DACC Health Sciences Building
Air Handler Assessment/Study

NMSU Facilities and Services Department
P.O. Box 30001
Las Cruces, NM  88003-8001

June 14, 2016
Final Submittal

DOÑA ANA COMMUNITY COLLEGE
DACC
OF NEW MEXICO STATE UNIVERSITY

1065 S. Main St., Bldg. D, Ste. A
Las Cruces, New Mexico 88005
(575) 647-1554

PO #P0158386
I. **Existing Conditions:**

The existing air handler is a built up air handler with casing walls and ceiling located on the second floor of the Health Sciences Building. The built up air handler is configured as follows:

1. Supply fan section: 2 plenum supply fans each in their own “room” created by a sheet metal divider wall. Operate independently under separate static pressure controls.
2. Cooling coil section.
3. Filter section: Bag filters with 2” standard pre Filters.
4. Mixing section: plenum with return air & outside air openings and control dampers.

The existing system operation sequence is as follows:

1. System is energized through the Building Automation System (BAS).
2. Both supply fans start and ramped up to maintain supply duct static pressure set point for each of the two duct systems in the building.
3. Cooling coil flow modulates to maintain desired leaving air set point temperature.
4. Variable Air Volume (VAV) boxes with reheat coils vary air quantities to meet space requirements. When required, they add heat via hot water coil to satisfy load.

The existing air distribution scheme is as follows:

1. Conditioned air is supplied to spaces through the supply duct system and VAV terminals maintain space temperature via the room sensor/thermostat.
2. Return air travels from the space through a series of ceiling openings and transfer ducts to the air handler mixing box.
3. Outside air is introduced into the unit in the mixing section via an outside air damper and louver in the south wall.
4. Building pressure is maintained via roof mounted relief fans located on the second floor.
II. Operation Issues - Observations & Discussion of Recommendation:

Supply Fans

Based on the discussions with the DACC facility staff indicate that the two supply fans are drawing air from each other when operating during high demand periods. The 2001 addition reconfigured the supply fan configuration adding another 40 HP supply fan and divided the supply plenum enclosing each supply fan in its own “room” or plenum. With both fans operating simultaneously the discharge CFM & static pressure for each would have to be identical in order for each fan not to take air from each other on the inlet side of the fan upstream of the cooling. The ductwork distribution connections to the two supply plenums are not configured to be equal in area or static pressure and cause an imbalance in the required static pressures to serve the two supply air duct systems.

Independent operation and control of fans is not recommended. Removal of the sheet metal dividing partition and a common static pressure control for both fans is recommended.

Return Air Plenum/Mixing Section of AHU

The return plenum has a 66” x 36” return air opening with control damper; this was not altered from original design during 2001 addition. Originally the static pressure drop through this opening with approximately 18,400 CFM of return air was 0.13 in wg. which is a reasonable pressure drop. The new addition added CFM, actually doubled the airflow but did not address the return air entrance to the mixing box by either enlarging the opening or adding another. With the new addition the CFM return quantity is now 35,770 CFM and corresponding pressure drop is approximately 0.49 in. w.g. This is another factor that is compounding the two supply fans taking air from one another. The return air path’s pressure drop has increased to the point where robbing air from the other fan is easier than pulling it through the return plenum. The 2012 ASHRAE Applications Chapter 4 air handling and distribution states that “A return fan is optional on small systems but is essential for proper operation of air economizer systems for free cooling from outdoor air if the return path has a significant pressure drop (greater than approximately 0.3 of water).” The pressure drop through the return air opening is approximately 0.49” and the total calculated return air path losses are less 1.42 in w.g. to mixing box. This building has an economizer sequence and meets all the conditions described in the ASHRAE applications chapter. The calculated original return air path pressure loss is 1.06 in. wg. A return fan could have originally been part of the air handler.

Increasing the size of the return air opening into the unit is an important recommendation. Revising the opening to 78”x42” cut the pressure loss through the opening in half improving the supply fans abilities to get their required airflow.

Adding a return fan in some configuration is recommended for proper building operation and return air path performance. However, we are recommending it as the last step in the mitigation effort due to the high cost.

Return Air Paths

The return air path for the building, as a whole is complex. Plenum return systems work well when it is one floor and the partitions do not extend into the ceiling cavity. This building is two story and has fire walls that divide the ceiling cavity, making it difficult for the return air from the most remote rooms relative to get back to the Air Handler. The remote classrooms have to transfer the air to the second floor ceiling cavity through a chase then across a fire rated
corridor through a transfer duct. There are high entrance and exit losses due to sudden changes of area in a system. Good air movement in and out of each room is important in order to maintain comfort conditions. Staff complaints include a lack of comfort and space control in areas at the end of the supply air duct system.

Improving the return air path(s) from space to space will improve space comfort conditions in the most remote areas and rooms. Refer to the attached schematic.

III. Summary of Recommendations:

The following recommendations should be done in order to assess the effect on system and AHU performance. Recommendation 1, 2 and 3 might be implemented simultaneously since they are relatively inexpensive and may even be able to be completed with DACC facility technicians. Last resort item 4 is a very aggressive measure, expensive and in my opinion will not be required.

1. Independent operation and control of fans as currently controlled is not recommended. Removal of the sheet metal dividing partition and a common static pressure control for both fans is recommended. The existing static pressure transducers in the two duct systems shall remain and BAS control programming revised to read settings, discriminate which zone needs airflow adjustment and then a SINGLE signal is sent to the fan VFD’s to modulate fan speed together. Added benefit, with the two supply fans operating to provide supply air for the entire building, if a fan needs maintenance or fails, the second fan can provide air for the building while the maintenance or repair work is completed.

2. Revise the AHU return air opening to increase the available area (make it bigger) and reduce pressure losses on the return air side of the supply fans.

3. Improving the return air path(s) from space to space will improve space comfort conditions in the most remote areas and rooms. Refer to the attached schematic.

4. Adding a return fan in some configuration is recommended for proper building operation and return air path performance. However, we are recommending it as the last step in the mitigation effort due to the high cost.
IV. **Estimated Implementation Costs**

Refer to the following cost summaries for specific information.
RE: DACC/NMSU Main Campus Health Science Bldg. AHU Revisions

Below is a summary cost for the above referenced project.

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demolition</td>
<td>$10,000.00</td>
</tr>
<tr>
<td>Return Opening Revision</td>
<td>$6,300.00</td>
</tr>
<tr>
<td>Supply Fan Controls &amp; Reprogramming</td>
<td>$8,500.00</td>
</tr>
<tr>
<td><strong>Sub-Total Cost for AHU Revisions (less return fan)</strong></td>
<td><strong>$24,800.00</strong></td>
</tr>
</tbody>
</table>

**Modular Return Fan Section**

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modular Return Section &amp; Controls</td>
<td>$51,000.00</td>
</tr>
<tr>
<td><strong>Sub-Total Cost for Modular Return Fan Section</strong></td>
<td><strong>$51,000.00</strong></td>
</tr>
</tbody>
</table>

**Sub-Total for all Projects**

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Contractors Mark ups 20% 0.2</td>
<td>$15,160.00</td>
</tr>
<tr>
<td><strong>Sub-Total</strong></td>
<td><strong>$90,960.00</strong></td>
</tr>
<tr>
<td>NMGRT 7.53% 0.0753</td>
<td>$6,849.29</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>$97,809.29</strong></td>
</tr>
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</table>

**Grand Total (AHU Revisions Only - no return fan)**

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>$32,000.93</strong></td>
</tr>
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</table>

**Cost with Contingency (10%)**

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cost with Contingency (10%)</strong></td>
<td><strong>$107,590.22</strong></td>
</tr>
</tbody>
</table>
RE: DACC/NMSU Main Campus Health Science Bldg. AHU Revisions

Below is a breakdown of the mechanical cost for the above referenced project. Please review and comment as necessary. All costs and calculations were comprised using the Means booklet or from vendors or manufacturer's representatives.

### Demolition:

<table>
<thead>
<tr>
<th>Line Item</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Cost</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Plenum wall</td>
<td>1</td>
<td>ls</td>
<td>$7,500.00</td>
<td>$7,500.00</td>
</tr>
<tr>
<td>Return opening</td>
<td>1</td>
<td>ls</td>
<td>$2,500.00</td>
<td>$2,500.00</td>
</tr>
</tbody>
</table>

Sub-Total: $10,000.00

### New Work (Return Opening Revision)

<table>
<thead>
<tr>
<th>Line Item</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Cost</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Return Opening</td>
<td>1</td>
<td>ls</td>
<td>$2,000.00</td>
<td>$2,000.00</td>
</tr>
<tr>
<td>New Return damper</td>
<td>1</td>
<td>ls</td>
<td>$1,800.00</td>
<td>$1,800.00</td>
</tr>
<tr>
<td>New Ret damper controls</td>
<td>1</td>
<td>ls</td>
<td>$2,500.00</td>
<td>$2,500.00</td>
</tr>
</tbody>
</table>

Sub-Total: $6,300.00

### New Work (Return Fan section)

<table>
<thead>
<tr>
<th>Line Item</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Cost</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modular ret fan section</td>
<td>1</td>
<td>ea</td>
<td>$40,000.00</td>
<td>$40,000.00</td>
</tr>
<tr>
<td>Electrical connections</td>
<td>1</td>
<td>ea</td>
<td>$8,500.00</td>
<td>$8,500.00</td>
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<tr>
<td>Return fan controls</td>
<td>1</td>
<td>ls</td>
<td>$2,500.00</td>
<td>$2,500.00</td>
</tr>
</tbody>
</table>

Sub-Total: $51,000.00

### New Work (Supply Fan Control Revision & Reprogramming)

<table>
<thead>
<tr>
<th>Line Item</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Cost</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controls and reprogram</td>
<td>1</td>
<td>ls</td>
<td>$8,500.00</td>
<td>$8,500.00</td>
</tr>
</tbody>
</table>

Sub-Total: $8,500.00

Sub-Total for all work options Work: $75,800.00
V. Plans and Schematics

1. Return Air Flow Schematic
2. Estimated Static Pressure Requirements for Return Air Path into AHU
3. Fire Damper Loss (node 2)
4. Opening Loss (node 2)
5. Opening Loss (node 3)
6. Return Air Control Damper to AHU Loss (node 5) – existing condition
7. Return Air Control Damper to AHU Loss (node 5) – original design
8. Return Air Control Damper to AHU Loss (node 5) – revised size condition
9. Enlarged AHU Room Plan
10. First Floor Return Air Flow Diagram
11. Second Floor Return Air Flow Diagram
12. Phase 1 HVAC Plans – Indicating location of static pressure controller
13. Phase 2 HVAC Plan – First Floor – Indicating location of static pressure controller
Estimated Static Pressure Requirements for Return Air Path into AHU

Supply fan revisions – control revisions, single static pressure control, fan section modification to eliminate segregated supply fan rooms.
Return revisions – Air handler return opening modification, outside air modification.

Sound attenuators (ST):

<table>
<thead>
<tr>
<th>ST</th>
<th>Size</th>
<th>Pressure Drop</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST-1</td>
<td>54 x 12 x 3</td>
<td>0.04 in. wg.</td>
</tr>
<tr>
<td>ST-2 &amp; 3</td>
<td>42 x 30 x 3</td>
<td>0.03 in. wg.</td>
</tr>
</tbody>
</table>

ST – 2 & 3(4)  
7438 CFM/ 8.75 SF = 850 FPM = .04 in. wg. Pressure drop

ST-1 (4)  
3533 CFM/ 4.5 sf = 785 FPM = .03 in. wg. Pressure drop

Return Air Opening and Damper: (5)  
3’ x 5’ - 6” @ 35,770 CFM = 2191 fpm = 0.49 in. wg. Pressure drop  
(0.21” wg revised opening)

Return Air path:

<table>
<thead>
<tr>
<th>Description</th>
<th>Pressure Drop</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transfer duct up to 2nd floor</td>
<td>0.007 in. wg. loss</td>
</tr>
<tr>
<td>Entrance into transfer duct up to 2nd floor</td>
<td>0.015</td>
</tr>
<tr>
<td>Across Fire damper</td>
<td>0.712</td>
</tr>
<tr>
<td>Transfer duct across corridor</td>
<td>0.036</td>
</tr>
<tr>
<td>Entrance into transfer duct across corridor</td>
<td>0.109</td>
</tr>
<tr>
<td>RA grille 850 CFM(1)</td>
<td>0.012</td>
</tr>
</tbody>
</table>

Estimated Static Pressure Loss thru return path(s) 1.42”
To AHU return opening at mixing box

Total Return Air Losses to AHU Filter Bank = 0.04+0.49+1.42=1.95 in. wg.  (Current installation)
Total Return Air Losses to AHU Filter Bank = 0.04+0.21+1.42=1.67 in. wg.  (Revised return air opening installation)
DFD-110
Dynamic Rated Fire Damper

Application & Design
Model DFD-110 is approved for use in walls, floors, and partitions with fire resistance ratings less than 3 hours. This model carries a 1 1/2 hour UL fire damper label. UL 555 classifies dynamic rated fire dampers for use in HVAC systems that are operational in the event of fire.

UL555 FIRE RESISTANCE RATING
Fire Rating: 1 1/2 hours
Maximum Velocity: 4,000 ft/min up to 24,000 in. x 24,000 in. vertical only
2,000 ft/min vertical or horizontal, all sizes
Maximum Pressure: 4 in. wg

Codes Approved
This model meets the requirements for fire dampers established by:
NFPA Standards 80, 90A & 101.
UL Classified to U.S. and Canadian Safety Standards 555 (Listing #R13317)
IBC (International Building Codes)
CSFM - California State Fire Marshal Fire Damper Listing (#3225-0861:102)
New York City (MEA Listing #260-91-M)

CONSTRUCTION FEATURES
Transition: A
Mounting: Vertical
Closure Device: Fusible Link
Closure Temp. (F): 165
Sizing: Nominal
Velocity (ft/min): 2,000
Static Pressure (in. wg): 4

<table>
<thead>
<tr>
<th>ID #</th>
<th>Tag</th>
<th>Qty</th>
<th>W (in.)</th>
<th>H (in.)</th>
<th>Sections Wide</th>
<th>Sections High</th>
<th>P-Dim (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-1</td>
<td>fd</td>
<td>1</td>
<td>30.000</td>
<td>24.000</td>
<td>1</td>
<td>1</td>
<td>3.050</td>
</tr>
</tbody>
</table>

Notes: All dimensions shown are in units of inches.
W & H furnished approximately 0.25 in. undersized. (sleeve thickness is NOT included)
Model: VCD-23

Ratings and General Construction

Blade Action: Opposed  Axle Bearings: Synthetic  Standoff Bracket: None
Frame Type: Channel  Axle/Linkage Material: Steel  Jackshafting: No Preference
Material: Galvanized  Blade Seal: TPE  Clean Wrap: No
Frame Thickness (ga): 16  Jamb Seal: 304 SS  Sizing: Nominal
Transition: None  Blade Seal: None  Temp. Rating (F): 180
Actuator Sizing: Default SqFt  Actuator Indicator: None

Actuator Type: None  Actuator Mounting: External  Actuator Location: Left Side

Application & Design

The VCD-23 is a ruggedly built low leakage control damper intended for application in low to medium pressure and velocity systems. A wide range of electric and pneumatic actuators are available.

Ratings

Pressure: Up to 5 in. wg pressure differential
Velocity: 3,000 ft/min
Leakage: Class 1A @ 1 in. wg, Class 1 @ up to 5 in. wg
Temperature: Up to 250°F

Greenheck Fan Corporation certifies that the model VCD-23 shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 511 and comply with the requirements of the AMCA Certified Ratings Programs. The AMCA Certified Ratings Seal applies to Air Leakage and Air Performance ratings.

Notes: All dimensions shown are in units of inches.
Width & Height furnished approximately 0.25 in. under size.

<table>
<thead>
<tr>
<th>Row ID</th>
<th>Tag</th>
<th>Qty</th>
<th>Opening W (In.)</th>
<th>Opening H (In.)</th>
<th>Drive Arrangement</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-1</td>
<td>1</td>
<td>1</td>
<td>30.000</td>
<td>24.000</td>
<td>Drive-CC-11-1CEL-0</td>
</tr>
</tbody>
</table>

Performance Calculation (informational purposes only. Not actual damper rating.)

<table>
<thead>
<tr>
<th>Row ID</th>
<th>AMCA</th>
<th>Volume (CFM)</th>
<th>Velocity (ft/min)</th>
<th>Pressure Drop (in. wg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-1</td>
<td>AMCA 5.5</td>
<td>1,780</td>
<td>363</td>
<td>0.015</td>
</tr>
</tbody>
</table>

Total Qty: 1
Model: VCD-23
Ratings and General Construction

<table>
<thead>
<tr>
<th></th>
<th>Opposed</th>
<th>Channel</th>
<th>Galvanized</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blade Action</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frame Type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frame Thickness (ga)</td>
<td>16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transition</td>
<td>None</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actuator Sizing</td>
<td>Default SqFt</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Axle Bearings:           | Synthetic |
| Axle/Linkage Material:   | Steel     |
| Blade Seal:              | Clean Wrap |
| Jamb Seal:               | 304 SS    |
| Blade Indicator:         | None      |

| Standoff Bracket:        | None |
| Jackshafting:            | No Preference |
| Clean Wrap:              | No     |
| Sizing:                  | Nominal |
| Temp. Rating (F):        | 180 |

Actuator

| Actuator Type: | None |
| Actuator Mounting: | External |
| Actuator Location: | Left Side |

Application & Design

The VCD-23 is a ruggedly built low leakage control damper intended for application in low to medium pressure and velocity systems. A wide range of electric and pneumatic actuators are available.

Ratings

| Pressure:  | Up to 5 in. wg pressure differential |
| Velocity:  | 3,000 ft/min |
| Leakage:   | Class 1A @ 1 in. wg, Class 1 @ up to 5 in. wg |
| Temperature: | Up to 250°F |

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Notes: All dimensions shown are in units of inches. Width & Height furnished approximately 0.25 in. under size. Installation instructions available at www.greenheck.com.

<table>
<thead>
<tr>
<th>Row ID</th>
<th>Tag</th>
<th>Qty</th>
<th>Opening W (in.)</th>
<th>Opening H (in.)</th>
<th>Drive Arrangement</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-1</td>
<td>trans duct</td>
<td>1</td>
<td>44.000</td>
<td>12.000</td>
<td>Drive-CC-11-1CEL-0</td>
</tr>
</tbody>
</table>

Performance Calculation (Informational purposes only. Not actual damper rating.)

<table>
<thead>
<tr>
<th>Row ID</th>
<th>AMCA</th>
<th>Volume (CFM)</th>
<th>Velocity (ft/min)</th>
<th>Pressure Drop (in. wg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-1</td>
<td>AMCA 5.5</td>
<td>3,533</td>
<td>890</td>
<td>0.108</td>
</tr>
</tbody>
</table>

Total Qty: 5
Model: VCD-23

Ratings and General Construction

Blade Action: Opposed
Axle/Linkage Material: Steel
Blade Seal: TPE
Blade Indicator: None

Actuator
Actuator Type: 120 VAC
Actuator Operation: Spring Return
Actuator Mounting: External Kit
Actuator Location: Left Side

Application & Design

The VCD-23 is a ruggedly built low leakage control damper intended for application in low to medium pressure and velocity systems. A wide range of electric and pneumatic actuators are available.

Ratings

- Pressure: Up to 5 in. wg pressure differential
- Velocity: 3,000 ft/min
- Leakage: Class 1A @ 1 in. wg, Class 1 @ up to 5 in. wg
- Temperature: Up to 250°F

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Notes: All dimensions shown are in units of inches.
Width & Height furnished approximately 0.25 in. under size.

<table>
<thead>
<tr>
<th>Row ID</th>
<th>Tag</th>
<th>Qty</th>
<th>Opening W (In.)</th>
<th>Opening H (In.)</th>
<th>Drive Arrangement</th>
<th>Actuator Model</th>
<th>Act. Qty.</th>
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<tbody>
<tr>
<td>2-1</td>
<td>1</td>
<td>1</td>
<td>66.000</td>
<td>36.000</td>
<td>Drive-CC-21-1FEL-1</td>
<td>AFBUP</td>
<td>1</td>
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Performance Calculation (Informational purposes only. Not actual damper rating.)

<table>
<thead>
<tr>
<th>Row ID</th>
<th>AMCA</th>
<th>Volume (CFM)</th>
<th>Velocity (ft/min)</th>
<th>Pressure Drop (in. wg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-1</td>
<td>AMCA 5.5</td>
<td>35,770</td>
<td>2,191</td>
<td>0.49</td>
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Total Qty: 1
Total Number of Actuators: 1
Model: VCD-23
Ratings and General Construction

Blade Action: Opposed
Frame Type: Channel
Material: Galvanized
Frame Thickness (ga): 16
Transition: None
Actuator Sizing: Default SqFt
Axle Bearings: Synthetic
Axle/Linkage Material: Steel
Blade Seal: TPE
Jamb Seal: 304 SS
Blade Indicator: None
Standoff Bracket: None
Jackshafting: No Preference
Clean Wrap: No
Sizing: Nominal
Temp. Rating (F): 180

Actuator
Actuator Type: None
Actuator Mounting: External
Actuator Location: Left Side

Application & Design

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Ratings
Pressure: Up to 5 in. wg pressure differential
Velocity: 3,000 ft/min
Leakage: Class 1A @ 1 in. wg, Class 1 @ up to 5 in. wg
Temperature: Up to 250°F

Greenheck Fan Corporation certifies that the model VCD-23 shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 511 and comply with the requirements of the AMCA Certified Ratings Programs. The AMCA Certified Ratings Seal applies to Air Leakage and Air Performance ratings.

Notes: All dimensions shown are in units of inches.
Width & Height furnished approximately 0.25 in. under size.

<table>
<thead>
<tr>
<th>Row ID</th>
<th>Tag</th>
<th>Qty</th>
<th>Opening W (in.)</th>
<th>Opening H (in.)</th>
<th>Drive Arrangement</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-1</td>
<td>1</td>
<td></td>
<td>66.000</td>
<td>36.000</td>
<td>Drive-CC-21-1CEL-1</td>
</tr>
</tbody>
</table>

Performance Calculation (Informational purposes only. Not actual damper rating.)

<table>
<thead>
<tr>
<th>Row ID</th>
<th>AMCA</th>
<th>Volume (CFM)</th>
<th>Velocity (ft/min)</th>
<th>Pressure Drop (in. wg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-1</td>
<td>AMCA 5.5</td>
<td>18,400</td>
<td>1,127</td>
<td>0.13</td>
</tr>
</tbody>
</table>

IN CALL'S ORIGINAL PRESSURES DIP THROUGH A L DAMPER.
**Model: VCD-33**

**Ratings and General Construction**

- **Blade Action:** Opposed
- **Axle Bearings:** Synthetic
- **Standoff Bracket:** None
- **Axle/Linkage Material:** Steel
- **Jackshafting:** No Preference
- **Material:** Galvanized
- **Clean Wrap:** No
- **Frame Type:** Channel
- **Blade Seal:** TPE
- **Sizing:** Nominal
- **Frame Thickness (ga):** 16
- **Jamb Seal:** 304 SS
- **Temp. Rating (ºF):** 180
- **Transition:** None
- **Blade Indicator:** None
- **Actuator Sizing:** Default SqFt
- **Actuator Type:** None
- **Actuator Mounting:** External
- **Actuator Location:** Left Side

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**Application & Design**

The model VCD-33 is a low leakage control damper for application as an automatic control or manual balancing damper. This model is intended for applications in low to medium pressure and velocity systems. A wide range of electric and pneumatic actuators are available. Non-jackshafted dampers will be supplied with a blade drive lever for internal actuator mounting. When external actuator mounting is specified, an extension pin with clip kit will be provided. Note: The extension pin with clip kit includes the extension pin and clip.

**Ratings**

- **Pressure:** Up to 10 in. wg pressure differential
- **Velocity:** 4,000 ft/min
- **Leakage:** Class 1A @ 1 in. wg, Class 1 @ up to 8 in. wg
- **Temperature:** Up to 250°F

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**Performance Calculation**

- **Row ID:** 1-1
- **Tag:** Return Damper @ AHU
- **Qty:** 1
- **Opening W (in.):** 42.000
- **Opening H (in.):** 78.000
- **Drive Arrangement:** Drive-CC-12-2CEL-0

**Notes:** All dimensions shown are in units of inches. Width & Height furnished approximately 0.25 in. under size. Installation instructions available at www.greenheck.com.

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**Increased RA opening.**

**Pressure drop reduces by 1/2.**
VI. Photos of Existing AHU

Figure 1 - Ceiling return air path in top of AHU room.

Figure 2 - Fire damper in AHU room wall for return path.
Figure 3 - Fire damper in AHU room wall for return air opening.

Figure 4 - Open wall into ceiling space from AHU room. Supply duct from SF in foreground. Fire damper return air opening adjacent to right.
Figure 5 - Typical congested ceiling space in building.

Figure 6 - Building ceiling space.
Figure 7 - Outside air control damper inside AHU mixing section. Control damper opens to outside air intake plenum and louver on wall of building.
Figure 8 - Return air control damper/return air opening from building into AHU mixing section. Located on top of AHU casing and opens to AHU room pulling return air through building ceiling space to AHU.
Figure 9 - Pre-filter bank inside mixing section of AHU.

Figure 10 - Bag filter section on downstream side of pre-filters. See figure 9 above.
Figure 11 - AHU cooling coil sections, downstream of bag filter bank.

Figure 12 - Supply duct from supply fan section to second floor air distribution system.
Figure 13 - Supply duct from supply fan section with smoke detector.

Figure 14 - Supply duct from supply fan section down to first floor air distribution system.
Figure 15 - Supply duct connections.

Figure 16 - Supply fan. Typical of two.