

Sagamore Hill Visitor Center Structure Fire

Serious Accident Investigation

Factual Report



National Park Service
Sagamore Hill National Historic Site
Draft August 27, 2019

SERIOUS ACCIDENT INVESTIGATION FACTUAL REPORT

Incident Name: Sagamore Hill Visitor Center Structure Fire

Location: Sagamore Hill National Historic Site

12 Sagamore Hill Road, Oyster Bay, NY 11771

Date of Incident: December 24, 2018

SERIOUS ACCIDENT INVESTIGATION TEAM

Team Leader:

Jimmy G. Stewart, National Structural Fire Prevention Program Manager, NPS
Washington Support Office

Signature

Date

Team Members:

Vincent Esposito, PE, Regional Structural Fire Manager, NPS Northeast Region

Signature

Date

Hassan Ford, PE, Fire Protection Engineer, NPS Northeast Region

Signature

Date

* Document was originally signed on 9/16/2019. It was resigned in order to facilitate uploading the document for public access.

Executive Summary

On Monday, December 24, 2018, a fire occurred in the furnace room of the visitor center at Sagamore Hill National Historic Site, which is located near Oyster Bay, New York. No injuries were reported and the majority of the fire was contained to the furnace room and adjacent attic area. Smoke damage occurred throughout the structure along with damage related to firefighter overhaul.¹

The visitor center building contained the bookstore, administrative offices, and public restrooms. The park and the visitor center were not open to the public due to the holiday and the partial government shutdown.

The fire was detected by an automatic fire alarm system at 08:42 a.m. and transmitted to the alarm monitoring company. The Oyster Bay Fire Department was dispatched 46 seconds later and responded to the park. The fire department arrival time is unknown, however security logs indicate the front door of the bookstore was opened at 08:52 a.m., which most likely corresponds with firefighters entering the building.

The National Park Service investigation into the cause of the fire was inconclusive, however there did not appear to be any indications of an intentionally-caused fire. Accidental causes of the fire were considered, including furnace malfunction, original equipment installation issues, and storage practices.

The area of the origin of the fire was determined to be the furnace room and the classification of the fire is listed as undetermined.

¹ NFPA 901, Section 3.3.81: Overhaul. The fire department act of making a fire scene safe after the fire is controlled, such as extinguishing or removing burned material and checking inside walls and hidden spaces.

Contents

Executive Summary	3
Acknowledgments	5
Abbreviations	6
SAIT Objectives and Investigative Process.....	7
Overview of the Park	8
Building Description	9
Installation Requirements.....	10
Events Prior to the Incident	11
Weather.....	11
Report of Fire	12
Fire Department Actions.....	12
Local Fire Investigation	12
SAIT Investigation.....	12
Follow-up Investigation	14
Determination of Fire Cause Process	15
Potential ignition sources	15
Potential first fuel ignited	15
Findings.....	17
Other findings.....	18
Recommendations	19
Appendix A – Floor Plans	20
Appendix B – Photographs.....	22
Incident Photos	22
Post-fire Photos.....	24
Fire Investigation Photos	25
SAIT Photos	30
Appendix C – Furnace Information.....	41

Acknowledgments

The actions and efforts of park personnel and emergency responders during and after the fire emergency are greatly appreciated. In addition, the following acknowledgements are given for individuals and agencies that supported the work of the team:

- Sagamore Hill National Historic Site Superintendent and park staff
- Northeast Regional Office Facilities Division and Structural Fire
- Washington Support Office Structural Fire
- Nassau County Fire Marshal's Office Fire Investigators
- Consumer Product Safety Commission

Abbreviations

CPSC	Consumer Product Safety Commission
FMSS	Facility Management Software System
FPCA	Fire Protection Condition Assessment
HVAC	Heating Ventilation Air Conditioning
IMARS	Incident Management Analysis and Reporting System
ITM	Inspection, Testing, and Maintenance
MOU	Memorandum of Understanding
NCFMO	Nassau County Fire Marshal's Office
NERO	Northeast Regional Office
NFPA	National Fire Protection Association
NPS	National Park Service
OBFD	Oyster Bay Fire Department
PSFC	Park Structural Fire Coordinator
RM-58	Reference Manual 58
RSFM	Regional Structural Fire Manager
SAHI	Sagamore Hill National Historic Site
SAIT	Serious Accident Investigation Team
SFDMS	Structural Fire Data Management System
SFMP	Structural Fire Management Plan

SAIT Objectives and Investigative Process

On February 11, 2019, the NPS Fire and Aviation Management Division Chief delegated authority to the Serious Accident Investigation Team (SAIT) to conduct a fire cause investigation at Sagamore Hill National Historic Site. The duties outlined in the delegation of authority included:

1. Conducting a National Park Service (NPS) led fire cause investigation.
2. Organizing, managing and conducting the accident investigation in accordance with Departmental Manual 485 Chapter 7 and National Park Service Reference Manual 50B, Occupational Safety and Health Program and Reference Manual 58, Structural Fire Management.
3. Providing for in-briefings and out-briefings with affected personnel and agency officials including the park superintendent.
4. Coordinating information exchange between team members, local fire cause investigators, NPS leadership, regional facilities staff and others who may be involved with investigating or ensuring recovery from the incident.
5. Maintaining liaison with the affected park and regional office staff.
6. Approving requests and allocating funding for resources to assist with the investigation.
7. Requesting technical, logistical or other support required to conduct the investigation.
8. Providing the following formal briefings/reports within the identified time frames:
 - a. Factual Report (45 days).
 - b. Briefing the Board of Review (BOR) in regard to the investigation and findings.
 - c. Conducting additional investigations and performing additional follow-up actions as requested by the BOR or the NPS Director.

The SAIT conducted an on-site investigation on February 12, 2019 to examine the fire-related damage and to develop a cause and origin of the fire. Interviews were conducted with park personnel and the visitor center fire damage was evaluated along with an examination of the furnace. Photographs were taken to assist with analyzing potential ignition sources, first fuels ignited, and fire extension.

Following the on-site examination, the team conducted additional research into the furnace equipment, fire and security logs, and local fire investigation reports.

An extension to the factual report was requested by the SAIT leader and was approved with a timeline of no later than April 27, 2019.

Overview of the Park

Sagamore Hill National Historic Site (SAHI) is located in Oyster Bay, New York, along the northern shore of Long Island. The park is located on an 83.02 acre site and was the home of the 26th president of the United States, Theodore Roosevelt. Congress established Sagamore Hill National Historic Site on July 25, 1962.

Structures located at SAHI include historic homes, maintenance facilities, barns, and sheds as well as the visitor center and Foreman's Cottage and Garage.

Figure 1 – SAHI Historic Rendition



Figure 2 – SAHI Site Map

Building Description

The visitor center is a single-story, 1192 square foot, wood framed building constructed in 1956. The building was in use as the SAHI Visitor Center and housed the Eastern National bookstore as well as offices for National Park Service (NPS) personnel. The building also contained public restroom facilities, which were accessed by exterior doors separate from the visitor center main entry.

Previous to being remodeled in 1984, the building was utilized as a concession operated business that provided food and refreshments.

The building is located at the main entrance to the park, adjacent to the visitor parking area. The “L” shaped building is in close proximity to the access driveway and a fire hydrant is located within 200 feet from the southeast corner.

Fire protection features included a monitored fire detection and alarm system and portable fire extinguishers. The fire alarm system was powered by a DMP XR500 conventional fire alarm control panel manufactured by Digital Monitor Products and consisted of smoke detectors, heat detectors, and manual pull stations. There was no fire sprinkler system installed in the building, nor were sprinklers required.

The building’s heating ventilation and air conditioning (HVAC) system was supplied by an oil-fired, Rheem furnace, Model ROPD-112QBGA, which was installed on January 10, 2006.

Model numbers use the following identifiers:

R = Rheem

O = Oil Furnace

P = Multi-position Downflow/horizontal

D = Design series

112 = Model (Output range 87,500, 97,800, or 113,200 BTU/HR)

Q = Blower motor designation 10”x10”

B = Variations (all Honeywell Primary Controls)

G = Heating and Cooling Designation (1450-1750 CFM)

A = Fuel pump (single stage)

The furnace fuel supply was stored in an adjacent underground tank. The previous fuel delivery records indicated #2 Heating Oil fuel delivery as follows:

- 01/25/2018 – ~300 gallons
- 03/27/2018 – ~300 gallons
- 07/16/2018 – ~100 gallons

Service records for the visitor center furnace indicated an inspection was conducted on October 30, 2007. Additional inspection records were not found in park records, however, the park did have invoices on file documenting maintenance activity had been accomplished within the manufacturer’s recommended frequency of at least once yearly. Preventative maintenance proposals from an HVAC service company were accepted by the park on October 6, 2017 and October 5, 2018 for annual maintenance

on the visitor center furnace as well as other mechanical equipment (boilers and water heaters) in other park buildings.

Normal furnace operation was reported with one exception - a mechanical issue occurred on December 3, 2018. Following that event, the park contacted the HVAC repair company for inspection and repair. Service records dated December 4, 2018 indicated the HVAC technician changed out a bad blower motor, replaced the unit's run capacitor, and checked the operation of the unit (Appendix C). The unit operated without issues after the repair. A review of the HVAC replacement parts invoice indicated the following part information for the December 4, 2018 repair:

- Blower Motor: Direct Drive ½ HP, 115 Volt, 3 speed
- Run Capacitor: Oval, 10MFD@440V, 440/10

Installation Requirements

A review of the furnace manual for this equipment identified specific information related to furnace installation on combustible floors. The manufacturer's installation instructions indicate that the downflow unit design is certified for installation on non-combustible floors and also indicates a special floor sub-base is required if this unit is installed on combustible floors. An exception to this requirement is listed in the instructions, which states the special base is not required when the furnace is installed on top of an air conditioning plenum. The manufacturer's installation instructions also indicate that plenum adapters are required in some instances for use on downflow applications when plenum and furnace size do not match.

Events Prior to the Incident

On Monday, December 3, 2018, the fire alarm in the visitor center automatically activated due to smoke reported to have come from the furnace. The building was evacuated and the Oyster Bay Fire Department (OBFD) responded to investigate. The building was ventilated and an HVAC repair company was contacted for inspection and repair.

On Tuesday, December 4, 2018, a repair technician from WJW HVAC-R performed repair work on the furnace, which consisted of “changing out bad blower motor” and “replace run capacitor.” The technician also checked the operation of the furnace. The furnace was used routinely after the repair with no reported issues.

On Friday, December 21, 2018, park staff implemented contingency plans related to the partial government shutdown. The visitor center building was closed on Friday and access over the weekend was limited to NPS employees entering the building for security checks.

On Saturday, December 22, 2018, the security system log recorded NPS employees accessing the building four times by four different employees:

- 07:14:53 – Open 07:18:00 – Close
- 08:20:51 – Open 08:26:26 – Close
- 08:31:59 – Open 08:37:31 – Close
- 09:41:22 – Open 09:45:47 – Close

On Monday, December 24, 2018, a park employee accessed the building as part of the daily security check. The temperature in the building was reportedly “colder than normal” and the employee adjusted the thermostat to provide additional heat. The temperature reading on the building’s thermostat was reported at 45 degrees Fahrenheit. The fan control was normally left in the “Fan/Auto” position, however, due to the cold temperature in the building the thermostat was placed in “Fan/Run” position.

The security system log recorded the following times:

- 07:27:07 – Open 07:28:23 – Close
- 08:04:56 – Open 08:05:22 – Close

Weather

The following historic weather report information was reported for Oyster Bay, NY:

Date	Time	Temperature (F)	Wind Direction	Wind Speed (mph)
Dec 3	0800	52	W	9
Dec 23	0800	35	WNW	6
Dec 24	0800	36	-	0

Report of Fire

On Monday, December 24, 2018 at 08:42:05 a.m. the fire alarm monitoring company received an automatic fire alarm from the SAHI Visitor Center, which reported “Visitor Center Smoke (Alarm).” The local fire department was dispatched at 08:42:51 a.m. Additional alarms were received, which included:

- 08:49:44 Bathroom Heats
- 08:58:44 Attic Heats
- 08:59:24 Attic Heats
- 08:59:29 Attic Heats

During the receipt of alarm and dispatching the fire department, the fire alarm monitoring company also contacted the customer contact person listed for this location. The designated NPS employee was contacted at 08:43:19 a.m. and responded to the location. The security system log reported “Burglary Alarm Bookstore Front Door” at 08:52:47, which likely corresponds with the fire department forcible entry. The dispatch log indicated the NPS employee reported on-site at 08:56:20 and was “with the fire department.” The employee also indicated there was smoke in the building.

Fire Department Actions

The OBFD responded to the scene and performed firefighting operations; including forcible entry, fire suppression and overhaul operations within the building. OBFD was assisted by numerous mutual aid fire departments. Firefighters connected supply hoses to the adjacent hydrant to augment the water supply. No injuries, incidents, or issues with water supply/hydrant were reported by OBFD.

SAHI personnel requested a copy of the OBFD fire incident report, but the report has not been received as of the date of this report.

Local Fire Investigation

On Monday, December 24, 2018, at 09:54 a.m. the Nassau County Fire Marshal’s Office (NCFMO) received a request from the fire department (OBFD Chief Barnett) to investigate the fire. Two fire investigators from NCFMO responded to SAHI and arrived at approximately 10:56 a.m. The fire investigators conducted an origin and cause investigation and classified the fire as accidental. They also indicated the cause of the fire was “an apparent failure/malfunction of the oil fired forced hot air heating unit near area of origin” and added “further forensic examination is suggested of the buildings heating/cooling unit to further determine a definitive cause of the fire.”

Refer to Nassau County Fire Marshal’s Office investigation report 0361-18 for the complete origin and cause report.

SAIT Investigation

Information was requested from the Northeast Regional Office (NERO) and SAHI on February 8, 2019 to gather facts and to plan for an onsite investigation. A shared folder was established to collect pertinent information, reports, and photos. A delegation of authority was developed by the NPS Chief of Fire and Aviation and delivered to the team.

Research was conducted with the Consumer Product Safety Commission (CPSC) online database to review any related product recall information. Of interest, during the review of CPSC reports, a recall had been issued by the CPSC on January 22, 2009 related to Rheem oil-fired furnaces. The recall involved Rheem Models that began with ROBF, ROPF, TZOUP, and TZODH. Of this list, only the ROPF model is a down-flow oil furnace. The visitor center furnace was a model ROPD and not listed in the recall.

The CPSC was contacted on February 11, 2019 to discuss the current recall and any other pertinent recalls that may be in process. The CPSC investigator indicated the current recall was only for the four model numbers listed in the recall notice and they were not aware of other Rheem furnace recalls.

The SAIT met on-site at SAHI on Tuesday, February 12, 2019, at approximately 08:30 a.m. and conducted an in-brief with the park superintendent and the chief of preservation and maintenance. During this meeting, additional discussion focused on the events preceding the fire, normal activities in and around the building, as well as next steps in the investigation. Park personnel confirmed there was no hot work activity, painting, repair work, or smoking in the area of the fire. Following the in-briefing, the SAIT conducted a walk-through of the visitor center to collect additional data and take photographs.

A systematic approach was used during the on-site investigation. Beginning with an exterior walk-around of the building and then transitioning to an interior walk-through; starting with areas of less fire damage and moving to areas with more fire damage.

The area of most fire damage was found to be the furnace room, with significant charring of structural members above and below the furnace. Fire extension was noted in the attic area with moderate smoke staining observed in the adjacent bookstore areas. Due to interior smoke conditions and the threat of fire spread through the attic, firefighters used aggressive overhaul techniques to pull ceilings throughout the structure to ensure the fire had not spread through the attic, which had multiple layers and interstitial spaces.

The floor and crawlspace area below and immediately adjacent to the furnace's location was examined. Of note, the furnace unit and associated duct work had been previously removed during the local fire investigation on December 24, 2018. Significant charring was noted below the floor level as well as laterally to the exterior (north) wall and sill plate at the building's foundation. An area of burn-through of the exterior (north) wall was noted. This burn-through was approximately 3" x 3" in area, centered on the hole that had been drilled through the wall to accommodate the air conditioning condensation drain pipe. The air conditioning cooling coils/fins located directly below the furnace did not show any signs of high heat exposure.

Of note, information contained with the Rheem installation manual, as well as the data plate inside the furnace, indicated this furnace is certified for use on non-combustible floors and also that installation on combustible floor surfaces would require the installation of a special factory supplied floor base. An exception is listed for installations where the furnace is installed on top of an air conditioning plenum. The floor area was examined to determine if a factory floor base was installed and none was apparent. It is unknown if a floor base was in place and removed during firefighting efforts or if a base had not been installed. It is also unknown if the air conditioning plenum under the furnace met the exception for installing a non-combustible floor base.

The furnace, which had been relocated to the exterior covered entryway, was examined for fire damage and possible fire cause. The blower motor, which would have been approximately 3 feet above the floor level, was found to be completely destroyed along with all adjacent electrical wiring, as a result of fire exposure. The fuel pump and ignitor area were examined and no apparent damage was visible to the equipment or the electrical wiring/insulation.

The ignition housing was disassembled and the ignitor was examined. No apparent damage or defect was noticed. The ignitor chamber and residual fuel appeared clean.

The electrical panel for the building was examined to determine if there were any tripped circuits. The panel cover had been previously removed and electrical service to the building was disconnected. Two breakers were found in the tripped position. All other breakers were found in the off position. It is unknown if these were turned off by firefighters or by park personnel.

At the conclusion of the investigation in the building, the team made contact with the park superintendent and chief of preservation and maintenance to conduct an out-briefing. The park staff was advised that the SAIT site inspection was completed and the building was turned back to the park to begin remediation work.

The team completed their work at SAHI and departed at approximately 11:30 a.m.

Follow-up Investigation

The local fire investigator from the NCFMO was contacted on February 26, 2019 to discuss findings and request photographs and a copy of their report. Photographs were received on March 5, 2019 and the report was received on March 26, 2019.

Technical data related to the furnace installation guidelines and recent furnace repair were reviewed and compared with manufacturer's specifications.

Follow-up questions were developed for park staff related to the following observations:

- Floor plans, dated in 1983, indicate a heat trace cable installed in the crawlspace in close proximity to the area of low burn. Heat trace cables are used to protect water pipes from freezing and could be a possible ignition source if not installed or maintained correctly. The park confirmed this heat trace cable was not in place and the crawlspace was now insulated and climate controlled.
- Fire scene photographs showed unknown plastic containers on the ground just outside of the furnace room, which appear to have been removed through the window during fire overhaul. The park confirmed the containers were Simple Green, Pequa liquid drain cleaner, and an empty snow melt container.

A detailed review of the photographs was conducted, comparing areas of charring, burn patterns, and equipment locations. The area of origin was confirmed to be inside the furnace room, consistent with the NCFMO investigation report.

The data collected throughout interviews, on-site investigation, and follow-up review of the equipment specifications were analyzed to develop possible hypotheses as to the fire cause. Potential ignition sources included the oil-fired furnace flame, furnace equipment failure, electrical distribution circuits, electric water heater failure, and spontaneous heating from incompatible chemicals. Potential ignitable fuels in the area of origin were identified and considered, which include combustible storage, combustible construction, and flammable/combustible liquids.

Determination of Fire Cause Process

Potential ignition sources

- Furnace flame: The furnace was recently repaired and was operating normally for approximately three weeks. Cold temperatures inside the visitor center on the morning of the fire indicate the furnace was not operating until the thermostat controls were activated by park staff between 38 and 66 minutes before the activation of the visitor center smoke detector. The operating furnace flame is considered a competent ignition source.²
- Furnace repair work: The ignition electrodes and combustion chamber did not display any apparent failure. Service records indicate the replacement motor and capacitor were properly sized. The blower motor, fan, capacitor, and adjacent wiring suffered significant fire damage, but it is unknown if this damage was an area of fire cause or a result of fire exposure. The furnace operated without reported issues after the repair.
- Furnace component failure: After a smoke issue on December 3, the furnace was repaired and operated without reported issue. It is unknown if other furnace issues were present in addition to the bad blower motor that was previously repaired. Component failure and/or equipment overheating condition could be considered a competent ignition source.
- Electrical distribution circuits: Electrical conduits in the area of origin appeared intact and without failure.
- Electric water heater: The water heater location was not in close proximity to the areas of low burn. Fire damage to the water heater appears to be external and a result of fire exposure, not fire cause.
- Spontaneous heating: Plastic chemical containers located in the storage room were reported to be stored on shelving approximately four feet from the areas of low burn. Although the chemicals could result in spontaneous heating if mixed, no melting of the plastic containers was evident in the post-fire photos and the containers were not located in the area of low burn. Additionally, the chemicals had not been recently used.

Potential first fuel ignited

- Combustible storage: The furnace room was reported to be used for storage of combustible material, such as furnace filters, cleaning equipment, and supplies. The park confirmed that no additional storage was added to the room as part of the federal government shutdown. The actual location and quantity of combustible storage is not known. A review of post-fire photographs does show a moderate amount of combustible storage on the east side of the furnace room, in proximity to the furnace. The combustible storage is a potential first fuel that could have been ignited by a properly operating furnace or by an overheated furnace. The manufacturer's equipment installation manual includes the following warning:

²NFPA 921, Section 3.3.37. Competent Ignition Source: An ignition source that has sufficient energy and is capable of transferring that energy to the fuel long enough to raise the fuel to its ignition temperature.

- *Combustible material must not be placed on or against the furnace jacket. The area around the furnace must be kept clear and free of all combustible material including gasoline and other flammable vapor or liquids.*
- Combustible construction: The building construction material consists of wooden walls, floors, joists, rafters, and roof deck. The furnace room walls and ceiling were covered with gypsum board (sheetrock). The floor covering material is not known.
 - No apparent ignition of adjacent wall studs or ceiling rafters was evident, due to protection by the non-combustible gypsum board. The fire did extend to the combustible attic area by traveling laterally across the gypsum ceiling before breaching the ceiling in an area near the southeast corner of the furnace room.
 - Areas of heavy char and low burn were noted adjacent and below the floor decking in close proximity to the furnace connection to the crawlspace ductwork connection. This area of low burn corresponds with a 3" x 3" hole that is burned through the north wall. The combustible floor decking and floor joists are potential first fuels that could have been ignited by a properly operating furnace if the original furnace installation did not include the required combustible floor base accessory.
 - The possibility exists that long-term exposure to heat in this area could have caused pyrolysis³ of the combustible floor decking and joists, making them more susceptible to ignition by the high temperature of the heating air. This condition could have existed over a long period of time and could have also been part of the smoke incident that occurred on December 3, 2019.
- Flammable/combustible liquids: There was no reported storage of flammable/combustible liquids in the vicinity of the furnace.
 - Cleaning supplies in plastic containers were reportedly stored on shelving approximately four feet from the furnace and did not show fire damage or melting. Areas of low burn below floor decking can sometimes be related to flammable/combustible liquids involved in fires, but no evidence of liquids was apparent in this area of the furnace room.
 - The fuel supply lines for the furnace were examined during the on-site investigation and appeared intact with tight connections.

³ NFPA 921, Section 3.3.150 Pyrolysis. A process in which material is decomposed, or broken down, into simpler molecular compounds by the effects of heat alone; pyrolysis often precedes combustion.

Findings

- 1) The park had an existing Structural Fire Management Plan (SFMP) on file. The SFMP is required by Reference Manual (RM) 58 to be reviewed annually and after a significant structural fire incident occurs. The SFMP was reviewed after this fire and updated for 2019.
- 2) The park has designated a Park Structural Fire Coordinator (PSFC) as required by RM-58.
- 3) A formal agreement was in place with the local fire department and pre-incident tours of the park had been accomplished.
- 4) A fire alarm system was installed in the building and the park has an active annual inspection, testing, and maintenance (ITM) program for the fire alarm in place.
- 5) A preventative maintenance program was in place at the park that included semi-annual inspections by a service contractor to inspect and service all boilers, furnaces, and water heaters.
- 6) Annual building inspections had been completed by park personnel in February each year, using a safety/fire prevention form. This process and form was different than that listed in RM-58. The park has received instruction in the RM-58 fire inspection process and has implemented updated procedures, which is also reflected in the park's updated SFMP.
- 7) The fire alarm monitoring company processed the fire alarm quickly and the local fire department was dispatched in 46 seconds. The dispatch center was also able to contact the listed NPS emergency contact person in 74 seconds, who responded to the scene promptly, arriving approximately 14 minutes after the fire alarm activated.
- 8) The response by the local fire department was efficient, with a response time of approximately 10 minutes after dispatch.
- 9) This fire incident was reported in the Incident Management Analysis and Reporting System (IMARS) and notification was made through the appropriate chain of command to the regional and national offices.
- 10) The classification of the fire is undetermined⁴. No evidence or indicators of an intentionally-caused fire or naturally-caused fire were identified and possible causes are indicative of an accidental fire.
- 11) The probable⁵ cause of the fire could not be determined, although three possible⁶ causes were considered:
 - a) Installation of the furnace on a combustible floor surface without the appropriate non-combustible floor base and/or plenum adapter.
 - b) Furnace component failure that resulted in the ignition of combustible construction or combustible storage.

⁴ NFPA 921, Section 20.1.4 Undetermined Fire Cause. Whenever the cause cannot be proven to an acceptable level of certainty, the proper classification is undetermined.

⁵ NFPA 921, Section 4.5.1: Probable. This level of certainty corresponds to being more likely true than not. At this level of certainty, the likelihood of the hypothesis being true is greater than 50 percent.

⁶ NFPA 921, Section 4.5.1: Possible. At this level of certainty, the hypothesis can be demonstrated to be feasible but cannot be declared probable. If two or more hypotheses are equally likely, then the level of certainty must be "possible."

- c) Combustible storage located in close proximity to the furnace.

Other findings

- 12) Storage of combustible material in mechanical rooms is not permitted by National Fire Protection Association (NFPA) 1 - Fire Code, Section 10.18.5.1, which states "Combustible material shall not be stored in boiler rooms, mechanical rooms, or electrical equipment rooms." The only exception to this requirement is for "Materials and supplies for the operation and maintenance of the equipment in the room."
- 13) The electrical panel labeling and circuit designation was found unreliable during the post-fire investigation. NFPA 1, Section 11.1.7.3.1 states "Each disconnecting means shall be legibly marked to indicate its purpose unless located and arranged so the purpose is evident. The marking shall be of sufficient durability to withstand the environment involved." Although this finding is not related to the fire ignition/cause, proper labeling of electrical circuits enhances the ability to locate and isolate circuits quickly and correctly.
- 14) There is no indication that this fire was a result of improper management decisions or failures.

Recommendations

- 1) The national structural fire program should disseminate educational information to all regions that:
 - a) Highlight the successes of establishing working relationships with local emergency responders.
 - b) Underscores the positive result of proper inspection, testing, and maintenance (ITM) of fire protection systems.
- 2) Contracting Officer's Representatives should assure that all project equipment and systems are installed in accordance with contract, code, and manufacturer requirements.

Appendix A – Floor Plans

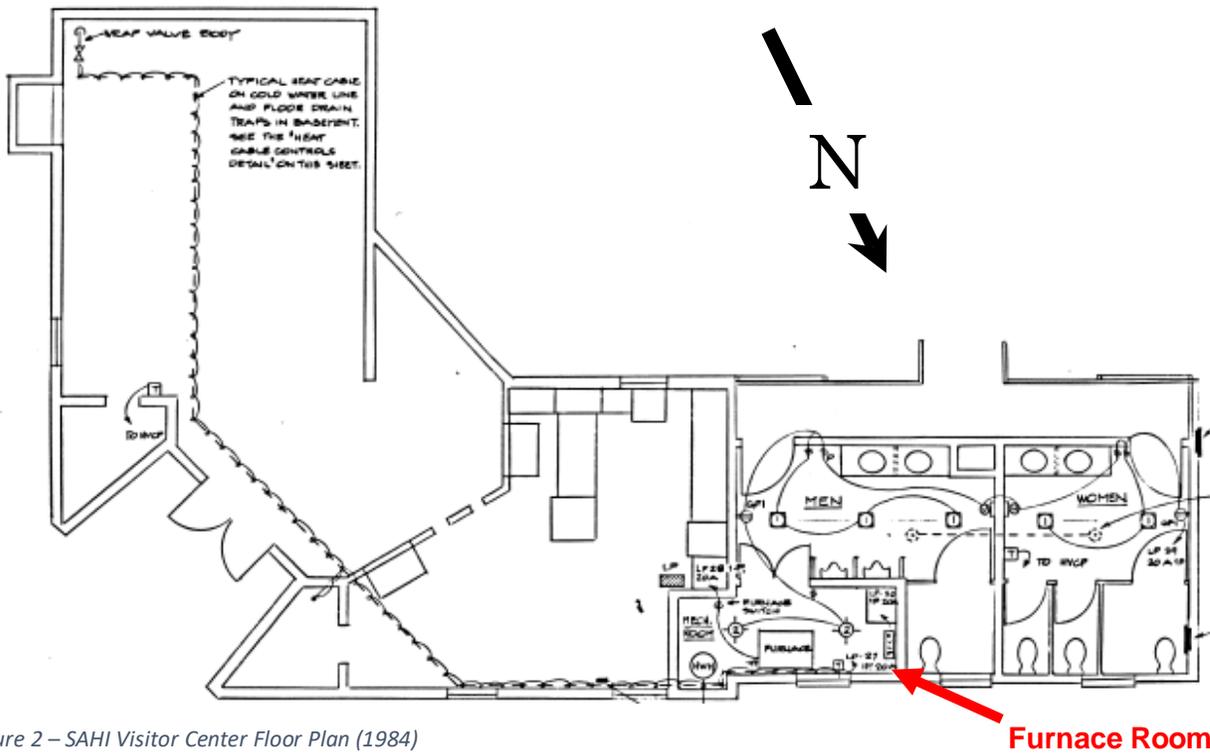


Figure 2 – SAHI Visitor Center Floor Plan (1984)

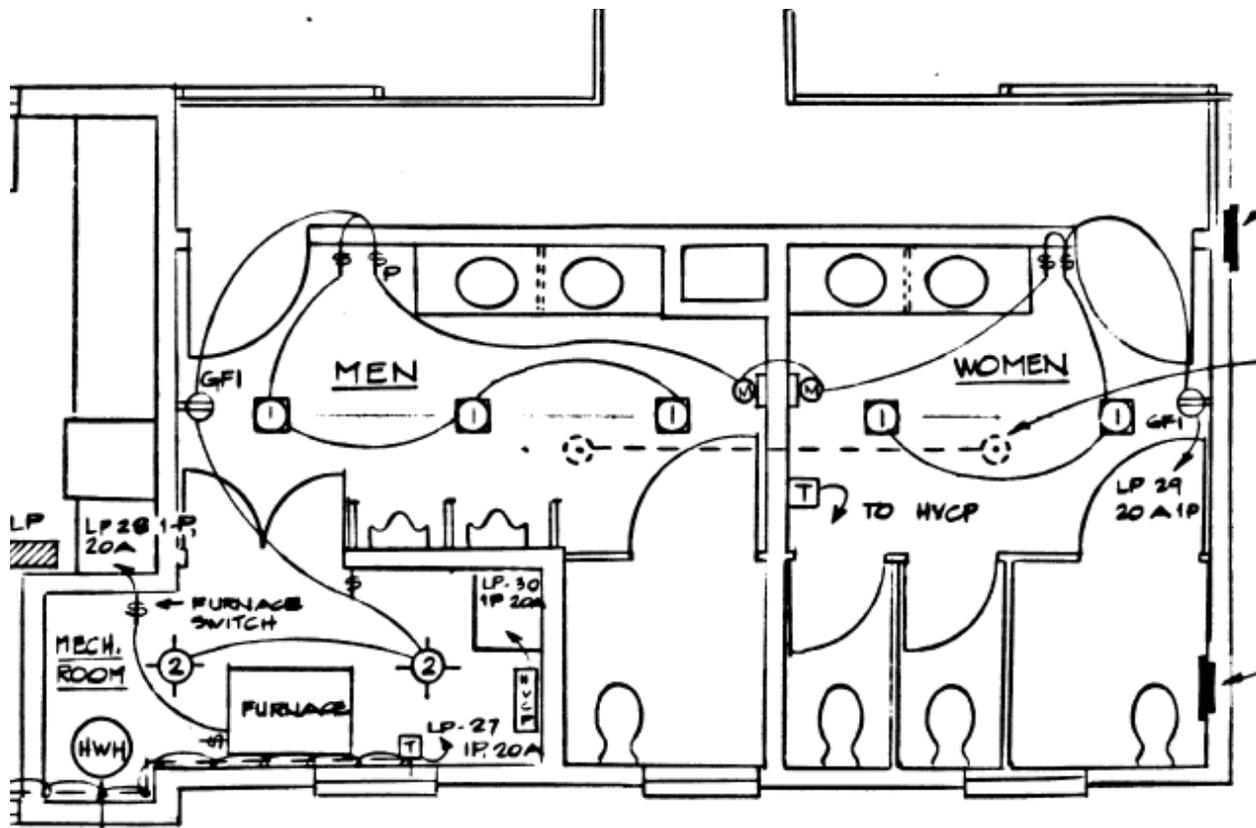


Figure 3 - SAHI Visitor Center – Restroom Detail – 1984

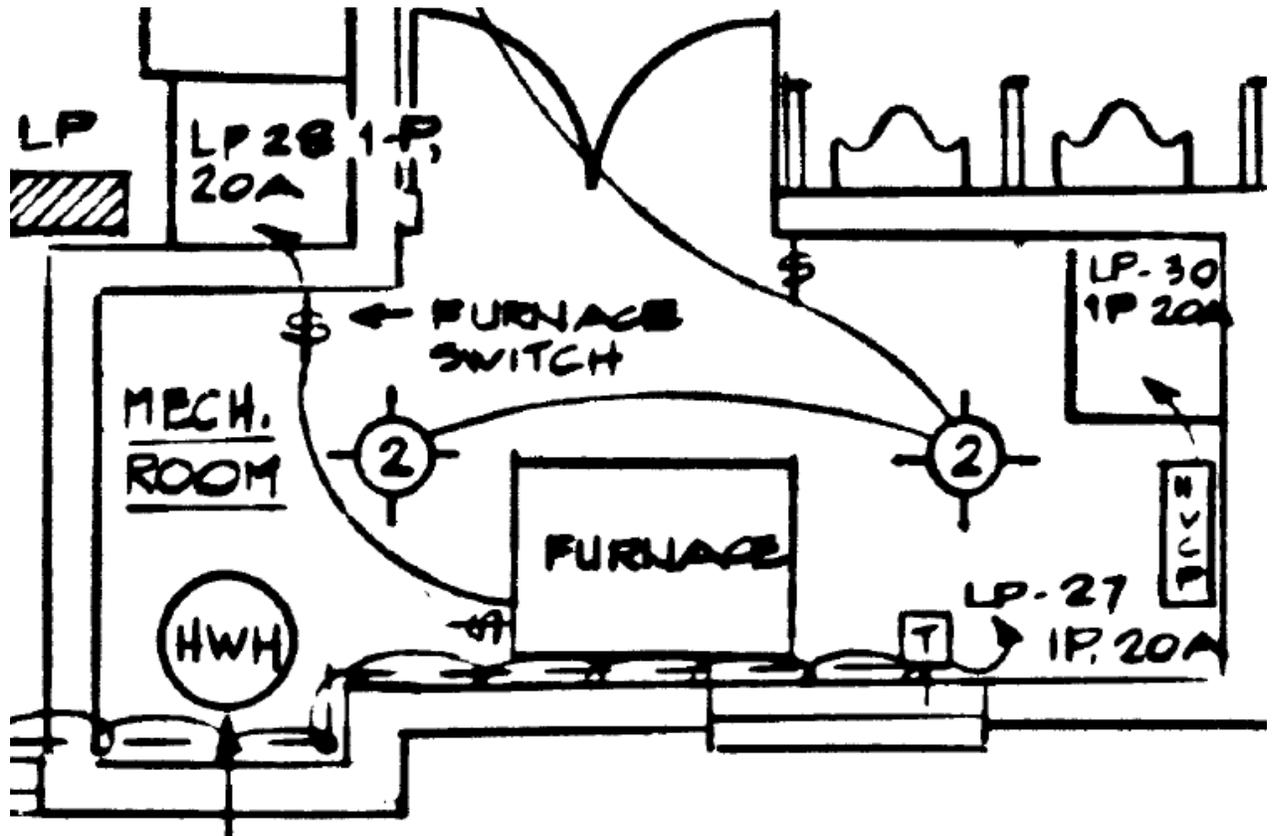


Figure 4 - SAHI Mechanical Room Detail – 1984 (enlarged)

Appendix B – Photographs

Incident Photos



Photo 1 – Firefighting Operations – South Side



Photo 2 – Firefighting Operations – North Side



Photo 3 – Firefighting Operations – Interior (Bookstore)



Photo 4 – Firefighting Operations – Interior (Restroom/Furnace Room)

Post-fire Photos



Photo 5 – Post Fire – Interior (Bookstore)



Photo 6 – Post Fire – Interior (Bookstore)



Photo 7 – Furnace Room Floor (Arrow denotes 3"x3" hole through the north wall)



Photo 8 – Furnace Room (Combustible storage, electrical conduits, water heater)



Photo 9 – Furnace Room Ceiling (heat detector)



Photo 10 – Exterior (north) Wall



Photo 11 – Rheem Furnace (north side, laying on west side)



Photo 12 – Rheem Furnace (bottom, laying on west side)



Photo 13 – Rheem Furnace (top, laying on west side)



Photo 14 – Crawlspace – HVAC Ductwork



Photo 15 – Furnace Duct Connection (Air Conditioner Coils)



Photo 16 - Furnace Room Floor (Arrow denotes 3"x3" hole through the north wall)



Photo 17 - Furnace Room, North Wall Sill Plate (glove placed in 3"x3" hole to block sunlight)

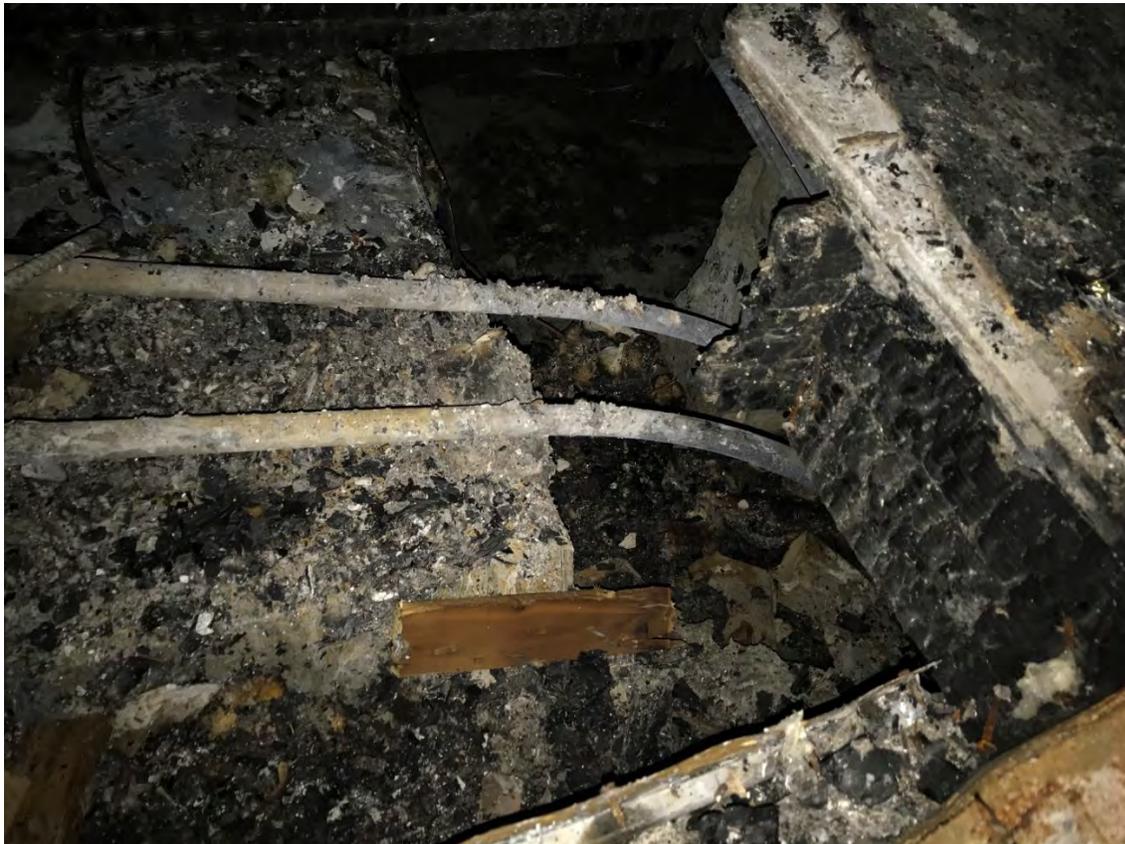


Photo 18 - Crawlspace, Charring of Floor Joists



Photo 19 – Furnace Blower and Capacitor



Photo 20 – Furnace Capacitor



Photo 21 – Furnace Oil Pump Assembly (note regarding leaves: furnace was located outside after the fire investigation)



Photo 22 – Furnace Burner Assembly



Photo 23 – Furnace Burner Electrodes



Photo 24 – Furnace Burner Electrodes



Photo 25 – Visitor Center Thermostat



Photo 26 – Visitor Center Electrical Panel Labeling (unreliable labeling)

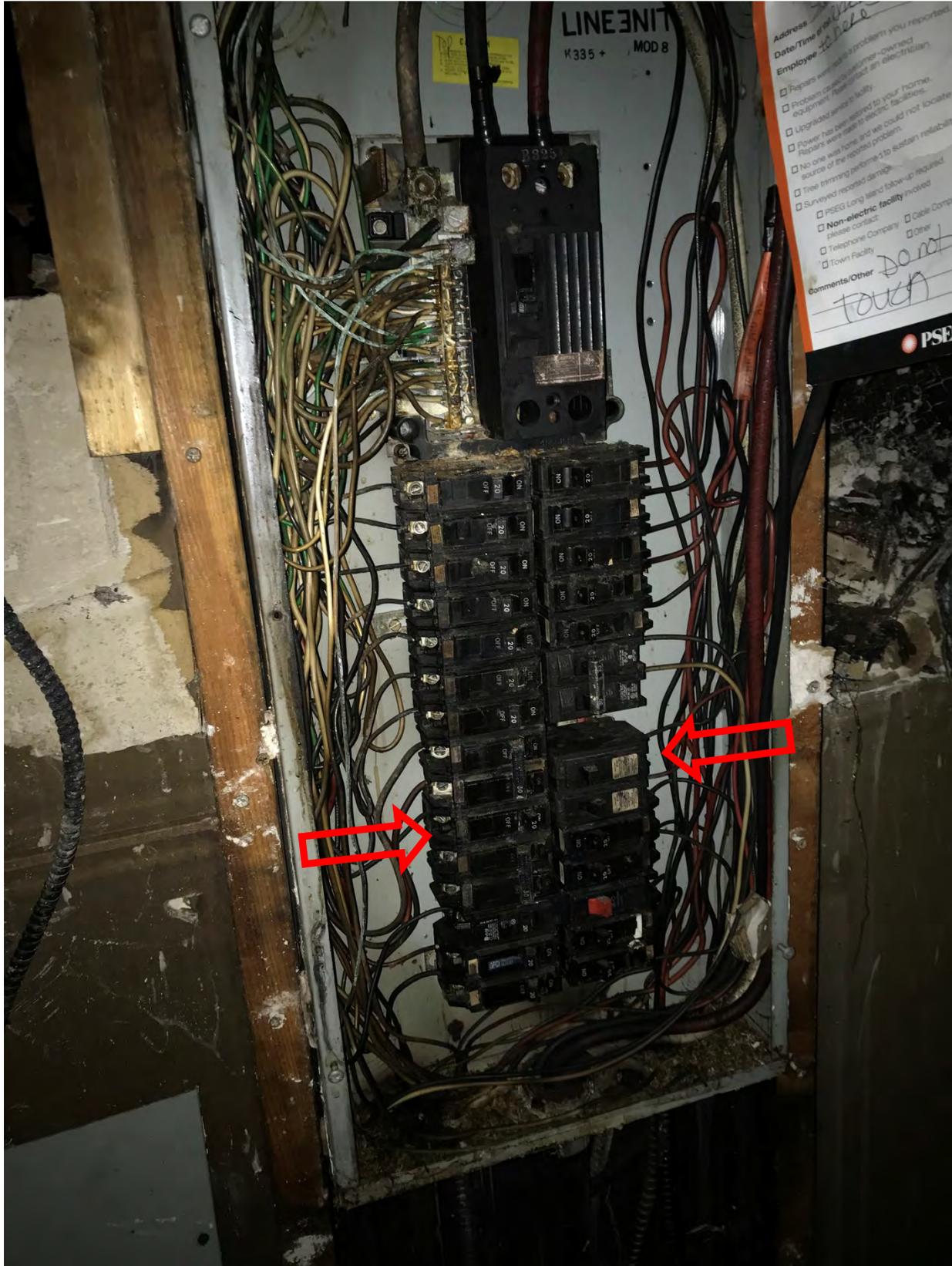


Photo 27 - Visitor Center Electrical Panel (red arrows denote tripped breakers)

Appendix C – Furnace Information



Asset Detail Information for Condition Assessments

Park: SAHI (P328) Sagamore Hill National Historic Site
 Asset Code: 4100
 Long Description: No

Asset: 185041 (Furnace, 28.66 KW) / Location: 47493 (BU- Visitors Center)					
Parent:	18755 (BU-Visitors Center HVAC Systems)	Type:	FACILITIES	Status:	OPERATING
Serial #:	CP172 M4205 21412	Asset Code:	4100	Critical System:	Y
Manufacturer:	12008 (Rheem)	Model:	ROPD-112QBGA	Quantity:	1
Classification:	HVAC / FURNACE			Unit of Measure:	EA
				Estimated Design Life:	30
				Installation Date:	01/10/2006
				Replacement Date:	01/10/2036
				Replacement Cost:	\$2,386

Figure 5 - FMSS Furnace Record

ACCESSORIES (DOWNFLOW)

IMPORTANT: This furnace is certified for use on non-combustible floor. May be installed on combustible flooring **only when equipped with a special factory supplied combustible floor base.**

PLENUM DATA

Plenum adapters are required in some instances for use on downflow applications when plenum and furnace size do not match.

FURNACE WIDTH (IN.) [mm]	PLENUM WIDTH (IN.) [mm]	PLENUM ADAPTER DOWNFLOW	COIL PLENUM
24 1/2 [622]	24 1/2 [622]	—	RXBC-A
28 [711]	28 [711]	—	RXBC-A

COMBUSTIBLE FLOOR BASE DIMENSIONS*

COMBUSTIBLE FLOOR BASE	USE WITH MBH INPUT FURNACE SIZES	A (IN.) [mm]	B (IN.) [mm]	C (IN.) [mm]
RXGC-B24	ROPD-112	25 [635]	23 3/4 [603]	21 3/4 [553]
RXGC-B28	ROPD-130	28 1/2 [724]	27 1/4 [692]	25 1/4 [642]

*This special base is not required when the furnace is installed on top of an air conditioning plenum.

Figure 6 - Excerpt from Rheem installation manual

Rheem Non-Combustible Floor Base (24.5" Wide Cabinet)

Part # **RXGC-B24**

[View Price In Cart](#)

Qty: [Add to Cart](#)

Figure 7- Example of manufacturer’s accessory for installation on combustible floor



WJW HVAC-R

3 Stanley Drive
 Shirley, NY, 11967
 Tel.: (631) 767-3277 Fax: (631) 256-5612
 wjwhvac@optonline.net

VC

CUSTOMER ORDER NO.		DATE		12/4/18			
NAME		PHONE NO.		Sagamore Hill Visitors Ctr.			
ADDRESS		CITY		STATE			
30 Sagamore Hill Rd		Wester Bay		NY			
SOLD BY	CASH	CHECK	CHARGE	COD	ON ACCT.	PAID OUT	MOSE. RETD.
			<input checked="" type="checkbox"/>				
QUANTITY	DESCRIPTION	PRICE	AMOUNT				
	Change out bad blower motor for oil fired furnace						
	Replace run capacitor						
	As per agreement		\$1550.00				
	Check operations						
VISA	46140200 9781 5417						
	04/23 360						
		TAX	Exempt				
		TOTAL	\$1550.00				

Received by

All claims and returned goods must be accompanied by this bill.

0005591

Thank You



GS-226-2

PRINTED IN U.S.A.

Figure 8 - HVAC Repair Invoice (December 4, 2018)

MAKE CHECKS PAYABLE AND REMIT TO
SID HARVEY INDUSTRIES, INC.
 605 LOCUST STREET • GARDEN CITY, NY 11530-6531
 www.sidharvey.com



PURCHASED AT
 STORE# 0009
 175 CENTRAL AVENUE, STE300
 FARMINGDALE, NY 11735

TELEPHONE: (631) 755-9192
 FAX: (631) 755-9247
 EMAIL: store009@sidharvey.com

INVOICE # 009381695
INVOICE DATE 12/03/18

Please include your account number on all remittances.

S 0057746
O WJW A/C REFRIGERATION HEATING
L 3 STANLEY DRIVE
D SHIRLEY, NY 11967
T
O

S 0000001
H WJW A/C REFRIGERATION HEATING
I 3 STANLEY DRIVE
P SHIRLEY, NY 11967
T
O



CUSTOMER ORDER NUMBER	ORDER DATE	SHIP VIA	TERMS	DATE SHIPPED	SALES TAX EXEMPTION NUMBER			
STOCK	12/03/18	CUSTOMER PICKUP	NET 10TH	12/03/18				
SPECIAL INSTRUCTIONS					SLS # 05074			
QTY. ORD.	QTY. SHPD	QTY. B/O	ITEM NUMBER	MFG. NUMBER	DESCRIPTION	UNIT PRICE	UOM	AMOUNT
			*****MUST HAVE VALID PO# IN PO FIELD*****					
			All Electrical and Gas Items cannot be returned.					
			Try the New Sid Harvey App - available at: Apple App Store and Google Play					
1	1	0	MTR12115DD	MTR12-115DD	MOTOR, BLME, DD, 1/2HP, 115V, 3SP 1075RPM	97.43	EA	97.43
1	1	0	AB02-166	TOCF10	CAPACITOR, RUN, OVAL, 10MFD±440V 440/10	5.45	EA	5.45

Figure 9 – HVAC Repair Parts (December 4, 2018)