Table of Contents

Project Team                                                                 Section 1
Executive Summary                                                           Section 2
Mechanical Summary                                                         Section 3
Phasing and Design Narrative                                               Section 4
MEP Basis of Design Narrative                                              Section 5
Structural Design Criteria Narrative                                       Section 6
Target Value Design                                                        Section 7
Assumptions and Exclusions                                                 Section 8
Conceptual Schedules                                                       Section 9
Appendix 1: Owner Project Requirements                                     Section A1
Appendix 2: Conceptual Drawings                                            Section A2
Appendix 3: MEP Product Data                                               Section A3
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Executive Summary

The overarching goal for the project is to provide an upgraded HVAC system [all new Air Handling Units (AHUs), exhaust fans and ductwork] with new Niagara HVAC controls as well as re-roofing the existing building to eliminate water intrusion.

The options that were explored are included below. Options 2 and 3A, bolded below, were determined to be best suited for further exploration.

Option 1: Replace the existing rooftop equipment (air handling units, exhaust fans, ductwork, etc.) with exterior grade equipment of the same capacity, but designed for long-life exterior use. This option was eliminated due to capacity limitations and phasing issues. Option 2 was much better from both standpoints and therefore this option was deemed not viable.

Option 2: Replace the existing rooftop equipment (air handling units, exhaust fans, ductwork, etc.) with exterior grade equipment in capacities and configuration that is better for efficiency and maintainability.

Option 3A: Replace the existing rooftop equipment and provide a conditioned penthouse to enclose the equipment and ductwork.

Option 3B: Replace the existing rooftop equipment and provide a conditioned penthouse to enclose the equipment and ductwork via prefabricated penthouses. This option was eliminated due to installation complexity including phasing limitations associated with downtime and crane limitations causing site disruptions.

Option 4: Infill the Atrium floor and use the mezzanine level (with new floor) as a penthouse. This option was eliminated due to interior atrium space.

Addition / Renovation Information

All work associated with this project is intended to be above the rooftop slab level (top of slab on level 5 in existing drawings). Notable exceptions to this include:

Notable exceptions are:
1. Chilled water lines that must be extended from the existing Central Energy Plant to the West roof to provide additional capacity required for the new AHUs.
2. Electrical tie-ins on lower floors.
3. HVAC controls tie-ins on lower floors.
### Option 2 & 3A Comparison

#### Option 2

**Pros**
- Existing units have redundancy that allows all work to be done from outside.
- Minimal impact to building occupants. The redundancy in design allows units to be switched with minimal downtime.
- Maintains look of existing building.
- Maintains natural light in atrium.
- Minimizes temporary work (relative to option 3A).

**Cons**
- HVAC will remain an exterior system.
- System will be more susceptible to UV damage and storms.

#### Option 3A

**Pros**
- Encloses HVAC system for a more durable system (longer lifespan of mechanical equipment and ductwork).
- Creates a more resilient system for storms and UV impacts.

**Cons**
- Requires longer shutdowns and more temporary work.
- Impacts building use of atrium while structural tie-ins are made. There will be significant scaffolding within the atrium while this work is completed.
- Impacts natural daylight in atrium. Requires constant lighting investment to maintain a similar aesthetic within the atrium.
- Raises screenwall and top of current building about 4'-0", impacting the look of the building from the street.
- More difficult to replace units in the future. Portions of the penthouse will need to be removed and reinstalled.
Comparative Matrix  

This matrix was utilized in the conceptual design phase to help Moffitt Cancer Center rate and eliminate different options.

<table>
<thead>
<tr>
<th>Option 1</th>
<th>Option 2</th>
<th>Option 3A</th>
<th>Option 3B</th>
<th>Option 4</th>
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<tbody>
<tr>
<td><strong>Criteria</strong></td>
<td><strong>MOS</strong></td>
<td><strong>COM</strong></td>
<td><strong>MOS</strong></td>
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<td>GC Cost</td>
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<td>Project Requirements (Temporary Requirements)</td>
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<tr>
<td>Aesthetics - Exterior (Change to Existing)</td>
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<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Aesthetics - Interior (Change to Existing)</td>
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<td>4</td>
<td>3</td>
<td>2</td>
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<tr>
<td>Structural Design Complexity</td>
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<td>2</td>
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<td>Interior Impact - Initial Phasing</td>
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<td>Interior Impact - Installation During Construction</td>
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<td>2</td>
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<td>Return on Investment</td>
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<td>Total</td>
<td>64</td>
<td>71</td>
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Current Designation is Type 1A per FBC Table 601

<table>
<thead>
<tr>
<th>Building Element</th>
<th>Fire Rating</th>
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<td>Primary structural frame:</td>
<td>3 HR</td>
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<tr>
<td>Bearing Walls</td>
<td></td>
</tr>
<tr>
<td>Exterior</td>
<td>3 HR</td>
</tr>
<tr>
<td>Interior</td>
<td>3 HR</td>
</tr>
<tr>
<td>Nonbearing Wall</td>
<td></td>
</tr>
<tr>
<td>Exterior</td>
<td>See Table 602</td>
</tr>
<tr>
<td>Interior</td>
<td>0 HR</td>
</tr>
<tr>
<td>Floor Construction and Associated Secondary members</td>
<td>2 HR</td>
</tr>
<tr>
<td>Roof Construction and Associated Secondary Members</td>
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</table>

Existing Ratings (to be maintained):

<table>
<thead>
<tr>
<th>Building Element</th>
<th>Fire Rating</th>
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<tbody>
<tr>
<td>Columns Supporting More Than One Floor</td>
<td>3 HR</td>
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<tr>
<td>Columns Supporting A Roof Only</td>
<td>2 HR</td>
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<tr>
<td>Beams Supporting One Floor Only</td>
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<tr>
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<tr>
<td>Roof Construction</td>
<td>1 1/2 HR</td>
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<tr>
<td>Exterior Non-Bearing Walls</td>
<td>Non-Comb.</td>
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</tbody>
</table>

Applicable Codes:

- **Florida Department of Business & Professional Regulation**
  - Florida Building Code, Sixth Edition
  - Florida Building Code, Sixth Edition (2017), Accessibility
  - Florida Building Code, Sixth Edition (2017), Mechanical
  - Florida Building Code, Sixth Edition (2017), Plumbing

- **State Fire Marshal**
    - NFPA 1 (with Florida Modifications)
    - NFPA 101 (with Florida Modifications)
    - NFPA 70 – 2017

- **Occupancy Classification**
  - FBC 6th Edition: Business Occupancy
  - NFPA 101: Existing Business Occupancy

- **Occupant Load**
  - 300 SF / Person for penthouse expansion options (Incidental Storage Occupancy)

- **Hurricane Requirements**
  - 153 MPH (See structural engineering narrative)
  - Requirements as detailed in Chapter 16 of the Florida Building Code
Mechanical Summary

SRB Rooftop Renovation Project

The Stabile Research Building (SRB) rooftop renovation project includes repairing the SRB roof to prevent water infiltration and upgrading the HVAC to properly condition the building while minimizing the research downtime. There are two design options: to replace the roof and equipment while making upgrades to penetrations and sheet metal (Option 2) or to replace the roof and equipment while adding a penthouse above the roofs (Option 3A). The mechanical scope of both options includes the removal and replacement of all air handling units and rooftop return and exhaust fans serving SRB. The renovation scope of work is limited above the roof line except for controls, chilled water, and electrical upgrades required to support new equipment. The project will be phased to minimize shutdowns for research. Redundancy will be maintained during construction. Refer to the phasing plan by Beck regarding the equipment phasing.

Mechanical Modifications

The air handling units are equipped with chilled water coils and heating hot water coils. Current Standards and Guidelines increase required cooling capacity of the new units compared to the original design of the SRB. Per Moffitt Mechanical Guidelines, airflow design requirements for new air handling units include 20% additional capacity above the connected design airflow. The Mechanical Guidelines increase the outside air design requirements as shown in Table 1. The ASHRAE recommendations are shown in Table 1 for reference.

Table 1: Outside Air Design Criteria

<table>
<thead>
<tr>
<th>Outside Airflow Location</th>
<th>Cooling DB (°F)</th>
<th>Cooling WB (°F)</th>
<th>Heating DB (°F)</th>
</tr>
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<tbody>
<tr>
<td>(Moffitt) Building Exterior</td>
<td>100</td>
<td>82</td>
<td>30</td>
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<tr>
<td>(Moffitt) Rooftop</td>
<td>110</td>
<td>92</td>
<td>30</td>
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<tr>
<td>ASHRAE Max 1% / Min 99%</td>
<td>91.4</td>
<td>77.5</td>
<td>40.6</td>
</tr>
</tbody>
</table>

Refer to the Owner Project Requirements (OPR) and Basis of Design (BOD) documents for the Moffitt requirements for the project. The airflow and design requirements increase the cooling required for the building. A 12” chilled water main pipe cannot support the increase in cooling. A new chilled water pipe from the CEP is required to support the building. Size and location will be determined in the design portion of the project.

The Moffitt Masterplan includes transferring all building controls to Niagara. Moffitt IT will route a new network cable through the stacked communications rooms in SRB to feed the rooftop equipment. Refer to the BOD for the control upgrades plan. The new network will be used to support future upgrades to the labs throughout the building. Air valves, terminal units, fan coil units and internal exhaust fans will be upgraded to support the Niagara system in a future project.

Existing Chilled Water Infrastructure

The central chilled water plant at Moffitt Cancer Center is overcapacity relative to design conditions. The maximum chilled water capacity from the plant is 4,257 tons of cooling not including age-related losses in efficiency. The central plant supports the following buildings and their respected design cooling capacity requirements: MCC (1,720 TR), MCB (1,715 TR), and SRB (3,082 TR) totaling 6,517 tons. The actual output capacity of 4,257 tons is less than required. A parallel project to the SRB renovation is underway to renovate the central energy plant and increase the cooling capacity to support the campus. As the SRB design continues, central plant modifications will be coordinated with the SRB design team.

During peak cooling periods, the existing chilled water supply temperature has been observed to be as high as 47 deg F (design 42-44 deg F) at the chilled water plant. Temperature losses due to piping length to SRB roof could raise the temperature another 1-2 deg F at the inlet of the AHU’s. Air handling units’ cooling coil selections will have to be carefully selected based on this and coordinated with the CEP upgrades timeline.
Option 2 Phasing Narrative

Replace the existing rooftop equipment (air handling units, exhaust fans, ductwork, etc.) with exterior grade equipment in capacities and configuration that is better for efficiency and maintainability.

Phase 1 (enabling work)

1. Relocation of smoke evacuation fans to atrium roof.
   a. Install new air inlets in Atrium ceiling, patch and repair ceiling finish.
   b. Mount new exhaust fans and outlets at rooftop level (8 fans).
      1. Provide support steel and new opening.
      2. Install new curbs and fans.
      3. Install new power (can be cut from existing fans one at a time to ensure full system functionality at all times).
2. Relocate all condensers and air-cooled chiller adjacent to existing AHUs (move away from penthouse approximately 8' further) and associated conduit and electrical shut-offs.
   a. Provide new post mounted (unistrut or similar) electrical shut-offs and (NEMA 4x) enclosure.
   b. Cut back stucco along entire perimeter of atrium and flash up wall an additional 12". Provide weather resistive barrier on existing substrate. Provide new stainless weep screen, patch existing stucco to remain. Provide new acrylic topcoat on all stucco.
3. Remove existing return air plenums.
   a. Patch and repair wall with metal stud infill, new weather resistive barrier (tied into existing) and new stucco. Provide counterflashing over top of new duct penetration.
   b. Provide new plenum box at interior of the building with louvered openings on 5 exposed sides.
4. Remove exterior return ductwork. (2 return fans serving atrium and 3 return fans serving second floor plenum)
   a. Break ductwork on discharge side of building at return fan.
   b. Return fans must remain operational during construction.
   c. Remove unused ductwork and supports. Provide new code compliant vent.
   d. Patch roofing where ductwork supports were removed.
   ** Note that after Phase 1, Phases 2-5 can happen simultaneously.

Phase 2 (complete work on North side of Atrium)

1. Ductwork
   a. Add curb and tie-in roofing at temporary exhaust fan at East end of building.
      i. Exhaust fan with redundancy provided on East end of the building to support maximum 23,190 CFM of lab exhaust.
   b. Remove exhaust ductwork.
   c. Infill and waterproof opening where existing exhaust ductwork was removed.
   d. Remove exhaust ductwork support steel and patch roofing.
   e. New Lab supply header

   i. Ductwork sizes to match existing plus 20% capacity as shown in the schematic drawings (see Appendix A2).
   ii. Provide ductwork supports and temporary roof flashing.
   f. Reroute Vivarium supply header south (to allow for crane drop)
      i. Ductwork sizes to match existing plus 20% capacity as shown in the schematic drawings.
      ii. Provide ductwork supports and temporary roof flashing.
   g. Remove existing supply header
      i. Remove existing supports
      ii. Patch and repair roofing

2. Add new AHU to support additional 20% air at Labs per Moffitt Standards.
   a. Tie into new Vivarium and Lab supply headers.
3. Replace remaining AHUs one at a time with exterior grade units, beginning with the Vivarium units
   a. Remove & replace existing AHU 3-29V
      i. See Vivarium AHU selection from Synergy (reference Appendix A3)
      ii. New louver (vertical louver to meet AMCA 550) concealed in air intake plenum. Provide miscellaneous steel supports as required by Florida Product Approval.
         1. Remove existing curb
         2. Temp in roofing
         3. Install new curb and tie-in roofing to new curb.
   b. Remove & Replace Existing AHU 3-25
   c. Remove & Replace Existing AHU 3-24
   d. Remove & Replace Existing AHU 3-23
   e. Remove & Replace Existing AHU 3-23

Phase 3 (complete work on South side of Atrium)

1. Temporary Ductwork
   a. Add curb and tie-in roofing at temporary exhaust fan at East end of building
      i. Exhaust fan with redundancy provided on east end of the building to support maximum 23,190 CFM of lab exhaust.
   b. Infill and waterproof opening where existing exhaust ductwork was removed.
   c. Remove exhaust ductwork support steel and patch roofing.
   d. Break return airflow ductwork and exhaust to the outside
      i. Remove unused ductwork and supports. Provide new code compliant vent.
      ii. Patch roofing where ductwork supports were removed.
e. New supply header
   i. Plus 20% capacity as shown in the schematic drawings
   ii. Ductwork supports and temporary roof flashing
f. Reroute Vivarium supply header south (to allow for crane drop)
   i. Ductwork sizes to match existing plus 20% capacity as shown in the schematic drawings.
   ii. Ductwork supports and temporary roof flashing.
g. Remove existing supply header
   i. Remove existing supports
   ii. Patch and repair roofing
h. Add new AHU to support additional 20% air at Labs per Moffitt Standards.
i. Tie into new Vivarium and Lab supply headers.
j. Replace remaining AHUs one at a time with exterior grade units, beginning with the Vivarium units
k. Remove & replace existing AHU 3-31V
   i. See Vivarium AHU Selection from Synergy.
   ii. New louver (vertical louver to meet AMCA 550) concealed in air intake plenum. Provide miscellaneous steel supports as required by Florida Product Approval.
   1. Remove existing curb
      2. Temp in roofing
      3. Install new curb and tie-in roofing to new curb.
   iii. Install new AHU
   iv. Tie-In AHU to supply header
l. Remove & Replace Existing AHU 3-32V
m. Remove & Replace Existing AHU 3-28
n. Remove & Replace Existing AHU 3-27
o. Remove & Replace Existing AHU 3-26

**Phase 4 (complete work on West side)**

1. New temporary return ductwork on West side
   a. Ductwork sizes to match existing plus 20% capacity as shown in the schematic drawings
   b. Ductwork has to temporarily clear the existing screen wall
   i. Associated steel supports to tie into roof.
1. Add on temporary AHU
   a. Unit selection to match future state AHUs.
   b. New temporary supply headers.
   c. Provide steel supports similar to existing.
2. Remove & replace existing AHU 2-22
   a. Remove existing AHU
   b. Replace louvers at air intakes with Greenheck EHV-901D to allow AHUs to function in a hurricane without taking on water.
   c. Install new curb and temporarily tie-in roofing to new curb.
   d. Install new AHU
   e. Tie-In AHU to supply header.
3. Remove & Replace Existing AHU 2-21
   a. Remove existing AHU
   b. Replace louvers at air intakes with Greenheck EHV-901D to allow AHUs to function in a hurricane without taking on water.
   c. Install new curb and temporarily tie-in roofing to new curb.
   d. Install new AHU
   e. Tie-In AHU to supply header.

**Phase 5 (Exhaust Fan & Return Fan Replacement)**

1. Remove and replace the existing exhaust fans
   a. Remove & replace existing exhaust fan 2.20 (Same Process for Each Exhaust Fan)
      ii. Remove existing exhaust fan
      iii. Remove existing Curb
      iv. Temp in roofing
   v. Install new curb and tie-in roofing to new curb.
   a. Remove & Replace Existing Exhaust Fan
   b. Remove & Replace Existing Exhaust Fan EF 3.21
   c. Remove & Replace Existing Exhaust Fan EF 3.22
   d. Remove & Replace Existing Exhaust Fan EF 3.23
   e. Remove & Replace Existing Exhaust Fan EF 3.24E
   f. Remove & Replace Existing Exhaust Fan EF 3.25E
   g. Remove & Replace Existing Exhaust Fan EF 3.26E
   h. Remove & Replace Existing Exhaust Fan EF 3.27E
   i. Remove & Replace Existing Exhaust Fan EF 3.28E
   j. Remove & Replace Existing Exhaust Fan EF 3.29
   k. Remove & Replace Existing Exhaust Fan EF 3.30
   l. Remove & Replace Existing Exhaust Fan EF 3.31E
   m. Remove & Replace Existing Exhaust Fan EF 3.32E
   n. Remove & Replace Existing Exhaust Fan EF 3.33E
   o. Remove & Replace Existing Exhaust Fan EF 3.34E
   p. Remove & Replace Existing Exhaust Fan EF 3.35
   q. Remove & Replace Existing Exhaust Fan EF 3.46
   r. Remove & Replace Existing Exhaust Fan EF 3.47
2. Include allowance for reflashings exterior of stair up to high roof.
Phase 6 (Project Completion)

1. Remove and replace existing roofing where no penthouse was installed.
   a. Remove existing roofing, insulation and substrate down to concrete.
   b. Relocate existing equipment to remain to new curbs (all condensers, etc)
      i. Relocate existing electrical conduits and condensate drain lines that are mounted low on roof and would impact the installation of new roofing.
      ii. Provide new hoods where chilled water lines come through roof.
   c. 2 Options:
      i. Modified SBS over (base Option)
         1. Install new modified bitumen substrate
         2. Install new light weight insulating concrete sloped at 1/4" per 12" towards existing drains
         3. Install new 2 layer fully adhered modified SBS
      ii. Modified SBS over polyiso insulation (deduct alternate)
         1. Install new light weight insulating concrete sloped at 1/4" per 12" towards existing drains
         2. Install new 2 layer fully adhered modified SBS
   2. Install new lightning protection.
**Option 3A Phasing Narrative**

Replace the existing rooftop equipment and provide a conditioned penthouse to enclose the equipment and ductwork.

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**Phase 1 (enabling work)**

1. Relocation of smoke evacuation fans to atrium roof.
   a. Install new air inlets in atrium ceiling, patch and repair ceiling finish.
   b. Mount new exhaust fans and outlets at rooftop level. (8 fans).
      1. Provide support steel and new opening.
      2. Install new curbs and fans.
      3. Install new power (can be cut from existing fans one at a time to ensure full system functionality at all times).

2. Relocate all compressors and air-cooled chiller adjacent to existing AHUs (move away from penthouse approximately 8' further) and associated conduit and electrical shut-offs.
   a. Provide new post mounted (unistrut or similar) electrical shut-offs and (NEMA 4x) enclosure.
   b. Cut back stucco along entire perimeter of atrium and flash up wall an additional 12" Professor provide weather resistant barrier on existing substrate. Provide new stainless weep screen, patch existing stucco to remain. Provide new acrylic topcoat on all stucco.

3. Remove existing return air plenums.
   a. Patch and repair wall with metal stud infill, new weather resistant barrier (laid into existing) and new stucco. Provide counterflashing over top of new duct penetration.
   b. Provide new plenum box at interior of the building with louvered openings on 5 exposed sides.

4. Remove exterior return ductwork. (2 return fans serving atrium and 3 return fans serving 2nd floor plenum)
   b. Return fans must remain operational during construction.
   c. Remove unused ductwork and supports, provide new code compliant vent.
   d. Patch roofing where ductwork supports were removed.

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**Phase 2 (complete work on North side of Atrium)**

1. Ductwork
   a. Add curb and tie-in roofing at temporary exhaust fan at East end of building
      i. Exhaust fan with redundancy provided on east end of the building to support maximum 23,190 CFM of lab exhaust.
   b. Remove exhaust ductwork.
   c. Infill and waterproof opening where existing exhaust ductwork was removed.
   d. Remove exhaust ductwork support steel and patch roofing.
   e. New Lab supply header
      i. Ductwork sizes to match existing plus 20% capacity as shown in the schematic drawings.
      ii. Ductwork supports and temporary roof flashing
   f. Reroute Vivarium supply header South (to allow for crane drop)

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4. Insulation & Roofing
   i. Install new light weight insulating concrete sloped at 1/4" per 12" towards existing drains
   ii. Install new 2 layer fully adhered modified SBS
5. Remove existing roofing inside penthouse.
6. Install new interior lights to mimic artificial lighting inside atrium space.
7. Relocate condensing units and air-cooled chiller on top of penthouse.
   a. Provide handrail as needed for serviceability on south end of penthouse.

Phase 3 (complete work on South side of Atrium)

1. Temporary Ductwork
   a. Add Curb and Tie-in roofing at temporary exhaust fan at East end of building
      i. Exhaust fan with redundancy provided on east end of the building to support maximum 23,190 CFM of lab exhaust.
   b. Infill and waterproof opening where existing exhaust ductwork was removed.
   c. Remove exhaust ductwork support steel and patch roofing.
   d. Break return airflow ductwork and exhaust to the outside
      i. Remove unused duct and supports. Provide new code compliant vent.
      ii. Patch roofing where ductwork supports were removed.
2. Add new AHU to support additional 20% air at Labs per Moffitt Standards.
   a. Tie into new Vivarium and Lab supply headers.
3. Replace remaining AHUs 1 at a time with exterior grade units, beginning with Vivarium units
   a. Remove & replace existing AHU 3-31V
      i. See Vivarium AHU selection from Synergy.
         1. Remove existing AHU
         2. New louver (vertical louver to meet AMCA 550) concealed in air intake plenum. Provide miscellaneous steel supports as required by Florida Product Approval Remove existing Curb.
      3. Temp in roofing
         i. Install new curb and tie-in roofing to new curb.
            ii. Install new AHU
            iii. Tie-in AHU to supply header
   b. Remove & Replace Existing AHU 3-32V
   c. Remove & Replace Existing AHU 3-28
   d. Remove & Replace Existing AHU 3-27
   e. Remove & Replace Existing AHU 3-26
4. Install new penthouse.
   a. Steel Structure
      i. Provide new vertical steel post to secure curtain wall top at the East end of the building.
      ii. Remove existing curtain wall and infill wall with metal stud framing, weather resistive barrier, exterior stucco and flashing as needed.
         iii. Interior
   b. Exterior Walls
      i. Metal Stud framing, insulation, and weather resistive barrier.
      1. Extend ACM panels up as shown on plans.
1. ACM wall system to include: gypsum sheathing (level 2 finish), metal studs with insulation (R-23 min), gypsum sheathing, weather resistant barrier, exterior insulation (R5), and aluminum panel system on z-furring channels.
2. Where penthouse is only visible from roof, provide corrugated aluminum panels to match existing.
   ii. Extend Curtain wall system up as shown on plans.
   i. Extend Louver support and louvers up 4'-9''
   c. Decking
   d. Insulation & Roofing
      i. Install new light weight insulating concrete sloped at 1/4" per 12" towards existing drains
      ii. Install new 2 layer fully adhered modified SBS
5. Remove existing roofing inside penthouse.
6. Install new interior lights to mimic artificial lighting.
7. Relocate condensing units and air-cooled chiller on top of penthouse.
   a. Provide handrail as needed for serviceability on north end of penthouse.

Phase 4 (complete work on West side)

1. New return ductwork on West side
   a. Ductwork sizes to match existing plus 20% capacity as shown in the schematic drawings.
   b. Associated steel supports roof tie-in.
2. Remove Existing Screen Wall
   a. Wall Panels, Steel frames, etc.
   b. Temporarily Patch Roofing
3. West Side
   a. Add (1) Temporary AHU
   a. New Supply Headers
   i. Steel supports and flash roof penetrations
4. Remove & replace existing AHU 2-20, AHU 2-21 & AHU 2-22 (follow below steps one at a time for each AHU)
   a. Install final supply header.
   b. Remove existing AHU
   c. Remove existing curb.
   d. Install new curb and temporarily tie-in roofing to new curb.
   e. Install new AHU.
   f. Tie-in AHU to supply header.
5. Remove temporary AHU and associated temporary ductwork
6. Install new penthouse.
   a. Steel Structure (See structural drawings)
   b. Exterior Walls
      i. Metal Stud framing, weather resistive panels and Aluminum corrugated panel to match existing color.
   c. New louvers (vertical louver to meet AMCA 550) at air intake. Provide miscellaneous steel supports as required by Florida Product Approval
   d. Decking
e. Insulation & Roofing
   i. Install new lightweight insulating concrete sloped at 1/4" per 12" towards existing drains
   ii. Install new 2 layer fully adhered modified SBS

**Phase 5 (Exhaust Fan & Return Fan Replacement)**

1. Remove and replace the existing exhaust fans
   a. Remove & replace existing exhaust fans EF 2.20 (same process for each exhaust fan)
      i. Remove Existing exhaust fan
      ii. Remove existing curb
      iii. Temp in roofing
   b. Remove & Replace Existing Exhaust Fan EF 3.21
   c. Remove & Replace Existing Exhaust Fan EF 3.22
   d. Remove & Replace Existing Exhaust Fan EF 3.23
   e. Remove & Replace Existing Exhaust Fan EF 3.24E
   f. Remove & Replace Existing Exhaust Fan EF 3.25E
   g. Remove & Replace Existing Exhaust Fan EF 3.26E
   h. Remove & Replace Existing Exhaust Fan EF 3.27E
   i. Remove & Replace Existing Exhaust Fan EF 3.28E
   j. Remove & Replace Existing Exhaust Fan EF 3.29
   k. Remove & Replace Existing Exhaust Fan EF 3.30
   l. Remove & Replace Existing Exhaust Fan EF 3.31E
   m. Remove & Replace Existing Exhaust Fan EF 3.32E
   n. Remove & Replace Existing Exhaust Fan EF 3.33E
   o. Remove & Replace Existing Exhaust Fan EF 3.34E
2. Add roof above exhaust fans and extend exhaust stacks minimum of 10ft above new roof level.

**Phase 6 (Project Completion)**

1. Remove and replace existing roofing where no penthouse was installed.
   a. Remove existing roofing, insulation and substrate down to concrete.
   b. Relocate existing equipment to remain to new curbs (all condensers, etc)
      i. Relocate existing electrical conduits and condensate drain lines that are mounted low on roof and
         would impact the installation of new roofing.
      ii. Provide new hoods where chilled water lines come through roof.
   c. Modified SBS over polyiso insulation (deduct alternate)
      i. Install new lightweight insulating concrete sloped at 1/4" per 12" towards existing drains
      ii. Install new 2 layer fully adhered modified SBS
2. Install new lightning protection for entire building.
1.01 General Building Description

A. Moffitt Cancer Center’s Stable Research Building (SRB) supports research conducted on Moffitt’s Magnolia Campus. The building consists of 5 floors and 1 roof (west, south, and north wings of the building) an atrium with a raised roof and a central area with 6 floors and 1 roof. The west end of the building serves administrative services. The north and south ends from the second to fourth floor serve BSL-2 laboratories. The basement of the building houses the vivarium and glass wash. The first level houses the auditorium and lecture rooms. Each floor is approximately 40,000 ft². The roof supports all major HVAC equipment (13 AHUs in total) providing cooling and ventilation for the building. This project includes replacing the roof and HVAC equipment on the roof along with electrical upgrades to support more HVAC equipment on emergency power.

B. Building Occupancy Classification: Business

C. Building Construction Type: 1A

1.02 Owner’s Standards And Guidelines

A. Refer to the standards and guidelines listed below. Project specific documents will accompany the Basis of Design document.

1. Moffitt Cancer Center Mechanical Guidelines
2. Moffitt Cancer Center Electrical Guidelines
3. Moffitt Cancer Center Plumbing Guidelines
4. Moffitt Cancer Center General Standards Guidelines

1.03 HVAC Design Basis

A. Codes and Guidelines

1. 2017 Florida Building Code
2. 2017 Florida Mechanical Code
3. 2017 Florida Existing Building Code
5. 2016 ASHRAE Standard 62 for ventilation requirements

B. Notable HVAC deviations from Owner’s Standards and Guidelines

1. 20% Added Capacity Not Met
   a. The following equipment will be replaced without the 20% added design capacity met.
      Smoke Evacuation Fans: EF 3-36, EF 3-37, EF 3-37, EF 3-38, EF 3-39, EF 3-40, EF 3-41, EF 3-42, EF 3-43.
      a) Fans will be replaced ‘like for like’ serving the atrium smoke evacuation system.

1) Atrium Return Fans: EF 3-20, RF 3-24
   a) Fans will be replaced ‘like for like’ serving the atrium.

C. Design Criteria

1. Building heating and cooling loads will be calculated using the following criteria:
   a. Outdoor Conditions (Exterior Facing Outside Air Intake)
      1) 30°F Heating (Per Moffitt Guidance on 02-03-20)
      2) 100°F DB/82°F WB (Per Moffitt Guidance on 02-03-20)
   b. Outdoor Conditions (Roof Facing Outside Air Intake)
      1) 30°F Heating (Per Moffitt Guidance on 02-03-20)
      2) 110°F DB/82°F WB (Per Moffitt Guidance on 02-03-20)
   c. Indoor Conditions (Occupied)
      d. Indoor Conditions (Unoccupied)
e. Outside Air Ventilation Rate:

<table>
<thead>
<tr>
<th>OCCUPANCY</th>
<th>AIR CHANGES</th>
<th>FILTER BED #1</th>
<th>FILTER BED #2</th>
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<tr>
<td></td>
<td>EA UNOCC</td>
<td>EA OCC</td>
<td>SA OCC</td>
</tr>
<tr>
<td>BSL-2 Laboratories</td>
<td>4</td>
<td>8</td>
<td>30</td>
</tr>
<tr>
<td>General Laboratories</td>
<td>4</td>
<td>4-6</td>
<td>30</td>
</tr>
<tr>
<td>Office / Conference</td>
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<td>30</td>
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1. Noise Criteria:

<table>
<thead>
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<th>Room Criteria (NC)</th>
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<tr>
<td>Private Offices</td>
<td>25-35</td>
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<tr>
<td>Open-Plan Offices</td>
<td>30-40</td>
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<tr>
<td>Office Corridors and Lobbies</td>
<td>40-45</td>
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<tr>
<td>Conference Rooms</td>
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<tr>
<td>Laboratories</td>
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</tr>
<tr>
<td>Animal Holding Rooms</td>
<td>35-45</td>
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</table>

2. Occupancy Schedule

<table>
<thead>
<tr>
<th>Day</th>
<th>Building Opens</th>
<th>Building Closes</th>
<th>Cleaning Begins</th>
<th>Cleaning Ends</th>
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<td>Monday</td>
<td>6am</td>
<td>8pm</td>
<td>5pm</td>
<td>1am</td>
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<tr>
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<tr>
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<td></td>
</tr>
<tr>
<td>Sunday</td>
<td>Closed with exception of experiments</td>
<td>5pm</td>
<td>1am</td>
<td></td>
</tr>
<tr>
<td>Holiday Hours</td>
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</tbody>
</table>

D. Air Systems

Note: Basis of design for the air handling units was Temtrol. The following manufacturers are approved alternatives to Temtrol.

- Haakon – Moffitt Facilities Recommendation
- Carrier
- York
- Governair

Note: Basis of design for the exhaust and return fans was Gree. The following manufacturers are approved alternatives to Temtrol.

- Cook

1. Heating & Cooling Air-Handling Equipment

a. West Roof AHUs: AHU 2-20, AHU-2-21, AHU 2-22

   1) Air Handling Units
   a) Type: Variable Air Volume Reheat
   b) Rooftop Unit manufacturer: Temtrol
   c) Control: Packaged with interface to BAS
   d) Cooling: Chilled Water with supply temperature of 44°F with 12°F differential temperature (oversized cooling coil to minimize pressure drop). Control cooling coil to 16°F differential temperature.
   e) Fan: Fan wall with a dedicated VFD controlling each fan
   f) Relief: Fan Powered Exhaust
   g) Energy Recovery: None
   h) Filtration: Filter Rack 1: 30% Filters (MERV 8)
   i) Additional Capacity Added to AHU: 20%
   j) Redundancy: None
   k) Emergency Power Requirement: None of these AHUs will be provided on emergency power.

b. North & South Roof Laboratory: AHU 3-23, AHU 3-24, AHU 3-25, AHU 3-26, AHU 3-27, AHU 3-28

   1) Air Handling Units
   a) Type: Variable Air Volume Reheat, 100% outside air.
   b) Air Handling Unit manufacturer: Temtrol
   c) Control: Packaged with interface to BAS
   d) Heating: Heating Hot Water with supply temperature of 150°F with differential temperature of 20°F.
   e) Cooling: Chilled Water with supply temperature of 44°F with 12°F differential temperature (oversized cooling coil to minimize pressure drop). Control cooling coil to 16°F differential temperature.
   f) Fan: Fan wall with a dedicated VFD controlling each fan
   g) Relief: None
   h) Energy Efficiency Measures: Laboratory unoccupied air changes per hour setback
   i) Filter Rack 1: 30% Filters (MERV 8) Filter Rack 2: 90% Filters (MERV 14)
   j) Additional Capacity Added to AHU: 20%
   k) Redundancy: One Additional AHU (N+1) for bank of North Laboratory AHUs and one for bank of South Laboratory AHUs. NOTE: The North & South Labs are not manifolded together.
   l) Emergency Power Requirement: AHU 3-23 and AHU 3-24 will be provided to run 100% of design airflow on emergency power.

c. North & South Roof Vivarium: AHU 3-29V, AHU 3-30V, AHU 3-31V, AHU 3-32V

   1) Air Handling Units
   a) Type: Variable Air Volume Reheat, 100% outside air.
   b) Air Handling Unit manufacturer: Temtrol
   c) Control: Packaged with interface to BAS
   d) Heating: Heating Hot Water with supply temperature of 150°F with differential temperature of 20°F.
e) Cooling: Chilled Water with supply temperature of 44°F with 12°F differential temperature (oversized cooling coil to minimize pressure drop). Control cooling coil to 16°F differential temperature.

f) Fan: Fan wall with a dedicated VFD controlling each fan

g) Relief: None

h) Energy Efficiency Measures: Laboratory unoccupied air changes per hour setback

i) Filter Rack 1: 30% Filters (MERV 8) Filter Rack 2: 80% Filters (MERV 13)

j) Additional Capacity Added to AHU: 20%

k) Redundancy: One Redundant AHU (N+1) NOTE: All Vivarium are manifolded together on the first floor. There will be one additional AHU out of the four Vivarium AHUs.

l) Emergency Power Requirement: AHU 3-29V, AHU 3-30V, AHU 3-31V and AHU 3-32V will be provided with emergency power to run 100% of design airflow. Consider the redundant arrangement.

2. Ventilating & Return Air Equipment

a. General/General Lab Exhaust: EF 2-20, EF 3-23, EF 3-35

1) Exhaust Fan

a) A central exhaust fan will ventilate the rooms.

b) Fan will operate based on occupancy schedule to reduce ventilation rate during unoccupied.

c) Capacity: 20% of design airflow will be added to the fan.

d) Redundancy: None

e) Emergency Power Requirement: EFs will not be provided emergency power.

b. North & South Laboratory Exhaust: EF 3-27, EF 2-28, EF 3-29, EF 3-30

1) Exhaust Fan

a) A central exhaust fan will ventilate rooms.

b) Fans will operate based on lab AHU status and pressurization relationships within the laboratories.

c) The fan will modulate based on the occupancy schedule to reduce minimum ventilation rate during unoccupied.

d) Capacity: 20% of design airflow will be added to the fan.

e) Redundancy: One Redundant EF (N+1) NOTE: All Laboratory Exhaust Air is manifolded together on the roof and roof penthouse.

f) Emergency Power Requirement: EF 3-27 and EF 3-28 will be provided with emergency power to operate the fans at 100% design airflow.

c. Wet Vivarium Exhaust: EF 3-24, EF 3-25, EF 3-26

1) Exhaust Fan

a) A central exhaust fan will ventilate rooms.

b) Fans will operate based on Vivarium AHU status and pressurization relationships within the Vivarium.

c) The fan will maintain minimum ventilation rate 24/7.

d) Capacity: 10% additional capacity was met during original design. Replacement of 20% of design airflow will be added to the fans during replacement.

e) Redundancy: One Redundant EF (N+1) NOTE: All Wet Vivarium Exhaust Air are manifolded together on the roof and roof penthouse.

f) Emergency Power Requirement: EF 3-24, EF 3-25 and EF 3-26 will be provided with emergency power to run 100% of design airflow. Consider the redundant arrangement.

d. Dry Vivarium Exhaust: EF 3-31, EF 3-32, EF 3-33

1) Exhaust Fan

a) A central exhaust fan will ventilate rooms.

b) Fans will operate based on Vivarium AHU status and pressurization relationships within the Vivarium.

c) The fan will maintain minimum ventilation rate 24/7.

d) Capacity: 20% additional capacity was met during original design. The 20% additional capacity will be maintained.

f) Emergency Power Requirement: EF 3-31, EF 3-32 and EF 3-33 will be provided with emergency power to run 100% of design airflow. Consider the redundant arrangement.

e. Radioisotope Lab Exhaust: EF 3-34, EF 3-46, EF 3-47

1) Exhaust Fan

a) A fan will be dedicated to serve each floor’s laboratory radioisotope exhaust airflow.

b) Fans will operate based on dedicated laboratory radioisotope usage.

c) Filtration: Existing filtration will be used to serve the fans.

d) Capacity: 20% capacity will be added to the radioisotope fans.

f) Emergency Power Requirement: All fans will be provided with emergency power to run 100% of design airflow.

f. Smoke Evacuation Atrium Exhaust: EF 3-36, EF 3-37, EF 3-38, EF 3-39, EF 3-40, EF 3-41, EF 3-42, EF 3-43

1) Exhaust Fan

a) All fans serve the atrium from the atrium penthouse.

b) Fans controlled together based on the building’s smoke evacuation system plan.

c) The fan will remain off until signal from BAS.

d) Capacity: No additional capacity will be added to the fans.

f) Emergency Power Requirement: All fans will be provided with emergency power to run 100% of design airflow.

g. Atrium Return Air: RF 3-29, RF 3-24

1) Return Fan

a) Return fans are dedicated to the north (RF 3-20) and south (RF 3-24) end of the atrium penthouse.

b) Fans operate based on the differential pressure within the atrium.

c) The fan will maintain differential pressure 24/7.

d) Capacity: No additional capacity will be added to the fans.

f) Emergency Power Requirement: RFs will not be provided emergency power.
b. South Labs: Three of the four AHUs will operate in parallel. The fourth unit will not be energized and will wait for an unoccupied time before modifications are made to change the redundant AHU. Pressurization within the north labs will control the supply airflow entering manifolded supply header at the AHUs. Match the exhaust fan plan as described above.

c. Vivarium: Three of the four AHUs will operate in parallel. The fourth unit will not be energized and will wait for an unoccupied time before modifications are made to change the redundant AHU. The exhaust systems include three fans serving the Wet Vivarium and three fans serving the Dry Vivarium. A redundant fan is provided and will not operate during normal operation. Two of the three fans will stage up and down together based on pressurization within the vivarium.

1.04 PLUMBING DESIGN BASIS

A. Codes and Guidelines
1. 2017 Florida Plumbing Code
2. International Fuel Gas Code
4. 2017 International Mechanical Code
5. NFPA 99 Standard for Health Care Facilities
7. NFPA 13 Standard for the Installation of Sprinkler Systems
8. NFPA 68 Standard for Explosion-Pressure Relief

B. Notable Plumbing deviations from Owner's Standards and Guidelines
1. None

C. Design Criteria
1. Flow test information: N/A
2. Sanitary sewer main information: N/A
3. Storm sewer main information: N/A

D. Domestic Water
1. Water source: City Water
2. Hot water generation: N/A

E. Sanitary Waste
1. Disposal method: City Sanitary Sewer
2. Lift station required: Yes (Located in Loading Dock)

F. Stormwater/Rainwater Removal
1. System type: Roof drains and interior piping to storm sewer
2. N/A

G. Fire Protection
1. Type of hazard: High Hazard
Type of system: Wet System
2. Fire Pump Required: Existing pump to remain serving SRB.
3. Additional Sprinklers: Tie new sprinklers into existing system. Fire pump capacity to be confirmed in design.
4. Number of standpipes: 3

1.05 ELECTRICAL DESIGN BASIS

A. Codes and Guidelines
1. 2014 NFPA 70 - National Electric Code
2. 2013 NFPA 72 - National Fire Alarm Code

B. Notable Electrical deviations from Owner’s Standards and Guidelines
1. None

C. Design Criteria
1. Emergency power distribution upgrades to support HVAC equipment.
2. Code required light fixtures
3. Code required equipment locations
4. Special owner requirements

D. Lighting
1. Voltage
a. 277V
b. Control via local lighting control
2. Egress / Life Safety
a. Exit Lights
b. New exit lighting shall be installed in the elevator lobby in the penthouse.
c. If new penthouse(s) is/are constructed new LED exit lighting shall be installed to meet Moffit Standards and Code.
3. Interior
a. New LED strip lighting shall be installed in the place of existing, aging fluorescent lighting in the existing penthouse.
b. If new penthouse(s) is/are constructed new LED strip lighting shall be installed to meet Moffit Standards and Code.
4. Exterior
a. New LED wall-pack lighting with integral photocells shall be installed on exterior spaces where maintenance on HVAC could take place during time of low ambient light levels.

E. Electrical Distribution System
1. Voltage

F. Normal Power System
1. The normal power system for the Stabile Research Building (SRB) is fed from a 2000kVA TECO transformer which is connected to a 3000A switchboard. The switchboard has adequate capacity to add the extra/adjusted HVAC load to serve the Lab Areas via ATS-7EQ.

G. Emergency Power System
1. The emergency power system for the Stabile Research Building (SRB) is fed from two locations originating in the Central Energy Plant. The first is from 2EMDP which feeds the main emergency switchboard EMSBA-RT located in the west lower level electrical room of SRB. The second feed is from 3EMDP which feeds ATS-7EQ located in the lower level east electrical room. Each of the normal power feeds comes from switchboard MSBA/B-RT. According to preliminary load calculations (below) it appears that the normal and emergency electrical service is adequate to handle the upgraded HVAC equipment. A majority of the HVAC equipment is currently connected to the emergency power system. There is adequate capacity on ATS-7EQ or EMDP-A to add the extra/adjusted HVAC load to serves the Lab Areas. See table below for load summary.

<table>
<thead>
<tr>
<th>Name</th>
<th>Size</th>
<th>Est. kVA</th>
<th>Est. KW</th>
<th>PF</th>
<th>Est. kVA</th>
<th>Load Served</th>
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<tbody>
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<td>ATS-2A</td>
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<td>CEP</td>
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<td>EMDPA-RT (2GEL1)</td>
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<td>EMDPA-RT (35EMCC)</td>
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Total: 682 kW 884 kVA 33%

H. Fire Alarm System
1. New duct smoke detectors and other controls points shall be connected to the existing fire alarm system.
Structural Design Criteria Narrative

Applicable Building Codes

2. ASCE 7-10
3. ACI 318-14
4. AISC 360-16

Floor Loads

<table>
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<tr>
<th>Live Loads</th>
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<tbody>
<tr>
<td>Roof – Mechanical - East</td>
<td>125 psf</td>
</tr>
<tr>
<td>Roof – Mechanical - West</td>
<td>65 psf</td>
</tr>
<tr>
<td>Atrium Infill</td>
<td>125 psf</td>
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<tr>
<td>Roof</td>
<td>20 psf</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Superimposed Dead Loads</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Allowance for Roofing Material / Ceiling / MEP</td>
<td>20 psf</td>
</tr>
</tbody>
</table>

Wind Loads

1. Basic Wind Speed (Vult) = 153 mph
2. Exposure Classifications = B
3. Building Classifications = Category IV
4. Wind Drift Limit = h/400
5. The structure is located in a wind-borne debris region and will be designed as enclosed. Impact-resistant exterior glazing or impact-resistant cover over exterior glazing is required.

HVAC Replacement – Option 2 (Replacement with Different Units)

1. AHU’s and ductwork to be replaced with different units with more durable design. No structural impact with this option provided design capacities are not exceeded.
2. Refer to attached Sketch “Option 1&2 - Roof plans - Existing Structure Capacities”

HVAC Replacement – Option 3a (Penthouse)

1. AHU’s to be replaced with different units. Roof deck supported by steel framing would be provided overtop of AHU’s approximately 4’ above existing screenwall to create a penthouse.
2. New steel framing would be supported by existing concrete columns. Connections would require drill and epoxy anchor rods and rebar and/or expansion anchors
3. Refer to attached Sketches “Option 3 - Roof plans - New Steel Framing” and “Option 3 - Roof plans - New Roof Capacities” for proposed steel layout and assumed design loads

Structural Materials

Division 03 – Concrete

1. Project includes
   a. Plant-Mixed Cast-In-Place Concrete:
      i. Columns
      ii. Housekeeping pads for MEP equipment
2. Products
   a. Concrete Design Mixes, ASTM C 94, 28 Day Compressive Strength:
      i. Columns:  5000 psi
      ii. Housekeeping Pads: 4000 psi
   b. Formwork: Plywood or metal panel formwork sufficient for structural and visual requirements.
      i. Metal, plastic or paper tubes for cylindrical columns and supports.
3. Reinforcing Materials:
   a. Reinforcing Bars:  ASTM A 615, Grade 60, deformed.
   b. Steel Wire:  ASTM A 82.
   c. Steel Wire Fabric:  ASTM A 185, welded.
4. Concrete Materials:  ASTM C 150, Type I, Portland cement; potable water.
5. Concrete Admixtures: Containing less than 0.1 percent chloride ions.
   a. Air-Entraining Admixture:  ASTM C 260, for exterior exposed concrete
   b. Water-Reducing Admixture:  ASTM C 494, Type A, for placement and workability.
6. Concrete Finishes for Formed Surfaces:
   a. Surfaces Not Exposed to View: As-cast form finish.
   b. Surfaces Exposed to View: Smooth-rubbed finish.

Division 05 - Metal

1. Project Includes
   a. Beams, girders, columns, base plates, deck edge support angle, and embed plates.
2. Products
   a. Steel Materials:
      i. Structural Steel Shapes (Wide Flange and WT):  ASTM A 992 (Fy=50 ksi)
      ii. Rectangular HSS:  ASTM A 500 (Fy=46 ksi)
      iii. Steel Angles, Plates and Bars:  ASTM A 36
      iv. Base plates and cap plates at columns:  ASTM A 572, Grade 50
v. Steel Pipe: ASTM A 53, Type E or S, Grade B; or ASTM A 501
vi. Headed Stud-Type Shear Connectors: ASTM A 108, Grade 1015 or 1020
vii. Anchor Bolts: ASTM F1554, Grade 55
viii. High-Strength Threaded Fasteners: ASTM A 325 or ASTM A 490, as applicable

b. Auxiliary Materials:
   i. Direct Tension Indicators: ASTM A 959.
   ii. Electrodes for Welding: AWS Code, E70XX.
   iii. Structural Steel Primer Paint: Fast-curing, lead- and chromate-free, universal modified-alkyd primer with good resistance to normal atmospheric corrosion, complying with performance requirements of FS TT-P-664, surface prepared according to SSPC-SP-2.
## UNIFORMAT LEVEL 2 REPORT

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**NOTES:**

1. Subtotal A * 5%
2. (Subtotal A + Conceptual Cost Model Allowance) * 5%
3. CCIP calculated on Total Design-Build Cost * 2.25%
4. SDI = (Subtotal B + Construction Contingency - Project Management & Field Supervision - Project Requirements - Envision-CS Staffing) * 1.5%
5. Payment & Performance Bond calculated on Total Design-Build Cost * 0.75%
6. Construction Contingency calculated on Subtotal C * 5%
7. Design-Build Management Fee calculated on Subtotal D * 5%
### DETAILED COST: Option 2

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<tr>
<td>HVAC System High Exhaust Roof - Controls</td>
<td>1.00 ls</td>
<td>$151,200.00</td>
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<tr>
<td>HVAC System High Exhaust Roof - Demolition</td>
<td>1.00 ls</td>
<td>$37,400.00</td>
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<tr>
<td>HVAC System High Exhaust Roof - Engineering for Roof Supports</td>
<td>1.00 ls</td>
<td>$6,000.00</td>
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<tr>
<td>HVAC System High Exhaust Roof - Rigging and Handling</td>
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<td>1.00 ls</td>
<td>$7,500.00</td>
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<td>HVAC System High Exhaust Roof - Vibration Isolators</td>
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<td>$37,200</td>
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<td>HVAC System North Roof - BIM</td>
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<td>HVAC System South Roof - Chilled Water Piping Insulation</td>
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<td>$394,000</td>
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<td>$114,600</td>
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## DETAILED COST: Option 2 [ CONTINUED ]

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<th>COST / AREA</th>
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<tr>
<td>Electrical Option 2 - Fire Alarm</td>
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<td>ls</td>
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<td>Electrical Option 2 - Architectural Lighting Allowance at Atrium</td>
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### G20 - SITE IMPROVEMENTS

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<tr>
<td>Hardscape &amp; Landscape Restoration@ Laydown</td>
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### H10 - PROJECT MANAGEMENT & FIELD SUPERVISION

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<td>Project Management &amp; Field Supervision</td>
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### H20 - PROJECT REQUIREMENTS

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### M20 - ENVISION-CS STAFFING

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<tr>
<td>Envision CS-Staffing</td>
<td>3,336.00</td>
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**TOTAL Option 2**

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- $28,148,035
- $670
### DETAILED COST: Option 3A

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<tr>
<td><strong>B10 - SUPERSTRUCTURE</strong></td>
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<td>$2,110,000</td>
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<td><strong>B1000 - SUPERSTRUCTURE</strong></td>
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<tr>
<td>Structural Steel - Penthouse</td>
<td>275.00 tn</td>
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<td>Spray Fireproofing - Beams, Columns, and Deck</td>
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<td>$1,502,200</td>
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<td><strong>B2000 - EXTERIOR ENCLOSURE</strong></td>
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<tr>
<td>Penthouse Exterior Framing</td>
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<td>Personnel Hoist</td>
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<td>Scaffold Rental - Atrium</td>
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<td>Scaffold Setup and Demolite - Atrium</td>
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<tr>
<td>Scaffolding - Holy Drive</td>
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### DETAILED COST: Option 3A [ CONTINUED ]

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### DETAILED COST: Option 3A [ CONTINUED ]

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<th>COST / AREA</th>
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#### D40 - FIRE PROTECTION

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#### D4000 - FIRE PROTECTION

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#### D50 - ELECTRICAL

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#### D5000 - ELECTRICAL

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#### G20 - SITE IMPROVEMENTS

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#### G2000 - SITE IMPROVEMENTS

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### TOTAL Option 3A

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Assumptions and Exclusions

General Assumptions

2. Budget is based on the information included in the Part 1 deliverable dated 3/13/2020.
3. Based on the date of construction, it is assumed there are no hazardous materials in the project. Any indication of hazardous material would require testing by the owner. No hazardous material abatement has been included in budget or schedule.
4. We assume that all the existing areas comply with current life safety and FBC codes. Cost and time for bringing systems and facilities up to code are not included, except as noted in the Electrical Narrative.
5. ICRA Risk Assessment provided by Owner.
6. A NTP for design will be requested by April 13th to start Design Development.
7. A GMP will be prepared following design development documents and will be incorporated as an amendment to the contract.
8. General Conditions assumes project administration and supervision for a construction duration shown on schedules. Construction trailer location to be coordinated with Owner. We have assumed temporary utilities available.
9. Offsite parking and shuttle service not included. Owner to provide any permits, passes, or identification required for workers to park in provided lots. No parking costs have been included for trades.
10. Contingent upon the ability to block off 2 lanes on USF Holly drive during the times when a crane is needed.
11. Contingent upon a nearby location for construction trailers. Parking costs are not assumed.
12. Mechanical, electrical, plumbing, steel, and roofing subcontractors have priced according to this document set.
13. Test and balance is included to verify new air handling units are functioning at their specified capacity, and that the flows at the ends of the main ductwork headers (roofop only) are correct.

Exclusions

1. Pricing includes labor and material escalation through Q3 of 2020. Beck recommends that the owner carry an additional 2.5-3% escalation for each fiscal quarter thereafter until GMP is approved.
2. Builder’s Risk Insurance is excluded.
3. Commissioning costs excluded.
4. Test and Balance Costs are excluded.
5. Existing ducts within the building are not being upsized to meet the 20% increased capacity provided by the new air handling units for the Labs and Offices. The existing Vivarium air handling units already meet Moffitt’s 20% additional capacity requirement and will not be upsized when replaced. Therefore, the ductwork to the Vivarium is already appropriately sized for the higher capacity.
6. Maintenance contracts are excluded outside of standard manufacturer warranties.
7. All work associated with this project is intended to be above the rooftop slab level (top of slab on level 5 in existing drawings). Notable exceptions are:
   a. Chilled water lines that must be extended from the existing Central Energy Plant to the West roof to provide additional capacity required for the new AHUs.
   b. Electrical tie-ins on lower floors.
   c. HVAC controls tie-ins on lower floors.
8. Work below the roof slab level to balance, clean, repair or otherwise refurbish the internal HVAC system of the building. It is strongly suggested that the owner carry an allowance to address any downstream issues (interior) that will require testing and balancing of the existing ductwork to remain once the new rooftop AHUs are installed.
9. Infectious controls are excluded.
10. Temporary chilled water is excluded. New chilled water lines are included in the base design.
# Moffitt SRB Building - Option 2

## Owner Activities
- **A020**: Owner Selection of Option and Approval
  - Start: 03/13/20
  - Finish: 04/09/20

- **A030**: Owner Approval of GMP
  - Original Duration: 130
  - Remaining Duration: 130
  - Start: 03/13/20
  - Finish: 09/15/20

## Design
- **A100**: Delivery of Part 1
  - Original Duration: 0
  - Remaining Duration: 0
  - Start: 03/13/20
  - Finish: 03/13/20

## Developmental Design
- **A101**: Design Development/GMP Documents
  - Original Duration: 60
  - Remaining Duration: 60
  - Start: 09/16/20
  - Finish: 07/07/21

## Contract Documents
- **A106**: Construction Documents
  - Original Duration: 30
  - Remaining Duration: 30
  - Start: 09/16/20
  - Finish: 07/07/21

## Permitting
- **A104**: Permitting
  - Original Duration: 10
  - Remaining Duration: 10
  - Start: 07/07/20
  - Finish: 07/07/20

## Preconstruction/Procurement
- **A105**: GMP Prep
  - Original Duration: 30
  - Remaining Duration: 30
  - Start: 07/07/20
  - Finish: 08/17/20

## Subcontractor Buy-out
- **A107**: Subcontractor Buyout
  - Original Duration: 25
  - Remaining Duration: 25
  - Start: 09/16/20
  - Finish: 10/20/20

## Construction
- **C.1000**: Mobilization
  - Original Duration: 10
  - Remaining Duration: 10
  - Start: 09/16/20
  - Finish: 09/29/20

- **C.1910**: Setup Roof Access
  - Original Duration: 20
  - Remaining Duration: 20
  - Start: 09/16/20
  - Finish: 09/29/20

### Phase 1

#### Phase 1.1
- **C.Ph1.1000**: Phase 1 - Return Air Demo & New Interior Planum Inst
  - Original Duration: 15
  - Remaining Duration: 15
  - Start: 10/28/20
  - Finish: 11/17/20

- **C.Ph1.1010**: Phase 1 - Demo and Reinstall New Smoke Evacs
  - Original Duration: 15
  - Remaining Duration: 15
  - Start: 11/18/20
  - Finish: 12/10/20

- **C.Ph1.1020**: Phase 1 - Relocate all DX equipment
  - Original Duration: 5
  - Remaining Duration: 5
  - Start: 11/25/20
  - Finish: 01/11/21

### Phase 2

#### Phase 2.1
- **C.Ph2.1000**: Phase 2.1A - Add curb and Tie in Temp Exhaust
  - Original Duration: 5
  - Remaining Duration: 5
  - Start: 05/18/21
  - Finish: 06/01/21

- **C.Ph2.1010**: Phase 2.1B - Add curb and Tie in Temp Exhaust
  - Original Duration: 5
  - Remaining Duration: 5
  - Start: 06/02/21
  - Finish: 06/15/21

- **C.Ph2.1020**: Phase 2.1C - Install New South Side AHU
  - Original Duration: 20
  - Remaining Duration: 20
  - Start: 06/16/21
  - Finish: 07/07/21

- **C.Ph2.1030**: Phase 2.1D - Install New North Side AHU
  - Original Duration: 5
  - Remaining Duration: 5
  - Start: 07/08/21
  - Finish: 07/28/21

- **C.Ph2.1040**: Phase 2.1E - Install New South Side AHU
  - Original Duration: 20
  - Remaining Duration: 20
  - Start: 08/01/21
  - Finish: 08/31/21

- **C.Ph2.1050**: Phase 2.1F - Install New North Side AHU
  - Original Duration: 5
  - Remaining Duration: 5
  - Start: 08/02/21
  - Finish: 08/28/21

### Phase 3

#### Phase 3.1
- **C.Ph3.1000**: Phase 3.1A - Add curb and Tie in Temp Exhaust
  - Original Duration: 5
  - Remaining Duration: 5
  - Start: 08/31/21
  - Finish: 09/15/21

- **C.Ph3.1010**: Phase 3.1B - Add curb and Tie in Temp Exhaust
  - Original Duration: 5
  - Remaining Duration: 5
  - Start: 09/16/21
  - Finish: 09/29/21

- **C.Ph3.1020**: Phase 3.1C - Install New South Side AHU
  - Original Duration: 5
  - Remaining Duration: 5
  - Start: 09/17/21
  - Finish: 09/29/21

- **C.Ph3.1030**: Phase 3.1D - Install New North Side AHU
  - Original Duration: 5
  - Remaining Duration: 5
  - Start: 09/30/21
  - Finish: 11/01/21

### Phase 4

#### Phase 4.1
- **C.Ph4.1000**: Phase 4.1A - Screen Wall demo
  - Original Duration: 5
  - Remaining Duration: 5
  - Start: 09/10/21
  - Finish: 09/16/21

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**Data Date:** 02/14/20

**Owner Activities:**
- Owner Selection of Option and Approval
  - Date: 03/13/20
  - Duration: 130

**Design:**
- Delivery of Part 1
  - Original Duration: 0
  - Remaining Duration: 0

**Developmental Design:**
- Design Development/GMP Documents
  - Original Duration: 60
  - Remaining Duration: 60

**Contract Documents:**
- Construction Documents
  - Original Duration: 30
  - Remaining Duration: 30

**Permitting:**
- Permitting
  - Original Duration: 10
  - Remaining Duration: 10

**Preconstruction/Procurement:**
- GMP Prep
  - Original Duration: 30
  - Remaining Duration: 30

**Subcontractor Buy-out:**
- Subcontractor Buyout
  - Original Duration: 25
  - Remaining Duration: 25

**Construction:**
- Mobilization
  - Original Duration: 10
  - Remaining Duration: 10

**Phase 1:**
- Return Air Demo & New Interior Planum Inst
  - Original Duration: 15
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**Phase 2:**
- Add curb and Tie in Temp Exhaust
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**Phase 3:**
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**Phase 4:**
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**Penthouse Phase 2.4**

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**Moffit SRB Building - Option 3A**

**Project ID:** 172192.WI.300227-3A  
**Layout:** Print Layout  
**TASK filters:** All Activities  
**Page 2 of 2**
Moffitt SRB Rooftop Refurbishment

Owner Project Requirements

Date: 02-18-2020
Table of Contents

INTRODUCTION .......................................................................................................................... 3

PROJECT OVERVIEW .................................................................................................................... 3

OWNERS PROJECT REQUIREMENTS (OPR) - PURPOSE .......................................................... 3

FACILITY REQUIREMENTS ........................................................................................................... 3

MISSION STATEMENT .................................................................................................................. 4

OVERALL MEASURES FOR SUCCESS ....................................................................................... 4

ENERGY EFFICIENCY TARGETS ............................................................................................... 4

SUSTAINABILITY TARGETS ........................................................................................................ 4

GENERAL BUILDING INFORMATION ......................................................................................... 4

GENERAL PROJECT REQUIREMENTS ......................................................................................... 4

OBJECTIVES: .................................................................................................................................. 4

SPECIFIC OWNER PROJECT REQUIREMENTS ........................................................................... 8

INDEPENDENT THIRD-PARTY SYSTEMS COMMISSIONING .................................................... 8

CONTRACTOR SELF-PERFORMED SYSTEMS COMMISSIONING .............................................. 9

BUILDING ENVELOPE SYSTEMS .............................................................................................. 10

ARCHITECTURAL........................................................................................................................ 10

OCCUPANCY SCHEDULES ........................................................................................................... 10

SPECIFIC OWNER PROJECT REQUIREMENTS – HVAC ........................................................... 11

GENERAL HVAC DESIGN REQUIREMENTS ......................................................................... 11

BUILDING SYSTEMS ENERGY CONSERVATION .................................................................... 12

ARCHITECTURAL; STRUCTURAL; AND SITE ENGINEERING DESIGN COORDINATION .......................... 12

SMOKE CONTROL SYSTEMS – SPECIAL INSPECTIONS ............................................................ 12

BUILDING AUTOMATION SYSTEM (BAS) ............................................................................... 12

VFD (VARIABLE FREQUENCY DRIVES) ..................................................................................... 13

CUSTOM AIR HANDLING UNITS ................................................................................................ 13

TEMPERATURE AND HUMIDITY DESIGN .............................................................................. 18

OUTDOOR DESIGN CONDITIONS ............................................................................................. 18

VENTILATION GOALS ............................................................................................................... 18

DUCTWORK STANDARDS .......................................................................................................... 18

HYDRONIC SYSTEMS ................................................................................................................ 19
INTRODUCTION

PROJECT OVERVIEW
In December of 2019, Moffitt Cancer Center approved a project to replace the aged rooftop infrastructure at the Stabile Research Building (SRB) on Moffitt’s Magnolia Campus. Phase 1 of the project included hiring a design build contractor to gather a Target Value Design (TVD) for 3 separate scenarios of how to design and construct the project. Documents required for the GMP include the Owner Project Requirements (OPR), Basis of Design (BOD) and schematic drawings. Phase 2 includes detailed construction drawings followed by the renovation. The project includes shutdowns to the entire SRB building. Shutdowns will impact research laboratories, vivarium, auditorium, and support services.

OWNERS PROJECT REQUIREMENTS (OPR) - PURPOSE
Moffitt Cancer Center has adopted the total building commissioning process as detailed in ASHRAE/NIBS Guideline 0 as their quality-oriented process for achieving, verifying, and documenting that the performance of the facility, systems, and assemblies meets their defined objectives and criteria as defined in this document.

FACILITY REQUIREMENTS
The following OPR outlines the required results for the entire SRB building (above and beyond the Rooftop Improvements). The Rooftop Renovation Project scope of work is limited to the rooftop.

The TVD excludes the cost of repairs below the roof level and costs to repair the envelope of the building.

Future projects include resolving all other HVAC issues, upgrading the terminal HVAC equipment within SRB to meet BAS standards, and repairing the building envelope.
MISSION STATEMENT

“To contribute to the prevention and cure of cancer” – Moffitt Cancer Center

OVERALL MEASURES FOR SUCCESS

1. The project must result in a stable indoor environment through a complete year (all seasons) of operations.
2. Removal of all sources of water and air leaks to the internal environment without loss of space functionality.
3. Update the building automation system (BAS) to improve efficiency, functionality, reliability, and monitoring of all key equipment and spaces.
4. Safety is not compromised for researchers, facility, and Moffitt personnel throughout all phases of design and construction.
5. Strong communication throughout all aspects of the project.

ENERGY EFFICIENCY TARGETS

1. Energy Use Index (EUI) to beat a source score of 318 and a site score of 115.
2. Meet an Energy Star score of 75.
3. Safety needs are met and prioritized while adapting energy efficiency measures that cannot interfere with safe lab operations.
4. Provide Unoccupied Occupancy Mode vs Occupied Mode for the laboratories and offices to reduce ventilation and exhaust airflow volumes.

SUSTAINABILITY TARGETS

1. Light harvesting and cooling in the penthouse.
2. Minimize total waste output produce by HVAC equipment during and after construction.

GENERAL BUILDING INFORMATION

Name: Moffit SRB Rooftop Refurbishment
Location: Magnolia Campus, Tampa, FL 33612
Gross Area (SF): The roof of SRB is approximately 42,000 square feet.

GENERAL PROJECT REQUIREMENTS

OBJECTIVES:
The following list summarizes the broad goals and objectives for the project, as defined by the project team. This list is categorized into three main categories: RESEARCH STAFF & AMENITIES, PROJECT DESIGN & CONSTRUCTION, and PROJECT TURNOVER.

A. RESEARCH STAFF & MOFFITT PERSONNEL
   1. Built Environment – The following list summarizes key attributes of the built environment:
      a. Visual Considerations
         i. Maintain screen walls after installation of equipment to hide rooftop equipment
      b. Acoustics
i. The Vivarium must be protected from all sound and vibration
   ii. Maintain sound travel appropriately into the building

c. Durable and Reliable environments
   i. Improved thermal comfort of the building inhabitants measured by reduction in hot/cold calls.
   ii. Requirement: Correct air met per ASHRAE ventilation codes. Target: Improved air quality - Measure new airflow against a baseline measurement such as spore count.
   iii. Easy to maintain
   iv. Long useful life
   v. Products & Finished with the ability to keep clean and show correct wear and tear through the life of the product.
   vi. Corrected open issues list. Prevent all air and water infiltration into the building.

d. Safety – A safe environment to be maintained.
   i. The HVAC equipment has the ability to increase ventilation and exhaust in an area in response to an alarm situation such as high levels of Carbon Dioxide or low levels of Oxygen.
   ii. Slip prevention
   iii. Fall prevention
   iv. Outside air / supply airflow contamination prevention
   v. Lighting free of dark areas
   vi. Rooftop fire ratings maintained

2. Functional Needs – The following list summarizes the key functional needs related to the building:
   a. Maintenance
      i. Ability to properly shut down systems
         • Adequate isolation valves
         • Training
         • N+1 redundancy required for all critical (north labs, south labs, north vivarium, south vivarium) air handling units.
         • Do not disrupt research to maintain the facility
      ii. Ability to properly start up systems following transition from power source
         • Normal power to emergency power
         • Emergency power to normal power
      iii. Provide proper accessibility to maintain equipment
      iv. New equipment built with maintainability as an emphasis
      v. Labeling
         • Provide nameplates on every panel, piece of equipment, shutoff valve
      vi. Proactive maintenance and notifications when systems are near failure
   
b. Infrastructure
      i. New Systems and Equipment
         • Long useful life (not low first cost) for primary equipment
Owners Project Requirements

- Provide minimum of **20% additional** capacity on the air handling units and exhaust fans serving Vivarium, Laboratories
  - To accommodate densification of labs and increasing requirements for ventilation.
- Provide appropriate redundancy for air handling units
- Provide space for future expansion and space above the current roof line:
  - AHUs
  - Piping systems (CHW, HHW)
  - Electrical panels
- Future Expansion Exceptions:
  - There will not be a freezer farm added to the SRB.
  - Office to wet laboratory conversion will not happen.
  - Laboratories will not exceed BSL-2 (BSL-3 or BSL-4).

ii. Provide advanced technology
- BAS compatible; See the **Building Automation System (BAS)** in the specific owner project requirements

c. Sustainability
i. Minimize excess waste throughout the construction process
- Develop a Construction Waste Management Plan

ii. Energy Efficiency
- Incorporate Energy Management Program
- Utilize Energy Star to measure energy performance of the building
- Overall reduction of building EUI as a derivative of increased efficiency and productivity of the building systems.
- Reduced energy cost as measured through lower consumption of power.
- LED lighting

B. PROJECT DESIGN AND CONSTRUCTION PROCESS

1. The Architects room numbers on the construction drawings to match the room numbering plan shown on the Moffitt Life Safety drawings.

2. The Moffitt’s Design & Construction Guidelines to be met throughout the construction process.
   a. Discrepancies from the Guidelines due to equipment staging, equipment phasing, or central plant constraints will be discussed and approved with Moffitt.

3. Moffitt’s equipment naming convention is used on MEP drawings and schedules.

4. O & M for primary equipment provided and approved by Moffitt immediately following submittal approval and prior to equipment start-up. Information used to populate the CMMS.

5. Design and Construction Process
   a. Construction to occur in a way to minimize the impact on the building and surrounding Moffitt buildings.
      i. Create a well detailed phasing plan.
         - Notice provided to the research team for all shutdowns must take place at a minimum 15 days in advance.
         - A detailed plan showing equipment and rooms affected is required.
ii. Expected shutdown events from Friday evening at 6pm to 4am Monday morning.
   - All shutdowns need to be approved by Moffitt.

iii. Value engineering will not provide a reduction in quality, equipment useful life, safety for facilities or research staff.

6. Design process should follow the guiding principals
   a. Is it safe?
   b. Does it add value to the research experience?
   c. Is it conducive to improve teamwork?
      i. Both for facilities and research.
   d. Can Moffitt afford it?
   e. Has the life cycle cost been approved by Moffitt?

7. Construction
   a. Manage indoor air quality; contractor’s responsibility to manage. All chemicals on or around the building need to be documented and approved by research to prevent contaminated supply air in the building. Verify low VOC materials near air intake locations.
   b. Fire smoke barrier penetration management; needs to be 100% complete
   c. Unobstructed access for repair and maintenance including actuators, service valves, fire/smoke dampers.
      i. Exception: Existing south smoke exhaust fans outside the scope of this project.
   d. Employ prefabrication opportunities when possible to reduce building shut down time.
   e. When construction turnover phasing occurs, design systems for a phased startup.
   f. Warranty for permanent HVAC to be provided.
   g. Properly identify all work force to avoid confusion with Moffitt and the design & construction team.

C. PROJECT TURN-OVER

1. Provide documents required for Moffitt’s FM Department Document Management System (ATG)
2. Follow Moffitt’s FM Department’s In-house Service model: Expanded Manufacturer Training for equipment over $30,000 in value, maintenance is self-performing with operations personnel, not be dependent on vendor service contracts. Asset components over $30,000, training included.
   a. Equipment Manufacturer Training is provided to Moffitt personnel
   b. Equipment parts available locally
   c. Factory service is available
3. Validate all new equipment into Moffitt’s CMMS before project turnover is complete.
4. Operation Manual
   a. Provide valuable close out information – As-built, valve locations, one-line diagrams, systems manual, and replacement records.
   b. Entire system is commissioned point to point including failure alarms.
   c. An operation manual shall be provided by the commissioning firm for each HVAC system for the project.
   d. The Operation & Maintenance Manual shall be in electronic (PDF) format.
5. Testing & Balancing Report
6. Accurate As-Builts
7. Zone Drawings  
   a. The engineering firm will provide updated HVAC and exhaust fan zone drawings serving the SRB following construction completion.

8. BIM Model  
   a. The architect and engineering firms shall update the BIM model through the construction process per the Moffitt’s BIM Execution Plan for this project.
   b. All roofs will be identified as a space and numbered on all drawings
   c. Provide a minimum two complete sets of hard copy prints of as-builts for maintenance department in addition to electronic files for all drawings.
   d. The project drawings and model shall be owned by Moffitt.

9. Asset Inventories  
   a. Prior to project turnover the following asset inventories will be provided. Moffitt will provide a listing of those items requiring inventory and the format of the required inventories.
      i. Utility Assets
      ii. Life Safety Assets

10. Facility Management Operational Requirements  
    a. Prior to turnover of the facility to the owner, the following information will be supplied; 
    b. Utility Asset Inventory - It is the intent with this effort that the facility management team can begin normal and routine maintenance of the building upon day one of occupancy, and in accordance with the building warranty period and subsequent building performance optimization period. A complete inventory of all Utility/Infrastructure assets will be compiled in a manner that will support direct upload and population of asset information in the owner designated CMMS system.
       i. Utility/Infrastructure assets are generally defined as those assets that support building heating, ventilating, and air-conditioning systems, mechanical, electrical, emergency power and switchgear plumbing, medical gas and pneumatic tube systems. (A complete reference list of asset types is included for reference.)
       ii. Moffitt will define exact asset types to be included.
       iii. Moffitt will define CMMS data standards (parent child relationships, naming conventions, etc.) and format of the asset inventory records.
       iv. Moffitt will coordinate proper asset tagging (bar codes, etc.) of all identified assets to allow for proper CMMS system utilization and asset record performance (PM, PE, WO events) from day 1 of occupancy.
       v. Inventories shall include all applicable make, model, serial number, installation date, warranty date, size information (e.g. X HP, Y CFM, etc.) such that the CMMS system can be properly configured. Note that size information standards are established in the asset type list document.
       vi. Inventories shall be risk ranked in accordance with owner requirements and standards.

SPECIFIC OWNER PROJECT REQUIREMENTS

INDEPENDENT THIRD-PARTY SYSTEMS COMMISSIONING

A. The Design-Build firm shall assist with coordinating the inclusion of the independent third-party systems commissioning specifications into the project specifications.

B. The following Mechanical systems are to have independent third-party commissioning:
1. In general, all new HVAC and exhaust equipment and systems including, but not limited to:
   a. Exhaust Systems
   b. Air Handling Systems
   c. Pressure Monitoring System
2. Heating hot water distribution systems
3. Chilled water distribution systems
4. New Building Automation and temperature control systems
C. The following Electrical systems to have independent third-party commissioning:
   1. Generator systems, including ATS’s
D. Other Commissioning Agent Responsibilities
   1. Shop Drawing Review
      a. Complete review of the shop drawings and approval of the commissioning agent and the MEP engineer.
   2. Utility Rebates
      a. Rebates to be considered for all LED lighting; VFD’s; BAS controls; lighting controls; high-efficiency chillers; high-efficient boilers. Other equipment shall be considered for rebates as applicable
      b. Commissioning agent or owner will submit for rebates to the utility companies.
      c. An operations manual shall be produced by either the commissioning or engineering firm for the chiller plant, boiler plant, and each HVAC system for the project.
         i. Report to include all motor information, fan information, pump information, belt information/sizes, traverse drawings, and design operating parameters.
         ii. O & M Documents
         iii. PM Requirements
         iv. Parts Diagrams
         v. Contact list of manufacturers

CONTRACTOR SELF-PERFORMED SYSTEMS COMMISSIONING

A. The Design Build firm shall assist with coordinating the inclusion of the contractor self-performed systems commissioning specifications into the project specifications.

B. In general, all mechanical and plumbing equipment and systems not being provided with independent third-party commissioning, shall be furnished with contractor self-performed systems commissioning. The equipment and systems include, but are not limited to:
   1. Plumbing systems including domestic hot and cold water, sanitary and storm water.
   2. Fire Suppression systems

C. In general, all electrical and communications equipment and systems not being provided with independent third-party commissioning, shall be furnished with contractor self-performed systems commissioning. The equipment and systems include, but are not limited to:
   1. Normal electrical power distribution
   2. Normal lighting systems and controls
   3. Fire Alarm Systems
BUILDING ENVELOPE SYSTEMS

A. Third Party Envelope Commissioning for the New Roof
   1. Design Review starting in Design Development
   2. Installation Inspections
   3. Performance Testing as required.

B. Roofs
   1. Ballast roofs are not allowed
   2. Modified Bitumen Roofing System will be the basis of design.
   3. EPDM roofs are acceptable
   4. PVC roofs are acceptable

ARCHITECTURAL

A. Mechanical rooms shall be generously sized to facilitate good operations and maintenance. The architect is to avoid providing machine rooms that require "stuffing mechanical systems" into small spaces.
   1. **Target:** Provide elevator in the mechanical room. Size shall be “in-house transportation elevator” at minimum. **Requirement:** Improve staging path for equipment to improve replacement of large motors up several flights of stairs.
   2. Main mechanical room corridor shall provide a clear 5’-0” space.
   3. Minimum space between AHU’s shall be 3’-0” or the coil pull.
   4. No drainage pipes across the main mechanical room floor.
   5. Must provide pull space for all AHU coils for replacement.
   6. Must provide storage space for AHU filters, maintenance storage, and maintenance equipment in mechanical room.
   7. Mechanical room floors and curbs shall be epoxy coated to waterproof.
   8. All equipment supported on concrete curbs.

B. Floor to heights of penthouse shall be selected to allow adequate space above ceilings for mechanical and piping systems.

C. Consider future renovations:
   1. Additional chemical fume hoods are planned for the 3rd floor.

D. HVAC air intake louvers: SEE HVAC SPECIFIC REQUIREMENTS

OCCUPANCY SCHEDULES

A. The Research Building is typically occupied according the to the following table:
   1. **EXCEPTION:** Vivarium occupied 100% of the time.

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<td>Saturday</td>
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<td>Sunday</td>
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<td>Holiday Hours</td>
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**SPECIFIC OWNER PROJECT REQUIREMENTS – HVAC**

**GENERAL HVAC DESIGN REQUIREMENTS**

**A.** Owner wishes construct a *high-performance* building. High-efficient HVAC systems are desirable.

**B.** HVAC systems should be designed to be simple to operate.

1. Isolation and balancing valves are easily accessible not requiring a ladder.
2. Monitor temperature, pressure, differential temperature, differential pressure, and filtration cleanliness locally and remotely.
3. Acceptable tolerances as outlined in the MOFFITT MECHANICAL GUIDELINES.

**C.** HVAC systems that inherently require low maintenance is highly desirable.

1. A safe way to bring up and down heavy parts and equipment is required.

**D.** Redundant (N + 1) HVAC equipment required for air handling units serving the Vivarium and Laboratories.

**E.** Air handlers to use “fan wall” configuration with minimum of 4 fans and 1 redundant (N + 1 fan configuration). Stratification must be considered when providing multiple fans to ensure a good air mix occurs in the air handler.

**F.** Equipment phasing and replacement considered for future replacement after equipment’s useful life.

**G.** Energy recovery system to be considered. Cross contamination of airflow to be avoided.

**H.** Direct digital control (DDC) controls to be used throughout building.

**I.** New equipment to match Moffitt standard naming convention.

**J.** Hurricane rated equipment for all exterior equipment.

**K.** Provide cooling for penthouse.

1. Chilled water air handling unit or direct exchange air handling unit to be determined.

**L.** Consider future renovations:
1. Chemical fume hoods are planned for the 3rd floor.

M. Maintain environmental conditions for existing and future:
   1. Acceptable vibration control
   2. Acceptable noise control

N. Exterior Ductwork: In the event that any ductwork will be exposed to the elements, the ductwork shall be round with all seams properly sealed, or of other design that prevents water from accumulating or standing on the ductwork.

BUILDING SYSTEMS ENERGY CONSERVATION

A. The following methods of attaining the energy conservation goal should be considered for this project. All of these methods should be addressed in the basis of design document.
   1. Dedicated Outside Air Systems
   2. Fan wall system
   3. Cooling coil condensate capture

ARCHITECTURAL; STRUCTURAL; AND SITE ENGINEERING DESIGN COORDINATION

A. Roof tops should be kept clear of mechanical equipment (as much as possible) to avoid possible roof leaks due to maintenance operations.

B. HVAC air intake louvers: Configuration of air intake louvers to match currently installed condition.

SMOKE CONTROL SYSTEMS – SPECIAL INSPECTIONS

A. The smoke control system shall remain operational. Modifications may be required based on penthouse options. The owner and construction manager shall select a special inspection agency to conduct special inspections as required by the building code. The proposed smoke control system special instruction agency/inspector shall be submitted to the AHJ for final approval – per the building code.

B. Special Inspection and Test Requirements (Design Build Firm Requirements):

C. In addition to the ordinary inspection and test requirements which buildings, structures, and parts thereof are required to undergo, smoke control systems subject to the provisions of Section 909 (of the MBC) shall undergo special instructions and tests sufficient to verify the proper commissioning of the smoke control design in its final installed condition.

D. The design submission accompanying the construction documents shall clearly detail procedures and methods to be used and the items subject to such inspections and tests.

BUILDING AUTOMATION SYSTEM (BAS)

A. Moffitt has a standard corporate temperature controls specification, which is to be used as the basis of design for all projects.
B. New HVAC equipment and BAS shall be BACnet I/P or MSTP compatible. New data cabling routed as needed to support new HVAC equipment.

C. No pneumatic controls or actuators without owner written approval.
   1. Removal of all pneumatic controls and actuators throughout the building for all exhaust fans, AHU’s, air valves, VAV’s, and reheat coils.

D. New BAS and temperature controls panels shall be connected via a dedicated Ethernet network.

E. New temperature controls work at existing Moffitt facilities shall be integrated into the existing Niagara 4 Supervisor. Active graphics are to reside in the Niagara 4 Supervisor. Graphics screens may be stored in the Niagara 4 JACE panels.

F. Building Systems Data Analytics, SkySpark, shall be used for Monitoring Based Commissioning & Troubleshooting.

G. All new HVAC and Electrical equipment and panels shall be named in accordance with the Moffitt naming standards.

H. A draft copy of the temperature controls Graphic screens for each AHU to be reviewed and approved by owner and engineer, prior to temperature controls contractor making new BAS graphic screens.

I. Metering
   1. The BAS will be used for metering, monitoring, and reporting energy usage for chilled water

**VFD (VARIABLE FREQUENCY DRIVES)**

A. Manufacturer: ABB drives, Factory startup,

B. All AHU’s to have fan motors furnished with VFD’s.
   1. Consider multiple VFD’s on supply and return fan motor fan arrays for redundancy.
   2. Prefer all AHU VFD’s provided with bypass.
   3. Multiple VFD’s for a fan wall are to be in a single cabinet with single connection point for power source
   4. The temperature controls system shall include a sequence of operation to control a bypass damper or other means of controlling the air handler duct pressure when AHU fans are in BYPASS.

C. All pumps 2HP and larger to be furnished with VFD and manual bypass.

D. All pumps to have grounding rings when controlled by VFD.

**CUSTOM AIR HANDLING UNITS**

A. The Moffitt Air Handling Design & Construction Guidelines shall be used for this project. Incorporate into Design Specifications as needed.

B. The design philosophy for air handling systems serving general spaces should consider the following:
   1. Prefer NO Large indoor air handling units that minimize N+1 opportunities
      a. Multiple indoor air handling units with N+1 is required
   2. Air Handling Units with chilled water and hot water heating.
   3. No DX cooling or gas heat. (exception: Specialized Spaces or IT closets where necessary)
C. General Requirements (AHUs with Return Air)

1. Air handling units and distribution systems serving office / administration areas within Owner’s buildings shall be variable air volume.

2. Office/Administration units will be fan wall, single duct, draw-through, re-circulating type with outside and return air introduced to the air handler through ductwork.

3. Each air handler shall be a variable volume draw through type and shall include the following components.
   a. Air inlet plenum section.
   b. 30 percent (MERV 8) pre-filter section.
   c. Hot water preheat coil; copper tubes, aluminum fins; maximum 9 fins per inch, minimum 2 fins per inch. There will be no need for preheat if the outside air pretreatment unit is installed. Refer also to the Coils Section of this Design Guideline Element.
      i. A preheat coil is only required if the quantity of outside air has the potential to lower the mixed air temperature below 36 degrees F.

4. Access section.

5. Chilled water cooling coil; copper tubes, copper fins; maximum 9 fins per inch, minimum 2 fins per inch, maximum 6-row coil. Refer also to the Coils Section of this Design Guideline Element.

6. Properly spaced ultra-violet germicidal irradiation (UVGI) lamps shall be located on the leaving air side of the cooling coil. Access section.

7. Direct drive fan preferred; centrifugal airfoil blade type, minimum 12 blades per fan wheel (Plug fans are preferred).

8. High static pressure shutdown control and reset capability.

9. Instrument measurement taps for static pressure, temperature, etc, as specified on Drawings.

D. General Requirements (AHUs with 100% Outside Air)

10. Depending on the ventilation and air conditioning system design situations, outside air pretreat units may be required to condition and dehumidify all outside air to existing mixed air handling units during a partial building renovation.

11. Outside air pretreat units shall be dedicated for the conditioning and dehumidification of all outside air to mixed air handling units on new construction projects.

12. All outside air pretreat units shall be designed as draw-through type.

13. Each outside air pretreat unit shall include, but not be limited to the following components:
   a. Inlet plenum (100 percent outside air).
   b. 30 percent pre-filter (MERV 8).
   c. Hot water heating coil (preheat position). Refer also to the Coils Section of this Design Guideline Element.
      i. If the building does not have a heating hot water system then electric heating coils are to be used. The electric heating coils shall be powered through the use of an SCR to maintain
a controlled leaving air set point. If the electric power requirement of the coil is large where a single SCR application is not viable, then the coil shall be step controlled using a Vernier (combination SCR and contactor) staging sequence.

d. Access section.

e. Chilled water cooling coil; refer also to the Coils Section of this Design Guideline Element.

f. Access section.

g. Direct drive fan preferred; centrifugal airfoil type, minimum 12 blades per fan wheel.

h. Instrument measurement taps for static pressure, temperature, etc.

i. High static pressure shutdown control and reset capability.

j. Properly spaced ultra violet germicidal irradiation (UVGI) lamps shall be located on the leaving air side of the cooling coil. The lamps shall have the capability of developing an intense UV between 250 to 270 nm. Short-wave ultraviolet light shall destroy DNA in living microorganisms and also breakdown organic material found in indoor air.

E. Acceptable air handler manufacturers:

1. Temtrol
2. Governair
3. Haakon
4. Carrier
5. York
6. Owner approved equal

F. AHU wall casing

1. Double wall construction
2. Minimum 3” thick walls for interior/exterior units.
3. Prefer all AHUs to be installed in mechanical room or penthouse where feasible.
4. When rooftop air handlers are specified the air handling units to be set on manufacturers recommended roof curb.
5. Provide standard color for AHUs.

G. Chilled Water Coils

1. To be selected for water with a 12 degree F differential temperature (oversized cooling coil to minimize hydronic pressure drop). The coil will be controlled to a differential temperature of 16 degrees F. Coordinate chilled water setpoints with the central energy plant building automation system.
2. The face velocity of the chilled water coil shall not exceed 400 FPM at max design supply air flow for 100% outside air units. Face velocity of the chilled water coil shall not exceed 450 fpm for variable volume air handling units with return air.
3. No drift eliminators to be allowed without owner approval.
4. No cooling coils over 48” tall; provide stacked coils above 48” tall.
5. Stainless steel drain pans to be provided.
6. Design two (2) coils in a series arrangement if the cooling coil capacity requirement exceeds the capability of a 6-row coil. Chilled water shall be piped in series through both coils and an access section shall be provided between the two coils. Chilled water coil velocity between 2 fpm and 8 fpm.
7. Maximum airside differential pressure across the air side of a 6-row cooling coil shall not exceed 0.7 in w.g.
8. Pipe spool connections at the coils must be bolted flange connections to allow the coils to be pulled and installed without having to remove the control valves.
9. Coil construction shall be 5/8” diameter, 0.020” thick copper tubing with 0.025” thick return bends; seamless copper or non-ferrous headers; schedule 40 red brass threaded MPT connections, 16 ga. Stainless steel casings, supports and blank-offs; maximum fin spacing of 10 fins/in.

H. Heating Coil
1. Nominal maximum face velocity of 700 FPM supply air design airflow.
2. Select heating coil for 20 degree F temperature differential.

I. Supply Fans
1. Variable speed fans with VFD (when serving VAV or CAV DDC terminal boxes with hydronic reheat) is the preferred supply fan arrangement. Other systems to be considered on a case by case basis.
2. 1-2 or 4 plug fans is the preferred supply fan arrangement.
3. If fan walls are to be specified, consider:
   a. Possible stratification issues and provide blender blades as may be required.
   b. Prefer max fan speeds of no more than 2800 RPM. Higher design fan speeds may be allowed by exception with owner written approval.
   c. Provide VFD on all supply fan applications. Over speed of VFDs allowed up to 90 Hz.
   d. Bypass on VFD on AHUs if accommodations are made for over pressurization of the ductwork at 60 Hz fan speed; or if 60 Hz is a reduced fan speed from the maximum design airflow.
   e. Status of all fans to be monitored. May use a single contact closure at each fan sensor wired in series to monitor the fan status.
   f. Type of backdraft dampers (if used) to be discussed with owner prior to specifying.

J. Return Fans
1. Return fans are preferred over relief fan arrangement.
2. Variable speed fans tracked volumetrically off from the supply fan measured air volume is the preferred control arrangement. Supply air; outside air; and return air to be measured with airflow stations to provide proper return fan tracking. Other systems to be considered on a case by case basis.
3. Prefer fan walls are to be specified for return air handlers:
   a. Prefer max fan speeds of no more than 2800 RPM. Higher design fan speeds may be allowed, by exception, with owner’s written approval
   b. Provide VFD on all return fan applications. Over speed of VFDs allowed up to 90 Hz.
   c. Bypass on return fan VFD not allowed, without a method of controlling the fans output pressure.
   d. Status of all return fans to be monitored. May use a single contact closure at each fan wired in series to monitor the fan status.
   e. Type of backdraft dampers (if used) to be discussed with owner prior to specifying.

K. Dampers
1. All dampers to be high seal low leakage dampers
2. Prefer no damper is selected over 48” long. Example: provide two (2) 36” long dampers vs 72” long damper.
3. Prefer Belimo type electric vs. pneumatically controlled actuators; or equivalent.
4. Outside air dampers shall be insulated type.
5. Consider smaller minimum outside air dampers for better airflow measure and control of outside air volume on air handlers over 8000 CFM total supply airflow.

L. AHU Controls
   1. AHU controls shall be BACnet IP or BACNet MSTP compatible.
   2. If AHU is provided on roof, temperature controls to be provided in a tempered AHU vestibule, which is to be designed integral into the custom air handler.

M. Sound attenuators
   1. Sound attenuators shall be considered for installation in or adjacent to each air handler supply and return fan.
TEMPERATURE AND HUMIDITY DESIGN

A. The design space temperature and humidity requirements are indicated in the table below.

<table>
<thead>
<tr>
<th>SPACE IDENTIFICATION</th>
<th>COOLING TEMP. °F</th>
<th>RELATIVE HUMIDITY %RH</th>
<th>HEATING TEMP. °F</th>
<th>RELATIVE HUMIDITY %RH</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSL-2 Laboratory</td>
<td>70</td>
<td>50 Max</td>
<td>75</td>
<td>30 Min</td>
</tr>
<tr>
<td>Conference Room</td>
<td>72</td>
<td>60 Max</td>
<td>75</td>
<td>30 Min</td>
</tr>
<tr>
<td>General Office, Conference, Lobby, Administrative Support, Corridors, Public Areas, Elevator Machine Rooms</td>
<td>75</td>
<td>60 Max</td>
<td>72</td>
<td>30 Min</td>
</tr>
<tr>
<td>Toilet Rooms</td>
<td>74 ± 4</td>
<td>60 Max</td>
<td>69 ± 4</td>
<td>60 Max</td>
</tr>
<tr>
<td>Equipment Rooms</td>
<td>55 - 80</td>
<td>60 Max</td>
<td>55 – 80</td>
<td>60 Max</td>
</tr>
<tr>
<td>Telephone, IDF, MDF, AV Rack Room</td>
<td>72 ± 3</td>
<td>40 - 70</td>
<td>67 ± 3</td>
<td>40 - 70</td>
</tr>
</tbody>
</table>

OUTDOOR DESIGN CONDITIONS

A. Per direction from Moffitt, the design will be based on cooling conditions of 100°F DB and 82°F WB and heating at 30°F DB. Consider cooling conditions of 110°F DB and 92°F WB, if OA intake is directly on the roof.

VENTILATION GOALS

<table>
<thead>
<tr>
<th>OCCUPANCY</th>
<th>AIR CHANGES</th>
<th>FILTER BED #1</th>
<th>FILTER BED #2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EA UNOCC</td>
<td>EA OCC</td>
<td>SA OCC</td>
</tr>
<tr>
<td>BSL 2</td>
<td>4</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>General Laboratories</td>
<td>4</td>
<td>4-6</td>
<td></td>
</tr>
<tr>
<td>Office / Conference</td>
<td>n/a</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

DUCTWORK STANDARDS

A. The Synergy design standard for duct velocities are listed the following table. Indicate facilities design standard if different from those listed.
HYDRONIC SYSTEMS

A. The design system temperatures are as follows:
   1. Chilled Water: 44°F (winter). Acceptable temperature rise from plant to coil: 2°F.
   2. Heating Water: 150°F supply with a 20°F delta T at plant. Acceptable temperature drop from plant to coil: 2°F.

B. Acceptable Manufacturers
   1. Pipe Valves: Belimo
   2. Hydronic Specialties: B&G, Armstrong
   3. Owner approved equal

C. The Synergy design standard for hydronic pipe sizing is listed in the following table.

<table>
<thead>
<tr>
<th>DUCT SYSTEM</th>
<th>MAXIMUM AIR VELOCITY (FPM)</th>
<th>MAXIMUM FRICTION LOSS (IN.W.G. PER 100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit Connections</td>
<td>2500</td>
<td>0.25</td>
</tr>
<tr>
<td>Equip RM – SA</td>
<td>2500</td>
<td>0.2</td>
</tr>
<tr>
<td>Risers – SA</td>
<td>2200</td>
<td>0.2</td>
</tr>
<tr>
<td>Shaft Tap – SA</td>
<td>2100</td>
<td>0.2</td>
</tr>
<tr>
<td>Equip RM – RA</td>
<td>2500</td>
<td>0.2</td>
</tr>
<tr>
<td>Risers – RA</td>
<td>2200</td>
<td>0.2</td>
</tr>
<tr>
<td>Shaft Tap – RA</td>
<td>2100</td>
<td>0.2</td>
</tr>
<tr>
<td>Floor Main – RA</td>
<td>1800</td>
<td>0.2</td>
</tr>
<tr>
<td>Floor Branches – RA</td>
<td>1500</td>
<td>0.1</td>
</tr>
<tr>
<td>Outside Air</td>
<td>2200</td>
<td>0.2</td>
</tr>
<tr>
<td>Relief Air</td>
<td>2200</td>
<td>0.2</td>
</tr>
<tr>
<td>Gravity Intake</td>
<td>600</td>
<td>0.03</td>
</tr>
<tr>
<td>Gravity Relief</td>
<td>700</td>
<td>0.03</td>
</tr>
<tr>
<td>Louvers</td>
<td>500</td>
<td>0.1</td>
</tr>
<tr>
<td>Runouts after VAV Box</td>
<td>1000</td>
<td>0.1</td>
</tr>
</tbody>
</table>
### System Specifications

<table>
<thead>
<tr>
<th>System</th>
<th>Pipe Size</th>
<th>Maximum Velocity (FPS)</th>
<th>Maximum Pressure Drop (FT/100FT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chilled Water</td>
<td>Up to 2 ½”</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>2 ½” to 12”</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>14” and Up</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>Condenser Water</td>
<td>Up to 2”</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>2 ½” to 12”</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>14” and Up</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>Heating Water</td>
<td>Up to 3”</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>2 ½” to 12”</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>14” and Up</td>
<td>10</td>
<td>4</td>
</tr>
</tbody>
</table>

### Specific Owner Project Requirements – Plumbing

**General Plumbing Design**

A. Maintain floor drain/roof drain spacing for penthouse/rooftop design.

B. Maintain domestic water nozzle with hose connection on rooftop for adequate cleaning.

C. Mechanical shafts and corridors shall be utilized for running piping to avoid running piping outside the building.

D. Heavy duty no hub couplings to be basis of design for cast iron sanitary and storm piping.

### Sustainability Goals

A. The goal of the facility to utilize a cooling coil condensate recapture system.

Study and recommend a solution.

### Specific Owner Project Requirements – Electrical

**HVAC Coordination Requirements**

A. Pumps

   1. All pumps to have grounding rings when controlled by VFD.

B. Custom Air Handler Specifications – Minimum Requirements

   1. Emergency Power

      a. In general, a minimum of 50% of air handler capacity in BSL-2 labs for this project shall be placed on emergency power. Notify owner of any air handler that may not be considered for emergency power.

      b. 100% of Vivarium air handler capacity shall be on emergency power.

C. All equipment must be configured so everything will restart automatically following restoration of power after loss of power.
ELECTRICAL SYSTEMS DESIGN REQUIREMENTS

A. Electrical Normal Power Service Considerations
   1. Existing normal power service to be used.
   2. Metering to be installed in existing main switchgear – beyond electrical utilities metering.

B. LED Light Fixtures
   1. Replace all damaged lighting fixtures damaged by water infiltration.

C. 120V Electrical Receptacles Sufficiently Spaced
   1. Add sufficiently spaced electrical receptacles on rooftop and within penthouse.
   2. Provide 120V power source on all new air handling units.

D. Emergency Power System/Generator Power
   1. Vivarium must maintain struct environmental control and lighting levels at all times (must be on emergency power).
   2. Existing Modifications
      a. A target to have airflow and all refrigerators on emergency power.
      b. A target to have cooling on emergency power.
   3. Maintain current ATS equipment branch types (Emergency and Life Safety)
   4. Existing automatic transfer switches (ATS's) to be closed transition with manual bypass – unless an exception is approved by the owner in writing. Any new ATS shall follow the same requirements.
   5. All new ATS's are to be provided with a current monitoring option for each current phase. BAS and/or optional generator load management software to monitor electrical current at each ATS.

OTHER OWNER REQUIREMENTS

A. Consider Utility Rebate Incentives
   1. Rebates to be considered for all LED lighting
   2. Rebates to be considered for all VFDs

FACILITY SITE

A. Utility Electrical Service
   1. Electric Utility Electric Service
      277Y / 480 V Secondary Service (Utility Owned Transformer)
      13.2 KV Primary Service (Current Configuration)
   2. Redundant Utility Feed
      Standby Utility Feeder (Current Configuration)

B. On Site Generation
   1. Emergency Standby Generators
      Existing Generator plant to be used (to be verified during NEC Load Study)

MECHANICAL | ELECTRICAL SPACE INTERIOR

A. Main Electrical Equipment
   1. Basis of Design Manufacturer: Square D
   2. List Required Features for the main switchgear:
      a. Sub-metering device at each set of switchgear with local display and BACnet connection to BAS
b. Main-tie-main arrangement that improves redundancy and allows for periodically cycling each main breaker
   c. Energy-Reducing Maintenance Switch

3. Include option for infrared inspection window at each section
4. Phasing of shutdowns of existing switchgear must be clearly shown on the construction drawings.

B. Interior Light Fixtures
   6. LED Light Fixtures are required.
   7. 50% of fixtures to remain on at all times

C. Fire Alarm System
   1. Expand (Reuse) Existing

D. Security Systems
   1. Access Control – Key Card & Mechanical Key
## OPR VERSION HISTORY

The following is a summary of the changes made to the Commissioning Plan document throughout Design, Construction Verification, Acceptance, and Persistence Phases.

<table>
<thead>
<tr>
<th>Rev. No.</th>
<th>Date</th>
<th>Description of Revisions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>01-30-2020</td>
<td>Submission from Synergy to Beck</td>
</tr>
<tr>
<td>2</td>
<td>02-03-2020</td>
<td>Moffitt Review</td>
</tr>
<tr>
<td>3</td>
<td>02-18-2020</td>
<td>Submission from Synergy to Beck Version 2</td>
</tr>
</tbody>
</table>
PHASE 1.2: RELOCATE ALL CONDENSERS AND AIR-COOLED CHILLER OUT OF THIS ZONE.

PHASE 1.3: REMOVE EXISTING RETURN PLENUMS. PROVIDE NEW PLENUM BOX AT INTERIOR OF BUILDING.

THE FANS NEED TO BE SERVICED. WE WILL NEED TO PROVIDE ACCESS TO THE TOP OF THE ATRIUM.

PHASE 1.1: DEMO EXISTING SMOKE EVAC FANS, TYP. 8 NEW SMOKE EVAC FANS TO BE INSTALLED ON ROOF ABOVE ATRIUM (SEE DETAIL BELOW). SIZE AND LOCATION OF FANS TO BE DETERMINED BY ENGINEER.

NEW CONSTRUCTION

DEMOLITION

ATRIUM ROOF

ATRIUM FAN DETAIL - SECTION VIEW

ATRIUM FAN DETAIL - SECTION VIEW

OPTION 2

PHASE 1

3/4/2020

3/4/2020

NEW CONSTRUCTION

DEMOLITION
PHASE 2.1A: ADD CURB AND TIE-IN ROOFING. ADD TWO NEW TEMP EXHAUST FANS.

PHASE 2.1B-D: REMOVE EXISTING EXHAUST DUCTWORK. INFILL OPENING AT BUILDING ENVELOPE. REMOVE STEEL SUPPORTS AND PATCH ROOF.

PHASE 2.1E: INSTALL NEW SUPPLY HEADER, DUCTWORK SUPPORTS AND TEMPORARY ROOF FLASHING.

PHASE 2.1F: REROUTE VIVARIUM SUPPLY HEADER, INSTALL ROOF SUPPORTS AND TEMPORARY ROOF FLASHING.

PHASE 2.1G: REMOVE EXISTING SUPPLY HEADER, PATCH AND REPAIR ROOFING.

PHASE 2.2: INSTALL NEW AHU. TIE INTO VIVARIUM AND LAB SUPPLY HEADERS.

PHASE 2.3: REMOVE AND REPLACE AHUs IN THIS ORDER:
1. AHU 3-29V
2. AHU 3-30V
3. AHU 3-25
4. AHU 3-24
5. AHU 3-23

3/4/2020
PHASE 3.1A: ADD CURB AND TIE-IN ROOFING. ADD TWO NEW TEMP EXHAUST FANS.

PHASE 3.1B-D: REMOVE EXISTING EXHAUST DUCTWORK. INFILL OPENING AT BUILDING ENVELOPE. REMOVE STEEL SUPPORTS AND PATCH ROOF.

PHASE 3.1E: INSTALL NEW SUPPLY HEADER, DUCTWORK SUPPORTS AND TEMPORARY ROOF FLASHING.

PHASE 3.1G: REMOVE EXISTING SUPPLY HEADER, PATCH AND REPAIR ROOFING.

PHASE 3.1F: REROUTE VIVARIUM SUPPLY HEADER, INSTALL ROOF SUPPORTS AND TEMPORARY ROOF FLASHING.

PHASE 3.2: INSTALL NEW AHU. TIE INTO VIVARIUM AND LAB SUPPLY HEADERS.

PHASE 3.3: REMOVE AND REPLACE AHUs IN THIS ORDER:
1. AHU 3-31V
2. AHU 3-32V
3. AHU 3-28
4. AHU 3-27
5. AHU 3-26

NEW AHU
NEW AHU
NEW AHU
NEW AHU
NEW AHU

AHU 3-28
AHU 3-27
AHU 3-26
AHU 3-27
AHU 3-26

AHU 3-29V
AHU 3-30V
AHU 3-29V
AHU 3-30V
AHU 3-29V

AHU 3-23
AHU 3-24
AHU 3-23
AHU 3-24
AHU 3-23

AHU 3-25
AHU 3-25
AHU 3-25
AHU 3-25
AHU 3-25

1/16" = 1'
PHASE 4.1A: INSTALL TEMPORARY RETURN DUCTWORK AND SUPPORTS.

PHASE 4.2: ADD TEMPORARY AHU, SUPPLY HEADER AND SUPPORTS.

PHASE 4.3: REMOVE AND REPLACE AHU 2-22

PHASE 4.4: REMOVE AND REPLACE AHU 2-21

PHASE 4.5: REMOVE AND REPLACE AHU 2-20

PHASE 4.6: REMOVE TEMPORARY UNIT, DUCTWORK AND SUPPORTS.

PHASE 4.7: INSTALL FINAL SUPPLY HEADER
PHASE 5.1:
ALTERNATE:
REMOVE AND REPLACE EXISTING EXHAUST FANS CALLED OUT ON THIS SHEET WITH "LIKE-FOR-LIKE" UNITS.
REPLACE CURBS AND TEMP-IN ROOF AT EACH FAN.

NEW CONSTRUCTION

DEMOLITION

3/4/2020
PHASE 1.1: DEMO
EXISTING SMOKE EVAC
FANS, TYP. 8 NEW
SMOKE EVAC FANS TO
BE INSTALLED ON
ROOF ABOVE ATRIUM
(SEE DETAIL BELOW).
SIZE AND LOCATION
OF FANS TO BE
DETERMINED BY
ENGINEER.

PHASE 1.2: RELOCATE
ALL CONDENSERS AND
AIR-COOLED CHILLER
OUT OF THIS ZONE.

PHASE 1.3: REMOVE
EXISTING RETURN
PLENUMS.
PROVIDE NEW PLENUM
BOX AT INTERIOR OF
BUILDING.

THE FANS NEED TO BE SERVICED.
WE WILL NEED TO PROVIDE ACCESS
TO THE TOP OF THE ATRIUM.

OPTION 3a
PHASE 2
3/4/2020

NEW CONSTRUCTION
**********
DEMOLITION
PHASE 2.1B-D: REMOVE EXISTING EXHAUST DUCTWORK. INFILL OPENING AT BUILDING ENVELOPE. REMOVE STEEL SUPPORTS AND PATCH ROOF.

PHASE 2.1E: INSTALL NEW SUPPLY HEADER, DUCTWORK SUPPORTS AND TEMPORARY ROOF FLASHING.

PHASE 2.1F: REROUTE VIVARIUM SUPPLY HEADER, INSTALL ROOF SUPPORTS AND TEMPORARY ROOF FLASHING.

PHASE 2.1G: REMOVE EXISTING SUPPLY HEADER, PATCH AND REPAIR ROOFING.

PHASE 2.2: INSTALL NEW AHU. TIE INTO VIVARIUM AND LAB SUPPLY HEADERS.

PHASE 2.3: REMOVE AND REPLACE AHUs IN THIS ORDER:
1. AHU 3-29V
2. AHU 3-30V
3. AHU 3-25
4. AHU 3-24
5. AHU 3-23

PHASE 2.4: INSTALL NEW PENTHOUSE (STEEL STRUCTURE, EXTERIOR WALLS AND ROOF).

PHASE 2.5: REMOVE EXISTING ROOFING INSIDE PENTHOUSE.

PHASE 2.6: INSTALL NEW INTERIOR LIGHTS TO MIMIC NATURAL LIGHT IN ATRIUM.

PHASE 2.1A: ADD CURB AND TIE-IN ROOFING. ADD TWO NEW TEMP EXHAUST FANS.

PROVIDE NEW GREENHECK EHV-901D LOUVERS. EXTEND STRUCTURAL STEEL SUPPORTS UP TO MEET PENTHOUSE STRUCTURE AND REMOVE STEEL KICKERS (SEE STRUCTURAL). LOUVER COLOR TO MATCH EXISTING. PROVIDE INSULATED BLANK OFF PANEL WHERE NOT ATTACHED TO AIR INTAKE. PROVIDE INSECT SCREEN AT ALL AIR INTAKES. PROVIDE MISCELLANEOUS STEEL PER FPA # 19-0516.09.

ADD NEW EXTERIOR WALL SYSTEM TO MATCH EXISTING (SEE PHOTO BELOW) TO INFILL NEW PENTHOUSE. PROVIDE ALTERNATE TO REPLACE EXISTING METAL PANELS ABOVE TOP LINE OF PRECAST.

ADD NEW CURTAIN WALL ABOVE EXISTING SYSTEM TO INFILL NEW PENTHOUSE. CURTAIN WALL TO MEET SMALL IMPACT MISSILE REQUIREMENTS.
COMPOSITE ROOF PLAN
1/16" = 1'

NEW CONSTRUCTION

PHASE 3

PHASE 3.1A: ADD CURB AND TIE-IN ROOFING.
ADD TWO NEW TEMP EXHAUST FANS.

PHASE 3.1B-D:
REMOVE EXISTING EXHAUST DUCTWORK.
INFILL OPENING AT BUILDING ENVELOPE.
REMOVE STEEL SUPPORTS AND PATCH ROOF.

PHASE 3.1E:
INSTALL NEW SUPPLY HEADER,
DUCTWORK SUPPORTS AND TEMPORARY ROOF FLASHING.

PHASE 3.1F:
REROUTE VIVARIUM SUPPLY HEADER, INSTALL ROOF SUPPORTS AND TEMPORARY ROOF FLASHING.

PHASE 3.1G:
REMOVE EXISTING SUPPLY HEADER, PATCH AND REPAIR ROOFING.

PHASE 3.2:
INSTALL NEW AHU. TIE INTO VIVARIUM AND LAB SUPPLY HEADERS.

PHASE 3.3:
REMOVE AND REPLACE AHUs IN THIS ORDER:
1. AHU 3-31V
2. AHU 3-32V
3. AHU 3-28
4. AHU 3-27
5. AHU 3-26

PHASE 3.4:
INSTALL NEW PENTHOUSE (STEEL STRUCTURE, EXTERIOR WALLS AND ROOF).

PHASE 3.5:
REMOVE EXISTING ROOFING INSIDE PENTHOUSE.

PHASE 3.6:
INSTALL NEW INTERIOR LIGHTS TO MIMIC NATURAL LIGHT IN ATRIUM.

PHASE 3.7:
DETROIT EXHAUST FANS AND REAR DUCTWORK AND PATCH ROOF.

NEW AHU

PHASE 3.1B-D:
REMOVE EXISTING EXHAUST DUCTWORK.
INFILL OPENING AT BUILDING ENVELOPE.
REMOVE STEEL SUPPORTS AND PATCH ROOF.

PHASE 3.1E:
INSTALL NEW SUPPLY HEADER,
DUCTWORK SUPPORTS AND TEMPORARY ROOF FLASHING.

PHASE 3.1F:
REROUTE VIVARIUM SUPPLY HEADER, INSTALL ROOF SUPPORTS AND TEMPORARY ROOF FLASHING.

PHASE 3.4:
INSTALL NEW PENTHOUSE (STEEL STRUCTURE, EXTERIOR WALLS AND ROOF).

PHASE 3.5:
REMOVE EXISTING ROOFING INSIDE PENTHOUSE.

PHASE 3.6:
INSTALL NEW INTERIOR LIGHTS TO MIMIC NATURAL LIGHT IN ATRIUM.

PHASE 3.7:
DETROIT EXHAUST FANS AND REAR DUCTWORK AND PATCH ROOF.

NEW AHU
PHASE 4

PHASE 4.1A: INSTALL TEMPORARY RETURN DUCTWORK AND SUPPORTS.

PHASE 4.1B: REMOVE EXISTING RETURN HEADER.

PHASE 4.2: REMOVE EXISTING SCREEN WALL.

PHASE 4.3: ADD TEMPORARY AHU, SUPPLY HEADER AND SUPPORTS.

PHASE 4.4A: INSTALL FINAL SUPPLY HEADER.

PHASE 4.4B-D: REMOVE AND REPLACE AHU 2-20, 2-21, AND 2-22.

PHASE 4.5: REMOVE TEMPORARY UNIT, DUCTWORK AND SUPPORTS.

PHASE 4.6: INSTALL NEW PENTHOUSE (STEEL STRUCTURE, EXTERIOR WALLS AND ROOF).

PHASE 4.7: REMOVE EXISTING ROOFING INSIDE PENTHOUSE.

NEW CONSTRUCTION

DESTRUCTION

COMPOSITE ROOF PLAN
1/16" = 1'

OU 3a PHASE 4
3/4/2020
PHASE 5.1: BASE BID:
- Replace exhaust fans highlighted in orange as Vektor fans to consolidate exterior exhaust ductwork.
- Replace all other units with "like-for-like".
- Replace curbs and temp-in roof at each fan.
- Patch existing holes in slab and core new holes as necessary.

PHASE 5.1: ALTERNATE:
- Remove and replace existing exhaust fans called out on this sheet with "like-for-like" units.
- Replace curbs and temp-in roof at each fan.

NEW CONSTRUCTION

DEMOlITION

OPTION 3a
PHASE 5
3/4/2020

LAB Vektor fans (EF 29 30 31 32)

Wet vivarium Vektor fans (EF 24 25 26)

Dry vivarium Vektor fans (EF 31, 32, 33)

Composite roof plan 1" = 1'

NEW CONSTRUCTION

DEMOlITION
**PHASE 6**

**PHASE 6.1: ATRIUM ROOF**
- Remove existing roofing, insulation and substrate down to concrete.
- Re-sheath and replace "eyebrow" envelope (metal panel system).
- Re-roof area.
- Install new lightning protection.

**PHASE 6.2: WEST ROOF**
- Remove existing roofing, insulation and substrate down to concrete.
- Relocate existing equipment to new curbs.
- Re-roof area.
- Install new lightning protection.

**PHASE 6.3: HIGH (EXHAUST) ROOF**
- Remove existing roofing, insulation and substrate down to concrete.
- Re-roof area.
- Install new lightning protection.
NEW W16x77 COLUMN OR 24"X24" CONCRETE COLUMN. TYPICAL

NEW HSS8X8X3/8 OR HSS 6X6X5/8 AT EDGES

NEW HSS8X8X1/4 OR HSS 6X6X1/2 AT INTERIOR POSTS
Option 3A only
Scale is 1/4" = 1'-0"

- Greenheck ERV-801D louvers. Extend structural steel supports up to underside of track and remove steel kickers. Ensure rebar to match existing. Provide insulated blanket on panels where not attached to air intake.
- Provide insect screen at all air intakes.
- Provide miscellaneous steel per FPA # 19-0516.09.

Rigid insulation and roofing applied to drains at 1/4" per foot per architectural narrative and drawings.

Roof deck per structural narrative and drawings.

Structural steel beam with SFRM (not shown for clarity) to support new penthouse roof per structural narrative and drawings. Location approximate.

EL. 113'-6" ROOF

3.154
8911.A1
3.152
MECHANICAL KEYNOTES

M1.1 PROVIDE MANUAL BALANCE DAMPER.
M1.2 DUCTWORK TO BE REMOVED FOLLOWING CONSTRUCTION. DUCTWORK USED TO PROVIDE REDUNDANCY FOR VIVARIUM AHUS DURING CONSTRUCTION.
M1.3 EF 3-48A AND EF 3-49B DUCTED TO (3) 60"X18" EXHAUST DUCTS SERVING LABS ON FLOORS 2, 3 AND 4.
M1.4 RETURN FAN END TERMINATION TO BE DETERMINED IN DESIGN PROCESS.
M1.5 EXHAUST PENETRATION THROUGH WALL TO BE CAPPED.
M1.6 EXHAUST DUCTWORK TO BE REMOVED AND PENETRATION THROUGH WALL TO BE CAPPED IF VEKTOR FANS ARE SELECTED FOR BASIS OF DESIGN.
M1.7 SMOKE EVACUATION FANS RELOCATED TO ATRIUM ROOF. SEE SHEET M5.01.
M1.8 PROVIDE MINIMUM OF 10 FT FROM FAN TO EDGE OF ATRIUM ROOF.
TYPICAL GENERAL MECHANICAL NOTES

1. REFER TO ARCHITECTURAL AND STRUCTURAL PLANS FOR PENTHOUSE DRAWINGS. PENTHOUSE NOT SHOWN IN MECHANICAL DRAWINGS.

Drawing Scale: 1/8" = 1'
MCF GROUND LEVEL MEP ZONES

1/16"=1'
SRB FIRST LEVEL MEP ZONES

SRB-MEP-1

SHEET NUMBER

CHECKED BY:

DATE:

ISSUED FOR:

CONCULTING ENGINEERS

www.synergy-engineers.com

Drawing Scale: 1"=20'

1/16"=1'

17-132

MOFFITT CANCER CENTER

INFRASTRUCTURE REPLACEMENT

12002 USF MAGNOLIA DRIVE, TAMPA, FL 33612

INFASTRUCTURE REPLACEM

ENT

MOFFITT CANCER CENTER

NPB, JAR, SPD

JES

03/12/2018

REV.

DATE

DESCRIPTION

SRB FIRST LEVEL MEP ZONES

SRB FIRST LEVEL MEP ZONES

SRB-MEP-1

CHW UP INTO

ABANDON

CHASE

SRB1 SEC-JACE
(HVAC SERVED FROM
GROUND FLOOR)

SHEET REVISIONS

DRAWN BY:
NEW DEDICATED CHW PIPING SERVING NEW AHUs
(SPECIFIC ROUTE TO BE DETERMINED)

NEW 10"

CONNECT TO NEW AHUs
APPENDIX 3

MEP Product Data

A3
Preliminary

Project Name: Moffitt SRB
Unit Tag: Vivarium @ 30K

General

<table>
<thead>
<tr>
<th>Environment</th>
<th>Outdoor - Miami Dade County</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roof Curb</td>
<td>Supplied by others</td>
</tr>
<tr>
<td>Tunnel Quantity</td>
<td>1</td>
</tr>
<tr>
<td>Knockdown Const</td>
<td>None</td>
</tr>
<tr>
<td>Panel Depth</td>
<td>3.000 in</td>
</tr>
<tr>
<td>Cabinet Const</td>
<td>ITF - Integrated Frame</td>
</tr>
<tr>
<td>Seismic Compliance</td>
<td>NO</td>
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Testing

| Air Performance      | NONE                        |
| Sound                | NONE                        |
| Cabinet Leak Test    | NONE                        |

Exterior Defaults

<table>
<thead>
<tr>
<th>Exterior Material</th>
<th>16Ga Galv Pre-Paint</th>
</tr>
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<tbody>
<tr>
<td>Interior Material</td>
<td>20Ga 304 SS</td>
</tr>
<tr>
<td>Blankoff Material</td>
<td>16Ga 304 SS</td>
</tr>
<tr>
<td>Fasteners</td>
<td>Drive Screws</td>
</tr>
<tr>
<td>Thermal Break</td>
<td>Modified Thermal Break</td>
</tr>
<tr>
<td>Insul (Solid Liner)</td>
<td>Polyurethane Foam</td>
</tr>
<tr>
<td>Insul (Perforated Liner)</td>
<td>HD Faced Fiberglass Roll</td>
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<td>Insul (No Liner)</td>
<td>N/A</td>
</tr>
<tr>
<td>Solid Weld Floor Seams</td>
<td>NO</td>
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<tr>
<td>Base Perimeter Material</td>
<td>304 Stainless Steel Tube 6 in</td>
</tr>
<tr>
<td>Base Floor Material</td>
<td>16Ga 304 SS</td>
</tr>
<tr>
<td>Base Floor Coating</td>
<td>None</td>
</tr>
<tr>
<td>Base Floor Option</td>
<td>None</td>
</tr>
<tr>
<td>Insulation</td>
<td>Polyurethane Foam</td>
</tr>
<tr>
<td>Base Liner Material</td>
<td>20Ga Galv</td>
</tr>
<tr>
<td>Lifting Lugs</td>
<td>Yes - Welded</td>
</tr>
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Box Dimensions*

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<thead>
<tr>
<th>Box</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>Shipping Weight</th>
<th>Operating Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>238.000 in</td>
<td>144.000 in</td>
<td>106.500 in</td>
<td>16,767 lb</td>
<td>17,615 lb</td>
</tr>
</tbody>
</table>

* Box dimensions do not include lifting lugs, electrical panels, pipe connections, door handles, etc. The height dimensions include raised roof seams and sloped roof for outdoor equipment.

AirTunnel 1: 30,000 ACFM

- End Wall Outside Air 114 in x 48 in with Ruskin Rain Resistant (EME6625D) Louver (Louver Size: 114 in x 48 in) and Ruskin CD 60 (Galvanized) Damper (Actuator Furnished by Factory, Mounted by Factory, Wired by Others) (Damper Size: 114.000 in (Blade Direction) x 48.000 in)
- Pre-Filter: (15) 24 in x 24 in, (5) 12 in x 24 in, 2 in M8, Upstream Load, 1 set of filters. 304 Stainless Steel frame material
  
  NOTES: Prefilter Vceocity = 429 ft/min
  (1) Pressure Gauge: Magnehelic 2002 (0-2” w.c.), Hinged Cover
  (2) Hot Water Coil: 128 FL x 42 FH, 2 Row, 7 Fins/in Aluminum 0.008 in, 0.625 in Copper 0.020 in Tube, 16Ga 304 SS Casing
  (2) Chilled Water Coil: 128 FL x 42 FH, 8 Row, 8 Fins/in Aluminum 0.008 in, 0.625 in Copper 0.020 in Tube, 16Ga 304 SS Casing
  UV Light: 3 rows, 1,110 W, 120/1/60, EncapsuLamp
  (1) Drain Pan, Conn. Size: 1.25 in, Flow Rate: 0.0 GPM
- FANWALL: Supply, 3 Wide x 2 High Array, HPF-A100 Size 16, 95% Wheel, 10 HP 2-Pole Toshiba Motors (460/3/60), Multi-Drive Electrical System, (6) 10 HP ABB Multi-Drive VFD (VFD is subject to change at time of supply), includes Airflow Totalization with Color Touch Screen with BACNet MSTP communication protocol
  (1) Type: Electrical Panel, Voltage: 460/3/60, FLA: 72.4 Amps, Size: 63.000 in (H) x 47.000 in (W) x 20.000 in (D), Internally Mounted
- Final Filter: (15) 24 in x 24 in, (5) 12 in x 24 in, 12 in Box (Single Header RF) M14, Upstream Load, 1 set of filters. 304 Stainless Steel frame material
  NOTES: Final Filter Velocity = 429 ft/min
  (1) Pressure Gauge: Magnehelic 2003 (0-3” w.c.), Hinged Cover
Project Name: Moffitt SRB

Design Summary

- End Wall Supply Air 78 in x 54 in

- Doors:
  1. (2) 3" Thermal Break Factory, Int Liner: 20Ga 304 SS, Ext. Liner: 16Ga Galv Pre-Paint, 72.000 in (H) x 24.000 in (W)
  2. (1) 3" Thermal Break Factory, Int Liner: 20Ga 304 SS, Ext. Liner: 16Ga Galv Pre-Paint, 72.000 in (H) x 18.000 in (W)
  3. (1) 3" Thermal Break Factory, Int Liner: 16Ga 304 SS, Ext. Liner: 20Ga Galv Pre-Paint, 72.000 in (H) x 24.000 in (W)
  4. (2) 2" Thermal Break Factory, Int Liner: 20Ga 304 SS, Ext. Liner: 16Ga Galv Pre-Paint, 72.000 in (H) x 24.000 in (W)

- Lights:
  1. (3) 15W LED Bulb Lights

- Switches:
  1. (1) Light Switch / 120V Outlet with GFCI with Weatherproof Cover
### Preliminary

**Project Name:** Moffitt SRB  
**Unit Tag:** Vivarium @ 30K

**Design Assistant**

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#### Coil Layout

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Coil Hand</strong></td>
<td>Right</td>
<td><strong>Rack Finish</strong></td>
</tr>
<tr>
<td><strong>Configuration</strong></td>
<td>Single</td>
<td><strong>Blankoff Material</strong></td>
</tr>
<tr>
<td><strong>Connection Orientation</strong></td>
<td>Exterior (Straight)</td>
<td><strong>Blankoff Finish</strong></td>
</tr>
<tr>
<td><strong>Rack Style</strong></td>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>

#### Construction

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Stand Height</th>
<th>Casing</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>0 in</td>
<td>16Ga 304 SS</td>
</tr>
<tr>
<td>Serpentine</td>
<td></td>
<td><strong>Fin Height</strong></td>
</tr>
<tr>
<td>Serpentine</td>
<td></td>
<td><strong>Material</strong></td>
</tr>
<tr>
<td>Serpentine</td>
<td></td>
<td><strong>Fin Length</strong></td>
</tr>
<tr>
<td><strong>Rows</strong></td>
<td>Spacing</td>
<td><strong>O.D. x Wall</strong></td>
</tr>
<tr>
<td>Rows</td>
<td></td>
<td><strong>Spacing</strong></td>
</tr>
<tr>
<td><strong>Fins per Inch</strong></td>
<td>Internal</td>
<td><strong>Thickness</strong></td>
</tr>
<tr>
<td>Face Area</td>
<td>Return Bends</td>
<td><strong>Configuration</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Single Bank, Right Hand, 2 per unit**

**5WC - 2 - 42 x 128 x 2 - 7 AL**

#### Supply / Return Connections

<table>
<thead>
<tr>
<th>Qty (Per Coil)</th>
<th>Type</th>
<th>Pipe Size</th>
<th>Material</th>
<th>Type</th>
<th>Pipe Size</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>MPT</td>
<td>2.5 in</td>
<td>Red Brass</td>
<td>0.125 in</td>
<td>FPT</td>
<td>Red Brass</td>
</tr>
</tbody>
</table>

#### Vent and Drain

<table>
<thead>
<tr>
<th>Type</th>
<th>Vent Location</th>
<th>Drain Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.125 in</td>
<td>Return Connection</td>
<td>Supply Connection</td>
</tr>
</tbody>
</table>

#### Condition 1

<table>
<thead>
<tr>
<th></th>
<th><strong>Entering</strong></th>
<th><strong>Leaving</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Actual Airflow</strong></td>
<td>30,000 ACFM</td>
<td></td>
</tr>
<tr>
<td><strong>Standard Airflow</strong></td>
<td>32,438 SCFM</td>
<td></td>
</tr>
<tr>
<td><strong>Elevation</strong></td>
<td>10 ft</td>
<td></td>
</tr>
<tr>
<td><strong>Entering Air DB</strong></td>
<td>30.0 °F</td>
<td></td>
</tr>
<tr>
<td><strong>Fluid Type</strong></td>
<td>Water</td>
<td></td>
</tr>
<tr>
<td><strong>Fluid Entering Temp</strong></td>
<td>150.0 °F</td>
<td></td>
</tr>
<tr>
<td><strong>Fluid Flow Rate</strong></td>
<td>174.7 GPM</td>
<td></td>
</tr>
<tr>
<td><strong>Fouling Factor</strong></td>
<td>0.0000</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**

Certified in accordance with the AHRI Forced-Circulation Air-Cooling and Air-Heating Coils Certification Program which is based on AHRI Standard 410 within the Range of Standard Rating Conditions listed in Table 1 of the Standard. Certified units may be found in the AHRI Directory at www.ahridirectory.org.

Freeze Warning: A water - glycol mixture is required to protect coil if fluid flow is interrupted at the specified EDB. on condition 1

#### Notes / Features

1. Manufacturer: Nortek Air Solutions, 5510 SW 29th Street, Oklahoma City, OK 73179
2. Top and bottom casing flange height is 1.000 in.
3. SCFM is corrected for Elevation And EDB.
4. Coils to be pressure tested at 315 PSI
5. Total operating weight is: 748 lb
6. Total fluid volume is: 21.2 Gal
### Preliminary

**Chilled Water Coil 1 : CW1 : Box A**

**Project Name:** Moffitt SRB  
**Unit Tag:** Vivarium @ 30K

---

#### Coil Layout

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Coil Hand</strong></td>
<td>Right</td>
<td><strong>Rack Finish</strong></td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Configuration</strong></td>
<td>Single</td>
<td><strong>Blankoff Material</strong></td>
<td>16Ga 304 SS</td>
</tr>
<tr>
<td><strong>Connection Orientation</strong></td>
<td>Exterior (Straight)</td>
<td><strong>Blankoff Finish</strong></td>
<td>None</td>
</tr>
<tr>
<td><strong>Rack Style</strong></td>
<td>None</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Construction

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Quantity</strong></td>
<td>2</td>
<td><strong>Stand Height</strong></td>
<td>1 in</td>
</tr>
<tr>
<td><strong>Serpentine</strong></td>
<td>2</td>
<td><strong>Casing</strong></td>
<td>16Ga 304 SS</td>
</tr>
<tr>
<td><strong>Fin Height</strong></td>
<td>42,000 in</td>
<td><strong>Material</strong></td>
<td>Copper</td>
</tr>
<tr>
<td><strong>Fin Length</strong></td>
<td>128,000 in</td>
<td><strong>O.D. x Wall</strong></td>
<td>0.625 x 0.020 in</td>
</tr>
<tr>
<td><strong>Rows</strong></td>
<td>8</td>
<td><strong>Spacing</strong></td>
<td>1,500 x 1,299 in</td>
</tr>
<tr>
<td><strong>Fins per Inch</strong></td>
<td>8</td>
<td><strong>Thickness</strong></td>
<td>0.008 in</td>
</tr>
<tr>
<td><strong>Face Area</strong></td>
<td>74.67 ft²</td>
<td><strong>Internal</strong></td>
<td>Smooth</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Configuration</strong></td>
<td>Corrugated, Waffle with Straight Edge</td>
</tr>
</tbody>
</table>

**Single Bank, Right Hand, 2 per unit**  
5WC - 4 - 42 x 128 x 8 - 8 AL

#### Supply / Return Connections

<table>
<thead>
<tr>
<th>Qty (Per Coil)</th>
<th>Type</th>
<th>Pipe Size</th>
<th>Material</th>
<th>Type</th>
<th>Vent Location</th>
<th>Drain Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>MPT</td>
<td>3.0 in</td>
<td>Red Brass</td>
<td>0.125 in FPT</td>
<td>Return Connection</td>
<td>Supply Connection</td>
</tr>
</tbody>
</table>

#### Condition 1

<table>
<thead>
<tr>
<th></th>
<th>Entering</th>
<th>Leaving</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Actual Airflow</strong></td>
<td>30,000 ACFM</td>
<td><strong>Total Capacity</strong></td>
<td>3,041.9 MBH</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>Standard Airflow</strong></td>
<td>27,517 SCFM</td>
<td><strong>Sensible Capacity</strong></td>
<td>1,495.6 MBH</td>
<td></td>
<td></td>
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<tr>
<td><strong>Elevation</strong></td>
<td>10 ft</td>
<td><strong>Actual Face Velocity</strong></td>
<td>401.79 ft/min</td>
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<tr>
<td><strong>Entering Air DB</strong></td>
<td>100.0 °F</td>
<td><strong>Leaving Air DB</strong></td>
<td>51.4 °F</td>
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<tr>
<td><strong>Entering Air WB</strong></td>
<td>82.0 °F</td>
<td><strong>Leaving Air WB</strong></td>
<td>51.3 °F</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fluid Type</strong></td>
<td>Water</td>
<td><strong>APD</strong></td>
<td>0.64 in.H20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fluid Entering Temp</strong></td>
<td>44.0 °F</td>
<td><strong>Leaving Fluid Temp</strong></td>
<td>56.0 °F</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fluid Flow Rate</strong></td>
<td>504.7 GPM</td>
<td><strong>Fluid Velocity</strong></td>
<td>5.00 ft/s</td>
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<td></td>
<td></td>
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<tr>
<td><strong>Fouling Factor</strong></td>
<td>0.0000</td>
<td><strong>Fluid Pressure Drop</strong></td>
<td>14.08 ft.H20</td>
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<td></td>
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</tr>
</tbody>
</table>

**Notes:**
Certified in accordance with the AHRI Forced-Circulation Air-Cooling and Air-Heating Coils Certification Program which is based on AHRI Standard 410 within the Range of Standard Rating Conditions listed in Table 1 of the Standard. Certified units may be found in the AHRI Directory at www.ahridirectory.org.

#### Notes / Features

1. Manufacturer: Nortek Air Solutions, 5510 SW 29th Street, Oklahoma City, OK 73179
2. Top and bottom casing flange height is 1.000 in.
3. SCFM is corrected for Elevation And EDB.
4. Coils to be pressure tested at 315 PSI
5. Total operating weight is: 2,666 lb
6. Total fluid volume is: 75.6 Gal
### Construction

<table>
<thead>
<tr>
<th></th>
<th>RLM Xtreme</th>
<th>Safety Switch</th>
<th>Purchased</th>
<th></th>
<th></th>
<th></th>
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<td></td>
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<tr>
<td>Fixture</td>
<td>Lamp Included</td>
<td>12V Contact Connector</td>
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<tr>
<td>Voltage</td>
<td>120/1/60</td>
<td>Extra Relay Switches</td>
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<td></td>
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<td></td>
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</tr>
<tr>
<td>Total Watts</td>
<td>1110</td>
<td>UV Report™</td>
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<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Watts at Coil Surface</td>
<td>11.12 Watts/ft²</td>
<td>UV Repeat™</td>
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</tr>
<tr>
<td>Rows of Lights</td>
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<td>Warning Sign</td>
<td>No</td>
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<tr>
<td>Fixtures Per Row</td>
<td>2</td>
<td>UV-C Hour Meter</td>
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<tr>
<td>Spare Lamp Sets</td>
<td>0</td>
<td>Conduit Loom Kits</td>
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<tr>
<td>Encapsulamp</td>
<td>Yes</td>
<td>LampLoom Side Exit</td>
<td>No</td>
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</tr>
<tr>
<td>X-Box Panel Type</td>
<td>P - 12V Contact Controller Not Included</td>
<td>Spectral Reflectors</td>
<td>N/A</td>
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<td></td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

### Dimensional Data (in)

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
</tr>
</thead>
<tbody>
<tr>
<td>91.50</td>
<td>138.00</td>
<td>88.00</td>
<td>128.00</td>
<td>128.00</td>
<td>6.00</td>
<td>9.80</td>
<td>33.00</td>
<td>15.70</td>
<td>-6.00</td>
</tr>
</tbody>
</table>

### Purchased Items

<table>
<thead>
<tr>
<th>UVR Part Number</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>55086551</td>
<td>RLM Xtreme 61&quot; Single Ended- High Output EncapsuLamp</td>
<td>6</td>
</tr>
<tr>
<td>55000020</td>
<td>RLM Loom Kit-20' Plenum Rated Wire with LampHolder</td>
<td>6</td>
</tr>
<tr>
<td>55000009</td>
<td>Dual LampHolster - Extended Base</td>
<td>3</td>
</tr>
<tr>
<td>90001500</td>
<td>Access Interlock Safety Switch-120-277Vac</td>
<td>1</td>
</tr>
<tr>
<td>55800066</td>
<td>RLM-X-Box 6P 120-277V w/CU2</td>
<td>1</td>
</tr>
</tbody>
</table>
## Preliminary

### FANWALL 1 (Supply) : FWT1 : Box A

**Project Name:** Moffitt SRB  
**Unit Tag:** Vivarium @ 30K  
**Quote #:**  
**Job #:**

<table>
<thead>
<tr>
<th>Function</th>
<th>Quantity</th>
<th>Array</th>
<th>Construction</th>
<th>Inlet Cone Location</th>
<th>Stand Height</th>
<th>FANWALL 1 (Supply) : FWT1 : Box A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell Size</td>
<td>Height</td>
<td>Width</td>
<td>Depth</td>
<td>Overall Depth</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>40.00 in</td>
<td>38.00 in</td>
<td>30.00 in</td>
<td>37.25 in</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Array</td>
<td>2 Rows x 3 Cols</td>
<td>Elev. / Temp.</td>
<td>Motor &amp; Wheel Weight</td>
<td>Fan Cell Weight</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction</td>
<td>PentaCube</td>
<td>Elevation 10 ft / 70.0 °F</td>
<td>266 lb</td>
<td>398 lb</td>
<td>Redundant 0</td>
<td>Empty 0</td>
</tr>
<tr>
<td>Inlet Cone Location</td>
<td>Upstream Removable</td>
<td></td>
<td></td>
<td></td>
<td>Ship Loose Fan (Wheel, Motor and Mounting Base)</td>
<td>0</td>
</tr>
<tr>
<td>Stand Height</td>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Options

- **Coplanar Insulation:** Standard Melamine  
- **Extended Coplanar:** NO  
- **Back Draft Dampers:** FBD6  
- **Inlet Cone Type:** A100 Curved Cone  
- **Discharge Guard:** NO  
- **Cell Material:** Steel

### Fan Wheel

- **Wheel Type:** HPF-A100  
- **Diameter:** 16  
- **Balancing Planes:** 1

### Motor

- **Manufacturer:** Toshiba  
- **Model:** 2OA010L1ZVS210  
- **HP Each / Total:** 10 / 60  
- **Poles / RPM:** 2-Pole / 3510  
- **Frame / Casing:** 215T / TEAO  
- **Volts / Phase / Hz:** 460/3/60  
- **Winding:** N/A

### Control System

- **Redundant VFD:** NO  
- **Bypass Circuit:** N/A  
- **Drive:** Multi-Drive  
- **Optimization Control:** NO

### Notes / Features

1. To view patents and other pending U.S. or Canadian applications visit [www.nortekair.com/patents](http://www.nortekair.com/patents).
2. (6) airflow measurement taps. Cone constant = 1671, cone flow differential pressure = 12.61 in.H2O at 5935 CFM per fan.
3. Differential pressure sensor taps to be mounted for measuring across FANWALL. The LO tap is mounted on the inlet of the FANWALL and the HI tap is on the exhaust of the FANWALL. Pressure tubing to be plumbed back to DP sensor(s) in electrical enclosure.
4. Airflow transducers and touch screen to be installed and wired to electrical enclosure.
5. The estimated VFD input watts are based on the motor and VFD efficiency at the selected load and RPM.
6. Fans balanced to a maximum allowable level of 0.022 inches per second peak.
### Operating Conditions

<table>
<thead>
<tr>
<th>Operating Condition</th>
<th>Usage (%)</th>
<th>CFM</th>
<th>SP (in.H20)</th>
<th>Cell Qty</th>
<th>RPM</th>
<th>Hz</th>
<th>Fanwheel BHP</th>
<th>Vel (ft/min)</th>
<th>Watts</th>
<th>FEG</th>
<th>% Off Peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition 1</td>
<td>100</td>
<td>30,000</td>
<td>6.91</td>
<td>7.42</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>3,316</td>
<td>56.7</td>
<td>8.07</td>
<td>48.43</td>
</tr>
<tr>
<td>Condition 1 at 60Hz</td>
<td>100</td>
<td>31,762</td>
<td>7.73</td>
<td>8.32</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>3,510</td>
<td>60.0</td>
<td>9.58</td>
<td>57.49</td>
</tr>
<tr>
<td>Condition 1 w/ Failed</td>
<td>100</td>
<td>29,674</td>
<td>6.76</td>
<td>7.55</td>
<td>5</td>
<td>0</td>
<td>1</td>
<td>3,606</td>
<td>61.6</td>
<td>9.97</td>
<td>49.87</td>
</tr>
</tbody>
</table>

### Bare Fan Sound Power with Coplanar Silencer (dB re: 10E-12 watts)

<table>
<thead>
<tr>
<th>Operating Condition</th>
<th>63</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1K</th>
<th>2K</th>
<th>4K</th>
<th>8K</th>
<th>LwA</th>
<th>Lw</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition 1</td>
<td>89</td>
<td>83</td>
<td>89</td>
<td>91</td>
<td>91</td>
<td>89</td>
<td>86</td>
<td>100</td>
<td>103</td>
<td></td>
</tr>
<tr>
<td>Outlet</td>
<td>97</td>
<td>91</td>
<td>88</td>
<td>96</td>
<td>92</td>
<td>90</td>
<td>82</td>
<td>73</td>
<td>97</td>
<td>101</td>
</tr>
<tr>
<td>Condition 1 at 60Hz</td>
<td>90</td>
<td>84</td>
<td>89</td>
<td>102</td>
<td>92</td>
<td>92</td>
<td>90</td>
<td>88</td>
<td>101</td>
<td>104</td>
</tr>
<tr>
<td>Outlet</td>
<td>99</td>
<td>92</td>
<td>88</td>
<td>97</td>
<td>92</td>
<td>91</td>
<td>84</td>
<td>74</td>
<td>98</td>
<td>103</td>
</tr>
<tr>
<td>Condition 1 w/ Failed</td>
<td>90</td>
<td>85</td>
<td>89</td>
<td>103</td>
<td>92</td>
<td>92</td>
<td>90</td>
<td>88</td>
<td>102</td>
<td>104</td>
</tr>
<tr>
<td>Outlet</td>
<td>98</td>
<td>92</td>
<td>88</td>
<td>96</td>
<td>92</td>
<td>92</td>
<td>84</td>
<td>75</td>
<td>98</td>
<td>102</td>
</tr>
</tbody>
</table>
Nortek Air Solutions LLC certifies that the HPF-A100 fan wheel shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and AMCA Publication 311 and comply with the requirements of the AMCA Certified Ratings Program.

The AMCA licensed air and/or sound performance data has been modified for installation, appurtenances or accessories, etc. not included in the certified data. The modified performance is not AMCA licensed but is provided to aid in selection and applications of the product. Performance certified is for installation type A: Free Inlet/Free Outlet Power [bhp] excludes drives

FWTRating DLL: Ver-1.2 / November 2017
### Condition 1

<table>
<thead>
<tr>
<th>Tunnel</th>
<th>Description</th>
<th>APD (in.H20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AirTunnel 1</td>
<td>OSA Opening - Louver &amp; Damper (Outside Air)</td>
<td>0.32</td>
</tr>
<tr>
<td>AirTunnel 1</td>
<td>SA Opening (Supply Air)</td>
<td>0.09</td>
</tr>
<tr>
<td>AirTunnel 1</td>
<td>Filter 1, Pre-Filter (Average Pressure Drop)</td>
<td>0.50</td>
</tr>
<tr>
<td>AirTunnel 1</td>
<td>Hot Water Coil 1</td>
<td>0.10</td>
</tr>
<tr>
<td>AirTunnel 1</td>
<td>Chilled Water Coil 1</td>
<td>0.64</td>
</tr>
<tr>
<td>AirTunnel 1</td>
<td>UVLight 1</td>
<td>0.03</td>
</tr>
<tr>
<td>AirTunnel 1</td>
<td>ESP</td>
<td>4.50</td>
</tr>
<tr>
<td>AirTunnel 1</td>
<td>Filter 2, Final Filter (Average Pressure Drop)</td>
<td>0.73</td>
</tr>
</tbody>
</table>

**Total Pressure:** 6.91
### Center Of Gravity

**Project Name:** Moffitt SRB  
**Unit Tag:** Vivarium @ 30K

#### Table: Center of Gravity (Inches)

<table>
<thead>
<tr>
<th>Box</th>
<th>Size (Inches)</th>
<th>Operating Weight (Pounds)</th>
<th>Corner Weights</th>
<th>Center of Gravity (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>C1</td>
</tr>
<tr>
<td>A</td>
<td>238.00</td>
<td>144.00</td>
<td>101.50</td>
<td>17,615</td>
</tr>
<tr>
<td>Total</td>
<td>238.00</td>
<td>144.00</td>
<td>101.50</td>
<td>17,615</td>
</tr>
</tbody>
</table>

**Notes:**

1. The weights shown are the operating weights and do not include packaging materials.
2. A 5% safety factor has been applied to the operating weights.
3. Weights shown do not include roof curbs provided by others.
4. Corner weights apply to rectangular boxes only.
### General

<table>
<thead>
<tr>
<th>Environment</th>
<th>Outdoor - Miami Dade County</th>
<th>Roof Curb</th>
<th>Supplied by others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tunnel Quantity</td>
<td>1</td>
<td>Interior Finish</td>
<td>NONE</td>
</tr>
<tr>
<td>Knockdown Const</td>
<td>None</td>
<td>Exterior Finish</td>
<td>Pre-Paint</td>
</tr>
<tr>
<td>Panel Depth</td>
<td>3.000 in</td>
<td>Product Type</td>
<td>Air Handler</td>
</tr>
<tr>
<td>Cabinet Const</td>
<td>ITF - Integrated Frame</td>
<td>Seismic Compliance</td>
<td>NO</td>
</tr>
</tbody>
</table>

### Testing

<table>
<thead>
<tr>
<th>Air Performance</th>
<th>NONE</th>
<th>Witness Test</th>
<th>NONE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sound</td>
<td>NONE</td>
<td>Inspection</td>
<td>NONE</td>
</tr>
<tr>
<td>Cabinet Leak Test</td>
<td>NONE</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Cabinet Defaults

<table>
<thead>
<tr>
<th>Exterior Material</th>
<th>16Ga Galv Pre-Paint</th>
<th>Solid Weld Floor Seams</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interior Material</td>
<td>20Ga 304 SS</td>
<td>Base Perimeter Material</td>
<td>304 Stainless Steel Tube 6 in</td>
</tr>
<tr>
<td>Blankoff Material</td>
<td>16Ga 304 SS</td>
<td>Base Floor Material</td>
<td>16Ga 304 SS</td>
</tr>
<tr>
<td>Fasteners</td>
<td>Drive Screws</td>
<td>Base Floor Coating</td>
<td>None</td>
</tr>
<tr>
<td>Thermal Break</td>
<td>Modified Thermal Break</td>
<td>Base Floor Option</td>
<td>None</td>
</tr>
<tr>
<td>Insul (Solid Liner)</td>
<td>Polyurethane Foam</td>
<td>Base Insulation</td>
<td>Polyurethane Foam</td>
</tr>
<tr>
<td>Insul (Perforated Liner)</td>
<td>HD Faced Fiberglass Roll</td>
<td>Base Liner Material</td>
<td>20Ga Galv</td>
</tr>
<tr>
<td>Insul (No Liner)</td>
<td>N/A</td>
<td>Lifting Lugs</td>
<td>Yes - Welded</td>
</tr>
</tbody>
</table>

### Box Dimensions *

<table>
<thead>
<tr>
<th>Box</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>Shipping Weight</th>
<th>Operating Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>238.000 in</td>
<td>144.000 in</td>
<td>118.500 in</td>
<td>17,732 lb</td>
<td>18,700 lb</td>
</tr>
</tbody>
</table>

* Box dimensions do not include lifting lugs, electrical panels, pipe connections, door handles, etc. The height dimensions include raised roof seams and sloped roof for outdoor equipment.

### AirTunnel 1: 33,210 ACFM

- End Wall Outside Air 120 in x 60 in with Ruskin Rain Resistant (EME6625D) Louver (Louver Size: 120 in x 60 in) and Ruskin CD 60 (Galvanized) Damper (Actuator Furnished by Factory, Mounted by Factory, Wired by Others) (Damper Size: 120.000 in (Blade Direction) x 60.000 in)
- Pre-Filter: (20) 24 in x 24 in, 2 in M8, Upstream Load, 1 set of filters. 304 Stainless Steel frame material
  - NOTES: Prefilter Velocity = 415 ft/min
  - (1) Pressure Gauge: Magnehelic 2002 (0-2" w.c.), Hinged Cover
- (2) Hot Water Coil: 128 FL x 48 FH, 2 Row, 7 Fins/in Aluminum 0.008 in, 0.625 in Copper 0.020 in Tube, 16Ga 304 SS Casing
- (2) Chilled Water Coil: 128 FL x 48 FH, 8 Row, 8 Fins/in Aluminum 0.008 in, 0.625 in Copper 0.020 in Tube, 16Ga 304 SS Casing
  - UV Light: 3 rows, 1,110 W, 120/1/60, EncapuLamp
  - (1) Drain Pan, Conn. Size: 1.25 in, Flow Rate: 0.0 GPM
- FANWALL: Supply, 3 Wide x 2 High Array, HPF-A100 Size 16, 105% Wheel, 12 HP 2-Pole Toshiba Motors (460/3/60), Multi-Drive Electrical System, (6) 10 HP ABB Multi-Drive VFD (VFD is subject to change at time of supply), includes Airflow Totalization with Color Touch Screen with BACNet MSTP communication protocol
  - (1) Type: Electrical Panel, Voltage: 460/3/60, FLA: 86.2 Amps, Size: 63.000 in (H) x 47.000 in (W) x 20.000 in (D), Internally Mounted
- Final Filter: (20) 24 in x 24 in, 12 in Box (Single Header RF) M14, Upstream Load, 1 set of filters. 304 Stainless Steel frame material
  - NOTES: Final Filter Velocity = 415 ft/min
  - (1) Pressure Gauge: Magnehelic 2003 (0-3" w.c.), Hinged Cover
- End Wall Supply Air 78 in x 54 in
• Doors:
  (2) 3” Thermal Break Factory, Int Liner: 20Ga 304 SS, Ext. Liner: 16Ga Galv Pre-Paint, 72.000 in (H) x 24.000 in (W)
  (1) 3” Thermal Break Factory, Int Liner: 20Ga 304 SS, Ext. Liner: 16Ga Galv Pre-Paint, 72.000 in (H) x 18.000 in (W)
  (1) 3” Thermal Break Factory, Int Liner: 16Ga 304 SS, Ext. Liner: 20Ga Galv Pre-Paint, 72.000 in (H) x 24.000 in (W)
  (2) 2” Thermal Break Factory, Int Liner: 20Ga 304 SS, Ext. Liner: 16Ga Galv Pre-Paint, 72.000 in (H) x 24.000 in (W)

• Lights:
  (3) 15W LED Bulb Lights

• Switches:
  (1) Light Switch / 120V Outlet with GFCI with Weatherproof Cover
All dimensions shown in inches. Operating weights shown in pounds. Overall unit dimensions do not include lifting lugs, electrical panels, pipe connections, door handles, etc. Weight and Box Qty are for a quantity of 1 design.

NF - Integrated Frame Construction 33,210 ACFM

Roof curb provided by others.

Moffitt SRB
### Preliminary

**Hot Water Coil 1: HW1: Box A**

**Project Name:** Moffitt SRB  
**Unit Tag:** N & S Labs @ 33K

---

#### Coil Layout

<table>
<thead>
<tr>
<th>Hand</th>
<th>Rack Finish</th>
<th>Configuration</th>
<th>Blankoff Material</th>
<th>Connection Orientation</th>
<th>Blankoff Finish</th>
<th>Rack Style</th>
<th>Blankoff Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right</td>
<td>N/A</td>
<td>Single</td>
<td>16Ga 304 SS</td>
<td>Exterior (Straight)</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

#### Construction

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Stand Height</th>
<th>Casing</th>
<th>Serpentine</th>
<th>Tube Detail - Primary Surface</th>
<th>Fin Detail - Secondary Surface</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>0 in</td>
<td>16Ga 304 SS</td>
<td>1</td>
<td>Material</td>
<td>Copper</td>
</tr>
</tbody>
</table>

#### Fin Height

- **Material:** Copper  
- **Material:** Aluminum

#### Fin Length

- **O.D. x Wall:** 0.625 x 0.020 in

#### Rows

- **Spacing:** 1.500 x 1.299 in

#### Fins per Inch

- **Configuration:** Smooth

#### Face Area

- **Return Bends:** 0.028 in

---

### Single Bank, Right Hand, 2 per unit

5WC - 2 - 48 x 128 x 2 - 7 AL

---

#### Supply / Return Connections

<table>
<thead>
<tr>
<th>Qty (Per Coil)</th>
<th>Type</th>
<th>Pipe Size</th>
<th>Material</th>
<th>Type</th>
<th>Vent Location</th>
<th>Drain Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>MPT</td>
<td>2.5 in</td>
<td>Red Brass</td>
<td>0.125 in FPT</td>
<td>Return Connection</td>
<td>Supply Connection</td>
</tr>
</tbody>
</table>

#### Condition 1

**Entering**

- **Actual Airflow:** 33,210 ACFM
- **Standard Airflow:** 35,909 SCFM
- **Elevation:** 10 ft
- **Entering Air DB:** 30.0 °F
- **Fluid Type:** Water
- **Fluid Entering Temp:** 150.0 °F
- **Fluid Flow Rate:** 195.8 GPM
- **Fouling Factor:** 0.0000

**Exiting**

- **Sensible Capacity:** 1,925.7 MBH
- **Actual Face Velocity:** 389.18 ft/min
- **Leaving Air DB:** 79.4 °F
- **Fluid Velocity:** 3.39 ft/s
- **Leaving Fluid Temp:** 130.0 °F
- **Fluid Pressure Drop:** 7.71 ft.H20

**Notes:**

Certified in accordance with the AHRI Forced-Circulation Air-Cooling and Air-Heating Coils Certification Program which is based on AHRI Standard 410 within the Range of Standard Rating Conditions listed in Table 1 of the Standard. Certified units may be found in the AHRI Directory at www.ahridirectory.org.

**Freeze Warning:** A water-glycol mixture is required to protect coil if fluid flow is interrupted at the specified EDB. on condition Condition 1

---

#### Notes / Features

1. Manufacturer: Nortek Air Solutions, 5510 SW 29th Street, Oklahoma City, OK 73179
2. Top and bottom casing flange height is 1.000 in.
3. SCFM is corrected for Elevation And EDB.
4. Coils to be pressure tested at 315 PSI
5. Total operating weight is: 833 lb
6. Total fluid volume is: 24.2 Gal

---
### Preliminary

**Chilled Water Coil 1: CW1: Box A**

**Project Name:** Moffitt SRB  
**Unit Tag:** N & S Labs @ 33K  
**Quote #:**  
**Job #:**

### Coil Layout

<table>
<thead>
<tr>
<th>Hand</th>
<th>Right</th>
<th>Rack Finish</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Config</td>
<td>Single</td>
<td>Blankoff Material</td>
<td>16Ga 304 SS</td>
</tr>
<tr>
<td>Connect</td>
<td>Exterior (Straight)</td>
<td>Blankoff Finish</td>
<td>None</td>
</tr>
<tr>
<td>Style</td>
<td>None</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Construction

<table>
<thead>
<tr>
<th>Quantity</th>
<th>2</th>
<th>Stand Height</th>
<th>1 in</th>
<th>Casing</th>
<th>16Ga 304 SS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serpentine</td>
<td>2</td>
<td><strong>Tube Detail - Primary Surface</strong></td>
<td>Coating</td>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fin Height</th>
<th>48,000 in</th>
<th>Material</th>
<th>Copper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fin Length</td>
<td>128,000 in</td>
<td>O.D. x Wall</td>
<td>0.625 x 0.020 in</td>
</tr>
<tr>
<td>Rows</td>
<td>8</td>
<td>Spacing</td>
<td>1.500 x 1.299 in</td>
</tr>
<tr>
<td>Fins per Inch</td>
<td>8</td>
<td>Internal</td>
<td>Smooth</td>
</tr>
<tr>
<td>Face Area</td>
<td>85.33 ft²</td>
<td>Return Bends</td>
<td>0.028 in</td>
</tr>
</tbody>
</table>

**Single Bank, Right Hand, 2 per unit**

**5WC - 4 - 48 x 128 x 8 - 8 AL**

### Supply / Return Connections

<table>
<thead>
<tr>
<th>Qty (Per Coil)</th>
<th>4</th>
<th>Type</th>
<th>MPT</th>
<th>Pipe Size</th>
<th>3.0 in</th>
<th>Material</th>
<th>Red Brass</th>
<th>Type</th>
<th>0.125 in FPT</th>
<th>Return Connection</th>
<th>Supply Connection</th>
</tr>
</thead>
</table>

### Vent and Drain

<table>
<thead>
<tr>
<th>Type</th>
<th>Vent Location</th>
<th>Drain Location</th>
</tr>
</thead>
</table>

### Condition 1

<table>
<thead>
<tr>
<th>Entering</th>
<th>Leaving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual Airflow</td>
<td>33,210 ACFM</td>
</tr>
<tr>
<td>Standard Airflow</td>
<td>30,461 SCFM</td>
</tr>
<tr>
<td>Elevation</td>
<td>10 ft</td>
</tr>
<tr>
<td>Entering Air DB</td>
<td>100.0 °F</td>
</tr>
<tr>
<td>Entering Air WB</td>
<td>82.0 °F</td>
</tr>
<tr>
<td>Fluid Type</td>
<td>Water</td>
</tr>
<tr>
<td>Fluid Entering Temp</td>
<td>44.0 °F</td>
</tr>
<tr>
<td>Fluid Flow Rate</td>
<td>561.3 GPM</td>
</tr>
<tr>
<td>Fouling Factor</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

**Notes:**

Certified in accordance with the AHRI Forced-Circulation Air-Cooling and Air-Heating Coils Certification Program which is based on AHRI Standard 410 within the Range of Standard Rating Conditions listed in Table 1 of the Standard. Certified units may be found in the AHRI Directory at www.ahridirectory.org.

### Notes / Features

1. **Manufacturer:** Nortek Air Solutions, 5510 SW 29th Street, Oklahoma City, OK 73179
2. **Top and bottom casing flange height is 1.000 in.**
3. **SCFM is corrected for Elevation And EDB.**
4. Coils to be pressure tested at 315 PSI
5. **Total operating weight is:** 2,991 lb
6. **Total fluid volume is:** 86.4 Gal

---

**Date (M/d/yyyy):** 2/13/2020  
**106 N Industrial Blvd. Okarche, Ok 73762**  
(405) 263-7286  FAX (405) 263-4980  
**Design Assistant:**  
**7.9.1**
**Preliminary**

Project Name: Moffitt SRB
Unit Tag: N & S Labs @ 33K

<table>
<thead>
<tr>
<th><strong>Construction</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Product Type</strong></td>
<td>RLM Xtreme</td>
</tr>
<tr>
<td><strong>Safety Switch</strong></td>
<td>Purchased</td>
</tr>
<tr>
<td><strong>Fixture</strong></td>
<td>Lamp Included</td>
</tr>
<tr>
<td><strong>12V Contact Connector</strong></td>
<td>No</td>
</tr>
<tr>
<td><strong>Voltage</strong></td>
<td>120/1/60</td>
</tr>
<tr>
<td><strong>Extra Relay Switches</strong></td>
<td>0</td>
</tr>
<tr>
<td><strong>Total Watts</strong></td>
<td>1110</td>
</tr>
<tr>
<td><strong>UV Report™</strong></td>
<td>No</td>
</tr>
<tr>
<td><strong>Watts at Coil Surface</strong></td>
<td>9.79 Watts/ft²</td>
</tr>
<tr>
<td><strong>UV Repeat™</strong></td>
<td>No</td>
</tr>
<tr>
<td><strong>Rows of Lights</strong></td>
<td>3</td>
</tr>
<tr>
<td><strong>Warning Sign</strong></td>
<td>No</td>
</tr>
<tr>
<td><strong>Fixtures Per Row</strong></td>
<td>2</td>
</tr>
<tr>
<td><strong>UV-C Hour Meter</strong></td>
<td>No</td>
</tr>
<tr>
<td><strong>Spare Lamp Sets</strong></td>
<td>0</td>
</tr>
<tr>
<td><strong>Conduit Loom Kits</strong></td>
<td>No</td>
</tr>
<tr>
<td><strong>Encapsulamp</strong></td>
<td>Yes</td>
</tr>
<tr>
<td><strong>LampLoom Side Exit</strong></td>
<td>No</td>
</tr>
<tr>
<td><strong>X-Box Panel Type</strong></td>
<td>P - 12V Contact Controller Not Included</td>
</tr>
<tr>
<td><strong>Spectral Reflectors</strong></td>
<td>N/A</td>
</tr>
</tbody>
</table>

**Dimensional Data (in)**

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>103.50</td>
<td>138.00</td>
<td>100.00</td>
<td>128.00</td>
<td>128.00</td>
<td>6.00</td>
<td>11.10</td>
<td>37.50</td>
<td>17.40</td>
<td>-6.00</td>
</tr>
</tbody>
</table>

**Purchased Items**

<table>
<thead>
<tr>
<th>UVR Part Number</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>55086551</td>
<td>RLM Xtreme 61&quot; Single Ended- High Output EncapsuLamp</td>
<td>6</td>
</tr>
<tr>
<td>55000020</td>
<td>RLM Loom Kit-20’ Plenum Rated Wire with LampHolder</td>
<td>6</td>
</tr>
<tr>
<td>55000009</td>
<td>Dual LampHolster - Extended Base</td>
<td>3</td>
</tr>
<tr>
<td>90001500</td>
<td>Access Interlock Safety Switch-120-277Vac</td>
<td>1</td>
</tr>
<tr>
<td>55800066</td>
<td>RLM-X-Box 6P 120-277V w/CU2</td>
<td>1</td>
</tr>
</tbody>
</table>

---

Date (M/d/yyyy): 2/13/2020
## Preliminary

### FANWALL 1 (Supply) : FWT1 : Box A

**Project Name:** Moffitt SRB  
**Unit Tag:** N & S Labs @ 33K

### Configuration / Quantity

<table>
<thead>
<tr>
<th>Function</th>
<th>Supply Fan</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Quantity</strong></td>
<td>6</td>
</tr>
<tr>
<td><strong>Array</strong></td>
<td>2 Rows x 3 Cols</td>
</tr>
<tr>
<td><strong>Construction</strong></td>
<td>PentaCube</td>
</tr>
<tr>
<td><strong>Inlet Cone Location</strong></td>
<td>Upstream Removable</td>
</tr>
<tr>
<td><strong>Stand Height</strong></td>
<td>N/A</td>
</tr>
</tbody>
</table>

### Options

<table>
<thead>
<tr>
<th><strong>Coplanar Insulation</strong></th>
<th>Standard Melamine</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Extended Coplanar</strong></td>
<td>NO</td>
</tr>
<tr>
<td><strong>Back Draft Dampers</strong></td>
<td>FBD6</td>
</tr>
<tr>
<td><strong>Inlet Cone Type</strong></td>
<td>A100 Curved Cone</td>
</tr>
<tr>
<td><strong>Discharge Guard</strong></td>
<td>NO</td>
</tr>
<tr>
<td><strong>Cell Material</strong></td>
<td>Steel</td>
</tr>
</tbody>
</table>

### Fan Wheel

<table>
<thead>
<tr>
<th><strong>Wheel Type</strong></th>
<th>HPF-A100</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Diameter</strong></td>
<td>16</td>
</tr>
<tr>
<td><strong>Balancing Planes</strong></td>
<td>1</td>
</tr>
</tbody>
</table>

### Motor

<table>
<thead>
<tr>
<th><strong>Manufacturer</strong></th>
<th>Toshiba</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HP Each / Total</strong></td>
<td>12 / 72</td>
</tr>
<tr>
<td><strong>Poles / RPM</strong></td>
<td>2-Pole / 3485</td>
</tr>
<tr>
<td><strong>Frame / Casing</strong></td>
<td>215T / TEAO</td>
</tr>
<tr>
<td><strong>Volts / Phase / Hz</strong></td>
<td>460/3/60</td>
</tr>
<tr>
<td><strong>Winding</strong></td>
<td>N/A</td>
</tr>
</tbody>
</table>

### Control System

<table>
<thead>
<tr>
<th><strong>Redundant VFD</strong></th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bypass Circuit</strong></td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Drive</strong></td>
<td>Multi-Drive</td>
</tr>
<tr>
<td><strong>Optimization Control</strong></td>
<td>NO</td>
</tr>
<tr>
<td><strong>Control Method</strong></td>
<td>Duct Static Pressure</td>
</tr>
</tbody>
</table>

### Notes / Features

1. To view patents and other pending U.S. or Canadian applications visit www.nortekair.com/patents.
2. Cell velocity is greater than 750 fpm.
3. (6) airflow measurement taps. Cone constant = 1671, cone flow differential pressure = 15.79 in.H2O at 6642 CFM per fan.
4. Differential pressure sensor taps to be mounted for measuring across FANWALL. The LO tap is mounted on the inlet of the FANWALL and the HI tap is on the exhaust of the FANWALL. Pressure tubing to be plumbed back to DP sensor(s) in electrical enclosure.
5. Airflow transducers and touch screen to be installed and wired to electrical enclosure.
6. The estimated VFD input watts are based on the motor and VFD efficiency at the selected load and RPM.
7. Fans balanced to a maximum allowable level of 0.022 inches per second peak.
Operating Conditions

<table>
<thead>
<tr>
<th>Operating Condition</th>
<th>Usage (%)</th>
<th>CFM</th>
<th>SP (in.H20)</th>
<th>Cell Qty</th>
<th>RPM</th>
<th>Hz</th>
<th>Fanwheel BHP</th>
<th>Vel (ft/min)</th>
<th>Watts</th>
<th>FEG</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Input</td>
<td>Adj</td>
<td>On</td>
<td>Off</td>
<td>Fail</td>
<td>Each</td>
<td>Total</td>
</tr>
<tr>
<td>Condition 1</td>
<td>100</td>
<td>33,210</td>
<td>6.75</td>
<td>7.41</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td></td>
<td>3,317</td>
<td>57.1</td>
</tr>
<tr>
<td>Condition 1 at 60Hz</td>
<td>100</td>
<td>34,864</td>
<td>7.42</td>
<td>8.17</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td></td>
<td>3,485</td>
<td>60.0</td>
</tr>
<tr>
<td>Condition 1 w/ Failed</td>
<td>100</td>
<td>33,210</td>
<td>6.75</td>
<td>7.79</td>
<td>5</td>
<td>0</td>
<td>1</td>
<td></td>
<td>3,665</td>
<td>63.1</td>
</tr>
</tbody>
</table>

Bare Fan Sound Power with Coplanar Silencer (dB re: 10E-12 watts)

<table>
<thead>
<tr>
<th>Operating Condition</th>
<th>Inlet</th>
<th>63</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1K</th>
<th>2K</th>
<th>4K</th>
<th>8K</th>
<th>LwA</th>
<th>Lw</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition 1</td>
<td></td>
<td>92</td>
<td>84</td>
<td>89</td>
<td>102</td>
<td>91</td>
<td>92</td>
<td>89</td>
<td>87</td>
<td>100</td>
<td>104</td>
</tr>
<tr>
<td>Outlet</td>
<td></td>
<td>100</td>
<td>92</td>
<td>89</td>
<td>96</td>
<td>92</td>
<td>91</td>
<td>83</td>
<td>74</td>
<td>97</td>
<td>103</td>
</tr>
<tr>
<td>Condition 1 at 60Hz</td>
<td></td>
<td>93</td>
<td>85</td>
<td>89</td>
<td>102</td>
<td>92</td>
<td>93</td>
<td>90</td>
<td>88</td>
<td>101</td>
<td>104</td>
</tr>
<tr>
<td>Outlet</td>
<td></td>
<td>101</td>
<td>94</td>
<td>90</td>
<td>97</td>
<td>93</td>
<td>92</td>
<td>85</td>
<td>75</td>
<td>98</td>
<td>104</td>
</tr>
<tr>
<td>Condition 1 w/ Failed</td>
<td></td>
<td>93</td>
<td>86</td>
<td>90</td>
<td>103</td>
<td>93</td>
<td>94</td>
<td>91</td>
<td>89</td>
<td>103</td>
<td>105</td>
</tr>
<tr>
<td>Outlet</td>
<td></td>
<td>103</td>
<td>94</td>
<td>90</td>
<td>97</td>
<td>94</td>
<td>93</td>
<td>85</td>
<td>76</td>
<td>99</td>
<td>105</td>
</tr>
</tbody>
</table>
Nortek Air Solutions LLC certifies that the HPF-A100 fan wheel shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and AMCA Publication 311 and comply with the requirements of the AMCA Certified Ratings Program.

The AMCA licensed air and/or sound performance data has been modified for installation, appurtenances or accessories, etc. not included in the certified data. The modified performance is not AMCA licensed but is provided to aid in selection and applications of the product. Performance certified is for installation type A: Free Inlet/Free Outlet Power [bhp] excludes drives.

FWTRating DLL: Ver-1.2 / November 2017
### Condition 1

#### Static Pressure Summary

<table>
<thead>
<tr>
<th>Tunnel</th>
<th>Description</th>
<th>APD (in.H2O)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AirTunnel 1</td>
<td>OSA Opening - Louver &amp; Damper (Outside Air)</td>
<td>0.21</td>
</tr>
<tr>
<td>AirTunnel 1</td>
<td>SA Opening (Supply Air)</td>
<td>0.11</td>
</tr>
<tr>
<td>AirTunnel 1</td>
<td>Filter 1, Pre-Filter (Average Pressure Drop)</td>
<td>0.48</td>
</tr>
<tr>
<td>AirTunnel 1</td>
<td>Hot Water Coil 1</td>
<td>0.09</td>
</tr>
<tr>
<td>AirTunnel 1</td>
<td>Chilled Water Coil 1</td>
<td>0.61</td>
</tr>
<tr>
<td>AirTunnel 1</td>
<td>UVLight 1</td>
<td>0.03</td>
</tr>
<tr>
<td>AirTunnel 1</td>
<td>ESP</td>
<td>4.50</td>
</tr>
<tr>
<td>AirTunnel 1</td>
<td>Filter 2, Final Filter (Average Pressure Drop)</td>
<td>0.69</td>
</tr>
</tbody>
</table>

Total Pressure: 6.72
Preliminary

Center Of Gravity

Project Name: Moffitt SRB
Unit Tag: N & S Labs @ 33K

<table>
<thead>
<tr>
<th>Box</th>
<th>Size (Inches)</th>
<th>Operating Weight (Pounds)</th>
<th>Corner Weights</th>
<th>Center of Gravity (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>C1</td>
</tr>
<tr>
<td>A</td>
<td>238.00</td>
<td>144.00</td>
<td>113.50</td>
<td>18,700</td>
</tr>
<tr>
<td>Total</td>
<td>238.00</td>
<td>144.00</td>
<td>113.50</td>
<td>18,700</td>
</tr>
</tbody>
</table>

Notes:
1. The weights shown are the operating weights and do not include packaging materials.
2. A 5% safety factor has been applied to the operating weights.
3. Weights shown do not include roof curbs provided by others.
4. Corner weights apply to rectangular boxes only.
## Preliminary Design Summary

**Project Name:** Moffitt SRB  
**Unit Tag:** W Office @ 36K

### General

<table>
<thead>
<tr>
<th>Environment</th>
<th>Outdoor - Miami Dade County</th>
<th>Roof Curb</th>
<th>Supplied by others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tunnel Quantity</td>
<td>1</td>
<td>Interior Finish</td>
<td>NONE</td>
</tr>
<tr>
<td>Knockdown Const</td>
<td>None</td>
<td>Exterior Finish</td>
<td>Pre-Paint</td>
</tr>
<tr>
<td>Panel Depth</td>
<td>3.000 in</td>
<td>Product Type</td>
<td>Air Handler</td>
</tr>
<tr>
<td>Cabinet Const</td>
<td>ITF - Integrated Frame</td>
<td>Seismic Compliance</td>
<td>NO</td>
</tr>
</tbody>
</table>

### Testing

<table>
<thead>
<tr>
<th>Air Performance</th>
<th>NONE</th>
<th>Witness Test</th>
<th>NONE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sound</td>
<td>NONE</td>
<td>Inspection</td>
<td>NONE</td>
</tr>
<tr>
<td>Cabinet Leak Test</td>
<td>NONE</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Cabinet Defaults

<table>
<thead>
<tr>
<th>Exterior Material</th>
<th>16Ga Galv Pre-Paint</th>
<th>Solid Weld Floor Seams</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interior Material</td>
<td>20Ga 304 SS</td>
<td>Base Perimeter Material</td>
<td>304 Stainless Steel Tube 6 in</td>
</tr>
<tr>
<td>Blankoff Material</td>
<td>16Ga 304 SS</td>
<td>Base Floor Material</td>
<td>16Ga 304 SS</td>
</tr>
<tr>
<td>Fasteners</td>
<td>Drive Screws</td>
<td>Base Floor Coating</td>
<td>None</td>
</tr>
<tr>
<td>Thermal Break</td>
<td>Modified Thermal Break</td>
<td>Base Floor Option</td>
<td>None</td>
</tr>
<tr>
<td>Insul (Solid Liner)</td>
<td>Polyurethane Foam</td>
<td>Base Insulation</td>
<td>Polyurethane Foam</td>
</tr>
<tr>
<td>Insul (Perforated Liner)</td>
<td>HD Faced Fiberglass Roll</td>
<td>Base Liner Material</td>
<td>20Ga Galv</td>
</tr>
<tr>
<td>Insul (No Liner)</td>
<td>N/A</td>
<td>Lifting Lugs</td>
<td>Yes - Welded</td>
</tr>
</tbody>
</table>

### Box Dimensions

<table>
<thead>
<tr>
<th>Box</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>Shipping Weight</th>
<th>Operating Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>202.000 in</td>
<td>144.000 in</td>
<td>128.000 in</td>
<td>16,103 lb</td>
<td>16,919 lb</td>
</tr>
</tbody>
</table>

* Box dimensions do not include lifting lugs, electrical panels, pipe connections, door handles, etc. The height dimensions include raised roof seams and sloped roof for outdoor equipment.

Sound test results may be affected by unit configuration and factory testing limitations.

### AirTunnel 1: 35,960 ACFM

- End Wall Outside Air 96 in x 54 in with Ruskin Rain Resistant (EME6625D) Louver (Louver Size: 96 in x 54 in) and Ruskin CD 60 (Galvanized) Damper (Actuator Furnished by Factory, Mounted by Factory, Wired by Others) (Damper Size: 96.000 in (Blade Direction) x 54.000 in)
- Floor Return Air 84 in x 24 in with TAMCO 1000 (Aluminum) Damper (Actuator Furnished by Others, Mounted by Others, Wired by Others) (Damper Size: 84.000 in (A - Blade Direction) x 24.000 in (B))
- Pre-Filter: (20) 24 in x 24 in, 2 in M8, Upstream Load, 1 set of filters. 304 Stainless Steel frame material
- NOTES: Prefilter Velocity = 450 ft/min
  1. Pressure Gauge: Magnehelic 2002 (0-2" w.c.), Hinged Cover
- (3) Chilled Water Coil: 128 FL x 34.5 FH, 8 Row, 8 Fins/in Aluminum 0.008 in, 0.625 in Copper 0.020 in Tube, 14Ga 304 SS Casing
  1. UV Light: 3 rows, 1,110 W, 120/1/60, EncapsuLamp
  1. Drain Pan, Conn. Size: 1.25 in, Flow Rate: 0.0 GPM
- FANWALL: Supply, 3 Wide x 2 High Array, HPF-A100 Size 22, 85% Wheel, 10 HP 4-Pole Toshiba Motors
  460/3/60, Multi-Drive Electrical System, (6) 10 HP ABB Multi-Drive VFD (VFD is subject to change at time of supply), includes Airflow Totalization with Color Touch Screen with BACNet MSTP communication protocol
  1. Type: Electrical Panel, Voltage: 460/3/60, FLA: 79.6 Amps, Size: 63.000 in (H) x 47.000 in (W) x 20.000 in (D), Internally Mounted
- End Wall Supply Air 78 in x 54 in
Project Name: Moffitt SRB

- Doors:
  (2) 3" Thermal Break Factory, Int Liner: 20Ga 304 SS, Ext. Liner: 16Ga Galv Pre-Paint, 72.000 in (H) x 24.000 in (W)
  (1) 3" Thermal Break Factory, Int Liner: 16Ga 304 SS, Ext. Liner: 20Ga Galv Pre-Paint, 72.000 in (H) x 24.000 in (W)
  (2) 2" Thermal Break Factory, Int Liner: 20Ga 304 SS, Ext. Liner: 16Ga Galv Pre-Paint, 72.000 in (H) x 24.000 in (W)

- Lights:
  (2) 15W LED Bulb Lights

- Switches:
  (1) Light Switch / 120V Outlet with GFCI with Weatherproof Cover
**Preliminary**

**Chilled Water Coil 1 : CW1 : Box A**

**Project Name:** Moffitt SRB  
**Unit Tag:** W Office @ 36K  
**Quote #:**  
**Job #:**

### Coil Layout

<table>
<thead>
<tr>
<th>Hand Configuration Orientation</th>
<th>Finish Material</th>
<th>Blankoff Material</th>
<th>Blankoff Finish</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right</td>
<td>Single</td>
<td>Exterior (Straight)</td>
<td>Blankoff</td>
<td>None</td>
</tr>
</tbody>
</table>

### Construction

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Stand Height</th>
<th>Casing</th>
<th>Tube Detail - Primary Surface</th>
<th>Coating</th>
<th>Fin Detail - Secondary Surface</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1 in</td>
<td>14Ga 304 SS</td>
<td>Copper</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Single Bank, Right Hand, 3 per unit**

**5WC - 4 - 34.5 x 128 x 8 - 8 AL**

### Supply / Return Connections

<table>
<thead>
<tr>
<th>Qty (Per Coil)</th>
<th>Type</th>
<th>Pipe Size</th>
<th>Material</th>
<th>Type</th>
<th>Pipe Size</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>MPT</td>
<td>3.0 in</td>
<td>Red Brass</td>
<td>0.125 in FPT</td>
<td>Return Connection</td>
<td>Supply Connection</td>
</tr>
</tbody>
</table>

### Vent and Drain

<table>
<thead>
<tr>
<th>Condition 1</th>
<th>Entering</th>
<th>Leaving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual Airflow</td>
<td>35,960 ACFM</td>
<td>Total Capacity</td>
</tr>
<tr>
<td>Standard Airflow</td>
<td>31,942 SCFM</td>
<td>Sensible Capacity</td>
</tr>
<tr>
<td>Elevation</td>
<td>10 ft</td>
<td>Actual Face Velocity</td>
</tr>
<tr>
<td>Entering Air DB</td>
<td>110.0 °F</td>
<td>Leaving Air DB</td>
</tr>
<tr>
<td>Entering Air WB</td>
<td>92.0 °F</td>
<td>Leaving Air WB</td>
</tr>
<tr>
<td>Fluid Type</td>
<td>Water</td>
<td>APD</td>
</tr>
<tr>
<td>Fluid Entering Temp</td>
<td>44.0 °F</td>
<td>Leaving Fluid Temp</td>
</tr>
<tr>
<td>Fluid Flow Rate</td>
<td>743.9 GPM</td>
<td>Fluid Velocity</td>
</tr>
<tr>
<td>Fouling Factor</td>
<td>0.0000</td>
<td>Fluid Pressure Drop</td>
</tr>
</tbody>
</table>

Notes:
- Coil is outside the scope of AHRI Standard 410.
- (EDB, EWB) falls outside the range of Standard Rating Conditions specified in Table 1 of 'AHRI Standard 410'.

**Notes / Features**

1. Manufacturer: Nortek Air Solutions, 5510 SW 29th Street, Oklahoma City, OK 73179
2. Top and bottom casing flange height is 1.000 in.
3. SCFM is corrected for Elevation And EDB.
4. Coils to be pressure tested at 315 PSI
5. Total operating weight is: 3,366 lb
6. Total fluid volume is: 93.1 Gal
**Construcion**

<table>
<thead>
<tr>
<th>Product Type</th>
<th>RLM Xtreme</th>
<th>Safety Switch</th>
<th>Purchased</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixture</td>
<td>Lamp Included</td>
<td>12V Contact Connector</td>
<td>No</td>
</tr>
<tr>
<td>Voltage</td>
<td>120/1/60</td>
<td>Extra Relay Switches</td>
<td>0</td>
</tr>
<tr>
<td>Total Watts</td>
<td>1110</td>
<td>UV Report™</td>
<td>No</td>
</tr>
<tr>
<td>Watts at Coil Surface</td>
<td>8.9 Watts/ft²</td>
<td>UV Repeat™</td>
<td>No</td>
</tr>
<tr>
<td>Rows of Lights</td>
<td>3</td>
<td>Warning Sign</td>
<td>No</td>
</tr>
<tr>
<td>Fixtures Per Row</td>
<td>2</td>
<td>UV-C Hour Meter</td>
<td>No</td>
</tr>
<tr>
<td>Spare Lamp Sets</td>
<td>0</td>
<td>Conduit Loom Kits</td>
<td>No</td>
</tr>
<tr>
<td>Encapsulamp</td>
<td>Yes</td>
<td>LampLoom Side Exit</td>
<td>No</td>
</tr>
<tr>
<td>X-Box Panel Type</td>
<td>P - 12V Contact Controller Not Included</td>
<td>Spectral Reflectors</td>
<td>N/A</td>
</tr>
</tbody>
</table>

---

**Dimensional Data (in)**

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
</tr>
</thead>
<tbody>
<tr>
<td>113.00</td>
<td>138.00</td>
<td>109.50</td>
<td>128.00</td>
<td>128.00</td>
<td>6.00</td>
<td>12.10</td>
<td>41.20</td>
<td>18.50</td>
<td>-6.00</td>
</tr>
</tbody>
</table>

**Purchased Items**

<table>
<thead>
<tr>
<th>UVR Part Number</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>55086551</td>
<td>RLM Xtreme 61” Single Ended- High Output EncapsuLamp</td>
<td>6</td>
</tr>
<tr>
<td>55000020</td>
<td>RLM Loom Kit-20’ Plenum Rated Wire with LampHolder</td>
<td>6</td>
</tr>
<tr>
<td>55000009</td>
<td>Dual LampHolster - Extended Base</td>
<td>3</td>
</tr>
<tr>
<td>90001500</td>
<td>Access Interlock Safety Switch-120-277Vac</td>
<td>1</td>
</tr>
<tr>
<td>55800066</td>
<td>RLM-X-Box 6P 120-277V w/CU2</td>
<td>1</td>
</tr>
</tbody>
</table>

---

*Date (M/d/yyyy): 2/13/2020*
## Preliminary

### Project Name: Moffitt SRB
### Unit Tag: W Office @ 36K
### Quote #: 
### Job #: 

#### Configuration / Quantity

<table>
<thead>
<tr>
<th>Function</th>
<th>Quantity</th>
<th>Array</th>
<th>Construction</th>
<th>Inlet Cone Location</th>
<th>Stand Height</th>
<th>Cell Size</th>
<th>Height</th>
<th>Width</th>
<th>Depth</th>
<th>Overall Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Fan</td>
<td>6</td>
<td>2 Rows x 3 Cols</td>
<td>PentaCube</td>
<td>Upstream Removable</td>
<td>N/A</td>
<td>40.00 in</td>
<td>38.00 in</td>
<td>34.00 in</td>
<td>41.25 in</td>
<td></td>
</tr>
</tbody>
</table>

#### Options

<table>
<thead>
<tr>
<th>Coplanar Insulation</th>
<th>Standard Melamine</th>
<th>Cell Finish</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extended Coplanar</td>
<td>NO</td>
<td>Insulation Retainer</td>
<td>NO</td>
</tr>
<tr>
<td>Back Draft Dampers</td>
<td>FBDB</td>
<td>Inlet Attenuation</td>
<td>None</td>
</tr>
<tr>
<td>Inlet Cone Type</td>
<td>A100 Curved Cone</td>
<td>Blankoff Material</td>
<td>16Ga 304 SS</td>
</tr>
<tr>
<td>Discharge Guard</td>
<td>NO</td>
<td>Blankoff Finish</td>
<td>None</td>
</tr>
<tr>
<td>Cell Material</td>
<td>Steel</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Fan Wheel

<table>
<thead>
<tr>
<th>Wheel Type</th>
<th>HPF-A100</th>
<th>Width</th>
<th>85 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter</td>
<td>22</td>
<td>Max RPM</td>
<td>3166</td>
</tr>
<tr>
<td>Balancing Planes</td>
<td>1</td>
<td>Wheel Finish</td>
<td>None</td>
</tr>
</tbody>
</table>

#### Motor

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Toshiba</th>
<th>Model</th>
<th>4OA010L1ZVS210</th>
</tr>
</thead>
<tbody>
<tr>
<td>HP Each / Total</td>
<td>10 / 60</td>
<td>Efficiency</td>
<td>91.7</td>
</tr>
<tr>
<td>Poles / RPM</td>
<td>4-Pole / 1760</td>
<td>Service Factor</td>
<td>1.15</td>
</tr>
<tr>
<td>Frame / Casing</td>
<td>215T / TEAO</td>
<td>Shaft Grounding</td>
<td>Ceramic Bearings</td>
</tr>
<tr>
<td>Volts / Phase / Hz</td>
<td>460/3/60</td>
<td>FLA Each / Total</td>
<td>13 / 78.0 Amps</td>
</tr>
<tr>
<td>Winding</td>
<td>N/A</td>
<td>Motor HP Safety Factor</td>
<td>3.0 %</td>
</tr>
</tbody>
</table>

#### Control System

| Redundant VFD       | NO                | Flow Monitoring | Yes |
| Bypass Circuit      | N/A               | Fans to Monitor | All Fans |
| Drive               | Multi-Drive       | Display        | Color Touch Screen 320x480 Color Siemens POL87T.50 |
| Optimization Control| NO                | Communication  | BACNet MSTP |
| Control Method      | Duct Static Pressure |             |      |

#### Notes / Features

1. To view patents and other pending U.S. or Canadian applications visit www.nortekair.com/patents.
2. Cell velocity is greater than 750 fpm.
3. (6) airflow measurement taps. Cone constant = 3086, cone flow differential pressure = 5.43 in.H2O at 7192 CFM per fan.
4. Differential pressure sensor taps to be mounted for measuring across FANWALL. The LO tap is mounted on the inlet of the FANWALL and the HI tap is on the exhaust of the FANWALL. Pressure tubing to be plumbed back to DP sensor(s) in electrical enclosure.
5. Airflow transducers and touch screen to be installed and wired to electrical enclosure.
6. The estimated VFD input watts are based on the motor and VFD efficiency at the selected load and RPM.
7. Fans balanced to a maximum allowable level of 0.022 inches per second peak.
Preliminary
FANWALL 1 (Supply) : FWT1 : Box A

Project Name: Moffitt SRB
Unit Tag: W Office @ 36K

Operating Conditions

<table>
<thead>
<tr>
<th>Operating Condition</th>
<th>Usage (%)</th>
<th>CFM</th>
<th>SP (in.H2O)</th>
<th>Cell Qty</th>
<th>RPM</th>
<th>Hz</th>
<th>Fanwheel BHP</th>
<th>Vel (ft/min)</th>
<th>Watts</th>
<th>FEG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition 1</td>
<td>100</td>
<td>35,960</td>
<td>5.60</td>
<td>6 0 0</td>
<td>2,069</td>
<td>70.5</td>
<td>7.51</td>
<td>45.04</td>
<td>705</td>
<td>37.692</td>
</tr>
<tr>
<td>Condition 1 at 60Hz</td>
<td>100</td>
<td>30,612</td>
<td>4.07</td>
<td>6 0 0</td>
<td>1,759</td>
<td>60.0</td>
<td>4.60</td>
<td>27.59</td>
<td>600</td>
<td>23.163</td>
</tr>
<tr>
<td>Condition 1 w/ Failed</td>
<td>100</td>
<td>35,960</td>
<td>5.60</td>
<td>6 1 0</td>
<td>2,200</td>
<td>75.0</td>
<td>9.15</td>
<td>45.75</td>
<td>846</td>
<td>38.502</td>
</tr>
</tbody>
</table>

Bare Fan Sound Power with Coplanar Silencer (dB re: 10E-12 watts)

<table>
<thead>
<tr>
<th>Operating Condition</th>
<th>Inlet</th>
<th>12S</th>
<th>250</th>
<th>500</th>
<th>1K</th>
<th>2K</th>
<th>4K</th>
<th>8K</th>
<th>LwA</th>
<th>Lw</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition 1</td>
<td>84</td>
<td>80</td>
<td>102</td>
<td>87</td>
<td>83</td>
<td>84</td>
<td>82</td>
<td>80</td>
<td>96</td>
<td>102</td>
</tr>
<tr>
<td>Outlet</td>
<td>93</td>
<td>87</td>
<td>97</td>
<td>86</td>
<td>83</td>
<td>79</td>
<td>77</td>
<td>66</td>
<td>92</td>
<td>99</td>
</tr>
<tr>
<td>Condition 1 at 60Hz</td>
<td>81</td>
<td>79</td>
<td>98</td>
<td>84</td>
<td>81</td>
<td>80</td>
<td>78</td>
<td>76</td>
<td>91</td>
<td>99</td>
</tr>
<tr>
<td>Outlet</td>
<td>88</td>
<td>84</td>
<td>93</td>
<td>82</td>
<td>80</td>
<td>75</td>
<td>72</td>
<td>62</td>
<td>87</td>
<td>95</td>
</tr>
<tr>
<td>Condition 1 w/ Failed</td>
<td>82</td>
<td>79</td>
<td>101</td>
<td>88</td>
<td>84</td>
<td>85</td>
<td>83</td>
<td>80</td>
<td>96</td>
<td>102</td>
</tr>
<tr>
<td>Outlet</td>
<td>92</td>
<td>86</td>
<td>96</td>
<td>86</td>
<td>84</td>
<td>80</td>
<td>77</td>
<td>66</td>
<td>91</td>
<td>98</td>
</tr>
</tbody>
</table>
Nortek Air Solutions LLC certifies that the HPF-A100 fan wheel shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and AMCA Publication 311 and comply with the requirements of the AMCA Certified Ratings Program.

The AMCA licensed air and/or sound performance data has been modified for installation, appurtenances or accessories, etc. not included in the certified data. The modified performance is not AMCA licensed but is provided to aid in selection and applications of the product. Performance certified is for installation type A: Free Inlet/Free Outlet Power [bhp] excludes drives

FWTRating DLL: Ver-1.2 / November 2017
# Static Pressure Summary

## Condition 1

<table>
<thead>
<tr>
<th>Tunnel</th>
<th>Description</th>
<th>APD (in. H2O)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AirTunnel 1</td>
<td>OSA Opening - Louver &amp; Damper (Outside Air)</td>
<td>0.22</td>
</tr>
<tr>
<td>AirTunnel 1</td>
<td>RA Opening - Damper (Return Air)</td>
<td>0.04</td>
</tr>
<tr>
<td>AirTunnel 1</td>
<td>SA Opening (Supply Air)</td>
<td>0.13</td>
</tr>
<tr>
<td>AirTunnel 1</td>
<td>Filter 1, Pre-Filter (Average Pressure Drop)</td>
<td>0.54</td>
</tr>
<tr>
<td>AirTunnel 1</td>
<td>Chilled Water Coil 1</td>
<td>0.61</td>
</tr>
<tr>
<td>AirTunnel 1</td>
<td>UVLight 1</td>
<td>0.03</td>
</tr>
<tr>
<td>AirTunnel 1</td>
<td>ESP</td>
<td>4.00</td>
</tr>
</tbody>
</table>

Total Pressure: 5.57
### Center Of Gravity

#### Project Name: Moffitt SRB  
Unit Tag: W Office @ 36K

### Box Details

<table>
<thead>
<tr>
<th>Box</th>
<th>Size (Inches)</th>
<th>Operating Weight (Pounds)</th>
<th>Corner Weights</th>
<th>Center of Gravity (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>X</td>
<td>Y</td>
<td>Z</td>
<td>C1</td>
</tr>
<tr>
<td>A</td>
<td>202.00</td>
<td>144.00</td>
<td>123.00</td>
<td>16,919</td>
</tr>
<tr>
<td>Total</td>
<td>202.00</td>
<td>144.00</td>
<td>123.00</td>
<td>16,919</td>
</tr>
</tbody>
</table>

### Notes:

1. The weights shown are the operating weights and do not include packaging materials.
2. A 5% safety factor has been applied to the operating weights.
3. Weights shown do not include roof curbs provided by others.
4. Corner weights apply to rectangular boxes only.
SUBMITTAL

Job Name: 19-124 SRB Selections

Job Site: SRB Rooftop Renovation
6250 Jupiter Ave
Suite B
Belmont, MI 49306
United States

Elevation: (ft) 10

Date: 2/18/2020

Submitted By: Nick Blank

GREENHECK ENGINEER OFFICE
100 GREENHECK DR
SCHOFIELD, WI 54476
US
Phone: (715)359-6171
Fax: (715)355-2399
Email Address: nickb@synergy-engineers.com

GREENHECK
Building Value in Air.

P.O. Box 410 Schofield, WI 54476 (715) 359-6171 FAX (715) 355-2399 www.greenheck.com

Generated by: nickb@synergy-engineers.com
**Model: 22-BCSW-FRP-10-IV-150**

**Centrifugal FRP Fan**

### Operating Performance

<table>
<thead>
<tr>
<th>Static Pressure (in. wg)</th>
<th>Brake Power (hp)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td>14</td>
<td>5</td>
</tr>
<tr>
<td>16</td>
<td>4</td>
</tr>
<tr>
<td>18</td>
<td>3</td>
</tr>
<tr>
<td>20</td>
<td>2</td>
</tr>
<tr>
<td>22</td>
<td>1</td>
</tr>
<tr>
<td>24</td>
<td>0</td>
</tr>
</tbody>
</table>

**System Curve**

- Operating point at Total External SP
- Fan curve
- Brake horsepower curve

**Sound Power by Octave Band**

<table>
<thead>
<tr>
<th>Sound Data</th>
<th>62.5</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
<th>8000</th>
<th>LwA</th>
<th>dBA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inlet</td>
<td>97</td>
<td>97</td>
<td>99</td>
<td>100</td>
<td>102</td>
<td>95</td>
<td>88</td>
<td>84</td>
<td>105</td>
<td>93</td>
</tr>
</tbody>
</table>

*PLA - based on tables 150 or 148 of National Electrical Code 2002. Actual motor FLA may vary, for sizing thermal overload, consult factory.*

*LwA - A weighted sound power level, based on ANSI S1.4 dB - A weighted sound pressure level, based on 11.5 dB attenuation per octave band at 5 ft. dB levels are not licensed by AMCA International.*

---

**Performance**

<table>
<thead>
<tr>
<th>Quantity</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume (CFM)</td>
<td>10,530</td>
</tr>
<tr>
<td>Total External SP (in. wg)</td>
<td>2.5</td>
</tr>
<tr>
<td>Operating Power (hp)</td>
<td>13.86</td>
</tr>
<tr>
<td>Required Power (hp)</td>
<td>13.86</td>
</tr>
<tr>
<td>Fan RPM</td>
<td>2324</td>
</tr>
<tr>
<td>Max Fan RPM</td>
<td>3,090</td>
</tr>
<tr>
<td>Elevation (ft)</td>
<td>10</td>
</tr>
<tr>
<td>Start-up Temp.(F)</td>
<td>70</td>
</tr>
<tr>
<td>Operating Temp.(F)</td>
<td>70</td>
</tr>
</tbody>
</table>

**Fan Configuration**

- Size: 22
- Arrangement: 10
- Class: IV
- Rotation: CW
- Discharge Position: TH
- Wheel Material: Fiberglass
- Inlet Cone Material: Steel

**Equipment Weights**

| Fan (LMD)(lb) | 300 |
| Motor/Drive (lb) | 239 |
| Accessories (lb) | 0 |

**Misc Fan Data**

| FEG | 71 |
| Outlet Velocity (ft/min) | 3,708 |
| Static Efficiency (%) | 31 |
| Tip Speed (ft/min) | 13,536 |

**Motor and Drives**

- Motor: Included
- Size (hp): 15
- RPM: 1725
- Enclosure: ODP
- V/C/P*: 460/60/3
- Location: Centered
- Pulley Type: Constant
- Drive Loss (%): 3.4
- NEC FLA* (Amps): 21

---

**Sound Power by Octave Band**

<table>
<thead>
<tr>
<th>Sound Data</th>
<th>62.5</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
<th>8000</th>
<th>LwA</th>
<th>dBA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inlet</td>
<td>97</td>
<td>97</td>
<td>99</td>
<td>100</td>
<td>102</td>
<td>95</td>
<td>88</td>
<td>84</td>
<td>105</td>
<td>93</td>
</tr>
</tbody>
</table>

*PLA - based on tables 150 or 148 of National Electrical Code 2002. Actual motor FLA may vary, for sizing thermal overload, consult factory.*

*LwA - A weighted sound power level, based on ANSI S1.4 dB - A weighted sound pressure level, based on 11.5 dB attenuation per octave band at 5 ft. dB levels are not licensed by AMCA International.*
Model: 22-BCSW-FRP-10-IV-150
Centrifugal FRP Fan

Standard Construction Features:

HOUSING: Fiberglass reinforced plastic scroll. Layers of protective "C" veil are included as standard for added corrosion protection. All hardware in contact with the airstream is made of stainless steel and encapsulated in FRP. DRIVE FRAME: Heavy-gauge steel coated in enamel. BEARINGS, SHAFT, AND WHEEL: Heavy duty, self-aligning ball or roller pillow block bearings - Polished solid steel shafts - Fiberglass reinforced plastic centrifugal wheel, with strapped in blades - 9 bladed construction - Backward Curved blade profile

Selected Options & Accessories:

NEMA Premium Efficient Motor - meets NEMA Table 12-12
Motor with Class B or Greater Insulation
Standard Bearings - L(10) Life of 80k Hours
Drain Connection
Inlet Connection - Inlet Collar, Slip Fit
Outlet Connection - Unpunched Outlet Flange
Weatherhood
Shaft Material - Steel
Coating - Wheel - GelCoat, Drive Frame - Brushed Enamel, Gray
Model: 22-BCSW-FRP-10-IV-150  Centrifugal FRP Fan

Notes: All dimensions shown are in units of in.
Standard Construction Features:
- Inlet collar standard
- Flanges (when selected) will be unpunched and strapped onto the inlet collar
- Companion flanges are available

INLET DRAWN TO SCALE
EXAMPLE SHOWS AIRFLOW DIRECTION

Notes: All dimensions shown are in units of in.
Outlet Connection

Standard Construction Features:
• Unpunched outlet flange is standard
• Rectangle to round outlet transitions and companion flanges are available
• Discharge transitions for sizes 48-73 will ship loose; for sizes 15-44 they will be integral with the fan

Notes: All dimensions shown are in units of in.
AMCA Licensed for Air Performance. Power rating (BHP/kW) includes transmission losses.

Greenheck Fan Corporation certifies that the model shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and comply with the requirements of the AMCA Certified Ratings Program. The AMCA Certified Ratings Seal applies to air performance ratings only. Performance certified is for installation type B: Free Inlet, Ducted Outlet. Power ratings (BHP/kW) include transmission losses. Performance ratings do not include the effects of appurtenances (accessories) in the airstream.
Performance

Quantity 1
Volume (CFM) 2,550
Total External SP (in. wg) 2
Operating Power (hp) 7.44
Required Power (hp) 7.44
Fan RPM 3331
Max Fan RPM 3,462
Elevation (ft) 10
Start-up Temp. (F) 70
Operating Temp. (F) 70

Fan Configuration
Size 8
Arrangement 10
Class III
Rotation CW
Discharge Position TH
Wheel Material Fiberglass
Inlet Cone Material Steel

Equipment Weights
Fan (LMD)(lb) 155
Motor/Drive (lb) 82
Accessories (lb) 0

Misc Fan Data
FEG 53
Outlet Velocity (ft/min) 7,658
Static Efficiency (%) 11
Tip Speed (ft/min) 13,951

Motor and Drives
Motor Included
Size (hp) 7 1/2
RPM 3600
Enclosure ODP
V/C/P 460/60/3
Location Centered
Pulley Type Constant
Drive Loss (%) 3.7

Sound Power by Octave Band

<table>
<thead>
<tr>
<th>Sound Data</th>
<th>62.5</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
<th>8000</th>
<th>LwA</th>
<th>dBA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inlet</td>
<td>94</td>
<td>96</td>
<td>100</td>
<td>102</td>
<td>96</td>
<td>90</td>
<td>84</td>
<td>78</td>
<td>102</td>
<td>90</td>
</tr>
</tbody>
</table>

LwA - A weighted sound power level, based on ANSI S1.4
dBA - A weighted sound pressure level, based on 11.5 dB attenuation per octave band at 5 ft
dBA levels are not licensed by AMCA International
Model: 8-BCSW-FRP-10-III-75
Centrifugal FRP Fan

**Standard Construction Features:**

HOUSING: Fiberglass reinforced plastic scroll. Layers of protective "C" veil are included as standard for added corrosion protection. All hardware in contact with the airstream is made of stainless steel and encapsulated in FRP.

DRIVE FRAME: Heavy-gauge steel coated in enamel.

BEARINGS, SHAFT, AND WHEEL: Heavy duty, self-aligning ball or roller pillow block bearings - Polished solid steel shafts - Fiberglass reinforced plastic centrifugal wheel, with strapped in blades - 9 bladed construction - Backward Curved blade profile

**Selected Options & Accessories:**

- NEMA Premium Efficient Motor - meets NEMA Table 12-12
- Motor with Class B or Greater Insulation
- Standard Bearings - L(10) Life of 80k Hours
- Drain Connection
- Inlet Connection - Inlet Collar, Slip Fit
- Outlet Connection - Unpunched Outlet Flange
- Weatherhood
- Shaft Material - Steel
- Coating - Wheel - GelCoat, Drive Frame - Brushed Enamel, Gray
CONNECTIONS

SHAFT DIA 1 KEYWAY

2 X 0.25 X 0.13

END VIEW

WEATHERHOOD

SHAF DIA 1 KEYWAY

2 X 0.25 X 0.13

INLET OD

WEATHERHOOD

SHAF CENTER LINE

Ø 0.56
4 Holes

13.00

28.81

6.50

5.75

2.50

0.38

FAN FOOTPRINT

20.00

22.34

10.75

27.50

33.31

18.00

15.32

18.00

SIDE VIEW

"SIDE VIEW IS VIEWED FROM DRIVE SIDE"

Notes: All dimensions shown are in units of in.
Inlet Connection

Standard Construction Features:
• Inlet collar standard
• Flanges (when selected) will be unpunched and strapped onto the inlet collar
• Companion flanges are available

Notes: All dimensions shown are in units of in.
Outlet Connection

Standard Construction Features:
• Unpunched outlet flange is standard
• Rectangle to round outlet transitions and companion flanges are available
• Discharge transitions for sizes 48-73 will ship loose; for sizes 15-44 they will be integral with the fan

0.44 DIA. 12 HOLES
OUTLET DRAWN TO SCALE
EXAMPLE SHOWS AIRFLOW DIRECTION
EXAMPLE DISCHARGE POSITION IS "TH"

Notes: All dimensions shown are in units of in.
Model: 33-AFDW-21-3-I-200
PermaLock Housing, Airfoil Double Width

Operating Performance

<table>
<thead>
<tr>
<th>Performance</th>
<th>Quantity</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume (CFM)</td>
<td></td>
<td>18,600</td>
</tr>
<tr>
<td>Total External SP (in. wg)</td>
<td></td>
<td>4.5</td>
</tr>
<tr>
<td>Operating Power (hp)</td>
<td></td>
<td>18.55</td>
</tr>
<tr>
<td>Required Power (hp)</td>
<td></td>
<td>18.55</td>
</tr>
<tr>
<td>Fan RPM</td>
<td></td>
<td>1082</td>
</tr>
<tr>
<td>Max Fan RPM</td>
<td></td>
<td>1,225</td>
</tr>
<tr>
<td>Oper. Frequency (Hz)</td>
<td></td>
<td>60</td>
</tr>
<tr>
<td>Elevation (ft)</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Start-up Temp. (F)</td>
<td></td>
<td>70</td>
</tr>
<tr>
<td>Operating Temp. (F)</td>
<td></td>
<td>70</td>
</tr>
</tbody>
</table>

Fan Configuration

- Size: 33
- Arrangement: 3
- Class: I
- Rotation: CW
- Discharge Position: TH
- Construction Type: PermaLock
- Spark Resistance: None
- Scroll Material: Steel
- Wheel Material: Steel
- Inlet Cone Material: Steel

Equipment Weights

- Fan (LMD)(lb): 936
- Motor/Drive (lb): 268
- Accessories (lb): 35

Misc Fan Data

- FEG: 85
- Outlet Velocity (ft/min): 1,650
- Static Efficiency (%): 73
- Tip Speed (ft/min): 9,349

Motor and Drives

- Motor: Included
- Size (hp): 20
- RPM: 1725
- Enclosure: ODP
- V/C/P: 460/60/3
- Frame Size: 256T
- Max Frame Size: 326
- Location: X
- Pulley Type: Constant
- Drive Loss (%): 3.3
- Drives: Multiple
- Drive Service Factor: 1.5
- NEC FLA* (Amps): 27

Sound Power by Octave Band

<table>
<thead>
<tr>
<th>Sound Data</th>
<th>62.5</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
<th>8000</th>
<th>LwA</th>
<th>dBA</th>
<th>Sones</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inlet</td>
<td>101</td>
<td>97</td>
<td>96</td>
<td>89</td>
<td>87</td>
<td>83</td>
<td>80</td>
<td>76</td>
<td>93</td>
<td>82</td>
<td>40</td>
</tr>
<tr>
<td>Outlet</td>
<td>105</td>
<td>99</td>
<td>94</td>
<td>87</td>
<td>85</td>
<td>79</td>
<td>76</td>
<td>74</td>
<td>92</td>
<td>80</td>
<td>41</td>
</tr>
</tbody>
</table>

*LwA - A weighted sound power level, based on ANSI S1.4
*dBA - A weighted sound pressure level, based on 11.5 dB attenuation per octave band at 5 ft. dBA levels are not licensed by AMCA International
*Sones - calculated using AMCA 301 at 5 ft
Model: 33-AFDW-21-3-I-200
PermaLock Housing, Airfoil Double Width

Standard Construction Features:

HOUSING: Class I and II fans feature PermaLock construction on sizes 18 - 49 and continuously welded steel housing on sizes 54 - 73 and all class III fans. Punched outlet flange standard (except for downblast - DB) on class I and II sizes 33 - 73, and all class III fans. Inlets are non-ducted. BEARINGS, SHAFT, AND WHEEL: Heavy duty, self-aligning ball or roller pillow block bearings. Polished, solid steel shafts. Welded centrifugal wheel.

Selected Options & Accessories:

NEMA Premium Efficient Motor - meets NEMA Table 12-12
Motor with Class B or Greater Insulation
Coating - Permatector, Concrete Gray-RAL 7023, Fan and Attached Accessories
Bearings - L(10) Life of 80k Hours
UL/cUL-705 - "Power Ventilators"
Isolation Base, Factory Mounted, Isolator-Rubber Mount, 0.25 Inch, Base Coating - Permatector
Access Door - Bolted
Outlet Connection - Punched
Belt Guard - TE
Motor Slide Base
Unit Warranty: 1 Yr (Standard)
Model: 33-AFDW-21-3-I-200  PermaLock Housing, Airfoil Double Width

*SIDE VIEW IS VIEWED FROM DRIVE SIDE
*DISCHARGE POSITION CAN NOT BE MODIFIED IN FIELD

Notes: All dimensions shown are in units of in.
Isolation Base
Type: Isolation Base

Standard Construction Features:
- Steel Channel - Welded construction - Pre-punched mounting holes for fan and isolator mounting - Integral lifting points - Motor slide base (Arr 1 and Arr 3 only)

**Fan Configuration**

<table>
<thead>
<tr>
<th>Model:</th>
<th>33-AFDW-21-3-I-200</th>
<th>Discharge Position:</th>
<th>TH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arrangement:</td>
<td>3</td>
<td>Class:</td>
<td>I</td>
</tr>
<tr>
<td>Rotation:</td>
<td>CW</td>
<td>Motor Frame Size:</td>
<td>256T</td>
</tr>
<tr>
<td>Motor Position:</td>
<td>X</td>
<td>Isolator/Deflection:</td>
<td>Rubber Mount, 0.25 Inch</td>
</tr>
</tbody>
</table>

Notes: All dimensions shown are in units of in.
## Isolators

**Type:** Rubber Mount, 0.25 Inch

**Standard Construction Features:**

Oil resistant neoprene. Color coded or identified to indicate load capacity. Tapped center hole to secure isolator to base. Flanged with through holes for attachment to supporting structure.

---

<table>
<thead>
<tr>
<th>Fan Configuration</th>
<th>Discharge Position</th>
<th>Class</th>
<th>Motor Frame Size</th>
<th>Isolator/Deflection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model: 33-AFDW-21-3-I-200</td>
<td>TH</td>
<td>I</td>
<td>256T</td>
<td>Rubber Mount, 0.25 Inch</td>
</tr>
<tr>
<td>Arrangement: 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rotation: CW</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motor Position: X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Consult Factory For Drawing Details

---

Notes: All dimensions shown are in units of in.
AMCA Licensed for Sound and Air Performance. Power rating (BHP/kW) includes transmission losses.

Greenheck Fan Corporation certifies that the model shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and AMCA Publication 311 and comply with the requirements of the AMCA Certified Ratings Program. Performance certified is for installation type B: Free inlet, Ducted outlet. Performance ratings do not include the effects of appurtenances (accessories). Power ratings (BHP/kW) include transmission losses. The sound power level ratings shown are in decibels, referred to 10-12 watts calculated per AMCA Standard 301. The A-weighted sound ratings shown have been calculated per AMCA International Standard 301. Values shown are for inlet Lwi, LwiA, and outlet Lwo, LwoA sound power levels for installation type B: Free inlet, Ducted outlet. Outlet ratings include the effects of duct end correction. dBA levels are not licensed by AMCA International. The AMCA Certified Ratings Seal for Sound applies to inlet LwiA and outlet LwoA ratings only.
# Model: VEKTOR-MD-30-9-85-LV-HPW
## Fume Exhaust System

### Design Condition
- **Number of Systems**: 1
- **Fans per System**: 3
- **Redundancy**: N+1
- **System Type**: Variable Volume
- **ERS Plenum**: No
- **Lab Exh. Vol. (CFM)**: 37,200
- **Min Lab Exh. Vol. (CFM)**: 18,600
- **Add. BAP Air (CFM)**: 0
- **Wind Speed (MPH)**: 10.0

### Selection Criteria - Normal [N] Oper.
- **Volume (CFM)**: 18,600
- **Total External SP (in. wg)**: 4.65
- **Air Stream Temp (F)**: 70
- **Elevation (ft)**: 10
- **Drive Loss (%)**: 3.3

### N Operating Fan Performance
- **Fan RPM**: 1525
- **Max Fan RPM**: 1670
- **Operating Power (hp)**: 24.45
- **Required Power (hp)**: 24.45
- **Oper. Frequency (Hz)**: 60

### N Operating Discharge Performance
- **Nozzle OV (ft/min)**: 3,413
- **Windband OV (ft/min)**: 2,025
- **WB Exit Vol. (CFM)**: 31,248
- **Dilution (%)**: 168
- **Effective Plume Ht. (ft)**: 42.04

### Fan Construction
- **Spark Resistance**: Spark C
- **Drive Type**: Belt
- **Arrangement**: 9

### Plenum Configuration
- **Bypass Air Plenum**: Yes
- **Plenum Arrangement**: Inline

### Motor Specs
- **Motor Size (hp)**: 25
- **RPM**: 1725
- **V/C/P**: 460/60/3
- **Enclosure**: TEFC
- **Motor Duty**: Industrial
- **Drives**: Multiple
- **Drive Service Factor**: 2

### Weight Totals
- **Fan Assembly (lb)**: 6,975
- **Plenum Assembly (lb)**: 3,164
- **Roof Curb (lb)**: 553
- **System Total (lb)**: 10,692

---

**AMCA tested and certified performance data includes pressure losses from discharge nozzles and windbands. Additional losses internal to the system are for selected optional accessories.**
## Sound Data

### Sound Power by Octave Band (Individual Fan Normal [N] Operating Condition)

<table>
<thead>
<tr>
<th>Sound Data</th>
<th>62.5</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
<th>8000</th>
<th>LwA 5 ft</th>
<th>dBA 5 ft</th>
<th>dBA 10 ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inlet Sound</td>
<td>95</td>
<td>92</td>
<td>97</td>
<td>94</td>
<td>93</td>
<td>88</td>
<td>82</td>
<td>75</td>
<td>97</td>
<td>85</td>
<td>N/A</td>
</tr>
<tr>
<td>Outlet Sound</td>
<td>91</td>
<td>92</td>
<td>98</td>
<td>99</td>
<td>96</td>
<td>92</td>
<td>87</td>
<td>79</td>
<td>101</td>
<td>89</td>
<td>83</td>
</tr>
</tbody>
</table>

LwA - A weighted sound power level, based on ANSI S1.4

dBA - A weighted sound pressure level, based on 11.5 dBA attenuation per octave band at 5 ft; dBA levels are not licensed by AMCA International

### Sound Testing Details

*Inlet sound is measured prior to the fan inlet. Sound is per individual fan operating at the design CFM and total Static Pressure.

*Outlet sound includes sound exiting the discharge as well as radiated sound from the fan casing. Optional attenuators are available.

### Total Outlet Sound by Octave Band (All Operating Fans Normal [N] Condition)

<table>
<thead>
<tr>
<th>62.5</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
<th>8000</th>
<th>LwA 5 ft</th>
<th>dBA 5 ft</th>
<th>dBA 10 ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>94</td>
<td>95</td>
<td>101</td>
<td>102</td>
<td>99</td>
<td>95</td>
<td>90</td>
<td>82</td>
<td>104</td>
<td>92</td>
<td>88</td>
</tr>
</tbody>
</table>

Total outlet sound values are not AMCA certified.
Selected Options & Accessories:

NEMA Premium Efficient Motor - meets NEMA Table 12-12
Motor VFD Rated without Shaft Grounding Protection
Motor with Class F or Greater Insulation
Motor Duty - Industrial
Motor with greaseable bearings
Bypass Air Plenum - Single Wall, Steel, Bottom Exhaust Intake
Coated with LabCoat, RAL7023, Entire Unit
Switch - NEMA-3R, Toggle, For Indoor or Outdoor Use, Mounted and Wired
UL/cUL-705 - “Power Ventilators”
Shaft Material - Turned and Polished Steel with Protective Coating
Fan Panel Material - Coated Steel
Bypass Damper - HCD-230-LE, Galvanized, Mill Finish, 18 in. x 18 in., Qty: 2
Isolation Damper - HCD-130-LE, Galvanal, Coated, 50 in. x 48 in., Parallel Blades, mounted in BAP, one per fan
Sure-Aire Flow Station (No Electronics), Qty 3
Factory Vibration Test, 0.10 in/sec, peak, filter-in as measured at the fan RPM
Extended Lube Lines - Nylon
Motor Cover - with Hinged Removable Access Panel
Standard weatherhood over Bypass damper with inlet screen
Unit Warranty: 1 Yr (Standard)
Notes: All dimensions shown are in units of in. and weights are shown in units of lb. Drawings are of standard unit and do not include dimensions for accessories or design modifications.
Fume Exhaust System

Model: VEKTOR-MD-30-9-85-LV-HPW

Notes: All dimensions shown are in units of in. and weights are shown in units of lb. Drawings are of standard unit and do not include dimensions for accessories or design modifications.
All bottom duct connections are open as standard.

A minimum of 72.63 inches from edge of plenum to allow the removal of the isolation damper or 12 inches from the farthest point sticking past unit for a clear walkway (which ever is greater) is recommended.

Notes: All dimensions shown are in units of in. and weights are shown in units of lb. Drawings are of standard unit and do not include dimensions for accessories or design modifications.
A maximum inlet velocity of 1500 FPM is recommended.

Notes: All dimensions shown are in units of in. and weights are shown in units of lb. Drawings are of standard unit and do not include dimensions for accessories or design modifications.
All sizes except 54 are AMCA Licensed for Sound and Air Performance.

Greenheck Fan Corporation certifies that the model shown herein is licensed to bear the AMCA Seal. The AMCA Certified Ratings Seal applies to Induced flow Fan Air and Sound Performance (AMCA Standard 260). The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and 311 and comply with the requirements of the AMCA Certified Ratings Program. Performance certified is for installation Type A: Free inlet, Free Outlet. Performance ratings do not include the effects of appertenances (accessories). Power ratings (BHP/kW) does not include transmission losses. Performance ratings do not include the effects of cross winds. The sound power ratings shown are in decibels, referred to 10-12 watts calculated per AMCA Standard 301. The A-weighted sound ratings shown have been calculated per AMCA International Standard 301. Values shown are for inlet Lwi LwiA and outlet Lwo, LwoA sound power levels for installation Type A: Free inlet Free outlet. dBA levels shown represent sound pressure levels 5 feet from the fan in a hemispherical free field. dBA levels are not licensed by AMCA International.
Roof Curb

Model: VKCURB

Standard Construction Features:
- Roof Curb fits between the building roof and the fan mounted directly to the roof support structure - Constructed of LabCoat coated steel (12 ga) - Concrete Gray RAL-7023 - Straight Sided - Vertical structural reinforcements (12 ga) - Single roof flashing flange (5 in. width) - Centering tabs on each side - Insulated (1 in. thick).

NOTES:
- The roof opening dimension may not be the same as the structural opening dimension.

All multi-fan roof curb designs will be shipped in single section square assemblies. Assembly of overall curb will be required in the field.

Notes: All dimensions shown are in units of in.
Model: 44-AFDW-21-3-II-750
PermaLock Housing, Airfoil Double Width

Operating Performance

- Quantity: 1
- Volume (CFM): 48,333
- Total External SP (in. wg): 6.5
- Operating Power (hp): 65.23
- Required Power (hp): 65.23
- Fan RPM: 982
- Max Fan RPM: 1,174
- Oper. Frequency (Hz): 60
- Elevation (ft): 10
- Start-up Temp.(F): 70
- Operating Temp.(F): 70

Fan Configuration
- Size: 44
- Arrangement: 3
- Class: II
- Rotation: CW
- Discharge Position: TH
- Construction Type: PermaLock
- Spark Resistance: None
- Scroll Material: Steel
- Wheel Material: Steel
- Inlet Cone Material: Steel

Equipment Weights
- Fan (LMD)(lb): 1,804
- Motor/Drive (lb): 841
- Accessories (lb): 50

Misc Fan Data
- FEG: 85
- Outlet Velocity (ft/min): 2,359
- Static Efficiency (%): 78
- Tip Speed (ft/min): 11,444

Motor and Drives
- Motor: Included
- Size (hp): 75
- RPM: 1725
- Enclosure: ODP
- V/C/P: 460/60/3
- Frame Size: 365T
- Max Frame Size: 445
- Location: X
- Pulley Type: Constant
- Drive Loss (%): 3.1
- Drives: Multiple
- Drive Service Factor: 1.5
- NEC FLA* (Amps): 96

Sound Power by Octave Band

<table>
<thead>
<tr>
<th>Sound Data</th>
<th>62.5</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
<th>8000</th>
<th>LwA</th>
<th>dBA</th>
<th>Sones</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inlet</td>
<td>98</td>
<td>107</td>
<td>97</td>
<td>91</td>
<td>92</td>
<td>88</td>
<td>86</td>
<td>83</td>
<td>98</td>
<td>86</td>
<td>57</td>
</tr>
<tr>
<td>Outlet</td>
<td>103</td>
<td>110</td>
<td>96</td>
<td>93</td>
<td>91</td>
<td>85</td>
<td>83</td>
<td>79</td>
<td>98</td>
<td>86</td>
<td>61</td>
</tr>
</tbody>
</table>

*LwA - A weighted sound power level, based on tables 150 or 148 of National Electrical Code 2002. Actual motor FLA may vary, for sizing thermal overload, consult factory.
dBA - A weighted sound pressure level, based on ANSI S1.4
Sones - calculated using AMCA 301 at 5 ft
Model: 44-AFDW-21-3-II-750
PermaLock Housing, Airfoil Double Width

Standard Construction Features:

HOUSING: Class I and II fans feature PermaLock construction on sizes 18 - 49 and continuously welded steel housing on sizes 54 - 73 and all class III fans. Punched outlet flange standard (except for downblast - DB) on class I and II sizes 33 - 73, and all class III fans. Inlets are non-ducted. BEARINGS, SHAFT, AND WHEEL: Heavy duty, self-aligning ball or roller pillow block bearings. Polished, solid steel shafts. Welded centrifugal wheel.

Selected Options & Accessories:

NEMA Premium Efficient Motor - meets NEMA Table 12-12
Motor with Class B or Greater Insulation
Coating - Permatector, Concrete Gray-RAL 7023, Fan and Attached Accessories
Bearings - L(10) Life of 80k Hours
UL/cUL-705 - "Power Ventilators"
Isolation Base, Factory Mounted, Isolator-Rubber Mount, 0.25 Inch, Base Coating - Permatector
Access Door - Bolted
Outlet Connection - Punched
Belt Guard - TE
Motor Slide Base
Unit Warranty: 1 Yr (Standard)
Model: 44-AFDW-21-3-II-750  PermaLock Housing, Airfoil Double Width

CONNECTIONS

SHAFT DIA 3.44
KEYWAY 0.63 X 0.31
END VIEW

HOUSING CENTERLINE

FAN FOOTPRINT

0.44 DIA. 26 HOLES OUTLET

SIDE VIEW

SIDE VIEW IS VIEWED FROM DRIVE SIDE
DISCHARGE POSITION CAN NOT BE MODIFIED IN FIELD

END VIEW

shafts dia 3.44
keyway 0.63 x 0.31

Notes: All dimensions shown are in units of in.
Isolation Base
Type: Isolation Base

Standard Construction Features:
- Steel Channel - Welded construction - Pre-punched mounting holes for fan and isolator mounting - Integral lifting points - Motor slide base (Arr 1 and Arr 3 only)

Fan Configuration
Model: 44-AFDW-21-3-II-750
Discharge Position: TH
Arrangement: 3
Class: II
Rotation: CW
Motor Frame Size: 365T
Motor Position: X
Isolator/Deflection: Rubber Mount, 0.25 Inch

Notes: All dimensions shown are in units of in.
Isolators

Type: Rubber Mount, 0.25 Inch

Standard Construction Features:

Oil resistant neoprene. Color coded or identified to indicate load capacity. Tapped center hole to secure isolator to base. Flanged with through holes for attachment to supporting structure.

Fan Configuration

Model: 44-AFDW-21-3-II-750
Arrangement: 3
Rotation: CW
Motor Position: X
Discharge Position: TH
Class: II
Motor Frame Size: 365T
Isolator/Deflection: Rubber Mount, 0.25 Inch

Consult Factory For Drawing Details

Notes: All dimensions shown are in units of in.
AMCA Licensed for Sound and Air Performance. Power rating (BHP/kW) includes transmission losses.

Greenheck Fan Corporation certifies that the model shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and AMCA Publication 311 and comply with the requirements of the AMCA Certified Ratings Program. Performance certified is for installation type B: Free inlet, Ducted outlet. Performance ratings do not include the effects of appurtenances (accessories). Power ratings (BHP/kW) include transmission losses. The sound power level ratings shown are in decibels, referred to 10-12 watts calculated per AMCA Standard 301. The A-weighted sound ratings shown have been calculated per AMCA International Standard 301. Values shown are for inlet Lwi, LwiA, and outlet Lwo, LwoA sound power levels for installation type B: Free inlet, Ducted outlet. Outlet ratings include the effects of duct end correction. dBA levels are not licensed by AMCA International. The AMCA Certified Ratings Seal for Sound applies to inlet LwiA and outlet LwoA ratings only.
# Fume Exhaust System

## Model: VEKTOR-MD-49-9-70-LV-HPW

### Design Condition

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Systems</td>
<td>1</td>
</tr>
<tr>
<td>Fans per System</td>
<td>4</td>
</tr>
<tr>
<td>Redundancy</td>
<td>N+1</td>
</tr>
<tr>
<td>System Type</td>
<td>Variable Volume</td>
</tr>
<tr>
<td>ERS Plenum</td>
<td>No</td>
</tr>
<tr>
<td>Lab Exh. Vol. (CFM)</td>
<td>144,999</td>
</tr>
<tr>
<td>Min Lab Exh. Vol. (CFM)</td>
<td>72,500</td>
</tr>
<tr>
<td>Add. BAP Air (CFM)</td>
<td>0</td>
</tr>
<tr>
<td>Wind Speed (MPH)</td>
<td>10.0</td>
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### Selection Criteria - Normal [N] Oper.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Volume (CFM)</td>
<td>48,333</td>
</tr>
<tr>
<td>Total External SP</td>
<td>6.85 in. wg</td>
</tr>
<tr>
<td>Air Stream Temp (F)</td>
<td>70</td>
</tr>
<tr>
<td>Elevation (ft)</td>
<td>10</td>
</tr>
<tr>
<td>Drive Loss (%)</td>
<td>3.1</td>
</tr>
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</table>

### Operating Fan Performance

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fan RPM</td>
<td>1076</td>
</tr>
<tr>
<td>Max Fan RPM</td>
<td>1153</td>
</tr>
<tr>
<td>Operating Power (hp)</td>
<td>91.51</td>
</tr>
<tr>
<td>Required Power (hp)</td>
<td>91.51</td>
</tr>
<tr>
<td>Oper. Frequency (Hz)</td>
<td>60</td>
</tr>
</tbody>
</table>

### Operating Discharge Performance

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nozzle OV (ft/min)</td>
<td>4,410</td>
</tr>
<tr>
<td>Windband OV (ft/min)</td>
<td>2,215</td>
</tr>
<tr>
<td>WB Exit Vol. (CFM)</td>
<td>81,199</td>
</tr>
<tr>
<td>Dilution (%)</td>
<td>168</td>
</tr>
<tr>
<td>Effective Plume Ht. (ft)</td>
<td>59.7</td>
</tr>
</tbody>
</table>

Calculation Method: Momentum Flux

### Fan Construction

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spark Resistance</td>
<td></td>
</tr>
<tr>
<td>Spark C</td>
<td></td>
</tr>
<tr>
<td>Drive Type</td>
<td>Belt</td>
</tr>
<tr>
<td>Arrangement</td>
<td>9</td>
</tr>
</tbody>
</table>

### Plenum Configuration

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Bypass Air Plenum</td>
<td>Yes</td>
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<tr>
<td>Plenum Arrangement</td>
<td>Inline</td>
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</tbody>
</table>

### Motor Specs

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Motor Size (hp)</td>
<td>100</td>
</tr>
<tr>
<td>RPM</td>
<td>1725</td>
</tr>
<tr>
<td>V/C/P</td>
<td>460/60/3</td>
</tr>
<tr>
<td>Enclosure</td>
<td>TEFC</td>
</tr>
<tr>
<td>Motor Duty</td>
<td>Industrial</td>
</tr>
<tr>
<td>Drives</td>
<td>Multiple</td>
</tr>
<tr>
<td>Drive Service Factor</td>
<td>2</td>
</tr>
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</table>

### Weight Totals

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fan Assembly (lb)</td>
<td>23,788</td>
</tr>
<tr>
<td>Plenum Assembly (lb)</td>
<td>10,758</td>
</tr>
<tr>
<td>Roof Curb (lb)</td>
<td>1,023</td>
</tr>
<tr>
<td>System Total (lb)</td>
<td>35,569</td>
</tr>
</tbody>
</table>

---

AMCA tested and certified performance data includes pressure losses from discharge nozzles and windbands. Additional losses internal to the system are for selected optional accessories.

---

**Static Pressure Calculations**

- External SP: 6.5 in. wg
- Isolation Damper: 0.15 in. wg
- Total External SP: 6.65 in. wg

---

**Generated by:** nickb@synergy-engineers.com
## Sound Data

### Sound Power by Octave Band (Individual Fan Normal [N] Operating Condition)

<table>
<thead>
<tr>
<th>Sound Data</th>
<th>62.5</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
<th>8000</th>
<th>LwA</th>
<th>dBA 5 ft</th>
<th>dBA 10 ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inlet Sound</td>
<td>105</td>
<td>108</td>
<td>104</td>
<td>102</td>
<td>98</td>
<td>94</td>
<td>89</td>
<td>81</td>
<td>104</td>
<td>92</td>
<td>N/A</td>
</tr>
<tr>
<td>Outlet Sound</td>
<td>100</td>
<td>106</td>
<td>107</td>
<td>105</td>
<td>100</td>
<td>97</td>
<td>93</td>
<td>86</td>
<td>106</td>
<td>95</td>
<td>89</td>
</tr>
</tbody>
</table>

LwA - A weighted sound power level, based on ANSI S1.4

dBA - A weighted sound pressure level, based on 11.5 dB attenuation per octave band at 5 ft

dBA levels are not licensed by AMCA International

### Sound Testing Details

*Inlet sound is measured prior to the fan inlet. Sound is per individual fan operating at the design CFM and total Static Pressure.

*Outlet sound includes sound exiting the discharge as well as radiated sound from the fan casing. Optional attenuators are available.

### Total Outlet Sound by Octave Band (All Operating Fans Normal [N] Condition)

<table>
<thead>
<tr>
<th>62.5</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
<th>8000</th>
<th>LwA</th>
<th>dBA 5 ft</th>
<th>dBA 10 ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>105</td>
<td>111</td>
<td>112</td>
<td>110</td>
<td>105</td>
<td>102</td>
<td>98</td>
<td>91</td>
<td>111</td>
<td>100</td>
<td>94</td>
</tr>
</tbody>
</table>

Total outlet sound values are not AMCA certified.
Selected Options & Accessories:

NEMA Premium Efficient Motor - meets NEMA Table 12-12
Motor VFD Rated without Shaft Grounding Protection
Motor with Class F or Greater Insulation
Motor Duty - Industrial
Motor with greaseable bearings
Bypass Air Plenum - Single Wall, Steel, Bottom Exhaust Intake
Coated with LabCoat, RAL7023, Entire Unit
Switch - NEMA-3R, Heavy Duty, For Indoor or Outdoor Use, Mounted and Wired
UL/cUL-705 - "Power Ventilators"
Shaft Material - Turned and Polished Steel with Protective Coating
Fan Panel Material - Coated Steel
Bypass Damper - HCD-130-LE, Galvanized, Mill Finish, 36 in. x 36 in., Qty: 3
Isolation Damper - HCD-230-LE, Galvanized, Coated, 78 in. x 76 in., Parallel Blades, mounted in BAP, one per fan
Sure-Aire Flow Station (No Electronics), Qty 4
Factory Vibration Test, 0.10 in/sec, peak, filter-in as measured at the fan RPM
Extended Lube Lines - Nylon
Motor Cover - with Hinged Removable Access Panel
Standard weatherhood over Bypass damper with inlet screen
Unit Warranty: 1 Yr (Standard)
Model: VEKTOR-MD-49-9-70-LV-HPW

Fume Exhaust System

Notes: All dimensions shown are in units of in. and weights are shown in units of lb.
Drawings are of standard unit and do not include dimensions for accessories or design modifications.
Model: VEKTOR-MD-49-9-70-LV-HPW

Fume Exhaust System

Notes: All dimensions shown are in units of in. and weights are shown in units of lb. Drawings are of standard unit and do not include dimensions for accessories or design modifications.
ALL BOTTOM DUCT CONNECTIONS ARE OPEN AS STANDARD

A MINIMUM OF 100.63 INCHES FROM EDGE OF PLENUM TO ALLOW THE REMOVAL OF THE ISOLATION DAMPER OR 12 INCHES FROM THE FARTHEST POINT STICKING PAST UNIT FOR A CLEAR WALKWAY (WHICH EVER IS GREATER) IS RECOMMENDED.

Notes: All dimensions shown are in units of in. and weights are shown in units of lb. Drawings are of standard unit and do not include dimensions for accessories or design modifications.
Inlet Connection Detail

**DUCT DROP**

**BY OTHERS**

**ROOF CURB**

**PLENUM SKIRT**

**BAP**

**BOTTOM INLET**

A MAXIMUM INLET VELOCITY OF 1500 FPM IS RECOMMENDED

ALL BOTTOM DUCT CONNECTIONS ARE OPEN AS STANDARD

Notes: All dimensions shown are in units of in. and weights are shown in units of lb. Drawings are of standard unit and do not include dimensions for accessories or design modifications.
All sizes except 54 are AMCA Licensed for Sound and Air Performance.

Greenheck Fan Corporation certifies that the model shown herein is licensed to bear the AMCA Seal. The AMCA Certified Ratings Seal applies to Induced flow Fan Air and Sound Performance (AMCA Standard 260). The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and 311 and comply with the requirements of the AMCA Certified Ratings Program. Performance certified is for installation Type A: Free inlet, Free Outlet. Performance ratings do not include the effects of appertances (accessories). Power ratings (BHP/kW) does not include transmission losses. Performance ratings do not include the effects of cross winds. The sound power ratings shown are in decibels, referred to 10-12 watts calculated per AMCA Standard 301. The A-weighted sound ratings shown have been calculated per AMCA International Standard 301. Values shown are for inlet Lwi, LwiA and outlet Lwo, LwoA sound power levels for installation Type A: Free inlet Free outlet. dBA levels shown represent sound pressure levels 5 feet from the fan in a hemispherical free field. dBA levels are not licensed by AMCA International.
Roof Curb

Model: VKCURB

Standard Construction Features:
- Roof Curb fits between the building roof and the fan mounted directly to the roof support structure
- Constructed of LabCoat coated steel (12 ga)
- Concrete Gray RAL-7023
- Straight Sided
- Vertical structural reinforcements (12 ga)
- Single roof flashing flange (5 in. width)
- Centering tabs on each side
- Insulated (1 in. thick).

NOTES:
- The roof opening dimension may not be the same as the structural opening dimension.

All multi-fan roof curb designs will be shipped in single section square assemblies. Assembly of overall curb will be required in the field.

Notes: All dimensions shown are in units of in.
### Performance

<table>
<thead>
<tr>
<th>Category</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity</td>
<td>1</td>
</tr>
<tr>
<td>Volume (CFM)</td>
<td>27,000</td>
</tr>
<tr>
<td>Total External SP (in. wg)</td>
<td>0</td>
</tr>
<tr>
<td>Operating Power (hp)</td>
<td>2.25</td>
</tr>
<tr>
<td>Required Power (hp)</td>
<td>2.25</td>
</tr>
<tr>
<td>Fan RPM</td>
<td>382</td>
</tr>
<tr>
<td>Max Fan RPM</td>
<td>996</td>
</tr>
<tr>
<td>Oper. Frequency (Hz)</td>
<td>60</td>
</tr>
<tr>
<td>Elevation (ft)</td>
<td>10</td>
</tr>
<tr>
<td>Start-up Temp. (F)</td>
<td>70</td>
</tr>
<tr>
<td>Operating Temp. (F)</td>
<td>70</td>
</tr>
</tbody>
</table>

### Fan Configuration

- **Size**: 40
- **Arrangement**: 3
- **Class**: I
- **Rotation**: CW
- **Discharge Position**: TH
- **Construction Type**: PermaLock
- **Spark Resistance**: None
- **Scroll Material**: Steel
- **Wheel Material**: Steel
- **Inlet Cone Material**: Steel

### Equipment Weights

- **Fan (LMD)(lb)**: 1,331
- **Motor/Drive (lb)**: 112
- **Accessories (lb)**: 45

### Misc Fan Data

- **FEG**: 85
- **Outlet Velocity (ft/min)**: 1,610
- **Static Efficiency (%)**: 0
- **Tip Speed (ft/min)**: 3,998

### Motor and Drives

- **Motor**: Included
- **Size (hp)**: 5
- **RPM**: 1725
- **Enclosure**: ODP
- **V/C/P**: 460/60/3
- **Frame Size**: 184T
- **Max Frame Size**: 364
- **Location**: X
- **Pulley Type**: Constant
- **Drive Loss (%)**: 4.7
- **Drives**: Multiple
- **Drive Service Factor**: 1.5
- **NEC FLA* (Amps)**: 7.6

### Sound Power by Octave Band

<table>
<thead>
<tr>
<th>Sound Data</th>
<th>LwA</th>
<th>dBA</th>
<th>Sones</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inlet</td>
<td>86</td>
<td>83</td>
<td>81</td>
</tr>
<tr>
<td>Outlet</td>
<td>92</td>
<td>85</td>
<td>78</td>
</tr>
</tbody>
</table>

*FLA - based on tables 150 or 148 of National Electrical Code 2002. Actual motor FLA may vary, for sizing thermal overload, consult factory.

LwA - A weighted sound power level, based on ANSI S1.4
dBA - A weighted sound pressure level, based on 11.5 dB attenuation per octave band at 5 ft
Sones - calculated using AMCA 301 at 5 ft

---

Model: 40-AFDW-21-3-I-50
PermaLock Housing, Airfoil Double Width

---

Operating Performance

- **Operating Bhp point**
- **Operating point at Total External SP**
- **Fan curve**
- **System curve**
- **Brake horsepower curve**

---

Printed Date: 02/18/2020
Job: 19-124 SRB Selections
Mark: EF 3-31 32 33 Non Vektor
Model: 40-AFDW-21-3-I-50

---

Generated by: nickb@synergy-engineers.com

C:\Users\SCE Eng\Project Records\2019\19-124 Moffitt SRB Roof HVAC SDs1.0 Design\1.1 Engineering\4 Cutsheets\EFs & RFs\19-124 SRB Selections.gfc Page 43 of 98
Model: 40-AFDW-21-3-I-50
PermaLock Housing, Airfoil Double Width

Standard Construction Features:

HOUISING: Class I and II fans feature PermaLock construction on sizes 18 - 49 and continuously welded steel housing on sizes 54 - 73 and all class III fans. Punched outlet flange standard (except for downblast - DB) on class I and II sizes 33 - 73, and all class III fans. Inlets are non-ducted. BEARINGS, SHAFT, AND WHEEL: Heavy duty, self-aligning ball or roller pillow block bearings. Polished, solid steel shafts. Welded centrifugal wheel.

Selected Options & Accessories:

NEMA Premium Efficient Motor - meets NEMA Table 12-12
Motor with Class B or Greater Insulation
Coating - Permatector, Concrete Gray-RAL 7023, Fan and Attached Accessories
Bearings - L(10) Life of 80k Hours
UL/cUL-705 - "Power Ventilators"
Isolation Base, Factory Mounted, Isolator-Rubber Mount, 0.25 Inch, Base Coating - Permatector
Access Door - Bolted
Outlet Connection - Punched
Belt Guard - TE
Motor Slide Base
Unit Warranty: 1 Yr (Standard)
Model: 40-AFDW-21-3-I-50 PermaLock Housing, Airfoil Double Width

CONNECTIONS

SHAFT DIA 2.94
KEYWAY 0.63 X 0.31

END VIEW

HOUSING CENTERLINE

FAN FOOTPRINT

SHAFT CENTERLINE

SHFT DIA 2.94
KEYWAY 0.63 X 0.31

OUTLET 0.44 DIA. 22 HOLES

SIDE VIEW

*SIDE VIEW IS VIEWED FROM DRIVE SIDE
*DISCHARGE POSITION CAN NOT BE MODIFIED IN FIELD

Notes: All dimensions shown are in units of in.
Isolation Base
Type: Isolation Base

Standard Construction Features:
- Steel Channel - Welded construction - Pre-punched mounting holes for fan and isolator mounting - Integral lifting points - Motor slide base (Arr 1 and Arr 3 only)

Fan Configuration
Model: 40-AFDW-21-3-I-50
Discharge Position: TH
Arrangement: 3
Class: I
Rotation: CW
Motor Frame Size: 184T
Motor Position: X
Isolator/Deflection: Rubber Mount, 0.25 Inch

Notes: All dimensions shown are in units of in.
Isolators
Type: Rubber Mount, 0.25 Inch

Standard Construction Features:

Oil resistant neoprene. Color coded or identified to indicate load capacity. Tapped center hole to secure isolator to base. Flanged with through holes for attachment to supporting structure.

Fan Configuration

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>40-AFDW-21-3-I-50</td>
</tr>
<tr>
<td>Arrangement</td>
<td>3</td>
</tr>
<tr>
<td>Rotation</td>
<td>CW</td>
</tr>
<tr>
<td>Motor Position</td>
<td>X</td>
</tr>
<tr>
<td>Discharge Position</td>
<td>TH</td>
</tr>
<tr>
<td>Class</td>
<td>I</td>
</tr>
<tr>
<td>Motor Frame Size</td>
<td>184T</td>
</tr>
<tr>
<td>Isolator/Deflection</td>
<td>Rubber Mount, 0.25 Inch</td>
</tr>
</tbody>
</table>

Consult Factory For Drawing Details

Notes: All dimensions shown are in units of in.
AMCA Licensed for Sound and Air Performance. Power rating (BHP/kW) includes transmission losses.

Greenheck Fan Corporation certifies that the model shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and AMCA Publication 311 and comply with the requirements of the AMCA Certified Ratings Program. Performance certified is for installation type B: Free inlet, Ducted outlet. Performance ratings do not include the effects of appurtenances (accessories). Power ratings (BHP/kW) include transmission losses. The sound power level ratings shown are in decibels, referred to 10-12 watts calculated per AMCA Standard 301. The A-weighted sound ratings shown have been calculated per AMCA International Standard 301. Values shown are for inlet Lwi, LwiA, and outlet Lwo, LwoA sound power levels for installation type B: Free inlet, Ducted outlet. Outlet ratings include the effects of duct end correction. dBA levels are not licensed by AMCA International. The AMCA Certified Ratings Seal for Sound applies to inlet LwiA and outlet LwoA ratings only.
<table>
<thead>
<tr>
<th>Design Condition</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Systems</td>
<td>1</td>
</tr>
<tr>
<td>Fans per System</td>
<td>3</td>
</tr>
<tr>
<td>Redundancy</td>
<td>N+1</td>
</tr>
<tr>
<td>System Type</td>
<td>Variable Volume</td>
</tr>
<tr>
<td>ERS Plenum</td>
<td>No</td>
</tr>
<tr>
<td>Lab Exh. Vol. (CFM)</td>
<td>54,000</td>
</tr>
<tr>
<td>Min Lab Exh. Vol. (CFM)</td>
<td>27,000</td>
</tr>
<tr>
<td>Add. BAP Air (CFM)</td>
<td>0</td>
</tr>
<tr>
<td>Wind Speed (MPH)</td>
<td>10.0</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Selection Criteria - Normal [N] Oper.</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume (CFM)</td>
<td>27,000</td>
</tr>
<tr>
<td>Total External SP (in. wg)</td>
<td>6.85</td>
</tr>
<tr>
<td>Air Stream Temp (F)</td>
<td>70</td>
</tr>
<tr>
<td>Elevation (ft)</td>
<td>10</td>
</tr>
<tr>
<td>Drive Loss (%)</td>
<td>3.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>N Operating Fan Performance</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fan RPM</td>
<td>1453</td>
</tr>
<tr>
<td>Max Fan RPM</td>
<td>1556</td>
</tr>
<tr>
<td>Operating Power (hp)</td>
<td>48.92</td>
</tr>
<tr>
<td>Required Power (hp)</td>
<td>48.92</td>
</tr>
<tr>
<td>Oper. Frequency (Hz)</td>
<td>60</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>N Operating Discharge Performance</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Nozzle OV (ft/min)</td>
<td>3,819</td>
</tr>
<tr>
<td>Effective Plume Ht. (ft)</td>
<td>52.6</td>
</tr>
<tr>
<td>Calculation Method</td>
<td>Momentum Flux</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Fan Construction</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Spark Resistance (in.)</td>
<td>9</td>
</tr>
<tr>
<td>Arrangement</td>
<td>Belt</td>
</tr>
<tr>
<td>Nozzle Size (in.)</td>
<td>9</td>
</tr>
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<table>
<thead>
<tr>
<th>Plenum Configuration</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bypass Air Plenum</td>
<td>Yes</td>
</tr>
<tr>
<td>Arrangement</td>
<td>Inline</td>
</tr>
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<table>
<thead>
<tr>
<th>Motor Specs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor Size (hp)</td>
<td>50</td>
</tr>
<tr>
<td>RPM</td>
<td>1725</td>
</tr>
<tr>
<td>V/C/P</td>
<td>460/60/3</td>
</tr>
<tr>
<td>Enclosure</td>
<td>TEFC</td>
</tr>
<tr>
<td>Motor Duty</td>
<td>Industrial</td>
</tr>
<tr>
<td>Drives</td>
<td>Multiple</td>
</tr>
<tr>
<td>Drive Service Factor</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Weight Totals</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fan Assembly (lb)</td>
<td>9,138</td>
</tr>
<tr>
<td>Plenum Assembly (lb)</td>
<td>4,690</td>
</tr>
<tr>
<td>Roof Curb (lb)</td>
<td>668</td>
</tr>
<tr>
<td>System Total (lb)</td>
<td>14,496</td>
</tr>
</tbody>
</table>

Model: VEKTOR-MH-36-9-70
Fume Exhaust System

**Static Pressure Calculations**
- External SP: 6.5 in. wg
- Isolation Damper: 0.15 in. wg
- Total External SP: 6.65 in. wg

AMCA tested and certified performance data includes pressure losses from discharge nozzles and windbands. Additional losses internal to the system are for selected optional accessories.
### Sound Data

#### Sound Power by Octave Band (Individual Fan Normal [N] Operating Condition)

<table>
<thead>
<tr>
<th>Sound Data</th>
<th>62.5</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
<th>8000</th>
<th>LwA</th>
<th>dBA 5 ft</th>
<th>dBA 10 ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inlet Sound</td>
<td>96</td>
<td>93</td>
<td>94</td>
<td>96</td>
<td>93</td>
<td>91</td>
<td>88</td>
<td>80</td>
<td>99</td>
<td>87</td>
<td>N/A</td>
</tr>
<tr>
<td>Outlet Sound</td>
<td>94</td>
<td>95</td>
<td>98</td>
<td>99</td>
<td>96</td>
<td>93</td>
<td>91</td>
<td>84</td>
<td>101</td>
<td>90</td>
<td>84</td>
</tr>
</tbody>
</table>

LwA - A weighted sound power level, based on ANSI S1.4

dBA - A weighted sound pressure level, based on 11.5 dB attenuation per octave band at 5 ft.

#### Sound Testing Details

*Inlet sound is measured prior to the fan inlet. Sound is per individual fan operating at the design CFM and total Static Pressure.

*Outlet sound includes sound exiting the discharge as well as radiated sound from the fan casing.

### Total Outlet Sound by Octave Band (All Operating Fans Normal [N] Condition)

<table>
<thead>
<tr>
<th>62.5</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
<th>8000</th>
<th>LwA</th>
<th>dBA 5 ft</th>
<th>dBA 10 ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>97</td>
<td>98</td>
<td>101</td>
<td>102</td>
<td>99</td>
<td>96</td>
<td>94</td>
<td>87</td>
<td>104</td>
<td>93</td>
<td>87</td>
</tr>
</tbody>
</table>

Total outlet sound values are not AMCA certified.
Selected Options & Accessories:

- NEMA Premium Efficient Motor - meets NEMA Table 12-12
- Motor VFD Rated without Shaft Grounding Protection
- Motor with Class F or Greater Insulation
- Motor Duty - Industrial
- Motor with greaseable bearings
- Bypass Air Plenum - Single Wall, Steel, Bottom Exhaust Intake
- Coated with LabCoat, RAL7023, Entire Unit
- Switch - NEMA-3R, Toggle, For Indoor or Outdoor Use, Mounted and Wired
- UL/cUL-705 - "Power Ventilators"
- Shaft Material - Turned and Polished Steel with Protective Coating
- Fan Panel Material - Coated Steel
- Bypass Damper - HCD-130-LE, Galvanized, Mill Finish, 23 in. x 23 in., Qty: 2
- Isolation Damper - HCD-230-LE, Galvanal, Coated, 66 in. x 64 in., Parallel Blades, mounted in BAP, one per fan
- Sure-Aire Flow Station (No Electronics), Qty 3
- Factory Vibration Test, 0.10 in/sec, peak, filter-in as measured at the fan RPM
- Extended Lube Lines - Nylon
- Motor Cover - with Hinged Removable Access Panel
- Standard weatherhood over Bypass damper with inlet screen
- Unit Warranty: 1 Yr (Standard)
Model: Vektor-MH-36-9-70

Fume Exhaust System

Notes: All dimensions shown are in units of in. and weights are shown in units of lb.
Drawings are of standard unit and do not include dimensions for accessories or design modifications.

Generated by: nickb@synergy-engineers.com
Model: VEKTOR-MH-36-9-70

Fume Exhaust System

WEIGHT TOTALS

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAN ASSEMBLY</td>
<td>3,046</td>
</tr>
<tr>
<td>PLENUM ASSEMBLY</td>
<td>4,690</td>
</tr>
<tr>
<td>ROOF CURB</td>
<td>668</td>
</tr>
<tr>
<td>SYSTEM TOTAL</td>
<td>14,496</td>
</tr>
</tbody>
</table>

Notes: All dimensions shown are in units of in. and weights are shown in units of lb. Drawings are of standard unit and do not include dimensions for accessories or design modifications.

Generated by: nickb@synergy-engineers.com
ALL BOTTOM DUCT CONNECTIONS ARE OPEN AS STANDARD

A MINIMUM OF 86.63 INCHES FROM EDGE OF PLENUM TO ALLOW THE REMOVAL OF THE ISOLATION DAMPER OR 12 INCHES FROM THE FARTHEST POINT STICKING PAST UNIT FOR A CLEAR WALKWAY (WHICH EVER IS GREATER) IS RECOMMENDED.

Notes: All dimensions shown are in units of in. and weights are shown in units of lb. Drawings are of standard unit and do not include dimensions for accessories or design modifications.
A maximum inlet velocity of 1500 FPM is recommended.

Notes: All dimensions shown are in units of in. and weights are shown in units of lb. Drawings are of standard unit and do not include dimensions for accessories or design modifications.
AMCA Licensed for Sound and Air Performance. Power rating (BHP/kW) includes transmission losses.

Greenheck Fan Corporation certifies that the model shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and AMCA Publication 311 and comply with the requirements of the AMCA Certified Ratings Program. Performance certified is for installation type A: Free inlet, free outlet. Power rating (BHP/kW) includes transmission losses. Performance ratings do not include the effects of appurtenances (accessories). Sound ratings do not include the effects of duct end correction. dBA levels are not licensed by AMCA International. The sound power level ratings shown are in decibels, referred to 10-12 watts, calculated per AMCA Standard 301. The A-weighted sound ratings shown have been calculated per AMCA International Standard 301. The AMCA Certified Ratings Seal applies to LwA values only. The sound pressure shown in fan dBA are loudness values at 5 ft. in a hemispherical free field calculated per AMCA Standard 301.
Roof Curb

Model: VKCURB

Standard Construction Features:
- Roof Curb fits between the building roof and the fan mounted directly to the roof support structure
- Constructed of LabCoat coated steel (12 ga)
- Concrete Gray RAL-7023
- Straight Sided
- Vertical structural reinforcements (12 ga)
- Single roof flashing flange (5 in. width)
- Centering tabs on each side
- Insulated (1 in. thick).

NOTES:
- The roof opening dimension may not be the same as the structural opening dimension.

All multi-fan roof curb designs will be shipped in single section square assemblies. Assembly of overall curb will be required in the field.

Notes: All dimensions shown are in units of in.
### Performance

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity</td>
<td>1</td>
</tr>
<tr>
<td>Volume (CFM)</td>
<td>1,080</td>
</tr>
<tr>
<td>Total External SP (in. wg)</td>
<td>3</td>
</tr>
<tr>
<td>Operating Power (hp)</td>
<td>0.91</td>
</tr>
<tr>
<td>Required Power (hp)</td>
<td>0.91</td>
</tr>
<tr>
<td>Fan RPM</td>
<td>1563</td>
</tr>
<tr>
<td>Max Fan RPM</td>
<td>2,081</td>
</tr>
<tr>
<td>Elevation (ft)</td>
<td>10</td>
</tr>
<tr>
<td>Start-up Temp. (F)</td>
<td>70</td>
</tr>
<tr>
<td>Operating Temp. (F)</td>
<td>70</td>
</tr>
</tbody>
</table>

### Fan Configuration

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>10</td>
</tr>
<tr>
<td>Arrangement</td>
<td>10</td>
</tr>
<tr>
<td>Class</td>
<td>I</td>
</tr>
<tr>
<td>Rotation</td>
<td>CW</td>
</tr>
<tr>
<td>Discharge Position</td>
<td>TH</td>
</tr>
<tr>
<td>Wheel Material</td>
<td>Fiberglass</td>
</tr>
<tr>
<td>Inlet Cone Material</td>
<td>Steel</td>
</tr>
</tbody>
</table>

### Equipment Weights

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fan (LMD) (lb)</td>
<td>185</td>
</tr>
<tr>
<td>Motor/Drive (lb)</td>
<td>41</td>
</tr>
<tr>
<td>Accessories (lb)</td>
<td>0</td>
</tr>
</tbody>
</table>

### Misc Fan Data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEG</td>
<td>71</td>
</tr>
<tr>
<td>Outlet Velocity</td>
<td>2,097</td>
</tr>
<tr>
<td>Static Efficiency</td>
<td>60%</td>
</tr>
<tr>
<td>Tip Speed (ft/min)</td>
<td>7,061</td>
</tr>
</tbody>
</table>

### Motor and Drives

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor</td>
<td>Included</td>
</tr>
<tr>
<td>Size (hp)</td>
<td>1</td>
</tr>
<tr>
<td>RPM</td>
<td>1725</td>
</tr>
<tr>
<td>Enclosure</td>
<td>ODP</td>
</tr>
<tr>
<td>V/C/P</td>
<td>460/60/3</td>
</tr>
<tr>
<td>Location</td>
<td>Centered</td>
</tr>
<tr>
<td>Pulley Type</td>
<td>Constant</td>
</tr>
<tr>
<td>Drive Loss (%)</td>
<td>6.4</td>
</tr>
<tr>
<td>NEC FLA* (Amps)</td>
<td>2.1</td>
</tr>
</tbody>
</table>

### Sound Power by Octave Band

<table>
<thead>
<tr>
<th>Octave Band</th>
<th>LwA</th>
<th>dBA</th>
</tr>
</thead>
<tbody>
<tr>
<td>62.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>125</td>
<td></td>
<td></td>
</tr>
<tr>
<td>250</td>
<td></td>
<td></td>
</tr>
<tr>
<td>500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*FLA - based on tables 150 or 148 of National Electrical Code 2002. Actual motor FLA may vary, for sizing thermal overload, consult factory.

LwA - A weighted sound power level, based on ANSI S1.4

dBA - A weighted sound pressure level, based on 11.5 dB attenuation per octave band at 5 ft. dBA levels are not licensed by AMCA International.
Model: 10-BCSW-FRP-10-I-10
Centrifugal FRP Fan

**Standard Construction Features:**

HOUSING: Fiberglass reinforced plastic scroll. Layers of protective "C" veil are included as standard for added corrosion protection. All hardware in contact with the airstream is made of stainless steel and encapsulated in FRP. DRIVE FRAME: Heavy-gauge steel coated in enamel. BEARINGS, SHAFT, AND WHEEL: Heavy duty, self-aligning ball or roller pillow block bearings - Polished solid steel shafts - Fiberglass reinforced plastic centrifugal wheel, with strapped in blades - 9 bladed construction - Backward Curved blade profile

**Selected Options & Accessories:**

Motor with Class B or Greater Insulation
Standard Bearings - L(10) Life of 80k Hours
Drain Connection
Inlet Connection - Inlet Collar, Slip Fit
Outlet Connection - Unpunched Outlet Flange
Weatherhood
Shaft Material - Steel
Coating - Wheel - GelCoat, Drive Frame - Brushed Enamel, Gray
Model: 10-BCSW-FRP-10-I-10  Centrifugal FRP Fan

CONNECTIONS

SHAFT DIA 1
KEYWAY

3 X 0.38 X 0.18

END VIEW

WEATHERHOOD

HOUSING

CENTERLINE

4 Holes

SHAFT CENTERLINE

Ø 0.56

Ø 10.63

INLET OD

INLET

OUTLET

FAN FOOTPRINT

28.13

Ø 10.63

8.13

6.37

27.88

34.25

2.31

10.75

10.75

7.13

15.00

SIDE VIEW

SIDE VIEW IS VIEWED FROM DRIVE SIDE

Ø 10.63

INLET OD

24.00

16.72

40.72

24.00

23.00

34.03

24.63

11.75

NOTES: All dimensions shown are in units of in.

WEATHERHOOD

SHAFT DIA 1
KEYWAY

3 X 0.38 X 0.18

END VIEW
Inlet Connection

Standard Construction Features:
- Inlet collar standard
- Flanges (when selected) will be unpunched and strapped onto the inlet collar
- Companion flanges are available

Notes: All dimensions shown are in units of in.
Outlet Connection

Standard Construction Features:
- Unpunched outlet flange is standard
- Rectangle to round outlet transitions and companion flanges are available
- Discharge transitions for sizes 48-73 will ship loose; for sizes 15-44 they will be integral with the fan

Notes: All dimensions shown are in units of in.
Model: 18-BCSW-FRP-10-II-50
Centrifugal FRP Fan

Operating Performance

- Volume (CFM): 4,710
- Total External SP (in. wg): 2
- Operating Power (hp): 3.59
- Required Power (hp): 3.59
- Fan RPM: 2018
- Max Fan RPM: 2,198
- Elevation (ft): 10
- Start-up Temp.(F): 70
- Operating Temp.(F): 70

Fan Configuration
- Size: 18
- Arrangement: 10
- Class: II
- Rotation: CW
- Discharge Position: TH
- Wheel Material: Fiberglass
- Inlet Cone Material: Steel

Equipment Weights
- Fan (LMD)(lb): 225
- Motor/Drive (lb): 86
- Accessories (lb): 0

Misc Fan Data
- FEG: 75
- Outlet Velocity (ft/min): 2,453
- Static Efficiency (%): 43
- Tip Speed (ft/min): 9,642

Motor and Drives
- Motor: Included
- Size (hp): 5
- RPM: 1725
- Enclosure: ODP
- V/C/P*: 460/60/3
- Location: Centered
- Pulley Type: Constant
- Drive Loss (%): 4.2
- NEC FLA* (Amps): 7.6

Sound Power by Octave Band

<table>
<thead>
<tr>
<th>Sound Data</th>
<th>62.5</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
<th>8000</th>
<th>LwA</th>
<th>dB(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inlet</td>
<td>88</td>
<td>88</td>
<td>91</td>
<td>92</td>
<td>91</td>
<td>83</td>
<td>78</td>
<td>74</td>
<td>94</td>
<td>83</td>
</tr>
</tbody>
</table>

*FLA - based on tables 150 or 148 of National Electrical Code 2002. Actual motor FLA may vary, for sizing thermal overload, consult factory.
LwA - A weighted sound power level, based on ANSI S1.4
dB(A) - A weighted sound pressure level, based on 11.5 dB attenuation per octave band at 5 ft. dB(A) levels are not licensed by AMCA International.
Model: 18-BCSW-FRP-10-II-50
Centrifugal FRP Fan

Standard Construction Features:

HOUSING: Fiberglass reinforced plastic scroll. Layers of protective "C" veil are included as standard for added corrosion protection. All hardware in contact with the airstream is made of stainless steel and encapsulated in FRP.

DRIVE FRAME: Heavy-gauge steel coated in enamel.

BEARINGS, SHAFT, AND WHEEL: Heavy duty, self-aligning ball or roller pillow block bearings - Polished solid steel shafts - Fiberglass reinforced plastic centrifugal wheel, with strapped in blades - 9 bladed construction - Backward Curved blade profile

Selected Options & Accessories:

NEMA Premium Efficient Motor - meets NEMA Table 12-12
Motor with Class B or Greater Insulation
Standard Bearings - L(10) Life of 80k Hours
Drain Connection
Inlet Connection - Inlet Collar, Slip Fit
Outlet Connection - Unpunched Outlet Flange
Weatherhood
Shaft Material - Steel
Coating - Wheel - GelCoat, Drive Frame - Brushed Enamel, Gray
Model: 18-BCSW-FRP-10-II-50  Centrifugal FRP Fan

**CONNECTIONS**

- Ø 18.5 INLET OD

**SIDE VIEW**

*SIDE VIEW IS VIEWED FROM DRIVE SIDE*

**END VIEW**

**FAN FOOTPRINT**

**WEATHERHOOD**

SHUNT DIA 1.5
KEYWAY
3 X 0.38 X 0.19

Notes: All dimensions shown are in units of in.
Inlet Connection

Standard Construction Features:
• Inlet collar standard
• Flanges (when selected) will be unpunched and strapped onto the inlet collar
• Companion flanges are available

Notes: All dimensions shown are in units of in.
Outlet Connection

Standard Construction Features:
• Unpunched outlet flange is standard
• Rectangle to round outlet transitions and companion flanges are available
• Discharge transitions for sizes 48-73 will ship loose; for sizes 15-44 they will be integral with the fan

0.44 DIA. 22 HOLES
OUTLET DRAWN TO SCALE
EXAMPLE SHOWS AIRFLOW DIRECTION
EXAMPLE DISCHARGE POSITION IS "TH"

Notes: All dimensions shown are in units of in.
AMCA Licensed for Air Performance. Power rating (BHP/kW) includes transmission losses.

Greenheck Fan Corporation certifies that the model shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and comply with the requirements of the AMCA Certified Ratings Program. The AMCA Certified Ratings Seal applies to air performance ratings only. Performance certified is for installation type B: Free Inlet, Ducted Outlet. Power ratings (BHP/kW) include transmission losses. Performance ratings do not include the effects of appurtenances (accessories) in the airstream.
Model: AER-E54C-325-C-VGD75
Sidewall Direct Drive Fan
Motor Access From Int. of Bldg.

### Dimensional
<table>
<thead>
<tr>
<th>Quantity</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight w/o Acc's (lb)</td>
<td>562</td>
</tr>
<tr>
<td>Weight w/ Acc's (lb)</td>
<td>572</td>
</tr>
<tr>
<td>Max T Motor Frame Size</td>
<td>324</td>
</tr>
<tr>
<td>Wall Opening (in.)</td>
<td>56.5 x 56.5</td>
</tr>
</tbody>
</table>

### Performance
| Requested Volume (CFM) | 39,104 |
| Actual Volume (CFM) | 37,321 |
| Total External SP (in. wg) | 0.455 |
| Fan RPM | 860 |
| Operating Power (hp) | 8.88 |
| Elevation (ft) | 10 |
| Airstream Temp. (F) | 70 |
| Air Density (lb/ft³) | 0.075 |
| Drive Loss (%) | 3.6 |
| Tip Speed (ft/min) | 12,327 |
| Static Eff. (%) | 31 |

### Motor
| Motor Mounted | Yes |
| Size (hp) | 7 1/2 |
| Voltage/Cycle/Phase | 460/60/3 |
| Enclosure | ODP |
| Motor RPM | 860 |
| Efficiency Rating | NEMA Premium |
| Windings | 1 |

### Sound Power by Octave Band

<table>
<thead>
<tr>
<th>Sound Data</th>
<th>62.5</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
<th>8000</th>
<th>LwA</th>
<th>dBA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inlet</td>
<td>102</td>
<td>101</td>
<td>97</td>
<td>94</td>
<td>90</td>
<td>87</td>
<td>85</td>
<td>83</td>
<td>97</td>
<td>85</td>
</tr>
</tbody>
</table>

### Notes:
- Sound value does not include carrier frequencies associated with motor controller.
- The motor provided on this fan is inverter ready and meets NEMA MG1 Part 31.4.4.2

---

**Generated by:** nickb@synergy-enginers.com
Model: AER-E54C-325-C-VGD75

Sidewall Direct Drive Fan

**Standard Construction Features:**
- Galvanized steel fan panel - Die formed, galvanized steel drive frame assembly
- Cast aluminum airfoil blade propeller - Ball bearing motors - Corrosion resistant fasteners

**Selected Options & Accessories:**
- NEMA Premium Efficient Motor - meets NEMA Table 12-12
- Motor VFD Rated without Shaft Grounding Protection
- Motor with 40 Degree C Ambient Temperature
- Vari-Green Drive 100+ 0-10VDC Input Signal
- Vari-Green Drive 100+ with Indoor Wall Mounting
- Airflow Direction: Exhaust
- Motor Access: From Int. of Bldg.
- Unit Warranty: 1 Yr (Standard)
AMCA Licensed for Sound and Air Performance. Power rating (BHP/kW) does not include transmission losses.

Greenheck Fan Corporation certifies that the model shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and AMCA Publication 311 and comply with the requirements of the AMCA Certified Ratings Program. Performance certified is for installation type A: Free inlet, Free outlet. Power rating (BHP/kW) does not include transmission losses. Performance ratings do not include the effects of appurtenances (accessories). The sound ratings shown are loudness values in fan sones at 5 ft. (1.5 m) in a hemispherical free field calculated per AMCA Standard 301. Values shown are for installation type A: free inlet hemispherical sone levels. dBA levels are not licensed by AMCA International. The AMCA Certified Ratings Seal applies to LwiA and inlet sone ratings only.
### Model: VEKTOR-MH-36-9-85

**Fume Exhaust System**

<table>
<thead>
<tr>
<th>Design Condition</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Systems</td>
<td>1</td>
</tr>
<tr>
<td>Fans per System</td>
<td>2</td>
</tr>
<tr>
<td>Redundancy</td>
<td>N+1</td>
</tr>
<tr>
<td>System Type</td>
<td>Variable Volume</td>
</tr>
<tr>
<td>ERS Plenum</td>
<td>No</td>
</tr>
<tr>
<td>Lab Exh. Vol. (CFM)</td>
<td>27,828</td>
</tr>
<tr>
<td>Min Lab Exh. Vol. (CFM)</td>
<td>13,914</td>
</tr>
<tr>
<td>Add. BAP Air (CFM)</td>
<td>0</td>
</tr>
<tr>
<td>Wind Speed (MPH)</td>
<td>10.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Selection Criteria - Normal [N] Oper.</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume (CFM)</td>
<td>27,828</td>
</tr>
<tr>
<td>Total External SP (in. wg)</td>
<td>3.65</td>
</tr>
<tr>
<td>Air Stream Temp (F)</td>
<td>70</td>
</tr>
<tr>
<td>Elevation (ft)</td>
<td>10</td>
</tr>
<tr>
<td>Drive Loss (%)</td>
<td>3.2</td>
</tr>
</tbody>
</table>

#### N Operating Fan Performance

- Fan RPM: 1227
- Max Fan RPM: 1377
- Operating Power (hp): 32.42
- Required Power (hp): 32.42
- Oper. Frequency (Hz): 60

#### N Operating Discharge Performance

- Nozzle OV (ft/min): 3,936
- Effective Plume Ht. (ft): 53.65
- Calculation Method: Momentum Flux

#### Fan Construction

- Spark Resistance: Spark C
- Drive Type: Bell
- Arrangement: 9
- Nozzle Size (in.): 36

#### Plenum Configuration

- Bypass Air Plenum: Yes
- Plenum Arrangement: Inline

#### Motor Specs

- Motor Size (hp): 40
- RPM: 1725
- V/C/P: 460/60/3
- Enclosure: TEFC
- Motor Duty: Industrial
- Drives: Multiple
- Drive Service Factor: 2

#### Weight Totals

- Fan Assembly (lb): 5,838
- Plenum Assembly (lb): 3,154
- Roof Curb (lb): 452
- System Total (lb): 9,444

---

AMCA tested and certified performance data includes pressure losses from discharge nozzles and windbands. Additional losses internal to the system are for selected optional accessories.
## Sound Data

### Sound Power by Octave Band (Individual Fan Normal [N] Operating Condition)

<table>
<thead>
<tr>
<th>Sound Data</th>
<th>62.5</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
<th>8000</th>
<th>LwA</th>
<th>dBA 5 ft</th>
<th>dBA 10 ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inlet Sound</td>
<td>93</td>
<td>93</td>
<td>95</td>
<td>95</td>
<td>92</td>
<td>90</td>
<td>85</td>
<td>76</td>
<td>97</td>
<td>86</td>
<td>N/A</td>
</tr>
<tr>
<td>Outlet Sound</td>
<td>90</td>
<td>92</td>
<td>97</td>
<td>98</td>
<td>94</td>
<td>91</td>
<td>87</td>
<td>79</td>
<td>99</td>
<td>88</td>
<td>82</td>
</tr>
</tbody>
</table>

LwA - A weighted sound power level, based on ANSI S1.4

dBA - A weighted sound pressure level, based on 11.5 dB attenuation per octave band at 5 ft.

### Sound Testing Details

- Inlet sound is measured prior to the fan inlet. Sound is per individual fan operating at the design CFM and total Static Pressure.
- Outlet sound includes sound exiting the discharge as well as radiated sound from the fan casing.

### Total Outlet Sound by Octave Band (All Operating Fans Normal [N] Condition)

<table>
<thead>
<tr>
<th>Sound Data</th>
<th>62.5</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
<th>8000</th>
<th>LwA</th>
<th>dBA 5 ft</th>
<th>dBA 10 ft</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>90</td>
<td>92</td>
<td>97</td>
<td>98</td>
<td>94</td>
<td>91</td>
<td>87</td>
<td>79</td>
<td>99</td>
<td>88</td>
<td>82</td>
</tr>
</tbody>
</table>

Total outlet sound values are not AMCA certified.
Selected Options & Accessories:

NEMA Premium Efficient Motor - meets NEMA Table 12-12
Motor VFD Rated without Shaft Grounding Protection
Motor with Class F or Greater Insulation
Motor Duty - Industrial
Motor with greaseable bearings
Bypass Air Plenum - Single Wall, Steel, Bottom Exhaust Intake
Coated with LabCoat, RAL7023, Entire Unit
Switch - NEMA-3R, Toggle, For Indoor or Outdoor Use, Mounted and Wired
UL/cUL-705 - "Power Ventilators"
Shaft Material - Turned and Polished Steel with Protective Coating
Fan Panel Material - Coated Steel
Bypass Damper - HCD-130-LE, Galvanized, Mill Finish, 23 in. x 23 in., Qty: 1
Isolation Damper - HCD-230-LE, Galvanal, Coated, 66 in. x 64 in., Parallel Blades, mounted in BAP, one per fan
Sure-Aire Flow Station (No Electronics), Qty 2
Factory Vibration Test, 0.10 in/sec, peak, filter-in as measured at the fan RPM
Extended Lube Lines - Nylon
Motor Cover - with Hinged Removable Access Panel
Standard weatherhood over Bypass damper with inlet screen
Unit Warranty: 1 Yr (Standard)
Model: Vektormh-36-9-85

Fume Exhaust System

Notes: All dimensions shown are in units of in. and weights are shown in units of lb. Drawings are of standard unit and do not include dimensions for accessories or design modifications.
Model: VEKTOR-MH-36-9-85

Fume Exhaust System

Notes: All dimensions shown are in units of in. and weights are shown in units of lb.
Drawings are of standard unit and do not include dimensions for accessories or design modifications.

Generated by: nickb@synergy-engineers.com
ALL BOTTOM DUCT CONNECTIONS ARE OPEN AS STANDARD

A MINIMUM OF 86.63 INCHES FROM EDGE OF PLENUM TO ALLOW THE REMOVAL OF THE ISOLATION DAMPER OR 12 INCHES FROM THE FARthest POINT STICKING PAST UNIT FOR A CLEAR WALKWAY (WHICH EVER IS GREATER) IS RECOMMENDED.

Notes: All dimensions shown are in units of in. and weights are shown in units of lb. Drawings are of standard unit and do not include dimensions for accessories or design modifications.
A maximum inlet velocity of 1500 FPM is recommended.

Notes: All dimensions shown are in units of in. and weights are shown in units of lb. Drawings are of standard unit and do not include dimensions for accessories or design modifications.
AMCA Licensed for Sound and Air Performance. Power rating (BHP/kW) includes transmission losses.

Greenheck Fan Corporation certifies that the model shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and AMCA Publication 311 and comply with the requirements of the AMCA Certified Ratings Program. Performance certified is for installation type A: Free inlet, free outlet. Power rating (BHP/kW) includes transmission losses. Performance ratings do not include the effects of appurtenances (accessories). Sound ratings do not include the effects of duct end correction. dBA levels are not licensed by AMCA International. The sound power level ratings shown are in decibels, referred to 10-12 watts, calculated per AMCA Standard 301. The A-weighted sound ratings shown have been calculated per AMCA International Standard 301. The AMCA Certified Ratings Seal applies to LwA values only. The sound pressure shown in fan dBA are loudness values at 5 ft. in a hemispherical free field calculated per AMCA Standard 301.
Roof Curb

Model: VKCURB

Standard Construction Features:
- Roof Curb fits between the building roof and the fan mounted directly to the roof support structure
- Constructed of LabCoat coated steel (12 ga)
- Concrete Gray RAL-7023
- Straight Sided
- Vertical structural reinforcements (12 ga)
- Single roof flashing flange (5 in. width)
- Centering tabs on each side
- Insulated (1 in. thick).

NOTES:
- The roof opening dimension may not be the same as the structural opening dimension.

All multi-fan roof curb designs will be shipped in single section square assemblies. Assembly of overall curb will be required in the field.

Notes: All dimensions shown are in units of in.
### Performance

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity</td>
<td>1</td>
</tr>
<tr>
<td>Volume (CFM)</td>
<td>11,825</td>
</tr>
<tr>
<td>Total External SP (in. wg)</td>
<td>1</td>
</tr>
<tr>
<td>Operating Power (hp)</td>
<td>4.72</td>
</tr>
<tr>
<td>Required Power (hp)</td>
<td>4.72</td>
</tr>
<tr>
<td>Fan RPM</td>
<td>1018</td>
</tr>
<tr>
<td>Max Fan RPM</td>
<td>1,070</td>
</tr>
<tr>
<td>Elevation (ft)</td>
<td>10</td>
</tr>
<tr>
<td>Start-up Temp. (F)</td>
<td>70</td>
</tr>
<tr>
<td>Operating Temp. (F)</td>
<td>70</td>
</tr>
</tbody>
</table>

### Fan Configuration

- **Size**: 30
- **Arrangement**: 9
- **Class**: I
- **Rotation**: CW
- **Discharge Position**: TH
- **Wheel Material**: Fiberglass
- **Inlet Cone Material**: Steel

### Equipment Weights

- Fan (LMD) (lb): 600
- Motor/Drive (lb): 94
- Accessories (lb): 0

### Misc Fan Data

- **FEG**: 85
- **Outlet Velocity (ft/min)**: 2,438
- **Static Efficiency (%)**: 41
- **Tip Speed (ft/min)**: 7,999

### Motor and Drives

- **Motor**: Included
- **Size (hp)**: 5
- **RPM**: 1725
- **Enclosure**: ODP
- **V/C/P**: 460/60/3
- **Location**: Left Side
- **Pulley Type**: Constant
- **Drive Loss (%)**: 4.0
- **NEC FLA* (Amps)**: 7.8

### Operating Performance

![Graph showing operating performance](image)

**Model: 30-BCSW-FRP-9-I-50 Centrifugal FRP Fan**

**Operating Performance**

- **Operating Bhp point**
- **Operating point at Total External SP**

### Sound Power by Octave Band

<table>
<thead>
<tr>
<th>Sound Data</th>
<th>62.5</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
<th>8000</th>
<th>LwA</th>
<th>dbA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inlet</td>
<td>95</td>
<td>99</td>
<td>95</td>
<td>87</td>
<td>84</td>
<td>76</td>
<td>69</td>
<td>65</td>
<td>91</td>
<td>79</td>
</tr>
</tbody>
</table>

*FLA - based on tables 150 or 148 of National Electrical Code 2002. Actual motor FLA may vary, for sizing thermal overload, consult factory.

LwA - A weighted sound power level, based on ANSI S1.4

dbA - A weighted sound pressure level, based on 11.5 dB attenuation per octave band at 5 ft. dbA levels are not licensed by AMCA International
Model: 30-BCSW-FRP-9-I-50
Centrifugal FRP Fan

Standard Construction Features:

HOUSING: Fiberglass reinforced plastic scroll. Layers of protective "C" veil are included as standard for added corrosion protection. All hardware in contact with the airstream is made of stainless steel and encapsulated in FRP. DRIVE FRAME: Heavy-gauge steel coated in enamel. BEARINGS, SHAFT, AND WHEEL: Heavy duty, self-aligning ball or roller pillow block bearings - Polished solid steel shafts - Fiberglass reinforced plastic centrifugal wheel, with strapped in blades - 9 bladed construction - Backward Curved blade profile

Selected Options & Accessories:

NEMA Premium Efficient Motor - meets NEMA Table 12-12
Motor with Class B or Greater Insulation
Standard Bearings - L(10) Life of 80k Hours
Motor Slide Base
Drain Connection
Inlet Connection - Inlet Collar, Slip Fit
Outlet Connection - Unpunched Outlet Flange
Belt Guard - Totally Enclosed
Shaft Guard
Shaft Material - Steel
Coating - Wheel - GelCoat, Drive Frame - Brushed Enamel, Gray
Model: 30-BCSW-FRP-9-I-50  Centrifugal FRP Fan

Notes: All dimensions shown are in units of in.
Inlet Connection

**Standard Construction Features:**

- Inlet collar standard
- Flanges (when selected) will be unpunched and strapped onto the inlet collar
- Companion flanges are available

**Notes:** All dimensions shown are in units of in.

**INLET DRAWN TO SCALE**

**EXAMPLE SHOWS AIRFLOW DIRECTION**
Outlet Connection

Standard Construction Features:
- Unpunched outlet flange is standard
- Rectangle to round outlet transitions and companion flanges are available
- Discharge transitions for sizes 48-73 will ship loose; for sizes 15-44 they will be integral with the fan

Notes: All dimensions shown are in units of in.
AMCA Licensed for Air Performance. Power rating (BHP/kW) includes transmission losses.

Greenheck Fan Corporation certifies that the model shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and comply with the requirements of the AMCA Certified Ratings Program. The AMCA Certified Ratings Seal applies to air performance ratings only. Performance certified is for installation type B: Free Inlet, Ducted Outlet. Power ratings (BHP/kW) include transmission losses. Performance ratings do not include the effects of appurtenances (accessories) in the airstream.
Performance

<table>
<thead>
<tr>
<th>Quantity</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume (CFM)</td>
<td>8,760</td>
</tr>
<tr>
<td>Total External SP (in. wg)</td>
<td>2</td>
</tr>
<tr>
<td>Operating Power (hp)</td>
<td>4.1</td>
</tr>
<tr>
<td>Required Power (hp)</td>
<td>4.1</td>
</tr>
<tr>
<td>Fan RPM</td>
<td>930</td>
</tr>
<tr>
<td>Max Fan RPM</td>
<td>1,070</td>
</tr>
<tr>
<td>Elevation (ft)</td>
<td>10</td>
</tr>
<tr>
<td>Start-up Temp.(F)</td>
<td>70</td>
</tr>
<tr>
<td>Operating Temp.(F)</td>
<td>70</td>
</tr>
</tbody>
</table>

Fan Configuration

| Size | 30 |
| Arrangement | 9 |
| Class | I |
| Rotation | CW |
| Discharge Position | TH |
| Wheel Material | Fiberglass |
| Inlet Cone Material | Steel |

Equipment Weights

| Fan (LMD)(lb) | 600 |
| Motor/Drive (lb) | 96 |
| Accessories (lb) | 0 |

Misc Fan Data

| FEG | 85 |
| Outlet Velocity (ft/min) | 1,806 |
| Static Efficiency (%) | 70 |
| Tip Speed (ft/min) | 7,303 |

Motor and Drives

| Motor | Included |
| Size (hp) | 5 |
| RPM | 1725 |
| Enclosure | ODP |
| V/C/P* | 460/60/3 |
| Location | Left Side |
| Pulley Type | Constant |
| Drive Loss (%) | 4.1 |
| NEC FLA* (Amps) | 7.6 |

Model: 30-BCSW-FRP-9-I-50
Centrifugal FRP Fan

Operating Performance

Sound Power by Octave Band

<table>
<thead>
<tr>
<th>Sound Data</th>
<th>62.5</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
<th>8000</th>
<th>LwA</th>
<th>dBA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inlet</td>
<td>90</td>
<td>95</td>
<td>89</td>
<td>81</td>
<td>76</td>
<td>69</td>
<td>64</td>
<td>61</td>
<td>85</td>
<td>73</td>
</tr>
</tbody>
</table>

*FLA - based on tables 150 or 148 of National Electrical Code 2002. Actual motor FLA may vary, for sizing thermal overload, consult factory.
LwA - A weighted sound power level, based on ANSI S1.4
dBA - A weighted sound pressure level, based on 11.5 dB attenuation per octave band at 5 ft dBA levels are not licensed by AMCA International
Model: 30-BCSW-FRP-9-I-50
Centrifugal FRP Fan

Standard Construction Features:

HOUSING: Fiberglass reinforced plastic scroll. Layers of protective "C" veil are included as standard for added corrosion protection. All hardware in contact with the airstream is made of stainless steel and encapsulated in FRP. DRIVE FRAME: Heavy-gauge steel coated in enamel. BEARINGS, SHAFT, AND WHEEL: Heavy duty, self-aligning ball or roller pillow block bearings - Polished solid steel shafts - Fiberglass reinforced plastic centrifugal wheel, with strapped in blades - 9 bladed construction - Backward Curved blade profile

Selected Options & Accessories:

NEMA Premium Efficient Motor - meets NEMA Table 12-12
Motor with Class B or Greater Insulation
Standard Bearings - L(10) Life of 80k Hours
Motor Slide Base
Drain Connection
Inlet Connection - Inlet Collar, Slip Fit
Outlet Connection - Unpunched Outlet Flange
Belt Guard - Totally Enclosed
Shaft Guard
Shaft Material - Steel
Coating - Wheel - GelCoat, Drive Frame - Brushed Enamel, Gray
Model: 30-BCSW-FRP-9-I-50  Centrifugal FRP Fan

**CONNECTIONS**

- Shaft Dia: 2
- Keyway: 4.5 x 0.5 x 0.25

**END VIEW**

- Housing Centerline
- Shaft Centerline
- Ø 0.75
- 8 Holes

**FAN FOOTPRINT**

- Ø 30.63
- Inlet OD: 30.5
- Outlet OD: 28.25
- Width: 22.75

**SIDE VIEW**

- Ø 30.63
- Inlet OD: 30.5
- Width: 22.75
- Depth: 36

*Side view is viewed from drive side*

Notes: All dimensions shown are in units of in.
Inlet Connection

Standard Construction Features:
• Inlet collar standard
• Flanges (when selected) will be unpunched and strapped onto the inlet collar
• Companion flanges are available

Notes: All dimensions shown are in units of in.
Outlet Connection

**Standard Construction Features:**
- Unpunched outlet flange is standard
- Rectangle to round outlet transitions and companion flanges are available
- Discharge transitions for sizes 48-73 will ship loose; for sizes 15-44 they will be integral with the fan

Notes: All dimensions shown are in units of in.

0.44 DIA. 32 HOLES
OUTLET DRAWN TO SCALE
EXAMPLE SHOWS AIRFLOW DIRECTION
EXAMPLE DISCHARGE POSITION IS "TH"
AMCA

AMCA Licensed for Air Performance. Power rating (BHP/kW) includes transmission losses.

Greenheck Fan Corporation certifies that the model shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and comply with the requirements of the AMCA Certified Ratings Program. The AMCA Certified Ratings Seal applies to air performance ratings only. Performance certified is for installation type B: Free Inlet, Ducted Outlet. Power ratings (BHP/kW) include transmission losses. Performance ratings do not include the effects of appurtenances (accessories) in the airstream.
## Model: 25-BCSW-FRP-10-I-50
Centrifugal FRP Fan

### Performance

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity</td>
<td>1</td>
</tr>
<tr>
<td>Volume (CFM)</td>
<td>7,230</td>
</tr>
<tr>
<td>Total External SP (in. wg)</td>
<td>2</td>
</tr>
<tr>
<td>Operating Power (hp)</td>
<td>4.53</td>
</tr>
<tr>
<td>Required Power (hp)</td>
<td>4.53</td>
</tr>
<tr>
<td>Fan RPM</td>
<td>1231</td>
</tr>
<tr>
<td>Max Fan RPM</td>
<td>1,258</td>
</tr>
<tr>
<td>Elevation (ft)</td>
<td>10</td>
</tr>
<tr>
<td>Start-up Temp. (F)</td>
<td>70</td>
</tr>
<tr>
<td>Operating Temp. (F)</td>
<td>70</td>
</tr>
</tbody>
</table>

### Fan Configuration

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>25</td>
</tr>
<tr>
<td>Arrangement</td>
<td>10</td>
</tr>
<tr>
<td>Class</td>
<td>I</td>
</tr>
<tr>
<td>Rotation</td>
<td>CW</td>
</tr>
<tr>
<td>Discharge Position</td>
<td>TH</td>
</tr>
<tr>
<td>Wheel Material</td>
<td>Fiberglass</td>
</tr>
<tr>
<td>Inlet Cone Material</td>
<td>Steel</td>
</tr>
</tbody>
</table>

### Equipment Weights

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Weight (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fan (LMD)</td>
<td>410</td>
</tr>
<tr>
<td>Motor/Drive</td>
<td>91</td>
</tr>
<tr>
<td>Accessories</td>
<td>0</td>
</tr>
</tbody>
</table>

### Misc Fan Data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEG</td>
<td>71</td>
</tr>
<tr>
<td>Outlet Velocity (ft/min)</td>
<td>1,944</td>
</tr>
<tr>
<td>Static Efficiency (%)</td>
<td>52</td>
</tr>
<tr>
<td>Tip Speed (ft/min)</td>
<td>8,215</td>
</tr>
</tbody>
</table>

### Motor and Drives

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor</td>
<td>Included</td>
</tr>
<tr>
<td>Size (hp)</td>
<td>5</td>
</tr>
<tr>
<td>RPM</td>
<td>1725</td>
</tr>
<tr>
<td>Enclosure</td>
<td>ODP</td>
</tr>
<tr>
<td>V/C/P</td>
<td>460/60/3</td>
</tr>
<tr>
<td>Location</td>
<td>Centered</td>
</tr>
<tr>
<td>Pulley Type</td>
<td>Constant</td>
</tr>
<tr>
<td>Drive Loss (%)</td>
<td>4.0</td>
</tr>
<tr>
<td>NEC FLA* (Amps)</td>
<td>7.6</td>
</tr>
</tbody>
</table>

### Operating Performance

- **Volume (CFM) x 1,000**
- **Static Pressure (in. wg)**
- **Brake Power (hp)**

### Sound Power by Octave Band

<table>
<thead>
<tr>
<th>Frequency (Hz)</th>
<th>Inlet LwA</th>
<th>125</th>
<th>250</th>
<th>500</th>
<th>1000</th>
<th>2000</th>
<th>4000</th>
<th>8000</th>
<th>StLwA</th>
</tr>
</thead>
<tbody>
<tr>
<td>62.5</td>
<td>87</td>
<td>90</td>
<td>90</td>
<td>89</td>
<td>84</td>
<td>79</td>
<td>75</td>
<td>71</td>
<td>90</td>
</tr>
</tbody>
</table>

*FLA - based on tables 150 or 148 of National Electrical Code 2002. Actual motor FLA may vary, for sizing thermal overload, consult factory.

LwA - A weighted sound power level, based on ANSI S1.4

dBA - A weighted sound pressure level, based on 11.5 dB attenuation per octave band at 5 ft. dBA levels are not licensed by AMCA International.
Model: 25-BCSW-FRP-10-I-50
Centrifugal FRP Fan

**Standard Construction Features:**

HOUSING: Fiberglass reinforced plastic scroll. Layers of protective "C" veil are included as standard for added corrosion protection. All hardware in contact with the airstream is made of stainless steel and encapsulated in FRP.

DRIVE FRAME: Heavy-gauge steel coated in enamel.

BEARINGS, SHAFT, AND WHEEL: Heavy duty, self-aligning ball or roller pillow block bearings - Polished solid steel shafts - Fiberglass reinforced plastic centrifugal wheel, with strapped in blades - 9 bladed construction - Backward Curved blade profile

**Selected Options & Accessories:**

NEMA Premium Efficient Motor - meets NEMA Table 12-12
Motor with Class B or Greater Insulation
Standard Bearings - L(10) Life of 80k Hours
Drain Connection
Inlet Connection - Inlet Collar, Slip Fit
Outlet Connection - Unpunched Outlet Flange
Weatherhood
Shaft Material - Steel
Coating - Wheel - GelCoat, Drive Frame - Brushed Enamel, Gray
Model: 25-BCSW-FRP-10-I-50  Centrifugal FRP Fan

CONNECTIONS

FAN FOOTPRINT

SIDE VIEW

_END VIEW

*SIDE VIEW IS VIEWED FROM DRIVE SIDE

Notes: All dimensions shown are in units of in.
Inlet Connection

Standard Construction Features:
• Inlet collar standard
• Flanges (when selected) will be unpunched and strapped onto the inlet collar
• Companion flanges are available

Notes: All dimensions shown are in units of in.
Outlet Connection

Standard Construction Features:
• Unpunched outlet flange is standard
• Rectangle to round outlet transitions and companion flanges are available
• Discharge transitions for sizes 48-73 will ship loose; for sizes 15-44 they will be integral with the fan

Notes: All dimensions shown are in units of in.
AMCA Licensed for Air Performance. Power rating (BHP/kW) includes transmission losses.

Greenheck Fan Corporation certifies that the model shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and comply with the requirements of the AMCA Certified Ratings Program. The AMCA Certified Ratings Seal applies to air performance ratings only. Performance certified is for installation type B: Free Inlet, Ducted Outlet. Power ratings (BHP/kW) include transmission losses. Performance ratings do not include the effects of appurtenances (accessories) in the airstream.
SECTION 233100
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SUBMITTALS
A. Product Data: Provide data for duct materials.
B. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work.

PART 2 PRODUCTS

2.01 DUCT ASSEMBLIES
A. Supply: 6 inch w.g. (1500 Pa) high pressure class, galvanized steel.
B. Return and Relief: 3 inch w.g. (750 Pa) low pressure class, galvanized steel.
C. General Exhaust: 3 inch w.g. (750 Pa) low pressure class, galvanized steel.
D. Fume Hood Exhaust: 10 inch w.g. (2500 Pa) high pressure class, galvanized steel.
E. Outside Air Intake: 3 inch w.g. (750 Pa) low pressure class, galvanized steel.

2.02 MATERIALS
A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.
B. Stainless Steel for Ducts: ASTM A666, Type 304.

2.03 DUCTWORK FABRICATION
A. Fabricate and support in accordance with SMACNA (DCS) and as indicated.
B. No variation of duct configuration or size permitted except by written permission. Size round duct installed in place of rectangular ducts in accordance with ASHRAE (FUND) Handbook - Fundamentals.
C. Duct systems have been designed for metal duct. At the Contractor’s option, fibrous glass duct may be substituted for metal duct.
D. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
E. Construct T’s, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.
F. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.
G. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
H. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).
I. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.04 MANUFACTURED DUCTWORK AND FITTINGS
1. Fittings: Elbows, End caps, Connecting couplings, Spin-in-collar, Sofit-discharge head, Support Brackets, Wall discharge head

B. Double Wall Insulated Round Ducts: Round spiral lockseam duct with stainless steel outer wall, perforated stainless steel inner wall; fitting with solid inner wall.
   1. Manufacture in accordance with SMACNA (DCS).
   2. Insulation:
      a. Thickness: 2 inch (50 mm).

C. Double Wall Insulated Rectangular Ducts: Rectangular spiral lockseam duct with stainless steel outer wall and perforated stainless steel inner wall; fitting with solid inner wall.
   1. Manufacture in accordance with SMACNA (DCS).
   2. Insulation:
      a. Thickness: 2 inch (50 mm).

D. Spiral Ducts: Round spiral lockseam duct with galvanized steel outer wall.
   1. Manufacture in accordance with SMACNA (DCS).
   2. Insulation:
      a. Thickness: 2 inch (50 mm) fiberboard insulation

E. Round Ducts: Round lockseam duct with galvanized steel outer wall.
   1. Manufacture in accordance with SMACNA (DCS).

F. Transverse Duct Connection System: SMACNA "E" rated rigidly class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips in accordance with SMACNA (DCS).

G. Round Duct Connection System: Interlocking duct connection system in accordance with SMACNA (DCS).

H. Specialty Coatings for Metal Ductwork: Factory or field-applied per manufacturers instructions.

I. Fume Hood Exhaust: Minimum 21 gage, 0.0344 inch (0.87 mm) thick, single wall, Type 304 stainless steel.
   1. Single wall, factory built chimney liner system.
   2. Designed, fabricated, and installed to be liquid tight preventing exhaust leakage into the building.
   3. Joints to be sealed during installation with factory supplied overlapping V-bands and sealant.

2.05 CASINGS

A. Fabricate casings in accordance with SMACNA (DCS) and construct for operating pressures indicated.

B. Mount floor mounted casings on 4 inch (100 mm) high concrete curbs. At floor, rivet panels on 8 inch (200 mm) centers to angles. Where floors are acoustically insulated, provide liner of galvanized 18 gage, 0.0478 inch (1.21 mm) expanded metal mesh supported at 12 inch (300 mm) centers, turned up 12 inches (300 mm) at sides with sheet metal shields.

C. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection.
1. Provide clear wire glass observation ports, minimum 6 by 6 inch (150 by 150 mm) size.

D. Fabricate acoustic casings with reinforcing turned inward. Provide 16 gage, 0.0598 inch (1.52 mm) sheet steel back facing and 22 gage, 0.0299 inch (0.76 mm) perforated sheet steel front facing with 3/32 inch (2.4 mm) diameter holes on 5/32 inch (4 mm) centers. Construct panels 3 inches (75 mm) thick packed with 4.5 lb/cu ft (72 kg/cu m) minimum glass fiber insulation media, on inverted channels of 16 gage, 0.0598 inch (1.52 mm) sheet steel.

END OF SECTION