DRAFT

SHAKER MEETING HOUSE – ALBANY, NY
MECHANICAL & ELECTRICAL SYSTEMS ASSESSMENT

Prepared by:

LANDMARK FACILITIES GROUP, INC.
252 East Avenue
Norwalk, CT 06855
www.LFGinc.com

December 2020

ASSESSMENT OF MECHANICAL, ELECTRICAL AND PLUMBING SYSTEMS

INTRODUCTION

In September 2020, Landmark Facilities Group, Inc. of Norwalk, Connecticut conducted an on-site evaluation of existing mechanical and electrical systems at the Shaker Meeting House located at 25 Meeting House Road, Albany, NY. This report describes the existing condition of these systems and identifies any deficiencies. It then provides recommendations that, if implemented, would improve the long term preservation and safety of the building and occupants.

OVERVIEW

The first settlement of the Shakers was established on this site in 1776 by "Mother" Ann Lee. The Shakers are renowned for their technological innovations, music, architecture, and furniture. The last Shakers left the community in 1938. The 1848 Meeting House is a special building that features a small museum and gift shop that features locally made crafts.

OBSERVATIONS

MECHANICAL

Heat for the building is provided by a combination of hot water and electric sources. Hot water is created by a gas-fired category IV condensing boiler with an output of 375,000 BTUH located in a 3rd floor mechanical room. The boiler is vented through the roof of the building. The system is equipped with two zones; one which serves radiators in the front of the building, and another that serves a hot water coil in the air handler that heats the assembly space. Heat to the radiators is controlled by a thermostat located in the northwest room on the 2nd floor, with additional control provided by thermostatic valves at each radiator.

Gas-fired condensing boiler on 3rd floor

Hot water radiators are constructed from steel and most are equipped with thermostatic valves for temperature control. They are located along perimeter walls, mostly below windows on the 1st, 2nd and 3rd floors.

Typical steel hot water radiator with thermostatic valve (at left)

An electric fan-style heater is installed along the wall at the main entrance. An electric baseboard heater is installed in the restroom located within the gift shop.

The attic air handler serving the assembly space has a nominal airflow capacity of 6000 cfm. It was manufactured in 1997. A pair of 1.5" hot water pipes from the boiler traverse the attic and connect to a hot water coil located inside the air handler. A 20x20 duct provides ventilation air through an exterior louver on the south side of the building.

Hot water piping and motorized control valve at air handler

Warm air is delivered to the assembly space from (14) linear registers located along the east and west perimeter walls. A cluster of (6) 24x24 grilles return air back to the air handler from the south end of the space.

There are no central cooling systems operating in the building. A window air conditioner provides cooling for the gift shop area, and window units are also installed in the two north rooms on the 2nd floor.

ELECTRICAL

The building is served by a 200A, 120/208V, three phase, 4 wire system that appears to run overhead from a pole on Meeting House Road to a 200A, 120/208V, 3 phase, 4 wire panel surface-mounted in the basement. This panel distributes power to the two subpanels (Panel 1 & 2) on the first floor and the attic panel as well as some building loads and appears to be in good condition. Panel 1 is a 125A main lugs only, 120/240V, single phase, 20 pole recessed load center and Panel 2 is a 100A main breaker, 120/240V, single phase, 24 pole recessed load center, both providing branch circuits to for lighting and power. Both panels appear to be in good condition. The attic panel is a 20 pole, surface-mounted load center with a separate 60A disconnect switch.

Photo 1 - Panel in basement

hoto 1 - Panel 1 on first floor

Photo 3 – Panel 2 on first floor

Photo 4 – Attic panel and disconnect switch

The branch wiring is a mixture of cloth insulated conductors and thermoplastic insulated conductors and BX cable. Feeders appear to be conductors in conduit.

PLUMBING

The water service enters the building as 2" black steel pipe that traverses the basement and rises up through the building near the main entrance. A hose rack for fire protection was observed on the 2nd floor (off the domestic water service). Sanitary piping is cast iron.

Hose rack located on 2nd floor

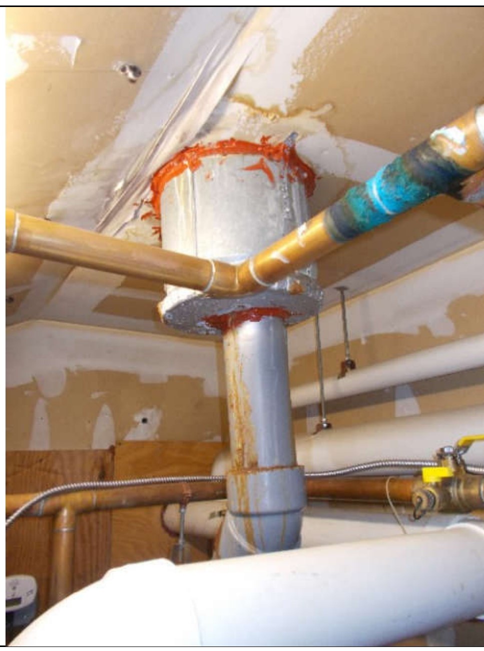
Domestic hot water is generated by two electric water heaters; one located in the basement, and another in the 2nd floor restroom.

Natural gas service enters on the west side of the building. A 1.5" pipe exits the meter and runs up to the 3rd floor mechanical room where it connects to the boiler.

FINDINGS

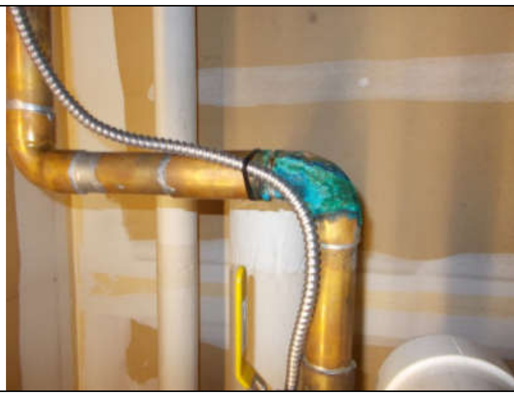
MECHANICAL

The boiler was manufactured in 2016 and is only 4 years old. However there is significant evidence of water leakage onto the boiler, apparently from the vent penetration through the roof above. This can shorten the service life of the boiler if left unattended, especially if water should come in contact with the boiler's microprocessor.

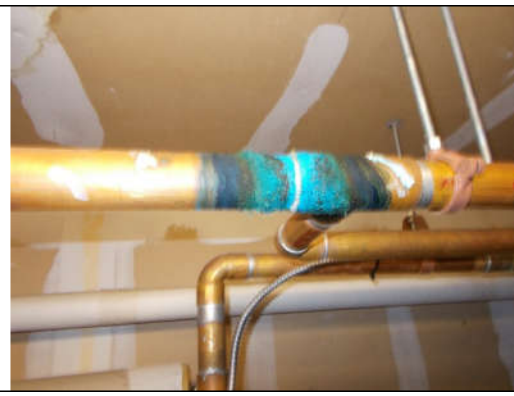
	
Faulty vent connection above boiler	**Evidence of water leakage onto boiler**

The CPVC boiler vent pipe connects to a section of larger metal vent pipe, which is not permitted by the manufacturer. The vent should be reconfigured so that the CPVC pipe passes through the roof without interruption. The repair will likely require a roofing contractor to remove the metal pipe and provide flashing around the CPVC vent pipe to create a water-tight penetration.

Additional concerns around the boiler include (1) corrosion on at least 2 copper fittings, (2) improper support of a hot water pump, and (3) a condensate neutralizer in need of cleaning or replacement.



Corrosion on copper elbow above boiler



Corrosion on copper tee above boiler

Poor support of Hot water pump

Condensate neutralizer in need of service

Also, we noted that the condensate pump at the outlet of the neutralizer was set on the boiler room floor, outside the drain pan of the boiler. We recommend that either the pump be relocated into the boiler drain pan, or a small drain pan (dedicated to the pump) is installed. Both pans should be equipped with an alarm to notify the building operator in the event that water is present.

We observed a chemical feed tank installed inside the boiler room. At least once a year (often in the Fall), a water treatment vendor should check the chemistry of the water in the closed hot water loop and add treatment chemicals as necessary.

The attic air handler is 23 years old and approaching the end of its useful service life. It should be replaced soon. A new modular air handler should be installed so that components can be rigged through the existing exterior louver or brought up the stairs. The hot water coil in the new air handler should be equipped with a 2-way control valve to take advantage of the existing variable speed pump in the boiler room. For outdoor ventilation air, a carbon dioxide sensor can be installed in the return air duct to achieve what is known as “demand control ventilation” or DCV. DCV can automatically reduce outdoor air quantities when there are few people present in the assembly space, to conserve energy. If the assembly space has a high occupancy (40 people or more) on a regular basis, an energy recovery ventilator should be installed to preheat ventilation air and save additional energy.

In the 2nd floor corridor, an actuator was found to have been detached from the thermostatic valve at the radiator. This valve should be repaired or replaced.

Broken actuator at thermostatic radiator valve

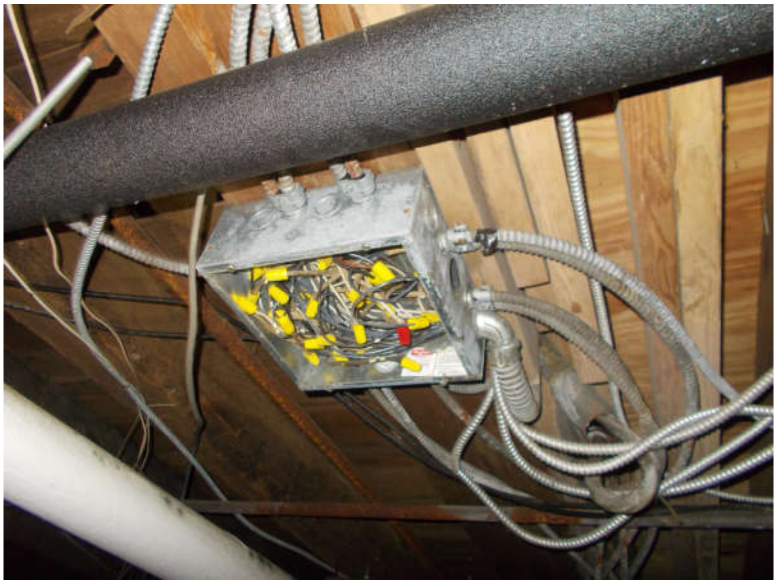
n the 3rd floor, the room on the north side has three hot water radiators. At least one of the radiators has a remote temperature sensor mounted on a cold exterior wall, which can skew its measurements. We recommend changing this valve to the type with an integral sensor to provide more accurate temperature sensing and better comfort.

Remote temperature sensor installed on exterior wall.

ELECTRICAL

There is a large junction box ceiling mounted in the crawlspace that shows evidence of extensive corrosion which appears to be due to water leakage. The water issue should be mitigated and the junction box replaced.

Another large ceiling mounted junction box in the crawlspace is missing its cover plate and exposing live wiring. The cover should be installed over this open junction box.



PLUMBING

While the hot water heater in the basement is newer, the unit installed in the 2nd floor restroom is 32 years old and should be replaced immediately. When this unit fails it can leak water down onto the 1st floor ceiling and cause damage to existing finishes. A new water heater can be set in an emergency drain pan with a liquid leak sensor.

Missing insulation on the 2" domestic water piping in the basement can increase moisture levels from condensation. This piping should be wrapped with insulation containing a continuous vapor barrier to prevent condensation on the pipe surface.

BUILDING ENVELOPE REMARKS

Typical for buildings constructed from this period, the envelope is quite porous or "leaky" to outdoors. Single pane glazing on windows offers high transmission of solar energy in summer, while letting drafts in and heat escape in winter.

In the absence of a vapor barrier, the dirt floor of the basement can add to interior moisture loads during heavy rains. While data loggers were deployed in select rooms on the upper floors, it may be useful to install a logger in the basement to monitor relative humidity levels and determine if the floor is a moisture load on the building.

Large gaps were observed around electrical conduit penetrations through the foundation wall. Such gaps can invite vermin and allow unconditioned air and moisture to enter; these gaps should be sealed airtight.

The thermal boundary for the unfinished attic is located at the floor, and the attic is vented to outdoors. This places the air handler, ductwork and piping in a cold environment in winter and increases the importance of complete and continuous insulation. The door to the attic should be weatherstripped to prevent air from passing through. While most of the hot water piping in the attic was insulated, components such as valves were not and this leads to heat loss and wasted energy. At worst, it creates a freeze risk if the boiler was unable to run for a prolonged period.

An inspection of the integrity of the attic floor insulation can be done from below (in the assembly space) using an infrared camera. This would best be done on a cold winter day when the temperature differential is high. Any "cold spots" detected by the camera would indicate locations where insulation should be added to avoid wasting energy.

Significant surface damage was observed on walls and ceilings in the assembly space. Most of the damage was limited to the southeast corner of the room, where paint and plaster finishes are failing – perhaps as a result of water intrusion. We recommend that a building conservator be brought in to identify the root cause and suggest remedial action before building structural elements are compromised.

RECOMMENDATIONS

Based on our findings from our site surveys, we recommend the following improvements to the building systems:

MECHANICAL

1. Replace boiler vent piping through roof and seal watertight.
2. Repair corroded copper fittings in boiler room.
3. Service or replace condensate neutralizer at boiler.
4. Verify that condensate pump is rated for boiler temperatures. Relocate pump into drain pan or provide small dedicated pan with water alarm.
5. Replace air handler serving assembly space. Provide new hot water and controls for Demand Control Ventilation, freezestat protection and duct smoke detector.
6. Insulate any exposed hot water valves, controls etc. in attic space.
7. Insulate all hot water piping in basement and provide labels with directional flow arrows.
8. Verify that a water treatment program is in place for the heating system.
9. Clean existing ductwork serving assembly space.
10. Repair or replace broken thermostatic radiator valve.

ELECTRICAL

1. The cloth-insulated conductors for branch wiring in the basement should be replaced with new thermo-plastic insulated conductors in conduit or MC cable. The cloth insulation is delicate and could crumble if disturbed potentially causing a fault resulting in a hazardous condition.
2. Panels do not have current directories. Verify branch circuits and provide current panel directories for all electrical panels.
3. Provide panel tags for panel in crawlspace and attic.
4. There appears to be corrosion on the contacts of the disconnect switch serving the air handling unit and should be verified. If so, this switch should be replaced and cause of corrosion mitigated.
5. Provide covers for all open junction boxes in basement and attic.

PLUMBING

1. Replace hot water heater in 2nd floor restroom.
2. Insulate domestic hot and cold water piping in basement and provide labels with directional flow arrows.

ENVELOPE

1. Address moisture problem in southeast corner of assembly space.
2. Seal openings into basement to exterior.
3. Provide weatherstrip and door sweep at attic door.
4. Perform infrared camera survey of insulation in attic floor.
5. Monitor humidity levels in basement and, if determined to be high, consider installation of polyethylene sheet on dirt floor.