NY-GEO 2020 Top Job Competition April 2021

GSHP Conversion of an Orthodox Synagogue

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Project Site and Existing Conditions

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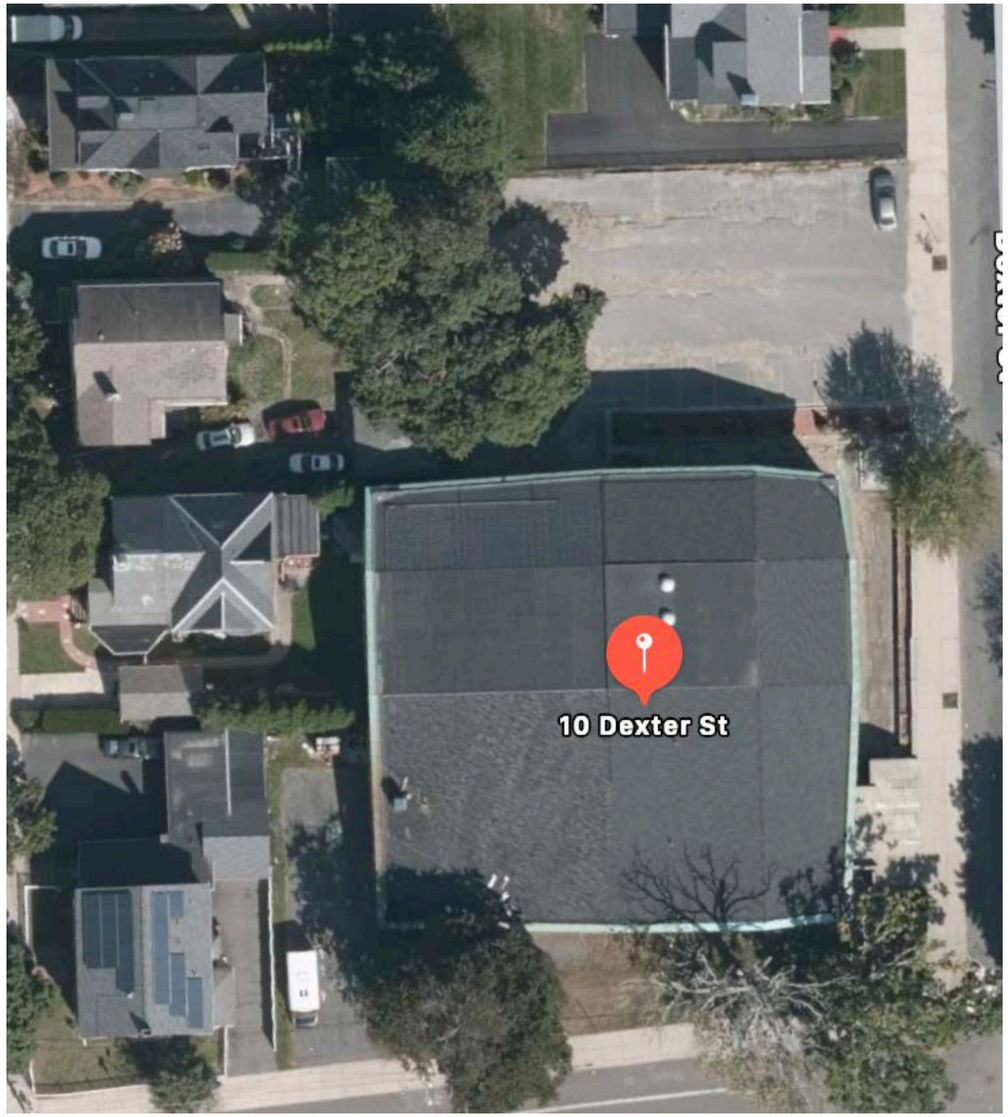
Building Exterior

Building Statistics



- Urban Lot about 0.8 Acres
- House of Worship
- Building Areas/Uses:
  - Sanctuary
  - Social Hall
  - Mikvah (Ritual Bath)
  - Library
  - Classrooms
  - Activity Rooms
  - Kitchen

Existing HVAC

- Three AHUs: 1 x 40-ton; 2 x 7.5-ton (one long defunct)
- Original 1960 Boiler (originally fuel oil converted to Fossil Fuel Gas)
- Chilled water via outside chiller
- AHUs: Provide heating with boiler water and cooling with chiller water.

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Existing AHUS

Project Goals

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Project Goals

- ➡Replace Aging Equipment
- ➡Make Energy Choices Consistent with Values
- ➡Reduce GHG Emissions
- ➡Provide Better Conditioning During Sabbath and Holidays
- ➡Adjust for Varied Occupancy
- ➡Improve Comfort and Zoning
- ➡Lower Operating Cost

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Evaluation and Design

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Evaluation and Design

- ➡Heating and Cooling Load Analysis
  - Manual N by Achieve
  - Alternate method by Mechanical Engineers
  - Adjust final for differences in methods
- ➡Evaluate Equipment Options
  - High efficiency/Variable Speed
  - Remote Monitoring
  - Programmability

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Evaluation and Design

- ➡Formation Thermal Conductivity Test
  - FTC: 1.63 Btu/hr.-ft-F
  - Therm. Diffusivity 1.25 Ft^2/day
- ➡Mechanical Engineering Design
  - Piping, Ducting, Fresh Air

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Evaluation and Design

- Estimate Value of Financial Incentives
  - State Rebate: $196,000
  - Renewable Energy Credits: Market Driven

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Installation

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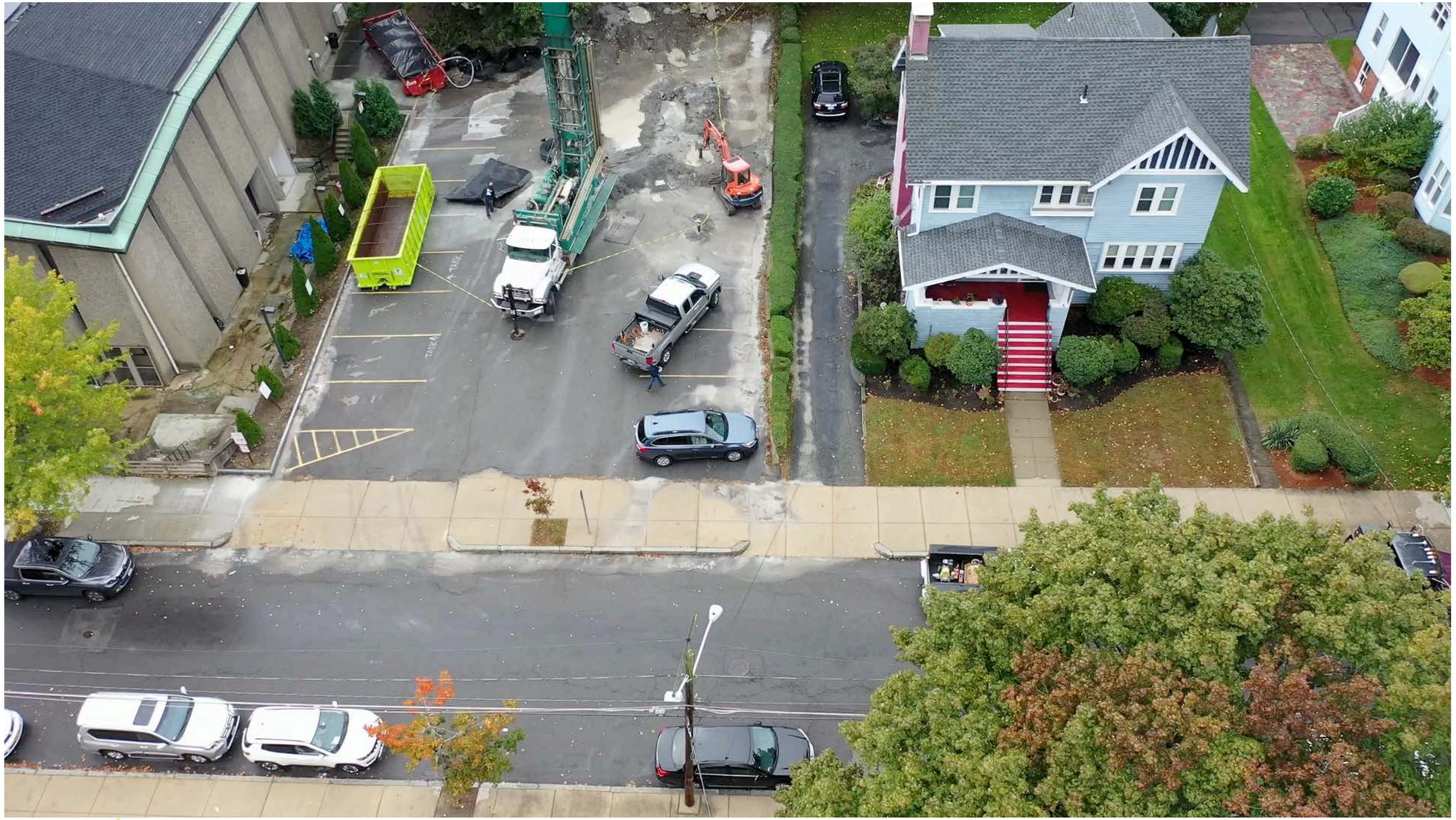
VCL Construction



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VCL Construction

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Piping and Circulation

- Piping
  - 1.25” Loops; 2” to manifold; 4” building loop
  - *Piping configured to maintain required separation from Mikvah and its water source*.

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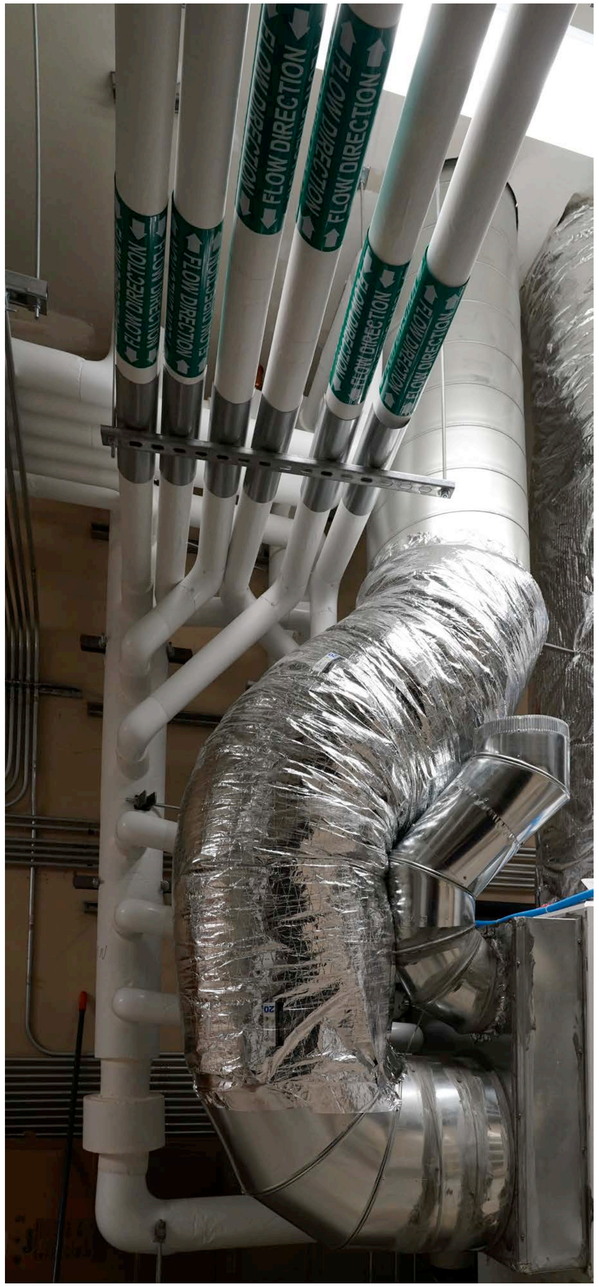
Typical GSHPs

Typical Piping



Circulation System

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Monitoring and Programming

- Web-based control
  - Each GSHP has a WaterFurnace Aurora Web Link
  - All equipment accessible via WaterFurnace Symphony

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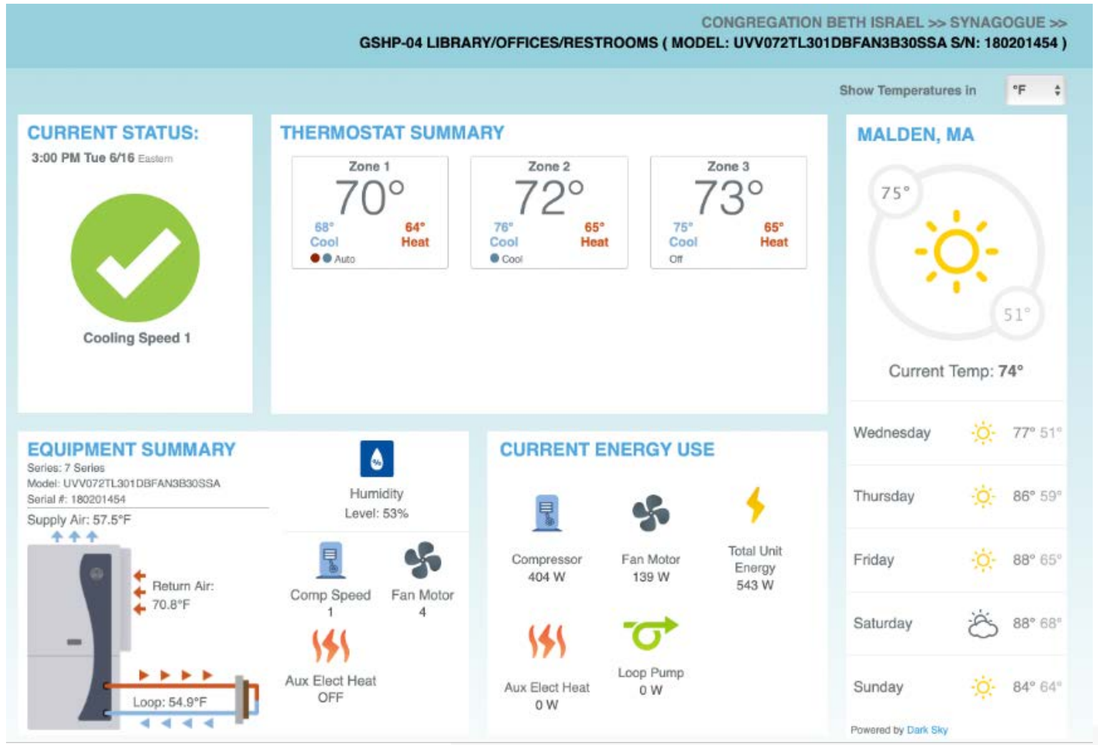
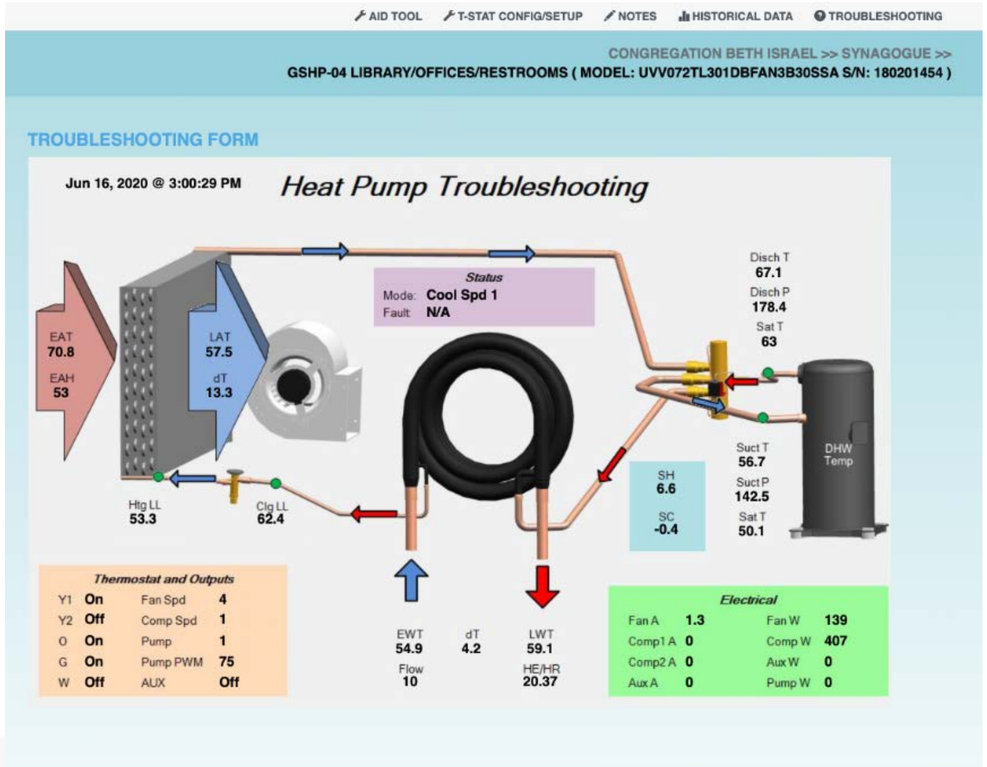
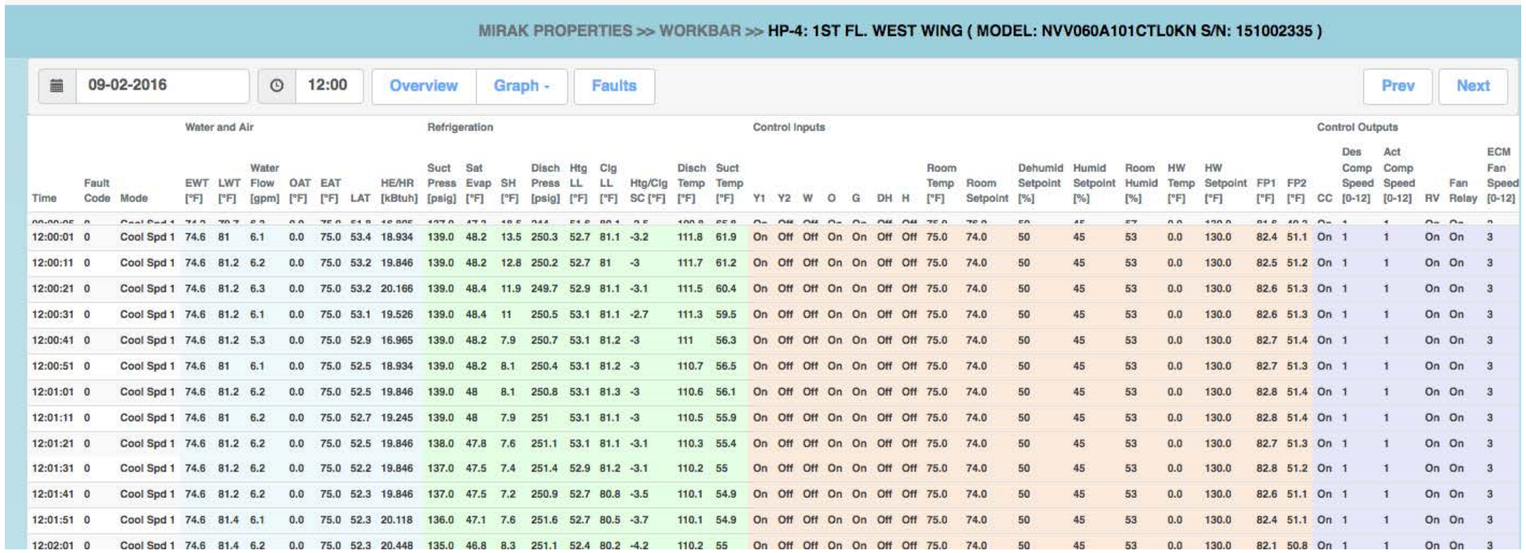
Remote Monitoring, Control and Configuration







			Water and Air							Refrigeration								Control Inputs															Control Outputs				
Time	Fault Code	Mode	EWT [°F]	LWT [°F]	Water Flow [gpm]	OAT [°F]	EAT [°F]	LAT	HE/HR [kBtuh]	Suct Press [psig]	Sat Evap [°F]	SH [°F]	Disch Press [psig]	Htg LL [°F]	Clg LL [°F]	Htg/Clg SC [°F]	Disch Temp [°F]	Suct Temp [°F]	Y1	Y2	W	O	G	DH	H	Room Temp [°F]	Room Setpoint	Dehumid Setpoint [%]	Humid Setpoint [%]	Room Humid [%]	HW Temp [°F]	HW Setpoint [°F]	FP1 [°F]	FP2 [°F]	CC	Des Comp Speed [0-12]	Act Comp Speed [0-12]	RV	Fan Relay	ECM Fan Speed [0-12]
12:00:01	0	Cool Spd 1	74.6	81	6.1	0.0	75.0	53.4	18.934	139.0	48.2	13.5	250.3	52.7	81.1	-3.2	111.8	61.9	On	Off	Off	On	On	Off	Off	75.0	74.0	50	45	53	0.0	130.0	82.4	51.1	On	1	1	On	On	3
12:00:11	0	Cool Spd 1	74.6	81.2	6.2	0.0	75.0	53.2	19.846	139.0	48.2	12.8	250.2	52.7	81	-3	111.7	61.2	On	Off	Off	On	On	Off	Off	75.0	74.0	50	45	53	0.0	130.0	82.5	51.2	On	1	1	On	On	3
12:00:21	0	Cool Spd 1	74.6	81.2	6.3	0.0	75.0	53.2	20.166	139.0	48.4	11.9	249.7	52.9	81.1	-3.1	111.5	60.4	On	Off	Off	On	On	Off	Off	75.0	74.0	50	45	53	0.0	130.0	82.6	51.3	On	1	1	On	On	3
12:00:31	0	Cool Spd 1	74.6	81.2	6.1	0.0	75.0	53.1	19.526	139.0	48.4	11	250.5	53.1	81.1	-2.7	111.3	59.5	On	Off	Off	On	On	Off	Off	75.0	74.0	50	45	53	0.0	130.0	82.6	51.3	On	1	1	On	On	3
12:00:41	0	Cool Spd 1	74.6	81.2	5.3	0.0	75.0	52.9	16.965	139.0	48.2	7.9	250.7	53.1	81.2	-3	111	56.3	On	Off	Off	On	On	Off	Off	75.0	74.0	50	45	53	0.0	130.0	82.7	51.4	On	1	1	On	On	3
12:00:51	0	Cool Spd 1	74.6	81	6.1	0.0	75.0	52.5	18.934	139.0	48.2	8.1	250.4	53.1	81.2	-3	110.7	56.5	On	Off	Off	On	On	Off	Off	75.0	74.0	50	45	53	0.0	130.0	82.7	51.3	On	1	1	On	On	3
12:01:01	0	Cool Spd 1	74.6	81.2	6.2	0.0	75.0	52.5	19.846	139.0	48	8.1	250.8	53.1	81.3	-3	110.6	56.1	On	Off	Off	On	On	Off	Off	75.0	74.0	50	45	53	0.0	130.0	82.8	51.4	On	1	1	On	On	3
12:01:11	0	Cool Spd 1	74.6	81	6.2	0.0	75.0	52.7	19.245	139.0	48	7.9	251	53.1	81.1	-3	110.5	55.9	On	Off	Off	On	On	Off	Off	75.0	74.0	50	45	53	0.0	130.0	82.8	51.4	On	1	1	On	On	3
12:01:21	0	Cool Spd 1	74.6	81.2	6.2	0.0	75.0	52.5	19.846	138.0	47.8	7.6	251.1	53.1	81.1	-3.1	110.3	55.4	On	Off	Off	On	On	Off	Off	75.0	74.0	50	45	53	0.0	130.0	82.7	51.3	On	1	1	On	On	3
12:01:31	0	Cool Spd 1	74.6	81.2	6.2	0.0	75.0	52.2	19.846	137.0	47.5	7.4	251.4	52.9	81.2	-3.1	110.2	55	On	Off	Off	On	On	Off	Off	75.0	74.0	50	45	53	0.0	130.0	82.8	51.2	On	1	1	On	On	3
12:01:41	0	Cool Spd 1	74.6	81.2	6.2	0.0	75.0	52.3	19.846	137.0	47.5	7.2	250.9	52.7	80.8	-3.5	110.1	54.9	On	Off	Off	On	On	Off	Off	75.0	74.0	50	45	53	0.0	130.0	82.6	51.1	On	1	1	On	On	3
12:01:51	0	Cool Spd 1	74.6	81.4	6.1	0.0	75.0	52.3	20.118	136.0	47.1	7.6	251.6	52.7	80.5	-3.7	110.1	54.9	On	Off	Off	On	On	Off	Off	75.0	74.0	50	45	53	0.0	130.0	82.4	51.1	On	1	1	On	On	3
12:02:01	0	Cool Spd 1	74.6	81.4	6.2	0.0	75.0	52.3	20.448	135.0	46.8	8.3	251.1	52.4	80.2	-4.2	110.2	55	On	Off	Off	On	On	Off	Off	75.0	74.0	50	45	53	0.0	130.0	82.1	50.8	On	1	1	On	On	3

New Fresh Air System

- Ducted Fresh Air
  - Modulating dampers controlled based on CO_2 Sensors
  - A base level of fresh air adjusts upward based on occupancy
  - No more cold air pouring down the stairwell

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Fire Stopping

- Engineered fire stopping for safety
  - Penetrations and conduits sealed to block fire spread
  - We likely improved fire resistance of building since it was 1960 construction

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Project Results

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Resulting Improvements

- ➡Modern Temperature Control with 16 zones.
- ➡Programmable controls allow for planned conditioning during Services and Events
- ➡Seamless Fresh Air System
- ➡Much quieter HVAC
- ➡Greenhouse Gas Emissions Greatly Reduced
- ➡Operating cost lower with better comfort

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Why is this the TOP JOB?

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- ☑ Efficiency
  - ☑ Highest COP GSHPs
  - ☑ ECM Fan Control
  - ☑ Highly Efficient Circulation
  - ☑ Programmability
- ☑ Workmanship
  - ☑ Durable HDPE throughout
  - ☑ Professional Insulation and Labeling
  - ☑ Care taken to protect the Mikvah

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- ☑ Accessibilty
  - ☑ Remote Access and Control
  - ☑ Data every 10 seconds
  - ☑ Programming for Services and Events
- ☑ Performance
  - ☑ Improved Comfort
  - ☑ Lower Operating Cost
  - ☑ Greatly reduced GHG Emission
  - ☑ System Longevity

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