will provide options for the School to consider

2. Options recommended by the engineer will take into consideration all normal industry standards, with special focus on

- Building & Occupant Health
- Installation cost
- Operating cycles
- Operating costs
- Environmental Impact/Energy Efficiency

III. Existing Systems

The building was constructed in 1998.

It was fitted with a two boiler system that provided domestic hot water to hand washing sinks in classroom, hot water to baseboard radiators, and hot water to heat exchangers in six (6) attic mounted air handing units for forced hot air and to heat fresh air for the classrooms. The boilers ran separately and together to meet the design load for the building. This system was sufficient to the comfort needs of the occupants.

Several non-boiler system building issues came up that resulted in water damage from frozen pipes in the domestic water and fire suppression system.

The "flat roof" areas over the hallways received remedial thermal treatment with spray foam insulation after domestic water lines froze and leaked through the ceilings.

The Air Handlers in the uninsulated and ventilated attics were wrapped in insulation after (the rooves were designed as "air washed") after the cold outside air caused one unit to go into "survival mode" during particularly cold weather, and a poorly installed section of the fire suppression system piping froze and burst flooding the classroom. Ceilings of classrooms also received additional insulation.

The Control system was modified at some point since construction when the PC controlled thermostats and outdated software/hardware were failing.

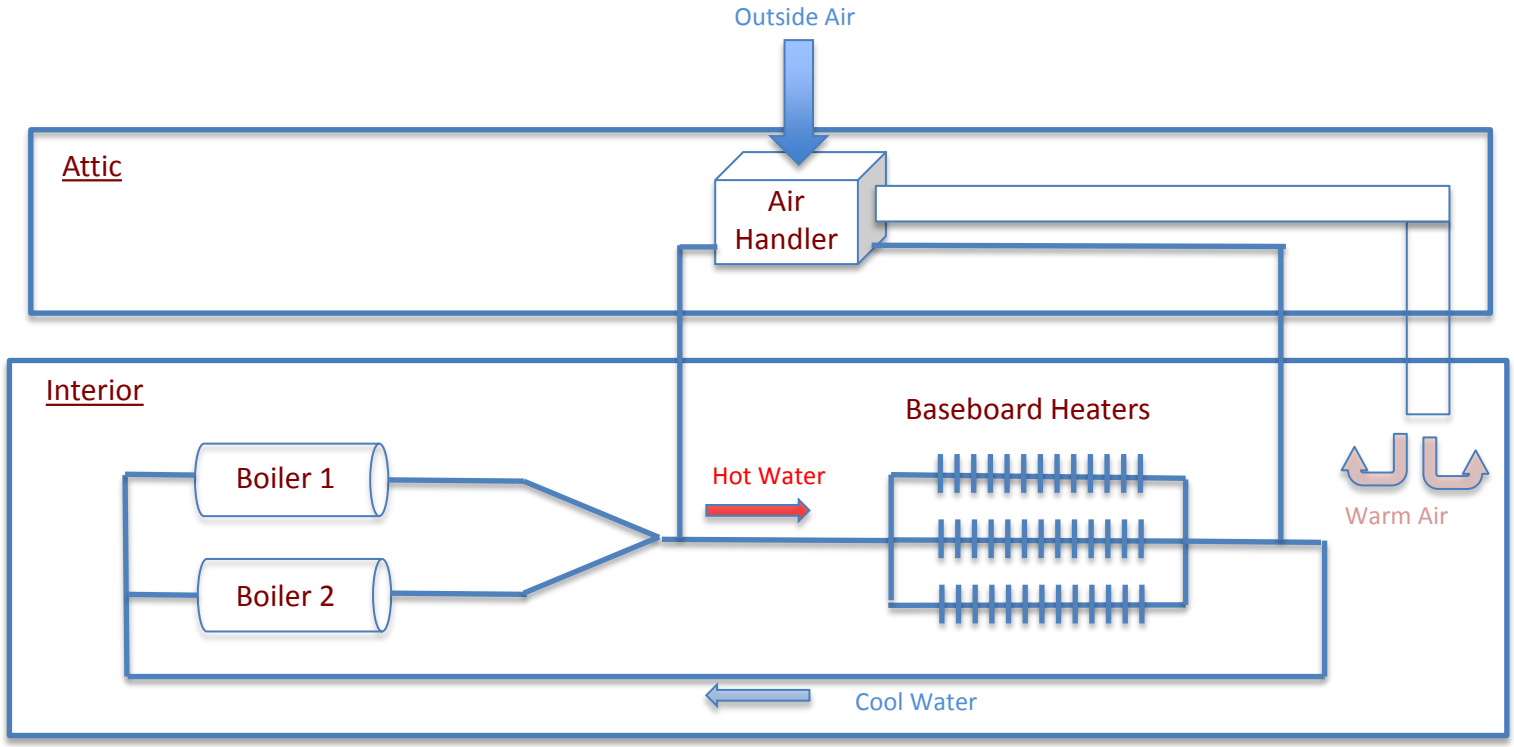
One of the two boilers has now failed. It was being replaced this summer, when the school decided to stop and consider the installation of non-fossil fuel heating. We are running successfully on one boiler at this time.

When the ERVs were installed into the classrooms, the air handlers were disabled. We don't know how they were disabled or if they were fully decommissioned in place.

With the disabling of the air handlers the classrooms stopped receiving heat from the forced hot air ceiling vents. This left some rooms colder as linear feet of baseboard covers was not all radiators. The installation of a donation "mini-split" in one classroom has made the room usable in the cold months again.

PROPOSALS should be sent to: DEADLINE is December 16, 2019 @ 5:00 PM
Town Administrator, PO Box 119, 401 Middle Road, Chilmark, MA 02535

QUESTIONS: Tim Carroll townadministrator@chilmarkma.gov 508-645-2101



Original Design

Heating with dual oil-fired boilers
Ventilation system poorly designed and located
AC non-existent

Needed Work

Appropriate insulation of attic space
Heat pump heating with 1 boiler as backup
Controls
Noise mitigation for classrooms

			BTU/hr/ft at 190F average water temperature					BTU/hr per CUH					
			1800		950		1320	9700		40000		Total	BTU/hr/ft2
ROOM	Area, ft2	FTR 1	BTU/hr	FTR 2	BTU/hr	FTR 3	BTU/hr	CUH 2,3,4		CUH 1,5,6,7,8			
Classroom 133	935	12	21600					1	9700			31300	33
Special Ed 132	160	3	5400									5400	34
Classroom 130	938	16	28800									28800	31
Classroom 126 Tech	677	12	21600									21600	32
Classroom 123 Art/Music	631	10	18000									18000	29
Reception 111	174	4	7200									7200	41
Lobby 110	890												
Hallways 127, 128, 129	1689			38	36100					5	200000	236100	92
Principal 117	136	4	7200									7200	53
Conference 118	156											0	0
Nurse 119	88											0	0
Entry adjacent Kindergarten	94					4	5280					5280	
Kindergarten 121	1082	12	21600					1	9700			31300	29
Classroom 131	942	16	28800									28800	31
Meeting 135	167	3	5400									5400	32
Classroom 134	942	12	21600					1	9700			31300	33
	9701												

Total @ 190F AWT 457,680 BTU/hr

Estimated Total @ 170F AWT 366,144 BTU/hr

CERTIFICATE OF INSPECTION
BOILER or PRESSURE VESSEL

Located at:

Chilmark Elementary School
8 State Road
Chilmark, MA 02535-1433

Owner or User:

Town of Chilmark
401 Middle Road
Chilmark, MA 02535-1995

Type	Tag Number
CI	**MA196835**

Pressure not to exceed **87** **lbs/sq. in.**

NB# Manufacturer **Buderus**

Expiration Date : **Jun-2019**

Plant Loc: **Boiler Room**

THE COMMONWEALTH OF
MASSACHUSETTS
DEPARTMENT OF FIRE SERVICES
BPV
One State Rd.
Stow, MA 01775-1025

This is to certify that the boiler or pressure vessel herein has been inspected and approved for use in accordance with the provisions of M.G.L. Chapter 146.

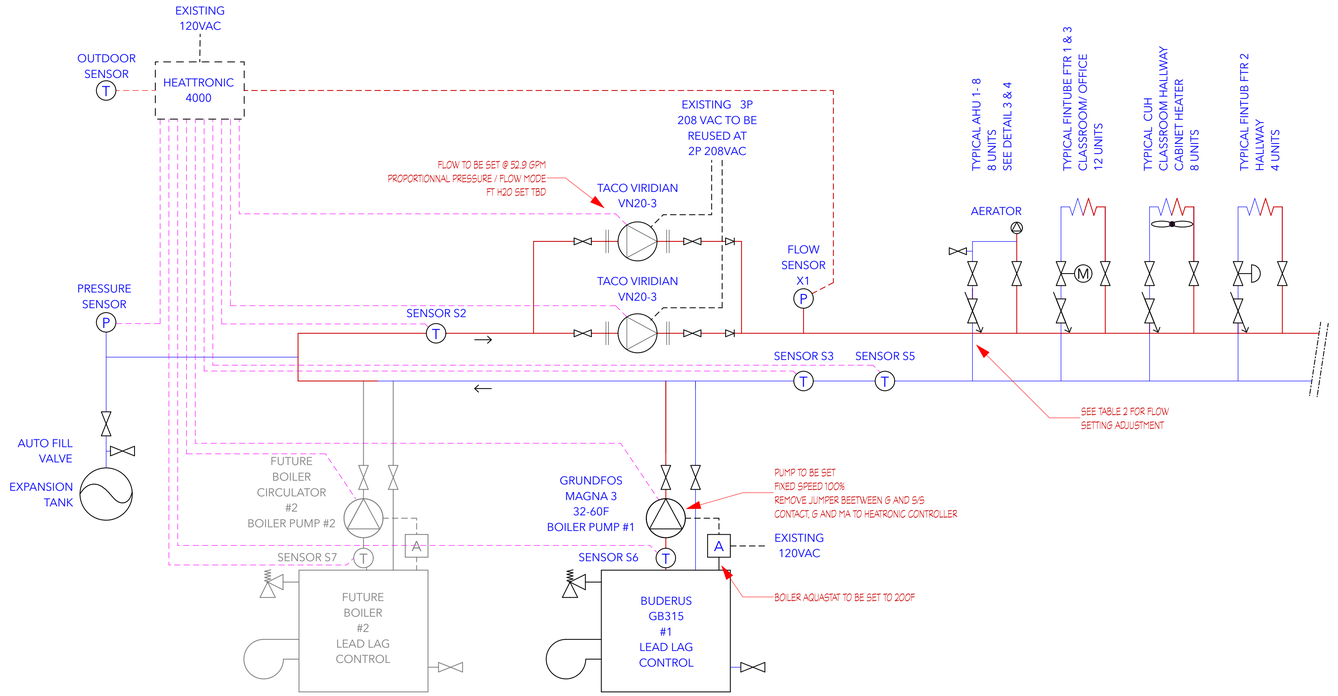
Notify this department at once if any defect is discovered.

POST UNDER GLASS IN CONSPICUOUS PLACE IN ENGINE OR BOILER ROOM OR NEXT TO PRESSURE VESSEL.

Christopher Hastings
Travelers

Peter J. Ostroskey
State Fire Marshal

	RETURN
	SUPPLY
	AUTOMATIC AIR VENT
T	LOW VOLTAGE SENSOR
T	THERMOMETER
	DIVERTING VALVE
	EXPANSION TANK
	CIRCULATOR
M	MOTORIZED ZONE VALVE
	FLOW BALANCING VALVE
	NON ELECTRIC THERMOSTATIC VALVE
	1/4 TURN VALVE
	PRESSURE RELIEF VALVE
	LOW VOLTAGE WIRING
	LINE VOLTAGE WIRING
	EXISTING LOW VOLTAGE WIRING
A	AQUASTAT CONTROL



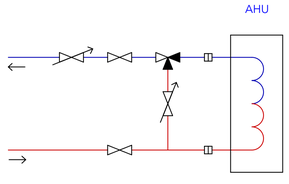
NOTE: THIS SCHEMATIC IS NOT AN AS BUILT DRAWING OF THE SYSTEM AND THEREFORE SOME COMPONENTS MIGHT NOT BE ACCURATELY DRAWN.

1 BOILER ROOM PIPPING AND CONTROL SCHEMATIC

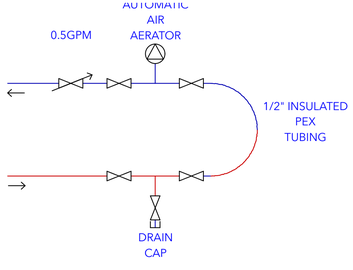
ROOM	AHU 1 TO 8	GPM	FTR 1	GPM	FTR 2	GPM	FTR 3	GPM	CUH 2,3,4	GPM	CUH 1,5,6,7,8	GPM	UH 1,2,3,4	GPM	TOTAL GPM
Classroom 133	1	0.50	12	2.16					1	0.97					
Special Ed 132			3	0.54											
Classroom 130	1	0.50	16	2.88											
Classroom 126 Tech	1	0.50	12	2.16											
Classroom 123 Art/Music	1	0.50	10	2.70											
Reception 111			4	0.72											
Lobby 110															
Hallways 127, 128, 129					36	3.61					1	20.01			
Principal 117	1	0.50	4	0.72											
Conference 116															
Nurse 119															
Entry adjacent Kindergarten							4	0.53							
Kindergarten 121	1	0.50	12	2.16					1	0.97					
Classroom 131	1	0.50	16	2.88											
Meeting 135			3	0.54											
Classroom 134	1	0.50	12	2.16					1	0.97					
Boiler and Storage													1	3.20	
Total		4.00		19.63		3.61		0.53		2.91		20.01		3.20	53.89

NOTE: Flow Calculation is calculated using a 20°F TD @ (200F Supply Temperature 180F Return Temperature)

2 TABLE 2 FLOW ADJUSTMENT PER ZONE



3 EXISTING AHU PIPING SCHEMATIC (8) LOCATIONS



4 EXISTING AHU PIPING SCHEMATIC MODIFICATION (8) LOCATIONS

NOT FOR CONSTRUCTION

south mountain COMPANY
designing & building for the future since 1975
DESIGN • BUILD • ENERGY
P.O. Box 1260
West Tisbury, MA 02575
508.693.4850
www.southmountain.com

Drawing Set Type and Issue Date:
Contract Set: 06/16/2016
Rev #1: 07/21/2016
As-Built 08/31/2016

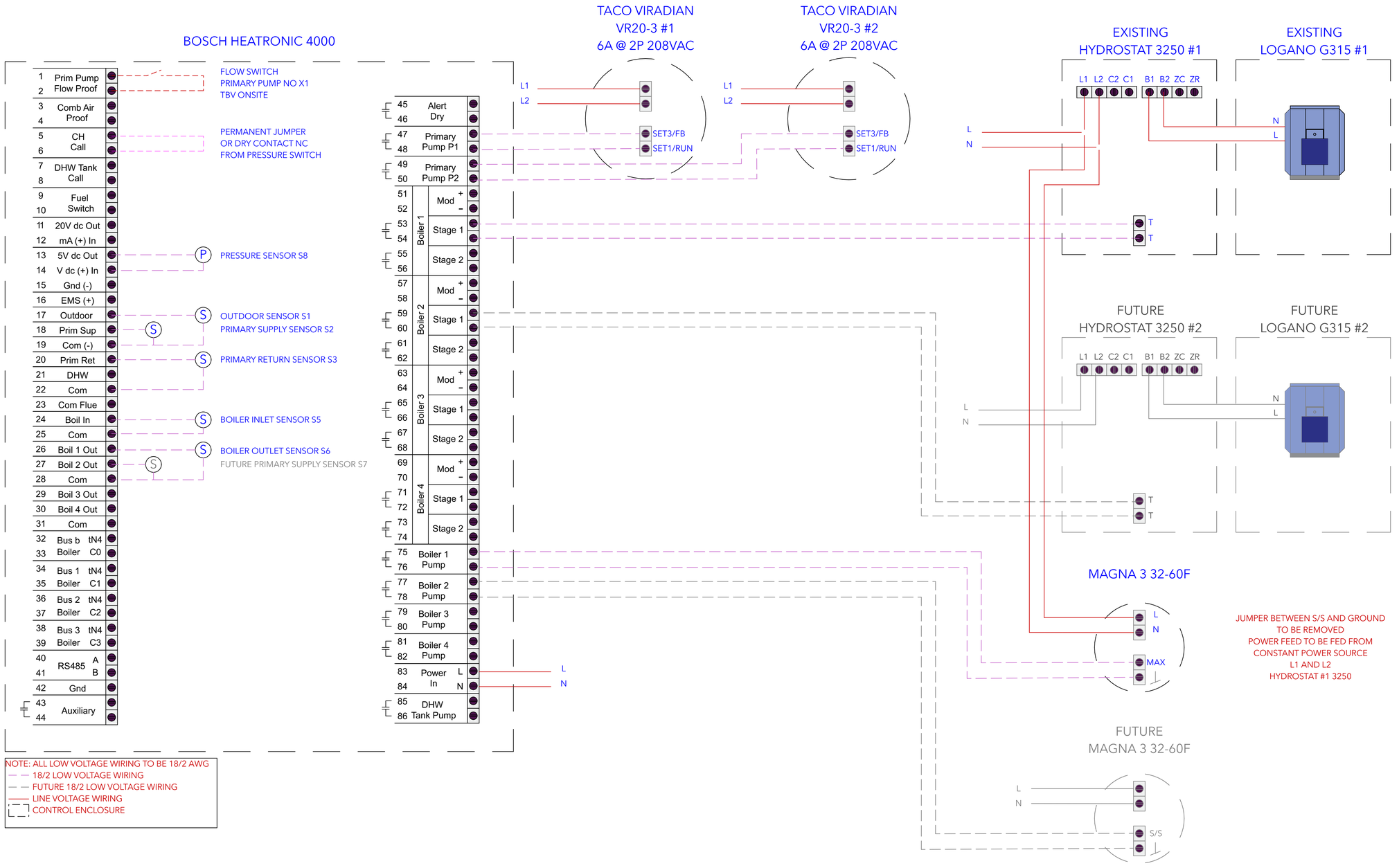
BOILER ROOM SCHEMATIC

CHILMARK SCHOOL

8 State Road Chilmark MA 02535

Date: 1/31/2018
Drawn by: BD
Scale: as noted

Sheet: M-08



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1 BOILER CONTROL SCHEMATIC

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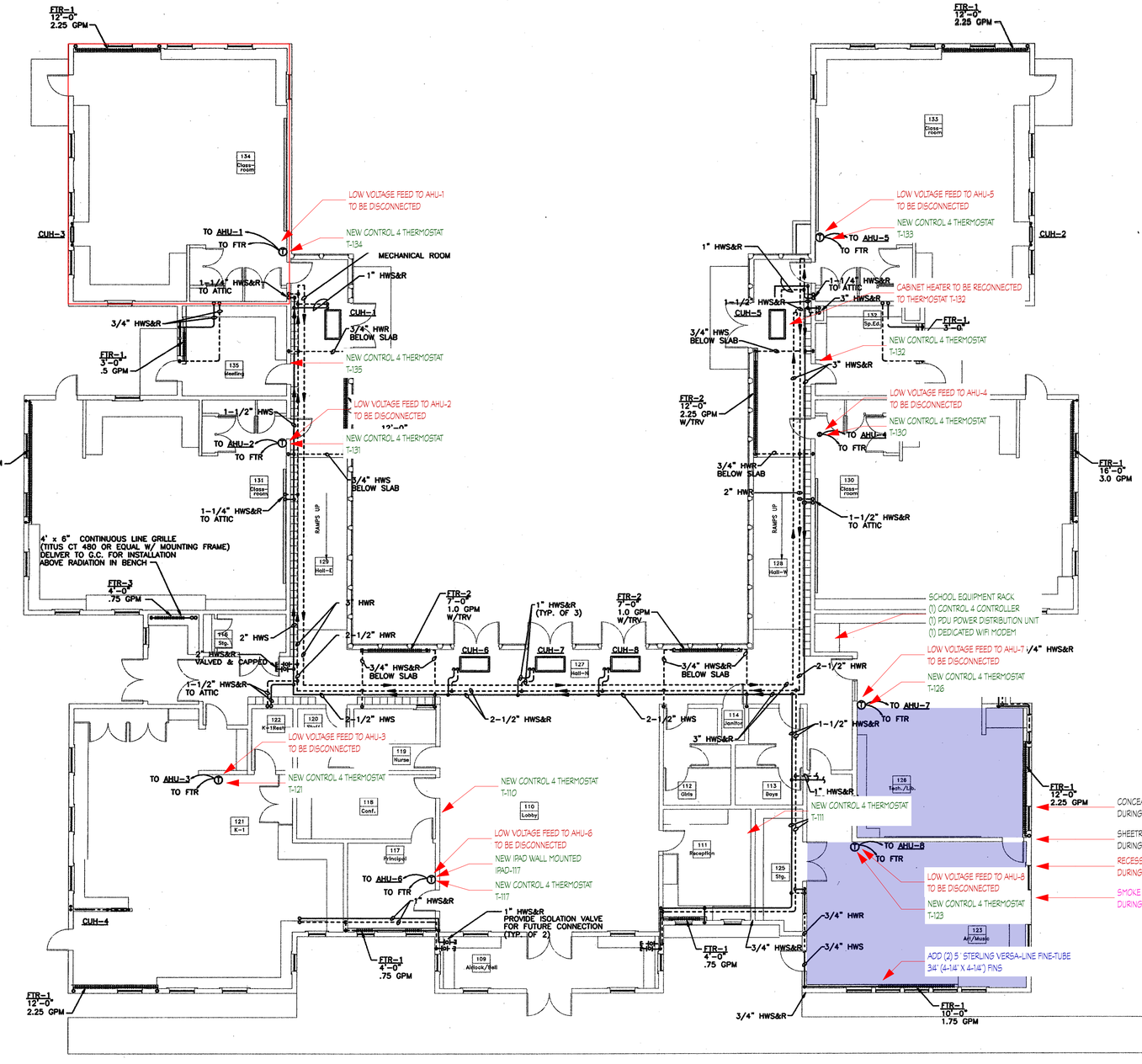
BOILER CONTROL SCHEMATIC

CHILMARK SCHOOL

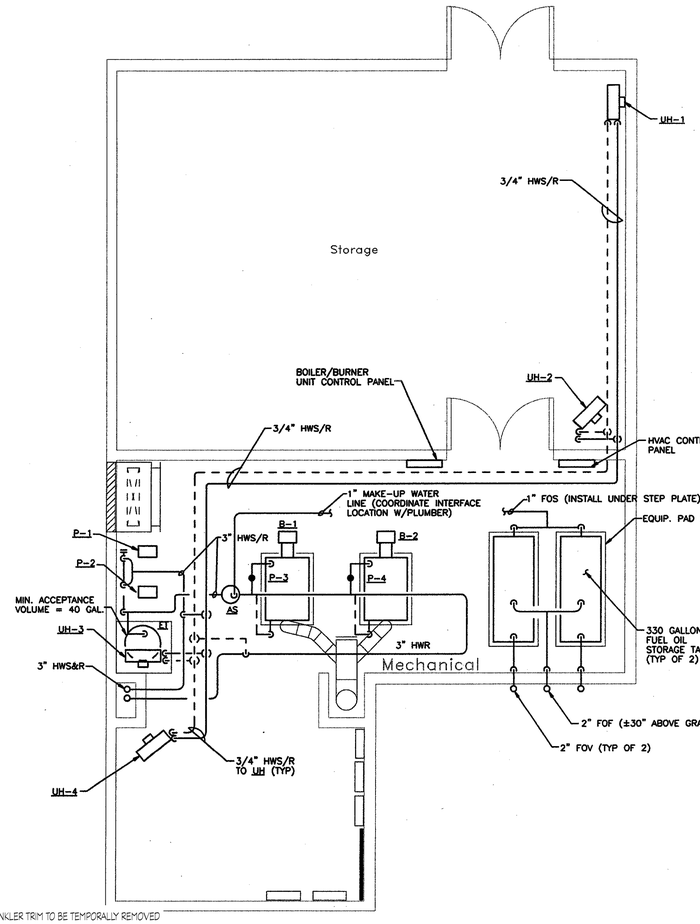
8 State Road Chilmark MA 02535

Date: 1/31/2018
Drawn by: BD
Scale: as noted

Sheet: M-09



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



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

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Rev #1: 07/21/2016
As-Built 08/31/2016

HVAC 1ST FLOOR HVAC LAYOUT

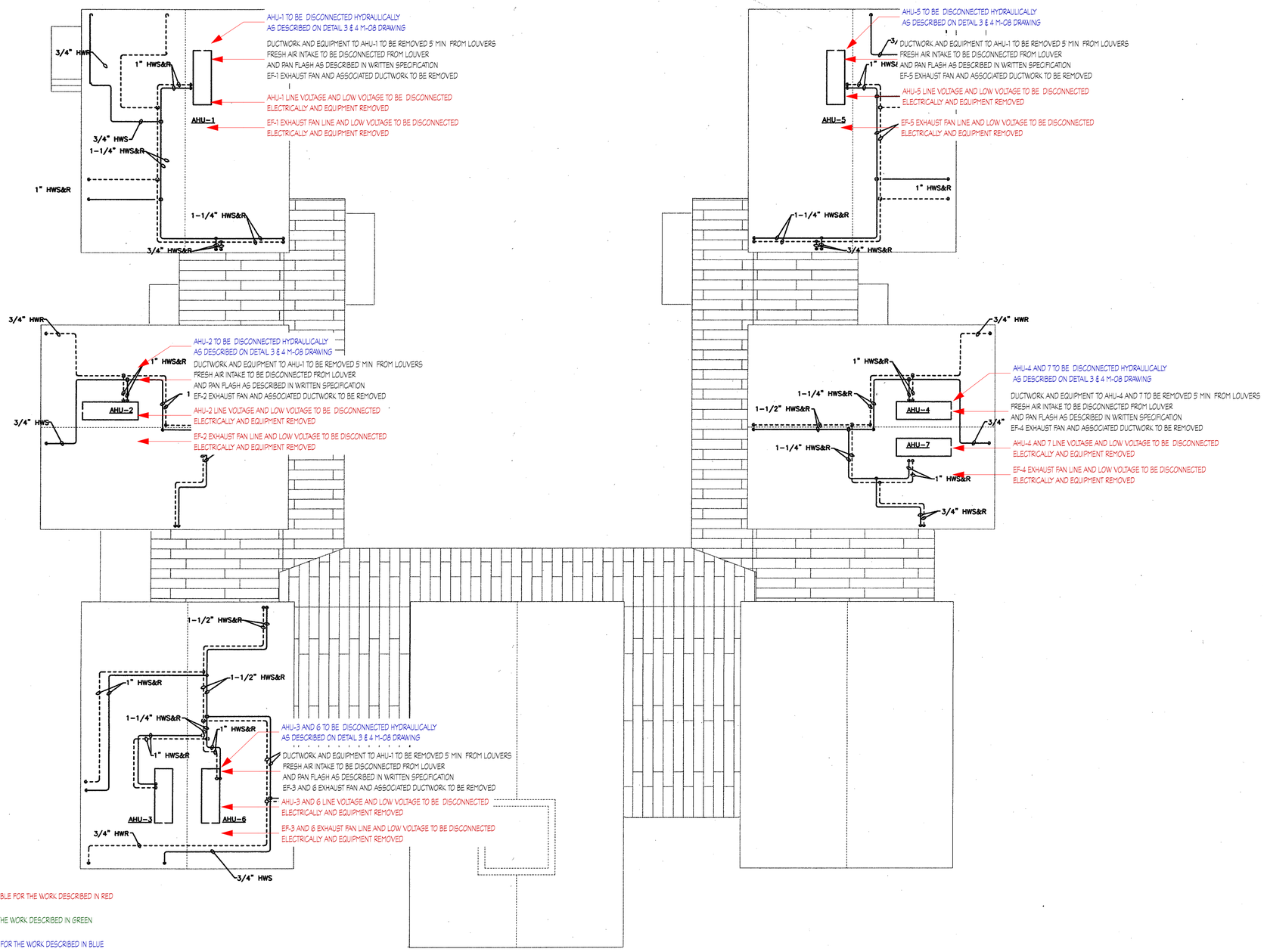
CHILMARK SCHOOL

8 State Road Chilmark MA 02535

Date: 1/31/2018
Drawn by: BD
Scale: as noted

Sheet: M-10

File:CHILMARK SCHOOL.pln Print Date: 1/29/18



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

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Contract Set: 06/16/2016
Rev #1: 07/21/2016
As-Built 08/31/2016

HVAC ATTIC HVAC LAYOUT

CHILMARK SCHOOL

8 State Road Chilmark MA 02535

Date: 1/31/2018
Drawn by: BD
Scale: as noted

Sheet: M-11

File: CHILMARK SCHOOL.pln Print Date: 1/29/18

CABINET UNIT HEATER SCHEDULE

UNIT NO.	SERVICE	LOCATION	TYPE	CAPACITY MBH	CFM	MOTOR	ELECTRICAL DATA	WATER DATA				MANUFACTURER MODEL (AS STANDARD)	REMARKS
						HP	V/PH/HZ	GPM	EWT (°F)	LWT (°F)	P.D. (FT)		
CUH-1	129 HALL-E	129 HALL-E	RECESSED CEILING	40	335	1/10	120/1/60	4	200	180	1.5	STERLING RC	(1)
CUH-2	135	CLASSROOM	RECESSED WALL	9.7	75	1/20	120/1/60	4	200	180	2.6	BEACON MORRIS TWIN FLO III	(2)
CUH-3	134	CLASSROOM	RECESSED WALL	9.7	75	1/20	120/1/60	4	200	180	2.6	BEACON MORRIS TWIN FLO III	(2)
CUH-4	121	CLASSROOM	RECESSED WALL	9.7	75	1/20	120/1/60	4	200	180	2.6	BEACON MORRIS TWIN FLO III	(2)
CUH-5	128 HALL-W	128 HALL-W	RECESSED CEILING	40	335	1/10	120/1/60	4	200	180	1.5	STERLING RC	(1)
CUH-6	127 HALL-N	127 HALL-N	RECESSED CEILING	40	335	1/10	120/1/60	4	200	180	1.5	STERLING RC	(1)
CUH-7	127 HALL-N	127 HALL-N	RECESSED CEILING	40	335	1/10	120/1/60	4	200	180	1.5	STERLING RC	(1)
CUH-8	127 HALL-N	127 HALL-N	RECESSED CEILING	40	335	1/10	120/1/60	4	200	180	1.5	STERLING RC	(1)

(1) PROVIDE HIGH CAPACITY TWO (2) ROW HEATING COIL.
(2) FLUSH MOUNTED UNIT
(3) FINISH COLOR OF FACE PANELS TO BE SELECTED BY THE ARCHITECT

REMARKS
–
–
–
–

UNIT HEATER SCHEDULE

UNIT NO.	LOCATION	TYPE	CAPACITY MBH	CFM	MOTOR WATTS	ELECTRICAL DATA	WATER DATA				MANUFACTURER MODEL (AS STANDARD)	REMARKS
						V/PH/HZ	GPM	EWT (°F)	LWT (°F)	PD (FT)		
UH-1	BASEMENT STORAGE	HORIZONTAL	8	245	9	120/1/60	18	200	180	.8	STERLING HS	
UH-2	BASEMENT STORAGE	HORIZONTAL	8	245	9	120/1/60	18	200	180	.8	STERLING HS	
UH-3	BASEMENT MECHANICAL	HORIZONTAL	8	245	9	120/1/60	18	200	180	.8	STERLING HS	
UH-4	BASEMENT MECHANICAL	HORIZONTAL	8	245	9	120/1/60	18	200	180	.8	STERLING HS	

MANUFACTURER MODEL (AS STANDARD)	REMARKS
TRANE	(1) (2) (3)
TRANE	(1) (2) (3)
TRANE	(1) (2) (3)
TRANE	(1) (2) (3)
TRANE	(1) (2) (3)
TRANE	(1) (2) (3)
TRANE	(1) (2) (3)
TRANE	(1) (2) (3)

DIFFUSER, REGISTER & GRILLE SCHEDULE

TAG	MODULE SIZE (IN)	SIZE (IN)	NECK SIZE (IN)	MAX CFM	SERVICE	BLOW	MANUFACTURER MODEL (AS STANDARD)	REMARKS
CD-1	---	9" x 9"	6"ø	125	SUPPLY	4-WAY	TITUS - TDCA	(1)
CD-2	---	12" x 12"	8"ø	200	SUPPLY	4-WAY	TITUS - TDCA	(1)
CD-3	---	12" x 12"	10"ø	275	SUPPLY	4-WAY	TITUS - TDCA	(1)
CD-4	---	12" x 12"	8"ø	200	SUPPLY	3-WAY	TITUS - TDCA	(1)
CR-1	---	8" x 8"	8" x 8"	125	RETURN	---	TITUS - 350RL	(2) (4)
CR-2	---	12" x 12"	12" x 12"	200	RETURN	---	TITUS - 350RL	(2) (4)
CR-3	---	12" x 24"	12" x 24"	350	RETURN	---	TITUS - 350RL	(2) (4)
CR-4	---	14" x 24"	14" x 24"	650	RETURN	---	TITUS - 350RL	(2) (4)
ER-1	---	8" x 8"	8" x 8"	125	EXHAUST	---	TITUS - 350RL	(2) (4)
ER-2	---	12" x 12"	12" x 12"	200	EXHAUST	---	TITUS - 350RL	(2) (4)
ER-3	---	18" x 6"	18" x 6"	200	EXHAUST	---	TITUS - 350RL	(3) (4)
ER-4	---	18" x 10"	18" x 10"	400	EXHAUST	---	TITUS - 350RL	(3) (4)
RR-1	---	12" x 6"	12" x 6"	200	RETURN	---	TITUS - 350RL	(3) (4)
SR-1	---	12" x 6"	12" x 6"	250	SUPPLY	---	TITUS - 300RL	(3) (5)

REMARKS
(1) (2)
(1) (2)
(1) (2)
(1) (2)
(1) (2)
(1) (2)
(1) (2)
(1) (2)

(1) SURFACE MOUNTED, "HARD CEILING" TYPE
(2) SURFACE MOUNTED WITH "HARD CEILING" FRAME
(3) SIDEWALL REGISTER
(4) SINGLE DEFLECTION WITH VOLUME DAMPER
(5) DOUBLE DEFLECTION

THOMPSON AND ROSE ARCHITECTS
1430 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02138
TEL 617/876-9906
FAX 617/876-9913

MEP Consultants

ERDMAN ANTHONY
CONSULTING ENGINEERS
ONE SOUTH MARKET BLDG
FANEUIL HALL MARKETPLACE
BOSTON MA 02109
TEL (617) 742-7700
FAX (617) 742-7508

MENEMSHA SCHOOL

Chilmark, Martha's Vineyard, Massachusetts

ISSUED

PURPOSE	DATE
PROGRESS ONLY	4-24-98
PROGRESS ONLY	6-5-98
BID SET	6-24-98

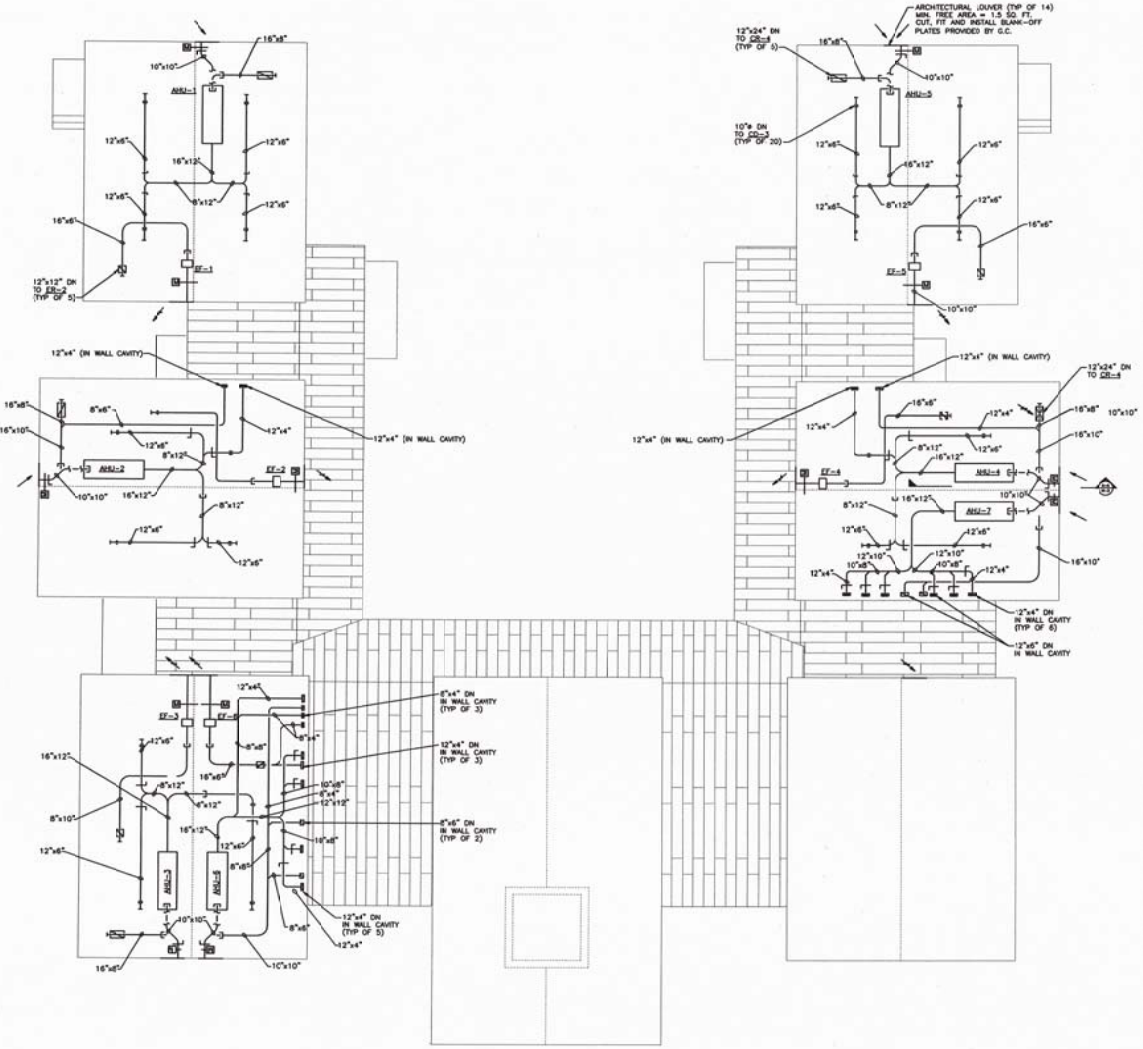
HVAC SCHEDULES

SCALE: NONE
DATE: June 24, 1998
DRAWN BY: K.J.P
FILE: 35650H01.DWG

SHEET

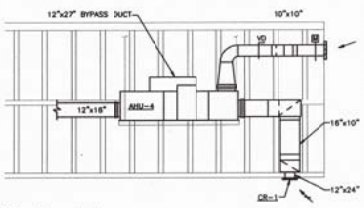
H-2

PROJECT #: 35650.00



2 Attic/Roof Plan

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



Section A-A

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

THOMPSON AND ROSE ARCHITECTS
1430 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02138
TEL 617/876-9566
FAX 617/876-9922

KEP Consultants

BRENNAN ANTHONY
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ONE SOUTH MARKET BLDG
FANEUIL HALL MARKETPLACE
BOSTON MA 02109
TEL (617) 742-7799
FAX (617) 742-7506

MENEMSHA SCHOOL

Chilmark, Martha's Vineyard, Massachusetts

ISSUED

PURPOSE	DATE
PROGRESS ONLY	4-24-98
PROGRESS ONLY	6-5-98
BID SET	6-24-98

HVAC ATTIC DUCTWORK AND SECTION

SCALE: AS NOTED

DATE: June 24, 1998

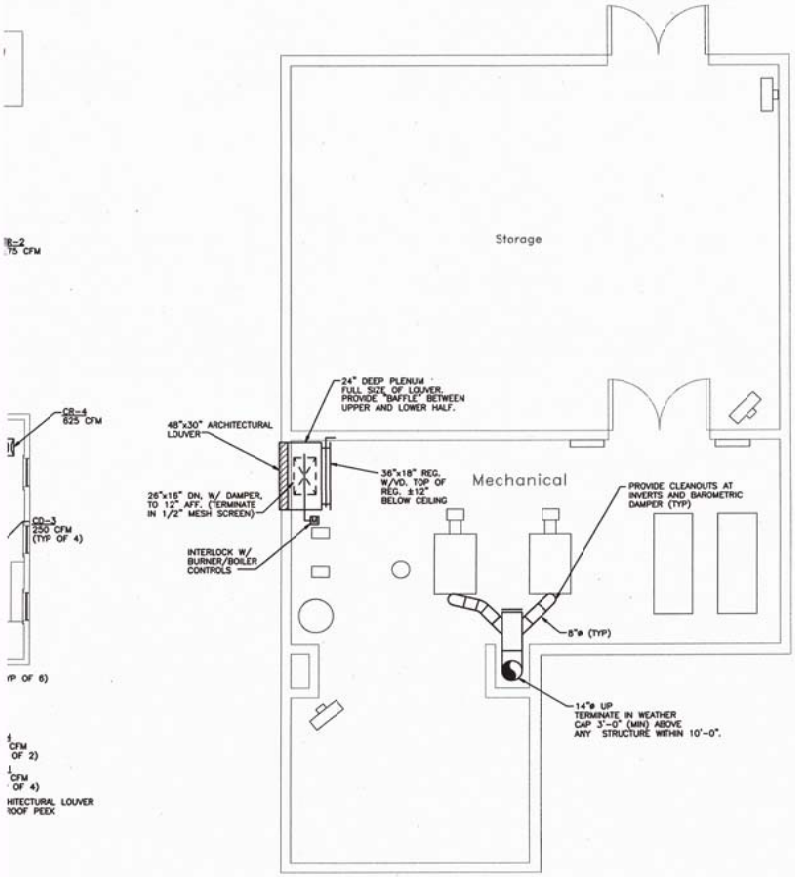
DRAWN BY: K.J.P

FILE: 35650H03.DWG

SHEET

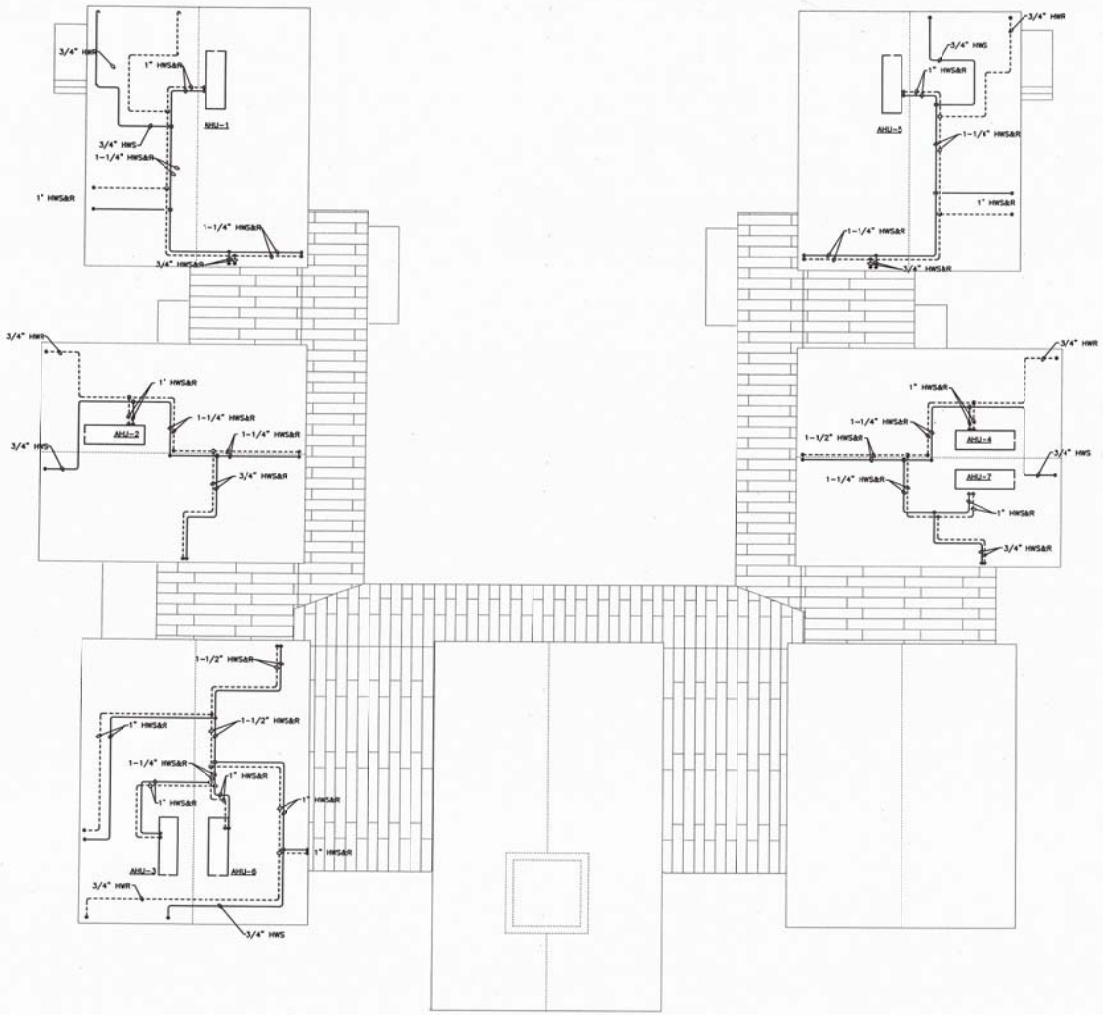
H-3

PROJECT #: 35650.00



② Basement Plan

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



1 Attic/Roof Plan
SCALE: 1/8"=1'-0"

THOMPSON AND ROSE ARCHITECTS
1430 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02138
TEL 617/876-1966
FAX 617/876-9922

MEP Consultants

ERDMAN ANTHONY
CONSULTING ENGINEERS
ONE SOUTH MARKET BLDG
FANEUIL HALL MARKETPLACE
BOSTON MA 02109
TEL (617) 742-7705
FAX (617) 742-7606

MENEMSHA SCHOOL

Chilmark, Martha's Vineyard, Massachusetts

ISSUED

PURPOSE	DATE
PROGRESS ONLY	4-24-98
PROGRESS ONLY	6-5-98
BID SET	6-24-98

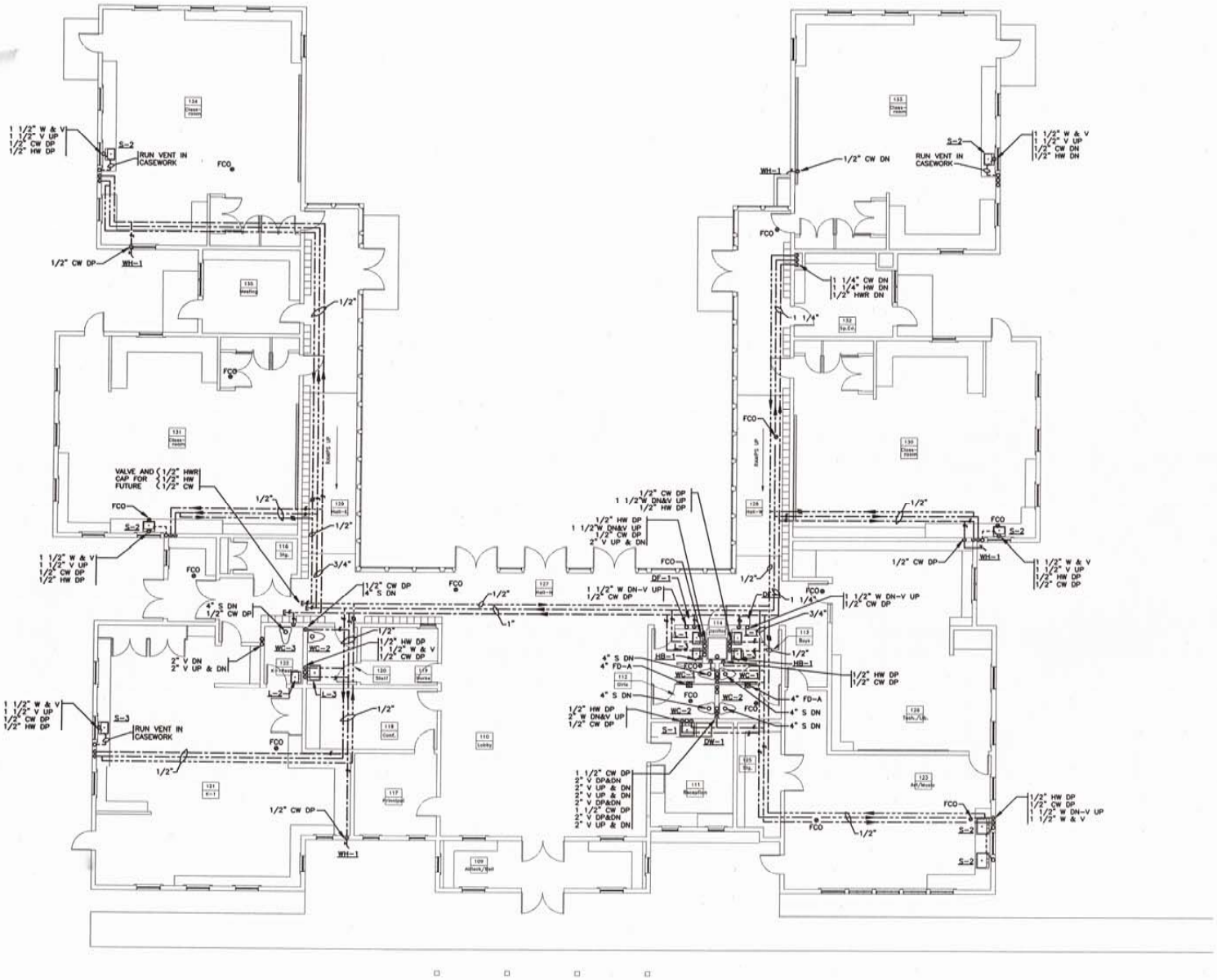
HVAC ATTIC PIPING PLAN

SCALE: 1/8"=1'-0"
DATE: June 24, 1998
DRAWN BY: K.J.P.
FILE: 35650H05.DWG

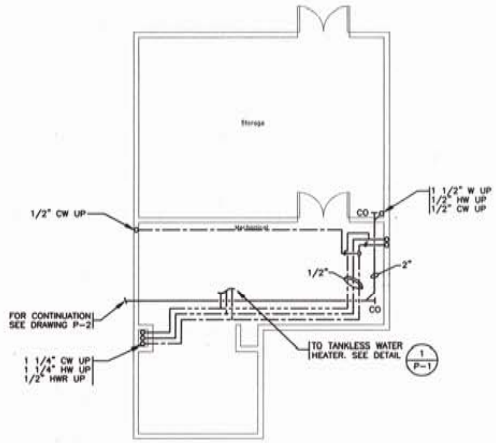
SHEET

H-5

PROJECT #: 35650.00



FIRST FLOOR PLAN



BASEMENT PART PLAN

Chilmark Select Board
Town Hall
401 Middle Road
Chilmark, MA 02535-0119

May 9, 2019

Re: Chilmark School HVAC Project (Phase 2)

In my role as chair of the town's Energy and Finance Advisory Committees, I would like to bring to your attention a number of issues with the above referenced project, which after several years of delay and discussion has still not progressed beyond the preparatory stage. In my opinion, the newly revised UIRSD plans, if carried out, are inappropriate for the school and financially questionable.

First, the current statement of work is completely different than the work for which we (and the other UIRSD towns) appropriated funds in the spring of 2018. The work contemplated in the new SOW is simply "removal and replacement of selected existing HVAC components". In fact, the plan now is to add an oil-fired boiler and replace one or more water pumps. It does not address the inadequate control systems, the need for insulation in the building to reduce wasted heating energy and increase comfort, or fix the excessively noisy ventilation system installed in an earlier phase. In other words, the plan as I understand it is not responsive to the HVAC issues identified and continually pointed out by the school staff.

Second, the addition of a second oil-fired boiler (as a back up to the relatively new boiler currently providing heat and hot water) is inappropriate for a 21st century municipal building. Installation of an electric heat pump primary HVAC approach, with the existing boiler as backup and hot water supply, will provide both heating and air conditioning – just as the HVAC upgrade to the Community Center will accomplish. Further, over a relatively short period of time I am confident that this approach will provide a significant cost savings for the town and the school district. Green Communities funds are potentially available for a significant fraction of the needed work; not so for the current plan.

Finally, a tour of the building in February revealed that the ventilation system previously installed could be interfering with the sprinkler system in several rooms. I am not a fire safety engineer, but if this is indeed the case we should initiate an inspection by the appropriate fire personnel.

I respectfully suggest that a Select Board review of this project is in order.

Sincerely,

Rob Hannemann

Cc: Susan Stevens, Head of School
Robert Lionette

Chilmark School HVAC Project Outline

When complete, the school will have an up-to-date HVAC system based on heat pump electric heat, with the existing oil-fired circulating water system as backup for heating (and the domestic hot water source). Controls will be distributed for the classroom and office spaces. Ventilation will be energy efficient, using energy recovery systems. Heat pumps will supply air conditioning for spring and fall hot weather.

Project outline:

1. Insulate all attic spaces at the roofline, to at least code level.
2. Complete the upgrade of existing oil-fired boiler system (variable speed circulating pumps, appropriate controls compatible with addition of heat pumps, potential extension of some baseboard units).
3. Removal of defunct boiler and obsolete air handlers
4. Design and equipment selection for heat pump system.
5. Installation of heat pumps external units, air handlers, and refrigerant coils.
6. Move ERVs to attic space as originally envisioned (addresses noise problem).
7. Upgrade control system.
8. Ensure integrity of fire suppression system.
9. Procure and install backup generator.

Heat Pump v. Oil Heating Operational Costs

As a starting point, assume 1 gallon of oil:

- 2019 price ~ $2.78
- Energy content ~ 137,381 BTU
- Delivered heat at 85% efficiency of oil/hydronic system ~ 116,744 BTU

Now examine a cold climate heat pump:

- Modern coefficient of performance (Northeast US climate conditions) over an entire heating season ~ 3.2
- That means to deliver the amount of heat equivalent to a gallon of oil is 116,744/3.2 = 36,482 BTU of electrical energy
- Converting that to kWh: 36,482/ 3412 = 10.7 kWh
- 2019 all-in Eversource electricity price estimate ~ $0.25 per kWh
- Therefore, the cost to provide this heat is ~ $2.68

Thus, the heat pump operational cost is about 4% less than oil heat.

Note also that oil prices will likely increase while electricity prices will decrease over the life of the project.