FACILITY ASSESSMENT REPORT

Visual Arts Center

January 4, 2023

WILSON & COMPANY

discipline | intensity | collaboration | shared ownership | solutions

FACILITY ASSESSMENT REPORT

Visual Arts Center

Prepared for

City of Santa Fe
Facilities Division
Public Work Department
2651 Siringo Rd
Santa Fe, NM 87505

STATE OF NEW MEXICO
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01/04/23

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WCI Project #: 21-600-030-10

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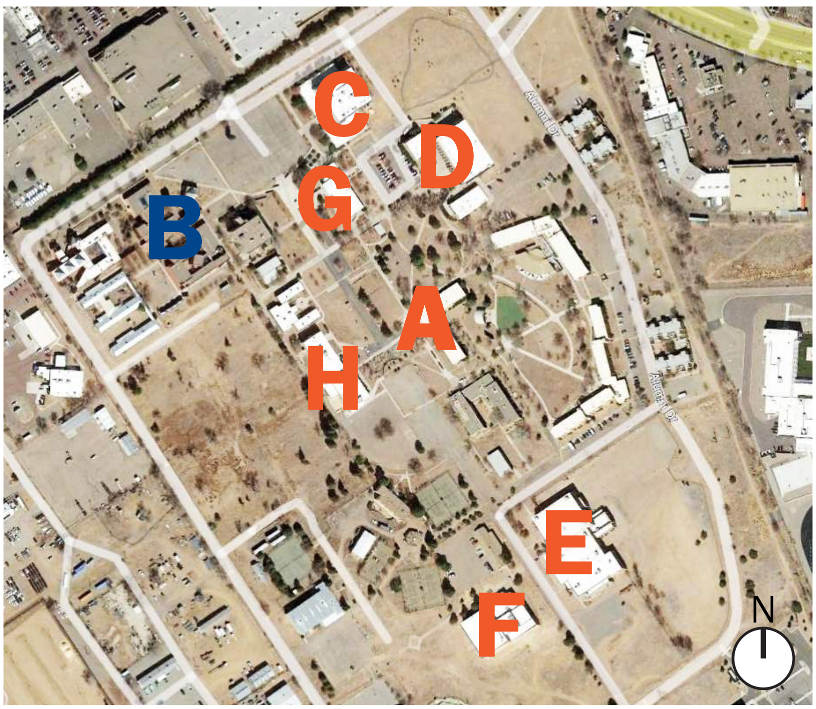
Contents

1.0 Introduction and Project Overview

The City of Santa Fe contracted Wilson & Company to assess and document the conditions of thirteen buildings on the former campus of Santa Fe University of Art and Design, located at 1600 St Michaels Dr, Santa Fe, NM 87505. The locations for assessment are noted below (labeled A, B, C, D, E, F, G, H). There are eight locations, two of which are complexes of multiple buildings.

Disclaimer: No destructive testing was performed; this report contains observations of the as-built facility only. No hazardous material testing was performed, and no hazardous materials testing report was provided to Wilson and Company. The City of Santa Fe should commission a phase 1 environmental assessment if one has not already been performed.

This second report covers (B) the Visual Arts Center, including Tipton Hall, Thaw Art History Center, Tishman Hall, and Marion Center for Photography. This report highlights our architectural findings and provides probable short and long-term issues that should be addressed to maintain the building. While current codes may be referenced, comprehensive code and accessibility reviews are not included. The following narratives describe Wilson and Company's findings from the on-site investigation on August 9th, 2022.



Map of Campus | A1

Visual Arts Complex Aerial View | A2

1.1 General Site

The Visual Arts Center is along the northern edge of campus on a site that generally slopes north to south. Site landscaping has degraded since the building became vacant. Much of what remains is either overgrown or dying. Volunteer plants are growing in the crack between the exterior wall and the sidewalk on the southeast elevation. Site lighting consists of pole-mounted down lights in a few areas along sidewalks and exterior building lighting.

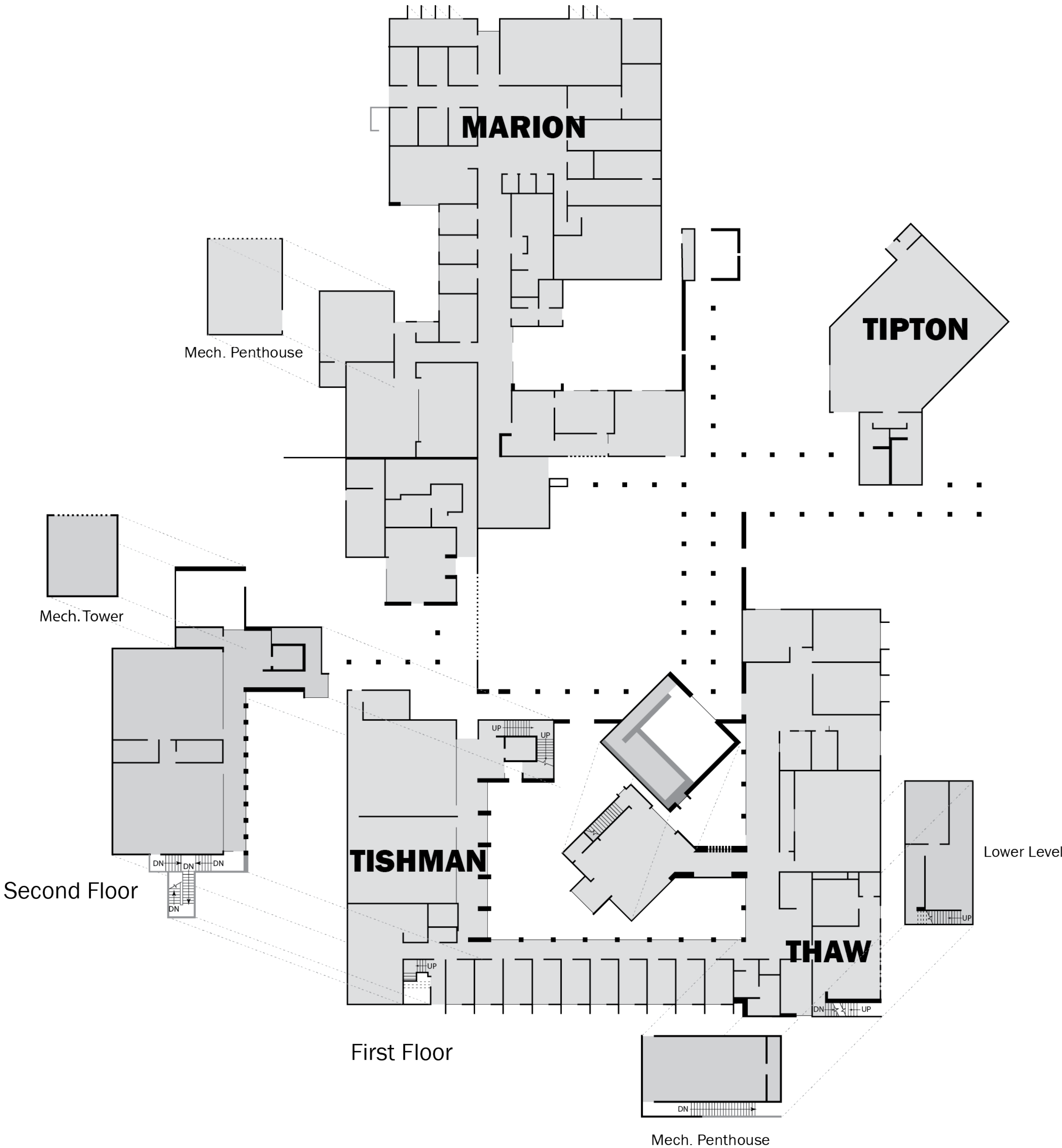
Concrete sidewalks around the site are mostly in good working order except for a few areas where water damage has lowered the condition to poor or critical (A3). The asphalt parking lot was formerly the main visitor lot. It is very worn and in poor condition. The striping is mostly gone, and the curb between the Visual Arts Center and the parking lot is broken. Parking spaces are also present along the road to the

Exterior Sidewalk Condition | A3

northwest. Handicapped spaces are in this area, next to the building. These handicapped spaces are not placed very well, as there are spaces closer to the door that would be better suited. This pavement is in similarly poor condition (A4).

The gas connection appears to enter the building at a gas meter/regulator at the northern corner of the building. The sewer line exits the building below the middle of the northwest elevation according to the original drawings. The electrical connection appears to enter the facility at the electrical courtyard on the southwestern elevation. Original facility drawings from 1999 were available to confirm existing conditions.

2.0 Architectural



The Visual Arts Center assessment focuses on the facility's overall structure, interior finishes, exterior finishes, roofing, equipment, special constructions, and code issues. The building was completed in 1999 and is between one and two stories, with one utility basement in Thaw. The Art History Research Library and the Newhall Library were locked and inaccessible for assessment during the site visit.

2.1 Exterior

Walls & Openings

The exterior walls are constructed of metal studs with gypsum wallboard on the interior and exterior-rated gypsum sheathing with a modified stucco system on the exterior. A small number of walls are CMU including the bellow-grade portion of the walls of the utility basement in Thaw. Exterior damage to the stucco was observed in a few places, but only one was immediately concerning. There is a crack in the exterior wall near the southern corner of Tishman Hall. This crack seems to correspond to a crack in the slab (see Floor section, below) (A7).

All windows appear to be custom. Many are fixed, double-pane windows with concealed frames. Most offices have square operable windows, most of them are double-pane, though some are single-pane. The operable windows have four latches around the perimeter and swing out on three hinges. One of the large, fixed windows looking into the courtyard from Tishman has had the external pane of glass shattered. The second pane is still intact on the interior (A5). The overall condition of the windows is acceptable.

The exterior doors are a mixture of three door types. Hollow metal doors are found at the entrances into Tishman, as well as at externally accessed mechanical spaces. Solid wood doors are found at the front entrance to Tipton Hall and Marion Hall. Hollow metal doors with glazing are found at the main courtyard entrance to Thaw Hall. The hardware is ADA-compliant (A6) and appears to be in good working order with a few exceptions. Multiple exterior automatic doors appear not to function properly and should be updated with new openers and buttons. The overall condition of the exterior doors is acceptable.

There are multiple external drain spouts around the building, many of which no longer have a splash block present. Some of these have been moved and some are gone altogether, and some erosion has occurred in these locations. A few splash blocks are still in place. Most of the drain spouts on the northeastern elevation have flexible plastic pipes attached to move water away from the building edge. Most of these pipes have come detached from the spout and have been capped with red tape.

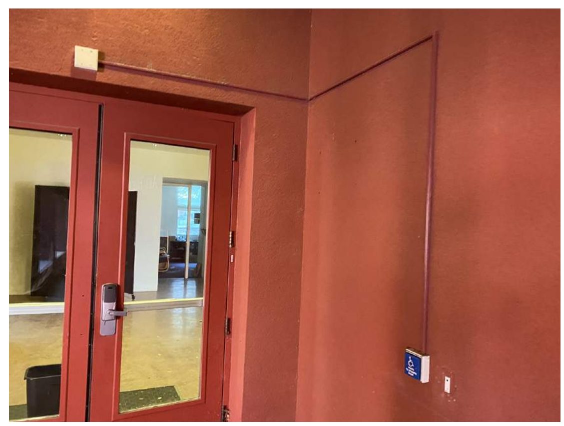
Roof

Please note that a full roof inspection was not performed for this report due to portions of the roof being inaccessible.

The roofing system appears to be the original ballasted Ethylene-

Parking lot condition | A4

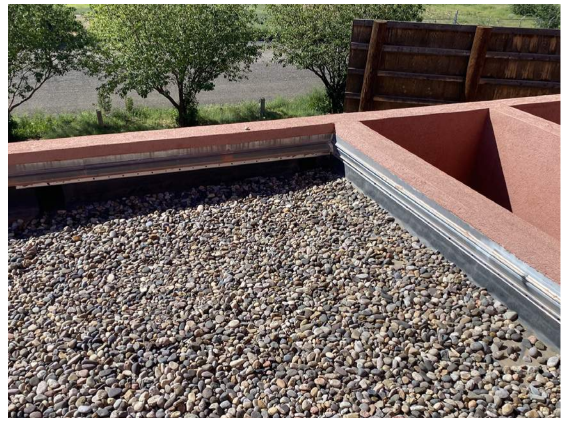
Window with external pane shattered | A5



Exterior entrance doors to Thaw | A6

Crack in exterior wall | A7

propylene-diene terpolymer (EPDM) membrane roofing assembly on 1" polyisocyanate insulation over a 22ga metal deck on steel joists. 1/4"/ft. slope to roof drains. This was confirmed by the original drawings. The age of the roof is assumed to be 23 years, the same age as the building. Roofs of this type have been commercially available for about 30 years and have so far proven to be a durable roofing system. The average lifespan is currently estimated to be over 30 years, though there is minimal real-world data past that mark. In general, the roof is in good condition with no noticeable leaks, cracks, or seam issues. The roof drains appear functional, and no obvious ponding was observed. Metal flashing at the edge of the membrane appears to be in good condition (A8).


Ballasted EPDM membrane roof | A8

2.2 Interior

Floors

According to the original drawings, the ground floor is a 4" thick, reinforced concrete slab. The second floor is a 4" floor system constituting a concrete slab poured on metal decking. The condition of the floor finishes ranges from acceptable to good working order with one exception, see below. Floor finishes include the following:

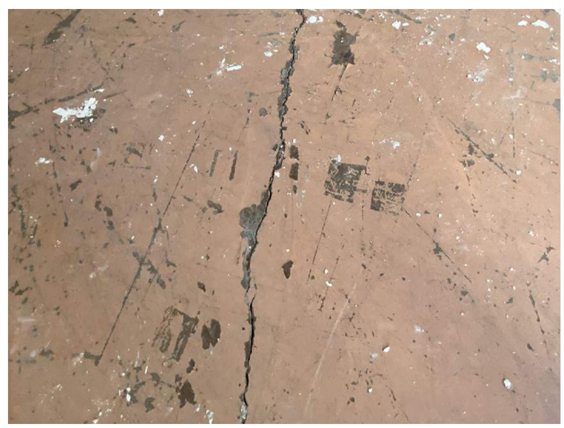
Carpet: Located in offices and classrooms. Acceptable to fair condition, with some areas showing more significant wear than others.

Colored, Sealed Concrete: Located in hallways, atria, utility spaces, dark room spaces in Marion, and the four large open studio rooms inside Tishman. Appears to be in good working order (A9).


Colored, sealed concrete | A9

Ceramic Tile: Located in some restrooms. Dirty, but in good working order.

The first floor rooms at the southern corner of Tishman appear to be mid-renovation. The carpet has been removed from the room, revealing a long crack in the slab (A10). This crack may be related to a crack in the exterior wall, as they appear to align. This appears to be evidence of settling at this corner of the building.


Crack in slab | A10

Partitions

Most of the partitions are metal studs with painted gypsum board. A few walls are CMU. The Newhall Library is separated from a restroom by a CMU wall with 2" furring and acoustical bats on the library side (according to original drawings).

Overall, the interior partition walls are in good condition with only minor damage in a few areas. The large bay window in the Tishman stairwell has some damage to the gypsum board, including some damage that may indicate a small leak in the bay roof (A11).


Bay window gypsum board damage | A11

Ceilings

Painted gypsum board ceilings and lay-in acoustic ceiling tile (ACT) are present in most places. The four large classrooms in Tishman, mechanical spaces and some janitor closets are exposed to structure.

Lay-in Acoustical Ceilings Tiles (ACT): The tiles used in the Visual Arts Center are notably of high quality and have a finely textured surface. Areas with ACT are generally in good condition. Some missing tiles will require replacement.

Painted Gypsum Board: Gypsum board ceilings are in hallways, restrooms, conference rooms, communal spaces, some janitor closets, and some offices and classrooms. Some classrooms have a perimeter of gypsum ceiling with ACT in the middle of the ceiling. Gypsum board ceilings appear to be in good condition.

Casework & Furnishings

Casework and furnishings are still present across the building and vary widely depending on room usage. Most offices have wall-mounted cabinets and L-shaped desks. Darkrooms have long counter-level cabinets with large analog photography equipment on top and some more specialized cabinetry for drying prints, disposal of chemicals, and other uses. The frame-making studio has cabinetry at the rear of the room for storing supplies and tools. A small sink and counter are installed in the preservation lab. Conference rooms have shelving and cabinetry that conceals a television, and a whiteboard and provides storage as well as display space. Conference rooms also have large custom wood tables and internal sliding wood shutters. Classrooms have a wide assortment of furniture, from custom pieces to basic institutional tables and chairs. The copy room has upper and lower cabinets around the room. The visual resource library is piled with furniture and appliances, likely moved from nearby rooms. Overall, built-in furnishings are in acceptable to good condition.

Doors

Interior doors include custom solid wood doors (with or without small windows), painted solid wood doors, full glass hollow metal doors, and tempered plate glass doors. They appear to be ADA-compliant in design and hardware (A14). Overall, the interior doors are in good condition.

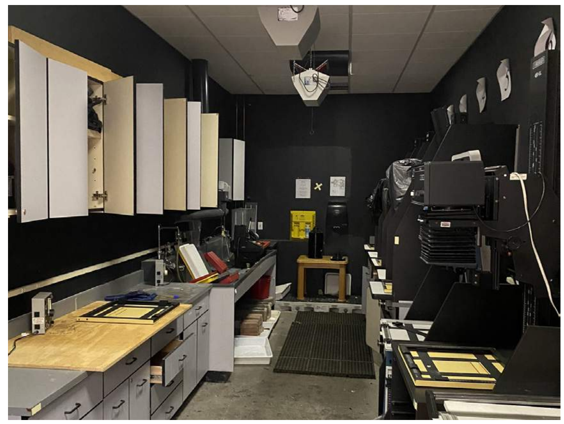
Stairs, Ramps & Elevators

There are two stairways leading up to the second floor of Tishman as well as an elevator at one of the stairways. The primary stairway (next to the elevator) is 5 ft wide and has code-compliant handrails. The elevator appears to be fully functional but may require new braille signage to be ADA-compliant.

3.0 Mechanical, Plumbing

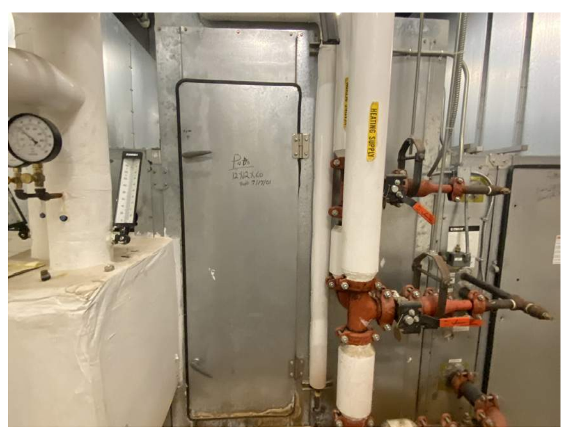
The building's mechanical and plumbing systems were not assessed as a part of the scope of work. The following information provided is general observation only and no attempt was made to verify or confirm the full conditions of these systems. No recommendations have been made regarding corrective measures relating to these systems in this report. An independent HVAC Assessment report by Maxson Engineering and B&D Industries has been attached as an appendix for reference.

Typical ACT office ceiling | A12



Fully equiped darkroom | A13

Typical interior door hardware | A14



Tishman mechanical penthouse | A15

3.1 Mechanical Systems

Mechanical penthouses contain the majority of HVAC equipment (A15), with some equipment located on the roof. The system utilizes a Direct Digital Control (DDC) system, a humidifier, evaporative cooling, and a gas boiler-fed heating coil system. It appears that the system is currently being repaired.

Ductwork

Portions of ductwork throughout the building were visible due to open ceiling hatches and ceiling tiles that were moved aside. The visible ductwork was rigid ducting wrapped with foil-sleeved duct insulation (A16).

Ducting in Tipton plenum | A16

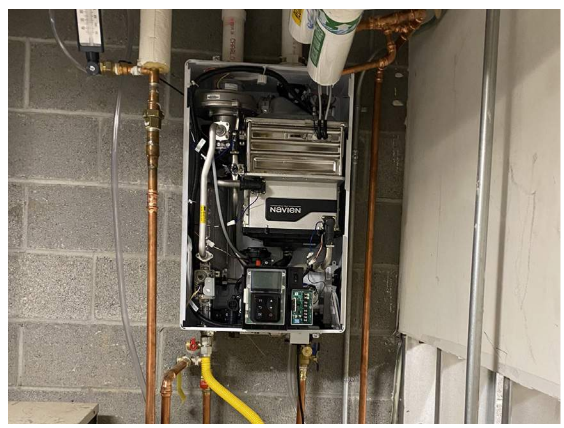
3.2 Plumbing Systems

The plumbing system is comprised of a domestic water system, and drainage via sanitary sewer piping. It is unclear what the state of any of the sanitary lines are in.

Boilers and Expansion Tanks

The general condition of the boiler heating system appears good and is comprised of two “Lochinvar” gas-fired boiler units. According to the original drawings, one is primary and the other is backup (A17). A large expansion tank is hung from the ceiling nearby. A “Navien” brand gas-fired instant water heater is present in the Thaw basement (A18).

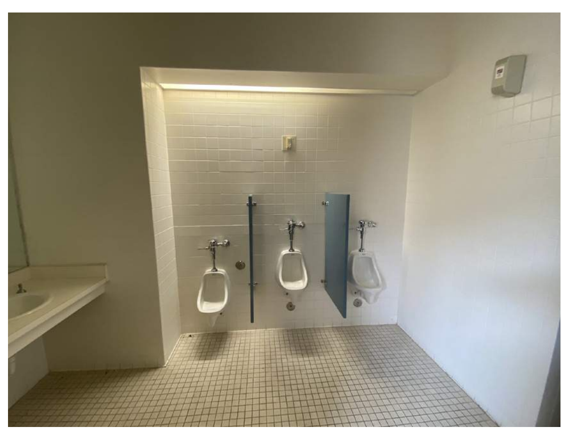
Primary and backup boilers | A17



Instant hot water heater | A18

Plumbing Fixtures

A wide variety of plumbing fixtures are present. All fixtures are manually actuated. Restrooms have single-handle faucets, built-in soap pumps, and top mount, self-rimming porcelain sinks. Toilets are floor mounted with manual flush valves. Urinals are wall mounted with manual flush valves (A19). Water fountains are small round bowl fixtures with a manual front button. Plumbing fixtures appear to be ADA-compliant.



Urinals in Marion | A19

Dark rooms are equipped with an assortment of specialty plumbing fixtures that include extra wide plastic basin sinks, spigots, and eye wash stations (A20). Floor drains are present in dark rooms with plumbing fixtures.

The small “coffee bar” rooms have small, top mount, self-rimming metal sinks with double-handle faucets.

Janitorial closets have floor sinks with wall-mounted double-handle faucets.

The small kitchen in Marion has a metal double bowl, top mount, self-rimming sink with a single-handle faucet, and a separate sprayer.

The four large open classrooms in Tishman have two oversized metal sinks with double-handle faucets, with some of the sinks having double basins (A21).

A small number of water connections are located around the exterior of the building. These connections are in the ground with a cover over the top. One cover in the trash collection area near the west corner of the building is partially open with the cover twisted and standing water visible at the bottom.

Fire Suppression
There is no fire sprinkler system installed in the building.

4.0 Electrical

The building's electrical systems were not assessed as a part of the scope of work. The following information provided is general observation only and no attempt was made to verify or confirm the full conditions of these systems.

4.1 General Electrical
Electrical appears to enter the building at the electrical courtyard on the southern end of Marion. A 480-volt transformer (A22) and a variety of other electrical equipment are also present in the mechanical basement in Thaw. Other electrical panels are present in a few places throughout the facility.

General Wiring Devices and Junction Boxes
The overall appearance of the wiring devices for the building is good except for a few in Thaw that are missing covers (A23). Some thermostats appear to be mid-replacement.

Ethernet and Coaxial
Telecommunications equipment was observed inside a cabinet in Marion, as well as in the Thaw basement. Network ports as well as coaxial ports were observed installed in offices and other spaces. They appear to be in good condition, though a full test was not completed.

Fire and Security Alarm System
Access control and fire alarm system hardware were observed inside a cabinet in Marion (A24) as well as inside the projection booth in Tipton. The system appears modern and in good condition, though a full test was not completed.

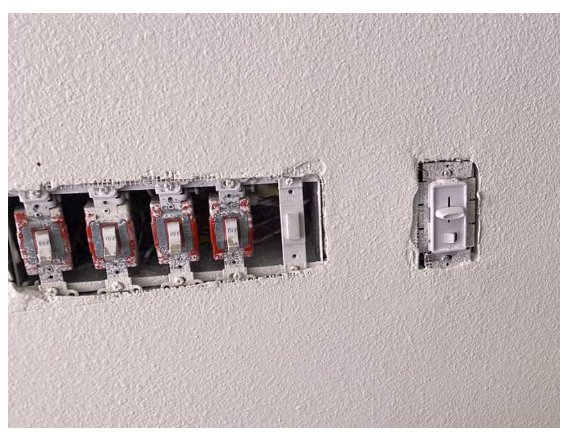
Exterior and Site Lighting
The exterior lighting appears to be in good condition. Emergency egress lights are installed at exits. Site lighting is provided by circular down lights on poles. Exterior building fixture types are as follows:

- Large wall packs.
- Small wall packs in wall-matched stucco surrounds.
- Recessed can lights.
- Inset lamps in wall niches.
- In-ground up-lights with grates.
- Wall-wash lights hidden in concrete housings (A25).

Group darkroom fixtures | A20

Oversized sink in Tishman | A21

480 volt transformer | A22



Wall switches without cover plates | A23

Interior Lighting

The facility is illuminated with a mixture of lighting technologies including fluorescent, incandescent, LED, and halogen lighting. The fixtures appear to be in acceptable condition overall. The fixture types are as follows:

- Recessed lamps in ceiling niches.
- Recessed linear fluorescent lights (A27).
- Recessed can lights.
- Recessed square lamps with diffusers.
- Track lights (A26).
- Recessed rectangular fluorescent fixtures.
- Wall-mounted or suspended exposed fluorescent tube fixtures.
- Surface-mounted linear fluorescent tube fixtures.
- Suspended linear fluorescent up lights.
- Wall-mounted single lamp fixtures with stone diffusers.
- Wall-mounted linear single lamp up lights.
- Wall-mounted two lamp light shelves.
- Specialty combination white and safe lights for dark rooms.
- Suspended safe lights in larger dark room areas.
- Lay-in 2x2 and 2x4 fluorescent fixtures.
- Suspended linear two-lamp fluorescent fixtures.
- Inset lamps in wall niches.

5.0 SUMMARY & RECOMMENDATIONS

5.1 Architectural Summary

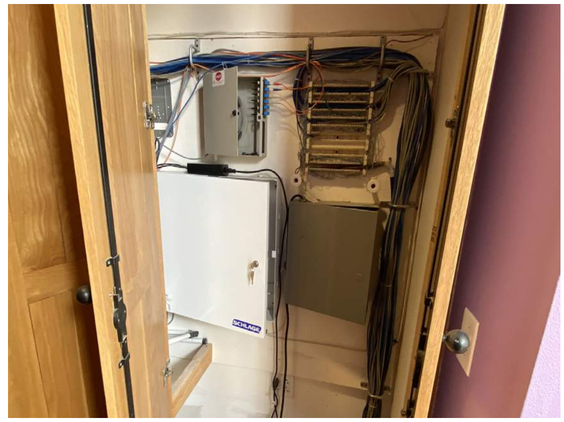
The facility is in acceptable condition overall with specific items needing attention. The following are recommendations for items that will require corrective measures.

Site

- Repave parking lot and access road with parking. Move handicapped spaces closer to the entrance.
- Trim overgrown plants, remove or adapt volunteer plants, and remove dead plants (A28). Landscaping should be addressed by a professional landscaper. If a long-term inhabitant is found, we recommend fully restoring the original landscaping plan in consultation with a licensed landscape architect.

Exterior

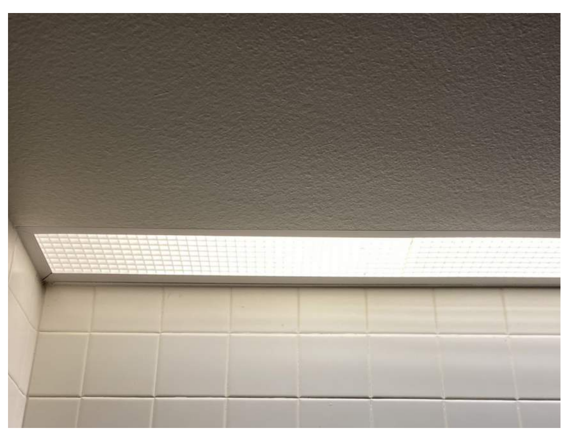
- Replace the broken glass in the window in Tishman. Retrofit



Access Control and Telecom | A24

Hidden wall-wash lights | A25

Track lighting in the gallery in Marion | A26



Recessed lights in the Marion bathrooms | A27

- double pane glass into windows that are single pane. Inspect flashings and sealants at all openings.
- Replace missing or moved splash blocks. Replace drain pipes on the northeastern elevation with a more permanent solution.
- Inspect and spot repair all exterior flashings and sealants. A full roof inspection by a licensed roofing contractor is recommended to verify the estimated life left in the current roofing system.
- Inspect the water connection in the trash collection area for damage and repair if necessary.
- Repair damage to stucco (A29).

Finishes

- Replace carpet, especially in higher wear areas.
- Professionally clean the tile in the restrooms.
- Complete the renovations in Tishman (A30).
- Repair damage to the bay window gypsum board in Tishman should and inspect the roof of the bay for leaks.

ADA

- Replace automatic door openers that are not functioning (A31).
- Add braille signage at the elevator in Tishman.

5.2 Electrical Summary

This report does not include a comprehensive electrical assessment. All electrical items mentioned are addressed from an architectural standpoint. The following are recommendations for items that will require corrective measures, starting with immediate concerns.

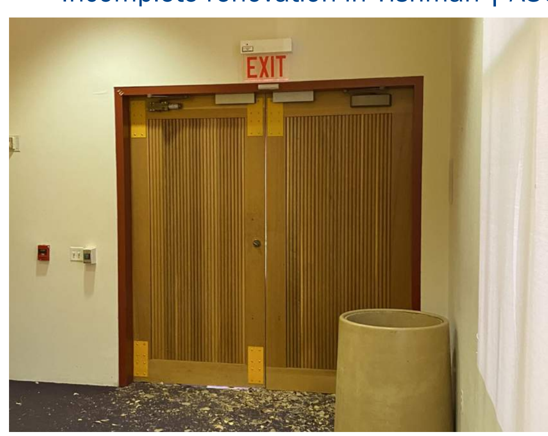
Electrical Upgrades/Maintenance

- Commission a comprehensive inspection of the electrical system.
- Test the fire alarm and security systems to verify functionality.
- Convert all light fixtures to LED to lower utility and maintenance cost. Typical fluorescent lamps have a lifespan of 10-25% as long as an LED lamp, require more maintenance, and use more than double the energy of newer LED lamps.

Overgrown area of the site | A28

Stucco damage at east corner | A29

Incomplete renovation in Tishman | A30



Automatic door to Tipton not working | A31

APPENDIX A

City of Santa Fe - Visual Arts Center HVAC Assessment

August 2022

Final Draft

Maxson Engineering

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TABLE OF CONTENTS

1 EXECUTIVE SUMMARY

At the request of the City of Santa Fe (“CoSF”, “City”), B&D Industries, Inc. (“B&D”) contracted with Maxson Engineering LLC (“Maxson”, “Maxson Engineering”) to assess various HVAC items at the Visual Arts Center (“VAC”) complex located at the Midtown Center in Santa Fe, New Mexico. B&D currently holds a service contract for this facility and maintains the systems and equipment for the City.

Site observations were completed, and existing documentation was reviewed to gather data about the existing facility. Block load calculations were done to determine required overall heating and cooling capacity requirements for the buildings and to cross-check with existing equipment to remain. Items reviewed are as follows:

- Existing HVAC controls
- Major airside equipment – air handler units (“AHUs”), rooftop units (“RTUs”)
- Boiler plants
- Chiller plants

After the assessment was complete, the findings found the following:

- HVAC Controls: Disabled and non-functional
- AHU-1: Replaced after original construction and undersized
- AHU-2 through AHU-7: Moderate to good condition
- Air Terminal Devices – VAV/CAV (50): Moderate condition. Unknown if dampers, valves or other devices are operational. Pipes had leak corrosion in several areas.
- RTU-1, RTU-1M, RTU-2M: Moderate to good condition
- Boilers (4): All in poor condition
- Boiler Pumps (4): Moderate to poor condition
- Chillers (2): Good condition
- Chiller Pumps (3): Good condition

The resulting recommendations are as follows:

- HVAC Controls: Install new BAS backbone, software and all controls connections/devices throughout the facility.
- AHU-1: Replace with properly sized unit and tie into existing heating and chilled water infrastructure. Tie into and integrate into new BAS with new control devices and controllers.
- AHU-2 through AHU-7: Service, replace filters, repair/replace motors (where necessary), repair cabinets (where necessary). Tie into and integrate into new BAS with all new control devices and controllers.
- VAV/CAV Units: Replace all as part of the controls replacement.
- RTU-1, RTU-1M, RTU-2M: Service and clean, replace filters. Integrate into new BAS.
- Boilers: Replace all with condensing boilers and controls. Integrate into new BAS.
- Boiler Pumps: Replace all with new VFD-duty, vertical inline centrifugal pumps. Integrate into new BAS. Four (4) total.
- Chillers: Service as necessary. Tie into and integrate into new BAS.
- Chiller Pumps: Service as necessary. Relocate pump serving AHU-2 to make room for AHU-1. Integrate into new BAS. Three (3) total.
- Water treatment systems: Provide new glycol feed systems at each boiler and chiller plant location. Four (4) total.

2 INTRODUCTION

The Visual Arts Center was originally designed by Ricardo Legorreta and Lloyd & Tryk Architects (now known as Lloyd & Associates) in 1997. The complex is made up of four areas that total 48,386 square feet of heated space:

- The Anne & John Marion Center for Photographic Arts (“Marion”)
    - 12,823 ft²
- Thaw Art History Center (“Thaw”)
    - 11,388 ft²
- Tipton Hall (“Tipton”)
    - 2,522 ft²
- Jill and Donald Tishman Hall (“Tishman”)
    - 16,276 ft²

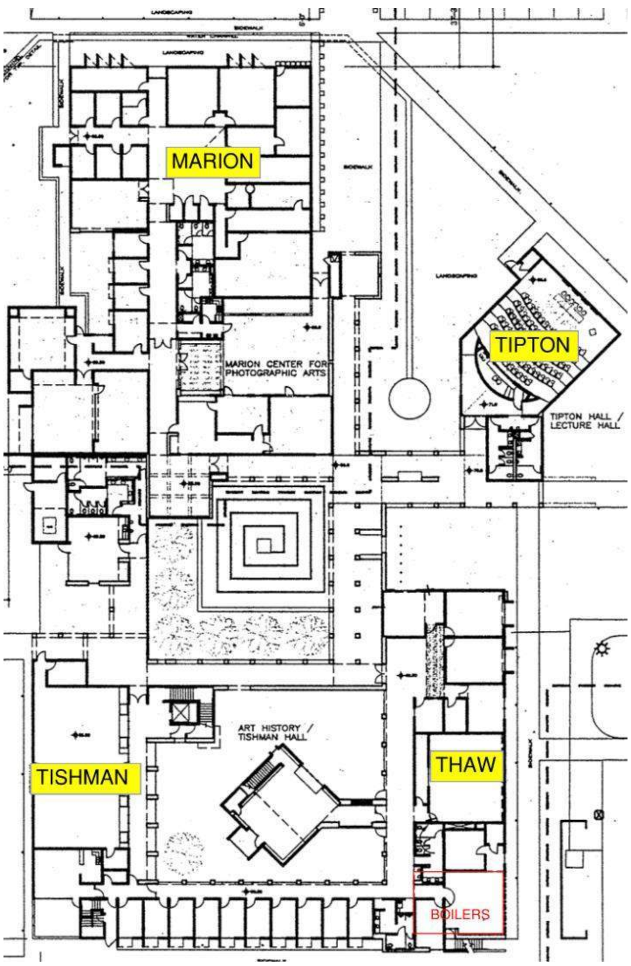


Figure 1 - VAC Overall Floor Plan

These buildings have been vacant since 2018 and were last used as an art institute. The City of Santa Fe is looking to lease the property or have the properties managed. To accomplish this, the HVAC systems need to be working properly and controllable. Some systems have been decommissioned, some damaged and some are just not working. Other systems are not properly controlled or “running rogue”. The main priorities are getting the heating systems operational again and getting the HVAC controls operational and working for potential occupants.

The City has asked B&D and Maxson to assess the existing airside HVAC systems – the air handlers, rooftop units and duct systems, as well as the existing boilers and associated equipment in the Thaw/Tishman building. As part of the assessment, Maxson will provide recommendations on repairs/upgrades and B&D will provide quotations for completing the recommended work.

3 ASSESSMENT APPROACH

A. APPROACH

1. Chillers and Boilers

a. The chillers, boilers and related equipment serving these buildings have been assessed for condition, lifespan, efficiency and potential replacement. As part of this assessment, Maxson performed a building block load analysis to determine the overall heating and cooling capacities required to properly condition the building. The boilers, chillers, hydronic pumps and controls were assessed as part of the scope of work. The piping was also reviewed and inspected by B&D, to the extent that was visually possible.

2. HVAC Airside Equipment

a. The existing air handling units (“AHUs”) and packaged rooftop units (“RTUs”) were assessed for condition, lifespan, efficiency and potential replacements or upgrades. There are six (6) AHUs, three (3) RTUs and a vertical fan coil that serve the complex.

b. There are constant air volume terminal units (“CAVs”) and variable air volume terminal units throughout the buildings that include hot water reheat coils and two-way control valves. These units were not assessed as part of this scope of work, as the heating systems were down during the assessment so the coils could not be tested. The dampers and associated actuators could also not be made to operate due to the ambiguous controls.

3. HVAC Controls

a. The existing HVAC controls are primarily Trane controls that were originally designed and installed as part of the building automation system (“BAS”). The existing controls were not assessed from a functional standpoint, as many of the controls systems are off, decommissioned or no longer operational. All controls devices such as valve/damper actuators, airflow stations, differential pressure sensors could not be evaluated or tested due to the state of the existing network and controls availability, and the controls being bypassed in many instances. The existing direct digital controls (“DDC”) systems were assessed for condition, application, age and potential replacements or upgrades.

4 ASSESSMENT FINDINGS

A. FINDINGS

1. Thaw/Tishman Boilers & Pumps

a. Boilers: The two (2) existing boilers that serve the Thaw/Tishman buildings are Lochinvar Models CHN 2070 – cast-iron, natural gas-fired boilers with copper-finned tube heat exchangers. Each boiler has an input rating of 2,070,000 BTU /H and an output rating of 1,738,000 BTU/H.

(1) Age: The existing boilers appear to be from the original construction, which would make them approximately 25 years old. According to the *American Society of Heating, Refrigerating and Air-Conditioning Engineers* or *ASHRAE*, the maximum serviceable lifespan of a cast-iron boiler is 35 years, with a median age of 30 years. This is provided the boilers have been properly designed, installed and maintained, as well as no damage or unforeseen wear and tear has occurred throughout the boiler's lifespan.

Figure 2 - Existing Boilers at Thaw/Tishman Building

b. Pumps/Hydronic Operation: The two (2) existing hot water circulation pumps are end suction, centrifugal pumps sized at 5 HP manufactured by Weinman/Crane Pumps.

(1) Age: These are also from the original construction installation and are approximately 25 years old. According to *ASHRAE*, the maximum serviceable lifespan of hydronic pumps is 20 years.

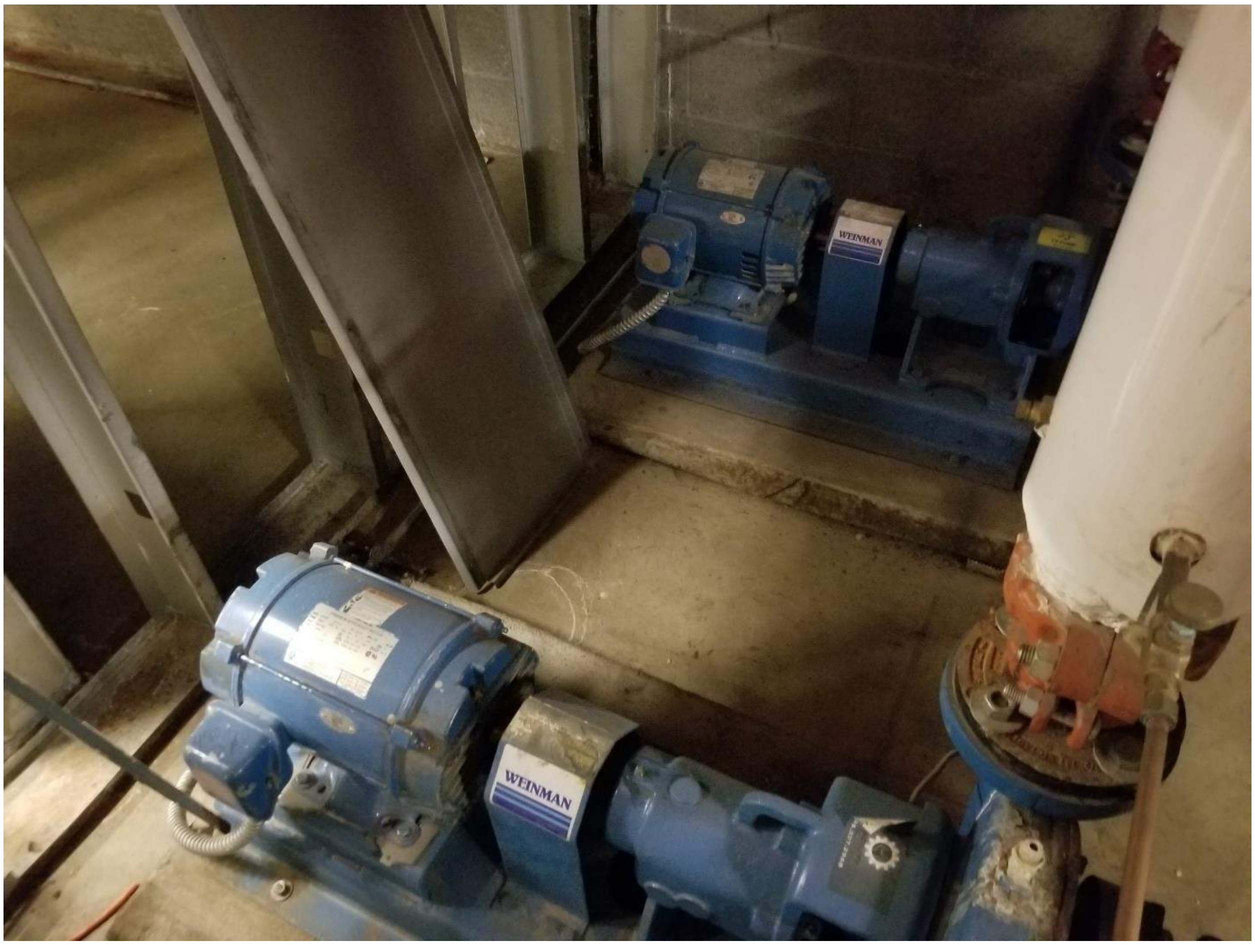


Figure 3 - Hot Water Hydronic Pumps at Thaw/Tishman

c. Condition/History:

(1) Boilers: The boilers appeared to have been moderately maintained over the years, but there are other factors that have impacted the longevity of the boilers. The boilers are located in the basement and, according to the City, there was a major leak in one of the main water pipes and the basement flooded with water 1-2 feet deep. This caused major damage to the electronic components within the boilers and consultation with the manufacturer and B&D resulted in the acknowledgement that energizing the boilers and testing them would be a safety risk. Additionally, the heat exchangers in both boilers have been found to be completely impacted/plugged due to lack of water treatment and maintenance over the years.

(a.) The existing boiler heat exchangers have a maximum flow rate of 90 GPM, and the total existing heating system load was designed to be 207 GPM. This means that the boilers would not be able to meet system peak demand during low temperature conditions and full load. Please see calculations below for additional assessment information.

(2) Pumps/Hydronic Operation: The two (2) hot water circulation pumps are Aurora Model 340-ES, end suction, centrifugal pumps sized at 5 HP. These pumps were originally sized to provide 207 GPM at 50' of head. The pumps appear to be in moderate condition, but the pumps were decommissioned and could not be verified to be operational. There is a high likelihood that these pumps were also damaged when the basement flooded. Please see calculations below for additional assessment information.

d. Building Load and Pipe Calculations:

(1) Building load calculations:

(a.) were completed using the *Carrier Hourly Analysis Program (HAP)* software version 5.11. See *Exhibit A* for additional load calculation information. The loads were completed using a block-load approach (one large zone per building in lieu of modeling every unique zone separately).

(b.) The total heat load calculated for the Thaw/Tishman building was calculated to be 779 MBH:

Zone Name	Design Supply Airflow (CFM)	Minimum Supply Airflow (CFM)	Zone CFM/ft²	Reheat Coil Load (MBH)	Reheat Coil Water gpm @ 20.0 °F	Zone Htg Unit Coil Load (MBH)	Zone Htg Unit Water gpm @ 20.0 °F	Mixing Box Fan Airflow (CFM)
Zone 1	32967	23193	1.19	779.0	77.94	0.0	-	0

(c.) The boilers are currently sized to deliver 1,738 MBH each and appear to be oversized for the load requirements.

(2) Piping/Flow Calculations

(a.) The total flow (GPM) and pump capacity required for the total system volume and heating capacity requirements were calculated to be 198 GPM at 60' of total dynamic head for the Thaw/Tishman building.

2. **Marion Boilers & Pumps**

a. Boilers: The two (2) existing boilers that serve the Marion buildings are Lochinvar Models CHN 2070 – cast-iron, natural gas-fired boilers with copper-finned tube heat exchangers. Each boiler has an input rating of 1,440,000 BTU/H and an output rating of 1,209,000 BTU/H.

(1) Age: The existing boilers appear to be from the original construction, which would make them approximately 25 years old. According to the *American Society of Heating, Refrigerating and Air-Conditioning Engineers* or *ASHRAE*, the maximum serviceable lifespan of a cast-iron boiler is 35 years, with a median age of 30 years. This is provided the boilers have been properly designed, installed and maintained, as well as no damage or unforeseen wear and tear has occurred throughout the boiler's lifespan.

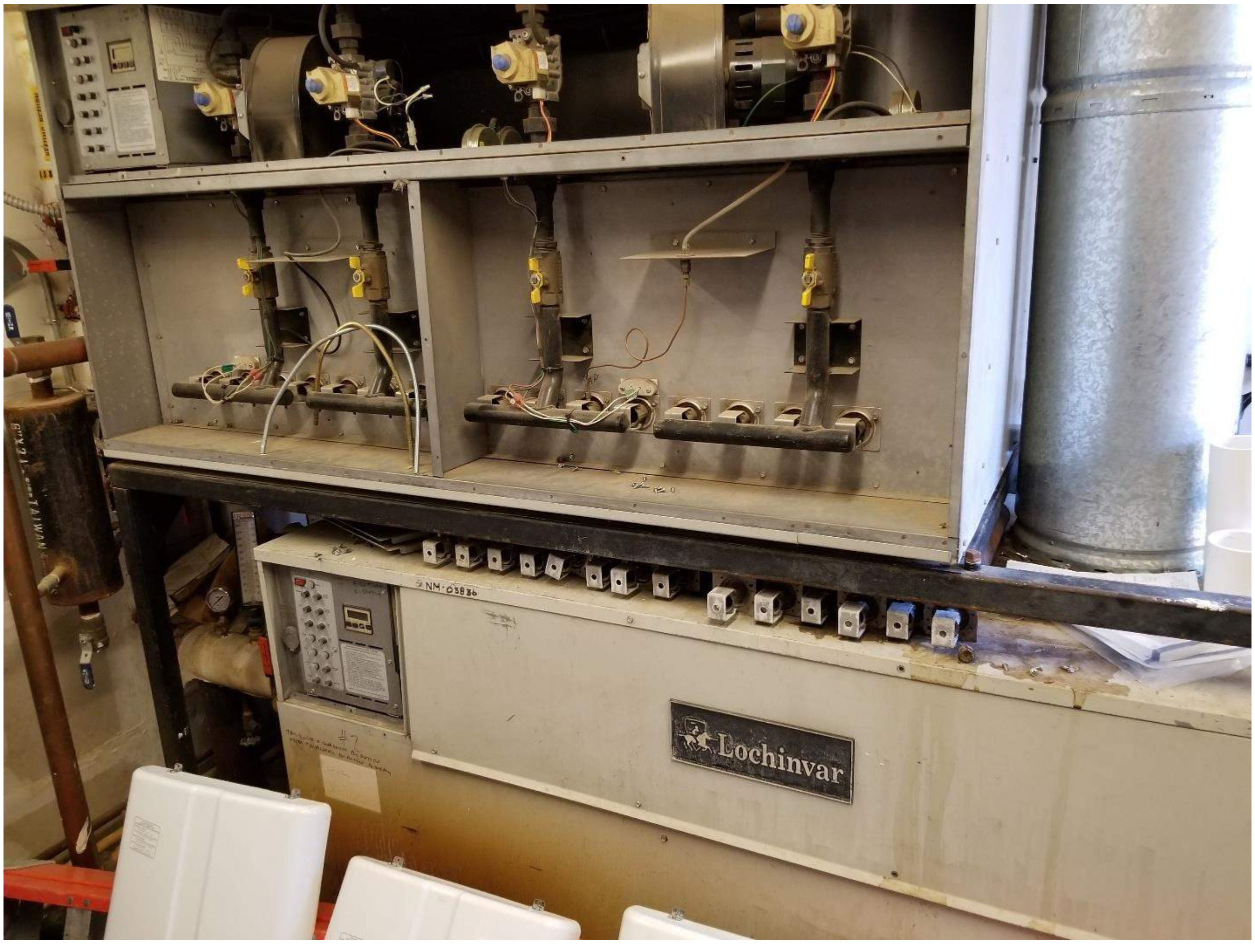


Figure 4 - Marion Boilers (Stacked - Top with Side Panel Off)

b. Pumps/Hydronic Operation: The two (2) existing hot water circulation pumps are vertical inline centrifugal pumps sized at 2 HP. The motors were manufactured by Marathon Electric, it could not be verified who manufactured the pump.

(1) Age: These are also from the original construction installation and are approximately 25 years old. According to *ASHRAE*, the maximum serviceable lifespan of hydronic pumps is 20 years.

Figure 5 - Marion Boiler Pumps

c. Condition/History:

(1) Boilers: The boilers appeared to have been poorly maintained over the years and are not currently operational. They have been decommissioned and are in poor condition and should be replaced. Additionally, the heat exchangers in both boilers have been found to be completely impacted/plugged due to lack of water treatment and maintenance over the years.

(2) Pumps/Hydronic Operation: The two (2) hot water circulation pumps are vertical inline centrifugal pumps sized at 2 HP. These pumps were originally sized to provide 72 GPM at 50’ of head. The pumps appear to be in moderate to poor condition, but the pumps were decommissioned and could not be verified to be operational. Please see calculations below for additional assessment information.

d. Building Load and Pipe Calculations:

(1) Building load calculations:

(a.) These were completed using the *Carrier Hourly Analysis Program (HAP)* software version 5.11. See *Exhibit A* for additional load calculation information. The loads were completed using a block-load approach (one large zone per building in lieu of modeling every unique zone separately).

(b.) The total heat load calculated for the Marion building was calculated to be 836 MBH:

Zone Name	Design Supply Airflow (CFM)	Minimum Supply Airflow (CFM)	Zone CFM/ft²	Reheat Coil Load (MBH)	Reheat Coil Water gpm @ 20.0 °F	Zone Htg Unit Coil Load (MBH)	Zone Htg Unit Water gpm @ 20.0 °F	Mixing Box Fan Airflow (CFM)
Zone 1	28998	24890	2.26	836.0	-	0.0	-	0

(a.) The boilers are currently sized to deliver 1,209 MBH each and appear to be oversized for the load requirements.

(2) Piping/Flow Calculations

(a.) The total flow (GPM) and pump capacity required for the total system volume and heating capacity requirements were calculated to be 82 GPM at 50 of total dynamic head for the Marion building.

3. **Thaw/Tishman Chiller Plant**

a. Chiller: The existing chiller currently resides just north of the south mechanical penthouse on the roof. The chiller currently serves AHU-2 but likely served a previous AHU-1 that was removed and replaced with a DX/refrigerated, smaller AHU. (See AHU-1 for more information). This chiller is a Trane Model CGAM 060F – a 60 ton air-cooled scroll chiller with a cooling capacity of approximately 693,000 BTU/h. The chiller has multiple R-410 refrigeration circuits and stages of 25%-50%-75%-100%.

(1) Age: The existing chiller was not part of the original construction. The age of this chiller is likely somewhere in the range of the other newer equipment which would put the age at 11-13 years old. According to the *American Society of Heating, Refrigerating and Air-Conditioning Engineers* or *ASHRAE*, the maximum serviceable lifespan of a chiller ranges between 20-23 years is 35 years. This is provided the chiller has been properly designed, installed and maintained, as well as no damage or unforeseen wear and tear has occurred throughout the chiller's lifespan.

Figure 6 - Thaw/Tishman Trane Chiller

b. Pumps/Hydronic Operation: The existing chiller water circulation pump is a Bell & Gosset Model 8.75 BF, end suction, centrifugal pumps sized at 5 HP. These pumps were originally sized to provide 141 GPM at 75' of head.

(1) Age: These were also installed after the original construction installation and are estimated to be approximately 11-13 years old. According to *ASHRAE*, the maximum serviceable lifespan of hydronic pumps is 20 years.

Figure 7 - Thaw/Tishman Chilled Water Pump and Water Treatment Pot Filler

c. The existing water treatment system leaves much to be desired and will cause maintenance issues in the future. When replacing glycol, it has to be fed (5 gallons poured at a time) and absorbed through a bypass pipe that feeds to the main chilled water piping and it is a slow and laborious process.

d. Condition/History:

(1) Chiller: The chiller appears to have been well maintained over the years and was witnessed to be operating and delivering 45°F water. It is assumed the chiller is in good working order and has been well maintained. Please see calculations below for additional assessment information.

(2) Pumps/Hydronic Operation: The pumps appear to be in good condition and one pump was witnessed to be operational. The pump controls/starters are disabled and disconnected with the controls bypassed. The pumps were wired to be on 24/7 when needed.

e. Building Load and Flow Calculations:

(1) Building load calculations:

(a.) These were completed using the *Carrier Hourly Analysis Program (HAP)* software version 5.11. See *Exhibit A* for additional load calculation information. The loads were completed using a block-load approach (one large zone per building in lieu of modeling every unique zone separately).

(b.) The total cooling load calculated for the Thaw/Tishman building was calculated to be 836 MBH:

Total coil load	**54.3**	Tons
Total coil load	**651.6**	MBH
Sensible coil load	**631.7**	MBH
Coil CFM at Jul 1500	**28833**	CFM
Max block CFM at Jul 1600	**32967**	CFM
Sum of peak zone CFM	**32967**	CFM
Sensible heat ratio	**0.970**	
CFM/Ton	**531.0**	
ft^2/Ton	**509.5**	
BTU/(hr·ft^2)	**23.6**	
Water flow @ 10.0 °F rise	**N/A**	

(c.) The current chiller capacity is estimated to be approximately 57-tons with derating for altitude/air density, which is 693 MBH. This chiller appears to be properly sized.

4. **Marion Chiller Plant**

a. Chiller: The existing chiller currently resides in a rooftop courtyard south of the mechanical penthouse. The chiller that serves the Marion building is Trane Model CGAM 052F – a 52 ton air-cooled scroll chiller with a cooling capacity of approximately 630,000 BTU/h. The chiller has multiple R-410 refrigeration circuits and stages of 25%-50%-75%-100%.

(1) Age: The existing chiller was not part of the original construction. The original chiller from 1998 was an R-22, 30-ton chiller that was designed for only AHU-7. It is hard to determine the exact date of manufacturing, but the newer RTUs were manufactured in 2011 and the AHU-1 vertical air handler in Thaw/Tishman was manufactured in 2013. The age of this chiller is likely somewhere in that range which would put the age at 11-13 years old. According to the *American Society of Heating, Refrigerating and Air-Conditioning Engineers* or *ASHRAE*, the maximum serviceable lifespan of a chiller ranges between 20-23 years is 35 years. This is provided the chiller has been properly designed, installed and maintained, as well as no damage or unforeseen wear and tear has occurred throughout the chiller's lifespan.

Figure 8 - Marion Trane Chiller

b. Pumps/Hydronic Operation: The two (2) existing chiller water circulation pumps are Bell & Gosset Model 5.375 BF, end suction, centrifugal pumps sized at 5 HP. These pumps were originally sized to provide 121 GPM at 50' of head.

(1) Age: These were also installed after the original construction installation and are estimated to be approximately 11-13 years old. According to *ASHRAE*, the maximum serviceable lifespan of hydronic pumps is 20 years.

Figure 9 - Marion Chilled Water Pumps and Open Disconnects/Starters

a. The existing water treatment system leaves much to be desired and will cause maintenance issues in the future. When replacing glycol, it has to be fed (5 gallons poured at a time) and absorbed through a bypass pipe that feeds to the main chilled water piping and it is a slow and laborious process.

b. Condition/History:

(1) Chiller: The chiller appears to have been well maintained over the years and was witnessed to be operating and delivering 45°F water. It is assumed the chiller is in good working order and has been well maintained. Please see calculations below for additional assessment information.

(2) Pumps/Hydronic Operation: The pumps appear to be in good condition and one pump was witnessed to be operational. The pump controls/starters are disabled and disconnected with the controls bypassed. The pumps were wired to be on 24/7 when needed.

c. Building Load and Flow Calculations:

(1) Building load calculations:

(a.) These were completed using the *Carrier Hourly Analysis Program (HAP)* software version 5.11. See *Exhibit A* for additional load calculation information. The loads were completed using a block-load approach (one large zone per building in lieu of modeling every unique zone separately).

(b.) The total cooling load calculated for the Marion building was calculated to be 631 MBH:

Total coil load	**52.6**	Tons
Total coil load	**630.6**	MBH
Sensible coil load	**619.6**	MBH
Coil CFM at Jul 1500	**25876**	CFM
Max block CFM at Jul 1500	**28998**	CFM
Sum of peak zone CFM	**28998**	CFM
Sensible heat ratio	**0.983**	
CFM/Ton	**492.4**	
ft^2/Ton	**244.0**	
BTU/(hr·ft^2)	**49.2**	
Water flow @ 10.0 °F rise	**N/A**	

(c.) The current chiller capacity is estimated to be approximately 50-tons with derating for altitude/air density, which is 630 MBH. This chiller appears to be properly sized.

B. HVAC AIRSIDE EQUIPMENT

1. Air Handling Units: Jill and Donald Tishman Hall

a. AHU-1: This unit was originally installed in the mechanical penthouse on the second floor of the Tishman building. The unit was originally designed to be a built-up air handling unit with outside air, return air, a hot water heating coil, a chilled water-cooling coil, cartridge filters and an electric steam humidifier with a dedicated reverse osmosis unit.

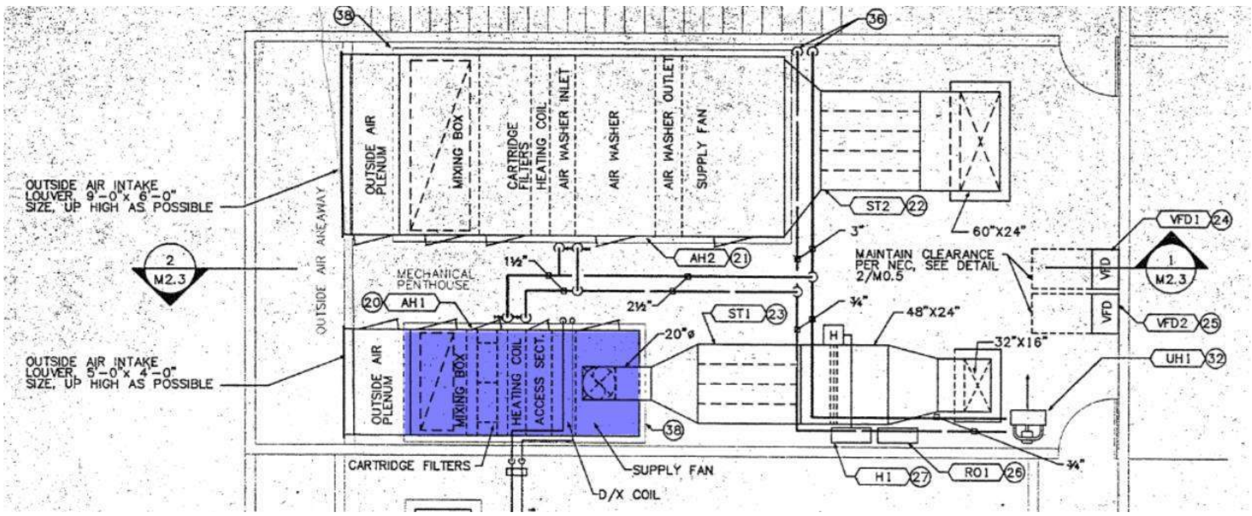


Figure 10 - Tishman Penthouse - AHU-1

b. This is no longer the case, as it appears AHU-1 was removed some time ago and replaced with a DX, refrigerated air, vertical modular fan coil with electric heat manufactured by Trane – Model# TAM4A0A36. This unit does not appear to incorporate outside air and serves areas previously identified as A.V. Equipment 115, Copy Stand 114, Visual Resource Library 116 and the central courtyard building previously identified as the Art History Research Library 111. These areas also include CAVs with reheat coils for heating.

(1) Size/Capacity:

(a.) The original size of AHU-1 was a 6,000 CFM unit with a heating capacity of 145.5 MBH and a cooling capacity of 188 MBH. This unit served areas immediately below the penthouse, but also the central courtyard building. The vertical fan coil that is installed in the place of AHU-1 has the capability to provide 1,200 CFM and approximately 3 tons of cooling or 36 MBH. The size of the electric heater was unable to be verified.

(2) Age:

(a.) This particular unit has been manufactured since 2016 and is relatively new putting it at approximately 6 years old. According to *ASHRAE*, the maximum serviceable lifespan of a DX cooling coil is 20 years and the maximum serviceable lifespan of a centrifugal fan is 25 years.

(3) Condition/History:

(a.) The unit appears to be in good condition. It is unknown how well it has been maintained. The liquid piping is uninsulated.

Figure 11 - AHU-1 Replacement Fan Coil

c. AHU-2: This unit is currently in place and part of the original construction. It is a built-up air handler with modular sections each for a mixing box, filters, a hot water heating coil, a chilled water-cooling coil and a supply fan section manufactured by Trane. It was originally designed to have an air washer/evaporative section that has since been removed and replaced with a chilled water coil.

Figure 12 - AHU-2

(1) Age:

(a.) The existing AHU is from the original construction, which would make it approximately 25 years old. According to *ASHRAE*, the maximum serviceable lifespan of a built-up air handler varies, as there are many components. The coils are typically good if well maintained up to 20 years, while the centrifugal fans typically have a maximum serviceable life of 25 years. This is provided the AHU has been properly installed and maintained, as well as no damage or unforeseen wear and tear has occurred throughout the AHU's lifespan.

(2) Condition/History:

(a.) AHU-2 appears to be well maintained, given that it is 25 years old. The old air washer section shows some water damage and rust, but this can be easily repaired. The heating coil is original and has some corrosion issues near the bottom of the coil, likely from being exposed to the excess moisture from the old air washer. The cooling coil appears to be in great condition, likely because it is much newer than the heating coil. The unit was not running at the time of observation, so it is unknown if the supply fan is in good working condition, but upon visual inspection it appeared to be in moderate condition, while the motor looked to be in good condition and more recently replaced (+/- 5-10 years). The size of the currently installed motor (20 HP) is less than what was originally designed: 20 HP. See more on this in the recommendations section of the report.

Figure 13 - AHU-2 Supply Fan

Figure 14 - AHU-2 Cooling Coil

Figure 15 - AHU-2 Heating Coil and Air Washer Damage to Pan and Coil

Figure 16 - AHU-2 Cartridge Filters

Figure 17 - AHU-2 Pleated Pre-Filters

Figure 18 - AHU-2 Existing Damper Actuator

Figure 19 - AHU-2 Outside Air Plenum and Debris

a. AHU-3: This unit is currently in place and part of the original construction. It is a built-up air handler with modular sections each for a mixing box, filters, a hot water heating coil, a chilled water-cooling coil and a supply fan section manufactured by Trane. It was originally designed to have an air washer/evaporative section that has since been removed and replaced with a chilled water coil.

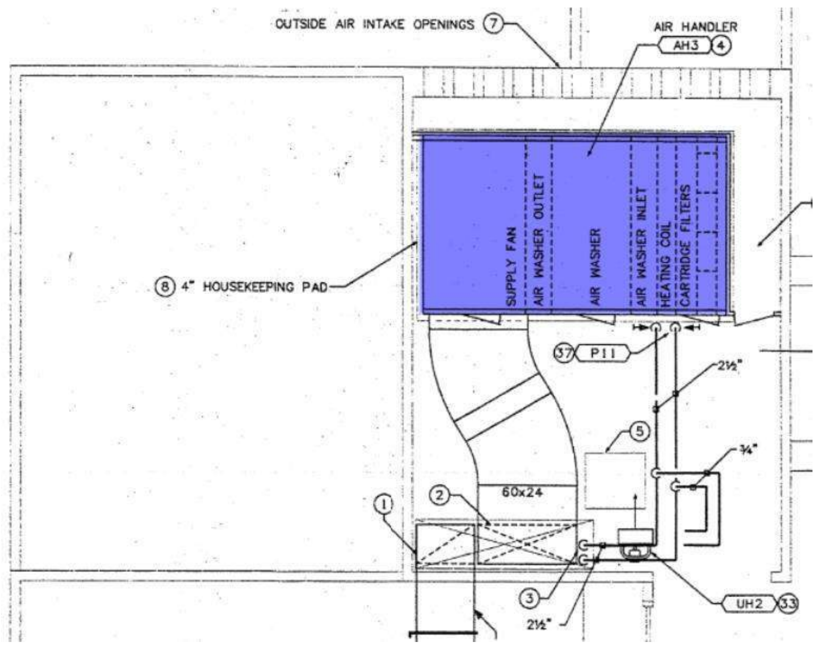


Figure 20 - Tishman Hall AHU-3

(1) Age:

(a.) The existing AHU is from the original construction, which would make it approximately 25 years old. According to *ASHRAE*, the maximum serviceable lifespan of a built-up air handler varies, as there are many components. The coils are typically good if well maintained up to 20 years, while the centrifugal fans typically have a maximum serviceable life of 25 years. This is provided the AHU has been properly installed and maintained, as well as no damage or unforeseen wear and tear has occurred throughout the AHU's lifespan.

Figure 21 - AHU-3

(2) Condition/History:

(a.) AHU-3 appears to be in moderate-to-good condition and appears well maintained. The old air washer section shows water damage and rust that should be repaired. This has also affected the cabinet floor and door to this section that should also be sealed/repaired. The heating coil is original and has some corrosion issues near the bottom of the coil, likely from being exposed to the excess moisture from the old air washer. The cooling coil appears to be in great condition. The unit was not running at the time of observation, so it is unknown if the supply fan is in good working condition, but upon visual inspection it appeared to be in moderate condition. There is some rust and corrosion on the supply fan, but nothing significant. The motor looked to be in good condition and more recently (+/- 5-10 years) replaced. The size of the currently installed motor (15 HP) is significantly less than what was originally designed: 25 HP. See more on this in the recommendations section of the report.

Figure 22 - AHU-3 Supply Fan and Motor

Figure 23 - AHU-3 Air Washer Water Damage

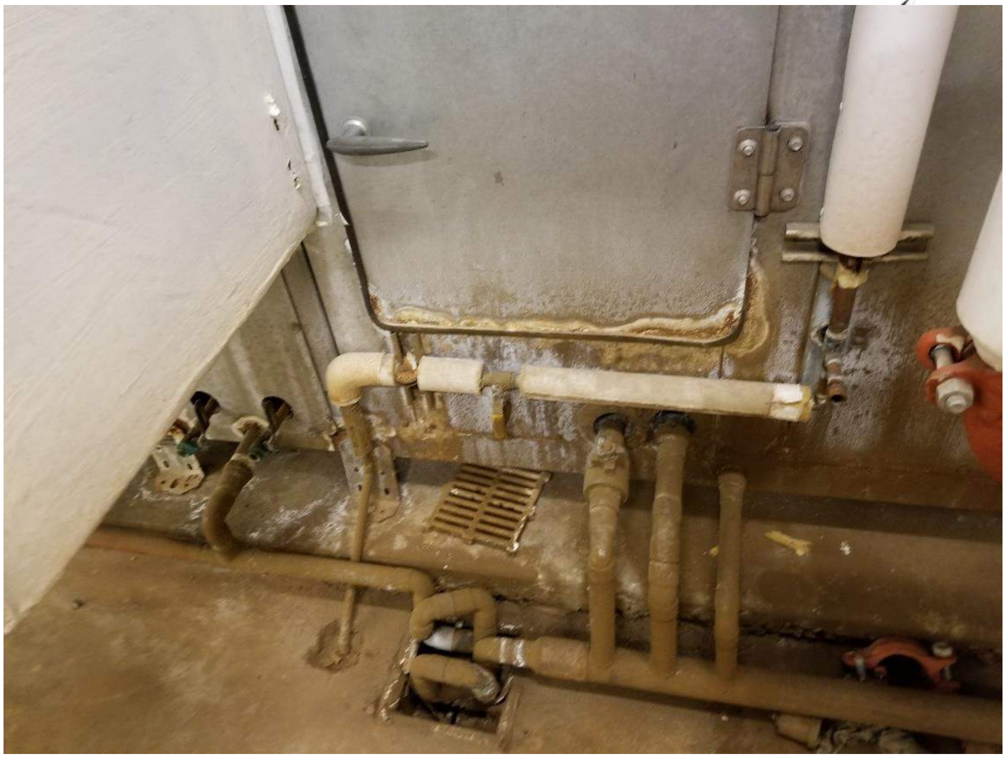


Figure 24 - AHU-3 Cabinet and Door Corrosion

2. Air Handling Units: The Anne & John Marion Center for Photographic Arts

   a. AHU-6: This unit is currently in place and part of the original construction. It is a built-up air handler with modular sections each for a mixing box, filters, a hot water heating coil, a chilled water-cooling coil and a supply fan section manufactured by Trane. It was originally designed to have an air washer/evaporative section that has since been removed and replaced with a chilled water coil.

Figure 25 - AHU-6

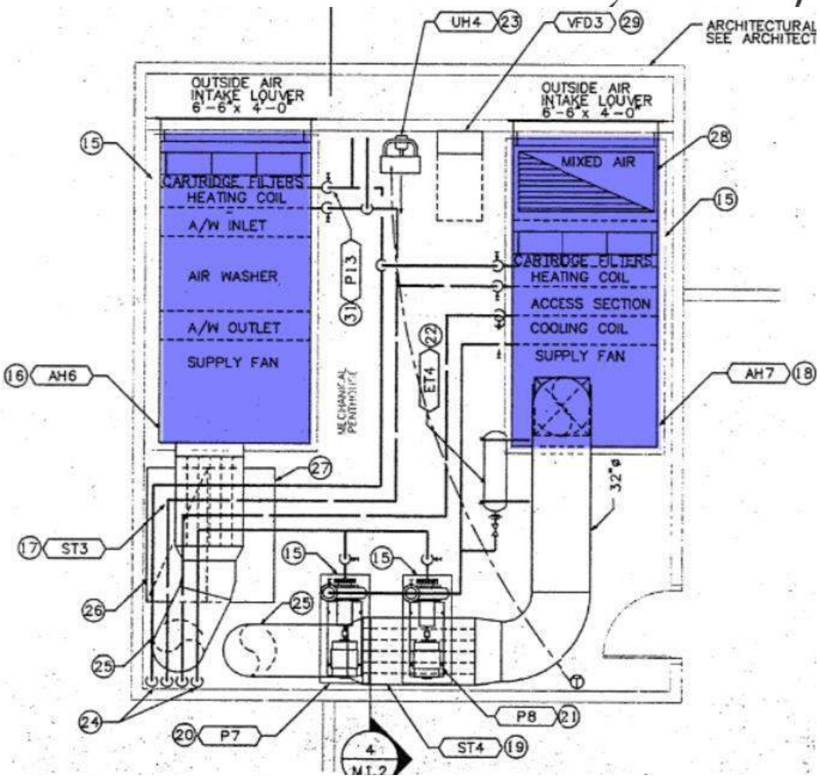


Figure 26 - AHU-6 & AHU-7

(1) Age:

(a.) The existing AHU is from the original construction, which would make it approximately 25 years old. According to *ASHRAE*, the maximum serviceable lifespan of a built-up air handler varies, as there are many components. The coils are typically good if well maintained up to 20 years, while the centrifugal fans typically have a maximum serviceable life of 25 years. This is provided the AHU has been properly installed and maintained, as well as no damage or unforeseen wear and tear has occurred throughout the AHU's lifespan.

(2) Condition/History:

(a.) AHU-6 appears to be in good condition and appears well maintained. The old air washer section does not show significant rust or corrosion. The heating coil is original appears to be in good condition but needs to be cleaned as it appears the unit was in operation without the filters properly installed. The cooling coil appears to be in great condition. The unit was not running at the time of observation, so it is unknown if the supply fan is in good working condition, but upon visual inspection it appeared to be in moderate condition. There is some rust and corrosion on the supply fan, but nothing significant. The motor looked to be well-used and possibly in need of replacement. The size of the currently installed motor (5 HP) is also less than what was originally designed: 15 HP. See more on this in the recommendations section of the report.

Figure 27 - AHU-6 Heating Coil and Old Air Washer Section

Figure 28 – AHU-6 Filter Section and Dirty Backside of Heating Coil

Figure 29 - AHU-6 Supply Fan and Motor

a. AHU-7: This unit is currently in place and part of the original construction. It is a built-up air handler with modular sections each for a mixing box, filters, a hot water heating coil, a chilled water-cooling coil and a supply fan section manufactured by Trane.

(1) Age:

(a.) The existing AHU is from the original construction, which would make it approximately 25 years old. According to *ASHRAE*, the maximum serviceable lifespan of a built-up air handler varies, as there are many components. The coils are typically good if well maintained up to 20 years, while the centrifugal fans typically have a maximum serviceable life of 25 years. This is provided the AHU has been properly installed and maintained, as well as no damage or unforeseen wear and tear has occurred throughout the AHU's lifespan.

(2) Condition/History:

(a.) AHU-7 appears to be in good condition. The heating coil is original appears to be in good condition but needs to be cleaned as it appears the unit was in operation with dirty or compromised filters. The cooling coil appears to be in great condition but also needs to be cleaned due to dust/dirt carry-over. Temperature sensors and freeze stat wiring was compromised and needs to be replaced. The mixed air/outside air dampers have an actuator with exposed wiring and likely a faulty actuator. An electrical junction box on the exterior of the unit was open with wires exposed. The unit was not running at the time of observation, so it is unknown if the supply fan is in good working condition, but upon visual inspection it appeared to be in good condition. The motor looked to be in good condition and replaced in the past 5-10 years. The filters were dirty and in need of replacement.

Figure 30 - AHU-7

Figure 31 - AHU-7 Supply Fan and Motor Section

Figure 32 - AHU-7 Coils with Loose Sensor Wiring

Figure 33 - AHU-7 Dirty Filters

Figure 34 - AHU-7 Old Actuator

Figure 35- AHU-7 Open J-Box

Figure 36 - AHU-7 Dirty Coil

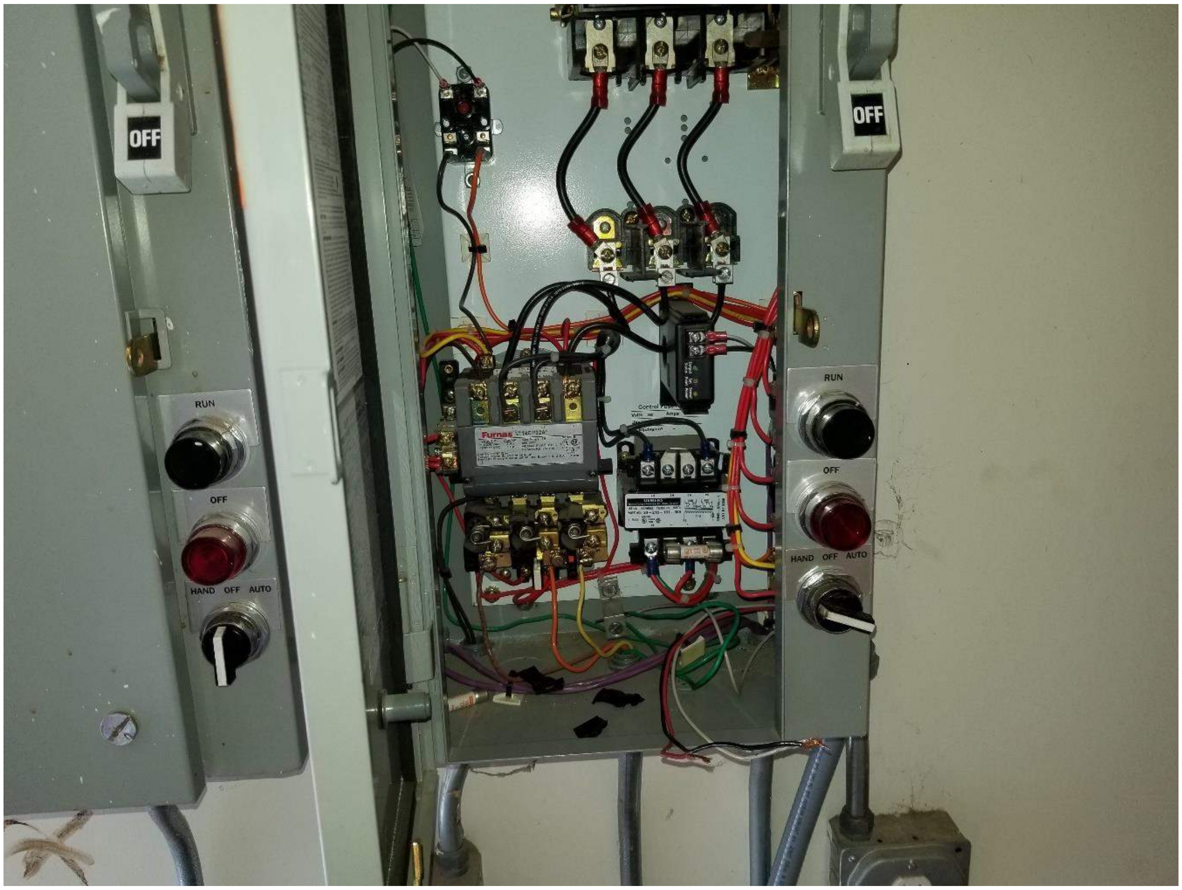


Figure 37 - AHU-6/AHU-7 Hydronic Pump Disconnect

(b.) Though review of electrical systems were not included in the scope of work, it was noted that one of the pumps disconnects/controls was opened and disabled. This will need to be addressed in order to have an operational system.

3. Rooftop Unit: Tipton Hall

a. RTU-1: This rooftop unit is currently in place and part of the original construction. It is a packaged rooftop unit with a natural-gas, indirect-fired furnace and DX-cooling. The unit is manufactured by Trane and is a 25-ton *Voyager* model #YCD300B4HGFA and utilized R-22 for refrigerant, which has been phased out and no longer available other than reclamation or existing stock. The unit is standard efficiency and has 2 scroll compressors and a single-speed supply fan.

(1) Age:

(a.) The existing RTU is from the original construction, which would make it approximately 25 years old. According to *ASHRAE*, the maximum serviceable lifespan of a single-zone packaged RTU is 15 years.

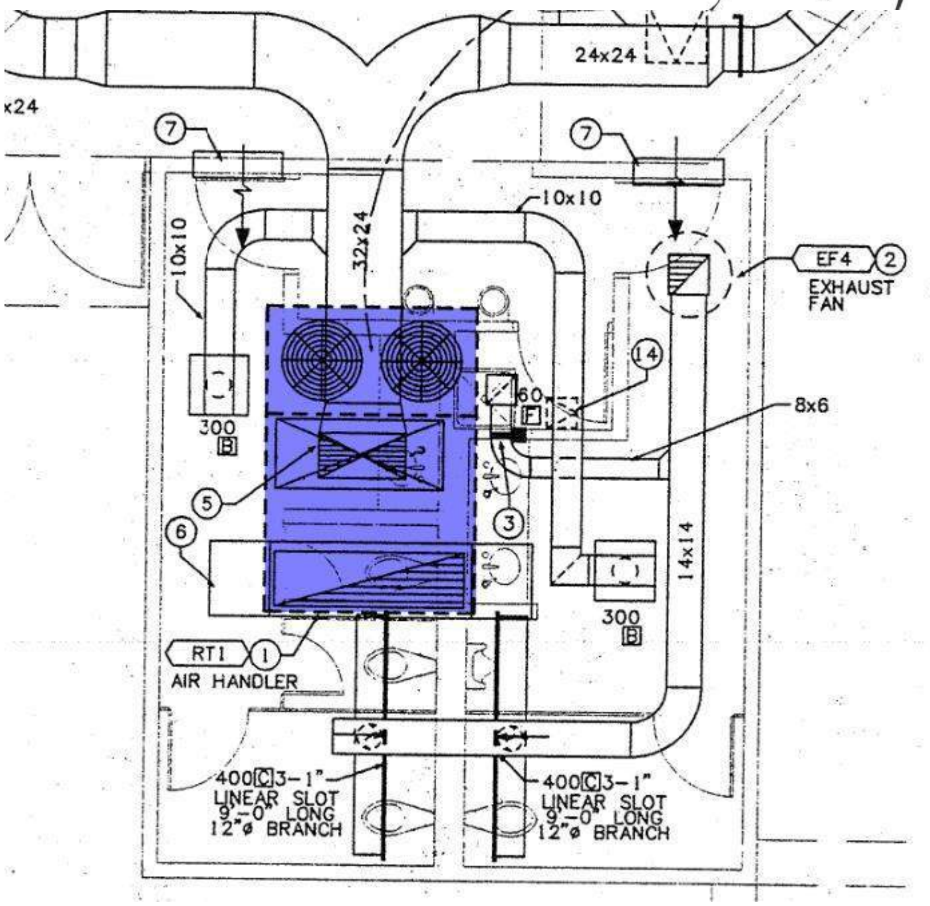


Figure 38 - RTU-1 - Tipton Hall

(2) Condition/History:

(a.) RTU-1 appears to be in poor condition. At the time of observation, the access panels for the coil and fan were laying on the ground and it appears had been for some time. It could be assumed there is water damage, as well, as the cabinet shows signs of rust and corrosion is areas that typically do not exhibit this type of condition through operation. It is likely the compressors are inoperable and not charged, but this could not be verified. It is also unknown if the supply fan is operational. The evaporator coil is damaged, likely from hail.

Figure 39 - RTU-1 - Tipton Hall

Figure 40 - RTU-1 - Evaporator Coil

Figure 41 - RTU-1 - Open Access Panels: Coil + Supply Fan

4. Rooftop Unit: The Anne & John Marion Center for Photographic Arts

a. RTU-1M: This rooftop unit was installed in 2011 and was not part of the original design. It appears to serve the area previously designed to be *Newhall Library 138* which has been recently remodeled (assuming 2011) to include restrooms, a corridor, storage areas and a student lounge. The RTU is a DX-cooling-only packaged rooftop unit. The unit is manufactured by Trane and is a 4-ton *Precedent* model #TSC048E4R0A and utilizes R-410A for refrigerant. The unit is standard efficiency and has 1 scroll compressor and a multi-speed direct drive supply fan.

(1) Age:

(a.) The existing RTU was manufactured in 2011 which makes it 11 years old. According to *ASHRAE*, the maximum serviceable lifespan of a single-zone packaged RTU is 15 years.

(2) Condition/History:

(a.) RTU-1M appears to be in moderately good condition. The unit appears well maintained and in much better condition than the original equipment installed. It is assumed this unit relies solely on the VAV reheat terminal boxes for heating which could be a challenge in annual low temperatures. The unit was not operating at the time of observation, so it cannot be verified if the compressors are operational and charged or if the supply fan is operational.

Figure 42 - RTU-1M - Marion Hall

b. RTU-2M: This rooftop unit was also installed in 2011 and was not part of the original design. It appears to serve the area directly below the unit previously designed to be *Digital 110*, *Finishing 111*, and potentially *Non-Silver 115* and *Advance Large 116* spaces, as well. The RTU is a DX-cooling-only packaged rooftop unit. The unit is manufactured by Trane and is a 4-ton *Precedent* model #TSC048E4R0A and utilizes R-410A for refrigerant. The unit is standard efficiency and has 1 scroll compressor and a multi-speed direct drive supply fan.

(1) Age:

(a.) The existing RTU was manufactured in 2011 which makes it 11 years old. According to *ASHRAE*, the maximum serviceable lifespan of a single-zone packaged RTU is 15 years.

(2) Condition/History:

(a.) RTU-2M appears to be in moderately good condition. The unit appears well maintained and in much better condition than the original equipment installed. It is assumed this unit relies solely on the VAV reheat terminal boxes for heating which could be a challenge in annual low temperatures. The unit was not operating at the time of observation, so it cannot be verified if the compressors are operational and charged or if the supply fan is operational.

Figure 43 - RTU-2M - Marion Hall

Figure 44 - RTU-2M - Marion Hall

5 ASSESSMENT RECOMMENDATIONS

A. THAW/TISHMAN BOILERS & PUMPS

1. Boilers:

a. Due to the knowledge that the basement flooded, the inability to test and diagnose operation, that fact that the heat exchangers are completely impacted and the fact that the boilers have a max capacity of 90 GPM, Maxson and B&D recommend that these boilers are removed and replaced. Maxson recommends replacing these boilers with high efficiency, condensing boilers sized at the appropriate capacity as the building loads require. It is also recommended that three modular boilers are installed in lieu of two, due to the accessibility challenges of the basement. This will provide more efficiency and staging abilities, as well as ease installation.

2. Pumps:

a. Again, due to the knowledge that the basement flooded and the inability to test and diagnose operation, Maxson and B&D recommend that these pumps are removed and replaced with new, vertical inline centrifugal pumps to match the existing sizes of the existing pumps. Maxson also recommends that these are VFD/Premium duty pumps. See controls recommendations for more information.

3. Water Treatment:

a. The existing water treatment pot feeders and piping arrangements are recommended to be removed and a new glycol feed and water treatment system is recommended to be installed. This will ease maintenance and ensure proper water treatment is done and monitored.

B. MARION BOILERS & PUMPS

1. Boilers:

a. Due to the poor condition of the existing boilers, the inability to test and diagnose operation and that the heat exchangers are completely impacted, Maxson and B&D recommend that these boilers are removed and replaced. Maxson recommends replacing these boilers with high efficiency, condensing boilers sized at the appropriate capacity as the building loads require.

2. Pumps:

a. Due to the pumps being outside of serviceable lifespan and the inability to test and diagnose operation, Maxson and B&D recommend that these pumps are removed and replaced with new, vertical inline centrifugal pumps to match the existing sizes of the existing pumps. Maxson also recommends that these are VFD/Premium duty pumps. See controls recommendations for more information.

3. **Water Treatment:**

a. The existing water treatment pot feeders and piping arrangements are recommended to be removed and a new glycol feed and water treatment system is recommended to be installed. This will ease maintenance and ensure proper water treatment is done and monitored.

C. BOILER TYPE RECOMMENDATIONS

a. The following is information on non-condensing boilers versus condensing boilers. This explains why Maxson and B&D are recommending condensing boilers for replacements.

(1) Non-condensing Boilers

(a.) Efficiency

(i) 85% thermal efficiency @ S.L.

(b.) Derates 4% / 1000 ft. ASL

(i) 26.8% Derate @ 6700 ft.

(ii) This includes high-altitude kit.

(c.) Flow Rate

(i) 90 GPM is the max for a copper heat exchanger of this size

(ii) Existing Thaw/Tishman system is designed for 207 GPM.

(iii) Excess GPM is bypassed and mixed, which is not recommended by the boiler manufacturer and provides worse performance and control.

(2) Condensing Boilers

(a.) Efficiency

(i) 95% thermal efficiency @ S.L.

(b.) ~5% derate @ 6700 ft depending on manufacturer

(c.) Can provide 207+ GPM flow

(d.) Modular condensing boilers allow for common ventilation, eliminating two, large round flue vents.

D. THAW/TISHMAN CHILLER & PUMP

1. **Chiller:**

   a. The existing chiller appears to be in good, operating condition. It is recommended that it is serviced (if it has not been already) and that the existing controls are implemented into a new building automation system.

2. **Pump:**

   a. The existing pumps also appears to be in good, operating condition. It is recommended that the seals are checked, and the pump is serviced, if they have not already been. If AHU-1 is to be replaced as recommended (see below), this pump and piping will need to be relocated and reinstalled. See controls recommendations for more information.

3. **Water Treatment:**

   a. The existing water treatment reservoirs and piping arrangements are recommended to be removed and a new glycol feed and water treatment system is recommended to be installed. This will ease maintenance and ensure proper water treatment is done and monitored.

E. MARION CHILLER & PUMPS

1. **Chiller:**

   a. The existing chiller appears to be in good, operating condition. It is recommended that it is serviced (if it has not been already) and that the existing controls are implemented into a new building automation system.

2. **Pumps:**

   a. The existing pumps also appear to be in good, operating condition. It is recommended that the seals are checked, and the pumps are serviced, if they have not already been. The starters/disconnects need to either be replaced or reconnected to be properly implemented into the new control strategy. See controls recommendations for more information.

3. **Water Treatment:**

   a. The existing water treatment reservoirs and piping arrangements are recommended to be removed and a new glycol feed and water treatment system is recommended to be installed. This will ease maintenance and ensure proper water treatment is done and monitored.

F. HVAC AIRSIDE EQUIPMENT

1. AHU-1 (Vertical Fan Coil Replacement):

a. It is unknown how the central courtyard building is being conditioned, as that was inaccessible during site observations and data collection, but the original construction documents showed this area being served by AHU-1 and now it is not, as this newer vertical fan coil is only 3 tons compared to 15 tons. That said, this unit appears to be in good condition and in good working order, but there does not appear to be any outside air which is required by code. It is recommended that a small energy recovery ventilator ("ERV") is installed to provide a minimum of 210 CFM of outside air to the unit, connected to the return duct and an outside air louver in the penthouse.

b. The liquid line should be insulated.

c. The unit should be serviced to ensure it is in good operating condition.

2. AHU-2:

a. It is recommended that the heating coil is cleaned and finned, and the coil section is cleaned and sealed, as there are a few small holes from the previous evaporative cooler/air washer corrosion damage.

b. The fan and motor should be tested and serviced to ensure good operating condition.

c. The mixed air and outside air dampers should also be actuated and tested to ensure they are operational.

d. The filters appear to be slightly dirty and should be changed prior to operation. If the City of Santa Fe wishes to meet ASHRAE's Pandemic Task Force recommendations for airborne pathogen mitigation, the filters should be replaced with MERV13 filters, and the fan/unit should be analyzed to determine if the fan needs to be upsized as a result of the added friction loss. If this is not done, the pre-filters and the cartridge filters should be replaced at a minimum.

e. The outside air damper/screen should be cleaned of debris and the unit sections should be cleaned in general to be made free of debris and corrosion.

f. See HVAC Controls Recommendations for additional recommendations.

3. AHU-3:

a. It is recommended that the heating coil is cleaned and finned, and the coil section is cleaned and sealed, as there are a few holes and corrosion on the access door from the previous evaporative cooler/air washer corrosion damage.

b. The fan and motor should be tested and serviced to ensure good operating condition.

c. The mixed air and outside air dampers should also be actuated and tested to ensure they are operational.

d. The filters appear to be slightly dirty and should be changed prior to operation. If the City of Santa Fe wishes to meet ASHRAE's Pandemic Task Force recommendations for airborne pathogen mitigation, the filters should be replaced with MERV13 filters, and the fan/unit should be analyzed to determine if the fan needs to be upsized as a result of the added friction loss. If this is not done, the pre-filters and the cartridge filters should be replaced at a minimum.

e. The outside air damper/screen should be cleaned of debris and the unit sections should be cleaned in general to be made free of debris and corrosion.

f. See HVAC Controls and Testing, Adjusting and Recommendations for additional recommendations.

4. **AHU-6:**

a. It is recommended that the heating coil is cleaned and finned, as the coils were found to be dirty at the time of observations.

b. The fan and motor should be tested and serviced to ensure good operating condition. Even if the motor is operating to design capacity, due to the age and visual observation of the condition of the motor – the Owner may want to replace it in kind.

c. The mixed air and outside air dampers should also be actuated and tested to ensure they are operational.

d. The filters were found to be missing or not properly installed and should be replaced prior to operation. If the City of Santa Fe wishes to meet ASHRAE's Pandemic Task Force recommendations for airborne pathogen mitigation, the filters should be replaced with MERV13 filters, and the fan/unit should be analyzed to determine if the fan needs to be upsized as a result of the added friction loss. If this is not done, the pre-filters and the cartridge filters should be replaced at a minimum.

e. The outside air damper/screen should be cleaned of debris and the unit sections should be cleaned in general to be made free of debris and corrosion.

f. See HVAC Controls and Testing, Adjusting and Recommendations for additional recommendations.

5. **AHU-7:**

a. It is recommended that the heating coil and the cooling coil is cleaned and finned, as the coils were found to be dirty at the time of observations.

b. The fan and motor should be tested and serviced to ensure good operating condition. Even if the motor is operating to design capacity, due to the age and visual observation of the condition of the motor – the Owner may want to replace it in kind.

c. The temperature sensors and freeze stat wiring should be replaced.

d. The mixed air and outside air dampers should be repaired or replaced. If they are repaired, they should be actuated and tested to ensure they are operational.

e. Electrical J-Box on exterior of unit should be covered.

f. The filters were found to be dirty and should be replaced prior to operation. If the City of Santa Fe wishes to meet ASHRAE's Pandemic Task Force recommendations for airborne pathogen mitigation, the filters should be replaced with MERV13 filters, and the fan/unit should be analyzed to determine if the fan needs to be upsized as a result of the added friction loss. If this is not done, the pre-filters and the cartridge filters should be replaced at a minimum.

g. The outside air damper/screen should be cleaned of debris and the unit sections should be cleaned in general to be made free of debris and corrosion.

h. See HVAC Controls and Testing, Adjusting and Recommendations for additional recommendations.

6. **RTU-1:**

a. It is recommended that this unit is replaced in kind with a new, packaged rooftop unit with natural-gas-fired indirect heating and DX-cooling. The unit should be high-efficiency, multi-speed with a variable compressor and integrated into the proposed controls system.

b. If the City of Santa Fe wishes to meet ASHRAE's Pandemic Task Force recommendations for airborne pathogen mitigation, the replacement unit should be provided and designed to include MERV13 filters.

c. See HVAC Controls Recommendations for additional recommendations.

7. **RTU-1M:**

a. Provided the VAV re-heat terminal box is sized adequately for low discharge air temperatures, it is recommended this unit is serviced to ensure the compressors/refrigerant is charged per manufacturer's recommendations and the fan is verified to be operational.

b. The filters should be replaced. If the City of Santa Fe wishes to meet ASHRAE's Pandemic Task Force recommendations for airborne pathogen mitigation, the filters should be replaced with MERV13 filters, and the fan/unit should be analyzed to determine if the fan needs to be upsized as a result of the added friction loss. If this is not done, the filters should be replaced with MERV 8 efficiency filters at a minimum.

c. See HVAC Controls Recommendations for additional recommendations.

8. **RTU-2M:**

   a. Provided the VAV re-heat terminal box is sized adequately for low discharge air temperatures, it is recommended this unit is serviced to ensure the compressors/refrigerant is charged per manufacturer's recommendations and the fan is verified to be operational.

   b. The filters should be replaced. If the City of Santa Fe wishes to meet ASHRAE's Pandemic Task Force recommendations for airborne pathogen mitigation, the filters should be replaced with MERV13 filters, and the fan/unit should be analyzed to determine if the fan needs to be upsized as a result of the added friction loss. If this is not done, the filters should be replaced with MERV 8 efficiency filters at a minimum.

   c. See HVAC Controls Recommendations for additional recommendations.

G. HVAC CONTROLS

1. The controls were not completely analyzed, because after speaking with the City of Santa Fe and B&D it was explained that the controls are bypassed, and the systems were made to "run rogue" in order to maintain temperatures and the facility operation prior to equipment being decommissioned.

2. The controls that were visually observed were manufactured and provided by Trane. The existing HVAC controls are outdated, and part of the original construction and it is recommended that the controls are completely replaced with a few exceptions. The following devices, equipment and control items are recommended to be replaced:

   (1) Hydronic control valves

   (2) Heating water pumps (Add variable frequency drives + controls)

   (3) Chilled water pumps to remain, add controls

   (4) AHU control devices:

      (a.) Actuators

      (b.) Control valves

      (c.) Temperature sensors

      (d.) Differential pressure transmitters (both air and hydronic)

      (e.) Airflow stations

   (5) Terminal VAV units

   (6) Terminal CAV units

(7) Zone sensors

(8) RTU-1 + Controls

(9) Main controller cabinet

(10) AHU controllers

b. It is recommended that the following are evaluated, tested and serviced to ensure they are operational:

(1) AHU and RTU supply fan motors

(2) Variable frequency drives

(3) RTU-1M/2M thermostats and controls operation

c. A new building automation system (BAS), central controller and operator station will also need to be provided if the controls are to work correctly and the sequences of operations are implemented. It is recommended that a non-proprietary manufacturer is provided with an open protocol such as BACNet or Alerton. It is recommended that the BAS system is tied to the City of Santa Fe central system for monitoring and maintenance.

H. TESTING, ADJUSTING AND BALANCING

1. AHU-2, AHU-3 & AHU-6: These units were installed with motor sizes less than what is shown in the original construction documents, some significantly so. This is not unusual, as once actual units are selected by the manufacturer's representatives it is often found that the desired airflows can be achieved with smaller motors than those originally specified. Regardless, it is recommended that these systems are tested to verify that the total air volumes shown for these units are achievable with the motors installed.

2. Overall: It is recommended that all existing and proposed AHUs, terminal boxes, diffusers, registers, pumps, control valves, volume dampers and devices associated with controlling the flow of air or hydronic heating/cooling water are tested, adjusted and balanced to meet the requirements of the original design documents.

6 ATTACHMENTS

A. EXHIBIT A – BLOCK LOAD BUILDING ANALYSIS

Exhibit A

Air System Sizing Summary for Marion Boilers/Chillers

Project Name: 22002 - CoSF Visual Arts Center HVAC Assessment 07/01/2022
Prepared by: Maxson Engineering 10:05AM

Air System Information

Air System Name	**Marion Boilers/Chillers**		Number of zones	**1**	
Equipment Class	**PKG ROOF**		Floor Area	**12823.0**	ft²
Air System Type	**VAV**		Location	**Santa Fe, New Mexico**	

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Peak zone sensible load**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

Central Cooling Coil Sizing Data

Total coil load	**52.6**	Tons	Load occurs at	**Jul 1500**	
Total coil load	**630.6**	MBH	OA DB / WB	**93.0 / 65.0**	°F
Sensible coil load	**619.6**	MBH	Entering DB / WB	**83.5 / 62.4**	°F
Coil CFM at Jul 1500	**25876**	CFM	Leaving DB / WB	**55.0 / 53.0**	°F
Max block CFM at Jul 1500	**28998**	CFM	Coil ADP	**51.8**	°F
Sum of peak zone CFM	**28998**	CFM	Bypass Factor	**0.100**	
Sensible heat ratio	**0.983**		Resulting RH	**49**	%
CFM/Ton	**492.4**		Design supply temp.	**55.0**	°F
ft²/Ton	**244.0**		Zone T-stat Check	**1 of 1**	OK
BTU/(hr·ft²)	**49.2**		Max zone temperature deviation	**0.0**	°F
Water flow @ 10.0 °F rise	**N/A**				

Preheat Coil Sizing Data

Max coil load	**559.7**	MBH	Load occurs at	**Des Htg**	
Coil CFM at Des Htg	**24890**	CFM	Ent. DB / Lvg DB	**23.2 / 50.0**	°F
Max coil CFM	**28998**	CFM			
Water flow @ 20.0 °F drop	**56.00**	gpm			

Supply Fan Sizing Data

Actual max CFM at Jul 1500	**28998**	CFM	Fan motor BHP	**0.00**	BHP
Standard CFM	**22546**	CFM	Fan motor kW	**0.00**	kW
Actual max CFM/ft²	**2.26**	CFM/ft²	Fan static	**0.00**	in wg

Outdoor Ventilation Air Data

Design airflow CFM	**14000**	CFM	CFM/person	**163.77**	CFM/person
CFM/ft²	**1.09**	CFM/ft²			

APPENDIX A

Air System Information

Air System Name .... **Marion Boilers/Chillers**
Equipment Class .... **PKG ROOF**
Air System Type .... **VAV**

Number of zones **1**
Floor Area .... **12823.0** ft²
Location .... **Santa Fe, New Mexico**

Sizing Calculation Information

Calculation Months .... **Jan to Dec**
Sizing Data .... **Calculated**

Zone CFM Sizing .... **Peak zone sensible load**
Space CFM Sizing .... **Individual peak space loads**

Zone Terminal Sizing Data

Zone Name	Design Supply Airflow (CFM)	Minimum Supply Airflow (CFM)	Zone CFM/ft²	Reheat Coil Load (MBH)	Reheat Coil Water gpm @ 20.0 °F	Zone Htg Unit Coil Load (MBH)	Zone Htg Unit Water gpm @ 20.0 °F	Mixing Box Fan Airflow (CFM)
Zone 1	28998	24890	2.26	836.0	-	0.0	-	0

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	414.0	Jul 1500	522.5	12823.0

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Marion Center	1	414.0	Jul 1500	28998	522.5	12823.0	2.26

APPENDIX A

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1500 COOLING OA DB / WB 93.0 °F / 65.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -10.0 °F / -10.0 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	3248 ft²	151946	-	3248 ft²	-	-
Wall Transmission	15842 ft²	24489	-	15842 ft²	57821	-
Roof Transmission	11823 ft²	25792	-	11823 ft²	26420	-
Window Transmission	2248 ft²	23356	-	2248 ft²	116896	-
Skylight Transmission	1000 ft²	10390	-	1000 ft²	52000	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	12823 ft²	0	-	12823 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	12823 W	43751	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	12823 W	43752	-	0	0	-
People	85	20944	17525	0	0	0
Infiltration	-	31900	-936	-	182283	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 10%	37632	1659	20%	87084	0
>> Total Zone Loads	**-**	**413951**	**18248**	**-**	**522504**	**0**
Zone Conditioning	-	376702	18248	-	503141	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Return Fan Load	11876 CFM	0	-	10890 CFM	0	-
Ventilation Load	14000 CFM	242909	-7244	14000 CFM	892582	0
Supply Fan Load	25876 CFM	0	-	24890 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**619611**	**11004**	**-**	**1395723**	**0**
Central Cooling Coil	-	619611	11005	-	0	0
Preheat Coil	-	0	-	-	559716	-
Terminal Reheat Coils	-	0	-	-	836007	-
>> Total Conditioning	**-**	**619611**	**11005**	**-**	**1395723**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

APPENDIX A

July DESIGN COOLING DAY, 1500

TABLE 1: SYSTEM DATA

Component	Location	Dry-Bulb Temp (°F)	Specific Humidity (lb/lb)	Airflow (CFM)	CO2 Level (ppm)	Sensible Heat (BTU/hr)	Latent Heat (BTU/hr)
Ventilation Air	Inlet	93.0	0.01061	14000	400	242909	-7244
Vent - Return Mixing	Outlet	83.5	0.01067	25876	435	-	-
Preheat Coil	Outlet	83.5	0.01067	25876	435	0	-
Central Cooling Coil	Outlet	55.0	0.01056	25876	435	619611	11005
Supply Fan	Outlet	55.0	0.01056	25876	435	0	-
Cold Supply Duct	Outlet	55.0	0.01056	25876	435	-	-
Zone Air	-	72.3	0.01075	25876	477	376702	18248
Zone Direct Exhaust	Outlet	72.3	0.01075	14000	477	-	-
Return Plenum	Outlet	72.3	0.01075	11876	477	0	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1.080; At site altitude = 0.840 BTU/(hr-CFM-F)
Air Density x Heat of Vaporization x Conversion Factor: At sea level = 4746.6; At site altitude = 3690.5 BTU/(hr-CFM)
Site Altitude = 6800.0 ft

TABLE 2: ZONE DATA

Zone Name	Zone Sensible Load (BTU/hr)	T-stat Mode	Zone Cond (BTU/hr)	Zone Temp (°F)	Zone Airflow (CFM)	CO2 Level (ppm)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
Zone 1	413951	Cooling	376702	72.3	25876	477	0	0

APPENDIX A

WINTER DESIGN HEATING

TABLE 1: SYSTEM DATA

Component	Location	Dry-Bulb Temp (°F)	Specific Humidity (lb/lb)	Airflow (CFM)	CO2 Level (ppm)	Sensible Heat (BTU/hr)	Latent Heat (BTU/hr)
Ventilation Air	Inlet	-10.0	0.00059	14000	400	-892582	0
Vent - Return Mixing	Outlet	23.2	0.00059	24890	406	-	-
Preheat Coil	Outlet	50.0	0.00059	24890	406	559716	-
Central Cooling Coil	Outlet	50.0	0.00059	24890	406	0	0
Supply Fan	Outlet	50.0	0.00059	24890	406	0	-
Cold Supply Duct	Outlet	50.0	0.00059	24890	406	-	-
Zone Air	-	65.9	0.00059	24890	415	-503141	0
Zone Direct Exhaust	Outlet	65.9	0.00059	14000	415	-	-
Return Plenum	Outlet	65.9	0.00059	10890	415	0	-

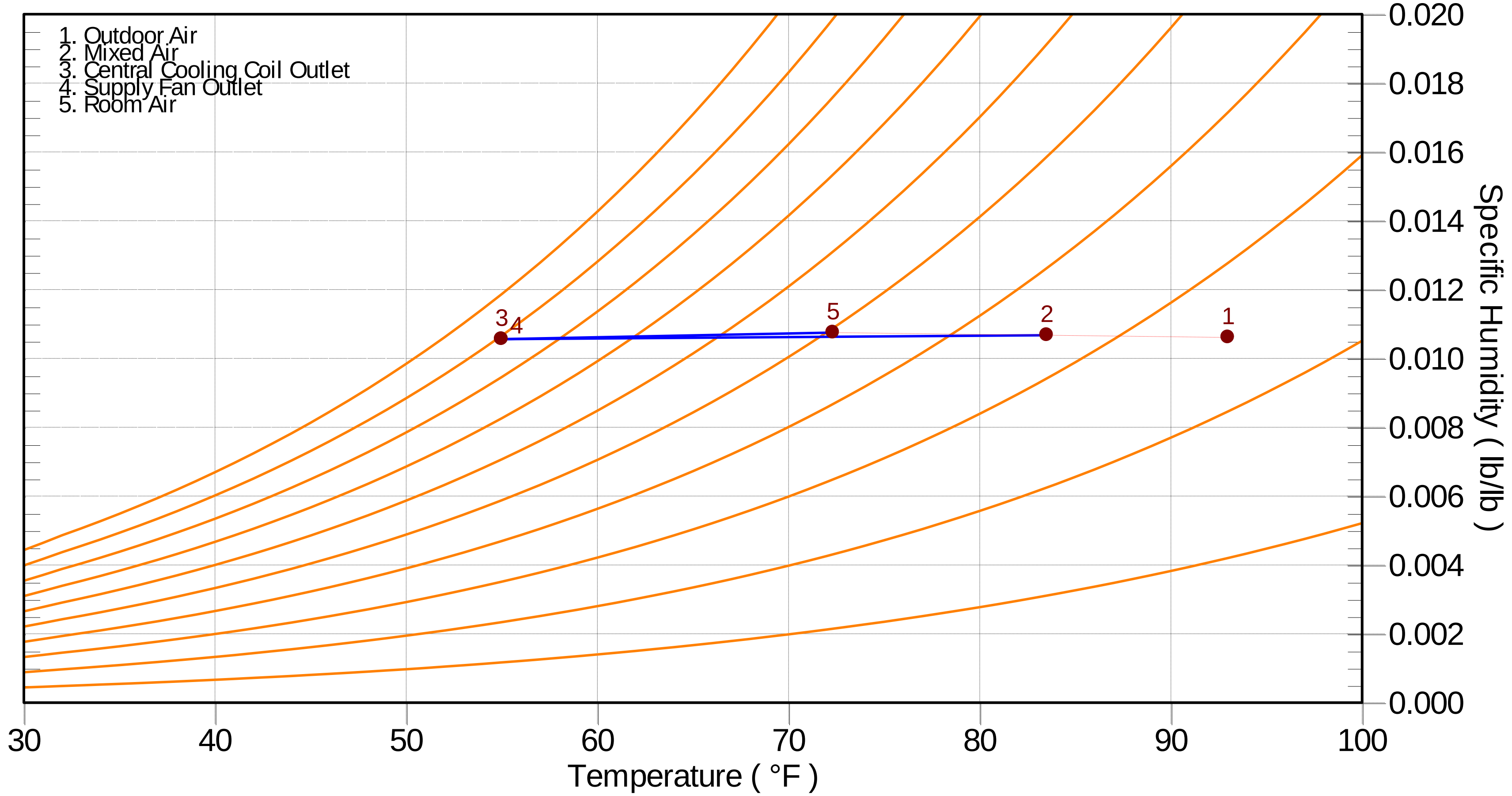
Air Density x Heat Capacity x Conversion Factor: At sea level = 1.080; At site altitude = 0.840 BTU/(hr-CFM-F)
Air Density x Heat of Vaporization x Conversion Factor: At sea level = 4746.6; At site altitude = 3690.5 BTU/(hr-CFM)
Site Altitude = 6800.0 ft

TABLE 2: ZONE DATA

Zone Name	Zone Sensible Load (BTU/hr)	T-stat Mode	Zone Cond (BTU/hr)	Zone Temp (°F)	Zone Airflow (CFM)	CO2 Level (ppm)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
Zone 1	-522504	Heating	-503141	65.9	24890	415	836007	0

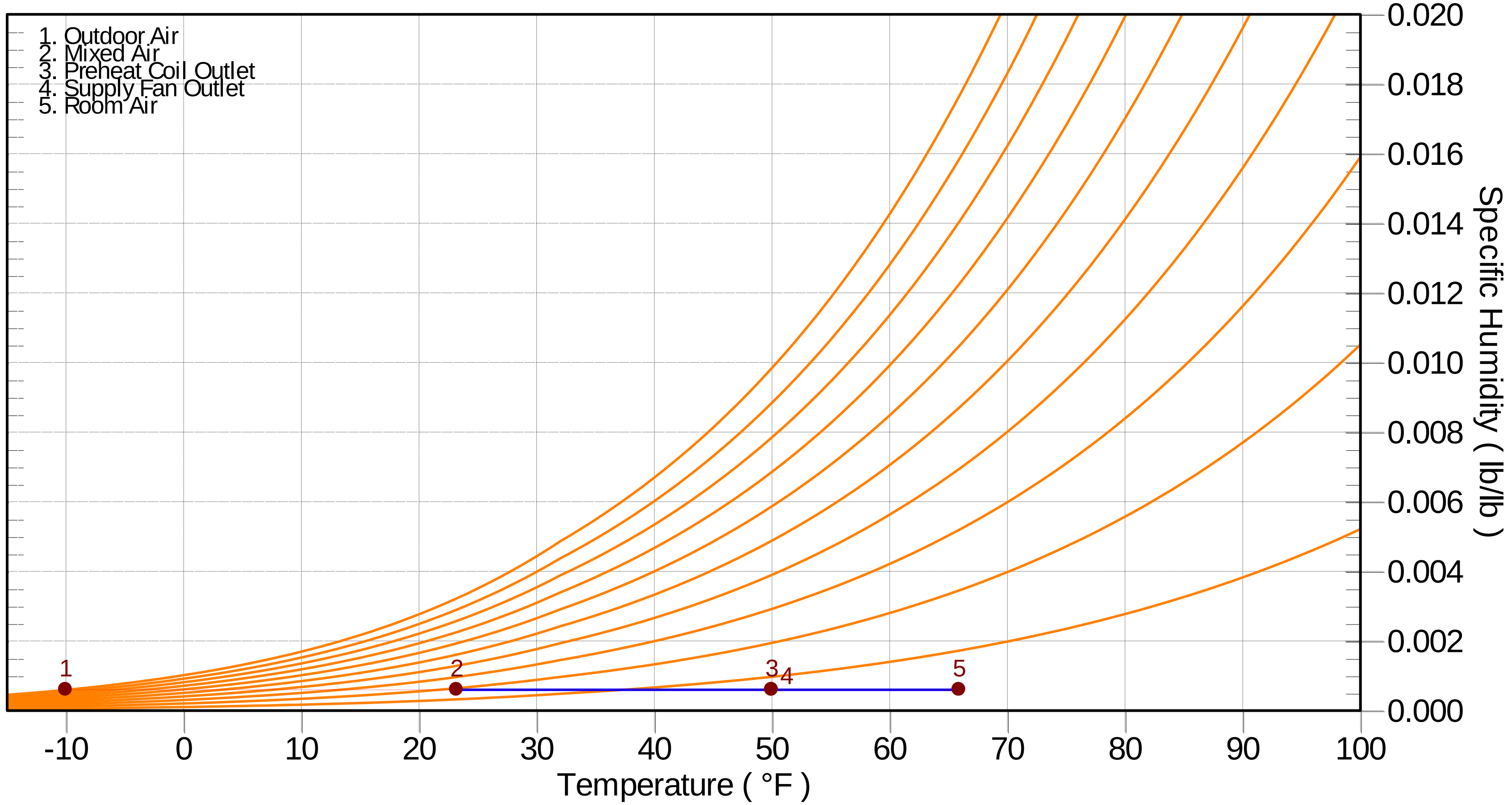
APPENDIX A

Location: Santa Fe, New Mexico
Altitude: 6800.0 ft.
Data for: July DESIGN COOLING DAY, 1500



APPENDIX A

Location: Santa Fe, New Mexico
Altitude: 6800.0 ft.
Data for: WINTER DESIGN HEATING



APPENDIX A

Air System Information

Air System Name	**Thaw/Tishman Boilers/Chillers**		Number of zones	**1**	
Equipment Class	**PKG ROOF**		Floor Area	**27664.0**	ft²
Air System Type	**VAV**		Location	**Santa Fe, New Mexico**	

Sizing Calculation Information

Calculation Months	**Jan to Dec**	Zone CFM Sizing	**Peak zone sensible load**
Sizing Data	**Calculated**	Space CFM Sizing	**Individual peak space loads**

Central Cooling Coil Sizing Data

Total coil load	**54.3**	Tons	Load occurs at	**Jul 1500**	
Total coil load	**651.6**	MBH	OA DB / WB	**93.0 / 65.0**	°F
Sensible coil load	**631.7**	MBH	Entering DB / WB	**81.1 / 61.9**	°F
Coil CFM at Jul 1500	**28833**	CFM	Leaving DB / WB	**55.0 / 53.2**	°F
Max block CFM at Jul 1600	**32967**	CFM	Coil ADP	**52.1**	°F
Sum of peak zone CFM	**32967**	CFM	Bypass Factor	**0.100**	
Sensible heat ratio	**0.970**		Resulting RH	**50**	%
CFM/Ton	**531.0**		Design supply temp.	**55.0**	°F
ft²/Ton	**509.5**		Zone T-stat Check	**1 of 1**	OK
BTU/(hr·ft²)	**23.6**		Max zone temperature deviation	**0.0**	°F
Water flow @ 10.0 °F rise	**N/A**				

Preheat Coil Sizing Data

Max coil load	**294.3**	MBH	Load occurs at	**Des Htg**	
Coil CFM at Des Htg	**23193**	CFM	Ent. DB / Lvg DB	**34.9 / 50.0**	°F
Max coil CFM	**32967**	CFM			
Water flow @ 20.0 °F drop	**29.44**	gpm			

Supply Fan Sizing Data

Actual max CFM at Jul 1600	**32967**	CFM	Fan motor BHP	**0.00**	BHP
Standard CFM	**25632**	CFM	Fan motor kW	**0.00**	kW
Actual max CFM/ft²	**1.19**	CFM/ft²	Fan static	**0.00**	in wg

Outdoor Ventilation Air Data

Design airflow CFM	**13500**	CFM	CFM/person	**73.20**	CFM/person
CFM/ft²	**0.49**	CFM/ft²			

APPENDIX A

Air System Information

Air System Name .. **Thaw/Tishman Boilers/Chillers**
Equipment Class .... **PKG ROOF**
Air System Type .... **VAV**

Number of zones **1**
Floor Area .... **27664.0** ft²
Location .... **Santa Fe, New Mexico**

Sizing Calculation Information

Calculation Months .... **Jan to Dec**
Sizing Data .... **Calculated**

Zone CFM Sizing .... **Peak zone sensible load**
Space CFM Sizing .... **Individual peak space loads**

Zone Terminal Sizing Data

Zone Name	Design Supply Airflow (CFM)	Minimum Supply Airflow (CFM)	Zone CFM/ft²	Reheat Coil Load (MBH)	Reheat Coil Water gpm @ 20.0 °F	Zone Htg Unit Coil Load (MBH)	Zone Htg Unit Water gpm @ 20.0 °F	Mixing Box Fan Airflow (CFM)
Zone 1	32967	23193	1.19	779.0	77.94	0.0	-	0

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	470.6	Jul 1600	486.9	27664.0

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
Tishman/Thaw Center	1	470.6	Jul 1600	32967	486.9	27664.0	1.19

APPENDIX A

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1500 COOLING OA DB / WB 93.0 °F / 65.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -10.0 °F / -10.0 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	1772 ft²	44857	-	1772 ft²	-	-
Wall Transmission	17042 ft²	26678	-	17042 ft²	62201	-
Roof Transmission	27664 ft²	60349	-	27664 ft²	61819	-
Window Transmission	1772 ft²	18411	-	1772 ft²	92144	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	27664 ft²	0	-	27664 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	30430 W	103827	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	27664 W	94389	-	0	0	-
People	184	45184	37807	0	0	0
Infiltration	-	33176	-2948	-	189579	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	10% / 10%	42687	3486	20%	81148	0
>> Total Zone Loads	**-**	**469557**	**38346**	**-**	**486891**	**0**
Zone Conditioning	-	431799	38346	-	467029	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Return Fan Load	17026 CFM	0	-	13696 CFM	0	-
Ventilation Load	11807 CFM	199935	-18500	9498 CFM	606284	0
Supply Fan Load	28833 CFM	0	-	23193 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**631734**	**19845**	**-**	**1073313**	**0**
Central Cooling Coil	-	631734	19850	-	0	0
Preheat Coil	-	0	-	-	294288	-
Terminal Reheat Coils	-	0	-	-	779025	-
>> Total Conditioning	**-**	**631734**	**19850**	**-**	**1073313**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

APPENDIX A

July DESIGN COOLING DAY, 1500

TABLE 1: SYSTEM DATA

Component	Location	Dry-Bulb Temp (°F)	Specific Humidity (lb/lb)	Airflow (CFM)	CO2 Level (ppm)	Sensible Heat (BTU/hr)	Latent Heat (BTU/hr)
Ventilation Air	Inlet	93.0	0.01061	11807	400	199935	-18500
Vent - Return Mixing	Outlet	81.1	0.01086	28833	504	-	-
Preheat Coil	Outlet	81.1	0.01086	28833	504	0	-
Central Cooling Coil	Outlet	55.0	0.01067	28833	504	631734	19850
Supply Fan	Outlet	55.0	0.01067	28833	504	0	-
Cold Supply Duct	Outlet	55.0	0.01067	28833	504	-	-
Zone Air	-	72.8	0.01103	28833	577	431799	38346
Zone Direct Exhaust	Outlet	72.8	0.01103	11807	577	-	-
Return Plenum	Outlet	72.8	0.01103	17026	577	0	-

Air Density x Heat Capacity x Conversion Factor: At sea level = 1.080; At site altitude = 0.840 BTU/(hr-CFM-F)
Air Density x Heat of Vaporization x Conversion Factor: At sea level = 4746.6; At site altitude = 3690.5 BTU/(hr-CFM)
Site Altitude = 6800.0 ft

TABLE 2: ZONE DATA

Zone Name	Zone Sensible Load (BTU/hr)	T-stat Mode	Zone Cond (BTU/hr)	Zone Temp (°F)	Zone Airflow (CFM)	CO2 Level (ppm)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
Zone 1	469558	Cooling	431799	72.8	28833	577	0	0

APPENDIX A

WINTER DESIGN HEATING

TABLE 1: SYSTEM DATA

Component	Location	Dry-Bulb Temp (°F)	Specific Humidity (lb/lb)	Airflow (CFM)	CO2 Level (ppm)	Sensible Heat (BTU/hr)	Latent Heat (BTU/hr)
Ventilation Air	Inlet	-10.0	0.00059	9498	400	-606284	0
Vent - Return Mixing	Outlet	34.9	0.00059	23193	410	-	-
Preheat Coil	Outlet	50.0	0.00059	23193	410	294288	-
Central Cooling Coil	Outlet	50.0	0.00059	23193	410	0	0
Supply Fan	Outlet	50.0	0.00059	23193	410	0	-
Cold Supply Duct	Outlet	50.0	0.00059	23193	410	-	-
Zone Air	-	66.0	0.00059	23193	417	-467029	0
Zone Direct Exhaust	Outlet	66.0	0.00059	9498	417	-	-
Return Plenum	Outlet	66.0	0.00059	13696	417	0	-

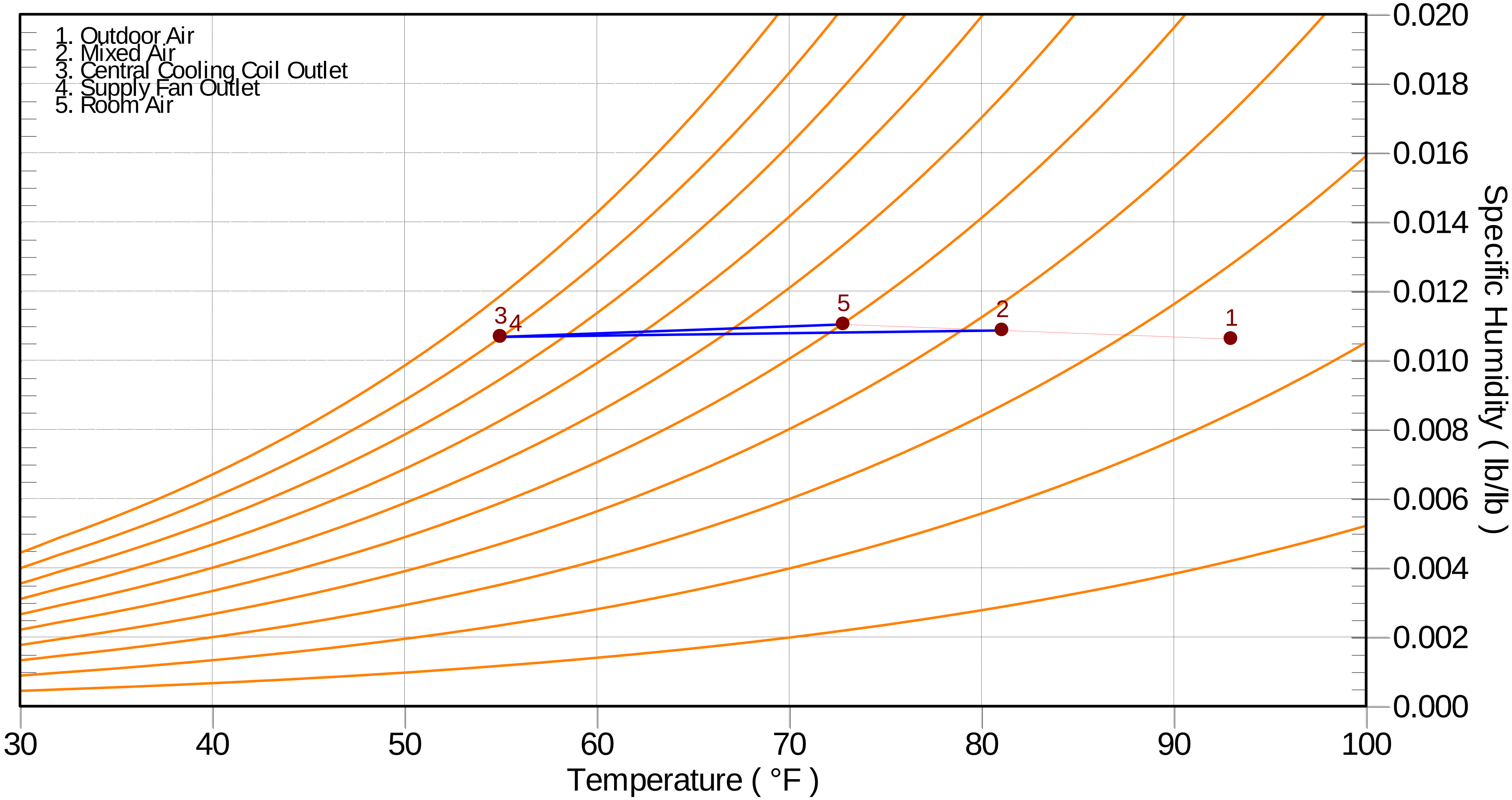
Air Density x Heat Capacity x Conversion Factor: At sea level = 1.080; At site altitude = 0.840 BTU/(hr-CFM-F)
Air Density x Heat of Vaporization x Conversion Factor: At sea level = 4746.6; At site altitude = 3690.5 BTU/(hr-CFM)
Site Altitude = 6800.0 ft

TABLE 2: ZONE DATA

Zone Name	Zone Sensible Load (BTU/hr)	T-stat Mode	Zone Cond (BTU/hr)	Zone Temp (°F)	Zone Airflow (CFM)	CO2 Level (ppm)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
Zone 1	-486891	Heating	-467029	66.0	23193	417	779025	0

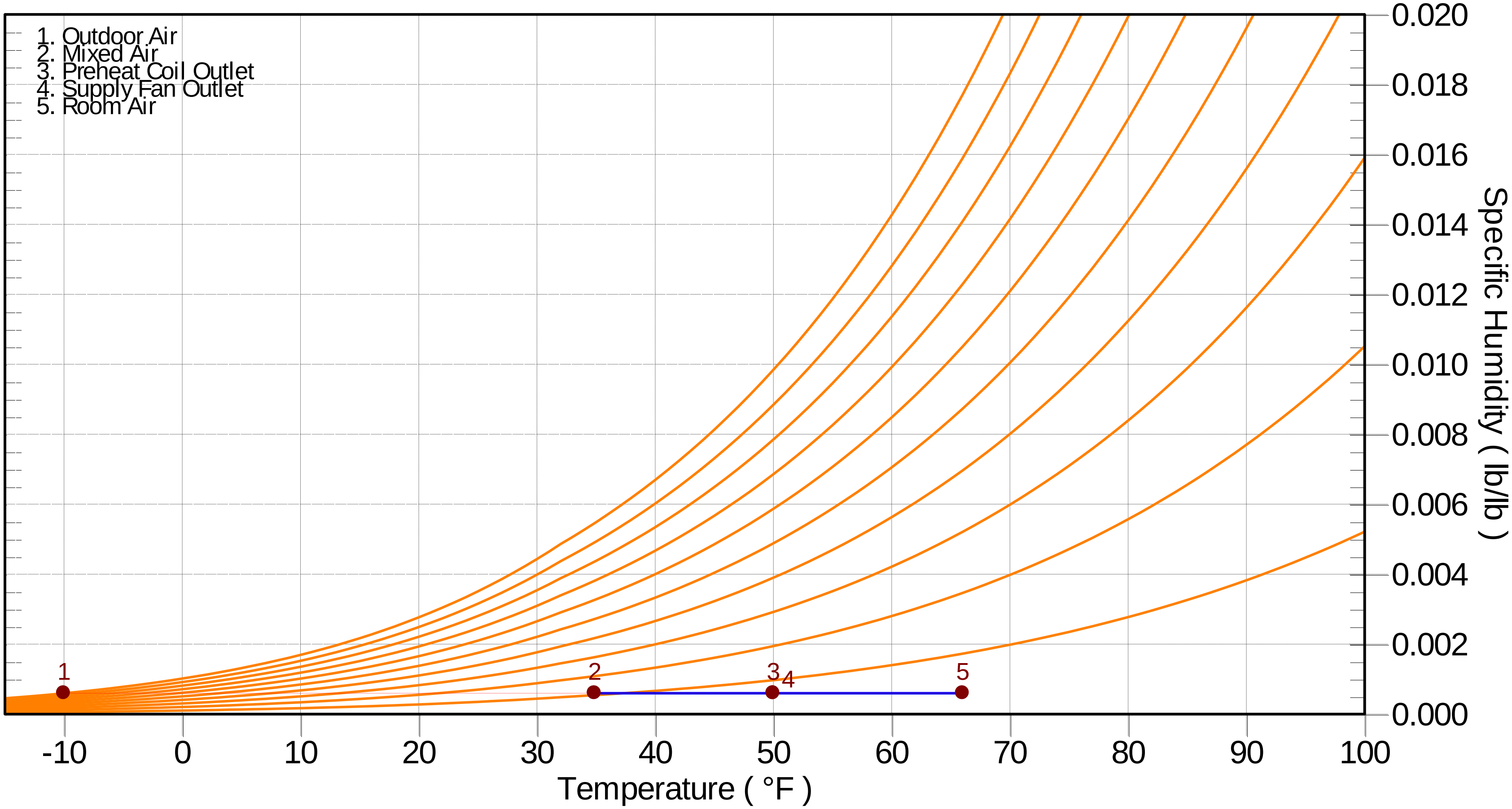
APPENDIX A

Location: Santa Fe, New Mexico
Altitude: 6800.0 ft.
Data for: July DESIGN COOLING DAY, 1500



APPENDIX A

Location: Santa Fe, New Mexico
Altitude: 6800.0 ft.
Data for: WINTER DESIGN HEATING



APPENDIX A

Santa Fe Midtown - Visual Arts Complex

PROBABLE COST ESTIMATE 12/29/22

ITEM	UNITS	COST/UNIT	COST	COMMENTS
A. ARCHITECTURAL				
Replace broken window in Tishman (60x98)	LS	-	$6,000.00	Recommended
Reseal/Spot Repair sealants and flashings	LS	-	$12,000.00	Req. to prevent further damage
Install Missing splash blocks	7	$100.00 EA	$700.00	Recommended
Correct exterior roof drain pipes / Catch basins	LS	-	$50,000.00	Recommended
Inspect & repair exterior Stucco	61,000 SF	$1.50 /SF	$91,500.00	Req. to prevent further damage
Replace / Repair floor finishes (majority sealed concrete)	65,022 SF	$1.75 /SF	$113,788.50	Recommended
Repainting and patching finishes	65,022 SF	$0.90 /SF	$58,519.80	Recommended
Complete Tishman Offices Renovation	3,000 SF	$50.00 /SF	$150,000.00	Req. to restore function
Replace non-functioning ADA door-openers	2	$1,800.00 EA	$3,600.00	Req. per 2015 IBC
		SUBTOTAL	**$486,108.30**	
B. ELECTRICAL				
Replace light fixtures with LED	65,022 SF	$6.50 /SF	$422,643.00	Recommended
Upgrade electrical system (including HVAC upgrades).	65,022 SF	$10.00 /SF	$650,220.00	Req. for HVAC
		SUBTOTAL	**$1,072,863.00**	
C. SITE				
Landscaping/Irrigation (dependent on scope)	-	-	-	Recommended
Parking Improvements	3,500 SY	$55.00 /SY	$192,500.00	Recommended
		SUBTOTAL	**$192,500.00**	
D. MECHANICAL				
Fire Sprinkler system	65,022 SF	$12.00 /SF	$780,264.00	Req. TBD on building use
HVAC Replacement:	65,022 SF	$22.00 /SF	$1,430,484.00	Req. to restore function
Replace undersized AHU-1 (recommended 15 Tons)	1	$15,000.00	-	Recommended
Replace Boilers (2 @ 1,440,000BTU/H input)	2	$50,000.00	-	Req. to restore function
Replace Boilers (2 @ 2,070,000BTU/H input)	2	$60,000.00	-	Req. to restore function
Replace Boiler Pumps (2 @ 5HP)	2	$15,000.00	-	Req. to restore function
Replace Boiler Pumps (2 @ 2HP)	2	$7,000.00	-	Req. to restore function
Install new water treatment systems for boilers (4)	LS	$8,000.00	-	Recommended
		SUBTOTAL	**$2,210,748.00**	
SUBTOTAL			**$3,962,219.30**	
Contingency		10.00%	$396,221.93	
NMGRT - Santa Fe		8.3125%	$329,359.48	
TOTAL ESTIMATED COST			**$4,687,800.71**	

The following is a general estimate of costs. It is intended as a tool to assist the City of Santa Fe with decision making and should not be viewed as a comprehensive cost estimate.

Prepared by

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HIGHER RELATIONSHIPS

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