MECHANICAL SYSTEMS

by
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of
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DEFINITIONS & ACRONYMS

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- ACRONYM
- Non-Profit Organization

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- ACRONYM
- Non-Profit Organization
- ENVELOPE
- Assembly Surrounding the Mechanical System

DEFINITIONS & ACRONYMS

- ACRONYM
- ENVELOPE
- LEED PP
- Non-Profit Organization
- Assembly Surrounding the Mechanical System
- LEED Plaque Peddler

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- POR_{Avg}
- Pump Oversizing Ratio (Average)

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- ATR_{ST}
- Average Truth Ratio (Solar Thermal)

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- ATR_{PV}
- Average Truth Ratio (Photovoltaic)

DEFINITIONS & ACRONYMS

- ACRONYM
- ENVELOPE
- LEED PP
- POR_{Avg}
- ATR_{ST}
- ATR_{PV}
- $KWH/M^2/YR_M$
- Non-Profit Organization
- Assembly Surrounding the Mechanical System
- LEED Plaque Peddler
- Pump Oversizing Ratio (Average)
- Average Truth Ratio (Solar Thermal)
- Average Truth Ratio (Photovoltaic)
- Energy Use/Year (Measured)

"I Predict that someday, energy use will be so important that we will measure it"

Henry Gifford

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- $KWH/M^2/YR_M$
- $KWH/M^2/YR_M$
- $CODE_V$
- Non-Profit Organization
- Assembly Surrounding the Mechanical System
- LEED Plaque Peddler
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- Energy Use/Year (Measured)
- Energy Use/Year (Modeled)
- Code they quote you

DEFINITIONS & ACRONYMS

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- ATR_{ST}
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- $KWH/M^2/YR_M$
- $CODE_V$
- $CODE_W$
- Non-Profit Organization
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- Code they quote you
- Code you quote them
- “Performance” code, or Prediction code, or Promise code

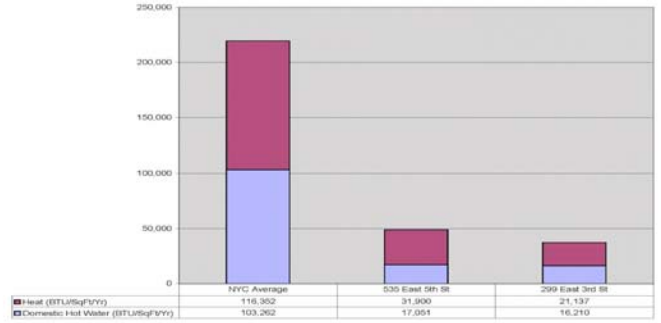
SUMMARY:

DO NOT:

- Model Energy Use
- Do VFD (Variable Frequency Drive)
- DDC (Direct Digital Controls)
- HVAC (Combined Heating, Ventilating, Air Conditioning (Cooling))
- Ducts (Except to ventilate with 100% outdoor air)

INSTEAD, DO:

- Measure Energy Use
- Design the system, run equipment 100%
- Thermostat in each room, simple setup
- Separate Heating, Cooling, and Ventilation systems
- Move heat in and out of rooms with water or freon

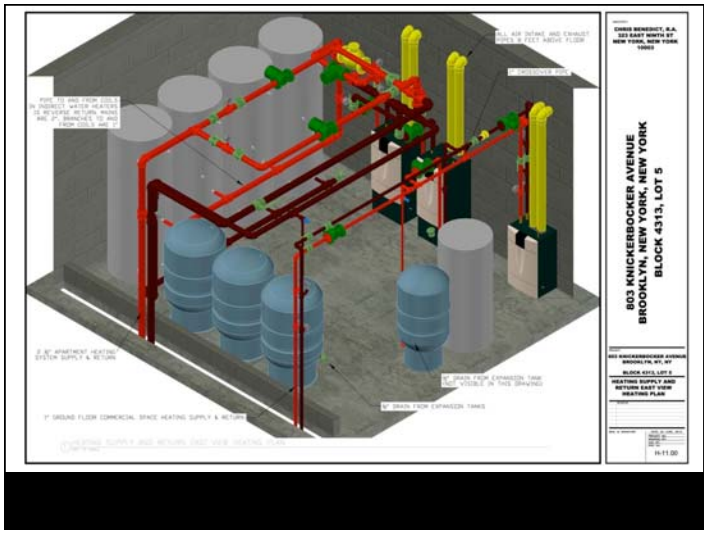


CUSTOMER SERVICE
conEdison Customer Service Online

From Date	To Date	Elec Use	Elec Demand	Electric Bill Amt	Gas Use	Gas Bill Amt	Total Bill Amt
08/04/2004	09/02/2004	6,040	16.00	$1,075.01	479	$581.72	$1,656.73
07/06/2004	08/04/2004	6,080	15.20	$1,163.76	486	$590.21	$1,753.97
06/04/2004	07/06/2004	6,680	16.40	$1,230.60	508	$606.65	$1,837.25
05/05/2004	06/04/2004	6,040	14.40	$898.69	589	$735.98	$1,634.67
04/06/2004	05/05/2004	6,240	15.60	$910.41	1,091	$1,274.15	$2,184.56
03/04/2004	04/06/2004	6,560	14.00	$838.98	1,822	$1,936.39	$2,775.37
02/05/2004	03/08/2004	7,360	14.40	$1,274.12	2,210	$2,658.61	$3,932.73
01/06/2004	02/05/2004	6,920	14.00	$992.12	3,280	$3,424.64	$4,416.76
12/05/2003	01/06/2004	7,360	15.20	$1,054.33	2,315	$2,729.31	$3,783.64
11/03/2003	12/05/2003	7,240	14.00	$1,029.17	1,730	$1,986.39	$3,015.56
10/03/2003	11/03/2003	6,720	14.40	$1,034.75	894	$1,009.87	$2,044.62
09/04/2003	10/03/2003	6,040	16.00	$1,021.05	467	$545.97	$1,567.02
08/05/2003	09/04/2003	5,760	16.00	$1,011.44	411	$497.18	$1,508.62
07/07/2003	08/05/2003	6,120	16.40	$1,190.96	452	$558.18	$1,749.14
06/05/2003	07/07/2003	6,680	16.40	$1,213.90	556	$697.64	$1,911.54
05/06/2003	06/05/2003	6,400	14.00	$1,055.23	762	$825.77	$1,881.00
04/07/2003	05/06/2003	6,320	13.20	$1,097.27	1,208	$1,358.26	$2,455.53
03/07/2003	04/07/2003	6,880	14.40	$1,148.14	1,786	$2,094.88	$3,243.02
02/05/2003	03/07/2003	6,840	14.40	$1,081.30	2,812	$2,863.19	$3,944.49

What Made 5th St Use Less Energy?

Boiler on the roof



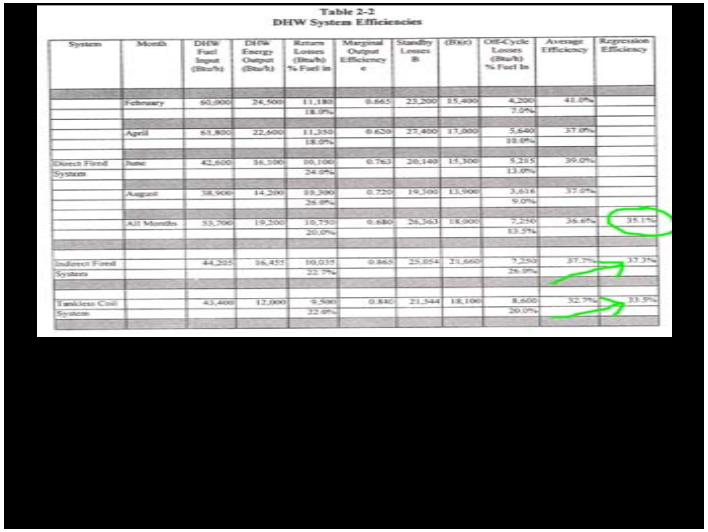
What Made 5th St Use Less Energy?

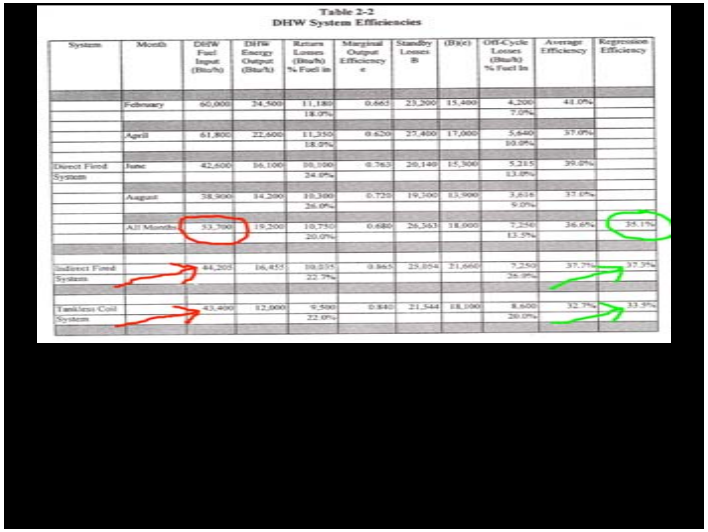
Boiler on the roof

One boiler makes both heat and hot water

Table 2-2
DHW System Efficiencies

System	Month	DHW Fuel Input (Btu/h)	DHW Energy Output (Btu/h)	Return Losses (Btu/h) % Fuel in	Marginal Output Efficiency e	Standby Losses B	(B)(e)	Off-Cycle Losses (Btu/h) % Fuel In	Average Efficiency	Regression Efficiency
	February	60,000	24,500	11,180	0.665	23,200	15,400	4,200	41.0%	
				18.0%				7.0%		
	April	61,800	22,600	11,350	0.620	27,400	17,000	5,640	37.0%	
				18.0%				10.0%		
Direct Fired System	June	42,600	16,100	10,100	0.763	20,140	15,300	5,215	39.0%	
				24.0%				13.0%		
	August	38,900	14,200	10,300	0.720	19,300	13,900	3,616	37.0%	
				26.0%				9.0%		
	All Months	53,700	19,200	10,750	0.680	26,363	18,000	7,250	36.6%	35.1%
				20.0%				13.5%		
Indirect Fired System		44,205	16,455	10,035	0.865	25,054	21,660	7,250	37.7%	37.3%
				22.7%				26.0%		
Tankless Coil System		43,400	12,000	9,500	0.840	21,544	18,100	8,600	32.7%	33.5%
				22.0%				20.0%		





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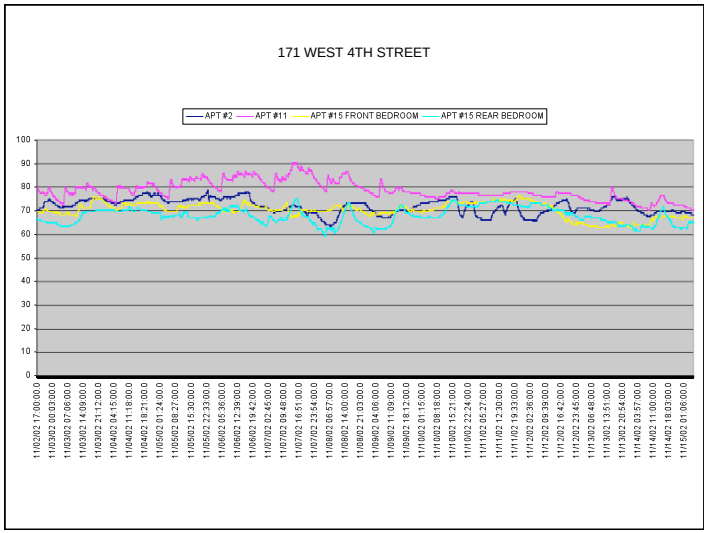
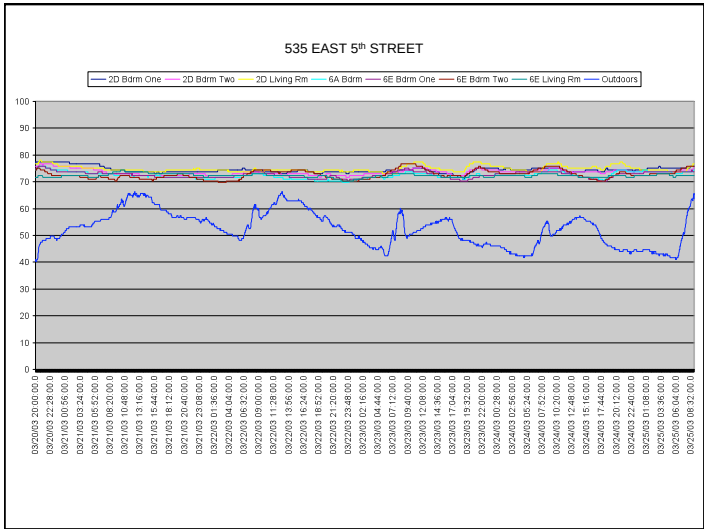
Boiler on the roof

One boiler makes both heat and hot water

Thermostat in every room

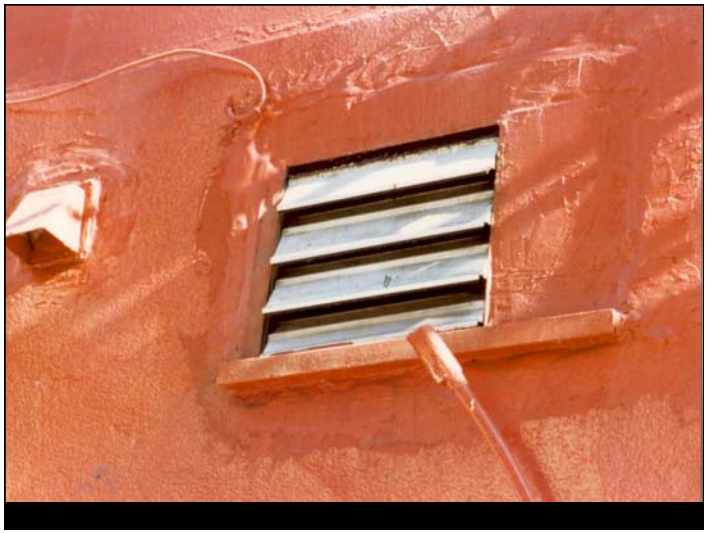




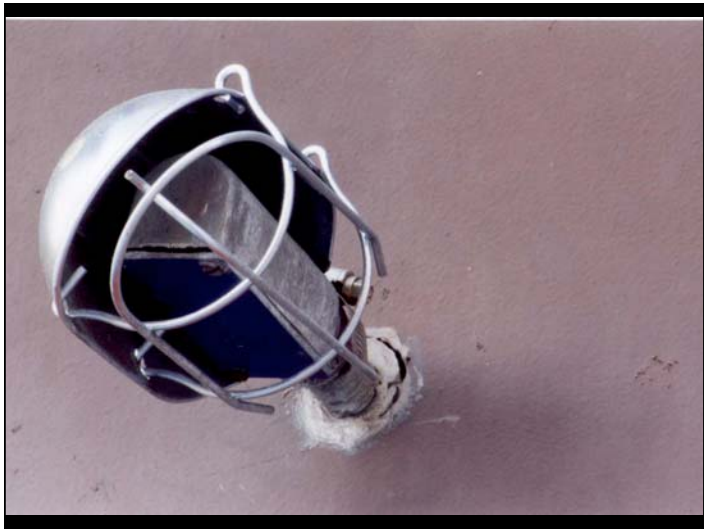

RINKING
EATING
NSTAIRS
TCH
R STEP!
THE
D-RAILS

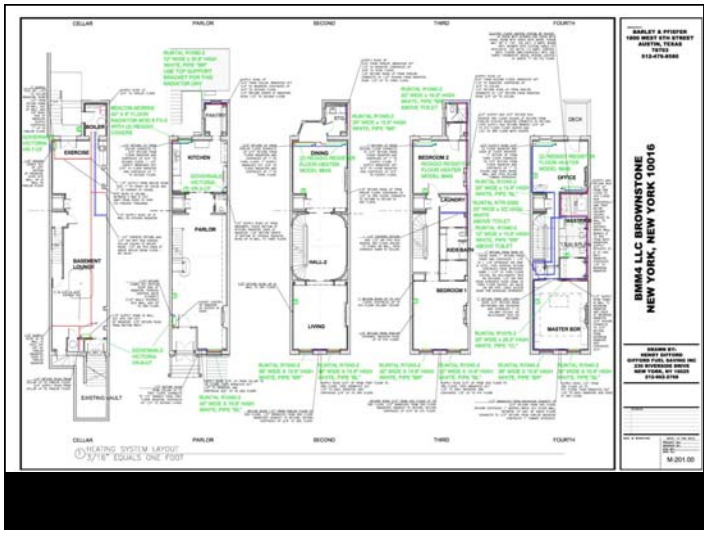

Comfort at your Fingertips
WARMER
COLDER
TEMP. CONTROL
OFF
EXH.
VENT.
HEAT
LO-COOL
HI-COOL
ICE-CAP inc.

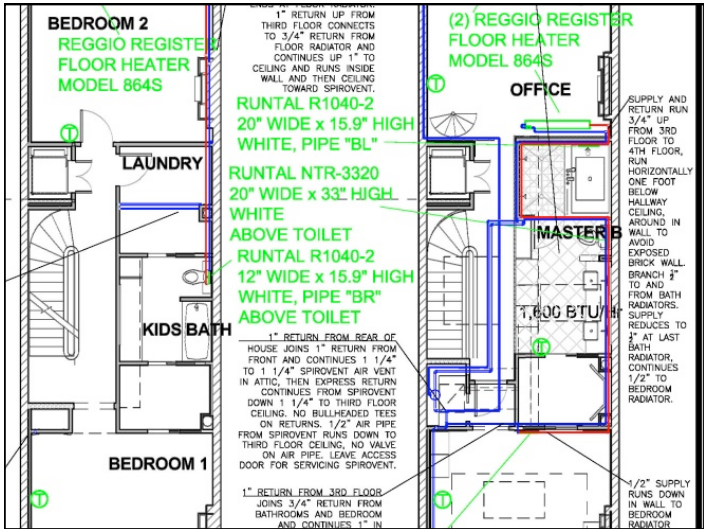

OFF
FAN
ONLY
HEAT
LOW
HIGH
COOL
LOW
HIGH
ALLOW 2 MINUTES BEFORE RESTARTING
WARMER
COOLER

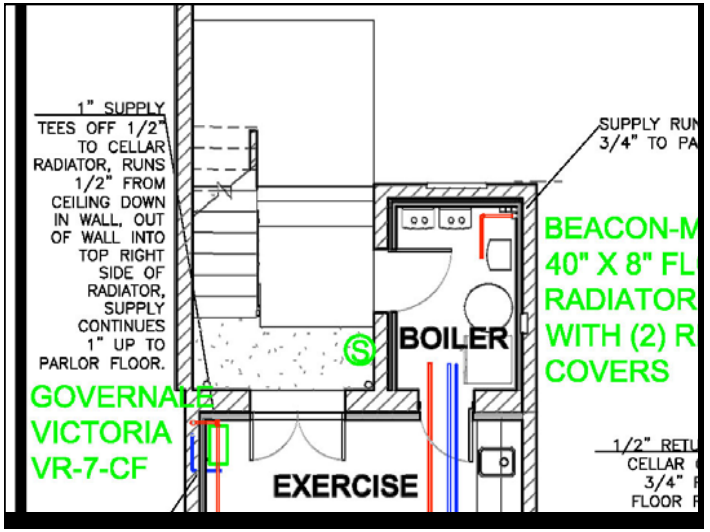


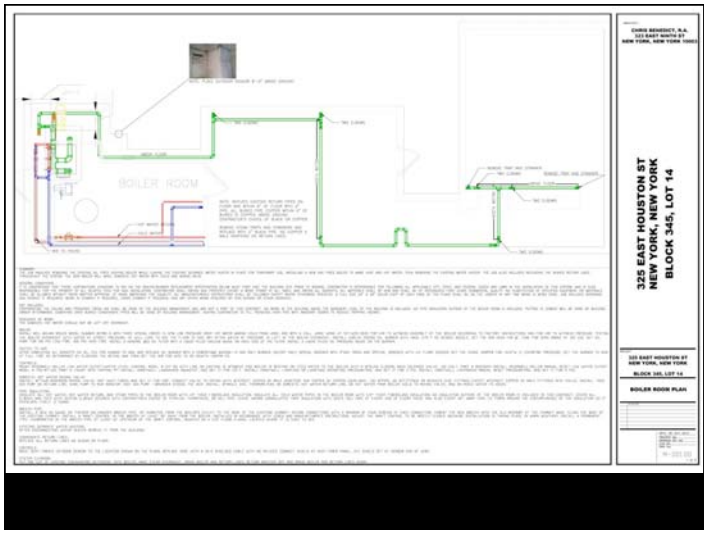

355

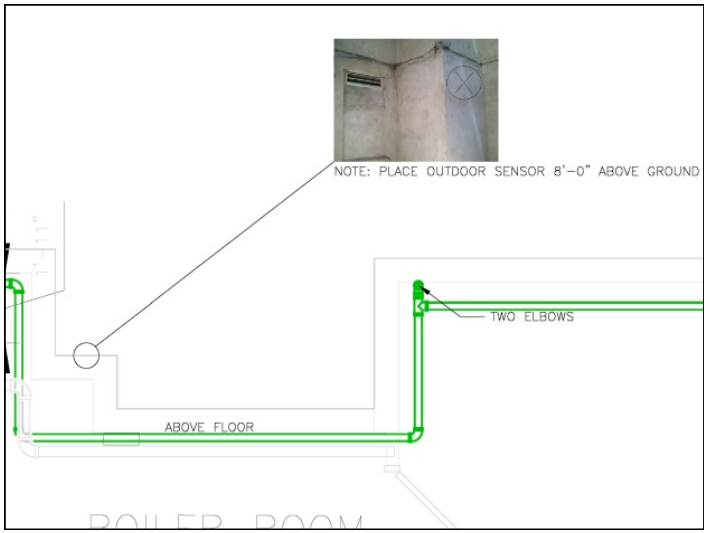



BM984 LLC BROWNSTONE
NEW YORK, NEW YORK 10016


BEDROOM 2
REGGIO REGISTER
FLOOR HEATER
MODEL 864S
LAUNDRY
KIDS BATH
BEDROOM 1
1" RETURN UP FROM THIRD FLOOR CONNECTS TO 3/4" RETURN FROM FLOOR RADIATOR AND CONTINUES UP 1" TO CEILING AND RUNS INSIDE WALL AND THEN CEILING TOWARD SPIROVENT.
RUNTAL R1040-2
20" WIDE x 15.9" HIGH
WHITE, PIPE "BL"
RUNTAL NTR-3320
20" WIDE x 33" HIGH
WHITE
ABOVE TOILET
RUNTAL R1040-2
12" WIDE x 15.9" HIGH
WHITE, PIPE "BR"
ABOVE TOILET
1" RETURN FROM REAR OF HOUSE JOINS 1" RETURN FROM FRONT AND CONTINUES 1 1/4" TO 1 1/4" SPIROVENT AIR VENT IN ATTIC, THEN EXPRESS RETURN CONTINUES FROM SPIROVENT DOWN 1 1/4" TO THIRD FLOOR CEILING. NO BULLHEADED TEES ON RETURNS. 1/2" AIR PIPE FROM SPIROVENT RUNS DOWN TO THIRD FLOOR CEILING, NO VALVE ON AIR PIPE. LEAVE ACCESS DOOR FOR SERVICING SPIROVENT.
1" RETURN FROM 3RD FLOOR JOINS 3/4" RETURN FROM BATHROOMS AND BEDROOM AND CONTINUES 1" IN
(2) REGGIO REGISTER
FLOOR HEATER
MODEL 864S
OFFICE
MASTER B
1,600 BTU/H
SUPPLY AND RETURN RUN 3/4" UP FROM 3RD FLOOR TO 4TH FLOOR, RUN HORIZONTALLY ONE FOOT BELOW HALLWAY CEILING, AROUND IN WALL TO AVOID EXPOSED BRICK WALL. BRANCH 3/4" TO AND FROM BATH RADIATORS. SUPPLY REDUCES TO 1/2" AT LAST BATH RADIATOR, CONTINUES 1/2" TO BEDROOM RADIATOR.
1/2" SUPPLY RUNS DOWN IN WALL TO BEDROOM RADIATOR


1" SUPPLY TEES OFF 1/2" TO CELLAR RADIATOR, RUNS 1/2" FROM CEILING DOWN IN WALL, OUT OF WALL INTO TOP RIGHT SIDE OF RADIATOR, SUPPLY CONTINUES 1" UP TO PARLOR FLOOR.
GOVERNALE
VICTORIA
VR-7-CF
BOILER
EXERCISE
SUPPLY RUN
3/4" TO PA
BEACON-M
40" X 8" FL
RADIATOR
WITH (2) R
COVERS
1/2" RETU
CELLAR
3/4"
FLOOR





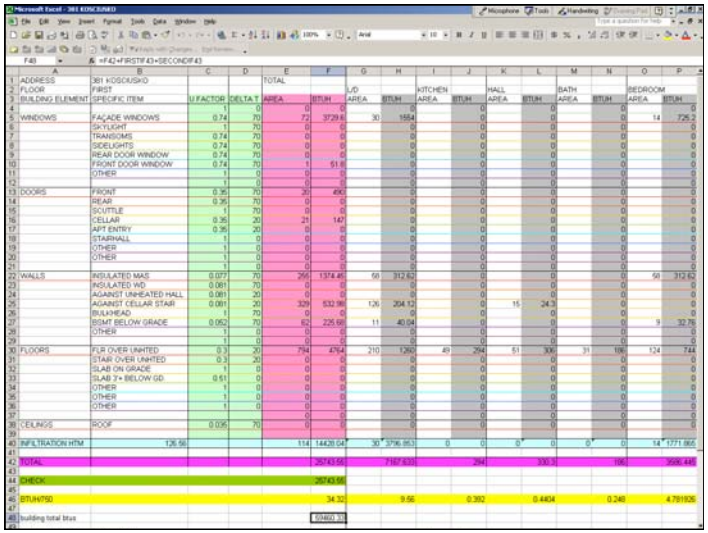
What Made 5th St Use Less Energy?

Boiler on the roof

One boiler makes both heat and hot water

Thermostat in every room

Properly sized system



A. Provide new forced draft hydronic boiler and gas/oil burner specified herein.

B. Provide a complete, reverse return hot water heat distribution system including pump, piping, expansion tank, zone valves, convectors, and electronic controls described herein.

C. Provide new gas fired domestic hot water heater, and all relatd trimmings and controls described herein.

D. Provide electrical hook up and alterations to boiler room described herein.

E. Provide new boiler chimney and breaching described herein.

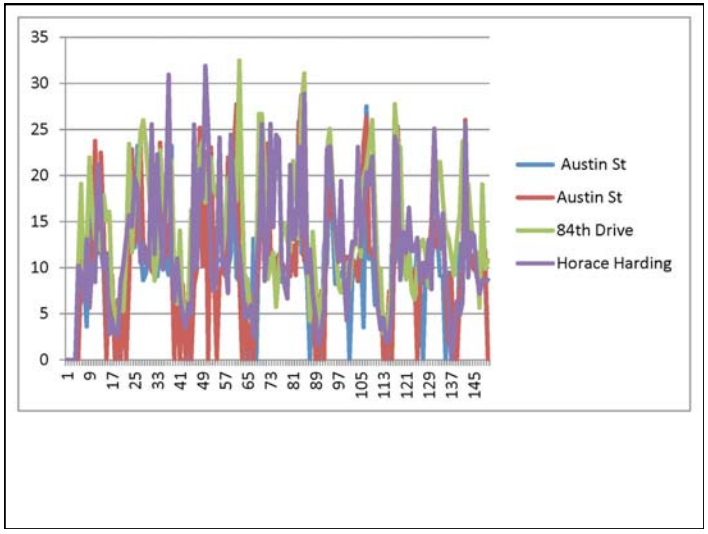
SPECIFICATIONS:

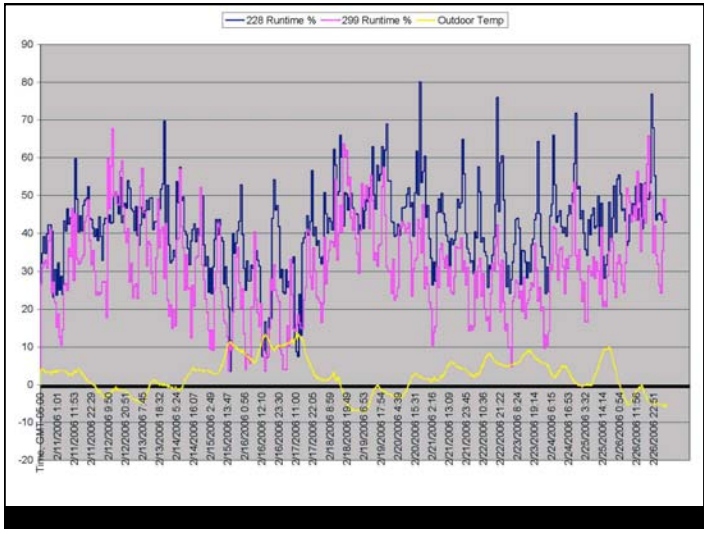
A. Boiler/Burner

1. Boiler shall be cast iron rated for 225 - 250 MBH manufactured by Weil McLain, H.B. Smith or an approved equal.

2. Burner shall be a combination gas/#2 oil type, self cleaning (automatic purge cycle), air atomizing rated at 85% efficiency or better with a gross output of 250 - 275 MBH. It shall be manufactured by Industrial Combustion, Iron Fireman or approved equal.It shall contain the following accessories:

1 of 14





SUMMARY:

DO NOT:

- Model Energy Use
- Do VFD (Variable Frequency Drive)
- DDC (Direct Digital Controls)
- HVAC (Combined Heating, Ventilating, Air Conditioning (Cooling))
- Ducts (Except to ventilate with 100% outdoor air)

INSTEAD, DO:

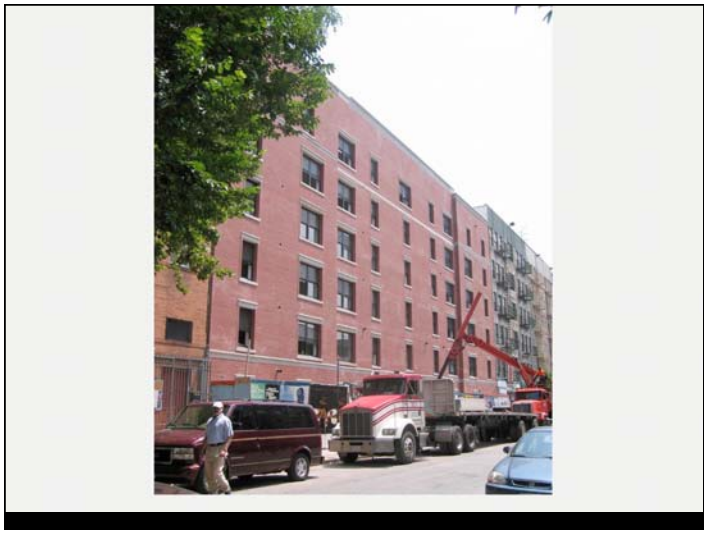
- Measure Energy Use
- Design the system, run equipment 100%
- Thermostat in each room, simple setup
- Separate Heating, Cooling, and Ventilation systems
- Move heat in and out of rooms with water or freon

Materials
(Body): Brass
(Stem): Stainless Steel
(Seat): Brass
(Packing O-Ring): EPDM rubber
(Ball Plug): Buna-N (NBR) Rubber Ball

802360MA 208V, 60 Hz Replacement motor for V4043, V4044 Zone Valves
802360NA 220V/50 Hz; 240V/60 Hz Replacement motor for V4043, V4044 Zone Valves

Product Number	Pipe Size (inch)	Pipe Size (DN)	Capacity (Cv)	Capacity (Kv)	Connection Type	Maximum Close-off Pressure (psi)	Maximum Close-off Pressure (kPa)	De-energized Position	Valve Action	Voltage	Current Draw (A)	Manual Opener
V4043A1002	1/2 in.	DN15	3.5 Cv	3 Kv	Flare	20 psi	138 kPa	Normally Closed	Spring return to close	120 Vac	0.08A	Yes
V4043A1010	1/2 in.	DN15	3.5 Cv	3 Kv	Sweat	20 psi	138 kPa	Normally Closed	Spring return to close	120 Vac	0.08A	Yes
V4043A1028	1/2 in.	DN15	3.5 Cv	3 Kv	Flare	20 psi	138 kPa	Normally Closed	Spring return to close	208 Vac	0.04A	Yes
V4043A1044	1/2 in.	DN15	3.5 Cv	3 Kv	Flare	20 psi	138 kPa	Normally Closed	Spring return to close	240 Vac	0.04A	Yes
V4043A1051	1/2 in.	DN15	3.5 Cv	3 Kv	Sweat	20 psi	138 kPa	Normally Closed	Spring return to close	240 Vac	0.04A	Yes
V4043A1184	1/2 in.	DN15	1 Cv	0.9 Kv	Sweat	50 psi	345 kPa	Normally Closed	Spring return to close	120 Vac	0.08A	Yes
V4043A1259	3/4 in.	DN20	8 Cv	6.9 Kv	Sweat	8 psi	55 kPa	Normally Closed	Spring return to close	120 Vac	0.08A	Yes
V4043A1317	1 in.	DN25	8 Cv	6.9 Kv	Sweat	8 psi	55 kPa	Normally Closed	Spring return to close	120 Vac	0.08A	Yes
V4043A1689	1/2 in.	DN15	3.5 Cv	3 Kv	NPT	20 psi	138 kPa	Normally Closed	Spring return to close	120 Vac	0.08A	Yes
V4043A1697	1 in.	DN25	10 Cv	8.6 Kv	NPT	6.5 psi	45 kPa	Normally Closed	Spring return to close	120 Vac	0.08A	Yes
V4043A1705	3/4 in.	DN20	3.5 Cv	3 Kv	NPT	20 psi	138 kPa	Normally Closed	Spring return to close	120 Vac	0.08A	Yes
V4043B1000	1/2 in.	DN15	3.5 Cv	3 Kv	Flare	20 psi	138 kPa	Normally Open	Spring return to open	120 Vac	0.08A	No
V4043B1018	1/2 in.	DN15	3.5 Cv	3 Kv	Sweat	20 psi	138 kPa	Normally Open	Spring return to open	120 Vac	0.08A	No
V4043B1059	1/2 in.	DN15	3.5 Cv	3 Kv	Sweat	20 psi	138 kPa	Normally Open	Spring return to open	240 Vac	0.04A	No

70-6910 229



Pump Sizing: Do the Work!

1/8 Horsepower (93 Watts)

3 Horsepower (2,238 Watts)

Pump Sizing Rule of Thumb #1:

$POR_{Avg} = 20$

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Pump Sizing Rule of Thumb #2:

Pump Wattage < Mechanical Room Lighting Wattage

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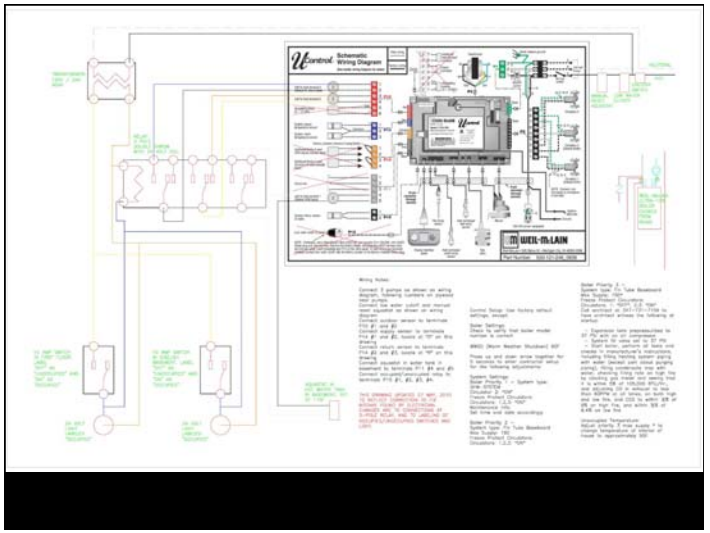
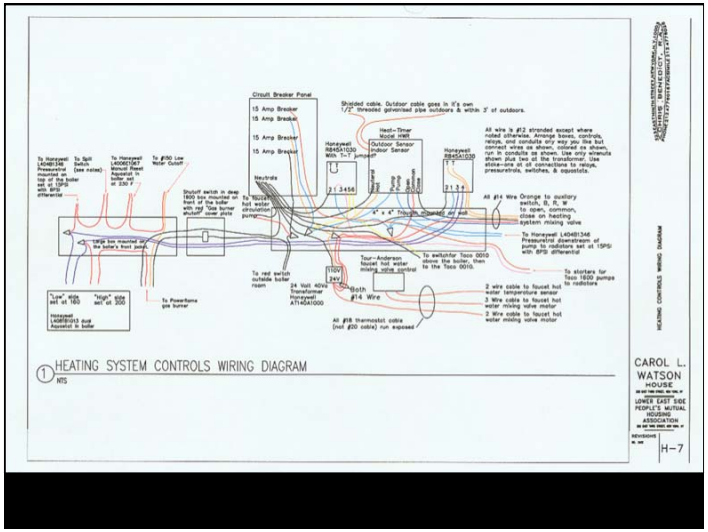
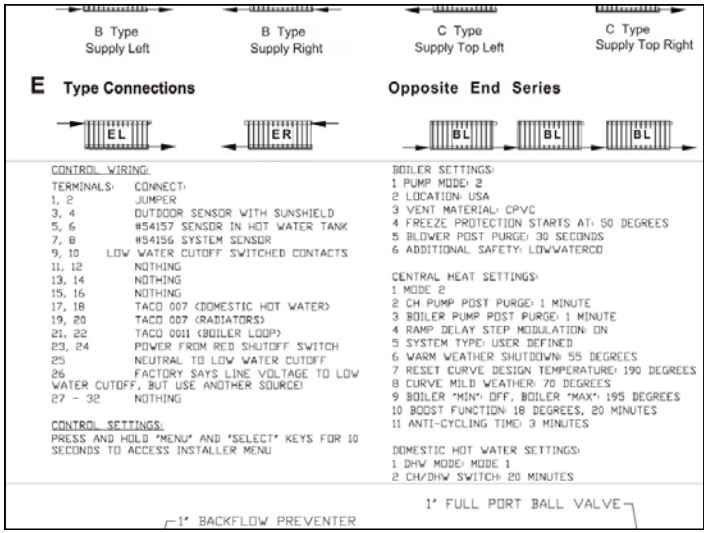






DDC:
Don't do it to people!

SUMMARY:

DO NOT:

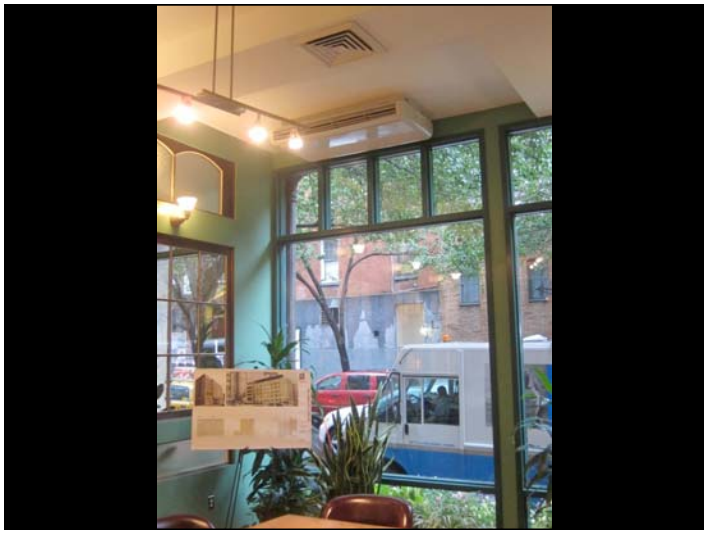
- Model Energy Use
- Do VFD (Variable Frequency Drive)
- DDC (Direct Digital Controls)
- HVAC (Combined Heating, Ventilating, Air Conditioning (Cooling))
- Ducts (Except to ventilate with 100% outdoor air)

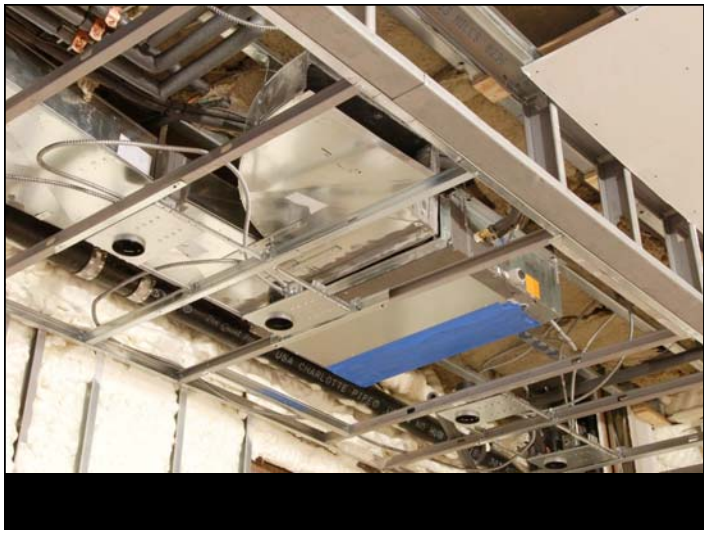
INSTEAD, DO:

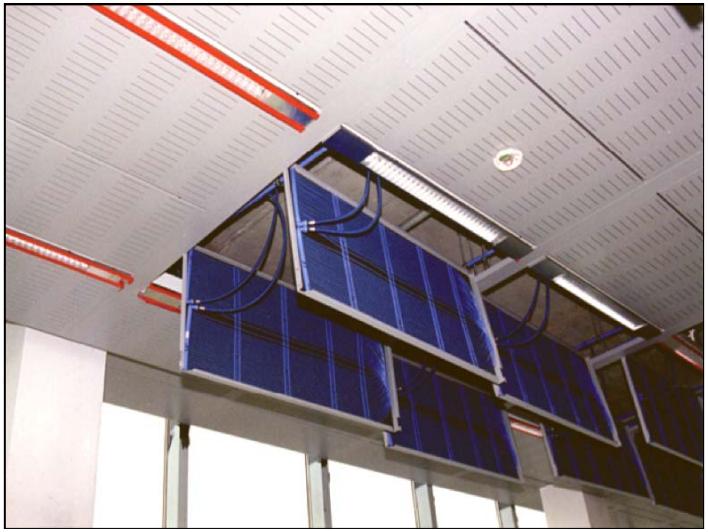
- Measure Energy Use
- Design the system, run equipment 100%
- Thermostat in each room, simple setup
- Separate Heating, Cooling, and Ventilation systems
- Move heat in and out of rooms with water or freon


PLAZA
HOTEL

COOLING WITHOUT DUCTS








TO TACK THE MATS


Spreepalais, D - Berlin

SUMMARY:

DO NOT:

- Model Energy Use
- Do VFD (Variable Frequency Drive)
- DDC (Direct Digital Controls)
- HVAC (Combined Heating, Ventilating, Air Conditioning (Cooling))
- Ducts (Except to ventilate with 100% outdoor air)

INSTEAD, DO:

- Measure Energy Use
- Design the system, run equipment 100%
- Thermostat in each room, simple setup
- Separate Heating, Cooling, and Ventilation systems
- Move heat in and out of rooms with water or freon

GIVE ME SOME H

GIVE ME SOME H

GIVE ME SOME V

GIVE ME SOME H

GIVE ME SOME V

AND GIVE ME SOME AC

GIVE ME SOME H

GIVE ME SOME V

AND GIVE ME SOME AC

BUT DON'T DO HVAC TO ME

HVAC
Don't do it to people!

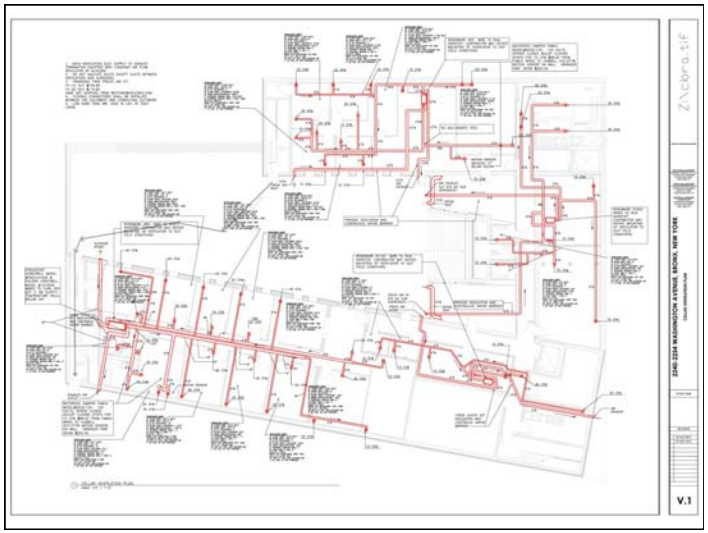
SUMMARY:

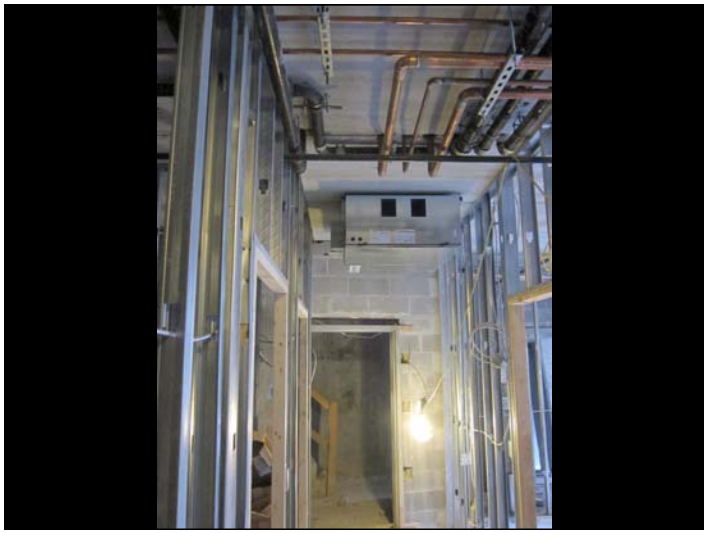
DO NOT:

- Model Energy Use
- Do VFD (Variable Frequency Drive)
- DDC (Direct Digital Controls)
- HVAC (Combined Heating, Ventilating, Air Conditioning (Cooling))
- Ducts (Except to ventilate with 100% outdoor air)

INSTEAD, DO:

- Measure Energy Use
- Design the system, run equipment 100%
- Thermostat in each room, simple setup
- Separate Heating, Cooling, and Ventilation systems
- Move heat in and out of rooms with water or freon


V.1




V.3

SUMMARY:

DO NOT:

- Model Energy Use
- Do VFD (Variable Frequency Drive)
- DDC (Direct Digital Controls)
- HVAC (Combined Heating, Ventilating, Air Conditioning (Cooling))
- Ducts (Except to ventilate with 100% outdoor air)

INSTEAD, DO:

- Measure Energy Use
- Design the system, run equipment 100%
- Thermostat in each room, simple setup
- Separate Heating, Cooling, and Ventilation systems
- Move heat in and out of rooms with water or freon

Chris Benedict's Design Criteria:

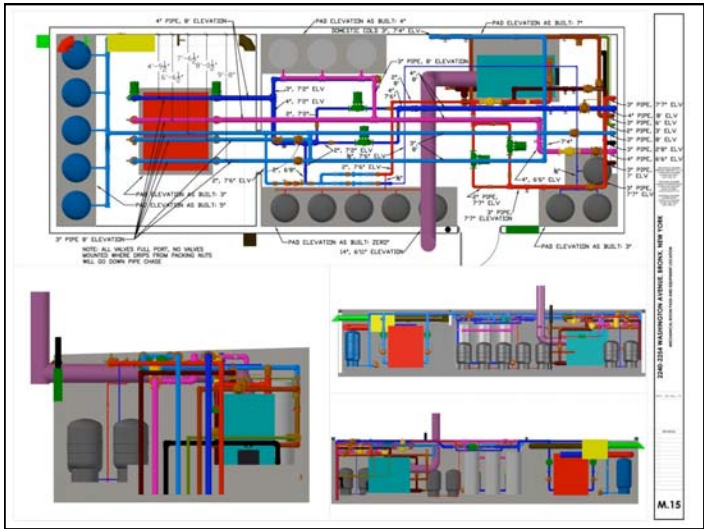
Very Energy Efficient

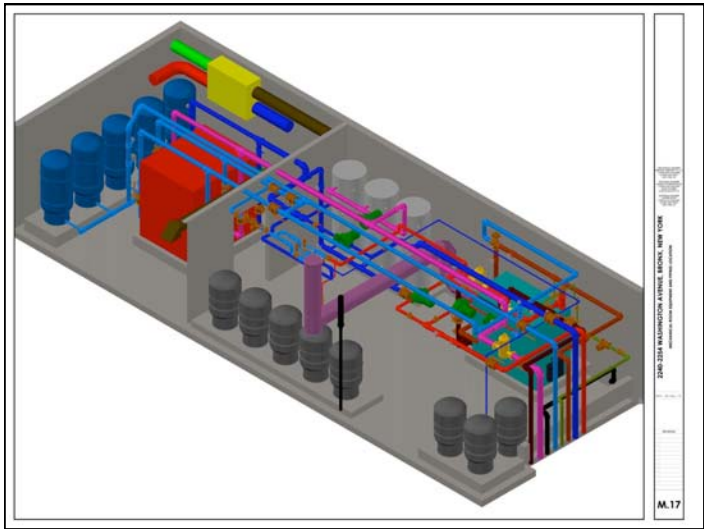
Very Quiet

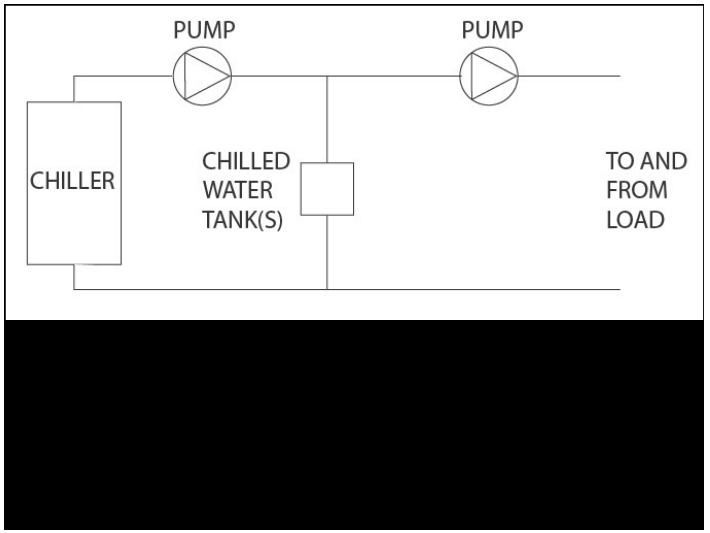
Very Simple to Install

Very Simple to Own

No Extra Cost







Commissioning Procedure:

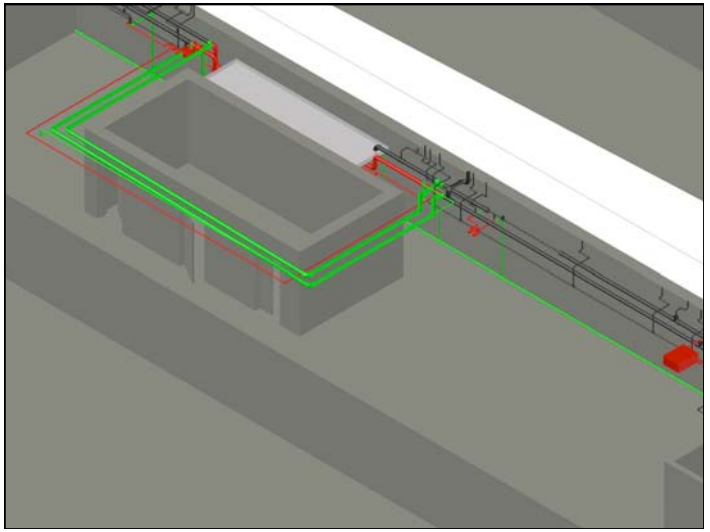
Testing and Balancing:

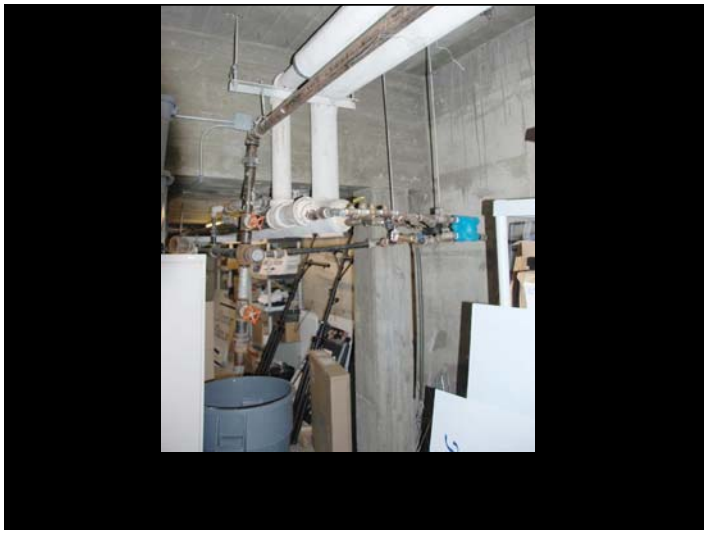
Controls:

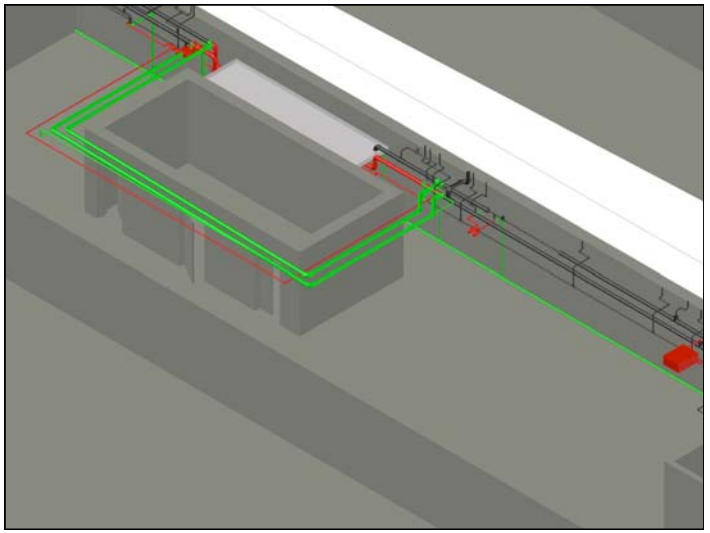
Thermostat on the wall in each room (with limit)

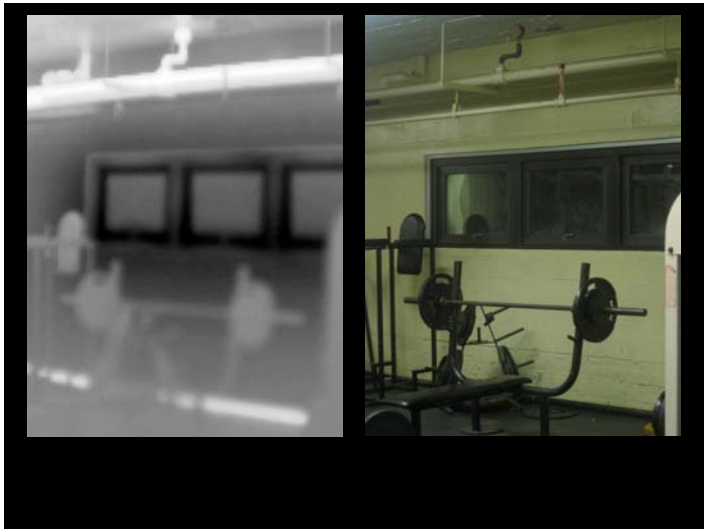
Outdoor temperature sensor and water temperature sensors control chillers

Outdoor temperature sensor and water temperature sensor controls boiler

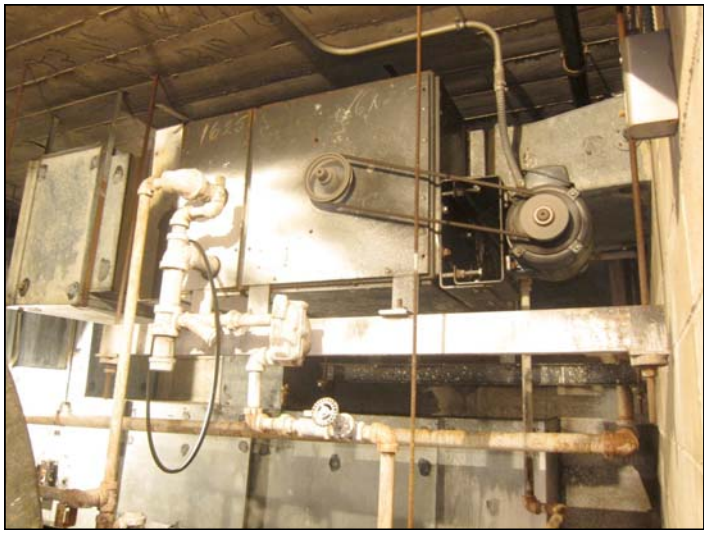




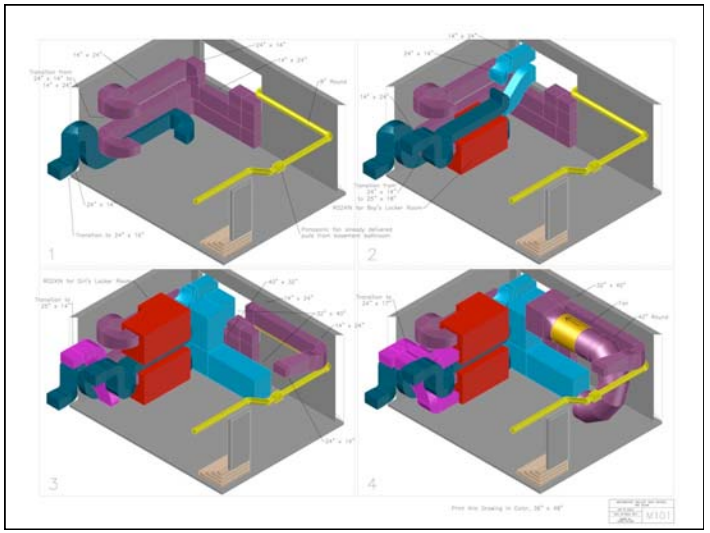


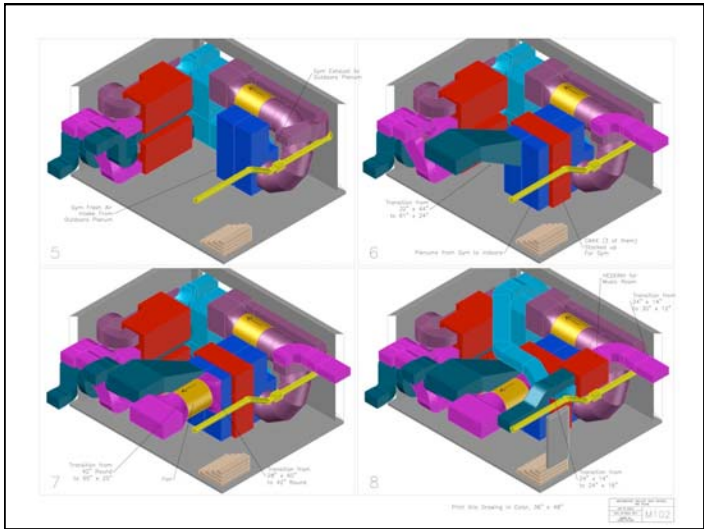


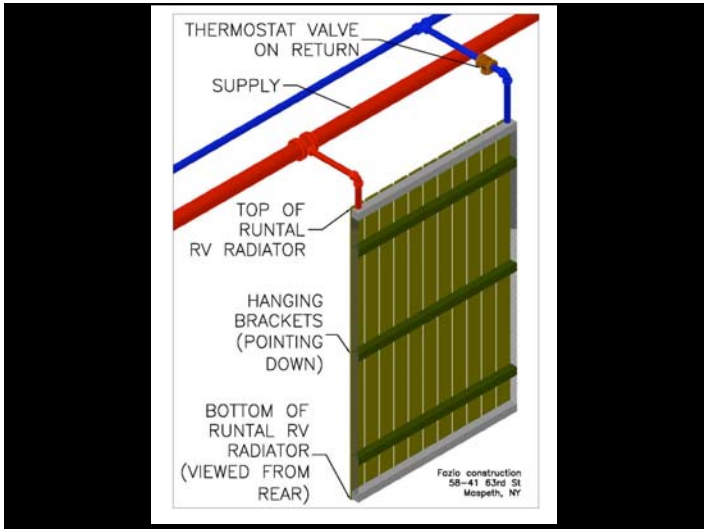

TEMPERATURE
SENSOR
ADJUSTMENT
KNOB

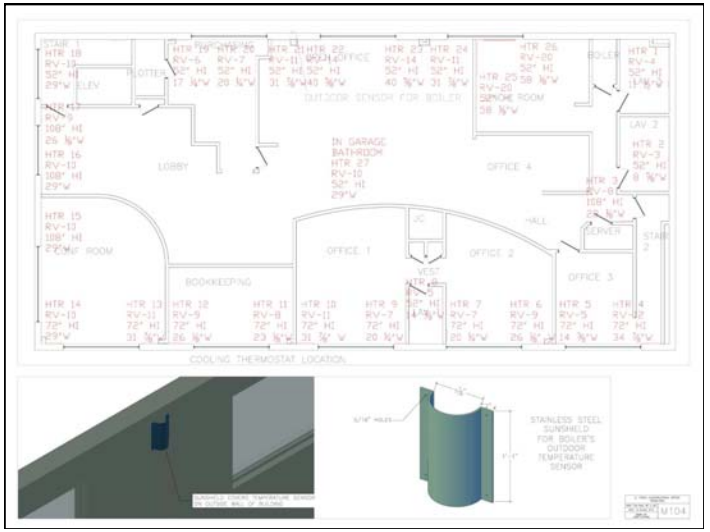


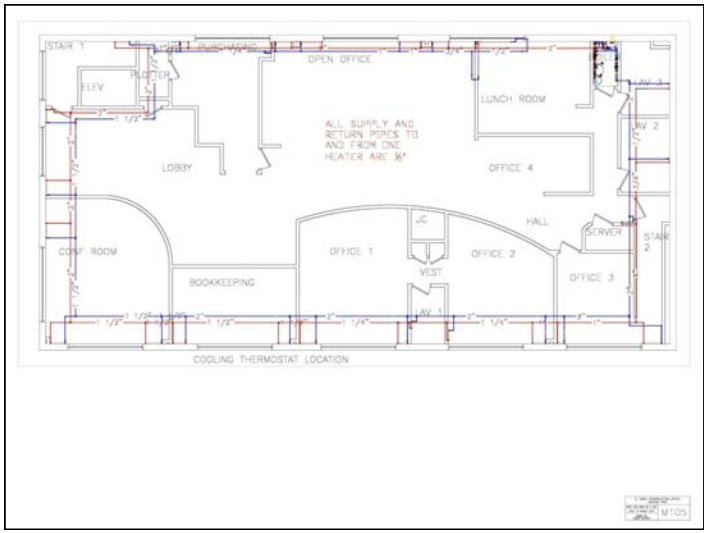

STEAM SUPPLY PIPE
STEAM RETURN PIPE

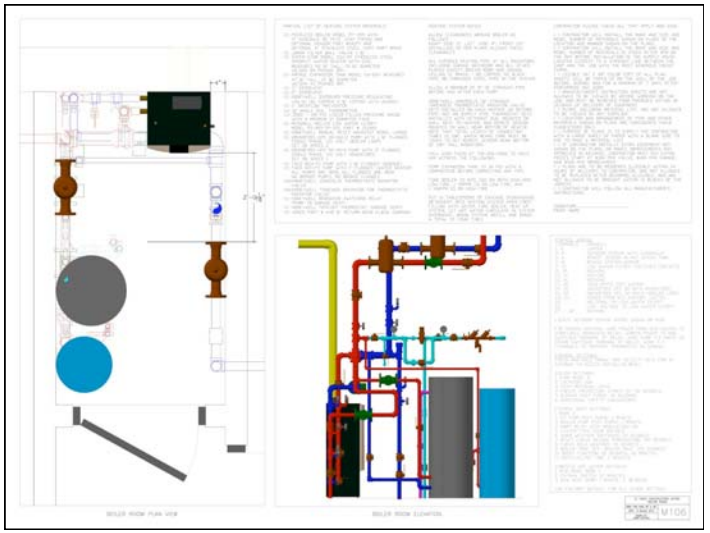


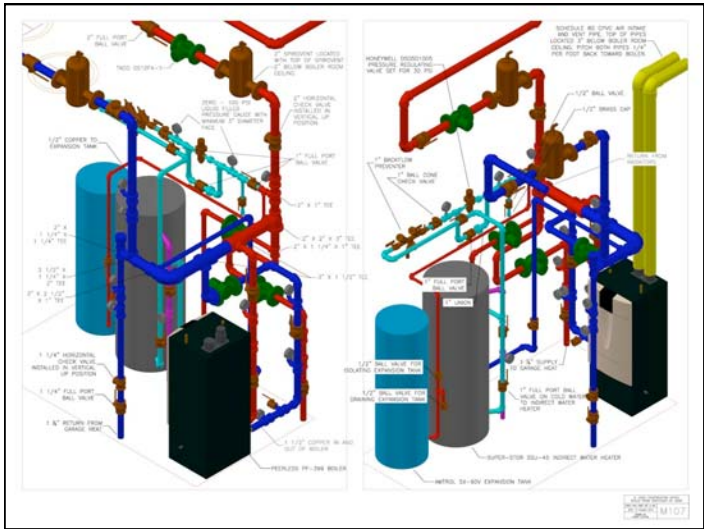


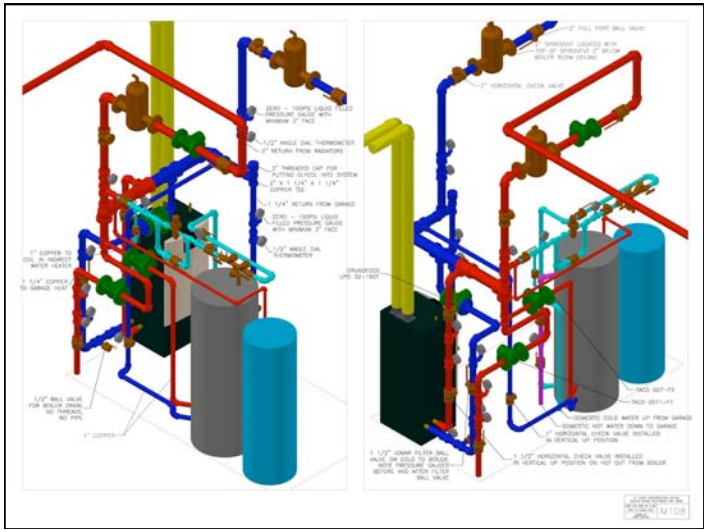

THERMOSTAT VALVE ON RETURN
SUPPLY
TOP OF RUNTAL RV RADIATOR
HANGING BRACKETS (POINTING DOWN)
BOTTOM OF RUNTAL RV RADIATOR (VIEWED FROM REAR)
Fazio construction
58-41 63rd St
Maspeth, NY

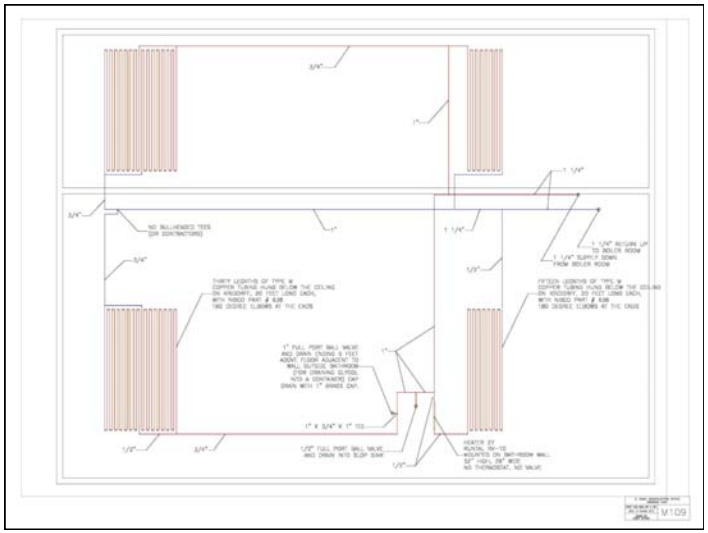


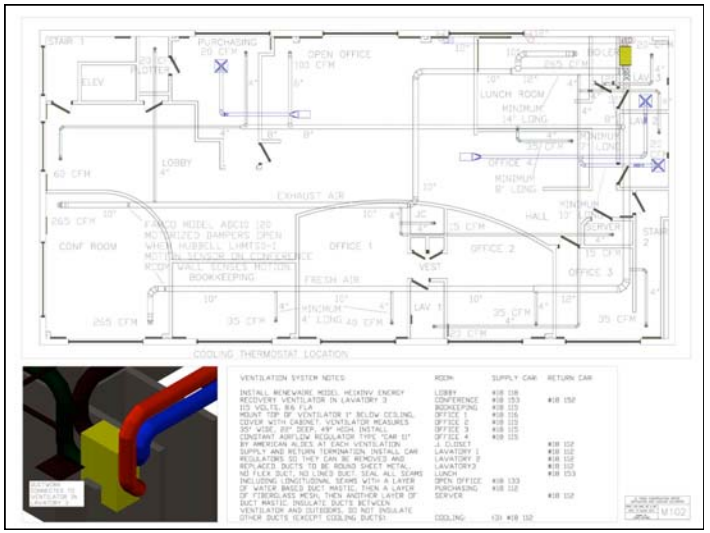

STAIR 1
OPEN OFFICE
PLOTTER
ELEV
LUNCH ROOM
ALL SUPPLY AND RETURN PIPES TO AND FROM ONE HEATER ARE 1"
LOBBY
OFFICE 4
HALL
SERVER
STAIR 2
CONF. ROOM
OFFICE 1
OFFICE 2
OFFICE 3
BOOKKEEPING
VEST
COOLING THERMOSTAT LOCATION

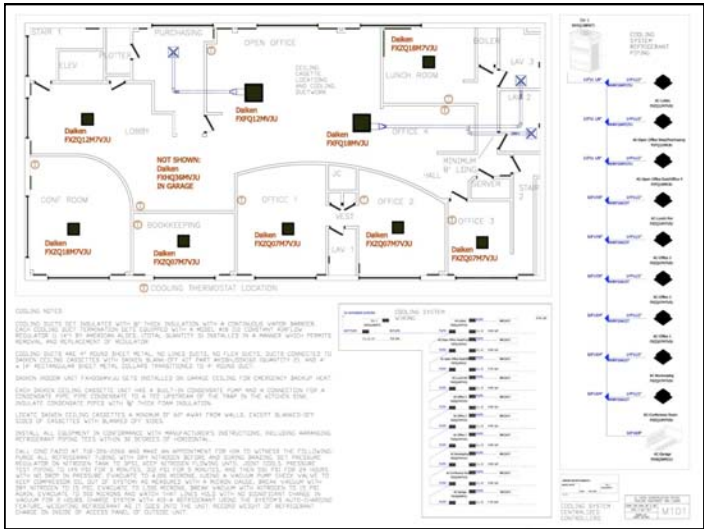


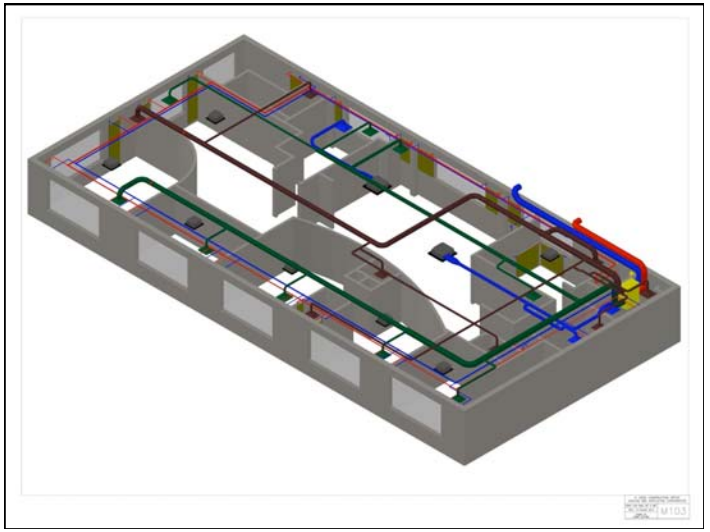


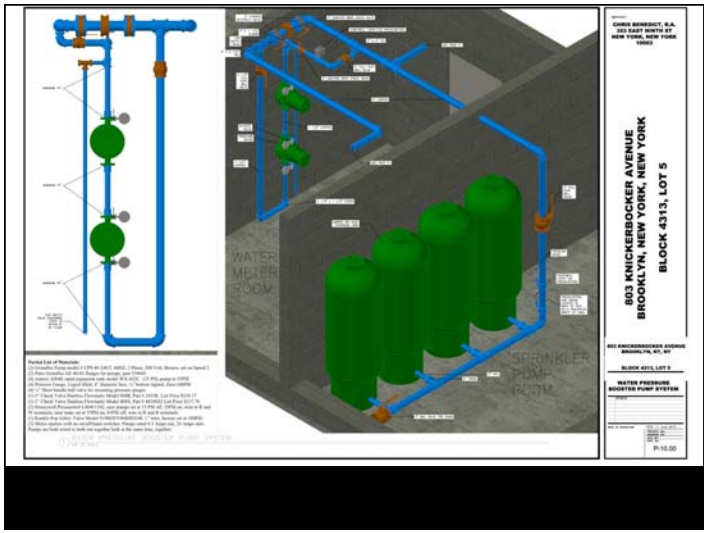


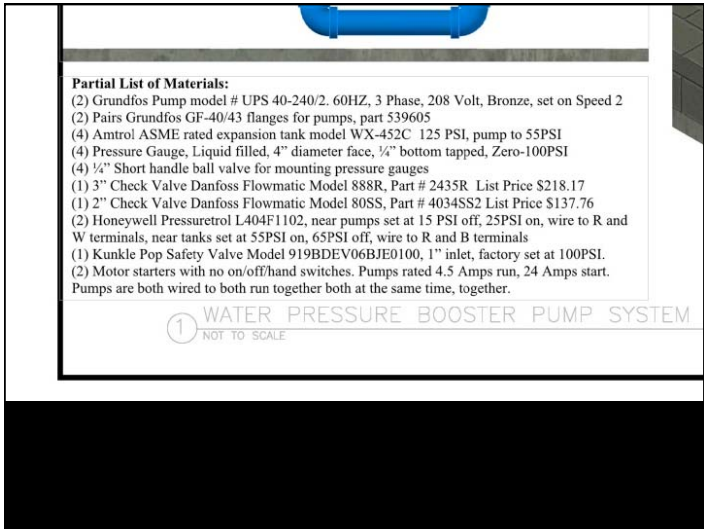


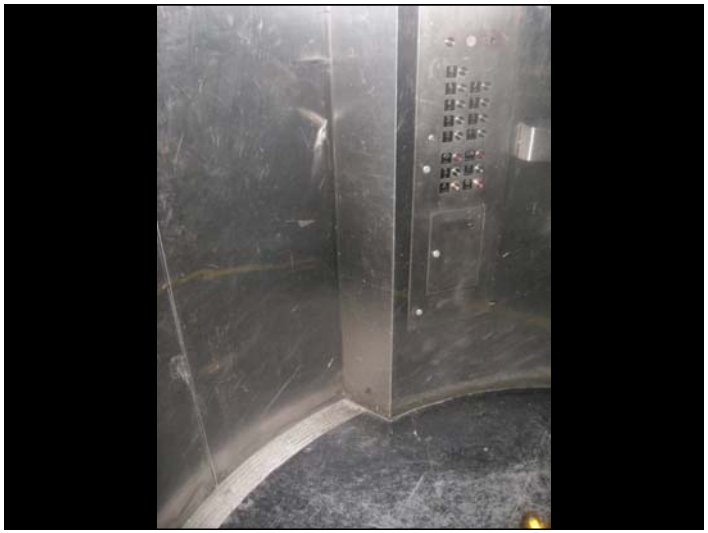


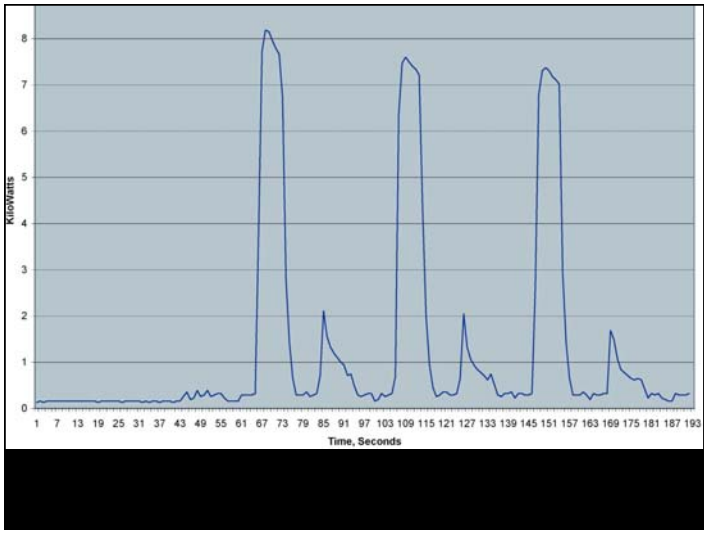





803 KNICKERBOCKER AVENUE
BROOKLYN, NEW YORK, NEW YORK
BLOCK 4313, LOT 5
WATER METER ROOM
SPRINKLER PUMP ROOM
WATER PRESSURE BOOSTER PUMP SYSTEM
P-10.00


Partial List of Materials:
(2) Grundfos Pump model # UPS 40-240/2. 60HZ, 3 Phase, 208 Volt, Bronze, set on Speed 2
(2) Pairs Grundfos GF-40/43 flanges for pumps, part 539605
(4) Amtrol ASME rated expansion tank model WX-452C 125 PSI, pump to 55PSI
(4) Pressure Gauge, Liquid filled, 4" diameter face, ¼" bottom tapped, Zero-100PSI
(4) ¼" Short handle ball valve for mounting pressure gauges
(1) 3" Check Valve Danfoss Flowmatic Model 888R, Part # 2435R List Price $218.17
(1) 2" Check Valve Danfoss Flowmatic Model 80SS, Part # 4034SS2 List Price $137.76
(2) Honeywell Pressuretrol L404F1102, near pumps set at 15 PSI off, 25PSI on, wire to R and W terminals, near tanks set at 55PSI on, 65PSI off, wire to R and B terminals
(1) Kunkle Pop Safety Valve Model 919BDEV06BJE0100, 1" inlet, factory set at 100PSI.
(2) Motor starters with no on/off/hand switches. Pumps rated 4.5 Amps run, 24 Amps start.
Pumps are both wired to both run together both at the same time, together.
1 WATER PRESSURE BOOSTER PUMP SYSTEM
NOT TO SCALE




KiloWatts
0
1
2
3
4
5
6
7
8
1 7 13 19 25 31 37 43 49 55 61 67 73 79 85 91 97 103 109 115 121 127 133 139 145 151 157 163 169 175 181 187 193
Time, Seconds


1


can shock, burn, or cause death.
Use lockout/tagout device and padlock to secure main line switch in OFF position.
MACHINE ROOM TEMPERATURE MAINTAINED BETWEEN 45° AND 90° F (7° AND 32° C)
RELATIVE HUMIDITY NOT TO EXCEED 95% NON-CONDENSING
AAA102ALA2


2

MECHANICAL SYSTEMS

by
Henry Gifford
of
Chris Benedict, R. A.

henry@energysavingscience.com
www.energysavingscience.com